

CHATSWOOD TO SYDENHAM  
**CENTRAL WALK  
MODIFICATION REPORT**

MAIN REPORT



# EXECUTIVE SUMMARY





# Executive Summary

## Introduction

Sydney Metro City & Southwest has been developed within the framework of the transport and planning strategies identified in State government policies. This includes the 12 NSW Premier priorities (established to grow the economy, deliver infrastructure, and improve health, education and other services across NSW), Sydney's Rail Future: Modernising Sydney's Trains, Draft Metropolitan Strategy for Sydney 2031 and the NSW Long Term Transport Master Plan. The project responds to these challenges delivering a step-change in the capacity of Sydney's rail network by providing a fully automated rail system across Sydney, supporting high demand with a high capacity, turn-up-and-go service.

Sydney Metro City & Southwest was declared by Ministerial Order on 10 December 2015 to be State significant infrastructure and critical State significant infrastructure. The assessment and approval process for a critical State significant infrastructure project is established under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

An Environmental Impact Statement for the Chatswood to Sydenham component of Sydney Metro City & Southwest was prepared and exhibited for 48 days from 11 May to 27 June 2016. A subsequent Submissions and Preferred Infrastructure Report was prepared and submitted to the Department of Planning and Environment in October 2016. Planning approval for the Chatswood to Sydenham component of Sydney Metro City & Southwest (the approved project) was granted by the Minister for Planning under Part 5.1 of the EP&A Act on 9 January 2017.

Pursuant to section 115ZI of the EP&A Act, Transport for NSW is seeking to modify the State significant infrastructure approval to include Central Walk as outlined below. This modification report includes:

- A description of the proposed modification to the approved project
- A justification for the modification
- Options considered for each element of the proposed modification
- An assessment of the environmental and community impacts and benefits of the proposed modification.

## Overview of the proposed modification

The proposed modification (Central Walk) would involve the addition of the following key features to the approved project at Central Station:

- **East concourse** – the concourse would provide an accessible connection to the suburban and metro platforms at a common floor level and cater for the growing demands at the station now and in the future. Escalators and a lift would connect the concourse with each of the aboveground suburban platforms
- **Eastern entry** – a new entry / exit would be provided to Central Station and the east concourse from Chalmers Street
- **Platform works** – general upgrade of lighting, signage and finishes, removal of platform clutter, and platform raising / re-levelling to provide a consistent height and finish across the aboveground suburban platforms.

The design and delivery of Central Walk would allow for a new western entry through the extension of the underground concourse to the west of the metro platforms.

## Need for the proposed modification

Around 270,000 people enter or exit at Central Station every weekday, more than any other station on the NSW rail network. Many more customers interchange within Central Station, transferring between rail services, light rail, coaches, taxis and the bus network. The need for easy customer transfer and improved pedestrian flows at Central Station will become even more critical with the introduction of a new light rail stop on Chalmers Street as part of the CBD and South East Light Rail and the new underground metro platforms to be delivered as part of the approved project. The large number of passenger movements into, out of and through Central is forecast to increase significantly due to the growth of the transport network and public transport demand in Sydney.

Central Station has been developed over many decades leading to its current layout and configuration which hinders efficient customer transfer. There are multiple level changes between each of the existing concourses, many of which no longer comply with current design standards. The only accessible route at the station that connects all platforms is via the North Concourse under the suburban platforms.

On 15 September 2016, the Minister for Transport and Infrastructure announced the Government's intention to revitalise Central Station and commence a process of public and industry consultation. This announcement identified that, in addition to the core transport customer requirements, Central Station has the potential to be a destination itself for domestic and international visitors. By building on the primary function of transport operations, the opportunity exists to activate the public spaces, showcase the heritage elements of the station and unlock the potential of the precinct. Feedback received during this consultation process identified the need to provide improved access, connectivity and legibility within the station and across the precinct.

Delivery of the proposed modification would provide improved transport interchange efficiency between the future metro services at Central Station, suburban services and the future light rail stop on Chalmers Street. The key customer benefits delivered by the proposed modification would include:

- Reduced travel time to access and transfer through Central Station
- Reduced customer crowding within Central Station
- Improved safety and amenity
- Improved legibility and wayfinding
- Improved accessibility
- Reduced congestion and improved clearance times on the aboveground suburban platforms.

The proposed modification would provide a range of customer experience benefits, passenger movement and interchange benefits, and better integration with the surrounding precinct. Without the proposed modification, the future operation of the station could become compromised from excessive congestion and queuing on the suburban platforms affecting train services. A new underground concourse with efficient access that is easy to use for customers would assist with redistribution of customers within the station and improve the customer experience. These improvements to transport functionality would also be a precursor to broader precinct renewal and revitalisation opportunities.

Delivering the proposed modification and the approved project works concurrently would minimise construction impacts to customers and deliver cost, program and interface efficiencies.

## Community consultation

Engagement with the community and stakeholders on issues relating to broader Central Station revitalisation began in June 2014, with early engagement around Sydney Metro City & Southwest and the new underground platforms.

On 15 September 2016, the NSW Government announced the opportunity to reimagine Central Station. The announcement initiated a round of community, stakeholder and industry consultation on the revitalisation of Central Station. This included doorknocks with shop keepers, online surveys and discussion forums, face to face intercept surveys and distribution of newsletters.

Further consultation was carried out following the announcement of Central Walk on 22 March 2017. This consultation included a media release, fact sheet, overview video and contact with a range of stakeholders.

Key stakeholder consultation has also occurred with relevant State agencies, the City of Sydney Council, and directly impacted communities and businesses.

Feedback received during consultation activities has been considered in ongoing development of the proposed modification.

Consultation would continue during construction consistent with approach for the approved project.

## Environmental assessment

The proposed modification would result in some additional minor environmental impacts to the approved project, particularly during construction. These impacts need to be considered in the context of the substantial benefits of the proposed modification in relation to facilitating the ongoing operation of Central Station. Potential environmental impacts have been considered during the design development of the proposed modification. In some cases this has resulted in changes to the design or construction methods.

Despite this, a number of adverse environmental impacts would remain. These include:

- Direct and indirect impacts to the State heritage listed Sydney Terminal and Central Railway Station group, and demolition of the locally listed Bounce Hostel (former MGM) building
- Increased duration and magnitude of construction noise and vibration impacts for some receivers, particularly near the eastern entry
- Some short-term construction traffic impacts, including some minor deterioration of intersection performance, the need to temporarily close Randle Lane, temporary closure of footpaths and cycle routes, and potential temporary impacts to the light rail event tracks on Chalmers Street
- The need for changed customer movements within Central Station, although this would be managed through the progressive opening of new elements
- Some adverse landscape character and visual amenity impacts due to construction works
- Increased interface with potentially contaminated areas, especially associated with railway use within Central Station.

The proposed modification would be constructed in accordance with the Sydney Metro Construction Environmental Management Framework provided as part of the Submissions and Preferred Infrastructure Report for the approved project. While the project-specific mitigation measures identified for the approved project are generally sufficient to address the potential impacts of the proposed modification, some additional measures or changes to measures have been identified to manage specific potential impacts of the proposed modification. The relevant conditions of approval for the approved project would also apply, with some recommendations made in relation to potential modifications to these conditions.

## Conclusion

Further details of the proposed modification to the approved project are provided in this report. Overall, the proposed modification is expected to provide substantial benefits to customers at Central Station which are expected to outweigh any potential minor additional impacts of the proposed modification.

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# INTRODUCTION

## CHAPTER ONE



# 1 Introduction

**This chapter provides an overview of the proposed modification (Central Walk), its strategic context and key features, and the structure of this report.**

## 1.1 Overview

Planning approval for Sydney Metro City & Southwest Chatswood to Sydenham (the approved project) was granted by the Minister for Planning under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 9 January 2017.

The works at Central Station as part of the approved project involve:

- New underground metro platforms and concourse below the existing suburban rail service platforms 12, 13, 14 and 15, and associated vertical transport (lifts and escalators)
- Reinstatement of platforms 12, 13 and 14 over the metro cavern
- Adjustments to the North Concourse and associated shortening of platforms 9 to 14 at the northern end, and a corresponding lengthening at the southern end.
- New canopies over the reinstated platforms 12 to 14 and between the Central Electric Building and the northern end of platforms 12 to 14
- A permanent access bridge for maintenance vehicles from Regent Street to Sydney Yard, located between the suburban and intercity rail lines (referred to as the Sydney Yard Access Bridge).

On 22 March 2017, the Premier of NSW and the Minister for Transport and Infrastructure announced Central Walk as the first step in revitalising Central Station. Central Walk (the proposed modification) would involve the construction and operation of a new east concourse and a new eastern entry (from Chalmers Street). Aboveground suburban platform works would also be carried out including suburban platform refresh and re-levelling.

Central Walk is being progressed as a proposed modification to the approved project in accordance with section 115ZI of the EP&A Act. This is one of several modification applications that are likely to occur as the detailed design is developed across the project.

## 1.2 Need for the modification

Around 270,000 people enter or exit at Central Station every weekday, more than any other station on the NSW rail network. Many more customers interchange within Central Station, transferring between rail services, light rail, coaches, taxis and the bus network. The need for easy and safe customer transfer and improved pedestrian flows at Central Station will become even more critical with the introduction of a new light rail stop on Chalmers Street as part of the CBD and South East Light Rail and the new underground metro platforms to be delivered as part of Sydney Metro City & Southwest.

The large number of passenger movements into, out of and through Central is forecast to increase significantly due to the growth of the transport network and public transport demand in Sydney. Based on patronage modelling carried out by Transport for NSW, the number of passengers interchanging at Central Station is expected to grow by 79 per cent between 2014 and 2026, and a further 15 per cent between 2026 and 2036.

Central Station has been developed over many decades leading to its current layout and configuration which hinders efficient customer movement and transfer. There are multiple level changes between each of the existing concourses, many of which no longer comply with current design standards. The only accessible route at the station that connects all platforms is via the North Concourse under the suburban platforms.

Several of the existing pedestrian tunnels under the suburban platforms have been converted from back of house baggage corridors which were not originally designed for public access. The various level changes, line-of-sight issues and dead end corridors create a potentially confusing pedestrian environment heavily reliant on signage and active surveillance.

On 15 September 2016, the Minister for Transport and Infrastructure announced the Government's intention to revitalise Central Station and commence a process of public and industry consultation. This announcement identified that, in addition to the core transport customer requirements, Central Station has the potential to be a destination itself for domestic and international visitors. By building on the primary function of transport operations, the opportunity exists to activate the public spaces, showcase the heritage elements of the station and unlock the potential of the precinct. Feedback received during this consultation process identified the need to provide improved access, connectivity and legibility within the station and across the precinct.

Delivery of the proposed modification would provide improved transport interchange efficiency between the future metro services at Central Station, suburban services and the future light rail stop on Chalmers Street. The proposed modification would also reduce congestion and improve customer amenity on the aboveground suburban platforms.

The proposed modification would provide a range of customer experience benefits, passenger movement and interchange benefits, and better integration with the surrounding precinct. Without the proposed modification, the future operation of the station could become compromised from excessive congestion and queuing on the suburban platforms affecting train services. A new underground concourse with efficient access that is easy to use for customers would assist with redistribution of customers within the station and improve the customer experience. These improvements to transport functionality would also be a precursor to broader precinct renewal and revitalisation opportunities.

Delivering the proposed modification and the approved project works concurrently would minimise construction impacts to customers and deliver cost, program and interface efficiencies.



## 1.3 Strategic context

The strategic context of the approved project was described in the Environmental Impact Statement. Key strategic drivers for the revitalisation of Central Station and Central Walk as the first step are:

- Improving customer experience to make transport a more attractive option and provide an easy and safe experience for customers
- Increasing the operating capacity of Central Station now and into the future through improved connections and reduced platform congestion allowing more efficient loading and unloading of trains
- Activating the station and surrounds so that it continues and thrives as a hub for economic and social activity in the southern CBD and connects to adjacent precincts like Eveleigh, Haymarket and Surry Hills.

The draft *District Plan for the Central District*, released by the Greater Sydney Commission, guides the delivery of the goals, directions and actions within *A Plan for Growing Sydney*. The draft Central District Plan (Greater Sydney Commission, 2016) identifies that an upgrade of Central Station would provide better links to nearby businesses and social areas, educational facilities and housing, supporting its productivity and liveability priorities.

The Central to Eveleigh Urban Transformation and Transport Program by UrbanGrowth NSW aims to progressively transform government-owned land along the rail corridor in the inner city, including within the Central Station precinct. The Program would help meet current and future needs for local residents and a growing global Sydney and would provide improved connectivity across the rail corridor.

Transport for NSW has developed a vision for Central Station as an inspiring and highly functional multi-modal interchange at the heart of the NSW transport network. In this vision Central Station would:

- Improve connections and increased accessibility across Sydney and NSW
- Provide for and is adaptable to future transport needs well into the 21st century
- Provide a defining customer experience
- Be a place whose heritage is part of its future
- Integrate into the surrounding educational, residential and commercial precinct.

Central Walk would primarily support efficient operations and customer experience objectives. It would also be an enabler for future precinct renewal around Central Station by making Central Station a more pleasant and welcoming environment and create opportunities around the new eastern entry.

## 1.4 Overview of Central Walk

### 1.4.1 Location

Central Station is located at the southern end of the Sydney CBD. Immediately north of the station is Belmore Park, to the west is Haymarket (including the University of Technology, Sydney and Chinatown), to the south is Prince Alfred Park and to the east is Surry Hills.

Key buildings located within and around the station include the Bounce Hostel on Chalmers Street, the Sydney Dental Hospital at the junction of Chalmers Street and Elizabeth Street, the Railway Square Youth Hostel Australia (YHA) building immediately west of the station off Ambulance Avenue, and the Adina Hotel next to the hostel fronting Lee Street and Ambulance Avenue. Central Station and the surrounding area are shown on Figure 1-1.

Central Station also forms part of the ‘Sydney Terminal and Central Railway Stations Group’ that is listed on the State Heritage Register, RailCorp’s Section 170 Heritage and Conservation Register and the heritage schedule of the *Sydney Local Environmental Plan 2012*.

There are currently seven station entry / exit points which provide pedestrian access to the Central Station Grand Concourse, North Concourse, South Concourse and Eastern Suburbs Concourse, and from there to the platforms which extend in a north-south alignment (refer to Figure 1-2).

Platforms 1-15 generally service regional and intercity trains. Located at a slightly higher level than platforms 1-15 (about 1.5 metres) are platforms 16-23 that service suburban trains. Platforms 24 and 25, which service the Eastern Suburbs and Illawarra Line, are located beneath Chalmers Street.

As part of the approved Chatswood to Sydenham component of Sydney Metro City & Southwest, new underground metro platforms at Central Station would be located beneath platforms 12-15. Platforms 12, 13 and 14 would be reinstated following construction of the metro platforms; platform 15 would not be reinstated.

Also surrounding the station are a number of transport interchange facilities including bus and coach stops, an existing light rail terminus on the upper level colonnade of the Grand Concourse, future light rail stops associated with the CBD and South East Light Rail, cycle paths and cycle parking, pedestrian footpaths, taxi ranks and kiss-and-ride areas.

### 1.4.2 Key features

Central Walk would involve the addition to the following key features (as shown on Figure 1-3) to the approved project at Central Station:

- **East concourse** – the concourse would provide an accessible connection to the suburban and metro platforms at a common floor level and cater for the growing demands at the station now and in the future. Escalators and a lift would connect the concourse to each of the aboveground suburban platforms
- **Eastern entry** – a new entry / exit would be provided to Central Station and the east concourse from Chalmers Street
- **Platform works** – general upgrade of lighting, signage and finishes, removal of platform clutter, and platform raising / re-levelling to provide a consistent height and finish across the aboveground suburban platforms.

The design and delivery of Central Walk would allow for a new western entry through the extension of the underground concourse to the west of the metro platforms.

Central Walk is described in more detail in Chapter 6 (Modification description – operation) and Chapter 7 (Modification description – construction).



Figure 1-1 Central Station and surrounds





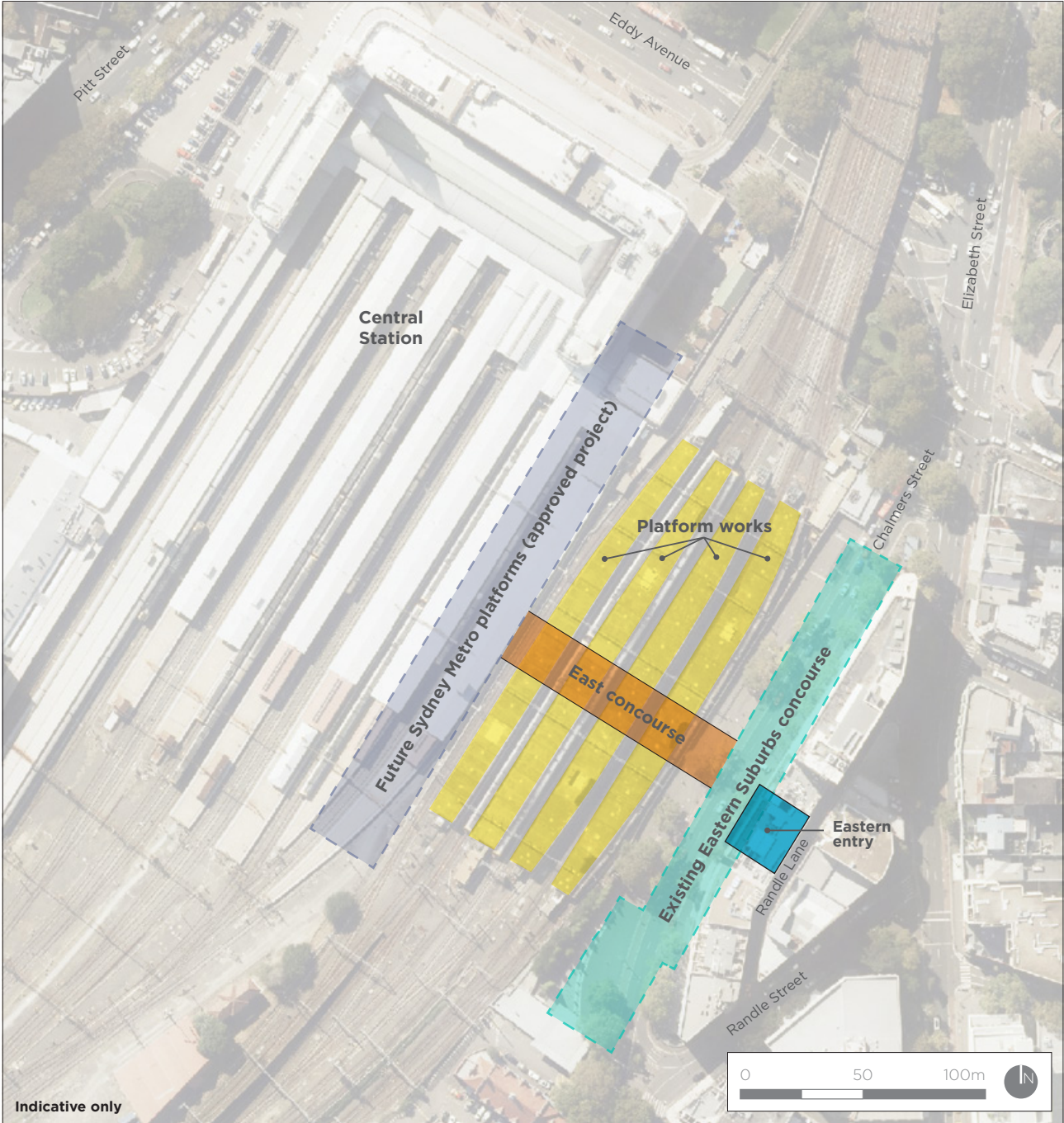


Figure 1-3 Key features of the proposed modification (Central Walk)



## 1.5 Purpose of this report

This report provides an assessment of the proposed modification in accordance with section 115ZI of the EP&A Act. This modification report includes:

- A description of the proposed modification to the approved project
- A justification for the modification
- Options considered for the proposed modification
- An assessment of the environmental and community impacts and benefits of the proposed modification.

## 1.6 Structure of this report

The structure and content of this report is outlined in *Table 1-1*.

**Table 1-1 Structure and content of the report**

| Chapter                       | Description   |
|-------------------------------|---|
| <b>Volume 1 – Main Report</b> |   |
| <b>Chapter 1</b>              | <b>Introduction (this chapter)</b><br>Provides an overview of the proposed modification (Central Walk). Outlines the structure and content of this report.  |
| <b>Chapter 2</b>              | <b>Strategic need and justification</b><br>Provides the strategic context, explains the need for the proposed modification and identifies the objectives for the revitalisation of Central Station.   |
| <b>Chapter 3</b>              | <b>Central Walk development and alternatives</b><br>Reviews the options that were considered for the proposed modification.   |
| <b>Chapter 4</b>              | <b>Planning and assessment process</b><br>Provides information on the legislation and environmental planning instruments that would apply to the proposed modification. Outlines the steps involved in the modification assessment and approval process.                                  |
| <b>Chapter 5</b>              | <b>Stakeholder and community engagement</b><br>Provides an overview of the community consultation and stakeholder engagement processes that have been carried out for Central Walk to date. Identifies issues raised during consultation and how these have been addressed.               |
| <b>Chapter 6</b>              | <b>Modification description – operation</b><br>Identifies the physical infrastructure and built form of the proposed modification. Describes the functionality and operation of the proposed modification and its relationship to the approved project.                                   |
| <b>Chapter 7</b>              | <b>Modification description – construction</b><br>Outlines how the proposed modification is likely to be constructed and identifies the location and function of the main construction sites.   |
| <b>Chapter 8</b>              | <b>Environmental screening assessment</b><br>Provides consideration of the potential for the proposed modification to change the impacts described in the Sydney Metro City & Southwest Chatswood to Sydenham planning approval documentation and whether further assessment is required. |

| Chapter    | Description  |
|------------|--|
| Chapter 9  | <b>Construction traffic and transport</b><br>Identifies and assesses the potential changes to impacts on the existing road, public transport, pedestrian and cyclist network from the proposed modification construction activities, with a focus on station operations and customers.                         |
| Chapter 10 | <b>Operational traffic and transport</b><br>Identifies how the proposed modification would function in relation to transport interchange within and around Central Station.  |
| Chapter 11 | <b>Noise and vibration</b><br>Assesses the potential changes to construction and operational noise and vibration impacts due to the proposed modification, including surface construction, underground construction and use of operational facilities.   |
| Chapter 12 | <b>Land use and property</b><br>Assesses the potential changes to property and land use impacts due to the proposed modification including property acquisition, changes to land use and integration with surrounding land use.  |
| Chapter 13 | <b>Business impacts</b><br>Assesses the potential changes to impacts on businesses due to construction and operation of the proposed modification.   |
| Chapter 14 | <b>Non-Aboriginal heritage</b><br>Assesses the potential changes to impacts on non-Aboriginal archaeological and built heritage due to construction and operation of the proposed modification.  |
| Chapter 15 | <b>Aboriginal heritage</b><br>Assesses the potential changes to impacts on Aboriginal heritage due to construction and operation of the proposed modification.   |
| Chapter 16 | <b>Landscape character and visual amenity</b><br>Assesses the potential changes to landscape character impacts from the introduction of the proposed modification including urban design elements, and the potential changes to visual impacts due to construction and operation of the proposed modification. |
| Chapter 17 | <b>Groundwater and geology</b><br>Assesses the potential changes to impacts associated with groundwater and geology due to construction and operation of the proposed modification.  |
| Chapter 18 | <b>Contamination</b><br>Assesses the potential changes to impacts associated with contamination due to construction and operation of the proposed modification.  |
| Chapter 19 | <b>Flooding and hydrology</b><br>Assesses the potential changes to impacts associated with flooding and hydrology due to construction and operation of the proposed modification.  |
| Chapter 20 | <b>Cumulative impacts</b><br>Assesses the potential for changes to cumulative impacts with other construction projects due to the proposed modification.   |
| Chapter 21 | <b>Consolidated revised environmental mitigation measures</b><br>Provides a consolidated list of the revised mitigation measures identified in Chapters 9 to 20.   |
| Chapter 22 | <b>Justification and conclusion</b><br>Confirms the justification for the proposed modification.   |

| Chapter               | Description  |
|-----------------------|--|
| Volume 2 – Appendices |  |
| Appendix A            | <b>Secretary’s environmental assessment requirements</b><br>Provides a checklist on the proposed modification against the Secretary’s environmental assessment requirements issues for the approved Sydney Metro City & Southwest Chatswood to Sydenham.   |
| Appendix B            | <b>Revised Sydney Metro City &amp; Southwest Chatswood to Sydenham Design Guidelines</b><br>Provides revised design guidelines to incorporate new project elements as part of the proposed modification.   |
| Appendix C            | <b>Construction traffic and transport technical information</b><br>Provides technical information to support the construction traffic and transport assessment.  |
| Appendix D            | <b>Construction noise and vibration technical information</b><br>Provides technical information to support the construction noise and vibration assessment.  |
| Appendix E            | <b>Non-Aboriginal heritage technical information</b><br>Provides technical information to support the non-Aboriginal heritage assessment.  |
| Appendix F            | <b>Historical Archaeological Assessment &amp; Research Design – Central Walk Addendum</b><br>Provides an addendum to the Historical Archaeological Assessment & Research Design for the project to cover the additional area potentially impacted by the proposed modification at Central Station. |
| Appendix G            | <b>Landscape character and visual amenity technical information</b><br>Provides technical information to support the landscape character and visual amenity assessment.  |



# **STRATEGIC JUSTIFICATION AND NEED**

## CHAPTER TWO



## 2 Strategic justification and need

**This chapter outlines the strategic justification and need for the proposed modification taking into account the current challenges and opportunities within the Central Station precinct and identifies the benefits of the proposed modification.**

### 2.1 Challenges and opportunities within the Central Station precinct

#### 2.1.1 Current and future demand

Central Station is the largest railway station and transport interchange in NSW, being the only station within the Sydney rail network that connects all intercity and suburban services (with the exception of the T5 Cumberland and T6 Carlingford Lines). On a typical weekday, there are around 2,700 train services to Central Station (based on the 2014 timetable).

Central Station is also the busiest station on the Sydney Trains network, both in terms of ticket sales and barrier counts (Train Statistics 2014, Bureau of Transport Statistics). In 2014, there were a total of 5.76 million ticket sales and 195,000 barrier movements per day.

During the morning peak, Central Station is an important destination station as the transport network's main interchange hub. During the AM peak, 29 per cent of peak passenger movements transfer within Central Station, 60 per cent of passengers leave Central Station and 11 per cent enter the station for the beginning of their rail journey. Of the passengers leaving the station, 36 per cent exit to the west, 33 per cent to the north and the remaining 31 per cent to the east. These flows occur approximately in reverse in the PM peak.

The large number of interchange and passenger movements in, out and through Central is forecast to increase significantly due to the introduction of Sydney Metro and the CBD and South East Light Rail, and the general growth of public transport demand in Sydney. Based on patronage modelling carried out by Transport for NSW, the number of passengers interchanging at Central Station is expected to grow by 79 per cent between 2014 and 2026, and a further 15 per cent between 2026 and 2036.

#### 2.1.2 Customer experience

Central Station has been developed over 100 years leading to its current layout and configuration. This hinders efficient customer transfer. There are multiple level changes between each of the existing concourses, many of which no longer comply with current design standards. The only accessible route at the station that connects all platforms is via the North Concourse which is located under the suburban platforms. In addition, several of the pedestrian tunnels under the suburban platforms have been converted from back of house baggage corridors which were not originally designed for public access.

The various level changes, line-of-sight issues and dead end corridors create an inefficient pedestrian environment and a confusing way-finding outcome relying heavily on signage and active surveillance.

With the increase in passenger movements, the ability of passengers to transfer to other rail services within Central or to other transport modes connecting to Central (such as light rail or bus) has become less efficient, more confusing and more time consuming. Interchange efficiency is expected to become more critical as the number of customers using Central Station continues to grow and following the introduction of the CBD and South East Light Rail and Sydney Metro.

Without an improvement to passenger movements within the station, an increase in the number of customers using Central Station will lead to station crowding and congestion. This is likely to have potential negative impacts on customer comfort and safety along with poorer rail network performance as customers struggle to exit or enter trains, platforms and concourses, affecting train dwell times at the station.

The current configuration provides poor customer outcomes and makes day-to-day use difficult for customers in terms of navigation, legibility, accessibility and capacity. The key drivers for change for the Central Station precinct relating to poor customer experience include:

- Poor customer amenity and limited accessible vertical transport (lift and escalator) options
- Confusing wayfinding and navigation
- Lengthy travel times associated with exiting the station
- Limited and poor quality retail
- Underutilised station heritage.

Recent customer feedback has indicated that the overall amenity of Central Station is poor and any improvements to not only the functional aspect of Central (such as layout and interchange ability) but the aesthetics of the station would be supported. The customer research findings also noted that overall the historical architecture and sandstone was almost unanimously liked, but it was not felt to be well utilised or showcased.

There is also significant retail opportunity due to the passenger volumes. However, research indicates that the current mix of retail is not meeting the needs of the current customer base or attracting other customers from around the Central Station precinct. There is also an opportunity for Central Station to become a destination in its own right through conservation of its unique assets combined with new development that not only facilitates the transport function, but provides facilities that contribute to a more positive customer experience.

### 2.1.3 Integration with the surrounding area

Due to the current layout of Central Station, there is a lack of integration between the station and surrounding precincts in the Southern CBD. Increasing activity around the precinct is expected due to the proximity of key residential, retail and education developments.

The Central Station precinct is considered to be underutilised from a development perspective. *Sustainable Sydney 2030 and Central to Eveleigh Urban Transformation and Transport Strategy* highlight the significant urban transformation and property redevelopment opportunities within the Central Station precinct.

Redevelopment of Central Station's transport functionality would act as an enabler to any future wider redevelopment of the station and surrounding precinct. The draft Central District Plan (Greater Sydney Commission, 2016) identifies that an upgrade of Central Station would provide better links to nearby businesses and social areas, educational facilities and housing. The draft plan also identifies that an upgrade of Central Station would support the renewal of the Central to Eveleigh precinct, the growth of the Camperdown-Ultimo health and education precinct, and the expansion of the Sydney CBD.

## 2.2 Key benefits of the proposed modification

### 2.2.1 Customer benefits

The proposed modification would deliver additional customer benefits at Central Station to the approved project. This would be primarily associated with improved customer transfer efficiency within and between suburban and future metro services. The current layout of the station hinders customer transfer, particularly the major suburban-suburban movements. By 2036, the demand for interchange movements is expected to increase, particularly suburban-suburban and metro-suburban interchange, which is expected to account for about 75 per cent of all interchange movements at the station. The proposed modification would improve customer transfer for these key movements.

The proposed modification would also provide safer and more direct interchange from suburban and metro services to the future light rail stop on Chalmers Street through the provision of a new eastern entry and diverting passengers from the already congested north-east entry points.

#### Reduced travel time to access and transfer through Central Station

Although the approved project would provide new metro platforms and a new north-south concourse at Central Station, it would not provide improvements to travel times for customers accessing or transferring through Central Station. The proposed modification would significantly reduce travel times into, out of, and through Central Station by providing a more direct east connection. This would replace the indirect, confusing and inefficient routes via the north or south of the station.

The addition of new vertical transport (lifts and escalators) to the aboveground suburban platforms would also alleviate existing bottlenecks and reduce journey times for customers. By way of example, Table 2-1 shows the savings for the average walk time from platforms 16/17 to selected locations to the east during the AM peak hour.

**Table 2-1 Average pedestrian walk times with and without the proposed modification (2036 AM peak hour)**

| Destination                   | Average walk time from platforms 16/17 by 2036 – without Central Walk | Average walk time from platforms 16/17 by 2036 – with Central Walk | Average walk time savings |
|-------------------------------|---|--|---------------------------|
| Chalmers Street exit          | 3 minutes, 15 seconds   | 1 minute, 50 seconds   | 1 minutes, 25 seconds     |
| Light rail on Chalmers Street | 5 minutes, 0 seconds  | 3 minutes, 35 seconds  | 1 minute, 25 seconds      |

#### Reduced crowding

Crowding currently occurs at some locations within Central Station during peak periods. With passenger travel demand to the Sydney CBD forecast to increase and with new development occurring in the vicinity of Central Station, additional constraints will be placed on Central Station, particularly with regards to crowding on platforms and around vertical transport (stairs, escalators and lifts). This is likely to result in increased delays to platform and station clearance times.

Whilst the approved project would provide additional pedestrian space within Central Station through the new north-south concourse, it would not address existing or future pedestrian congestion within the station.

A key benefit of the proposed modification is a reduction in platform crowding and passenger time spent under heavily crowded platform and concourse conditions. The provision of the eastern concourse would spread the passenger load at Central Station, resulting in improvements in pedestrian Level of Service, and decreased pedestrian crowding and congestion throughout the station, particularly at key locations such as on platforms 16/17 and 20/21, at the top and base of vertical transport (stairs, escalators and lifts, and at gatelines. Further information regarding reduced congestion and crowding at Central Station due to the proposed modification is provided in Chapter 10.

### **Improved amenity and safety**

The approved project would provide amenity benefits at Central Station through new metro platforms and a new north-south concourse. The proposed modification would further improve customer amenity and safety as a result of:

- Wider and higher spaces. The new east concourse would be around 19 metres wide and four metres high (as a comparison the Devonshire Street Tunnel is six metres wide and 2.75 metres high)
- Consistent gradient. The east concourse would be at the same level as the Eastern Suburbs concourse and the future metro concourse
- Improved legibility. The eastern entry would provide more direct access to the east, and the east concourse would improve sight lines
- Personal safety. The eastern entry and east concourse would provide more open areas for pedestrian thoroughfare and improved sight lines along key pedestrian routes. The underground connection of the east concourse to the eastern entry would minimise pedestrian conflicts with other road users on Chalmers Street. Aboveground suburban platform refresh work would improve safety on the platforms by reducing platform clutter and providing a more consistent platform surface
- Improved ventilation. The east concourse would include a modern ventilation system and provide more open areas for pedestrian thoroughfare resulting in an improved underground customer environment.

### **Improved legibility and wayfinding**

The proposed modification would provide substantial improvements in legibility and wayfinding, resulting in an easy to use station for customers. This would be achieved through:

- The new east concourse extending across the aboveground suburban platforms and providing clear lines of sight
- The eastern entry providing a direct connection to the new east concourse
- Consistency of entry and exit locations on all aboveground suburban platforms
- Closure of redundant stairs and tunnels on the aboveground suburban platforms
- Fewer obstructions on the aboveground suburban platforms
- Clear signage and information boards.

### **Improved accessibility**

Currently, and for the approved project, the only accessible route to all suburban platforms is via the North Concourse and the Eastern Suburbs Concourse. The converted baggage tunnels are connected to the aboveground suburban platforms by stairs only. This results in mobility impaired customers travelling longer distances to transfer between services or to exit the station.



The approved project would improve accessibility at Central Station by providing an accessible route from the North Concourse to the metro platforms. The proposed modification would provide a new accessible route between suburban and metro services by providing a new east concourse at a consistent grade with the Eastern Suburbs concourse and the future metro concourse. This would provide substantial improvements in travel time and functionality. The existing and future (ie with the proposed modification) accessible routes through Central Station are shown on Figure 2-1 and Figure 2-2 respectively.



Figure 2-1 Existing accessible routes at Central Station

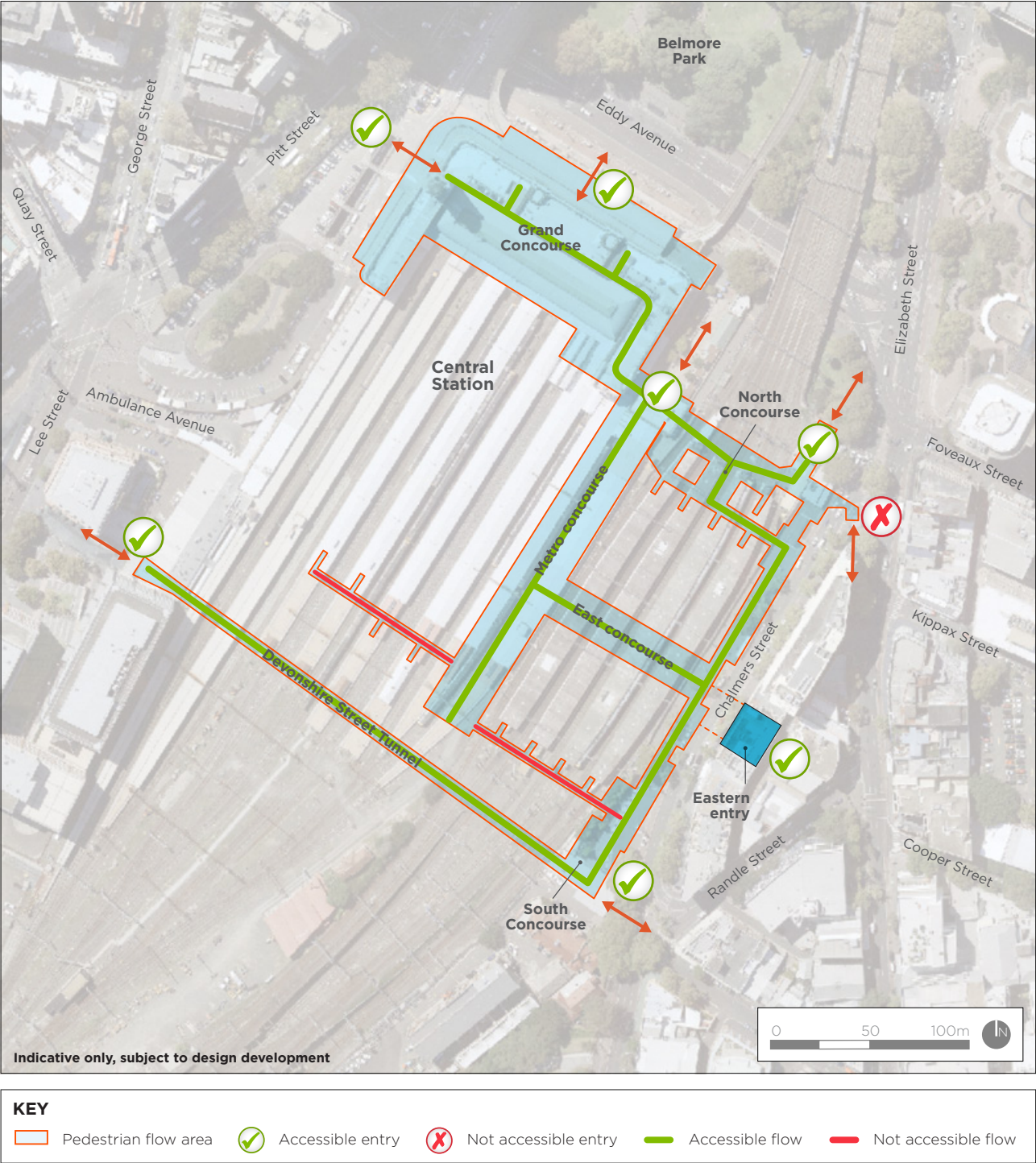


Figure 2-2 Future accessible routes at Central Station with the approved project and the proposed modification

Opportunities for retail activation

The proposed modification would provide opportunities for retail activation within and around Central Station, particularly within the areas to the east of the station. This retail activation would assist with meeting the needs of rail customers and making Central Station a destination in its own right.



## 2.2.2 Transport operations

The approved project would provide transport operation benefits at Central Station through the provision of a new metro service with direct interchange potential to other rail services. This would assist with reducing crowding on other rail services and reduce congestion on some aboveground suburban platforms at Central Station. The proposed modification would provide substantial additional reductions in crowding at Central Station. Reduced crowding at Central Station resulting from the proposed modification is expected to provide the following benefits to increase the efficiency of the transport network.

### Rail network impacts

Without the proposed modification, in the AM peak hour between 2036 and 2056 aboveground suburban platform clearance times would exceed the average headway between trains. When this occurs, delays to train services would result. With the proposed modification, aboveground suburban platform clearance times would reduce below the average headways and platforms queues would not build up to the extent that they obstruct train doors. For example:

- On Platforms 20/21, the average time between trains is around three minutes. Without the proposed modification, by 2036 platform clearance times would be up to three minutes, and by 2056 the platforms would not clear. With the proposed modification, platforms clearance times by 2036 would be around two minutes and in 2056 would be below the average headway at 2:20
- On platforms 16/17, the average time between trains is around three minutes. Without the proposed modification, by 2036, platform clearance times would be up to 2:30, and by 2056 the platforms would not clear. With the proposed modification, the maximum platforms clearance time by 2036 would be 1:45 and in 2056 would be 2:05. This would be below the average headway.

Platform clearance time for platforms 16/17 and 20/21 with and without the proposed modification are shown in Table 2-2.

**Table 2-2 Platform clearance times**

| Period      | Platform 20/21       |                   |                      | Platform 16/17       |                   |                      |
|-------------|----------------------|-------------------|----------------------|----------------------|-------------------|----------------------|
|             | Without Central Walk | With Central Walk | Saving               | Without Central Walk | With Central Walk | Saving               |
| <b>2026</b> |                      |                   |                      |                      |                   |                      |
| Average     | 1:55                 | 1:30              | 0:25                 | 1:25                 | 1:25              | 0:00                 |
| Maximum     | 2:45                 | 1:45              | 1:00                 | 2:10                 | 1:45              | 0:25                 |
| <b>2036</b> |                      |                   |                      |                      |                   |                      |
| Average     | 2:00                 | 1:25              | 0:35                 | 1:35                 | 1:30              | 0:05                 |
| Maximum     | 3:00                 | 2:05              | 0:55                 | 2:30                 | 1:45              | 0:45                 |
| <b>2056</b> |                      |                   |                      |                      |                   |                      |
| Average     | No data <sup>1</sup> | 1:45              | No data <sup>1</sup> | No data <sup>1</sup> | 1:45              | No data <sup>1</sup> |
| Maximum     | No data <sup>1</sup> | 2:20              | No data <sup>1</sup> | No data <sup>1</sup> | 2:05              | No data <sup>1</sup> |

<sup>1</sup> No platform clearance times are available for the '2056 without Central Walk' case because substantial level of crowding prevent data being extracted from the model

### Displaced rail customers

Without the proposed modification, station crowding in peak periods between 2036 and 2056 would block train doors on the aboveground suburban platforms preventing arriving customers from exiting the train and preventing people from moving out of the station. This would result in some passengers being displaced to travel at a different time, by a different mode, or choosing not to travel at all. The proposed modification would reduce this level of station crowding, and accommodate more rail trips when customers want to travel.

### 2.2.3 Place making benefits

The proposed modification would be the first step in revitalising the Central Station precinct, aimed at improving the transport functionality of the station. The amenity and transport benefits would improve the quality of the environment in the immediate vicinity of the station and make the precinct to the east more attractive for redevelopment and renewal. The design and delivery of the proposed modification would also allow for a new western entry through the extension of the underground concourse to the west of the metro platforms, which could enable further precinct renewal and revitalisation opportunities.

### 2.2.4 Delivery benefits

The concurrent construction of the proposed modification and the approved project at Central Station would deliver the following benefits:

- Avoid an additional six years of disruption to Central Station customers, which would make it more difficult to navigate through a poorer quality pedestrian environment
- Avoid duplication of works such as services relocation
- Provide construction efficiencies by sharing construction access points and construction compounds, concurrent works during rail possessions and alternate station operation arrangements
- Reduce overall capital costs (such as avoiding duplication of pedestrian access, temporary transport arrangements to support additional rail possessions, and project management costs).

## 2.3 Central Station objectives

The proposed modification would assist in meeting the objectives of the approved project. In addition, due to the unique nature of Central Station as a key transport interchange and its State heritage listing, Transport for NSW have developed specific objectives for the revitalisation of the Central Station precinct. As a result, the development of the Sydney Metro works at Central Station, including the proposed modification, are also considering these objectives.

The objectives to support Transport for NSW's vision for the Central Station precinct are:

- Provide an intuitive and easy to use station environment for customers
- Accentuate Central Station as a grand heritage asset
- Re-establish Central as an iconic destination within an expanded CBD footprint
- Develop a highly functional multi-modal transport interchange that accommodates long-term demand
- Improve accessibility, permeability and connectivity within and across the station precinct
- Unlock opportunities and stimulate economic activity in and around Central

- Improve the relationship to Belmore Park, Haymarket, Darling Harbour, Central Park, Broadway and Surry Hills by delivering an integrated urban outcome
- Provide an enduring and sustainable legacy.

The proposed modification would primarily support the objectives regarding the efficient operation of the station, while being an essential enabler for the broader revitalisation of the precinct.

These objectives are:

- Provide an intuitive and easy to use station environment for customers
- Develop a highly functional multi-modal transport interchange that accommodates long-term demand
- Improve accessibility, permeability and connectivity within and across the station precinct.

The remaining objectives regarding place making, integration of the station to the surrounding precinct and stimulating economic activity in and around Central Station would be met by broader precinct renewal and revitalisation works. The successful implementation of the renewal and revitalisation of the broader precinct cannot be achieved without the delivery of the proposed modification to improve to station functionality and efficient operations.

In addition to the objectives for the precinct, the following delivery objectives have been identified as specific to the Sydney Metro works at Central Station including the proposed modification:

- Implement a reasonable and feasible solution within timing constraints that considers approval and delivery risks
- Implement a reasonable and feasible solution that considers environmental and heritage impacts
- Maintain acceptable customer amenity and connectivity and transport operations during construction.

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# **CENTRAL WALK DEVELOPMENT AND ALTERNATIVES**

## CHAPTER THREE



## 3 Central Walk development and alternatives

This chapter describes the options evaluation process used to determine the preferred option for each element of the proposed modification.

### 3.1 Overview of options analysis process

As identified in Chapter 2, Transport for NSW have developed specific objectives for the revitalisation of the Central Station precinct due to the unique nature of Central Station as a key transport interchange and its State heritage listing. To fulfil the desire for the various stages of the revitalisation of Central Station to be considered holistically and provide a coherent design solution, the options analysis for each element of the proposed modification has been considered against the specific objectives for the revitalisation of Central Station. The specific delivery objectives developed for the proposed modification have also been considered.

### 3.2 Options for the east connection

A number of options for the east connection were identified:

- Minor upgrades to existing tunnels
- Pedestrian overbridge
- Connection of the metro concourse to the Devonshire Street Tunnel
- New east concourse.

These options are described below.

#### 3.2.1 Minor upgrades to existing tunnels

The minor upgrades to the existing tunnels would involve improvements to customer amenity through a refresh of the existing tunnels and improvements to wayfinding signage. This option would be cost effective to construct and could be completed in a short space of time; however this option would not address capacity, wayfinding and navigation challenges.

This option would also not improve accessibility, permeability and connectivity between suburban and metro services within the station; and would not provide interchange connectivity to light rail on Chalmers Street. As a result, this option has not been progressed.

#### 3.2.2 Pedestrian overbridge

This option would involve a pedestrian overbridge spanning over the aboveground suburban platforms and connecting to Chalmers Street. Lifts and escalators would be provided in addition to stairs to connect to the street level and platforms. The overbridge would be covered to provide weather protection.

A pedestrian overbridge would be cost effective to construct and could be constructed in a relatively short period of time when compared to the proposed east concourse option. A new overbridge would enable the existing pedestrian tunnel system to be maintained for increased capacity. However, this option would not address existing wayfinding and navigation challenges.

A permanent pedestrian overbridge option would not improve accessibility, permeability and connectivity within and across the station precinct. The overbridge would not provide a direct connection to the new metro platforms or T4 Eastern Suburbs Line concourses, limiting efficient interchange within the station.

The physical structure required to support an overbridge would also significantly impact already cluttered aboveground suburban platforms and remove existing platform space, resulting in additional passenger crowding issues. The provision of a new overbridge would also have the potential to detract from the heritage significance of Central Station and fundamentally change the fabric of the station.

This option has not been progressed as it would result in:

- Compromised customer experience
- No direct connection to the metro concourse
- Limited future capacity
- Significant heritage impacts.

### **3.2.3 Connection to the Devonshire Street Tunnel**

This option would involve a direct connection from the new metro concourse into the Devonshire Street Tunnel. This would enable passengers to access the tunnel directly and move in either an east or west direction without having to go through the southeast gate line.

However the existing Devonshire Street Tunnel currently has a low head height (2.7 metres), narrow width (5.4 metres), and lack of natural light. Pedestrian modelling indicates that the tunnel width would need to be expanded substantially to meet anticipated future capacity requirements. Widening the tunnel would require a cut and cover construction method and due to the insufficient space between the top of the tunnel and the track formation above, this would necessitate the progressive shut down of all suburban train lines. This would result in a lengthy process over several years with the tunnel closed to pedestrians during that time.

Although this option would provide an additional benefit of passengers being able to travel to both the east and the west, this option would not benefit passengers wishing to interchange between the suburban and the future metro platforms. Passengers would be required to use the existing pedestrian tunnels within the station, which would not address the existing wayfinding and navigation challenges, and capacity constraints.

Due to the technical complexities and limited customer benefit, this option has not been progressed.

### **3.2.4 New east concourse**

This option would involve a new east concourse underneath the existing aboveground suburban platforms connecting to the future metro concourse, the aboveground suburban platforms, the Eastern Suburbs concourse and the new eastern entry.

The new east concourse would represent a step change in the way customers would access and circulate through Central Station, and connect to the eastern precinct. It would significantly improve interchange for suburban and metro customers making it more efficient and direct and eliminating the need for multiple level changes. A new entrance on the eastern side of the station would provide a direct connection to the new light rail stop on Chalmers Street and act as a major interchange point.

A new east concourse could also be extended in the future to the west of the metro platforms, to meet future capacity requirements and further enable precinct revitalisation.

The new east concourse and associated eastern entry would best meet the objectives and therefore has been taken forward as the preferred option.



### 3.2.5 Performance of east connection options

Table 3-1 provides a summary of the east connection options against the relevant objectives.

**Table 3-1 Performance of east connection options against the objectives**

| Objective   | Minor upgrades to existing tunnels | Pedestrian overbridge | Devonshire Street Tunnel | Devonshire Street Tunnel with widening | East concourse |
|---|------------------------------------|-----------------------|--------------------------|--|----------------|
| Provide an intuitive and easy to use station environment for customers  | ■                                  | ●                     | ■                        | ●                                      | ○              |
| Develop a highly functional multi-modal transport interchange that accommodates long term demand                  | ■                                  | ●                     | ■                        | ■                                      | ○              |
| Improve accessibility, permeability and connectivity within and across the station precinct                       | ■                                  | ●                     | ■                        | ●                                      | ○              |
| Implement a reasonable and feasible solution within timing constraints that considers approval and delivery risks | ○                                  | ○                     | ○                        | ■                                      | ○              |
| Implement a reasonable and feasible solution that considers environmental and heritage impacts                    | ○                                  | ■                     | ○                        | ●                                      | ○              |
| Maintain an acceptable customer amenity and connectivity and transport operations during construction             | ○                                  | ○                     | ○                        | ■                                      | ○              |

■ Does not support the objective      ○ Moderate support for objective  
 ● Low support for objective      ○ Strong support for objective

The new east concourse option had support for the objective relating to timing constraints due to the duration of works required for construction. However, the concurrent construction of the proposed modification and the approved project reduce overall construction timeframes at Central Station. Additionally, the options which strongly supported this objective would not deliver the transport improvements necessary at Central Station. Overall, the new east concourse best aligns with the objectives for Central Station as it would provide a new east connection at a consistent grade making it easy to use. The new east concourse when combined with the new eastern entry would improve legibility and connect well with other transport modes particularly light rail, when compared with the other options. The east concourse option would also provide additional capacity to meet future customer demands.

The pedestrian overbridge option rated well in terms of construction impacts as there would be a reduced construction timeframe when compared with the east concourse and the existing tunnels could be used for customer access. However, this option was discounted as a new aboveground structure could preclude broader precinct renewal works and would dramatically alter the heritage setting and adversely affect the heritage values of the station. The change in levels for customers to travel up to the pedestrian overbridge and down to the platforms was also not considered to be a positive access outcome. This option would also not provide a direct link to the Sydney Metro concourse.

Neither of the Devonshire Street Tunnel options or the option of upgrading existing tunnels would achieve the transport and access objectives (as they only provided a connection to the Sydney Metro concourse and not the aboveground suburban platforms, and they would not resolve existing aboveground suburban platform crowding issues). These options would not meet the longer term demands of Central Station.

When compared with the other options, the east concourse would best meet the objectives, and has therefore been taken forward as the preferred option.

## 3.3 Options for the east concourse

### 3.3.1 Concourse alignment

A high-level assessment of alignment options for the new east concourse was carried out. In summary, the optimum location for the alignment of the concourse was determined to be around the centre of the aboveground suburban platforms. This would allow for a more efficient distribution of customers across the aboveground suburban platforms (compared to the current arrangement with the stairs located primarily at either end of the platforms), and would place the footprint of the concourse within the widest section of the aboveground suburban platforms, maximising waiting space at platform level and allowing efficient passenger circulation.

### 3.3.2 East concourse construction approach

A key challenge of the construction of the east concourse is to minimise heritage impacts, maintain rail operations and minimise disruptions for customers. A shortlist of options of different construction approaches was developed:

- **Mined construction:** involves excavating part of the platform down to the new concourse level. The excavation at platform level would be in the final location of the vertical transport and the openings in the platforms would then be used as the starting points for mining underneath the rail track
- **Cut-and-cover construction:** involves the removal of tracks between two platforms and the installation of a steel deck. The tracks would be reinstated and the steel deck would act as a bridge to enable the material below to be excavated while maintaining rail operations. The platforms would be excavated down to the required concourse depth to allow the removal of the material from underneath the track. Once the new concourse has been formed, the steel deck would be removed. This process would be repeated between each set of island platforms
- **Hybrid construction:** involves a combination of and cut-and-cover and mined construction methods. The tracks and associated platforms would be excavated and structural supports and roof slabs constructed. The tracks and platforms would then be reinstated and the material underneath mined to form the concourse.

The relative height of the aboveground suburban platforms to the top of the proposed east concourse provides adequate space to support a mined construction option. This approach would minimise heritage impacts on the aboveground suburban platforms and remove the need for a large number of extended rail possessions affecting suburban train services. Therefore, the mined construction option has been progressed into further development for the east concourse.

## 3.4 Eastern entry options

A number of options for the provision of an eastern entry were identified as shown in Figure 3-1:

- Option 1: Upgrade existing entrances at Chalmers Street and Devonshire Street
- Option 2: New pavilion entry in Chalmers Street
- Option 3: New entry on Bounce Hostel site with entry on Chalmers Street (with potential connection to other surrounding streets).

The location of options on Chalmers Street was based on the need to provide an entry which closely aligns to the plane of the east concourse (based on providing the optimum transport interchange outcome). The use of other locations on Chalmers Street (other than the Bounce Hostel) would have resulted in customers needing to change direction underground and creating potential customer congestion points. As such, other locations were not considered to be feasible options.

The options were assessed against the relevant objectives as summarised in Table 3-2.

**Table 3-2 Performance of eastern entry options against the objectives**

| Objective   | Option 1 | Option 2 | Option 3 |
|---|----------|----------|----------|
| Provide an intuitive and easy to use station environment for customers  | ■        | ○        | ○        |
| Develop a highly functional multi-modal transport interchange that accommodates long term demand                  | ■        | ■        | ○        |
| Improve accessibility, permeability and connectivity within and across the station precinct                       | ■        | ○        | ○        |
| Implement a reasonable and feasible solution within timing constraints that considers approval and delivery risks | ○        | ■        | ○        |
| Implement a reasonable and feasible solution that considers environmental and heritage impacts                    | ○        | ○        | ●        |
| Maintain an acceptable customer amenity and connectivity and transport operations during construction             | ○        | ●        | ○        |

Does not support the objective
  Moderate support for objective
  Low support for objective
  Strong support for objective

Option 1 did not perform well against the objectives, particularly in relation to providing a highly functional multi-modal transport interchange (poor connection with light rail) and an intuitive and easy to use station environment. This option would also not accommodate long term demand.

Option 2 was not progressed as there would be insufficient space to accommodate a new entry due to the construction and operation of light rail. In addition it did not support the objective of a highly functional multi-modal transport interchange.

Option 3 did not perform as strongly as option 1 or 2 against the objective of implementing a reasonable and feasible solution that considers environmental and heritage impacts (as it would directly impact a local heritage item). However, options 1 and 2 did not support the transport objectives and would not deliver the transport benefits required at Central Station. Option 3 generally aligned and supported the objectives with strong support for providing an intuitive and easy to use station environment, a highly functional multi-modal transport interchange and maintaining acceptable customer amenity during construction. This option would also allow future enhancements and connections to be considered in the future as part of broader precinct renewal.



Figure 3-1 Options considered for the eastern entry

## 3.5 Consideration of options during design development

### 3.5.1 Ancillary works

The proposed modification provides the opportunity to carry out other works at Central Station concurrently, including aboveground suburban platform refresh and aboveground suburban platform re-levelling. In determining whether to carry out these works, a 'do-nothing' scenario was considered against a scenario where the works are completed.

#### **Aboveground suburban platform refresh**

Platform refresh works would improve the customer environment by upgrading finishes and provide increased pedestrian waiting space by removing clutter and underused buildings from the aboveground suburban platforms. In contrast, the do-nothing option would not provide improvements to the customer environment on the aboveground suburban platforms and would result in increasing customer congestion on the aboveground suburban platforms. As a result, it was determined to proceed with the aboveground suburban platform refresh works.

#### **Aboveground suburban platform re-levelling**

The existing aboveground suburban platforms at Central Station do not provide level access to the suburban trains at all locations. Currently, the vertical gap between the platform and trains range from around 20 millimetres to greater than 120 millimetres depending on the platform. Aboveground suburban platform re-levelling would raise the height of the platforms to provide a consistent finish and provide accessibility improvements. The work would also slope the aboveground suburban platforms, where possible, to the centre providing improvements to drainage and customer safety.

The do-nothing option would not address the current vertical gap differences and would not provide accessibility and safety improvements. As such, it was determined to proceed with the aboveground suburban platform re-levelling works where significant structural works would not be required to achieve a consistent height.

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# **PLANNING AND ASSESSMENT PROCESS**

CHAPTER FOUR





## 4 Planning and assessment process

This chapter describes the statutory planning process for the proposed modification.

### 4.1 NSW environmental planning approvals

Sydney Metro City & Southwest was declared by Ministerial Order on 10 December 2015 to be State significant infrastructure and critical State significant infrastructure. The assessment and approval process for a critical State significant infrastructure project is established under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). An Environmental Impact Statement for the Chatswood to Sydenham component of Sydney Metro City & Southwest was prepared and exhibited for 48 days from 11 May to 27 June 2016. A subsequent Submissions and Preferred Infrastructure Report was prepared and submitted to the Department of Planning and Environment in October 2016. Planning approval was granted by the Minister for Planning under Part 5.1 of the EP&A Act on 9 January 2017.

Pursuant to section 115ZI of the EP&A Act, Transport for NSW is seeking to modify the State significant infrastructure approval to include Central Walk.

Appendix A provides consideration of the Secretary's environmental assessment requirements issued for the Environmental Impact Statement for Sydney Metro City & Southwest Chatswood to Sydenham, including the relevance of each assessment requirement to the proposed modification and, for the relevant requirements, where they have been addressed in this report.

### 4.2 NSW legislation that may still be applicable

The Environmental Impact Statement for the approved project considered other NSW legislation that may be applicable to the project. Table 4-1 provides further consideration of this legislation in relation to the proposed modification.

Table 4-1 Environmental related legislation of potential relevance to the proposed modification

| Legislation                                  | Requirement   | Where addressed   |
|--|---|---|
| <i>Aboriginal Land Rights Act 1983</i>       | The <i>NSW Aboriginal Land Rights Act 1983</i> applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land. No claimable Crown lands would be affected by the proposed modification.           | Aboriginal heritage impacts are assessed in Chapter 15<br>Property impacts are assessed in Chapter 12 |
| <i>Contaminated Land Management Act 1997</i> | This Act outlines the circumstances in which notification of the Environment Protection Authority (EPA) is required in relation to the contamination of land. This may become relevant during construction and / or operation of the proposed modification. | Chapter 18  |
| <i>Crowns Lands Act 1989</i>                 | Ministerial approval is required to grant a 'relevant interest' (ie a lease, licence, permit, easement or right of way) over a Crown Reserve if required. The proposed modification would not be carried out on Crown land.                                 | Chapter 12  |

| Legislation  | Requirement  | Where addressed  |
|--|--|--|
| <i>Greater Sydney Commission Act 2015</i>                  | <p>This Act establishes the Greater Sydney Commission which has a principal objective of leading metropolitan planning for the Greater Sydney Region.</p> <p>The core functions of the Greater Sydney Commission are to provide advice to Government and assist local Councils plans or proposals relating to development in the Greater Sydney Region.</p> <p>The Greater Sydney Commission would not have a formal statutory role for the proposed modification but would be consulted with respect to its core functions.</p> | Chapter 12   |
| <i>Heritage Act 1977 (Section 146)</i>                     | The Heritage Council must be notified of a relic that is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic.   | Chapter 14   |
| <i>Land Acquisition (Just Terms Compensation) Act 1991</i> | This Act would apply to the acquisition of land required for the proposed modification. However, provisions of the <i>Transport Administration Act 1988</i> have the effect that for underground stratum acquisition compensation is not payable except in certain circumstances.  | Chapter 12   |
| <i>Native Title (New South Wales) Act 1994</i>             | This Act provides for native title in relation to land or waters. Central Walk would not affect land subject to native title or to which an Indigenous Land Use Agreement applies.   | <p>Aboriginal heritage impacts are assessed in Chapter 15</p> <p>Property impacts are assessed in Chapter 12</p> |
| <i>Water Management Act 2000</i>                           | The <i>NSW Aquifer Interference Policy</i> (Department of Primary Industries, 2012) documents the NSW Government's intention to implement the requirement for approval of 'aquifer interference activities' under the <i>Water Management Act 2000</i> . The requirement for aquifer interference approvals has not yet commenced.   | Chapter 17   |

## 4.3 Commonwealth legislation

### 4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas.

The Environmental Impact Statement for the approved project did not identify any impacts to matters of national environmental significance. As such, the project was not referred to the Commonwealth Department of the Environment.

With respect to matters of national environmental significance, the assessment carried out for the proposed modification did not identify any changes to the impacts as assessed for the approved project. That is, the assessment for the proposed modification did not identify any potential impacts to matters of national environmental significance. Similarly, the proposed modification would not involve any actions on Commonwealth land. As such, a referral to the Commonwealth Department of the Environment for the proposed modification is not considered necessary.

### 4.3.2 Native Title Act 1993

The main objective of the *Commonwealth Native Title Act 1993* is to recognise and protect native title. Section 8 states that the *Native Title Act* is not intended to affect the operation of any law of a State or a Territory that is capable of operating concurrently with the Act. Searches of the register maintained by the National Native Title Tribunal indicate there are no native title claims registered with respect to land within the area of the proposed modification. The proposed modification would not directly affect any Crown land that is currently the subject of a native title claim.

### 4.3.3 Disability Discrimination Act 1992

The *Disability Discrimination Act 1992* aims to eliminate as far as possible discrimination against persons on the ground of disability in areas including access to premises and the provision of facilities, services and land. The proposed new east concourses and associated eastern entry would be designed to be independently accessible and in compliance with the objectives and requirements of the *Disability Discrimination Act 1992*.

### 4.3.4 Disability Standards for Accessible Public Transport 2002

Section 33.1 of the *Disability Standards for Accessible Public Transport 2002* requires all new public transport premises, infrastructure and conveyances to be compliant with the requirements of the standard and referenced to the Australian Standards and Design Rules therein, unless unjustifiable hardship is incurred by implementation. The proposed modification would be designed to be compliant with the requirements of the *Disability Standards for Accessible Public Transport 2002*.

### 4.3.5 Copyright Act 1968

Section 195AT of the *Copyright Act 1968* deems certain treatment of copyright works not to constitute an infringement of the author's (ie the architect's) right of integrity. With respect to the demolition of a building, an architect's right of integrity will not be infringed if, when wishing to demolish a building, the architect is provided with a written notice of such intentions and is provided access to make a record of the artistic work and consult in good faith. Notification would be provided in accordance with these legislative requirements.

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# **STAKEHOLDER AND COMMUNITY ENGAGEMENT**

CHAPTER FIVE



# 5 Stakeholder and community engagement

**This chapter provides an outline of the consultation carried out for Central Walk and how this has influenced the development of Central Walk. It identifies who has been consulted, how the consultation was carried out, the issues raised and how those issues have been addressed.**

## 5.1 Overview

Engagement with the community and stakeholders on issues relating to broader Central Station revitalisation began in June 2014, with early engagement around Sydney Metro City & Southwest and the new underground platforms as part of the approved project.

In September 2016, the NSW Government announced the opportunity to rejuvenate Central Station, putting it on par with some of the grand stations of the world. With work now commenced on a new light rail stop and new underground Sydney Metro platforms, reimagining Central Station will enable Central Station to best realise its iconic place in Sydney's history and future. On 22 March 2017, the Premier of NSW and the Minister for Transport and Infrastructure announced Central Walk as the first step in revitalising Central Station.

Transport for NSW and project teams from Sydney Metro City & Southwest and CBD and South East Light Rail are working together to ensure the designs for the new metro rail and light rail stops provide easy interchange with the existing rail network.

Engagement and consultation has continued during the planning approval process for Central Walk. If approved, consultation would continue throughout the construction period of the project.

Key stakeholders include (but are not necessarily limited to):

- State agencies
- City of Sydney Council
- Public utilities, business and industry groups near the project
- Central Station customers
- Directly impacted stakeholders
- Directly impacted communities and businesses
- The broader community.

This chapter provides an overview of the consultation activities carried out to date. Consultation activities during construction would be consistent with approach for the approved project.

## 5.2 Consultation to date

### 5.2.1 Reimagining Central Station Precinct – Have your say

On 15 September 2016, the NSW Government announced the opportunity to reimagine Central Station. The announcement initiated a round of community, stakeholder and industry consultation on the revitalisation of Central Station.

This consultation was not a statutory process, but was carried out to collect public feedback on ideas to revitalise inside and around Central, and also engage industry through an extensive consultation program.

#### Community consultation

Following the announcement, Transport for NSW mobilised teams at Central Station to engage with shop keepers and customers including:

- Doorknocks with shop keepers on 15 and 16 September 2016
- Online survey and discussion forum on the 'Have you Say' website
- Face to face intercept surveys at Central Station with over 150 customers
- 6,000 *Reimagining Central Station Precinct* newsletters distributed to customers at Central Station on 23 and 26 September 2016.

#### Public information

Table 5-1 identifies the activities that were used to provide information to the community and stakeholders and receive feedback.

**Table 5-1 Reimagining Central Station Precinct community contact and feedback points**

| Activity                   | Date              | Detail                           |
|----------------------------|-------------------|----------------------------------|
| Media release              | 15 September 2016 | 'Revitalising Central Station'   |
| Community Information Line | Existing          | 1800 684 490                     |
| Community email address    | Existing          | projects@transport.nsw.gov.au    |
| Have you Say website       | 15 September 2016 | www.yoursay.transport.nsw.gov.au |

#### Online discussion forum and surveys

The Have Your Say website included two components for compiling community feedback, a discussion forum and a survey.

The forum prompted discussion by asking the following questions:

- How can we improve connections within the station and to the surrounding neighbourhood?
  - ◆ In addition to being a major transport hub, Central Station sits at the heart of a busy area that includes parks, residential, commercial, retail and educational institutions.
  - ◆ What improvements to connections to the surrounding precinct do you think are required?
  - ◆ Are there new connections needed?
  - ◆ What are your priorities for improving connectivity both within the station and to the nearby areas?



- What would a world-class transport hub look like?
  - ◆ Consider the features and benefits you'd like to see from a future Central Station and precinct.
- What do you value about the existing Central Station and precinct?
  - ◆ Customers and the community have shared with us some of the things they value about the current station.
  - ◆ What do you value?
  - ◆ How can we ensure that the things you value about the station are retained or enhanced in the future?
- Can you suggest any national or international examples of great connectivity, innovation, community and integration that we should consider?
  - ◆ Have you visited other transport hubs and seen something you liked?  
Or have you seen examples in books or on television?
  - ◆ What was it about the international example that you liked? How can we integrate the lessons from other projects in to planning for Central Station Precinct?
- What facilities can we add to Central Station Precinct to create a unique place?
  - ◆ Consider the themes of connectivity, community, innovation and integration.
- How can we get better use from our existing assets at Central Station precinct?
- What is most important to you in planning the future for central Station precinct?
- What needs are most important to you and least important?
  - ◆ What are your priorities for the future of Central Station Precinct?  
Consider the themes of connectivity, innovation, community and integration.

The online survey asked the following questions:

- What you like about Central Station – transport
  - ◆ Thinking about how you experience Central Station as a transport hub, what are three things that you like or think currently work well?
- What you'd like to see improved at Central Station – transport
  - ◆ Thinking of how you experience Central Station as a transport hub, what are three things that you don't like or think could be improved?
- More than a transport hub
  - ◆ In addition to the core transport customer requirements, Central Station Precinct has the potential to be a destination itself for domestic and international travellers. Customers have told us they'd like to build on the central function of transport operations, breathing new life into public spaces and unlocking the building's potential.
  - ◆ What are three things you think we should do to make Central Station a more attractive and useful public space?

- Where have other cities done this well?
  - ◆ Have you seen any great examples of other cities around the world that have renewed transport hubs, heritage buildings or public spaces that you think we can learn from?
  - ◆ Tell us about other cities that have done a great job at revitalising major transport hubs? What did you like and what are the lessons for Sydney?

### Face to face intercept surveys

Face to face intercept surveys were conducted with customers at Central Station and asked the following questions:

- Thinking of how you experience Central Station as a transport hub, what are three things that you like or think currently work well?
- Thinking of how you experience Central Station as a transport hub, what are three things that you don't like or think could be improved?
- As well as being a transport hub, Central Station also has retail outlets, provides links to nearby residential and business areas and a park. It is also a historical landmark and a gateway for visitors. If Central was to be revitalised, what do you think are three things we should do to make it a more attractive and useful public space?
- Have you seen any great example of other places around the world that have renewed transport hubs, heritage buildings or public spaces that you think we could learn from?
- Is there anything else you'd like to share with us about Central Station?

### Industry consultation

Transport for NSW has sought industry's thoughts on how to make Central Station a world-class transport hub and help to revitalise the southern CBD. The Reimagining Central Station and Sydney Metro teams will continue to work together to brief industry on the scope of all projects and the process for industry to contribute to the projects and take part in their delivery.

## 5.2.2 Announcement of Central Walk

On 22 March 2017, the NSW Government announced Central Walk as the first step in revitalising Central Station which initiated further stakeholder and industry consultation.

### Public information

Table 5-2 identifies the activities that were used to provide information to the community and stakeholders and receive feedback.

**Table 5-2 Central Walk announcement community contact and feedback points**

| Activity                    | Date          | Detail   |
|-----------------------------|---------------|--|
| Media release               | 22 March 2017 | 'Central walk to revitalise an icon'   |
| Community Information Line  | Existing      | 1800 171 386   |
| Community email address     | Existing      | <a href="mailto:sydneymetro@transport.nsw.gov.au">sydneymetro@transport.nsw.gov.au</a> |
| Sydney Metro website        | Existing      | <a href="http://www.sydneymetro.info">www.sydneymetro.info</a>                         |
| Project overview fact sheet | 22 March 2017 | Available on the Sydney Metro website  |
| Project overview video      | 22 March 2017 | Available on the Sydney Metro website and Facebook page                                |

## Stakeholder consultation

At the time of the announcement, contact was made with a range of stakeholders via meetings, presentations and phone calls. The meetings were designed to enable stakeholders to be adequately briefed on Central Walk and encourage feedback.

### 5.2.3 Additional community consultation

A number of avenues of consultation were available during the preparation of the modification report to collect feedback from the community and to further inform the investigations being carried out for Central Walk. Key elements of this consultation are outlined below.

#### Place Managers

The Sydney Metro City & Southwest Place Manager for the Central Station area continued their role as a vital link in maintaining close and ongoing contact with local communities and stakeholders during preparation of the modification report, including those stakeholders affected by property acquisition or those neighbouring future construction sites. They sought to understand local issues and bring this feedback to the project team.

#### Community contact and information

The community contact and information tools established for Sydney Metro City & Southwest as outlined in Table 5-3 were available during the planning and approval process.

**Table 5-3 Community contact and information points available during the planning and approval process**

| Activity                               | Detail   |
|--|--|
| Community Information Line (toll free) | 1800 171 386   |
| Community email address                | <a href="mailto:sydneymetro@transport.nsw.gov.au">sydneymetro@transport.nsw.gov.au</a> |
| Website                                | <a href="http://www.sydneymetro.info">www.sydneymetro.info</a>                         |
| Postal address                         | Sydney Metro City & Southwest<br>PO Box K659, Haymarket, NSW 1240                      |
| Place Manager                          | Central  |

### 5.2.4 Stakeholder consultation

Transport for NSW's stakeholder consultation team have enabled local, state and federal elected representatives, peak bodies, business, professional and industry groups, major institutions, hotels and retail, and other transport operators to be informed about Central Walk via meetings, presentations and phone calls.

The meetings were designed to enable stakeholders to be adequately briefed on Central Walk; to enable issues and concerns to be understood, captured and addressed in the planning process; and to receive feedback.

### 5.2.5 Government agency consultation

Ongoing consultation has been carried out with specific groups to inform technical assessments, including regular meetings with:

- **Sydney Metro Roads Integration Working Group:** This group was consulted on the traffic and transport assessment methodology, the potential impacts and management strategies. The group includes Transport Coordination (formerly known as CBD/Sydney Coordination Office) and Roads and Maritime Services
- **Heritage Working Group:** This group was consulted on the non-Aboriginal heritage assessments method, the potential impacts and management strategies. The group includes heritage specialists and representatives from the Department of Planning and Environment, Transport for NSW, Sydney Trains Environment, and Office of Environment and Heritage.

Transport for NSW's government agency consultation focussed on cross-agency integration and communication. Regular meetings were held with a variety of government stakeholders to ensure key issues were appropriately addressed, including (but not limited to):

- Transport Coordination
- Sydney Light Rail
- City of Sydney Council
- Department of Planning and Environment
- Environment Protection Authority
- Heritage Council of NSW
- Greater Sydney Commission
- Department of Premier and Cabinet
- Infrastructure NSW
- NSW Trains
- Office of Environment and Heritage
- Roads and Maritime Services
- Sydney Trains
- UrbanGrowth NSW.

## 5.3 Feedback

Sydney Metro and the underground platforms at Central Station were heavily supported during consultation for the approved project.

Feedback received from the community during the Reimagining Central Station Precinct consultation was reported in the *Reimagining Central Station Precinct: Engagement Program Outcomes Report* (Transport for NSW, 2017). This feedback identified three emerging patterns, being:

- A need for better connections across the station (east to west), and underground connections to other precincts – including information, wayfinding, and circulation and flow around the station
- Food and retail – a one stop shop – catering to people's needs including cafes, green areas, childcare, play areas, medical facilities and supermarkets
- Homelessness – within and around Central Station.

In addition, there was a focus on architecture and heritage with a desire to retain the historical façade and to revitalise the interior without compromising the original features of the station.

A more detailed summary of the issues raised and the project response is provided in Table 5-4.

**Table 5-4 Response to community feedback received**

| Feedback received  | Project response   |
|--|--|
| <b>Positive aspects about the current Central Station</b>  |  |
| <ul style="list-style-type: none"> <li>○ Multiple entry and egress points to assist customers in transit</li> <li>○ Underground pathways and large concourses</li> <li>○ Good connectivity and access:               <ul style="list-style-type: none"> <li>◆ To other transport modes and services, particularly to light rail</li> <li>◆ To frequent services to the Sydney CBD, other Sydney suburbs and NSW destinations.</li> </ul> </li> </ul>   | <p>Overall, Central Walk seeks to reinforce and improve connections within and around Central Station. Through the introduction of a new eastern entry, Central Station would be better connected to surrounding transport services and destinations to the east. In particular, Central Walk would improve pedestrian connections to transport services on Chalmers Street, including CBD and South East Light Rail.</p> <p>The proposed east concourse would simplify and support the underground pedestrian network within Central Station. The concourse would provide a large new underground pedestrian connection with direct east access to the suburban and metro platforms and the new eastern entry.</p>  |
| <b>Accessibility and connectivity within Central Station</b>   |  |
| <ul style="list-style-type: none"> <li>○ Improved wayfinding and signage</li> <li>○ Better connectivity between intercity and aboveground suburban platforms with reduced walking distances</li> <li>○ Upgrade of underground pedestrian concourses to simplify, open out station layout and make journeys more direct</li> <li>○ New east-west pedestrian concourse to reduce pressure on Devonshire Street Tunnel and connect all intercity and aboveground suburban platforms</li> <li>○ Better access to platforms, including more stairs and vertical transport options (lifts and escalators) along the length of the platforms</li> <li>○ Separate pedestrian flows in peak periods to enable access in the contra-flow direction.</li> </ul> | <p>The east concourse would provide connections across the station between suburban and metro services and help simplify pedestrian movements during interchange. The concourse would be designed as a large open area to maximise pedestrian movement and incorporate appropriate wayfinding and signage.</p> <p>The concourse would connect to suburban and future metro platforms using new vertical transport, including lifts and escalators.</p> <p>The location of the east concourse would reduce pressure on existing aboveground suburban platform stairs and vertical transport by better distributing pedestrian movements across the platforms.</p> <p>The design and delivery of Central Walk would safe guard a future extension of the underground concourse to the west of the metro platforms and the creation of a new western entry.</p> |

| Feedback received   | Project response   |
|---|--|
| <b>Accessibility and connectivity around Central Station</b>  |  |
| <ul style="list-style-type: none"> <li>○ New pedestrian connections to:               <ul style="list-style-type: none"> <li>◆ Bypass major road crossings to improve pedestrian safety</li> <li>◆ Improve connectivity with other transport modes</li> <li>◆ Better connect Central Station with surrounding destinations and suburbs</li> </ul> </li> <li>○ Wider station entrances with improved visibility</li> <li>○ Introduction of wide open pedestrian areas and plazas to create a sense of space around Central Station.</li> </ul> | <p>The eastern entry and east concourse would provide a direct underground pedestrian connection to the eastern side of Chalmers Street. The eastern entry would improve pedestrian access for customers to the CBD and South East Light Rail stop on Chalmers Street and to destinations east of Central Station.</p>   |
| <b>Station safety and amenity</b>   |  |
| <ul style="list-style-type: none"> <li>○ Upgrade of platforms and station seating</li> <li>○ Upgrade of underground pedestrian tunnels.</li> </ul>  | <p>The proposed aboveground suburban platform works would improve safety and amenity. Work would involve decluttering to maximise space for customers on the aboveground suburban platforms. Aboveground suburban platform re-levelling and resurfacing would reduce trip hazards and reducing the space required to step up between the platform and the train.</p> <p>The east concourse would improve the amenity of the underground tunnels by providing a new, open underground pedestrian space. The concourse would replace a number of smaller existing tunnels that currently create line-of-sight and wayfinding issues for customers.</p> |
| <b>Functions of Central Station</b>   |  |
| <ul style="list-style-type: none"> <li>○ Transform the station into a destination through the inclusion of retail and services</li> <li>○ Provide bus stops closer to Central Station to improve function as a transport interchange.</li> </ul>  | <p>Central Walk would provide opportunities for retail activation within and around Central Station, particularly in the precinct to the east. This retail activation would assist with meeting the needs of transport customers and making Central Station a destination in its own right.</p> <p>The proposed east concourse and associated eastern entry would improve the function of Central Station as a transport interchange. Central Walk would provide new direct connections to other transport modes, including future light rail services on Chalmers Street.</p>   |

## 5.4 Public exhibition of this report

The Department of Planning and Environment will place this modification report on public exhibition. During the exhibition period, government agencies, stakeholders and the community will be able to review the modification report and will have an opportunity to make a written submission to the Department of Planning and Environment for consideration in its assessment of Central Walk.

Advertisements will be placed in newspapers to advise of the public exhibition period, where the modification report can be viewed, and to invite the public to community information sessions where they can meet representatives from the project team.

Consultation activities during the public exhibition of the modification report will include:

- Contact points (ie Community Information Line and email address)
- Media releases
- Community information sessions
- Newsletter letterbox drops
- Doorknocks with neighbouring properties
- Project website
- Local business engagement
- Government stakeholder engagement
- Newspaper advertising
- Displays at local council
- Stakeholder briefings.

### 5.4.1 Submissions report

At the completion of the public exhibition period for the modification report, the Department of Planning and Environment will collate and provide Transport for NSW with a copy of all submissions received. After reviewing the submissions, Transport for NSW will prepare a submissions report that responds to the relevant issues raised. The submissions report will be made publicly available on the Department of Planning and Environment website. Anyone making a public submission will receive a letter notifying them of the publication of the submissions report on the Department of Planning and Environment website.

## 5.5 Future consultation and engagement

Should Central Walk be approved, the project team would continue to consult with the community and key stakeholders during the planning and construction of the project. In general, this consultation would involve:

- Ongoing consultation with key stakeholders, local council and other government agencies
- Provision of regular updates to commuters and the nearby community
- Development and implementation of a Community Communications Strategy.

Further details regarding stakeholder and community involvement requirements during project delivery are outlined in the Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report for the approved project). Transport for NSW would also specifically consult with stakeholders to fulfil mitigation measures outlined in this modification report. These consultation activities are identified in the relevant mitigation measures in Chapter 21 (Consolidated revised environmental mitigation measures).



# **MODIFICATION DESCRIPTION - OPERATION**

CHAPTER SIX



## 6 Modification description – operation

This chapter identifies the physical infrastructure and built form, and describes the functionality and operation of Central Walk.

### 6.1 Approved Sydney Metro works at Central Station

The Sydney Metro City & Southwest Chatswood to Sydenham project was approved by the Minister for Planning on 9 January 2017. At Central Station, the approved works associated with Sydney Metro includes:

- New underground metro platforms and concourse below the existing suburban rail service platforms 12, 13, 14 and 15, and associated vertical transport (lifts and escalators)
- Reinstatement of platforms 12, 13 and 14 over the metro cavern
- Adjustments to the North Concourse and associated shortening of platforms 9 to 14 at the northern end, and a corresponding lengthening at the southern end.
- New canopies over the reinstated platforms 12 to 14 and between the Central Electric Building and the northern end of platforms 12 to 14
- A permanent access bridge for maintenance vehicles from Regent Street to Sydney Yard, located between the suburban and intercity rail lines (referred to as the Sydney Yard Access Bridge).

### 6.2 Proposed Central Walk modification

#### 6.2.1 Key features

The proposed modification would involve the addition to the following key features (as shown on Figure 6-1) to the project:

- **East concourse** – an accessible connection to the suburban and metro platforms at a common floor level to cater for the growing demands at the station now and in the future. The east concourse would connect the existing T4 Eastern Suburbs Line concourse with the future metro concourse as well as new escalators and a lift to each of the aboveground suburban platforms
- **Eastern entry** – a new entry / exit to Central Station and the east concourse from Chalmers Street. This would provide a direct interchange with light rail services. The eastern entry would be located at the site of the Bounce Hostel. A future connection to Randle Lane and / or Elizabeth Street would be safe guarded
- **Aboveground suburban platform works** – general upgrade of lighting, signage and finishes and removal of platform clutter, and platform raising / re-levelling to provide a consistent height and finish across the aboveground suburban platforms.

The design and delivery of Central Walk would allow for a new western entry through the extension of the underground concourse to the west of the metro platforms.

The proposed modification is described in more detail in the following sections.

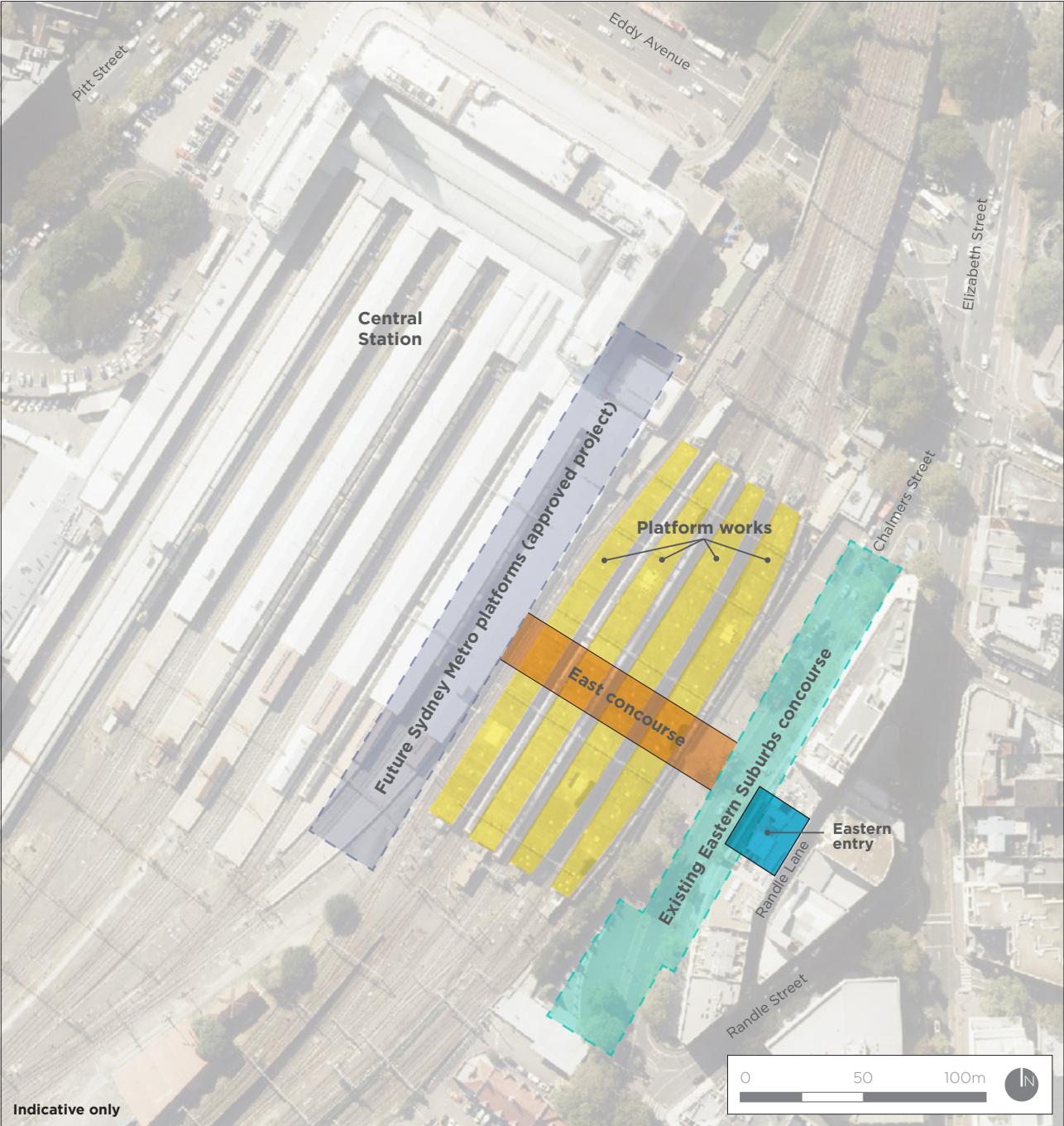


Figure 6-1 Key features of the approved project and the proposed modification

## 6.3 East concourse

The east concourse would be located below the existing suburban platforms (platforms 16 to 23), extending from the future north-south metro concourse, and connecting into the Eastern Suburbs concourse and the new eastern entry (see Figure 6-2). The east concourse would provide a direct connection to the aboveground suburban platforms 16 to 23 via vertical transport. Four escalators and one lift would link from the concourse to each island platform (platforms 16 to 21), and (due to platform space restrictions and the need to maintain adequate platform circulation space) three escalators and one lift would link from the concourse to platforms 22 / 23 (see Figure 6-3 and Figure 6-4).

To support the change in pedestrian flows within the station as a result of the new east concourse, changes would be made to the existing ticket gates at the Devonshire Street entry to realign its arrangement and increase the number of gates.

An artist's impression of the east concourse is provided as Plate 6-1.

The installation of vertical transport for the east concourse would require the lift shafts to penetrate the existing platform canopies. Minor patching would be required in these locations.

Design of the east concourse would allow for a future western extension of the concourse and other initiatives as part of the broader Central Station precinct renewal.



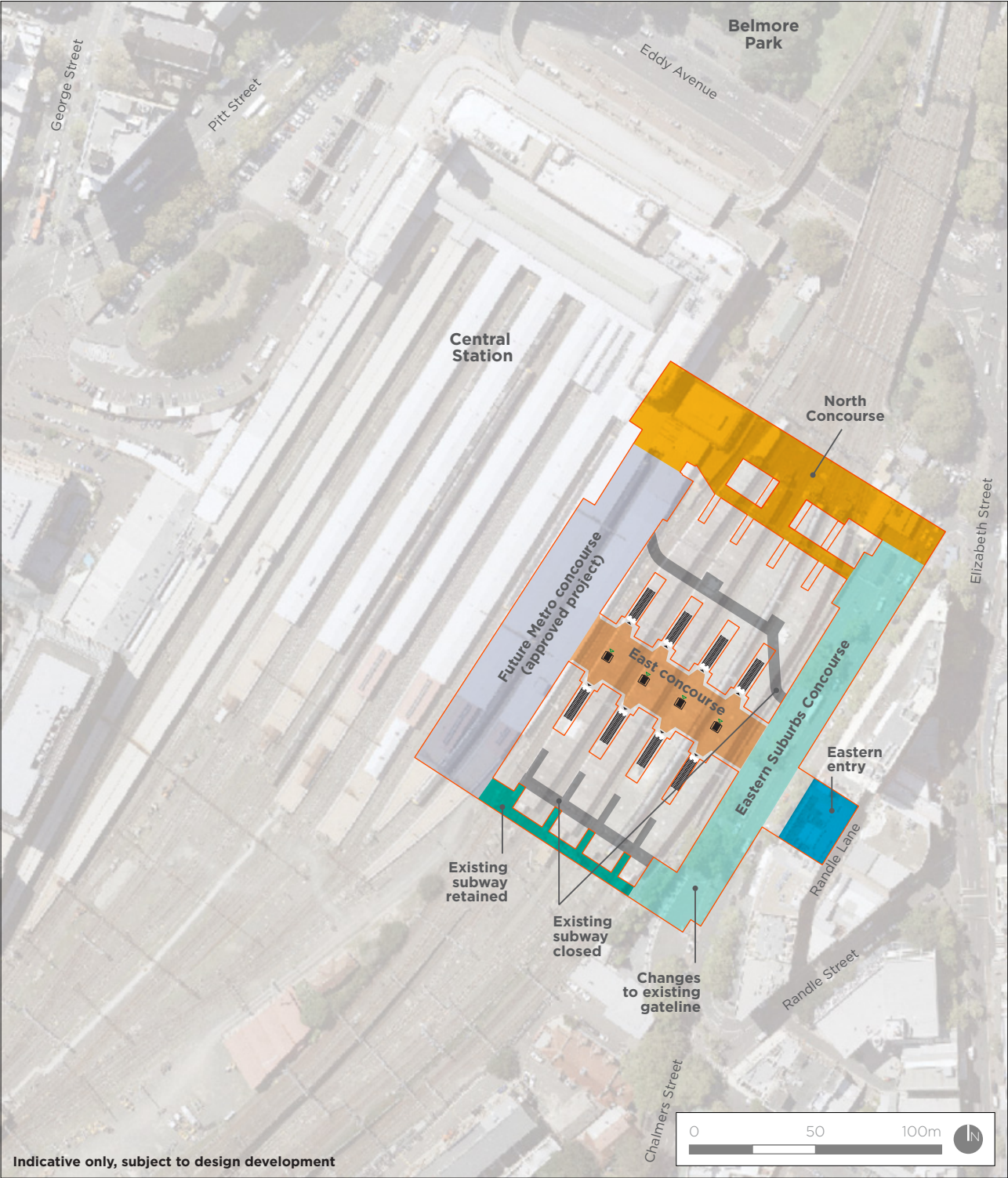


Figure 6-2 East concourse – indicative plan

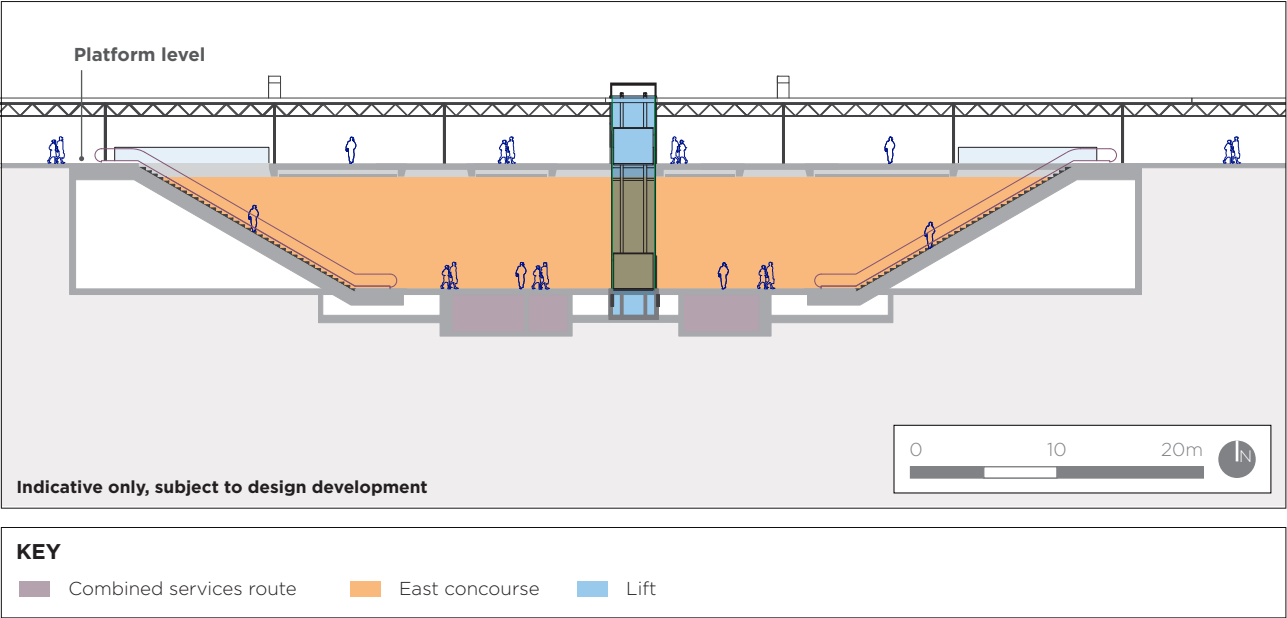


Figure 6-3 East concourse - cross section

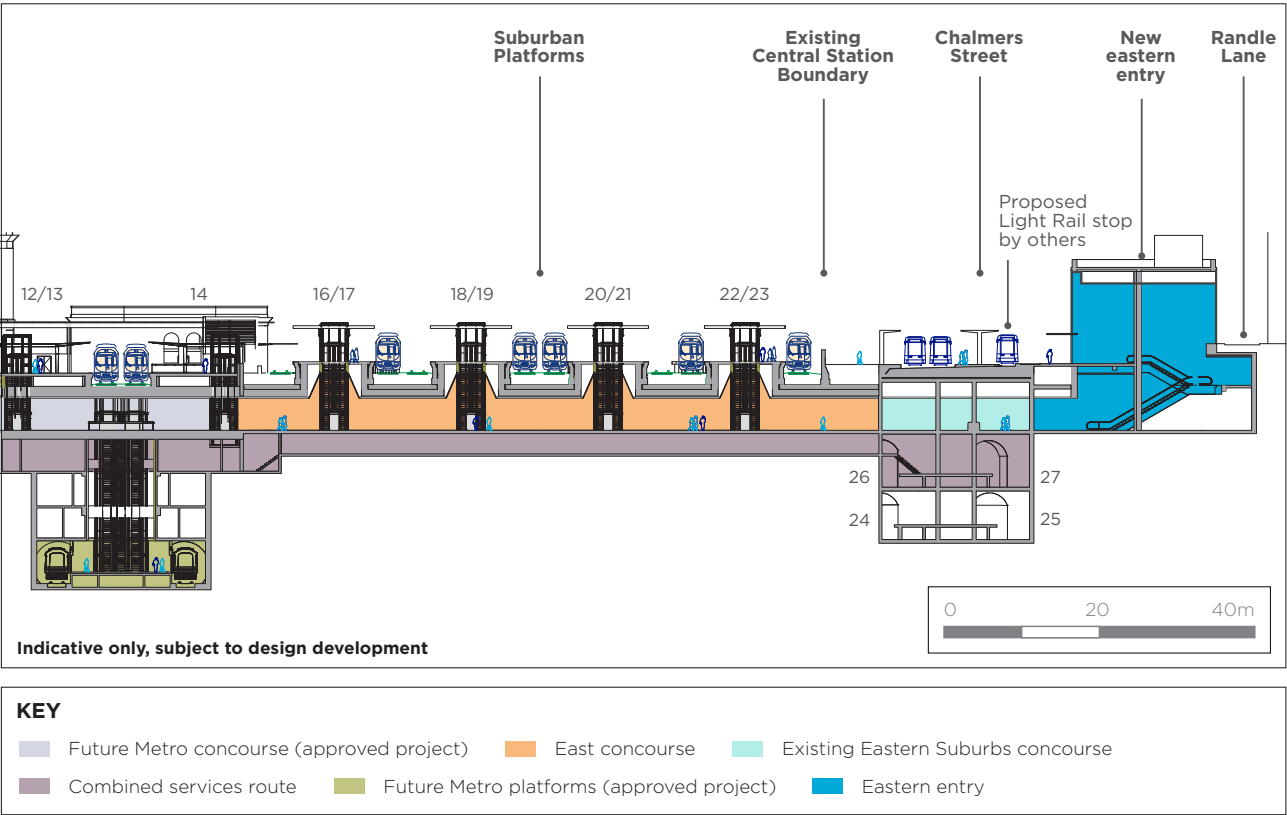


Figure 6-4 East concourse - long section



Plate 6-1 East concourse – artist's impression

## 6.4 Eastern entry

The new eastern entry would be located at 20-28 Chalmers Street, on the site of the current Bounce Hostel. The entry would provide direct access to Central Station for customers from the Surry Hills catchment area and a direct interchange for passengers from CBD and South East light rail.

Three escalators and two lifts would provide vertical transport to and from the new east concourse. New ticket gates would be installed at the bottom of the vertical transport.

The location and key features of the eastern entry are shown on Figure 6-5 and Figure 6-6. An artist's impression of the eastern entry is provided as Plate 6-2.

The eastern entry would also be designed to safe guard a future connection to Randle Lane and / or Elizabeth Street.

The connection of the eastern entry to the Eastern Suburbs concourse would require modifications to the existing concourse including remodelling of an existing staircase, removal of an existing ramp and installation of a new lift.

The eastern entry would also make physical provision for future over site development. This would include structural elements, building grids, column loadings, building infrastructure and services to enable the construction of future over site development. Future over site development would be subject to separate assessment and approval processes.

Opportunities for cycle parking would be further investigated in consultation with Sydney Trains and would be provided within 50 metres of the station entries where feasible.



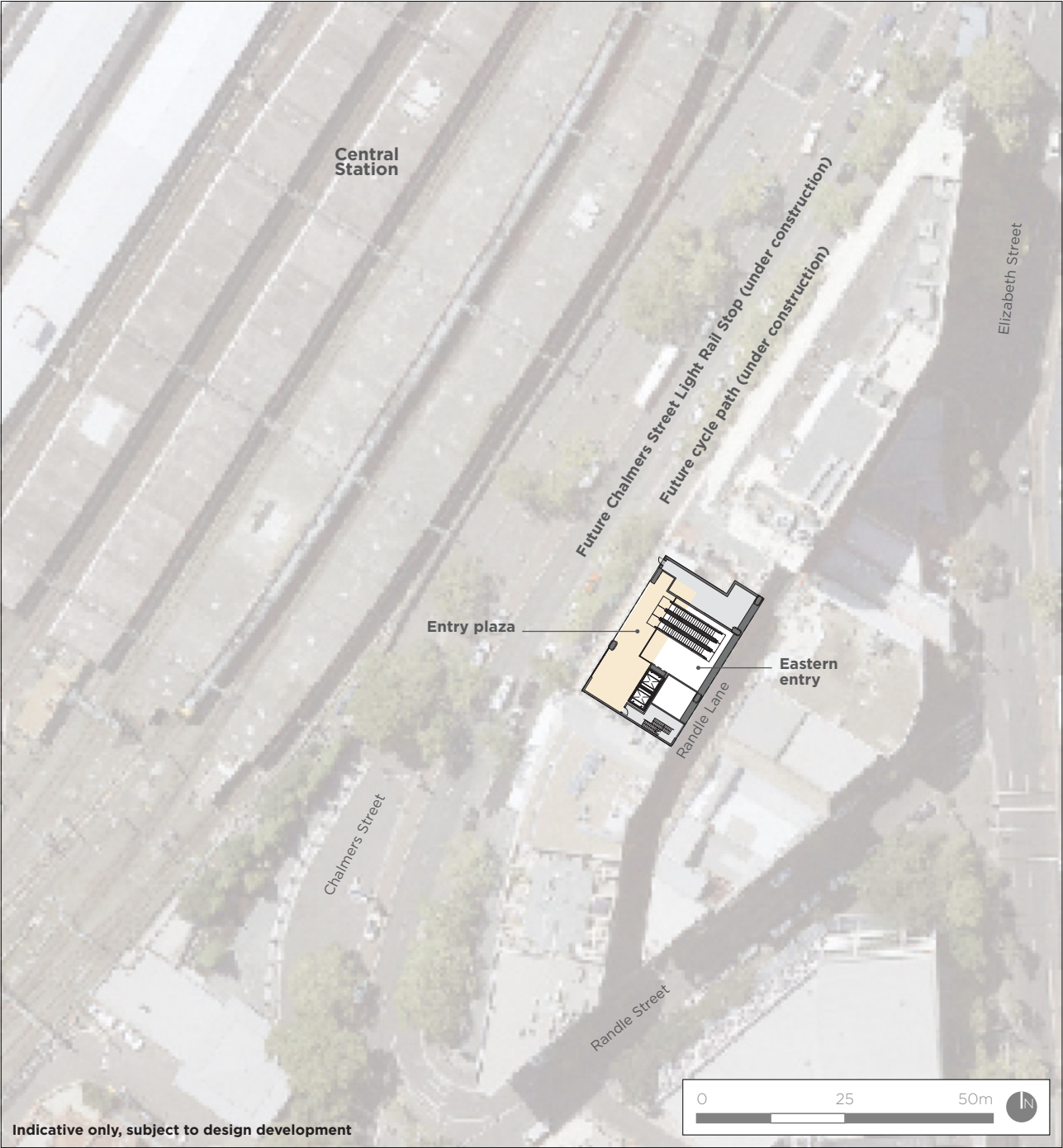


Figure 6-5 Eastern entry - indicative plan

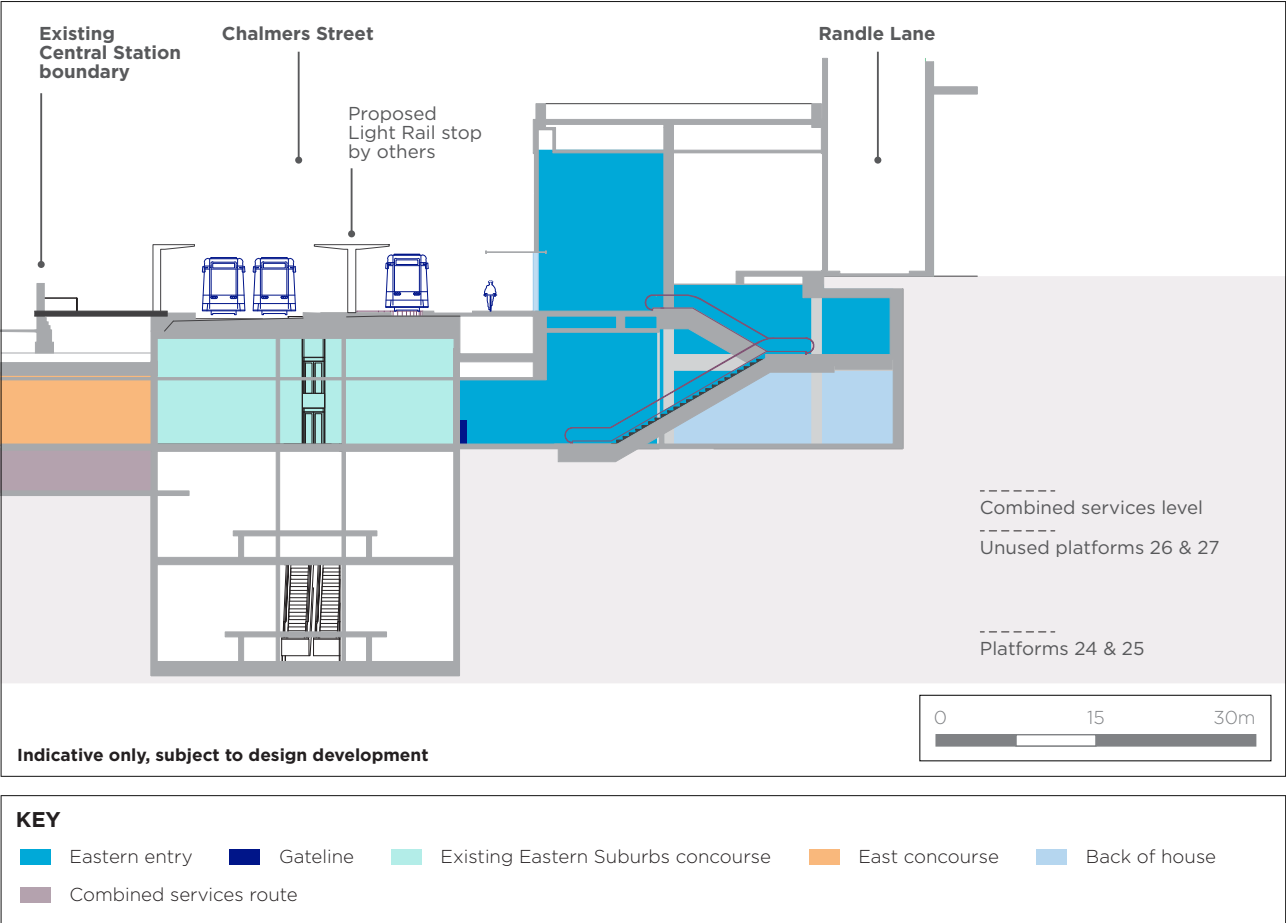


Figure 6-6 Eastern entry – cross section



Plate 6-2 Eastern entry – artist's impression

## 6.5 Aboveground suburban platform works

The extent of aboveground suburban platform works including both platform refresh and platform re-levelling is shown on Figure 6-7 and detailed below.

### 6.5.1 Platform refresh

Platform refresh works would be carried out on the aboveground suburban platforms (platforms 16-23) to provide a consistent customer experience between the old and the new platform areas. The platform refresh works would involve:

- De-cluttering (removal of redundant platform furniture, vending machines and services infrastructure)
- Removal of all buildings and staircases from the aboveground suburban platforms impacted by the east concourse works
- Wayfinding upgrades
- New finishes (tiling, painting, and lighting) and provision of platform furniture
- Increasing the space provided for passenger waiting.

Detailed platform refresh plans would be developed in consultation with Sydney Trains.



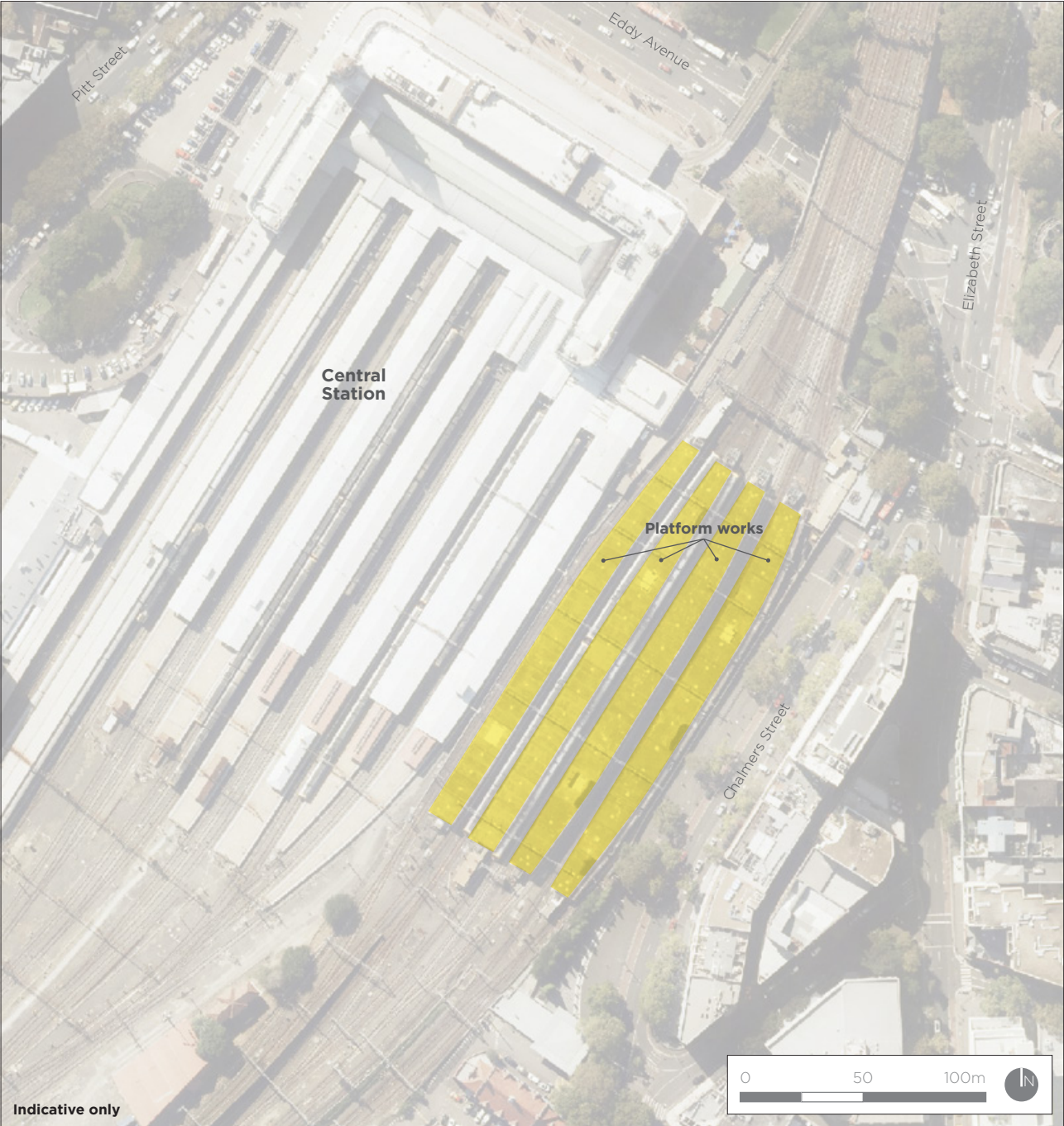


Figure 6-7    Extent of Central Walk aboveground suburban platform works

### 6.5.2 Platform raising / re-levelling

Vertical gaps between trains and each platform would be reduced through re-surfacing works to provide a consistent finish and step-on / step-off height. This would be achieved through the application of a topping to the platforms and raising of platform edge copers. Localised structural repairs to existing platforms edges may also be required. Platform re-levelling works would not be undertaken where significant structural works would be required to achieve a consistent height.

Platform levelling work would consider the ongoing functionality of existing vertical transport, which is based on the existing platform levels.

The existing aboveground suburban platform drainage would be modified as part of this work to reduce rainwater discharging directly onto the tracks. A strip drain would be installed in the centre of each platform, which would be connected into the existing platform drainage system. During the platform re-levelling process, the platforms would be graded to fall into the centre of the platform to enable the system to function more efficiently.

## 6.6 Ancillary infrastructure and services

### 6.6.1 Service route

Central Station currently has a number and complex arrangement of services running in various locations through the station, including in dedicated services tunnel and tunnels used by pedestrians. These services would be severed by both the approved project works at Central Station and the construction works for the proposed modification.

The approved project presented a solution to this issue, being a combined services route around Central Station and through Sydney Yard (located to the south of the aboveground platforms). The proposed east concourse presents an opportunity to provide a superior option for the location of the combined services route through Central Station. As a result, it is proposed to modify the location of the combined services route at Central Station.

The proposed combined service route would be primarily located under the floor of the east concourse (as shown on Figure 6-1). The combined services route would provide a link from the services located in the basement level of the Sydney Metro concourse through to the eastern service route and plant room in the existing unused platforms 26 / 27 (beneath the Eastern Suburbs concourse). A long section of the combined service route to be provided as part of the east concourse is shown on Figure 6-4.

From the Sydney Metro concourse, the services route would run:

- Through the services building at the southern end of the metro platforms
- On a gantry to the south of the intercity platforms across to Platforms 4 / 5
- Through a trench from the south of Platform 4/5 and through Platform 4 / 5 to above the baggage tunnel
- Through a vertical bore through Platform 4/5 to the baggage tunnel below.

The design of the gantry component of the combined services route would meet the intent of the Sydney Metro City & Southwest Chatswood to Sydenham Design Guidelines. Specifically, the services would be encased on the gantry to minimise visual impact.

The combined service route under the east concourse would be large enough to allow access by a person, with access points provided from the unused platforms 26 / 27 in the east, and from the metro concourse.

This combined service route would provide:

- A reticulation path for east concourse services
- A route for Sydney Trains high voltage (HV) power, low voltage (LV) power, communications and hydraulic services serving the east concourse, the wider station and rail operations for Sydney Trains network
- A route for any metro services that need to be extended to the wider Central Station precinct from the metro station.

The service route would be designed to safe guard the incorporation of future services, including services required for an extension of the concourse to the west and broader precinct renewal opportunities. A service zone would also be provided behind the east concourse wall finishes to accommodate electrical and communication cabinets, fire hydrant and hose reels. This would also connect the services within the under-floor combined service route to the ceiling space risers through to platform level (through a service and cladding zone within the ceiling).

Ventilation would be provided to the services route in the east through the unused platforms 26 / 27 to an outlet near the Devonshire Street station entry.

## 6.6.2 Electrical infrastructure

A new 33/11kV transformer and associated switching equipment would be provided to support the additional electrical loads required for the proposed modification. This would be located within the existing Lee Street substation. The existing low voltage network at Central Station, where impacted by the proposed modification, would be upgraded with new distribution boards and rewired in order to comply with current standards. A connection between the Lee Street Substation (currently under construction) and the approved Sydney Metro services building would be provided as part of the proposed modification.

A connection from the Chalmers Street Substation (currently under construction) to the services route and plant room in the existing unused platforms 26 / 27 would also be provided as part of the proposed modification.

## 6.6.3 Ventilation and life safety systems

Mechanical ventilation of the east concourse would be required for heat removal, air flow and passenger amenity. This ventilation system would be in addition to the natural air flow provided by vertical transport openings connecting the concourse and platforms. The air would not be conditioned however the ventilation would ensure a flow of air through the east concourse. The mechanical plant to service the ventilation system would be located within the unused platforms 26 / 27.

The east concourse would be sprinkler protected, and have hydrant and hose reel coverage extending from the existing Central Station systems. Other life safety systems, such as smoke and heat detection, would also be linked back into the existing station systems. A smoke extraction system would be installed for the east concourse as part of the wider ventilation system.

### 6.6.4 Communication systems

The following communication systems and cabling would be installed within the east concourse:

- Passenger information
- Public address
- Closed circuit television (CCTV)
- Help points
- Telephone services, including mobile phone service
- Supervisory control and data acquisition
- Electronic security system and electronic access control
- Radio distributed antenna systems (police and government radio network)
- Station radio.

The location and requirements of these communication systems would be further developed in consultation with Sydney Trains.

### 6.6.5 Drainage infrastructure

#### Surface drainage

Platform canopy, platform and track drainage catchments impacted by construction would be reinstated and continue to drain through the unaffected pipes. The design of the surface stormwater drainage would maintain catchment areas as close as possible to the existing system.

#### Subsurface drainage

As part of the east concourse construction, permanent pumped drainage piping would be provided in the combined service route to tie back into the existing station drainage system.

## 6.7 Design guidelines

Sydney Metro has developed design guidelines in order to guide the design development process and establish the aesthetic standards for the project. The Chatswood to Sydenham design guidelines were provided as part of the approved Sydney Metro City & Southwest Chatswood to Sydenham Environmental Impact Statement and revised as part of the Submissions and Preferred Infrastructure Report.

These guidelines would be applied to the proposed modification. In addition, due to the broader planning underway for the revitalisation of Central Station, the unique nature of Central Station as a key transport interchange and the State heritage nature of the station, design objectives for Central Station and element specific guidelines for Central Walk have been developed. These are provided in a revised Chatswood to Sydenham design guidelines in Appendix B. The development of the Sydney Metro works at Central Station, including the proposed modification, would also consider these design objectives and guidelines.

### 6.7.1 Heritage vision

Given the State heritage significance of Central Station, particular emphasis has been placed on the involvement of heritage architectural inputs in the process. This included the development of a heritage vision for Central Station that clearly articulates how heritage is to be incorporated into Central Station upgrades, such as the Sydney Metro works at Central Station (including the proposed modification). The heritage vision for Central Station sets the aspirations for the station to continue to be a functional and active transport interchange, whilst maintaining and continually transmitting the key heritage values of the place. The heritage vision for the works at Central Station is:

*The overlay of the Sydney Metro works, including Central Walk, at Central Station will facilitate the conservation of this landmark place and enable it to remain in active use as Sydney's principal rail terminus and interchange. The works will continue the tradition of phased evolution, as the third major phase of development at Central, but will retain the legibility of the earlier phases. The works will retain and interpret the overall heritage values of the station as a place of heritage significance to the State of NSW, while minimising the loss of individual elements that contribute to this significance. The introduction of quality design of new infrastructure combined with the reactivation of high value spaces for public uses will enhance the vitality and viability of Central Station as one of Sydney's iconic places.*

### 6.7.2 Urban design context

Central Station is a landmark public building, heritage place and the largest transport interchange in NSW. Managing the complex heritage values of the place, whilst providing for the evolving needs of customers and seamless integration into the surrounding precincts, presents a unique challenge.

The grand terminus building and clock tower, constructed of distinctive yellow block sandstone, is testament to the importance of the development of the railway in NSW and Central Station's pivotal role in the operation of the transport network. Central Station, when constructed in 1906, was an urban intervention of unprecedented scale. These elements are still defining elements within the southern Sydney CBD today and represent the civic significance of the station.

The southern Sydney CBD continues to change, with the CBD and South East Light Rail, Central Park development, the various new UTS Sydney and Notre Dame University developments and the Central to Eveleigh urban transformation program having influenced, or likely to further influence the area in the future. The importance of Central Station remains, however the contribution it makes to the urban fabric of the Sydney CBD will depend on successfully responding to the changes that are occurring and will continue to occur.

The Sydney Metro works at Central Station, including Central Walk, represent a major intervention in Central Station. It brings major opportunities to improve the functionality of Central Station and to better connect the surrounding areas. Successful implementation of Central Walk will however also require design solutions that are sensitive to Central Station, responsive to the changing environment and of a quality that is aligned with the importance of Central Station to Sydney.



### 6.7.3 Central Station design objectives

The Central Station design objectives have been developed cognisant of the urban design context. The Central Station design objectives are:

1. A World class integrated multi-modal transport interchange that:
  - a. Incorporates an architectural response that is distinctive to Central
  - b. Integrates Sydney Metro design characteristics
  - c. Integrates transport modes and services
  - d. Builds on nominated world class precedents
  - e. Exemplifies design excellence
  - f. Integrates and allows for Sydney Metro line-wide components.
2. An enduring and sustainable legacy where heritage is integral to the identity of the place that:
  - a. Builds on the legacy of the Central Station origins by integrating the next stage of Central and the NSW transport network's evolution with the introduction of Sydney Metro
  - b. Achieves a sustainable outcome that respects Central's architectural, transport and social heritage and supports environmentally, economically and socially sustainable development
3. An interchange that provides effortless accessibility and connectivity by:
  - a. Improving the accessibility and connectivity within and across the precinct
  - b. Improving accessibility and connectivity with other transport modes between Sydney Metro and train services
  - c. Improving accessibility and connectivity to connecting transport services within the interchange precinct including buses and future light rail
  - d. Providing equitable and universal accessibility
  - e. Providing sufficient capacity to meet anticipated demand well into the future
  - f. Providing for transfer between Sydney Metro and connecting services
  - g. Minimising level and direction change
  - h. Including self-navigating spaces with integrated active signage where necessary
4. A Premium customer experience as part of an iconic place that:
  - a. Is unique and memorable
  - b. Creates a welcoming and intuitive customer experience with simple, uncluttered spaces ensuring a comfortable, enjoyable and safe experience for a diverse range of customers
  - c. Provides an easy customer journey
  - d. Includes high quality public art that is integrated with architecture and engineering

5. A revitalised place with an enhanced civic role as a key part of the city by:
  - a. Reinforcing and supporting Central Station as a gateway to the city and NSW transport network
  - b. Reinforcing and supporting Central Station as the key access and interchange station for Sydney Metro
  - c. Creating spaces that contribute to city life
  - d. Designing the interchange to be a social and cultural asset
  - e. Delivering a curated retail space
  - f. Delivering seamless integration throughout the interchange and the surrounding precinct.

# **MODIFICATION DESCRIPTION - CONSTRUCTION**

CHAPTER SEVEN



# 7 Modification description – construction

This chapter describes the likely key construction activities for the proposed modification and identifies the construction sites required. A description of the proposed modification once operational is provided in Chapter 6 (Modification description – operation).

## 7.1 Approved Sydney Metro works at Central Station

The key construction activities as part of the approved project at Central Station are:

- Establishment of a construction site at Sydney Yard and another adjacent to Mortuary Station
- Demolition of platforms 12-15 and subsequent reinstatement of platforms 12-14
- Demolition of five 2 storey terraces at 56-62 Regent Street and construction of the Sydney Yard Access Bridge
- Excavation, construction and fit out of new underground metro platforms beneath platforms 12-15
- Construction of metro services buildings at the north and south of platform 14
- Adjustment to the length of platforms 9 and 10 / 11
- Construction of temporary stairs descending from platforms 20 / 21 and 22 / 23 to the Olympic Tunnel.

The construction of the new underground metro platforms at Central Station provides a unique opportunity to carry out construction works for Central Walk concurrently and improve efficiencies by avoiding duplication of works such as services relocation, sharing construction access points and construction compounds, concurrent works during rail possessions and alternate station operation arrangements.

## 7.2 Overview of Central Walk

The construction activities for the proposed modification, in addition to those required for the approved metro works at Central Station, are described in this chapter. These activities would involve:

- Demolishing / repurposing of buildings and relocating services
- Excavation works to establish the eastern entry
- Civil and structural works for the eastern entry
- Construction of the east concourse using a mined technique
- Platform works (re-levelling and refresh)
- Fit-out of the east concourse and eastern entry (vertical transport, services etc)
- Testing and commissioning.

### 7.2.1 Environmental considerations in construction

The inclusion of Central Walk as a proposed modification to the approved project would minimise construction impacts at Central Station. In addition, the construction methodology for the proposed modification has been guided by a number of environmental factors. Specific construction methods developed to avoid and minimise adverse impacts of the proposed modification are identified in Table 7-1.

Table 7-1 Adverse construction impacts avoided or minimised through construction methods

| Environmental aspect  | Construction method response  |
|-----------------------|---|
| Traffic and transport | <ul style="list-style-type: none"> <li>Mined solution under aboveground suburban platforms to minimise possession time required and therefore minimise impacts on the transport network</li> <li>Haul routes have been developed to minimise impacts on the road network.</li> </ul>  |
| Heritage              | <ul style="list-style-type: none"> <li>Mined solution under aboveground suburban platforms to avoid extensive impacts to the aboveground suburban platforms</li> </ul>  |
| Property and land use | <ul style="list-style-type: none"> <li>Majority of works contained within the NSW Government owned land and the rail corridor to minimise private property acquisition</li> <li>Construction footprint for the eastern entry consistent with the operational footprint to minimise private property acquisition.</li> </ul> |

## 7.3 East concourse

The proposed east concourse would be located beneath aboveground suburban platforms 16 to 23, between the Eastern Suburbs Concourse and the approved metro concourse. Construction of the east concourse would use a mined method to minimise impacts to the platforms and platform canopies and the extent of work required during rail possessions. Construction of the east concourse would involve surface works on the platforms and underground work beneath the platforms and tracks.

### 7.3.1 Surface platform works

The work on the surface of the platforms as part of the proposed modification would be primarily completed during rail possessions. Following each possession, hoarding would be placed around work zones or a temporary cover would be placed over new platform openings.

The surface platform works would involve:

- Temporary support for the existing canopies
- Demolition of the existing stair openings from the platforms to the existing underground tunnels, including (as numbered from north to south) the fourth set of stairs on platforms 20-23 and the fourth and fifth sets of stairs on platforms 16-19
- Reinforcing the existing brick platform edges, and supporting and re-arranging existing canopy foundations
- Piling and excavation of the new platform openings for escalators and lifts
- Providing necessary support (likely through pre-cast concrete elements) for the future canopy tube support (during underground works)
- Re-installing platform furniture.

The lift structures connecting the east concourse to the aboveground suburban platforms would extend through the canopies. Minor patching and repairs of the canopies would be required around these areas.

### 7.3.2 Underground works

Underground works would be progressively carried out concurrent to the surface platform works described above. This is likely to progress from east to west and would be supported from the eastern entry construction site with access primarily gained through the unused platforms (platforms 26-27) beneath the Eastern Suburbs Concourse.

To construct the connection between the east concourse and the Eastern Suburbs Concourse, access would also be required from the Eastern Suburbs Concourse.

The underground works would involve:

- Installation of the canopy tube ahead of the excavation works. A canopy tube involves drilling a number of perforated pipes or canopy tubes horizontally above the area to be excavated, which are then injected with grout, to establish a protective cover under which the tunnel can then be excavated. This construction technique is regularly used where there is insufficient ground cover
- Excavation of the concourse under the tracks and platforms, with ground support
- Final excavation and connection of the future escalator and lift openings
- Progressive construction of the services tunnel with concrete elements to form the services tunnel roof and concrete base slab
- Construction of concourse walls and roof, concourse columns and walls of escalator shafts
- Installation of electrical and mechanical equipment in the services tunnel.

In the event that obstructions are encountered for the canopy tubes, access may also be required from above by removal of tracks and localised excavation.

The start of the underground excavation works from the Eastern Suburbs Concourse may result in some minor ground settlement prior to the establishment of permanent structural support. Due to this risk, a section of the existing brick wall along the eastern side of the station (and western side of Chalmers Street) would be temporarily dismantled and the bricks stored. A temporary fence would be established for security. Following the establishment of permanent structural support, these bricks would be reinstated.

Following excavation of the east concourse, fit out works would be carried out including mechanical and electrical services (including escalators and lifts), and architectural elements such as wall and ceiling cladding, and floor finishes.

To support the change in pedestrian flows within the station as a result of the new east concourse, changes would be made to the existing ticket gates at the Devonshire Street entry. This would involve removal of an existing services room and realignment of the ticket gates.

Concurrently with these works, platform refresh and relevering works would be carried out. Further detail of these works is provided in Section 7.5.

## 7.4 Eastern entry

The following activities would be required to construct the eastern entry:

- Demolition of the Bounce Hostel building and excavation of a shaft to form the proposed entry. A shaft would be excavated from the surface / street level down to the level of the unused platforms of the T4 Eastern Suburbs Line. Cut-and-cover excavation works may also be required through Randle Lane which would require the short term (around three months) closure of Randle Lane and through the footpath and the future cycleway on the eastern side of Chalmers Street. Transport for NSW will continue to investigate alternative construction methods that would avoid surface impacts at these locations however for the purposes of this report and to provide a worst-case assessment, cut-and-cover excavation works have been assessed.
- Civil and structural works (including structural supports for the entrance building on street level)
- Excavation of a new opening through the unused platforms to provide access for the construction of the east concourse
- Modification of the existing Eastern Suburbs Concourse (including demolition of existing back of house rooms, the existing ramp, widening of the existing stairs and installation of new lift).

Once the east concourse is complete (refer to Section 7.3) the following works would be carried out to complete the eastern entry:

- Fit-out of mechanical and electrical services (including vertical transport)
- Fit-out of architectural elements such as glazing, wall and ceiling cladding, and floor finishes
- Completion of the eastern entry works at street level.

The eastern entry site would also be used to support the excavation of the east concourse. This would involve lowering of excavation equipment through the shaft to excavate the east concourse (refer to Section 7.3). Spoil from the east concourse excavation would be moved back to the shaft, transferred to the surface and then removed from site.

## 7.5 Platform works

Platform works would include platform refresh and platform raising / re-levelling. The construction of these elements is described in the following sections. To minimise impacts to rail customers, these works would be carried out concurrently with possession works required for the east concourse to complete the surface platforms works.

### 7.5.1 Platform refresh

Platform refresh works would include demolition of platform buildings, redundant staircases and services infrastructure; de-cluttering (ie removal of seating, bins and vending machines); new painting; installation of new signage, lighting and tiles; and provision of platform furniture.

### 7.5.2 Platform raising / re-levelling

To achieve a consistent finish and height across the aboveground suburban platforms a topping would be applied and the platform coping (edges) would be raised so that there is a slope back towards the centre of the platform. This may also involve localised structural repairs to the existing platform edges. A strip drain would also be installed in the centre of the platform to collect rainfall which would then connect to the existing platform drainage.

Due to the curved nature of some of the platforms it is not possible to resolve horizontal gap issues.



## 7.6 Modified combined services route

As described in Chapter 6, the location of the combined services route is proposed to be modified as part of the proposed modification. The combined services route would be constructed primarily as part of the east concourse (as described in Section 7.3). The combined services route would also involve the construction of:

- A gantry from the Sydney Metro services buildings across the intercity lines to the south of the platforms to platforms 4 / 5
- Trenching to the south of platforms 4 / 5 and through platforms 4 / 5 to above the baggage tunnel
- A vertical bore through platforms 4 / 5 to the baggage tunnel.

Other ancillary elements to the combined services route would also be constructed including:

- Ventilation risers and an outlet in the east. Ventilation ducting and risers would be installed between the services route and an outlet at the existing Devonshire Street entry building (through the unused platforms 26 / 27). The ventilation outlet would be installed at the end of the ducting through the buildings
- An under bore for an electrical connection from the Lee Street substation (currently under construction) to the approved Sydney Metro services building. This would pass beneath the intercity tracks
- An under bore for an electrical connection from the Chalmers Street substation (currently under construction) to the existing unused platforms 26 / 27 (beneath the Eastern Suburbs Concourse). This would connect to new electrical equipment within the existing Prince Alfred Substation building (this new equipment is being placed in the Prince Alfred Substation building as part of the Chalmers Street substation project).

## 7.7 Ancillary construction sites

### 7.7.1 Eastern entry construction site

The eastern entry construction site would be located on the site of the future eastern entry. This would involve the demolition of the existing building.

This site would be used to support:


- Construction of the eastern entry (refer to Section 7.4)
- Construction of the east concourse (refer to Section 7.3).


Access to and egress from the site would be via Randle Lane, including the loading of building demolition waste. Due to the narrowness of Randle Lane, this is likely to require reversing movements to either access or egress the site.


The location and indicative layout of the eastern entry construction site, including vehicle access and egress, are illustrated on Figure 7-1.



KEY

 Site Offices / Amenities  
suspended above hoarding

 Site area

 Working platform


 Temporary occupation of Randle Lane

Figure 7-1 Indicative layout of the eastern entry construction site

7.7.2 Sydney Yard construction site

The establishment and use of the Sydney Yard construction site has been assessed and approved. Works associated with Central Walk would not extend the overall timeframe for the use of this site.

The proposed modification would require the addition of a track crossing of the suburban tracks to access the suburban surface platforms works (including the delivery and removal of materials). The location of this crossing is shown on Figure 7-2.

The location and indicative layout of the Sydney Yard construction site, including vehicle access and egress, are illustrated on Figure 7-2.

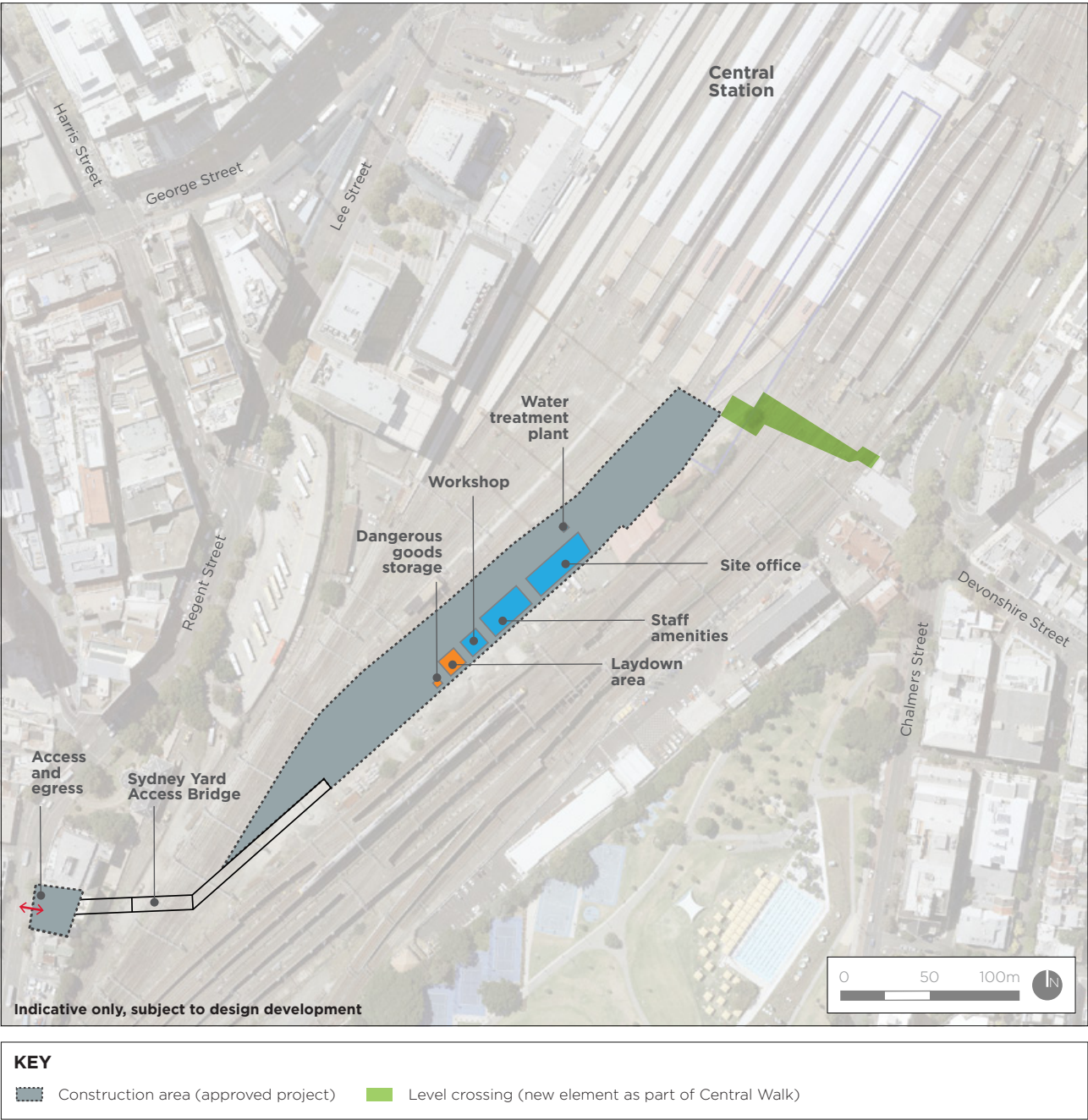


Figure 7-2 Indicative layout of the Sydney Yard construction site



## 7.8 Other construction elements

This section provides an overview of other construction elements required for the proposed modification. These elements are in addition to those identified for the approved project.

### 7.8.1 Additional demolition

Table 7-2 lists the major structures that would need to be demolished to allow for construction of the new infrastructure elements.

**Table 7-2 Major buildings and structures to be demolished**

| Works area                     | Building / structure to be demolished  |
|--------------------------------|--|
| Eastern entry                  | <ul style="list-style-type: none"> <li>Bounce Hostel building on Chalmers Street</li> <li>Existing services rooms in the Eastern Suburbs concourse</li> <li>Columns, internal walls, sections of flooring, stairs and a ramp in the Eastern Suburbs concourse.</li> </ul>  |
| Aboveground suburban platforms | <ul style="list-style-type: none"> <li>Overhead wiring structures</li> <li>Parts of the platforms required for the east concourse</li> <li>Buildings on the platforms impacted by the east concourse works</li> <li>Redundant infrastructure and furniture</li> <li>Stairs at the southern end of platforms 16-23</li> <li>Additional stairs on platform 16-19.</li> </ul> |
| Other                          | <ul style="list-style-type: none"> <li>Food retail outlet (Subway Snacks) near the existing Devonshire Street station entry.</li> </ul>  |

Typically, building demolition would involve:

- Establishment of hoarding, scaffolding and protection barriers around the perimeter of the site or structure, including provision of alternative safe pedestrian routes
- Decommissioning of all services into the buildings to be made safe and redundant
- Soft stripping internal building materials
- Demolition using an excavator, bobcat cranes or other conventional methods following a top-down approach. Temporary propping and / or waterproofing would be provided to maintain structural integrity of adjacent structures as required during the demolition works.

A hazardous materials analysis would be carried out prior to stripping and demolition. Any hazardous materials would be removed and disposed in accordance with the relevant legislation, codes of practice and Australian Standards.

Materials such as bricks, tiles, timber, plastics and metals would be sorted where practicable and sent to a waste facility with recycling capabilities.

### 7.8.2 Utility and power supply

Utilities such as low voltage power, water, sewer and telecommunications would need to be supplied to the eastern entry construction site. Generally, these utilities are located close to the site (such as the adjacent footpath or under the adjacent road) and the supply is considered 'business as usual' for supply companies.

The requirement for high voltage power supply to Central Station was described and assessed as part of the approved Sydney Metro works. The proposed modification would use the same power supply from the Belmore Park substation.

### 7.8.3 Additional utility and services adjustment and protection

Additional utilities would need to be adjusted, relocated and / or protected where there is a possibility they would otherwise be impacted by construction. In particular, adjustments and protection is likely to be required around the eastern entry on both Chalmers Street and Randle Lane. The location of utilities has been determined from Dial Before You Dig plans, utility data, and local authority and council records. Further investigation and consultation with service asset owners would be carried out as the design develops to confirm exact locations, heights and depths of the utilities.

As described in the Environmental Impact Statement, where an existing utility conflicts with the proposed design, it may be necessary to:

- Provide physical protection for the utility where the utility is not directly affected but may be indirectly affected by vibration or accidental impact. Protection could include constructing a piled wall between the excavation and the utility, plating over the utility to minimise the impact of construction traffic, or marking out or fencing off the location of a utility to avoid it being accidentally damaged
- Modify construction methods to avoid impacting a nearby utility. For example, this could involve using only hand excavation and compaction tools such as hand digging tools, a vibration plate or pedestrian rollers where compacting within a specified distance of utilities
- Wrap and support the utility service to provide mechanical protection
- Divert the utility around the construction site.

#### Temporary services route

As described in Chapter 6, the location of the combined services route is proposed to be modified as part of the proposed modification. This revised route would however, require a temporary services route so that these services would not be impacted by construction for the approved project and the proposed modification.

The temporary services route would carry high voltage power, low voltage power, communications and hydraulic services. The temporary services route would be generally to the south of the platforms as shown on Figure 7-3. This route would include the following features:

- An overhead gantry from the eastern side of Central Station (commencing near the Devonshire Street / Chalmers Street intersection) across the suburban rail lines. The gantry structure would be similar to other overhead support structures in this location
- Attached to temporary hoarding adjacent to the Sydney Metro works
- Located in protected conduit along the ground to the south of the Sydney Metro excavation through the Sydney Yard construction site
- An overhead gantry across the intercity rail lines to Platform 4 / 5
- Trenched in the location to the south of Platform 4 / 5 and through Platform 4 / 5 to above the baggage tunnel. The trench would be around 300 millimetres wide and 300 millimetres deep
- Through a vertical bored hole through Platform 4 / 5 to the baggage tunnel below.

Following construction, the section of the temporary route to the east of the metro concourse would be removed with the permanent route located beneath the east concourse. As described in Chapter 6 (Modification description – operation), the western portion (to the west of the metro southern services building) would form part of the permanent combined services route.

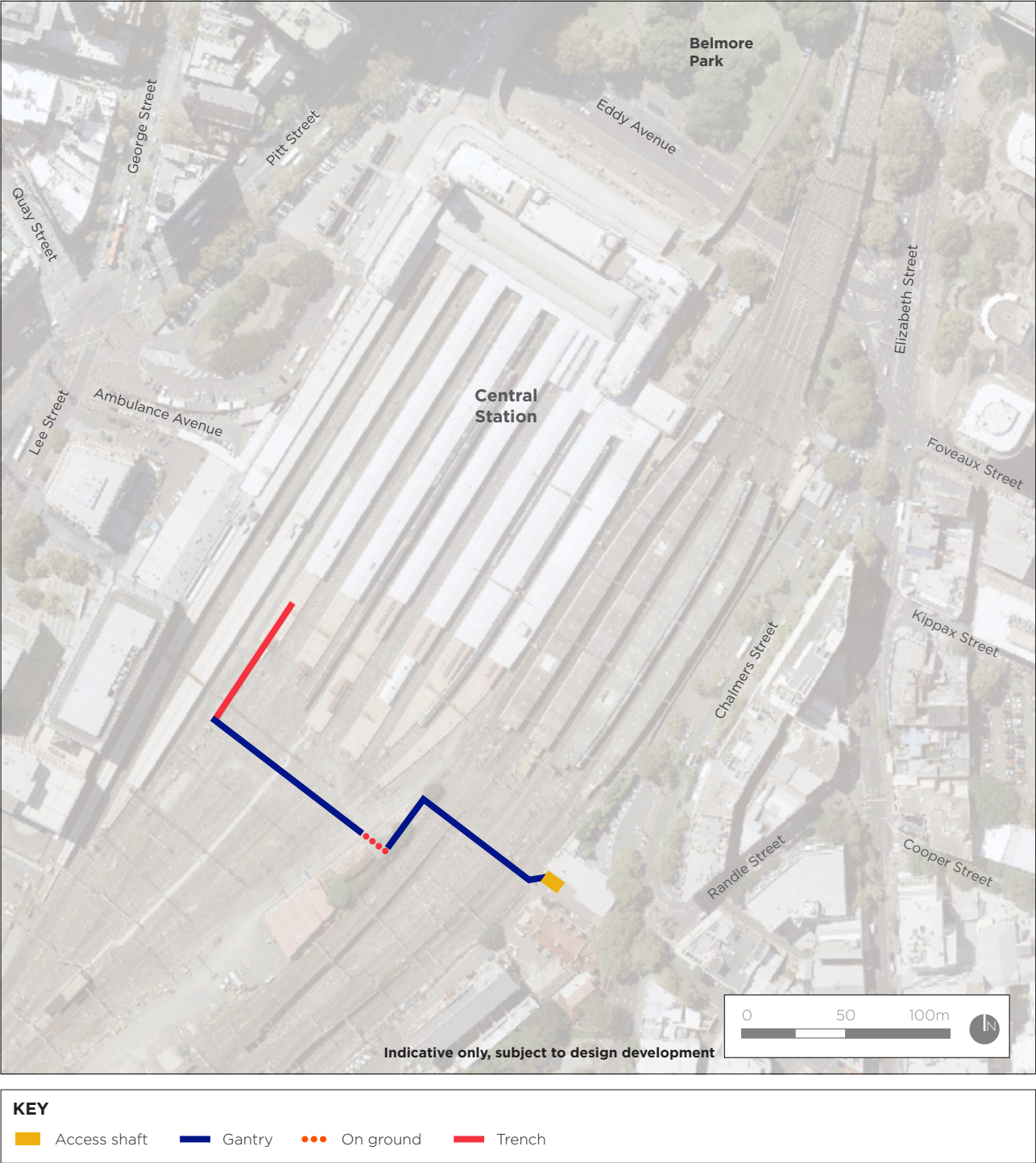


Figure 7-3 Plan view of the temporary services route

### 7.8.4 Additional heritage investigations, protection and archival recordings

Where required, additional heritage investigations, protection work and archival recordings would be carried out prior to main construction works to minimise delays and provide unrestricted access to the sites.

### 7.8.5 Construction traffic and access

The proposed access arrangements to the construction sites and work areas are summarised in Table 7-3. Wherever possible, access is proposed to be gained from major arterial roads. Other access points would also be required for short term construction activities such as through existing driveways to the Prince Alfred Sidings.

For surface works within the station, materials may also be delivered and removed by work trains.

As indicated for the approved project, Transport Coordination has been established to oversee all traffic and transport in Sydney including decisions, directions and approvals affecting all road and traffic arrangements in the Sydney. Transport for NSW would liaise closely with Transport Coordination during detailed construction planning and throughout the construction phase to minimise potential construction traffic impacts, including potential cumulative impacts with other projects or special events.

Consistent with the approved project, construction traffic management plans for each site would be submitted to the relevant roads authority and the Centre for Road Safety for review before work starts. Further information relating to haulage routes, construction traffic impacts and mitigation is provided in Chapter 9 (Construction traffic and transport).

**Table 7-3 Major construction access**

| Construction site or work area  | Access arrangement  |
|---------------------------------|---|
| Eastern entry construction site | Left-in and left-out via Randle Lane  |
| Sydney Yard construction site   | Left-in and left-out via Regent Street using the Sydney Yard Access Bridge (part of the approved project) |

### 7.8.6 Rail possessions

A rail possession is a term used to indicate that a section of track is blocked for a specified period, so that no trains can operate on that section of track for a specified time. This is necessary to ensure the safety of workers and rail users.

A number of rail possessions would be required at Central Station for the approved project. The construction works required for the proposed modification would also require some activities to be carried out during rail possessions, of which there are typically up to 30 each year in varying configurations. However, there are likely to be some additional and / or extended rail possessions which are discussed in more detail below.

There are five configurations possible for a rail possession at Central Station. However, for each configuration, a one-way train on the City Circle would be maintained with a bus provided for customers in the other direction. The relevant configuration used during each rail possession would be determined by Sydney Trains based on the construction requirements at Central Station, as well as other planned projects or maintenance activities along the remainder of the rail network.

Two of the five rail possession configuration types identified would impact the T2 Airport Line and one-way running of trains on this line would be maintained, with a bus provided for customers in the other direction. The remaining three configuration types would require services on the T1 North Shore Line to terminate at North Sydney Station or Wynyard Station and services on the T1 Northern Line to terminate at Central Station. These configurations would require customers to change platforms at either North Sydney, Wynyard or Central Stations to access one-way trains of the City Circle.

Public transport services and timetables would need to be altered to accommodate these changes during the construction phase. Weekend rail possessions would be scheduled to avoid or minimise impacts on special events.

### East concourse

One of the major benefits of the mined construction methodology for the east concourse is that it would allow for trains to operate while excavation occurs underneath. However, some construction activities would still be required to take place during rail possession periods (eg platform works and overhead wiring modifications).

During the rail possessions required for the surface platforms works as part of the east concourse, other platform works including refresh and re-levelling would also be carried out.

## 7.8.7 Station operation modifications

The approved project involves impacts to some of the underground pedestrian tunnels at Central Station. The construction of the east concourse would impact additional tunnels beneath the platforms that are used for customer interchange and entry / exit purposes.

As part of the approved project, a new underground pedestrian connection would be constructed to maintain interchange connectivity between the suburban and intercity platforms. Temporary stairs would also be provided from the Olympic Tunnel to platforms 20-23.

The construction of the east concourse would require temporary closure of some sections of the Eastern Suburbs concourse and also the permanent closure of the Olympic Tunnel and the north branches of the southern commuter subway, and their stairs to the aboveground suburban platforms. This disruption would be minimised through a phased opening of the east concourse, with pedestrian flows temporarily redirected through the metro concourse.

The phasing of these activities in relation to pedestrian flows is shown on Figure 7-4a-c and would be as follows (for ease, the pedestrian interchange tunnels at the south of the platforms have been named A to E):

- Phase 1 (this would be the arrangement for the majority of the construction period and is consistent with the construction pedestrian arrangement within the station for the approved project):
  - ◆ The majority of existing staircases (and the future stairs from the Olympic Tunnel to platforms 20-23) and walkways would remain open
  - ◆ Closure of pedestrian tunnel E and its stairs to platforms 16-19.
- Phase 2:
  - ◆ Opening of the southern portion of the east concourse and the southern escalators to platforms 16-23, and the western portion of the approved metro concourse
  - ◆ Closure of the Olympic Tunnel and its stairs to platforms 16-23
  - ◆ Pedestrian tunnel E and its stairs to platforms 16-19 would remain closed.
- Phase 3 (this is effectively the end-state arrangement):
  - Opening of the northern portion of the east concourse and the northern escalators and lifts to platforms 16-23
  - Closure of pedestrian tunnel D and its stairs to platforms 16-23
  - The Olympic Tunnel and pedestrian tunnel E and their stairs to the platforms would remain closed.



Pedestrian tunnels A and C, the North Concourse, and their stairs to respective platforms would remain open throughout the construction period and following the commissioning of the east concourse.

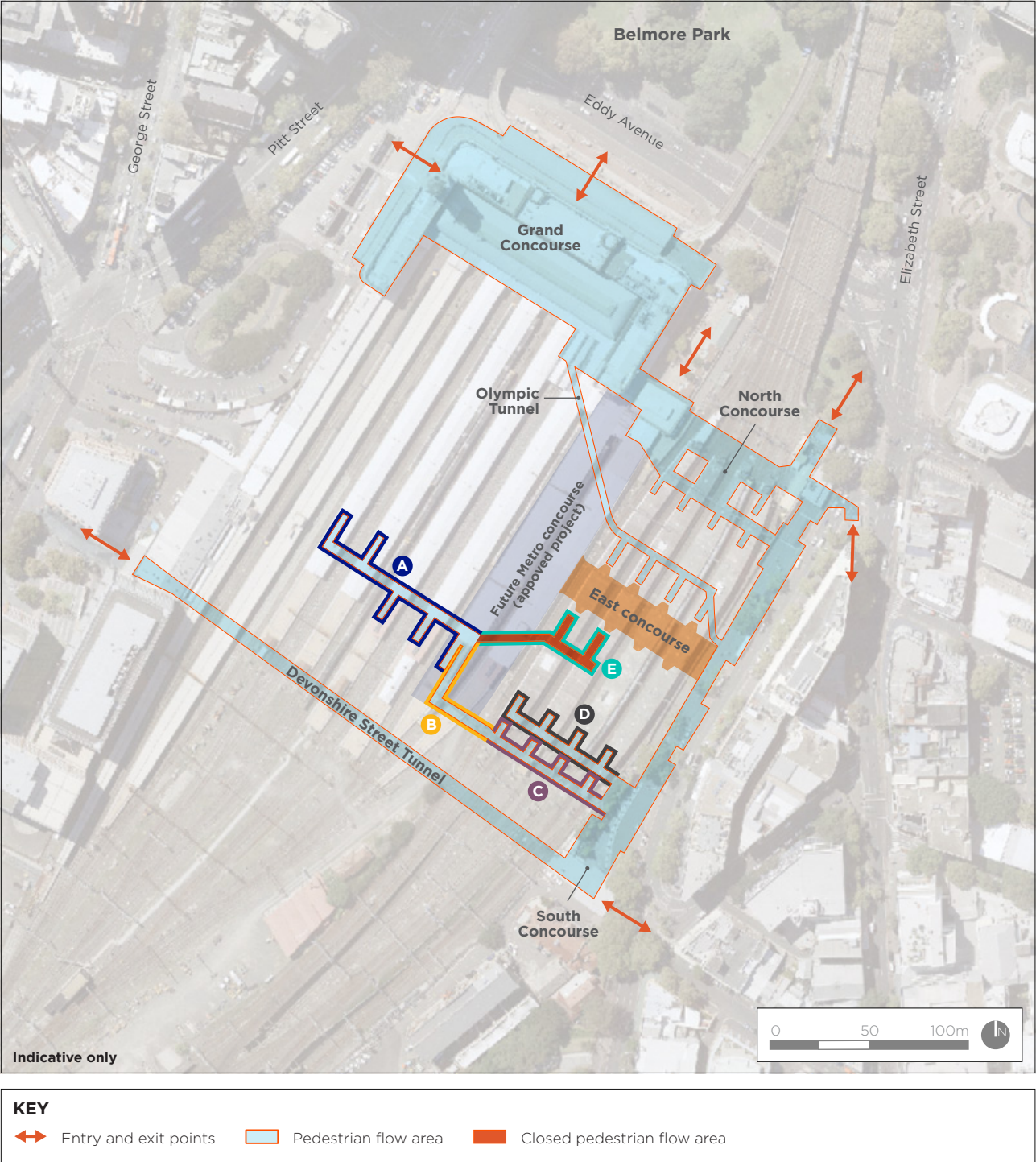


Figure 7-4a Pedestrian movements Phase 1

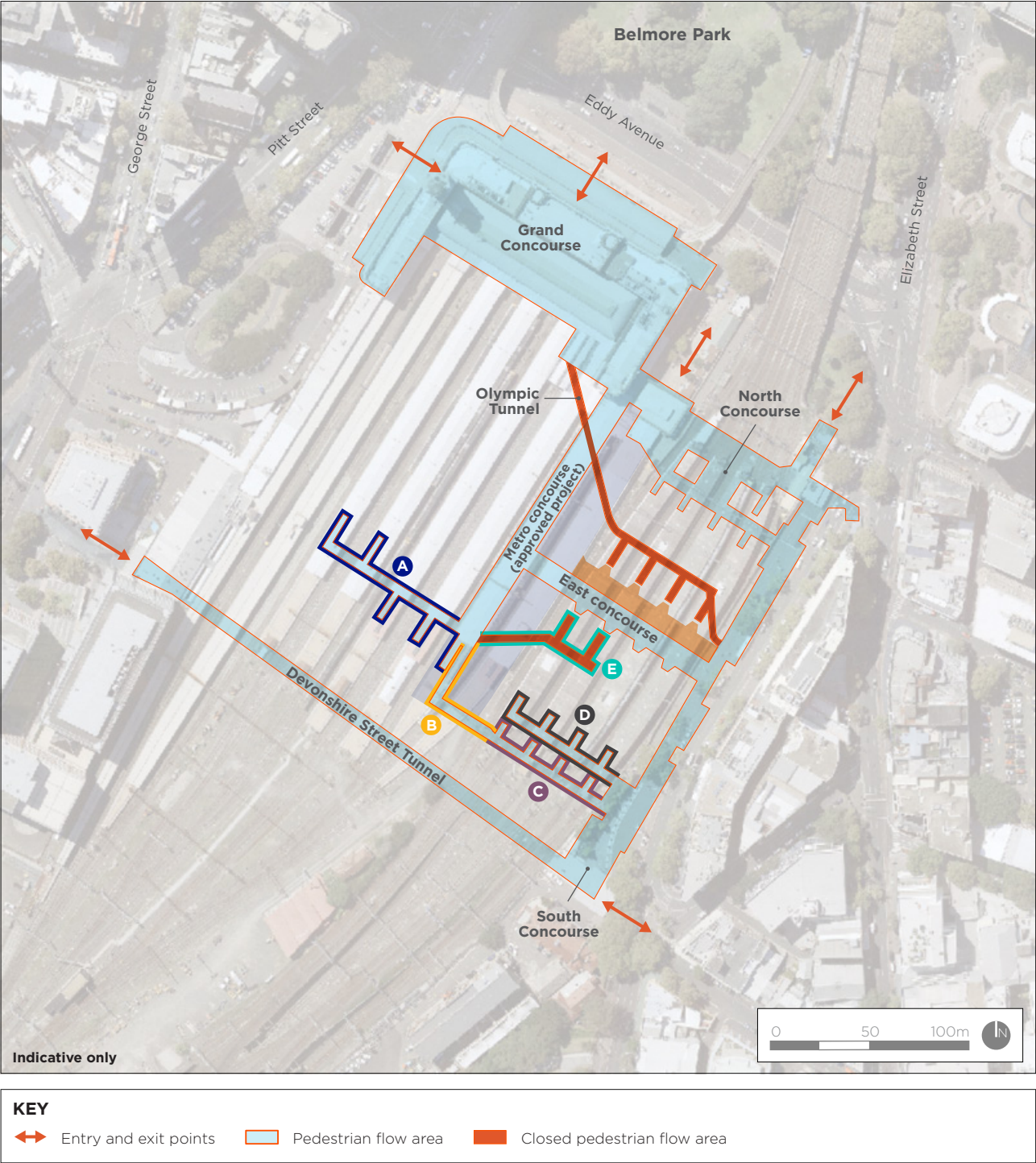


Figure 7-4b Pedestrian movements Phase 2



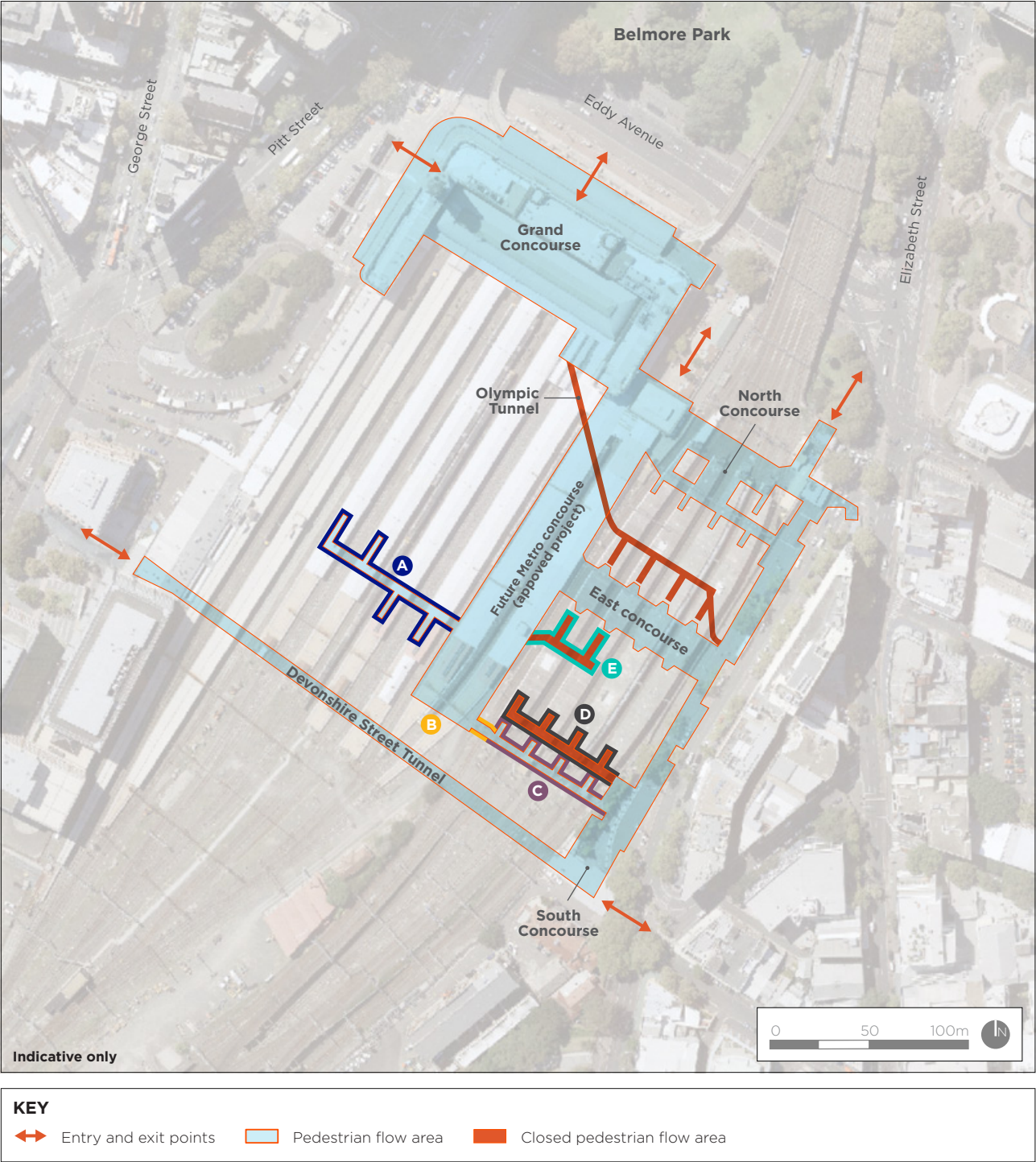


Figure 7-4c Pedestrian movements Phase 3

### 7.8.8 Additional traffic and transport network modifications

It is anticipated that some additional modifications would be required to the surrounding traffic and transport network to facilitate construction of the proposed modification. These modifications would be reviewed by the construction contractor during the preparation of Construction Traffic Management Plans, with the objective of minimising disruptions and potential risks to road safety.

Details of these changes, potential impacts and proposed mitigation measures are provided in Chapter 9 (Construction traffic and transport).

#### Road network

The approved project did not require adjustment of the road network around Central Station.

Modifications to the road network to support the construction of Central Walk would include the temporary closure of Randle Lane (for a period of around three months) to carry out cut and cover works for the new eastern entry. During this period, controlled access to adjacent properties would be maintained for either end of Randle Lane and / or alternative nearby parking locations would be provided.

#### Light rail

The approved project would not result in impacts to the light rail network.

Minor modifications may be required to the light rail network (event platform and related tracks) during the cut-and-cover works in the eastern footpath of Chalmers Street.

#### Pedestrian and cyclist network

The approved project involved some impacts to the surrounding pedestrian and cyclist network including the two week closure of Devonshire Street Tunnel. Additional modifications to the pedestrian and cyclist network around Central Station would include:

- Temporary closure of the footpath and proposed cycle path on the eastern side of Chalmers Street to carry out cut-and-cover works
- Temporary occupation of part of the footpath on the western side of Chalmers Street to remove and subsequently reinstate the station boundary wall.

These works would be timed so that closure of the eastern footpath and the western footpath on Chalmers Street do not occur at the same time.

Transport for NSW will continue to investigate alternative construction methods that would avoid surface impacts at these locations however for the purposes of this report and to provide a worst-case assessment, cut-and-cover excavation works have been assessed.

### 7.8.9 Construction hours

Proposed construction hours for the each element of proposed modification are shown in Table 7-4. These hours have been determined based on a balanced consideration of the construction program and the need to minimise noise and traffic related impacts.

Where possible, the majority of construction activities would be carried out during the following hours:

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm Saturdays
- No works on Sundays or public holidays.

However, other substantial activities (as identified in Table 7-4) would need to be carried out outside these hours to maintain the safety of the public, construction and rail workers; to protect rail assets; and to minimise disruptions to the transport network.

Table 7-4 Proposed construction hours

| Activity  | Construction hours   | Comments or exceptions  |
|---|--|---|
| Demolition – general<br>Eastern entry excavation<br>East concourse and eastern entry fit-out  | <ul style="list-style-type: none"> <li>7 am to 6 pm Monday to Friday</li> <li>8 am to 1 pm Saturdays</li> <li>No works on Sundays and Public Holidays</li> </ul> | <p>Non-disruptive preparatory work, repairs or maintenance may be carried out on Saturday afternoons between 1 pm and 5 pm or Sundays between 8 am and 5 pm.</p> <p>Activities requiring the temporary possession of roads or to accommodate road network requirements may need to be carried out outside the standard daytime construction hours during periods of low demand to minimise safety impacts and inconvenience to commuters.</p> <p>Activities requiring rail possessions and possession of areas within Central Station may need to be carried out outside the standard construction hours up to 24 hours per day, seven days per week.</p> |
| Surface suburban platform works for the east concourse<br>Underground east concourse excavation<br>Aboveground suburban platform works (refresh and re-levelling) | 24 hours per day, seven days per week  | <p>Activities requiring rail possessions and possession of areas within Central Station would be carried out up to 24 hours per day and seven days per week in order to minimise the duration of disruption to rail customers and services.</p> <p>Surface activities supporting underground excavation, including activities at ancillary construction sites, would also be carried out up to 24 hours per day and seven days per week.</p>  |

### 7.8.10 Construction plant and equipment

The plant and equipment likely to be used during construction of the proposed modification are listed in Table 7-5. This list is indicative only. The actual plant and equipment used on site and the numbers required would be further refined during detailed construction planning for the proposed modification.

Table 7-5 Indicative construction plant and equipment

| Plant and equipment    | Eastern entry | East concourse |
|------------------------|---------------|----------------|
| Excavator              | ✓             | ✓              |
| Excavator with breaker | ✓             | ✓              |
| Dozer                  | ✓             | ✓              |
| Truck                  | ✓             | ✓              |
| Backhoe                | ✓             | ✓              |
| Mobile crane           | ✓             | ✓              |
| Elevated work platform | ✓             | ✓              |
| Concrete truck         | ✓             | ✓              |
| Concrete pump          | ✓             | ✓              |
| Concrete vibrator      | ✓             | ✓              |
| Concrete saw           | ✓             | ✓              |
| Sucker truck           | ✓             | ✓              |
| Bobcat                 | ✓             | ✓              |
| Vibratory roller       | ✓             | ✓              |
| Rock anchor drill      | ✓             |                |

| Plant and equipment  | Eastern entry | East concourse |
|----------------------|---------------|----------------|
| Piling rig           | ✓             |                |
| Compressor           | ✓             | ✓              |
| Ventilation scrubber | ✓             | ✓              |
| Road header          | ✓             | ✓              |
| Generator            | ✓             | ✓              |
| Welding equipment    | ✓             | ✓              |
| Hand tools           | ✓             | ✓              |

### 7.8.11 Construction water management

Groundwater may be encountered during excavations and appropriate dewatering would be required. As part of the approved project, a water treatment plant is proposed to be located within the Sydney Yard construction site to treat groundwater inflow within the metro platform excavation. This water treatment plant would also be used to treat groundwater inflow to the east concourse and other excavations as part of the proposed modification. An environment protection licence would be obtained by the contractor carrying out the Sydney Metro and Central Walk works at Central Station. Consistent with the approach for the approved project, water would be treated to meet the requirements of this environment protection licence prior to discharge to the existing surface water environment.

Surface water impacts would be managed through the implementation of standard erosion and sediment control measures in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction Volume 2* (Department of Environment and Climate Change, 2008a).

### 7.8.12 Spoil volume and management

Total spoil generated by the proposed modification is expected to be around 33,000 cubic metres. This would be in addition to the estimated 230,000 cubic metres of spoil generated by the approved Sydney Metro works at Central Station.

Given the volume and potentially contaminated nature of the material to be excavated, spoil removal sites would be secured prior to commencement. Potential sites include:

- Chullora Waste Management Facility (particularly for contaminated spoil)
- Bombo Quarry
- Schofields Quarry
- Horsley Park Quarry.

### 7.8.13 Materials and water usage

The volumes of materials generated by the proposed modification would be relatively minor in comparison of the estimated volume of the approved project.

### 7.8.14 Construction workforce

About 85 additional jobs are expected to be directly created during the peak construction period for Central Walk. These jobs would be in addition to the estimated 320 jobs created at Central Station during the peak construction period for the approved project.

Sydney Metro has developed a Workforce Development and Industry Participation strategy which includes objectives to support local employment and business opportunities, provide skills development and increase workplace diversity. Details of the workforce strategy are provided in Environmental Impact Statement for the approved project.

### 7.8.15 Demobilisation and reinstatement

At the end of the construction, the contractor would demobilise all construction equipment from the construction sites. As part of the operational readiness phase, the contractor would progressively deliver the elements as described in Chapter 6 (Modification description – operation). Typically, this would involve the progressive removal of construction equipment, site sheds and other temporary construction site elements.

Finishing works would be carried out as described in Chapter 6 (Modification description – operation) and Chapter 16 (Landscape character and visual amenity).

## 7.9 Testing and commissioning

Once all services are installed, testing and commissioning of the power, communications and other systems would occur in three stages:

- Collection of safety and quality assurance documentation and commissioning of readiness checks
- Installation and operation tests and checks
- Final inspection, site acceptance tests, commissioning and validation of individual systems.



## 7.10 Indicative construction program

An indicative construction program for the approved project and the proposed modification at Central Station is shown in Table 7-6. Subject to approval, construction of the elements forming the proposed modification is expected to commence in 2018, with the eastern entry and full east concourse scheduled to open at the same time as approved Sydney Metro Chatswood to Sydenham in 2024. Line-wide testing and commissioning between Chatswood and Sydenham would occur in 2023.

**Table 7-6 Indicative construction program**

| Construction activity                     | 2017 |    |    |    | 2018 |    |    |    | 2019 |    |    |    | 2020 |    |    |    | 2021 |    |    |    | 2022 |    |    |    | 2023 |    |    |    | 2024 |    |    |    |
|---|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|
|   | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 | Q1   | Q2 | Q3 | Q4 |
| Eastern Entry                             |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Demolition                                |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Excavation and structural works           |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Fit out, electrical and mechanical works  |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Testing and commissioning                 |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| East Concourse and platform works         |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Platform 22 / 23 works                    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Platform 20 / 21 works                    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Platform 18 / 19 works                    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Platform 16 / 17 works                    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Concourse excavation                      |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Fit out, electrical and mechanical works  |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Testing and commissioning                 |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Approved project works at Central Station |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Enabling works and site establishment     |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Station excavation                        |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| TBM pass through station                  |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Station structural works                  |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Station fit out                           |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |
| Station testing and commissioning         |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |      |    |    |    |

# **ENVIRONMENTAL SCREENING ASSESSMENT**

## CHAPTER EIGHT



## 8 Environmental screening assessment

This chapter provides a consideration of the potential for change to the impacts as assessed for the approved project and whether further assessment of each issue is required.

Consideration of each environmental issue as assessed for the approved project was carried out to determine the potential for change to the impacts and, therefore, whether further assessment of the potential impacts of the proposed modification is required. A screening assessment of the potential change in impacts is provided in Table 8-1.

**Table 8-1 Environmental screening assessment**

| Issue                              | Potential change in impact? | Description   |
|------------------------------------|-----------------------------|---|
| Construction traffic and transport | Yes                         | <p>The proposed modification would introduce additional construction sites, additional construction vehicles, and alterations to how customers travel through Central Station during construction.</p> <p>An assessment of potential changes to construction traffic and transport impacts associated with the proposed modification is provided in Chapter 9.</p>              |
| Operational traffic and transport  | Yes                         | <p>The proposed modification would introduce a new station entry and a new concourse within Central Station, changing the way customers move in and around Central Station.</p> <p>An assessment of potential changes to operational traffic and transport impacts associated with the proposed modification is provided in Chapter 10.</p>                                     |
| Construction noise and vibration   | Yes                         | <p>The proposed modification would require additional construction activities in new locations which may introduce new or increased noise and vibration impacts to receivers.</p> <p>An assessment of potential changes to construction noise and vibration impacts associated with the proposed modification is provided in Chapter 11.</p>                                    |
| Operational noise and vibration    | Yes                         | <p>The proposed modification would introduce new fixed infrastructure (mechanical and electrical) at the proposed eastern entry and near the existing Devonshire Street station entry.</p> <p>An assessment of potential changes to operational noise and vibration impacts associated with the proposed modification is provided in Chapter 11.</p>                            |
| Land use and property              | Yes                         | <p>The proposed modification would require additional property acquisition, impact additional areas of land and provide additional opportunities to integrate with surrounding land use through the proposed eastern entry.</p> <p>An assessment of potential changes to land use and property impacts associated with the proposed modification is provided in Chapter 12.</p> |
| Business impacts                   | Yes                         | <p>The proposed modification would directly and indirectly impact additional businesses within Central Station and to the east of Central Station.</p> <p>An assessment of potential changes to business impacts associated with the proposed modification is provided in Chapter 13.</p>   |
| Non-Aboriginal heritage            | Yes                         | <p>The proposed modification would impact additional elements within the State heritage listed Central Station and require demolition of the locally listed former MGM building.</p> <p>An assessment of potential changes to non-Aboriginal heritage impacts associated with the proposed modification is provided in Chapter 14.</p>  |

| Issue                                       | Potential change in impact? | Description   |
|---|-----------------------------|---|
| Aboriginal heritage                         | Yes                         | <p>The proposed modification would require excavation in additional areas which may have Aboriginal heritage potential.</p> <p>An assessment of potential changes to Aboriginal heritage impacts associated with the proposed modification is provided in Chapter 15.</p>   |
| Landscape character and visual amenity      | Yes                         | <p>The proposed modification would require construction activities in new locations, and would introduce new built infrastructure in new locations.</p> <p>An assessment of potential changes to landscape character and visual amenity impacts associated with the proposed modification is provided in Chapter 16.</p>  |
| Groundwater and geology                     | Yes                         | <p>The proposed modification would involve underground excavation for the eastern entry and the east concourse which may intercept groundwater.</p> <p>An assessment of potential changes to groundwater and geology impacts associated with the proposed modification is provided in Chapter 17.</p>   |
| Soils, contamination and water quality      | Yes                         | <p>As the construction activities for the proposed modification are generally consistent with the types of construction activities for the approved project, there would not be any additional soil or water quality risks. The mitigation measures identified for the approved project would be applied to the proposed modification.</p> <p>An additional assessment of potential changes to soil and water quality impact associated with the proposed modification is not considered necessary.</p> <p>The proposed modification would involve excavation in additional areas which may have increased or new contamination risks.</p> <p>An assessment of potential changes to contamination impacts associated with the proposed modification is provided in Chapter 18.</p>  |
| Social impacts and community infrastructure | No                          | <p>The Environmental Impact Statement for the approved project identified potential social impacts associated with property acquisition, changes to community values, community health and safety, and changes to access and connectivity. Potential impacts to community infrastructure from the approved project include direct loss of infrastructure, changes to amenity and access.</p> <p>The proposed modification would not introduce any new potential social impacts, or directly impact any additional community infrastructure. The mitigation measures identified for the approved project would be applied to the proposed modification and are considered sufficient to manage these risks. Potential changed impacts associated with property acquisition, amenity and access are considered as part of the relevant issue-specific assessment chapters.</p> <p>An additional assessment of potential changes to social and community infrastructure impacts associated with the proposed modification is not considered necessary.</p> |
| Biodiversity                                | No                          | <p>The proposed modification would not involve the clearing of any vegetation. The buildings and structures within Central Station which would be impacted by the proposed modification were considered for their potential to provide fauna habitat. It was determined that these buildings and structure are unlikely to provide potential habitat due to their location with a busy railway environment, the nature of the buildings with poor thermal qualities, and lack of available water and native vegetation in proximity to the site.</p> <p>An assessment of potential changes to biodiversity impacts associated with the proposed modification is not considered necessary.</p>   |

| Issue                  | Potential change in impact? | Description  |
|------------------------|-----------------------------|--|
| Flooding and hydrology | Yes                         | <p>An overland flow path exists along Chalmers Street, with flooding beginning to occur in the 50 year average recurrence interval event.</p> <p>Flooding begins to occur on the Central Station tracks in the two year average recurrence interval event.</p> <p>An assessment of potential changes to flooding impacts associated with the proposed modification is provided in Chapter 19.</p>  |
| Air quality            | No                          | <p>The Environmental Impact Statement for the approved project identified potential air quality impacts associated with the generation of dust and exhaust emissions during construction. The proposed modification would not introduce any new air quality impacts and the mitigation measures identified for the approved project would be applied to the proposed modification.</p> <p>An assessment of potential changes to air quality impacts associated with the proposed modification is not considered necessary.</p>   |
| Hazard and risk        | No                          | <p>The Environmental Impact Statement for the approved project identified potential hazard and risk impacts associated with the storage, use and transport of dangerous goods and hazardous substances, the rupture or interference of underground utilities, and damage to adjacent buildings due to ground movement. The proposed modification would not introduce any new hazard and risk impacts and the mitigation measures identified in for the approved project would be applied to the proposed modification.</p> <p>An assessment of potential changes to hazard and risk impacts associated with the proposed modification is not considered necessary.</p>   |
| Waste management       | No                          | <p>The Environmental Impact Statement for the approved project identified potential waste management impacts associated with the handling and disposal of waste (including spoil) generated during construction and operation. The proposed modification would not introduce any new waste streams, although it would result in some minor additions to the volume of waste (including spoil) generated. The mitigation measures identified for the approved project would be applied to the proposed modification and would be sufficient to manage the minor increase in waste volumes.</p> <p>During operation, waste would be managed in accordance with the existing procedure at Central Station.</p> <p>An assessment of potential changes to waste management impacts associated with the proposed modification is not considered necessary.</p>   |
| Sustainability         | No                          | <p>The Environmental Impact Statement for the approved project identified potential sustainability impacts associated with climate change adaptation, construction resource use and greenhouse gas emissions. The proposed modification would not introduce any new sustainability impacts, although there would be some minor increases in the volumes of materials used and the greenhouse gas emissions emitted. These increases are not considered to make a material change to the assessment. The mitigation measures identified for the approved project would be applied to the proposed modification and would be sufficient to manage these minor increases.</p> <p>In addition, the Environmental Impact Statement for the approved project provided the sustainability strategy, objectives and initiatives for Sydney Metro City &amp; Southwest. These would also apply to the proposed modification.</p> <p>An assessment of potential changes to sustainability impacts associated with the proposed modification is not considered necessary.</p> |

| Issue              | Potential change in impact? | Description   |
|--------------------|-----------------------------|---|
| Cumulative impacts | Yes                         | <p>The Environmental Impact Statement for the approved project identified potential cumulative impacts at Central Station associated with the concurrent construction of CBD and South East Light Rail.</p> <p>The proposed modification would carry out works on Chalmers Street, potentially introducing new cumulative impacts with CBD and South East Light Rail. The proposed modification may also have cumulative impacts with other nearby projects such as the Power Supply Upgrade (Chalmers Street and Lee Street substations).</p> <p>An assessment of potential changes to cumulative impacts associated with the proposed modification is provided in Chapter 20.</p> |

# **CONSTRUCTION TRAFFIC AND TRANSPORT**

## CHAPTER NINE





# 9 Construction traffic and transport

This chapter assesses the potential change in traffic and transport impacts during the construction phase of the proposed modification. Any changes to mitigation measures to address the potential impacts are also identified.

## 9.1 Assessment methodology and assumptions

The construction traffic and transport assessment method followed the same approach as was carried out for the approved project. This methodology is summarised in the following sections.

### 9.1.1 Traffic assessment

The construction traffic impact assessment is based on the analysis of existing traffic movements on the local road network to determine the current operational performance. Construction traffic from the proposed modification is combined with the approved project. This traffic is then added to the existing network and analysed to identify potential impacts. The approach to traffic modelling carried out for this assessment aligns with the *Traffic Modelling Guidelines* (Roads and Maritime, 2013).

For the purposes of this assessment, it has been assumed that all spoil would be transported from the construction site by truck. As identified for the approved project, the transport of spoil by train from Central Station is not considered feasible due to the infrastructure required to support a rail siding and spoil loading, and the potential impacts to passenger rail services.

Consistent with the standard approach for traffic assessments on major infrastructure projects, the traffic modelling carried out is of the morning (AM) and evening (PM) peak periods only. These peak traffic periods represent a 'worst case scenario' as during these periods the road network experiences the maximum background traffic demand and the available spare capacity of the road network is at its most limited.

To minimise impacts to the local road network, construction vehicle volumes have been planned to be higher outside the AM and PM weekday peak periods; however, the number movements would remain relatively low and would be within the range of daily variations in traffic volumes on the road network when compared to background traffic. Construction traffic volumes applied to the modelled road networks to assess the impacts of the approved project and the proposed modification represent the highest upper limit between possession and non-possession works during the modelled peak periods.

To assess the impact of the construction activities on the road network performance, intersections along the proposed construction routes between construction sites and the arterial road network have been assessed using LinSig. The main performance indicators for LinSig 3.2 include:

- Degree of Saturation (DoS) – the ratio between traffic volumes and capacity ( $v / c$ ) of the intersection used to measure how close to capacity an intersection is operating. The DoS is a direct measure of the congestion level at the intersection. As DoS approaches 1.0, both queue length and delays increase rapidly. Satisfactory operations usually occur with a DoS range between 0.8-0.9 or below
- Average Delay – duration, in seconds, of the average vehicle waiting time at an intersection
- Level of Service (LoS) – a measure of the overall performance of the intersection. For this purpose, average delay from Roads and Maritime Services LoS calculations has been used.

Criteria for these performance indicators are provided in Table 9-1.

Table 9-1 Intersection Level of Service criteria

| Level of Service | Average Delay (seconds per vehicle) | Traffic signals and roundabout operations                     |
|------------------|-------------------------------------|---|
| A                | Less than 14                        | Good operation  |
| B                | 15 to 28                            | Good with acceptable delays and spare capacity                |
| C                | 29 to 42                            | Satisfactory  |
| D                | 43 to 56                            | Operating near capacity                                       |
| E                | 57 to 70                            | At capacity; at signals incidents will cause excessive delays |
| F                | >70                                 | Exceeds capacity; roundabouts require other control mode      |

Source: Guide to Traffic Generating Development (Roads and Traffic Authority, 2002)

The following scenarios have been modelled:

- Existing scenario – existing network performance, assuming the CBD and South East Light Rail is in operation
- Approved project – network performance with Sydney Metro City & Southwest Chatswood to Sydenham construction vehicles
- Central Walk scenario 1 (Primary route) – network performance during construction of Central Walk including construction vehicles associated with the approved project works, and using the primary haul route
- Central Walk scenario 2 (Secondary route) – network performance during construction of Central Walk including construction vehicles associated with the approved project works, and using the secondary haul route.

The assessment includes all construction vehicles using the primary route and all construction vehicles using the secondary route. This is considered to provide a conservative assessment.

Due to the observed changes in traffic patterns which have occurred in the Sydney CBD since the preparation of the assessment for the approved project (due to the progressive closure of George Street associated with the construction of CBD and South East Light Rail), updated background traffic counts have been carried out and are used to inform this assessment. As a result, in some locations, this assessment may present different intersection performance results for the existing scenario and the approved project scenario to those presented in the Environmental Impact Statement and the Submissions and Preferred Infrastructure Report.

### 9.1.2 Transport assessment

A qualitative assessment has been carried out to assess the potential impacts to transport services during construction. This includes consideration of the active transport network (pedestrian and cyclist facilities) and public transport services (suburban rail, buses and ferries).

### 9.1.3 Hours of truck operation

As identified in Chapter 7 (Modification description – construction), construction activities would be carried out up to 24 hours per day and seven days per week, requiring construction vehicles to access and egress the site up to 24 hours per day, depending on the stage of construction and the activity.

The proposed timing of vehicle movements throughout the day for the construction site is identified in Section 9.4.1. The development of these truck movements has aimed to minimise movements during the AM and PM peak traffic periods and during the night-time period. Section 9.4.1 provides further discussion regarding the hours of heavy vehicle operations that have been assessed in the traffic model.

#### 9.1.4 Haul routes

Haul routes to and from the construction site are generally consistent with the haul routes for the approved project at Central Station and have been developed in consultation with Roads and Maritime Services and Transport Coordination, and with the following aims:

- Minimise the use of local or residential streets and maximise the use of arterial roads
- Minimise potential safety implications for pedestrians, cyclists and other road users
- Minimise impact on bus services
- Exit the Sydney CBD as efficiently as possible
- Minimise the cumulative use of roads by trucks accessing different Sydney CBD construction sites.

The proposed haul routes for the construction site are provided in Section 9.4.1.

#### 9.1.5 Spoil generation

Total spoil generated by the construction activities for Central Walk is expected to be around 33,000 cubic metres. This would be in addition to the 230,000 cubic metres generated by the approved project works at Central Station.

Given the volume and potentially contaminated nature of the material to be excavated, spoil removal sites would be secured prior to commencement. Potential sites include:

- Chullora Waste Management Facility (particularly for contaminated spoil) to the southwest
- Bombo Quarry to the south
- Schofields Quarry to the northwest
- Horsley Park Quarry to the southwest.

## 9.2 Existing environment

Central Station is the busiest station in NSW, catering to about 195,000 customers on an average weekday. Central Station is the primary destination for intercity services with the majority of these services terminating at Central Station. Central Station is a major interchange hub between heavy rail, light rail, bus and coach services.

The existing layout of Central Station including existing entry and exit points is shown in Chapter 1 (Introduction).

The traffic and transport environment around Central Station is currently undergoing changes through the implementation of major transport projects such as the CBD and South East Light Rail. Construction of these projects, and other changes to the traffic and transport environment within the Sydney CBD would be occurring concurrently with the construction of the approved project and the proposed modification. The existing environment described in this section provides information, where relevant, relating to the proposed changes due to these projects.

## 9.2.1 Rail traffic and transport

### Heavy rail

Central Station is the largest railway station and transport interchange in NSW, being the only station within the Sydney rail network that connects all intercity and suburban services (except for the T5 Cumberland and T6 Carlingford lines). On a typical weekday, there are around 2,700 train services to Central Station (based on the 2014 timetable).

Central Station is served by suburban, intercity, regional and interstate railway services over 25 platforms, operating within the Sydney Metropolitan area, to regional New South Wales and interstate. Table 9-2 shows the primary platforms for railway services at Central Station.

**Table 9-2 Railway services at Central Station**

| Service                 | Lines / regions   | Primary platforms   |
|-------------------------|---|---|
| Regional and interstate | <ul style="list-style-type: none"> <li>North Coast</li> <li>North Western</li> <li>Western</li> <li>Southern NSW</li> <li>Brisbane</li> <li>Melbourne</li> <li>Perth via Adelaide</li> </ul>  | Platforms 1-3   |
| Intercity               | <ul style="list-style-type: none"> <li>Blue Mountains Line</li> <li>Central Coast &amp; Newcastle Line</li> <li>Hunter Line</li> <li>South Coast Line</li> <li>Southern Highlands Line</li> </ul>   | Platforms 4-15<br>Platform 24-25<br>(South Coast Line only) |
| Suburban                | <ul style="list-style-type: none"> <li>T1 North Shore, Northern &amp; Western Line</li> <li>T2 Airport, Inner West &amp; South Line</li> <li>T3 Bankstown Line</li> <li>T4 Eastern Suburbs &amp; Illawarra Line</li> <li>T7 Olympic Park Line (during special events only)</li> </ul> | Platforms 16-25   |

Of the 25 heavy rail platforms at Central Station, platforms 1 to 23 are located above ground level, while platforms 24 and 25 are located underground at the eastern edge of the station. Two additional unused underground platforms also exist at the station (platforms 26 / 27) above platforms 24 / 25.

### Approved Sydney Metro works at Central Station

The approved project involves the construction of new metro platforms and the new north-south concourse below existing platforms 12 to 15. Under the approved project, the future metro concourse will connect to the existing concourse network within Central Station.

### Light rail

The L1 Dulwich Hill Line is currently the only light rail line in operation. The L1 Dulwich Hill Line connects Central Station and the inner western suburbs via Pyrmont. The Central light rail terminus is located on the upper level colonnade of the Grand Concourse parallel to Eddy Avenue and accessible from the Grand Concourse.

The CBD and South East Light Rail is currently under construction and will connect the Sydney CBD and south eastern suburbs. In the vicinity of Central Station, the CBD and South East Light Rail network will run along Devonshire Street, Chalmers Street, Eddy Avenue and Rawson Place, with stops located on Chalmers Street and Rawson Place.

## 9.2.2 Pedestrian access and interchange networks

### Pedestrian access to Central Station

Pedestrian access to Central Station via Eddy Avenue has footpaths on both sides. Pedestrian access is also available from Lee Street to the southwest and Devonshire Street to the southeast, which are connected by the Devonshire Street Tunnel, providing subsurface access to the station from its southern approaches.

### Entries and exits

Central Station is accessed from seven entry and exit points with the majority located on the northern and eastern sides of the station. These entries connect at differing levels, resulting in multiple level changes between each of the concourses. Access from the west is provided via the Devonshire Street Tunnel to the south or across the Grand Concourse to the vertical transport at the western extent of the North Concourse.

Data from 2014 shows that Central Station serves a higher number of total customers during the morning peak hour than the evening peak hour. Of the customers leaving the station during the morning peak hour, 36 per cent exit to the west, 33 per cent to the north, and 31 per cent to the east. The majority of these trips are customers walking to their destination, while those transferring to bus services outside of the station account for 22 per cent of exiting trips and customers transferring to light rail account for two per cent of exiting trips.

### Tunnels and concourses

All operational platforms are connected to four existing concourses either directly via vertical transport (stairs, escalators or lifts), or via a series of tunnels. The four concourses are:

- The Grand Concourse, located at the north-western side of the station. This predominately serves regional and intercity railway lines and the light rail line
- The North Concourse, located at the north-eastern side of the station. This generally serves the suburban railway lines. The Grand Concourse and North Concourse are currently connected by two escalators and two stairs
- The South Concourse, located at the south-eastern side of the station. This concourse also serves the suburban railway lines as well as intercity services via the southern baggage tunnels
- The Eastern Suburbs Concourse, which runs north-south at the eastern edge of the station between the North and South Concourse. This concourse provides access to the T4 Eastern Suburbs & Illawarra Line.

A series of internal tunnels exist at the station which connects the South Concourse and North Concourse, underground platforms 24 / 25, and the Olympic Tunnel.

### 9.2.3 External traffic and transport environment

#### Pedestrian network

Pedestrian crossing facilities are generally available on both sides of all surface roads adjacent to the station. Footpaths front Eddy Avenue, Railway Square and the western side of Chalmers Street between Devonshire Street and Eddy Avenue due to high pedestrian volumes.

There are high volumes of pedestrian activity on the footpaths surrounding Central Station, with congestion occurring near a number of pedestrian crossings locations.

Footpaths fronting George Street, Rawson Place, Pitt Street north of Eddy Avenue, Foveaux Street and Chalmers Street attract the highest number of pedestrian movements. Conflict between pedestrians and those waiting at bus stops also occurs, particularly on Eddy Avenue, Railway Square and Chalmers Street.

#### Cycle facilities

Central Station currently has a number of cycle paths within its vicinity. Of relevance to the proposed modification, a shared off-road cycle path currently runs along part of Chalmers Street and through Prince Alfred Park and Belmore Park.

As part of CBD and South East Light Rail, a separated bicycle path will be formalised along a section of Chalmers Street and will replace the shared path along this section of road.

Cycle racks are available around the station on Chalmers Street, Eddy Avenue and the Western Forecourt.

#### Bus network

The Central Station and its immediate surrounds are serviced by 58 bus routes. Two major north-south bus spines exist; via Chalmers Street and Elizabeth Street on the eastern edge of the station, and via George Street, Lee Street and Pitt Street on the western edge of the station. Buses also travel east-west via Eddy Avenue, Albion Street, Foveaux Street and Cleveland Street. Major interchanges are located at Railway Square, Eddy Avenue, Elizabeth Street and Chalmers Street.

NightRide bus services, which replace train operations generally between 12:00 am and 4:30 am, also operate from Central Station. A total of 11 bus routes are accessible at Railway Square.

Due to CBD and South East Light Rail, a number of bus stops and bus routes around Central Station will change. This include:

- Buses prohibited on Chalmers Street between Devonshire Street and Eddy Avenue, with buses redirected via Randle Street and Elizabeth Street between Eddy Avenue and Randle Street. Buses on Randle Street will travel one way northbound
- Rawson Place converted to a bus only zone
- George Street between Rawson Place and Lee Street traversed by buses in the southbound direction
- Removal of bus stops on Chalmers Street between Devonshire Street and Eddy Avenue
- Additional bus stop on Elizabeth Street in the northbound direction south of Foveaux Street
- Additional bus stop on Rawson Place adjacent to the light rail stop.

The final configuration of bus services around Central Station is being finalised by Transport for NSW prior to the commencement of light rail services in 2019. This may include further relocation of existing bus stops and minor changes to bus routes.

NightRide bus services, which replace train operations generally between 12:00 am and 4:30 am, also operate from Central Station with a total of 11 bus routes accessible at Railway Square.

During regular rail possession works, rail replacement buses operate to and from Central Station. These services mainly arrive and depart from the Western Forecourt, with access and egress to the Western Forecourt via the Hay Street ramp, and an additional egress via Lee Street.

### Coach services

A number of coach services operate to and from Central Station providing intrastate and interstate services. These coach services depart from the Western Forecourt and Pitt Street. Coaches access and depart the Western Forecourt via the Hay Street ramp, with an additional egress via Lee Street.

### Taxi facilities

Taxi ranks are located around Central Station at the Western Forecourt, Chalmers Street, Devonshire Street, Regent Street and Thomas Street.

### Road network

Central Station is surrounded by a number of major roads interconnected by a series of collector and local roads. Roads that provide direct access to Central Station are described in Table 9-3. Future road changes as a result of CBD and South East Light Rail are also detailed in Table 9-3.

**Table 9-3 Roads surrounding Central Station**

| Road          | Direction of traffic | Lane provisions  | Future planned changes  |
|---------------|----------------------|--|---|
| Eddy Avenue   | East-west            | Eastbound: Three general traffic lanes, one bus lane                     | Nil   |
|               |                      | Westbound: Three general traffic lanes, two bus / taxi lanes             | Westbound: North of the new light rail line, a bus lane and two lanes for general traffic as well as an additional bus only lane between Pitt Street and the signalised midblock crossing |
| Pitt Street   | North-south          | Northbound: Three lanes  | Nil   |
|               |                      | Southbound: Three lanes  | Nil   |
|               |                      | Vehicular access to the western forecourt from Pitt Street               | Nil   |
| Lee Street    | North-south          | Northbound: Three lanes  | Nil   |
|               |                      | Southbound: Two lanes  | Nil   |
|               |                      | Vehicular exit lane from the western forecourt (southbound traffic only) | Nil   |
|               |                      | Access to Ambulance Avenue and the Adina Hotel                           | Nil   |
| George Street | North-south          | Northbound: Four lanes   | Nil   |
|               |                      | Southbound: Three general traffic lanes, two bus lanes                   | Nil   |



| Road  | Direction of traffic | Lane provisions   | Future planned changes  |
|---|----------------------|---|---|
| Chalmers Street                                   | North only           | Two general traffic lanes                                   | Closed to general traffic north of Randle Street.<br><br>Reconfiguration of the Chalmers Street / Randle Street / Devonshire Street intersection with left, through and right turn movements allowed on the Chalmers Street northbound approach |
|   |                      | One bus lane (western side)                                 |   |
|   |                      | One parking lane (eastern side)                             |   |
|   |                      | Parking lanes on both sides                                 |   |
| Randle Street                                     | South only           | One general traffic lane                                    | Converted to a one way northbound road, with bus lane   |
|   |                      | Parking lanes on both sides                                 |   |
| Randle Lane                                       | South only           | One general traffic lane                                    | Nil   |
| Elizabeth Street (south of Eddy Avenue)           | South only           | Three general traffic lanes                                 | Reconfigured as a bi-directional road consisting of two northbound and two southbound lanes between Foveaux Street and Randle Street  |
|   |                      | One bus lane (eastern side)                                 |   |
| Foveaux Street                                    | West only            | Three general traffic lanes                                 | Nil   |
|   |                      | One parking lane (northern side)                            | Nil   |
| Devonshire Street                                 | East-west            | Eastbound: One general traffic lane, one parking lane       | Nil   |
|   |                      | Westbound: One general traffic lane, one parking lanes      | Nil   |
| Regent Street (north of Cleveland Street)         | North-south          | Northbound: Two lanes                                       | Nil   |
|   |                      | Southbound: Three lanes                                     |   |
| Hay Street (between Castlereagh and Pitt streets) | East-west            | Eastbound: Two generally traffic lanes, one light rail lane | Nil   |
|   |                      | Westbound: Two general traffic lane                         |   |

In addition to the on-street parking identified in Table 9-3, paid car parking is available at Central Station at the western forecourt, with access provided at the Pitt Street / Hay Street intersection and the Pitt Street / Lee Street / George Street / Quay Street intersection.

The existing traffic volumes on the surrounding road network are provided in the assessment carried out for the approved project. Currently there are very high volumes on all nearby major roads including on George Street and Regent Street. In the evening peak, Elizabeth Street (southbound) experiences similarly high volumes.

As identified in the assessment for the approved project, a number of intersections near the Central Station construction sites currently operate near, at or over capacity in the AM and PM peak periods.

## 9.3 Potential impacts within Central Station

Potential impacts within Central Station relate to the movement of customers within the station, including those interchanging between services and those entering or exiting the station; and impacts to rail services due to the need for rail possessions.

### 9.3.1 Customer movements within Central Station

#### Approved project

The potential impacts of the approved project to customers within Central Station include the closure of some underground pedestrian tunnels. These impacts were proposed to be managed through the construction and opening of a new pedestrian connection between platforms 12 and 16 at the southern end of the metro excavation, and the provision of new stairs from the Olympic Tunnel to platforms 20-23. The assessment of these works found that the underground connections would be built with similar dimensions to the existing tunnels and would continue to function at similar levels of service to the existing arrangements.

#### Proposed modification

The construction of the east concourse would impact additional pedestrian tunnels beneath the platforms that are used for customer interchange and entry / exit purposes.

The construction of the east concourse would require temporary closure of some sections of the Eastern Suburbs concourse and the permanent closure of the Olympic Tunnel and the north branches of the southern commuter subway, and their stairs to the suburban platforms. Maintenance of passenger movements through Central Station during the construction period is important to allow the station to continue to perform its transport function. Construction staging has been planned to minimise disruption to passenger movements through a phased opening of the east concourse, with pedestrian flows temporarily redirected through the future metro concourse.

As described and shown on figures in Chapter 7 (Modification description – construction), there would be three key phases of pedestrian movements through the station during construction.

A construction pedestrian assessment has been provided for Phase 2 only as:

- Phase 1 is consistent with the pedestrian movements described and assessed as part of the approved project. This assessment found that the pedestrian tunnels at the station would continue to operate at a similar level of service to the existing arrangements
- Phase 3 represents the operation phase. Consideration of the potential impacts and benefits as a result of the proposed modification is provided in Chapter 10 (Operational traffic and transport).

The pedestrian assessment for Phase 2 uses forecast 2026 passenger numbers at Central Station as a base case to determine the potential impacts. This is considered to provide a conservative assessment considering these works would occur a number of years earlier than 2026 during a period with less forecast patronage.

In both the AM and PM peak periods, construction works would result in some deterioration of pedestrian performance in some locations. Specific areas where deterioration may occur and where impacts may arise during Phase 2 construction works are:

- In the AM peak:
  - ◆ The northern end of platforms 16 / 17 where passengers would experience Level of Service E / F
  - ◆ The areas on platforms 16 / 17 directly adjacent to platform hoarding where passengers would have difficulty boarding and alighting trains
- In the PM peak:
  - ◆ The base of the two northern stairs to platforms 18 / 19 where passengers would experience Level of Service E / F.

To manage these potential impacts, specific station management measures would be implemented during Phase 2. This would include strategies such as encouraging passengers to exit platforms at the closest stair case or escalator, signage and marshalling of passengers waiting to board to minimise those waiting adjacent to hoarding and to direct passengers so that there is even distribution along the platform.

### Impacts to rail services

The approved project would require a number of rail possessions at Central Station. The construction method for the east concourse would minimise impacts to rail services by allowing trains to continue to operate whilst excavation works occur below. However, some construction activities for the proposed modification would still be required to take place during rail possession periods (eg platform works and overhead wiring modifications).

Where possible, works for the approved project and the proposed modification would be timed to be carried out during the same possessions and to be carried out concurrently with standard rail possessions planned by Sydney Trains. At Central Station there are typically 30 rail possessions per year in varying configurations. However, there are likely to be some additional and / or extended rail possessions to support the construction works.

There are five configurations possible for a rail possession at Central Station. However, for each configuration, a one-way train on the City Circle would be maintained with a bus provided for customers in the other direction.

Two of the five rail possession configuration types identified would impact the T2 Airport Line and one-way running of trains on this line would be maintained, with a bus provided for customers in the other direction. The remaining three configuration types would require services on the T1 North Shore Line to terminate at North Sydney Station or Wynyard Station and services on the T1 Northern Line to terminate at Central Station.

Customers would be notified of any planned rail possession works to allow customers to plan their journey well ahead of time. Announcements would be made by station staff and appropriate signage would be provided to inform customers of any changes to rail services. Rail replacement services would be provided during rail possessions. This is similar to the current practices of Sydney Trains at Central Station. Rail possessions would be scheduled to avoid or minimise impacts on special events.

## 9.4 Potential impacts external to Central Station

Potential construction traffic and transport impacts would primarily relate to the addition of trucks and light vehicles to the road network surrounding the construction sites. The establishment and use of the construction sites would also result in some additional direct and indirect impacts to pedestrian and cyclist facilities, public transport services and existing car parking.

### 9.4.1 Vehicle movement forecasts and routes

Construction vehicle numbers generated at each of the Central Station construction sites would differ during rail possessions (rail possessions and possession of areas within Central Station) and non-possession periods. Indicative average hourly movements during possession and non-possession periods are provided for each construction site in the following sections. For the purposes of this assessment, the upper limit of indicative hourly movements from each site has been used to provide a conservative worst-case assessment.

The primary and secondary haul routes proposed for the proposed modification are generally consistent with the haul routes for the approved project works at Central Station. These haul routes are shown in Figure 9-1 and Figure 9-2. The primary haul route is intended to be the main haul route used during the construction works, with the secondary haul route used to minimise impacts on the primary route, during periods when the primary route is not available (such as during special events), or to access specific destination to and from the west.

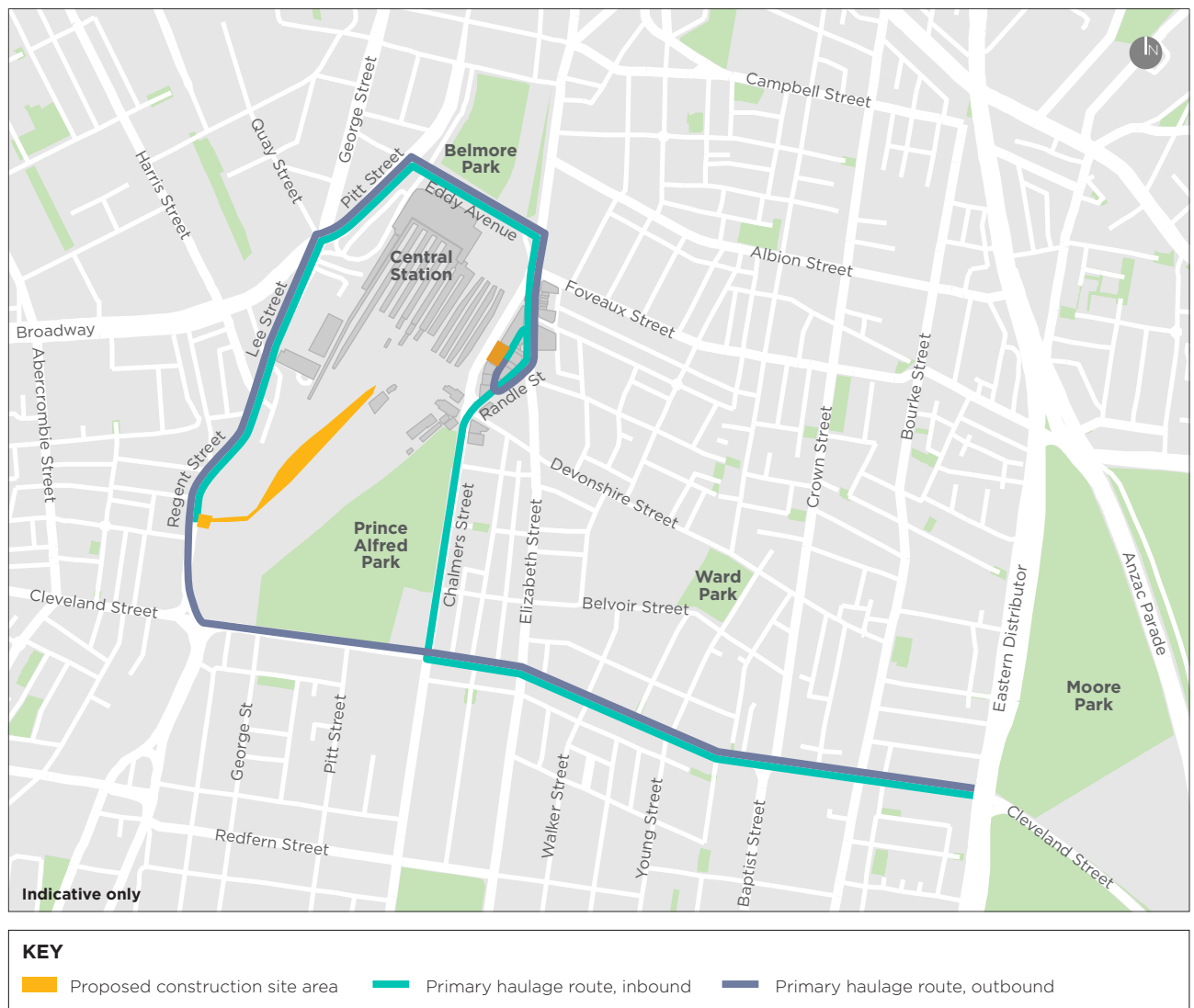


Figure 9-1 Primary haul route

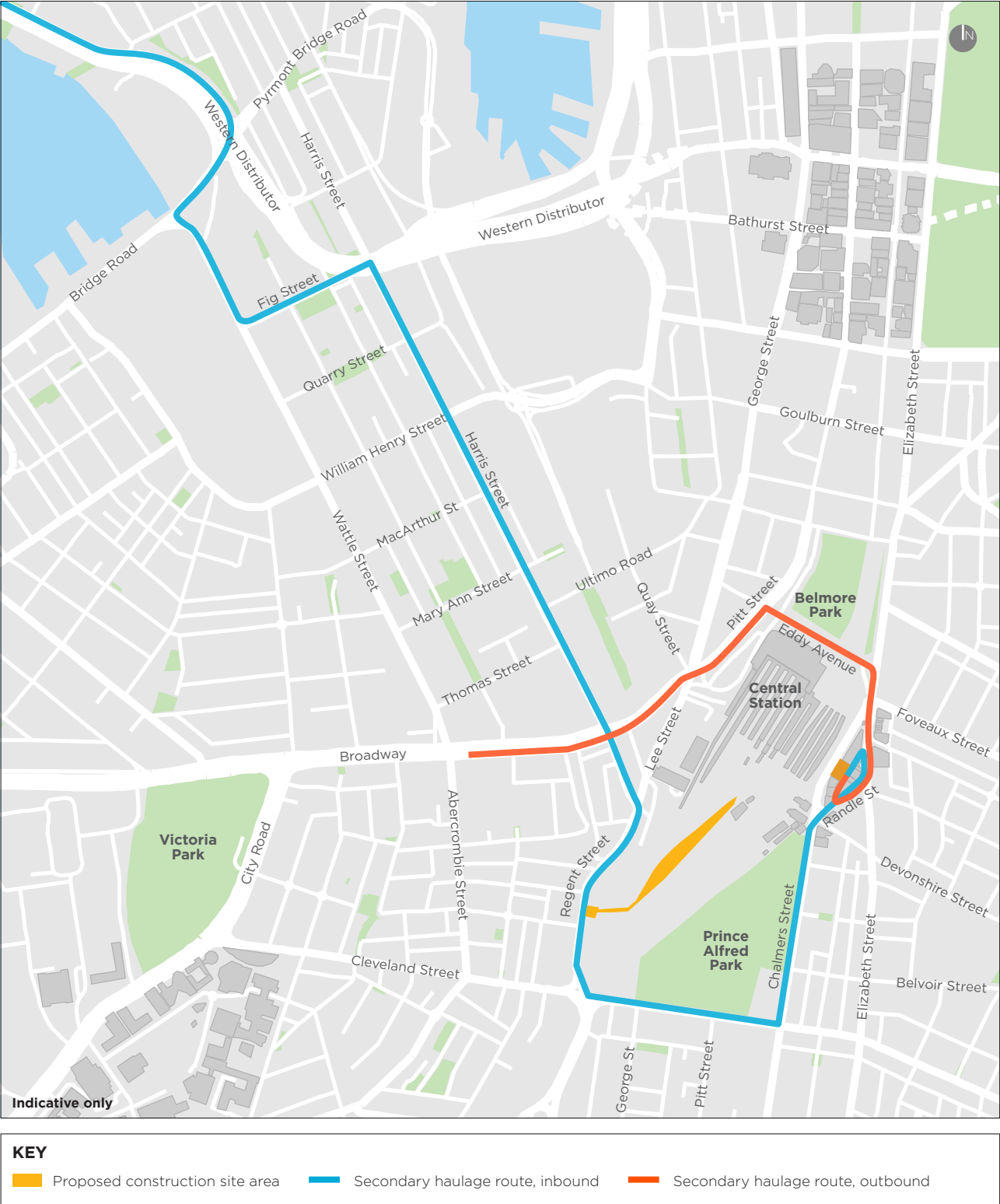


Figure 9-2 Secondary haul route

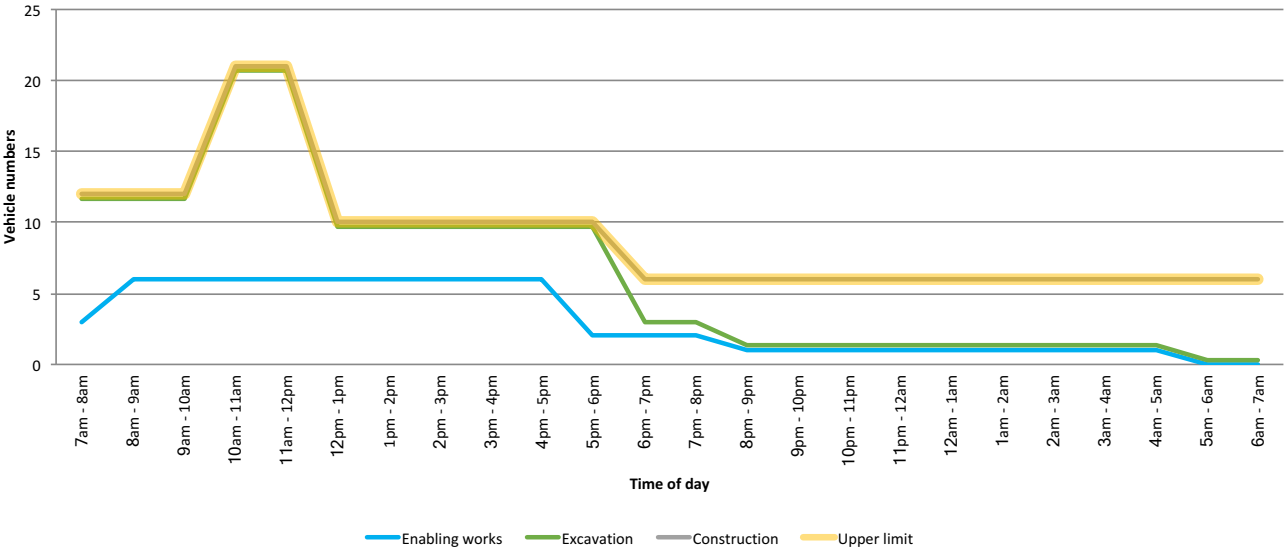
### **Sydney Yard construction site**

During non-possession periods, the Sydney Yard construction site would generate a maximum of 40 vehicles entering the site per hour for the proposed modification. It is anticipated that the same number of vehicles would exit the site per hour. The anticipated vehicle numbers (heavy and light vehicles) that would access the Sydney Yard construction site over a typical day per hour during non-possession periods are provided in Figure 9-3. These graphs show that during non-possession periods, the peak light and heavy vehicle movements in the AM peak period (7am to 10am) would be 12 light vehicles per hour and 16 heavy vehicles per hour during the excavation and construction phases.

During possession periods, the Sydney Yard construction site would generate a maximum of 43 vehicles entering the site per hour. It is anticipated that the same number of vehicles would exit the site per hour. The anticipated vehicles numbers (heavy and light vehicles) that would access the Sydney Yard construction site over a typical day per hour during possession periods are provided in Figure 9-4. These graphs show that during possession periods, the peak light and heavy vehicle movements in the AM peak period (7am to 10am) would be 12 light vehicles per hour and 16 heavy vehicles per hour during the excavation and construction phases.

Access to and egress from the site would be left in and left out via Regent Street using the Sydney Yard Access Bridge (part of the approved project).

Light vehicles



Heavy vehicles

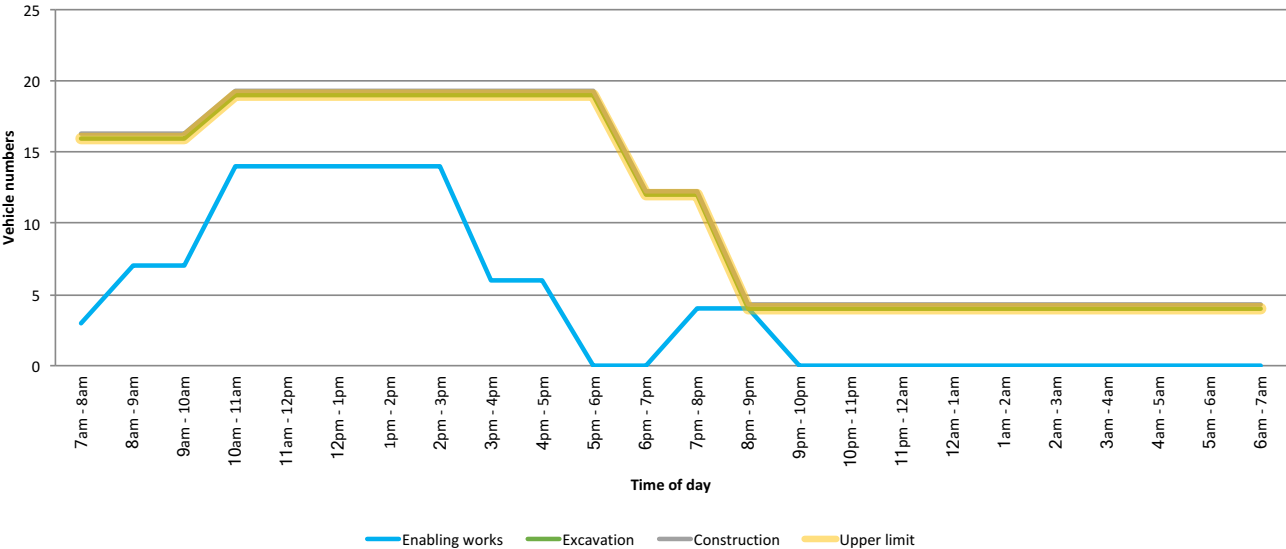
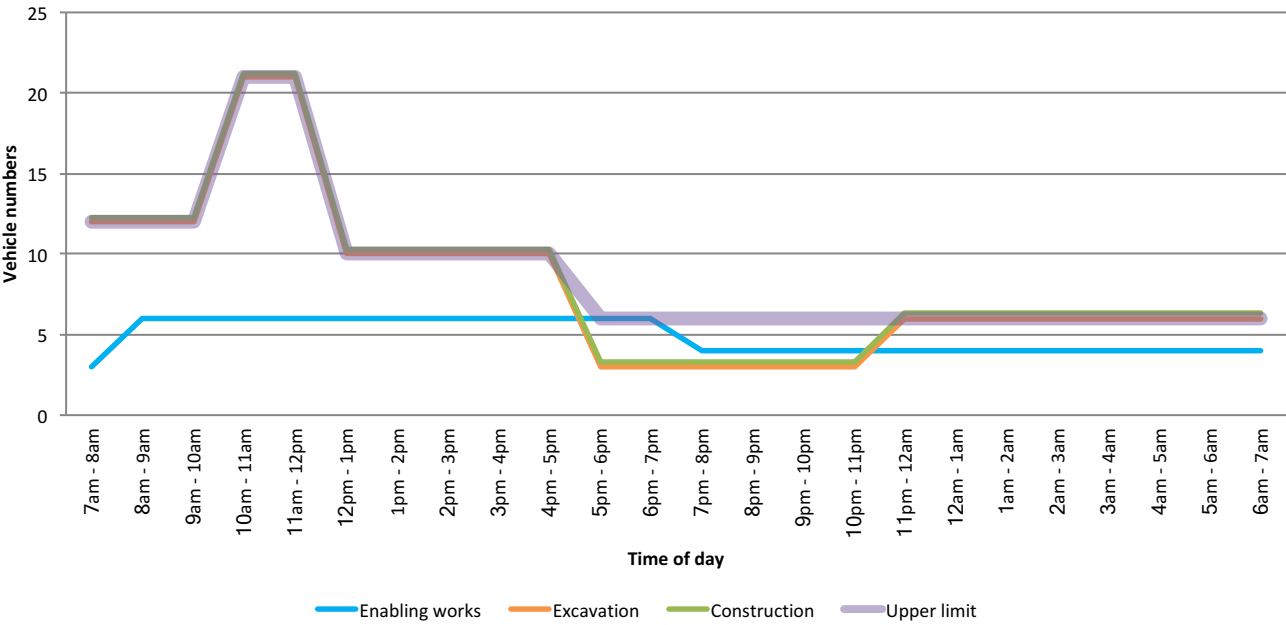


Figure 9-3 Sydney Yard construction site vehicle numbers (arrival only) during non-possession periods (proposed modification only)



Light vehicles



Heavy vehicles

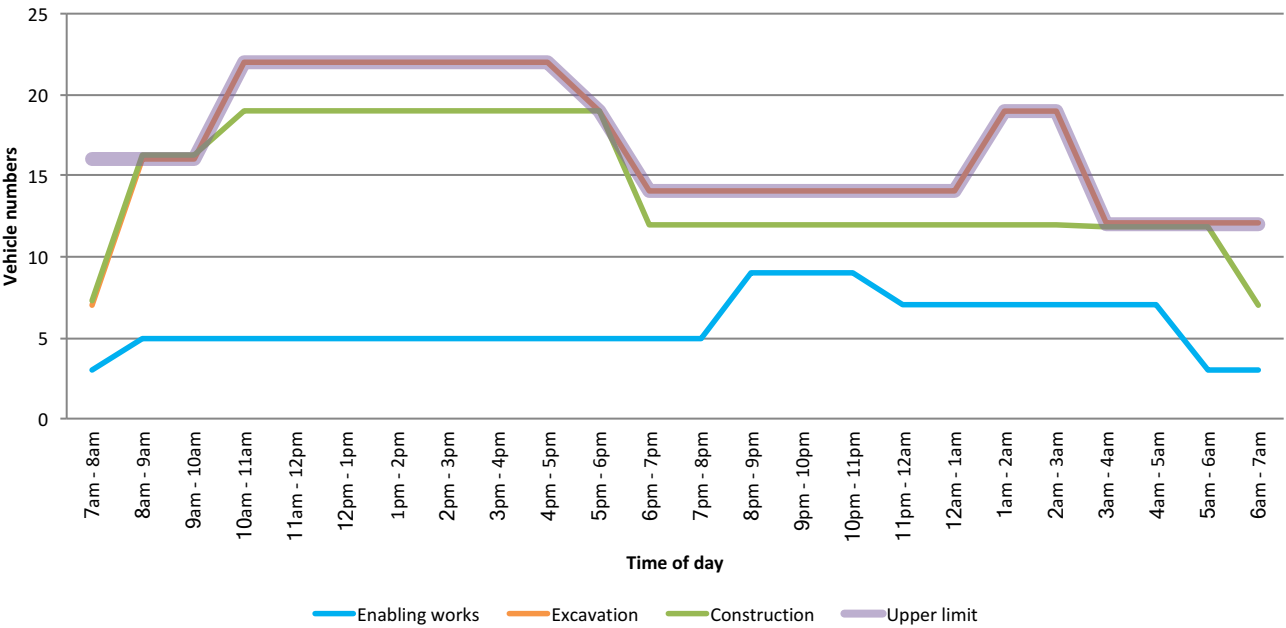


Figure 9-4 Sydney Yard construction site vehicle numbers (arrival only) during possession periods (proposed modification only)

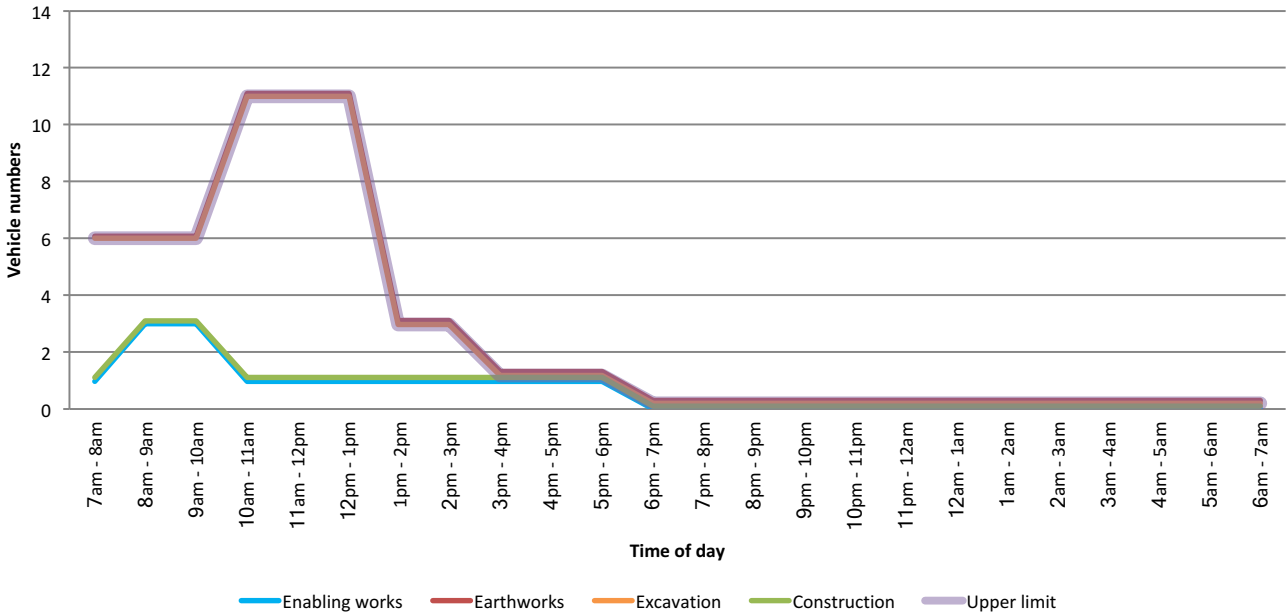
### **Eastern entry construction site**

During non-possession periods, vehicles would only access the eastern entry construction during the standard daytime construction hours of 7 am to 6 pm. During these periods, a maximum of 24 vehicles would enter the site per hour. It is anticipated that the same number of vehicles would exit the site per hour. The anticipated vehicle numbers (heavy and light vehicles) that would access the eastern entry construction site over a typical day per hour during non-possession periods are provided in Figure 9-5. These graphs show that during non-possession periods, the peak light and heavy vehicle movements in the AM peak period (7am to 10am) would be six light vehicles per hour and eight heavy vehicles per hour during the excavation and earthworks phases.

During possession periods, vehicles would access the eastern entry construction site up to 24 hours a day. During these periods, a maximum of 12 vehicles would enter the site per hour. The anticipated vehicle numbers (heavy and light vehicles) that would access the eastern entry construction site over a typical day per hour during possession periods are provided in Figure 9-6. These graphs show that during possession periods, the peak light and heavy vehicle movements in the AM peak period (7am to 10am) would be two light vehicles per hour and six heavy vehicles per hour during the excavation and earthworks phases.

Access to and egress from the site would be via Randle Lane.

Light vehicles



Heavy vehicles

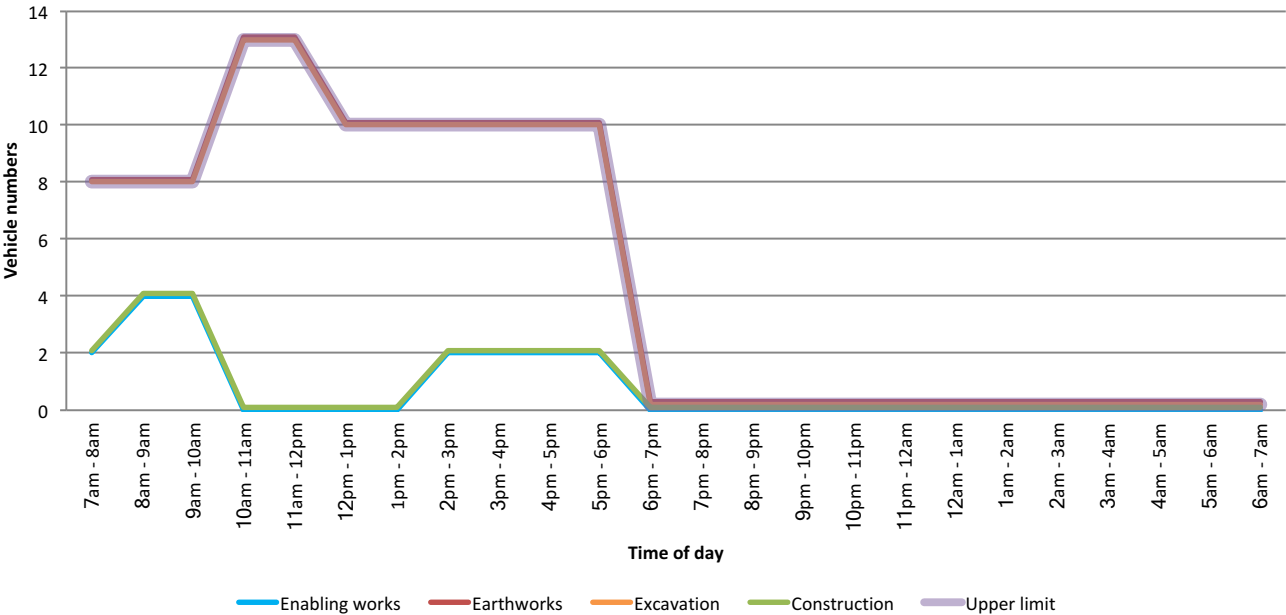
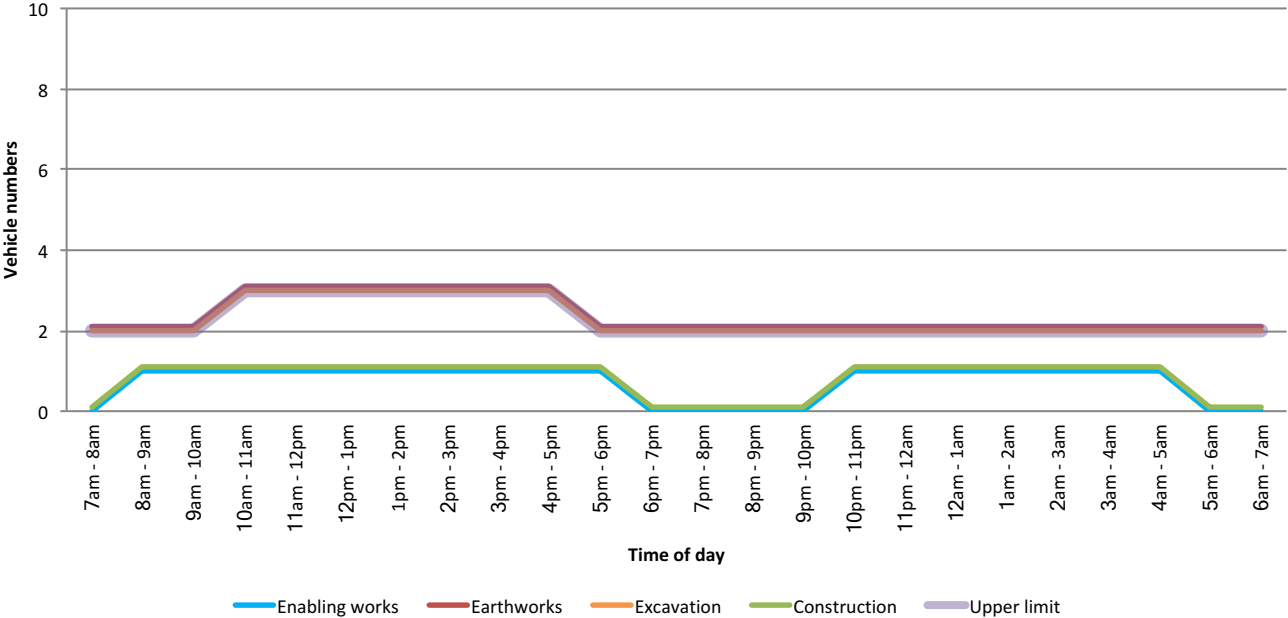


Figure 9-5 Eastern entry construction site vehicle numbers (arrival only) during non-possession periods (proposed modification only)

Light vehicles



Heavy vehicles

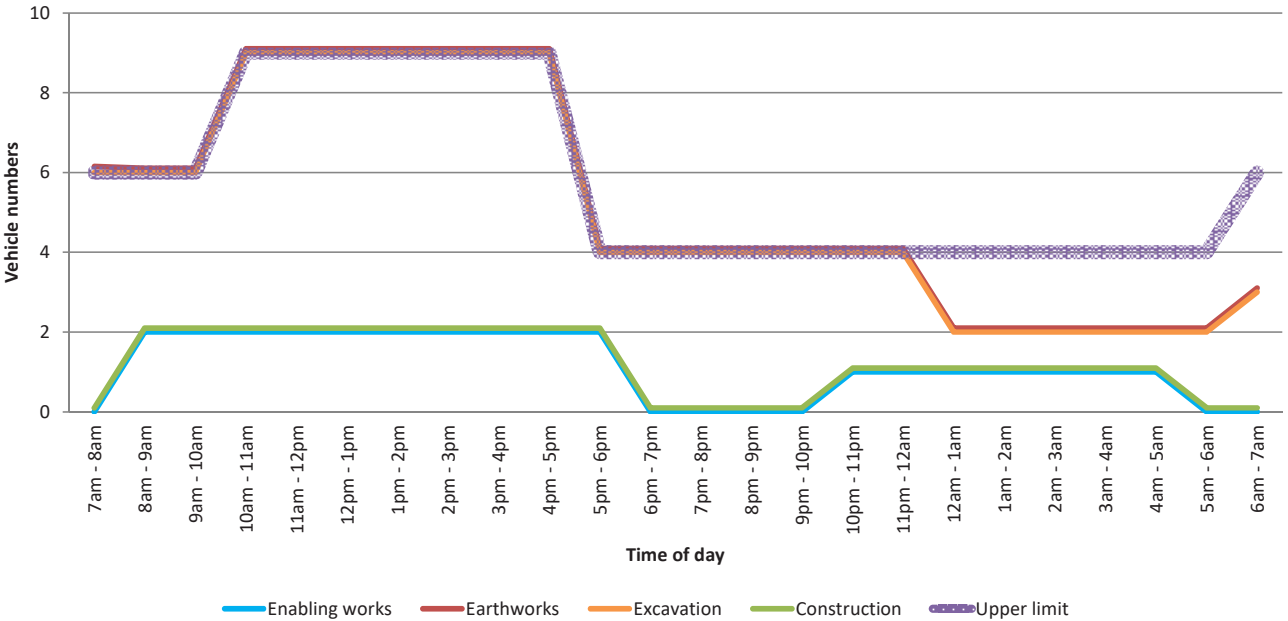


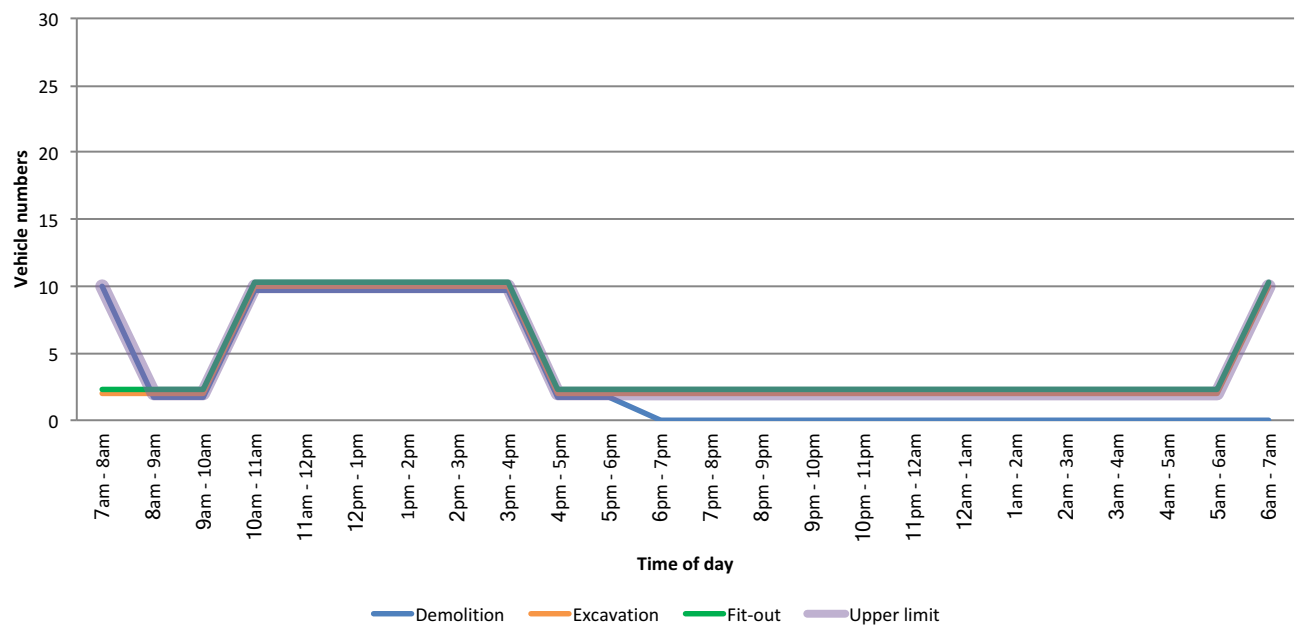
Figure 9-6 Eastern entry construction site vehicle numbers (arrival only) during possession periods (proposed modification only)

### Approved project works at Central Station

Construction works for the proposed modification would occur concurrently with construction of approved project at Central Station. As such, the anticipated vehicle numbers for the proposed modification would be in addition to the anticipated vehicle numbers for the approved project. Figure 9-7 shows the total hourly construction vehicle numbers anticipated at Central Station for to the approved project.

In addition, the northern haul route for Waterloo Station uses Cleveland Street and would partially overlap with the proposed haul routes for Central Station. To provide an assessment of the total potential impacts to the road network, the anticipated vehicles numbers for the approved project works at Central Station and Waterloo Station have been considered for the relevant intersections.

#### Light vehicles



#### Heavy vehicles

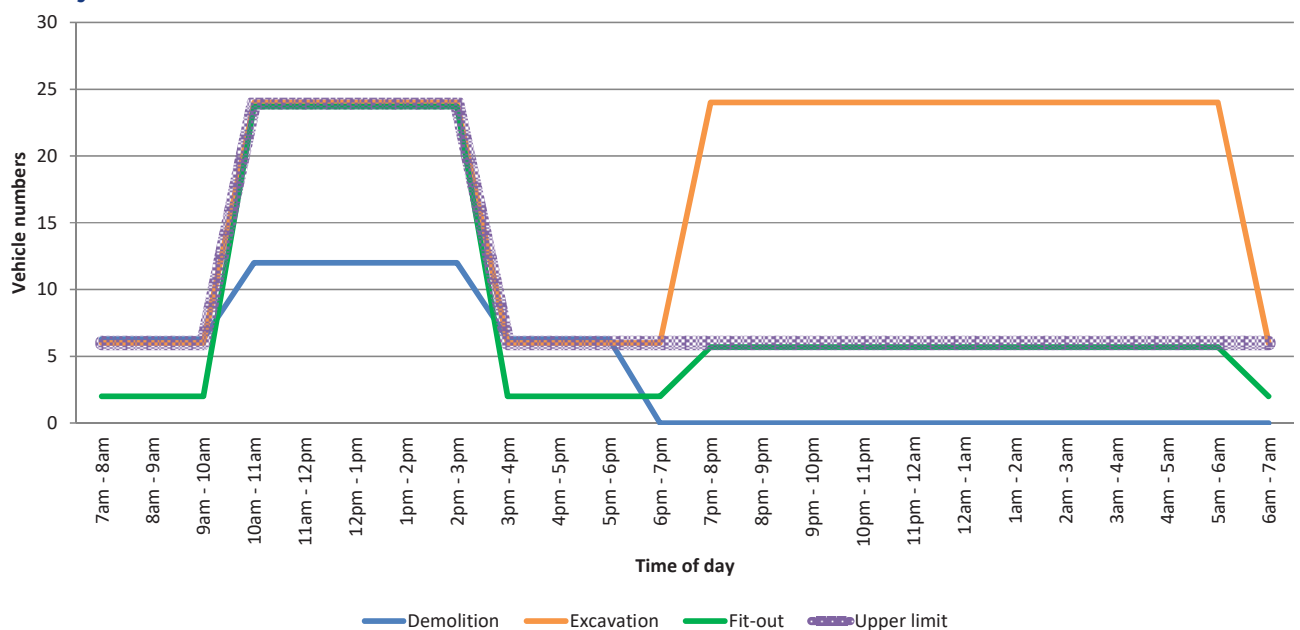


Figure 9-7 Approved project Central Station construction vehicle numbers (arrival only)

### 9.4.2 Pedestrian, cyclist and motorist safety

The assessment of the approved project identified that the introduction of additional heavy vehicles to the network has the potential to result in safety impacts to pedestrians, cyclists and other motorists, especially where there is an increased likelihood for interaction with pedestrians and cyclists. This section considers specific issues which may arise due to the addition of the proposed modification.

Key locations where pedestrian and cyclist safety issues may arise due to the construction of the proposed modification include:

- Construction site access and egress points where construction vehicles would interface with pedestrians using surrounding footpaths, including sections of Chalmers Street and Randle Lane
- Construction sites where access and egress points, or haul routes would interface with marked cycle routes such as along parts of Chalmers Street
- The shared path on the western side of Chalmers Street where a short section is required to be temporarily narrowed. This reduction would not significantly extend into the shared path and adequate north-south access would remain available given the width of the path at this location
- The footpath and future cycleway adjacent to the eastern entry on the eastern side of Chalmers Street which is required to be temporarily closed during cut and cover works. During this time, alternative arrangements for pedestrians and cyclists would be provided. This could include the use of the western shared path along Chalmers Street. Signage would be provided to give advanced warning to pedestrians and cyclists of the closure, with crossing opportunities provided near the Elizabeth Street intersection and the Devonshire Street intersection
- Randle Lane which is required to be temporarily closed for a period of around three months. Pedestrians would need to use alternative roads for access including Elizabeth Street, Randle Street and Chalmers Street.

Access and egress arrangements at construction sites have been developed with consideration for pedestrian, cyclist and motorist safety. For example, the need for construction vehicles to turn right to or from arterial roads to access construction sites has been avoided at both construction sites.

As identified for the approved project, appropriate controls would be established where vehicles are required to cross footpaths to access construction sites. This may include manual supervision, physical barriers or temporary traffic signals as required. Safety audits would be carried out at each of the construction site traffic access and egress points.

### 9.4.3 Emergency services access

The assessment of the approved project identified that there would not be any substantial change to emergency vehicle access during construction. It further identified that emergency access to nearby buildings and precincts would be maintained, construction sites would be made available for emergency vehicle passage if required and ongoing consultation would be carried out with emergency service providers in relation to changed traffic conditions. These arrangements would also apply to construction of the proposed modification. As such, there is not anticipated to be any change to the impacts described for the approved project.

#### 9.4.4 Special events

The assessment of the approved project identified special events in the Sydney CBD.

Due to Central Station's role as a major interchange and focal point for customers travelling to and from special events in the Sydney region, and particularly at Moore Park, construction of the proposed modification has the potential to result in additional impacts.

The approved project identified a process for managing Class 1 and 2 events in consultation with Transport Coordination and Roads and Maritime Services to determine appropriate management during these periods. This may involve measures such as temporary adjustment to haul routes, working hours or potentially stopping works for the duration of the event.

This process would also be applied to the construction of the proposed modification and would effectively manage any potential impacts.

#### 9.4.5 Construction worker parking

Due to the generally constrained nature of the construction sites at Central Station, car parking for construction works would not be provided.

The approach to construction worker travel to and from the construction sites would be consistent with that described for the approved project. This would include encouraging workers to use public transport services. This may include incentive systems. In addition, consideration would be given to remote car parking in existing under-used car parks and shuttle bus transfers to the construction sites. These car parks could include The Domain, Goulburn Street and Darling Harbour.

#### 9.4.6 Active transport network

The approved project works at Central Station would require the short term (around two week) closure of Devonshire Street Tunnel. The timing of this closure will consider period of peak pedestrian demand.

The proposed modification would require the following additional temporary adjustments to the pedestrian and cyclist network around Central Station:

- Temporary closure of the footpath and proposed cycle path on the eastern side of Chalmers Street to carry out cut-and-cover works. During this period, pedestrians and cyclists would need to use the western footpath of Chalmers Street. Crossing opportunities are available at the Elizabeth Street and Devonshire Street intersections. This would add minimal distance to a travel journey and would be of minimal impact
- Temporary occupation of part of the shared path on the western side of Chalmers Street to remove and subsequently reinstate the station boundary wall. Given the width of the shared path in this location, adequate north-south access would remain on this shared path
- Temporary closure of Randle Lane to carry out cut-and-cover works. Pedestrians would be required to use Elizabeth Street, Randle Street and Chalmers Street as alternatives. Given the low volumes of pedestrians using Randle Lane, and the availability of alternatives, the impact on pedestrian access would be minor.

The temporary closures of footpaths on Chalmers Street would not be carried out at the same time as the closure of the Devonshire Street Tunnel required for the approved project.



### 9.4.7 Surrounding public transport services

The assessment of the approved project did not identify any potential changes required or impact to surrounding public transport services. The proposed modification, however, may result in some minor impacts to surrounding light rail, bus and coach services.

#### Light rail services

Some minor modifications to Chalmers Street would be required immediately in front of the eastern entry to carry out cut-and-cover works. These works may directly impact the light rail event platform and related tracks. As a result, these works would not occur concurrently with special events to minimise impacts to light rail customers. These would not impact on the standard light rail tracks and services.

#### Buses and coaches

Bus and coach services currently operate on roads surrounding Central Station, including Cleveland Street, Chalmers Street, Elizabeth Street, Eddy Avenue, Pitt Street, George Street and Lee Street. Bus services may experience some short-term delays due to the additional construction vehicles on the road network. This however is expected to be minimal. Changes to bus stops and access to coaches are not required to support construction of the proposed modification.

### 9.4.8 Parking and taxis

The approved project would not result in the permanent loss of any parking or impacts to taxi facilities around Central Station.

Construction of the proposed modification is not anticipated to directly impact any taxi facilities. However, the temporary closure of Randle Lane (for a period of around three months) to undertake cut and cover works for the new eastern entry would result in impacts to the access to underground car parking for nearby properties. Where possible, access to car parking of these properties would be maintained during the works, potentially through controlled access provisions. In the event that access to car parking areas cannot be reasonably maintained during this period, alternative parking arrangements would be provided elsewhere for occupants of impacted buildings. Consultation with affected residents and occupants of impacted buildings would occur to manage any disruption to access as a result of construction activities.

### 9.4.9 Road network performance

An assessment of potential impacts to road network performance has been carried out for both the primary and secondary haul routes. This assessment provides a comparison of existing performance (with no construction traffic), the impacts of the approved project only, and the impacts of both the approved project and the proposed modification.

#### Primary haul route

Table 9-4 and Figure 9-8 shows the impact of construction vehicles on nearby key intersections along the primary haul route. Additional intersection performance parameters including total demand flow through the intersection and average delay at the intersection are provided in Appendix C.

With construction vehicles for both the approved project and the proposed modification included on the network, the majority of the intersections maintain their base level of service. The exception is the Cleveland Street / Bourke Street intersection which deteriorates from level of service B to level of service C in the PM peak with the addition of the proposed modification construction vehicles. This intersection is currently operating with spare capacity and this impact is considered to be minor.

Overall, the introduction of construction vehicles would have minor impacts on intersection performance along the primary haul route.

Table 9-4 Intersection performance – primary haul route

| Intersection / peak period                                  | Existing         |                      | Approved project only |                      | Approved project plus proposed modification |                      |
|---|------------------|----------------------|-----------------------|----------------------|---|----------------------|
|   | Level of Service | Degree of Saturation | Level of Service      | Degree of Saturation | Level of Service                            | Degree of Saturation |
| <b>Cleveland Street / South Dowling Street</b>              |                  |                      |                       |                      |   |                      |
| AM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Cleveland Street / Bourke Street</b>                     |                  |                      |                       |                      |   |                      |
| AM peak   | B                | 0.83                 | B                     | 0.84                 | B   | 0.87                 |
| PM peak   | B                | 0.87                 | B                     | 0.88                 | C   | 0.97                 |
| <b>Cleveland Street / Crown Street / Baptist Street</b>     |                  |                      |                       |                      |   |                      |
| AM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Cleveland Street / Marlborough Street / Young Street</b> |                  |                      |                       |                      |   |                      |
| AM peak   | A                | 0.49                 | A                     | 0.51                 | A   | 0.57                 |
| PM peak   | A                | 0.53                 | A                     | 0.53                 | A   | 0.60                 |
| <b>Cleveland Street / Wilton Street / Walker Street</b>     |                  |                      |                       |                      |   |                      |
| AM peak   | B                | >1.00                | B                     | >1.00                | B   | >1.00                |
| PM peak   | A                | 0.58                 | A                     | 0.58                 | A   | 0.61                 |
| <b>Cleveland Street / Elizabeth Street</b>                  |                  |                      |                       |                      |   |                      |
| AM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Cleveland Street / Chalmers Street</b>                   |                  |                      |                       |                      |   |                      |
| AM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Chalmers Street / Randle Street / Devonshire Street</b>  |                  |                      |                       |                      |   |                      |
| AM peak   | B                | 0.73                 | B                     | 0.73                 | B   | 0.73                 |
| PM peak   | A                | 0.64                 | A                     | 0.64                 | A   | 0.64                 |
| <b>Elizabeth Street / Randle Street</b>                     |                  |                      |                       |                      |   |                      |
| AM peak   | A                | 0.49                 | A                     | 0.49                 | A   | 0.49                 |
| PM peak   | A                | 0.57                 | A                     | 0.57                 | A   | 0.57                 |

| Intersection / peak period   | Existing         |                      | Approved project only |                      | Approved project plus proposed modification |                      |
|--|------------------|----------------------|-----------------------|----------------------|---|----------------------|
|  | Level of Service | Degree of Saturation | Level of Service      | Degree of Saturation | Level of Service                            | Degree of Saturation |
| <b>Elizabeth Street / Chalmers Street / Foveaux Street / Eddy Avenue</b> |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Eddy Avenue / Pitt Street / Rawson Place</b>                          |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>George Street / Lee Street / Pitt Street / Quay Street</b>            |                  |                      |                       |                      |   |                      |
| AM peak  | E                | >1.00                | E                     | >1.00                | E   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Lee Street / Regent Street</b>  |                  |                      |                       |                      |   |                      |
| AM peak  | B                | 0.79                 | B                     | 0.79                 | B   | 0.79                 |
| PM peak  | B                | 0.83                 | B                     | 0.83                 | B   | 0.83                 |
| <b>Regent Street / Kensington Street</b>                                 |                  |                      |                       |                      |   |                      |
| AM peak  | A                | 0.54                 | A                     | 0.54                 | A   | 0.57                 |
| PM peak  | A                | 0.72                 | A                     | 0.72                 | A   | 0.72                 |
| <b>Cleveland Street / Regent Street</b>                                  |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Cleveland Street / George Street</b>                                  |                  |                      |                       |                      |   |                      |
| AM peak  | A                | 0.62                 | A                     | 0.62                 | A   | 0.63                 |
| PM peak  | A                | 0.71                 | A                     | 0.71                 | A   | 0.70                 |
| <b>Cleveland Street / Pitt Street</b>                                    |                  |                      |                       |                      |   |                      |
| AM peak  | C                | >1.00                | C                     | >1.00                | C   | >1.00                |
| PM peak  | B                | 0.75                 | B                     | 0.75                 | B   | 0.75                 |

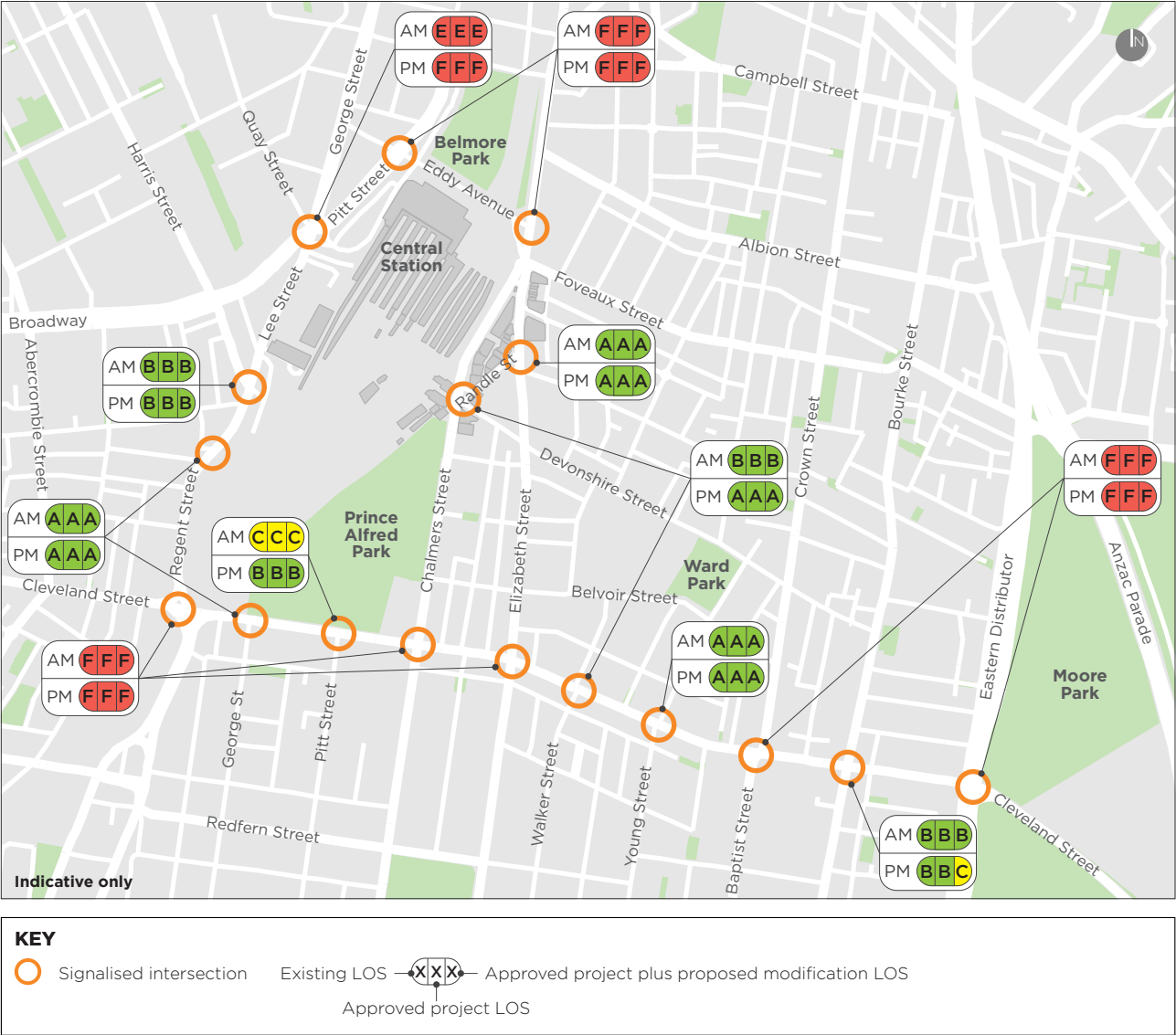


Figure 9-8 Primary haul route assessed intersection locations

Secondary haul route

Table 9-5 and Figure 9-9 shows the impact of construction vehicles on nearby key intersections along the secondary haul route. Additional intersection performance parameters including total demand flow through the intersection and average delay at the intersection are provided in Appendix C.

With construction vehicles for both the approved project and the proposed modification included on the network, the majority of the intersections maintain their base level of service. The exception is the Western Distributor / Bank Street intersection which shows the following deterioration in performance:

- In the AM peak from level of service D with the approved project construction traffic, to level of service F with the addition of the proposed modification construction traffic
- In the PM peak from level of service E to level of service F with the addition of the proposed modification construction traffic.

This deterioration is likely due to this intersection currently operating close to its theoretical capacity and exacerbated by the high volume of conflicting movements at the adjacent Western Distributor / Pyrmont Bridge Road / Bank Street intersection.

This assessment also assumes that all construction vehicles from Central Station would use the secondary route. In reality, it is likely that there would be a split of vehicles across the primary and secondary routes, or the secondary route would be used in isolation for a short period of time (such as during major events to manage traffic congestion along the primary route).

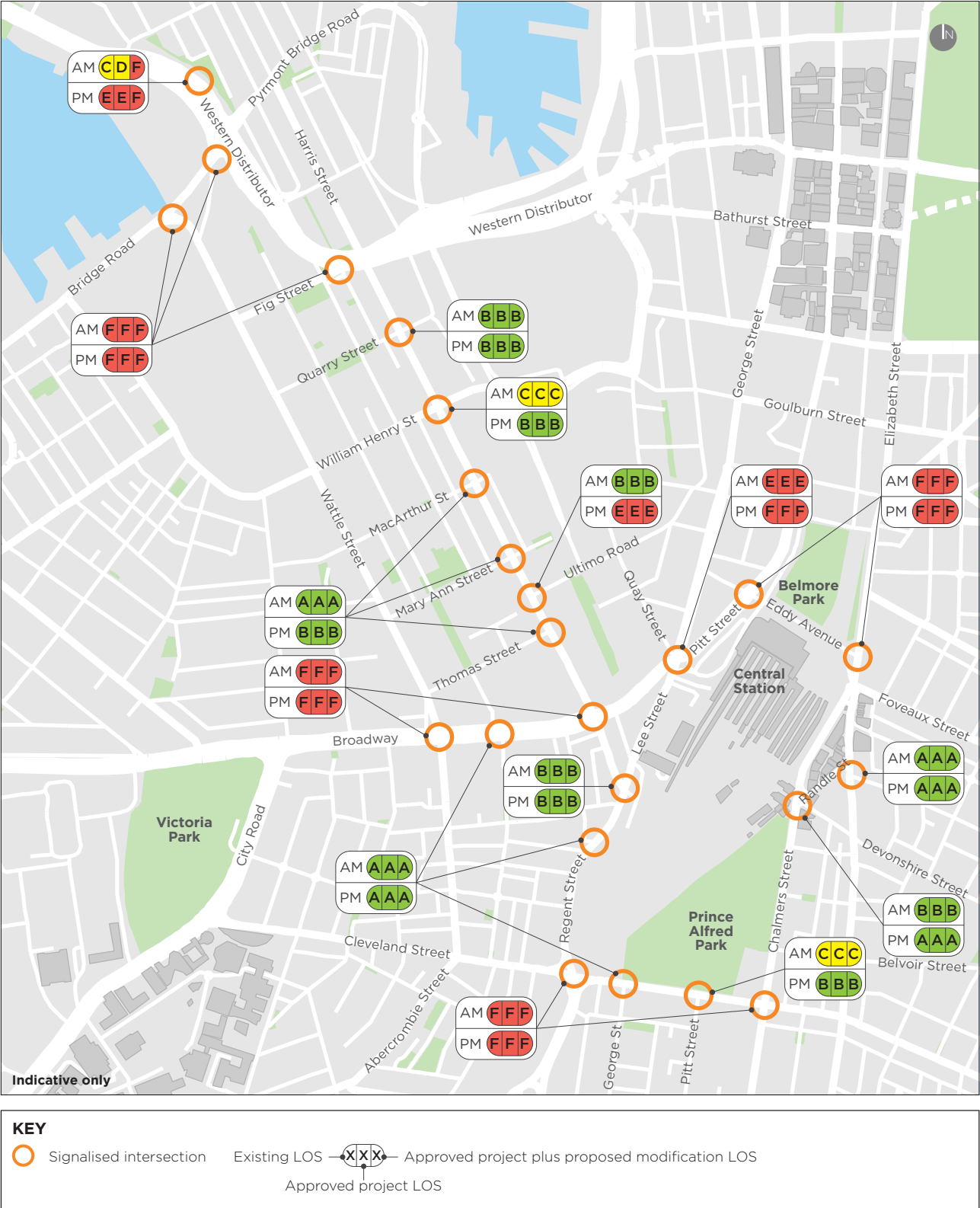
**Table 9-5 Intersection performance – secondary haul route**

| Intersection / peak period                                     | Existing         |                      | Approved project only |                      | Approved project plus the proposed modification |                      |
|--|------------------|----------------------|-----------------------|----------------------|---|----------------------|
|  | Level of Service | Degree of Saturation | Level of Service      | Degree of Saturation | Level of Service                                | Degree of Saturation |
| <b>Western Distributor / Bank Street</b>                       |                  |                      |                       |                      |   |                      |
| AM peak  | C                | 0.91                 | D                     | 0.95                 | F   | >1.00                |
| PM peak  | E                | 1.00                 | E                     | >1.00                | F   | >1.00                |
| <b>Western Distributor / Pyrmont Bridge Road / Bank Street</b> |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Pyrmont Bridge Road / Bridge Street / Wattle Street</b>     |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Western Distributor / Harris Street / Fig Street</b>        |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Harris Street / Quarry Street</b>                           |                  |                      |                       |                      |   |                      |
| AM peak  | B                | 0.72                 | B                     | 0.72                 | B   | 0.72                 |
| PM peak  | B                | 0.80                 | B                     | 0.80                 | B   | 0.80                 |
| <b>Harris Street / William Henry Street</b>                    |                  |                      |                       |                      |   |                      |
| AM peak  | C                | 0.96                 | C                     | 0.96                 | C   | 0.96                 |
| PM peak  | B                | 0.83                 | B                     | 0.83                 | B   | 0.83                 |
| <b>Harris Street / Macarthur Street</b>                        |                  |                      |                       |                      |   |                      |
| AM peak  | A                | 0.73                 | A                     | 0.73                 | A   | 0.73                 |
| PM peak  | B                | >1.00                | B                     | 0.87                 | B   | 0.87                 |
| <b>Harris Street / Mary Ann Street</b>                         |                  |                      |                       |                      |   |                      |
| AM peak  | A                | 0.70                 | A                     | 0.69                 | A   | 0.69                 |
| PM peak  | B                | 0.82                 | B                     | 0.86                 | B   | 0.87                 |

| Intersection / peak period                                      | Existing         |                      | Approved project only |                      | Approved project plus the proposed modification |                      |
|---|------------------|----------------------|-----------------------|----------------------|---|----------------------|
|   | Level of Service | Degree of Saturation | Level of Service      | Degree of Saturation | Level of Service                                | Degree of Saturation |
| <b>Harris Street / Ultimo Road</b>                              |                  |                      |                       |                      |   |                      |
| AM peak   | B                | 0.94                 | B                     | 0.94                 | B   | 0.94                 |
| PM peak   | E                | >1.00                | E                     | >1.00                | E   | >1.00                |
| <b>Harris Street / Thomas Street</b>                            |                  |                      |                       |                      |   |                      |
| AM peak   | A                | 0.87                 | A                     | 0.87                 | A   | 0.87                 |
| PM peak   | B                | 0.96                 | B                     | 0.95                 | B   | 0.95                 |
| <b>George Street / Harris Street / Regent Street / Broadway</b> |                  |                      |                       |                      |   |                      |
| AM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Lee Street / Regent Street</b>                               |                  |                      |                       |                      |   |                      |
| AM peak   | B                | 0.79                 | B                     | 0.79                 | B   | 0.80                 |
| PM peak   | B                | 0.83                 | B                     | 0.83                 | B   | 0.83                 |
| <b>Regent Street / Kensington Street</b>                        |                  |                      |                       |                      |   |                      |
| AM peak   | A                | 0.54                 | A                     | 0.54                 | A   | 0.52                 |
| PM peak   | A                | 0.72                 | A                     | 0.72                 | A   | 0.72                 |
| <b>Cleveland Street / Regent Street</b>                         |                  |                      |                       |                      |   |                      |
| AM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak   | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Cleveland Street / George Street</b>                         |                  |                      |                       |                      |   |                      |
| AM peak   | A                | 0.62                 | A                     | 0.62                 | A   | 0.63                 |
| PM peak   | A                | 0.71                 | A                     | 0.71                 | A   | 0.71                 |
| <b>Cleveland Street / Pitt Street</b>                           |                  |                      |                       |                      |   |                      |
| AM peak   | C                | >1.00                | C                     | >1.00                | C   | >1.00                |
| PM peak   | B                | 0.75                 | B                     | 0.75                 | B   | 0.75                 |

| Intersection / peak period   | Existing         |                      | Approved project only |                      | Approved project plus the proposed modification |                      |
|--|------------------|----------------------|-----------------------|----------------------|---|----------------------|
|  | Level of Service | Degree of Saturation | Level of Service      | Degree of Saturation | Level of Service                                | Degree of Saturation |
| <b>Cleveland Street / Chalmers Street</b>                                |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Chalmers Street / Randle Street / Devonshire Street</b>               |                  |                      |                       |                      |   |                      |
| AM peak  | B                | 0.73                 | B                     | 0.73                 | B   | 0.73                 |
| PM peak  | A                | 0.64                 | A                     | 0.64                 | A   | 0.64                 |
| <b>Elizabeth Street / Randle Street</b>                                  |                  |                      |                       |                      |   |                      |
| AM peak  | A                | 0.49                 | A                     | 0.49                 | A   | 0.49                 |
| PM peak  | A                | 0.57                 | A                     | 0.57                 | A   | 0.57                 |
| <b>Elizabeth Street / Chalmers Street / Foveaux Street / Eddy Avenue</b> |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Eddy Avenue / Pitt Street / Rawson Place</b>                          |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>George Street / Lee Street / Pitt Street / Quay Street</b>            |                  |                      |                       |                      |   |                      |
| AM peak  | E                | >1.00                | E                     | >1.00                | E   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| <b>Broadway / Chippendale Way</b>  |                  |                      |                       |                      |   |                      |
| AM peak  | A                | 0.38                 | A                     | 0.38                 | A   | 0.38                 |
| PM peak  | A                | 0.71                 | A                     | 0.71                 | A   | 0.71                 |
| <b>Broadway / Wattle Street / Abercrombie Street</b>                     |                  |                      |                       |                      |   |                      |
| AM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |
| PM peak  | F                | >1.00                | F                     | >1.00                | F   | >1.00                |





### Other road network impacts

Works at the eastern entry construction site would result in direct impact to Randle Lane. Randle Lane provides rear lane access to a number of properties, including underground car parking areas. Traffic using this laneway is expected to consist of vehicles accessing or departing garages and underground car parks, as well as service vehicles (such as garbage services). As such, volumes are anticipated to be low.

During demolition of the existing building at the proposed eastern entry, trucks would be directly loaded on Randle Lane. This would result in Randle Lane being blocked to through traffic for periods of about 15 minutes per truck. Appropriate traffic management would be implemented during this period.

Construction of the eastern entry would require the temporary closure of Randle Lane (for a period of around three months) to carry out cut-and-cover works for the new eastern entry.

During the period of closure of Randle Lane, controlled access at either end of Randle Lane would be required to facilitate vehicle movements. Larger vehicles such as trucks would be required to reverse out of Randle Lane into Elizabeth Street and Randle Street as the width of Randle Lane is not sufficient to enable large vehicles to turn around. Traffic control would be required at Elizabeth Street and Randle Street to enable reversing vehicles to safely exit Randle Lane. This would result in delays for traffic on Elizabeth Street and Randle Street. Given the low traffic volume on Randle Lane, the impact of these delays to traffic flow on Elizabeth Street and Randle Street is expected to be minor. Reversing movements out of Randle Lane onto Elizabeth Street and Randle Street would not be carried out during the peak periods of 7 am to 10 am and 3 pm to 7 pm.

The potential impacts associated with access to basement car parking of properties along Randle Lane is discussed in section 9.4.8.

## 9.5 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The construction traffic and transport assessment for the proposed modification identified that new mitigation measures would be required to manage some of the changes to traffic and transport impacts. These mitigation measures are provided in Table 9-6.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Condition E80 – minimising truck movements during peak periods
- Condition E81 – development of a Construction Traffic Management Framework which sets out the approach to manage traffic and transport issues for the project

Table 9-6 Mitigation measures – construction traffic and transport

| Ref | Mitigation measure   | Applicable location(s) <sup>1</sup> |
|-----|--|-------------------------------------|
| T23 | Specific station management measures would be implemented during pedestrian movement Phase 2. This would include strategies such as encouraging passengers to exit platforms at the closest stair case or escalator, signage and marshalling of passengers waiting to board to minimise those waiting adjacent to hoarding and to direct passengers so that there is even distribution along the platform. | CS                                  |
| T24 | The temporary closures of footpaths on Chalmers Street would not occur at the same time as the temporary closure of the Devonshire Street Tunnel.  | CS                                  |
| T25 | During the closure of Randle Lane, traffic control would be provided at either end. Reversing movements out of Randle Lane onto Elizabeth Street and Randle Street would not be carried out during the peak periods of 7 am to 10 am and 3 pm to 7 pm.   | CS                                  |
| T26 | During the closure of Randle Lane, access to basement car parking would be maintained where feasible and reasonable. If access cannot be maintained, alternative parking would be arranged.  | CS                                  |

<sup>1</sup> STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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# **OPERATIONAL TRAFFIC AND TRANSPORT**

## CHAPTER TEN



# 10 Operational traffic and transport

**This chapter assesses the potential changes to operational traffic and transport impact as a result of the proposed modification, and identifies any changes to mitigation measures to minimise these impacts.**

## 10.1 Assessment methodology

The methodology for the operational traffic and transport assessment of the proposed modification was generally consistent with the approach carried out for the approved project.

In addition, pedestrian modelling of customer movements within the station was carried out with the use of Legion SpaceWorks modelling software.

## 10.2 Existing environment

The existing traffic and transport environment around Central Station is described in Chapter 9 (Construction traffic and transport).

The existing customer environment and movements within Central Station are described in Chapter 2 (Strategic justification and need) and summarised below.

During the morning peak, Central Station is an important destination station as the transport network's main interchange hub. During the AM peak, 29 per cent of peak passenger movements transfer within Central Station, 60 per cent of passengers leave Central Station and 11 per cent enter the station for the beginning of their rail journey. For customers interchanging at the station, the majority of customers during the AM peak (2014) do so between the suburban platforms. Of the passengers leaving the station, 36 per cent exit to the west, 33 per cent to the north and the remaining 31 per cent to the east. These flows occur approximately in reverse in the PM peak.

Pedestrian modelling was carried out by Transport for NSW to evaluate the performance of pedestrian areas within the station and adjacent footpaths by determining the Level of Service for walkways and queuing. Queuing was used to assess the performance of platforms, while all other areas were evaluated as a walkway. The Level of Service is expressed as a ranking from 'A' (best level) to 'F' (worst level).

Pedestrian modelling carried out during the peak 15 minute period (8:30 am to 8:45 am) identified the following capacity issues associated with the current layout of Central Station:

- The North Concourse at the end of Platform 14 and 15 is constrained due to the location of the vertical transport which restricts access to the walkway. This area operates at Level of Service E
- Congestion occurs at all gate lines, with Eddy Avenue and Chalmers Street operating at Level of Service C / D while the Devonshire Street gateline worse at Level of Service D / E
- The South Concourse and Devonshire Street Tunnel predominately operate at Level of Service C, with some areas, particularly where pedestrian flows merge, operating at Level of Service D
- Around 17 per cent of customers experience Level of Service D or worse within the station concourse.



## 10.3 Potential impacts

### 10.3.1 Customer movements within Central Station

The assessment of the approved project identified that customers would be able to interchange between metro and suburban train lines using the North Concourse and the existing pedestrian connections within the paid area of the station. The proposed east concourse would provide an alternative to the North Concourse for interchange movements.

Chapter 2 provides information relating to the key benefits of the proposed modification including benefits to customer movements within Central Station. In summary this includes:

- Reduced travel times into, out of, and through Central Station by providing a more direct east connection
- Improved legibility and wayfinding, primarily through the new east concourse
- Improved accessibility through the provision of a new accessible entry and accessible connection to all suburban and metro platforms.

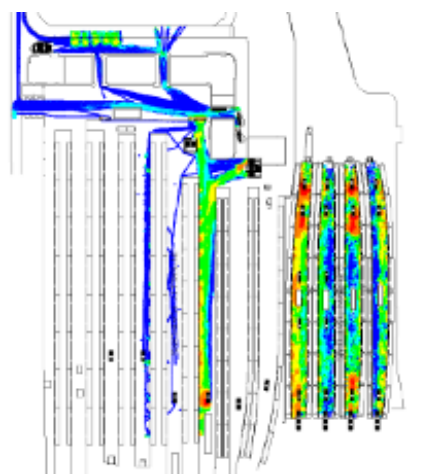
#### Decreased station crowding and congestion

Whilst the approved project provides additional pedestrian space within Central Station through the new north-south concourse, it would not address existing or future pedestrian congestion within the station. The proposed modification however, would address station congestion, particularly associated with interchange movements.

Pedestrian modelling at Central Station has been undertaken for 2026 both with and without the proposed modification to evaluate the performance of pedestrian areas on the platforms and concourses within the station. The modelling provides a Level of Service for walkways and queuing. This modelling was undertaken for the peak 5 minute AM average, which occurs between 8:45am and 8:50am. The Level of Service is expressed as a ranking from 'A' (best level) to 'F' (worst level).

Figure 10-1 and Figure 10-2 show the peak 5 minute average Level of Service for platforms and concourses with and without the proposed modification, and Table 10-1 provides a comparison in the performance of key areas of the station with and without the proposed modification. In general, it is evident that the proposed modification would result in a more legible layout that supports direct access, improved conditions for pedestrian movement (ie Level of Service) and decreased pedestrian crowding and congestion, throughout the station.

Platforms



Concourses

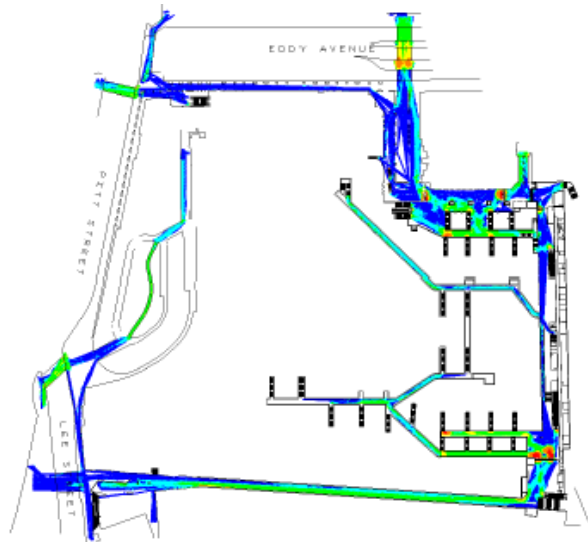
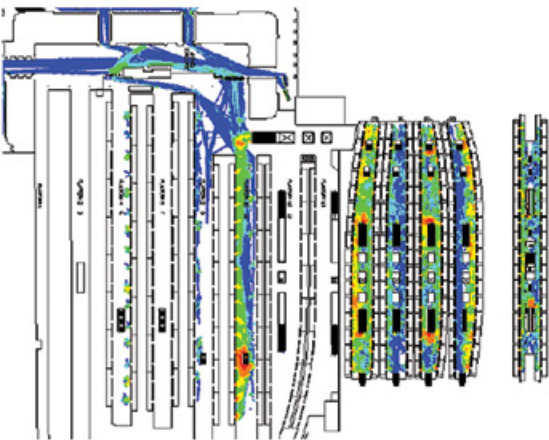


Figure 10-1 Peak 5 minute (8:45-8:50am) average Level of Service - without proposed modification (Year 2026)

Platforms



Concourses

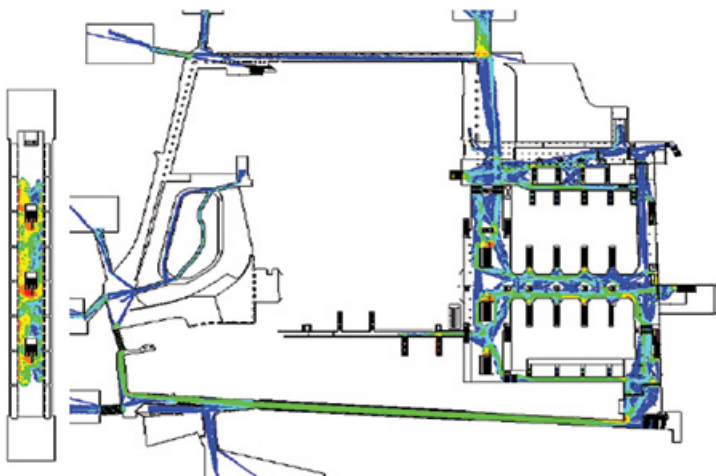


Figure 10-2 Peak 5 minute (8:45-8:50am) average Level of Service - with proposed modification (Year 2026)

Table 10-1 Pedestrian Level of Service with and without proposed modification

| Station area                                   | Pedestrian performance without proposed modification   | Pedestrian performance with proposed modification   |
|--|--|---|
| Above ground suburban platforms                | <ul style="list-style-type: none"> <li>○ Congestion and queuing (Level of Service E / F) would occur at the top of the stairs to the North Concourse on platforms 16 / 17 and 20 / 21, and the stairs to the southern tunnels from platforms 20 / 21</li> <li>○ Platform 16 is the most congested, performing at Level of Service D or worse for most of its length</li> </ul> | <ul style="list-style-type: none"> <li>○ The performance at the top of the stairs from platforms 16 / 17 and 20 / 21 shows a substantial improvement in performance</li> <li>○ Some minor congestion and queuing would occur at the top of the escalators from platforms 16 / 17 and 20 / 21 to the east concourse</li> <li>○ Platform 16 remain the most congested, however the Level of Service improves to C / D for most of its length</li> </ul> |
| Underground tunnels (including east concourse) | <ul style="list-style-type: none"> <li>○ The performance of the Olympic Tunnel indicates it has capacity for more passengers, with an average Level of Service B</li> <li>○ The southern tunnels generally perform at Level of Service C, with some areas of congestion (Level of Service D-F) around the base of the stairs</li> </ul>  | <ul style="list-style-type: none"> <li>○ The east concourse generally performs at Level of Service A-C, with some minor areas of congestion (Level of Service D-E) around the base of the escalators</li> <li>○ The southern tunnels improve to perform at Level of Service A-B</li> </ul>  |
| North Concourse                                | <ul style="list-style-type: none"> <li>○ Average Level of Service C. Localised congestion occurs at the base of some stairs (Level of Service D / E)</li> </ul>  | <ul style="list-style-type: none"> <li>○ Would improve to perform at an average Level of Service B. Some localised congestion would still occur at the base of some stairs however this would improve to Level of Service C / D</li> </ul>  |
| South Concourse                                | <ul style="list-style-type: none"> <li>○ Average Level of Service C. Localised congestion occurs at staircases (Level of Service D / E), however Level of Service E queuing at the top of the stairs does not exceed one minute</li> </ul>   | <ul style="list-style-type: none"> <li>○ Would improve to perform at an average Level of Service A / B with some minor areas of Level of Service C</li> </ul>   |
| Devonshire Street gateline                     | <ul style="list-style-type: none"> <li>○ Localised queuing would occur with an average Level of Service E / F)</li> </ul>  | <ul style="list-style-type: none"> <li>○ Would improve to perform at an average Level of Service C / D</li> </ul>   |
| Eddy Avenue gateline                           | <ul style="list-style-type: none"> <li>○ Localised queuing would occur with an average Level of Service E / F</li> </ul>   | <ul style="list-style-type: none"> <li>○ Would improve to perform at an average Level of Service A / B with some discrete areas of Level of Service C</li> </ul>  |

### 10.3.2 Integration with the surrounding traffic and transport network

#### Approved project

The assessment of the approved project identified that there was a well established traffic and transport network around Central Station. In general, this would provide sufficient facilities for the integration of the metro platforms. This includes:

- Pedestrians – eight people per minute would be added to the street level footpaths around Central Station in the AM peak hour due to the approved project. Due to the small increase it was considered unlikely that the approved project would result in any issues related to pedestrian capacity
- Cyclists – existing and planned cycle routes around Central Station would facilitate cyclist interchange opportunities. Metro customers would be able to use existing cycle parking facilities at Central Station
- Public transport – metro customers would be able to use existing access options to interchange with bus, coach and light rail services around Central Station
- Road network – metro customers would be able to use existing drop-off facilities such as those located within the western forecourt.

#### Proposed modification

The proposed modification would enhance safe integration with the surrounding traffic and transport network, primarily through the new eastern entry. This would include:

- Pedestrians – the proposed eastern entry would provide an additional option for customers entering and exiting Central Station. This would take pressure off the other, already congested entries on the eastern side of Central Station. The new eastern entry may also result in changed pedestrian movement patterns in the precinct to the east of Central Station. This could result in both positive and negative impacts in different locations. For example, there could be increased congestion on the footpaths around and leading to the eastern entry; and there could be reduced congestion at some key intersections such as at the currently congested Elizabeth Street / Chalmers Street / Foveaux Street crossing. Other changes occurring in the area, including the new light rail stop on Chalmers Street, would also change pedestrian movement patterns and may provide additional footpath space and road crossing capacity. The Sydney Metro and light rail delivery teams would continue to work together so that appropriate pedestrian facilities are provided around the new eastern entry and Chalmers Street
- Cyclists – the new eastern entry would provide interchange opportunity via the adjacent planned cycle route along Chalmers Street (currently under construction). Additional cycle parking facilities are also being investigated and would be provided within 50 metres of station entries where feasible
- Public transport – the new eastern entry would provide efficient interchange between metro, suburban and light rail services. As identified in Chapter 2, the eastern entry, combined with the east concourse would substantially reduce travel times for customer interchanging with light rail services on Chalmers Street.

## 10.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These mitigation measures would adequately address the potential operational traffic and transport impacts. No additional or revised operational traffic and transport mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Condition E75 – in relation to integration with surrounding transport network and facilitating an improved level of service
- Condition E92 – the preparation of Interchange Access Plans for each station.

# **NOISE AND VIBRATION**

## CHAPTER ELEVEN



# 11 Noise and vibration

**This chapter assesses the potential changes to noise and vibration impact during the construction and operational as a result of the proposed modification. Any changes to mitigation measures to address the potential impacts are also identified.**

## 11.1 Assessment methodology

The assessment of potential changes to construction and operational noise and vibration impacts followed the same approach as was carried out for the approved project and involved:

- Identifying and classifying sensitive receivers
- Characterising the existing noise environment based on attended and unattended noise measurements at nearby receiver locations
- Determining noise and vibration management levels in accordance with relevant guidelines.

### 11.1.1 Construction

The assessment methodology for the construction noise and vibration assessment generally involved:

- Modelling to quantify the potential construction noise and vibration impacts from the construction activities for the proposed modification in isolation, and modelling of the project as proposed to be modified (that is modelling the combined impacts of the construction activities for the approved project and the proposed modification)
- Identifying the potential changes to the impacts from the approved project and assessing the significance of potential impacts identified
- Examining the proposed construction methodologies and identifying mitigation measures that are likely to be required to minimise construction noise and vibration impacts
- Preparing and documenting any changes to the mitigation measures identified for the approved project that would be implemented during construction.

The assessment provides a 'worst-case' scenario based on the proposed works within a 15 minute period which is typically associated with works located within the nearest site area to a particular receiver. However, in reality at any particular location, the potential construction noise impacts can vary greatly depending on factors including the following:

- The position of the construction works within the site and distance to the nearest sensitive receiver
- The overall duration of the construction works
- The intensity of the noise levels, typically due to different activities taking place through the works period
- The time at which the construction works are undertaken
- The character of the noise.

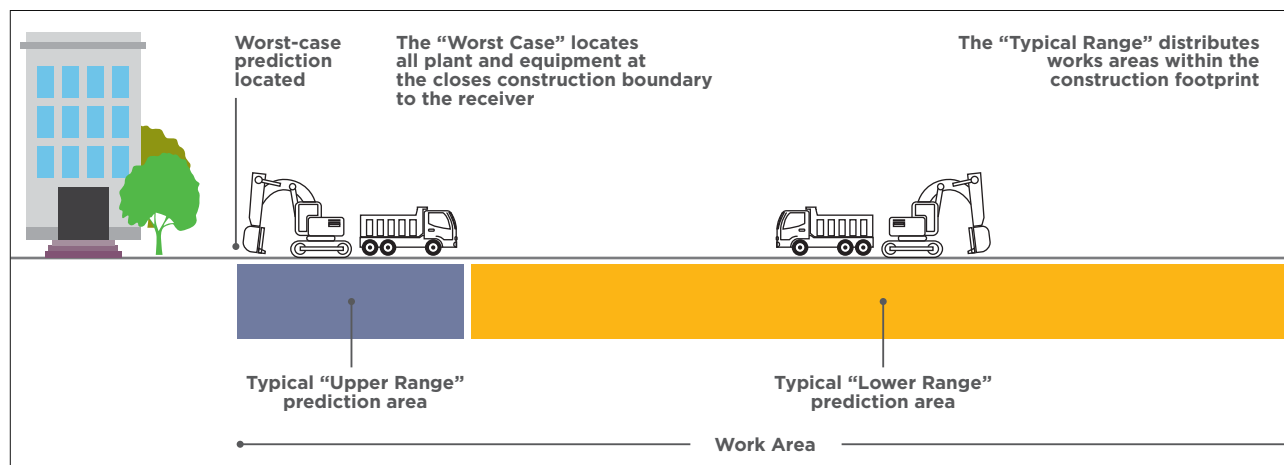
In response to feedback received on the assessment carried out for the approved project and to present a more refined assessment of the potential variance in noise impacts over the duration of works activity, this assessment refers to the  $L_{Aeq(15\text{minute})}$  'typical range' to describe the range of impacts likely to be experienced by a receiver.



The ‘worst-case’ and ‘typical range’ are defined as:

- The ‘worst-case’  $L_{Aeq(15\text{minute})}$  noise level corresponds to the worst case noise level expected during construction works for a given activity. This is consistent with the requirements of the ICNG. The ‘worst-case’ noise prediction denotes a scenario where all works are located at the closest construction boundary to the receiver and that all equipment is running simultaneously within each works area. The upper noise level is expected to occur on occasion, typically only over several days corresponding to each scenario activity and would typically occur for a short period only during those days
- The ‘typical range’ of  $L_{Aeq(15\text{minute})}$  noise level expected during construction works for a given activity is representative of the construction noise levels likely to be experienced by a receiver as works progress through other areas of the site and cater for the likely variability in the intensity of the works and utilisation rate of the plant and equipment. This approach represents a typical worst case prediction for the works which is expected to occur on a regular basis, typically occurring several times per day corresponding to each scenario and it is the level which is likely to correlate to the ongoing level of disturbance experienced by the surrounding sensitive receivers.

A figure showing the indicative work locations of the ‘worst-case’, ‘typical upper’ and ‘typical lower’ range assessment locations is provided in Figure 11-1.



**Figure 11-1** Illustration of relative equipment location for worst-case, typical upper and lower range assessments

To further quantify the range of levels that may be experienced throughout a typical work day, detailed information surrounding the composition of equipment for each activity has been included. A works activity within a construction scenario is comprised of a number of individual items of plant that make up the activity. Generally, one item of plant dominates the noise emissions from that particular works activity. The use of and location of the dominant item of plant generally controls the worst-case noise level from the site. To represent periods of construction where the dominant items of plant are not working, a ‘Supporting Works Only’ scenario has been included for each activity. The ‘Supporting Works Only’ prediction includes all items of plant for a given activity, except for the dominant noise source.

### 11.1.2 Operation

The assessment methodology for the operational noise assessment involved determining the allowable airborne noise emissions from mechanical plant and ventilation systems in accordance with criteria derived from the *Industrial Noise Policy* (Environment Protection Authority, 2000).

### 11.1.3 Terminology

Noise parameters most relevant to the noise assessment are described below:

- Rating Background Level (RBL) or  $L_{A90}$  – the background noise level in the absence of proposed construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods and is used to set the  $L_{Aeq(15\text{ minute})}$  Noise Management Levels (NMLs) for residential receivers
- $L_{Aeq(15\text{ minute})}$  – the “energy average noise level” evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts
- $L_{Aeq(\text{period})}$  – the Energy Average Noise Level evaluated over a defined measurement period (typically 15 minutes for construction noise or the relevant daytime, evening or night-time period for ambient noise monitoring)
- $L_{Amax}$  or  $L_{A1(1\text{ min})}$  – the ‘typical maximum noise level’ for an event, used in the assessment of potential sleep disturbance during night-time periods.

### 11.1.4 Sensitive receivers

The sensitivity of occupants to noise and vibration varies according to the nature of the occupancy and the activities performed within the affected premises. For example, recording studios are more sensitive to vibration and ground-borne noise than residential premises, which in turn are more sensitive than typical commercial and industrial premises.

Properties within about 400 metres of the project area were classified as part of the assessment for the approved project into one of the following receiver categories:

- Residential
- Commercial
- Industrial
- Educational
- Child care
- Medical (hospital wards or other uses including medical centres)
- Places of worship
- Recreation (passive and active recreation).

Additional classification of receivers has been carried out as part of this assessment where necessary.

The receivers surrounding Central Station are predominantly residential and commercial with some of the other receiver types located within the vicinity of the station. Receivers located beyond 400 metres are unlikely to hear any construction or operational noise.

In addition, there are building and structures located within or adjacent to the proposed modification works that are of heritage significance, as well as buildings with vibration sensitive uses. Buildings nearby the works associated with the proposed modification comprising vibration sensitive uses include:

- Sydney Dental Hospital, 2 Chalmers Street, Surry Hills (sensitive use)
- 30-34 Chalmers Street, Surry Hills (residential and commercial occupancy)
- 101 Chalmers Street, Surry Hills (Former 'Railway Institute' Building, a heritage item)
- 1-5 Randle Street, Surry Hills (residential occupancy)
- 405 Elizabeth Street, Surry Hills (residential occupancy).

### **11.1.5 Noise Catchment Areas**

The study area for the project has been divided into multiple Noise Catchment Areas (NCAs). These NCAs reflect the changing land uses and where receivers are affected by the same construction works or operational activities and are shown in Figure 11-2.

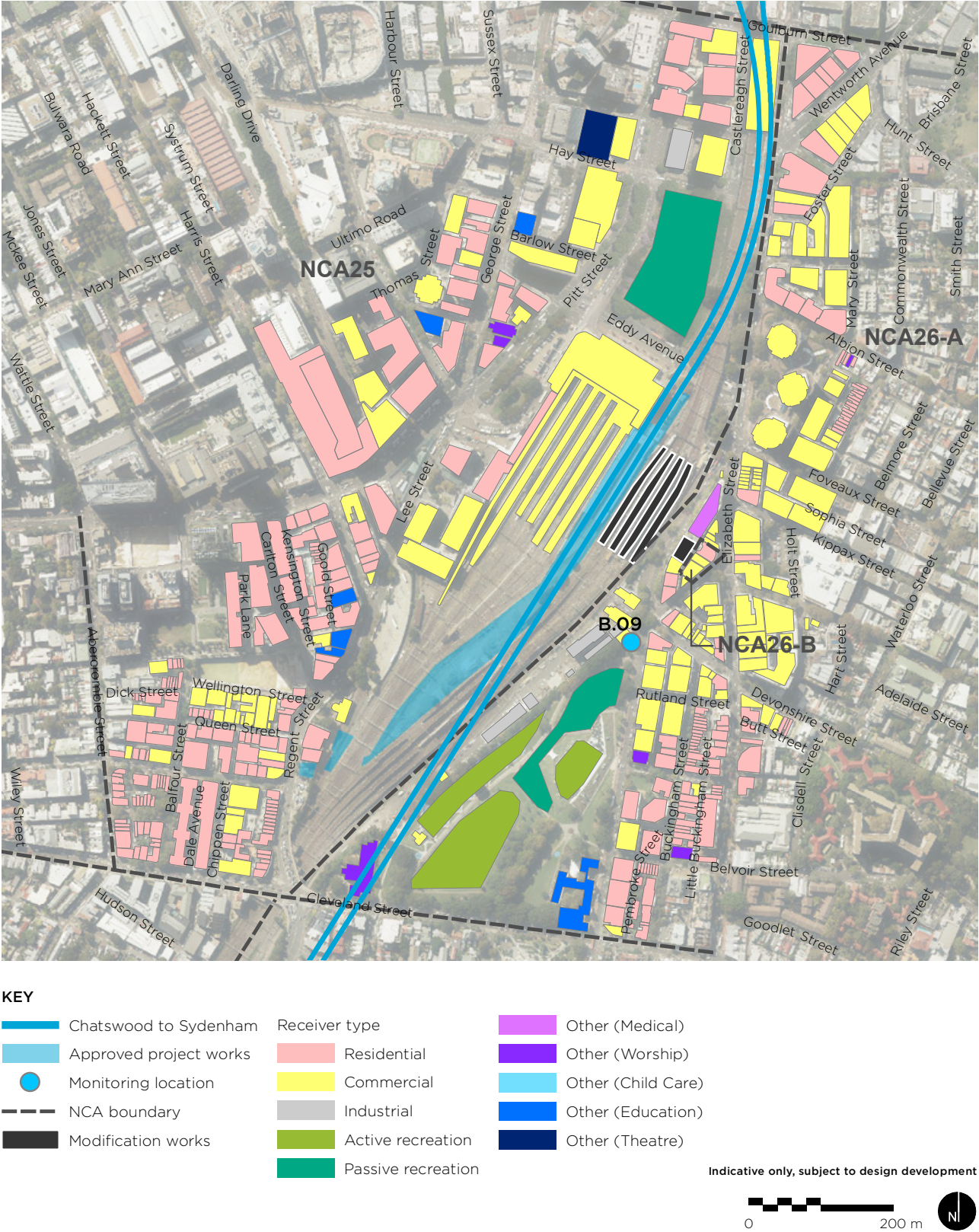


Figure 11-2 Noise catchment areas

## 11.2 Existing environment

The existing noise and vibration environment around Central Station was described as part of the Environmental Impact Statement. As part of the assessment of the proposed modification, additional background noise monitoring has been carried out to further refine the existing noise environment. This section provides further details of the existing noise and vibration environment specifically relating to the proposed modification.

### 11.2.1 Ambient noise surveys and monitoring locations

To characterise the existing ambient noise environment and to establish ambient noise levels on which to base the construction noise management levels (NMLs), noise monitoring was carried out during June to July 2015 and September 2015 as part of the assessment of the approved project. These results were supplemented with ambient noise data obtained during November 2016 to account for additional areas of construction activity specific to the proposed modification.

In addition, operator-attended noise monitoring was carried out at Randle Lane as no suitable monitoring location could be obtained in this area.

The location of unattended and attended noise surveys is shown on Figure 11-2. The results of the unattended noise survey are summarised in Table 11-1 and the results of the attended noise monitoring in Table 11-2.

**Table 11-1 Summary of unattended noise monitoring results**

| Location ID    | Noise Level (dBA) <sup>1</sup> |      |                       |      |                          |      |
|----------------|--------------------------------|------|-----------------------|------|--------------------------|------|
|                | Daytime 7 am to 6 pm           |      | Evening 6 pm to 10 pm |      | Night-time 10 pm to 7 am |      |
|                | RBL                            | LAeq | RBL                   | LAeq | RBL                      | LAeq |
| B.09 (NCA 26A) | 56                             | 68   | 53                    | 66   | 45                       | 64   |
| B.10 (NCA 25)  | 58                             | 70   | 56                    | 69   | 52                       | 66   |

<sup>1</sup> The RBL and LAeq noise levels have been obtained using the calculation procedures documented in the INP.

**Table 11-2 Summary of attended noise monitoring results**

| Location ID   | Period     | Date and time of monitoring   | Noise Level (dBA) <sup>1</sup> |      |
|---------------|------------|-------------------------------|--------------------------------|------|
|               |            |                               | LA90                           | LAeq |
| B30 (NCA 26B) | Daytime    | 18 November 2016 7 am to 8 am | 61                             | 65   |
|               | Evening    | 17 November 2016 6 pm to 7pm  | 62                             | 65   |
|               | Night-time | 18 November 2016 6am to 7am   | 54                             | 62   |

<sup>1</sup> The ABL and LAeq noise levels have been obtained using the calculation procedures documented in the INP.



## 11.3 Construction noise and vibration criteria

### 11.3.1 Construction noise management levels

#### Airborne noise

Construction noise management levels for airborne noise were determined using the same approach as for the approved project. This involved:

- For residential receivers deriving noise management levels based on the background noise level and the guidance provided in the *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change, 2009)
- For non-residential receivers, applying the applicable noise management level from the ICNG
- For hotels, cafes, bars, restaurants and libraries applying the ‘maximum’ internal levels presented in *AS 2107 2000 Recommended Design Sound Levels and Reverberation Times for Building Interiors* as documented in the Construction Noise and Vibration Strategy
- For child care centres applying the criteria from *Technical Guideline Child Care Centre Noise Assessment* (Association of Australian Acoustical Consultants, 2008).

Table 11-3 provides a summary of the NMLs relevant for each noise catchment area and receiver type.

**Table 11-3 Summary of external noise management levels, applicable at the most affected facade**

| NCA    | Receiver type                         | Standard construction hours <sup>1</sup> | Out of hours <sup>2</sup> |         |            | Sleep disturbance screening (RBL + 15) |
|--------|---------------------------------------|--|---------------------------|---------|------------|--|
|        |                                       | Daytime                                  | Daytime                   | Evening | Night-time |  |
| NCA25  | Residential                           | 68                                       | 63                        | 61      | 57         | 67                                     |
| NCA26A | Residential                           | 66                                       | 61                        | 58      | 50         | 60                                     |
| NCA26B | Residential                           | 71                                       | 66                        | 67      | 59         | 69                                     |
| All    | Commercial                            | 70                                       | 70                        | N/A     | N/A        | N/A                                    |
|        | Industrial                            | 75                                       | 75                        | N/A     | N/A        | N/A                                    |
|        | Other (Childcare)                     | 50                                       | 50                        | N/A     | N/A        | N/A                                    |
|        | Other (Educational) <sup>3</sup>      | 55                                       | N/A                       | N/A     | N/A        | N/A                                    |
|        | Other (Medical) <sup>3</sup>          | 55                                       | 55                        | 55      | N/A        | N/A                                    |
|        | Other (Place of Worship) <sup>3</sup> | 55                                       | 55                        | N/A     | N/A        | N/A                                    |
|        | Other (Outdoor active)                | 65                                       | 65                        | 65      | N/A        | N/A                                    |
|        | Outdoor (Passive)                     | 60                                       | 60                        | 60      | N/A        | N/A                                    |

<sup>1</sup> Standard construction hours are: 7am-6pm Monday to Friday, 8am-1pm Saturdays

<sup>2</sup> Out of hours periods are: Daytime: 1pm-6pm Saturdays and 8am-6pm Sunday; Evening 6pm-10pm; Night time hours 10pm-7am Sunday to Saturday and 10pm Saturday to 8am Sunday.

<sup>3</sup> External levels, based on the internal levels specified in the ICNG / applicable standards or guidelines, plus 10 dB (assuming open windows)

### Ground-borne noise

Consistent with the approach for the assessment of the approved project, ground-borne noise management levels were applied from the ICNG. Construction noise management levels for ground-borne noise were determined using the same approach as for the approved project. Ground-borne NMLs for residential receivers, based on levels provided in the ICNG and the Construction Noise and Vibration Strategy, are presented in Table 11-4.

**Table 11-4 Ground-borne noise management levels for residential receivers**

| Time of day              | Ground-borne NMLs $L_{Aeq}(15 \text{ minute})$ |
|--------------------------|--|
| Daytime 7 am to 6 pm     | 45 dBA – internal                              |
| Evening 6 pm to 10 pm    | 40 dBA – internal                              |
| Night-time 10 pm to 7 am | 35 dBA – internal                              |

For commercial receivers, the ICNG does not provide guidance in relation to acceptable ground-borne noise levels. However, the assessment of the approved project adopted an internal NML of  $L_{Aeq}(15 \text{ minute})$  50 dBA based on the ICNG external airborne noise NML of 70 dBA and that when commercial premises have windows closed this would provide typically 20 dB of noise reduction from outside to inside. This level has also been applied to this assessment.

For other sensitive receivers, such as education institutions, hospital wards and operating theatres, and place of worship, the ICNG does not provide guidance in relation to acceptable ground-borne noise levels. However, the internal airborne noise NMLs provided in the ICNG and AS 2107 for these receivers have been adopted in order to assist in identifying potential impacts.

### 11.3.2 Construction ground-borne vibration

The assessment of potential changes to construction vibration used the same screening criteria as the assessment of the approved project. These were derived from guidance provided in British Standard BS 7385 for cosmetic damage levels and are:

- Reinforced or framed structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s
- Heritage items: 7.5 mm/s.

### 11.3.3 Construction traffic noise

The assessment of road traffic noise adopted the same approach as was applied for the assessment of the approved project by using guidance in the *NSW Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water, 2011a).

One of the objectives of the RNP is to protect against excessive reduction in amenity as the result of a project by comparing traffic noise levels to the following relevant road traffic noise criteria:

- Existing freeway / arterial / sub-arterial roads:
  - ◆  $L_{Aeq}(15 \text{ hour})$  60 dBA day
  - ◆  $L_{Aeq}(9 \text{ hour})$  55 dBA night
- Existing local roads:
  - ◆  $L_{Aeq}(1 \text{ hour})$  55 dBA day
  - ◆  $L_{Aeq}(1 \text{ hour})$  50 dBA night.

Where traffic noise levels from the existing traffic plus the additional traffic generated by the project exceeds the above criteria, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no project option'.

In considering feasible and reasonable mitigation measures where the relevant noise increase is greater than 2 dB, consideration is also given to the actual noise levels associated with construction traffic.

#### 11.3.4 Sleep disturbance

Consistent with the approach for the assessment of the approved project a sleep disturbance NML of  $L_{A1(1\text{minute})}$  55 dBA (internal) has been adopted, which equates to an external noise level of 65 dBA (assuming open windows).

#### 11.3.5 Work health and safety

Due to the location of the proposed modification close proximity to station workers, retail staff and the public; and based on feedback received on the assessment for the approved project, consideration of work health and safety noise levels has been carried out.

Noise induced hearing loss typically occurs when individuals are exposed to excessive noise levels for extended periods of time (normally over several months or perhaps years). Alternatively, hearing damage can occur when a person is exposed to very high (peak) noise levels.

Section 56 of the *Work Health and Safety Regulation 2011* provides acceptable noise limits for the workplace which are:

- $L_{Aeq(8\text{hour})}$  85 dB(A)
- $L_{Cpeak}$  140 dB(C).

## 11.4 Operational noise criteria

Operational noise criteria for the assessment of noise from fixed mechanical, electrical and ventilation have been derived from the *Industrial Noise Policy* (INP) (Environment Protection Authority, 2000). This is consistent with the approach taken for the assessment of the approved project.

The INP sets two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. These criteria are to be met at the most-affected boundary of the receiver property. The more stringent of the criteria usually defines the proposal specific noise levels. For both amenity and intrusiveness, night-time criteria are more stringent than daytime or evening criteria.

To provide for protection against intrusive noise, the INP states that the  $L_{Aeq}$  noise level of the source, measured over a period of 15 minutes, should not be more than five decibels above the background  $L_{A90}$  noise level (or RBL), measured during the daytime, evening and night-time periods at the nearest sensitive residential receiver. In this case, the intrusiveness criteria are determined from the rating background levels at sensitive receiver locations nearest to the facilities.

To provide protection against impacts on amenity, the INP specifies suitable maximum noise levels for particular land uses and activities during the daytime, evening and night-time periods. The relevant INP external amenity noise criteria are presented in Table 11-5.



Table 11-5 Industrial Noise Policy amenity criteria

| Type of receiver       | Indicative noise amenity area | Time of day                  | Recommended $L_{Aeq}$ noise level (dBA) |                     |
|------------------------|-------------------------------|------------------------------|---|---------------------|
|                        |                               |                              | Acceptable                              | Recommended maximum |
| Residence              | Suburban <sup>1</sup>         | Day                          | 55                                      | 60                  |
|                        |                               | Evening                      | 45                                      | 50                  |
|                        |                               | Night                        | 40                                      | 45                  |
| Residence              | Urban <sup>2</sup>            | Day                          | 60                                      | 65                  |
|                        |                               | Evening                      | 50                                      | 55                  |
|                        |                               | Night                        | 45                                      | 50                  |
| Commercial             | All                           | When in use                  | 65                                      | 70                  |
| Active recreation area | All                           | When in use                  | 55                                      | 60                  |
| Hospital ward          | All                           | Noisiest 1 hour, when in use | 50                                      | 55                  |
| Educational            | All                           | Noisiest 1 hour, when in use | 45 <sup>1</sup>                         | 50 <sup>1</sup>     |
| Place of worship       | All                           | When in use                  | 50 <sup>1</sup>                         | 55 <sup>3</sup>     |

<sup>1</sup> Suburban area is characterised by local traffic with intermittent traffic flows, decreasing noise levels in the evening period, and / or evening ambient levels defined by the natural environment and infrequent human activity.

<sup>2</sup> Urban areas are characterised by an acoustic environment dominated by 'urban hum' or industrial noise sources, through traffic with heavy and continuous traffic flows during peak hours, and / or located near commercial or industrial districts.

<sup>3</sup> External levels, based on the internal levels specified in the INP plus 10 dB (assuming open windows).

## 11.5 Potential construction impacts

### 11.5.1 Airborne noise

This section provides an assessment of the potential change in airborne noise impacts as a result of the proposed modification. Specifically, this section includes:

- Figures showing the combined potential airborne noise impacts of the approved project and the proposed modification for all construction scenarios and relevant time periods
- Tables highlighting the potential change in impact due to the addition of the proposed modification for all construction scenarios and relevant time periods.

Additional graphical and tabulated results of airborne noise impact of the approved project in isolation, the proposed modification in isolation, and the combined impact of the approved project and proposed modification are provided in Appendix D.

Receiver types in the tables have been abbreviated as follows:

- RES – Residential (including hotels)
- COM – Commercial
- IND – Industrial
- OED – Other educational
- OME – Other medical
- OOP – Other outdoor passive recreation

- OOA – Other outdoor active recreation
- OPW – Other place of worship
- OTH – Other theatre.

In general, the majority of sensitive receivers surrounding Central Station would experience no change in noise impacts as a result of the proposed modification. In most cases, the predicted noise level increases associated with the proposed modification compared to the approved project are less than 1 dB. However, as detailed in Table 11-6 to Table 11-13, the construction activities for the proposed modification would result in some additional exceedances of the NMLs for some receivers.

The receivers which would experience the largest potential change in impacts are those located in the immediate vicinity of the proposed eastern entry. These properties are:

- Residential at 30-34 Chalmers Street (NCA 26A)
- Sydney Dental Hospital at 2 Chalmers Street (NCA 26A)
- Residential at 17 Randle Street (NCA 26A)
- Residential at 38 Chalmers Street (NCA 26A)
- Residential at 86-92 Chalmers Street (NCA 26A)
- Commercial at 11 Randle Street (NCA 26B)
- Commercial at 405 Elizabeth Street (NCA 26B).

### Enabling works

The enabling works scenario includes demolition, site establishment and adjustments to services and utilities.

The anticipated noise level exceedances for enabling works with all plant in use during the relevant time periods for the approved project and with the proposed modification are shown on Figure 11-3 to Figure 11-6.

The potential change in the number of receivers in each noise management level exceedance category, based on the typical upper level is provided in Table 11-6 for enabling works with all plant in use and Table 11-7 for enabling works with supporting works only occurring.

The enabling works for the eastern entry would be carried out during standard construction hours over a period of around nine months. This would involve adjustments of services and utilities for a period of around two months, followed by demolition works for around seven months. Enabling works for the east concourse would be carried out during all time periods over a period of 30 months (moving progressively from platform 22 / 23 to platform 16 / 17).

The additional impacts during the out of hours periods are due to enabling works for the east concourse. These works would be primarily carried out during rail possessions and, as such, these impacts would be experienced periodically over around a 30 month period. The impact from these works would vary depending on the platform that works are occurring on, ie impacts would be lower than those shown whenever works are occurring on platforms 16-21. Works on the closest platform (platform 22 / 23) would occur periodically over a duration of around nine months.

During periods when supporting works only are occurring, there would be a reduction in noise levels with a corresponding reduction in the number of receivers experiencing an increase in impact due to the proposed modification.



Figure 11-3 Noise management level exceedance map – enabling works daytime





Figure 11-4 Noise management level exceedance map – enabling works daytime out of hours





Figure 11-5 Noise management level exceedance map – enabling works evening





Figure 11-6 Noise management level exceedance map – enabling works night-time

Table 11-6 Changes to the approved project resulting from the proposed modification – all enabling works

|        | Changes to<br>L <sub>Aeq</sub> (15 minute)<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |    |    |   |                  |    |   |   |         |    |   |   |       |    |    |   |       |    |   |   |
|--------|--|-------|--|---|----|----|---|------------------|----|---|---|---------|----|---|---|-------|----|----|---|-------|----|---|---|
| Type   | Lower  | Upper |  | Day   |    |    |   | Day out of hours |    |   |   | Evening |    |   |   | Night |    |    |   | Sleep |    |   |   |
| NCA25  |  |       |  |   |    |    |   |                  |    |   |   |         |    |   |   |       |    |    |   |       |    |   |   |
| COM    | 2  | 0     | 46                                     | -   | -  | -  | - | -1               | 1  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| IND    | 17   | 0     | 1                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | -     | -  | -  | - | NA    | -  | - | - |
| OED    | 0  | 0     | 5                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OOP    | 17   | 0     | 1                                      | -   | -  | -  | - | -                | -  | - | - | NA      | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OPW    | 0  | 0     | 2                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OTH    | 9  | 0     | 1                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| RES    | 4  | 0     | 169                                    | -   | -  | -  | - | -10              | 10 | - | - | -15     | 15 | - | - | -48   | 44 | 4  | - | -13   | 12 | 1 | - |
| NCA26A |  |       |  |   |    |    |   |                  |    |   |   |         |    |   |   |       |    |    |   |       |    |   |   |
| COM    | 7  | 42    | 91                                     | -5  | 1  | 2  | 2 | -12              | 10 | 1 | 1 | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| IND    | 0  | 0     | 6                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | -     | -  | -  | - | NA    | -  | - | - |
| OED    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OME    | 20   | 14    | 1                                      | -   | -  | -1 | 1 | -1               | -  | - | 1 | NA      | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OOA    | 0  | 0     | 3                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OOP    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | -  | - | - | NA      | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| OPW    | 0  | 0     | 4                                      | -   | -  | -  | - | -                | -  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| RES    | 33   | 33    | 115                                    | -   | -3 | 1  | 2 | -12              | 7  | 3 | 2 | -21     | 16 | 2 | 3 | -53   | 38 | 10 | 5 | -34   | 28 | 3 | 3 |
| NCA26B |  |       |  |   |    |    |   |                  |    |   |   |         |    |   |   |       |    |    |   |       |    |   |   |
| COM    | 24   | 31    | 2                                      | -   | -2 | -  | 2 | -2               | 2  | - | - | -       | -  | - | - | NA    | -  | -  | - | NA    | -  | - | - |
| RES    | 23   | 28    | 1                                      | -   | -1 | -  | 1 | -1               | -  | 1 | - | -1      | -  | 1 | - | -1    | -  | -  | 1 | -1    | -  | 1 | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver



Tablet 11-7 Changes to the approved project resulting from the proposed modification – supporting enabling works

|        | Changes to $L_{Aeq}(15\text{ minute})$ typical range <sup>1</sup> |       | Number of receivers in catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |                  |    |   |    |   |         |    |    |       |   |    |       |    |   |    |    |   |   |   |
|--------|---|-------|----------------------------------|---|------------------|----|---|----|---|---------|----|----|-------|---|----|-------|----|---|----|----|---|---|---|
| Type   | Lower   | Upper |                                  | Day   | Day out of hours |    |   |    |   | Evening |    |    | Night |   |    | Sleep |    |   |    |    |   |   |   |
| NCA25  |   |       |                                  |   |                  |    |   |    |   |         |    |    |       |   |    |       |    |   |    |    |   |   |   |
| COM    | 0   | 0     | 46                               | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| IND    | 14  | 0     | 1                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | -  | -     | -  | - | NA | -  | - | - |   |
| OED    | 0   | 0     | 5                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OOP    | 13  | 0     | 1                                | -   | -                | -  | - | -  | - | -       | NA | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OPW    | 0   | 0     | 2                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OTH    | 6   | 0     | 1                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| RES    | 8   | 0     | 169                              | -   | -                | -  | - | -2 | 2 | -       | -  | -3 | 3     | - | -  | -9    | 8  | 1 | -  | -2 | 1 | 1 | - |
| NCA26A |   |       |                                  |   |                  |    |   |    |   |         |    |    |       |   |    |       |    |   |    |    |   |   |   |
| COM    | 7   | 42    | 91                               | -5  | 1                | 2  | 2 | -2 | 1 | -       | 1  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| IND    | 0   | 0     | 6                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | -  | -     | -  | - | NA | -  | - | - |   |
| OED    | 0   | 0     | 1                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OME    | 20  | 19    | 1                                | -   | -                | -1 | 1 | -1 | - | 1       | -  | NA | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OOA    | 0   | 0     | 3                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OOP    | 0   | 0     | 1                                | -   | -                | -  | - | -  | - | -       | NA | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| OPW    | 0   | 0     | 4                                | -   | -                | -  | - | -  | - | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| RES    | 33  | 40    | 115                              | -2  | -1               | 1  | 2 | -5 | 2 | 3       | -  | -6 | 3     | 3 | -  | -25   | 20 | 2 | 3  | -5 | 2 | 3 | - |
| NCA26B |   |       |                                  |   |                  |    |   |    |   |         |    |    |       |   |    |       |    |   |    |    |   |   |   |
| COM    | 24  | 38    | 2                                | -2  | -                | -  | 2 | -2 | 2 | -       | -  | -  | -     | - | NA | -     | -  | - | NA | -  | - | - |   |
| RES    | 23  | 35    | 1                                | -1  | -                | -  | 1 | -1 | 1 | -       | -  | -1 | 1     | - | -  | -1    | -  | 1 | -  | -1 | 1 | - | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

## Earthworks

The earthworks scenario includes piling and initial excavation activities.

The anticipated noise level exceedances from the approved project and with the proposed modification are shown on Figure 11-7 for earthworks with all plant in use during the daytime. Earthworks are not proposed to be carried out during out of hours periods.

The potential change in the number of receivers in each noise management level exceedance category, based on the typical upper level is provided in Table 11-8 for earthworks with all plant in use and Table 11-9 for earthworks with supporting works only occurring.

Earthworks for the eastern entry would be carried out during standard construction hours only over a period of around one month.

During earthworks, there would be a relatively minor number of receivers which would experience a change in impact from the approved project. These impacts would be limited to the daytime period and would be experienced for a short period of the overall construction timeframe.

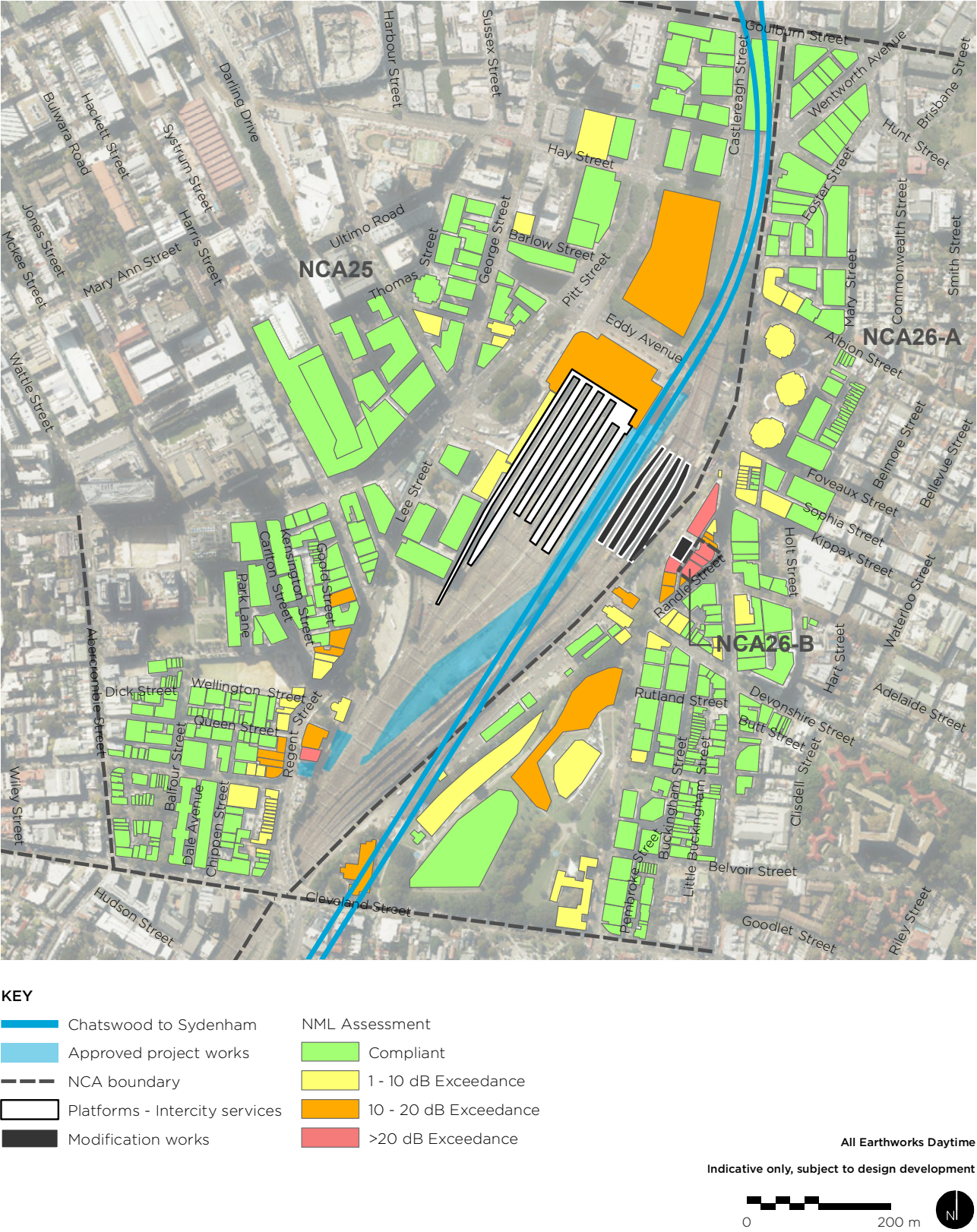


Figure 11-7 Noise management level exceedance map – earthworks daytime

Table 11-8 Changes to the approved project resulting from the proposed modification – all earthworks

|        | Changes to<br>L <sub>Aeq</sub> (15 minute)<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |    |    |   |                  |   |   |   |         |   |   |   |       |   |   |   |       |   |   |   |
|--------|--|-------|--|---|----|----|---|------------------|---|---|---|---------|---|---|---|-------|---|---|---|-------|---|---|---|
| Type   | Lower  | Upper |  | Day   |    |    |   | Day out of hours |   |   |   | Evening |   |   |   | Night |   |   |   | Sleep |   |   |   |
| NCA25  |  |       |  |   |    |    |   |                  |   |   |   |         |   |   |   |       |   |   |   |       |   |   |   |
| COM    | 0  | 0     | 46                                     | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| IND    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OED    | 0  | 0     | 5                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OOP    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OPW    | 0  | 0     | 2                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OTH    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| RES    | 7  | 0     | 169                                    | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| NCA26A |  |       |  |   |    |    |   |                  |   |   |   |         |   |   |   |       |   |   |   |       |   |   |   |
| COM    | 7  | 7     | 91                                     | -5  | 2  | 3  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| IND    | 0  | 0     | 6                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OED    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OME    | 15   | 15    | 1                                      | -   | -  | -1 | 1 | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OOA    | 0  | 0     | 3                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OOP    | 0  | 0     | 1                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| OPW    | 0  | 0     | 4                                      | -   | -  | -  | - | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| RES    | 32   | 32    | 115                                    | -   | -3 | 2  | 1 | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| NCA26B |  |       |  |   |    |    |   |                  |   |   |   |         |   |   |   |       |   |   |   |       |   |   |   |
| COM    | 21   | 21    | 2                                      | -   | -2 | -  | 2 | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |
| RES    | 20   | 20    | 1                                      | -   | -1 | -  | 1 | -                | - | - | - | -       | - | - | - | -     | - | - | - | -     | - | - | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

Table 11-9 Changes to the approved project resulting from the proposed modification – supporting earthworks

|        | Changes to<br>$L_{Aeq}(15 \text{ minute})$<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |   |    |                  |   |   |         |   |   |       |   |   |       |   |   |   |   |   |
|--------|--|-------|--|---|---|----|------------------|---|---|---------|---|---|-------|---|---|-------|---|---|---|---|---|
| Type   | Lower  | Upper |  | Day   |   |    | Day out of hours |   |   | Evening |   |   | Night |   |   | Sleep |   |   |   |   |   |
| NCA25  |  |       |  |   |   |    |                  |   |   |         |   |   |       |   |   |       |   |   |   |   |   |
| COM    | 0  | 0     | 46                                     | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| IND    | 0  | 0     | 1                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OED    | 0  | 0     | 5                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OOP    | 0  | 0     | 1                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OPW    | 0  | 0     | 2                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OTH    | 0  | 0     | 1                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| RES    | 8  | 0     | 169                                    | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| NCA26A |  |       |  |   |   |    |                  |   |   |         |   |   |       |   |   |       |   |   |   |   |   |
| COM    | 7  | 7     | 91                                     | -3  | 3 | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| IND    | 0  | 0     | 6                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OED    | 0  | 0     | 1                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OME    | 15   | 15    | 1                                      | -   | - | -1 | 1                | - | - | -       | - | - | -     | - | - | -     | 1 | - | - | - | - |
| OOA    | 0  | 0     | 3                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OOP    | 0  | 0     | 1                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| OPW    | 0  | 0     | 4                                      | -   | - | -  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| RES    | 32   | 32    | 115                                    | -3  | 2 | -  | 1                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| NCA26B |  |       |  |   |   |    |                  |   |   |         |   |   |       |   |   |       |   |   |   |   |   |
| COM    | 21   | 21    | 2                                      | -2  | - | 2  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |
| RES    | 20   | 20    | 1                                      | -1  | - | 1  | -                | - | - | -       | - | - | -     | - | - | -     | - | - | - | - | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

## Excavation works

The excavation scenario includes excavation of the metro platforms, the shaft for the eastern entry, the vertical transport shafts through the suburban platforms and the mined excavation of the east concourse.

The anticipated noise level exceedances from the approved project and with the proposed modification are shown on Figure 11-8 to Figure 11-11 for excavation works with all plant in use during the relevant periods.

The potential change in the number of receivers in each noise management level exceedance category, based on the typical upper level is provided in Table 11-10 for excavation works with all plant in use and Table 11-11 for excavation works with supporting works only occurring.

Excavation works for the eastern entry would be carried out during standard construction hours over a period of around two months. Excavation works for the east concourse would be carried out during all time periods over a period of around 20 months.

The potential change in impact to residential receivers has been minimised through restricting the excavation of the eastern entry to the daytime period only. Notwithstanding, there are some additional impacts for residential properties on Chalmers Street and Randle Lane during out of hours periods due to the excavation works for the east concourse. These additional impacts would reduce as the excavation works move westwards into the station. Additionally, these impacts would also reduce during periods when supporting works only are occurring. A typical excavation activity would have all plant operating for 50 per cent of the time, with supporting works (mucking out and shoring up the excavation) occurring for the other 50 per cent.

The excavation of the eastern entry, occurring during the daytime period only, would still result in increased impacts to the Sydney Dental Hospital, with overall noise levels at this receiver exceeding 20 dB during excavation works. These impacts are based on excavation using rock breakers. Although the total excavation period for the eastern entry would be around two months, the majority of the material to be excavated is rippable material and the use of rock breakers would not be required. The final four metres of the excavation would be within hard sandstone and, as such, rock breakers would be required for this section. This is expected to occur for a period of around two weeks during the daytime period only. Consultation would be carried out with the Sydney Dental Hospital to determine suitable periods when this excavation work would result in a minimised impact to the operation of the Hospital.



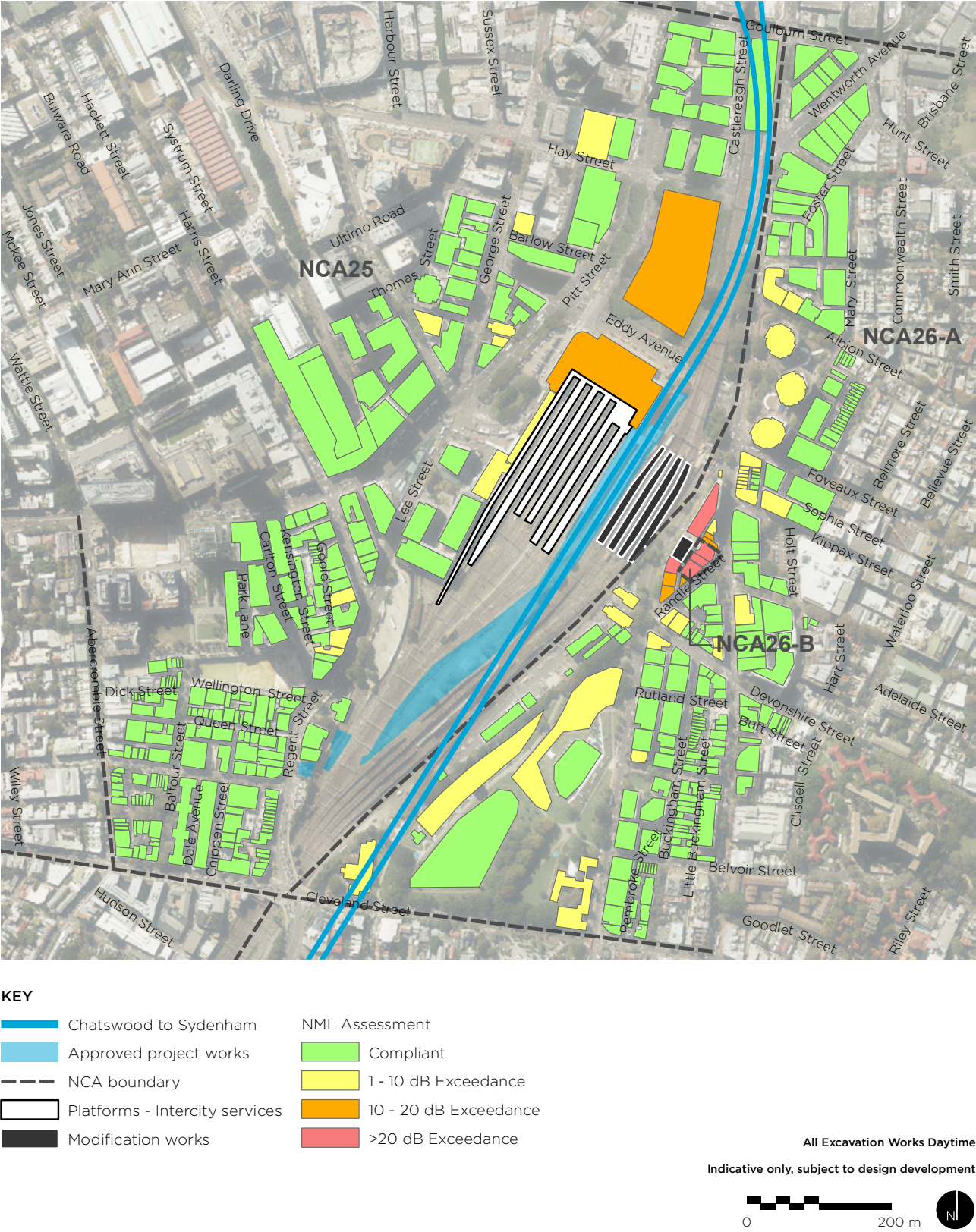


Figure 11-8 Noise management level exceedance map - excavation works daytime



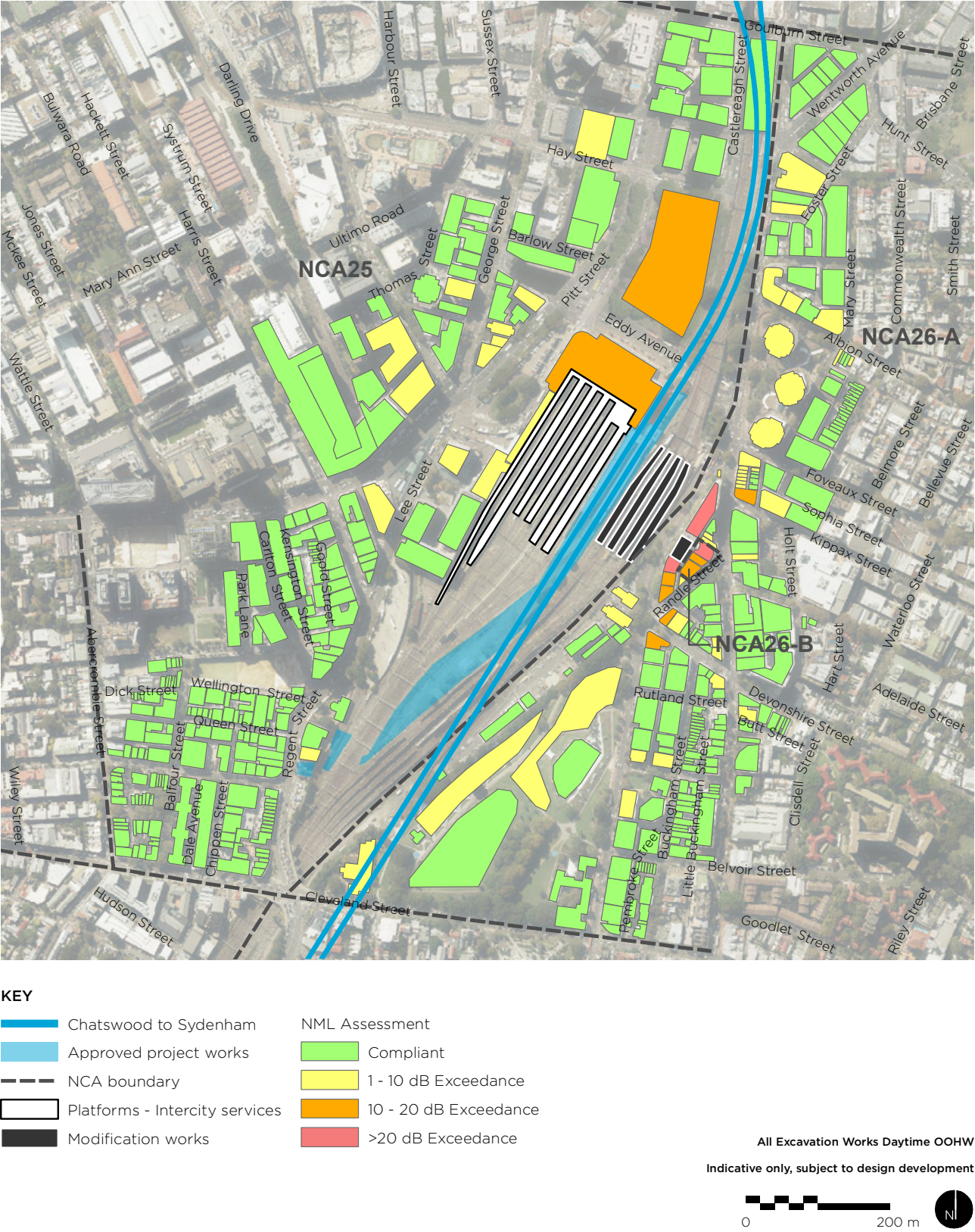
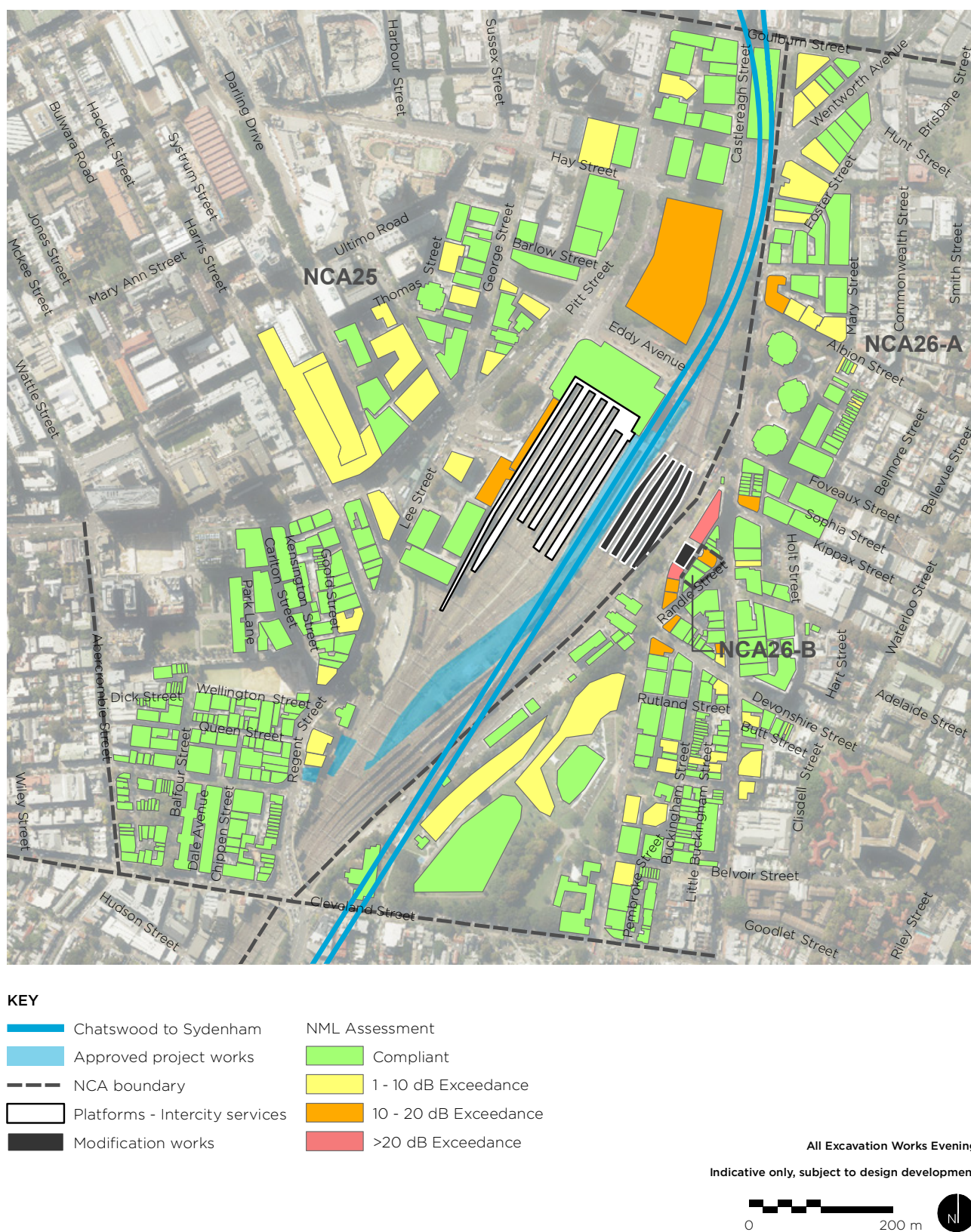


Figure 11-9 Noise management level exceedance map – excavation works daytime out of hours







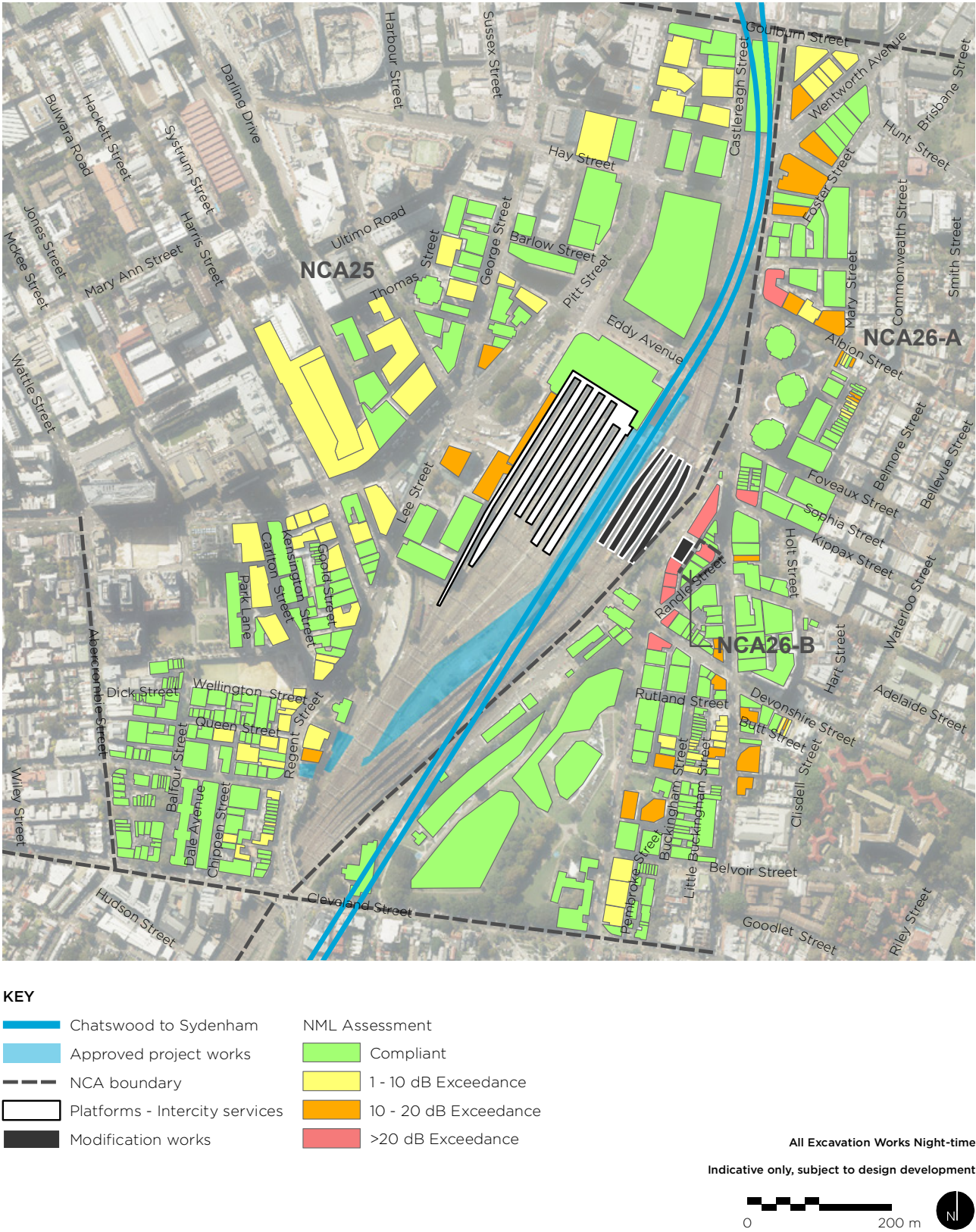


Figure 11-11 Noise management level exceedance map – excavation works night-time

Table 11-10 Changes to the approved project resulting from the proposed modification – all excavation works

|        | Changes to<br>$L_{Aeq}(15\text{ minute})$<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |    |    |   |                  |    |    |   |         |    |    |   |       |    |    |   |       |    |    |   |
|--------|---|-------|--|---|----|----|---|------------------|----|----|---|---------|----|----|---|-------|----|----|---|-------|----|----|---|
| Type   | Lower   | Upper |  | Day   |    |    |   | Day out of hours |    |    |   | Evening |    |    |   | Night |    |    |   | Sleep |    |    |   |
| NCA25  |   |       |  |   |    |    |   |                  |    |    |   |         |    |    |   |       |    |    |   |       |    |    |   |
| COM    | 0   | 0     | 46                                     | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| IND    | 0   | 0     | 1                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | -     | -  | -  | - | NA    | -  | -  | - |
| OED    | 6   | 0     | 5                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OOP    | 0   | 0     | 1                                      | -   | -  | -  | - | -                | -  | -  | - | NA      | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OPW    | 7   | 0     | 2                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OTH    | 0   | 0     | 1                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| RES    | 11  | 0     | 169                                    | -1  | 1  | -  | - | -1               | 1  | -  | - | -3      | 3  | -  | - | -     | -1 | 1  | - | -4    | -3 | -1 | - |
| NCA26A |   |       |  |   |    |    |   |                  |    |    |   |         |    |    |   |       |    |    |   |       |    |    |   |
| COM    | 7   | 7     | 91                                     | -5  | 2  | 3  | - | -4               | 4  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| IND    | 3   | 0     | 6                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | -     | -  | -  | - | NA    | -  | -  | - |
| OED    | 0   | 0     | 1                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OME    | 15  | 15    | 1                                      | -   | -  | -1 | 1 | -                | -  | -1 | 1 | NA      | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OOA    | 3   | 0     | 3                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OOP    | 5   | 0     | 1                                      | -   | -  | -  | - | -                | -  | -  | - | NA      | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| OPW    | 6   | 1     | 4                                      | -   | -  | -  | - | -                | -  | -  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| RES    | 32  | 32    | 115                                    | -   | -3 | 2  | 1 | -                | -  | -1 | 1 | -       | -  | -1 | 1 | -     | -  | -  | - | -     | -1 | -2 | 3 |
| NCA26B |   |       |  |   |    |    |   |                  |    |    |   |         |    |    |   |       |    |    |   |       |    |    |   |
| COM    | 21  | 21    | 2                                      | -   | -2 | -  | 2 | -                | -2 | 2  | - | -       | -  | -  | - | NA    | -  | -  | - | NA    | -  | -  | - |
| RES    | 20  | 20    | 1                                      | -   | -1 | -  | 1 | -                | -1 | -  | 1 | -       | -1 | 1  | - | -     | -  | -1 | 1 | -     | -1 | 1  | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

Table 11-11 Changes to the approved project resulting from the proposed modification – supporting excavation works

|        | Changes to<br>L <sub>Aeq</sub> (15 minute)<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |    |   |   |    |                  |   |   |    |    |         |   |    |    |       |   |    |    |       |   |  |
|--------|--|-------|--|---|----|---|---|----|------------------|---|---|----|----|---------|---|----|----|-------|---|----|----|-------|---|--|
| Type   | Lower  | Upper |  | Day   |    |   |   |    | Day out of hours |   |   |    |    | Evening |   |    |    | Night |   |    |    | Sleep |   |  |
| NCA25  |  |       |  |   |    |   |   |    |                  |   |   |    |    |         |   |    |    |       |   |    |    |       |   |  |
| COM    | 0  | 0     | 46                                     | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| IND    | 0  | 0     | 1                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | -  | -  | -     | - | NA | -  | -     | - |  |
| OED    | 0  | 2     | 5                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OOP    | 0  | 0     | 1                                      | -   | -  | - | - | -  | -                | - | - | NA | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OPW    | 1  | 5     | 2                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OTH    | 0  | 2     | 1                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| RES    | 12   | 8     | 169                                    | -1  | 1  | - | - | -1 | 1                | - | - | -1 | 1  | -       | - | -2 | 1  | 1     | - | -2 | 1  | 1     | - |  |
| NCA26A |  |       |  |   |    |   |   |    |                  |   |   |    |    |         |   |    |    |       |   |    |    |       |   |  |
| COM    | 8  | 13    | 91                                     | -4  | 4  | - | - | -4 | 4                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| IND    | 3  | 0     | 6                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | -  | -  | -     | - | NA | -  | -     | - |  |
| OED    | 0  | 0     | 1                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OME    | 16   | 20    | 1                                      | -   | -1 | - | 1 | -  | -1               | - | 1 | NA | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OOA    | 0  | 0     | 3                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OOP    | 0  | 0     | 1                                      | -   | -  | - | - | -  | -                | - | - | NA | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| OPW    | 0  | 0     | 4                                      | -   | -  | - | - | -  | -                | - | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| RES    | 34   | 38    | 115                                    | -3  | 1  | 1 | 1 | -2 | -1               | 2 | 1 | -  | -3 | 2       | 1 | -4 | 3  | -2    | 3 | -  | -3 | 2     | 1 |  |
| NCA26B |  |       |  |   |    |   |   |    |                  |   |   |    |    |         |   |    |    |       |   |    |    |       |   |  |
| COM    | 22   | 27    | 2                                      | -2  | -  | 2 | - | -2 | -                | 2 | - | -  | -  | -       | - | NA | -  | -     | - | NA | -  | -     | - |  |
| RES    | 22   | 26    | 1                                      | -1  | -  | 1 | - | -1 | -                | - | 1 | -1 | -  | 1       | - | -  | -1 | -     | 1 | -1 | -  | 1     | - |  |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

## Construction works

The construction scenario includes fit out of the new metro platforms, concourses and eastern entry, construction of above ground buildings, re-instatement of platforms 12 to 14 and platforms works (refresh and re-levelling) on the suburban platforms.

The anticipated noise level exceedances from the approved project and with the proposed modification are shown on Figure 11-12 to Figure 11-15 for construction works with all plant in use during the relevant periods.

The potential change in the number of receivers in each noise management level exceedance category, based on the typical upper level is provided in Table 11-10 for construction works with all plant in use and Table 11-11 for construction works with supporting works only occurring. The construction works scenario for the approved project was only proposed to be carried out during standard daytime construction hours, whereas the construction works scenario for the proposed modification would be carried out up to 24 hours per day and seven days per week. As such, the tables showing the relative changes to the number of receivers in each exceedance category show a large increase in the number of receivers in the compliance category.

Construction works for the eastern entry would be carried out during standard construction hours. Underground building structural works would be carried out for around three months, followed by above ground construction and fitout for a period of around eight months.

Construction of the east concourse would be carried out during all time periods over a period of around seven months. The concourse fit-out and mechanical and engineering works would be carried out for around five months, followed by testing and commissioning for a period of around three months.

Similar to the other scenarios, construction works would result in a relatively small number of receivers experiencing an increase in noise levels. Similar to the enabling works scenario, the additional impacts during the out of hours periods would be dependent on the platform that works are occurring on and would occur periodically associated with rail possessions.





Figure 11-12 Noise management level exceedance map – construction works daytime





Figure 11-13 Noise management level exceedance map – construction works daytime out of hours









Figure 11-15 Noise management level exceedance map – construction works night-time

Table 11-12 Changes to the approved project resulting from the proposed modification – all construction works

|        | Changes to<br>L <sub>Aeq</sub> (15 minute)<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |   |    |   |                  |   |   |   |         |   |   |   |       |    |   |   |       |   |   |   |
|--------|--|-------|--|---|---|----|---|------------------|---|---|---|---------|---|---|---|-------|----|---|---|-------|---|---|---|
| Type   | Lower  | Upper |  | Day   |   |    |   | Day out of hours |   |   |   | Evening |   |   |   | Night |    |   |   | Sleep |   |   |   |
| NCA25  |  |       |  |   |   |    |   |                  |   |   |   |         |   |   |   |       |    |   |   |       |   |   |   |
| COM    | 0  | 2     | 46                                     | -2  | 1 | 1  | - | 43               | 2 | 1 | - | 46      | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| IND    | 0  | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | 1       | - | - | - | 1     | -  | - | - | NA    | - | - | - |
| OED    | 0  | 0     | 5                                      | -   | - | -  | - | 5                | - | - | - | 5       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OOP    | 0  | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | NA      | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OPW    | 0  | 4     | 2                                      | -   | - | -  | - | 2                | - | - | - | 2       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OTH    | 0  | 2     | 1                                      | -   | - | -  | - | 1                | - | - | - | 1       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| RES    | 11   | 0     | 169                                    | -3  | 1 | 2  | - | 165              | 2 | 2 | - | 164     | 3 | 2 | - | 152   | 13 | 2 | 2 | 164   | 2 | 3 | - |
| NCA26A |  |       |  |   |   |    |   |                  |   |   |   |         |   |   |   |       |    |   |   |       |   |   |   |
| COM    | 5  | 7     | 91                                     | -5  | 5 | -  | - | 91               | - | - | - | 91      | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| IND    | 0  | 0     | 6                                      | -   | - | -  | - | 6                | - | - | - | 6       | - | - | - | 6     | -  | - | - | NA    | - | - | - |
| OED    | 0  | 1     | 1                                      | -   | - | -  | - | 1                | - | - | - | 1       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OME    | 13   | 15    | 1                                      | -   | - | -1 | 1 | -                | - | 1 | - | NA      | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OOA    | 0  | 0     | 3                                      | -   | - | -  | - | 3                | - | - | - | 3       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OOP    | 0  | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | NA      | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| OPW    | 0  | 0     | 4                                      | -   | - | -  | - | 3                | 1 | - | - | 4       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| RES    | 30   | 32    | 115                                    | -4  | 3 | -  | 1 | 110              | 4 | 1 | - | 108     | 5 | 2 | - | 80    | 29 | 5 | 1 | 109   | 5 | 1 | - |
| NCA26B |  |       |  |   |   |    |   |                  |   |   |   |         |   |   |   |       |    |   |   |       |   |   |   |
| COM    | 19   | 21    | 2                                      | -2  | - | 2  | - | -                | 2 | - | - | 2       | - | - | - | NA    | -  | - | - | NA    | - | - | - |
| RES    | 18   | 20    | 1                                      | -1  | - | 1  | - | -                | 1 | - | - | -       | 1 | - | - | -     | -  | 1 | - | 1     | - | - | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

Table 11-13 Changes to the approved project resulting from the proposed modification – supporting construction works

|        | Changes to<br>$L_{Aeq}(15\text{ minute})$<br>typical range <sup>1</sup> |       | Number of<br>receivers in<br>catchment | Changes to number of receivers per NML assessment category (based on typical upper level) |   |    |   |                  |   |   |   |         |    |   |   |       |    |   |   |       |    |   |   |
|--------|---|-------|--|---|---|----|---|------------------|---|---|---|---------|----|---|---|-------|----|---|---|-------|----|---|---|
| Type   | Lower   | Upper |  | Day   |   |    |   | Day out of hours |   |   |   | Evening |    |   |   | Night |    |   |   | Sleep |    |   |   |
| NCA25  |   |       |  |   |   |    |   |                  |   |   |   |         |    |   |   |       |    |   |   |       |    |   |   |
| COM    | 0   | 2     | 46                                     | -2  | 1 | 1  | - | 43               | 2 | 1 | - | 46      | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| IND    | 0   | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | 1       | -  | - | - | 1     | -  | - | - | NA    | -  | - | - |
| OED    | 0   | 0     | 5                                      | -   | - | -  | - | 5                | - | - | - | 5       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| OOP    | 0   | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | NA      | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| OPW    | 0   | 4     | 2                                      | -   | - | -  | - | 2                | - | - | - | 2       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| OTH    | 0   | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | 1       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| RES    | 11  | 0     | 169                                    | -3  | 1 | 2  | - | 165              | 2 | 2 | - | 164     | 3  | 2 | - | 152   | 13 | 2 | 2 | 164   | 2  | 3 | - |
| NCA26A |   |       |  |   |   |    |   |                  |   |   |   |         |    |   |   |       |    |   |   |       |    |   |   |
| COM    | 5   | 7     | 91                                     | -5  | 5 | -  | - | 91               | - | - | - | 91      | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| IND    | 0   | 0     | 6                                      | -   | - | -  | - | 6                | - | - | - | 6       | -  | - | - | 6     | -  | - | - | NA    | -  | - | - |
| OED    | 0   | 1     | 1                                      | -   | - | -  | - | 1                | - | - | - | 1       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| OME    | 13  | 15    | 1                                      | -   | - | -1 | 1 | -                | - | - | 1 | -       | NA | - | - | -     | NA | - | - | -     | NA | - | - |
| OOA    | 0   | 0     | 3                                      | -   | - | -  | - | 3                | - | - | - | 3       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| OOP    | 0   | 0     | 1                                      | -   | - | -  | - | 1                | - | - | - | NA      | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| OPW    | 0   | 0     | 4                                      | -   | - | -  | - | 3                | 1 | - | - | 4       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| RES    | 30  | 32    | 115                                    | -4  | 3 | -  | 1 | 110              | 4 | 1 | - | 108     | 5  | 2 | - | 80    | 29 | 5 | 1 | 109   | 5  | 1 | - |
| NCA26B |   |       |  |   |   |    |   |                  |   |   |   |         |    |   |   |       |    |   |   |       |    |   |   |
| COM    | 19  | 21    | 2                                      | -2  | - | 2  | - | -                | 2 | - | - | 2       | -  | - | - | NA    | -  | - | - | NA    | -  | - | - |
| RES    | 18  | 20    | 1                                      | -1  | - | 1  | - | -                | 1 | - | - | -       | 1  | - | - | -     | -  | 1 | - | 1     | -  | - | - |

**Key**

- NML compliance
- NML exceedance of less than 10dB
- NML exceedance between 11dB and 20dB
- NML exceedance of greater than 20dB

<sup>1</sup> Changes to the typical range are at the most affected receiver

### 11.5.2 Ground-borne noise

The assessment of the approved project found that ground-borne noise impacts would be restricted to within the rail corridor. Excavation works required for the proposed modification (for both the eastern entry and east concourse) would result in ground-borne noise impacts to receivers outside the rail corridor. As such, this would represent new impacts associated with the proposed modification.

In summary, the analysis of potential daytime ground-borne noise impacts of the proposed modification indicates:

- Three residences located around the eastern entry would have exceedances of the NML of greater than 20 dB
- The Sydney Dental Hospital would have an exceedance of the NML of greater than 20 dB
- Two additional residences located around the eastern entry would have exceedances of the NML of 10 dB to 20 dB
- Two additional residences located around the eastern entry would have exceedances of the NML of up to 10 dB
- Around four commercial receivers located around the eastern entry would have exceedances of the NML of greater than 20 dB.

The predicted ground-borne noise levels represent a worst-case 15 minute period rather than a continuous noise level exceedance. During excavation works, rock breaking would occur for around 50 per cent of the total time with supporting activities (muck-out and shoring up of the excavation) occurring for the other 50 per cent. Ground-borne noise emissions from the supporting activities would be negligible and would provide periods of respite.

As identified for the potential airborne noise impacts, rock breaking of the eastern entry would be required for the final four metres of the shaft. This is expected to occur for a period of around two weeks. Consultation would be carried out with the Sydney Dental Hospital to determine suitable periods when this excavation work would result in a minimised impact to the operation of the Hospital.

### 11.5.3 Vibration

The assessment of the approved project identified that, during excavation of the station, vibration levels are anticipated to exceed the cosmetic damage screening criteria at two station platforms and three commercial buildings located to the east around the northern corner of Prince Alfred Park.

In addition, the works associated with the proposed modification are anticipated to result in exceedances of the relevant cosmetic damage screening criteria at:

- The heritage listed Former R.C. Henderson Ltd Factory, Railway Institute Building and the Sydney Dental Hospital are predicted to be above the relevant heritage building cosmetic damage screening criteria of 7.5 mm/s
- Residential buildings immediately adjacent to the eastern entry on Chalmers Street, Randle Lane and Elizabeth Street are predicted to be above the building cosmetic damage screening criteria of 7.5 mm/s for unreinforced or light framed structures. These buildings, however, may be more typical of a reinforced or framed structure with a higher cosmetic damage screening criterion (of 25 mm/s).



Consistent with the management approach identified for the approved project, a more detailed assessment of these structures and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for these structures.

In addition, the Sydney Dental Hospital may contain various items of vibration sensitive scientific and medical equipment. In accordance with the approach identified in the Construction Noise and Vibration Strategy (provided as part of the Submissions and Preferred Infrastructure Report), the development of appropriate limits for this receiver would consider the presence of this equipment.

### 11.5.4 Construction traffic noise

The assessment for the approved project identified that construction traffic noise would exceed the base criteria on Regent and Chalmers streets, however the relative increase would be less than 2 dB. Therefore, sensitive receivers are not likely to notice an increase in average road traffic noise levels from the approved project works at Central Station.

The additional traffic associated with the proposed modification would still result in an increase in traffic noise of less than 2 dB on Regent and Chalmers streets. As such, there would be no change in impact on these roads associated with the proposed modification.

The proposed modification would introduce construction traffic on Randle Lane. As construction traffic movements would vary on Randle Lane during possession and non-possession periods, an assessment of both scenarios has been carried out. The predicted road traffic noise and road traffic noise increase on Randle Lane during possession and non-possession works are presented in Table 11-14.

**Table 11-14 Randle Lane – road traffic noise**

| Base criteria<br>(Day $L_{Aeq}(15\text{hour})$ /<br>Night $L_{Aeq}(9\text{hour})$ ) | Possessions                                     |  | Non-possession                                  |  |
|---|---|--|---|--|
|   | Predicted road traffic noise (dB) (Day / Night) | Predicted road traffic noise increase (dB) (Day / Night) | Predicted road traffic noise (dB) (Day / Night) | Predicted road traffic noise increase (dB) (Day / Night) |
| 55 / 50   | 58 / 54   | 15 / 12  | 60 / 0  | 17 / 0   |

Table 11-14 indicates that the addition of construction traffic on Randle Lane for the proposed modification is likely to result in an exceedance of the base criteria during both non-possession and possession periods. Due to the relatively low traffic volumes on Randle Lane, the increase in construction traffic would also exceed the 2 dB allowance criteria. As a result, opportunities to minimise heavy vehicles movements on Randle Lane at night would be further investigated during detailed construction planning. Any residual impacts would be managed through the implementation of additional mitigation measures detailed in the Construction Noise and Vibration Strategy.

### 11.5.5 Work health and safety

Qualitative consideration has been given to potential work health and safety noise levels for station and retail workers within Central Station.

Based on the assessment of construction noise and the typical work methods, it is unlikely that any station workers, retail staff and the members of the public would be exposed to continuous high noise exposure for the durations long enough to exceed the work health and safety criteria.

Notwithstanding, a number of management and mitigation measures would be implemented to reduce potential noise exposure for station workers, retail staff and the members of the public. These measures are provided in Section 11.7.

## 11.6 Potential operational noise impacts

The assessment of operational noise from stations and ancillary facilities for the approved project identified the nearest receiver types and the relevant external noise criteria for each services location to comply with the *Industrial Noise Policy* (EPA, 2000). For the Central Station area, this identified external noise criteria of 50 dBA for residential and hotels and 65 dBA for commercial.

Based on the location of plant and equipment at the proposed eastern entry associated with the proposed modification, additional external noise criteria would be required due to the proximity of the Sydney Dental Hospital. The additional external noise criterion to be applied around Central Station as a result of the proposed modification is provided in Table 11-15.

**Table 11-15 Central Station – additional external noise criterion applicable to stations and ancillary facilities**

| Nearest receiver type | External noise criterion (dBA) |
|-----------------------|--------------------------------|
| Hospital              | 50                             |

As identified for the approved project, this criterion would be used to guide the detailed design so that compliance with the applicable criteria from the *Industrial Noise Policy* (EPA, 2000) is achieved. Based on previous experience on projects such as Epping to Chatswood Rail Line, it is expected that these levels can be achieved through the use of appropriate noise attenuation measures such as equipment selection, positioning of plant and ventilation discharges, in-duct attenuators, and acoustic enclosures.

## 11.7 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The assessment of the potential changes to noise and vibration impacts identified that additional mitigation measures are required. These additional mitigation measures are provided in Table 11-16.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Conditions E37 and E38 – respite periods for ground-borne noise impacts
- Condition E41 – trigger levels for additional mitigation measures for residential receivers in non-residential zones
- Condition E43 – maximum noise level for workplace health and safety of nearby workers.

Table 11-16 Mitigation measures – construction noise and vibration

| Ref | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|-----|---|-------------------------------------|
| NV8 | Opportunities to minimise heavy vehicles movements on Randle Lane at night would be further investigated during detailed construction planning.   | CS                                  |
| NV9 | <p>Measures would be implemented to reduce work health and safety noise exposure for station workers, retail staff and members of the public within Central Station. These would include:</p> <ul style="list-style-type: none"> <li>• The use of hoarding and / or temporary noise barriers around construction sites</li> <li>• Providing hearing protection to station staff employees where appropriate</li> <li>• Providing specific work health and safety noise training to commercial receiver employers including guidance on managing their employees during highly noisy periods</li> <li>• The use of signage around construction sites to inform the general public of high noise exposure areas.</li> </ul> | CS                                  |

<sup>1</sup> STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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# **LAND USE AND PROPERTY**

## CHAPTER TWELVE





## 12 Land use and property

This chapter provides an assessment of the potential changes to land use and property impacts as a result of the construction and operation of the proposed modification and identifies any changes to mitigation measures.

### 12.1 Existing environment

The existing land use and property environment in and around Central Station was described in the Environmental Impact Statement. This section provides additional land use and property information specifically relating to the proposed modification.

#### 12.1.1 Land use

The primary land use surrounding the proposed modification is rail infrastructure associated with Central Station, with a small section of mixed-use associated with Chalmers Street. Central Station has functioned as transport infrastructure for over 150 years and provides a major interchange between suburban, intercity and regional rail services, buses, coaches and light rail. George Street and Elizabeth Street are the main north-south roads in the area and experience high traffic volumes. The CBD and South East Light Rail (currently under construction) will travel along Eddy Avenue and have two stops near Central Station – one located at Rawson Place to the northwest of Central Station and the other on Chalmers Street to the east of Central Station.

To the east of Central Station is Surry Hills, which has become a creative cluster of Global Sydney, attracting advertising, design, architecture, engineering and boutique services. Prince Alfred Park is also located southeast of Central Station providing a large area of open space, a public pool and tennis courts.

#### 12.1.2 Planning controls

The *Sydney Local Environment Plan 2012* (Sydney LEP 2012) defines the land use zoning relevant to the proposed modification as SP2 Infrastructure and B4 Mixed Use.

The relevant zoning and objectives of the zones are described in Table 12-1.

**Table 12-1 Relevant land zoning**

| Central Walk element            | Zoning             | Aims of zone   |
|---------------------------------|--------------------|--|
| Elements within Central Station | SP2 Infrastructure | To provide for infrastructure and related uses and to prevent development that is not compatible with, or that may detract from, the provision of infrastructure.  |
| Eastern entry                   | B4 Mixed Use       | To provide a mixture of compatible land uses to integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage, encourage walking and cycling and ensure uses support the viability of centres. |

## 12.2 Integration with local planning strategies

The approved project would support State and local strategic planning by encouraging economic growth in the Central to Eveleigh corridor, facilitating connections to the Global Economic Corridor and enabling a range of services and infrastructure that meets the needs of residents, workers and visitors.

The proposed modification would provide additional opportunities to support land use and transport integration priorities and future development opportunities consistent with a number of wider strategic plans and planning controls. The following sections describe the integration of the proposed modification with key local planning documents.

The strategies and opportunities identified below would be further developed in consultation with the Department of Planning and Environment, Greater Sydney Commission and City of Sydney Council.

### 12.2.1 City of Sydney Development Control Plan 2012 (Sydney DCP)

The proposed modification is primarily located within the Railway Square / Central Station Special Character Area as identified in the Sydney DCP. The proposed modification would support the principles of this area outlined in the Locality Statement. The proposed modification would enhance the character of the precinct as a major transport interchange node and the historic focus of the Sydney rail system by improving connectivity and wayfinding within and around Central Station. The proposed aboveground suburban platform works would complement the existing heritage fabric with high quality contemporary fabric, contributing to the layers of meaning and content of the locality.

The eastern entry would be located within the Prince Alfred Park East locality. In accordance with the Locality Statement and supporting principles set out in the Sydney DCP, the development of the eastern entry would present an opportunity to increase the diversity of the mixed use character of the neighbourhood. The eastern entry would bring a beneficial change to the area while maintaining existing pockets of consistent character; notably avoiding the landmark Sydney Dental Hospital building and the warehouse buildings along the edge of Prince Alfred Park. The design and finish of the eastern entry would consider and respond to the heritage items and streetscapes in the locality, and would retain street corridor views to Prince Alfred Park.

### 12.2.2 Community Strategic Plan 2014 / Sustainable Sydney 2030

The Sustainable Sydney 2030 Plan, recently updated by the Community Strategic Plan 2014, outlines the long term program of the City of Sydney to achieve 10 targets set out for a 'green, global, connected city'.

The proposed modification responds to multiple targets set out by the Community Strategic Plan. The Central Station precinct objectives (refer to Chapter 2 – Strategic justification and need) seek to develop it as a highly functional multi-modal transport interchange fit to service Sydney as a globally competitive city. The proposed modification aims to improve pedestrian accessibility, permeability and connectivity within the station precinct, as well as to the surrounding areas of Surry Hills and Prince Alfred Park. The eastern entry would specifically help to integrate the existing heavy rail system with the CBD and South East Light Rail at Chalmers Street.

A sustainability strategy has been developed for Sydney Metro City & Southwest to maximise the environmental performance. The strategy incorporates the environment and sustainability policy, provides a response to relevant government regulations and policies, and sets out specific objectives and initiatives to be integrated into the planning and design, procurement, construction and operational stages of the proposed modification.

### 12.2.3 Liveable Green Network Strategy and Master Plan 2011

The *Liveable Green Network Strategy and Master Plan 2011* was developed by the City of Sydney to aid the delivery of Sustainable Sydney 2030 active transport goals. The focus of the Liveable Green Network is to provide the most convenient pedestrian and cycle connections to major destinations, public transport, parks and recreation facilities across the inner city. Central Station forms part of the Redfern – Surry Hills – Haymarket network component that focuses on north-south pedestrian activity generated from Central Station and major bus stops in the vicinity. Central Station is also included in the Devonshire Street – Surry Hills – Central Railway – Haymarket network component focusing on east-west connections across the precinct, and the Central – Moore Park component providing eastern connections.

Chalmers Street is included in the Liveable Green Network Priority Network – Pedestrian and Cycle and services Prince Alfred Park as a major park and recreational facility. The eastern entry and east concourse would provide additional pedestrian access from Chalmers Street.

### 12.2.4 Draft Central Sydney Strategy 2016

The *Draft Central Sydney Strategy 2016* (Draft Strategy) is a 20-year growth strategy that revises previous planning controls to support employment growth and balance residential and social land uses. It is closely aligned with the Sustainable Sydney 2030 program and the NSW Government's *A Plan for Growing Sydney*.

The Draft Strategy presents 10 'moves', or key areas of planning control amendments, that present opportunities for integration with the proposed modification. Central Station provides a major public transport interchange to service the Sydney CBD, and is consequently included in the revised Central Sydney boundaries (Move 3). Central Walk would assist in enabling infrastructure to keep pace with growth outlined in the Draft Strategy and optimises new development (Move 5).

The eastern entry and east concourse would contribute to the pedestrian and open space network identified in the Draft Strategy and would make walking more attractive within and around Central Station (Move 8). The planned approach to the aboveground suburban platform refresh within Central Station, and to the design of the eastern entry would align with the commitment by the City of Sydney to design excellence and tailored solutions, particularly with respect to the heritage value of the precinct (Move 9).

Further opportunities provided by the final Central Sydney Strategy would be considered subject to the timing of the release of this document by the City of Sydney.

### 12.2.5 Draft Open Space, Sports and Recreation Needs Study 2016

The *Draft Open Space, Sports and Recreation Needs Study 2016* seeks to update the City of Sydney Open Space and Recreation Needs Strategy 2007, which outlines space and facility priorities for the inner city. The east concourse and the eastern entry would improve community access to Prince Alfred Park.

Further opportunities provided by the final Open Space, Sports and Recreation Needs Strategy would be considered subject to the timing of the release of this document by the City of Sydney.

## 12.3 Potential impacts

### 12.3.1 Property

The majority of the proposed modification would be located on State Government owned land. The additional acquisition requirements for the proposed modification are summarised in Table 12-2.

**Table 12-2 Property acquisition requirements**

|                                     | Land use type | Area of acquisition (m <sup>2</sup> ) | Number of acquisitions |
|-------------------------------------|---------------|---------------------------------------|------------------------|
| Approved project at Central Station | Mixed         | 613                                   | 10                     |
| Proposed modification               | Mixed         | 510                                   | 1                      |
| <b>TOTAL</b>                        | Mixed         | 1,123                                 | 11                     |

The additional property requiring acquisition would be 20-28 Chalmers Street. This property is used for mixed use (accommodation and retail) and has a land area of around 510 square metres. This acquired site would require demolition of the building and therefore, in addition to acquisition, Transport for NSW would also be required to manage the transfer or termination of any leases within this building.

As described in the Environmental Impact Statement, all property acquisition would be managed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Every effort would be made to acquire the affected property through negotiated purchase. The changes made to the land acquisition process as a result of the Russell Review would be implemented.

In addition to the property acquisition required, the proposed modification would require the termination of a lease between Transport for NSW and the existing retail tenant within Central Station near the Devonshire Street entry.

### 12.3.2 Land use

The approved project includes a change in land use on Regent Street from residential to infrastructure (due to the construction of Sydney Yard Access Bridge). The assessment also identified that the broader area contains other residential and mixed use areas.

The proposed modification would result in the following additional land use changes:

- A retail premise within Central Station near the Devonshire Street entry and retail within 20-28 Chalmers Street would be removed and replaced with infrastructure. Alternative retail facilities would be available within Central Station and the broader precinct
- The loss of one accommodation provider located within the Central Station precinct, within 20-28 Chalmers Street. This site would be changed to infrastructure for the proposed eastern entry. A number of other short-term accommodation providers are located near to Central Station and within the broader Sydney CBD, including accommodation providers offering similar backpacker, hostel and hotel style accommodation.

As described in the Environmental Impact Statement, other land use impacts would largely relate to business and amenity issues (ie visual, noise and vibration, air quality, traffic, social impacts etc) and are addressed in other chapters of this modification report.

The amenity and transport benefits delivered by the proposed modification would improve the quality of the environment in the immediate vicinity of Central Station and make the area to the east more attractive for redevelopment and renewal around the station. As identified in Chapter 2 (Strategic justification and need), the additional capacity to support the anticipated patronage growth at Central Station would result in increased foot traffic and additional potential customers for retained businesses within and around Central Station (further details are provided in Chapter 13 – Business impacts).

## 12.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

One additional mitigation measure has been identified for the proposed modification in relation to integrating the eastern entry with local strategic planning initiatives. This additional mitigation measure is provided in Table 12-3.

**Table 12-3 Mitigation measures – land use and property**

| ID  | Mitigation measures   | Applicable location(s) <sup>1</sup> |
|-----|---|-------------------------------------|
| LP1 | Opportunities to integrate the eastern entry with local strategic planning initiatives would be investigated in consultation with City of Sydney Council. | CS                                  |

<sup>1</sup> STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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# **BUSINESS IMPACTS**

## CHAPTER THIRTEEN



# 13 Business impacts

**This chapter provides an assessment of the potential changes to impacts on local businesses as a result of the proposed modification, and identifies any changes to mitigation measures to minimise these impacts.**

## 13.1 Assessment methodology

The assessment of potential impacts on local businesses from the proposed modification followed a similar process as was carried out for the approved project and included three broad stages:

- Examination of the existing business composition and function within and around Central Station.
- Assessment of impacts categorised by business type and location, through construction and operation of the proposed modification including:
  - ◆ Servicing and delivery access
  - ◆ Customer access, behaviour and passing trade
  - ◆ Supply of and access to car parking
  - ◆ Noise, vibration and dust
  - ◆ Traffic congestion
  - ◆ Property acquisition and termination of leases
  - ◆ Development stimulus and competition.
- Development of mitigation strategies to minimise construction phase disruption and maximise leverage of the proposed modification for local businesses once the project is operational.

## 13.2 Existing environment

The existing local business environment in and around Central Station was described in the Environmental Impact Statement. This section provides additional local business information specifically relating to the proposed modification.

A range of business and commercial uses are located within and around Central Station servicing passing pedestrians and local communities. These include:

- Small scale retail uses, such as newsagencies, convenience stores, book stores and clothing stores
- Accommodation including hostels and hotels
- Food uses including cafes and takeaway shops
- Health and medical facilities
- Commercial office space.

For the purposes of this assessment, the following business areas within and around Central Station have been identified:

- Devonshire Street station entry
- Chalmers Street, Randle Lane and Randle Street.

Two convenience stores located to the north of platforms 10 / 11 and in the North Concourse will be demolished by the construction of the approved project. As such, they have not been considered further in this assessment.

### 13.2.1 Devonshire Street station entry

This business area contains two businesses that are located at the base of the vertical transport (stairs, escalators and lift) that connect Devonshire Street / Chalmers Street to Central Station and the Devonshire Street Tunnel. These generally service passing pedestrians and rail customers, and include a take-away food outlet and a convenience retail store. General vehicular access is not available, with servicing and delivery access provided from within Central Station.

### 13.2.2 Chalmers Street, Randle Lane and Randle Street

The Chalmers Street frontage between Randle Street and Elizabeth Street, Surry Hills, is dominated by the Sydney Dental Hospital, which is located in the north of this business area. Sydney Dental Hospital provides healthcare services to a regional catchment and contains a range of vibration sensitive medical equipment. The pedestrian entrance to the Sydney Dental Hospital is located on Chalmers Street. Authorised vehicular access is also provided at Chalmers Street to the Sydney Dental Hospital. The Bounce Hostel, located directly adjacent to the Sydney Dental Hospital, provides short-term accommodation including a range of dormitory and private room facilities, primarily for backpackers and travellers in Sydney. Pedestrian access to the hostel is provided at street level along with a combined bar and restaurant.

The remaining businesses on Chalmers Street include:

- Cafés and take-away food outlets, including some with outdoor dining
- Small scale retail uses, such as convenience stores
- The Central Hotel at the corner of Chalmers Street and Randle Street.

Ticketed parking was previously available at Chalmers Street near these businesses at various times of the day, although this was removed for the CBD and South East Light Rail project in early 2017.

The western side of Randle Street comprises a number of former factory buildings. Business and commercial uses on Randle Street include:

- Offices that provide for a range of professional services such as architecture and design, legal, and digital media and creative arts
- Performing arts space
- Entertainment facilities, at the corner of Randle Street and Elizabeth Street
- Health and medical facilities.

Randle Lane provides rear vehicular access and undercover parking for a range of businesses fronting Chalmers Street and Randle Street. There are no businesses that front directly onto Randle Lane.

## 13.3 Potential impacts

### 13.3.1 Direct impacts

The approved project includes direct impacts to businesses that may be operating within the 10 properties to be acquired. In particular, this includes businesses currently operating along the Eddy Avenue station entry.

The proposed modification would require the acquisition of one additional building (containing two businesses) and the termination of one lease arrangement for a business currently operating within properties owned by Transport for NSW. These are summarised in Table 13-1.

**Table 13-1 Direct business impacts**

| Location   | Business types                   |
|--|----------------------------------|
| <b>Acquisition of building</b>                           |                                  |
| 20-28 Chalmers Street                                    | Accommodation; food and beverage |
| <b>Termination of lease</b>                              |                                  |
| Within Central Station – Devonshire Street station entry | Food and beverage                |

These businesses would be required to relocate prior to the commencement of construction or alternatively, some business owners may also choose to cease operations.

As identified for the approved project property acquisition would be managed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Transport for NSW has commenced consultation with business owners affected by property acquisition and will continue to consult with business owners as the project develops to assist in managing potential impacts.

### 13.3.2 Indirect impacts – construction

The Environmental Impact Statement for the approved project identified potential indirect impacts to business associated with changed customer access and passing trade (due to the presence of construction hoarding and altered pedestrian routes), and amenity impacts due to noise, vibration and dust.

These potential indirect impacts would also be applicable to the proposed modification, however they may apply to additional businesses located on Chalmers Street and Randle Street. These particular impacts are described in Table 13-2.

Table 13-2 Indirect business impacts

| Impact type                               | Description   |
|---|---|
| <b>Changes in access and connectivity</b> | <p>Changes to pedestrian routes around the eastern entry during construction may have additional negative impacts for businesses. For example, construction of Central Walk would require the temporary closure of the eastern footpath on Chalmers Street. During this time, businesses operating on Chalmers Street would experience a decrease in passing pedestrian traffic, which may have temporary impacts on the level of customers.</p> <p>Temporary closures, relocation / removal of car parking, and the location of construction sites may restrict servicing, delivery and customer access opportunities for businesses who use Chalmers Street and Randle Lane for access. This may require changes to operations for some businesses in relation to service access. Access to businesses would be maintained during construction. Where temporary changes are required, these would be determined in consultation with business owners to ensure that potential impacts are appropriately managed.</p> <p>Construction of the proposed modification has the potential to result in additional direct and indirect impacts on businesses as a result of traffic delays and congestion. Businesses may be directly affected by delayed or hindered access to work places or servicing areas due to local traffic constraints and congestion. Businesses may also be indirectly affected by increased traffic and travel times for staff or deliveries on major thoroughfares due to construction of Central Walk.</p> |
| <b>Changes in amenity</b>                 | <p>Additional changes to amenity may be experienced by businesses near the eastern entry due to increased dust, visual impacts and noise and vibration. This may impact on employee productivity and the ability to interact with customers.</p> <p>Potential additional amenity impacts on more sensitive businesses such as the Sydney Dental Hospital during construction are discussed in the relevant chapters of this report, particularly Chapter 11 (Noise and vibration).</p>  |
| <b>Changes in visibility</b>              | <p>Construction activities, hoardings and other structures around the eastern entry site may reduce the visibility of some additional businesses. Without mitigation, businesses close to construction activities which rely on passing trade (such as cafes, food outlets and convenience stores) may experience temporary reductions in trade due to reduced visibility to passing customers.</p>   |
| <b>Disruption to utilities</b>            | <p>During construction, additional businesses may be disrupted by accidental or planned shutdowns of electricity or other utilities to enable construction works. Business owners and managers would be notified of planned power or utility shutdown periods, however accidental power or utility shutdown periods may also occur.</p>   |

The Environmental Impact Statement for the approved project also identified potential benefits to surrounding businesses. The proposed modification would enhance these benefits and may extend these benefits to additional businesses. These benefits include:

- Increased expenditure by construction workers on local goods and services (such as local shops and food outlets near construction activities)
- Increased trade for businesses supplying goods and services to construction from increased construction activities locally
- Creation of direct employment opportunities
- Increase in passing trade for some businesses (depending on their location) due to changes to pedestrian routes.



### 13.3.3 Indirect impacts – operation

The Environmental Impact Statement for the approved project identified a number of positive impacts for business around Central Station including:

- Increased commercial rent
- Enhanced access for customers and visitors
- Enhanced business connectivity
- Staff access, recruitment and retention
- Development stimulus.

These positive impacts would be enhanced by the proposed modification. The proposed east concourse and eastern entry would provide an improved pedestrian link from Central Station to surrounding suburbs including Surry Hills and Darlinghurst. This is likely to increase the attractiveness of the area to the east of Central Station to both rail and other customers. In particular Central Walk would support future economic development within the area to the east of Central Station enabling future renewal and redevelopment. Central Walk would also underpin the development of retail and commercial offerings that would transform the area and provide the opportunity for major urban renewal by improving functionality of the station and links to the surrounding areas.

The Environmental Impact Statement for the approved project also identified that increased commercial rent could be a negative impact on some businesses. The development stimulus resulting from the proposed modification may exacerbate this impact.

The operation of the new eastern entry and east concourse may result in changes to movement patterns for some pedestrians travelling between Surry Hills and Central Station. This may change the level of passing pedestrian traffic in some locations. The potential impact would be both positive and negative depending on the location of the business and the reliance of individual businesses on passing trade. For example, small scale convenience retail uses and cafes are likely to experience greater impacts from changes in passing trade compared to office based businesses.

## 13.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These mitigation measures would adequately address the potential additional local business impacts. No additional or revised local business mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes condition E64 requiring the development of a Business Management Plan to minimise impacts on businesses adjacent to major construction sites.

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# **NON-ABORIGINAL HERITAGE**

## CHAPTER FOURTEEN



# 14 Non-Aboriginal heritage

This chapter provides an assessment of the potential changes to impacts on non-Aboriginal heritage items and archaeological remains as a result of the proposed modification, and identifies any changes to mitigation measures.

## 14.1 Assessment methodology

### 14.1.1 Study area

The study area used in the assessment of the approved project has been expanded to include all areas of the proposed modification plus a buffer zone of 25 metres. The updated study area is shown on Figure 14-1.

### 14.1.2 Identification, significance and assessment of heritage items

#### Identification of heritage items

This chapter considers potential change in impacts of the proposed modification on:

- Heritage listed items – buildings or other structures, places, items, areas or cultural landscapes that are located aboveground
- Archaeological heritage – significant physical remains of the past, including relics and artefacts, that are located underground.

Heritage listed items have been identified through a search of various heritage registers. These listed heritage items have been previously assessed against the NSW Heritage Office guideline *Assessing Heritage Significance* (2001). Statements of heritage significance identified in this chapter are consistent with those included in relevant heritage inventory sheets and are based on the 2001 guideline.

For the Sydney Terminal and Central Railway Station Group listing, a Conservation Management Plan was prepared in 1996 (the 1996 CMP) and has been endorsed by the Heritage Council of NSW. A subsequent Conservation Management Plan was prepared in 2013 (the 2013 CMP). This assessment has referenced the 2013 CMP. It is acknowledged that this document is yet to be endorsed by the Heritage Council of NSW, however, the 2013 CMP is considered to be a more current document, and incorporates those modifications and changes that have taken place within the Central Station precinct since endorsement of the 1996 CMP. The 2013 CMP also incorporates current heritage management best practise and conservation guidelines.

Historic archaeological potential is defined as the potential of a site to contain historical archaeological relics, (as defined under the *NSW Heritage Act 1977*). Preliminary assessment of the archaeological potential was considered based on a review of several historical archaeological investigations within or close to the study area. This provides evidence that helps to evaluate the potential historical archaeological resource of the study area.





### Significance of heritage items

Consistent with the approach for the assessment of the approved project, determining the significance of heritage items or a potential archaeological resource generally follows the evaluation criteria set out in the NSW Heritage Office guideline *Assessing Heritage Significance* (2001).

The heritage significance of all identified relics, items, areas and / or landscapes that are considered to be potentially directly or indirectly affected by the proposed modification are identified in Appendix E.

### Assessment of heritage impact

As identified for the approved project, impacts on heritage are either:

- Direct impacts, resulting in the demolition or alteration of fabric of heritage significance
- Indirect impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes or views
- Potential direct impact, resulting in impacts from vibration and demolition of adjoining structures.

Specific terminology and corresponding definitions are used in this assessment to consistently identify the magnitude of the direct, indirect or potentially direct impacts on heritage items or archaeological remains. The terminology and definitions (shown in Table 14-1) are based on those contained in guidelines produced by the International Council on Monuments and Sites (ICOMOS) and are consistent with those used for the assessment of the approved project.

**Table 14-1 Terminology for assessing the magnitude of heritage impact**

| Magnitude  | Definition   |
|------------|--|
| Major      | Actions that would have a long term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated. |
| Moderate   | Actions involving the modification of a heritage, including altering the setting of a heritage item or landscape, partially removing archaeological remains, or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.  |
| Minor      | Actions that would result in the slight alteration of heritage buildings, archaeological remains, or the setting of an historical item. The impacts arising from such actions can usually be mitigated.  |
| Negligible | Actions that would result in very minor changes to heritage items.   |
| Neutral    | Actions that would have no heritage impact.  |

### Vibration screening level

As per the assessment of the approved project, a conservative vibration damage screening level of 7.5 millimetres per second peak particle velocity has been adopted for all heritage items. This vibration level is designed to minimise the risk of threshold or cosmetic surface cracks, and is set well below the levels that have potential to cause damage to the main structure.

### Archaeological assessment

The assessment of historical archaeological potential uses the same approach as was carried out for the approved project and is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses.

The archaeological potential is presented in terms of the likelihood of the presence of archaeological remains considering the land use history and previous impacts at the site. This is presented using the grades of archaeological potential listed in Table 14-2.

**Table 14-2 Grades of archaeological potential**

| Magnitude | Definition   |
|-----------|--|
| Nil       | No evidence of historical development or use, or where previous impacts such as deep basement structures would have removed all archaeological potential   |
| Low       | Research indicates little or low intensity historical development, or where there have been substantial previous impacts, disturbance and truncation in locations where some archaeological remains such as deep subsurface features may survive |
| Moderate  | Analysis demonstrates known historical development and some previous impacts, but it is likely that archaeological remains survive with some localised truncation and disturbance  |
| High      | Evidence of multiple phases of historical development and structures with minimal or localised twentieth century development impacts, and it is likely the archaeological resource would be largely intact                                       |

The potential archaeological remains are then assessed against the NSW heritage assessment criteria and identified as either being of:

- No significance
- Local significance
- State significance.

The significance assessment is informed by the NSW Heritage Division's 2009 guidelines *Assessing Significance for Historical Archaeological Sites and Relics* (the 2009 guidelines).

## 14.2 Historical context

The historical context of Central Station was described in the Environmental Impact Statement and includes the following historical phases:

- Phase 1: 1788 – 1855
  - ◆ Devonshire Street Cemetery
  - ◆ Benevolent Asylum
- Phase 2: 1855 – 1890
  - ◆ First railway station, including Mortuary Station
  - ◆ Second railway station
- Phase 3: 1890 – 1930
  - ◆ Third railway station
    - Construction of Grand Concourse, tram terminus and clock tower
    - Resumption of Devonshire Street Cemetery
    - Construction of electrified subway lines
- Phase 4: 1930 – present
  - ◆ Twentieth century station modifications – Eastern Suburbs Railway construction.

Of particular interest to the proposed modification area on the eastern side of Central Station, the construction of the Eastern Suburbs Railway involved cut-and-cover excavation beneath Chalmers Street, which would have largely removed any archaeological deposits associated with previous phases of station development in this location.

## 14.3 Assessment of heritage significance and impact

This section summarises the potential changes to impacts as a result of the proposed modification on heritage items or potential archaeological remains. Detail on all heritage listed items and potential archaeological remains is provided in Appendix E.

### 14.3.1 Sydney Terminal and Central Railway Station Group

The Sydney Terminal and Central Railway Station Group (Central Station) is a heritage item of State significance. Central Station is listed on the State Heritage Register (01255), Sydney Trains Section 170 register and Sydney LEP 2012 (1824). It is also included within the Sydney DCP 2012 Railway Square / Central Station Special Character Area (non-legislative listing).

As identified in the 2013 CMP, Central Station encompasses several precincts that contribute to the overall significance of the railway station to varying degrees. Each precinct consists of a number of 'items' and each item is comprised of numerous 'elements'. All items and elements contribute to the overall significance of each precinct.

In response to feedback received on the assessment carried out for the approved project and to present a more refined assessment, this assessment considers the potential impacts to the items, elements and precincts that contribute to the heritage significance of the Sydney Terminal and Central Railway Station Group. Appendix E provides further information on the potential impacts of the proposed modification on each individual element, the combined impact on each item and precinct, and consideration of the overall impact on the State heritage register listing. This section provides an assessment of potential change in impacts as a result of the proposed modification to the overall listing.

The impacts to the Sydney Terminal and Central Railway Station Group from the approved project include:

- **Direct impacts (moderate to major)** – physical impacts to the station as a result of the excavation of the new platforms, impacts to underground pedestrian tunnels including Devonshire Street Tunnel, impacts associated with access and egress from Eddy Avenue, construction of the Sydney Yard Access Bridge and use of a temporary construction site in the Sydney Yards
- **Indirect impact (moderate to major)** – the approved project is likely to result in moderate to major temporary and permanent visual impacts through the establishment of the construction site in Sydney Yards, excavation of the metro platforms, and construction of the Sydney Yard Access Bridge. On completion of the construction works, the introduction of new station infrastructure may have a minor, or negligible, visual impact.

The potential change in heritage impacts to the Sydney Terminal and Central Railway Station Group due to the proposed modification is outlined in Table 14-3. This table provides consideration of potential changes to impacts for different elements within the group and provides a revised magnitude of impact from the project as proposed to be modified.

As identified in the table, the proposed modification would result in increased magnitude of impacts to the aboveground suburban platforms and would introduce new impacts to the underground platforms and Eastern Suburbs Railway concourse and the Devonshire Street entrance and environs. Although there would be some additional impacts to the country and interstate platforms; subway passage systems; the Devonshire Street Tunnel and concourse; and the Sydney Yards, the overall magnitude of impact would remain unchanged.

The State heritage register listing identifies a number of elements contributing to the state significance of Central Station, primarily its continuity of use as a multi-level transport interchange. The proposed modification would be the first step in allowing for the ongoing viability of Central Station as a major rail terminus. Central Station is fast reaching its capacity to operate effectively.

The project as proposed to be modified would not result in a lessening of Central Station's State significant historic values, as defined in the 2013 CMP statement of significance and the State heritage register statement of significance. The proposed modification would allow Central Station to remain a viable and highly functioning transport hub into the future, and therefore retain a large component of its significant heritage value.

Overall, the project as proposed to be modified would not adversely impact on the State heritage significance of the Sydney Terminal and Central Railway Station Group.

Impacts to potential changes to archaeological remains are addressed in Section 14.4.3.

**Table 14-3 Sydney Terminal and Central Railway Station Group – changes to heritage impacts**

| Approved project impact   |           | Proposed modification impact  |                   |
|---|-----------|---|-------------------|
| Discussion  | Magnitude | Discussion  | Revised magnitude |
| <b>Aboveground suburban platforms</b>   |           |   |                   |
| <ul style="list-style-type: none"> <li>Excavation within platforms for new stairs from the Olympic Tunnel to platforms 20 / 21 and 22 / 23</li> <li>Visual impact from Sydney Yard Access Bridge</li> </ul> | Moderate  | <ul style="list-style-type: none"> <li>Excavation within platforms 16-23 for the construction of vertical transport to and from the east concourse</li> <li>Localised impact to canopies where new lift structures would extend through the canopy, including the removal and replacement of overhead wiring</li> <li>Platform refresh and relevelling works would remove a number of modern elements resulting in decluttered views and vistas within the platforms</li> <li>Removal of some stairs and existing entrances on platforms 16-23, including balustrades and metal folding screens would result in an adverse impact to heritage fabric and considerably alter the configuration of the platforms</li> </ul> | Major             |

| Approved project impact  |                   | Proposed modification impact  |                   |
|--|-------------------|---|-------------------|
| Discussion   | Magnitude         | Discussion  | Revised magnitude |
| <b>Subway passage systems</b>  |                   |   |                   |
| <ul style="list-style-type: none"> <li>Demolition of a section of the subway passage system through the metro platform excavation area. This would result in the loss of fabric and changes to the historical alignment.</li> </ul>  | Moderate to major | <ul style="list-style-type: none"> <li>The closure of existing access points to the north and south east-west baggage tunnels (stairs and platform connections) through the introduction of the east concourse would result in a minor impact due to the removal of fabric. Historically, commuters did not use the baggage tunnels, and they have only been open to pedestrians for a relatively short period of time. The removal of this access would not impact on their historical use</li> <li>Connection of the services route to the subway passage system below platform 4 / 5.</li> </ul> | Moderate to major |
| <b>Country and interstate platforms</b>  |                   |   |                   |
| <ul style="list-style-type: none"> <li>Demolition of platforms 12, 13, 14 and 15, including canopies and removal of associated infrastructure including OHW and structures, awnings and trusswork, goods lifts and hardwood buffers</li> <li>Reconstruction of platforms 12 to 14 and new replacement canopies</li> <li>Lengthening of platforms 9 – 11</li> <li>Visual impact through the addition of new platforms and services building.</li> </ul> | Major             | <ul style="list-style-type: none"> <li>Trenching within platform 4 / 5 for the services route resulting in the loss of a small amount of heritage fabric</li> <li>Visual impact of the services gantry in the Sydney Yards to the south of the platforms.</li> </ul>  | Major             |
| <b>Underground platforms and Eastern Suburbs Railway concourse</b>   |                   |   |                   |
| <ul style="list-style-type: none"> <li>No impact</li> </ul>  | No impact         | <ul style="list-style-type: none"> <li>Demolition and formation of new connections to the eastern entry and the east concourse</li> <li>Removal of existing ramp, widening of existing stairs and construction of a new lift</li> <li>Impacts to a portion of the wall of the unused platforms 26 / 27 to provide a connection for the temporary and permanent combined services routes</li> <li>Introduction of new mechanical and electrical plant to the unused platforms 26 / 27</li> <li>Temporary use of the unused platforms 26 / 27 for machinery and access to east concourse.</li> </ul>  | Moderate          |

| Approved project impact   |           | Proposed modification impact  |                   |
|---|-----------|---|-------------------|
| Discussion  | Magnitude | Discussion  | Revised magnitude |
| <b>Devonshire Street Tunnel and concourse</b>   |           |   |                   |
| <ul style="list-style-type: none"> <li>Removal and reconstruction of a section of the Devonshire Street Tunnel along the same alignment</li> </ul>  | Major     | <ul style="list-style-type: none"> <li>Removal of one existing retail outlet and impacts to a small portion of the concourse for a shaft for permanent ventilation and the temporary services route</li> <li>Modifications on the concourse to the gateline and demolition of an existing services room.</li> </ul>   | Major             |
| <b>Devonshire Street entrance and environs</b>  |           |   |                   |
| <ul style="list-style-type: none"> <li>No impact</li> </ul>   | No impact | <ul style="list-style-type: none"> <li>Introduction of permanent ventilation outlet near the existing station entry</li> <li>Removal and reinstatement of portion of brick boundary wall on Chalmers Street including murals</li> <li>Use of the eastern entry construction site and construction of the new eastern entry. This would be located outside the curtilage of the listing and would result in negligible visual impacts</li> <li>Introduction of a new eastern entry.</li> </ul> | Minor             |
| <b>Sydney Yard</b>  |           |   |                   |
| <ul style="list-style-type: none"> <li>Establishment of the Sydney Yard construction site including the demolition of a number of heritage structures (the Rolling Stock Officers Garden, Rolling Stock Officers Building and Cleaners Amenities Building)</li> <li>Construction of the Sydney Yard Access Bridge, including the use of several temporary cranes and crane pads to the east of Mortuary Station.</li> </ul> | Moderate  | <ul style="list-style-type: none"> <li>Temporary and permanent services gantry through Sydney Yard</li> <li>Under bore for a services route to the Lee Street substation would be located around 11-12 metres below the intercity tracks.</li> </ul>  | Moderate          |

### 14.3.2 Other listed heritage items

The proposed modification would impact, directly or indirectly, on a number of additional listed heritage items that will not be impacted by the approved project. These constitute new impacts as a result of the proposed modification and are identified and assessed in Table 14-4 and shown in Figure 14-2.

**Table 14-4 Impacts on listed heritage items**

| Item   | Significance | Heritage impact  | Magnitude |
|--|--------------|--|-----------|
| Former 'Metro Goldwyn Mayer' MGM building including interior | Local        | <b>Direct impact – demolition</b><br>The building would be demolished for the new eastern entry. During construction, the site would be used as a construction site to support construction of the eastern entry and the east concourse. | Major     |



| Item                                      | Significance | Heritage impact  | Magnitude  |
|---|--------------|--|------------|
| Sydney Dental Hospital including interior | State        | <b>Potential direct impact – vibration</b><br>Vibration due to demolition of the Bounce Hostel (former MGM building) and excavation activities for the eastern entry. The closest façade of the item is expected to experience vibration levels above the screening criterion for cosmetic damage.   | Minor      |
|   |              | <b>Indirect impact – setting</b><br>The demolition of the Bounce Hostel (former MGM building) and construction of the new eastern entry would impact the setting of the Sydney Dental Hospital. There is a historical connection between the two buildings dating to the period of ownership of the former MGM building by the University of Sydney's Faculty of Dentistry (1970s) and the Sydney Dental Hospital phase of use (1980s). This relationship is not legible from street-level, however it may survive internally. The demolition of the Bounce Hostel would remove the historical connection between the two buildings. | Minor      |
| Former R.C. Henderson Ltd Factory         | Local        | <b>Potential direct impact – vibration</b><br>Vibration due to demolition of the Bounce Hostel (former MGM building), excavation activities for the new eastern entry (including within Randle Lane) and use of Randle Lane for access. The closest façade of the item is expected to experience vibration levels above the screening criterion for cosmetic damage.   | Minor      |
|   |              | <b>Indirect – setting</b><br>Potential impacts to the setting would be minor as the frontage of this heritage item is orientated to the east (away from the proposed eastern entry). The former MGM building does not contribute to the setting of the heritage item (as it is orientated away from the proposed entry), or the Randle Lane facade.  | Negligible |
| Railway Institute Building                | State        | <b>Potential direct impact – vibration</b><br>Vibration due to excavation of a shaft within the Devonshire Street station entrance and the under bore to the Chalmers Street substation. The closest façade of the item is expected to experience vibration levels above the screening criterion for cosmetic damage.  | Minor      |
|   |              | <b>Indirect impact – setting</b><br>Temporary impacts to setting from the introduction of the temporary services route, however the proposed gantries would be similar to other overhead structures within the rail corridor in this location.<br><br>Permanent impacts to setting from the introduction of ventilation louvres near the Devonshire Street station entry. This would not significantly alter the station entrance building and, therefore, would not result in visual impacts to the Railway Institute Building.   | Negligible |



Figure 14-2 Location of additional listed heritage items impacted by the proposed modification

### 14.3.3 Archaeological remains

#### Central Station archaeology

Potential additional impacts of the proposed modification on archaeological resources within the boundaries of Central Station is summarised in Table 14-5.

**Table 14-5 Central Station archaeological resources**

| Resource   | Significance  | Potential | Approved project interface   | Proposed modification interface  |
|--|---------------|-----------|--|--|
| Devonshire Street Cemetery                           | State         | Low       | <ul style="list-style-type: none"> <li>Excavation of the metro platforms beneath platforms 12 – 15.</li> </ul>                                 | <ul style="list-style-type: none"> <li>Mined excavation of the east concourse.</li> </ul>  |
| Former phases of Central Station                     | Local – State | Moderate  | <ul style="list-style-type: none"> <li>Excavation within and beneath platforms 12 – 15</li> <li>Excavation within the Sydney Yards.</li> </ul> | <ul style="list-style-type: none"> <li>Excavation within platforms 16 – 23</li> <li>Excavation within Sydney Yard for the services gantry</li> <li>Excavation of a shaft within the Devonshire Street station entrance.</li> </ul> |
| Early unmapped service lines (sewage and stormwater) | Local         | Moderate  | <ul style="list-style-type: none"> <li>NA</li> </ul>   | <ul style="list-style-type: none"> <li>Excavation within Sydney Yard for the services gantry</li> <li>Excavation of a shaft within the Devonshire Street station entrance.</li> </ul>  |

#### Surrounding archaeology

The proposed modification would impact areas around Central Station which were not impacted by the approved project. As such, there would be potential archaeological impacts in new locations.

There is high potential that archaeological remains associated with the former Railway Place residences (local significance) would be located within the footprint of the eastern entry (including within Randle Lane). There is also low potential that remains would be located within the Chalmers Street footpath, although these are not likely to be intact due to the previous installation of services and excavation for the Eastern Suburbs rail line. While archaeological remains in some locations may have been impacted by construction of the Bounce Hostel building and installation and upgrading of service lines, overall, the majority of the remains are likely to be intact.

It is also possible that partial and truncated remains may be preserved in the Chalmers Street frontage / footpath. Demolition and excavation for the eastern entry and east concourse would have a major impact on this archaeological resource (if present), resulting in its complete removal.

## 14.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Environmental Impact Statement) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified for the approved project would continue to apply to the project as proposed to be modified.

Proposed changes to mitigation measures identified for the approved project are provided in Table 14-7. New mitigation measures or additions to existing mitigation measures are shown in **bold** text.

An addendum to the Historical Archaeological Assessment & Research Design for the project has been prepared to cover the additional area potentially impacted by the proposed modification at Central Station. This addendum is provided as Appendix F. This would be implemented during the works at Central Station in accordance with existing mitigation measure NAH2.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- Condition E21 – preparation of a Heritage Interpretation Plan for Central Station
- Condition E27 – preparation of an Exhumation Management Plan to guide the relocation of recovered human remains.

It is also recommended that conditions E13 and E16 regarding archival recording and salvage respectively are modified to include the former MGM Building.

Mitigation measures for other environmental aspects identified for the approved project and changes that have been identified in other chapters of this report would also be relevant to the management of potential heritage impacts. These include:

- Chapter 11 (Noise and vibration) with respect to management of potential vibration impacts
- Chapter 16 (Landscape character and visual amenity) with respect to management of potential visual impacts during construction and operation.

Table 14-7 Mitigation measures – Non-Aboriginal heritage

| Ref  | Mitigation measure   | Applicable location(s) <sup>1</sup> |
|------|--|-------------------------------------|
| NAH1 | <p>Archival recording and reporting of the following items would be carried out in accordance with the <i>NSW Heritage Office's How to Prepare Archival Records of Heritage Items</i> (1998), and <i>Photographic Recording of Heritage Items Using Film or Digital Capture</i> (2006):</p> <ul style="list-style-type: none"> <li>• The internal heritage fabric and any non-original elements removed from within the curtilage of Mowbray House, Chatswood</li> <li>• The interior, exterior and setting of the shop at 187 Miller Street, North Sydney</li> <li>• The fabric and setting of the North Sydney bus shelters requiring removal and temporary relocation at Victoria Cross Station and Blues Point temporary site</li> <li>• Any component of the Blues Point Waterfront Group and the McMahons Point South heritage conservation area to be directly affected or altered, including vegetation and significant landscape features</li> <li>• Hickson Road wall in the vicinity of proposed ventilation risers and skylights for Barangaroo Station</li> <li>• The interior, exterior and setting of the 'Flat Building' at 7 Elizabeth Street, Sydney Martin Place, between Elizabeth and Castlereagh streets, Sydney</li> <li>• The heritage fabric of areas of the existing Martin Place Station affected by the project</li> <li>• The Rolling Stock Officers Garden, Rolling Stock Officers Building and Cleaners Amenities Building in Sydney Yard and any other component of the Sydney Terminal and Central Railway Stations group to be removed or altered</li> <li>• <b>The Bounce Hostel building (former MGM building)</b></li> <li>• Directly impacted parts of the Congregational Church at Waterloo.</li> </ul> | CDS, VC, BP, MP, CS, WS             |
| NAH5 | <p>Prior to total or partial demolition of heritage items at Victoria Cross and Martin Place stations, and the <b>Bounce Hostel building (former MGM building at Central Station)</b>, heritage fabric for salvage would be identified and reuse opportunities for salvaged fabric considered. This would include salvage and reuse of heritage tiles to be impacted at Martin Place Station.</p>  | VC, MP, CS                          |

<sup>1</sup> STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.

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# **ABORIGINAL HERITAGE**

## CHAPTER FIFTEEN



# 15 Aboriginal heritage

**This chapter provides an assessment of the potential change in impacts on Aboriginal heritage sites and areas of archaeological potential as a result of the proposed modification, and identifies any changes to mitigation measures.**

## 15.1 Assessment methodology

The scope of the Aboriginal heritage assessment for the proposed modification is consistent with the methodology used for the approved project and involved:

- A review of previous archaeological investigations and a search of the NSW Office of Environment and Heritage's (OEH) Aboriginal Heritage Information Management System (AHIMS) to determine whether Aboriginal heritage sites had previously been recorded in the vicinity of the proposed modification. Information from the search was also used to determine the archaeological context of the area
- Consideration of a predictive model to help determine archaeological potential
- Assessment of the potential of the proposed modification to disturb Aboriginal heritage (sites, objects, remains, values, features or places) and, where this is the case:
  - ◆ Determine, in consultation with relevant stakeholders, the potential for Aboriginal heritage resources within the study area
  - ◆ Determine the extent and significance of impact on those resources as a result of construction and / or operation of the proposed modification, including consideration of the approved project
  - ◆ Identify any requirements for in-situ conservation of items and / or areas (as appropriate), further archaeological testing and / or detailed archaeological excavations additional to those included in the approved project.

As per the approved project, the following government guidelines were considered during the preparation of the Aboriginal heritage assessment for the proposed modification:

- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (Department of Environment, Climate Change and Water, 2011b)
- *Aboriginal Cultural Heritage Consultation requirements for proponents* (Department of Environment, Climate Change and Water, 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010b)
- *NSW Skeletal Remains: Guidelines for Management of Human Remains* (Heritage Office, 1998)
- *Criteria for the assessment of excavation directors* (NSW Heritage Council, 2011).

## 15.2 Existing environment

The existing Aboriginal heritage environment was described in the Environmental Impact Statement for the approved project. This section provides further details regarding the existing Aboriginal heritage environment specific to the proposed modification.

### 15.2.1 Previously registered Aboriginal heritage sites

Searches of AHIMS did not identify any previously recorded Aboriginal heritage site within 100 metres of the proposed modification.

Six previously recorded Aboriginal heritage sites were identified within 500 metres of the proposed modification with the closest site being an artefact site recorded 330 metres to the northwest.

### 15.2.2 Archaeological potential and significance

The project area, as proposed to be modified, would have been in an environment and landform conducive to Aboriginal occupation. The location of Central Station on a raised, well-drained area in close proximity to estuarine resources at Cockle Bay suggests potential for Aboriginal objects beneath the ground surface in areas that have not been significantly impacted or excavated.

Archaeological potential across the proposed modification varies. Geotechnical investigations carried out by Transport for NSW suggests that the natural dune levels across the eastern portion of Central Station have been truncated during exhumation of the Devonshire Street Cemetery and construction of Central Station and associated infrastructure.

Overall there is a moderate to high potential for buried Aboriginal objects to be located in localised areas of remnant soil profile. This is consistent with the potential for buried Aboriginal objects identified at Central Station for the approved project.

The potential for intact deposits to remain in-situ is low within the Sydney Yard and the eastern areas of the proposed modification. There is a moderate-high potential that intact deposits will remain in the western areas around the footprint of the services gantry. There is a moderate potential that intact deposits would be located in association with historical archaeological deposits under the Bounce Hostel building and the eastern side of Chalmers Street.

As per the approved project, the research significance of any intact Aboriginal archaeological deposit identified would be high, given the rarity of such deposits in the Sydney CBD. It is also possible that out of context artefacts may be present in the layers of fill used in the area. However, such artefacts are not considered likely to demonstrate high archaeological significance as they would be unlikely to provide accurate information or answers to relevant research questions.

## 15.3 Potential impacts

The potential impacts on Aboriginal heritage during construction of the proposed modification are provided in this section. Aboriginal heritage would not be impacted during the operation of the proposed modification as widespread ground disturbance and excavation would be restricted to the construction phase.

### 15.3.1 Aboriginal heritage sites

Similar to the approved project, construction of the proposed modification would not directly (ie damaged as a direct result of construction) or indirectly (ie damaged due to construction vibration) impact on any previously recorded Aboriginal heritage sites.

As such, there would be no change in direct impact to Aboriginal heritage sites from the approved project as a result of the proposed modification.

### 15.3.2 Archaeological potential and significance

At Central Station, the assessment of the approved project covered the area within and around the excavation works required to construct the metro platforms and ancillary facilities. This assessment concluded that, although Central Station has been subject to significant sub-surface impacts during the various stages of construction, an intact Quaternary sand layer is present beneath overlying layers of fill in the vicinity of Platforms 14 and 15. In this location, there is high potential for significant intact sand deposits.

The elements of the proposed modification are located outside of the area assessed at Central Station for the approved project. As such, the additional potential for Aboriginal deposits to be located in these areas has been considered and is summarised in Table 15-1.

Consistent with the assessment for the approved project, it is also possible that out of context artefacts may be present in the layers of fill used in the area. However, any such artefacts would not be likely to demonstrate high archaeological significance as they would not have the potential to provide accurate information or answers to relevant research questions.

**Table 15-1 Aboriginal archaeological potential**

| Proposed modification element                          | Discussion  | Archaeological potential |
|--|---|--------------------------|
| East concourse and aboveground suburban platform works | Geotechnical investigation carried out by Transport for NSW suggest that it is unlikely intact deposits which may contain Aboriginal objects would be located within the footprint of the east concourse. Truncation of the natural dune surface and disturbance associated with the exhumation of the cemetery and construction of Central Station is likely to have impacted any archaeological remains.<br><br>Platform refresh works on the aboveground suburban platforms would not involve subsurface excavation therefore impacts are not expected.  | Low                      |
| Eastern entry  | The area of excavation for the eastern entry has been previously disturbed by the construction of the Bounce Hostel building. It is likely that this disturbance would have impacted any potential archaeology in this location.<br><br>The portion of Chalmers Street which would be potentially affected by cut-and-cover excavation for the proposed modification was subject to extensive disturbance associated with excavation of the Eastern Suburbs Line underground platforms 24-27 and associated concourse. The works completely removed the natural profile above the platforms, however it is unclear if the excavation removed the entirety of the present-day Chalmers Street road corridor. Historical records from the time indicate that a narrow portion of the road alignment remained open during construction of the platforms and, as such, a narrow strip of archaeology in the frontage of the buildings on Chalmers Street may remain intact. | Moderate                 |

| Proposed modification element         | Discussion   | Archaeological potential  |
|---------------------------------------|--|---|
| Services route and access shaft       | Intact Quaternary sand deposits in the eastern portion of Central Station have not been identified during geotechnical investigations and are likely to have been removed by previous ground disturbance. There is however a moderate-high potential for Aboriginal objects to be located within areas of Botany sands remnant soil profiles within the western portion of the proposed services route near platforms 4 / 5. | Low (eastern portion)<br>Moderate-high (western portion near platforms 4 / 5) |
| Chalmers Street substation connection | The services route connecting to Chalmers Street substation is unlikely to impact intact deposits due to the depth of under bore.  | Negligible  |
| Lee Street substation connection      | The services route connecting to Lee Street substation is unlikely to impact intact deposits due to the depth of under bore.   | Negligible  |

## 15.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

The Aboriginal heritage assessment for the proposed modification identified that one new mitigation measure would be required in relation to updating the cultural heritage assessment report to include the proposed modification scope. This mitigation measures is provided in Table 15-2. In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

**Table 15-2 Mitigation measures – Aboriginal heritage**

| Ref | Mitigation measure   | Applicable location(s) <sup>1</sup> |
|-----|--|-------------------------------------|
| AH7 | The cultural heritage assessment report would be updated to include the scope of the proposed Central Walk modification. | CS                                  |

<sup>1</sup> STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works); PSR: Power supply routes.



# **LANDSCAPE CHARACTER AND VISUAL AMENITY**

CHAPTER SIXTEEN



# 16 Landscape character and visual amenity

This chapter provides an assessment of the potential changes to impact of the proposed modification on landscape character and visual amenity, and identifies any changes to mitigation measures.

## 16.1 Assessment methodology

The potential changes to landscape character and visual amenity impacts were assessed during construction and operation of the proposed modification. The assessment methodology is consistent with the approach used for the approved project and includes:

- A description of the existing environment
- Identification of potential landscape and visual receivers and the sensitivity of those receivers
- Identification of potential landscape character and visual amenity impacts
- A general assessment of the potential improvement or reduction in landscape character and visual values
- Identification of any changes to mitigation measures.

### 16.1.1 Landscape impact assessment

Landscape in the urban context refers to the overall character and function of a place. It includes all elements within the public realm and the interrelationship between these elements and the people who use them.

To identify these impacts, the assessment identified the sensitivity of the element to change and the magnitude of change expected as a result of Central Walk, and then made an overall assessment of the level of impact expected.

The degree of sensitivity of each landscape element to change was identified as either neighbourhood, local, regional, State or National. Definitions are provided in the Environmental Impact Statement.

The magnitude of modification to landscape quality of each landscape element was identified as either a considerable reduction, noticeable reduction, no perceived change, noticeable improvement, or considerable improvement. Definitions are provided in the Environmental Impact Statement.

The assessed sensitivity and landscape modification change was then combined for each element to identify a level of landscape impact based on the matrix in Table 16-1.

Table 16-1 Landscape impact matrix

| Landscape change         | Landscape sensitivity |                      |                     |                     |                  |
|--------------------------|-----------------------|----------------------|---------------------|---------------------|------------------|
|                          | National              | State                | Regional            | Local               | Neighbourhood    |
| Considerable reduction   | Very high adverse     | Very high adverse    | High adverse        | Moderate adverse    | Minor adverse    |
| Noticeable reduction     | Very high adverse     | High adverse         | Moderate adverse    | Minor adverse       | Negligible       |
| No perceived change      | Negligible            | Negligible           | Negligible          | Negligible          | Negligible       |
| Noticeable improvement   | Very high beneficial  | High beneficial      | Moderate beneficial | Minor beneficial    | Negligible       |
| Considerable improvement | Very high beneficial  | Very high beneficial | High beneficial     | Moderate beneficial | Minor beneficial |

## 16.1.2 Visual impact assessment

### Daytime

The daytime visual impact assessment, as described in the Environmental Impact Statement, considered visual amenity as experienced by the people (including rail customers, residents, workers, tourists, etc) using the site surrounds. It aimed to identify the range of views to the site that may be impacted, including views from public spaces, residential areas, offices and streets. The assessment of these impacts involved identifying the existing visual conditions, views that are representative of these conditions, the sensitivity of the views (based on the definitions in the Environmental Impact Statement) and the magnitude of change expected as a result of Central Walk (based on the definitions in the Environmental Impact Statement). An overall assessment was then made of the level of impact expected (based on the matrix in Table 16-2).

The sensitivity levels incorporate a consideration of heritage values within a viewpoint, however the visual impact assessment is based on the potential change in views only. Assessment of potential impacts to views and vistas associated with individual heritage items and elements is provided in Chapter 14 (Non-Aboriginal heritage).

Table 16-2 Daytime visual impact matrix

| Visual change            | Daytime visual sensitivity |                      |                     |                     |                  |
|--------------------------|----------------------------|----------------------|---------------------|---------------------|------------------|
|                          | National                   | State                | Regional            | Local               | Neighbourhood    |
| Considerable reduction   | Very high adverse          | Very high adverse    | High adverse        | Moderate adverse    | Minor adverse    |
| Noticeable reduction     | Very high adverse          | High adverse         | Moderate adverse    | Minor adverse       | Negligible       |
| No perceived change      | Negligible                 | Negligible           | Negligible          | Negligible          | Negligible       |
| Noticeable improvement   | Very high beneficial       | High beneficial      | Moderate beneficial | Minor beneficial    | Negligible       |
| Considerable improvement | Very high beneficial       | Very high beneficial | High beneficial     | Moderate beneficial | Minor beneficial |

## Night-time

The assessment of night-time impacts was carried out with a similar methodology to the daytime assessment as described in the Environmental Impact Statement.

The resulting impact levels are shown in Table 16-3.

**Table 16-3 Night-time visual impact matrix**

| Visual change            | Night-time visual sensitivity     |                             |                                |                              |
|--------------------------|-----------------------------------|-----------------------------|--------------------------------|------------------------------|
|                          | E1: Intrinsically dark landscapes | E2: Low district brightness | E3: Medium district brightness | E4: High district brightness |
| Considerable reduction   | Very high adverse                 | Very high adverse           | High adverse                   | Moderate adverse             |
| Noticeable reduction     | Very high adverse                 | High adverse                | Moderate adverse               | Minor adverse                |
| No perceived change      | Negligible                        | Negligible                  | Negligible                     | Negligible                   |
| Noticeable improvement   | Very high beneficial              | High beneficial             | Moderate beneficial            | Minor beneficial             |
| Considerable improvement | Very high beneficial              | Very high beneficial        | High beneficial                | Moderate beneficial          |

## 16.2 Existing environment

The existing landscape character and visual environment in and around Central Station was described in the Environmental Impact Statement. This section provides further details specific to the landscape character and visual environment associated with the proposed modification.

### 16.2.1 Chalmers Street

Chalmers Street is a heavily trafficked four lane roadway located to the southeast of Central station. A wide asphalt footpath with street trees and a double row of footpath light poles is located on the western road verge directly adjacent to the station. This footpath widens to the south with a plaza, the 'Plaza Iberoamericana', which includes a series of busts of famous Latin American heroes set within a formal row of conifer trees. South of the plaza, and aligned with Devonshire Street there is a station entry building with stairs, escalators and lifts descending into the south-western station entry and Devonshire Street Tunnel. A number of midrise commercial and residential buildings are located along the eastern side of Chalmers Street.

The CBD and South East Light Rail (currently under construction) is anticipated to be operational at a similar time that the construction works for the proposed modification commence. The light rail will run along Chalmers Street between Devonshire Street and Eddy Avenue, and include a stop on Chalmers Street adjacent to the proposed eastern entry.

Randle Lane provides rear access to several medium density commercial and residential properties. Although views within Randle Lane itself are largely contained and the purpose of the lane is primarily access, buildings located to the east on Chalmers Street overlook Central Station, and include views to the Central Station clock tower, and the Sydney CBD skyline beyond. This area is experiencing inner city urban renewal and has a mixed character with both rundown and newly renovated buildings.

### **16.2.2 Central Station suburban platforms**

The suburban platforms 16-23 are located on the eastern side of the station. These platforms are covered with gabled canopies of concrete supported with steel columns and with exposed steel trusses. These platforms are accessed from below by stairs and lift structures. From these platforms, the main Central Station clock tower and main sandstone station buildings can be seen, with the Sydney CBD skyline beyond.

### **16.2.3 Sydney Yard**

Sydney Yard is located to the south of the Central Station platforms and is surrounded by several rail lines entering Central Station from the south and west, giving it an open, working railway character. This area of the station merges visually with the surrounding rail lines, characterised by corridors of ballast, and overhead wiring equipment and support structures.

### **16.2.4 Prince Alfred Park**

Prince Alfred Park is an historic parkland southeast of Central Station, within the suburb of Surry Hills. The park is bounded by Chalmers Street, Cleveland Street and the railway lines. Trees and elements of the layout from the original 1870 plan of the park still exist on the site today, including Moreton Bay fig trees arranged as an informal row along the boundaries.

### **16.2.5 Future development**

The visual character around Central Station (including areas along Eddy Avenue and Chalmers Street) is expected to change following the introduction of CBD and South East Light Rail, which will introduce a light rail stop on Chalmers Street, light rail tracks and associated infrastructure.

Another key development initiative in this precinct, which would substantially affect the existing visual setting, is the Central to Eveleigh Transformation and Transport Program. This is a 30-year program that aims to gradually transform 80 hectares of largely under-used government owned land in and around the rail corridor from Central to Macdonaldtown and Erskineville stations. It involves the development of land to provide thousands of additional homes and jobs and new open space.

The proposed modification would be the first step in revitalising the Central Station precinct, aimed at improving the transport functionality of the station. The amenity and transport benefits would improve the quality of the environment in the immediate vicinity of the station and make the precinct to the east more attractive for redevelopment and renewal. The design and delivery of the proposed modification would also allow for a future western entry through the extension of the underground concourse to the west of the metro platforms, which could enable further precinct renewal and revitalisation opportunities.



## 16.3 Potential impacts

### 16.3.1 Landscape character impacts

One landscape character area, the Northern Concourse, was assessed for the approved project. The proposed modification would not result in any additional landscape character impacts to this area and, as such, there would be no change to the approved project impacts.

The proposed modification would introduce potential landscape character impacts in new areas. Two additional landscape character areas were identified to inform the landscape character assessment for the proposed modification. The additional landscape character areas are:

- Central Station
- Chalmers Street.

Landscape impacts anticipated during construction and operation are summarised in Table 16-4. Further information relating to determining sensitivity levels and change ratings are provided in Appendix G.

**Table 16-4 Landscape character impacts**

| Location        | Sensitivity rating | Construction impact  |                  | Operation impact       |                     |
|-----------------|--------------------|----------------------|------------------|------------------------|---------------------|
|                 |                    | Landscape change     | Landscape impact | Landscape change       | Landscape impact    |
| Central Station | Regional           | Noticeable reduction | Moderate adverse | Noticeable improvement | Moderate beneficial |
| Chalmers Street | Local              | Noticeable reduction | Minor adverse    | No perceived change    | Negligible          |

Overall, it is expected that there would be a noticeable reduction in the landscape quality of Central Station and Chalmers Street during construction of the proposed modification as a result of a potential reduction in accessibility, legibility and wayfinding due to the presence of construction works for the east concourse, on the suburban platforms and for the eastern entry.

During operation, it is expected that there would be a noticeable improvement in the landscape quality of the Central Station landscape character area, producing an overall beneficial result. These benefits would be due to improvements from the east concourse and suburban platforms works in accessibility, legibility and wayfinding, as well as comfort and amenity when compared to the customer experience using Central Station. For Chalmers Street, the improvements in accessibility, customer comfort and safety would be balanced against the loss of the heritage listed Bounce Hostel building, resulting in a negligible change to the landscape character.

## 16.3.2 Visual impacts

### Daytime visual impacts

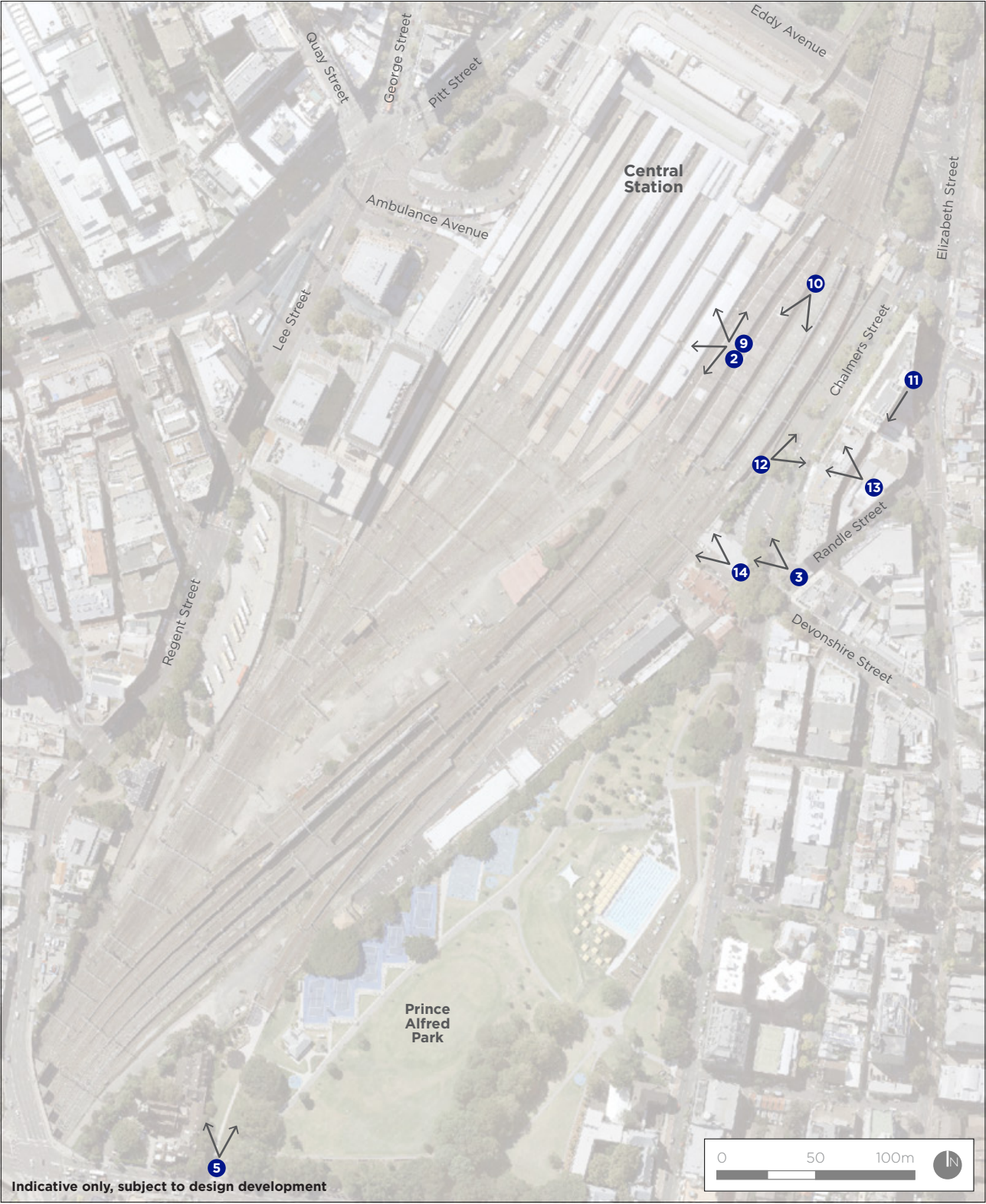
In total 12 representative viewpoints were assessed for the approved project for the daytime visual impact assessment (two of these were not numbered). Of these, seven are considered relevant to the proposed modification and have been re-assessed. These six viewpoints (shown on Figure 16-1) are:

- Viewpoint 2: View south from platform 16
- Viewpoint 3: View west from Chalmers and Devonshire Streets
- Viewpoint 5: View west from Prince Alfred Park
- Views from the rail corridor
- Viewpoint 9: View north from platform 16
- Views from residential properties on Regent Street
- Viewpoint 10: View south from platforms 20 / 21 (and 22 / 23).

The remaining viewpoints assessed for the approved project would not have views to the proposed modification and there would be no change to the approved project impacts.

Four additional representative viewpoints were selected to inform the visual amenity assessment for the proposed modification. The five additional representative viewpoints (shown on Figure 16-1) are:

- Viewpoint 11: View southwest along Randle Lane
- Viewpoint 12: Views northeast along Chalmers Street
- Viewpoint 13: Views from residential areas on Chalmers Street and Randle Lane
- Viewpoint 14: View west from the service access at the Devonshire Street station entry.



| KEY      |                    |
|----------|--------------------|
| <b>1</b> | Viewpoint location |

Figure 16-1 Representative viewpoints

The anticipated daytime visual impacts and the relative change in impact compared to the approved project on representative viewpoints during construction and operation are summarised in Table 16-5 and Table 16-6 respectively. Further information relating to determining sensitivity levels and change ratings are provided in Appendix G.

Existing views and an indicative artist's impressions of the proposed eastern entry and the new vertical transport (lifts and escalators) to the east concourse on platform 22 are provided on Plate 16-1 and Plate 16-2.

**Table 16-5 Daytime visual impacts – construction**

| Location  | Sensitivity rating | Approved project       |                  | Proposed modification  |                  |
|---|--------------------|------------------------|------------------|------------------------|------------------|
|   |                    | Visual change          | Visual impact    | Visual change          | Visual impact    |
| <b>Viewpoint 2</b><br>View south from platform 16   | Regional           | Noticeable reduction   | Moderate adverse | Noticeable reduction   | Moderate adverse |
| <b>Viewpoint 3</b><br>View northwest from the corner of Devonshire and Chalmers streets         | Local              | No perceived reduction | Negligible       | Noticeable reduction   | Minor adverse    |
| <b>Viewpoint 5</b><br>View west from Prince Alfred Park   | Regional           | No perceived reduction | Negligible       | No perceived reduction | Negligible       |
| Views from the rail corridor  | Regional           | Noticeable reduction   | Moderate adverse | Noticeable reduction   | Moderate adverse |
| <b>Viewpoint 9</b><br>View north from platform 16   | Regional           | Noticeable reduction   | Moderate adverse | Noticeable reduction   | Moderate adverse |
| Views from residential properties on Regent Street  | Neighbourhood      | Considerable reduction | Minor adverse    | Considerable reduction | Minor adverse    |
| <b>Viewpoint 10</b><br>View north from platform 20 / 21 and 22 / 23                             | Regional           | Noticeable reduction   | Moderate adverse | Noticeable reduction   | Moderate adverse |
| <b>Viewpoint 11</b><br>View southwest along Randle Lane   | Neighbourhood      | NA                     | NA               | Noticeable reduction   | Negligible       |
| <b>Viewpoint 12</b><br>Views northeast along Chalmers Street                                    | Local              | NA                     | NA               | Noticeable reduction   | Minor adverse    |
| <b>Viewpoint 13</b><br>Views from residential areas on Chalmers Street and Randle Lane          | Neighbourhood      | NA                     | NA               | Considerable reduction | Minor adverse    |
| <b>Viewpoint 14</b><br>View west from the service access at the Devonshire Street station entry | Regional           | NA                     | NA               | No perceived change    | Negligible       |

In general, the proposed modification would not result in changes to impacts on the viewpoints assessed for the approved project. During construction, the proposed modification would cause a slight increase in adverse impacts from negligible to minor adverse to views northwest from the corner of Devonshire and Chalmers streets.

The proposed modification would also result in additional visual impacts at new locations than the approved project. Construction of the proposed modification would result in the following additional visual impacts:

- Minor adverse visual impacts on views northeast along Chalmers Street (viewpoint 12) and from residential areas on Chalmers Street and Randle Lane (viewpoint 13). This impact would be due to the establishment of a construction site in areas of neighborhood and local sensitivity along Chalmers Street and Randle Lane. In particular, residential properties adjacent to the eastern entry construction site may have close proximity views to demolition and construction works
- Negligible visual impacts on viewpoints southwest along Randle Lane (viewpoint 11) and west from the service access at the Devonshire Street station entry (viewpoint 14) due to the lack of perceived change in the amenity of these views.

**Table 16-6 Daytime visual impacts – operation**

| Location  | Sensitivity rating | Approved project       |                  | Proposed modification  |                  |
|---|--------------------|------------------------|------------------|------------------------|------------------|
|   |                    | Visual change          | Visual impact    | Visual change          | Visual impact    |
| <b>Viewpoint 2</b><br>View south from platform 16                                       | Regional           | No perceived change    | Negligible       | No perceived change    | Negligible       |
| <b>Viewpoint 3</b><br>View northwest from the corner of Devonshire and Chalmers streets | Local              | No perceived change    | Negligible       | No perceived change    | Negligible       |
| <b>Viewpoint 5</b><br>View west from Prince Alfred Park                                 | Regional           | No perceived change    | Negligible       | No perceived change    | Negligible       |
| Views from the rail corridor  | Regional           | Noticeable reduction   | Moderate adverse | Noticeable reduction   | Moderate adverse |
| <b>Viewpoint 9</b><br>View north from platform 16                                       | Regional           | No perceived change    | Negligible       | Noticeable improvement | Moderate benefit |
| Views from residential properties on Regent Street                                      | Neighbourhood      | Considerable reduction | Minor adverse    | Considerable reduction | Minor adverse    |
| <b>Viewpoint 10</b><br>View north from platform 20 / 21 and 22 / 23                     | Regional           | No perceived change    | Negligible       | Noticeable improvement | Moderate benefit |
| <b>Viewpoint 11</b><br>View southwest along Randle Lane                                 | Neighbourhood      | NA                     | NA               | Noticeable reduction   | Negligible       |
| <b>Viewpoint 12</b><br>Views northeast along Chalmers Street                            | Local              | NA                     | NA               | No perceived change    | Negligible       |



| Location  | Sensitivity rating | Approved project |               | Proposed modification |               |
|---|--------------------|------------------|---------------|-----------------------|---------------|
|   |                    | Visual change    | Visual impact | Visual change         | Visual impact |
| <b>Viewpoint 13</b><br>Views from residential areas on Chalmers Street and Randle Lane          | Neighbourhood      | NA               | NA            | No perceived change   | Negligible    |
| <b>Viewpoint 14</b><br>View west from the service access at the Devonshire Street station entry | Regional           | NA               | NA            | No perceived change   | Negligible    |

The proposed modification would result in a change in operational visual impacts from negligible to moderate benefits at views north from platform 16 (viewpoint 9) and north from platform 20 / 21 and 22 / 23 (viewpoint 10) due to the proposed platform refresh works.

The proposed modification would not result in changes to impacts on the other viewpoints assessed for the approved project.

The proposed modification would also result in additional visual impacts at new locations than the approved project. Operation of the proposed modification would result in negligible visual impacts at all new viewpoints generally due to the lack of perceived change. The higher levels of buildings on Randle Lane and Elizabeth Street (viewpoint 13) would have views towards the station following the removal of the Bounce Hostel. This would continue until any such time that any future over entry development is provided.



Plate 16-1a Eastern entry – existing view





**Plate 16-1b Eastern entry – indicative artist's impression**

*Note: Blue shading represents a potential future over entry development (which would be subject to a separate approval process)*



Plate 16-2a Platform 22 – existing view



Plate 16-2b Platform 22 – indicative artist's impression

### Night-time visual impacts

Two locations were assessed for the approved project for the night-time visual impact assessment. Of these, one location, being Central Station and surrounds, is considered relevant to the proposed modification and has been re-assessed. The other location, the Sydney Yard access bridge site, would not be impacted by the proposed modification and there would be no change to the approved project impacts.

No additional locations were considered necessary to inform the assessment for the proposed modification.

A summary of the potential night-time visual impacts, and the potential change in night-time visual impacts from the approved project, is provided for construction and operation in Table 16-7 and Table 16-8 respectively. Further information relating to determining sensitivity levels and change ratings are provided in Appendix G.

**Table 16-7 Night-time visual impacts – construction**

| Location                      | Sensitivity rating           | Approved project    |               | Proposed modification |               |
|-------------------------------|------------------------------|---------------------|---------------|-----------------------|---------------|
|                               |                              | Visual change       | Visual impact | Visual change         | Visual impact |
| Central Station and surrounds | E4: High district brightness | No perceived change | Negligible    | Noticeable reduction  | Negligible    |

**Table 16-8 Night-time visual impacts – operation**

| Location                      | Sensitivity rating           | Approved project    |               | Proposed modification |               |
|-------------------------------|------------------------------|---------------------|---------------|-----------------------|---------------|
|                               |                              | Visual change       | Visual impact | Visual change         | Visual impact |
| Central Station and surrounds | E4: High district brightness | No perceived change | Negligible    | No perceived change   | Negligible    |

As part of the proposed modification, during construction the eastern entry construction site would be used at night to support construction works within station. Lighting of the site would be required for these activities. This site would be overlooked by adjacent residential buildings. There would also be some vehicle movements at night via Randle Lane introducing additional lighting from these vehicles. The lighting associated with this activity may result in some additional sky glow and direct light sources seen from adjacent residential windows. Overall, it is expected that due to the potential impacts from residential areas on Randle Lane and Chalmers Street, there would be a noticeable reduction in the amenity of views in this area. This would be an increased change rating from the approved project which resulted in no perceived change. However, the overall negligible impact rating would remain unchanged from the approved project.

During operation, the proposed modification would not result in any change to the potential night-time visual impacts of the approved project.



## 16.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) would apply to Central Walk. This framework sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans. The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified.

These mitigation measures would adequately address the potential changes to landscape character and visual amenity impacts during construction. However, to manage potential light spill during operation of the eastern entry, it was identified that existing operational mitigation measure LV11 would be amended to apply to Central Station. This change has been made to the consolidated revised mitigation measures in Chapter 21 of this report.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes:

- ◉ Condition E101 – development of Station Design and Precinct Plans to present an integrated urban and place making outcome
- ◉ Condition E102 – requirement to achieve a minimum visual impact of ‘minor benefit’ for all design elements of the project
- ◉ Condition E104 – requirement for permanent external lighting to comply with relevant Australian Standards.

# **GROUNDWATER AND GEOLOGY**

## CHAPTER SEVENTEEN





# 17 Groundwater and geology

This chapter provides an assessment of the potential changes to impacts on groundwater and geology, as a result of the proposed modification, and identifies any changes to mitigation measures.

## 17.1 Assessment methodology

The methodology for the assessment of changes to groundwater and geology impacts used the same approach as was carried out for the approved project and involved:

- A review of previous reports, publicly available data and web-based information searches, including:
  - ◆ *Sydney 1:100,000 Geological Series Sheet 9130* (NSW Department of Mineral Resources, 1983)
  - ◆ Office of Water Groundwater Database (NSW Department of Primary Industries, 2015)
- Identification of potential impacts of the proposed modification on groundwater and geology
- Development of mitigation measures to address potential groundwater and geology impacts.

## 17.2 Existing environment

The existing groundwater and geology environment around Central Station was described in the Environmental Impact Statement. This section provides specific information of relevance to the proposed modification.

### 17.2.1 Geology

A description of the geological formations underlying Central Walk determined from the *Sydney 1:100,000 Geological Series Sheet 9130* (NSW Department of Mineral Resources, 1983) is provided in Table 17-2.

Table 17-2 Geological units underlying the proposed modification

| Unit                            | Description  |
|---------------------------------|--|
| Quaternary Geology (Qha)        | Silty to peaty quartz sand, silt and clay. Ferruginous and humic cementation in places. Common shell layers. |
| Quaternary Geology (Qhd)        | Medium to fine grained “marine” sand with podsols.   |
| Wianamatta Ashfield Shale (Rwa) | Black to dark grey shale and laminate.   |

### Hydrogeology

The direction of groundwater flow could not be definitively determined based on current information, although the surrounding topography of the area and location of water bodies suggests that groundwater would flow in a generally northerly direction towards Cockle Bay from Central Station.

Based on geotechnical investigations carried out in and around Central Station, the groundwater system is expected to consist of:

- A localised surface groundwater aquifer (where groundwater flows through overlying residual soils, fill and fractured shale layer). This aquifer is likely to be recharged by rainfall as well as incidental runoff from impervious surfaces such as platforms, platform canopies, roads and footpaths
- A deep groundwater aquifer (where groundwater flows through the underlying sandstone rock layers). Recharge of this aquifer is expected to be via downward percolation through the residual soil or fill. Water levels in the deep groundwater aquifer are around RL 4 metres.

A site inspection carried out in and around Central Station found evidence of groundwater seepage and associated drainage infrastructure in the baggage corridors beneath the station platforms.

A search of the NSW Office of Water PINNEENA database did not identify any registered groundwater users within one kilometre of Central Station.

A search of the Bureau of Meteorology – Atlas of Groundwater Dependant Ecosystems indicated there were no groundwater dependant ecosystems located within one kilometre of the proposed modification.

## 17.3 Potential impacts

The Environmental Impact Statement for the approved project identified that the metro excavation at Central Station would be a drained structure and would have an ongoing inflow of groundwater. This excavation is likely to intercept the deeper groundwater aquifer. The Environmental Impact Statement also provided target changes to groundwater levels at surrounding land uses.

Due to the depth of the proposed infrastructure as part of the proposed modification (with the base of the services tunnel under the east concourse at around RL 10.6 metres), excavation works would likely intercept the surface groundwater aquifer only. This aquifer exists in the residual fill and soil layer and is recharged through rainfall and runoff from impervious surfaces such as roads, footpaths platforms and platform canopies.

As the nearest existing groundwater user is located greater than one kilometre from the proposed modification, and the works are only anticipated to intercept the surface groundwater aquifer, no additional impacts are anticipated to any nearby groundwater user. The target changes to groundwater levels at surrounding land uses would continue to apply to the project.

The excavation of the eastern entry and the east concourse, intercepting the surface groundwater aquifer, would result in the need to capture, treat and discharge additional water. As identified in the Environmental Impact Statement a water treatment plant would be located within the Sydney Yard construction site. This treatment plant would be used to treat all intercepted groundwater for the project as proposed to be modified. The groundwater would be treated to meet the requirements of an environment protection licence obtained by the contractor carrying out the works at Central Station, which are anticipated to be:

- pH – 6.5 to 8.5
- Total suspended solids – less than 50 milligrams per litre
- Oil and grease – non visible.

As also identified in the Environmental Impact Statement, the re-use of treated water would be maximised during construction for activities such as dust suppression.

## 17.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These measures would adequately manage the potential changes to groundwater impacts. No additional or revised groundwater mitigation measures are considered necessary.

# CONTAMINATION

CHAPTER EIGHTEEN



# 18 Contamination

**This chapter provides an assessment of the potential changes to contamination impacts as a result of the proposed modification, and identifies any changes to mitigation measures.**

## 18.1 Assessment methodology

The assessment methodology applied for the assessment of contamination impacts of the proposed modification is consistent with the method applied for the approved project and involved:

- A review of contamination assessments previously carried out near the proposed modification area, where available
- A review of publicly available data and web-based information searches, including the Contaminated Sites Register and Record of Notices (NSW Environment Protection Authority, 2015)
- A review of historical aerial photography to identify potential contamination sources located near the proposed modification area based on previous land use
- A site inspection to determine potential contamination sources and verify those potential areas of environmental concern identified in the review
- Recommendations for additional investigations and / or management of potentially contaminated sites which may be encountered during construction
- Development of mitigation measures to address potential contamination impacts.

The following guidelines were considered (where relevant):

- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
- *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage, 2000).

## 18.2 Existing environment

Known contaminated sites and potentially contaminated sites within and around Central Station were identified and assessed for the approved project. This also included the area potentially impacted by Central Walk. This section provides further details on the existing environment specifically relevant to the proposed modification.

A number of contamination issues would potentially be present in areas adjacent to the proposed modification including contaminated soils, groundwater and vapours associated with the former use of the area as a cemetery, a gasworks and general railway use, as well as historical filling activities in Prince Alfred Park (which could have resulted in the migration of contaminated groundwater into the Central Walk area).

A search of the NSW EPA Contaminated Sites Register and Record of Notices (under Section 58 of the *Contaminated Land Management Act 1997*) indicated that there were no regulated sites and two notified sites registered with the NSW EPA within 500 metres of the proposed modification or within the City of Sydney Local Government Area. The sites are summarised in Table 18-1.

Table 18-1 Notified sites within 500 metres of the proposed modification

| Site | Suburb      | Notified site address             | Notified site activity | Contamination status   | Location relative to the proposed modification |
|------|-------------|-----------------------------------|------------------------|--|--|
| 1    | Surry Hills | 69-81 Foveaux Street              | Service Station        | Under assessment   | About 200 metres to the east                   |
| 2    | Surry Hills | Ausgrid Road Reserve, Mary Street | Other industry         | Regulation under <i>Contaminated Land Management Act 1997</i> not required | About 200 metres to the north east             |

These two sites are unlikely to pose a potential risk to construction activities considering the likely small scale of the site activity and distance from the proposed modification (ie greater than 200 metres).

An additional site inspection carried out in and around Central Station found the following potential sources of contamination:

- A number of plant rooms / switch rooms that exist below the station operational areas
- Loose construction materials observed behind the wall of the baggage tunnel
- Asbestos, synthetic mineral fibres and lead based paint warning stickers were observed on walls leading to the unused platforms (platforms 26 / 27).

Sydney Trains maintain a hazardous materials register for Central Station. A review of this register identified occurrences of hazardous building materials including:

- Asbestos Containing Materials (actual and potential) – pipe box, sheeting under tiles, wall sheeting, backing board, ceiling panels, cubicle partitions, vinyl floor tiles, window packing, exterior eaves, fascia, stair infill, roof sheeting, power distribution boards and toilet cisterns
- Lead paint – painted surfaces on walls, ceilings and architraves
- Lead dust – on surfaces in general, ceiling voids and roof cavities
- Synthetic Mineral Fibres (SMF) – roof cavity insulation, air conditioning duct insulation and hot water pipe insulation
- Polychlorinated Biphenyl (PCB) containing capacitors – fluorescent light fittings.

## 18.3 Potential impacts

### 18.3.1 Potentially contaminated sites

Areas of potential contamination interest in the vicinity of the proposed modification and associated risks are outlined in Table 18-2. The likely risk associated with the approved project is also provided.



Table 18-2 Potential areas of contamination interest

| Potential area of interest                            | Location   | Potential contamination source  | Potential contaminant of concern   | Approved project likely risk  | Proposed modification likely risk   |
|---|--|---|--|---|---|
| Former cemetery                                       | Within the additional construction footprint   | Coffin materials (lead caskets) and corpses   | Heavy metals, nutrients  | NA  | Low<br>Majority of the contamination source likely to have been removed in 1901                                       |
| Former gasworks within railyards                      | Within and adjacent to the Sydney Yard construction site and within close proximity to the services gantry | Historical activities as a gasworks   | Heavy metals, hydrocarbons, BTEX, PAHs, phenolic compounds, cyanide, nutrients   | Moderate<br>Possible contamination / major demolition activities proposed | Low-Moderate<br>Possible contamination / major excavation activities proposed some distance from the area of interest |
| Railway use of Central Station                        | Within and adjacent to the east concourse, services gantry and construction footprint                      | On site activities associated with railway use (including below station plant, switch rooms and uncontrolled filling) | Asbestos, heavy metals, hydrocarbons, BTEX, PAHs, phenolic compounds, pesticides | Low<br>Possible contamination / minimal excavation proposed               | High<br>Possible contamination / excavation activities proposed within area of interest                               |
| Station platforms and below station operational areas | Within and adjacent to the east concourse and platform works construction footprint                        | Degradation of building materials   | Asbestos, lead, synthetic mineral fibres and polychlorinated biphenyls           | NA  | High<br>Possible contamination / excavation activities proposed within area of interest                               |
| Construction of below station operational areas       | Within and adjacent to the east concourse and eastern entry construction footprint                         | Filling using material of unknown quality (eg construction materials observed behind walls of baggage tunnel)         | Heavy metals, hydrocarbons, BTEX, PAHs, asbestos                                 | NA  | High<br>Possible contamination / excavation activities proposed within area of interest                               |
| Prince Alfred Park                                    | Around 200 metres to the south east of the proposed modification   | Fill of unknown quality   | Heavy metals, hydrocarbons, BTEX, PAHs, asbestos                                 | NA  | Low<br>Possible contamination / not with the additional construction footprint  |

Based on Table 18-2, the proposed modification would introduce a potential interface with new areas of contamination interest. In particular, there is a high risk associated with construction in the below station operational areas. The proposed modification would also result in an increased risk associated with railway use at Central Station due to the extent of the excavation activities.

The potential impact associated with exposure or disturbance of contaminants during construction of the proposed modification would be consistent with the risks identified for the approved project. These are:

- Mobilisation of surface and subsurface contaminants (impacting groundwater, surface water and soils)
- Migration of potential contaminants into surrounding areas (impacting groundwater, surface water and soils) via leaching, overland flow and / or subsurface flow (water and / or vapour)
- Mobilising potential groundwater and / or surface water contaminants
- Exposure to site workers, site users and site visitors
- Exposure to surrounding environmental receivers (such as flora, fauna and surrounding ecosystems).

The sensitive receiving environments could be potentially impacted by contamination (if present) within the project area include Cockle Bay (Darling Harbour) and Blackwattle Bay. Beneficial users of groundwater downslope from the respective sites could also be affected by contamination, however this risk is considered to be negligible.

### 18.3.2 Potentially contaminating construction activities

Construction activities have the potential to result in contamination of soils and / or groundwater due to spills and leaks of fuel, oils and other hazardous materials. These potential impacts were also identified for the approved project and would be readily manageable by implementing standard construction environment mitigation measures as outlined in the Environmental Impact Statement.

The demolition of buildings and structures, including the Bounce Hostel and underground structures within Central Station, also have the potential to result in the disturbance of hazardous materials, including asbestos and / or materials containing lead paint. Mishandling of hazardous material waste has the potential to contaminate soils and to create health risks to construction workers and the community. These potential impacts associated with building demolition were also identified for the approved project and would be managed in accordance with the mitigation measures identified for the approved project.

### 18.3.3 Operation

Depending on the outcome of further investigations to determine if contamination is present there may be an ongoing requirement to manage and / or monitor potential contamination risks to receivers during operation of the proposed modification. If required, the design of the proposed modification would incorporate appropriate remediation and / or management and monitoring of contamination risks.

## 18.4 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These measures would be adequate to manage the potential changes to contamination impacts. No additional or revised contamination mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification. Of relevance this includes condition E66 requiring the development of a Site Contamination Report to document the outcomes of Phase 1 and Phase 2 contamination assessments.

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# **FLOODING AND HYDROLOGY**

## CHAPTER NINETEEN





# 19 Flooding and hydrology

**This chapter provides an assessment of the potential changes to impact on flooding and hydrology, as a result of the proposed modification, and identifies any changes to mitigation measures.**

## 19.1 Assessment methodology

The methodology for the assessment of flooding and hydrology impacts as a result of the proposed modification used the same approach as was carried out for the approved project and involved:

- A review of previous reports, publicly available data and web-based information searches, including the *Darling Harbour Catchment Flood Study* (City of Sydney, 2014b).
- Consideration of the potential impacts of the proposed modification and on the proposed modification associated with flooding and hydrology
- Development of mitigation measures to address potential flooding and hydrology impacts.

## 19.2 Existing environment

The existing flooding and hydrology environment around Central Station was described in the Environmental Impact Statement. This section provides specific information regarding the existing flooding and hydrology environment relevant to the proposed modification.

### 19.2.1 Topography, drainage and flooding

The topography surrounding the project area generally slopes in a north to north westerly direction towards Darling Harbour (Cockle Bay) and Blackwattle Bay. The slopes across the project area and to the north-west are gentle with steeper topography to the east and south east of Central Station towards Surry Hills.

The majority of the proposed modification area is impermeable (ie station platforms and tracks, roads, roofs of buildings) with some open space (ie parks, yards and grassed verges). Rainfall from these areas would infiltrate into sub-soils and / or runoff into formalised storm water drains.

Central Station has an established drainage system consisting of pits and undertrack pipes. Rail corridor drainage in the northern half of the site connects to drainage in Eddy Avenue or a trunk drain under the site near Devonshire Street, both of which are part of the Darling Harbour catchment. Rail drainage in the southern half of the site connects to trunk mains under the site from Prince Alfred Park that forms part of the Blackwattle Bay catchment.

Surface water around Central Station is generally collected by developed stormwater networks that consist of road kerb and guttering, lined and unlined drainage channels, and sub-surface pit and pipe networks. The majority of the drainage systems are owned and maintained by City of Sydney Council, while a number of the larger trunk drainage systems are assets of Sydney Water.

The existing flooding behaviour around the proposed modification is described in Table 19-1.

Table 19-1 Existing flooding environment

| Location                        | Description  |
|---------------------------------|--|
| Chalmers Street (eastern entry) | <ul style="list-style-type: none"> <li>Minor flooding begins to occur from Devonshire Street on the western side of Chalmers Street in the 500 year average recurrence interval event</li> <li>In the probable maximum flood event, minor flooding extends down Chalmers Street connecting from Devonshire Street to Elizabeth Street</li> <li>In the probable maximum flood event, Chalmers Street is categorised as a floodway and a low flood hazard area.</li> </ul> |
| Central Station tracks          | <ul style="list-style-type: none"> <li>Minor flooding begins to occur on the Central Station tracks in the two year average recurrence interval event. As this is isolated and localised flooding, there is minimal change in flood depth up to the probable maximum flood event</li> <li>In the probable maximum flood event, the tracks are categorised as a flood storage zone and a low flood hazard area.</li> </ul>  |

## 19.3 Potential impacts

The Environmental Impact Statement for the approved project identified that there may be a requirement to alter existing drainage infrastructure during construction and operation. Although flooding begins to occur in parts of Central Station during the two year average recurrence interval event, impacts to flooding were not anticipated to occur from the approved project.

The following provides consideration of the potential flooding and hydrology impacts associated with the proposed modification.

### 19.3.1 Construction

#### Surface hydrology and drainage infrastructure

Similar to the impacts identified for the approved project, construction of the proposed modification has the potential to alter existing stormwater flows due to changes (relocation and / or additions) to existing stormwater drainage infrastructure, dewatering activities, and the establishment of erosion and sediment control measures (to redirect stormwater runoff around the construction sites).

With the exception of the railway tracks, the proposed modification area is currently impervious to infiltration and well-established drainage systems are already in place to cater for stormwater flows. The construction sites would not result in any major increase to stormwater volumes or peak flow rates.

Within the station, excavation works for the east concourse would directly impact existing drainage infrastructure. Temporary or permanent diversions would be installed so that the drainage system continues to function during the construction phase.

For the eastern entry, construction work may result in a minor redistribution of surface flows. However, this redistribution of flows would not affect the performance of downstream drainage infrastructure.

## **Flooding**

As identified in Section 19.2.1, the railway tracks would be at risk of flooding during construction. Flooding in this location could result in water entering the east concourse excavations or stockpiles of construction materials and spoil being washed into nearby stormwater systems.

As this location is a flood storage areas and not a flood conveyance area, it is unlikely to obstruct overland flow paths. Any loss of floodplain storage would be relatively minor and any increases in flood levels or extent would be contained to the rail corridor to the south. As such, there would be no material change in flooding impacts from those assessed for the approved project.

### **19.3.2 Operation**

#### **Drainage**

Within Central Station, the proposed modification would alter existing drainage infrastructure from:

- Re-grading existing aboveground suburban platforms and the introduction of new drainage
- Adjustments to drainage impacted by the surface platform excavation and / or excavation of the east concourse.

All new and adjusted drainage would tie-in to the existing drainage infrastructure. As there would be no change to existing catchments, and no increase in impervious surfaces within the station, there would be no overall impacts to the capacity or functionality of the existing drainage network.

For the eastern entry, the new infrastructure would be located within the footprint of existing development and would have negligible impact on existing surface hydrology. The runoff rate and volumes would be similar to the existing conditions and there would be no impact on the capacity or functionality of existing downstream stormwater infrastructure.

#### **Flooding**

As identified in Section 19.2.1, the proposed modification area is subject to existing localised flooding in events ranging from the two year average recurrence interval to the probable maximum flood. The proposed modification would not introduce new built elements into flood prone areas, nor would the project alter existing overland flood flow paths. As a result, the proposed modification is not anticipated to have any impact on surrounding flood behaviour.

## **19.4 Mitigation measures**

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. Of particular relevance to the proposed modification this includes design criteria for project infrastructure and adjacent land. These measures would be adequate to manage the potential changes to flooding and hydrology impacts. No additional or revised flooding and hydrology mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

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# **CUMULATIVE IMPACTS**

## CHAPTER TWENTY



# 20 Cumulative impacts

This chapter provides an assessment of the potential changes to cumulative impacts as a result of the proposed modification, and identifies any changes to mitigation measures.

## 20.1 Assessment methodology

### 20.1.1 Overview

Potential cumulative impacts associated with the construction of the metro platforms at Central Station with the concurrent construction of CBD and South East Light Rail were assessed in the Environmental Impact Statement for the approved project. This assessment provides consideration of any changes in potential cumulative impacts with CBD and South East Light Rail, and whether there are any potential cumulative impacts with other projects due to the addition of the proposed modification.

Cumulative impacts would occur when impacts from the project interact or overlap with impacts from other projects and potentially resulting in a larger overall impact.

Projects assessed as part of this assessment of potential changes to cumulative impacts are described in Table 20-1 along with their likely timeframe and proximity to the proposed modification.

Table 20-1 Projects assessed as part of the cumulative impact assessment

| Project and date  | Project details and proximity to the proposed modification  |
|---|---|
| <b>CBD and South East Light Rail</b><br>September 2015 – 2019 | <p>The 12 kilometre CBD and South East Light Rail project will extend from Circular Quay along George Street to Central Station, through Surry Hills to Moore Park, then to Kensington and Kingsford via Anzac Parade and Randwick via Alison Road and High Street.</p> <p>In the vicinity of Central Station, the project will include the construction and operation of light rail services on Eddy Avenue and Chalmers Street. Two light rail stops will service Central Station, at the corner of Pitt Street and Eddy Avenue, and on Chalmers Street between Eddy Avenue and Devonshire Street.</p> <p>The existing westbound lanes of Eddy Avenue and Chalmers Street between Eddy Avenue and Devonshire Street would be closed to road traffic during construction and operation. Construction work in these areas has commenced and is expected to be complete by the end of 2017, followed by testing and commissioning</p>  |
| <b>Power Supply Upgrade Program at Central</b><br>2014 – 2018 | <p>The Power Supply Upgrade Program involves construction of new electrical infrastructure and upgrades to substations, section huts, overhead wiring and feeder across the suburban and intercity network. The program at Central Station began in 2014 and is scheduled to be complete in 2018.</p> <p>In the vicinity of Central Station, the program involves major works at Lee Street substation and Chalmers Street substation. The Lee Street substation project involves the construction of a new substation at Lee Street, immediately west of Central Station, to provide additional power supply to the intercity lines at platforms 1 to 15. The Chalmers Street substation project involves the construction of a new substation within the Prince Alfred Sidings precinct to supply traction power to the Main Line and Eastern Suburbs Railway.</p> <p>Early works for the substations began in 2014 and 2015 respectively and are due to be operational in 2018.</p> <p>Due to the relative distance of these projects from the approved project, they were not considered in the Environmental Impact Statement. The proposed modification would involve development of infrastructure in close proximity to the Chalmers Street substation and involves direct connections to both the Chalmers Street and Lee Street substations. As such, consideration of potential cumulative impacts has been carried out.</p> |



| Project and date   | Project details and proximity to the proposed modification   |
|--|--|
| University of Technology Sydney (UTS) Central project<br>2016 – 2019 | <p>The UTS Central project involves the demolition of the existing Building 2, located on Broadway, and the construction of a new 15 storey building on the site. A four storey extension to the podium of Building 1 (also located on Broadway) would be integrated with the new podium of Building 2, along with associated public domain improvement works and extension of utilities.</p> <p>Demolition of the existing Building 2 commenced in November 2016, with the new buildings scheduled to be opened by early 2019.</p> <p>This project was identified in the Environmental Impact Statement, however details were not available at the time of preparation. Project details are now available and consideration of potential cumulative impacts has been carried out.</p>   |
| Central Park development<br>Project specific timeframes unknown      | <p>Central Park is a multi-stage \$2 billion mixed-use development on the former Carlton and United brewery site. Construction began in 2010 and is due to be finished in 2020. Projects that may be constructed between 2018 and 2020 include Kensington Street and Abercrombie Street student accommodation, and residential apartments on Wellington Street and O'Connor Street.</p> <p>The specific construction timeline for future stages of Central Park is yet to be confirmed. There is potential for construction timeframes to overlap with the construction of the proposed modification.</p> <p>This project was identified in the Environmental Impact Statement, however details were not available at the time of preparation. Project details are now available and consideration of potential cumulative impacts has been carried out.</p> |

Other planned projects that may result in cumulative impact but that have not yet been approved are identified in Table 20-2. Potential cumulative impacts have not been considered given the uncertainty of the status and timing of these projects.

**Table 20-2 Other projects and programs with potential cumulative impacts**

| Project  | Project details and proximity to the project   |
|--|--|
| Central to Eveleigh Urban Transformation and Transport Program<br>(Projects within program not yet approved) | <p>The Central to Eveleigh Urban Transformation and Transport Program is a 30-year project to develop 80ha of largely under-used State Government land in and around the rail corridor between Central, Macdonaldtown and Erskineville stations. The program proposes renewal of Central Station as a major transport interchange and iconic landmark to prelude redevelopment of the southern Sydney CBD.</p> <p>The program is at the masterplanning stage and the initial construction timeline is yet to be confirmed. There is potential for construction timeframes for work around Central Station to overlap with the construction of the proposed modification.</p> |
| New Inner Sydney High School   | <p>The New Inner Sydney High School is proposed to be developed on the site of the current Cleveland Street Intensive English High School on the corner of Cleveland Street and Chalmers Street, Sydney. The proposal involves the demolition of an existing building, adaptive reuse of other heritage-listed buildings and a proposed new tower building, collectively to accommodate around 1,200 students.</p> <p>The Environmental Impact Statement is currently being prepared and no construction or scheduling information is available. There is potential for construction timeframes to overlap with the construction of the proposed modification.</p>           |

## 20.2 Potential impacts

The potential changes to cumulative impacts, based on the likely interactions with the projects described above are identified in the following sections. Mitigation measures are included in Section 20.3.

There is potential that some or all of these projects may be constructed currently with the proposed modification and with each other. In this event, the cumulative impacts would be similar to those described below, however they may be exacerbated. The cumulative impact mitigation measures would adequately address this situation through co-ordination and consultation with the other projects.

### 20.2.1 CBD and South East Light Rail

Based on the anticipated timeframes, it is anticipated that major construction works for CBD and South East Light Rail in the immediate vicinity of Central Station would be completed prior to Central Walk construction works commencing. However, there may be some finishing works being carried out for CBD and South East Light Rail concurrently with the proposed modification and, for completeness, an assessment of potential additional cumulative impacts is provided in Table 20-3.

**Table 20-3 CBD and South East Light Rail – potential additional cumulative impacts**

| Environmental impact               | Potential additional cumulative impacts   |
|------------------------------------|---|
| Operational traffic and transport  | <ul style="list-style-type: none"> <li>○ Potential additional cumulative benefits associated with enhanced modal transport interchange between metro, suburban rail and light rail services.</li> </ul>   |
| Construction traffic and transport | <ul style="list-style-type: none"> <li>○ Shared use of, and additional traffic delays on, key roads by light and heavy construction vehicles, primarily Eddy Avenue, Elizabeth Street, Devonshire Street, Chalmers Street south of Devonshire Street, and Cleveland Street</li> <li>○ Additional alteration of pedestrian and cyclist movements and associated impacts on safety and amenity around Chalmers Street and the Chalmers Street entrance to Central Station.</li> </ul>   |
| Noise and vibration                | <ul style="list-style-type: none"> <li>○ Additional temporary increase in noise and vibration around Chalmers Street during shared construction periods.</li> </ul>   |
| Non-Aboriginal heritage            | <ul style="list-style-type: none"> <li>○ Additional impacts to the Sydney Terminal and Central Railway Station Group (State heritage listed). CBD and South East Light Rail would impact the setting of Eddy Avenue, the setting of Chalmers Street and directly impact the Elizabeth Street Garden.<br/>Works associated with the proposed modification would result in direct impacts to other individual items including: <ul style="list-style-type: none"> <li>◆ Country and Interstate platforms</li> <li>◆ Subway Passage Systems</li> <li>◆ Devonshire Street Tunnel</li> <li>◆ Above ground platforms</li> <li>◆ Underground platforms and Eastern Suburbs railway concourse</li> <li>◆ Chalmers Street entrance and environs</li> </ul> </li> <li>○ Additional impacts to heritage items around Central Station. CBD and South East Light Rail would impact the setting of Sydney Dental Hospital and the Railway Institute Building.<br/>Works associated with the proposed modification would result in potential direct vibration impacts and indirect setting impacts to the following items: <ul style="list-style-type: none"> <li>◆ Sydney Dental Hospital including interior</li> <li>◆ Former R.C Henderson Ltd Factory</li> <li>◆ Railway Institute Building</li> </ul> </li> </ul> |

| Environmental impact         | Potential additional cumulative impacts   |
|------------------------------|---|
|                              | <ul style="list-style-type: none"> <li>○ Potential additional impacts to unidentified non-Aboriginal archaeology on Chalmers Street and near Central Station including the following archaeological resources: <ul style="list-style-type: none"> <li>◆ Devonshire Street Cemetery</li> <li>◆ First and second Sydney Railway Stations (including remains within platform structures)</li> <li>◆ Early service lines (sewerage and storm water).</li> </ul> </li> </ul>                                   |
| Landscape and visual impacts | <ul style="list-style-type: none"> <li>○ Additional temporary visual impacts due to the presence of multiple construction sites and out-of-hours light spill around Chalmers Street near Central Station.</li> <li>○ Additional permanent visual impacts to the Chalmers Street landscape due to the demolition of the Bounce Hostel and the construction of the eastern entry on Chalmers Street near Central Station, and the introduction of new infrastructure associated with light rail.</li> </ul> |
| Business impacts             | <ul style="list-style-type: none"> <li>○ Additional altered access, visibility and amenity of businesses on Chalmers Street near Central Station.</li> </ul>  |

## 20.2.2 Power Supply Upgrade Program – Chalmers Street Substation

Potential cumulative impacts associated with the proposed modification and the Power Supply Upgrade Program Chalmers Street Substation are outlined in Table 20-6.

Table 20-6 Power Supply Upgrade Program Chalmers Street Substation – potential cumulative impacts

| Environmental impact               | Potential cumulative impacts  |
|------------------------------------|---|
| Construction traffic and transport | <ul style="list-style-type: none"> <li>○ Shared used of, and additional traffic delays on, key roads by light and heavy construction vehicles, primarily Chalmers Street.</li> </ul>  |
| Noise and vibration                | <ul style="list-style-type: none"> <li>○ Additional temporary increase in noise and vibration around Chalmers Street during shared construction periods.</li> </ul>   |
| Non-Aboriginal heritage            | <ul style="list-style-type: none"> <li>○ Additional impacts to the Sydney Terminal and Central Railway Station Group (State heritage listed). The Chalmers Street Substation would include direct impacts on Prince Alfred Sidings Precinct, specifically the Prince Alfred Substation Group.<br/>The Chalmers Street Substation would have indirect impacts to the setting of the following: <ul style="list-style-type: none"> <li>◆ Prince Alfred Sidings Precinct</li> <li>◆ Former Railways Institute Building.</li> </ul> </li> <li>○ The Chalmers Street Substation would have indirect impacts to the setting of Prince Alfred Park, which is located directly adjacent to the Central Railway Station Group and the Chalmers Street Substation site. Works associated with the proposed modification would result in direct impacts to other individual items including: <ul style="list-style-type: none"> <li>◆ Country and Interstate platforms</li> <li>◆ Subway Passage Systems</li> <li>◆ Devonshire Street Tunnel</li> <li>◆ Above ground platforms</li> <li>◆ Underground platforms and Eastern Suburbs railway concourse</li> <li>◆ Chalmers Street entrance and environs.</li> </ul> </li> </ul> |

| Environmental impact         | Potential cumulative impacts   |
|------------------------------|--|
| Landscape and visual impacts | <ul style="list-style-type: none"> <li>Additional temporary visual impacts due to the presence of multiple construction sites and out-of-hours light spill around Chalmers Street near Central Station.</li> </ul> |
| Air quality                  | <ul style="list-style-type: none"> <li>Additional temporary reduction in air quality around Central Station.</li> </ul>  |

### 20.2.3 Power Supply Upgrade Program – Lee Street Substation

Potential cumulative impacts associated with the proposed modification and the Power Supply Upgrade Program Lee Street Substation are outlined in Table 20-7.

Table 20-7 Power Supply Upgrade Program Lee Street Substation – potential cumulative impacts

| Environmental impact               | Potential cumulative impacts   |
|------------------------------------|--|
| Construction traffic and transport | <ul style="list-style-type: none"> <li>Shared used of, and additional traffic delays on, key roads by light and heavy construction vehicles.</li> </ul>  |
| Noise and vibration                | <ul style="list-style-type: none"> <li>Additional temporary increase in noise and vibration around Lee Street during shared construction periods.</li> </ul>   |
| Non-Aboriginal heritage            | <ul style="list-style-type: none"> <li>Additional impacts to the Sydney Terminal and Central Railway Station Group (State heritage listed). The Lee Street Substation would include direct impacts the following: <ul style="list-style-type: none"> <li>Sydney Yards</li> <li>Sandstone wall on eastern side of Goods Line cutting (temporary impacts only).</li> </ul> <p>The Lee Street Substation would include indirect impacts to the setting of the following:</p> <ul style="list-style-type: none"> <li>Brick retailing wall on the western side of the Goods Line cutting</li> <li>Ultimo Railway overbridge and tunnel</li> <li>Darling Harbour (Goods Line) cutting including track and bed</li> <li>Brick store building on eastern side of Goods Line cutting</li> <li>Brick wall along Regent and Lee Streets.</li> </ul> <p>The Lee Street Substation would include indirect impacts to the setting of the following heritage items around Central Station:</p> <ul style="list-style-type: none"> <li>Henry Deane Plaza</li> <li>Former John Storey Memorial Dispensary Building.</li> </ul> <p>Works associated with the proposed modification would result in direct impacts to other individual items including:</p> <ul style="list-style-type: none"> <li>Country and Interstate platforms</li> <li>Subway Passage Systems</li> <li>Devonshire Street Tunnel</li> <li>Above ground platforms</li> <li>Underground platforms and Eastern Suburbs railway concourse</li> <li>Chalmers Street entrance and environs.</li> </ul> </li> </ul> |
| Landscape and visual impacts       | <ul style="list-style-type: none"> <li>Additional temporary visual impacts due to the presence of multiple construction sites and out-of-hours light spill around Lee Street near Central Station.</li> </ul>  |
| Air quality                        | <ul style="list-style-type: none"> <li>Additional temporary reduction in air quality around Central Station.</li> </ul>  |

20.2.4 University of Technology (UTS) Central project

Potential cumulative impacts associated with the proposed modification and the University of Technology (UTS) Central project are outlined in Table 20-8.

Table 20-8 University of Technology (UTS) Central project – potential cumulative impacts

| Environmental impact               | Potential cumulative impacts  |
|------------------------------------|---|
| Construction traffic and transport | Shared used of, and additional traffic delays on, key roads by light and heavy construction vehicles, primarily George Street and Broadway. |

20.2.5 Central Park development

Potential cumulative impacts associated with the proposed modification and the Central Park development are outlined in Table 20-9.

Table 20-9 Central Park development – potential cumulative impacts

| Environmental impact               | Potential cumulative impacts  |
|------------------------------------|---|
| Construction traffic and transport | Shared used of, and additional traffic delays on, key roads by light and heavy construction vehicles, primarily George Street and Broadway. |

20.3 Mitigation measures

The Sydney Metro Construction Environmental Management Framework (provided as part of the Submissions and Preferred Infrastructure Report) sets out the environmental management approach and strategy for the project, and includes commitments regarding the development and implementation of a construction environmental management plan and associated sub-plans.

The relevant project-specific mitigation measures identified in the approval documentation would continue to apply to the project as proposed to be modified. These measures would be adequate to manage the potential changes to cumulative impacts. No additional or revised cumulative impact mitigation measures are considered necessary.

In addition, the conditions of approval issued for the approved project would also apply to the proposed modification.

# **CONSOLIDATED REVISED ENVIRONMENTAL MITIGATION MEASURES**

## **CHAPTER TWENTY ONE**





# 21 Consolidated revised environmental mitigation measures

## 21.1 Approach to environmental mitigation and management

The project approach to environmental mitigation and management was described in the Environmental Impact Statement and the Submissions and Preferred Infrastructure Report. The approach is illustrated in Figure 21-1 and includes:

- Project design – measures which are inherent in the design of the project to avoid and minimise impacts
- Mitigation measures – additional to the project design which are identified through the environment impact assessment in Chapters 9 to 20. These measures are consolidated in Table 21-1
- Construction environmental management framework – details the management processes and documentation for the project. Further details are provided in the Preferred Infrastructure Report
- Construction noise and vibration strategy – identifies how Sydney Metro proposes to manage construction noise and vibration. Further details are provided in the Preferred Infrastructure Report
- Design guidelines – provides an assurance of end-state design quality. Further details are provided in the Preferred Infrastructure Report
- Environmental performance outcomes – which establish the intended outcomes which would be achieved by the project. The performance outcomes are identified in the Preferred Infrastructure Report.

This approach would also be applied to the proposed Central Walk modification.

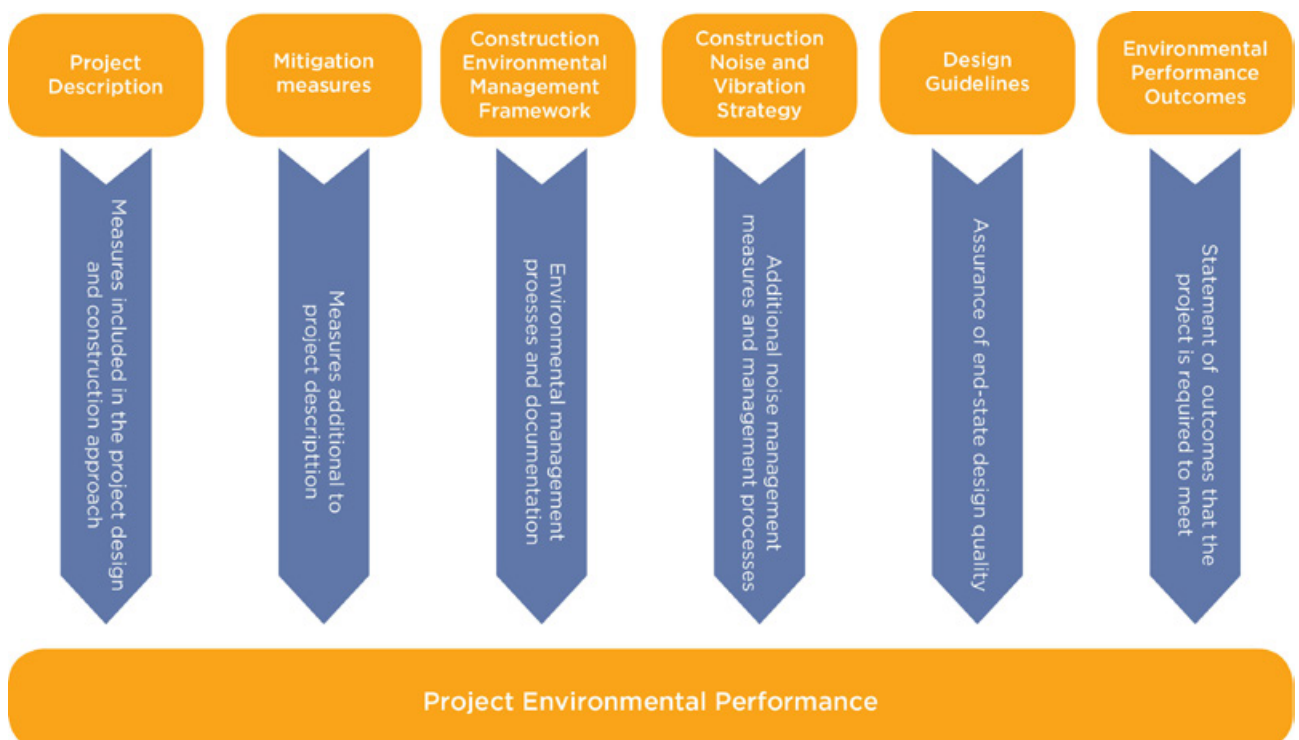


Figure 21-1 Project approach to environmental mitigation and management

## 21.2 Revised environmental mitigation measures

The list of mitigation measures presented in Chapter 11 of the Submissions and Preferred Infrastructure Report and Chapter 18 of the Victoria Cross and Artarmon Substation modification has been revised based on the assessment carried out for Central Walk.

Table 21-1 provides the revised consolidated environmental mitigation measures. This table supersedes the mitigation measures presented in the Submissions and Preferred Infrastructure Report and the Victoria Cross and Artarmon Substation modification. New mitigation measures or additions to existing mitigation measures are shown in **bold** text, with deletions shown with a ~~striketrough~~. This table assumes that the Victoria Cross and Artarmon Substation modification is approved without changes.

As per the approach for the approved project, the location(s) applicable to each mitigation measure are identified by using a unique identifier as follows:

- STW – Surface track works
- CDS – Chatswood dive site
- AS – Artarmon substation
- CN – Crows Nest Station
- VC – Victoria Cross Station
- BP – Blues Point temporary site
- GI – Ground improvement works
- BN – Barangaroo Station
- MP – Martin Place Station
- PS – Pitt Street Station
- CS – Central Station
- WS – Waterloo Station
- MDS – Marrickville dive site
- Metro rail tunnels – Metro rail tunnels not related to other sites (eg TBM works)
- PSR – Power supply routes.

**Table 21-1 Consolidated environmental mitigation measures**

| ID  | Mitigation measure   | Applicable location(s) <sup>1</sup> |
|---|--|-------------------------------------|
| <b>Construction traffic and transport</b> |  |                                     |
| T1  | Ongoing consultation would be carried out with (as relevant to the location) the CBD Coordination Office, Roads and Maritime Services, Sydney Trains, NSW Trains, the Port Authority of NSW, Barangaroo Delivery Authority, local councils, emergency services and bus operators in order to minimise traffic and transport impacts during construction. | All except metro rail tunnels       |
| T2  | Road Safety Audits would be carried out at each construction site. Audits would address vehicular access and egress, and pedestrian, cyclist and public transport safety.  | All except metro rail tunnels       |

| ID  | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|-----|---|-------------------------------------|
| T3  | Directional signage and line marking would be used to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by Variable Message Signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternate routes.   | All except metro rail tunnels       |
| T4  | In the event of a traffic related incident, co-ordination would be carried out with the CBD Coordination Office and / or the Transport Management Centre's Operations Manager.  | All except metro rail tunnels       |
| T5  | The community would be notified in advance of proposed road and pedestrian network changes through media channels and other appropriate forms of community liaison.   | All except metro rail tunnels       |
| T6  | Vehicle access to and from construction sites would be managed to ensure pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasions, police presence.   | All except metro rail tunnels       |
| T7  | <p>Additional enhancements for pedestrian, cyclist and motorist safety in the vicinity of the construction sites would be implemented during construction. This would include measures such as:</p> <ul style="list-style-type: none"> <li>● Use of speed awareness signs in conjunction with variable message signs near construction sites to provide alerts to drivers</li> <li>● Community educational events that allow pedestrians, cyclists or motorists to sit in trucks and understand the visibility restrictions of truck drivers, and for truck drivers to understand the visibility from a bicycle; and a campaign to engage with local schools to educate children about road safety and to encourage visual contact with drivers to ensure they are aware of the presence of children</li> <li>● Specific construction driver training to understand route constraints, expectations, safety issues, human error and its relationship with fitness for work and chain of responsibility duties, and to limit the use of compression braking</li> <li>● Use of In Vehicle Monitoring Systems (telematics) to monitor vehicle location and driver behavior</li> <li>● Safety devices on construction vehicles that warn drivers of the presence of a vulnerable road user located in the vehicles' blind spots and warn the vulnerable road user that a vehicle is about to turn.</li> </ul> | All except metro rail tunnels       |
| T8  | Access to existing properties and buildings would be maintained in consultation with property owners.   | All except metro rail tunnels       |
| T9  | All trucks would enter and exit construction sites in a forward gear, where feasible and reasonable.  | All except metro rail tunnels       |
| T10 | Any relocation of bus stops would be carried out by Transport for NSW in consultation with Roads and Maritime Services, the CBD Coordination Office (for relevant locations), the relevant local council and bus operators. Wayfinding and customer information would be provided to notify customers of relocated bus stops.   | All except metro rail tunnels       |
| T11 | For special events that require specific traffic measures, those measures would be developed in consultation the CBD Coordination Office (for relevant locations), Roads and Maritime Services, Barangaroo Delivery Authority (for relevant locations) and the organisers of the event.   | BN, MP, PS, CS                      |

| ID  | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|-----|---|-------------------------------------|
| T12 | <p>Construction sites would be managed to minimise construction staff parking on surrounding streets. The following measures would be implemented:</p> <ul style="list-style-type: none"> <li>Encouraging staff to use public or active transport</li> <li>Encouraging ride sharing</li> <li>Provision of alternative parking locations and shuttle bus transfers where feasible and reasonable.</li> </ul> <p>Transport for NSW would work with local councils to minimise adverse impacts of construction on parking and other kerbside use in local streets, such as loading zones, bus zones, taxi zones and coach zones.</p> | All except metro rail tunnels       |
| T13 | Construction site traffic would be managed to minimise movements in the AM and PM peak periods.   | All except metro rail tunnels       |
| T14 | Construction site traffic immediately around construction sites would be managed to minimise movements through school zones during pick up and drop off times.  | All except metro rail tunnels       |
| T15 | Pedestrian and cyclist access would be maintained at Crows Nest during the temporary closure of Hume Street, and at Martin Place during the temporary partial closure of Martin Place. Wayfinding and customer information would be provided to guide pedestrians and cyclists to alternative routes.   | CN, MP                              |
| T16 | Timing for the temporary closure of the Devonshire Street tunnel would avoid periods of peak pedestrian demand. Wayfinding and customer information would be provided to guide pedestrians to alternative routes.   | CS                                  |
| T17 | Consultation would occur with the Harbour Master, Roads and Maritime Services and Sydney Ferries' to ensure shipping channels are maintained during the Sydney Harbour ground improvement works.  | GI                                  |
| T18 | During the closure of existing entrances to Martin Place Station, marshalls would be provided during the AM and PM peak periods to direct customers to available access and egress points.  | MP                                  |
| T19 | Where existing parking is removed to facilitate construction activities, alternative parking facilities would be provided where feasible and reasonable.  | All except metro rail tunnels       |
| T20 | Alternative pedestrian routes and property access would be provided where these are affected during the construction of the power supply routes.  | PSR                                 |
| T21 | The potential combined impact of trucks from multiple construction sites would be further considered during the development of Construction Traffic Management Plans.   | All except metro rail tunnels       |
| T22 | Where existing footpath routes used by pedestrians and / or cyclists are affected by construction, a condition survey would be carried out to confirm they are suitable for use (eg suitably paved and lit), with any necessary modifications to be carried out in consultation with the relevant local council.  | All except metro rail tunnels       |
| T23 | <b>Specific station management measures would be implemented during pedestrian movement Phase 2. This would include strategies such as encouraging passengers to exit platforms at the closest stair case or escalator, signage and marshalling of passengers waiting to board to minimise those waiting adjacent to hoarding and to direct passengers so that that there is even distribution along the platform.</b>  | CS                                  |
| T24 | <b>The temporary closures of footpaths on Chalmers Street would not occur at the same time as the temporary closure of the Devonshire Street Tunnel.</b>  | CS                                  |

| ID                                       | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|--|---|-------------------------------------|
| T25                                      | During the closure of Randle Lane, traffic control would be provided at either end. Reversing movements out of Randle Lane onto Elizabeth Street and Randle Street would not be carried out during the peak periods of 7 am to 10 am and 3 pm to 7 pm.  | CS                                  |
| T26                                      | During the closure of Randle Lane, access to basement car parking would be maintained where feasible and reasonable. If access cannot be maintained, alternative parking would be arranged.   | CS                                  |
| <b>Operational traffic and transport</b> |   |                                     |
| OpT1                                     | Enhancement of pedestrian infrastructure in the vicinity of Victoria Cross and Martin Place stations would be investigated further in consultation with (as relevant to the location) the CBD Coordination Office, Roads and Maritime Services and the relevant local council.  | VC, MP                              |
| OpT2                                     | Access would be maintained to neighbouring properties.  | All except metro rail tunnels       |
| OpT3                                     | The design of the interface between the Frank Channon Walk extension and the signalised intersection at Mowbray Road / Hampden Road (including any shared zone proposal) would be developed in consultation with Roads and Maritime Services and Willoughby Council.  | CDS                                 |
| OpT4                                     | Transport for NSW would work with local councils to minimise adverse impacts of operation on parking and other kerbside use in local streets, such as loading zones, bus zones, taxi zones and coach zones.   | All except metro rail tunnels       |
| OpT5                                     | During detailed design, Transport for NSW would consult with Inner West Council, Roads and Maritime Services and other stakeholder on strategies to reduce the number of staged pedestrian marked foot crossings at the Edinburgh Road / Edgeware Road intersection.  | MDS                                 |
| <b>Construction noise and vibration</b>  |   |                                     |
| NV1                                      | <p>The Construction Noise and Vibration Strategy would be implemented with the aim of achieving the noise management levels where feasible and reasonable.</p> <p>This would include the following example standard mitigation measures where feasible and reasonable:</p> <ul style="list-style-type: none"> <li>Provision of noise barriers around each construction site</li> <li>Provision of acoustic sheds at Chatswood dive site, Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and Marrickville dive site</li> <li>The coincidence of noisy plant working simultaneously close together would be avoided</li> <li>Offset distances between noisy plant and sensitive receivers would be increased</li> <li>Residential grade mufflers would be fitted to all mobile plant</li> <li>Dampened rock hammers would be used</li> <li>Non-tonal reversing alarms would be fitted to all permanent mobile plant</li> <li>High noise generating activities would be scheduled for less sensitive period considering the nearby receivers</li> <li>The layout of construction sites would consider opportunities to shield receivers from noise.</li> </ul> <p>This would also include carrying out the requirements in relation to construction noise and vibration monitoring.</p> | All                                 |

| ID  | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|-----|---|-------------------------------------|
| NV2 | <p>Unless compliance with the relevant traffic noise criteria can be achieved, night time heavy vehicle movements at the Chatswood dive site, Crows Nest Station, Victoria Cross Station and Waterloo Station sites would be restricted to:</p> <ul style="list-style-type: none"> <li>• The Pacific Highway and Mowbray Road at the Chatswood dive site</li> <li>• The Pacific Highway, Hume Street and Oxley Street at the Crows Nest Station construction site</li> <li>• McLaren Street, Miller Street and Berry Street at the Victoria Cross station construction site.</li> <li>• Botany Road and Raglan Street at the Waterloo Station construction site.</li> </ul>   | CDS, CN, VC, WS                     |
| NV3 | <p>Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure.</p> <p>For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.</p>  | All except metro rail tunnels       |
| NV4 | Feasible and reasonable measures would be implemented to minimise ground borne noise where exceedences are predicted.   | All                                 |
| NV5 | <p>Feasible and reasonable mitigation measures would be implemented where power supply works would result in elevated noise levels at receivers. This would include:</p> <ul style="list-style-type: none"> <li>• Carrying out works during the daytime period when in the vicinity of residential receivers</li> <li>• Where out of hours works are required, scheduling the noisiest activities to occur in the evening period (up to 10 pm)</li> <li>• Use of portable noise barriers around particularly noisy equipment such as concrete saws.</li> </ul>  | PSR                                 |
| NV6 | <p>Transport for NSW would engage an Independent Acoustic Advisor to act independently of the design and construction teams and provide oversight of construction methods, construction noise and vibration planning, management and mitigation, and construction noise and vibration monitoring and reporting. The key responsibilities of the Independent Acoustic Advisor would include :</p> <ul style="list-style-type: none"> <li>• Assurance of contractor noise and vibration planning, modelling, management and monitoring practices</li> <li>• Verification of compliance with relevant guidelines and approval requirements</li> <li>• Audit noise and vibration management practices.</li> </ul>   | All                                 |
| NV7 | <p>Alternative demolition techniques that minimise noise and vibration levels would be investigated and implemented where feasible and reasonable. This would include consideration of:</p> <ul style="list-style-type: none"> <li>• The use of hydraulic concrete shears in lieu of hammers/rock breakers</li> <li>• Sequencing works to shield noise sensitive receivers by retaining building wall elements</li> <li>• Locating demolition load out areas away from the nearby noise sensitive receivers</li> <li>• Providing respite periods for noise intensive works</li> <li>• Methods to minimise structural-borne noise to adjacent buildings including separating the structural connection prior to demolition through saw-cutting and propping, using hand held splitters and pulverisers or hand demolition</li> <li>• Installing sound barrier screening to scaffolding facing noise sensitive neighbours</li> <li>• Modifying demolition works sequencing / hours to minimise impacts during peak pedestrian times and / or adjoining neighbour outdoor activity periods.</li> </ul> | All except metro rail tunnels       |

| ID                                     | Mitigation measure   | Applicable location(s) <sup>1</sup> |
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| NV8                                    | Opportunities to minimise heavy vehicles movements on Randle Lane at night would be further investigated during detailed construction planning.  | CS                                  |
| NV9                                    | Measures would be implemented to reduce work health and safety noise exposure for station workers, retail staff and members of the public within Central Station. These would include: <ul style="list-style-type: none"> <li>○ The use of hoarding and / or temporary noise barriers around construction sites</li> <li>○ Providing hearing protection to station staff employees where appropriate</li> <li>○ Providing specific work health and safety noise training to commercial receiver employers including guidance on managing their employees during highly noisy periods</li> <li>○ The use of signage around construction sites to inform the general public of high noise exposure areas.</li> </ul> | CS                                  |
| <b>Operational noise and vibration</b> |  |                                     |
| OpNV1                                  | The height and extent of noise barriers adjacent to the northern surface track works would be confirmed during detailed design with the aim of not exceeding trigger levels from the <i>Rail Infrastructure Noise Guidelines</i> (Environment Protection Authority, 2013). At property treatments would be offered where there are residual exceedances of the trigger levels.   | STW                                 |
| OpNV2                                  | Track form would be confirmed during the detailed design process in order to meet the relevant ground-borne noise and vibration criteria from the Rail Infrastructure Noise Guidelines (EPA, 2013) and the <i>Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects</i> (DECC, 2007a).   | Metro rail tunnels                  |
| OpNV3                                  | Stations and ancillary facilities including train breakout noise from draught relief shafts would be designed to meet the applicable noise criteria derived from the <i>Industrial Noise Policy</i> (EPA, 2000).   | All except metro rail tunnels       |
| <b>Land use and property</b>           |  |                                     |
| LP1                                    | Opportunities to integrate the eastern entry with local strategic planning initiatives would be investigated in consultation with City of Sydney Council   | CS                                  |
| <b>Business impacts</b>                |  |                                     |
| BI1                                    | Specific consultation would be carried out with businesses potentially impacted during construction. Consultation would aim to identify and develop measures to manage the specific construction impacts for individual businesses.  | All                                 |
| BI2                                    | A business impact risk register would be developed to identify, rate and manage the specific construction impacts for individual businesses.   | All                                 |
| BI3                                    | Appropriate signage would be provided around construction sites to provide visibility to retained businesses.  | All except metro rail tunnels       |



| ID                             | Mitigation measure  | Applicable location(s) <sup>1</sup>      |
|--------------------------------|---|--|
| <b>Non-Aboriginal heritage</b> |   |  |
| NAH1                           | <p>Archival recording and reporting of the following heritage items would be carried out in accordance with the NSW Heritage Office's <i>How to Prepare Archival Records of Heritage Items</i> (1998a), and <i>Photographic Recording of Heritage Items Using Film or Digital Capture</i> (2006):</p> <ul style="list-style-type: none"> <li>• The internal heritage fabric and any non-original elements removed from within the curtilage of Mowbray House, Chatswood</li> <li>• The interior, exterior and setting of the shop at 187 Miller Street, North Sydney</li> <li>• The fabric and setting of the North Sydney bus shelters requiring removal and temporary relocation at Victoria Cross Station and Blues Point temporary site</li> <li>• Any component of the Blues Point Waterfront Group and the McMahons Point South heritage conservation area to be directly affected or altered, including vegetation and significant landscape features</li> <li>• Hickson Road wall in the vicinity of proposed ventilation risers and skylights for Barangaroo Station</li> <li>• The interior, exterior and setting of the 'Flat Building' at 7 Elizabeth Street, Sydney</li> <li>• Martin Place, between Elizabeth and Castlereagh streets, Sydney</li> <li>• The heritage fabric of areas of the existing Martin Place Station affected by the project</li> <li>• The Rolling Stock Officers Garden, Rolling Stock Officers Building and Cleaners Amenities Building in Sydney Yard and any other component of the Sydney Terminal and Central Railway Stations group to be removed or altered</li> <li>• <b>The Bounce Hostel building (former MGM building)</b></li> <li>• Directly impacted parts of the Congregational Church at Waterloo.</li> </ul> | CDS, VC, BP, MP, CS, WS                  |
| NAH2                           | <p>The archaeological research design would be implemented.</p> <p>Significant archaeological findings would be considered for inclusion in heritage interpretation (as per NAH8) for the project and be developed in consultation with the relevant local council.</p>   | CDS, CN, VC, BP, BN, MP, PS, CS, WS, PSR |
| NAH3                           | <p>An Exhumation Policy and Guideline would be prepared and implemented. It would be developed in accordance with the Guidelines for Management of Human Skeletal Remains (NSW Heritage Office, 1998b) and NSW Health Policy Directive – Exhumation of human remains (December, 2013). It would be prepared in consultation with NSW Heritage Office and NSW Health.</p>  | All except metro rail tunnels            |
| NAH4                           | <p>The method for the demolition of existing buildings and / or structures at Chatswood dive site, Victoria Cross Station, Martin Place Station, Pitt Street Station, Central Station and Waterloo Station would be developed to minimise direct and indirect impacts to adjacent and / or adjoining heritage items.</p>  | CDS, VC, MP, PS, CS, WS                  |
| NAH5                           | <p>Prior to total or partial demolition of heritage items at Victoria Cross and Martin Place stations, <b>and the Bounce Hostel building (former MGM building at Central Station)</b>, heritage fabric for salvage would be identified and reuse opportunities for salvaged fabric considered. This would include salvage and reuse of heritage tiles to be impacted at Martin Place Station.</p>   | VC, MP, CS                               |
| NAH6                           | <p>An appropriately qualified and experienced heritage architect would form part of the Sydney Metro Design Review Panel and would provide independent review periodically throughout detailed design.</p>  | All                                      |

| ID    | Mitigation measure   | Applicable location(s) <sup>1</sup>       |
|-------|--|---|
| NAH7  | The project design would be sympathetic to heritage items and, where reasonable and feasible, minimise impacts to the setting of heritage items. The detailed design for Martin Place Station and Central Station would be developed with input from a heritage architect.   | STW, CDS, CN, VC, BN, MP, PS, CS, WS, MDS |
| NAH8  | Appropriate heritage interpretation would be incorporated into the design for the project in accordance with the NSW Heritage Manual, the NSW Heritage Office's <i>Interpreting Heritage Places and Items: Guidelines</i> (August 2005), and the NSW Heritage Council's <i>Heritage Interpretation Policy</i> .  | CDS, CN, VC, BP, BN, MP, PS, WS           |
| NAH9  | A Central Station heritage interpretation plan would be developed and implemented. It would be consistent with the <i>Central Station Conservation Management Plan</i> (Rappoport and Government Architects Office, 2013) and in accordance with the guidelines identified in NAH8.  | CS  |
| NAH10 | The detailed design of the Sydney Yard Access Bridge would be carried out in accordance with the relevant specific element principles in the Design Guidelines.  | CS  |
| NAH11 | Except for heritage significant elements affected by the project, direct impact on other heritage significant elements forming part of the following items would be avoided: <ul style="list-style-type: none"> <li>• The Blues Point Waterfront Group (including the former tram turning circle, stone retaining wall, bollards and steps)</li> <li>• The Millers Point and Dawes Point Village Precinct</li> <li>• The existing Martin Place Station</li> <li>• Sydney Terminal and Central Railway Stations group</li> <li>• Sydney Yard (including the Shunters Hut and Prince Alfred Sewer).</li> </ul> | BP, BN, MP, CS                            |
| NAH12 | Power supply works would be designed and constructed to avoid impacts to the Tank Stream and Bennelong Stormwater Channel.   | PSR                                       |
| NAH13 | The design and detailed construction planning of work at Central Station would consider the requirements of the <i>Central Station Conservation Management Plan</i> (Rappoport and Government Architects Office, 2013) and include consideration of opportunities for the retention, conservation and / or reuse of original and significant heritage fabric and movable heritage items.<br><br>Consultation would be carried out with Sydney Trains and the Heritage Council of NSW during design development.  | CS  |
| NAH14 | The final design and location of the new connection and opening at Martin Place Railway Station would minimise removal of the significant red ceramic tiling where feasible and reasonable.  | MP  |
| NAH15 | Opportunities for the reuse of any tiles at Martin Place Railway Station that are removed would be investigated.   | MP  |
| NAH16 | Opportunities for the reuse of the circular seating within Martin Place Station would be investigated.   | MP  |
| NAH17 | Opportunities for the salvage and reuse of the bus shelters temporarily removed at Victoria Cross and Blues Point would be investigated in consultation with North Sydney Council.   | VC, BP                                    |
| NAH18 | Works at Central Station would be carried out with the oversight of heritage specialists.  | CS  |
| NAH19 | Subject to outcomes of consultation with the church, temporary and permanent works at the Congregational Church would: <ul style="list-style-type: none"> <li>• Minimise impacts to heritage fabric</li> <li>• Be sympathetic to the heritage values and architectural form of the building.</li> </ul>  | WS  |

| ID  | Mitigation measure  | Applicable location(s) <sup>1</sup> |
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| <b>Aboriginal heritage</b>                    |   |                                     |
| AH1   | Aboriginal stakeholder consultation would be carried out in accordance with the NSW Office of Environment and Heritage's Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.  | All                                 |
| AH2   | The cultural heritage assessment report would be implemented.   | All                                 |
| AH3   | Archaeological test excavation (and salvage when required) would be carried out where intact natural soil profiles with the potential to contain significant archaeological deposits are encountered at the Blues Point temporary site, Barangaroo Station, Martin Place Station, Pitt Street Station, Central Station, Waterloo Station and Marrickville dive site. Excavations would be conducted in accordance with the methodology outlined in the Aboriginal cultural heritage assessment report | BP, BN, MP, PS, CS, WS, MDS         |
| AH4   | Appropriate Aboriginal heritage interpretation would be incorporated into the design for the project in consultation with Aboriginal stakeholders.  | All                                 |
| AH5   | Feasible and reasonable mitigation at the ground improvement locations would be identified in consultation with the Office of Environment and Heritage.   | GI                                  |
| AH6   | The Aboriginal cultural heritage assessment report would address areas of archaeological potential associated with the power supply routes.   | PSR                                 |
| AH7   | <b>The cultural heritage assessment report would be updated to include the scope of the proposed Central Walk modification.</b>   | <b>CS</b>                           |
| <b>Landscape character and visual amenity</b> |   |                                     |
| <b>Construction</b>                           |   |                                     |
| LV1   | Where feasible and reasonable, the elements within construction sites would be located to minimise visual impacts, for example materials and machinery would be stored behind fencing.  | All except metro rail tunnels       |
| LV2   | Existing trees to be retained would be protected prior to the commencement of construction in accordance with Australian Standard AS4970 the <i>Australian Standard for Protection of Trees on Development Sites and Adjoining Properties</i> .   | All except metro rail tunnels       |
| LV3   | Lighting of construction sites would be oriented to minimise glare and light spill impact on adjacent receivers.  | All except metro rail tunnels       |
| LV4   | Visual mitigation would be implemented as soon as feasible and reasonable after the commencement of construction, and remain for the duration of the construction period.   | All except metro rail tunnels       |
| LV5   | Opportunities for the retention and protection of existing trees would be identified during detailed construction planning.   | All except metro rail tunnels       |
| LV6   | The design and maintenance of construction site hoardings would aim to minimise visual amenity and landscape character impacts, including the prompt removal of graffiti. Public art opportunities would be considered.   | All except metro rail tunnels       |
| LV7   | The selection of materials and colours for acoustic sheds would aim to minimise their visual prominence.  | CDS, CN, VC, BN, MP, PS, WS, MDS    |
| LV8   | Tunnel boring machine retrieval works at the Blues Point temporary site would be timed to avoid key harbour viewing events.   | BP                                  |
| LV9   | Benching would be used where feasible and reasonable at Blues Point temporary site to minimise visual amenity impacts.  | BP                                  |

| ID                             | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|--------------------------------|---|-------------------------------------|
| LV10                           | Temporary impacts to public open space would be rehabilitated in consultation with the relevant local council and / or landowner.   | All except metro rail tunnels       |
| <b>Operation</b>               |   |                                     |
| LV11                           | Cut off and direct light fittings (or similar technologies) would be used to minimise glare and light spill onto private property.  | CDS, AS, CS, MDS                    |
| LV12                           | Where feasible and reasonable, vegetation would be provided to screen and visually integrate sites with the surrounding area.   | STW, CDS, AS, MDS                   |
| LV13                           | Identify and implement appropriate landscape treatments for Frank Channon Walk.   | STW, CDS                            |
| LV14                           | The architectural treatment of Artarmon substation would minimise visual amenity and landscape character impacts.   | AS                                  |
| LV15                           | The Harbour cycles sculpture at North Sydney would be reinstated at a location determined in consultation with North Sydney Council.  | VC                                  |
| LV16                           | The P&O Fountain, the mid-20th century bas relief sculpture and the Douglas Annand glass screen at 55 Hunter Street would be reinstated at a location determined in consultation with City of Sydney Council.   | MP                                  |
| LV17                           | Opportunities would be investigated to provide a permanent wall for street art at Marrickville dive site in consultation with Marrickville Council.   | MDS                                 |
| LV18                           | Noise barriers would be transparent where they are augmenting existing transparent noise barriers.  | STW                                 |
| LV19                           | Notification processes in relation to moral rights for public art and architecture under Commonwealth <i>Copyright Act 1968</i> would be carried out.   | All except metro rail tunnels       |
| <b>Groundwater and geology</b> |   |                                     |
| GWG1                           | <p>A detailed geotechnical model for the project would be developed and progressively updated during design and construction. The detailed geotechnical model would include:</p> <ul style="list-style-type: none"> <li>Assessment of the potential for damage to structures, services, basements and other sub-surface elements through settlement or strain</li> <li>Predicted changes to groundwater levels, including at nearby water supply works.</li> </ul> <p>Where building damage risk is rated as moderate or higher (as per the CIRIA 1996 risk-based criteria), a structural assessment of the affected buildings / structures would be carried out and specific measures implemented to address the risk of damage.</p> <p>With each progressive update of the geotechnical model the potential for exceedance of the following target changes to groundwater levels would be reviewed:</p> <ul style="list-style-type: none"> <li>Less than 2.0 metres – general target</li> <li>Less than 4.0 metres – where deep building foundations present</li> <li>Less than 1.0 metre – residual soils</li> <li>Less than 0.5 metre – residual soils (Blues Point) (fill / Aeolian sand).</li> </ul> <p>Where a significant exceedance of target changes to groundwater levels are predicted at surrounding land uses and nearby water supply works, an appropriate groundwater monitoring program would be developed and implemented. The program would aim to confirm no adverse impacts on groundwater levels or to appropriately manage any impacts. Monitoring at any specific location would be subject to the status of the water supply work and agreement with the landowner.</p> <p>The geotechnical model and groundwater monitoring program would be developed in consultation with the Department of Primary Industry (Water).</p> | All                                 |

| ID  | Mitigation measure  | Applicable location(s) <sup>1</sup> |
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| GWG2  | Condition surveys of buildings and structures in the vicinity of the tunnel and excavations would be carried out prior to the commencement of excavation at each site.  | All                                 |
| <b>Soils, contamination and water quality</b> |   |                                     |
| <b>Construction</b>                           |   |                                     |
| SCW1  | <p>Updated desktop contamination assessments would be carried out for Chatswood dive site, Victoria Cross Station, Artarmon substation, Blues Point temporary site, Barangaroo Station, Central Station and Waterloo Station. If sufficient information is not available to determine the remediation requirements and the impact on potential receivers, then detailed contamination assessments, including collection and analysis of soil and groundwater samples would be carried out.</p> <p>Detailed contamination assessment would also be carried out for the Barangaroo power supply route within Hickson Road and the Marrickville power supply route adjacent to Sydney Park and Camdenville Oval.</p> <p>In the event a Remediation Action Plan is required, these would be developed in accordance with <i>Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land</i> (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) and a site auditor would be engaged.</p> | CDS, AS, VC, BP, BN, CS, WS, PSR    |
| SCW2  | <p>Prior to ground disturbance in high probability acid sulfate areas at Barangaroo Station, Waterloo Station and Marrickville dive site, testing would be carried out to determine the presence of acid sulfate soils.</p> <p>If acid sulfate soils are encountered, they would be managed in accordance with the <i>Acid Sulfate Soil Manual</i> (Acid Sulfate Soil Management Advisory Committee, 1998).</p>   | BN, WS, MDS                         |
| SCW3  | Erosion and sediment control measures would be implemented in accordance with <i>Managing Urban Stormwater: Soils and Construction Volume 1</i> (Landcom, 2004) and <i>Managing Urban Stormwater: Soils and Construction Volume 2</i> (Department of Environment and Climate Change, 2008a). Measures would be designed as a minimum for the 80th percentile; 5-day rainfall event.   | All except metro rail tunnels       |
| SCW4  | Discharges from the construction water treatment plants would be monitored to ensure compliance with the discharge criteria in an environment protection licence issued to the project.   | All except metro rail tunnels       |
| SCW5  | A silt curtain would be used around the Sydney Harbour ground improvement work barges.  | GI                                  |
| SCW6  | <p>A water quality monitoring program would be implemented to monitor water quality within Sydney Harbour during ground improvement work.</p> <p>The water quality monitoring program would be carried out to detect any potential impacts on the water quality of Sydney Harbour from the ground improvement work and inform management responses in the event any impacts are identified.</p> <p>Specific monitoring locations and frequencies would be determined during the development of the program in consultation with the Environment Protection Authority.</p>   | GI                                  |
| <b>Operation</b>                              |   |                                     |
| SCW7  | Discharges from the tunnel water treatment plant would be monitored to ensure compliance with the discharge criteria determined in consultation with the NSW Environment Protection Authority.  | MDS                                 |

| ID   | Mitigation measure  | Applicable location(s) <sup>1</sup> |
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| <b>Social impacts and community infrastructure</b> |   |                                     |
| SO1  | Direct impacts to public open space at the Blues Point temporary site would be minimised.   | BP                                  |
| SO2  | Specific consultation would be carried out with sensitive community facilities (including aged care, child care centres, educational institutions and places of worship) potentially impacted during construction. Consultation would aim to identify and develop measures to manage the specific construction impacts for individual sensitive community facilities.   | All except metro rail tunnels       |
| <b>Biodiversity</b>                                |   |                                     |
| B1   | An ecologist would be present during the removal of any hollow-bearing trees.   | CDS                                 |
| B2   | Potential bat roosting locations at Central Station, Waterloo Station and Marrickville dive sites would be checked by a qualified ecologist or wildlife handler prior to demolition. Any bats found would be relocated, unless in torpor, in which case the relocation would be delayed until the end of the torpor period.   | CS, WS, MDS                         |
| B3   | The local WIRES group and / or veterinarian would be contacted if any fauna are injured on site or require capture and / or relocation.   | All except metro rail tunnels       |
| B4   | Procedures would be developed and implemented, in accordance with the National System for the Prevention and Management of Marine Pest Incursions, during Sydney Harbour ground improvement works to avoid transportation of marine pests from other locations, particularly the marine alga <i>Caulerpa taxifolia</i> .  | GI                                  |
| <b>Flooding and hydrology</b>                      |   |                                     |
| <b>Construction</b>                                |   |                                     |
| FH1  | Detailed construction planning would consider flood risk at Barangaroo Station, Martin Place Station and the Waterloo Station construction sites. This would include identification of measures to, where feasible and reasonable, not worsen existing flooding characteristics up to and including the 100 year annual recurrence interval event in the vicinity of the project.<br><br>Not worsen is defined as: <ul style="list-style-type: none"> <li>● A maximum increase flood levels of 50mm in a 100 year Average Recurrence Interval flood event</li> <li>● A maximum increase in time of inundation of one hour in a 100 year Average Recurrence Interval flood event</li> <li>● No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100 year Average Recurrence Interval flood event..</li> </ul> | BN, MP, WS                          |
| FH2  | The site layout and staging of construction activities at Marrickville dive site would avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required.  | MDS                                 |

| ID               | Mitigation measure  | Applicable location(s) <sup>1</sup> |
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| FH3              | <p>Overland flow diversions during construction at the Marrickville dive site would meet the following criteria, where feasible and reasonable:</p> <ul style="list-style-type: none"> <li>Not worsen existing flooding characteristics up to and including the 100 year annual recurrence interval event in the vicinity of the project</li> <li>Dedicated evacuation routes would not be adversely impacted in flood events up to and including the probable maximum flood. This may include the requirement for changes to existing arrangements for flood warning systems and signage.</li> </ul> <p>Construction planning for the Marrickville dive site would be carried out in consultation with the State Emergency Services and Inner West Council.</p> <p>Not worsen is defined as:</p> <ul style="list-style-type: none"> <li>A maximum increase flood levels of 50mm in a 100 year Average Recurrence Interval flood event</li> <li>A maximum increase in time of inundation of one hour in a 100 year Average Recurrence Interval flood event</li> <li>No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100 year Average Recurrence Interval flood event.</li> </ul> | MDS                                 |
| <b>Operation</b> |   |                                     |
| FH4              | Where feasible and reasonable, detailed design would result in no net increase in stormwater runoff rates in all storm events unless it can be demonstrated that increased runoff rates as a result of the project would not increase downstream flood risk.  | STW, AS, MDS                        |
| FH5              | Where space permits, on-site detention of stormwater would be introduced where stormwater runoff rates are increased. Where there is insufficient space for the provision of on-site detention, the upgrade of downstream infrastructure would be implemented where feasible and reasonable.  | STW, AS, MDS                        |
| FH6              | Detailed design would occur in consultation with Inner West Council to ensure future drainage improvement works around the Marrickville dive site would not be precluded.   | MDS                                 |
| FH7              | Consultation would be carried out with Inner West Council to ensure flood-related outcomes of the project are consistent with any future floodplain risk management study and / or plan developed for the Marrickville Valley Catchment.  | MDS                                 |
| FH8              | The frequency of Sydney Trains rail service disruptions due to flooding would not be increased in the vicinity of the Marrickville dive structure.  | MDS                                 |



| ID                 | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|--------------------|---|-------------------------------------|
| FH9                | <p>Design of the project would be reviewed to, where feasible and reasonable, not worsen existing flooding characteristics up to and including the 100 year annual recurrence interval event in the vicinity of the project. Detailed flood modelling would consider:</p> <ul style="list-style-type: none"> <li>○ Potential changes to flood prone land and flood levels</li> <li>○ Potential changes to overland flow paths</li> <li>○ Redistribution of surface runoff as a result of project infrastructure</li> <li>○ Behaviour of existing stormwater runoff</li> <li>○ Potential changes required to flood evacuation routes, flood warning systems and signage.</li> </ul> <p>Flood modelling to support detailed design would be carried out in accordance with the following guidelines:</p> <ul style="list-style-type: none"> <li>○ <i>Floodplain Development Manual</i> (NSW Government, 2005b)</li> <li>○ <i>Floodplain Risk Management Guideline: Practical Consideration of Climate Change</i> (DECC, 2007b)</li> <li>○ <i>Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments</i> (DECCW, 2010c)</li> <li>○ <i>New guideline and changes to section 117 direction and EP&amp;A Regulation on flood prone land, Planning Circular PS 07-003</i> (NSW Department of Planning, 2007).</li> <li>○ Flood modelling and consideration of mitigation measures would be carried out in consultation with the relevant local councils, the Office of Environment and Heritage and the State Emergency Services.</li> </ul> <p>Not worsen is defined as:</p> <ul style="list-style-type: none"> <li>○ A maximum increase flood levels of 50mm in a 100 year Average Recurrence Interval flood event</li> <li>○ A maximum increase in time of inundation of one hour in a 100 year Average Recurrence Interval flood event</li> <li>○ No increase in the potential for soil erosion and scouring from any increase in flow velocity in a 100 year Average Recurrence Interval flood event.</li> </ul> | All except metro rail tunnels       |
| FH10               | <p>During detailed design, project infrastructure would be designed to meet the following criteria, where feasible and reasonable:</p> <ul style="list-style-type: none"> <li>○ Locate station and service entrances to underground stations above the greater of the 100 year annual recurrence interval flood level plus 500mm or the probable maximum flood level</li> <li>○ Provide site surface grading and drainage collection systems at the Chatswood and Marrickville dive structures to manage the risk of local catchment and overland flooding for events up to and including the probable maximum flood event</li> <li>○ Locate aboveground rail system facilities (such as traction power supply sub stations) at least above the 100 year annual recurrence interval flood level plus 500mm</li> <li>○ Protect facilities that are identified as being critical to emergency response operations from the probable maximum flood level.</li> </ul>   | All except metro rail tunnels       |
| <b>Air quality</b> |   |                                     |
| AQ1                | The engines of all on-site vehicles and plant would be switched off when not in use for an extended period.   | All                                 |
| AQ2                | Plant would be well maintained and serviced to minimise emissions. Emissions from plant would be considered as part of pre-acceptance checks.   | All                                 |

| ID                     | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|------------------------|---|-------------------------------------|
| AQ3                    | Construction site layout and placement of plant would consider air quality impacts to nearby receivers.   | All except metro rail tunnels       |
| AQ4                    | Hard surfaces would be installed on long term haul routes and regularly cleaned.  | All except metro rail tunnels       |
| AQ5                    | Unsurfaced haul routes and work area would be regularly damped down in dry and windy conditions.  | All except metro rail tunnels       |
| AQ6                    | All vehicles carrying loose or potentially dusty material to or from the site would be fully covered.   | All except metro rail tunnels       |
| AQ7                    | Stockpiles would be managed to minimise dust generation.  | All except metro rail tunnels       |
| AQ8                    | Demolition would be managed to minimise dust generation.  | All except metro rail tunnels       |
| AQ9                    | Ventilation from acoustic sheds would be filtered.  | CDS, CN, VC, BN, MP, PS, WS, MDS    |
| <b>Hazard and risk</b> |   |                                     |
| <b>Construction</b>    |   |                                     |
| HR1                    | All hazardous substances that may be required for construction would be stored and managed in accordance with the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and <i>Hazardous and Offensive Development Application Guidelines: Applying SEPP 33</i> (Department of Planning, 2011).   | All                                 |
| HR2                    | Dial before you dig searches and non-destructive digging would be carried out to identify the presence of underground utilities.  | All                                 |
| HR3                    | A hazardous material survey would be completed for those buildings and structures suspected of containing hazardous materials (particularly asbestos) prior to their demolition. If asbestos is encountered, it would be handled and managed in accordance with relevant legislation, codes of practice and Australian standards. | CDS, CN, VC, MP, PS, CS, WS, MDS    |
| HR4                    | The method for delivery of explosives would developed prior to the commencement of blasting in consultation with the Department of Planning and Environment and be timed to avoid the need for on-site storage.   | CN, VC, BN, MP, PS, WS              |
| <b>Operation</b>       |   |                                     |
| HR5                    | All hazardous substances that may be required for operation would be stored and managed in accordance with the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and <i>Hazardous and Offensive Development Application Guidelines: Applying SEPP 33</i> (Department of Planning, 2011).      | All                                 |

| ID                      | Mitigation measure  | Applicable location(s) <sup>1</sup> |
|-------------------------|---|-------------------------------------|
| <b>Waste management</b> |   |                                     |
| <b>Construction</b>     |   |                                     |
| WM1                     | All waste would be assessed, classified, managed and disposed of in accordance with the <i>NSW Waste Classification Guidelines</i> .  | All                                 |
| WM2                     | 100 per cent of spoil that can be reused would be beneficially reused in accordance with the project spoil reuse hierarchy.   | All                                 |
| WM3                     | A recycling target of at least 90 per cent would be adopted for the project.  | All                                 |
| WM4                     | Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.   | All                                 |
| <b>Operation</b>        |   |                                     |
| WM5                     | Generation of operation phase waste would be minimised.   | All                                 |
| <b>Sustainability</b>   |   |                                     |
| <b>Construction</b>     |   |                                     |
| SUS1                    | Sustainability initiatives would be incorporated into the detailed design and construction of the project to support the achievement of the project sustainability objectives.  | All                                 |
| SUS2                    | A best practice level of performance would be achieved using market leading sustainability rating tools during design and construction.   | All                                 |
| SUS3                    | A workforce development and industry participation strategy would be developed and implemented during construction.   | All                                 |
| SUS4                    | Climate change risk treatments would be incorporated into the detailed design of the project including: <ul style="list-style-type: none"> <li>Ensuring that adequate flood modelling is carried out and integrated with design</li> <li>Testing the sensitivity of air-conditioning systems to increased temperatures, and identify potential additional capacity of air-conditioning systems that may be required within the life of the project, with a view to safeguarding space if required</li> <li>Testing the sensitivity of ventilation systems to increased temperatures and provide adequate capacity.</li> </ul> | All                                 |
| SUS5                    | An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions.  |                                     |
|                         | Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a defined reference footprint.  | All                                 |
| SUS6                    | 25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.   | All                                 |
| <b>Operation</b>        |   |                                     |
| SUS7                    | Sustainability initiatives would be incorporated into the operation of the project to support the achievement of the project sustainability objectives.   | All                                 |
| SUS8                    | Periodic review of climate change risks would be carried out to ensure ongoing resilience to the impacts of climate change.   | All                                 |
| SUS9                    | A workforce development and industry participation strategy would be developed and implemented during operation.  | All                                 |
| SUS10                   | 100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.   | All                                 |

| ID                        | Mitigation measure   | Applicable location(s) <sup>1</sup> |
|---------------------------|--|-------------------------------------|
| <b>Cumulative impacts</b> |  |                                     |
| CU1                       | <p>Transport for NSW would manage and co-ordinate the interface with projects under construction at the same time. Co-ordination and consultation with the following stakeholders would occur, where required:</p> <ul style="list-style-type: none"> <li>○ CBD Coordination Office</li> <li>○ Department of Planning and Environment</li> <li>○ Roads and Maritime Services</li> <li>○ Sydney Trains</li> <li>○ NSW Trains</li> <li>○ Sydney Buses</li> <li>○ Sydney Water</li> <li>○ Port Authority of NSW</li> <li>○ Willoughby Council</li> <li>○ North Sydney Council</li> <li>○ City of Sydney Council</li> <li>○ Marrickville Council</li> <li>○ Sydney Motorways Corporation</li> <li>○ Barangaroo Delivery Authority</li> <li>○ Emergency service providers</li> <li>○ Utility providers</li> <li>○ Construction contractors.</li> </ul> <p>Co-ordination and consultation with these stakeholders would include:</p> <ul style="list-style-type: none"> <li>○ Provision of regular updates to the detailed construction program, construction sites and haul routes</li> <li>○ Identification of key potential conflict points with other construction projects</li> <li>○ Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve:</li> <li>○ Adjustments to the Sydney Metro construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of other construction projects</li> <li>○ Co-ordination of traffic management arrangements between projects.</li> </ul> | All                                 |

<sup>1</sup> STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg vTBM works); PSR: Power supply routes.

## 21.3 Recommended changes to conditions of approval

The assessment carried out for the proposed modification has identified recommended changes to the conditions of approval. These recommended changes, beyond the necessary changes to administrative conditions, are:

- Inclusion of the former MGM building in condition E13 relating to archival recording
- Inclusion of the former MGM building in condition E16 relating the heritage salvage.

# **JUSTIFICATION AND CONCLUSION**

CHAPTER TWENTY TWO



## 22 Justification and conclusion

Around 270,000 people enter or exit at Central Station every weekday, more than any other station on the NSW rail network. Many more customers interchange within Central Station, transferring between rail services, light rail, coaches, taxis and the bus network. The need for easy customer transfer and improved pedestrian flows at Central Station will become even more critical with the introduction of a new light rail stop on Chalmers Street as part of the CBD and South East Light Rail and the new underground metro platforms to be delivered as part of the approved project. The large number of passenger movements into, out of and through Central is forecast to increase significantly due to the growth of the transport network and public transport demand in Sydney.

Central Station has been developed over many decades leading to its current layout and configuration which hinders efficient customer transfer. There are multiple level changes between each of the existing concourses, many of which no longer comply with current design standards. The only accessible route at the station that connects all platforms is via the North Concourse under the suburban platforms.

On 15 September 2016, the Minister for Transport and Infrastructure announced the Government's intention to revitalise Central Station and commence a process of public and industry consultation. This announcement identified that, in addition to the core transport customer requirements, Central Station has the potential to be a destination itself for domestic and international visitors. By building on the primary function of transport operations, the opportunity exists to activate the public spaces, showcase the heritage elements of the station and unlock the potential of the precinct. Feedback received during this consultation process identified the need to provide improved access, connectivity and legibility within the station and across the precinct.

Delivery of the proposed modification would provide improved transport interchange efficiency between the future metro services at Central Station, suburban services and the future light rail stop on Chalmers Street. The key benefits delivered by the proposed modification would include:

- Reduced travel time to access and transfer through Central Station
- Reduced customer crowding within Central Station
- Improved safety and amenity
- Improved legibility and wayfinding
- Improved accessibility
- Reduced congestion and improved clearance times on the aboveground suburban platforms.

The proposed modification would provide a range of customer experience benefits, passenger movement and interchange benefits, and better integration with the surrounding precinct. Without the proposed modification, the future operation of the station could become compromised from excessive congestion and queuing on the aboveground suburban platforms affecting train services. A new underground concourse with efficient access that is easy to use for customers would assist with redistribution of customers within the station and improve the customer experience. These improvements to transport functionality would also be a precursor to broader precinct renewal and revitalisation opportunities.

Delivering the proposed modification and the approved project works concurrently would minimise construction impacts to customers and deliver cost, program and interface efficiencies.



Some additional minor environmental impacts would also occur as a result of the proposed modification, including:

- Direct and indirect impacts to the State heritage listed Sydney Terminal and Central Railway Station group, and demolition of the locally listed Bounce Hostel (former MGM) building
- Increased duration and magnitude of construction noise and vibration impacts for some receivers, particularly near the eastern entry
- Some short-term construction traffic impacts, including some minor deterioration of intersection performance and the need to temporarily close Randle Lane
- The need for changed customer movements within Central Station, although this would be managed through the progressive opening of new elements
- Some adverse landscape character and visual amenity impacts due to construction works
- Increased interface with potentially contaminated areas, especially associated with railway use within Central Station.

The proposed modification would be constructed in accordance with the Sydney Metro Construction Environmental Management Framework provided as part of the Submissions and Preferred Infrastructure Report for the approved project. While the project-specific mitigation measures identified for the approved project are generally sufficient to address the potential impacts of the proposed modification, some additional measures or changes to measures have been identified to manage specific potential impacts of the proposed modification. The relevant conditions of approval for the approved project would also apply, with some recommendations made in relation to potential modifications to these conditions.

Overall, the proposed modification is considered to be justified and would represent an overall beneficial outcome for the approved project, and would be the first step in addressing existing and future customer interchange and amenity issues at Central Station.

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# GLOSSARY





# Glossary

| Acronym / term     | Definition   |
|--------------------|--|
| ABS                | Australian Bureau of Statistics                                      |
| AHIMS              | Aboriginal Heritage Information Management System                    |
| BTEX               | Benzene, toluene, ethylbenzene and xylene chemicals                  |
| CCTV               | Closed circuit television  |
| CMP                | Conservation management plan   |
| CPTED              | Crime Prevention Through Environmental Design                        |
| CSELR              | CBD and South East Light Rail  |
| dB                 | Decibels   |
| dBA                | A-weighted decibels  |
| DCP                | Development Control Plan   |
| DoS                | Degree of saturation   |
| EPA                | Environment Protection Authority                                     |
| EP&A Act           | <i>Environmental Planning and Assessment Act 1979</i>                |
| EPBC Act           | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| HV                 | High voltage   |
| ICNG               | Interim Construction Noise Guideline                                 |
| ICOMOS             | International Council on Monuments and Sites                         |
| INP                | Industrial Noise Policy  |
| LEP                | Local Environmental Plan   |
| LGA                | Local Government Area  |
| LoS                | Level of service   |
| LV                 | Low voltage  |
| MGM building       | Metro Goldwyn Mayer building   |
| NCA's              | Noise catchment areas  |
| NML's              | Noise management levels  |
| OEH                | Office of Environment and Heritage                                   |
| PAHs               | Polycyclic aromatic hydrocarbons                                     |
| PCB                | Polychlorinated biphenyl   |
| pH                 | Potential of hydrogen  |
| Qha and Qhd        | Quaternary Geology   |
| RBL                | Rating background level  |
| RNP                | Road Noise Policy  |
| Roads and Maritime | Roads and Maritime Services  |
| Rwa                | Wianamatta Ashfield Shale  |
| SMF                | Synthetic mineral fibres   |
| UTS                | University of Technology Sydney                                      |
| v/c                | Ratio between traffic volumes and capacity                           |
| YHA                | Youth Hostels Australia  |

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CHATSWOOD TO SYDENHAM  
**CENTRAL WALK MODIFICATION REPORT**