

## ACOUSTICS ADVISOR ENDORSEMENT SYDNEY METRO WEST (SSI 10038)

Review of	Central Tunnelling Package: DNVIS for Sydney Olympic Park	Reviewed document reference:	21028-NV-RP-6-8
Prepared by:	[REDACTED], Alternate Acoustics Advisor		Revision 8
Date of issue:	2 November 2023 (Rev 2)		Dated: 14 August 2023

As approved alternate Acoustics Advisor (AA) for the Sydney Metro West project, I reviewed and provided comments on previous versions of Rev 8 of the Sydney Metro West – CTP – Detailed Noise and Vibration Impact Statement (DNVIS) for Sydney Olympic Park (SOP).

Revision 8 is an update to include nozzle excavation. I note that:

- Predicted noise levels for highly noise intensive work (HNIW) do not exceed  $75\text{dBL}_{\text{Aeq},15\text{minute}}$  at any residence. However, predicted noise levels for some works do exceed non-residential NMLs, and I consider therefore that Condition of Approval (CoA) D36 is triggered. AFJV advised by email that in practice they developed their methodology around the requirements of CoA D36. AFJV will need to ensure that in all cases this practice continues to be applied, as per the commitments in the DNVIS.
- The DNVIS commits to meeting evening and night-time NMLs at SOP for all activities.
- The DNVIS outlines the consultation completed by AFJV to date and the specific mitigation measures identified so far, through consultation with affected sensitive land users. It also commits to ongoing consultation to continue this process.

On this basis I endorse Rev 8 of the Detailed Noise and Vibration Impact Statement (DNVIS) for Sydney Olympic Park, in accordance with Condition of Approval A36(e).

[REDACTED]

[REDACTED], Metro West Alternate Acoustics Advisor

**Acciona Ferrovia Joint Venture  
Sydney Metro West Central Tunnelling Package  
Sydney Olympic Park**

**Detailed noise and vibration impact statement  
August 2023**

**Doc no. 21028-NV-RP-6-8**





## Detailed noise and vibration impact statement

Client	Acciona Ferrovia Joint Venture
Project	Sydney Metro West Central Tunnelling Package
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### Revision history

0	16 November 2021	Draft report to client
1	16 December 2021	Updated as per client comments
2	17 January 2022	Amendments following client and AA comments
3	17 February 2022	Amended following client comments
4	11 April 2022	Updated to include rock hammering during demolition
5	2 May 2022	Updated comments sections
6	19 May 2023	Updated nozzle activity equipment list
7	19 July 2023	Updated to address AA/ER comments
8	14 August 2023	Updated Table 6-2 for stockpile and nozzle results

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## Definition of acoustic terms and acronyms

<b>AA</b>	Acoustic Advisor
<b>AMM</b>	Additional mitigation measures – applicable where standard measures have been implemented and NML is still expected to be exceeded.
<b>Assessment period</b>	The period in a day over which assessments are made.
<b>Background noise</b>	The underlying level of noise present in the ambient noise, excluding the noise source under investigation.
<b>CSSI</b>	Critical
<b>Decibel (dB)</b>	A measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm (to base 10) of the ratio of a given sound power to a reference power.
<b>dB(A)</b>	Unit used to measure ‘A-weighted’ sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
<b>dB(C)</b>	Unit used to measure ‘C-weighted’ sound pressure levels, an adjustment made to sound level to approximate low frequency noise between 10 Hz and 200 Hz.
<b>DPIE</b>	NSW Department of Planning, Industry and Environment
<b>EIS</b>	Environmental Impact Statement
<b>Extraneous noise</b>	Noise resulting from activities that are not typical of the area such as construction, and traffic generated by holiday periods or special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
<b>Highly affected receivers</b>	Residential receivers are considered to be highly noise affected where construction activities are determined to have an $L_{Aeq}$ , 15 minute noise level of 75 dB(A) or higher.
<b>Highly noise intensive works</b>	Construction activities which are defined as annoying under the ICNG. See Section 2.1.2.
<b>ICNG</b>	Interim Construction Noise Guideline (Department of Environment and Climate Change 2009)
<b>Noise assessment criteria</b>	A standard rule or test by which the acceptability of the nature and characteristics of noise may be judged or evaluated. Criteria are generally based on guidelines or standards developed by Government agencies (eg EPA) to protect the majority of people for the majority of the time from adverse impacts.
<b>NCA</b>	Noise Catchment Area

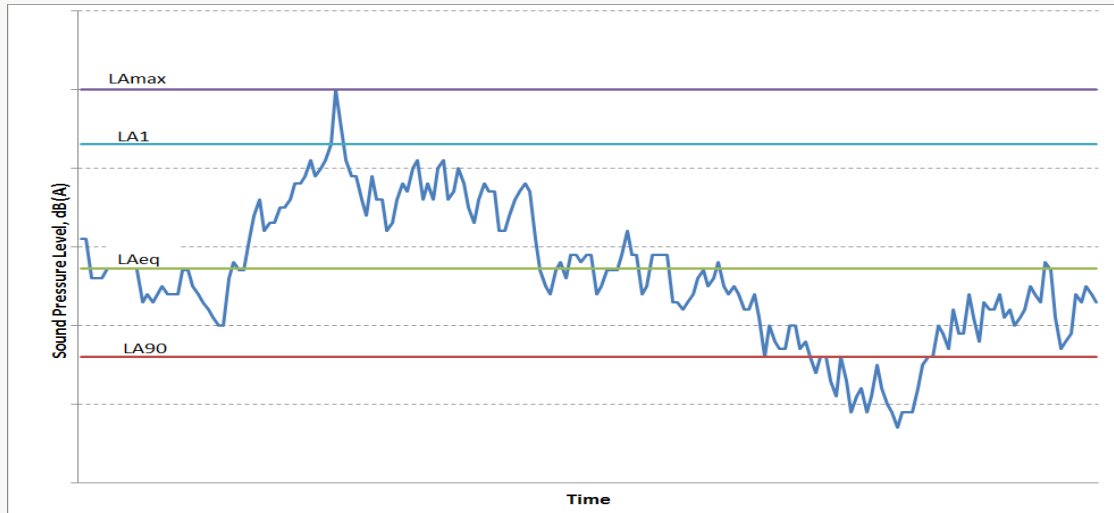
### Noise level statistics

$L_{A90}$  – The A-weighted sound pressure level exceeded 90% of the monitoring period. This is considered to represent the background noise.

$L_{Aeq}$  – The equivalent continuous A-weighted noise level—the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

$L_{A1}$  – The A-weighted sound pressure level exceeded 1% of the monitoring period.

$L_{Amax}$  – The maximum A-weighted noise level associated with the measurement period.



<b>NML</b>	Noise Management Level
<b>PPV</b>	Peak Particle Velocity – Measurement of ground-borne vibration in units of mm/s
<b>RBL</b>	Rating Background Level - a single figure that represents the background noise level for assessment purposes
<b>ROL</b>	Road Occupancy Licence – granted by Transport for NSW and required for any activity likely to impact on traffic flow.
<b>Sound Power Level (SWL)</b>	The A-weighted sound power level is a logarithmic ratio of the acoustic power output of a source relative to 10-12 watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

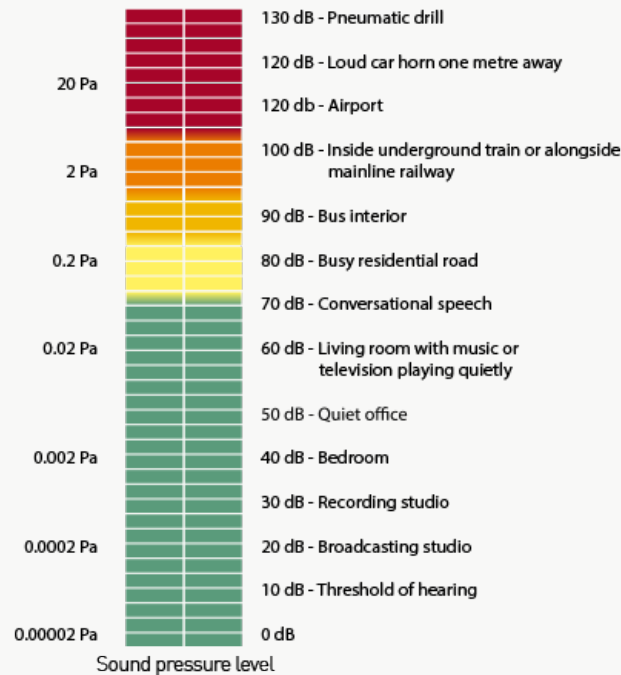


### Sound Pressure Level (SPL)

This is the level of noise, usually expressed in dB(A), as measured by a standard sound level meter with a pressure microphone. The sound pressure level in dB(A) gives a close indication of the subjective loudness of noise.

A technical definition for the sound pressure level, in decibels, is 20 times the logarithm (base 10) of the ratio of any two quantities related to a given sound pressure to a reference pressure (typically 20  $\mu$ Pa equivalent to 0 dB). Examples of typical sound pressure levels are shown below.

Threshold of pain



Source: [https://www.osha.gov/dts/osta/otm/noise/health\\_effects/soundpropagation.html](https://www.osha.gov/dts/osta/otm/noise/health_effects/soundpropagation.html)

### Tonal noise

Noise with perceptible and definite pitch or tone

### VDV

Vibration dose value – used when assessing intermittent vibration as it is sensitive to peaks in vibration acceleration and accumulates the vibration energy received over the daytime and night-time periods

**\*Note: Additional definitions for construction related terms can be found in the Project Conditions of Approval.**



# 1. Introduction

## 1.1 Project overview

Sydney Metro is Australia's biggest public transport program comprising four main packages of work including Metro North West Line, Sydney Metro City and Southwest, Sydney Metro West and Sydney Metro Greater West. The Sydney Metro West component involves the construction and operation of a metro rail line, around 24km in length, between Westmead and the Sydney CBD.

The planning approvals and environmental impact assessment for Sydney Metro West has been split into a number of stages recognising the size of the project. This includes:

- Stage 1 – Concept and all major civil construction works including station excavation and tunnelling between Westmead and The Bays. Planning approval for this stage was granted in March 2021.
- Stage 2 – All major civil construction works including station excavation and tunnelling from The Bays to Sydney CBD.
- Stage 3 – Tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line.

Acciona Ferroviaria Joint Venture (AFJV) was commissioned to deliver the Central Tunnel Package of Stage 1, comprising excavation of five station boxes and around 11.5 kilometres of twin-bore tunnel between The Bays and Sydney Olympic Park (the Project). An overview of the Project is presented in Figure 1-1, which includes the tunnel alignment and location of the station boxes at:

- The Bays
- Five Dock
- Burwood North
- North Strathfield
- Sydney Olympic Park

This Detailed Noise and Vibration Impact Statement (DNVIS) covers activities for construction of Sydney Olympic Park Station box located adjacent to the existing Sydney Olympic Park train station and comprises several phases including:

- Site establishment
- Excavation of the station box
- Tunnelling
- Demobilisation

An overview of the site layout of Sydney Olympic Park is presented in Figure 1-2.

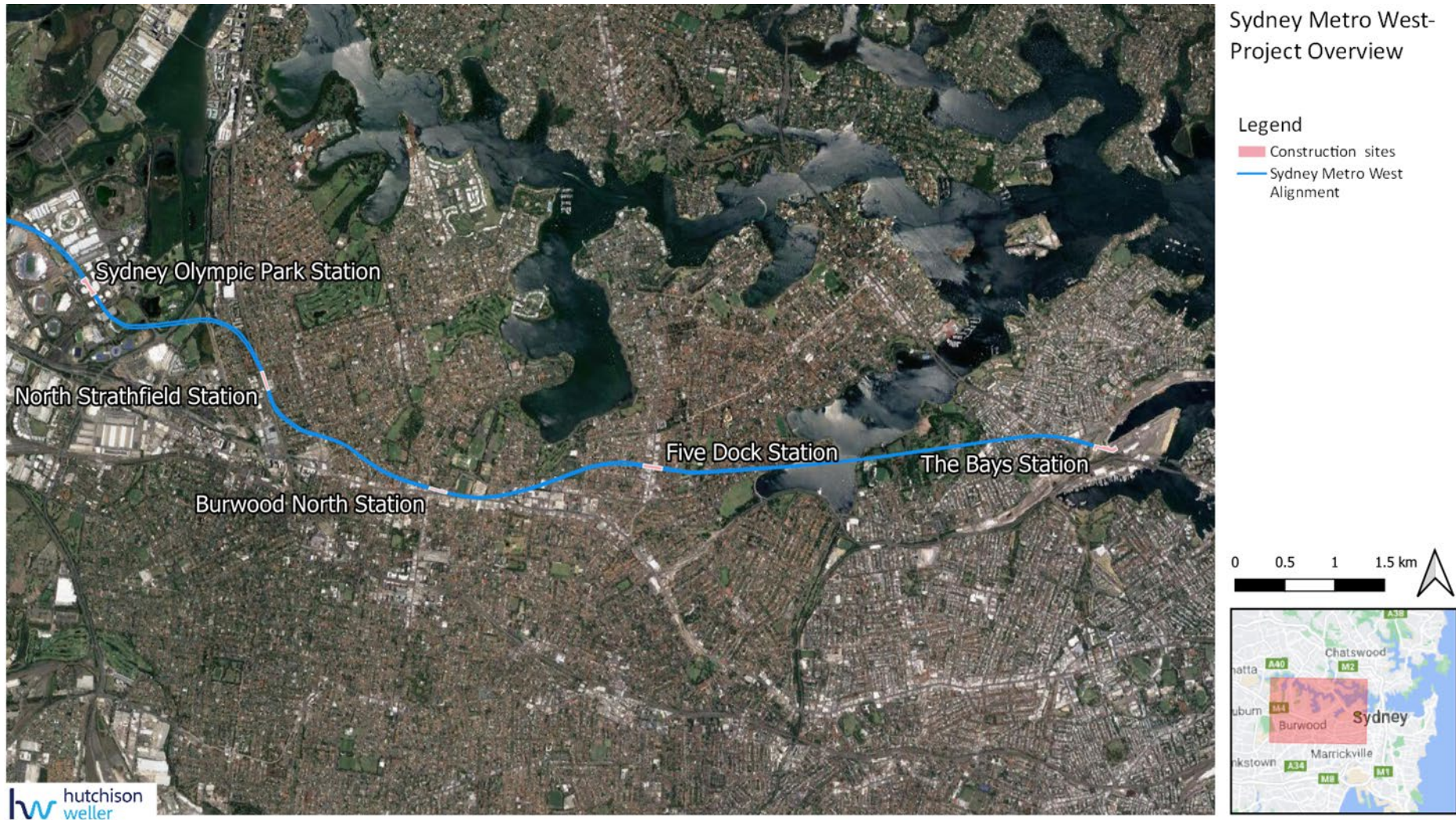


Figure 1-1 Overview of the CTP of Stage 1 of the Sydney Metro West Project.



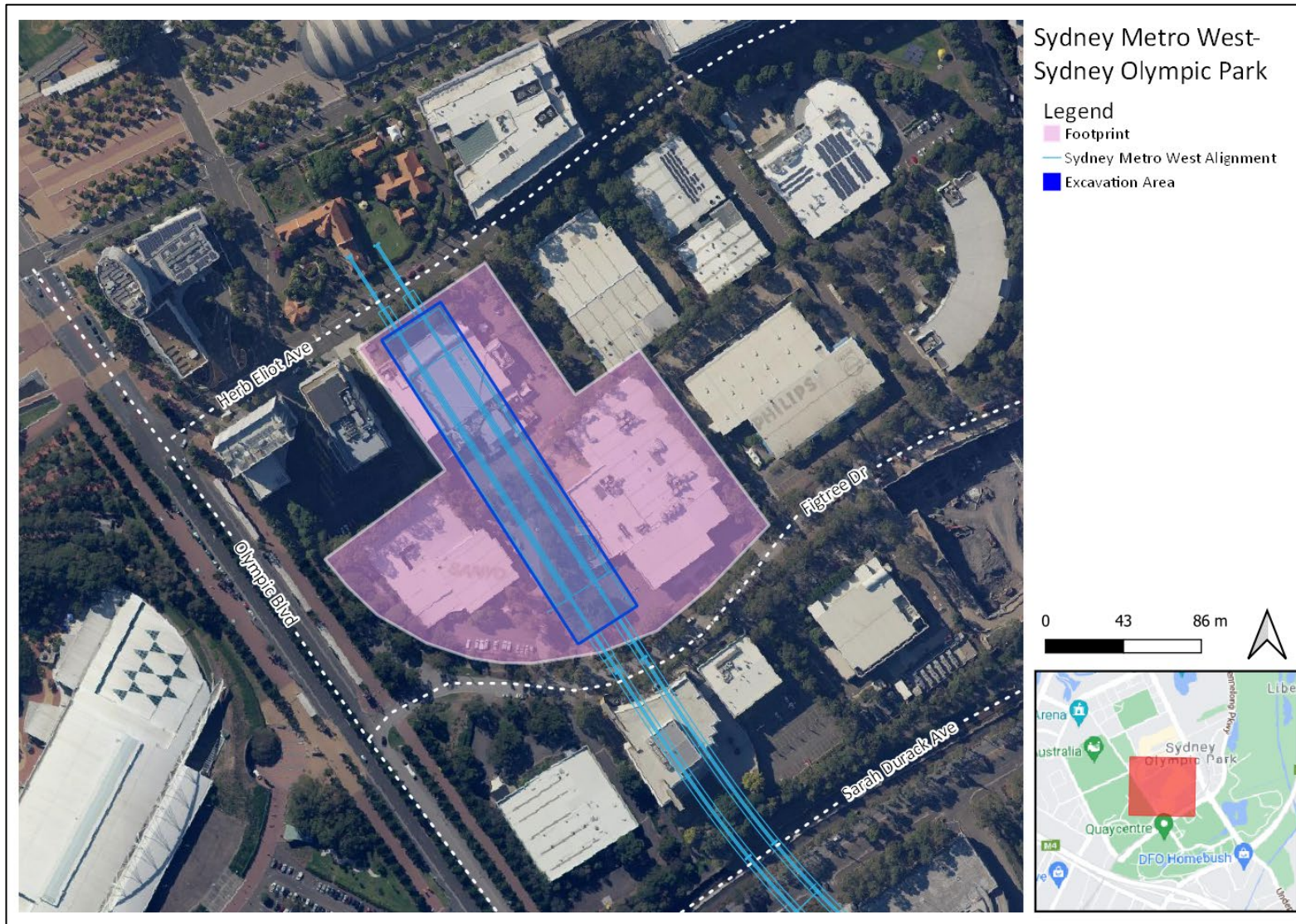


Figure 1-2 Sydney Olympic Park construction site

## **1.2 Detailed noise and vibration impact statement**

Considering the risk of noise and vibration impact is necessary to ensure appropriate mitigation and management measures can be applied. This Detailed Noise and Vibration Impact Assessment (DNVIS) has been prepared in accordance with the Sydney Metro (2020) Construction Noise and Vibration Standard, v 4.3 (CNVS) and supplements the Project's Construction Noise and Vibration Management Plan (CNVMP) as required in the Project's Condition of Approval (CoA) D43.

The objective of the DNVIS is to establish the location, nature and scale of proposed works, assess the level of impact on the community's amenity and include mitigation measures identified through consultation with affected sensitive land users.

The structure of this DNVIS meets the requirements of the Condition of Approval D43 and the CNVS and includes:

- Section 2 – Construction works and hours
- Section 3 – Identification of noise and vibration sensitive receivers and existing noise levels
- Section 4 – Construction noise and vibration objectives
- Section 5 – Description of planned works, equipment and sound power levels
- Section 6 – Construction noise assessment – predicted noise levels and exceedances of objectives, including sleep disturbance
- Section 7 – Construction vibration assessment
- Section 8 – Traffic noise assessment
- Section 9 – Mitigation and management, including consultation

## 2. Construction works and hours

### 2.1 Planned works

Activities associated with construction of the Sydney Olympic Park station box are summarised in Table 2-1, which will be completed in three main phases for each site generally including establishment, excavation and tunnelling support.

Works commenced in November 2021 and will continue for around 3 years. The current program is illustrated in Table 2-2 and shows the duration of each phase. All construction works would occur during standard hours of operation.

Currently the site is excavated to around 20 metres below surface level with piling and ripping excavation completed. Nozzle excavation work at the northern end of the station box has commenced with loading out of spoil via a telescopic excavator during approved of operation.

The updated nozzle activity assessed for this DNVIS includes the addition of concrete pumping equipment at the surface of the site surface and the telescopic excavator.

This DNVIS addresses the activities and impacts from the construction work phases as detailed in Table 2-1 .

**Table 2-1 Summary of proposed activities at Sydney Olympic Park Station Box**

Construction phase	Activity		Outside approved hours?
<b>1. Site Establishment</b>	1a	General activities	No
	1b	Demolition/Earthworks	No
	1c		
	1d	Fencing & hoarding	No
	1e	Utilities disconnection/relocation	No
	1f	Site Concrete Works	No
<b>2. Station Box Excavation</b>	2a	Piling	No
	2b	Capping beams	Detailed excavation, break back & capping beam
	2c	Active anchors	Ground stabilisation
	2d	Excavation	Other Than Rock (OTR) – Dozer (No ripping)
	2e		Rippable – Dozer (Ripping)
	2f		Non-rippable – Excavators with hammers or eccentric rippers
	2g		Grouting
<b>3. Mucking out &amp; Tunnel Nozzle</b>	3a	Spoil handling	Clearing during OTR – No Kibble
	3b	Tunnel Nozzle Excavation	No
	3c	Tunnel Nozzle Concrete Lining	No
<b>4. TBM Retrieval</b>	4a	Retrieval	No



Table 2-2 Anticipated program for Sydney Olympic Park

Sydney Olympic Park		2023							2024											
Phase	Activity	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station Box	1. Site Establishment/Demob																			
	2. Station Box Excavation																			
	3. Mucking out & Tunnel Nozzles																			
	4. TBM Retrieval																			

## 2.1.1 Approved construction hours

Working hours are set by CoA D35 to D36 as summarised in Table 2-3. Use of power saws, rock breakers, drills and other tonal or impulsive activities are defined as annoying under the Interim Construction Noise Guideline (ICNG) and are 'highly noise intensive works'.

**Table 2-3 Approved construction hours**

CoA	Construction activity	Monday to Friday	Saturday	Sunday / Public holiday
D35	Approved construction	7:00 am to 6:00 pm	8:00 am to 6:00 pm	No work (unless approved under out-of-hours work protocol)
D36	Highly noise intensive works	8:00 am to 6:00 pm <sup>1</sup>	8:00 am to 1:00 pm <sup>1</sup>	No work (unless approved under out-of-hours work protocol)

Notes:

1. if continuously, then not exceeding three hours, with a minimum cessation of work of not less than one hour.

## 2.1.2 Variations to work hours

In some circumstances, the planned construction activities would be undertaken outside the hours described in CoA D35 and D36. As specified in the Conditions of Approval, these activities include those which are:

- Low impact as described in CoA D37b), including:
  - i. construction that causes LAeq(15 minute) noise levels:
    - no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and
    - no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and
  - ii. construction that causes LAFmax(15 minute) noise levels no more than 15 dB(A) above the rating background level at any residence; or
  - iii. construction that causes:
    - continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or
    - intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006).
- By Prescribed Activity, as described in CoA D37d) and applying to Sydney Olympic Park construction scenarios:
  - i. tunnelling (excluding cut and cover tunnelling and surface works) which is permitted 24 hours a day, seven days a week; or
  - ii. delivery of material that is required to be delivered outside of standard construction hours in Condition D35 of this schedule to directly support tunnelling activities
  - iii. work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in (b) above, unless otherwise agreed by the Planning Secretary.



### 3. Existing environment

#### 3.1 Existing environment

The Sydney Olympic Park site is in the heart of Sydney Olympic Park at the intersection of Olympic Boulevard and Figtree Drive and covers an area of around 3 hectares. Adjacent land uses to this site are mostly commercial with some mixed-use commercial/ residential buildings. There are additionally three hotels located directly adjacent to the site to the north west.

The closest residences are located along Figtree Drive and Australia Avenue. These residences are high rise apartments that are likely to overlook the construction site. To the north of the site is also the heritage conservation area 'State Abattoirs' which comprises the area bounded by Herb Elliott Avenue, Showground Road, Dawn Fraser Avenue and the Railway Garden, containing the Avenue of Palms, administration building precinct and landscaped gardens.

The acoustic environment In all areas is described in the EIS as dominated by road traffic noise along transport corridors such as Sarah Durack Avenue, and the adjacent Western Motorway.

To assess and manage construction noise and vibration impacts, a detailed land use survey was prepared for the Project in line with CoA D34, with results of the survey provided in the Construction Noise and Vibration Management Plan (CNVMP) and relevant land uses to Sydney Olympic Park presented in Appendix A of this DNVIS.

#### 3.2 Heritage items

There was one area of heritage value directly adjacent to the construction site identified in the EIS. This item will be considered for impacts of vibration-intensive activities.

- Heritage Conservation Area- State Abattoirs this includes an assortment of attractive Federation era brick buildings with terracotta tiled roofs and plastered walls, a carriage loop, palm grove, garden beds, interpretive elements, and other landscaping.

#### 3.3 Noise catchment areas

To facilitate the assessment of noise impacts from the project and to apply representative Noise Management Levels (NMLs) to all receivers, receivers adjacent to the Sydney Olympic Park sites have been divided into Noise Catchment Areas (NCAs). The Sydney Olympic Park site contains two noise catchments (NCA08 and NCA09).

NCAs group individual sensitive receivers by representative traits such as existing noise environment and potential exposure to noise and vibration from the Project.

NCAs established as part of the EIS are summarised in Table 3-1 and illustrated in Figure 1-1. Background noise monitoring has been completed as part of the EIS to apply appropriate NML to each NCA (see Section 4.2).

**Table 3-1 Summary of work areas, Noise Catchment Areas and land uses**

NCA	Location	Description	Ambient noise influences
NCA08	Olympic Park, western portion	Covers the western portion of Olympic Park near the existing Olympic Park Station. This catchment is mainly of commercial and sporting related uses, with some 'other sensitive' receivers including hotels and educational facilities. Residential apartment blocks are in the south, east and west.	Existing noise is controlled by distant road traffic noise from the M4 Motorway and Homebush Bay Drive, some rail noise, and general noise from the sports and entertainment complex.
NCA09	Olympic Park, eastern portion	Covers the eastern portion of Olympic Park and is a mixture of commercial and residential. There are several high-rise residential apartment buildings near Australia Avenue.	

## 3.4 Background noise survey

Background noise monitoring was undertaken as part of the Sydney Metro West Project EIS (Section 2, Technical Paper 2) through unattended background noise monitoring at representative locations. Monitoring was completed in March and July 2019 for each of the NCAs listed in Table 3-1.

Ambient noise around Sydney Olympic Park is heavily influenced by traffic flows that generate lower noise levels during the night-time than the daytime and evening periods. This pattern of reduced noise levels in the evening and night time is characteristic of urban and suburban areas, where there is no industrial or infrastructure noise influences.

The baseline information was used to establish the Rating Background Level (RBL), which represents the average minimum background sound level for each measurement period, averaged over the measurement days. The RBL at each NCA is provided in Table 3-2.

**Table 3-2 Background noise levels**

NCA	Noise level (dBA) <sup>1</sup>		
	Day <sup>2</sup>	Evening <sup>2</sup>	Night <sup>2</sup>
NCA08	48	48	46
NCA09	48	46	41

Notes:

1. The RBL values have been extracted from the EIS; refer to Table 4 in the EIS Technical Paper 2.
2. Daytime is 7:00am to 6:00pm, evening is 6:00pm to 10:00pm and night-time is 10:00pm to 7:00am.

## 4. Noise and vibration assessment criteria

### 4.1 Overview

Project CoA D43 requires works to be assessed within this DNVIS where they may exceed the NMLs, vibration criteria and/or ground-borne noise levels specified in CoA D39 and D40 at any residence outside construction hours identified in CoA D35, or where receivers will be highly noise affected.

This DNVIS includes specific mitigation measures identified through consultation with affected sensitive land user(s) and these mitigation measures will be implemented for the duration of site establishment and shaft construction activities.

This DNVIS has been provided to the AA and ER before the commencement of the planned works.

CoA D39 requires noise and vibration from construction activity to be managed with guidance from:

- Noise: the Interim Construction Noise Guideline (ICNG, DECC 2009)
- Vibration for human exposure: Assessing Vibration: A Technical Guideline (DEC, 2006)
- Vibration for building damage: BS 7385 Part 2-1993 – Evaluation and measurement for vibration in buildings Part 2, and
- Vibration for damage of unsound heritage items: DIN 4150-3 Structural Vibration – effects of vibration on structures.

The over-arching document for assessment and management of noise and vibration impacts on this Sydney Metro project is the Sydney Metro *Construction Noise and Vibration Standard* (CNVS, vers. 4.3, Transport for NSW 2020). The following sections outline the framework of these guidelines and the way this DNVIS will assist to assess and manage impacts.

### 4.2 Noise

#### 4.2.1 ICNG

The CNVS refers to the *Interim Construction Noise Guideline* (ICNG) (DECC 2009), which provides guidance on management of construction noise. The ICNG notes noise that exceeds background noise levels may result in adverse impacts and an increased likelihood of complaints.

During approved hours, where construction noise is within 10 dB(A) of the RBL, impacts are considered acceptable. Where construction noise is more than 10 dB(A) above the RBL, a residential receiver is taken to be noise affected and the proponent should undertake all reasonable and feasible steps to manage the impact and consult with the affected community.

Above a  $L_{Aeq, 15 \text{ minute}}$  noise level of 75 dB(A), a residential receiver is considered to be highly noise affected, requiring respite to be given in consultation with the regulatory authority and the community.

Outside approved construction hours, construction noise at a residential receiver more than 5 dB(A) above the RBL is taken to be noise affected.

In addition, noise from activities/equipment such as rock hammers, impact piling, or other impulsive noise sources usually result in greater annoyance than continuous construction noise. A 5 dB(A) penalty is applicable to such activities prior to comparison with the NMLs and a 3 hours on, 1 hour off respite schedule applies.

A noise level above  $L_{Aeq, 15min}$  70 dB(A) at a commercial property is considered to warrant noise mitigation. Similarly, an industrial facility would warrant noise mitigation at  $L_{Aeq, 15 minute}$  noise levels above 75 dB(A).

Table 4-1 presents management levels for noise at other relevant sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

Internal noise levels are assessed at the centre of the occupied room. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences.

**Table 4-1 NMLs for non-residential sensitive receivers**

Sensitive receiver type	NML applicable when in use, $L_{Aeq, 15 min}$
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Childcare centres <ul style="list-style-type: none"> <li>- sleeping areas</li> <li>- play areas</li> </ul>	Internal noise level 45 dB(A) External noise level 65 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

### 4.2.2 Sleep disturbance

The CNVS requires maximum noise levels to be analysed in terms of the extent and number of times the maximum noise exceeds specific noise trigger levels, in general accordance with the Noise Policy for Industry (nPfi) (EPA 2017). These triggers are:

- $L_{Aeq, 15 minute}$  40 dBA or the prevailing RBL plus 5 dB, whichever is greater, and the
- $L_{Amax}$  52 dBA or the prevailing RBL plus 15 dB, whichever is greater.

The nPfi also recommends the DECCW (2011) Road Noise Policy (RNP) be reviewed for further risk assessment. The RNP recommends maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep and one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.

### 4.2.3 Ground-borne noise

CoA D40 requires all reasonable and feasible mitigation measures to be applied when the following residential ground-borne noise levels are exceeded. These levels are only applicable when ground-borne noise levels are higher than airborne noise levels at residential receivers during the evening and night periods.

- evening (6:00 pm to 10:00 pm) — internal  $L_{Aeq}(15 minute)$ : 40 dB(A); and
- night (10:00 pm to 7:00 am) — internal  $L_{Aeq}(15 minute)$ : 35 dB(A).

## 4.2.4 Construction traffic

While operating within the construction site, construction vehicles are assessed as part of the construction activity of which they are a part. However, once these vehicles leave the construction site and enter public roads, they are assessed as road traffic.

The Road Noise Policy (RNP) is generally adopted to assess the impact of construction traffic on public roads. A screening test is first applied to establish whether existing road traffic noise levels will increase by more than 2 dB due to construction traffic. Where any noise increase is less than 2 dB, the objectives of the Road Noise Policy have been met.

The CNVS recommends, where the road traffic noise levels are predicted to increase by more than 2 dB as a result of construction traffic, consideration should be given to feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

In considering feasible and reasonable mitigation measures, the actual noise levels associated with construction traffic and whether these levels comply with the road traffic noise criteria in the RNP would be reviewed.

- 60 dB LAeq(15hour) day and 55 dB LAeq(9hour) night for existing freeway/ arterial/ sub-arterial roads.
- 55 dB LAeq(1hour) day and 50 dB LAeq(1hour) night for existing local roads.

## 4.2.5 Additional mitigation measures

The CNVS builds on the guidance provided by the ICNG and recommended further mitigation measures where all reasonable and feasible mitigation measures to minimise noise at the nearest receivers have been implemented and construction noise is still predicted to exceed the noise or vibration objectives. The Additional Mitigation Measures Matrix (AMMM) for airborne and ground-borne noise taken from the CNVS are presented in Table 4-2 and.

**Table 4-2 Additional Mitigation Measures Matrix for airborne noise (CNVS)**

Construction hours	dB above NML	Additional management measures
<b>Approved hours</b> Monday – Friday: 7am – 6pm Saturday: 8am to 6pm	0 to 10	-
	10 to 20	LB
	20 to 30	LB, M, SN
	>30	LB, M, SN
<b>Evening</b> Monday – Friday: 6pm – 10pm Saturday: 7am – 8am, 6pm – 10pm Sunday / PH: 8am – 6pm	0 to 10	LB
	10 to 20	LB, M
	20 to 30	LB, M, SN, RO
	> 30	LB, M, SN, IB, PC, RO
<b>Night</b> Monday – Saturday: 10am – 7am Saturday: 10pm – 8am) Sunday / PH: 6pm – 7am	0 to 10	LB
	10 to 20	LB, M, SN, RO
	20 to 30	LB, M, SN, IB, PC, RO, AA
	> 30	LB, M, SN, IB, PC, RO, AA

Notes:      PN = Project notification      SN = Specific notification  
               M = monitoring                      LB = Letterbox drops  
               IB = Individual briefings        DR = Duration reduction  
               AA = Alternative accommodation      RO = Project specific respite offer

Table 4-3 Additional Mitigation Measures Matrix for ground-borne noise (CNVS)

Construction hours	dB above NML	Additional management measures
<b>Approved hours</b> Monday – Friday: 7am – 6pm Saturday: 8am to 6pm	No NML for ground-borne noise during standard hours (refer to Table 4-7)	
<b>Evening</b> Monday – Friday: 6pm – 10pm Saturday: 7am – 8am, 6pm – 10pm Sunday / PH: 8am – 6pm	0 to 10	LB
	10 to 20	LB, M, SN
	> 20	LB, M, SN, IB, PNN, RO
<b>Night</b> Monday – Saturday: 10am – 7am Saturday: 10pm – 8am) Sunday / PH: 6pm – 7am	0 to 10	LB, M, SN
	10 to 20	LB, M, SN, IB, PC, RO, AA
	> 20	LB, M, SN, IB, PC, RO, AA

Notes: PN = Project notification SN = Specific notification  
M = monitoring LB = Letterbox drops  
IB = Individual briefings DR = Duration reduction  
AA = Alternative accommodation RO = Project specific respite offer

### 4.3 Project-specific construction noise management levels

Based on the measured RBLs for each NCA and requirements of the ICNG and CNVS, project-specific NMLs are summarised in Table 4-4. NMLs for non-residential receivers are described in Table 4-1.

Table 4-4 Noise management levels

NCA	Noise Management Level, $L_{Aeq}$ 15 minute						
	Approved hours		Outside approved hours				
	Noise affected	Highly noise affected	Day	Evening	Night	Sleep disturbance (CNVS)	
						$L_{Aeq}$ , 15 minute	$L_{Amax}$
NCA08	58	75	53	53	51	51	61
NCA09	58	75	53	51	46	46	56

## 4.4 Vibration management

### 4.4.1 Human comfort

When assessing human exposure to construction-related vibration, the CNVS requires vibration goals to be established using *Environmental Noise Management Assessing Vibration: A Technical Guideline* (DECC 2006), which provides criteria for the assessment of vibration impacts on humans.

Construction activities typically generate vibration of an intermittent nature, which is assessed using a Vibration Dose Value (VDV). Acceptable values of vibration doses are presented in Table 4-5 for sensitive receivers.

**Table 4-5 VDV Vibration criteria**

Receiver type	Low probability of adverse comment (m/s <sup>1.75</sup> )	Adverse comment possible (m/s <sup>1.75</sup> )	Adverse comment probable (m/s <sup>1.75</sup> )
Residential buildings – 16 hour day (7am to 11pm) <sup>1</sup>	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings – 8 hour night (11pm to 7am) <sup>1</sup>	0.13	0.26	0.51

Note 1: Day time and night time as described in BS6472:1992 (as referenced in the CNVS), i.e. a daytime period of 16 h or a night time period of 8 h, for example 23.00 h to 07.00 h.

### 4.4.2 Buildings

Potential building damage from construction vibration requires the application of values in BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2. These values are presented in Table 4-6 and relate to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

**Table 4-6 Guideline values for vibration velocity for the effects of short-term vibration on structures (BS 7385).**

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz to 50 mm/s at 40 Hz and above

Where vibration may give rise to magnification due to resonance, especially at lower frequencies where lower guide values apply, the guide values may be reduced by 50%. The CNVS describes rock breaking/hammering and sheet piling activities as having potential to cause dynamic loading in some structures (e.g. residences).

For activity involving rock breakers, piling rigs, vibratory rollers, excavators, vibration predominantly occurs at frequencies in the 10 Hz to 100 Hz range. On this basis, a conservative vibration damage screening level is:

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

### 4.4.3 Heritage

Heritage buildings and structures would be assessed under a conservative cosmetic damage objectives of 2.5 mm/s peak component particle velocity (from DIN 4150). Where vibration levels at heritage items are identified as exceeding this screening level, structural assessment would be completed by the Project team to confirm the structure's sensitivity to vibration. If a heritage building or structure is found to be structurally unsound



(following inspection) the conservative criterion would stand. Where the structure is suitably sound, the guideline values from Table 4-6 would be applicable.

### 4.4.4 Additional mitigation measures

The CNVS recommends additional mitigation measures where all standard mitigation measures to minimise vibration at the nearest receivers have been implemented and vibration is still predicted to exceed the maximum guideline values. The Additional Mitigation Measures Matrix (AMMM) for vibration from the CNVS is presented in Table 4-7. Acronyms are defined at Table 4-2.

**Table 4-7 Additional Vibration Mitigation Measures (CNVS)**

Construction hours	Mitigation measures where predicted vibration levels exceed maximum levels
<b>Approved hours</b> Monday – Friday: 7am – 6pm, Saturday: 8am to 6pm	LB, M, RO
<b>Evening</b> Monday – Friday: 6pm – 10pm; Saturday: 7am – 8am, 6pm – 10pm; Sunday / PH: 8am – 6pm	LB, M, IB, PC, RO, SN
<b>Night</b> Monday – Saturday: 10am – 7am Saturday: 10pm – 8am; Sunday / PH: 6pm – 7am	LB, M, IB, PC, RO, SN, AA

## 5. Impact assessment

### 5.1 Plant and equipment

A summary of proposed activities at the Sydney Olympic Park site was provided in Table 2-1. Nominal equipment and estimated sound power levels of each item and activity are presented in Appendix B. No work is proposed outside the approved construction hours.

During site establishment, several activities were undertaken concurrently so cumulative impacts were assessed as part of this DNVIS.

Sound power levels (SWLs) and predicted noise levels depend on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. The SWLs include item quantities and nominal usage factors (proportion of a 15-minute assessment period the equipment would be operating at its maximum noise output).

### 5.2 Noise modelling

SoundPlan noise modelling software was used to calculate noise impacts in accordance with the ISO9613 prediction method at all identified noise-sensitive receivers. The model included:

- Topography – 1 metre DEM based on LPI Lidar data.
- Individual buildings for façade calculations and to account for shielding and reflections. Building heights are also taken from Lidar data.
- Individual sensitive receivers – One receiver location representing each residential dwelling and located 1.5 metres above most affected floor level (e.g. level 2) and most-affected façade at up to around 600 metres radius.
- Construction noise sources – Activities and equipment included in the noise model as area sources in locations specified by AFJV. SoundPlan takes the worst-case point within each area to perform its calculations, a conservative approach. Sound power levels in Appendix B. Source is modelled at 1.5 metres above ground.
- Shaft excavation depth was accounted for in the modelling.
- Meteorology – worst-case conditions: gentle breeze (3-5 m/s) source to receiver and stable conditions (conducive of temperature inversion).

### 5.3 Mitigation measures included in the modelling

Mitigation measures would be implemented to ameliorate noise impacts as standard practice throughout the works. Mitigation measures, which may affect the predicted levels include the following, which have been incorporated in the assessment as base assumptions for noise predictions.

- Source noise control strategies:
  - Where the NML outside approved hours cannot be achieved, work is not proposed to be undertaken unless unavoidable and completed under the procedures contained in the CNVMP.
  - Equipment sound power levels will not exceed those described in Table 13 of the CNVS.
  - Residential grade mufflers fitted to all mobile plant, with equipment maintained and operated effectively.
  - ‘Damped’ rock hammers with reductions of around 10 dB in comparison to similar sized un-damped hammers

- No shouting or swearing or playing of loud radios
- Engine and exhaust brakes avoided
- Stationary plant placed behind larger objects or as far from receivers as possible
- Engines switched off when not in use for extended periods (15 minutes) and no idling trucks in front of residences
- Dropping of heavy objects or metal-on-metal impacts avoided
- Non-tonal reverse alarms installed on all mobile equipment regularly used on the project.

The above measures have been included in the assessment and are reiterated in Section 7.

- Noise barrier control strategies:
  - No hoarding has been considered in the modelling of noise from the Sydney Olympic Park site. The location of adjacent multi-story buildings reduces the effectiveness of hoarding around the boundary, which in some instances is over 100 metres from the noise source in the direction of the receivers.
  - Moveable hoarding of 2.4 metres in height is proposed for the site but has not been included in the noise model for the assessment of impacts since its configuration and application is not known at this time.
- Acoustic sheds
  - The Sydney Olympic Park site was assessed for 24 hour operations for the Environmental Impact Statement. AFJV have determined that works can be completed within the program time frame within standard construction hours. As works are to be wholly undertaken during standard construction hours there is no acoustic shed proposed for the site.

## 6. Predicted noise levels

### 6.1.1 Overview

Construction work at Sydney Olympic Park is to be undertaken during standard operating hours for all activities. A summary of predicted noise levels for approved hours works is provided in the following sections for each construction phase. Detailed results for all sensitive receivers are provided in Appendix D.

Noise contours for typical noisy activities are presented in Appendix C. The contours demonstrate the extent of the worst-case cumulative impacts and illustrate buildings around the work sites generally providing good noise screening.

### 6.1.2 Phase 1 - Site establishment

Site establishment was undertaken across the whole site with noisy activities such as demolition and utilities relocation occurring within about 10-15 metres of the nearest commercial receivers. During the initial demolition phase of the works, use of excavator mounted hammers was minimised in favour of demolition jaws and Erkat head. Rock hammers however, were used break up the foundation slabs during the final stages of the site clearing.

Site establishment was completed during standard hours with respite periods incorporated into the construction program. During the establishment works, exceedances in NML were predicted for some impact classes however, as the site is around three hectares in area, these higher noise levels are only apparent when the work is closest to the affected receiver locations.

The closest receivers are commercial operations at 6 Herb Elliot Drive, 10 Herb Elliot Drive, and 3 Figtree Drive which have a higher threshold for noise impacts than residential receivers. The buildings at 6 Herb Elliott Drive and 3 Figtree Drive have limited window area facing the site, which will minimise noise transmission into workspaces adjacent to the site.

At 10 Herb Elliot Drive the upper floors are fully glazed, which will limit the amount of noise reduction across the facade. These facades also overlook the northern half of the site and would not gain any benefit from local hoarding around the excavation area.

The Pullman and Ibis hotels have some shielding from direct impacts depending on the location of the work but are likely to experience high noise levels at various times during the establishment phase. Residential receivers are generally located further from the site, reducing the direct noise impacts from daily activities.

The highest impacts occur during demolition works using rock hammers where around 18 commercial receivers would experience noise levels >75 dB(A). The noise impact class for the 0-10 dB above daytime NML range would be exceeded for about 19 receiver locations and a further 8 receivers may experience exceedances of up to 20 dB above NML.

During the demolition phase, the Ibis and Pullman hotels would each experience noise levels of up to 68 and 70 dB(A) respectively on the most affected facades during some portions of the work. As the demolition proceeds, these levels would decrease due to distance and shielding from neighbouring buildings.

Highly noise intensive work is undertaken in accordance with COA D36 and are reflected in Table 7-1 detailing standard mitigation measures relating to construction hours.

A summary of maximum predicted noise levels at residential and non-residential land uses and predicted exceedances of the NMLs are presented in Table 6-1.

### 6.1.3 Phase 2 – Station box construction

At Sydney Olympic Park the initial station box construction activities are primarily surface works in the excavation zone shown in Figure 1-2. These works include the piling, pouring and breaking of capping beams and installation of active ground anchors. The highest impact during these works will be from the installation of active anchors with a maximum expected noise level of around 79 dB(A) at the closest commercial receiver. Residential receivers would experience a maximum noise level of around 60 dB(A). Where a non-percussive drill rig is used for this work, predicted noise impacts will be minimised and the maximum noise levels reduced accordingly.

The highest impacts for the station box construction are expected to occur during the rippable phase of the work at around 6 metres below ground level. Noise impacts during this times are higher due to the use of rock breakers and percussive drill rigs respectively.

The noise impacts from ripping and other noisy work are largely mitigated by the depth of the station box, which provides significant shielding for most nearby receivers. Being multi storey buildings, the closest receivers at 10 Herb Elliot Avenue and 6 Figtree Drive would experience the highest noise levels with the upper floors overlooking the works. The Pullman Hotel would also have a line of sight to sections of the work area during ripping of the station box, with this activity indicating the highest noise level for the hotel of around 74 dB(A) during the noisiest part of the excavation.

When ripping work commences at around 6 metres depth, 23 receiver locations are expected to exceed the NML in the 0-10 dB(A) range and about 2 receivers would exceed in the 10-20 dB(A) range. During ripping, up to 5 commercial receivers experiencing levels of more than 75 dB(A) at various times with noise impacts reducing across the board as the depth of activity, and therefore the available shielding, increases.

Once at the station box floor, excavation work continues to the tunnel nozzles located at the northern end of the site. Initially, equipment would be located within the station box where shielding from the station box walls would provide some noise reduction during the noisiest activities. As work progresses into the nozzles, this shielding will increase.

Noise impact during the nozzle excavation would be minimal due to the depth of the station box below the natural surface and the location of the bulk of the equipment inside the tunnel portal. Noise contours showing the extent of the predicted impacts are presented in Appendix C.

As there are no evening or night works planned for the Sydney Olympic Park station box site, noise impacts are managed in accordance with the project CNVMP that includes mitigation and management measures outlined in Section 7.1.2 of this report.

A summary of noise level impacts for the excavation phase of works is presented in Table 6-2.

### 6.1.4 Sleep disturbance

There are no activities proposed outside approved hours and sleep disturbance has not been assessed in this DNVIS. Should work outside approved hours be proposed later, impacts will be assessed and managed in accordance with the Project's out-of-hours works protocol and CNVMP.



Table 6-1 Summary of predicted NML exceedances for Phase 1 – Site establishment

Activity		Maximum level, dBA			Predicted no. receivers with exceedance of NML														
					Approved hours			Outside approved hours - Day				Outside approved hours - Evening				Outside approved hours - night			
		Res	Non-res	Rec. >75	0-10	10-20	20+	0-10	10-20	20-30	30+	0-10	10-20	20-30	30+	0-10	10-20	20-30	30+
1a	Daily activities	57	68	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
1b	Demolition (no hammer)	68	86	10	22	2	-	-	-	-	-	-	-	-	-	-	-	-	-
1c	Demolition (with hammer)	74	90	18	19	8	-	-	-	-	-	-	-	-	-	-	-	-	-
1d	Fencing & hoarding	59	80	2	6	0	-	-	-	-	-	-	-	-	-	-	-	-	-
1e	Utilities Connections	63	81	4	9	0	-	-	-	-	-	-	-	-	-	-	-	-	-
1ff	Hardstand/Concrete	62	80	4	9	0	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6-2 Summary of predicted NML exceedances for Phase 2–Excavation activities

Activity		Maximum level, dBA			Predicted no. receivers with exceedance of NML														
					Approved hours			Outside approved hours - Day				Outside approved hours - Evening				Outside approved hours - night			
		Res	Non-res	Rec. >75	0-10	10-20	20+	0-10	10-20	20-30	30+	0-10	10-20	20-30	30+	0-10	10-20	20-30	30+
2a	Piling	64	80	4	8	0	0	-	-	-	-	-	-	-	-	-	-	-	-
2b	Capping Beams	60	77	1	7	0	0	-	-	-	-	-	-	-	-	-	-	-	-
2c	Active Anchors	62	79	3	17	0	0	-	-	-	-	-	-	-	-	-	-	-	-
2d	OTR 0m-6m	64	80	5	22	0	0	-	-	-	-	-	-	-	-	-	-	-	-
2e	Rippable 6m-19m	68	84	13	25	2	0	-	-	-	-	-	-	-	-	-	-	-	-
2f	Retention 3m-20m	65	78	3	16	0	0	-	-	-	-	-	-	-	-	-	-	-	-
3a	Stockpile	63	73	0	9	0	0	-	-	-	-	-	-	-	-	-	-	-	-
3b	Nozzle Excavation	63	74	0	12	0	0	-	-	-	-	-	-	-	-	-	-	-	-
3c	Concrete Lining	52	65	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
4a	TBM Walkthrough	55	67	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-

## 6.2 Ground-borne noise

The requirement to consider ground-borne noise is applicable to tunnelling or other subterranean works which have the potential to generate internal noise impacts within a sensitive receiver. However, as discussed in Section 4.2.3, ground-borne noise is only assessed for the evening and night periods in residential locations. During excavation of the station box, vibration-intensive equipment such as rock hammers and rock bolters would be used but these would only be during standard hours and airborne noise is expected to result in noise levels greater than the ground-borne noise component.

Therefore, ground-borne noise has not been considered further in this DNVIS. Once tunnelling commences, this matter will be reviewed as part of the revised DNVIS for activities outside approved hours.

## 6.3 Vibration impact assessment

### 6.3.1 Assessment method and reference data

Vibration-intensive surface works will form part of site establishment and ongoing excavation works for the duration of the Project. Potential items of plant that can generate vibration impacts are:

- Rock Hammers
- Percussive drills
- Vibratory rollers

To assess the likelihood of impacts on human comfort and structures, reference vibration levels are summarised in Table 6-3 and curves of vibration with distance are presented in Figure 6-1. Reference vibration levels are based on previously measured levels.

**Table 6-3 Summary of vibration-intensive activities**

Activity	Typical equipment	Typical PPV vibration emission levels	Source
Demolition/Rock breaking	15-20 t Excavator with hammer	1.3 mm/s at 10 m	Site measurement
	47t - 49t excavator with hammer	4.8 mm/s at 10 m	Site measurement
Site compaction	Vibratory roller 20 t	4.5 mm/s at 10 m	Site measurement
Percussive drilling	Airtrack drill or similar	1.5 mm/s at 10 m	Site measurement
Rock bolting	Jumbo bolter	0.4 mm/s at 2.5 m	Site measurement
Ripping	Dozer in Sydney Sandstone	0.15 mm/s at 10 m	Site measurement

Based on the estimated vibration emission levels of each activity and the following equation for geometric damping (conservatively ignoring material damping), levels of vibration with distance can be estimated.

$$PPV_2 = PPV_1 \left( \frac{R_1}{R_2} \right)^n$$

Where:

PPV – Peak Particle Velocity at the source (PPV<sub>1</sub>) and Receiver (PPV<sub>2</sub>)

R – distance from source of reference level (R<sub>1</sub>) and distance from source of receiver (R<sub>2</sub>)

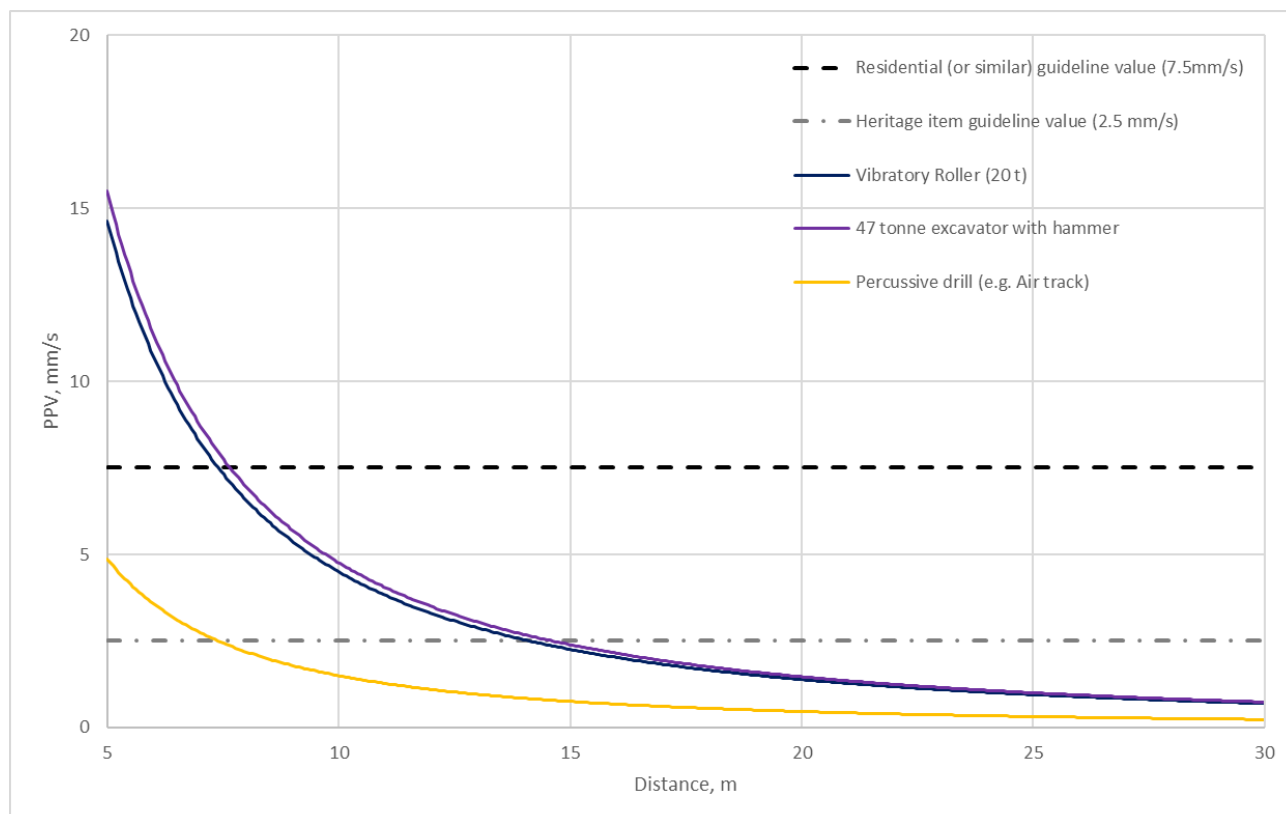
n – ground factor assumed as 1.7 for body waves near the ground surface

Predicted levels of vibration over distance are summarised in the following sections.



## 6.3.2 Risk of cosmetic damage

Predicted levels of vibration over distance are illustrated in Figure 6-1. Considering the vibration guideline values prescribed in the CNVS of 25 mm/s for reinforced structures such as the commercial buildings near the site, the risk of cosmetic damage is low for equipment outside 5 metres from the source. Where unsound heritage items are present, with a guideline value of 2.5 mm, the risk of damage increases below about 15 metres.



**Figure 6-1 Curves of vibration with distance from the source**

Contours representing the distance at which the vibration guideline values for each item are predicted to be achieved are presented in Appendix C. Where sensitive structures are within the buffer distance, trial monitoring should be undertaken prior to any works commencing to determine actual vibration levels.

The nearest buildings are commercial structures, outside the nominal buffer distances and the risk of vibration impact is low. The heritage structures to the north of the site are also outside the nominal buffer.

Where equipment changes, monitoring and establishment of a site-specific vibration curve would be undertaken.

Consideration of vibration generating activities should include alternative methods where necessary to minimise vibration risk, such as:

- Employ non-vibratory (static) rolling methods for compaction where practicable.
- Use a ripper and bucket in place of a hammer where possible.
- Use smallest available excavator and hammer combination when breaking concrete or rock.

Details of the locations for monitoring will be included in a specific vibration monitoring programme for the Sydney Olympic Park site to be developed in conjunction with the appropriate stakeholders as part of the noise and vibration monitoring programme detailed in the Project CEMP.

### 6.3.3 Human exposure

The CNVIS applies vibration dose value (VDV) criteria to residential buildings over the day and night periods. No residential buildings are in the vicinity of the site; however, for completeness, acceptable VDV for intermittent vibration from *Assessing Vibration: A technical Guideline* (DEC 2006) have been referred to. These guidelines require a maximum VDV of  $0.8 \text{ m/s}^{1.75}$  in offices.

Over site establishment, typical vibration-intensive activities such as rolling, drilling and demolition are unlikely to result in extended periods of vibration that would exceed the nominal VDV. However, excavation of the station box by rock hammering may generate vibration over an extended time during approved hours.

To estimate the vibration dose value of hammering, the estimated VDV (eVDV) equation from DEC 2006 has been used:

$$\text{eVDV} = 1.4 \times a \times t^{0.25}$$

where  $a$  represents the root mean square (rms) vibration acceleration in  $\text{m/s}^2$  and  $t$  is the duration of the activity in seconds. Since we only have velocity values for vibration, acceleration is substituted for velocity by the following equation:

$$a_{\text{rms}} = 2 \times \pi \times f \times v_{\text{rms}} / 1000$$

where  $f$  is the dominant frequency of the vibration and  $v$  is the root mean square (rms) velocity.

The rms velocity was derived from the peak particle velocity assuming a crest factor (the ratio of the peak value to its rms value) of 4. The dominant frequency of hammering is taken as 80 Hz.

eVDVs for durations of hammering of between 1 hour and 8 hours, are presented in Figure 6-2 and show the VDV at various distances from the source for a range of exposure durations. From the graph, hammering in the daytime would result in possible adverse comment within about 15 metres from the source for a total of up to 8 hours of work. For shorter durations, the buffer distance would be smaller.

Human exposure to vibration applies when a sensitive receiver is impacted in a habitable room, where no receiver is present, human comfort criteria would not apply. In addition, where the work moves further from the impacted building a reduced impact would be predicted and duration of exposure would increase proportionally.

Human comfort should be assessed inside the residence at the centre of a habitable room. Therefore, the building's construction, how many floors, how the building is coupled to the ground and the distance to the nearest habitable room would influence the actual levels measured during compaction and would likely be lower than predicted.

Vibration contours are presented in Appendix C and illustrate the receivers that may fall within the 15 metre contours for possible adverse comment during daytime hours. No receivers are predicted to experience vibration in excess of human comfort criteria.

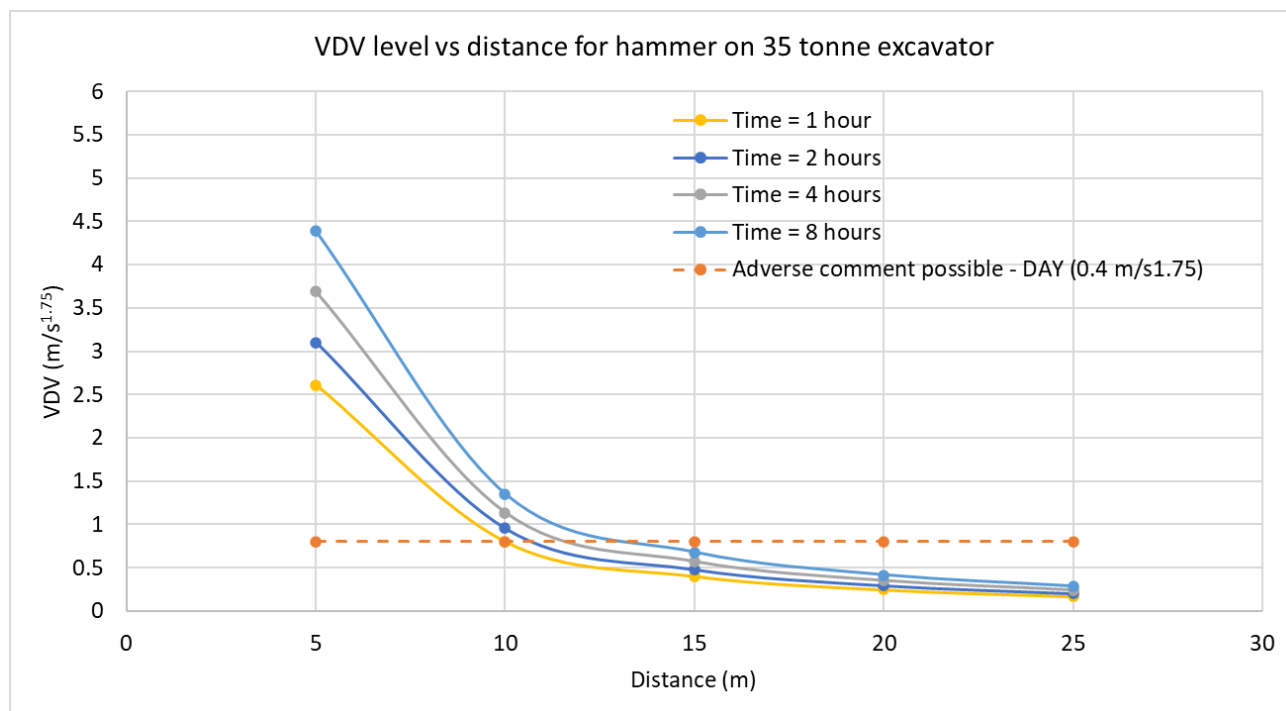


Figure 6-2 VDV curves for excavator and hammer

## 6.4 Construction traffic

Heavy vehicle movements related to Sydney Olympic Park construction activities will comprise of deliveries of materials and equipment as well as spoil haulage during excavation. Figure 6-3 presents primary and alternate inbound and outbound haul routes. The primary routes would cater for daily ingress and egress of the site and would be used by all vehicles. Alternative routes for site access would be used only during special events to ensure no traffic congestion impacts on Olympic Boulevard at these times.

For the primary routes, all heavy vehicles would enter the site via Sarah Durack Avenue onto Olympic Boulevard and then into Herb Elliot Avenue. Sensitive receivers for this route include the Ibis Hotel located 11A Olympic Boulevard and the Pullman Hotel at 9 Olympic Boulevard situated on the corner of Herb Elliot Avenue, both multi storey towers; however there are no residential receivers identified for Olympic Boulevard.

Vehicle exit is via Figtree Drive onto Olympic Boulevard and returning along Sarah Durack Avenue. This route creates a circular traffic flow through the site, minimising the number of heavy vehicles returning along Olympic Boulevard, passing the hotels for a second time.

The EIS noted construction related traffic has the potential to temporarily increase road traffic noise levels at receivers adjacent to construction haulage routes. However, at the Sydney Olympic Park site it was noted that no roads were anticipated to have a greater than 2 dB increase. Based on nominal activities, approximately 150 heavy vehicles are expected to access and leave the site each day during the peak excavation period. These movements would be during approved hours only.

The haul routes along Olympic Boulevard and Herb Elliot Avenue leading to the construction site are defined as local roads and appropriate criteria for daytime traffic noise from the Road Noise Policy would be 55 dB L<sub>Aeq</sub> 15hr. Australia Avenue is an arterial road, therefore the appropriate criteria for daytime traffic noise would be 60 dB L<sub>Aeq</sub> 15hr. To calculate noise levels for potentially impacted receivers, an assessment against the RNP criteria has been undertaken using the Calculation of Road Traffic Noise (CoRTN) methodology.

To calculate the comparable  $L_{Aeq}$  15 hr noise level, noise emissions from 150 vehicles are evenly spread across the 15hour assessment period.

Based on a speed limit of 40km/h for vehicles entering and exiting the sites, predicted noise levels at 10 metres for the average peak periods of construction-related heavy vehicles are as follows:

- Australia Avenue – 62.6  $L_{Aeq}$  15hr
- All other roads - 59.5  $L_{Aeq}$  15 Hr

At the nearest receivers along the primary access routes through Olympic Boulevard and Herb Elliot Avenue, incoming vehicles would be about 151 metres from the nearest building facade on either side of the road and further for floors higher than ground level. At these distances, the noise levels are expected to reduce by a further 11.5 dB(A) indicating a traffic noise level of around  $L_{Aeq}$  15hr 58.8 dB(A) for heavy vehicle movements.

For multi storey residential that back onto Sarah Durack Avenue, outbound trucks would be approximately 57 metres from the nearest residences plus additional shielding from infrastructure not accounted for. At this distance, the noise from truck movements would reduce by around 7.5 dB(A) indicating a façade noise level of  $L_{Aeq}$  15hr 52 dB(A).

The alternate route along Australia Avenue would experience double the daily traffic as both inbound and outbound vehicles would use this road, hence the higher predicted base noise level. The facade setback of the residential buildings along this route is around 20 metres as an average between north and south bound lanes, resulting in around a 2-3 dB(A) reduction of the base level.

For the primary routes, construction traffic noise levels are expected to exceed the local road criteria for Olympic Boulevard/Herb Elliot Avenue by around 3 dB(A) at the most affected facades, during peak periods. Generally a 2 dB(A) or greater exceedance of the criteria would require a review of mitigation options. While a theoretical exceedance is possible for these locations, the following factors would influence the need for mitigation measures at these locations:

- The nature of the business ensures that affected receivers are only impacted on a short-term basis depending on length of stay and only during daytime hours
- Construction of the hotel buildings is expected to be in accordance with building code requirements, meaning a commercial-style façade with substantial transmission losses (e.g. 25 dB), sealed windows and air conditioning. Therefore treatments to mitigate an additional 3 dB(A) exceedance would not be reasonable.

For the alternate route along Australia Avenue, traffic noise levels during special event periods are expected to be at or marginally below the RNP criteria for an arterial road. As these traffic noise levels are expected to be about equal to the criteria and additionally, would only occur during a few days of the year, no further mitigation is recommended at this stage of the project.

These impacts are the predicted worst case during peak vehicle movements and are therefore not representative of the longer-term trends from construction traffic noise which would be lower during some periods. Where complaints are received regarding construction traffic noise, an additional review of actual traffic noise following a monitoring survey would be required.



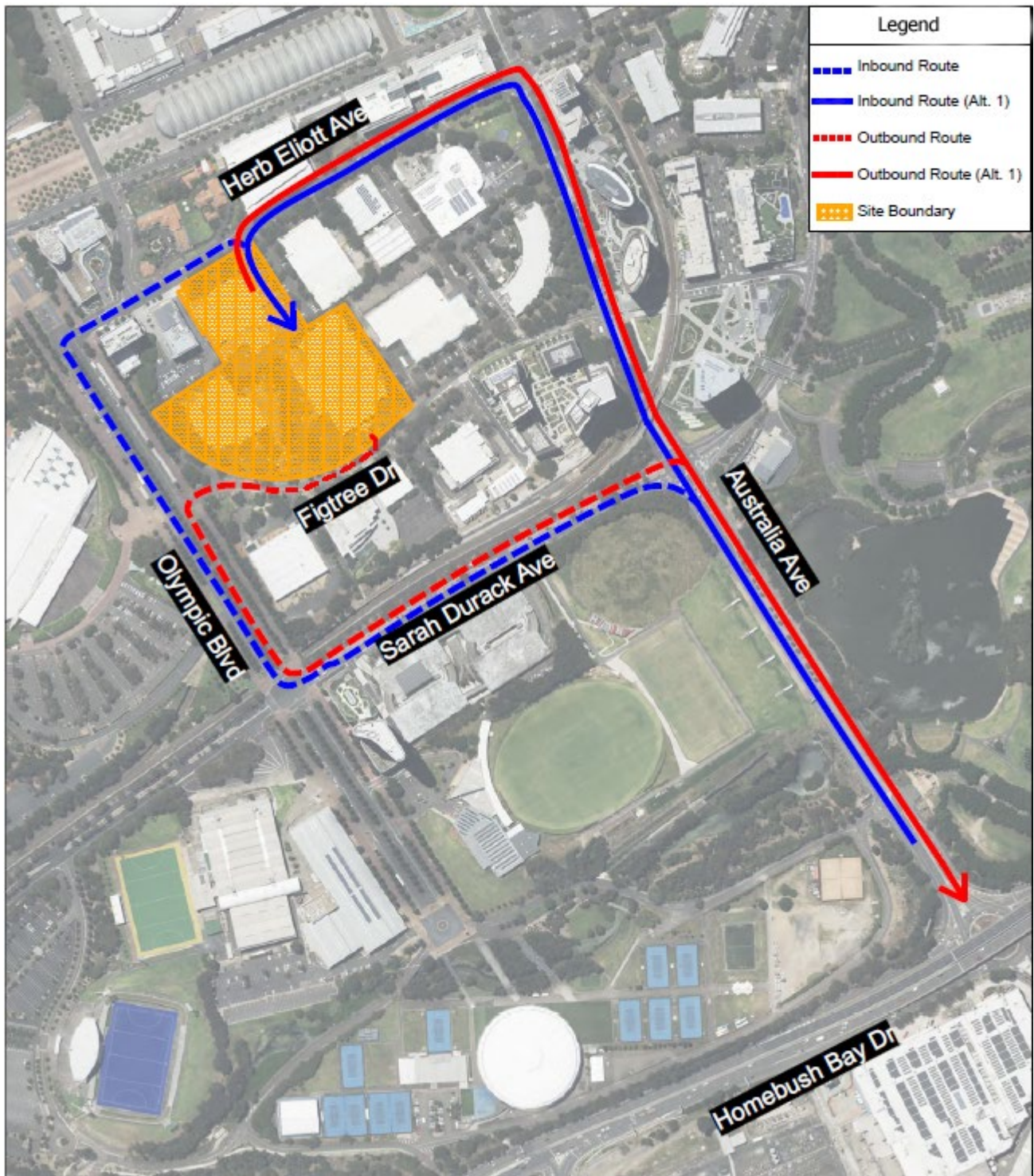


Figure 6-3 Sydney Olympic Park construction traffic movement

## 7. Summary and recommendations

### 7.1.1 Impact summary

This DNVIS has established that during some early construction activities, noise and vibration is likely to result in adverse impacts on the closest receiver locations. To provide a balanced assessment the DNVIS does not assume a worst-case scenario where all equipment is operational adjacent to the nearest receiver. Predicted noise levels can only represent a static case; however, in practice, noise levels will vary thorough the course of the project, often quieter than the levels represented for the assessment of impacts.

Predicted noise levels for this assessment identify likely equipment combinations from the overall equipment list, working near the most affected location for each receiver. This provides a typical 'worst case' noise level that may be reasonably expected over the course of the modelled construction activity. The impacts from these activities will vary based on the location and type of building for each noise sensitive receiver.

In Sydney Olympic Park the local community is largely comprised of commercial buildings with some residential high-rise buildings located around 100 metres away from the site boundary and around 160 metres to the station box excavations, although being multi storey residential, the receivers overlook the site.

There are two multi storey hotels within about 65-100 metres of the station box works with direct line of site from some floors to the construction zones. At times the location of the works will be further from these hotels and will have some shielding benefit offered by the adjacent commercial buildings that will reduce the overall levels of the predicted noise impacts.

The works are programmed for daytime activities only and therefore, no impacts outside approved hours for residential receivers or the nearby hotels are predicted. Commercial buildings directly adjacent to the works will experience the greatest level of impact; however, the location of equipment will vary over the duration of the works as will the depth of excavation providing increased shielding as the project progresses.

Based on the predicted noise levels, proposed construction program and sensitivity of the community to noise and vibration, this site is classed as a low risk and mitigation measures in line with this classification are proposed. This would include substitution of noisy equipment where practicable and regularly scheduled respite periods during noisy works.

Vibration impacts from surface works may be perceptible where vibration generating equipment such as rock hammering or vibratory rolling is undertaken. However, cosmetic damage and human exposure risks are low and there are no heritage structures identified within the nominal buffer zones.

Out of hours work will be required for works outside the scope of this DNVIS such as out of hours utility relocations and oversized plant deliveries undertaken where they comply with CoA D37 and EPL 21610, and this will be assessed through the out of hours work process. These activities may cause impacts above NML and sleep disturbance levels and mitigation measures such as offering alternative accommodation will be implemented as required.

The Project CEMP requires the development of a noise and vibration monitoring plan at key locations. These plans will be site specific and will be determined in conjunction with the appropriate stakeholders for each site.

## 7.1.2 Standard mitigation

Standard noise mitigation measures described in Table 7-1 should be implemented at all stages of the project in addition to those described in the project Construction Noise and Vibration Management Plan (CNVMP).

In line with CoA D42 best practice construction methods will be implemented where reasonable and feasible to ensure noise is maintained at a practical minimum. Practices will include:

- use of regularly serviced low sound power equipment;
- temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities; and
- use of alternative construction techniques.

Hoarding has been installed around the perimeter of the site to provide both an acoustic benefit and a visual indicator to the public that all reasonable and feasible measures are being undertaken for specific activities.

Equipment should be selected with consideration of noise emissions and the quietest equipment that can do the job should be chosen.

Alternatives to hammering on pile caps was investigated, such as cropping, and were implemented where reasonable and feasible.

As required by CoA D37, any night works predicted to exceed the NML would be undertaken under the out-of-hours works protocol, requiring review and endorsement by the ER and AA.

Consultation will be critical in ensuring the community's expectations are managed, with impacts and durations clearly conveyed, resident's concerns heard, appropriate respite and other mitigation is offered and/or implemented and works outside of hours are not unexpected. Refer to Section 7.1.5 for more details on consultation.

**Table 7-1 Standard mitigation measures**

Measure	Description
<b>Administrative</b>	
Construction hours	<ul style="list-style-type: none"> <li>• As much work as possible will be programmed during approved hours. Where work outside approved hours is proposed, this will be completed in line with the CNVMP and Out of hours works protocol.</li> <li>• In accordance with CoA D36, noisy activities as defined in the ICNG, such as concrete cutting, will be undertaken on a 3 hours on, with a minimum cessation of work of not less than one (1) hour., unless otherwise approved.</li> </ul>
Community consultation	<ul style="list-style-type: none"> <li>• In line with the CNVMP, nearby receivers should be notified of the upcoming works, including the duration and predicted level of impact.</li> <li>• In line with the CNVS, community consultation will be undertaken regarding the DNVIS and proposed mitigation such as respite offers</li> </ul>
Site induction	<ul style="list-style-type: none"> <li>• Site Environmental Induction should be delivered to the team and should include consideration and awareness of noise impacts.</li> </ul>
Cumulative impacts	<ul style="list-style-type: none"> <li>• Programming for works undertaken outside approved hours will also consider works being undertaken by third parties</li> </ul>
Behaviour	<ul style="list-style-type: none"> <li>• Avoid yelling and swearing near sensitive receivers.</li> </ul>
<b>Noise control</b>	
	<ul style="list-style-type: none"> <li>• Priority will be given to the use of quieter and less vibration emitting construction methods and plant alternatives where feasible and reasonable.</li> </ul>



Measure	Description
Equipment selection	<ul style="list-style-type: none"> <li>All equipment shall be well maintained, including mufflers and any noise suppression</li> <li>All equipment will meet the maximum sound power requirements of Table 13 of the CNVS.</li> <li>Trucks approaching construction sites will avoid the use of compression braking, especially in the night period</li> <li>Traffic management signage vehicles shall be padded to reduce rattling as much as possible.</li> </ul>
Noise barriers	<ul style="list-style-type: none"> <li>Use temporary noise screens and enclosures as much as possible to reduce noise emissions from equipment when stationary or operating in one location for a reasonable duration. Screens (such as Echo barrier) should be placed between source and receivers, be continuous (without gaps) and installed according to manufacturer directions.</li> </ul>
Use and siting of plant	<ul style="list-style-type: none"> <li>Plant used intermittently to be throttled down or shut down. Switch engines off when not in use for a short time (e.g. 15 minutes)</li> <li>Noise-emitting plant to be directed away from sensitive receivers where possible.</li> <li>Stationary plant should be located behind a structure or enclosed if practicable.</li> <li>Avoid compression breaking on approach to the site.</li> </ul>
Non-tonal reversing alarms.	<ul style="list-style-type: none"> <li>Non-tonal reversing beepers (or equivalent) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.</li> </ul>
<b>Monitoring</b>	
Noise monitoring	<ul style="list-style-type: none"> <li>Noise monitoring shall be completed to: <ul style="list-style-type: none"> <li>- verify assumptions of this DNVIS regarding estimated equipment noise emissions,</li> <li>- ensure compliance with the NMLs,</li> <li>- as required by the AMM for each assessed activity and</li> <li>- as required by the NVMP and associated monitoring program.</li> </ul> </li> </ul>
Vibration monitoring	<ul style="list-style-type: none"> <li>Attended vibration measurements would be undertaken at the commencement of vibration generating activities within safe working distances shown in Appendix B. Where there is potential for exceedances of criteria vibration, site law investigations would be undertaken to determine site-specific safe working.</li> </ul>

### 7.1.3 Additional mitigation measures

Additional noise mitigation measures described in the CNVS AMMM should also be implemented as indicated in Appendix A for each receiver. AMM for each receiver is indicated by colour-coding as per the AMMM in Table 4-2.

For vibration, AMM should be applied for sensitive receivers where measurement indicates it is applicable. In this case, measurement means either at a single location, which also indicates the likely level (and relevant AMM) at other similarly exposed locations or as established by site law measurements to indicate which receivers would be within the site-specific safe working distances.

### 7.1.4 Monitoring

Several assumptions have been made in this assessment to provide representative predictions, such as work location, equipment types, numbers, intensity of operation and noise screening options and these will be verified once works commence and regularly throughout the program.

Noise and vibration monitoring will be undertaken in line with the Noise and Vibration Monitoring Program and out-of-hours protocol as appropriate, with the following monitoring to be completed as a minimum.

- Sound power level verification to ensure equipment meets the requirements of the CNVS
- Compliance monitoring at nearby sensitive receivers to verify predictions at various stages of construction.

- Ground-borne noise and vibration monitoring to verify predicted levels and maintain compliance with objectives.
- Vibration monitoring at heritage items while any vibratory work is underway within safe working distances.
- To meet the requirements of CoA D63, fixed monitoring locations have been identified for this site and are detailed in the CNVMP. Long-term noise and vibration monitoring data at these locations will be readily available as required in the CNVMP and Monitoring Program.

### **7.1.5 Consultation**

Condition of Approval D43 requires mitigation measures presented in this DNVIS to be identified through consultation with the affected community. This applies to standard hours and works outside standard hours.

All mitigation measures developed as part of this DNVIS have been formed around community needs and concerns established through the community consultation process, as required by CoA D43.

AFJV place manager has been on site since November 2021. Various communication materials and face to face meetings have resulted in the identification of several stakeholders that require individual consultation on upcoming activities to manage their operations, such as the General Managers of Pullman, Novotel and Ibis Hotels have requested early dialogue regarding any out of hours work to enable staff to manage customer expectations.

The adjacent NSW Institute of Sport has not raised any concerns around noise or vibration impacts. This building is a commercial-style facility, with fixed windows, so would be less susceptible to impacts than a traditional educational receiver. Buildings either side of the NSWIS site have been engaged with and have no issues or concerns regarding the project to date.

AFJV has regular dialogue with the building manager of 10 Herb Elliott Avenue, which houses several businesses and many with different day / night operating conditions. Additional tailored communications will continue with this sensitive receiver to ensure all disruptive activity is communicated clearly in advance to minimise impact on the day to day operations. We have on various occasions adjusted our daytime site activity on certain days and times to accommodate events taking place within the building.

AFJV has also met with local food outlets in the area to ascertain their specific needs and concerns and ensure the construction team are fully informed regarding various requirements.

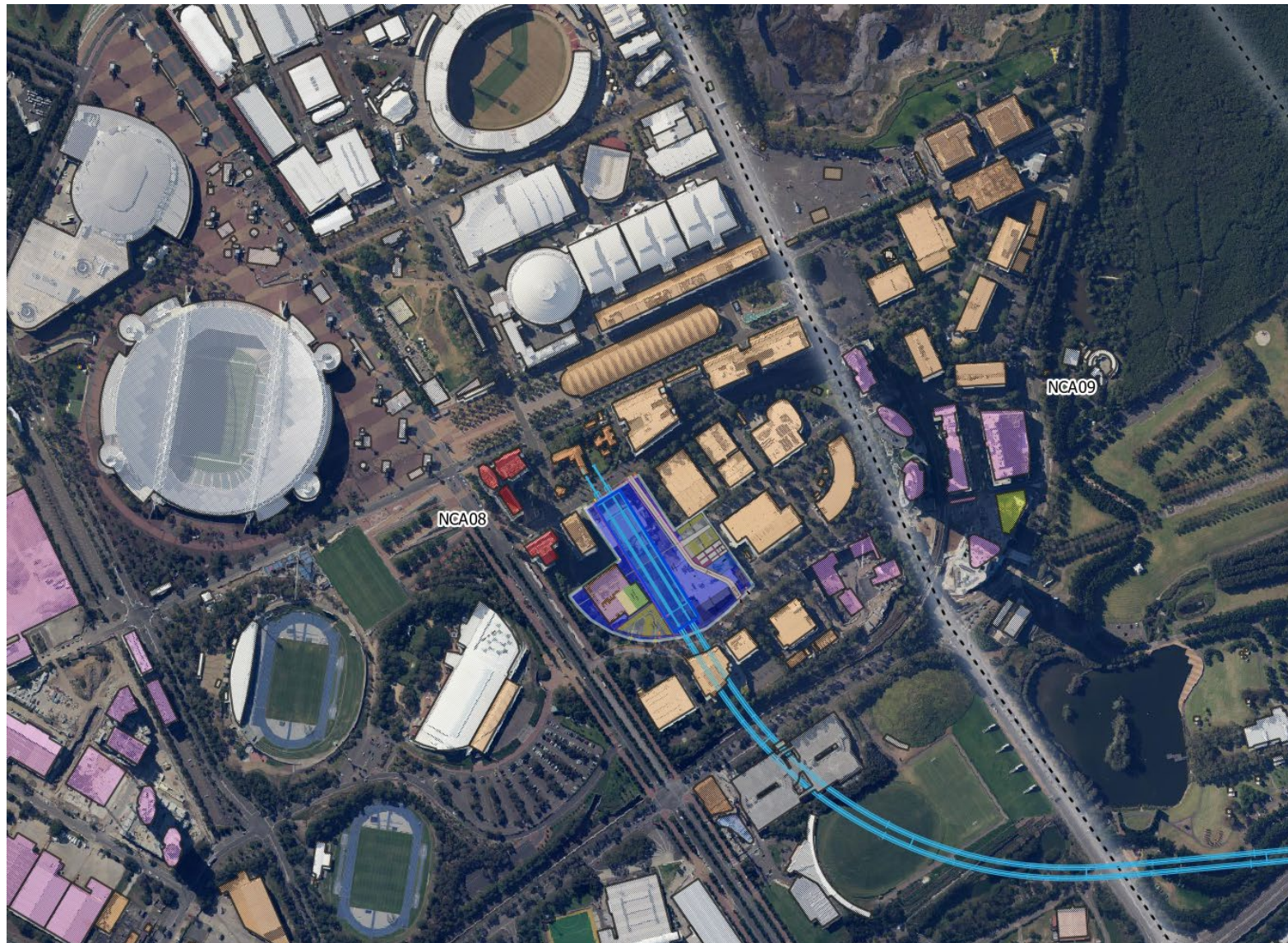
AFJV will continue to consult with the community about planned out of hours work by providing regular updates to the community about upcoming out of hours activities, associated impacts and mitigation measures being implemented as well as invite ongoing feedback to be provided via email, 24-hour phone line or in person meetings. A drop-in-session was host in November 2022 and are looking to host a site open day in September 2023, to invite the community into the site to ask any questions and provide any feedback they may have.

AFJV have issued 2 Sydney Olympic Park site-specific newsletters which include information about expected out of hours work and any associated impacts. Information obtained from the ongoing engagement will be considered as the out of hours scope of work is confirmed and where appropriate, targeted mitigation measures would be implemented.



## Appendix A. Land use survey and NCA maps





Sydney Olympic Park  
Land use survey

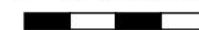
- Site footprint
- Sydney Olympic Park NCA
- Sydney Metro West

## Land uses

- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Community/Residential
- Education
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- Recreational Passive
- None



0 50 100 150 200 m







Appendix B. Proposed equipment and sound power levels

B.1 Site establishment

Phase		Activity/Work Area	Aspect		Plant/Equipment	Day	Evening	Night	SWL, dBA	Usage	Temp. barrier reduction, dB	Penalty, dB	Adj equipment SWL, LAeq,15 minute				Activity LAeq, 15 min SWL		
						7am - 6pm	6pm - 10pm	10pm - 7am					Lmax	Day	Evening	Night	Day	Evening	Night
1	Site Establishment	Construction Compound	1a	Daily activities	Light vehicle (8/hr)	2			85	0.6		0	90	86	0	0	106	0	0
					Road trucks (deliveries to site)	2			102	0.6		0	107	103	0	0			
					Wheel wash unit	1			93	0.3		0	98	88	0	0			
					Telehandler	1			100	0.4		0	105	96	0	0			
					Water treatment plant pump	1			92	1		0	95	92	0	0			
					Watercart/Sweeper	1			103	0.4		0	108	99	0	0			
					Generator 450KVa (CAT)	1			98	1		0	99	98	0	0			
		Demolition	1b	Demolition (no hammer)	3x40t Excavator + Bucket+ Jaw+ Erkat	2			112	0.5		0	117	112	0	0	114	0	0
					EWP	1			89	0.3		0	94	84	0	0			
					Bobcat	1			107	0.3		0	112	102	0	0			
					Pad foot roller*	1			105	0.5		5	113	107	0	0			
					Smooth drum roller*	1			105	0.5		5	113	107	0	0			
					Grader	1			108	0.5		0	113	105	0	0			
					Franna	1			98	0.5		0	103	95	0	0			
					Watercart/Sweeper	1			103	0.5		0	108	100	0	0			
					100T Mobile Crane	1			98	0.5		0	103	95	0	0			
			1c	Demolition (with hammer)	49t Excavator + Hammer	1			122	0.3		5	130	122	0	0	122	0	0
					14t Excavator	1			107	0.4		0	112	103	0	0			
					Truck and Dog	1			108	0.2		0	113	101	0	0			
			Temporary fencing/ hoardings	1d	Fencing & hoarding	Bobcat	1			107	0.3		0	112	102	0	0	107	0
		Tracked excavator w bucket				1			107	0.4		0	112	103	0	0			
		Flat bed truck				1			93	0.3		0	98	88	0	0			
		Hiab				1			101	0.3		0	106	96	0	0			
		Hand tools				1			94	0.2		0	99	87	0	0			
		Concrete agitator trucks				1			103	0.3		0	108	98	0	0			
		Utilities (Power/Water)	1e	Utilities Connections	15t tracked excavator + bucket	1			107	0.4		0	112	103	0	0	110	0	0
					EWP	1			89	0.3		0	94	84	0	0			
					Bogie trucks	1			93	1		0	98	93	0	0			
					Compressor	1			93	0.5		0	98	90	0	0			
					Jackhammer*	1			111	0.2		5	119	109	0	0			
		Concrete Works	1f	Hardstand/Concrete	15t tracked excavator + bucket	1			107	0.4		0	112	103	0	0	110	0	0
					Franna crane	1			98	0.4		0	103	94	0	0			
					Concrete agitator trucks	1			103	0.3		0	108	98	0	0			
					Concrete Pump	1			108	0.3		0	113	103	0	0			
					Generator	1			106	1		0	107	106	0	0			
					vibrator	1			100	0.2		0	105	93	0	0			



B.2 Station box excavation

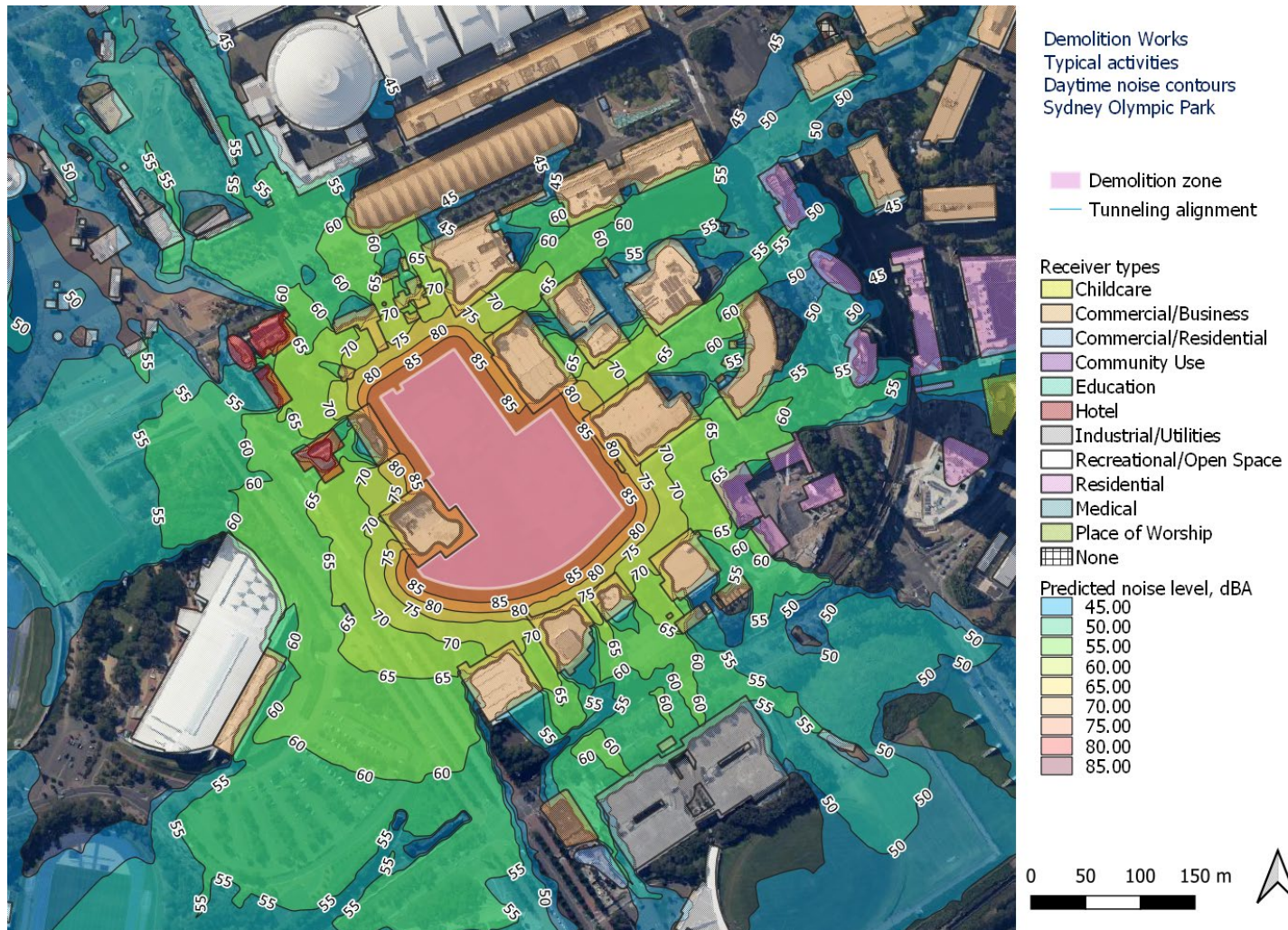
Phase	Activity/Work Area	Aspect	Plant/Equipment	Day	Evening	Night	SWL, dBA	Usage	Temp. barrier reduction, dB	Penalty, dB	Adj equipment SWL, LAeq,15 minute				Activity LAeq, 15 min SWL		
				7am - 6pm	6pm - 10pm	10pm - 7am					Lmax	Day	Evening	Night	Day	Evening	Night
2	Surface Works	Piling	2a	Piling	3 x Piling Rig (Liebherr LB 20)	1		113	0.4	0	118	109	0	0	111	0	0
					2x100t Crane	1		98	0.4	0	103	94	0	0			
					Concrete agitator trucks	1		103	0.3	0	108	98	0	0			
					Concrete Pump	1		108	0.3	0	113	103	0	0			
					20T excavator	1		105	0.4	0	110	101	0	0			
					15t tracked excavator + bucket	1		107	0.4	0	112	103	0	0			
		Capping Beams	2b	Capping Beams	Franna	1		98	0.4	0	103	94	0	0	113	0	0
					5T Excavator	1		94	0.4	0	99	90	0	0			
					Concrete Trucks	1		103	0.3	0	108	98	0	0			
					Concrete pump	1		108	0.3	0	113	103	0	0			
					Vibrator	1		100	0.4	0	105	96	0	0			
					2 x Jack Hammers (Break Back Piles)*	2		111	0.2	5	119	112	0	0			
		Active Anchors	2c	Active Anchors	Drill rig	1		114	0.4	5	119	115	0	0	115	0	0
					Shotcrete rig	1		106	0.4	0	111	102	0	0			
					Franna	1		98	0.4	0	103	94	0	0			
	Excavation Works	Excavation- OTR	2d	OTR 0m-6m	2 x D10 Dozer	1		118	0.4	0	123	114	0	0	117	0	0
					2 x 50T Excavator + Bucket	1		112	0.4	0	117	108	0	0			
					2 x 30T Excavator + Bucket	1		109	0.4	0	114	105	0	0			
					4 x 40t ADT (haul to surface)	4		107	0.3	0	112	108	0	0			
					2 x CAT 980 Loader	1		112	0.4	0	117	108	0	0			
		Excavation Rippable	2e	Rip 6m-19m	2xD10 Dozer	1		118	0.3	0	123	113	0	0	121	0	0
					4 x30T Excavator + Bucket + Hammer*	1		120	0.3	5	128	120	0	0			
					2 x50t Excavator + Bucket (Load ADT)	1		112	0.4	0	117	108	0	0			
					3 x 40t ADT (haul to surface)	4		107	0.3	0	112	108	0	0			
					2 x Loader CAT 980 (Surface/Stockpile)	1		112	0.4	0	117	108	0	0			
					2x50t Telescopic Excavator (surface)	1		108	0.8	0	113	107	0	0			
		Retention- Anchors & Rockbolts	2f	Retention 3m-20m	2-4xDrill Rig (eg Casagrande C6xp-2)	1		120	0.2	5	128	118	0	0	118	0	0
					Shotcrete rig	1		106	0.4	0	111	102	0	0			
					telehandler	1		100	0.4	0	105	96	0	0			
					EWP x 2	1		89	0.3	0	94	84	0	0			
					Franna	1		98	0.4	0	103	94	0	0			
3	Stockpile	Loading - Excavator	3a	Stockpile	50t telescopic excavator +bucket	1		112	0.6	0	117	110	0	0	112	0	0
					35t excavator and bucket	1		109	0.6	0	114	107	0	0			
					Street Sweeper	1		109	0.3	0	114	104	0	0			
	Tunnel Nozzles	Tunnel nozzle excavation	3b	Nozzle Excavation	14t Excavator + Hammer + Erkat	1		118	0.4	5	126	119	0	0	125	0	0
					35t Excavator + Hammer	1		120	0.3	5	128	120	0	0			
					150 m³/h Scrubber	1		104	1	0	106	104	0	0			
					Concrete agi + pump (surface)	1		113	1	0	118	113	0	0			



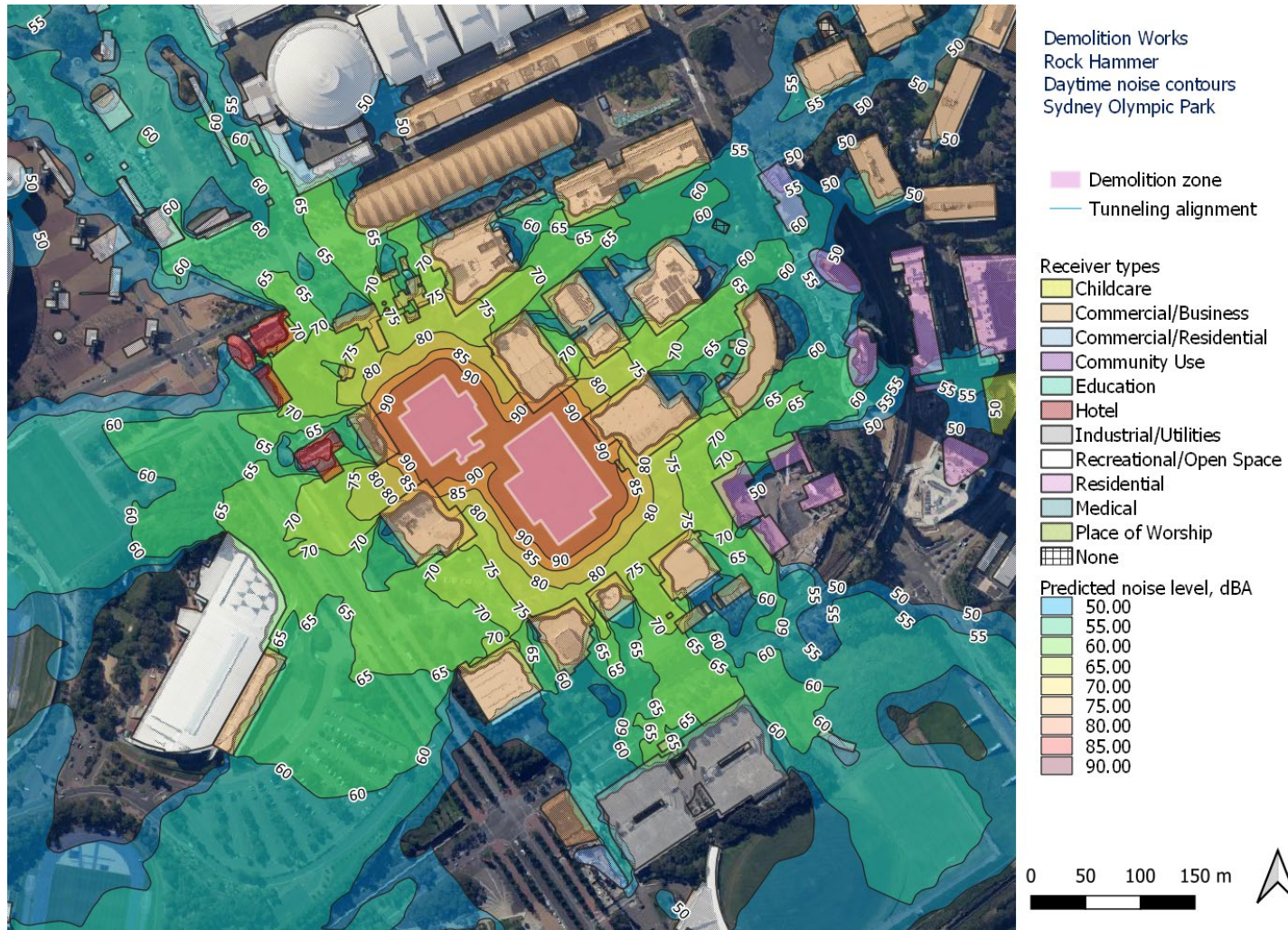
Phase		Activity/Work Area	Aspect		Plant/Equipment	Day	Evening	Night	SWL, dBA	Usage	Temp. barrier reduction, dB	Penalty, dB	Adj equipment SWL, LAeq,15 minute				Activity LAeq, 15 min SWL		
						7am - 6pm	6pm - 10pm	10pm - 7am					Lmax	Day	Evening	Night	Day	Evening	Night
					JCB dumper	1			100	0.4		0	105	96	0	0			
					1x Shotcrete Rig	1			106	0.4		0	111	102	0	0			
					1x Drilling Rig	1			120	0.4		5	128	121	0	0			
					Generator (surface)	2			98	1		0	99	101	0	0			
		Concrete Lining	3c	Concrete Lining	1x Telehandler	1			100	0.4		0	105	96	0	0	105	0	0
					4x E.W.P	4			89	0.3		0	94	0	0	0			
					1x Diesel Concrete Line Pump	1			108	0.3		0	113	103	0	0			
					2x Concrete agitator trucks (at Surface level)	2			103	0.3		0	108	101	0	0			
4	TBM Retrieval	TBM Retrieval	4a	TBM walkthrough	2x Telehandlers	2			100	0.4		0	105	99	0	0	108	0	0
					2x E.W.Ps	2			89	0.3		0	94	87	0	0			
					1x Bobcat	1			107	0.3		0	112	102	0	0			
					1x 40T Volvo Loader	1			110	0.4		0	115	106	0	0			

## Appendix C. Construction noise and vibration contours

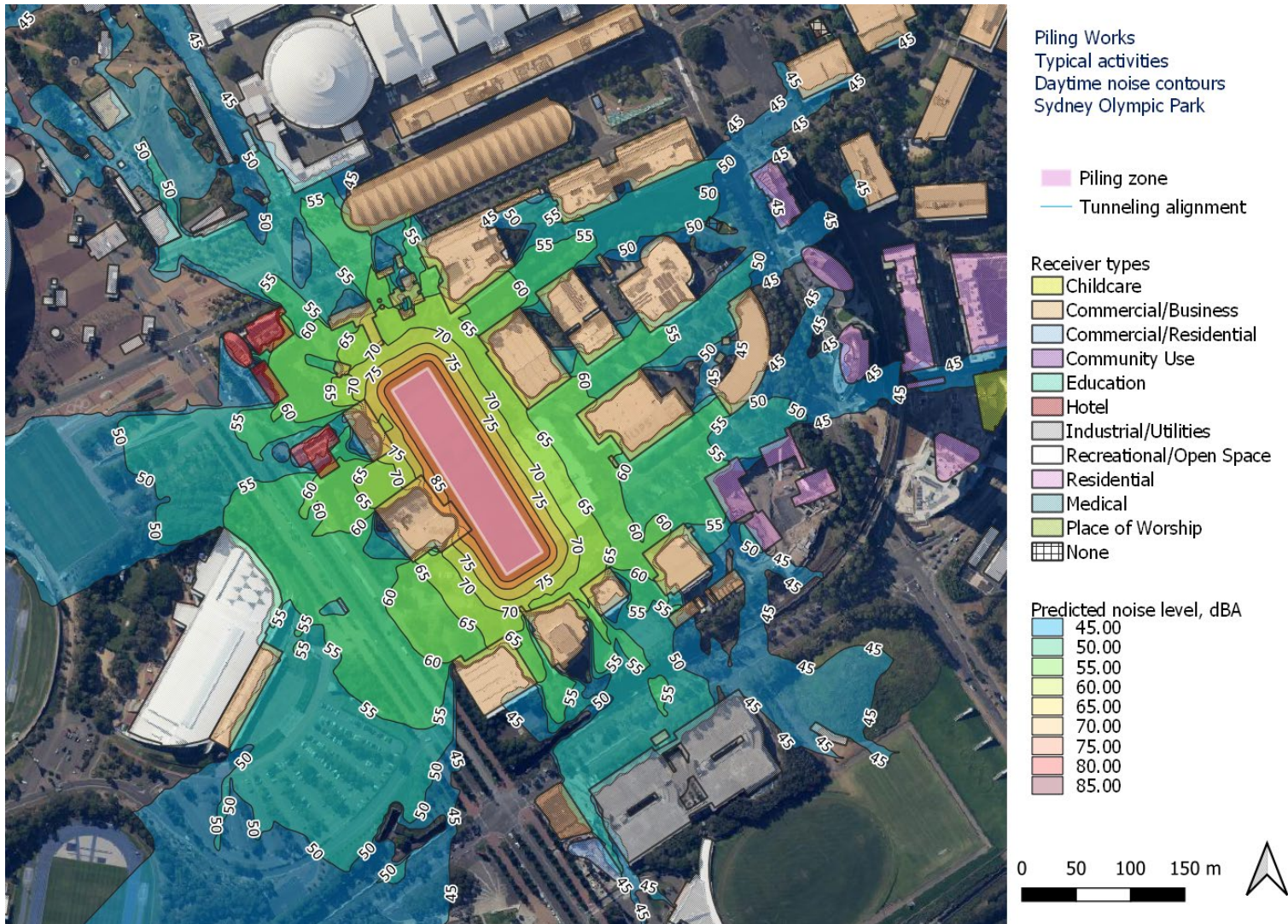
### C.1 Construction noise contours



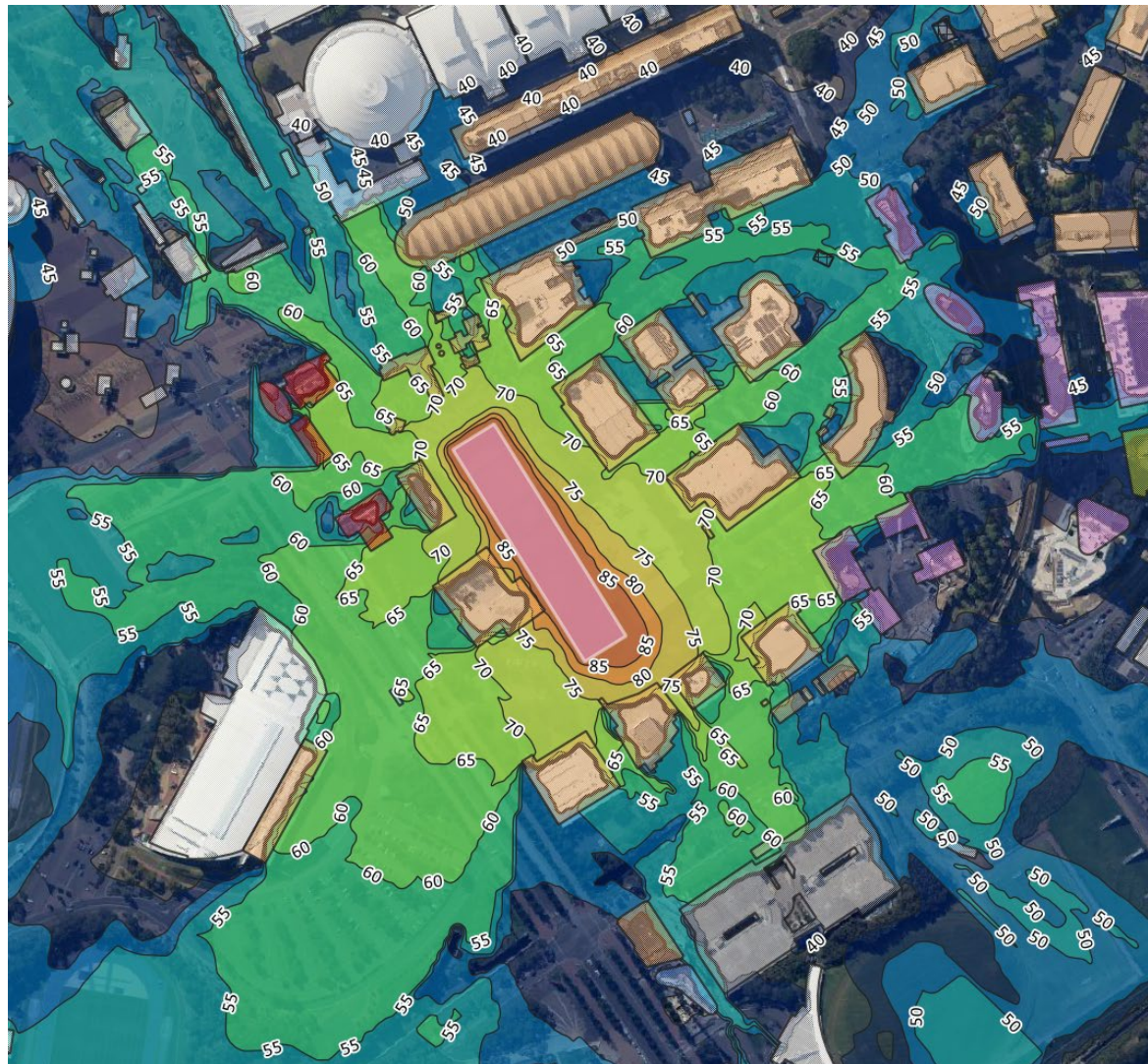












Ripping Works  
Typical activities  
Daytime noise contours  
Sydney Olympic Park

Ripping zone  
 Tunneling alignment

## Receiver types

- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Education
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- None

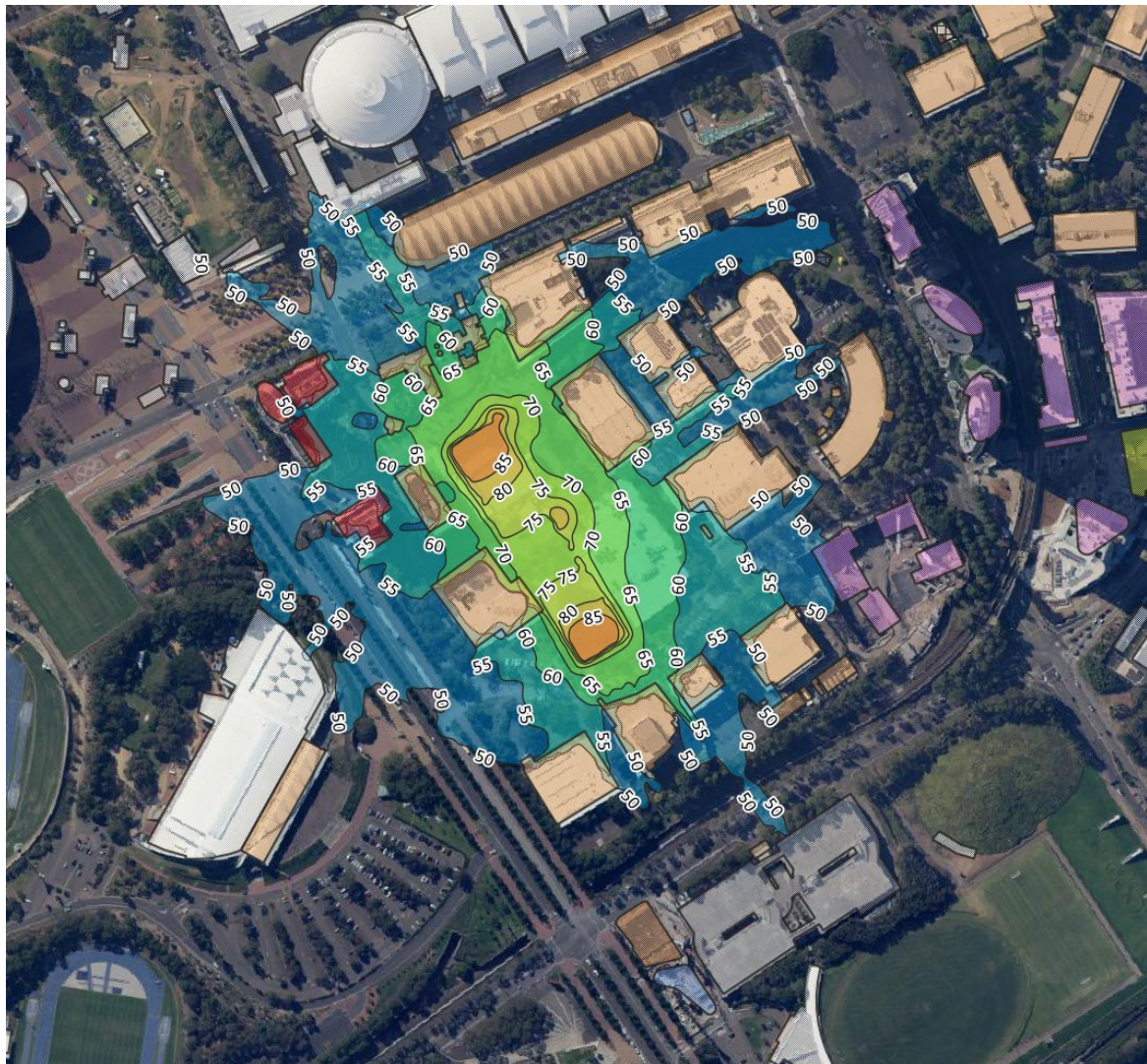
## Predicted noise level, dBA

- 45.00
- 50.00
- 55.00
- 60.00
- 65.00
- 70.00
- 75.00
- 80.00
- 85.00

0 50 100 150 m







Excavation  
Nozzle caverns  
Daytime noise contours  
Sydney Olympic Park

## Receiver types

- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Education
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- None

## Predicted noise level, dBA

- 50.00
- 55.00
- 60.00
- 65.00
- 70.00
- 75.00
- 80.00
- 85.00

0 50 100 150 m





## C.2 Construction vibration contours



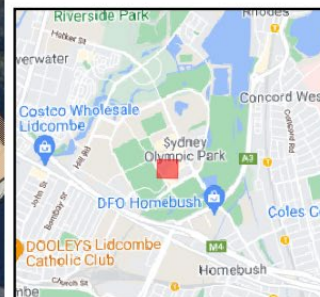
### Sydney Metro West-Sydney Olympic Park Vibration Buffers

#### Legend

- Sydney Olympic Park Site
- 5m Commercial Cosmetic
- 15m Heritage

#### Receiver Types

- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Community/Residential
- Education
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- Recreational Passive
- None






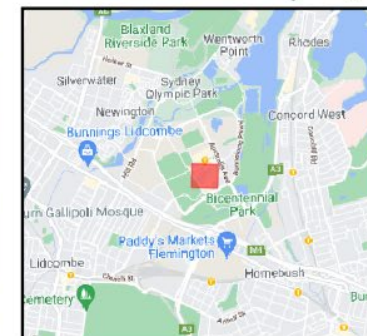


Vibration Safe Working  
Distances-  
SOP Project Sources

#### Legend

- Demolition Boundary
- SOP Site Boundary
- Cosmetic Damage (5m)
- Human Comfort (10m - 1 Hour)

0 25 50 m







## Appendix D. Detailed noise predictions for individual receivers

D.1 Phase 1 Site Establishment

D.2 Phase 2 Piling and Excavation

Supplied as Excel spreadsheets

Receivers			Land use	NML				Sleep disturbance		Site establishment					
				Standard hours	Weekend day	Evening	Night	L <sub>90</sub> , 15min	L <sub>max</sub>	1a	1b	1c	1d	1e	1f
Ref	NCA	Address								Daily activities	Demolition no hammer	Demolition with hammer	Fencing & hoarding	Utilities Connections	Hardstand/Concrete
Exceedance legend				>75dBA (highly affected)			1 - 10dB > NML		10-20 > NML				20-30 > NML		30+ dB > NML
1	NCA_08	3 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	68	82	88	74	77	76	
2	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	61	76	80	69	72	71	
3	NCA_08	28 FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	52	62	69	54	58	57	
4	NCA_08	SHOP 1 4 DAWN FRASER AV, SYDNEY OLYMPIC	COM	70	70	70	70	70	50	63	66	55	58	57	
5	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	45	57	63	49	52	51	
6	NCA_08	10 DAWN FRASER AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	56	74	77	67	69	69	
7	NCA_08	2A FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	55	64	70	56	60	59	
8	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	61	79	79	71	74	73	
9	NCA_08	8 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	57	71	70	63	67	66	
10	NCA_08	8 DAWN FRASER AV, SYDNEY OLYMPIC PARK NS	COM	70	70	70	70	70	37	56	62	47	51	50	
11	NCA_08	PULLMAN HOTEL 9 OLYMPIC BVD, SYDNEY OLYM	HOT	65	65	65	65	65	55	70	77	66	65	65	
12	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	60	72	76	64	67	66	
13	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	48	68	72	60	63	62	
14	NCA_08	3 OLYMPIC BVD, SYDNEY OLYMPIC	RES	58	53	53	51	51	48	62	64	54	57	56	
15	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	49	65	70	57	60	60	
16	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	52	65	71	57	60	60	
17	NCA_08	1 SHOWGROUND RD, SYDNEY OLYMPIC PARK NSW	COM	70	70	70	70	70	40	58	65	50	54	53	
18	NCA_08	BUILDING C 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	54	73	76	66	68	67	
19	NCA_08	3 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	68	82	88	74	77	76	
20	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	61	76	80	69	72	71	
21	NCA_08	28 FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	52	62	69	54	58	57	
22	NCA_08	SHOP 1 4 DAWN FRASER AV, SYDNEY OLYMPIC	COM	70	70	70	70	70	50	63	66	55	58	57	
23	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	45	57	63	49	52	51	
24	NCA_08	10 DAWN FRASER AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	56	74	77	67	69	69	
25	NCA_08	2A FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	55	64	70	56	60	59	
26	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	61	79	79	71	74	73	
27	NCA_08	8 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	57	71	70	63	67	66	
28	NCA_08	8 DAWN FRASER AV, SYDNEY OLYMPIC PARK NS	COM	70	70	70	70	70	37	56	62	47	51	50	
29	NCA_08	PULLMAN HOTEL 9 OLYMPIC BVD, SYDNEY OLYM	HOT	65	65	65	65	65	55	70	77	66	65	65	
30	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	60	72	76	64	67	66	
31	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	48	68	72	60	63	62	
32	NCA_08	3 OLYMPIC BVD, SYDNEY OLYMPIC	RES	58	53	53	51	51	48	62	64	54	57	56	
33	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	49	65	70	57	60	60	
34	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	52	65	71	57	60	60	
35	NCA_08	2 AUSTRALIA AV, SYDNEY OLYMPIC PARK NSW	COM	70	70	70	70	70	42	63	69	54	58	57	
36	NCA_08	BUILDING B 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	46	67	72	59	62	61	
37	NCA_08	BUILDING C 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	52	76	78	68	71	71	
38	NCA_08	SHOP 19 3-5 UNDERWOOD RD, HOMEBUSH NSW 2	IND	75	75	75	75	75	36	46	53	38	41	41	
39	NCA_08	BUILDING B 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	50	77	77	69	72	71	
40	NCA_08	10 HERB ELLIOTT AV, SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	56	85	89	78	80	79	
41	NCA_08	3 OLYMPIC BVD, SYDNEY OLYMPIC	COM	70	70	70	70	70	37	59	59	51	54	54	
42	NCA_08	4 HERB ELLIOTT AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	55	69	76	61	64	64	
43	NCA_08	1 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	44	63	68	55	58	58	
44	NCA_08	6 HERB ELLIOTT AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	61	86	90	80	81	80	
45	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	40	58	63	50	53	52	
46	NCA_08	2C FIGTREE DR, SYDNEY OLYMPIC PARK NSW 2	RES	58	53	53	51	51	57	68	74	59	63	62	
47	NCA_09	102 BENNELONG PARKWAY SYDNEY OLY	COM	70	70	70	70	70	24	43	50	33	38	38	
48	NCA_09	3 PARKVIEW DRIVE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	28	50	54	41	45	44	
49	NCA_09	5 MURRAY ROSE AVENUE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	33	49	54	40	44	43	
50	NCA_08	6 EDWIN FLACK AVENUE SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	34	47	53	40	42	41	
51	NCA_09	4 MURRAY ROSE AVENUE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	28	50	56	40	45	44	
52	NCA_09	3 AUSTRALIA AVENUE SYDNEY OLYMP	RES	58	51	51	46	46	51	61	0	54	56	56	
53	NCA_09	7 AUSTRALIA AVENUE SYDNEY OLYM	RES	58	51	51	46	46	50	60	0	52	55	54	
54	NCA_09	1 BETTY CUTHBERT AVENUE SYDNEY	RES	58	51	51	46	46	40	51	57	42	46	45	
55	NCA_08	13 CARTER STREET LIDCOMBE	COM	70	70	70	70	70	15	30	36	21	25	24	
56	NCA_09	5 PARKVIEW DRIVE SYDNEY OLYMPIC	COM	70	70	70	70	70	26	49	52	39	44	43	
57	NCA_09	10 PARKVIEW DRIVE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	30	48	54	39	43	42	
58	NCA_09	6 BETTY CUTHBERT AVENUE SYDNEY	RES	58	51	51	46	46	43	55	60	47	51	50	
59	NCA_09	11 AUSTRALIA AVENUE SYDNEY OLYMP	RES	58	51	51	46	46	50	60	65	52	55	55	
60	NCA_09	3 MURRAY ROSE AVENUE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	23	45	51	36	41	40	
61	NCA_09	8 PARKVIEW DRIVE SYDNEY OLYMPIC PA	COM	70	70	70	70	70	25	48	53	35	43	42	
62	NCA_09	6 PARKVIEW DRIVE SYDNEY OLYMPIC PA	COM	70	70	70	70	70	30	51	58	43	46	46	
63	NCA_08	8 EDWIN FLACK AVENUE SYDNEY OLYM	RES	58	53	53	51	51	35	48	54	41	43	42	
64	NCA_09	10 PARKVIEW DRIVE SYDNEY OLYMPIC P	COM	70	70	70	70	70	21	43	48	32	38	38	
65	NCA_09	10 PARKVIEW DRIVE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	21	40	44	31	35	34	
66	NCA_09	10 PARKVIEW DRIVE SYDNEY OLYMPIC P	COM	70	70	70	70	70	20	34	37	30	29	29	
67	NCA_09	1 BRUSHBOX STREET SYDNEY OLYMPIC PARK	RES	58	51	51	46	46	46	32	53	61	44	48	
68	NCA_08	5 UHRIG ROAD LIDCOMBE	COM	70	70	70	70	70	22	44	50	36	40	39	
69	NCA_09	3 BRUSHBOX STREET SYDNEY OLYMPIC PARK	CHC	50	50	50	50	50	26	46	52	38	41	40	
70	NCA_08	7 FLOCK STREET SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	36	49	54	42	44	43	
71	NCA_08	7 FLOCK STREET SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	35	47	53	41	42	42	
72	NCA_08	3 CARTER STREET SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	35	48	55	42	44	43	
73	NCA_08	3 CARTER STREET SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	37	49	54	40	44	43	

Receivers			Land use	NML					Sleep disturbance		Excavation Phase									
Ref	NCA	Address		Standard hours	Weekend day	Evening	Night	LAeq, 15min	Lmax	2a	2b	2c	2d	2e	2f	3a	3b	3c	4a	
Exceedance legend					>75dBA (highly affected)		1 - 10dB > NML			10-20 > NML		20-30 > NML		30+ dB > NML						
1	NCA_08	3 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	77	63	66	67	72	68	68	64	55	58	
2	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	69	70	72	74	78	74	73	68	61	64	
3	NCA_08	2B FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	51	59	59	61	63	67	64	60	62	51	54	
4	NCA_08	SHOP 1 4 DAWN FRASER AV, SYDNEY OLYMPIC	COM	70	70	70	70	70	70	56	58	61	62	67	60	53	58	45	48	
5	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	53	50	52	54	58	49	44	51	35	38	
6	NCA_08	10 DAWN FRASER AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	70	67	68	71	72	76	71	56	69	49	52	
7	NCA_08	2A FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	51	59	57	59	61	65	61	59	54	48	51	
8	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	69	75	77	78	82	78	73	71	65	67	
9	NCA_08	8 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	60	67	69	71	75	69	63	61	57	59	
10	NCA_08	8 DAWN FRASER AV, SYDNEY OLYMPIC PARK NS	COM	70	70	70	70	70	70	51	52	55	56	61	53	48	52	37	40	
11	NCA_08	PULLMAN HOTEL 9 OLYMPIC BVD, SYDNEY OLYM	HOT	65	65	65	65	65	65	66	67	69	71	75	70	60	69	56	59	
12	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	65	64	66	67	72	68	68	61	55	58	
13	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	65	62	64	66	68	72	65	48	63	45	47	
14	NCA_08	3 OLYMPIC BVD, SYDNEY OLYMPIC	RES	58	53	53	51	51	51	54	57	60	61	66	61	55	63	48	50	
15	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	65	60	62	64	66	70	66	54	60	52	54	
16	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	61	56	58	60	64	59	62	54	38	41	
17	NCA_08	1 SHOWGROUND RD, SYDNEY OLYMPIC PARK NSW	COM	70	70	70	70	70	70	54	56	59	60	65	57	48	52	39	42	
18	NCA_08	BUILDING C 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	70	65	68	70	72	76	66	56	69	48	51	
19	NCA_08	3 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	77	63	66	67	72	68	68	64	55	58	
20	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	69	70	72	74	78	74	73	68	61	64	
21	NCA_08	2B FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	51	59	59	61	63	67	64	60	62	51	54	
22	NCA_08	SHOP 1 4 DAWN FRASER AV, SYDNEY OLYMPIC	COM	70	70	70	70	70	70	56	58	61	62	67	60	53	58	45	48	
23	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	53	50	52	54	58	49	44	51	35	38	
24	NCA_08	10 DAWN FRASER AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	70	67	68	71	72	76	71	56	69	49	52	
25	NCA_08	2A FIGTREE DR, SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	51	59	57	59	61	65	61	59	54	48	51	
26	NCA_08	6 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	69	75	77	78	82	78	73	71	65	67	
27	NCA_08	8 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	60	67	69	71	75	69	63	61	57	59	
28	NCA_08	8 DAWN FRASER AV, SYDNEY OLYMPIC PARK NS	COM	70	70	70	70	70	70	51	52	55	56	61	53	48	52	37	40	
29	NCA_08	PULLMAN HOTEL 9 OLYMPIC BVD, SYDNEY OLYM	HOT	65	65	65	65	65	65	66	67	69	71	75	70	60	69	56	59	
30	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	65	64	66	67	72	68	68	61	55	58	
31	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	65	62	64	66	68	72	65	48	63	45	47	
32	NCA_08	3 OLYMPIC BVD, SYDNEY OLYMPIC	RES	58	53	53	51	51	51	54	57	60	61	66	61	55	63	48	50	
33	NCA_08	IBIS & NOVOTEL 11 OLYMPIC BVD, SYDNEY OL	HOT	65	65	65	65	65	65	60	62	64	66	70	66	54	60	52	54	
34	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	61	56	58	60	64	59	62	54	38	41	
35	NCA_08	2 AUSTRALIA AV, SYDNEY OLYMPIC PARK NSW	COM	70	70	70	70	70	70	59	57	59	61	65	60	50	57	43	46	
36	NCA_08	BUILDING B 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	70	62	64	66	68	72	61	51	64	44	46	
37	NCA_08	BUILDING C 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	70	68	72	74	76	80	68	56	71	51	53	
38	NCA_08	SHOP 19 3-5 UNDERWOOD RD, HOMEBUSH NSW 2	IND	75	75	75	75	75	75	43	43	46	47	52	48	43	51	36	38	
39	NCA_08	BUILDING B 1 HERB ELLIOTT AV, SYDNEY OLY	COM	70	70	70	70	70	70	67	72	74	75	79	67	55	66	49	51	
40	NCA_08	10 HERB ELLIOTT AV, SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	70	79	77	79	80	84	77	57	74	60	63	
41	NCA_08	3 OLYMPIC BVD, SYDNEY OLYMPIC	COM	70	70	70	70	70	70	48	55	57	59	64	55	39	51	41	44	
42	NCA_08	4 HERB ELLIOTT AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	70	65	59	62	63	68	62	56	60	48	50	
43	NCA_08	1 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	58	58	60	62	65	61	59	56	48	51	
44	NCA_08	6 HERB ELLIOTT AV, SYDNEY OLYMPIC PARK N	COM	70	70	70	70	70	70	80	71	73	75	79	68	60	71	52	54	
45	NCA_08	4 FIGTREE DR, SYDNEY OLYMPIC PARK NSW 21	COM	70	70	70	70	70	70	53	51	53	55	59	53	53	51	38	40	
46	NCA_08	2C FIGTREE DR, SYDNEY OLYMPIC PARK NSW 2	RES	58	53	53	51	51	51	64	60	62	64	68	65	63	61	52	55	
47	NCA_09	102 BENNELONG PARKWAY SYDNEY OLY	COM	70	70	70	70	70	70	40	41	43	45	49	41	34	44	28	30	
48	NCA_09	3 PARKVIEW DRIVE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	70	43	48	50	52	56	45	39	47	31	34	
49	NCA_09	5 MURRAY ROSE AVENUE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	70	43	47	49	51	55	51	42	42	35	37	
50	NCA_08	6 EDWIN FLACK AVENUE SYDNEY OLYMPIC PARK	RES	58	53	53	51	51	51	43	43	46	47	52	48	41	43	34	37	
51	NCA_09	4 MURRAY ROSE AVENUE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	70	45	48	50	51	56	50	42	44	33	36	
52	NCA_09	3 AUSTRALIA AVENUE SYDNEY OLYMP	RES	58	51	51	46	46	46	0	56	58	60	64	60	57	0	48	50	
53	NCA_09	7 AUSTRALIA AVENUE SYDNEY OLYM	RES	58	51	51	46	46	46	0	55	57	59	63	58	53	0	44	47	
54	NCA_09	1 BETTY CUTHBERT AVENUE SYDNEY	RES	58	51	51	46	46	46	47	48	50	52	56	51	43	44	37	40	
55	NCA_08	13 CARTER STREET LIDCOMBE	COM	70	70	70	70	70	70	26	28	30	32	36	31	27	40	18	20	
56	NCA_09	5 PARKVIEW DRIVE SYDNEY OLYMPIC	COM	70	70	70	70	70	70	41	46	49	50	55	46	36	44	29	31	
57	NCA_09	10 PARKVIEW DRIVE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	70	43	45	48	49	53	48	41	43	35	37	
58	NCA_09	6 BETTY CUTHBERT AVENUE SYDNEY	RES	58	51	51	46	46	46	49	50	52	54	58	54	52	47	41	43	
59	NCA_09	11 AUSTRALIA AVENUE SYDNEY OLYMP	RES	58	51	51	46	46	46	55	55	58	59	63	59	54	55	46	48	
60	NCA_09	3 MURRAY ROSE AVENUE SYDNEY OLYMPIC PARK	COM	70	70	70	70	70	70	41	43	46	47	52	44	25	42	29	31	
61	NCA_09	8 PARKVIEW DRIVE SYDNEY OLYMPIC PA	COM	70	70	70	70	70	70	43	45	48	49	54	43	37	44	30	33	
62	NCA_09	6 PARKVIEW DRIVE SYDNEY OLYMPIC PA	COM	70	70	70	70	70	70	47	50	52	54	58	51	39	48	32	35	
63	NCA_08	8 EDWIN FLACK AVENUE SYDNEY OLYM	RES</																	