Detailed Noise and Vibration Impact Statement 2 –

Out of Hours Deliveries - Elizabeth Drive Compound

Western Sydney Airport – Surface and Civil Alignment Works

Project Name	Sydney Metro – Western Sydney Airport, Surface and Civil Alignment Works
Project Number	N81150
Revision Date	9/01/2023
Revision	C
Document Number	[redacted]

Document Revision

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
A	8/12/2022	[redacted]	[redacted]	[redacted]	First Draft
B	14/12/2022	[redacted]	[redacted]	[redacted]	See Revision Details.
C	9/01/2023	[redacted]	[redacted]	[redacted]	See Revision Details

Distribution and Authorisation

Document Control

The CPBUI JV Project Director is responsible for ensuring this report is reviewed and approved. The Project Director is responsible for updating this plan to reflect changes to the project, legal and other requirements, as required.

The controlled master version will be maintained on TeamBinder. All circulated hard copies are deemed to be uncontrolled.

Amendments

The implementation of this report is under the authority of the CPBUI Delegated Authority Matrix. All Contract personnel will perform their duties in accordance with this report, supporting plans, and related procedures.

Revision Details

Rev.	Details
A	8 December 2022 – First Draft
B	14 December 2022 – Updated in response to CPBUI Comments
C	9 January 2023 – Updated in response to SM and ER Comments

Table of contents

Abbreviations and definitions ..... **iv**
Part A Overview **1**
1. Introduction **1**
1.1 Background 1
1.2 Project description 1
1.2.1 SCAW scope of works 1
1.2.2 SCAW construction methodology 3
1.3 Detailed Noise and Vibration Impact Statement 3
2. Construction works and hours **5**
2.1 Planned works 5
2.2 Approved Construction Hours 5
2.3 Working Outside of Standard Construction Hours 5
2.4 Justification of out of hours works 7
3. Existing environment **8**
3.1 Noise Catchment Areas 8
3.2 Sensitive Receivers 10
3.3 Ambient Noise Environment 10
4. Construction Noise and Vibration Management Levels **11**
4.1 Airborne Noise 11
4.1.1 Sleep disturbance 12
4.1.2 Other receivers 12
4.2 Ground-borne Noise 12
4.3 Construction Traffic 13
4.4 Construction Vibration Criteria 13
4.4.1 Cosmetic building damage 13
4.4.1 Human comfort 14
4.4.2 Vibration sensitive structures – Heritage 16
4.4.3 Utilities and other vibration sensitive structures 16
4.4.4 Safe working distance 16
5. Construction Noise and Vibration Assessment **18**
5.1 Construction activities 18
5.2 Noise and vibration impacts 18
5.2.1 Construction noise assessment 18
5.2.2 Construction traffic 19
5.2.3 Construction vibration assessment 21
6. Mitigation and Management **22**
6.1 Standard construction noise mitigation measures 22
6.2 Additional construction noise mitigation measures 22
6.3 Construction vibration 23
7. Conclusion **24**

Appendix A – Site layout and works areas **25**
Appendix B – Noise contours **26**
Appendix C – Detailed noise predictions **27**
Appendix D – Sleep disturbance **28**

List of figures

Figure 1 – SCAW Project scope 2
Figure 2 – Noise catchment areas and noise monitoring locations 9
Figure 3 – Roads considered for EIS construction traffic noise assessment 20

List of tables

Table 1 – Abbreviations and definitions iv
Table 2 – Activities during construction 3
Table 3 – Approved Construction Hours 5
Table 4 – Noise catchment areas (NCA) 8
Table 5 – Summary of unattended noise monitoring results 10
Table 6 – ICNG noise management levels for residential receivers 11
Table 7 – Noise Management Levels and Sleep Disturbance Screening Criteria by NCA and period 11
Table 8 – Noise management levels for non-residential receivers 12
Table 9 – Ground-borne NML – Residential 13
Table 10 – Road traffic noise criteria for residential receivers on existing roads affected by additional traffic from land use developments 13
Table 11 – Recommended vibration limits for cosmetic damage 14
Table 12 – Vibration limits for human exposure from intermittent vibration 14
Table 13 – Preferred maximum values for continuous and impulsive vibration 15
Table 14 – Guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework 16
Table 15 – Recommended minimum working distances for vibration intensive plant 17
Table 16 - Construction stages and sound power levels used in the modelling of construction noise 18
Table 17 – Additional mitigation measures – Airborne construction noise 22
Table 18 – Additional mitigation measures by construction stage and NCA 23

Abbreviations and definitions

Refer to Definitions, Abbreviations and Acronyms, Sydney Metro – Western Sydney Airport Surface Civil and Alignment Works Package, Schedule C1 General Specification.

Table 1 – Abbreviations and definitions

Abbreviation	Description
CAP	Construction Area Plan
CCM	Community Complaints Mediator
CEMF	Sydney Metro Construction Environmental Management Framework
CEMP	Construction Environmental Management Plan
CEMS	Contractors Environmental Management System
CJM	Customer Journey Management
CNVS	Sydney Metro Construction Noise and Vibration Standard
Condition	Planning Minister's Conditions of Approval
CPB	CPB Contractors Pty Ltd
CPBUI JV	CPB Contractors Pty Limited and United Infrastructure Pty Limited Joint Venture
CSSI	Critical State Significant Infrastructure
CTMF	Construction Traffic Management Framework
CTMP	Construction Traffic Management Plan
dBA	A-weighted decibels is an expression of the relative loudness of sounds in the air as perceived by the human ear.
DNVIS	Detailed Noise and Vibration Impact Statement
DSI	Detailed Site Investigation
DPE	Department of Planning and Environment
ECM	Environmental Control Maps
EIS	Environmental Impact Statement
EM	Environmental Manager
EMS	Environmental Management System
Environmental aspect	Defined by AS/NZS ISO 14001:2015 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2015 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance with the terms of the SSI 10051 Planning Approval.
Environmental objective	Defined by AS/NZS ISO 14001:2015 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental policy	Statement by an organisation of its intention and principles for environmental performance
Environmental target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises

Abbreviation	Description
	from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ER	Environmental Representative. Suitably qualified and experienced person independent of project design and construction personnel employed for the duration of construction. The principal point of advice in relation to all questions and complaints concerning environmental performance.
ESCP	Erosion and Sediment Control Plan
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Hold point	Is a verification point that prevents work from commencing prior to approval from Transport for New South Wales Services
IC	Independent Certifier
ICNG	Interim Construction Noise Guideline
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The “equivalent noise level” is the summation of noise events and integrated over a selected period of time.
Minister	Minister of the NSW Department for Planning and Public Spaces
MIRRA	Monitoring, Inspections, Reporting, Review and Audit
NCA	Noise Catchment Area
NML	Noise Management Level
NPI	NSW EPA’s *Noise Policy for Industry*
Non-compliance	Failure to comply with the requirements of the Infrastructure Approval or any applicable licence, permit or legal requirements.
Non-conformance	Failure to conform to the requirements of Project system documentation including this CEMP or supporting documentation.
OOH	Out-of-Hours, i.e. outside of standard construction hours
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)

Abbreviation	Description
Principal, the	Sydney Metro
Project, the	Sydney Metro Western Sydney Airport
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
REMM	Revised Environmental Mitigation Measure
ROL	Road Occupancy Licence
SAP	Sensitive Area Plan
SBT	Station Boxes and Tunnelling
SCAW	Western Sydney Airport Surface and Civil Alignment Works
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L_{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
SSI	State Significant Infrastructure
SWMS	Safe Work Method Statement
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.
UI	United Infrastructure Pty Limited
WSI	Western Sydney International

Part A Overview

1. Introduction

1.1 Background

The Sydney Metro Western Sydney Airport will become the transport spine for Greater Western Sydney, connecting communities and travellers with the new Western Sydney International (Nancy-Bird Walton) Airport (referred to as Western Sydney International) and the growing region.

The Sydney Metro Western Sydney Airport EIS was prepared in October 2020 to assess the impacts of construction and operation of the Project and was placed on public exhibition between 21 October 2020 and 2 December 2020. The Project was declared a Critical State Significant Infrastructure (CSSI) Project and is listed in Schedule 5 of *State Environmental Planning Policy (State and Regional Development)*.

The Sydney Metro Western Sydney Airport was approved by the Minister for Planning and Public Spaces on 23 July 2021 (SSI 10051) under section 5.19 of the *NSW Environmental Planning and Assessment Act 1997* (EP&A Act).

1.2 Project description

The Project will be undertaken on Darug Country and will form part of the future Western Parkland City. The Project involves the construction and operation of a new 23 km metro rail line that extends from the existing Sydney Trains suburban T1 western line (at St Marys) in the north to the Aerotropolis (at Bringelly) in the south. The alignment includes a combination of tunnels and civil structures, including viaducts, bridges, and surface and open-cut troughs between the two tunnel sections. The Project also includes six new metro stations, and a stabling and maintenance facility and operational control centre at Orchard Hills. The SCAW package is the second major contract package to be procured for the Project. The successful and timely completion of the SCAW package is critical to the subsequent construction activities and ultimate completion of the entire Project.

1.2.1 SCAW scope of works

The scope for the SCAW package includes approximately 10.6 km of alignment up to the underside of track formation from Orchard Hills to the Western Sydney International (WSI) airport. This includes approximately:

- 3.6 km of viaduct
  - 400 m of viaduct over Blaxland Creek
  - 660 m of viaduct over the Patons Lane area and un-named creek
  - 2.5 km of viaduct in the Luddenham Road area including across the Warragamba pipeline, at Luddenham Station, across Luddenham Road and across Cosgrove Creek
- 205 metres of bridges
  - An over rail bridge, approximately 180 m long, over the proposed M12 Motorway
  - An over rail bridge, approximately 25 m long, over the drainage swale on the WSI airport site
- 6.9 km of at-grade alignment
  - 600 m at Orchard Hills, south of Lansdowne Road
  - 1.6 km alongside the stabling maintenance facility in Orchard Hills
  - 900 m to the north of the Warragamba pipelines
  - 1.1 km north of the proposed M12 motorway
  - 1.4 km south of the proposed M12 Motorway on Elizabeth Derive
  - 1.3 km within the Airport site from the northern boundary to the Airport Business Park Station
- Temporary and permanent access roads.

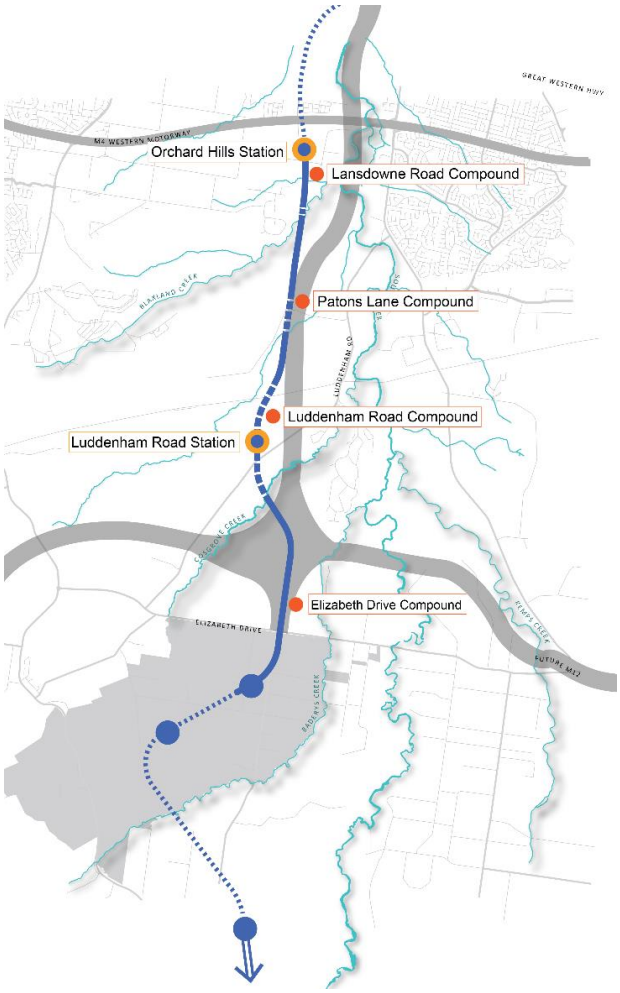

Figure 1 – SCAW Project scope

1.2.2 SCAW construction methodology

Activities that will be undertaken during construction are summarised in Table 2.

Table 2 – Activities during construction

Works	Activities
Early works	▪ Investigation works – survey, geotechnical, contamination and utilities ▪ Establishment of temporary ancillary facilities, construction site fencing, signage and lighting ▪ Pre-clearing vegetation surveys and setting up environmental 'no-go' zones ▪ Stockpiling of imported spoil for the stabling and maintenance facility
Earth works	▪ Installation of environmental controls ▪ Vegetation clearing ▪ Stripping, stockpiling and management of topsoil and unsuitable material ▪ Embankment and cutting construction, including the improvement layers/treatments, general fill, structural fill zone and capping layers ▪ Importation and reuse of fill materials ▪ Placing, compacting and finishing of rail alignment sub-base and base layers ▪ Dewatering and backfilling farm dams ▪ Preparation of piling pads.
Bridge works	▪ 400 metres of viaduct over Blaxland Creek ▪ 660 metres of viaduct over the Patons Lane area and unnamed creek ▪ 2.5 kilometres of viaduct in the Luddenham Road area including across the Warragamba Pipeline, at Luddenham Station, across Luddenham Road and across Cosgrove Creek ▪ 205 metres of bridges
Drainage works	▪ Construction of table drains ▪ Installation of culverts and other drainage structures ▪ Construction of temporary diversion channels ▪ Construction of temporary watercourse crossings such as causeways ▪ Installation of scour protection measures.

1.3 Detailed Noise and Vibration Impact Statement

This Detailed Noise and Vibration Impact Assessment (DNVIS) has been prepared in line with the Project's Condition of Approval (CoA) E47 (reproduced below) and supplements the Construction Noise and Vibration Management Sub-plan (CNVMSP). The DNVIS establishes the location, nature and scale of proposed works and assesses the level of impact on the community's amenity. Additionally, mitigation measures are identified and evaluated.

In accordance with Condition E47, this DNVIS has been prepared for works that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions E43 and E44 at any residence outside construction hours identified in Condition E38, or where receivers will be highly noise affected or subject to vibration levels above those otherwise determined as appropriate by a suitably qualified structural engineer under Condition E87.

CoA E47:

Detailed Noise and Vibration Impact Statements (DNVIS) must be prepared for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions E43 and E44 at any residence outside construction hours identified in Condition E38, or where receivers will be

highly noise affected or subject to vibration levels above those otherwise determined as appropriate by a suitably qualified structural engineer under Condition E87. The DNVIS must include specific mitigation measures identified through consultation with affected sensitive land user(s) and the mitigation measures must be implemented for the duration of the works. A copy of the DNVIS must be provided to the ER before the commencement of the associated works. The Planning Secretary and the EPA may request a copy(ies) of the DNVIS.

This DNVIS follows the following structure:

- Section 2 – Construction Works and Hours
- Section 3 – Existing Environment and Sensitive Receivers
- Section 4 – Construction Noise and Vibration Management Levels
- Section 5 – Construction Noise and Vibration Assessment
- Section 6 – Mitigation and Management

2. Construction works and hours

2.1 Planned works

This DNVIS provides an assessment of potential noise and vibration impacts from activities associated with the early works. The area of works is shown in Appendix A – Site layout and works areas. The works include:

- Drop deck semi-trailer trucks arriving to Elizabeth Drive via the M7.

A detailed list of activities and equipment is provided in Section 5.1. Works are expected to commence from 12 December 2022 however may be required to be carried out up until 31 January 2025.

2.2 Approved Construction Hours

The approved construction hours for SCAW are in accordance with Condition E38 and E39, the Sydney Metro Construction Noise and Vibration Standard and the project Environment Protection Licence and are summarised in Table 3.

Refer to Section 1 for detail on the works permitted to be undertaken outside of approved construction hours (out of hours work (OOHW)).

Table 3 – Approved Construction Hours

<table>
<tr><th rowspan="2">Source</th><th rowspan="2">Activity</th><th colspan="3">Approved Construction Hours</th></tr>
<tr><th>Monday to Friday</th><th>Saturday</th><th>Sunday / Public Holiday</th></tr>
<tr><td>Condition E38</td><td>Standard construction hours</td><td>7:00am to 6:00pm</td><td>8:00am to 1:00pm</td><td>At no time</td></tr>
<tr><td>Condition E39</td><td rowspan="3">Except as permitted by an EPL or approved in accordance with the Out-of-Hours Works Protocol required by Condition E42, highly noise intensive work that result in an exceedance of the applicable NML at the same receiver must only be undertaken during the following times:</td><td>8:00am to 6:00pm</td><td>8:00am to 1:00pm</td><td>At no time</td></tr>
<tr><td></td><td colspan="3">If continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour.</td></tr>
<tr><td></td><td colspan="3">'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work</td></tr>
<tr><td>SCAW EPL</td><td>To be added when granted</td><td colspan="3"></td></tr>
</table>

2.3 Working Outside of Standard Construction Hours

In accordance with Condition E41 works may be carried out outside the standard construction hours (detailed in Section 2.2) in the following circumstances:

a) Safety and Emergencies
   i) the delivery of materials required by the NSW Police or other authority for safety reasons; or
   ii) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or

b) Low Impact
   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:

- 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); or

c) By Approval, including:

i) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or

ii) works which are not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E42; or

iii) negotiated agreements with directly affected residents and sensitive land user(s); or

d) By Prescribed Activity, including:

i) tunnelling and ancillary support activities (excluding cut and cover tunnelling and surface works not directly supporting tunnelling) are permitted 24 hours a day, seven days a week; or

ii) grout batching at the Orchard Hills construction site is permitted 24 hours per day, seven days per week; or

iii) delivery of material that is required to be delivered outside of standard construction hours in Condition E38 to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Orchard Hills ancillary facility; or

iv) haulage of spoil generated through tunnelling is permitted 24 hours per day, seven days per week except between the hours of 10:00 pm and 7:00 am to / from the Orchard Hills construction site; or

v) works within an acoustic enclosure are permitted 24 hours a day, seven days a week where there is no exceedance of noise levels or intermittent vibration levels under Low impact circumstances identified in Condition E41(b), unless otherwise agreed with the Planning Secretary; or

vi) tunnel and underground station box fit out works are permitted 24 hours per day, seven days per week.

On becoming aware of the need for emergency works in accordance with (a)(ii) above, CPBUI JV will notify the ER, the Planning Secretary and the EPA of the need for the emergency works. The CPBUI JV will notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of the emergency works, where possible.

In accordance with Condition E42, and as required by Condition E41(c)(i) an Out of Hours Work Protocol has been prepared identify a process for the consideration, management and approval of work (not subject to an EPL) that is outside the hours defined in Condition E38 and E39. .

Where possible, works will be completed during the standard day time construction hours as per Condition E38. CPBUI would endeavour to schedule out of hours works in accordance with the CNVS being:

- Lower Impact: 6:00pm till 10:00pm weekdays, 1:00pm till 10:00pm Saturdays and 8:00am till 6:00pm Sundays or Public Holidays
- Moderate Impact: 10.00 pm to 7.00 am Weekday Nights 10.00 pm to 8.00 am Saturdays.
- High Impact: 6.00 pm to 7.00 am Sundays and Public Holidays.

Approval from the EPA via the Environment Protection Licence (EPL) will be obtained for out of hours works (OOHW) in accordance with Condition E41(c).

2.4 Justification of out of hours works

Works outside of standard construction hours are justified in accordance with part aii of Condition E41 to ensure the safety of the works noting that road occupancy will be required in order to ensure safety of road users and construction personnel.

3. Existing environment

3.1 Noise Catchment Areas

Noise Catchment Areas (NCAs) are groups of receivers that are likely to experience similar impacts from the project and are reflective of the land use of each area. The NCAs are based on the EIS and predicted impacts for each NCA are considered to represent typical noise and vibration impacts at each individual receiver within that NCA. Table 4 describes the location of the NCAs adopted for the Project, applicable to the SCAW scope and are presented in Figure 2.

Table 4 – Noise catchment areas (NCA)

NCA	Description
NCA07	Predominantly medium density single-storey residential dwellings, located to the east of the project. Ambient noise conditions are dominated by traffic along Mamre Road.
NCA08	Predominantly low density single storey residential dwellings. East of the project is mostly open land with scattered receivers along Samuel Marsden Road and Lansdowne Road. Ambient noise conditions are dominated by traffic along the M4 Western Motorway.
NCA09	Open farmland and a grouping of low density single storey residential dwellings within 1200 metres east of the project along Luddenham Road.
NCA10	Open farmland with low density single storey and multi-storey residential dwellings within the Twin Creeks area east of the project, and scattered residential dwellings along Luddenham Road.
NCA11	Predominantly Western Sydney International (on-airport) land. Low density residential dwellings along Lawson Road and Martin Road to the east of the project. Medium density residential dwellings at Luddenham to the west of the project.

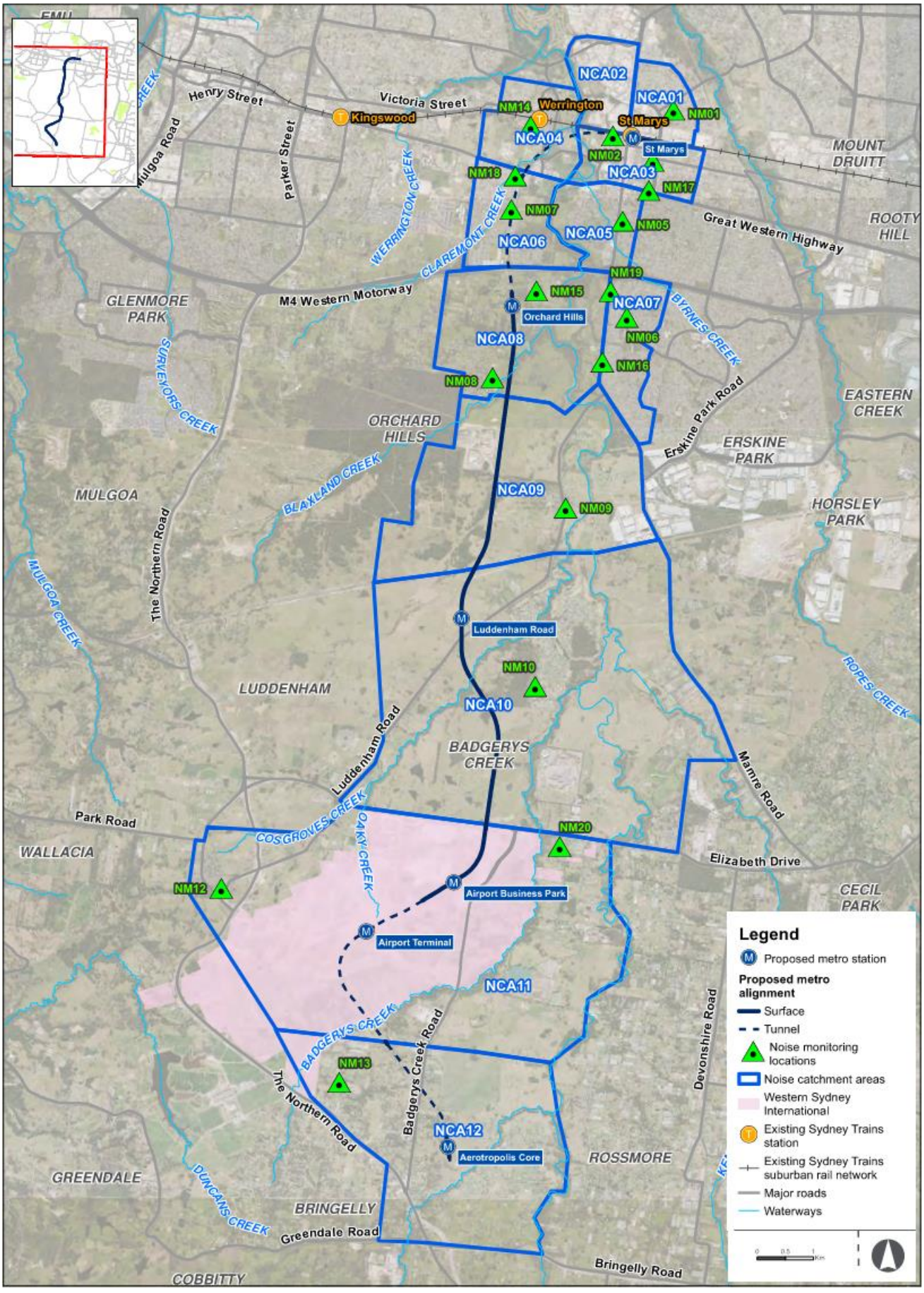

Figure 2 – Noise catchment areas and noise monitoring locations

3.2 Sensitive Receivers

In accordance with Condition E37 a detailed land use survey was undertaken to confirm sensitive land use(s) (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration and construction ground-borne noise.

3.3 Ambient Noise Environment

The prevailing background (existing) noise levels in the study area were determined in the EIS through unattended noise monitoring. The measured Rating Background Levels (RBLs) and ambient noise levels are summarised in Table 5. Refer to Figure 2 for an illustration of the noise monitoring locations.

Table 5 – Summary of unattended noise monitoring results

Noise monitoring location	Rating Background Level (RBL) dB(A)[1]			Ambient Noise Level $L_{eq,\ 15\ minute}$		
	Day	Evening	Night	Day	Evening	Night
NM01	38	(41) 38[3]	(40) 38[3]	53	53	50
NM02	37	(40) 37[3]	36	55	59	51
NM03	38	32	31	50	41	46
NM04[1]	-	-	-	-	-	-
NM05	40	(44) 40[3]	(44) 40[3]	54	51	50
NM06	42	(44) 42[3]	38	59	57	52
NM07	37	37	36	48	49	45
NM08	31	(32) 31[3]	30	52	48	40
NM09	40	39	34	61	57	54
NM10	(30) 35[2]	30	30	47	42	37
NM11[1]	-	-	-	-	-	-
NM12	(34) 35[2]	32	(24) 32[2]	58	60	48
NM13	38	35	34	58	52	51
NM14	35	32	31	48	47	43
NM15	44	(47) 44[3]	40	55	53	50
NM16	47	42	(28) 30[2]	59	56	54
NM17	54	50	36	63	62	59
NM18	42	(43) 42[3]	39	55	53	52
NM19	53	48	36	62	59	57
NM20	39	37	(28) 30[2]	49	47	42

(1) Time periods defined as – Day: 7am to 6pm Monday to Saturday, 8am to 6pm Sunday; Evening, 6pm to 10pm; Night 10pm to 7am Monday to Saturday, 10pm to 8am Sunday

(2) Where background levels are below the minimum assumed rating background noise levels outlined in the NPI, they have been adjusted to 35 dB(A) during the day period, and 30 dB(A) during the evening and night periods in accordance with the NPI

(3) Where evening or night background noise levels exceed that of the previous period, they have been set at the background noise level of the previous period, in line with the NPI, to reflect community's expectation for greater noise control during more sensitive periods

4. Construction Noise and Vibration Management Levels

4.1 Airborne Noise

The CNVS identifies the ICNG as the reference document for the determination of construction Noise Management Levels (NMLs). Table 6 sets out the application of the management levels for noise at residential receivers.

Table 6 – ICNG noise management levels for residential receivers

Time of Day	Noise Management Level, $L_{Aeq(15\ min)}$	Application
Recommended standard hours: ▪ Monday to Friday 7am to 6pm ▪ Saturday 8am to 1pm ▪ No work on Sundays or public holidays	Noise affected RBL + 10 dB	CPBUI will apply feasible and reasonable work practices to meet the noise affected level where the predicated or measured L_{Aeq} (15 min) is greater than the noise affected level.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would be required for works undertaken outside of the recommended standard hours. CPBUI will apply feasible and reasonable work practices to meet the noise affected level.

NMLs have been derived for the identified land uses, and representative RBLs for residential receivers as described in Table 5. presents the adopted NMLs for residential receivers within each NCA are derived from EIS Tech Paper 2 (Table 4-9) and are provided in Table 7

Table 7 – Noise Management Levels and Sleep Disturbance Screening Criteria by NCA and period

NCA	Noise Management Level – dB(A)				
	Standard hours	OOH - Day	OOH - Evening	OOH - Night	Sleep Disturbance
NCA01	48	43	43	43	53
NCA02	47	42	42	41	51
NCA03	47	42	42	41	51
NCA04	45	40	37	36	46
NCA05	50	45	45	45	55
NCA06	47	42	37	36	46

NCA	Noise Management Level – dB(A)				
	Standard hours	OOH - Day	OOH - Evening	OOH - Night	Sleep Disturbance
NCA07	57	52	47	35	45
NCA08	54	49	49	45	55
NCA09	50	45	44	39	49
NCA10	45	40	35	35	45
NCA11	49	44	42	35	45
NCA12	48	43	40	39	49

4.1.1 Sleep disturbance

Construction noise during the night (10pm to 7am Monday to Saturday, 10pm to 8am Sunday) has the potential to awaken residents from sleep. In line with the CNVS, the approach to managing events that cause sleep disturbance shall be consistent with the Noise Policy for Industry (EPA, 2017).

A detailed maximum noise level event is to be undertaken when night time noise levels at a residential receiver are predicted to exceed:

- $L_{eq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{fmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.

Sleep disturbance and awakening external noise level screening levels of RBL+15 dB and Lmax 65 dB(A), whichever is most conservative (lowest) within each NCA, has been adopted and provided for each NCA in Table 7.

4.1.2 Other receivers

Table 8 presents the NMLs for non-residential sensitive receivers derived from the criteria in the ICNG. In accordance with Condition E45, noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs will not be timetabled within sensitive periods, unless other reasonable arrangements have been made with the affected institution.

Table 8 – Noise management levels for non-residential receivers

Land Use	Noise Management Level (External) $L_{eq,\ 15\ min}$ – dB(A)
Educational	55[1]
Commercial (offices, retail outlets)	70
Commercial (industrial)	75
Active recreation	65
Passive recreation	60
Place of worship	55[1]
Child care centres	55[1]

(1) An internal to external correction of +10 dB has been applied as per the ICNG

4.2 Ground-borne Noise

Ground-borne noise is generated by vibration transmitted through the ground and into a structure. The CNVS refers to guidance in the ICNG, which specifies ground-borne noise management levels for residences. Mitigation measures will be applied when residential ground-borne NMLs are exceeded in accordance with Condition E44. Table 9 provides the NML for residential receivers. These levels are

applicable when ground-borne noise levels are higher than airborne noise levels during the evening and night periods.

Table 9 – Ground-borne NML – Residential

Period	Time of Day	NML $L_{eq,15min}$
Evening	6pm to 10pm	40 dB(A) internal
Night	10pm to 7am	35 dB(A) internal

4.3 Construction Traffic

The CNVS outlines guidance for the assessment of road traffic noise generated by construction vehicles be taken from the Road Noise Policy (RNP) (NSW EPA, 2011). As the RNP provides guidance with relation to operational noise impacts, and noise from construction traffic is non-permanent, further guidance has been taken from the *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime, 2016).

The RNP provides guidance on the assessment of noise impacts on sensitive receivers from additional road traffic generated by the project operating on a public road network. Where vehicles operate within the boundaries of a construction site, noise impacts generated by these vehicles are included in the overall Leq,15min construction site noise emissions undertaken in line with the ICNG.

The RNP makes a distinction between the assessment of freeway/arterial/sub-arterial roads and local roads. Freeway/arterial/sub-arterial roads are assessed over day (7 am to 10 pm) and night (10 pm to 7 am) periods. Table 10 presents a summary of the applicable road traffic criteria for residential receivers.

The CNVG states that 'an initial screening test should first be applied by evaluating whether noise levels will increase by more than 2 dB(A) due to construction traffic or a temporary reroute due to a road closure. Where increases are 2 dB(A) or less then no further assessment is required'.

Therefore, if the road traffic noise levels increase by more than 2 dB(A) as a result of the proposed construction traffic, and the criteria in Table 10 are exceeded, investigation of mitigation options would be required.

Table 10 – Road traffic noise criteria for residential receivers on existing roads affected by additional traffic from land use developments

Road type	Road traffic noise criteria	
	Day (7am to 10pm)	Night (10pm to 7am)
Freeway/Arterial/Sub-arterial	60 $L_{eq,15hr}$ dB(A)	55 $L_{eq,9hr}$ dB(A)
Local roads	55 $L_{eq,1hr}$ dB(A)	50 $L_{eq,1hr}$ dB(A)

4.4 Construction Vibration Criteria

Condition E43 requires that the project be constructed with aim of achieving the following vibration criteria:

- Assessing vibration: a technical guideline (DEC, 2006) – for human exposure
- BS 7385 Part 2-1993 'Evaluation and measurement for vibration in buildings Part 2'as they are applicable to Australian conditions, and
- The vibration limits set out in the German Standard DIN 4150-3: Structural Vibration – effects of vibration on structures (for structural damage).

The following sections provide detail on each criterion.

4.4.1 Cosmetic building damage

The CNVS refers to the EPA's Assessing Vibration – A technical guideline (AVTG) which recommends the use of British Standard BS 7385-2: Evaluation and measurement for vibration in buildings, Guide to damage levels from ground-borne vibration (BS7385-2) in defining frequency dependent guideline

values and assessment methods as they “are applicable to Australian conditions”. However, the SEARs specify German Standard DIN 4150-3: Structural vibration – Effects of vibration on structures (DIN 4150). DIN 4150 provides the more conservative guidance, and hence, adoption of DIN 4150 as recommended results in compliance with the CNVS. Table 11 summarises the recommended limits outlined in DIN 4150 to ensure minimal risk of cosmetic damage to residential and industrial buildings.

On this basis, conservative general vibration screening levels (Peak Particle Velocity (PPV)) is provided for intermittent vibration sources as follows:

- reinforced or framed structures: 10 mm/s
- unreinforced or light framed structures 5 mm/s.

At locations where the predicted and/or measured vibration levels are greater than shown above, monitoring should be performed during construction. A more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would also be performed to determine the applicable safe vibration level.

Table 11 – Recommended vibration limits for cosmetic damage

Type of structure	Guideline values for velocity, v_i, in mm/s, of vibration in horizontal plane of highest floor, at all frequencies[1]
Buildings used for commercial purposes, industrial buildings and buildings of similar design	10
Dwellings and buildings of similar design and/or occupancy	5
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

(1) If a building is subjected to harmonic vibration, then the maximum values can also occur in floors other than the top floor, or in the foundation. The values given in the table also apply in these cases.

4.4.1 Human comfort

With regards to assessing loss of amenity due to perceptible vibration, the CNVS requires the assessment of vibration impacts on human comfort in accordance with Assessing Vibration – A technical guideline (DEC, 2006) (AVTG). AVTG presents preferred and maximum vibration values (vibration dose values), above which there is considered to be a risk that the amenity and comfort of people occupying buildings would be adversely affected by construction work. The preferred vibration values are not mandatory limits but should be sought to be achieved through application of all feasible and reasonable mitigation measures.

Intermittent vibration is expected to be generated from most construction works, and can be defined as interrupted periods of continuous vibration (e.g. a drill), or repeated periods of impulsive vibration (e.g. a pile driver). The applicable criteria for intermittent vibration are shown in Table 12 as vibration dose value ($m/s^{1.75}$).

The vibration guideline also specifies limits for continuous and impulsive vibration. These summarised vibration limits are expressed in acceleration (m/s^2) and PPV (mm/s) as presented in Table 2.2 and Appendix C of the AVTG and summarised in Table 13. When short-term works such as piling, demolition and construction give rise to impulsive vibrations, undue restriction on vibration values may significantly prolong these operations and result in greater annoyance. Where work is short term, feasible and reasonable mitigation measures have been applied, then higher vibration values may apply.

Table 12 – Vibration limits for human exposure from intermittent vibration

Location	Assessment period[1]	Vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residences	Daytime	0.2	0.4

Location	Assessment period[1]	Vibration dose value (m/s$^{1.75}$)	
		Preferred value	Maximum value
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Anytime	0.4	0.8
Workshops	Anytime	0.8	1.6

(1) Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am

Table 13 – Preferred maximum values for continuous and impulsive vibration

Location	Assessment period	[1]RMS acceleration m/s^2				[2]Peak Particle Velocity mm/s	
		Preferred values		Maximum values		Preferred values	Maximum values
		Z-Axis	X and Y axis	Z-axis	X and Y axis		
Continuous vibration							
Critical areas	Day or night-time	0.0050	0.0036	0.010	0.0072	0.14	0.28
Residences	Daytime[3]	0.010	0.0071	0.020	0.014	0.28	0.56
	Night-time	0.007	0.005	0.014	0.010	0.20	0.40
Offices, schools, educational institutions, and places of worship	Day or night-time	0.020	0.014	0.040	0.028	0.56	1.1
Workshops	Day or night-time	0.04	0.029	0.080	0.058	1.1	2.2
Impulsive vibration							
Critical areas	Day or night-time	0.0050	0.0036	0.010	0.0072	0.14	0.28
Residences	Daytime[3]	0.3	0.21	0.60	0.42	8.6	17.0
	Night-time	0.10	0.071	0.20	0.14	2.8	5.6
Offices, schools, educational institutions, and places of worship	Day or night-time	0.64	0.46	1.28	0.92	18.0	36.0
Workshops	Day or night-time	0.64	0.46	1.28	0.92	18.0	36.0

(1) Values derived from z-axis critical frequency range
(2) Values given for the most critical frequency range >8 Hz assuming sinusoidal motion. Where required, a more detailed analysis can be conducted as per AS 2670.2-1990. Sufficient justification should accompany the use of a peak velocity approach if used in an assessment.
(3) Specific values depend on social and cultural factors, psychological attitudes and expected degree of intrusion.

4.4.2 Vibration sensitive structures – Heritage

Heritage listed structures should not be assumed to be more sensitive to vibration unless they are structurally unsound, which is unlikely for a regularly maintained structure. Where a historic structure is deemed to be sensitive to damage from vibration following inspection by qualified structural and/or civil engineers, more conservative superficial cosmetic damage criterion (2.5 mm/s PPV) should be considered, as noted in Table 11.

Buildings that are potentially at risk of threshold or cosmetic damage would be identified by the contractor prior to the commencement of construction works. Management at these locations will include building condition surveys before the commencement of construction activities and after construction is completed in accordance with Condition E84 and E85.

In accordance with REMM NAH8, a dilapidation survey of the Warragamba to Prospect Water Supply Pipelines would be undertaken prior to construction commencing in the vicinity of this item. In accordance with Condition E121 CPBUI will consult with WaterNSW where SCAW interacts with the Warragamba to Prospect Water Supply Pipeline to ensure that design and construction methodology is consistent with *Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines.*

4.4.3 Utilities and other vibration sensitive structures

In accordance with Condition E82 the SCAW must be designed and constructed with the objective of minimising impacts to, and interference with third party property, and that such infrastructure and property is protected ruing construction.

Where structures and utilities sensitive to vibration are encountered, or where that asset provides an essential service for the community, a vibration goal, which is more stringent than structural damage goals may need to be adopted. Examples of such structures and utilities include:

- tunnels
- pipelines
- fibre optic cables.

Specific vibration criteria would be determined on a case-by-case basis. In accordance with Condition E83, the services potentially affected by construction will be identified to determine requirements for diversion, protection and / or support. In consideration of proposed civils activities works are likely to be required in close proximity to existing utilities and services. In all cases, protection requirements or alterations to services will be determined by negotiation with the service providers. This will be managed in accordance with the specific process of the asset owner, and as identified in the Project Interface Management Plan. Disruption to services resulting from construction will be avoided, wherever possible, and advised to customers where it is not possible. In lieu of specific vibration criteria being provided by the asset owner, screening criteria would be adopted from guidance provided in DIN 4150-3 for buried pipework. The screening criteria is outlined in Table 14.

Table 14 – Guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework

Pipe Material	Guideline values for velocity measured on the pipe, vi, in mm/s
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
Masonry, plastic	50

4.4.4 Safe working distance

Where vibration intensive works are required to be undertaken within the specific minimum working distances, vibration monitoring should be undertaken to ensure acceptable levels of vibration are satisfied. In relation to human comfort, the minimum working distances relate to continuous vibration. For most construction activities, vibration emissions would be intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods may be allowed. Table 15 presents the recommended minimum working distances for vibration intensive plant.

Table 15 – Recommended minimum working distances for vibration intensive plant

Plant item	Rating / description	Minimum working distance – cosmetic damage (BS7385)	Minimum working distance – human response (DECC 2006)
Vibratory roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Handheld	1 m (nominal)	2 m

5. Construction Noise and Vibration Assessment

5.1 Construction activities

Prediction of construction noise levels at sensitive receivers was modelled using the SoundPLAN (Version 8.2) noise modelling software based on the ISO9613 prediction algorithm. This three-dimensional model accounts for noise source and receiver locations, ground and air absorption as well as any acoustic shielding provided by intervening topography and structures. Conservatively, it does not include any standard or project-specific mitigation measures. Proposed mitigation measures, and their acoustical benefits are detailed in Section 6.

It has been assumed that there will be one (1) truck movement per 15 minute period. Predictions for up to three (3) truck movements per 15 minute period have been provided however this is not considered to be a likely scenario. Truck movements will be from Elizabeth Drive and will end at the compound area. Daymakers will be located at the corners of the vehicle route. Site layout is shown in Appendix A – Site layout and works areas. No unloading is proposed to be conducted Out of Hours. Trucks are to remain parked on arrival.

Construction noise activities and proposed equipment are indicated in Table 16. Sound Power Levels (L_w) of equipment were either sourced from Transport for NSW's "*Construction Noise and Vibration Strategy*", the UK's Department for Environment, Food and Rural Affairs "*Update of Noise Database for Prediction of Noise On Construction and Open Sites*", or Resonate's construction plant & equipment noise database.

Table 16 - Construction stages and sound power levels used in the modelling of construction noise

Stage	Plant and equipment	Plant items total	Individual plant item L_w, dB(A)	Plant items at a given location
CS1 – Out of Hours Deliveries	Daymaker	3	98	1
	Drop deck semi-trailer	1 – 3 per 15 minutes	104	1

5.2 Noise and vibration impacts

5.2.1 Construction noise assessment

L_{Aeq} noise contours from the construction activity are presented in Appendix B – Noise contours. Detailed predictions of noise levels from construction activities at individual residences are presented in Appendix C – Detailed noise predictions. The degree to which the NMLs are exceeded dictates the extent of additional noise mitigation measures (refer to Section 6.2).

Discussion of NML exceedances and Noise Levels

The following discusses the noise levels and NML exceedances for each construction scenario during the most stringent out of hours Period 2 (night-time) as presented in Appendix C.

- Construction stage CS1 – 1 truck per 15 minute period
  - The noise levels range up to the NML of 35 dB(A) at the most potentially affected receiver.
  - There are no receivers predicted to be in the highly noise affected category (> 75 dB(A)).
- Construction stage CS1 – 2 trucks per 15 minute period
  - The noise levels range up to 36 dB(A) at the most potentially affected receiver.
  - There are no receivers predicted to be in the highly noise affected category (> 75 dB(A)).
- Construction stage CS1 – 3 trucks per 15 minute period
  - The noise levels range up to 37 dB(A) at the most potentially affected receiver.
  - There are no receivers predicted to be in the highly noise affected category (> 75 dB(A)).

Discussion on Sleep Disturbance and Duration of Works

- The sleep disturbance criterion is not predicted to be exceeded at any residential receiver locations. Predictions for individual residences are presented in Appendix D – Sleep disturbance.
- The following should also be noted:
  - The works are not classified as highly noise intensive and do not include plant items such as rock hammers, vibratory rollers, jackhammers and the like.
  - The maximum noise levels are in the range what would be expected by a typical truck at low speed and unlikely to be discerned as specifically relating to the construction site relative to the ambient traffic noise environment.

5.2.2 Construction traffic

The results of the construction traffic assessment presented in Table 4-31 of the EIS, and shown in Figure 3 indicate that construction road traffic noise levels are predicted to comply with relevant RNP noise criteria at the majority of project affected roads. SCAW construction traffic will access worksites via the designated heavy vehicle routes illustrated in Figure 4. Therefore, no additional noise mitigation or management measures would be required at these locations.

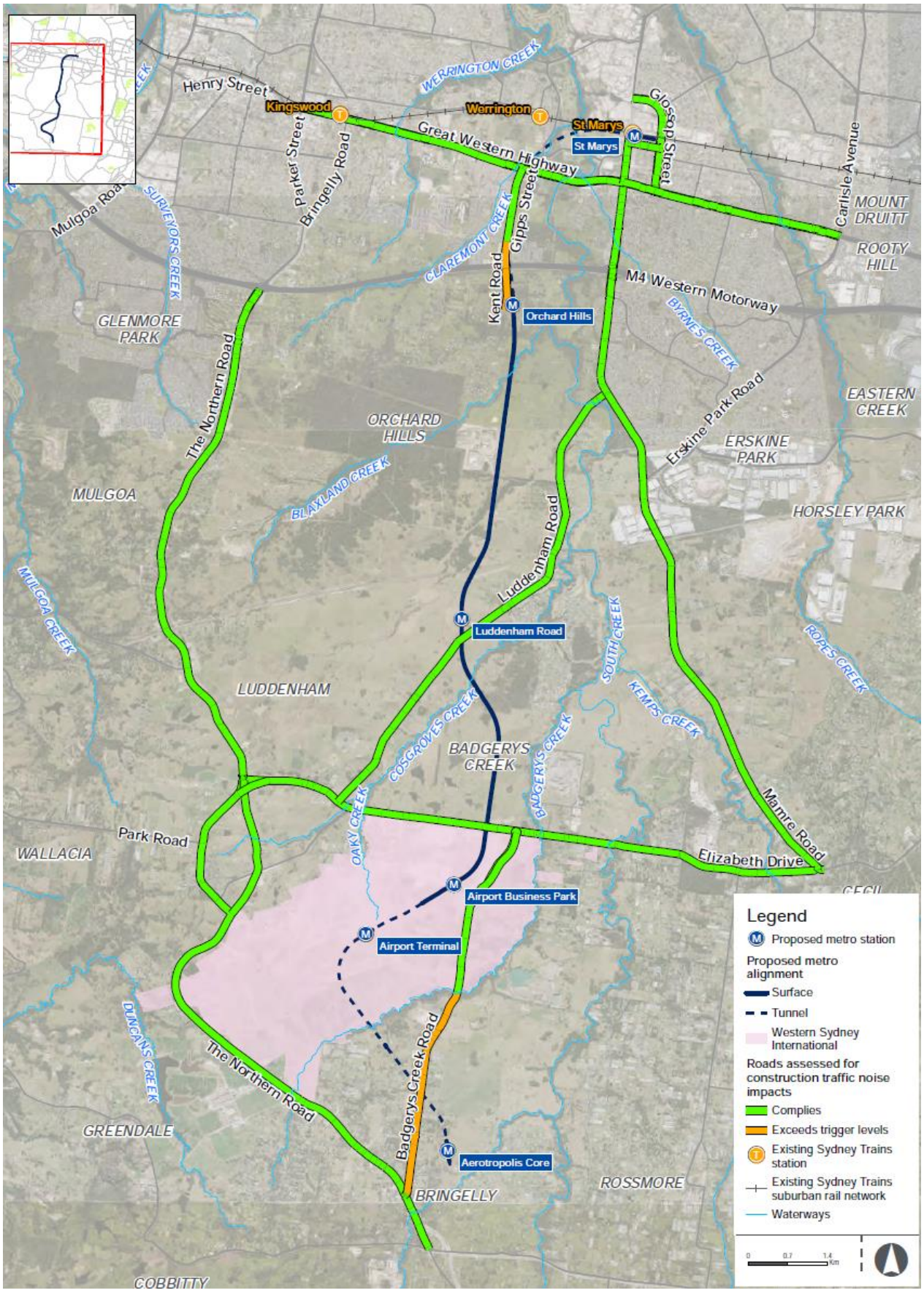

Figure 3 – Roads considered for EIS construction traffic noise assessment

5.2.2.1 Ground-borne noise

Ground-borne noise results from the transmission of vibration rather than the direct transmission of noise through the air. Ground-borne (or regenerated) construction noise is often of primary concern on tunnelling projects when vibration from activities such as rock-breaking, road heading, rotary cutting, tunnel boring and rock drilling/sawing can be transmitted through the ground and into the habitable areas of nearby buildings. Ground-borne noise occurs when this vibration in the ground and/or building elements is regenerated as audible noise within areas of occupancy inside the building.

The ICNG defines internal ground-borne noise goals for residential receivers of 40 dB(A) Leq(15min) during the evening (6 pm to 10 pm) and 35 dB(A) Leq(15min) during the night-time (10 pm to 7 am). These goals are only applicable when ground-borne noise levels are higher than airborne noise levels.

Due to the distance between construction works and receivers, ground-borne noise impacts are expected to be negligible in comparison to airborne noise impacts. For this reason, ground-borne noise is not anticipated to be the controlling factor for these proposed works and therefore further assessment is not warranted. As identified in the EIS, the application of standard mitigation measures for the control of airborne noise emissions and vibration is expected to adequately address ground-borne noise.

5.2.3 Construction vibration assessment

The proposed scope of work that is the subject of this DNVIS does not include the use of vibration intensive plant and therefore no further assessment of construction vibration is warranted, baring the limitation of use of vibratory compaction equipment within two metres of underground services.

6. Mitigation and Management

6.1 Standard construction noise mitigation measures

The CNVS outlines standard mitigation measures that should be incorporated by default in all construction projects. Those most relevant to the construction of the project are listed below.

- Restricting works to standard construction hours as far as practicable, considering safety and traffic management requirements
- Selecting quieter plant and equipment
- Maximising offset distances between receivers and noisy plant or activities
- Orientating plant and processes away from residences
- Regularly maintaining and monitoring plant and equipment to ensure that their noise emissions are not excessive
- Minimising the annoyance from reversing alarms by either fitting closed circuit monitors or non-tonal reversing alarms ("quackers") on vehicles or deploying 'spotters' to oversee reversing movements. Sites should be designed to minimise or remove the need for plant to undertake reversing manoeuvres
- Reducing throttle settings and switching off equipment when it's not being used.
- Screening noise-intensive processes such as jackhammering by the use of mobile screens Such screens can reduce noise levels by approximately 5-10 dB(A) where the line of sight to a receiver from the works is blocked.

6.2 Additional construction noise mitigation measures

Table 17 presents the additional mitigation measures that are recommended in the Sydney Metro *Construction Noise and Vibration Standard* that are based on the extent of NML exceedance. These predicted levels are shown by receiver for each construction stage in Appendix C – Detailed noise predictions.

Table 17 – Additional mitigation measures – Airborne construction noise

Time Period		Mitigation Measures Predicted $L_{Aeq(15\ minute)}$ noise level above NML			
		0 to 10 dB	10 to 20 dB	20 to 30 dB	> 30 dB
Approved construction hours	Mon-Fri (7.00 am - 6.00 pm)	-	LB	LB, M, SN	LB, M, SN
	Sat (8.00 am - 1.00 pm)				
	Sun/Pub Hol (Nil)				
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M	LB, M, SN, RO	LB, M, SN, IB, PC, RO
	Sat (1.00 pm - 10.00 pm)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
OOOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB	LB, M, SN, RO	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)				
	Sun/Pub Hol (6.00 pm - 7.00 am)				

Note: Phone calls (PC), Monitoring (M), Individual briefings (IB), alternative accommodation (AA), specific notification (SN), letterbox drop (LB), duration reduction (DR), Project specific respite offer (RO)

It is anticipated that works would occur for a maximum of 1 – 2 nights outside of any individual sensitive receiver. This would represent the worst-case scenario for out of hours deliveries. Additional mitigation measures by construction stage are presented in Table 18 below.

Table 18 – Additional mitigation measures by construction stage and NCA

		NCA10
CS1 – Out of Hours Deliveries (1 truck per 15 minutes)		
OOHW 2	LB	-
	LB,M,SN,RO	-
	(LB, M, SN, IB, PC, RO, AA)	-
	(LB, M, SN, IB, PC, RO, AA)	-
CS1 – Out of Hours Deliveries (2 trucks per 15 minutes)		
OOHW 2	LB	1
	LB,M,SN,RO	-
	(LB, M, SN, IB, PC, RO, AA)	-
	(LB, M, SN, IB, PC, RO, AA)	-
CS1 – Out of Hours Deliveries (3 trucks per 15 minutes)		
OOHW 2	LB	1
	LB,M,SN,RO	-
	(LB, M, SN, IB, PC, RO, AA)	-
	(LB, M, SN, IB, PC, RO, AA)	-

6.3 Construction vibration

The assessments of construction vibration found that the risk of impact at surrounding receivers was low. As such, no specific mitigation measures are proposed, baring the limitation of use of vibratory compaction equipment within two metres of underground services.

7. Conclusion

A DNVIS has been completed to support the proposed out of hours works.

Regarding construction noise, an assessment was carried out as per guidance presented in the Sydney Metro Construction Noise and Vibration Standard and the Construction Noise and Vibration Management Plan. The assessment identified that one receiver may marginally exceed the night-time NML by 1 dB to 2 dB where more than one delivery truck operates per 15 minute period. The significance of this exceedance was evaluated and an additional mitigation measure in the form of a letter box drop was determined.

No exceedances of the sleep disturbance criterion was predicted.

Whilst one marginal NML exceedance may occur in some cases, the works are not classified as highly noise intensive and do not include plant items such as rock hammers, vibratory rollers, jackhammers and the like.

Due to the distance between construction works and receivers, ground-borne noise impacts are expected to be negligible in comparison to airborne noise impacts. For this reason, ground-borne noise is not anticipated to be the controlling factor for these proposed works and therefore further assessment is not warranted. As identified in the EIS, the application of standard mitigation measures for the control of airborne noise emissions and vibration is expected to adequately address ground-borne noise.

The proposed scope of work that is the subject of this DNVIS does not include the use of vibration intensive plant and therefore no further assessment of construction vibration is warranted, baring the limitation of use of vibratory compaction equipment within two metres of underground services.

Appendix A – Site layout and works areas

S220189 SCAW DNVIS 2
Site layout

PROJECT NUMBER	S220189
DRAWN BY	AS
CHECKED BY	AP
DATE ISSUED	January 2023

Legend

- Noise Catchment Areas
- Truck route
- Day makers

Receivers

- Commercial
- Industrial
- Residential
- Educational
- Medical facility
- Place of worship
- Child care facility

N

100 200 300 400 500 m

Datum GDA2020, Projection MGA ZONE 56

Resonate

www.resonate-consultants.com

Appendix B – Noise contours

S220189 SCAW DNVIS 2
LAeq Noise level contours

PROJECT NUMBER	S220189
DRAWN BY	AS
CHECKED BY	AP
DATE ISSUED	January 2023

Legend

- Noise Catchment Areas
- Truck route
- Day makers

Receivers
- Commercial
- Industrial
- Residential
- Educational
- Medical facility
- Place of worship
- Child care facility

Leq dB(A)
- <40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- >75

N

200 400 600 800 1,000 m

Datum GDA2020, Projection MGA ZONE 56

Resonate

www.resonate-consultants.com

Appendix C – Detailed noise predictions

Out of Hours Delivery 1 truck per 15 minutes, 3 day makers						
No.	Name	L_{eq} Night	Type	NML OOH-Night	Address	Unique_ID
41816	NCA10.RES.52	35	RES	35	1783-1789 ELIZABETH DRIVE	52
41890	NCA10.RES.88	30	RES	35	1953-2109 ELIZABETH DRIVE	88

Out of Hours Delivery 2 trucks per 15 minutes, 3 day makers						
No.	Name	L_{eq} Night	Type	NML OOH-Night	Address	Unique_ID
41816	NCA10.RES.52	36	RES	35	1783-1789 ELIZABETH DRIVE	52
41888	NCA10.RES.88	31	RES	35	1953-2109 ELIZABETH DRIVE	88

Out of Hours Delivery 3 trucks per 15 minutes, 3 day makers						
No.	Name	L_{eq} Night	Type	NML OOH-Night	Address	Unique_ID
41816	NCA10.RES.52	37	RES	35	1783-1789 ELIZABETH DRIVE	52
41888	NCA10.RES.88	32	RES	35	1953-2109 ELIZABETH DRIVE	88

Appendix D – Sleep disturbance

Out of Hours Delivery 1 truck per 15 minutes, 3 day makers						
No.	Name	L_{max} Night	Type	Sleep disturbance criteria	Address	Unique_ID
41816	NCA10.RES.52	43	RES	45	1783-1789 ELIZABETH DRIVE	52
41890	NCA10.RES.88	38	RES	45	1953-2109 ELIZABETH DRIVE	88

Out of Hours Delivery 2 trucks per 15 minutes, 3 day makers						
No.	Name	L_{max} Night	Type	Sleep disturbance criteria	Address	Unique_ID
41816	NCA10.RES.52	44	RES	45	1783-1789 ELIZABETH DRIVE	52
41888	NCA10.RES.88	39	RES	45	1953-2109 ELIZABETH DRIVE	88

Out of Hours Delivery 3 trucks per 15 minutes, 3 day makers						
No.	Name	L_{max} Night	Type	Sleep disturbance criteria	Address	Unique_ID
41816	NCA10.RES.52	45	RES	45	1783-1789 ELIZABETH DRIVE	52
41888	NCA10.RES.88	40	RES	45	1953-2109 ELIZABETH DRIVE	88