

Appendix B3

SGWPW-JHSW-NWW-PM-PLN-000516

Noise and Vibration Management Sub Plan

SSI 9737

Sydney Gateway Road Project

June 2021

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Appendices

- Appendix A Noise and Vibration Monitoring Program**
- Appendix B Land Use Survey**
- Appendix C Vibration screening drawings**

Document control

Approval and certification

Title	Noise and Vibration Management Sub Plan
Endorsed by Environment Representative	Cameron Weller Hutchison Weller Pty Ltd
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Dated	
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The document is uncontrolled when printed. One controlled hard copy of the NVMP as part of the CEMP and supporting documentation will be maintained by the Quality Manager at the Project office (and on the Project website).

Copy number	Issued to	Version
1	Transport for New South Wales	
2	Independent Verifier	
3	Environmental Representative	
4	Project Director	
5	Environment, Approvals and Sustainability Manager	
6	Quality Manager	

Glossary/ Abbreviations

Abbreviations	Expanded Text
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Attenuation	The reduction in the level of sound or vibration.
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline (Roads and Maritime 2016)
CNVIS	Construction Noise and Vibration Impact Statement
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
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.
EMM	Environmental Management Measure
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 target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ER	Environmental Representative
ERG	Environmental Review Group
EWMS	Environmental Work Method Statements
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements..

Abbreviations	Expanded Text
Highly noise intensive works	Dynamic compaction and any works defined as annoying under the ICNG being: a) use of 'beeper' style reversing or movement alarms, particularly at night-time; b) use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work; c) grinding metal, concrete or masonry; d) rock drilling; e) line drilling; f) vibratory rolling; g) rail tamping and regulating; h) bitumen milling or profiling; i) jackhammering, rock hammering or rock breaking; and j) impact piling.
ICNG	<i>Interim Construction Noise Guideline (DECC, 2009)</i>
INP	<i>NSW Industrial Noise Policy (EPA 2000)</i>
L _{Aeq} (15min)	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
L _A (max)	the A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
MDP	Major Development Plan
NCA	Noise catchment areas
NML	Noise Management Level
NVMP	Noise and Vibration Management Sub Plan (this document)
OEH	Office of Environment and Heritage
OOHW	Out-of-hours works
OSR	Other Sensitive Receivers
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
SWP	Sound Power Level
SSI	State Significant Infrastructure
SPL	Sound Pressure Level
TfNSW	Transport for NSW (formerly Roads and Maritime Services, RMS)
UMM	Updated Mitigation Measure

1 Introduction

1.1 Context

This Noise and Vibration Management Sub Plan (NVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Sydney Gateway Road Project (the Project).

This NVMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the environmental management measures listed in the Project's combined Environmental Impact Statement (EIS) / Major Development Plan (MDP), Updated Management Measures (UMM's) from the Response to Submissions Report and all applicable legislation and TfNSW requirements.

1.2 Background and Project description

1.2.1 Background

Transport for NSW (TfNSW) have gained approval to deliver a high-capacity road connection linking the Sydney motorway network at St Peters interchange with Sydney Airport's domestic and international terminals and the Port Botany Precinct. The Project is located on both State and Commonwealth land.

For areas on State land, the Project was declared to be critical State significant infrastructure (CSSI) under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and was approved by the NSW Minister for Planning and Public Spaces on 27 August 2020.

Commonwealth approval under the *Airports Act 1996* (the *Airports Act*) was granted by the Australian Minister for Infrastructure, Transport and Regional Development on 23 September 2020.

John Holland Seymour White Joint Venture (JHSWJV) have been contracted by Transport for New South Wales (TfNSW) for the Design and Construction of Sydney Gateway Stage 1 & Stage 3 (the Project).

1.2.2 Project Objectives

The objectives of the Project are to connect Sydney Airport Terminal 1 (the International Terminal) and Terminals 2/3 (the Domestic Terminals) with each other and with the Sydney motorway network via St Peters interchange. The Project aims to facilitate the movement of traffic towards Port Botany via General Holmes Drive, and will provide three main routes for traffic:

- Between the Sydney motorway network and Terminal 1, and towards the M5 motorway and the Princes Highway
- Between the Sydney motorway network and Terminals 2/3, and towards General Holmes Drive, Port Botany and Southern Cross Drive
- Between Terminal 1 and Terminals 2/3.

The Project also aims to provide improved access to Sydney Airport land located on both sides of Alexandra Canal and across the Botany Rail Line.

1.2.3 Detailed Description

The Project is located about eight kilometres south of the Sydney Central Business District, in the suburbs of Tempe, St Peters and Mascot. It sits within the boundaries of the Inner West, City of Sydney and Bayside local government areas.

The key features of the Project are illustrated in Figure 1-1, which include:

- Road links to provide access between the Sydney motorway network and Sydney Airport's terminals, consisting of the following components:

- St Peters interchange connection – a new elevated section of road extending from St Peters interchange to the Botany Rail Line, including an overpass over Canal Road.
- Terminal 1 connection – a new section of road connecting Terminal 1 with the St Peters interchange connection, including a bridge over Alexandra Canal and an overpass over the Botany Rail Line.
- Qantas Drive upgrade and extension – widening and upgrading Qantas Drive to connect Terminals 2/3 with the St Peters interchange connection, including a high-level bridge over Alexandra Canal.
- Terminal links – two new sections of road connecting Terminal 1 and Terminals 2/3, including a bridge over Alexandra Canal.
- Terminals 2/3 access – a new elevated viaduct and overpass connecting Terminals 2/3 with the upgraded Qantas Drive.
- Road links to provide access to Sydney Airport land:
 - A new section of road and an overpass connecting Sydney Airport's northern lands on either side of the Botany Rail line (the northern lands access)
 - A new section of road, including a signalised intersection with the Terminal 1 connection and a bridge, connecting Sydney Airport's existing and proposed freight facilities on either side of Alexandra Canal (the freight terminal access)
- An active transport link, about 1.5 kilometres long and located along the western side of Alexandra Canal, to maintain connections between Sydney Airport, Mascot and the Sydney central business district
- Intersection upgrades and/or modifications
- Construction of operational ancillary infrastructure including maintenance bays, new and upgraded drainage infrastructure, signage and lighting, retaining walls, noise barriers, flood mitigation basin, emplacement mounds, utility works and landscaping.

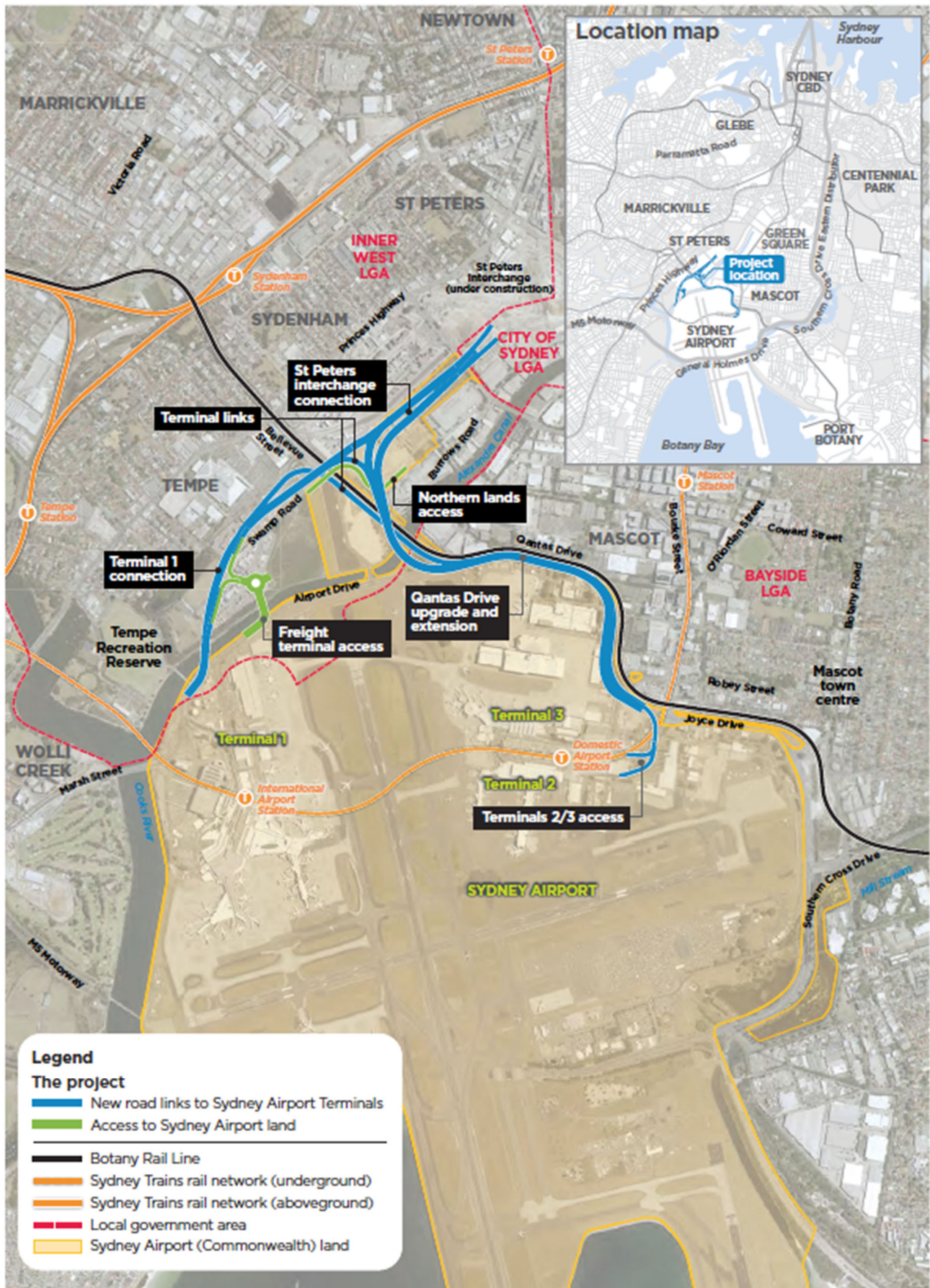


Figure 1-1 Project overview

1.3 Scope of the Plan

This Plan has been developed specifically for works occurring within NSW State land under approval SSI 9737, which, is administered by the NSW Department of Planning, Industry and Environment (DPIE). Works occurring within Commonwealth land are detailed in the Noise and Vibration Management Plan – Commonwealth.

1.4 Environmental management systems overview

The environmental management system overview is described in Section 1.5 of the CEMP. Used together, the CEMP, issue specific environmental management plans, strategies, procedures and environmental work method statements (EWMS) form management guides that clearly identify required environmental management actions for reference by JHSWJV personnel and contractors.

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how the JHSWJV proposes to manage potential noise and vibration impacts during construction of the Project. It provides the framework and mechanisms for the implementation of feasible and reasonable mitigation and management of potential noise and vibration impacts.

2.2 Objectives

The key objective of the NVMP is to ensure all CoA, environmental management measures and licence/permit requirements relevant to noise and vibration are described, scheduled and assigned responsibility as outlined in:

- The combined Environmental Impact Statement (EIS) / Major Development Plan (MDP) prepared for the Sydney Gateway Project – Stages 1 & 3.
- Conditions of Approval for SSI 9737 issued by the Minister for Planning and Public Spaces (NSW), on 27 August 2020.
- Updated Management Measures (UMM's), as detailed in the Response to Submissions Report.
- Roads and Maritime specifications G36, G38 and G40.
- The Project's Environmental Protection Licence (EPL).
- Relevant legislation and other requirements described in Section 3.1 of this Plan.

2.3 Targets and performance outcomes

The following targets have been established for the management of noise and vibration impacts during the delivery of the Project:

- Ensure compliance with the relevant legislative requirements, CoA and UMM.
- Meet environment protection licence (EPL) requirements.
- Effective management of noise and vibration impacts during construction in accordance with the Roads and Maritime Construction Noise and Vibration Guideline (CNVG).
- Ensure training is provided in the form of inductions to relevant Project personnel relating to noise and vibration issues before they begin work on site.
- Notify affected sensitive receivers of upcoming works and any out-of-hours works
- Implement reasonably practicable measures to minimise noise and vibration impacts on surrounding residents, commercial and other sensitive receivers during construction.
- No exceedance of predicted noise and vibration impacts during construction of the Project as a result of Project works
- Address complaints in a timely and efficient manner.

The following performance outcomes relevant to noise and vibration (as identified in Chapter 27.4 Compilation of performance outcomes of the EIS/MDP) are detailed in Table 2-1 below.

Table 2-1: Noise and Vibration Performance Outcomes

No.	Performance outcome	Where Addressed
1	<p>Noise and Vibration- Amenity</p> <ul style="list-style-type: none"> The project minimises impacts on the local community by controlling noise and vibration. Feasible and reasonable mitigation measures are implemented to minimise the noise and vibration impacts on sensitive receivers. 	<p>This Plan details management measures to minimise noise and vibration impacts on the local community, businesses, and stakeholders along the project alignment.</p> <p>Section 8 of this Plan details mitigation measures to be implemented to minimise noise and vibration impacts throughout the Project.</p>
2	<p>Noise and Vibration- Structural</p> <ul style="list-style-type: none"> The project minimises impacts on structures by controlling vibration through construction planning. Feasible and reasonable mitigation measures are implemented to minimise the structural vibration impacts. Vibration intensive construction work is managed to avoid or minimise adverse impacts on the structural integrity of buildings and heritage items. 	<p>Planning of vibration intensive works is detailed in Section 5.5 and Section 7.</p> <p>Section 8.4 specifically deals with minimising vibration impacts and the assessment required. The Monitoring Program in Appendix A of this Plan confirms the monitoring in place to validate and manage vibration intensive works throughout the Project.</p> <p>The above referenced sections also include management of buildings and heritage items.</p>

3 Environmental requirements

3.1 Relevant legislation

3.1.1 Legislation

All legislation relevant to this NVMP is included in Section 3.2.2 of the CEMP.

3.1.2 Guidelines

The main guidelines, specifications and policy documents relevant to this Plan include:

- Roads and Maritime QA Specification G36 – Environmental Protection (Management System).
- Roads and Maritime Construction Noise and Vibration Guidelines (CNVG) (Roads and Maritime 2016)
- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Noise Policy for Industry (NPfI), Environment Protection Authority 2017
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
- Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
- Australian Standard AS2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN 4150-2016 Structural vibration Part 3: Effects of vibration on Structures.

3.1.3 Construction Noise and Vibration Guideline (CNVG)

The Construction Noise and Vibration Guideline (CNVG, Roads and Maritime 2016) provides practical guidance on how to minimise the impact of construction noise and vibration on the community. It outlines the principles for managing construction noise and vibration, including all feasible and reasonable mitigation measures that should be considered by the Project. JHSWJV will adopt the CNVG to guide management of construction noise and vibration impacts.

3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed Table 3-1 below. A cross reference is also included to indicate where the condition is addressed in this Plan or other project management documents.

Table 3-1 Minister's Conditions of Approval

CoA No.	Condition Requirements	Document Reference
C5	<p>The following CEMP Sub-plans must be prepared in consultation with the relevant agencies identified for each CEMP Sub-plan. Details of all information requested by an agency during consultation must be included in the relevant CEMP Sub-plan, including copies of all correspondence from those agencies.</p> <p>(b) Noise and Vibration -- (Pipeline Operators and Sydney Water (where vibration generating activities will impact on their assets) and relevant councils)</p>	<p>This document</p> <p>Section 3.5</p>
C6	<p>The CEMP Sub-plans must state how:</p> <p>(a) the environmental performance outcomes identified in the documents listed in Condition A1 will be achieved;</p> <p>(b) the mitigation measures identified in the documents listed in Condition A1 will be implemented;</p> <p>(c) the relevant terms of this approval will be complied with; and</p> <p>(d) issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.</p>	<p>Section 2.3, Section 5</p> <p>Section 8</p> <p>Table 3-1</p> <p>Section 6, Section 7 and Section 8</p>
C11	<p>The Noise and Vibration CEMP Sub-plan must be prepared in consultation with businesses that contain noise and vibration sensitive critical working areas that are operational and will be impacted by construction noise and vibration. The Sub-plan must detail how construction would be managed in accordance with Condition E22 to avoid or minimise impacts during sensitive periods.</p>	<p>Section 3.5</p> <p>Section 4.1</p> <p>Section 8</p>

CoA No.	Condition Requirements	Document Reference
C15	<p>The following Construction Monitoring Programs must be prepared in consultation with the relevant agencies identified for each program to compare actual performance of construction of the CSSI against the predicted performance and to inform management measures.</p> <p>(a) Noise and vibration -- (Pipeline operators and relevant councils)</p>	<p>Details of consultation are included in Section 3.5.</p> <p>The monitoring program is introduced in Section 9.3.</p> <p>The Noise and Vibration Monitoring Program is provided in Appendix A</p>
C18	<p>The Noise and Vibration Monitoring Program must include, but not be limited to:</p> <p>(a) noise and vibration monitoring at agreed representative locations adjacent to the construction to confirm construction noise and vibration levels;</p> <p>(b) for the purposes of (a), noise monitoring must be undertaken during the day, evening and night-time periods and within the first month of Work as well as throughout the construction period and cover the range of activities being undertaken at the sites; and</p> <p>(c) provision of any real time noise and vibration monitoring data. The data must be readily available to the construction team, Proponent and ER. The Department and EPA must be provided with access to the real-time monitoring data, on request.</p>	<p>The Noise and Vibration Monitoring Program is provided in Appendix A.</p>
E13	<p>A detailed land use survey must be undertaken to confirm sensitive receivers (including critical working areas such as flight simulators, operating theatres and precision laboratories) potentially exposed to construction noise and vibration, construction ground-borne noise and operational noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of Work which generates construction or operational noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Noise and Vibration CEMP Sub-plan.</p>	<p>Refer to Section 4.1 and Appendix B.</p> <p>This will also be included in the CNVIS</p>

CoA No.	Condition Requirements	Document Reference
E14	<p>Work must only be undertaken during the following hours:</p> <p>(a) 7:00 am to 6:00 pm Monday to Fridays, inclusive;</p> <p>(b) 8:00 am to 6:00 pm Saturdays; and</p> <p>(c) At no time on Sundays or public holidays.</p>	Section 5.2
E15	<p>Except as permitted by an EPL or Out-of-Hours Work Protocol (where an EPL does not apply), highly noise intensive works that result in an exceedance of the applicable NML at the same receiver must only be undertaken:</p> <p>(a) between the hours of 8:00 am to 6:00 pm Monday to Friday;</p> <p>(b) between the hours of 8:00 am to 1:00 pm Saturday; and</p> <p>(c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour.</p> <p>For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the highly noise intensive works.</p>	Section 5.2
E16	<p>Notwithstanding Conditions E14 and E15, Work may be undertaken outside the hours specified in the following circumstances:</p> <p>(a) for the delivery of materials required by the NSW Police Force or other appropriate authority for safety reasons; or</p> <p>(b) 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</p> <p>(c) where the relevant road authority has advised the Proponent in writing that carrying out Work during the hours specified in Condition E14 would result in a high risk to road network operational performance and a road occupancy licence will not be issued during the hours specified in Condition E14; or</p> <p>(d) where an approval is required for a controlled activity in accordance with the Airports Act 1996 and the approved time is outside the hours specified in Condition E14; or</p> <p>(e) where the rail authority has advised the Proponent in writing that a Rail Possession is required and approval has been given to complete Work during the rail possession; or</p>	Section 5.2 and Section 8.6

CoA No.	Condition Requirements	Document Reference
	<p>(f) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or</p> <p>(g) where an EPL is not required or in force, Work approved through an Out-of-Hours Work Protocol developed in accordance with Condition E18; or</p> <p>(h) construction that causes:</p> <p>(i) $L_{Aeq(15 \text{ minute})}$ noise levels no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and</p> <p>(ii) $L_{Aeq(15 \text{ minute})}$ noise levels no more than the 'Noise affected' noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and</p> <p>(iii) 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), and</p> <p>(iv) 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</p> <p>(i) where negotiated agreements with directly affected residents and sensitive land uses have been reached.</p> <p>Note: Section 5.24(1)(e) of the EP&A Act requires that an EPL be substantially consistent with this approval.</p>	
E17	<p>On becoming aware of the need for emergency Work in accordance with Condition E16(b), the Proponent must notify the ER, the Planning Secretary and the EPA of the reasons for such work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those Works.</p>	Section 5.2

CoA No.	Condition Requirements	Document Reference
E18	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of Work outside the hours defined in Condition E14 and that is not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of the Work. The Protocol must identify Work activities in terms of their risk of adverse impacts on sensitive receivers and include:</p> <p>(a) a process for the consideration of out-of-hours Work against the relevant noise management level (NML) and vibration criteria, including the determination of low, medium and high-risk activities;</p> <p>(b) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition E19 and Condition E20. The measures must take into account the predicted noise and vibration levels and the likely frequency and duration that sensitive receivers would be exposed to residual impacts, including the number of noise-awakening events;</p> <p>(c) procedures to facilitate the coordination of out-of-hours Work, including those approved by an EPL or undertaken by a third party, to ensure appropriate respite is provided;</p> <p>(d) an approval process that considers the risks, proposed mitigation, management and coordination of Work, including where -</p> <ul style="list-style-type: none"> (i) the ER reviews all proposed out-of-hours Works and confirms their risk levels, (ii) low risk activities can be approved by the ER, and (iii) medium and high-risk activities are approved by the Planning Secretary; and <p>(e) notification arrangements for affected receivers and the EPA for all approved out-of-hours Work and notification to the Planning Secretary of approved low risk out-of-hours Work.</p>	<p>Section 5.2</p> <p>Section 8.6</p> <p>SGWPW-JHSW-NWW-EN-PRO-000531 - Out of Hours Works Protocol</p>
E19	<p>In order to undertake Work outside hours specified in Condition E14, the Proponent must identify appropriate respite periods for out-of-hours Work in consultation with the community likely to exceed the NML and vibration criteria in Condition E23(a) and (b) at each affected location on at least a three (3) monthly basis. This consultation must include (but not be limited to) providing the community with:</p> <p>(a) a schedule of likely out-of-hours work for a period no less than three (3) months;</p> <p>(b) a description of the potential Work, location and duration;</p> <p>(c) the noise characteristics and likely noise levels of the Work; and</p> <p>(d) likely mitigation and management measures to be implemented.</p>	<p>Section 8.6</p> <p>SGWPW-JHSW-NWW-EN-PRO-000531 - Out of Hours Works Protocol</p>

CoA No.	Condition Requirements	Document Reference
	<p>The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour Work must be provided to the EPA, ER and Planning Secretary for information within two (2) week of undertaking the community consultation.</p> <p>Note: Respite periods can be any combination of days or hours where out-of-hours Work would not be more than 5 dB(A) above the rating background level at any residence.</p>	
E20	<p>Additional mitigation measures such as temporary alternative accommodation or other agreed mitigation measures, must be offered/ made available to residents affected by out-of-hours Work (including where utility works are being undertaken for the CSSI) where the construction noise levels, between:</p> <p>(a) 10:00 pm and 7:00 am, Monday to Friday; (b) 10:00 pm Saturday to 8:00 am Sunday; and (c) 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00 am,</p> <p>are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA (LAeq(15 min), whichever is the lesser and the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period.</p> <p>The NML must be reduced by 5 dB where the noise contains annoying characteristics and increased by 10 dB if the property has received at-property noise treatment. The noise levels and duration requirements identified in this condition may be changed through an EPL applying to the CSSI.</p>	<p>Section 8.6 SGWPW-JHSW-NWW-EN-PRO-000531 - Out of Hours Works Protocol</p>
E21	<p>All Work undertaken for the delivery of the CSSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must:</p> <p>(a) reschedule any Work to provide respite to impacted residential receivers so that the respite is achieved in accordance with Conditions E19 and E20; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the ER in support of any decision made by the Proponent in relation to respite or mitigation.</p>	<p>Section 8.6</p>

CoA No.	Condition Requirements	Document Reference
E22	Noise and vibration generating Work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as flight simulators, theatres, laboratories and operating theatres) resulting in noise levels above the NMLs or vibration levels above the relevant criteria must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	Section 5.3.2 Section 8 (Table 8-1)
E23	<p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <ul style="list-style-type: none"> (a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009); (b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure); (c) Australian Standard AS 2187.2 • 2006 "Explosives - Storage and Use - Use of Explosives"; (d) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and (e) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage). <p>Any construction work identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan.</p> <p>Note: The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.</p>	Section 5 Section 8 (Table 8-1)
E24	<p>Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:</p> <ul style="list-style-type: none"> (a) evening (6:00 pm to 10:00 pm) - internal LAeq(15 minute): 40 dB(A); and (b) night (10:00 pm to 7:00 am)- internal LAeq(15 minute): 35 dB(A). <p>The mitigation measures must be outlined in the Noise and Vibration CEMP Sub-plan required by Condition C5, including in any Out-of-Hours Work Protocol required by Condition E18.</p>	Section 5 Section 8

CoA No.	Condition Requirements	Document Reference
E25	<p>Prior to undertaking dynamic compaction, the Proponent must:</p> <ul style="list-style-type: none"> (a) complete a trial of different weights and heights at a location that is the furthest from any sensitive structure and residents to refine the minimum working distances for human comfort <ul style="list-style-type: none"> - preferred values for human exposure to vibration specified in Tables 2.2 and 2.4 of Assessing Vibration: a technical guideline and cosmetic damage in accordance with BS 7385 and DIN 4150; (b) schedule dynamic compaction to occur during the hours specified in Condition E14 unless: <ul style="list-style-type: none"> (i) the compaction work requires approval as a controlled activity in accordance with the Airports Act 1996 and the approved time is outside the hours specified in Condition E14, or (ii) it can be demonstrated that the preferred values would not be exceeded; and (iii) evidence of this is provided to the Planning Secretary at least one (1) week prior to the activity being undertaken; and (c) provide alternative accommodation for residents within the minimum working distances where exceedance of the preferred values for human comfort are likely and: <ul style="list-style-type: none"> (i) the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period; and (ii) the works must be completed at night (10:00 pm to 7:00 am). 	<p>Section 8.4.2</p> <p>Appendix A Monitoring Program</p>
E26	<p>Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before Work that generates vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan.</p>	<p>Section 7.3</p>
E27	<p>The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic and structural damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, amend the methodology and/or implement additional mitigation measures to prevent damage.</p>	<p>Section 9.3.2</p> <p>Appendix A Monitoring Program</p>
E28	<p>The Proponent must seek and implement the advice of a heritage specialist on impacts to heritage listed structures from installing equipment used for vibration, movement and noise monitoring before its installation.</p>	<p>Section 9.3.2</p>

CoA No.	Condition Requirements	Document Reference
E29	The Proponent must consult with proponents or applicants of other State significant development and infrastructure projects within 200 metres of the CSSI and take reasonable steps to coordinate Work, including utility Work, to minimise cumulative noise and vibration impacts and maximise respite for affected sensitive receivers.	Section 3.4 Section 7.3
E30	At no time can noise generated by Work exceed the National Standard for exposure to noise in the occupational environment of an eight-hour (8 hr) equivalent continuous A-weighted sound pressure level of LAeq, 8h of 85 dB(A) for any employee working at a location near the CSSI.	Section 5.3.4
E32	Operational noise mitigation measures for residences identified: (a) as eligible for consideration of additional mitigation in the Sydney Gateway Road Project Response to Submissions Report Appendix B - Memo Sydney Gateway Road Project Submissions Report Revised Operational Modelling Figure 6 Receivers Eligible for Consideration of Additional Mitigation; and (b) as likely to exceed the noise management level in Condition E23(a); must be implemented within six (6) months of the commencement of construction at and in the vicinity of the impacted residences(s) to minimise construction noise impacts, and detailed in the Noise and Vibration CEMP Sub-plan for the CSSI, unless otherwise approved by the Planning Secretary in accordance with Condition E33. Additional mitigation must be prioritised so that those receivers with the largest likely exceedance of the noise management level receive the mitigation first.	Section 8.5
E39	The Proponent must offer pre-construction surveys to the owners of surface and sub-surface structures and other relevant assets identified at risk of damage from vibration. Where the offer is accepted, the survey must be undertaken by a suitably qualified and experienced engineer prior to the commencement of vibration-generating works that could impact on the structure. The results of each survey must be documented in a Pre-construction Condition Survey Report and the report must be provided to the owner of the structure or other relevant asset for review one month prior to the commencement of potentially impacting works.	Section 8.1

3.3 Other Requirements Relevant to the Development of this Plan

Other requirements detailed in the EIS/MDP, Submissions Report and relevant TfNSW Specifications (G36) are detailed in Table 3-2 below. This includes reference to required outcomes, the timing of when the commitment applies and relevant documents or sections of the environmental assessment influencing the outcome and implementation.

Table 3-2 Other environmental requirements relevant to this NVMP

Source	Condition Requirements	Document Reference
UMM - NV5	A Construction Noise and Vibration Management Plan will be prepared as part of the CEMP and implemented during construction. The plan will detail processes, responsibilities, and measures to manage noise and vibration and minimise the potential for impacts during construction, consistent with the management approach and mitigation measures in the Roads and Maritime's Construction Noise and Vibration Guideline (Roads and Maritime, 2016).	This Plan
UMM - NV6	<p>Location and activity specific noise and vibration impact assessments will be undertaken prior to those works (as a minimum):</p> <ul style="list-style-type: none"> • With the potential to result in noise levels above 75 dBA at any receiver • That need to occur outside standard construction hours and are likely to result in noise levels greater than the relevant noise management levels • With the potential to exceed relevant performance criteria for vibration. <p>The assessments will confirm predicted impacts at relevant receivers in the vicinity of the activities to assist with the selection of appropriate management measures.</p> <p>Monitoring will be carried out at the start of new noise and vibration intensive activities to confirm that actual levels are consistent with the predictions.</p>	<p>Section 4.1 and Section 7.2</p> <p>Section 9.3</p>
UMM - NV7	The facades of hotels likely to be affected by construction will be assessed to confirm existing façade performance (external to internal noise transmission) in consultation with the hotel operators.	<p>Section 3.5.1</p> <p>Section 5.4</p> <p>Section 7.2</p>
UMM - NV8	The potential for impacts on the existing Flight Training Centre will be managed in accordance with the acoustic framework that has been agreed with Qantas.	<p>Section 7.2</p> <p>Section 3.4.2</p>

Source	Condition Requirements	Document Reference
UMM - NV9	Investigate and implement alternative methods of demolition to avoid hydraulic/pneumatic hammering where high noise impacts are anticipated. Alternative methods could include shears, pulveriser or ripper attachments fitted onto the excavators.	Section 8.4.2
UMM - NV10	Noisy work and vibration intensive activities (those activities that exceed the vibration criteria) will be scheduled during standard construction hours as far as possible. Works or activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods. Respite measures will be implemented for noisy work and vibration intensive activities in a manner consistent with the Roads and Maritime's Construction Noise and Vibration Guideline (Roads and Maritime, 2016).	Section 5.2 and Section 8.2
UMM - NV11	Hoarding, or other shielding structures, will be used for construction compounds and where receivers are impacted near fixed works areas where construction noise would exceed relevant noise management levels at nearby sensitive receivers . The barriers should be of solid construction with minimal gaps.	Section 8.2 and CNVIs
UMM - NV12	<p>Vibration generating activities will be managed to minimise the potential for impacts on structures and sensitive receivers, including maximising minimum working distances where practicable, or alternate methods to minimise vibration where minimum working distances cannot be achieved.</p> <p>Prior to the commencement of vibration-intensive works within the minimum working distances for cosmetic damage, the potential for damage will be assessed. Where there is potential for damage, alternative methods that generate less vibration will be investigated and substituted where practicable.</p> <p>Where residual risks remain, condition surveys will be carried out and vibration monitoring will be undertaken. Vibration monitors will provide real-time notification of exceedances of levels approaching cosmetic damage and human comfort criteria. Any identified vibration-related damage to the items will be rectified.</p>	Section 8.4
UMM - NV13	<p>Prior to vibration intensive works in the vicinity of pipelines, the owners of each potentially affected pipeline will be consulted to confirm the potential for impacts from vibration and any appropriate criteria.</p> <p>Management protocols to protect the integrity of each affected pipeline, including monitoring requirements, will be developed in consultation with each asset owner as required, and implemented for all vibration intensive works in the vicinity of pipelines.</p>	Section 5.5.4

Source	Condition Requirements	Document Reference
UMM - NV14	Building condition surveys will be completed before and after construction works where buildings or structures are within the minimum vibration working distances for cosmetic damage.	Section 8.4.2
UMM - NV15	The likelihood of cumulative and consecutive construction noise impacts, particularly when undertaken outside standard construction hours, will be reviewed prior to construction and coordinated with other nearby projects to minimise impacts, where possible.	Section 3.4.3 and Section 8.2
G36 4.6	Prepare and implement a Noise Management Sub-Plan as part of the CEMP, or include mitigation strategies within the CEMP, to minimise the impact of noise from your operations on adjacent properties. The Noise Management Sub-Plan or mitigation strategies must include proposed environmental control measures for all significant noise generating activities.	This Plan

3.4 Consultation

This Plan has been provided to City of Sydney Council, Bayside Council, Inner West Council, Sydney Water and Pipeline Operators (where vibration generating activities will impact on their assets), in accordance with CoA C5 (b). In addition, the Monitoring Program included in Appendix A of this Plan has also been provided to the above stakeholders in accordance with CoA C15(a).

Consultation would also be undertaken with the owners of businesses that contain noise and vibration sensitive critical working areas that are operational and would be impacted by construction noise and vibration, in accordance with CoA C11. A review and assessment has been completed of the Project area which has identified three properties in St Peters (film /television studio, optometrist, and IT business) relevant to this requirement. The assessment concludes that these properties would only be impacted where impact piling was completed within 180 metres (film/television studio) and 300 metres (optometrist, and IT business) of any impact piling. As impact piling is not currently proposed as part of the scope of the Project works, no consultation is required. If construction methodologies are amended to undertake impact piling, consultation in accordance with CoA C11 will be completed in advance to the works and this Plan will be updated.

Noise and vibration sensitive receiver buildings identified in in the EIS/ MDP are summarised in the table below. Further review and identification of relevant sensitive receivers would be undertaken during the preparation of Construction Noise and Vibration Impact Statements for the construction works and further consultation will be undertaken, where required.

Table 3-2 Noise and vibration sensitive receivers identified in the EIS/ MDP

NCA	Receiver type	Receiver name/ address	Impacts requiring consultation
NCA01	Place of worship	St Peters Anglican Church, 183 Princes Hwy, St Peters NSW 2044	Noise
NCA02	Place of worship	St Peter & St Paul Catholic Church, 545 Princes Hwy, Tempe NSW 2044	Noise
NCA03	Child care	Guardian Early Learning Centre, 18 Holbeach Ave, Tempe NSW 2044	Noise
NCA03	Child care	Betty Spears Child Care Centre, 1A Gannon St, Tempe NSW 2044	Noise
NCA04	Industrial	CCA Alexandria, 4 Burrows Rd S, St Peters NSW 2044	Vibration
NCA04	Industrial	5 and 13 Burrows Rd S, St Peters NSW 2044	Vibration
NCA05	Commercial	Active Automobile Electrics, 258 Link Rd, Mascot NSW 2020	Noise
NCA06	Child care	Storey House Early Learning Centre, Suite 2, 11/247 Coward Street, Mascot NSW 2020	Noise
NCA06	Hotel	Stamford Plaza Hotel, 241 O'Riordan Street, Mascot, NSW 2020	Noise and vibration

NCA	Receiver type	Receiver name/ address	Impacts requiring consultation
NCA06	Hotel	Holiday Inn Express Sydney Airport, 2/12 Sarah St, Mascot NSW 2020	Noise and vibration
NCA07	Hotel	Airport Hotel (proposed)	TBC
NCA07	Hotel	Mantra Hotel, 3 Ross Smith Ave, Mascot NSW 2020	Noise and vibration
NCA07	Hotel	Ibis Budget Sydney Airport, 5 Ross Smith Ave, Mascot NSW 2020	Noise
NCA07	Educational facility	Qantas Flight Training Centre, S148, Qantas Jet Base, Qantas Dr, Mascot NSW 2020	Noise and vibration
NCA07	Commercial	AMG Showroom, 2 Sir Reginald Ansett Dr, Mascot NSW 2020	Noise and vibration
NCA07	Commercial	Qantas Jet Base Security Office, Qantas Service Rd, Mascot NSW 2020	Noise and vibration
NCA07	Commercial	Arthur Baird Jetbase (Qantas Hangars), Qantas Service Rd, Mascot NSW 2020	Vibration
NCA07	Commercial	DHL Sydney Gateway, Sir Reginald Ansett Dr, Mascot NSW 2020	Noise and vibration
NCA08	Hotel	Citadines Connect Sydney Airport, 121 Baxter Rd, Mascot NSW 2020	Noise
NCA08	Hotel	Quest Mascot, 108-114 Robey St, Mascot NSW 2020	Noise
-	Pipelines	Jemena Primary and Secondary Gas Mains Qenos Ethylene Pipeline Fuel Pipelines Airport Water Supply Line Sydney Desalination Pipeline	Vibration

Ongoing consultation with relevant councils and other stakeholders, including any unique local receivers, owners of businesses and the community, may be carried out for particular issues pertaining to the Project's noise and vibration impacts, including the identification of appropriate respite periods for out-of-hours works (OOHW).

Community feedback and complaints relating to noise and vibration will be dealt with in accordance with the Communications Strategy and the Complaints Management System.

3.4.1 Hotel facade performance

Hotels likely to be affected by construction noise will be identified as part of the assessment process (see Section 7). Consultation with identified hotels will be undertaken to confirm the location of sensitive spaces within the hotels. The hotel facades likely to be construction noise affected will be assessed to confirm the existing facade performance (external to internal noise transmission) in consultation with the hotel operators. From these investigations, external

equivalent noise management levels are able to be developed for each hotel, taking into account the internal noise management level and the facade performance. Acceptable internal noise levels would be expected to result inside hotel rooms when construction noise levels are within the external equivalent noise management levels.

This will allow further assessment of construction noise impact on the hotels and provision of detailed advice regarding likely impacts on hotel guests and form part of the Construction Noise and Vibration Impact Statements (CNVIS, see Section 7.2) for the Project.

3.4.2 Qantas Flight Training Centre

The potential for impacts on the existing Flight Training Centre will be managed in accordance with the acoustic framework that has been agreed with Qantas.

A similar acoustic framework will be developed for the new Qantas Flight Training Centre and implemented once the facility is operational to minimise potential impacts during Project's construction. The acoustic framework for the new Qantas Flight Training Centre would be consistent with what will be applied to the existing Flight Training Centre.

The acoustic framework for the new Qantas Flight Training Centre will be implemented and include:

- Confirmation of building and simulator cabin acoustic performance and external to internal transfer functions for noise and vibration
- A process for setting external triggers levels for monitoring that are protective of the internal facility training functions from an acoustic perspective
- Monitoring requirements
- Communication protocols.

3.4.3 Cumulative noise impact

Ongoing consultation will include regular coordination with State significant developments and infrastructure projects being undertaken within 200m of the Project, which may include Botany Rail Duplication Project (SSI-9714). This consultation will be undertaken with the aim of coordinating works to minimise cumulative noise and vibration impacts and maximise respite for affected sensitive receivers, in accordance with CoA E29.

4 Existing environment

The Project is located in the suburbs of Tempe, St Peters and Mascot and is close to a number of major existing road and rail transportation corridors and is located adjacent to the Sydney Airport which is located generally to the south of the Project.

Major roads in the study area include Princes Highway in the north, Airport Drive in the west, and Qantas Drive, Joyce Drive and O'Riordan Street in the east near to Sydney Airport Terminals 2/3. The Botany Rail Line runs through the Project area and is a freight only line that connects Port Botany to the Sydney metropolitan rail network.

Existing noise levels in the study area are generally dominated by transportation noise, with road noise affecting most locations. Rail and aircraft noise also contribute to existing noise levels in certain areas, depending on the proximity to the Botany Rail Line and Sydney Airport. During the night-time, noise levels generally decrease due to reduced road traffic volumes on the surrounding road network. There is also a curfew on passenger flights at Sydney Airport from 11 pm to 6 am.

The suburbs of Tempe and Mascot have large areas of suburban residential receivers, however these are generally not in close proximity to the Project area. The nearest residential receivers in Tempe are around 130 metres away from the Project, to the north of Tempe Recreation Reserve. The nearest residential receivers in Mascot are around 90 metres to the north east, on Baxter Road.

Relatively large parts of the study area are of commercial or industrial use, especially around Sydney Airport, in the western section of Mascot near Alexandra Canal and along Princes Highway. The commercial uses include retail outlets, distribution warehouses, shipping container storage and areas of heavy industry, such as Boral Concrete St Peters which is located close to project site on Burrows Road South.

The assessment of impacts from the Project uses a number of Noise Catchment Areas (NCAs) that reflect the land uses in the study area. The NCAs are based on those identified in the EIS/MDP, with some modifications following review of the existing acoustic environment. The modifications are minor and mostly extend beyond the EIS/MDP study area to ensure that noise impact to sensitive receivers is managed in accordance with the requirements outlined in Section 3.

The NCAs are shown in Figure 4-1 and described in Table 4-1 below. Table 4-1 also notes where NCAs are modified from the EIS/MDP..

Table 4-1 Noise Catchment Areas and Surrounding Land Uses

NCA	Minimum distance ¹	Description	Commonwealth Land?
NCA00	550 m	This catchment is located to the north east of St Peters interchange where construction of WestConnex New M5 is currently occurring. Residential receivers are located on Campbell Street/Road which face the interchange, however, they are relatively far from Sydney Gateway road Project. Sydney Park is in this catchment, off Campbell Street.	-

NCA	Minimum distance ¹	Description	Commonwealth Land?
NCA01	160 m	This catchment is located north of Alexandra Canal and east of Reilly Lane, Sydenham and southwest of Campbell Street/Road. It is mainly residential with the exception of commercial receivers along Princes Highway. St Peters Anglican Church, Public School and Preschool are in the north-east of the catchment. The closest receivers to the Project are commercial receivers on Princes Highway.	Partly – southern boundary of the NCA
NCA01a	550 m	New NCA not included in EIS/MDP. This catchment is located to the north of St Peters interchange, north of Campbell Street/Road. It is mainly residential with the exception of industrial receivers along Princes Highway, Hutchison Street and May Street	-
NCA02	5 m	This catchment is located in Tempe, north of Sydney Airport and Alexandra Canal. The EIS/MDP NCA02 has been divided into three separate NCAs to better represent the existing acoustic environment. NCA02 now comprises of the southern section of the EIS/MDP NCA02 and is mainly commercial and includes IKEA Tempe.	-
NCA02a	300 m	This catchment is located in Tempe, north of Sydney Airport and Princes Highway. The EIS/MDP NCA02 has been divided into three separate NCAs to better represent the existing acoustic environment. NCA02a comprises of the more distant area of the EIS/MDP NCA02 to the north of Princes Highway is mainly residential.	-
NCA02b	200 m	This new catchment is located in Tempe, south west of Alexandra Canal. It has been added to ensure that impacts, in particular during out of hours works, can be adequately managed. It comprises of mixed residential and commercial, with some industrial premises.	-
NCA03	130 m	This catchment is located in Tempe to the north-west of Sydney Airport Terminal 1. The catchment is mainly residential with the exception of commercial receivers on Princes Highway. The catchment includes Tempe Recreation Reserve and the Guardian Early Learning Child Care Centre.	-
NCA04	15 m	This catchment is north of Sydney Airport and Airport Drive and is entirely commercial. It includes Boral Concrete St Peters and Boral Recycling St Peters to the north Alexandra Canal. The nearest buildings are located close to the Project site in the north and west of	Partly – north-west and south sections near Alexandra



NCA	Minimum distance ¹	Description	Commonwealth Land?
		the catchment, and also along Airport Drive and Qantas Drive.	Canal and Qantas Drive
NCA05	5 m	This catchment covers the western section of Sydney Airport and is generally commercial use associated with Sydney Airport Terminal 1.	Yes
NCA06	35 m	This catchment is located in Mascot to the north of Sydney Airport Terminals 2/3 and Qantas Drive. The EIS/MDP NCA06 has been divided into two separate NCAs to better represent the existing acoustic environment. This catchment is mainly commercial with a number of hotels along the eastern border on O'Riordan Street, including the Stamford Plaza Hotel.	Partly – Coleman Reserve and adjacent to Qantas Drive
NCA06a	35 m	This catchment is located in Mascot to the north of Sydney Airport Terminals 2/3 and Qantas Drive. The EIS/MDP NCA06 has been divided into two separate NCAs to better represent the existing acoustic environment. This catchment is mostly residential and mixed use receivers north of Coward Street and east of Kent Road.	-
NCA07	5 m	This catchment covers the eastern section of Sydney Airport and is generally of commercial use associated with Qantas and Sydney Airport Terminals 2/3. The Project would remove a number of the buildings next to Qantas Drive. The catchment has a number of hotels near the Qantas Drive and O'Riordan Street intersection, including the Ibis Budget, Mantra Hotel and also a future hotel at Sydney Airport.	Yes
NCA08	85 m	This catchment is located in Mascot to the north-east of Sydney Airport. The area is mainly residential, with the nearest receivers being on Baxter Road. Two hotels, Quest Mascot and Citadines Connect Sydney Airport, are located near to O'Riordan Street. Mascot Public School is located in the north east of the catchment on King Street.	Partly – small section next to Joyce Drive
NCA08a	250 m	This new catchment is located in Mascot, to the north-east of Sydney Airport and north of NCA08. It essentially extends EIS/MDP NCA08 to the north, which will assist with managing impacts, in particular during out of hours works. It comprises of mostly residential premises, with scattered commercial and industrial premises.	-

NOTE:

1. Approximate minimum horizontal distance from Project to nearest receiver in each NCA.

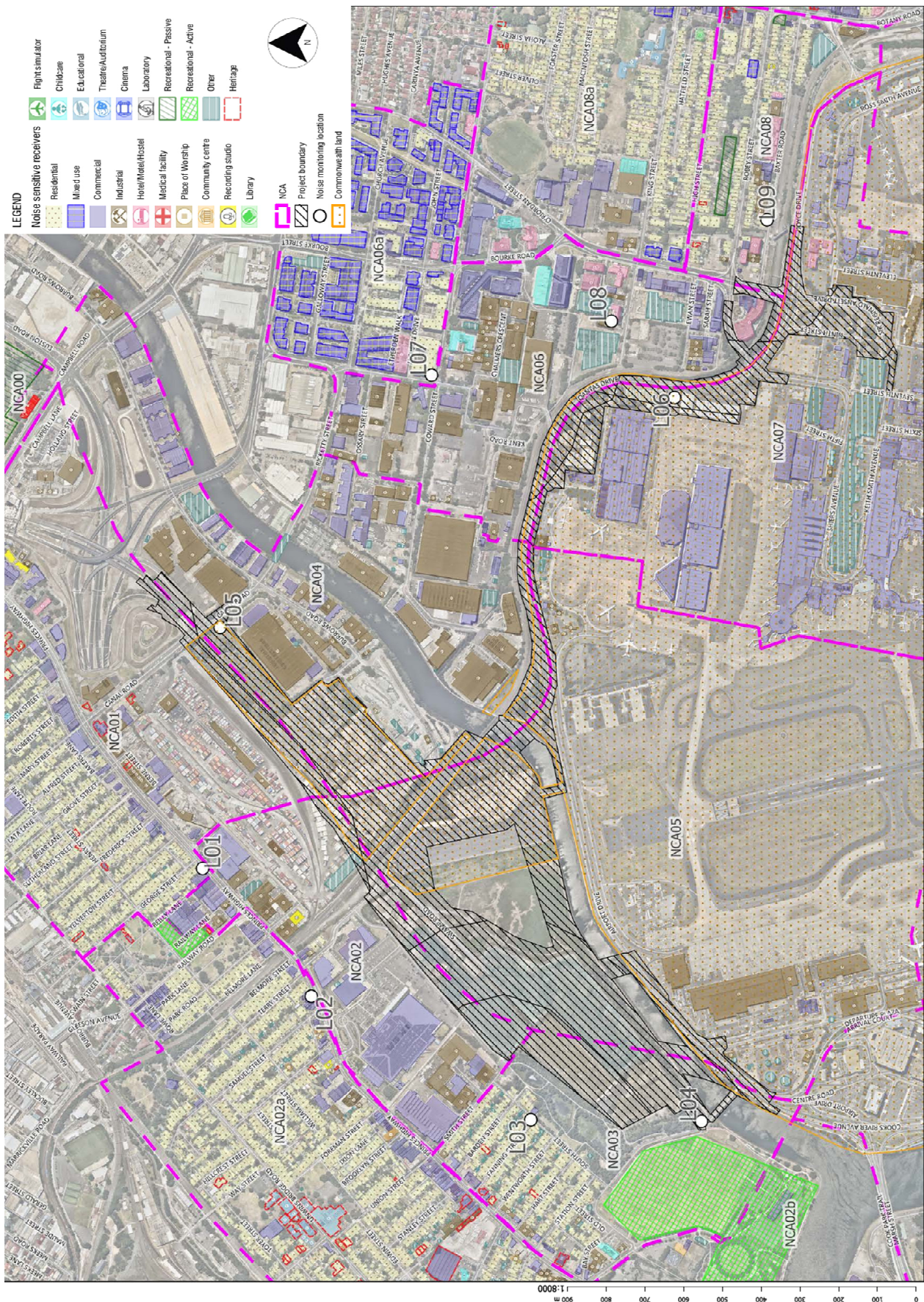


Figure 4-1 Site Plan, Receivers and Noise Monitoring Locations

4.1 Sensitive receivers

Receivers potentially sensitive to noise and vibration have been categorised as residential dwellings, commercial/industrial buildings, or 'other sensitive' land uses which includes educational institutions, child care centres, hospital wards and operating theatres, places of worship, outdoor recreation areas, and community centres. Refer to Table 3-2 for the noise and vibration sensitive receivers identified in the EIS/MDP.

In accordance with CoA E13 a detailed land use survey was undertaken to confirm sensitive receivers (including critical working areas such as flight simulators, operating theatres, recording studios and precision laboratories) potentially exposed to construction noise and vibration, construction ground-borne noise and operational noise. The survey brought the NSW cadastral database and identified land use details into a Geographic Information System (GIS). The GIS allows potentially critical areas that are sensitive to construction noise and vibration impacts to be easily identified and updated as land uses change during the Project timeline.

The land-use data can be readily included into the noise and vibration modelling, to allow effective management of noise and vibration impacts on identified sensitive receivers. The results of this survey are included in Appendix B and will also be included in the CNVIS.

4.2 Ambient noise

Attended and unattended noise monitoring was completed at each of the monitoring locations shown in Figure 4-1 and Figure 4-2 during development of the EIS/MDP. The monitoring locations were representative of receivers that would likely be most affected by the construction and operation of the Project in each NCA. The attended measurements were generally found to be consistent with the results of the unattended noise monitoring and show that existing noise levels are typically dominated by transportation noise sources including road, rail and air, depending on location.

A summary of the unattended noise logging results is provided in Table 4-2 below, which is sourced from the Technical Working Paper 2 of the EIS/MDP. This table provides a summary of the ambient noise monitoring results.

Table 4-2 Summary of unattended noise logging results

Monitor ID (EIS)	Rating Background Level (RBL)			Existing ambient noise levels (L_{Aeq})			Address
	Day	Evening	Night	Day	Evening	Night	
L00 ²	54	45	40	68	65	61	18 Campbell St, St Peters
L01	65	62	53	75	74	72	Princes Highway, St Peters
L02	64	60	48	75	74	72	535 Princes Highway, Tempe
L03	42	40	38	61	60	53	1 Fanning St, Tempe
L04	53	53(56) ³	46	64	64	58	Alexandra Canal, Tempe
L05	58	54	49	67	65	63	Canal Road, St Peters
L06	63	60	52	73	72	70	Qantas Dr, Mascot



Monitor ID (EIS)	Rating Background Level (RBL)			Existing ambient noise levels (L _{Aeq})			Address
	Day	Evening	Night	Day	Evening	Night	
L07	60	56	50	71	68	67	39 Kent Rd, Botany
L08	60	58	53	68	66	64	289 King St, Mascot
L09	54	51	45	67	65	62	105 Baxter Rd, Mascot

NOTES:

1. Construction noise is assessed during the daytime, which is 7am to 6pm Monday to Friday and 8am to 6pm Saturdays, evening which is 6pm to 10pm Monday to Sunday and night-time which is 10pm to 7am Monday to Friday and 10pm to 8am on Saturday, Sunday and public holidays.
2. Results taken from NL03 in the WestConnex New M5 EIS, Roads and Maritime 2015.
3. The monitored evening level was found to be higher than the daytime. The NSW EPA Noise Policy for Industry therefore requires that the evening level be reduced to match the daytime level.

This noise monitoring summarised above was utilised to determine appropriate Rating Background Levels (RBLs) and Noise Management Levels (NMLs) for each NCA. The RBLs for each area were determined for each of the day, evening and night periods as per the Industrial Noise Policy (INP).

5 Noise and vibration objectives

5.1 Summary of construction noise and vibration objectives

The policies and standards outlined in Table 5-1 have been used to establish construction noise and vibration management objectives for the Project.

Table 5-1 Summary of construction noise and vibration objectives

Environment impact	Relevant policy/ standard used to establish noise and vibration management level
Construction hours	Conditions of Approval EPL
Airborne noise	Conditions of Approval Interim Construction Noise Guideline (ICNG)
Sleep disturbance and maximum noise events	No specific guidelines. Guidance taken from the Interim Construction Noise Guideline (ICNG), the Road Noise Policy (RNP) and Roads and Maritime Environmental Noise Management Manual (ENMM) Practice
Ground-borne noise	Conditions of Approval Interim Construction Noise Guideline (ICNG)
Construction-related road traffic noise	No specific guidelines. Guidance taken from the Interim Construction Noise Guideline (ICNG) and the Road Noise Policy (RNP).
Vibration (disturbance to building occupants)	Conditions of Approval NSW DECC's Assessing vibration; a technical guideline, published in February 2006, in line with CoA D16(b), which incorporates British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)
Vibration (structural damage to buildings)	Conditions of Approval British Standard 7385:1993 Evaluation and measurement of vibration in buildings – Part 2 Guide to damage from ground-borne vibration German Standard DIN 4150:1999 – Part 3 Structural vibration in buildings – Effects on structures (for structurally unsound heritage structures)
Vibration (structural damage to buried services)	German Standard DIN 4150:1999 – Part 3 Structural vibration in buildings – Effects on structures

Environment impact	Relevant policy/ standard used to establish noise and vibration management level
Vibration (sensitive scientific and medical equipment)	<p>ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control</p> <p>Gordon GC 28 September 1999 Generic Vibration Criteria for Vibration Sensitive Equipment</p> <p>Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration</p>

5.2 Construction hours

Working hours for the Project will be applied in accordance with CoA E14 to E16. Table 5-2 following summarises the information that the CoA and EPL (should it be issued³) require regarding construction working hours for the Project. Construction would be undertaken during the approved construction hours wherever possible.

Where construction cannot be undertaken during standard construction hours, works will be scheduled with the following hierarchy, in accordance with the Roads and Maritime Construction Noise and Vibration Guideline:

1. 8:00 am to 6:00 pm Sunday (or public holidays) or 6:00 pm to 10:00pm weekdays
2. 10:00 pm to 7:00 am weekday nights
3. 10:00 pm to 8:00 am Saturday night or 6:00 pm to 7:00 am Sunday or public holiday nights.

³ This NVMP would be updated to address any EPL conditions

Table 5-2 Summary of construction working hours for the Project

CoA	EPL	Construction activity	Working hours applicable		
			Monday to Friday	Saturday	Sunday/ Public Holiday
E14	TBC	Standard construction hours	7:00 am to 6:00 pm	8:00 am to 6:00 pm	No work ¹
E15	TBC	Respite periods during standard construction hours Except as permitted by an EPL or Out-Of-Hour Protocol, respite periods must be implemented for highly noise intensive works that result in an exceedance of the applicable NML ² at the same receiver.	8:00 am to 6:00 pm	8:00 am to 1:00 pm	No work ¹
			In continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block.		

CoA	EPL	Construction activity	Working hours applicable		
			Monday to Friday	Saturday	Sunday/ Public Holiday
E16	N/A	<p>Variation to work hours³</p> <p>Work may be undertaken outside the hours specified in the following circumstances:</p> <ul style="list-style-type: none"> • Works may be undertaken outside the standard construction hours in the following circumstances: • for the delivery of materials required by the NSW Police Force or other appropriate authority for safety reasons; or • 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 harm⁴; or • where the relevant road authority has advised the Proponent in writing that carrying out work during the approved construction hours would result in a high risk to road network operational performance and a road occupancy licence will not be issued; or • where an approval is required for a controlled activity in accordance with the Airports Act 1996 and the approved time is outside the approved construction hours; or • where the rail authority has advised that a Rail Possession is required and approval has been given to complete work during the rail possession that is outside the approved construction hours; or • where different construction hours are permitted or required under an EPL in force in respect of the Project; or • where an EPL is not required or in force, work approved through an Out-of-Hours Work Protocol 	6:00 pm to 7:00 am	6:00 pm to 8:00 am	8:00 am to 7:00am

CoA	EPL	Construction activity	Working hours applicable		
			Monday to Friday	Saturday	Sunday/ Public Holiday
E16	TBC	<p>Variation to work hours – low impact work</p> <p>Work may be undertaken outside the hours specified where it causes:</p> <ul style="list-style-type: none"> • $L_{Aeq(15 \text{ min})}$ noise levels no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and • $L_{Aeq(15 \text{ min})}$ noise levels no more than the 'Noise affected' noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and • 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), and • 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 <p>Or where negotiated agreements with directly affected residents and sensitive land uses have been reached.</p>	6:00 pm to 7:00 am	6:00 pm to 8:00 am	8:00 to 7:00am
E18	N/A	<p>Out of Hours Work Protocol (works not subject to an EPL)</p> <p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of Work outside the hours defined in Condition E14 and that is not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of the Work.</p>	6:00 pm to 7:00 am	6:00 pm to 8:00 am	8:00 to 7:00am

CoA	EPL	Construction activity	Working hours applicable		
			Monday to Friday	Saturday	Sunday/ Public Holiday
E21	N/A	<p>Out of Hours Work Scheduling and Respite</p> <p>Out-of-hours work undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must:</p> <p>(a) reschedule any Work to provide respite to impacted residential receivers so that the respite is achieved in accordance with Conditions E19 and E20; or</p> <p>(b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and</p> <p>(c) provide documentary evidence to the ER in support of any decision made by the Proponent in relation to respite or mitigation.</p>	6:00 pm to 7:00 am	6:00 pm to 8:00 am	8:00 to 7:00am

NOTES:

1. No work unless permitted and approved under the Out of Hours Work Protocol or, where applicable the EPL allows.
2. The applicable NML for residential receivers is the highly noise affected level of 75dB(A) (Table 5-3).
3. Required for activities that may impact on critical infrastructure and operations, including the operation of Sydney Airport, arterial roads and the Botany Rail line.
4. In accordance with CoA E17, on becoming aware of the need for emergency works to avoid the loss of life, damage of property or environmental harm, JHSWJV will notify the ER, the Planning Secretary, and the EPA of the reasons for such work. In these circumstances, JHSWJV will use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of the works.

5.3 Airborne construction noise objectives

The ICNG provides guidelines for the assessment and management of construction noise. The ICNG focuses on applying a range of work practices to minimise construction noise impacts rather than focusing on achieving numeric noise levels.

The main objectives of the ICNG are to:

- Identify and minimise noise from construction works
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts
- Encourage construction during the recommended standard hours only, unless approval is given for works that cannot be undertaken during these hours
- Reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

5.3.1 Residential receivers

General airborne construction noise

Table 5-3 below, which was sourced from the ICNG, shows how NMLs at residential receivers are determined and how they are to be applied.

Table 5-3 Noise Management Levels at Residential Receivers

Time of Day	Noise Management Level L_{Aeq} (15min)	How to Apply
Standard hours: <ul style="list-style-type: none"> • Monday to Friday 7 am to 6 pm • Saturday 8 am to 1 pm 	RBL + 10 dB(A)	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p>
	Highly noise affected 75dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, JHSWJV would carefully consider other ways to reduce noise to below this level. If no quieter work method is feasible or reasonable and the works proceed, the proponent would provide respite periods and communicate with the impacted residents.</p>

Time of Day	Noise Management Level L_{Aeq} (15min)	How to Apply
Outside recommended standard hours	Noise affected RBL + 5 dB(A)	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, additional noise mitigation measures should be applied in accordance with RMS CNVG.</p>

The rating background level (RBL) is used when determining the noise management level (NML). The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term and methodology to obtain RBLs is described in detail within the Noise Policy for Industry (NPfI)(EPA, 2017).

Sleep disturbance

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed. The ICNG refers to the Environmental criteria for road traffic noise (EPA 1999) for assessing the potential impacts, which notes that to limit the level of sleep disturbance the L_{Amax} should not exceed the existing L_{90} noise level by more than 15 dB. Sleep disturbance screening criteria is provided in Table 5-2 below. Where there are noise events found to be above the initial screening level, further analysis is made to identify whether events are above an 'awakening reaction' level of 55 dB(A) L_{Amax} (internal).

Adopted Project noise management levels for residential receivers

Table 5-4 below shows the NMLs for residential receivers for each of the NCAs shown and described in Section 4. NMLs apply at the most noise-affected affected locations within the property boundary and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Table 5-4 Noise management levels for residential receivers

Noise catchment area	Monitor ID (EIS)	Noise management level ($L_{Aeq}(15\text{ minute}) - \text{dBA}$)				Sleep disturbance L_{AFmax} (RBL + 15 dB)
		Standard hours ¹ (RBL + 10 dB)	Out-of-hours ² (RBL + 5 dB)			
		Daytime	Daytime	Evening	Night	
NCA00	L00	64	59	50	45	55
NCA01	L01	75	70	67	58	68
NCA01a	L01	75	70	67	58	68
NCA02	L02	74	69	65	53	63
NCA02a	L02	74	69	65	53	63
NCA02b	L02	74	69	65	53	63
NCA03	L03	52	47	45	43	53
NCA04	L05	68	63	59	54	64
NCA05	L06	73	68	65	57	67
NCA06	L08	70	65	63	58	68
NCA06a	L07	70	65	61	55	65
NCA07	L06	73	68	65	57	57
NCA08	L09	64	59	56	50	60
NCA08a	L09	64	59	56	50	60

NOTES:

- Standard construction hours are 7am to 6pm Monday to Friday and 8am to 6pm Saturdays.
- Daytime out-of-hours are 7am to 8am on Saturday, and 8am to 6pm on Sunday and public holidays; evening out-of-hours are 6pm to 10pm Monday to Saturday; and night-time out-of-hours are 10pm to 7am Monday to Saturday and 6pm to 8am on Sunday and public holidays.

5.3.2 Other sensitive land uses

The ICNG provides noise management levels for commercial and industrial premises and 'other sensitive' land uses (ICNG, Table 3). The management levels for other noise sensitive receivers not listed in the ICNG that are applicable to the Project, such as hotels and libraries, are derived from *AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors* and the AAAC Guideline for Child Care Centre Acoustic Assessment. The management levels from AS2107 are the upper range levels to account for the variable and short-term nature of construction noise.

Table 5-5 outlines the management levels for other sensitive land uses.

Table 5-5 Noise management levels for other sensitive receivers (non-residential)

Land Use	Noise Management Level L _{Aeq} (15min)	Where NML applies	Referenced from:	Assumed facade loss (conservative)	External equivalent NML - L _{Aeq} (15min)
Studio building (music recording studio)	25 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	45 dB(A)
Studio building (film or television studio)	30 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	50 dB(A)
Cinema space, theatre, auditorium	35 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	55 dB(A)
Hotel (Sleeping areas: Hotels near major roads)	40 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A) ¹	60 dB(A)
Classrooms at schools and other educational institutions	45 dB(A)	Internal noise level	ICNG	10 dB(A)	55 dB(A)
Childcare centre (sleeping areas)	40 dB(A)	Internal noise level	AAAC - guideline for Child Care Centre Acoustic Assessment	10 dB(A)	50 dB(A)
Hospital wards and operating theatres	45 dB(A)	Internal noise level	ICNG	20 dB(A)	65 dB(A)
Places of worship	45 dB(A)	Internal noise level	ICNG	10 dB(A)	55 dB(A)
Library (reading areas)	45 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	65 dB(A)
Hotel (bars and lounges)	50 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	70 dB(A)
Community centres – Municipal Buildings	50 dB(A)	Internal noise level	AS2107 'maximum'	10 dB(A)	60 dB(A)
Restaurant, bar (Bars and lounges/ Restaurant)	50 dB(A)	Internal noise level	AS2107 'maximum'	20 dB(A)	70 dB(A)

Land Use	Noise Management Level L _{Aeq} (15min)	Where NML applies	Referenced from:	Assumed facade loss (conservative)	External equivalent NML - L _{Aeq} (15min)
Passive recreation (e.g. area used for reading, meditation)	60 dB(A)	External noise level	ICNG	-	60 dB(A)
Active recreation (e.g. sports fields)	65 dB(A)	External noise level	ICNG	-	65 dB(A)
Commercial premises (including offices and retail outlets)	70 dB(A)	External noise level	ICNG	-	70 dB(A)
Industrial premises	75 dB(A)	External noise level	ICNG	-	75 dB(A)

NOTES:

1. Most affected hotels are expected to have high performance façade (i.e. more than 20dB) to mitigate high existing noise levels near the airport. Appropriate criteria should be set which takes into account the existing face performance of affected hotels (see Section 3.4.1).

In accordance with CoA E22, noise generating works in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as recording studios and laboratories) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with affected institutions are made at no cost to the affected institution. The reasonable arrangements will be different for the various stakeholders identified above and therefore will be dealt with on a case by case basis in consultation with the relevant stakeholder(s).

Where works cannot be timetabled outside of sensitive periods, consultation with impacted sensitive receivers will be carried out, as per the Communications Strategy (Version 1 approved by DPIE 5 February 2021).

5.3.3 Annoying noise

The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level. Annoying activities identified in the ICNG include:

- use of 'beeper' style reversing or movement alarms, particularly at night-time;
- use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work;
- grinding metal, concrete or masonry;
- rock drilling;
- line drilling;
- vibratory rolling;
- rail tamping and regulating;
- bitumen milling or profiling;

- jackhammering, rock hammering or rock breaking; and
- impact piling.

Dynamic compaction would also be considered as annoying.

Where monitoring has confirmed that activities described above do not possess annoying characteristics in accordance with the ICNG (i.e. tonality or impulsive etc), the above addition of 5 dB(A) will not apply. Such monitoring will be provided to the ER for endorsement of such activities outside of the EPL, otherwise to the EPA for approval.

5.3.4 National Standard for exposure to noise

In accordance with CoA E30, Project worksites will be managed to ensure that noise generated by construction will not exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of LAeq,8h, of 85dB(A) for any employee working at a location near the Gateway Project. Ground-borne construction noise

Construction works can cause ground-borne noise impacts in nearby buildings when vibration generating equipment is in use. Ground-borne noise impacts should be considered where ground-borne noise levels are higher than noise transmitted through the air, such as where buildings near to construction works have high performing facades which attenuate the airborne component.

The majority of works would be undertaken at a sufficient distance from receivers for ground-borne noise impacts to be minimal. The EIS/ concluded that airborne noise levels would likely be dominant over the ground-borne component for construction works across the Project, which was confirmed through the land use survey provided in the CNVIS. The exception to this is potentially affected hotels, due to their high-performance facades and glazing performance. The potentially affected hotels include:

- Stamford Plaza Hotel in NCA06
- The Mantra Hotel, Ibis Budget Sydney and the future airport hotel site in NCA07
- Quest Mascot and Citadines Connect Sydney Airport in NCA08.

In accordance with the ICNG and CoA E24, mitigation measures will be applied when ground-borne noise levels exceed the ground-borne noise objectives detailed in Table 5-6 below.

Table 5-6 Ground-borne noise objectives

Receiver type	Period	Noise assessment location	Ground-borne noise objectives (L _{Aeq} (15 minute) – dBA)
Residential	Evening ¹	Internal	40
Residential	Night ²	Internal	35
Hotel - Sleeping areas (hotels near a major road)	When in use	Internal	40

NOTES:

1. Evening period applies to 6:00pm to 10:00pm
2. Night period applies to 10:00pm to 7:00am

5.4 Construction related road traffic noise

5.4.1 Construction related road traffic

JHSW JV has developed a Heavy Vehicle Driver Code of Conduct to assist with managing driver behaviour both on site and on public roads.

When trucks and other vehicles are operating within the boundary of a construction site, road vehicle noise contributions are included in the overall predicted $L_{Aeq(15\text{minute})}$ construction site noise emissions. When construction-related traffic moves onto the public road network a different noise assessment methodology is appropriate, as vehicle movements would be regarded as 'additional road traffic' rather than as part of the construction site.

The community may associate heavy vehicle movements with the Project works, when vehicles are travelling on roads located immediately adjacent to construction sites. However, once the heavy vehicles move further from construction sites onto arterial roads, the noise may be perceived as being part of the general road traffic.

The ICNG refers to the NSW Road Noise Policy (RNP) for the assessment of noise from construction traffic on public roads. In line with the RNP and the Construction Noise and Vibration Guideline (Roads and Maritime 2016), the Project will adopt the following approach for assessing and managing construction traffic noise impact:

1. Complete an initial screening test to evaluate whether traffic noise levels increase by more than 2 dB(A) as a result of construction traffic within 600m of the Project sites.
 - Where increases are 2 dB or less than the corresponding 'without construction traffic' scenario, no further assessment is required.
 - Where the road traffic noise levels are predicted to increase by more than 2 dB as a result of construction traffic, consider the total road traffic noise levels (i.e. existing road traffic plus additional construction traffic) as per item 2 below
2. Review the total road traffic noise levels and whether these levels comply with the following road traffic noise criteria in the RNP:
 - 60 dB $L_{Aeq(15\text{hour})}$ day and 55 dB $L_{Aeq(9\text{hour})}$ night for existing freeway/arterial/sub-arterial roads, and
 - 55 dB $L_{Aeq(1\text{hour})}$ day and 50 dB $L_{Aeq(1\text{hour})}$ night for existing local roads.

Where total road traffic noise levels are less than or equal to RNP noise criteria, no further assessment is required.

Where total road traffic noise levels are above the RNP noise criteria, feasible and reasonable noise mitigation measures would be applied to reduce the potential noise impacts and preserve acoustic amenity. This may include consideration of alternative truck routes or potential reduction of truck movements.

5.5 Construction vibration criteria

Effects of ground vibration on buildings resulting from construction may be segregated into the following three categories:

- Human comfort – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building contents – vibration where the building contents may be affected.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

5.5.1 Human exposure

Vibration criteria relating to human comfort from construction are identified in *Assessing Vibration: A Technical Guideline* (DEC, 2006a). The vibration dose value applies to critical working areas, such as operating theatres or laboratories, residences, offices, educational institutions and places of worship, both during the day and during the night-time. The criteria for human comfort are provided in Table 5-7 and Table 5-8 and include those applicable to intermittent vibration, continuous vibration, and impulsive vibration.

Intermittent vibration criteria for human comfort, such as from drilling, compacting or other sources which operate intermittently, but which would produce continuous vibration if operated continuously, is presented in Table 5-7. This type of vibration is assessed on the basis of vibration dose values (VDV) and is identified as the most likely source of vibration impacts on the Project.

Table 5-7 Vibration dose value criteria for intermittent vibration

Building type	Assessment period ¹	Vibration dose values (m/s ^{1.75})	
		Preferred	Maximum
Critical working areas (eg operating theatres or laboratories) ²	Daytime or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Daytime or night-time	0.40	0.80
Workshops	Daytime or night-time	0.80	1.60

NOTES:

1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Source: BS 6472-2008

Continuous vibration from uninterrupted sources assessed on the basis of weighted rms acceleration values presented in Table 5-8. Project activities are generally not anticipated to result in continuous vibration impacts.

Impulsive vibration can be defined as up to three instances of sudden impact per monitoring period, such as dropping heavy items. Impulsive vibration is assessed on the basis of acceleration values presented in Table 5-8.

Table 5-8 Preferred and Maximum Weighted Root Mean Square Values for Continuous and Impulsive Vibration Acceleration (m/s²) 1–80 Hz

Location	Assessment period ¹	Preferred values		Maximum values	
		Z-axis	X- and Y-axis	Z-axis	X- and Y-axis
Continuous vibration (rms acceleration, m/s ²)					
Critical working areas (eg operating theatres or laboratories)	Daytime or night-time	0.0050	0.036	0.010	0.0072

Location	Assessment period ¹	Preferred values		Maximum values	
		Z-axis	X- and Y-axis	Z-axis	X- and Y-axis
Residential	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Daytime or night-time	0.020	0.014	0.040	0.028
Workshops	Daytime or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (rms acceleration, m/s ²)					
Critical working areas (eg operating theatres or laboratories)	Daytime or night-time	0.0050	0.0036	0.010	0.0072
Residential	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Daytime or night-time	0.64	0.46	1.28	0.92
Workshops	Daytime or night-time	0.64	0.46	1.28	0.92

NOTES:

1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Source: BS 6472-2008

5.5.2 Structural damage to buildings

Cosmetic damage vibration limits for buildings and associated minimum working distances are identified in the *Construction Noise and Vibration Guideline*, British Standard BS7385 *Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* and German Standard DIN 4150: *Part 3-2016 Structural vibration – Effects of vibration on structures*.

The cosmetic damage levels set by BS7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Table 5-9 sets out the recommended vibration limits from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to residential, commercial and industrial buildings and is frequency dependent and specific to particular categories of structure.

Table 5-9 BS 7385 Transient vibration values for minimal risk of damage

Group	Type of building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial type buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

5.5.3 Vibration screening criteria

The limits presented in Table 5-9 above relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, then the guide values in Table 5-9 may need to be reduced by up to 50 percent. This is especially applicable at the lower frequencies where lower guide values apply.

On this basis, consistent a conservative vibration screening criteria per receiver type is given below:

- Reinforced or framed structures (Line 1): 25.0 mm/s
- Unreinforced or light framed structures (Line 2): 7.5 mm/s

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level. The analysis would take into consideration the transient vibration guide values for minimal risk of cosmetic damage set out in Table 5-9.

5.5.4 Heritage items and buried pipework

The German standard provides a conservative criterion for vibration limits for different buildings and buried pipework and has been used to identify the vibration criteria for the Project where the British Standard does not apply. The German standard values for peak particle velocity (PPV) (mm/s) measured at the foundation of the building are summarised in Table 5-10 and short-term vibration on buried pipework is shown in Table 5-11.

As noted in BS 7385, heritage buildings and structures should not be assumed to be more sensitive to vibration, unless structurally unsound. A conservative vibration damage screening level (peak component particle velocity) for heritage buildings/structures can be set to 2.5mm/s (the more stringent criterion in the German Standard DIN 4150-2016 Structural Vibration Part 3: Effects of Vibration on Structures). This screening level will allow potentially impacted heritage structures to be identified. If a heritage structure is predicted to be exposed to vibration levels above the conservative vibration screening level of 2.5mm/s, further investigation would be undertaken to determine whether the structure is structurally unsound. Where a heritage building is deemed to be sensitive to vibration impacts, the more stringent DIN 4150-2016 Group 3 guideline values can be applied. Otherwise, structural damage vibration limits based on BS 7385 (Section 5.5.2 and 5.5.3) can be applied.

Table 5-10 DIN 4150-3 guideline values for short-term vibration on structures

Group	Type of structure	Guideline values vibration velocity (mm/s)				
		Foundation, all directions at a frequency of:			Topmost floor, horizontal	Floor slabs, vertical
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 and are of great intrinsic value (eg heritage listed buildings)	3	3 to 8	8 to 10	8	20 ¹

Note: 1. It may be necessary to lower the relevant guideline value markedly to prevent minor damage.

Whilst Table 5-11 provides a vibration criterion for buried pipe utilities, this will be used as a guide and further consultation with utility owners and pipeline operators will be undertaken to apply the most appropriate vibration criteria for each utility, in accordance with CoA C5. Where consultation confirms that alternate vibration criteria are required for specific utilities or pipeline operators, a technical memorandum will be completed (as required) for that asset and provided to the asset owner (Note: these technical memorandums will sit outside of this Plan). Where assets have a specific exclusion zone for vibration intensive works, this will also be considered in the technical memorandum.

Table 5-11 DIN 4150-3 guideline values for short-term vibration on buried pipework

Line	Pipe material	Guideline values for vibration velocity measured on the pipe
1	Steel (including welded pipes)	100 mm/s
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s
3	Masonry, plastic	50 mm/s

5.5.5 Sensitive scientific and medical equipment

Some scientific equipment, such as electron microscopes and microelectronics manufacturing equipment, can require stringent vibration goals than those applicable to human comfort or cosmetic building damage.

Where vibration sensitive equipment is potentially affected by construction works, vibration limits for the operation of the equipment should be taken from manufacturer's data or provided by the equipment owner. Where this is not available the generic Vibration Criterion (VC) curves as published by the Society of Photo-Optical Instrumentation Engineers (Colin G. Gordon - 28 September 1999) may be adopted as vibration goals. These generic VC curves are provided below in Table 5-12.

Vibration goals associated with the new Qantas Flight Training Centre will be consistent with the acoustic framework.

Table 5-12 VC Curves for Vibration Sensitive Equipment

Criterion curve	Max level (µm/sec, rms) ¹	Detail size (microns) ²	Description of Use
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	12.5	1	A good standard for most lithography and inspection equipment to 1 micron detail size.
VC-D	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.
VC-E	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

NOTE:

1. As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz
2. The detail size refers to the line widths for microelectronics fabrication, the particle (cell) size for medical and pharmaceutical research, etc. The values given consider the observation requirements of many items depend upon the detail size of the process.

5.6 Blast criteria

Blasting activities are not proposed for the Project.

6 Environmental aspects and impacts

6.1 Construction activities

The Project will involve a range of activities incorporating various heavy machinery, plant and equipment that will operate in a number of locations across the Project. In order to assess the level of potential impact on noise and vibration sensitive receivers, the broad categories of construction activity likely to interact with these receivers are identified below.

- Enabling works
- Site establishment
- Clearing and grubbing
- Building and structure demolition
- Earthworks and drainage
- Dynamic compaction
- Crushing and grinding
- Impact piling
- Road construction and widening
- Bridgeworks and overpass construction
- Retaining wall construction
- Road furnishing
- Rehabilitation

6.2 Impacts

The potential for noise and vibration impacts on sensitive receivers or structures will depend on a number of factors. Typically these might include:

- The type of equipment in use
- The number of equipment simultaneously in use
- Ground condition
- Topography and other physical barriers
- Proximity to sensitive receivers
- The physical condition of sensitive receiver structure
- Hours/duration of construction works
- Existing background noise.

Relevant aspects and the potential for related impacts have been considered in a risk assessment in Appendix A2 of the CEMP.

Noise and vibration impacts attributable to the Project are anticipated and are detailed in the Technical Working Paper 2, Chapter 10 of the EIS/MDP and Appendix B of the Response to Submissions Report. Chapter 8 of this Plan provides a suite of mitigation measures that will be implemented to avoid or minimise impacts on the receiving community and/or built environment.

7 Construction noise and vibration assessment

7.1 Method for evaluation and assessment of impacts

The process of assessment of construction noise and vibration impacts is detailed in Figure 7-1. This process will form the basis of the assessments that will be prepared prior to construction works commencement. Where significant new/additional activities and/or significant changes to site layout or construction methodology are proposed, additional assessment as per this section will be undertaken. Site-specific or activity-specific noise assessments will be prepared to assess all construction activities and ancillary facilities for the Project.

Noise and vibration monitoring data will be collected throughout the delivery of the Project in accordance with the Construction Noise and Vibration Monitoring Program (refer to Appendix A).

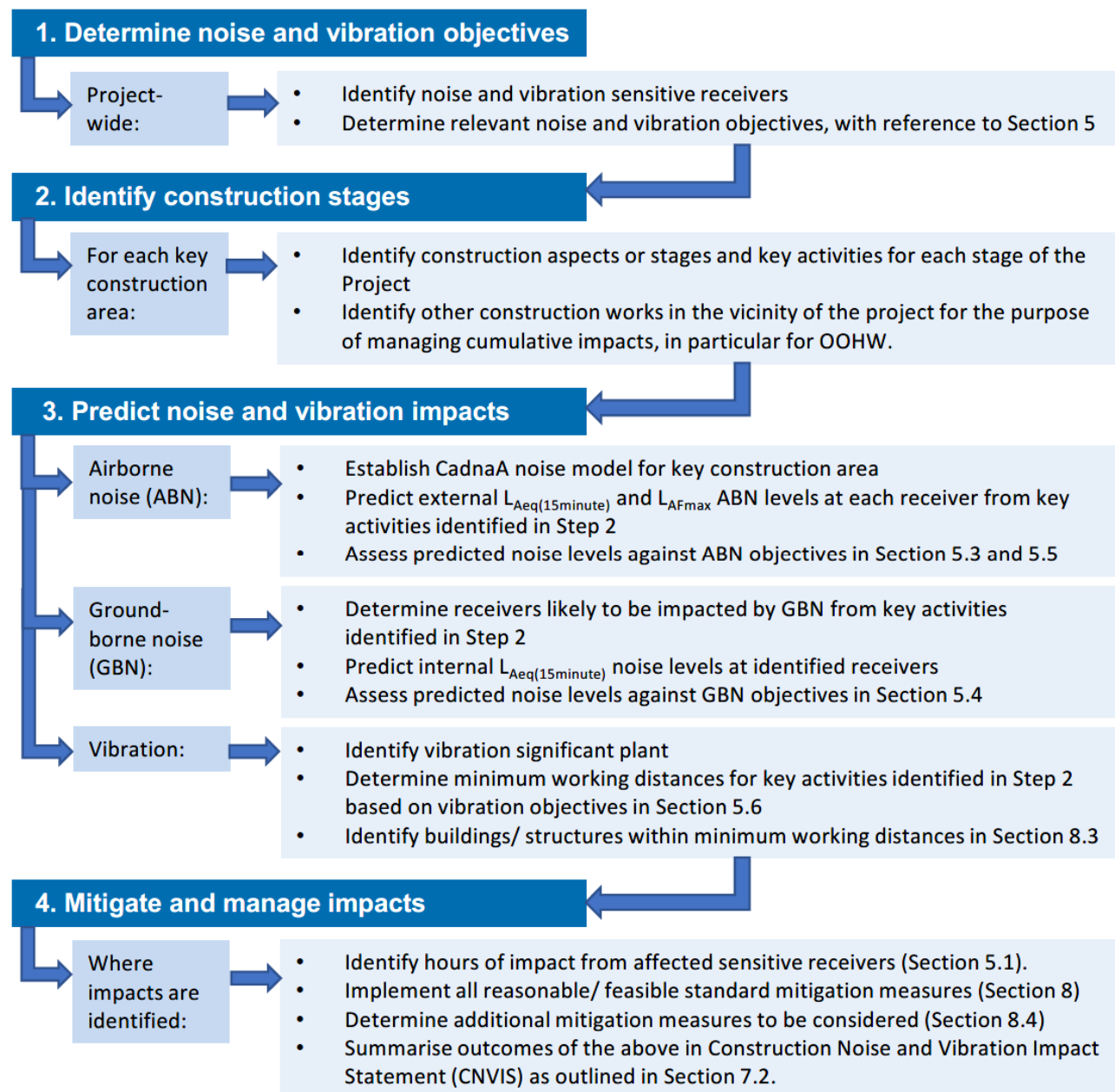


Figure 7-1 Process for assessing and managing construction noise and vibration

7.2 Construction Noise and Vibration Impact Statements

The Construction Noise and Vibration Impact Statements (CNVIS) will be a key site management tool providing clear instructions for managing each construction worksite. Each CNVIS will be prepared before any works that result in noise and vibration impacts commence at the relevant construction worksite. The CNVIS will be progressively prepared for the construction phase to identify noise and vibration impact predictions and applicable management measures. In accordance with CoA E23, any construction work identified in the CNVIS as exceeding the noise management levels and/ or vibration criteria established in Section 5 must be managed in accordance with this NVMP.

All CNVIS will be prepared by an appropriately qualified and experienced acoustic consultant.

Each CNVIS would set out the mitigation and management measures required for the construction stage, through consultation with affected sensitive receivers. They will address:

- Scope of work covered by CNVIS
- Justification for OOHV (where required)
- Nearest noise and vibration sensitive receivers, based on the land use survey required by CoA E13 (refer Appendix B)
- Construction noise and vibration objectives (outlined in Section 5)
- Construction noise and vibration impact assessment
- Mitigation options, preferred management measures and ongoing risk management
- Noise and vibration monitoring requirements and auditing process.

Construction noise and vibration impacts associated with a construction worksite would be assessed by identifying the construction activities for each worksite and stage of the Project, including likely plant and equipment. Construction noise and vibration from the identified activities would be predicted and assessed against the relevant noise and vibration objectives to identify the risk of impact. Where there is a risk of impact, all reasonable and feasible noise and vibration management measures would be recommended to reduce or manage the impacts as much as practicable.

Monitored noise and vibration levels will be analysed against the predictions made in the relevant CNVIS. This will allow for ongoing review and verification of the predictive model, and a feedback mechanism to construction planning to ensure ongoing noise and vibration risks are identified and managed appropriately.

Noise monitoring the internal noise levels within hotels will confirm the external to internal insertion loss. In addition, the facades of hotels likely to be affected by construction will be assessed to confirm existing facade performance (external to internal noise transmission) in consultation with the hotel operators. This information will be applied to the internal NMLs to establish appropriate external NMLs for assessing impact from construction on the hotels.

Physical noise mitigation measures such as noise barriers and acoustic enclosures around fixed plant will be outlined in the CNVIS. Furthermore, specific management measures such as a staging of works, respite periods (CoA E19 and E21) and community notification (CoA B2(c), B2(e)) will also be summarised, and implemented.

The CNVIS will identify the sensitive receivers that JHSW JV is required to notify regarding upcoming works to ensure ongoing noise and vibration risks are managed throughout the Project.. This notification will include the likely noise and vibration impacts during the assessed works, the duration of impact and any additional mitigation (e.g. respite periods) that may be required to manage noise and vibration impacts.

The key CNVIS to be prepared under the NVMP are summarised in Table 7-1. Further to this, the Gatewave noise and vibration management tool will be used to manage ongoing noise and vibration risks as works progress, as outlined in Section 7.3.

Table 7-1 Indicative CNVIS prepared under this NVMP

Construction worksite/ stage	Construction activity
Sydney Gateway	Early works, compound operation, demolition, bulk earthworks, bridge construction, road construction, controlled modulus columns (CMC) works

7.3 Gatewave noise and vibration management tool

A 3D construction noise and vibration management tool, Gatewave (www.gatewave.com.au), has been developed specifically for the Project to allow specific work areas and activities to be planned, assessed and managed as construction works progress. It would also allow cumulative noise impact from other aspects of the Project or, where relevant, noise from other construction projects, to be assessed and managed in accordance with this NVMP.

Gatewave incorporates ground elevation contours, building heights, the built environment and atmospheric conditions to predict construction noise in accordance with the International Standard ISO 9613-2:1996 implementing quality standard ISO 17534-1:2015. All sensitive receivers identified by the land use survey (see Section 4.1 and Appendix B) are integrated into the Gatewave tool.

CNVISs prepared for the Project would establish the overall impacts associated with worksites and ancillary facilities. The Project environment team would use Gatewave to manage construction noise and vibration impact by defining specific work areas/activities in the CNVIS as construction progresses and identifying:

- Sensitive receivers where predicted noise levels are above the NMLs so that, where there are residual impacts even after all feasible and reasonable mitigation measures have been adopted, mitigation and management measures can be applied in accordance with this NVMP
- Buildings/structures within minimum working distances established for cosmetic damage and human annoyance so that appropriate mitigation and management measures can be applied in accordance with this NVMP.

Noise and vibration monitoring data would be collected throughout the delivery of the Sydney Gateway Project. This feedback loop would ensure the prediction tool is verified and adjusted as required to ensure accuracy across the Project.

7.4 Blasting assessment

No blasting assessment has been undertaken, as blasting is not proposed for the Project. In the event that this circumstance changes, an assessment will be completed.

8 Environmental control measures

8.1 Noise and vibration mitigation and management measures

In accordance with CoA E23, mitigation measures will be implemented with the aim of achieving the construction noise management levels and vibration criteria detailed in Section 5 of this Plan. Specific measures and requirements to address contract specifications, CoA and UMM's in relation to impacts from noise and vibration are outlined below in Table 8-1.

Table 8-1 Noise and vibration management and mitigation measures

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
N&V1	Boundary screening required under Condition A18 of this approval must minimise visual, noise and air quality impacts on adjacent sensitive receivers.	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA A20	SEMP, Site inspection reports
N&V2	The following CEMP Sub-plans must be prepared in consultation with the relevant agencies identified for each CEMP Sub-plan. Details of all information requested by an agency during consultation must be included in the relevant CEMP Sub-plan, including copies of all correspondence from those agencies. (b) Noise and Vibration - (Pipeline Operators and Sydney Water (where vibration generating activities will impact on their assets) and relevant councils)	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA C5	This Plan
N&V3	The Noise and Vibration CEMP Sub-plan must be prepared in consultation with businesses that contain noise and vibration sensitive critical working areas that are operational and will be impacted by construction noise and vibration. The Sub-plan must detail how construction would be managed in accordance with Condition E22 to avoid or minimise impacts during sensitive periods.	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA C11	This Plan- refer to Section 3.4.
N&V4	The following Construction Monitoring Programs must be prepared in consultation with the relevant agencies identified for each program to compare actual performance of construction of the CSSI against the predicted performance and to inform management measures. (a) Noise and vibration -- (Pipeline operators and relevant councils)	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA C15	Appendix A Noise and Vibration Monitoring Program
N&V5	The Noise and Vibration Monitoring Program must include, but not be limited to: (a) noise and vibration monitoring at agreed representative locations adjacent to the construction to confirm construction noise and vibration levels; (b) for the purposes of (a), noise monitoring must be undertaken during the day, evening and night-time periods and within the first month of Work as well as throughout the construction period and cover the range of activities being undertaken at the sites; and (c) provision of any real time noise and vibration monitoring data. The data must be readily available to the construction team, Proponent and ER. The Department and EPA must be provided with access to the real-time monitoring data, on request.	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA C18	Appendix A Noise and Vibration Monitoring Program

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
N&V6	A detailed land use survey must be undertaken to confirm sensitive receivers (including critical working areas such as flight simulators, operating theatres and precision laboratories) potentially exposed to construction noise and vibration, construction ground-borne noise and operational noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of Work which generates construction or operational noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Noise and Vibration CEMP Sub-plan.	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E13	Land Use Survey Mapping included in Appendix B (will also be included in the CNVIS)
N&V7	Except as permitted by an EPL or Out-of-Hours Work Protocol (where an EPL does not apply), highly noise intensive works that result in an exceedance of the applicable NML at the same receiver must only be undertaken: (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour. For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the highly noise intensive works.	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E15	Out of Hours Works Protocol – State
N&V8	Notwithstanding Conditions E14 and E15, Work may be undertaken outside the hours specified in the following circumstances: (a) for the delivery of materials required by the NSW Police Force or other appropriate authority for safety reasons; or (b) 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 (c) where the relevant road authority has advised the Proponent in writing that carrying out Work during the hours specified in Condition E14 would result in a high risk to road network operational performance and a road occupancy licence will not be issued during the hours specified in Condition E14; or (d) where an approval is required for a controlled activity in accordance with the Airports Act 1996 and the approved time is outside the hours specified in Condition E14; or (e) where the rail authority has advised the Proponent in writing that a Rail Possession is required and approval has been given to complete Work during the rail possession; or (f) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or (g) where an EPL is not required or in force, Work approved through an Out-of-Hours Work Protocol developed in accordance with Condition E18; or	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E16	OOHW Permits

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
	<p>(h) construction that causes:</p> <p>(i) $L_{Aeq(15 \text{ minute})}$ noise levels no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and</p> <p>(ii) $L_{Aeq(15 \text{ minute})}$ noise levels no more than the 'Noise affected' noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and</p> <p>(iii) 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), and</p> <p>(iv) 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</p> <p>(i) where negotiated agreements with directly affected residents and sensitive land uses have been reached.</p> <p>Note: Section 5.24(1)(e) of the EP&A Act requires that an EPL be substantially consistent with this approval.</p>				
N&V9	On becoming aware of the need for emergency Work in accordance with Condition E16(b), the Proponent must notify the ER, the Planning Secretary and the EPA of the reasons for such work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those Works.	Design Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E17	Notification of works
N&V10	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of Work outside the hours defined in Condition E14 and that is not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of the Work. The Protocol must identify Work activities in terms of their risk of adverse impacts on sensitive receivers and include:</p> <p>(d) a process for the consideration of out-of-hours Work against the relevant noise management level (NML) and vibration criteria, including the determination of low, medium and high-risk activities;</p> <p>(e) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition E19 and Condition E20. The measures must take into account the predicted noise and vibration levels and the likely frequency and duration that sensitive receivers would be exposed to residual impacts, including the number of noise-awakening events;</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E18	Out of Hours Works Protocol – State

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
	<p>(f) procedures to facilitate the coordination of out-of-hours Work, including those approved by an EPL or undertaken by a third party, to ensure appropriate respite is provided;</p> <p>(g) an approval process that considers the risks, proposed mitigation, management and coordination of Work, including where -</p> <p>(i) the ER reviews all proposed out-of-hours Works and confirms their risk levels,</p> <p>(ii) low risk activities can be approved by the ER, and</p> <p>(iii) medium and high-risk activities are approved by the Planning Secretary; and</p> <p>(h) notification arrangements for affected receivers and the EPA for all approved out-of-hours Work and notification to the Planning Secretary of approved low risk out-of-hours Work.</p>				
N&V11	<p>In order to undertake Work outside hours specified in Condition E14, the Proponent must identify appropriate respite periods for out-of-hours Work in consultation with the community likely to exceed the NML and vibration criteria in Condition E23(a) and (b) at each affected location on at least a three (3) monthly basis. This consultation must include (but not be limited to) providing the community with:</p> <p>(a) a schedule of likely out-of-hours work for a period no less than three (3) months;</p> <p>(b) a description of the potential Work, location and duration;</p> <p>(c) the noise characteristics and likely noise levels of the Work; and</p> <p>(d) likely mitigation and management measures to be implemented.</p> <p>The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour Work must be provided to the EPA, ER and Planning Secretary for information within two (2) week of undertaking the community consultation.</p> <p>Note: Respite periods can be any combination of days or hours where out-of-hours Work would not be more than 5 dB(A) above the rating background level at any residence.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E19	OOHW Permits
N&V12	<p>Additional mitigation measures such as temporary alternative accommodation or other agreed mitigation measures, must be offered/ made available to residents affected by out-of-hours Work (including where utility works are being undertaken for the CSSI) where the construction noise levels, between:</p> <p>(a) 10:00 pm and 7:00 am, Monday to Friday;</p> <p>(b) 10:00 pm Saturday to 8:00 am Sunday; and</p> <p>(c) 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00 am,</p> <p>are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA (LAeq(15 min), whichever is the lesser and the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E20	OOHW Permits

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
	The NML must be reduced by 5 dB where the noise contains annoying characteristics and increased by 10 dB if the property has received at-property noise treatment. The noise levels and duration requirements identified in this condition may be changed through an EPL applying to the CSSI.				
N&V13	<p>All Work undertaken for the delivery of the CSSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must:</p> <p>(a) reschedule any Work to provide respite to impacted residential receivers so that the respite is achieved in accordance with Conditions E19 and E20; or</p> <p>(b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and</p> <p>(c) provide documentary evidence to the ER in support of any decision made by the Proponent in relation to respite or mitigation.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E21	Section 8.6.2 Meeting minutes, Correspondence
N&V14	Noise and vibration generating Work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as flight simulators, theatres, laboratories and operating theatres) resulting in noise levels above the NMLs or vibration levels above the relevant criteria must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E22	Section 5.3.2; Sensitive receivers are also identified on the land use survey in Appendix B. Vibration drawings are included in Appendix C. Meeting minutes Site inspection records
N&V15	<p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <p>(a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009)¹;</p> <p>(b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure);</p> <p>(c) Australian Standard AS 2187.2 • 2006 "Explosives - Storage and Use - Use of Explosives";</p> <p>(d) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and</p> <p>(e) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration-effects of vibration on structures (for structural damage).</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E23	This Plan, CNVIS's, Site inspection records

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
	<p>Any Work² identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan.</p> <p>Note:</p> <ol style="list-style-type: none"> The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level. This text has since been clarified with DPIE as relating to "construction" and not "Works" as defined in the Project Approval. 				
N&V16	<p>Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:</p> <p>(a) evening (6:00 pm to 10:00 pm) - internal $L_{Aeq(15 \text{ minute})}$: 40 dB(A); and</p> <p>(b) night (10:00 pm to 7:00 am)- internal $L_{Aeq(15 \text{ minute})}$: 35 dB(A).</p> <p>The mitigation measures must be outlined in the Noise and Vibration CEMP Sub-plan required by Condition CS, including in any Out-of-Hours Work Protocol required by Condition E18.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E24	This Plan, CNVISs Monitoring records
N&V17	<p>Prior to undertaking dynamic compaction, the Proponent must:</p> <p>(a) complete a trial of different weights and heights at a location that is the furthest from any sensitive structure and residents to refine the minimum working distances for human comfort - preferred values for human exposure to vibration specified in Tables 2.2 and 2.4 of Assessing Vibration: a technical guideline and cosmetic damage in accordance with BS 7385 and DIN 4150;</p> <p>(b) schedule dynamic compaction to occur during the hours specified in Condition E14 unless:</p> <p>(i) the compaction work requires approval as a controlled activity in accordance with the Airports Act 1996 and the approved time is outside the hours specified in Condition E14, or</p> <p>(ii) it can be demonstrated that the preferred values would not be exceeded; and</p> <p>(iii) evidence of this is provided to the Planning Secretary at least one (1) week prior to the activity being undertaken; and</p> <p>(c) provide alternative accommodation for residents within the minimum working distances where exceedance of the preferred values for human comfort are likely and:</p> <p>(i) the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period; and</p> <p>(ii) the works must be completed at night (10:00 pm to 7:00 am).</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E25	Section 8.4.2 Site inspection records Monitoring Records
N&V18	<p>Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before Work that generates vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a</p>	Construction	JHSW Environment, Approvals and	CoA E26	Section 8.4.1 Section 8.7

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
	period of 24 hours, owners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan.		Sustainability Manager		Community notifications
N&V19	The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic and structural damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, amend the methodology and/or implement additional mitigation measures to prevent damage.	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E27	Monitoring records
N&V20	The Proponent must seek and implement the advice of a heritage specialist on impacts to heritage listed structures from installing equipment used for vibration, movement and noise monitoring before its installation.	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E28	Meeting minutes, Correspondence
N&V21	The Proponent must consult with proponents or applicants of other State significant development and infrastructure projects within 200 metres of the CSSI and take reasonable steps to coordinate Work, including utility Work, to minimise cumulative noise and vibration impacts and maximise respite for affected sensitive receivers.	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E29	Correspondence, noise modelling, Community notifications, Section 3.4, Section 7.3
N&V22	At no time can noise generated by Work exceed the National Standard for exposure to noise in the occupational environment of an eight-hour (8 hr) equivalent continuous A-weighted sound pressure level of LAeq(15 minute) of 85 dB(A) for any employee working at a location near the CSSI.		JHSW Environment, Approvals and Sustainability Manager JHSW WHS Manager	CoA E30	Site inspection records
N&V23	Operational noise mitigation measures for residences identified: (a) as eligible for consideration of additional mitigation in the Sydney Gateway Road Project Response to Submissions Report Appendix B - Memo Sydney Gateway Road Project Submissions Report Revised Operational Modelling Figure 6 Receivers Eligible for Consideration of Additional Mitigation; and (b) as likely to exceed the noise management level in Condition E23(a); must be implemented within six (6) months of the commencement of construction at and in the vicinity of the impacted residences(s) to minimise construction noise impacts, and detailed in the Noise and Vibration CEMP Sub-plan for the CSSI, unless otherwise approved by the Planning Secretary in accordance with Condition E33. Additional mitigation must be prioritised so that those receivers with the largest likely exceedance of the noise management level receive the mitigation first.	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E32	Meeting minutes, Section 8.5

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
N&V24	<p>Where the implementation of operational noise mitigation measures required by Condition E32 would not be implemented, the Proponent must submit to the Planning Secretary a report to justify this position. The report must detail the temporary measures that would be implemented to reduce construction noise impacts, until such time that the operational noise mitigation measures are implemented. The report must be endorsed by the ER and submitted to the Planning Secretary prior to the commencement of Work which would affect the identified residences.</p> <p>Note: Not having finalised detailed design is not sufficient justification for not implementing the proposed mitigation measures.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E33	<p>E32 Justification Report</p> <p>Section 8.5</p>
N&V25	The Proponent must offer pre-construction surveys to the owners of surface and sub-surface structures and other relevant assets identified at risk of damage from vibration. Where the offer is accepted, the survey must be undertaken by a suitably qualified and experienced engineer prior to the commencement of vibration-generating works that could impact on the structure. The results of each survey must be documented in a Pre-construction Condition Survey Report and the report must be provided to the owner of the structure or other relevant asset for review one month prior to the commencement of potentially impacting works.	Construction	JHSW Environment, Approvals and Sustainability Manager	CoA E39	<p>Community consultation records</p> <p>Pre-construction survey reports (including any survey reports required by Third Party Agreements- eg Desalination Pipeline)</p>
N&V30	Noise barriers will be designed to minimise their visual prominence as much as possible.	Design	JHSW Environment, Approvals and Sustainability Manager	UMM LV6	Site inspection records
N&V31	A Construction Noise and Vibration Management Plan will be prepared as part of the CEMP and implemented during construction. The plan will detail processes, responsibilities and measures to manage noise and vibration and minimise the potential for impacts during construction, consistent with the management approach and mitigation measures in the <i>Construction Noise and Vibration Guideline</i> (Roads and Maritime, 2016).	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV5	This plan.
N&V32	<p>Location and activity specific noise and vibration impact assessments will be undertaken prior to those works (as a minimum):</p> <ul style="list-style-type: none"> - With the potential to result in noise levels above 75 dBA at any receiver - That need to occur outside standard construction hours and are likely to result in noise levels greater than the relevant noise management levels - With the potential to exceed relevant performance criteria for vibration. 	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV6	CNVIS

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
	The assessments will confirm predicted impacts at relevant receivers in the vicinity of the activities to assist with the selection of appropriate management measures. Monitoring will be carried out at the start of new noise and vibration intensive activities to confirm that actual levels are consistent with the predictions.				
N&V33	<p>The facades of hotels likely to be affected by construction will be assessed to confirm existing façade performance (external to internal noise transmission) in consultation with the hotel operators.</p> <p>Location and activity-specific noise and vibration impact assessments undertaken for works in the vicinity of hotels will adopt the results of the assessment for each affected hotel to assess potential internal noise levels within the hotel rooms more accurately (see Technical Working Paper 2).</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV7	Monitoring records CNVIS
N&V34	<p>The potential for impacts on the existing Flight Training Centre will be managed in accordance with the acoustic framework that has been agreed with Qantas. A similar acoustic framework will be developed for the new Qantas Flight Training Centre and implemented (once constructed) to minimise potential impacts during construction. The framework will be developed in consultation with Qantas and will include:</p> <ul style="list-style-type: none"> - Confirmation of building and simulator cabin acoustic performance and external to internal transfer functions for noise and vibration - A process for setting external triggers levels for monitoring that are protective of the internal facility training functions from an acoustic perspective - Monitoring requirements - Communication protocols 	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV8	Qantas acoustic framework
N&V35	Investigate and implement alternative methods of demolition to avoid hydraulic/pneumatic hammering where high noise impacts are anticipated. Alternative methods could include shears, pulveriser or ripper attachments fitted onto the excavators.	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV9	CNVIS, Site inspection records, Monitoring records
N&V36	<p>Noisy work and vibration intensive activities (those activities that exceed the vibration criteria) will be scheduled during standard construction hours as far as possible. Works or activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods. Respite measures will be implemented for noisy work and vibration intensive activities in a manner consistent with the Construction Noise and Vibration Guideline (Roads and Maritime, 2016).</p> <p>Respite measures will be implemented for noisy work and vibration intensive activities in a manner consistent with the Construction Noise and Vibration Guideline (Roads and Maritime, 2016).</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV10	CNVIS, Meeting minutes, Out of Hours Works Permits, Site inspection records

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
N&V37	Hoarding, or other shielding structures, will be used for construction compounds and fixed works areas where construction noise would exceed relevant noise management levels at nearby sensitive receivers. The barriers should be of solid construction with minimal gaps.	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV11	CNVISs Site inspection records
N&V38	<p>Vibration generating activities will be managed to minimise the potential for impacts on structures and sensitive receivers, including maximising minimum working distances where practicable, or alternate methods to minimise vibration where minimum working distances cannot be achieved.</p> <p>Prior to the commencement of vibration-intensive works within the minimum working distances for cosmetic damage, the potential for damage will be assessed. Where there is potential for damage, alternative methods that generate less vibration will be investigated and substituted where practicable.</p> <p>Where residual risks remain, condition surveys will be carried out and vibration monitoring will be undertaken. Vibration monitors will provide real-time notification of exceedances of levels approaching cosmetic damage and human comfort criteria. Any identified vibration-related damage to the items will be rectified.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV12	CNVISs Site inspection records and Building Condition Surveys Monitoring records
N&V39	<p>Prior to vibration intensive works in the vicinity of pipelines, the owners of each potentially affected pipeline will be consulted to confirm the potential for impacts from vibration and any appropriate criteria.</p> <p>Management protocols to protect the integrity of each affected pipeline, including monitoring requirements, will be developed in consultation with each asset owner as required, and implemented for all vibration intensive works in the vicinity of pipelines.</p>	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV13	Consultation records, Site inspection records, Monitoring records
N&V40	Building condition surveys will be completed before and after construction works where buildings or structures are within the minimum vibration working distances for cosmetic damage.	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV14	Building condition survey reports Consultation records
N&V41	The likelihood of cumulative and consecutive construction noise impacts, particularly when undertaken outside standard construction hours, will be reviewed prior to construction and coordinated with other nearby projects to minimise impacts, where possible.	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NV15	Meeting minutes, Out of Hours Works Permit
N&V42	Potential vibration impacts on features of heritage significance will be managed in accordance with the Construction Noise and Vibration Management Plan (measure NV5) and noise and vibration mitigation measure NV12.	Construction	JHSW Environment, Approvals and Sustainability Manager	UMM NAH11	Site inspection records, Monitoring records
N&V43	Measures to mitigate noise during construction (and operation) have been identified and implemented	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	Site inspection records

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
N&V44	Baseline studies should be undertaken and noise predictions established to inform the management process and measures.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	EIS/MDP and CNVIS
N&V45	Monitoring of noise is undertaken at appropriate intervals and in response to complaints during construction	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	Monitoring records
N&V46	Noise goals should be determined based on relevant regulations and the advice of a qualified acoustic specialist. Noise goals are limits that must not be exceeded or noise levels that projects aim to keep within.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	This plan
N&V47	Monitoring should include auditing of the implementation of additional mitigation measures where noise goals are predicted to be exceeded.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	Monitoring records
N&V48	For construction, modelling and monitoring demonstrates no recurring or major divergences from the noise management process in ISCA approved noise guidelines Note: A divergence from the noise management process is defined as a goal being predicted to be exceeded and one or more of the relevant mitigation measures not being implemented. Implemented means implemented as part of the relevant construction activity, rather than in response to monitoring 'discovering' an exceedance. A recurring divergence is defined as more than two divergences of a similar nature within a 12 month period. A major divergence is defined as a noise goal being predicted to be exceeded by more than 10 dBA and one or more of the additional mitigation measures not being implemented.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	This plan CNVIS, monitoring records
N&V49	Where continuous monitoring with real-time alerts is in place, Level 2 or 3 of the credit can still be achieved provided that: • Exceedances are investigated and addressed as soon as practicable following detection, and this is documented; • Appropriate action was taken to prevent any reoccurrence within 12 months; • No complaints relating to the exceedance were received, or evidence is provided that the exceedance has been addressed to the satisfaction of the complainant.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-2	Monitoring records
N&V51	For construction, modelling and monitoring demonstrates no divergence from the noise management process in ISCA approved noise guidelines	Construction	JHSW Environment, Approvals and	ISCA v1.2 Dis-2	This plan

ID	Measure / Requirement	When to implement	Responsibility	Reference	Evidence
			Sustainability Manager		CNVIS Monitoring records
N&V53	Measures to mitigate vibration during construction and operation have been identified and implemented Note: Vibration goals are limits that must not be exceeded or vibration levels which the Project aims to keep within.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	Site inspection records
N&V54	Baseline studies should be undertaken and vibration predictions established to inform the management process and measures.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	This plan CNVIS
N&V55	Monitoring of vibration is undertaken at appropriate intervals and in response to complaints during construction	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	Monitoring records
N&V56	Measures should be documented in management plans such as Construction Environmental Management Plans or specific Vibration Management Plans	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	This plan CNVIS ONVR
N&V57	They (the Verifier) should take into account the nature of vibration, objectivity, repeatability, probably of identifying vibration impacts, complaints and complaint management and meeting the intent of the credit.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	Audit records
N&V58	Vibration goals should be determined based on relevant regulations and the advice of a qualified acoustic specialist.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	This plan
N&V59	For construction, modelling and monitoring demonstrates no exceedances of vibration goals for structural damage to buildings and structures. Note: Exceedances are measured vibration levels above the vibration goals. Recurring exceedances are defined as more than two of a similar type within a 12 month period. Major exceedances are defined as more than doubling the vibration goals.	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	This plan CNVIS
N&V62	No physical damage has been caused to any buildings or structures by vibration caused by construction	Construction	JHSW Environment, Approvals and Sustainability Manager	ISCA v1.2 Dis-3	Site inspection records Building condition survey reports

8.2 Standard noise and vibration mitigation and management measures

Table 8-2 sets out an indicative list of standard noise and vibration mitigation measures to be implemented during the Project where feasible and reasonable to minimise the construction noise and vibration impacts from the works as far as practicable. This information is based on information available at the time of preparation of this CNVMP and the Roads and Maritime Construction Noise and Vibration Guideline (CNVG).

Table 8-2 Standard Mitigation and Management Measures

Action required	Applies to	Details
Management measures		
Implementation of any project specific mitigation measures required.	Airborne noise	Project and activity specific mitigation measures will be identified and confirmed in the CNVIS prepared for the Project and implementation as early as practicable, as noted in the CNVIS.
Implement community consultation or notification measures.	Airborne noise Ground-borne noise Vibration	Community consultation will be conducted as detailed in the Communications Strategy and Section 0 and Section 8.7 of this plan.
Work scheduling around sensitive areas	Airborne noise Ground-borne noise Vibration	Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels would be scheduled during less sensitive time periods. When working adjacent to flight simulators, recording studios and precision laboratories, scheduling particularly noisy activities around HSC exam times, child care sleep times and other identified sensitive times should be considered, where feasible and reasonable. When working adjacent to places of worship particularly noisy activities should be scheduled outside services, where feasible and reasonable. Also refer to Section 0 of this Plan.
Cumulative construction noise and vibration impacts	Airborne noise Ground-borne noise Vibration	Consult proponents of other construction works in the vicinity of the Project area, in accordance with Project Planning Approvals. Undertake reasonable steps to coordinate works to minimise impacts on, and maximise respite for, affected sensitive receivers.
Site inductions	Airborne noise Ground-borne noise Vibration	All employees, contractors & subcontractors are to receive a Project induction. The environmental component must include: <ul style="list-style-type: none"> • relevant licence & approval conditions; • permissible hours of work; • any limitations on high noise activities; • location of nearest sensitive receivers;

Action required	Applies to	Details
		<ul style="list-style-type: none"> • construction employee parking areas; • relevant site-specific mitigation measures • appropriate behavioral practices
Behavioural practices	Airborne noise	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height where practicable, throwing of items & slamming of doors.
Verification	Airborne noise Ground-borne noise Vibration	Noise and vibration verification monitoring is to be undertaken in accordance with this Plan, as identified in the CNVISs and any EPL conditions.
Building condition surveys	Vibration	Building condition surveys will be completed before and after construction works where buildings or structures are within the minimum vibration working distances for cosmetic damage (see Section 8.4 for more detail).
Source controls		
Construction hours and scheduling	Airborne noise Ground-borne noise Vibration	Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods, where practicable and as outlined in Table 5-2.
Equipment selection	Airborne noise Vibration	Use quieter & less noise/ vibration emitting construction methods where feasible & reasonable. Investigate and implement alternative methods of demolition to avoid hydraulic/pneumatic hammering where high noise impacts are anticipated. Alternative methods could include shears, pulveriser or ripper attachments fitted onto the excavators. Where vibration intensive equipment is used within the minimum working distances, determine whether alternative construction methodology or less vibration intensive equipment can be used, e.g. use bored piles rather than impact or percussion piling.
Rental plant and equipment	Airborne noise	The noise levels of plant & equipment items are to be considered in rental decisions.
Alternative demolition methods	Airborne noise	Investigate and implement alternative methods of demolition to avoid hydraulic/pneumatic hammering where high noise impacts are anticipated. Alternative methods could include shears, pulveriser or ripper attachments fitted onto the excavators.
Use and siting of plant	Airborne noise Vibration	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be limited/ avoided where possible.

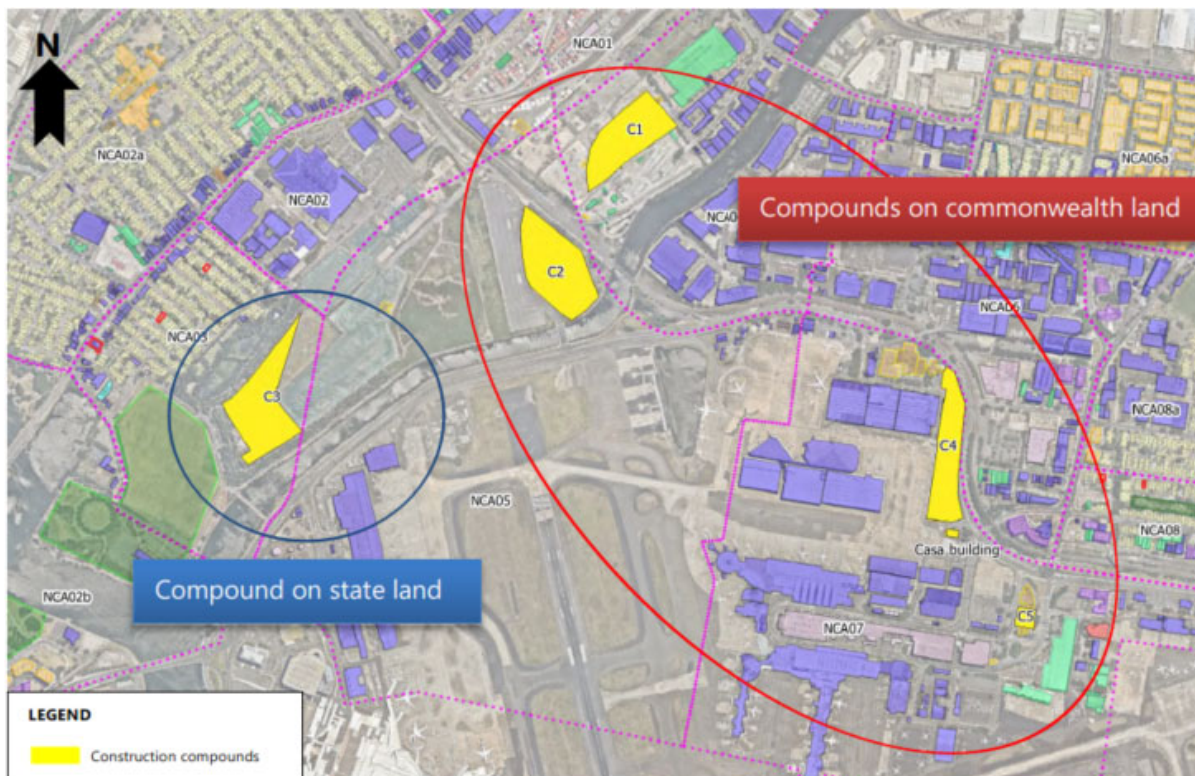
Action required	Applies to	Details
		<p>The offset distance between noisy or vibration significant plant & adjacent sensitive receivers is to be maximised where practicable.</p> <p>Plant used intermittently to be throttled down or shut down when not in use where practicable.</p> <p>Noise-emitting plant to be directed away from sensitive receivers where possible, particularly during OOHW.</p> <p>Only have necessary equipment on site.</p> <p>Use only the necessary size and power.</p> <p>NOTE: Due to limited land available for construction this may not at times be practical.</p>
Plan worksite and activities to minimise noise and vibration	Airborne noise Vibration	Plan traffic flow, parking & loading/unloading areas to minimise reversing movements within the site.
Non-tonal and ambient sensitive reversing alarms	Airborne noise	Non-tonal movement alarms (or an equivalent mechanism) must be fitted & used on all construction vehicles & mobile plant regularly used on site and on all equipment required for OOHW.
Minimise disturbance arising from delivery of goods to construction sites.	Airborne noise	Ensure all deliveries occur during standard construction hours, except where detailed in Section 5.2.
Plant noise levels	Airborne noise	<p>The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the levels in Section 8.2.1 of this Plan, or as specified in the CNVIS.</p> <p>Regular compliance checks on the noise emissions of all plant and machinery used for the Project would indicate whether noise emissions from plant items were higher than predicted. This also identifies defective silencing equipment on the items of plant.</p>
Site specific attended vibration measurements	Vibration	Representative attended vibration measurements are required at the commencement of vibration generating activities, where these are likely to occur within the recommended minimum working distances in Section 8.4.2 to confirm that vibration is within the acceptable range to prevent cosmetic building damage.
Path controls		
Shield sensitive receivers from noisy activities.	Airborne noise	<p>Where reasonable & feasible, use structures to shield residential receivers from noise such as:</p> <ul style="list-style-type: none"> • site shed placement • earth bunds/ mounds • hoarding

Action required	Applies to	Details
		<ul style="list-style-type: none"> enclosures to shield fixed noise sources such as pumps, compressors, fans etc. (where practicable) acoustic curtains.
Operational noise barriers and temporary noise barriers	Airborne noise	<p>Where feasible and reasonable,</p> <ul style="list-style-type: none"> operation noise barriers shall be implemented at the start of construction (or at other times during construction) to minimise construction noise impacts temporary acoustic fencing/barriers should be installed around the site perimeter where construction is concentrated in a single area to mitigate construction noise, as identified in the CNVISs
Temporary, relocatable noise barriers	Airborne noise	<p>Use a portable barrier (or similar protection) to shield equipment where works occur in proximity to residential receivers where reasonable and feasible. The height and nature of the barrier would be determined when the equipment selection is finalised. The barrier would be construction of a material of minimum mass 12 kilograms per metre squared such as 20 millimetre plywood or a proprietary barrier such as Echobarrier.</p>

8.2.1 Boundary screening of construction ancillary facilities

CoA A18 requires that boundary screening is erected around all construction ancillary facilities that are adjacent to sensitive receivers for the duration of construction. Figure 8-1 following shows the location of the construction ancillary facilities in relation to surrounding land uses. No ancillary facilities are planned adjacent to sensitive receivers.

Figure 8-1 Sydney Gateway – Construction ancillary facilities on federal and state land



8.3 Maximum noise levels for plant and equipment

The Sound Power Level (SWL) represents the total noise output of operating plant and equipment. The SWL is used in computer noise models to predict Sound Pressure Levels (SPLs) at nearby receivers.

When undertaking site compliance measurements, it is normally the SPL that is measured at a specified distance (typically 7m) from the plant or equipment.

All plant and equipment used for the Project should have SWL and SPL which are no higher than the corresponding figures shown in Table 8-3. Plant and equipment with SWLs or SPLs higher than those on the table would be deemed to be emitting an excessive level of noise and would not be permitted to operate on the Project. Plant and equipment will be subject to regular noise level checks to verify compliance (see Section 9.3.1 and Appendix A), as stated in Table 8-3.

Table 8-3 Maximum Allowable Sound Power Levels for Construction Equipment

Equipment	Maximum Allowable Sound Power Level (dB) L_{Amax}	Maximum Allowable Sound Pressure Level (dB) L_{Amax} at 7 m	Not recommended Out of Hours (where practicable)
Air track drill	124	99	✓
Asphalt truck & sprayer	103	78	
Backhoe	111	86	
Bulldozer D9	116	91	
Chainsaw 4-5hp	114	89	✓
Compactor	106	81	
Compressor	109	84	
Concrete pump	109	84	

Equipment	Maximum Allowable Sound Power Level (dB) L_{Amax}	Maximum Allowable Sound Pressure Level (dB) L_{Amax} at 7 m	Not recommended Out of Hours (where practicable)
Concrete saw	118	93	✓
Concrete truck	109	84	
Concrete vibrator	113	88	
Daymakers	98	73	
Dump truck	110	85	
Dynamic compaction	TBC	TBC	✓
Excavator ≤ 10 tonne	100	75	
Excavator \leq tonne	105	80	
Excavator ≤ 30 tonne	110	85	
Excavator ≤ 40 tonne	115	90	
Excavator ≤ 40 tonne with hydraulic hammer	122	97	✓
Fixed crane	113	88	
Franna crane 20t	98	73	
Front end loader	112	87	
Grader 35t	113	88	
Light vehicles	88	63	
Light vehicles (eg 4WD)	103	78	
Line marking truck	108	83	
Mobile crane	113	88	
Pavement laying machine	114	89	
Pavement profiler	117	92	✓
Piling rig - bored	112	87	✓
Piling rig – vibratory driven	116	91	✓
Piling rig – impact hammer	126	101	✓
Pneumatic hammer (jackhammer)	115	90	✓
Power generator	103	78	
Road truck	108	83	
Rock crusher	118	93	✓
Roller (large pad foot)	109	84	✓
Scissor lift	98	73	
Scraper 651	110	85	
Smooth drum roller	107	82	
Truck (medium rigid)	103	78	
Truck compressor	75	50	
Tub grinder/ mulcher 40-50hp	116	91	✓

Equipment	Maximum Allowable Sound Power Level (dB) L_{Amax}	Maximum Allowable Sound Pressure Level (dB) L_{Amax} at 7 m	Not recommended Out of Hours (where practicable)
Vacuum truck	109	84	
Vibratory roller	109	84	✓
Water cart	107	82	
Welding equipment	105	80	

8.4 Minimising vibration impacts

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is very site specific. Final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

Recommended minimum working distances presented in the following sections provide a conservative screening method for indicating buildings and structures where there is a risk of vibration impact. Vibration monitoring would be carried out to confirm the minimum working distances at specific sites, where vibration significant plant is required to operate within or near the recommended minimum working distances.

8.4.1 Human exposure

Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures. At properties near the construction works nearby receivers may be able to feel vibration when vibration-generating equipment is being utilised. For this reason it is appropriate identify properties where there is a probability of adverse comment so that impacts can be managed.

Recommended minimum working distances for typical vibration intensive construction equipment for human comfort (response) are shown in Table 8-4. These recommended distances relate to continuous vibration and are presented as a guide only. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels occurring over shorter time periods are allowed (see Section 5.5).

Table 8-4 Recommended minimum working distances (m) – human comfort (response)

Vibration significant plant item	Critical area	Residence (Day)	Residence (Night)	Office	Workshop
Concrete saw	15	10	10	5	5
Excavator (tracked) \leq 5t + hydraulic hammer	25	20	20	15	10
Excavator (tracked) \leq 15t + hydraulic hammer	30	20	25	15	10
Excavator (tracked) \leq 35t + hydraulic hammer	40	25	30	20	15
Percussive drill (small)	20	10	15	5	5
Piling rig – bored (rock)	20	15	15	10	10
Piling rig – bored (soft ground)	10	10	10	5	5
Piling rig - vibratory driven	305	170	225	100	55
Pneumatic hammer (jackhammer)	25	15	20	10	5

Vibration significant plant item	Critical area	Residence (Day)	Residence (Night)	Office	Workshop
Terrain leveller	30	15	20	5	5
Vibratory roller (11t) padfoot - High vibration	120	70	90	40	25
Vibratory roller (11t) padfoot - Low vibration	110	60	80	35	20
Vibratory roller (13t) smooth drum - High vibration	105	55	75	30	15
Vibratory roller (13t) smooth drum - Low vibration	75	40	55	20	10
Wacker packer	20	10	15	5	5

8.4.2 Buildings and structures

Pre- and post-construction building condition surveys will be conducted on nearby buildings and structures. The inspections will document the existing condition of the property and typically note the location of all visible cracks and/or defects observed by the inspector. The post construction survey will record any changes to the property at construction completion.

Recommended minimum working distances to reduce the risk of cosmetic damage to buildings or structures from typical vibration intensive construction equipment are presented in Table 8-5 following. These are aimed at reducing the risk of cosmetic damage (as per BS 7385:1993 and DIN 4150-3:2016) and are based on the vibration screening criteria set in Section 5.5.

Unlike noise, vibration cannot be readily predicted. The minimum working distances below are indicative and will vary depending on the plant item, building types and foundations and local geotechnical conditions. Vibration monitoring would be carried out to confirm the site specific minimum working distances for this Project.

Table 8-5 Minimum working distances (m) – cosmetic damage¹

Vibration significant plant item	Reinforced or frame structures (BS7385) ²	Unreinforced or light framed structures (BS7385) ²	Structurally unsound heritage structures (DIN 4150-3) ³
Concrete/ road saw	5	5	5
Excavator (tracked) ≤ 15t + hydraulic hammer	5	5	10
Excavator (tracked) ≤ 35t + hydraulic hammer	5	10	10
Excavator (tracked) ≤ 50t + hydraulic hammer	5	10	20
Drill Rig	5	5	10
Dynamic compaction	TBC	TBC	TBC
Pneumatic hammer (jackhammer)	5	5	5
Piling rig – bored (rock)	5	5	5
Piling rig – bored (soft ground)	5	5	5
Piling rig - impact hammer (high)	15	30	65
Piling rig - impact hammer (typical)	10	15	35

Vibration significant plant item	Reinforced or frame structures (BS7385) ²	Unreinforced or light framed structures (BS7385) ²	Structurally unsound heritage structures (DIN 4150-3) ³
Piling rig - vibratory driven	10	20	50
Terrain leveller	5	5	5
Vibratory roller ≤ 25t padfoot	5	10	20
Vibratory roller ≤ 13t smooth drum - High vibration	5	5	15
Vibratory roller ≤ 13t smooth drum - Low vibration	5	5	10
Wacker packer	5	5	5

NOTES:

1. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method
2. Minimum working distance based on vibration screening criterion which reduced the cosmetic damage levels set by BS7385 (see Table 5-9) by 50% due to potential dynamic magnification.
3. A building condition inspection should determine whether a heritage item is structurally unsound.

CoA E26 requires owners of properties at risk of exceeding the screening criteria for cosmetic damage to be notified before the commencement of vibration-generating works. Properties at risk of cosmetic damage will be identified through the vibration screening drawings, prepared based on proposed vibration intensive construction activities and presented in the CNVIS prepared for the Project. To provide an indication of the typical worst case vibration impact, vibration screening drawings based on the likely highest vibration generating plant (excluding impact piling and dynamic compaction) are presented in Appendix C. Structures within the minimum working distance screening limits and potentially at risk of damage from vibration are identified on the drawings.

Pre-construction surveys must be offered to the owners of surface and sub-surface structures and other relevant assets identified at risk of damage from vibration, in accordance with CoA E39 (see Table 8-1). Survey reports will be provided to the owner of the structure or other relevant asset for review one month prior to the commencement of potentially impacting works. Specific properties will be identified in the CNVIS prepared for the Project.

Where properties are identified as within the recommended minimum working distances presented in Table 8-5, vibration monitoring is recommended to determine site specific minimum working distances that will prevent cosmetic and structural damage. If the monitoring above identifies that vibration is likely to exceed the screening criteria for cosmetic damage, further analysis would be undertaken, including consideration of a different construction method (for example a smaller hammer attachment to the excavator) with lower source vibration levels and/or implement additional mitigation measures to prevent damage. This notably applies to heritage items to satisfy CoA E27. Furthermore, if the potential exceedance is likely to occur more than once or extend over a period of 24 hours, owners and occupiers would be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier.

For highly sensitive receivers (e.g. high technology facilities, laboratories, recording studios and cinemas), specific assessment is required to ensure satisfactory operation of the facility and determine if any mitigation or management measures are required to minimise the potential impacts. Highly sensitive receivers in the vicinity of the Sydney Gateway construction work areas are identified in the Land Use Survey (refer to Appendix B) and will be further investigated in the relevant CNVIS.

Dynamic compaction

The EIS/MDP identified that dynamic compaction may be required within the former Tempe landfill site. It involves dropping a large weight from height using a crane and is used to improve the

bearing capacity and settlement characteristics of non-cohesive soils. The ground improvement methodology for the Project is being reviewed as part of the detailed design and alternative methodologies are being considered.

In order to satisfy CoA E25, prior to undertaking dynamic compaction, JHSW JV would:

- Complete a trial of different weights and heights at a location that is the furthest from any sensitive structure and residents to refine the minimum working distances for human exposure
- Schedule dynamic compaction to occur during the hours specified in CoA E14 unless:
 - the compaction work requires approval as a controlled activity in accordance with the Airports Act 1996 and the approved time is outside the hours specified in CoA E14, or
 - it can be demonstrated that the preferred values would not be exceeded, and
 - evidence of this is provided to the Planning Secretary at least one (1) week prior to the activity being undertaken
- Provide alternative accommodation for residents within the minimum working distances for human exposure where:
 - the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period and
 - the works must be completed at night (10:00 pm to 7:00 am).

8.5 Early implementation of operational noise mitigation measures

In accordance with CoA E32, mitigation measures for those receivers identified as eligible for consideration of additional mitigation and are likely to experience exceedances of the applicable NML, will be installed as early as possible. The identified mitigation measures will be implemented within six months of the commencement of construction at, and in the vicinity of, the impacted residences. Receivers who satisfy the eligibility requirements detailed in CoA E32, but have previously received satisfactory at-property treatment, may not require additional mitigation if previous treatments are considered adequate.

The at-receiver acoustic treatments are being scoped in accordance with the At-receiver Noise Treatment Guideline as part of detailed design. The At-Receiver Noise Treatment Guideline recommends treatments that may comprise of the following measures:

- Ventilation systems that meet Building Code of Australia fresh air requirements with the windows and doors shut;
- Upgraded windows, glazing and solid core doors on the exposed facades of substantial structures on (e.g. masonry or insulated board cladding each with sealed underfloor);
- Upgraded window or door seals;
- The sealing of wall vents;
- The sealing of the underfloor below the bearers and appropriately treating sub-floors ventilation;
- Roof insulation; and
- The sealing of eaves.

Where implementation of operational noise mitigation measures would not be implemented in accordance with CoA E32, JHSW will prepare a report detailing the justification as to why. JHSWJV will detail in this report the temporary measures that would be implemented to reduce

construction noise impacts. This report will be endorsed by the ER and provided to the Planning Secretary, in accordance with CoA E33.

8.6 Mitigation and management of out-of-hours Work

8.6.1 Out-of-Hours Works Protocol

An Out-of-Hours Work Protocol (OOHW Protocol) has been prepared in accordance with CoA E18 (Document No SGWPW-JHSW-NWW-EM-PRO-000531). The OOHW Protocol provides a process for the consideration, management, and approval of work outside the approved construction hours detailed in Section 5.3.1, and that is not subject to an EPL.

The aim of the OOHW Protocol is to ensure that OOHW not subject to an EPL follow a rigorous process to identify the associated risk of adverse impacts on sensitive receivers with regards to the OOHW and include:

- Consideration of the OOHW against the relevant NMLs and vibration criteria, and providing a determination of low, medium and high-risk activities
- Processes for selecting and implementing mitigation measures for residual impacts in consultation with the community
- Procedures to facilitate the coordination of OOHW with those approved under an EPL or undertaken by a third party, to ensure appropriate respite is provided;
- An approval process for OOHW that considers risks, proposed mitigation, management and coordination, and includes review and approval the ER for low risk activities and Planning Secretary approval for medium and high-risk activities;
- Details of notification requirements for affected receivers and the EPA for all approved OOHW, including notification to the Planning Secretary for low risk OOHW approved by the ER.

8.6.2 Community consultation on respite

To satisfy CoAE19, consultation with the community to determine appropriate respite periods for OOHW would be undertaken where works are:

- undertaken outside standard construction hours and
- likely to exceed the noise and vibration objectives identified in CoA E23(a) and (b).

The consultation would include, but not be limited to providing the community with:

- a schedule of likely OOHW for a period no less than three (3) months;
- a description of the potential Work, location and duration;
- the noise characteristics and likely noise levels of the Work; and
- likely mitigation and management measures to be implemented.

Note: Respite periods can be any combination of days or hours where OOHW would not be more than 5 dB(A) above the rating background level at any residence.

The outcomes of the community consultation, including the identified respite periods and the scheduling of OOHW would be documented and provided to the EPA, ER and Planning Secretary for information within two (2) week of undertaking the community consultation.

To satisfy CoA E21, all OOHW undertaken on the Project, including works undertaken by third parties (such as utility relocations), would be coordinated to ensure respite periods are provided in accordance with CoA E19 and E20. Where this is unable to be achieved, provision of alternative accommodation or mitigation to impacted noise sensitive receivers would be considered. This would be documented as part of the CNVIS.

8.6.3 Temporary alternative accommodation

Where out of hours works are planned, noise modelling and assessment would be carried out to identify all residential receivers where the construction noise levels are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA ($L_{Aeq(15 \text{ min})}$), whichever is the lesser, between:

- 10:00 pm and 7:00 am, Monday to Friday;
- 10:00 pm Saturday to 8:00 am Sunday; and
- 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00 am.

Where the predicted impact is planned to occur for more than two (2) nights over a seven (7) day rolling period, additional mitigation measures such as temporary alternative accommodation or other agreed mitigation measures would be offered to residents, consistent with CoA E20.

The NML must be reduced by 5 dB where the noise contains annoying characteristics and increased by 10 dB if the property has received at-property noise treatments which allow the residents to close their windows at night.

8.7 Additional noise and vibration mitigation measures

In instances where noise levels are still predicted to exceed the NML at receivers, after the application of all reasonable and feasible mitigation and management measures (refer to Section 8.1), the CNVG directs that the Project should consider implementing the additional mitigation measures such as (refer to Appendix C of the CNVG for more detail):

- Notification (letterbox drop or equivalent) detailing work activities, time periods of which these will occur, impacts and mitigation measures
- Specific notifications, which provide additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops
- Phone calls, which detail relevant information to identified/affected stakeholders and provide personalised contact, tailored advice and the opportunity to comment on the proposed work
- Individual briefings, which inform stakeholders about the impacts of high noise activities and mitigation measures, and provide personalised contact, tailored advice and the opportunity to comment on the proposed work
- Respite offers, to provide residents with respite from an ongoing impact
- Respite period 1, where out-of-hours construction noise in OOHW Period 1 is generally limited to no more than three consecutive evenings per week
- Respite period 2, where night-time construction noise in OOHW Period 2 is generally limited to two consecutive nights
- Duration respite, which is where the work duration, number of evenings or nights is increased so that the Project can be completed more quickly
- Alternative accommodation, and/or
- Verification, including measurement of the background noise level and construction noise.

The standard hours and OOHW periods are depicted in Figure 8-2. The OOHW periods are further defined as OOHW Period 1 and 2, based on the Roads and Maritime Construction Noise and Vibration Guideline (CNVG).

Figure 8-3, Figure 8-4 and Figure 8-5 detail the additional mitigation measures for airborne noise, ground-borne noise and vibration respectively, as recommended in the CNVG, for standard hours

and out-of-hours work (OOHW). Where feasible and reasonable, this approach will be implemented.

Figure 8-2 Construction hours

Day	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Monday																								
Tuesday																								
Wednesday																								
Thursday																								
Friday																								
Saturday																								
Sunday or Public Holiday																								

Figure 8-3 Triggers for Additional Mitigation Measures – Airborne Noise

When is the work being undertaken?	How much does the predicted noise level exceed the ANML by?	Identify additional management measures to be implemented
All Hours	75 dB(A) or greater	V, N, PC, RO
Standard Hours M-F 7am to 6pm Sat 8am to 6pm	0 dB(A) ≤ 10 dB(A) 10 to 20 dB(A) > 20 dB(A)	- - V, N V, N
OOHW Period 1 M-F 6pm to 10pm Sat 6pm to 10pm Sun/ PH 8am to 10pm	< 5 dB(A) 5 to 15 dB(A) 15 to 25 dB(A) > 25 dB(A)	- N, R1, DR V, N, R1, DR V, N, SN, IB, PC, R1, DR
OOHW Period 2* M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	< 5 dB(A) 5 to 15 dB(A) 15 to 25 dB(A) > 25 dB(A)	N V, N, R2, DR V, N, SN, IB, PC, R2, DR AA, V, N, SN, IB, PC, R2, DR

Notes: Use the abbreviation codes in the table above to confirm management measures required

* Where OOHW occur in the evening/night shoulder period (10pm to 12am) or the night/morning shoulder period (5am to 7am) apply additional airborne mitigation measures from the OOHW Period 2, excluding AA.

N = Notification (should be issued a minimum of five working days prior to the start of works)

SN = Specific notifications (issued no later than seven calendar days ahead of construction activities)

IB = Individual briefing

PC = Phone Call

AA = Alternative accommodation**

RO = Project specific respite offer

R1 = Respite period 1

V = Verification of predicted noise

DR = Duration respite

R2 = Respite period 2

** Where construction activity impacts receiver for more than two (2) nights over a seven (7) day rolling period (CoA E20).

AA is not applicable to shoulder periods.

Figure 8-4 Triggers for Additional Mitigation Measures – Ground-borne noise

When is the work being undertaken?	How much does the predicted noise level exceed the GNML by?	Identify additional management measures to be implemented
Standard Hours M-F 7am to 6pm Sat 8am to 6pm	Note: vibration only applicable during standard hours > 10 dB(A) (guidance only) > 20 dB(A) (guidance only)	N V, N
OOHW Period 1 M-F 6pm to 10pm Sat 6pm to 10pm Sun/ PH 8am to 10pm	< 10 dB(A) 10 to 20 dB(A) > 20 dB(A)	N V, N, SN, R1, DR V, N, SN, IB, PC, R1, DR
OOHW Period 2* M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	< 10 dB(A) 10 to 20 dB(A) > 20 dB(A)	V, N, SN V, N, SN, IB, PC, R2, DR, AA V, N, SN, IB, PC, R2, DR, AA

Notes: Use the abbreviation codes in the table above to confirm management measures required
 * Where OOHW occur in the evening/night shoulder period (10pm to 12am) or the night/morning shoulder period (5am to 7am) apply additional airborne mitigation measures from the OOHW Period 2, excluding AA.
 N = Notification (should be issued a minimum of five working days prior to the start of works)
 SN = Specific notifications (issued no later than seven calendar days ahead of construction activities)
 IB = Individual briefing PC = Phone Call
 AA = Alternative accommodation** RO = Project specific respite offer R1 = Respite period 1
 V = Verification of predicted noise DR = Duration respite R2 = Respite period 2
 ** Where construction activity impacts receiver for more than two (2) nights over a seven (7) day rolling period (CoA E20).
 AA is not applicable to shoulder periods.

Figure 8-5 Triggers for Additional Mitigation Measures – Vibration

When is the work being undertaken?	Does the eVDV exceed the VML?	Identify additional management measures to be implemented
Standard Hours M-F 7am to 6pm Sat 8am to 6pm	Yes	V, N, RO
OOHW Period 1 M-F 6pm to 10pm Sat 6pm to 10pm Sun/ PH 8am to 10pm	Yes	V, N, SN, IB, PC, RO
OOHW Period 2* M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	Yes	V, N, SN, IB, PC, RO, AA

Notes: Use the abbreviation codes in the table above to confirm management measures required
 * Where OOHW occur in the evening/night shoulder period (10pm to 12am) or the night/morning shoulder period (5am to 7am) apply additional airborne mitigation measures from the OOHW Period 2, excluding AA.
 N = Notification (should be issued a minimum of five working days prior to the start of works)
 SN = Specific notifications (issued no later than seven calendar days ahead of construction activities)
 IB = Individual briefing PC = Phone Call
 AA = Alternative accommodation** RO = Project specific respite offer R1 = Respite period 1
 V = Verification of predicted noise DR = Duration respite R2 = Respite period 2
 ** Where construction activity impacts receiver for more than two (2) nights over a seven (7) day rolling period (CoA E20).
 AA is not applicable to shoulder periods.

9 Compliance management

9.1 Roles and responsibilities

The JHSWJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Chapter 8 of this Plan.

9.2 Training

All employees, contractors, sub-contractors and utility staff working on site will undergo site induction training that includes construction noise and vibration management issues. The induction training will address elements related to noise and vibration management including:

- Existence and requirements of this sub-plan
- Relevant legislation
- Approved construction hours
- The process for seeking approval for OOHW, including consultation
- Location of noise sensitive areas
- Complaints reporting
- General noise and vibration management measures
- Specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.

Further details regarding staff induction and training are outlined in Section 3.5 of the CEMP.

9.3 Inspection and monitoring

Weekly and other routine inspections by the JHSWJV Environment Team, TfNSW, ERG representatives and ER will occur throughout construction. Detail on the nature and frequency of these inspections are documented in Section 3.9 of the CEMP.

Noise and vibration monitoring will also occur routinely for the duration of the Project, in accordance with the Project's Noise and Vibration Monitoring Program, which is detailed in Appendix A of this Plan.

The noise and vibration monitoring program details when monitoring will be undertaken, as well as the representative locations adjacent to the construction works where noise and vibration monitoring will be undertaken.

To satisfy CoA C18, where real time noise and vibration monitoring is undertaken, the data would be readily available to the construction team, Transport for NSW and ER. DPIE and EPA would be provided with access to the real-time monitoring data, on request.

Monitored noise and vibration levels will be analysed against the predictions made in the relevant noise and vibration assessments. Where monitored noise levels are found to be above modelling predictions or vibration goals are exceeded, the following actions will be undertaken:

- Cease the noise and/or vibration generating source which causes the exceeded predictions,
- Confirm the monitored levels are not being impacted by other (non-Project related) noise or vibration sources,
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment,

- Identify if the equipment can be swapped out for another piece of equipment or alternative equipment or plant, or if additional mitigation can be included in the site design,
- Confirm that the modelling reflects the actual activity being undertaken,
- Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternative construction methodology or a combination of these,
- Review work practices to ensure compliance with the management levels set out in this NVMP,
- Ensure that the learnings from the above are fed back into the noise modelling assessment process for fine-tuning,
- Continue work where impacts can be reduced and
- Communicate lessons learnt to relevant personnel.

In accordance with CoA E28, consultation with a heritage specialist will be undertaken prior to the installation of any monitoring equipment, where installation may impact on heritage listed structures.

9.3.1 Noise monitoring

Baseline noise monitoring data

Baseline noise monitoring data was reported in the EIS/MDP as noted in Section 4.2.

Parameters to be monitored

Refer to noise monitoring specifications in Appendix A.

Plant and Equipment Noise Audits

A plant induction process will be put in place for the Project. Part of the Plant Induction Process will be to complete periodic noise audits of plant and equipment in use to confirm actual plant noise levels are compliant with the Table 8-3 maximum noise levels.

The plant and equipment noise monitoring procedure is further detailed in Appendix A.

Attended Airborne Noise Monitoring in the Community

Attended monitoring of construction noise levels will be undertaken as follows:

- At the first opportunity within the first month of starting construction activities as well as throughout the construction period to ensure the range of activities being undertaken at the site are measured to confirm noise predictions, the effectiveness of actions and mitigation measures. This would be undertaken in consultation with the ER
- Where appropriate in response to a noise related complaint(s) (determined on a case-by-case basis)
- During sensitive periods (i.e. night works)
- As directed by an authorised officer of the EPA.

Monitoring would be undertaken at the potentially most exposed receivers in proximity to construction activities. Noise monitoring locations will consider factors including:

- The location of previous monitoring sites
- The proximity of the receiver to a worksite
- The sensitivity of the receiver to noise

- Background noise levels
- Safety
- The expected duration of the impact.

Where monitoring indicates that the construction noise levels are above the predicted levels, work practices would be reviewed and further mitigation measures applied where reasonable and feasible.

The attended measurements will need to be carried out by an appropriately trained person in the measurement and assessment of construction noise, who is familiar with the requirements of the relevant standards and procedures.

Ground-Borne Noise Monitoring in the Community

Attended monitoring of ground-borne construction noise levels will be undertaken as follows:

- Where appropriate in response to a noise related complaint(s) (determined on a case-by-case basis)
- As directed by an authorised officer of the EPA.

Monitoring will be undertaken in the most affected room of the residence or other sensitive building and will be conducted in conjunction with vibration measurements whenever practicable (see Section 9.3.2). Note that the room selected for noise monitoring should be well shielded from airborne noise intrusions, such as road traffic noise; to allow the ground-borne noise to dominate over non-construction generated airborne noise.

The attended measurements will need to be carried out by an appropriately trained person in the measurement and assessment of construction noise, who is familiar with the requirements of the relevant standards and procedures.

9.3.2 Vibration monitoring

Attended Vibration Monitoring in the Community

Attended vibration monitoring is to be undertaken as follows:

- At the commencement of construction for each plant or activity on site where the vibration screening criteria is likely to be exceeded, to refine the identified minimum working distances to suit site-specific conditions
- Where vibration generating activities have the potential to impact on heritage items. In the event that the vibration monitoring shows that the preferred values for vibration are likely to be exceeded, an alternative, lower impact construction methodology would be considered
- Where it is not feasible to modify construction methodology to reduce vibration intensive construction activities within the minimum working distances for cosmetic damage
- For short periods of potential risk for cosmetic damage to buildings and structures
- Where deemed to be relevant to construction works in response to a vibration-related complaint
- As otherwise required by the CNVIS (or by an authorised officer of the EPA).

Where attended vibration monitoring is not feasible, due to extended periods of vibration intensive works, a permanent vibration monitoring system would be installed to warn plant operators (via flashing light, SMS alert, etc.) that there is potential cosmetic damage to buildings and structures.

Plant and equipment vibration measurement procedures are further detailed in the CNVIS.

Advice of a heritage specialist will be sought regarding methods and locations for installing equipment used for vibration monitoring on heritage-listed structures, accordance the CoA E28.

9.4 Complaints

Complaints will be recorded and managed as detailed in Section 3.7.3 of the CEMP and the Communications Strategy.

9.5 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this NVMP, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 3.9.3 of the CEMP.

9.6 Reporting

Reporting requirements and responsibilities are documented in Section 3.9 of the CEMP, and are further detailed in the Project's Noise and Vibration Monitoring Program in Appendix A.

Specific reports prepared in response to noise and vibration monitoring will include reporting required in accordance with the POEO Act and Regulations, and will capture the following information:

- The locations and descriptions of monitoring carried out
- A tabulation of results (e.g. for noise including L_{Amax} , L_{A90} and L_{Aeq} noise levels) together with notes identifying the principle sources and operations
- Summary of any measurements exceeding the nominated criteria, and descriptions of the plant or operations causing these exceedances
- Detail of any corrective actions and confirmation of their successful implementation.

10 Review and improvement

10.1 Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

10.2 Update and amendment

The processes described in Chapters 3.9 to 3.13 of the CEMP may result in the need to update or revise this Plan. This will occur as needed, in accordance with the process outlined in Section 3.13 of the CEMP.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 3.11.2 of the CEMP

Appendix A

Noise and Vibration Monitoring Program

Noise and Vibration Monitoring Program

SGWPW-JHSW-NWW-PM-PLN-000532

Sydney Gateway Road Project

Document status

Revision	Date	Description	Approval
A	19/02/21	Draft from Renzo Tonins for review	
B	04/03/21	Draft for Internal JHSW review	
C	21/03/2021	Updated to address TfNSW, ER, IV comments	
D	23/05/2021	Updated and finalised following consultation	IK
E	21/06/2021	Updated to address DPIE comments and issued for Approval	IK

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Glossary/ Abbreviations

Abbreviations	Expanded Text
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Attenuation	The reduction in the level of sound or vibration.
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline (Roads and Maritime 2016)
CNVIS	Construction Noise and Vibration Impact Statement
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
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.
EMM	Environmental Management Measure
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 target	Defined by AS/NZS ISO 14001:2015 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ER	Environmental Representative
ERG	Environmental Review Group
EWMS	Environmental Work Method Statements
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
ICNG	<i>Interim Construction Noise Guideline (DECC, 2009)</i>

Abbreviations	Expanded Text
INP	<i>NSW Industrial Noise Policy (EPA 2000)</i>
L _{Aeq} (15min)	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
L _A (max)	the A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
MDP	Major Development Plan
NCA	Noise catchment areas
NML	Noise Management Level
NVMP	Noise and Vibration Management Sub Plan (this document)
OEH	Office of Environment and Heritage
OOHW	Out-of-hours works
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
SWP	Sound Power Level
SSI	State Significant Infrastructure
SPL	Sound Pressure Level
TfNSW	Transport for NSW (formerly Roads and Maritime Services, RMS)
UMM	Updated Mitigation Measure

1 Introduction

1.1 Purpose

This Noise and Vibration Monitoring Program (monitoring Program) for the Project has been prepared in accordance with State Conditions of Approval (CoA) C18.

This monitoring Program has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the environmental management measures listed in the Projects combined Environmental Impact Statement (EIS) / Major Development Plan (MDP), Updated Management Measures (UMM's) from the Response to Submissions Report and all applicable legislation and TfNSW requirements.

1.2 Scope of the monitoring program

The scope of this monitoring Program is to describe how JHSW JV proposes to carry out noise and vibration monitoring during the construction of the Project. Monitoring will be undertaken for modelling verification at sensitive receivers, to assess compliance in response to complaints, for equipment spot checks and for the verification of construction traffic. For further information refer to Sections 4 and 5.

This monitoring Program has been developed specifically for works occurring within NSW State owned land under approval SSI 9737, which, is administered by the NSW Department of Planning, Industry and Environment (DPIE). Works occurring within Commonwealth land are detailed in the Noise and Vibration Management Plan – Commonwealth.

This Monitoring Program forms part of the Construction Noise and Vibration Management Plan (NVMP). Operational noise and vibration monitoring does not fall within the scope of this monitoring Program and therefore is not included within the processes contained within this monitoring Program.

This monitoring Program will apply for the duration of the Project's construction works, unless a longer period is specified by the Secretary of the Department of Planning, Industry and Environment (DPIE).

2 Environmental requirements

2.1 Relevant legislation

2.1.1 Legislation

All legislation relevant to this NVMP is included in Section 3.2.2 of the CEMP.

2.1.2 Guidelines

The main guidelines, specifications and policy documents relevant to this Plan include:

- Roads and Maritime QA Specification G36 – Environmental Protection (Management System).
- Roads and Maritime Construction Noise and Vibration Guidelines (CNVG) (Roads and Maritime 2015)
- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Industrial Noise Policy (INP), Environment Protection Authority 2000
- NSW Noise Policy for Industry (NPfI), Environment Protection Authority 2017
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Sydney Airport Master Plan 2039 and Environment Strategy 2019-2039
- Australian Standard AS/NZS 1055 Acoustics - Description and Measurement of Environmental Noise
- Australian Standard AS/NZS 2012.1 Acoustics - Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors - Stationary test condition - Determination of compliance with limits for exterior noise
- Australian Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
- Australian Standard AS2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- Australian Standard 2775 Mechanical Mounting of Accelerometers
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN4150- 2016 Structural vibration Part 3: Effects of vibration on Structures,
- ISO 3744 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane

- ISO 3746 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane
- ISO 6393 Earth-moving machinery - Determination of sound power level - Stationary test condition
- ISO 6395 Earth-moving machinery - Determination of sound power level - Dynamic test conditions.

2.2 Consultation

This monitoring Program was provided to City of Sydney Council, Bayside Council, Inner West Council, and Sydney Water and other Pipeline Operators (where vibration generating activities will impact on their assets), in accordance with CoA C15 (a). A summary of the consultation undertaken is provided in the NVMP.

Community feedback and complaints relating to noise and vibration will be dealt with in accordance with the Communications Strategy and the Complaints Management System.

3 Baseline monitoring data

As part of the EIS process, baseline noise monitoring was conducted between September and October 2018 at a total of 10 locations. The baseline noise monitoring locations were selected to be representative of the appropriate Noise Catchment Areas (NCAs) within and around the Project. The monitoring data was verified with additional measurements in 2019 to confirm the 2018 data was valid and not erroneously impacted by extraneous noise.

The monitoring locations were representative of receivers that would likely be most affected by the construction of the Project in each NCA. For NCAs where receivers are close to the Project site, the monitoring equipment was located at front row receivers which would have line-of-sight to the Project, within constraints such as accessibility, security and land owner permission.

The baseline noise monitoring data is presented in **Error! Reference source not found.** below. For further information regarding baseline noise monitoring refer to Section 2 of the EIS Technical Working Paper 2: Noise and Vibration (the EIS).

Table 3-1 Baseline noise monitoring data from the EIS

NCA	Monitor ID (EIS)	Rating Background Level (RBL)			Existing ambient noise levels (L_{Aeq})			Address
		Day	Evening	Night	Day	Evening	Night	
NCA00 ²	L00	54	45	40	68	65	61	18 Campbell St, St Peters
NCA01 NCA01a	L01	65	62	53	75	74	72	Princes Hwy, St Peters
NCA02 NCA02a NCA02b	L02	64	60	48	75	74	72	535 Princes Hwy, Tempe
NCA03	L03	42	40	38	61	60	53	1 Fanning St, Tempe
NCA04	L05	58	54	49	67	65	63	Canal Rd, St Peters
NCA05 NCA07	L06	63	60	52	73	72	70	Qantas Dr, Mascot
NCA06	L08	60	58	53	68	66	64	289 King St, Mascot
NCA06a	L07	60	56	50	71	68	67	39 Kent Rd, Botany
NCA08 NCA08a	L09	54	51	45	67	65	62	105 Baxter Rd, Mascot

NOTES:

- Construction noise is assessed during the Day, which is 7am to 6pm Monday to Friday and 8am to 6pm Saturdays, Evening which is 6pm to 10pm Monday to Sunday and Night which is 10pm to 7am Monday to Friday and 10pm to 8am on Saturday, Sunday and public holidays.
- Results taken from NL03 in the WestConnex New M5 EIS, Roads and Maritime 2015.

A review of the EIS noise monitoring data by JHSW JV found that it adequately represented the acoustic environment surrounding the Project. To assist with managing impacts from construction, some NCA boundaries were altered and some new NCAs were added. The EIS noise monitoring data was considered representative of the revised and additional NCAs.

No further additional baseline monitoring is anticipated, however, if required, it will be undertaken in accordance with the relevant guidance and the NVMP will be updated as necessary and issued to DPIE for approval.

4 Noise monitoring

4.1 Attended and unattended airborne noise monitoring

Attended monitoring of construction noise levels will be undertaken as follows:

- Monitoring will be carried out at the first opportunity within the first month of starting construction activities as well as throughout the construction period to ensure the range of activities being undertaken at the site are measured (see NVMP Section 9.3.1), to confirm that actual noise levels are consistent with predicted noise impacts and that the management measures that have been implemented are appropriate. This would be undertaken in consultation with the ER,
- Where a change in methodology, plant or equipment is anticipated to result in a significant increase in construction noise impact than what has been assessed,
- Where appropriate in response to a noise related complaint(s) (determined on a case-by-case basis) and in accordance with EPL Conditions,
- As directed by an authorised officer of the EPA,
- As otherwise required by the CNVIS (refer to NVMP Section 7.2 for information regarding CNVIS). Specific monitoring requirements will be identified in the relevant CNVIS as they are location and task specific.
- As required by the Out of Hours Works (OOHW) Protocol (refer Section 4.3) or EPL (refer Section 4.5),
- Following the implementation of mitigation measures or noise attenuation as a result of exceedance of predicted noise levels,
- Ongoing spot checks for noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with the noise levels for construction equipment assumed in the CNVIS (see Appendix C, Table C1 of the relevant CNVIS) or the levels established in Table F.1 of the CNVG. Spot checks would be carried out as required on a case-by-case basis, such as in response to a specific noise related complaint and during noise and vibration assessment validation monitoring when it is possible to isolate the noise from one piece of plant or equipment.
- Unattended airborne noise monitoring may also be undertaken, with a noise logger deployed to obtain noise results over longer periods.

Attended noise monitoring locations may vary throughout the life of the Project. Locations would be determined on a case-by-case basis in a CNVIS, via the Project's predictive noise and vibration management tool (Gatewave, see NVMP Section 7.3) or in response to complaints. Changes to unattended monitoring locations would be determined in consultation with the ER.

In accordance with the ICNG the duration and amount of noise monitoring will depend on the scale of the construction activities and extent of expected noise impacts. Noise monitoring will cover a representative period of the construction activity. A representative period is the stage of a construction activity where all the plant and equipment operating is consistent with the full range of plant and equipment modelled in the noise assessment, i.e. noise monitoring is not to be undertaken when the key noise contributing plant and equipment are turned off.

Where possible, monitoring will be undertaken at the most affected noise sensitive receiver location in proximity to the Project's construction activities. Noise monitoring locations will consider factors, including the:

- Location of previous monitoring sites,
- Proximity of the receiver to a Project worksite,

- Sensitivity of the receiver to noise,
- Background noise levels, and
- Safety of personnel undertaking the measurements,
- Expected duration of the impact.

4.1.1 Parameters to be monitored

All environmental noise measurement will be taken with the following meter settings:

- Time Constant: Fast (i.e. 125 milliseconds),
- Frequency Weightings: A-weighting, and
- Sample period: 15 minutes.

Environmental noise monitoring (excluding spot checks of plant and equipment) will be recorded over 15-minute sample intervals, excluding periods of extraneous noise until a representative sample has been obtained. A representative sample will be determined by the operator, who will be competent, suitability trained and experienced in undertaking noise measurements and familiar with the relevant Australian Standards (as detailed in Section 2.1). The minimum range of noise metrics to be recorded include the following A-weighted noise levels: L_{A90} , L_{Aeq} and L_{Amax} .

For spot checks of noise intensive plant and equipment, duration of monitoring will depend on the source of noise being monitored. Sources of continuous noise (such as generators or fans), measurements will be monitored over one-to-two-minute intervals. For dynamic plant, such as front-end loaders, spot checks will capture a representative activity, such as one truck-and-trailer load cycle.

4.2 Attended and unattended ground-borne noise monitoring

Attended monitoring of ground-borne construction noise levels will be undertaken as follows:

- At the first opportunity following the commencement of works if ground-borne noise impacts are identified,
- Where appropriate in response to a ground-borne noise related complaint(s) (determined on a case-by- case basis) and in accordance with the EPL, and
- As otherwise required by a CNVIS, OOHV Protocol or EPL.

Monitoring will be undertaken in the most affected habitable room of the sensitive receiver building and will be conducted in conjunction with vibration measurements whenever practicable. The room selected for noise monitoring should be well shielded from airborne noise intrusions, such as road traffic noise to allow the ground-borne noise to dominate over non-construction generated airborne noise.

There may be instances where the resident does not allow access to monitor in the most suitable habitable room. In these instances, JHSW JV will endeavour to monitor at the next most suitable available room or location, noting this in the monitoring form.

Given that ground-borne noise is mostly noticed during the evening or at night, noise loggers may also be left in place over night and picked up at a mutually agreed time with the resident. In these instances, noise loggers will record audio to allow for the identification construction noise contribution and the presence of any extraneous noise, provided privacy concerns can be overcome. Where the sensitive receiver will not allow the noise logger to record audio, attended noise monitoring will be offered instead.

Measurements will be carried out by an appropriately trained and competent person in the measurement and assessment of construction noise and vibration, who is familiar with the requirements of the relevant standards and procedures.

4.2.1 Parameters to be monitored

Ground-borne noise measurement will be taken with the following meter settings:

- Time Constant: Fast (i.e. 125 milliseconds),
- Frequency Weightings: A-weighting, and
- Sample period: 15 minutes.

Ground-borne noise monitoring will be recorded over 15-minute sample intervals, where every 15 minutes the data is to be processed statistically. The minimum range of noise metrics to be recorded include the following A-weighted noise levels: L_{A90} , L_{Aeq} and L_{Amax} .

4.3 Real-time (unattended) noise monitoring

Real-time (unattended) noise monitoring would be undertaken in accordance with CoA C18.

Real-time noise monitor will be installed near residential receivers in NCA03 (Annexure A). The timing, duration and final location of the real-time noise monitoring equipment will be subject to the construction program, availability of mains power, safety requirements and consultation.

The monitor will be installed by a person appropriately trained in the measurement and assessment of construction noise and vibration, who is familiar with the requirements of the relevant standards and procedures and the establishment of real-time monitoring equipment.

The real-time monitoring data will be available to the construction team, TfNSW and ER. The real-time monitoring data will be available to DPIE and EPA on request following an initial screening review, to identify any anomalies or corruption in the dataset.

4.3.1 Parameters to be monitored

Real-time unattended noise monitoring will be taken with the following meter settings:

- Time Constant: Fast (i.e. 125 milliseconds),
- Frequency Weightings: A-weighting, and
- Sample period: 15 minutes.

Real-time noise monitoring will be recorded over 15-minute sample intervals, where every 15 minutes the data is to be processed statistically in real-time and displayed. The minimum range of noise metrics include the following A-weighted noise levels: L_{A90} , L_{Aeq} and L_{Amax} .

4.4 Out-of-hours Work Protocol monitoring requirements

An Out-of-Hours Work Protocol (OOHW Protocol) has been prepared in accordance with CoA E18 and is available in Appendix C of the NVMP.

In accordance with the Protocol, noise monitoring must be undertaken in accordance with the requirements of the work specific OOHW permit to validate predicted noise impacts. Section 5 of the Out-of-Hours Works Protocol identifies that noise verification monitoring would be undertaken when the impact classification is predicted to be moderately intrusive or highly intrusive (during OOHW period 1) or clearly audible, moderately intrusive or highly intrusive (during OOHW period 2).

4.5 Out-of-hours EPL monitoring requirements

To be updated once the EPL is issued.

4.6 Calibration, QA and competency

All monitoring will be undertaken by competent personnel, suitably trained and experienced in undertaking noise measurements.

Noise monitoring equipment used will be at least Type 2 instruments and calibrated in accordance with manufacturer specifications or relevant Australian Standards. Records of equipment laboratory calibration will be maintained by JHSW JV throughout the delivery of the Project. The calibration of the monitoring equipment will be checked in the field before and after the noise measurement period.

All monitoring records will be retained throughout the delivery of the Project by JHSW JV. Noise monitoring records will be completed to record:

- Date and time of measurement,
- Name of person undertaking the measurement,
- Type and model number of monitoring instrumentation,
- Results of field calibration checks,
- Time of day, length of measurement and any measurement time intervals,
- Monitoring location, including a sketched map of area and/or photographs clearly identifying the monitoring location,
- Measurement location details and number of measurements at each location,
- Weather conditions during measurements,
- Operation and activities of the noise sources under investigation,
- Estimated contribution of the Project's activities, and
- Noise due to other extraneous and environmental sources (e.g. traffic, aircraft, trains, dogs barking, insects).

Noise monitoring will be undertaken and recorded in accordance with the relevant noise measurement requirements in the reference standards and documents in Section 2.1.

All outdoor noise measurements will be undertaken with a windscreen over the microphone and measurements of noise will be disregarded when it is raining and/or the wind speed is greater than 5 m/s (18 km/h).

Where high background noise levels obscure construction noise contribution during attended noise measurements, operators will either:

- Measure closer to the source and calculate back to the required position, or
- Measure with the source noise off and then on (where possible) and calculate the difference or use the 'pause and cut' feature on the sound level meter to try to exclude as much of the extraneous noise as possible.

Where possible, outdoor noise monitoring is to be carried out at least 3.5 m from any reflective surface other than the ground. The preferred microphone/measurement height is 1.2-1.5 m above the ground level.

Measurements taken inside buildings should be at least one metre from walls or other reflective surface, and about 1.5 metres from windows, where such instrument siting is possible. The preferred microphone/measurement height is 1.2-1.5 m above the floor level.

5 Vibration monitoring

5.1 Short term attended and unattended vibration monitoring

Attended vibration monitoring is to be undertaken as follows:

- To confirm/identify the site specific minimum working distances to prevent cosmetic damage or damage to sensitive equipment or buried pipework
 - at the commencement of vibration intensive activities on site that have been identified in a CNVIS (refer to NVMP Section 7.2 for information regarding CNVIS) or in the noise and vibration management tool (Gatewave) as likely to exceed the vibration screening criteria
 - at the commencement of vibration generating activities that have the potential to impact on heritage items,
 - where vibration sensitive locations are found to fall within the recommended minimum working distances established for vibration intensive plant,
- Prior to undertaking dynamic compaction, to satisfy CoA E25,
- Where appropriate in response to a vibration related complaint(s) (determined on a case-by-case basis) and in accordance with the EPL (once issued),
- As directed by the AEO or an authorised officer of the EPA, and
- As otherwise required by a CNVIS (note that specific monitoring requirements will be identified in the relevant CNVIS and not prescribed in this Program), OOHV Protocol (Section 6.3) or EPL.

Vibration monitoring will be undertaken in accordance with the relevant vibration measurement requirements in the reference standards and documents in Section 2.1.

Where human comfort is a concern, vibration monitoring would be undertaken as outlined in **Annexure B**. Vibration monitoring results would be assessed and reported against the values set out in Tables 2.2 and 2.4 of the EPA's Assessing Vibration – a technical guideline, as presented in the NVMP (Section 5.6.1).

Where property damage is a concern, vibration monitoring would be undertaken as outlined in **Annexure C**. Vibration monitoring results will be assessed and reported against the British Standard 7385 and German Standard DIN 4150, as presented in the NVMP (Section 5.6.2). The approach that will be adopted for the Project to assess and manage potential vibration impact, including on heritage structures is outlined in Section 8.3 of the NVMP.

The following notes of importance are included:

- Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest, closest to the vibrating plant, where access is permitted
- The surface should be solid and rigid to best represent the vibration entering the structure of the building under investigation,
- The vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces,
- The vibration sensor or transducer shall be directly mounted to the vibrating surface using either bees wax or a magnetic mounting plate onto a steel washer, plate or bracket which shall be either fastened or glued to the surface of interest,
- Where a suitable mounting surface is unavailable, then a metal stake of at least 300mm in length shall be driven into solid ground adjacent to the building of interest and the vibration sensor or transducer shall be mounted on that.

Where attended vibration monitoring is not feasible, due to extended periods of vibration intensive works, an unattended vibration monitoring system will be installed where initial monitoring to establish site specific minimum working distances is insufficient to ensure vibration criteria are met, due to changing plant or unknown/unstable ground conditions. Unattended monitors will warn plant operators (e.g. SMS, etc.) that vibration is approaching levels where there is potential for cosmetic damage to buildings and structures.

Where unattended vibration monitors are left in place on a private property they will be picked up at a mutually agreed time with the resident.

Monitored vibration levels will be analysed against the predictions made in the relevant CNVIS or using the Project's vibration prediction and management tool (Gateway). Where monitored construction vibration is found to be above the vibration criteria, refer to Section 9 for further information.

5.1.1 Parameters to be monitored

Vibration data will be processed statistically and stored in memory. The minimum range of vibration metrics to be recorded is the following:

- Root-Mean-Square acceleration (RMS), or
- Vector-sum peak-particle velocity (PPV).

All short term attended vibration monitoring will be recorded over a representative sampling interval where the worst-case vibration levels can be captured.

Where unattended vibration monitoring is proposed, monitoring will be undertaken continuously whilst the vibrating plant is operational to capture the worst-case vibration impacting on the structure.

5.2 Real-time (unattended) vibration monitoring

Real-time (unattended) vibration monitoring will be undertaken to satisfy CoA C18. The monitors will be installed following approval of this monitoring Program.

Real time vibration monitors will be installed as indicatively identified in **Annexure A**. The final timing, duration and location of the real-time vibration monitoring equipment will be subject to the construction program, availability of mains power, safety requirements and consultation. The monitor will be installed by a person appropriately trained in the measurement and assessment of construction vibration monitoring, who is familiar with the requirements of the relevant standards and procedures and the establishment of real-time monitoring equipment.

The real-time monitoring data will be available to the construction team, TfNSW and ER. The real-time monitoring data will be available to DPIE and EPA on request following an initial screening review, to identify any anomalies or corruption in the dataset.

5.2.1 Parameters to be monitored

Real time vibration monitoring will continuously monitor PPV or Velocity RMS.

5.3 Out-of-hours Protocol monitoring requirements

An Out-of-Hours Work Protocol (OOHW Protocol) has been prepared in accordance with CoA E18 and is available in Appendix C of the NVMP.

If vibration intensive activities with the potential to impact on sensitive receivers or structures are proposed as OOHW, vibration monitoring requirements would be identified in a CNVIS (refer to Section 7.2 of the NVMP) or using the Project's vibration prediction and management tool (Gateway).

5.4 Calibration and QA

All monitoring will be undertaken by competent personnel, suitably trained and experienced in undertaking vibration measurements.

All vibration instruments will be calibrated in accordance with manufacturers specifications or relevant Australian Standards. Records of monitoring equipment calibration will be maintained by JHSW JV throughout the delivery of the Project.

All monitoring records will be retained throughout the delivery of the Project by JHSW JV. Vibration monitoring records will be completed to record:

- Date and time of measurements,
- Name of person undertaking the measurements,
- Calibration dates of monitoring equipment,
- Type and model number of instrument,
- Time of day, length of measurement and measurement time intervals,
- Monitoring location (including a sketched map of area and/or photographs clearly identifying the monitoring location),
- Measurement location details and number of measurements at each location, operation and load conditions of the vibrating plant under investigation, and
- Possible vibration influences from other sources (e.g. domestic vibrations, other mechanical plant, traffic etc.).

6 Heritage listed structures

The location and activity specific CNVIS prepared for the Project will identify heritage items at risk of impact from vibration intensive activities.

In accordance with CoA E27, JHSW JV will conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items. Heritage items at risk of being impacted will be identified in the CNVIS, based on the conservative recommended minimum working distances in the NVMP (Table 8-5). Monitoring of identified plant will be undertaken to determine site/ plant specific minimum working distances to prevent the likelihood of cosmetic damage as far as practicable. Should vibration testing and monitoring show that the preferred values for vibration are likely to be exceeded, JHSW JV will follow the process in Section 9 of the NVMP.

Heritage items which have the potential to be impacted by vibration are identified in the Land Use Survey in Appendix B of the NVMP. Vibration Screening Criteria drawings for vibration intensive activities have been prepared and included in the NVMP (refer to Appendix C of the NVMP) and include the minimum working distances for heritage buildings. More detailed review of specific vibration intensive activities will be undertaken in the CNVIS prepared for the Project. The CNVIS will identify where monitoring should be conducted at heritage items.

JHSW JV will seek the advice of the Project's heritage and noise and vibration specialists, on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures.

Section 8.3 of the NVMP also provides further detail on the approach to managing potential vibration impacts on heritage structures.

7 Continual improvement and corrective action

Monitored noise and vibration levels will be analysed against the predictions made in the relevant CNVIS or using the Project's noise and vibration prediction and management tool (Gatewave). Where monitored construction noise levels are found to be above modelling predictions or vibration criteria are exceeded, the following actions will be undertaken:

- Cease the noise and/or vibration generating activity which causes the exceeded predictions,
- Confirm the monitored levels are not being impacted by other noise or vibration sources,
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment,
- Identify if the equipment can be swapped out for another piece of equipment or alternative equipment or plant,
- Confirm if the exceedance is due to an uncharacteristically vibratory piece of equipment and if an alternative, less vibration generating mode of operation can be used,
- Confirm that the modelling reflects the actual activity being undertaken,
- Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternative construction methodology or a combination of these,
- Review work practices to ensure compliance with the relevant guidelines identified in Section 3.1 of the NVMP,
- Ensure that the learnings from the above are fed back into the noise and vibration assessment process and where applicable, the Project's noise and vibration prediction and management tool (Gatewave), for fine-tuning,
- Continue work where impacts can be reduced,
- Where no alternative construction method is available and an exceedance of vibration objectives is still measured, site specific mitigation measures should be identified on a case-by-case basis. In this case, a site and activity specific management strategy for the vibration intensive works should be established so that the risk of building/structure damage can be minimised.
- Communicate lessons learnt to relevant personnel.

JHSW JV will review the work or activity or combination of simultaneous works or activities and where possible, modify the work or activity to prevent any recurrence. Lessons learnt will be communicated to relevant personnel in toolbox talks.

Where a complaint relating to impact to human comfort from vibration is received, JHSW JV will review the vibration model. If it is determined from the review that there is insufficient local monitoring to validate the vibration model, JHSW JV will offer additional monitoring following the process defined in Section 6.1.

8 Reporting of monitoring results

During construction, real time noise and vibration monitoring data will be collected, tabulated and assessed against baseline conditions and performance criteria.

Reporting requirements associated with the Program for the construction phase of the Project are presented in Table 1.

Table 8-1 Reporting of construction noise and vibration monitoring results

Schedule (during construction)	Requirements	Recipient (relevant authority)	Frequency
Construction Monitoring Report	Noise and vibration monitoring data will be reported within a Construction Monitoring Report (as per CoA C24)	ER, DPIE, SYD,	Monthly
EPL monitoring data	Noise and vibration monitoring data will be published on the John Holland website in line with POEO Act and Regulations. (Once EPL issued)	EPA	Monthly (subject to finalised EPL)

8.1 Review and improvement

8.1.1 Continuous improvement

Continuous improvement of this Monitoring Procedure will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance,
- Determine the cause or causes of non-conformances and deficiencies,
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies,
- Verify the effectiveness of the corrective and preventative actions,
- Document any changes in procedures resulting from process improvement,
- Make comparisons with objectives and targets.

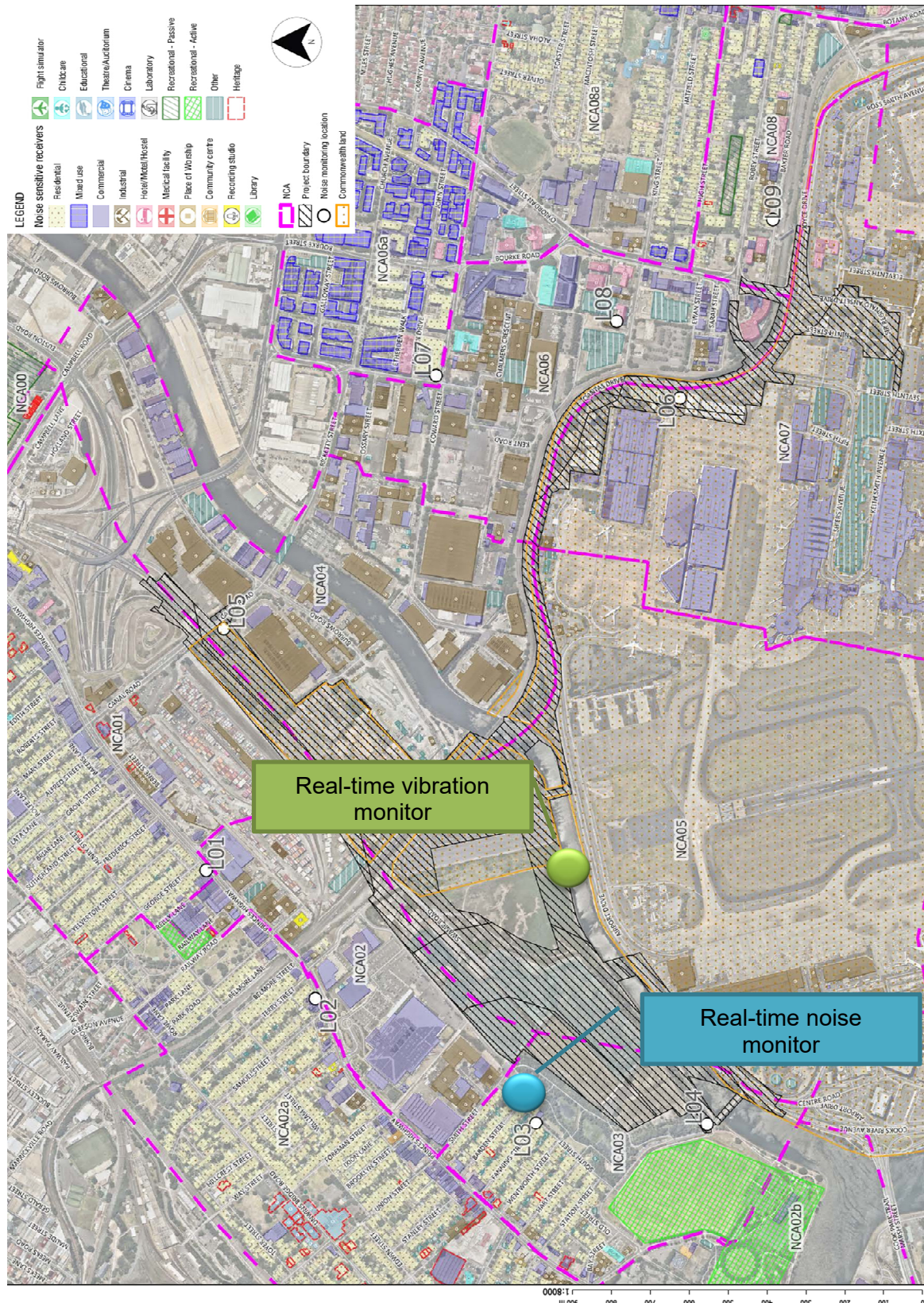
8.1.2 Update and amendment

The processes described in Chapters 3.9 to 3.13 of the CEMP may result in the need to update or revise this Monitoring Procedure . This will occur as needed, in accordance with the process outlined in Section 3.13 of the CEMP.

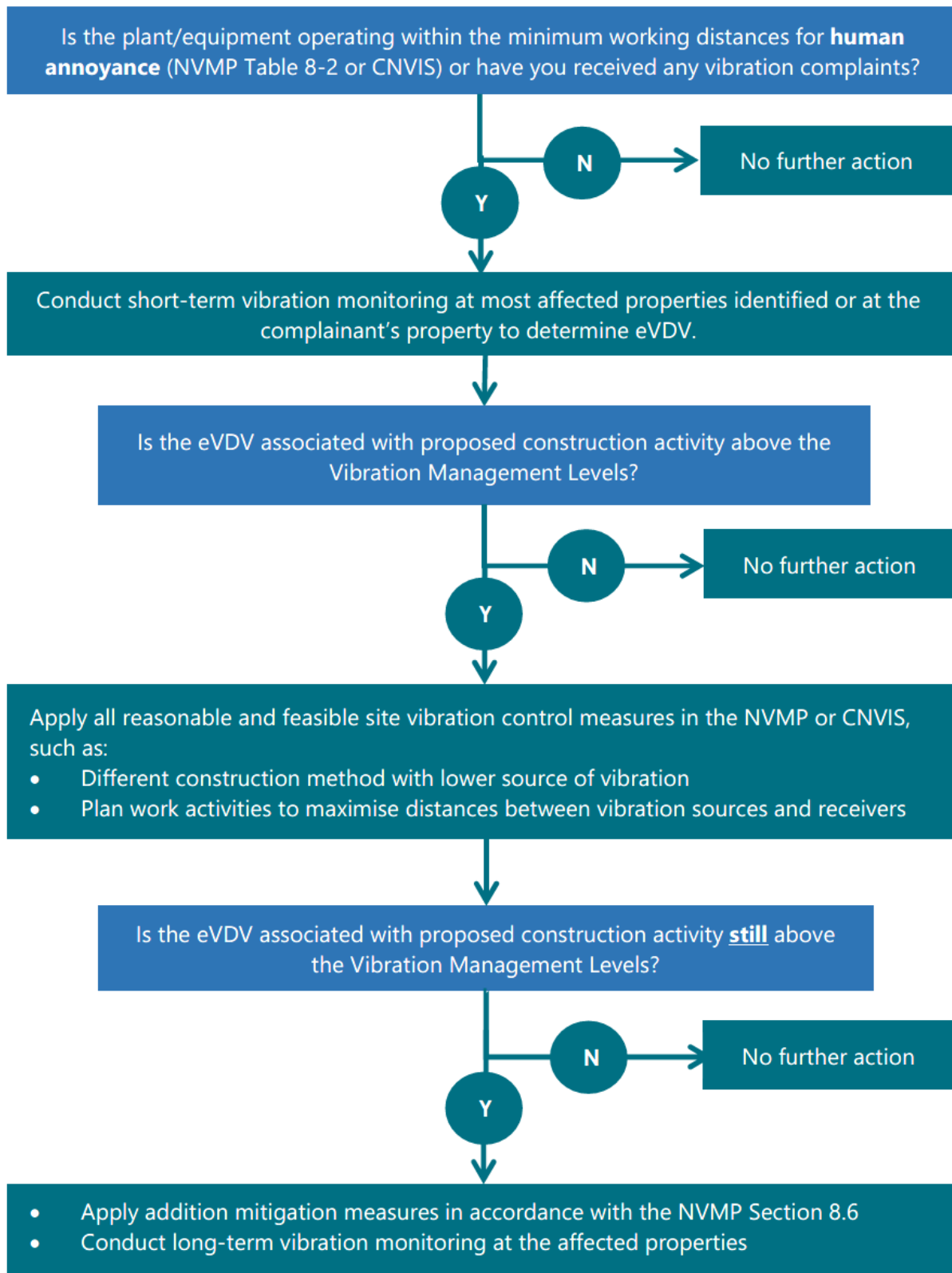
A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 3.11.2 of the CEMP

9 Appendices

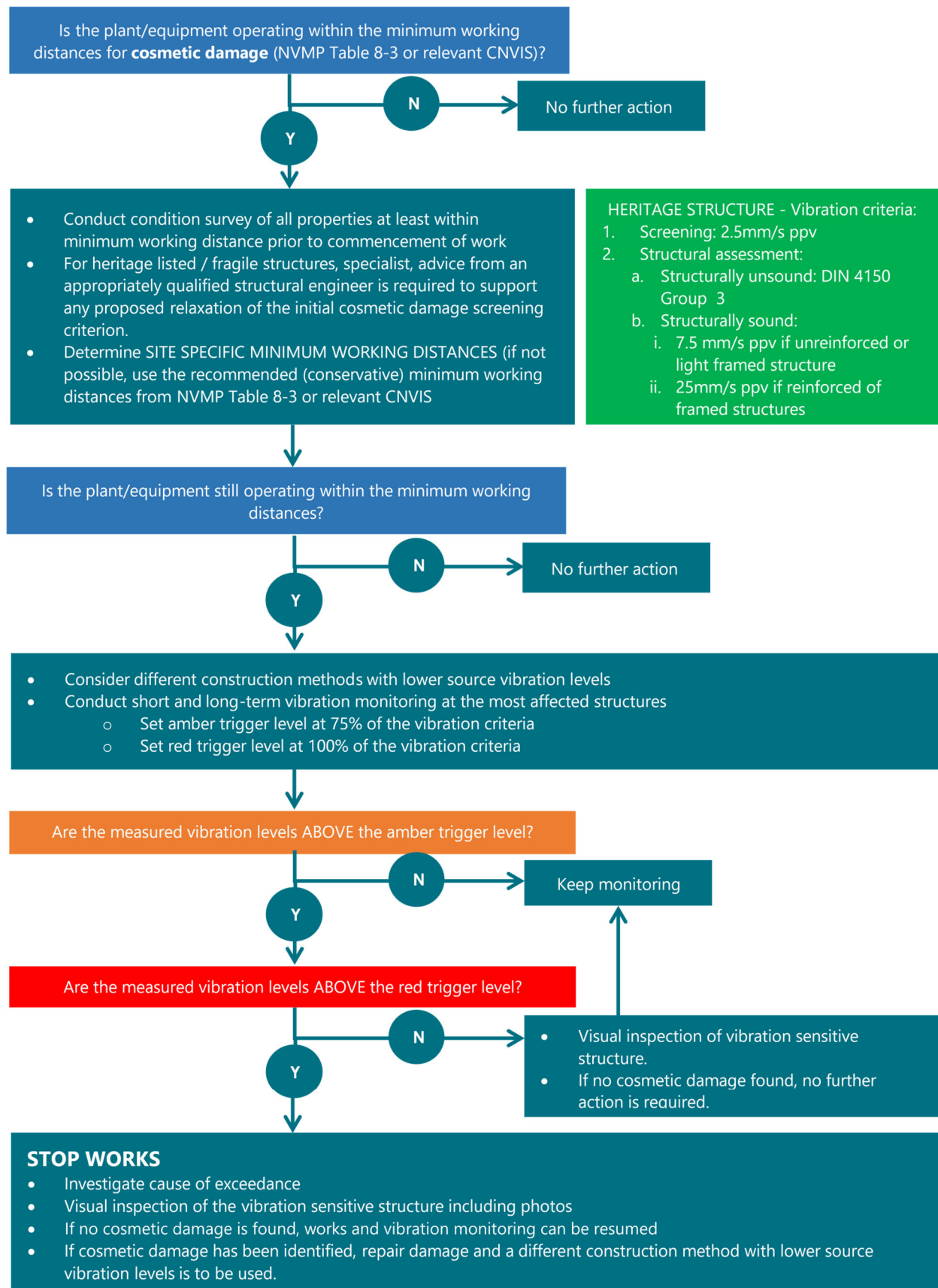
Annexure A – JHSW Sydney Gateway Project – Indicative real-time monitoring locations



Annexure B – JHSW Sydney Gateway Project Vibration monitoring (human comfort) Flow Chart



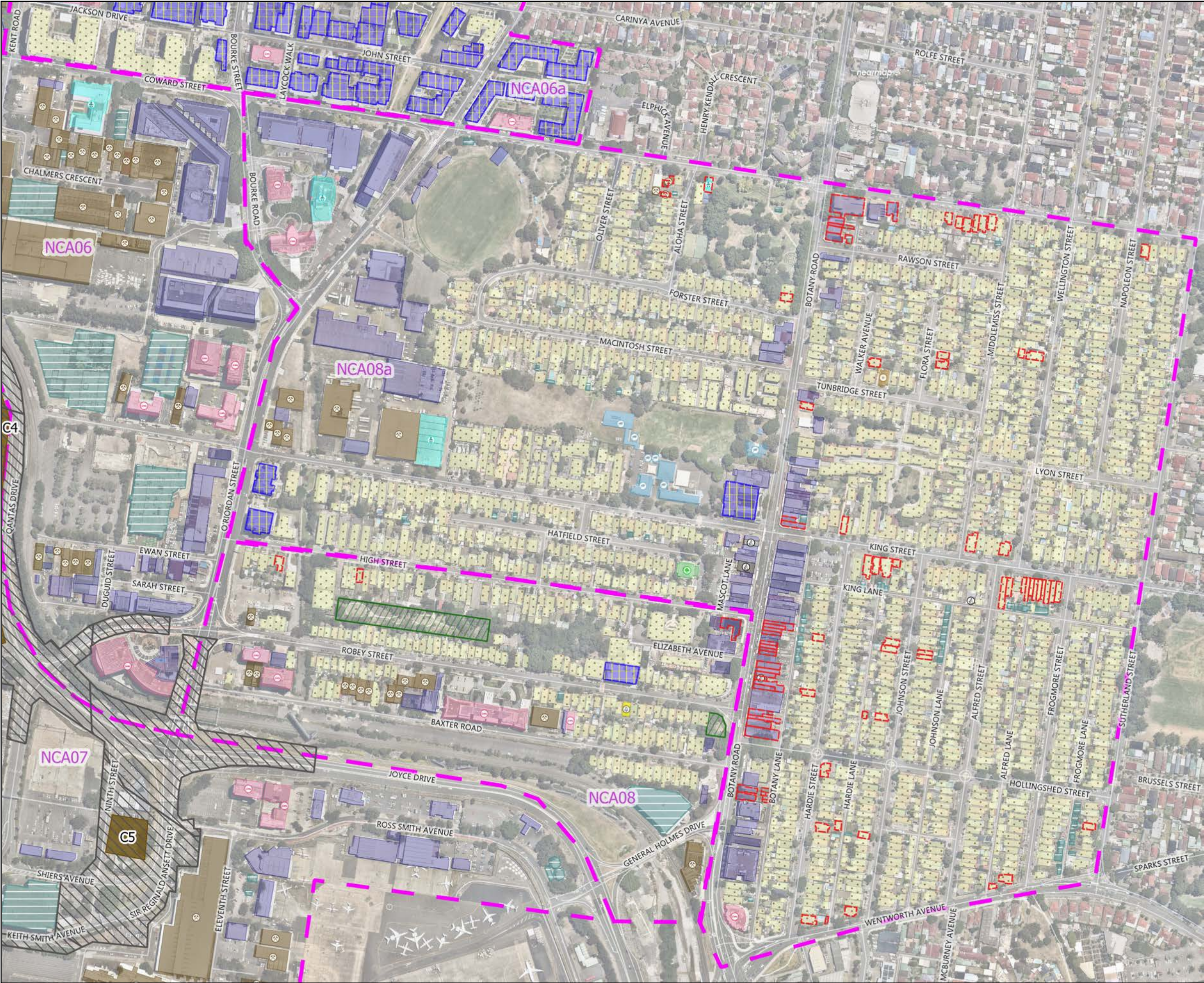
Annexure C – JHSW Sydney Gateway Project Vibration monitoring (cosmetic damage to structures) Flow Chart



Appendix B

Land Use Survey

500 m
400
300
200
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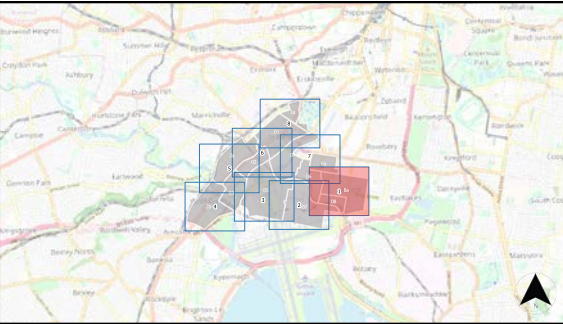


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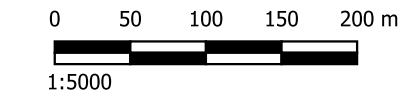
- Noise sensitive receivers
- Residential
 - Mixed use
 - Commercial
 - Industrial
 - Hotel/Motel/Hostel
 - Medical facility
 - Place of Worship
 - Community centre
 - Recording studio
 - Library
 - Flight simulator
 - Childcare
 - Educational
 - Theatre/Auditorium
 - Cinema
 - Laboratory
 - Recreational - Passive
 - Recreational - Active
 - Other
 - Heritage

- NCA
- Compounds
- Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
NCA08	64	59	56	50
NCA03	52	47	45	43
NCA00	64	59	50	45
NCA01	75	70	67	58
NCA07	70	65	61	55
NCA06	70	65	61	55
NCA02	74	69	65	53
NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58



REV	BY	DATE	DESCRIPTION	APPROVER
r2	MS	24/03/21	Updated figures	MT
r1	MS	02/02/21	Updated figures	MT
r0	MS	13/01/21	Prepare figures	MT
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NOTE: Do not scale from this drawing.

CLIENT



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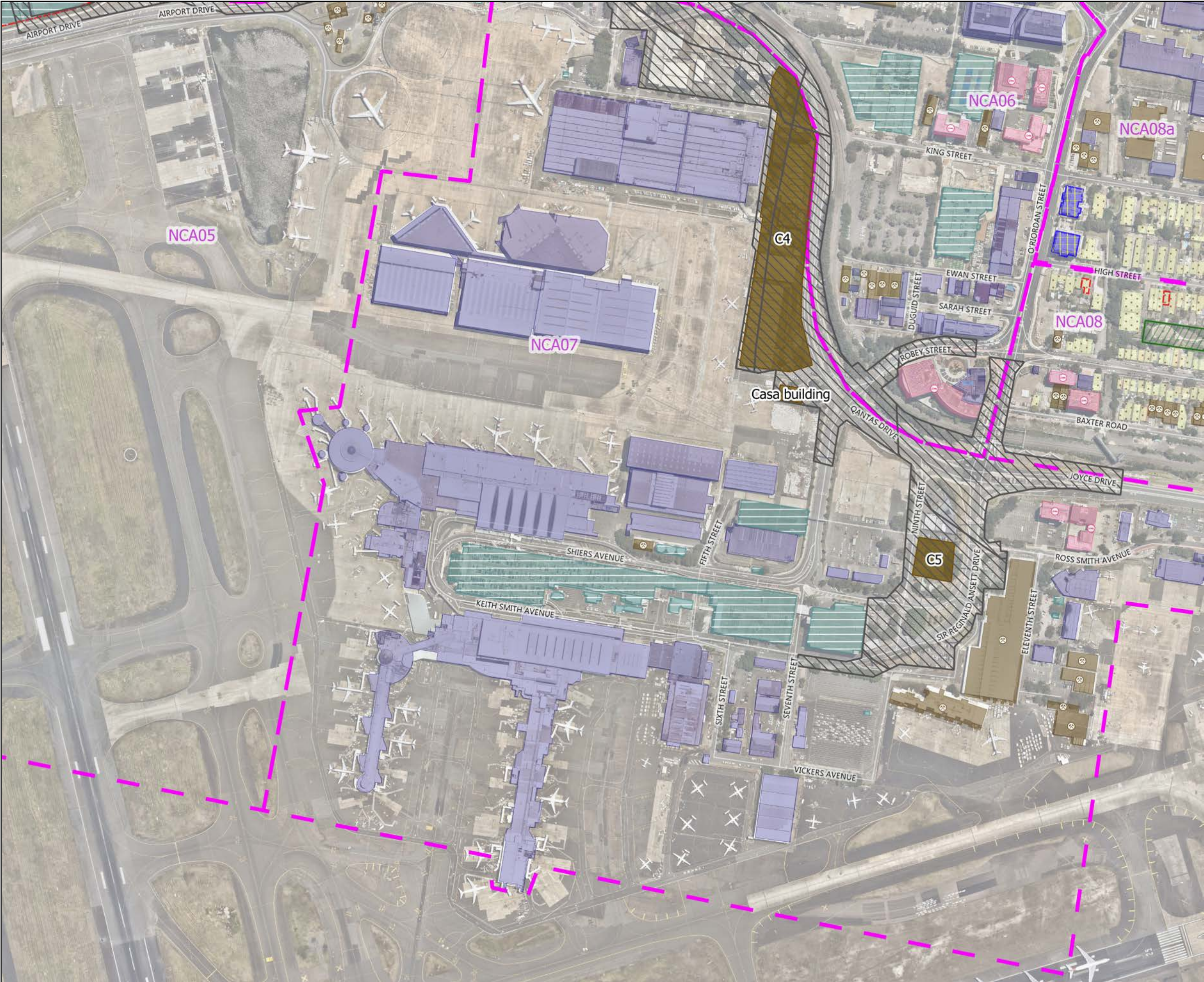


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SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary

500 m
400
300
200
100
0



LEGEND

Noise sensitive receivers

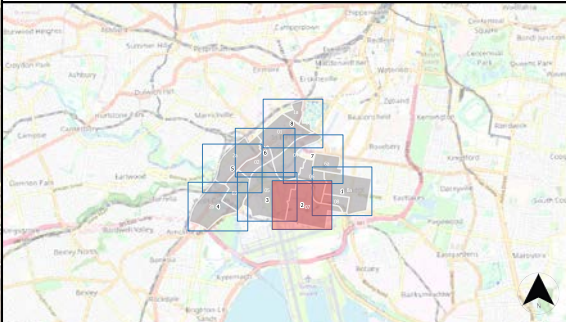
- Residential
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- Flight simulator
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- Cinema
- Laboratory
- Recreational - Passive
- Recreational - Active
- Other
- Heritage

NCA

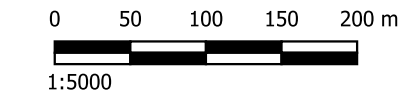
Compounds

Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
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NCA03	52	47	45	43
NCA00	64	59	50	45
NCA01	75	70	67	58
NCA07	70	65	61	55
NCA06	70	65	61	55
NCA02	74	69	65	53
NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58



REV	BY	DATE	DESCRIPTION	APPROVER
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r1	MS	02/02/21	Updated figures	MT
r0	MS	13/01/21	Prepare figures	MT
A3	Original			



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NOTE: Do not scale from this drawing.

CLIENT



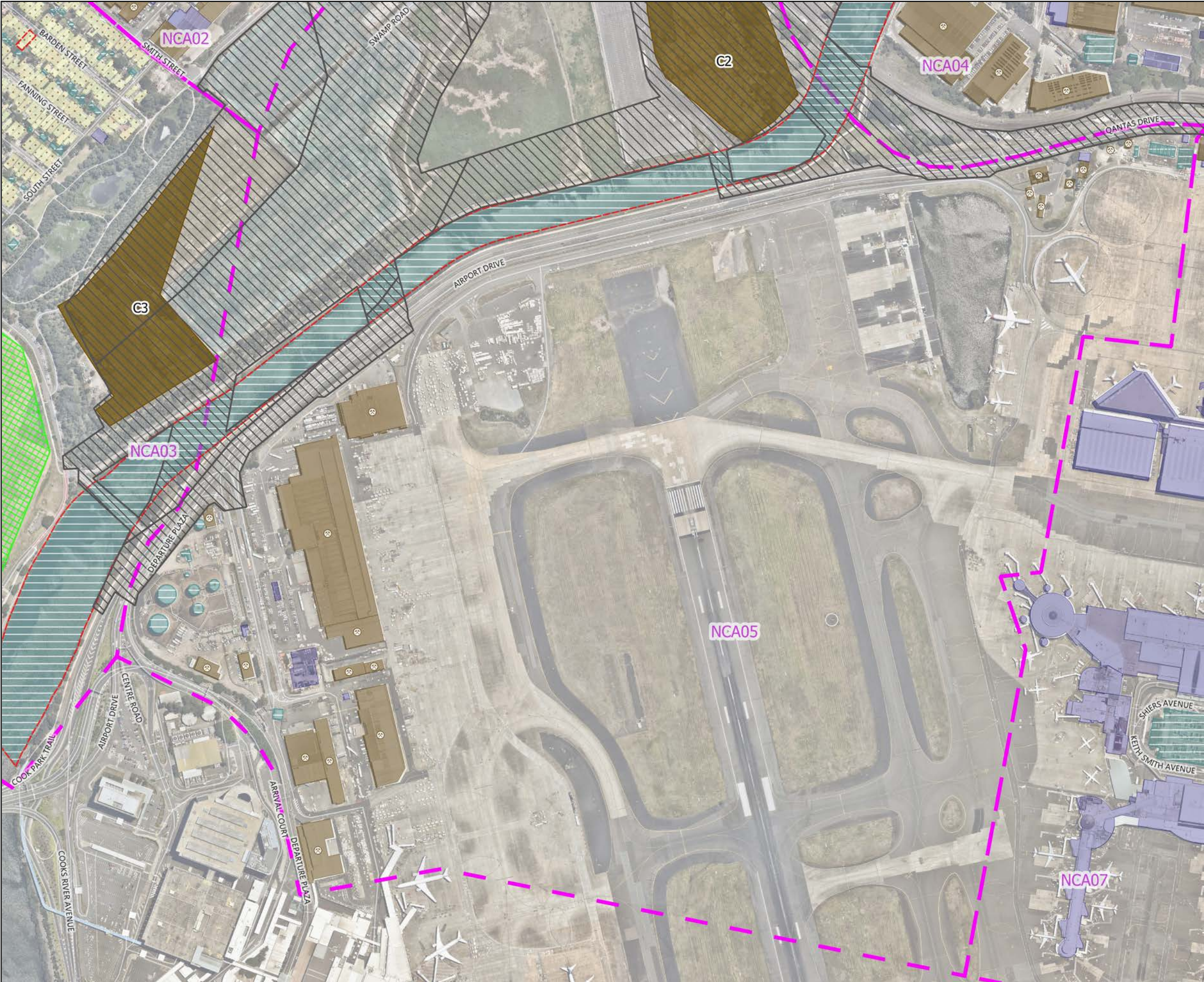
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SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary

500 m
400
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200
100
0

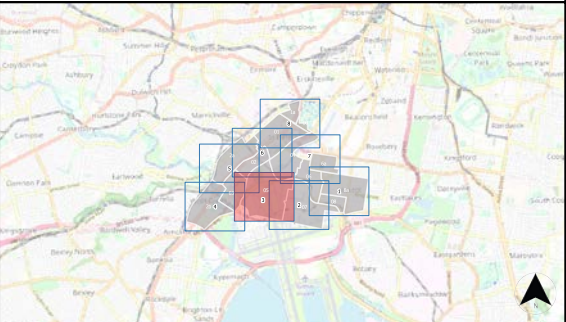


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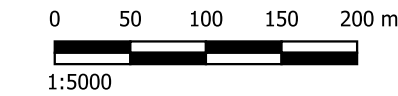
- Noise sensitive receivers
- Residential
 - Mixed use
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 - Laboratory
 - Recreational - Passive
 - Recreational - Active
 - Other
 - Heritage

- NCA
- Compounds
- Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
NCA08	64	59	56	50
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NCA00	64	59	50	45
NCA01	75	70	67	58
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NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58



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r0	MS	13/01/21	Prepare figures	MT
A3	Original		Co-ordinate System: MGA Zone 56	



FULL SIZE A3
NOTE: Do not scale from this drawing.

CLIENT



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SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary

500 m
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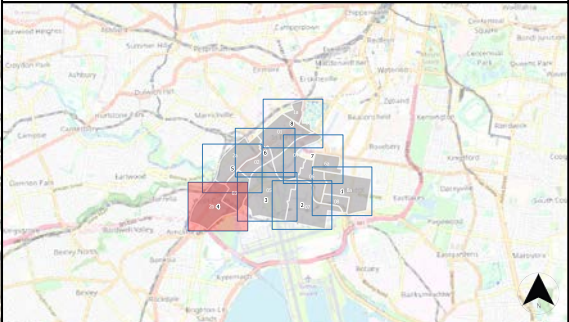


LEGEND

- Noise sensitive receivers
- Residential
 - Mixed use
 - Commercial
 - Industrial
 - Hotel/Motel/Hostel
 - Medical facility
 - Place of Worship
 - Community centre
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- NCA
- Compounds
- Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
NCA08	64	59	56	50
NCA03	52	47	45	43
NCA00	64	59	50	45
NCA01	75	70	67	58
NCA07	70	65	61	55
NCA06	70	65	61	55
NCA02	74	69	65	53
NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58



REV	BY	DATE	DESCRIPTION	APPROVER
r2	MS	24/03/21	Updated figures	MT
r1	MS	02/02/21	Updated figures	MT
r0	MS	13/01/21	Prepare figures	MT
A3 Original				

0 50 100 150 200 m
1:5000

FULL SIZE A3
NOTE: Do not scale from this drawing.

CLIENT



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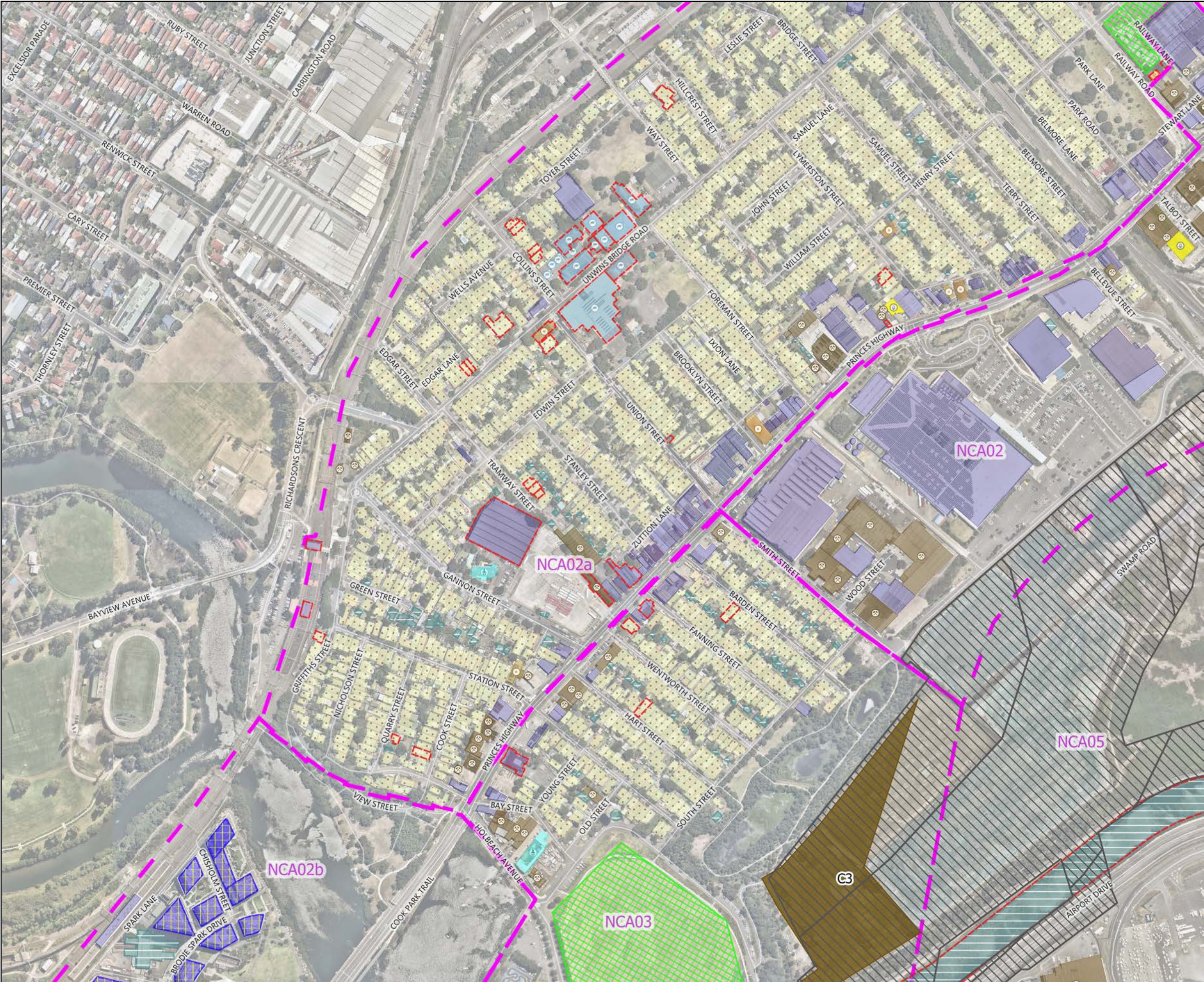


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SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary

500 m
400
300
200
100
0

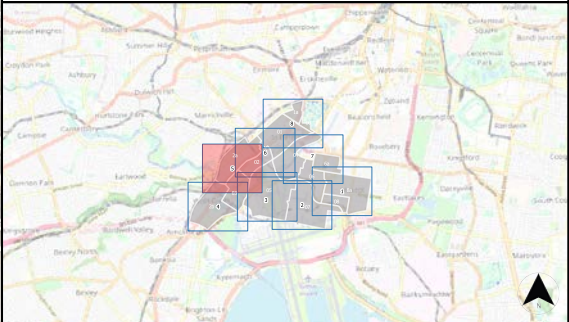


LEGEND

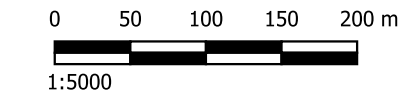
- Noise sensitive receivers
- Residential
 - Mixed use
 - Commercial
 - Industrial
 - Hotel/Motel/Hostel
 - Medical facility
 - Place of Worship
 - Community centre
 - Recording studio
 - Library
 - Flight simulator
 - Childcare
 - Educational
 - Theatre/Auditorium
 - Cinema
 - Laboratory
 - Recreational - Passive
 - Recreational - Active
 - Other
 - Heritage

- NCA
- Compounds
- Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
NCA08	64	59	56	50
NCA03	52	47	45	43
NCA00	64	59	50	45
NCA01	75	70	67	58
NCA07	70	65	61	55
NCA06	70	65	61	55
NCA02	74	69	65	53
NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58



REV	BY	DATE	DESCRIPTION	APPROVER
r2	MS	24/03/21	Updated figures	MT
r1	MS	02/02/21	Updated figures	MT
r0	MS	13/01/21	Prepare figures	MT
A3 Original				



FULL SIZE A3
NOTE: Do not scale from this drawing.

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SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary



NOTE: Do not scale from this drawing



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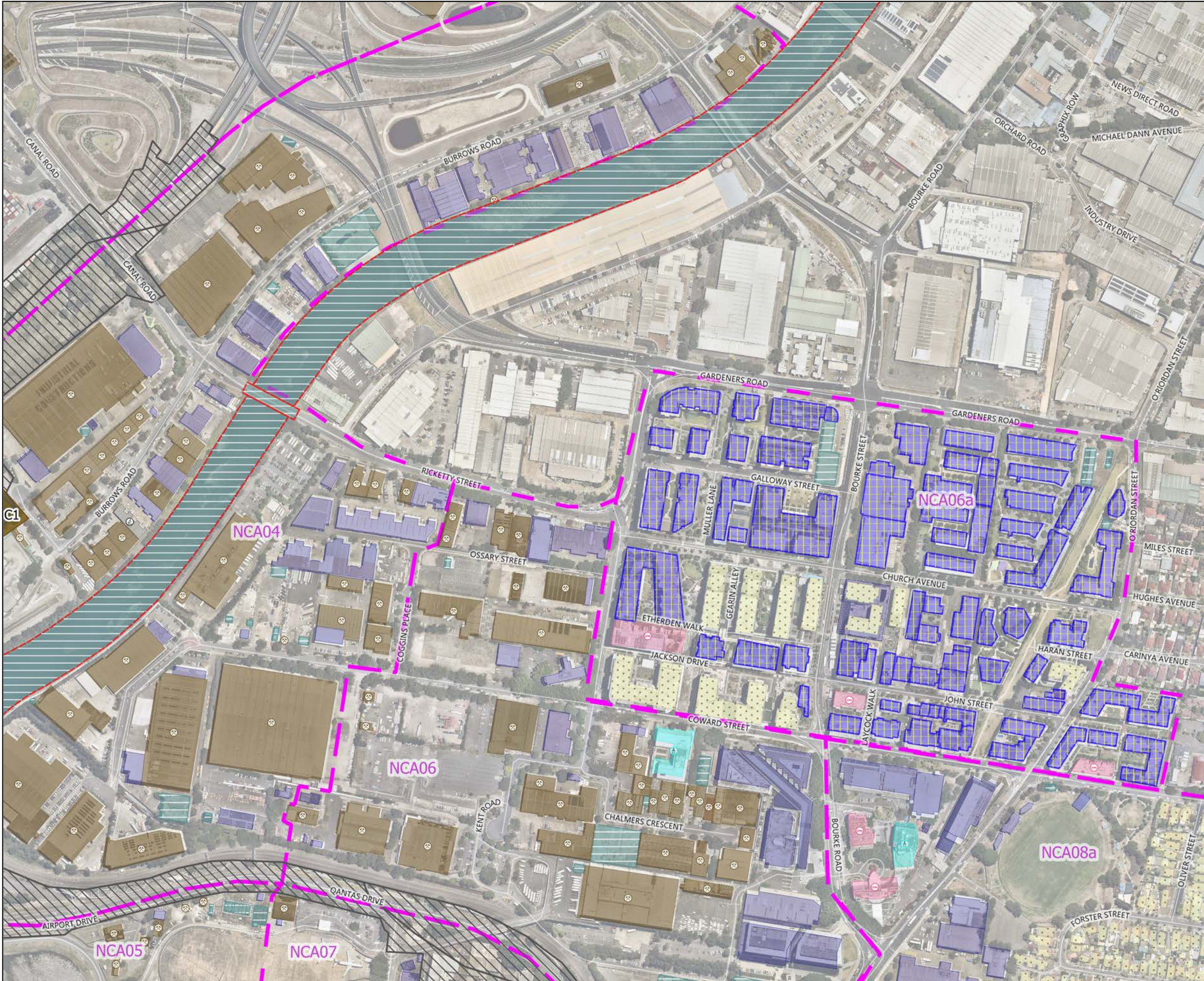
 Project boundary

NCA01a	75	70	67	58
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Sheet 6 of 8

500 m
400
300
200
100
0

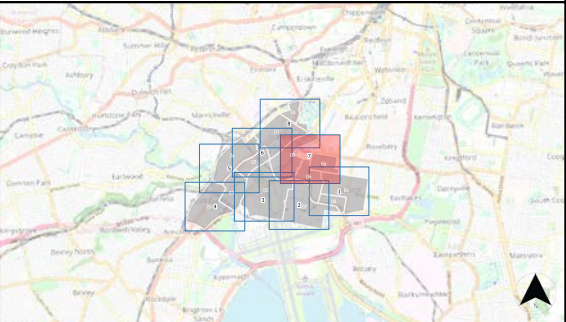


LEGEND

- Noise sensitive receivers
- Residential
 - Mixed use
 - Commercial
 - Industrial
 - Hotel/Motel/Hostel
 - Medical facility
 - Place of Worship
 - Community centre
 - Recording studio
 - Library
 - Flight simulator
 - Childcare
 - Educational
 - Theatre/Auditorium
 - Cinema
 - Laboratory
 - Recreational - Passive
 - Recreational - Active
 - Other
 - Heritage

- NCA
- Compounds
- Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
NCA08	64	59	56	50
NCA03	52	47	45	43
NCA00	64	59	50	45
NCA01	75	70	67	58
NCA07	70	65	61	55
NCA06	70	65	61	55
NCA02	74	69	65	53
NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58



REV	BY	DATE	DESCRIPTION	APPROVER
r2	MS	24/03/21	Updated figures	MT
r1	MS	02/02/21	Updated figures	MT
r0	MS	13/01/21	Prepare figures	MT

0 50 100 150 200 m
1:5000

FULL SIZE A3
NOTE: Do not scale from this drawing.

CLIENT



ACOUSTIC CONSULTANT

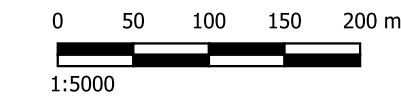


SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary



r2	MS	24/03/21	Updated figures	MT	
r1	MS	02/02/21	Updated figures	MT	
r0	MS	13/01/21	Prepare figures	MT	
REV	BY	DATE	DESCRIPTION	APPROVER	
A3	Original		Co-ordinate System: MGA Zone 56		



FULL SIZE A3

NOTE: Do not scale from this drawing

CLIENT






















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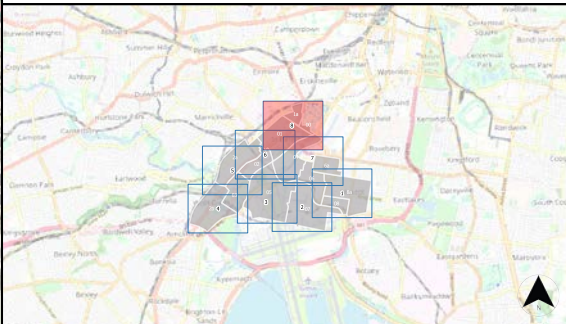
LEGEND

Noise sensitive receivers

- | | | | |
|---|--------------------|---|------------------------|
|  | Residential |  | Childcare |
|  | Mixed use |  | Educational |
|  | Commercial |  | Theatre/Auditorium |
|  | Industrial |  | Cinema |
|  | Hotel/Motel/Hostel |  | Laboratory |
|  | Medical facility |  | Recreational - Passive |
|  | Place of Worship |  | Recreational - Active |
|  | Community centre |  | Other |
|  | Recording studio |  | Heritage |
|  | Library | | |

-  NCA
 Compounds
 Project boundary

NCA	NMLDS	NMLDO	NMLE	NMLN
NCA08	64	59	56	50
NCA03	52	47	45	43
NCA00	64	59	50	45
NCA01	75	70	67	58
NCA07	70	65	61	55
NCA06	70	65	61	55
NCA02	74	69	65	53
NCA05	73	68	65	57
NCA04	68	63	59	54
NCA08a	64	59	56	50
NCA06a	70	65	61	55
NCA02a	74	69	65	53
NCA02b	74	69	65	53
NCA01a	75	70	67	58

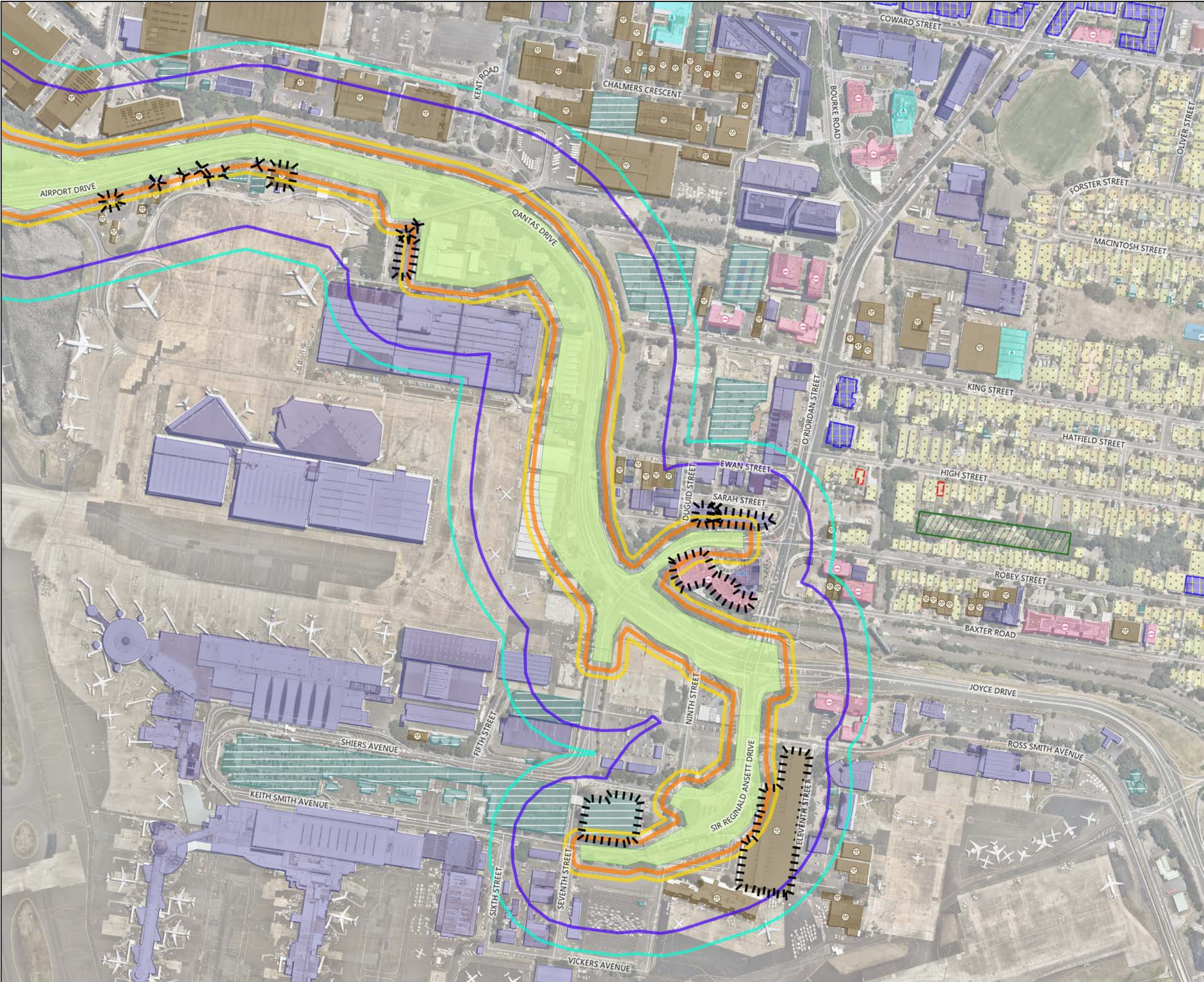


SYDNEY GATEWAY

Land Use, NCAs, Compounds, Project boundary

Appendix C

Vibration screening drawings



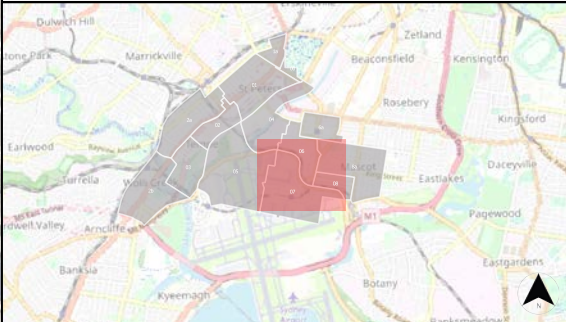
LEGEND

- Noise sensitive receivers
- Residential
 - Mixed use
 - Commercial
 - Industrial
 - Hotel/Motel/Hostel
 - Medical facility
 - Place of Worship
 - Community centre
 - Recording studio
 - Library
 - Flight simulator
 - Childcare
 - Educational
 - Theatre/Auditorium
 - Cinema
 - Laboratory
 - Recreational - Passive
 - Recreational - Active
 - Other
 - Heritage

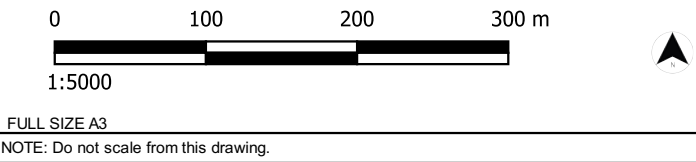
MWD for cosmetic damage and human annoyance for Vibratory Roller (25T Padfoot)

- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (night)
- Human annoyance - Critical

- Receivers within MWD for cosmetic damage
- Project work area



..
..
..
..
..
r1	MS	24/03/21	Update figures	TG	..
r0	MS	17/02/21	Prepare figures	AMO	..
REV	BY	DATE	DESCRIPTION	APPROVER	
A3	Original		Co-ordinate System: MGA Zone 56		



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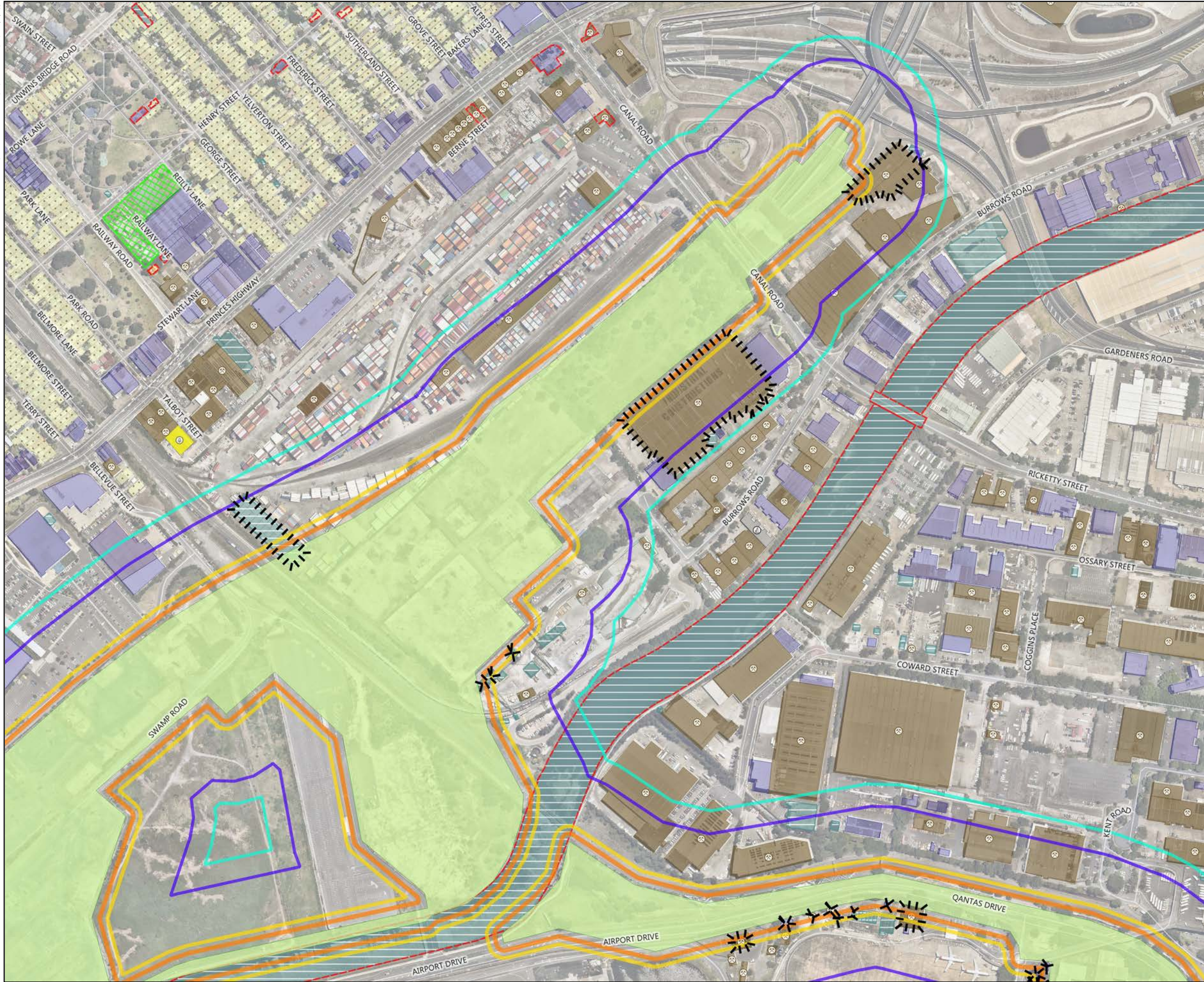
CNVMP - Vibration Screening Drawing

MWD for cosmetic damage and human annoyance

Project wide

Sheet 1 of 3

450 m
400
350
300
250
200
150
100
50
0



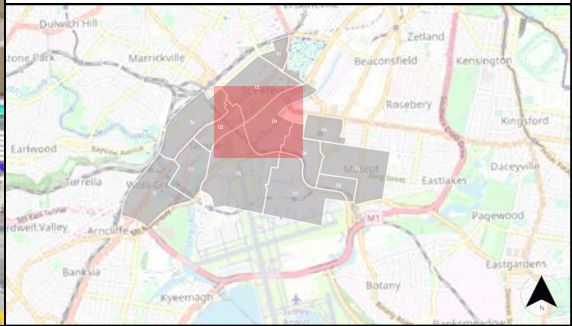
LEGEND

- Noise sensitive receivers
- Residential
 - Mixed use
 - Commercial
 - Industrial
 - Hotel/Motel/Hostel
 - Medical facility
 - Place of Worship
 - Community centre
 - Recording studio
 - Library
 - Flight simulator
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 - Recreational - Passive
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- Human annoyance - Residential (night)
- Human annoyance - Critical

- Receivers within MWD for cosmetic damage
- Project work area



..
..
..
..
r1	MS	24/03/21	Update figures	TG	..
r0	MS	17/02/21	Prepare figures	AMO	..
REV	BY	DATE	DESCRIPTION	APPROVER	
A3	Original		Co-ordinate System: MGA Zone 56		

0 100 200 300 m

1:5000

FULL SIZE A3

NOTE: Do not scale from this drawing.

CLIENT

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SYDNEY GATEWAY

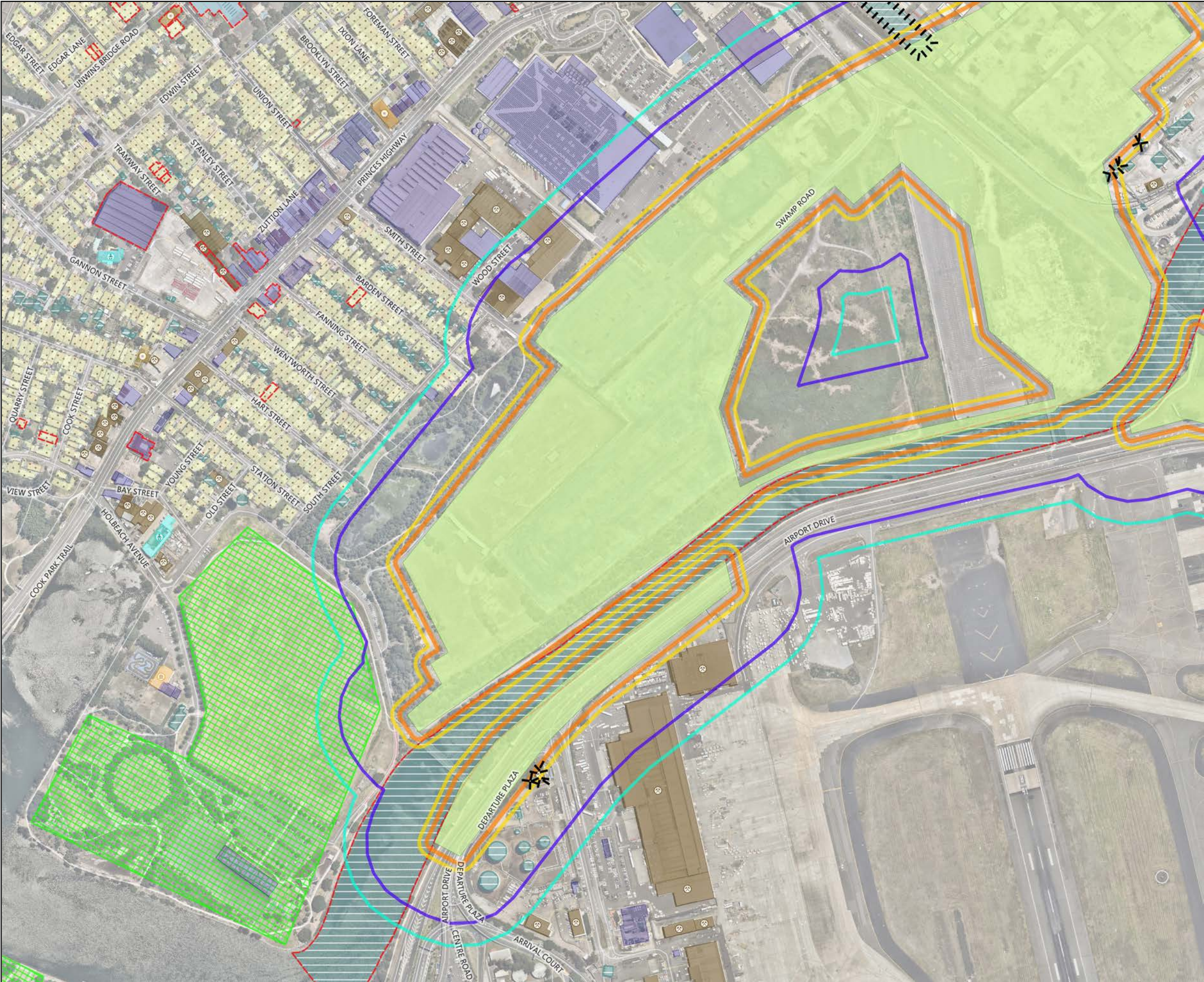
CNVMP - Vibration Screening Drawing

MWD for cosmetic damage and human annoyance

Project wide

Sheet 2 of 3

450 m
400
350
300
250
200
150
100
50
0



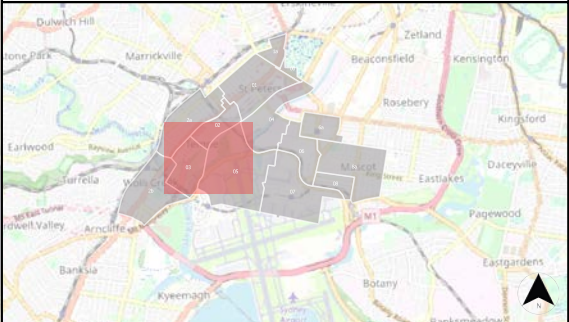
LEGEND

- Noise sensitive receivers
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 - Industrial
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..
..
..
..
..
r1	MS	24/03/21	Update figures	TG	..
r0	MS	17/02/21	Prepare figures	AMO	..
REV	BY	DATE	DESCRIPTION	APPROVER	
A3 Original			Co-ordinate System: MGA Zone 56		



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SYDNEY GATEWAY

CNVMP - Vibration Screening Drawing

MWD for cosmetic damage and human annoyance

Project wide

Sheet 3 of 3