

LIGHT HORSE BUSINESS HUB

Construction Noise and Vibration Management Plan

Prepared for:

Charter Hall
Level 20, 1 Martin Place
Sydney NSW 2000

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SLR 

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Charter Hall (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30501-R01-v1.0	8 October 2021	Steven Luzuriaga Joshua Ridgway	Aaron Miller	Aaron Miller

CONTENTS

1	INTRODUCTION	5
2	DEVELOPMENT OVERVIEW	5
3	STATUTORY REQUIREMENTS.....	7
3.1	Development Consent.....	7
3.2	Relevant Standards and Guidelines	10
4	EXISTING NOISE ENVIRONMENT	11
5	CONSTRUCTION NOISE AND VIBRATION CRITERIA	12
5.1	Noise Guidelines	12
5.1.1	Interim Construction Noise Guideline.....	12
5.1.2	NML Summary.....	14
5.2	Construction Road Traffic Noise Guidelines	14
5.3	Construction Ground-borne Noise Guidelines	15
5.4	Vibration Guidelines.....	16
5.4.1	Human Comfort Vibration.....	16
5.4.2	Effects on Building Contents.....	16
5.4.3	Structural and Cosmetic Damage Vibration.....	17
5.4.3.1	Heritage Items.....	17
5.4.4	Minimum Working Distances for Vibration Intensive Works.....	18
6	CONSTRUCTION WORKS.....	19
6.1	Construction Activities	19
6.2	Hours of Construction	20
6.3	Construction Noise Predictions	20
6.3.1	Summary of Findings	21
6.4	Construction Vibration	22
7	MITIGATION AND MANAGEMENT MEASURES	23
8	MONITORING	25
9	COMPLAINTS MANAGEMENT	27
10	CONTINGENCY PLAN.....	27
11	INTERNAL AUDITS.....	27
12	ROLES AND RESPONSIBILITIES	28
12.1	Contractor’s Project Manager	28
12.2	Environmental Coordinator.....	28
12.3	All Workers on Site.....	28

CONTENTS

13	REVIEW AND IMPROVEMENT OF NOISE MANAGEMENT PLAN	29
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DOCUMENT REFERENCES

TABLES

Table 1	Development Consent Conditions.....	7
Table 2	Construction Noise and Vibration Standards and Guidelines	10
Table 3	Ambient Noise Monitoring Locations	11
Table 4	Summary of Ambient and Background Noise Levels.....	11
Table 5	ICNG NMLs for Residential Receivers	12
Table 6	Construction Noise Management Levels at ‘Other Sensitive’ Land Uses	13
Table 7	Project Specific Noise Management Levels (dBA)	14
Table 8	RNP Criteria for Assessing Construction Vehicles on Public Roads	15
Table 9	Vibration Dose Values for Intermittent Vibration	16
Table 10	DIN 4150 Guideline Values for Short-term Vibration on Structures	17
Table 11	Recommended Minimum Working Distances from Vibration Intensive Equipment.....	18
Table 12	Sound Power Levels for Construction Equipment.....	19
Table 13	Predicted Worst-Case Construction Airborne Noise Levels.....	21
Table 14	Environmental Management Controls for Construction Noise and Vibration.....	23

FIGURES

Figure 1	Development Location and Sensitive Receivers Areas.....	6
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APPENDICES

Appendix A	Acoustic Terminology
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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Charter Hall to prepare a Construction Noise and Vibration Management Plan (CNVMP) for construction works associated with the development of the Light Horse Business Hub (LHBH) located adjacent to the Light Horse Interchange in Eastern Creek, NSW.

The CNVMP addresses the potential noise and vibration impacts associated with the construction of the development and details the mitigation and management procedures for dealing with potential impacts. Construction noise and vibration impacts were previously assessed for Western Sydney Parklands Trust (WSPT) as part of the *Light Horse Interchange Business Hub SSDA Noise Impact Assessment* prepared by SLR in March 2019 (the NIA).

This CNVMP was prepared by a suitably qualified and experienced acoustics consultant and member of the Australian Acoustical Society (MAAS). SLR is a member firm of the Association of Australasian Acoustical Consultants (AAAC). Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in **Appendix A**.

2 Development Overview

The development site is located to the southeast of the Light Horse Interchange, adjacent to the M4 and M7 Motorways. The development will consist of twelve warehouses situated across seven lots, along with associated offices, hardstands, parking and landscaping.

The development site is surrounded primarily by other commercial/industrial estates, along with the Sydney Motorsport Park to the east. A small number of isolated residential receivers are located to the north of the development site adjacent to Pikes Lane on Western Sydney Parkland Trusts land, and a suburban residential area is located to the northwest.

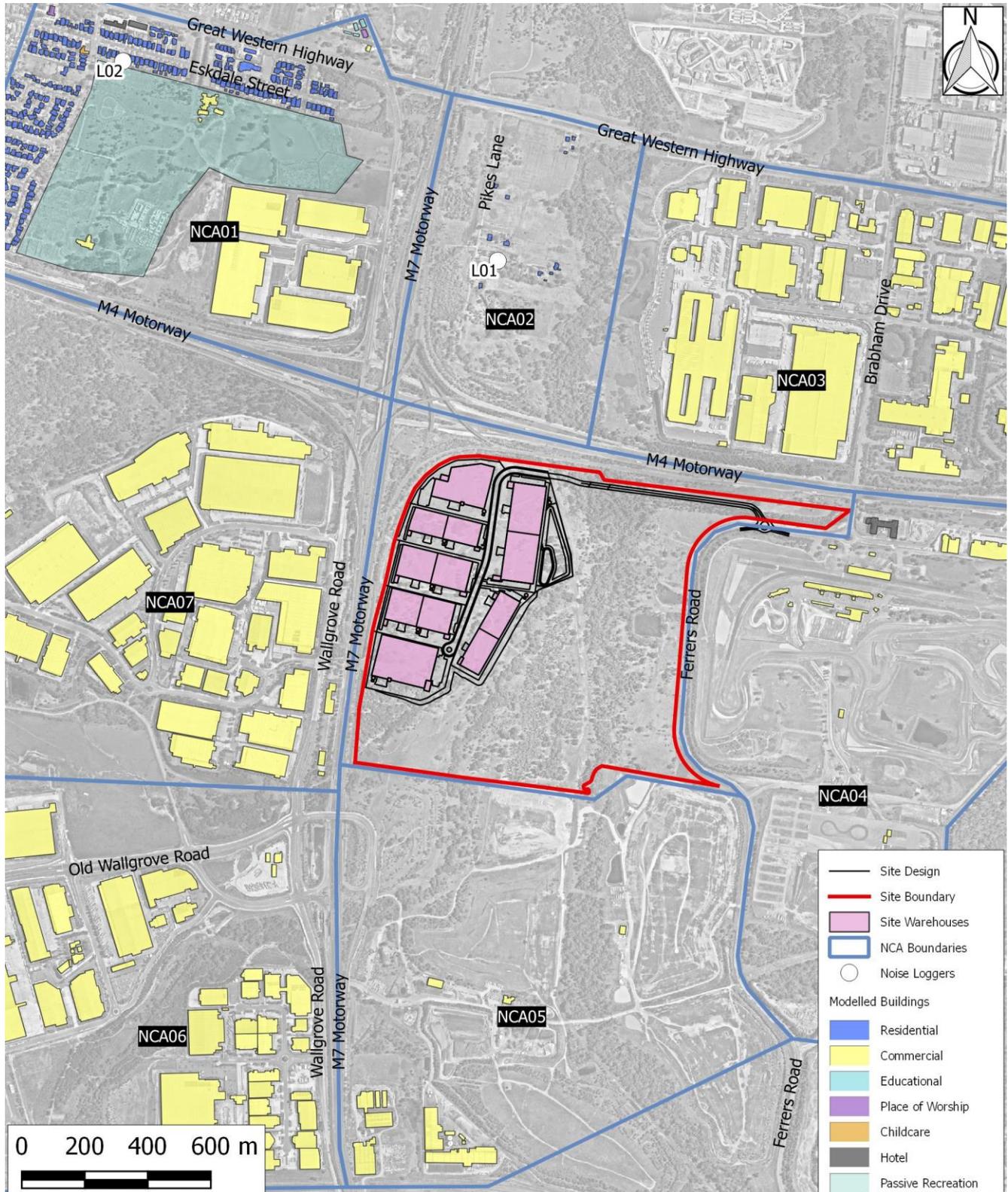
The project would allow for the future use of the site as a business hub with industrial, warehousing and distribution centre land uses. The project includes:

- establishment of up to 165,500 m² of gross floor area for general industrial, light industrial, warehouse and distribution centres and ancillary office land uses; and
- conceptual development levels, footprints and building envelopes for Lots 1-7, roads, parking, site access and landscape design.

The Concept Proposal for LHBH obtained Development Consent (SSD 9667), on 31 August 2020 from the Department of Planning, Industry and Environment (DPIE). The locations of the development, surrounding receivers and noise catchment areas (NCA) are shown in **Figure 1**.

In accordance with condition B21, construction of any relevant stage of works must not commence until this CNVMP is approved by the Planning Secretary.

Figure 1 Development Location and Sensitive Receivers Areas



3 Statutory Requirements

This CNVMP has been prepared to accompany the Construction Environmental Management Plan (CEMP) for the development of the LHBH. The conditions of consent, standards and guidelines relevant to this CNVMP are outlined in the following sections.

3.1 Development Consent

Conditions for the LHBH are specified in the DPIE Development Consent SSD 9667, dated 31 August 2020. The conditions relevant to this CNVMP are in Schedule 3 of SSD 9667, and are reproduced in **Table 1**.

Table 1 Development Consent Conditions

Development Consent	Comments								
Noise									
<p>Hours of Work</p> <p>B17. The Applicant must comply with the hours detailed in Table 3, unless otherwise agreed in writing by the Planning Secretary.</p> <p>Table 3 Hours of Work</p> <table border="1"> <thead> <tr> <th>Activity</th> <th>Day</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Earthworks and Construction</td> <td>Monday – Friday</td> <td>7 am to 6 pm</td> </tr> <tr> <td>Saturday</td> <td>8 am to 1 pm</td> </tr> </tbody> </table>	Activity	Day	Time	Earthworks and Construction	Monday – Friday	7 am to 6 pm	Saturday	8 am to 1 pm	Refer to Section 6.2
Activity	Day	Time							
Earthworks and Construction	Monday – Friday	7 am to 6 pm							
	Saturday	8 am to 1 pm							
<p>B18. Works outside of the hours identified in condition B17 may be undertaken in the following circumstances:</p> <ul style="list-style-type: none"> a) works that are inaudible at the nearest sensitive receivers; b) works agreed to in writing by the Planning Secretary; c) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or d) where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm. 	Refer to Section 6.2								
<p>Construction Noise Limits</p> <p>B19. The development must be constructed to achieve the construction noise management levels detailed in <i>the Interim Construction Noise Guideline</i> (DECC, 2009) (as may be updated or replaced from time to time). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures in the Appendix 2.</p>	Refer to Section 5.1								

Development Consent	Comments
Construction Noise and Vibration Management Plan	
<p>B20. The Applicant must prepare a Construction Noise and Vibration Management Plan for the Stage 1 development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with condition C2 and must:</p> <ul style="list-style-type: none"> a) be prepared by a suitably qualified and experienced noise expert; b) be approved by the Planning Secretary prior to the commencement of construction of each stage of the Stage 1 development; c) describe procedures for achieving the noise management levels in EPA's <i>Interim Construction Noise Guideline</i> (DECC, 2009) (as may be updated or replaced from time to time); d) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers; e) include strategies that have been developed with the community for managing high noise generating works; f) describe the community consultation undertaken to develop the strategies in condition B20(e); and g) include a complaints management system that would be implemented for the duration of the development. 	<p>This CNVMP</p> <p>Refer to Section 1 Refer to Section 2</p> <p>Refer to Section 7</p> <p>Refer to Section 7</p> <p>Refer to Section 7</p> <p>Refer to Section 7 and Appendix B</p> <p>Refer to Section 9</p>
<p>B21. The Applicant must:</p> <ul style="list-style-type: none"> a) not commence construction of any relevant stage until the Construction Noise and Vibration Management Plan required by condition B20 is approved by the Planning Secretary; and b) implement the most recent version of the Construction Noise and Vibration Management Plan approved by the Planning Secretary for the duration of construction. 	<p>Refer to Section 2</p> <p>Refer to Section 13</p>
<p>B22. Vibration caused by construction at any residence or structure outside the site must be limited to:</p> <ul style="list-style-type: none"> a) for structural damage, the latest version of <i>DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures</i> (German Institute for Standardisation, 1999); and b) for human exposure, the acceptable vibration values set out in the <i>Environmental Noise Management Assessing Vibration: a technical guideline</i> (DEC, 2006) (as may be updated or replaced from time to time). 	<p>Refer to Section 5.4</p>
<p>B23. The limits in conditions B22 apply unless otherwise outlined in a Construction Noise and Vibration Management Plan, approved as part of the CEMP required by condition C2 of this consent.</p>	<p>Refer to Section 5.4</p>

Development Consent	Comments
Environmental Management	
<p>Management Plan Requirements</p> <p>C1. Management plans required under this consent must be prepared in accordance with relevant guidelines, and include:</p> <ul style="list-style-type: none"> a) detailed baseline data; b) details of: <ul style="list-style-type: none"> (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions); (ii) any relevant limits or performance measures and criteria; and (iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; c) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria; d) a program to monitor and report on the: <ul style="list-style-type: none"> (i) impacts and environmental performance of the development; and (ii) effectiveness of the management measures set out pursuant to paragraph (c) above; e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible; f) a program to investigate and implement ways to improve the environmental performance of the development over time; g) a protocol for managing and reporting any: <ul style="list-style-type: none"> (i) incident and any non-compliance (specifically including any exceedance of the impact assessment criteria and performance criteria); (ii) complaint; (iii) failure to comply with statutory requirements; and h) a protocol for periodic review of the plan. <p><i>Note: the Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans</i></p>	<p>This CNVMP</p> <p>Refer to Section 4</p> <p>Refer to Section 3</p> <p>Refer to Section 5</p> <p>Refer to Section 7</p> <p>Refer to Section 8</p> <p>Refer to Section 10</p> <p>Refer to Section 13</p> <p>Refer to Section 9 and Section 10</p> <p>Refer to Section 13</p>
Appendices	
<p>Appendix 2 - Noise Impacts</p> <p>1. Management measures, source control, path controls and receptor control measures will be incorporated into the Construction Management Plan (CMP) to minimise noise emissions and avoid unacceptable impacts.</p>	<p>Refer to Section 7</p>
<p>Appendix 4 – Noise Receiver Locations</p>	<p>Refer to Figure 1</p>

3.2 Relevant Standards and Guidelines

The standards and guidelines relevant to the development are listed in **Table 2**. The guidelines aim to protect the community and environment from excessive noise and vibration impacts that may result from construction of the development.

Table 2 Construction Noise and Vibration Standards and Guidelines

Guideline/Policy Name	Where Used
Environment Protection Authority (EPA) (2009) <i>Interim Construction Noise Guideline</i> (ICNG)	Assessment of noise impacts on sensitive receivers.
Roads and Maritime Services (2016) <i>Construction Noise and Vibration Guideline</i> (CNVG)	Assessment and management protocols for noise and vibration impacts.
Environment Protection Authority (EPA) (2006) <i>Assessing Vibration: a technical guideline</i>	Assessment of vibration impacts on sensitive receivers.
British Standard Institution (BSI) (1993) <i>BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2</i> (BS 7385)	Assessment of vibration impacts (structural damage) to sensitive structures.
German Institute for Standardisation (Deutsches Institut für Normung) (2016) <i>DIN 4150 – Structural vibration - Effects of vibration on structures</i> (DIN 4150)	Assessment of vibration impacts (structural damage) to sensitive structures.

4 Existing Noise Environment

Unattended noise monitoring was completed at the nearest residential receivers on Pikes Lane, Eastern Creek (NCA02) and Eskdale Street, Minchinbury (NCA01) in December 2018 to measure the existing ambient noise environment of the area. This baseline noise monitoring was undertaken by SLR as part of the NIA.

The measured data was processed with reference to the NSW *Noise Policy for Industry* (NPfI) and the data was filtered to remove extraneous noise events and periods affected by adverse weather conditions, based on Bureau of Meteorology automated weather station data (Horsley Park AWS 67119). A summary of the background noise monitoring locations and results are provided in **Table 3** and **Table 4**, and presented in **Figure 1**.

Further information regarding the baseline noise assessment, including methodology and detailed data is provided in the NIA.

Table 3 Ambient Noise Monitoring Locations

Noise Monitoring Location ID	Location Address	Representative Receiver Area	Monitoring Dates	Location Details
L01	51 Pikes Lane, Eastern Creek	NCA02	6 December 2018 to 17 December 2018	Noise logger deployed in open area adjacent to residence entrance driveway.
L02	60 Eskdale Street, Minchinbury	NCA01	6 December 2018 to 14 December 2018	Noise logger deployed in rear yard (southern side) of residence.

Table 4 Summary of Ambient and Background Noise Levels

Location ID	Address	Measured Noise Level (dBA) ¹					
		Daytime		Evening		Night-time	
		RBL	LAeq	RBL	LAeq	RBL	LAeq
L01	51 Pikes Lane, Eastern Creek	47	52	47	51	41	52
L02	60 Eskdale Street, Minchinbury	41	50	43	50	38	46

Note 1: The Rating Background Levels (RBLs) and Ambient (LAeq) noise levels have been obtained from the measured data using the calculation procedures outlined in the NPfI.

Note 2: NPfI time periods – Day: 7:00 am to 6:00 pm Monday to Saturday, 8:00 am to 6:00 pm Sundays and public holidays; Evening: 6:00 pm to 10:00 pm; Night: the remaining periods.

5 Construction Noise and Vibration Criteria

5.1 Noise Guidelines

5.1.1 Interim Construction Noise Guideline

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The ‘worst-case’ noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the project.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 5**.

Table 5 ICNG NMLs for Residential Receivers

Time of Day	NML LAeq(15minute)	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	RBL ¹ + 10 dB	<ul style="list-style-type: none"> The noise affected level represents the point above which there may be some community reaction to noise Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level 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.
	Highly Noise Affected 75 dBA	<ul style="list-style-type: none"> The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: <ul style="list-style-type: none"> Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences) If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of Day	NML LAeq(15minute)	How to Apply
Outside Standard Construction Hours	RBL + 5 dB	<ul style="list-style-type: none"> • A strong justification would typically be required for works outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where all feasible and reasonable practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy (INP)*. The INP has been superseded by the NSW EPA *Noise Policy for Industry (NPfi)*.

‘Other Sensitive’ Land Uses and Commercial Receivers

The ICNG NMLs for ‘other sensitive’ non-residential land uses are shown in **Table 6**. The ICNG references AS 2107 for criteria for other sensitive receivers which are not listed in the guideline.

Table 6 Construction Noise Management Levels at ‘Other Sensitive’ Land Uses

Land Use	Noise Management Level LAeq(15minute) (Applied when the property is in use)
Classrooms at schools and other education institutions	External noise level 55 dBA ¹
Hospital wards and operating theatres	External noise level 55 dBA ¹
Places of Worship	External noise level 55 dBA ¹
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion)	External noise level 60 dBA
Community centres	Refer to the recommended ‘maximum’ internal levels in AS 2107 for specific uses
Commercial	External noise level 70 dBA
Industrial	External noise level 75 dBA

Note 1: External noise level derived from 45 dBA internal NML. A conservative estimate of the difference between internal and external noise levels of 10 dBA was adopted.

Sleep Disturbance

In accordance with Condition B17, works will be undertaken during standard daytime construction hours. Where works are required during the night-time period and are approved under Condition B18, the following sleep disturbance criteria would apply.

A method for assessing sleep disturbance is contained in the NPfi. Although the NPfi sleep disturbance criteria relates to industrial noise, it is also considered relevant for reviewing potential impacts from construction noise as a screening criteria to identify the need for further assessment. The NPfi notes that a detailed maximum noise level assessment should be undertaken where a project results in night-time noise levels which exceed 52 dBA LA_{Fmax} or the prevailing background level plus 15 dB, whichever is the greater.

For the LHBH development, the existing night-time RBL plus 15 dB has been adopted as the sleep disturbance screening level.

5.1.2 NML Summary

A summary of the NMLs adopted for the project are presented below in **Table 7**. Further information regarding the NMLs is provided in the NIA.

Table 7 Project Specific Noise Management Levels (dBA)

Receiver Type	NCA ²	NML (LAeq(15minute) – dBA)				Sleep Disturbance Screening Level (RBL+15 dB) (L _{Amax} dBA)
		Standard Construction Hours (RBL+10dB)	Out of Hours ⁵ (RBL+5dB)			
		Daytime	Daytime ³	Evening	Night-time	Night-time
Residential	NCA01	51	46	46 ¹	43	53
Residential	NCA02	57	52	52	46	56
Educational	NCA01	55	55 (when in use)			-
Place of Worship	NCA01	55	55 (when in use)			-
Passive Recreation	NCA01	60	60 (when in use)			-
Child Care (play areas)	NCA01	65 (internal 55 ⁴)	65 (when in use)			-
Child Care (sleep areas)	NCA01	50 (internal 40 ⁴)	50 (when in use)			-
Hotel (sleep areas)	NCA01/04	50 (internal 40 ⁴)	50 (when in use)			-
Commercial	Various	70	70 (when in use)			-
Industrial	Various	75	75 (when in use)			-

Note 1: Where the evening RBL is higher than the daytime RBL, the daytime RBL has been adopted.

Note 2: No residential receivers are located in NCA03 to NCA07.

Note 3: Daytime out of hours is 7 am to 8 am and 1 pm to 6 pm on Saturday, and 8 am to 6 pm on Sunday and public holidays.

Note 4: Internal Noise level. It should be conservatively assumed that these receivers have operable windows, therefore a conservative estimate of the difference between internal and external noise levels of 10 dBA should be adopted.

Note 5: In accordance with Condition B17, works will be undertaken during standard daytime construction hours. Where out of hours works are required and are approved under Condition B18, the out of hours NMLs would apply.

5.2 Construction Road Traffic Noise Guidelines

The potential impacts from construction traffic on public roads are assessed under the NSW EPA *Road Noise Policy* (RNP) and *Roads and Maritime Construction Noise and Vibration Guideline* (CNVG).

To assess noise impacts that may result from construction traffic, an initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2 dB with the addition of construction traffic at nearby residential and other sensitive receivers. Where road traffic noise levels are increased by more than 2 dBA, further assessment is required using the RNP base criteria shown in **Table 8**.

Table 8 RNP Criteria for Assessing Construction Vehicles on Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am - 10 pm)	Night-time (10 pm - 7 am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq(15hour) 60 (external)	LAeq(9hour) 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq(1hour) 55 (external)	LAeq(1hour) 50 (external)

Based on the NIA, the proposed construction traffic is predicted to result in a minimal increase (ie <1 dBA) in the overall traffic noise levels along the construction vehicle routes to the development. As such, construction traffic noise have not been addressed further in this plan.

5.3 Construction Ground-borne Noise Guidelines

Construction works can cause ground-borne noise impacts in nearby buildings when vibration generating equipment is in use. Vibration can be transmitted through the ground and into the structure of nearby buildings, which can then create audible noise impacts inside buildings. The ICNG provides evening and night-time ground-borne noise NMLs for residences to protect the amenity and sleep of residents. The ICNG ground-borne noise NMLs are:

- Evening LAeq(15minute) 40 dBA
- Night-time LAeq(15minute) 35 dBA

The NMLs only apply where internal ground-borne noise levels are higher than noise transmitted through the air. This situation can occur where buildings near to construction works have high performing facades which attenuate the airborne component or where sensitive internal areas do not have facades which face the construction works.

The majority of receivers are sufficiently distant from the works for ground-borne noise impacts to be minimal. Due to the surface nature of the construction works for the development, airborne noise levels would typically be dominant over the ground-borne component where receivers are located near to construction works. As such, ground-borne noise has not been addressed further in this plan.

5.4 Vibration Guidelines

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

5.4.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDV's for human comfort impacts are shown in **Table 9**.

Table 9 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value ¹ (m/s ^{1.75})	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day 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	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

5.4.2 Effects on Building Contents

People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes, are located in buildings near to construction works. No such items of equipment have been identified in the project area.

5.4.3 Structural and Cosmetic Damage Vibration

If vibration from construction works is sufficiently high it can cause damage to structural elements of affected buildings. The levels of vibration required to cause cosmetic damage tend to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration.

Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. Structural damage vibration limits are contained in British Standard BS 7385 and German Standard DIN 4150. In accordance with condition B22 the German Standard DIN 4150 have been adopted for the LHBH development.

DIN 4150

German Standard DIN 4150 provides guideline vibration limits for different buildings and buried pipework. Damage is not expected to occur where the values are complied with and the values are generally recognised to be conservative. The DIN 4150 values for buildings and structures are shown in **Table 10**.

Table 10 DIN 4150 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 (e.g. 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.

The site is adjacent to the M4 and M7 motorways. DIN 4150 states that for civil engineering structures such as reinforced concrete constructions used as abutments or block foundations, a value of 80 mm/s shall be used as a guideline value, provided no hazards arise as a result of soil mechanical processes in the ground.

5.4.3.1 Heritage Items

Heritage buildings and structures should be considered on a case-by-case basis but as noted in BS 7385 should not be assumed to be more sensitive to vibration, unless structurally unsound. Where a heritage building is deemed to be sensitive, the more stringent DIN 4150 Group 3 guideline values in **Table 10** can be applied.

Some Aboriginal and Non-Aboriginal heritage items have been identified in the heritage reports for the site. Where these items are not being removed or demolished as part of the project, vibration monitoring must be undertaken on structures within the minimum working distances of vibration intensive equipment.

5.4.4 Minimum Working Distances for Vibration Intensive Works

Minimum working distances for typical vibration intensive construction equipment are provided in the Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG) and are shown in **Table 11**. The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort (from the NSW EPA Vibration Guideline). They are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

Table 11 Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Distance	
		Cosmetic Damage	Human Response
		Heritage Items (DIN 4150, Group 3) ²	(NSW EPA Guideline)
Vibratory Roller	<50 kN (1–2 tonne)	11 m	15 m to 20 m
	<100 kN (2–4 tonne)	13 m	20 m
	<200 kN (4–6 tonne)	15 m	40 m
	<300 kN (7–13 tonne)	31 m	100 m
	>300 kN (13–18 tonne)	40 m	100 m
	>300 kN (>18 tonne)	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	15 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	44 m	73 m
Vibratory Pile Driver	Sheet piles	5 m to 40 m	20 m
Piling Rig – Bored	≤ 800 mm	5 m	4 m
Jackhammer	Hand held	3 m	2 m

Note 1: Criteria reference from Roads and Maritime CNVG.

Note 2: Criteria reference from DIN 4150.

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to cosmetic damage of typical buildings under typical geotechnical conditions.

For works with large vibratory rollers or hydraulic hammers adjacent to the M4 and M7 Motorway structures a minimum working distance of 25 m shall be applied to meet the vibration criteria detailed in DIN 4150.

6 Construction Works

6.1 Construction Activities

The NIA assessed noise impacts from general construction activities required for the development. The activities and equipment are listed in **Table 12**. Sound power levels for the typical operation of construction equipment used in the modelling have been taken from verified test data and global standards that form part of SLR's noise database.

Table 12 Sound Power Levels for Construction Equipment

ID	Construction Activity	Equipment	Operating minutes in 15-min period ²	No of items in same location	Sound Power Level LWA (dB)	
					Item	Activity
W.001	Site Clearing and Earthworks	Dozer	15	1	100	116
		Dump Truck (approx. 15 tonne)	15	2	100	
		Excavator (25 tonne)	15	1	102	
		Front End Loader	15	1	112	
		Grader	15	1	108	
		Roller – Vibratory (12 tonne) ¹	15	1	105	
W.002	Construction of Roadways	Bitumen Spray Truck	15	1	100	111
		Line Marking Plant	15	1	98	
		Paving Machine	15	1	104	
		Roller – Vibratory (12 tonne) ¹	15	1	109	
W.003	Paving Works including Concrete Pours	Concrete Mixer Truck	7.5	1	106	112
		Concrete Pump	7.5	1	106	
		Concrete Vibrator	15	1	102	
		Paving Machine	15	1	104	
		Roller – Vibratory (12 tonne) ¹	15	1	109	
W.004	Construction of Warehouse and Office Buildings	Elevated Working Platform	15	2	97	107
		Flatbed Truck	15	1	100	
		Hand Tools (Electric)	15	4	96	
		Mobile Crane (100 tonne)	15	1	101	
W.005	Landscaping and Finishing Works	Hydromulching Equipment	15	1	97	102
		Skidsteer Loaders (approx. 0.5 tonne)	15	1	97	
		Light Vehicle (Ute/4WD)	15	1	98	

Note 1: In accordance with the ICNG, for activities identified as particularly annoying (such as jackhammering, rock breaking and power saw operations), a 5 dB 'penalty' is added to the source sound power level when predicting noise using the quantitative method.

Note 2: This refers to the amount of time in minutes that individual items of equipment would be in use for during the worst-case 15 minute assessment period, based on site observations. Some items of plant, such as Concrete Pumps, are not typically used in a continuous manner.

6.2 Hours of Construction

In accordance with Condition B17, the construction activities associated with the project will only be undertaken during the following hours:

- 7:00 am to 6:00 pm, Mondays to Fridays
- 8:00 am to 1:00 pm on Saturdays;
- at no time on Sundays or Public Holidays.

In accordance with Condition B18, works outside of the hours identified in condition B17 may be undertaken in the following circumstances:

- works that are inaudible at the nearest sensitive receivers;
- works agreed to in writing by the Planning Secretary;
- for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or
- where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm.

6.3 Construction Noise Predictions

A summary of the NIA predicted noise levels (without additional mitigation) for each of the closest residential receivers for the various work activities is presented in **Table 13**.

A qualitative description of the NML exceedance bands is given below, noting that the impact of these potential exceedances would depend on the period in which they were to occur:

- Noise levels 1 to 10 dB above NML – impact would typically be marginal to minor
- Noise levels 11 dB to 20 dB above NML – impact would typically be moderate
- Noise levels >20 dB above NML – impact would typically be high

For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted at the most-exposed receiver, as the noise levels presented in this report are based on each scenario occurring at the site boundary.

Table 13 Predicted Worst-Case Construction Airborne Noise Levels

NCA	Receiver Type	Period	NML	Predicted Noise Level - LAeq(15 minutes) (dBA)				
				W.001	W.002	W.003	W.004	W.005
NCA01	Residential	Daytime – Standard Hours	51	46	41	42	37	32
		Daytime – OOH	46	46	41	42	37	32
		Evening	46	46	41	42	37	32
		Night-time	43	46	41	42	37	32
	Childcare	When in use	50	39	34	35	30	<30
	Educational	When in use	55	43	38	39	34	<30
	Place of Worship	When in use	55	43	38	39	34	<30
	Hotel	When in use	50	42	37	38	33	<30
	Passive Recreation	When in use	60	45	40	41	36	31
Commercial	When in use	70	51	46	47	42	37	
NCA02	Residential	Daytime – Standard Hours	57	55	50	51	46	41
		Daytime – OOH	52	55	50	51	46	41
		Evening	52	55	50	51	46	41
		Night-time	46	55	50	51	46	41
NCA03	Commercial	When in use	70	61	56	57	52	47
NCA04	Hotel	When in use	50	58	53	54	49	44
	Commercial	When in use	70	57	52	53	48	43
NCA05	Commercial	When in use	70	44	39	40	35	30
NCA06	Commercial	When in use	70	47	42	43	38	33
NCA07	Commercial	When in use	70	56	51	52	47	42

Note 1: Green cell colour indicates noise levels 1 to 10 dB above NML; Yellow cell colour indicates noise levels 11 to 20 dB above NML; Red cell colour indicates noise levels >20 dB above NML.

6.3.1 Summary of Findings

The predicted noise levels in **Table 13** and the outcomes of the NIA identify the following:

- Construction airborne noise levels up to 58 dBA are predicted at the nearest sensitive receivers.
- No exceedances of the NMLs during daytime standard hours are predicted at any of the surrounding residential receivers during any of the works. No residential receivers are predicted to be Highly Noise Affected (>75 dBA).
- Minor exceedances of the Out of Hours NMLs of up to 9 dBA are predicted at the nearest residential receivers during W.001 (site clearing and earthworks), W.002 (construction of roadways), and W.003 (paving works including concrete pours). However, it is understood that generally these works would not be conducted outside of standard construction hours. Sleep disturbance impacts are therefore not anticipated.

- Minor exceedances of the NMLs of up to 8 dBA at the hotel in NCA04 are predicted during W.001 (site clearing and earthworks), W.002 (construction of roadways), and W.003 (paving works including concrete pours).
- No exceedances of the NMLs are predicted at other sensitive receivers during any period during any of the works.

Implementation of feasible and reasonable construction noise mitigation measures will be undertaken where exceedances of the NMLs are predicted. Construction noise and vibration mitigation measures are discussed in **Section 7**.

6.4 Construction Vibration

Vibration intensive items of plant proposed for use during the construction of the development would include vibratory rollers. These items of equipment are proposed to be used during site clearing and earthworks (W.001), construction of roadways (W.002), and paving works including concrete pours (W.003).

The nearest existing vibration sensitive receivers to the development construction works are commercial receivers located over 100 m to the west of the development. As such, there are no vibration sensitive receivers located within the minimum working distances outlined in **Table 11**. The separation distance between the works location and the nearest vibration sensitive receivers is considered sufficient to mitigate potential vibration generated from the site and specific vibration mitigation measures are not required.

Where large vibratory rollers or hydraulic hammers are proposed to be used within 25 m of M4 or M7 Motorway structures vibration monitoring should be undertaken to verify that vibration levels do not exceed the criteria detailed in **Section 5.4.3**. Alternatively, smaller vibratory rollers or hydraulic hammers can be used without vibration monitoring where works are more than 10 m from these structures.

As noted in **Section 5.4.3.1**, some Aboriginal and Non-Aboriginal heritage items have been identified in the heritage reports for the site. Where these items are not being removed or demolished as part of the project, vibration monitoring must be undertaken on structures within the minimum working distances of vibration intensive equipment.

7 Mitigation and Management Measures

The ICNG acknowledges that due to the nature of construction works it is inevitable that there will be impacts where construction is near to sensitive receivers. The impacts during construction of the project are predicted to be relatively minor. Notwithstanding, all feasible and reasonable mitigation measures will be implemented by the project to minimise the potential impacts as far as practicable. The measures relevant to the project are detailed in **Table 14**.

As detailed in **Section 6.3**, no exceedances of the NMLs during daytime standard hours are predicted at any of the surrounding residential receivers during any of the works and no receivers are predicted to be Highly Noise Affected (>75 dBA). As such, it is considered that there are no high noise generating works near sensitive receivers and consent conditions B20 e) and f) do not require specific measures to be implemented. Regardless, community notification has been undertaken in accordance with the Community Consultation and Complaints Handling section within the CEMP. A copy of the Consultation Summary Report is provided in **Appendix B**.

Table 14 Environmental Management Controls for Construction Noise and Vibration

Measure	Person Responsible	Timing / Frequency	Reference / Notes
Project Planning			
Use quieter and less vibration emitting construction methods where feasible and reasonable.	Project Manager	Ongoing	Best practice
Works will be completed during standard daytime construction hours outlined in Section 6.2 .			
Truck routes to site should be limited to major roads.			
Scheduling			
Respite offers should be considered where high noise and vibration generating activities are near receivers. As a guide, work should be carried out in blocks that do not exceed three hours, with a minimum respite period of one hour between each block.	Project Manager/ Communications and Community Liaison Representative	Ongoing	Best practice
Consult with the affected community to determine the need for respite periods.			
Site Layout			
Compounds and worksites will be designed to promote one-way traffic and minimise the need for vehicle reversing.	Project Manager	Ongoing	Best practice
Where practicable, work compounds, parking areas, and equipment and material stockpiles will be positioned away from noise-sensitive locations and take advantage of existing screening from local topography.			
Equipment that is noisy will be started away from sensitive receivers			

Measure	Person Responsible	Timing / Frequency	Reference / Notes
Training			
Training will be provided to all personnel on noise and vibration requirements for the project. Inductions and toolbox talks to be used to inform personnel of the location and sensitivity of surrounding receivers.	Project Manager	Ongoing	Best practice
Plant and Equipment Source Mitigation			
Where practicable, tonal reversing alarms (beepers) will be replaced with non-tonal alarms (squawkers) on all equipment in use (subject to occupational health and safety requirements).	Project Manager	Ongoing	Best practice
Noisy equipment will be sited behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.			
Noise generating equipment will be regularly checked and effectively maintained, including checking of hatches/enclosures regularly to ensure that seals are in good condition and doors close properly against seals.			
Dropping materials from a height will be avoided.			
Loading and unloading will be carried out away from noise sensitive areas, where practicable.			
Trucks will not queue outside residential properties. Truck drivers will avoid compression braking as far as practicable.			
Truck movements will be kept to a minimum, i.e. trucks are fully loaded on each trip.			
Screening			
Where possible, install purpose-built screening or enclosures around long-term fixed plant that has the potential to impact nearby receivers	Project Manager	Ongoing	Best practice
Site layout should take advantage of existing screening from local topography, where possible. Position site huts, maintenance sheds and/or shipping containers between noisy equipment and the affected receivers.			
Community Consultation			
Notifications will be provided to the affected community where high impacts are anticipated or where out of hours works are required, in accordance with the CEMP. Notification will be a minimum of 24 hours.	Communications and Community Liaison Representative	Ongoing	Best practice
Where complaints are received, work practices will be reviewed and feasible and reasonable practices implemented to minimise any further impacts. Refer to Section 9 .			

Measure	Person Responsible	Timing / Frequency	Reference / Notes
Monitoring			
Noise and/or vibration monitoring will be conducted (as appropriate) in response to any complaints received to verify that levels are not substantially above the predicted levels.	Environmental Coordinator	Ongoing	Best practice
Refer to Section 8 for full details of monitoring requirements.			
Vibration			
If vibration generating works are required within the minimum cosmetic damage working distances and considered likely to exceed the criteria: <ul style="list-style-type: none"> Different construction methods with lower source vibration levels will be investigated and implemented, where feasible Attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels at the item. Works will cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria. 	Environmental Coordinator	Ongoing	Best practice
Where works are required within the cosmetic damage minimum working distances, building condition surveys will be completed before and after the works to ensure no cosmetic damage has occurred.			

8 Monitoring

Construction noise and vibration impacts were previously assessed for the project as part of the NIA. Project specific NMLs have been established, as outlined in **Section 5**.

The NMLs are not mandatory limits, however, in the event construction noise levels are predicted to be above the NMLs, feasible and reasonable work practices are to be investigated to minimise noise emissions. Noise and/or vibration monitoring may be required in response to any formal complaints received to verify that levels are not substantially above the predicted levels.

Should monitoring be required in the case of receipt of a complaint regarding noise or vibration, monitoring will be conducted by suitably qualified specialists. The location and extent of attended monitoring will be determined in consultation with project staff and would be dependent on the activities taking place.

Noise monitoring will take place during the expected noisiest construction periods and be representative / indicative of any impact across all potentially affected sensitive receivers.

Vibration monitoring will be undertaken with geophones installed by an acoustic consultant at the closest points of the sensitive structure to the vibration intensive works to continuously monitor vibration for the duration of the works. Should the works location change, the geophones will be relocated to remain at the closest point of the structure to the works.

All items of acoustic and vibration instrumentation utilised will be designed to comply with applicable guidelines and carry current calibration certificates.

A monitoring report will be prepared after each monitoring survey which will be to the site manager and Charter Hall for review. Monitoring reports will be provided to the relevant regulatory authorities after review, unless otherwise agreed by the relevant regulatory authorities. Monitoring reports should include the following details, at a minimum:

- Noise/vibration monitoring/measurement locations
- Date, time and length of noise monitoring/measurements
- Weather conditions during the measurements
- Name and position of personnel undertaking measurements
- Construction activities being undertaken during measurements
- Locations of construction equipment and distance from monitoring location
- Measured L_{Aeq} and L_{Amax} noise levels during construction works (for each activity) along with a comparison to the predicted noise levels (noise monitoring only)
- Measured L_{A90} background noise level in absence of the construction works (noise monitoring only)
- Measured vibration levels during construction works (for each activity) along with a comparison to the relevant vibration criteria (vibration monitoring only)
- Measured vibration levels and relevant details of any of exceedance of the warning vibration level or vibration limits (vibration monitoring only)
- Measured background vibration level in absence of the construction works (vibration monitoring only)
- Operator observations noting any extraneous noise/vibration sources or other points of relevance.

9 Complaints Management

Complaints will be able to be made via a dedicated contact telephone number which will be included on the site signage. Responses will be provided to the complainant within 24 hours.

Information recorded in the complaints register with respect to each complaint will include:

- Date and time of complaint
- Name, address and telephone number of complainant
- Nature of complaint
- Response actions taken to date.

A report of complaints will be provided to the relevant regulatory authorities every three months throughout the construction of the project, or as otherwise agreed by the relevant regulatory authorities.

Preliminary investigations into the complaint will commence within 48 hours of the complaint receipt and adequate measures to identify and manage will be considered and implemented. Where required, noise monitoring will be undertaken as per **Section 8**.

10 Contingency Plan

In the event that a non-compliance with the noise conditions is identified, the Contractor will implement the following Contingency Plan:

- The Contractor will report any non-compliance to the relevant regulatory authorities within five working days.
- The Contractor will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists and the relevant regulatory authorities, as necessary.
- The Contractor will notify affected landholders and tenants at the location of the exceedance within five working days and provide them with details of actions taken, including noise or vibration monitoring results (if applicable), until it can be shown that the site is complying with the noise and vibration criteria.
- The Contractor will, on request, submit the proposed course of action to the relevant regulatory authorities for approval.
- The Contractor will implement the approved course of action.

11 Internal Audits

Periodic internal audits will be conducted to ensure that the development consent conditions and commitments and environmental management controls outlined in this CNVMP are being properly implemented. Audit reports will be used to inform of any corrective actions.

12 Roles and Responsibilities

Overall roles and responsibilities relating to the project are outlined in the overarching CEMP. The key responsibilities specifically for noise and vibration management are as follows:

12.1 Contractor's Project Manager

- Ensuring appropriate resources are available for the implementation of this CNVMP;
- Assessing data from inspections and providing project-wide advice to ensure consistent approach and outcomes are achieved;
- Providing necessary training for project personnel to cover noise and vibration management;
- Reviewing and update of this CNVMP;
- Commissioning a suitably qualified consultant to install and maintain noise and vibration monitors and ensuring that the environmental coordinator undertakes any attended noise and vibration measurements required by this CNVMP;
- Assessing and (as required) mitigating risks of elevated noise and vibration levels before commencing works each day and ensuring that the appropriate controls are implemented and effective;
- Reviewing weather forecasts and current observations of meteorological conditions (as recorded at Horsley Park AWS);
- Ceasing works in the event of excessive noise and vibration generation due to noise enhancing weather conditions or inadequately controlled construction activities (e.g. strong winds blowing from the noise source to nearby receivers, temperature inversions, etc.); and
- In the event that a noise or vibration complaint is received, implementing the procedure outlined in **Section 9**.

12.2 Environmental Coordinator

- Coordinating noise and/or vibration monitoring program (as required);
- Review that control measures are working in accordance with the CNVMP; and
- Identifying and reporting noise and vibration emissions incidents.

12.3 All Workers on Site

- Observing any noise and vibration emission control instructions and procedures that apply to their work;
- Taking action to prevent or minimise noise and vibration emission incidents; and
- Identifying and reporting noise and vibration emission incidents.

13 Review and Improvement of Noise Management Plan

This CNVMP will be reviewed, and if necessary, updated in the following circumstances:

- Significant changes to the equipment, machinery and plant operated within the site.
- Where it is identified via monitoring that the performance of the project is not meeting the objectives of the CNVMP
- At the request of the relevant regulatory authority or other relevant government agency.

All employees and contractors will be informed of any revisions to the CNVMP by Site Management during toolbox talks. The most recent version of the CNVMP as approved by the Planning Secretary, will be implemented for the duration of construction works.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms ‘sound’ and ‘noise’ are almost interchangeable, except that ‘noise’ often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. ‘A’ Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an ‘A-weighting’ filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	Loud
80	Kerbside of busy street	
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as ‘linear’, and the units are expressed as dB(lin) or dB.

3. Sound Power Level

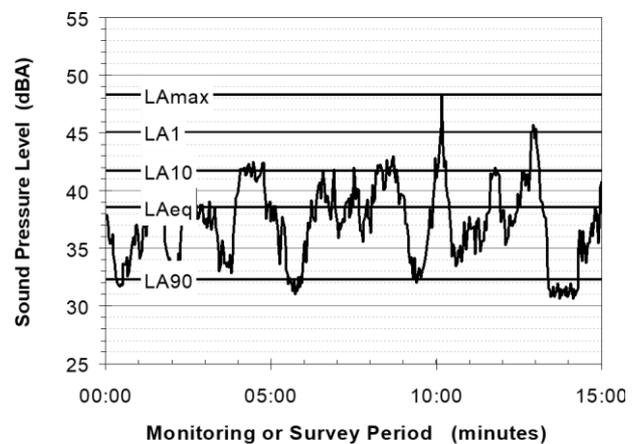
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

- LA1 The noise level exceeded for 1% of the 15 minute interval.
- LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.
- LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
- LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

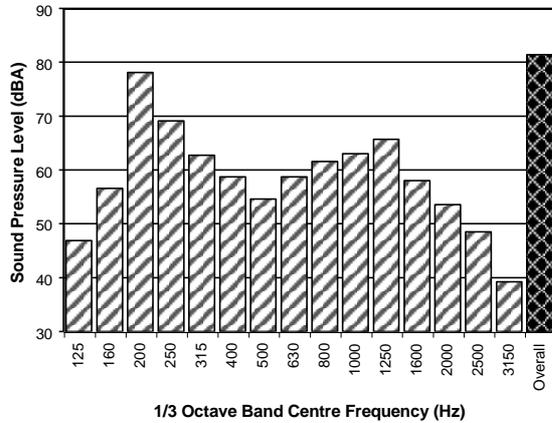
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V , expressed in mm/s can be converted to decibels by the formula $20 \log (V/V_0)$, where V_0 is the reference level (10⁻⁹ m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

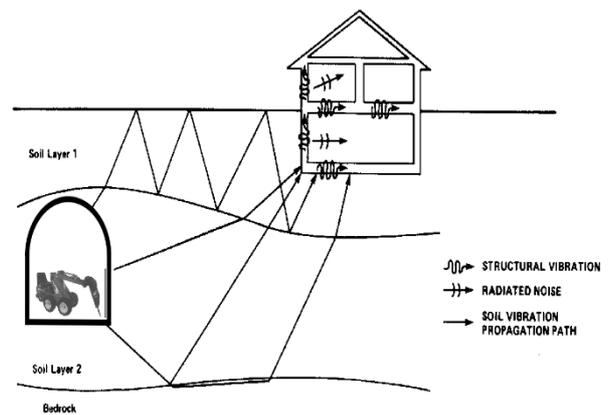
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

APPENDIX B

CNVMP Consultation Summary Report

To satisfy these conditions, SLR Consulting undertook a consultation campaign to notify and consult with potential sensitive receivers surrounding the site.

1 Consultation Campaign – Methodology and Outcomes

Potential receivers were identified within the CNVMP as properties within proximity to the site, including residential receivers to the north and a hotel located to the east. It is noted that the CNVMP concluded that the approved development was unlikely to result in high noise generating works that would impact on surrounding receivers, however consultation was still undertaken, taking a precautionary approach and undertaken in accordance with the Community Consultation Strategy (CCS) which forms part of the Construction Environmental Management Plan (CEMP) for the Project.

For the purposes of consultation, all properties in proximity to the site were identified as Stakeholders and were notified of the development and invited to engage via formal letter, delivered via Australia Post. Identified properties are included in **Attachment 1**. The engagement letter sought to introduce Charter Hall and SLR Consulting and their role in the approved development and provide general awareness among the local community about the proposal and specific information with respect to the CNVMP. The correspondence included a summary of the approved development, including a site plan and outlined proposed strategies to manage high noise generating works, including:

- The establishment of a construction phonenumber upon commencement of works, for the receipt of comment or complaint relating to the project, with respect to noise or any other impact experienced. Phonenumber details to be distributed by mail to surrounding land occupiers prior to the commencement of works.
- The notification of surrounding land occupiers of upcoming high noise generating works via letterbox drop prior to the event (noting these events are not expected to occur)

Stakeholders were invited to participate in consultation regarding the strategies and provided contact details should they have any queries with respect to the development. A copy of the engagement letter is included at **Attachment 2**.

This method of engagement was chosen as most effective for reaching geographically targeted community stakeholders given the reliability of the postal service. Alternative methods of contact (such as door knocking or community drop in sessions) were not considered given the COVID 19 Pandemic. The engagement options offered within the mail out correspondence were designed to accommodate various preferences, abilities and willingness to engage in the consultation process.

The options included phone or email address provided for written submissions. It is considered that the method of engagement was appropriate in both scale and form, allowing for the sharing of information with the raising of awareness for surrounding Stakeholders to the proposed strategies for managing high noise generating works, whilst acknowledging that these works are not expected to occur in the course of the project's construction. The approach taken provided information and avenues for comment and obtaining further information whilst respecting the privacy of surrounding landholders.

No contact or response was received from Stakeholders following the mail out campaign.

The consultation required under B20 (e) and (f) of SSD 9667 is concluded. Should you have any questions please contact the undersigned.

Kind Regards,

A handwritten signature in black ink, appearing to read "Kneak".Two lines of text that have been completely redacted with black boxes.

Checked/ Authorised by: DT

Attachment 1: List of Mail Out Stakeholders

Attachment 2: Engagement Letter (Copy)

Attachment 1: List of Mailout Stakeholders

Street Address	Suburb	State	Postcode
1 PETER BROCK DRIVE	Eastern Creek	NSW	2766
45 PIKES LANE	Eastern Creek	NSW	2766
47 PIKES LANE	Eastern Creek	NSW	2766
2 WONDERLAND DRIVE	Eastern Creek	NSW	2766
65 HUNTINGWOOD DRIVE	Huntingwood	NSW	2148
51 PIKES LANE	Eastern Creek	NSW	2766
55 PIKES LANE	Eastern Creek	NSW	2766
28 WALLGROVE ROAD	Minchinbury	NSW	2770
1 WONDERLAND DRIVE	Eastern Creek	NSW	2766
41 PIKES LANE	Eastern Creek	NSW	2766
733 GREAT WESTERN HIGHWAY	Eastern Creek	NSW	2766
5 PETER BROCK DRIVE	Eastern Creek	NSW	2766
25 PIKES LANE	Eastern Creek	NSW	2766
39 PIKES LANE	Eastern Creek	NSW	2766
10 INTERCHANGE DRIVE	Eastern Creek	NSW	2766
18 PETER BROCK DRIVE	Eastern Creek	NSW	2766
10 PETER BROCK DRIVE	Eastern Creek	NSW	2766
14 PETER BROCK DRIVE	Eastern Creek	NSW	2766
3 ALSPEC PLACE	Eastern Creek	NSW	2766
5 WONDERLAND DRIVE	Eastern Creek	NSW	2766
7 WILLIAM DEAN STREET	Eastern Creek	NSW	2766
60 WALLGROVE ROAD	Minchinbury	NSW	2770
400 FERRERS ROAD	Eastern Creek	NSW	2766
12A PETER BROCK DRIVE	Eastern Creek	NSW	2766
71-73 HUNTINGWOOD DRIVE	Eastern Creek	NSW	2766
715 GREAT WESTERN HIGHWAY	Eastern Creek	NSW	2766
711 GREAT WESTERN HIGHWAY	Eastern Creek	NSW	2766
100 WALLGROVE ROAD	Eastern Creek	NSW	2766
9 INTERCHANGE DRIVE	Eastern Creek	NSW	2766
13 INTERCHANGE DRIVE	Eastern Creek	NSW	2766

5 October 2021

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Attention: The Occupier

Community and Stakeholder Consultation - Noise and Vibration Light Horse Interchange Business Hub

To whom it may concern,

This letter has been prepared by SLR Consulting on behalf of Charter Hall. Charter Hall are undertaking development approved under SSD-9667 for:

A Concept Proposal for:

- establishment of up to 165,500m² of gross floor area for general industrial, light industrial, warehouse and distribution centres and ancillary office land uses; and
- conceptual development levels, footprints and building envelopes for Lots 1-7, roads, parking, site access and landscape design.

And Stage 1 works for:

- demolition of existing structures;
- remediation of the site;
- site preparation and bulk earthworks;
- construction of road access and internal roads and installation of essential infrastructure services;
- flood and stormwater management infrastructure works; and
- subdivision of the site into 11 Torrens title lots, including seven future development lots and four lots comprising the stormwater detention basin, access road reserve and residual land to remain within Western Sydney Parklands.

At 165 Wallgrove Road & 475 Ferrers Road, Eastern Creek, legally described as Part Lot 10 DP 1061237 and Part Lot 5 DP 804051. A plan identifying the proposed development area is attached.

We are writing to you today to introduce ourselves, outline the likely noise impacts of the proposed development and identify ways you can obtain further information, raise questions or make comments.

As part of the Conditions of Consent for SSD-9667, the developer is required to prepare a Construction Noise and Vibration Management Plan (CNVMP), inclusive of strategies developed to mitigate the impact of high noise generating works on the surrounding area. In developing these strategies, Charter Hall are seeking to engage with the land users and occupiers surrounding the development. SLR Consulting have been engaged to undertake this consultation. Investigations undertaken to inform the CNVMP have revealed that the proposed development is unlikely to result in high noise generating works or impacts to the surrounding area. It is proposed however that the following strategies be adopted to manage unforeseen noise impacts arising from the development:

- The establishment of a construction phonenumber upon commencement of works, for the receipt of comment or complaint relating to the project, with respect to noise or any other impact experienced. Phonenumber details to be distributed by mail to surrounding land occupiers prior to the commencement of works.
- The notification of surrounding land occupiers of upcoming high noise generating works via letterbox drop prior to the event (noting these events are not expected to occur)

If you would like to provide feedback or have queries relating to the above or would like a copy of the CNVMP, please contact the undersigned utilising the following contact details:

Contact: [REDACTED]
Ph: [REDACTED]
Email: [REDACTED]

Yours sincerely



[REDACTED]
[REDACTED]

Checked/
Authorised by: DT



Western Sydney
Parklands Trust

Light Horse Interchange Business Hub
Eastern Creek NSW [SSD 9667]

Locality Plan



DATE Sept, 2021

DRAWING NUMBER 10935_MP001[P2]

NTS@ A3/A1

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