Airtunk SYD3 Datacentre

Construction Noise and Vibration Management Plan

A W Edwards Pty Limited
Level 12, 558 Pacific Highway
St Leonards NSW 2065

Report Reference: 220118 – Airtunk SYD3 Datacentre – Construction Noise and Vibration Management Plan – R4

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1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) have been engaged by A W Edwards to prepare a Construction Noise and Vibration Management Plan for the construction of the Airtunk SYD3 Datacentre at 51 Huntingwood Drive, Huntingwood.

This report:

- identifies the project consent conditions relevant to construction noise and vibration;
- identifies the applicable construction noise and vibration criteria;
- defines the construction methodology, equipment and indicative timing;
- presents the likely noise and vibration impacts from the construction activities; and
- and provides practicable noise and vibration management and mitigation measures suitable to the site.

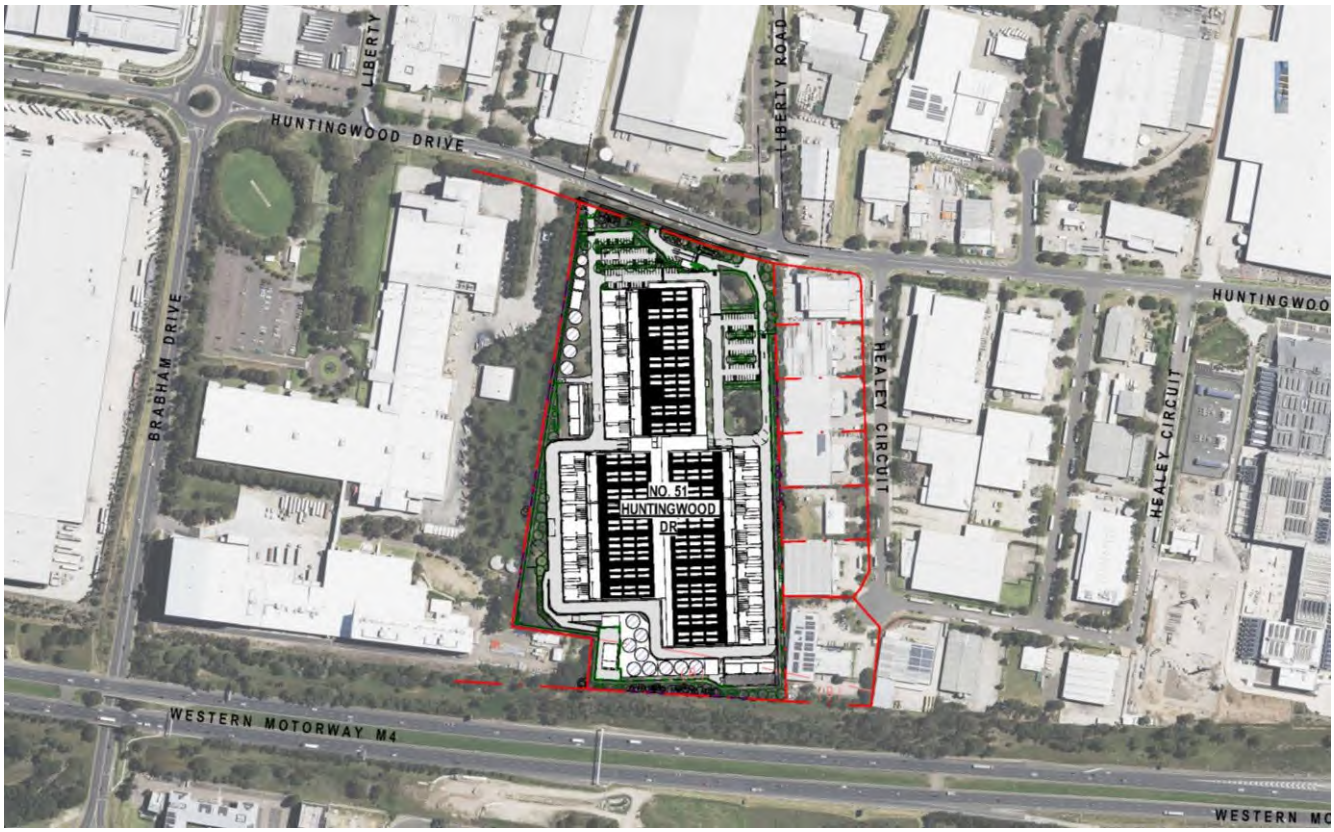
1.1 Site location

The datacentre will be located at 51 Huntingwood Drive, Huntingwood NSW 2148. The site is zoned IN2 (Light Industrial) and is located in the Blacktown City Council area.

Residential receivers are located to the south of the site within the Alpha Hotel Eastern Creek. A childcare centre (Grace Village Early Learning Centre) exists to the north of the project site at 44 Huntingwood Drive. Industrial receivers are located to the east and west of the project site, as well as to the north across Huntingwood Drive and to the south across the Western Motorway.

The subject site and surrounding areas are shown in Figure 1 below.

Figure 1 Site location



1.2 Construction description

The project involves the demolition and clearing of the existing site, piling works, and construction of the datacentre buildings.

Construction of Stage 1 and Stage 2 is expected to take 22 months with some overlap between the stages listed below. Presented below is a summary of the expected construction equipment which would be used during the identified construction stages.

Excavation and Demolition

- Multiple excavators
- Water pumps
- Concrete pumps
- Graders
- Vibratory Rollers
- Trucks and articulated vehicles to move materials and components
- Power hand tools

Piling works

- Piling rigs
- Impact pile testing
- Excavators
- Water pumps
- Concrete pumps
- Concrete agitator
- Trucks and articulated vehicles to move materials and components
- Power hand tools

Construction

- Multiple excavators
- Water pumps
- Concrete pumps, booms and associated concrete trucks
- Use of general hand tools including drills, angle grinders, jackhammers
- Tower cranes
- Mobile cranes

1.3 Staging

The site is separated into three construction stages, 1, 2, and 3. Presented below in Figure 2 is an illustration of the staging of the project. This CNVMP has considered Stage 1 and Stage 2 occurring simultaneously, with Stage 3 occurring once these two stages are completed.

Figure 2 Construction Staging

In the figure above, the three colours represent the three stages with Stage 1 shown green, Stage 2 blue, and Stage 3 purple.

1.4 State Significant Development Application

The development State Significant Development (SSD) application (SSD- 41589232) was approved 15 September 2023.

Presented below in Table 1 is a summary of the construction noise and vibration conditions which apply to these works. The location in the report where the condition has been addressed is also included.

Table 1 SSD-41589232 development consent conditions

<table>
<tr><th>Condition</th><th>Details</th><th>Location addressed</th></tr>
<tr><td colspan="3">Hours of Work</td></tr>
<tr><td>B1</td><td>The Applicant must comply with the hours detailed in Table 1.
Table 1: Hours of work
<table>
<tr><th>Activity</th><th>Day</th><th>Time</th></tr>
<tr><td>Construction</td><td>Monday – Friday
Saturday</td><td>7 am to 6 pm
8 am to 1 pm</td></tr>
<tr><td>Operation (excluding backup generator testing)</td><td>Monday - Sunday</td><td>24 hours</td></tr>
<tr><td>Backup generator testing</td><td>Monday - Friday</td><td>7 am to 6 pm</td></tr>
</table></td><td>Section 4.2</td></tr>
</table>

Condition	Details	Location addressed
B2	Works outside of the hours identified in condition B1 may be undertaken in the following circumstances: a) works that are inaudible at the nearest sensitive receivers; or b) works agreed to in writing by the Planning Secretary; or 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.	Section 4.2
Construction Noise Limits		
B3	The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (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 Appendix 2.	Section 3.1, Section 5
Construction Noise Management Plan		
B4	The Applicant must prepare a Construction Noise Management Plan for the development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with Condition C2 and must: a) be prepared by a suitably qualified and experienced noise expert, b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time), c) describe the measures to be implemented to manage high noise generating works (such as piling); d) describe the community consultation undertaken in relation to construction noise management and outline any strategies development with the community to manage high noise generating works, or to provide respite periods; and e) include a complaints management system that would be implemented for the duration of the development.	This report, Section 5, and Section 6
B5	The Applicant must: a) not commence construction of any relevant stage of the development until the Construction Noise Management Plan required by condition B4 is approved by the Planning Secretary; and b) implement the most recent version of the Construction Noise Management Plan approved by the Planning Secretary for the duration of construction.	

2 EXISTING ENVIRONMENT

2.1 Sensitive receiver locations

Several potentially impacted noise receivers are located in the vicinity of the subject site.

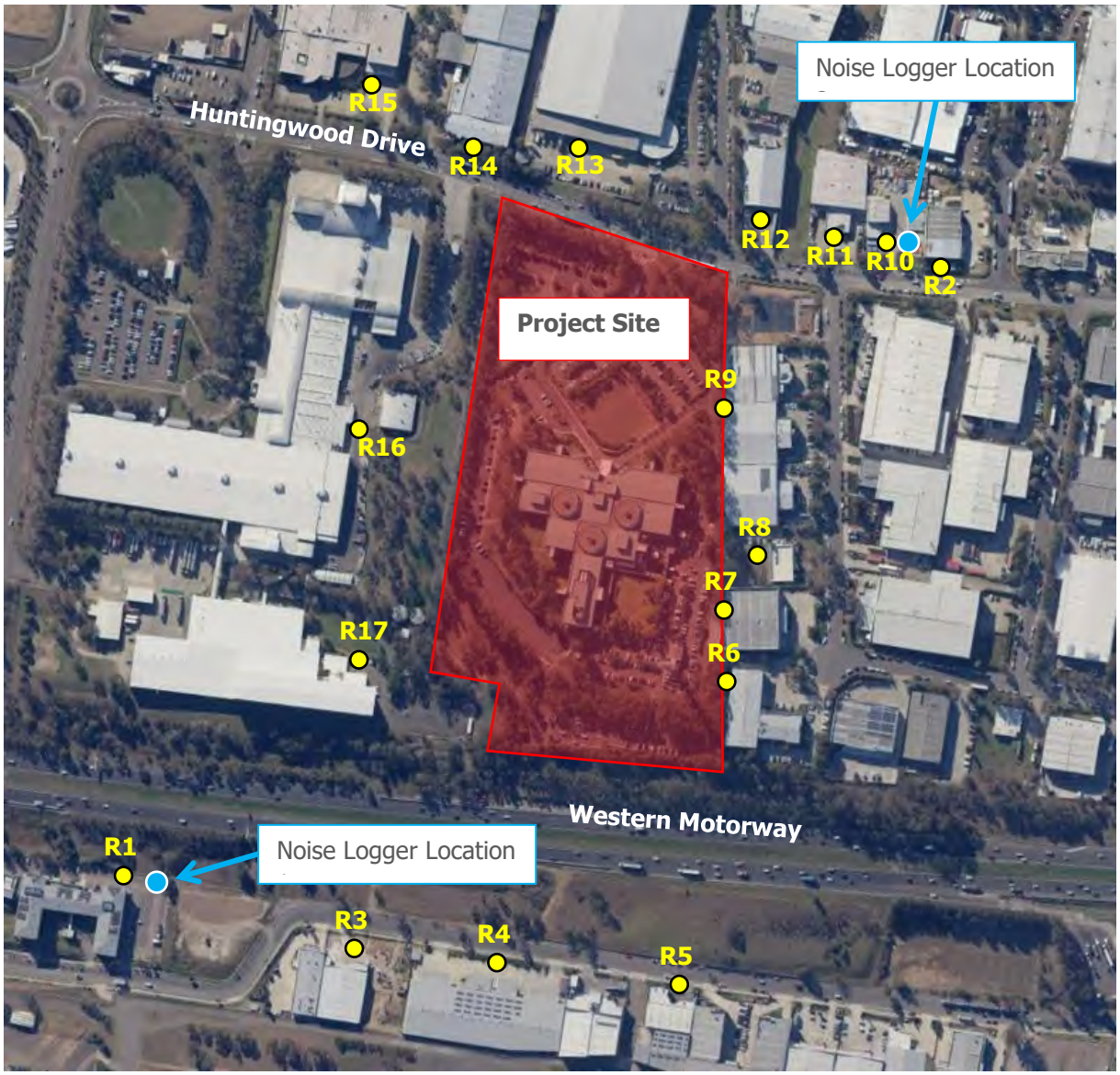
The receptors in this report are considered representative of the closest off-site receivers for the proposed datacentre. The considered receivers are listed in Table 2 and presented in Figure 4 below.

Note that the residential receivers to the north-east of the proposed development adjacent to Holbeche Road are approximately 1.5 km away from the proposed datacentre development site. Based on this distance attenuation as well as the numerous substantial buildings obstructing the line of sight between the residents and the project site, the noise levels at these residential receivers are predicted to be inaudible (i.e., at least 10 dB below the background noise level). Therefore, the Alpha Hotel Eastern Creek is the only residential receiver relevant to our assessment.

Table 2 Sensitive receiver locations

Receptor ID	Address	Type of Receiver
R1	Alpha Hotel Eastern Creek – Brabham Drive and, Peter Brock Drive, Eastern Creek NSW 2766	Residential
R2	Grace Village Early Learning Centre – 44 Huntingwood Drive, Huntingwood NSW 2148	School classroom – internal
R3	10-12 Peter Brock Drive, Eastern Creek NSW 2766	Industrial
R4	18 Peter Brock Drive, Eastern Creek NSW 2766	Industrial
R5	30 Peter Brock Drive, Eastern Creek NSW 2766	Industrial
R6	14 Healy Circuit, Huntingwood NSW 2148	Industrial
R7	12 Healy Circuit, Huntingwood NSW 2148	Industrial
R8	10 Healy Circuit, Huntingwood NSW 2148	Industrial
R9	4-8 Healy Circuit, Huntingwood NSW 2148	Industrial
R10	46 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R11	48 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R12	50 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R13	52 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R14	58 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R15	60 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R16	61 Huntingwood Drive, Huntingwood NSW 2148	Industrial
R17	26 Brabham Drive, Eastern Creek NSW 2766	Industrial

Figure 3 Sensitive receiver locations



2.2 Noise descriptors and terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure noise in terms of quantifiable time periods with statistical descriptors. Typically, environmental noise is measured over 15 minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' linear arithmetic does not apply, e.g., adding two sound sources of equal values result in an increase of 3 dB (i.e., 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level 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 roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the LAeq, LA1, LA10 and LA90 noise levels. The LAeq noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The LA1, LA10 and LA90 levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included in Appendix A.

2.3 Ambient noise monitoring

To determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at the Alpha Hotel Eastern Creek to the south of the project site, and 44 Huntingwood Drive, Huntingwood to the north of the project site.

The unattended noise logger at the Alpha Hotel Eastern Creek was chosen as it is the closest residential receiver to the subject site. The noise logger was positioned along the northern façade of the building. The location of this unattended noise logger is shown in Figure 4.

The second unattended noise logger was located at 46 Huntingwood Drive, Huntingwood, which is indicative of the existing acoustic environment at the adjacent Grace Village Early Learning Centre. This was chosen as another potentially affected noise-sensitive receiver to the subject site. The location of this unattended noise logger is shown in Figure 4.

Instrumentation used for the noise survey comprised two Rion NL 42 sound level meters / analysers (serial numbers 00998079 and 01000231), both fitted with microphone windshields. Calibration of both loggers was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B and Appendix C. These charts, representing each 24 hour period, show the LA1, LA10, LAeq and LA90 noise levels measured over 15 minute time periods.

Logging was conducted from Thursday 24th March 2022 to Wednesday 6th April 2022. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology weather station at Horsley Park (AWS 067119). Detailed noise logging results are shown in Appendix B and Appendix C.

The measured background noise data of the logger was processed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) Noise Policy for Industry (NPI).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. The RBL LA90 (15minute) and LAeq noise levels are presented in Table 3.

The results of the measurement survey provide ambient noise levels that are considered to be representative of the levels to be expected at the nearest and most affected receivers to the proposed development.

Table 3 Measured ambient noise levels

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Alpha Hotel Eastern Creek – Brabham Drive and, Peter Brock Drive	66	69	61	67	53	65
46 Huntingwood Drive, Huntingwood	51	64	48	61	46	60

3 ASSESSMENT CRITERIA

3.1 Construction noise criteria

The EPA's Interim Construction Noise Guideline (ICNG) provides guidance on appropriate construction noise management levels that should be adhered to on construction projects throughout NSW. This guideline identifies that potential impacts from construction noise is determined based on time of day of the noise, the increase in noise above background noise, the duration of the event, and any adverse characteristics of the noise

The ICNG prevents assessment procedures for the assessment of noise impacts, and management and mitigation measures procedures to address potential impacts on sensitive receivers. The main objectives of the ICNG are:

- Promote a clear understanding of ways to identify and minimise noise from construction works,
- Focus on applying all feasible and reasonable work practices to minimise construction noise impacts,
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours,
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

The ICNG identifies a quantitative assessment approach which is applicable to this project. The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with site specific Noise Management Levels (NMLs). The NML affectation categories for receivers have been reproduced from the guideline and are listed in the table below.

Table 4 Construction noise management levels – residential receivers

Receiver type	Time of day	Noise management level $L_{Aeq(15minute)}$[1,2]	How to apply
Residential	Approved working hours of the project, including: Monday- Friday 7am-5pm and Saturday 8am-5pm	Noise affected RBL + 10 dB	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 practices 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	The highly noise affected 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 restricting the hours that the very noisy activities can occur, taking into account: 1. 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. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Receiver type	Time of day	Noise management level $L_{Aeq(15minute)}$[1,2]	How to apply
	Outside recommended standard hours	Noise affected RBL + 5 dB	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 practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.
Office, retail outlets	When is use	Highly noise affected 70 dBA	The external noise levels should be assessed at the most-affected occupied point of the premises

Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, 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. Noise levels may be higher at upper floors of the noise affected residence.

Note 2 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 RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

The ICNG also provides NMLs for non-residential land uses. Unlike residential receivers, these criteria are fixed levels, independent of local background noise levels. Presented below in Table 5 are NMLs for non-residential land uses.

Table 5 Construction noise management levels – other receivers

Land use	Location applied	Noise management level, $L_{Aeq,15min}$
Classrooms and other educations institutions	Internal noise level	45 dB(A)
Hospital wards and operating theatres	Internal noise level	45 dB(A)
Places of worship	Internal noise level	45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level	65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level	60 dB(A)
Community centres	Refer to the recommended "maximum" internal levels in AS2107 for specific uses	
Industrial premises	External noise level	75 dB(A)
Offices, retail outlets	External noise level	70 dB(A)

3.2 Site specific Construction Noise Management levels (NML)

The measured RBLs are below the Noise Policy for Industry's (NPfI) minimum RBLs (Table 2 of the NPfI). In accordance with the requirements of the NPfI, the ICNG noise management levels have been based on the NPfI RBLs, rather than the lower measured levels.

Presented below in Table 6 is the noise management levels for each noise logger.

Table 6 Site specific external construction Noise Management Levels (NML) dB(A)

Type	Daytime 7am to 6pm	Evening[1] 6pm to 10pm	Night-time[1] 10pm to 7am	Highly noise affected
Residential	75[2]	66	58	75
Childcare (internal)	45	Not applicable	Not applicable	Not applicable
Industrial	75	75	75	Not applicable

Note 1 Out of Hours work during the evening and night-time periods are not proposed for this project.

Note 2 The daytime RBL + 10 dB is 76 dB(A). This has been reduced to 75 dB(A) so that it is no higher than the highly noise affected criterion.

3.3 Construction vibration criteria

Effects of ground borne vibration on buildings may be segregated into two major categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself

Vibration criteria – human comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"*. (AVTG) This type of impact can be defined based on the nature of the construction works:

- Continuous vibration – from uninterrupted sources (refer to Table 7).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 8).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 9).

Table 7 Continuous vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	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	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 8 Impulsive vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	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	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 9 Intermittent vibration impacts criteria ($m/s^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred	Maximum	Preferred	Maximum
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Vibration criteria – building contents and structure

The vibration effects on the building is provided by British Standard BS 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993)

The criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 7 and illustrated in Figure 2.

Table 10 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in standard	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 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

Standard BS 7385 Part 2 – 1993 states that the values in Table 10 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 10 may need to be reduced by up to 50% (refer to Line 3 in Figure 2).

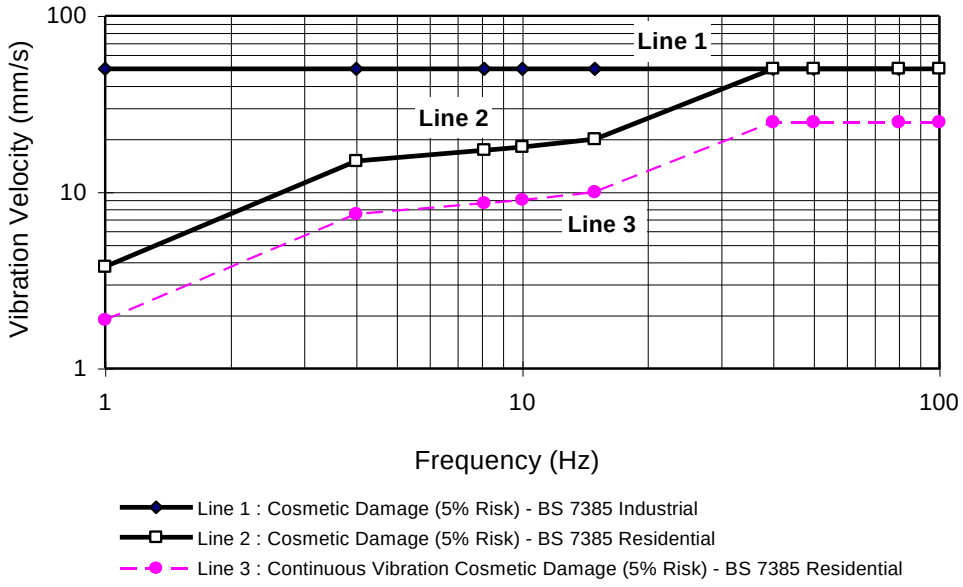


Figure 4 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 10, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 10 should not be reduced for fatigue considerations.

Project vibration criteria

Based on the details included in the sections above the project specific vibration criteria to protect the surrounding residential receivers from structural or architectural damage includes the following:

- Project construction vibration management level at all surrounding building structures – 7.5 mm/s.

In the event that this vibration criteria is exceeded, further investigation is required, including an assessment of the nature of the vibration and frequency characteristics to determine if the vibration criteria can be relaxed for the specific nature of the works.

4 CONSTRUCTION NOISE AND VIBRATION IMPACTS

Noise impacts from construction works associated with the project have been predicted in accordance with the requirements in the EPAs NPfI. Presented below is a summary of the construction activities, equipment and associated sound power levels, and a summary of the predicted noise impacts from the works. An assessment has been completed of the typical worst-case noise impacts. Noise from the project is likely to be often lower than the noise levels presented in this assessment.

4.1 Construction noise scenarios

Sound power levels have been predicted for the construction tasks identified in the project program. The equipment anticipated for use in each task is based on previous project experience. The sound power levels for the equipment likely to be used for each of the listed tasks are provided in Table 11 below.

Table 11 Summary of predicted sound power levels, dB(A)

Tasks	Equipment	Sound power levels (dBA re 1pW)	Aggregate per task (dBA re 1pW)
Excavation and demolition	Excavators	103	119
	Hydraulic Hammer	118	
	Water pumps	90	
	Concrete pumps	97	
	Graders	113	
	Vibratory rollers	109	
	Dump trucks	103	
	Power hand tools	99	
Piling works	Piling rig	116	118
	Excavators	103	
	Water pumps	90	
	Concrete pumps	97	
	Concrete agitators	105	
	Dump trucks	103	
	Power hand tools	99	
Construction	Excavator	109	116
	Water pump	90	
	Concrete pumps and booms	97	
	Concrete trucks	109	
	Hand tools	99	
	Tower cranes	113	
	Mobile cranes	93	

4.2 Assessment methodology

Calculation of the noise impacts have been undertaken in accordance with the ISO9613 noise propagation algorithm at the most affected sensitive receiver locations. Receivers located further from the site would have lower noise levels from the proposed works.

The construction works would be undertaken in accordance with the approved SSDA development consent conditions. The construction hours are restricted to:

- Monday to Friday 7 am to 6 pm
- Saturday 8am to 1pm
- Sunday/Public Holiday No work or ancillary activity

Outside these hours, the following work may be undertaken:

a. works that are inaudible at the nearest sensitive receivers; or
b. works agreed to in writing by the Planning Secretary; or
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.

4.3 Stage 1 and Stage 2 predicted construction noise impacts

An assessment of the expected construction noise impacts has been assessed using the ISO9613 noise propagation algorithm. The assessment has been based on the expected noise levels to be generated on the site including those detailed in the Section above. The scenario considers the cumulative noise impact of Stage 1 and Stage 2 occurring simultaneously. The noise impacts are up to 3 dB greater than the noise impacts from Stage 1 or Stage 2 occurring in isolation.

Calculations of the resulting construction noise levels of the receivers within proximity to the site is detailed in the table below for the potentially most affected sensitive receivers. Construction noise contours are presented in Appendix B to illustrate the noise impacts for all receivers surrounding the site.

Table 12 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A)

Receiver	Criteria	Predicted level	Exceedance	Highly noise affected
Excavation and demolition				
R1	75	59	-	No
R2	55	64	9	Not applicable
R3	75	63	-	Not applicable
R4	75	64	-	Not applicable
R5	75	64	-	Not applicable
R6	75	81	6	Not applicable
R7	75	70	-	Not applicable
R8	75	68	-	Not applicable
R9	75	75	-	Not applicable

Receiver	Criteria	Predicted level	Exceedance	Highly noise affected
R10	75	66	-	Not applicable
R11	75	69	-	Not applicable
R12	75	73	-	Not applicable
R13	75	73	-	Not applicable
R14	75	76	1	Not applicable
R15	75	65	-	Not applicable
R16	75	72	-	Not applicable
R17	75	76	1	Not applicable
Piling works				
R1	75	58	-	No
R2	55	63	8	Not applicable
R3	75	62	-	Not applicable
R4	75	63	-	Not applicable
R5	75	63	-	Not applicable
R6	75	80	5	Not applicable
R7	75	69	-	Not applicable
R8	75	67	-	Not applicable
R9	75	74	-	Not applicable
R10	75	65	-	Not applicable
R11	75	68	-	Not applicable
R12	75	72	-	Not applicable
R13	75	72	-	Not applicable
R14	75	75	-	Not applicable
R15	75	64	-	Not applicable
R16	75	71	-	Not applicable
R17	75	75	-	Not applicable
Construction				
R1	75	56	-	No
R2	55	61	6	Not applicable
R3	75	60	-	Not applicable
R4	75	61	-	Not applicable

Receiver	Criteria	Predicted level	Exceedance	Highly noise affected
R5	75	61	-	Not applicable
R6	75	78	3	Not applicable
R7	75	67	-	Not applicable
R8	75	65	-	Not applicable
R9	75	72	-	Not applicable
R10	75	63	-	Not applicable
R11	75	66	-	Not applicable
R12	75	70	-	Not applicable
R13	75	70	-	Not applicable
R14	75	73	-	Not applicable
R15	75	62	-	Not applicable
R16	75	69	-	Not applicable
R17	75	73	-	Not applicable

The predicted construction noise impacts provided in Table 12 identify that exceedance of the noise management levels are unlikely to occur on a regular basis, however they have the potential to occur during the most noise intensive periods at the nearest sensitive receivers. Impacts of this magnitude are common for this type of project and highlight the need for appropriate noise management and mitigation measures. Provided in Section 5 is a summary of recommended management and mitigation measures which should be followed.

4.4 Stage 3 predicted construction noise impacts

An assessment of the expected construction noise impacts has been assessed using the ISO9613 noise propagation algorithm. The assessment has been based on the expected noise levels to be generated on the site. The impacts of Stage 3 are presented in this section.

Calculations of the resulting construction noise levels of the receivers within proximity to the site is detailed in the table below for the potentially most affected sensitive receivers. Construction noise contours are presented in Appendix B to show the impact for all receivers surrounding the site.

Table 13 Predicted construction noise impacts, $L_{Aeq,15min}$ dB(A)

Receiver	Criteria	Predicted level	Exceedance	Highly noise affected
Excavation and demolition				
R1	75	57	-	No
R2	55	66	11	Not applicable
R3	75	60	-	Not applicable

Receiver	Criteria	Predicted level	Exceedance	Highly noise affected
R4	75	63	-	Not applicable
R5	75	63	-	Not applicable
R6	75	91	16	Not applicable
R7	75	94	19	Not applicable
R8	75	77	2	Not applicable
R9	75	95	20	Not applicable
R10	75	68	-	Not applicable
R11	75	69	-	Not applicable
R12	75	74	-	Not applicable
R13	75	67	-	Not applicable
R14	75	63	-	Not applicable
R15	75	58	-	Not applicable
R16	75	57	-	Not applicable
R17	75	63	-	Not applicable
Piling works				
R1	75	56	-	No
R2	55	65	10	Not applicable
R3	75	59	-	Not applicable
R4	75	62	-	Not applicable
R5	75	62	-	Not applicable
R6	75	90	15	Not applicable
R7	75	93	18	Not applicable
R8	75	76	1	Not applicable
R9	75	94	19	Not applicable
R10	75	67	-	Not applicable
R11	75	68	-	Not applicable
R12	75	73	-	Not applicable
R13	75	66	-	Not applicable
R14	75	62	-	Not applicable
R15	75	57	-	Not applicable
R16	75	56	-	Not applicable

Receiver	Criteria	Predicted level	Exceedance	Highly noise affected
R17	75	62	-	Not applicable
Construction				
R1	75	54	-	No
R2	55	63	8	Not applicable
R3	75	57	-	Not applicable
R4	75	60	-	Not applicable
R5	75	60	-	Not applicable
R6	75	88	13	Not applicable
R7	75	91	16	Not applicable
R8	75	74	-	Not applicable
R9	75	92	17	Not applicable
R10	75	65	-	Not applicable
R11	75	66	-	Not applicable
R12	75	71	-	Not applicable
R13	75	64	-	Not applicable
R14	75	60	-	Not applicable
R15	75	55	-	Not applicable
R16	75	54	-	Not applicable
R17	75	60	-	Not applicable

The predicted construction noise impacts provided in Table 13 identify that exceedance of the noise management levels are unlikely to occur on a regular basis, however they have the potential to occur during the most noise intensive periods at the nearest sensitive receivers. The impacts for the receivers on the eastern side of the site are for the rear of the building which is unlikely to be inhabited. Noise levels are likely to be at least 15 dB lower on the other side of the building.

Impacts of this magnitude are common for this type of project and highlight the need for appropriate noise management and mitigation measures. Provided in Section 5 is a summary of recommended management and mitigation measures which should be followed.

4.5 Construction vibration assessment

To maintain compliance with the human comfort vibration criteria identified in Section 3.2, it is recommended that the indicative safe distances listed in Table 14 should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction equipment to be used on site.

If applicable, the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort. Vibration validating measurements should be conducted at each site to determine the vibration level and potential impact onto this sensitive equipment.

Recommended safe working distances for various items of plant are included in the following table.

Table 14 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

An assessment of the potential for vibration generated as part of the required construction activities on the project (including excavation) has been undertaken based on the expected vibration detailed in the table above.

The cometic damage safe working distances listed in Table 14 are for residential buildings. The receivers directly surrounding the site are industrial, which have much higher allowable vibration safe working distances. While the potential for exceedances of the human comfort criteria is possible, exceedance of the cosmetic damage criteria for industrial buildings is less likely.

5 NOISE AND VIBRATION MANAGEMENT MEASURES

Provided below in Table 15 is a summary of the recommended management procedures for airborne noise and vibration impacts. These procedures are also further discussed in the report. Hence, where applicable, links to further references are provided in Table 15.

Table 15 Summary of mitigation procedures

Procedure	Abbreviation	Description	Further Reference
General Management Measures	GMM	Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.	Refer to Section 5.3.3 For vibration impact, also refer to Section 5.4 and Section 5.5
Project Notification	PN	Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included. Content and length to be determined on a project-by-project basis.	Refer to Section 6
Verification Monitoring	V	Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers. If the measured levels are higher than those predicted, then the measures will need to be reviewed and the management plan will need to be amended.	For noise impact, refer to Section 5.4. For vibration impact, refer to Section 5.4 and Section 5.5
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders	Refer to Section 6.1
Specific Notification	SN	Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives. Alternatively, contractor could visit stakeholders individually in order to brief them with regards to the noise impact and the mitigation measures that will be implemented.	Refer to Section 6

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 5.1

For vibration, the criteria either correspond to human comfort, building damage or scientific and medical equipment. The application of these procedures is discussed in Section 5.2.

5.1 Allocation of noise management procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs (refer to Section 3.1). The allocation of these procedures is summarised in Table 16 below.

Table 16 Allocation of noise management procedures

Construction Hours	Exceedance over NML (dB)	Management procedures (see definition above)
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	0 - 3	GMM
	4 - 10	GMM, PN, V [1], CMS
	> 10	GMM, PN, V, CMS, SN

1. Verification monitoring to be undertaken upon complaints received from affected receivers

Please note the following regarding the allocation of these procedures:

- The exceedances have been estimated as part of the acoustic assessment, and these are summarised in Section 4.3.
- The allocation of procedures is based on the assumptions used for noise level predictions (refer to Section 4). Consequently, these allocations can be further refined once additional details of the construction program become available.

5.2 Allocation of vibration management procedures

Table 17 below summarises the vibration management procedures to be adopted based on exceedance scenarios (i.e., whether the exceedance occurs over human comfort criteria, building damage criteria, or criteria for scientific and medical equipment). Please note these management procedures apply for any type of affected receiver.

Table 17 Allocation of vibration management procedures

Construction Hours	Exceedance Scenario	Management procedures
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	Over human comfort criteria (refer to Section 3.3)	GMM, PN, V
	Over building damage criteria (refer to Section 3.3)	GMM, V

5.3 General comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

5.3.1 Alternate equipment or process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

5.3.2 Acoustic enclosures/screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant i.e. (diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

5.3.3 General mitigation measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 *"Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites"* sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.

5.3.4 Adoption of universal work practices

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevating work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

5.3.5 Plant and equipment

The operation of plant and equipment on the site should be undertaken, including the following:

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operating plant and equipment in the quietest and most efficient manner.

5.3.6 Work scheduling

- Providing respite periods which could include restricting very noisy activities to time periods that least affect the nearby noise sensitive locations, restricting the number of nights that after-hours work is conducted near residences or by determining any specific requirements.
- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

5.3.7 Source noise control strategies

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment 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.
- Regular and effective maintenance.

5.3.8 Miscellaneous comments

Deliveries should be undertaken, where possible, during standard construction hours.

Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site and monitor the profiles in use.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site.

5.4 Vibration mitigation measures

The following general vibration mitigation measures should be implemented:

- Any vibration generating plant and equipment is to be located in areas within the site that results in lower vibration impacts on the nearest receivers, where possible.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.

- Use lower vibration generating items of construction plant and equipment; that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Undertake the removal of concrete within the building using saw cutting or pulverising where possible.

5.5 Construction vibration mitigation

An assessment of the potential for vibration generation as part of the required construction activities as part of the project (including ground works and construction) has been undertaken. The assessment of potential vibration impact has been undertaken such that safe working distances can be assessed such that vibration impacts can be managed for compliance with the criteria detailed in the table below.

Table 18 Recommended indicative safe working distances

Plant	Rating / Description	Safe Working Distances (m)
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5 m
	< 100 kN (Typically 2 – 4 tonnes)	6 m
	> 200 kN (Typically 4 – 6 tonnes)	12 m
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2 m
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7 m
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22 m
Vibratory pile driver	Sheet piles	20 m
Jackhammer	Hand held	3 m
Auger or Rotary Piling	Piling including non-percussive piling equipment	2m
Demolition Activities	Including demolition of the exiting building with excavator with hydraulic hammers and the like	5 m
Ground works of soft fill and material	Including excavators with buckets and the like	No limit
Movement of tracks and excavators	Movement of construction equipment without mitigation	5 m
Saw cutting of rock	Saw cutting using cutters installed to excavators or hand held equipment	No limit

Recommended construction methodologies which should be included as part of the proposed construction of the site include the following:

1. The processing (such as pummelling of material and the like) of materials should be undertaken at a location with a maximum distance from the noise sensitive receivers, including distance of not less than 10m.

2. In the event rock breaking is required within proximity to the noise sensitive receivers included in the table above a saw cut at the perimeter of the area to be removed is required to be undertaken prior to other activities commencing.

5.6 Noise and vibration monitoring

Noise monitoring, if required, will be performed by an acoustical consultant directly engaged by the contractor in accordance with the projects Conditions of Consent.

Noise monitoring is recommended to be undertaken by attended noise measurements at the start of any new phase of works (i.e. demolition, ground works or remediation works etc.). The statistical parameters to be measured should include the following noise descriptors: L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq}. Unattended noise measurements should be conducted over consecutive 15 minute periods.

The survey methodology and any equipment should comply with the requirements discussed in Standard AS 1055.1-1997.

As part of the management of noise and vibration from the proposed demolition and ground works activities to be undertaken on the site the following noise and vibration measurements are recommended to be undertaken:

1. Noise Monitoring –
    a. Attended noise level measurements of typical demolition and ground works activities should be undertaken at site. Attended construction noise surveys of the site and surrounding impacts on neighbours should be undertaken during the following as a minimum:
        i. Start of Demolition
        ii. Commencement of any rock breaking or sawing on the site.
        iii. In response to any ongoing complaints received from neighbours.

2. Vibration Monitoring– To confirm vibration magnitudes are within the expected levels the following attended vibration measurements are required:
    a. Short term attended vibration measurements – Attended short term vibration measurement of activities with the potential to generate maximum vibration to be undertaken on commencement at the site, including the following:
        i. Measurements to be undertaken at a representative location from the activity being conducted with a similar distance to the potentially affected receiver.
        ii. Activities with the potential to generate the greatest magnitudes of vibration include:
        iii. Hydraulic hammering of concrete slabs.
        iv. Hydraulic hammering during ground works within rock.

6 COMMUNITY ENGAGEMENT AND CONSULTATION

Active community consultation and the maintenance of positive relations with local residents and businesses would assist in alleviating concerns and thereby minimising complaint. It is common for construction projects to provide community consultation if an exceedance of noise goals has been predicted. This communication is commonly conducted in the form of a letter box drop or more active engagement with more highly impacted receivers.

This form of notification should provide specific notification of the duration and timing of the construction activities so that residents are informed about the proposed works ahead of time. The letter should also provide the community with a hotline number for a community liaison officer available to adequately respond to all project related enquiries.

Ideally the hotline number should provide concerned locals an opportunity to raise any concerns with the project proponent and provide an opportunity to determine the best method to satisfy all requirements.

Prior to the works onsite being undertaken, it is recommended that community consultation with the neighbouring affected parties be undertaken as detailed in the projects Community Consultation and Engagement Plan which will be undertaken by the building contractor.

However, should not be limited to the beginning of the onsite works but throughout, providing the community with constant updates on the progress and upcoming works. In our experience these could include:

- Site noticeboard,
- Email notifications; and
- Letterbox drops.

During the proposed construction of the project (including demolition, ground works and construction) the building contractor is required to engage in community interaction. The community interaction and notification is required to include the following:

1. Notification of the proposed works to be undertaken on the site and the periods when works will be conducted, including information regarding the programme of works such as demolition and ground works. This should include the expected period when activities such as hydraulic hammering, rock breaking, concrete or rock sawing is required to be undertaken.
2. Details of the relevant site representative where complaints can be registered.
3. Details of the methodology to respond to complaints raised from the surrounding receivers.
4. A register of complaints, to be kept on site including record of time and nature of the complaint as well as the outcomes and comments regarding investigations resulting from the complaint.

6.1 Complaints management system

Should complaints arise they must be dealt with in a responsible and uniform manner, therefore, a management system to deal with complaints is detailed below:

Local residents and land owners should be informed by direct mail of a direct 24-hour telephone line where any noise complaints related to the construction will be recorded. The 24-hour telephone line number will be made available on the construction site signage.

All complaints should be investigated by the Contractor in accordance with the procedures outlined in Australia Standard 2436-2010. Consequently, a complaint response procedure should be implemented. Information to be gathered as part of this process should include:

- location of complainant
- time/s of occurrence of alleged noise or vibration impacts
- nature of impact particularly with respect to vibration
- Perceived source
- Prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint.

All resident complaints will be responded to in the required timeframe and action taken recorded.

Post receiving a noise and or vibration complaint, the process outlined in the *Contingency Plans* below should be undertaken.

6.2 Contingency plans

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

The Superintendent shall have access to view the Contractor's noise measurement records on request. The Superintendent may undertake noise monitoring if and when required.

7 CONCLUSION

Pulse White Noise Acoustics (PWNA) have been engaged by A W Edwards to prepare a Construction Noise and Vibration Management Plan for the construction of the Airtunk SYD3 Datacentre at 51 Huntingwood Drive, Huntingwood. This CNVMP has been prepared to satisfy the requirements of the project SSD (SSD-41589232) development consent conditions.

Residential receivers are located to the south of the site within the Alpha Hotel Eastern Creek. A childcare centre (Grace Village Early Learning Centre) exists to the north of the project site at 44 Huntingwood Drive. Industrial receivers are located to the east and west of the project site, as well as to the north across Huntingwood Drive and to the south across the Western Motorway.

To determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at the Alpha Hotel Eastern Creek to the south of the project site, and 44 Huntingwood Drive, Huntingwood to the north of the project site.

The unattended noise logger at the Alpha Hotel Eastern Creek was chosen as it is the closest residential receiver to the subject site. The noise logger was positioned along the northern façade of the building.

Noise and vibration criteria have been based on the conditions of consent, the EPAs ICNG, and the EPAs AVATG. The ICNG and NMLs are based on the background noise measurements and the requirements of the ICNG.

Noise and vibration impacts have been assessed for three construction scenarios and associated construction equipment. The assessment has found that at times works would exceed the applicable noise management levels. During times where the most noise intensive equipment is not operating, the noise levels are likely to slightly exceed or potentially comply with the NMLs.

These impacts are typical of construction works of this nature and highlight the importance of effective management and mitigation measures. Recommended measures to reduce the impacts from the works is provided in Section 5 of this document.

Vibration impacts have been assessed against the EPAs AVATG. The assessment has identified that the proposed equipment will comply with the safe working distances and meet the requirements of the vibration criteria defined in the condition of consent. Vibration management and mitigation measures have been recommended in Section 5 to ensure that impacts are reduced as much as practicable.

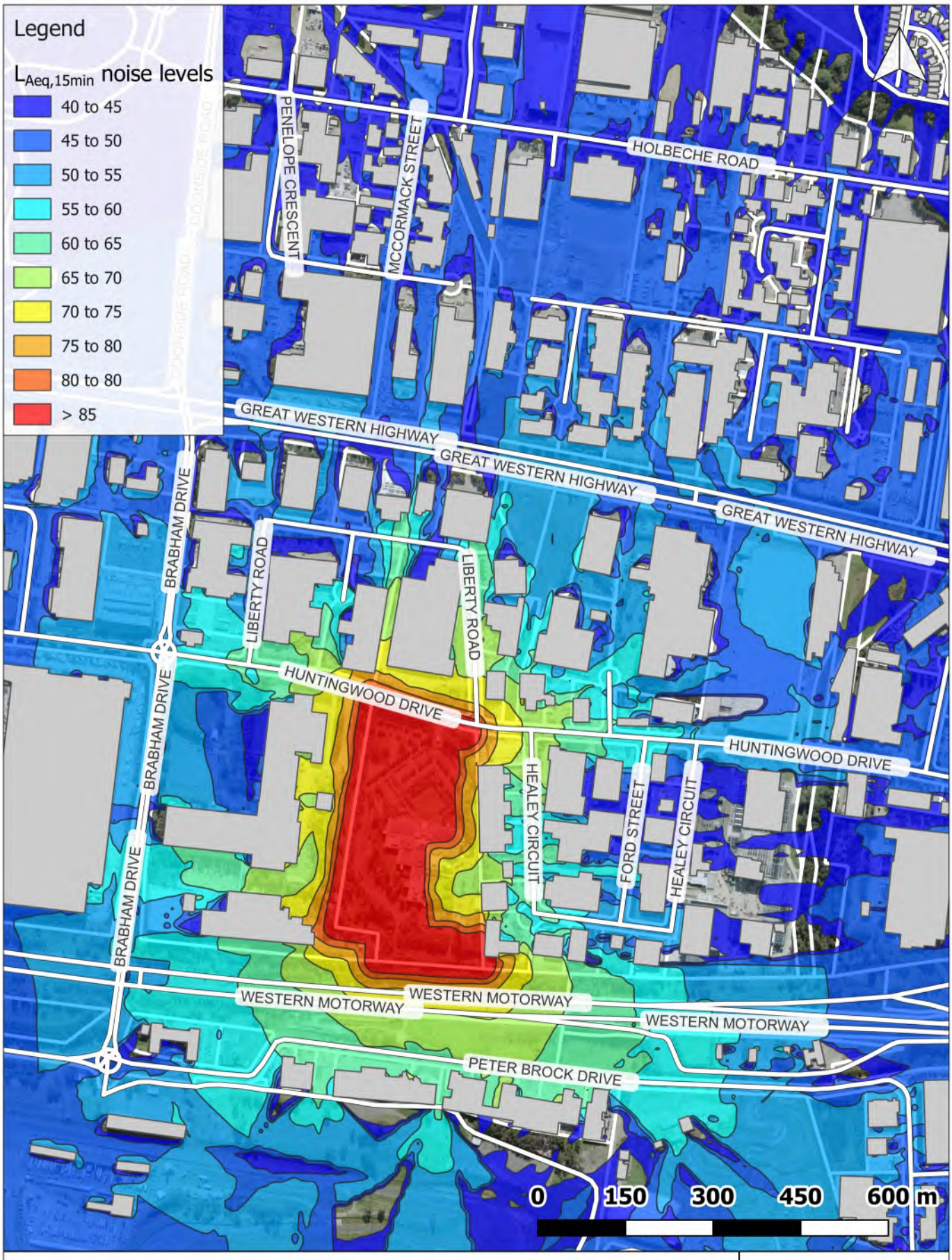
Provided in Section 6 are community engagement and consultation recommendations to assist in alleviating concerns from local residents and businesses. The incorporation of these recommendations in the approach to the works should reduce adverse reactions from the local community.

APPENDIX A. ACOUSTIC TERMINOLOGY

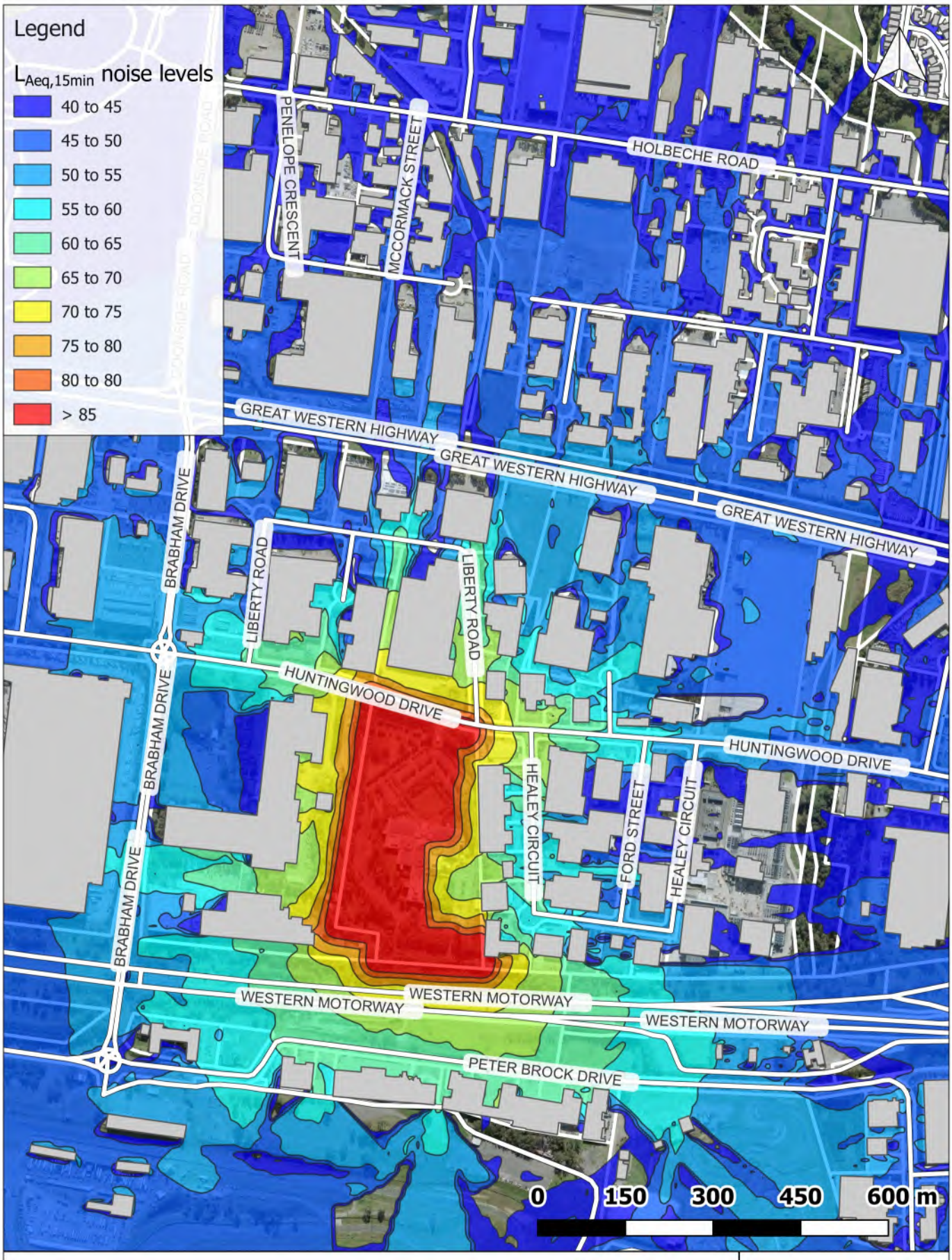
The following is a brief description of the acoustic terminology used in this report:

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dBA	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dBA. Practically all noise is measured using the A filter. The sound pressure level in dBA gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
L_{max}	The maximum sound pressure level measured over a given period.
L_{min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dBA.
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Sound Pressure Level, LP dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt.

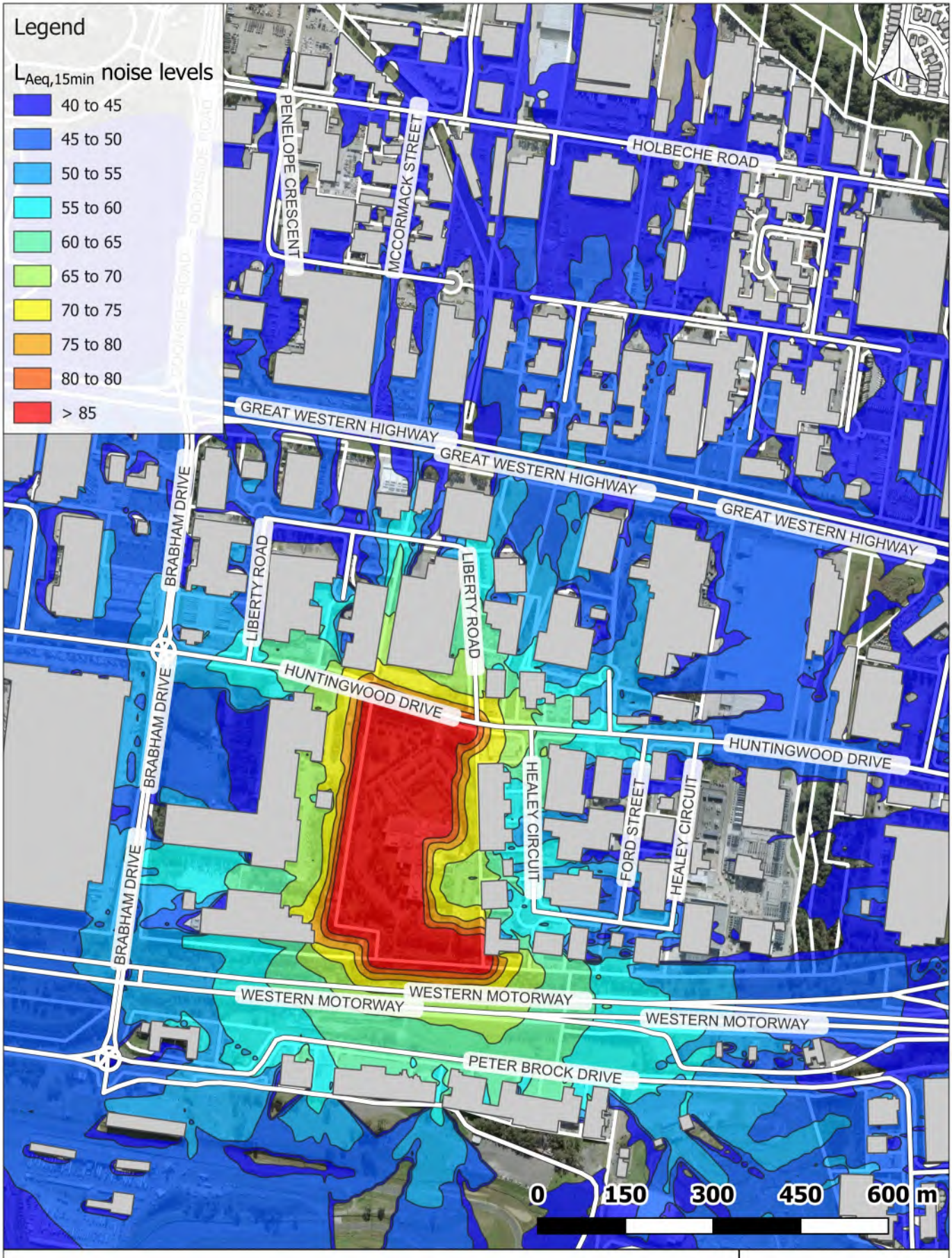
APPENDIX B. CONSTRUCTION NOISE CONTOURS



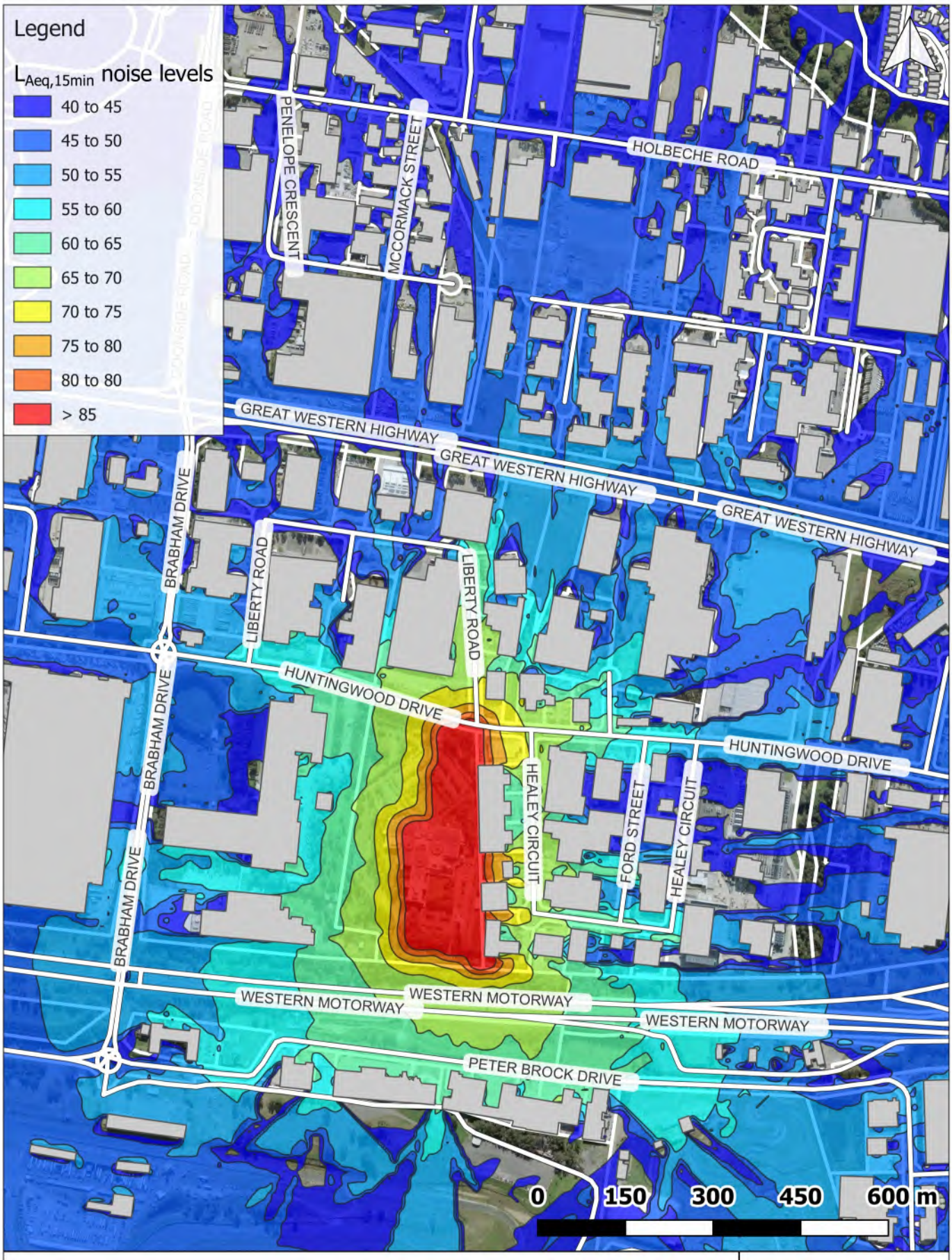
Airtrunk SYD3
Stage 1 and Stage 2 cumulative noise impacts
Excavation and demolition



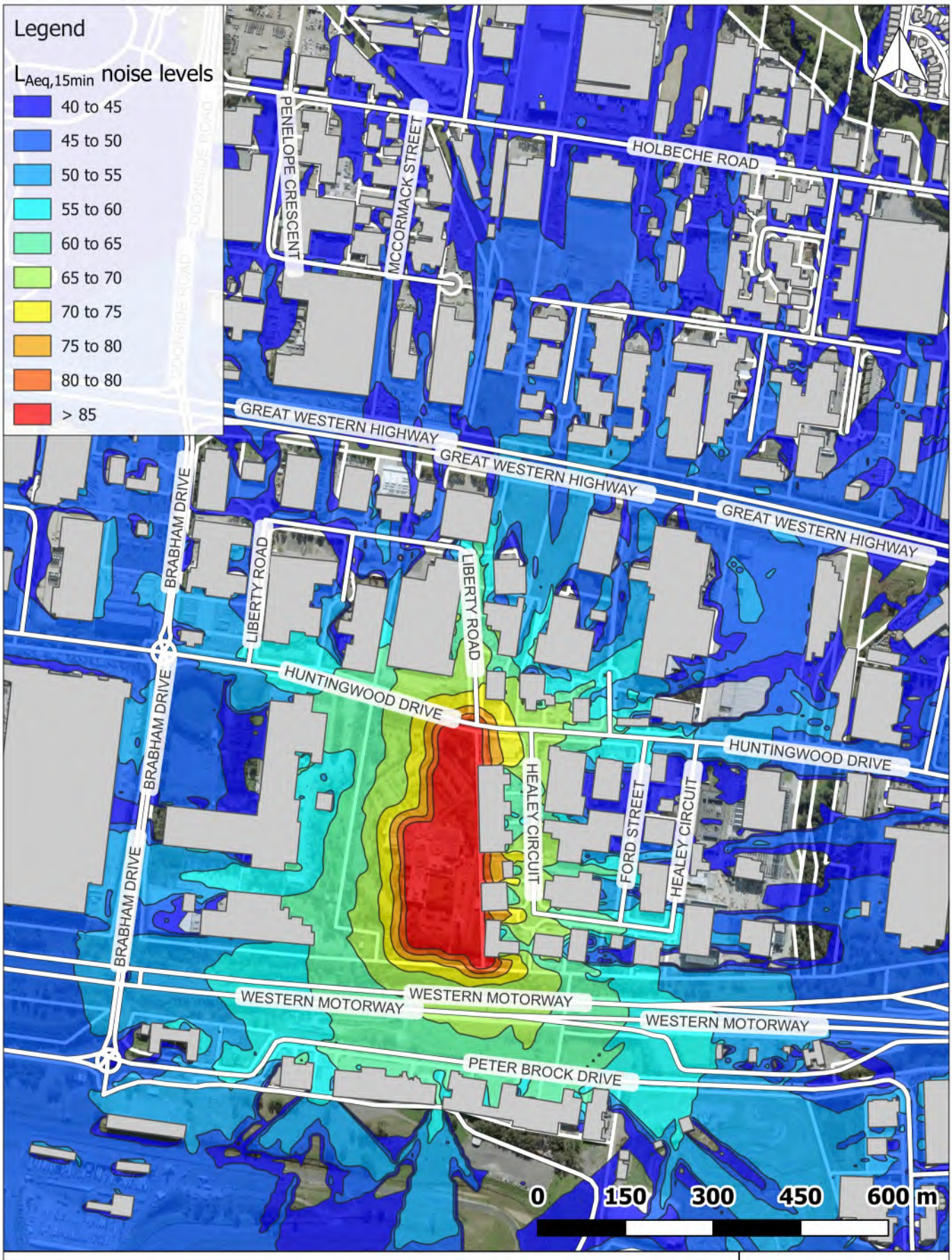
Airtrunk SYD3
Stage 1 and Stage 2 cumulative noise impacts
Piling



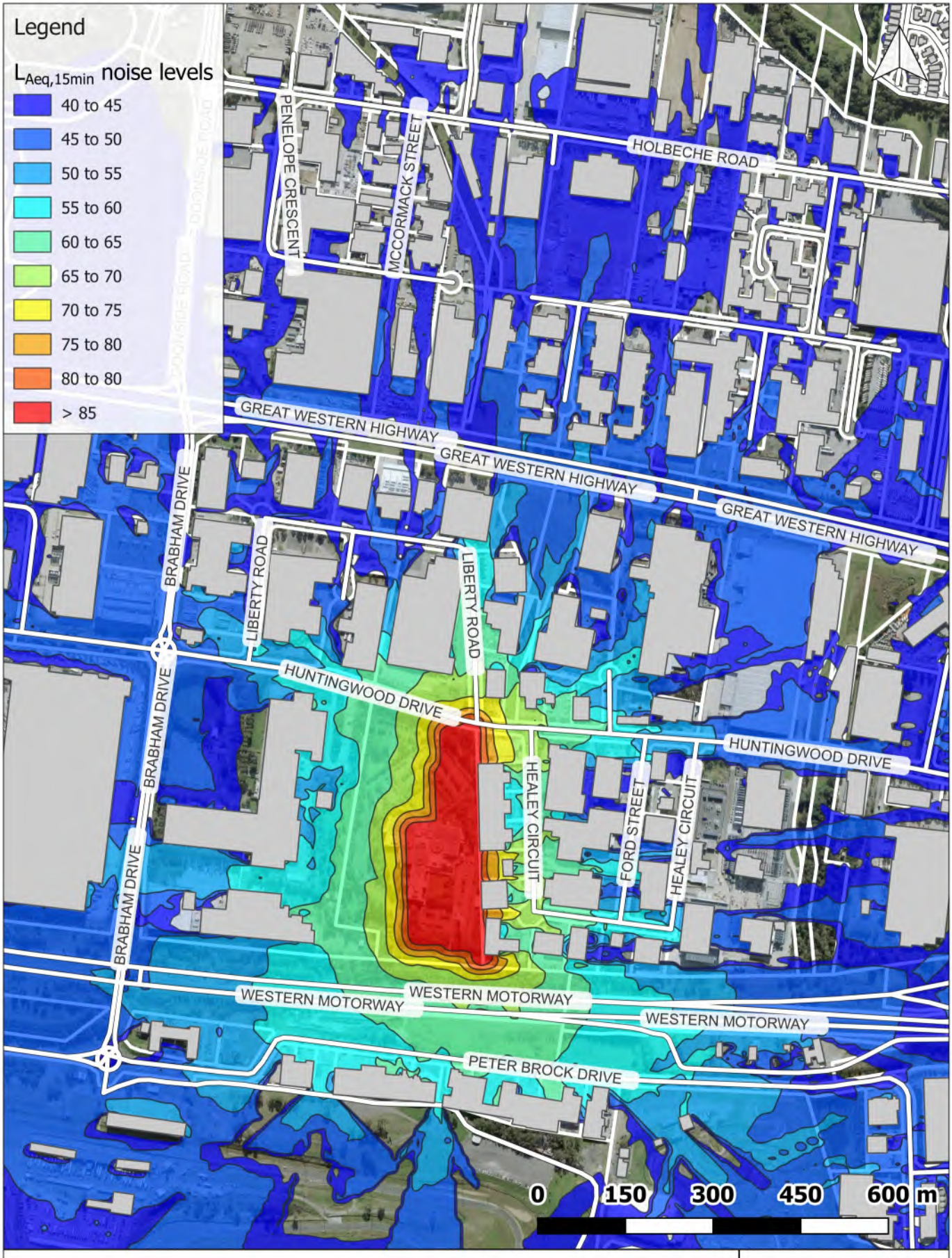
Airtrunk SYD3
Stage 1 and Stage 2 cumulative noise impacts
Construction



Airtrunk SYD3
Stage 3 noise impacts
Excavation and demolition



Airtrunk SYD3
Stage 3 noise impacts
Piling



Airtrunk SYD3
Stage 3 noise impacts
Construction