

## Westmead Hospital IMHC Early Works

# Construction Noise & Vibration Management Plan

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Attention To	Roberts Co (NSW) Pty Ltd

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# 1 INTRODUCTION

This report has been prepared as an update to the approved CNVMP referenced in condition 31.1 of the Review of Environmental Factors decision for the IMHC Early Works Project at Westmead Hospital. Conditions 24 and 31.1 of the decision contains requirements for noise and vibration management during the works. The report has been updated based on specific information regarding construction program and activities provided by Roberts Co and outlines the consent requirements for the REF works with respect to construction noise and vibration management. The conditions are reproduced below:

## Noise Management Measures

- 24.1 During preparation of the construction program, consult with the hospital to determine what areas (if any) of the hospital is particularly noise sensitive, and at what time (ward rooms, operating theatres, etc.).
- 24.2 Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.
- 24.3 For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

## Noise and Vibration Management

- 31.1 Prior to the commencement of works the submitted Construction Noise and Vibration Management Plan (CNVMP) is to be updated to be relevant to the engaged contractor to undertake the works. The CNVP is required to include the recommendations as included in the approved Acoustics Assessment, prepared by Acoustic Logic, dated 15 September 2022, and include the following provisions for acoustic mitigation:
  - a. The use of temporary acoustic barriers around particularly noisy activities;
  - b. Implementation of respite periods;
  - c. Continuous community liaison and consultation with affected parties – ongoing and regular communication and consultation with neighbouring uses should occur and a complaints management strategy will need to be developed.
  - d. Use of drum rollers in lieu of vibratory rollers ie Non-vibratory rollers shall be used on site. If alternative plant selections are not practicable, the use of this plant is only to be accepted where vibration measurements confirm compliance with DIN 4150-3 and EPA criteria prior to use.)
  - e. Blocking line of site between receivers and noisy activities through the use of barriers, screens, site sheds, stockpiles, earth mounds, install solid Barriers around static plant such as diesel generators and any stationary concrete pumps and A solid hoarding/s shall be installed at the adjacent childcare centre/s and Redbank School to reduce noise impacts.
  - f. Selection of quietest available equipment;
  - g. Ensuring all site vehicles are fitted with broadband reversing alarms as opposed to tonal reversing alarms;
  - h. Implementation of a noise complaint management procedure;
  - i. Site induction (including noise management practices) for all workers;
  - j. Screw piling is recommended above hammer or vibro-piling which pose greater risk of exceeding vibration criteria and noise management levels.
  - k. Concrete/water pumps shall not be operated prior to 7.30am and shall be placed as close to the centre of the site (where feasible) to reduce proximity to the nearby receivers or otherwise near to the site boundary hoardings which will also maximise noise reduction from screening.
  - l. Works shall be scheduled so that noise impacts are reduced. A detailed plan scheduling activities and times shall be developed with noisier works should be scheduled to avoid conflicts with the school and child-care centre operations with noisier more intensive works being outside the peak time of 9am to 3pm.
  - m. Respite periods should be implemented.
  - n. Treatment of specific plant by the use of silencing devices shall be included (where possible) such as engine shrouding or special industrial silences to exhausts.
  - o. Materials handling - consider installing rubber matting over material handling areas to reduce the sound of impacts of dropped materials etc.
  - p. Selecting alternative appliance or process – where an appliance or machinery is found to be particularly noisy it may be possible to select an alternative approach or appliance for example instead of using a hydraulic hammer the use of a bulldozer ripping and/or milling machines will reduce the noise impact.
  - q. Management training – site managers, workers, contractors and sub-contractors will need to be trained to understand noise and vibration limits. They shall be provided a copy of the Noise and Vibration Management Plan and an induction be organised so they are aware of the procedures.
  - r. Noise and Vibration monitoring will need to occur and shall be consistent with the requirements in Section 9.8.8 and 9.8.9 of the Acoustic Assessment prepared by Acoustic Logic and dated 15 September 2022. Implementation of a noise and vibration monitoring

program (i.e. unattended noise and vibration monitoring from adjoining land uses). If any real time exceedance alerts to be issued to the site operator to allow for alternative work practices or methodologies to be employed;

- s. A noise complaints management strategy and handling procedure shall be established in accordance with the provisions outlined in Section 9.8 and Section 10 of the Acoustic Assessment prepared by Acoustic Logic. Contingency plans shall be prepared if noise levels exceed required levels and these plans should be prepared in accordance with the requirements of the Acoustic Assessment.

Ensure that all other specific and general noise management techniques as stipulated in the Acoustic Assessment shall be implemented and addressed in the CNVMP in accordance with Section 9 of the Acoustic report.

The requirements of condition conditions 24 and 31.1 are to be implemented for the duration of the works. We note that the requirements noted in the conditions generally refer to noise mitigation techniques and best practice outlined in the approved CNVMP. For ease of reference, the table below outlines the consent requirements and reference in the report where relevant.

**Table 1 – Consent Condition Satisfaction Table**

<b>Consent Condition Requirement</b>	<b>Comment/Report Reference</b>
24.1 During preparation of the construction program, consult with the hospital to determine what areas (if any) of the hospital is particularly noise sensitive, and at what time (ward rooms, operating theatres, etc.).	Refer Section 9.6.6
24.2 Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.	Refer Section 9, 10
24.3 For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.	Refer Section 10
31.1 a. The use of temporary acoustic barriers around particularly noisy activities;	Refer Section 9.4
b. Implementation of respite periods;	Respite periods only necessary where NMLs are expected to be exceeded. Refer Section 7
c. Continuous community liaison and consultation with affected parties – ongoing and regular communication and consultation with neighbouring uses should occur and a complaints management strategy will need to be developed.	Sections 9.6.6, 10
d. Use of drum rollers in lieu of vibratory rollers ie Non-vibratory rollers shall be used on site. If alternative plant selections are not practicable, the use of this plant is only to be accepted where vibration measurements confirm compliance with DIN 4150-3 and EPA criteria prior to use.)	Drum rollers have been proposed in lieu of vibratory rollers
e. Blocking line of site between receivers and noisy activities through the use of barriers,	A solid barrier has been proposed adjacent to these receivers

<p>screens, site sheds, stockpiles, earth mounds, install solid Barriers around static plant such as diesel generators and any stationary concrete pumps and A solid hoarding/s shall be installed at the adjacent childcare centre/s and Redbank School to reduce noise impacts.</p>	
<p>f. Selection of quietest available equipment;</p>	<p>Section 9.6.3</p>
<p>g. Ensuring all site vehicles are fitted with broadband reversing alarms as opposed to tonal reversing alarms;</p>	<p>To be implemented</p>
<p>h. Implementation of a noise complaint management procedure;</p>	<p>Section 10</p>
<p>i. Site induction (including noise management practices) for all workers;</p>	<p>Section 9.6.5</p>
<p>j. Screw piling is recommended above hammer or vibro-piling which pose greater risk of exceeding vibration criteria and noise management levels.</p>	<p>Piling is not proposed as part of the REF works</p>
<p>k. Concrete/water pumps shall not be operated prior to 7.30am and shall be placed as close to the centre of the site (where feasible) to reduce proximity to the nearby receivers or otherwise near to the site boundary hoardings which will also maximise noise reduction from screening.</p>	<p>Refer Section 4.1</p>
<p>l. Works shall be scheduled so that noise impacts are reduced. A detailed plan scheduling activities and times shall be developed with noisier works should be scheduled to avoid conflicts with the school and child-care centre operations with noisier more intensive works being outside the peak time of 9am to 3pm.</p>	<p>Refer Construction Program prepared by Roberts Co</p>
<p>m. Respite periods should be implemented.</p>	<p>Respite periods only necessary where NMLs are expected to be exceeded. Refer Section 7</p>
<p>n. Treatment of specific plant by the use of silencing devices shall be included (where possible) such as engine shrouding or special industrial silences to exhausts.</p>	<p>Refer Section 9.6.1</p>
<p>o. Materials handling - consider installing rubber matting over material handling areas to reduce the sound of impacts of dropped materials etc.</p>	<p>Refer Section 9.6.2</p>
<p>p. Selecting alternative appliance or process – where an appliance or machinery is found to be particularly noisy it may be possible to select an alternative approach or appliance for example</p>	<p>Refer Section 9.6.3</p>

<p>instead of using a hydraulic hammer the use of a bulldozer ripping and/or milling machines will reduce the noise impact.</p>	
<p>q. Management training – site managers, workers, contractors and sub-contractors will need to be trained to understand noise and vibration limits. They shall be provided a copy of the Noise and Vibration Management Plan and an induction be organised so they are aware of the procedures.</p>	<p>Refer Section 9.6.5</p>
<p>r. Noise and Vibration monitoring will need to occur and shall be consistent with the requirements in Section 9.6.8 and 9.6.9 of the Acoustic Assessment prepared by Acoustic Logic and dated 15 September 2022. Implementation of a noise and vibration monitoring program (i.e. unattended noise and vibration monitoring from adjoining land uses). If any real time exceedance alerts to be issued to the site operator to allow for alternative work practices or methodologies to be employed;</p>	<p>Refer Sections 8.2, 9.6.8, 9.6.9</p>
<p>s. A noise complaints management strategy and handling procedure shall be established in accordance with the provisions outlined in Section 9.8 and Section 10 of the Acoustic Assessment prepared by Acoustic Logic. Contingency plans shall be prepared if noise levels exceed required levels and these plans should be prepared in accordance with the requirements of the Acoustic Assessment.</p>	<p>Refer Section 10</p>
<p>Ensure that all other specific and general noise management techniques as stipulated in the Acoustic Assessment shall be implemented and addressed in the CNVMP in accordance with Section 9 of the Acoustic report.</p>	<p>Refer Section 9</p>



Criteria and recommendations contained within this report have been formulated with reference to the following documents:

- NSW EPA/DECC – ‘Interim Construction Noise Guideline’ (“ICNG”) July 2009.
- NSW Department of Environment and Conservation NSW “Assessing Vibration: A Technical Guideline” (Feb 2006).
- Australian Standard AS2436:2010 “Guide to Noise Control on Construction, Maintenance and Demolition Sites.
- German Standard DIN 4150-3 (1999-02)

## **2 SITE DESCRIPTION & PROPOSAL**

### **2.1 THE PROPOSAL**

The Cumberland West Mental Health Services Relocation Early Works project (CWMH Early Works) forms part of the Westmead Health and Education Precinct redevelopment. The new purpose-built Mental Health Complex will offer the potential to transform care through new holistic service models co-located with physical health services and better integrated with mental health services in the community.

The CWMH Early Works project is the first stage of the new Westmead Integrated Mental Health Complex (IMHC), with main works scheduled to commence in April 2024. The scope of the early works includes the following works split into two separate approvals:

#### **REF**

- Construction of the P14 Car Park ramp and associated access controls.
- Services diversions including private sewer and trade waste, Sydney Water sewer, water main, LV, communications fibre cabling and lighting.
- Demolition of the BIRS, WRPO and Casuarina Lodge buildings.

#### **SSDA**

- Bulk earthworks.
- Piling.
- Retention structures.
- HV conduit installation.
- Diesel tank installation.
- Trenching for inground hydraulic.
- Stormwater works.
- Bioretention basin.

Given the SSDA has not been determined at this stage, this report focuses on REF works. The duration of the works

## 2.2 SITE DESCRIPTION/SENSITIVE RECEIVERS

Site investigation indicates that the site is bounded by:

- Dragonfly Drive to the west.
- Redbank Road to the south.

Each of these roadways carrying low to moderate volumes of traffic.

An investigation of site and surrounds provides that the site is bounded by developments part of the hospital precinct. Nearest external sensitive noise receivers are as follows:

- **R1:** A combination of medical and residential receivers to the west.
- **R2:** Residential receivers to the south-east along and beyond Hawkesbury Road.
- **R3:** Educational uses across Darcy Road.
- **R4:** Residential receivers north of Redbank Creek.
- **R5:** Industrial uses and active recreation (Redbank Track)

Sensitive uses within the Westmead Hospital precinct in the vicinity of site are identified as:

- **H1:** Redbank House & Redbank School to the north – mix of medical consultation and educational areas.
- **H2:** Children's Hospital at Westmead Childcare & Westmeadow Day Care Centre to the east.
- **H3:** Westmead CASB and PSB (future) to the south across Redbank Road.
- **H4:** Westmead ICPMR/Pathology/Entomology Building
- **H5:** Westmead Children's Hospital

A site map, measurement description and surrounding receivers are presented in Figure 1.

The risk of adverse noise and vibration impacts primarily occurs in relation to noise sensitive developments on the Westmead Hospital site.

The residential receivers to the south-east (R2) are closest (approx. 280m from the site) but the loudest works will be screened from these receivers by Hospital buildings. The nearest residential uses to the west, north and south are more than 400m from the site and the loudest stages of the works near ground level will largely be screened by other buildings on the hospital site.

- Site
- Greater Westmead Hospital Site
- Residential Receivers
- Education Receivers
- Commercial Receivers
- Westmead Hospital Receivers



**Figure 1 – Site & Surrounds including Surrounding Receivers**





### 3 ACTIVITIES TO BE CONDUCTED AND ASSOCIATED NOISE SOURCES

The primary noise producing equipment and activities likely to occur during the various stages of the REF approved works have been provided by Roberts Co and outlined below.

#### **Stage 1: Construction of the P14 Car Park ramp and associated access controls.**

- Concrete pumps
- Rock breakers
- Compactors
- Padfoot/smooth drum rollers
- Medium excavators
- Rigid vehicles

#### **Stage 2: Services diversions including private sewer and trade waste, Sydney Water sewer, water main, LV, communications fibre cabling and lighting.**

- Small excavators
- Bored piling rig
- Rigid vehicles
- Mobile Decontamination Units

#### **Stage 3: Demolition of the BIRS, WRPO and Casuarina Lodge buildings.**

- Large excavators
- Dozer
- Positracks
- Articulated haul trucks
- Bogie trucks
- Bored piling rig
- Concrete pump
- Hand jackhammers
- Vac trucks
- Water cart
- Street sweeper
- Mobile Decontamination Units
- Haulage trucks (bogie/truck & dogs)

Vehicle access routes are detailed in Figure 3. The anticipated duration of works is approximately 7 months based on construction program provided by Roberts Co.



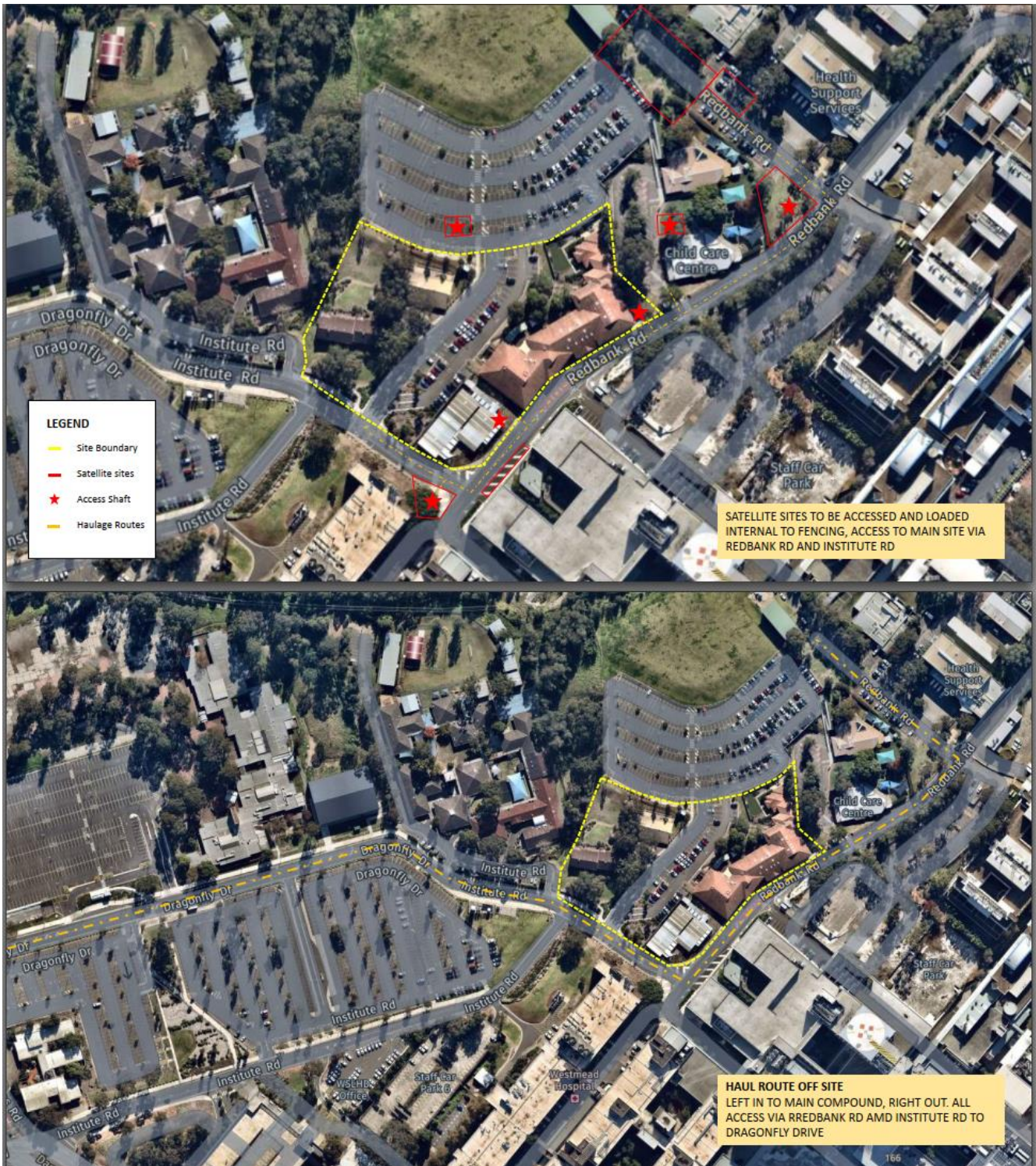


Figure 3 – Site Access (Source: Roberts Co)

## 4 HOURS OF WORK AND DURATION

### 4.1 HOURS OF WORK

Construction will be undertaken during recommended standard hours as defined by EPA Interim Construction Noise Guideline. These are summarised as follows:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sundays or Public Holiday No work.

In accordance with consent condition 31.1k, concrete/water pumps shall not be operated prior to 7.30am and shall be placed as close to the centre of the site (where feasible).

## 5 EXISTING BACKGROUND NOISE LEVELS

Long term unattended noise logging was undertaken by this office as part of the main works 'Noise and Vibration Impact Assessment' under SSDA No.44034342 (ref 20210938.1/0808A/R2/TH).

Supplementary noise monitoring data has been adopted from the following documents:

- 'Noise Impact and Vibration Assessment' for the Central Acute Services Building (CASB) prepared by Acoustic Studio (Report Reference: CASB-ACS-AC-RT-0020-02, dated 6th July 2016) - SSDA approved.
- "Paediatric Services Building, The Children's Hospital at Westmead Acoustic Report" prepared by Stantec dated 17 March 2021 (ref: 44311-1).

The following table summarises the rating background noise levels determined for the day, evening and night periods as defined in the NSW EPA's NPfl.

**Table 2 – NPfl Rating Background Noise Levels**

Location	Assessment Background Noise Level (dB(A) L <sub>90</sub> )		
	Day	Evening	Night
Mons Road & Darcy Road Receivers (R1 & R3)	45	45 (46*)	45
Hawkesbury Road Receivers (R2)	42	42	39
North of Redbank Creek Receivers (R4 & R5)	43	43 (44*)	42

\*Measured noise level.



## 6 CONSTRUCTION NOISE AND VIBRATION EMISSION MANAGEMENT LEVELS

### 6.1 NOISE MANAGEMENT LEVELS

Noise emissions associated with construction activities on the project site to external areas of receivers will be assessed in with reference to the following:

- NSW EPA's *Interim Construction Noise Guideline (DECC, 2009)*,
- Protection of the Environment Operations Act 1997,
- Australian Standard AS2436:2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites.

#### 6.1.1 2009 NSW Environmental Protection Authority (EPA) document – "*Interim Construction Noise Guideline (ICNG) 2009*"

The EPA's ICNG assessment requires:

- Review of noise levels at nearby development
- If necessary, recommendation of noise control strategies in the event that compliance with noise emission goals is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences for construction during the recommended standard hours:

- "*Noise Affected*" level – Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the noise affected level. For residential properties, the noise affected level occurs when construction noise exceeds the rating background noise level by more than 10dB.
- "*Highly Noise Affected*" level – Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the highly noise affected level occurs when construction noise exceeds 75dB(A)<sub>L<sub>eq</sub>(15min)</sub> at nearby residences.

The guideline also provides external management levels for land used for commercial or industrial purposes to be assessed at the most affect occupied point of the premises. EPA guidelines recommend a construction noise management level for industrial receivers of 75dB(A)<sub>L<sub>eq</sub>(15-minute)</sub>.

Section 4.1.2 of the guideline provides that, for other sensitive land uses such as classrooms at educational institutions, the noise management level should not exceed 45 dB(A) internally.



### 6.1.2 Construction Noise Management Levels Summary

Noise management levels applicable to the development site and surrounding receivers are summarised in the following tables.

**Table 3 – Construction Noise Emission Noise Management Levels - Residential**

<b>Location</b>	<b>“Noise Affected”/“Noise Management Level” – dB(A)<math>L_{eq}(15min)</math></b>	<b>“Highly Noise Affected” Level – dB(A)<math>L_{eq}(15min)</math></b>
R1 Receivers – Mons Road	55 (Standard Construction Hours)	75
R2 Receivers – Hawkesbury Road	52 (Standard Construction Hours)	75
R4 Receivers – North of Redbank Creek	53 (Standard Construction Hours)	75

**Table 4 – Construction Noise Emission Noise Management Levels – Other Receiver Types**

<b>Location</b>	<b>“Noise Management Level” – dB(A)<math>L_{eq}(15min)</math></b>
R3– Darcy Rd Educational	45 internal (when in use)
R5- Industrial Receivers	75
R5- Active Recreation Areas	65 (when in use)
H1 – Redbank House & Redbank School	45 internal (when in use)
H2 - Childcare Facilities	65 - Outdoor Play Areas (Based on ICNG guidelines for active recreation)
H3 & H4 -Hospital Buildings	45 internal

### 6.1.3 Australian Standard AS2436:2010 “Guide to Noise Control on Construction, Maintenance and Demolition Sites

Australian Standard AS2436 does not provide specific noise management targets. The guideline focuses on strategies for developing feasible and reasonable mitigation methodologies, management controls and community liaison to reach realistic compromises between the needs of construction activities and potentially affected receivers.

For the control and regulation of noise from construction sites AS2436:2010 *Guide to noise control on construction, maintenance and demolition sites* nominates the following:

- That reasonable suitable noise management objectives are established.
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating demolition hours, and

## 6.2 VIBRATION OBJECTIVES

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For structural damage vibration, German Standard DIN 4150-3 Structural Vibration: Effects of Vibration on Structures; and
- For human exposure to vibration, the evaluation levels presented in the British Standard BS 6472:1992 Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz) for low probability of adverse comment.

### 6.2.1 German Standard DIN 4150-3 (1999-02) - Ground Borne Vibrations and Damage Limits

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 5.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

### 6.2.2 Structure Borne Vibrations (Building Damage Levels)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The vibration levels presented in DIN 4150-3 (1999-02) are detailed in Table 4. It is noted that the peak velocity is the value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

**Table 5 – DIN 4150-3 (1999-02) SAFE LIMITS FOR BUILDING VIBRATION**

Type of structure		PEAK PARTICALE VELOCITY (MMS <sup>-1</sup> )			
		At Foundation at a frequency			Plane of Floor of Uppermost Storey
		<10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under preservation order)	3	3 to 8	8 to 10	8

### 6.2.3 Assessing Amenity

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels are presented below:

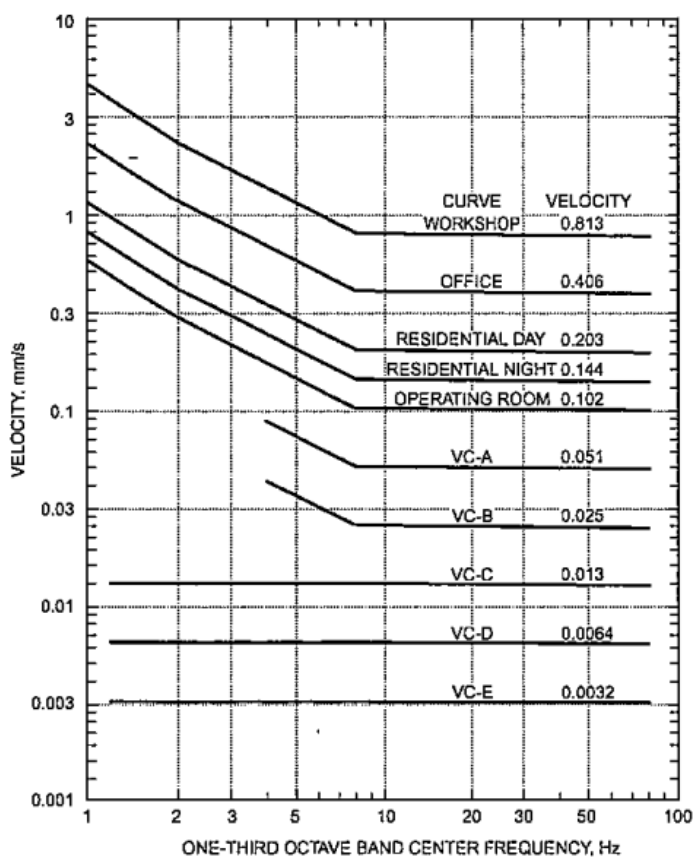
**Table 6 – Construction Vibration Goals**

Place	Time	RMS acceleration (m/s <sup>2</sup> )		RMS velocity (mm/s)		Peak velocity (mm/s)	
		<u>Preferred</u>	<u>Maximum</u>	<u>Preferred</u>	<u>Maximum</u>	<u>Preferred</u>	<u>Maximum</u>
<b>Continuous Vibration</b>							
<b>Critical Working Areas (e.g. Hospital Operating Theatres)</b>	<b>Daytime</b>	0.005	0.01	0.1	0.2	0.14	0.28
<b>Residences</b>		0.01	0.02	0.2	0.4	0.28	0.56
<b>Offices</b>		0.02	0.04	0.4	0.8	0.56	1.1
<b>Workshops</b>		0.04	0.08	0.8	1.6	1.1	2.2
<b>Impulsive Vibration</b>							
<b>Critical Working Areas (e.g. Hospital Operating Theatres)</b>	<b>Daytime</b>	0.005	0.01	0.1	0.2	0.14	0.28
<b>Residences</b>		0.3	0.6	6.0	12.0	8.6	17.0
<b>Offices</b>		0.64	1.28	13.0	26.0	18.0	36.0
<b>Workshops</b>		0.64	1.28	13.0	26.0	18.0	36.0

### 6.2.4 Sensitive Equipment within Hospital Buildings

Where sensitive equipment is located within nearby buildings (i.e CASB), criteria are to be determined based on data provided by the manufacturer/supplier/operator. These are to be determined prior to the commencement of any works. When setting vibration limits for sensitive medical equipment for vibration generated by construction activities, the appropriate vibration curve from the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) Handbook based on the equipment type is typically applied.

The ASHRAE Handbook provides specific vibration levels associated with potential disruption to the use of sensitive equipment within the clinic. The maximum vibration velocities ( $\text{mm}\cdot\text{s}^{-1}$ ) recommended from 1-100Hz is given in Figure 37 of the Handbook, used in conjunction with the recommended equipment requirement curves given in Table 46. Figure 37 and Table 46 of the Handbook are reproduced below in Figure 4 and Table 7 respectively.



**Fig. 37 Building Vibration Criteria for Vibration Measured on Building Structure**

**Figure 4 – Vibration Curves as per Figure 37 of ASHRAE Handbook (2007)**

**Table 7 – Equipment Vibration Criteria – ASHRAE Handbook (2007)**

Equipment Requirements	Curve
Adequate for computer equipment, probe test equipment, and microscopes less than 40x magnification	0.203 (Residential – day)
Bench Microscopes up to 100x magnification; laboratory robots	0.102 (Operating Room)
Bench microscopes up to 400x magnification; optical and other precision balances; coordinate measuring machines; metrology laboratories; optical comparators; microelectronics manufacturing equipment; proximity and projection aligners, etc.	0.051 (VC – A)
Microsurgery, eye surgery, neurosurgery; bench microscopes at magnification greater than 400x magnification; optical equipment on isolation tables; microelectronic manufacturing equipment, such as inspection and lithography equipment (including steppers) to 3mm line widths	0.025 (VC – B)
Electron microscopes up to 30,000x magnification; microtomes; magnetic resonance imagers; microelectronics manufacturing equipment, such as lithography and inspection equipment to 1mm detail size	0.013 (VC – C)
Electron microscopes at magnification greater than 30,000x magnification; mass spectrometers; cell implant equipment; microelectronic manufacturing equipment such as, aligners, steppers and other critical equipment for photolithography with line widths of 1/2µm; includes electron beam systems	0.0064 (VC – D)
Un-isolated laser and optical research systems; microelectronics manufacturing equipment, such as aligners, steppers and other critical equipment for photolithography with line widths of 1/4µm; includes electron beam systems	0.0032 (VC – E)

**Table Notes:**

- Refer to Figure 2 for corresponding vibration curve

We note that the sensitive equipment vibration requirements may already be exceeded under ambient conditions. As such, AL recommends ambient vibration monitoring be undertaken prior to the commencement of construction works so that a baseline vibration level may be established for comparison to vibration generated by the works.

## 7 ASSESSMENT OF NOISE EMISSIONS

### 7.1 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Typical equipment/processes anticipated to be used on the project site. Noise impacts from these activities on the amenity of the surrounding identified sensitive receivers will be predicted based on the A-weighted sound power levels outlined in the table below.

**Table 8 – Equipment Sound Power Levels**

<b>EQUIPMENT /PROCESS</b>	<b>SOUND POWER LEVEL dB(A)*</b>	<b>DUTY%</b>
<b>Stage 1: Construction of the P14 Car Park ramp</b>		
20T excavators	105	75
Rock breaking	118	75
Compactor	106	100
smooth drum rollers	107	100
Rigid vehicles	103	10
Concrete pump	109	100
<b>Stage 2: Services diversions including private sewer and trade waste, Sydney Water sewer, water main, LV, communications fibre cabling and lighting.</b>		
6T excavators	95	75
Rigid vehicles	103	10
Mobile Decontamination Units	95	100
Bored piling rig	112	100
<b>Stage 3: Demolition of the BIRS, WRPO and Casuarina Lodge buildings.</b>		
50T excavators	115	75
Dozer	116	75
Positracks	107	75
Articulated haul trucks	110	10
Hand jackhammers	113	75
Bored piling rig	112	100
Concrete pump	109	100
Street sweeper	95	75
Mobile Decontamination Units	95	100

**\*Noise levels take into account correction factors (for tonality, intermittency where necessary).**

The noise levels presented in the above table are derived from the following sources:

1. On-site measurements;
2. Table D2 of Australian Standard 2436-1981 & Table A1 of Australian Standard 2436-2010; and
3. Data held by this office from other similar studies.

## 7.2 NOISE EMISSION PREDICTIONS AND ASSESSMENT

### 7.2.1 Construction Noise Predictions

Construction noise emissions to nearby development will be dependent on the activities being undertaken at the time, and where on the site the activities occur.

Noise levels have been predicted using the cumulative plant sound power levels indicated in Section 7.1, taking into account time corrections based on percentage of time on duty, distance attenuation, screening provided by existing buildings and barrier attenuation from the 2 metre barrier screening the site from the childcare centre and Redbank House as recommended in the REF consent conditions.

### 7.2.2 Predicted Noise Impacts

Noise emissions from the proposed REF works have been predicted at the receiver locations using SoundPlan™ modelling software implementing the ISO 9613-2:1996 *“Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation”* noise propagation Standard. Sound Power Level data used in the SoundPlan™ modelling is based on Tables 1 to 5 of this report. The following weather conditions are included in the modelling based on the requirements of ISO9613:

- Wind speed of between 1m/s and 5m/s.
- 10 degrees with 70% relative humidity.

The predicted noise levels are summarised in the following table with sound plan noise maps presented overleaf. A range of noise levels is indicated depending on where on the site the plant is located. The range of noise levels presented in the table are those predicted at the worst affected point on the worst affected facades.



**Table 9 – Summary of Predicted Noise Emissions**

<b>Stage</b>	<b>R1 (Residential to the west)</b>	<b>R2 (Residential to the south east)</b>	<b>R3 (Educational use across Darcy Road)</b>	<b>R4 (Residential to the west)</b>	<b>H1 (Redbank House/School to the west)</b>	<b>H2 (Childcare)</b>	<b>H3 &amp; H4 (CASB &amp; PSB)</b>	<b>H5 (Westmead Children’s Hospital)</b>
1	<40	<40	<40	<40	45-55 (at façade)	63-65	59-62 (at façade)	63-65 (at façade)
2	<40	<40	<40	<40	49	<45	<45 (at façade)	<45 (at façade)
3	<40	<40	<40	<40	55-61	49-53	61-65 (at facade)	47-51 (at façade)
<b>NML, dB(A) L<sub>eq</sub>(15 minute)</b>	55	52	45 (Assessed internally when in use)	53	45 (Assessed internally) **65 (at facade)	65 (Assessed at outdoor areas)	45 (Assessed internally) *75 (at facade)	45 (Assessed internally) *75 (at facade)
<b>HANML, dB(A) L<sub>eq</sub>(15 minute)</b>	75	75	-	75	-	-	-	-

\*Assumes a 30 dB(A) façade reduction

\*\* Assumes a 20 dB(A) façade reduction

# Westmead Hospital IMHC Early Works

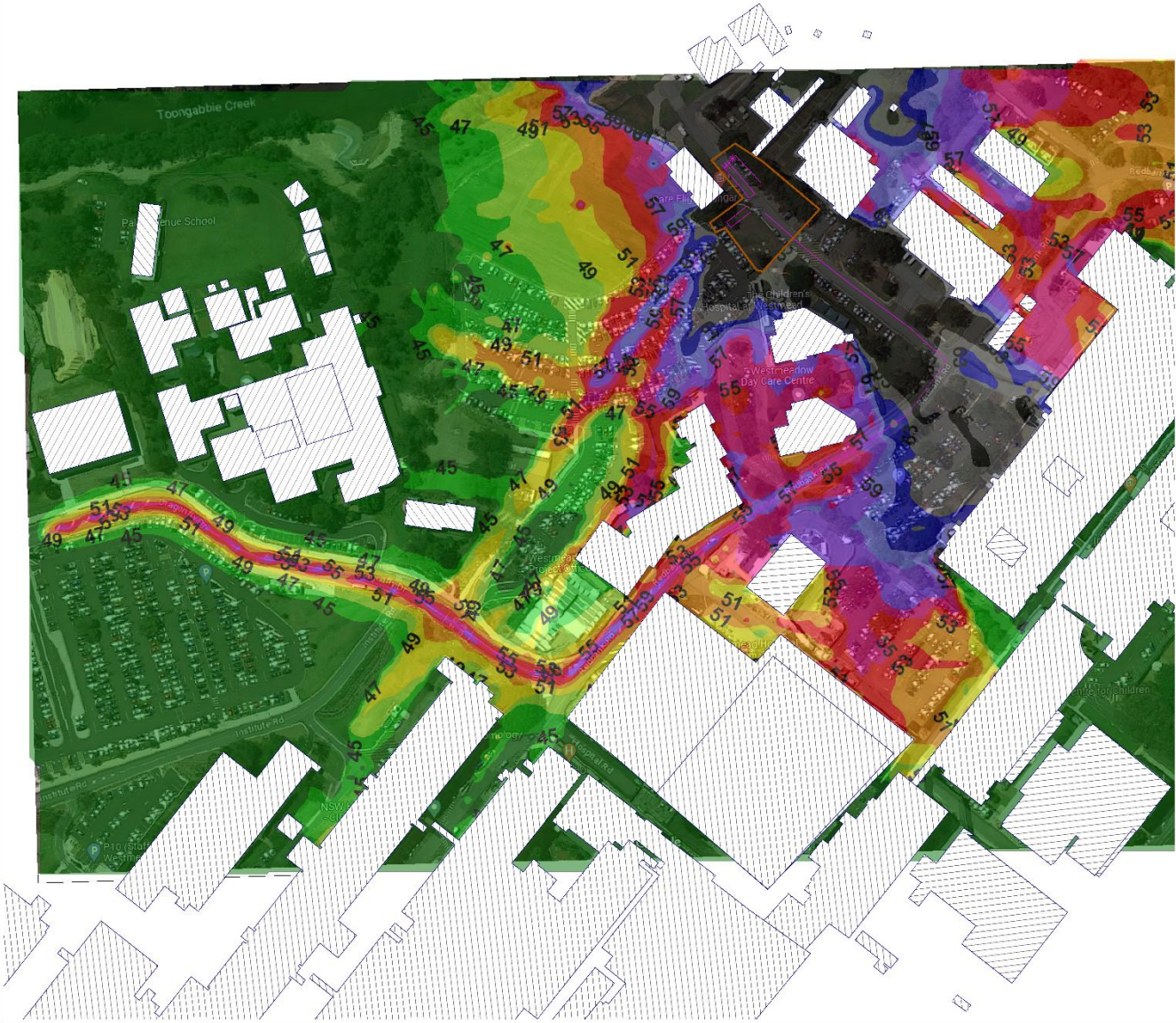
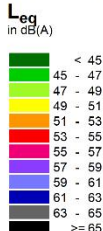
## Construction Noise Prediction

P14 Car park construction  
(Scenario 1)

- 20T excavators
- 10T excavator with hydraulic hammer
- Compactor
- Smooth drum rollers
- Rigid vehicles
- Concrete pump

Prepared by: P. Feng  
Date: 23/08/2023

### Noise Level





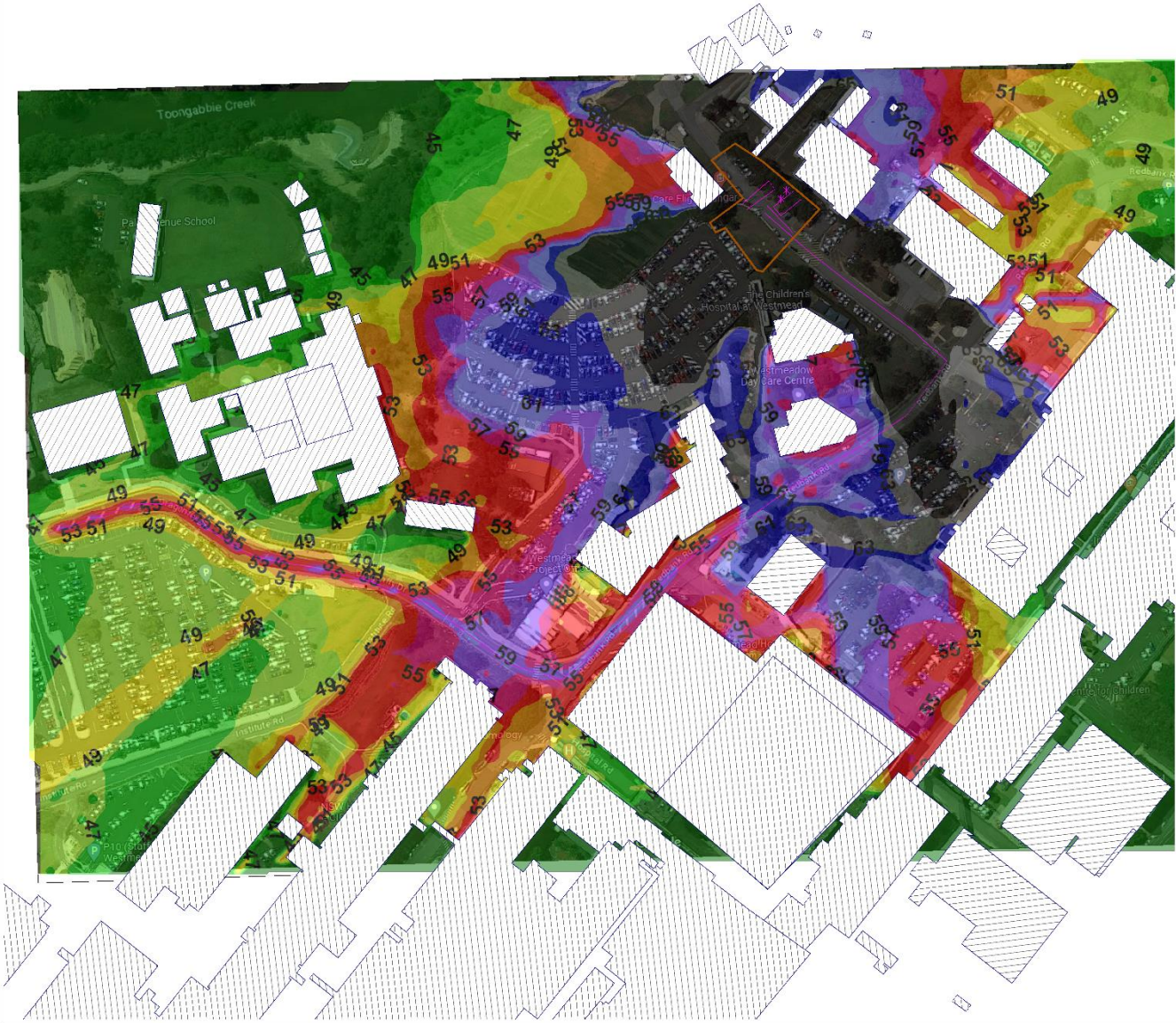
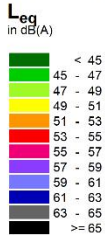
# Westmead Hospital IMHC Early Works

## Construction Noise Prediction

- P14 Car park construction  
(Scenario 2)**
- 20T excavators
  - 10T excavator with hydraulic hammer
  - Compactor
  - Smooth drum rollers
  - Rigid vehicles
  - Concrete pump

Prepared by: P. Feng  
Date: 23/08/2023

### Noise Level



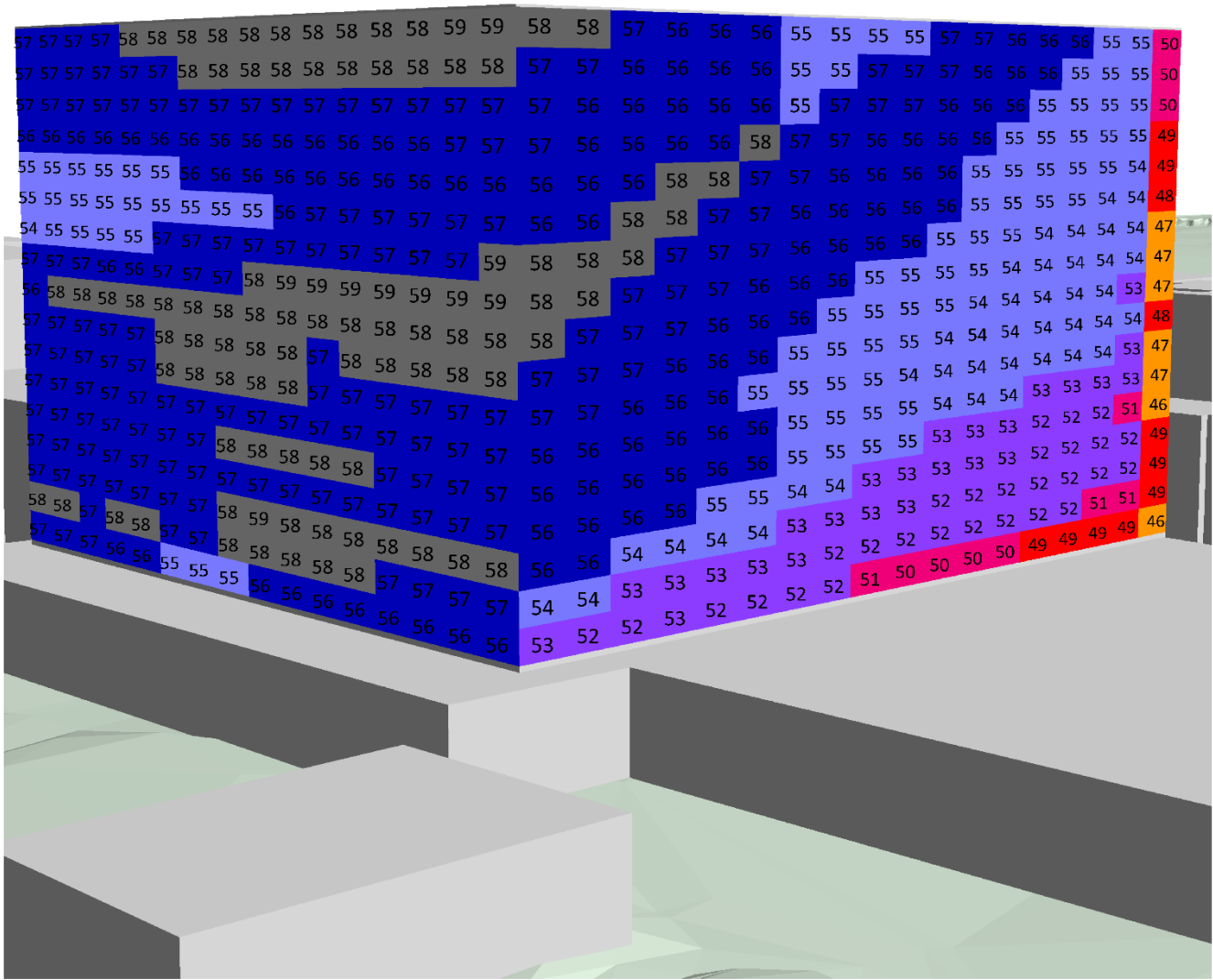
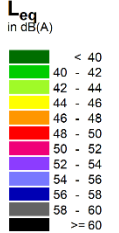
# Westmead Hospital IMHC Early Works

## Construction Noise Prediction

- P14 Car park construction (Scenario 1)**
- 20T excavators**
- 10T excavator with Hydraulic hammer**
- Compactor**
- Smooth drum rollers**
- Rigid vehicles**
- Concrete pump**

Prepared by: P. Feng  
Date: 21/08/2023

### Noise Level



# Westmead Hospital IMHC Early Works

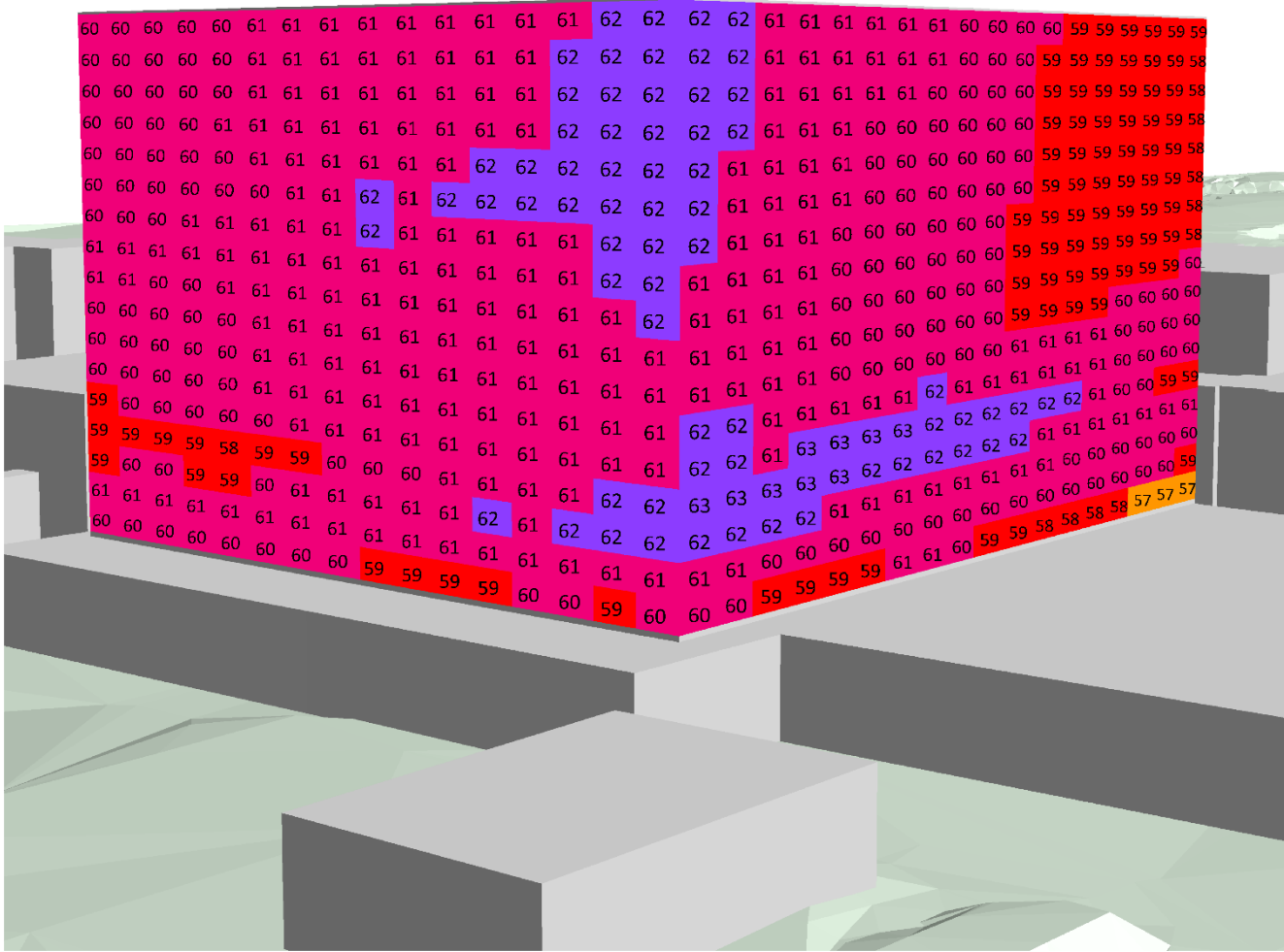
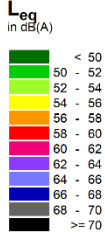
## Construction Noise Prediction

P14 Car park construction  
(Scenario 2)

- 20T excavators
- 10T excavator with hydraulic hammer
- Compactor
- Smooth drum rollers
- Rigid vehicles
- Concrete pump

Prepared by: P. Feng  
Date: 21/08/2023

### Noise Level





# Westmead Hospital IMHC Early Works

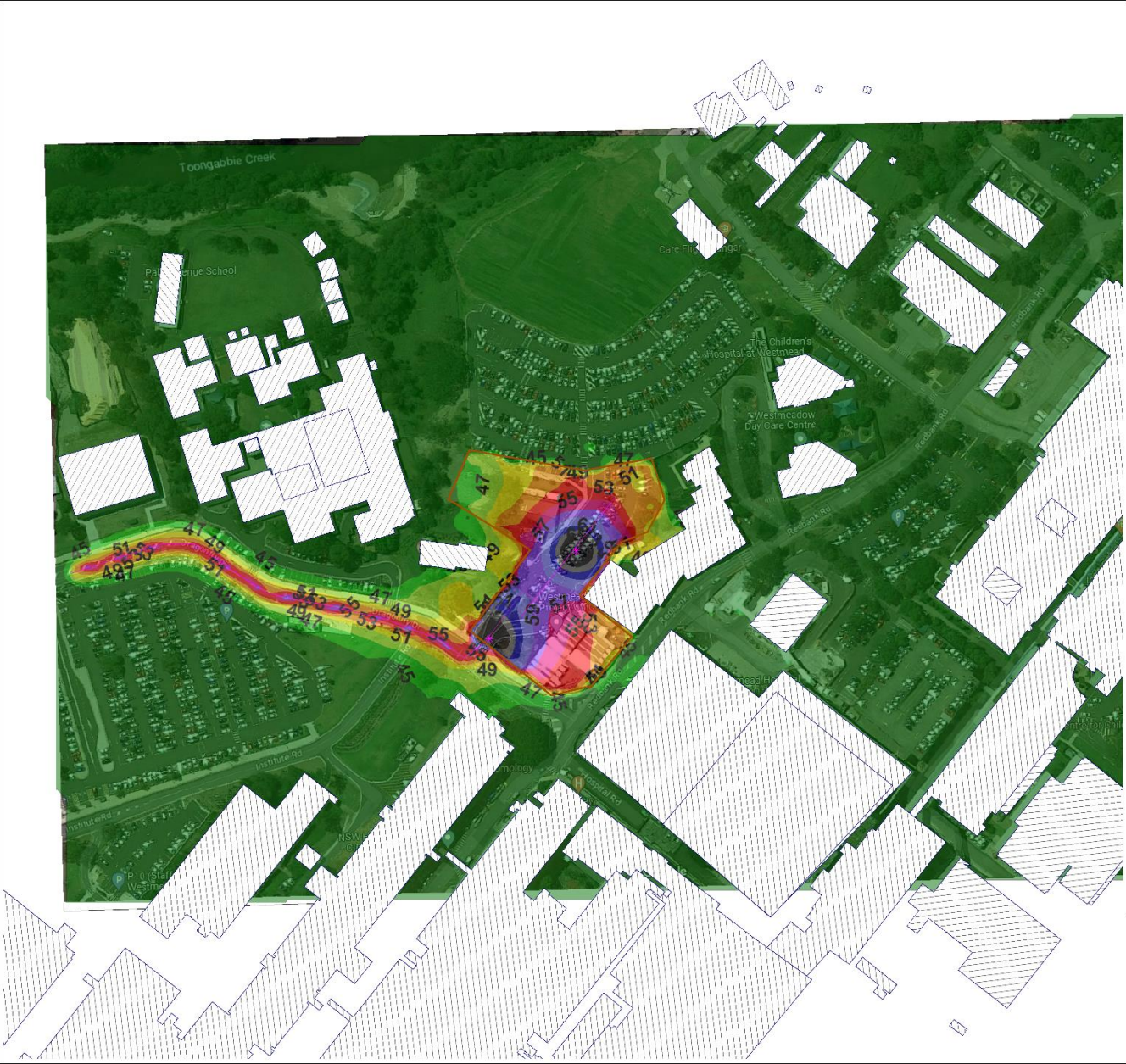
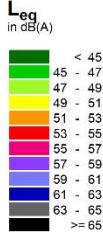
## Construction Noise Prediction

### Services diversions

- 6T excavators
- Rigid vehicles
- Piling rig - bored
- Mobile Decontamination units

Prepared by: P. Feng  
Date: 23/08/2023

### Noise Level



# Westmead Hospital IMHC Early Works

## Construction Noise Prediction

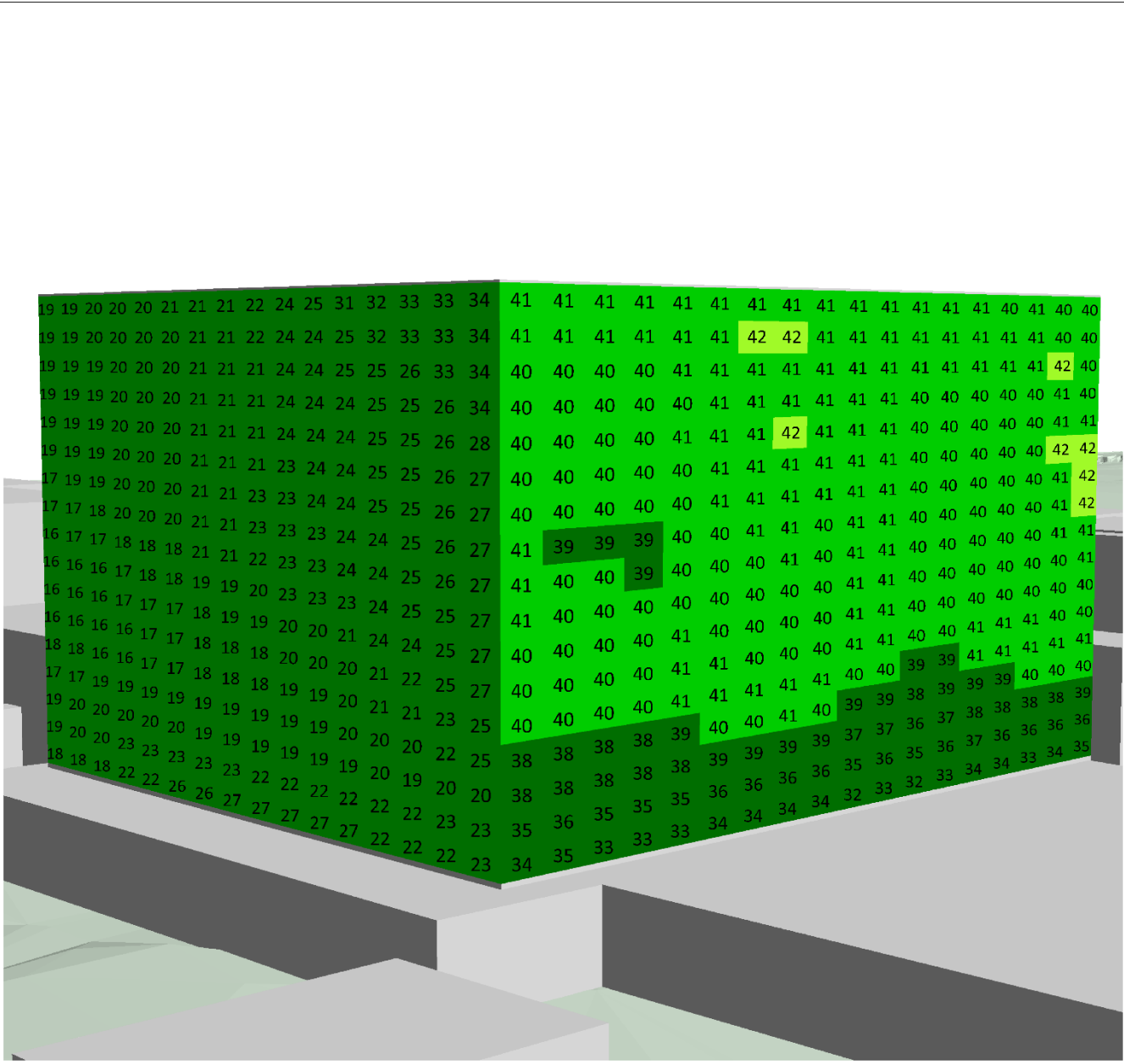
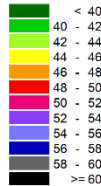
### Services diversions

- 6T excavators
- Rigid vehicles
- Piling rig-bored
- Mobile Decontamination units

Prepared by: P. Feng  
Date: 21/08/2023

### Noise Level

$L_{eq}$   
in dB(A)





# Westmead Hospital IMHC Early Works

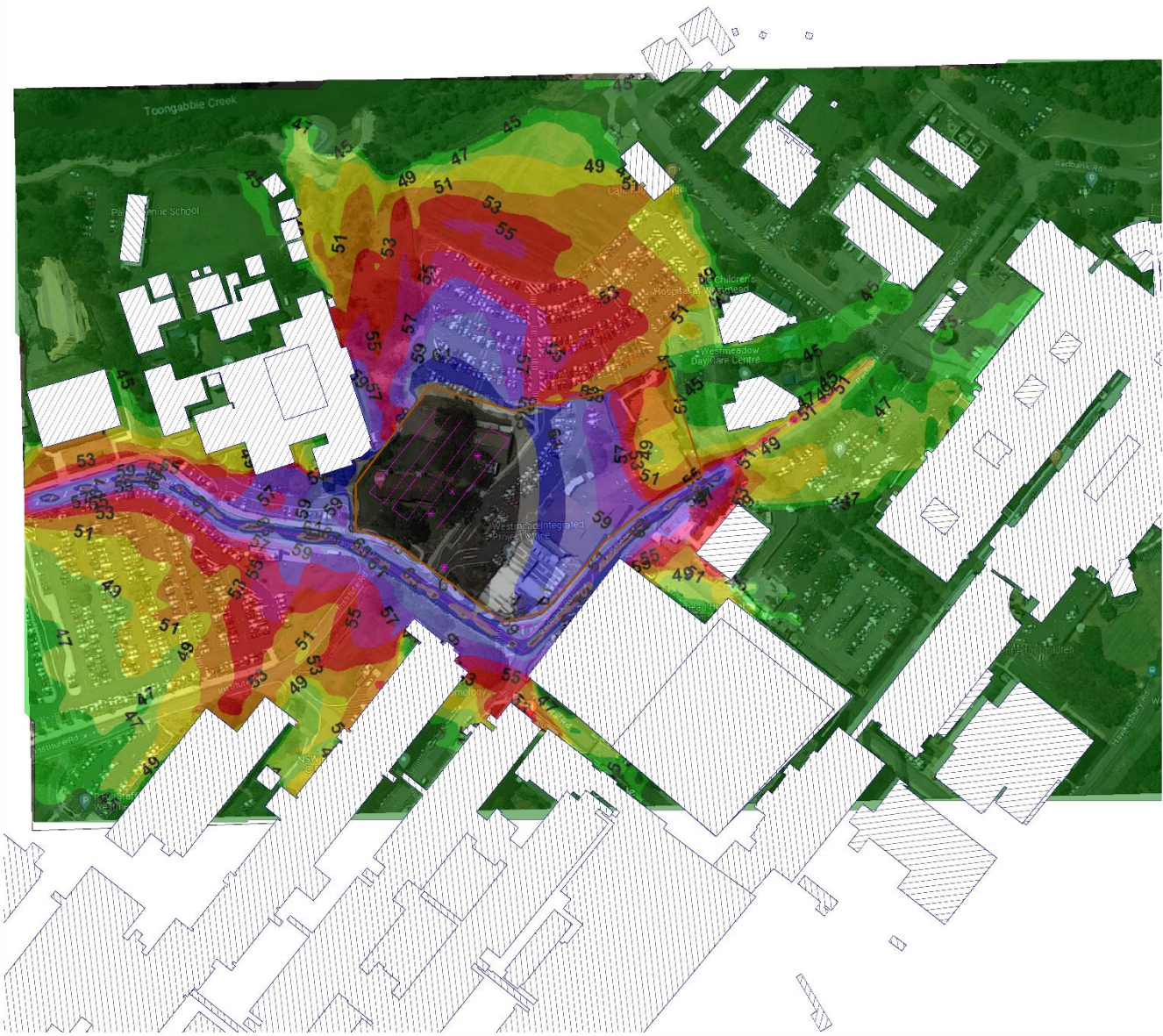
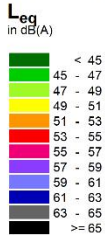
## Construction Noise Prediction

### Demolition (Scenario 1)

- Large excavators
- Dozer
- Positracks
- Large trucks
- Hand jackhammers
- Street sweeper
- Mobile Decontamination units
- Piling rig-bored
- Concrete pump

Prepared by: P. Feng  
Date: 23/08/2023

### Noise Level





# Westmead Hospital IMHC Early Works

## Construction Noise Prediction

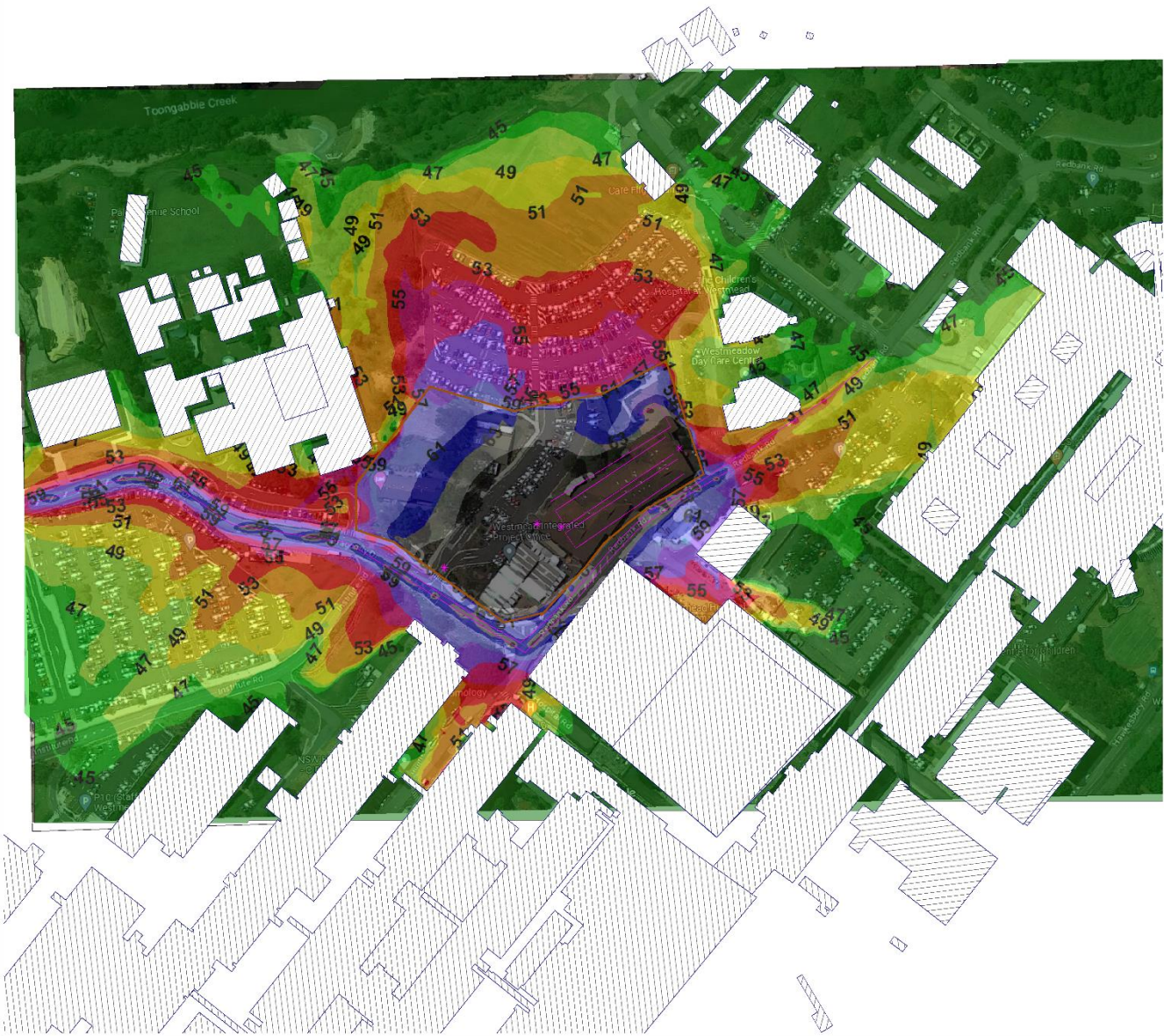
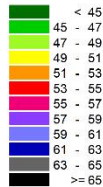
### Demolition (Scenario 2)

- Large excavators
- Dozer
- Positracks
- Large trucks
- Hand jackhammers
- Street sweeper
- Mobile Decontamination units
- Piling rig-bored
- Concrete Pump

Prepared by: P. Feng  
Date: 23/08/2023

### Noise Level

$L_{eq}$   
in dB(A)



# Westmead Hospital IMHC Early Works

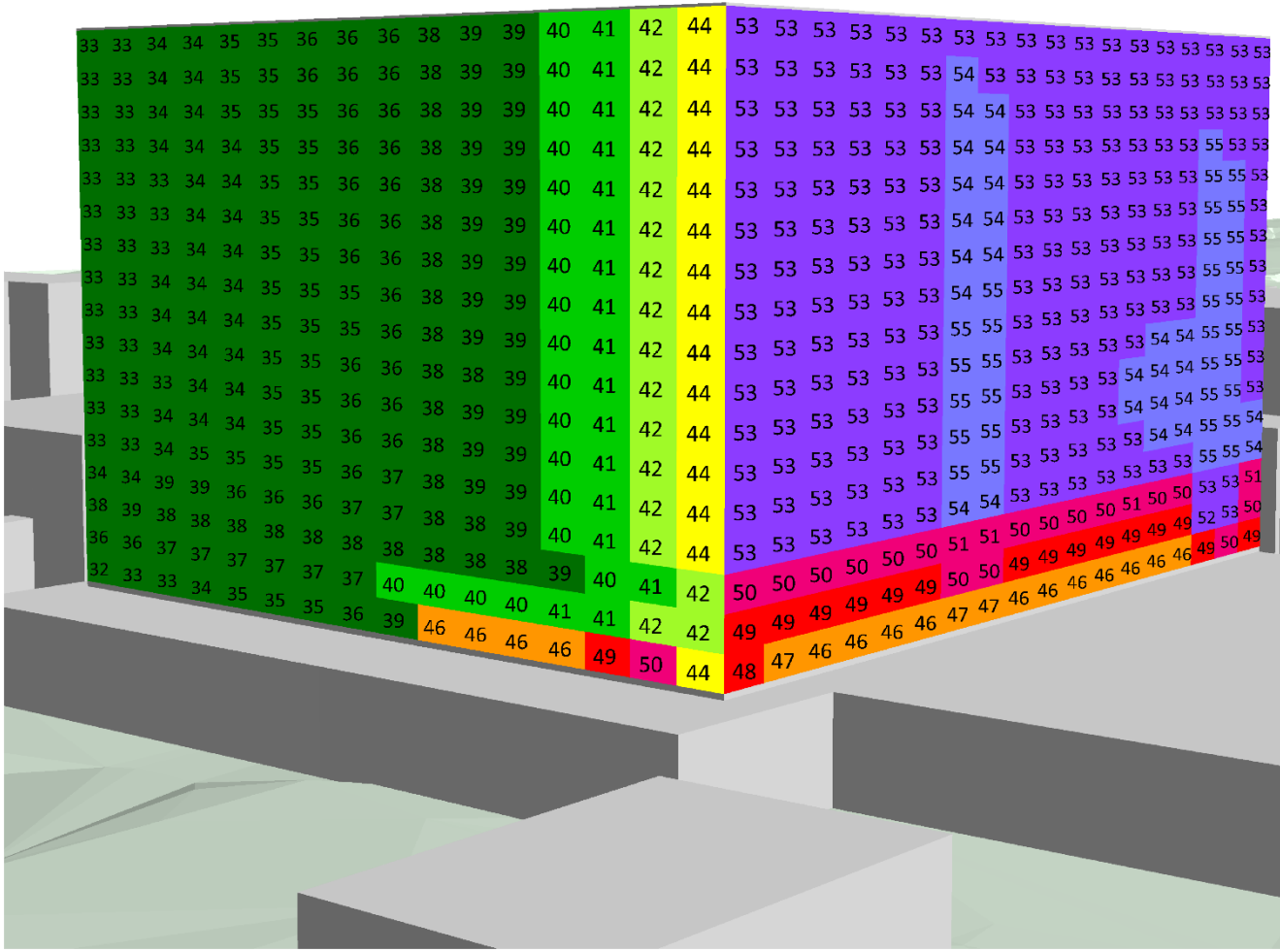
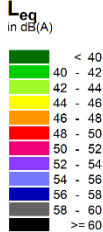
## Construction Noise Prediction

### Demolition (Scenario 1)

- Large excavators
- Dozer
- Positracks
- Large trucks
- Hand jackhammers
- Street sweeper
- Mobile Decontamination units
- Piling rig bored
- Concrete pump

Prepared by: P. Feng  
Date: 21/08/2023

### Noise Level



# Westmead Hospital IMHC Early Works

## Construction Noise Prediction

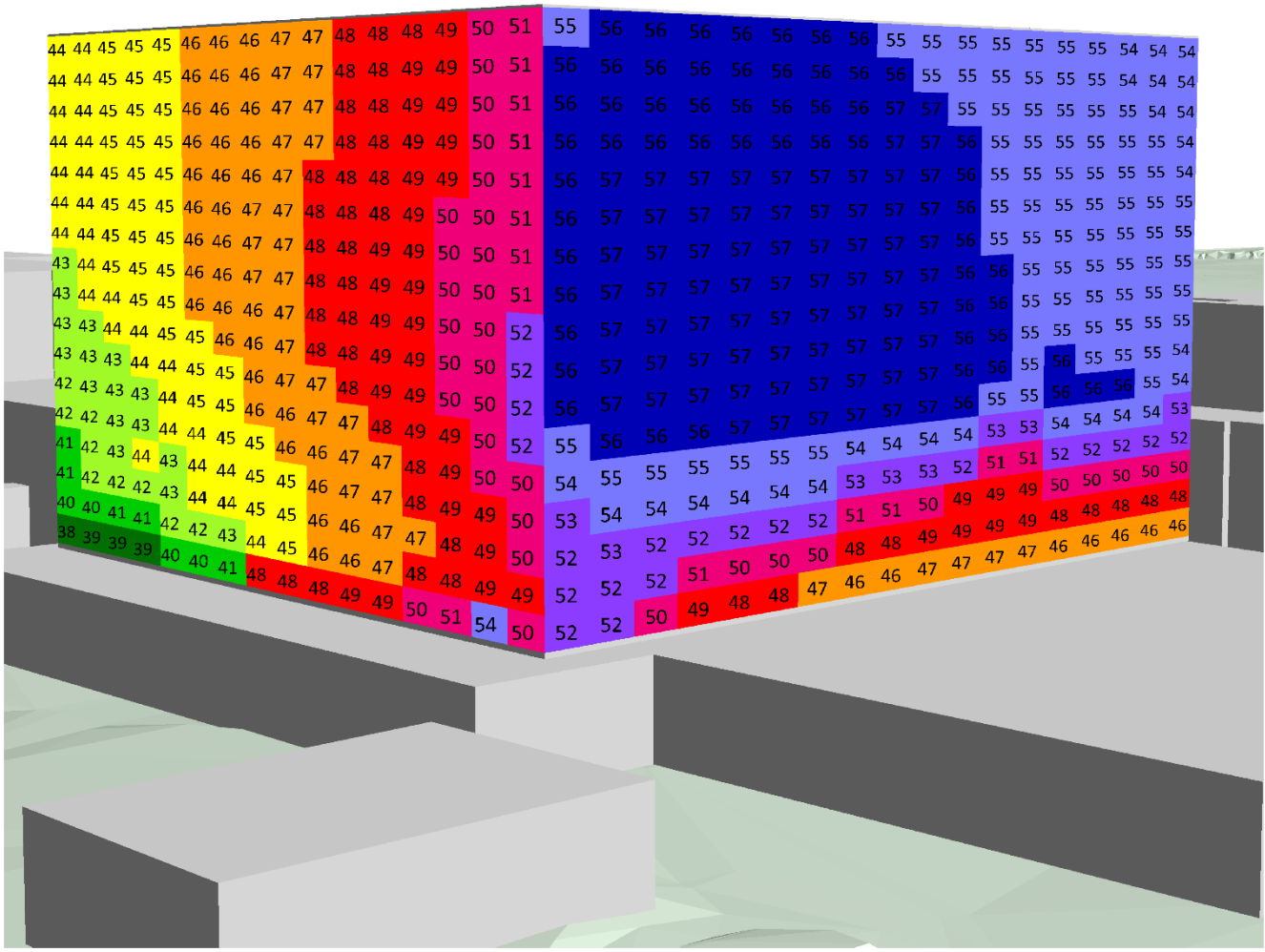
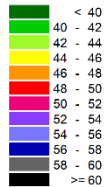
### Demolition (Scenario 2)

- Large excavators
- Dozer
- Positracks
- Large trucks
- Hand jackhammers
- Street sweeper
- Mobile Decontamination units
- Piling rig-bored
- Concrete pump

Prepared by: P. Feng  
Date: 21/08/2023

### Noise Level

$L_{eq}$   
in dB(A)



### 7.3 DISCUSSION – NOISE

Predicted construction noise levels to surrounding receivers, as presented above, are summarised and discussed below:

With respect to receivers external of the hospital site (R1-R4), noise management levels will typically not be exceeded given the distance to site and, in most cases, screening provided by surrounding hospital buildings.

During phase 1 there is potential for noise management levels to be exceeded occasionally at receivers H1 & H2 during noisy works, however, NMLs are not expected to be exceeded for remaining phases and activities given that these receivers are single storey and receive the full benefit screening provided by the site barriers.

The highest noise levels are likely to be generated during the demolition stage and will have the most impact on receivers H3 and H4, the CASB and future PSB buildings respectively. However, given that these buildings have a fixed façade, it is expected that the internal noise management levels will be met.

Given that noise levels are not expected to exceed NMLs for the majority of the works, no additional mitigation measures are indicated beyond the REF requirements and best practice as detailed in this plan. Notwithstanding, all works should be carried out in accordance with this plan to ensure noise impacts to surrounding receivers are minimised.

## 8 GROUND VIBRATION IMPACTS

Given the distance of the development site from residential receivers to the north, vibration levels are highly unlikely to exceed structural damage or amenity vibration criteria at these locations.

The greatest risk of vibration to nearby buildings within the hospital site will occur from (in order of likely significance):

- Excavation using excavator mounted hydraulic hammers.
- Ground compaction.
- Interface works with other buildings.
- Piling.
- Ripping using bulldozer mounted rippers.
- Dropping of demolished structure.

The prediction of actual vibration levels is difficult because receiver vibration levels are affected by a number of factors including the vibration force imparted, sub-soil propagation conditions, building footings and building structural design.

Vibration monitoring of these activities is recommended in the event of complaints or concern for structural damage to nearby buildings or vibration sensitive equipment is identified close the working area.



## **8.1 SAFEGUARDS TO PROTECT SENSITIVE STRUCTURES & EQUIPMENT**

It is impossible to predict the vibrations induced by the excavation/construction operations on site at potentially affected receivers. This is because vibration level is principally proportional to the energy impact which is unknown nature of terrain in the area (type of soil), drop weight, height etc.

In locations where sensitive equipment is housed within nearby buildings (i.e CASB), the specific location and applicable vibration criteria are to be advised to the project acoustic/vibration consultant.

## **8.2 VIBRATION MONITORING**

Vibration monitoring is recommended for areas in the hospital where sensitive equipment is located or in the event of complaints or concern of operation of the sensitive equipment.

The monitors are proposed to be fitted with GSM modem and remotely signal up to five mobile phones indicating any exceedance of the prescribed vibration criteria to enable immediate notification to be sent to the contractor when vibration thresholds are approached.

Whilst it is impossible to predict the vibrations induced by the excavation/construction operations on site at potentially affected receivers, the total vibration emissions are to be limited with real-time alarm notification given to the plant operators. Based on feedback from the real-time monitoring system, the plant operators will be able to modify their operations to ensure the vibrations are kept within acceptable limits.

### **8.2.1 Vibration Monitoring Download**

Downloading of the vibration logger will be conducted on a regular basis. In the event exceedance of vibration criteria or alarms occur, downloading of the logger will be conducted more frequently. Results obtained from the vibration monitor will be presented in a graph format and will be forwarded to the client for review. It is proposed that reports are provided fortnightly with any exceedance in the vibration criteria reported as detailed in this report.

### **8.2.2 Vibration Monitoring Reports**

A fortnightly report will be submitted to the client via email summarising the vibration events. The vibration exceedance of limit is recorded the report shall be submitted within 24 hours. Complete results of the continuous vibration logging will be presented in fortnightly reports including graphs of collected data.

## **9 SPECIFIC NOISE CONTROLS**

### **9.1 STATIC PLANT**

If required, additional noise reduction can be achieved by erecting solid barriers around static plant such as diesel generators and any stationary concrete pumps.

### **9.2 PUMPS, PILING PLANT**

Noise from pump plant and piling rigs have the potential to result in intermittent exceedances of allowable noise levels. Screw piling is recommended above hammer or vibro-piling which pose greater risk of exceeding vibration criteria and noise management levels.

Concrete/water pumps should not be operated prior to 7:30 am and be placed as close as possible to the middle of the site (where feasible) to reduce proximity to the nearby receivers or otherwise near to site boundary barriers which will also maximise noise reduction from screening.

### **9.3 VIBRATORY ROLLERS & COMPACTORS**

We recommend that only non-vibratory rollers be used on site. If alternative plant selections are not practicable, the use of this plant is only to be accepted where vibration measurements confirm compliance with DIN 4150-3 and EPA criteria prior to the use.

### **9.4 ACOUSTIC BARRIERS**

The placement of barriers at the source is generally only effective for static plant (i.e. diesel generators). Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source. Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

Screens around work areas will provide little material benefit for receivers at higher levels as these will overlook screening. This is most relevant when considering noise to CASB (H3). Notwithstanding, a barrier is required at boundaries separating site from Childcare receivers (H2) and Redbank School/House (H1) to reduce noise impacts at these locations.

Where high noise producing works are expected to occur at the satellite work site 'Carpark access ramp' for extended periods, consideration is to be given for installing a solid barrier at the adjacent childcare facility boundary.

Barriers are used to provide shielding and do not act as an enclosure. The material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier screening. In this case, the use of a material such as 'Flexshield Sonic Curtain' or equivalent performing product may be used for barrier screening.

## **9.5 OTHER ACTIVITIES**

In the event of complaint, noise management techniques identified in this report should be employed to minimise the level of noise impact if management levels are found to be exceeded. This may include additional community consultation and re-scheduling of loud construction processes.

Notwithstanding above, general management techniques and acoustic treatments are included in Section 9.6 which may be implemented on a case-by-case basis to reduce noise emissions to surrounding receivers.

## **9.6 GENERAL RECOMMENDATIONS**

Other noise management practices which may be adopted are discussed below. In addition, notification, reporting and complaints handling procedures should be adopted as recommended in this report.

### **9.6.1 Treatment of Specific Equipment**

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

### **9.6.2 Material Handling**

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

### **9.6.3 Selection of Alternate Appliance or Process**

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying out this activity by use of bulldozers ripping and/or milling machines lower levels of noise will result.

### **9.6.4 Establishment of Site Practices**

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers. Construction vehicles accessing the site should not queue in residential streets and should only use the designated construction vehicle routes. Loading of these vehicles should occur as far as possible from any sensitive receiver.

### **9.6.5 Management Training**

All site managers should be aware of noise and vibration limits, applicable control measures and methods. They should ensure that all agreed noise and vibration measures are carried out by employees and sub-contractors.

A copy of the Noise Management Plan is to be available to contractors, and site inductions should detail the site contact in the event of noise complaints.

### 9.6.6 Consultation with Affected Parties

Consultation with the hospital is required as per Condition 24.1 'Noise Measures' to determine noise sensitive areas and times. Works program should take this into account where feasible.

*'During preparation of the construction program, consult with the hospital to determine what areas (if any) of the hospital is particularly noise sensitive, and at what time (ward rooms, operating theatres, etc).'*

In addition, consultation with Westmead Hospital (particularly the CASB and PSB) is recommended in order to determine locations of sensitive equipment that may require vibration monitoring.

Ongoing communication with the affective parties can in many cases resolve potential conflicts, with the parties working together. An understanding of the constraints, the available mitigation, period of noise impact can in many cases minimise adverse community reaction.

### 9.6.7 Time Management

When operating close to sensitive receivers, activities may be able to be scheduled to avoid critical periods during the day. Respite periods can also be used when highly affected management levels are exceeded and there is no other reasonable or feasible management available.

### 9.6.8 Noise Monitoring

Noise monitoring can be undertaken to determine the effectiveness of measures which are been implemented, whilst the results of monitoring can be used to devise further control measures.

Attended noise measurements can be undertaken at key stages when particularly noise generating activities are undertaken or specific items of plant are in operation.

Attended noise measurements are to be conducted in accordance with Australian Standard AS1055: 2018 'Acoustics- Description and measurement of environmental noise', and should include the following:

- Type 1 or 2 sound meter (calibrated)
- Use of appropriate noise descriptor (in this case,  $L_{eq(15min)}$ ).
- Detail of measurement position and proximity to reflecting surface if any (building or similar). Measurement positions will typically be a residential property boundary.

Monitoring should not be conducted under adverse weather conditions. The conditions applying at the time of the measurements should be indicated in the reporting.

### 9.6.9 Vibration Monitoring

Vibration monitoring should be carried out in the event of complaints or concern for structural damage to nearby buildings or vibration sensitive equipment located close the proposed work during demolition, and excavation until which time it can be determined there is no further risk for vibration criteria exceedance. This would be determined by the project acoustic/vibration consultant or other suitably qualified vibration expert.

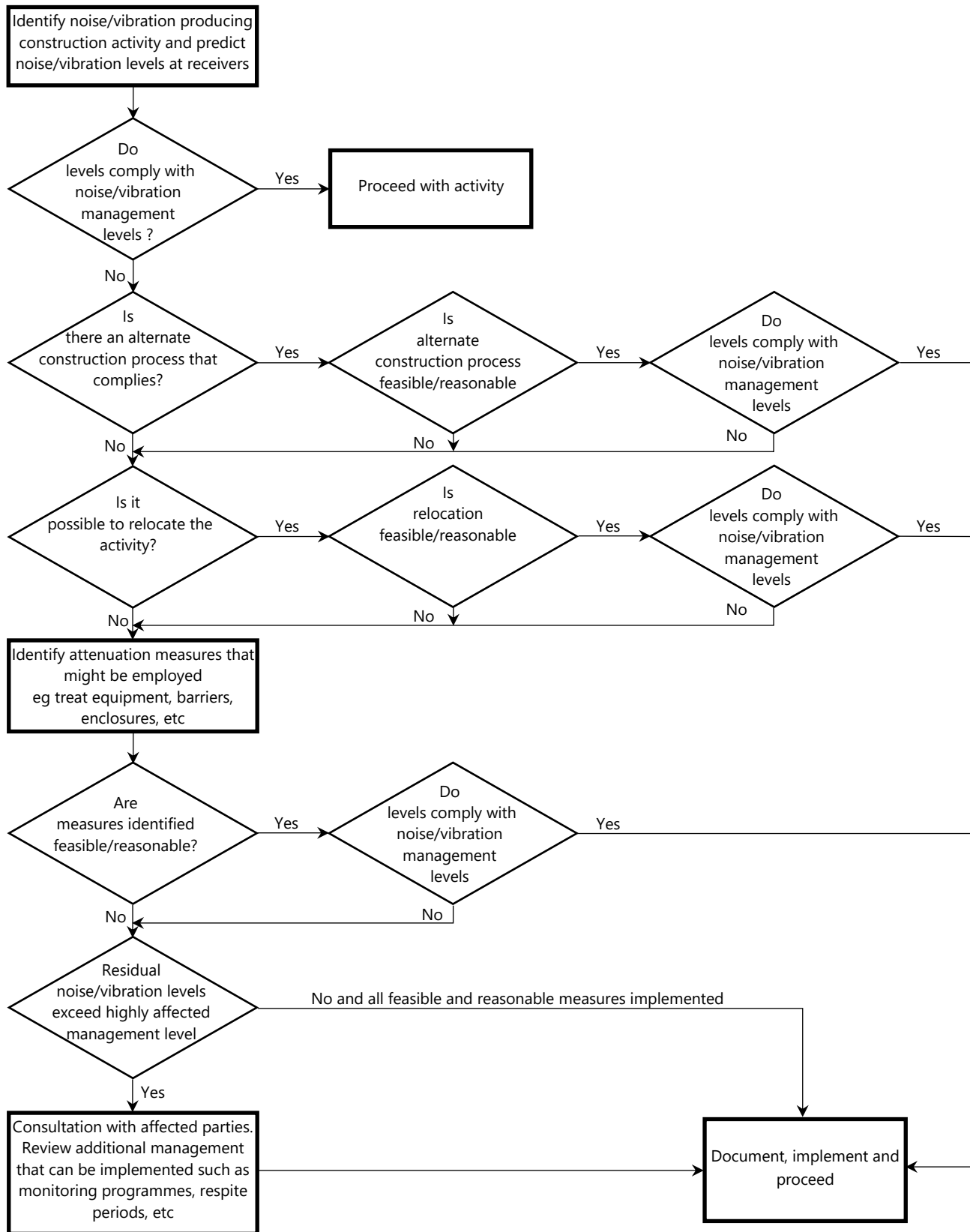
The monitoring locations should be near the middle of the common boundary between the two properties, or as otherwise determined from time to time to best measure representative vibration levels. The monitor used should log the peak particle velocities and also transmit SMS warnings to the contractor and acoustic expert if a pre-determined threshold is exceeded. Regular reports should be provided (twice monthly) showing the vibration levels recorded and comparing these to the criteria.

Attended or unattended monitoring should also be undertaken at other locations in response to complaints, or as needed to confirm the use of additional plant/processes with the potential to exceed vibration criteria.



## 9.7 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that should be followed in assessing construction activities.



## 9.8 DEALING WITH OFFENSIVE NOISE LEVELS

Should ongoing complaints of excessive noise occur, immediate measures shall be undertaken to investigate the complaint, the cause of noise exceedances and identify the required changes to work practices.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

All complaints or offensive noise received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of offensive noise shall involve where applicable:

- noise measurements at the affected receiver.
- an investigation of the activities occurring at the time of the incident.
- inspection of the activity to determine whether any undue noise is being emitted by equipment.
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

## 10 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

### 10.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continuous communication is required between all parties, which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation process is to:

- Inform and educate the groups about the project and the noise controls being implemented.
- Increase understanding of all acoustic issues related to the project and options available.
- Identify group concerns generated by the project, so that they can be addressed; and
- Ensure that concerned individuals or groups are aware of and have access to the Site Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular scheduled meetings will be required for a finite period, until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generate higher noise/vibration levels.

For receivers within the hospital site, consultation is to be undertaken with the relevant government organisations and surrounding stakeholders.

## 10.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration occur, immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. In the case of exceedances of the vibration limits all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Setup vibration monitoring system at the location represents the nearest vibration receiver location with alarm device which can inform the project manager on site if the vibration exceedance happened.
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of a complaint shall involve where applicable;

- noise measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

## 11 CONTINGENCY PLANS

Where non-compliances or noise complaints are raised the following methodology will be implemented.

1. Determine the offending plant/equipment/process.
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc. where practical.
4. Selecting alternative equipment/processes where practical
5. Setup noise monitoring devices at locations represent nearest noise receivers and provide noise data for each complain time period. Analysis is required and determine suitable noise mitigation measures.

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

## 12 CONCLUSION

This document presents the updated construction noise and vibration management plan for construction activities associated with IMHC Early Works Project at Westmead Hospital, based on the requirements outlined in the REF decision.

The principal issues which addressed in this report are:

- Specific activities that will be conducted and the associated noise/vibration sources;
- Identification of potentially affected noise/ vibration sensitive receivers;
- The development, hours of work and excavation period;
- The construction noise and vibration requirements specified in development conditions of consent;
- Noise/ vibration response procedures;
- Assessment of potential noise/ vibration from the proposed construction activities; and
- Contingency plans to be implemented in the event of non-compliances and/or noise complaints.

The assessment of noise indicates that construction activities associated with the project development are unlikely to generate noise levels that will require additional management, beyond the requirements of the REF consent conditions. Notwithstanding, adoption of the controls detailed in Section 9 of this report will ensure that noise impacts to surrounding receivers will be minimised.

Vibration goals have also been set in this report to minimise structural damage risk for existing structures close to the project site and to protect human comfort. Consultation with the hospital is to take place prior to the commencement of works to determine vibration requirements for sensitive equipment.

Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd