



# CONSTRUCTION NOISE & VIBRATION MANAGEMENT SUB-PLAN

POWERHOUSE - MUSEUM DISCOVERY CENTRE  
NEW CARPARK WORKS

172 Showground Road,  
Castle Hill NSW 2154

Simmons Civil Contracting  
Attention: Marc Jamieson  
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MONITORING PERIOD


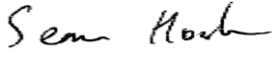

16<sup>th</sup> – 23<sup>rd</sup> June 2021

CONTRACT NO. C21 8606  
REPORT NO. EMS21 8850

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# 1 Introduction

## 1.1 Project Description

Environmental Monitoring Services Pty Ltd was engaged by Simmons Civil Contracting to provide a Construction Noise & Vibration Management Sub-Plan prior to the demolition of the existing carpark and vehicle accessway along the eastern parts of the site and for the construction of a new at-grade carpark to be constructed on the eastern side of the TAFE site accommodating 24 car parking spaces for the Powerhouse MDC, 172 Showground Rd, Castle Hill (the site).

The project will begin with the clearing of the site and tree removal, followed by the laying of base course with installation of the kerbs and gutters, followed by the final laying of the asphalt along with all necessary final clean-up and any remaining miscellaneous works. Works are proposed to be carried out over 6 consecutive weeks with all works to occur during daytime hours.

The purpose of this plan is to provide procedures to prevent excessive noise being emitted from the onsite works which may cause unreasonable loss of amenity to nearby receivers.

This report will include noise impact predictions based on the sound power level of the proposed onsite plant, tools and equipment for the project and their distance to nearby noise receivers. The purpose of these predictions is to serve as a guideline in preparing suitable noise controls needed for the project.

Recommendations for noise & vibration criteria for the project will be established under the guidance of the Department of Planning, Industry and Environment (DPIE) consent conditions for the site (SSD 10472, 2021), the Acoustic Report for SSDA (Ref: SY181569-AUR01) prepared for the site by Northrop in February 2021, the NSW Department of Environmental & Climate Change (DECC) publication *Interim Construction Noise Guideline* and the NSW Environmental Protection Authority (EPA) *Noise Policy for Industry (NPfI)*.

## 1.2 Site Location and Noise Receivers

The Powerhouse MDC area of the site is located on the western side of the block bounded by residential property to the north, Windsor Road to the west, Showground Road to the south and Green Road to the east. On the eastern side of the block is the TAFE NSW – The Hills campus. This report pertains to the construction of the new carpark area to the east of the TAFE building.

Table 1.1 below details the most affected receivers adjacent to the site.

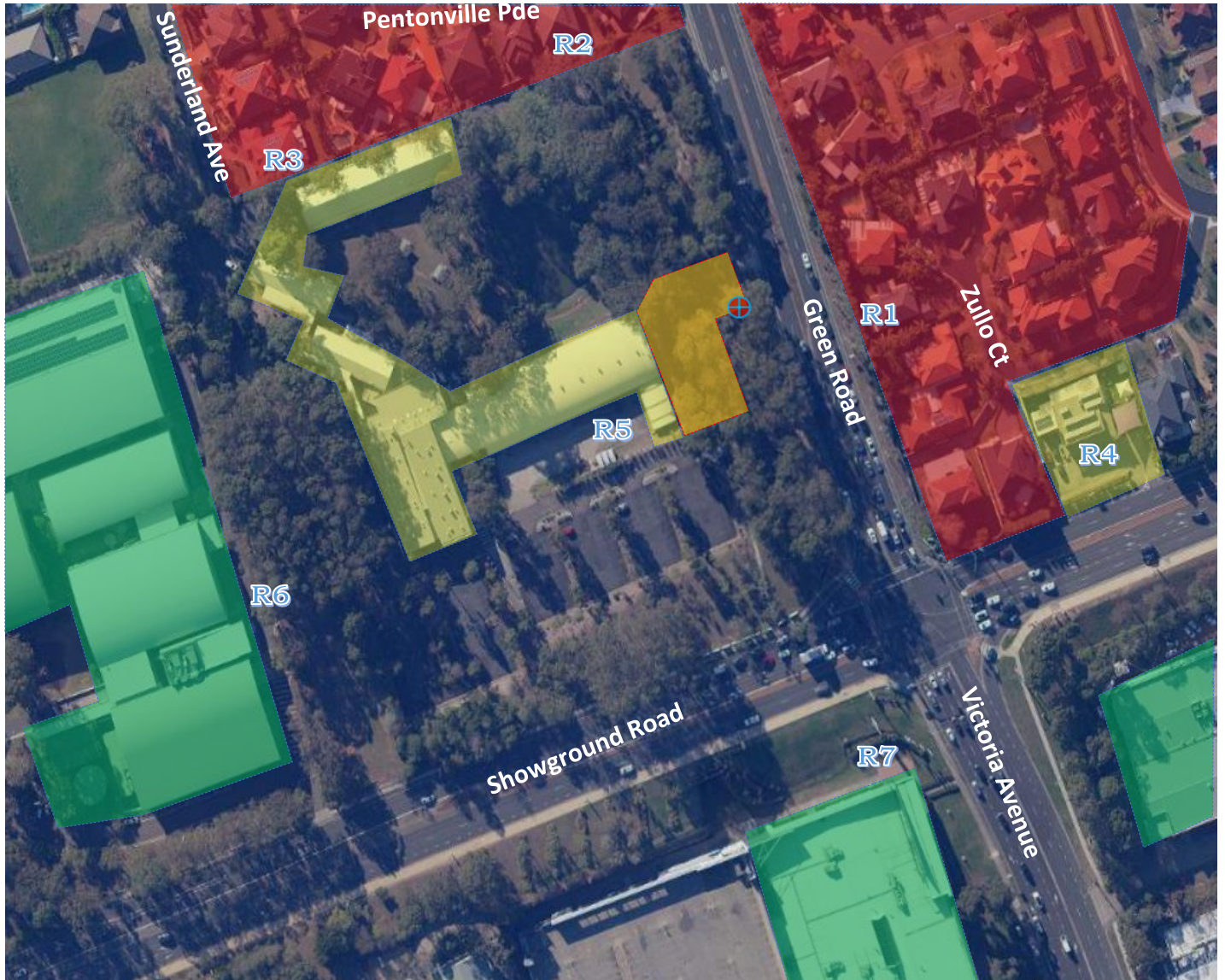
**Table 1.1 – Noise receivers surrounding the site**

Receiver	Address	Description
R1	20 Zullo Circuit	Two storey residential dwelling
R2	80 Pentonville Parade	Two storey residential dwelling
R3	10 Sunderland Ave	Two storey residential dwelling
R4	170 Showground Road	One storey commercial building - (Just For Kids Childcare)
R5	Cnr Showground and Green Rds.	TAFE NSW - The Hills campus – Buildings D & F
R6	172 Showground Road	Museum Discovery Centre
R7	16-18 Victoria Avenue	Hills Super Centre



Figure 1.1 below outlines the site's location and the nearby noise receivers.

**Figure 1.1 – Site Layout and Noise Receivers**



Map Source: SIX Maps



Legends

- Work Site
- Residential Receiver
- Commercial Receiver
- Educational Receiver
- + Noise Monitor Location
- R1 ... Noise Receiver Locations

Site Address: 172 Showground Road,  
 Castle Hill NSW  
 Contract No.: C21 8606  
 Report No.: EMS21 8850

## 2 Noise Monitoring

### 2.1 Background Noise Measurement

Unattended noise monitoring was conducted at the site between 9:00am 16<sup>th</sup> and 8:30am 23<sup>rd</sup> of June 2021, using an ARL 215 noise logger (serial number: 194461), to establish the Rating Background Level (RBL) for the immediate area surrounding the site. The noise logger was field calibrated prior to and after monitoring, and no significant drift was found.

Rating Background Level for the site and for the establishment of a relevant noise criterion. This statistical measurement  $L_{A90}$  is the sound pressure level measurement that is exceeded for 90% of the measurement period.

The noise logger also collected the  $L_{Aeq}$ ; this represents the level of noise equivalent to the energy average of noise levels occurring over a measurement period. The  $L_{A10}$  was also obtained; this is the sound pressure level that is exceeded for 10% of the measurement period.

## 3 Monitoring Results

### 3.1 Background Noise Results

Table 3.1 outlines the  $L_{A90}$  background noise measurement results collected from the noise monitor located at the carpark of 172 Showground Road, Castle Hill. Rain affected noise data was excluded from the calculations as determined by Bureau of Meteorology's Sydney Olympic Park Automatic Weather Station (AWS).

The wind speeds at the microphone height were calculated from the same BOM weather station data using the method described in a paper titled "Converting Bureau of Meteorology wind speed data to local wind speeds at 1.5m above ground level".

**Table 3.1 –  $L_{A90}$  Background Noise Measurement and Rating Background Level**

	16 <sup>th</sup> Jun	17 <sup>th</sup> Jun	18 <sup>th</sup> Jun	19 <sup>th</sup> Jun	20 <sup>th</sup> Jun	21 <sup>st</sup> Jun	22 <sup>nd</sup> Jun	RBL
Day $L_{A90}$	-	54	53.5	55.5	53	53.5	53.5	<b>54</b>
Evening $L_{A90}$	50.3	52	53.5	50	47.8	48.5	49.5	<b>50</b>
Night $L_{A90}$	34.5	36	37.8	38	35.5	34.5	32.8	<b>36</b>

During the daytime site inspection, it was observed that the dominant noise source was road traffic noise emissions from Green and Showground Roads.

Appendix B of this report shows the time trace of the logged background noise data.

## 4 Relevant Criteria

### 4.1 Department of Planning, Industry and Environment

The development consent from the Department of Planning, Industry and Environment for the expansion of the Museums Discovery Centre (MDC), which includes the demolition of the existing carpark and construction of a new one, notes the following Hours of Construction and Construction Noise and Vibration Management conditions:

#### HOURS OF CONSTRUCTION

- C6. Construction, including the delivery of plant, equipment and any materials to and from the site, may only be carried out between the following hours:
- (a) between 7 am and 5 pm, Mondays to Fridays inclusive; and
  - (b) between 8 am and 1 pm, Saturdays.
  - (c) No work may be carried out on Sundays or public holidays.
- C7. Construction activities may be undertaken outside of the hours in Condition C6:
- (a) if required by the Police or a public authority for the delivery of vehicles, plant or materials; or
  - (b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or
  - (c) where the works are inaudible at the nearest sensitive receivers.
- C8. Notification of such construction activities as referenced in Condition C7 must be given to affected residents before undertaking the activities or as soon as is practical afterwards.
- C9. Rock breaking, rock hammering, sheet piling, piledriving and similar activities may only be carried out between the following hours:
- (a) 9.00 am to 12.00 pm, Monday to Friday;
  - (b) 2.00 pm to 5.00 pm, Monday to Friday; and
  - (c) 9.00 am to 12.00 pm, Saturday.

#### CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

- C11. The development must achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009). 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 CEMP and CNVMP.
- C12. If the noise from a construction activity is substantially tonal or impulsive in nature, 5 dB(A) must be added to the measured construction noise level when comparing the measured noise with the construction noise management levels.
- C13. Heavy vehicles and oversized vehicles must not queue or idle on surrounding local roads outside of construction zones.

- C14. The Applicant must schedule intra-day 'respite periods' for construction activities predicted to result in noise levels in excess of the "highly noise affected" levels, including the addition of 5 dB to the predicted levels for those activities identified in the Interim Construction Noise Guideline.
- C15. Where sensitive receivers may be affected, piling activities are to be completed using bored piles. If driven piles are required, they must only be installed where outlined in the CEMP.
- C16. Vibration caused by construction at any residence or structure outside the subject site must be limited to:
- for structural damage vibration to buildings (excluding heritage buildings), *British Standard BS 7385 Part 2-1993 Evaluation and Measurement for Vibration in Buildings*
  - for human exposure to vibration, the evaluation criteria presented in *British Standard BS 6472- Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80 Hz)* for low probability of adverse comment
  - the above limits, unless otherwise outlined in the CEMP.
- C17. Any noise generated during the construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act 1997 or exceed noise limits for the site.
- C18. The Applicant must ensure that any work generating high noise impact (i.e. work exceeding a NML of  $L_{Aeq} 75dBA$ ) as measured at the sensitive receiver must only be undertaken in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers. For the purposes of this condition 'continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work the subject of this condition.

## 4.2 DECC Interim Construction Noise Guideline

The Noise Criteria will be in compliance with the Department of Environment and Climate Change's *Interim Construction Noise Guideline* is aimed to manage noise from construction work. The main objectives of the guidelines are:

- To protect the majority of residences and other sensitive land uses from noise pollution most of the time;
- Identify and minimise noise from construction works;
- Applying 'feasible' and 'reasonable' work practices to minimise construction noise; and
- Encouraging construction to be undertaken only during least sensitive noise periods.

Table 4.1 below outlines the Noise Criteria for the residential properties near the construction site calculated from the Rating Background Level gathered during the noise monitoring period.

Below this Table 4.2 displays the internal and external noise criteria for sensitive land use properties. Table 4.3, further down, outlines the noise criteria for commercial and educational premises.



## Residential Premises

**Table 4.1 – Applicable Noise Criteria – Residents surrounding work site**

Time of Day	Management Level <i>L</i> <sub>Aeq, 15 mins</sub>	How to Apply
<b>Standard Hours as approved by DPIE:</b>  Monday to Friday 7:00 am to 5:00 pm  Saturday 8:00am to 1:00pm  No work on Sundays or public holidays	Noise Affected RBL + 10 dB  Based on monitored levels, project specific management level is  <b>Daytime:</b> <b>07:00 – 17:00 (M-F)</b> <b>08:00 – 13:00 (Sat)</b>  <b>64 dB(A)</b>	The noise affected level represents the point above which there may be some community reaction to noise.  1. Where the predicted or measured <i>L</i> <sub>Aeq (15 min)</sub> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.  2. 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  <b>75 dB(A)</b>	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.
<b>Outside recommended standard hours:</b>	Noise Affected RBL + 5dB  <b>Evening: 18:00 – 22:00</b> <b>55 dB(A)</b>  <b>Night: 22:00 – 07:00</b> <b>41 dB(A)</b>	<ul style="list-style-type: none"> <li>• A strong justification would typically be required for works outside the recommended standard hours</li> <li>• The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> <li>• Where all feasible and reasonable practices have been applied and noise is more than 5dB (A) above the noise affected level, the proponent should negotiate with the community.</li> </ul>

## Sensitive Land Use Premises

Table 4.2 displays the internal and external noise criteria for sensitive land use properties.

**Table 4.2 – Noise Criteria at Sensitive Land Use Premises**

Land Use	Noise Management Level $L_{Aeq}(15 \text{ minute})$
<b>Classrooms at schools and other educational institutions (including childcare centres)</b>	<b>Internal Noise Level 45 dB(A) External Noise Level 65 dB(A)*</b>
Hospital wards and operating theatres	Internal Noise Level 45 dB(A) External Noise Level 65 dB(A)*
Place of Worship	Internal Noise Level 45 dB(A) External Noise Level 65 dB(A)*
Active recreation areas (characterised by sporting activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External Noise Level 65dB (A)
Passive recreation area (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation etc.)	External Noise Level 60dB (A)

\* EMS assumes a noise reduction of 20 dB(A) across the closed façade for educational institutions, hospitals and religious receivers.

## Commercial and industrial premises

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories, outlined below in Table 4.3. The external noise levels should be assessed at the most-affected point within 50 m of the area boundary.

**Table 4.3 – Noise Criteria at Commercial Premises**

Land Use	Noise Management Level $L_{Aeq}(15 \text{ minute})$
Industrial premises	External Noise Level 75dB (A)
<b>Offices, retail outlets</b>	<b>External Noise Level 70dB (A)</b>
Other businesses that may be very sensitive to noise. Where the noise level is project specific the proponent should undertake a special investigation to determine suitable noise levels on a project-by-project basis; the recommended 'maximum' internal noise levels in AS 2107 Acoustics – <i>Recommended design sound levels and reverberation times for building interiors</i> may assist in determining relevant noise levels.	

### 4.3 Vibration Criteria

The effects of vibration can be divided into concerns over structural damage and human annoyance. This section will outline the relevant vibration criteria for the two concerns.

#### 4.3.1 Structural Damage Criteria

The Acoustic Report for SSDA (Ref: SY181569-AUR01) prepared for the site by Northrop in February 2021 makes reference to the German DIN4150 standard with regards to the damage to dwellings criteria.

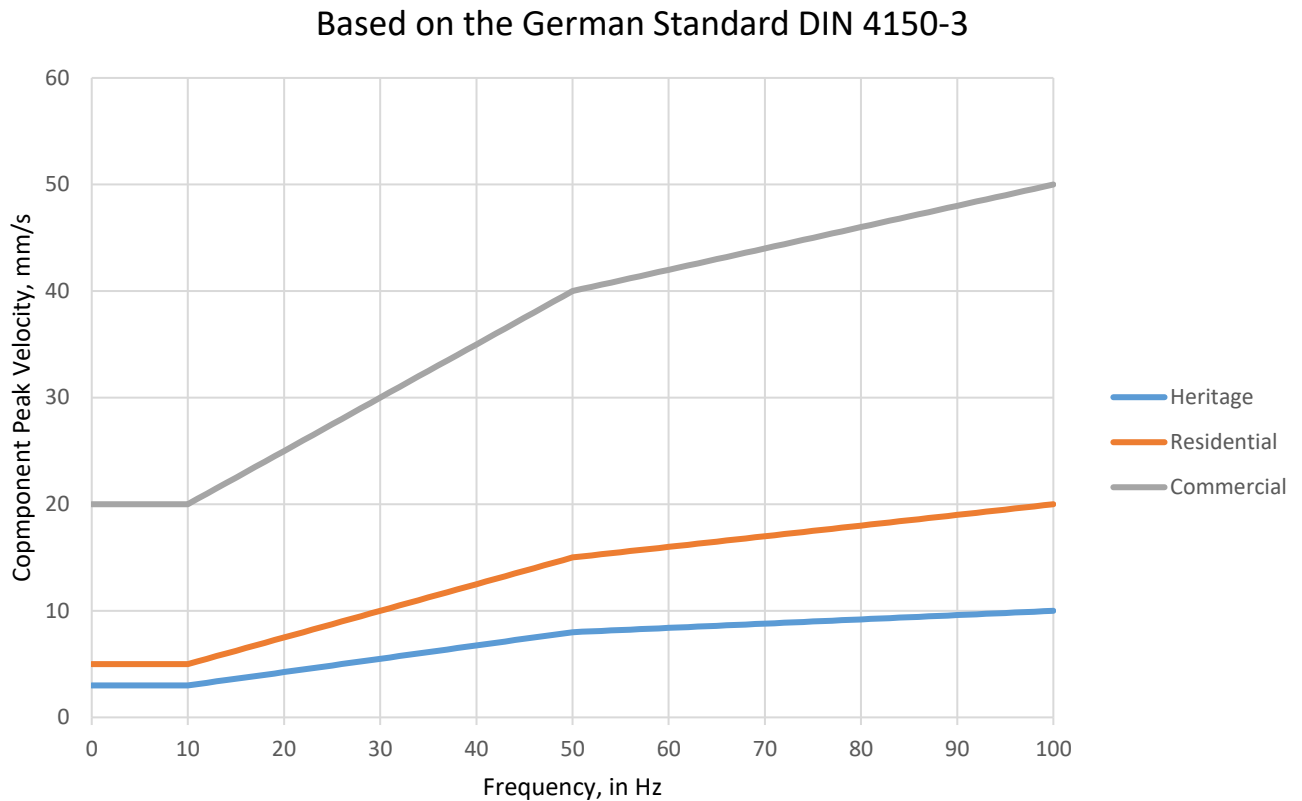
The German Standard DIN 4150-3 (2016) – *Effects of vibration on structures* (below) gives structural damage vibration criteria for vibration affected buildings based on the type of building occupancy and frequency or vibration.

Table 4.4 below gives a guideline value for short term vibration velocity at the foundation. Short term vibration is classified as vibrations which do not occur often enough to cause structural fatigue.

**Table 4.44 – Structural Damage – Short Term Vibration (mm/s)**

Type of Structure	Velocity values in mm/s at the foundation at a frequency of			Plane of floor of uppermost storey
	Less than 10Hz	10-50Hz	50-100Hz	All frequencies
<b>Building use for commercial purposes, industrial buildings and buildings of similar design</b>	<b>20</b>	<b>20-40</b>	<b>40-50</b>	<b>40</b>
Dwelling and buildings of similar design and/or occupancy	5	5-15	15-20	15
Structures that because of their particular sensitivity to vibration and are of great intrinsic value (e.g. heritage listed structures )	3	3-8	8-10	8

Figure 4.1



#### 4.3.2 Human Comfort Criteria

The human annoyance vibration assessment should be undertaken using the EPA’s publication ‘Interim Construction Noise Guideline’ which states that human comfort vibration is to be measured and assessed in accordance with the EPA’s ‘Assessing Vibration: a technical Guideline’, based on the BS 6472 Standard. This standard is also referenced within the Acoustic Report for SSDA (Ref: SY181569-AUR01) prepared for the site by Northrop in February 2021.

This Guideline covers the appropriate methods and criteria for the assessment of the intrusive vibration on living and working space. The guideline describes the following:

- The characteristics of vibration and associated effects that can cause community disturbance and concern to people, in particular the occupants of buildings.
- Criteria defining values of vibration to protect amenity.
- Procedures for the measurement and evaluation of vibration values and other associated emissions.

The preferred assessment method is the Vibration Dose Value (VDV). A summary of the VDV criteria for human comfort limits are adopted from the EPA’s publication ‘Assessing Vibration: a technical Guideline and are presented in Table 4.55 below.

**Table 4.55 – Acceptable vibration dose values for intermittent vibration (m/s<sup>1.75</sup>)**

Location	Daytime		Night Time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical Areas	0.10	0.20	0.10	0.20
Residents	0.20	0.40	0.13	0.26
<b>Offices, Schools, Educational, institutions and places of worship</b>	<b>0.40</b>	<b>0.80</b>	<b>0.40</b>	<b>0.80</b>
Workshops	0.80	1.60	0.80	1.60

The EPA’s vibration publication also gives the preferred and maximum vibration limits for continuous (e.g. continuous construction or maintenance activity) and impulsive (e.g. occasional loading and unloading, or dropping of heavy equipment) types of vibration, seen below in Table 4.66.

**Table 4.66 7 – Acceptable continuous and impulsive vibration**

Location	Vibration Type	Time	RMS Acceleration (m/s <sup>2</sup> )		RMS Velocity (mm/s)		Peak Velocity (mm/s)	
			Preferred Value	Maximum Value	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical Areas	Continuous	Day- or night-time	0.005	0.01	0.10	0.20	0.14	0.28
	Impulsive							
Residents	Continuous	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
		Night-time	0.007	0.014	0.14	0.28	0.2	0.4
	Impulsive	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
		Night-time	0.1	0.2	2.0	4.0	2.8	5.6
Offices	Continuous	Day- or night-time	<b>0.02</b>	<b>0.04</b>	<b>0.4</b>	<b>0.80</b>	<b>0.56</b>	<b>1.1</b>
	Impulsive		<b>0.64</b>	<b>1.28</b>	<b>13.0</b>	<b>26.0</b>	<b>18.0</b>	<b>36.0</b>
Workshops	Continuous	Day- or night-time	0.04	0.08	0.8	1.6	1.1	2.2
	Impulsive		0.64	1.28	13.0	26.0	18.0	36.0



## 5 Predicted Noise Levels

### 5.1 Construction Noise Sources

This section will outline the proposed noise sources found in the proposed works on site and outlines the sound power level from each noise source. The Sound Power levels for each noise source was gathered from manufacturer data or were adopted from the Australian Standard 2436-2010 (R2016) – *Guide to Noise Control on Construction, maintenance and Demolition sites* and TfNSW *Construction Noise and Vibration Strategy* (version 4.1 24 April 2019).

The works are proposed to be conducted with the following plant and maximum operating times as advised by Simmons Civil Contracting listed below in Table 5.1.

**Table 5.1 – Typical Noise Sources and their Sound Power Levels**

Construction Equipment List			
Noise Source	Sound Power Level dB(A)	Data Source	% Time Operated during the 15-minute period
Pavement Profiler	117	TfNSW	75 %
1T Skidsteer Loader	110	TfNSW	70 %
Smooth Drum Roller	107	TfNSW	75 %
10T Vibratory Roller	108*	AS2436–2010:2016	75 %
Medium Rigid Truck (20T)	103	TfNSW	50 %
Bogie Truck (>20T)	107	AS2436–2010:2016	40 %
Asphalt Truck and Sprayer	106	TfNSW	90 %
Asphalt Paver	108	AS2436–2010:2016	90 %
Hand Tools (Electric)	102	AS2436–2010:2016	50 %
Concrete Saw	117*	AS2436–2010:2016	15 %
Small Excavator (8T)	100	TfNSW	50 %
Chain Saw – 4-5hp	114*	TfNSW	40 %
Tree Mulcher 40-50hp	116*	TfNSW	50 %

\* 5 dB(A) has been added to the shown SWL of these sources in accordance with C12 of the DPIE consent conditions for the site (SSD 10472, 2021) and DECC's *Interim Construction Noise Guideline* (2009).

## **5.2 Construction Scenarios**

### **Scenario 1 – Site Establishment and Clearing**

- Medium Rigid Truck (20T)
- Hand Tools (Electric)

### **Scenario 2 – Tree Removal**

- Chain Saw
- Tree Mulcher

### **Scenario 3 – Kerb Demolition**

- Excavator
- Concrete Saw

### **Scenario 4 – Profiler/Miling Machine**

- Profiler/Miling Machine
- Bogie Truck

### **Scenario 5 – Asphaltting**

- Asphalt Truck and Sprayer
- Asphalt Paver
- 1T Skidsteer Loader

### **Scenario 6 – Vibratory Rollers**

- Smooth Drum Roller
- 10T Vibratory Roller

### 5.3 Construction Noise Impact Prediction

These impact noise predictions are all conducted on the “worst case” assumption using the scenarios from Section 5.2.

Table 5.2 outlines the noise impact predictions corresponding to the nearby receiver locations as displayed in Figure 1.1.

**Table 5.2 – Predicted Noise Level at the Surrounding Noise Receivers in dB(A)**

Receivers	Predicted Noise Level dB(A) $L_{Aeq}(15\text{minute})$ (Worst-case)						Daytime NML (7am – 5pm)	
	Scenario 1 Site Establishment and Clearing	Scenario 2 Tree Removal	Scenario 3 Kerb Demolition	Scenario 4 Profiling	Scenario 5 Asphalting	Scenario 6 Vibratory Rolling		
<b>R1</b> 20 Zullo Ct	56	<b>71</b>	50	<b>70</b>	<b>67</b>	<b>66</b>	64	
<b>R2</b> 80 Pentonville Pde	50	<b>66</b>	45	64	60	60	Highly Noise Affected 75	
<b>R3</b> 10 Sunderland Ave	35	51	37	<b>56</b>	48	52	54 <sup>1</sup> Highly Noise Affected 75	
<b>R4</b> 170 Showground Rd (Just for Kids Childcare)	37	54	33	52	48	48	65	
<b>R5</b> Cnr Showground & Green Rds (TAFE NSW)	Carpentry Workshop D Block	<b>71</b>	<b>84</b>	63	<b>83</b>	<b>81</b>	<b>80</b>	70
	F Block	43	58	37	58	55	53	
<b>R6</b> 172 Showground Rd (Museum Discover Centre)	29	45	24	44	40	40		
<b>R7</b> 16-18 Victoria Ave (Hills Super Centre)	44	59	38	58	55	54		

1. The Acoustic Report for State Significant Development prepared by Northrop (Ref: SY181569-AUR01 – Rev7 12.02.2021) measured the RBL for the residential receivers adjacent to Sunderland Ave. The NML for R3 is based on the RBL presented in the Northrop report.

The noise calculations were carried out using the Acoustic Software SoundPLAN (version 8.2), with separate situations for each phase of construction.

The construction noise levels at all residential receivers, immediately to the north of the site along Pentonville Parade and to the east of the site adjacent to Green Road (having residential addresses on Zullo Ct and Hilltop Ct), were modelled with the results from the most affected property and are displayed in Table 5.2.

The SoundPLAN model included the building structures from the area surrounding the site to include the façade correction at the receiver locations and sound reflections from neighbouring buildings. All receivers were placed at the receiver building facades (apart from R4) and positioned at a height of 1.5 metres above the most affected floor level. A reflective ground surface (0.1) was applied to the hard surfaces surrounding the site and the grassed and other soft surfaces were given a 0.9 absorption coefficient.

The noise sources were placed towards the centre of the site. For Scenario 6, only the 10T vibratory roller was modelled as both rollers are not expected to be operating simultaneously during this phase.

As seen in Table 5.2, the residential receiver R1 is likely to be affected by noise levels that are above the Noise Management Level during Scenarios 2, 4, 5 and 6, R2 is predicted to exceed during Scenario 2 and receiver R3 is likely to slightly exceed the NML during Scenario 4.

The Highly Noise Affected level of 75 dB(A) is not predicted to be exceeded at the residential receivers during the daytime works.

The NML is not predicted to be exceeded at the educational and commercial receivers, apart from the D Block (TAFE NSW carpentry workshop) receiver during Scenarios 1, 2, 4, 5 and 6 due to the close proximity of the works. The remaining TAFE blocks will unlikely experience noise levels above the criteria.

Some community reaction may be expected from the residential receivers the tree removal, profiling, asphaltting works and vibratory rolling if dynamic rolling is undertaken. Implement all feasible and reasonable noise control measures.

## 6 Noise Control

The following noise mitigation plan outlined in Sections 6.1 to 6.7 should be implemented where feasible and reasonable to reduce noise levels from the project.

### 6.1 Development Consent Conditions

- C6. Construction, including the delivery of plant, equipment and any materials to and from the site, may only be carried out between the following hours:
- (a) between 7 am and 5 pm, Mondays to Fridays inclusive; and
  - (b) between 8 am and 1 pm, Saturdays.
  - (c) No work may be carried out on Sundays or public holidays.
- C13. Heavy vehicles and oversized vehicles must not queue or idle on surrounding local roads outside of construction zones.
- C14. The Applicant must schedule intra-day 'respite periods' for construction activities predicted to result in noise levels in excess of the "highly noise affected" levels, including the addition of 5 dB to the predicted levels for those activities identified in the Interim Construction Noise Guideline.
- C17. Any noise generated during the construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act 1997 or exceed noise limits for the site.
- C18. The Applicant must ensure that any work generating high noise impact (i.e. work exceeding a NML of  $L_{Aeq} 75\text{dBA}$ ) as measured at the sensitive receiver must only be undertaken in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers.

### 6.2 Best Management Practice (BMP) Noise Control

Best Management Practice (BMP) is the adoption of particular operational procedures that minimise noise while retaining productive efficiency. The majority of the proposed noise mitigation recommendations will be adopted from the *Interim Construction Noise Guideline* and the Australian Standard AS 2436:2010 - *Guide to Noise Control on Construction, Maintenance and Demolition Sites*.

All work should implement the following noise mitigation strategies:

- **Implementing quiet work practices** – Using equipment in ways to minimise noise, this includes reducing throttle setting and turning off equipment when not being used, i.e. trucks and saws.
- **Distance** – Provide as much distance from the noise source to the receivers as possible. Stationary machinery, especially, should be located towards the southern border of the site if possible.
- **Maintain equipment** – Regularly inspect and maintain equipment to ensure it is in good working order. Also check the conditions of mufflers and keep the cutting saw sharp.
- **Scheduling** – Sensitive residential receivers surround the site and as per the development consent conditions, time restrictions or respite periods for any intense work should be utilised.
- **Limiting** – Reduce the number of machines or tools operating simultaneously.



### 6.3 Best Available Technology Economically Achievable (BATEA) Noise Control

BATEA is a noise mitigation strategy based on equipment, plant and machinery modification to minimise noise output. The following BATEA strategies are to be implemented:

- **Substituting quieter equipment** – examining different types of machinery that perform the same function and compare the noise level data to select the least noisy machine, examination includes tyre noise, exhaust and compressor/fan noise. For example, rubber wheeled tractors can be less noisy than steel tracked tractors.
- **Adjusting reversing alarms** on heavy equipment to make them ‘smarter’ by limiting the acoustic range to the immediate danger area or a broadband style alarm sometimes referred to as a ‘quacker’ alarm.
- **High Performance Exhaust Mufflers** could be fitted to the excavators working within the site. Silencers/mufflers are likely to reduce noise emission from 5 to 15dB.
- **Pneumatic equipment** is traditionally a problem – select silenced damped bits where possible.
- **Trucks** should be properly maintained and have proper silencers fitted to control the engine and brake noise.

### 6.4 Acoustic Screens

Acoustic screens or barriers can be an effective way to reduce noise emissions from the site. Barriers can be installed at either the location of the noise source or the location of the noise receiver. The reduction provided by the acoustic screen is determined by how much of the line of sight between the source and receiver is blocked. If the noise source is fully shielded a noise reduction of up to 15 dB(A) can be achieved. When the line of sight is only partially blocked the noise reduction can be up to 5-8 dB(A). Acoustic screens are more effective for stationary plant.

Due to the proposed moving plant onsite, solid non-movable barriers at the site’s boundaries will not be effective for this project. Acoustic screens are not practical for chain sawing at heights.

EMS recommends the usage of moveable solid barriers or moveable absorptive barriers such as Echo Barrier H4 or similar acoustic fencing with minimum height of 2m to be situated to block the line of site from noise sources to residential receiver buildings, where possible, as works progress. The eastern façade of the R5 TAFE NSW D Block Building should be lined with an absorptive barrier with minimum height of 2 metres to attenuate reflections towards residential receivers to the east of the site.

The barrier should have the following properties:

- Echo Barrier H4 acoustic fencing or similar for absorptive barriers and solid barriers to have a surface density of at least 10 kg/m<sup>2</sup>.
- There should be no gaps or openings at joints or at the bottom of the barrier material.
- Should be located as close as practical to the noise source.

### 6.5 Noise Monitoring

Due to the nearby noise sensitive receivers, unattended noise monitoring should be undertaken at the nearest adjoining surrounding residential receivers (R1) or (R2). Attended short term noise measurements may also be taken during intense noise stages, to ensure noise levels are complying with the noise criterion at all sensitive receivers. Unattended or attended noise monitoring after a complaint should be undertaken to monitor the noise impact at the affected receiver.

Commentary should be added to the reports which evaluates the performance and effectiveness of management measures during that monitoring period and provides recommendations for any improvements deemed necessary.

## 6.6 Vibration Mitigation Control

Work that is anticipated to cause elevated vibration levels is vibratory rolling if dynamic compaction is undertaken. EMS was not informed of any excavator hammering taking place during works.

It should be noted that vibrations that are below threshold levels for structural damage may be experienced by the surrounding receivers causing annoyance. If hammering is undertaken, further mitigation measures may need to be explored and employed, should levels increase to such a point that complaints arise due to annoyance.

EMS notes the EPA's Publication *Assessing Vibration: a technical guide* states "The criteria (for human comfort) are non-mandatory: they are goals that should be sought to be achieved through the application of all feasible and reasonable mitigation measures."

The following practices should be implemented to reduce any potential vibrations affecting the surrounding structures:

- Place as much distance, where possible, between the demolition/excavation work and the surrounding properties. Distance is one of the most effective mitigation measures against vibration.
- Organise high impacting operations so they do not occur in the same time period.
- Conduct lower impact methods wherever possible, including the following:
  - Orientation of hammers (if required) away from property boundaries and into the centre of the site;
  - Operate any required excavator hammering in short bursts only, to reduce amplification of vibrations and the rise of noise; and
  - Restrict the usage of the vibratory function on rollers where possible.

Table 6.1 below shows safe working distances for the onsite plant referenced from the British Standard 7385 Part 2-1993. The minimum working distances are indicative as the situation on each site will vary based on the individual item of plant, geotechnical conditions onsite and the dominant frequency of the construction vibration levels.

**Table 6.1 – Recommended Safe Working Distances for Vibration Intensive Plant**

Plant Item	Rating Description	Safe working Distances	
		Cosmetic Damage (BS7385)	Human Response (EPA Vibration Guideline)
<b>Jack Hammer</b>	Handheld	1m (nominal)	2m
<b>Vibratory Rollers</b>	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
<b>Small Hydraulic Hammer</b>	(300 kg - 5 to 12t excavator)	2 m	7 m
<b>Medium Hydraulic Hammer</b>	(900 kg – 12 to 18t excavator)	7 m	23 m

## 6.7 Trial Vibration Measurements

Vibration monitoring trials are recommended at various distances from the TAFE building structure if dynamic vibratory rolling and/or excavator hammering were undertaken to confirm the minimum working distance for each type of intense vibratory equipment that will be used on site.

The results from this trial vibration monitoring run will be the important information that will allow operators of the machinery to work with confidence knowing the safe distances and limits to adhere to with their equipment.

These results will be specific to this site layout, with exact equipment used and would be a typical and more accurate representation of the site, rather than general approximate safe working distances, as shown in Table 6.1 above.

## 6.8 Vibration Monitoring

Vibration monitoring will be required at the western side of the TAFE NSW D Block Building – receiver (R5) adjacent to the works area. Monitors should be in place whenever dynamic vibratory rolling or excavator hammering is occurring adjacent to the building within 15 and 2 metres respectively.

The sensor of the vibration monitor should be affixed at the founding level of the adjacent structures in question, on a solid building element. Vibration monitoring should be undertaken at any affected receiver location, should complaints arise.

The vibration monitors should be equipped with the ability to send SMS alerts to the plant operator(s) and appropriate staff and supervisors if the vibration limit is exceeded.

### Vibration Alarm Procedure

Should the vibration warning alerts be activated the following procedure should be implemented by the site foreman/supervisor:

1. Stop all work immediately and make a note of all work activities that are currently taking place at the vibration alerts. The project geotechnical engineer and/or structural engineers should be informed immediately.
2. Alternative construction methods/use of smaller equipment should be sought in conjunction with the machine operator, geotechnical engineer and/or structural engineer and details of the new procedures documented.

The vibration monitors shall be downloaded at weekly intervals by the acoustic consultant and weekly reports prepared that are to be distributed to the geotechnical and/or structural engineer.

Commentary should be added to the report which evaluates the performance and effectiveness of management measures during that monitoring period and provides recommendations for any improvements deemed necessary.

## 6.9 Complaint Management

It is also important to interact with nearby receivers and the community to ensure a good working relationship between the proponent and the community and to receive feedback on the project's performance and work cooperatively towards the outcomes of benefit to the project.

Table 6. (below) gives a guideline approach to community consultation, notification and complaint handling. This guide is adopted from the Interim Construction Noise guideline and only some items are suitable for this project and provide measures such as letter box drops, project specific respite offer, phone calls and specific notification.

Communication shall be upheld between the surrounding residential and commercial receivers.

**Table 6.2 – Standard consultation and notification guideline adopted from the Interim Construction Noise Guideline**

Consultation and Notification
Notification before and during construction
<ul style="list-style-type: none"> <li>• Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement.</li> <li>• Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information.</li> <li>• Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage shall be clearly visible from the outside and include afterhours emergency contact details.</li> <li>• Maintain good communication between the community and project staff.</li> <li>• Appoint a community liaison officer where required.</li> <li>• For larger projects consider a regular newsletter with site news, significant project events and timing of different activities.</li> <li>• Provide a toll free contact phone number for enquiries during the works.</li> <li>• Facilitate contact with people to ensure that everyone can see that the Site Manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.</li> </ul>
Complaints handling
<ul style="list-style-type: none"> <li>• Provide a readily accessible contact point, for example through 24 hour toll free information and complaint's line.</li> <li>• Give complaints a fair hearing.</li> <li>• Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.</li> <li>• Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night time only if requested by the complainant to avoid further disturbance.</li> <li>• Provide a quick response to complaints, with complaints handling staff having both a good knowledge of the project and ready access to information.</li> <li>• Keep a register of any complaints, including details such as date, time, person receiving complaint, complainant's phone number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate</li> </ul>



## 7 Conclusions

A Construction Noise & Vibration Management Sub-Plan was prepared prior to the demolition of the existing carpark and construction of a new carpark on the eastern side of the TAFE site accommodating 24 car parking spaces for the Powerhouse MDC, 172 Showground Rd, Castle Hill.

The purpose of this assessment is to provide methods to prevent noise and vibration from the site works causing unreasonable loss of amenity to nearby receivers. The report has been prepared in accordance with the DPIE Consent Conditions – Part C “During Construction”.

The noise predictions from the site are provided in Section 5 of the report and outline that the noise levels will at times likely be exceeding the Noise Management Level (NML) at the nearby residential receivers during some phases of works.

Of the remaining receivers surrounding the site, the D Block (Carpentry Workshop) TAFE NSW receiver building is predicted to exceed the NML due to the close proximity to the works, however, the remaining TAFE NSW and other commercial and educational receivers are predicted to be within the NML.

At the time of publishing this report, NSW Health COVID-19 rules and restrictions were in force. These restrictions may see less occupants at the commercial and educational areas around the site such as the TAFE NSW campus, the shopping centre across the road and the childcare centre on Showground Rd. Conversely, residential receiver locations will likely have more occupants at home during the daytime hours when works are conducted, therefore increasing the likelihood of annoyance and complains due to the works.

Section 6 outlines noise mitigation controls to be implemented on site.

Appendix A provides for a Noise/Vibration Complaint Form template which can be used as seen fit.

## References

Australian Standard AS 2436-2050 (R2016) – *Guide to Noise Control on Construction, Maintenance and Demolition Sites*

Australian Standard 2107-2000 – *Recommended design sound levels and reverberation times for building interiors.*

British Standard (BS 6472–1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)

British Standard (BS7385: Part 2-1993) - Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration

DECC's *Interim Construction Noise Guideline* (2009)

EPA's *Noise Policy for Industry* (2017)

TfNSW's *Construction Noise and Vibration Strategy* (2019)

Development Consent – SSD 10472 - Department of Planning, Industry and Environment (DPIE) 2021

Acoustic Report for SSDA (Ref: SY181569-AUR01) prepared for the site by Northrop in February 2021

Construction Drawings & Plans provided by Simmons Civil Contracting

## Appendix A – Complaint Form Content Template

### Complainant to Detail:

Date: \_\_\_\_\_

Complainant's Name: \_\_\_\_\_

Complainant's Address: \_\_\_\_\_

Complainant's Contact Details: \_\_\_\_\_

Describe when the noise/vibration problem began, what equipment caused the complaint (if seen/known), which location is the problem noticeable/audible etc:

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### Simmons Civil Contracting to Detail:

Complaint Received by: \_\_\_\_\_

Determination of what equipment was used on site and what methods were employed at time of complaint:

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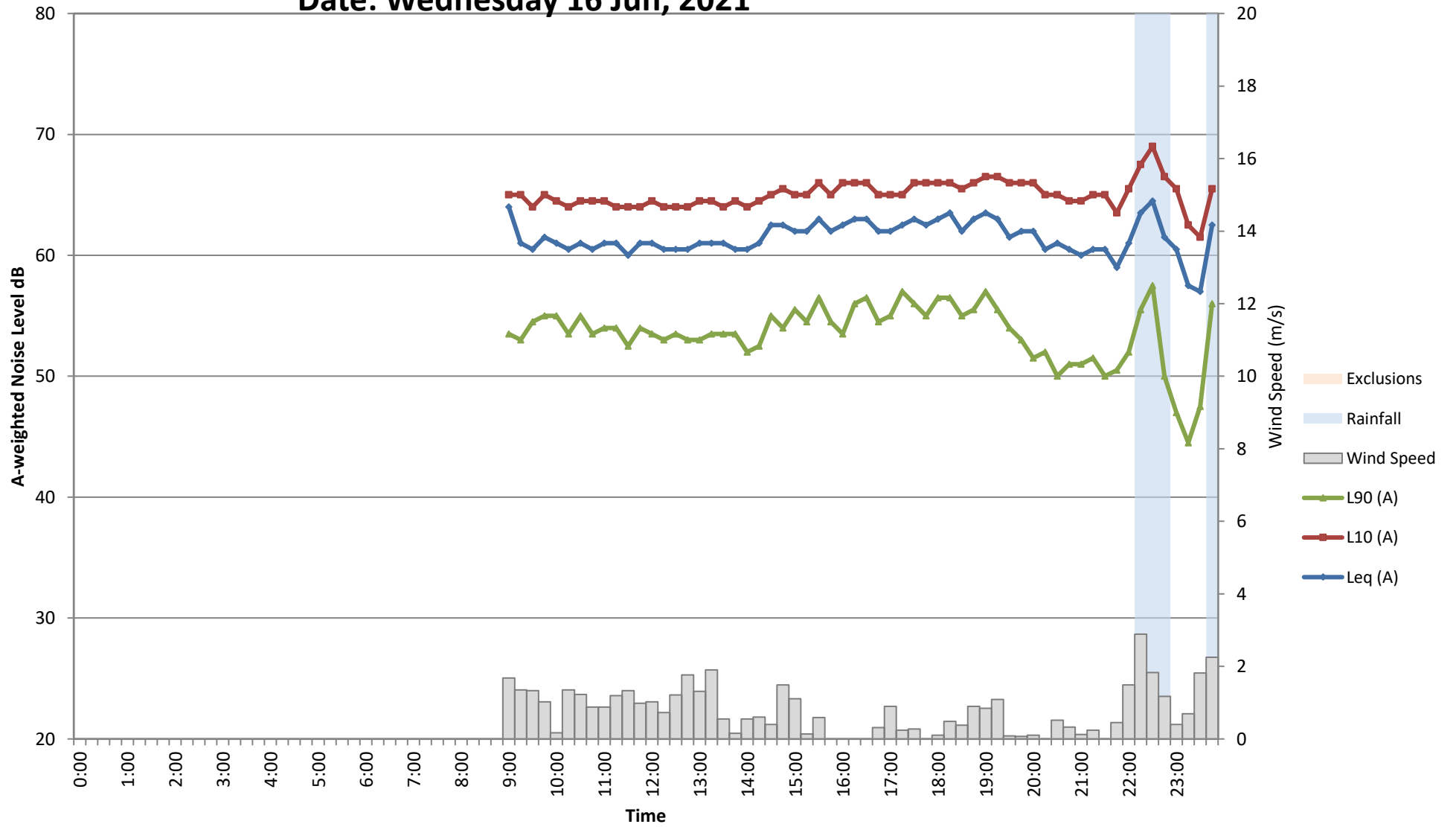
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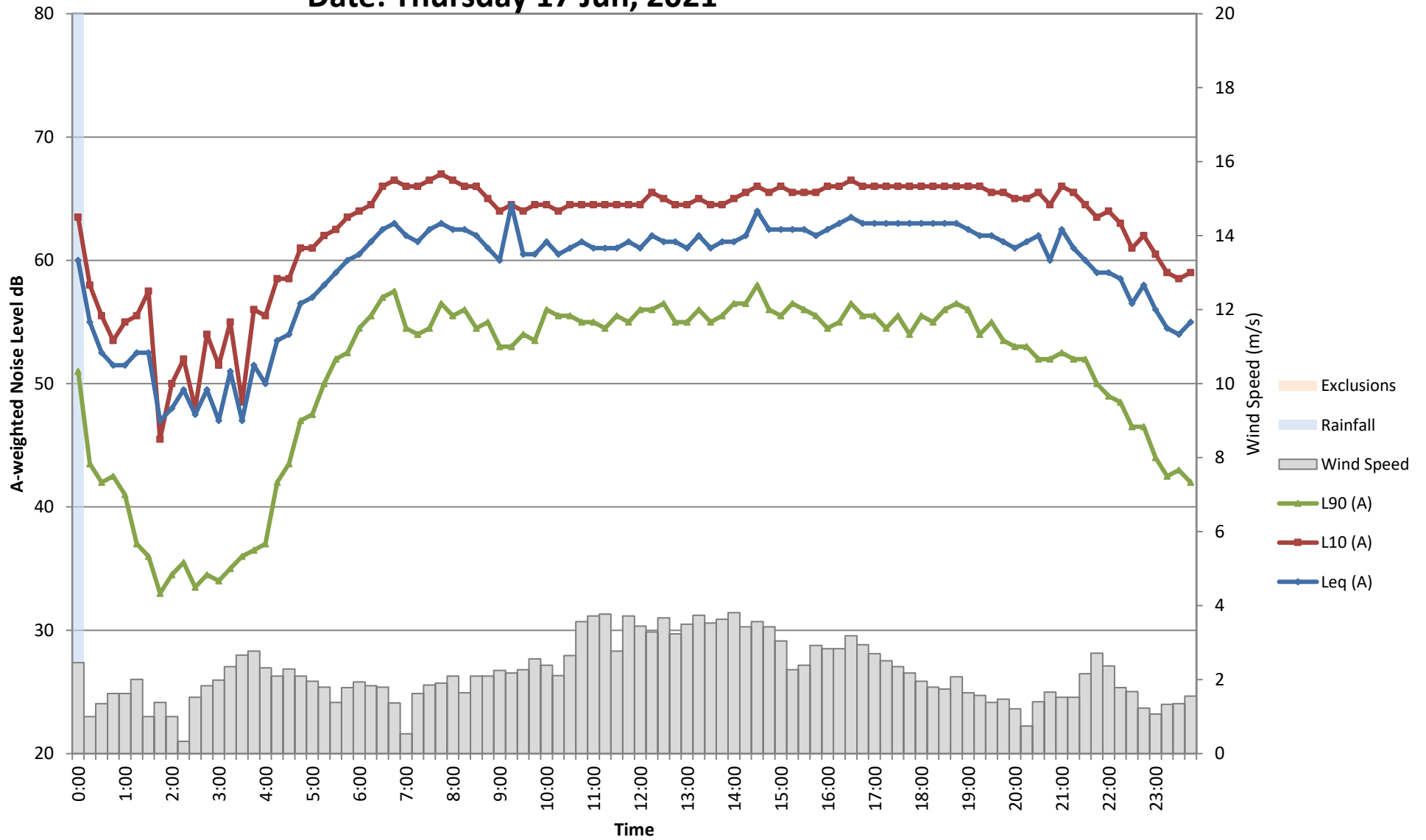
Option to contact Acoustic Consultants to provide attended monitoring or weekly unattended monitoring at complainant's address.

## **Appendix B – Background Noise Measurement**

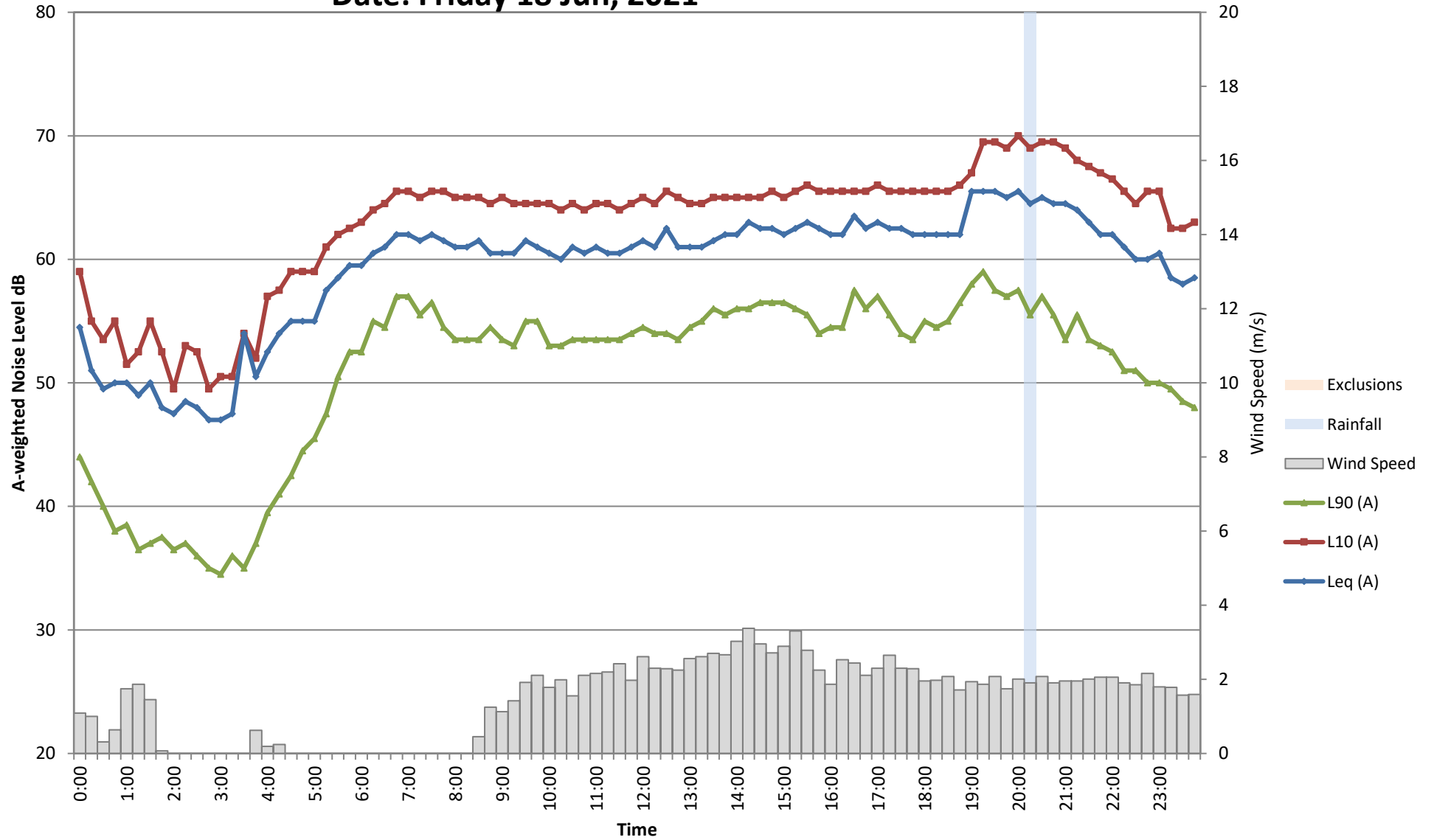
**Noise Level Measurements**  
**Monitor Location: Powerhouse MDC - Castle Hill**  
**Date: Wednesday 16 Jun, 2021**



**Noise Level Measurements**  
**Monitor Location: Powerhouse MDC - Castle Hill**  
**Date: Thursday 17 Jun, 2021**

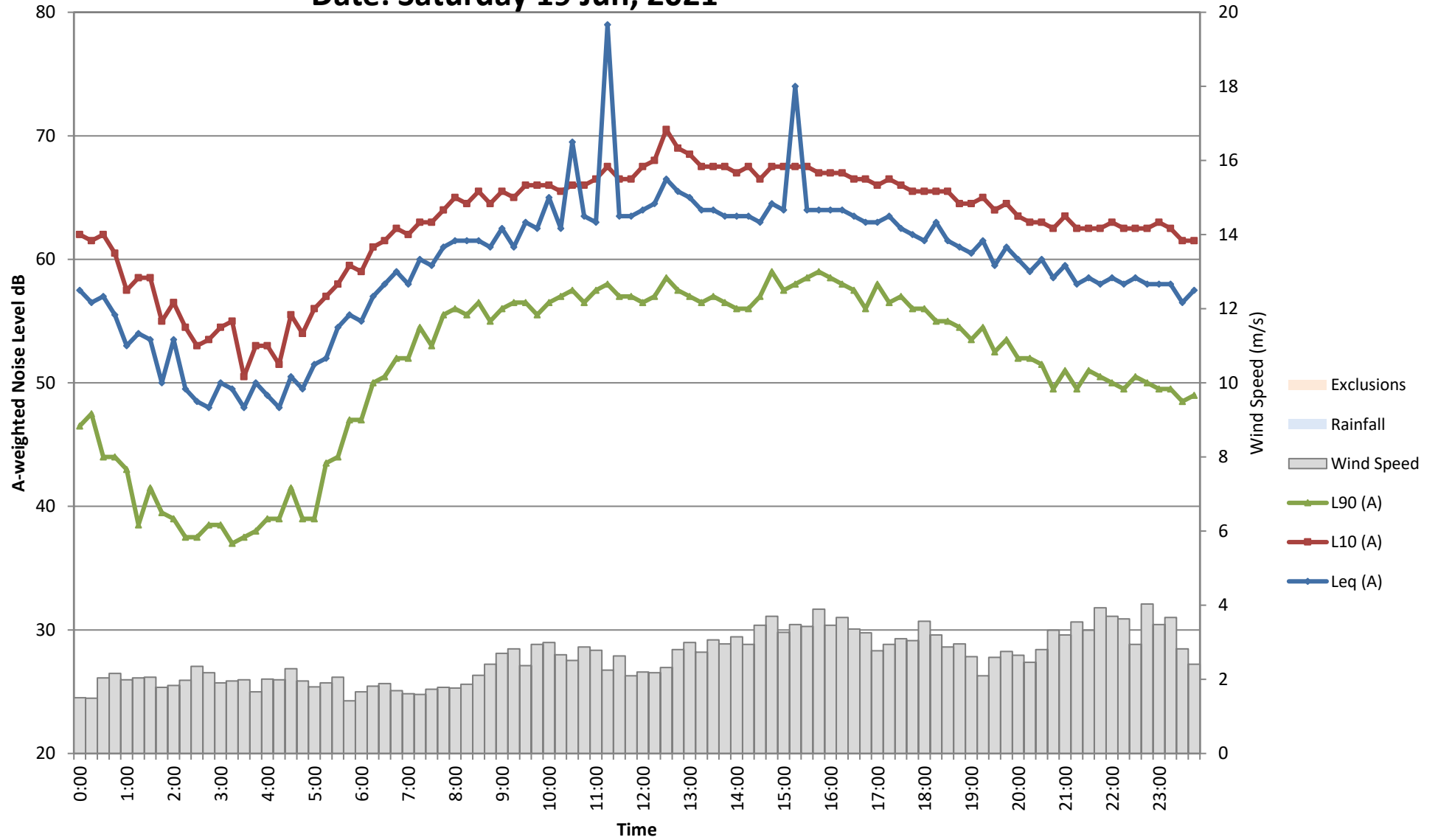


**Noise Level Measurements**  
**Monitor Location: Powerhouse MDC - Castle Hill**  
**Date: Friday 18 Jun, 2021**





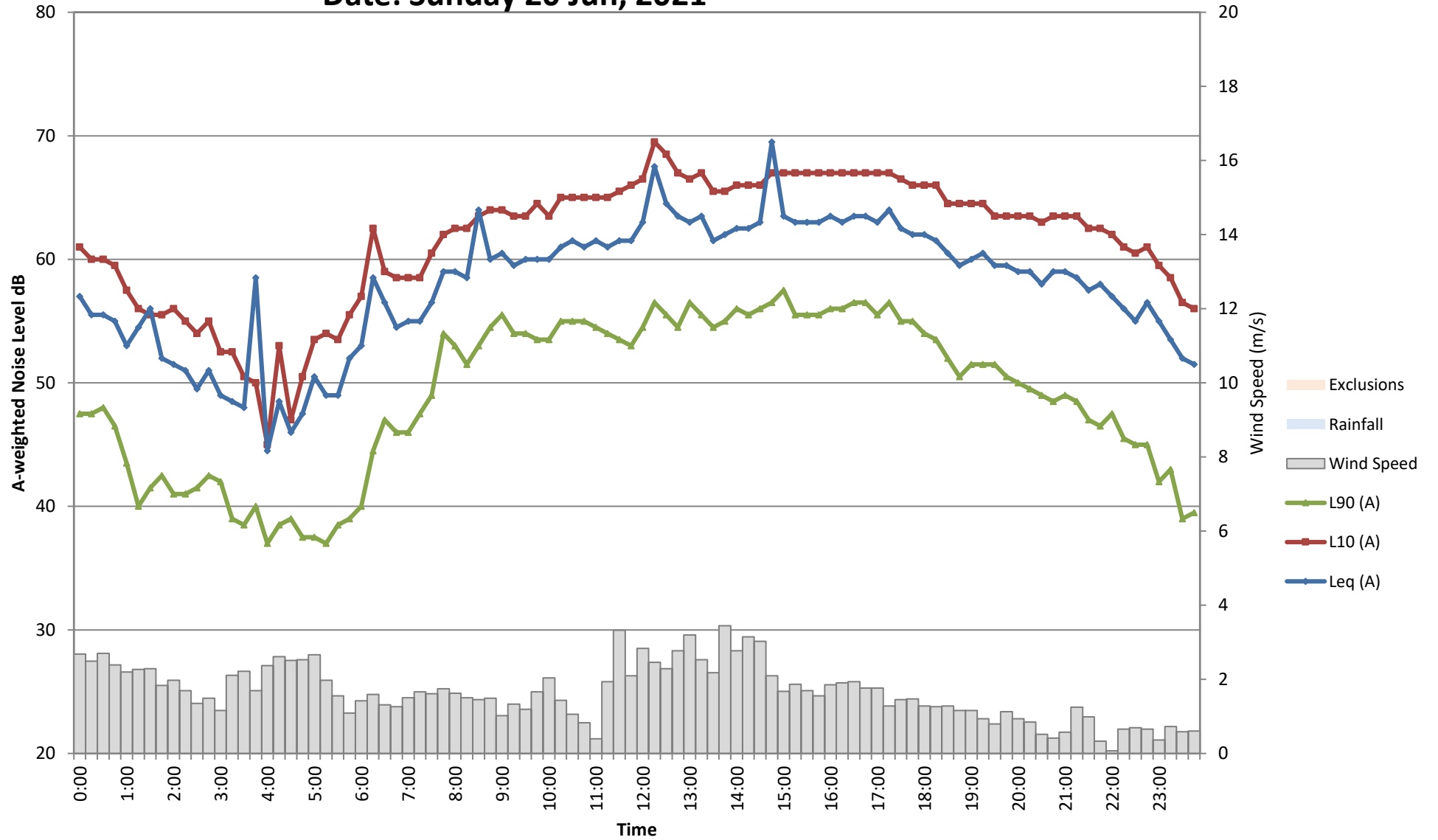
**Noise Level Measurements**  
**Monitor Location: Powerhouse MDC - Castle Hill**  
**Date: Saturday 19 Jun, 2021**



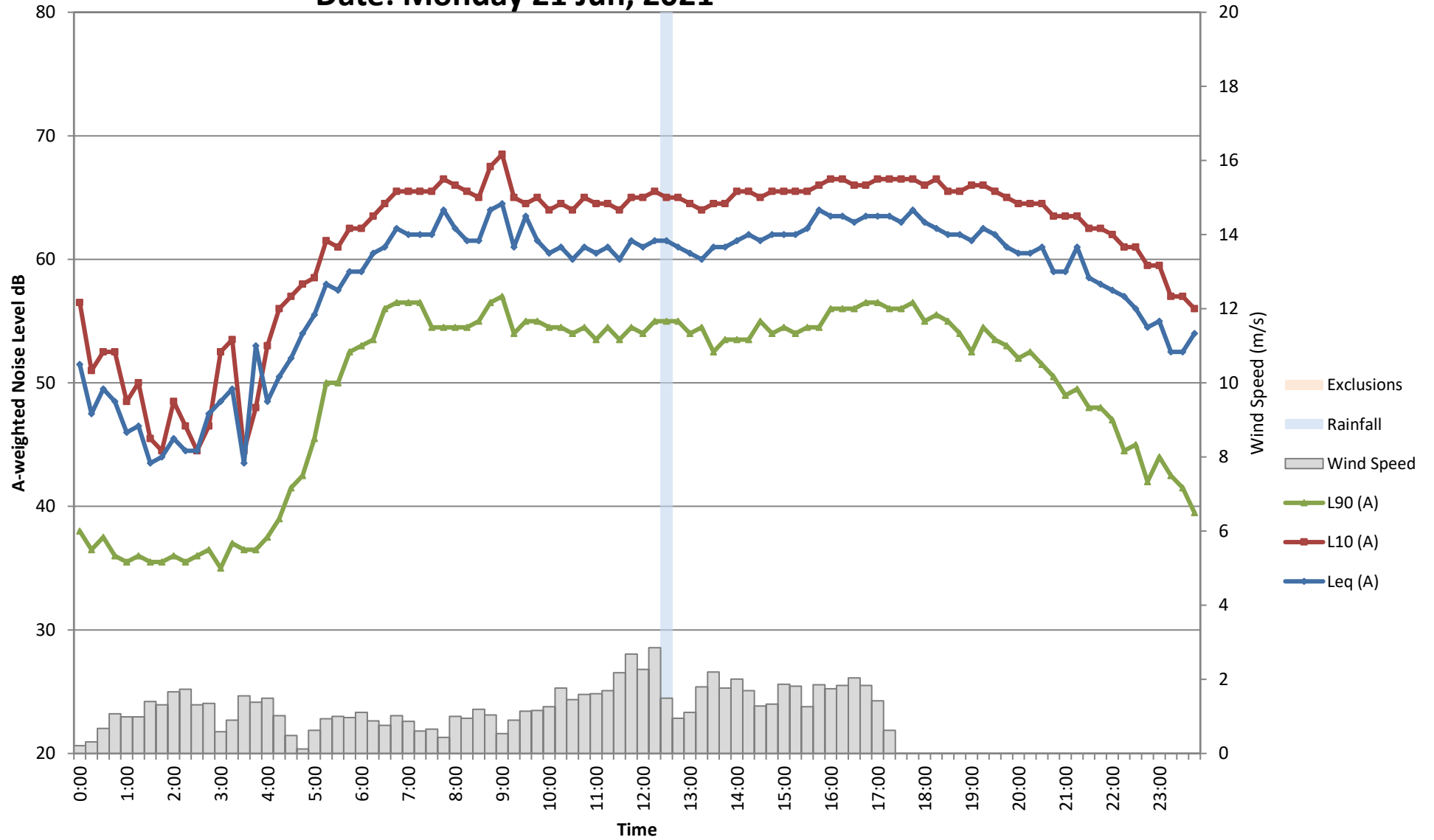
# Noise Level Measurements

## Monitor Location: Powerhouse MDC - Castle Hill

### Date: Sunday 20 Jun, 2021



**Noise Level Measurements**  
**Monitor Location: Powerhouse MDC - Castle Hill**  
**Date: Monday 21 Jun, 2021**



**Noise Level Measurements**  
**Monitor Location: Powerhouse MDC - Castle Hill**  
**Date: Tuesday 22 Jun, 2021**

