Health Infrastructure NSW

Westmead PSB and MSCP Construction Noise Monitoring

Noise monitoring report 2023-09-01 to 2023-09-30

AC22

v1 | 13 October 2023

Job number 271985

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Appendices

1 Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of Health Infrastructure NSW to install noise monitors within the Central Acute Services Building (CASB), Children's Hospital Westmead (CHW) and Kids Research (KR) and Ronald McDonald House (RMH) buildings to monitor construction noise from the Paediatric Service Building (PSB) and Multi Storey Car Park (MSCP) development sites in the Westmead Precinct.

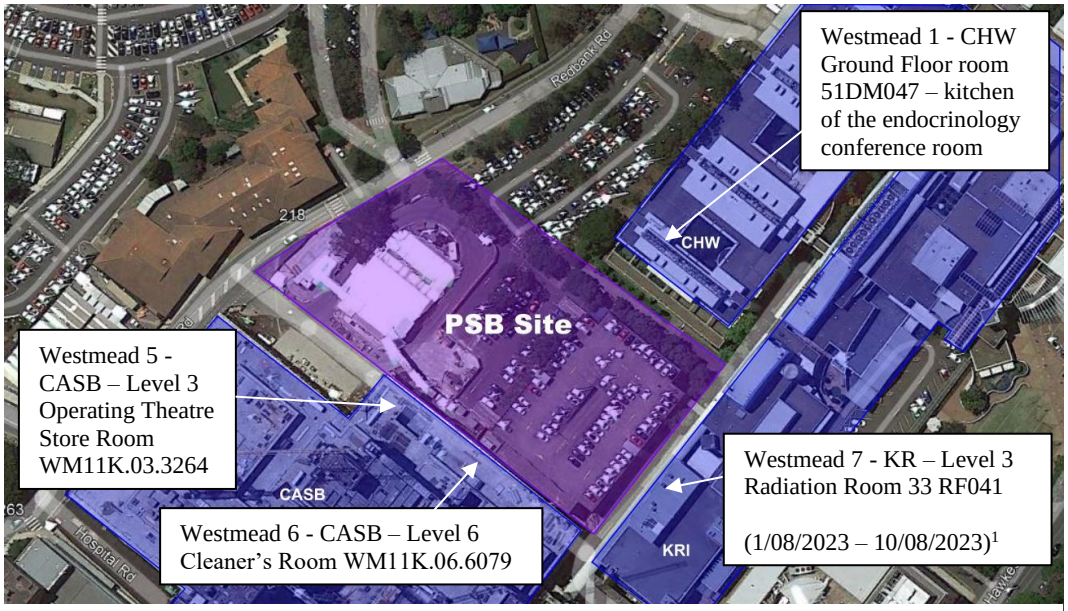
The noise loggers have been setup to send email and SMS notifications to stakeholders when construction Noise Management Levels (NMLs) are exceeded.

This report details noise measurement results from **1 September 2023 to 30 September 2023** inclusive.

2 Noise logger locations

Acoustic Research Labs Ngara noise loggers have been installed in the locations shown in Figure 1 and Figure 2 below.

The noise loggers were calibrated by Acoustic Research Labs (NATA-accredited calibration) in November 2021.



Note 1: Westmead 7 noise logger was temporarily repurposed for another project on the 10/8/2023. See Section 2.1.

Figure 1: PSB noise monitoring locations.

Figure 2: MSCP noise monitoring locations.

2.1 Noise Logger relocation

No logger relocation to report during this period.

3 Noise Management Levels

The current construction Noise Management Levels for each internal monitoring location are set out in Table 1.

Measurement data taken from 'standard' construction work hours for the project only are assessed against the Noise Management Level criteria, being:

- 7am-6pm Mon-Fri
- 8am-1pm Sat
- No work on Sundays and Public Holidays.

As part of the previous installation works a baseline noise study was conducted to determine appropriate noise management level. Refer to Arup's *Baseline noise measurements* report[1] for details regarding how these Management Levels were nominated.

Table 1: Baseline noise measurement results.

Logger ID	**Location**	**Noise Management Level (upper limit), dB $L_{Aeq,15min}$**
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	**60**
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	**50**
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	**52**
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	**58**
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	**64**
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	**47**

3.1 Management Level updates

The following provides a progressive record of management level updates:

- None to-date.

[1] Arup report reference 271985-AC02.

4 Noise monitoring results

4.1 Outages

Noise monitoring outages are shown below. This excludes outages related to logger data collection and calibration.

Table 2: Noise logger outages during monitoring period.

Logger Id	Noise logger location	Outages
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	1/09/2023 to 30/09/2023
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	-
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	-
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	N/A[1]
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	2/09/2023 to 30/09/2023
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	1/09/2023 to 30/09/2023

Note 1: Westmead 7 logger was temporarily relocated to the WIMR bike store room on Thursday 10 August 2023 to support the VVMF construction project.

4.2 Exceedances

The number of Management Level exceedances recorded at each noise monitoring location during the assessment period are shown below.

Table 3: Recorded Management Level exceedances.

Logger Id	Noise logger location	Noise Management Level exceedance instances
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	-
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	198
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	83
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	N/A[1]
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	-
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	-

Logger Id	Noise logger location	Noise Management Level exceedance instances

Note 1: Westmead 7 logger was temporarily relocated to the WIMR bike store room on Thursday 10 August 2023 to support the VVMF construction project, hence all potential exceedances recorded by this logger are currently not relevant for this project.

It is the responsibility of Ford Civils (the Head Contractor) to respond to each Noise Management Level exceedance when it occurs and record the outcome of the exceedance investigation (cause of NML exceedance, any noise mitigation measures implemented to address the exceedance, etc.).

4.3 Daily noise monitoring results

Daily noise monitoring results are showing for each location in Appendix A.

Appendix A

Noise Monitoring Daily Results

A1 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)

Unattended monitoring: CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Internal)

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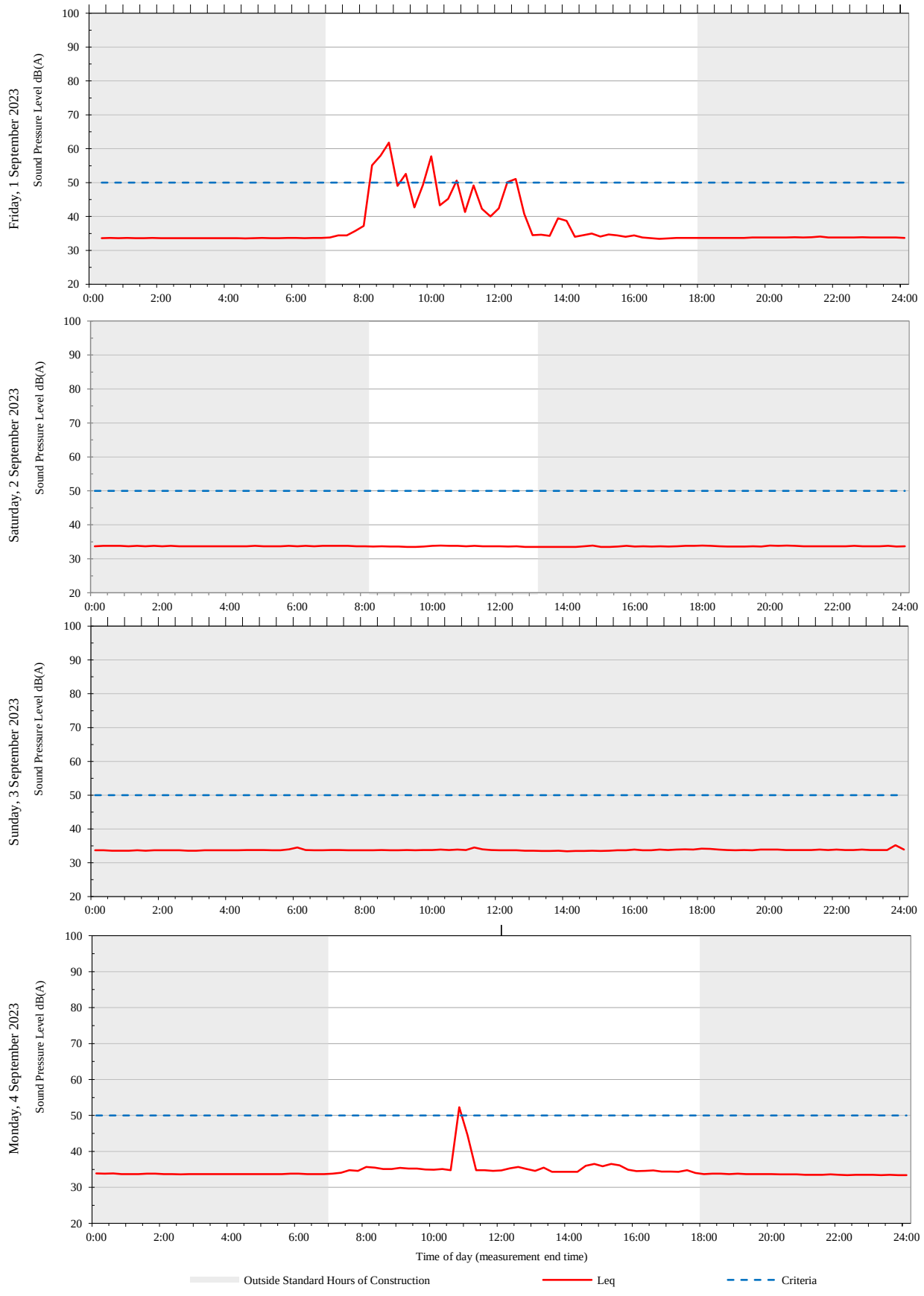

Unattended monitoring: CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Internal)

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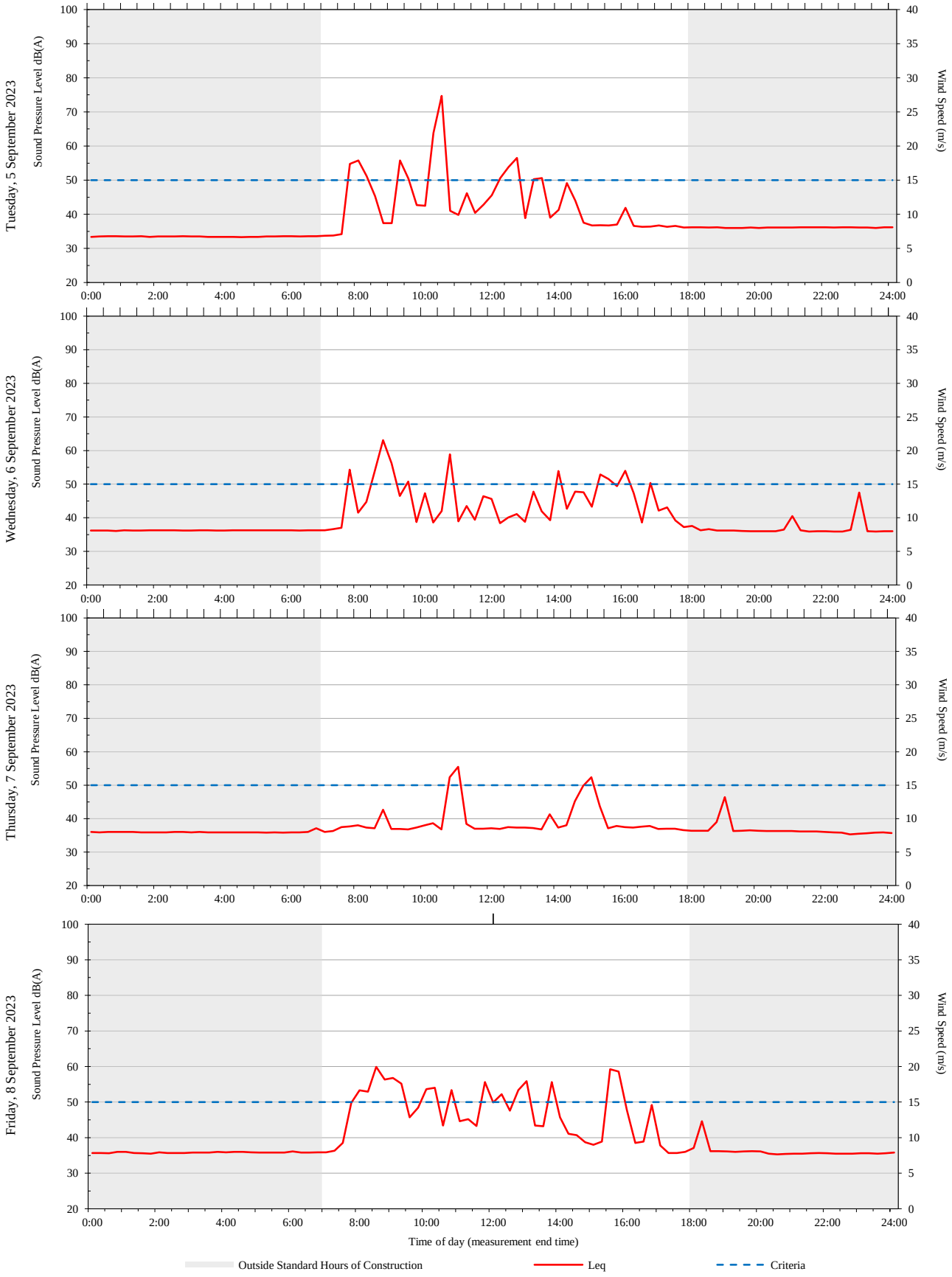

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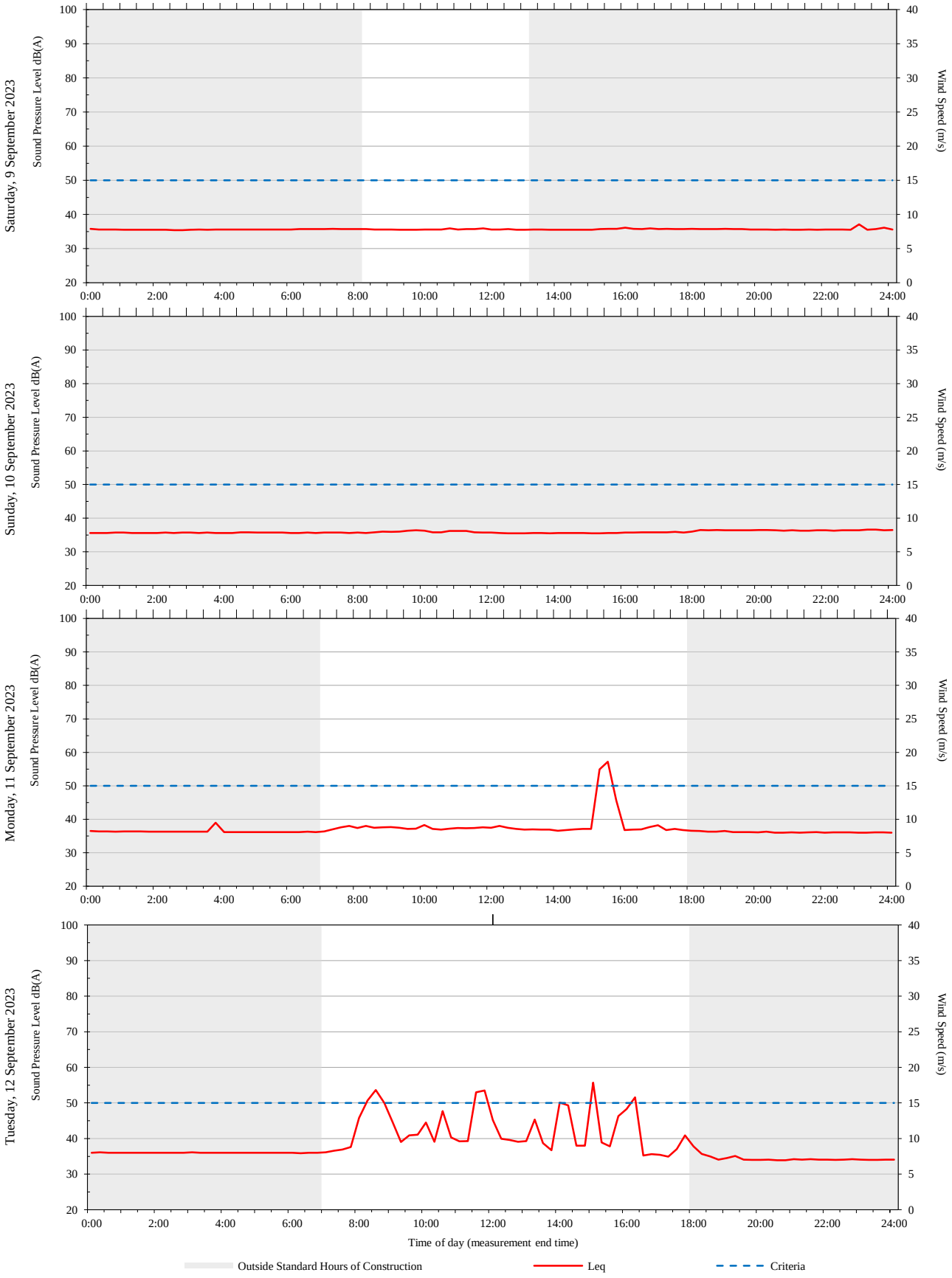

Unattended monitoring: CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Internal)

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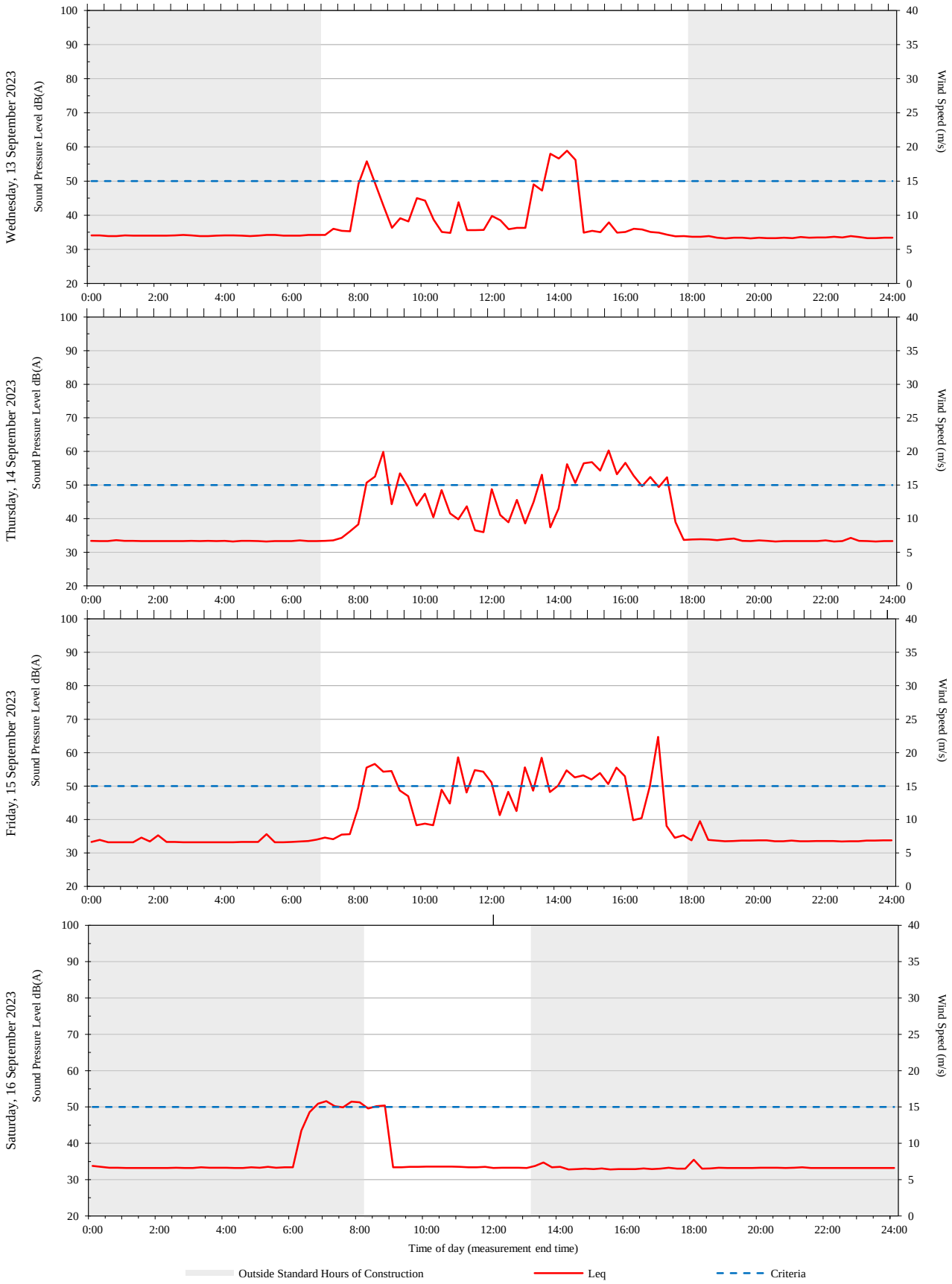

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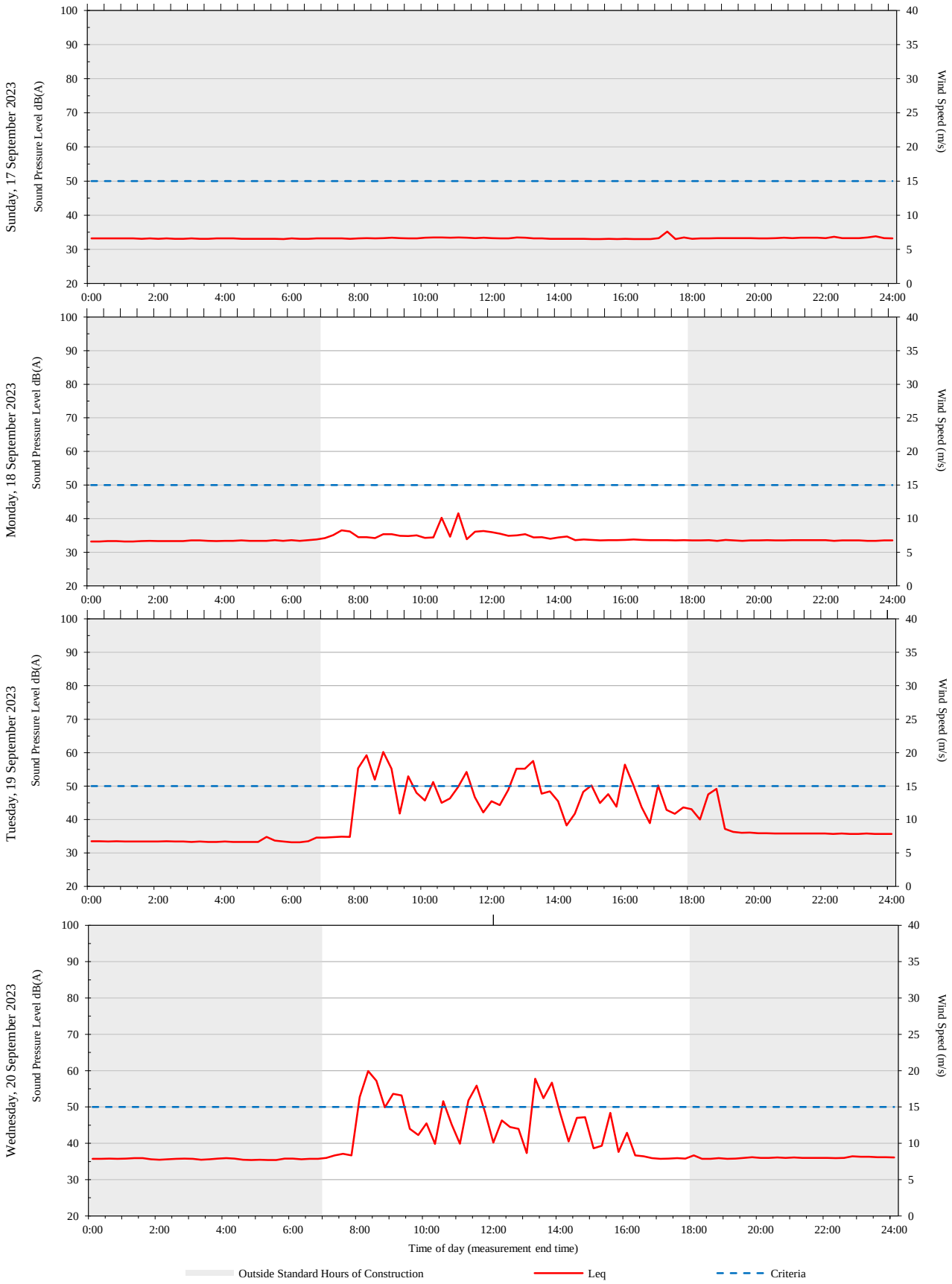

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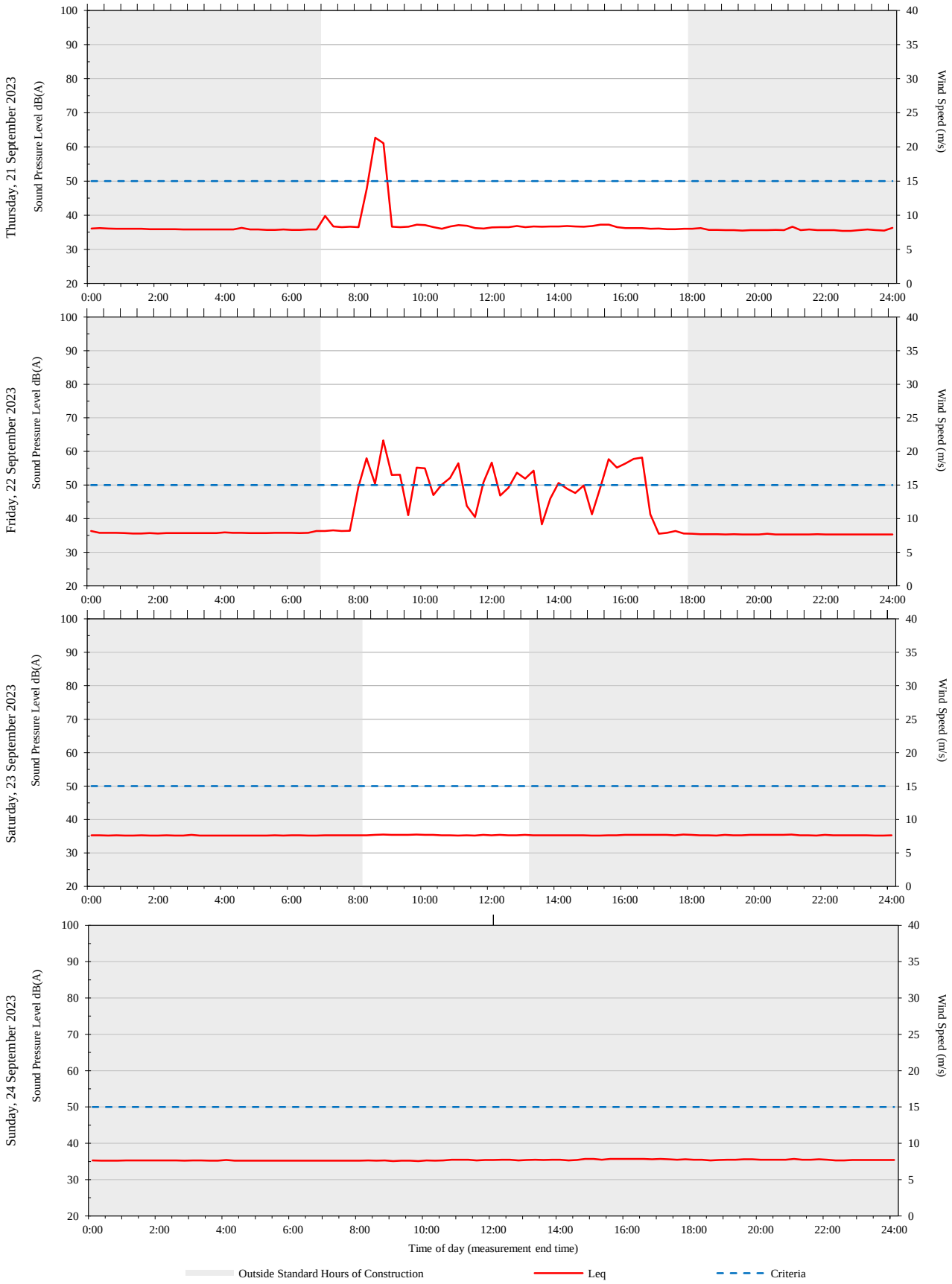

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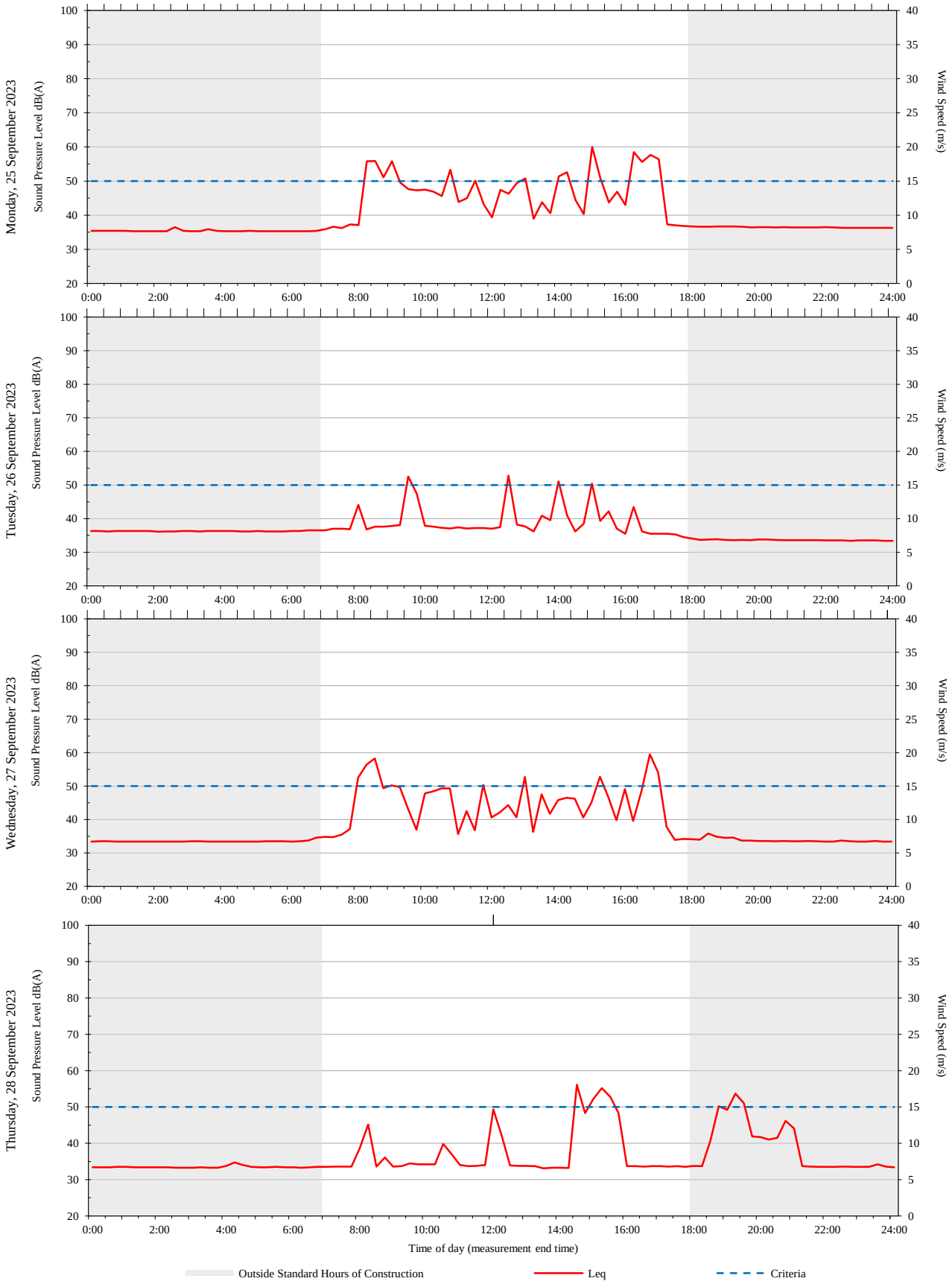

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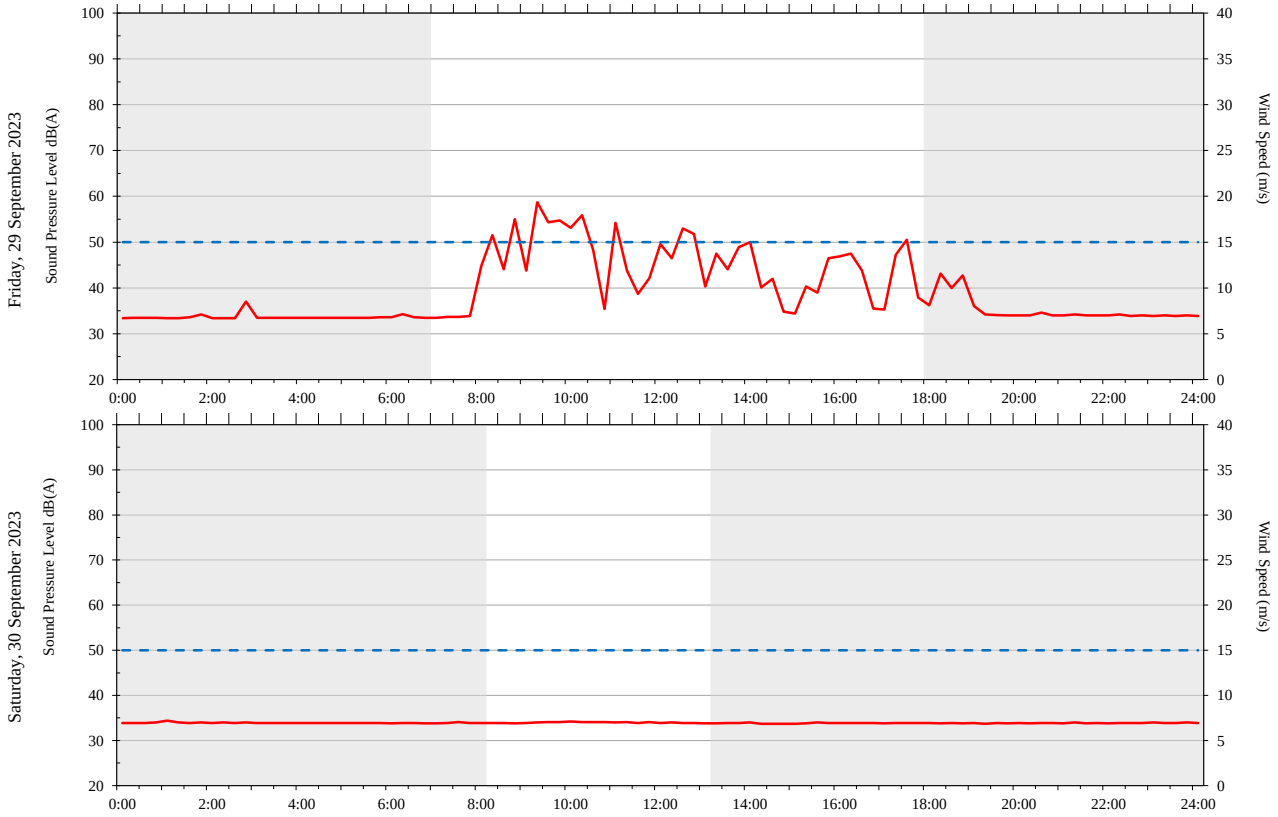

A2 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)

Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)

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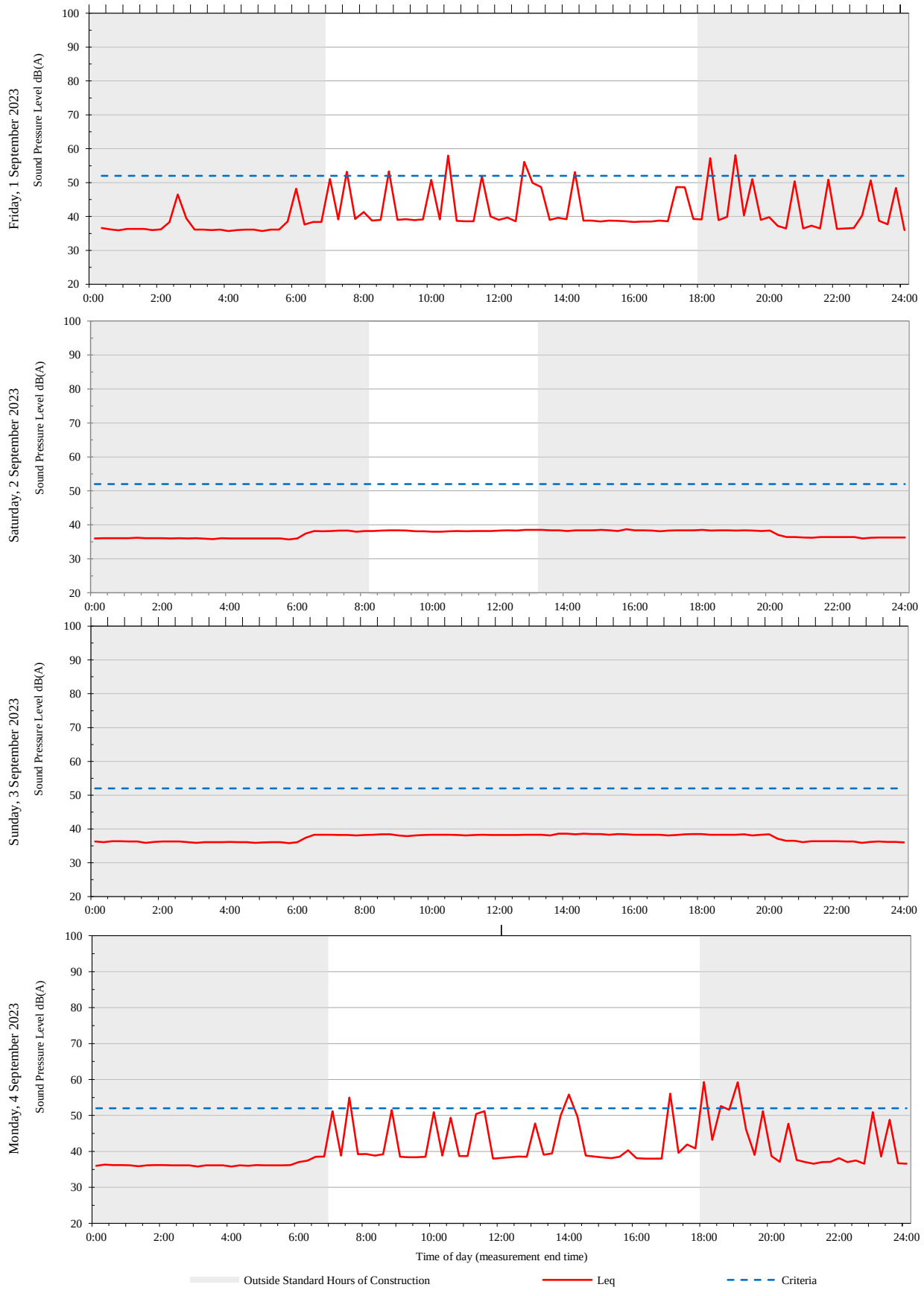

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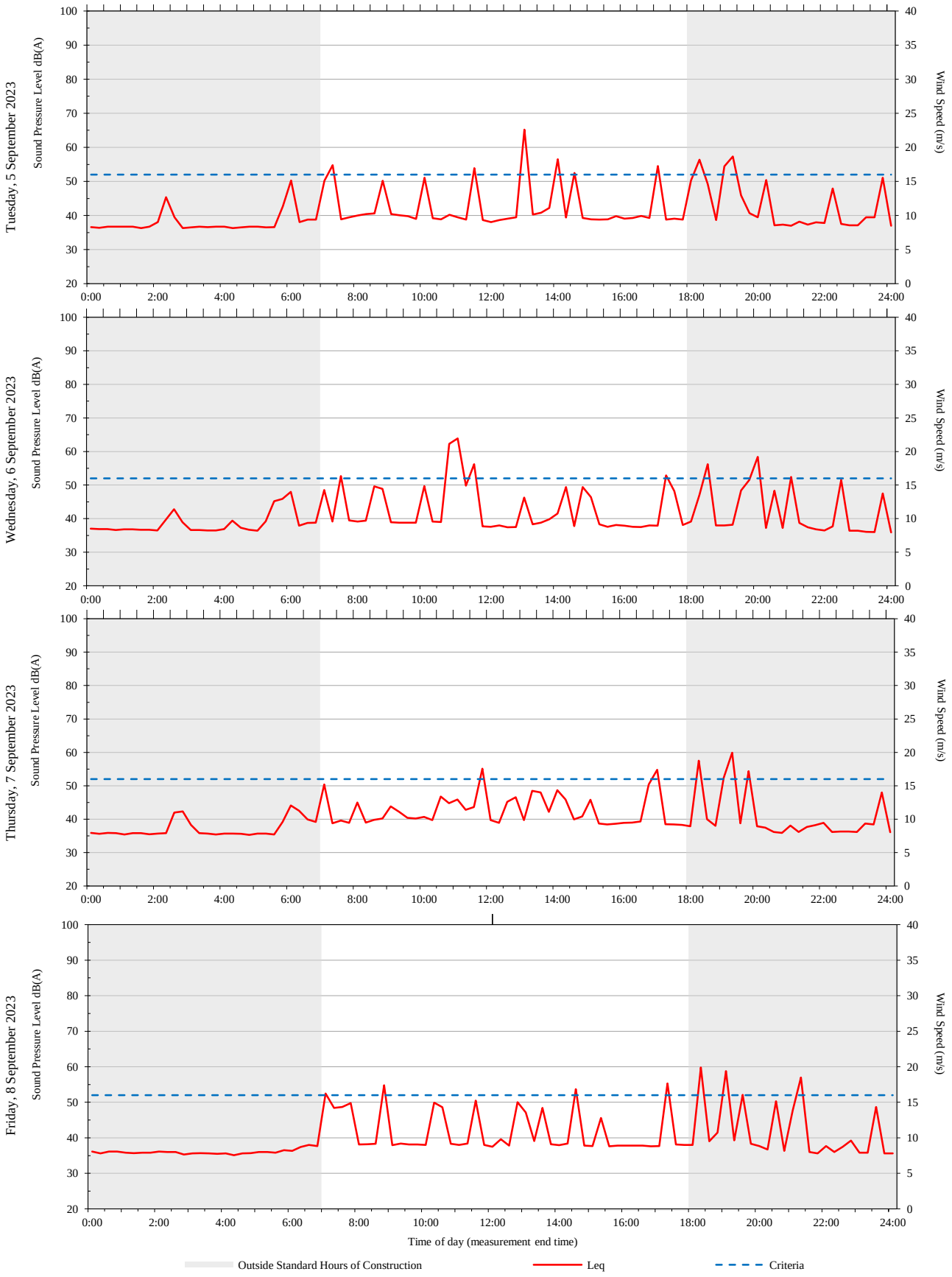

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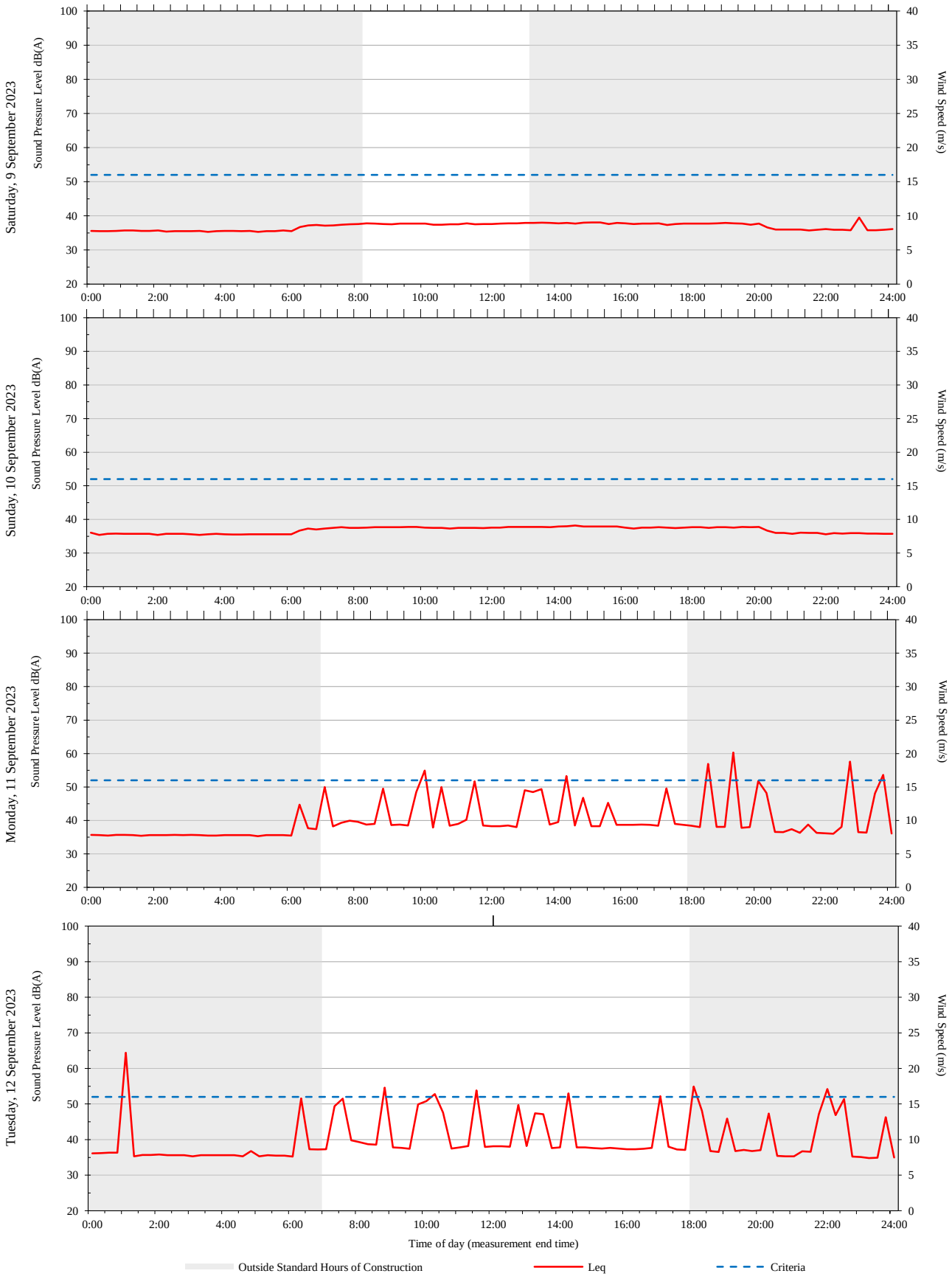

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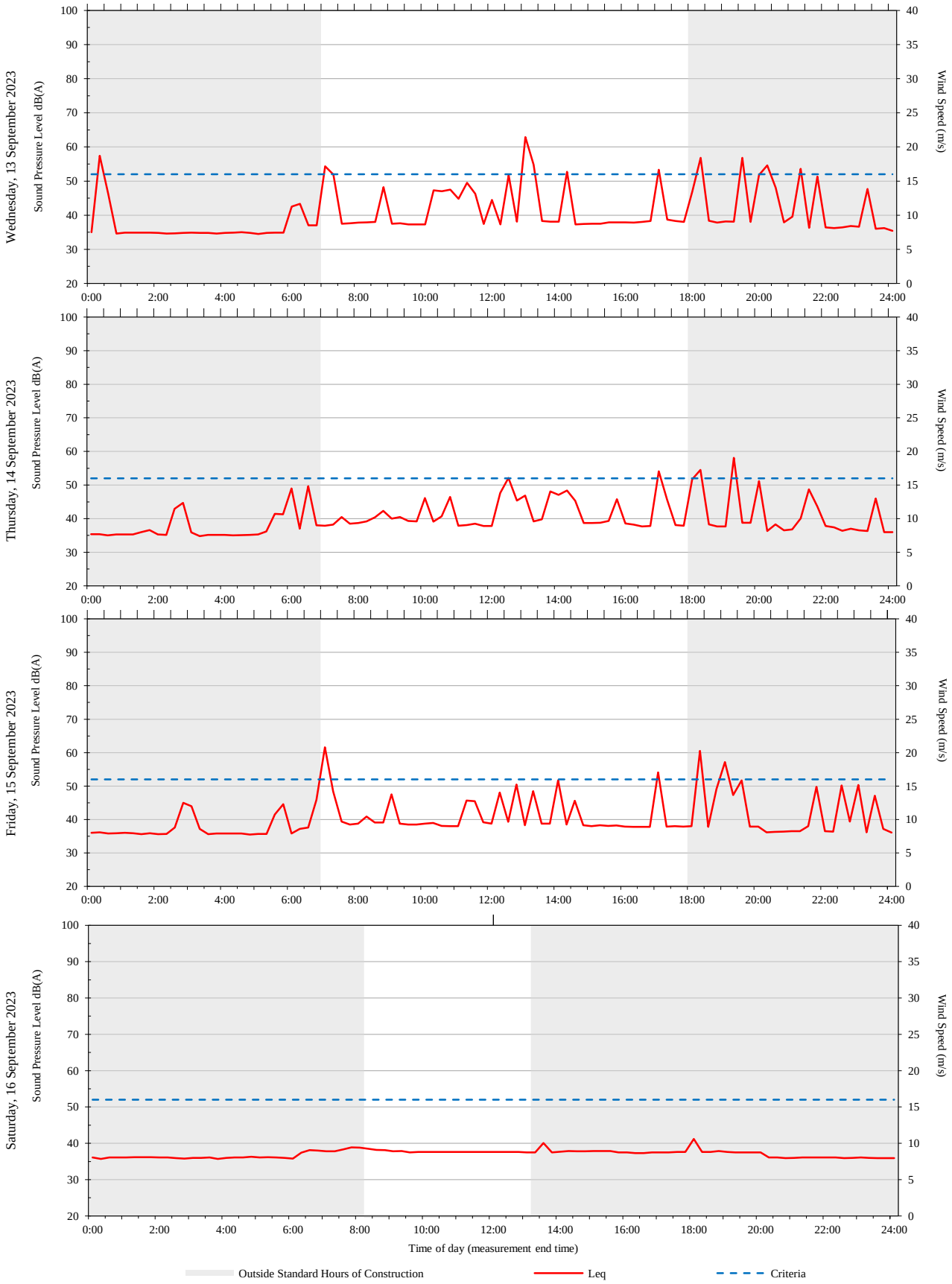

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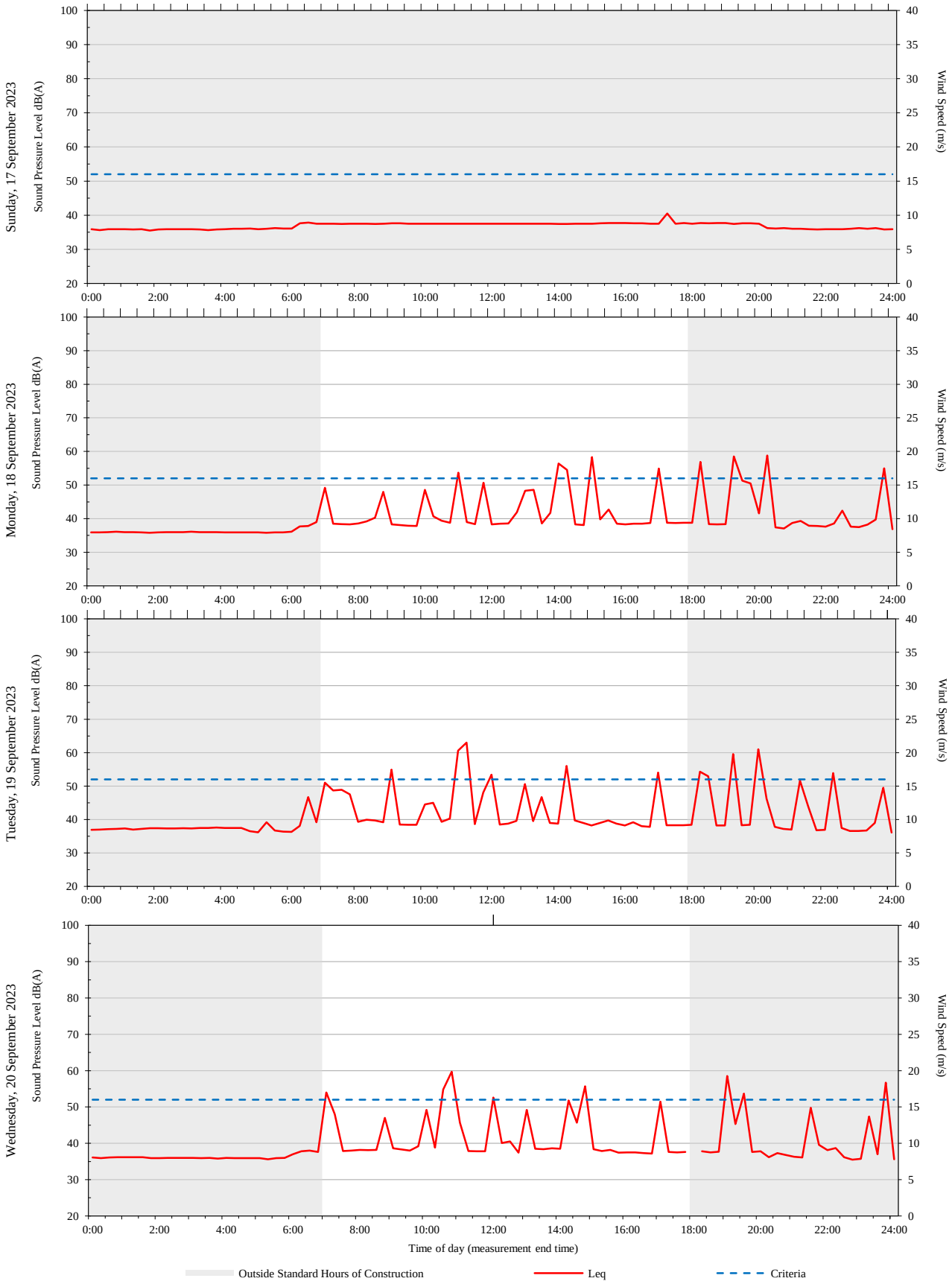

Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)

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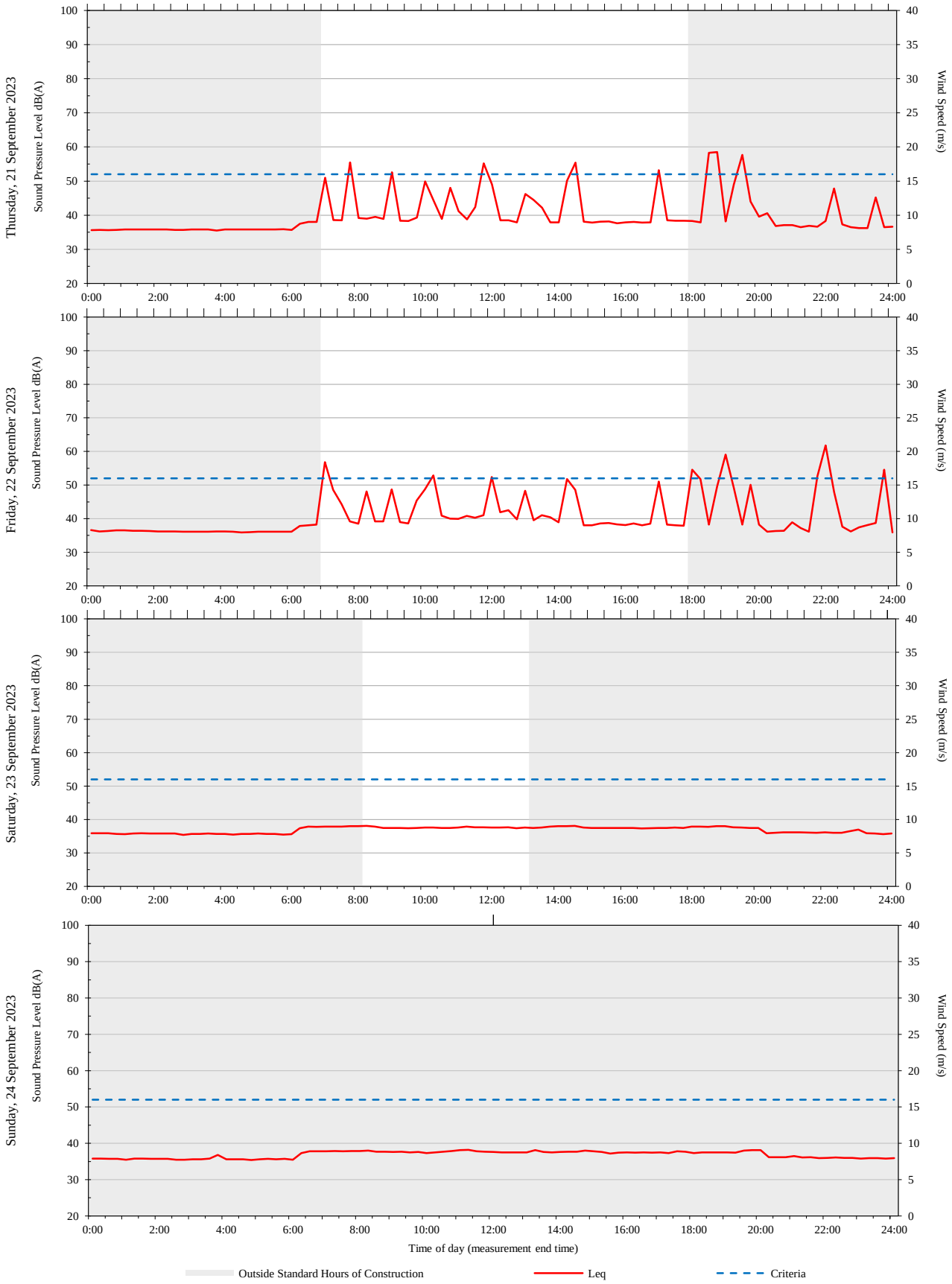

Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)

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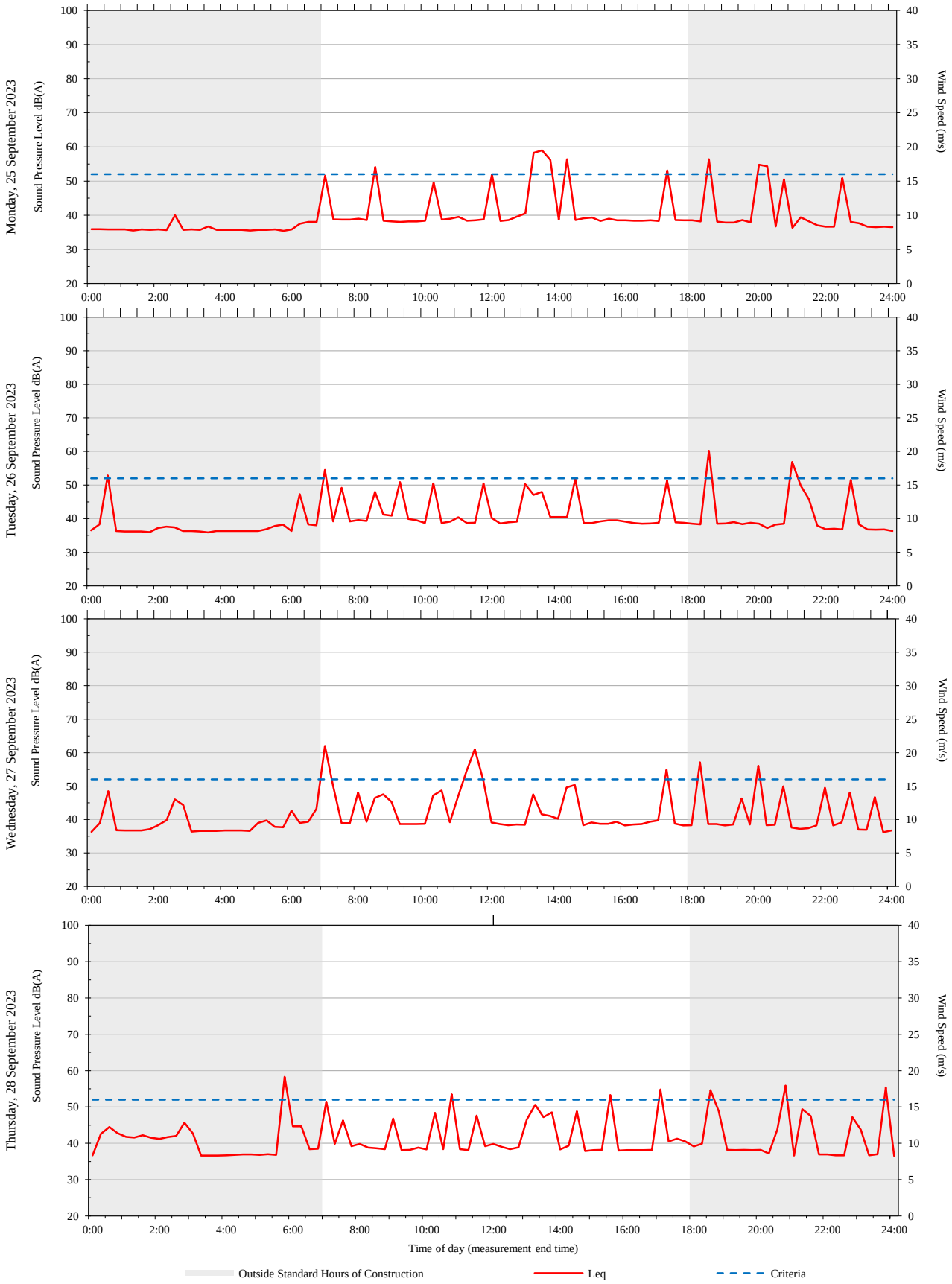

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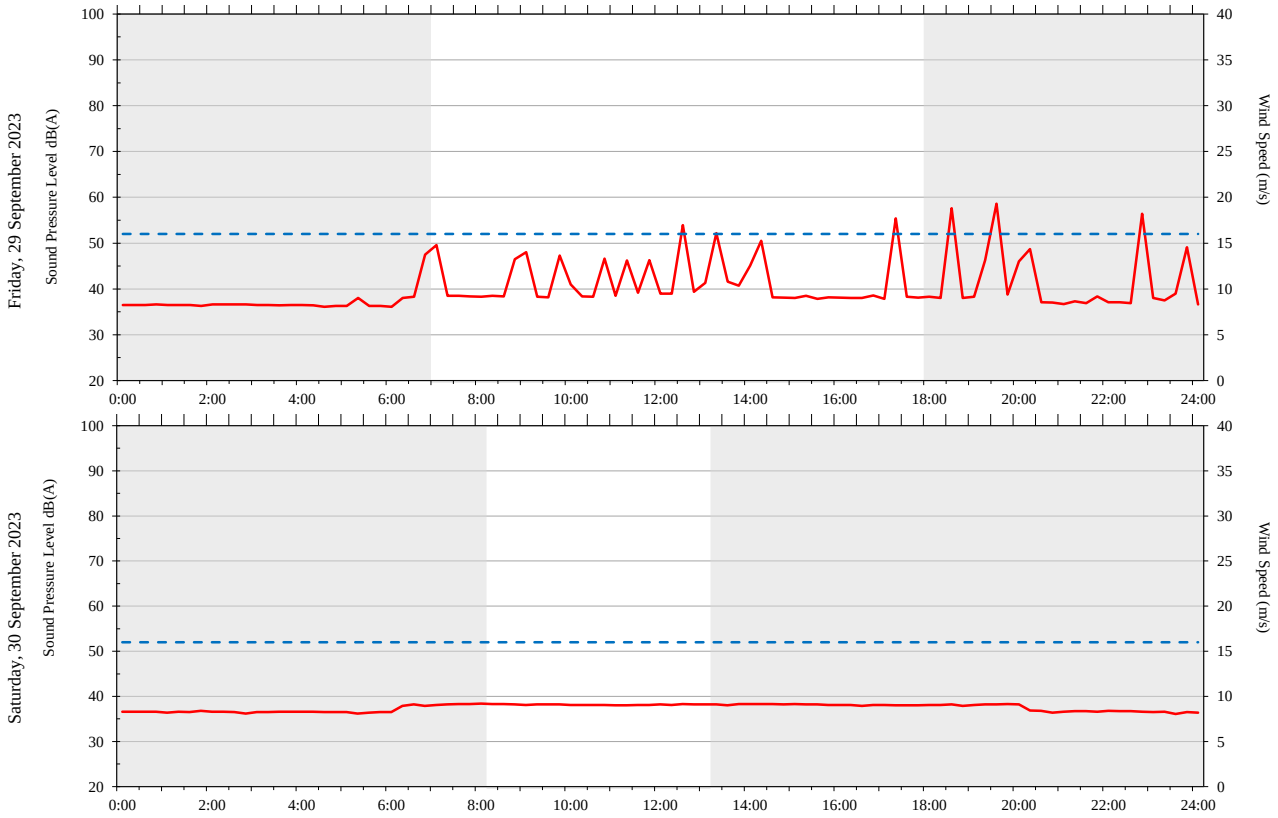

A3 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)

Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

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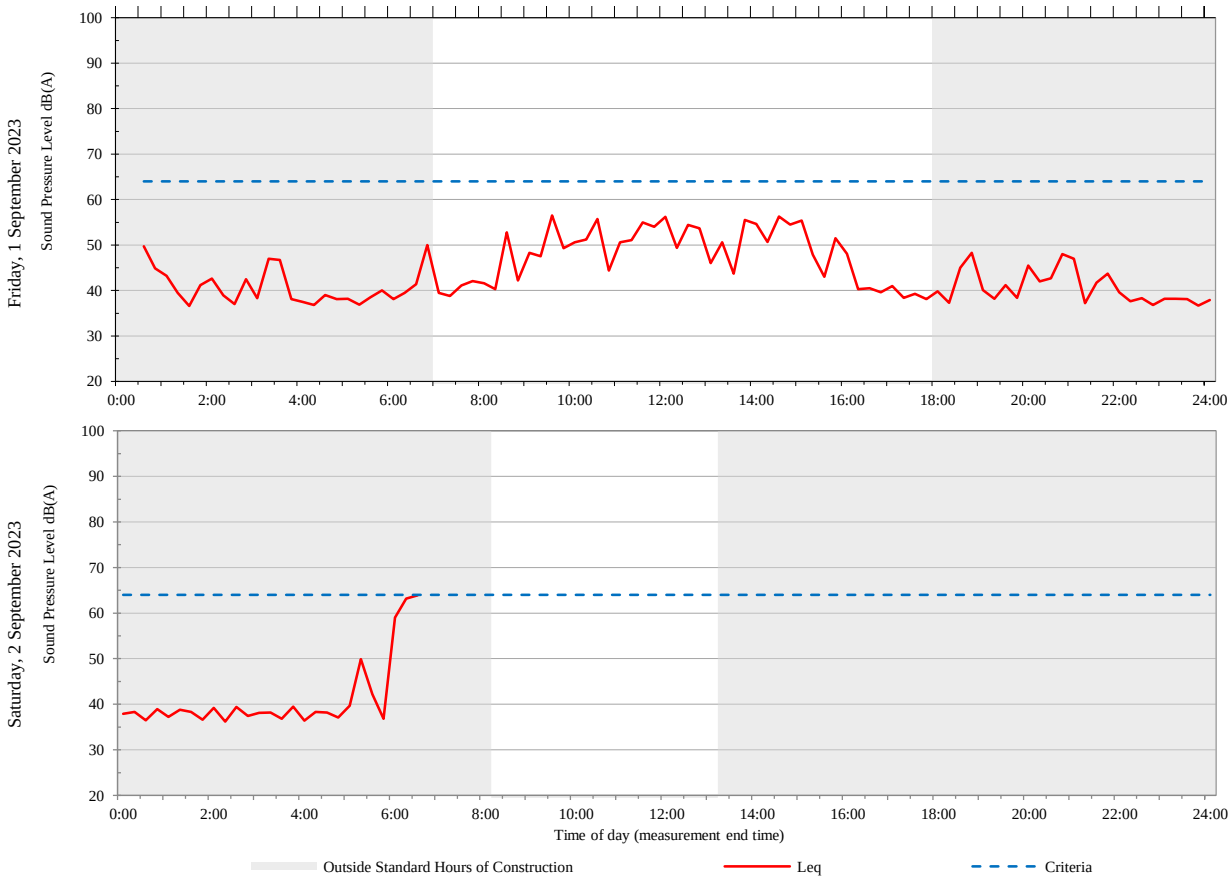

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Health Infrastructure NSW

Westmead VVMF Construction Noise Monitoring

Noise monitoring report 2023-09-01 to 2023-09-30

Reference: AC06

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		Filename			
		Description			
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		Signature			
		Filename			
		Description			
			Prepared by	**Checked by**	**Approved by**
		Name			
		Signature			

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1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of Health Infrastructure NSW to install a noise monitor within the Westmead Institute for Medical Research (WIMR) to monitor and manage noise from the construction of the Viral Vector Manufacturing Facility (VVMF) in the Westmead Precinct.

The noise logger was deployed on the 8th of March 2023 and has been setup to send email and SMS notifications to stakeholders when construction Noise Management Levels (NMLs) are exceeded.

This report details noise measurement results from **1 September 2023** to **30 September 2023** inclusive.

2. Noise logger location

One Acoustic Research Labs Ngara noise logger is installed at the location shown in Figure 1 below.

The noise logger was calibrated by Acoustic Research Labs (NATA accredited calibration) in November 2021.

On Thursday 10 August 2023, the Ngara noise logger Westmead 4 (previously installed in WIMR Clean prep room) was temporarily replaced by the Ngara noise logger Westmead 7 (previously installed in KR radiation room as part of the PSB and MSCP noise monitoring project). The decision to swap Westmead 4 noise logger with Westmead 7 noise logger was driven by concerns about the performance of Westmead 4 noise logger.

The noise loggers were calibrated by Acoustic Research Labs (NATA accredited calibration) in November 2021.

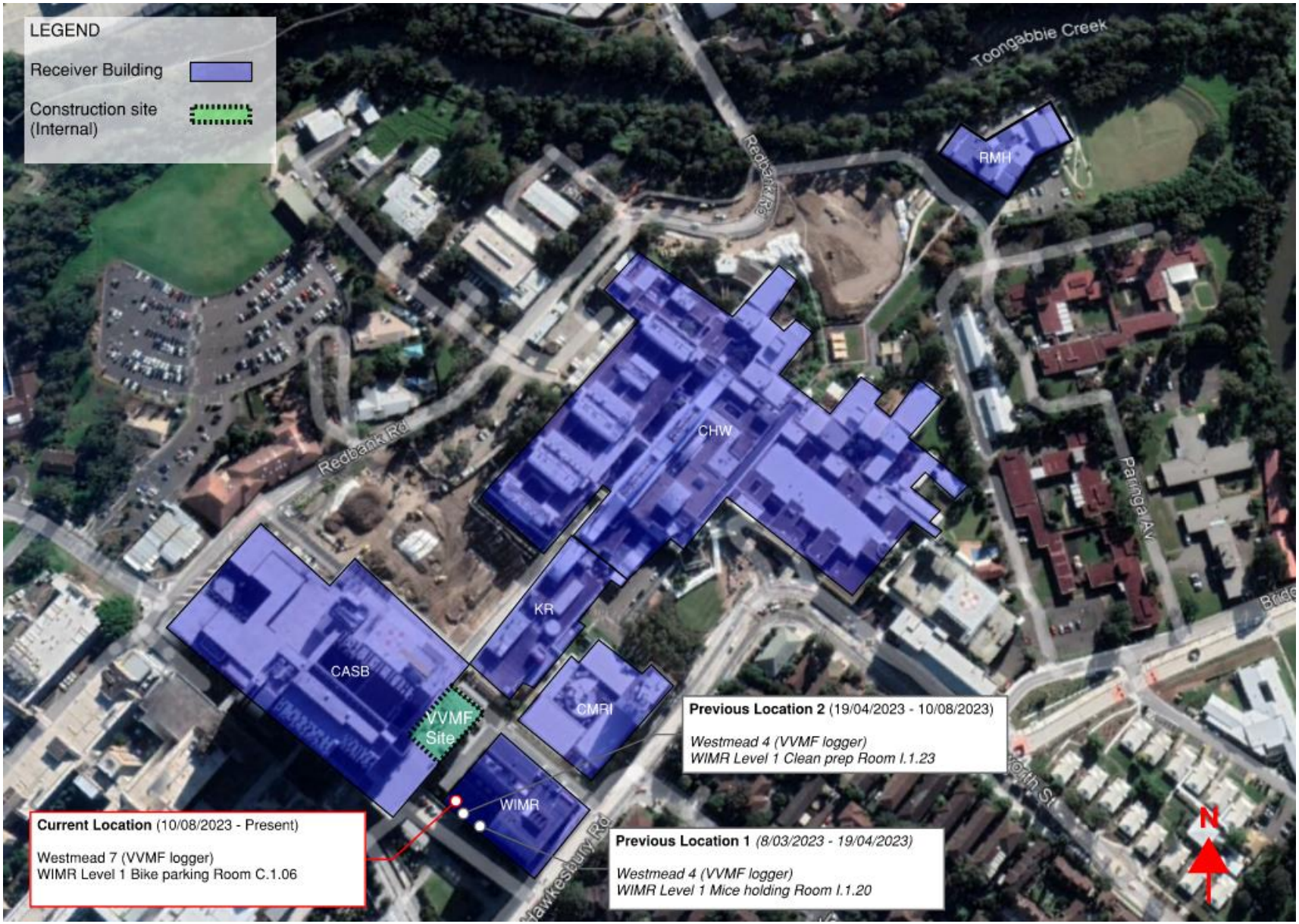

Figure 1: VVMF noise monitoring locations

2.1 Noise logger relocation

No logger relocation to report within this period.

A summary of all logger relocations can be found in Table 1 below.

Table 1: Logger relocation records

Logger ID	Original Location	Current location	
	Location	Date moved	Location
Westmead 4	WIMR Level 1 Mice holding room	19/4/2023	WIMR Level 1 Clean Prep Room
Westmead 4	WIMR Level 1 Clean Prep Room	10/08/2023	*Removed from site*
Westmead 7	KR Level 3 Radiation Room	10/08/2023	WIMR Level 1 Bike Parking room

3. Noise Management Levels

The current Construction Noise Management Levels (NMLs) are set out in Table 2. The NMLs have been determined following a baseline noise study conducted in April 2023. (Refer to Arup's *Westmead Hospital N&V Monitoring – Attended Noise Measurements – VVMF Construction Activity*[1] memo for details regarding how these NMLs were nominated.)

Measurement data taken from 'standard' construction work hours for the project only are assessed against the Noise Management Level criteria, being:

7am-6pm Mon-Fri

8am-1pm Sat

No work on Sundays and Public Holidays.

The NMLs levels in Table 2 were determined following both the review of current noise levels within the mice holding room when no construction was conducted, and available information with regards to the sensitivity to noise of research animals. The NMLs below represent the level of construction noise if exceeded may result in a negative impact on research animals.

To safeguard the research animals, the previously established NMLs were retained despite relocating the logger. However, it's important to note that the results may be conservative due to the logger's closer proximity to the construction works.

Table 2: Noise Management Levels

Logger ID	Location	Noise Management Level, dB	Description
Westmead 4 (1/08/2023 – 10/08/2023)	WIMR L1 Clean Prep Room (I.1.23)	L_{Amax} 85	For short duration high noise levels
		$L_{Aeq(1minute)}$ 69	For more continuous noise generation
Westmead 7 (10/08/2023 – On Going)	WIMR L1 Bike Room (C.1.06)	L_{Amax} 85	For short duration high noise levels
		$L_{Aeq(1minute)}$ 69	For more continuous noise generation

3.1 Management Level updates

The following provides a progressive record of management level updates:

- None-to-date

[1] Arup report reference: 283812-16

4. Noise monitoring results

4.1 Outages

Noise monitoring outages are shown below. This excludes outages related to logger data collection and calibration.

Table 3: Noise logger outages during monitoring period

Logger ID	Noise logger location	Outages
Westmead 7	WIMR L1 Bike Room (C.1.06)	2/09/2023 (6:41 – 9:02)

4.2 Exceedances

The number of Noise Management Level exceedances recorded during the assessment period are shown below.

Table 4: Recorded NML exceedances

Logger Id	Noise logger location	Noise Management Level exceedance instances	
		Short duration L_{Amax} criteria	Continuous $L_{Aeq(1minute)}$ criteria
Westmead 7	WIMR L1 Bike Room (C.1.06)	13	5

It is noted that the exceedances of the NMLs may be the result of noise generated by either internal activities unrelated to construction, or by construction activities.

It is the responsibility of Ford Civils (the Head Contractor) to respond to each NML exceedance when it occurs and record the outcome of the exceedance investigation (cause of NML exceedance, any noise mitigation measures implemented to address the exceedances, etc.).

Appendix A

Noise monitoring results

A.1 WIMR L1 Bike Room (C.1.06)

Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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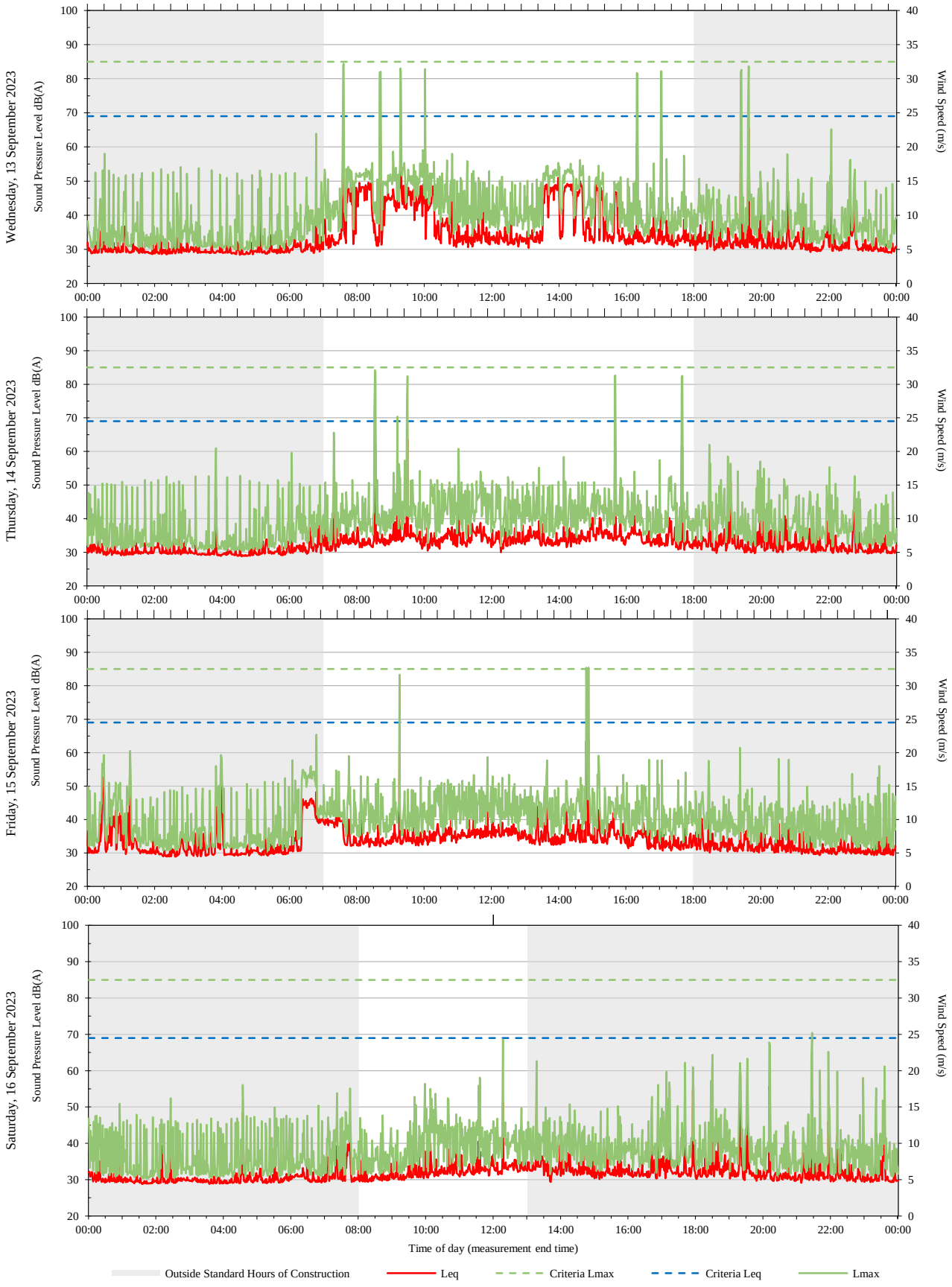

Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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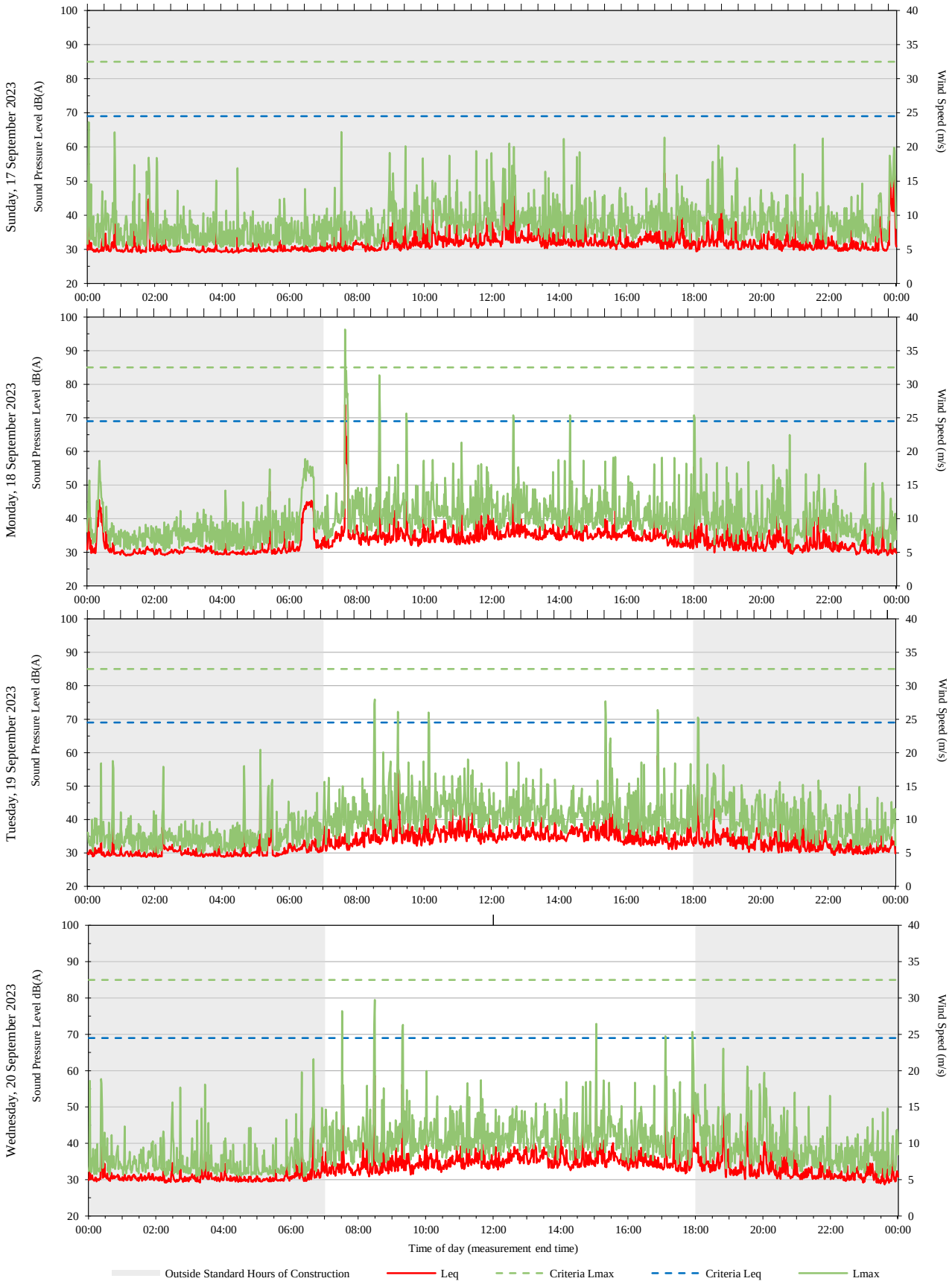

Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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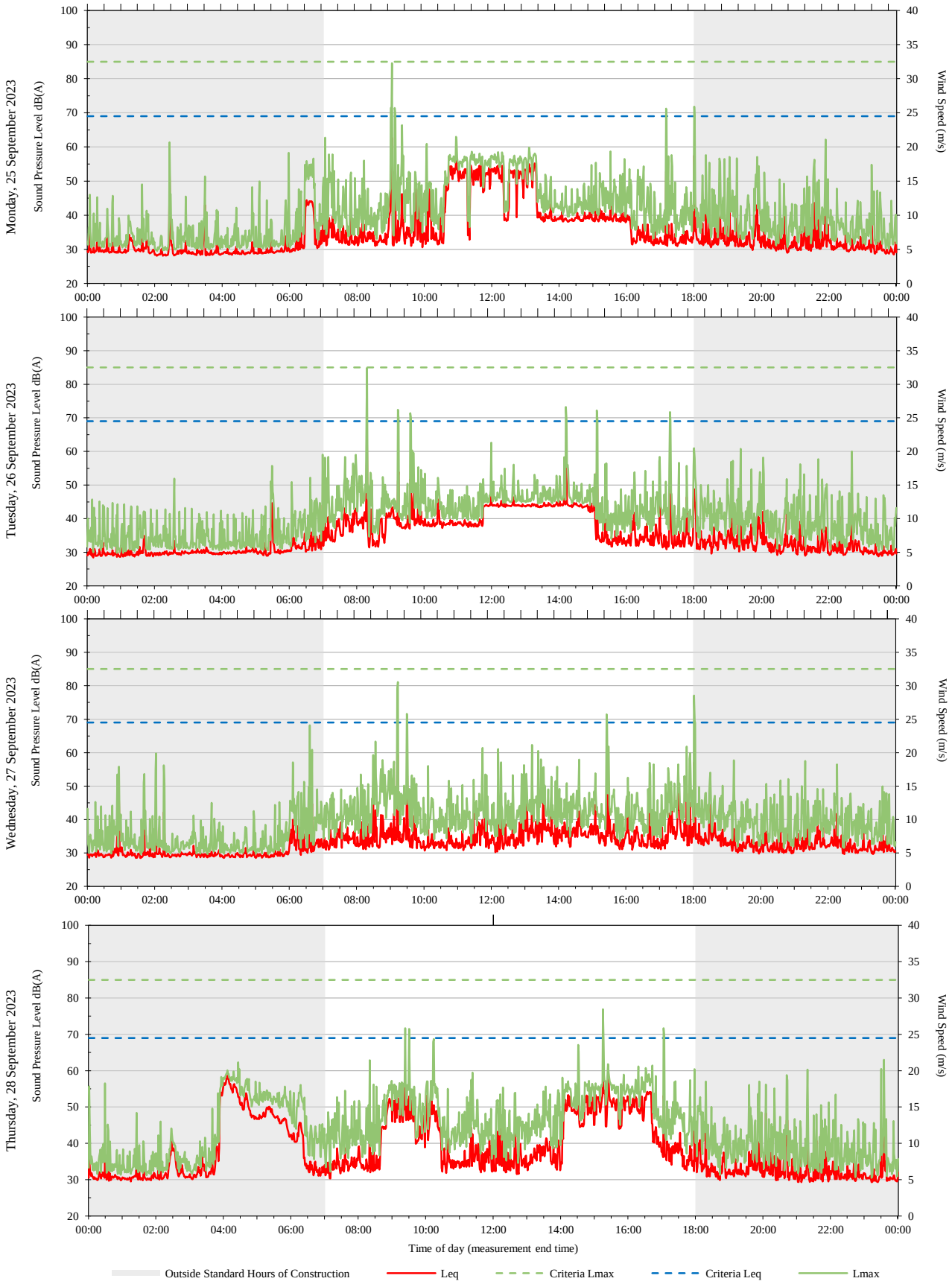

Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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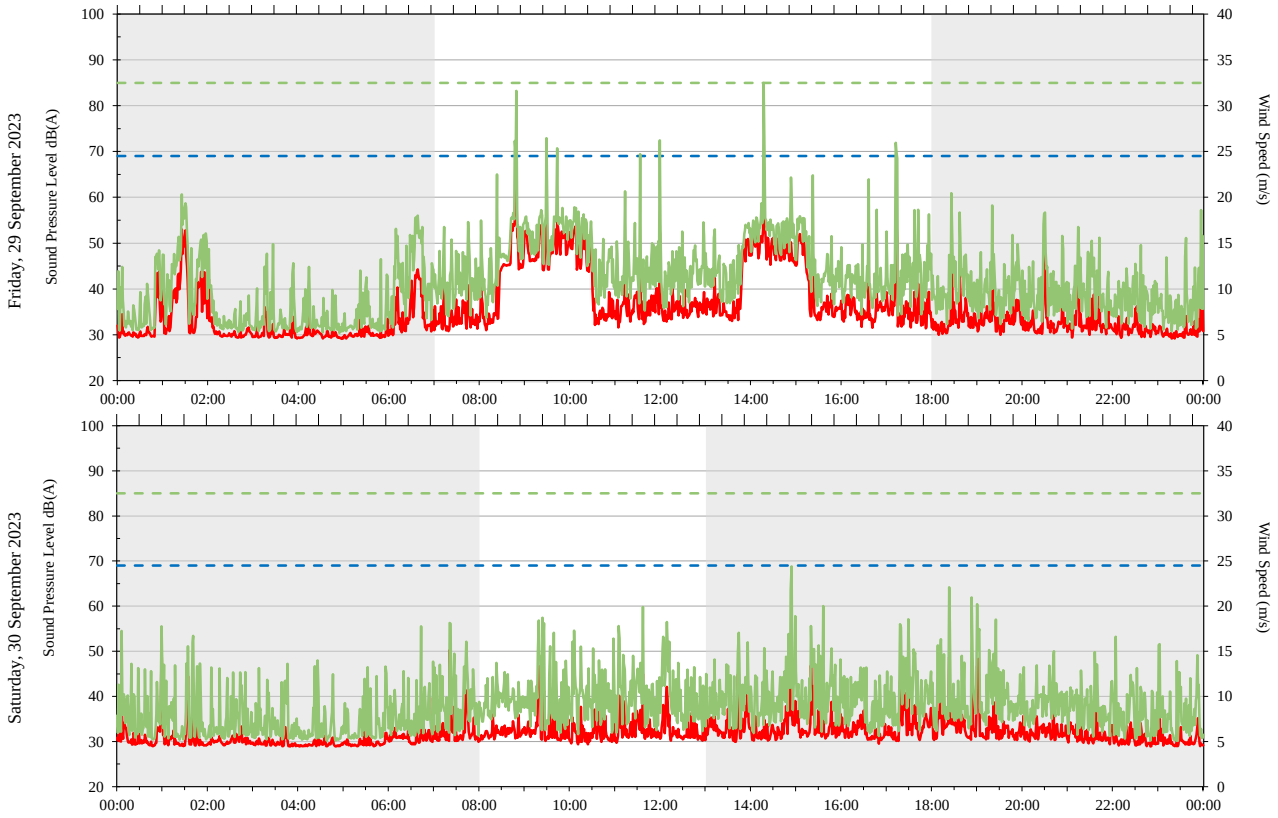

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Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - WIMR - BSF Mice Holding Room - Rack - September 2023

CVM/ WIMR/202309

Issue 1 | 13/10/2023

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Signature			

Filename		
Description		

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Name			
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

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Contents

Executive Summary

This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Rack, over one month – from 01/09/2023 to 30/09/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

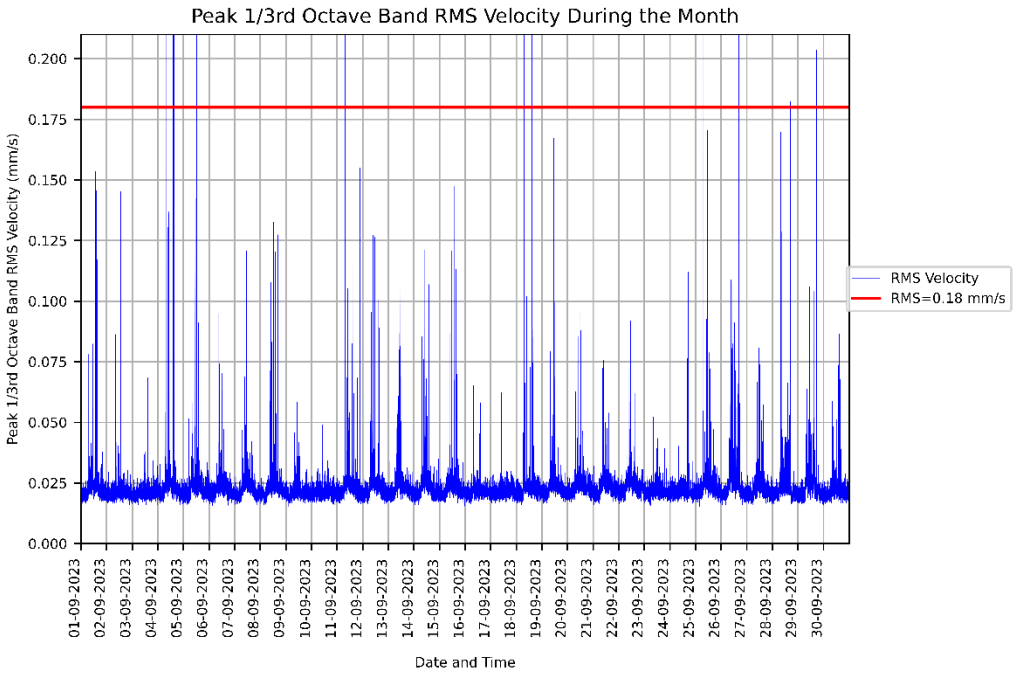

Figure 1: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Rack.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
13	0

PPV Vibration Levels

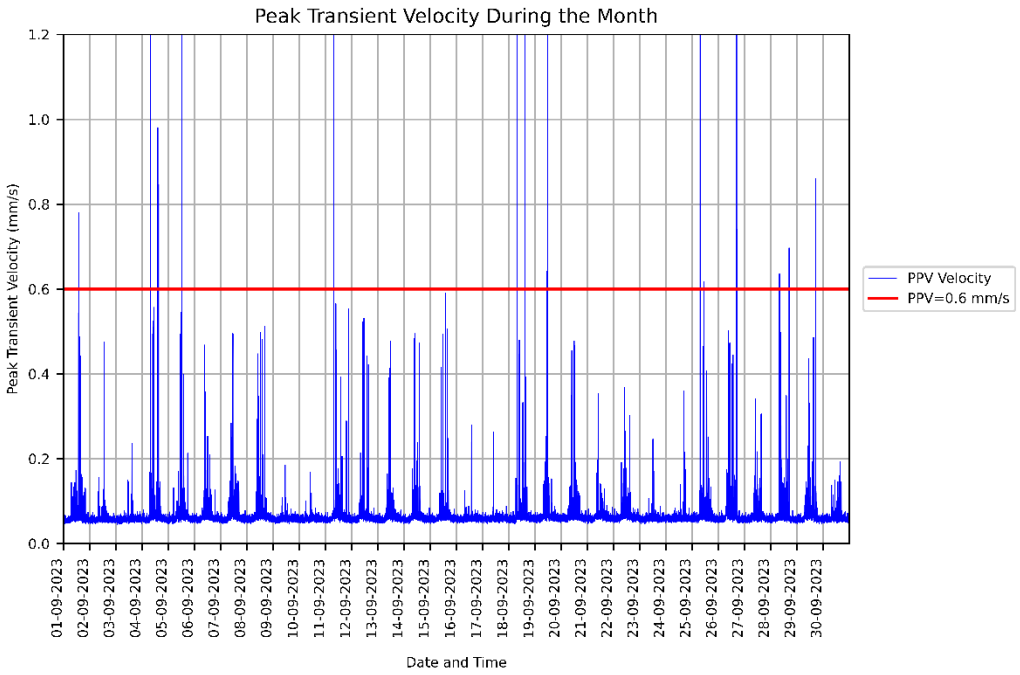

Figure 2: Measured vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Rack.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
14	3

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the VVMF Innovation Centre development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Rack during the period of the 01/09/2023 to 30/09/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

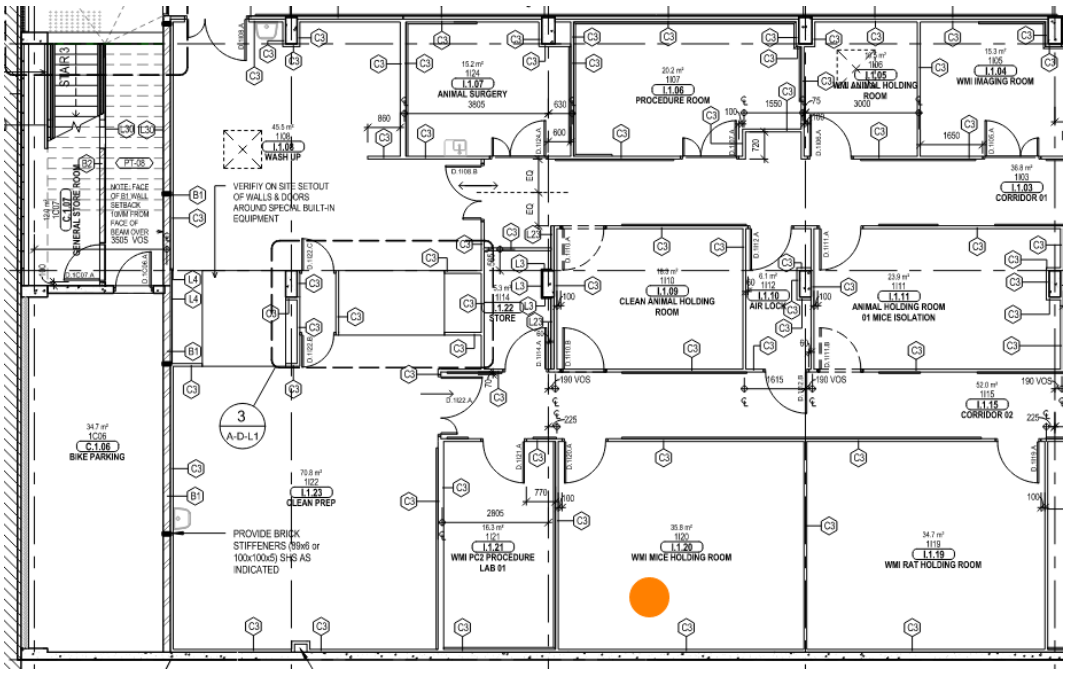

Figure 3: WIMR - BSF Mice Holding Room - Rack vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.18mm/s (V_{RMS}) is shown in red.

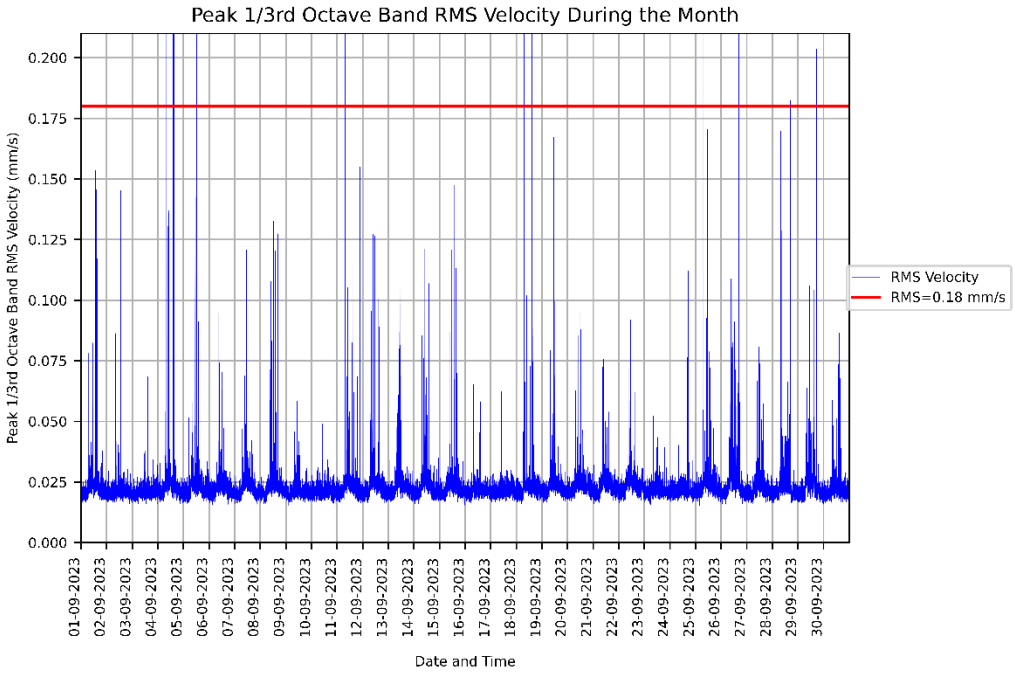

Figure 4: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Rack.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
13	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.6mm/s (V_{PPV}) is shown in red.

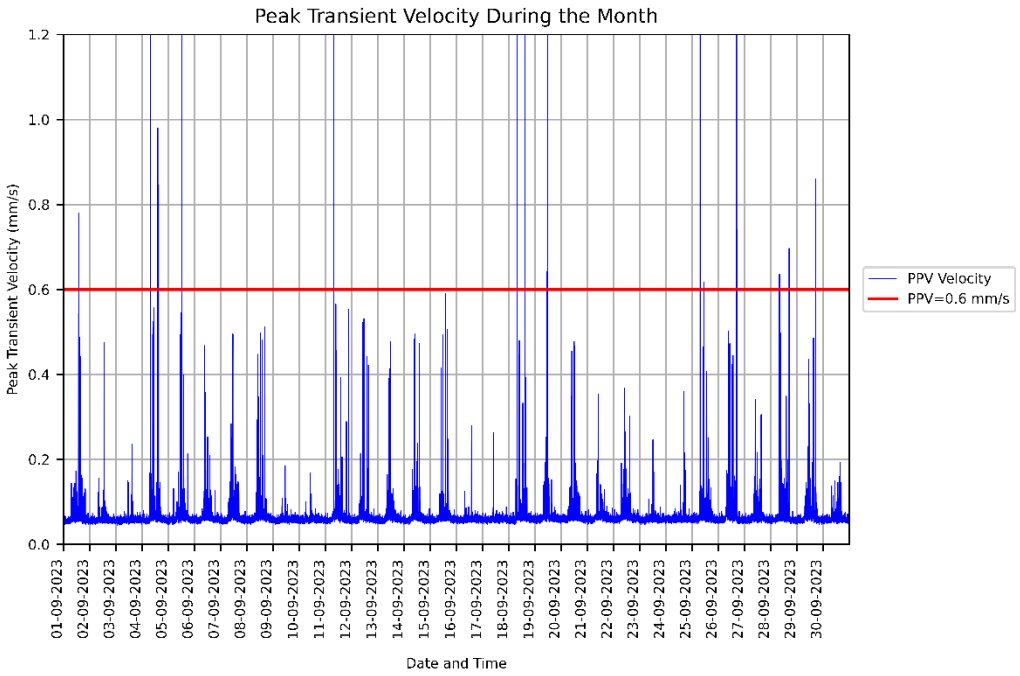

Figure 5: Measured PPV vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Rack.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
14	3

Appendix A: Calibration Certificates

Test Record GMSplus

Test Record	1	**Job**	31057
S/N	103677	**Test Procedure**	GS_GMSplus_TestProcedure_V01

Customer	AU_ARUP_ Riddet	**Date**	01.02.2018
		Tested by	Ross Baradoy

Model	GMSplus	103677	**Option 1**		
Type	3Ch		**Option 2**		
Description	Recorder		**Option 3**		
Main board	GS_IA18_S-MN.V06.H2	160281	**Option 4**		
Conn. board	GS_IA18_S-MN.V06.H2	160305	**Option 5**		
Input range	± 10 V DIFF		**Option 6**		
Sensor 1	VE-11	56865	**Ext. Option 1**	GXX-3GUE	17738
Sensor 2	0		**Ext. Option 2**		
Power	15 VDC		**Ext. Option 3**		
Armdas/Predas	21.12.16		**MAC**	8C:8E:76:00:C2:01	
Linux	gms-linux-firmware-r121_20170321.gsfw		**DSP**	51.03.05	
			RTC	80.02.03	

Remarks:

1. Test Equipment

1.1. Test equipment is as per list and ready	☒ Ok

2. Visual Check

2.1. No defects found during visual check	☒ Ok

3. Configuration

3.1. Description	GMSplus GeoSIG Ltd
3.2. Memory	8 GB
3.3. Station	GSGMS
3.4. Location	Australia
3.5. Sampling rate	200 SPS
3.6. Units	mm/s
3.7. LSB value	0.0000132500000mm/s /count
3.8. Pre event	5 s
3.9. Post event	10 s
3.10. Trigger level	2 and 3 mm/s
3.11. Alarms Trigger level	n/a

4. Sensor input test

4.1. AC input test	☒ Ok
4.2. DC input test	☒ Ok
4.3. Noise test	☒ Ok

5. Real sensor test

5.1. Test pulse	☒ Ok	☐ n/a
5.2. Event X-Y-Z	☒ Ok	☐ n/a
5.3. Tilt	☒ Ok	☐ n/a
5.4. Over range	☒ Ok	☐ n/a

6. Options testing

6.1. GMS-Wi-Fi	☐ Ok	☒ n/a
6.2. GMS-GPS	☐ Ok	☒ n/a
6.3. GXX-3GUM	☒ Ok	☐ n/a
6.4. ALC, Config:	☐ Ok	☒ n/a
6.5. GMS-Interconnection	☐ Ok	☒ n/a
6.6. Serial modem	☐ Ok	☒ n/a
6.7. Ethernet modem	☐ Ok	☒ n/a
6.8. Sensor junction box	☐ Ok	☒ n/a

7. Physical inspection

7.1. Housing	☒ Ok
7.2. Fixation and screws	☒ Ok
7.3. Cables and connectors	☒ Ok
7.4. Labels	☒ Ok
7.5. Cleanness	☒ Ok

8. Configuration backup

8.1. Instrument configuration (*.xml)	☒ Ok
8.2. Software configuration (*.gsc)	☒ Ok
8.3. Test files archived	☒ Ok

Final Acceptance

All tests were executed according to the test procedure and all results were checked and are according to the specifications.

Tested by Ross Baradoy on 26.02.2018

Approved by Tobias Liesching on 02.03.2018

ARUP

Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - KR - Gait Lab - September 2023

CVM/ KR/202309

Issue 1 | 13/10/2023

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd
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151 Clarence Street
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ARUP

Document Verification

Project title	Children's Hospital Westmead
Document title	Monthly Vibration Monitoring Report
Job number	271985
Document ref	CVM/KR/202309
File reference	-

Revision	**Date**	**Filename**	Westmead Hospital – 103156 KR - Gait Lab - Summary of Recent Vibration Measurments (01-09 to 30-09).docx
Issue 1	13/10/2023	**Description**	Issue

	Prepared by	**Checked by**	**Approved by**
Name	PR	MJW	MJW
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

Issue Document Verification with Document ✓

Contents

Executive Summary

This report summarises the vibration monitoring data recorded at KR - Gait Lab, over one month – from 01/09/2023 to 30/09/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

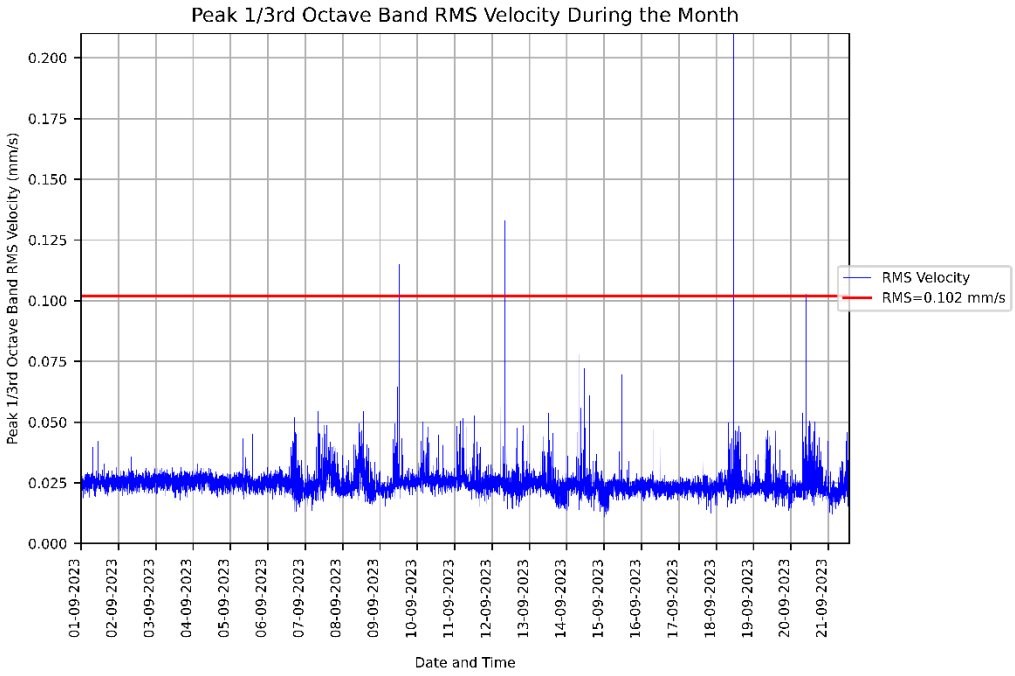


Figure 1: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the KR - Gait Lab.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
4	0

PPV Vibration Levels

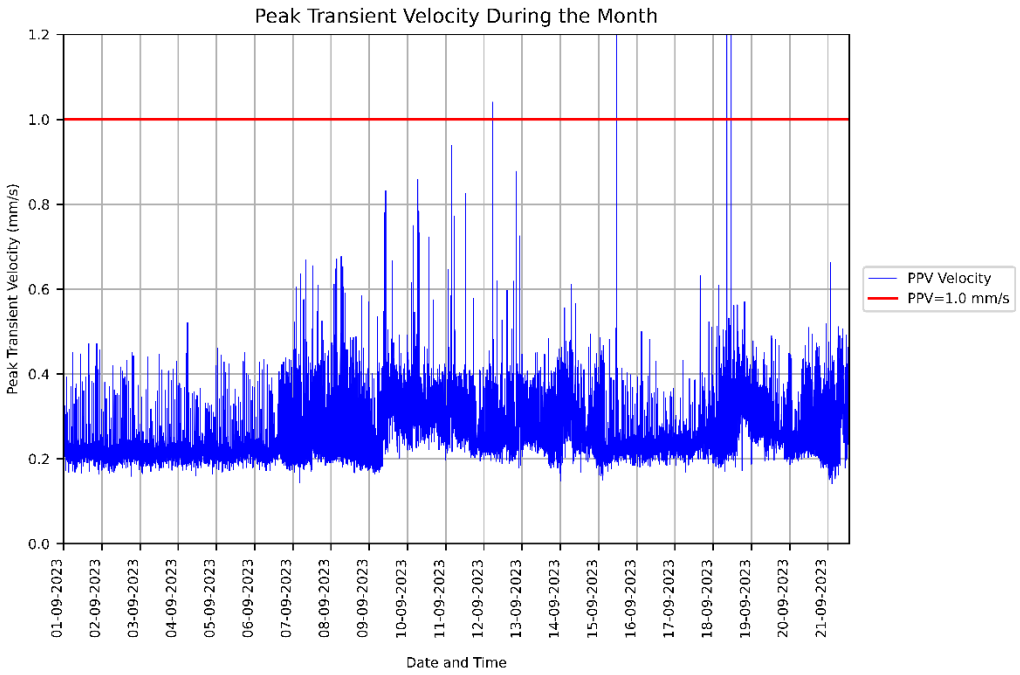


Figure 2: Measured vibration levels for 01/09/2023 to 30/09/2023 at the KR - Gait Lab.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
2	2

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at KR - Gait Lab during the period of the 01/09/2023 to 30/09/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

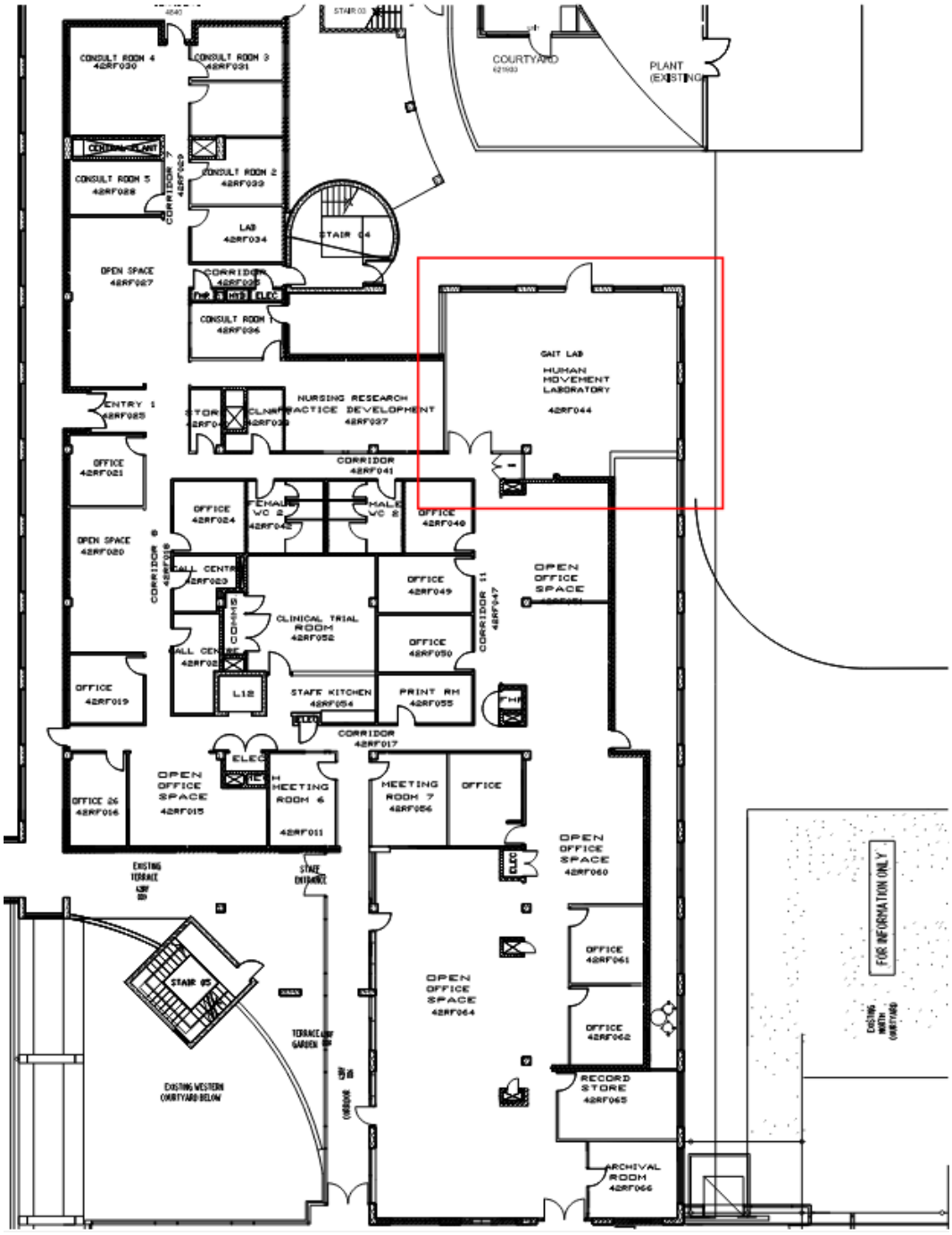


Figure 3: KR - Gait Lab vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

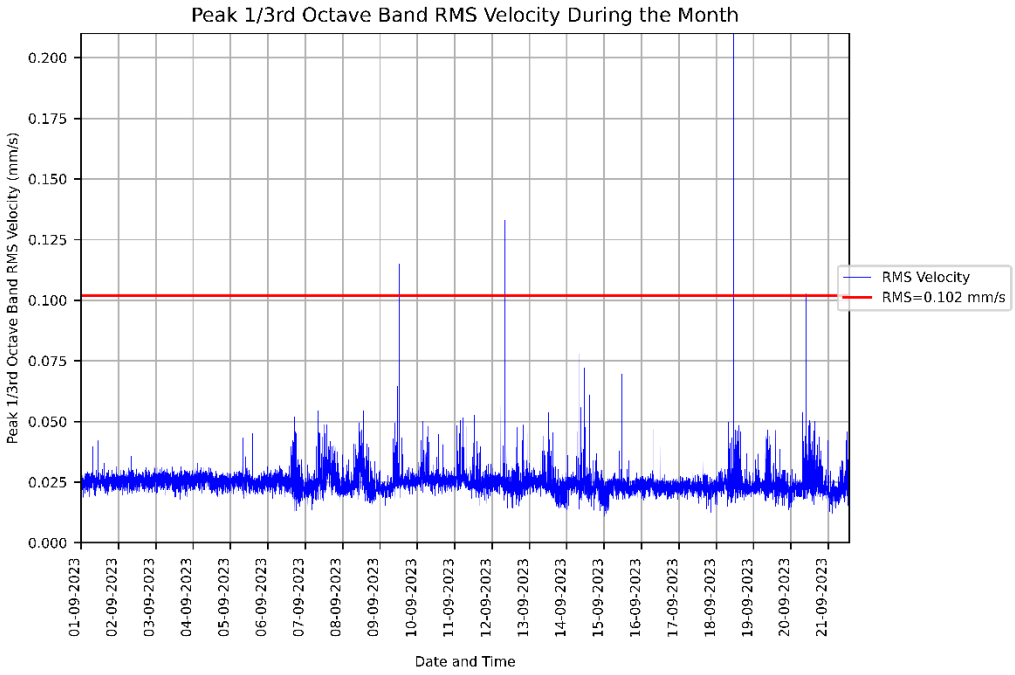


Figure 4: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the KR - Gait Lab.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
4	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 1.0mm/s (V_{PPV}) is shown in red.

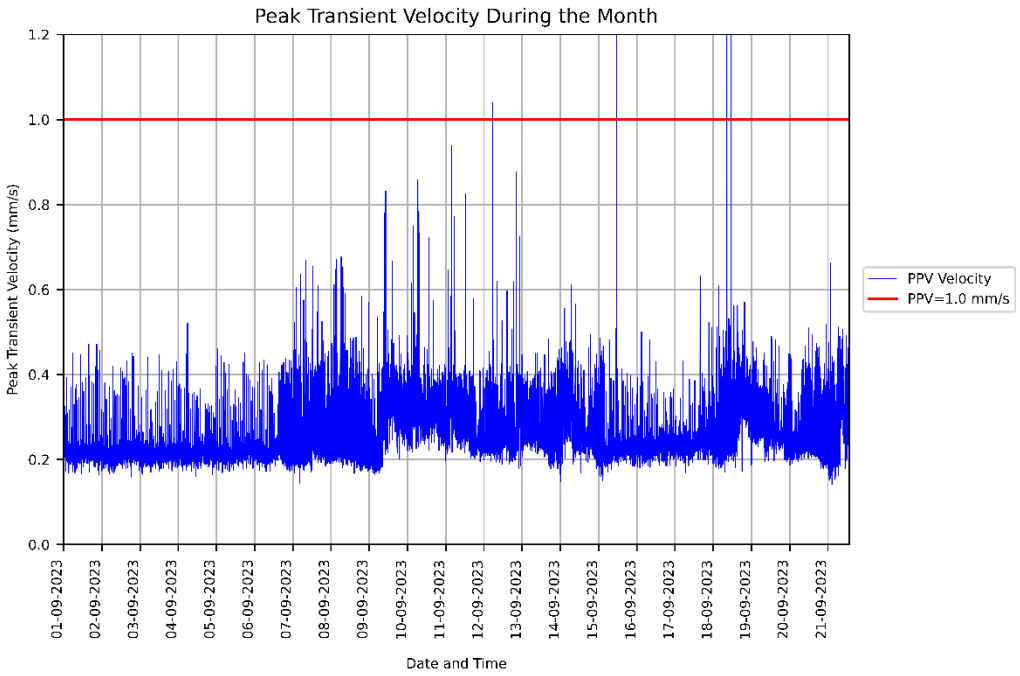
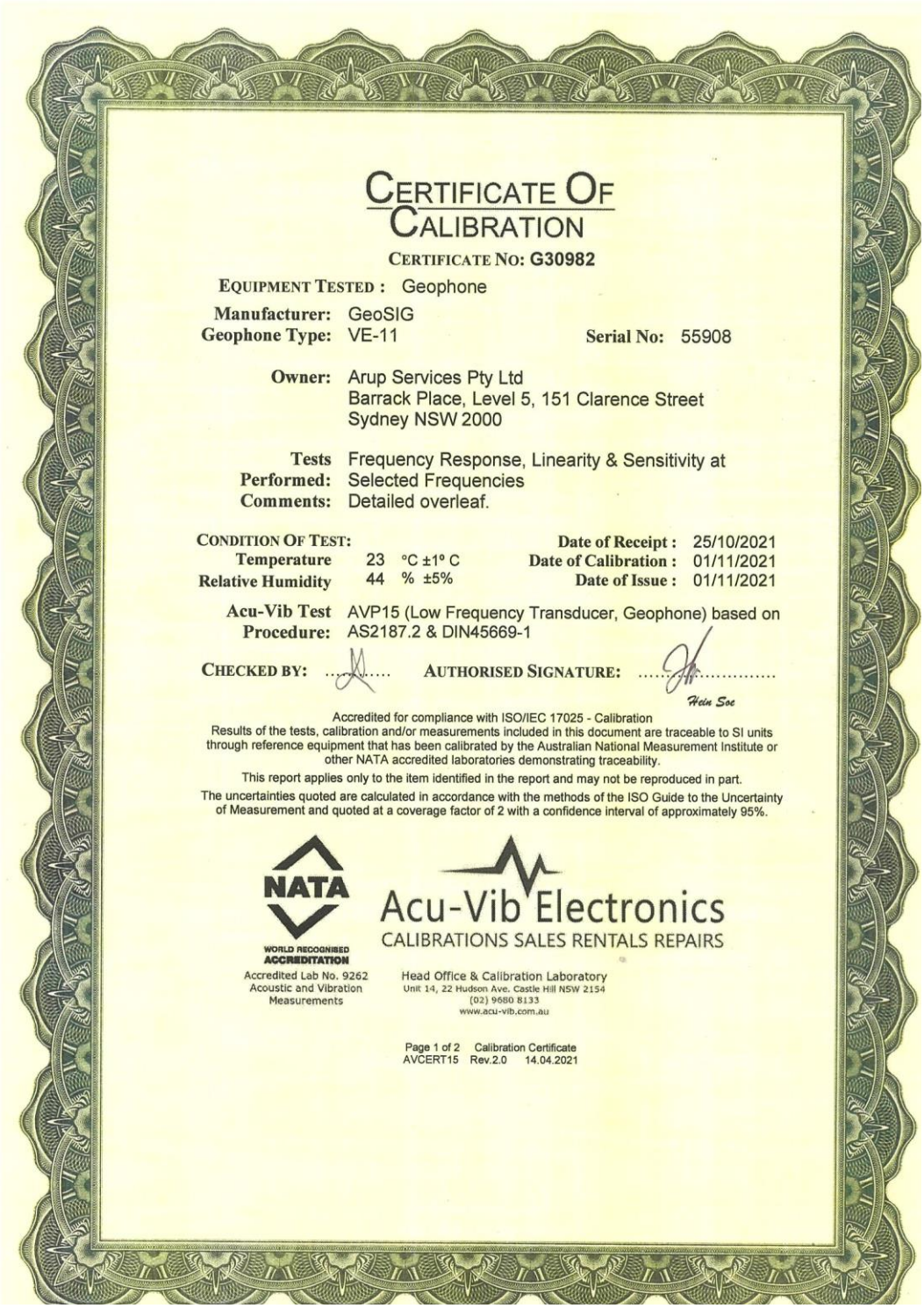


Figure 5: Measured PPV vibration levels for 01/09/2023 to 30/09/2023 at the KR - Gait Lab.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
2	2

Appendix A: Calibration Certificates



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: G30982

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11 **Serial No:** 55908

Owner: Arup Services Pty Ltd
Barrack Place, Level 5, 151 Clarence Street
Sydney NSW 2000

Tests Performed: Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments: Detailed overleaf.

CONDITION OF TEST:
Temperature 23 °C ±1° C
Relative Humidity 44 % ±5%

Date of Receipt : 25/10/2021
Date of Calibration : 01/11/2021
Date of Issue : 01/11/2021

Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Page 1 of 2 Calibration Certificate
AVCERT15 Rev.2.0 14.04.2021

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55908**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz
12VDC Power Supply Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mms^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U_{95} %
3.00	18.85	10.0	110.73	1.00%
4.00	25.13	10.0	110.65	0.90%
6.00	37.70	10.0	107.04	0.90%
10.00	62.83	10.0	101.63	0.90%
15.00	94.25	10.0	99.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	93.34	0.90%
15.92	**94.25**	**10.0**	**93.15**	**0.90%**
15.92	94.25	50.0	93.10	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	97.57	0.50%
60.00	376.99	10.0	98.58	0.50%
120.00	753.98	10.0	110.55	0.50%
150.00	942.48	10.0	125.20	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U_{95} %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2: The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.

Page 2 of 2
End of Certificate

ARUP

Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - WIMR - BSF Mice Holding Room - Floor - September 2023

CVM/ WIMR/202309

Issue 1 | 13/10/2023

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd
Level 5
151 Clarence Street
Sydney NSW 2000
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Document Verification

Project title	Children's Hospital Westmead
Document title	Monthly Vibration Monitoring Report
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Document ref	CVM/WIMR/202309
File reference	-

Revision	**Date**		
		Filename	Westmead Hospital – 103158 WIMR - BSF Mice Holding Room - Floor - Summary of Recent Vibration Measurments (01-09 to 30-09).docx
Issue 1	13/10/2023	**Description**	Issue

	Prepared by	**Checked by**	**Approved by**
Name	PR	MJW	MJW
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

Issue Document Verification with Document ✓

Contents

Executive Summary

This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Floor, over one month – from 01/09/2023 to 30/09/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

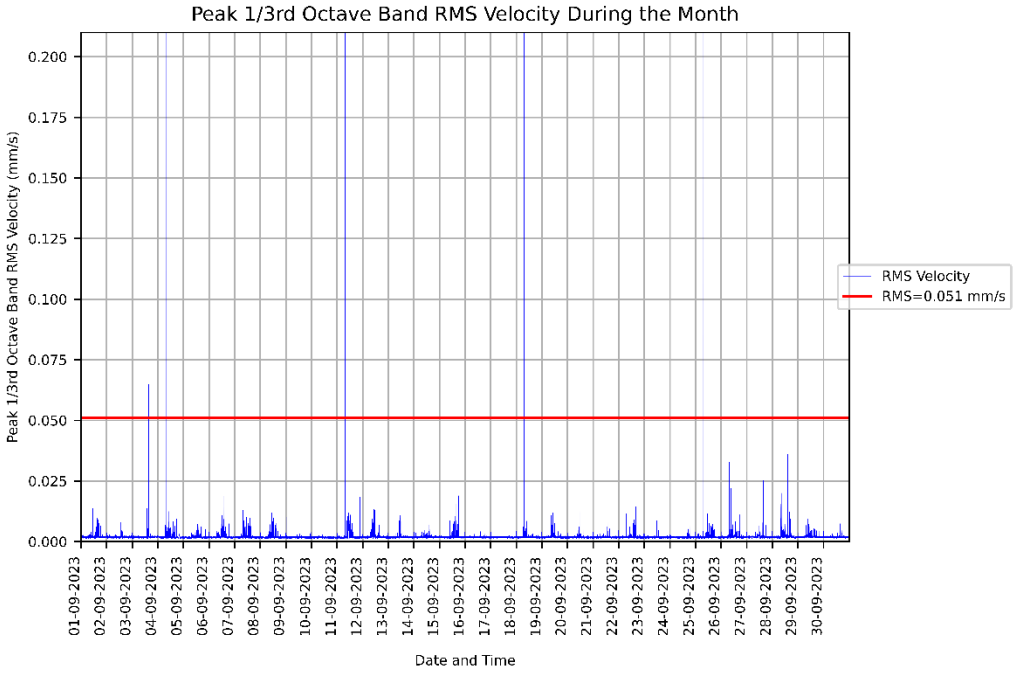


Figure 1: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
4	1

PPV Vibration Levels

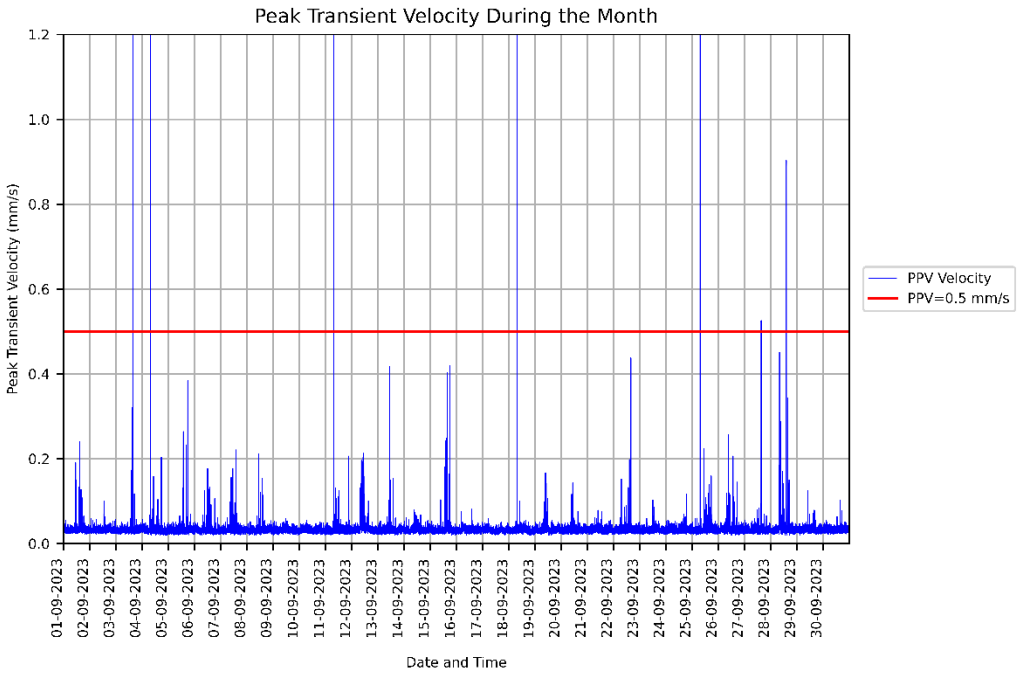


Figure 2: Measured vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
7	2

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the VVMF development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Floor during the period of the 01/09/2023 to 30/09/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

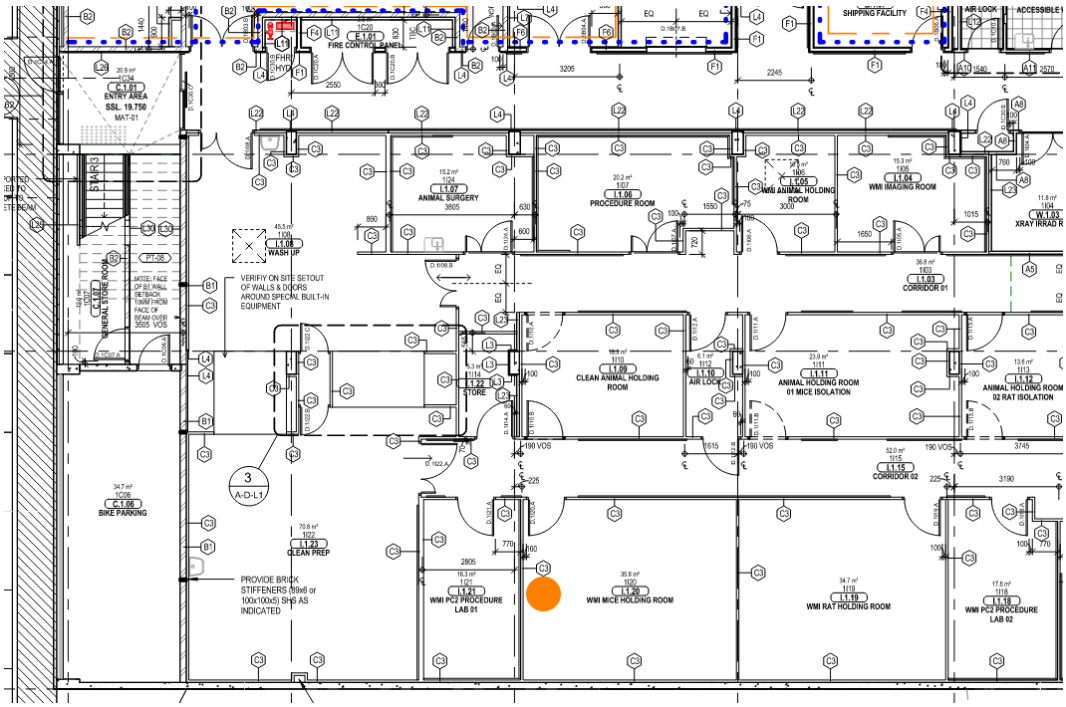


Figure 3: WIMR - BSF Mice Holding Room - Floor vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

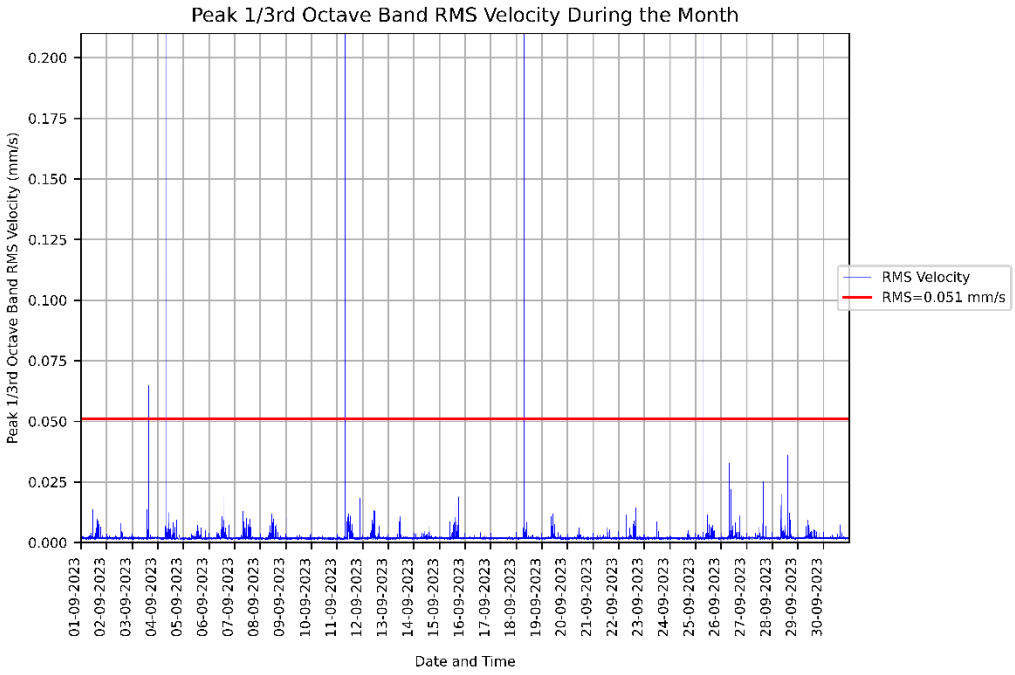


Figure 4: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
4	1

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.5mm/s (V_{PPV}) is shown in red.

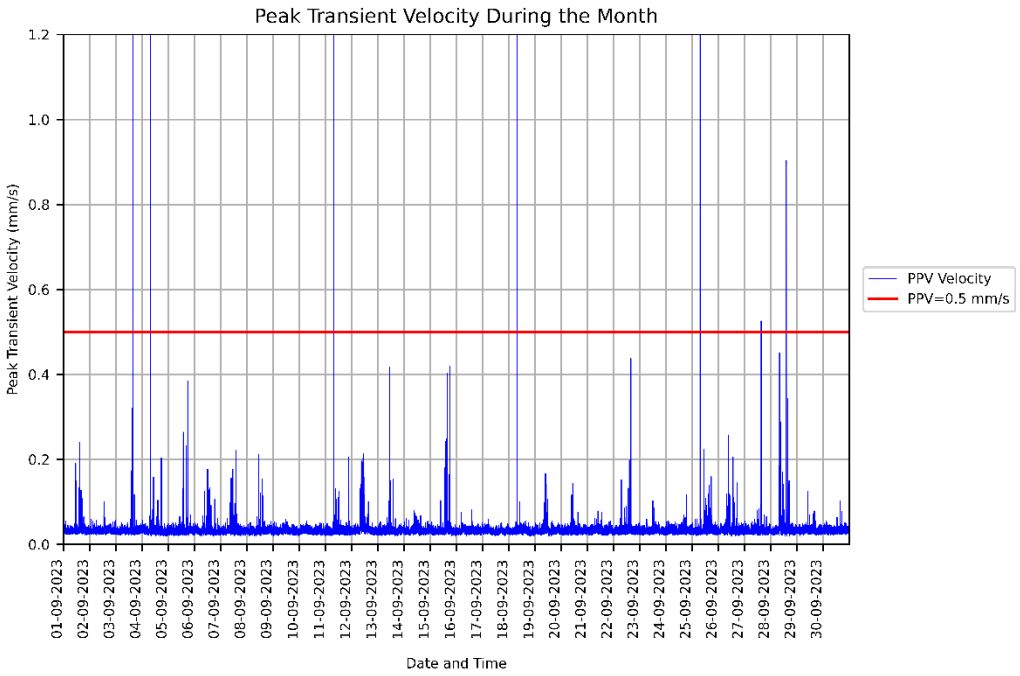
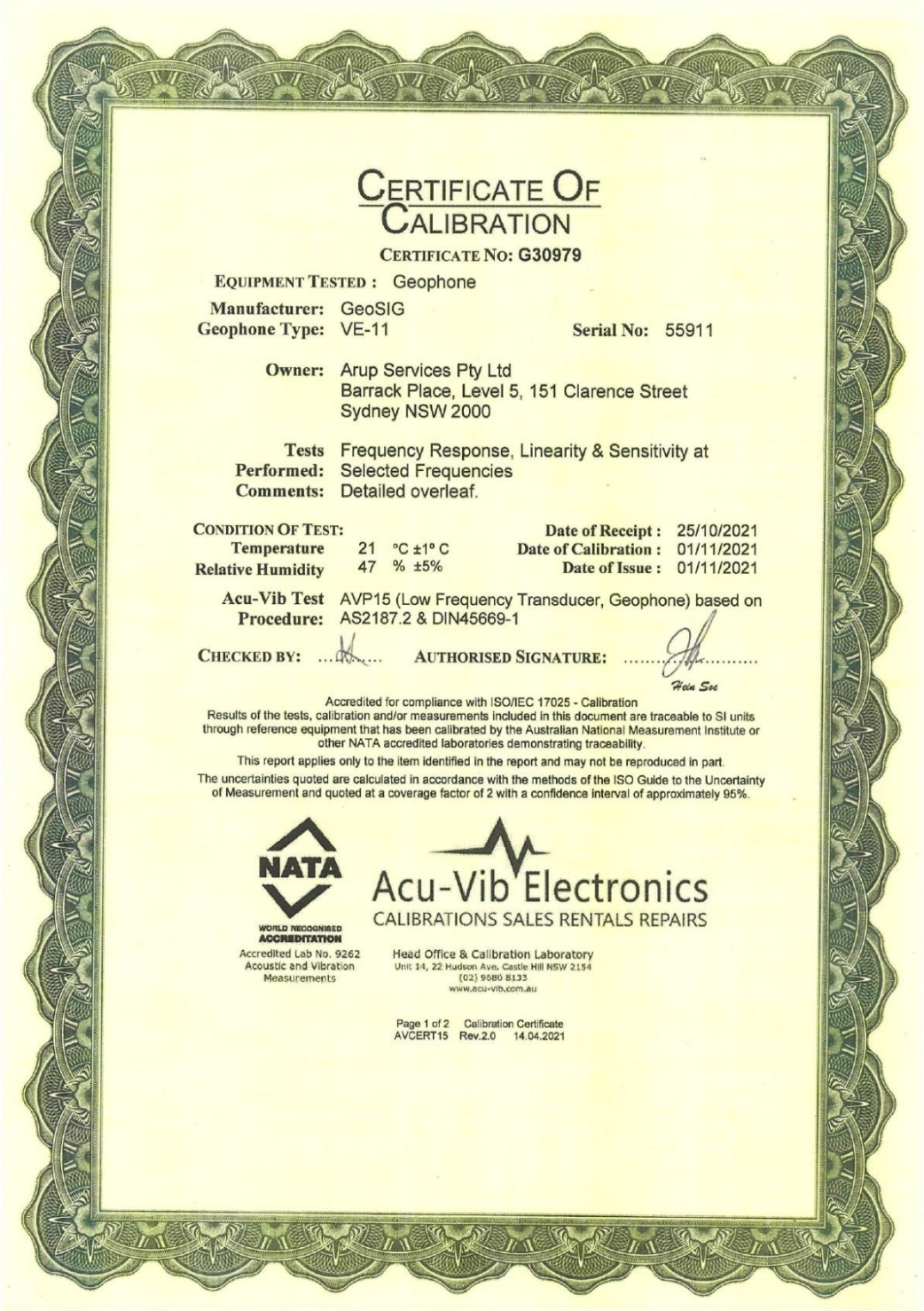


Figure 5: Measured PPV vibration levels for 01/09/2023 to 30/09/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
7	2

Appendix A: Calibration Certificates



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: G30979

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11 **Serial No:** 55911

Owner: Arup Services Pty Ltd
Barrack Place, Level 5, 151 Clarence Street
Sydney NSW 2000

Tests Performed: Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments: Detailed overleaf.

CONDITION OF TEST:
Temperature 21 °C ±1° C
Relative Humidity 47 % ±5%

Date of Receipt : 25/10/2021
Date of Calibration : 01/11/2021
Date of Issue : 01/11/2021

Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.
This report applies only to the item identified in the report and may not be reproduced in part.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Page 1 of 2 Calibration Certificate
AVCERT15 Rev.2.0 14.04.2021

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55911**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz
12VDC Power Supply Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mms^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U_{95} %
3.00	18.85	10.0	112.66	1.00%
4.00	25.13	10.0	112.97	0.90%
6.00	37.70	10.0	108.80	0.90%
10.00	62.83	10.0	101.91	0.90%
15.00	94.25	10.0	98.58	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	92.57	0.90%
15.92	**94.25**	**10.0**	**92.49**	**0.90%**
15.92	94.25	50.0	92.48	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	95.98	0.50%
60.00	376.99	10.0	96.13	0.50%
120.00	753.98	10.0	106.11	0.50%
150.00	942.48	10.0	116.46	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U_{95} %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2: The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.

Page 2 of 2
End of Certificate

ARUP

Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - CASB level 3 Surgical Suite - September 2023

CVM/ CASB/202309

Issue 1 | 13/10/2023

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd
Level 5
151 Clarence Street
Sydney NSW 2000
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Document Verification

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Document title	Monthly Vibration Monitoring Report
Job number	271985
Document ref	CVM/CASB/202309
File reference	-

Revision	Date		
		Filename	Westmead Hospital – 103160 CASB level 3 Surgical Suite - Summary of Recent Vibration Measurments (01-09 to 30-09).docx
Issue 1	13/10/2023	**Description**	Issue

	Prepared by	**Checked by**	**Approved by**
Name	PR	MJW	MJW
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

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Contents

Executive Summary

This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite, over one month – from 01/09/2023 to 30/09/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

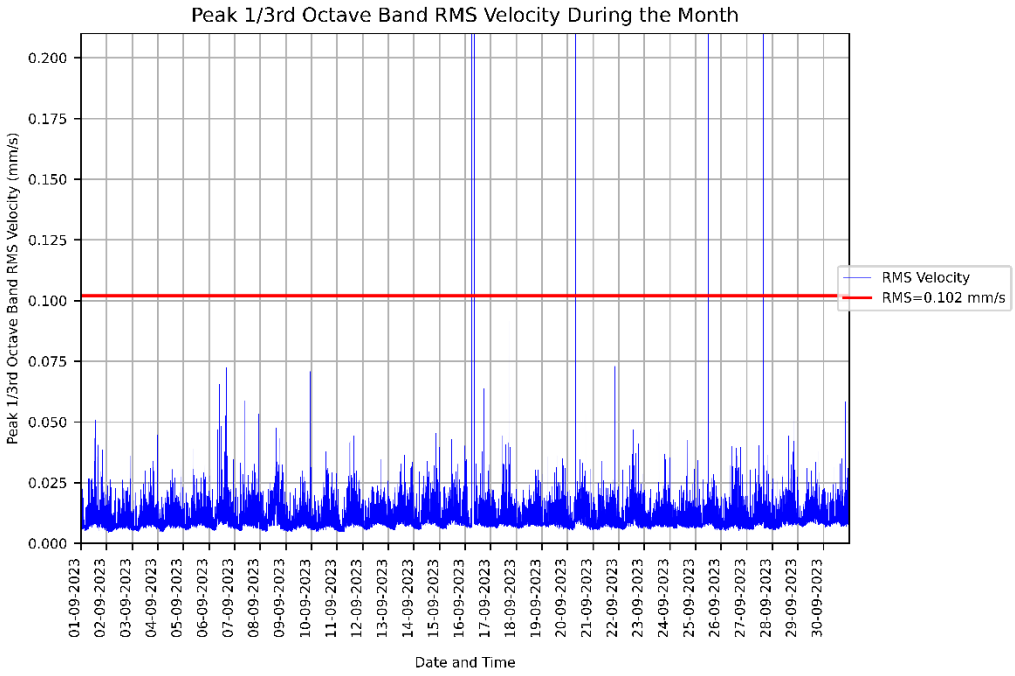


Figure 1: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the CASB level 3 Surgical Suite.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
24	56

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite during the period of the 01/09/2023 to 30/09/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	**Construction Hours**
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

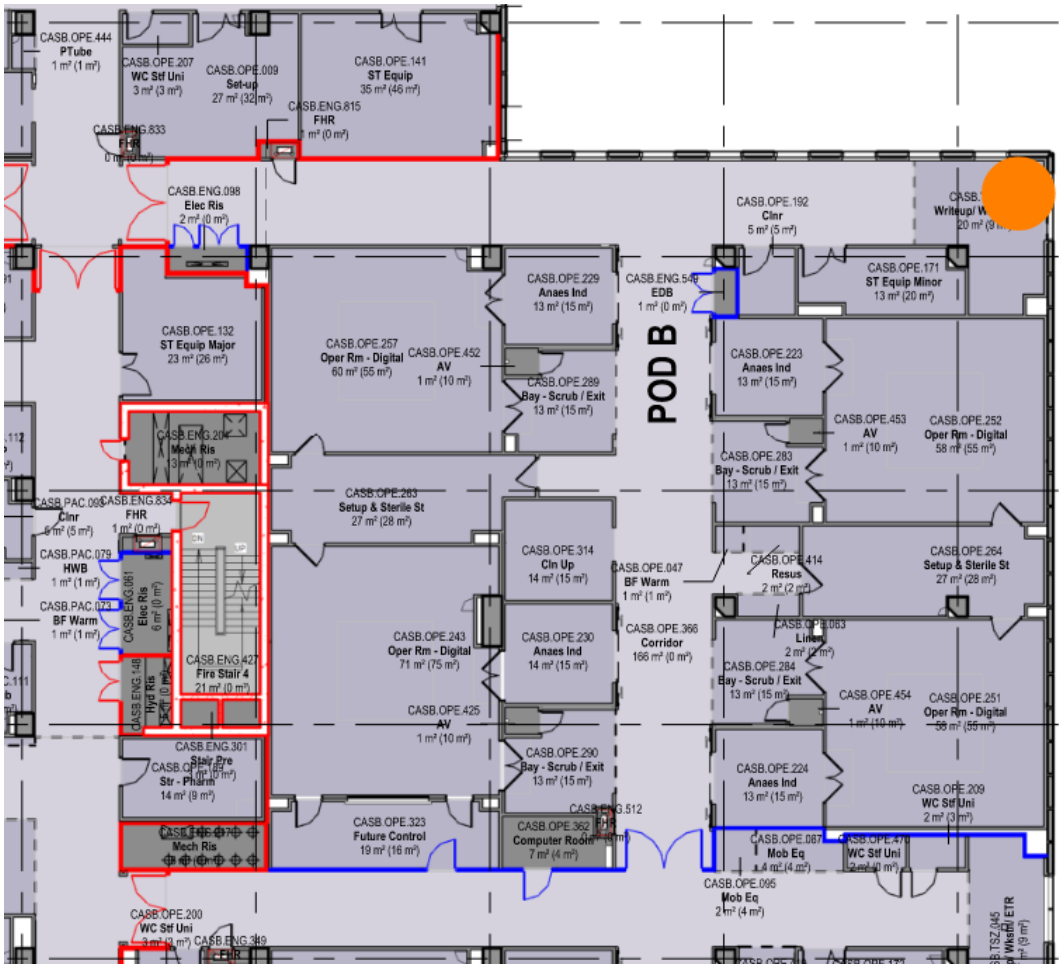


Figure 3: CASB level 3 Surgical Suite vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

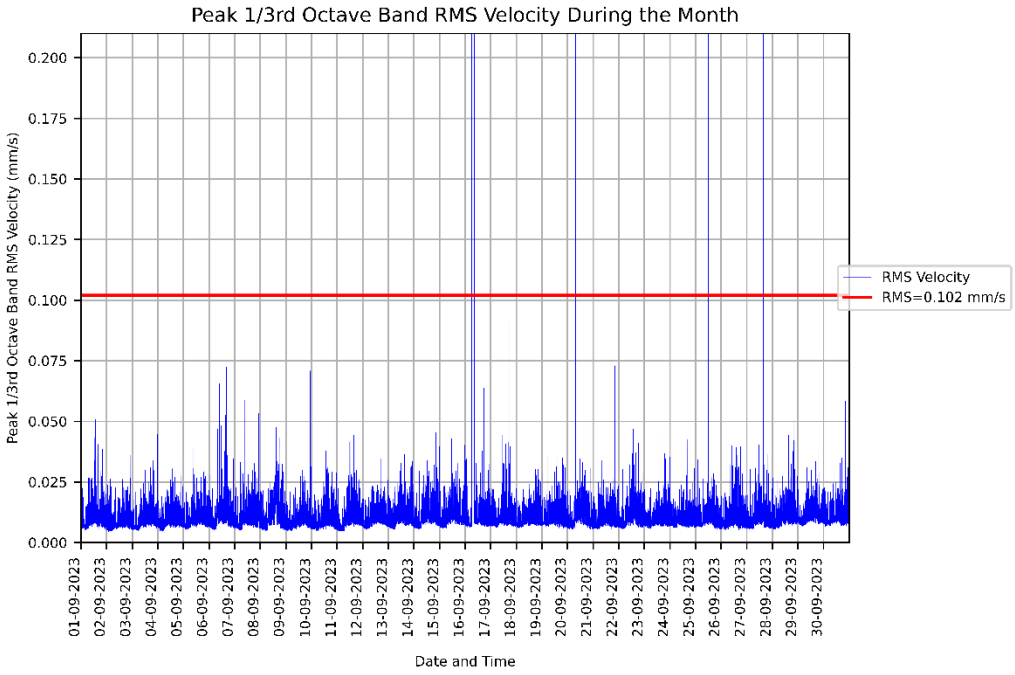
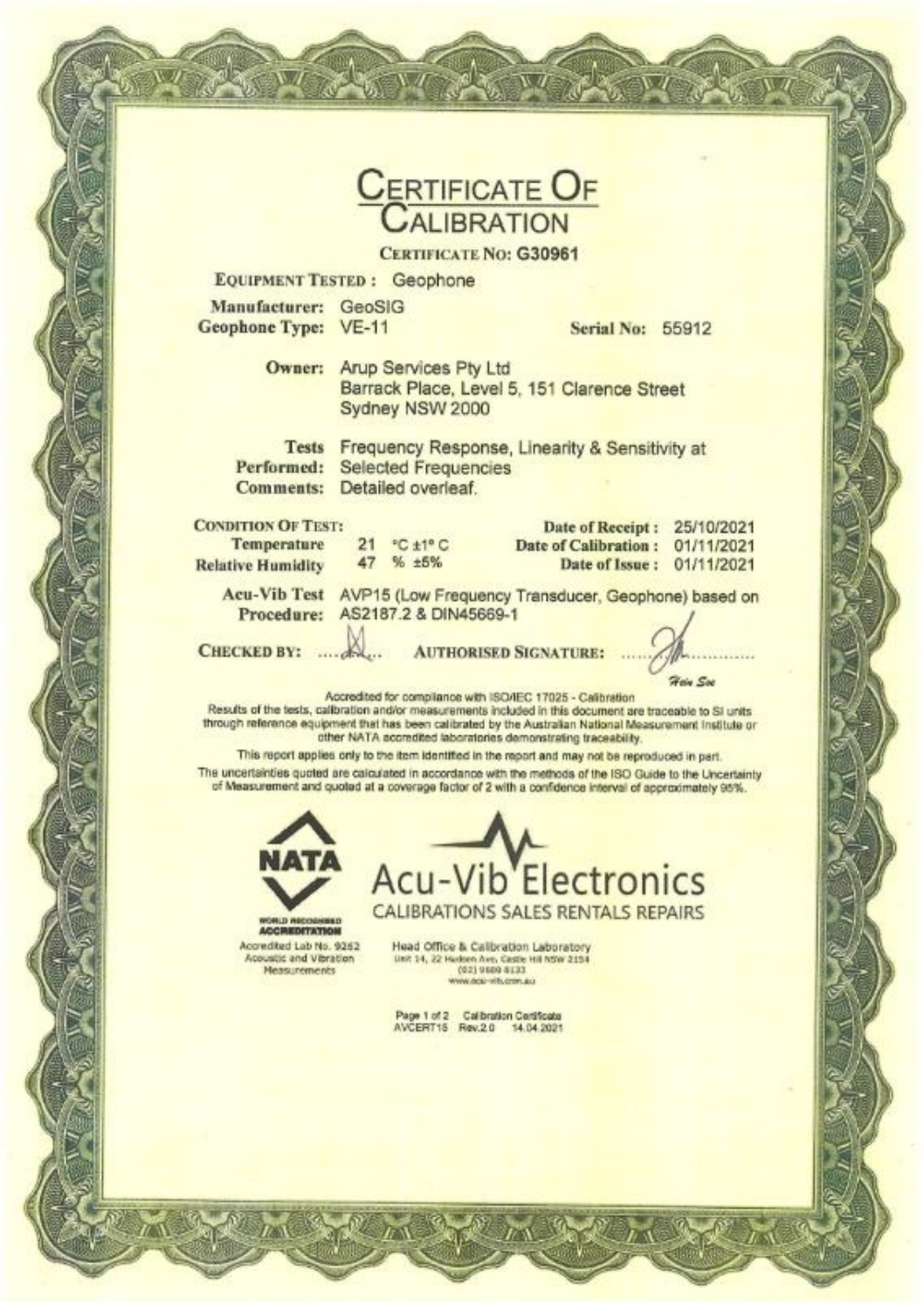


Figure 4: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the CASB level 3 Surgical Suite.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
24	56

Appendix A: Calibration Certificates



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: G30961

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11 **Serial No:** 55912

Owner: Arup Services Pty Ltd
Barrack Place, Level 5, 151 Clarence Street
Sydney NSW 2000

Tests Performed: Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments: Detailed overleaf.

CONDITION OF TEST:
Temperature 21 °C ±1° C
Relative Humidity 47 % ±5%

Date of Receipt : 25/10/2021
Date of Calibration : 01/11/2021
Date of Issue : 01/11/2021

Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.
This report applies only to the item identified in the report and may not be reproduced in part.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Page 1 of 2 Calibration Certificate
AVCERT15 Rev.2.0 14.04.2021

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55912**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz
12VDC Power Supply Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mms^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U_{95} %
3.00	18.85	10.0	112.74	1.00%
4.00	25.13	10.0	113.82	0.90%
6.00	37.70	10.0	109.59	0.90%
10.00	62.83	10.0	100.79	0.90%
15.00	94.25	10.0	96.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	90.09	0.90%
15.92	**94.25**	**10.0**	**89.99**	**0.90%**
15.92	94.25	50.0	89.89	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	92.45	0.50%
60.00	376.99	10.0	92.89	0.50%
120.00	753.98	10.0	100.92	0.50%
150.00	942.48	10.0	117.80	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U_{95} %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2: The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.

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End of Certificate

ARUP

Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - CMRI Animal Holding Facility - September 2023

CVM/ CMRI/202309

Issue 1 | 13/10/2023

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd
Level 5
151 Clarence Street
Sydney NSW 2000
Australia
www.arup.com

ARUP

Document Verification

Project title	Children's Hospital Westmead
Document title	Monthly Vibration Monitoring Report
Job number	271985
Document ref	CVM/CMRI/202309
File reference	-

Revision	**Date**	**Filename**	Westmead Hospital – 103161 CMRI Animal Holding Facility - Summary of Recent Vibration Measurments (01-09 to 30-09).docx
Issue 1	13/10/2023	**Description**	Issue

	Prepared by	**Checked by**	**Approved by**
Name	PR	MJW	MJW
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
Signature			

Filename		
Description		

	Prepared by	**Checked by**	**Approved by**
Name			
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Issue Document Verification with Document ✓

Contents

Executive Summary

This report summarises the vibration monitoring data recorded at CMRI Animal Holding Facility, over one month – from 01/09/2023 to 30/09/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

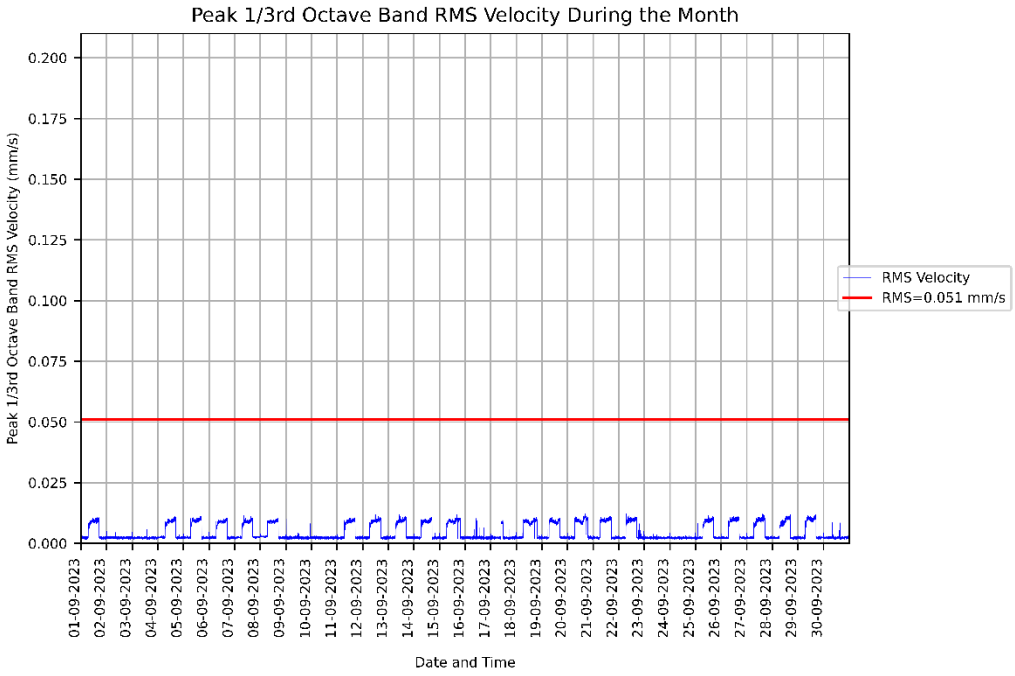

Figure 1: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

PPV Vibration Levels

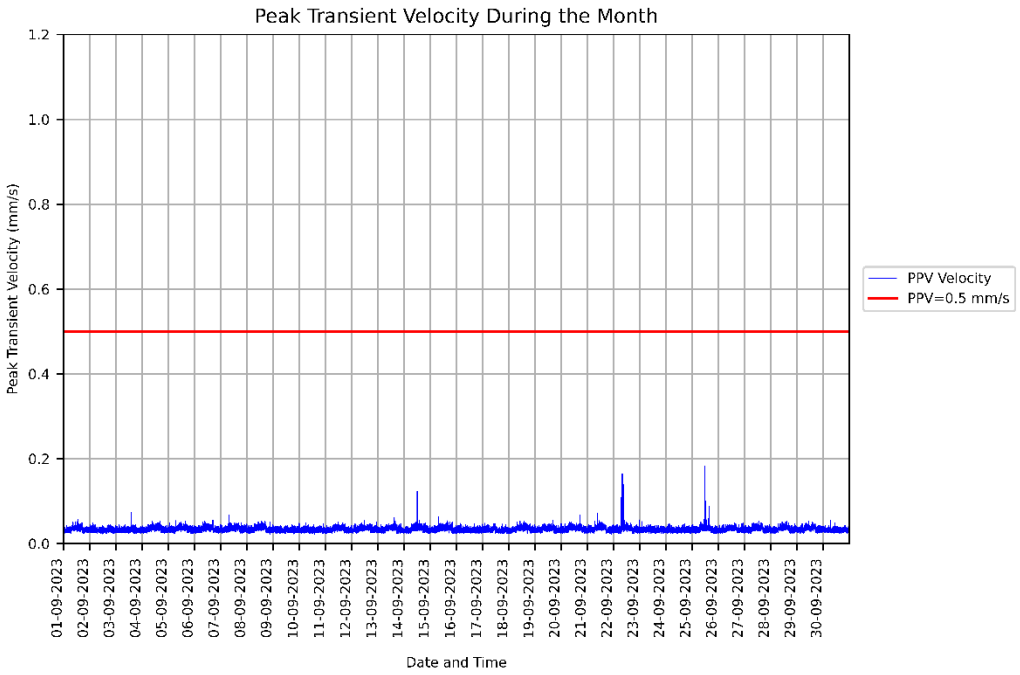

Figure 2: Measured vibration levels for 01/09/2023 to 30/09/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CMRI Animal Holding Facility during the period of the 01/09/2023 to 30/09/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	**Construction Hours**
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

Figure 3: CMRI Animal Holding Facility vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

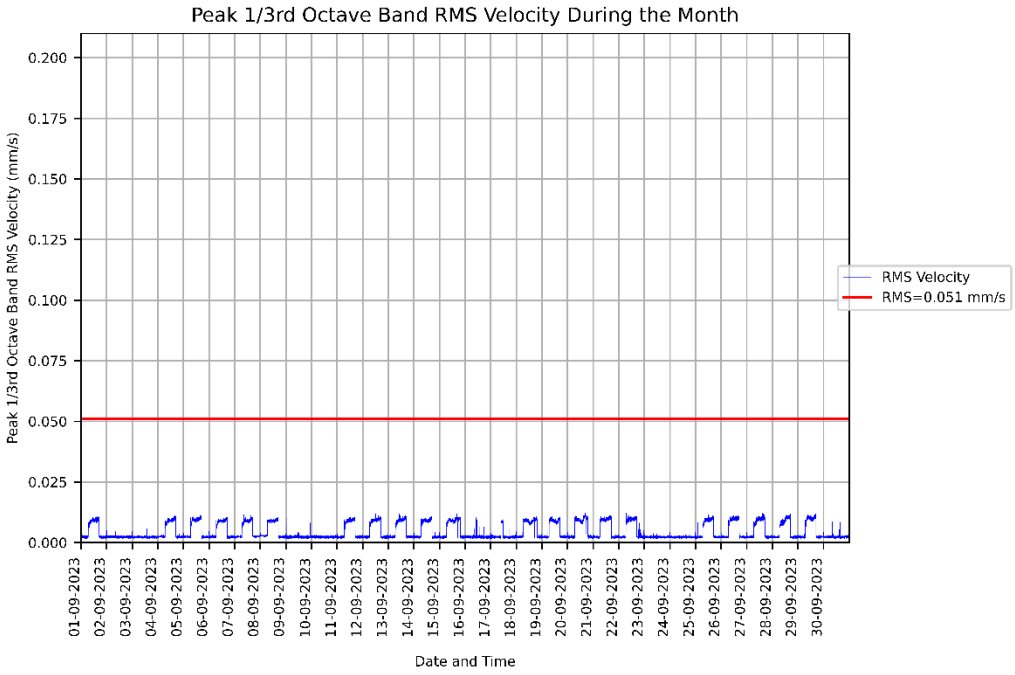

Figure 4: Measured RMSV vibration levels for 01/09/2023 to 30/09/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/09/2023 and 30/09/2023. The recorded data is shown in blue, while the limit of 0.5mm/s (V_{PPV}) is shown in red.

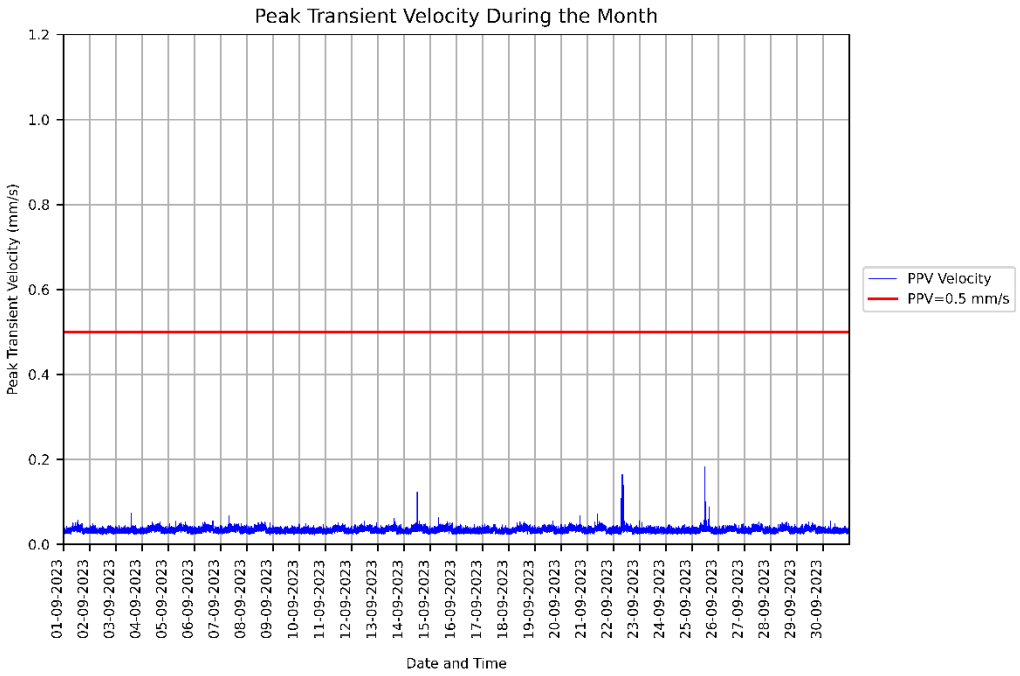

Figure 5: Measured PPV vibration levels for 01/09/2023 to 30/09/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: G30976

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11 **Serial No:** 55913

Owner: Arup Services Pty Ltd
Barrack Place, Level 5, 151 Clarence Street
Sydney NSW 2000

Tests Performed: Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments: Detailed overleaf.

CONDITION OF TEST:
Temperature 21 °C ±1° C
Relative Humidity 47 % ±5%

Date of Receipt : 25/10/2021
Date of Calibration : 01/11/2021
Date of Issue : 01/11/2021

Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

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AVCERT15 Rev.2.0 14.04.2021

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55913**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz
12VDC Power Supply Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mms^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U_{95} %
3.00	18.85	10.0	106.24	1.00%
4.00	25.13	10.0	105.59	0.90%
6.00	37.70	10.0	100.69	0.90%
10.00	62.83	10.0	94.25	0.90%
15.00	94.25	10.0	91.31	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	85.93	0.90%
15.92	**94.25**	**10.0**	**85.77**	**0.90%**
15.92	94.25	50.0	85.76	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	89.27	0.50%
60.00	376.99	10.0	90.17	0.50%
120.00	753.98	10.0	100.67	0.50%
150.00	942.48	10.0	115.82	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U_{95} %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2: The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.

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End of Certificate