Health Infrastructure NSW

Westmead PSB and MSCP Construction Noise Monitoring

Noise monitoring report 2022-09-01 to 2022-09-30

AC10

v1 | 26 October 2022

Job number 271985

Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10 201 Kent Street
PO Box 76 Millers Point
Sydney 2000
Australia
www.arup.com

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Document Verification

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

Contents

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 2022 to 30 September 2022** 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.

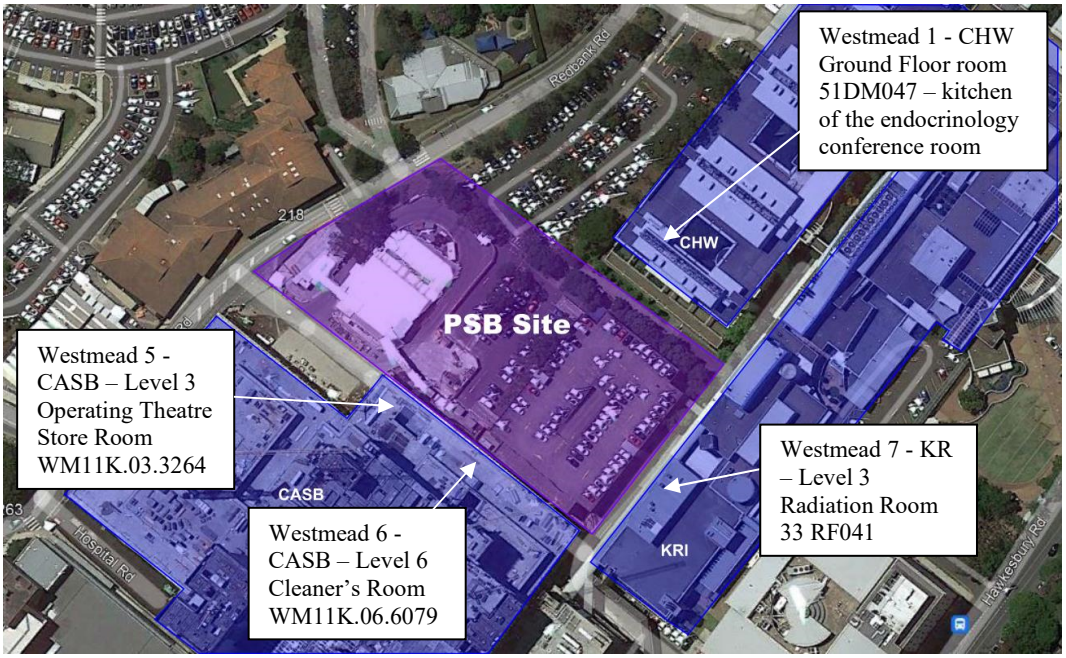

Figure 1: PSB noise monitoring locations.

Figure 2: MSCP noise monitoring locations.

2.1 Noise Logger relocation

The following table provides a record of the noise loggers which have been relocated during the project.

Table 1: Noise logger relocation records

Logger ID	Original location	Current location	
	Location	Date moved	Location
Westmead 2	CHW Level 2 Consult Room 92BW025	14/04/22	CHW Level 2 Parent Kitchen 92BW028

3 Noise Management Levels

The current construction Noise Management Levels for each internal monitoring location are set out in Table 2.

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 2: 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 3: 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)	30/09/22-30/09/22
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	30/09/22-30/09/22
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	30/09/22-30/09/22
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	30/09/22-30/09/22
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	-
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	30/09/22-30/09/22

4.2 Exceedances

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

Table 4: 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)	58
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	11
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	4
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	3
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	7
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	11

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 CHW Ground Floor room 51DM047 (Westmead 1)

Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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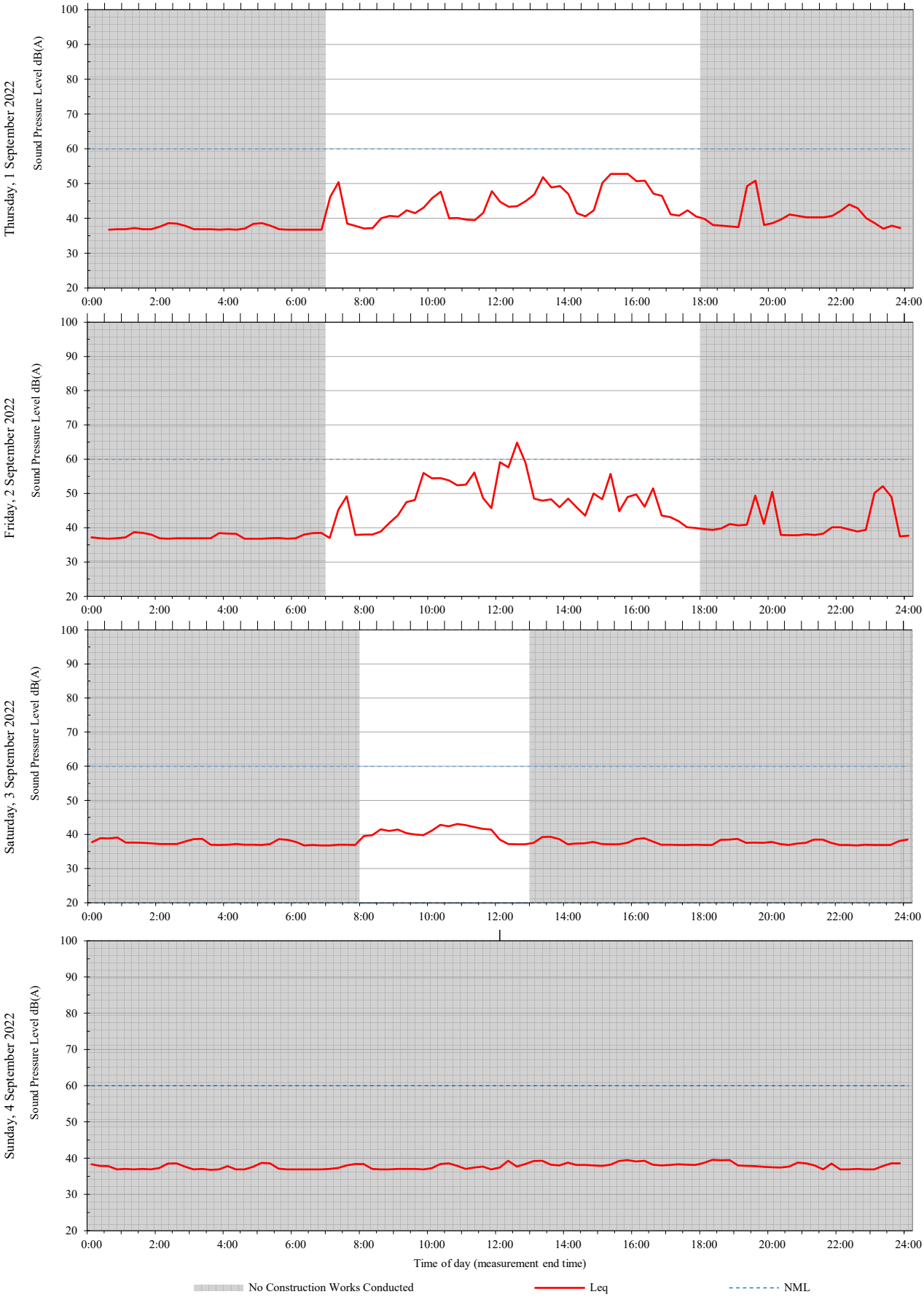

Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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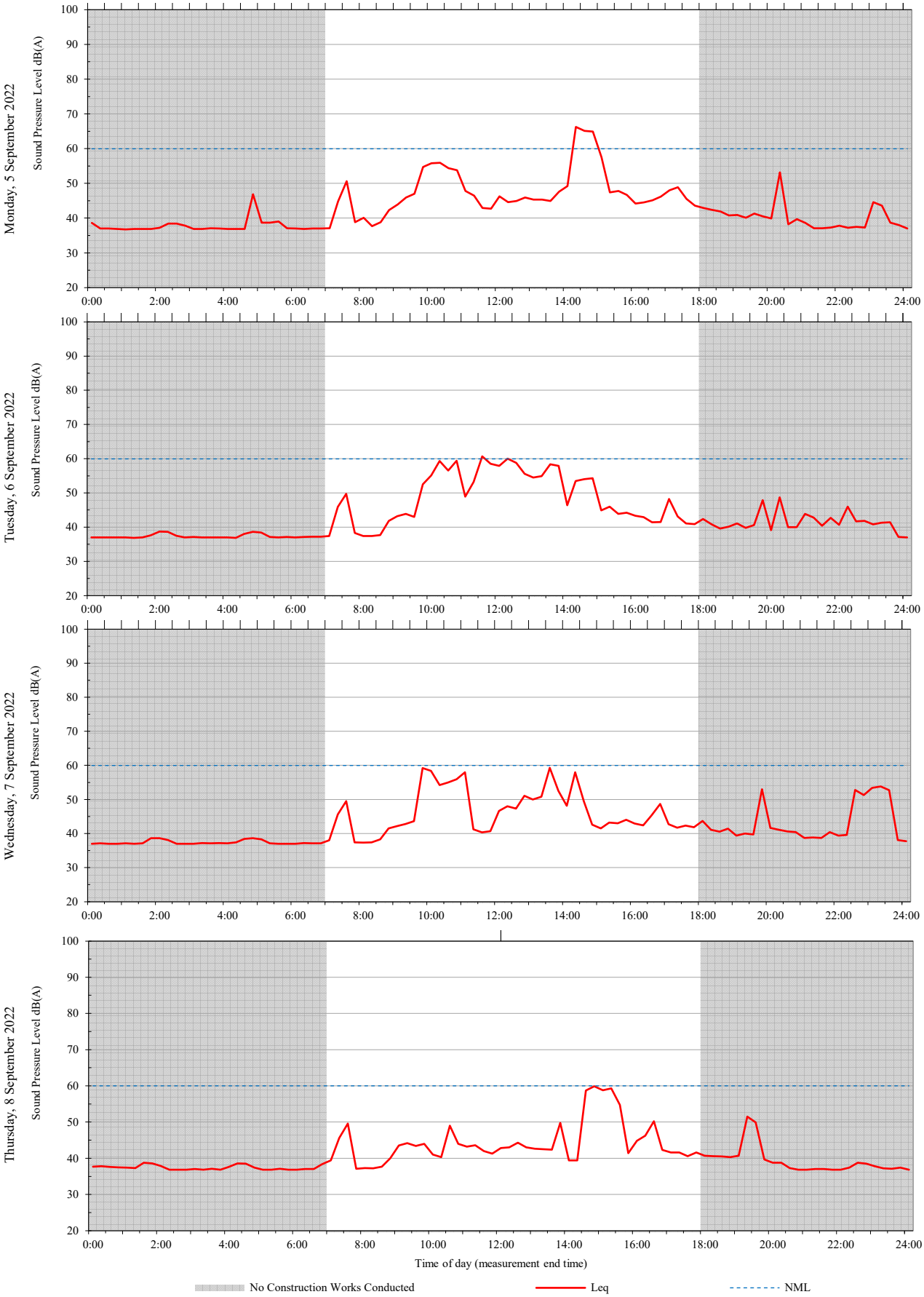
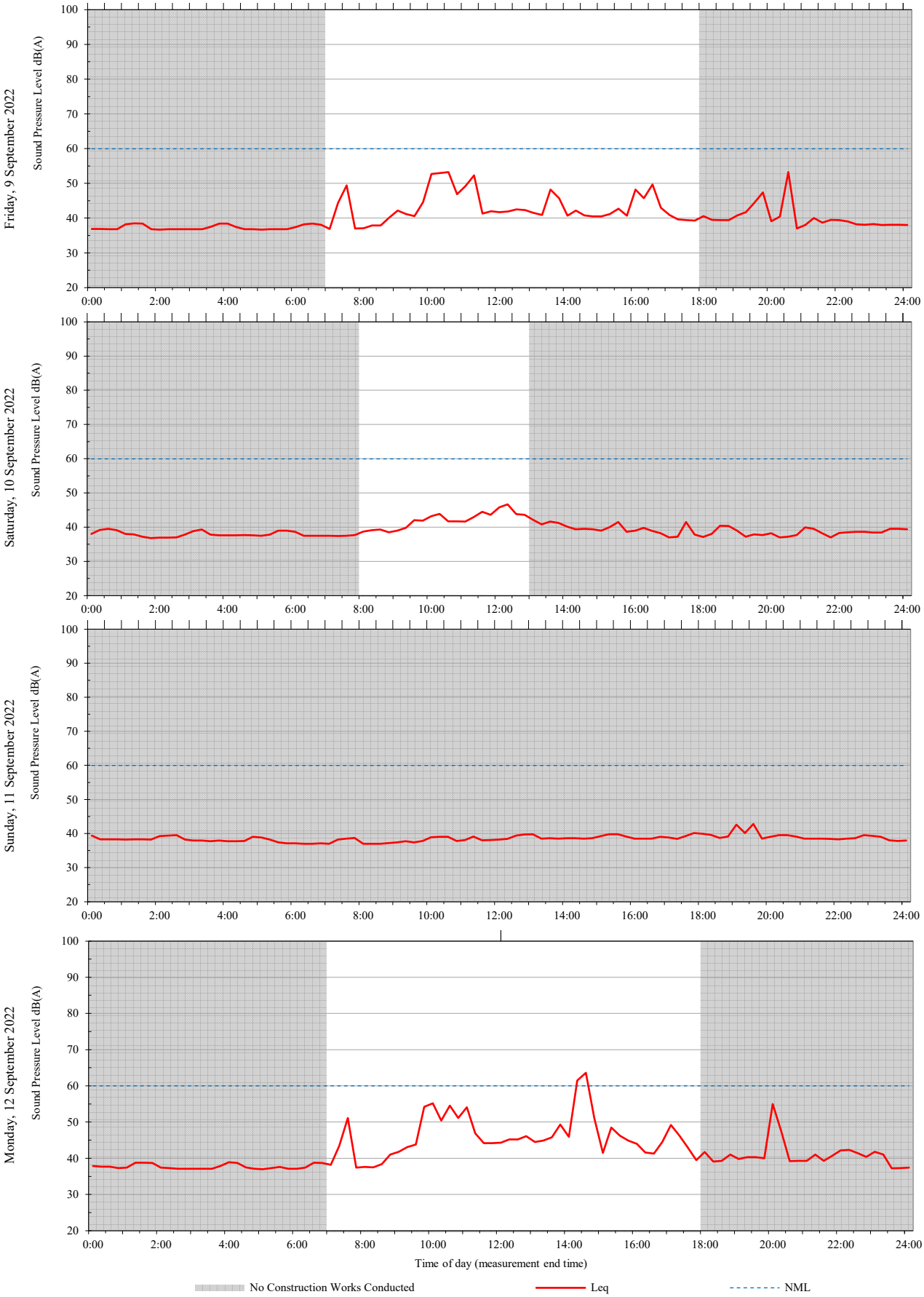


Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

ARUP



Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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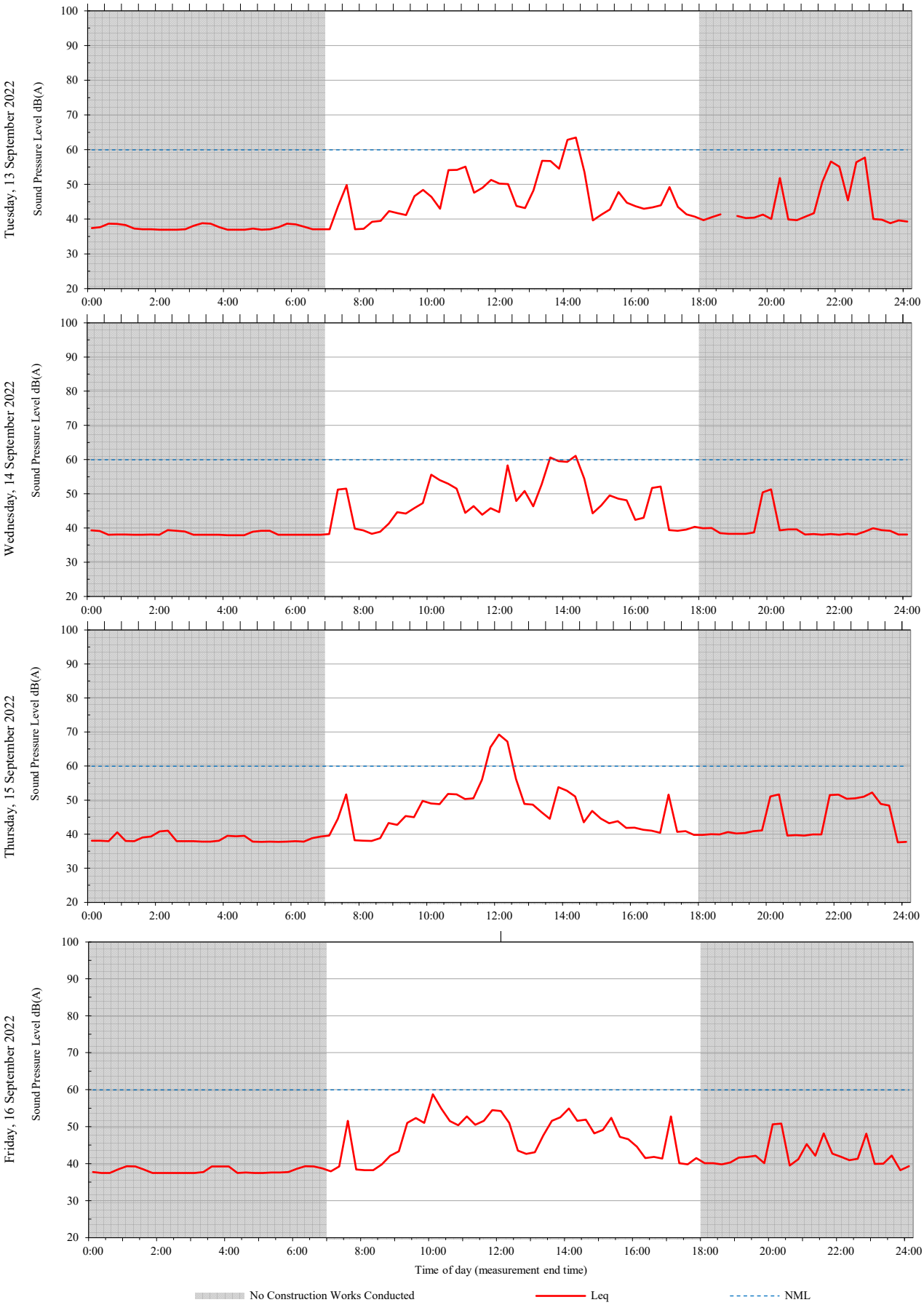
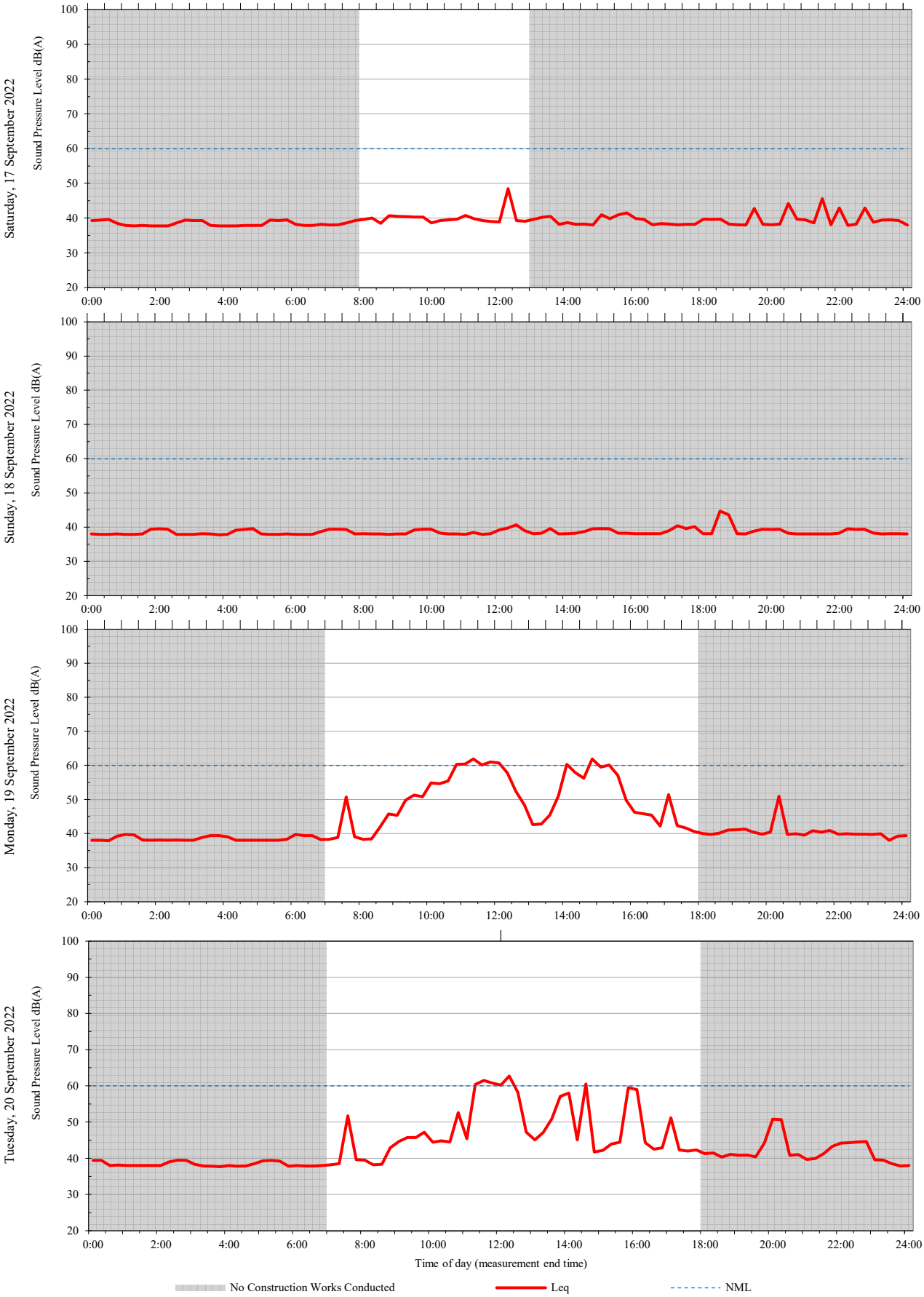


Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

ARUP



Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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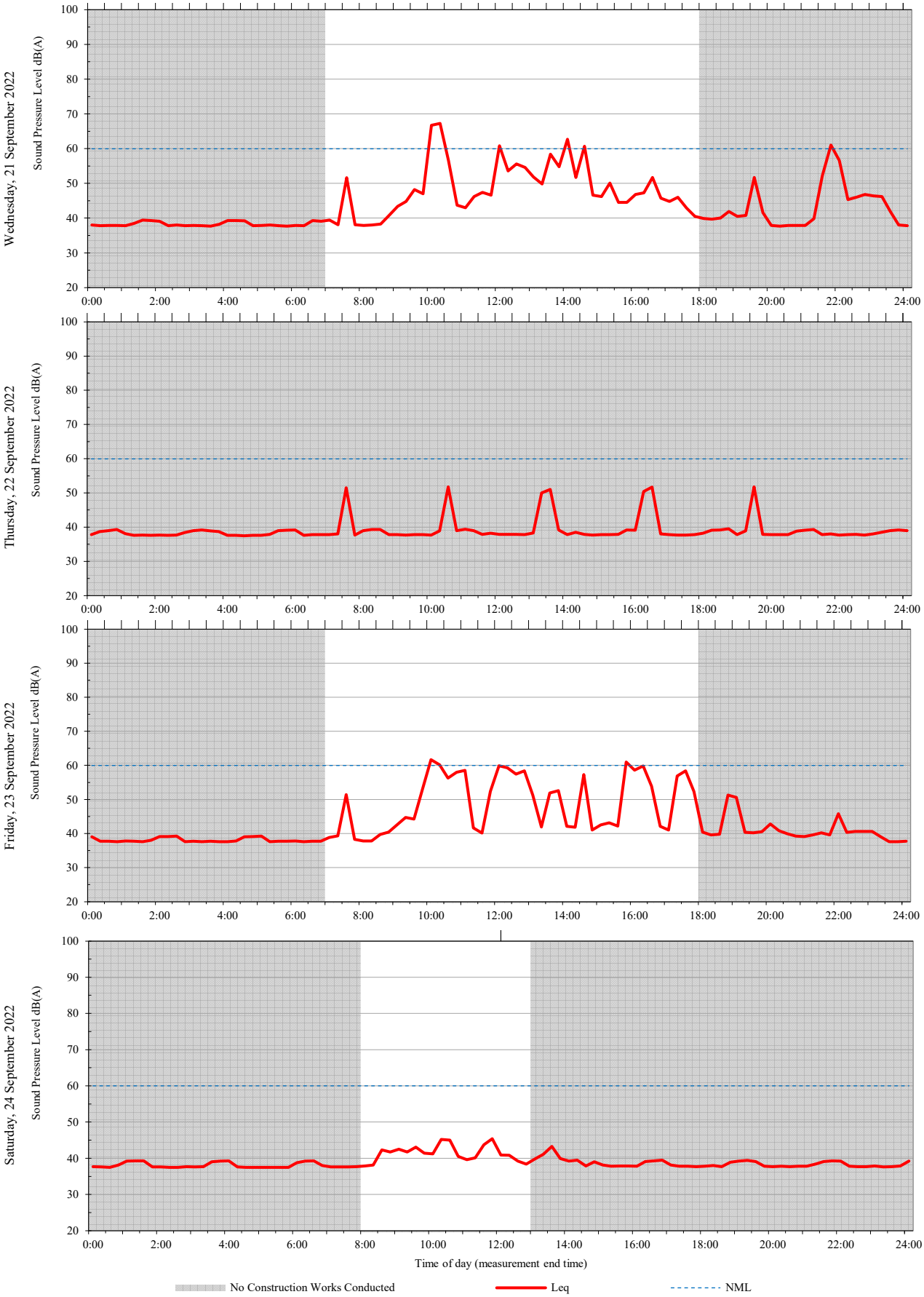

Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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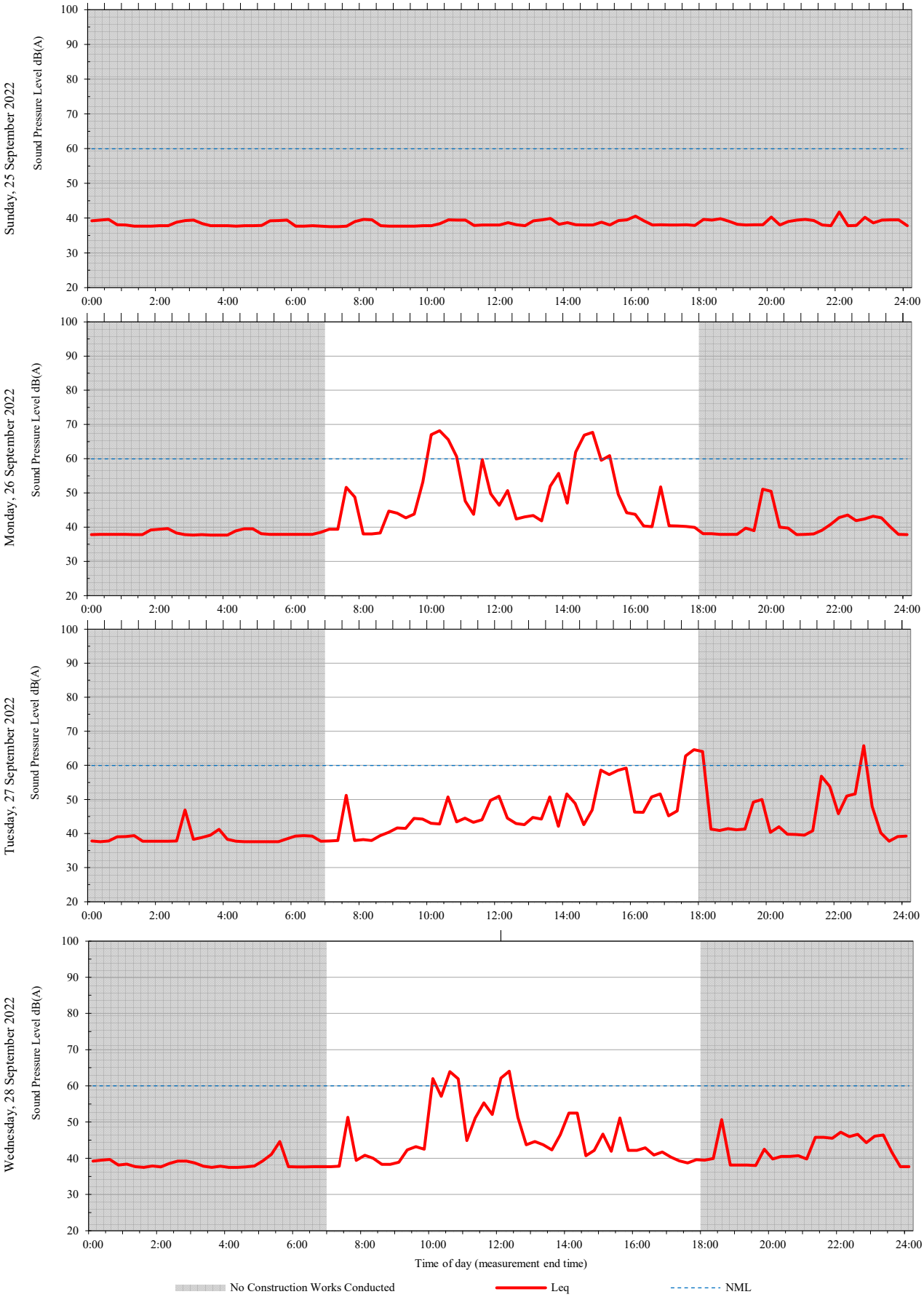

Unattended monitoring: Westmead 1 (CHW Endocrinology Kitchen) (51DM047) (Internal)

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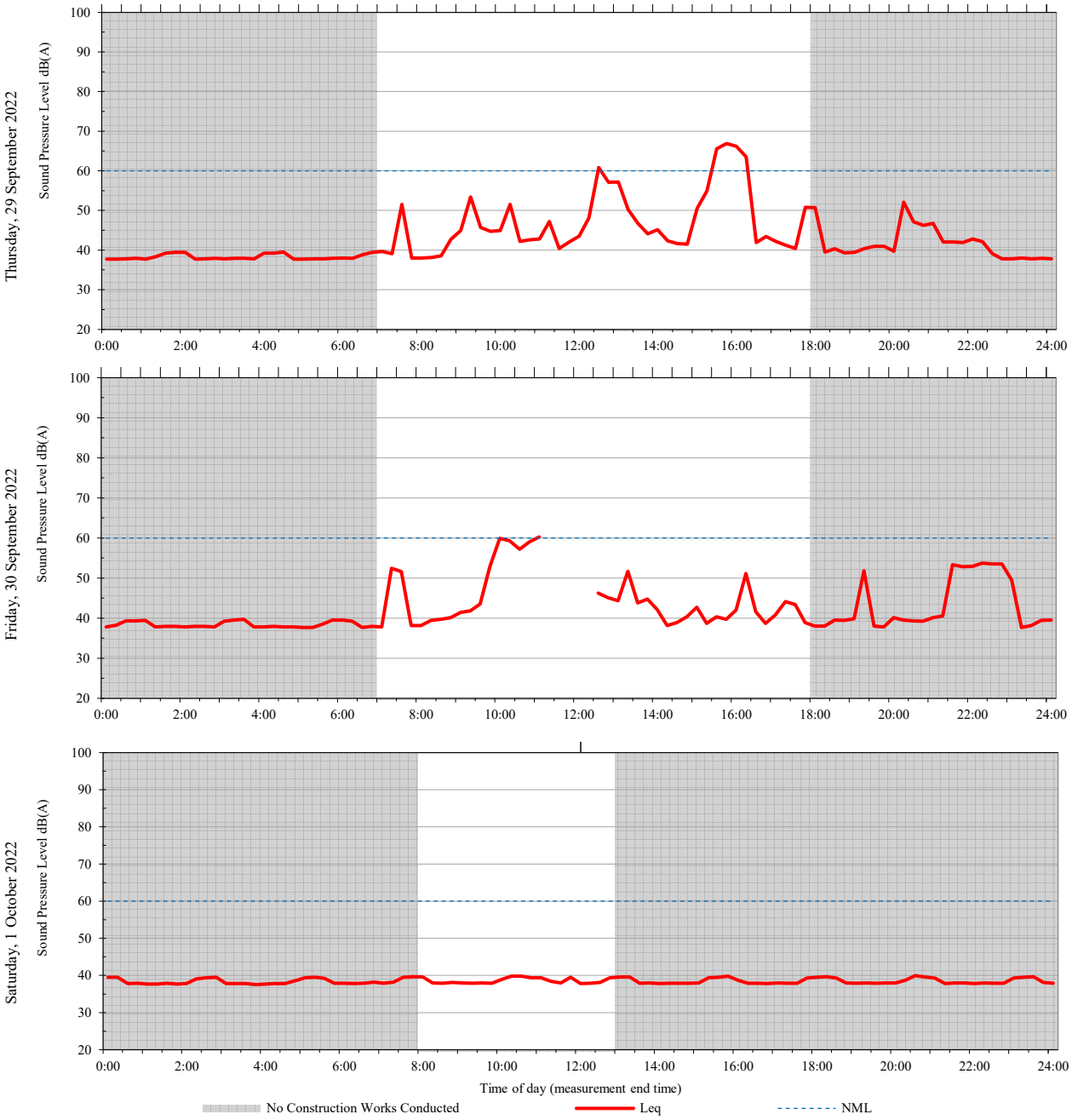
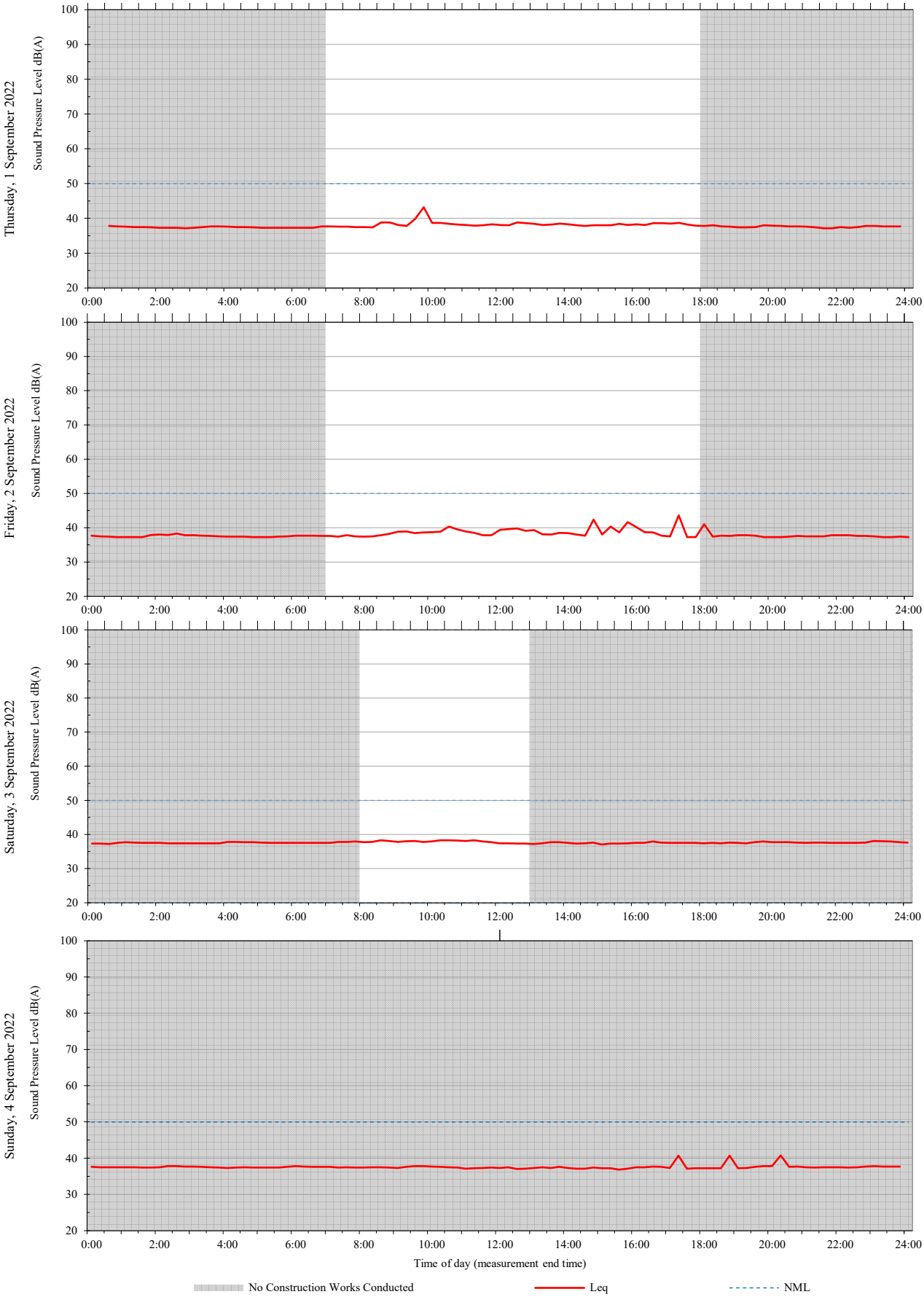


A2 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)

Unattended monitoring: Westmead 5 - CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (In



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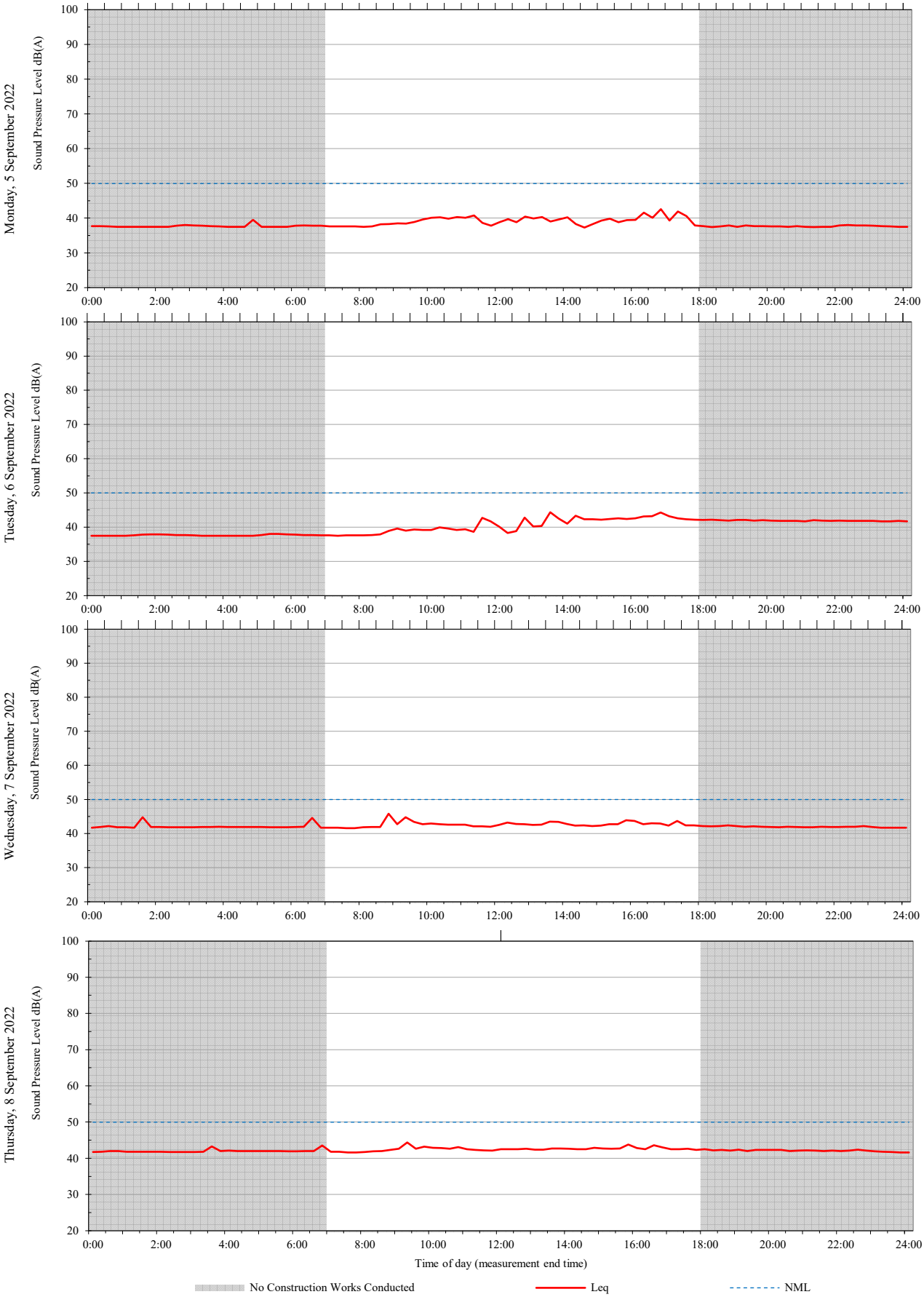

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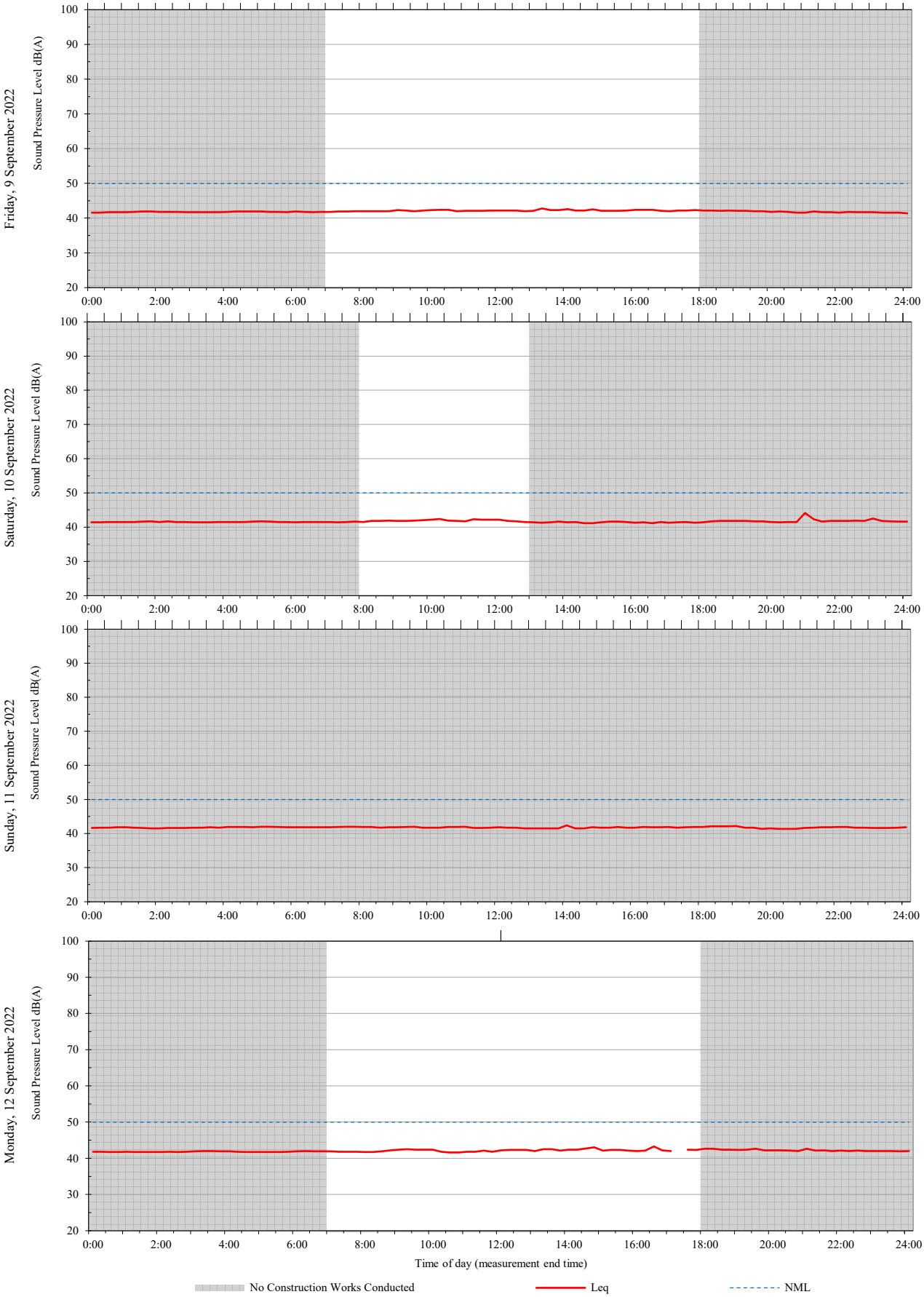

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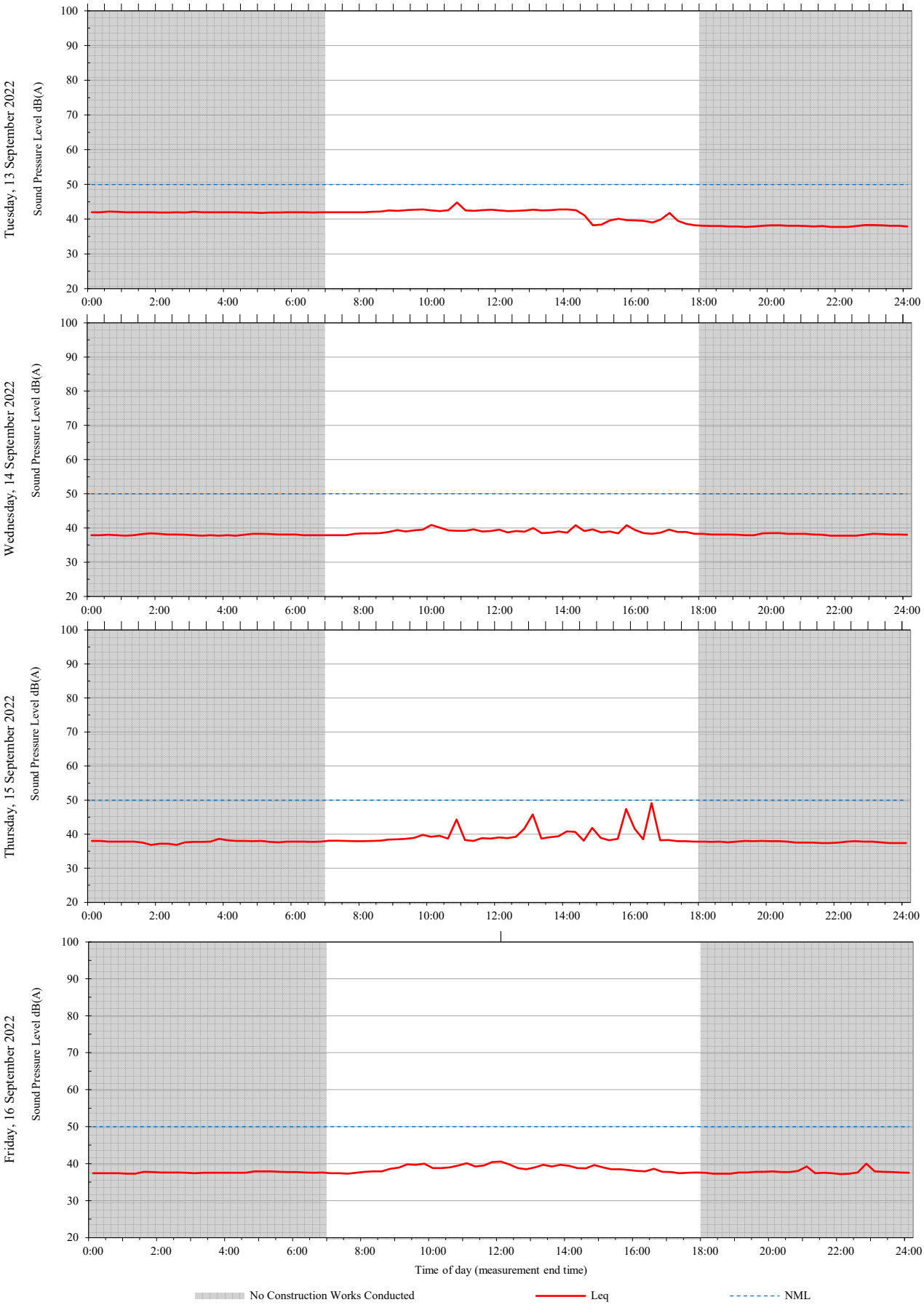

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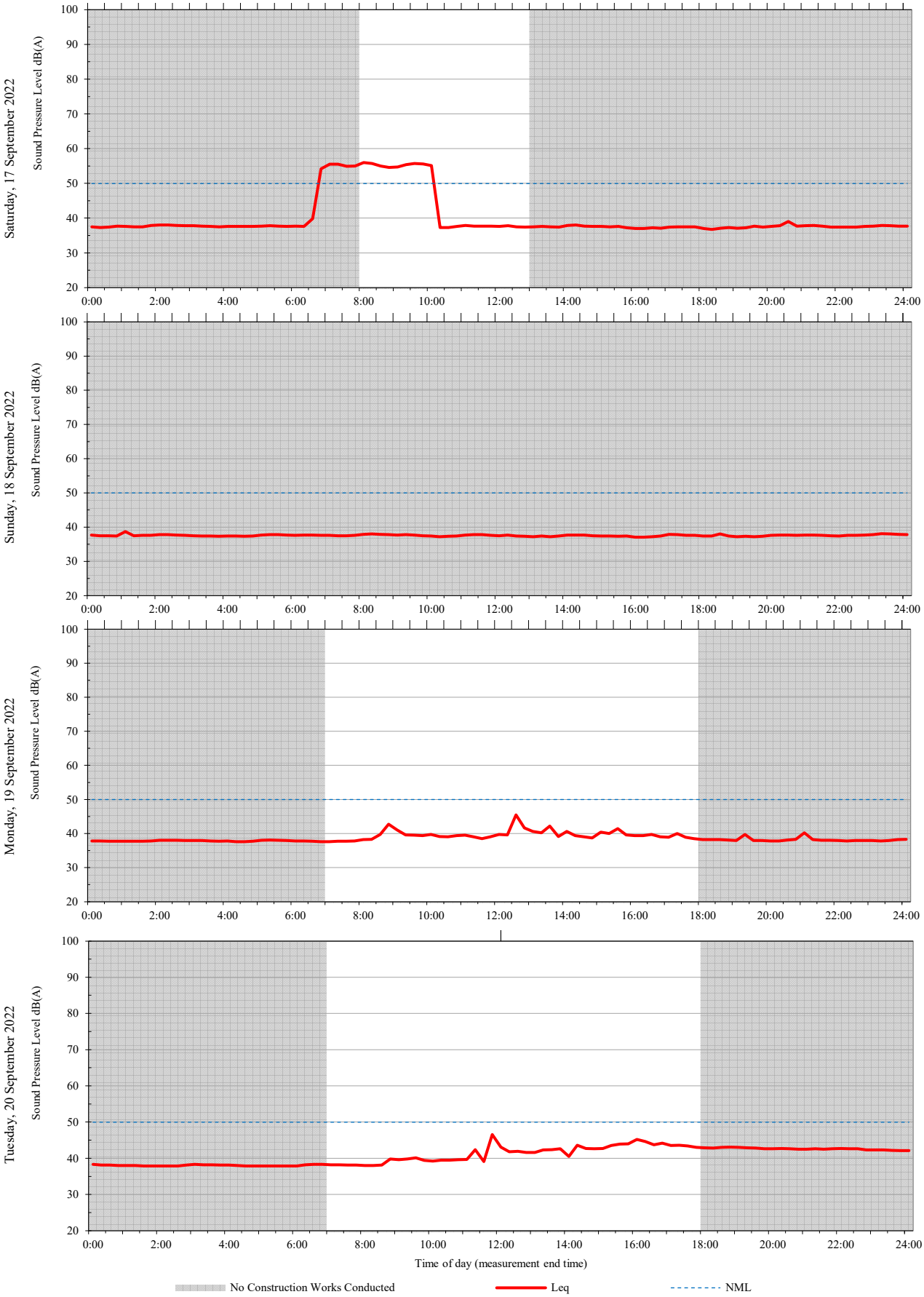

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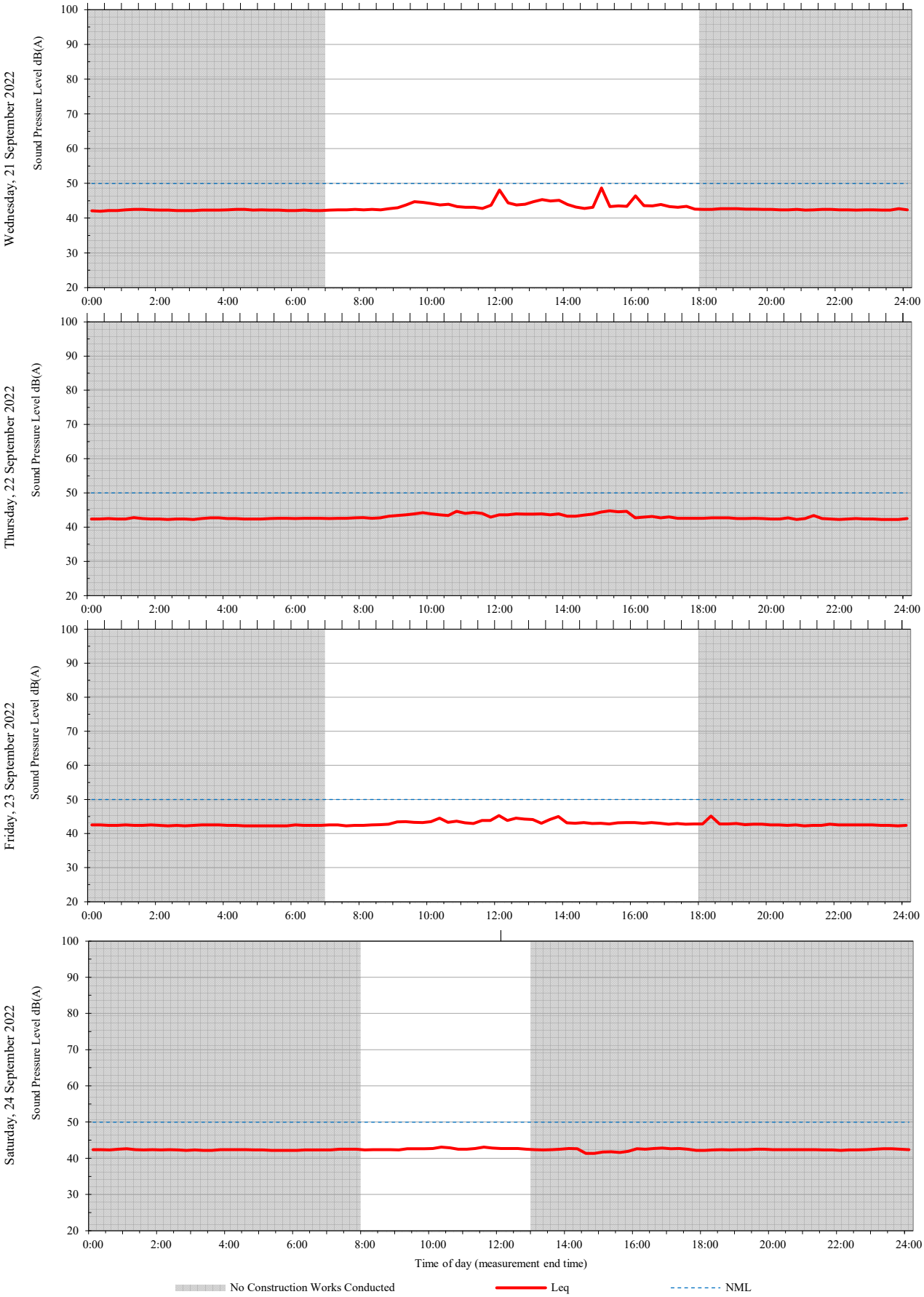

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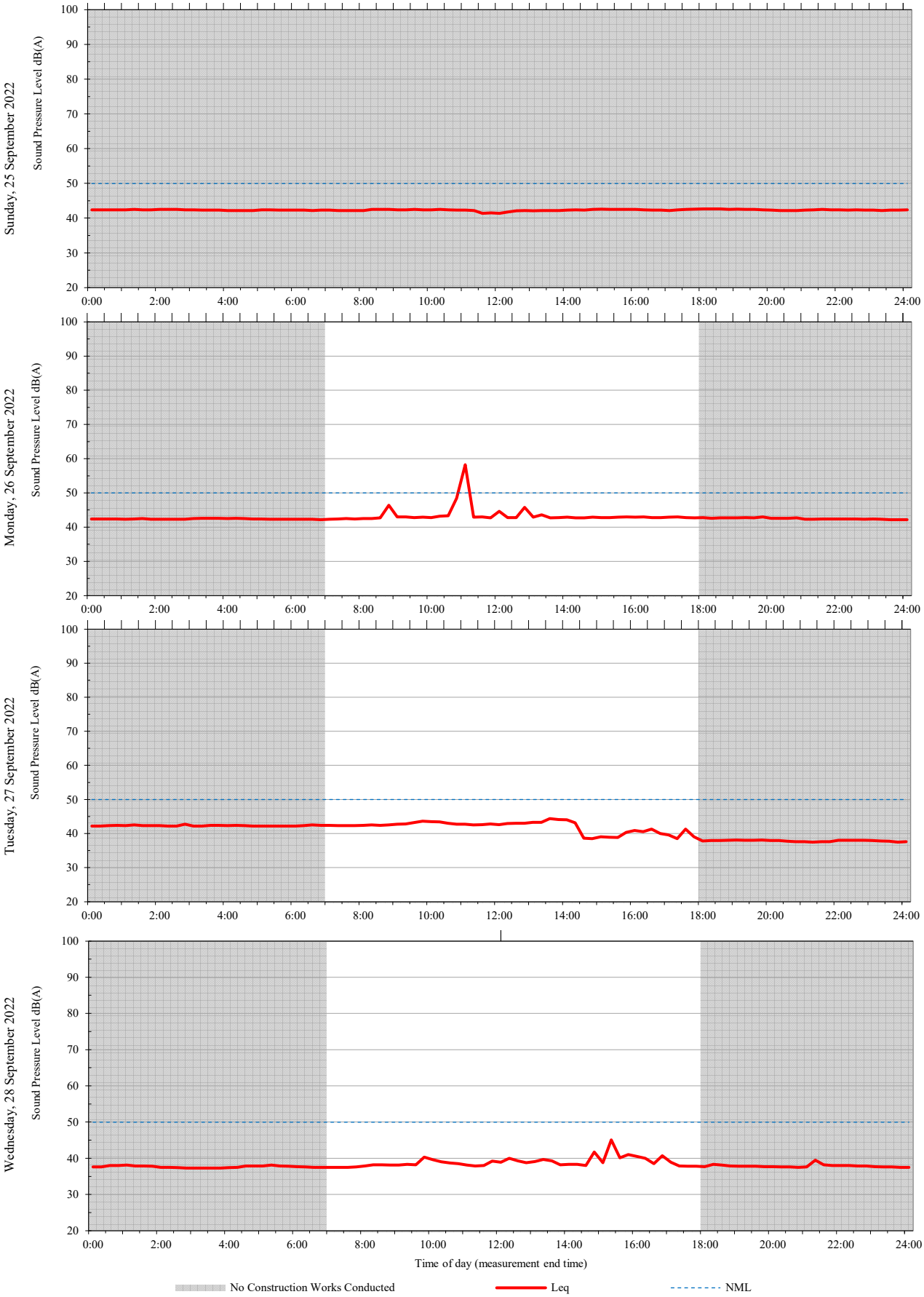

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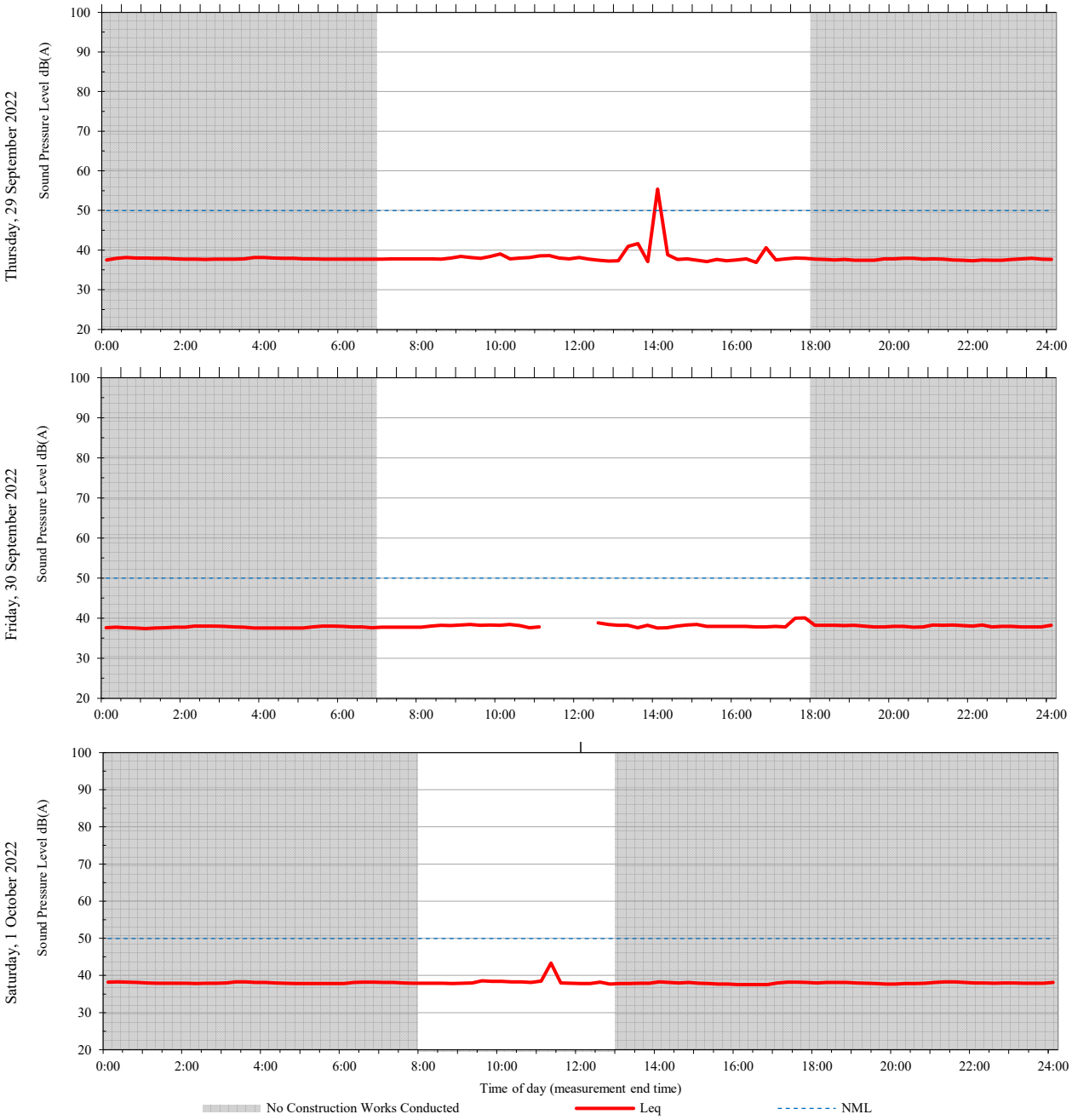
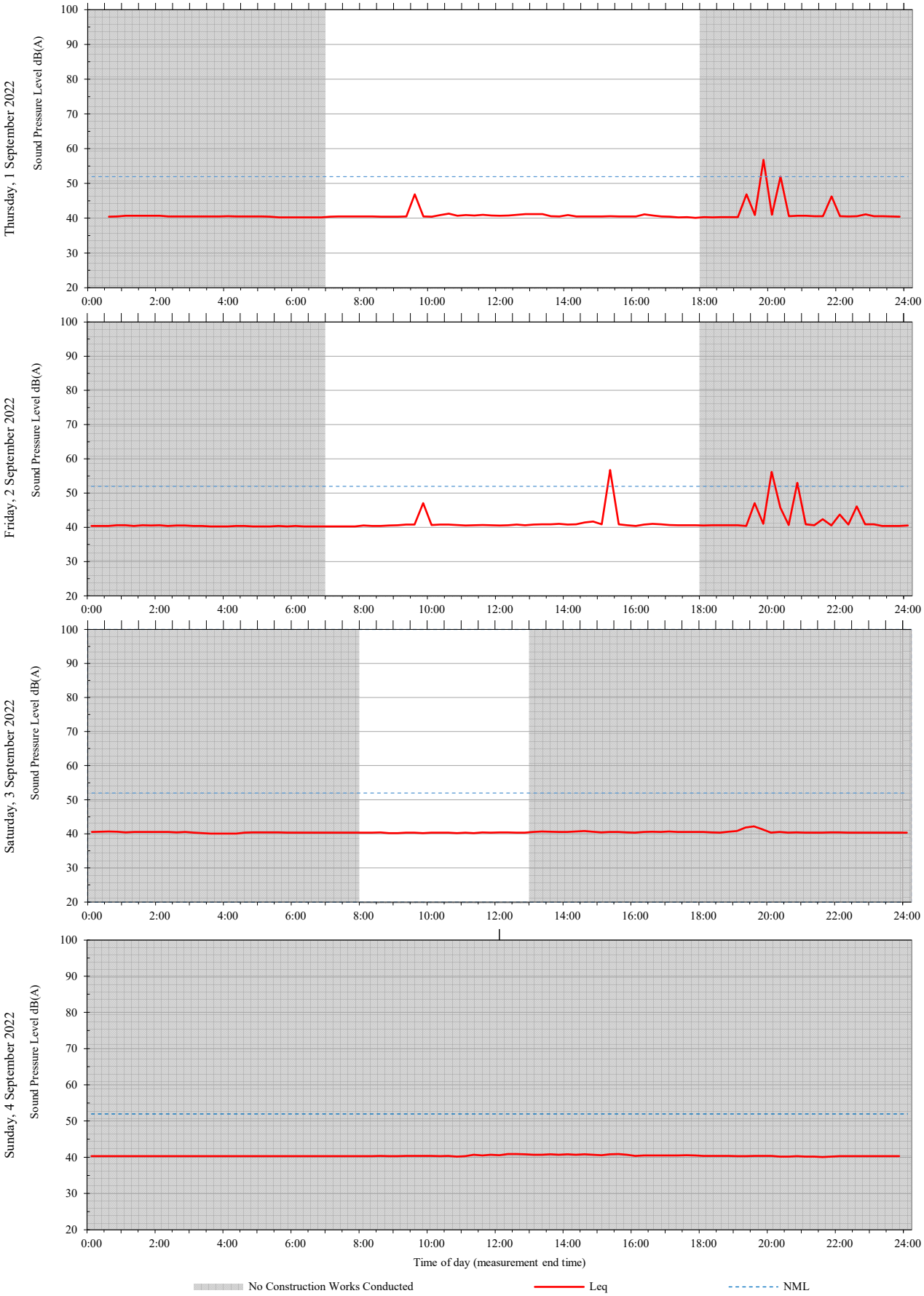


A3 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)

Unattended monitoring: Westmead 6 - CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site) (I



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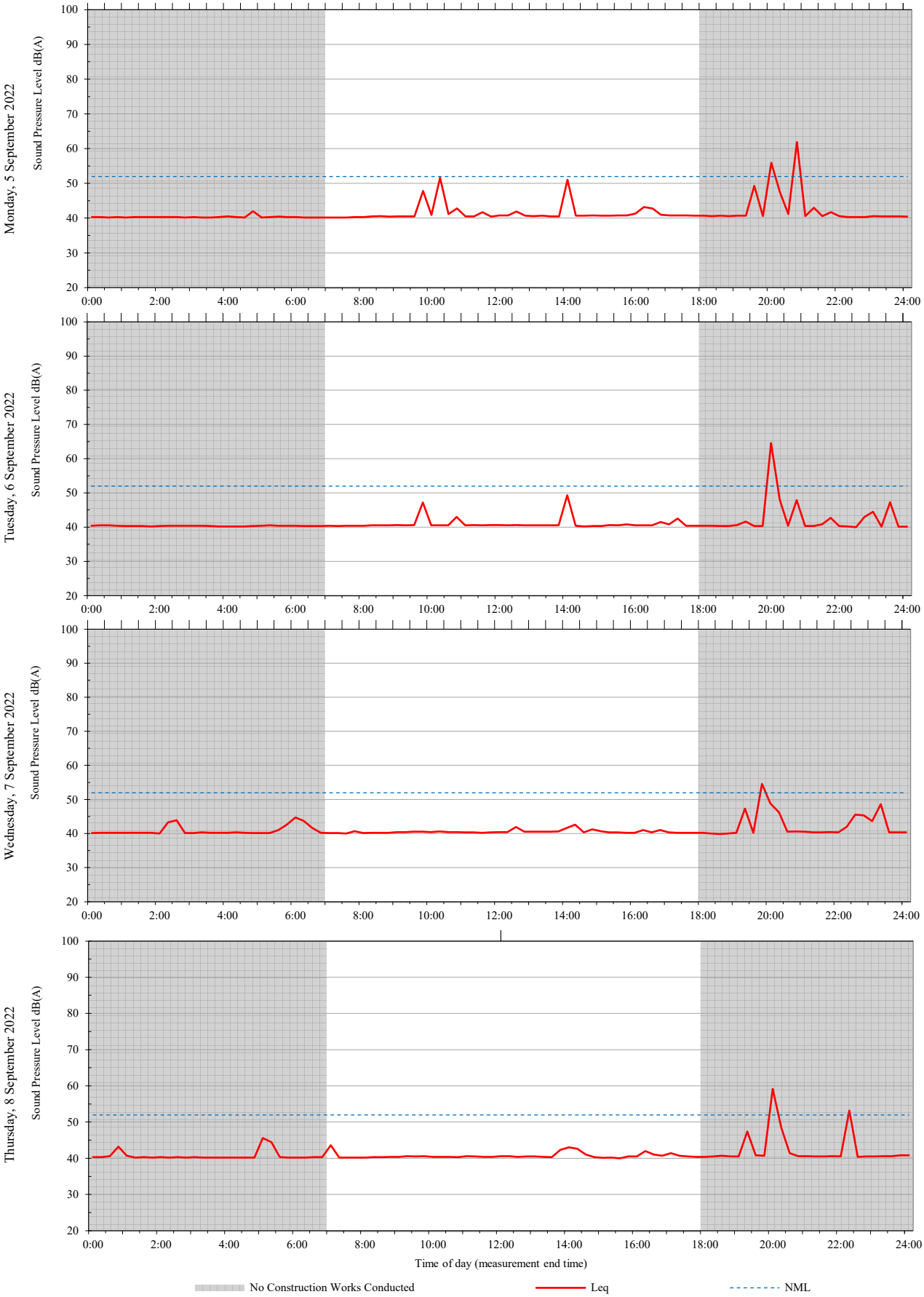

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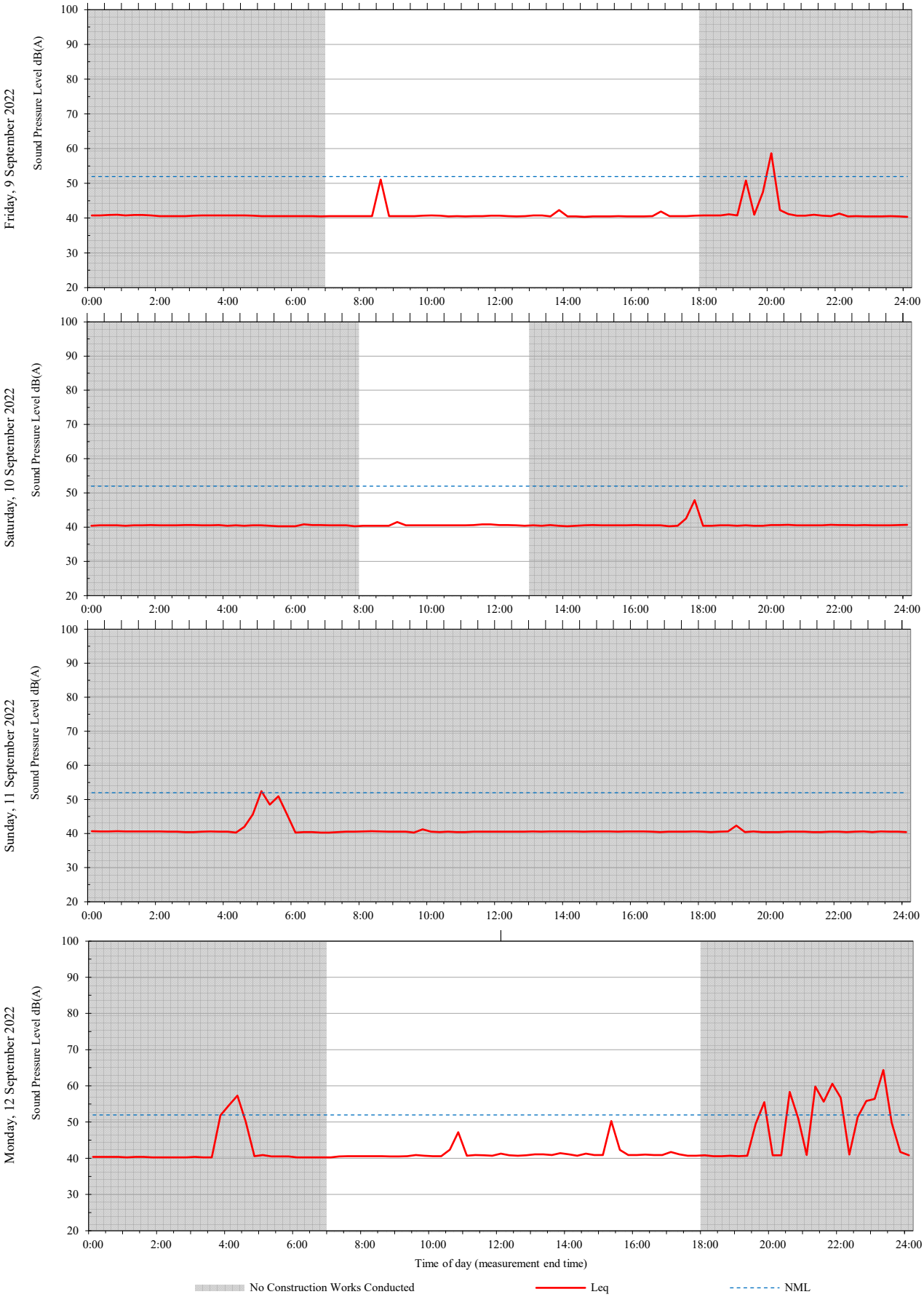

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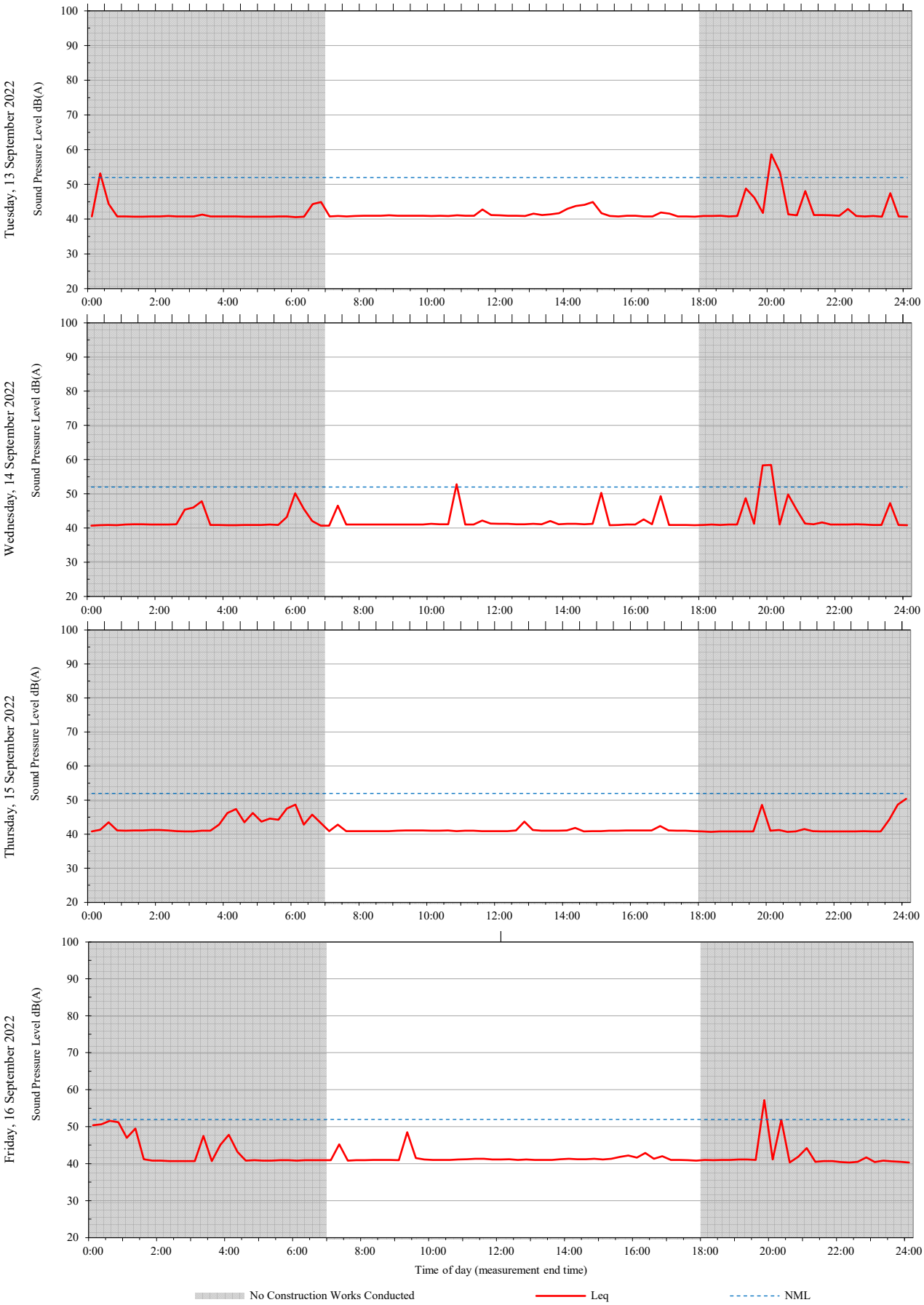

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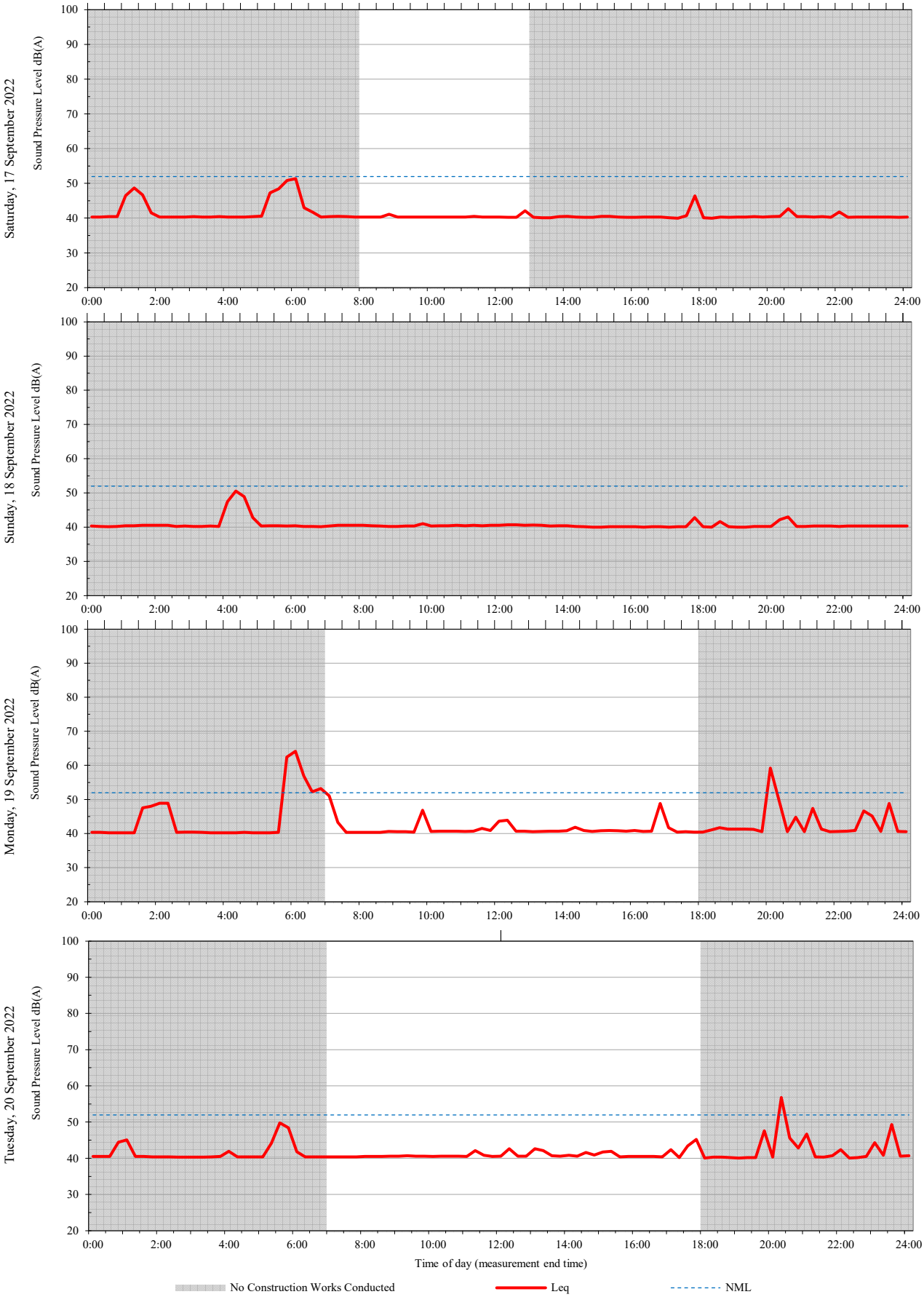

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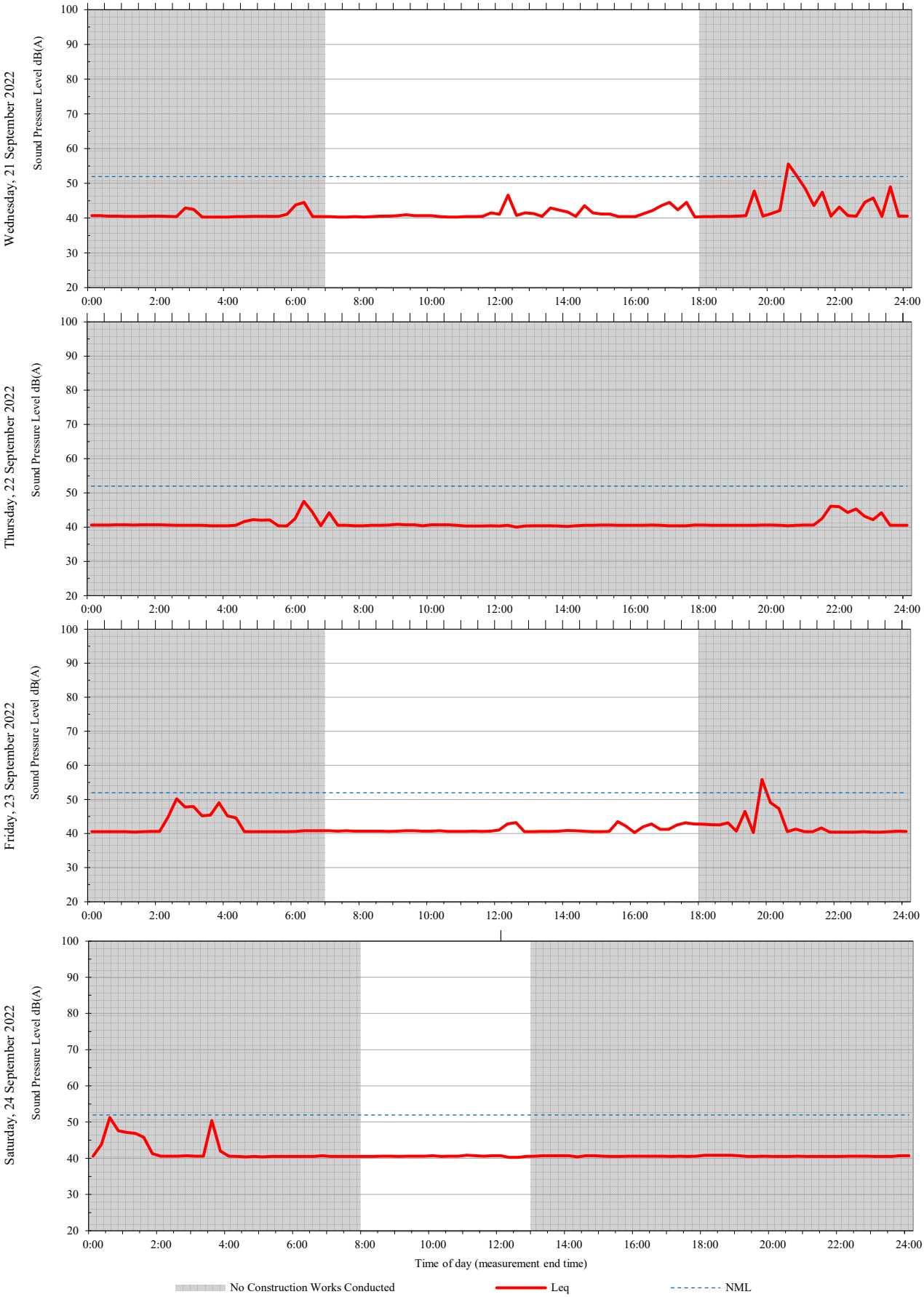

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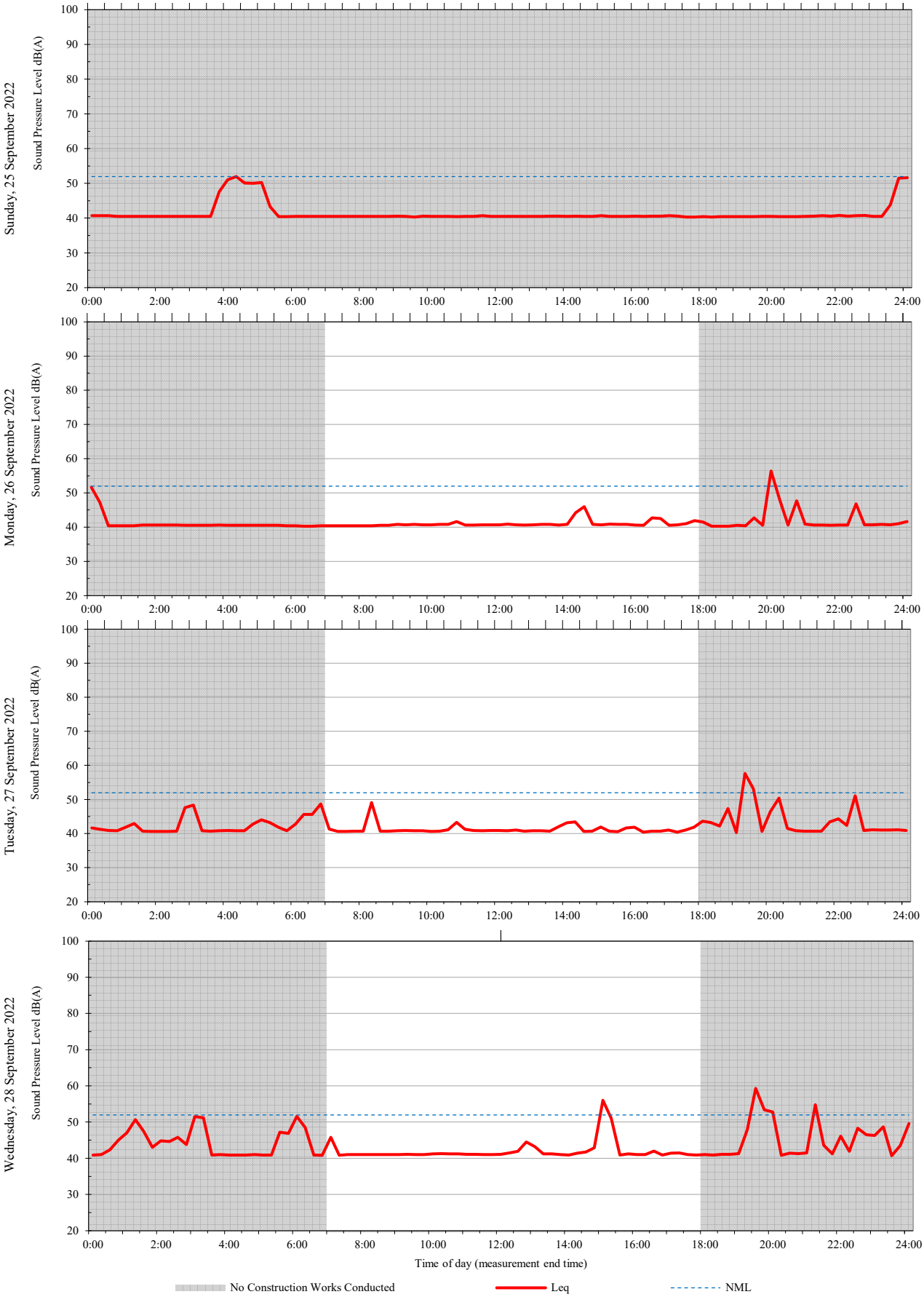

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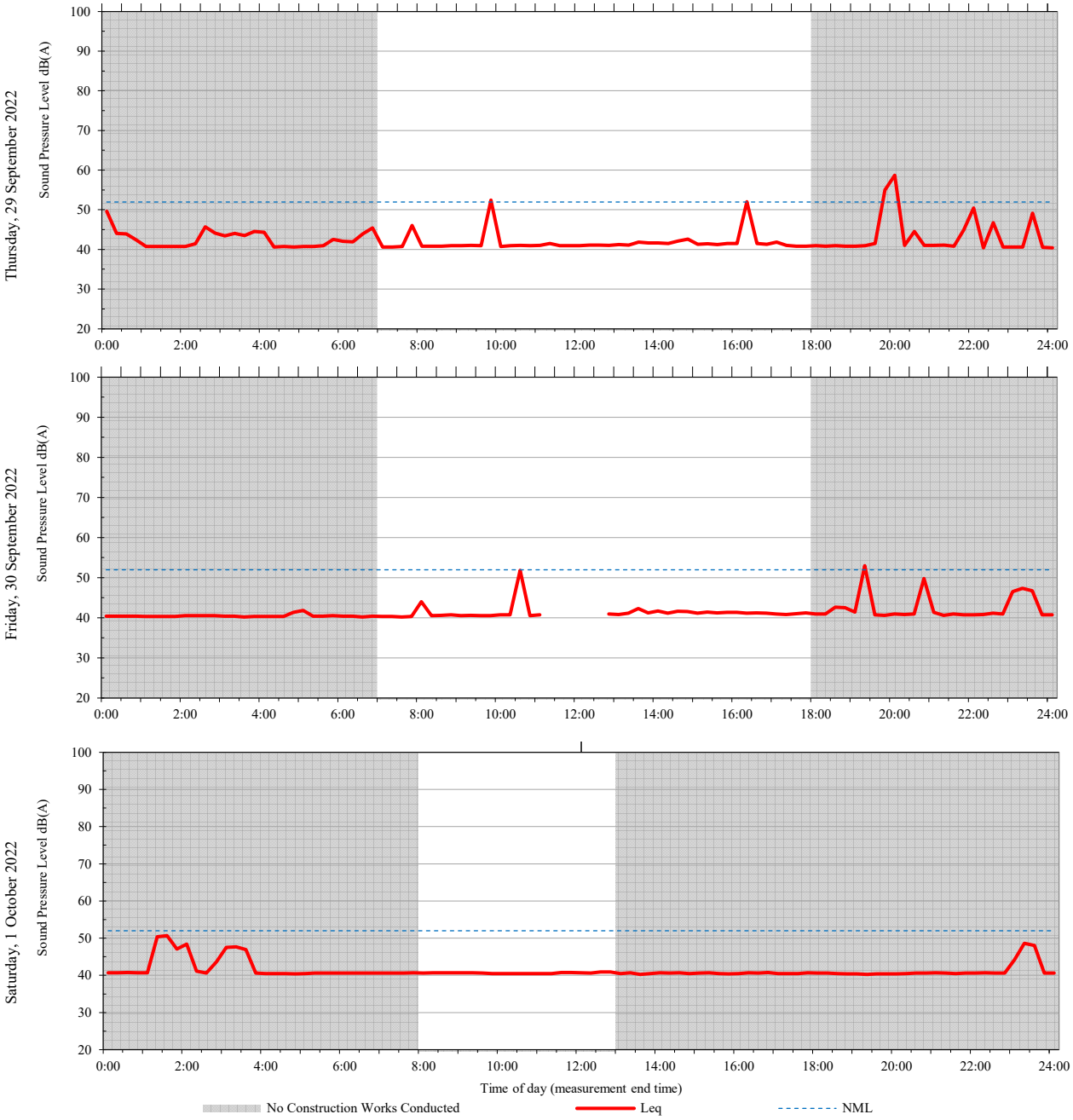

A4 KR Level 3 Radiation Room 33 RF041 (Westmead 7)

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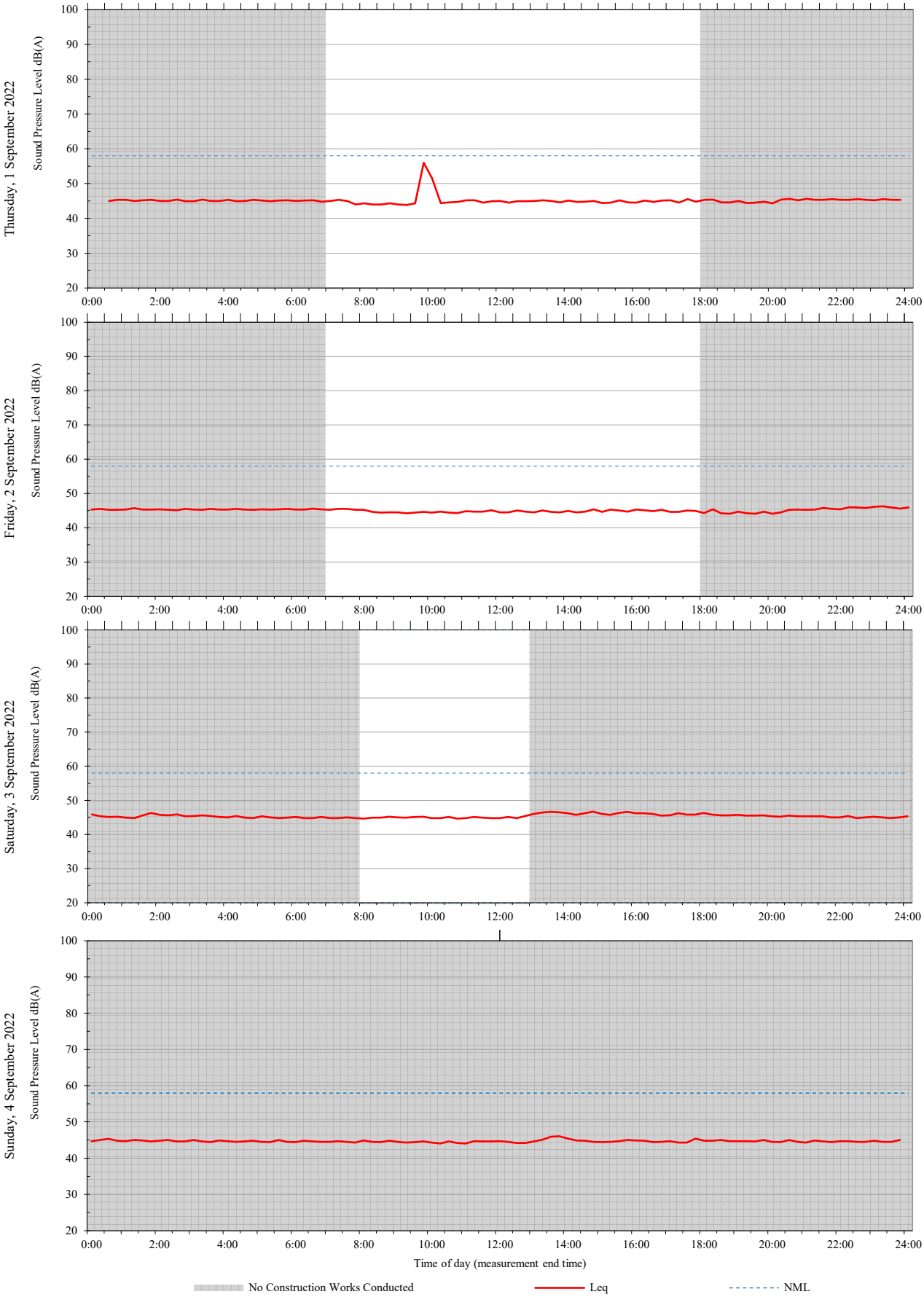

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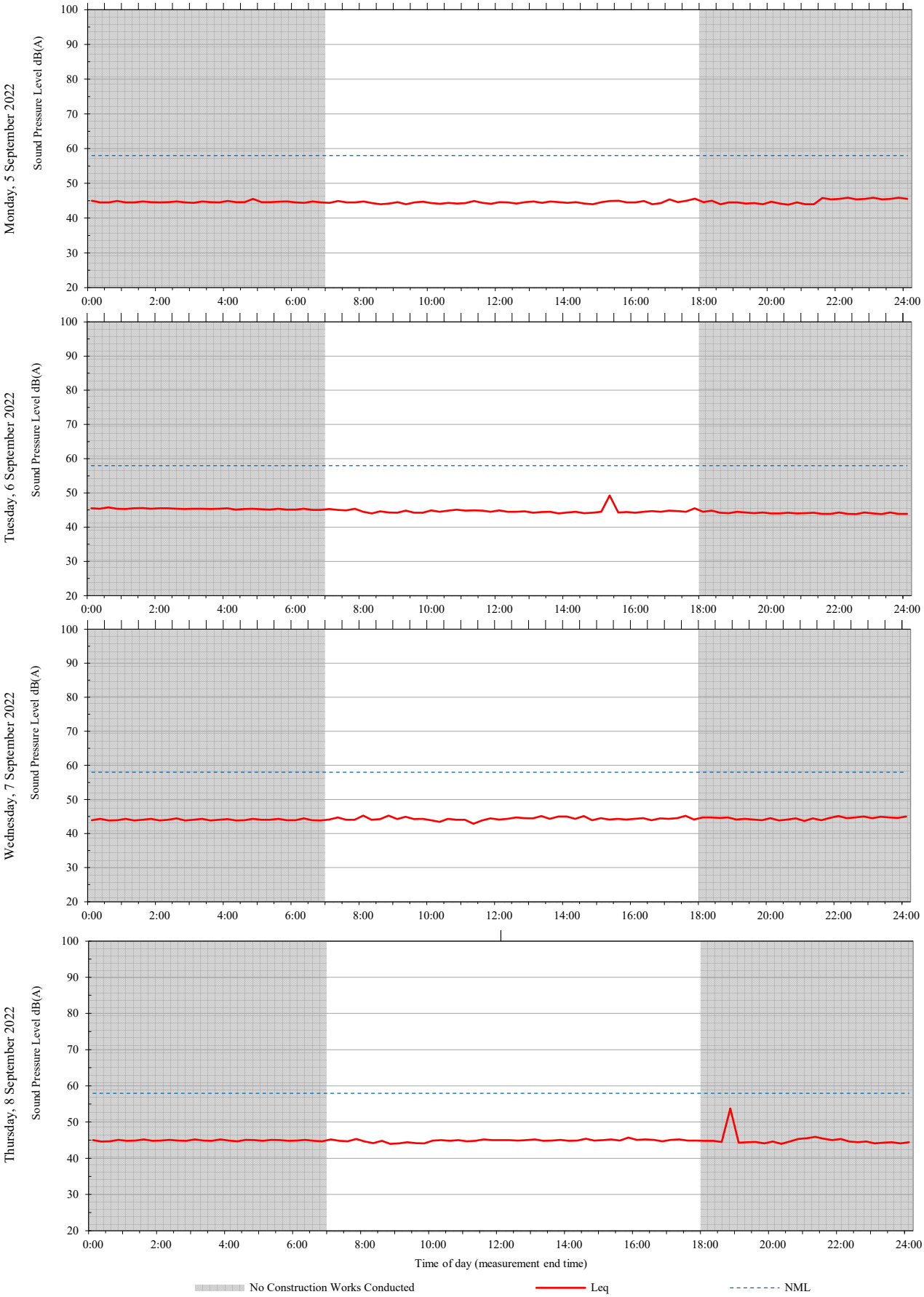

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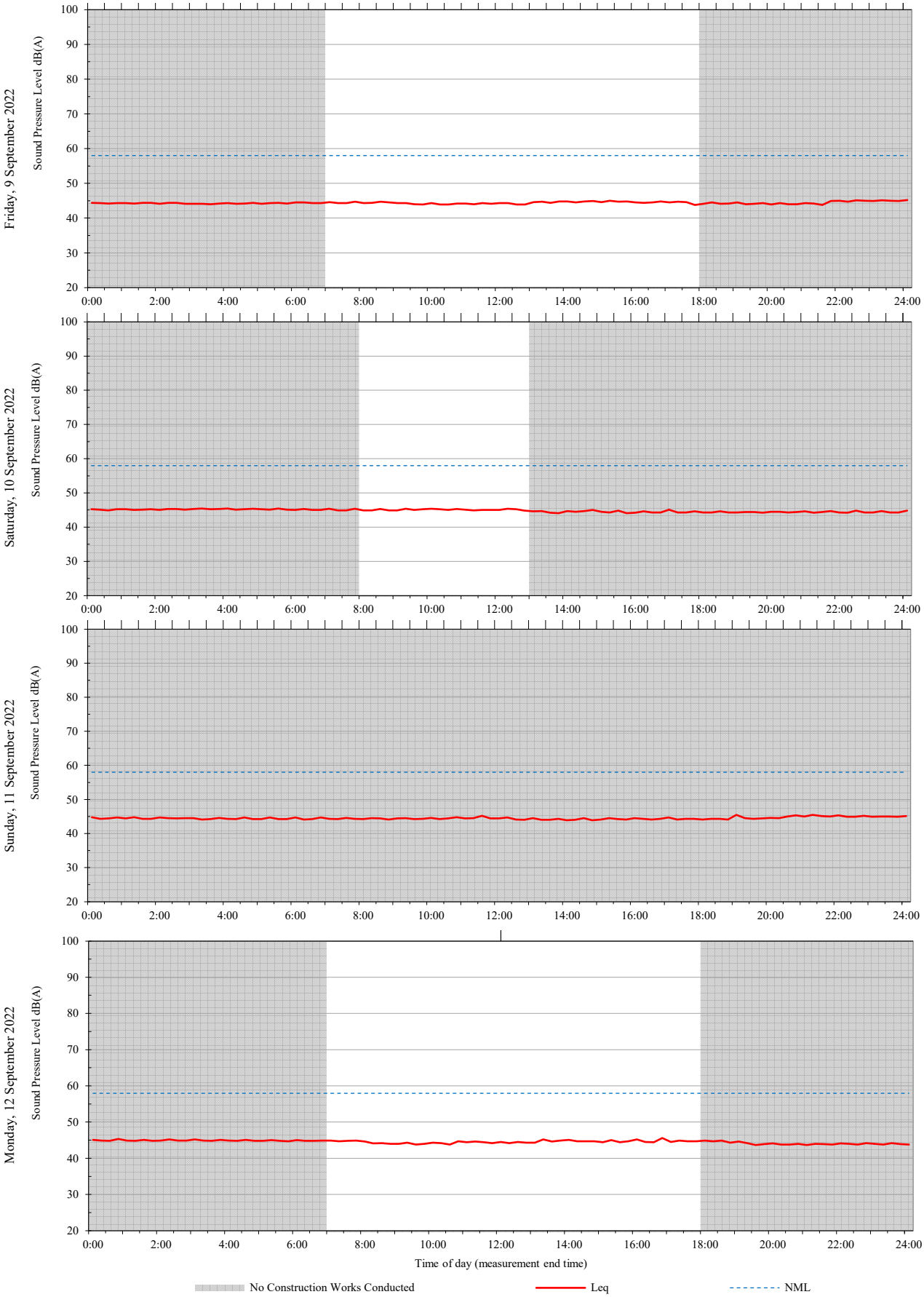

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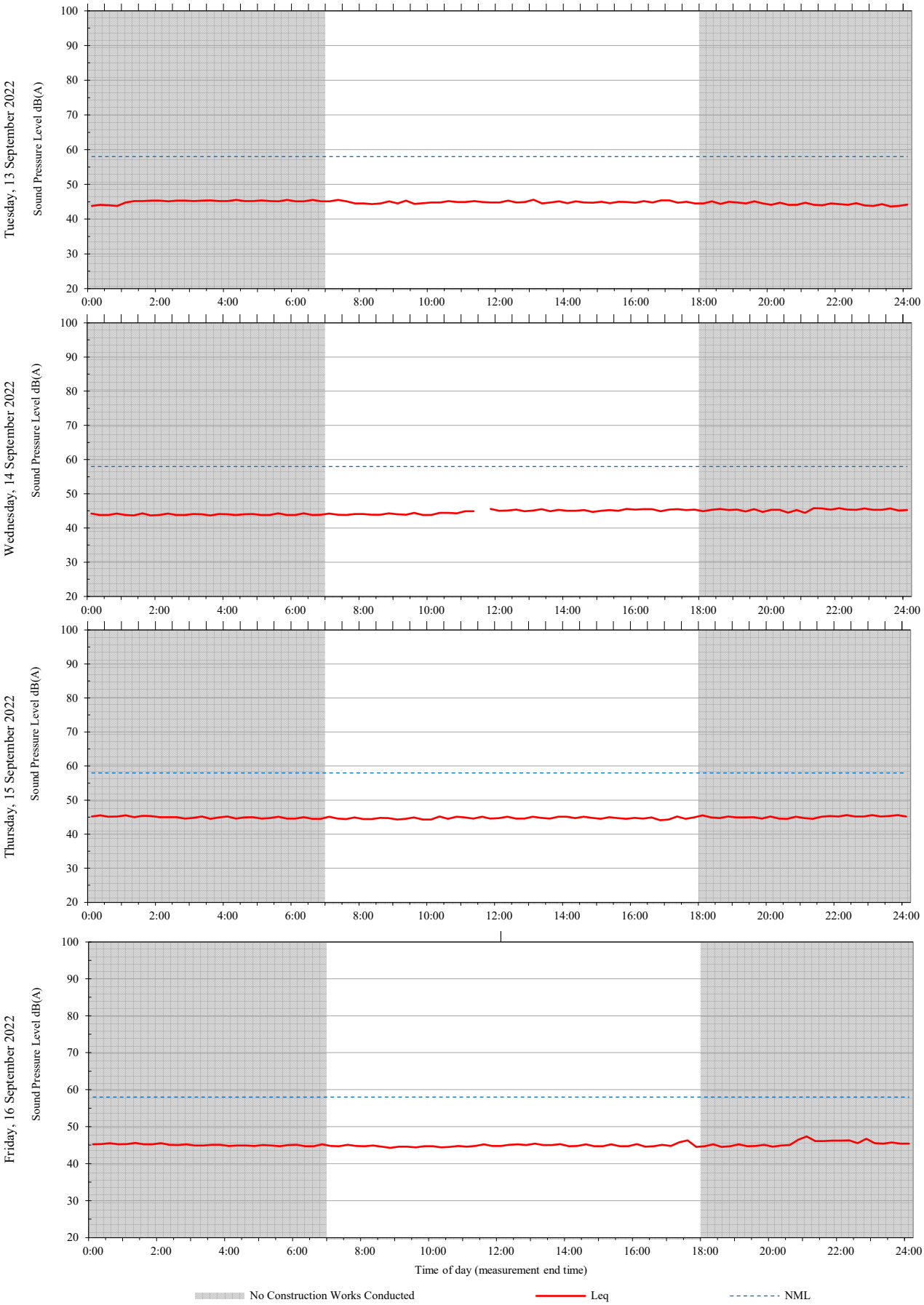
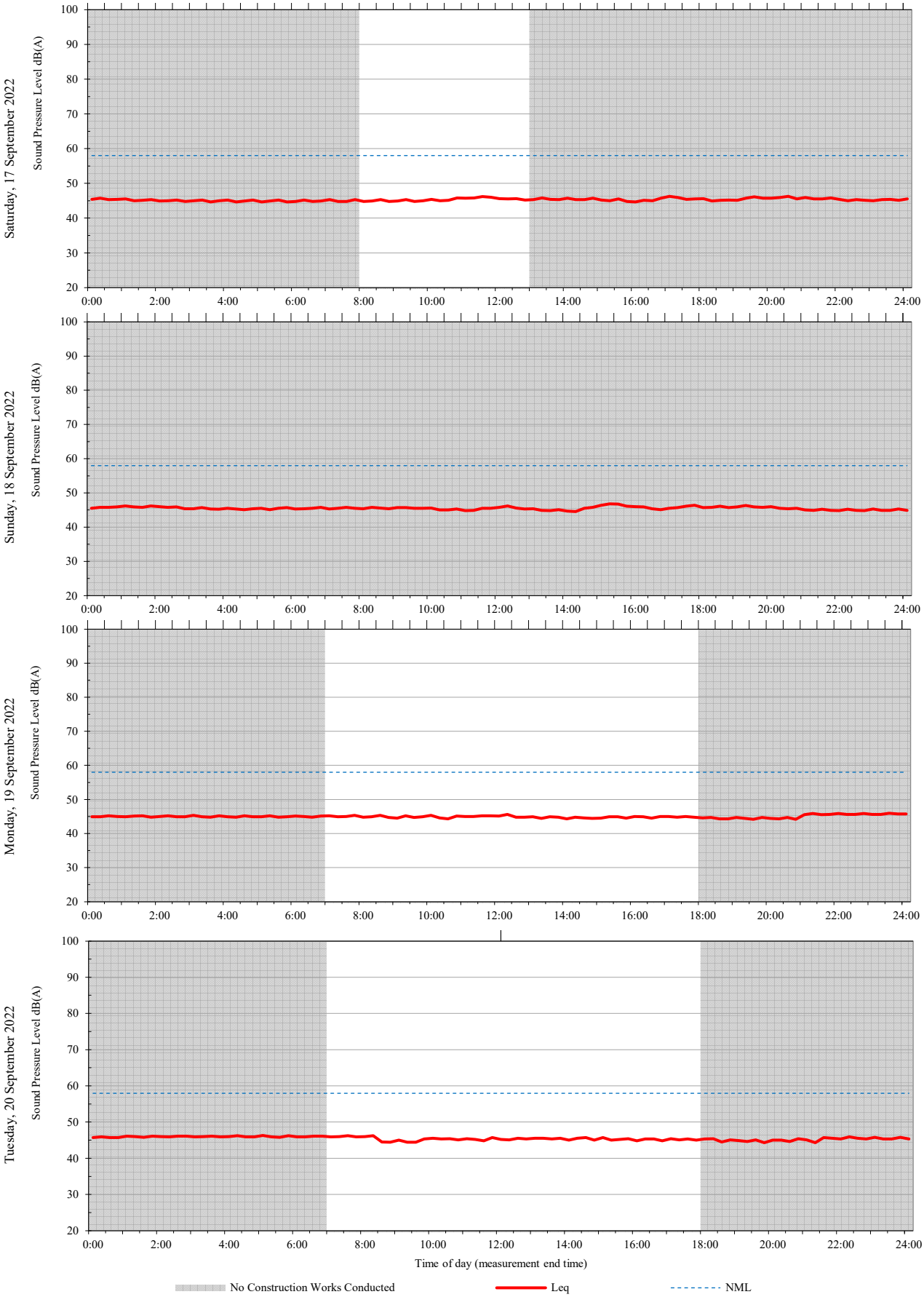


Unattended monitoring: Westmead 7 - KR Level 3 Radiation Room 33 RF041(facing PSB site) (Internal) ARUP



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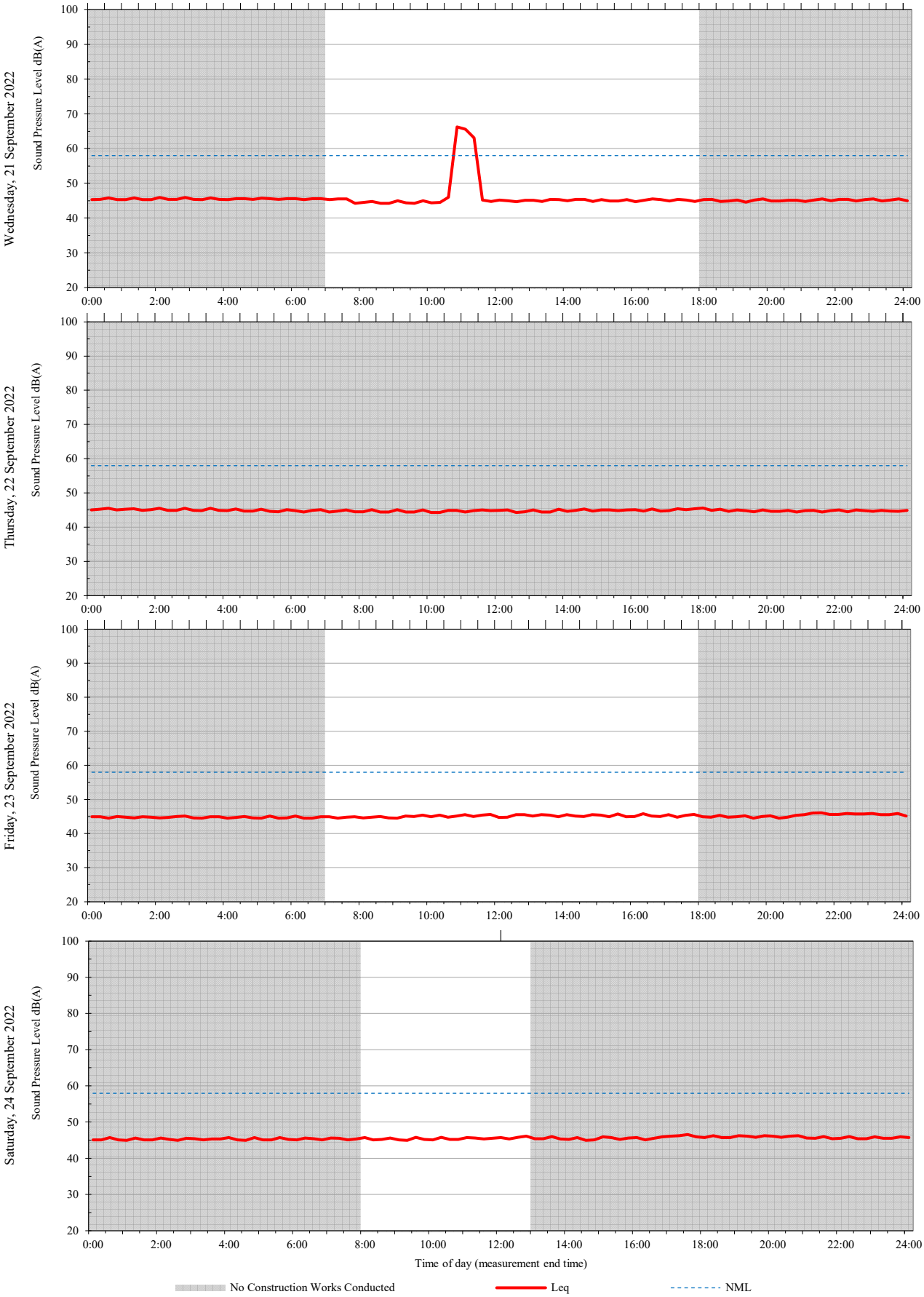

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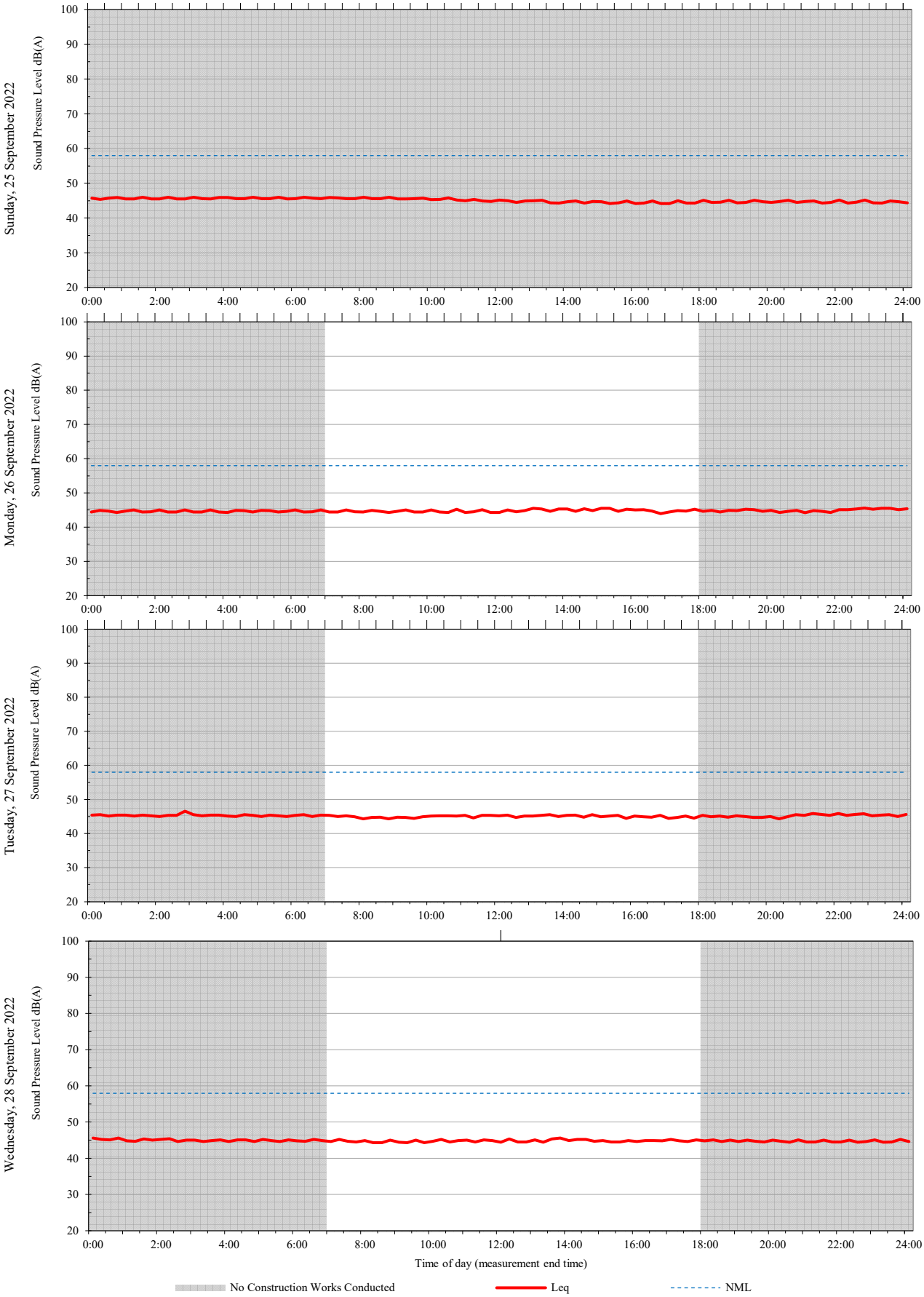
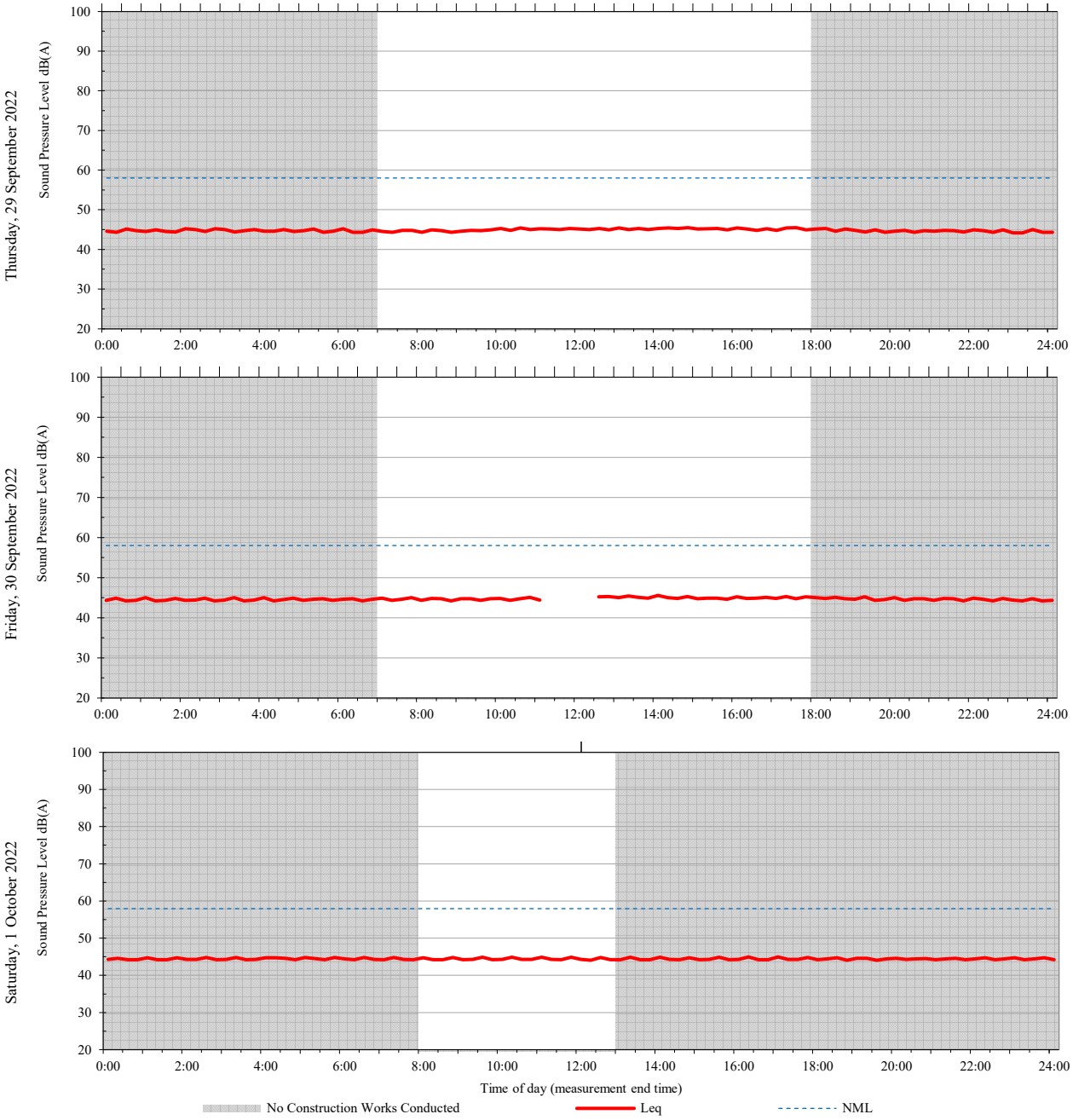


Unattended monitoring: Westmead 7 - KR Level 3 Radiation Room 33 RF041(facing PSB site) (Internal) ARUP



A5 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)

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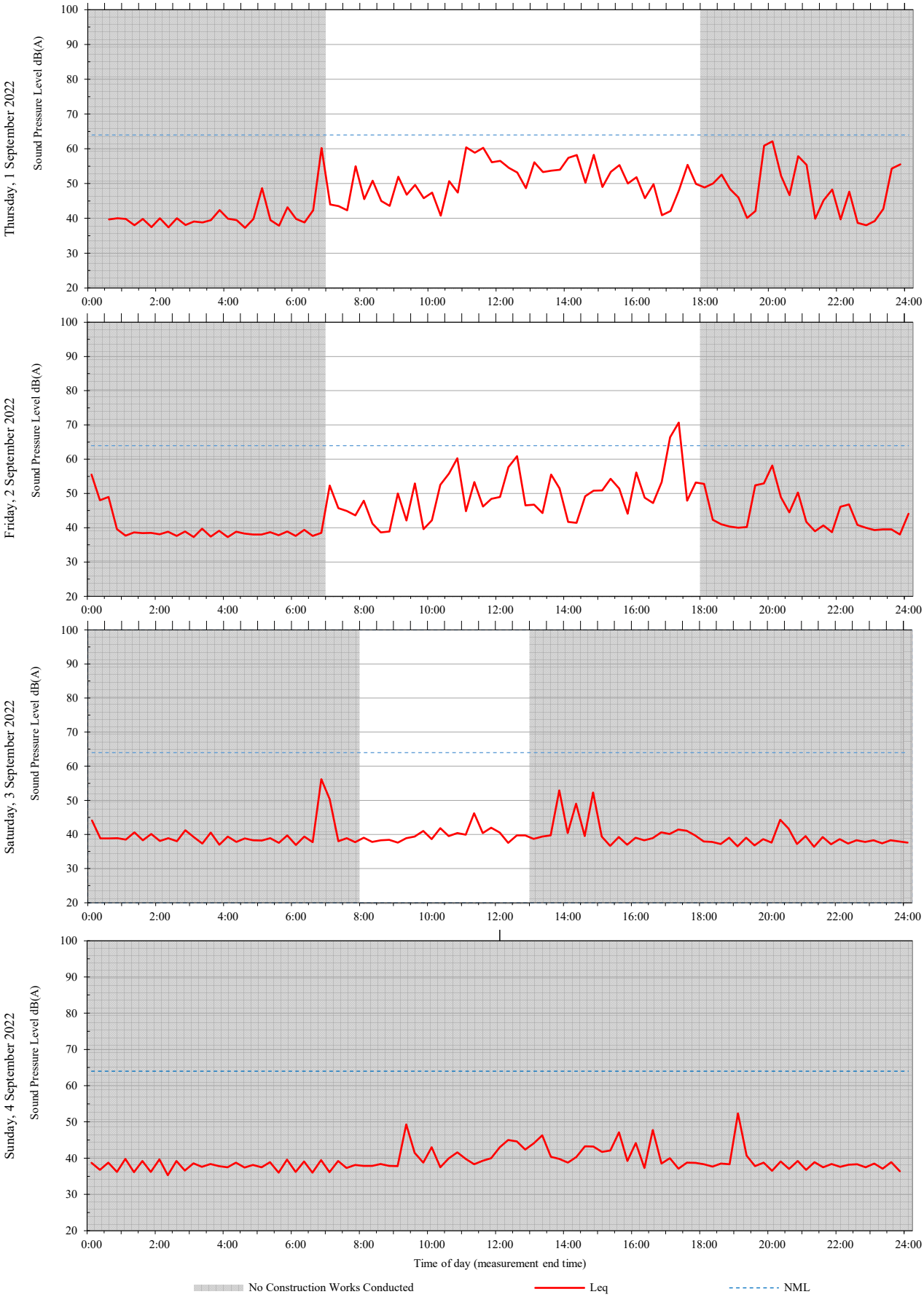
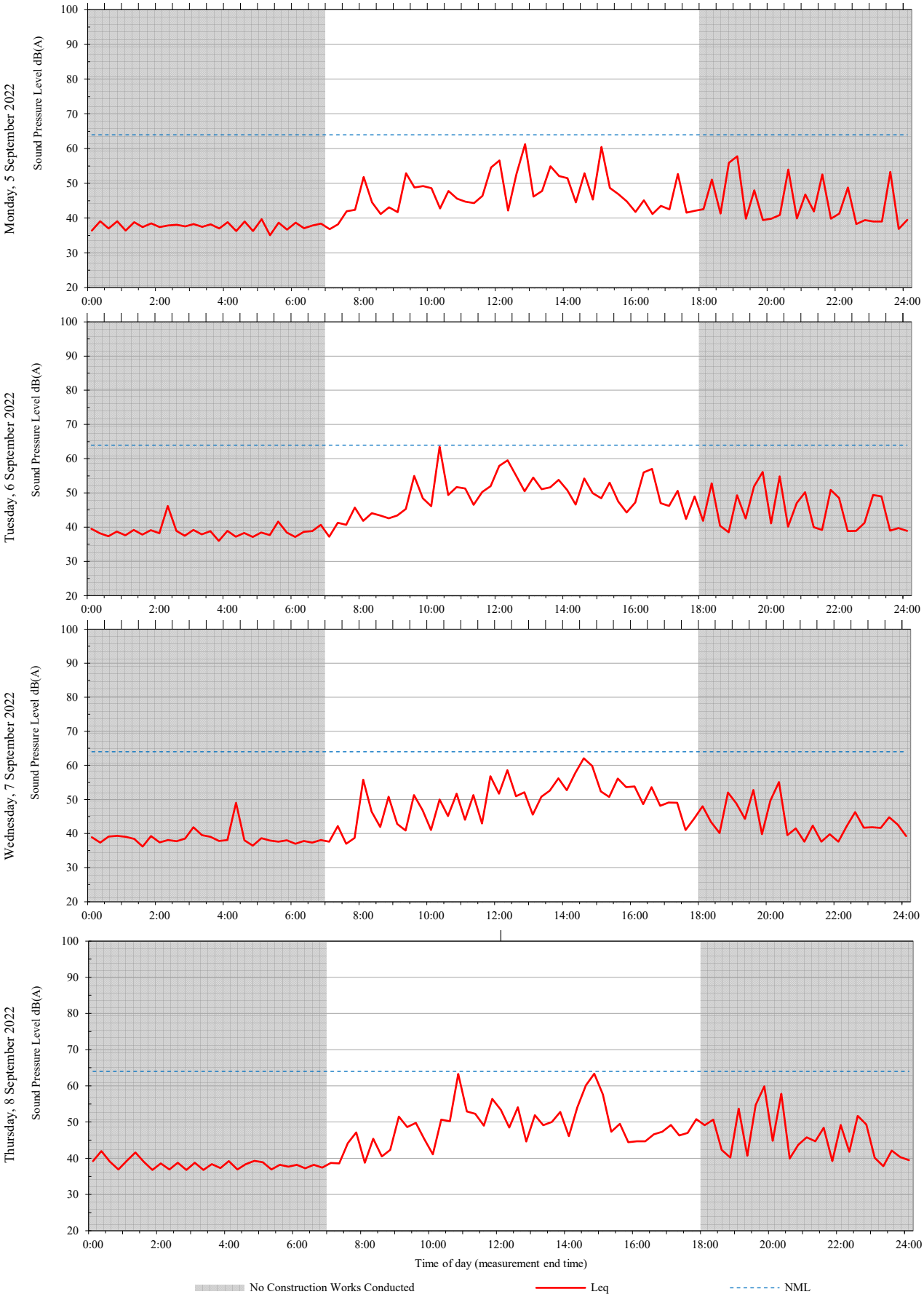
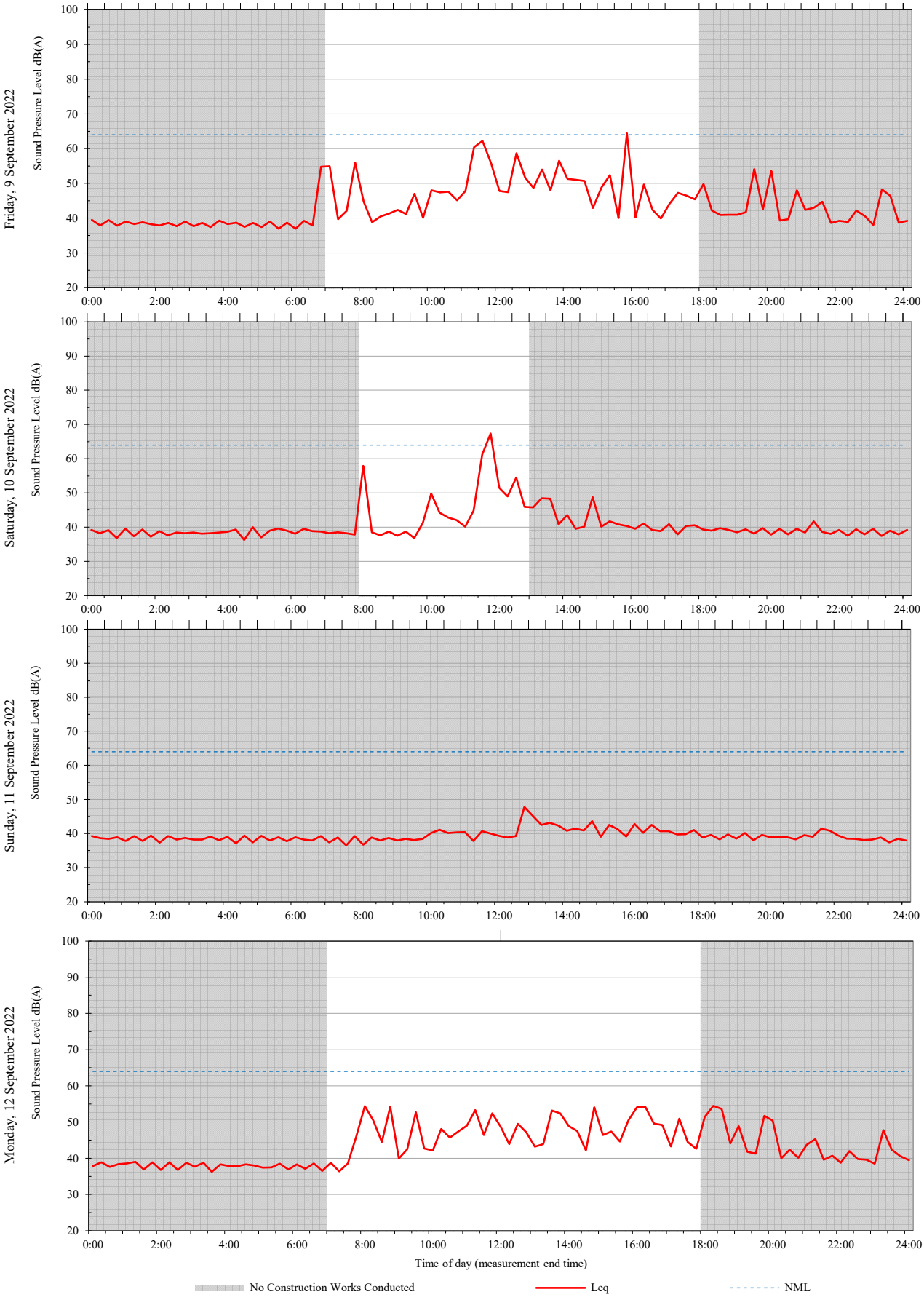

Thursday, 1 September 2022
Friday, 2 September 2022
Saturday, 3 September 2022
Sunday, 4 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

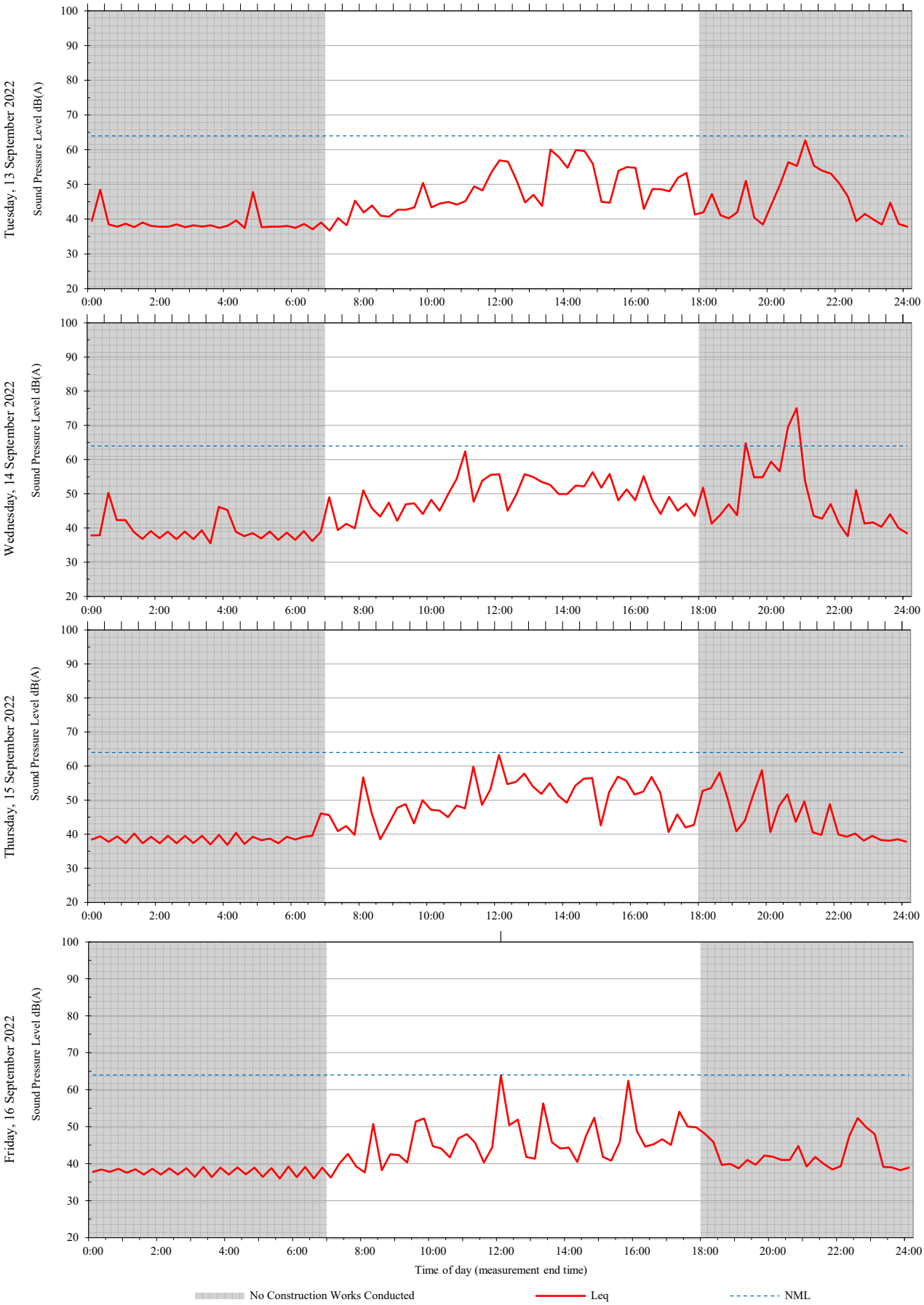
ARUP


Monday, 5 September 2022
Tuesday, 6 September 2022
Wednesday, 7 September 2022
Thursday, 8 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

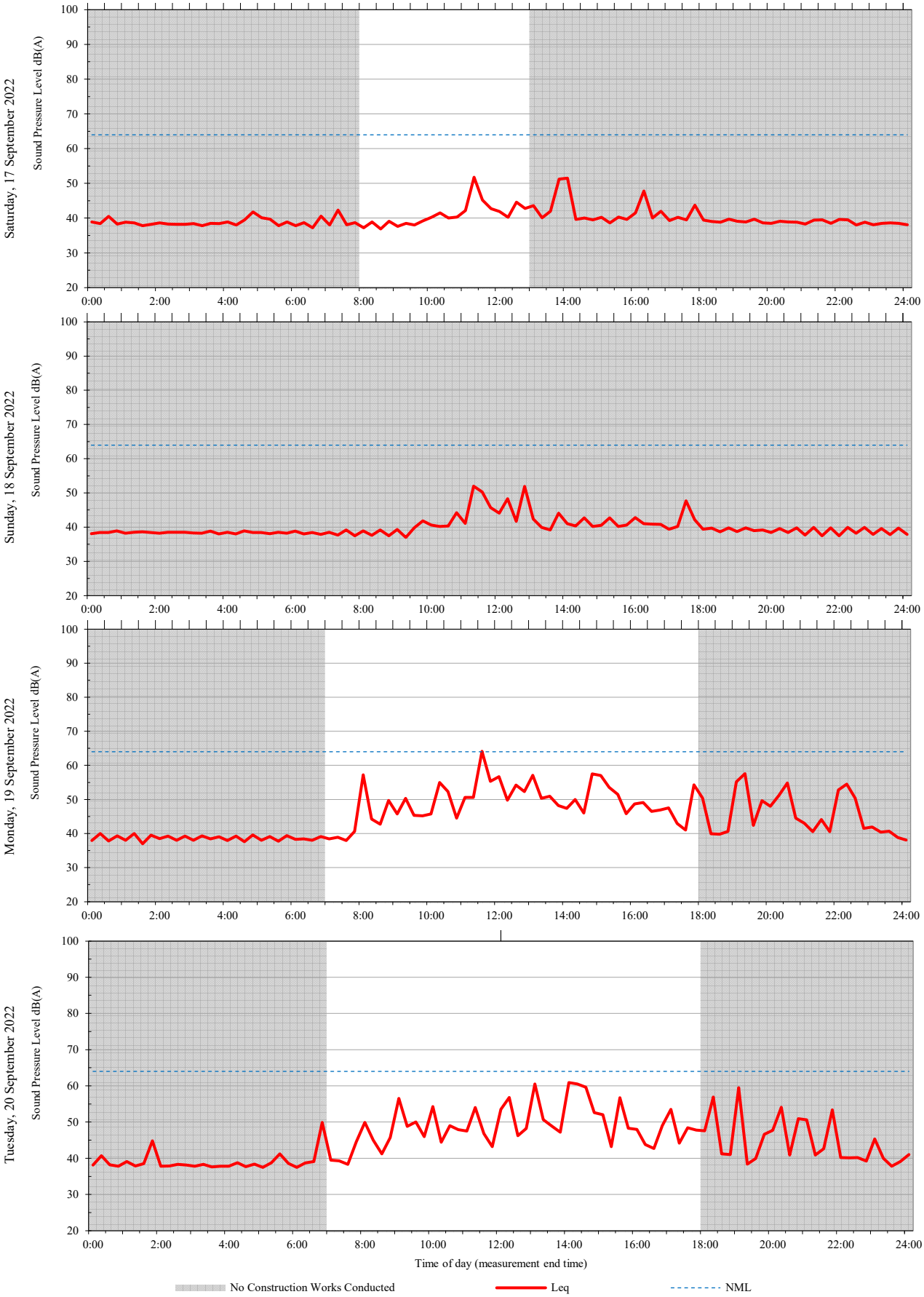
ARUP


Friday, 9 September 2022
Saturday, 10 September 2022
Sunday, 11 September 2022
Monday, 12 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

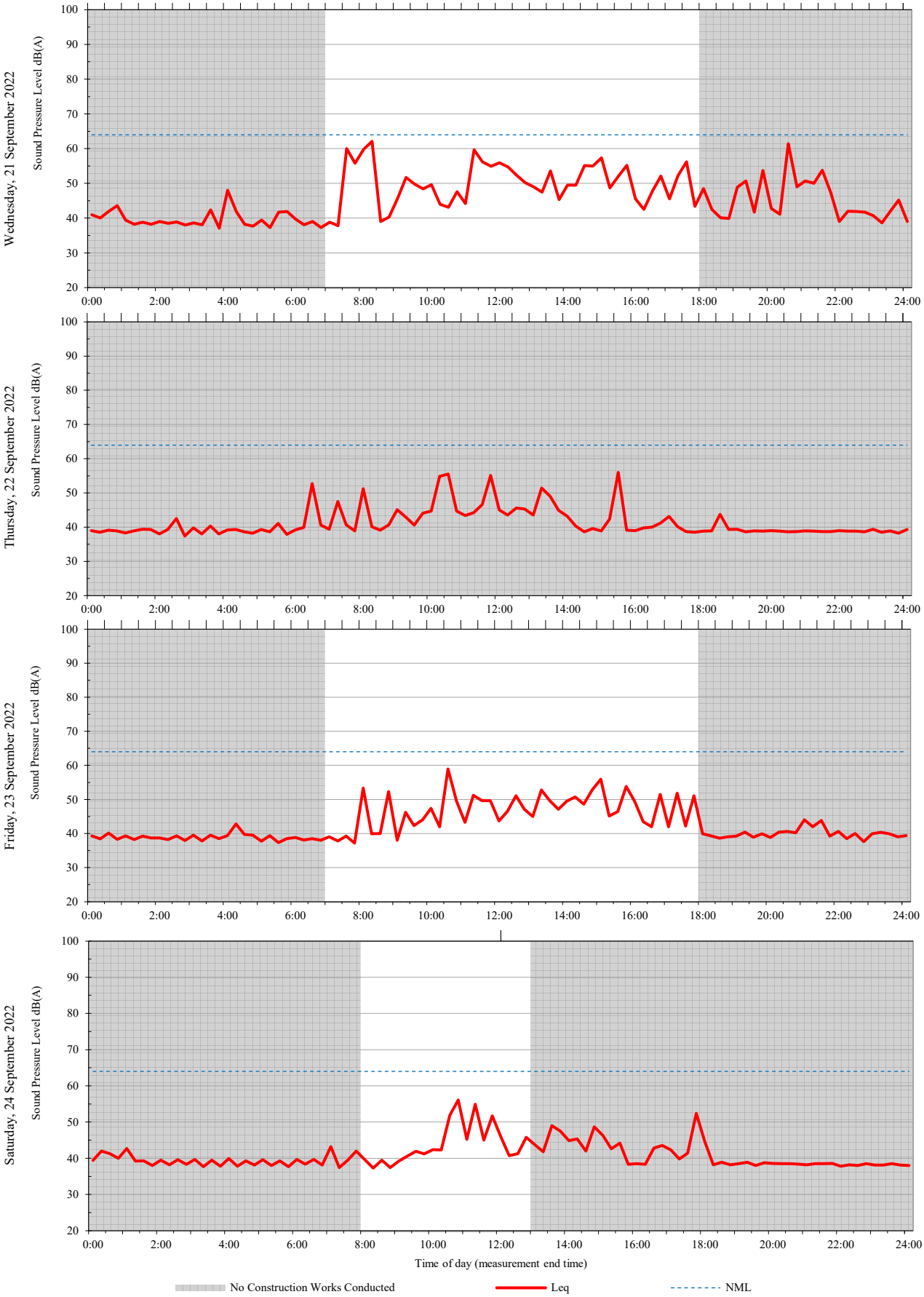
ARUP


Tuesday, 13 September 2022
Wednesday, 14 September 2022
Thursday, 15 September 2022
Friday, 16 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

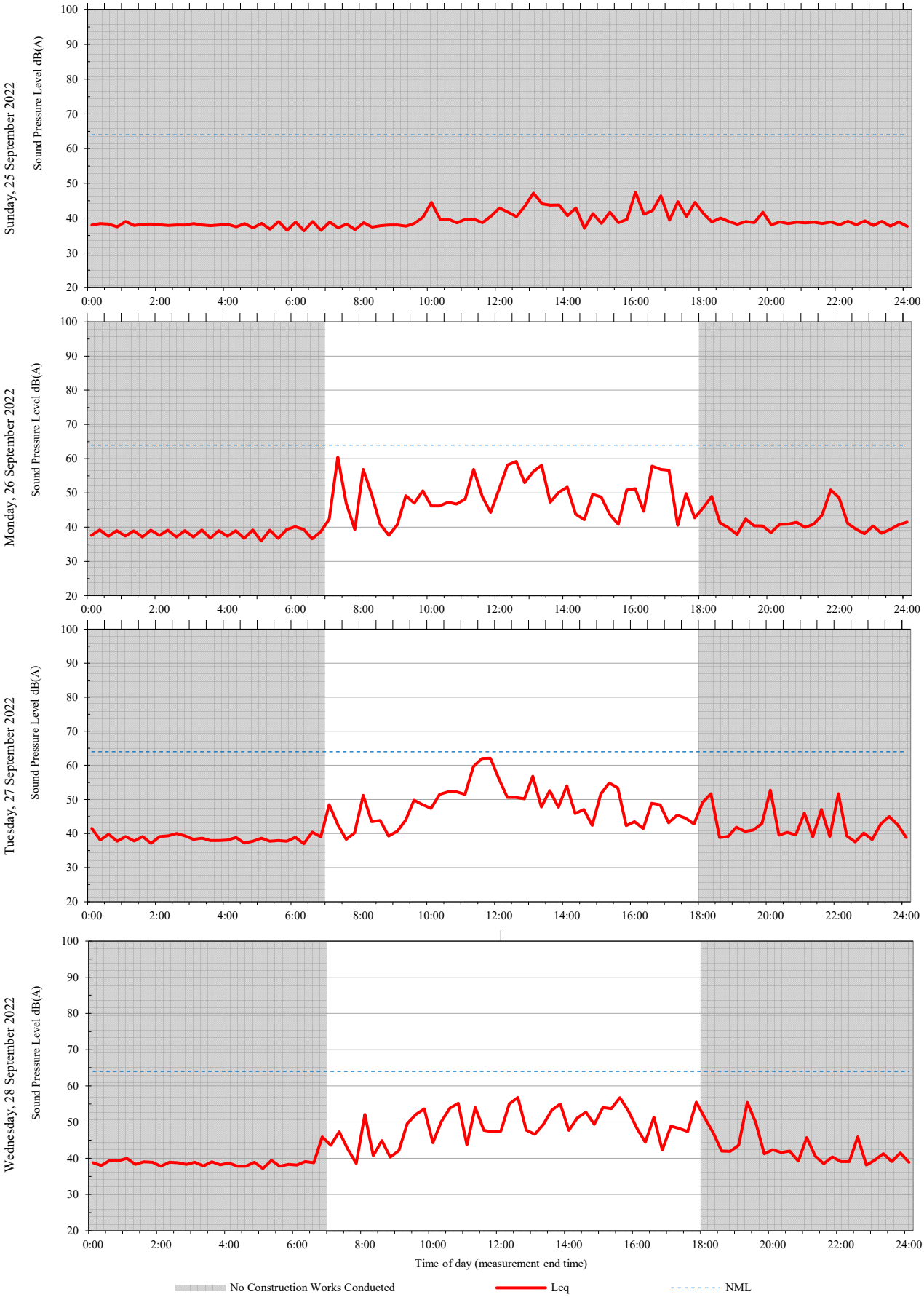
ARUP


Saturday, 17 September 2022
Sunday, 18 September 2022
Monday, 19 September 2022
Tuesday, 20 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

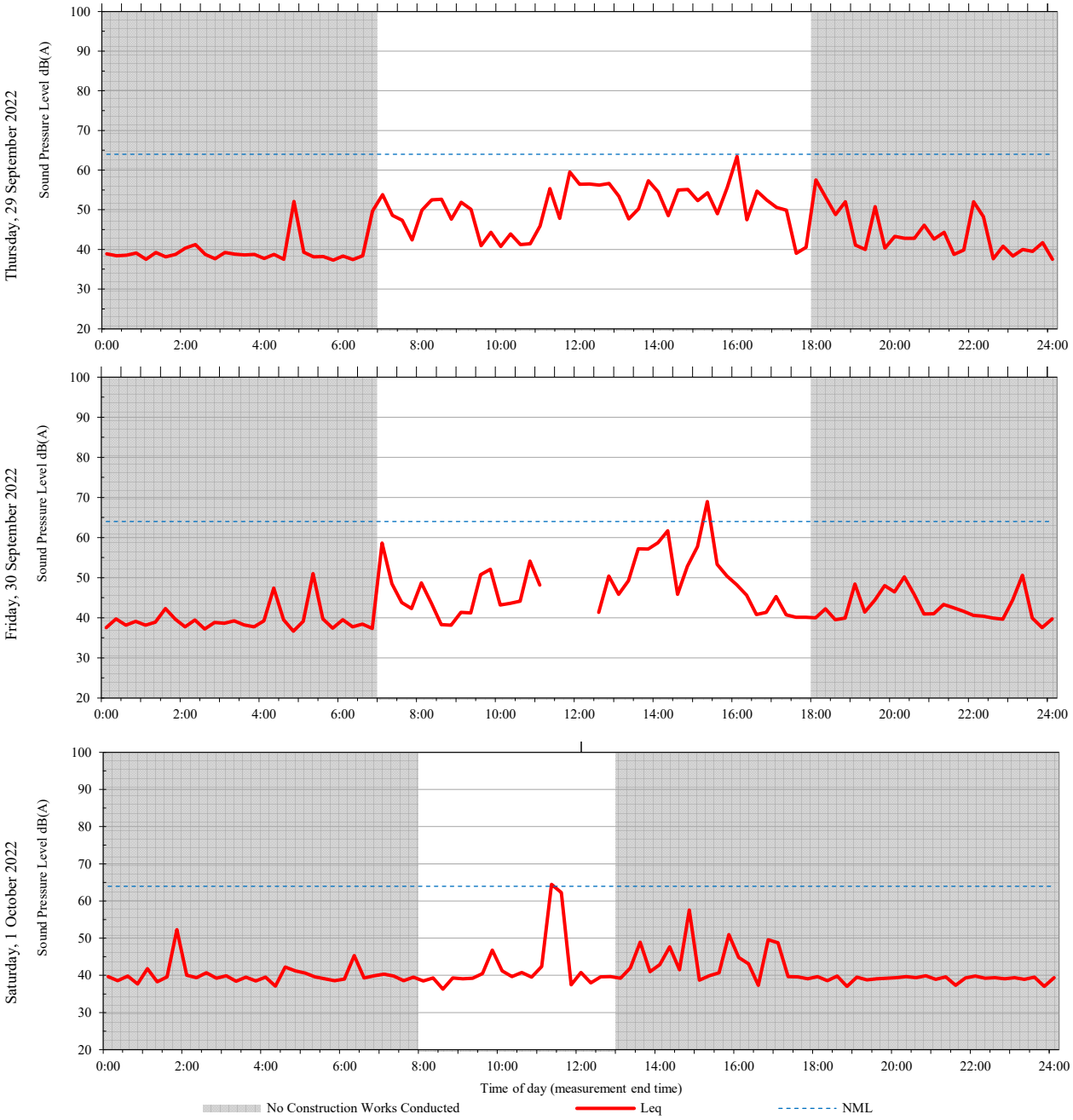
ARUP


Wednesday, 21 September 2022
Thursday, 22 September 2022
Friday, 23 September 2022
Saturday, 24 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

ARUP


Sunday, 25 September 2022
Monday, 26 September 2022
Tuesday, 27 September 2022
Wednesday, 28 September 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

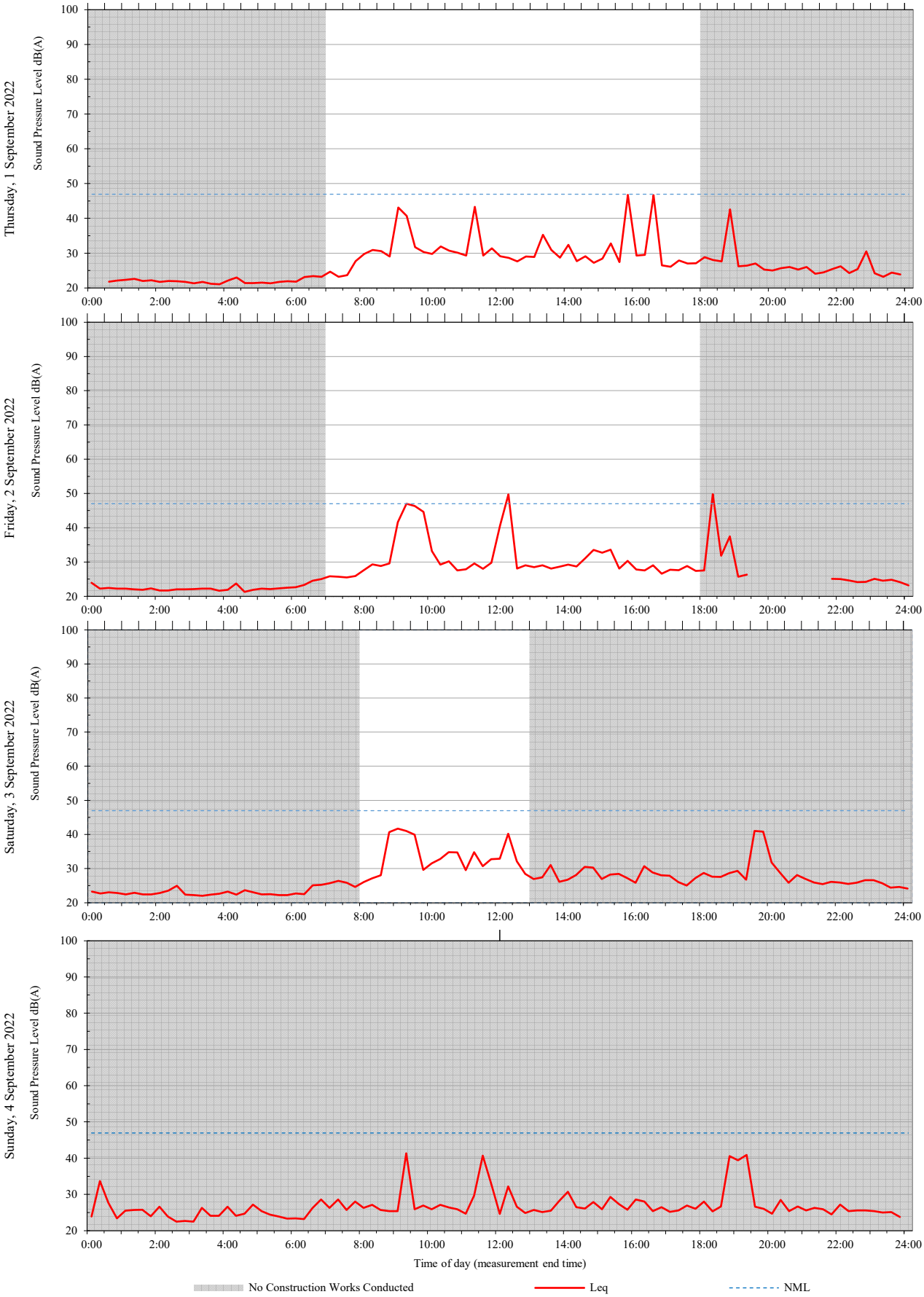
ARUP


Thursday, 29 September 2022
Friday, 30 September 2022
Saturday, 1 October 2022
Sound Pressure Level dB(A)
100
90
80
70
60
50
40
30
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time of day (measurement end time)
No Construction Works Conducted
Leq
NML

A6 RMH Level 1 Store Room 101 (Westmead 3)

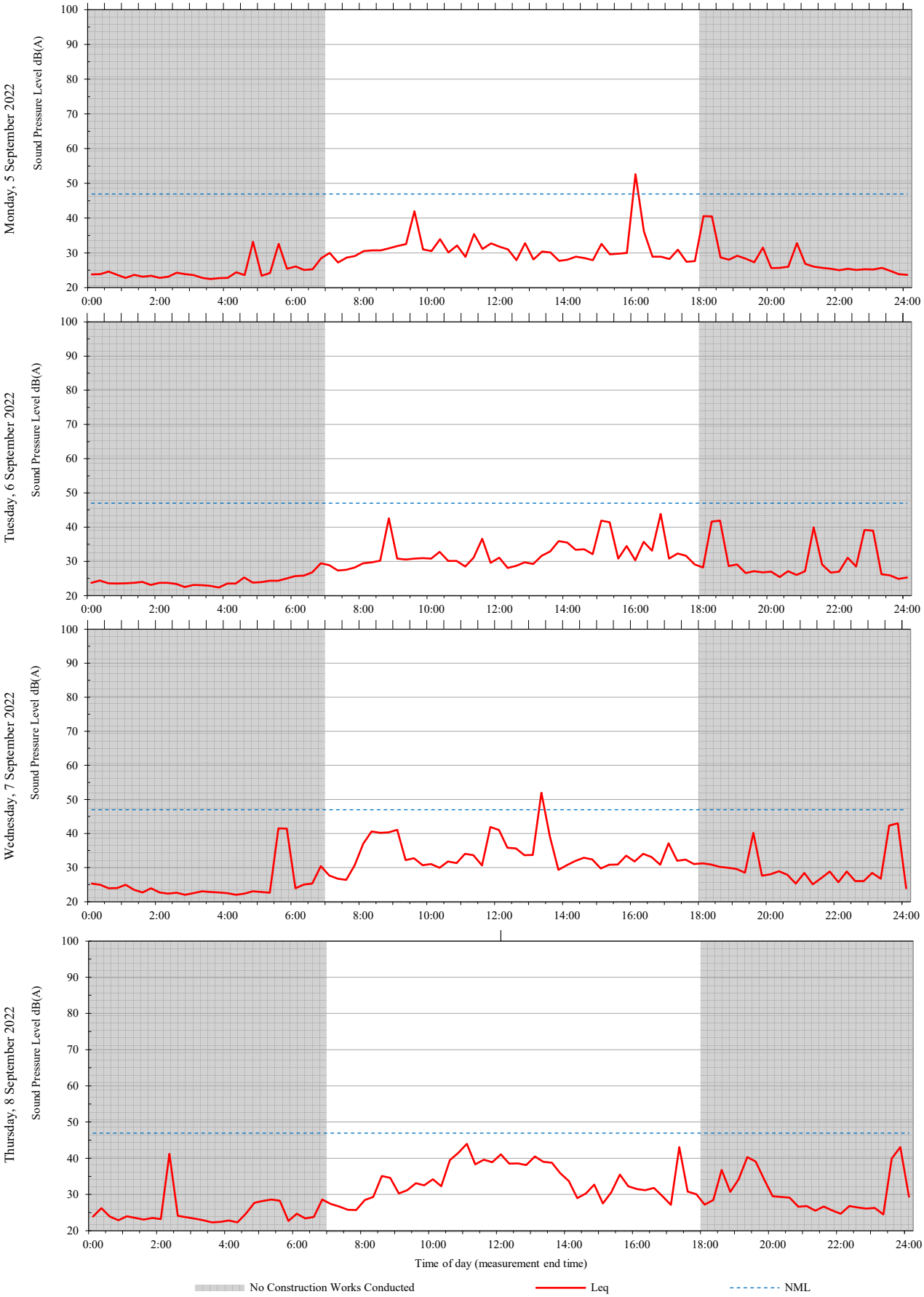
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



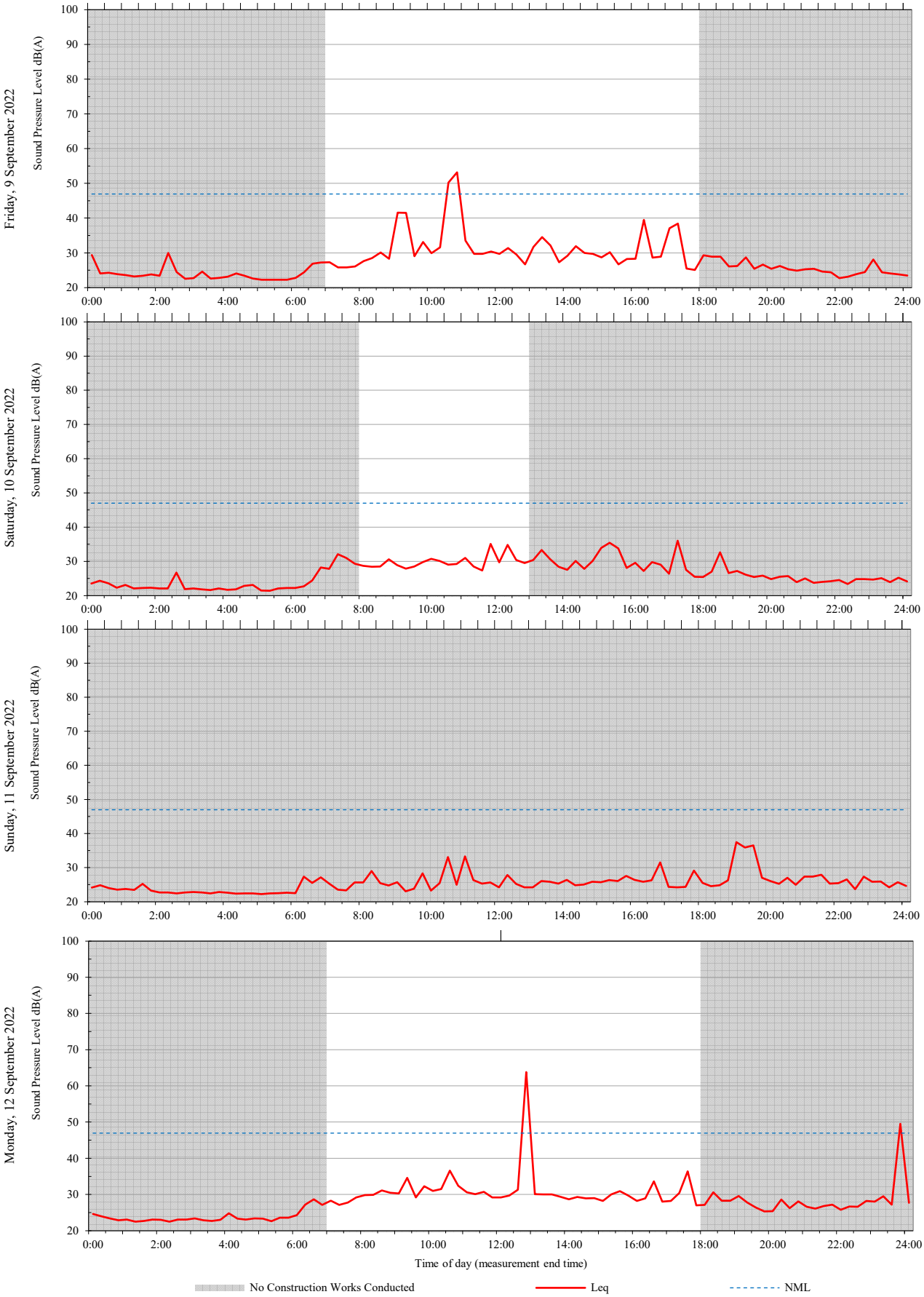
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



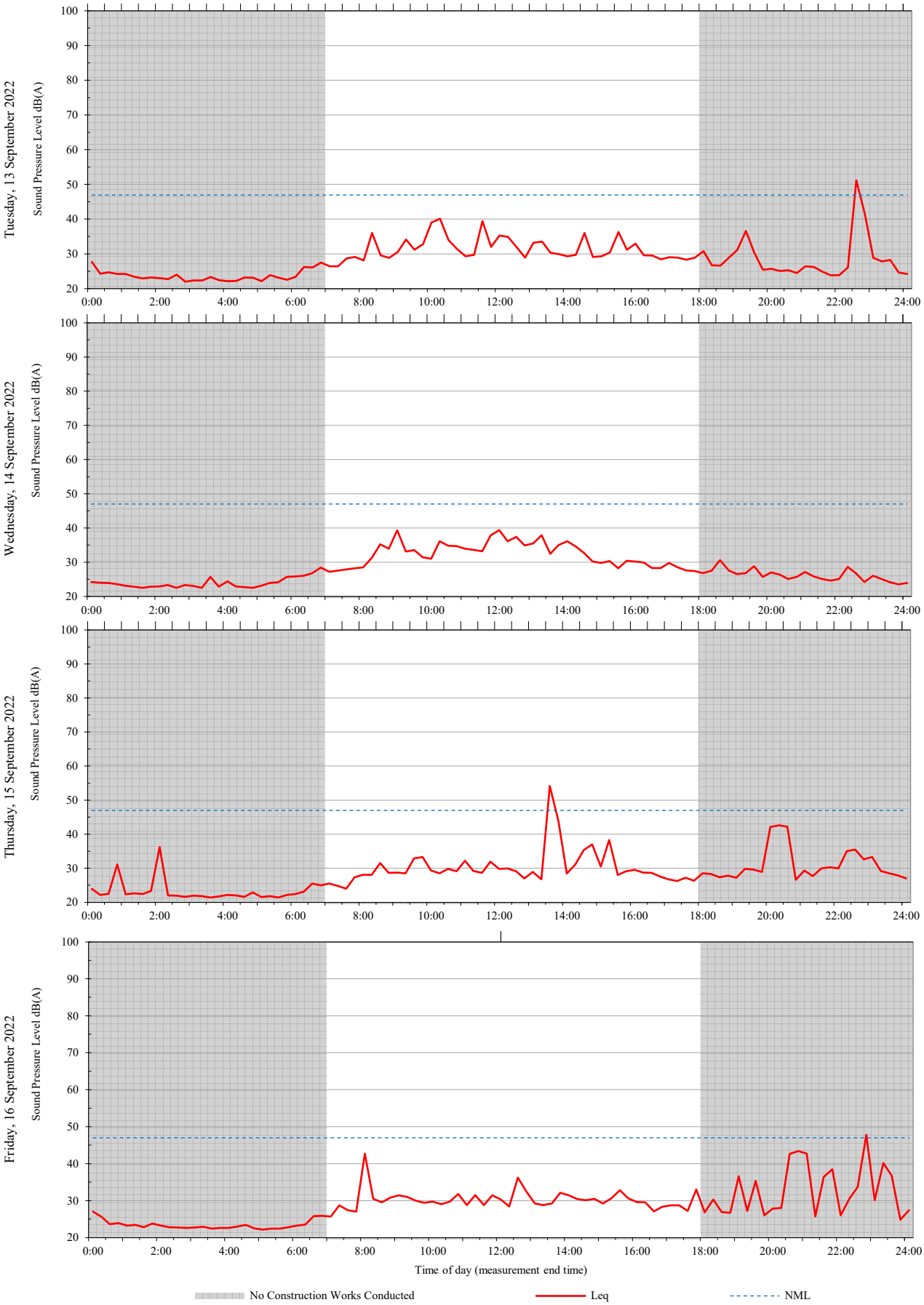
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



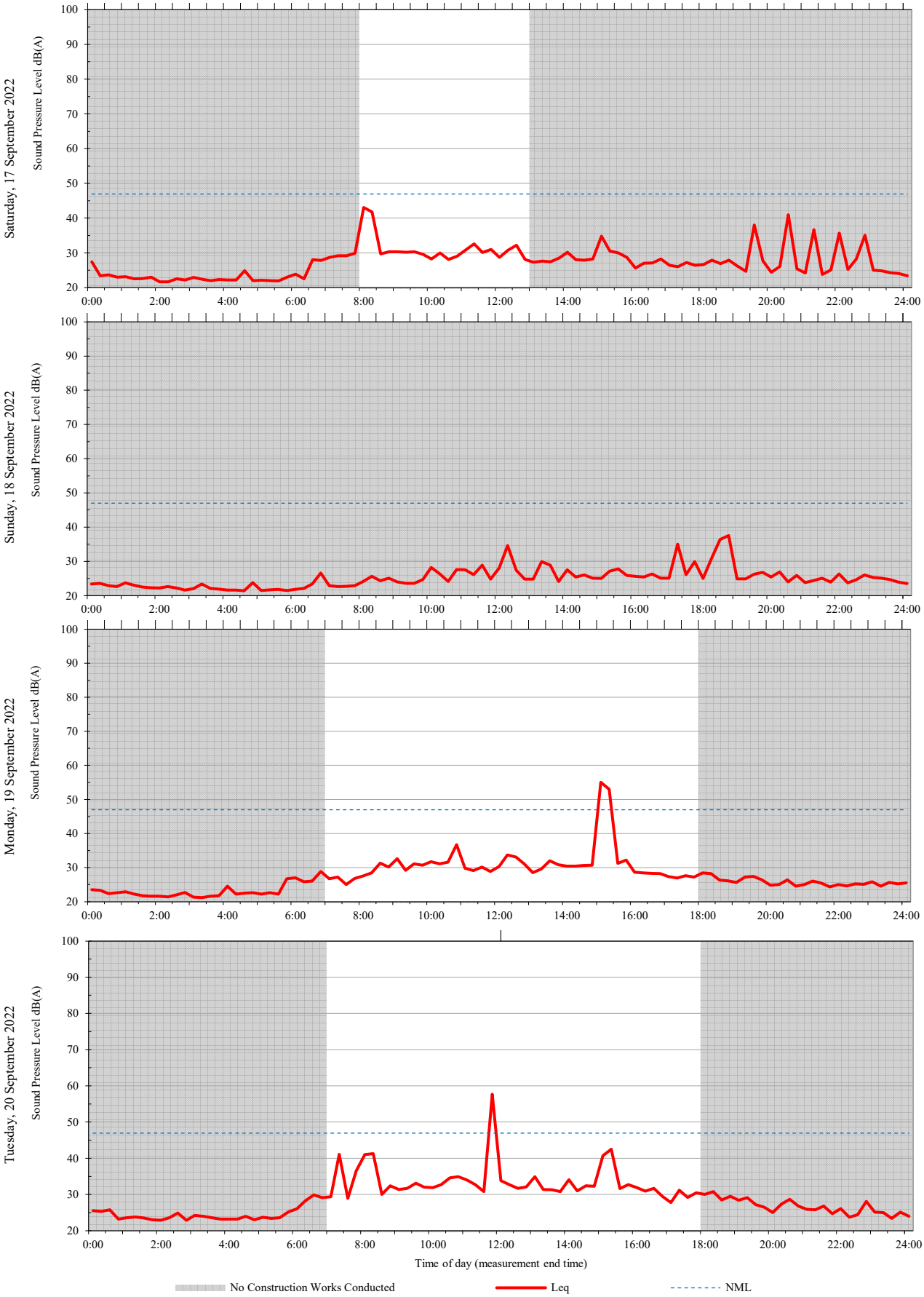
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



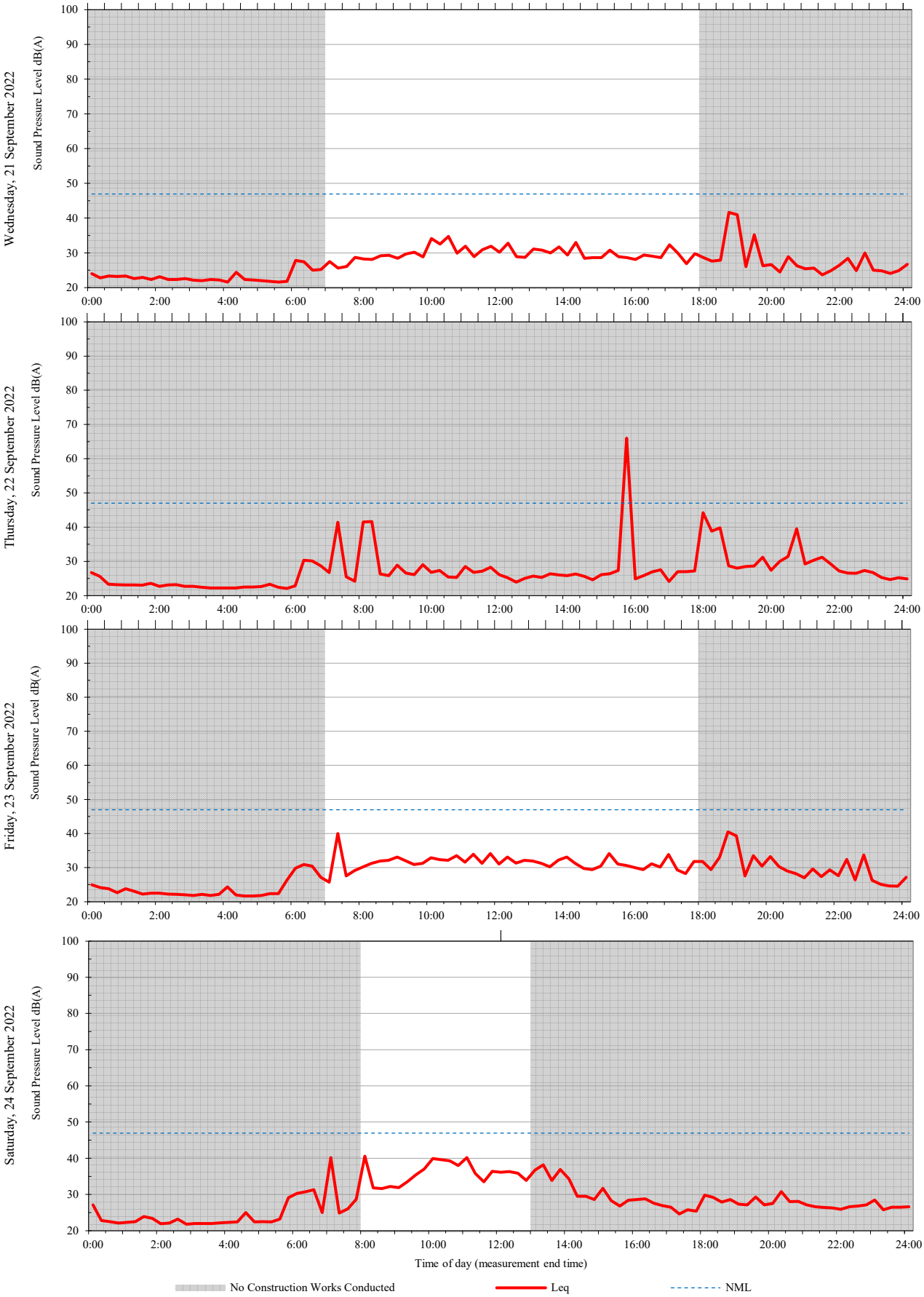
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



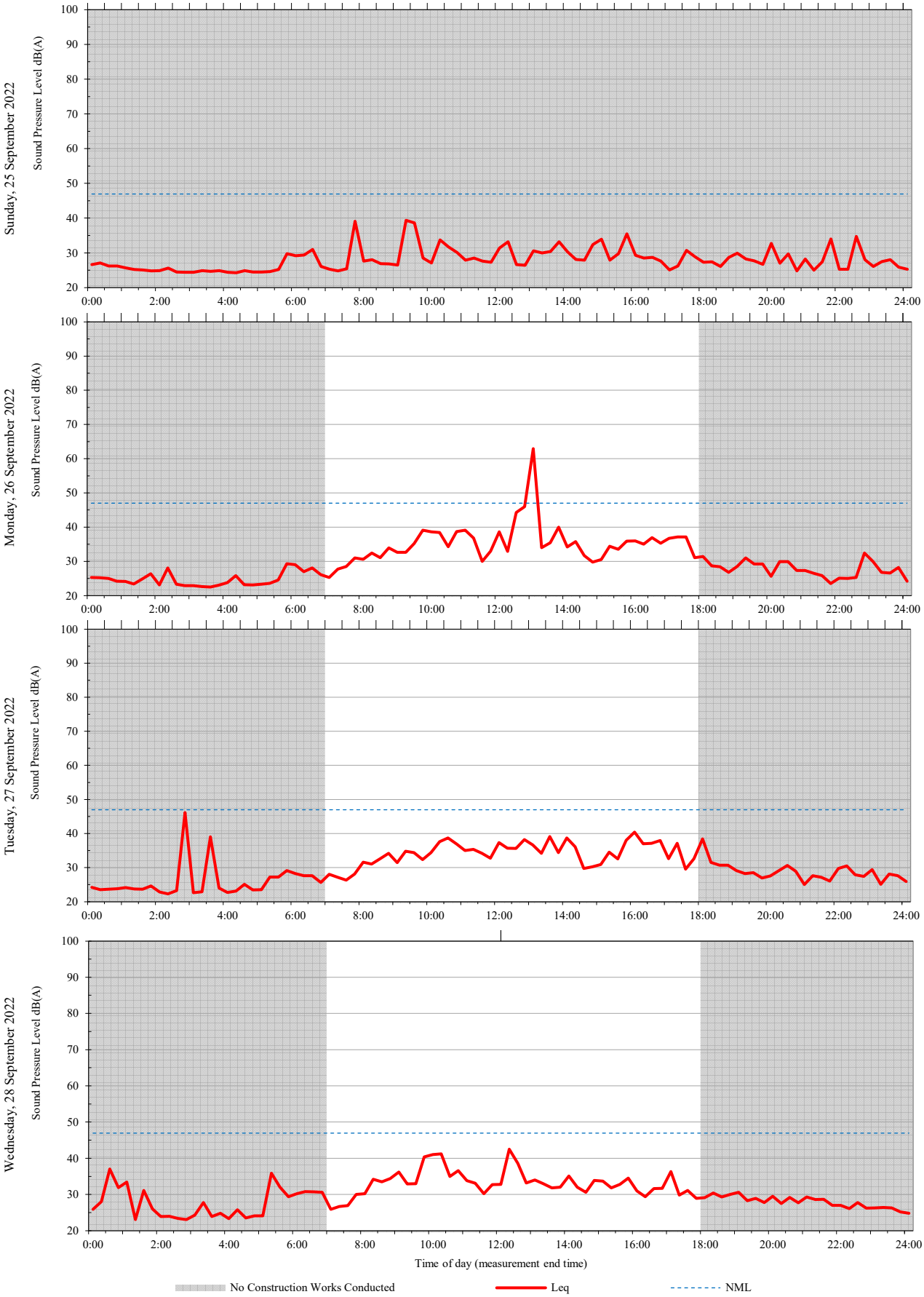
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



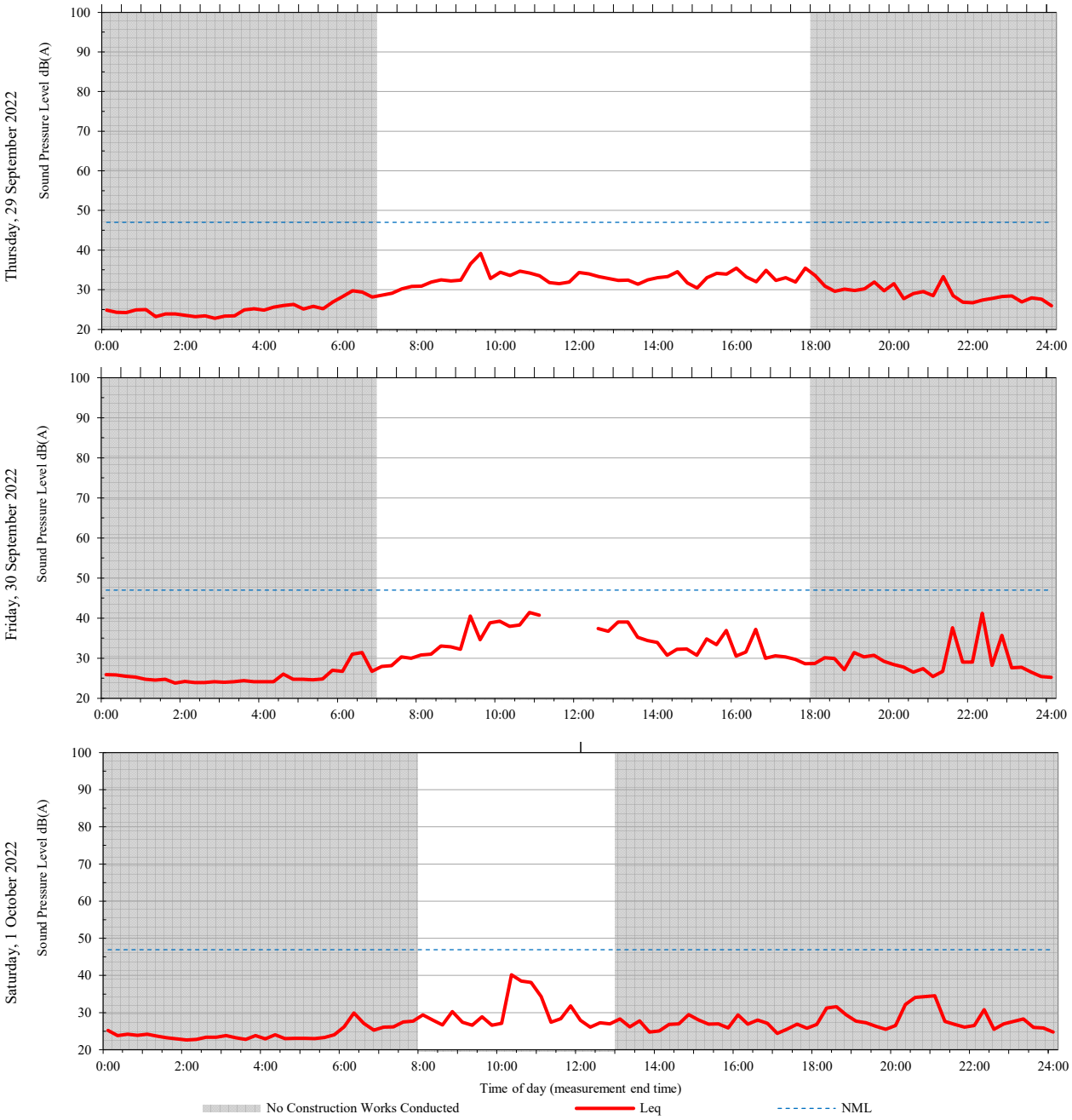
Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



Unattended monitoring: Westmead 3 - (RMH - L1 Store Room 101) (Internal)

ARUP



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Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - KR - Animal House - September 2022

CVM/ KR/202209

Issue 1 | 13/10/2022

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

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Document Verification

Project title	Children's Hospital Westmead
Document title	Monthly Vibration Monitoring Report
Job number	271985
Document ref	CVM/KR/202209
File reference	-

Revision	**Date**	**Filename**	Westmead Hospital – 103156 KR - Animal House - Summary of Recent Vibration Measurments (01-09 to 30-09).docx
Issue 1	13/10/2022	**Description**	Issue

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

Filename		
Description		

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Name			
Signature			

Filename		
Description		

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

Contents

Executive Summary

This report summarises the vibration monitoring data recorded at KR - Animal House, over one month – from 01/09/2022 to 30/09/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

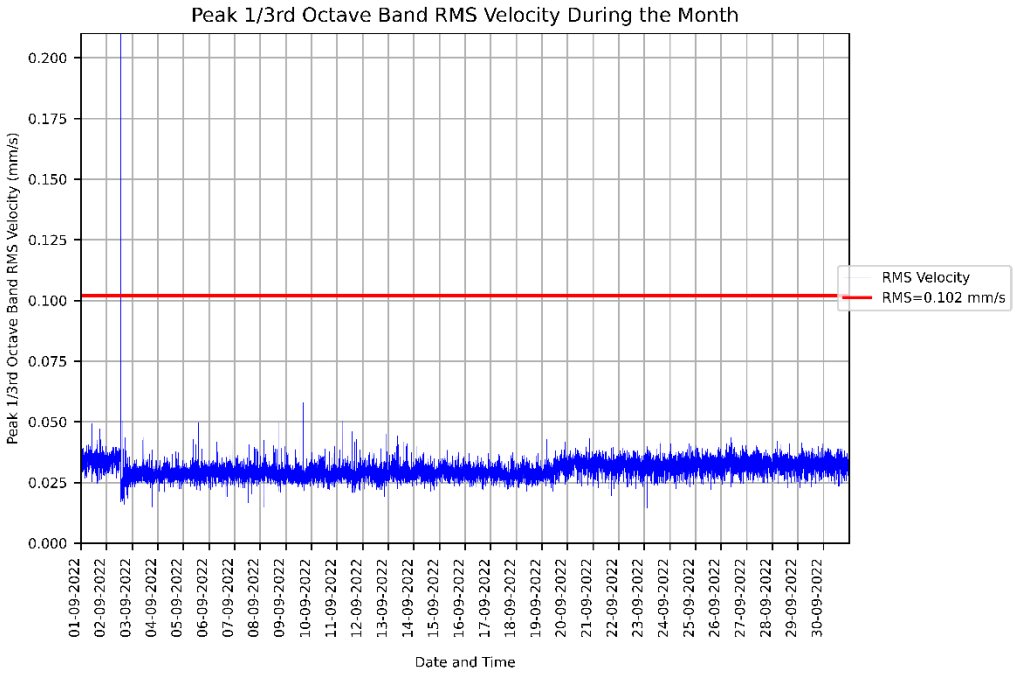


Figure 1: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the KR - Animal House.

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
1	0

PPV Vibration Levels

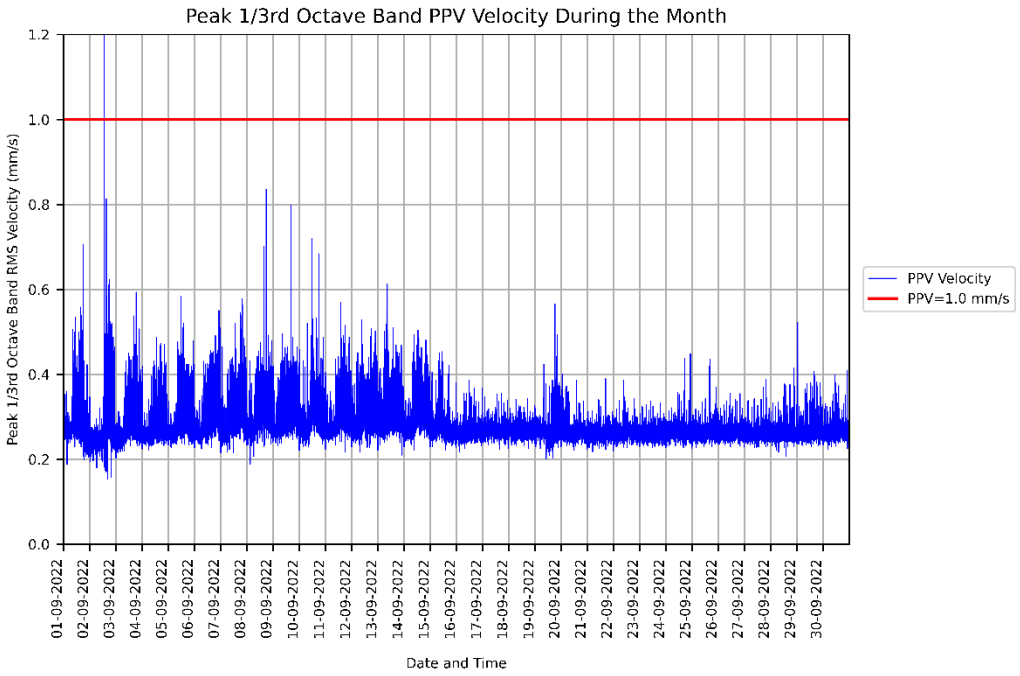


Figure 2: Measured vibration levels for 01/09/2022 to 30/09/2022 at the KR - Animal House.

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	1

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 KR - Animal House during the period of the 01/09/2022 to 30/09/2022.

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 3Figure .

Figure 3: KR - Animal House vibration monitor location shown in orange

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 01/09/2022 and 30/09/2022. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

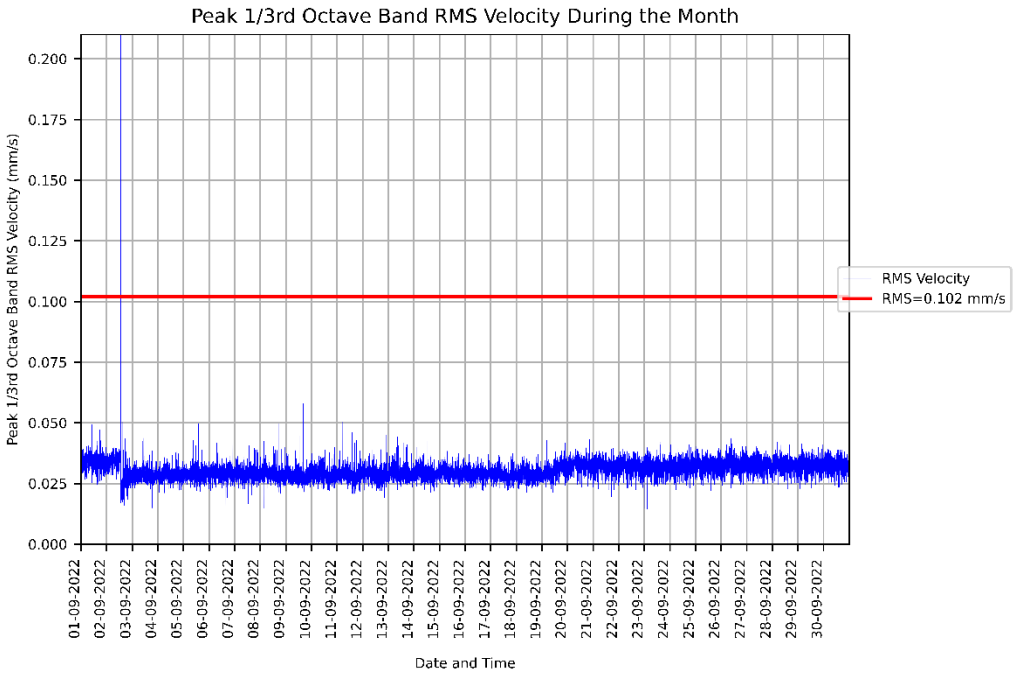


Figure 4: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the KR - Animal House.

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
1	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/09/2022 and 30/09/2022. The recorded data is shown in blue, while the limit of 1.0mm/s (V_{PPV}) is shown in red.

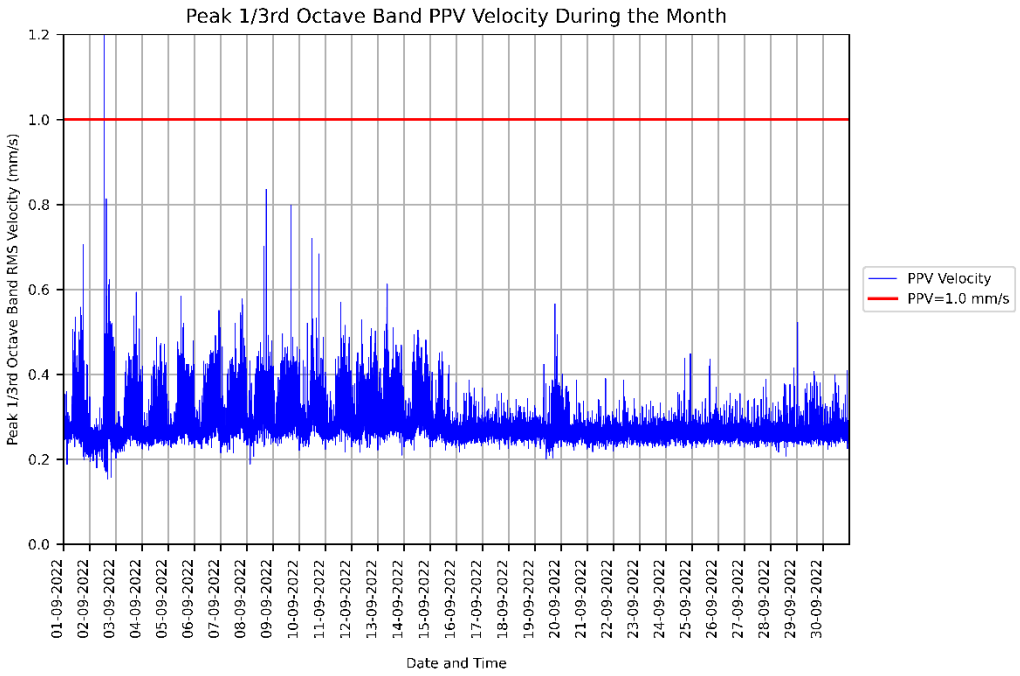
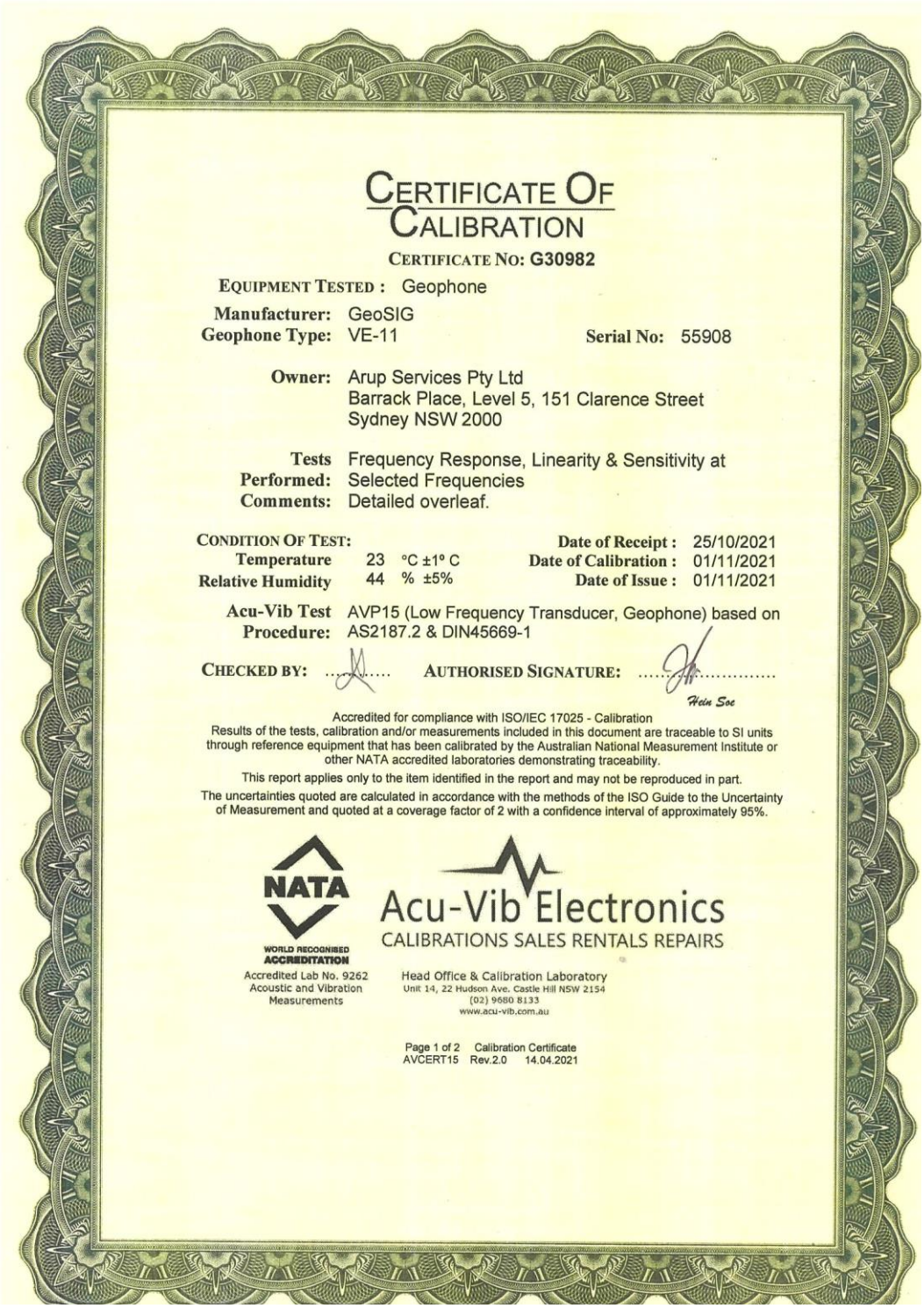


Figure 5: Measured PPV vibration levels for 01/09/2022 to 30/09/2022 at the KR - Animal House.

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	1

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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Acoustic and Vibration Measurements

Acu-Vib Electronics
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Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

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 - CHW - L1 Lab - September 2022

CVM/ CHW/202209

Issue 1 | 13/10/2022

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

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Document Verification

Project title	Children's Hospital Westmead
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File reference	-

Revision	**Date**		
		Filename	Westmead Hospital – 103157 CHW - L1 Lab - Summary of Recent Vibration Measurments (01-09 to 30-09).docx
Issue 1	13/10/2022	**Description**	Issue

	Prepared by	**Checked by**	**Approved by**
Name	PR	KF	KF
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 CHW - L1 Lab, over one month – from 01/09/2022 to 30/09/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

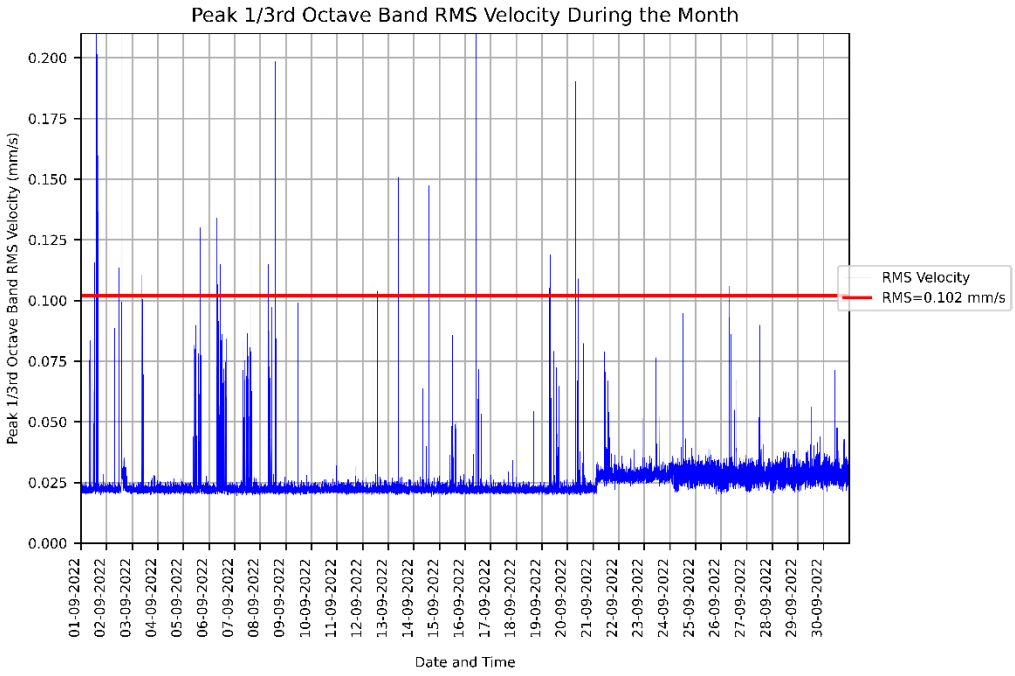


Figure 1: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the CHW - L1 Lab.

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
62	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 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 CHW - L1 Lab during the period of the 01/09/2022 to 30/09/2022.

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 2.

Figure 2: CHW - L1 Lab vibration monitor location shown in orange

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 3 below shows the vibration levels (RMS velocity) recorded between 01/09/2022 and 30/09/2022. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

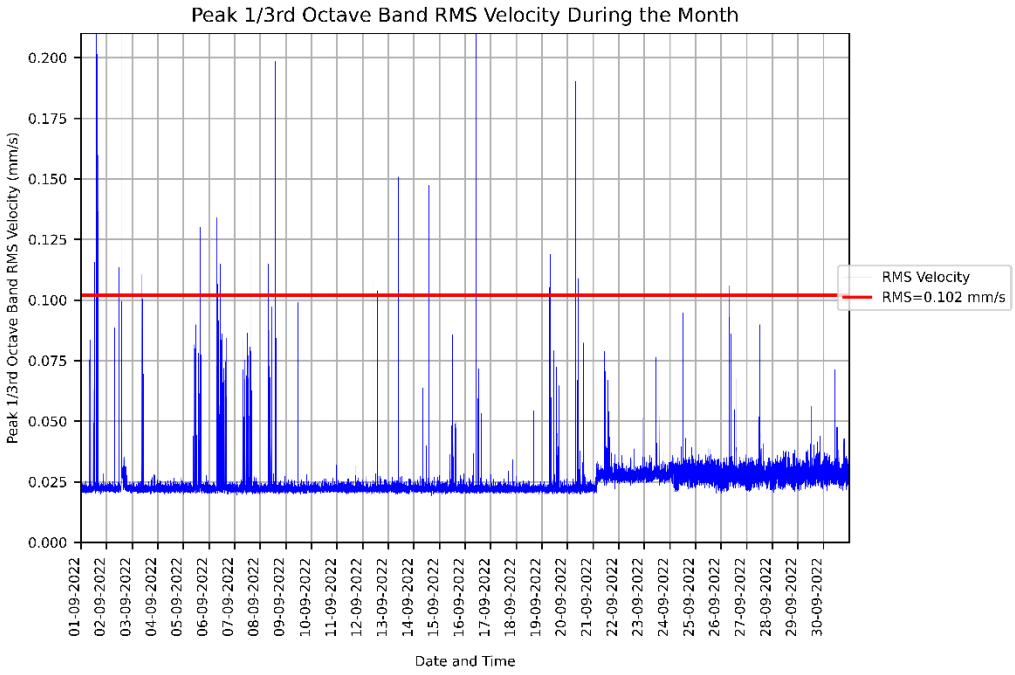
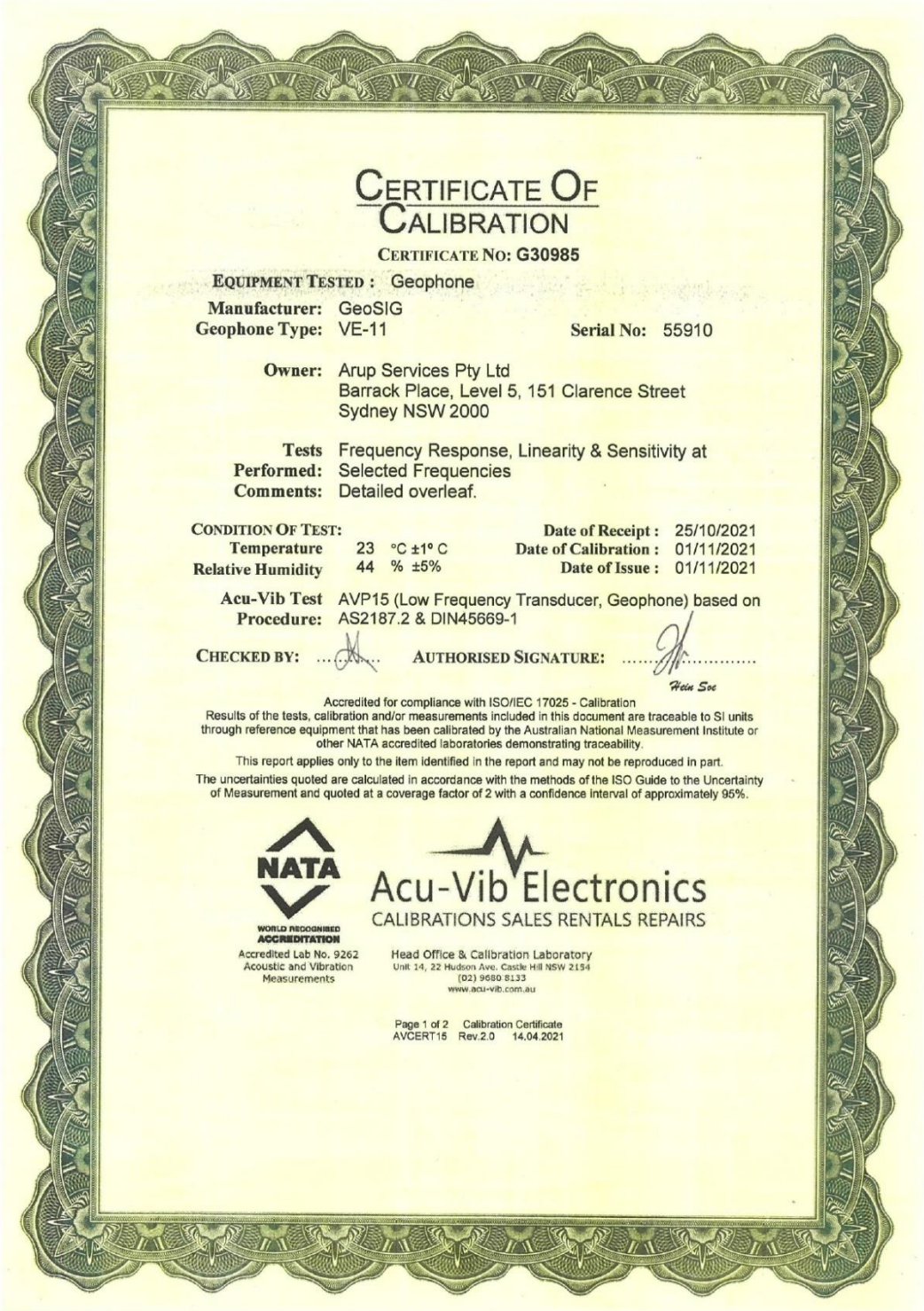


Figure 3: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the CHW - L1 Lab.

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
62	0

Appendix A: Calibration Certificates



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: G30985

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11 **Serial No:** 55910

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.

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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. **55910**
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	109.76	1.00%
4.00	25.13	10.0	111.50	0.90%
6.00	37.70	10.0	108.98	0.90%
10.00	62.83	10.0	103.80	0.90%
15.00	94.25	10.0	101.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	95.09	0.90%
15.92	**94.25**	**10.0**	**94.96**	**0.90%**
15.92	94.25	50.0	94.83	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	99.03	0.50%
60.00	376.99	10.0	100.56	0.50%
120.00	753.98	10.0	113.91	0.50%
150.00	942.48	10.0	119.09	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.

ARUP

Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - CASB Level 2 MRI - September 2022

CVM/ CASB/202209

Issue 1 | 13/10/2022

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

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File reference	-

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Name	PR	KF	KF
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 CASB Level 2 MRI, over one month – from 01/09/2022 to 30/09/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

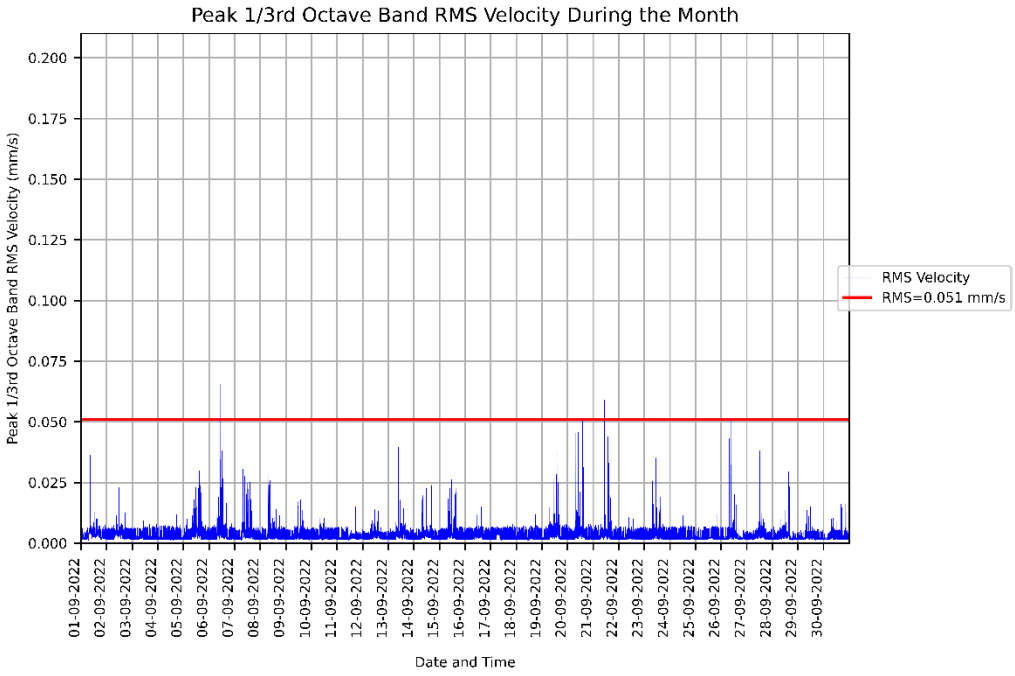


Figure 1: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the CASB Level 2 MRI.

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

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 2 MRI during the period of the 01/09/2022 to 30/09/2022.

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 2.

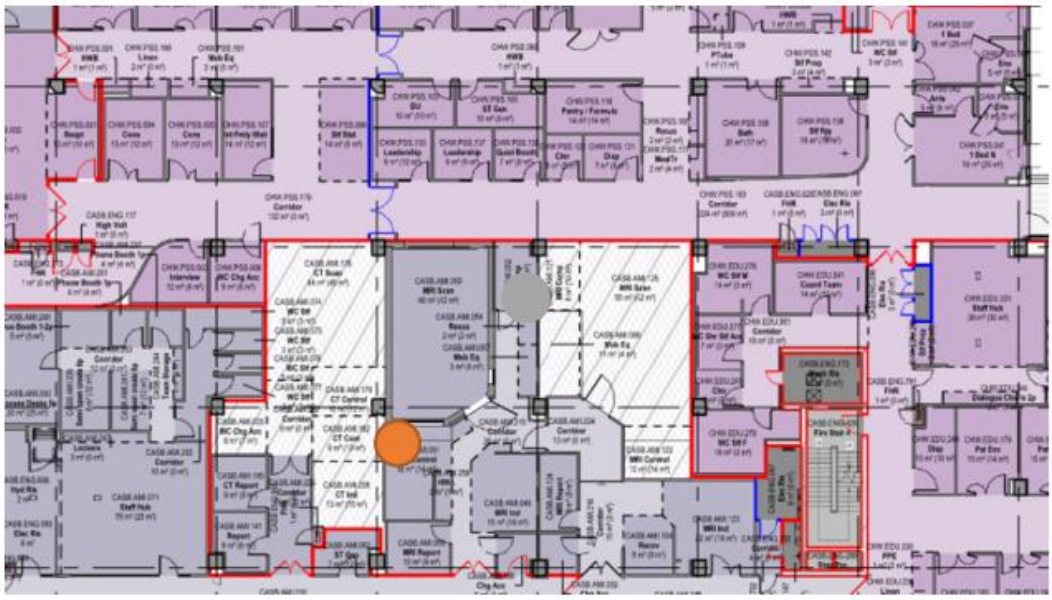


Figure 2: CASB Level 2 MRI vibration monitor location shown in orange

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 3 below shows the vibration levels (RMS velocity) recorded between 01/09/2022 and 30/09/2022. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

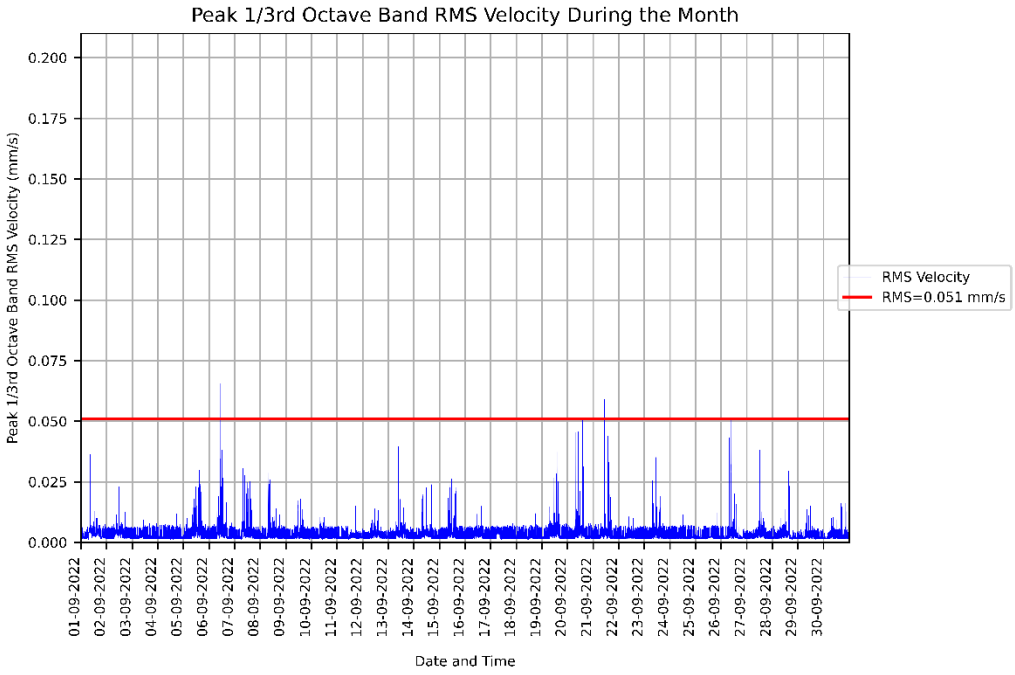
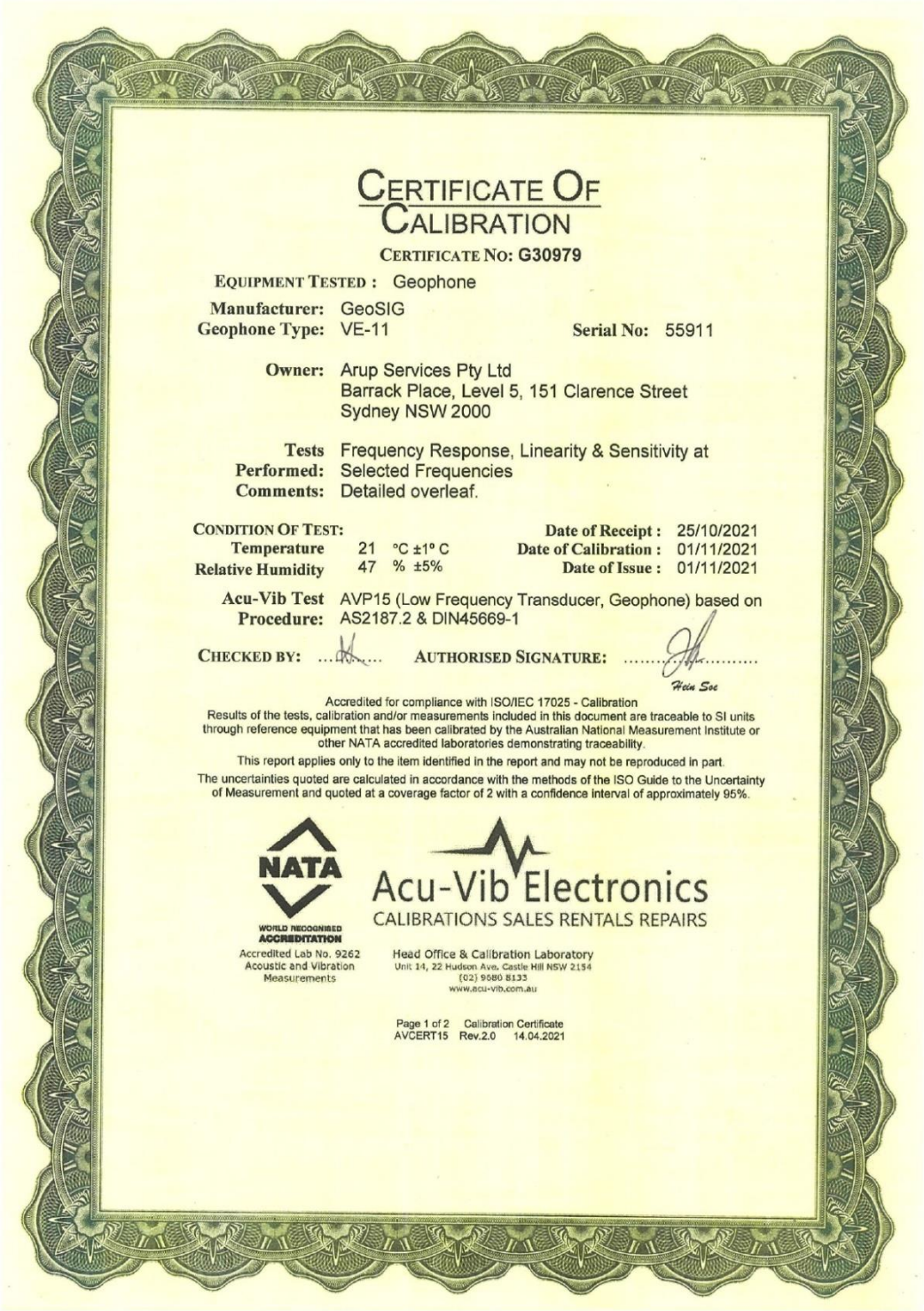


Figure 3: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the CASB Level 2 MRI.

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

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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Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

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 2022

CVM/ CASB/202209

Issue 1 | 13/10/2022

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/CASB/202209
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	13/10/2022	**Description**	Issue

	Prepared by	**Checked by**	**Approved by**
Name	PR	KF	KF
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 CASB level 3 Surgical Suite, over one month – from 01/09/2022 to 30/09/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

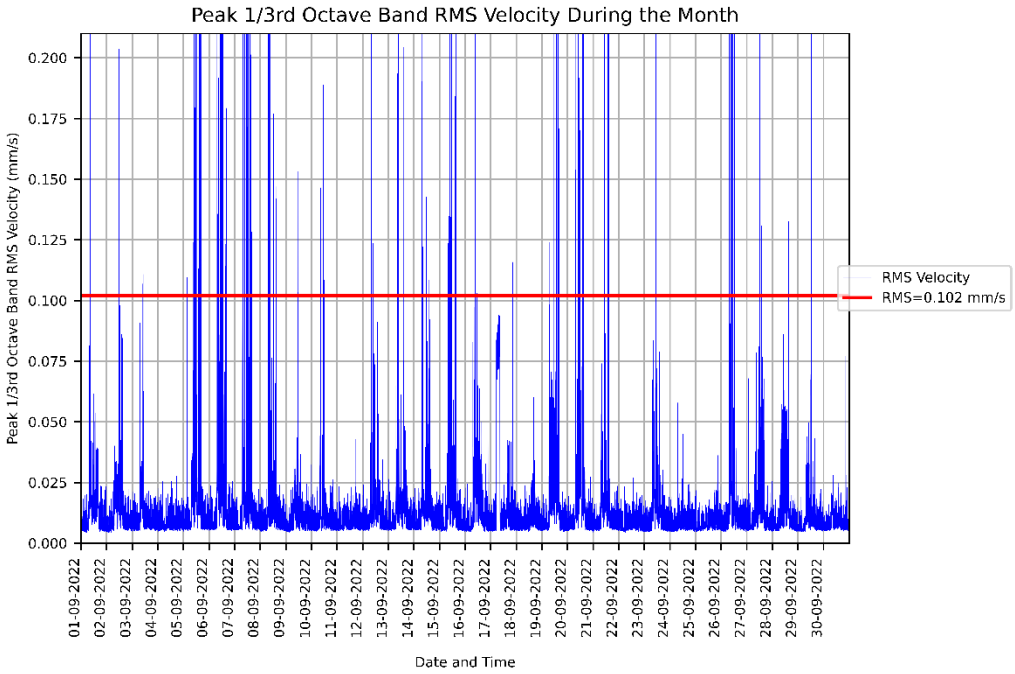

Figure 1: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the CASB level 3 Surgical Suite.

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
272	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 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 01/09/2022 to 30/09/2022.

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 2.

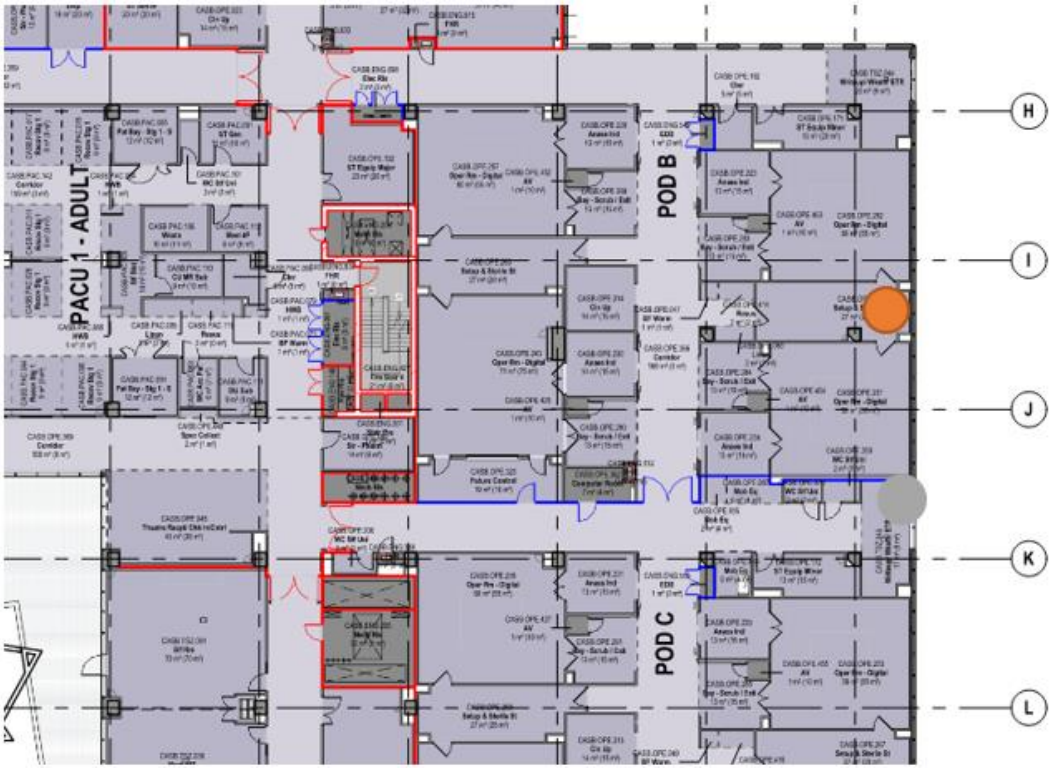

Figure 2: CASB level 3 Surgical Suite vibration monitor location shown in orange

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 3 below shows the vibration levels (RMS velocity) recorded between 01/09/2022 and 30/09/2022. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

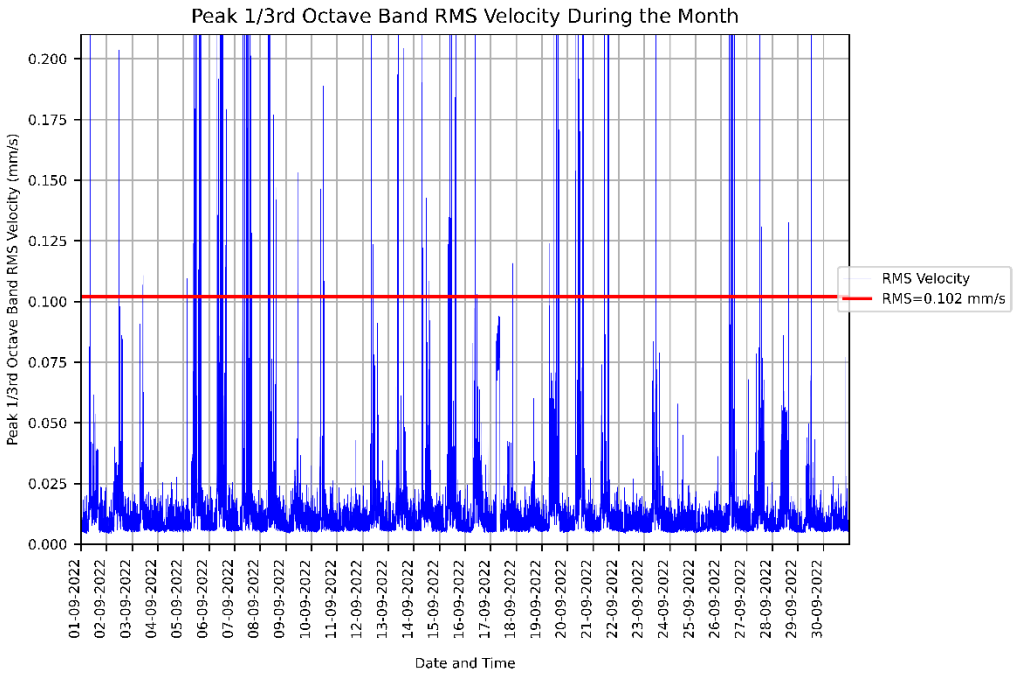

Figure 3: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the CASB level 3 Surgical Suite.

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
272	2

Appendix A: Calibration Certificates

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.

Page 2 of 2
End of Certificate

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55910**
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	109.76	1.00%
4.00	25.13	10.0	111.50	0.90%
6.00	37.70	10.0	108.98	0.90%
10.00	62.83	10.0	103.80	0.90%
15.00	94.25	10.0	101.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	95.09	0.90%
15.92	**94.25**	**10.0**	**94.96**	**0.90%**
15.92	94.25	50.0	94.83	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	99.03	0.50%
60.00	376.99	10.0	100.56	0.50%
120.00	753.98	10.0	113.91	0.50%
150.00	942.48	10.0	119.09	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

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Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - KR - L4 Lab 9 - September 2022

CVM/ KR/202209

Issue 1 | 13/10/2022

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

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Document Verification

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Document title	Monthly Vibration Monitoring Report
Job number	271985
Document ref	CVM/KR/202209
File reference	-

Revision	**Date**	**Filename**	Westmead Hospital – 103161 KR - L4 Lab 9 - Summary of Recent Vibration Measurments (01-09 to 30-09).docx		
Issue 1	13/10/2022	**Description**	Issue		
			Prepared by	**Checked by**	**Approved by**
		Name	PR	KF	KF
		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 - L4 Lab 9, over one month – from 01/09/2022 to 30/09/2022. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red. Missing data during this measurement period was due to the power source for the monitoring equipment being physically removed on site.

RMSV Vibration Levels

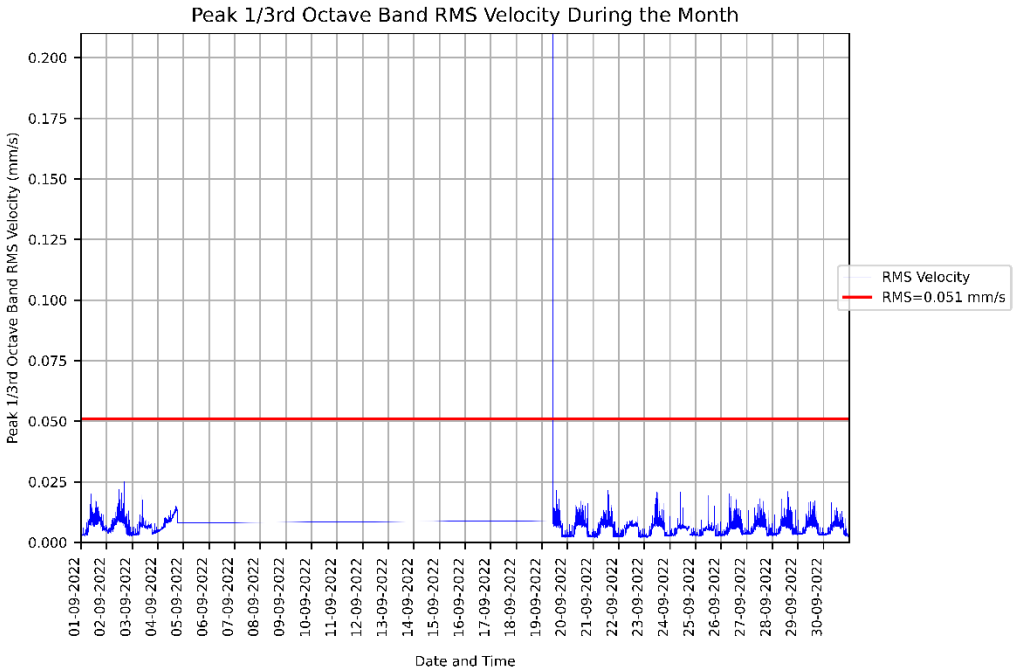


Figure 1: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the KR - L4 Lab 9.

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
2	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 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 KR - L4 Lab 9 during the period of the 01/09/2022 to 30/09/2022.

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 2.

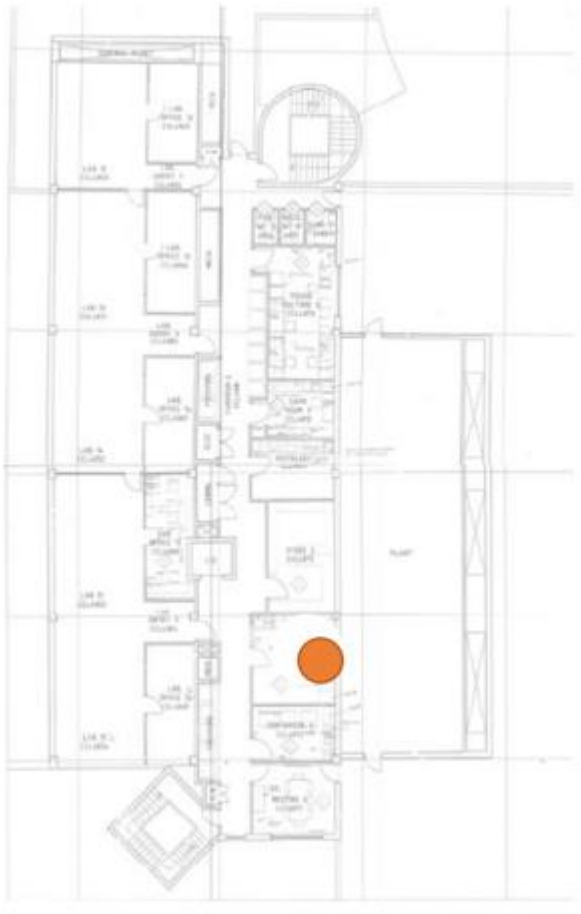


Figure 2: KR - L4 Lab 9 vibration monitor location shown in orange

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 3 below shows the vibration levels (RMS velocity) recorded between 01/09/2022 and 30/09/2022. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

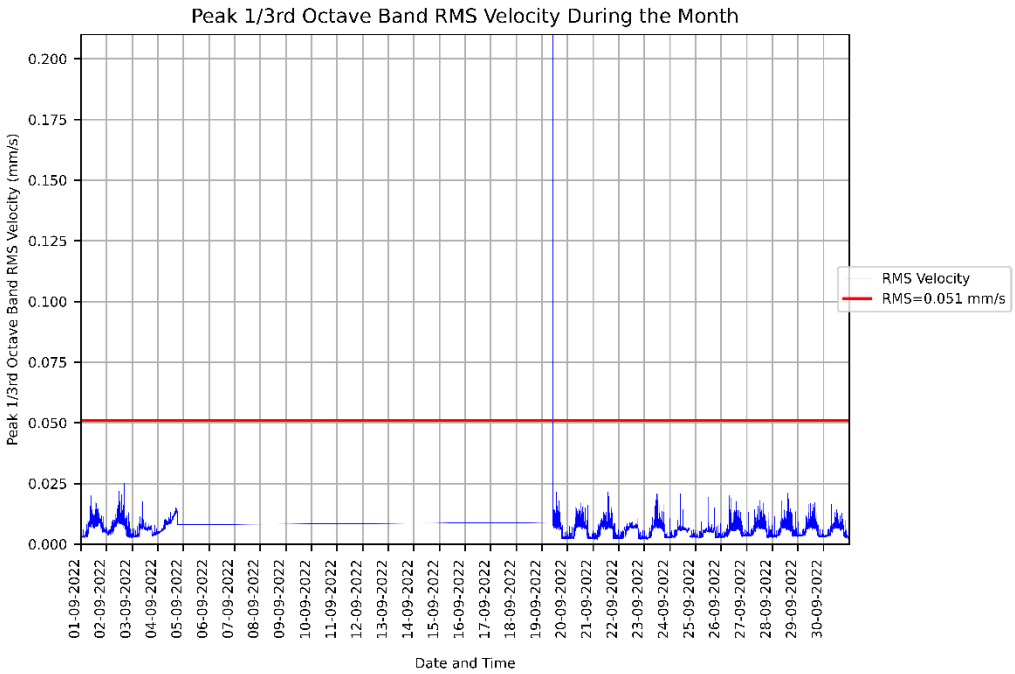
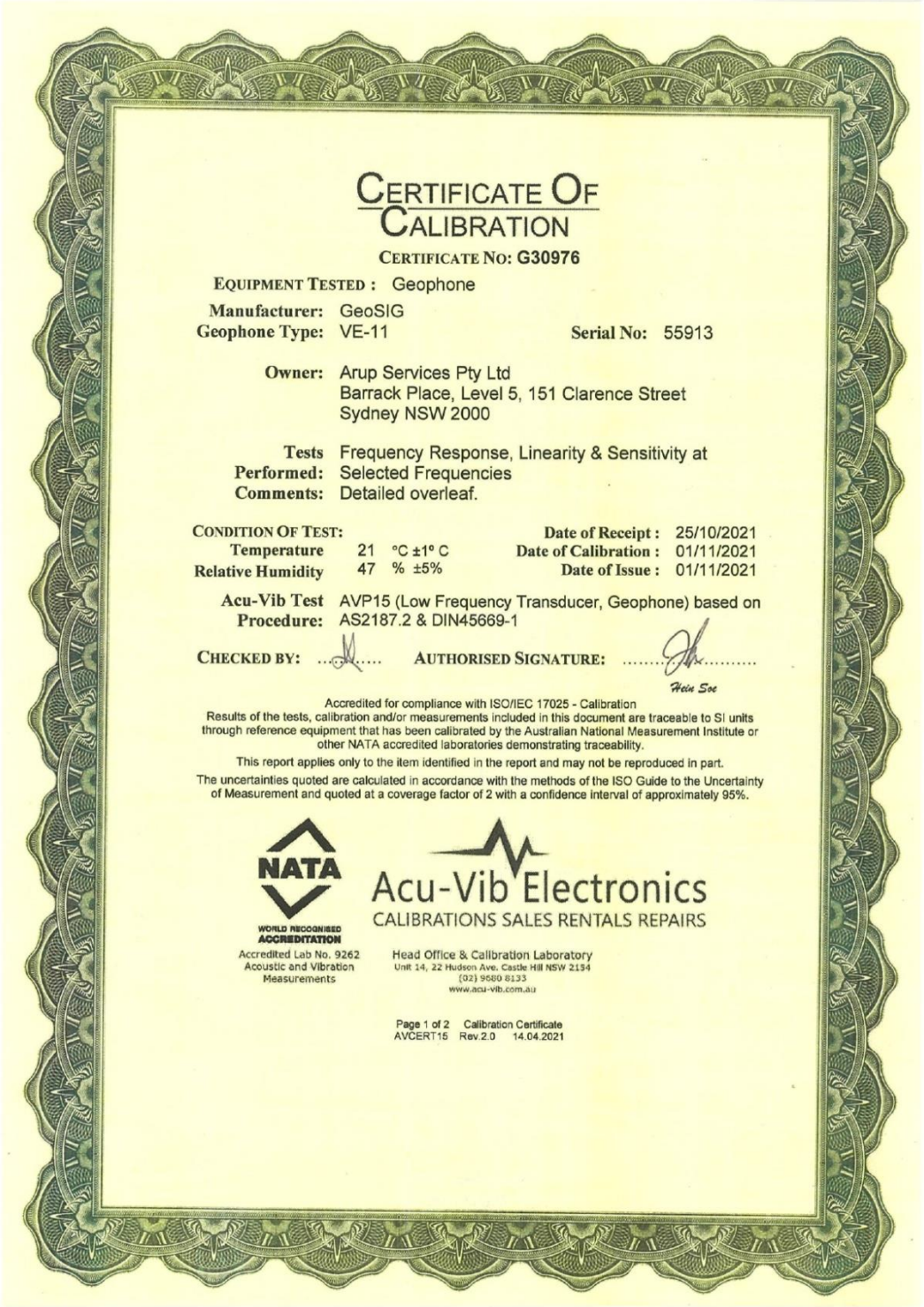


Figure 3: Measured RMSV vibration levels for 01/09/2022 to 30/09/2022 at the KR - L4 Lab 9.

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
2	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

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. **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.

Page 2 of 2
End of Certificate