HS2

October 2019

Construction noise and vibration Monthly Report – September 2019

Birmingham City Council

gov.uk/hs2

List of tables

Non-technical summary

This noise and vibration monitoring report fulfils HS2 Limited's commitment detailed in the Environmental Minimum Requirements (EMRs), Annex 1, Code of Construction Practice, to present the results of noise and vibration monitoring carried out within the Birmingham City Council (BCC) area during the month of September 2019.

This report presents data from three noise monitoring installations near to the Washwood Heath worksite and one monitoring installation at the Unite Buildings demolition worksite. Works at both sites included demolition and ancillary activities. Two vibration monitors were also installed in September at the Museum Collection Centre to collect baseline information ahead of commencement of construction activities in the area.

Measured noise levels were generally similar to pre-construction ambient noise levels. At Washwood Heath noise levels were elevated during demolition works near the monitors. The monitors were demobilised on the 27th of September, following completion of noise significant works. There were no exceedances of the SOAEL due to site works at any monitoring location.

No exceedances of S61 trigger levels were measured due to HS2 related works during the monitoring period. No complaints were reported to HS2 for the BCC region during the monitoring period.

Abbreviations and descriptions

The abbreviations, descriptions and project terminology used within this report can be found in the Project Dictionary (HS2-HS2-PM-GDE-000-000002).

Table 1: Table of abbreviations

Acronym/Term	Definition
$L_{Aeq,T}$	See equivalent continuous sound pressure level
Ambient sound	A description of the all-encompassing sound at a given location and time which will include sound from many sources near and far. Ambient sound can be quantified in terms of the equivalent continuous sound pressure level, $L_{pAeq,T}$
Decibel(s), or dB	Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal (Pa)). Because of this wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audibility of sound covers a range of approximately 0-140dB.
Decibel(s) A-weighted, or dB(A)	The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'.
Equivalent continuous sound pressure level, or $L_{Aeq,T}$	An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.
Exclusion of data	Measurement of noise levels can be affected by weather conditions such as prolonged periods of rain, winds speeds higher than 5m/s and snow/ice ground cover. Noise levels measured during these periods are considered not representative of normal noise conditions at the site and, for the purposes of this report, are excluded from the assessment of exceedances and calculation of typical noise levels and are also greyed out in charts. Identifiable incongruous noise and vibration events not attributable to HS2 construction noise are also excluded.
Façade	A facade noise level is the noise level 1m in front of a large reflecting surface. The effect of reflection, is to produce a slightly higher (typically +2.5 to +3 dB) sound level than it would be if the reflecting surface was not there.
Free-field	A free-field noise level is the noise level measured at a location where no reflective surfaces, other than the ground, lies within 3.5 metres of the microphone position.
Equivalent continuous sound pressure level, or $L_{pAeq,T}$	An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.
Peak particle velocity, or PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position. The PPV is a simple indicator of perceptibility and risk of damage to structures due to vibration. It is usually measured in mm/s.
Sound pressure level	The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.
Vibration dose value, or VDV	An index used to evaluate human exposure to vibration in buildings. While the PPV provides information regarding the magnitude of single vibration events, the VDV provides a measure of the total vibration experienced over a specified period of time (typically 16h daytime and 8h night-time). It takes into account the magnitude, the number and the duration of vibration events and can be used to quantify exposure to continuous, impulsive, occasional and intermittent vibration. The vibration dose value is measured in $m/s^{1.75}$.

1 Introduction

1.1.1 The nominated undertaker is required to undertake noise (and vibration) monitoring as necessary to comply with the requirements of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements, including specifically Annex 1: Code of Construction Practice, in addition to any monitoring requirements arising from conditions imposed through consents under Section 61 of the Control of Pollution Act, 1974 or through Undertakings & Assurances given to third parties. Such monitoring may be undertaken for the following purposes:

- monitoring the impact of construction works;
- to investigate complaints, incidents and exceedance of trigger levels; or
- monitoring the effectiveness of noise and vibration control measures.

Monitoring data and interpretive reports are to be provided to each relevant local authority on a monthly basis and shall include a summary of the construction activities occurring, the data recorded over the monitoring period, any complaints received, any periods in exceedance of agreed trigger levels, the results of any investigations and any actions taken or mitigation measures implemented. This report provides noise data, and interpretation thereof, for monitoring carried out by HS2 within the Birmingham City Council (BCC) for the period 1st to 30th September 2019.

1.1.2 Active construction sites in the local authority area during this period include:

- Washwood Heath site (see plan 1 in Appendix A)
  - Works activities include demolition works and crushing activities.

The site was demobilised on the 20th September and monitors were removed on the 27th September.

- Unite Buildings demolition (see plan 1 in Appendix A)
  - Works activities include demolition works and crushing activities.

The site was demobilised and monitor was removed on the 27th September.

Works took place during core hours only. No works took place at the weekend or during night time periods.

1.1.3 The applicable standards, guidance, and monitoring methodology is outlined in the construction noise and vibration monitoring methodology report which can be found at the following location https://www.gov.uk/government/collections/monitoring-the-environmental-effects-of-hs2. Noise and vibration monitoring reports for previous months can also be found at this location.

1.2 Measurement locations

1.2.1 The following table summarises the position of noise and vibration monitoring installations within the BCC area in September 2019. Two vibration monitors were installed in September (Vib 1 on the 5th and Vib 2 on the 8th of September) within the Museum Collection Centre to collect baseline information ahead of commencement of construction activities in the area.

1.2.2 Maps showing the locations of noise and vibration monitoring installations are presented in Appendix B.

Table 2: Monitoring locations

Worksite Reference	Measurement Reference	Address
Washwood Heath (worksite 1)	Loc 1	City Hassanat College, B8 2YH
	Loc 2	Leigh Junior Infant and Nursery School, B8 2YH
	Loc 3	64 Common Lane, Birmingham, B8 2UN
Unite Buildings demolition (worksite 2)	Loc 4	BCU Library (Curzon Street), 4 Cardigan Street, Birmingham, B4 7BD
Museum Collection Centre	Vib 1	(Top Floor) 25 Dolman Street, Birmingham, B7 4RQ
	Vib 2	(Outside) 25 Dolman Street, Birmingham, B7 4RQ

2 Summary of results

2.1 Exceedances of SOAEL

2.1.1 The significant observed adverse effect level (SOAEL) is defined in the 'Planning Practice Guidance – Noise' as the level above which "noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."

2.1.2 Where construction noise levels exceed the SOAEL, relevant periods will be identified and summary statistics provided in order to evaluate ongoing qualification for noise insulation and temporary rehousing.

2.1.3 Table 3 presents a summary of recorded exceedances of the SOAEL due to HS2 related construction noise at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 3: Summary of exceedances of SOAEL

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of SOAEL
1	Loc 1	City Hassanat College	All days	All periods	No exceedance
	Loc 2	Leigh Junior Infant and Nursery School	All days	All periods	No exceedance
	Loc 3	64 Common Lane	All days	All periods	No exceedance
2	Loc 4	BCU Library (Curzon Street), 4 Cardigan Street	All days	All periods	No exceedance

2.1.4 HS2 construction activities were undertaken between 08:00 and 18:00 on weekdays. There were no exceedances of the SOAEL during periods of works.

2.1.5 Monitoring of vibration peak particle velocity (PPV) was undertaken with the purpose to ensure construction generated vibration levels were below those with potential to damage adjacent buildings, in accordance with Annex 1: Code of Construction Practice of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements. There are no LOAEL and SOAEL criteria based on PPV applicable to HS2 construction vibration.

2.2 Summary of measured noise and vibration levels

2.2.1 Table 4 presents a summary of the measured noise levels at each monitoring location over the reporting period. The $L_{Aeq,T}$ is presented for each of the relevant time periods averaged over the calendar month, along with the highest single period $L_{Aeq,T}$ that was found to occur within the month.

2.2.2 Appendix C presents graphs of the noise and vibration monitoring data over the month for each of the measurement locations. Noise data presented includes the hourly L_{Aeq} values and, where relevant, the $L_{Aeq,T}$ values (where the time period T has been taken to be the averaging period as specified in Table 1 of HS2 Information Paper E23). The full data set for the monitoring equipment can be found at the following location: https://data.gov.uk/dataset/24542ae7-dd44-444f-b259-871c4cc43b5e/environmental-monitoring-data.

2.2.3 Noise levels measured around the Washwood Heath site and at the BCU library were similar to pre-construction ambient noise levels and largely dominated by the underlying ambient noise sources, rather than being attributable to HS2 related construction noise. At Washwood Heath noise levels were elevated during demolition works near the monitors.

Table 4: Summary of measured dB L_{Aeq} data over the monitoring period

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade Measurement	Weekday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$) *					Saturday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$) *					Sunday / Public Holiday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$) *	
				0700 - 0800	0800 - 1800	1800 - 1900	1900 - 2200	2200 - 0700	0700 - 0800	0800 - 1300	1300 - 1400	1400 - 2200	2200 - 0700	0700 - 2200	2200 - 0700
1	Loc 1	City Hassanat College	Free-field	56.7 (61.3)	59.8 (68.4)	53.7 (57.5)	53.9 (60.1)	52.3 (60.6)	58.5 (58.9)	55.4 (57.7)	51.8 (56.8)	52.8 (58.8)	51.8 (56.6)	53.0 (57.3)	48.8 (57.1)
	Loc 2	Leigh Junior Infant and Nursery School	Free-field	55.6 (60.6)	59.4 (66.3)	52.6 (56.5)	53.0 (59.4)	52.0 (60.2)	56.9 (58.1)	54.2 (56.6)	51.5 (55.8)	51.6 (57.6)	51.5 (56.5)	53.2 (61.8)	48.3 (56.2)
	Loc 3	64 Common Lane	Free-field	54.7 (59.5)	57.9 (64.9)	54.2 (57.2)	53.9 (58.8)	51.3 (59.4)	55.4 (57.0)	52.1 (55.8)	50.0 (55.5)	52.4 (56.6)	50.7 (55.8)	52.6 (60.3)	47.8 (55.2)
2	Loc 4	BCU Library (Curzon Street), 4 Cardigan Street	Façade	60.3 (63.5)	62.1 (65.0)	61.0 (64.0)	59.7 (64.6)	55.7 (61.7)	56.3 (56.9)	59.4 (62.6)	61.8 (64.1)	59.7 (63.5)	56.0 (60.2)	58.3 (62.6)	54.9 (58.8)

2.2.4 Table 5 presents a summary of the vibration levels measured at monitors Vib 1 and Vib 2 over the reporting period.

Table 5: Summary of measured PPV data over the monitoring period.

Worksite Reference	Measurement Reference	Site Address	Highest PPV measured in any axis, mm/s
Museum Collection Centre	Vib 1	(Top Floor) 25 Dolman Street, Birmingham	0.77 (X axis)
	Vib 2	(Outside) 25 Dolman Street, Birmingham	0.21 (Y axis)

2.2.5 No worksites were active in the area surrounding the Museum Collection Centre and measured vibration levels are considered representative of baseline conditions.

2.3 Exceedances of trigger level

2.3.1 Table 6 provides a summary of exceedances of the S61 trigger noise levels determined to be due to HS2 related construction noise and vibration measured during the reporting period, along with the findings of any investigation.

Table 6: Summary of exceedances of trigger levels

Complaint Reference Number (if applicable)	Worksite Reference	Date and Time Period	Identified Source	Results of Investigation (including noise monitoring results)	Actions Taken
-	-	-	-	-	-

2.3.2 There were no exceedances of trigger levels as defined in section 61 consents during the reporting period at any monitoring position.

2.4 Complaints

2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

Table 7: Summary of complaints

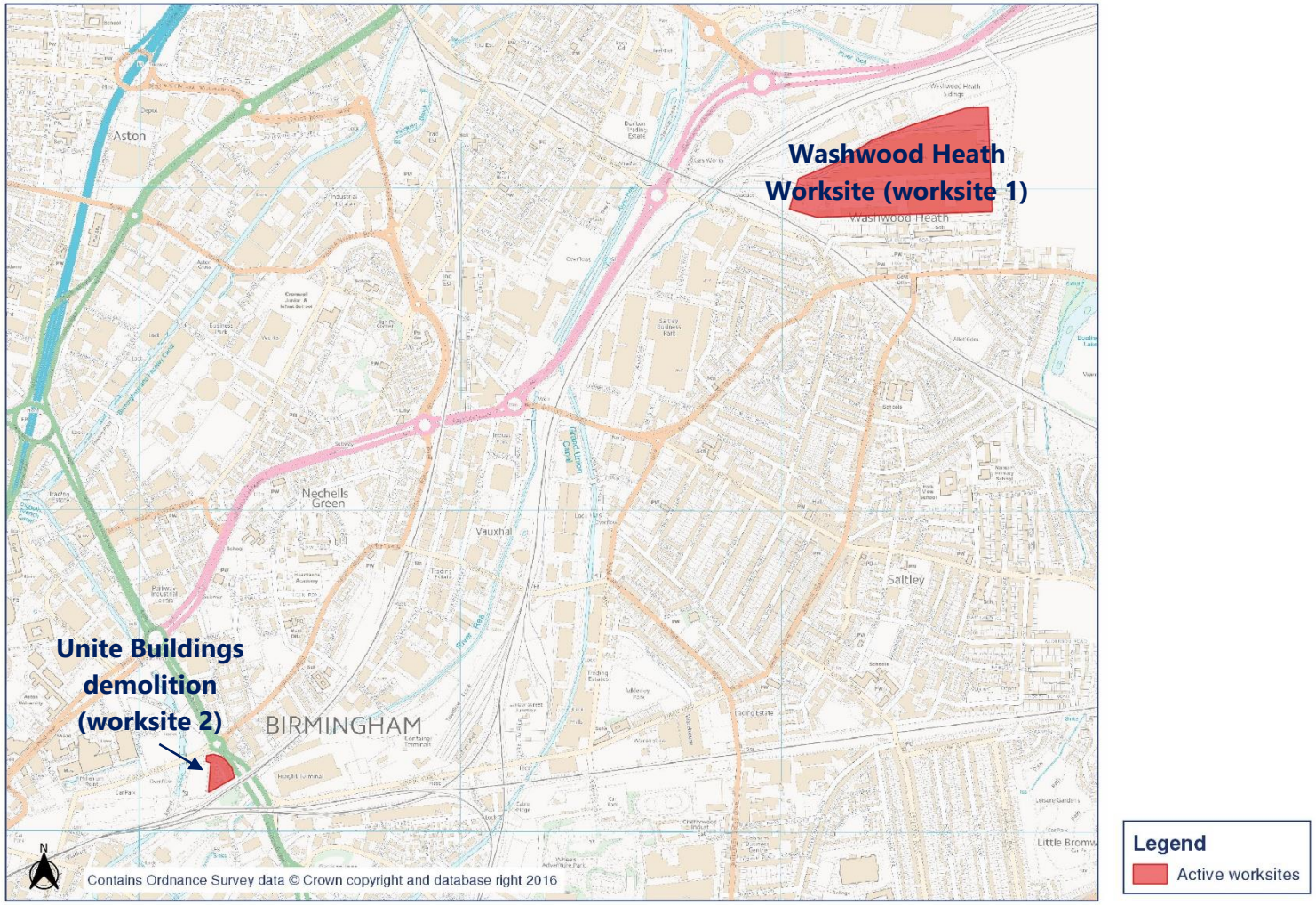
Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
-	-	-	-	-

2.4.2 No complaint regarding HS2 related construction noise or vibration were received during the reporting period in the BCC area.

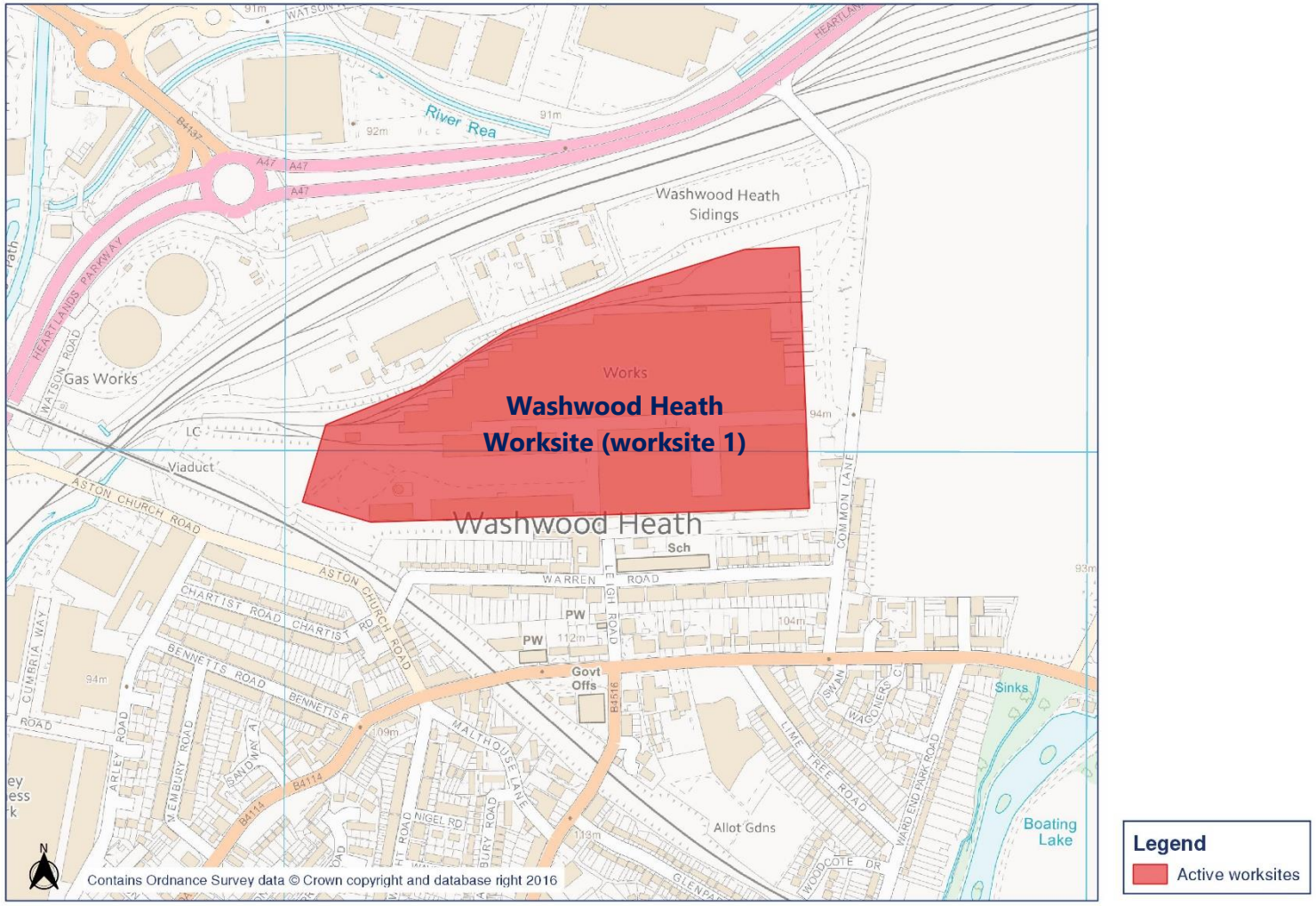
Appendix A Site Locations

HS2

Worksite identification plan - 1



HS2 Worksite identification plan - 2



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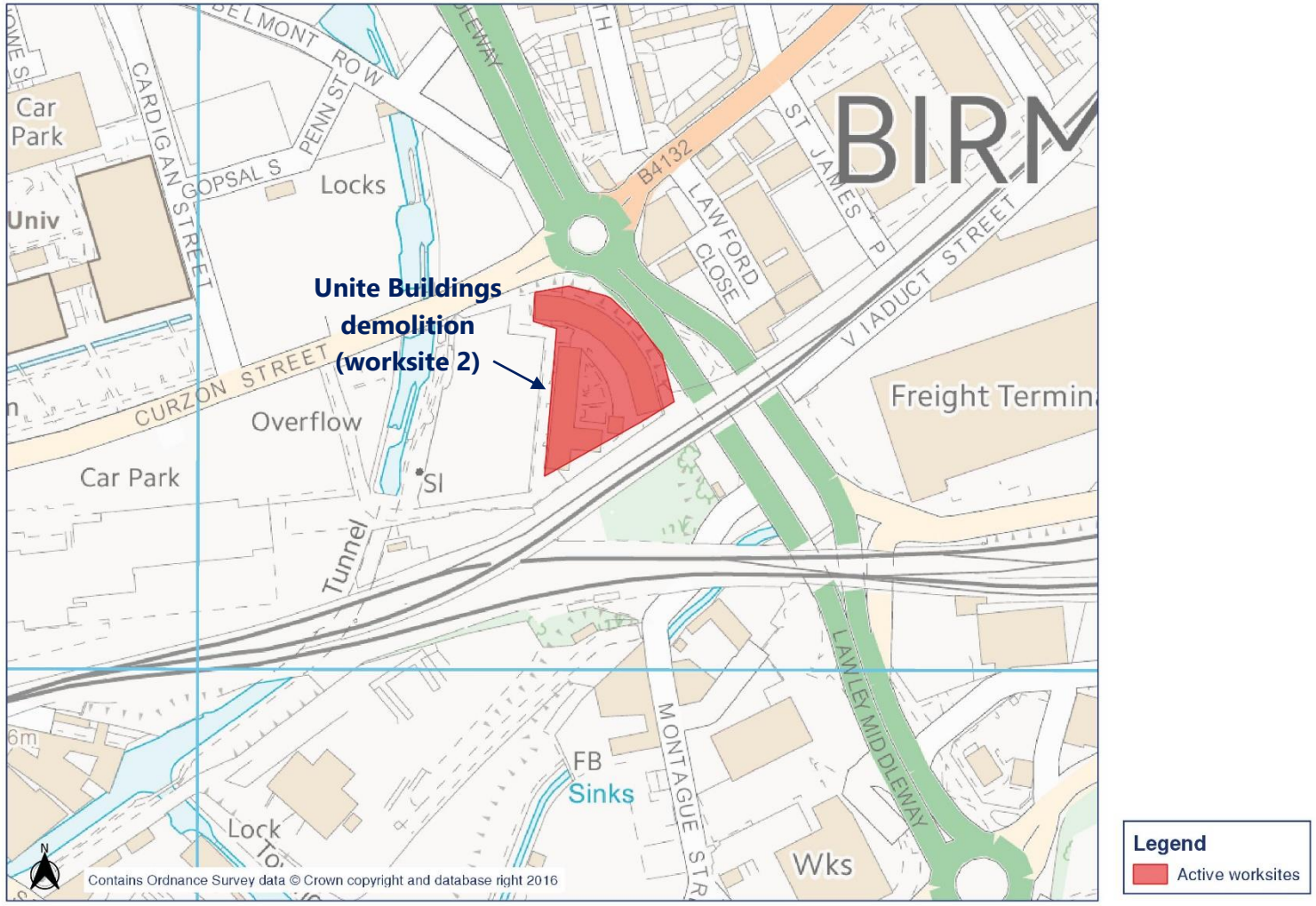
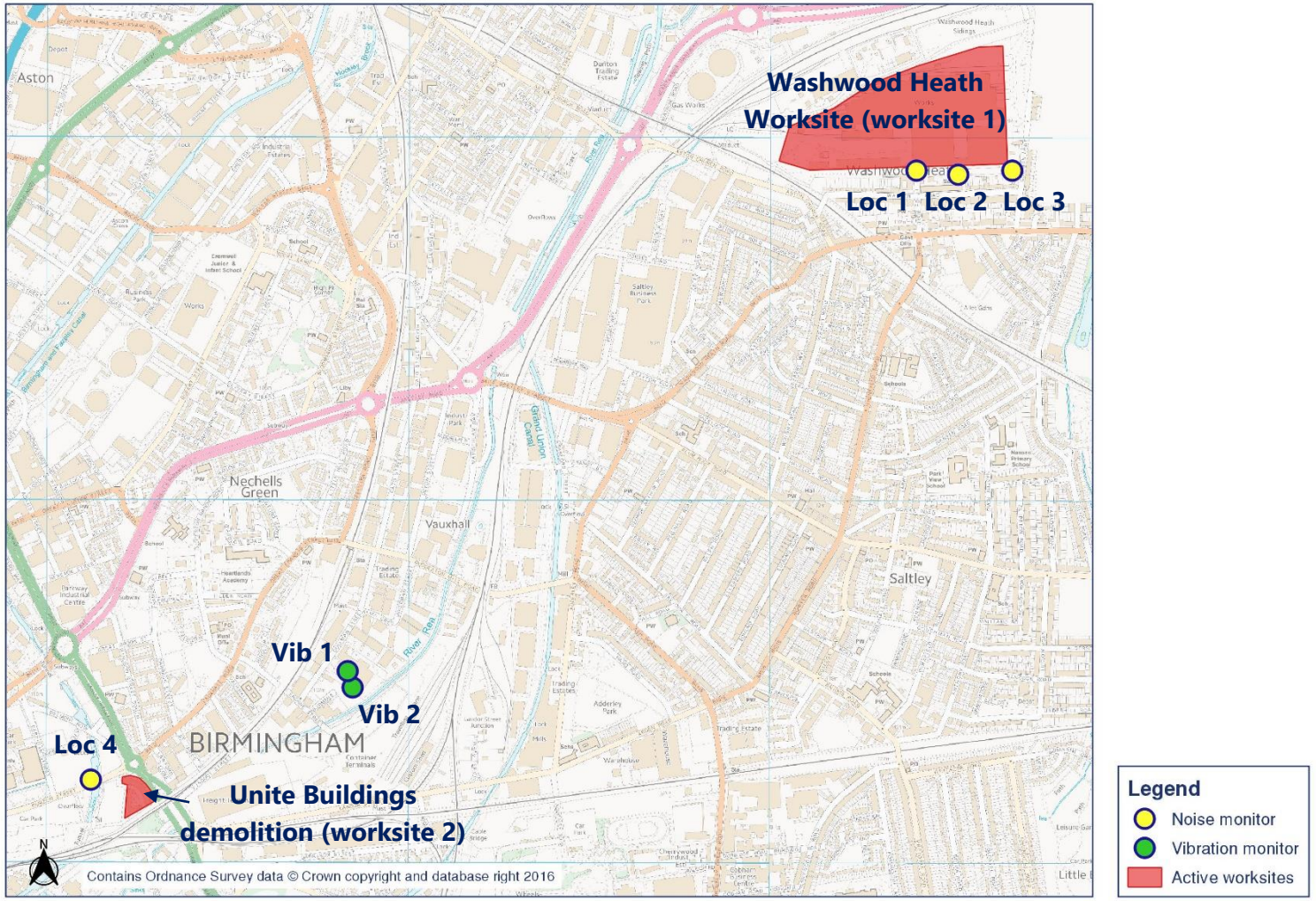


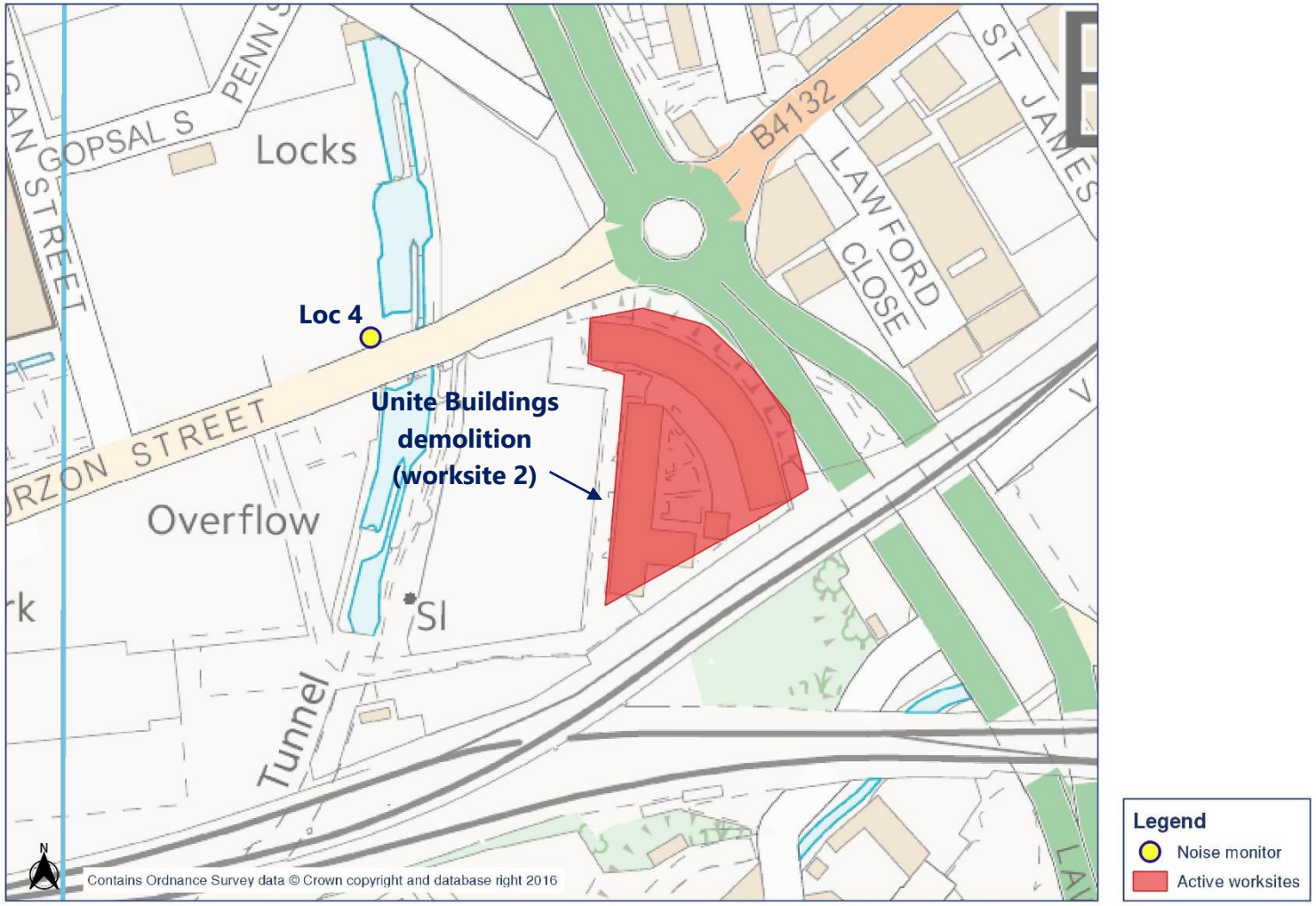
Appendix B Monitoring Locations

HS2 Noise and vibration monitoring plan - 1

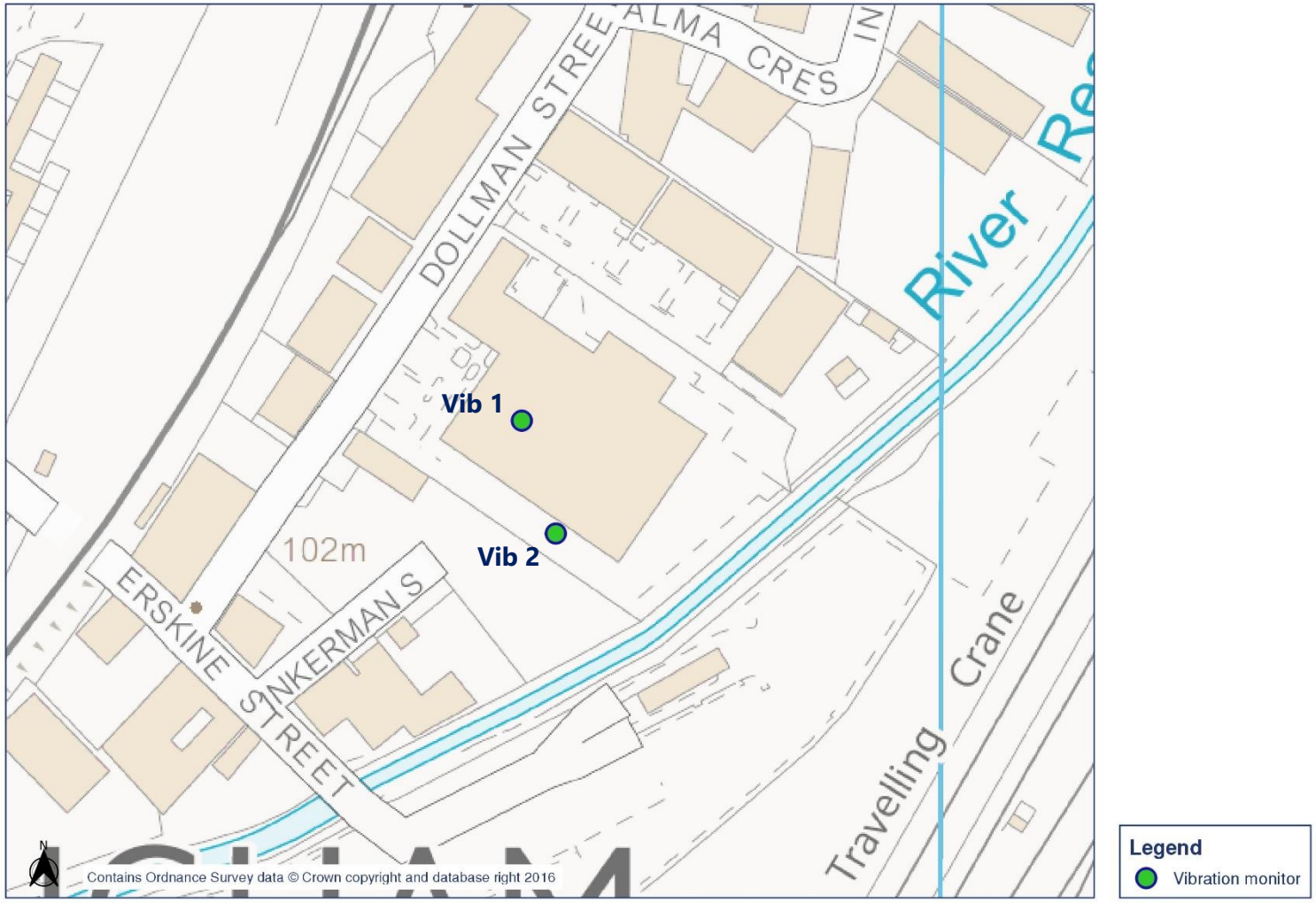


HS2 Noise and vibration monitoring plan - 2

Noise and vibration monitoring plan - 3



HS2 Noise and vibration monitoring plan - 4



Appendix C Data

Noise

The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values.

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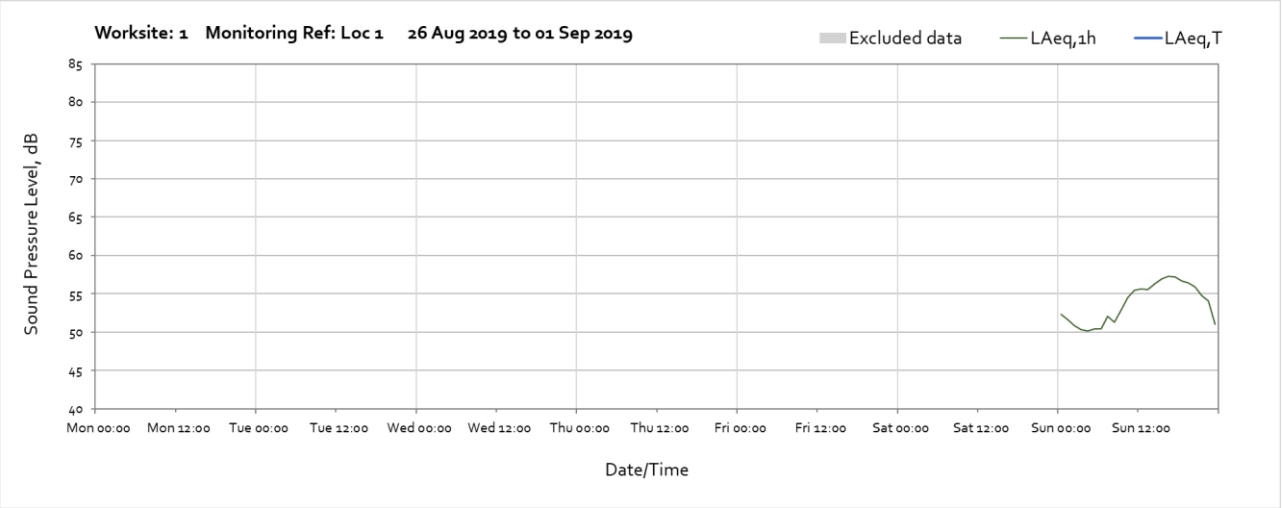

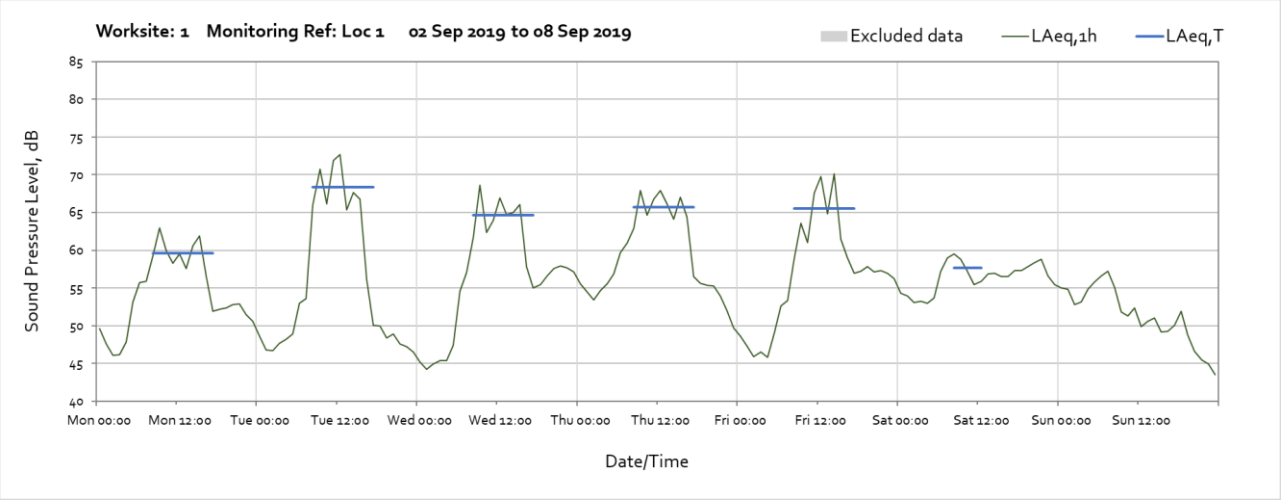

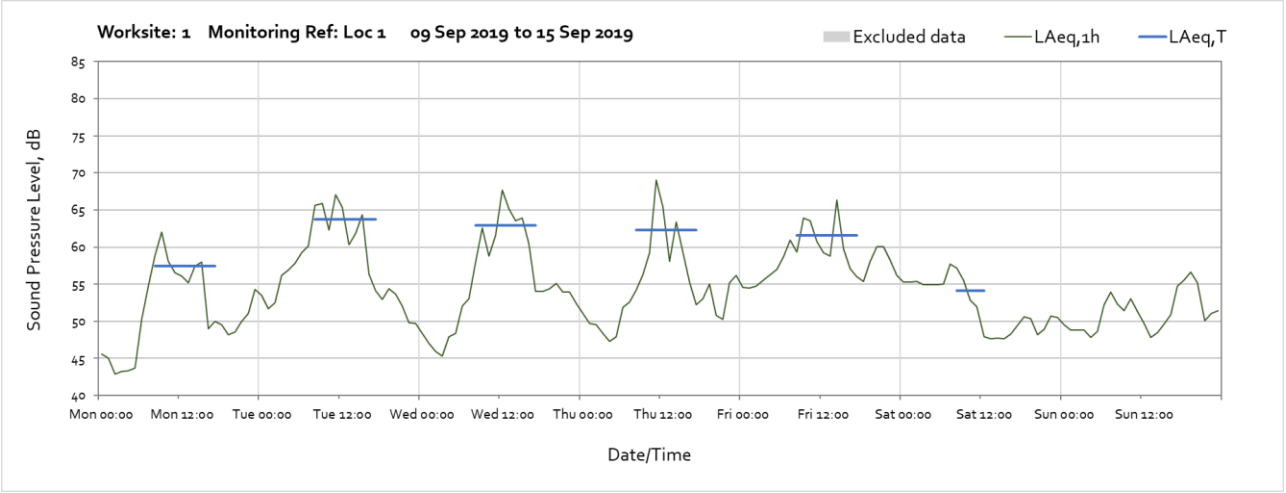
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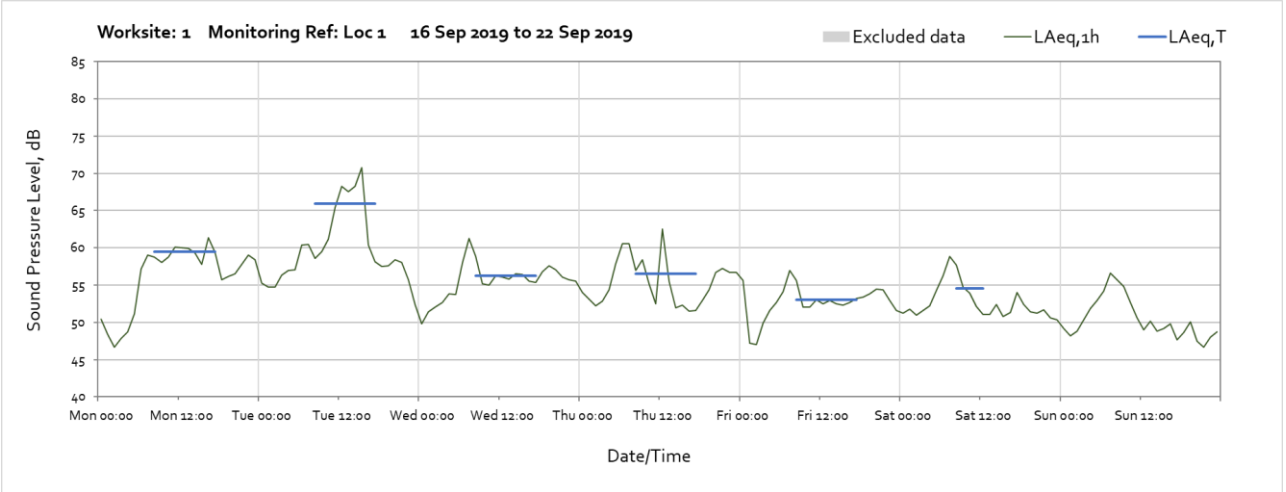
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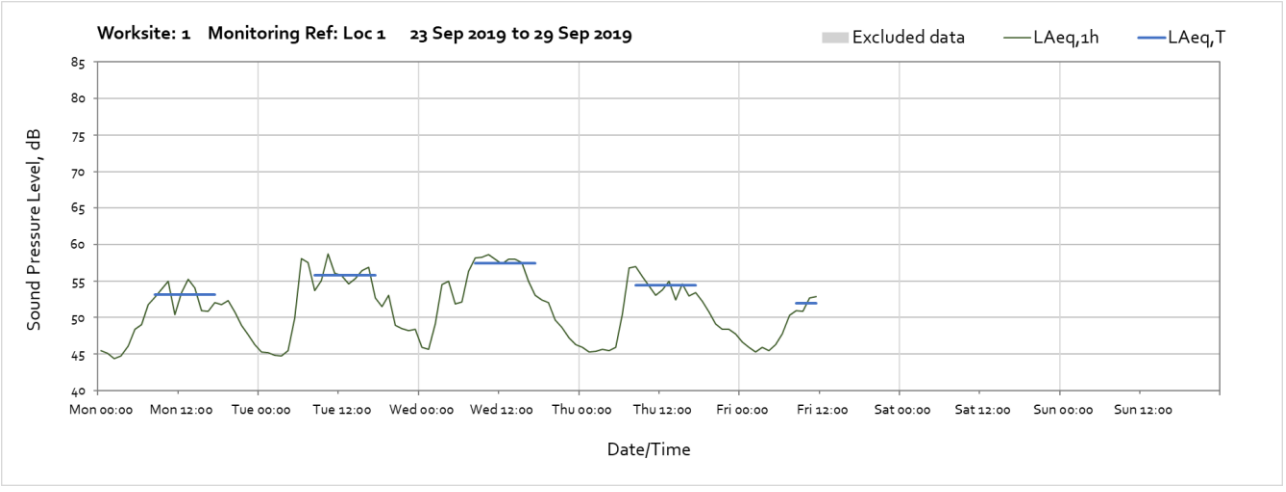
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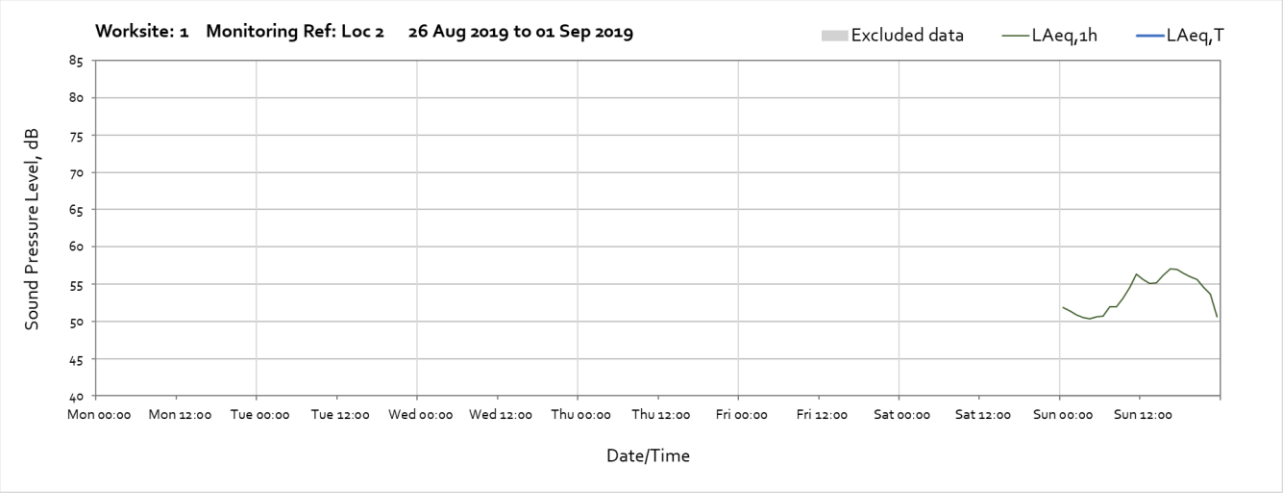

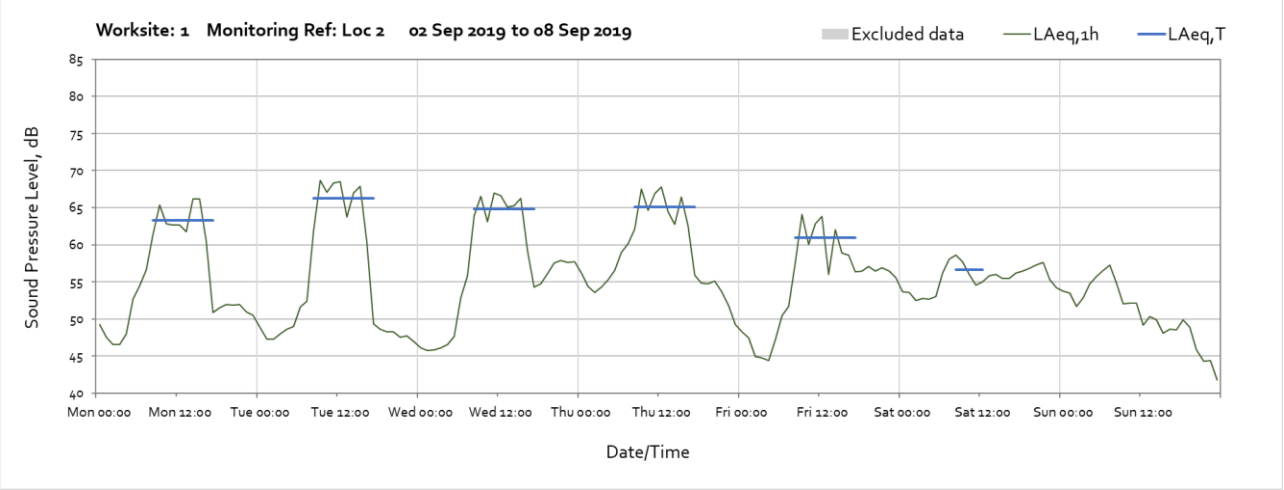

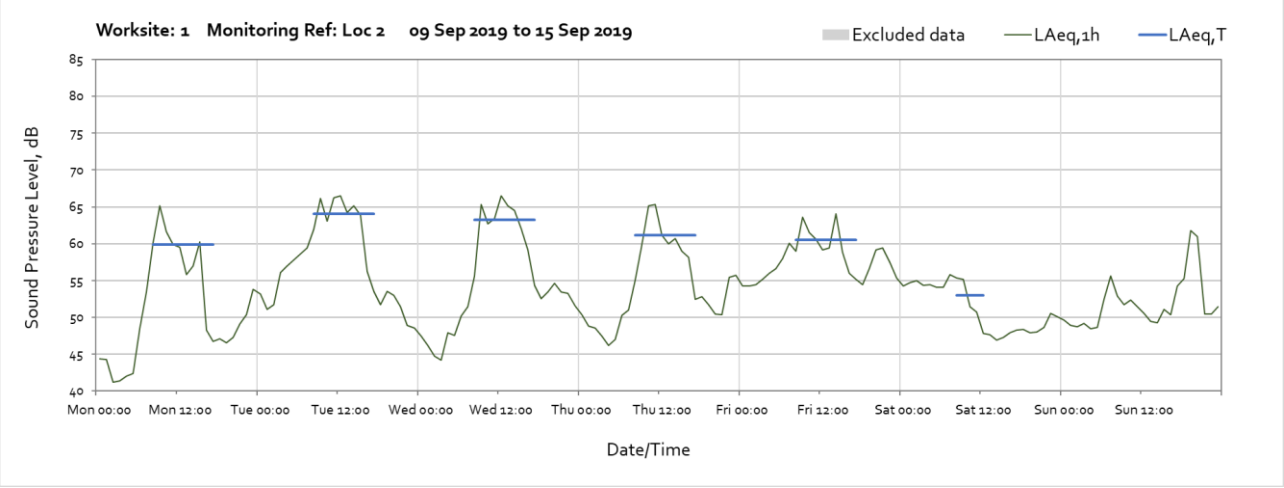

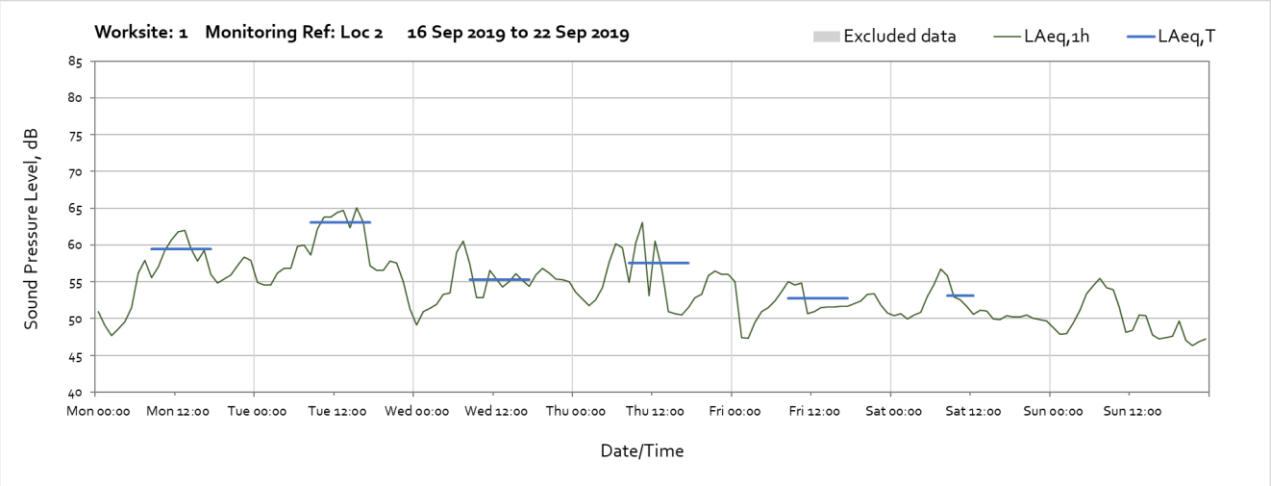

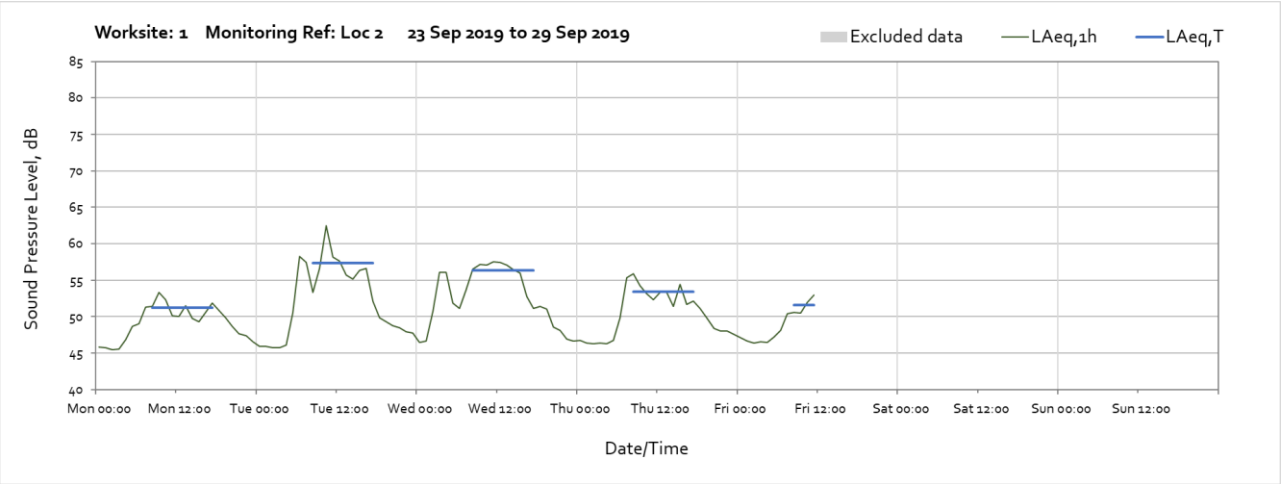

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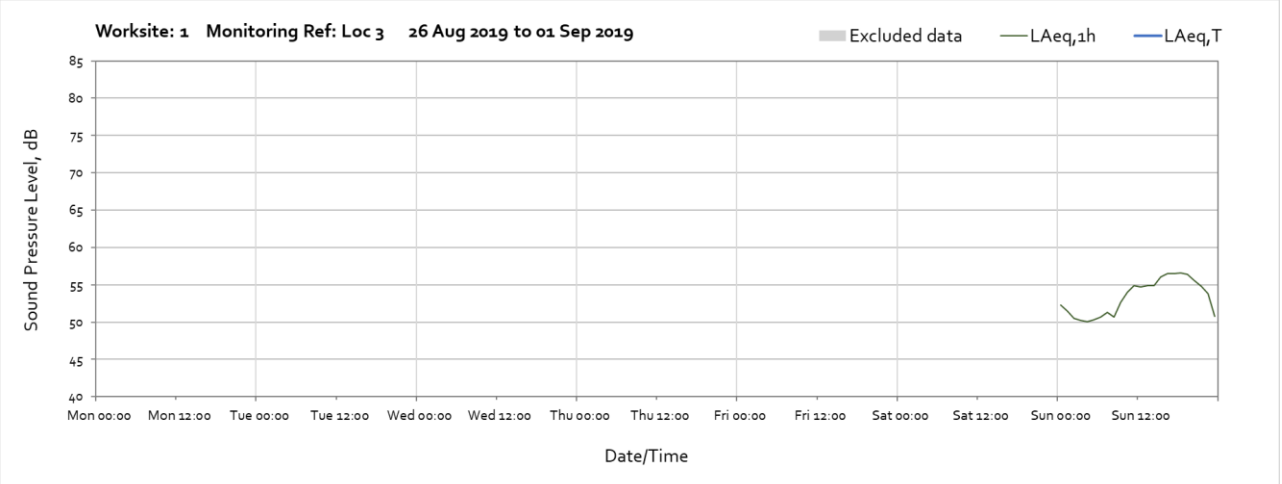

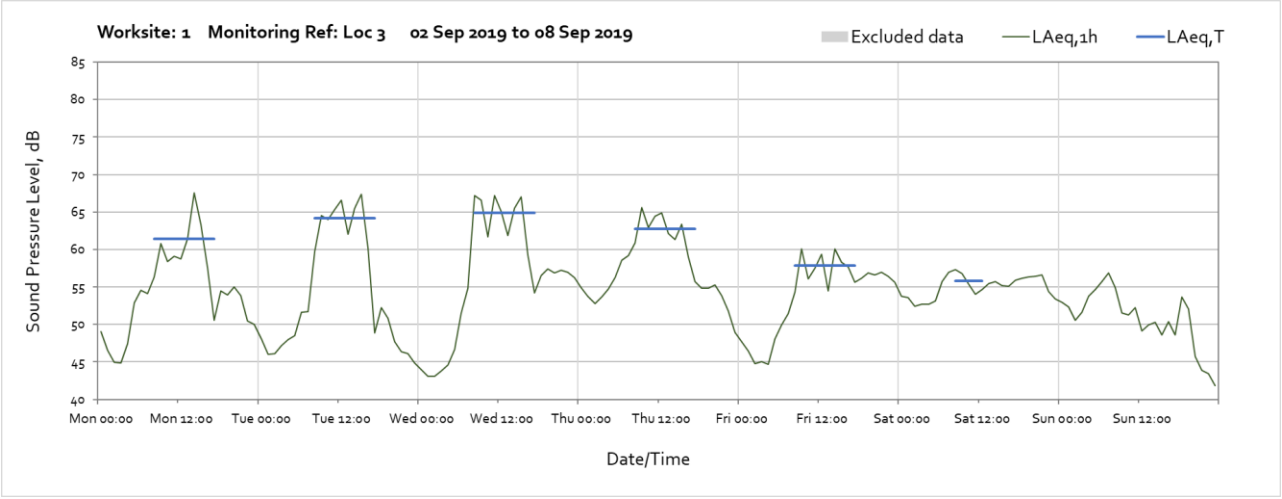
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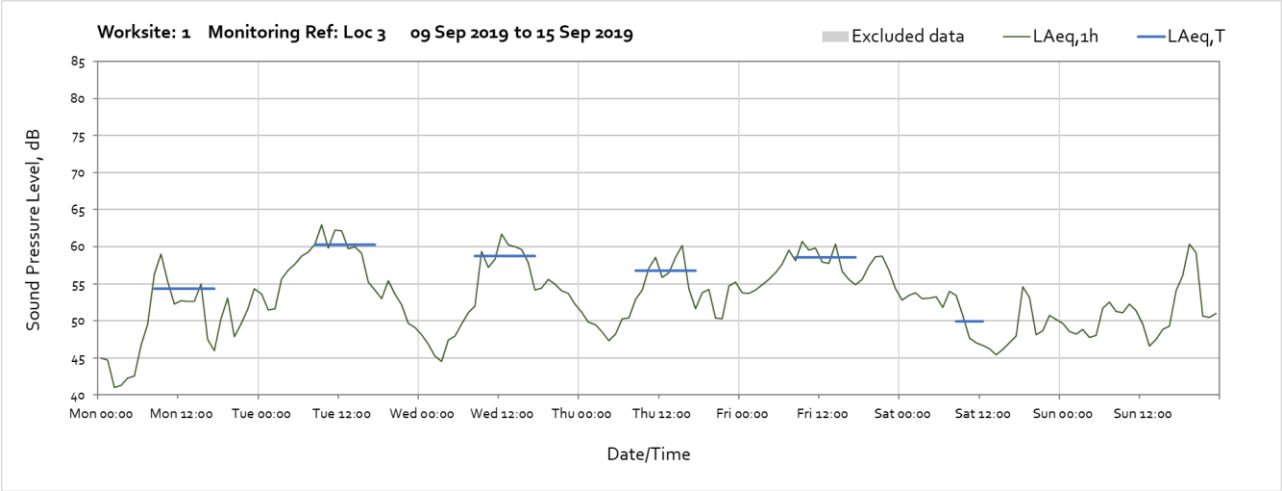
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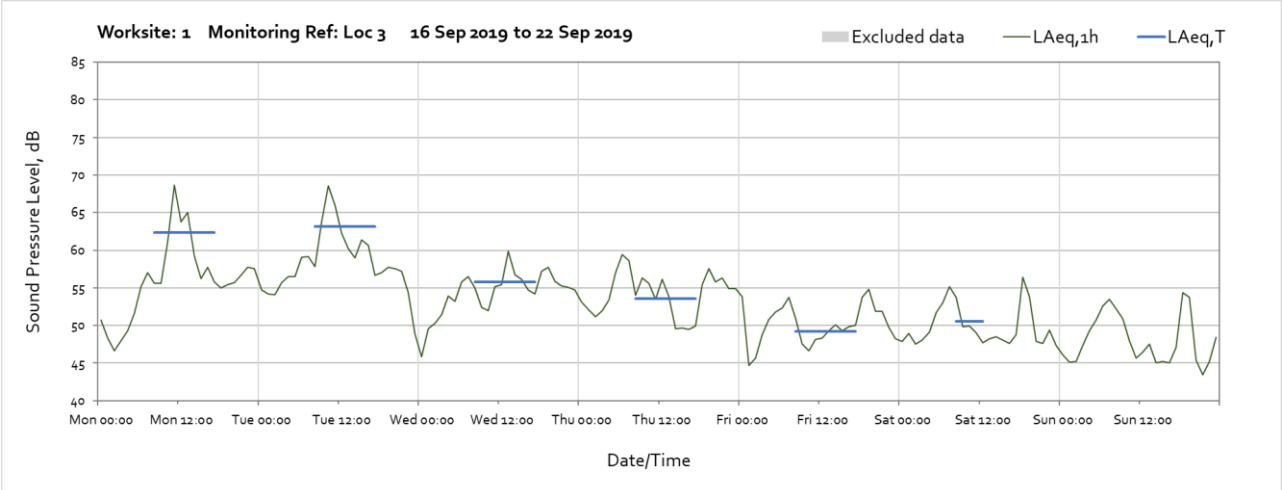
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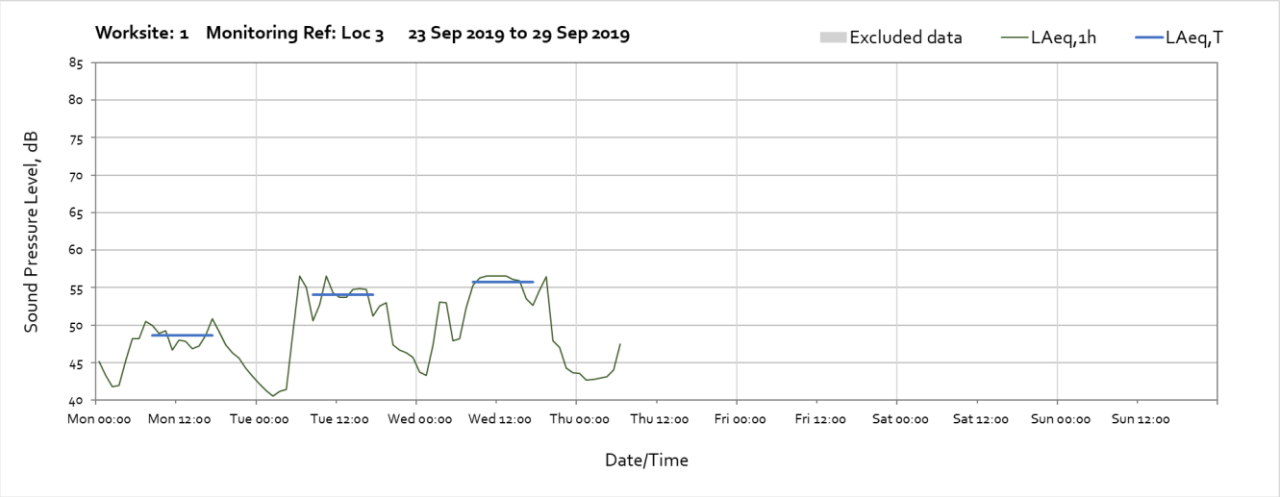

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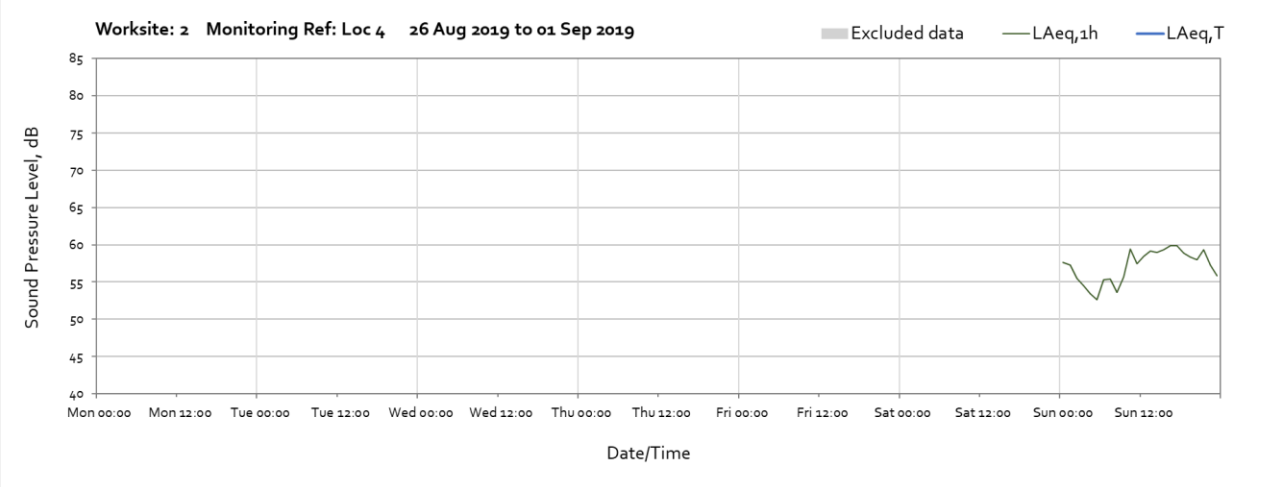

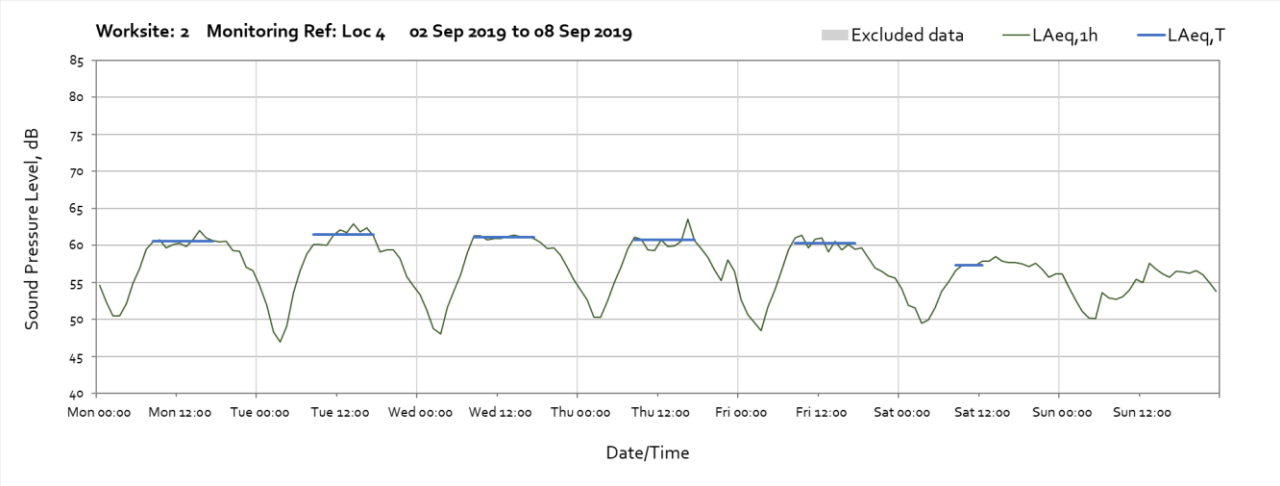

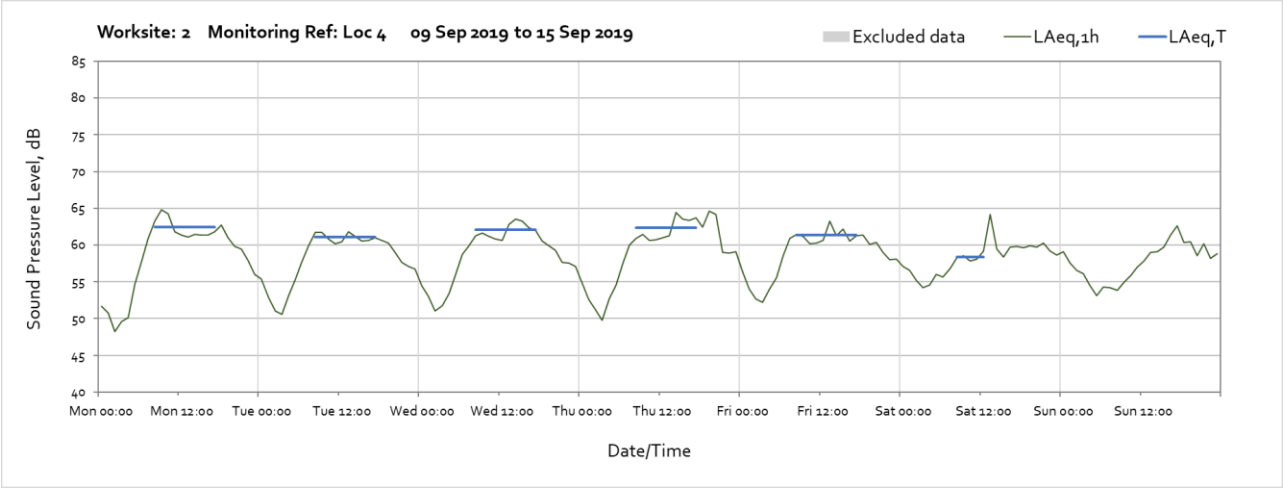
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LAeq,T
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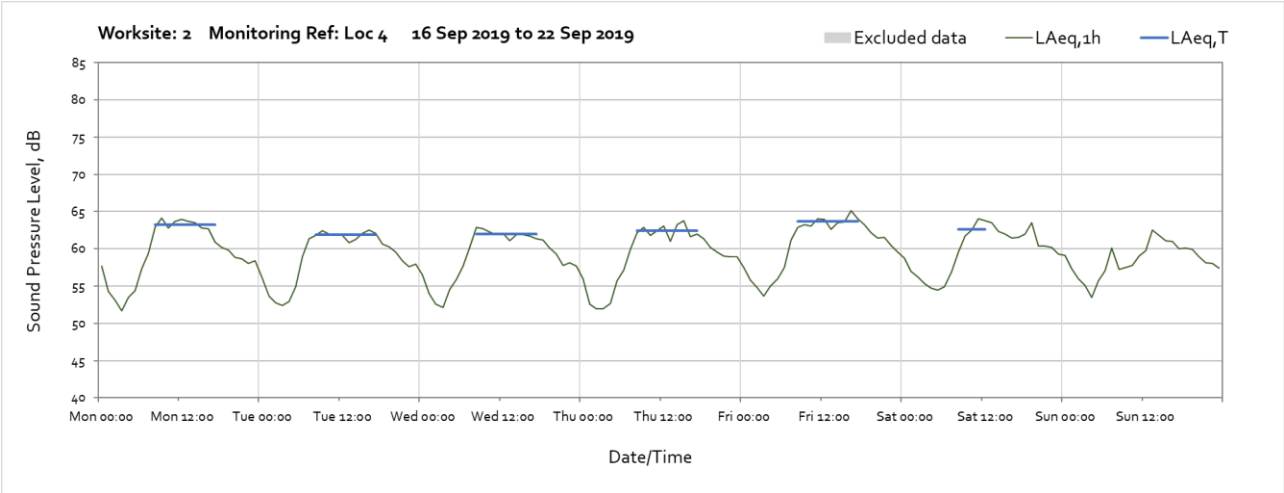
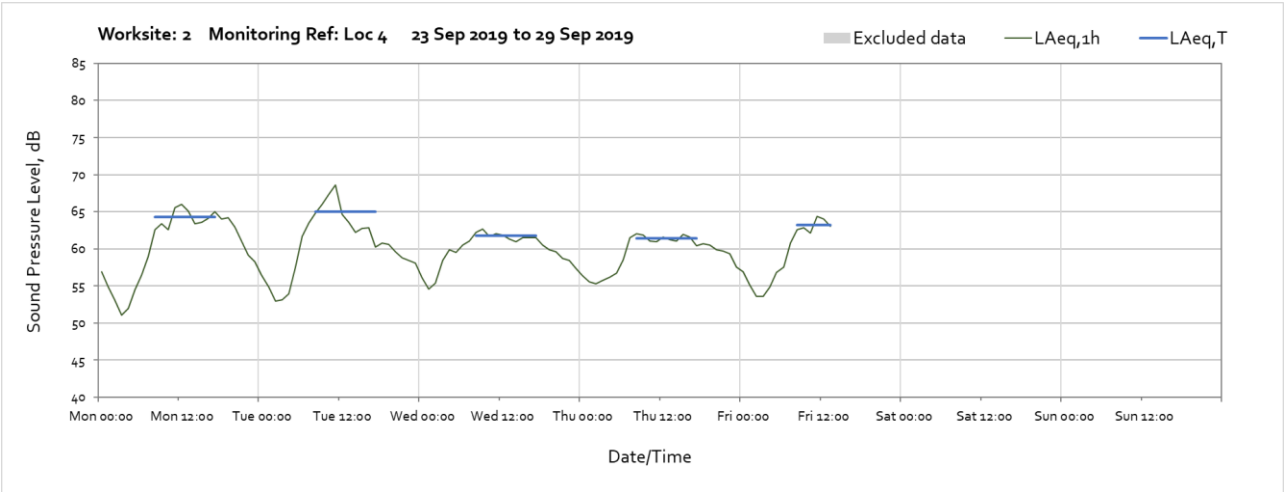
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

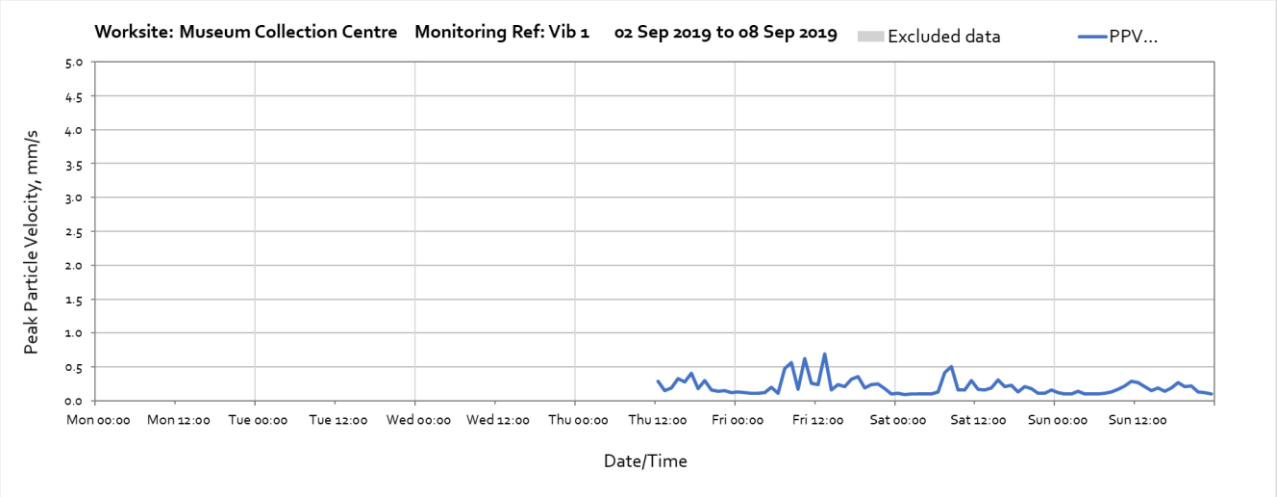

Worksite: 2 Monitoring Ref: Loc 4 16 Sep 2019 to 22 Sep 2019
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

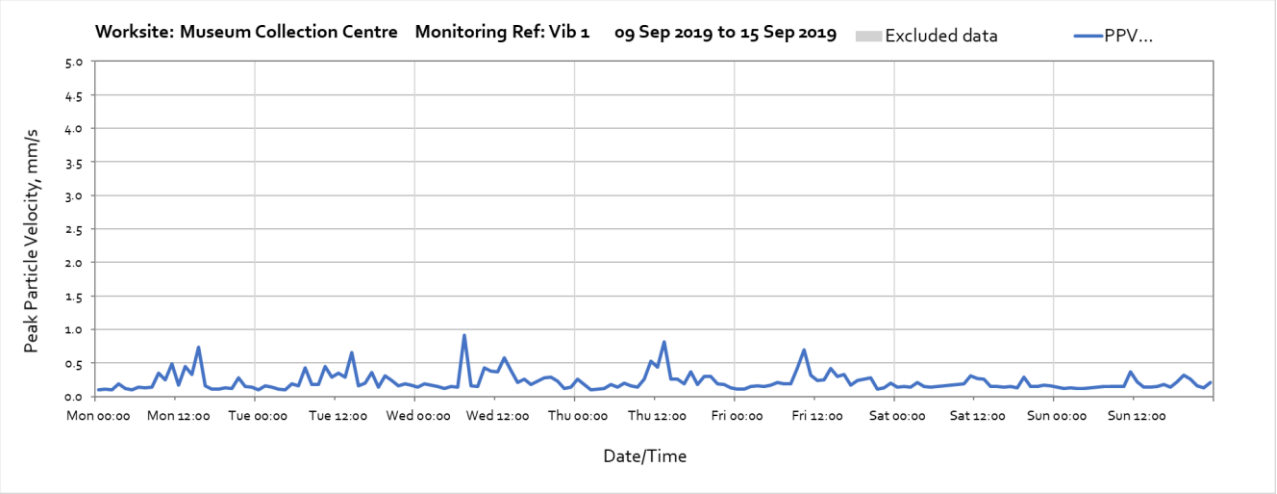

Worksite: 2 Monitoring Ref: Loc 4 23 Sep 2019 to 29 Sep 2019
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

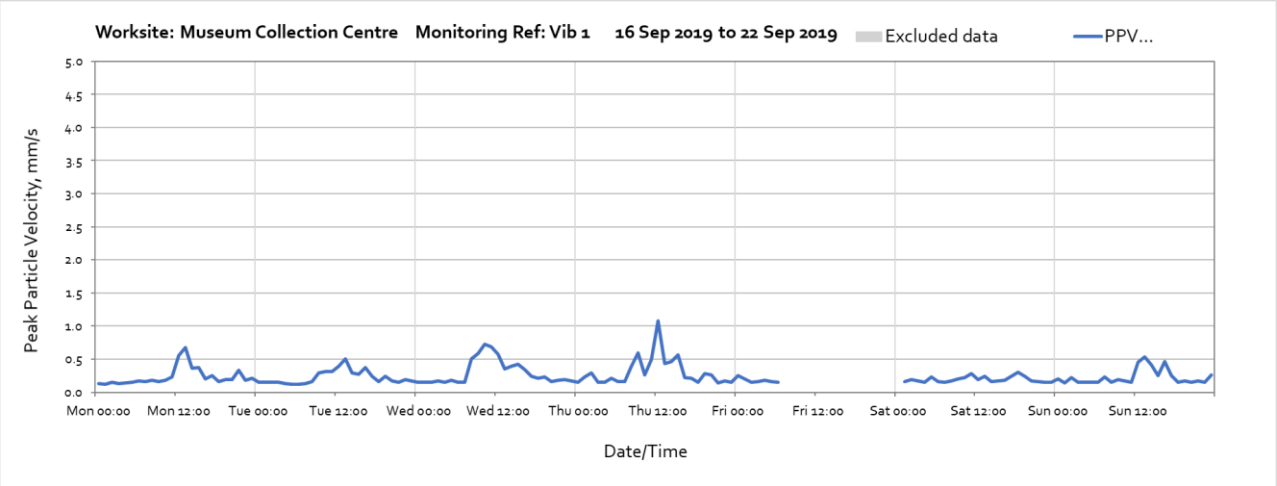
Vibration

The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the resultant PPV due to vibration components on three orthogonal axis x, y and z.

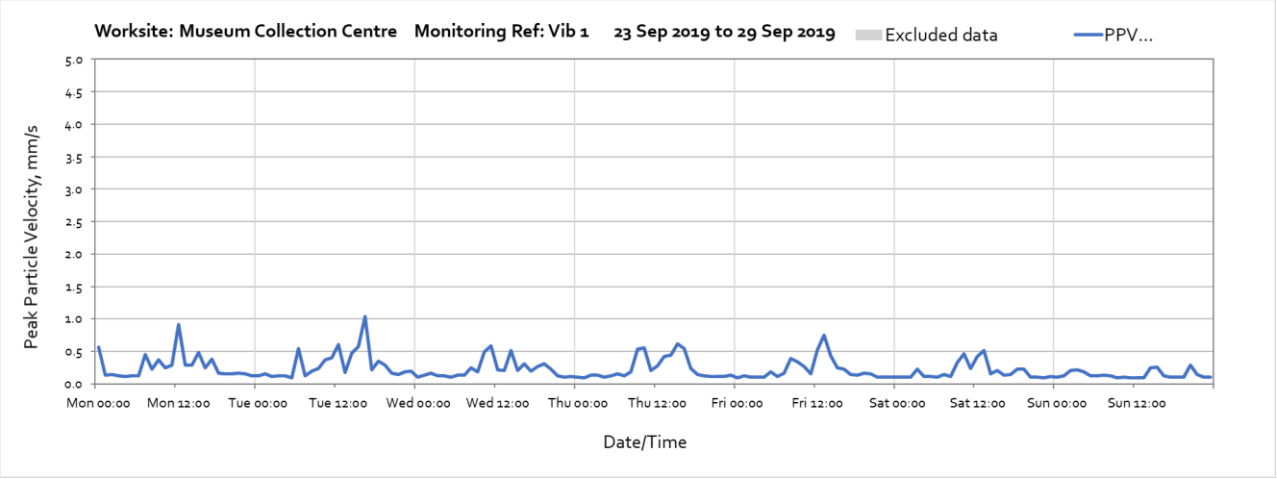
Worksite: Museum Collection Centre – Monitoring Ref: Vib 1



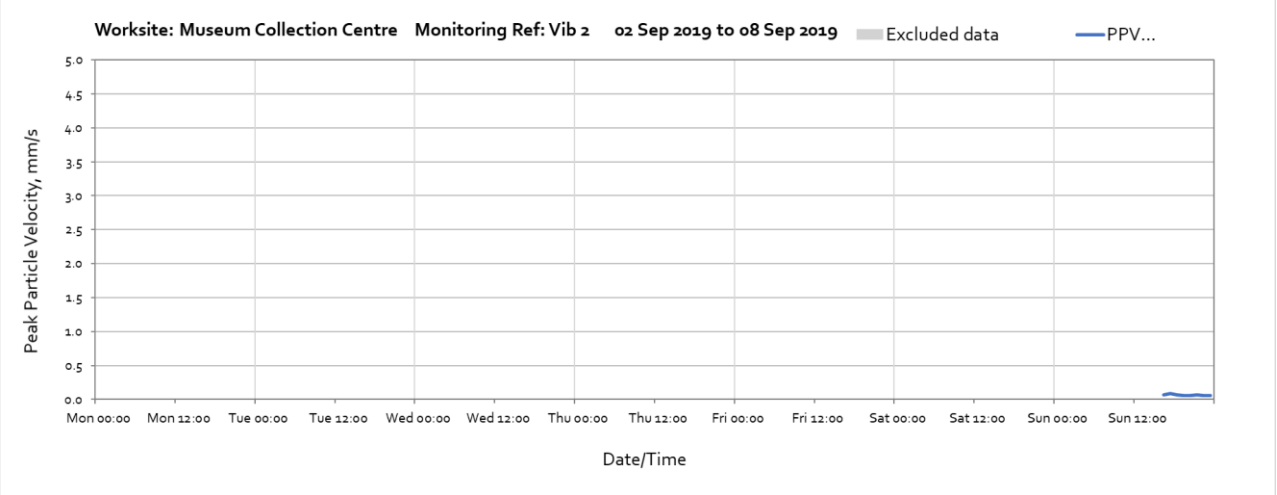


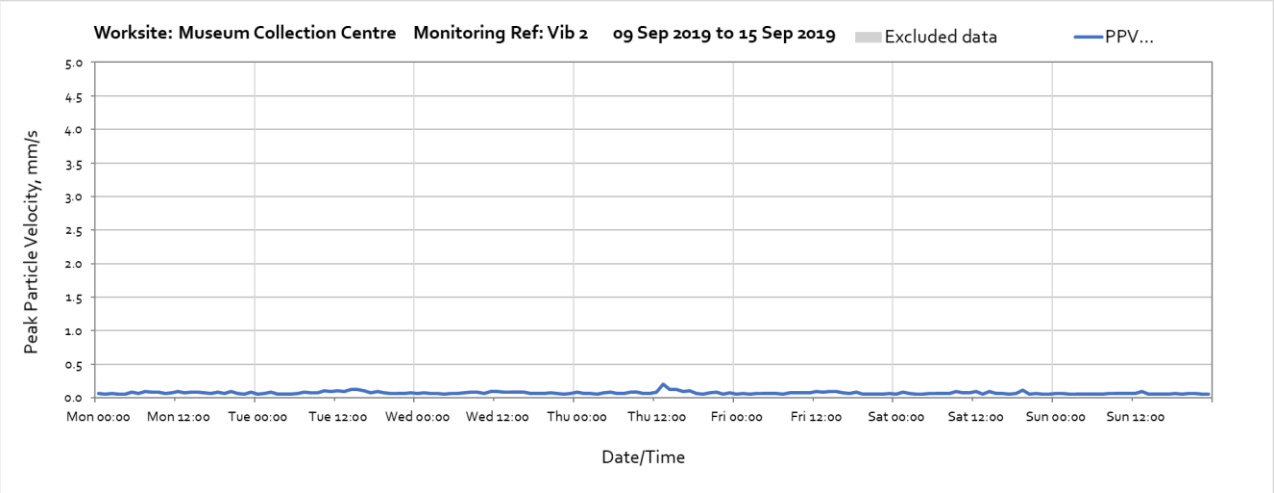


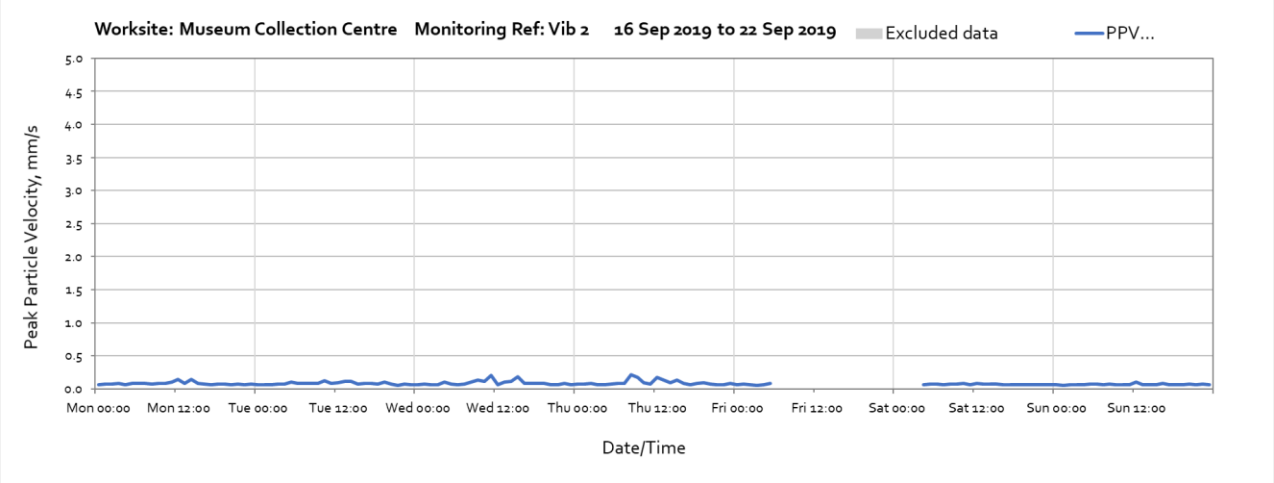
Note: missing data between 07:00 on Friday 20th and 01:00 on Saturday 21st of September was due to change of the remote data storage platform.



Worksite: Museum Collection Centre – Monitoring Ref: Vib 2







Note: missing data between 06:00 on Friday 20th and 04:00 on Saturday 21st of September was due to change of the remote data storage platform.