

## **Construction Noise and Vibration Monthly Report – October 2022**

**North Warwickshire Borough Council**

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# 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 North Warwickshire Borough Council (NWBC) area during the month of October 2022.

Within this period monitoring was undertaken at the following worksites:

- Noise monitoring was undertaken at the Church Lane Embankment worksite (ref.: CLE) where minimal site set-up works were underway.
- Noise monitoring was undertaken at the Kingsbury Main Compound worksite (ref.: KMC), where work activities included services installation, trimming works, material movement, road sweeping, and kerb installation.
- Noise monitoring was undertaken at the Birmingham & Fazeley Canal Viaduct worksite (ref.: BFCV), where work activities included laying geotextile and geogrid, stone laying, soil stripping.
- Noise and vibration monitoring were undertaken at the Marston Box/Marston Lane worksite (ref.: MB), where work activities included concrete works, formwork, steel fixing, excavation works, erecting scaffolding and demolition works.
- Noise monitoring was undertaken at the Faraday Avenue Embankment and Underbridge worksite (ref.: FAEU), where work activities included stockpiling, piling works, material deliveries and movement.
- Noise monitoring was not undertaken at the Water Orton South Compound worksite (ref.: WOSC), where work activities included building bentonite farm, earthworks and material deliveries.
- Noise monitoring was undertaken at the Attleboro Lane Overbridge worksite (ref.: ALO), where work activities included site maintenance activities, diaphragm wall operations and ground works.
- Noise monitoring was undertaken at the Gilson Drive worksite (ref.: GLD), where work activities included material deliveries, embankment works and heavy machinery movement.
- Noise monitoring was undertaken at the Birmingham Road worksite (ref.: BRD), where work activities included earthworks and pumping of water.

Further works, where noise and vibration monitoring did not take place, were also undertaken at Gilson as part of sewer works.

The HS2 threshold levels for significant noise impacts, which are defined in Information Paper E23 (<https://www.gov.uk/government/publications/hs2-information-papers-environment>) were not exceeded due to HS2 works in the Local Authority Area during October 2022.

There were no exceedances of trigger levels, as defined in Section 61 consents during the reporting period.

One (1) complaint was received within the North Warwickshire area during the monitoring period. A description of complaints, the results of investigations and any actions taken are detailed in Table 7 of this report.



# Abbreviations and Descriptions

The abbreviations, descriptions and project terminology used within this report can be found in Table 1.

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 +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.
LOAEL	Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.
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.
SOAEL	Significant Observed Adverse Effect Level - the level above which significant adverse effects on health and quality of life occur.
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 HS2 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.

1.1.2 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 North Warwickshire Borough Council (NWBC) area for the period 1<sup>st</sup> to 31<sup>st</sup> October 2022.

1.1.3 Construction sites in the local authority area where monitoring was undertaken during this period include:

- Church Lane Embankment worksite, ref.: CLE (see Plan 1 in Appendix A), where minimal site set-up works were underway.
- Kingsbury Main Compound worksite, ref.: KMC (see Plan 1 in Appendix A), where work activities included:
  - Services installation.
  - Trimming works.
  - Material movement.
  - Road sweeping.
  - Kerb placement.
- Birmingham & Fazeley Canal Viaduct worksite, ref.: BFCV (see Plan 1 in Appendix A), where works included:

- Laying geotextile and geogrid.
- Stone laying.
- Soil stripping.
- Marston Box/Marston Lane worksite, ref.: MB (see Plan 1 in Appendix A), where work activities included:
  - Concrete works.
  - Formwork.
  - Steel fixing.
  - Excavation works, including cutting and digging works.
  - Erecting scaffolding.
  - Demolition works.
- Faraday Avenue Embankment and Underbridge worksite, ref.: FAEU (see Plan 2 in Appendix A), work activities included:
  - Stockpiling.
  - Material deliveries and movement.
  - Piling works.
- Water Orton South Compound worksite, ref.: WOSC (see Plan 3 in Appendix A), work activities included:
  - Building bentonite farm.
  - Earthworks.
  - Material deliveries.
- Attleboro Lane Overbridge worksite, ref.: ALO (see Plan 3 in Appendix A), where work activities included:
  - Site maintenance activities.
  - Diaphragm wall operations.

- Ground works.
- Gilson Drive worksite, ref.: GLD (see Plan 3 in Appendix A), works activities included:
  - Material deliveries.
  - Embankment works
  - Heavy machinery movement.
- Birmingham Road worksite, ref.: BRD (see Plan 4 in Appendix A), work activities included:
  - Earthworks.
  - Pumping of water.

1.1.4 Further works, where noise and vibration monitoring did not take place, were also undertaken at Gilson as part of sewer works.

1.1.5 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 Ten (10) noise monitoring installations and seven (7) vibration monitoring installations were active in October in the NWBC area. Table 2 summarises the position of noise and vibration monitoring installations within the NWBC area in October 2022.
- 1.2.2 A noise monitor was installed at ref: CLE-N1, worksite ref: CLE, on the Tuesday 25<sup>th</sup> October 2022.
- 1.2.3 Noise monitor ref: BFCV-N1 and vibration monitor BFCV-V1, worksite ref: BFCV were relocated and will now be referred as BFCV-N2 and BFCV-V4. The monitors have not been installed and hence the noise and vibration levels were not recorded in October 2022 at this monitor.
- 1.2.4 Maps showing the position of noise and vibration monitoring installations are presented in Appendix B.

Table 2: Monitoring Locations

Worksite Reference	Measurement Reference	Address
Church Lane Embankment (CLE)	CLE-N1	Highfields Cottage, Middleton, North Warwickshire
Kingsbury Main Compound (KMC)	KMC-N1	Kingsbury Road, Curdworth CP, Marston, Warwick, West Midlands
	KMC-N2	Kingsbury Road, Curdworth CP, Marston, Warwick, West Midlands
Birmingham Fazeley Canal Viaduct (BFCV)	BFCV-N2	Lock Cottage, Marston Lane, Curdworth CP, North Warwickshire
	BFCV-V4	Lock Cottage, Marston Lane, Curdworth CP, North Warwickshire
Marston Box (MB)	MB-N1	Kingsbury Road, Curdworth, Sutton Coldfield, West Midlands
	MB-V1	Kingsbury Road, Curdworth, Sutton Coldfield, West Midlands
Faraday Avenue Embankment and Underbridge (FAEU)	FAEU-N1	Orchard Cottage, Newlands Lane, Curdworth, Warwickshire
	FAEU-V1	Orchard Cottage, Newlands Lane, Curdworth, Warwickshire
Water Orton South Compound (WOSC)	WOSC-N1	53 Watton Lane, Water Orton CP, Warwickshire
	WOSC-V1	53 Watton Lane, Water Orton CP, Warwickshire
Attleboro Lane Overbridge (ALO)	ALO-N1	47 Attleboro Lane, Water Orton, Birmingham
	ALO-V1	47 Attleboro Lane, Water Orton, Birmingham
Gilson Drive (GLD)	GLD-N1	Gilson Dr, Coleshill, Birmingham
	GLD-V1	Gilson Dr, Coleshill, Birmingham
Birmingham Road (BRD)	BRD-N2	New Cottages, Birmingham Road, Coleshill, Birmingham
	BRD-V1	New Cottages, Birmingham Road, Coleshill, Birmingham

## 2 Summary of Results

### 2.1 Summary of Measured Noise and Vibration Levels

2.1.1 Table 3 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.

Table 3: Summary of Measured dB L<sub>Aeq</sub> Data over the Monitoring Period

Worksite Reference	Measurement Reference	Site Address	Free-Field or Façade Measurement	Weekday Average L <sub>Aeq,T</sub> (Highest Day L <sub>Aeq,T</sub> )					Saturday Average L <sub>Aeq,T</sub> (Highest Day L <sub>Aeq,T</sub> )					Sunday / Public Holiday Average L <sub>Aeq,T</sub> (Highest Day L <sub>Aeq,T</sub> )	
				0700 - 0800	0800 - 1800	1800 - 1900	1900 - 2200	2200 - 0700	0700 - 0800	0800 - 1300	1300 - 1400	1400 - 2200	2200 - 0700	0700 - 2200	2200 - 0700
CLE	CLE-N1	Highfields Cottage, Middleton	Free-field	47.7 (48.3)	45.9 (47.2)	46.1 (47.0)	46.4 (56.0)	42.4 (46.6)	44.9* (44.9)*	46.7 (46.7)	45.6 (45.6)	43.9 (45.6)	39.6 (42.5)	46.7 (49.8)	42.3 (47.4)
KMC	KMC-N1	Kingsbury Road, Curdworth CP, Marston	Free-field	59.3 (62.1)	59.5 (61.7)	56.1 (61.2)	54.9 (59.7)	53.7 (60.6)	56.2 (58.2)	58.1 (58.9)	57.5 (59.6)	55.8 (59.9)	52.2 (55.6)	54.7 (59.1)	54.4 (60.1)
	KMC-N2	Kingsbury Road, Curdworth CP, Marston	Free-field	57.9 (68.8)	59.0 (63.3)	56.3 (59.9)	55.3 (58.0)	54.5 (59.5)	55.6 (57.7)	56.5 (57.8)	56.0 (57.6)	54.8 (58.3)	53.2 (60.6)	54.9 (57.7)	55.1 (58.7)
MB	MB-N1	Kingsbury Road, Curdworth, Sutton Coldfield	Free-field	57.3 (61.6)	56.6 (59.4)	56.3 (60.8)	55.2 (59.4)	53.1 (61.1)	56.6 (58.1)	56.8 (58.7)	56.3 (59.1)	55.5 (60.0)	50.3 (55.3)	55.0 (63.0)	53.4 (59.7)
FAEU	FAEU-N1	Orchard Cottage, Newlands Lane, Curdworth	Free-field	58.8 (66.1)	61.7 (66.0)	57.7 (61.9)	57.1 (60.8)	55.8 (65.7)	58.8 (60.0)	58.7 (60.7)	58.7 (61.8)	57.6 (62.4)	53.0 (57.7)	56.2 (62.1)	55.9 (61.5)
WOSC	WOSC-N1	53 Watton Lane, Water Orton CP	Free-field	66.3 (68.2)	65.3 (68.5)	64.7 (68.5)	63.0 (68.0)	60.6 (67.4)	62.4 (63.1)	64.4 (66.1)	63.8 (65.9)	62.8 (66.0)	57.4 (61.1)	63.9 (67.7)	60.3 (65.9)
ALO	ALO-N1	47 Attleboro Lane, Water Orton	Free-field	57.9 (61.2)	61.9 (67.2)	56.6 (59.9)	56.6 (60.2)	54.8 (62.8)	57.3 (59.3)	62.6 (67.2)	56.8 (59.2)	57.2 (60.2)	53.8 (58.0)	56.0 (61.2)	54.9 (60.1)

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
GLD	GLD-N1	10 Gilson Dr, Coleshill, Birmingham	Free-field	61.4 (65.2)	60.1 (63.6)	59.4 (63.1)	59.3 (62.4)	57.7 (63.8)	58.7 (60.3)	59.4 (62.9)	57.1 (62.9)	58.3 (62.8)	55.1 (59.7)	59.5 (64.3)	57.2 (63.9)
BRD	BRD-N2	1, New Cottages, Birmingham Road, Coleshill	Free field	65.1 (65.8)	65.6 (72.4)	63.7 (64.4)	62.8 (64.3)	60.2 (65.5)	61.8 (62.2)	63.5 (65.4)	62.6 (64.4)	62.0 (64.0)	56.9 (60.0)	62.7 (65.5)	59.0 (64.8)

\* Following installation of the noise monitor on Tuesday 25<sup>th</sup> October 2022 all data recorded during this period was affected by poor weather conditions and has been excluded in the remainder of the report.



2.1.2 Table 4 presents a summary of the measured vibration levels at the monitoring location over the reporting period. The highest PPV measured during the monitoring along any axis is presented in the table.

Table 4: Summary of Measured PPV Data over the Monitoring Period

Worksite Reference	Measurement Reference	Monitor Address	Highest PPV measured in any axis, mm/s
MB - Marston Box	MB-V1	Kingsbury Road, Curdworth, Sutton Coldfield, West Midland, B76 0DF	0.42 (X-axis)
WOSC - Water Orton South Compound	WOSC-V1	53 Watton Lane, Water Orton CP, Warwickshire	3.02 (X-axis)
ALO - Attleboro Lane Overbridge	ALO-V1	47 Attleboro Lane, Water Orton, Birmingham	15.18 (X-axis)*
BRD - Birmingham Road	BRD-V1	1, New Cottages, Birmingham Road, Coleshill, Birmingham B46 1DP	0.88 (X-axis)
FAEU - Orchard Cottage	FAEU-V1	Orchard Cottage, Newlands Lane, Curdworth, Warwickshire, B76 0BE	1.19 (X-axis)
GLD - Gilson Drive	GLD-V1	10 Gilson Dr, Coleshill, Birmingham B46 1DN	1.12 (X-axis)

\* Note: Pond digging works were undertaken in close proximity to the vibration monitor, the NSR is 50 meters further away and therefore the levels will be lower.

2.1.3 Appendix C presents graphs of the noise and vibration monitoring data over the month for each of the measurement locations. Noise data presented consists of 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). Vibration data presented consist of hourly PPV values. 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 Exceedances of the LOAEL and SOAEL

2.2.1 The lowest observed adverse effect level (LOAEL) is defined in the Planning Practice Guidance – Noise (PPG) as the level above which "noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life".

2.2.2 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."

2.2.3 HS2 Phase One Information Paper E23: Control of Construction Noise and Vibration sets out the LOAELs and SOAELs for construction noise.

2.2.4 Where reported construction noise levels exceed the LOAEL and SOAEL, relevant periods will be identified. Summary statistics to evaluate ongoing qualification for noise insulation and temporary rehousing are also presented where relevant.

2.2.5 Table 5 presents a summary of recorded exceedances of the LOAEL and SOAEL at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 5: Summary of Exceedances of LOAEL and SOAEL

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of LOAEL	Number of exceedances of SOAEL
CLE	CLE-N1*	Highfields Cottage, Middleton	All days	All periods	No exceedances	No exceedances
KMC	KMC-N1*	Wheatley House, Kingsbury Road, Sutton Coldfield	All days	All periods	No exceedances	No exceedances
	KMC-N2	Wheatley House, Kingsbury Road, Sutton Coldfield	All days	All periods	No exceedances	No exceedances
MB	MB-N1*	Kingsbury Road, Curdworth	All days	All periods	No exceedances	No exceedances
FAEU	FAEU-N1	Orchard Cottage, Newlands Lane, Curdworth	Weekday	0800-1800	2	No exceedances

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of LOAEL	Number of exceedances of SOAEL
WOSC	WOSC-N1	53 Watton Lane, Water Orton CP, Warwickshire	All days	All periods	No exceedances	No exceedances
ALO	ALO-N1	47 Attleboro Lane, Water Orton, Birmingham	Weekday Saturday	0800-1800 0800-1300	8 2	No exceedances
GLD	GLD-N1	Gilson Dr, Coleshill, Birmingham	All days	All periods	No exceedances	No exceedances
BRD	BRD-N2	New Cottages, Birmingham Road, Coleshill, Birmingham B46 1DP	Weekday	0800-1800	1	No exceedances

\* A distance correction has been applied when calculating exceedances of the LOAEL and SOAEL.

2.2.6 Thirteen (13) exceedances of the LOAEL were recorded during weekday core working hours at the monitoring locations ref.: FAEU-N1, ALO-N1 and BRD-N2. No exceedance of the SOAEL was recorded during October 2022

## 2.3 Exceedances of Trigger Level

2.3.1 Table 6 provides a summary of exceedances of the Section 61 trigger noise levels determined to be due to HS2 related construction noise 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
-	-	-	-	-	-

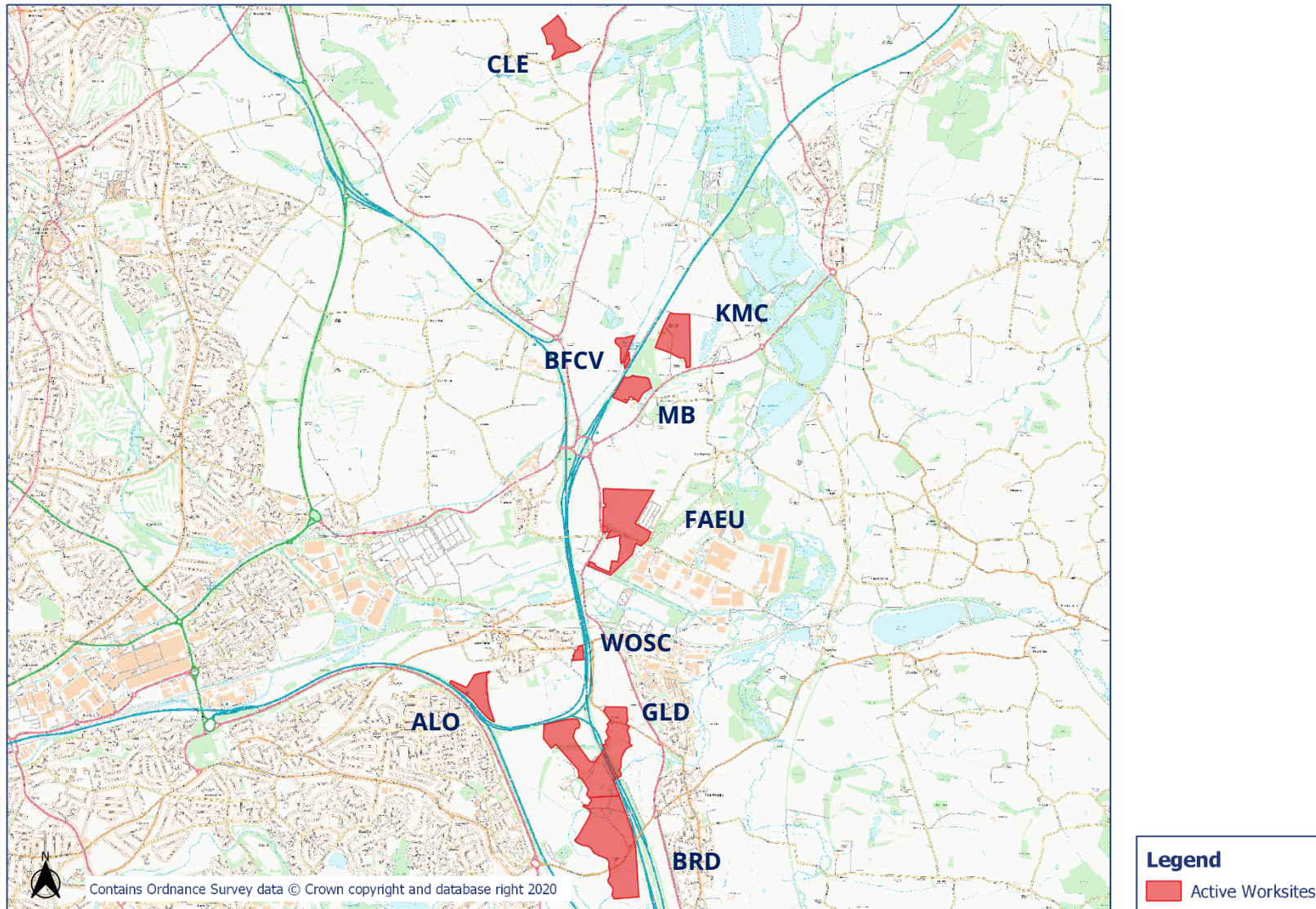
## 2.4 Complaints

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

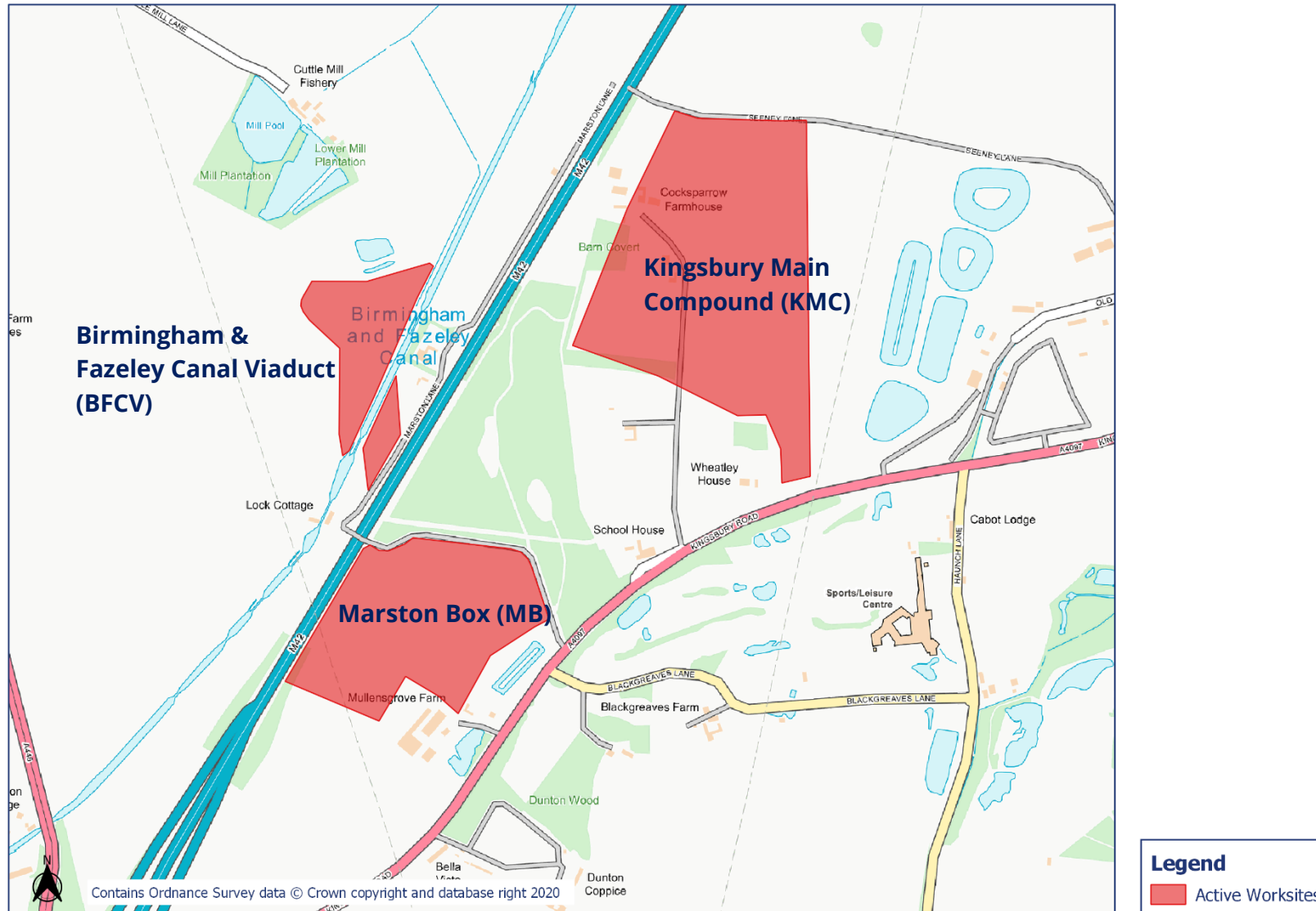
Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
HS2-22-44043-C	ALO	Complaint due to high levels of vibration felt inside the property.	Conversation with the stakeholder remain ongoing for the investigation.	The complaint remains open for detailed review of the situation.

# Appendix A Site Locations

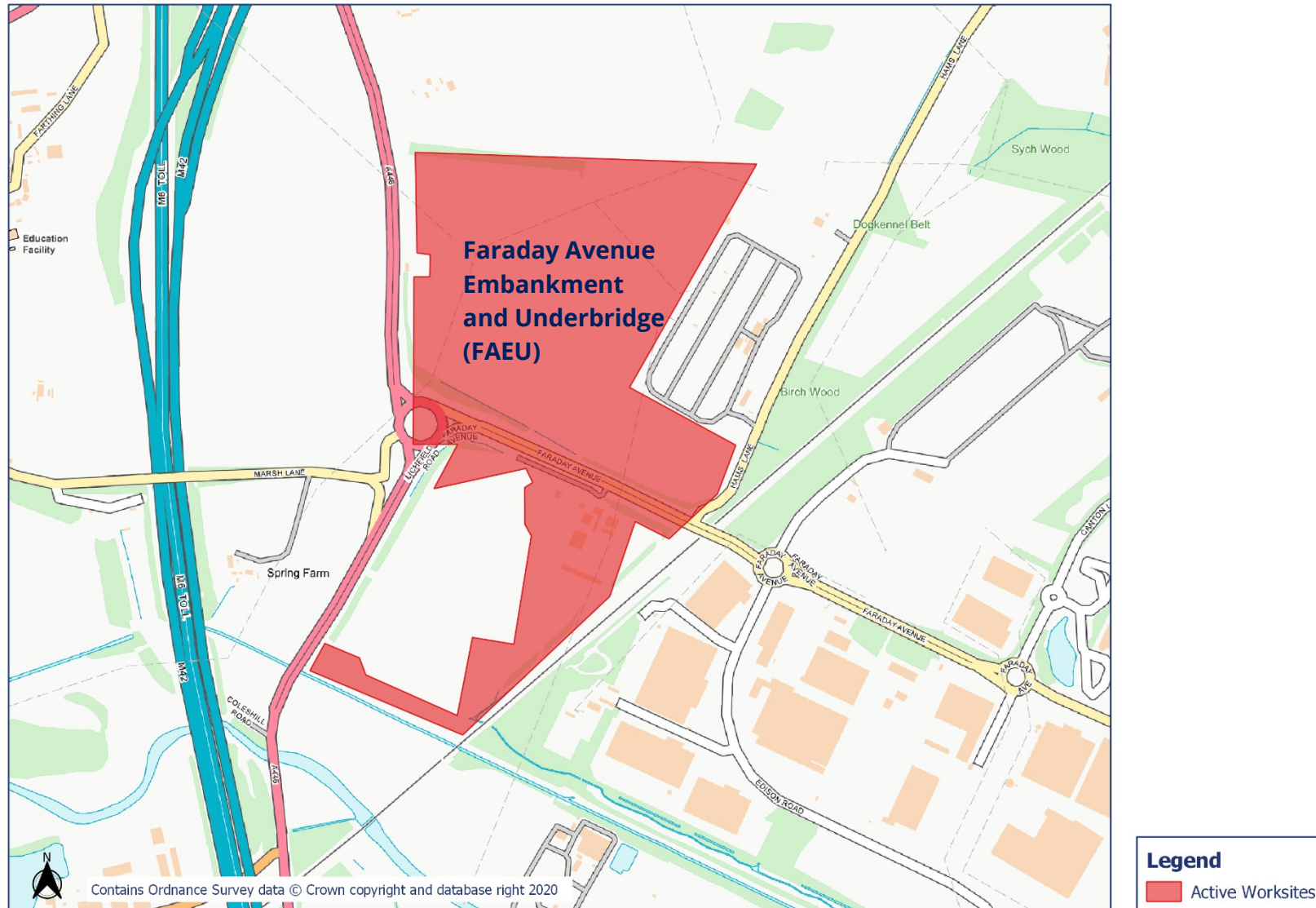


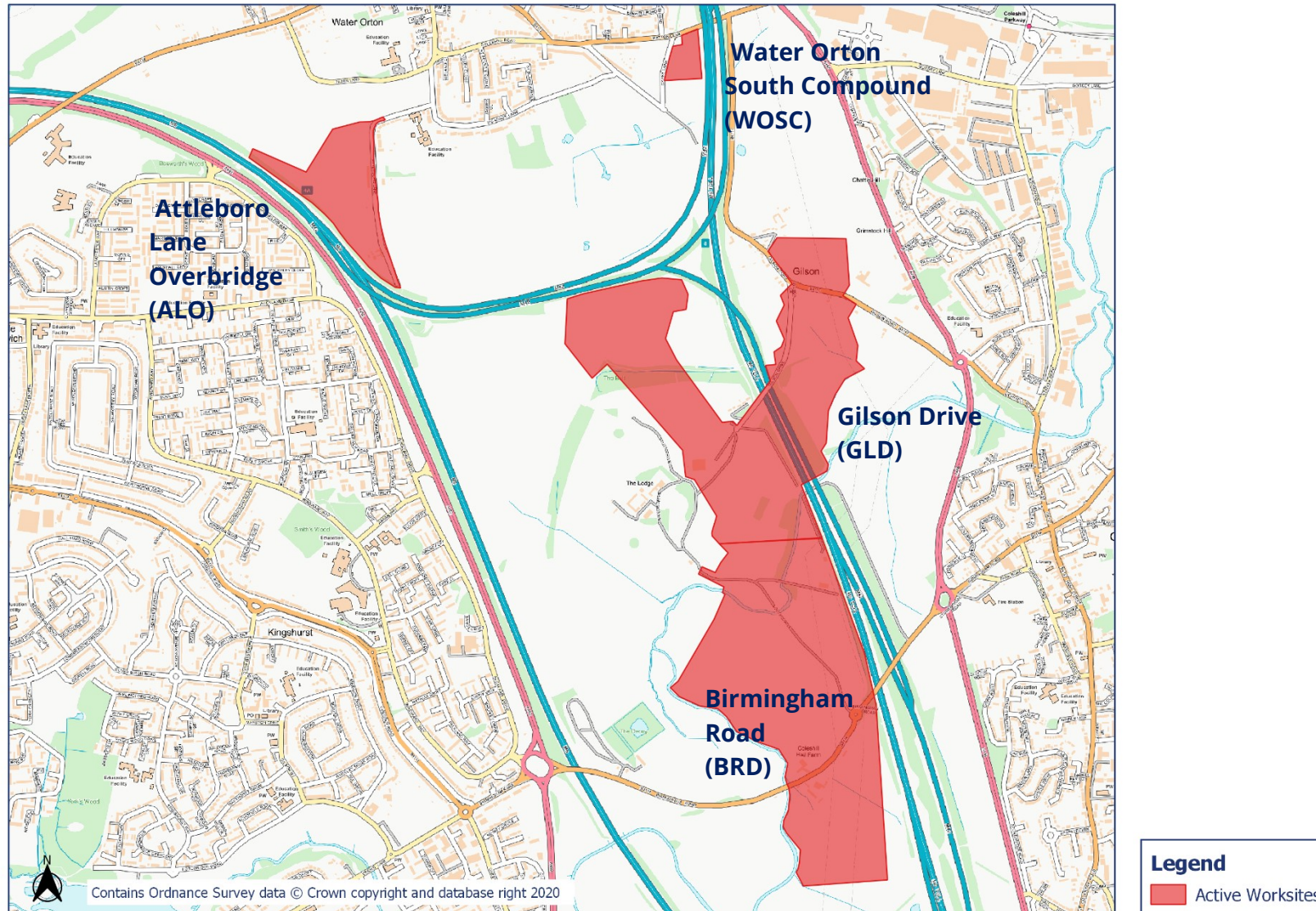




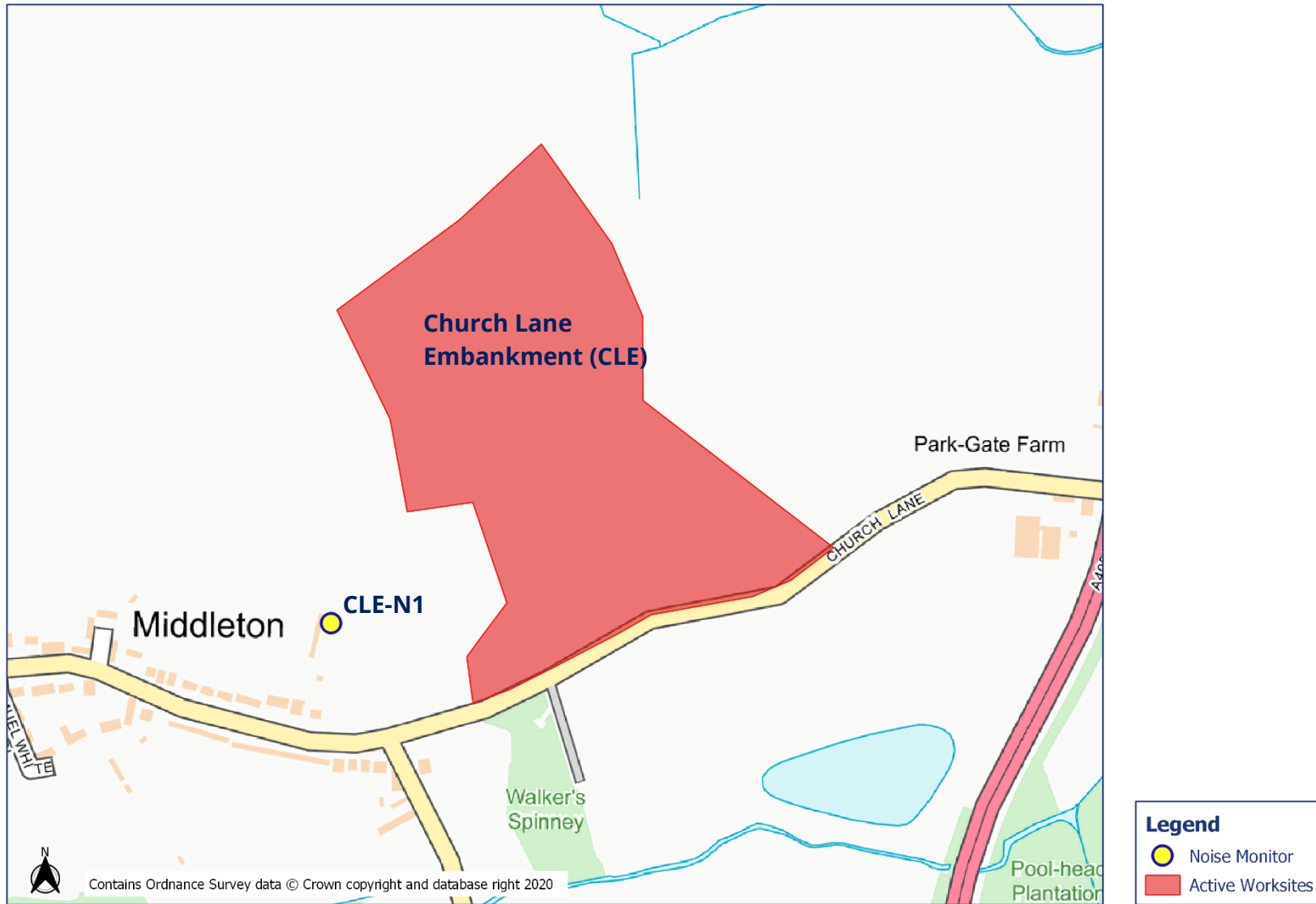




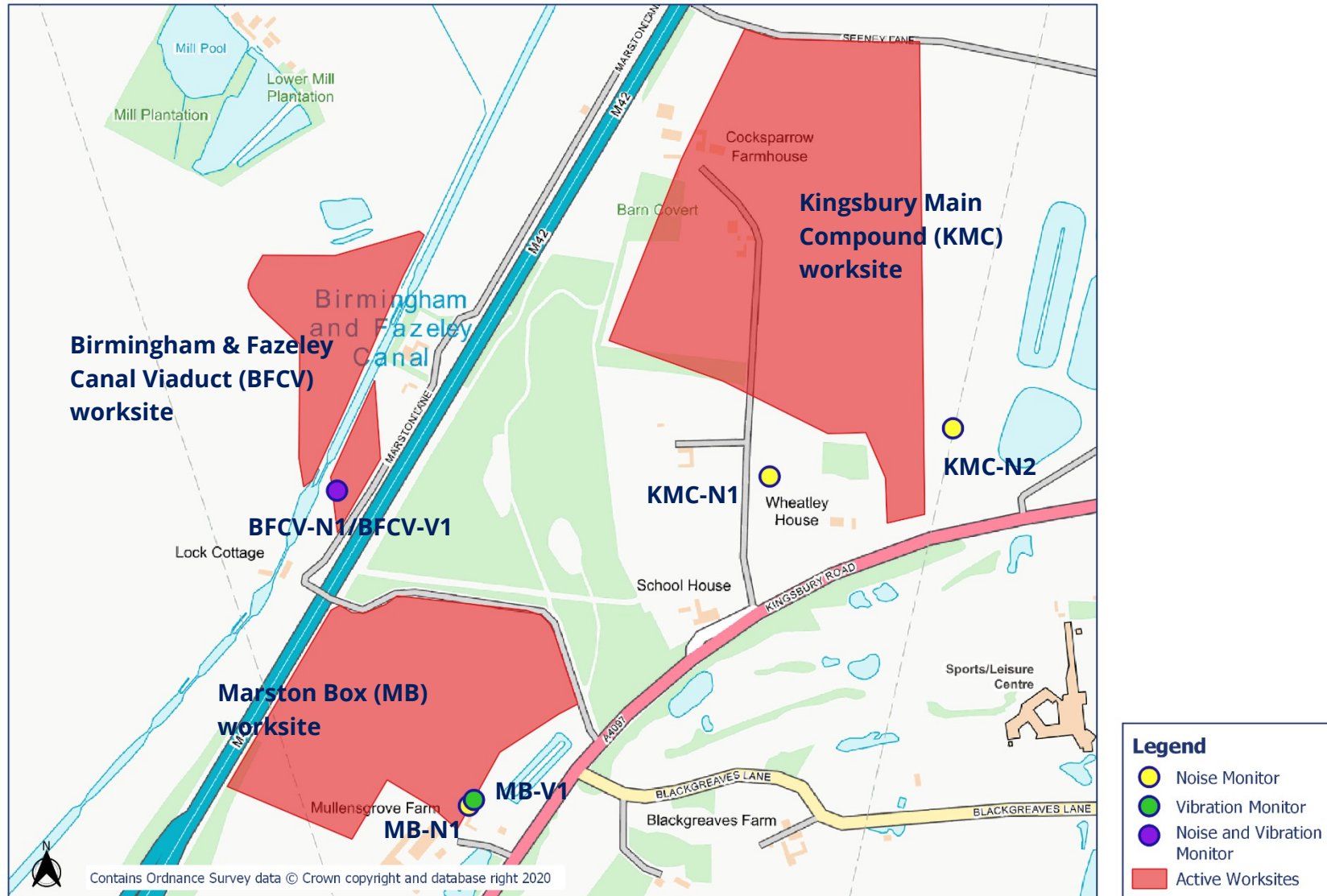




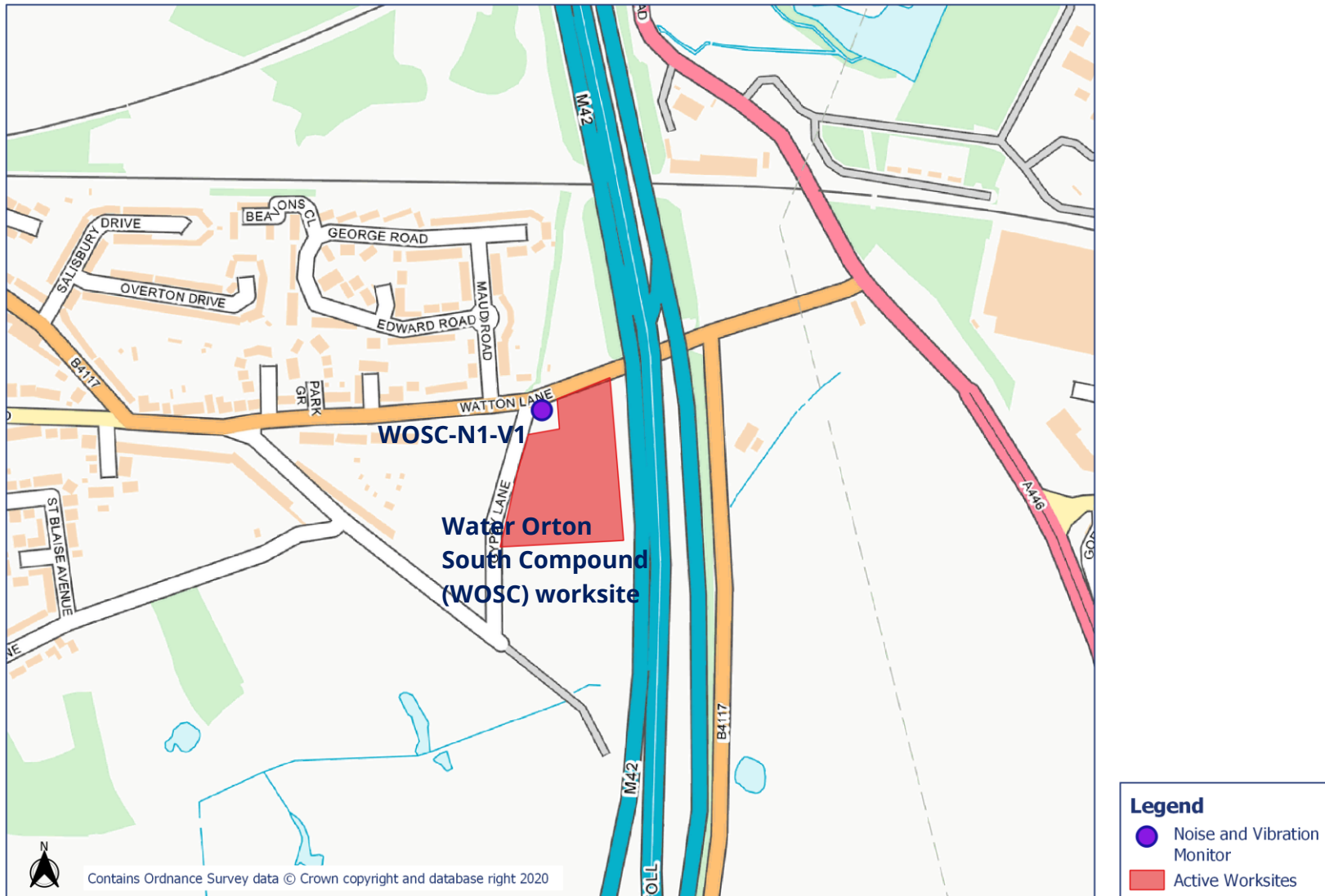
# Appendix B Monitoring Locations



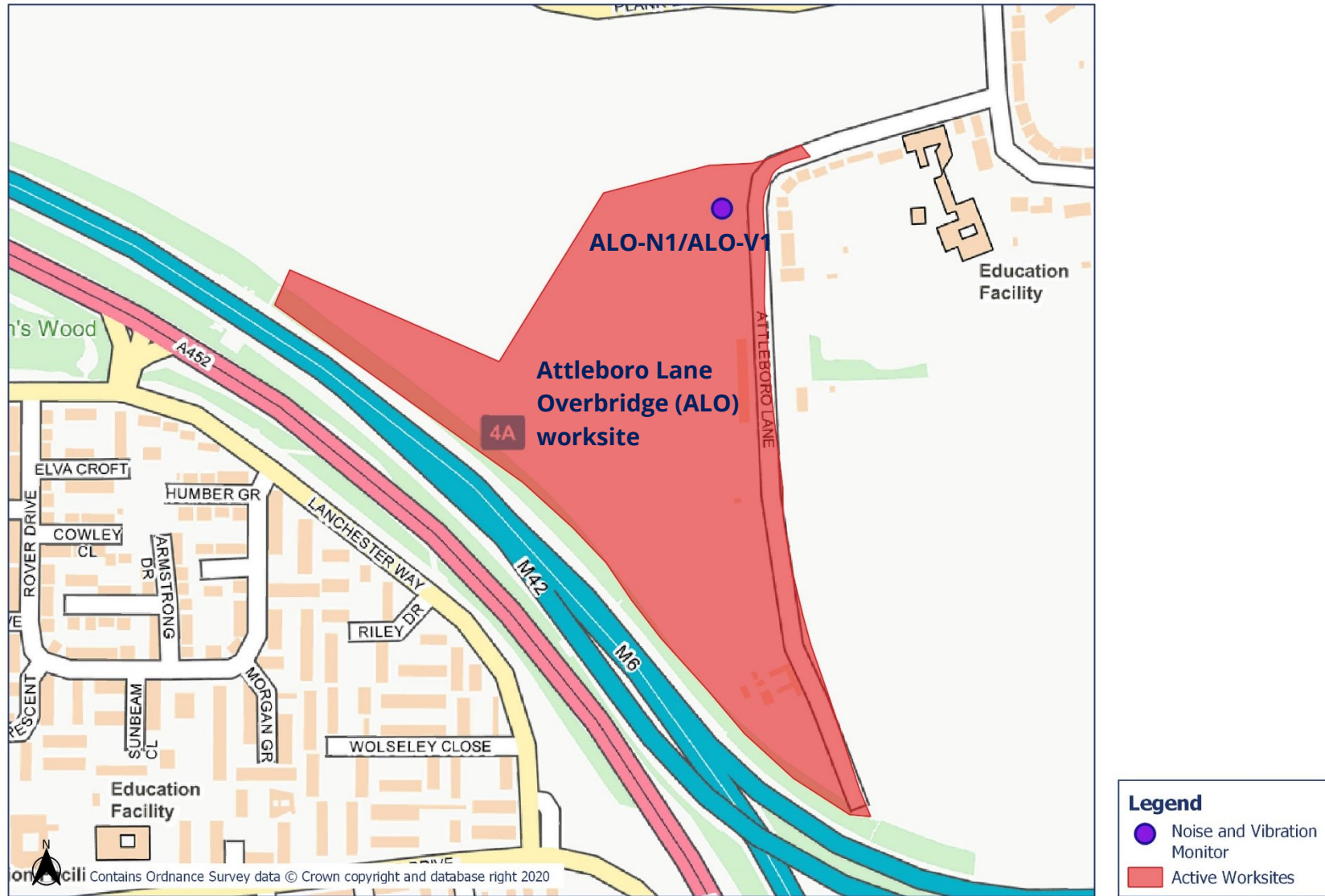




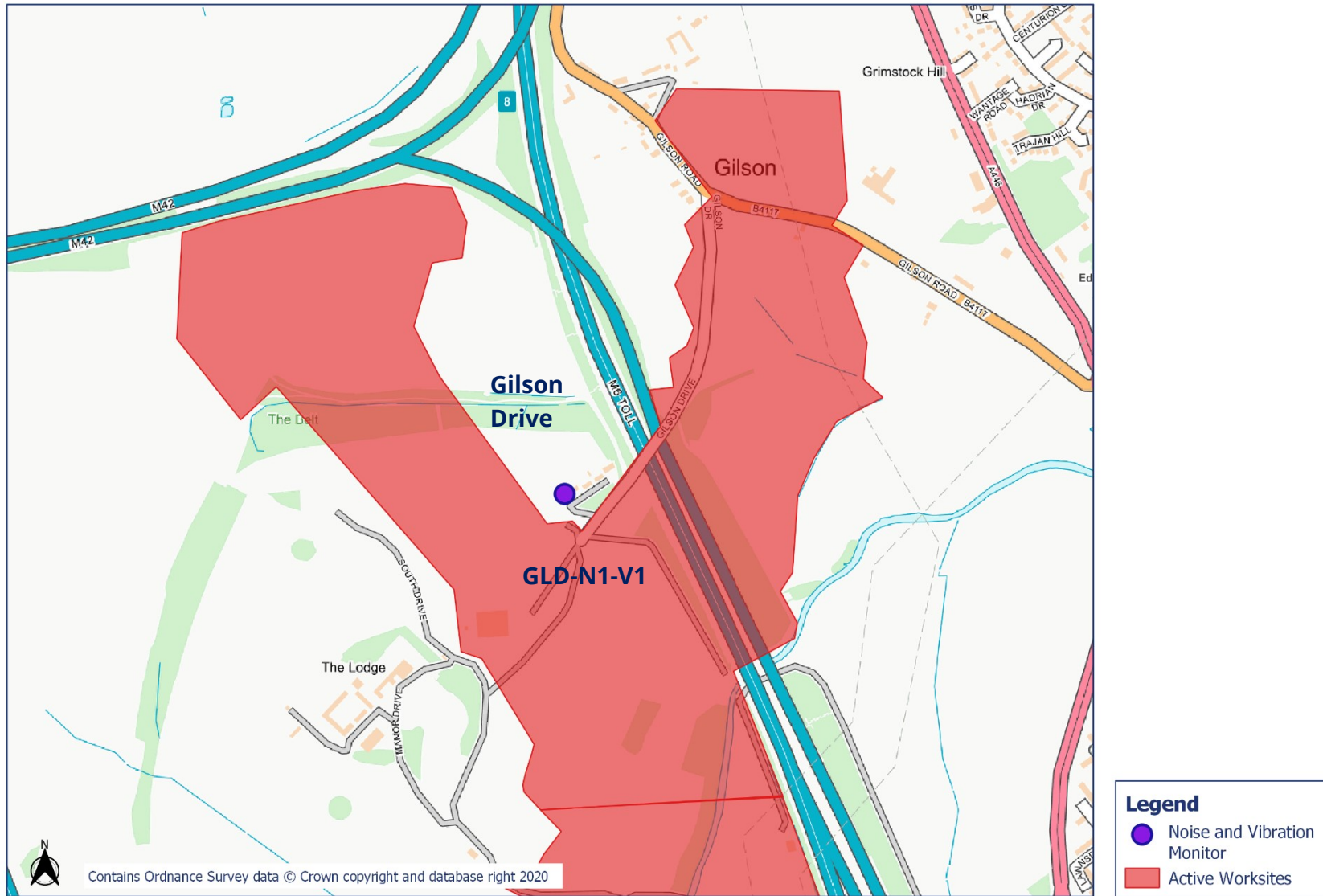


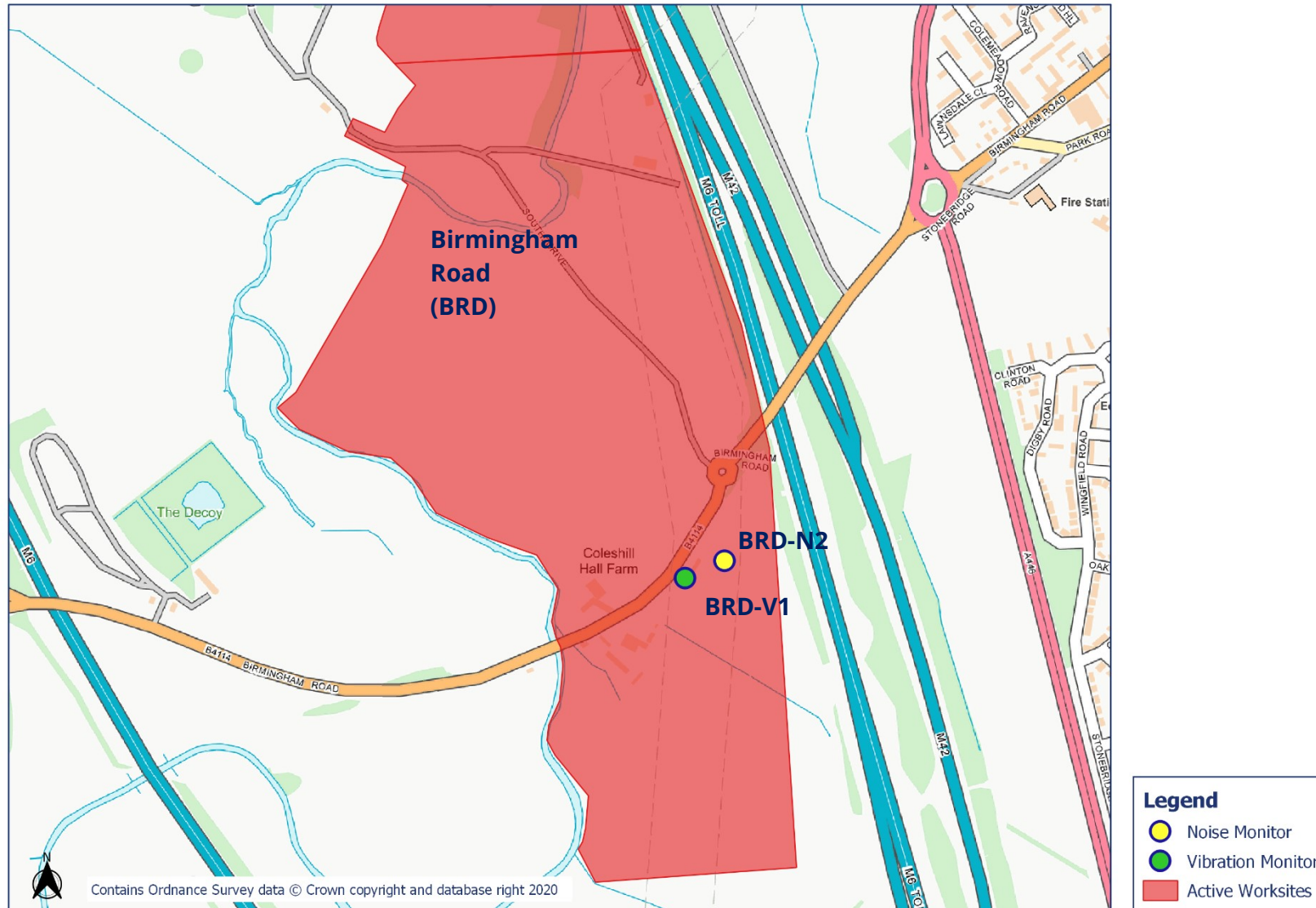










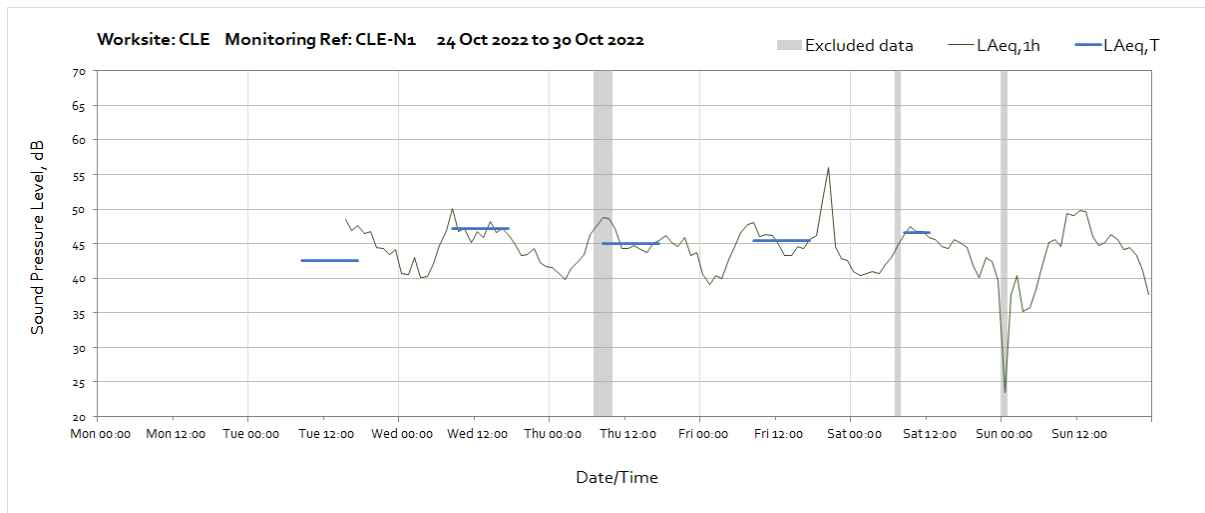


# Appendix C Data

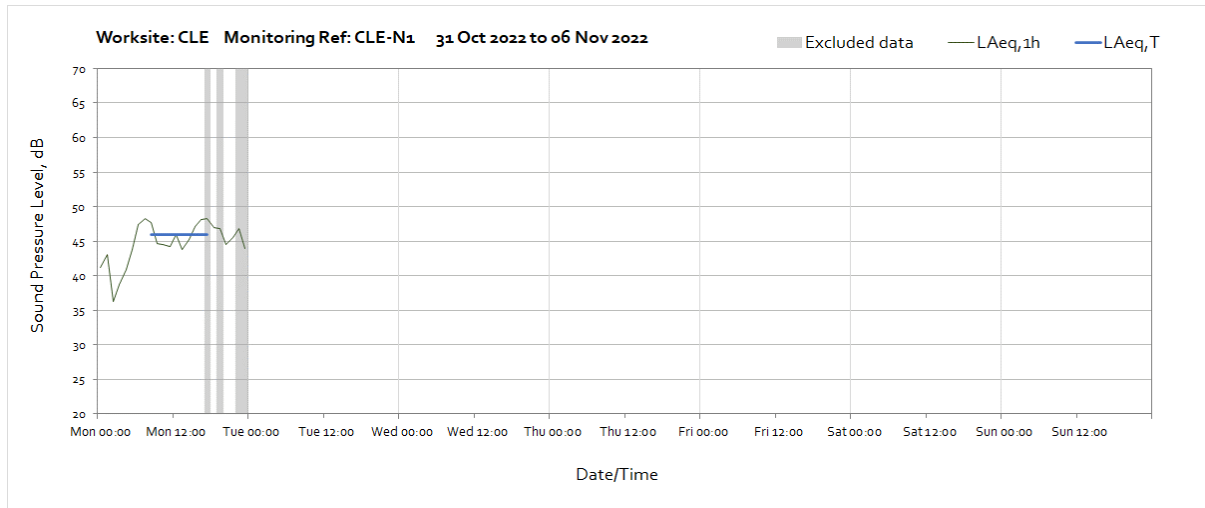
## Noise

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 in Table 3 of the main report.:

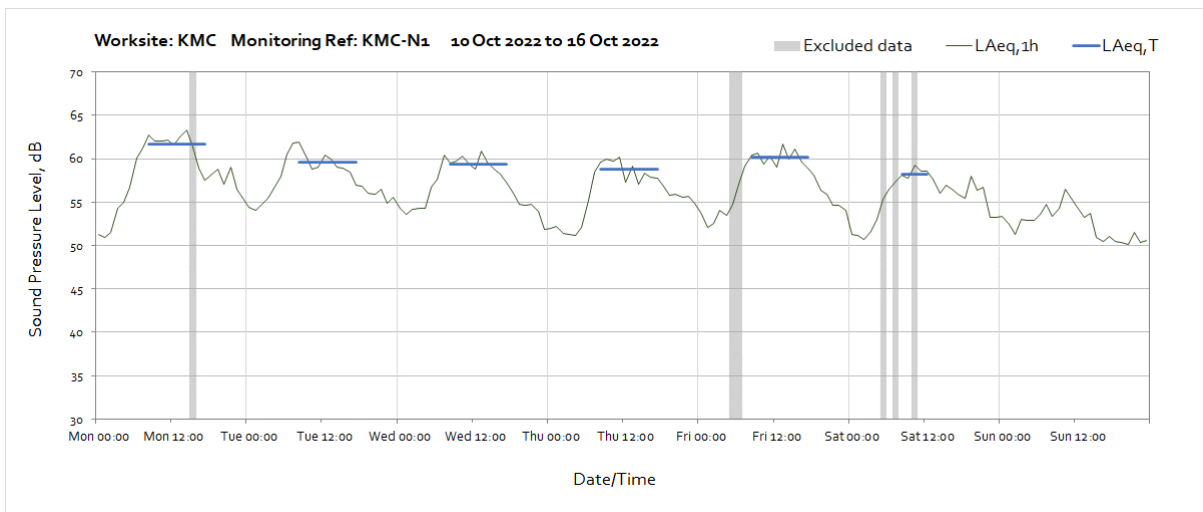
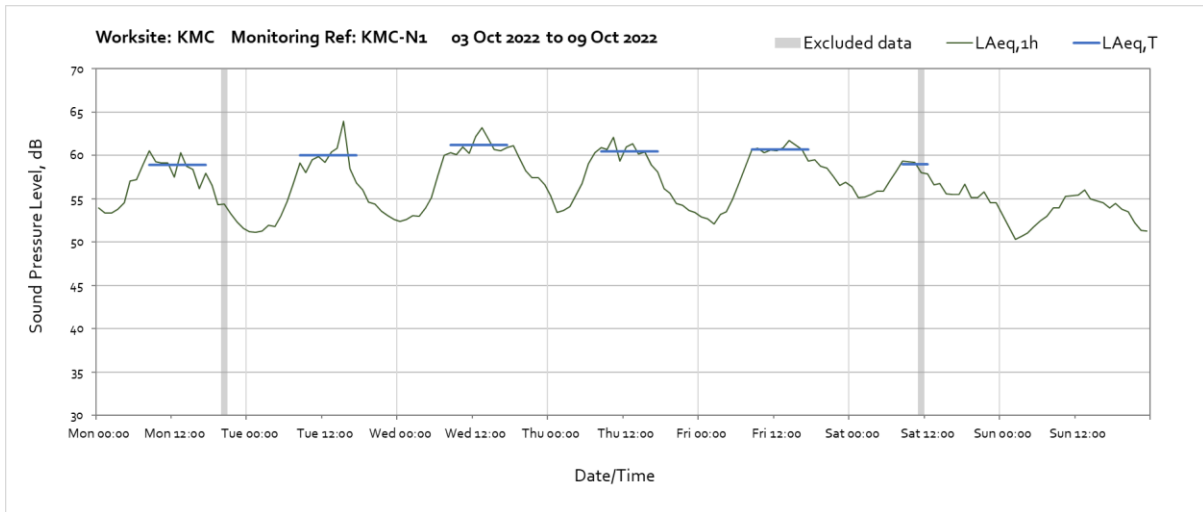
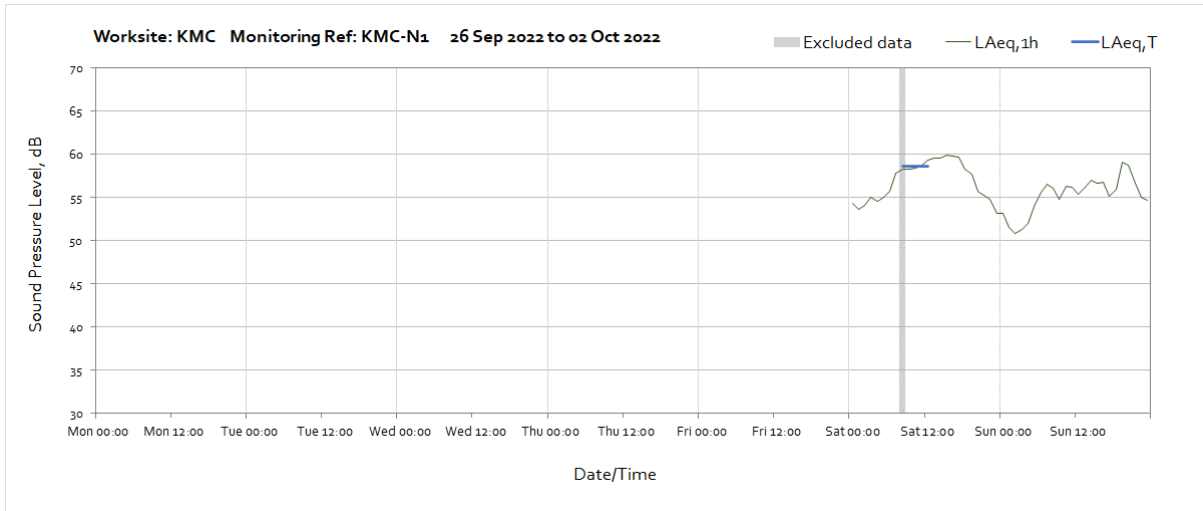
### Worksite: CLE – Monitoring Ref: CLE-N1

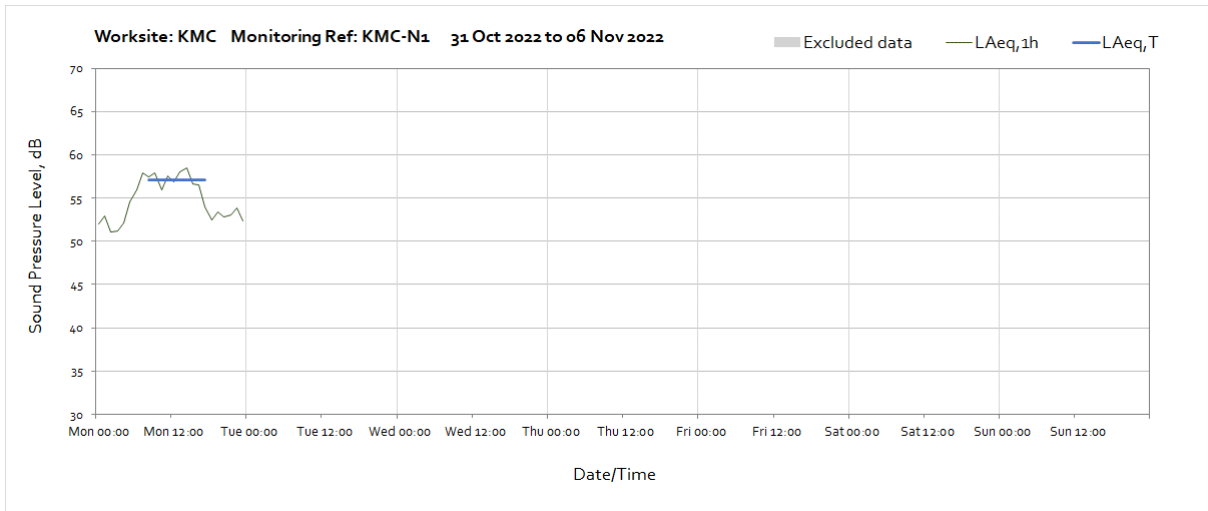
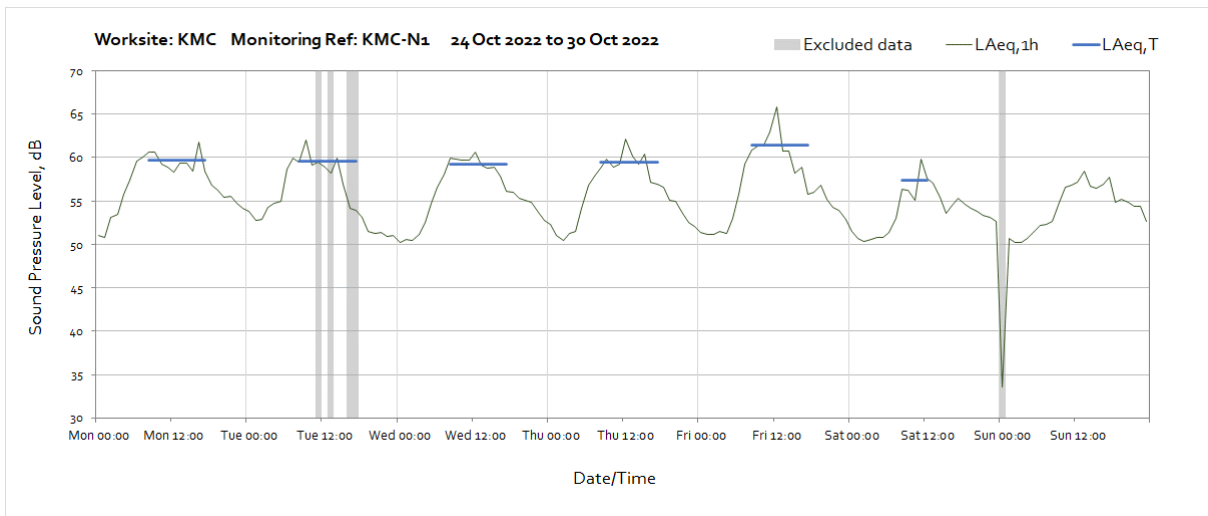
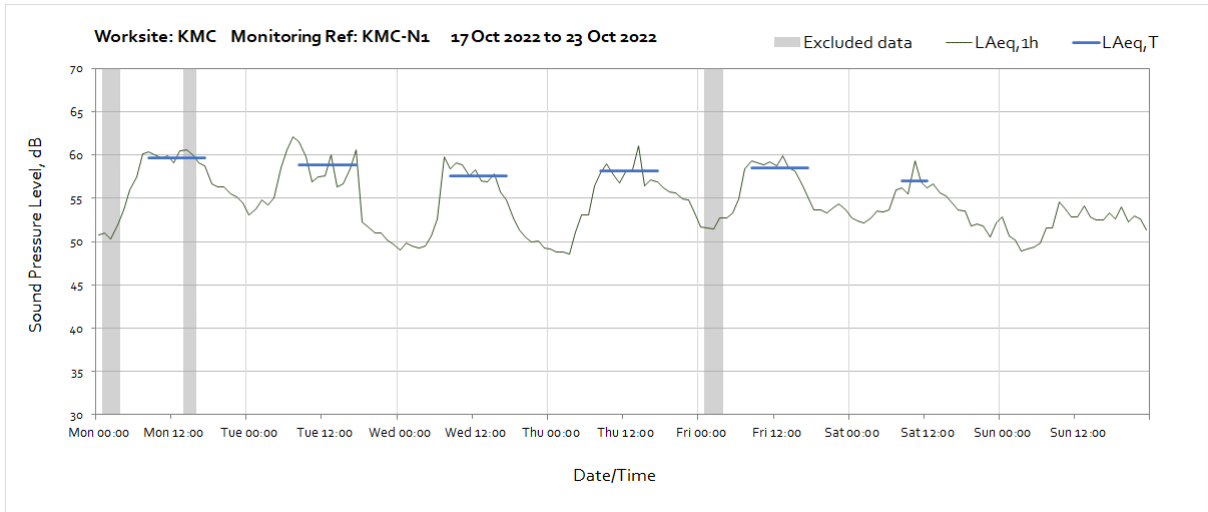


Note: Noise monitor installed at 15:00 on Tuesday 25<sup>th</sup> October 2022.

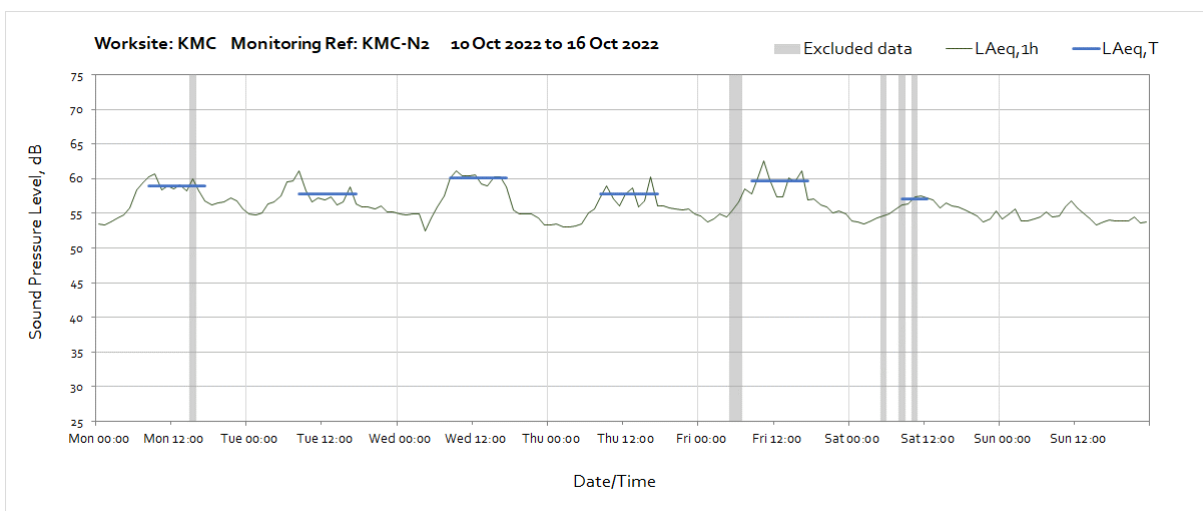
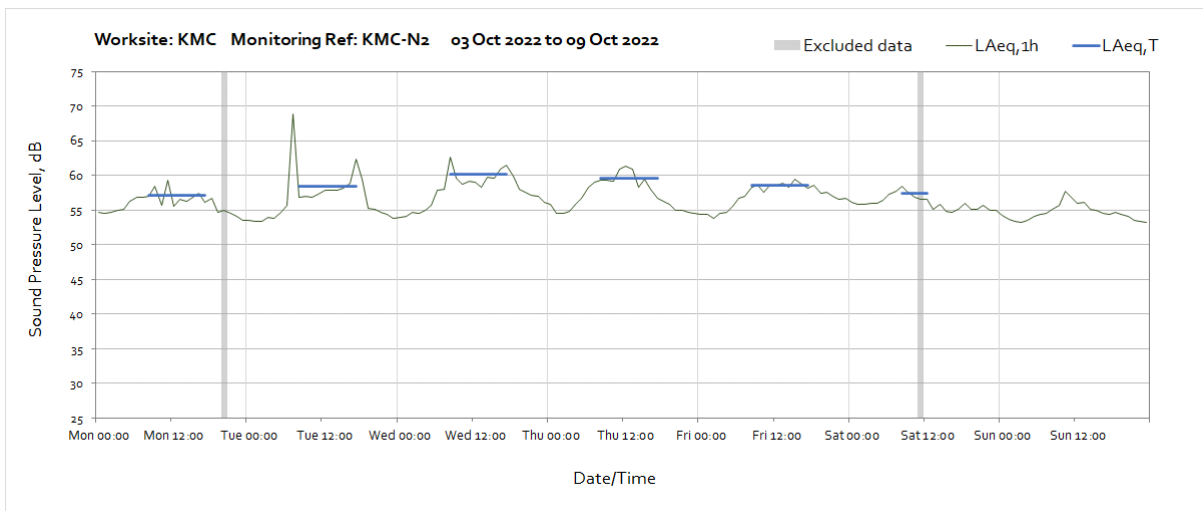
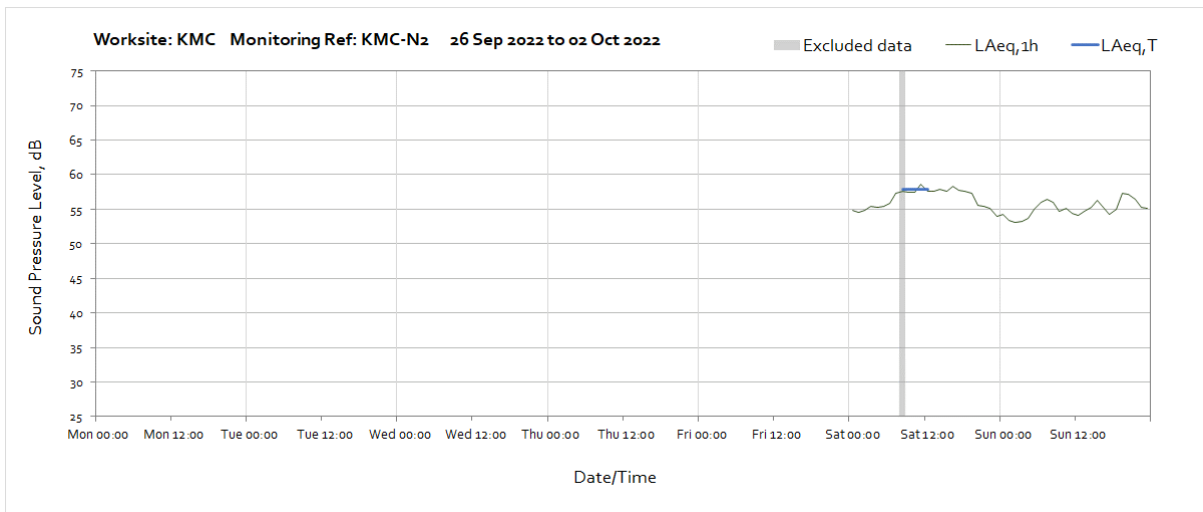


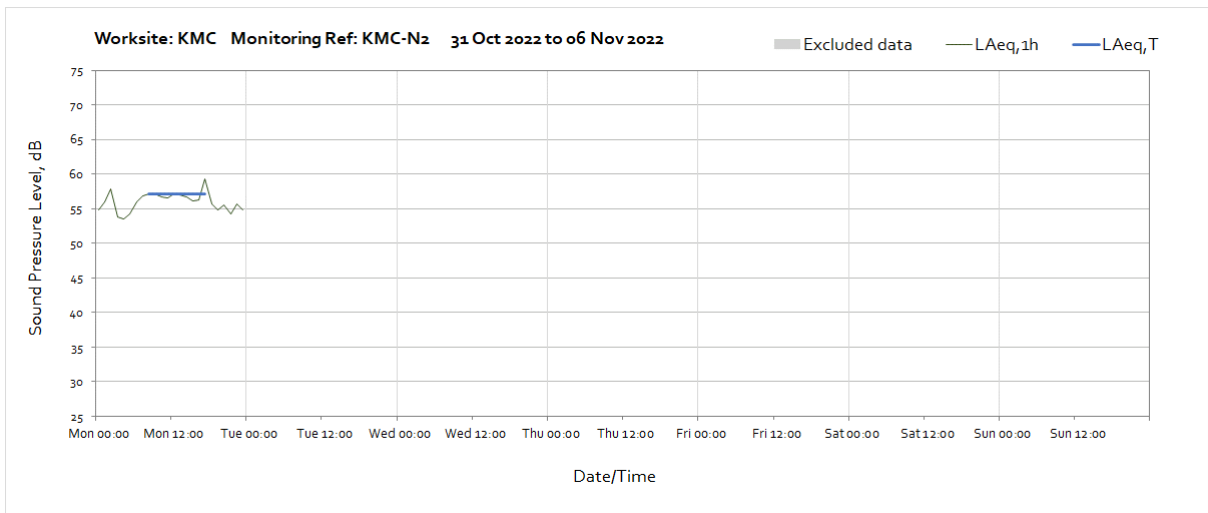
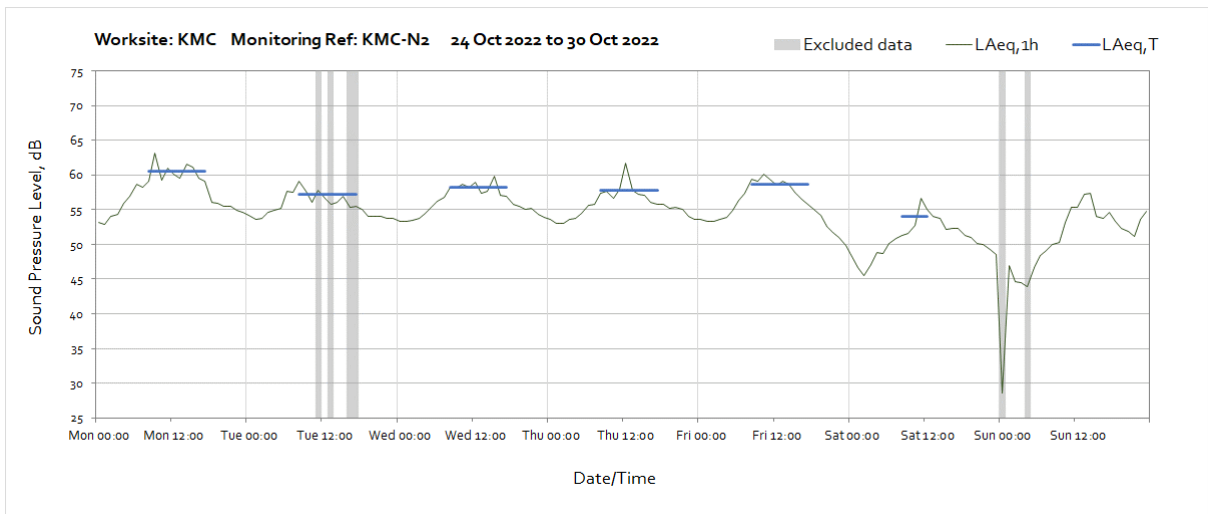
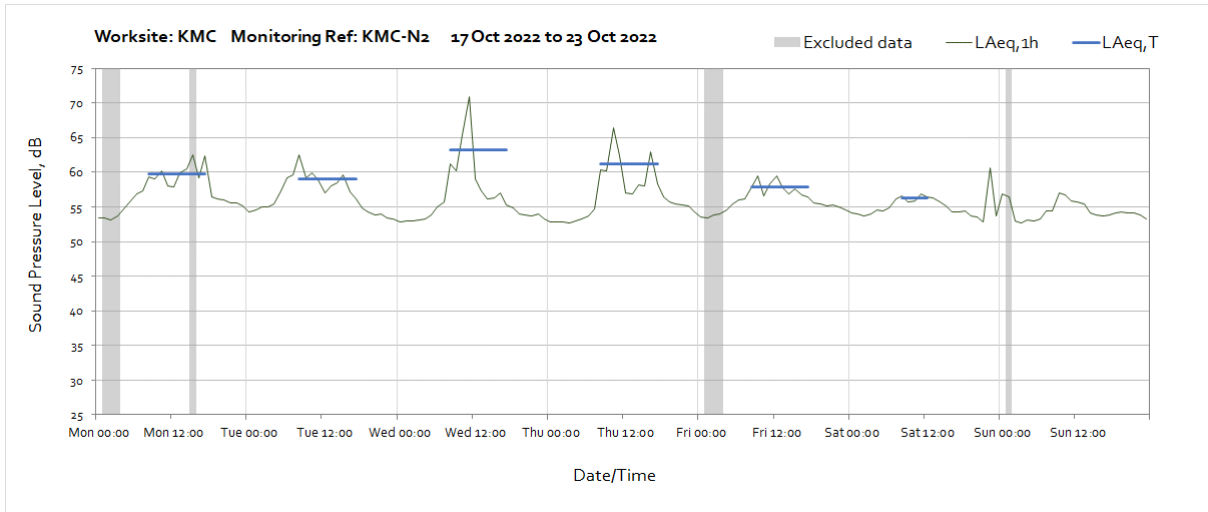
## Worksite: KMC – Monitoring Ref: KMC-N1



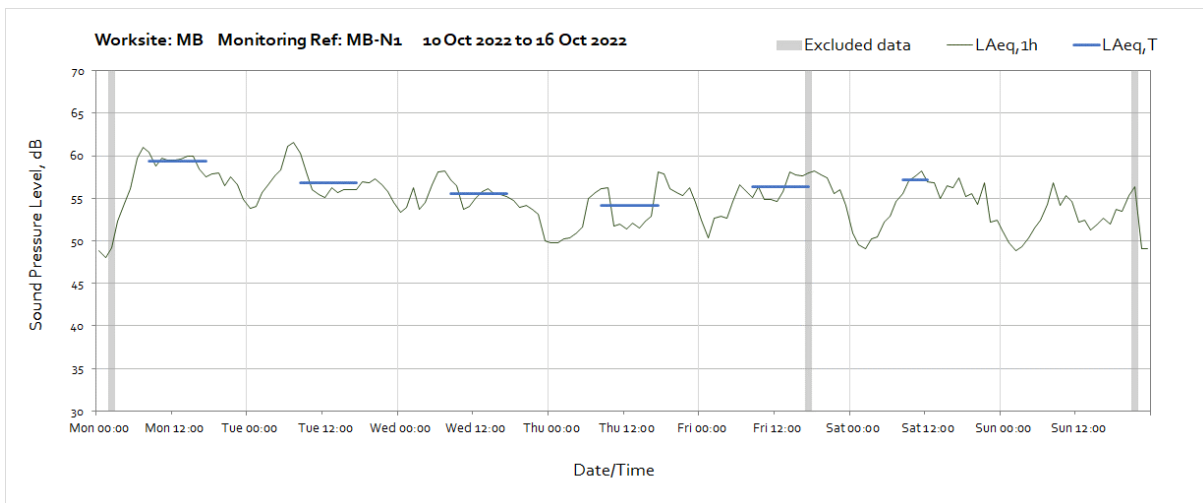
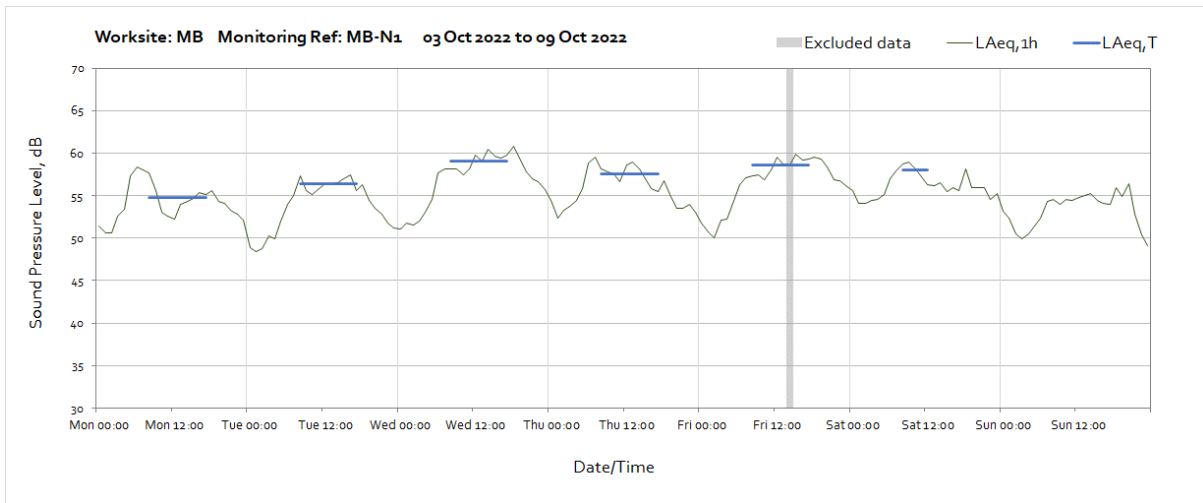
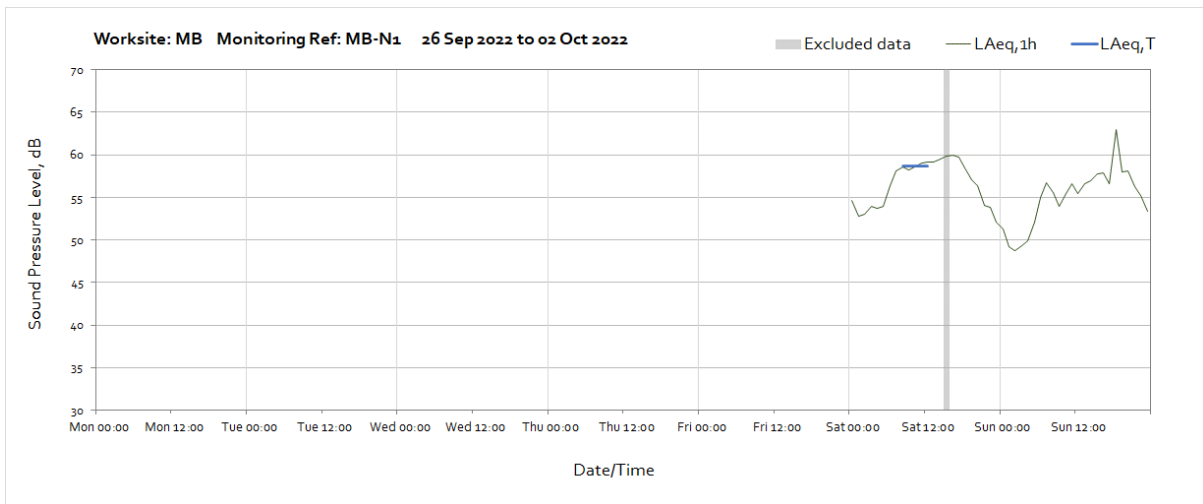


# Worksite: KMC – Monitoring Ref: KMC-N2

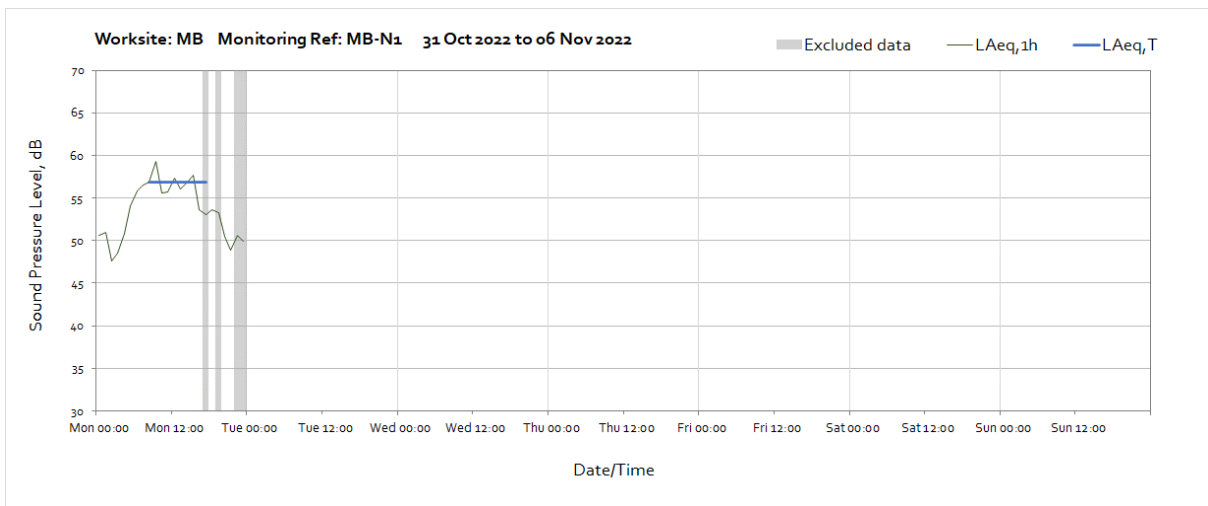
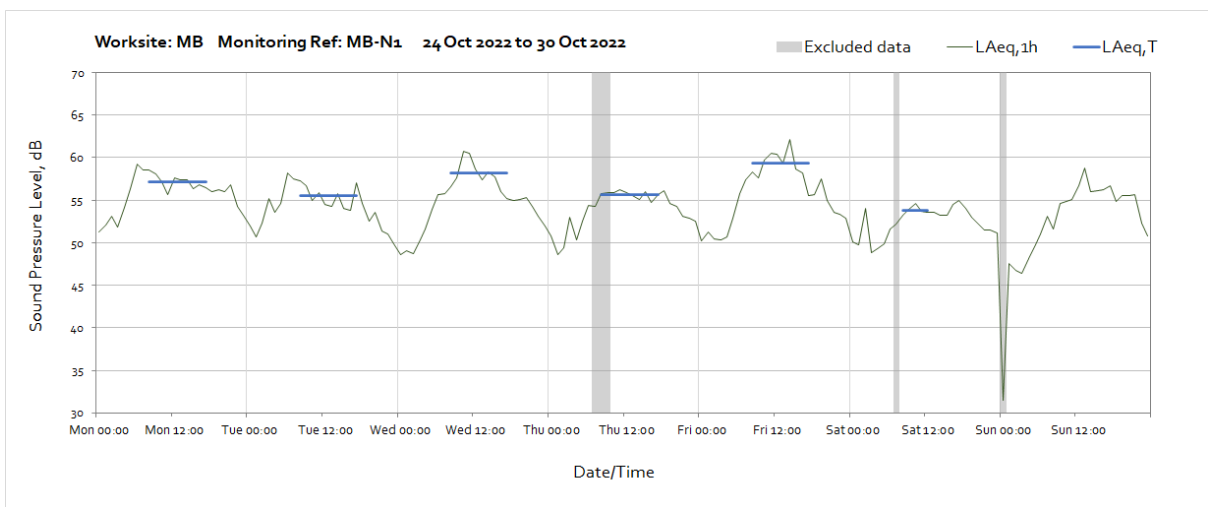
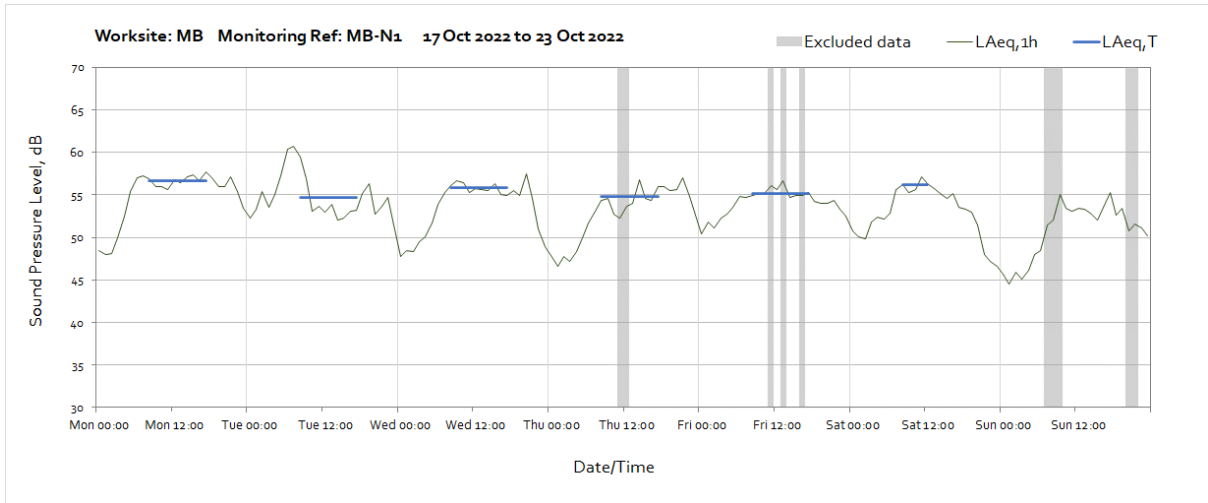




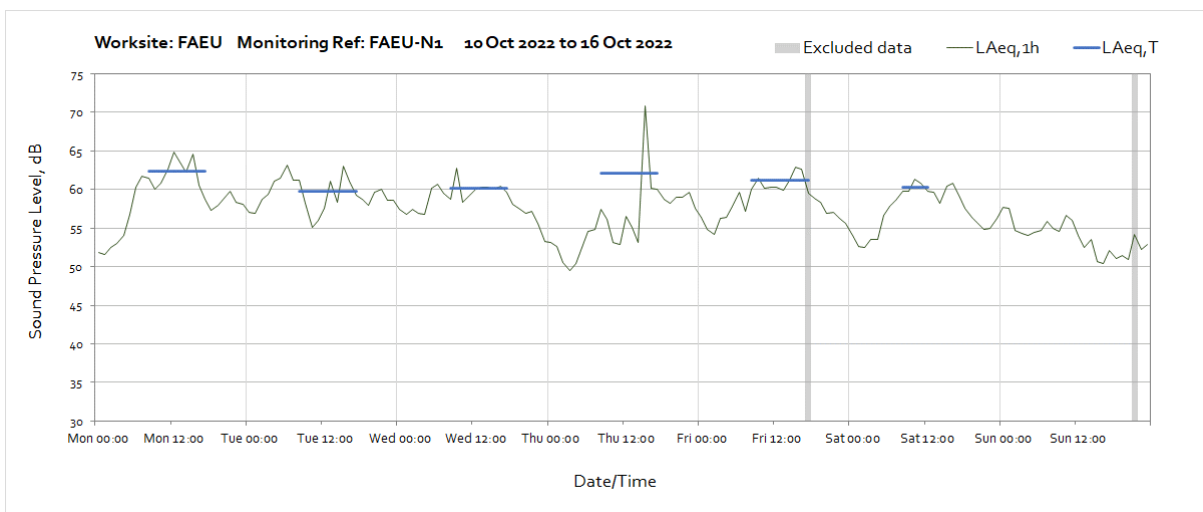
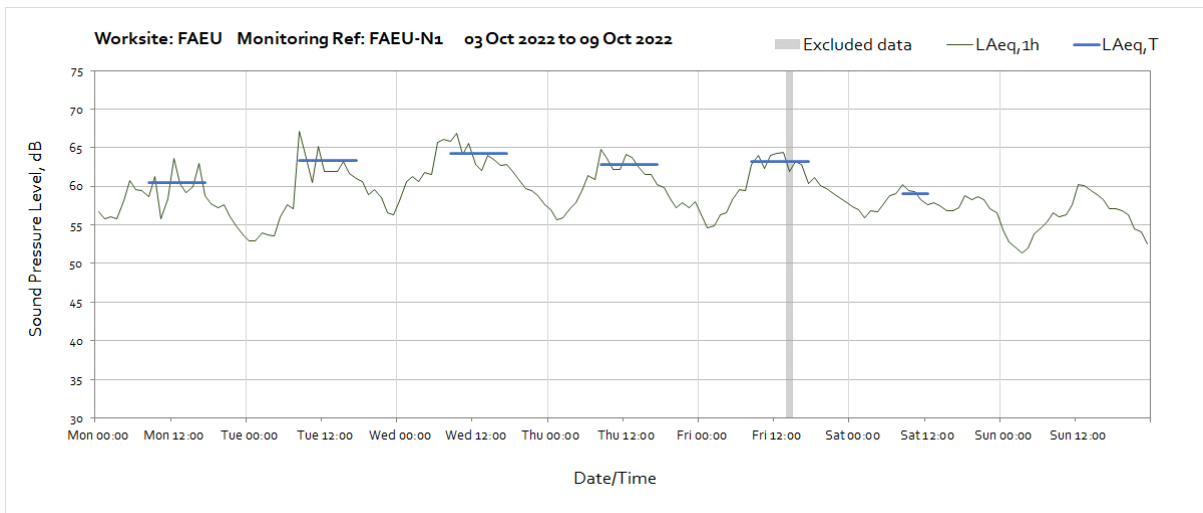
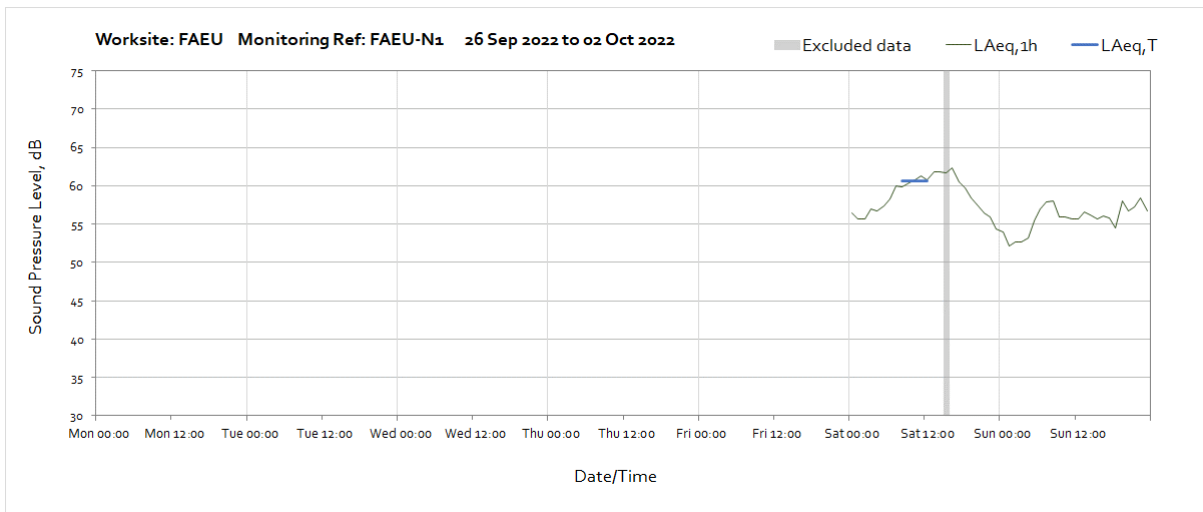
## Worksite: MB – Monitoring Ref: MB-N1

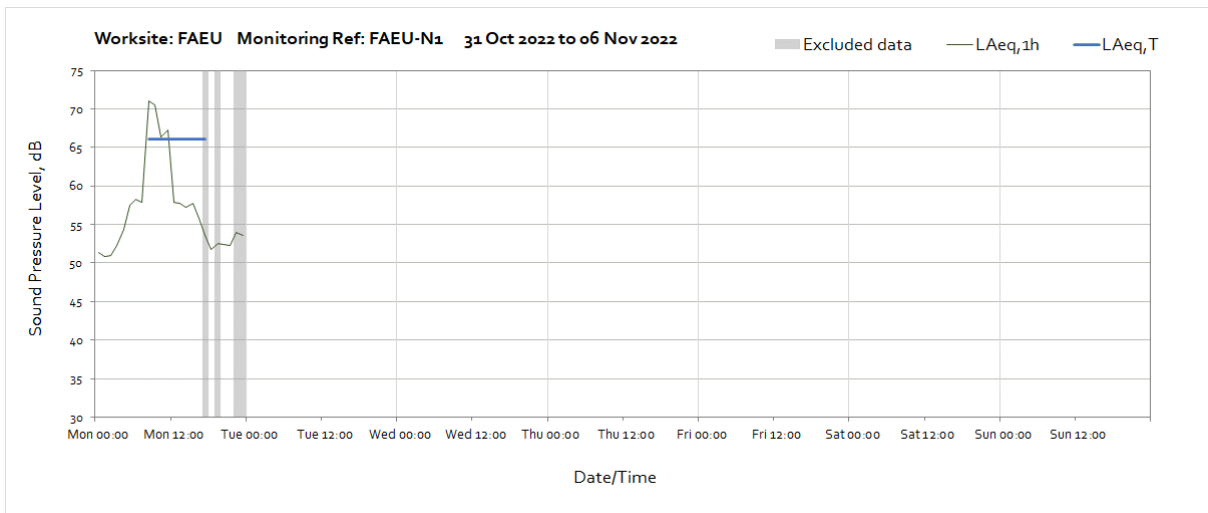
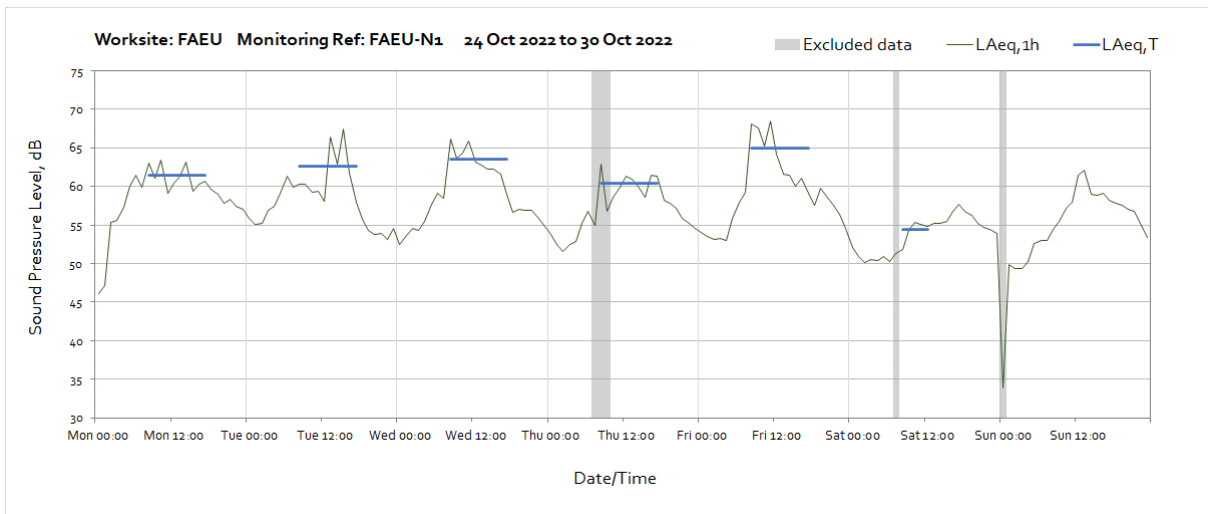
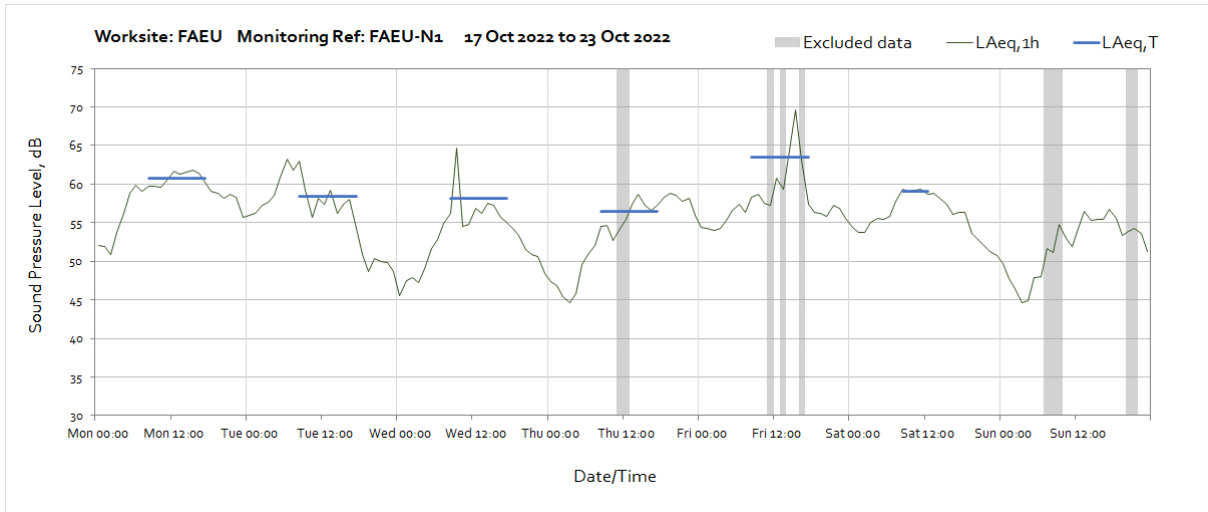




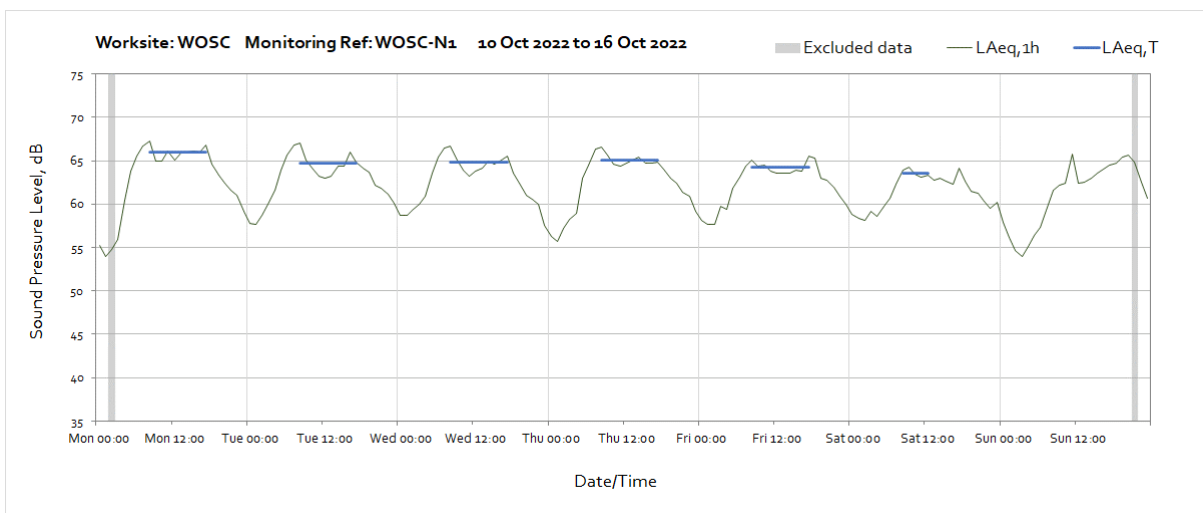
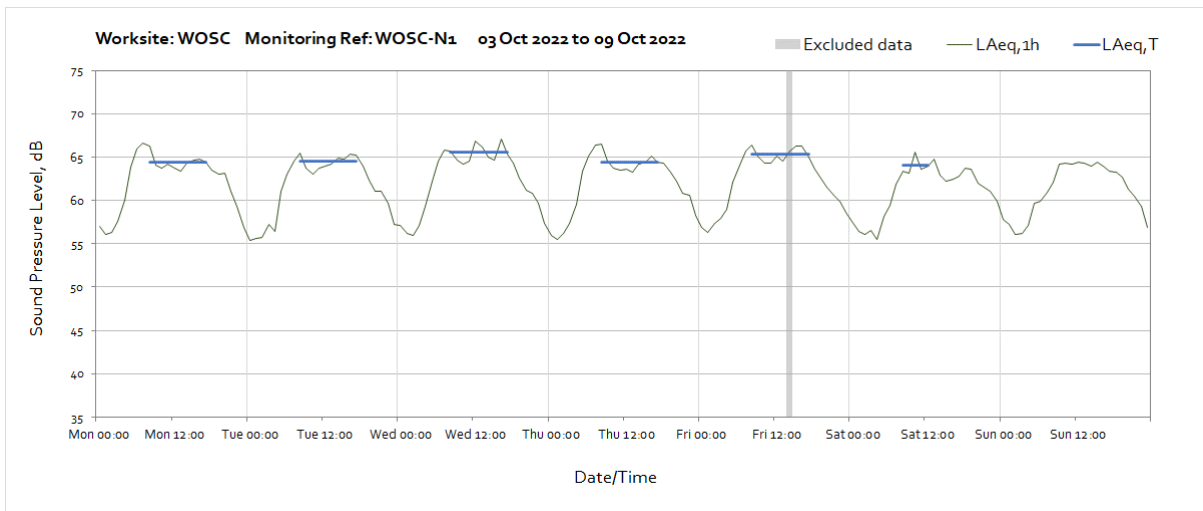
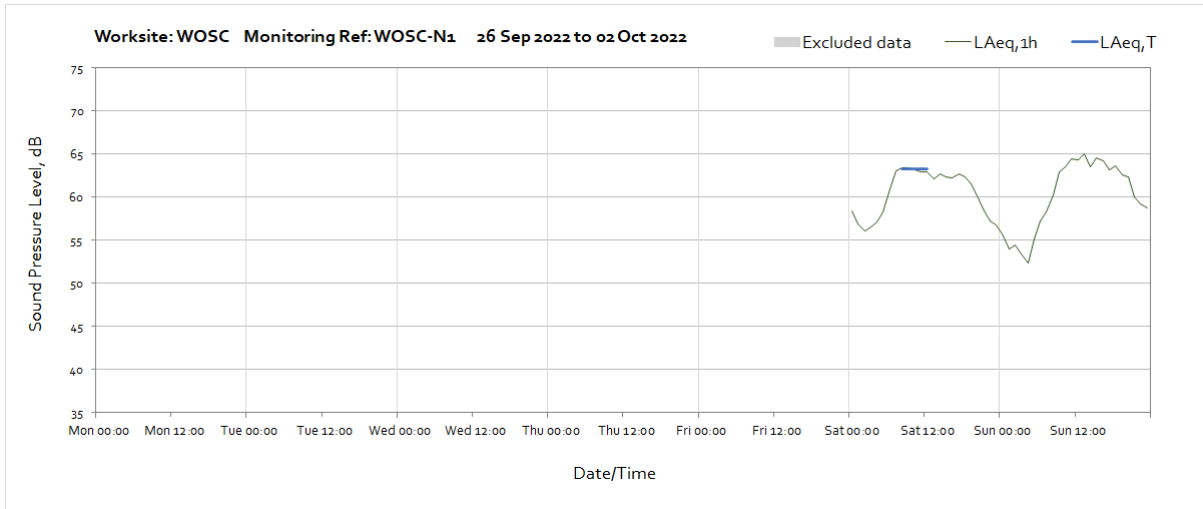


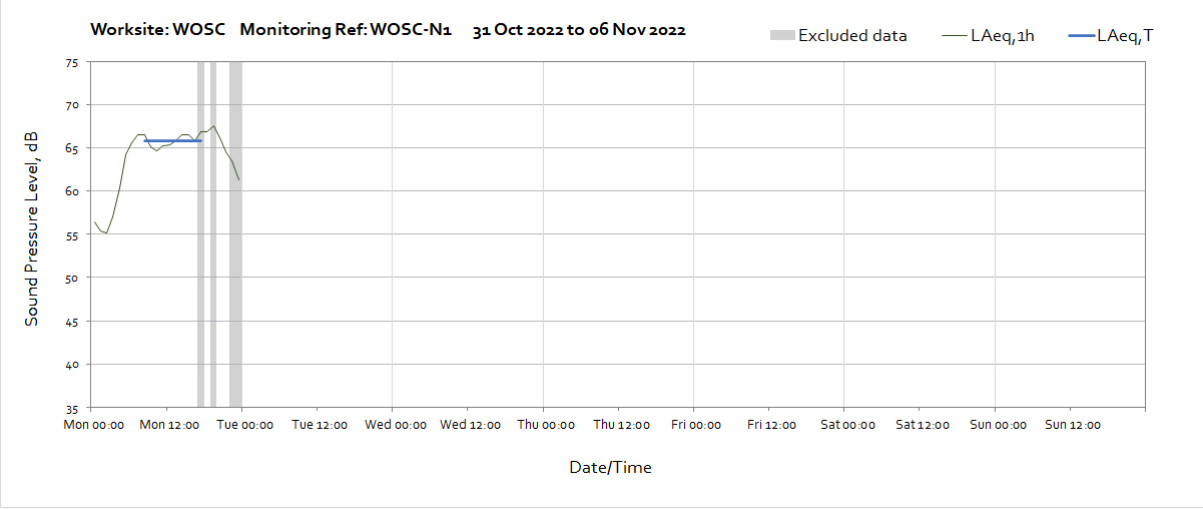
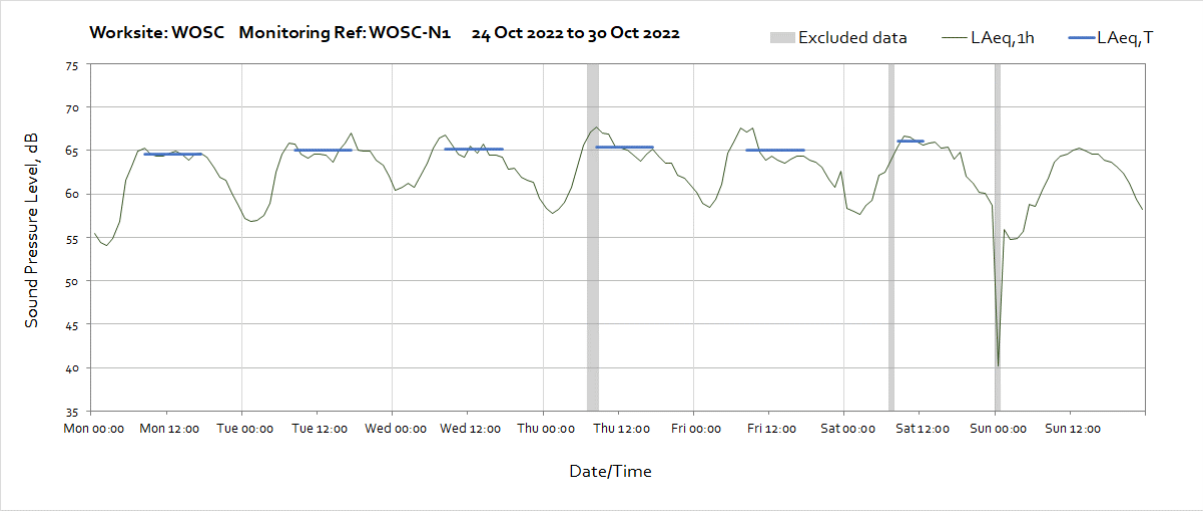
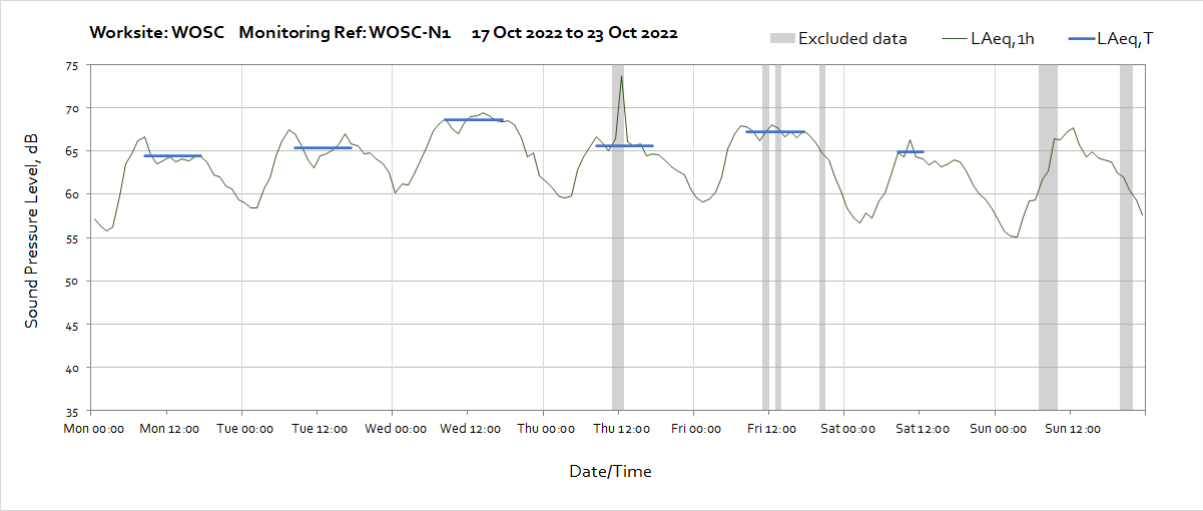
## Worksite: FAEU – Monitoring Ref: FAEU-N1



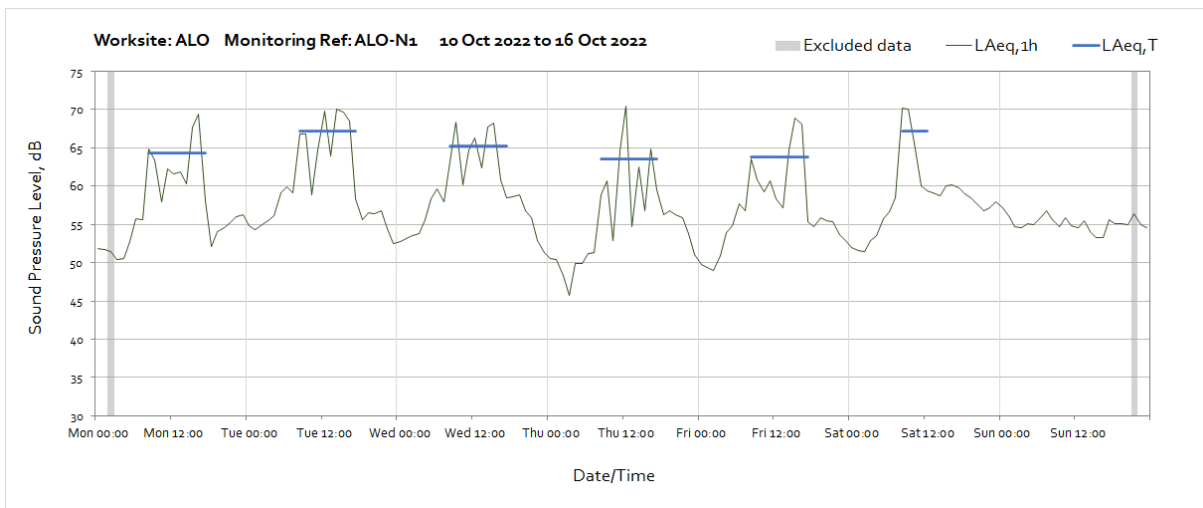
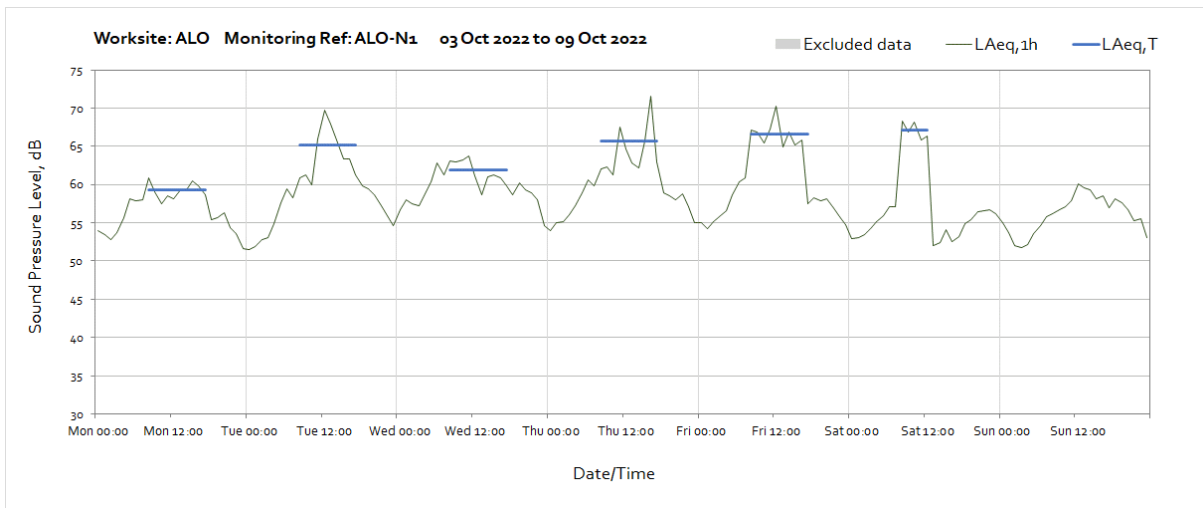
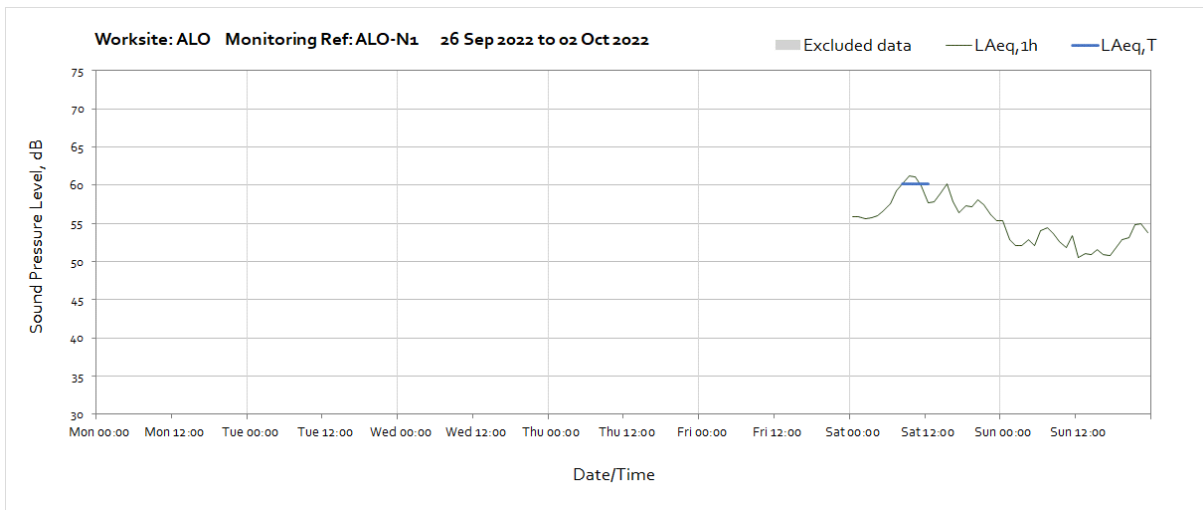


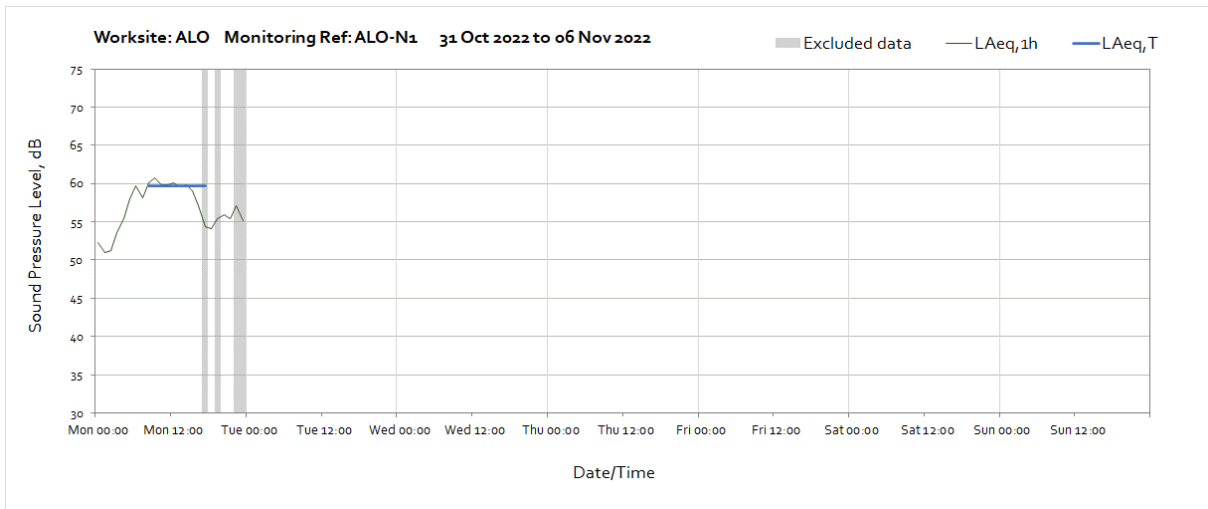
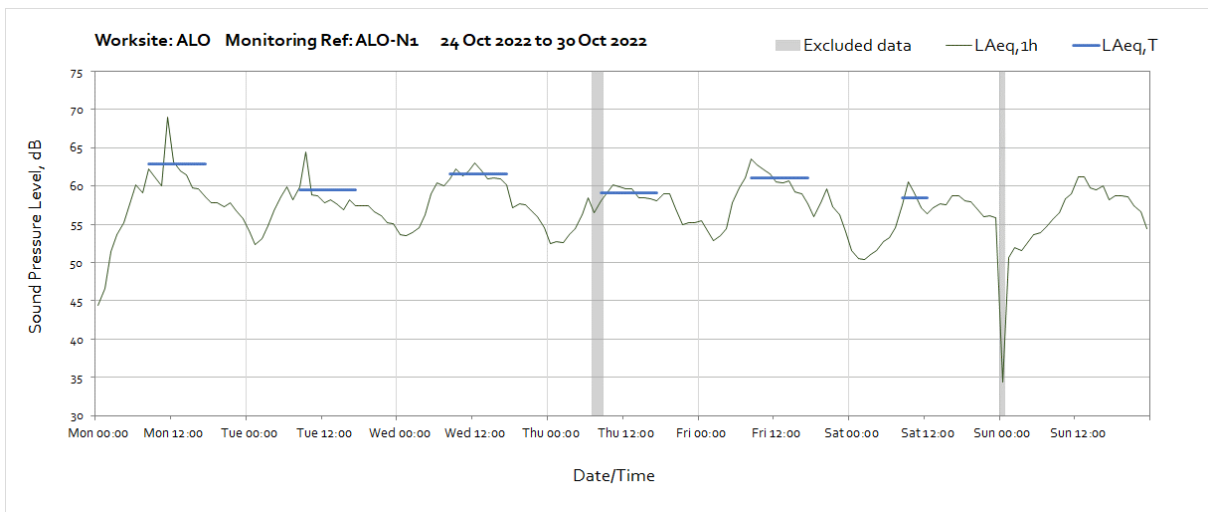
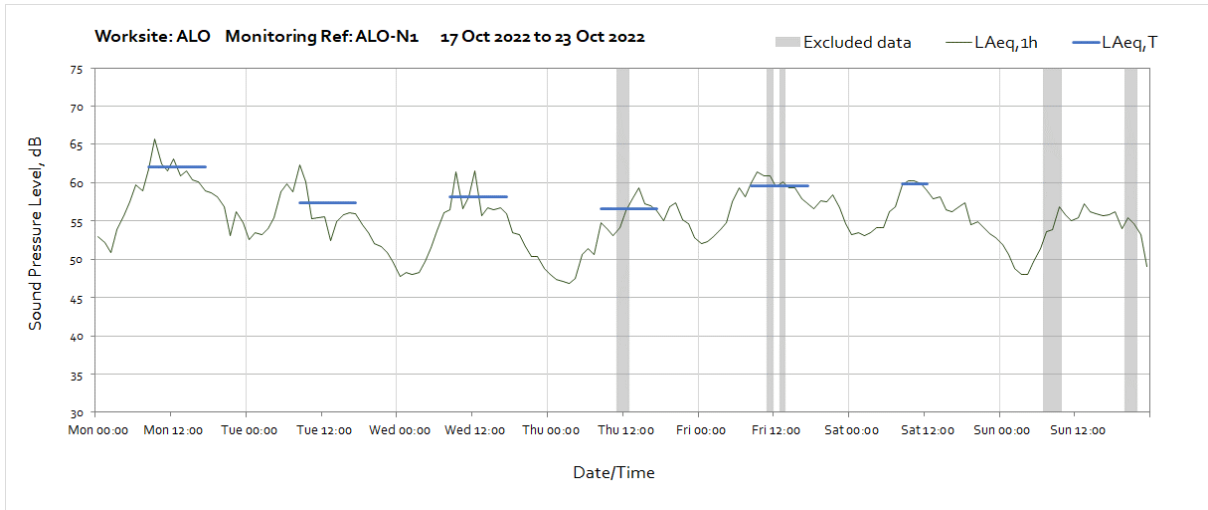
# Worksite: WOSC – Monitoring Ref: WOSC-N1





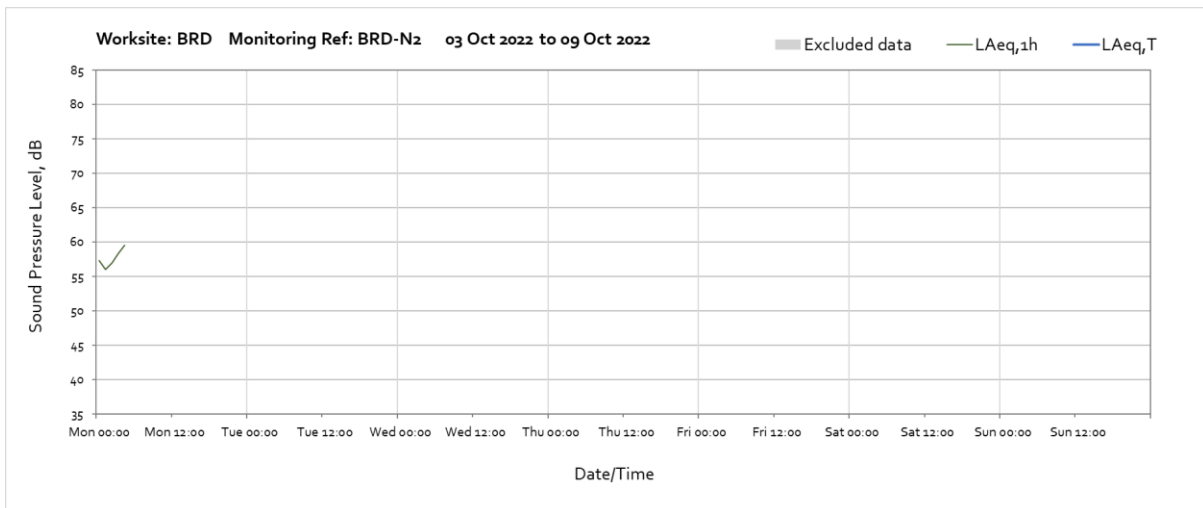
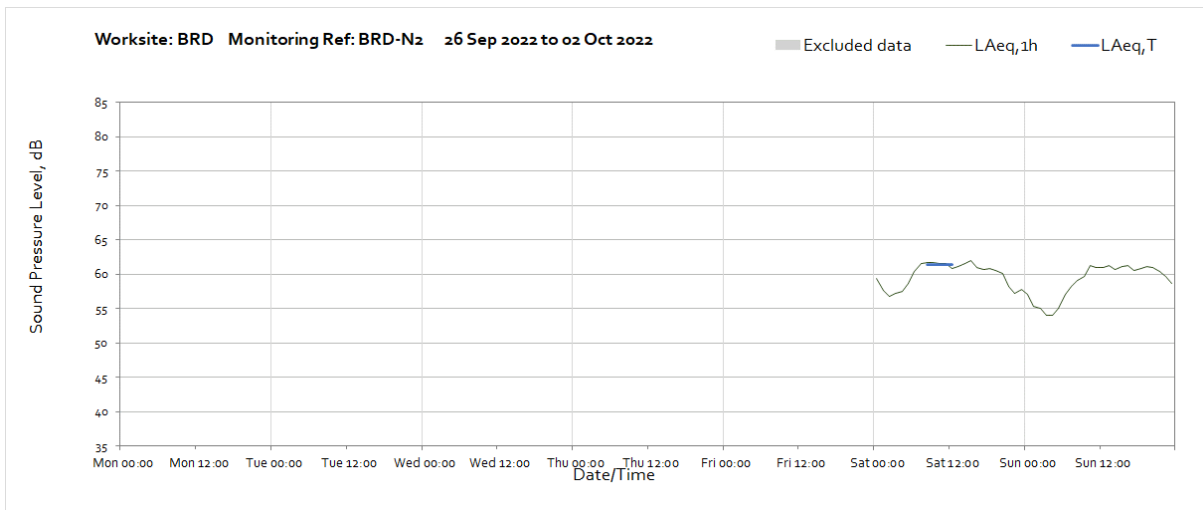
## Worksite: ALO – Monitoring Ref: ALO-N1



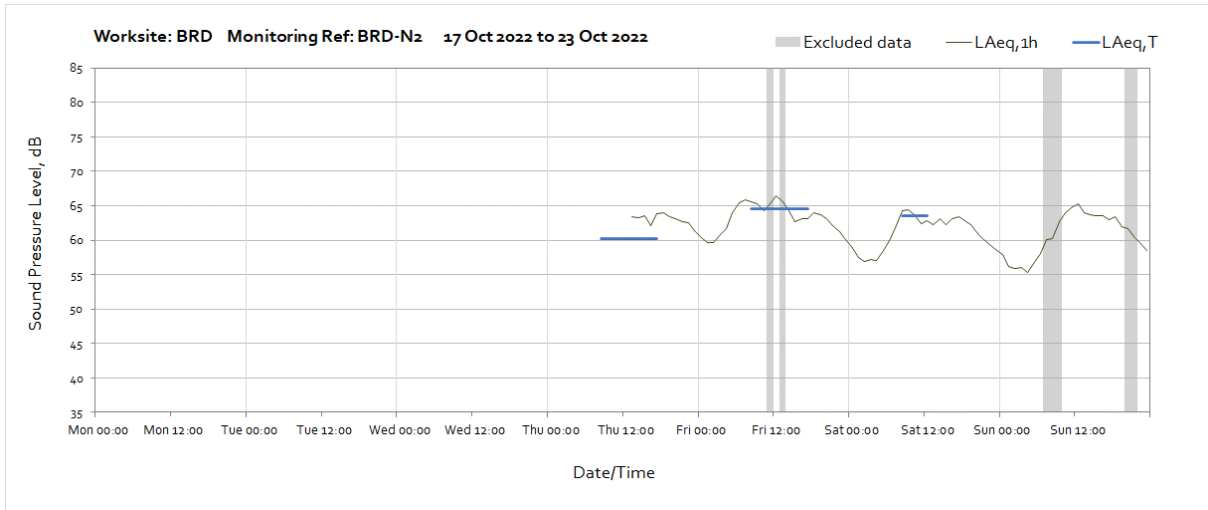




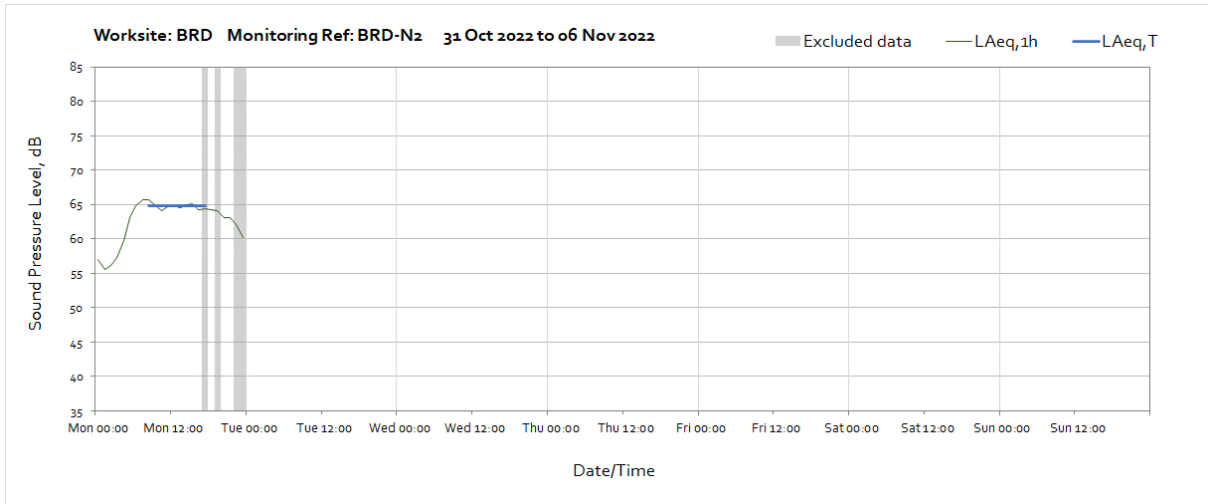
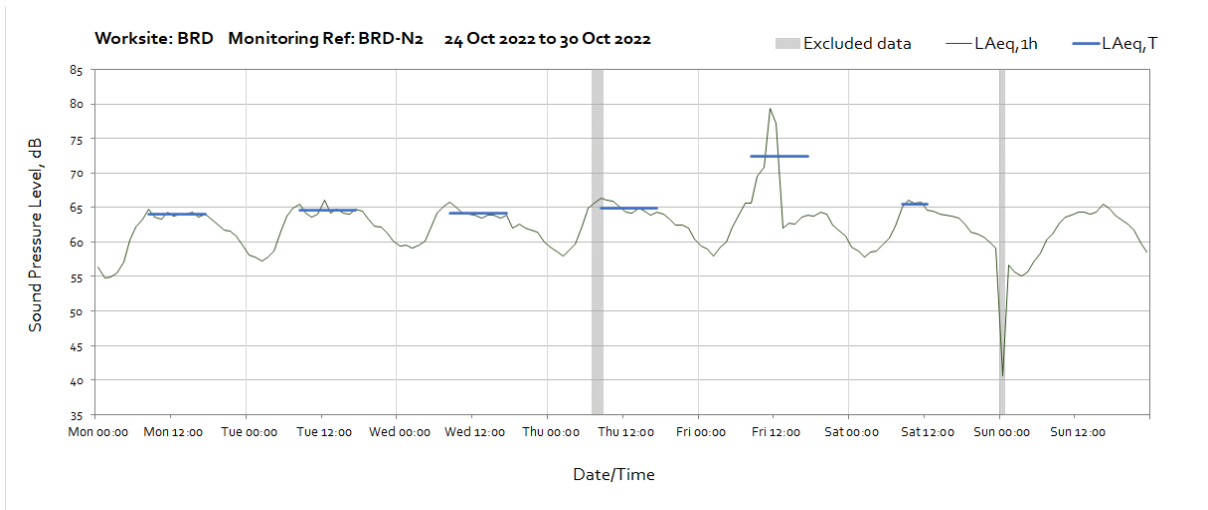
## Worksite: BRD - Monitoring Ref: BRD-N2



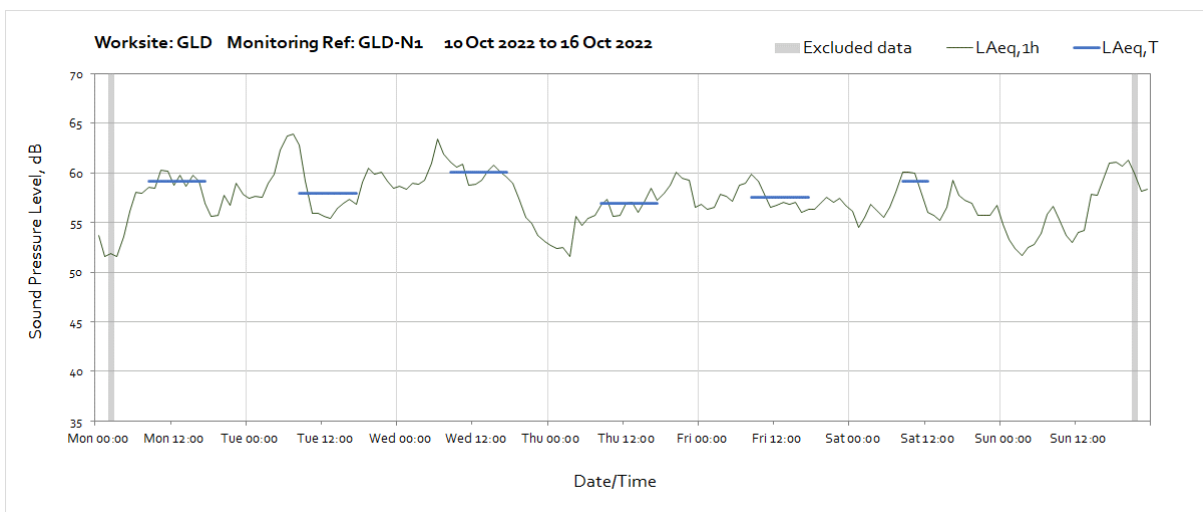
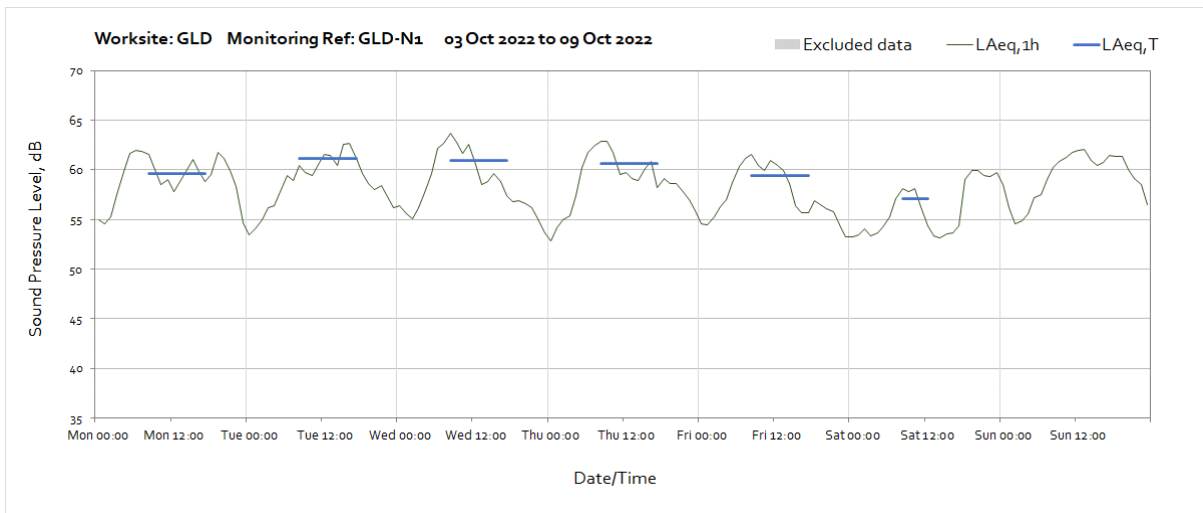
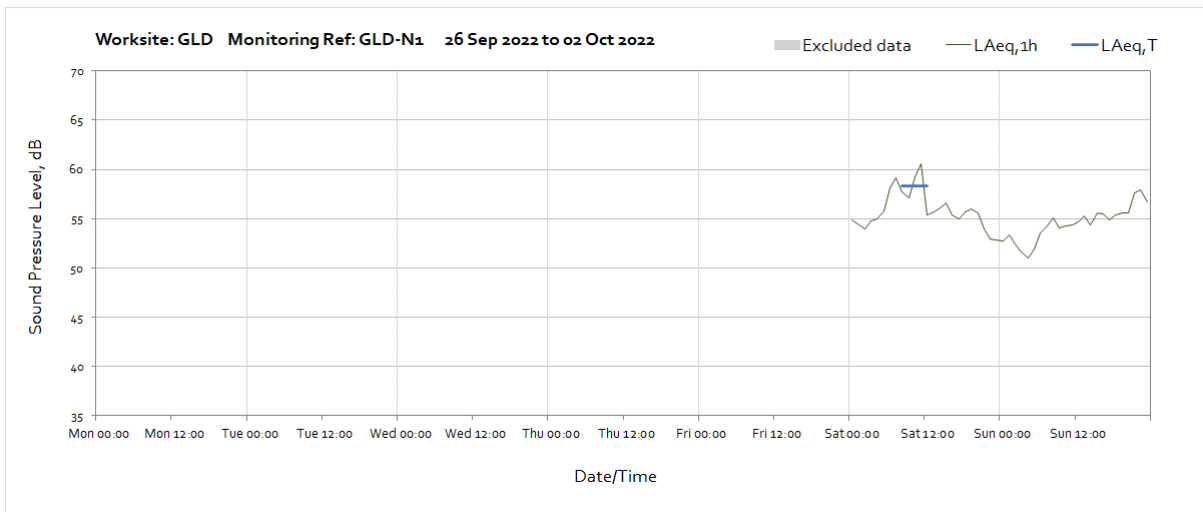
Note: Missing data between 05:00 on Monday 3<sup>rd</sup> October and 12:00 on Thursday 20<sup>th</sup> October due to loss of power to battery.

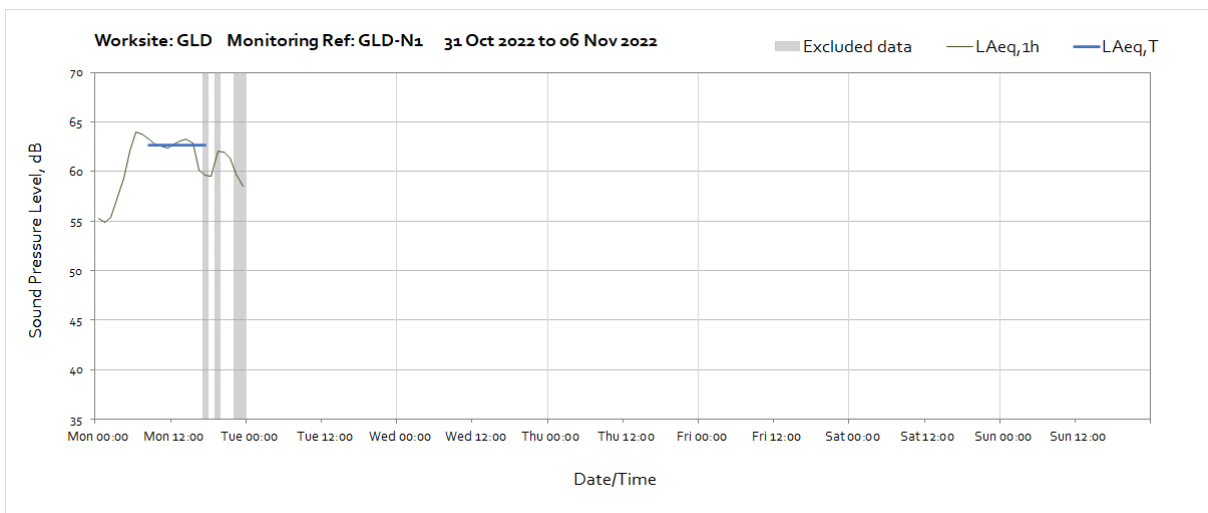
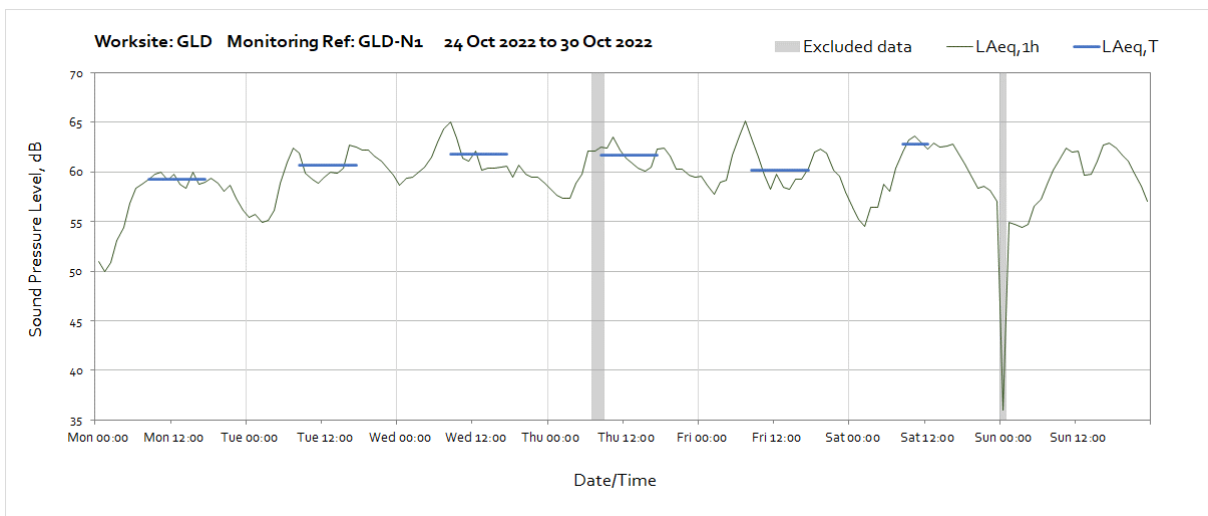
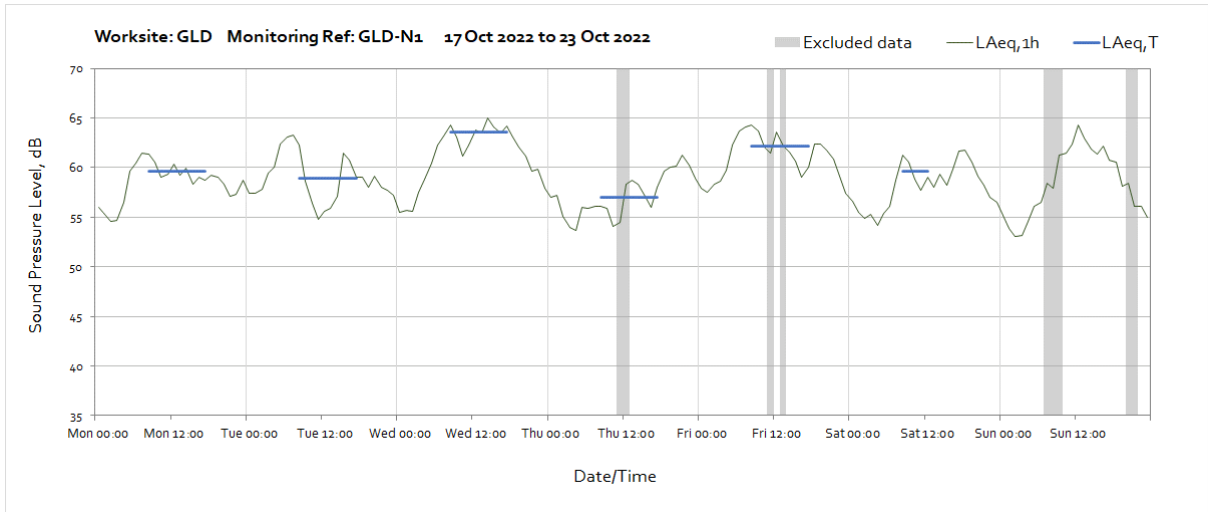


Note: Missing data between 05:00 on Monday 3<sup>rd</sup> October and 12:00 on Thursday 20<sup>th</sup> October due to loss of power to battery.



## Worksite: GLD - Monitoring Ref: GLD-N1

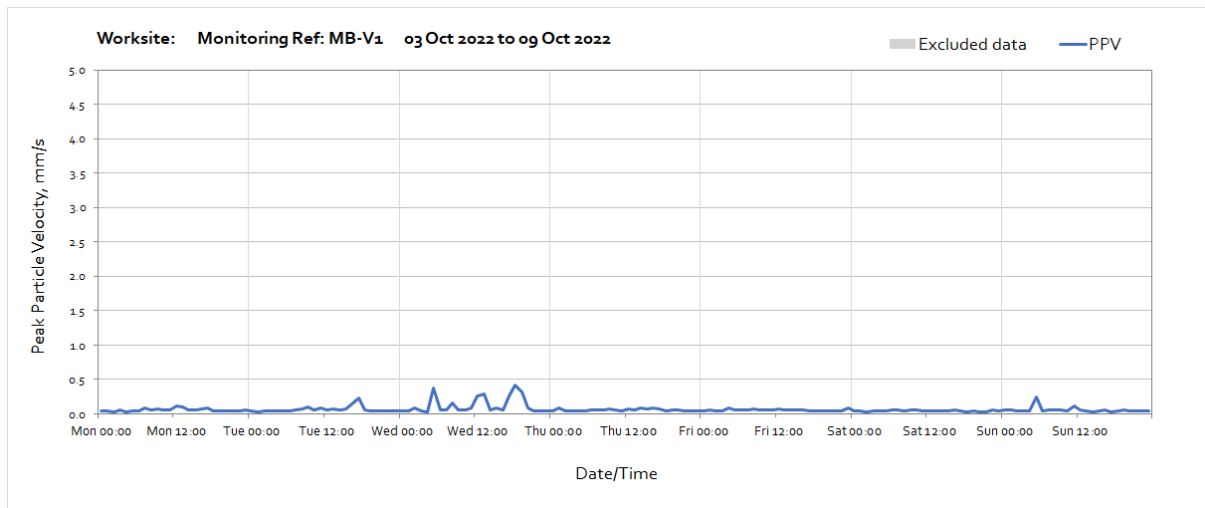
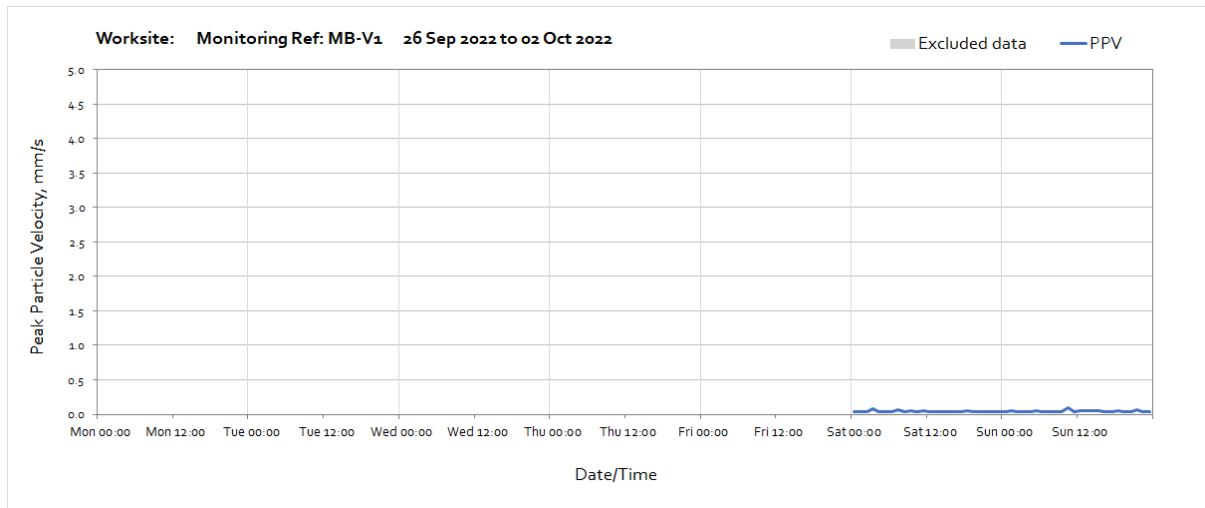


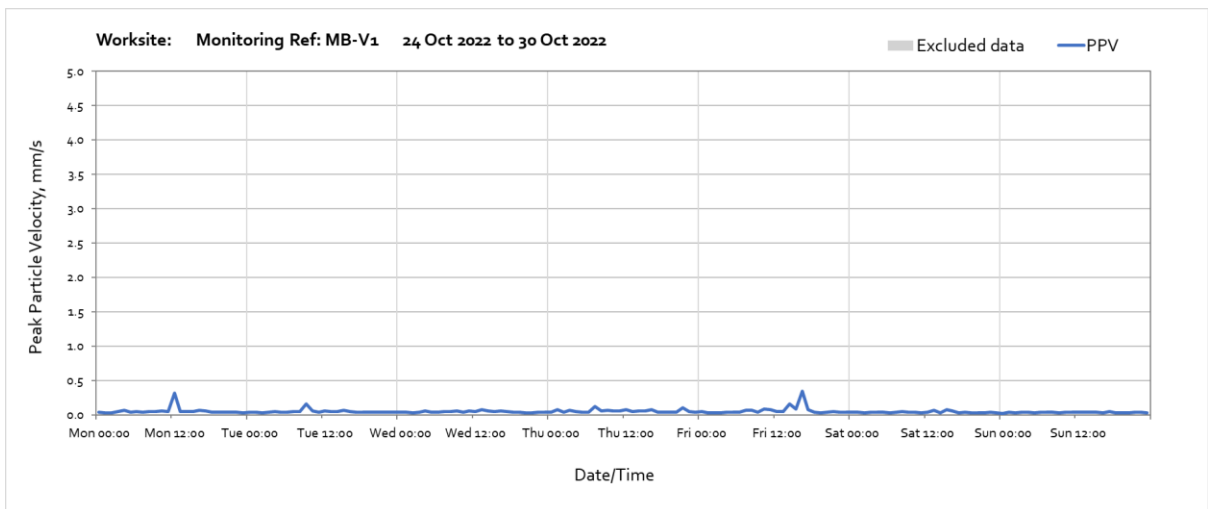
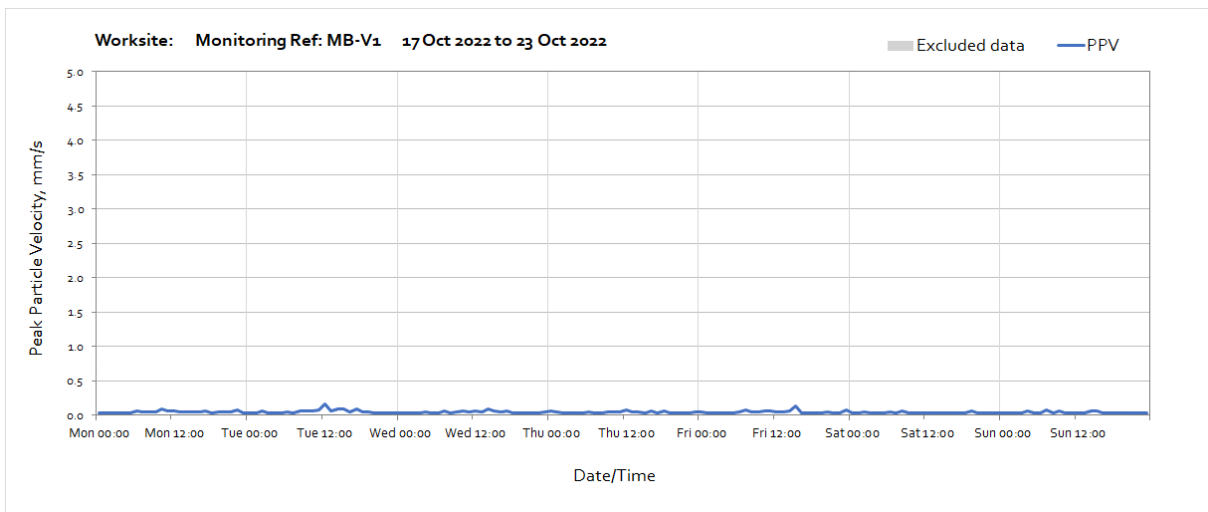
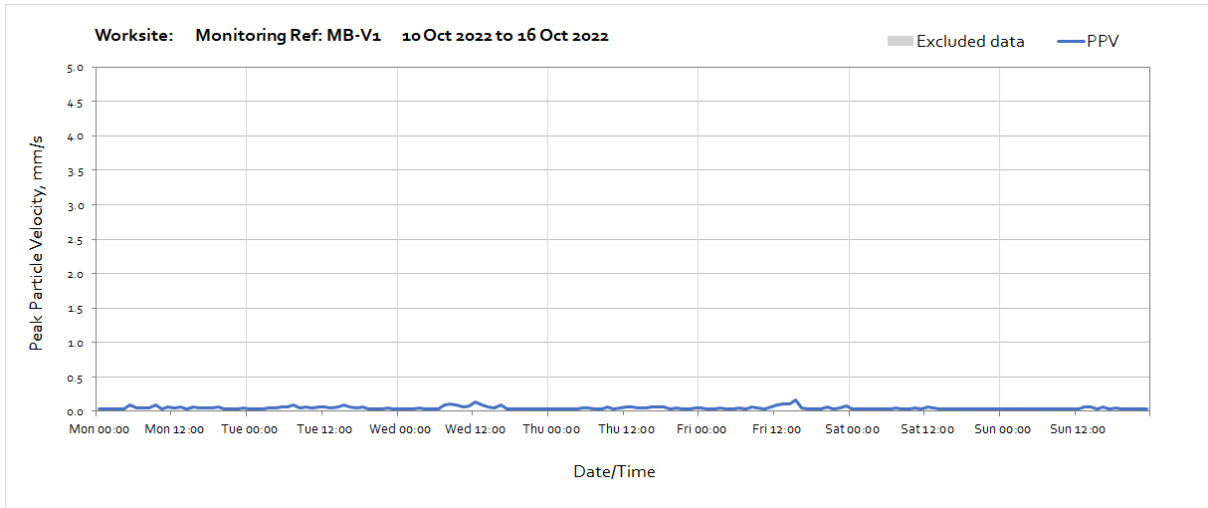


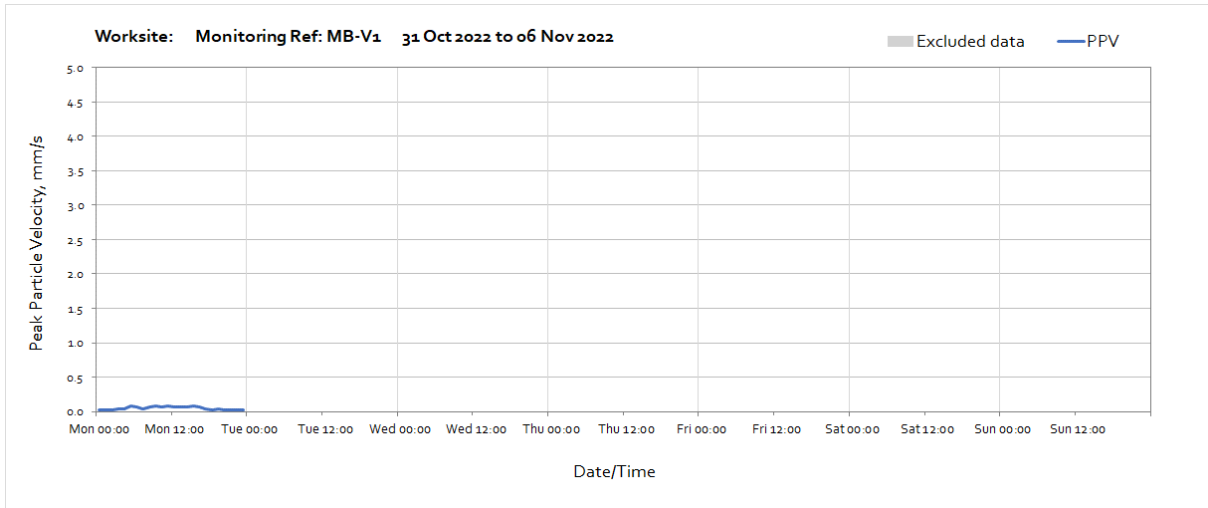
## Vibration

The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the highest PPV of the three orthogonal axes x, y and z. Where high values of PPV were caused by local interference with the vibration monitor, which are not representative of HS2 construction works, these values have been greyed out in the following charts and have been excluded to calculate values in Table 4 of the main report.

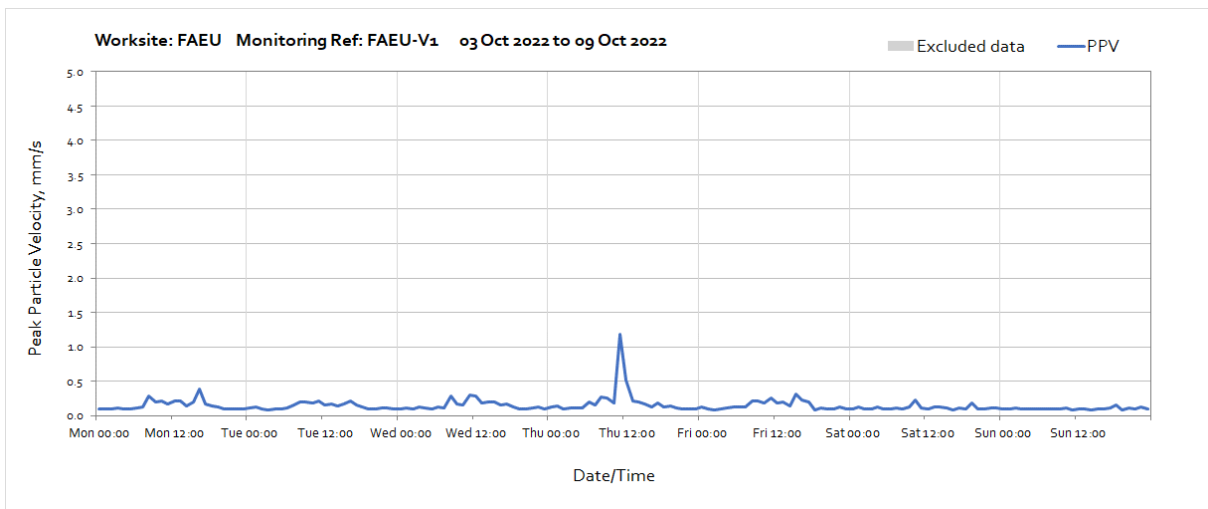
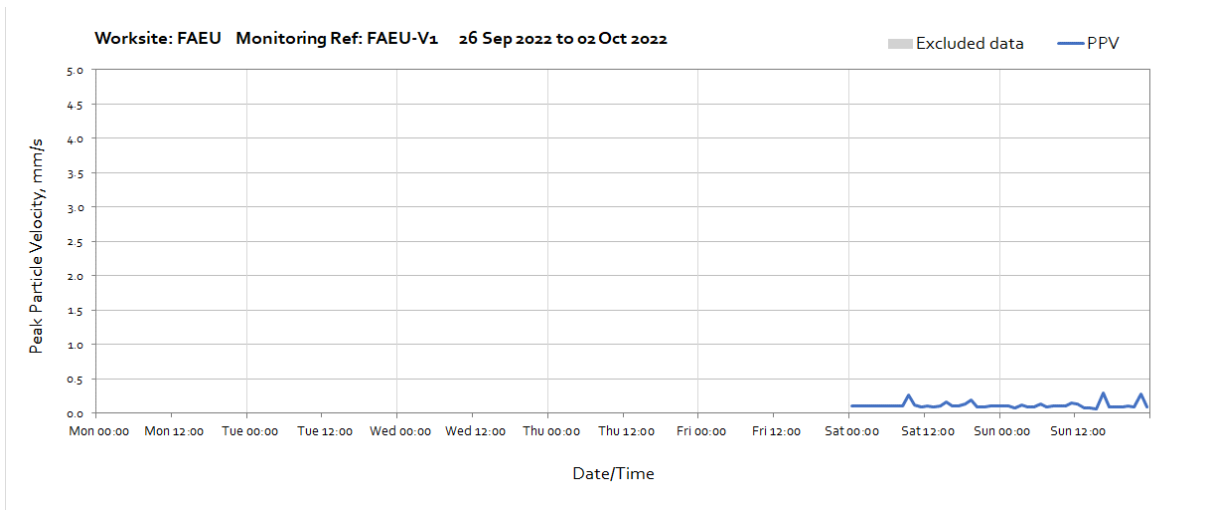
### Worksite: MB - Monitoring Ref: MB-V1

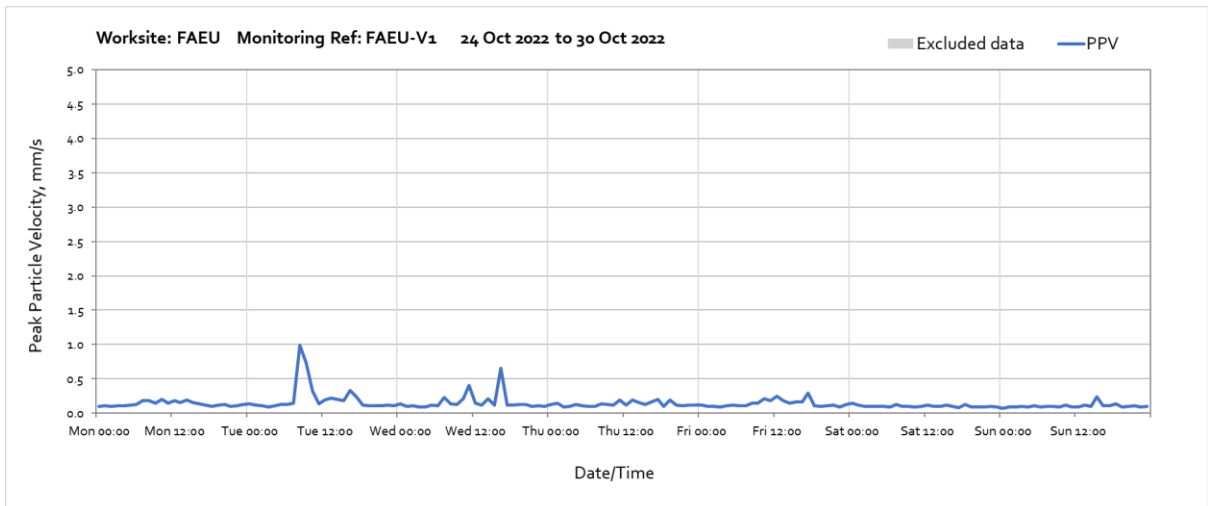
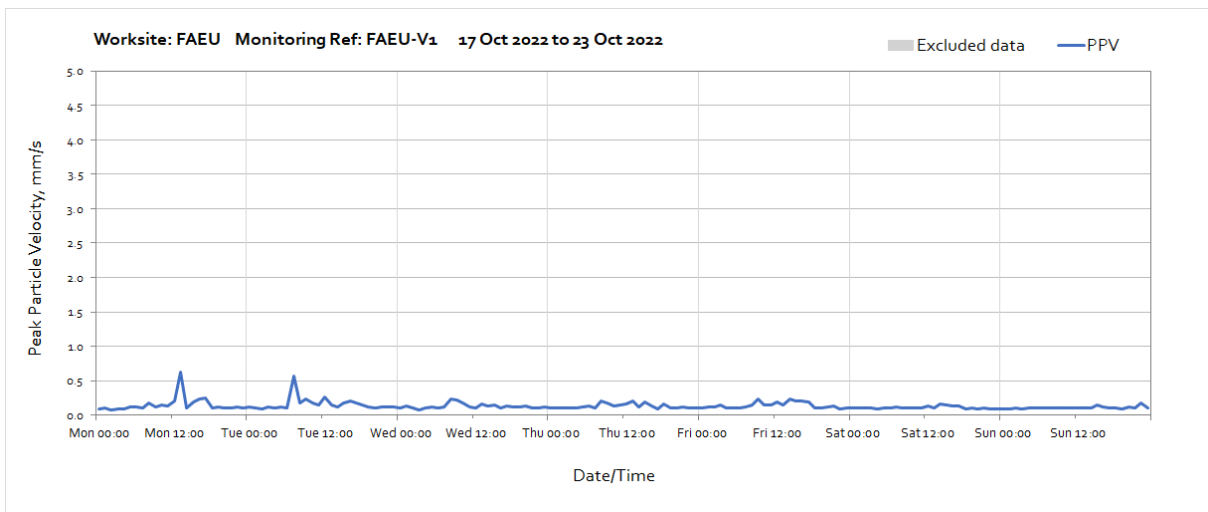
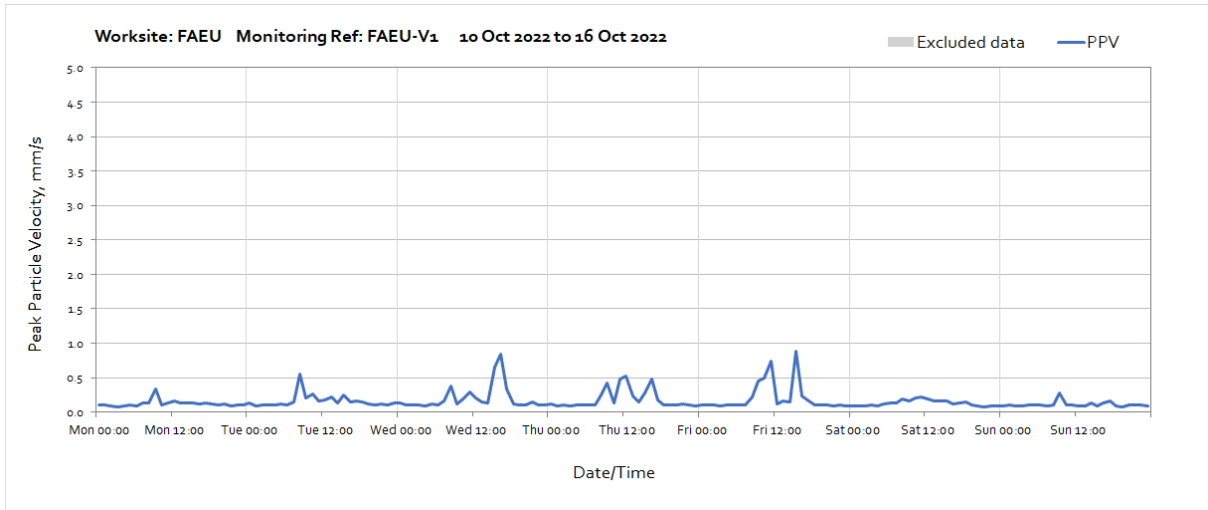




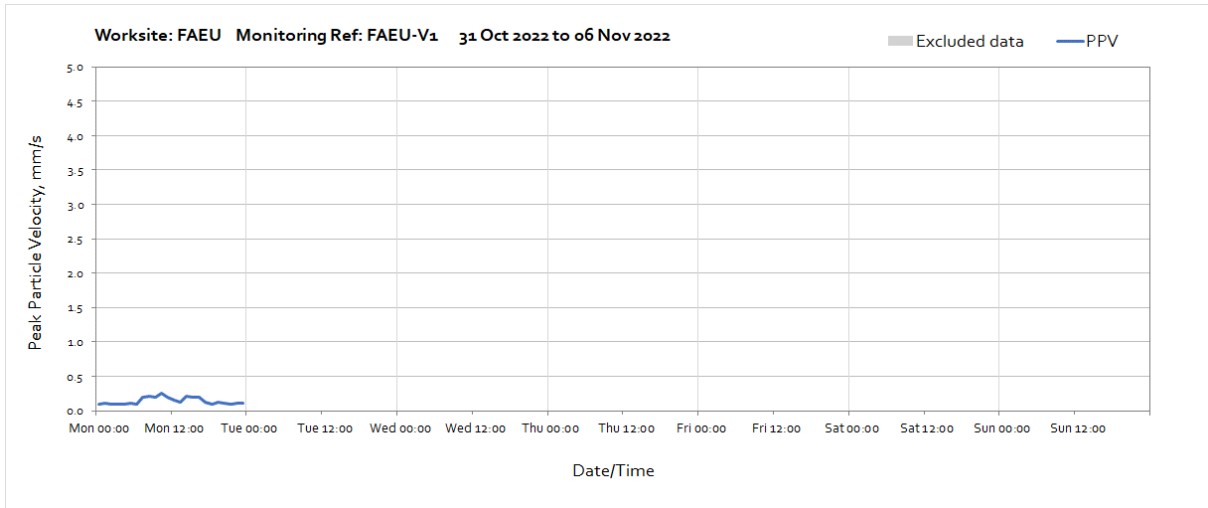


**Worksite: FAEU – Monitoring Ref: FAEU-V1**

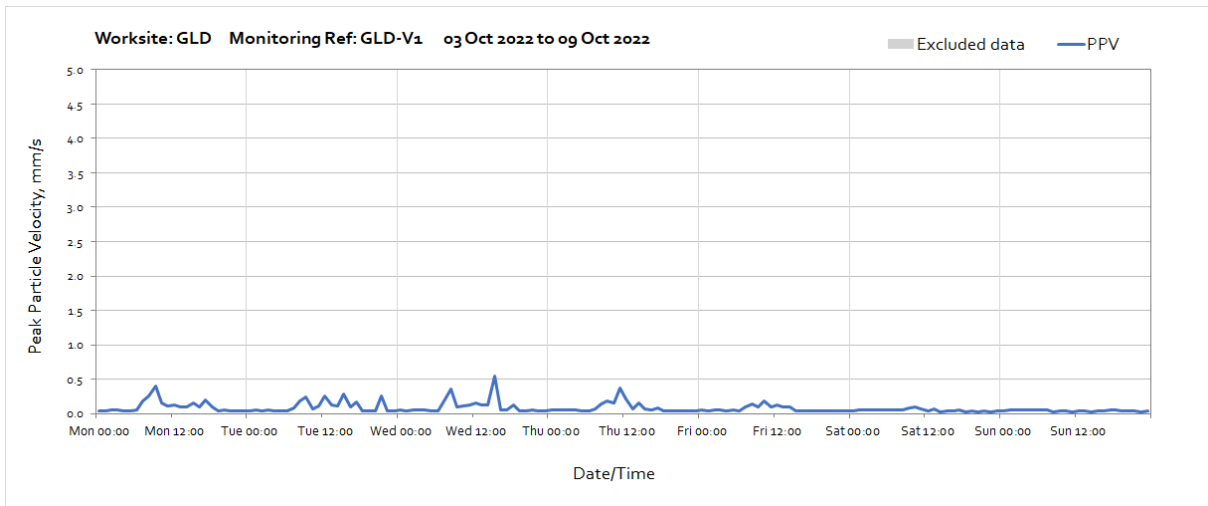
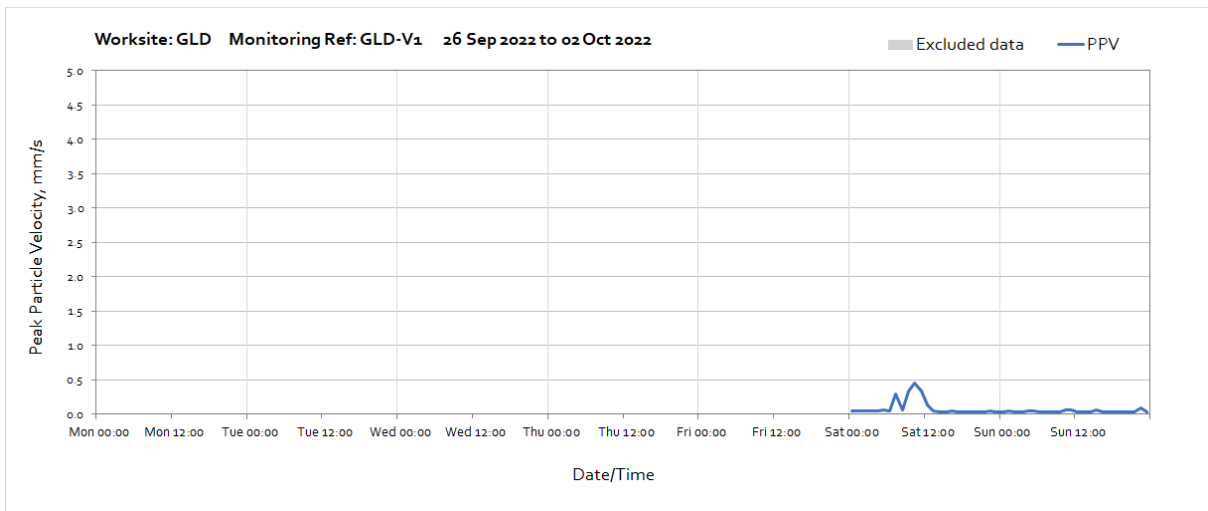


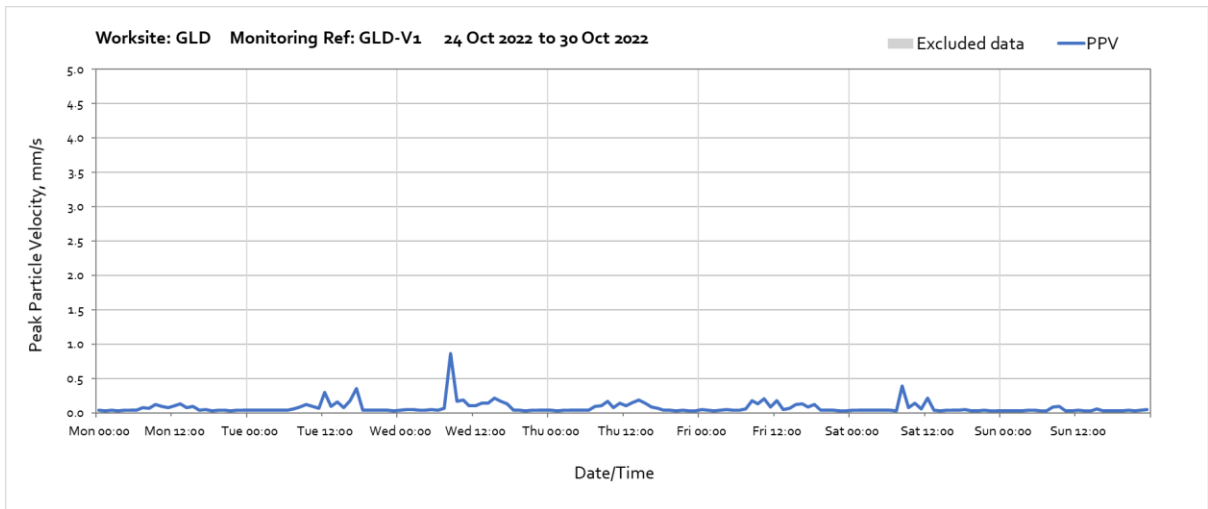
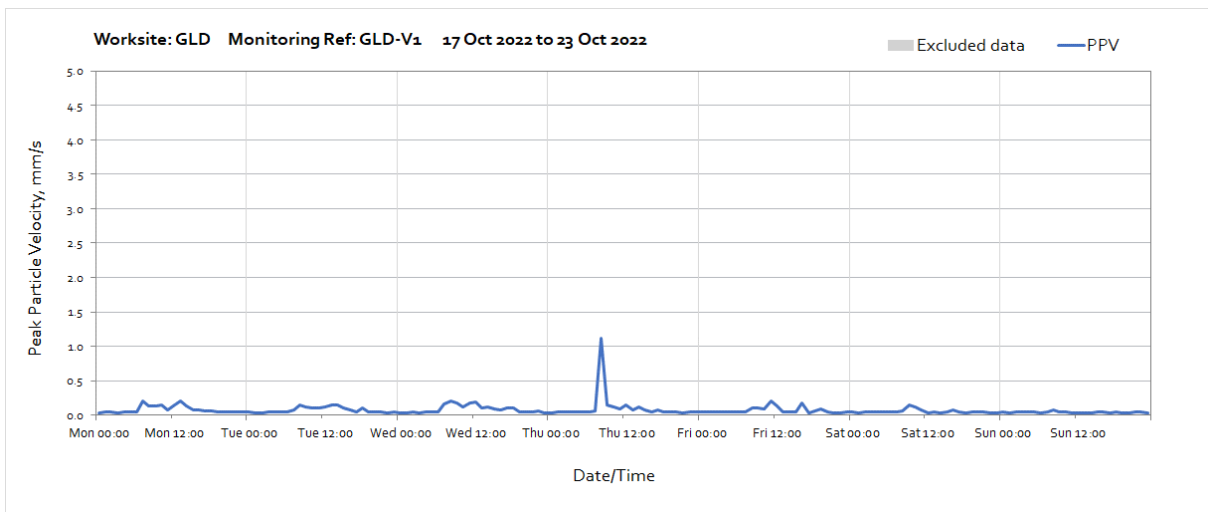
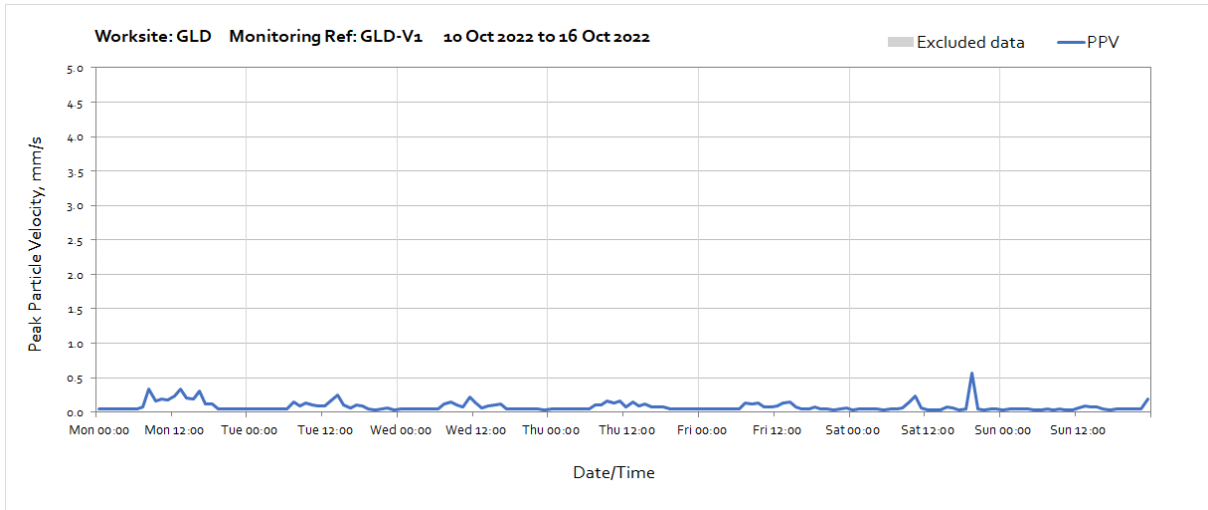


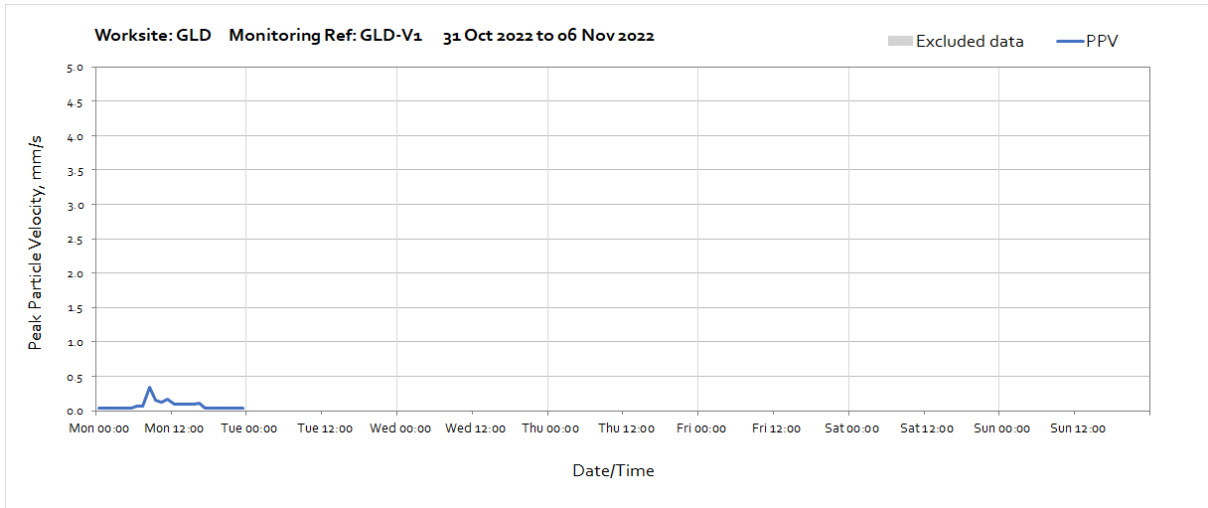




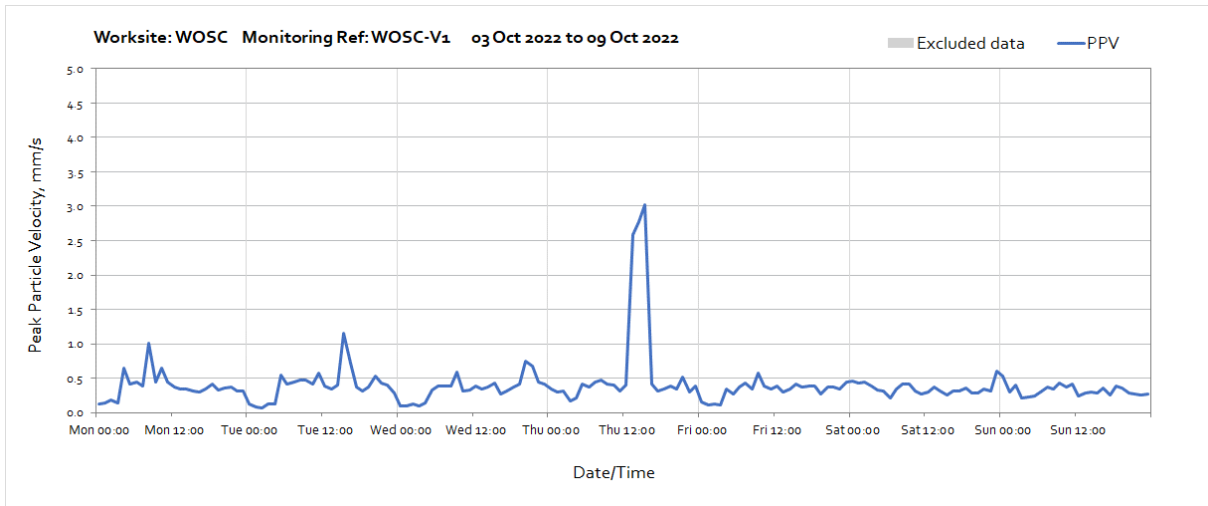
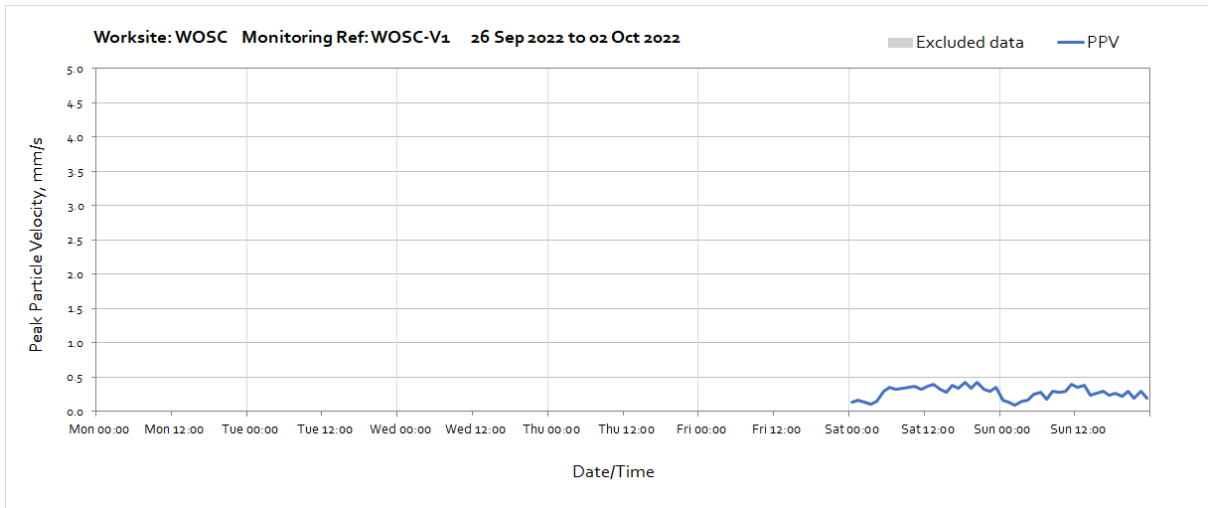
**Worksite: GLD – Monitoring Ref: GLD-V1**

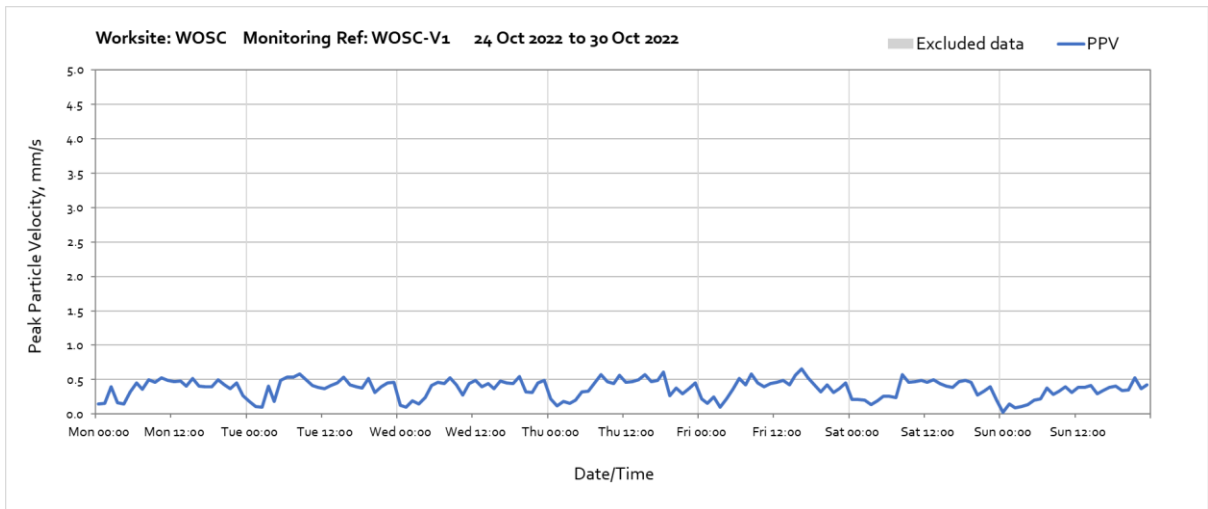
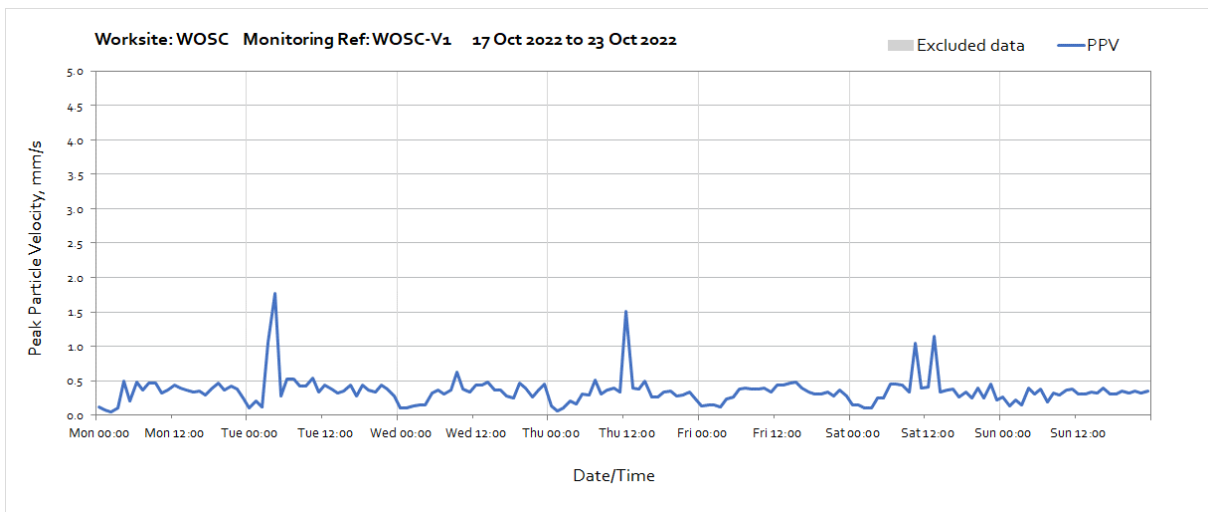
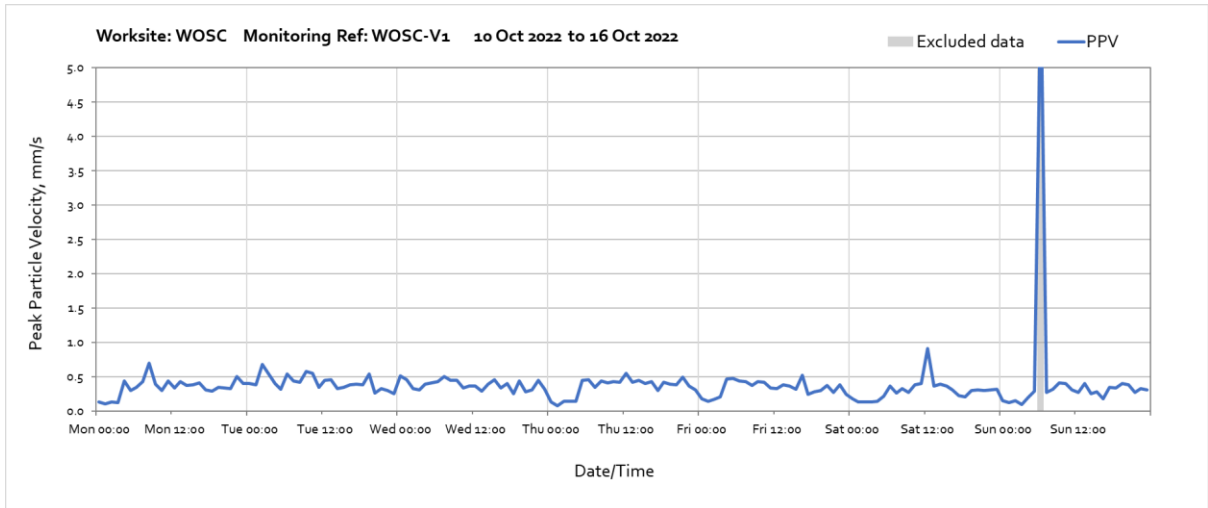


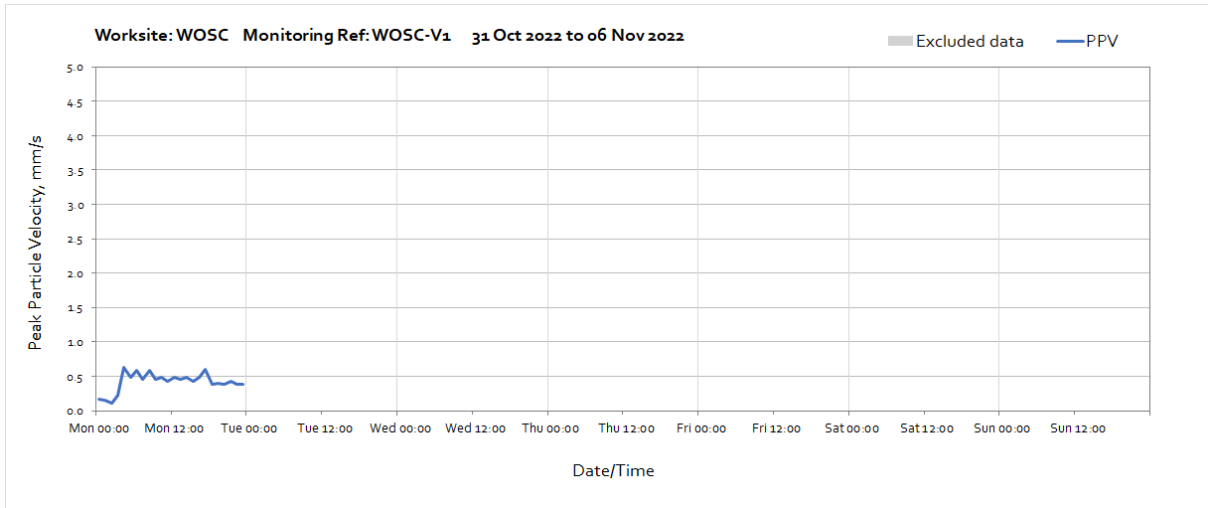




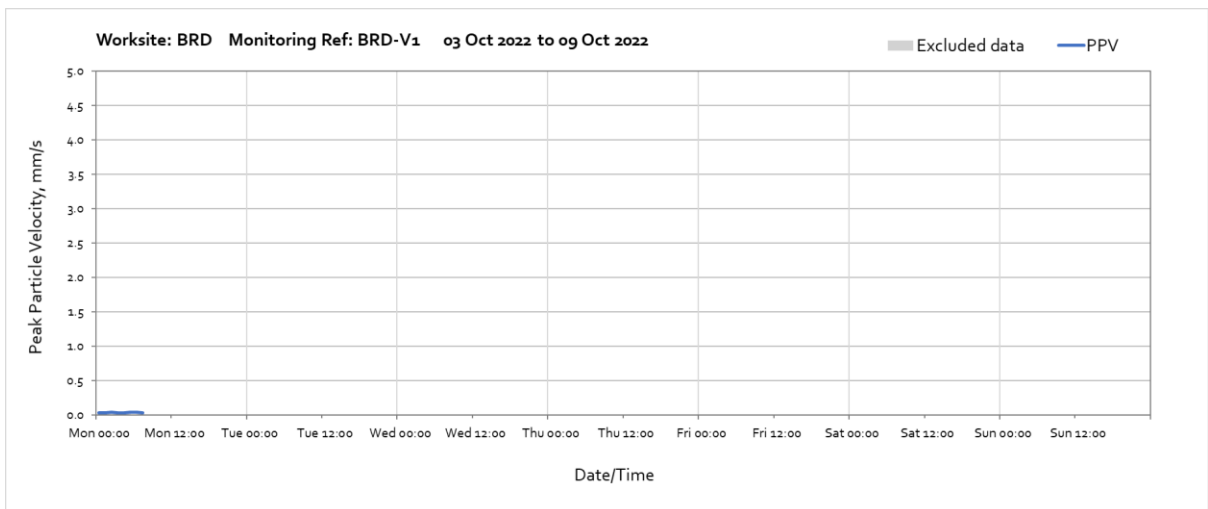
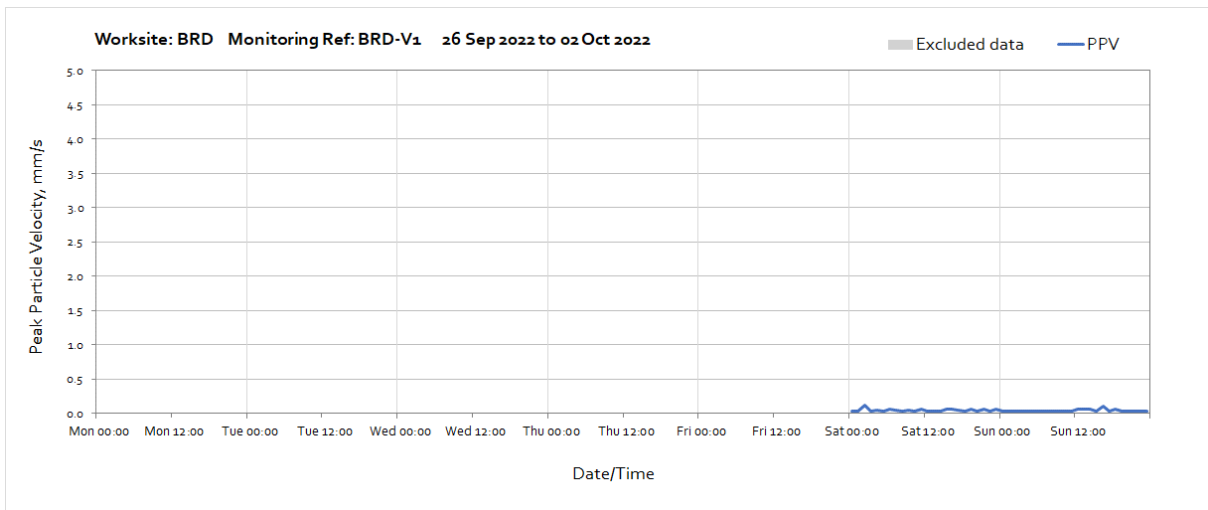
**Worksite: WOSC – Monitoring Ref: WOSC-V1**





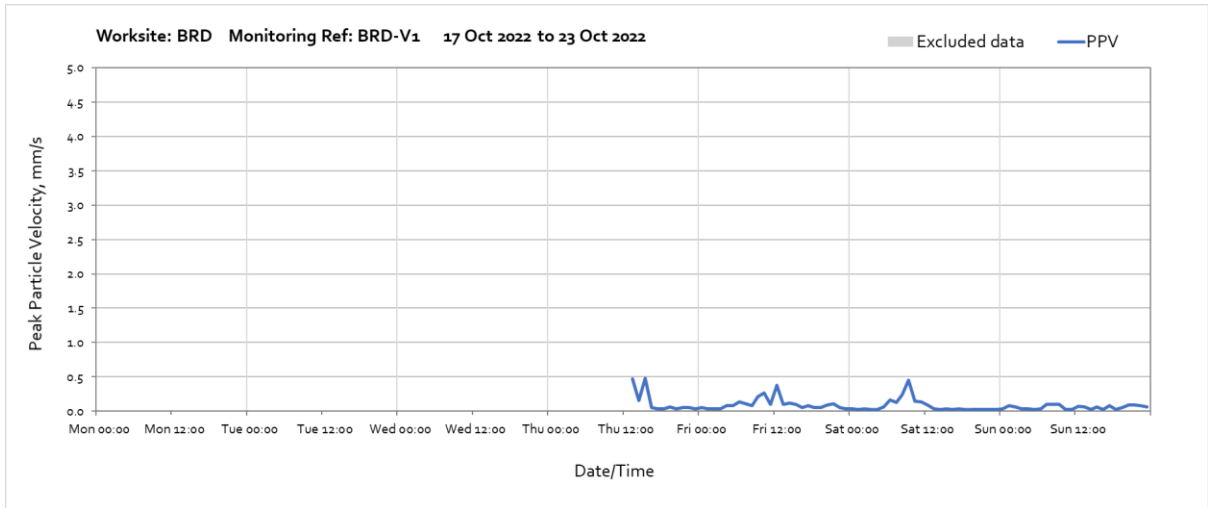


### Worksite: BRD – Monitoring Ref: BRD-V1

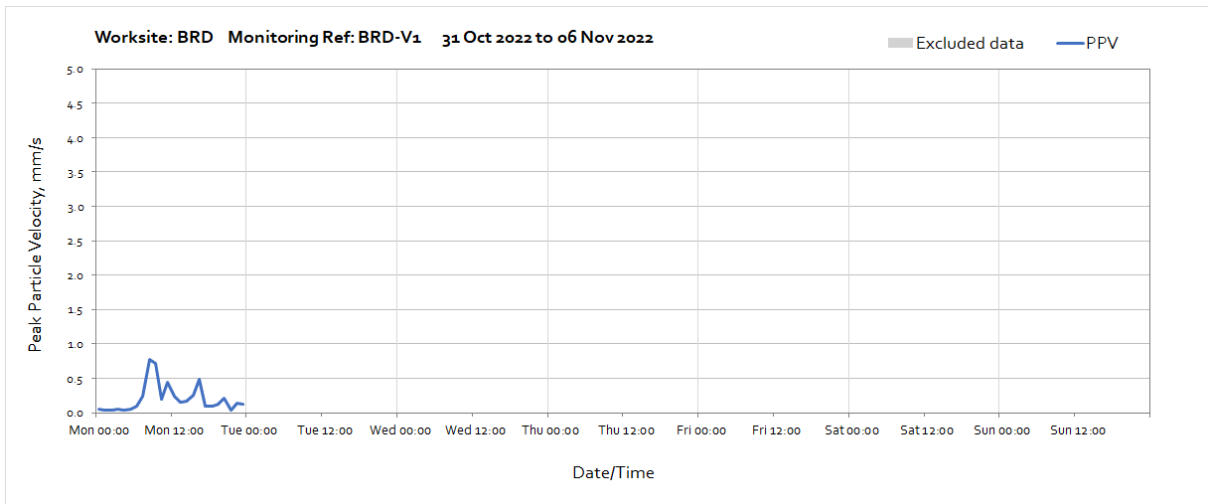
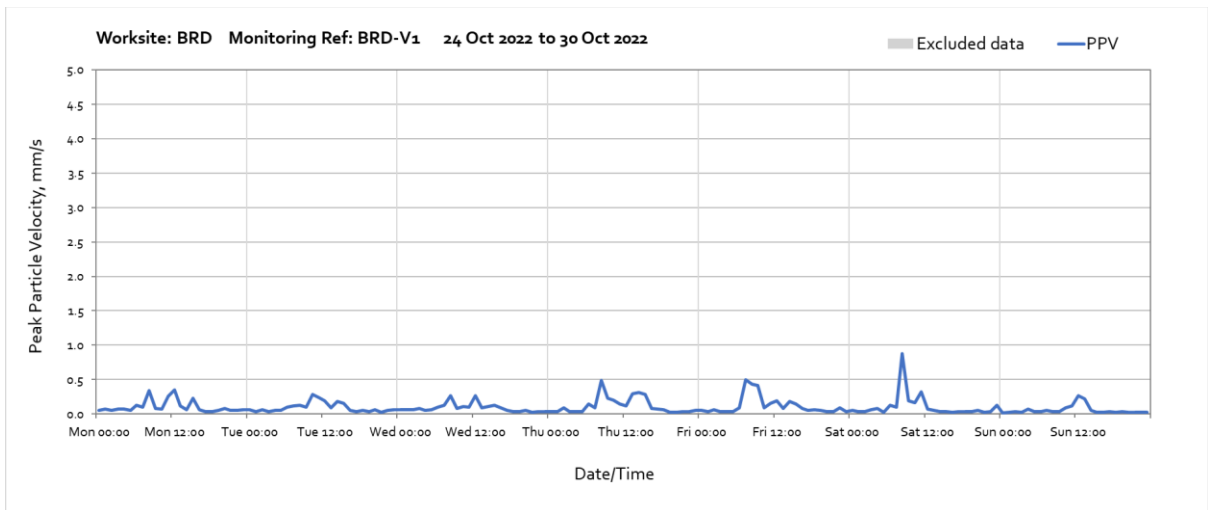


Note: Missing data between 07:00 on Monday 3<sup>rd</sup> October and 12:00 on Thursday 20<sup>th</sup> October due to loss of power to battery.

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Note: Missing data between 07:00 on Monday 3<sup>rd</sup> October and 12:00 on Thursday 20<sup>th</sup> October due to loss of power to battery.



## Worksite: ALO – Monitoring Ref: ALO-V1

