

Construction noise and vibration Monthly Report – December 2021

Birmingham City

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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 Birmingham City during the month of December 2021.

Within this period monitoring was undertaken at the following worksites:

- Noise monitoring was undertaken in the vicinity of the Curzon Street worksite (ref.: CS), where offloading material deliveries and storage, on-site excavating, laying utility ducting and backfilling works, installation of turnstiles, trial piling/boring with piling rig for ground investigation, general maintenance of platform area, water treatment plant operation, concrete pours works, movement of plant/materials for storage, break out of concrete foundations works, reduce dig and backfilling works, stockpiling of aggregate deliveries and removal of arising stockpiles off-site works were underway.
- Noise and vibration monitoring was undertaken in the vicinity of the Twisted Oak Stables worksite (ref.: TOS), where pouring of concrete slabs, placing concrete troughs, pouring of Slurry Treatment Plant (STP) and de-sanding unit building and deliveries of Tunnel Boring Machine (TBM) components were underway.
- Noise and vibration monitoring was undertaken in the vicinity of the Washwood Heath Depot worksite (ref.: WWHD), where obstruction removal and platform construction at portal and diaphragm wall area works, construction of attenuation ponds, early works for the brook diversion footprint, delineation of boreholes, bentonite plant setup, guide wall installation, completion of demolition scope and de-mobilisation from site, continuation on west side breakout and crushing works, support works site, bailey bridge relocation, compound pond works and wheel wash foundation works and batching plant operational works were underway.
- Noise monitoring was undertaken in the vicinity of the SAS13 Bridge Replacement worksite in Washwood Heath (ref.: SAS13), where construction of steel fixing and constructing shuttering, concrete pouring, laying aggregate for crane platform, and installation of the bridge deck were underway.

Further works, where monitoring did not take place, were also undertaken at:

- Duddeston Mill Road (water works);
- Erskine Street (water utility works);
- Bromford Tunnel (power utility works);
- Curzon Street West Midlands Fire Station (grayscourt mobilise);
- B4114 Saltley Viaduct (water and power utility works); and
- Curzon Street Substation (power utility works).

There were no exceedances of 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>), during the reporting period.

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

No complaint was received during the monitoring period.

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 +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.
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 vibration data, and interpretation thereof, for monitoring carried out by HS2 within Birmingham City for the period 1st to 31st December 2021.

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

- Curzon Street worksite ref.: CS (see plan 1 in Appendix A) where work activities included:
 - offloading material deliveries and storage;
 - on-site excavating, laying utility ducting and backfilling in north-western most corner of site;
 - installation of turnstiles opposite site entrance;
 - trial piling/boring with piling rig for ground investigation;
 - general maintenance of platform area, including vibrating roller, compaction and stockpiles;
 - water treatment plant operation;
 - concrete pours for steel pre-fabrication yard area;
 - movement of plant/materials for storage;

- breakout of student accommodation concrete foundations using breaker attachment for gridlines.
- reduce dig and backfill with aggregate for piling platform;
- stockpiling of arisings from excavations across site;
- stockpiling of aggregate deliveries; and
- removal of arising stockpiles off-site via 8-wheel wagons.
- Twisted Oak Stables worksite, ref.: TOS (see plan 3 in Appendix A) where work activities included:
 - pouring of concrete slabs
 - placing concrete troughs;
 - pouring of Slurry Treatment Plant (STP) and de-sanding unit building; and
 - deliveries of Tunnel Boring Machine (TBM) components.
- Washwood Heath Depot worksite, ref.: WWHD (see plan 2 in Appendix A) where work activities included:
 - obstruction removal and platform construction at portal and diaphragm wall area;
 - construction of attenuation ponds;
 - early works for the brook diversion footprint including obstruction removal;
 - delineation boreholes;
 - bentonite plant setup;
 - guide wall installation in the portal area;
 - completion of demolition scope (of a concrete slab) and de-mobilisation from site;
 - continuation on west side breakout and crushing works;
 - support works site, bailey bridge relocation, compound pond works and wheel wash foundation works; and
 - batching plant operational works.
- SAS13 Bridge Replacement worksite, ref.: SAS13 (see plan 3 in Appendix A) where work activities included:
 - ongoing construction of steel fixing and construction shuttering for the West and East Abutment sites;

- concrete pouring;
- laying aggregate for crane platform; and
- installation of the bridge deck (steel fixing, installing glass reinforced plastic (GRP) panels and shuttering).

1.1.4 Further work where monitoring did not take place, were also undertaken at the following locations:

- Duddeston Mill Road (water works);
- Erskine Street (water utility works);
- Bromford Tunnel (power utility works);
- Curzon Street West Midlands Fire Station (grayscourt mobilise);
- B4114 Saltley Viaduct (water and power utility works); and
- Curzon Street Substation (power utility 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 Six noise and three vibration monitoring installations were active in December in the Birmingham City area. Table 2 summarises the position of noise and vibration monitoring installations within the Birmingham City area in December 2021.

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

Table 2: Monitoring Locations

Worksite Reference	Measurement Reference	Address
Curzon Street (CS)	CS-N1	Curzon Street, Birmingham
Twisted Oak Stables (TOS)	TOS-N1	B4118-Birmingham Road, Water Orton, Birmingham
	TOS-V1	B4118-Birmingham Road, Water Orton, Birmingham
Washwood Heath Depot (WWHD)	WWHD-N1	Drews Lane, Birmingham
	WWHD-V1	Drews Lane, Birmingham

Worksite Reference	Measurement Reference	Address
	WWHD-N2	Common Lane, Birmingham
	WWHD-V2	Common Lane, Birmingham
SAS13 Bridge Replacement (SAS13)	SAS13-N1 (East)	Taroni Avenue, off Aston Church Road, Birmingham
	SAS13-N2 (West)	Heartlands Parkway, Nechells, 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 LAeq Data over the Monitoring Period

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade Measurement	Weekday Average LAeq,T (highest day LAeq,T)					Saturday Average LAeq,T (highest day LAeq,T)					Sunday / Public Holiday Average LAeq,T (highest day LAeq,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
CS	CS-N1	Curzon Street, Birmingham	Free-field	65.2 (68.3)	66.9 (69.6)	65.6 (67.7)	64.3 (67.4)	61.9 (68.0)	62.1 (64.6)	63.6 (64.9)	65.6 (69.4)	65.3 (68.6)	62.5 (66.0)	63.9 (65.9)	61.5 (64.3)
TOS	TOS-N1	B4118- Birmingham Road, Water Orton, Birmingham	Free-field	67.5 (71.1)	68.5 (70.8)	67.2 (71.5)	66.5 (71.3)	64.2 (70.6)	65.2 (67.5)	67.6 (69.1)	67.1 (67.6)	67.1 (70.1)	62.0 (66.7)	65.6 (70.1)	64.2 (69.8)
WWHD	WWHD-N1	Drews Lane, Birmingham	Free-field	52.9 (55.9)	55.7 (60.1)	55.7 (60.2)	54.4 (59.7)	50.0 (56.5)	52.0 (52.0)	57.4 (58.6)	58.5 (59.9)	57.7 (60.4)	53.6 (59.8)	56.8 (62.4)	52.9 (58.8)
	WWHD-N2	Common Lane, Birmingham	Free-field	54.1 (59.9)	59.1 (66.9)	52.3 (59.2)	52.2 (59.7)	52.3 (64.3)	53.1 (55.3)	52.9 (55.8)	51.9 (55.6)	52.3 (58.0)	49.1 (57.2)	53.7 (59.7)	50.2 (57.9)
SAS13	SAS13-N1 (East)	Taroni Avenue, off Aston Church Road, Birmingham	Free-field	66.9 (69.7)	68.5 (70.4)	68.2 (70.0)	67.6 (71.3)	63.9 (69.3)	64.4 (66.3)	67.1 (68.0)	68.0 (69.4)	68.3 (70.5)	64.5 (69.9)	67.4 (70.2)	63.6 (67.4)
	SAS13-N2 (West)	Heartlands Parkway, Nechells, Birmingham	Free-field	59.3 (64.0)	61.5 (73.6)	60.0 (63.7)	59.2 (65.3)	56.7 (62.7)	56.8 (58.2)	57.6 (60.2)	58.9 (62.0)	59.3 (63.3)	56.0 (60.3)	57.9 (62.5)	57.0 (63.5)

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

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

Worksite Reference	Measurement Reference	Monitor Address	Highest PPV measured in any axis, mm/s
TOS	TOS-V1	B4118-Birmingham Road, Water Orton, Birmingham	2.87 (X-axis)
WWHD	WWHD-V1	Drews Lane, Birmingham	1.83 (Z-axis)
WWHD	WWHD-V2	Common Lane, Birmingham	2.42 (Y-axis)*

* Higher vibration levels are due to machinery working near to the monitoring equipment.

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
CS	CS-N1*	Curzon Street, Birmingham	All days	All periods	No exceedance	No exceedance
TOS	TOS-N1*	B4118-Birmingham Road, Water Orton, Birmingham	All days	All periods	No exceedance	No exceedance
WWHD	WWHD-N1*	Drews Lane, Birmingham	All days	All periods	No exceedance	No exceedance
WWHD	WWHD-N2*	Common Lane, Birmingham	Weekday	0800 - 1800	2	No exceedance
SAS13	SAS13-N1 (East)	Taroni Avenue, off Aston Church Road, Birmingham	Weekday	0800 - 1800	7	No exceedance
SAS13	SAS13-N2 (West)*	Heartlands Parkway, Nechells, Birmingham	All days	All periods	No exceedance	No exceedance

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

- 2.2.6 Nine (9) exceedances of the LOAEL were recorded across the Washwood Heath Depot and SAS13 Bridge Replacement East worksites. No exceedances of the SOAEL were recorded during December 2021.

2.3 Exceedances of Trigger Level

2.3.1 Table 6 provides a summary of exceedances of the S61 trigger vibration levels determined to be due to HS2 related construction 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
-	-	-	-	-	-

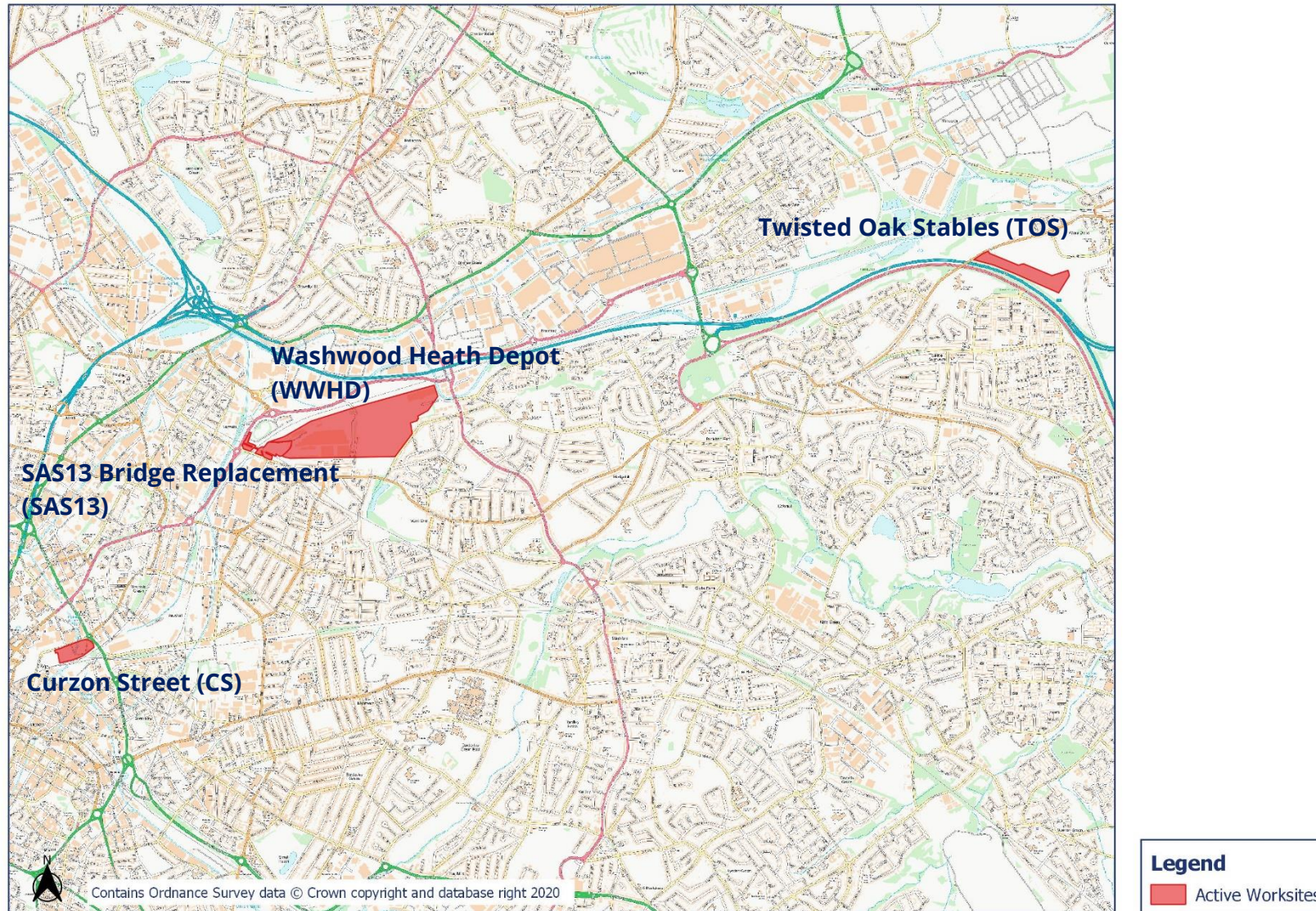
2.4 Complaints

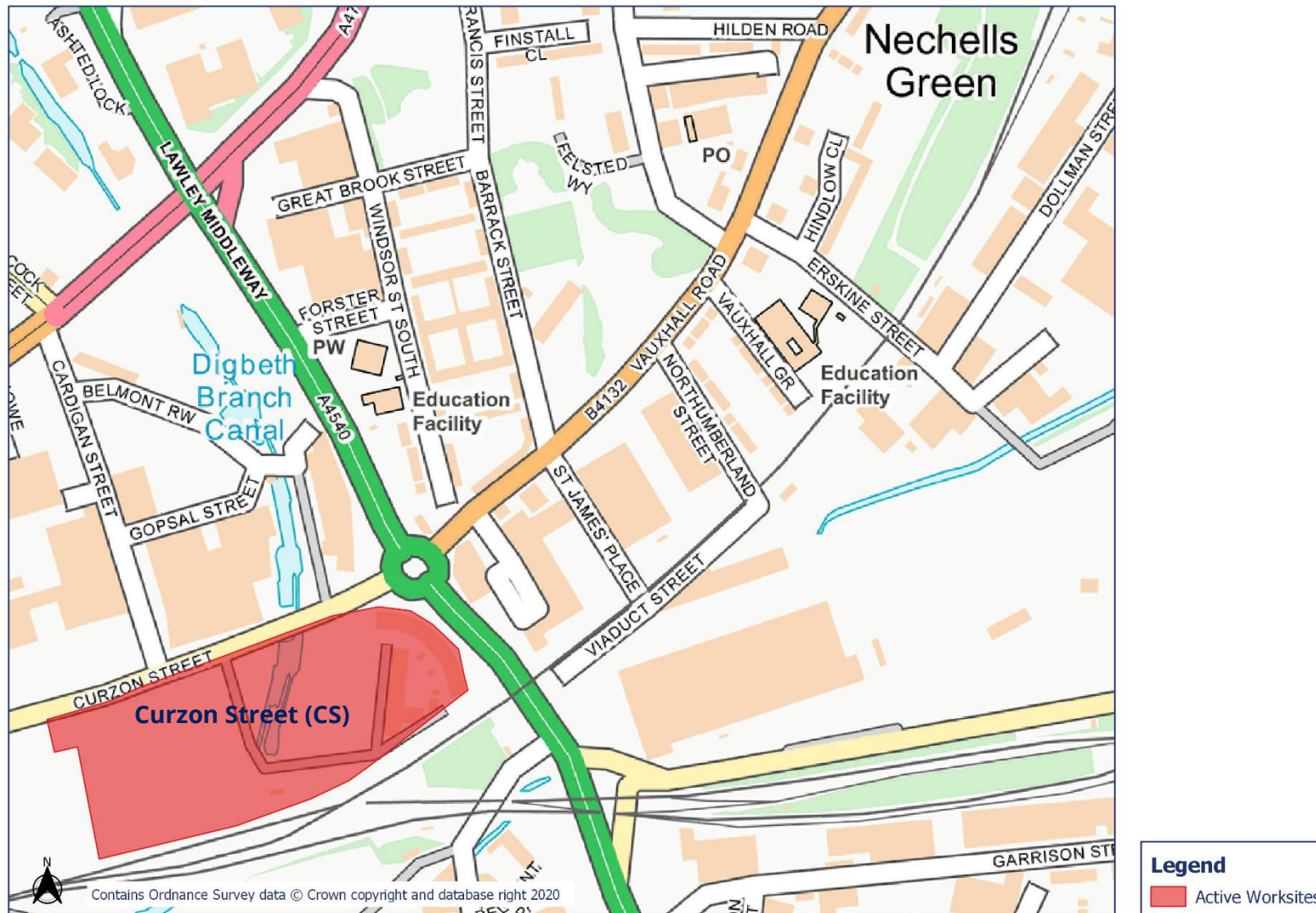
2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

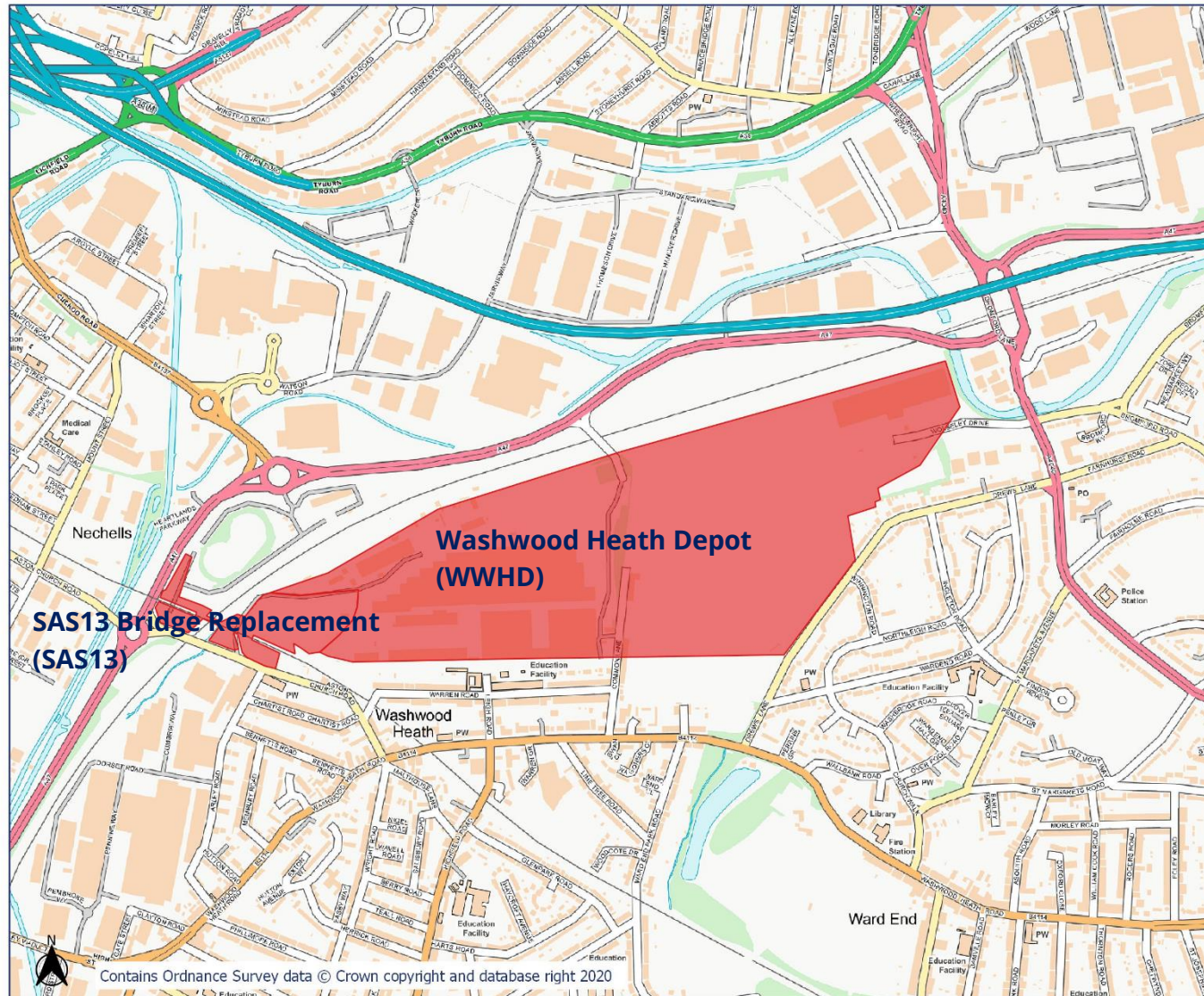
Table 7: Summary of Complaints

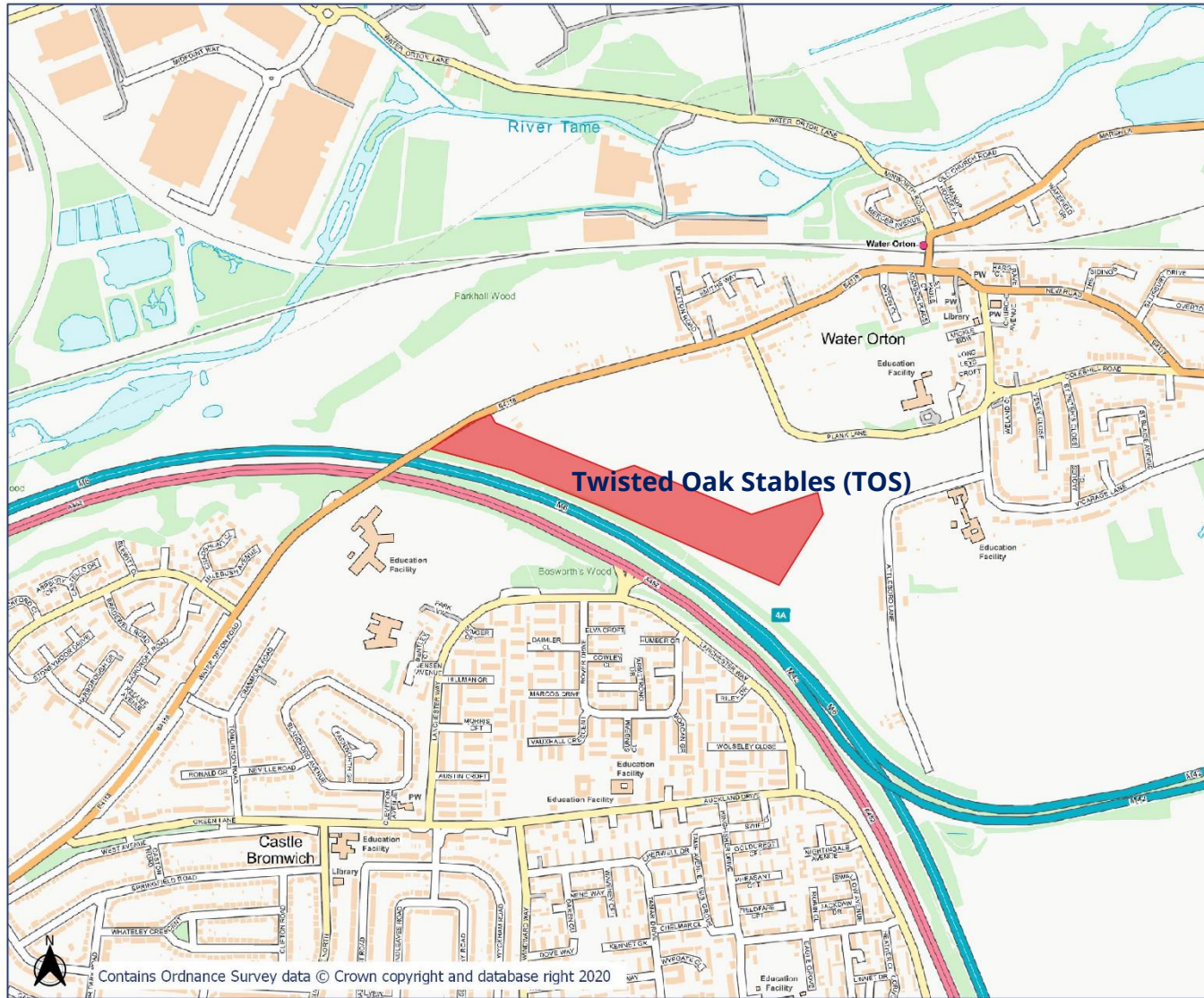
Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
-	-	-	-	-

Appendix A Site Locations

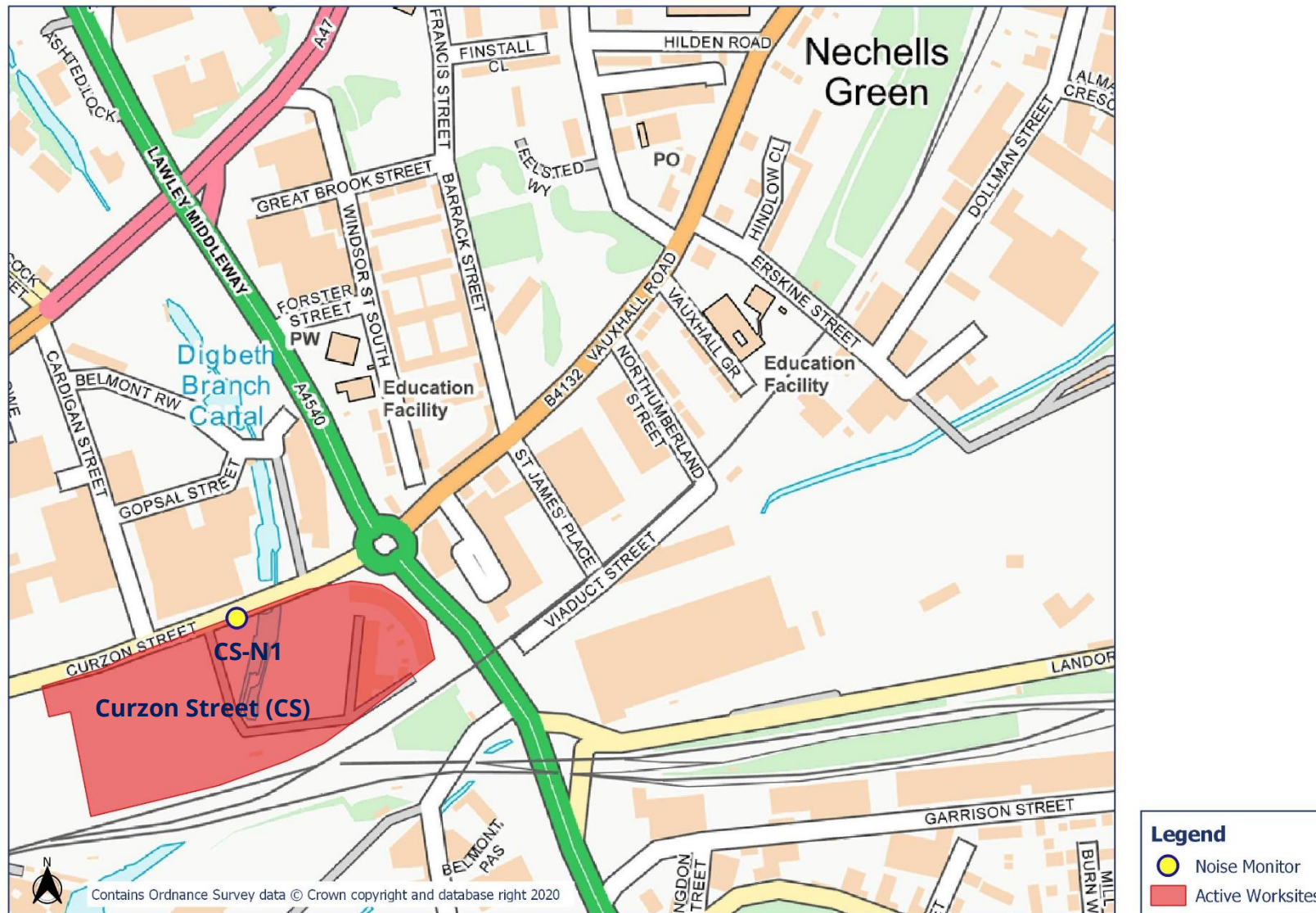


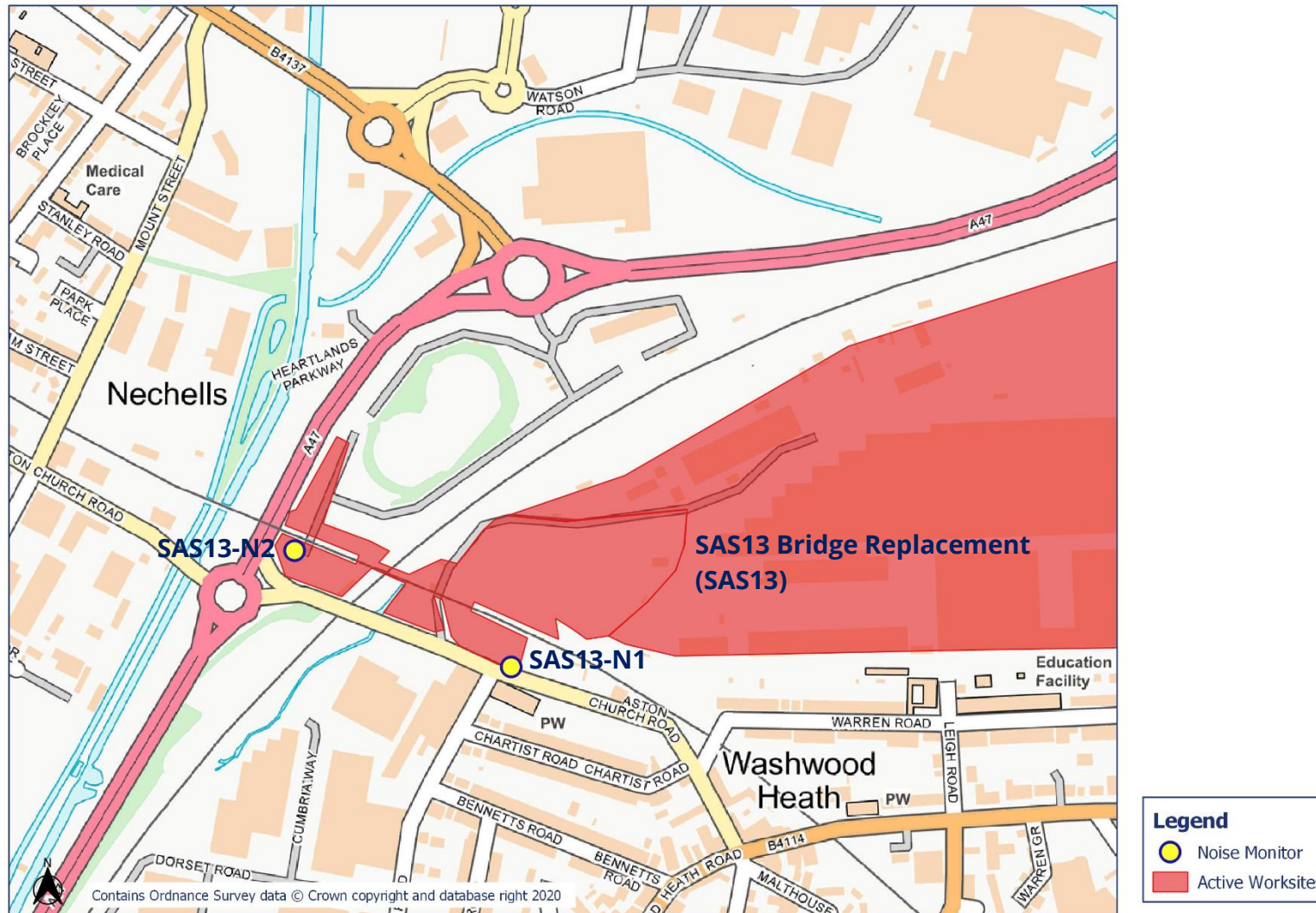


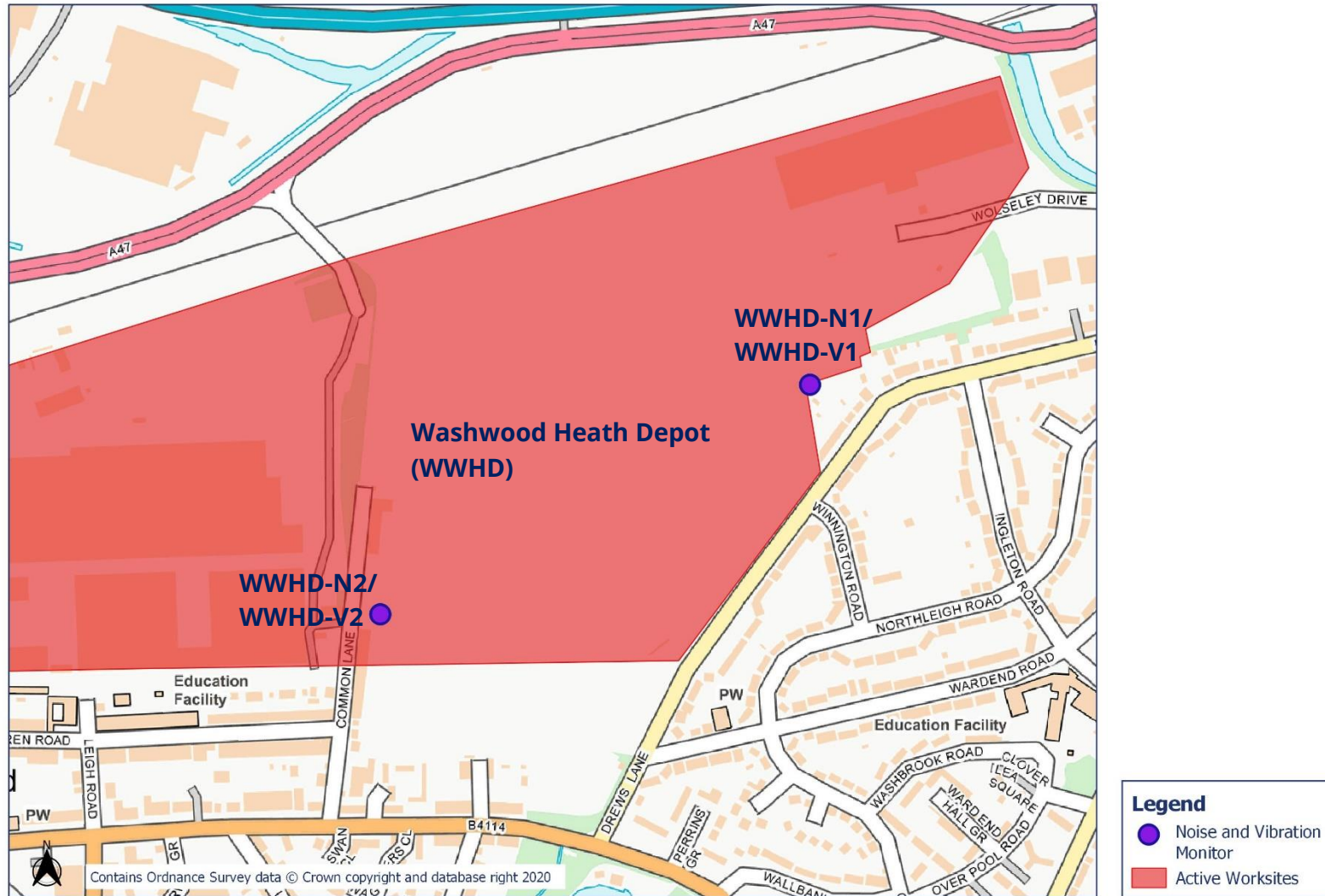




Appendix B Monitoring Locations

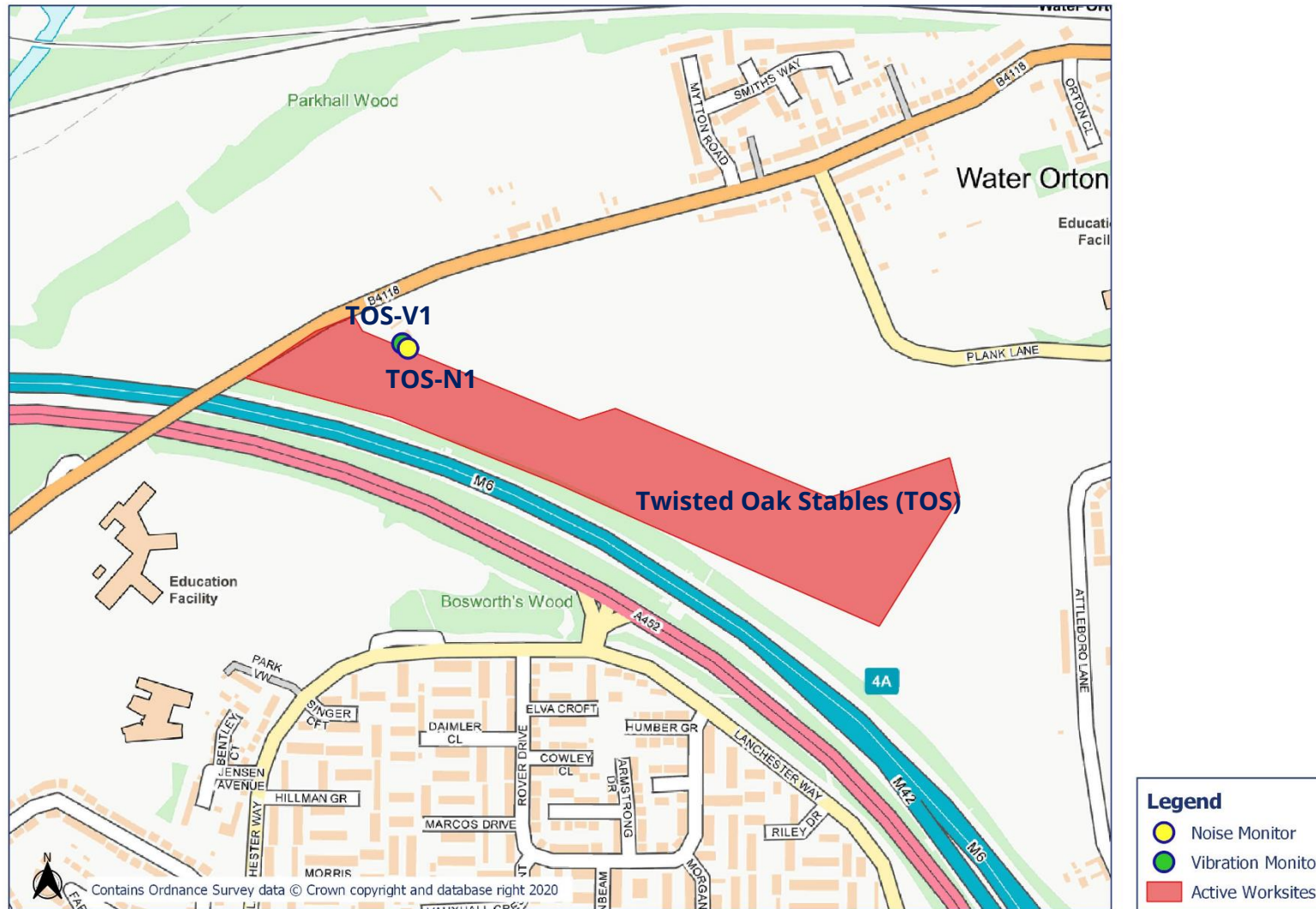






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Noise and Vibration Monitoring Plan - 4

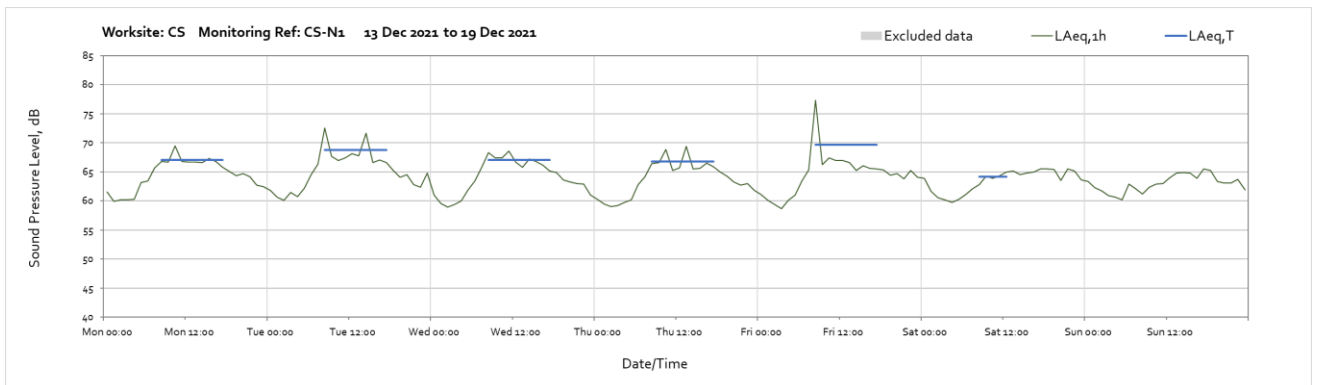
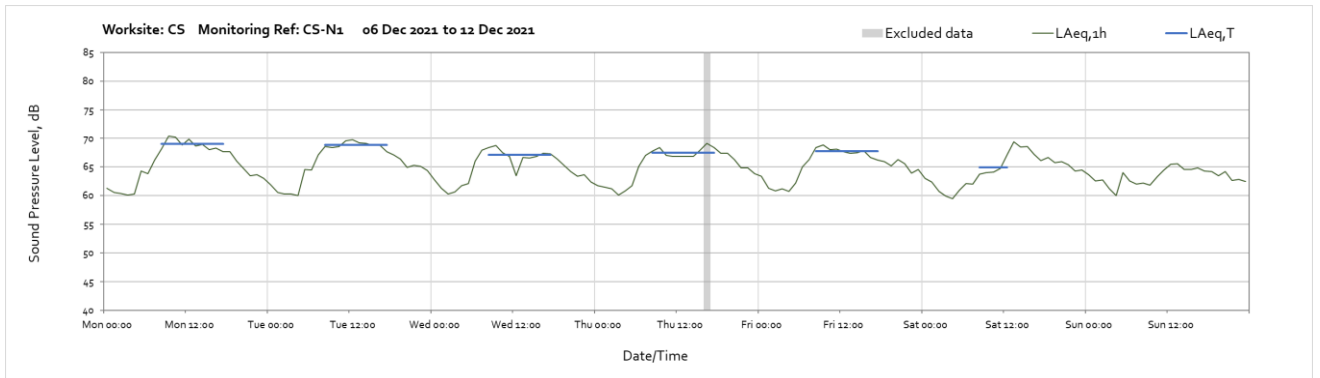
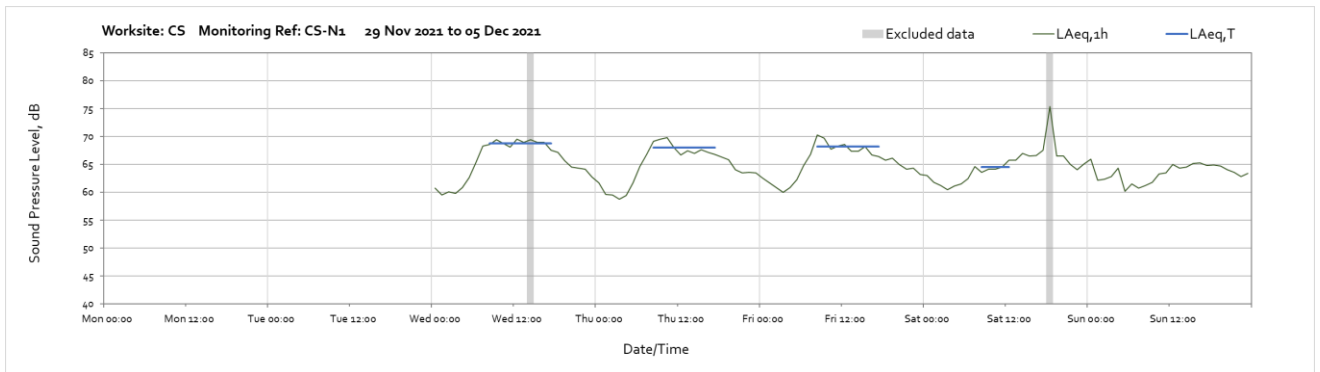


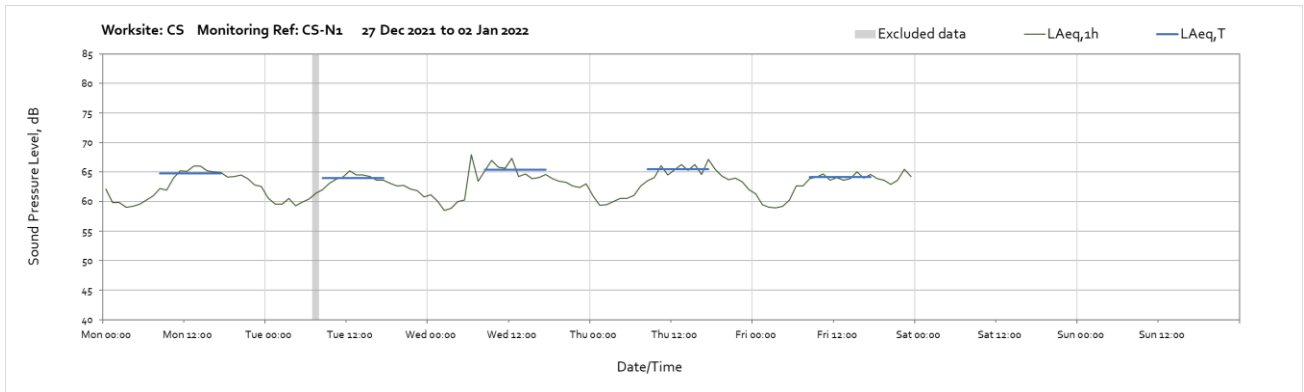
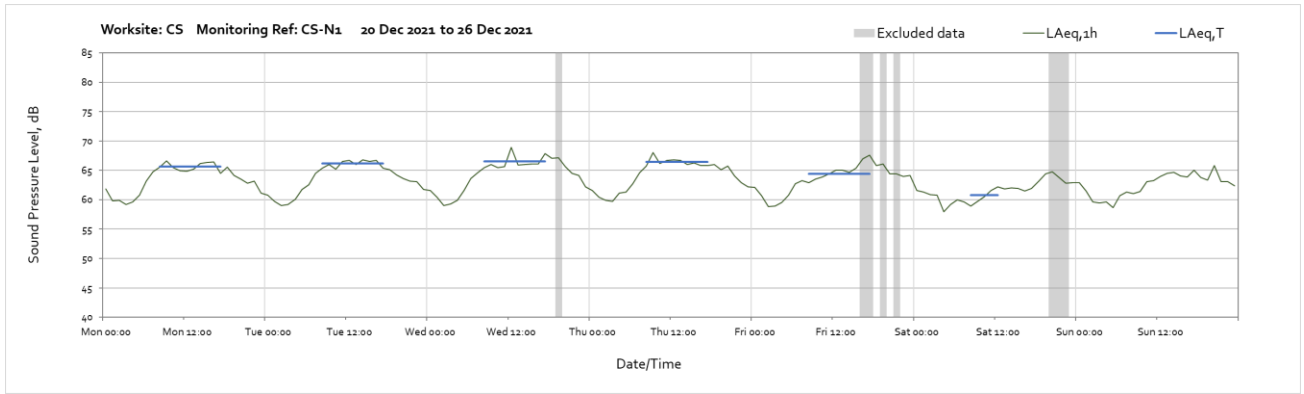
Appendix C Data

Noise

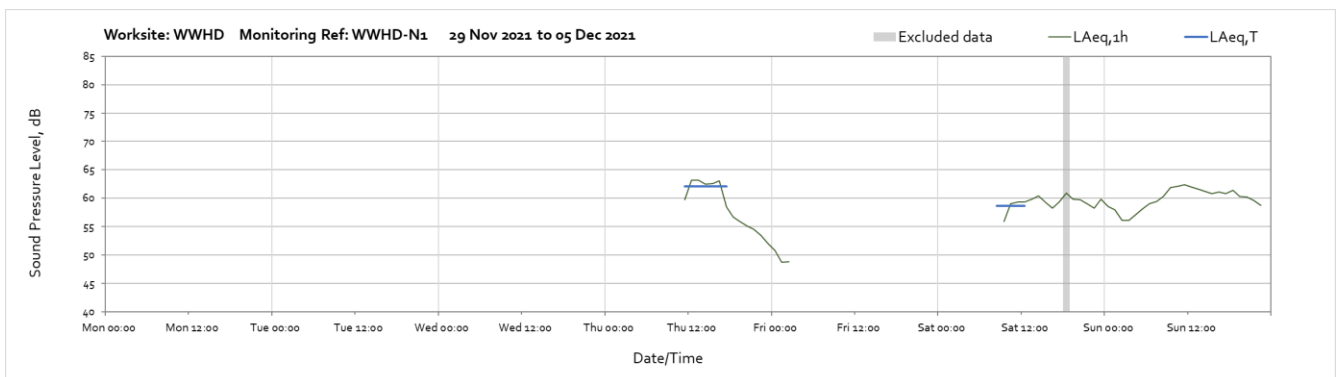
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values in Table 3 of the main report.

Worksite: Curzon Street (CS) – Monitoring Ref: CS-N1

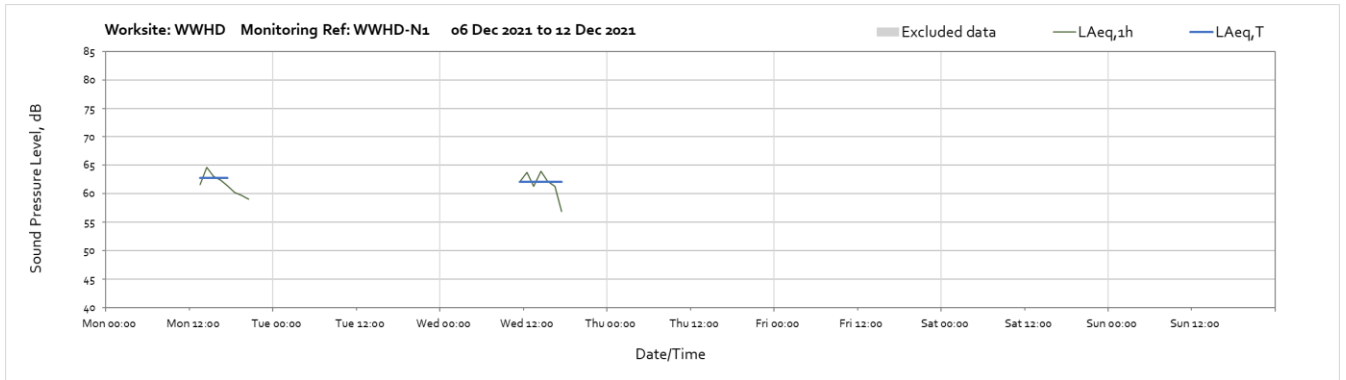




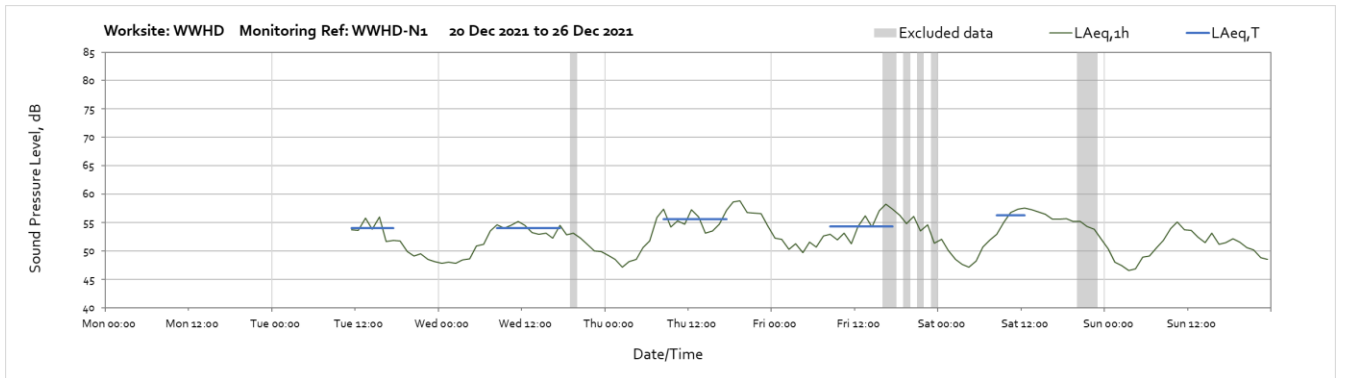
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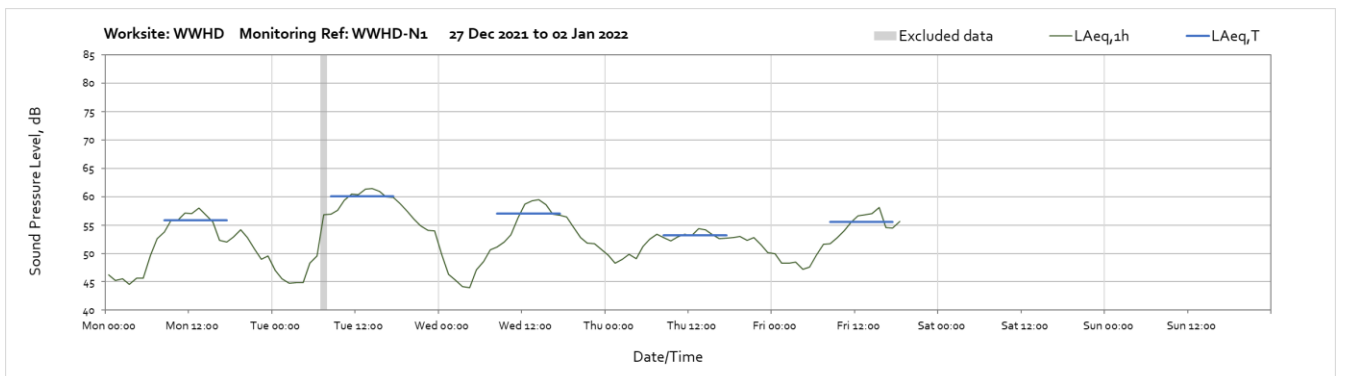
Note: Missing data during the week was due to battery falling below required voltage limit caused by prolonged insufficient sunlight.



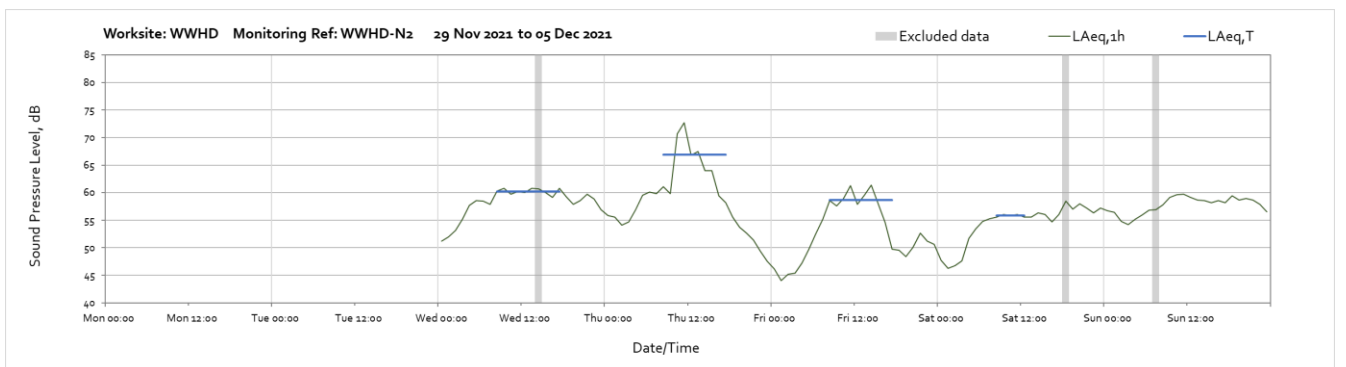
Note: Missing data between 18:00 on Wednesday 8th December and 11:00 on Tuesday 21st December was due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

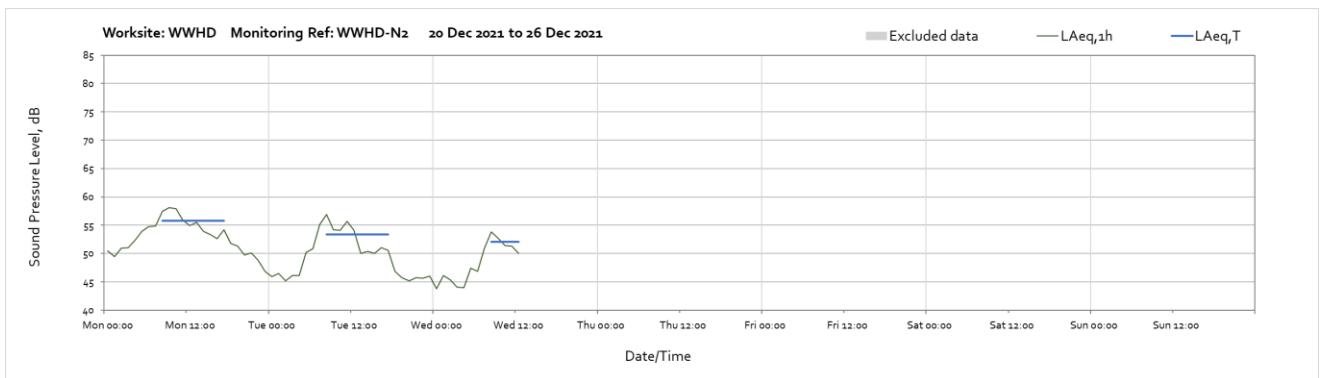
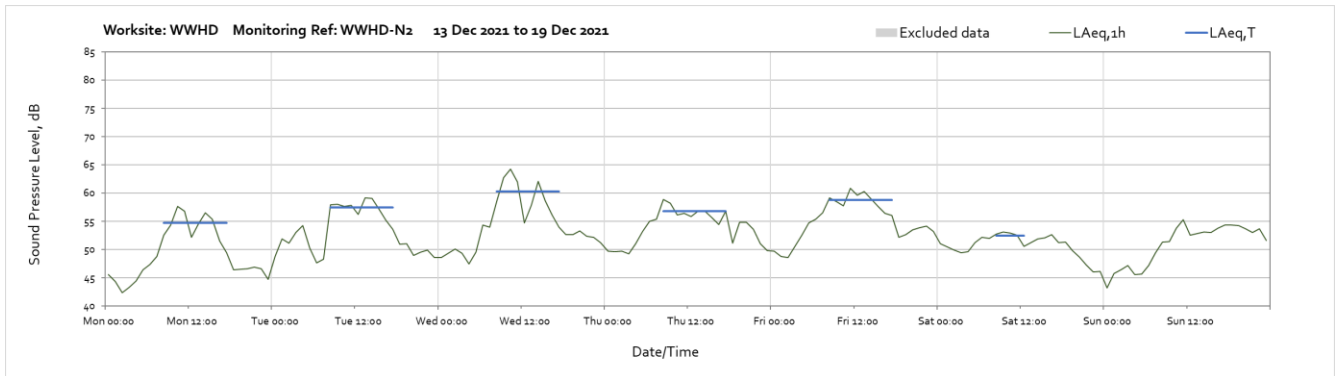
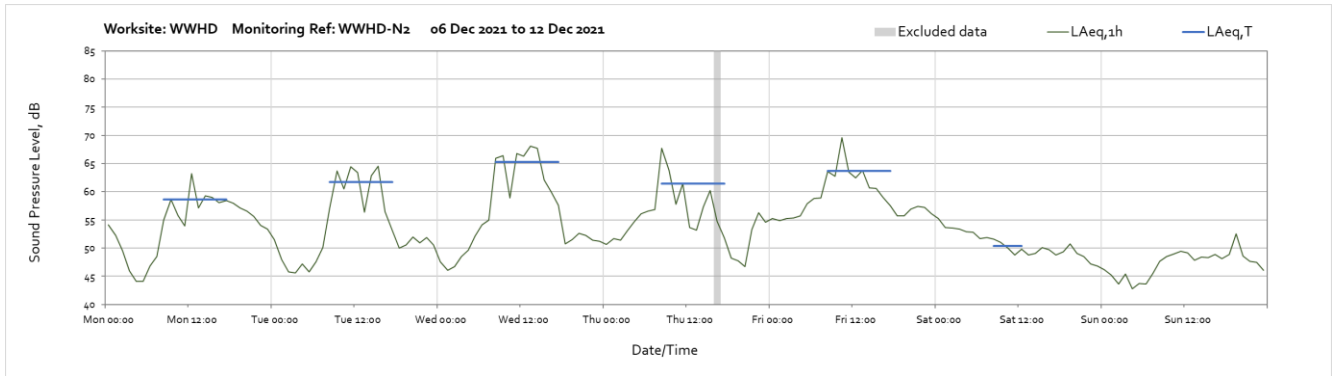


Note: Missing data between 18:00 on Wednesday 8th December and 11:00 on Tuesday 21st December was due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

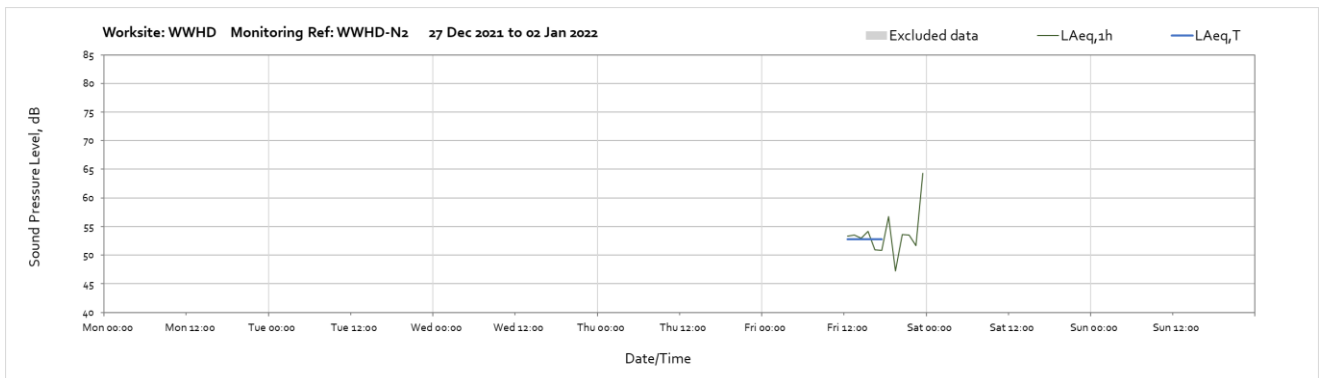


Worksite: Washwood Heath Depot (WWHD) - Monitoring Ref: WWHD-N2



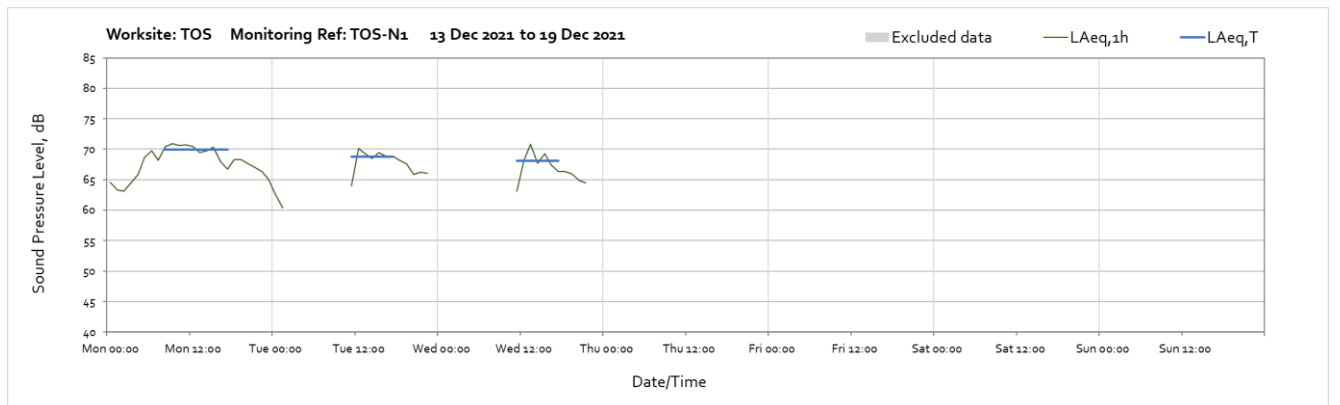
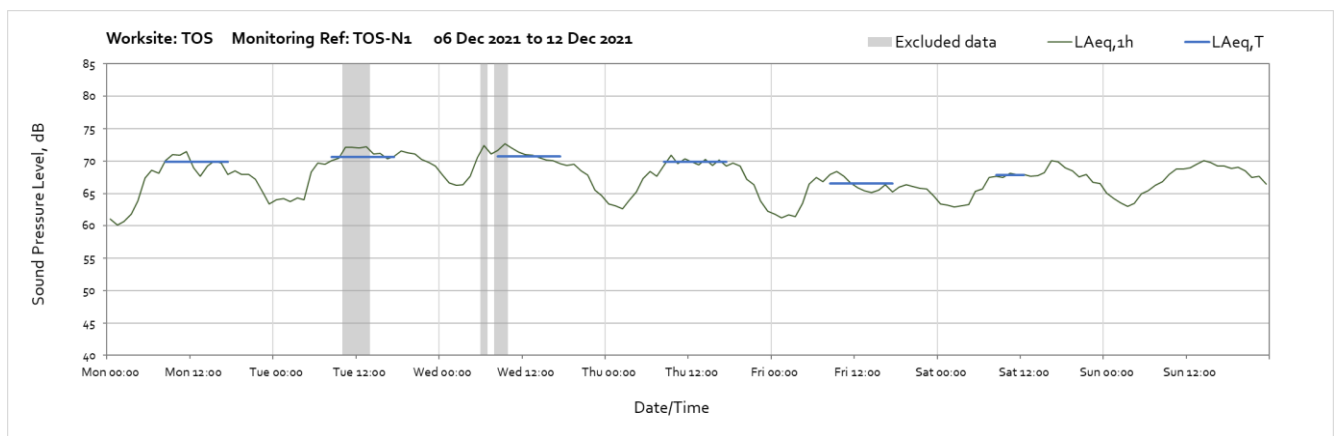


Note: Missing data during the week was due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

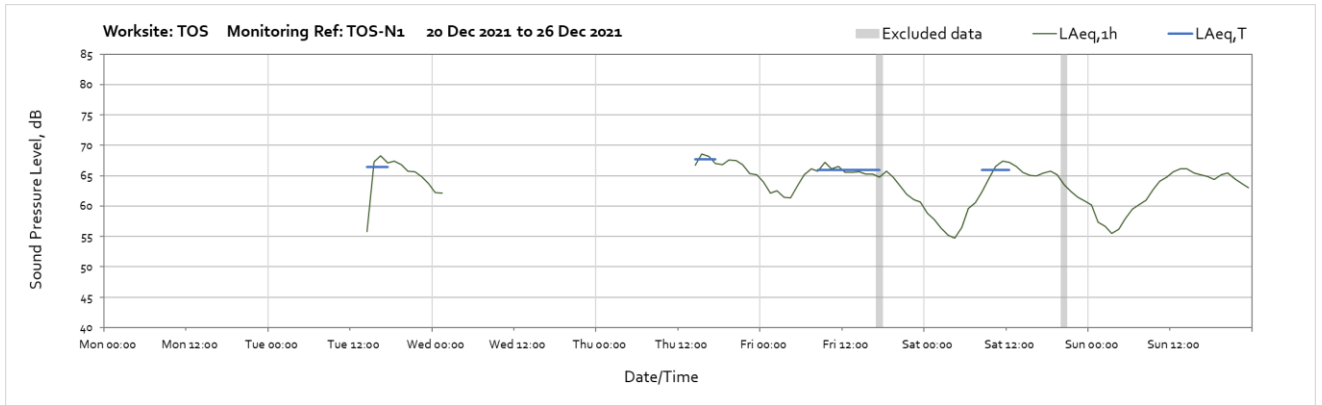


Note: Missing data during the week was due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

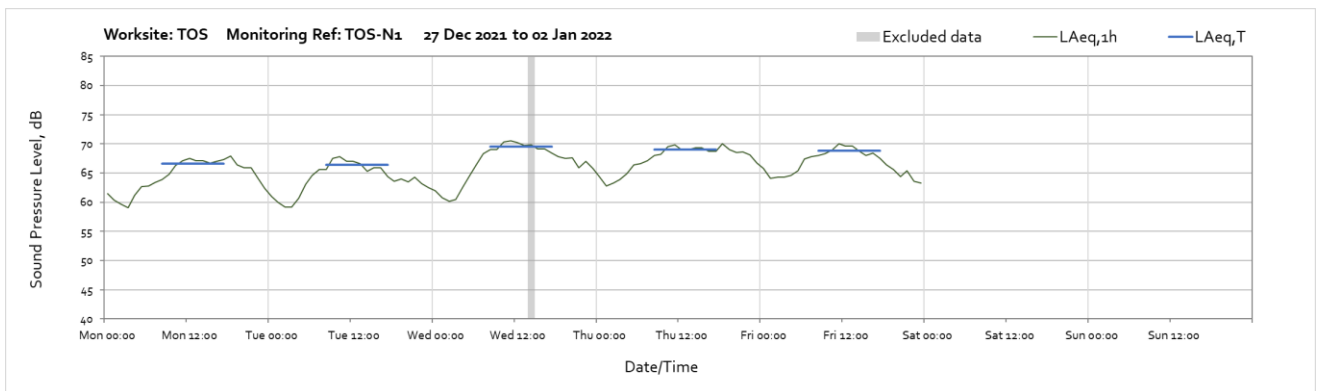
Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-N1



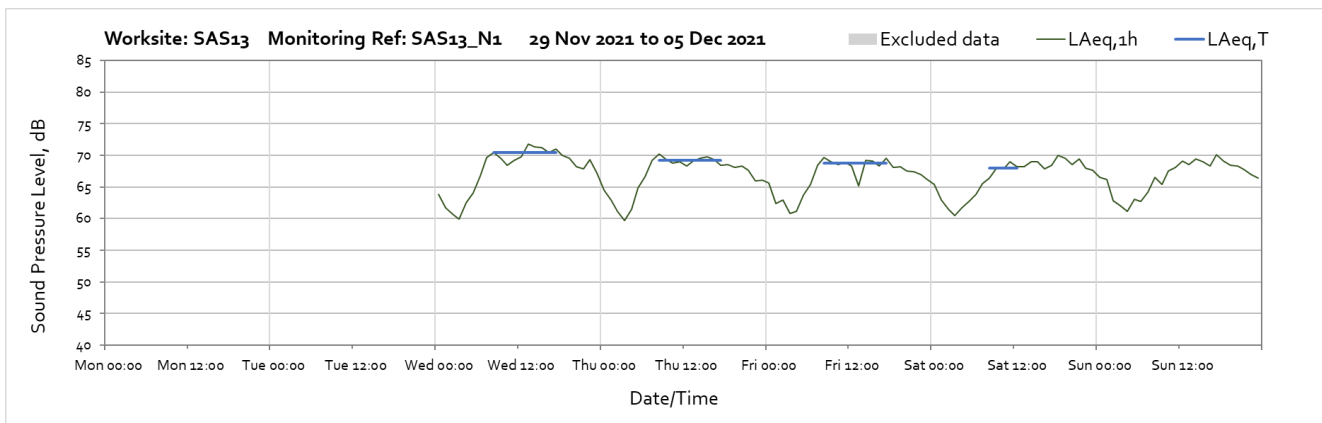
Note: Missing data between 02:00 and 11:00 on Tuesday 14th December, between 23:00 on Tuesday 14th December and 11:00 on Wednesday 15th December, and between 22:00 on Wednesday 15th December and 14:00 on Tuesday 21st December were due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

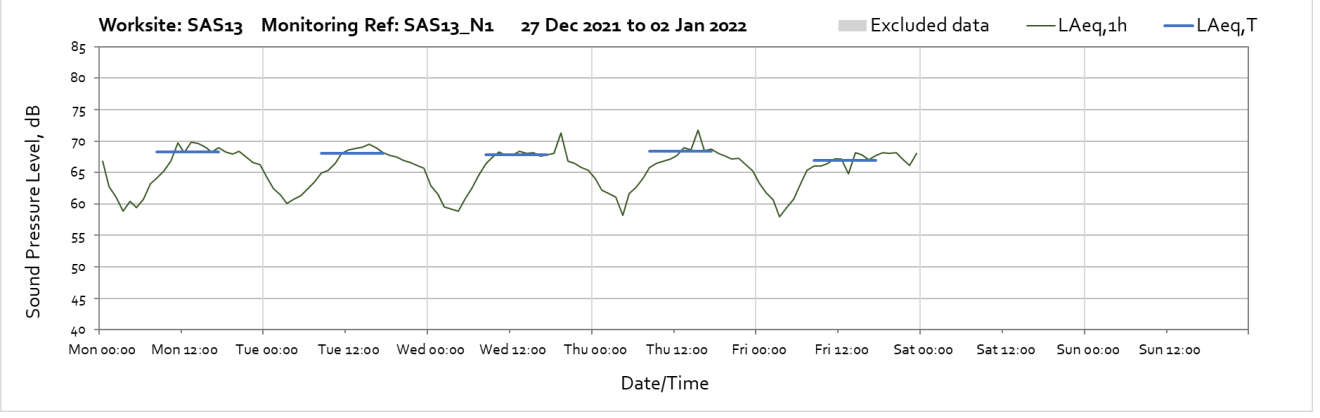
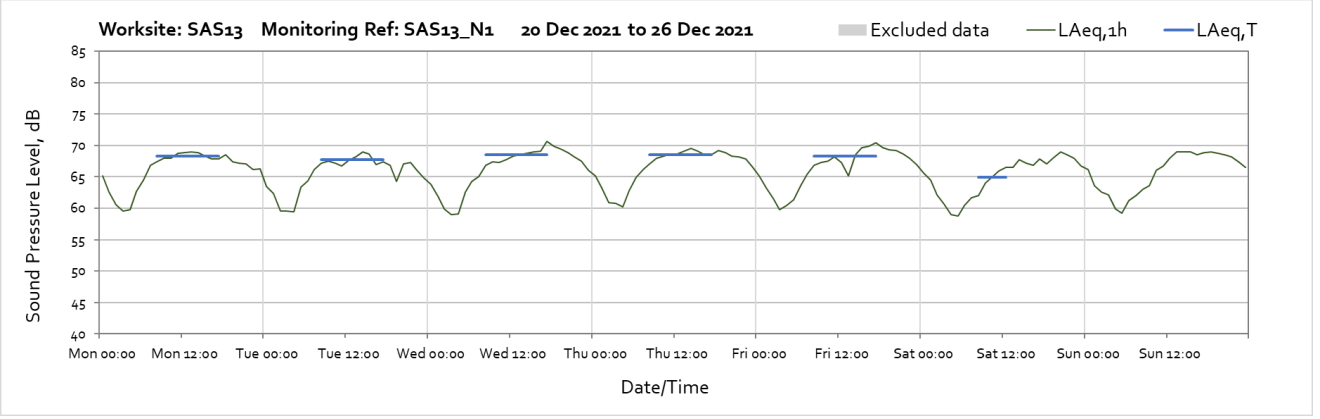
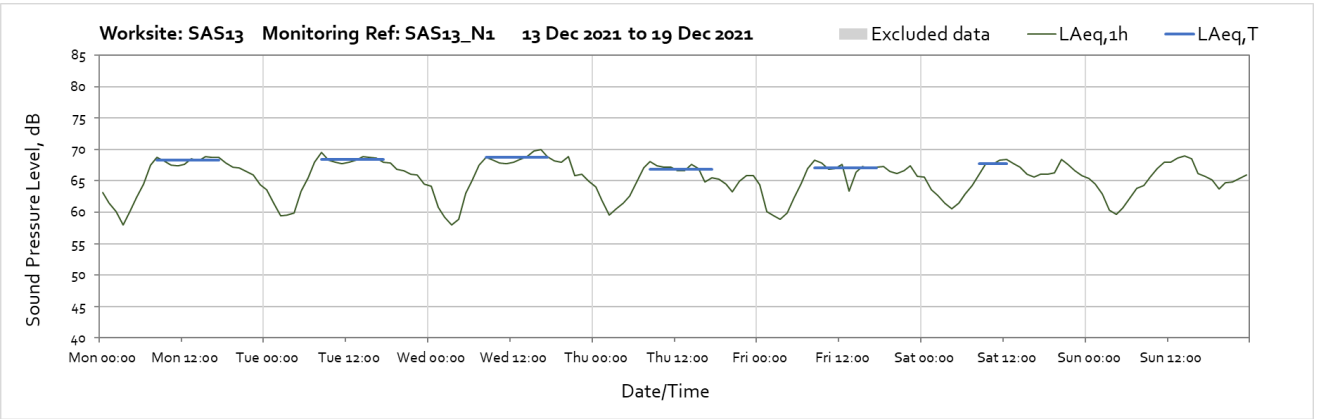
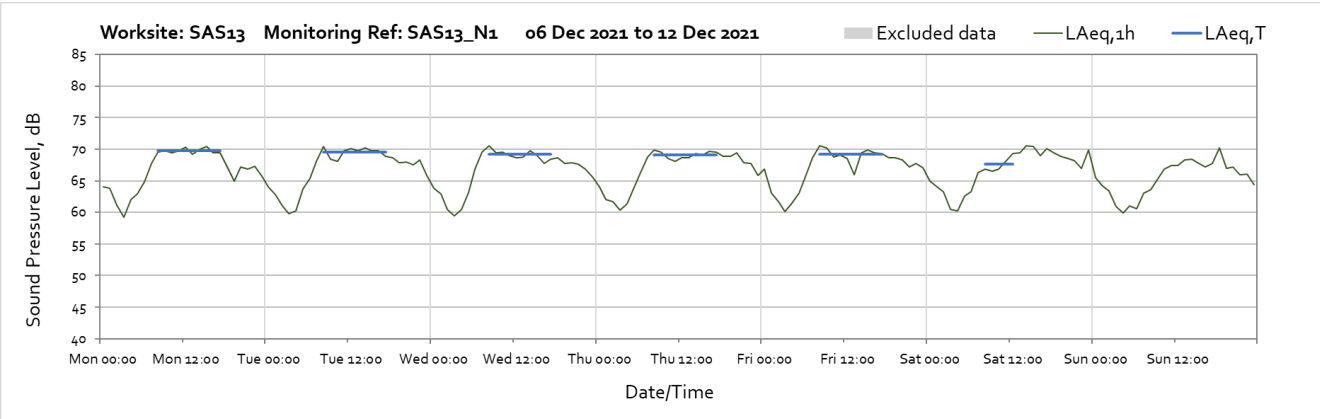


Note: Missing between 22:00 on Wednesday 15th December and 14:00 on Tuesday 21st December, and between 02:00 on Wednesday 22nd December and 14:00 on Thursday 23rd December were due to were due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

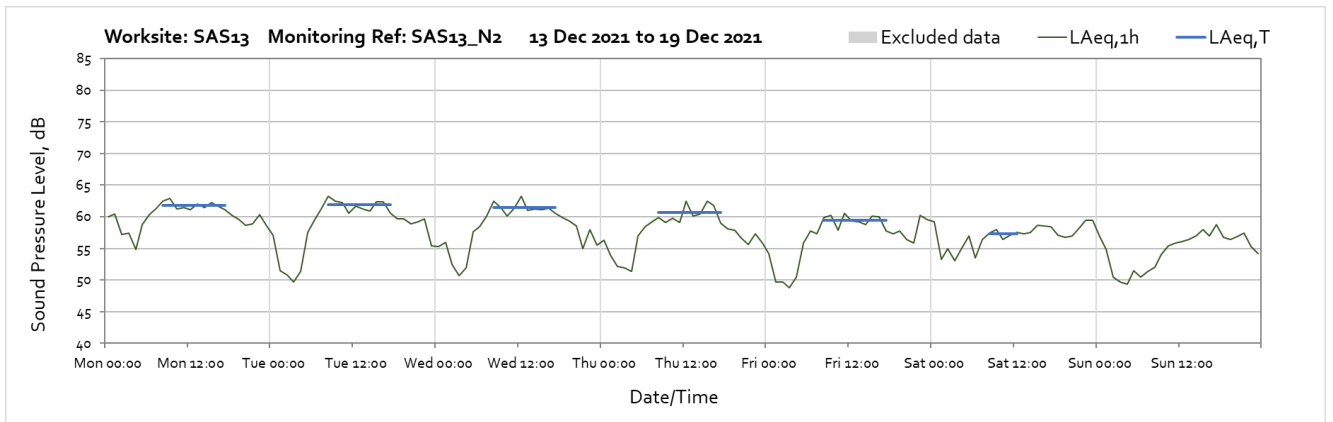
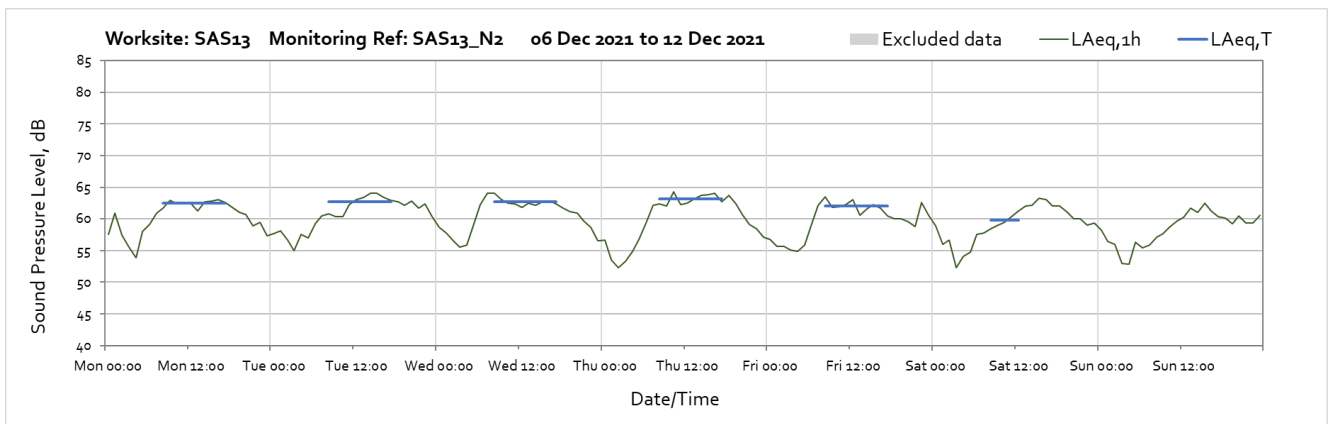
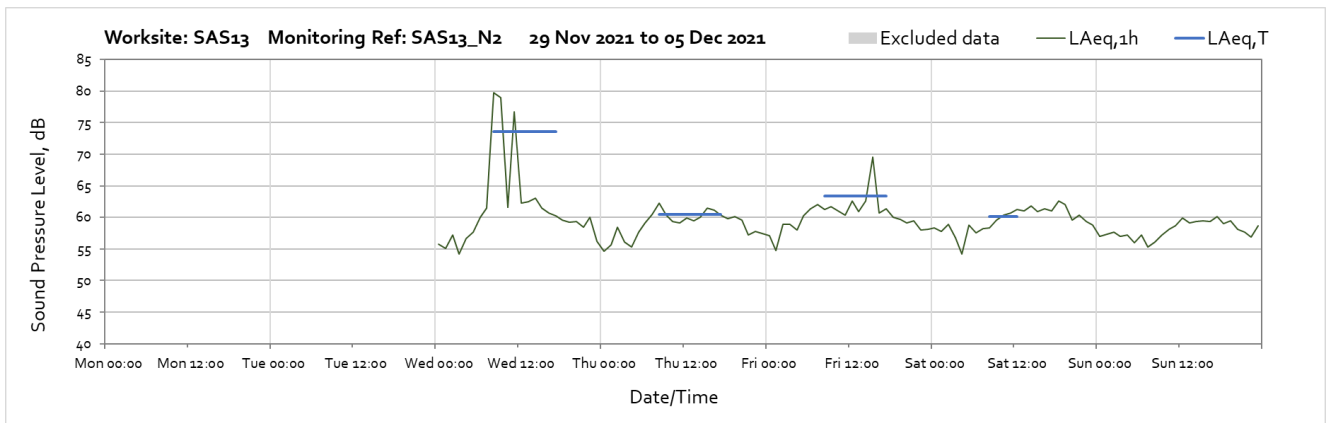


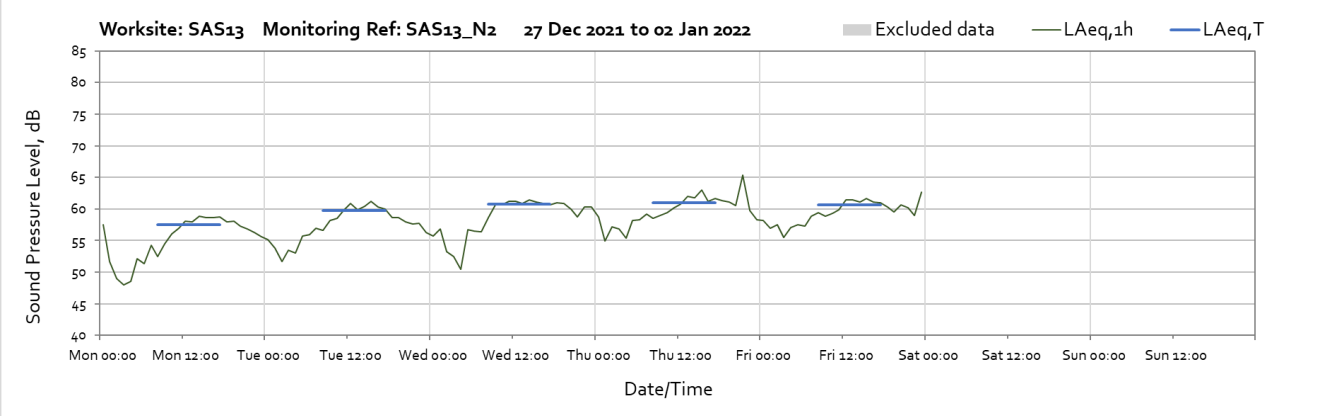
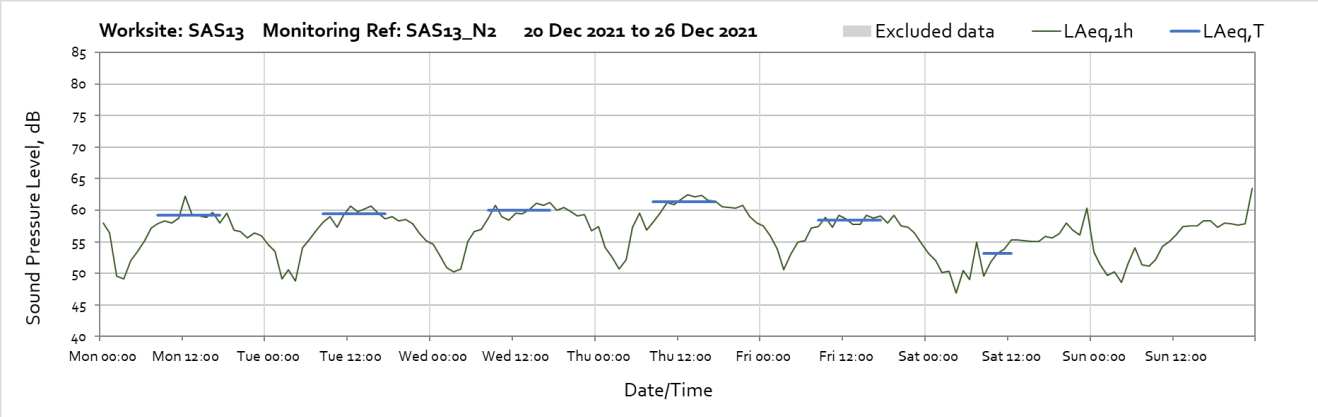
Worksite: SAS13 Bridge Replacement (SAS13) – Monitoring Ref: SAS13-N1





Worksite: SAS13 Bridge Replacement (SAS13) – Monitoring Ref: SAS13-N2

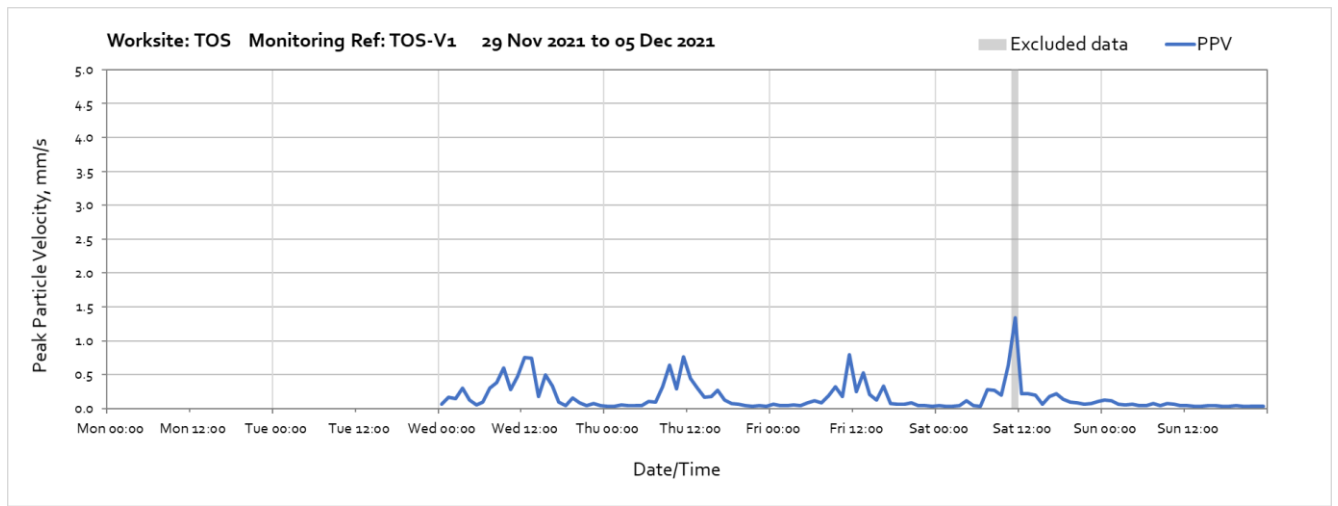




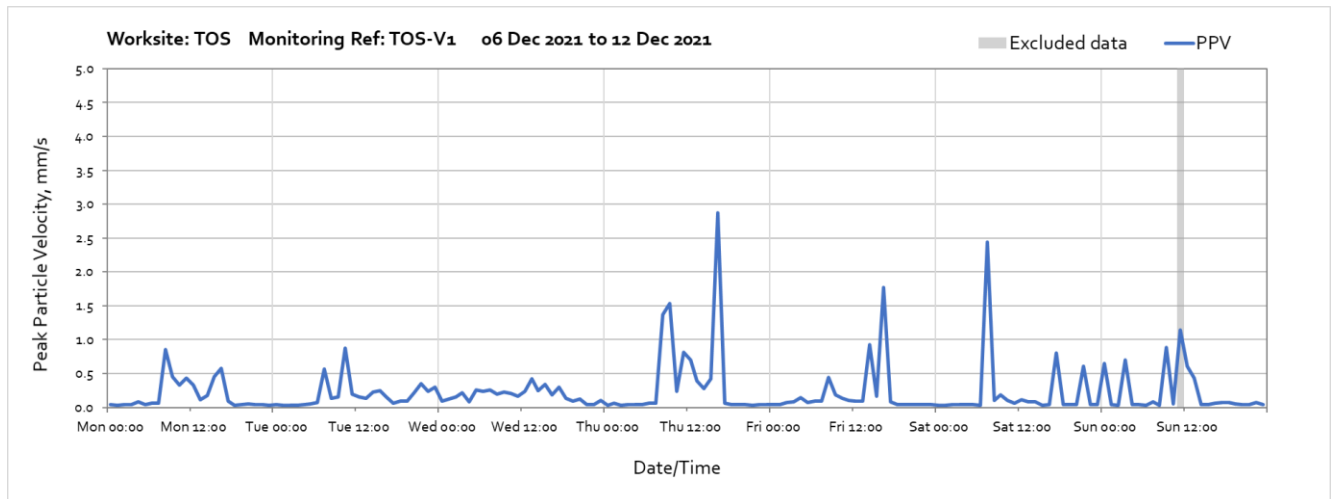
Vibration

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 axis 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: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-V1



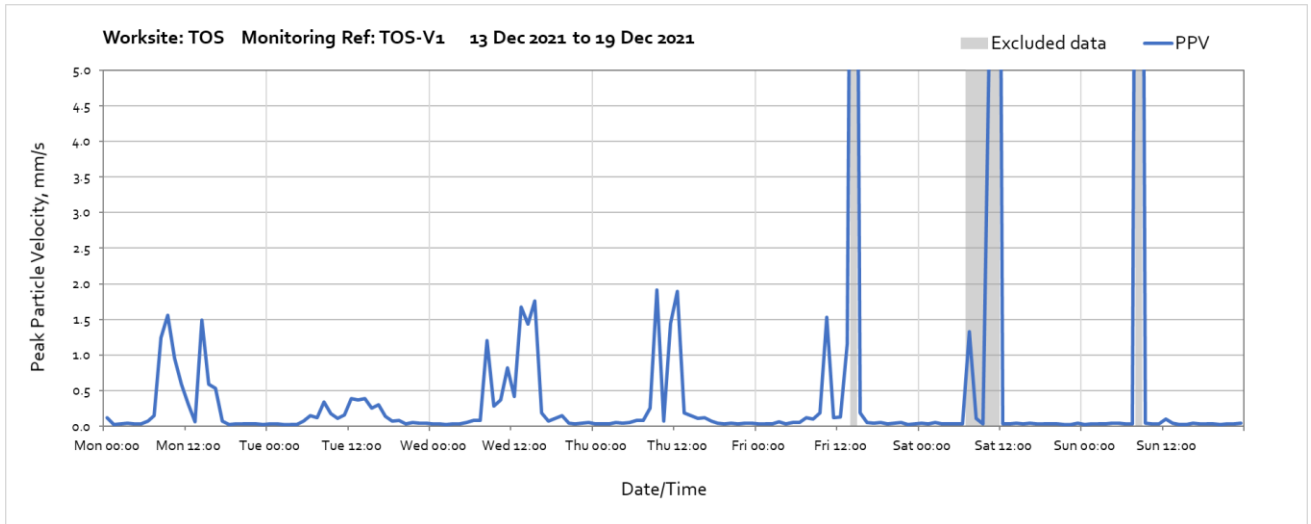
Note: Higher Vibration levels measured at 11:00 on Saturday 4th December was due to local inference with the monitor, which are not representative of HS2 construction works.



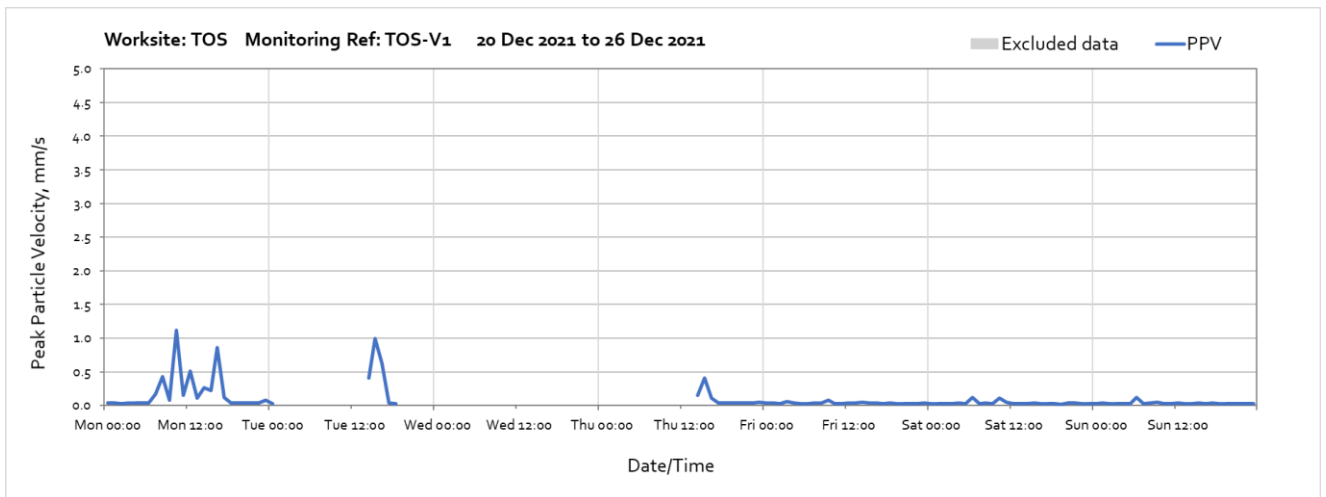
Note: Higher vibration levels measured across the week were due to installation of troughs, steel fixing, pouring of Slurry Treatment Plant (STP) slab, maintenance and operation of crane, and shuttering installation of precast troughs.

Higher Vibration levels measured at 11:00 on Sunday 12th December was due to local inference with the monitor, which are not representative of HS2 construction works.

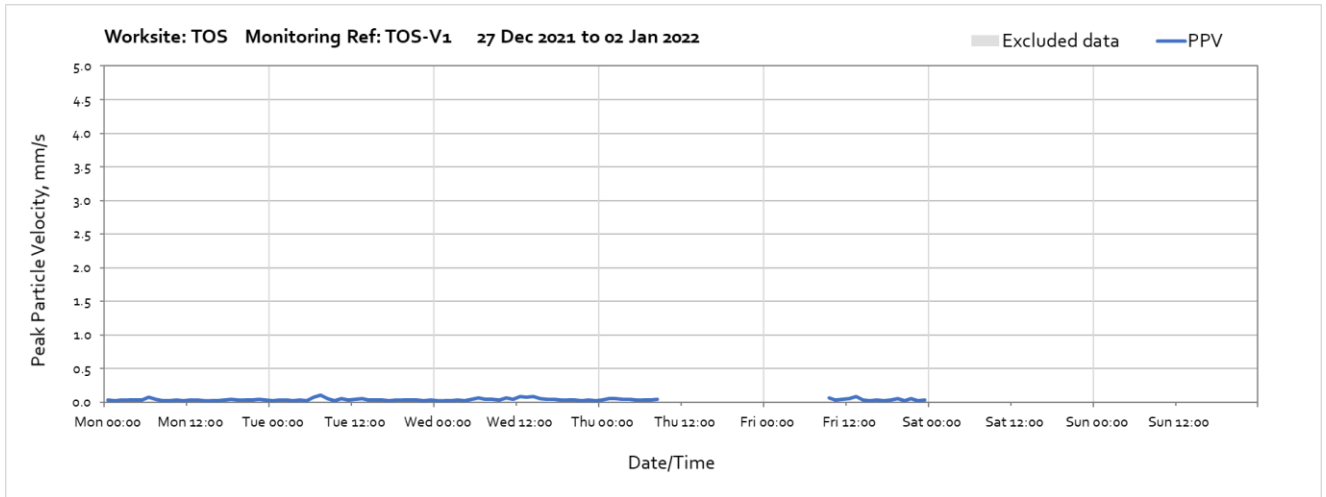
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Note: High vibration levels measured at 14:00 on Friday 17th December, between 07:00 and 11:00 on Saturday 18th December and at 08:00 on Sunday 19th December were due to local disturbance of the vibration monitoring station and are not representative of HS2 vibration levels.

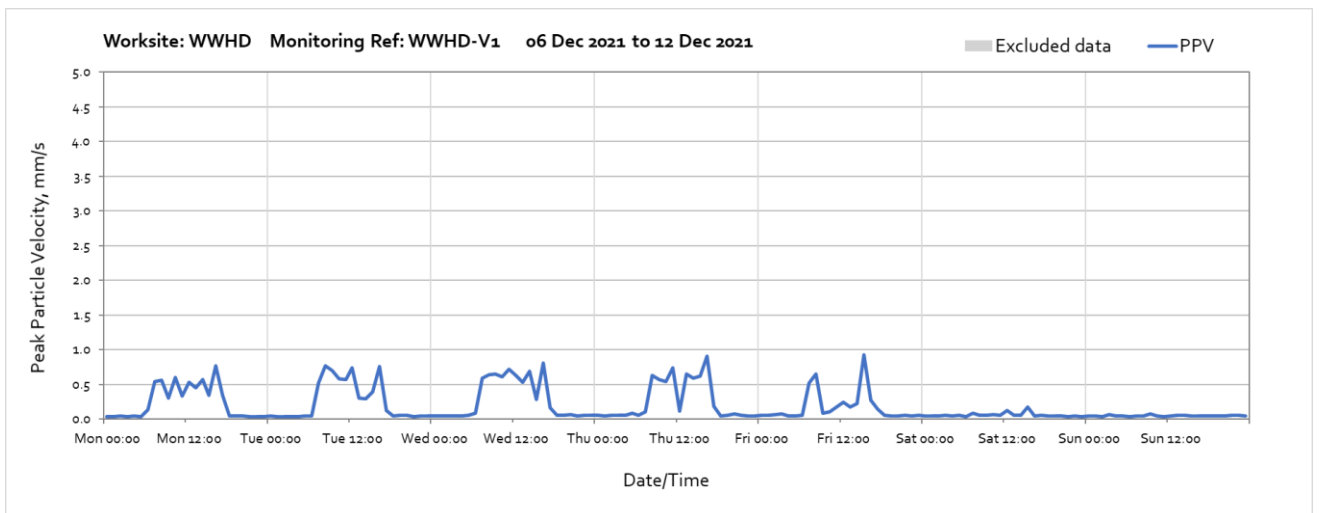
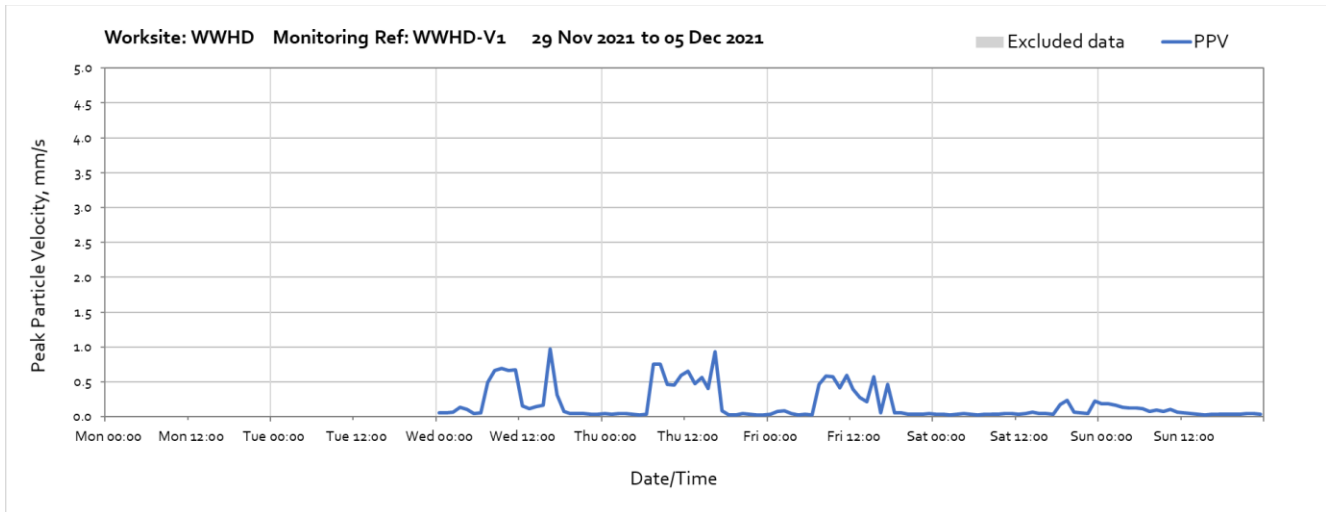


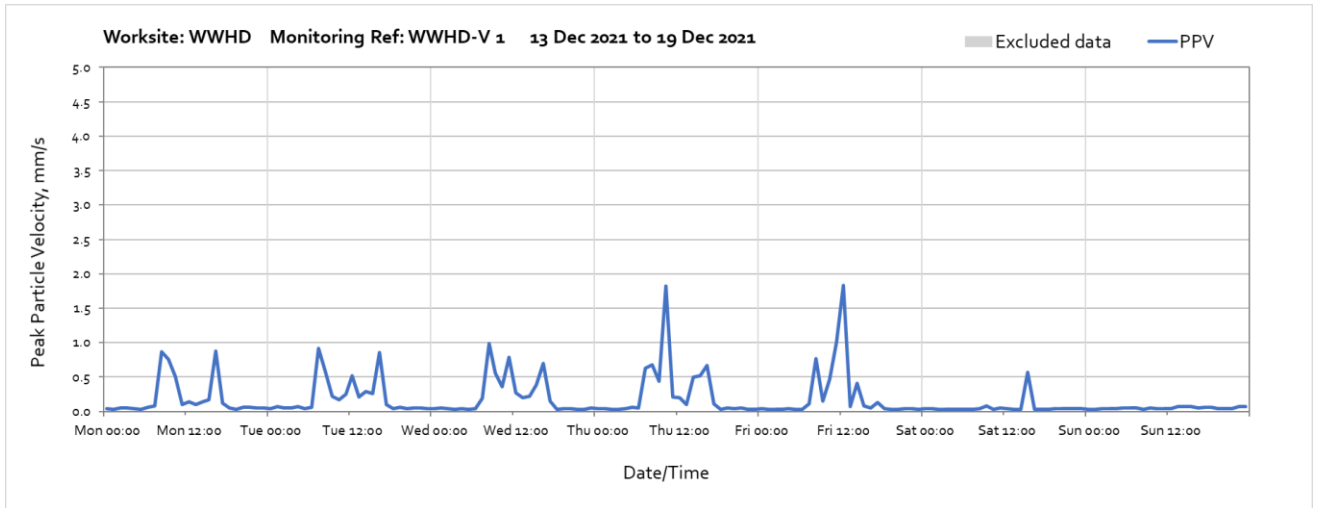
Note: Higher Vibration levels measured between 10:00 on Monday 20th December and 15:00 on Tuesday 21st December were due to lifting operations works. Missing between 01:00 and 14:00 on Tuesday 21st December and between 19:00 on Tuesday 21st December and 14:00 on Thursday 23rd December were due to were due to battery falling below required voltage limit caused by prolonged insufficient sunlight. A battery swap was carried out.



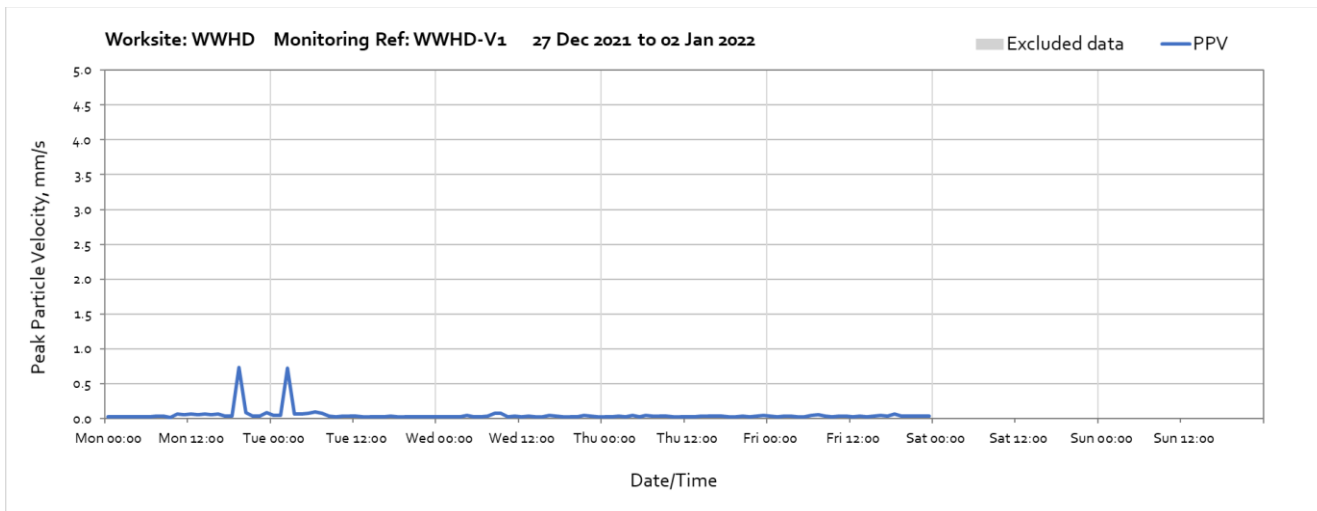
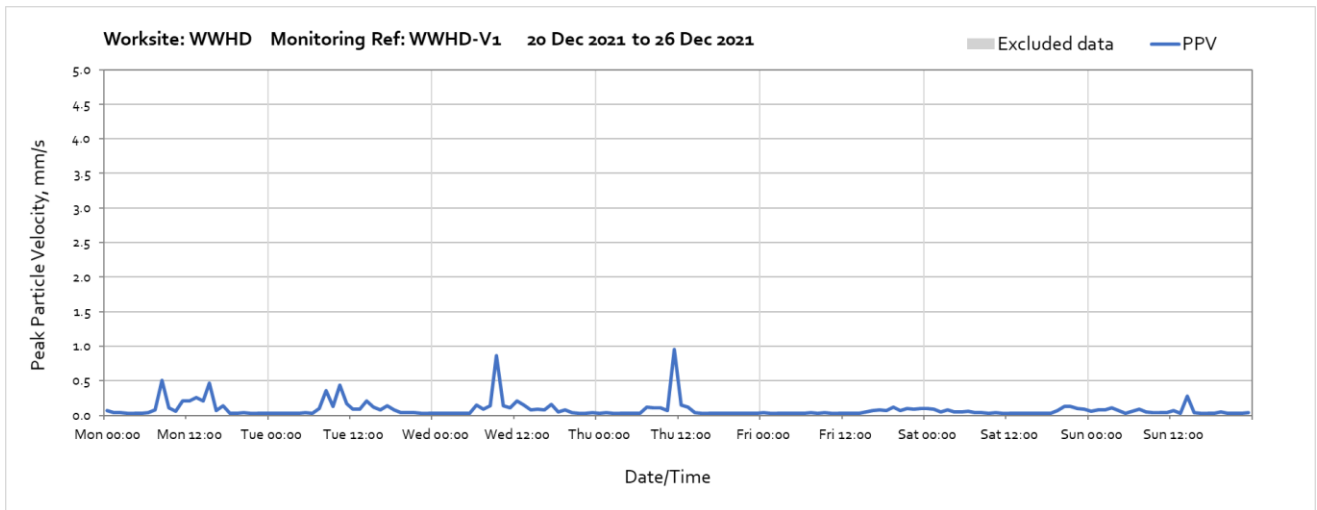
Note: Missing between 09:00 on Thursday 30th December and 09:00 on Friday 31st December were due to battery falling below required voltage limit caused by prolonged insufficient sunlight.

Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-V1

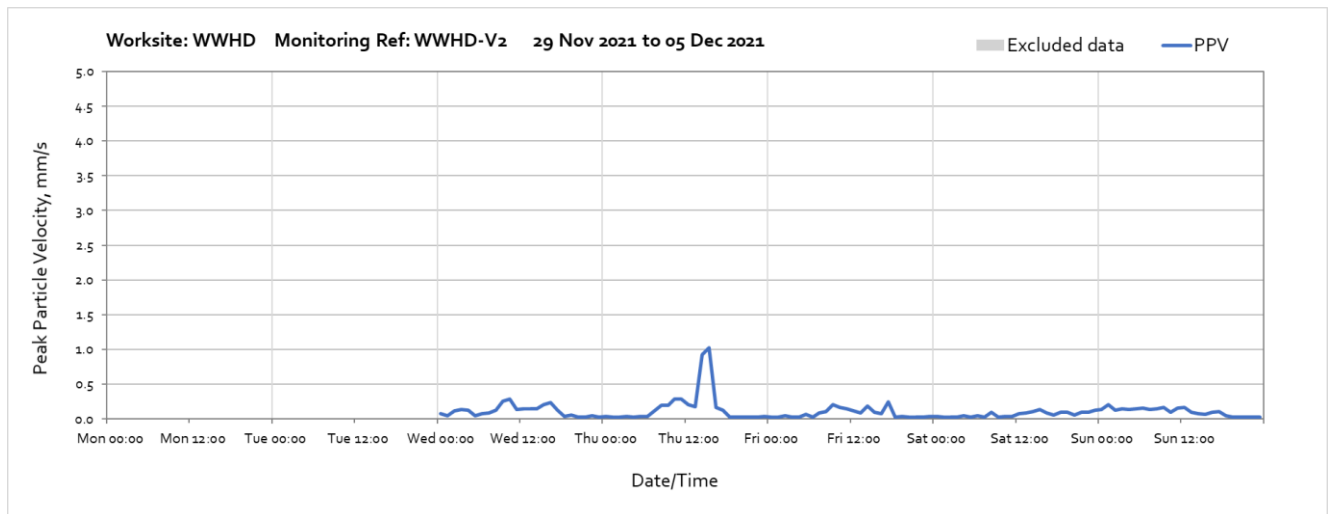




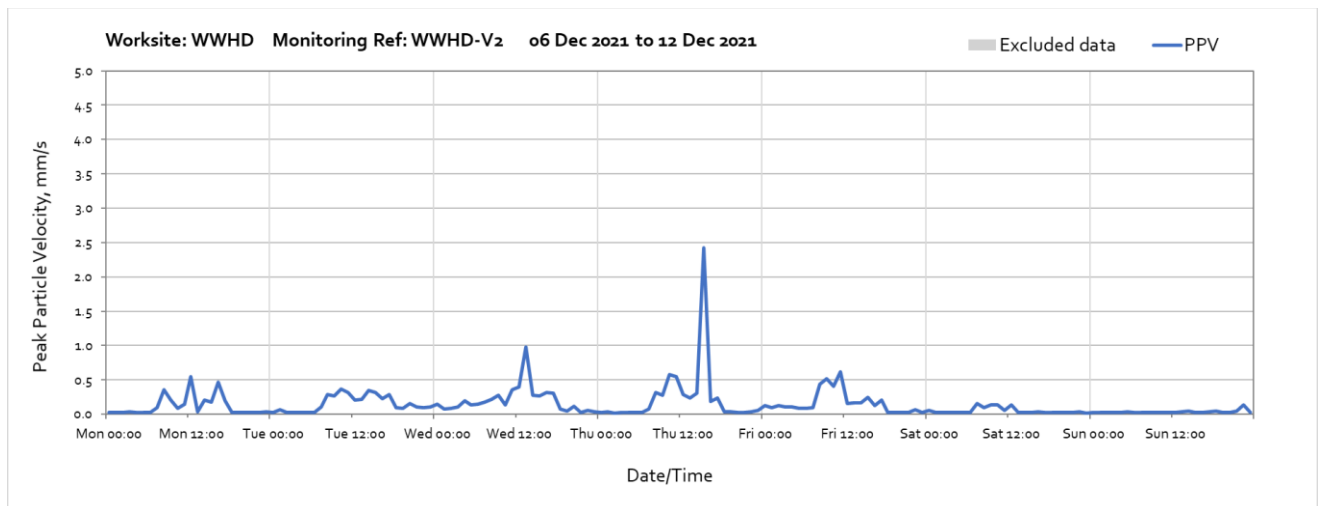
Note: Higher vibration levels measured during the week were due to plant working on north side of haul road, roller and dosser working and ground prep for unexploded ordinance (UXO) survey probing, and plant movement of a 30^t excavator for removing concrete blocks in the area.



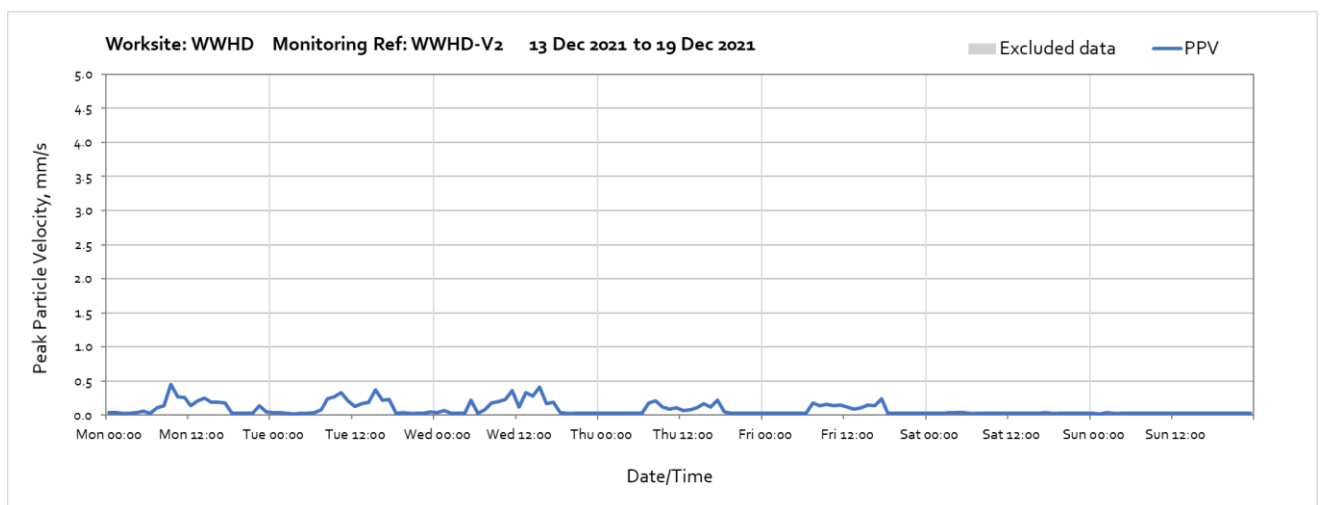
Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-V2



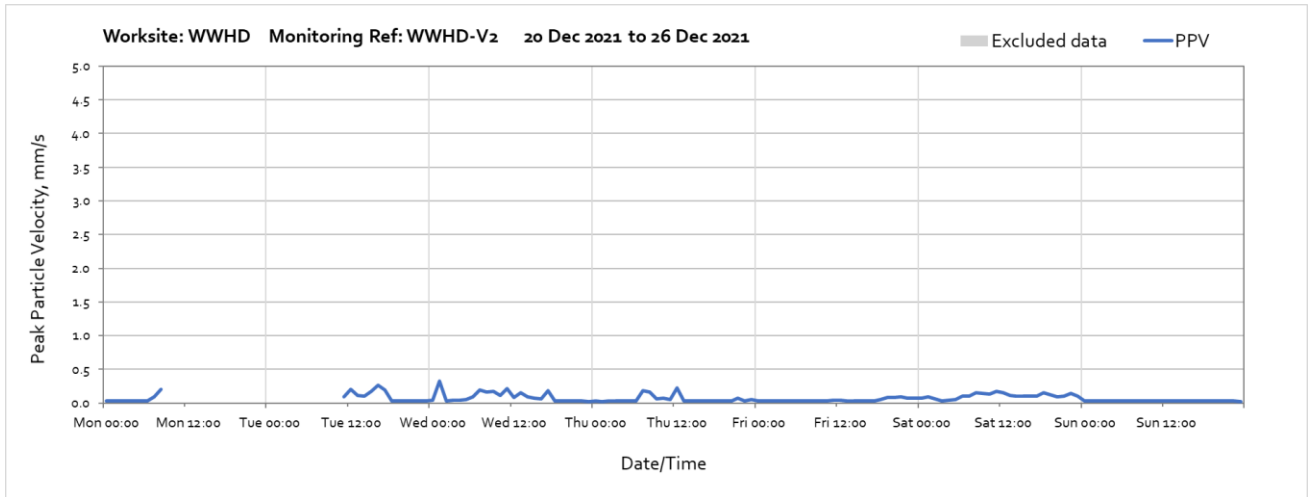
Note: Higher vibration levels measured at 15:00 on Thursday 2nd December was due to excavators movement around the area near to the monitor.



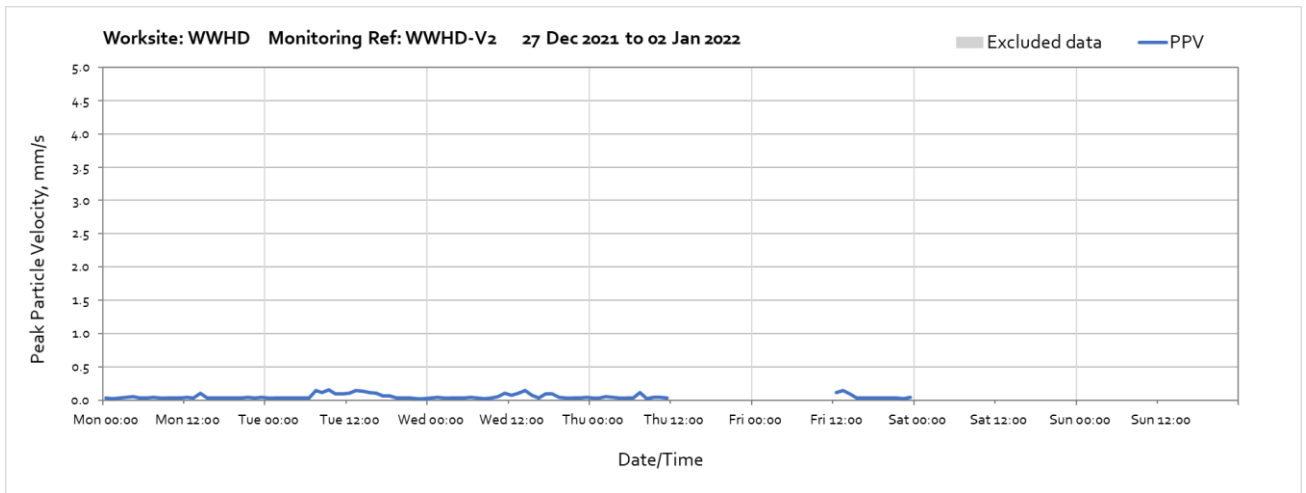
Note: Higher vibration levels measured at 15:00 on Thursday 9th December was due to breaker works.



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Note: Missing between 09:00 on Monday 20th December and 11:00 on Tuesday 21st December were due to battery falling below required voltage limit caused by prolonged insufficient sunlight.



Note: Missing between 12:00 on Thursday 23rd December and 12:00 on Friday 31st December were due to battery falling below required voltage limit caused by prolonged insufficient sunlight.