

## **Construction noise and vibration Monthly Report – August 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 August 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 deliveries, asphalt surfacing, ducting works, excavations, backfilling, concrete works, drainage works, stockpiling works, water treatment installation, unexploded ordinance (UXO) surveys, ramp installation, concrete breaking and hoarding works were underway.
- Noise and vibration monitoring was undertaken in the vicinity of the Twisted Oak Stables worksite (ref.: TOS), where concrete blinding works, excavating and pouring of diaphragm walls, prefabricating cages for capping beams, and movement of excavated material to stockpile were underway.
- Noise and vibration monitoring was undertaken in the vicinity of the Washwood Heath Depot worksite (ref.: WWHD), where excavation of trial holes, Bentonite water main works including excavating route and laying water pipes, Bentonite plant works including concrete works and placing of pre-cast concrete panels, Cheetham Hill Construction works including demolition of concrete slabs and A47 bridge demolition and clear up works were underway.
- Noise monitoring was undertaken in the vicinity of the Skanska SAS13 Bridge Replacement worksite in Washwood Heath (ref.: SAS13), where caissons ring installation for the west abutment, ongoing construction of the east abutment, and steel fabrication works were underway.

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

- Dorset Road, Saltley Business Park and Network Park (water utility works);
- Duddeston Mill Road (water and power utility works);
- Erskine Street (water utility works);
- B4114 Saltley Viaduct (water and 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.

Eleven complaints was received during the monitoring period. A description of the complaints, the results of investigations and any actions taken are detailed in Table 8 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 +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 1<sup>st</sup> to 31<sup>st</sup> August 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:
  - Material deliveries;
  - Asphalt surfacing;
  - Ducting works, including excavation of trenches for utility ducting;
  - Excavation works, including for attenuation pond, grid line dig and muckaway to reduce ground level;
  - Backfilling works and compaction of trenches and attenuation pond;
  - General maintenance work of platform area and stockpiling works;
  - Concrete works;
  - Drainage works;
  - Breaking out of concrete foundations;

- Stockpile works, including stockpiling of deliveries, from excavations across site, and removal of stockpiles off-site;
  - Water treatment installation;
  - Unexploded ordinance (UXO) surveys;
  - Ramp installation;
  - Concrete breaking; and
  - Hoarding works.
- Twisted Oak Stables worksite, ref.: TOS (see plan 3 in Appendix A) where work activities included:
    - Concrete blinding works;
    - Excavating and pouring of diaphragm walls;
    - Prefabricating cages for capping beams; and
    - Movement of excavated material to stockpile.
- Washwood Heath Depot worksite, ref.: WWHD (see plan 2 in Appendix A) where work activities included:
    - Excavation of trial holes;
    - Bentonite water main works, including excavating route and laying water pipes;
    - Bentonite plant works including concrete works and placing of pre-cast concrete panels;
    - Cheetham Hill Construction works, including demolition of concrete slabs; and
    - A47 bridge demolition and clear up works.
- Skanska SAS13 Bridge Replacement worksite, ref.: SAS13 (see plan 3 in Appendix A) where work activities included:
    - Caisson ring installation;
    - Rebar installation;
    - Pile cropping works;
    - Concrete pouring works for the pile cap;
    - Cleaning out the River Rae Overflow Channel using suction tanker; and

- Fabrication works, replacement of steel bridge involving bolting and welding bridge sections together.

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

- Dorset Road, Saltley Business Park and Network Park (water utility works);
- Duddeston Mill Road (water and power utility works);
- Erskine Street (water utility works);
- B4114 Saltley Viaduct (water and 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 August in the Birmingham City area.

1.2.2 Table 2 summarises the position of noise and vibration monitoring installations within the Birmingham City area in August 2021.

1.2.3 Two additional noise monitors (ref.: SAS13-N1 and SAS13-N2), were installed at Skanska SAS13 Bridge Replacement (worksite ref.: SAS13) on Sunday 1<sup>st</sup> August 2021.

1.2.4 One noise monitor (ref.: CS-N1), installed at Curzon Street (worksite ref.: CS) was re-located on 19<sup>th</sup> August 2021 to install the solar panels.

1.2.5 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 (old)           | Curzon Street, Birmingham                        |
|  | CS-N1 (new)           | 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                           |
|  | WWHD-N2               | Common Lane, Birmingham                          |
|  | WWHD-V2               | Common Lane, Birmingham                          |
| Skanska 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 L<sub>Aeq</sub> Data over the Monitoring Period

| Worksite Reference | Measurement Reference | Site Address                                     | Free-field or Façade Measurement | Weekly 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    |
| CS                 | CS-N1 (old)           | Curzon Street, Birmingham                        | Free-field                       | 64.8<br>(66.3)  | 68.2<br>(68.8) | 63.2<br>(64.2) | 62.0<br>(64.9) | 59.6<br>(63.0) | 0.0*<br>(0.0)   | 0.0*<br>(0.0)  | 0.0*<br>(0.0)  | 63.2<br>(64.6) | 60.5<br>(61.5) | 62.4<br>(63.8)   | 59.0<br>(63.6) |
| CS                 | CS-N1 (new)           | Curzon Street, Birmingham                        | Free-field                       | 64.6<br>(66.0)  | 65.4<br>(67.3) | 64.1<br>(64.7) | 62.7<br>(64.7) | 60.0<br>(64.0) | 62.0<br>(63.7)  | 66.4<br>(71.1) | 64.1<br>(64.1) | 64.0<br>(67.7) | 60.2<br>(62.8) | 62.3<br>(63.0)   | 59.5<br>(63.4) |
| TOS                | TOS-N1                | B4118-Birmingham Road, Water Orton, Birmingham   | Free-field                       | 65.2<br>(69.1)  | 67.1<br>(72.9) | 64.4<br>(68.6) | 63.8<br>(68.4) | 61.5<br>(68.6) | 64.2<br>(66.3)  | 65.3<br>(68.0) | 63.5<br>(67.5) | 64.1<br>(67.2) | 60.8<br>(65.2) | 63.2<br>(68.6)   | 60.5<br>(67.0) |
| WWHD               | WWHD-N1               | Drews Lane, Birmingham                           | Free-field                       | 56.7<br>(59.4)  | 58.1<br>(59.5) | 54.6<br>(65.0) | 54.9<br>(59.3) | 52.5<br>(59.8) | 53.0<br>(56.7)  | 53.4<br>(57.7) | 53.5<br>(53.5) | 54.6<br>(58.0) | 52.9<br>(58.9) | 56.9<br>(57.8)   | 52.4<br>(59.8) |
|                    | WWHD-N2               | Common Lane, Birmingham                          | Free-field                       | 53.3<br>(57.8)  | 56.8<br>(59.2) | 52.0<br>(56.3) | 53.1<br>(59.6) | 50.6<br>(59.7) | 49.8<br>(54.2)  | 52.0<br>(54.4) | 49.8<br>(49.8) | 51.6<br>(57.6) | 50.5<br>(58.0) | 55.4<br>(56.4)   | 49.9<br>(57.5) |
| SAS13              | SAS13-N1 (East)       | Taroni Avenue, off Aston Church Road, Birmingham | Free-field                       | 67.5<br>(70.8)  | 66.2<br>(67.7) | 59.9<br>(68.9) | 62.6<br>(68.4) | 66.3<br>(71.2) | 67.5<br>(67.9)  | 67.4<br>(67.5) | 66.4<br>(66.8) | 62.3<br>(65.7) | 64.5<br>(68.1) | 65.6<br>(70.2)   | 65.9<br>(69.0) |
|                    | SAS13-N2 (West)       | Heartlands Parkway, Nechells, Birmingham         | Free-field                       | 59.8<br>(64.9)  | 62.4<br>(68.3) | 59.2<br>(63.9) | 57.6<br>(64.2) | 55.1<br>(62.0) | 54.9<br>(56.4)  | 57.8<br>(59.4) | 58.5<br>(60.0) | 58.3<br>(61.7) | 54.4<br>(59.7) | 57.8<br>(62.7)   | 55.3<br>(59.9) |

\* No valid data was obtained.

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-<br>Birmingham Road,<br>Water Orton,<br>Birmingham | 2.28 (Z-axis) *                        |
| WWHD               | WWHD-V1               | Drews Lane,<br>Birmingham                                | 1.36 (Z-axis)                          |
| WWHD               | WWHD-V2               | Common Lane,<br>Birmingham                               | 1.63 (Z-axis)                          |

\* Higher vibration levels are due to the proximity of the construction activities to the vibration monitor. The nearest residential receptors are further away from the works and vibration levels at the receptor will therefore 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 |
|--------------------|-----------------------|---|--|-------------|--------------------------------|--------------------------------|
| CS                 | CS-N1 (old)*          | Curzon Street, Birmingham                       | All days                               | All periods | No exceedance                  | No exceedance                  |
| CS                 | CS-N1 (new)*          | Curzon Street, Birmingham                       | Weekday                                | 0800- 1800  | 5                              | No exceedance                  |
|                    |                       |   | Saturdays                              | 0800- 1200  | 1                              |                                |
| TOS                | TOS-N1*               | B4118- Birmingham Road, Water Orton, Birmingham | All days                               | All periods | No exceedance                  | No exceedance                  |
| WWHD               | WWHD-N1*              | Drews Lane, Birmingham                          | Weekday                                | 0800- 1800  | 6                              | No exceedance                  |
|                    |                       |   | Weekday                                | 1900- 2200  | 4                              | No exceedance                  |
|                    |                       |   | Night                                  | 2200- 0700  | 38                             | 9                              |
|                    |                       |   | Weekend                                | 1800- 1900  | 1                              | No exceedance                  |
|                    |                       |   | Weekend                                | 1900- 2200  | 2                              | No exceedance                  |
| WWHD               | WWHD-N2*              | Common Lane, Birmingham                         | Night                                  | 2200- 0700  | 30                             | 3                              |
|                    |                       |   | Weekday                                | 19:00- 2200 | 1                              | No exceedance                  |
| SAS13              | SAS13-N1 (East)       | Taroni Avenue, off Aston Church                 | All days                               | All periods | No exceedance                  | No exceedance                  |

| Worksite Reference | Measurement Reference | Site Address                             | Day (Weekday, Saturday, Sunday, Night) | Time period | Number of exceedances of LOAEL | Number of exceedances of SOAEL |
|--------------------|-----------------------|--|--|-------------|--------------------------------|--------------------------------|
|                    |                       | Road, Birmingham                         |  |             |                                |                                |
| SAS13              | SAS13-N2 (West)       | Heartlands Parkway, Nechells, Birmingham | All days                               | All periods | 2                              | No exceedance                  |

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

2.2.6 90 exceedances of the LOAEL were recorded across the Curzon Street, Washwood Heath Depot and Skanska SAS13 Bridge Replacement worksites. 12 exceedances of the SOAEL were recorded near Washwood Heath Depot worksite due to the A47 bridge demolition 24h works during August 2021.

2.2.7 For the purpose of assessing eligibility for noise insulation or temporary rehousing, multiple exceedances of the SOAEL in a 24-hour period would be counted as a single exceedance during that day. Over the reporting period, the overall number of SOAEL exceedances at each measurement location is shown in Table 6 and may be lower than the total sum of individual exceedances reported in Table 5 for each location.

Table 6: Summary of Total Exceedances of SOAEL

| Worksite Reference | Measurement Reference | Monitor Address         | Total of SOAEL exceedances in the month |
|--------------------|-----------------------|-------------------------|---|
| WWHD               | WWHD-N1               | Drews Lane, Birmingham  | 3                                       |
|                    | WWHD-N2               | Common Lane, Birmingham | 1                                       |

## 2.3 Exceedances of Trigger Level

2.3.1 Table 7 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 7: 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 8 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

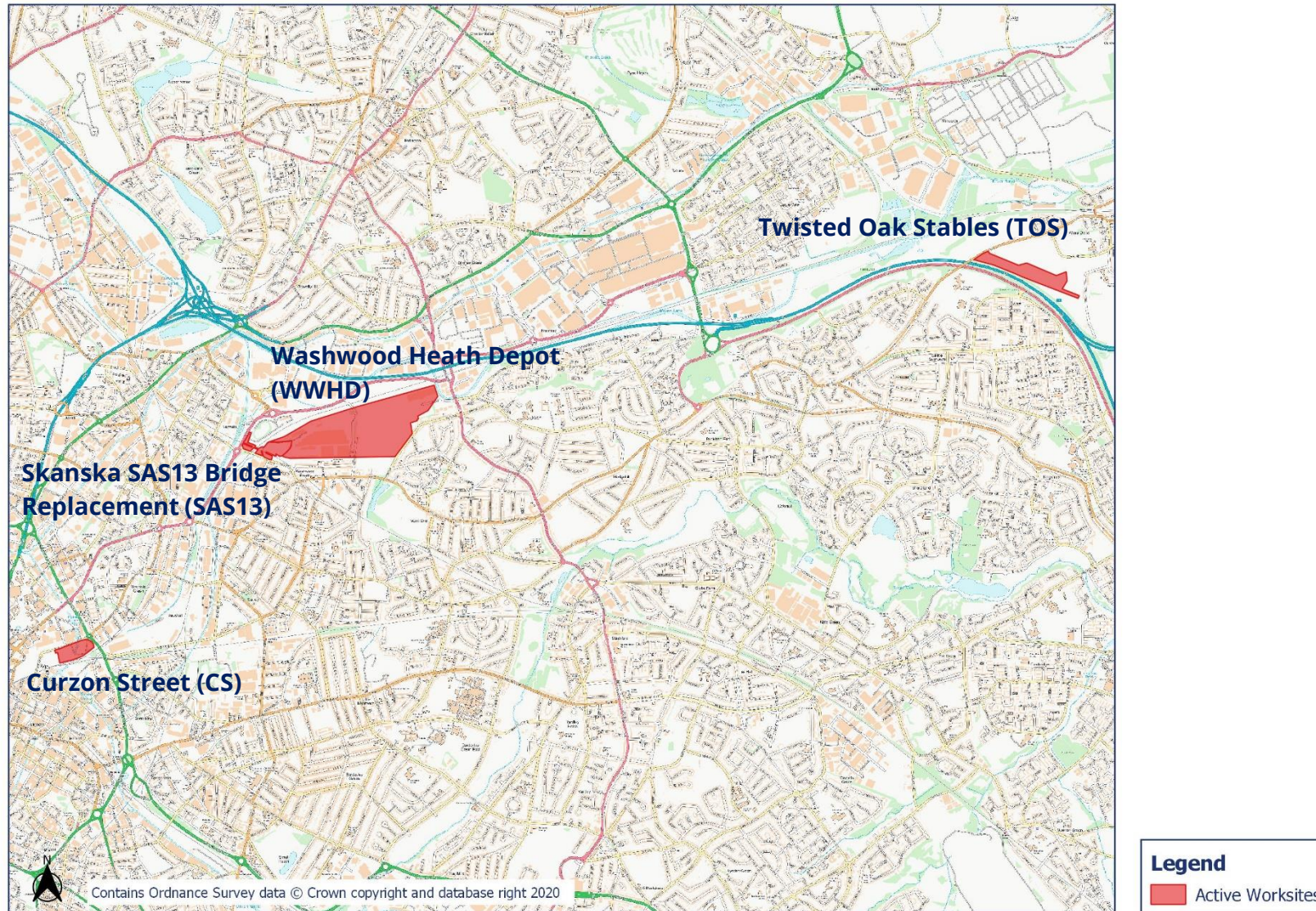
Table 8: Summary of Complaints

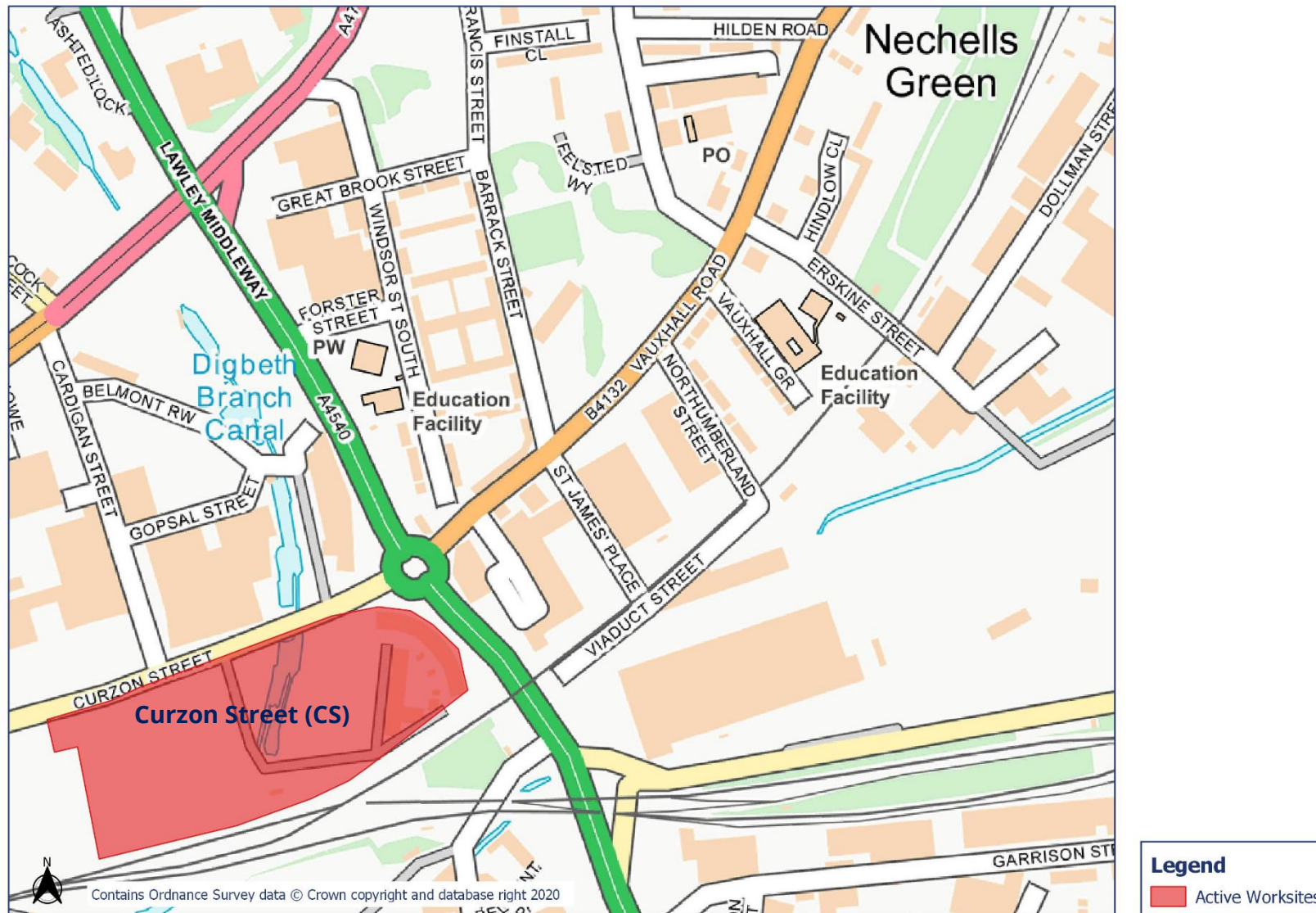
| Complaint Reference Number | Worksite Reference | Description of Complaint   | Results of Investigation       | Actions Taken   |
|----------------------------|--------------------|--|--------------------------------|---|
| HS2-21-42427-C             | WWHD               | Noise disturbance from loud works taking place on the weekend.         | Demolition work on A47 bridge. | Confirmed the cause of the noise to stakeholder. Confirmed that consents were in place and that advanced notifications to residents had been provided. Confirmed that due to the nature of the works noise mitigation measures could not be used immediately, however after progress from the weekend of 28th the following were in place: <ul style="list-style-type: none"> <li>• Introduction of mats on the bridge structure</li> <li>• Wrapping the breaker in an acoustic blanket</li> <li>• Placement of acoustic barriers at strategic points around the site.</li> <li>• Placement of loose granular material on the hard floor surfaces to stop reverberation.</li> </ul> |
| HS2-21-42428-C             | WWHD               | Noise disturbance from worksite.                                       |                                |   |
| HS2-21-42429-C             | WWHD               | Noise disturbance disturbing sleep. No advance notification.           |                                |   |
| HS2-21-42431-C             | WWHD               | Noise disturbance through the night.                                   |                                |   |
| HS2-21-42432-C             | WWHD               | Loud drilling noise & vibration disturbance through night and weekend. |                                |   |
| HS2-21-42433-C             | WWHD               | Noise disturbance at night without warning or mitigation.              |                                |   |
| HS2-21-42434-C             | WWHD               | Noise disturbance at night from continuous banging noise.              |                                |   |

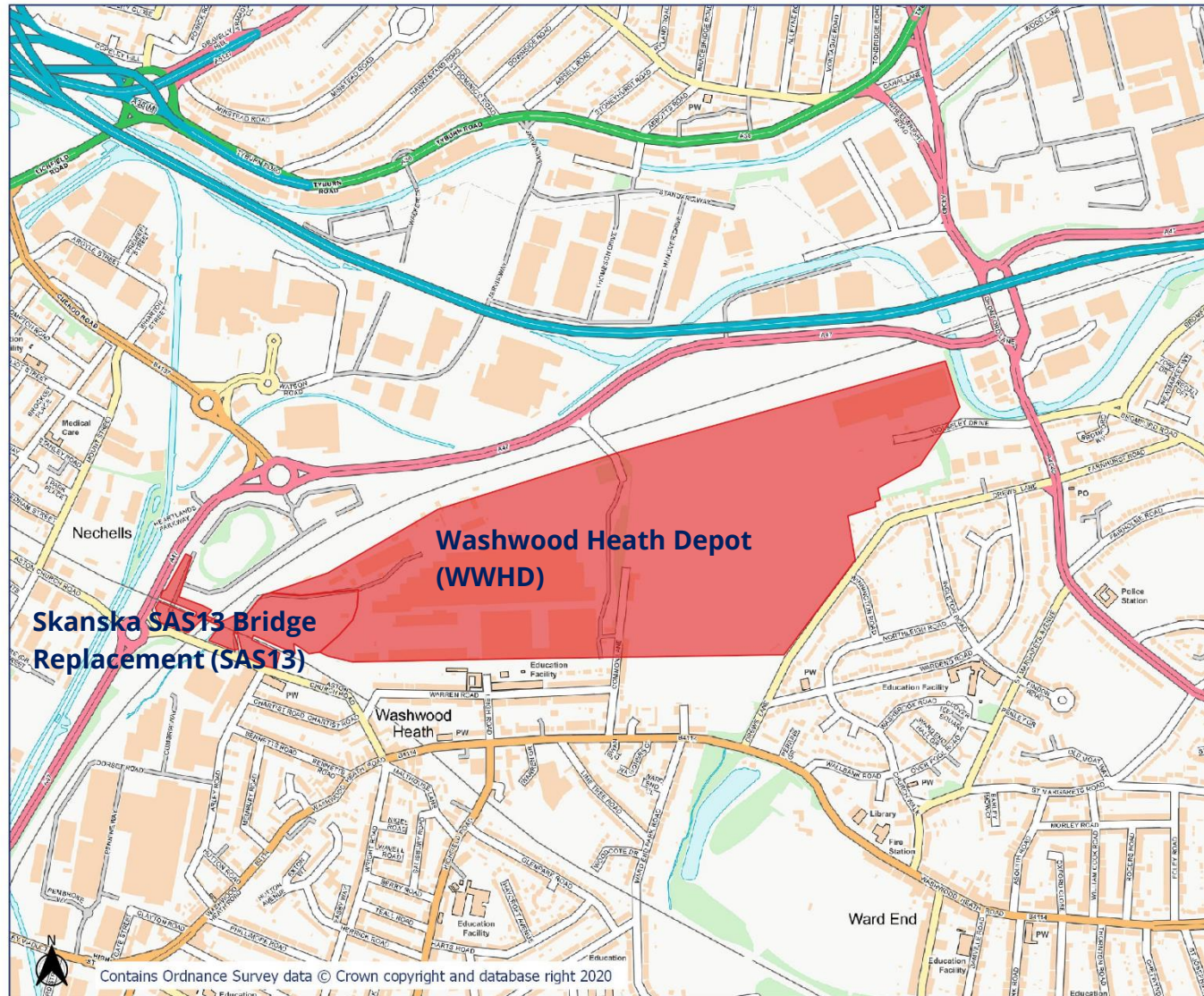
|                |      |   |  |  |
|----------------|------|---|--|--|
| HS2-21-42435-C | WWHD | Noise disturbance at night from continuous banging noise. |  |  |
| HS2-21-42454-C | WWHD | Drilling noise.   |  |  |
| HS2-21-42463-C | WWHD | Noise due to weekend works.                               |  |  |
| HS2-21-42464-C | WWHD | Noise through night-time.                                 |  |  |

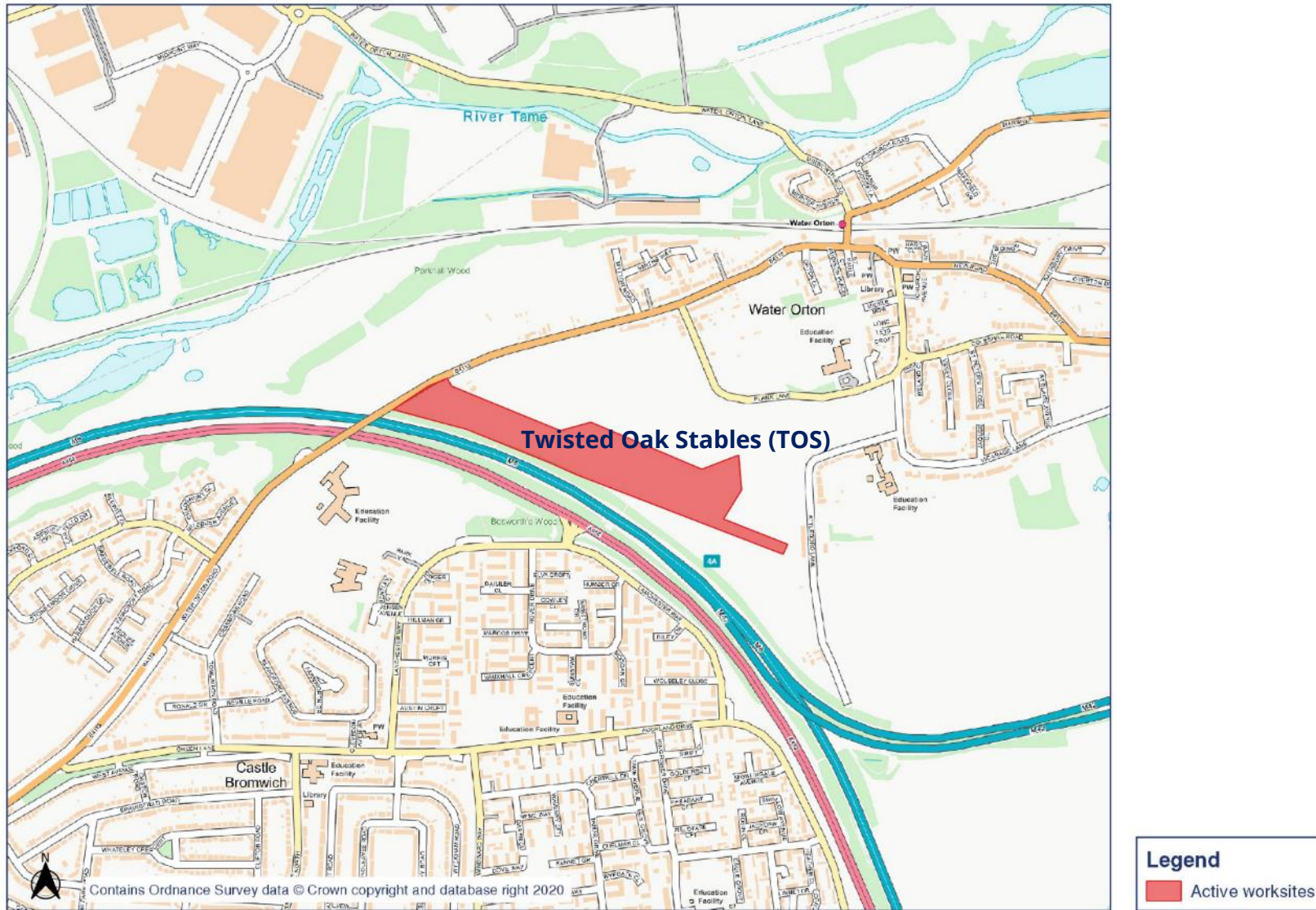


# Appendix A Site Locations

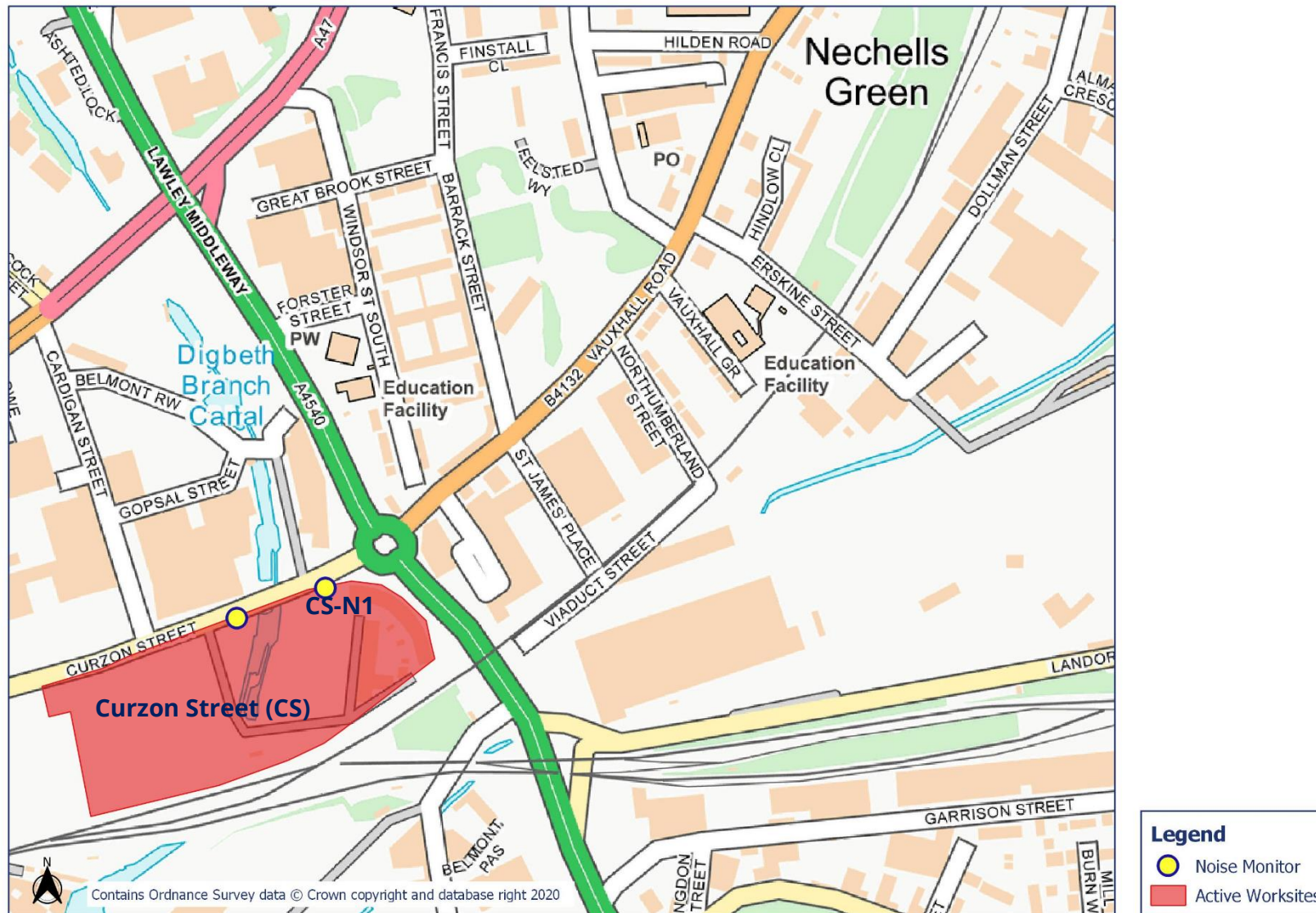


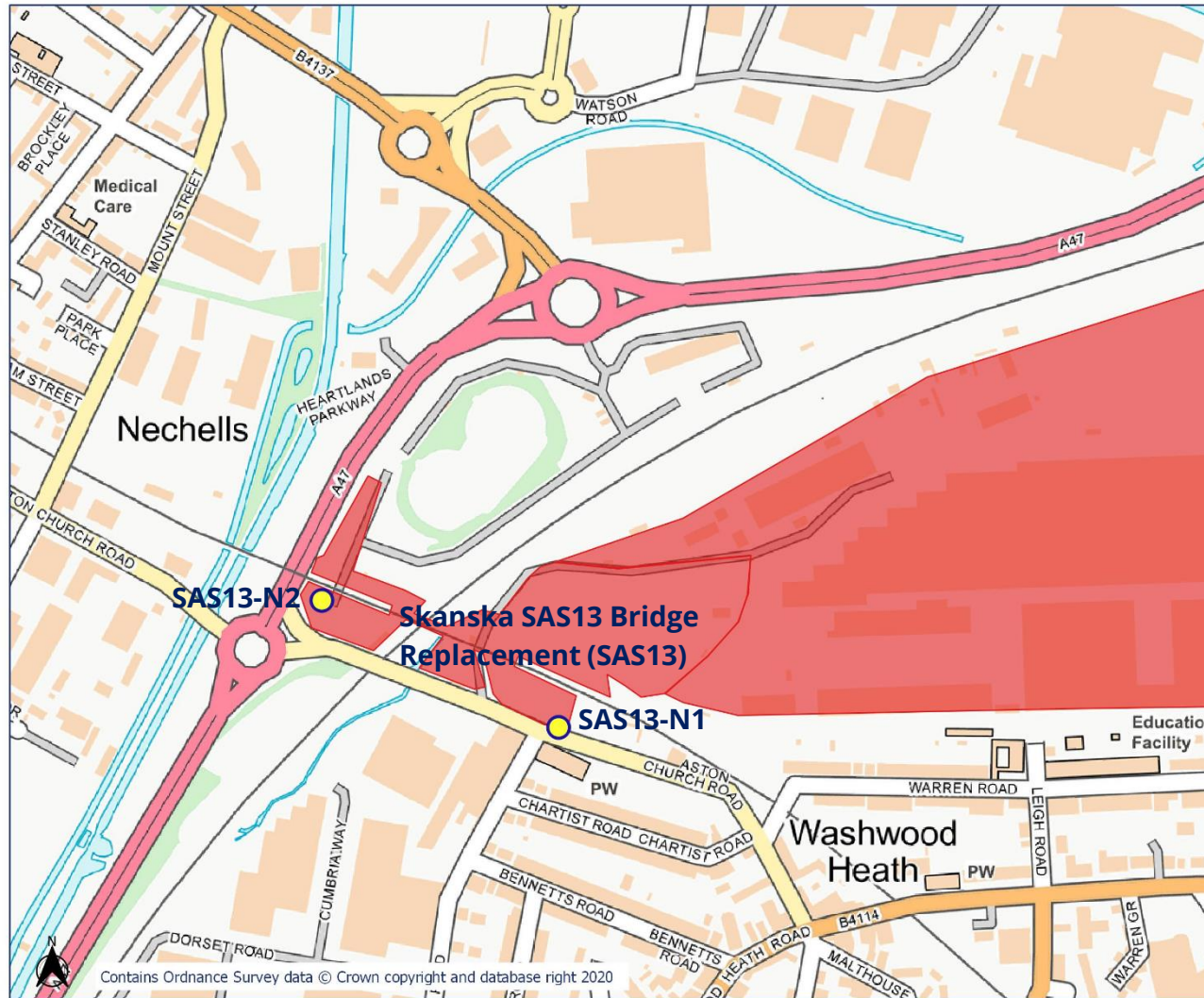




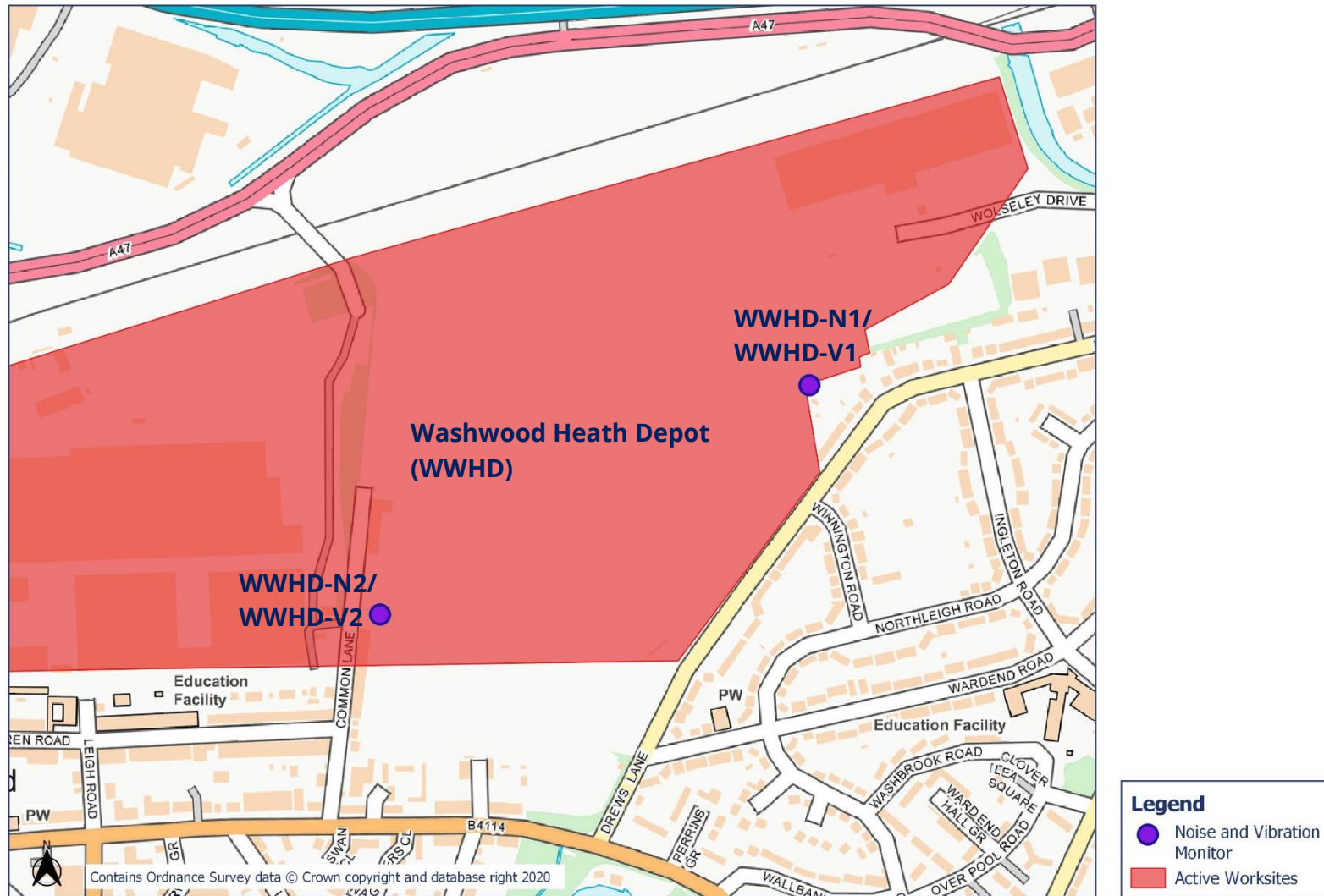


# Appendix B Monitoring Locations



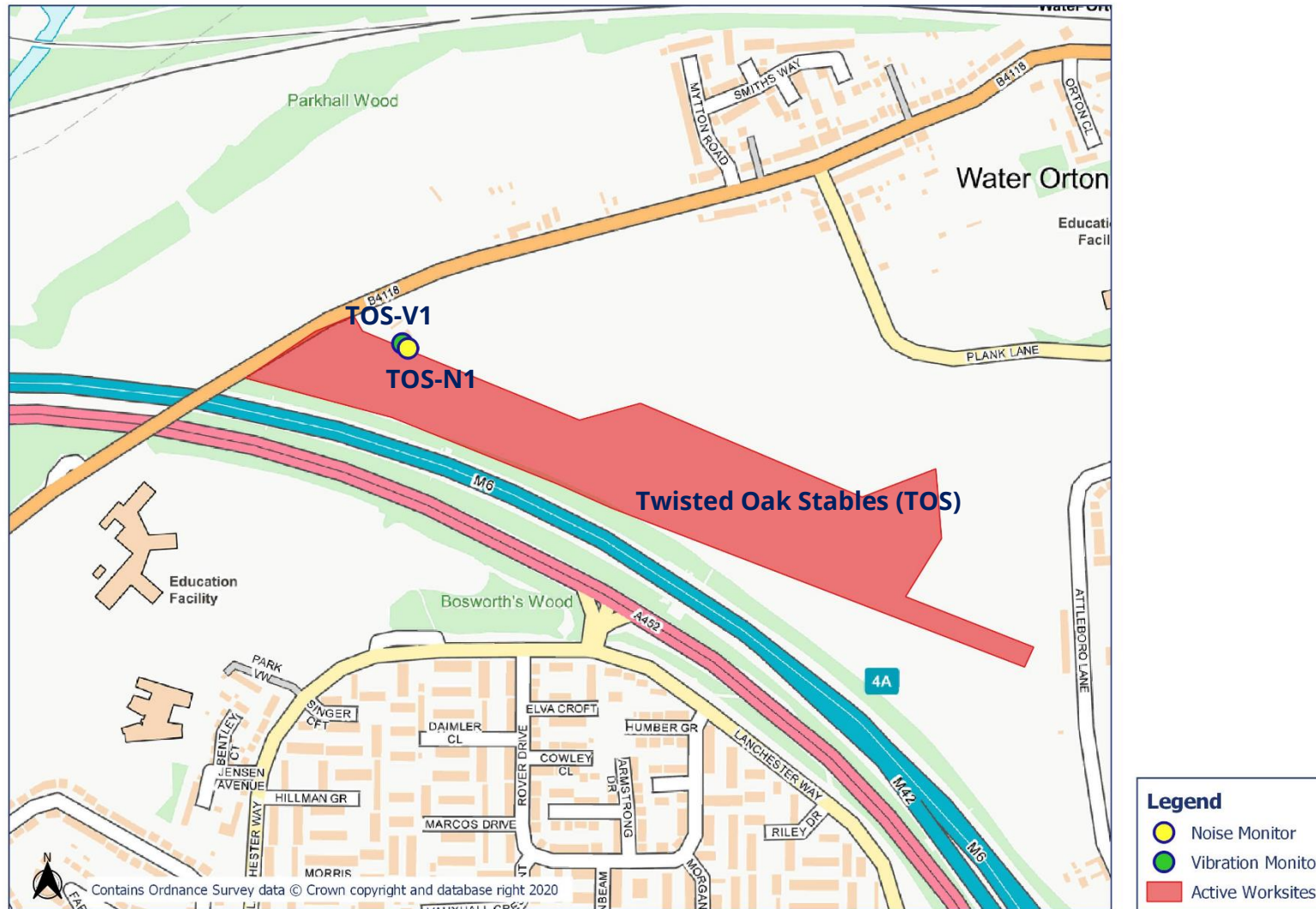






# HS2

## Noise and Vibration Monitoring Plan - 4

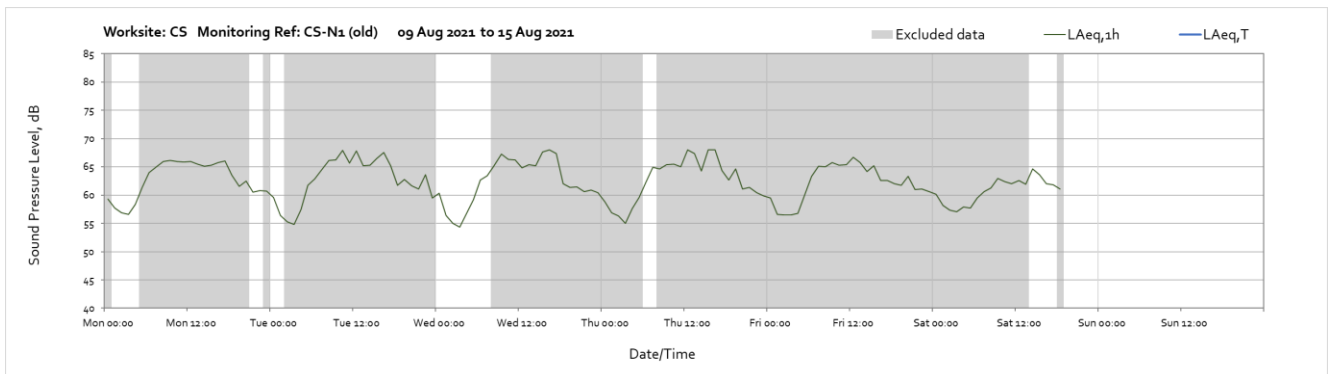
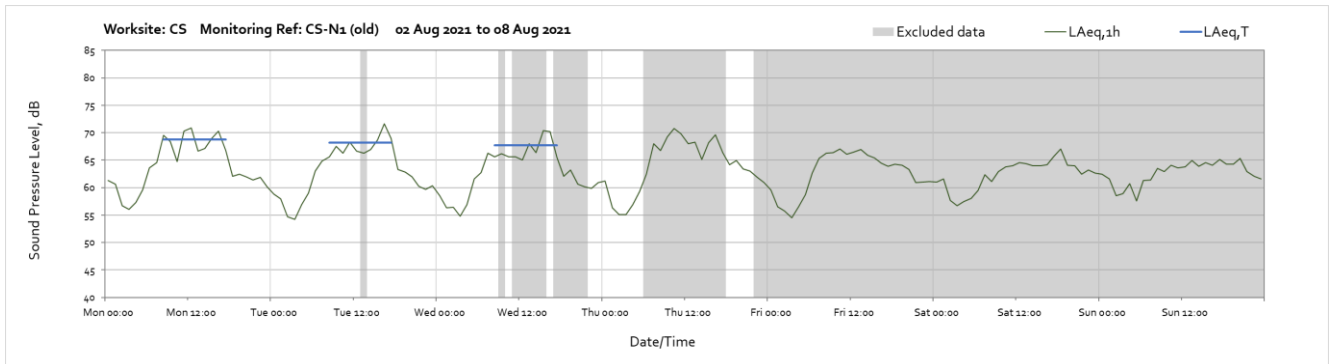
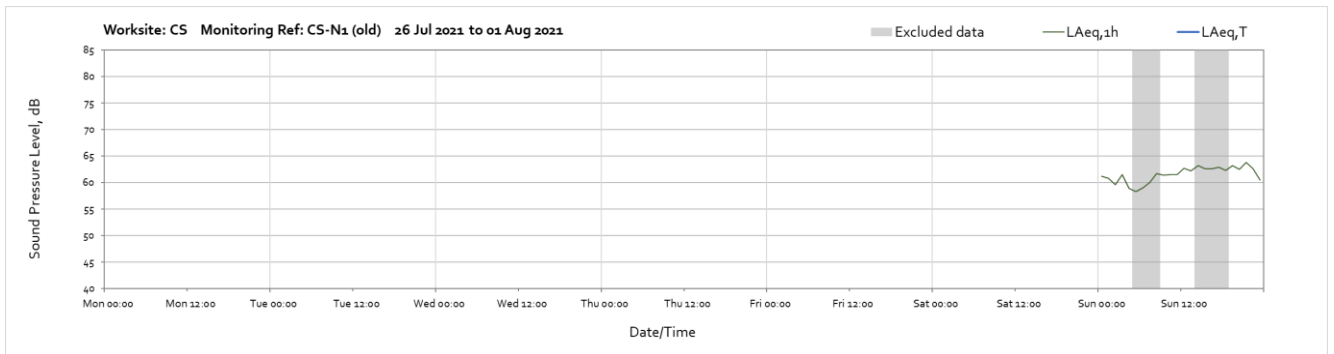


# Appendix C Data

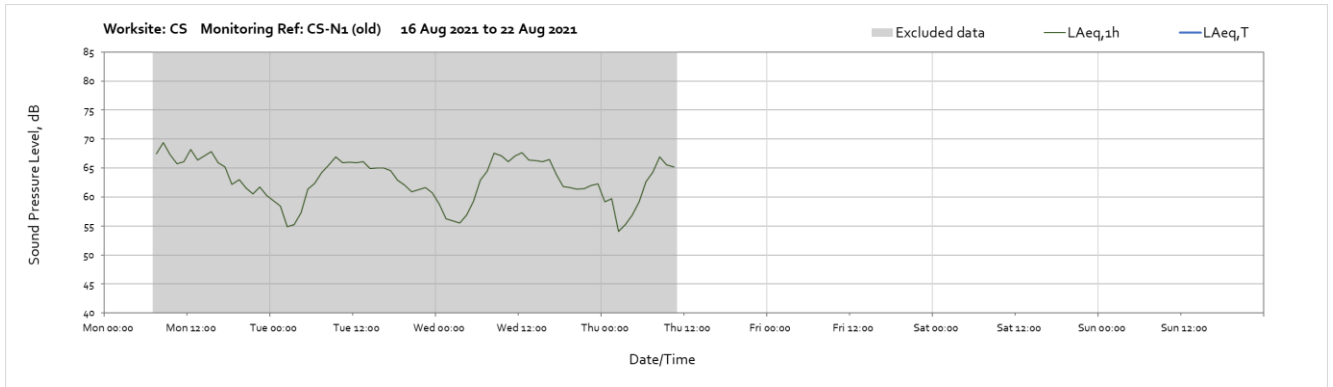
## Noise

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 in Table 3 of the main report.

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



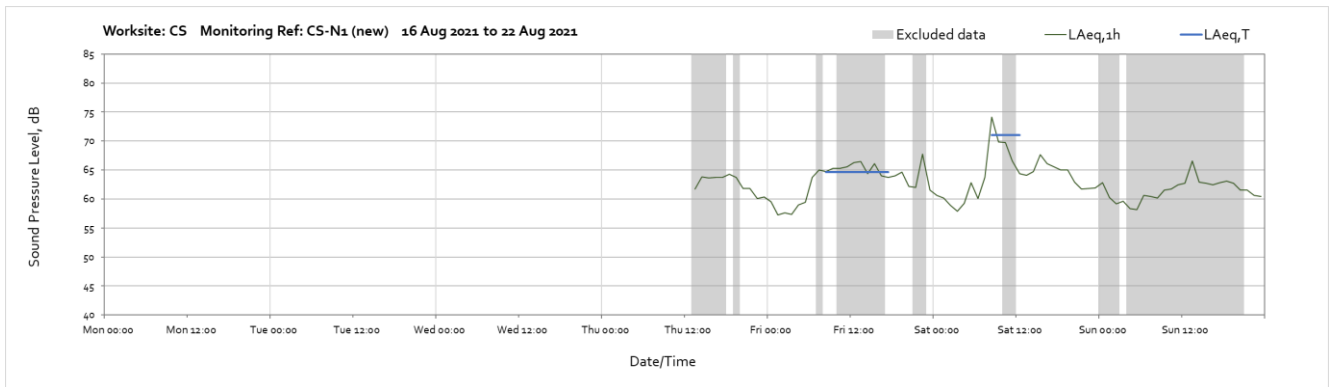
Note: Missing data between 18:00 on Saturday 14<sup>th</sup> August and 07:00 on Monday 20<sup>th</sup> August were due to loss of power at the monitor station.



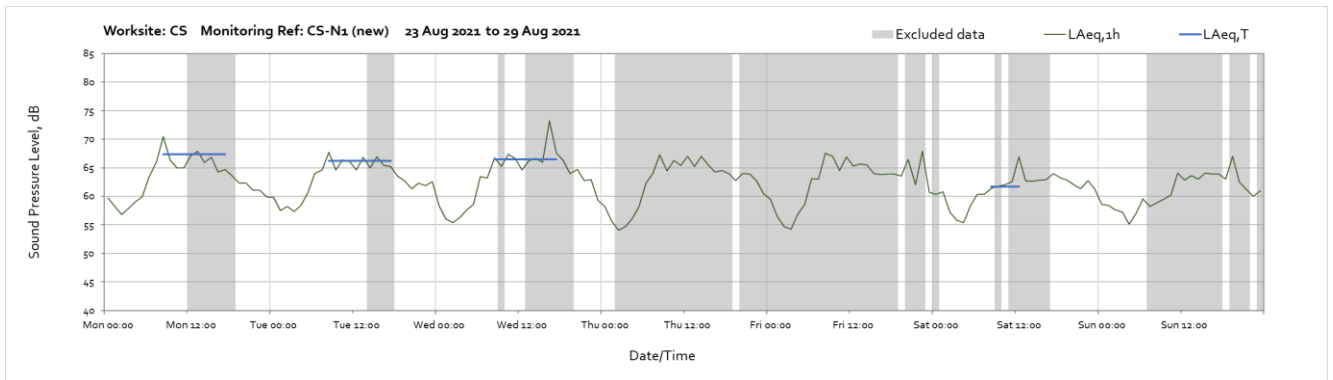
Note: Missing data between 18:00 on Saturday 14<sup>th</sup> August and 07:00 on Monday 16<sup>th</sup> August were due to loss of power at the monitor station.

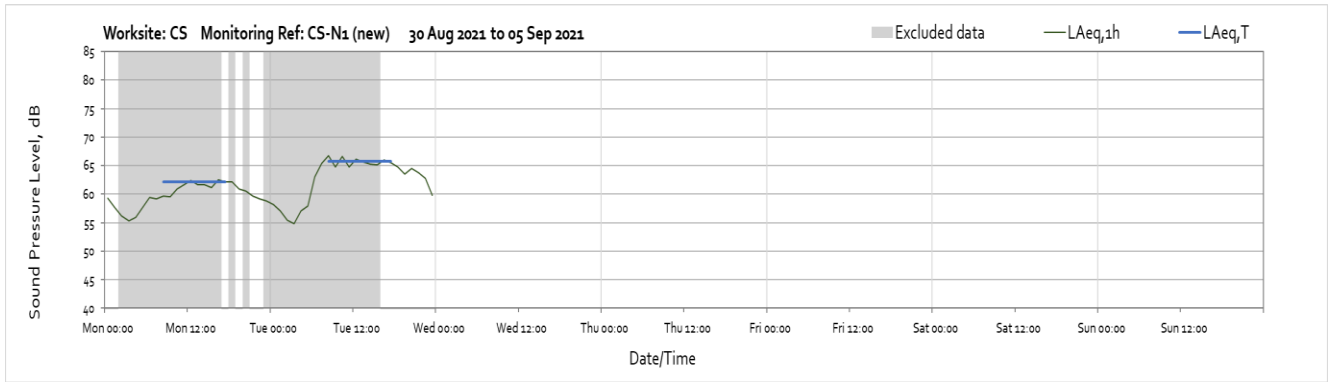
At 10:00 on Thursday 19<sup>th</sup> August, the monitor station was re-located to install the solar panels.

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

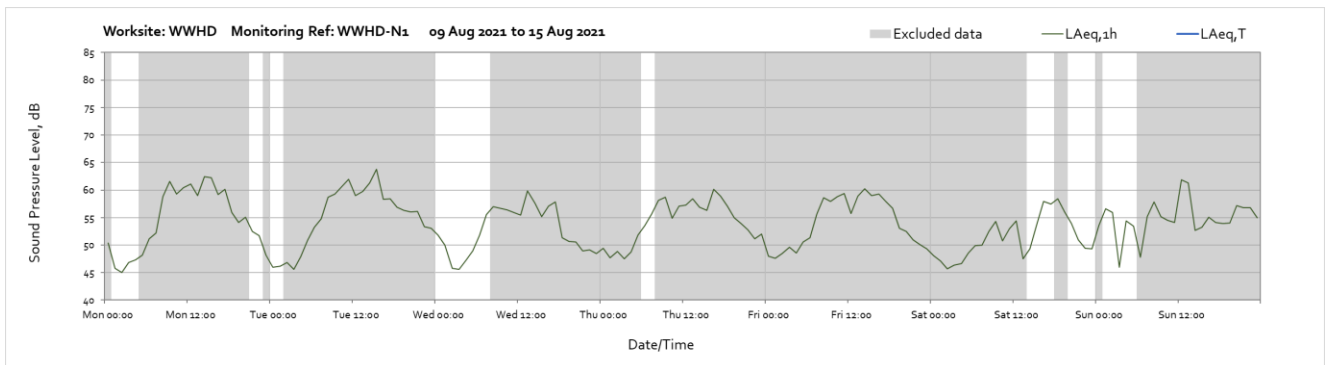
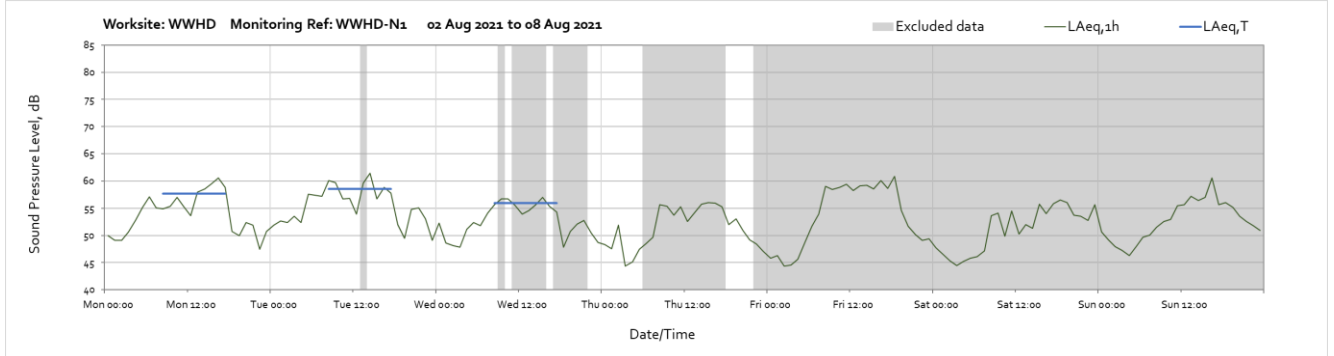
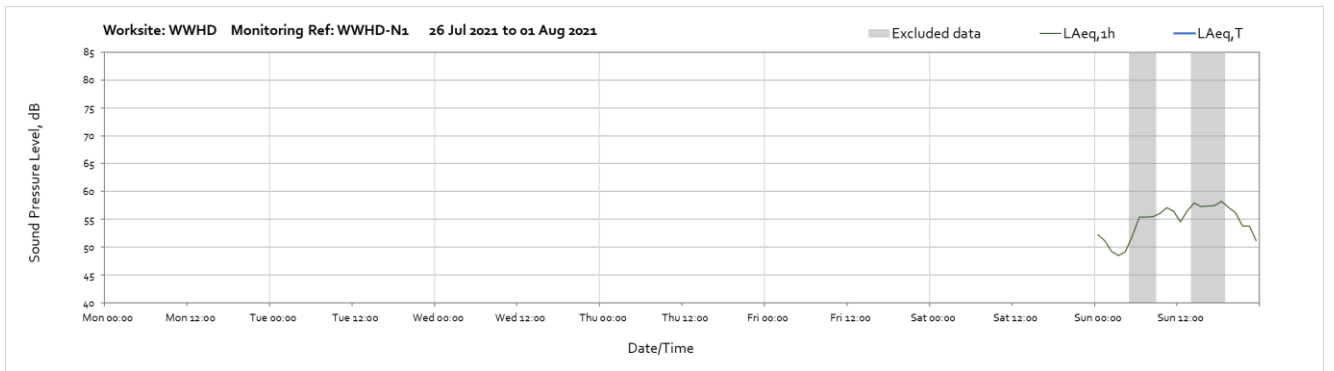


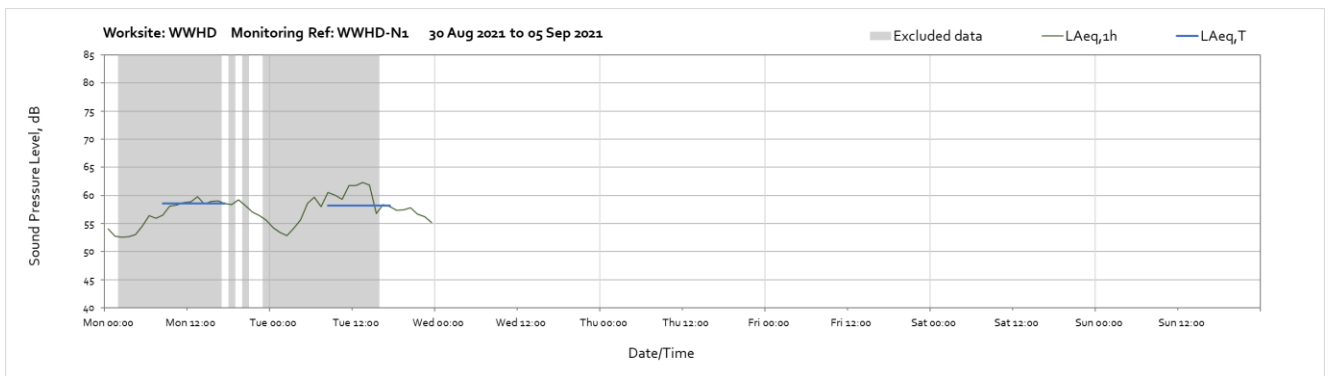
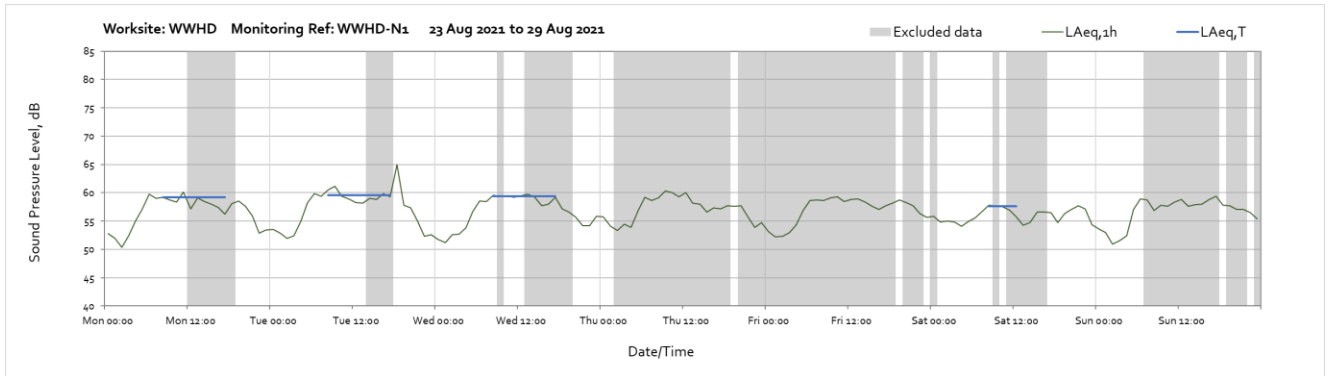
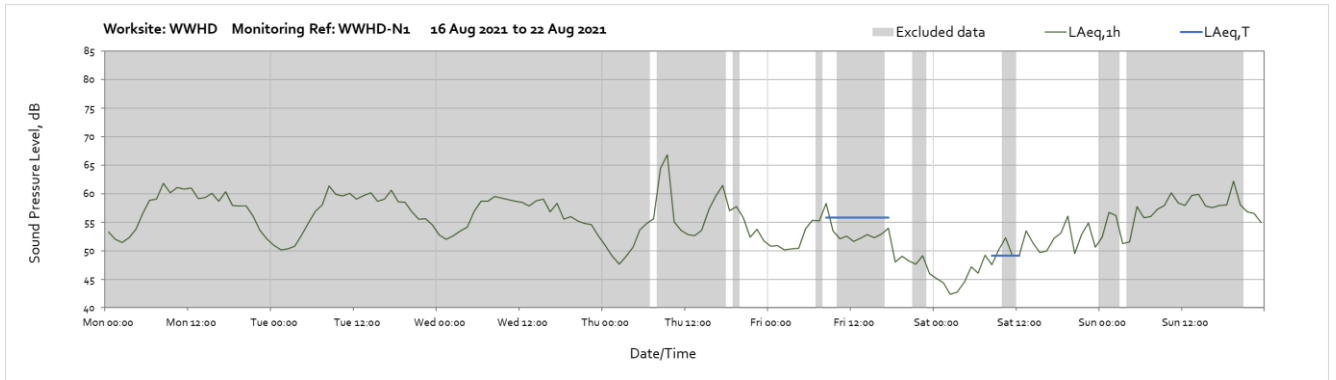
At 13:00 on Thursday 19<sup>th</sup> August, the relocation of the monitor station had finished.



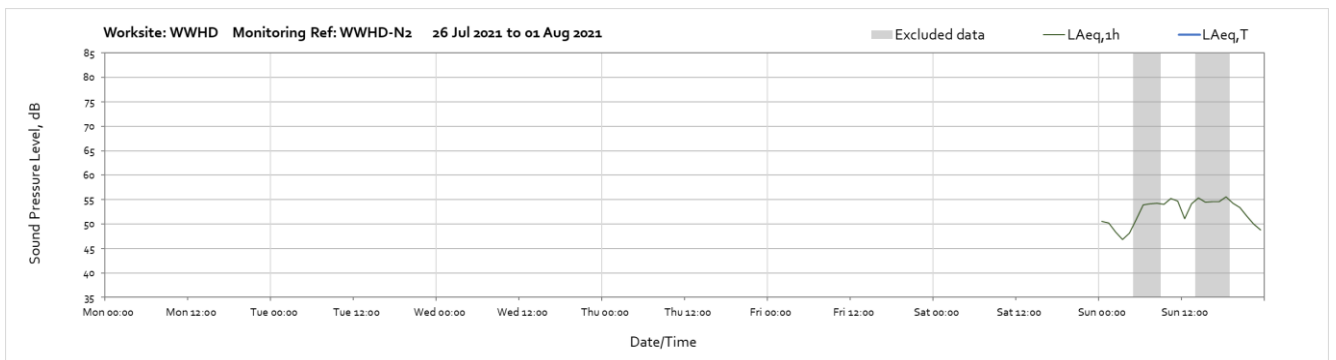


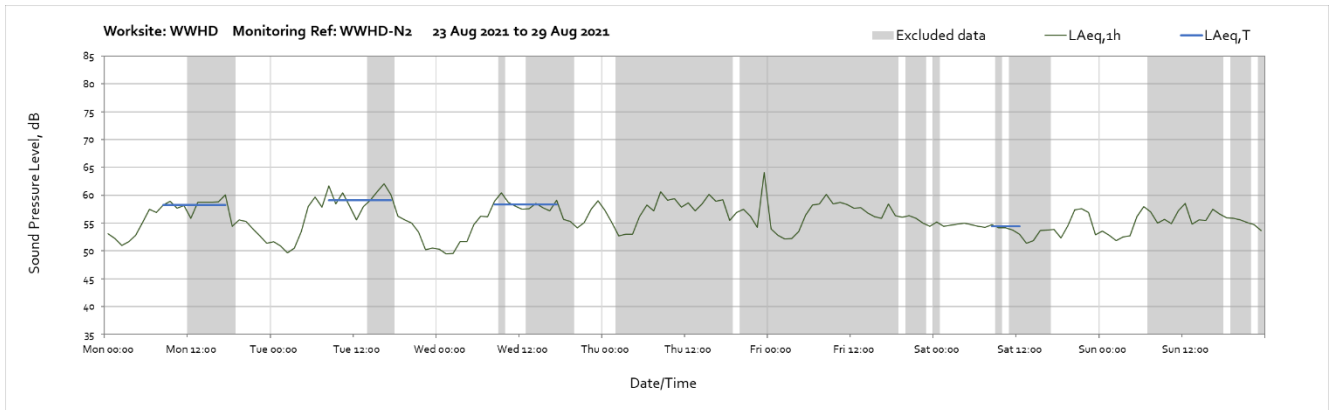
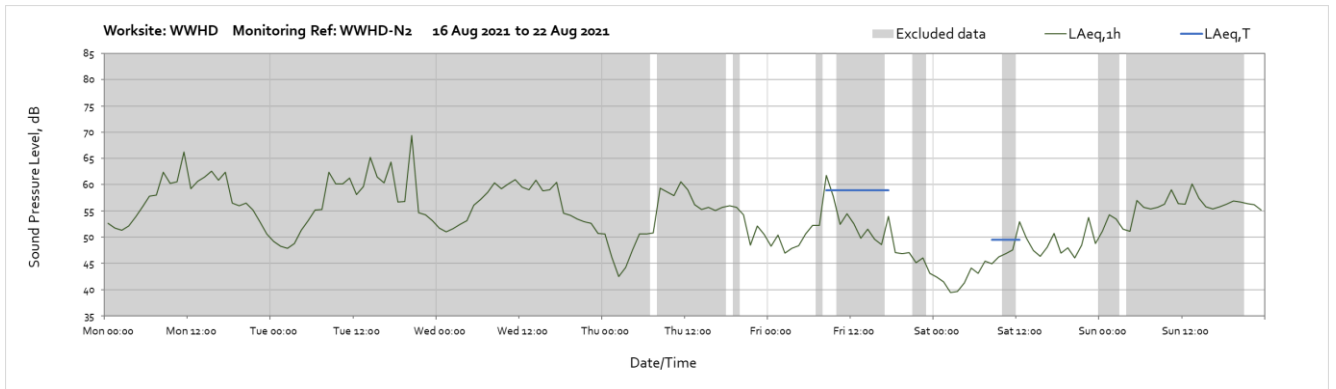
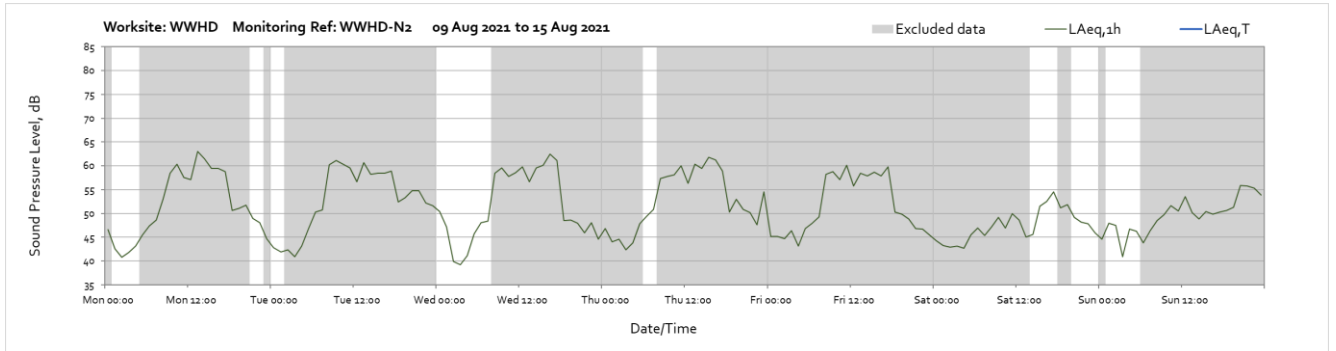
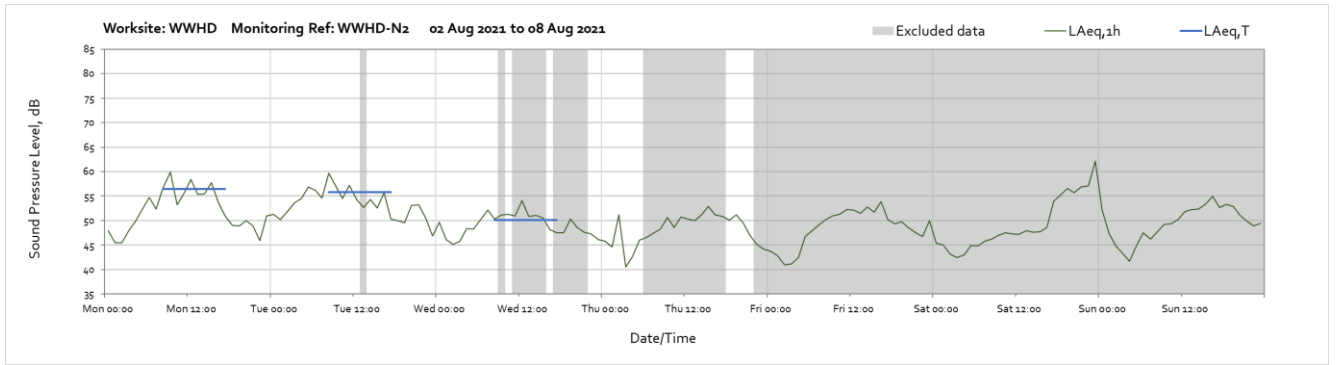
## Worksite: Washwood Heath Depot (WWHD) - Monitoring Ref: WWHD-N1

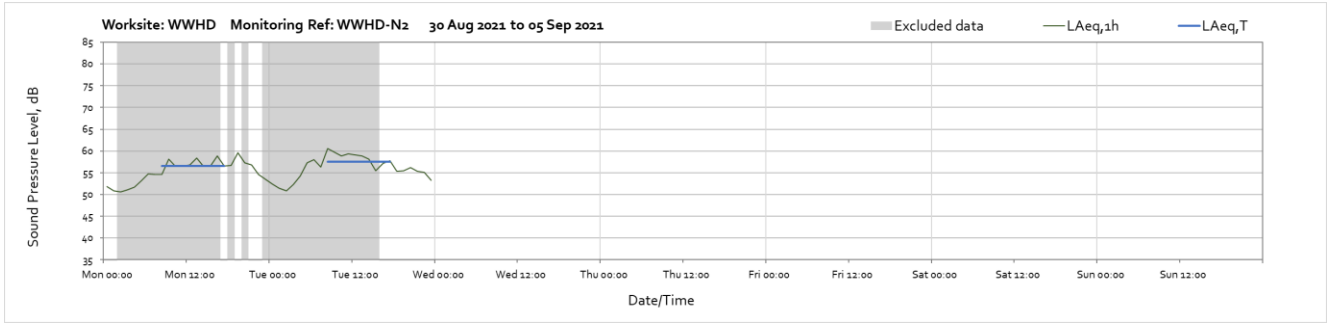




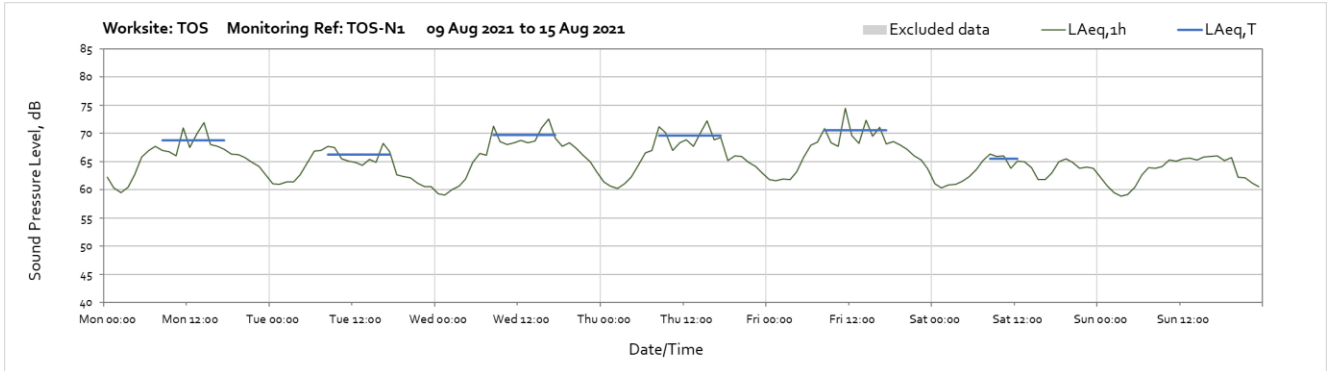
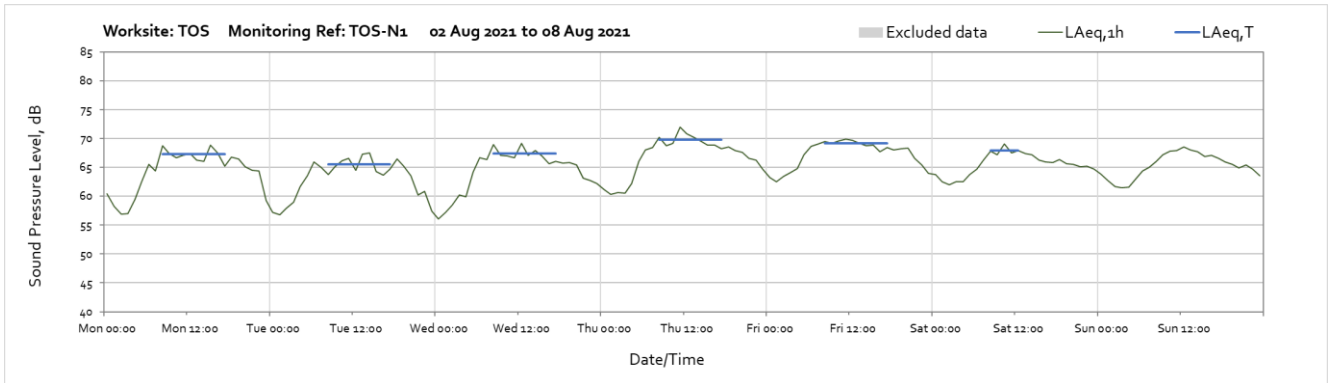
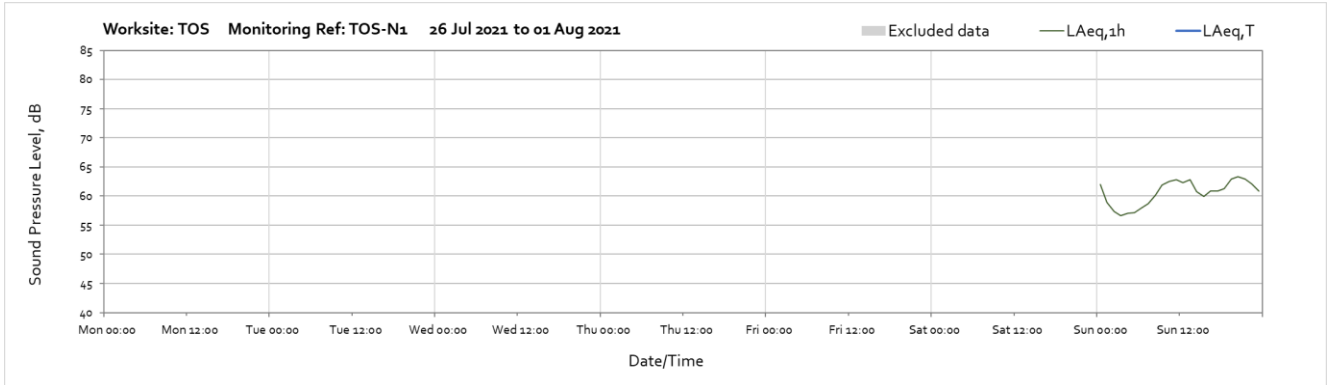
## Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-N2



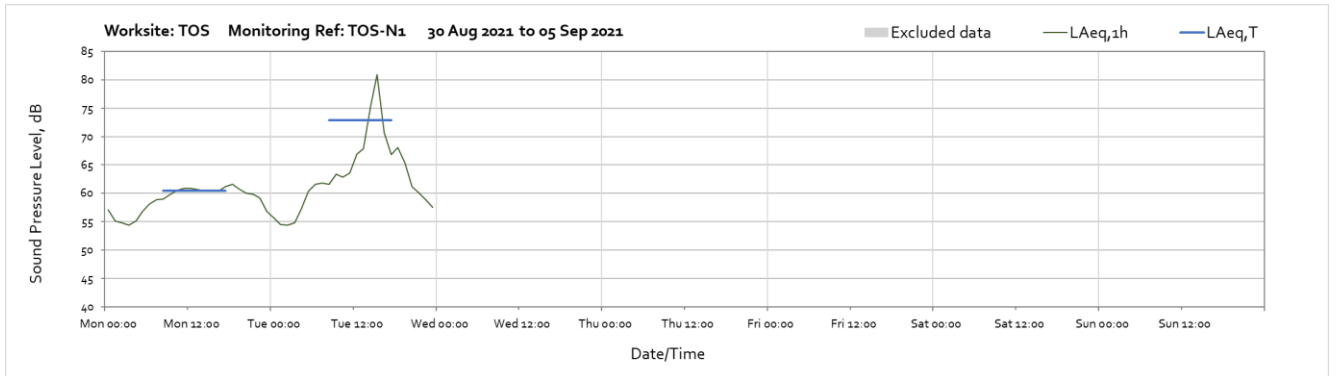
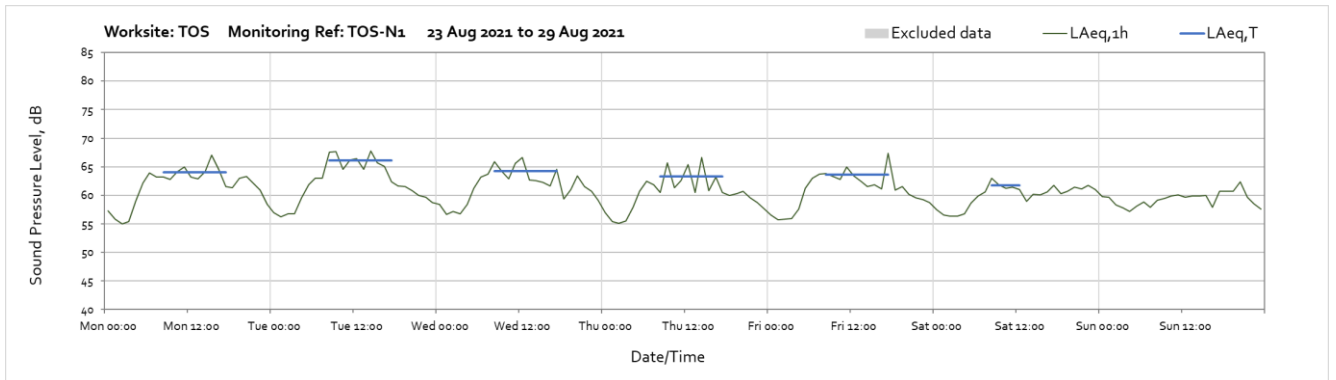
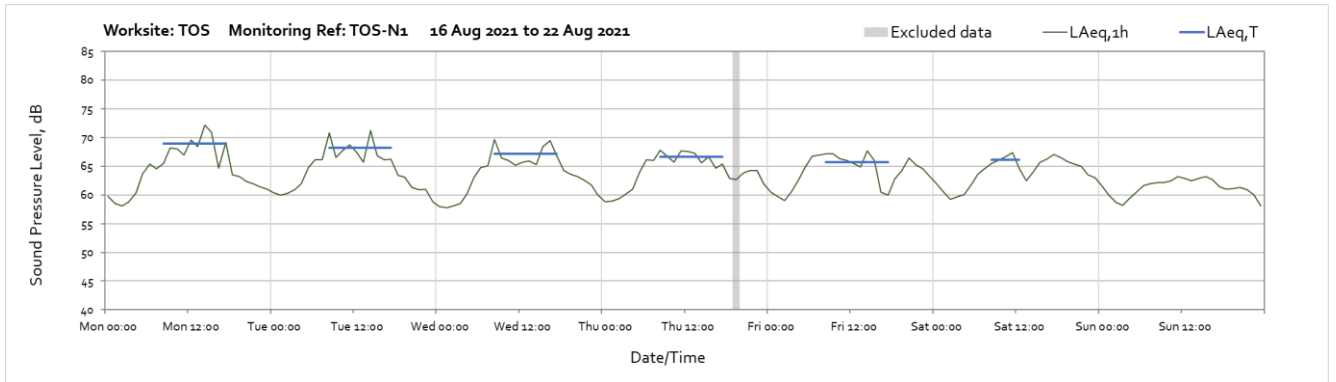




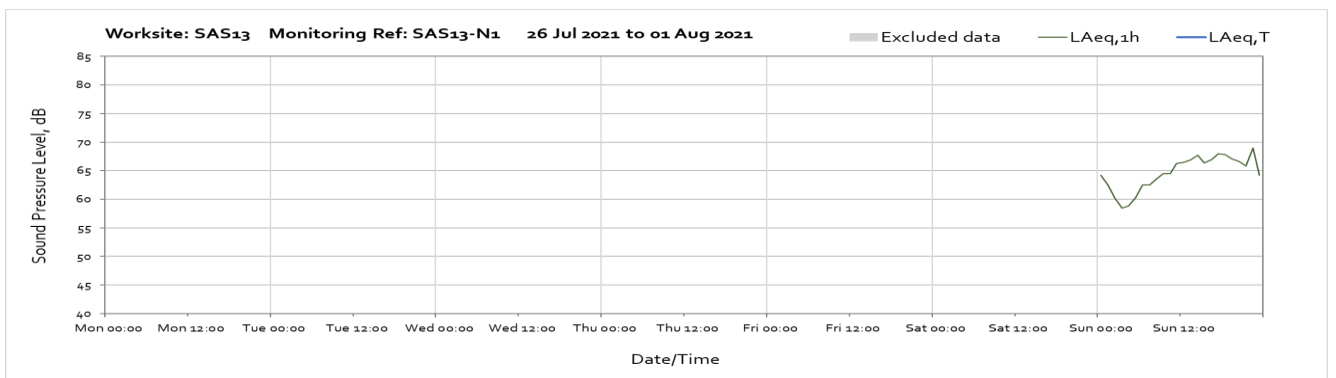
## Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-N1

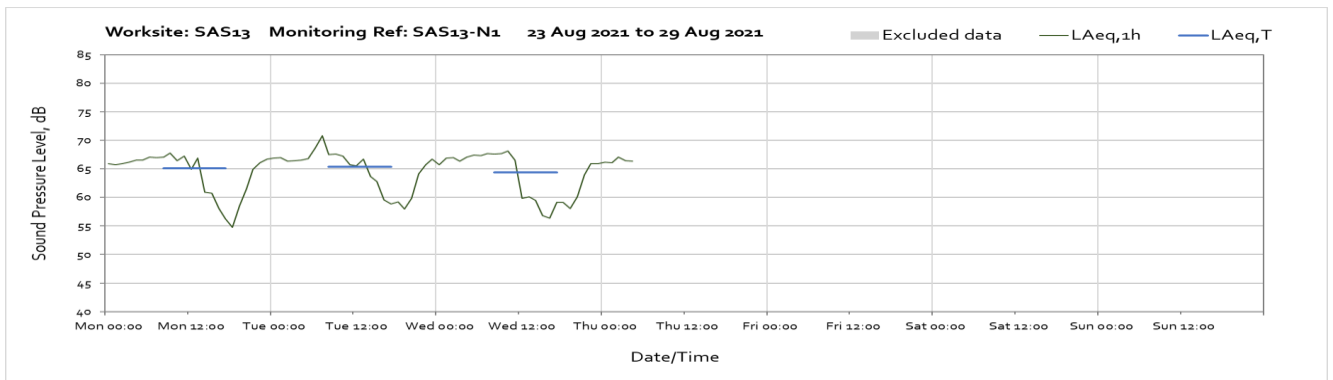
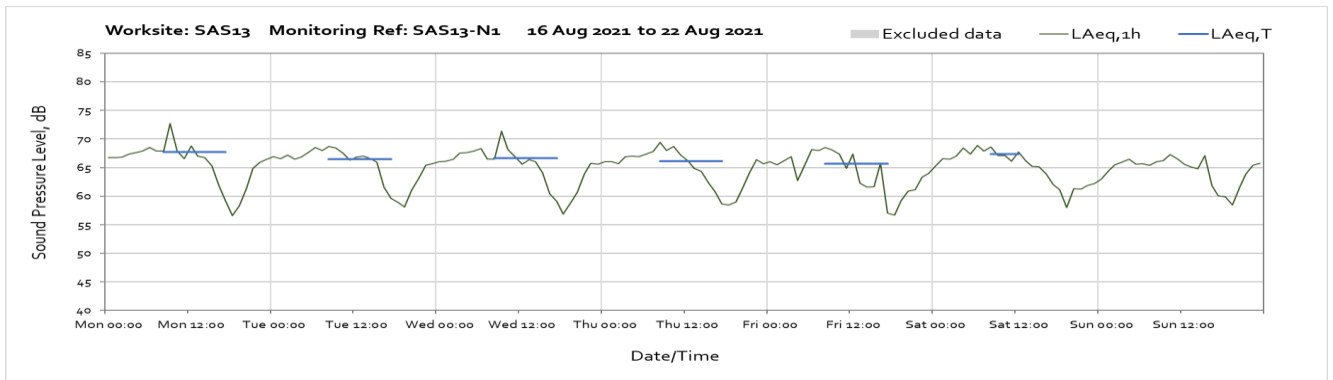
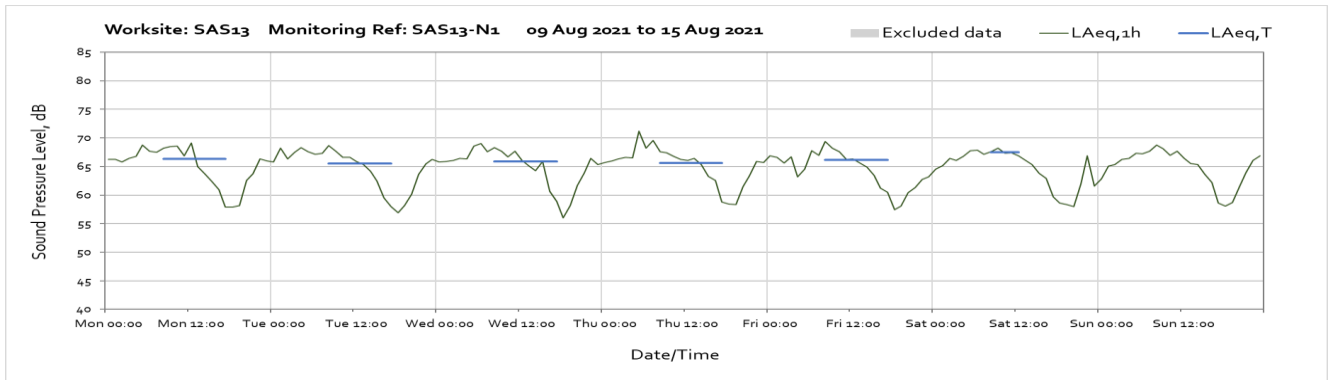
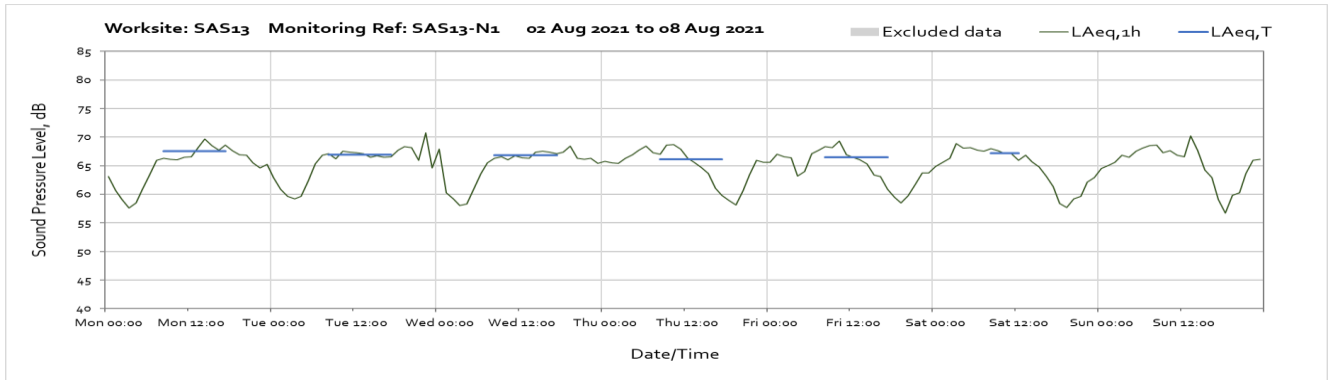




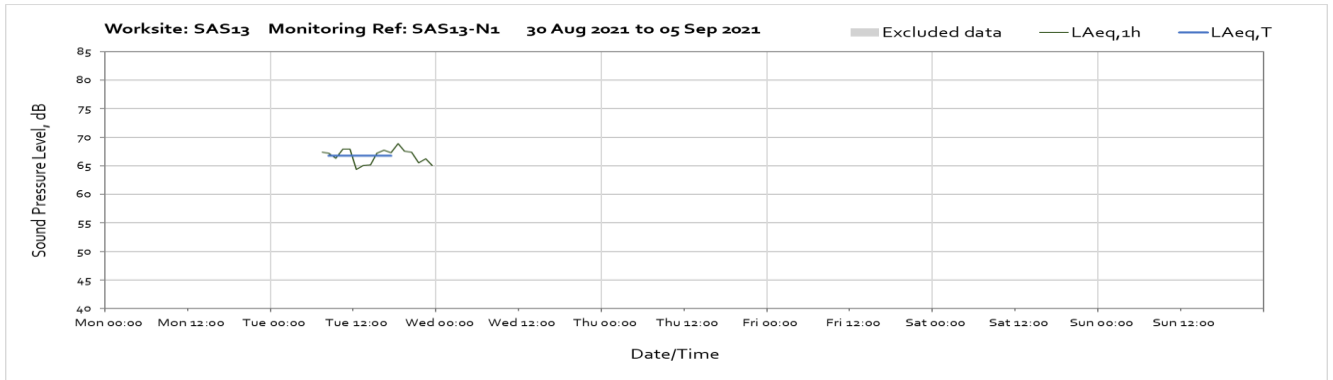


## Worksite: Skanska SAS13 Bridge Replacement (SAS13) – Monitoring Ref: SAS13-N1



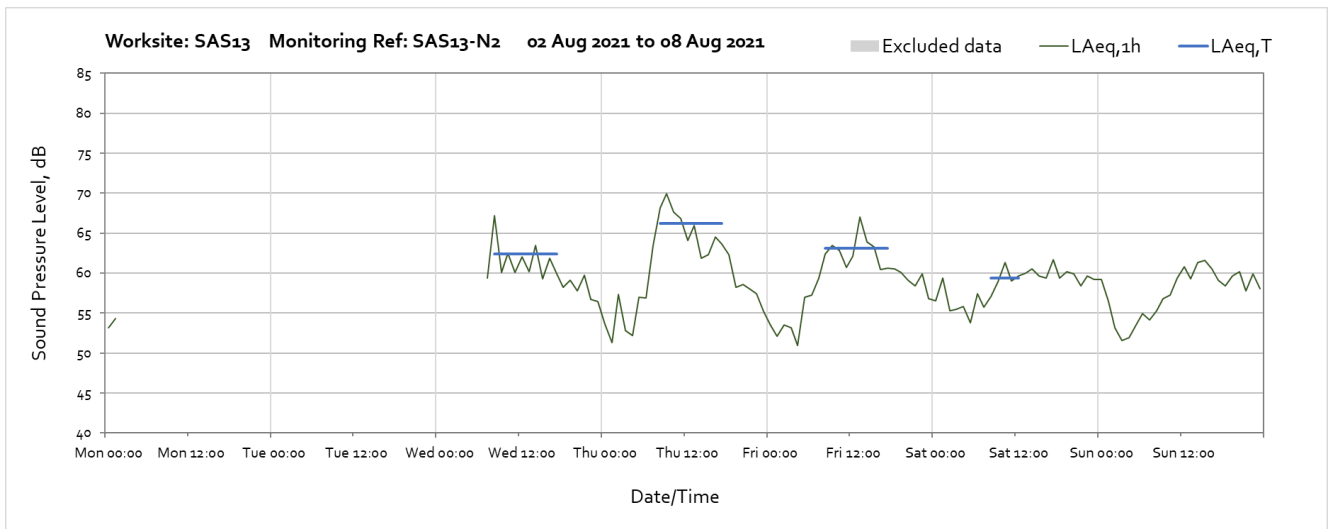
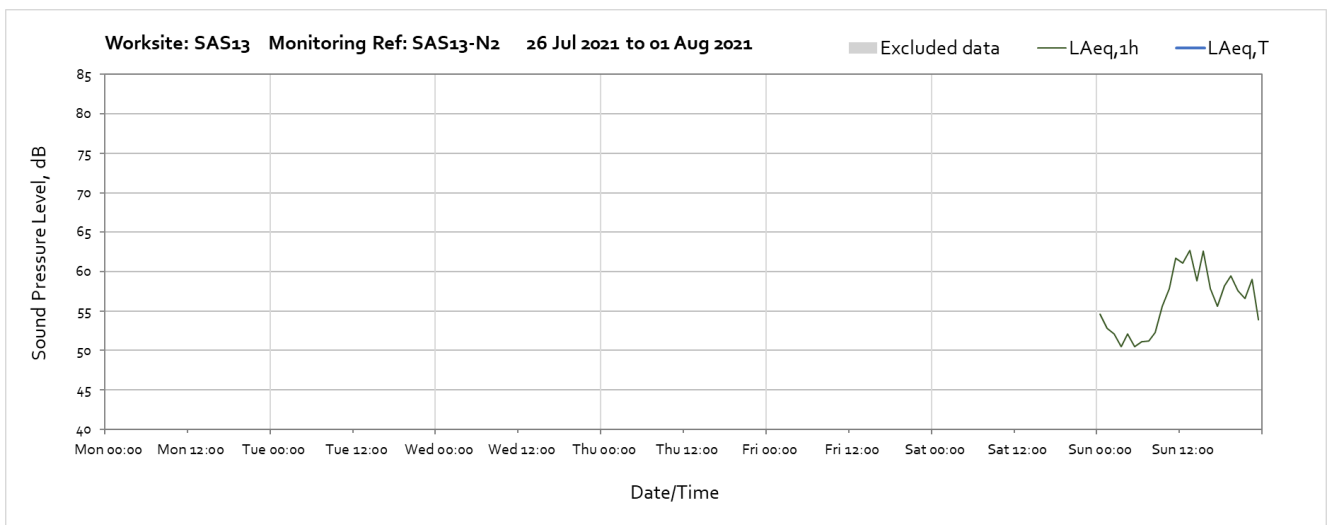


Note: Missing data between 05:00 on Thursday 26<sup>th</sup> August and 06:00 on Tuesday 31<sup>st</sup> August were due to loss of battery power at the monitor station.



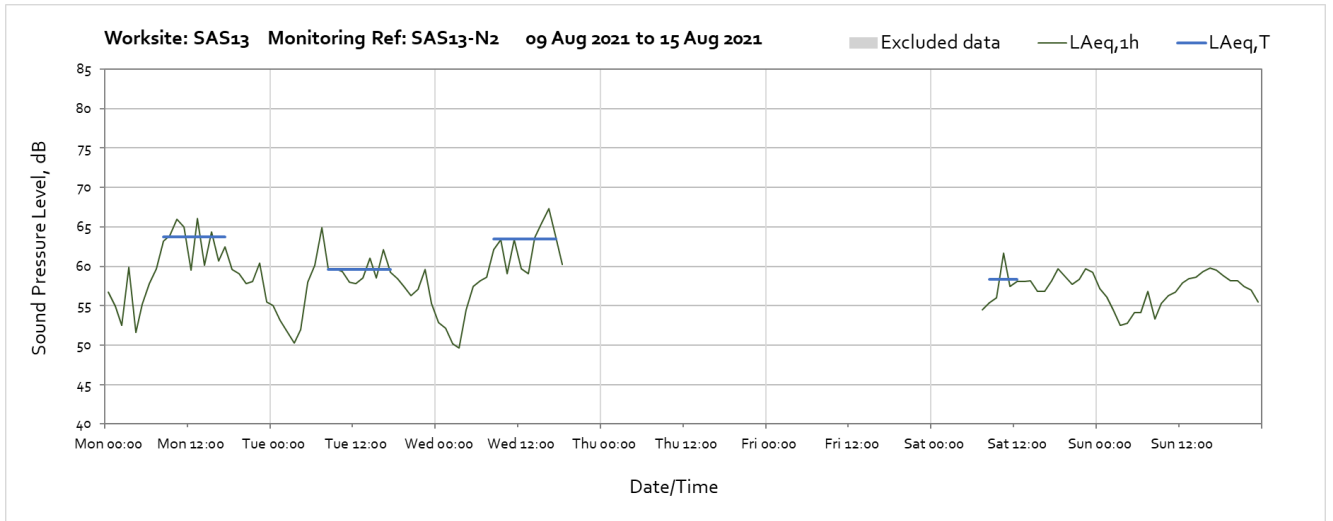
Note: Missing data between 05:00 on Thursday 26<sup>th</sup> August and 06:00 on Tuesday 31<sup>st</sup> August were due to loss of battery power at the monitor station.

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

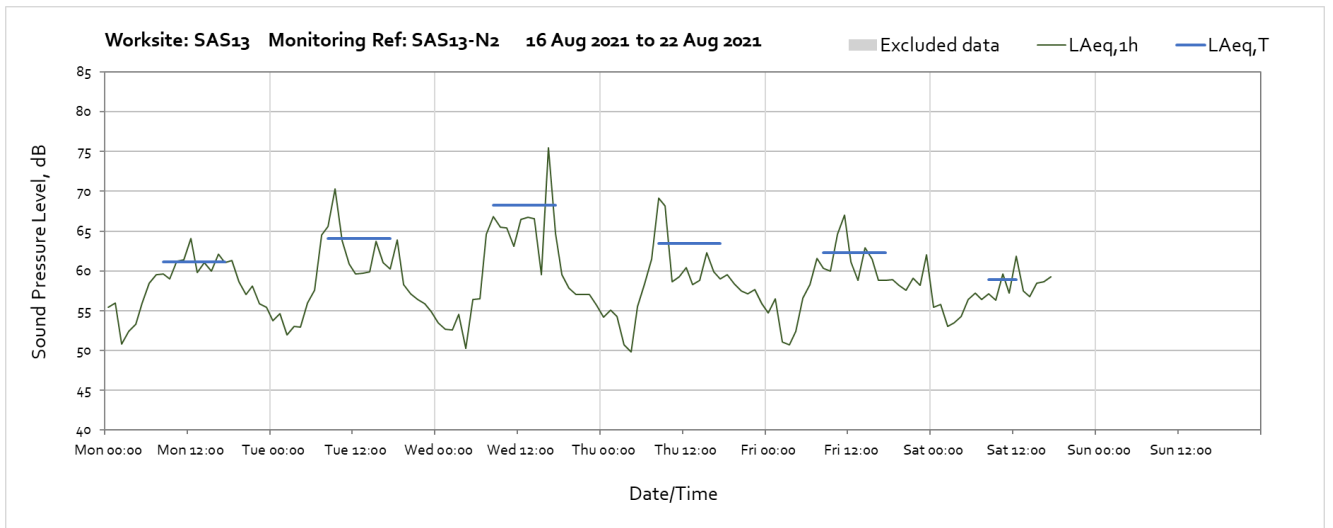


Note: Missing data between 02:00 on Monday 2<sup>nd</sup> August and 06:00 on Wednesday 04<sup>th</sup> August were due to loss of battery power at the monitor station.

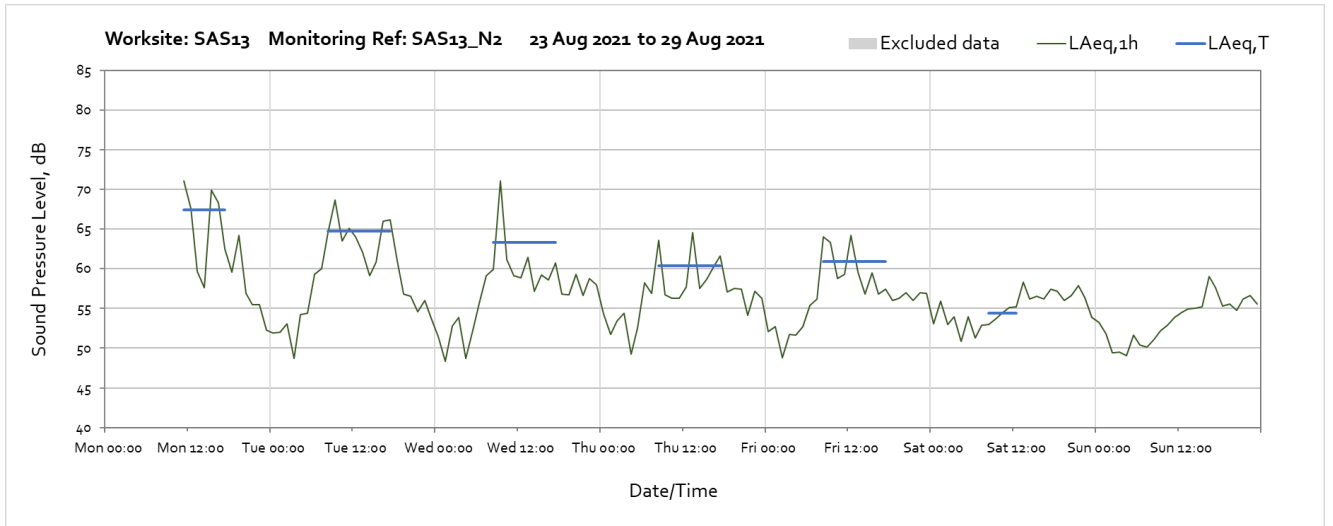
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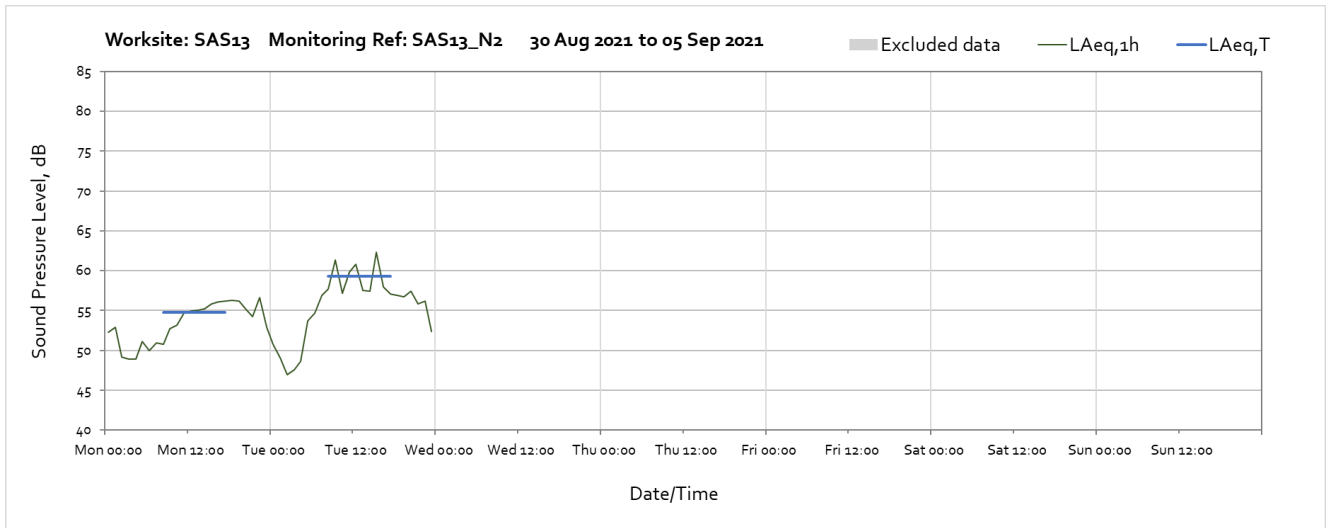
Note: Missing data between 19:00 on Wednesday 11<sup>th</sup> August and 06:00 on Saturday 14<sup>th</sup> August were due to loss of battery power at the monitor station.



Note: Missing data between 18:00 on Saturday 21<sup>st</sup> August and 10:00 on Monday 23<sup>rd</sup> August were due to loss of battery power at the monitor station.



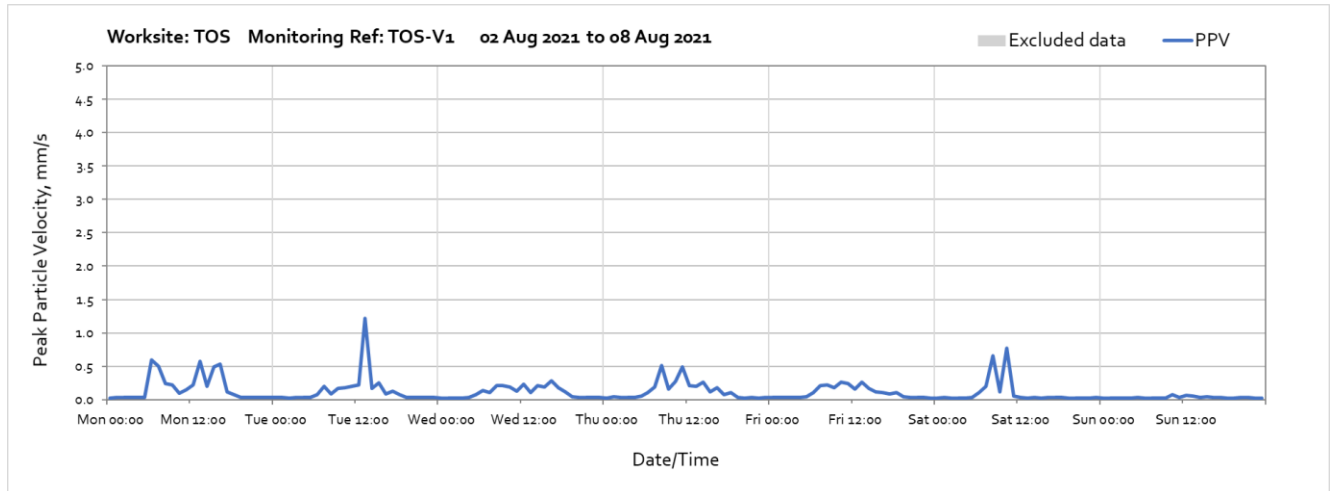
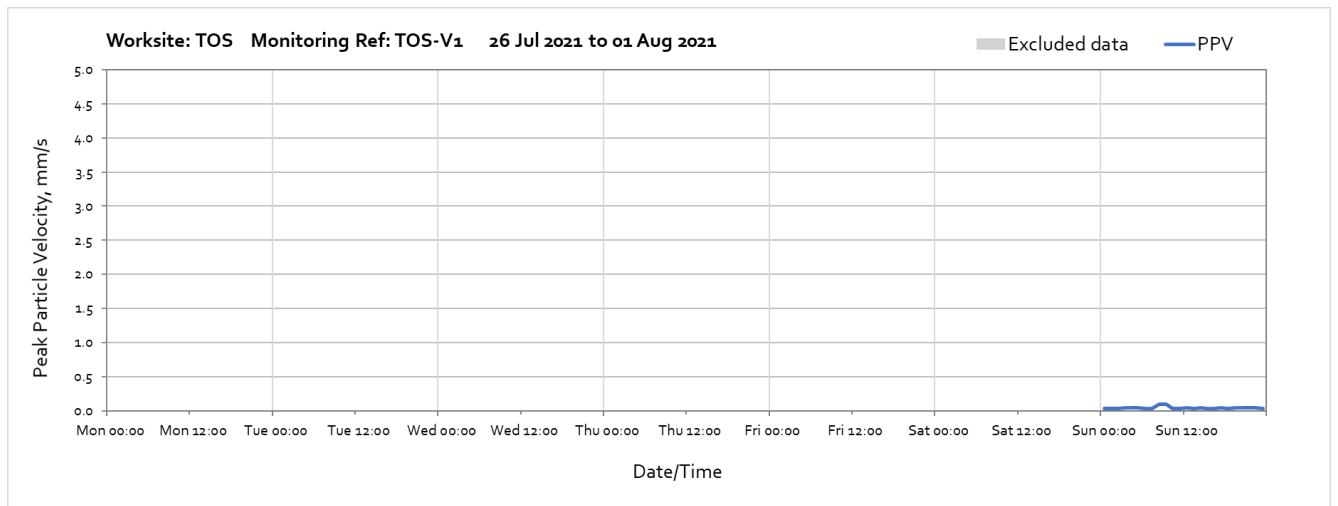
Note: Missing data between 18:00 on Saturday 21<sup>st</sup> August and 10:00 on Monday 23<sup>rd</sup> August were due to loss of battery power at the monitor station.



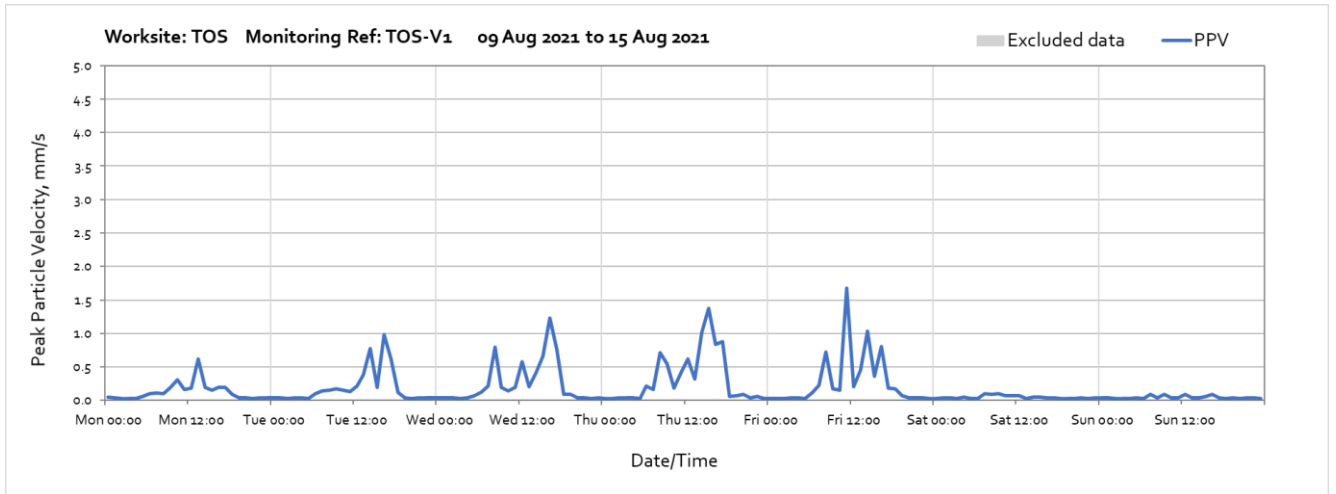
## Vibration

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.

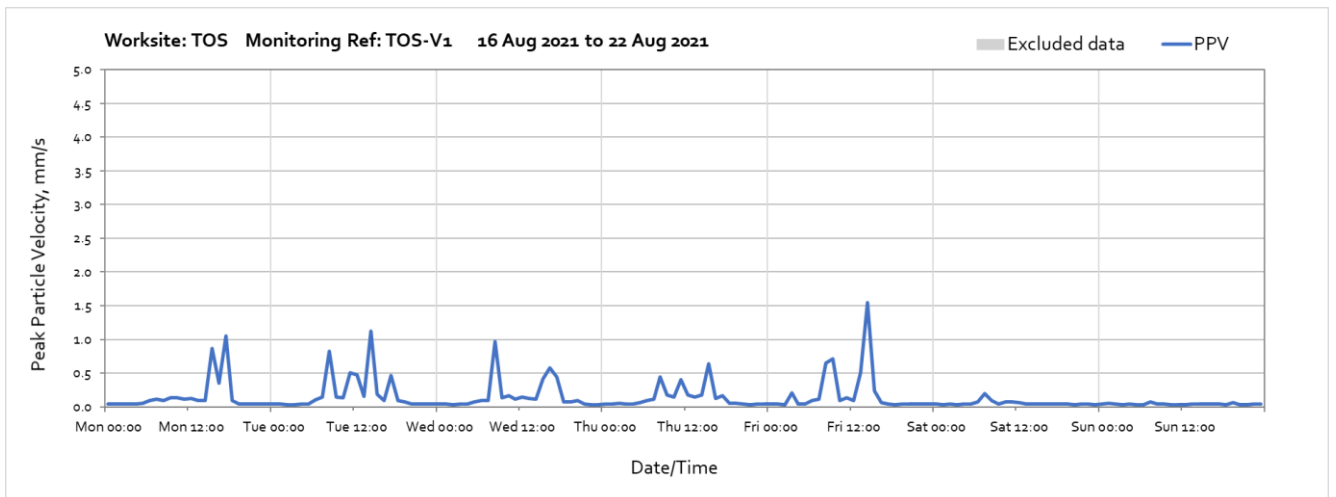
### Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-V1



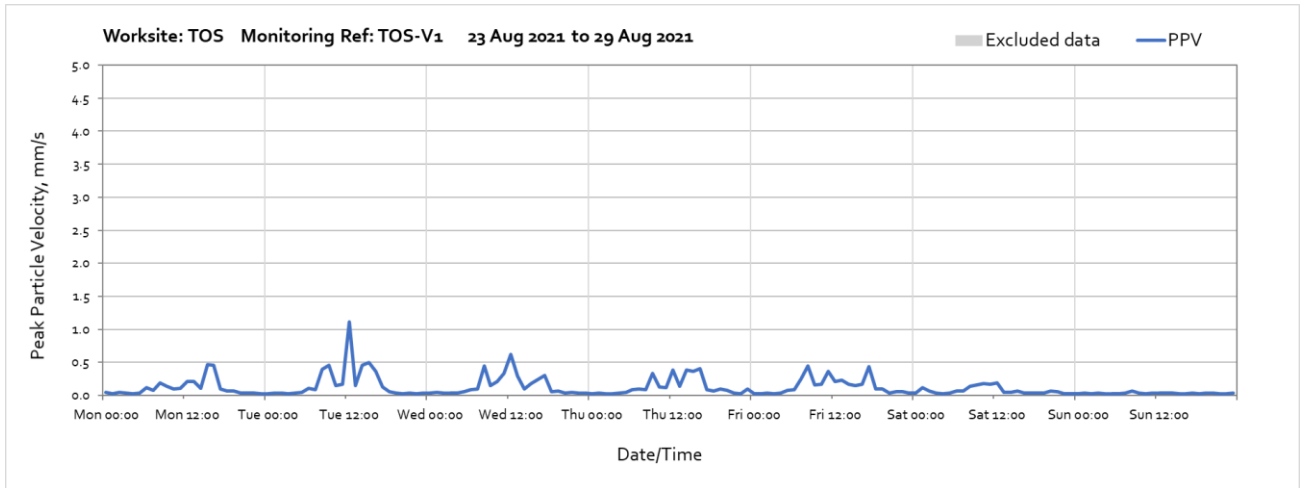
Note: Higher vibration levels measured at 13:00 on Tuesday 3<sup>rd</sup> August is due to plant tracking on haul road nearby the monitoring equipment. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.



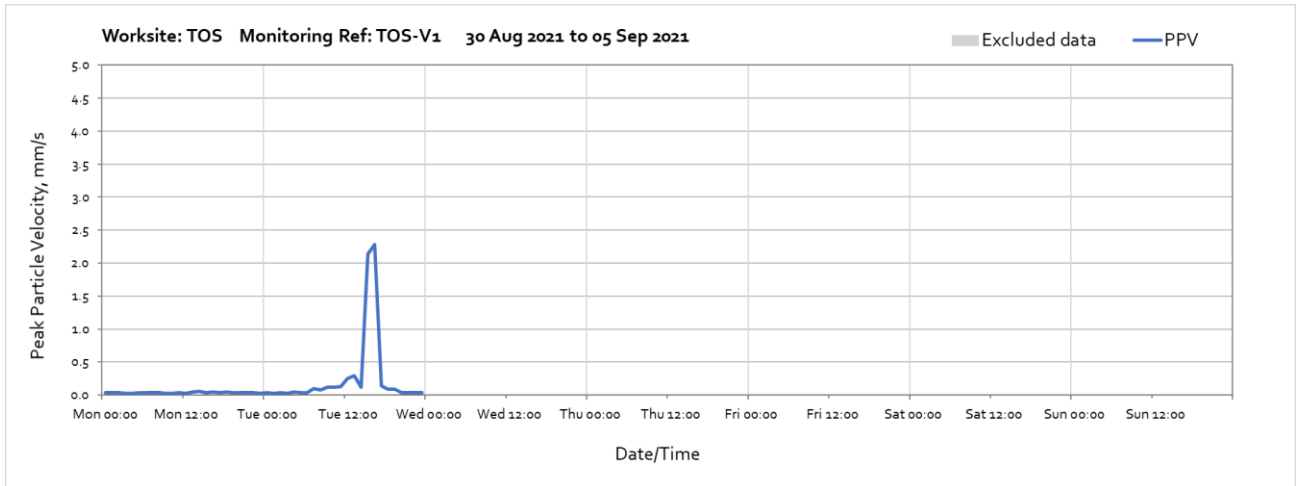
Note: Higher vibration levels measured across the week were due to plant tracking on haul road nearby the monitoring equipment. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.



Note: Higher vibration levels measured across the week were due to plant tracking on haul road nearby the monitoring equipment. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.



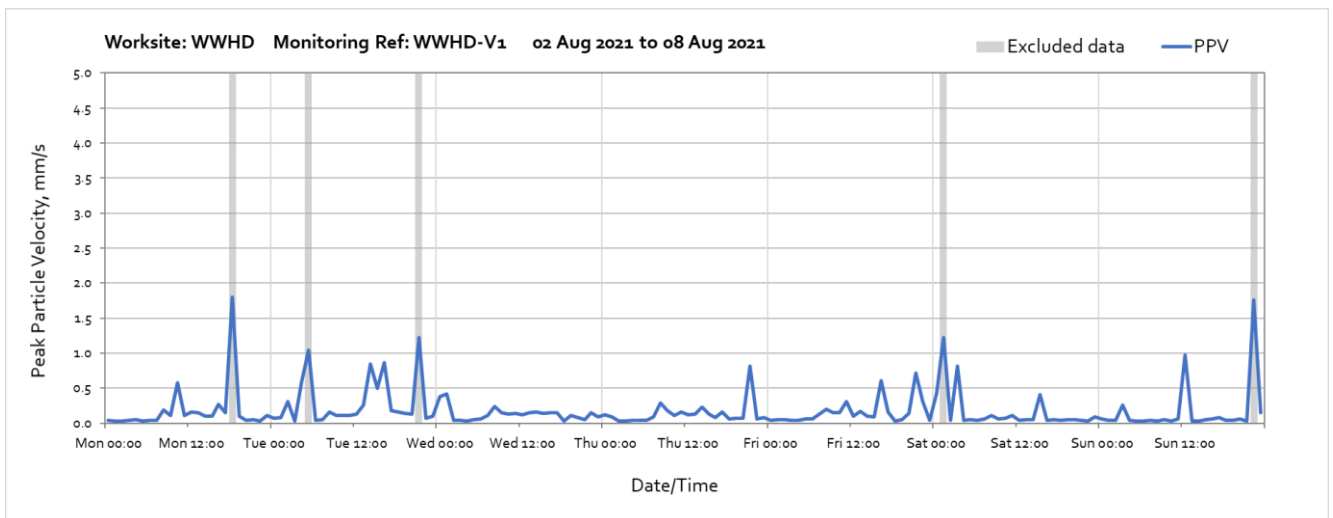
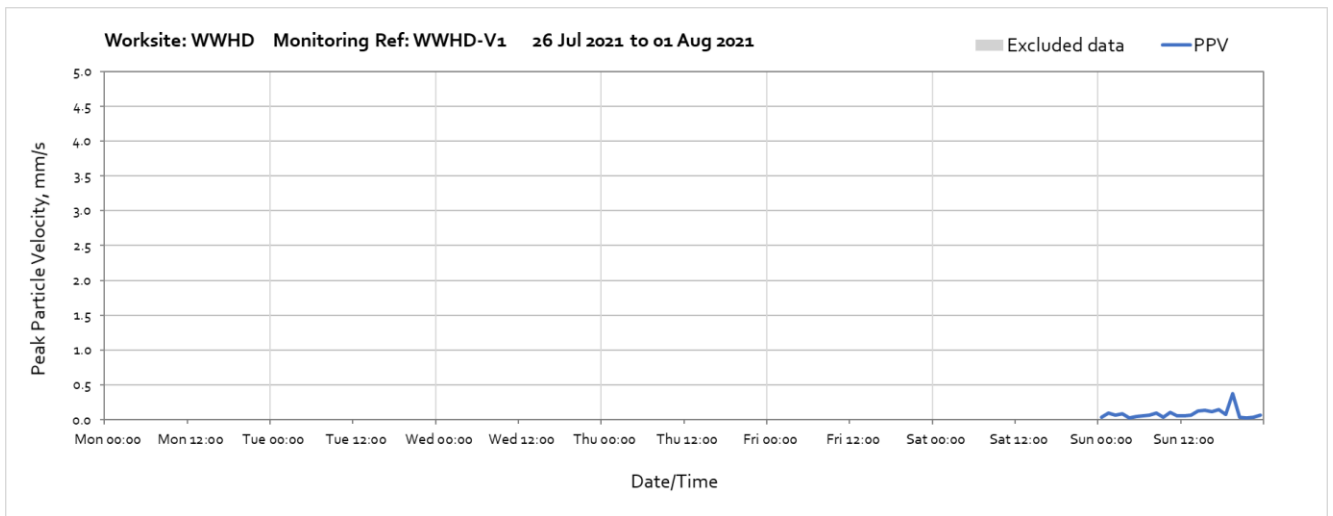
Note: Higher vibration levels measured at 12:00 on Tuesday 24<sup>th</sup> August is due to plant tracking on haul road nearby the monitoring equipment. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.



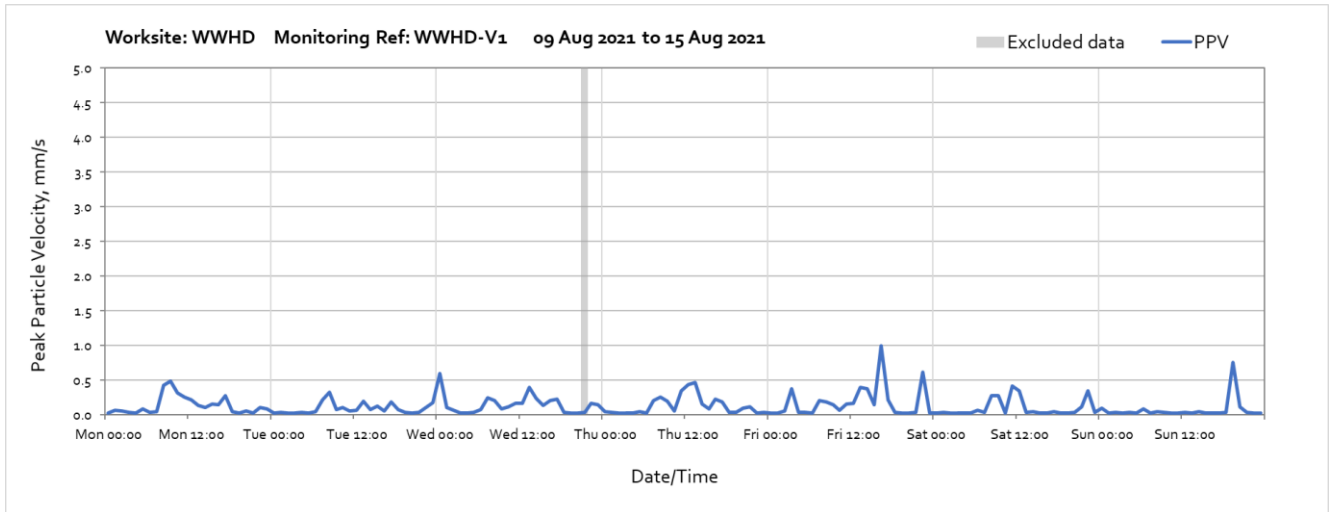
Note: Higher vibration levels measured between 15:00 and 17:00 on Tuesday 31<sup>st</sup> August are due to plant tracking on haul road nearby the monitoring equipment. The nearest residential receptors are further away from the works and vibration levels at the receptors will therefore be lower.



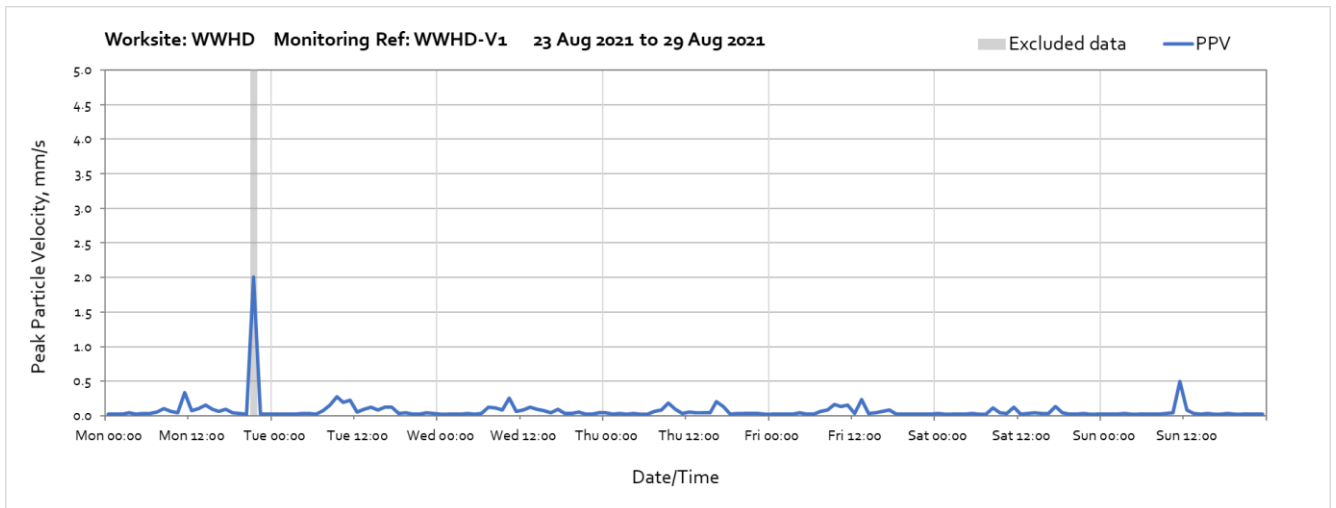
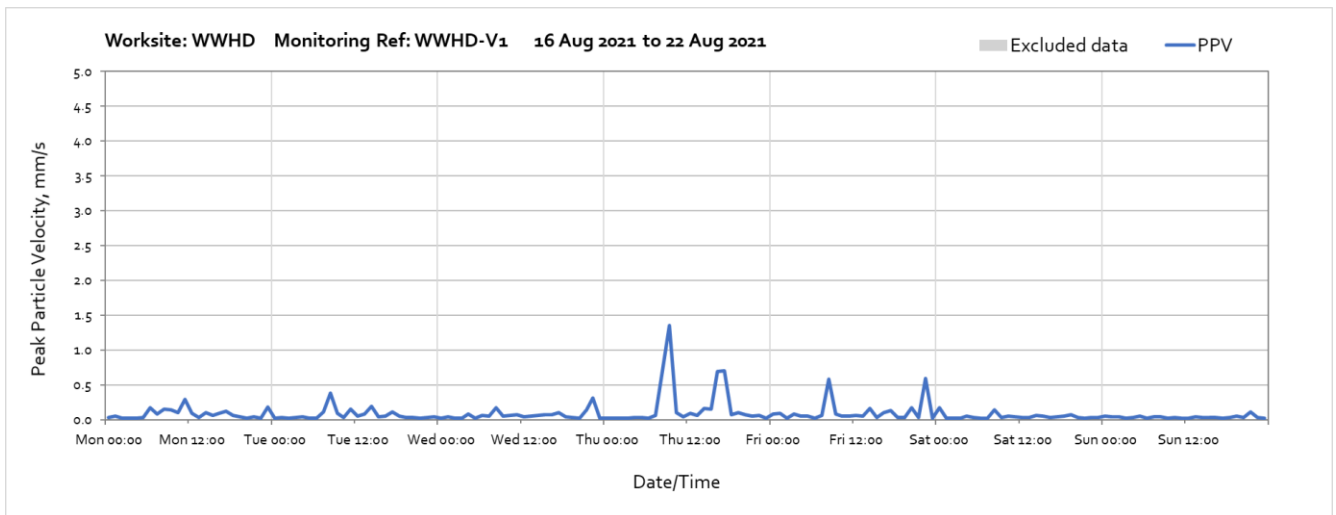
## Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-V1



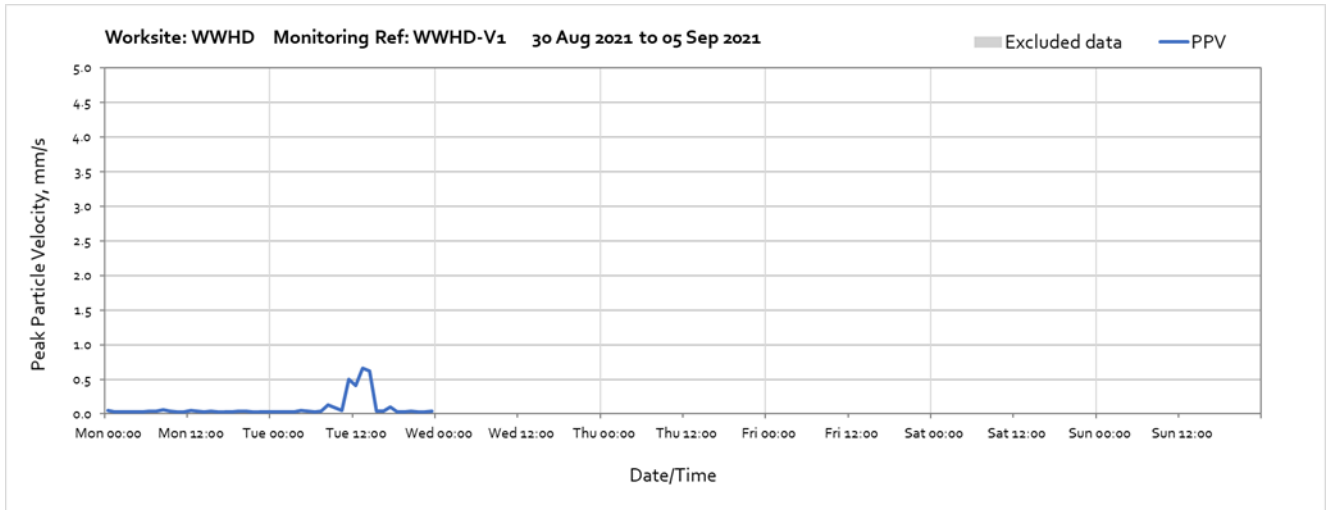
Note: Note: High vibration levels at 18:00 on Monday 2<sup>nd</sup> August, at 05:00 and 21:00 on Tuesday 3<sup>rd</sup> August, at 01:00 on Saturday 7<sup>th</sup> August, at 22:00 on Sunday 8<sup>th</sup> August were due to local interference of the monitor and are not representative of HS2 vibration levels at nearby receptors.



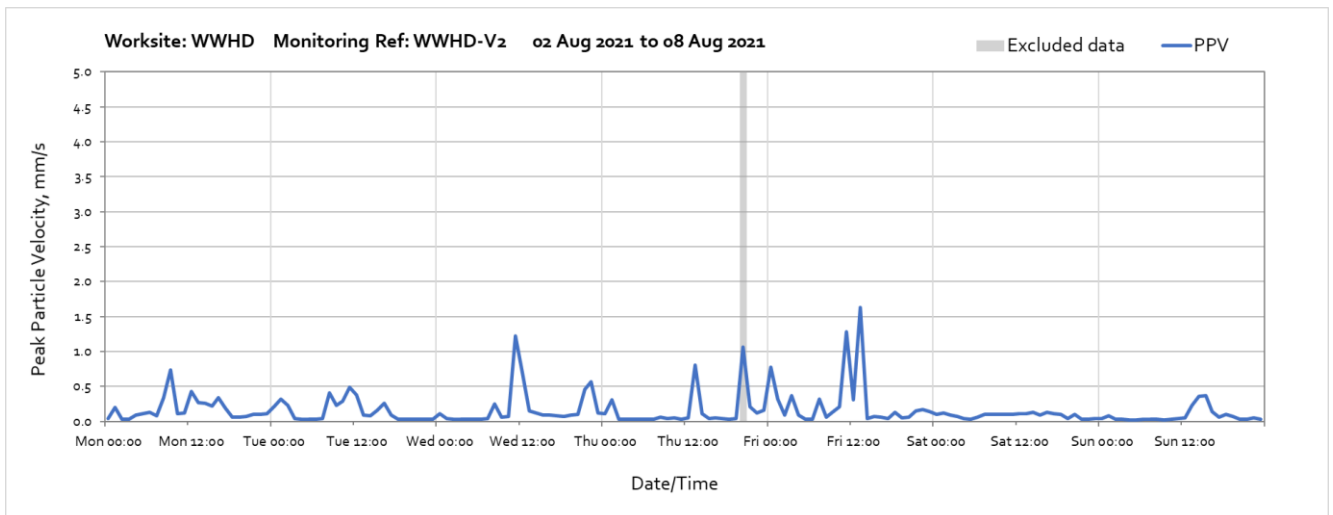
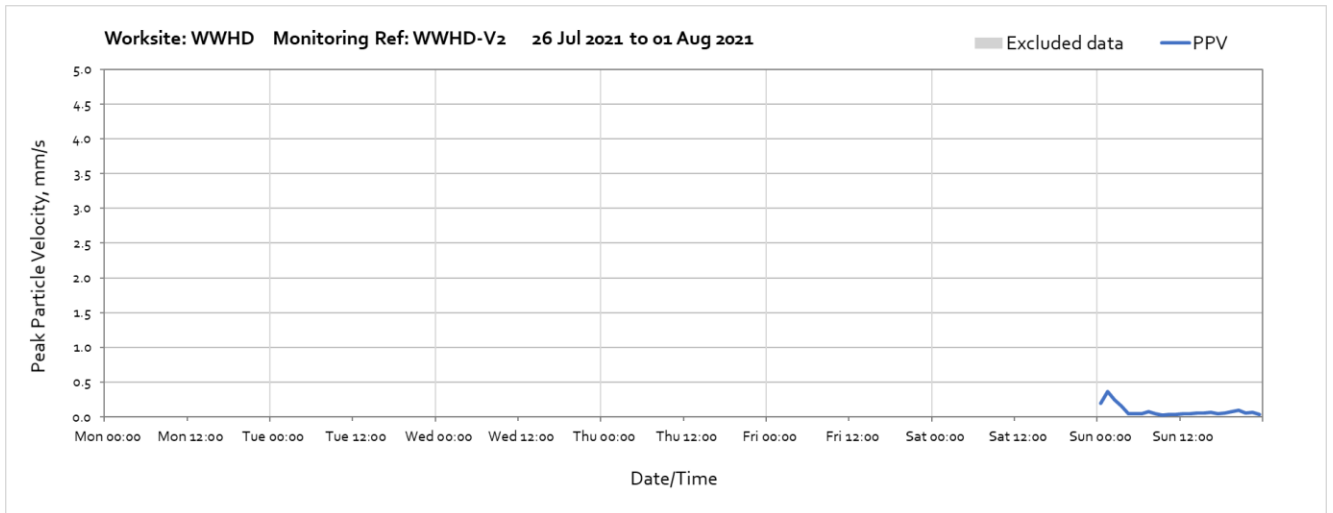
Note: Exclusion of data between 21:00 and 22:00 on Wednesday 11th August was due to software glitch.



Note: Note: High vibration levels at 21:00 on Monday 23<sup>rd</sup> August were due to local interference of the monitor and are not representative of HS2 vibration levels at nearby receptors.

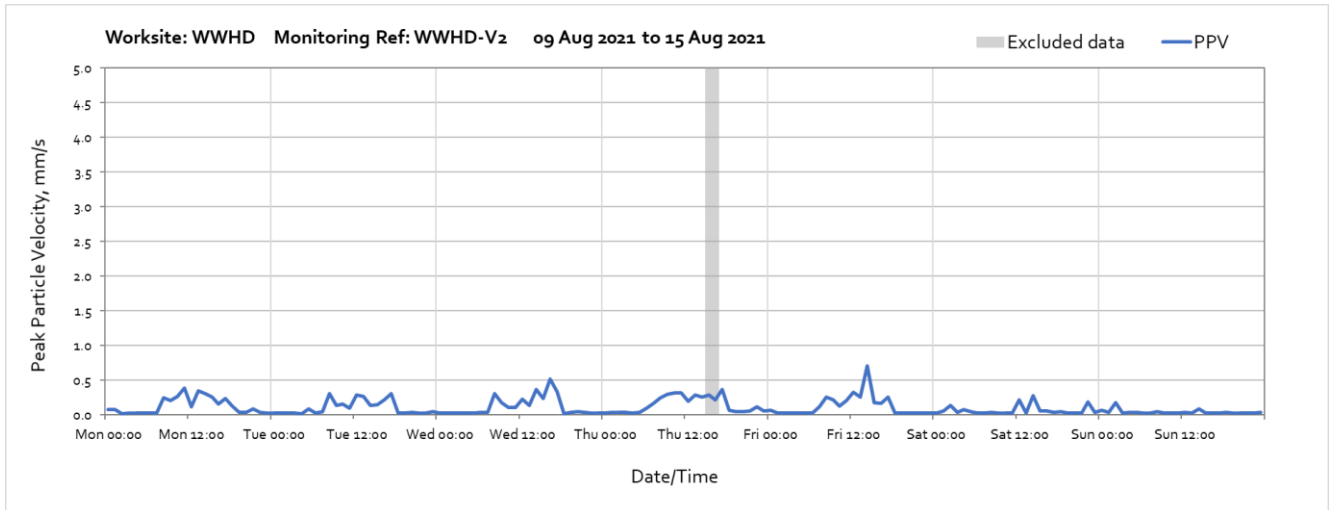


### Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-V2



Note: High vibration levels at 20:00 on Thursday 5<sup>th</sup> August were due to local interference of the monitor and are not representative of HS2 vibration levels at nearby receptors.

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Note: Exclusion of data between 15:00 and 17:00 on Thursday 12th August was due to a software glitch.

