Contract No. 1MC08

Long Itchington Wood North Portal - Slurry Treatment Plant - Noise Impact Assessment

Document Number: 1MC08-BBV-EV-REP-NS01_NL01-000001

Current Revision	Author	Reviewed By	Approved By	Date Approved	Reason for Review
P01/C01	Sam Williams	Roger Dentoni	Steve Phipps	05/03/2021	

Stakeholder Review Required (SRR)
☐ Yes – Please Specify Below
☒ No
Click or tap here to enter text.

Purpose of SRR
☐ Comment
☐ Information
☐ Approval

HS2 Signature Required
☐ Yes – Please Specify Below
☐ No
Click or tap here to enter text.

Handling Instructions: Produced by BBV for project use only

Review Required

Team	Yes/No	Name	Position	Date
Quality	No			
Health & Safety	No			
Environment & Sustainability	Yes	Roger Dentoni	Noise and Vibration Specialist	04/03/2021
Materials	No			

Revision History

Previous Revision	Author	Reviewed By	Approved By	Date Approved	Reason for Review

Revision Summary

Paragraph Modified	Details of Modification

Contents

1 NOISE IMPACT ASSESSMENT

1.1 Scope and purpose

The Long Itchington Wood tunnel section will be bored using a tunnel boring machine (TBM) which relies on the hydrostatic pressure behind the cutter face to seal the bore during excavation. The hydrostatic pressure will be produced by a slurry, which will be supplied by a slurry treatment plant (STP) located at the surface at the Long Itchington Wood North Portal construction site.

The slurry comprises a mixture of water and bentonite and is transported between the TBM and STP by pipelines. The slurry will mix with debris at the TBM cutter face and will then be pumped back to the STP at the construction site. The STP removes the solid material (debris) from the slurry, and the slurry is then reconditioned (by adding water and or bentonite) and recirculated for reuse at the cutter head. The STP is essential construction equipment required to operate the tunnel boring machine.

The pre-application advice for the bespoke permit indicates that a noise impact assessment (NIA) based on BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound' should be provided with the permit application for the STP. BBV does not consider BS 4142 to be an appropriate assessment methodology for construction noise, but nonetheless has produced this NIA in accordance with BS 4142 in the interest of expediency.

1.1.1 Premises

The STP will be located at the Long Itchington Wood North Portal construction site. The construction site is in a deep cutting, shown in Figure 1.1 below.

Other construction noise, which is outside the scope of this NIA, will be generated by:

- the operation of the construction site, including boring the twin tunnels,
- further major bulk earthworks cut, fill and creation of large landscaped fill areas,
- the grout batching plant which will be situated beside the STP (24/7 operation), and
- the operation of the Wastewater Treatment Plant (24/7 operation).

Figure 1.1 Long Itchington Wood North Portal site

1.1.2 Hours and modes of operation

The operation of the slurry treatment plant is expected to operate continuously on a 24/7 basis for around 2 years whilst the tunnel is bored from the Long Itchington Wood North Portal to the Long Itchington Wood South Portal site.

1.1.3 Noise Sensitive Receptors

The LIW North Portal site is located at the approximate national grid reference: SP 38578 63531 (BNG: 438578,263531) and was developed on farmland. The surrounding land use is predominantly agricultural however there are three residences within 300-400 m of the STP:

- Wood Farm: (BNG: 438427.09,263157.15; OS Grid: SP 38427 63157)
- Woodmeadow Farm: (BNG: 438989.18, 263269.50; OS Grid: SP 38989 63269)
- Welsh Road Lock Cottage: (BNG:438588.84, 263966.75; OS Grid: SP 38589 63967)

A site location plan is included in the application pack.

1.2 Technical competence

This noise impact assessment (including the noise modelling) has been completed by Sam Williams who is a corporate Member of the Institute of Acoustics and who has been responsible for the acoustic assessment of over 150 schemes. Career highlights include advising the airports commission on the potential noise effects of adding an additional runway to either Gatwick or

Heathrow airport; the calculation of city-wide road traffic noise immission maps of Birmingham and Coventry; and mitigating potential noise impacts of one of the largest oil and gas field in the world.

Sam is familiar with the permitting process and has provided expert evidence at planning appeals, public inquiries, and commissions:

- Advisor and lead author of reports for the Airports Commission established by Government to advise on how best to maintain the UK's status as global hub for aviation.
- Expert witness and head of discipline for the proposed £14 billion Wylfa Newydd New Nuclear Power Station DCO.
- Expert witness for the Hamilton Energy from Waste planning appeal (PPA-380-2049).
- Expert witness for The Proposed Ashton Vale to Temple Meads and Bristol City Centre Rapid Transit Order Public Inquiry (2012).
- Expert witness for The Fishguard to Bangor Trunk Road (A487). This project has since been completed and has won the 'Environmental Project of the year' at the Construction News Awards 2012, the Green Organisation's Green Apple Award winner and the ICE Wales Project of the Year for projects >£3m.
- Expert witness for The London Development Agency (Lower Lea Valley, Olympic and Legacy) Compulsory Purchase Order (2006). This inquiry concerned the acquisition of land for the Olympics and associated transport infrastructure.

1.3 Measurements

1.3.1 Location

Background sound level measurements were undertaken between 19 - 22 of February 2021 at Woodmeadow Farm. This location was selected for the background sound level measurements as Woodmeadow Farm is close to the Long Itchington Wood North Portal construction site, is in a rural setting where the background sound levels are low, and the property owners have given permission to conduct noise monitoring. The noise monitoring equipment was set up by Mike Breslin of ANV who is a corporate member of the Institute of Acoustics.

The noise monitoring location is situated approximately 430 m to the south-east of the STP, and 6.63 m from the west corner of the dwelling at the property boundary. The intervening ground between the construction site and the monitoring location is almost entirely ploughed arable fields and the land rises from approximately 70 m A.o.D at the edge of the STP to 81 m A.o.D at Woodmeadow Farm.

This location is already used for long-term noise construction noise monitoring location. The location has the identifier 'SL1A-LIWNP-N1', and details about the noise meter installation are given in the noise monitoring location sheet at Appendix A.

Weather monitoring was conducted throughout this period on at a position just within the boundary of the Long Itchington Wood North Portal construction site.

1.3.2 Equipment

The equipment used for the measurements is set out in table 1.2 below. The noise monitoring equipment calibration certificates are included in Appendix B. The sound levels meter conforms to the class 1 requirements of IEC 61672-1:2002, and the acoustic calibrator conforms to all the class 1 requirements of IEC 60942:2003.

Figure 1.2 Details of noise and weather monitoring equipment

Equipment	Make	Model	Serial Number	Laboratory Calibration Date	Certificate No.
Sound Level Meter	Rion	NL-52	001088821	15 July 2020	UCRT20/1631
Preamplifier	Rion	NH-25	99085		
Microphone	Rion	UC-59	16752		
Acoustic calibrator	Rion	NC-74	35015343	7 January 2021	UCRT21/1035
Weather station	Lufft	WS10	007.0220.1601.010	N/A	N/A

The noise monitoring equipment is field calibrated at three-month intervals. The most recent calibration was on 16 February 2021 and the SLM reported a level of 93.8 dB against a reference level of 94.0 dB. A calibration correction of +0.2 dB was applied to return the reported level to 94.0 dB as per the manufacturer's recommendations. This correction is not significant.

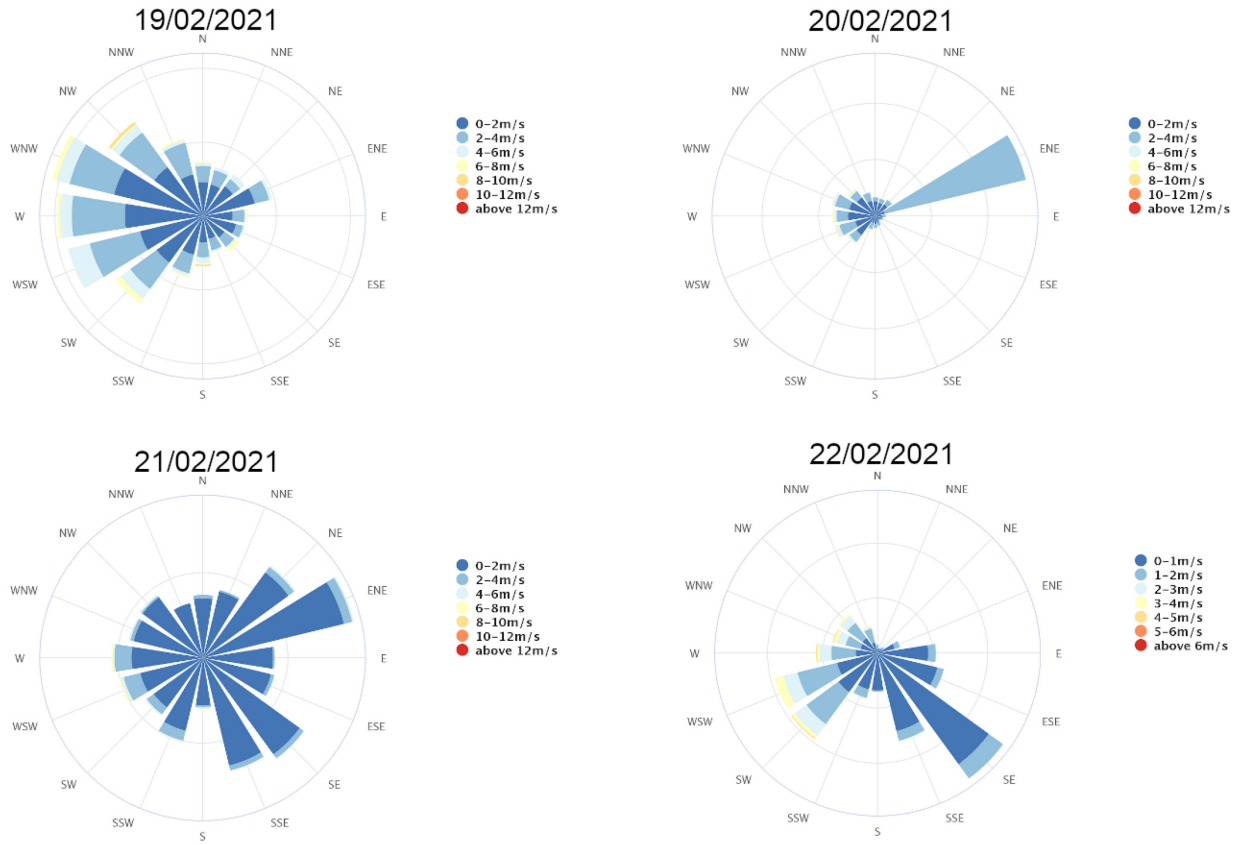
The sound level meter was set to record samples at 15-minute intervals. A statistical analysis of the resulting L_{A90} values has been used to derive typical background sound levels in accordance with BS 4142:2014+A1:2019 for the daytime and the night-time. A non-normative comment below section 7.2 of BS 4142 indicates that daytime is typically between 07:00 h – 23:00 h and accordingly night-time is between 23:00 h – 07:00 h. This assessment has adopted these time periods.

1.3.3 Weather

Weather conditions during the survey were generally suitable for background sound measurements, with low wind speeds (less than 1% of the samples recorded wind speeds of over 6m/s) and little rain.

The wind directions and speeds recorded during the baseline sound monitoring period are shown graphically as wind roses in Figure 1.3 overleaf. It can be seen that a range of wind directions were experienced over the survey period, but as noted above the wind speeds were generally low.

Figure 1.3 Daily wind roses, 19th to 22 Feb 2021



The high relative humidity was generally high (typically over 80%) but the dewpoint remained below the air temperature throughout the survey. Air temperatures were typically between 2°C during the coldest parts of the night and 13°C during the warmest times of the day.

There was some precipitation (rain, no snow) during the survey period. However, it was rarely heavy and the only periods where it exceeded 0.25mm/hr were:

- 19/02/2020 11:00 - 12:00
- 19/02/2020 13:00 - 14:00
- 20/02/2020 00:00 - 04:00
- 20/02/2020 05:00 - 07:00
- 20/02/2020 16:00 - 18:00

The sound level samples taken while rainfall was greater than 0.25mm/hr have been excluded from the data analysis.

1.3.4 Background sound levels

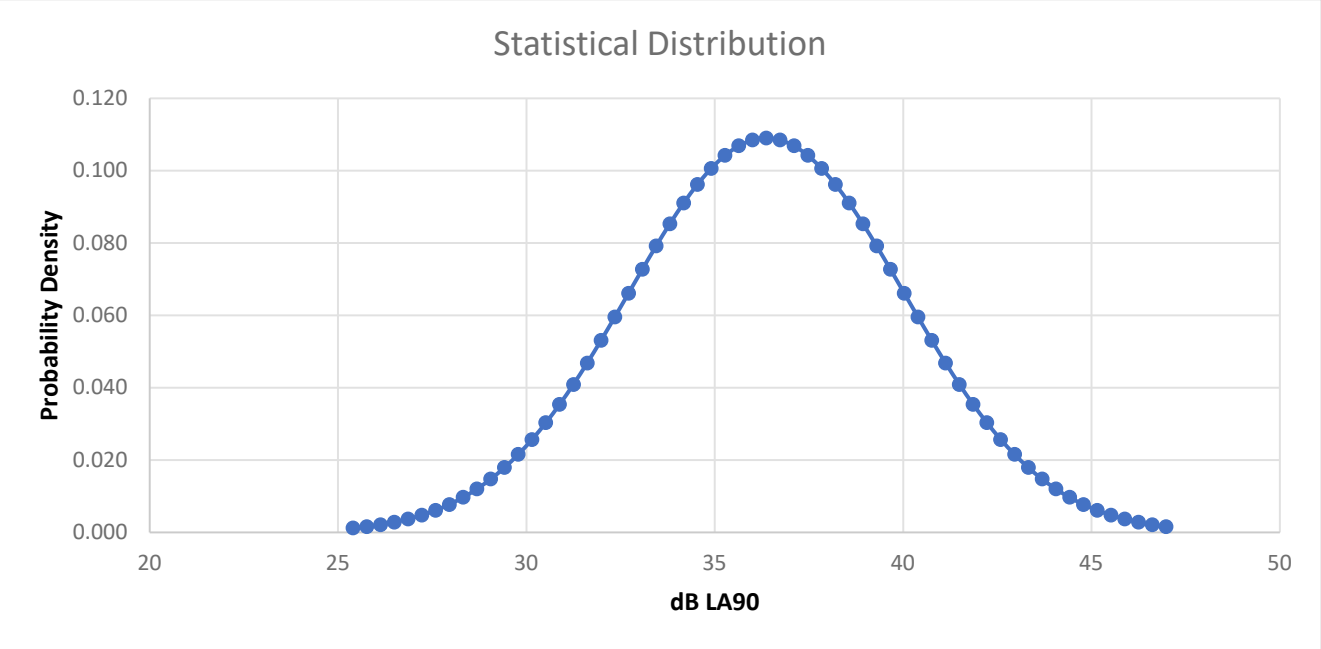
A statistical analysis of the remaining 15-minute background sound level samples yields the following metrics.

Table 3.1 Statistical analysis of background sound level samples.

Statistical measure	Daytime, dB $L_{A90,15min}$	Night-time, dB $L_{A90,15min}$
Min	30.7	29.3
Max	45.0	39.3
Average	37.1	32.8
Mode	35	31

It can be seen from figure 1.4 below that the measured sound level samples show a normal distribution.

Figure 1.4 Statistical distribution of background sound level samples

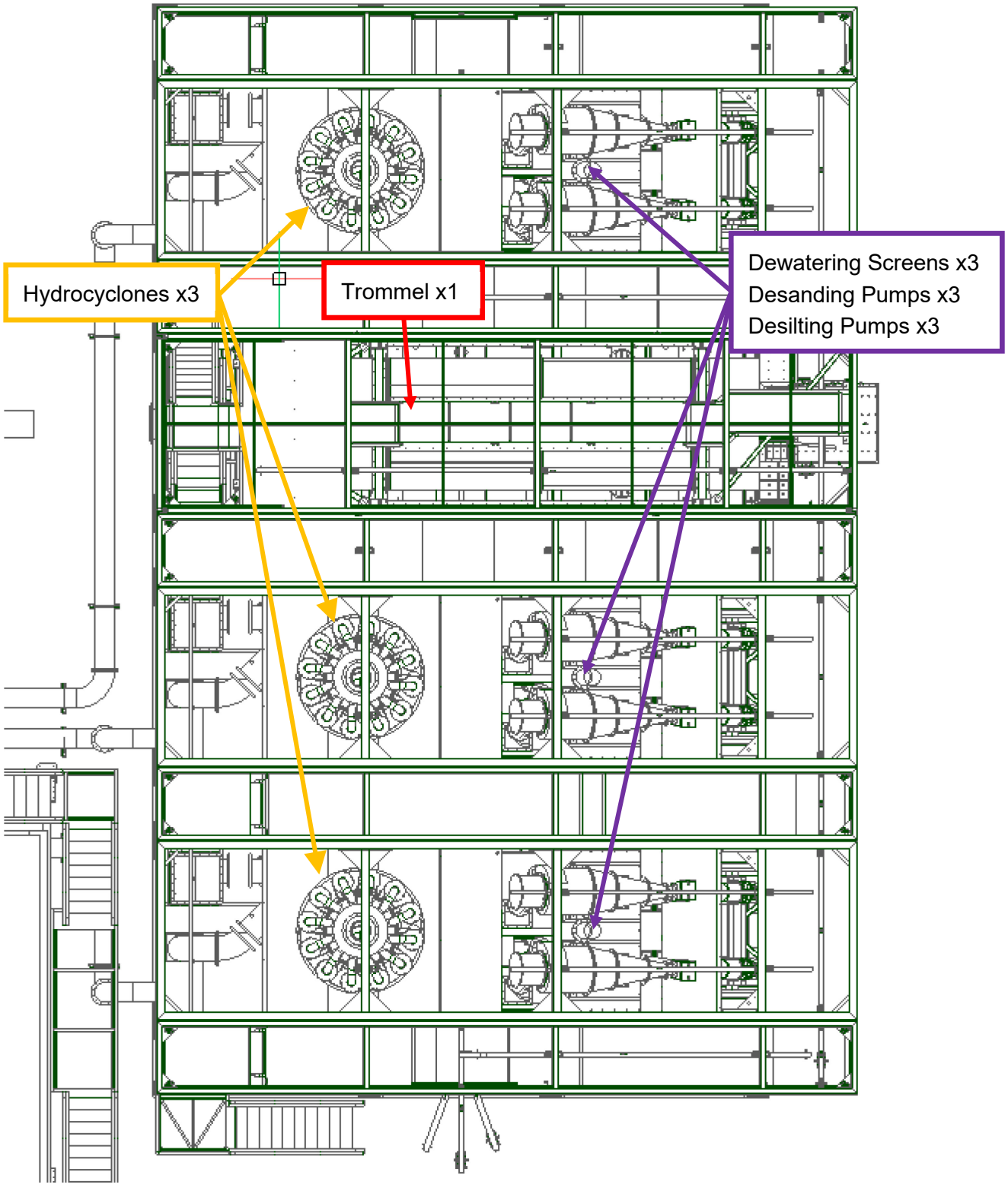


1.4 Noise Modelling

1.4.1 Noise sources

The STP equipment with the highest sound power levels are the revolving trommel screen and the three desanding modules which separate coarse solids from the returning slurry. To reduce the potential for these items to cause significant adverse noise effects they are housed within a noise enclosure. Figure 4.1 overleaf shows the arrangement of these items within the noise enclosure which measures 18.125 m long, 11.500 m wide and 13.700 m tall above the STP slab. The composite panels forming of the noise enclosure comprise 15% translucent material + 130mm rockwool + 0.75mm external facing metal cladding and have a weighed apparent sound reduction (R_w) of 36 dB.

Figure 1.5 Plan view showing internal layout of noise enclosure.



The broadband sound power levels of the major noise sources are as follows:

ID	Noise source	No. of noise sources	Source height (m)	Sound power level dB(A) [1]
STP_1	Trommel	1	5	115
STP_2	Hydrocyclones	3	5	97
STP_3	Dewatering screen	3	5	109
STP_4	Desanding pumps	3	5	108
STP_5	Desilting pumps	3	5	109
STP_6A	STP Conveyor	1	5	75 per meter
STP_6B	Conveyor dropping zone	1	5	88
STP_7	SP pump 10/8 EM + motor 132kW	9	1.5	75
STP_8	Filter press feeding pump	5	1.5	83
STP_9	Filter press inflating pump	5	1.5	74
STP_10	Filter press filtrate pump	5	1.5	33
STP_11	Filter press demoulding	5	1.5	26
STP_12	Filter press room (12FP)	1	1.5	85

Note: Where available, the octave band sound power levels are for equipment have been sourced from BS5228-1.

1.4.2 Methodology

The calculation method set out in International Standard: ISO 9613-2: 1996(E): '*Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*' enables the prediction of noise levels in the community from sources of known sound emission and has been adopted for the noise modelling. Calculations have been undertaken for the 1/1 octave bands with centre frequencies between 31.5 Hz and 8 kHz.

The noise prediction method described in this part of the standard is general and is suitable for a wide range of engineering applications where the noise level outdoors is of interest. The noise source(s) may be moving or stationary and the method considers the following major mechanisms of noise attenuation:

- geometrical divergence (also known as distance loss or geometric damping);
- atmospheric absorption;
- ground effect;
- reflection from surfaces; and,
- screening by obstacles.

The method predicts noise levels under metrological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation, or equivalently, propagation under a moderate ground-based temperature inversion as commonly occurs at night. Alternatively, the method can be corrected to predict the long-term average noise level over a period, often several months, which considers a variety of metrological conditions. However, calculation of the long-term average noise level requires statistical information on wind speed, wind direction and temperature gradients gathered over several years; this information is not available for this site and therefore downwind propagation to all receptors is assumed.

A number of environmental parameters can be set that affect the outcome of predictions in accordance with ISO 9613. The ground absorption is set to G=0.5 (partially absorptive) apart from within the STP compound where it is set to G=1 (reflective), the air temperature is set to 10°C and the relative humidity is set to 70%.

The CadnaA noise model is available for review if requested.

1.4.3 Predicted noise levels

The predicted noise levels from the STP at nearby noise sensitive receptors are presented below. Like most construction noise, it is expected that the noise from the STP will have some noticeable acoustic characteristics, specifically tonality (due to the large number of pumps and screens) and to a lesser degree impulsivity (from material landing in the conveyor drop zone). It is not expected to be intermittent as the process is continuous and most major noise sources will operate continuously. The predicted specific noise level, acoustic character corrections and resulting rating levels are presented below.

Table 4.2 Predicted specific noise levels and rating levels.

Receptor	Specific Noise Level, dB $L_{Aeq,T}$	Acoustic Character Correction			Rating Level, dB $L_{Ar,Tr}$
		Tonality	Impulsivity	Intermittency	
Welsh Road Lock Cottage	38.3	4	3	0	45.3
Wood Farm	39.0	4	3	0	46.0
Woodmeadow Farm	36.4	4	3	0	43.4

1.5 Assessment of Impact

1.5.1 Initial estimate of impact

An initial estimate of the impact for the STP operation at night is made by subtracting the measured background sound level from the predicted rating level, as detailed in Table 5.1 below.

Table 5.3 Initial estimate of impact at night

Results	Welsh Road Lock Cottage	Wood Farm	Woodmeadow Farm
Representative night-time background sound level, dB $L_{A90,15\ min}$	31	31	31
Predicted Rating Level, dB $L_{Ar,Tr}$	48.2	48.2	47.2
Difference between background sound level and rating level	17.2	17.2	16.2
Initial estimate of impact	Significant adverse	Significant adverse	Significant adverse

1.5.2 Modification for context

BS 4142 requires that where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be taken into consideration. This section of the assessment sets out the factors which are considered to modify the initial estimate of impact.

1.5.2.1 Absolute level of sound

BS4142 states that "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night".

The specific noise levels are predicted to be below 40 dB $L_{night,outside}$ at all receptors. This is relevant as 40 dB $L_{night,outside}$ is the night noise guideline (NNG) for Europe recommended by the World Health Organisation. This level is the Lowest Observable Adverse Effect Level (LOAEL) for health effects at night, and is set at a level intended to prevent subclinical adverse health effects. Whilst the NNG is not specifically applicable to noise from construction sites, it is in part based on research into aircraft nose which consists of distinct noise events with significant acoustic character.

Both the specific noise level and the rating level are well below the WHO Interim target (IT) for night-time noise of 55 dB $L_{night,outside}$. This threshold is recommended by the WHO for situations where the achievement of NNG "is not feasible in the short run for various reasons". This noise level (as a daily not an annual average) has been adopted by HS2 as the Significant Observable Adverse Effect Level (SOAEL) for the assessment of construction noise at night.

The low absolute level of the specific noise level indicates that subclinical adverse health effects would not be expected due to the operation of the STP; this is a strong indicator that a significant adverse impact will not occur.

1.5.2.2 Other noise sources

The STP is only one part of a complex construction site which will typically operate on a 24/7 basis. There will be other noise from the following activities:

- Wider site works (fabrication, concrete pours etc.)

- Daily site mobilisation and demobilisation (shoulder hours)
- Major bulk earthworks comprising cut to fill and large landscaped fill areas (core hours: Monday-Friday 08:00-18:00, Saturday 08:00-13:00)
- Boring the twin tunnels using the tunnel boring machine (24/7)
- Operation of the grout batching plant (24/7)
- Operation of the Wastewater Treatment Plant (24/7)

While these noise sources are not operating at present, it is expected that the background sound level (to some extent) and the residual sound level (to a much greater extent) will both increase once they commence. These noise sources will have tonal, intermittent and impulsive acoustic character and are likely to making any acoustic characteristics of the STP less perceptible, which would effectively reduce the rating level. It may also be the case that the STP is not the dominant night-time noise source on the construction site due to the contributions of the other activities, some of which will be closer to the receptors.

1.5.2.3 Validity of assessment methodology

Slurry from the STP provides the hydrostatic pressure behind the cutter face that is necessary for the TBM to bore the twin tunnels, and the STP is an integral part of the tunnelling construction equipment.

The BS4142 noise assessment methodology is specifically for rating and assessing industrial and commercial sound' as the title suggests. Section 1.3(d) of BS 4142 states that standard "… **is not intended to be applied to the rating and assessment of sound from: …. d) construction and demolition**;".

Conversely, BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' ('BS 5228' for brevity) considers the "… need for the **protection against noise and vibration of persons living** and working **in the vicinity of**, and those working on, **construction and open sites**" ('open sites' refers to mineral extraction). BS 5228 notes that "*Construction and demolition works can pose different noise control problems compared with most other types of industrial activity for the following reasons:*

- *they are mainly carried out in the open;*
- *they are of temporary duration although they can cause great disturbance while they last;*
- *the noise they make arises from many different activities and kinds of plant, and its intensity and character can vary greatly at different phases of the work; and*
- *the sites cannot be excluded by planning control, as factories can, from areas that are sensitive to noise."*

All of the bullet points quoted from BS 5228 above apply to the operation of the STP.

Annex E to BS 5228 provides **three** assessment methods which may be used to identify the likely significance of noise from construction activity. The category 'ABC' methodology set out in Annex E was adopted as the basis of the construction noise assessments conducted for the HS2 Environmental Statement which supported the passage of the HS2 Phase 1 Hybrid Bill through

parliament to Royal Assent. Noise from the tunnel boring machine and supporting equipment was assessed at the three receptors that this NIA considers using the methodology set out in the Environmental Statement which is based on the BS5228 'ABC' approach.

The BS5228 category 'ABC' methodology also underpins the construction noise and vibration assurances made by the Secretary of State in the Code of Construction Practice and the associated HS2 Information Paper E23. It should be noted that BS 5228 is given the legal status of a '**Code of Practice**' in relation to construction noise and vibration by section 71 of the Control of Pollution Act 1974 and due consideration must be given to the Best Practical Means of noise control set out in BS 5228 in relation to statutory noise nuisance under section 79 of the Environmental Protection Act 1990.

In summary, the method adopted for assessing noise from HS2 construction activities by the Secretary of State is based on BS 5228 and the thresholds of significance adopted for HS2 construction noise were debated by Parliament before Royal Ascent. As BS 4142 is not intended to be applied to the rating and assessment of sound from construction, BBV remain of the opinion that it is unsuitable for assessing the potential significance of construction noise.

1.5.3 Modified impact

Considering (1) the low ambient (specific plus residual) noise levels, which are predicted to be below the WHO Night Noise Guideline (taken to be the Lowest Observable Adverse Effect Level) and Interim Target levels, and (2) the anticipated increase in ambient and background sound levels at the nearby receptors once tunnelling works begin, it concluded that the noise contribution from the STP alone is unlikely to lead to an adverse noise effect at the nearby residences.

1.6 Uncertainty

ISO 9613-2:1996 provides an estimate of accuracy for broadband noise predictions using this method; where the mean height of the source and receiver is between 0 and 5m above ground level, and the intervening distance is less than 1km the estimated accuracy is ±3dB. There is no stated bias in relation to over- or under- predicting noise levels using this method, however the conservative settings for ground attenuation and environmental variables will tend to increase the noise predictions.

2 NOISE & VIBRATION MANAGEMENT PLAN

All BBV construction works for HS2 contracts N1 are undertaken accordance with the “N1 and N2 Construction Noise & Vibration Management Plan” (document number: 1MC08-BBV-EV-PLN-N001-000006). This Noise and Vibration Management Plan (NVMP) is applicable to all construction activities undertaken by the Balfour Beatty VINCI Joint Venture (BBV) and its supply chain on the Main Works Civils Contracts (MWCC) for Sectors N1 & N2.

The NVMP details how the general control measures and the standards to which the nominated undertaker and its contractors are held to by the HS2 Code of Construction Practice will be implemented in practice. The development of a NVMP is a robust process; the NVMP is a living document that is not a static and will be regularly updated following comments from HS2 and other stakeholders, although the main commitments will not change as these are required by the Code of Construction Practice.

The NVMP applies to all construction (and construction related) activities at the Long Itchington Wood North Portal site, including but not limited to the operation of the STP. The current NVMP is included at Appendix C but key points are summarised below:

- The NVMP ensures that where noise from the construction is expected or found to exceed the levels set out in Table 5 of Appendix B to HS2 Information Paper E23, noise insulation (and temporary re-housing) will be offered to avoid construction noise giving rise to significant adverse effects on health and quality of life. The noise insulation threshold at night is a façade-incident noise level of 55 dB $L_{Aeq,1\text{-}hour}$ which corresponds to a free-field level of 52 dB $L_{Aeq,1\text{-}hour}$. Specific eligibility for noise insulation (and temporary re-housing) is explained in Appendix B of HS2 Information Paper E23.
- Continuous noise monitoring using the equipment set out in section 1.3 of this noise impact assessment is already installed and operational at a free-field location near Woodmeadow Farm. Continuous weather monitoring is also being undertaken within the site boundary, close to the office cabins. The monitoring equipment meets the requirements set out in Section 6 of the NVMP, is inspected and calibrated in accordance with Section 6.5 of the NVMP, and is connected to a web based portal that provides access to current and historic results. The web portal also enables SMS/email alerts based on a wide combination of noise descriptor, noise level, duration of noise event, and time of day/week criteria to be set. This noise monitoring will continue throughout the entire operational period of the STP.
- The hourly noise monitoring data is reported to HS2 on a monthly basis, and provides a record of whether the noise level or temporal criteria associated with noise insulation (and temporary rehousing) is exceeded at the receptor. The data is aggregated into reports by HS2 that are then shared with the relevant local authorities.

Appendix A Noise monitoring location sheet

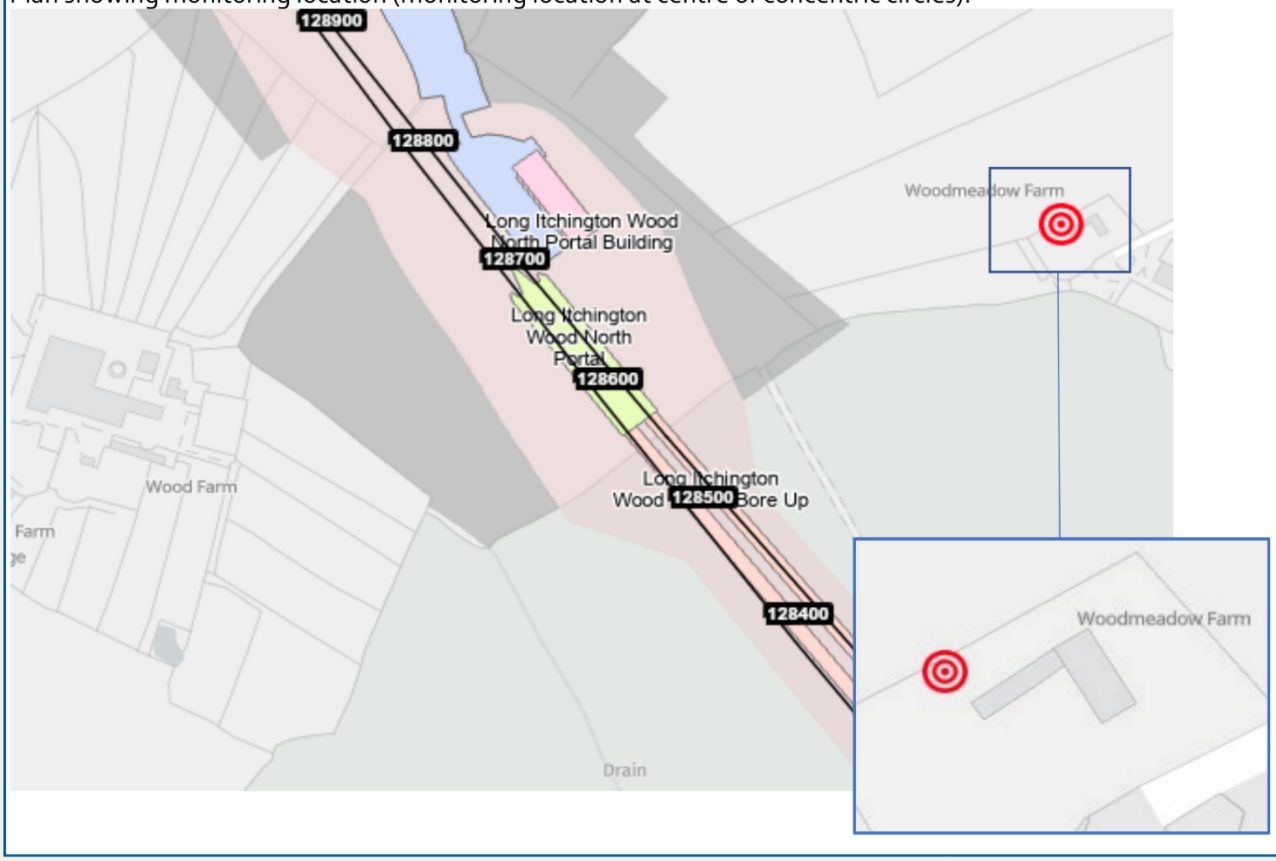
Balfour Beatty VINCI Working in partnership with HS2

Balfour Beatty VINCI Working on behalf of HS2

ES Reference (or N/A)	CNo30L	BBV Identifier	**SL1A-LIWNP-N1**

Form completed by	S Williams			BBV Sub-lot	SL1A			
Form completion date	44,224.00			Approx. chainage	128+550			
Power supply	Solar panels (2 Nos.)			Environmental Manager				
Monitoring equipment	✓	Noise	✖	Vibration	✖	Dust	✖	Weather
Closest receptor	Woodmeadow Farm (ES Assessment ID 232863)							
Closest BBV worksite	Long Itchington North Portal / Satellite							
Distance to worksite	240.00	m		Distance to receptor	6.00	m		
WGS84 (GPS) Coordinates	52.266242, -1.430164			EPSG27700 Coordinates	438985.502 , 263273.746			
Ground type	Lawn/grass			Height above ground	4.00	m		
Dist. to refl. Surface	6.63	m		Method of support	4m telescopic mast			
Facade or free-field	Free-field (≥3.5m)			Requires traffic mgmt.	No			
Within LoD / LLAU	Outside limits			Landowner	Private			
Sch. 4 / Sch. 33 consents	None required							
Additional details	*Relocation of equipment from LIW NP site to closest receptor with line of sight. To north side of house to avoid patio area used by resident.*							

Plan showing monitoring location (monitoring location at centre of concentric circles):



Template Revision 1.03 (28/01/2021)

Appendix B Equipment calibration certificates

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 15 July 2020 **Certificate Number: UCRT20/1631**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	Balfour Beatty Vinci JV-HS2 3rd Floor Eleven Brindley Place 2 Brunswick Square Birmingham B1 2LP			
Order No.	240100208479			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00108821
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	99085
	Rion	Microphone	UC-59	16752
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49 *Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	13 July 2020	ANV Job No.	UKAS20/07361	
Date Calibrated	15 July 2020			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number UCRT20/1631

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Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	11 June 2020		
Calibrator cert. number	UCRT20/1487		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.00	dB	Calibration reference sound pressure level
Calibrator frequency	1001.96	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End			
Temperature	22.59	22.77	±	0.30	°C
Humidity	56.0	56.9	±	3.00	%RH
Ambient Pressure	100.53	100.54	±	0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise	This test is currently not performed by this Lab.			
Microphone installed (if requested by customer) = Less Than		N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±		N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.4	dB	UR	16.2	dB	UR	23.0	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

…….. END ……

Calibrated by: B. Bogdan R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 07 January 2021 **Certificate Number: UCRT21/1035**

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL			
Order No.	ANV MS HIRE			
Test Procedure	Procedure TP 1 Calibration of Sound Calibrators			
Description	Acoustic Calibrator			
Identification	*Manufacturer* Rion	*Instrument* Calibrator	*Model* NC-74	*Serial No.* 35015343

The calibrator has been tested as specified in Annex B of IEC 60942:2003. As public evidence was available from a testing organisation (PTB) responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

ANV Job No.	UKAS21/01010	
Date Received	06 January 2021	
Date Calibrated	07 January 2021	
Previous Certificate	*Dated*	14 January 2020
	Certificate No.	UCRT20/1060
	Laboratory	0653

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number UCRT20/1631

Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	11 June 2020		
Calibrator cert. number	UCRT20/1487		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.00	dB	Calibration reference sound pressure level
Calibrator frequency	1001.96	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End			
Temperature	22.59	22.77	±	0.30	°C
Humidity	56.0	56.9	±	3.00	%RH
Ambient Pressure	100.53	100.54	±	0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB		Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±					0.10	dB

Self Generated Noise	This test is currently not performed by this Lab.		
Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.4	dB	UR	16.2	dB	UR	23.0	dB	UR
Uncertainty of the electrical self generated noise ±				0.12	dB				

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

…… END ……

Calibrated by: B. Bogdan R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
None

Appendix C N1 and N2 Construction Noise and Vibration Management Plan

Balfour Beatty VINCI Working on behalf of HS2

Contract No. 1MC08_09

N1 and N2 Construction Noise & Vibration Management Plan

Document Number: 1MC08-BBV-EV-PLN-N001-000006

Current Revision	Author	Reviewed By	Approved By	Date Approved	Reason for Review
C01	C. O'Connor	W. Bowers	E. Warner	23/01/2020	First Issue

Stakeholder Review Required (SRR)		Purpose of SRR
☐ Yes – Please Specify Below ☒ No Click or tap here to enter text.		☐ Comment ☐ Information ☒ Approval

Handling Instructions: Produced by BBV for project use only

Review Required

Team	Yes/No	Name	Position	Date
Quality				
Health & Safety				
Environment & Sustainability	Yes	Ed Warner	Environment and Sustainability Manager	
Other teams if required				

Revision History

Previous Revision	Author	Reviewed By	Approved By	Date Approved	Reason for Review

Revision Summary

Paragraph Modified	Details of Modification

Contents

1 INTRODUCTION

1.1 Scope

This Noise and Vibration Management Plan (NVMP) is applicable to all activities undertaken by the Balfour Beatty VINCI Joint Venture (BBV) and its supply chain on the Main Works Civils Contracts (MWCC) for Sectors N1 & N2, project references [1MC08] and [1MC09] for the provision of Design and Construction in accordance with the requirements of the contract.

This NVMP details how noise and vibration will be managed on the project by BBV and its supply chain throughout the N1 & N2. This plan, together with the processes included in the BBV Way and any associated documents listed in section 2, will ensure compliance with statutory and regulatory requirements, in addition to the Code of Construction Practice (CoCP) and the HS2 Environmental Minimum Requirements (EMR).

This plan should be read in conjunction with the documents listed in Table 1 in section 2.1.

Project background and description are detailed in the Project Execution Plan (1MC08-BBV-PM-PLN-N001-000001).

1.2 Purpose

The purpose of this document is to present the methodology for undertaking construction noise and vibration monitoring during the construction of the Area North section of the Main Works Civils Contract (MWCC) of the High Speed 2 (HS2) rail project.

This NVMP contains information on the procedures that BBV and its supply chain will follow to manage, control and report on construction noise and vibration, for the MWCC N1 and N2 contract areas, in accordance with relevant legislation, regulations and HS2 Ltd Project Requirements Specification.

This management plan will define:

- roles and responsibilities at project and site-specific levels;
- the approach to construction noise and vibration low risk assessment (Statement of Intent);
- Section 61 (CoPA 1974) consent process;
- noise and vibration control measures;
- noise & vibration monitoring;
- complaint and incident procedures;
- communication arrangements; and
- reporting requirements.

2 REFERENCE DOCUMENTS

2.1 High Speed Rail (London – West Midlands) Act 2017

On 23 February 2017, Royal Assent was granted for Phase One of HS2. The High Speed Two Bill is now an Act of Parliament, including Environmental Minimum Requirements (EMRs).

Table 1 refers to the HS2 related documents that support this management plan.

Table 2-1 Reference documents

Number	Reference Title	Document Number / Link
1.	High Speed Rail (London - West Midlands) Act 2017	http://www.legislation.gov.uk/ukpga/2017/7/contents/enacted
2.	Annex 1: HS2 Environmental Minimum Requirements: Code of Construction Practice	LWM-HS2-EV-STA-000-000107 (0.3)
3.	Annex 2: HS2 Environmental Minimum Requirements: Planning Memorandum	HS2-HS2-EV-STD-000-000003 (0.3)
4.	Annex 3: HS2 Environmental Minimum Requirements: Heritage Memorandum	HS2-HS2-EV-STD-000-000001 (0.3)
5.	Annex 4: HS2 Environmental Minimum Requirements: Environmental Memorandum	HS2-HS2-EV-STD-000-000004 (0.3)
6.	Register of Undertakings and Assurances (including change log)	https://www.gov.uk/government/publications/hs2-phase-2a-register-of-undertakings-and-assurances
7.	Construction noise and vibration monitoring - monthly report	HS2-HS2-EV-TEM-000-000024
8.	E20: Control of airborne noise	LWM-HS2-HY-PPR-000-000054 (0.3)
9.	E21: Control of ground-borne noise and vibration	LWM-HS2-HY-PPR-000-000055 (0.3)
10.	Information Paper - E23: Control of Construction Noise and Vibration	LWM-HS2-HY-PPR-000-000057 (0.3)
11.	Technical Standard – Sound, Noise and Vibration Instrumentation and Monitoring	HS2-HS2-EN-STD-000-000009 (0.4)
12.	Technical Standard – Prediction of airborne noise, ground-borne noise and vibration from construction	HS2-HS2-EN-STD-000-000001 (0.4)
13.	Technical Standard – Sound, Noise and Vibration Instrumentation and Monitoring	HS2-HS2-EN-STD-000-000009 (0.4)

Number	Reference Title	Document Number / Link
14.	CFA Sound, Noise and Vibration Baseline Reports	https://www.gov.uk/government/publications/hs2-phase-one-environmental-statement-volume-5-sound-noise-and-vibration/hs2-phase-one-environmental-statement-volume-5-sound-noise-and-vibration
15.	Section 61 Guidance Document	HS2-HS2-EV-GDE-000-000009 (0.2)

The HS2 Phase One Environmental Statements CFA Sound, Noise and Vibration Baseline Reports (number 12 in Table 1), identify the predicted environmental effects of the HS2 scheme. Volume 5 technical appendices include:

- Baseline reports;
- Construction assessment reports; and
- Operational assessment reports.

The Supplementary Environmental Statement and Additional Provisions 2 documentation must be referred to in conjunction with the ES technical appendices. New baseline information along with changes in design and corrections to the main ES are included in the Supplementary Environmental Statement Additional Provisions (SES/AP) reports.

2.1.1 Environmental Minimum Requirements – General Principles

The EMRs set out the high level environmental and sustainability commitments and are contained in the EMR General Principles document supported by a series of papers, see Table 1.

The EMR General Principles require that the controls to be implemented in delivering the scheme (including the EMRs, powers contained in the Act and Undertakings) will ensure that impacts which have been assessed in the ES will not be exceeded. If the significant adverse impacts identified in the ES are likely to be exceeded, all reasonable steps will be taken to minimise or eliminate those additional impacts.

2.1.2 Code of Construction Practice (CoCP)

The Code of Construction Practice (CoCP) sets out the general control measures to be implemented and the standards to which the nominated undertaker and its contractors will comply in delivering the scheme. Its aim is to ensure that likely significant construction effects that are reported in the Environmental Statement will either be avoided or mitigated. BBV and its supply chain will adopt appropriate measures to design and construct the scheme so that noise and vibration from the construction does not give rise to adverse effects, as identified in the HS2 Environmental Statement (ES). Where reasonably practicable, environmental mitigation will be integrated within the design and implemented during the works.

The general control measures and monitoring arrangements for noise and vibration identified in the CoCP have been considered in the development of this NVMP and, where appropriate, are incorporated in section 5.

Site specific controls are to be developed and agreed with local authorities and other stakeholders and will be captured in site specific Construction Environmental Management Plans (CEMPs) where site specific control measures, as part of Section 61 consents or U&As, will be taken into consideration.

2.1.3 Information Papers

In addition to the EMRs, Information Papers explain the project commitments and how they will be applied to the design and construction of the scheme. It also provides information about the HS2 scheme, the powers contained in the Act and how particular decisions have been reached. For noise and vibration with regard to N1 and N2, Information Paper E23 should be consulted, see Number 8 in Table 1.

2.1.4 Technical Standards

Various Technical Standards (TS) and guidance documents have been developed by HS2, which prescribe the methodologies, processes or specifications which the contractor shall comply with in carrying out the works and implementing the various control measures. See numbers 9-11 in Table 1 above for the relevant noise and vibration TS references.

2.1.5 HS2 Register of Undertakings and Assurances

The HS2 Register of Undertakings and Assurances (Number 6, Table 1 above) details all commitments offered throughout the parliamentary process for the High-Speed Rail (London - West Midlands) Bill up until Royal Assent.

Requirements or mitigations needed to meet applicable Undertakings and Assurances will be set out separately to this NVMP in the site specific EMR Compliance Notes and CEMPs and will be briefed to site teams and contractors, to ensure they are met.

Evidence of compliance against Undertakings and Assurances will be submitted by BBV to HS2 Ltd through site specific EMR Compliance Notes and the monthly noise & vibration and PMU reporting. N1 and N2 noise and vibration related U&As are captured in Appendix B.

2.2 Legislation

The applicable legislation to noise and vibration control are as follows:

- The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015;
- Control of Pollution Act, 1974;
- Environmental Protection Act, 1990;
- The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, 1996; and
- High Speed Rail (London – West Midlands) Act, 2017.

Refer to the N1 N2 Environmental Legislation Register, document reference 1MC08_09-IBBV-EV-REG-N0001-000003, for legal and other requirements associated with the management of construction noise and vibration and the disapplication and requirements under the HS2 (London – West Midlands) Act 2017.

2.2.1 Control of Pollution Act 1974 (CoPA)

The Control of Pollution Act (CoPA) gives Local Authorities (LAs) powers for controlling noise and vibration from construction sites and other similar works. These powers may be exercised either prior to, or during the works.

BBV will obtain prior consent from the relevant local authorities under Section 61 of the CoPA. This will enable BBV and its contractors to carry out approved construction activities.

A Section 61 describes the plant, methodology, location of construction work, hours of work, best practicable means and predicts construction noise levels for the works. This provides a defence against prosecution under Section 60 of the Act, providing that the BBV and its contractors are working within the approved consent conditions.

Best Practicable Means (BPM) will be applied during construction works to reduce noise and vibration impacts as far as is reasonably practicable. If construction work has taken place without employing BPM to control noise, this can lead to a Section 60 abatement or improvement notice being served.

Alternatively, for low noise risk activities and areas a Statement of Intent (SOI) approach may be agreed with the LA.

2.2.2 Consents and Licencing

All proposed noise monitoring locations will be submitted to HS2 for acceptance so that agreements can be obtained from local authorities and any private asset holders.

The installation of equipment for all proposed monitoring locations will not be undertaken until all written consents and agreements are in place and communicated accordingly.

2.3 Standards

The following British Standards contain guideline threshold levels that have been incorporated into the HS2 key reference documents and have been included below for information only.

- BS5228-1: 2009+A1:2014 – Noise and vibration control on construction and open sites: Part 1 – Noise.
- BS5228-2: 2009+A1:2014 – Noise and vibration control on construction and open sites: Part 2 – Vibration.
- BS8233: 2014 – Guidance on sound insulation and noise reduction in buildings. British Standards Institution.
- BS6472-1:2008 – Evaluation of human exposure to vibration. British Standards Institution.
- BS7385-2: 1993 – Evaluation and measurement for vibration in buildings: Part 2 – Guide to damage levels from groundborne vibration.

2.4 The BBV Way

The BBV Way is the Balfour Beatty VINCI Business Management System for the project. It contains the processes that we will use to manage the project. Further details on The BBV Way can be found

in the BBV Environmental Management Plan (EMP), Section 2.4 (1MC08-BBV-EV-PLN-N001-000001).

3 ABBREVIATIONS AND DEFINITIONS

3.1 Abbreviations

AP	Additional Provisions of the Environmental Statement
BBV	Balfour Beatty VINCI
BPM	Best practicable means
BS	British Standard
CEMP	Construction Environmental Management Plan
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act
DJV	Design Joint Venture
EHO	Environmental Health Officer
EMRs	Environmental Minimum Requirements
EMP	Environmental Management Plan
ES	Environmental Statement
EWC	Enabling Works Contractor
EWC	Early Works Contract
GPCN	General Principle Compliance Notes
HORACE	HS2 On-line incident reporting system
HS2	High Speed Two Limited, also referred to as “HS2” or “EMPLOYER”
ITT	Invitation to Tender
LA	Local authority
LEMP	Local Environmental Management Plan
MWCC	Main Works Construction Contract
NVMP	Noise and Vibration Management Plan
NI	Noise Insulation
PQQ	Pre-Qualification Questionnaire
RAMS	Risk Assessment Method Statement
S61	Section 61 of the Control of Pollution Act 1974
SES	Supplementary Environmental Statement
SOI	Statement of Intent for low noise and vibration risk sites
TBT	Tool Box Talk

TRH	Temporary re-housing
TS	Technical Standard
U&As	Undertakings and Assurances

3.2 Topic Specific Definitions

L_{Amax}	This is the maximum noise level recorded over the measurement period.
$L_{Aeq, T}$	This is the "equivalent continuous A-weighted sound pressure level, in decibels", and is defined in British Standard BS 7445 as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure level as a sound under consideration whose level varies with time".
$L_{A90, T}$	The A-weighed sound pressure level that is exceeded for 90% of the measurement period, T. This is commonly used as the 'Background Sound Level' for assessing the effects of industrial noise in the UK.
$L_{A10, T}$	The A-weighed sound pressure level that is exceeded for 10% of the measurement period, T. This is commonly used for the assessment of traffic noise.
PPV	Peak Particle Velocity - Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
VDV	Vibration Dose Value - Measurement of the cumulative vibration dose, based on vibration level and duration, over a specified period of time. VDV is utilised to assess the human response to vibration.
SOAEL	Significant Observed Adverse Effect Level - this is the level above which significant adverse effects on health and quality of life occur
LOAEL	Lowest Observed Adverse Effect Level - this is the level above which adverse effects on health and quality of life can be detected

4 RESPONSIBILITIES

The BBV organisational structure is critical to the delivery of the noise and vibration management requirements of the MWCC. The structure will be as follows:

- Environmental & Sustainability Manager;
- Area Environmental Managers and Advisors;
- Construction Site Teams;
- Environmental Consents Manager; and
- Noise and Vibration Specialist.

In addition to the BBV Structure and Responsibilities that are detailed in Section 4 of the BBV EMP, the noise and vibration management roles are summarised below in Table 2.

Table 4-1 Noise & Vibration Roles and Responsibilities

Reference Title	Document Number
BBV Environment & Sustainability Manager	– Develop scopes of works, Pre-Qualification Questionnaire (PQQ) and Invitation to Tender (ITT) questionnaires and resource the noise and vibration lead. – Review/QA and agree scope of works within noise and vibration deliverables prior to submission to HS2. – Ensure the appointed Noise and Vibration specialist meets the appropriate competencies and can meet the resourcing needs to deliver contract topic requirements. – Lead, support and advise the construction team to ensure they have the required training, competences and resources and that they are suitably deployed for the successful implementation of the noise and vibration monitoring Plan. – Organise noise and vibration audits across N1 and N2. – Sharing of lesson learned, good practice and noise and vibration related innovations with other HS2 contracts.

Reference Title	Document Number
Area Environmental Manager	– Assurance activities such as audit and inspection of work sites (for CoCP, EMR, EMP, HS2 Technical Standards and other control plan conformance). – Facilitate the investigation of complaints, incidents or exceedances. Ensure closeout within 5 working days (using the HS2 On-line incident reporting system (HORACE)). – Provide support and direction to Stakeholder Manager to ensure compliance with Undertakings and Assurances is achieved. – Undertake site inspections to ensure BPM is being implemented, as detailed in the Section 61 consent. – Review monitoring data as provided by the Noise and Vibration Specialist. – Investigation of any complaints or incidents and investigate any exceedances. – Provide training to the construction team and workforce as required. – Attend site meetings.
Construction Environmental Advisor	– Responsible for providing support to Construction Site Teams and Area Environmental Manager to ensure compliance with BPM, environmental legal and contractual requirements. – Communication of the noise and vibration management and monitoring related requirements in the CoCP and HS2 Technical Standards to construction teams. – Assist Area Environmental Manager in assurance activities such as audit and inspection of work sites (for CoCP, EMR, EMP, HS2 Technical Standards and other control plan conformance). – Support Noise and Vibration Specialist with attended monitoring, as required, to demonstrate compliance with consented Section 61 applications. – Undertake inspections to ensure BPM is being implemented and identify any environmental issues to reduce risks. – Support site meetings as required.

Reference Title	Document Number
Construction Site Team	– Collaborate with the Environmental Team on the development of work methodologies and mitigation in accordance with BPM to control noise and vibration. – Implementation of control measures in accordance with Section 61 consent and U&A requirements. – Responsible for compiling and complying with Risk Assessment Method Statements (RAMS) Environmental Control Plans and instructions given by supervision in relation to the work they are undertaking and for reporting and responding to any noise and vibration or other environmental incident. – Responsible for communicating the noise and vibration monitoring requirements to subcontractors and the effective management of the works in line with the Noise and Vibration Monitoring Plan and consent requirements outlined within each of the appropriate local authority Section 61 Consents. – Lead on the investigation of any exceedances of Section 61 consent or Trigger Action Levels and report to the local authority/HS2. – Attend site inspections and meetings with Noise & Vibration Specialist and Area Environmental Manager/Advisor as required. – Daily records of operations undertaken, together with noise and vibration conditions. – Provide site supervision / support through site inspections, identification and delivery of environmental tool box talks (TBTs).
Environmental Consents Manager	– Manage consents applications. – Update the consents applications methods and processes where appropriate. – Identify the need for Section 61 consents across the project. – Managing the Section 61 application process and advising BBV personnel to ensure compliance with Section 61 consents and contractual requirements. – Liaise with Area Environmental Manager and Noise and Vibration Specialist.

Reference Title	Document Number
Noise and Vibration Specialist	– Produce, update and ensure implementation of the Noise and Vibration Management and Monitoring Plans. – Sharing of lesson learned, good practice and noise and vibration related innovations with the BBV Environment & Sustainability Manager and other MWCC Area North sites. – Manage the installation of permanent monitoring equipment (either oversee the adoption of equipment from the Enabling Works Contractor (EWC) or installation of additional monitoring equipment). – Responsible for completion of weekly monitoring reports to the Area Environmental Manager and monthly monitoring reporting to HS2. – Production of vibration risk assessments and advise on noise insulation (NI) or temporary re-housing (TRH) as required. – Advise and instruct construction teams on how to meet noise and vibration requirements, including Section 61 consents. – Assist the Environmental Consents Manager with producing Section 61 applications, dispensations and variations. – Responsibility to undertake or train competent persons to carry out attended monitoring of noise and vibration to demonstrate compliance with consented Section 61 applications. BPM checks will be carried out during attended monitoring. – Support Environmental Advisors with ensuring noise and vibration compliance. – Provide technical support on noise and vibration issues. – Assist in the investigation of any complaints or incidents as required.

4.1 RACI (Responsible – Accountable – Consulted - Informed)

All parties involved in delivering the MWCC works for BBV have a duty to protect receptors from the noise and vibration impacts associated with the construction phase. Responsibility, accountability, consultation and information requirements for BBV is detailed in Table 3 below.

Table 4-2 BBV RACI

Role	Accountable	Responsible	Consulted	Information
Project Director	✓			
HSQE Director	✓			
Environment and Sustainability Manager		✓	✓	
Sub Lot Project Managers		✓	✓	
Noise and Vibration Specialist		✓		

Role	Accountable	Responsible	Consulted	Information
Area Environmental Manager & Advisor		✓	✓	
Consents Manager		✓	✓	
Logistics Manager			✓	✓
Traffic Manager			✓	✓
Plant and Materials Buyer			✓	✓
Commercial / procurement representative			✓	✓
Community Engagement Manager			✓	✓
Engineers / Agents / Works / Section Managers		✓	✓	✓
Site Supervisors		✓		✓
Site Operatives		✓		✓
Subcontractor		✓	✓	✓

5 NOISE AND VIBRATION CONTROL MEASURES

To manage and comply with statutory, regulatory and HS2 Ltd's noise and vibration requirements, pre-construction assessments will be undertaken to establish the potential environmental impacts of the N1 and N2 MWCC works in relation to the sensitivity of the surrounding areas. Identified impacts will enable site specific control measures, in line with Best Practicable Means (BPM), to be implemented to minimise noise and vibration during pre-construction phase of the works.

To mitigate and understand the noise and vibration impact of the proposed works for MWCC and to effectively implement controls stated in the EMR, a Noise and Vibration Specialist with relevant competences and resources, will be appointed. The Noise and Vibration Specialist will be required to undertake or to coordinate delivery of noise and vibration risk assessments for all of N1 and N2 works that require a prior consent under Section 61 of the CoPA (unless otherwise agreed for low risk works). Site conditions, receptors and construction activities will determine whether the proposed works will result in low, medium or high-risk sites.

Control measure checks to be incorporated at the pre-construction and construction phase for the management of noise and vibration are set out below:

- Pre-construction:
  - Competencies and resourcing;
  - Vibration risk assessment;
  - Section 61 consent (or Statement of Intent for low risk works);
  - Best Practicable Means;
  - Noise insulation and temporary re-housing assessment; and
  - Communication with LA / community engagement.

- Construction:
  - Inspections and audit;
  - Noise and vibration monitoring and reporting;
  - Complaint and incident management; and
  - Communication with LA / community engagement and notification.

5.1 Noise and Vibration Management

5.1.1 Management

BBV will produce a site-specific Construction Environmental Management Plan (CEMP) which will identify the noise and vibration constraints from the ES, SES/AP documents, as well as results of any environmental surveys or assessments completed prior to handover from the EWC. Noise and vibration mitigation will be assessed and revised, if required, during the Detailed Design stage for each area within N1 and N2. BBV and its supply chain will be responsible for the implementation of the site-specific CEMP, ensuring that the required noise and vibration monitoring and mitigation is in place and compliance with U&As and EMRs by use of the BBV EMR Compliance Note tool. Document reference to the EMR Compliance Note will be provided in further revisions of this NVMP.

Any measurement of noise and vibration, including the monitoring regime proposed by the Noise and Vibration Specialist for N1 and N2, will be in full consultation with the relevant LA. Monitoring locations that have been identified in the ES will be discussed and, if required, revised and submitted along with other supplementary information to the Statement of Intent (see section 5.2) or Section 61 application (see section 5.3).

5.1.2 Local Environmental Management Plans

Local Environmental Management Plans (LEMPs) outline specific control measures for LAs, including those required for noise and vibration, especially with regard to sensitive receptors.

LEMPs identify locations that may be potentially affected by noise and vibration, from surface construction activity. Site specific CEMPs will reference the information contained in the relevant LEMP so these are briefed out to the site teams.

5.2 Statement of Intent Noise and Vibration Risk Assessment for Low Risk Sites

The Statement of Intent (SOI) is part of a risk assessed approach in accordance with the method set out in the London Good Practice Guide: Noise & Vibration Control for Demolition and Construction. Where low risk works or sites are agreed, a SOI for small sites shall be completed and submitted to

the LA. See Appendix B for a completed sample SOI and Table 1 for HS2's Section 61 Guidance Document for further information and the SOI template.

Where a SOI has been identified, BBV will undertake early engagement with the relevant LA to discuss the SOI submission on noise and vibration matters, including advance discussion of proposed works, methodologies, monitoring requirements and mitigation measures.

For the production of a Statement of Intent, the following information is required:

- A summary of what the works will involve;
- Length of time on site;
- Equipment that will be left on site;
- Details of any intrusive work;
- The number of people that will be on site;
- Receptor noise predictions where appropriate; and
- A map of the area/working area.

Where it is agreed with the LA that a SOI is appropriate for the works, BBV will issue the document to the LA at least 10 working days in advance of works commencing on site. If works are being undertaken by the BBV Supply Chain, the required information must be provided to BBV at least 30 working days prior to commencing works on site.

If the nature of works changes, such as working times, methodology or plant in use, the LA must be informed and a revised SOI must have to be prepared, if requested.

The SOI is only intended for sites that have been deemed as Low Risk and does not give prior approval for works under Section 61. If a complaint is received or works change from that given in the SOI and the changes have not been communicated to the relevant LA, the site can be served notice under Section 60 of CoPA 1974 and works may be conditioned by the LA.

5.3 Section 61 Prior Consent

BBV will obtain prior consent from the relevant LA under Section 61 of the CoPA for all construction and engineering works that fall within the scope of section 60(1) of CoPA.

In preparing and submitting a Section 61 consent application, or any dispensations, variations or notification of overrun or emergency works, BBV will reference the processes and guidance requirements of the HS2 Phase 1 Section 61 Guidance Document (Table 1), including timescales for preparation and submission of documentation and consultation with both HS2 and the LA.

Submission of Section 61 applications will be via BBV's Noise and Vibration Specialist and the relevant LA who have a statutory 28-day determination period. BBV and its Contractors will implement the terms of any consent and comply with the conditions set out by the LA.

Cumulative effects resulting from multiple contractors working in the same area are to be identified in advance by BBV and communicated to the LA and included in the noise modelling of the Section 61

consent prior to submission. BBV Contractors working in the same area will be responsible for re-assessing noise and vibration impacts, collaborating in order to remove cumulative impacts (e.g. planning deliveries and noisy works at alternate times where possible) and / or putting in place control measures to reduce the risk of cumulative noise and vibration impacts. Cumulative effect control measures will be revised in this plan when approved by the appointed Noise and Vibration Specialist.

5.3.1 Working Hours

Core working hours, as specified in the CoPA 1974 and HS2 CoCP are:

Monday to Friday	08:00 to 18:00
Saturday	08:00 to 13:00

5.3.1.1 Start-up and close down periods

Shoulder periods to maintain the core working hours; a period of up to one hour before core working hours (07:00 to 08:00 - Monday to Saturday) and up to one hour after core working hours (18:00 to 19:00 - Monday to Friday and 13:00 to 14:00 Saturday) for start-up and close down of activities.

Activities to be undertaken during this period may include but are not be limited to:

- Deliveries to and from site;
- Loading/unloading;
- Arrival and departure of workforce and staff at site and movement to and from place of work;
- General refuelling;
- Site inspections;
- Site clean-up;
- Site maintenance; and
- Maintenance and checking of plant and machinery.

5.3.1.2 Additional working hours

Any additional workings hours or out of hours working, will be identified within the Section 61 application to the LA for prior consideration and approval.

Certain operations such as earthworks are season and weather dependent. In these instances, BBV will seek to extend the core working hours and/or days for such operations to take advantage of daylight hours, with the consent of the relevant LA.

5.3.2 Dispensation

Where planned work has to be rescheduled from the original programme as given in the application, to require operations outside the terms of the approved S.61 consent, BBV Noise and Vibration Specialist will apply to the relevant LA for a Dispensation, at least 14 days in advance of the proposed operation.

The application will include the following information:

- Full details of the operation in question;

- Reasons why the operation cannot be carried out within the terms of the consent;
- Proposed working hours;
- Details of plant to be used;
- Predicted noise and vibration levels at relevant locations; and
- Proposed steps taken to reduce noise and/or vibration to a minimum.

The Dispensation proforma must be used and can be found in the HS2 Phase 1 Section 61 Procedure Document. See Table 1 for HS2's Section 61 Guidance Document for further information and the Dispensation template. In addition, a noise assessment for the predicted noise output from the operation requiring dispensation, may be required by the LA.

Where Dispensation is required for works of a critical nature for reasons not envisaged and beyond the control of the site team (such as key activities likely to delay other key activities) written application shall be made where practicable at least 48 hours in advance and at least 7 days in advance, if the works are expected to last for a period of 5 days or more.

5.3.3 Variation

Where consented works require a Variation as work progresses, such that a rescheduling of works is of a critical nature, and/or additional activities, not included in the original Section 61 application, are required, and in both cases do not materially affect the predicted noise or vibration levels, the BBV Noise and Vibration Specialist will apply for a Variation to the Section 61 consent.

Rescheduling relates to work of a critical nature for reasons not envisaged and beyond the control of the site team (such as key activities likely to delay other key activities).

Variation applications will be made where practicable at least 7 days ahead of the start of the works using the Variation proforma that can be found in the HS2 Phase 1 Section 61 Procedure Document.

See Table 1 for HS2's Section 61 Guidance Document for further information and the Variation template.

5.3.4 Overrun

In circumstances when it is apparent that the pre-planned construction works, which are not covered by Dispensation or Variation, are going to run after Section 61 consented Core Hours of working, the LA must be notified via email using the agreed Notification of Overrun proforma in the HS2 Phase 1 Section 61 Procedure Document.

Unlike a Dispensation or Variation, an Overrun is not an approval process. If the LA subsequently determines that the Overrun was not for sound engineering or health and safety reasons, and could have been reasonably avoided, the matter can potentially be taken up as a breach of the Section 61 Consent.

5.3.5 Emergency Works

In the event of construction works needing to be undertaken at very short notice, in response to an emergency situation, or where works if not completed, would be unsafe or detrimental to the

permanent works, then the LA shall be contacted as soon as is reasonably practicable via the nominated emergency contact number that will be in the CEMP.

The reason for the emergency, likely duration and site contact details will need to be reported. The Area Environmental Advisor and Area Environmental Manager must be contacted in the first instance to contact the LA directly to inform them of the emergency works.

Unlike a Dispensation or Variation, this is not an approval process. If the LA subsequently determines that the emergency work was not for sound engineering or health and safety reasons and could have been reasonably avoided, the matter can potentially be taken up as a breach of the relevant agreement or Section 61 consent that in place for the works.

5.4 Noise Insulation and Temporary Re-housing

5.4.1 Eligibility

Eligibility and quantification criteria for noise insulation (NI), provision for additional noise mitigation and temporary re-housing (TRH), has been assessed in the HS2 Phase One SES and will be considered in further detail by the BBV Noise and Vibration Specialist.

Eligibility for NI and TRH, including consideration of special cases, is explained in HS2 document E23 Appendix B. The noise level for TRH is set 10dB higher than the Significant Observed Adverse Effect Level (SOAEL).

5.4.2 Identification

Identification of NI, additional noise mitigation and TRH will be established by BBV following the outlines and measures contained within E23: Control of Construction Noise and Vibration, HS2 information papers and CoCP, Section 13 (paragraph 13.2.12). BBV Noise and Vibration Specialist will ensure that all properties with the potential to be impacted by the construction works has been considered and assessed.

In order to facilitate installation of NI prior to the commencement of works on site, qualification should be identified at least 6 months in advance of works or, where listed buildings may be concerned, at least 9 months in advance of works.

Information Paper E23, Appendix A details levels considered to the Lowest Observed Adverse Effect Level (LOAEL) and SOAEL. Where noise or vibration from the construction exceed the SOAEL set out in E23'sTable 1 and 3 of Appendix A, NI or temporary re-housing will be offered, with the aim that noise and vibration from the construction of the proposed scheme does not give rise to significant adverse effects on health and quality of life.

NI and TRH arrangements apply to private dwellings where predicted noise levels exceed the actual noise threshold for:

- A period of 10 or more days of working in any 15 consecutive days during construction; or
- For a total of 40 days or more in any 6 consecutive months during construction.

Where the actual noise is less than the predicted noise level, the works impact will be monitored via a noise field assessment as the work progresses.

If noise levels are higher than predicted, prolonged or exceed the thresholds, NI or TRH may be necessary. BBV Noise and Vibration Specialist will ensure that all properties with the potential to be impacted by the construction works has been considered and assessed.

5.4.3 Noise & Vibration Trigger Levels for Residential Properties

Trigger levels summarised below for noise and vibration as stated in HS2 Information Paper E23.

Table 5-1 Noise – Thresholds for Noise Insulation/Temporary Re-housing

Day	Time (hours)	Averaging Period (T)	Noise Insulation trigger level LAeq,T (dB) *	Temporary re-housing trigger level LAeq,T (dB) *
Monday to Friday	0700 – 0800	1 hour	70	80
	0800 – 1800	10 hours	75	85
	1800 – 1900	1 hour	70	80
	1900 – 2200	1 hour	65	75
Saturday	0700 – 0800	1 hour	70	80
	0800 – 1300	5 hours	75	85
	1300 – 1400	1 hour	70	80
	1400 – 2200	1 hour	65	75
Sunday and Public Holidays	0700 – 2200	1 hour	65	75
Any night	0700 – 2200	1 hour	55	65

* Proposed Scheme construction sound only. Levels represent measurements taken at 1m from closest façade of a habitable room.

Table 5.2 Vibration – Adverse Effect Levels, Residential

Parameter	LOAEL/SOAEL	Unit	Level
Groundborne Noise	LOAEL	L_{fASmax} [dB]	35
	SOAEL	L_{fASmax} [dB]	45
Vibration	LOAEL	VDVday [$m/s^{-1.75}$]	0.2
		VDVnight [$m/s^{-1.75}$]	0.1
	SOAEL	VDVday [$m/s^{-1.75}$]	0.8
		VDVnight [$m/s^{-1.75}$]	0.4

BBV will carry out a vibration scoping assessment before the end of Detailed Design to determine whether the trigger levels for vibration as set out in Section 13 of the HS2 Code of Construction

Practice are likely to be exceeded, including activities such as vibratory compaction and other driven processes.

If predicted vibration levels exceed 1mm/s component PPV at occupied residential buildings or 3mm/s PPV at occupied commercial buildings, a more detailed assessment should be carried out in accordance with BS7385-2:1993, Evaluation and measuring for vibration in buildings. Part 2 Guide to damage levels from ground borne vibration.

Sensitive times for commercial premises will be identified where construction activities are carried out in locations that have structural connections with or are very close to the foundations of other buildings, the noise and vibration impact will be considered and identified within the site-specific CEMP, once assessed by the Noise and Vibration Specialist.

5.5 Best Practicable Means (BPM)

Best Practicable Means (BPM) will be applied during construction works to reduce noise (including vibration) at neighbouring residential properties and other sensitive receptors (including local businesses and any quiet areas designated by the LA) arising from construction activities. BPM are defined in Section 72 of the Control of Pollution Act 1974 and Section 79 of the Environmental Protection Act 1990 as those measures which are "*reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications*".

BPM measures specified in Appendix A of this NVMP are mitigation control measures that may be applied by MWCC construction activities to minimise adverse impact and effects. The CoCP (section 13, paragraph 12.2.2) details the mitigation hierarchy that must be considered in addition to the BPM measures set out in the CoCP, section 13 paragraph 13.2.4).

These BPM measures will be considered when planning all works and must be included in method statements, Statement of Intents and Section 61 consent applications, to minimise the noise and vibration impact of the works.

6 MEASUREMENT AND MONITORING

6.1 Specification of Monitoring Noise Equipment

All sound level meters utilised for attended or unattended monitoring and field calibrators will confirm to class 1 specification in line with the HS2 Technical Standard – Sound, Noise and Vibration Instrumentation and Monitoring.

The measurement equipment will be capable of continuously measuring and logging the following parameters as a minimum.

- LAeq, 5 Minute
- LAFmax, 5 Minute
- LAFmin, 5 Minute

- LA10, 5 Minute
- LA90, 5 Minute
- Leq, 5 Minute in Octave Bands 31.5Hz to 8kHz

The noise monitoring system will be capable of streaming data wirelessly to an online web-based server. The web-based system will allow the programming of trigger alert levels that will be transmitted by text and email to nominated parties for the purpose of preventing exceedances of consented levels.

6.2 Specification of Monitoring Vibration Equipment

The sensitivity of the vibration monitoring equipment will be compliant with the guidance specification in line with the HS2 Technical Standard – Sound, Noise and Vibration Instrumentation and Monitoring.

All vibration equipment will be capable of logging independent time histories for the three orthogonal directions of motion.

The vibration system installed will be capable of time synchronisation in order to easily identify specific time periods within the measured data, the time will be set via means of GPS or radio clock to guarantee consistency.

The vibration monitoring system will be capable of streaming data wirelessly to an online web-based server. The web-based system will allow the programming of trigger alert levels that will be transmitted by text and email to nominated parties for the purpose of preventing exceedances of consented levels.

6.3 Installation of Unattended Monitoring Equipment

The Noise and Vibration Specialist will liaise with the LA and the construction teams to determine the most suitable location for any proposed monitoring equipment. Priority will be given to locations that will be in situ long-term, will not obstruct the proposed works and will remain accessible throughout the construction phase.

For the proposed monitoring locations, a method statement will be produced to detail any equipment already installed at that location, the condition of the dwelling/asset, along with any information regarding any specific access requirements. In addition to this, the method statements will identify any potential health and safety risks, along with additional mitigation to manage the identified risks throughout the installation, operational and calibration periods.

The monitoring equipment will be installed 1 month prior to the commencement of construction work to allow for the determination of existing baseline noise and vibration levels.

6.3.1 Noise monitor installation

Equipment will be located at least 3.5m away from reflective surfaces, with the exception of the ground, at ground floor level. If ground floor positions are not representative, then a position of 4m above ground should be adopted to replicate the first floor.

6.3.2 Vibration monitor installation

Vibration equipment will be installed in a representative position close to the boundary of the identified sensitive receptor. The vibration monitor will be located in a locked case with an accelerometer, which will either be installed into soft ground using ground spikes or in the instance of hard will be weighted sufficiently to avoid movement that is not associated with the proposed works.

6.3.3 Weather Stations

It is not necessary to install weather stations at every monitoring location as localised weather is unlikely to significantly alter, therefore at least 1 weather station, as a minimum will be installed in a representative position of all proposed monitoring locations. The weather station will be capable of uploading weather data to the same online platform as the measured noise and vibration data. If there is a notable change to the weather conditions or the areas of monitoring are significantly apart then additional weather stations will be required. The representative positions for weather stations will be agreed in conjunction with all relevant stakeholders.

6.4 Baseline Monitoring

BBV may undertake further baseline noise and vibration assessments for medium to high risk sites, in addition to sensitive receptors that have been identified in the relevant LEMP or as part of a U&A commitment. In addition, the relevant LA may request further pre-construction baseline monitoring prior to applying for Section 61 consent. Refer to HS2 Section 61 Guidance document (see Table 1), for further details.

6.5 Maintenance of monitoring equipment

6.5.1 Visual Inspections

Visual inspections will take place at two-week intervals to check that no obvious damage has occurred to the sound or vibration monitors and any associated equipment. Detailed inspections of equipment will be undertaken in line with the requirements for onsite field calibration unless an issue is identified with a specific meter and detailed investigations are required.

6.5.2 Calibration

Sound level meters will undergo traceable calibration by an UKAS approved laboratory every two years, field calibrators will be calibrated every year in line with manufacturer recommendations and acoustic good practice.

Attended noise monitoring will be field calibrated before and after each monitoring period and the drift noted.

6.6 Web Based Noise and Vibration Monitoring Alerts System

Web based hosting will be utilised for all unattended measurement positions that will collect process and manage noise, vibration and weather data and will display it to anyone that has relevant access authorisation.

Historic data will be available through an online portal that can be downloaded in a spreadsheet format for instant review by the BBV Noise and Vibration Specialist and Construction Teams as required.

6.6.1 SMS & Email Alerts

The web-based monitoring system will be configured to allow the sending of text message and email alerts to authorised nominated parties. Alerts will be set at specific trigger levels dependent on the works being undertaken and the time period these occur in.

Proactive trigger alerts will be sent initially as a warning, known as an amber alert to allow on-site works to be reviewed if it is likely that current activity could exceed an agreed noise limits if continued at the same intensity. This would allow for a review of working methods to minimise the risk of an exceedance. It will be clear within the text message or email that this is an Amber Alert.

Red alerts will also be configured which will send an alert to nominated parties to notify if the limit has been exceeded, if red alerts are received then the relevant protocols for noise and or vibration investigation should be undertaken immediately. If a red alert is received, then the noise level for that relevant time period will have been exceeded and will not be reset until the next measurement period.

7 REPORTING

7.1 Noise and Vibration Reporting

BBV is will submit monthly reports containing all unattended and attended noise and vibration data to HS2 by the second calendar week of the month following the monitoring period. All reports will be submitted in the relevant HS2 template ('Construction noise and vibration monitoring monthly report'). HS2 will then review the submitted data provided by BBV, before making the monthly reports available to the public.

All monthly reports produced by BBV shall be compiled by the BBV Noise and Vibration Specialist and will include the following:

- the works and any activities being undertaken that could generate noise and vibration at the specific monitoring position;
- Information on the equipment installed with serial numbers and calibration dates;
- dates of field calibrations undertaken during the specified reporting period;
- a summary of the weather conditions with any measurements periods that have been excluded as a result of poor weather conditions during the specific monitoring report period;
- summary of complaints received, broken down into appropriate time periods; and
- results of investigations, including the identified source, cause, immediate action taken and actions to prevent recurrence.

The noise and vibration reporting regime is detailed in the CoCP and Section 5 within the HS2 Technical Standard – Predication of airborne noise, ground-borne noise and vibration from construction, which details HS2 methodologies and reporting requirements.

7.2 Incidents

Noise and vibration incidents will be defined according to the HS2 incident recording and levels and will be reported as per the BBV Incident Reporting and Investigation Procedure for N1 and N2 (1MC08-BBV-HS-PRO-N001-000004).

All personnel, including visitors, subcontractors and supply chain, must report all environmental incidents and near misses promptly, as per BBV Incident Reporting and Investigation Procedure.

For all environmental incidents, not only noise and vibration incidents, the HS2 helpline and the relevant BBV Project Manager must be notified immediately by telephone if there are/is:

- any enforcement action or threat of enforcement action;
- any environmental harm caused outside of the site;
- any environmental harm caused within the site;
- complaints from stakeholders or third parties;
- repeated justifiable complaints from members of the public; or
- trespass/vandalism on site that has caused environmental harm within site or outside of site.

In the event of a noise or vibration exceedance or complaint being received, a review of mitigation measures and working methods will need to be undertaken between BBV and the Supply Chain involved with the works, the relevant BBV Project Manager, BBV Area Environmental Manager, BBV Environmental Noise and Vibration Specialist and the BBV Environmental Advisor to identify the immediate cause of the exceedance, and where necessary, implement suitable control measures.

BBV must provide a written record of the incident, including remedial action taken and photographs if required. A copy of the report must be issued as per the BBV Incident Reporting and Investigation Procedure.

7.3 Complaints

Any complaints received in person at worksites must be logged including the name and contact details of the complainant, including the nature of the complaint and how the team dealt with the individual(s).

Investigation of complaints or exceedance of trigger levels may include but not be limited to the following actions:

- site inspection (including subjective impression of noise and/or vibration at complainant's premises) and review of construction works and control measures (including BPM);
- inspect site daily record sheets including deliveries to site;
- review the noise monitoring results to determine as far as possible the activities/plant responsible for exceeding the relevant noise level;
- investigate possible extraneous noise sources, e.g. neighbouring construction sites;
- consider the influence of weather conditions (review weather data);
- inspect and undertake field calibration of monitoring equipment;
- evaluate and implement any reasonably practicable means of reducing the measured construction noise levels to the predicted level (or as low as is reasonably practicable);
- prepare an incident/complaint investigation report;
- close out of any complaints with complainant by BBV;

- complaint / incident register to be updated; and
- issue the incident/ complaint investigation report to HS2 and the local authority.

Complaints received via the HS2 Helpline will be directed to the BBV Community Engagement Manager who will inform the BBV Environment & Sustainability Manager and relevant BBV Sub Lot Project Manager for the works. The approach to community engagement is included in a separate Community Liaison Plan N1 & N2 (1MC08-BBV-HR-PLN-N001-000005.

HS2 helpdesk is operational 24 hours a day, 7 days a week. The helpdesk manages complaints and handles enquires. The HS2 helpdesk is contactable by phone on 08081 434 434 or email HS2enquiries@hs2.org.uk.

Appendix A Best Practicable Means (BPM)

Specific BPM noise and vibration mitigation measures relevant to N1 and N2 works:

- The investigation and use of acoustic blankets on site to minimise the quantity of noise leaving the site boundary;
- Where 'Heras' panels are being used to demarcate worksites noise blankets may need to be installed adjacent to sources of noise, if appropriate;
- Noise barriers comprising noise blankets will be provided around static equipment and/or around areas where activities could give rise to potential nuisance;
- High noise generating activities have been planned and restricted to core hours to minimise disruption;
- All deliveries to/from site will be carried out during the day so that there will be no standard night time deliveries. Exceptions to this rule will be deliveries associated with the large plant or similar requiring movement orders. These occurrences must be detailed in Section 61 consent applications or notifiable to the relevant Local Authority;
- Care will be taken to reduce noise impacts, when loading or unloading vehicles or moving materials. Workforce will be reminded about dropping hand tools and materials handling before the start of a shift;
- All site operatives will be briefed on the requirements of the site constraints and ensure any unnecessary noise is avoided including shouting and banging. This especially applies during consented 'out of hours' working;
- All waste to be removed during day time shifts;
- Generator use will be minimised, where practical, and a permanent supply to be sought;
- Equipment to be sited as far from sensitive receptors or as close to any acoustic screen located between the activity and the receptor as reasonably practicable;
- Use of silenced tools where possible;
- Plant will use white noise reversing beacons where practical;
- Super-silenced generators will be sought where practical;
- If required, the use of an electric cement mixer will be sought where possible;
- Where appropriate, the use of real time noise and vibration monitoring equipment, with alarms to enable monitoring against trigger levels and email/text alerts to be issued; and
- Construction noise levels to be measured, if required, using a hand-held meter. The frequency and location of these surveys will be dependent upon the nature and sensitivity of the works being undertaken.

General recommended measures will include the following as appropriate:

- Ensure adequate planning within sensitive locations to minimise noise generated by double handling of materials or overlapping of high noise activities;
- Stationary plant to be located so that the noise impact at all occupied commercial and residential buildings is minimised and, wherever practicable, every item of static plant shall be sound attenuated using methods based on the guidance given in BS5228;

- Equipment to be sited as far from sensitive receptors or as close to any acoustic screen located between the activity and the receptor as reasonably practicable;
- Minimise drop heights;
- Ensure compressor covers closed when they are running, and lined and sealed where possible;
- Ensure machinery panels are secured and do not rattle;
- Ensure adequate maintenance of equipment and machinery;
- Ensure machinery is not running unnecessarily, or is running in the lowest noise output mode;
- Contractors working on behalf of BBV will be required to submit full details of work programmes, plant and personnel and will be made fully aware of the requirement of the Section 61 Consent or Statement of Intent;
- Choice of routes for transport, spoil and personnel to minimise noise at noise sensitive receptors;
- Ensure that Subcontractors and suppliers are aware of the environmental constraints of the site and follow the necessary procedures for Environmentally Responsible Working Practices;
- Prevent any unnecessary noise such as shouting or banging at all times;
- Ensure that site workers do not congregate near to sensitive receptors. All workers will be briefed on the sensitivity of the site at induction stage and this will be reinforced prior to every shift;
- Ensure Site Induction sessions cover Environmentally Responsible Working Practices and Environmental Awareness especially with regard to noise disturbance;
- Put up signs within the Sites to raise awareness and to stress the importance of noise control and its impact on local residents;
- Activity Notices to residents and Local Authority prior to, or when practical, before commencement at a new site making them aware of forthcoming activities, to be issued more than 14 days in advance of works commencing on site;
- Signage around the sites displaying the HS2 helpline number;
- Operatives' induction training will include the requirements relative to BPM as regards noise and vibration;
- Ensure and maintain a high level score within the Considerate Constructors Scheme;
- No personal radios on site;
- Arranging delivery / materials transfer points away from noise sensitive boundaries;
- Changes to proposed method of work or alternative systems to reduce impact of noise;
- Temporary infrastructure (i.e. haul roads) should be constructed of materials that minimise noise and vibration (i.e. laying a tarmac surface);
- Handling all materials in a manner which minimises noise, for example storing materials as far as possible from sensitive receptors and using resilient mats around steel handling areas; and
- Area Central work teams shall, as far as reasonably practicable, ensure that the noise from reversing alarms is controlled and limited. This will be managed through the following hierarchy of techniques:
    a. The site layout will be designed to limit and where reasonably practicable, avoid the need for the reversing of vehicles. Ensure drivers are familiar with the worksite layout by displaying posters on the site notice board and at key locations to show the site layout while traffic marshals will be directing the drivers at all time;

b. Banksmen will be utilised to avoid, as far as reasonably practicable, the use of reversing alarms;
c. Broadband reversing alarms will be deployed on mobile plant and delivery / collection vehicles.

Supply Chain working on behalf of BBV on the MWCC sections N1 and N2, will be required to demonstrate BPM compliance at the procurement stage.

Appendix B Sample SOI Risk Assessment for Low Risk Sites

A completed sample of a risk assessed approach for low risk noise and vibration works, based on the London Good Practice Guide: Noise & Vibration Control for Demolition and Construction.

Total - Risk Assessment	Low (SOI)	Medium (s.61)	High (s.61)
Risk Assessment A - Locality / Site Information Carry over SUBTOTAL A	2	2	0
Risk Assessment B - Works Information Carry over SUBTOTAL B	2	1	0
For the highest number of ticks in **SUBTOTAL B** Add one tick to the equivalent tick column	1	-	-
TOTAL	**5**	**3**	**0**

	RISK ASSESSMENT A	Low	Medium	High
Locality / Site Information	**Programme Duration**			
	<6 months	X		
	6 months to 12 months			
	>12 months			
	Proximity of nearest sensitive receptor			
	>50m from the site boundary			
	Between 25m and 50m		X	
	<25m			
	Day-time Ambient Noise Level			
	High ambient noise level			
	Medium ambient noise level		X	
	Low ambient noise level			
	Working Hours			
	Normal workings hours only*	X		
	Some extended evening or weekend working			
	Some night-time working			
	SUBTOTAL A **Add up the number of ticks in each column**	2	2	0

	RISK ASSESSMENT B	Low	Medium	High	
Works Information	**Location of Works**				
	Majority within existing complete building envelope	X			
	Majority of works external				
	External Demolition				N/A
	Limited to 2 weeks **				
	External demolition between 2 weeks and 3 months **				
	External demolition greater than 3 months **				
	Ground Works				
	Limited to non-percussive methods (i.e. hand tools/small excavator / small backhoe)	X			
	Percussive methods *** less than 3 months **				
	Percussive methods greater than 3 months **				
	Piling				N/A
	Limited to 1 week **, ****				
	Bored piling only. No impact or vibratory piling				
	Impact or vibratory piling				
	Vibration Generating Activities				N/A
	Limited to less than 1 week				
	Between 1 week and 1 month				
	Greater than 1 month				
	Street Management (Vehicles Expected on Road)				
	Required for less than 1 week / or not at all				
	Required for less than 1 month		X		
	Required for greater than 1 month				
	SUBTOTAL B **Add up the number of ticks in each column**	2	1	0	

** *Total across entire programme*

*** *For example, breaking out using hydraulic or pneumatic breakers*

**** *Hydraulic jacking (or press-in piling) is considered to be acceptable for longer periods*