



Environmental Noise Survey, Noise Break-In Assessment & Sound Insulation Scheme

Client: Conroy Brook Developments Ltd.

Client Address: Burdwell Works, 172 New Mill Road, Holmfirth, Yorkshire, HD9 7AZ

Site Address: Land Adjacent to The Fountain Inn, Ingbirchworth, Barnsley, S36 7GS

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Authorisation and Version Control

Report Prepared By	Mr M Caley, MSc, MIOA
Report Checked By	Mr J Barratt Gibson, MSc, MIOA, MIET
Report Approved By	Mr A T Martin, MSc, MIOA, MCIEH, MIET, MInstSCE
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Executive Summary

An environmental noise survey and noise impact assessment has been undertaken to assess the suitability of the site on land adjacent to The Fountain Inn, Ingbirchworth, Barnsley, S36 7GS for residential development. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

A sound insulation scheme has been provided in Section 5.0, including glazing and an alternative ventilation strategy. These recommendations should be sufficient to achieve appropriate internal and external noise levels for the proposed development according to the BS8233:2014 criteria.

An overview of all recommendations can be found in the table below:

Recommendations and Mitigation Overview
- All glazing requires the sound reduction specified in Table 9.0. - Appropriate glazing specifications can be found in Table 11.0. - Appropriate acoustically treated alternative ventilation can be found in Table 12.0. - The noise levels in the external amenity areas are predicted to be within the BS8233:2014 criteria. This has been calculated assuming that standard 1.8m tall timber fences will be installed around the garden areas. The fences should be of close-board construction, should contain no holes or gaps, and should have a minimum surface density of 10 kg/m².

The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the Proposed Development') on land adjacent to The Fountain Inn, Ingbirchworth, Barnsley, S36 7GS ('the Site').

The applicant is preparing a planning application to be submitted ('the Application') to Barnsley Metropolitan Borough Council.

The following technical noise assessment has been prepared to support the planning application to Barnsley Metropolitan Borough Council. This report details the ambient sound climate at the proposed development site and provides a sound insulation scheme to protect the amenity of the occupants of the proposed residential dwellings.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Scope & Objectives

The scope of the noise assessment can be summarized as follows:

- Ambient sound monitoring survey to evaluate the prevailing ambient and maximum sound levels incident on the proposed development;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2019), Noise Policy Statement for England (2010) and British Standard BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings. Further information on the legislation can be found in Appendix B.

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, an environmental sound survey was carried out from 29/01/21 to 01/02/21. For the long-term monitoring, a sound level meter was attached to a sign with the microphone positioned approximately 3m from the ground. The monitoring position was chosen in order to collect representative sound levels at the proposed development during the day time and night time periods. The monitoring location is shown in Figure 1.0.

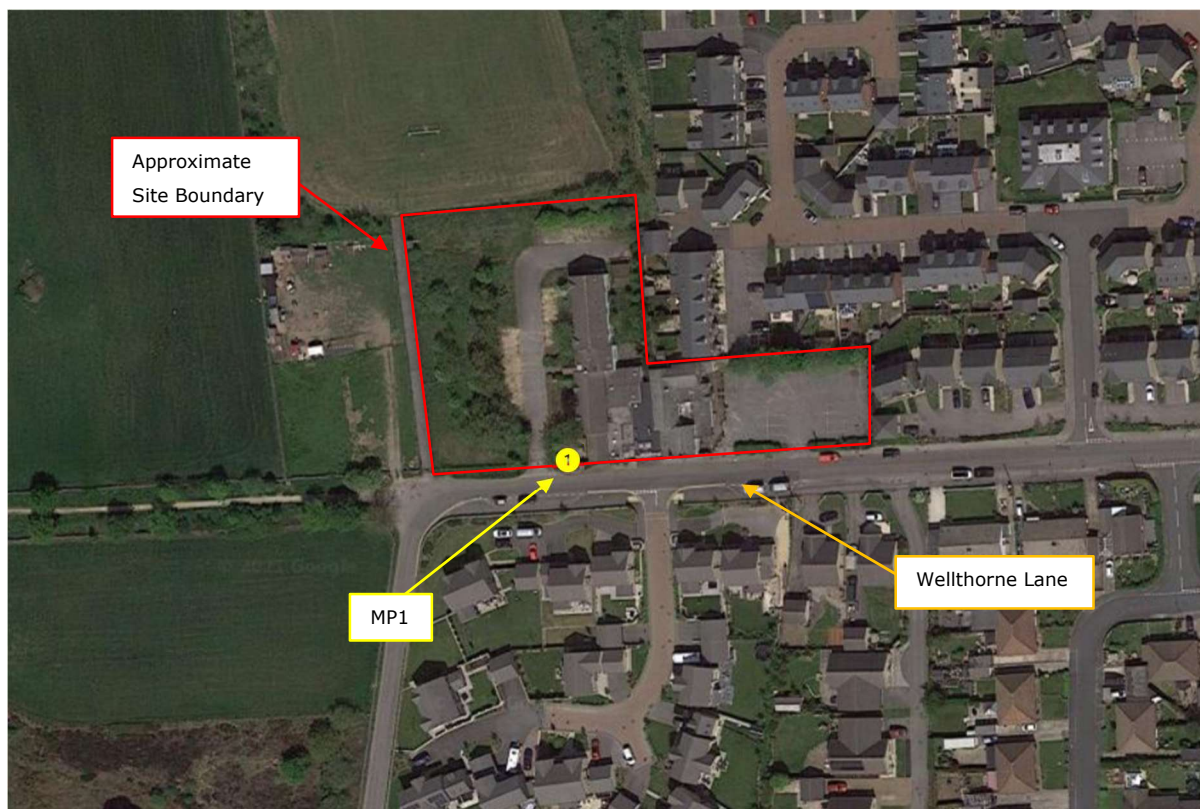


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The area surrounding the site is a mixture of arable farmland and residential dwellings. The acoustic environment is deemed to be of a low level and the noise profile of the area is dominated by intermittent traffic noise from Wellthorne Lane. The residential development will be located adjacent to The Fountain Inn. The pub is not currently operational but is due to be renovated, operational hours of the pub are currently unknown, so to present a worst-case scenario, it will be assumed the pub could operate at any time during the day and night and that it could host live music events.

Environmental Noise Survey Results

The following table outlines the highest $L_{Aeq,1hour}$ sound levels measured during the day time and night time periods that will be used in the noise break in assessment. The measurements from night 1 of the survey (29/01/21 – 23:00 – 07:00) have been removed due to adverse weather conditions affecting the results. A full summary of all results can be found in Appendix D.

Measurement Position	Measurement Period ('t')	L _{Aeq,t}	L _{Amax,t}	L _{A90,t}	L _{A10,t}
MP1	Highest 1-hour (Day)	60.0	89.0	55.0	63.0
	Highest 1-hour (Night)	46.0	71.0	39.0	46.0

Table 1.0 – Highest 1-Hour Measurements During Day and Night

Maximum Sound Level Results

In the following section, the maximum noise level events are assessed. ProPG states:

"...in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB L_{Amax,F} more than 10 times a night."

The following table shows a summary of the maximum sound level results.

Measurement Position	Measurement Period ('t')	L _{AFMax,15min}	*SMR L _{AFMax,15min}	10 th Highest L _{AFMax,15min}
MP1	Night 2	74.0	49.0	54.0
	Night 3	71.0	48.0	54.0

Table 2.0 – Maximum Sound Level Summary Results

*Statistically Most Repeated

CRTN Ambient Sound Level Prediction

Due to the COVID-19 outbreak and public health emergency lockdown, further analysis of the measured noise data on-site is required to assess whether the measured noise levels are representative. This will allow a robust assessment of the noise levels incident on the façade of the development and will ensure that façade elements such as glazing are robustly specified ensuring the internal noise criteria of BS8233:2014 can be achieved.

As assessment of the proposed site and its surroundings indicates that the primary traffic noise source is Wellthorne Lane. Consequently, it can be assumed that comparing the predicted noise levels from the road, based on Department of transport vehicle pass by data, will provide a good indication as to whether the noise levels measured at the site are representative of the typical scenario outside of the COVID-19 lockdown.

To calculate noise emissions caused by traffic flow, formulas from the 'Calculation of Road Traffic Noise: 1988' (CRTN) document have been used. The CRTN:1988 document is used to specify predicted noise from traffic considering the following variables:

- Number of vehicles
- Types of vehicles (heavy or light)
- Speed of vehicles

There is currently no vehicle pass by data for Wellthorne Lane, and as such, data has instead been taken from a proxy location on Park Avenue to the south-east of the site. This location is thought to

have a similar traffic profile to Wellthorne Lane. The traffic count data can be found at <https://roadtraffic.dft.gov.uk/manualcountpoints/810691>.

Description	Park Avenue
Total Vehicles Per Day	1709
Heavy Vehicles & Busses Per Day	32
Speed (kph)	30 kph (48mph)
Road Surface	Impervious Bituminous Surface
Predicted Noise Level at Measurement Position ($L_{Aeq,16hr}$)	59.0 dB (MP1)
Measured Noise Level ($L_{Aeq,16hour}$)	58.0 dB (MP1)

Table 3.0 – CRTN Calculation

Discussion

As can be seen in the table above, the predicted noise level from the Wellthorne Lane outside of the lockdown conditions is 59.0 dB at MP1. The measured $L_{Aeq,16hour}$ level at MP1 is 58.0 dB, which indicates that lockdown may have influenced traffic levels. In order to present a robust assessment and reduce the level uncertainty, the loudest 1-hour measurements during the day time and night time, and the maximum measurement (L_{Amax}) from nights 1 and 2, will be used to calibrate the sound map.

Commercial Noise Penalties and BS4142:2014

BS4142:2014 provides commentary on situations where new noise sensitive premises are introduced to a site and where the new development incorporates specific noise control measures. Section 8.5 of the Standard states *'Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognised that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances, other guidance and criteria in addition to, or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.'*

In addition, the standard states that it uses outdoor levels to assess the likely effects of sound on people who might be inside or outside a dwelling upon which the sound is incident. Where this is applied to new dwellings, the context is important. Subsequent to the publication of the standard, guidance notes have been issued in this respect.

Section 11 of the Standard advises that *'When making assessments and arriving at decisions... it is essential to place the sound in context'* and further clarifies this by stating *'Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following...*

3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;*

i) façade insulation treatment

ii) ventilation and/or cooling that will reduce the need to have windows open so as to avoid rapid or purge ventilation; and

iii) acoustic screening'

This commentary implies, therefore, that all control measures should be taken into consideration and that sound levels within a dwelling after allowance for these measures may be assessed on the basis of other design criteria appropriate to residential property.

The proposed residential development is located adjacent to The Fountain Inn public house, and as such, the noise from fixed plant units associated with the business must be assessed. It is assumed the renovated public house will have an air conditioning system, a kitchen extract system, and an external cooling plant unit for the cellar. The client has stated that the noise emissions from the cooling plant will be a maximum of 79.0 dB at 1m. In order to present a worst-case scenario, three plant units will be included in the sound model to represent the air conditioning, cooling and extraction systems. The plant units for the existing building are located at the southern façade and it is assumed that the future location of the plant units will either be at the southern façade, or in a plant enclosure in the beer garden/roof. It is recommended that the plant units are not located on the western or northern facades of the building as the noise emissions would be likely to lead to a loss of residential amenity.

The predicted BS4142:2014 rating noise level for the plant units is shown in the table below.

Description	Sound Level (dB)
Predicted Maximum Plant Noise Level	79.0
BS4142:2014 Rating Level	+2.0
Rating Noise Level	81.0*
Calculated Sound Power Per Unit (L_w)	89.0

Table 4.0 – BS4142:2014 Rating Noise Level

**A +2.0 dB penalty has been added to account for the possibility of slight tonality.*

Public House Beer Garden Noise Assessment

The noise emissions from the public house beer garden must also be assessed. In order to predict the level of noise generated in the beer garden, the noise levels of 20 people talking in raised voices, and two people shouting, will be included in the sound model. This will be modelled as an area noise source at a height of approximately 1m. This predicted noise level is shown in the table below.

Description	Sound Level (dB)
20 Raised Adult Voices at 1m	79.0
2 Shouting Adult Voices at 1m	81.0
Cumulative Noise Level at 1m	83.0
Calculated Sound Power Level	91.0

Table 5.0 – Public House Beer Garden Noise Levels

Public House Entertainment Noise

It is possible that the public house could hold live music in events in the future. The predicted internal noise levels for a live music event have been taken from a report compiled by NOVA Acoustics for a similar sized venue. The measurements were taken in the centre of the dancefloor with a band playing through a 4kw P.A. system. The breakout noise level from the pub is calculated considering the sound reduction provided by the weakest façade element (assumed to be standard double glazing, 4mm glass, 12mm air cavity, 4mm glass). A 6.0 dB reduction is applied to account for the change from internal reverberant conditions to external non-reverberant conditions. The calculations can be seen in the table below.

Description	Value (dB)
Predicted Internal Noise Level	95.0
R _w of Standard Double Glazing	29.0
Façade Noise Level (int. – R _w – 6)	60.0

Table 6.0 – Public House Entertainment Noise Breakout

Public House Car Park

It is assumed during a worst-case 1-hour period, 20 cars could enter/exit the public house carpark. Based on these vehicle movements, the noise level has been calculated using the CRTN methodology to obtain the L_{Aeq,1hr} in the carpark. This has also been inputted into the SoundPlan noise model.

Description	Public House Car Park
Total Vehicles Per Hour	20
Heavy Vehicles & Busses Per Hour	0
Speed (kph)	16 (10mph)
Road Surface	Impervious Bituminous Surface
Calculated L _{A10,1hr} Noise Level	50.0 dB
Resulting L _{Aeq,1hr} Noise Level	48.0 dB

Table 7.0 – Public House Car Park CRTN Calculation

L_{Amax} Car Door Slams in Public House Carpark

In order to consider the effects of maximum sound level events from the public house car park on the proposed development, the L_{Amax} noise level of car door slams in two parking spaces have been inputted to the SoundPlan noise model as point source emitters. The sound power level is shown in the table below.

Description	Sound Power Level (dBA)
1no. Car Door Slam	85.0

Table 8.0 – L_{Amax} Car Door Slam Sound Power Level

3. Noise Modelling

Based on the measured noise levels sound maps have been generated using SoundPlan 8.2, which undertakes its calculations in accordance with the guidance given in ISO9613 – 1:1993 and ISO9613 – 2:1996. The following assumptions have been made within the calculation software:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years.
- The ground between the source and receiver is modelled as a mixture of acoustically 'hard' and 'soft' surfaces.
- The sound maps are shown at a height of 1.5m.
- The highest $L_{Aeq,1hr}$ values from the day time and night time periods measured at MP1 have been used to calibrate the sound map. Further noise sources have been included to represent public house beer garden, the public house carpark, and entertainment breakout noise.
- The highest measured $L_{AFmax,15min}$ value from MP1.

The noise maps showing the day time and night time L_{Aeq} sound levels incident on the Proposed Development can be seen in Figures 2.0 and 3.0 below.

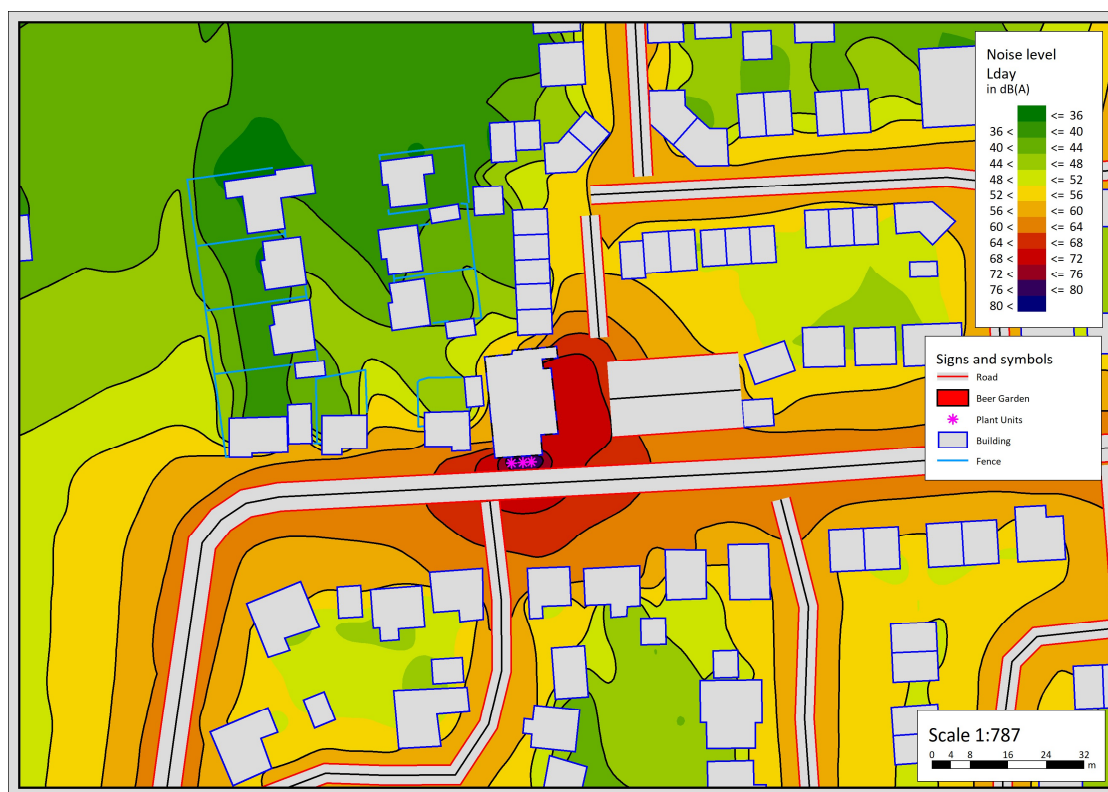


Figure 2.0 – Sound Level Map – Day Time L_{Aeq} – 1.5m Grid Height

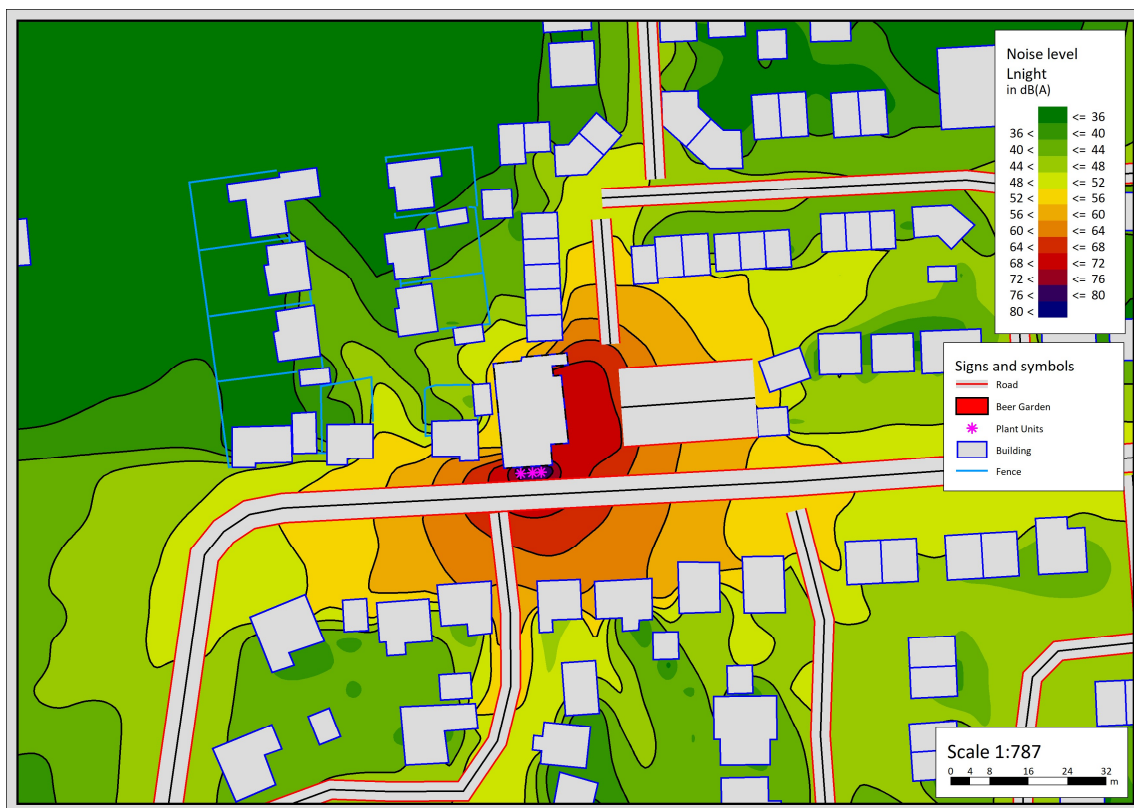


Figure 3.0 – Sound Level Map – Night Time L_{Aeq} – 1.5m Grid Height

The noise map showing the maximum noise emissions incident on the Proposed Development can be seen in Figure 4.0 below.

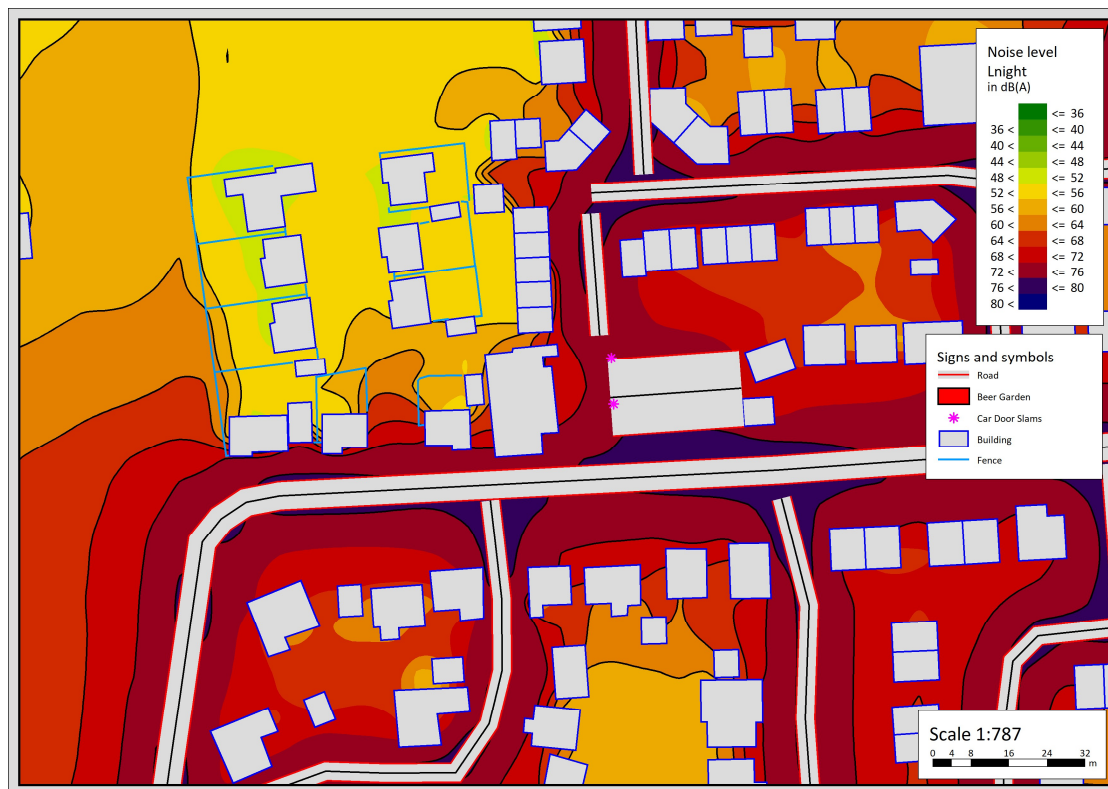


Figure 4.0 – Sound Level Map – Night Time L_{Amax} – 1.5m Grid Height

4. Noise Break-in & External Noise Level Assessment

Façade Layout

As the noise levels vary significantly across the development site, the façade sound reduction has been grouped as shown in the figure below.



Figure 5.0 – Façade Allocation

Noise Break-In Assessment

The following section analyses the ambient sound levels incident on the development compared with the internal noise level criteria presented within BS8233:2014.

To ensure a robust analysis the following considerations have been taken:

- The $L_{AFmax,15min}$ during the night predicted using the SoundPlan Model.
- The highest L_{Aeq} sound levels for each façade predicted using the SoundPlan model.
- The additional noise sources included in the SoundPlan model.

The following table outlines the minimum sound reduction required of the building envelope in order to achieve appropriate internal noise levels.

Façade Colour	Location	Time Period	Façade Noise Level	BS8233:2014 Criteria	Min. SRI Required (dB)
Red	Bedroom / Living Room	Day time	64.0	35.0 dB $L_{Aeq,16hour}$	29.0 $R_w + C_{tr}$
	Bedroom	Night time	60.0	30.0 dB $L_{Aeq,8hour}$	30.0 $R_w + C_{tr}$
	Bedroom	Night time	76.0	45.0 dB $L_{Amax,8hour}$	31.0 R_w
Amber	Bedroom / Living Room	Day time	62.0	35.0 dB $L_{Aeq,16hour}$	27.0 $R_w + C_{tr}$
	Bedroom	Night time	55.0	30.0 dB $L_{Aeq,8hour}$	25.0 $R_w + C_{tr}$
	Bedroom	Night time	76.0	45.0 dB $L_{Amax,8hour}$	31.0 R_w
Green	Bedroom / Living Room	Day time	58.0	35.0 dB $L_{Aeq,16hour}$	23.0 $R_w + C_{tr}$
	Bedroom	Night time	52.0	30.0 dB $L_{Aeq,8hour}$	22.0 $R_w + C_{tr}$
	Bedroom	Night time	71.0	45.0 dB $L_{Amax,8hour}$	26.0 R_w

Table 9.0 – Internal Noise Level Analysis

External Noise Level Assessment

The following table shows the predicted noise levels within the external amenity areas (gardens) of the Proposed Development compared with the BS8233:2014 criteria.

Plot No.	Time Period	Garden Noise Levels	BS8233 Criteria (dB $L_{Aeq,16hour}$)	Further Attenuation Required (dB)
Plot 1	Day time	48.0	50.0 – 55.0	0.0
Plot 2	Day time	44.0	50.0 – 55.0	0.0
Plot 3	Day time	39.0	50.0 – 55.0	0.0
Plot 4	Day time	43.0	50.0 – 55.0	0.0
Plot 5	Day time	41.0	50.0 – 55.0	0.0
Plot 6	Day time	37.0	50.0 – 55.0	0.0
Plot 7	Day time	39.0	50.0 – 55.0	0.0
Plot 8	Day time	42.0	50.0 – 55.0	0.0
Plot 9	Day time	44.0	50.0 – 55.0	0.0

Table 10.0 – External Noise Level Analysis

Discussion

As can be seen in the table above, the external noise levels are predicted to be within the criteria in the garden areas of all plots. This has been calculated assuming that standard 1.8m tall timber

fences will be installed around the garden areas. The fences should be of close-board construction, should contain no holes or gaps, and should have a minimum surface density of 10 kg/m².

5. Sound Insulation Scheme

The following section outlines the required sound insulation scheme that should be installed at the proposed development to protect the amenity of the future residents. The sound insulation scheme should be installed prior to occupation and be retained thereafter.

Building Envelope

The noise levels within the proposed dwellings will be dictated by the configuration, materials, and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels. The façade construction for lightweight or heavyweight constructions will provide ample levels of sound insulation, for the purposes of this report it is assumed the façade provides a minimum sound reduction of 50dB R_w . The following section provides a sound insulation scheme based on the weakest elements of the façade, including the glazing, ventilation and roof construction.

a) Roof Specification

If the development has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. Where the roof, is being utilized as a voided loft space with thermal insulation the following detailing is not required. Where rooms are within the roof, the ceilings should consist of standard roofing slates, 100mm 45kg/m³ Insulation fitted tightly between the 200mm roof joists and 1no. 15mm SoundBloc plasterboard fixed to British Gypsum RB1 resilient bars to achieve a minimum sound reduction of 50dB R_w . Any other configuration of roof that would achieve at least 50dB R_w will be suitable for the development.

b) Glazing Specification

Windows can be considered the weakest point of a façade in terms of noise reduction from external noise. The glazed elements installed in all the living rooms and bedrooms require the minimum sound reduction as shown in Section 4.0. The glazing units shown in the following table provide the required sound reduction, however any other window capable of providing this attenuation will be suitable. The performance is specified for the whole window unit, including frame and other design features. The glazing specifications have been taken from the Pilkington Optiphon Range.

Façade Colour	Location	Glazing Configuration	Attenuation (dB)
Red	Living Rooms	<i>Double Glazing</i> 8mm Glass – 16mm Air Cavity – 4mm Glass	29.0 R_w + C_{tr} 33.0 R_w
	Bedrooms	<i>Double Glazing</i> 10mm Glass – 16mm Air Cavity – 4mm Glass	30.0 R_w + C_{tr} 35.0 R_w
Amber	Living Rooms and Bedrooms	<i>Double Glazing</i> 6mm Glass – 16mm Air Cavity – 4mm Glass	28.0 R_w + C_{tr} 32.0 R_w
Green	Living Rooms and Bedrooms	<i>Double Glazing</i> 4mm Glass – 16mm Air Cavity – 4mm Glass	25.0 R_w + C_{tr} 29.0 R_w

Table 11.0 – Glazing Specification

The glazing suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

a) Ventilation Specification

BS8233 States:

"If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

and

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

An alternative ventilation system, should be installed within habitable rooms to fully protect the amenity of future residents. As stated in BS8233:2014 section 5.4.4, having complete enclosure of the noise source or receiver is the most effective barrier of sound. An alternative ventilation strategy allows for maximum sound insulation from the noise source whilst still maintaining a sufficient level of ventilation. It is recommended that the alternative ventilation should provide the same resistance to sound as the glazed elements. The following table provides ventilation systems that meets the above recommendations.

Background Ventilation		
Façade Colour	Model	Attenuation (dB)
All Façades – All Rooms	Titon Standard Vent + C25 (Trickle)	34.0 Open / 50.0 Closed $D_{n,e,w} + C_{tr}$
Through Wall Ventilation (not purge)		
Façade Colour	Model	Attenuation (dB)
All Façades – All Rooms	Titon Sonair F+ Mechanical Input Ventilator with G3 filter and DV100F duct ¹	56.0 dB $D_{n,e,w}$

Table 12.0 – Ventilation Specification

¹ The self-generated noise from the Titon Sonair F+ when measured at the maximum ventilation capacity of 60m³/h emits 23.5dB $L_{PA:10m2}$ which is below the required internal noise criteria from BS8233:2014.

The through wall ventilation specified within the table above is also capable of providing background ventilation. If the mechanical ventilation option is opted for the background trickle ventilation option is not required to be installed.

The ventilation suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

The following table outlines recommended noise levels from mechanical ventilation in dwellings.

Ventilation Condition	Possible System	Desirable Internal Ambient Noise Levels from Mechanical Services, L_{Aeq} (dB)		
		Bedrooms	Living Rooms	Bathrooms / Kitchens
Whole dwelling ventilation	Continuous MEV ¹ at low ventilation rates	$\leq 26 - 30$	≤ 30	--
	Continuous MVHR ² at minimum ventilation rates			
Extract ventilation	Intermittent Extract Fans	$\leq 26 - 30$	≤ 35	≤ 45
	Continuous MEV at high ventilation rates			

Table 13.0 – Recommended Internal Noise Levels from Mechanical Ventilation

The ventilation suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

6. BS4142:2014 Plant Noise Assessment

At this stage of the development, specific models of plant unit associated with the public house have not yet been specified. Consequently, a plant limit level has been defined to ensure all noise emissions from any external plant will fall significantly below the background sound level at the closest Noise Sensitive Receptors. The background sound levels have been taken from the lowest statistically most repeated L_{A90} levels for the day time and night time periods.

Description	Day Time (dBA)	Night Time (dBA)
Lowest Most Repeated Background Sound Level	38.0	28.0
Maximum cumulative Rating Level of external plant equipment at the Façade of the Closest NSR (Noise Sensitive Receptor)	33.0	23.0
The level above the background sound level	-5.0	-5.0

Table 14.0 – Plant Noise Level Limit Summary

Discussion:

As can be seen in the assessment above, provided the Cumulative Rating Level is adhered to, all noise emissions for the plant are predicted to fall a minimum of 5.0 dB below the prevailing background sound level. This would be viewed as 'Negligible Impact' when assessed with BS4142 and 'No Observed Effect Level' (NOEL) when assessed with the NPSE.

Recommendations

The following section outlines the mitigation measures that are necessary to reduce the impact of any proposed plant.

- The cumulative sound level of all plant should not exceed the **Rating** Level of **33.0 dB** during the day time and **23.0 dB** during the night time at the façade of the nearest NSR.
- The plant should be installed on appropriate anti vibrational mounts.
- Once the plant has been specified, a suitably qualified person should assess whether the Plant Noise Limit Levels can be achieved. Further acoustic design and mitigation may be required once specified.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
L _{eq,T}	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
L _{max,T}	A noise level index defined as the maximum noise level during the period T. L _{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L _{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L _{90,T}	A noise level index. The noise level exceeded for 90% of the time over the period T. L ₉₀ can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L _{10,T}	A noise level index. The noise level exceeded for 10% of the time over the period T. L ₁₀ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the

time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} .

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1\text{hour}}$ dB and $L_{A90,15\text{mins}}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms.

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

B.1 – National Planning Policy Framework (2019)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2019. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 170e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 180 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 180 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;*
- Mitigate and minimise adverse impacts on health and quality of life;*
- Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’

The British Standard BS 8233: 2014, Guidance on Sound insulation and noise reduction for buildings provides additional guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, WHO Guidelines on Community Noise, 1999. The criteria desirable levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 15.0 – BS8233:2014 Internal Noise Level Criteria

It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

The standard also recommends that for traditional external amenity areas, such as gardens, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, and that 55 dB $L_{Aeq,T}$ would be acceptable in noisier environments. However, it is recognised that these values may not be achievable in all areas where development is desirable and in such locations, development should be designed to achieve the lowest practicable levels.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the LOAEL as defined in the NPSE above.

Appendix C – Site Plans



Appendix D – Environmental Survey

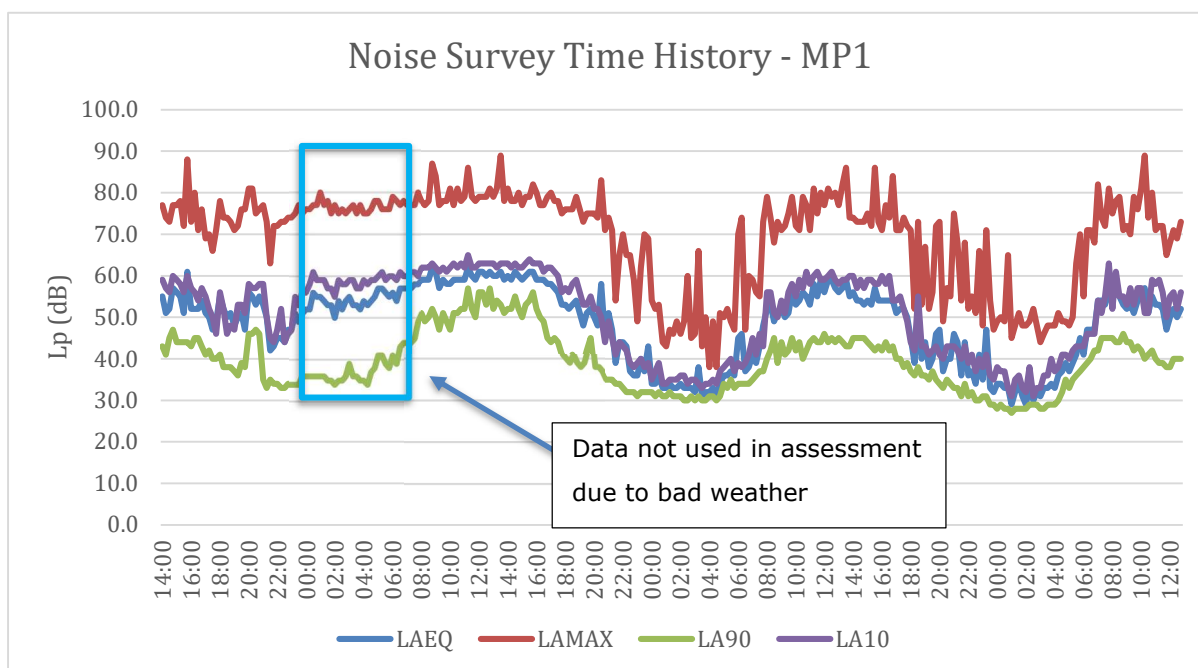
D.1 – Tabulated Summary Noise Data

Measurement Position MP1								
Measurement Period ('t')	Octave Band $L_{eq,t}$						$L_{Aeq,t}$	$L_{Amax,t}$
	125	250	500	1k	2k	4k		
29/01/21 – 14:00 – 23:00	43.0	43.0	42.0	40.0	37.0	31.0	53.0	88.0
29/01/21 – 23:00 – 07:00*	54.0*	50.0*	48.0*	45.0*	42.0*	39.0*	54.0*	80.0*
30/01/21 – 07:00 – 23:00	46.0	46.0	44.0	42.0	38.0	29.0	58.0	89.0
30/01/21 – 23:00 – 07:00	32.0	32.0	32.0	27.0	21.0	12.0	38.0	74.0
31/01/21 – 07:00 – 23:00	37.0	36.0	37.0	34.0	29.0	15.0	53.0	86.0
31/01/21 – 23:00 – 07:00	30.0	31.0	30.0	26.0	19.0	11.0	40.0	71.0
01/02/21 – 07:00 – 13:00	46.0	45.0	47.0	46.0	42.0	35.0	54.0	89.0
Measurement Position MP1 – Background Noise Levels (L_{A90})								
Measurement Period ('t')	$L_{A90,t}$	SMR $L_{A90,t}^{**}$	Min. $L_{A90,t}$	Max. $L_{A90,t}$				
29/01/21 – 14:00 – 23:00	45.0	38.0	33.0	47.0				
29/01/21 – 23:00 – 07:00*	38.0*	36.0*	34.0*	44.0*				
30/01/21 – 07:00 – 23:00	46.0	52.0	32.0	57.0				
30/01/21 – 23:00 – 07:00	32.0	31.0	30.0	35.0				
31/01/21 – 07:00 – 23:00	39.0	44.0	30.0	46.0				
31/01/21 – 23:00 – 07:00	31.0	28.0	27.0	42.0				
01/02/21 – 07:00 – 13:00	43.0	40.0	38.0	46.0				

Table 16.0 – Sound Survey Summary Results

*Measurements not used for survey due to adverse weather conditions.

**Statistically most repeated



D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246471	≤0.5
CESVA CB006 Class 1 Calibrator	901955	

Table 17.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localized records of weather conditions were taken. However, during the set up and collection of the monitoring equipment the weather conditions have been documented in the following table. All measurements have been compared with met office weather data of the area, specifically the closest weather station, the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Sheffield Weather – World Weather Online				
Time Period	Air Temp (°C)	Rainfall mm/h	Prevailing Wind Direction	Wind Speed (m/s)
29/01/21 – 00:00 – 23:59	3.0 – 9.0	0.0 – 1.7	W	3.6 – 6.1
30/01/21 – 00:00 – 23:59	1.0 – 4.0	0.0 – 0.1	ENE	4.7 – 8.6
31/01/21 – 00:00 – 23:59	0.0 – 2.0	0.0	E	1.4 – 4.2
01/02/21 – 00:00 – 23:59	0.0 – 4.0	0.0	ENE	1.4 – 3.6

Table 18.0 – Weather Summary