



Entertainment & Plant Noise Impact Assessment

Client: Cloud Water Brew Co.

Site Address: Unit 9, Piccadilly Trading Estate, Giddings Road, Manchester, M1 2NP

Date: 11/03/2021



Authorisation and Version Control

Report Prepared By	Mr M Caley, MSc, MIOA
Report Checked By	Mr J Barratt Gibson, MSc, AMIOA
Report Approved By	Mr A T Martin, MSc, MIOA, MCIEH, MIET, MInstSCE
Date	11/03/2021
Project Number	5331CW
Version Reference	002

Disclaimer

The opinions and interpretations presented in this report represent our best technical interpretation of the data made available to us. However, due to uncertainty inherent in the estimation of all parameters, we cannot, and do not guarantee the accuracy or correctness of any interpretation and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, cost, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. The findings and opinions expressed are relevant to the dates of the site works and should not be relied upon to represent conditions at substantially later dates. If additional information becomes available which may affect our comments, conclusions or recommendations, the author reserves the right to review the information, reassess any new potential concerns and modify our opinions accordingly. Except for the provision of professional services on a fee basis, NOVA Acoustics Ltd does not have a commercial arrangement with any person or company involved in the interests that are the subject of this report. NOVA Acoustics Ltd cannot accept any liability for the correctness, applicability or validity for the information they have provided, or indeed for any consequential costs or losses in this regard. Our efforts have been made on a "best endeavours" basis and no responsibility or liability is warranted or accepted by NOVA Acoustics Ltd.

Copyright © The material presented within this report is confidential. This report has been prepared for the exclusive use of the client and shall not be distributed or made available to any other company or person without the knowledge and written consent of NOVA Acoustics Ltd and the client. All works undertaken by NOVA Acoustics Ltd are carried out in accordance with NOVA Acoustics Ltd's terms and conditions found at www.novaacoustics.co.uk.

CONTENTS

AUTHORISATION AND VERSION CONTROL	2
EXECUTIVE SUMMARY	5
1. INTRODUCTION.....	6
Overview	6
Scope & Objectives	6
Local Council Comments & Discussions.....	6
2. ENVIRONMENTAL NOISE SURVEY.....	7
Context & Subjective Impression	7
Background Proposed Use	7
Environmental Noise Survey Results	8
3. NOISE BREAK OUT ASSESSMENT	9
Internal Noise Levels.....	9
Noise Breakout Assessment	9
4. PLANT NOISE ASSESSMENT.....	11
APPENDIX A – ACOUSTIC TERMINOLOGY.....	12
APPENDIX B – LEGISLATION, POLICY AND GUIDANCE	15
B.1 – National Planning Policy Framework (2019)	15
B.2 – Noise Policy Statement for England (2010).....	15
B.3 – BS8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’	16
B.4 – British Standard BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound.....	17
B.5 – Entertainment & Leisure Noise Legislation	20
APPENDIX C – SITE PLANS.....	22
APPENDIX D – ENVIRONMENTAL SURVEY	23
D.1 – Tabulated Summary Noise Data.....	23
D.2 – Surveying Equipment	24
D.3 – Meteorological Conditions.....	24
APPENDIX D – MANUFACTURER’S DATASHEETS.....	25

Tables

<i>Table 1.0 – Octave Band Background Sound Levels – Sensitive Operational Period.....</i>	<i>8</i>
<i>Table 2.0 – Background Sound Level Summary Results – Sensitive Operational Period</i>	<i>8</i>
<i>Table 3.0 – Internal Music Measurement.....</i>	<i>9</i>
<i>Table 4.0 – Structural Sound Reduction</i>	<i>9</i>
<i>Table 5.0 – Music Noise Breakout Assessment</i>	<i>10</i>
<i>Table 6.0 – Maximum Amplified Music Limit Level</i>	<i>10</i>
<i>Table 7.0 – Plant Noise Emissions</i>	<i>11</i>
<i>Table 8.0 – BS4142:2014 Noise Assessment</i>	<i>11</i>
<i>Table 9.0 – BS8233 Internal Noise Level Criteria.....</i>	<i>17</i>
<i>Table 10.0 – Sound Survey Summary Results.....</i>	<i>23</i>
<i>Table 11.0 – Measurement Equipment</i>	<i>24</i>
<i>Table 12.0 – Weather Summary</i>	<i>24</i>

Figures

<i>Figure 1.0 – Indicative Site Layout.....</i>	<i>7</i>
<i>Figure 2.0 – Moorhouse Low Frequency Noise Rating Curve.....</i>	<i>21</i>

Executive Summary

This report has been prepared to assess the level of noise impact from the bar ('the Proposed Development') at Unit 9, Piccadilly Trading Estate, Giddings Road, Manchester, Greater Manchester M1 2NP. A summary of the assessments is shown below.

Noise Breakout Assessment

- The noise levels at the closest NSR (Noise Sensitive Receptor) are predicted to be significantly below the lowest background sound levels during the most sensitive operational hours. This indicates 'No Observed Effect Level' (NOEL) when assessed with the NPSE and NPPF and constitutes inaudibility at the NSR. In order to account for areas where background noise levels may be lower than at the measurement position, the lowest measured $L_{90,15min}$ values have been used. This is thought to present a robust and conservative assessment baseline.
- During the site visit the engineer noted that the noise emissions from the venue were not audible at the NSR4 during the day time, and only faintly audible at the fire escape door to the rear of the building. This correlates with the results of the assessment.
- An amplified music limit level has been prescribed to limit noise egress when the main door is opened due to patrons entering and exiting the bar.

Plant Noise Assessment

- The cumulative noise emissions from the plant units are predicted to be 16.0 dB below the background sound level at the closest NSR. This indicates 'Negligible Impact' according to BS4142:2014 and 'No Observed Effect Level' when assessed with the NPSE and NPPF. This has been calculated considering a global background noise level of 50.0 dB, which is the lowest measured $L_{A90,15min}$ stated in the acoustic report for the proposed hotel at 1 Adair Street (report ref: HT: 25564/NIA, planning ref: 122599/FO/2019). As this is the lowest measured $L_{A90,15min}$, it is again thought to present a robust and conservative baseline for assessment.

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 impact assessment for the proposed bar ('the Proposed Development') at Unit 9, Piccadilly Trading Estate, Giddings Road, Manchester, M1 2NP ('the Site').

The applicant is preparing a planning application to be submitted ('the Application') to Manchester City Council.

The following technical noise assessment has been prepared to support the planning application to Manchester City Council. This report details an assessment of:

- Amplified music noise breakout of the proposed development.
- Plant noise from external plant equipment.

Based on the level of noise impact expected, as required, a series of sound insulation and noise control measures are outlined within the report to reduce the likelihood of impact and to protect the amenity of the closest Noise Sensitive Receptors. 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:

- Baseline sound monitoring survey to evaluate the prevailing ambient and background sound levels at the closest noise sensitive receptor to 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), Entertainment Noise Legislation, British Standard BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound 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

Local Council Comments & Discussions

"An acoustic study identifying ambient noise levels during daytime, night time and weekends along with details of the noise levels that are currently achieved within the accommodation at various times during operating hours. The study should identify the acoustic treatment and measures necessary to limit the breakout of noise in accordance with a noise study of the premises and a scheme of acoustic treatment. The scheme proposed shall include measures such as acoustic lobbies at access and egress points of the premises, acoustic treatment of the building structure, sound limiters linked to sound amplification equipment, details of the acoustic glazing and acoustically treated ventilation you have installed/propose to use and specified maximum internal noise levels."

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 20/11/20 to 23/11/20. For the long-term sound survey, a sound level meter was attached to a lamppost approximately 3.5m from the floor and away from any other reflective surface. The monitoring position was chosen in order to collect representative background sound levels at the closest Noise Sensitive Receptor during the day time and night time operational periods. The monitoring location is shown in Figure 1.0 below.

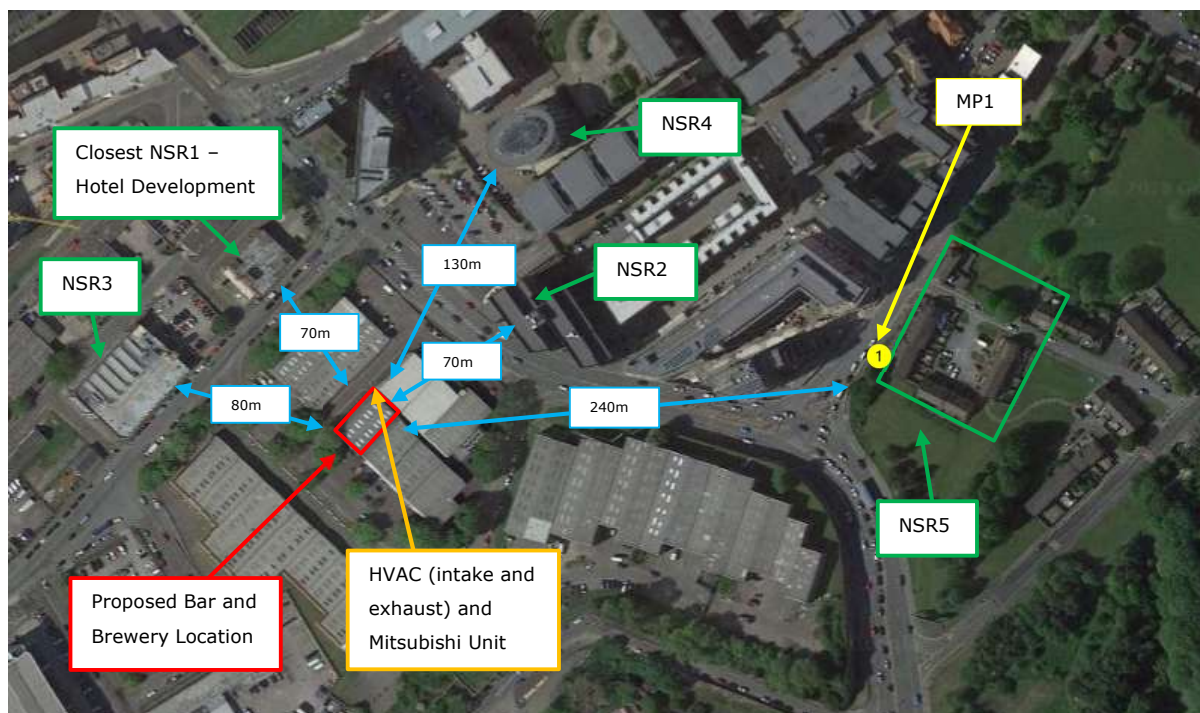


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The area surrounding the site is primarily mixed in nature with both commercial properties and residential dwellings. The noise profile of the area is dominated by the road traffic noise.

Background Proposed Use

The proposed development is the conversion of an existing storage unit into a bar located on the first-floor level, with a brewery located on the ground floor. The proposed operational times of the bar are Thursday to Sunday, 12:00 to 22:00. The venue is not expected to host live music and will have background music only.

The venue has Systemair HVAC and Mitsubishi Air Conditioning systems installed. The exhaust and intake of the Systemair is located on the north-eastern façade of the building along with the Mitsubishi external unit, as shown in Figure 1.0 above.

Environmental Noise Survey Results

The following tables outline the lowest background noise levels measured during the most sensitive operational hours of the proposed development (19:00 – 22:00). To account for areas where the background noise levels may be lower than the measurement location, the lowest 15-minute octave band measurements will be used.

A full summary of all results can be found in Appendix D.

Measurement Period ('t')	Lowest Octave Band $L_{90,15min}$ (Hz, dB)						
	63	125	250	500	1k	2k	4k
20/11/20 to 23/11/20 – 19:00 – 22:00	52.0	50.0	49.0	49.0	51.0	45.0	33.0

Table 1.0 – Octave Band Background Sound Levels – Sensitive Operational Period

Measurement Period ('t')	$L_{A90,15min}$	*SMR $L_{A90,15min}$	Min. $L_{A90,15min}$	Max. $L_{A90,15min}$
22/11/20 – 19:00 – 22:00	59.0	60.0	54.0	62.0

Table 2.0 – Background Sound Level Summary Results – Sensitive Operational Period

*Statistically Most Repeated

As can be seen in the table above, the lowest measured $L_{A90,15min}$ during the most sensitive operational period was 54.0 dB. A noise assessment for a new hotel development at 1 Adair Street states that the lowest measured background noise level in this location is approximately 50.0 dB. In order to present a robust and conservative assessment, 50.0 dB will instead be used as the global background noise level.

3. Noise Break Out Assessment

Internal Noise Levels

During the site visit a 15-minute measurement was taken of music being played within the bar at a typical operational volume. The measurement was taken in the centre of the room equidistant between two wall-mounted Sonos speakers and at least 1.5m from any walls. In order to provide a robust assessment, 6.0 dB will be added to the results to account for patrons talking and transient increases in music level. The results are shown in the table below.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
20/11/20 – 13:25 – 13:40	82.0	76.0	70.0	68.0	69.0	66.0	60.0	73.0
Correction (+6.0 dB)	88.0	82.0	76.0	74.0	75.0	72.0	66.0	79.0

Table 3.0 – Internal Music Measurement

Noise Breakout Assessment

The breakout assessment will be based on sound escaping from the skylights in the roof directly above the bar, which are predicted to be the weakest elements of the structure in terms of sound reduction. The skylights are thought to be constructed from a product similar to Kingspan Daylite panels, which provide a minimum of 22.0 dB R_w sound reduction. They are assumed to provide the same octave band sound reduction as 3mm Perspex.

The octave band and global sound reduction of the panels has been calculated in INSUL 9.0 prediction software and is shown in the table below.

Description	Octave Band R_w (Hz, dB)							Overall R_w (dBA)
	63	125	250	500	1k	2k	4k	
Kingspan Daylite / 3mm Perspex Panels	7.0	8.0	12.0	16.0	21.0	27.0	32.0	22.0

Table 4.0 – Structural Sound Reduction

The predicted noise level at the closest NSR can be seen in the table below. This has been calculated considering a 70m distance correction and a 6.0 dB difference between internal reverberant conditions within the bar and external non-reverberant conditions. The noise levels at NSR1 are compared with the background sound levels measured during the most sensitive operational period.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Internal Noise Level	88.0	82.0	76.0	74.0	75.0	72.0	66.0	79.0
Kingspan Daylite / 3mm Perspex R_w	7.0	8.0	12.0	16.0	21.0	27.0	32.0	22.0
Façade Noise Level (int. level – R_w – 6)	75.0	68.0	58.0	52.0	48.0	39.0	28.0	51.0
Distance Correction (70m)	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0	-37.0
Noise Level at NSR1	38.0	31.0	21.0	15.0	11.0	2.0	-9.0	14.0
Background Sound Level (Lowest $L_{A90,15min}$)	52.0	50.0	49.0	49.0	51.0	45.0	33.0	50.0*
Exceedance of Background Noise Level	-14.0	-19.0	-28.0	-34.0	-40.0	-43.0	-42.0	-36.0

Table 5.0 – Music Noise Breakout Assessment

*Value taken from noise report for hotel development at 1 Adair Street.

Discussion

As can be seen in the assessment above, the octave band and global sound levels are significantly below the measured background sound levels. This indicates 'No Observed Effect Level' (NOEL) when assessed with the NPSE and constitutes inaudibility at the NSR.

Further to this, during the site visit the engineer noted that the noise emissions from the venue were not audible at the NSR4 during the day time, and were only faintly audible when directly next to the fire escape door to the rear of the property.

Recommendations and Mitigation

In order to limit noise egress when the main door is opened due to patrons entering and exiting the bar, it is recommended that an automated noise limiter is installed. The following limit level should be adhered to to ensure noise levels fall a minimum of 10.0 dB below the background sound level at the closest NSR in all octave band frequencies. This is calculated considering a -5.0 dB correction for partial shielding between the entrance of the bar and the closest NSR.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Recommended Limit Level	90.0	88.0	82.0	80.0	81.0	78.0	71.0	85.0

Table 6.0 – Maximum Amplified Music Limit Level

4. Plant Noise Assessment

The following section of the report analyses the expected impact from the noise emissions associated with the plant equipment servicing the bar.

Plant Equipment	Specific Noise Level @ 1m	Distance to NSR	Specific Noise Level at NSR*	Acoustic Feature Correction**
System Air - Exhaust	79.0 dB	70m	32.0 dB	Tonality +2
System Air – Outdoor Air Intake	59.0 dB	70m	12.0 dB	Tonality +2
Mitsubishi Mr. Slim PUHZ-P140VKA	57.0 dB	70m	10.0 dB	Tonality +2
Cumulative Rating Noise Level $L_{AR,Tr}$ @ NSR			34.0 dB	

Table 7.0 – Plant Noise Emissions

*The noise level at the NSR has been calculated using the following equation $20\log(r1/r2)$ and includes a -10 dB correction to account for the total shielding provided by the surrounding buildings.

**A +2 dB correction has been applied to account for a possible tonal component at the NSR.

The BS4142 Assessment of the plant units associated with the bar is outlined in the table below.

Results	Sound Level (dB)	Notes
Rating Sound Level	34.0	Acoustic feature corrections as shown in Table 7.0.
Background Sound Level	50.0	Taken from noise report for hotel development at 1 Adair Street.
Excess of Rating over Background Sound Level	-16.0	The assessment indicates 'Negligible Impact'.

Table 8.0 – BS4142:2014 Noise Assessment

Discussion

The assessment above shows that the rating level is below the background sound level at the closest Noise Sensitive Receptor by 16.0 dB. This indicates 'Negligible Impact' when assessed with BS4142:2014 and 'No Observed Effect Level' when assessed with the NPSE and NPPF.

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 log ₁₀ (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 be 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 9.0 – BS8233 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.

B.4 – British Standard BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound

Overview

BS4142:2014 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142:2014 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142:2014 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

- a) subjective method;*
- b) objective method for tonality;*
- c) reference method."*

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142:2014 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."

d) Intermittency

BS4142:2014 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time ... if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142:2014 states: "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- "Typically, the greater this difference, the greater the magnitude of the impact."
- "A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."
- "A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."
- "The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact, depending on the context."

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating sound level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact and would therefore classified as a No Observed Adverse Effect Level.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

B.5 – Entertainment & Leisure Noise Legislation

Noise from entertainment and leisure venues, e.g. noise from recorded music, live bands, gyms or karaoke, can be particularly annoying for residents and business if it is not adequately contained within the venue. When considering the potential impact of a proposal for an entertainment premises or residential near to entertainment premises a consideration for the overall noise level (L_{Aeq}) and the 63Hz and 125Hz octave band noise levels. Music noise in the 63Hz and 125Hz octave bands, which is described as 'bass noise' is particularly difficult to contain and the impulsive and non-steady character of low frequency music noise is particularly disturbing for residents exposed to it.

A lively city centre bar can operate around 95 dB L_{Aeq} and nightclubs can be even higher at 105 dB L_{Aeq} . The range of level of 63Hz and 125Hz octave bands is wider than the a-weighted levels and can be up to 115 dB L_{eq} and 110 dB L_{eq} respectively (Davies et al 2005).

There is a lack of consensus on an assessment method for noise levels within habitable rooms regarding entertainment noise. The design aim should be to design to 'inaudible'*. The building structure is therefore key, and will usually involve a high performing solution in either the music venue or residential premises. Existing noise standards/criteria are not appropriate for evaluating low frequency noise; in almost all other situations the established noise descriptors are based on the A-weighted sound level (dBA) which effectively filters out low frequency sound (Moorhouse et al 2011).

**Noise is considered to be inaudible when it is at a sufficiently low level such that it is not recognizable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question. The DEFRA report 'Noise from Pubs and Clubs – Phase 1', which, on page 17 reproduces the Institute of Acoustics (IOA) working group guidance to achieve music noise levels which are 'virtually inaudible' inside a residential property.*

When dealing with noise control, especially at the lower frequencies it is usual to look at the octave band data as a Z-weighting (linear) and not the A-weighting, due in main to the amount you have to 'take off', resulting in meaningless data (-26.2dB at 63Hz) and also with respect to the sound insulation performance of various constructions materials. Rather than just A-weighted levels being assessed e.g. internal noise levels as per BS8233:2014; a low frequency band analysis should be carried out (McCullough et al 2004).

In the 'Procedure for the assessment of low frequency noise complaints – Revision 1', Moorhouse et al (2011) use limits for low frequency noise levels in 1/3 octave bands between 10Hz and 160Hz. For the assessment of low frequency music noise, it is more practical to consider the 63Hz and 125 Hz octave bands. The Noise Council's Code of Practice on 'Environmental Noise Control at Concerts' suggests limits on both these octave bands. The DEFRA report 'Noise from Pubs and Clubs – Phase 1' suggests limits on 1/3 octave bands. However, the problem with this suggestion, and one of the reasons it is not widely used, is due to the difficulty in obtaining 1/3 octave band sound insulation

performance data for various construction materials. With regards to assessing music noise at the 63 Hz and 125 Hz octave band levels a good correlation is shown between the NR 15 curve and Moorhouse curve at low frequencies. See Figure 2.0.

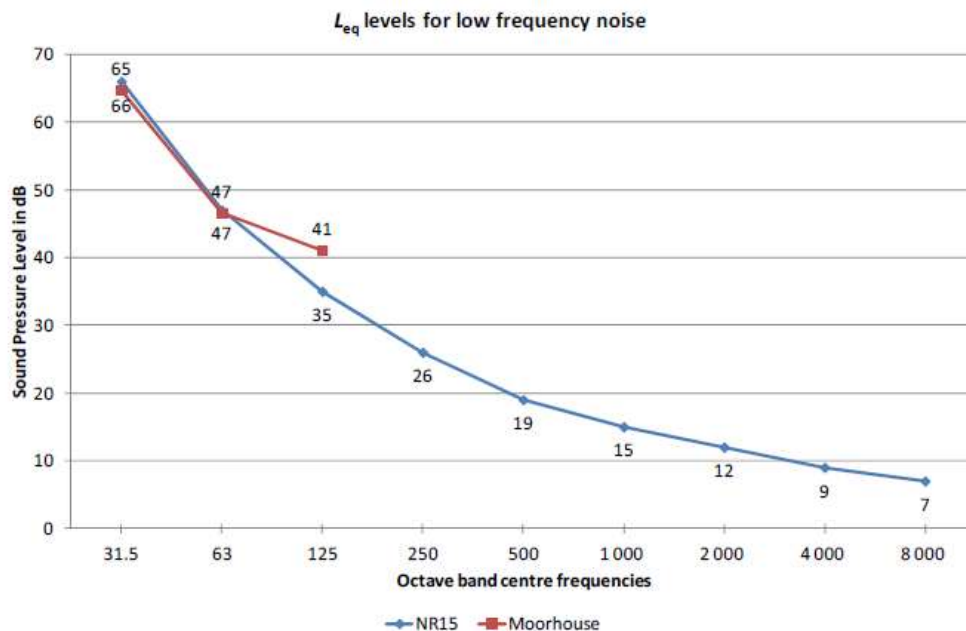


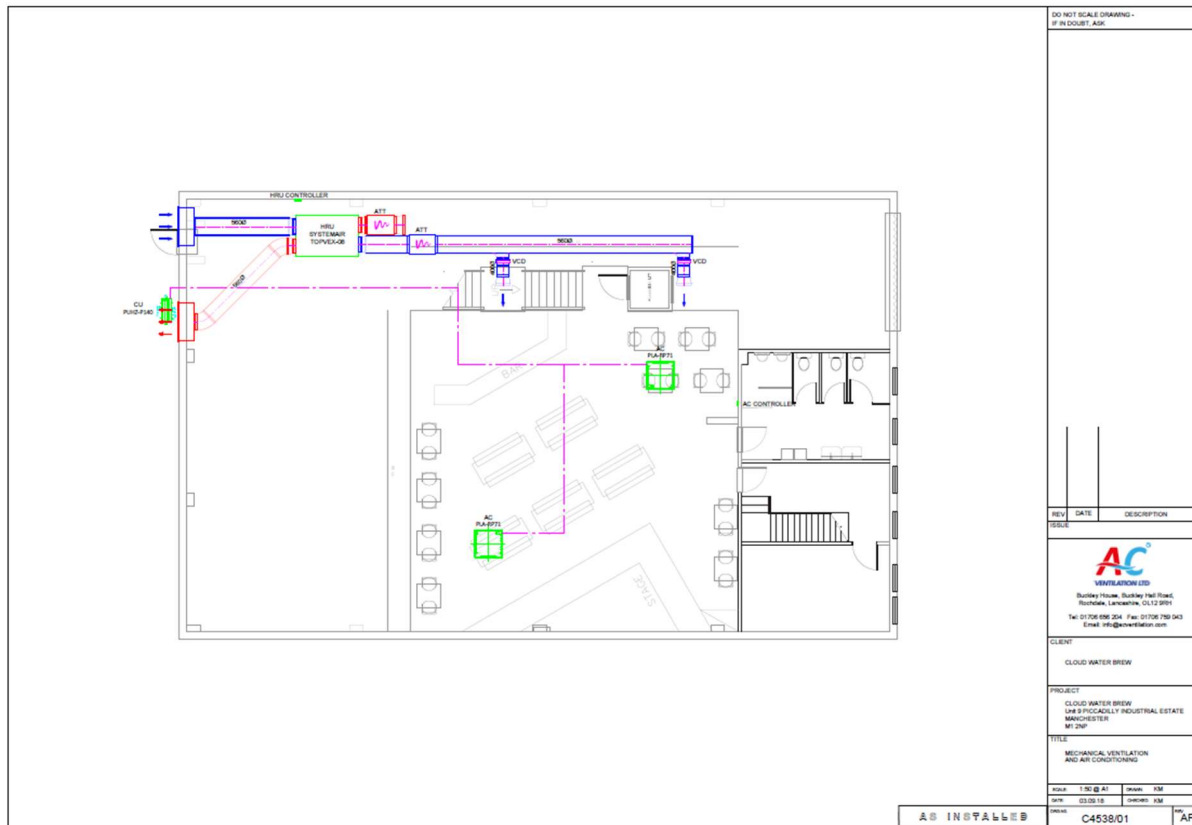
Figure 2.0 – Moorhouse Low Frequency Noise Rating Curve

However, The NR curve may be too stringent at mid and higher frequencies and may be lower than background noise levels in habitable spaces. Further, the NR curve is most commonly used to set limits for mechanical services noise in buildings i.e. steady, continuous noise sources. Music noise has distinctive characteristics and as such can be described as unsteady and non-continuous in comparison. Even though the Moorhouse curve does not specifically relate to entertainment noise (as per the caveat in the revised edition) these levels provide a good practical basis to assess low frequency music noise. They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces. Therefore, a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be: *'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}), respectively'.* This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue.

References:

- i) Institute of Acoustics (2002) – Good practice guide on the control of noise from pubs and clubs – Draft Annex 2.
- ii) McCullough et al (2004) A practical evaluation of objective noise criteria used for the assessment of disturbance due to entertainment music
- iii) Moorhouse et al (2005) Proposed criteria for the assessment of low frequency noise disturbance, Defra (updated in 2008 and 2011)

Appendix C – Site Plans



Appendix D – Environmental Survey

D.1 – Tabulated Summary Noise Data

Background Sound Level Summary							
Measurement Period ('t')	Octave Band $L_{90,t}$ (Hz, dB)						
	63	125	250	500	1k	2k	4k
20/11/20 – 19:00 – 22:00	60.0	57.0	56.0	56.0	59.0	54.0	42.0
21/11/20 – 19:00 – 22:00	57.0	54.0	54.0	54.0	57.0	52.0	40.0
22/11/20 – 19:00 – 22:00	56.0	54.0	54.0	53.0	56.0	51.0	39.0
Measurement Period ('t')	$L_{A90,15min}$	SMR $L_{A90,15min}$		Min $L_{A90,15min}$		Max $L_{A90,15min}$	
20/11/20 – 19:00 – 22:00	61.0	62.0		58.0		63.0	
21/11/20 – 19:00 – 22:00	60.0	57.0		55.0		63.0	
22/11/20 – 19:00 – 22:00	59.0	60.0		54.0		62.0	

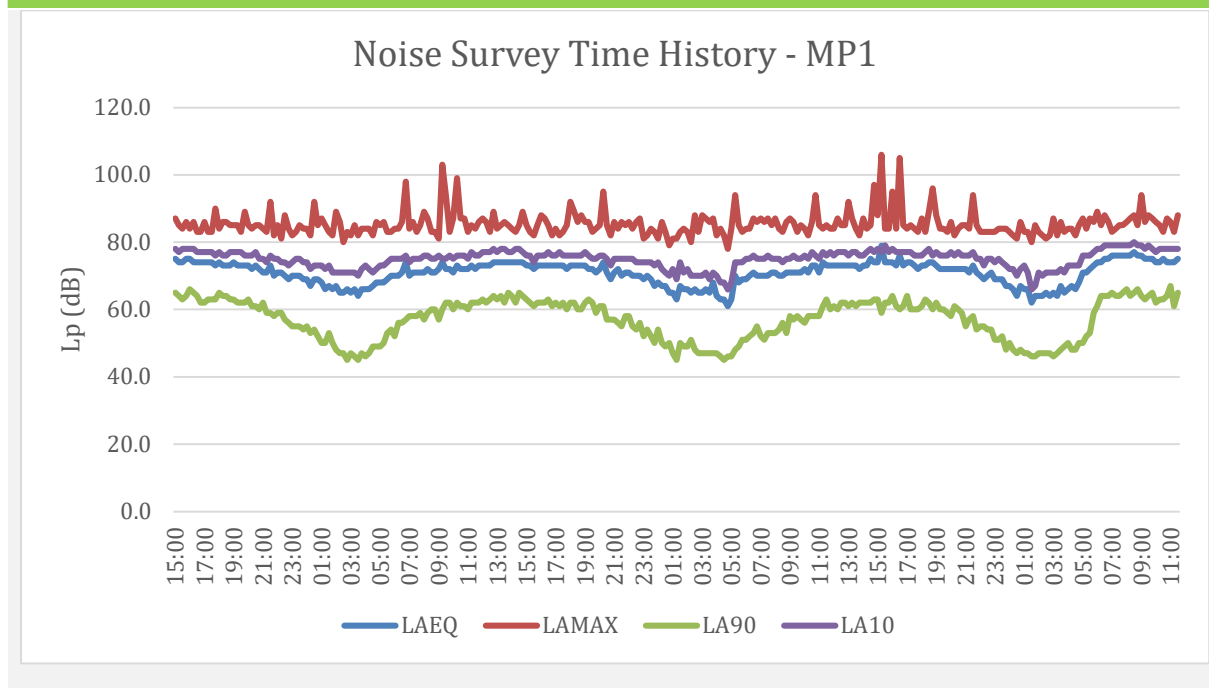


Table 10.0 – Sound Survey Summary Results

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246452	≤0.5
CESVA CB006 Class 1 Calibrator	901997	

Table 11.0 – 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, and 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 – Stalybridge – 12km East of Site				
Time Period	Air Temp (°C)	Rainfall mm/h	Prevailing Wind Direction	Wind Speed (m/s)
20/11/20 – 00:00 – 23:59	2.9 – 10.2	0.0 – 1.3	WSW	0.0 – 2.2
21/11/20 – 00:00 – 23:59	7.4 – 10.9	0.0 – 2.3	ESE	0.0 – 3.1
22/11/20 – 00:00 – 23:59	3.8 – 7.8	0.0 – 0.4	S	0.0 – 3.1
23/11/20 – 00:00 – 23:59	1.8 – 9.6	0.0 – 0.5	NW	0.0 – 2.2

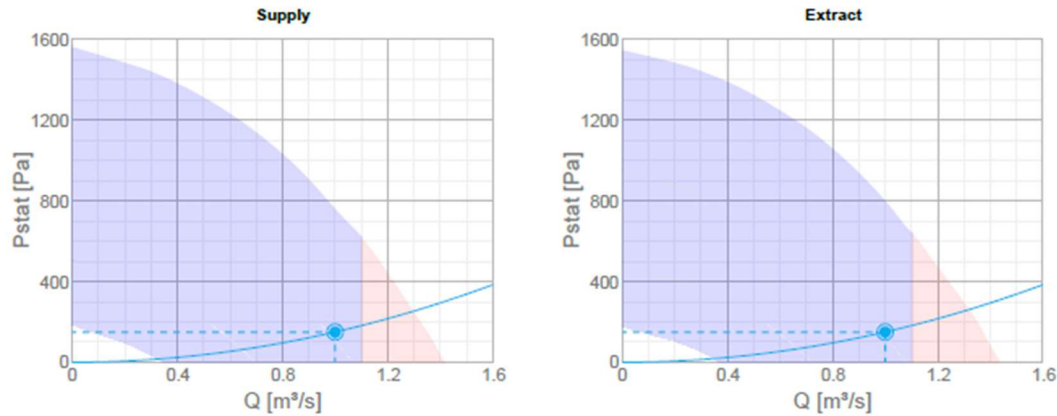
Table 12.0 – Weather Summary

Appendix D – Manufacturer's Datasheets

Performance

Diagrams

Diagrams and calculations are made for the performance with dimensioning filters.



User

Unit	Supply	Extract
☐ Required air flow	1	1 m³/s
☒ Working air flow	1	1 m³/s
☐ Required external pressure	150	150 Pa
☒ Working air pressure	150	150 Pa
Power	1222	1145 W
Speed	2359	2323 r.p.m.
SFP (dimensioning filters)	2,37	kW/(m³/s)
Supply air temperature	12	°C

Sound power level	63	125	250	500	1k	2k	4k	8k	Tot
Supply	85	83	91	81	78	73	68	61 dB	85 dB(A)
Outdoor	82	79	74	62	51	43	34	26 dB	67 dB(A)
Exhaust	87	82	93	83	80	75	68	60 dB	87 dB(A)
Extract	82	78	73	56	50	42	32	24 dB	67 dB(A)
Surrounding	72	71	74	59	49	45	43	34 dB	66 dB(A)

Sound pressure level (reverberant field)									Tot
Surrounding	(-7 dB)	dB						20m² (Sabin)	59

SUZ-KA / PUHZ-P - OUTDOOR UNITS		SUZ-KA35VA6	SUZ-KA50VA6	SUZ-KA60VA6	SUZ-KA71VA6	PUHZ-P100VKA	PUHZ-P125VKA	PUHZ-P140VKA
SOUND PRESSURE LEVEL (dBA)	Heating/Cooling	50 / 49	52 / 52	55 / 55	55 / 55	54 / 51	56 / 54	57 / 56
SOUND POWER LEVEL (dBA)	Cooling	62	65	65	69	70	72	75
WEIGHT (kg)		35	54	50	53	76	84	84
DIMENSIONS (mm)	Width x Depth x Height	800 x 285 x 550	840 x 330 x 880	840 x 330 x 880	840 x 330 x 880	1050 x 330 x 981	1050 x 330 x 981	1050 x 330 x 981
ELECTRICAL SUPPLY		220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz
PHASE		Single	Single	Single	Single	Single	Single	Single
SYSTEM POWER	Heating/Cooling (nominal)	1.00 / 1.02	1.69 / 1.61	1.97 / 1.76	2.20 / 2.10	3.26 / 3.18	3.84 / 4.10	4.67 / 5.42
INPUT (kW)	Heating/Cooling (UK)	0.85 / 0.88	1.44 / 1.38	1.67 / 1.51	1.87 / 1.81	2.93 / 2.64	3.46 / 3.40	4.20 / 4.50
STARTING CURRENT (A)		4.7	7.7	8.7	9.9	7.0	11.1	11.1
SYSTEM RUNNING CURRENT (A)	Heating/Cooling [MAX]	4.7 / 4.6 [8.4]	7.3 / 7.7 [12.2]	7.8 / 8.7 [14.2]	9.3 / 9.9 [16.4]	14.3 / 14.3 [20]	18.3 / 17.9 [26.5]	23.95 / 20.9 [30]
FUSE RATING (BS88) - HRC (A)		10	20	20	20	32	32	40
MAINS CABLE No. Cores		3	3	3	3	3	3	3
MAX PIPE LENGTH (m)		20	30	30	30	50	50	50
MAX HEIGHT DIFFERENCE (m)		12	30	30	30	30	30	30
CHARGE REFRIGERANT (kg) / CO ₂ EQUIVALENT (t)	R410A (GWP 2088)	1.15 / 2.40 (7m)	1.60 / 3.34 (7m)	1.60 / 3.34 (7m)	1.80 / 3.76 (7m)	3.30 / 6.89 (30m)	3.80 / 7.93 (30m)	3.80 / 7.93 (30m)
MAX ADDITIONAL REFRIGERANT (kg) / CO ₂ EQUIVALENT (t)	R410A (GWP 2088)	0.39 / 0.81	0.46 / 0.96	0.46 / 0.96	1.265 / 2.64	1.20 / 2.51	1.20 / 2.51	1.20 / 2.51
Note: No duty/standby operation on SUZ-KA35/50/60/71VA6.								
PRODUCT DIMENSIONS		PLA-RP35/50/60/71/100/125/140EA						