Appendix 10

NOVA ACOUSTICS

Noise Impact Assessment for External Amplified Music of a Live Events Space

Client: [redacted]

Site Address: The Ash Tree Inn, London Road, Tadcaster, LS24 9PP

Date: 28/09/2022

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Date	28/09/2022
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Executive Summary

This report has been prepared to assess the level of noise impact from the proposed external live events space with associated amplified music ('the Proposed Development') at The Ash Tree Inn, London Road, Tadcaster, LS24 9PP. A summary of the assessment results can be seen below.

External Amplified Music Assessment

Provided one of the two mitigation options specified within this report is implemented, the noise levels at the closest NSRs (Noise Sensitive Receptors) are predicted to be at least 10.0 dB below the measured background sound levels in all octave frequency bands. This indicates 'No Observed Effect Level' (NOEL) when assessed in accordance with the NPSE and NPPF.

It should be noted that without erecting a permanent structure, constructed from a heavy weight material such as masonry or composite steel, it is unlikely that live amplified music can take place in the external area without causing significant adverse impact at the closest NSRs. However, building a new structure is not thought to be possible, and as such, noise limit levels and upgrades to the existing marquee have been recommended in order to allow for noise levels to be as loud as possible without causing adverse impact. If mitigation option 2 is implemented, the proposed limit levels are expected to be loud enough to allow for amplified acoustic performances and music for background purposes.

The following table presents an overview of the recommended mitigation measures that should be implemented.

Recommendations and Mitigation Overview
- It is advised that one of the two mitigation options specified within the body of the report is implemented prior to operation and are retained thereafter. - The noise management plan outlined in Section 5.0 should be adhered to.

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 an external live events space with associated amplified music ('the Proposed Development') at The Ash Tree Inn, London Road, Tadcaster, LS24 9PP ('the Site').

The applicant is preparing a licencing application ('The Application') to Selby District Council, who have requested further documentation in order to approve the application.

The following technical noise assessment has been prepared to support the licencing application to Selby District Council. This report details an assessment of:

- Amplified music noise emanating from the live events space within the canvas marquee.

Based on the level of noise impact expected, 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 (where required).

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 summarised 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 (2021), Noise Policy Statement for England (2010), Entertainment Noise Legislation 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.

Background and Proposed Operational Hours

The proposal is for more regular use of the marquee that sits within the pub grounds and includes regular live amplified music for events such as weddings. The proposed operational hours for regular entertainment noise are: 10:00 to 23:00 hours, Sunday to Thursday and 10:00 to 00:00 hours, Saturday and Sunday.

Proposed Criteria – Entertainment Noise

'The Good Practice guide on the Control of Noise from Pubs and Clubs' comments that where entertainment noise takes place on a regular basis, music and associated sources should be inaudible within noise-sensitive properties at any time. For the purpose of this assessment inaudibility is considered 10.0 dB below, and 'faintly perceptible' is considered to be 5.0 dB below the measured background sound level (L_{90}) in each octave band.

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 15/09/2022 to 19/09/2022. For the long-term sound survey, a sound level meter was attached to a lamppost along Black Lane (MP1). The microphone was situated approximately 3.5m from the ground and at least 3.5m from any other large reflective surface. The monitoring position was chosen in order to collect representative sound levels at the closest NSR during the proposed operational periods. The monitoring location is shown below in Figure 1.0.

Furthermore, a 4-hour attended survey was conducted during an event on 15/09/2022. During the event, short-term measurements were taken within the vicinity of NSR1, within the marquee, and the areas surrounding the marquee. Further information is detailed in the body of the report.

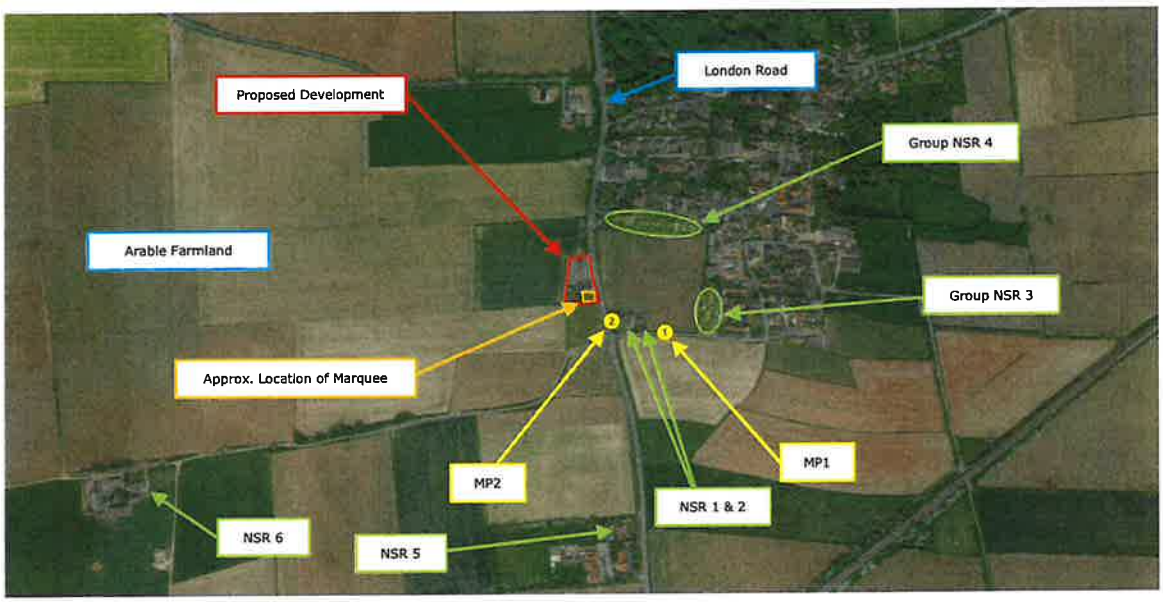

Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The area surrounding the site is mixed in nature with arable farmland to the west and residential dwellings to the north-east/east. Situated approximately 44m to the south-east of the Proposed Development is a residential dwelling (along Black Lane), and due to this dwellings proximity to the Proposed Development, it is considered to be the closest Noise Sensitive Receptor (NSR1). NSR2 neighbours NSR1 to the east. A pair of residential dwellings (NSR3) are located approximately 173m to the east of the Proposed Development, and a group of dwellings labelled NSR4 are located a minimum of 118m to the north-east (6 Main St. being the closest). NSR5 & NSR6 are situated approximately 350m to the south and 714m to the south-west of the Proposed Development, respectively.

The acoustic environment is deemed to be low in level and the noise profile during the evenings and night time periods is dominated by intermittent road traffic noise emissions from London Road. During lulls in the road traffic flow, no other noise sources were audible and acoustic environment was particularly calm. However, during the attended monitoring of a live event on 15/09/2022 the

noise profile at NSR1 during lulls in road traffic flow was dominated by the live amplified music from within the marquee. The vocals were clearly audible at NSR1 and then low frequencies of percussion and bass lines were clearly audible at NSR3 and NSR4.

The site currently operates under an annual 28-day licence and hold approximately 6 events a year, however, noise complaints regarding amplified music noise have been made by the local residents. The surrounding area is not conducive to live amplified music, therefore, it is deemed appropriate to achieve 'inaudibility' at the closest NSRs.

Environmental Noise Survey Results

Background Results Summary:

The following tables outline the background sound levels measured during the most sensitive operational hours of the proposed development that will be used in the subsequent assessments. A full summary of all results can be found in Appendix C.

Measurement Position MP1							
Measurement Period ('t')	Octave Band $L_{90,t}$ (Hz, dB)						
	63	125	250	500	1k	2k	4k
Day 4: 19:00 – 23:00	40.0	33.0	28.0	30.0	33.0	25.0	13.0
Night 2: 23:00 – 00:00	38.0	31.0	30.0	30.0	32.0	23.0	12.0

Table 1.0 – Octave Band Background Sound Levels

Measurement Position MP1				
Measurement Period ('t')	$L_{A90,t}$	Statistically Most Repeated $L_{A90,t}$	Min. $L_{A90,t}$	Max. $L_{A90,t}$
Day 4: 19:00 – 23:00	35.0	**35.0**	27.0	39.0
Night 2: 23:00 – 00:00	35.0	**34.0**	34.0	36.0

Table 2.0 – Global Background Sound Level Summary Results

As can be seen in the table above, the range of measured background sound levels is relatively low during the night time period. The statistically most repeated (SMR) value is located near the top of the range, however, given that the average value is also located near the top of the range, the $L_{A90,15min}$ SMR value of 34.0 dB is deemed to be 'typical' and will be used in the subsequent assessments.

Short-Term Ambient Results Summary:

The figure below indicates the short-term measurement locations used for the attended surveying of a live event. Unless otherwise stated, all measurement positions were approximately 1.5m above the ground and the sound level meter was set to a 1-second integration logging period.

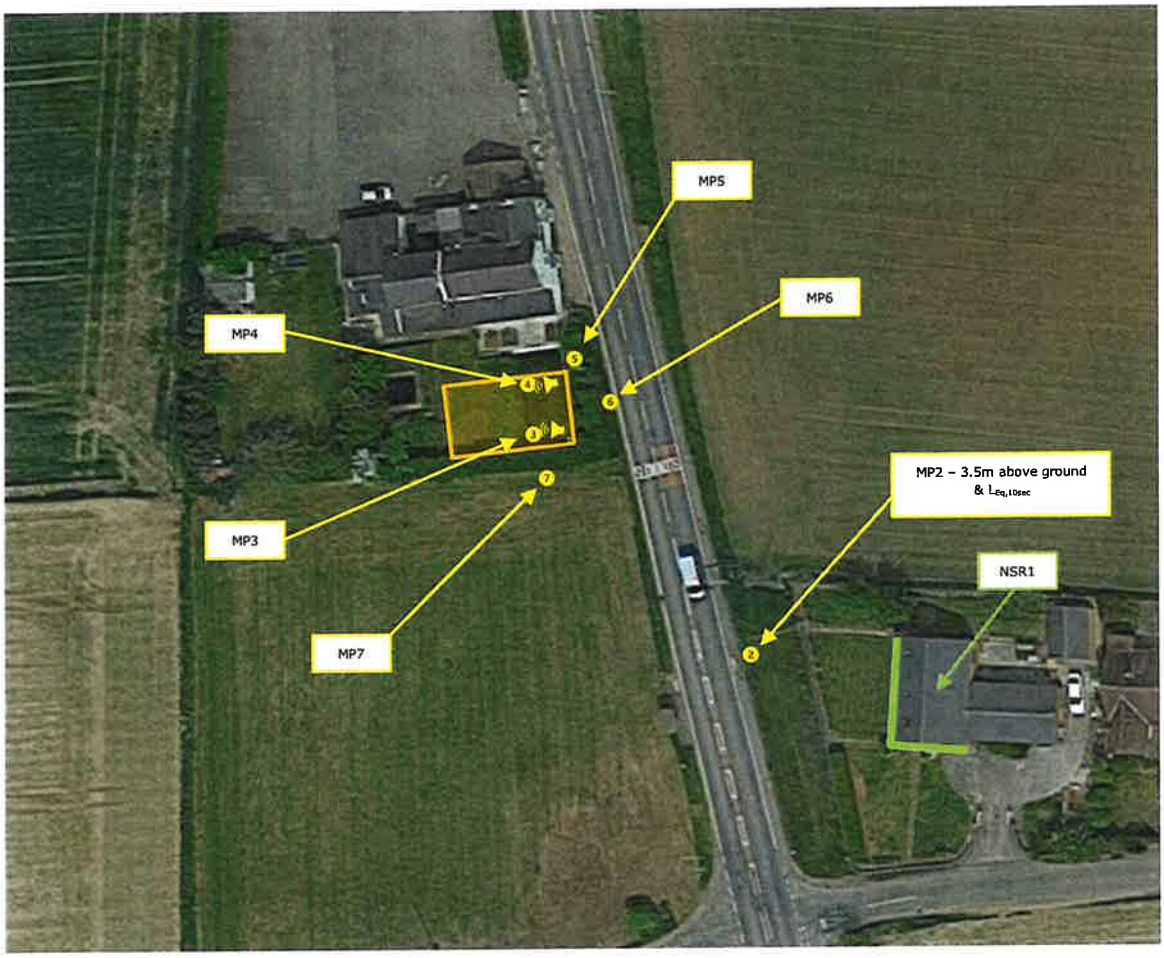

Figure 2.0 – Short-Term Survey Measurement Positions

Currently, the Proposed Development does not own its own P.A. speaker system and relies on guests bringing their own. On the day of the attended surveying, 2 P.A. speaker systems were arranged: 2 No. QSC K12.2 FOH speakers for the amplified reinforcement of live music and 2 No. EV 5x300 for the playback of pre-recorded music.

The following table presents the ambient sound levels measured at various locations and calculated specific sound levels within and around the Proposed Development during a live event that will be used to augment the noise model. The event was a wedding reception and included amplified background music until 19:00 hours and then live amplified music from 19:00 to 23:00 hours. All vehicle pass-bys have been removed from the measured data at MP2. All other measurements were paused as to not capture vehicle pass-bys.

Short-Term Measurement Results Summary								
Description	Octave Band $L_{eq,t}$ (Hz, dB)							$L_{Aeq,t}$ (dA)
	63	125	250	500	1k	2k	4k	
MP2 – 2:40 hour Measurement with Amplified Music Playing	65.0	63.0	55.0	55.0	55.0	51.0	38.0	58.0
MP3 – 50-min Measurement at 2.5m from Speakers	91.0	91.0	87.0	88.0	92.0	82.0	79.0	93.0
MP4 – 2-min Measurement at 2.5m from Speakers	87.0	86.0	84.0	93.0	89.0	82.0	75.0	93.0
MP5 – Specific Sound Level of Amplified Music	86.0	80.0	73.0	70.0	68.0	59.0	48.0	72.0
MP6 – Specific Sound Level of Amplified Music	81.0	75.0	63.0	57.0	58.0	49.0	35.0	64.0
MP7 – A Specific Sound Level of Amplified Music	82.0	81.0	65.0	61.0	60.0	51.0	37.0	66.0

Table 3.0 – Short-Term Ambient Sound Level Results & Specific Sound Levels

3. External Amplified Music Noise Assessment

In the following section, the external amplified music from the Proposed Development is assessed. The external amplified music noise assessment has been conducted assuming the following:

- The amplified music within the marquee does not exceed the operational hours stated in Section 1.0.

Amplified Music Noise Levels

The following table presents unweighted sound pressure levels within the marquee at 2.5m from the P.A. speakers.

Measured Internal Noise Levels of Marquee								
Description	Octave Band $L_{eq,t}$ (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Level at 2.5m	91.0	91.0	87.0	88.0	92.0	82.0	79.0	93.0

Table 4.0 – Measured Internal Noise Levels

Noise Breakout Analysis

The level of music noise breaking out of the marquee has been calculated assuming the following criteria:

- The fabric of the marquee provides negligible sound reduction. This is based on previous measurements and calculations undertaken by NOVA Acoustics.
- Due to the material properties of the fabric marquee, there is a negligible build-up of reverberant sound and subsequently, there is no difference between internal and external conditions.
- The client has erected a 50mm timber stud wall with a timber cladded external leaf, 50mm mineral wool insulation and a chipboard internal leaf. At lower frequencies this detail does not provide any meaningful sound reduction, however, the screening has been modelled according to on-site inspections.

Specific Sound Levels

The specific sound level at the NSRs has been calculated using SoundPlan 8.2, which undertakes its calculations in accordance with the guidance provided in ISO 9613-1:1996.

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.
- For the purpose of this assessment, the ground between the source and receiver is considered to be primarily acoustically 'soft' surfaces.
- The sound map is set to a grid height of 1.5m.
- The structure has been modelled according to an on-site inspection and drawings provided by the client.
- The noise model has been calibrated to the specific sound levels presented in Table 4.0.
- Point source emitters have been used to represent the 2 No. QSC K12.2 speakers. The point source directivity data was ascertained from .CF2 files and imported into the software. The directivity data has been taken from the QSC website for the K12.2 speaker, thus replicating the system in-situ.

The sound map showing the specific sound level emissions from the proposed development can be seen in the figure below.

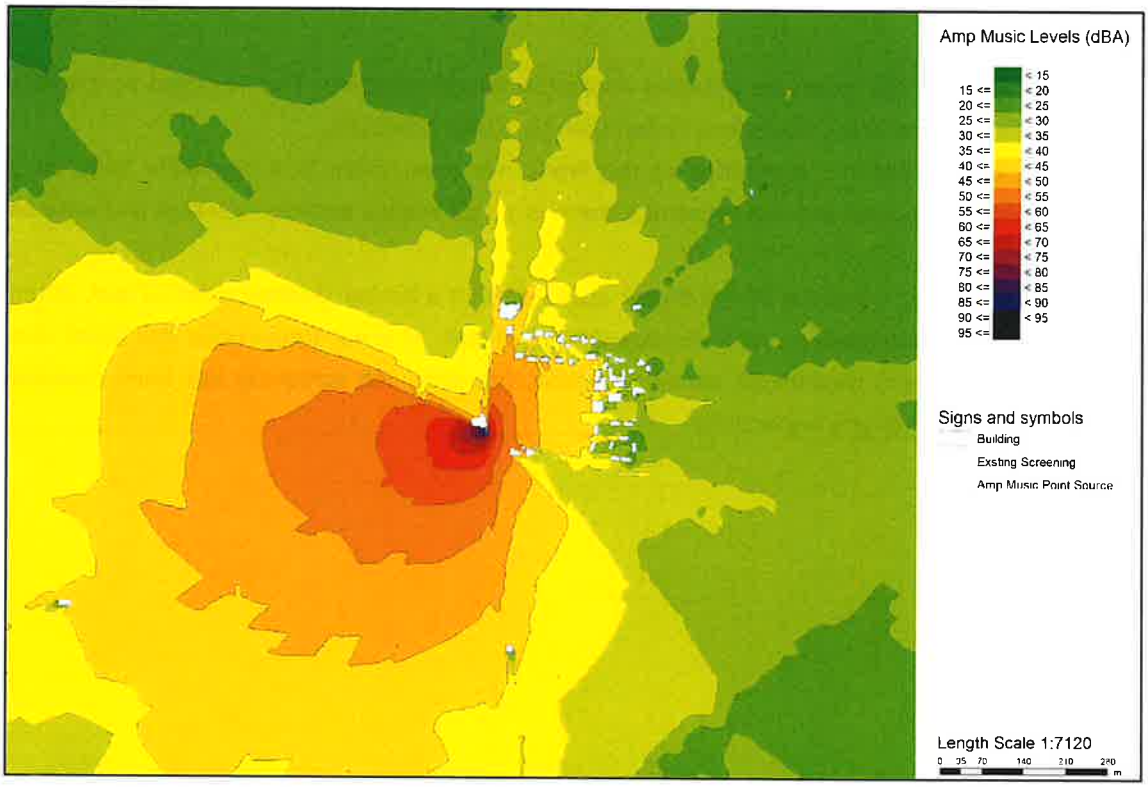

Figure 3.0 – Specific Sound Level Map of Amp Music Emissions – 1.5m Grid Map Height

Noise Breakout Assessment

The following table compares the predicted specific noise emissions at the most affected NSR with the measured background sound levels presented in Tables 1.0 and 2.0.

Amplified Music Noise Assessment – Sensitive Day Time								
Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Predicted Noise Level at NSR1	61.0	60.0	54.0	52.0	46.0	28.0	20.0	53.0
Background Sound Level (L_{90})	40.0	33.0	28.0	30.0	33.0	25.0	13.0	35.0
Exceedance of Background Sound Level	+21.0	+27.0	+26.0	+22.0	+13.0	+3.0	+7.0	+18.0
Amplified Music Noise Assessment – Night Time								
Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Predicted Noise Level at NSR1	61.0	60.0	54.0	52.0	46.0	28.0	20.0	53.0
Background Sound Level (L_{90})	38.0	31.0	30.0	30.0	32.0	23.0	12.0	34.0
Exceedance of Background Sound Level	+23.0	+29.0	+24.0	+22.0	+14.0	+5.0	+8.0	+19.0

Table 5.0 – Amplified Music Noise Assessment

**Sum of L_{eq} noise levels considering the A-weighting scale correction.*

Discussion

As can be seen in the assessment above, the specific sound levels of amplified music noise emanating from the Proposed Development are precited to exceed the prevailing background sound level at the closest NSR (NSR1) in all octave frequency bands. These exceedances would be likely to be clearly audible and would be classed as 'Significant Observed Adverse Effect Level' ('SOAEL') when assessed in accordance with the NPSE and NPPF. Consequently, mitigation measures are required to reduce noise levels.

4. Recommendations and Mitigation Measures

The following section outlines the recommended mitigation measures and sound insulation upgrades required to ensure the Proposed Development does not adversely impact the residential amenity of the neighbouring NSRs.

Whilst every effort has been made to consider multiple mitigation measures, only two solutions were found to be effective:

- Adhere to restrictive amplified music limit levels, or,
- Improve the sound insulation of marquee (and apply less restrictive amplified music limit levels).

Option 1 – Amplified Music Limit Levels in Existing Marquee

Automated volume controls capable of limiting noise at specific frequencies to prevent significant low frequency music should be implemented within the marquee. The music limit levels should be set as shown in the following table.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Level at 2.5m from FOH Speaker	58.0	54.0	53.0	57.0	69.0	67.0	61.0	72.0

Table 6.0 – Maximum Amplified Music Limit Levels (Option 1)

The example noise limiting system shown below would be appropriate for this task, however, other manufacturers may also provide appropriate equipment. This should be researched prior to purchase.

- Cesva LRF04-F – Frequency Filter Sound Level Limiter-recorder

External acts or DJs should be prohibited from using their own equipment unless plugged into the main FOH system through the volume control measures. It should be noted that any automated volume control measures should be installed and activated by an appropriately experienced noise control consultant/engineer to ensure that the equipment operates effectively.

The music limit level above should be adhered to and during the calibration of the equipment, the noise level should be set as to be inaudible at the closest Noise Sensitive Receptor.

It should be noted that these music limit levels are not high enough to retain the feeling of loudness even with a distributed speaker system, and live amplified music is unlikely to be possible.

The sound map showing the specific sound level emissions from the proposed development considering the amplified music limit levels stated in Table 6.0 can be seen in the figure below.

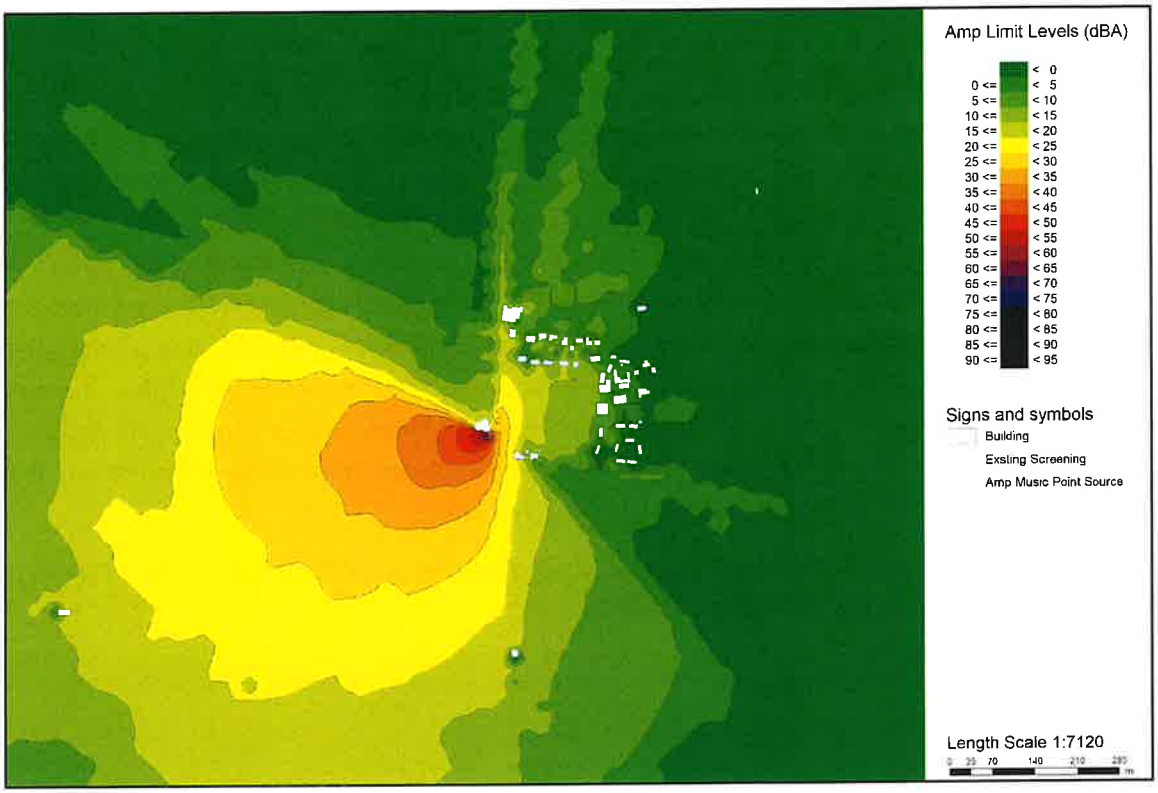

Figure 4.0 – Specific Sound Level Map Option 1 Mitigation – 1.5m Grid Map Height

The following table compares the predicted specific noise emissions at the most affected NSR considering the music limit levels in Table 6.0, with the lowest measured background sound levels from either the day or night time period as presented in Tables 1.0 and 2.0.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Predicted Noise Level at NSR1	28.0	21.0	18.0	20.0	22.0	13.0	0.0	24.0
Background Sound Level (L_{90})	38.0	31.0	28.0	30.0	32.0	23.0	12.0	34.0
Exceedance of Background Sound Level	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-12.0	-10.0

Table 7.0 – Noise Assessment Considering Music Limit Levels

As can be seen in the assessment above, should the maximum music limit levels be adhered to, the specific sound levels of amplified music emanating from the Proposed Development are precited to be at least 10.0 dB below prevailing background sound level at the closest NSR (NSR1) in all octave frequency bands. This constitutes inaudibility and would be classed as 'No Observed Effect Level' ('NOEL') when assessed in accordance with the NPSE and NPPF.

Option 2 – Upgraded Marquee & Amplified Music Limit Levels

Options 2 involves upgrading the sound insulation of the marquee which would allow for less restrictive amplified music limit levels.

Sound Insulation Upgrades to Marquee

The most effective solution to insulate against sound is to house the events space in a fully sealed structure with more mass, e.g., masonry or composite steel constructions. However, this was deemed impracticable due to the planning implications of such a structure, therefore, it is advised instead to install a heavyweight acoustic lining within the marquee. Acoustic lining baffles can be slotted into the internal kader channel of a 4-track marquee aluminium profile. One such product that meets these requirements can be sort from 'Direct Acoustics' however, any product that achieves the minimum sound insulation requirements outlined in this section will suffice. It should be noted that the acoustic linings can be heavy and may require an isolated concrete foundation to support the weight and reduce vibrations generated through structure borne transmission. It is advised to seek an installation specialist for further information.

The following table presents the UKAS certified Sound Reduction Index (SRI) in 1/1 octave frequency bands. The certification can be found in Appendix E.

Description	Octave Band SRI (Hz, dB)							R_w (dB)
	63	125	250	500	1k	2k	4k	
SRI of MAL22 Acoustic Lining	11.0	12.0	17.0	17.0	20.0	27.0	34.0	22.0

Table 8.0 – SRI of Marquee Acoustic Linings (Option 2)

Maximum Amplified Music Limit Levels

The following maximum amplified music limit levels should be set as shown in the following table. Please note these are a baseline and would need calibrating on-site.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Level at 2.5m from FOH Speaker	69.0	66.0	70.0	74.0	74.0	72.0	70.0	79.0

Table 9.0 – Maximum Amplified Music Limit Levels (Option 2)

The amplified music limit levels presented in the table above are deemed similar to those of a busy restaurant and would be suitable for a wide variety of events, including amplified acoustic performances, however, they are thought to be too low for the purpose of live amplified music used for dancing. Consequently, it would be necessary to implement a 'zone array distributed speaker system'.

Zone Array Distributed Speaker System

To minimise the internal sound level required to achieve a uniform and distributed noise level within the marquee, a distributed and zonal P.A. system should be installed. A distributed sound system involves installing a higher quantity of speakers all emitting a lower level. This takes advantage of the proximity of the listener to the speaker, thus reducing the overall noise emissions of the marquee whilst maintaining a feeling of 'loudness'. Constructive and deconstructive speaker interference should be used to localise low frequencies; it is advised to contact a specialist for further information.

The speakers should be focused on the main operational area of and not located near to entrances and exits. All speakers should be installed on appropriate anti-vibrational mounts.

A distributed and zonal P.A. system would result in slightly higher amplified music limit levels, however, this cannot be accurately modelled and as such the limit levels would require on-site calibration ensuring the amplified music is inaudible at the closest/most affected NSR.

Noise Assessment Considering Option 2 Mitigation

The following table compares the predicted specific noise emissions at the most affected NSR considering the mitigation measures outlined in option 2, with the lowest measured background sound levels from either the day or night time period as presented in Tables 1.0 and 2.0.

Description	Octave Band L_{eq} (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Predicted Noise Level at NSR1 – No Marquee Linings	39.0	33.0	35.0	37.0	27.0	18.0	11.0	36.0
Sound Reduction of Marquee Linings	-11.0	-12.0	-17.0	-17.0	-20.0	-27.0	-34.0	
Expected Noise Level at NSR1 – with Marquee Linings	28.0	21.0	18.0	20.0	7.0	0.0	0.0	18.0*
Background Sound Level (L_{90})	38.0	31.0	28.0	30.0	32.0	23.0	11.0	34.0
Exceedance of Background Sound Level	-10.0	-10.0	-10.0	-10.0	-25.0	-32.0	-34.0	-16.0

Table 10.0 – Noise Assessment Considering Music Limit Levels

**Sum of L_{eq} noise levels considering the A-weighting scale correction.*

As can be seen in the assessment above, should the mitigation measures outlined in option 2 be adhered to, the specific sound levels of amplified music emanating from the Proposed Development are precited to be at least 10.0 dB below prevailing background sound level at the closest NSR (NSR1) in all octave frequency bands. This constitutes inaudibility and would be classed as 'No Observed Effect Level' ('NOEL') when assessed in accordance with the NPSE and NPPF.

5. Noise Management Plan

The following section outlines the required noise control measures that are necessary to protect the amenity of the closest Noise Sensitive Receptors.

Noise Control Measures

The management measures are outlined in the following section.

Noise Control Measures:

- One of the two mitigation options specified in Section 4.0 should be adhered to.
- All doors and windows in the marquee should be kept closed during operational hours, except when access is required, therefore, mechanical door closers should be installed and an alternative means of ventilation during hot days may be required.
- Operational hours should not exceed 23:00 hours Sunday to Thursday and 00:30 hours Friday and Saturday.

Premises Management Responsibility:

The designated premises supervisor 'DPS' will have the responsibility for ensuring that nuisances and hazards arising from the premises due to noise are minimised.

Management Control Measures:

The following range of management control methods should be implemented at the premises, including but not limited to:

- Site staff should be made aware that they are working in the vicinity of noise-sensitive receptors and avoid all unnecessary noise due to elevated music levels, opening of doors/windows or excessive noise from patrons. The DPS will be required to implement strict staff rules to ensure that the staff immediately respond to unnecessary elevated noise levels.
- Staff training should involve reviewing the Noise Management Plan and Operational Noise Management Guide.
- All operational staff will be responsible for reporting any noise problems immediately to the DPS.
- No annual quantitative noise monitoring is proposed; however, qualitative monitoring of nose levels will be included as a factor to be considered by the DPS as part of daily operations of the premises.

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. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq 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. L90 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. L10 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 $L_{A90,1hour}$ dB and $L_{A90,15mins}$ 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 (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. 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 174e, 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 185 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 185 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 11.0 – 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.

B.4 – Entertainment & Leisure Noise Legislation

Noise from entertainment and leisure venues, e.g. noise from recorded music, live bands, gyms or karaoke, ca 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 a 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 5.0.

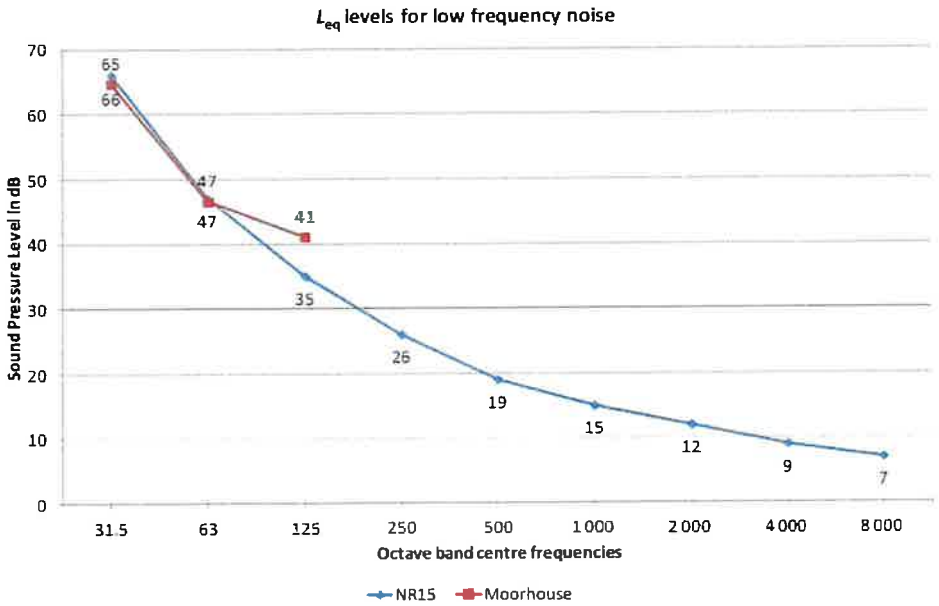

Figure 5.0 – Moorhouse Low Frequency Noise Rating Curve

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)

NOVA ACOUSTICS

Appendix C – Environmental Survey

C.1 – Tabulated Summary Noise Data

Background Sound Level Summary – Site Not in Operation (Full Period)							
Measurement Period ('t')	Octave Band $L_{90,t}$ (Hz, dB)						
	63	125	250	500	1k	2k	4k
Day 1 – 15/09/22: 21:45 – 23:00	53.0	46.0	42.0	44.0	48.0	42.0	28.0
Night 1 - 15/09/22: 23:00 – 07:00	42.0	35.0	32.0	34.0	37.0	31.0	20.0
Day 2 – 16/09/22: 07:00 – 23:00	55.0	47.0	45.0	47.0	48.0	43.0	31.0
Night 2 - 16/09/22: 23:00 – 07:00	43.0	37.0	33.0	34.0	37.0	29.0	18.0
Day 3 – 17/09/22: 07:00 – 23:00	53.0	47.0	44.0	45.0	48.0	42.0	31.0
Night 3 - 17/09/22: 23:00 – 07:00	41.0	36.0	35.0	35.0	39.0	33.0	21.0
Day 4 – 18/09/22: 07:00 – 23:00	52.0	44.0	41.0	43.0	45.0	40.0	28.0
Night 4 – 18/09/22: 23:00 – 07:00	38.0	31.0	29.0	31.0	35.0	28.0	18.0

Measurement Time Period ('t')	$L_{A90,15min}$	SMR $L_{A90,15min}$	Min $L_{A90,15min}$	Max $L_{A90,15min}$
Day 1 – 15/09/22: 21:45 – 23:00	40.0	0.0	36.0	44.0
Night 1 - 15/09/22: 23:00 – 07:00	40.0	23.0	20.0	49.0
Day 2 – 16/09/22: 07:00 – 23:00	51.0	50.0	32.0	52.0
Night 2 - 16/09/22: 23:00 – 07:00	39.0	27.0	22.0	42.0
Day 3 – 17/09/22: 07:00 – 23:00	46.0	47.0	32.0	49.0
Night 3 - 17/09/22: 23:00 – 07:00	32.0	27.0	24.0	38.0
Day 4 – 18/09/22: 07:00 – 23:00	47.0	47.0	27.0	49.0
Night 4 – 18/09/22: 23:00 – 07:00	27.0	18.0	17.0	36.0

Table 12.0 – Sound Survey Summary Results

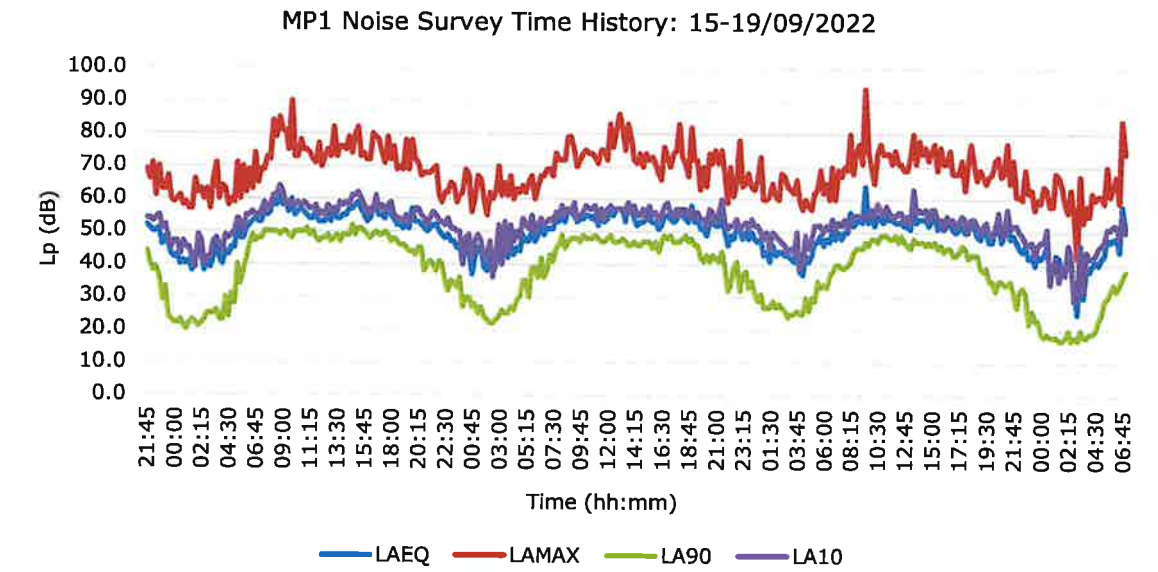

Figure 6.0 – MP1 Noise Survey Time History

C.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	
CESVA SC250 Class 1 Sound Level Meter	T252860	≤0.5
CESVA CB011 Class 1 Calibrator	T253524	

Table 13.0 – 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.

C.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, 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 – Garforth (Approx. 8.2km SW of Site)				
Time Period	**Air Temp (°C)**	**Rainfall (mm/h)**	**Prevailing Wind Direction**	**Wind Speed (m/s)**
15/09/2022: 00:00 – 23:59	9.6 – 18.7	0.0	ESE	0.0 – 1.7
16/09/2022: 00:00 – 23:59	8.3 – 17.4	0.0	E	0.0 – 1.4
17/09/2022: 00:00 – 23:59	7.5 – 19.3	0.0	SSW	0.0 – 2.0
18/09/2022: 00:00 – 23:59	9.6 – 20.1	0.0 – 0.3	SE	0.0 – 2.0
19/09/2022: 00:00 – 23:59	10.2 – 21.6	0.0 – 2.3	E	0.0 – 21.5*

Table 14.0 – Weather Summary

**This wind speed is thought to be anomalous, however, it occurred outside the time period used for the assessments.*

Appendix E – Manufacturers Data Sheets

MAL22

SRL

0444

Test Report :

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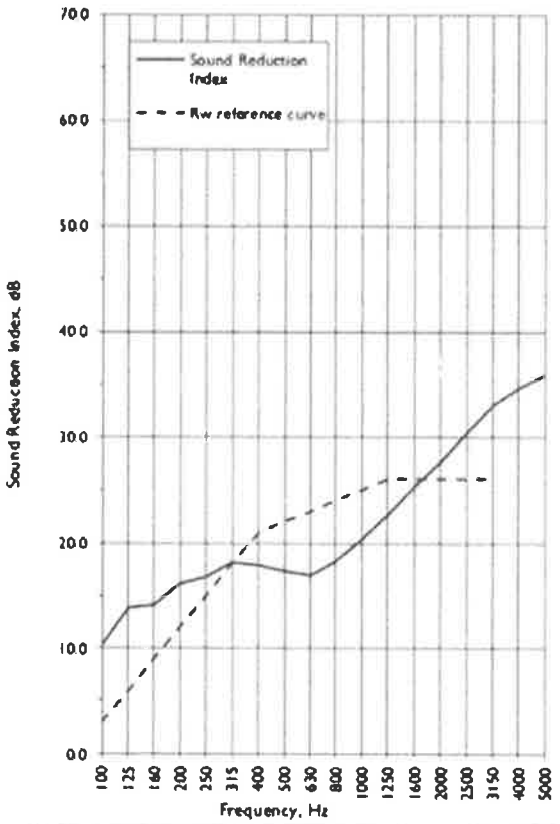
Date: 13/11/2018

Data Sheet 5

Test Number:	6	**Test Room:**	**Source**	**Receiving**
Client:	Direct Acoustics	**Air Temperature:**	11.8 °C	12.6 °C
Test Date:	02/11/2018	**Air Humidity:**	61 %	57 %
Sample Height:	2.2 m	**Volume:**	115 m³	300 m³
Sample Width:	2 m			
Sample Weight:	6.9 kg/m²	**Air Pressure:**	1015 mbar	

Product Identification:

Freq. f Hz	Sound Reduction Index, dB	
	⅓ Oct	Octave
50+	**14.3**	11.3
63+	**13.5**	
80+	**8.6**	
100	10.2	12.4
125	13.9	
160	14.1	
200	16.1	16.9
250	16.8	
315	18.1	
400	17.9	17.3
500	17.3	
630	16.9	
800	18.3	20.1
1000	20.3	
1250	22.7	
1600	25.3	27.3
2000	27.7	
2500	30.4	
3150	33.1	34.4
4000	34.6	
5000	35.9	
6300+	**36.8**	37.2
8000+	36.9	
10000+	38.0	
Average 100-3150	19.9	Version v3.1



Rating according to BS EN ISO 717-1:2013

$R_w(C;C_{tr})$= 22 (-1 ; -3) dB

* shows measurement corrected for background

> shows measurement limited by background

* shows Frequency beyond standard and not UKAS accredited