

Noise Impact Assessment Verification Report

Hough End Leisure Centre

Manchester

M20 1NA

Stroma Built Environment Ltd.

SBE Ref: OPP-079040 – AC - 4v1

I. Revision History

Revision	Date	Description	
4v1	30/04/2024	Initial Issue	
		Compiled By	Authorised By
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1. Introduction

- 1.1 Stroma Built Environment (SBE) have been appointed by ISG Construction Ltd to provide a verification survey and noise impact assessment for the extension to Hough End Leisure Centre, 480 Princess Road, Manchester M20 1NA.
- 1.2 As part of this development, new items of externally mounted building services plant have been installed and the end user wishes to have amplified music in two of the spaces within the development. During the planning phase, Manchester City Council imposed planning conditions 19 and 20 on the development. These conditions sought to limit the noise impact the building services noise and the noise break out from the amplified music could have on the nearby noise sensitive receptors.
- 1.3 The purpose of this report is to assess the operating externally mounted building services plant and noise break out from the development and discharge the relevant planning conditions. By satisfying Manchester City Councils requirements, the BREEAM credits for Pol 05 may also be awarded.
- 1.4 This document has been prepared for the sole use, benefit and information of the client for the purposes set out. The liability of SBE in respect of any information contained herein shall not extend to any third party.
- 1.5 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature. A glossary of acoustic terms is included as Appendix IV.

2. Noise Assessment Guidance and Criteria

Manchester City Council

- 2.1 The site lies within the jurisdiction of Manchester City Council (MCC). MCC have imposed planning conditions 19 and 20 on the site. Planning condition 19 states the following:

"Prior to occupation of the development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved Noise Impact Assessment. The report shall also undertake post completion testing to confirm that acceptable criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria."

- 2.2 The referred to 'approved noise impact assessment' is a document produced by Waterman Infrastructure and Environment Limited (Waterman) titled '*Hough End Leisure Village – Noise Impact Assessment*' dated February 2022, report reference: 132513_VO_2021-NOISE_IMPACT_ASSESSMENT-1842718.

- 2.3 Given that planning condition 20 refers specifically to plant noise emissions, it is assumed that planning condition 19 refers to the potential noise break-out of amplified music from the development and noise from the sports pitches. The sports pitches were not constructed by ISG and therefore outside the scope of this report.

- 2.4 Waterman have conducted a desktop assessment of the potential noise break-out. This is detailed in section 4.2 of their report. Their assessment process has been described in Section 4 of this report.

- 2.5 Planning condition 20 states the following:

a) Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB ($L_{Aeq,T}$) below the typical background ($L_{A90,T}$) level at the nearest noise sensitive location. Prior to commencement of the use hereby approved the scheme shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site.

- 2.6 This planning condition refers specifically to noise from externally mounted building services plant. The criterion of this planning condition is the same as the criterion for BREEAM 2018 Pol 05. Thus, achieving the requirements of the planning condition will also achieve the requirements for the BREEAM Pol 05 credit.

BS 4142:2014 Methods for rating and assessing industrial and commercial sound

- 2.7 BS 4142 describes a method for assessing the adverse impact from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc). The assessment methodology is based upon determining a 'rating level' for the equipment being assessed, which is the level of noise from an item or items of plant being assessed (measured as an $L_{Aeq,T}$). This is then compared to the typical background sound level at the nearby noise sensitive receptor (measured as an $L_{A90,T}$).
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on the context.
 - A difference of +5 dB 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 that the specific sound source has a low impact, depending on the context.
- 2.8 BS 4142 states that a penalty should be added for any plant that have noise features that may increase disturbance, such as tonal, impulsive, or intermittent characteristics. With respect to acoustic feature correction, BS 4142 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."*
- 2.9 A rating penalty for a sound may be based on a subjective assessment of its characteristics or using objective methods to determine tonality.

3. Site Description and Noise Survey

- 3.1 The proposed development is situated along Princess Road, Manchester, M20 1NA. To the north and west are buildings and sports facilities that belong to Manchester Rovers Football Club, The Greater Manchester Police Sports and Social Club, and YSG Football Academy. The sports facilities mainly consist of sports pitches with the associated facility buildings.
- 3.2 Residential dwellings are located east from the site on the opposite side of Princess Road. The proposed development comprises of a new two-storey extension to Hough End Leisure Centre, this contains a café, changing spaces with WCs on the ground floor and fitness suite with a club room and training room on the first floor.

Identified Nearest Noise Sensitive Receptors

- 3.3 The nearest identified Noise Sensitive Receptors (NSRs) are set out in Table 1 and labelled NSR A.

Table 1: Identified NSRs

NSR	Description	Approximate Distance from Site Boundary
A	Residential Dwellings (Princess Road)	70m

- 3.4 Figure 1 below displays the location of the nearest Noise Sensitive Receptor (NSR A) highlighted with a blue box. The NSR marked below has been chosen due to this position having the least amount of screening from the proposed development, specifically the externally located Air Source Heat Pumps (ASHP), therefore this location presents a worse-case assessment.



Figure 1: Nearest Noise Sensitive Receptor

Noise Survey

- 3.5 SBE have not been appointed to undertake a noise survey, therefore, the assessment has been based on data contained within the Waterman noise assessment. It is understood that the Waterman report was produced during the COVID-19 pandemic. As such, baseline noise conditions were based on historic noise survey data obtained at another site in the vicinity of the development site in September 2017 and publicly available road traffic noise mapping (extrium.co.uk/noiseviewer).
- 3.6 Figure 2 shows the baseline noise levels used to inform the Waterman report.

Period	dB L _{Aeq,T}	dB L _{A90,T}	L _{Amax}
Daytime	75 ¹	54 ¹	92
Night-time	66 ¹	45 ¹	84

Figure 2: Waterman adopted baseline noise levels

- 3.7 The above data displayed in Figure 2 has been used to inform the rating level limits for fixed plant items. This has been set at 5 dB below the adopted background sound level in line with the requirements of MCC and BREEAM 2018 Pol 05.

4. Noise Break-out Assessment

- 4.1 At the planning stage of this development, Waterman assessed the potential noise break-out from the site. Using the proposed façade construction, they calculated the noise break-out using typical amplified music noise levels in a Gym. The octave band noise level used in their assessment is shown in Table 2, below.
- 4.2 The results of the Waterman assessment showed that the noise break-out is calculated to be 19 dB below the typical background noise level and hence, unlikely to cause disruption.

Table 2: Spectrum used in the noise break-out assessments

Unit	Octave Band Sound Pressure Level at 1m (dB L_p)							Total A-weighted Sound Pressure Level (dB L_{pA})
	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	
Waterman internal noise spectrum	67	72	68	84	84	81	71	88
Measured Noise Level in 01-01-14 Training/Club Room	80	92	89	86	82	77	74	88
Measured Noise Level in 01-01-01 Fitness Suite Extension	82	93	90	86	83	77	77	88

Verification Measurements and Assessment

- 4.3 To assess the noise break-out from the building, SBE placed sound sources in the two spaces that the end user would like to have amplified music; the 01-01-14 Training/Club room and the 01-01-01 Fitness Suite Extension. Please note that the removeable wall in the Training/Club room had been removed, so this has been considered as one large space.
- 4.4 The sound sources were then tuned to match the Waterman internal noise spectrum as closely as possible. Due to the limitations of the equipment, an exact octave band match was not possible, however, the overall noise level was the same in both rooms and the low frequency noise was significantly louder. Lower frequencies are more easily transmitted through the building façade. Measurements were taken to verify the octave band noise level. These are also shown in Table 2.
- 4.5 Measurements were then taken at the nearby NSR, shown in Figure 1, with and without the sound sources operating. The noise environment at the NSR was dominated by the road traffic noise from

Princess Road. The noise from the sound sources was not audible. The measured noise levels are shown in Table 3. All measurements were 5 minutes in duration.

Table 3: Measured Noise break-out at the nearby noise sensitive receptor

Measurement Conditions	Measured Ambient Noise Level (dB $L_{Aeq,5min}$)	Maximum Noise Level (dB L_{AFMax})	Background Noise Level (dB $L_{A90,5min}$)	Observations
NSR measurement with internal sound sources	74	84	70	Measurements dominated by road traffic noise from Princess Road. Maximum noise events due to HGV passes. Background noise due to distant road traffic. Sound source noise not audible at NSR.
NSR measurement without internal sound sources	74	80	69	

- 4.6 The measured ambient noise level at the NSR did not change with the internal sound source operating. This matches the observations that the sound source is not audible at the NSR.
- 4.7 There was a slight variation in the background noise, dB $L_{A90,T}$, between the two measurements. This was due to slight variations in the road traffic noise and not due to the internal sound sources. The noise from the internal sound sources was not audible above the road traffic noise.
- 4.8 Based on the above, the subjective assessment indicates that the noise breaking out of the building is not audible at the noise sensitive receptor. On this basis, the noise breaking out of the building is unlikely to disturb the receptor. The noise from the sports pitches lies outside the scope of this report.

5. External Plant Noise Assessment

Plant Noise Limits

- 5.1 The Waterman report sets out plant noise limits based on the baseline data shown in Figure 2. Limits are set at 5 dB below the background noise level (L_{A90}) in line with planning condition 20 imposed by MCC and BREEAM 2018 Pol 05 guidance. These rating level limits are set out in Table 4 in terms of dB $L_{A,T}$ for daytime and night-time periods.

Table 4: BS 4142 Maximum Plant Noise Limits

Location	Period	Representative Background Noise Level (dB $L_{A90,T}$)	Rating Noise Level Limit (dB $L_{A,T}$)
All NSRs	Daytime (07:00 – 23:00)	54	≤ 49
	Night-time (23:00 – 07:00)	45	≤ 40

- 5.2 The building services plant has been installed in three areas. There is an external plant area on the first floor that contains condensers and Heat Recovery Units (HRUs). This plant area is screened from the NSR by the façade of the building, which continues up to roof level, forming an approximately 4m high noise barrier. This plant area is approximately 75m from the nearest NSR.
- 5.3 There are two external ASHP areas that are approximately 10m away from the southern façade of the development. These are approximately 70m and 85m from the NSR respectively and there are two ASHPs contained in each area. There are screens surrounding the ASHP areas, however, they have large gaps in between the slats and so would provide no significant acoustic benefit. The screens have therefore been excluded from this assessment.
- 5.4 Measurements were taken in each of these plant areas to determine the specific sound level of the plant within them. If the plant noise measurement contained road traffic noise from Princess Road, then a background ambient noise level measurement was also taken. The background ambient noise level reading was taken at the same distance from the road as the relevant plant noise reading, but at a location where the plant noise was not audible. The background ambient noise level reading was then subtracted from the plant noise reading to obtain the specific noise level in each of the plant areas. The specific noise level of each of the plant areas is shown in Table 5.

Table 5: Specific Noise Levels of Plant Areas

Plant Area	Calculated Specific Noise Level (dB $L_{Aeq,T}$)
1 st Floor External Plant Area	58
ASHP Area 1	52
ASHP Area 2	72

- 5.5 Using the specific noise levels shown above, the total plant noise rating level was then calculated at the NSR.
- 5.6 No corrections have been made for the acoustic character as the noise is anticipated to be broadband in character. Plant is understood to operate continuously and shall not be intermittent or impulsive, therefore no corrections have been made.
- 5.7 Beyond a correction for the façade screen for the 1st Floor External Plant Area, no other corrections have been made for screening.
- 5.8 It is understood that the plant was operating at 'normal' duty when the measurements were taken and that it will continue to do so in the night-time period.
- 5.9 Table 6 presents the cumulative plant noise levels at the nearest identified NSRs, along with a comparison against the rating noise level limits set out in Table 4.

Table 6: Calculated Plant Noise Levels at NSR A.

Location and Period	Calculated Cumulative Noise Level at NSR (dB $L_{A,T,r}$)	Rating Level Limit (dB $L_{A,T,r}$)	Level Above Rating Level Limit (dB)	Compliant
NSR A Daytime (07:00 – 23:00)	33	49	-16	YES
NSR A Night-time (23:00 – 07:00)	33	40	-7	YES

- 5.10 Table 6 shows that the calculated cumulative plant noise level is more than 5 dB below the typical background noise level at the nearest NSR. Observations at the NSR when other measurements were being taken were that the plant noise is not audible. Planning condition 20 can therefore be discharged and the credit for BREEAM 2018 Pol 05 be awarded.

Estimate of Calculation Uncertainty

- 5.11 An assessment of uncertainty in measurement and calculation is undertaken following guidance in University of Salford document '*A good practice guide on the sources and magnitude of uncertainty arising in the practical measurement of environmental noise*' (2007).
- 5.12 Assessment is undertaken against measured site background sound level measurements. The uncertainty of noise survey measurements is expected to be ± 1 dB based on the allowable uncertainty for a calibrated Class 1 precision integrating sound level meter, quoted by BS 61672-11:2003 as ± 1 dB at 1 kHz.
- 5.13 Sound data for plant equipment has been taken from manufacturer quoted noise. In accordance with BS EN ISO 3740:2001 the uncertainty of source measurement is expected to be ± 1 dB in each octave band.
- 5.14 The uncertainty in a distance attenuation calculation is quoted by ISO 9613-2:1996 as ± 3 dB for sources < 5 m from ground level.
- 5.15 It is therefore considered that the maximum uncertainty in measurement and calculation is ± 4 dB. The uncertainty in the assessment will not change the results of the assessment.

6. Summary and Conclusion

- 6.1 ISG Construction Limited (The Client) have commissioned Stroma Built Environment (SBE) to carry out a noise impact verification survey and report for the proposed extension of Hough End Leisure Centre, 480 Princess Road, Manchester, M20 1NA.
- 6.2 The potential noise break-out from amplified music sources within the development has been measured and assessed. Sound sources were tuned to a typical Gym noise spectrum and placed in rooms where amplified music is likely to be used.
- 6.3 Measurements were then taken at the NSR with and without the sound sources operating. Observations were that the sound sources were not audible at the NSR and that the noise environment at the NSR is dominated by road traffic noise from princess road. The measurements taken showed no change in the ambient noise level with and without the sound sources operating.
- 6.4 On this basis, the noise break-out from the development is not likely to disturb the nearby NSRs. The noise break out aspect of planning condition 19 has been met. The noise from the sports pitches lies outside the scope of this report.
- 6.5 This report has considered the acoustic impact of the operation of mechanical building services plant associated with the proposed development at the nearest identified Noise Sensitive Receptors (NSRs) in relation to satisfying the requirements of BREEAM 2018 Pol 05.
- 6.6 Assessment has been based on the baseline noise condition information detailed in the Waterman report (ref: *WIE17320-100-R-1.1.2(001)*).
- 6.7 In planning condition 20, Manchester City Council require the cumulative plant noise level of all operational plant to be designed to be 5 dB below the prevailing background noise level (L_{A90}) during the daytime and night-time periods. This is the same requirement as for BREEAM 2018 Pol 05.
- 6.8 The results of the assessment (displayed within Table 6) indicates that noise from mechanical building services plant associated with the development meet the requirements of planning condition 20. This planning can therefore be discharged. The credit for BREEAM 2018 Pol 05 may also be awarded.

Appendix I. Acoustic Glossary

Sound pressure level and the decibel, dB

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. The decibel is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Frequency and hertz, Hz

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz. The human range of hearing is commonly accepted to be 20 Hz to 20,000 Hz. Additionally, an octave can be used to describe the interval between a frequency in Hz and either half or double that frequency.

Frequency weighting

Different weighting networks can be applied to a given sound level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The most commonly used weighting network is the 'A' weighting, and the letter 'A' will be included within a descriptor to indicate that the value has been 'A' weighted, e.g. $L_{Aeq,T}$ or L_{A90} . An 'A' weighted noise level may also be written as dB(A). Other weightings less commonly used are 'C' and 'D' weighting.

Noise indices

When a noise level varies with time, the measured 'A' weighted dB level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple 'A' weighted dB value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The various indices used are described as below:

$L_{Aeq,T}$	The 'A' weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, T
L_{Amax}	The maximum 'A' weighted noise level that was recorded during the monitoring period.
L_{A10}	The 'A' weighted noise level that was recorded for at least 10% of the monitoring period.
L_{A90}	The 'A' weighted noise level that was recorded for at least 90% of the monitoring period, usually taken as the underlying 'background' noise level.

Sound level difference, D

The sound level difference between two internal spaces, or between internal and external spaces. The ' D ' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to

describe an overall performance. Note that the 'D' value will always describe an in-situ or on-site acoustic performance. All values are described using the decibel.

D_w	Single figure weighted sound level difference, simply the measured source noise level minus receiver noise level, not adjusted to reference conditions
$D_{nT,w}$	Weighted normalised sound level difference – a single, weighted sound insulation value, normalised to a reference reverberation time using the measured reverberation time in the receive room
$D_{nT,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
$D_{nf,w}$	Overall flanking normalised level difference - A parameter that defines the flanking transmission of sound from room to room where a dividing partition or floor construction abuts a flanking building element common to both rooms, such as the building façade or ceiling
$D_{n,e,w}$	Element normalised level difference. A level difference level derived transmission through the small technical element only, irrespective of area. This value is used to represent the sound insulation of façade ventilators.
$D_{n,e,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise

Sound reduction index, R

This describes the sound transmitted through a material or building element, such as a wall, door or window. It is measured in a laboratory with suppressed flanking transmission. The 'R' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to describe an overall performance. All values are described using the decibel.

R_w	Weighted single figure sound reduction index
$R_w + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
R'_w	The 'apparent sound reduction index', a field measurement to obtain the sound reduction index of a material or element, with all effects of site installation accepted.

Standardised impact sound pressure level, $L'_{nT,w}$

$L'_{nT,w}$ is the single figure used to characterise the impact sound pressure level in a receiving room, normalised to a reference reverberation time. Impact noise can be classified as (but is not limited to) the result of footfall impact on a separating floor to a habitable space below. All values are described using the decibel.

Reverberation time, T and T_{mf}

The reverberation time of a space is a measure of the rate at which sound decays, measured in seconds. It is defined as the time taken for the sound pressure level to reduce by 60 dB from its original impulse level.

Reverberation time is commonly quoted in terms of the mid-frequency reverberation time, T_{mf} , the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands.

Absorption Coefficient

The acoustic absorption provided by a surface is defined as the sound absorption coefficient α , which denotes the fraction of sound energy absorbed between 0 (no absorption) and 1 (no reflection). The absorption coefficient of a material varies with the frequency of incident sound waves, therefore is considered for different frequencies.

Absorption Class

Based on the absorption coefficients, the overall sound absorption of a material is classified from Class A to Class E as defined in BS EN ISO 11654:1997, with Class A providing the highest level of acoustic absorption.

Noise rating, NR

The noise rating or NR system is commonly used in the design of noise emitted by internal building services systems. The system is frequency dependent, and was empirically derived to prevent disturbance to occupants in habitable or working areas from building services noise that exhibits 'tonal' elements, e.g. rumbles, whines, whistles etc. There is no direct relationship between the average 'A' weighted noise level in dB and the NR. However, as a guide, and assuming the absence of strong low frequency content in a given noise, the NR could generally be said to be 6 dB less than the average 'A' weighted dB value.

Privacy

Privacy is the addition of the level of sound insulation between two rooms and the background noise within a receiving room. It can be used to assess the level of privacy afforded in the 'receiving room' for speech from the 'source room'. The 'privacy factor' is a unit-less value that is the combination of the average 'A' weighted background noise level in dB and the weighted sound level difference (D_w) in dB.

Appendix II. SBE Acoustic Credentials

SBE have specialised in providing the UK Construction Industry with a range of acoustics services since 2006. Specialising in Building Acoustics, all SBE acousticians are members of the Institute of Acoustics.

SBE is accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) (Testing Laboratory Number 2731).

SBE meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

This report has been authorised by Tom Chaffer, Associate who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;

1. Holds an MSc degree in Audio Acoustics from the University of Salford
2. Has been an Acoustic Consultant for more than three year's (within the last five years). This experience includes a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.
3. Holds Membership of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed by Tom Chaffer and has been found to;

1. Represent sound industry practice
2. Be appropriate given the building being assessed and scope of works proposed
3. Avoid invalid, biased and exaggerated recommendations.

Appendix III. Report Conditions

This document has been prepared for the sole use, benefit and information of the Client. The liability of Stroma Built Environment Ltd. in respect of the information contained herein will not extend to any third party unless prior agreement is obtained in writing from Stroma Built Environment Ltd.

This report is limited to addressing the specific acoustic issues contained herein. Advice has been provided for acoustic reasons only and it is recommended that appropriate expert advice be sought on all the ramifications, e.g. safety, fire, structural, CDM etc., associated with any proposals contained herein.

The in-situ performance of acoustic measures is influenced to a large extent by the quality of workmanship and compliance with the specifications on-site during construction, as such, Stroma Built Environment Ltd. accepts no liability for issues with acoustic performance arising from such factors.

Acoustic survey and testing work carried out for the project is representative of the prevailing conditions at the time of the work. Conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

In particular, it should be noted that where calculations are carried out that are based on assumptions regarding certain aspects where information has not been supplied, these are provided for indicative purposes only and should be treated as such.