



REPORT REFERENCE:

IMP7451-1

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

PRoPG Planning and Noise

British Standard 8233: 2014

British Standard 4142: 2014 +A1:2019

CLIENT:

CAAD Ltd

SITE:

25 Mengham Road, Hayling Island

SURVEY DATES:

25th – 29th October 2023

Impact Acoustics Ltd

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1 EXECUTIVE SUMMARY

1.1 Instruction

Impact Acoustics Ltd have been instructed by CAAD Ltd to undertake a background noise survey to British Standard 8233: 2014 and BS 4142: 2014+A1: 2019 to determine the impact of noise sources on the proposed accommodation scheme at 25 Mengham Road, Hayling Island.

1.2 Scope of Report

The measurements will be undertaken in accordance with ISO 1996 – Part 2: 2017 to determine the existing background noise levels and British Standard 8233: 2014 will be used to determine the impact of existing traffic on the internal noise environment within the proposed residential dwellings. This report aims to establish the following:

- Existing background noise levels within the area;
- Assess the potential internal noise levels on the proposed rooms;
- Provide specifications for the ventilation and window glazing with the proposed rooms.

1.3 Summary of Results

1.3.1 Background Noise Levels (Representative)

A background noise survey was undertaken from 25th – 29th October 2023 at the nearest site boundary to establish the underling background noise levels. The average maximum day time levels were found to be $L_{Aeq, 16 \text{ hour}}$ 54.6 dB and the maximum night time levels were found to be $L_{Aeq, 8 \text{ hours}}$ 45.3 dB.

1.3.1.1 Measured Data

Assessment Position	Date	Day (0700 - 2300)	Night (2300 -0700)
1	25/10/2023	52.7	45.4
1	26/10/2023	54.1	44.0
1	27/10/2023	56.6	47.5
1	28/10/2023	55.0	44.1
1	29/10/2023	54.7	45.7

Assessment Position	Date Start	Date Finish	Daytime LAeq	Night Time LAeq
Position 1	25/10/2023	29/10/2023	54.6	45.3

Date	Time Frame	Leq (63Hz)	Leq (125Hz)	Leq (250Hz)	Leq (500Hz)	Leq (1kHz)	Leq (2kHz)	Leq (4kHz)
25/10/2023	Day	60.3	55.3	49.6	46.5	49.1	45.4	39.3
25/10/2023	Night	53.7	45.0	42.7	40.8	41.9	40.7	35.0
26/10/2023	Day	60.6	57.3	51.9	47.6	50.3	47.0	41.3
26/10/2023	Night	52.1	43.8	40.2	38.1	40.7	39.4	35.3
27/10/2023	Day	60.6	57.3	51.9	47.6	50.3	47.0	41.3
27/10/2023	Night	52.1	43.8	40.2	38.1	40.7	39.4	35.3
28/10/2023	Day	60.1	55.8	51.6	48.8	51.1	48.4	43.2
28/10/2023	Night	46.0	42.3	39.4	37.2	38.8	37.2	33.5

1.3.2 Potential Façade Noise Levels

Noise Risk Category	0 – Negligible	1 – Low	2 – Medium	3 - High
Average Daytime	<50 dB	50 – 63 dB	63 – 70 dB	>70 dB
Average Night Time	<40 dB	40 – 55 dB	55 – 60 dB	>60 dB
Maximum Night Time			>80 dB (2 Times in 8 Hours)	

1.3.2.1 Daytime (07:00-23:00)

Time Period	Highest Potential Façade Noise Level	Noise Risk Category 1 - Low
Average Daytime (07:00-23:00)	L _{Aeq} , 16 HOUR 54.6 dB	50-63 dB

1.3.2.2 Night Time (23:00-07:00)

Time Period	Highest Potential Façade Noise Level	Noise Risk Category 1 Low
Average Night Time (23:00-07:00)	L _{Aeq} , 16 HOUR 45.3 dB	40 – 55 dB
		>80 dB (0 Times in 8 Hours)

1.4 Risk Assessment

1.4.1 Daytime (07:00-23:00)

Risk Assessment Category	Risk Assessment
1 – Low	At Low noise levels, the site is likely to be acceptable from a noise perspective provided that good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development

1.4.2 Night Time (23:00-07:00)

Risk Assessment Category	Risk Assessment
1 – Low	At Low noise levels, the site is likely to be acceptable from a noise perspective provided that good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development

1.5 Requirements for noise mitigation

In order to meet reasonable internal levels in accordance with BS8233:2014; all facades should implement the following mitigation measures:

Construction of Walls	Standard masonry construction
Construction of Windows	4mm glass / 16mm air gap / 4mm glass
Construction of Ventilation	MVHR

Detailed calculations indicated that internal noise levels within the proposed residential properties will comply with the requirements of British Standard 8233: 2014.

Time Period	Façade / Area	Specification	Room / Space	Resulting Internal Level dB(A)	Criteria Limit
Day	Front	4 /16 / 4 + MVHR	Bed	28 dB LAeq,16hour	35dB
Night	Front	4 /16 / 4 + MVHR	Bed	17 dB LAeq, 8hour	30dB
Resulting Internal Levels calculated in accordance with BS8233:2014 per time period					

1.6 Conclusions

Representative source levels have been recorded and assessments made in accordance with BS8233:2014. Internal criterion has been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

1.7 NPPF 2019

National Planning Policy Framework 2019 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

1.8 Planning Approval Recommendation

Based on the calculations and assessments made within this report it is the professional opinion of Impact Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2019, NPPF & NPSE and that, with regards to sound, planning permission can be granted.

2 INTRODUCTION

Impact Acoustics Ltd have been instructed by CAAD Ltd to undertake a background noise survey to British Standard 8233: 2014 and BS 4142: 2014+A1: 2019 to determine the impact of noise sources on the proposed accommodation scheme at 25 Mengham Road, Hayling Island.

A background noise survey was undertaken from 25th – 29th October 2023 at the nearest site boundary to establish the underling background noise levels. The average maximum day time levels were found to be $L_{Aeq, 16 \text{ hour}}$ 54.6 dB and the maximum night time levels were found to be $L_{Aeq, 8 \text{ hours}}$ 45.3 dB.

This report by Impact Acoustics Ltd gives the results of these measurements and an assessment in accordance with government planning guidelines and relevant standards together with mitigation measures as required.

With regards to external ambient noise, environmental noise levels are to be monitored at the site in accordance with British Standard 7445: 2003 'Description and measurement of environmental noise assessments and assessments made in-line with PROPG: Planning and Noise.

3 CRITERION

3.1 Planning Practice Guidance and Noise

March 2014 saw the publication of the Planning Practice Guidance for Noise (PPG-Noise) and this was subsequently updated in 2023. The Planning Practice Guidance and Noise sets out details of how potential noise impacts should be evaluated.

‘Local planning authorities’ plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.’

In accordance with Stage 2: Full Assessment, Other Noise Sources, detailed calculations and assessments should be carried out pertaining to these as PPG Noise does not provide advice and guidance when taking these elements into consideration.

3.1.1 Professional Practice Guidance on Planning & Noise.

The Professional Practice Guidance (PRoPG) on Planning and Noise for New Residential Development was published in May 2017 by the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH). This document was developed in order to offer professional guidance on recommended strategies to the management of noise for use in the associated planning applications for specific sites. This furthermore, provides a numerical acoustic standard in accordance with the Government’s planning and noise policies.

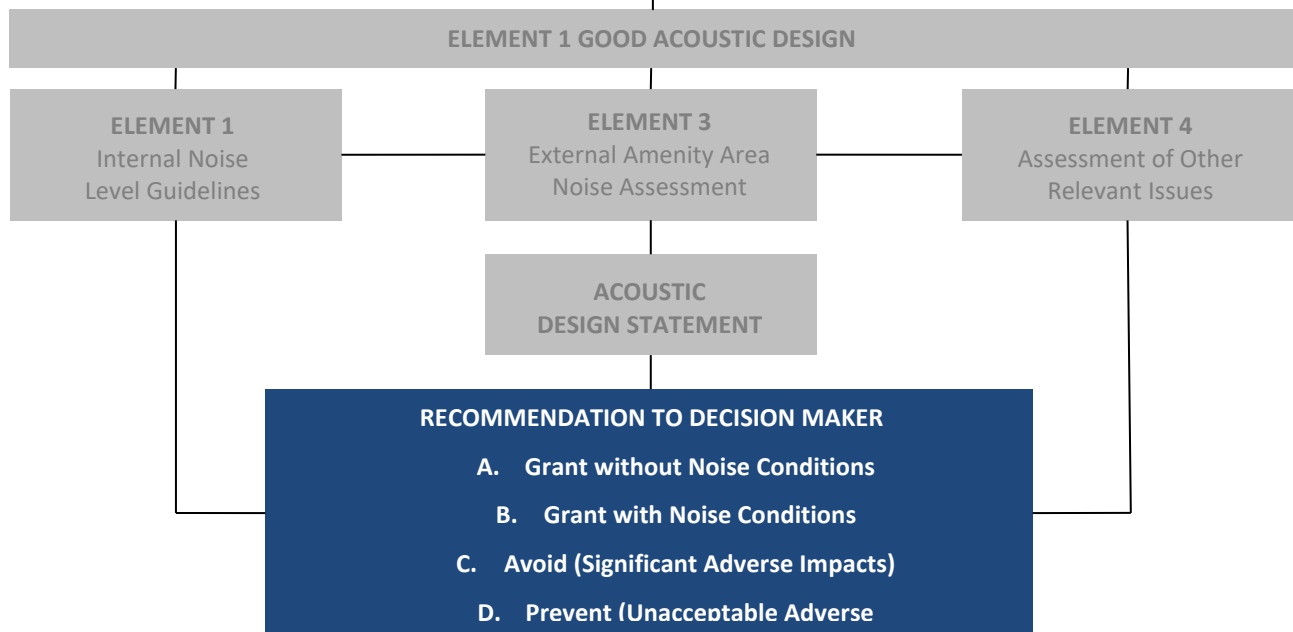
This document has been developed to ensure the developers adopts a good acoustic design process to ensure protection for future residents from the potential harmful effects from noise. The PRoPG denotes that it *‘does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy on which users should take their own advice as appropriate’*.

The PRoPG adopts a twin-stage approach, firstly providing an ‘Initial Noise Risk Assessment’ of the proposed development site before undertaking a detailed approach of a noise impact assessment. The results from the initial noise risk assessment are an indication of the general acoustic environment of the proposed development and demonstrate how detailed the noise impact assessment will need to be in order to mitigate any acoustic issues.

STAGE 1: INITIAL SITE RISK ASSESSMENT

NEGLIGIBLE RISK	LOW RISK	MEDIUM RISK	HIGH RISK
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STAGE 2: FULL ASSESSMENT



3.2 British Standard 8233: 2014

Calculations are to be made in accordance with BS 8233: 2014 Sound Insulation and Noise Reduction for Buildings Code of Practice.

BS 8233: 2014 set the following parameters as target levels that should be designed to within rooms such as Living Rooms and Bedrooms.

Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important		
Objective	Typical situations	Design Range $L_{Aeq,t}$ dB
Typical noise levels for acoustic privacy in shared spaces	Living room	35 – 40
NOTE: See Noise control in building services [28] and BS EN ISO 3382.		

Indoor ambient noise levels for dwellings			
Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB L_{Aeq} 16 HOUR	--
Dining	Dining Room / Area	40 dB L_{Aeq} 16 HOUR	--
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} 16 HOUR	30 dB L_{Aeq} 8 HOUR

Calculations and assessments are therefore to be carried out in order to satisfy the above requirements of BS8233: 2014.

3.3 National Planning Policy Framework 2023 (NPPF) and Noise Policy Statement for England 2010 (NPSE).

References and evaluations are to be made to the National Planning Policy Framework 2023 (NPPF) and the Noise Policy Statement for England 2010 (NPSE). The purpose of this document is to include all aspects of environmental noise within assessments i.e. environmental noise, neighbour noise and neighbourhood noise. Noise is to be considered alongside other relevant issues relating to the site and should not be considered in isolation, according to the NPSE. There are several key phrases within the NPSE aims and these are discussed below.

3.3.1 “Significant adverse” and “adverse”

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

3.3.2 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.

3.3.3 LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

3.3.4 SOAEL – Significant Observed Adverse Effect Level

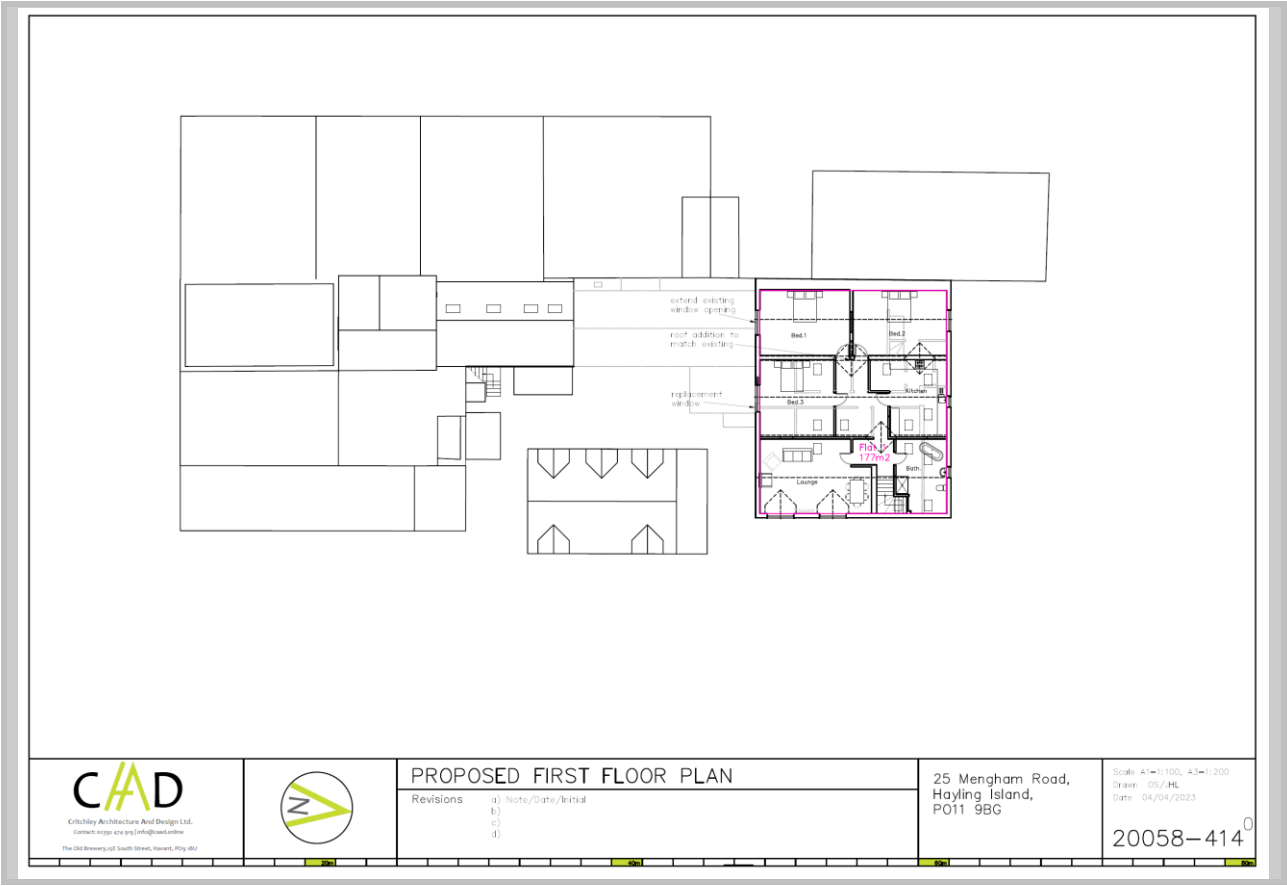
This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

Finally, assessments and references are to be made to the World Health Organisation Night Time Noise Guidance 2009.

4 PROPOSED DEVELOPMENT

4.1 Proposed Layout



5 BACKGROUND NOISE LEVELS

5.1 Location of Measurements



The background noise levels were assessed by positioning one environmental noise monitoring station as labelled above per position. The position was ascertained at the proposed first floor façade level.

6 PROCEDURE

External noise levels were recorded over a typical period and analysis date extrapolated between 25th – 29th October 2023 at 1 position as detailed within this report.

Position 1 was located at the site to capture the noise from the environment. Sample measurements were recorded over continuous 15 minute samples and from this data the hourly LAeq daytime values have been evaluated. Sound Pressure Levels were recorded on the following setting along with a full octave band frequency analysis measured simultaneously and between 31.5 Hz and 16.0 kHz.

<u>Daytime 07:00 – 23:00</u>		<u>Night Time 23:00 – 07:00</u>	
LAeq 1 HOUR dB	LA10 1 HOUR dB	LAeq 15 MINUTES dB	LA10 15 MINUTES dB
LAMAX 1 HOUR dB	LA50 1 HOUR dB	LAMAX 15 MINUTES dB	LA50 15 MINUTES dB
LAMIN 1 HOUR dB	LA90 1 HOUR dB	LAMIN 15 MINUTES dB	LA90 15 MINUTES dB

Calculations have been made in accordance with BS 8233: 2014 'Sound Insulation and Reduction of Buildings - Code of Practice'. Recommendations were made for any additional acoustics measures to conform to these standards.

From the downloaded recorded results, the daytime and night time periods were assessed and used within the above calculations as LAeq 16 HOUR dB levels for daytime and LAeq 8 HOUR dB levels for night time. These are detailed within this report. All data averaged throughout the day has been done so on a logarithmic basis to give accurate LAeq 16 Hour dB daytime and LAeq 8 Hour dB night time noise levels.

7 BACKGROUND NOISE MEASUREMENT

7.1.1 Background Noise Levels (Representative)

A background noise survey was undertaken from 25th – 29th October 2023 at the nearest site boundary to establish the underlying background noise levels. The average maximum day time levels were found to be $L_{Aeq, 16 \text{ hour}}$ 54.6 dB and the maximum night time levels were found to be $L_{Aeq, 8 \text{ hours}}$ 45.3 dB.

7.1.1.1 Measured Data

Assessment Position	Date	Day (0700 - 2300)	Night (2300 -0700)
1	25/10/2023	52.7	45.4
1	26/10/2023	54.1	44.0
1	27/10/2023	56.6	47.5
1	28/10/2023	55.0	44.1
1	29/10/2023	54.7	45.7

Assessment Position	Date Start	Date Finish	Daytime LAeq	Night Time LAeq
Position 1	25/10/2023	29/10/2023	54.6	45.3

Date	Time Frame	Leq (63Hz)	Leq (125Hz)	Leq (250Hz)	Leq (500Hz)	Leq (1kHz)	Leq (2kHz)	Leq (4kHz)
25/10/2023	Day	60.3	55.3	49.6	46.5	49.1	45.4	39.3
25/10/2023	Night	53.7	45.0	42.7	40.8	41.9	40.7	35.0
26/10/2023	Day	60.6	57.3	51.9	47.6	50.3	47.0	41.3
26/10/2023	Night	52.1	43.8	40.2	38.1	40.7	39.4	35.3
27/10/2023	Day	60.6	57.3	51.9	47.6	50.3	47.0	41.3
27/10/2023	Night	52.1	43.8	40.2	38.1	40.7	39.4	35.3
28/10/2023	Day	60.1	55.8	51.6	48.8	51.1	48.4	43.2
28/10/2023	Night	46.0	42.3	39.4	37.2	38.8	37.2	33.5

7.1.2

7.1.3 Potential Façade Noise Levels

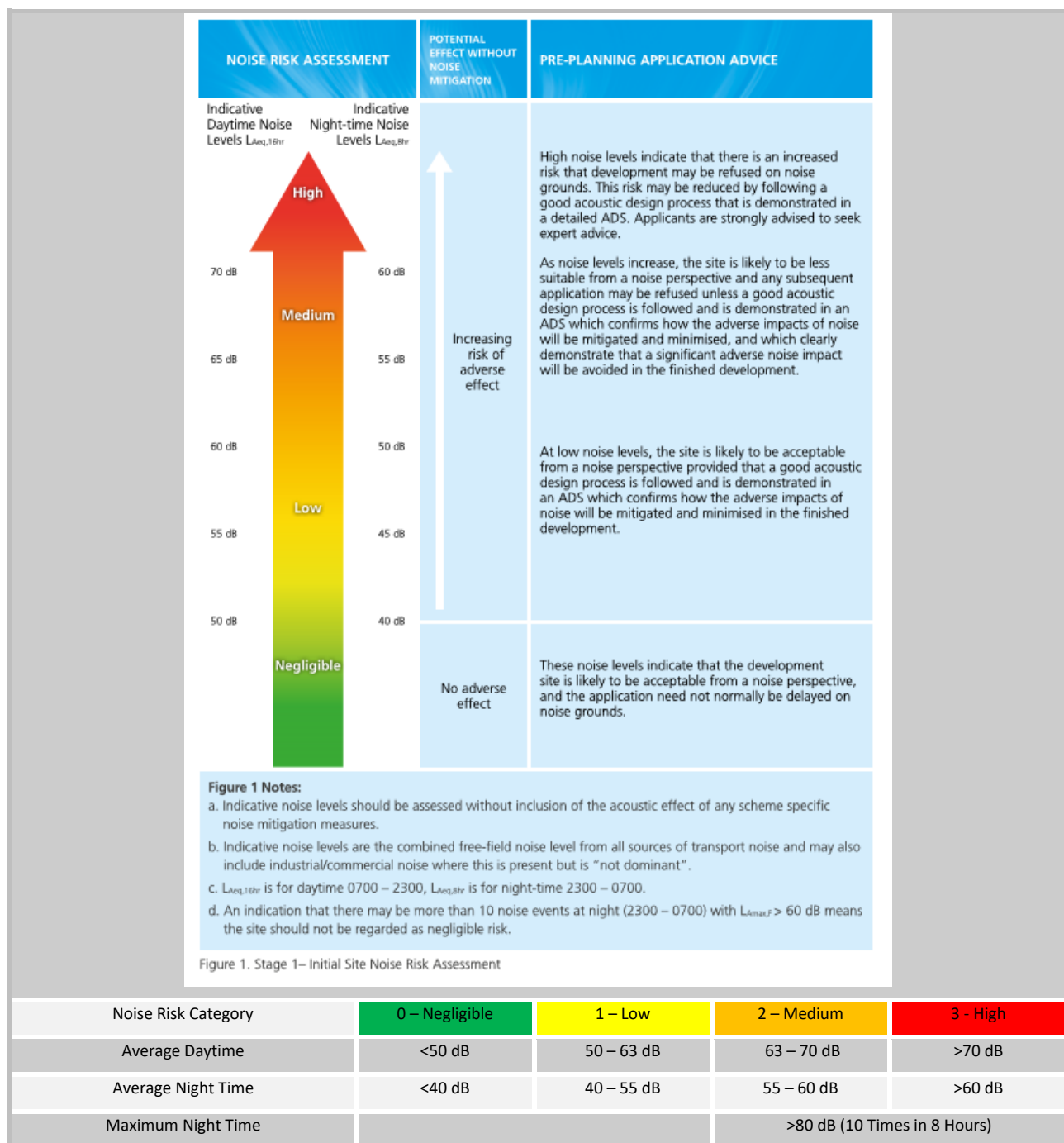
Noise Risk Category	0 – Negligible	1 – Low	2 – Medium	3 - High
Average Daytime	<50 dB	50 – 63 dB	63 – 70 dB	>70 dB
Average Night Time	<40 dB	40 – 55 dB	55 – 60 dB	>60 dB
Maximum Night Time			>80 dB (2 Times in 8 Hours)	

8 PROPG PLANNING & NOISE STAGE 1

8.1 Stage 1: Initial Site Noise Risk Assessment

The Stage 1, Initial Noise Risk Assessment, compares the recorded ambient noise levels obtained from the acoustic survey and correlates these against the risk scale within the Pro PG Document in order to evaluate any potential adverse effects the site is currently exposed to with regards to noise.

The outcome of the Stage 1 assessment will determine the level of detail required within Stage 2 in order to demonstrate suitable mitigations can be introduced to ensure continuing compliance with the relevant standards, local planning policies and Pro PG. The following table demonstrates the Initial Risk Assessment Noise Levels as detailed within PROPG Figure.1:-



Based on the data collected from the aforementioned noise survey, the following PROPG Stage 1 assessments can be made:-

8.1.1.1 Daytime (07:00-23:00)

Time Period	Highest Potential Façade Noise Level	Noise Risk Category 1 - Low
Average Daytime (07:00-23:00)	L _{Aeq, 16 HOUR} 54.6 dB	50-63 dB

8.1.1.2 Night Time (23:00-07:00)

Time Period	Highest Potential Façade Noise Level	Noise Risk Category 1 Low
Average Night Time (23:00-07:00)	L _{Aeq, 16 HOUR} 45.3 dB	40 – 55 dB
		>80 dB (0 Times in 8 Hours)

8.2 Risk Assessment

8.2.1 Daytime (07:00-23:00)

Risk Assessment Category	Risk Assessment
1 – Low	At Low noise levels, the site is likely to be acceptable from a noise perspective provided that good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development

8.2.2 Night Time (23:00-07:00)

Risk Assessment Category	Risk Assessment
1 – Low	At Low noise levels, the site is likely to be acceptable from a noise perspective provided that good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development

9 PROPG PLANNING & NOISE STAGE 2 - ELEMENT 1 – GOOD ACOUSTIC DESIGN

Given the size and orientation of the proposed site, it is recommended that the developer adopt, where practically possible, a good acoustic design which should include careful consideration of the positioning of the proposed properties together with thoughts being taken as to internal layouts to minimise noise sensitive rooms facing onto dominant noise sources within the local areas.

10 CALCULATIONS

10.1 Calculation Procedure

$$L_{eq,2} \approx L_{eq,ff} + 10 \cdot \log_{10} \left(\frac{A_0}{S} \cdot 10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S} \cdot 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} \cdot 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} \cdot 10^{\frac{-R_{rr}}{10}} \right) + 10 \cdot \log_{10} \left(\frac{S}{A} \right) + 3$$

$L_{eq,2}$ = Equivalent sound pressure level internally within the room (dB) – reference $2 \times 10^{-5} \text{Nm}^{-2}$.

$L_{eq,ff}$ = Equivalent sound pressure level externally outside the room under consideration (dB) – reference $2 \times 10^{-5} \text{Nm}^{-2}$.

A_0 = Reference absorption area within room of 10m^2 and independent of frequency.

S_f = Total façade area of room in question (m^2).

S_{wi} = Area of windows or glazing within the room (m^2).

S_{ew} = Area of external wall within the room (m^2).

S_{rr} = Area of the ceiling within the room (m^2).

S = Total area of elements through which sound enters the room (m^2). i.e. $S = S_f + S_{rr}$

$D_{n,e}$ = Sound insulation of the trickle vent measured to British Standard 20140 – Part 10: 1992 (Withdrawn)

R_{wi} = Sound reduction index of the window (dB)

R_{ew} = Sound reduction index of the external wall (dB)

R_{rr} = Sound reduction index of the ceiling (dB)

A = Equivalent absorption of the room under consideration (m)

10.2 Ventilation (D_{ne})

In accordance with Note 5 from BS8233:2014 below a mechanical ventilation system or MVHR is recommended:

NOTE 5 *If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level.*

Note 5 Page 25 BS8233:2014

Due to the façade levels at certain section of the site being in excess of 45dB LAeq, daytime; suitable mechanical ventilation is recommended that meets the requirements of Part F of the Building Regulations to alleviate the requirement for ventilation by open windows.

10.3 Ventilation (D_{ne})

Octave Band Frequency	63	125	250	500	1000	2000	4000
MVHR	40	43	42	45	53	55	55

10.4 Glazing (R_{wi})

Octave Band Frequency	63	125	250	500	1000	2000	4000
4mm glass / 16mm air gap / 6mm glass	24	24	18	26	40	45	39

10.5 Walls (R_{ew})

Octave Band Frequency	63	125	250	500	1000	2000	4000
Brick and Concrete Block	40	43	42	45	53	55	55

10.6 Ceiling (R_{rr})

Octave Band Frequency	63	125	250	500	1000	2000	4000
1 x 12mm Fireline	26	28	34	40	45	49	49

The above are minimum construction attenuation values and should alternative methods be selected; these should be equal to or greater than the above corresponding values. Calculations carried out have indicated the following specifications should be installed for this site.

10.7 Calculations

10.7.1 1st Floor Bed

Proposed Window Configuration			Ventilation	Daytime Corrected		Night time corrected
4mm glass / 16mm air gap / 4mm glass			MVHR			
Leqff	The equivalent continuous sound pressure level outside the room elements under consideration					
A0	The reference absorption area of 10m2 and is independent of frequency					
Sf	The total façade area of the room in question					
Swi	The area of the windows in the room					
Sew	The area of the external wall of the room					
Srr	The area of the ceiling of the room (if applicable)					
S	The total area of the elements through which sound enters the room					
Dne	The insulation value of the trickle ventilator (if applicable)					
Rwi	The sound reduction index of the window					
Rew	The sound reduction index of the external wall					
Rrr	The sound reduction index of the ceiling/roof (if applicable)					
A	The equivalent absorption area of the receiving room where A=0.163V/T					
Formula	$Leq2=Leqff+10\log[A0/S*10^{(-Dne/10)}+Swi/S*10^{(-Rwi/10)}+Sew/10*10^{(-Rew/10)}+Srr/S*10^{(-Rrr/10)}]+10\log(S/A)+3$					
	Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000
Sf	9.2	9.2	9.2	9.2	9.2	9.2
Sr	0.0	0.0	0.0	0.0	0.0	1.0
Swi	3.0	3.0	3.0	3.0	3.0	3.0
Sew	6.2	6.2	6.2	6.2	6.2	6.2
Srr	0.0	0.0	0.0	0.0	0.0	1.0
S	9.2	9.2	9.2	9.2	9.2	10.2
A0	10.0	10.0	10.0	10.0	10.0	10.0
V	27.6	27.6	27.6	27.6	27.6	27.6
T (BS8233)	0.5	0.5	0.5	0.5	0.5	0.5
A	8.9	8.9	8.9	8.9	8.9	8.9
Daytime Leqff	55.8	51.6	48.8	51.1	48.4	43.2
Night time Leqff	43.8	40.2	38.1	40.7	39.4	35.3
Dne	40	38	37	34	37	38
Rwi	24	18	26	40	45	39
Rew	40	38	37	34	37	56
Rrr	28	34	40	45	49	49
Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)			LAeq 16 HOUR		28	dB(A)
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)			LAeq 8 HOUR		17	dB(A)

10.7.2 Glazing & Ventilation Assessment

The house should be designed with a 4mm glass / 16mm air gap / 4mm glass glazed windows and an MVHR unit to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

10.8 Night Noise Guidelines Europe 2009

The Night Noise Guidelines 2009 make direct reference to the World Health Organisations Guidelines for Community Noise 1999 with recommended guideline criteria of L_{Aeq} 30 dB indoors for continuous noise. The document goes on to explain that sleep disturbance correlates best with L_{Amax} and effects have been observed at 45 dB or less. This is particularly true if the background noise level is low. Noise events exceeding 45 dB(A) should therefore be limited.

Pro PG: Planning and Noise Appendix A 'Dealing with Noise Events' A.17 states that:-

Various studies have linked the L_{Amax} from individual noise events to behavioural awakenings. For example one study found that the "Probability of sleep stage changes to wake/S1 from railway noise increased significantly from 6.5% at 35 dB(A) to 20.5% at 80 dB(A) $L_{Amax,F}$ whilst another study concluded that "noise disturbance of sleep may be expected to become significant once the outdoor L_{Aeq} exceeds 55 dB provided peak noise levels do not exceed 75 to 80 dB. Higher L_{Aeq} values up to 60 dB may be allowed providing the peak levels do not exceed 85 dB, and the number of such events is less than about 20 per night". Based on these studies it can be concluded that at night (2300 - 0700 hrs) a significant effect on sleep disturbance e.g. behavioural awakening, is likely to occur where the maximum sound level at the façade of a building with partially open windows is above:

85 dB $L_{Amax,F}$ (where the number of events exceeding this value is ≤ 20);

or

80 dB $L_{Amax,F}$ (where the number of events exceeding this value is > 20).

Pro PG: Planning and Noise Appendix A 'Dealing with Noise Events' A.18 goes on to explain that:-

A.18 The main body of sleep research is consistent with a careful interpretation of the viewpoint set out in the World Health Organisation Guidelines which for the ordinary population is that:

- *Impacts on sleep can be detected from relatively low level maximum noise events, however the degree of resulting harm may not be significant.*
- *'Effects' on sleep (such as EEG awakenings and sleep stage changes) occur spontaneously in the general population many times per night regardless of any impacts due to noise.*
- *The smaller the number of noise events, the louder the maximum noise level that can be tolerated without adverse effects upon sleep; subject to an upper limit.*
- *At relatively low levels e.g. around 45 dB $L_{Amax,F}$ when sufficient number of such events take place during the night the adverse effects of individual noise events are likely to be limited to sleep disturbance in the form of changes in sleep state or perhaps some EEG awakenings.*
- *It normally requires noise levels higher than 45 dB $L_{Amax,F}$ before significant adverse effects such as behavioural awakenings, difficulty getting to sleep, premature awakening or difficulty getting back to sleep generally occur and the latest field research on and aircraft noise suggest that it requires internal L_{Amax} noise levels of around 65 dB before noise induced awakenings become distinguishable from spontaneous awakenings).*

Therefore the following tabulated results from the worst night have been calculated and demonstrate compliance with the requirements of Pro PG.

The 15 minute data has been split down into 5 minute segments and the L_{Amax} dB levels evaluated for each section throughout the night with the highest L_{Amax} dB Level.

The following table demonstrate the results and the evaluated 11th highest L_{Amax} .

NIGHT TIME NOISE LEVELS 23:00 - 07:00 15 MINUTE SAMPLES – CALCULATED UNIT 1				
Date / Time	LAeq	LAmax	$L_{Amax,F}$ 80 - 85 dB	$L_{Amax,F}$ > 85 dB
23:00 - 23:15	23:00 - 23:15	40	50	–
23:15 - 23:30	23:15 - 23:30	41	52	–
23:30 - 23:45	23:30 - 23:45	42	54	–
23:45 - 00:00	23:45 - 00:00	50	71	–
00:00 - 00:15	00:00 - 00:15	49	72	–
00:15 - 00:30	00:15 - 00:30	45	67	–
00:30 - 00:45	00:30 - 00:45	42	58	–
00:45 - 01:00	00:45 - 01:00	40	55	–
01:00 - 01:15	01:00 - 01:15	37	55	–
01:15 - 01:30	01:15 - 01:30	57	74	–
01:30 - 01:45	01:30 - 01:45	45	60	–
01:45 - 02:00	01:45 - 02:00	51	73	–
02:00 - 02:15	02:00 - 02:15	48	70	–
02:15 - 02:30	02:15 - 02:30	42	56	–
02:30 - 02:45	02:30 - 02:45	38	51	–
02:45 - 03:00	02:45 - 03:00	40	60	–
03:00 - 03:15	03:00 - 03:15	42	62	–
03:15 - 03:30	03:15 - 03:30	39	51	–
03:30 - 03:45	03:30 - 03:45	43	64	–
03:45 - 04:00	03:45 - 04:00	46	66	–
04:00 - 04:15	04:00 - 04:15	37	54	–
04:15 - 04:30	04:15 - 04:30	45	53	–
04:30 - 04:45	04:30 - 04:45	43	49	–
04:45 - 05:00	04:45 - 05:00	40	51	–
05:00 - 05:15	05:00 - 05:15	36	47	–
05:15 - 05:30	05:15 - 05:30	38	52	–
05:30 - 05:45	05:30 - 05:45	35	49	–
05:45 - 06:00	05:45 - 06:00	48	71	–
06:00 - 06:15	06:00 - 06:15	50	72	–
06:15 - 06:30	06:15 - 06:30	54	73	–
06:30 - 06:45	06:30 - 06:45	52	76	–
06:45 - 07:00	06:45 - 07:00	46	68	–
Total Event Count			0	0
Pro PG Annex Event Quantity Criteria			>20	<20
Pro PG Criteria Assessment			Achieved	Achieved

With the proposed glazing and ventilation strategies implemented on this site, the following calculated internal levels have been evaluated accordingly:-

Item		Night Time (23:00-07:00)	Description
1	Recorded External Noise Level	44	Recorded Noise Level at the Monitoring Position
2	Calculated Highest Façade Level	44	Highest recorded façade level of the proposed development closest to the above associated monitoring position.
3	Façade Correction	0	Difference between Recorded and Calculated (Item 1 and 2)
4	Calculated Façade Attenuation	27	Calculated façade attenuation taken from the highest recorded LAeq 8 HOUR dB night time noise level, minus the highest calculated internal noise level taken from the BS 8233 calculations.
5	L _{Amax} 45 dB Criteria	45	L _{Amax} 45 dB Criteria taken from WHO Guidelines. BS 8233 does not reference L _{Amax} dB noise level criteria.
6	Calculated Façade Level Outside	72	Addition of Items 4 and 5 to give a resultant target level for the 11th Highest L _{Amax}
7	11 th Percentile Recorded L _{Amax}	68	11th Recorded L _{Amax}
8	L _{Amax} Criteria Achieved	YES	If Item 7 is equal or less than 6, then the site is likely to be compliant. If not, further calculations are required

The above table demonstrates that the upgraded glazing and ventilation will result in the internal L_{Amax} 45 dB criteria being achieved. Therefore, no further BS 8233: 2014 calculations are required.

11 APPROVED DOCUMENT O 2021 – ‘OVERHEATING’

11.1 Approved Document O – Section 3: Ensuring the Overheating Mitigation Strategy is Usable.

Building Regulations 2010 Approved Document O 2021 ‘Overheating’ states the following within Section 3: ‘Ensuring the Overheating Mitigation Strategy is Usable’:-

- 3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
- 3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
 - a. 40dB L , averaged over 8 hours (between 11pm and 7am)
 - b. 55dB L , more than 10 times a night (between 11pm and 7am).
- 3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants *Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use*.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants’ Acoustics, Ventilation and Overheating: Residential Design Guide (2020)

11.2 TM59 Overheating ‘Assessment of Requirement for Testing’

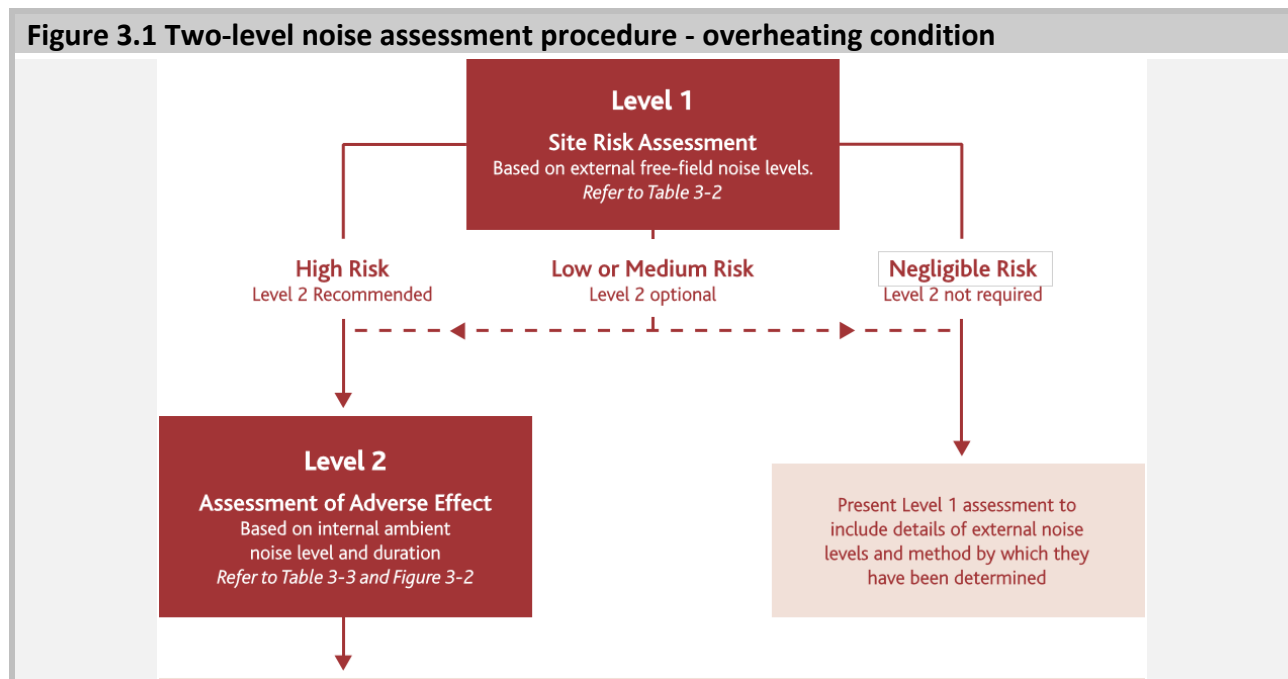
With regards to potential overheating at the proposed development and any TM59 assessment that may be required for this site, we would like to confirm that having opening windows to dissipate excessive summer heat vs the internal acoustics is always a fine balancing act.

With regards to the internal acoustic criteria of Daytime $L_{Aeq\ 16\text{ HOUR}}$ 35 dB and Night Time $L_{Aeq\ 8\text{ HOUR}}$ 30 dB, this is a planning requirement under BS 8233: 2014 to which this report and calculations have been carried out to and is based on. This assessment has detailed the glazing and ventilation requirements required in order to achieve these criteria based on the assumption that the windows are closed.

References and assessments are to be made to the Association of Noise Consultants ‘Acoustic Ventilation & Overheating – Residential Design Guide’ 2020. The calculations carried out within this report have identified an acoustic requirement for System 1 & 2 and therefore guidelines values from Table 4 of BS 8233: 2014 are to be adopted.

This document takes a Level 1 and Level 2 approach to an acoustic overheating assessment and depending on the outcome of Level 1, further determines the need or necessity for a Level 2 assessment.

11.2.3 Figure 3.1 Two-Level Noise Assessment Procedure



11.2.4 Requirement for Testing Conclusion

Based on the above assessments, it is concluded that a detailed TM59 assessment is not required for this site and that the proposed glazing & ventilation strategy would be acceptable.

12 ELEMENT 4 – ASSESSMENT OF OTHER RELEVANT ISSUES

The National Planning Policy Framework 2023 (NPPF) and assessments to the Noise Policy Statement for England 2010 (NPSE) should be made in conjunction with each other. Paragraphs 185 - 188 of the National Planning Policy Framework 2023 (NPPF) states the following:

Paragraph 185 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 impacts 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.

Paragraph 186 Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications.

Paragraph 187 Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

Paragraph 188 The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities

The Noise Policy Statement for England gives various levels of effect as detailed within this report.

With the glazing / ventilation specifications achieved within this report, the development can be implemented within the guidelines of the aforementioned documents and ensure a conclusion of 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.

13 ACOUSTIC DESIGN STATEMENT

Good Acoustic Design	Given the size and orientation of the proposed site, it is recommended that the developer adopted, where practically possible, a good acoustic design which should include careful consideration of the positioning of the proposed properties together with thoughts being taken as to internal layouts to minimise noise sensitive rooms facing onto dominant noise sources within the local areas.
Internal Noise Levels	Calculations have been carried out and assessments made to BS 8233: 2014 together with design specifications supplied for the required glazing and ventilation specifications required across the development to ensure compliance.
L _{Amax} dB Noise Levels	Assessments and calculations demonstrate that the L _{Amax} dB Levels are within the criteria set out within P _{RoPG}
NPPF & NPSE	With the glazing / ventilation specifications achieved within this report, the development can be implemented within the guidelines of the aforementioned documents and ensure a conclusion of LOEL – Low 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.
OVERALL OUTCOME	LOEL – Low Observed Effect Level

14 RECOMMENDATION TO DECISION MAKER

Levels have been recorded and assessments made in accordance with the relevant standards. Internal criteria's have been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

National Planning Policy Framework 2023 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

Based on the calculations and assessments made within this report it is the professional opinion of Impact Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2023, NPPF & NPSE and that, with regards to sound, planning permission can be granted using the following parameters.

As indicated in Section 2 of PRoPG, following the PRoPG approach will lead to the choice of one of four possible recommendations from the noise practitioner to the decision maker:

- A. Planning consent may be granted without any need for noise conditions;
- B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
- C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or
- D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

RECOMMENDATION TO DECISION MAKER

B: Grant with Noise Conditions

15 CONCLUSION

15.1 Summary of Results

15.1.1 Background Noise Levels (Representative)

A background noise survey was undertaken from 25th – 29th October 2023 at the nearest site boundary to establish the underlying background noise levels. The average maximum day time levels were found to be $L_{Aeq, 16 \text{ hour}}$ 54.6 dB and the maximum night time levels were found to be $L_{Aeq, 8 \text{ hours}}$ 45.3 dB.

15.1.1.1 Measured Data

Assessment Position	Date	Day (0700 - 2300)	Night (2300 -0700)
1	25/10/2023	52.7	45.4
1	26/10/2023	54.1	44.0
1	27/10/2023	56.6	47.5
1	28/10/2023	55.0	44.1
1	29/10/2023	54.7	45.7

Assessment Position	Date Start	Date Finish	Daytime LAeq	Night Time LAeq
Position 1	25/10/2023	29/10/2023	54.6	45.3

Date	Time Frame	Leq (63Hz)	Leq (125Hz)	Leq (250Hz)	Leq (500Hz)	Leq (1kHz)	Leq (2kHz)	Leq (4kHz)
25/10/2023	Day	60.3	55.3	49.6	46.5	49.1	45.4	39.3
25/10/2023	Night	53.7	45.0	42.7	40.8	41.9	40.7	35.0
26/10/2023	Day	60.6	57.3	51.9	47.6	50.3	47.0	41.3
26/10/2023	Night	52.1	43.8	40.2	38.1	40.7	39.4	35.3
27/10/2023	Day	60.6	57.3	51.9	47.6	50.3	47.0	41.3
27/10/2023	Night	52.1	43.8	40.2	38.1	40.7	39.4	35.3
28/10/2023	Day	60.1	55.8	51.6	48.8	51.1	48.4	43.2
28/10/2023	Night	46.0	42.3	39.4	37.2	38.8	37.2	33.5

15.1.2 Potential Façade Noise Levels

Noise Risk Category	0 – Negligible	1 – Low	2 – Medium	3 - High
Average Daytime	<50 dB	50 – 63 dB	63 – 70 dB	>70 dB
Average Night Time	<40 dB	40 – 55 dB	55 – 60 dB	>60 dB
Maximum Night Time			>80 dB (2 Times in 8 Hours)	

15.1.2.1 Daytime (07:00-23:00)

Time Period	Highest Potential Façade Noise Level	Noise Risk Category 1 - Low
Average Daytime (07:00-23:00)	$L_{Aeq, 16 \text{ HOUR}}$ 54.6 dB	50-63 dB

15.1.2.2 Night Time (23:00-07:00)

Time Period	Highest Potential Façade Noise Level	Noise Risk Category 1 Low
Average Night Time (23:00-07:00)	L _{Aeq} , 16 HOUR 45.3 dB	40 – 55 dB
		>80 dB (0 Times in 8 Hours)

15.2 Risk Assessment

15.2.1 Daytime (07:00-23:00)

Risk Assessment Category	Risk Assessment
1 – Low	At Low noise levels, the site is likely to be acceptable from a noise perspective provided that good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development

15.2.2 Night Time (23:00-07:00)

Risk Assessment Category	Risk Assessment
1 – Low	At Low noise levels, the site is likely to be acceptable from a noise perspective provided that good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development

15.3 Requirements for noise mitigation

In order to meet reasonable internal levels in accordance with BS8233:2014; all facades should implement the following mitigation measures:

Construction of Walls	Standard masonry construction
Construction of Windows	4mm glass / 16mm air gap / 4mm glass
Construction of Ventilation	MVHR

Detailed calculations indicated that internal noise levels within the proposed residential properties will comply with the requirements of British Standard 8233: 2014.

Time Period	Façade / Area	Specification	Room / Space	Resulting Internal Level dB(A)	Criteria Limit
Day	Front	4 / 16 / 4 + MVHR	Bed	28 dB LAeq,16hour	35dB
Night	Front	4 / 16 / 4 + MVHR	Bed	17 dB LAeq, 8hour	30dB
Resulting Internal Levels calculated in accordance with BS8233:2014 per time period					

15.4 Conclusions

Representative source levels have been recorded and assessments made in accordance with BS8233:2014. Internal criterion has been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

15.5 NPPF 2019

National Planning Policy Framework 2019 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

15.6 Planning Approval Recommendation

Based on the calculations and assessments made within this report it is the professional opinion of Impact Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2019, NPPF & NPSE and that, with regards to sound, planning permission can be granted.

16 APPENDIX A - BACKGROUND MEASUREMENT DATA

		Lmax	min Laeq	min La90	Laeq,1h our	L90,1h our	L10, 1hour	Leq (63Hz)	Leq (125Hz)	Leq (250Hz)	Leq (500Hz)	Leq (1kHz)	Leq (2kHz)	Leq (4kHz)
25/10/2023	12:00	82.8	53.7	41.1	58.0	41.7	60.8	65.6	58.4	53.4	49.6	54.7	50.3	43.2
25/10/2023	13:00	76.3	54.7	39.1	55.9	40.3	59.3	59.4	52.5	50.2	47.5	50.6	47.0	40.1
25/10/2023	14:00	71.0	51.9	38.4	52.6	39.5	56.0	67.6	63.1	53.5	47.9	50.8	46.6	39.8
25/10/2023	15:00	73.8	53.0	38.8	55.2	40.4	58.9	62.2	54.4	50.3	47.6	50.5	46.9	39.9
25/10/2023	16:00	77.0	53.4	39.4	54.2	40.6	57.7	62.8	56.2	51.6	49.0	51.8	48.0	41.4
25/10/2023	17:00	73.2	50.9	39.2	53.6	39.8	57.0	57.9	52.7	48.9	46.5	47.9	43.7	36.7
25/10/2023	18:00	77.1	50.4	36.6	51.3	37.5	48.9	55.4	53.2	47.5	45.2	47.8	44.2	36.1
25/10/2023	19:00	75.3	50.7	34.7	50.9	35.4	49.1	55.3	47.3	44.5	42.0	46.4	42.4	34.5
25/10/2023	20:00	79.0	43.5	32.8	50.5	34.2	44.7	55.3	59.5	53.0	47.3	46.3	41.4	35.5
25/10/2023	21:00	75.3	43.4	33.0	48.1	33.2	44.0	51.9	47.0	41.6	38.3	41.7	38.0	30.1
25/10/2023	22:00	71.9	39.7	32.4	42.3	33.5	43.2	48.3	43.6	40.6	37.8	40.6	37.7	33.3
25/10/2023	23:00	73.0	39.0	28.7	45.3	30.4	41.3	44.8	39.5	37.4	35.3	38.2	34.6	30.2
26/10/2023	00:00	57.7	31.4	24.9	32.3	25.4	35.1	39.5	35.2	31.1	31.3	33.0	33.5	30.5
26/10/2023	01:00	53.3	31.5	24.4	39.0	32.4	42.3	38.2	33.4	29.1	27.9	28.5	27.9	25.3
26/10/2023	02:00	52.3	31.7	26.6	36.4	29.3	39.2	38.7	35.3	31.9	31.8	32.5	33.9	31.6
26/10/2023	03:00	61.5	34.9	30.6	39.0	33.8	40.7	41.4	36.3	33.1	31.6	31.8	31.5	28.9
26/10/2023	04:00	67.0	34.5	32.4	38.7	35.2	40.7	44.5	39.7	37.7	35.8	37.7	37.5	33.4
26/10/2023	05:00	73.2	38.9	30.2	47.2	35.0	44.0	51.3	44.6	42.9	40.9	44.3	43.3	36.7
26/10/2023	06:00	76.1	46.0	32.1	52.0	36.0	52.9	61.6	52.3	50.0	48.1	48.4	46.8	40.6
26/10/2023	07:00	72.1	49.1	39.9	52.2	40.9	54.1	58.2	51.6	47.7	46.0	49.8	46.9	39.2
26/10/2023	08:00	72.6	51.4	39.5	53.1	40.3	54.9	57.9	53.4	49.8	47.4	51.2	47.4	40.0
26/10/2023	09:00	75.0	53.7	38.1	54.8	40.1	57.9	62.4	53.9	51.0	48.2	51.6	48.0	41.6
26/10/2023	10:00	74.7	54.1	39.7	54.6	40.6	58.2	62.2	63.0	53.8	48.9	51.5	47.1	39.9
26/10/2023	11:00	85.4	51.2	40.2	55.4	41.1	57.8	61.6	60.0	53.3	48.9	51.3	47.0	39.9
26/10/2023	12:00	72.0	53.8	40.7	55.1	41.6	59.5	62.3	54.4	51.5	49.2	52.4	49.8	45.9
26/10/2023	13:00	76.6	53.1	39.4	55.4	40.9	58.2	59.9	53.3	50.1	47.9	51.5	48.5	42.7
26/10/2023	14:00	80.6	53.4	40.6	57.5	41.1	60.9	66.0	64.2	58.8	50.4	51.7	48.1	42.2
26/10/2023	15:00	77.8	52.3	40.3	54.1	41.8	56.8	61.3	56.0	51.8	49.9	52.3	48.5	41.3
26/10/2023	16:00	71.8	53.9	38.9	55.1	40.8	59.9	62.0	54.9	50.8	47.3	50.9	47.7	42.4
26/10/2023	17:00	72.8	53.2	40.0	54.8	41.8	56.5	58.4	55.3	49.0	46.6	50.3	48.1	44.7
26/10/2023	18:00	80.3	50.7	38.6	54.0	39.4	51.9	61.0	56.8	51.4	47.0	49.6	47.0	42.4
26/10/2023	19:00	77.8	49.6	35.7	51.8	37.3	51.5	55.2	50.7	46.5	43.4	46.5	41.9	34.6
26/10/2023	20:00	77.5	47.3	33.1	50.3	34.0	45.7	54.9	53.7	52.6	47.7	47.5	44.6	37.9
26/10/2023	21:00	76.7	43.1	30.8	50.3	31.9	51.9	51.0	44.7	42.7	39.3	42.7	39.5	32.5
26/10/2023	22:00	69.2	36.7	28.9	44.4	30.2	42.1	45.5	40.2	36.8	34.4	37.8	32.7	24.2
26/10/2023	23:00	49.2	34.0	28.1	35.5	29.1	39.4	46.3	39.4	35.3	33.7	36.2	33.6	28.3
27/10/2023	00:00	67.3	35.4	27.1	39.8	29.4	39.5	41.1	34.4	30.2	29.1	29.7	30.6	26.1
27/10/2023	01:00	53.5	30.8	26.7	33.8	28.5	37.0	43.4	38.0	37.2	35.3	37.8	37.6	34.2
27/10/2023	02:00	74.7	27.1	24.8	42.8	25.2	31.9	43.2	34.9	33.2	31.4	33.7	31.6	26.8
27/10/2023	03:00	63.3	30.1	26.7	38.2	28.1	40.0	58.6	47.6	39.1	35.3	38.1	35.8	32.3
27/10/2023	04:00	73.5	28.8	25.9	42.7	26.9	36.9	44.3	39.3	38.6	33.4	31.2	26.7	21.8
27/10/2023	05:00	70.8	38.3	29.0	46.1	36.4	45.8	51.6	45.2	42.9	41.1	42.8	43.3	39.3
27/10/2023	06:00	74.4	39.8	33.7	50.0	33.8	47.6	54.8	48.6	45.7	44.0	47.3	45.3	41.0
27/10/2023	07:00	73.1	50.4	39.5	53.3	41.2	52.2	58.7	52.9	47.8	46.1	49.8	48.4	44.8
27/10/2023	08:00	77.3	53.2	37.5	54.0	39.5	56.8	60.8	53.6	49.9	48.0	52.1	49.0	42.7
27/10/2023	09:00	74.1	54.8	40.7	55.5	41.5	58.9	58.9	54.4	49.9	47.8	51.2	48.1	42.2
27/10/2023	10:00	88.5	53.4	42.0	56.2	42.7	57.0	63.9	66.5	56.4	52.7	55.0	51.5	46.6
27/10/2023	11:00	74.0	55.2	41.7	62.7	60.3	65.6	66.8	72.5	60.9	56.0	57.3	54.8	50.2

27/10/2023	12:00	87.2	53.9	41.7	58.6	44.5	62.0	63.0	55.8	52.2	48.9	53.4	51.6	47.2
27/10/2023	13:00	87.7	54.6	39.5	56.3	40.6	59.7	62.9	57.2	52.3	49.5	52.7	50.2	46.0
27/10/2023	14:00	78.4	57.2	41.6	58.0	43.2	62.3	63.1	55.5	51.9	50.0	53.9	51.5	47.3
27/10/2023	15:00	76.0	55.7	41.5	56.9	42.4	61.6	64.0	58.4	53.0	50.0	53.4	50.2	44.1
27/10/2023	16:00	84.3	54.6	42.2	56.2	43.7	60.1	63.7	56.1	52.8	50.8	53.1	49.7	43.1
27/10/2023	17:00	81.2	55.0	42.9	56.2	43.9	59.6	60.7	53.8	50.7	48.6	51.9	47.7	39.5
27/10/2023	18:00	75.2	53.9	40.3	54.3	42.7	54.8	58.4	55.5	58.1	50.4	51.3	49.3	45.6
27/10/2023	19:00	81.8	51.5	40.7	56.2	43.0	58.8	58.1	53.0	50.5	48.0	49.4	46.8	42.2
27/10/2023	20:00	77.3	49.4	40.3	52.1	41.4	51.7	53.7	47.6	45.4	43.9	46.7	45.4	42.1
27/10/2023	21:00	82.9	48.8	40.0	52.6	44.8	51.5	52.7	51.1	51.9	45.3	47.3	48.6	46.5
27/10/2023	22:00	75.5	39.0	33.5	51.5	38.5	53.6	46.7	43.1	39.0	36.5	37.7	33.7	26.9
27/10/2023	23:00	70.5	39.7	34.7	45.2	36.9	45.6	47.5	43.1	40.5	39.6	42.7	41.9	38.2
28/10/2023	00:00	71.9	39.6	35.2	45.2	37.4	45.3	51.9	43.8	41.5	42.1	44.6	46.1	44.2
28/10/2023	01:00	73.5	37.1	33.1	52.0	42.1	54.1	47.3	41.2	39.9	39.2	42.3	42.8	38.9
28/10/2023	02:00	69.9	37.9	33.0	44.0	36.7	46.3	44.6	40.8	34.4	32.5	34.7	34.5	29.6
28/10/2023	03:00	66.1	38.5	31.3	43.0	35.9	46.3	43.6	37.6	36.2	35.9	37.9	39.0	33.8
28/10/2023	04:00	53.5	37.0	34.3	42.0	37.1	44.7	41.7	35.5	32.2	32.4	34.7	35.4	29.4
28/10/2023	05:00	71.1	34.6	30.5	42.6	31.3	43.0	51.7	46.6	44.4	42.2	45.2	46.0	38.9
28/10/2023	06:00	75.9	45.7	33.6	51.5	37.1	48.3	51.1	45.8	44.3	43.4	46.7	46.7	40.3
28/10/2023	07:00	77.2	50.6	37.3	53.1	40.5	53.9	56.7	49.6	46.8	45.6	49.6	48.4	40.9
28/10/2023	08:00	74.3	53.2	40.7	53.8	41.6	55.7	62.2	53.0	48.6	46.7	50.8	48.6	39.8
28/10/2023	09:00	78.6	53.2	41.0	54.4	42.3	56.8	59.4	55.7	51.4	48.5	51.5	48.5	41.0
28/10/2023	10:00	76.1	52.5	44.4	55.7	45.0	59.9	62.6	60.9	52.9	49.2	52.4	49.3	41.9
28/10/2023	11:00	75.4	55.2	45.4	55.9	45.9	59.9	61.4	57.0	53.4	51.2	53.0	48.9	42.4
28/10/2023	12:00	78.6	56.4	47.8	57.1	48.5	60.4	61.5	56.7	54.4	51.3	53.0	50.4	44.2
28/10/2023	13:00	73.0	54.4	46.9	55.7	47.5	59.2	60.7	55.3	51.8	49.5	52.2	48.8	43.4
28/10/2023	14:00	72.8	55.3	47.5	55.7	48.3	59.0	61.9	59.4	52.9	49.9	52.0	48.2	42.9
28/10/2023	15:00	78.9	55.6	47.6	56.2	48.0	58.8	60.6	55.0	52.3	49.4	52.4	50.0	46.2
28/10/2023	16:00	73.5	55.2	48.7	56.6	50.7	58.7	61.6	57.6	53.5	50.5	53.1	50.2	45.7
28/10/2023	17:00	75.1	54.1	47.8	55.8	49.1	57.4	60.9	54.3	52.0	49.7	51.6	48.7	44.5
28/10/2023	18:00	79.8	53.4	46.0	55.7	46.3	56.7	60.9	55.8	52.7	48.9	50.3	48.0	43.8
28/10/2023	19:00	77.5	51.5	45.4	53.6	46.9	54.5	55.4	51.3	49.1	48.2	48.7	46.4	42.6
28/10/2023	20:00	74.4	49.5	43.5	51.5	45.0	52.0	55.3	53.1	51.7	48.1	47.4	44.3	39.3
28/10/2023	21:00	76.4	42.0	34.1	50.4	41.3	52.3	54.2	46.8	42.7	41.3	44.3	43.4	40.3
28/10/2023	22:00	73.3	43.2	34.2	52.5	46.6	54.8	51.5	45.0	43.2	43.6	45.9	46.6	44.8
28/10/2023	23:00	73.7	38.8	34.2	48.1	38.9	46.5	46.5	42.5	39.2	37.2	41.9	37.7	30.8
29/10/2023	00:00	67.9	37.2	31.7	42.1	32.7	41.3	46.9	41.9	38.9	37.3	40.4	38.5	35.5
29/10/2023	01:00	74.3	35.8	31.0	46.3	33.8	42.0	47.1	46.5	42.4	39.3	39.8	39.2	35.5
29/10/2023	02:00	71.5	34.8	31.2	44.0	36.7	47.2	43.9	41.8	40.5	38.9	38.4	37.8	34.6
29/10/2023	03:00	57.0	36.0	31.0	41.3	35.9	44.2	41.5	36.4	33.2	32.0	31.5	29.2	26.3
29/10/2023	04:00	55.2	30.3	27.3	31.5	28.0	33.3	41.0	37.0	34.9	30.4	28.9	26.9	24.2
29/10/2023	05:00	53.4	35.1	31.0	39.3	34.8	42.3	45.7	41.0	38.8	36.9	36.4	35.9	33.5
29/10/2023	06:00	73.8	39.9	36.3	45.1	36.5	44.1	49.5	43.1	41.1	38.4	40.4	39.5	35.7
29/10/2023	07:00	71.2	38.0	33.1	45.4	34.5	44.1	54.4	47.0	42.6	40.8	43.8	41.3	35.8
29/10/2023	08:00	67.9	47.3	36.2	49.0	39.8	48.4	55.7	47.5	45.2	43.3	46.1	44.2	39.7

17 APPENDIX B – UNCERTAINTY BUDGET

Sources of Uncertainty	Uncertainty Notes	Commentary	Value (half Width)	Convert to Same Units (dB)	Distribution Divisor			Standard Uncertainty (u) dB
					Normal	Rectangular	Other	
Measurement Position	Choice of position, ,	1m in 10m		0.2		rect($\sqrt{3}$)		0.13
	microphone orientation	Type 1 0 - 30deg	0.4		Normal			0.50
Instrumentation	Calibration	Calibration Drift	0.1		Normal			0.10
	Accuracy and precision (type 1)	Type 1 practical	1.9			rect($\sqrt{3}$)		0.50
Background Noise Level	Timing of Measurement							
Background Noise Level	Modal Analysis Day	Calculated Standard Deviation	3.7				s/ $\sqrt{n}$	0.39
Background Noise Level	Modal Analysis Night	Calculated Standard Deviation	2.2				s/ $\sqrt{n}$	0.16
Combined Uncertainty (root sum of squares)								1.78
Expanded Uncertainty U = Kuc (95% Confidence K =2)								3.56
Final Answer Expressed as Value +/- U dB with a confidence Level of 95%								
REFERENCE: Uncertainty Budget Calculated in line with M3003: The Expression of Uncertainty and Confidence in Measurement Edition 3, November 2012 and A Good Practice Guide on the Sources and Magnitude of Uncertainty Arising in the Practical Measurement of Environmental Noise N J Craven, G Kerry Edition 1a – May 2007.								

#END OF REPORT#