



Residential Noise Assessment

Site Address: 872 Manchester Road, Rochdale, OL11 2SP

Client Name: Harrison Construction

Project Reference No: NP-012206



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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the proposed development') at 872 Manchester Road, Rochdale, OL11 2SP ('the site'). The proposed development is for the conversion of a section of the existing building into homes for multiple occupancy (HMO) and a ground floor commercial unit.

The applicant is preparing to submit a planning application to Rochdale Metropolitan Borough Council. This report has been prepared to accompany the planning application to be submitted to the Local Planning Authority ('LPA').

A noise survey has been undertaken to establish the prevailing sound levels at the proposed development. The findings have been subsequently used to assess the suitability of the site for residential use. Measures required to mitigate noise impacts for the proposed development have been assessed in accordance with the relevant performance standards, legislation, policy, and guidance.

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

1.1 Standards, Legislation, Policy & Guidance

The following performance standards, legislation, policy, and guidance have been considered to ensure good acoustic design in the assessment:

- National Planning Policy Framework (2024).
- Noise Policy Statement for England (2010).
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings'.
- Approved Document F: Volume 1 Dwellings (2021).
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide).

Further information on the legislation can be found in Appendix B.

2. Environmental Noise Survey

2.1 Measurement Methodology

An unattended noise level survey was undertaken at the proposed development. Two measurement locations were selected, and the following table outlines the measurement dates and particulars.

A 130mm diameter windshield was fitted to each microphone. The equipment was field calibrated before and after the survey; negligible drift was noted.

Location	Survey Dates	Measurement Particulars
MP1	31/01/2025 – 04/02/2025	Equipment mounted on a lamp post in a free-field location overlooking Hope Place at a height of 3.5m above ground.
MP2		Equipment mounted 3.5m above ground on a lamppost, under façade conditions.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



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Figure 2 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The proposed development site is located on the basement, ground and first floors of the existing building. The site is bound by Well Pharmacy to the north, Manchester Road to the east, Hope Place to the south, and a small area of vacant land to the west.

The acoustic environment is dominated by road noise at all locations. The noise profile is extremely diurnal as a result and movements from rail to the north-west did not impact the measurements either.

The Commercial is a pub with an external seating area that is located to the north of the site that is open until 22:30 hours, Monday to Thursday, and until 00:00, Friday to Sunday. Access to the rear of the site for measurements was not possible, however, MP2 was selected to measure the noise profile breaking out of the front envelope. At no periods during the measurements was any noise breakout observed within the time history due to amplified music events that may be occurring. Based on a review of online sources, reviews indicate that the pub may occasionally have karaoke and / or live music. Furthermore, it was observed that the rear external seating area was not in use, which is expected to be due to the time of year.

2.3 Environmental Noise Survey Results

The following section outlines the measured sound levels during the survey. The tenth highest night-time maximum sound levels measured over a 2-minute sampling period is also provided. The time history results can be found in Appendix D.

In relation to MP2, the below noise levels have been corrected to allow for the conversion of a façade to a free-field level.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$, dB)							$L_{Aeq,T}$ (dB)	'Typical' $L_{AFmax,2min}$ (dB)
		63	125	250	500	1k	2k	4k		
MP1	$L_{eq,16hr}$ (Day)	60	56	53	55	56	50	44	59	--
	$L_{eq,8hr}$ (Night)	54	50	48	50	51	46	45	54	77
MP2	$L_{eq,16hr}$ (Day)	71	65	62	61	64	60	54	67	--
	$L_{eq,8hr}$ (Night)	64	58	56	55	58	55	50	62	80

Table 2 – Sound Level Results Summary

Based on a review of the DEFRA Extrium noise maps, noise emissions from the railway line to the west would be <55dB $L_{Aeq,16hr}$ and <50dB $L_{Aeq,8hr}$ at the western façade of the proposed development. As this is significantly below the above noise levels, this confirms that road traffic is the dominating noise source in the area and the influence of rail has not been considered further.

2.4 Low Frequency Entertainment Noise Time Histories

Due to the potential for entertainment noise breakout emissions from The Commercial to adversely impact the future occupant of the proposed development, further analysis has been undertaken.

As the site does not have an online presence, it has not been possible to verify if there were any live bands at the site during the measurement period. However, based on google reviews, as a minimum it is likely that some form of amplified music / karaoke would have been playing over the weekend.

The overall noise levels measured at MP2 during the operating hours of The Commercial are presented in the figure below.

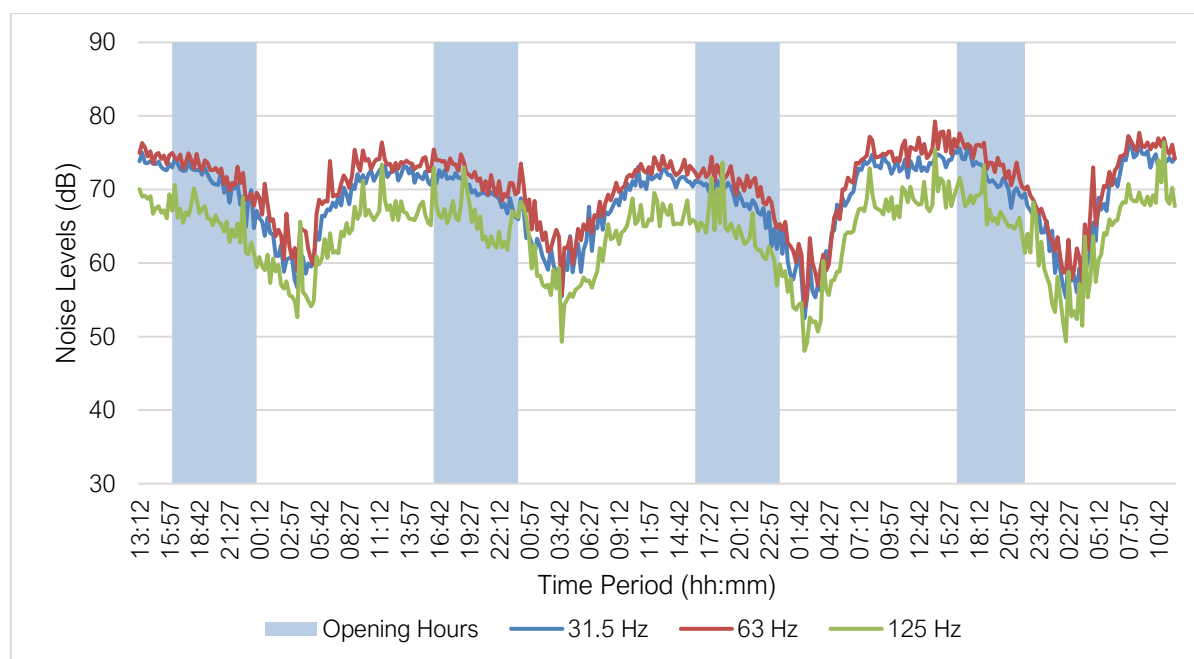


Figure 3 – Low-Frequency Noise Survey Time History – MP1

Discussion

As identified above, there is no clear indication of low-frequency noise present during the measurement period on any of the days. There is a small spike at 125Hz on the third night at approximately 19:00 hours, however, for this to be amplified music an expectation of a similar spike at 31.5Hz and 63Hz would also be expected.

2.5 Plant Noise Measurements

Whilst on-site, it was observed that there were two air conditioning units located at the rear of the neighbouring pharmacy. Spot measurements of the plant equipment were conducted. For all on-site measurements the following methodology was adhered to:

- Where possible, measurements have been taken at a position where point source propagation is expected and corrected for residual noise.
- All measurements were taken using a fast time-weighting and the sound level meter was set to log every 100ms.
- Measurements were taken in 1/3 octave frequency bands; however, the report details the 1/1 octave band sound levels used in the specific sound level calculations.

The following table shows the calculated specific sound levels for both items of plant combined.

Description	Distance (m)	Octave Band (Hz, L_{eq} dB)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
2no. ACU's Operating	1.5	68	67	67	58	60	57	54	47	65

Table 3 – Calculated Specific Sound Levels of Plant Equipment

It was observed that both plant items were intermittent in their operation. They were, however, not tonal or impulsive. The items of plant were approximately 3m away from the nearest window within the proposed development. It is assumed these operate only during daytime hours.

3. Noise Break-in Assessment and Sound Insulation Scheme

3.1 Internal Noise Level Criteria

The following table outlines the internal acoustic design criteria used in the following assessment.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB L_{AFmax}^*

**NOTE 1: The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.*

**NOTE 2: ProPG:2017 which is relevant to 'New Residential' states; "In most circumstances in noise sensitive rooms at night (e.g., bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax, F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability, and regularity of noise events".*

Note 3: BS8233:2014 states: "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved".

Note 4: BS8233:2014 states: "The levels shown in Table 4 (criteria shown above) are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

Note 5: BS8233:2014 states: "If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Table 4 – Internal Acoustic Design Criteria

In terms of noise breakout from The Commercial, 'The Good Practice guide on the Control of Noise from Pubs and Clubs (NANR92)' states that where entertainment noise takes place on a regular basis, music and associated sources should be inaudible within noise sensitive properties at any time.

Whilst the term 'inaudibility' is open to interpretation, it is advised that internal noise levels from these noise sources are controlled to 10dB below the figures presented in Table 4. Furthermore, it would be appropriate to ensure that internal low frequency noise in the 63Hz and 125Hz frequency bands does not exceed 47dB and 41dB L_{eq} , respectively (in line with the Moorhouse Curve criteria).

In relation to plant associated with the pharmacy, as there are no external amenity areas at the proposed development, it would be appropriate to ensure that internal noise levels due to the plant are also controlled to 10dB below the figures presented in Table 4. This would ensure that specific noise levels from plant is inaudible internally and would allow for any associated character feature corrections still not increasing noise levels to that above the figures presented in Table 4.

Determined External Noise Levels

The determined external noise levels will be based on the measured noise levels in Table 2. However, as previously stated, the external seating area associated with The Commercial was not in use. Therefore, an assessment of patron noise breakout will be based on calculation and is shown below. There were no observed external speakers and, therefore, this has been excluded.

Patron Noise Breakout

Based on a review of the size of the patron area, it is assumed that it would be occupied by 20 patrons at maximum capacity. Considering this, the calculations have been conducted assuming the following:

- 20no. patrons are speaking at once; 10no. patrons speaking in a 'normal' voice and 10no. patrons speaking in a 'raised' voice simultaneously. The source noise levels are taken from ANSI S3.5-1997 (R2017) in the 250Hz to 4kHz octave bands.
- No acoustic shielding is included in the calculation to form a robust assessment.
- The nearest windows of the proposed development to the patron area are approximately 10m away. Distance attenuation will allow for this.
- As the patron area is completely enclosed, a worst-case scenario of Q8 will be allowed for.
- Noise levels have been calculated to the worst-case NSR.

Description	Octave Frequency Band (Hz, dB)					Overall (dBA)
	250	500	1k	2k	4k	
1 No. Normal Voice Noise Level (L_w)	65	69	63	56	50	68
10 No. Normal Voices Noise Level (L_w)	75	79	73	66	60	78
1 No. Raised Voice Noise Level (L_w)	70	75	72	64	57	76
10 No. Raised Voices Noise Level (L_w)	80	85	82	74	67	86
Cumulative Noise Level of Patron Area (L_w)	81	86	83	75	68	86
Distance Correction to NSR (10m, Q8)	-22					--
Patron Noise Level at NSR (L_{eq})	59	64	61	53	46	64

Table 5 – External Patron Noise Level Calculations

The above determined noise levels will be used to inform the external envelope of the proposed development.

In relation to maximum sound level events, ANSI indicates that a person 'shouting' is equivalent to approximately 101dB(A) L_{wA} . This would be expected to be the loudest single event from the patron area. Allowing for distance attenuation and Q8 propagation, maximum sound levels from shouting would be equivalent to 79dB(A) at the nearest façade of the proposed development. This will also be used to inform the assessment of the external envelope.

Entertainment Noise Breakout

As previously stated, it is understood that The Commercial may potentially have amplified and live music. As measurements of noise breakout were not possible, this has been predicted assuming reasonable worst-case assumptions.

To determine an appropriate internal noise level within the pub that will be based on data from 'The Little Red Book of Acoustics: A Practical Guide' by the Association of Noise Consultants ('ANC'). It is assumed that the pub would operate similarly to a 'busy pub / bar'. However, for robustness, there will be an enhancement on the low frequency noise levels used within the assessment and these will be set at 90dB at the 63Hz and 125Hz frequency bands.

3.2 Noise Breakout Assessment

Noise breakout levels have been assessed to the proposed development, which is approximately 10m away. The calculations have been conducted assuming the following:

- Only breakout from the weakest element will be assessed, which is expected to be an open door to the external patron area. This would also be applicable to the entrance door on Manchester Road. It is unlikely there will be any management of this so a reasonable worst-case assumption would be to assume these doors are left opened for sustained periods. As this would perform more than 10dB poorer than any other element, only consideration of this will be made within the assessment.
- The sound power levels of the door element has been calculated using the formula: $L_{W,rad} = L_{P,rev} - C_d - R + 10 \cdot \log(S)$, where, S is the surface area of the glazed element, C_d is the correction for the difference between reverberant internal conditions and non-reverberant external conditions (-6 dB), and R is the sound reduction provided by the element. The planar propagation loss from the glazed elements has been calculated from the point source region.

The resulting L_{eq} noise breakout emissions at the closest window of the proposed development have been assessed in the table below.

Description	Octave Frequency Band (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Total Internal Noise Level (L_{eq})	90	90	85	85	85	80	80	89
Double Glazed Door SRI (R')	0							--
Internal to External Correction (C_d)	-6							--
Sound Power Level of Door (L_w)	87	87	82	82	82	77	77	86
Distance Correction (10m, $Q=4$)	-26							--
Total External Noise Level at Receptor (L_{eq})	61	61	56	56	56	51	51	60

Table 6 – NSR1 Noise Breakout Assessment to Proposed Development

The above will be used to inform the noise break-in assessment for the development.

Assuming internal maximum noise levels are 10dB higher in every octave band to the figures shown above, external noise levels incident on the facades of the development would be 70dB L_{AFmax} . This will also be used to inform the break-in assessment.

Summary of Determined External Noise Levels

A summary of the determined external noise levels incident on the facades of the development are presented in the table below. The sources producing these noise levels are also presented. These have been compiled onto the figure below.

Elevation	Source	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	
		Ambient ($L_{Aeq,16hr}$)	Ambient ($L_{Aeq,8hr}$)	Maximum (L_{AFmax})
Red	The Commercial – Front Door	60	60	70
	Road Traffic - MP2	67	62	80
Orange	Road Traffic - MP1 & MP2	<65	<60	<75
Blue	The Commercial – Rear Door	60	60	70
	The Commercial – External Patrons	64	64	79
	Pharmacy Plant	59	--	--
	Road Traffic - MP1	59	54	77

Table 7 – Internal Acoustic Design Criteria

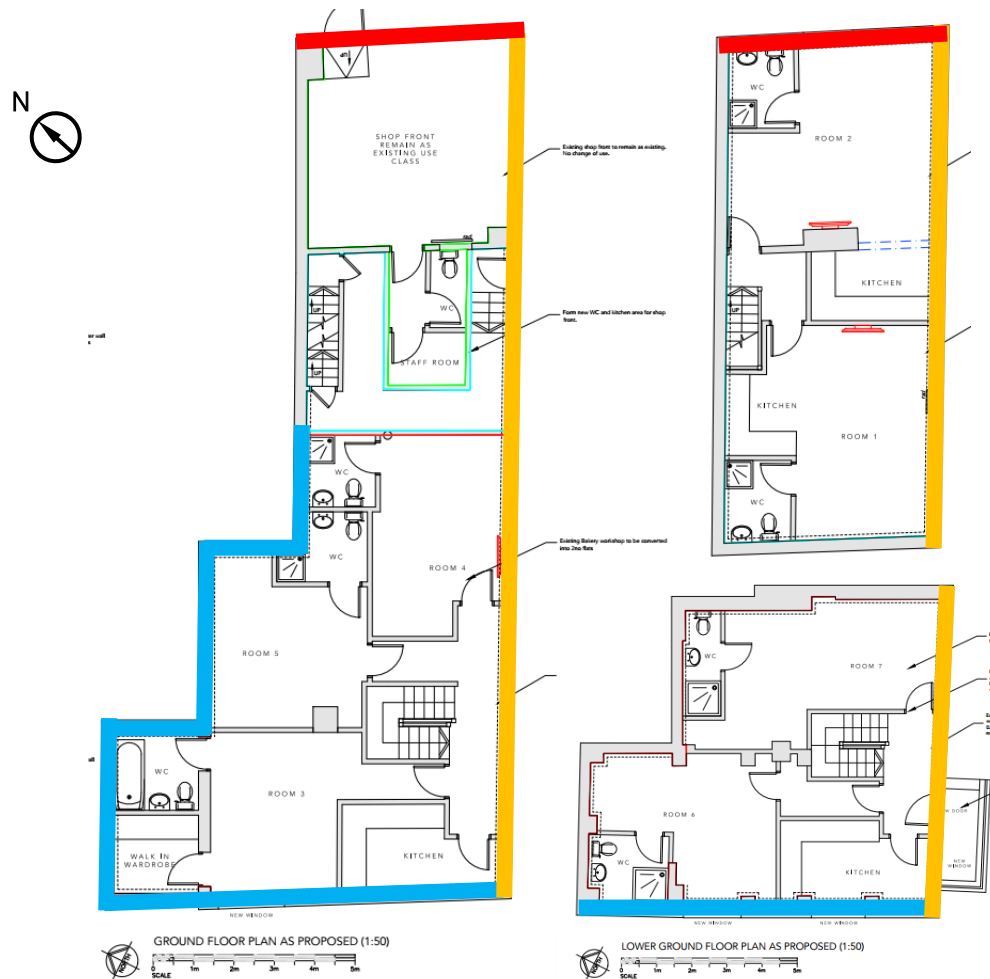


Figure 4 – Determined External Noise Level Reference

As previously stated, it is proposed that all amplified and plant noise is controlled to 10dB below the criteria stated in Section 3.1. Therefore, noise levels from 'The Commercial – Front Door' will be used to inform the external envelope design, only when they are less than 10dB below any other noise levels incident on the relevant facades.

3.3 Glazing and Background Ventilation Specification

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria. The calculations considering the following sound insulation scheme can be found in Appendix E.

Description	Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Blue Facade								
6mm Optiphon Glass / 16mm Argon / 6.8mm Optiphon Glass	24	25	27	38	48	47	55	41 R _W (-6; C _{tr})
Greenwoods 2500EA.AC1 (1 No. Trickle) ^[1]	31	41	40	37	47	43	46	42 D _{ne,W} (-2; C _{tr})
Orange Facade								
6mm Glass / 16mm Air Cavity / 6mm Laminated Glass	19	21	17	25	35	37	31	33 R _W (-5; C _{tr})
Greenwoods 2500EA.AC1 (2 No. Trickle)	31	41	40	37	47	43	46	42 D _{ne,W} (-2; C _{tr})
Red Facade								
6mm Optiphon Glass / 16mm Argon / 6.8mm Optiphon Glass	24	25	27	38	48	47	55	41 R _W (-6; C _{tr})
Greenwoods 2500EA.AC1 (1 No. Trickle) ^[1]	31	41	40	37	47	43	46	42 D _{ne,W} (-2; C _{tr})
Notes: <i>*Any other window or ventilation specification capable of providing this attenuation will be suitable provided the glazing suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.</i> <i>[1] It is unknown whether rooms will function as living rooms or bedrooms. Given that the latter has more onerous criteria, high performing 'through-the-wall' ventilators will be required in replace of the above specified trickle vents. These would need to achieve 55dB D_{n,e,w}. An example would be the Greenwood MA3051.</i>								

Table 8 – Glazing & Background Ventilation Specification

4. Overheating Screening Assessment

To avoid excessively high temperatures and provide adequate levels of thermal comfort within dwellings, an overheating mitigation strategy must be developed. In low noise areas, this strategy can often rely upon opening windows as the primary source of ventilation, however, in areas with higher levels of noise, this would present a risk of adverse effects on health and quality of life.

4.1 Overheating Criteria

Considering that the development is a change of use and not new build, it is not a requirement to achieve the criteria defined in Approved Document O ('ADO'). However, to allow for a reasonable living environment, it is recommended that the less onerous criteria given in the 'Acoustics Ventilation and Overheating Design Guide' ('AVO') should be applied. Considering that a partially open window provides approximately 13 dB of attenuation (as stated in 'AVO') the proposed internal and external noise criteria are summarised as follows:

Period	Proposed Criteria (dB)		External Level (dB)	
	Internal	External	Measured	Exceedance
Red Façade				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	67	+4
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	62	+7
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	80	+2
Orange Façade				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	65	+2
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	60	+5
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	75	-3
Blue Façade				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	64	+1
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	64	+9
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	79	+1
Notes: [1] Criterion taken from the AVO guide. Above this level, it is stated: "Noise causes a material change in behaviour, e.g., having to keep windows closed most of the time." [2] L_{AFmax} exceeded fewer than 10 times per night.				

Table 9 – External Noise Level Limits for Overheating Criteria

4.2 Overheating Assessment

The noise levels incident on the facades of the proposed development exceed the external noise criteria shown in the table above. Typically, this would trigger a more detailed assessment of whether the development is at risk of overheating. This would need to be undertaken by a suitably qualified person.

However, given the influence of commercial noise at the proposed development, it is recommended that provision of a secondary ventilation strategy is included within the design. This will minimise the requirement for future residents to open windows, whereby unwarranted levels of commercial noise will likely cause adverse impact.

Alternative forms of ventilation include passive systems (such as acoustic louvres) and mechanical systems (such as 'centralised mechanical extract ventilation' and 'mechanical ventilation with heat recovery'). The installation of passive systems is generally preferable; however, the precise requirements must be confirmed with a ventilation specialist. Further to this, it must also be ensured that all ventilation strategies are compliant with the requirements of Approved Document F.

It should be noted that this assessment relates exclusively to overheating mitigation, and as such, open windows may be used for purge ventilation without acoustic constraint.

Further advice can be provided by NOVA Acoustics if required.

5. Noise Breakthrough Assessment and Sound Insulation Scheme

5.1 Noise Breakthrough Criteria

A section of the basement, ground and first floor will structurally adjoin the proposed ground floor retail unit via separating walls and floor. BS8233:2014 states that the internal noise criteria include 'overall noise' which is the sum of structure borne and airborne noise sources. Noise breaking through from structurally adjoining commercial property will be considered to ensure the total noise from both structurally adjoining commercial properties and external noise ingress, does not exceed the proposed acoustic design criteria. Guidance on sound insulation between adjoining domestic and non-domestic dwellings is discussed in Approved Document E (ADE) of the Building Regulations, section 0.8 of Part E states.

The performance standards set out in Tables 1a and 1b are appropriate for walls, floors and stairs that separate spaces used for normal domestic purposes. A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations, the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice may be needed to establish if a higher standard of sound insulation is required and, if so, to determine the appropriate level.

The higher standard of sound insulation required is dependent on the level of noise generated within the commercial property. Noise from structurally adjoining commercial sources can lead to elevated impact and as such further consideration is given to the level of audibility, dominance, attention grabbing features, spectral distribution, regularity, change in level, duration, and time of day the sound is occurring. The commercial properties 'Use Classes' can assist in defining a suitable higher standard of sound insulation.

5.2 Noise Breakthrough Assessment and Specification

At this stage, the class use is understood to be either a small retail shop or office space. The following table outlines the expected level of risk associated with the 'Class Use' of the structurally adjoining commercial unit and provides a required sound insulation limit.

Planning Class	Level of Risk from Noise	Required Sound Insulation Standard (dB)
E(b) Sale of food and drink for consumption (mostly) on the premises	High	$\geq 55 D_{nT,w} + C_{tr}$

Discussion: *The noise emissions produced by small retail units and offices could at most include low background level music. It would not be expected to generate high noise levels to that of a restaurant.*

Table 10 – Noise Breakthrough Assessment

5.3 Testing Results Summary & Assessment

Airborne sound insulation testing was conducted on site using a Svantek 977 Class 1 sound level meter (S/N: 97493) and a Svantek 103 Dodecahedral Speaker. The sound level meter was field calibrated before and after testing and was found to have negligible calibration drift noted. The testing was conducted following the procedures and guidance specified within Annex B of the Building Regulations Approved Document E (ADE) 2003 edition which incorporates 2004, 2010, 2013 and 2015 amendments. The results are assessed in accordance with Section 0: performance - table 1.0a and 1.0b of ADE to indicate compliance.

The results below are indicative of the sound insulation performance of the separating partition between sensitive spaces and adjoining areas.

Test Type	Source Room	Receiving Room	Measured Level (dB)
Airborne Floor Test	Ground Floor Commercial	Basement	28 $D_{nT,w} + C_{tr}$
Impact Floor Test	Ground Floor Commercial	Basement	78 $L_{nT,w}$
Airborne Floor Test	Ground Floor Commercial	First Floor	39 $D_{nT,w} + C_{tr}$

Table 11 – Sound Insulation Testing Results

Based on the above, significant upgrades are required to all floors and mitigation measures are provided below. The separating wall was not built yet and a specification is also provided below.

Separating Floors

It is assumed that all the floors are a timber construction. An indicative specification that can achieve the required sound insulation standard is outlined below. The airborne sound reduction provided by the proposed system has been modelled in INSUL 9.0.

- 12mm Overlay Plywood
- 4mm MuteBarrier Mass Loaded Vinyl (Min. density of 10kg/m²)
- 18mm Flooring Chipboard
- 200mm Timber Joists with 150mm Rockwool RW3 (60kg/m³) tightly and evenly fitted.
- MuteClip™ and Furring Channel System affixed to the underside of the joist. (In accordance with the manufacturers guidelines)
- 2 No. 15mm Soundbloc Plasterboards (with overlapping joints and sealed with flexible mastic at the perimeter)

Separating Wall

An indicative specification that can achieve the required sound insulation standard is outlined below. The airborne sound reduction provided by the proposed system has been modelled in INSUL 9.0.

- 3 No. 15mm Soundbloc Plasterboards (with overlapping joints and sealed with flexible mastic at the perimeter)
- 100mm Timber Joists with 150mm Rockwool RW3 (60kg/m³) tightly and evenly fitted.

- MuteClip™ and Furring Channel System affixed to the joist. (In accordance with the manufacturers guidelines)
- 2 No. 15mm Soundbloc Plasterboards (with overlapping joints and sealed with flexible mastic at the perimeter).

It should be noted that this report provides an indicative specification that can achieve the required acoustic performance and considers that all flanking routes for sound have been appropriately suppressed. As with any construction project, the ability to meet the specification will rely upon the quality of the built structure. As such the works should be carried out to a high standard of workmanship to ensure that any sound insulation measures are not breached, for example by installing a rigid connection across an isolated connection. The development cannot achieve compliance until sound insulation testing is carried out by a UKAS accredited sound insulation testing company upon completion and assessed against the required sound insulation standard.

It should be noted that the above may not be sufficient if an alternative use such as a restaurant were to take over the unit. In such an instance, further upgrades would be required, and NOVA Acoustics should be consulted.

Separating Wall to Pharmacy

It is likely that the separating wall to the pharmacy is a masonry construction. Given that the site previously functioned as light use retail, it is expected that noise breakthrough via this element is appropriately controlled. This is supported by the fact that the pharmacy is expected to have no amplified music.

However, to form a robust approach, investigations should be undertaken to ascertain the existing construction of this wall. It is likely that an internal lining should need to be installed comprised of 2no. layers of 12.5mm Gyproc SoundBloc on a British Gypsum Gypliner System, and further details can be provided during the design stages of the development. 25mm mineral wool (min. density 10kg/m³) would be required within the cavity.

6. Conclusion and Action Plan

The proposed development has been assessed against the acoustic design criteria and a sound insulation scheme has been provided to ensure the criteria has been achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. A summary of the noise levels measured on-site is presented in Section 2.
2. Based on these, the proposed glazing and background ventilation system, or a suitable alternative, should be installed as shown in Section 3.
3. Relying on openable windows during potential overheating conditions would likely result in unsuitable internal noise levels. Therefore, it is recommended that a secondary ventilation/cooling system is installed. By minimising the requirement for future residents to open windows, this will also help to mitigate against potential impacts from nearby commercial activity.
4. The separating walls and floor to the proposed ground floor retail unit should be designed to achieve the required sound insulation. An indicative specification has been provided in section 5.
5. Further design assistance can be provided by NOVA Acoustics Ltd if required.

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

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T , has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for $N\%$ of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10 \log_{10} (p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

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

B.1 – National Planning Policy Framework (2024)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2024. 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 187e, 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 198 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 198 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.”

This is further expanded using the updated “Noise Exposure Hierarchy Table” which includes an additional level of impact referred to as the ‘No Observed Adverse Effect Level’ (‘NOAEL’). It is stated that at this level: *“noise can be heard, but does not cause any change in behaviour, attitude or other physiological response”*. In addition, noise at this level *“can slightly affect the acoustic character of the area but not such that there is a change in the quality of life”*.

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’

BS8233 provides 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 Guidelines on Community Noise (1999) document defines community noise to include noise from “industries” and “construction”. The desirable criteria 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	Daytime (07:00 – 23:00)	Night-time (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 $L_{Aeq,8hour}$ 45 dB L_{AFmax}^*

Table 12 – BS8233:2014 Internal Ambient Noise Level Criteria

**ProPG:2017 states that's good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 time a night within noise sensitive rooms such as bedrooms. However, where it is not reasonably practicable to achieve the guideline then the judgment of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number distribution, predictability, and regularity of noise events.*

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.

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 in Appendix B.

B.4 – Approved Document F Volume 1: Dwellings (2021)

Approved Document F states the following in relation to noise:

- Mechanical ventilation systems, including both continuous and intermittent mechanical ventilation, should be designed and installed to minimise noise. This includes doing all of the following.
 - o Correctly sizing and jointing ducts.
 - o Ensuring that equipment is appropriately and securely fixed, such as using resilient mountings where noise carried by the structure of the building could be a problem.
 - o Selecting appropriate equipment, including following paragraph
- For mechanical ventilation systems, fan units should be appropriately sized so that fans operating in normal background ventilation mode are not overly noisy. This might require fans to be sized so that they do not operate near maximum capacity when in normal background ventilation mode.
- Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation.
- If an exposed façade is close to an area of sustained and loud noise (e.g. a main road), then a noise attenuating background ventilator should be fitted.

B.5 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233:2014 should be achieved considering adequate ventilation as defined by Building Regulations 'Approved Document F' ('ADF') whole dwelling ventilation. However, for a whole dwelling ventilation system such as MVHR it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

The 'Institute of Acoustics' ('IOA') and the 'Association of Noise Consultant's' ('ANC') have published 'The AVO Guide: 2020' document 2020. It provides guidance for those acousticians involved in the design of buildings to prevent noise ingress to and achieve reasonable internal levels. This provides valuable guidance on ventilation and overheating in support of the "Good Acoustic Design" principle advocated by ProPG. Along with guidance showing an acoustic assessment during the overheating condition, the AVO Guide (2020) provides a framework that has a two-level assessment procedure to estimate the potential impact on occupants:

Level 1 Risk Assessment

AVO 'Level 1' risk assessment criteria guide based on external free field ambient noise levels for dwellings relying on purge ventilation (e.g., opening windows) to prevent summertime overheating. AVO Guide Table 3-2 detailed in the figure below. To assess the possibility of overheating it is reasonable to relax the BS 8233:2014 internal ambient noise levels from opening a window by 5 decibels (5 dB). Also, it is assumed that a partially open window will provide a sound reduction of 13 dB. Therefore, to achieve internal noise levels in line with BS 8233:2014 the façade external noise levels should fall inside the levels shown in Table 3-2.

Risk category for Level 1 assessment ^[Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,T}$ ^[Note 3] during 07:00 - 23:00 $L_{Aeq,8hr}$ during 23:00 - 07:00 High 65 dB 55 dB Medium 60 dB 50 dB Low 55 dB 45 dB Negligible 50 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Table 3-2 of AVO Guide (2020)

Figure 5 – AVO Guide Level 1 Risk Category

The AVO Guide (2020) seeks to determine the level of risk associated with overheating in a new residential development based on the existing noise climate. The AVO risk categories are detailed in the table below with clearer categorisation.

AVO Guide (2020) Level 1 Risk Assessment			
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥ 63 dB $L_{Aeq,16hour}$	≥ 55 dB $L_{Aeq,8hour}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62 dB $L_{Aeq,16hour}$	52 – 54 dB $L_{Aeq,8hour}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56 dB $L_{Aeq,16hour}$	49 – 51 dB $L_{Aeq,8hour}$	Low Risk	
≤ 53 dB $L_{Aeq,16hour}$	≤ 48 dB $L_{Aeq,8hour}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 13 – AVO Guide (2020) Level 1 Risk Assessment

Level 2 Risk Assessment:

A 'Level 2' assessment of noise is recommended where a dwelling using purge ventilation (e.g., open windows) reaches Level 1 'High Risk' or 'Medium Risk'. The Level 2 assessment guidance comments that where internal ambient noise levels are >50 dB $L_{Aeq,16hr}$ (day) or >42 dB $L_{Aeq,8hr}$ (night) then the outcome might be that the noise causes a material change in behaviour, e.g., having to keep windows closed for the majority of the time, or there is the potential for sleep disturbance.

To conduct a Level 2 assessment, the following minimum information is required:

- Statement of the overheating criteria being applied.
- Description of the provisions for meeting the stated overheating criteria. This should include, where relevant, the area of façade opening.
- Details of the likely internal ambient noise levels whilst using provisions for mitigating overheating, and the method used to predict these.
- Estimation of how frequently and for what duration such provisions are required to mitigate overheating.
- Consideration of the effect of individual noise events.
- Assessment of the adverse effect on occupants.

The figure below outlines the AVO Guide (2020) guidance for a Level 2 assessment of noise from transport sources relating to the Overheating Condition.

Internal ambient noise level ^[Note 2]			Examples of Outcomes ^[Note 5]	
$L_{Aeq,T}$ ^[Note 3] during 07:00 – 23:00 ^[Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{A,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
 Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. ^[Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{A,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response ^[Note 9] . Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

Table 3-3 of AVO Guide (2020)

Figure 6 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Location Plans

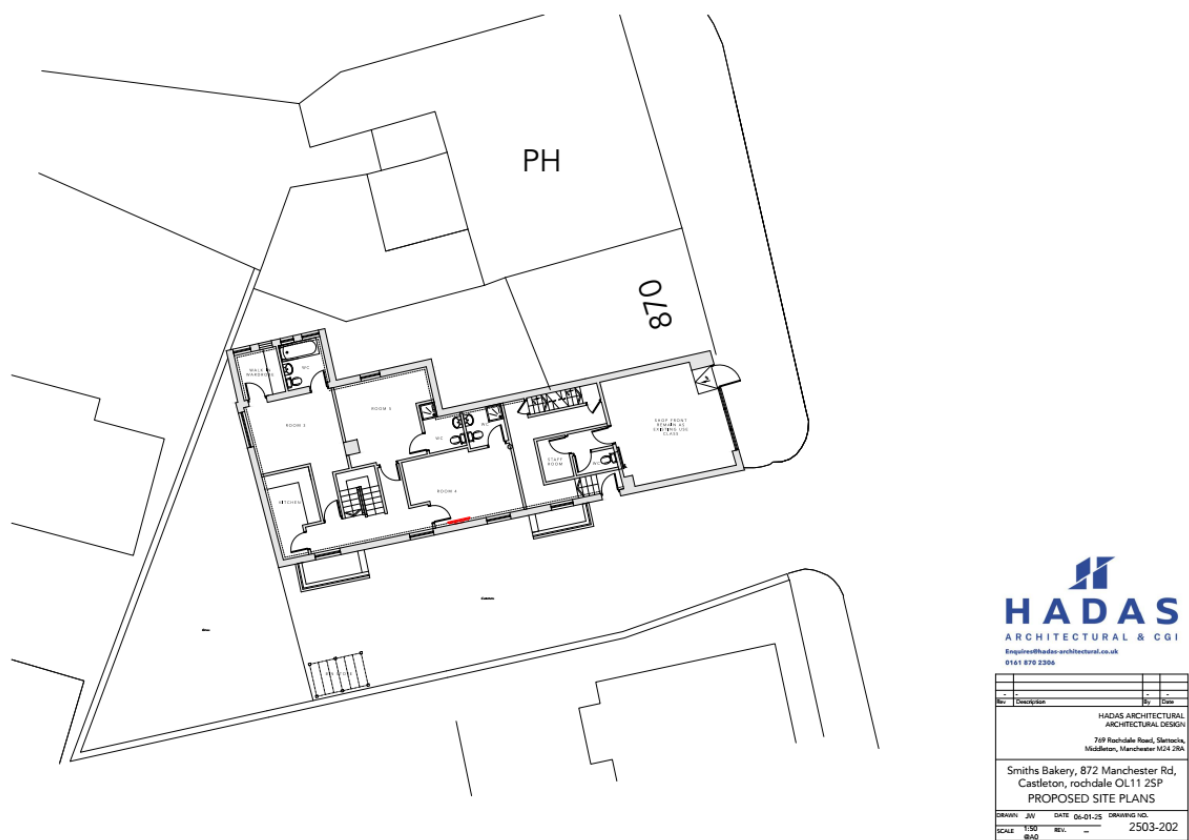


Figure 7 – Location Plans

Appendix D – Environmental Survey

D.1 – Time History Noise Data

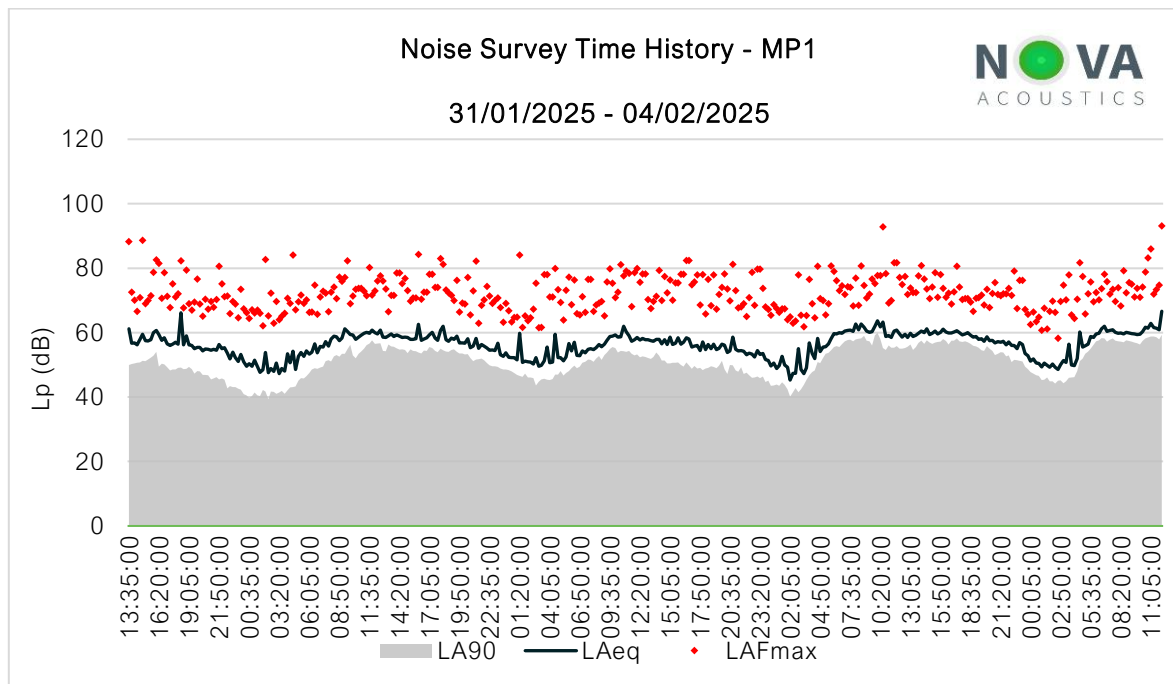


Figure 8 – MP1 Noise Survey Time History

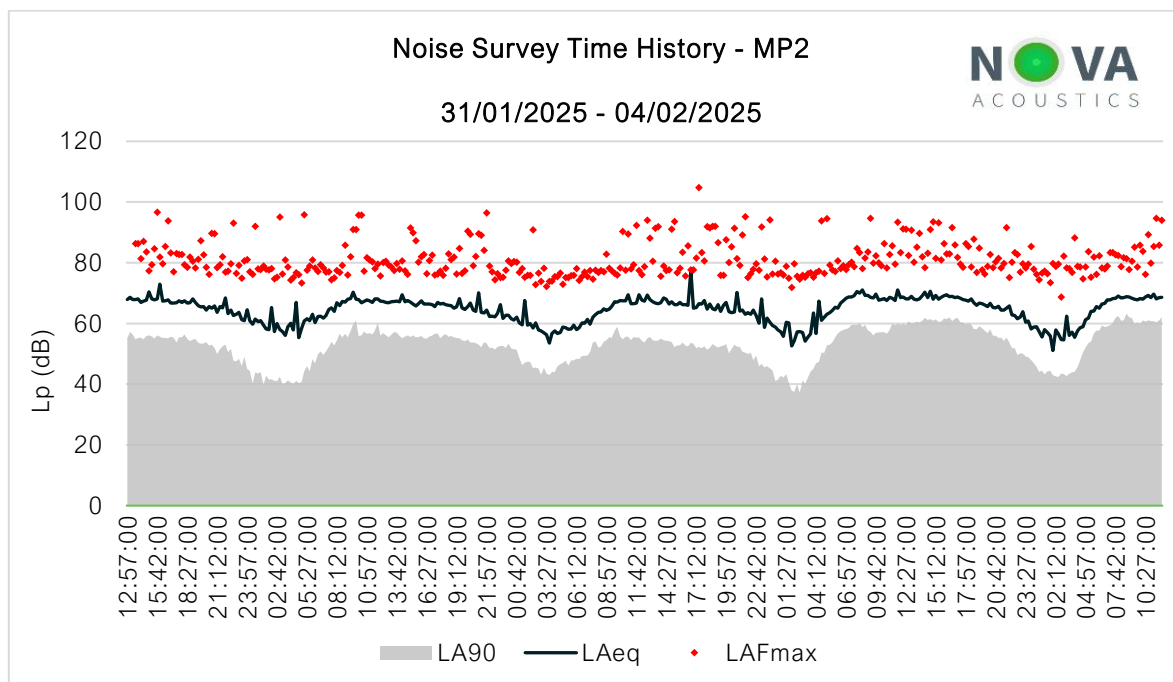


Figure 9 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV971A Class 1 Sound Level Meter	141425	≤0.2
Svantek CB006 Class 1 Calibrator	901955	
Svantek SV971A Class 1 Sound Level Meter	141427	≤0.2
Svantek CB006 Class 1 Calibrator	901955	

Table 14 – Surveying Equipment

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

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no 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 – Chadderton (Approx. 4.2km S of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
31/01/25 – 00:00 – 23:59	2.8 – 6.5	0.0	NE	0.0 – 2.6
01/02/25 – 00:00 – 23:59	4.1 – 5.8	0.2	SSW	0.0 - 3.5
02/02/25 – 00:00 – 23:59	3.9 – 6.0	0.0	S	0.0 - 3.0
03/02/25 – 00:00 – 23:59	4.3 - 9.5	0.2	SW	0.0 – 3.5
04/02/25 – 00:00 – 23:59	7.6 – 9.6	0.0	SSW	0.0 – 5.0

Table 15 – Weather Conditions

Appendix E – Noise Break-in Calculations

E.1 – Façades with Background Ventilation

The façade sound reduction and predicted internal noise levels are calculated assuming the following:

- The calculation method for façade sound reduction is in accordance with BS8233:2014 and BS EN 12354-3.
- The reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room in the UK. This value is used for both living rooms and bedrooms.
- Based on the technical drawings provided to NOVA Acoustics, glazed areas of 15%, 28% and 14% have been allowed for on the blue, orange and red facades. Where these areas increase as the design develops (due to increased glazing areas and / or reductions in room size), these calculations will need to be reviewed.
- The acoustic performance of the façade elements is taken from the relevant manufacturer's technical information, or the sound reduction has been predicted using INSUL 9.0.
- For background trickle ventilation, total Equivalent Areas of 2500m² have been allowed for on the blue and red elevation. 5000mm² per habitable room has been used in the calculations for the orange elevation.
- Any exceedances of 1-2dB are considered marginal and deemed acceptable.

Blue Façade

Living Room (Room 5) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	60	61	61	56	56	56	51	51	51
Glazing Noise Ingress	12	25	24	17	6	-4	-8	-16	-16
Ventilation Noise Ingress	14	26	16	12	15	5	4	1	1
Wall Noise Ingress	6	15	17	9	1	-4	-14	-14	-14
Roof Noise Ingress	6	28	14	4	-1	-1	-6	-6	-6
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	23	38	32	25	22	13	10	6	5
NR20 & Moorhouse	29	47	41	30	23	20	16	14	12
Exceedance of Criteria	-6	-9	-9	-5	-1	-7	-6	-8	-7

Bedroom (Room 5) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	60	61	61	56	56	56	51	51	51
Glazing Noise Ingress	12	25	24	17	6	-4	-8	-16	-16
Ventilation Noise Ingress	5	27	11	7	2	-3	-18	-20	-20
Wall Noise Ingress	6	15	17	9	1	-4	-14	-14	-14
Roof Noise Ingress	6	28	14	4	-1	-1	-6	-6	-6
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	21	39	32	24	15	9	2	-1	-2
NR20 & Moorhouse	29	47	41	30	23	20	16	14	12
Exceedance of Criteria	-9	-8	-9	-6	-8	-11	-14	-15	-14

Bedroom (Room 5) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	60	61	61	56	56	56	51	51	51
Glazing Noise Ingress	12	25	24	17	6	-4	-8	-16	-16
Ventilation Noise Ingress	5	27	11	7	2	-3	-18	-20	-20
Wall Noise Ingress	6	15	17	9	1	-4	-14	-14	-14
Roof Noise Ingress	6	28	14	4	-1	-1	-6	-6	-6
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	21	39	32	24	15	9	2	-1	-2
NR15 & Moorhouse	28	47	41	25	18	15	11	9	7
Exceedance of Criteria	-7	-8	-9	-1	-3	-6	-9	-10	-9

Bedroom (Room 5) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Corrected Lmax Spectrum	70	71	71	66	66	66	61	61	61
Glazing Noise Ingress	21	34	33	26	15	5	1	-7	-7
Ventilation Noise Ingress	15	36	20	16	11	6	-9	-11	-11
Wall Noise Ingress	15	25	27	19	11	6	-4	-4	-4
Roof Noise Ingress	16	38	24	14	9	9	4	4	4
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	30	48	41	34	24	19	12	9	8
NR30 & Moorhouse	36	47	41	39	33	30	26	24	22
Exceedance of Criteria	-6	1	0	-5	-9	-11	-14	-15	-14

Orange Façade

Living Room (Room 1) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Corrected Leq,T Spectrum	65	69	63	60	59	62	58	52	52
Glazing Noise Ingress	26	40	34	32	20	14	12	-3	-3
Ventilation Noise Ingress	21	36	20	18	20	13	13	4	4
Wall Noise Ingress	9	23	19	13	4	2	-7	-13	-13
Roof Noise Ingress	12	35	15	7	1	4	0	-6	-6
Room Absorption Correction		5	4	4	3	3	3	2	0
Total Noise Ingress	34	50	41	39	29	23	22	10	9
NR30	35	59	48	39	33	30	26	24	22
Exceedance of Criteria	-1	-9	-7	0	-4	-7	-4	-14	-13

Bedroom (Room 1) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Corrected Leq,T Spectrum	65	69	63	60	59	62	58	52	52
Glazing Noise Ingress	26	40	34	32	20	14	12	-3	-3
Ventilation Noise Ingress	21	36	20	18	20	13	13	4	4
Wall Noise Ingress	9	23	19	13	4	2	-7	-13	-13
Roof Noise Ingress	12	35	15	7	1	4	0	-6	-6
Room Absorption Correction		5	4	4	3	3	3	2	0
Total Noise Ingress	34	50	41	39	29	23	22	10	9
NR30	35	59	48	39	33	30	26	24	22
Exceedance of Criteria	-1	-9	-7	0	-4	-7	-4	-14	-13

Bedroom (Room 1) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Corrected Leq,T Spectrum	60	62	56	54	53	56	53	48	48
Glazing Noise Ingress	20	33	27	26	14	8	7	-7	-7
Ventilation Noise Ingress	16	30	14	13	15	8	9	1	1
Wall Noise Ingress	3	16	12	7	-2	-4	-12	-17	-17
Roof Noise Ingress	6	29	9	2	-4	-1	-4	-9	-9
Room Absorption Correction		5	4	4	3	3	3	2	0
Total Noise Ingress	28	43	35	33	24	18	17	7	5
NR25	30	55	43	35	28	25	21	19	17
Exceedance of Criteria	-2	-12	-8	-2	-4	-7	-4	-12	-12

Bedroom (Room 1) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Corrected Lmax Spectrum	75	74	68	67	70	71	68	66	59
Glazing Noise Ingress	34	45	39	39	31	23	22	11	4
Ventilation Noise Ingress	31	41	25	25	31	22	23	18	11
Wall Noise Ingress	17	28	24	20	15	11	3	1	-6
Roof Noise Ingress	20	41	20	14	12	13	11	8	2
Room Absorption Correction		5	4	4	3	3	3	2	0
Total Noise Ingress	42	55	46	46	40	32	32	24	16
NR40	45	67	56	49	43	40	37	34	33
Exceedance of Criteria	-3	-12	-10	-3	-3	-8	-5	-10	-17

Red Façade

Living Room (Room 2) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	60	61	61	56	56	56	51	51	51
Glazing Noise Ingress	12	24	23	16	5	-5	-9	-17	-17
Ventilation Noise Ingress	14	26	16	12	15	5	4	1	1
Wall Noise Ingress	6	15	17	9	1	-4	-14	-14	-14
Roof Noise Ingress	6	28	14	4	-1	-1	-6	-6	-6
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	23	38	32	25	21	12	10	6	4
NR20 & Moorhouse	29	47	41	30	23	20	16	14	12
Exceedance of Criteria	-7	-9	-9	-5	-2	-8	-6	-8	-8

Bedroom (Room 2) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	60	61	61	56	56	56	51	51	51
Glazing Noise Ingress	12	24	23	16	5	-5	-9	-17	-17
Ventilation Noise Ingress	5	27	11	7	2	-3	-18	-20	-20
Wall Noise Ingress	6	15	17	9	1	-4	-14	-14	-14
Roof Noise Ingress	6	28	14	4	-1	-1	-6	-6	-6
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	20	38	31	24	14	9	2	-1	-2
NR20 & Moorhouse	29	47	41	30	23	20	16	14	12
Exceedance of Criteria	-9	-9	-10	-6	-9	-11	-14	-15	-14

Bedroom (Room 2) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	60	61	61	56	56	56	51	51	51
Glazing Noise Ingress	12	24	23	16	5	-5	-9	-17	-17
Ventilation Noise Ingress	5	27	11	7	2	-3	-18	-20	-20
Wall Noise Ingress	6	15	17	9	1	-4	-14	-14	-14
Roof Noise Ingress	6	28	14	4	-1	-1	-6	-6	-6
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	20	38	31	24	14	9	2	-1	-2
NR15 & Moorhouse	28	47	41	25	18	15	11	9	7
Exceedance of Criteria	-7	-9	-10	-1	-4	-6	-9	-10	-9

Bedroom (Room 2) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Corrected Lmax Spectrum	70	71	71	66	66	66	61	61	61
Glazing Noise Ingress	21	34	33	26	15	5	1	-7	-7
Ventilation Noise Ingress	15	36	20	16	11	6	-9	-11	-11
Wall Noise Ingress	15	25	27	19	11	6	-4	-4	-4
Roof Noise Ingress	16	38	24	14	9	9	4	4	4
Room Absorption Correction		4	4	3	3	3	2	1	0
Total Noise Ingress	30	48	41	34	24	18	11	9	7
NR30 & Moorhouse	36	47	41	39	33	30	26	24	22
Exceedance of Criteria	-7	1	0	-5	-9	-12	-15	-15	-15



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