RS Acoustic Engineering

577-579 Wilbraham Road
Noise Assessment Report



Project: 577-579 Wilbraham Road, Chorlton-cum-Hardy

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1. Introduction

1.1 RS Acoustic Engineering Ltd has been appointed by Nota Construction to undertake a noise assessment with regard to a proposed mixed commercial and residential development at No.577-579 Wilbraham Road, Chorlton-cum-Hardy, Manchester, M21.

1.2 The proposals are to refurbish and remodel the existing property and construct a new three-storey extension to the rear, including alterations to the Barlow Moor Road and Wilbraham Road elevations. A total of two retail units will be created on the ground floor (Class E) and six self-contained apartments will be created on the upper floors (Class C3).

1.3 Manchester City Council granted full planning permission for the proposed development on the 20 September 2023, subject to a number of conditions.

1.4 The property was most recently used as an art gallery, with a residential dwelling on the upper floor. Prior to the previous use, the property was formerly a bank.

1.5 The dominant source of noise at the site is passing road traffic on Barlow Moor Road and Wilbraham Road.

1.6 A noise assessment has been undertaken taking into consideration the guidance contained within British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and ProPG's *Planning & Noise*. Manchester City Council's planning and noise guidance has also been taken into consideration.

1.7 This assessment is based on the results of an environmental noise survey undertaken by RS Acoustic Engineering Ltd. Continuous sound level monitoring was conducted over several days in order to establish the ambient sound pressure levels during the daytime and night-time period.

1.8 The measured sound level data has been used to determine the acoustic performance requirements for the building envelope construction and to determine whether it will be suitable to naturally ventilate habitable rooms via opening windows alone.

1.9 An assessment of noise ingress through the building envelope with windows open and closed has been undertaken to determine the resulting sound levels.

1.10 The guidance given within Approved Document F (Ventilation) has also been taken into consideration with regard to noise ingress and opening windows.

1.11 The survey and assessment was conducted by Mr Ryan Swales ($BSc_{(Hons)}$, MIOA), Principal Acoustic Consultant and Member of the Institute of Acoustics.

1.12 The results of the noise survey have been presented, along with the assessment criteria and a discussion of the results with respect to the appropriate guidance and targets.

1.13 Recommendations regarding sound insulation, ventilation and noise mitigation are also provided within this report.

2. Assessment Guidance & Acoustic Criteria

Manchester City Council Planning Conditions

2.1 Manchester City Council (MCC) granted full planning permission for the development, subject to eighteen conditions in total (ref: 137425/FO/2023).

2.2 With regard to noise impacting on the dwellings and noise emanating from the commercial units, condition number's 7 to 10 are relevant:

7) a) Any externally mounted ancillary plant, equipment and servicing to be installed shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location. Prior to its installation, the scheme shall be submitted to and approved in writing by the City Council as Local Planning Authority in order to secure a reduction in the level of noise emanating from the site.

b) Prior to any externally mounted ancillary plant, equipment and servicing to be installed becoming operational, an approved verification report shall be submitted to and approved in writing by the City Council as Local Planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of non - conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

Reason - To minimise the impact of the development and to prevent a general increase in pre-existing background noise levels around the site, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester and policies DM1 and SP1 of the Manchester Core Strategy.

8) a) Before above ground development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Wilbraham Road and Barlow Moor Road shall be submitted to and approved in writing by the City Council as Local Planning Authority. The potential for overheating shall also be assessed and the noise insulation scheme shall take this into account. The approved noise insulation and ventilation scheme shall be completed before any of the dwelling units hereby approved are occupied.

b) Prior to first occupation of the residential units, a verification report shall be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the internal noise criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the internal noise criteria.

Reason: To secure a reduction in noise from traffic or other sources in order to protect future residents from noise disturbance and to reduce the potential for overheating, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester and policies DM1 and SP1 of the Manchester Core Strategy.

9) The retail units (Class E) hereby approved shall not be open outside the following hours:

07:00 to 22.00 hrs daily.

Reason - To safeguard residential amenity, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester and policies SP1 and DM1 of the Manchester Core Strategy.

10) Deliveries, servicing and collections, including waste collections shall not take place outside of the following hours:

07.30 to 20.00 hrs Monday to Saturday; No deliveries/waste collections on Sundays and Bank Holidays.

Reason - To safeguard the amenities of nearby occupiers, pursuant to Policies DM1 and SP1 of the Manchester Core Strategy.

Manchester City Council: Planning & Noise Technical Guidance

2.3 With regard to residential developments, Manchester City Council has adopted the following noise criteria:

- Bedrooms (night time - 23.00 - 07.00) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 10 times).
- Living Rooms (daytime - 07.00 - 23.00) 35 dB L_{Aeq}.
- Gardens and terraces (daytime) 55 dB L_{Aeq}.

2.4 These criteria have been adopted for the following reasons:

- BS 8233: 2014 recognises these levels as a good standard for resting/sleeping conditions.
- The WHO document 'Guidelines for Community Noise' recommends an internal L_{Aeq} of 30 dB for optimal sleep conditions (and no more than 35 dB for internal rooms during daytime).
- The performance of acoustic insulation schemes can often be below that specified, according to the quality of installation, materials, noise spectrum and deterioration / wear and tear of building elements. A high design specification introduces a 'safety margin' should building elements not perform as well as expected ('on-site' performance).
- Performance specification for glazing does not usually take into account the detrimental effect of vents on the sound insulation. Even 'acoustic' vents will reduce the performance of the facade insulation, as they will inherently contain a free open area for air exchange.
- There is a general increase in urban noise levels, which can in the future be reasonably accommodated by these standards.
- The standards support the Local Authority corporate objective to prevent ill-health and improve local people's health and well-being.

British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings

2.5 BS 8233 provides guidance regarding acoustic criteria and noise levels appropriate for various types of space that have different functions.

2.6 With regard to dwellings, appropriate internal ambient sound levels are given for bedrooms, living rooms and dining rooms (habitable rooms). The guidelines take into consideration the effect of internal noise on sleep and also the effect of noise on resting, listening and communicating.

2.7 The internal sound level targets presented in Table 2.1 have been reproduced directly from Table 4 of the standard.

Table 2.1 - Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 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 $L_{Aeq,8hour}$

2.8 Note 7 of the standard also suggests that in some circumstances it may be appropriate to relax the indoor ambient noise level targets by up to 5 dB:

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.

2.9 Note 5 also states:

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

World Health Organisation: Guidelines for community noise (1999)

2.10 To help avoid sleep disturbance within bedrooms, this historical guidance document recommends that the night-time internal ambient sound level should not exceed 30 dB $L_{Aeq,T}$ and the maximum sound level should not typically exceed 45 dB $L_{AFmax,T}$.

2.11 The corresponding values directly outside of bedroom windows are therefore 45 dB $L_{Aeq,8hour}$ and 60 dB $L_{AFmax,T}$. This is based on the assumption that a partially open window provides approximately 15 dB of sound attenuation (from external noise).

2.12 With regard to sleep disturbance and maximum L_{AFmax} sound levels, the study undertaken by Vallet & Vernet (1991) suggests that for good sleep, indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night.

Professional Practice Guidance on Planning & Noise (2017)

2.13 Professional Practice Guidance on Planning and Noise (ProPG) has been produced in order to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

2.14 The NPPF encourages improved standards of design. This guidance document encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

2.15 The scope of ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transportation sources.

Internal noise level guidelines

2.16 The recommended ProPG internal noise level guidelines are presented in Table 2.2. The guidelines reflect and extend current practice contained within BS 8233:2014.

Table 2.2 - ProPG internal noise level guidelines

Activity	Location	07:00 to 23:00	23:00 to 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 $L_{Amax,F}$

2.17 Where the local planning authority accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment.

2.18 In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "*whole dwelling ventilation*" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position.

2.19 It should also be noted that the internal noise level guidelines are generally not applicable under "*purge ventilation*" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

2.20 BS 4142 (amended June 2019) describes methods for rating and assessing sound of an industrial and/or commercial nature, such as sound from manufacturing processes and fixed mechanical plant/machinery.

2.21 Outdoor sound levels are used to assess the likely effect on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.22 BS 4142 is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.

2.23 The standard has three different methods (subjective, objective and reference) of applying a penalty to tonal, impulsive and intermittent noises, as separate entities.

2.24 The current standard no longer indicates significance of noise impacts as giving rise to a '*likelihood of complaint*' but rather as an '*indication*' of varying degrees of '*adverse impact'*.

2.25 BS 4142:2014 states that a difference of around +10 dB or more (excess of rating level above the background sound level) is likely to be an indication of a significant adverse impact, depending on the context.

2.26 A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

2.27 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.

2.28 Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3. Environmental Noise Survey

Survey methodology

3.1 Continuous sound level monitoring was conducted over a 121-hour period on the front elevation facing Wilbraham Road and Barlow Moor Road. The equipment was installed at first floor level (Position A). Measurements were performed from 12:30 hours on Wednesday 15th through to 13:30 hours on Monday 20th November 2023.

3.2 Sample measurements were also conducted during the daytime period at ground floor level on the rear elevation (Position B). Measurements were time synchronised with the front elevation.

3.3 A measurement interval of 2-minutes was used during the survey and measurements were considered to be subject to sound reflections from the façade (as opposed to free field). One-third octave band and A-weighted broadband sound pressure levels were recorded during the survey.

3.4 The site location, surrounding area and survey measurement positions are shown in Figure 3.1 and Figure 3.2. The site location plan is presented in Appendix A.

Figure 3.1 - Site location and survey measurement positions (source: Google Earth)

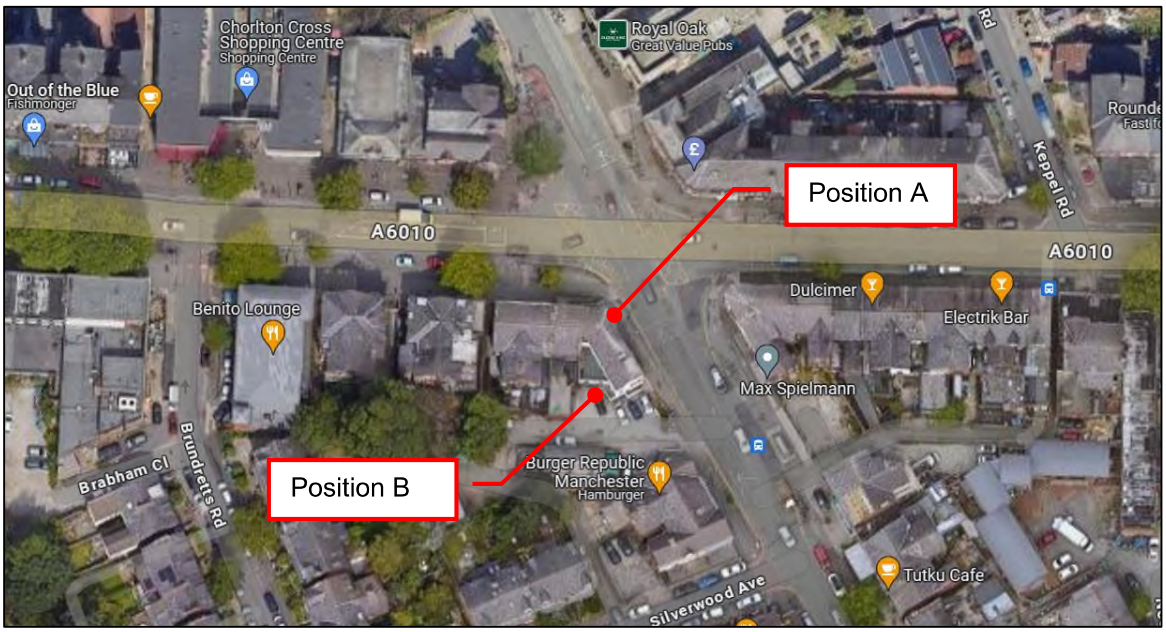


Figure 3.2 - Photographs showing continuous monitoring position



Survey equipment

3.5 The survey was conducted using the following Class-1 specification equipment:

- Brüel & Kjaer 2250-Light sound level meter, microphone type 4189, preamplifier type ZC0032.
- Brüel & Kjaer 2260 sound level meter, microphone type 4189, preamplifier type ZC0032.
- CEL-120/1 Acoustic calibrator.

3.6 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories (calibration certificates are available upon request).

3.7 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the measurements performed. Calibration drift was less than 0.1 dB.

Weather conditions

3.8 The weather conditions during the survey were generally dry and fine with a light cloud cover. There was intermittent rainfall on Friday and Saturday and wind speed measurements taken outside of the building were between 0.8 and 2.1 m/s^{-1}.

3.9 The air temperature during the survey ranged between 4°C and 14°C. The overall weather conditions were considered suitable to obtain representative measurements.

Subjective observations of the acoustic environment

3.10 The dominant and consistent source of noise at the site is road traffic on Barlow Moor Road and Wilbraham Road.

3.11 There are various commercial properties in the local neighbouring area, however operational noise associated with the neighbouring premises was considered to be negligible during the daytime and night-time site visits. The most notable source of noise was the occasional delivery vehicle stopping on Barlow Moor Road and footfall from customers visiting neighbouring retail units such as Café Nero on the opposite side of the road.

3.12 There was no audible building services plant noise at the front and rear elevation of the property during the site visits (e.g. from condenser units, commercial extract fans etc).

3.13 Other sources of noise include high altitude aircraft and passing pedestrians.

Measured indices

3.14 Although a wide range of statistical sound level data was recorded during the survey, the L_{Aeq} and L_{AFmax} indices are of most interest in this instance:

- $L_{Aeq,T}$ - The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
- $L_{AFmax,T}$ - The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of occasional loud noises).

3.15 Sound pressure level measurements are taken with an A-weighting (denoted by a subscript 'A', e.g. L_{Aeq}) to approximate the frequency response of the human ear.

Results summary

Continuous sound level monitoring

3.16 Table 3.1 presents a summary of the continuously measured ambient and background sound pressure levels. Measured values have been rounded to the nearest whole number.

Table 3.1 - Summary of continuously measured sound pressure levels

Date	Period	Duration, T (hours)	$L_{Aeq,T}$ dB	10th Highest[1] $L_{AFmax,T}$ dB	Typical[2] $L_{A90,T}$ dB
Wednesday 15/11/2023	Daytime (12:30-23:00)	10.5	65	---	57
	Night-time (23:00-07:00)	8	59	78	40
Thursday 16/11/2023	Daytime (07:00-23:00)	16	65	---	57
	Night-time (23:00-07:00)	8	61	79	42
Friday 17/11/2023	Daytime (07:00-23:00)	16	66	---	58
	Night-time (23:00-07:00)	8	62	77	47
Saturday 18/11/2023	Daytime (07:00-23:00)	16	66	---	57
	Night-time (23:00-07:00)	8	61	80	40
Sunday 19/11/2023	Daytime (07:00-23:00)	16	65	---	56
	Night-time (23:00-07:00)	8	59	79	39
Monday 20/11/2023	Daytime (07:00-13:30)	6.5	66	---	57

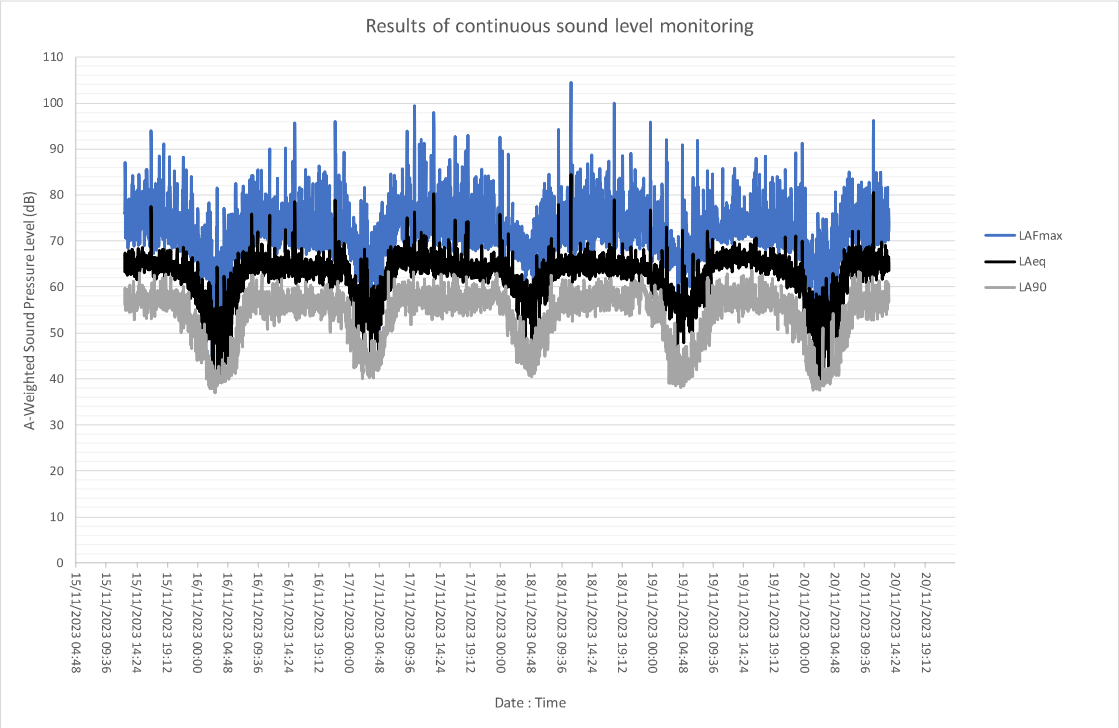
[1]The 10th highest value from 240 measurement periods (indoor sound pressure levels should ideally not exceed 45 dB L_{Amax} more than 10-15 times per night). [2]Considered to be the representative background sound level from a statistical analysis (modal value).

3.17 The daytime ambient sound pressure level was approximately 65 to 66 dB $L_{Aeq,16hour}$ and the night-time ambient sound pressure level was approximately 59 to 62 dB $L_{Aeq,8hour}$.

3.18 The typical daytime background sound pressure was approximately 56 to 58 dB $L_{A90,T}$ and the typical night-time background sound pressure level was approximately 39 to 47 dB $L_{A90,T}$.

3.19 The ambient and background sound pressure levels are presented graphically in Figure 3.3 overleaf. Additional tabulated survey data can be made available upon request.

Figure 3.3 - Graph showing results of continuous sound level monitoring



Sample measurements

3.20 The daytime ambient sound pressure level was approximately 52 to 56 dB $L_{Aeq,2min}$ at the sample measurement position on the rear elevation. The sound level was approximately 10 to 15 dB lower than the sound level measured simultaneously at the continuous monitoring position.

4. Assessment & Discussion

Building envelope construction and acoustic performance

4.1 The external walls are of a traditional double-leaf brickwork construction. The sound insulation performance is expected to be approximately 50 to 60 dB R_w.

4.2 The external walls to the new extension are expected to consist of a brickwork/cavity/blockwork construction. The sound insulation performance is expected to be approximately 50 to 60 dB R_w.

4.3 The roof and ceiling construction consists of a pitched tiled roof, minimum 100 mm thick insulation (estimated) and plasterboard ceiling. The roof and ceiling combination is expected to provide a sound insulation performance of approximately 40 to 50 dB R_w.

4.4 The existing windows are single glazed, approximately 4 mm thick with timber frames. The sound insulation performance of the glazing is expected to be approximately 24 to 25 dB R_w.

4.5 The glazing is therefore the weakest element with regard to the sound insulation performance of the building envelope.

4.6 Ventilation is currently provided via opening sash windows (i.e. there are no trickle vents to windows).

Noise ingress with windows closed

Standard double glazing to habitable rooms

4.7 Table 4.1 and Table 4.2 present the noise ingress calculation results for the open-plan lounges on the elevations facing Barlow Moor Road and Wilbraham Road (Apartment No's 2 and 5).

4.8 The highest measured daytime ambient sound pressure level has been used in the calculations (66 dB $L_{Aeq,16hour}$). Standard thermal double glazing consisting of 4 mm glass / 16 – 20 mm cavity / 4 mm glass has been assumed for the calculation.

4.9 The calculations take into account the sound insulation performance of each building element, surface area and internal room dimensions. The proposed floor plans and elevations are presented in Appendix A.

4.10 The measured octave-band sound levels and typical reverberation time for a habitable room have also been taken into consideration.

Table 4.1 - Noise ingress calculation results with standard glazing (apartment 2 - lounge/dining)

Title: Apartment 2 (Lounge/Dining) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				26.3	22.4	30.4	40.2	42.3	36.4			
L_{in}				43.7	46.6	31.6	18.8	14.7	14.6			
Materials												
4mm glass/16 - 20 mm cavity/4mm glass		6.6		21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Double-leaf brickwork wall		14.6		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				26.3	22.4	30.4	40.2	42.3	36.4			
Plane façade	ΔL_{fs}	21.2		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	x_{fs}	0.0		26.3	22.4	30.4	40.2	42.3	36.4			34
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				43.7	46.6	31.6	18.8	14.7	14.6		39	dBA

Table 4.2 - Noise ingress calculation results with standard glazing (apartment 5 - lounge/dining)

Title: Apartment 5 (Lounge/Dining) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				24.5	24.0	31.6	39.9	42.8	38.3			
L_{in}				45.5	45.0	30.4	19.1	14.2	12.7			
Materials												
4mm glass/16 - 20 mm cavity/4mm glass		3.2		21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Double-leaf brickwork wall		14.2		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
Tiled roof, insulation, plasterboard ceiling		25.1		28.0	34.0	40.0	45.0	49.0	50.0		44	(-2,-5)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				24.5	24.0	31.6	39.9	42.8	38.3			
Plane façade	ΔL_{fs}	42.5		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		24.5	24.0	31.6	39.9	42.8	38.3			36
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				45.5	45.0	30.4	19.1	14.2	12.7		38	dBA

4.11 The calculation results indicate a daytime internal sound level of approximately 38 to 39 dB $L_{Aeq,16hour}$ with standard thermal double glazing.

4.12 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore not be achieved with windows closed.

4.13 It is worth noting that the acoustic performance of the existing single glazed sash units will be less than that of a double glazed unit and therefore the current ambient sound level will be slightly higher than that predicted in the calculations above.

Acoustically laminated double glazing to habitable rooms

4.14 Table 4.3 and Table 4.4 present the noise ingress calculation results for the same open-plan lounges with acoustically laminated double glazing (e.g. 6 mm glass /16 – 20 mm cavity / 8.8 mm acoustic laminate).

4.15 Table 4.5 and Table 4.6 overleaf present the calculation results for the bedrooms of apartment no's 2 and 5 with the same acoustically laminated glazing.

Table 4.3 - Noise ingress calculation results with laminated glazing (apartment 2 - lounge/dining)

Title: Apartment 2 (Lounge/Dining) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				29.2	31.3	43.1	50.2	50.6	57.5			
L_{in}				40.8	37.7	18.9	8.8	6.4	-6.5			
Materials												
6mm glass/16 - 20 mm cavity/8.8mm lam		6.6		24.0	26.0	40.0	48.0	46.0	54.0		41	(-3,-7)
Double-leaf brickwork wall		14.6		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				29.2	31.3	43.1	50.2	50.6	57.5			
Plane façade	ΔL_{fs}	21.2		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		29.2	31.3	43.1	50.2	50.6	57.5			45
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				40.8	37.7	18.9	8.8	6.4	-6.5		31	dBA

Table 4.4 - Noise ingress calculation results with laminated glazing (apartment 5 - lounge/dining)

Title: Apartment 5 (Lounge/Dining) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				25.4	30.1	37.6	43.0	46.4	48.3			
L_{in}				44.6	38.9	24.4	16.0	10.6	2.7			
Materials												
6mm glass/16 - 20 mm cavity/8.8mm lam		3.2		24.0	26.0	40.0	48.0	46.0	54.0		41	(-3,-7)
Double-leaf brickwork wall		14.2		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
Tiled roof, insulation, plasterboard ceiling		25.1		28.0	34.0	40.0	45.0	49.0	50.0		44	(-2,-5)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				25.4	30.1	37.6	43.0	46.4	48.3			
Plane façade	ΔL_{fs}	42.5		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		25.4	30.1	37.6	43.0	46.4	48.3			41
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				44.6	38.9	24.4	16.0	10.6	2.7		33	dBA

Table 4.5 - Noise ingress calculation results with laminated glazing (apartment 2 - bedrooms)

Title: Apartment 2 (Bedroom 2) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				29.8	31.9	43.3	50.3	51.0	57.8			
L_{in}				40.2	37.1	18.7	8.7	6.0	-6.8			
Materials												
6mm glass/16 - 20 mm cavity/8.8mm lam		2.0		24.0	26.0	40.0	48.0	46.0	54.0		41	(-3,-7)
Double-leaf brickwork wall		5.7		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				29.8	31.9	43.3	50.3	51.0	57.8			
Plane façade	ΔL_{fs}	7.7		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		29.8	31.9	43.3	50.3	51.0	57.8			46
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				40.2	37.1	18.7	8.7	6.0	-6.8		30	dBA
Title: Apartment 2 (Bedroom 1) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				28.3	30.4	42.7	49.9	49.8	57.0			
L_{in}				41.7	38.6	19.3	9.1	7.2	-6.0			
Materials												
6mm glass/16 - 20 mm cavity/8.8mm lam		3.6		24.0	26.0	40.0	48.0	46.0	54.0		41	(-3,-7)
Double-leaf brickwork wall		5.8		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				28.3	30.4	42.7	49.9	49.8	57.0			
Plane façade	ΔL_{fs}	9.4		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		28.3	30.4	42.7	49.9	49.8	57.0			44
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				41.7	38.6	19.3	9.1	7.2	-6.0		32	dBA

Table 4.6 - Noise ingress calculation results with laminated glazing (apartment 5 - bedrooms)

Title: Apartment 5 (Bedroom 2) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				25.3	29.9	37.6	42.9	46.3	48.3			
L_{in}				44.7	39.1	24.4	16.1	10.7	2.7			
Materials												
6mm glass/16 - 20 mm cavity/8.8mm lam		1.3		24.0	26.0	40.0	48.0	46.0	54.0		41	(-3,-7)
Double-leaf brickwork wall		5.1		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
Tiled roof, insulation, plasterboard ceiling		9.0		28.0	34.0	40.0	45.0	49.0	50.0		44	(-2,-5)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				25.3	29.9	37.6	42.9	46.3	48.3			
Plane façade	ΔL_{fs}	15.3		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		25.3	29.9	37.6	42.9	46.3	48.3			41
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				44.7	39.1	24.4	16.1	10.7	2.7		33	dBA

Title: Apartment 5 (Bedroom 1) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				24.5	28.5	37.3	42.8	45.7	48.2			
L_{in}				45.5	40.5	24.7	16.2	11.3	2.8			
Materials												
6mm glass/16 - 20 mm cavity/8.8mm lam		2.5		24.0	26.0	40.0	48.0	46.0	54.0		41	(-3,-7)
Double-leaf brickwork wall		4.7		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
Tiled roof, insulation, plasterboard ceiling		9.6		28.0	34.0	40.0	45.0	49.0	50.0		44	(-2,-5)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				24.5	28.5	37.3	42.8	45.7	48.2			
Plane façade	ΔL_{fs}	16.8		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		24.5	28.5	37.3	42.8	45.7	48.2			40
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				45.5	40.5	24.7	16.2	11.3	2.8		34	dBA

4.16 The calculation results indicate a daytime internal sound level of approximately 30 to 34 dB $L_{Aeq,16hour}$ with acoustically laminated double glazing.

4.17 The daytime sound level target of 35 dB $L_{Aeq,16hour}$ will therefore be achieved with windows closed.

4.18 Since the night-time L_{Aeq} sound level is at least 4 dB lower than the daytime sound level, the night-time sound level target of 30 dB $L_{Aeq,8hour}$ will also be achieved.

4.19 With regard to the maximum L_{AFmax} internal sound levels, the recommended target of 45 dB L_{AFmax} will also be achieved within bedrooms for the majority of the night-time period.

- 79 dB $L_{AFmax,2min}$ – 34 dB R_w+C_{tr} = 45 dB $L_{AFmax,2min}$

4.20 As an example, Pilkington Optiphon or Stadip Silence are both high performing acoustic laminates that can be used within double glazed systems.

- www.pilkington.com/en-gb/uk/products/product-categories/noise-control/pilkington-optiphon/
- SGG STADIP SILENCE® | Saint-Gobain Building Glass (saint-gobain-building-glass.com)

4.21 The acoustic performance of a particular construction may differ slightly between manufacturers and therefore the sound insulation performance should be verified where possible.

Secondary glazing to habitable rooms

4.22 An alternative solution would be to install secondary glazing and retain the original single glazed sash windows where possible. The secondary unit may be face-fixed to the primary (original) timber frame or reveal-fixed.

4.23 Table 4.7 presents the calculation results for an example 6 mm thick secondary glazed unit installed in addition to the existing glazing.

Table 4.7 - Noise ingress calculation results with 6 mm thick secondary glazing

Title: Apartment 5 (Lounge/Dining) **Noise Break In (ISO 12354-3)**												
Formula/Comment	***Single Value***		***63***	***125***	***250***	***500***	***1000***	***2000***	***4000***	***8000***	***Rw***	***(C,C$_{tr}$)***
				25.2	30.1	37.2	42.7	47.0	48.3			
L_{in}				44.8	38.9	24.8	16.3	10.0	2.7			
Materials												
Existing with 6mm secondary		3.2		23.0	26.0	37.0	45.0	51.0	53.0		39	(-2,-6)
Double-leaf brickwork wall		14.2		40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
Tiled roof, insulation, plasterboard ceiling		25.1		28.0	34.0	40.0	45.0	49.0	50.0		44	(-2,-5)
$L_{out,s}$												
$L_{out,2m}$	Add Element			70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{out,free\ field}$				67.0	66.0	59.0	56.0	54.0	48.0		63	
Element 1				25.2	30.1	37.2	42.7	47.0	48.3			
Plane façade	ΔL_{fs}	42.5		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X_{fs}	0.0		25.2	30.1	37.2	42.7	47.0	48.3			41
$L_{p,out,2m}$				70.0	69.0	62.0	59.0	57.0	51.0		66	
$L_{p,in}$				44.8	38.9	24.8	16.3	10.0	2.7		33	dBA

4.24 The calculation results indicate a daytime internal sound level of approximately 33 dB $L_{Aeq,16hour}$ with secondary glazing installed and the original units retained.

4.25 Example suppliers of secondary glazing units appropriate for dwellings include:

- Selectaglaze I Secondary Glazing Specialist I London & UK
- Clearview Secondary Glazing | High Performance Secondary Glazing (clearviewsg.co.uk)

4.26 To achieve the optimum performance, windows should be well sealed around the frame when installed. Large gaps between the frame and the brickwork and poorly sealed frames can notably reduce performance.

Standard double glazing to rear elevation

4.27 Ambient sound pressure levels are approximately 10 to 15 dB lower on the rear elevation, due to being screened from passing road traffic.

4.28 On this basis, the daytime and night-time sound level targets will be easily achieved within habitable rooms with standard thermal double glazing.

4.29 The floor plans overleaf show the windows where standard thermal double glazing will be suitable (windows highlighted in blue). All other glazing should be acoustically laminated (or secondary glazing).

Figure 4.1 - Diagram showing standard thermal double glazed windows



Noise ingress with windows open

4.30 The level of sound attenuation through an open window is dependent on the type and size of window, the extent of opening, the angle of sound incidence and the characteristics of the noise source in question.

4.31 It is reasonable to assume a sound attenuation performance of approximately 15 dB for a partially open window. Partially open windows will provide background ventilation only, as opposed to rapid/purge ventilation.

4.32 ProPG also acknowledges that the acoustic performance of the building envelope will be reduced to no more than 15 dBA when windows are opened for ventilation or cooling purposes.

4.33 Daytime façade sound pressure levels are approximately 65 to 66 dB $L_{Aeq,16hour}$ and night-time sound pressure levels are approximately 59 to 62 dB $L_{Aeq,8hour}$.

4.34 When assessing noise ingress through an open window, it is appropriate to correct the measured sound levels at the façade by approximately -3 dB to give an equivalent free-field sound level.

4.35 The corresponding 'free-field' sound pressure levels are therefore 62 to 63 dB $L_{Aeq,16hour}$ during the daytime and 56 to 59 dB $L_{Aeq,16hour}$ during the night-time.

4.36 Assuming a partially open window provides 15 dB of sound attenuation, the resulting internal sound level is approximately 47 to 48 dB $L_{Aeq,16hour}$ during the daytime and 41 to 44 dB $L_{Aeq,8hour}$ during the night-time.

- 63 dB $L_{Aeq,16hour}$ – 15 dB = 48 dB $L_{Aeq,16hour}$
- 59 dB $L_{Aeq,16hour}$ – 15 dB = 44 dB $L_{Aeq,16hour}$

4.37 The daytime and night-time sound level targets will therefore not be achieved with windows open.

4.38 The recommended sound level limit of 45 dB L_{AFmax} within bedrooms during the night will also be exceeded.

Alternative means of ventilation and noise mitigation options

4.39 BS 8233 states where occupants rely on closed windows to meet the internal noise limits, there needs to be appropriate alternative ventilation that does not compromise the facade sound insulation or resulting internal sound level.

4.40 BS 8233 also provides the following comment with regard to ventilation:

The Building Regulations' supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

4.41 On this basis, an alternative means of ventilation should be provided to all habitable rooms.

4.42 A suitable mitigation measure would be to install good quality sound attenuating (acoustically treated) ventilator units to habitable rooms.

4.43 As an alternative to acoustic ventilator units, a mechanically assisted ventilation system could be used to serve the habitable rooms (e.g. MVHR system) and would provide greater noise mitigation compared to acoustic ventilator units (i.e. there would be no apertures in the walls/frames).

4.44 Opening windows are appropriate for providing rapid or purge ventilation (e.g. to remove odour from painting and decorating or from burnt food).

Ambient sound level in outdoor living areas

4.45 With regard to outdoor living areas, BS 8233 provides the following guidelines:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

4.46 ProPG also states the following with regard to noise levels:

The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$.

4.47 The measured façade sound pressure level is above the guideline values at the front of the property, however the ambient sound pressure level is approximately 10 to 15 dB lower at the rear elevation. On this basis, it is anticipated that the daytime ambient sound pressure level on the proposed rear balconies to apartment no's 3 and 6 will achieve the guideline values.

4.48 It is worth noting that there are Juliet balconies on the neighbouring building fronting Wilbraham Road.

4.49 Although the ambient sound level will be above the guideline values within the balcony area of apartment no's 1 and 2, if practicable a glazed screen could be installed to the balcony area with a height of approximately 1.5 to 1.6 metres. This would help to attenuate the noise from passing road traffic for seated occupants (assuming a height of circa 1.25 metres for a tall person sitting down).

4.50 It should be also noted that ProPg states that the noise related impact may be partially off-set if the residents are provided with access to '*a relatively quiet, protected, publically accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.*

4.51 Chorlton Park is located approximately 800 metres south of the property and Longford Park is located approximately 1 km to the north west. Future residents would therefore benefit from these local green spaces in addition to the amenity space provided as part of the development.

5. Ventilation & Noise Mitigation

Approved Document F, Volume 1: Dwellings

5.1 Approved Document F (Volume 1: Dwellings) provides guidance on how to comply with Part F of Schedule 1 to the Building Regulations 2010 and came into effect on 15th June 2022.

5.2 The aim of the document is to protect the health of occupants within a dwelling by providing adequate ventilation. Without adequate ventilation, mould and internal air pollution may become hazardous to health.

5.3 Guidance on the non-dwelling parts of the building, such as shared communal rooms and commercial or retail space, can be found within Approved Document F, Volume 2: Buildings other than dwellings.

Ventilation strategy

5.4 Ventilation of a dwelling may be delivered through natural ventilation (without the use of mechanically driven equipment), mechanical ventilation or a combination of both methods.

5.5 The ventilation systems in Approved Document F are examples of systems that comply with the Building Regulations. Other ventilation systems may be acceptable if they can be shown to meet an equal level of performance.

5.6 The ventilation strategy in the approved document relies on a combination of all of the following:

a). Extract ventilation from rooms where water vapour or pollutants are likely to be released (e.g. bathrooms, WC's, kitchens and utility rooms), to minimise their spread to the rest of the building. Ventilation fans may be either intermittent operation or continuous operation.

b). Whole dwelling ventilation to provide fresh air to the building and to dilute, disperse and remove water vapour and pollutants not removed by extract ventilation.

c). Purge ventilation to remove high concentrations of pollutants and water vapour. Purge ventilation is used intermittently and required only for pollutants produced by occasional activities (e.g. fumes from painting).

5.7 With regard to whole dwelling ventilation, supply air for the dwelling should be delivered by either continuous supply fans or background ventilator units.

5.8 The minimum whole dwelling ventilation rate for the supply of air to the habitable rooms in a dwelling should meet a minimum rate of 0.3 litres per second per m^2 of internal floor area and also a minimum rate (l/s) determined by the number of bedrooms, as specified in Table 1.3 of the document.

5.9 The document also provides minimum standards for purge ventilation for rapidly diluting indoor air pollutants and extracting water vapour where necessary in habitable rooms. For domestic-type buildings, Part O (overheating) may require a higher standard in order to remove excess heat.

Acoustically rated ventilator units

5.10 Manually controlled trickle ventilators (the most common type of background ventilators) can be located over the window frames, in window frames or just above the glass. Background ventilators are intended to normally be left open.

5.11 Ventilation should be controllable. Controls may be either manual (i.e. operated by the occupant) or automatic. Background ventilators should be at least 1700 mm above floor level, to reduce cold draughts, but still be easy for the occupant to reach.

5.12 Installing a background ventilator directly through a wall that provides the equivalent areas described in Approved Document F can also be an acceptable route to compliance.

5.13 Sound attenuating ventilator units are often installed to habitable rooms in order to allow background ventilation whilst maintaining a high sound insulation performance from the façade.

5.14 The ventilator should provide a sound insulation performance of at least **40 dB $D_{n,e,w}$** in the open position. Further guidance regarding ventilator type and performance can be provided once the glazing specification and ventilator type/size has been finalised.

5.15 Example manufacturers of acoustically-rated ventilator units include:

- www.aereco.co.uk/products-and-systems/
- www.greenwood.co.uk/acoustic
- http://brookvent.co.uk/product/airvent-sm-acoustic/

5.16 The minimum 'equivalent area' of background ventilators for natural ventilation should follow the guidance in Table 1.7 of Approved Document F for each room type.

5.17 Bathrooms, toilets, utility rooms and circulation areas do not require sound attenuating ventilator units. Standard (non-acoustic) trickle vents may be fitted to bathrooms to achieve the required equivalent area.

5.18 It should be noted that a window with a 'night-latch' position is not adequate for background ventilation, due to the risk of draughts, security issues and the difficulty of measuring the equivalent area.

Mechanically assisted ventilation

5.19 A further option with regard to ventilating and cooling habitable rooms whilst achieving a high facade sound insulation would be to use a mechanical ventilation system, such as a heat recovery system (MVHR) or positive input ventilation system (PIV).

5.20 Example suppliers of MVHR and PIV systems include:

- www.nuaire.co.uk/residential/positive-input-ventilation
- www.envirovent.com/specifier/products/heat-recovery-systems/
- www.envirovent.com/specifier/products/positive-input-ventilation/
- www.greenwood.co.uk/range/5/heat-recovery-mvhr.html

5.21 Appropriate ventilation rates will depend on the number of bedrooms and the anticipated occupancy rate (refer to Approved Document F for guidance). Such systems can also be supplied with a 'boost' function in order to reduce the need to open windows for purge ventilation.

5.22 With a loft mounted motor and control unit, particular attention should be paid to the construction of bedroom ceilings and the mounting of the motor unit in order to minimise the noise transmission into adjacent rooms. It is commonplace for a double-boarded ceiling construction and acoustically enhanced loft-hatch to be used where there is a loft mounted motor/control unit.

5.23 To avoid unintended air pathways, background ventilators should not be installed with mechanical ventilation with heat recovery.

Noise from mechanical systems (comments within Approved Document F)

5.24 With regard to noise from mechanical systems, page 6 of the document states the following:

1.5 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.

a. Correctly sizing and jointing ducts.

b. 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.

c. Selecting appropriate equipment, including following paragraph 1.6.

1.6 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.

1.7 Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation.

Note: Although there is no requirement to undertake noise testing, achieving the levels in the following guidance would ensure good acoustic conditions. The average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following.

a. 30 dB $L_{Aeq,T}$ for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical ventilation system is running on its minimum low rate.*

b. 45 dB $L_{Aeq,T}$ in less noise-sensitive rooms (e.g. kitchens and bathrooms) when a continuous operation system is running at the minimum high rate or an intermittent operation system is running.*

** The noise index $L_{Aeq,T}$ is used in BS 8233, where T is the duration of the measurement. If the noise from the sound source is steady (i.e. fluctuating by up to 3dB), a measuring time of 1 minute will be adequate and the L_{Aeq}, 1 min level will be similar to the dB(A) level used elsewhere. If the noise from the sound source fluctuates more than this, a longer measuring time (T) may be required, but the higher portion of the fluctuating level should be considered, and the sound may attract more attention due to the changes in level.*

Note: Methods for measuring the sound power level produced by the fan unit of decentralised extract ventilation, centralised extract ventilation and balanced mechanical ventilation with heat recovery systems are described in BS EN 13141.

6. Building Services Plant & Equipment

Sound level targets for new building services plant

6.1 The tenant details for the ground floor units are not yet confirmed and therefore the specification details for mechanical plant and equipment are not available at this time.

6.2 It is anticipated that there may be at least one outdoor condensing unit associated with the ground floor units (e.g. for air-conditioning or the refrigeration of stock).

6.3 Plant such as outdoor condenser units may operate intermittently during the daytime and night-time period when used for the refrigeration of stock.

6.4 Since the plant specification is not available, it is considered appropriate to set external noise level targets based on the measured background sound levels and the criteria set by Manchester City Council.

6.5 Taking into account MCC's requirements, the sound rating level (L_{Aeq}) from all new building services plant should be at least 5 dB below the typical background sound level (L_{A90}).

6.6 BS 4142 states '*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context'.*

6.7 Table 6.1 presents the applicable sound level targets for new fixed plant. It is considered prudent to use the lowest typical background sound level when determining appropriate targets.

6.8 The sound level targets should be achieved at approximately 1 metre from the nearest residential window. Where free-field measurements are undertaken, the sound level targets may be reduced by 3 dB.

Table 6.1 - Sound level targets for new building services plant

Period, Hours	Typical Background Sound Level $L_{A90,T}$ dB	Target Rating Level $L_{Aeq,T}$ dB
Daytime (07:00-23:00)	56	51
Night-time (23:00-07:00)	39	34

6.9 Calculations will need to be undertaken once the plant details are confirmed, so that appropriate noise control measures can be determined.

7. Conclusion

7.1 The building envelope construction will provide sufficient sound insulation from external noise.

7.2 Acoustically laminated double glazing is required for all habitable rooms on the Barlow Moor Road and Wilbraham Road elevations. A suitable construction would be 6 mm glass/16 - 20 mm cavity/8.8 mm acoustic laminate.

7.3 Alternatively, the existing sash windows could be retained and 6 mm thick secondary glazing could be installed to habitable rooms.

7.4 Standard thermal double glazing will provide sufficient sound insulation on the rear elevation. A suitable construction for the new glazing would be 4 mm glass/16 – 20 mm cavity/6 mm glass.

7.5 With windows open, the daytime and night-time sound level targets will not be achieved within habitable rooms.

7.6 An alternative means of ventilation should be provided to habitable rooms, such as installing sound attenuating ventilator units to walls/frames or alternatively installing a mechanically assisted ventilation system. Appropriate ventilation rates could then be achieved with windows closed.

7.7 Opening windows are appropriate for providing rapid or purge ventilation (e.g. to remove odour from painting and decorating or from burnt food).

7.8 Appropriate noise limits have been determined for new building services plant based on the measured background sound levels and the criteria set by Manchester City Council.

7.9 On the basis of the measured sound levels and identified mitigation measures, the property is considered suitable for both residential and commercial development.

Appendix A
Site plan, floor plans and elevations

Figure A.1 - Site location plan

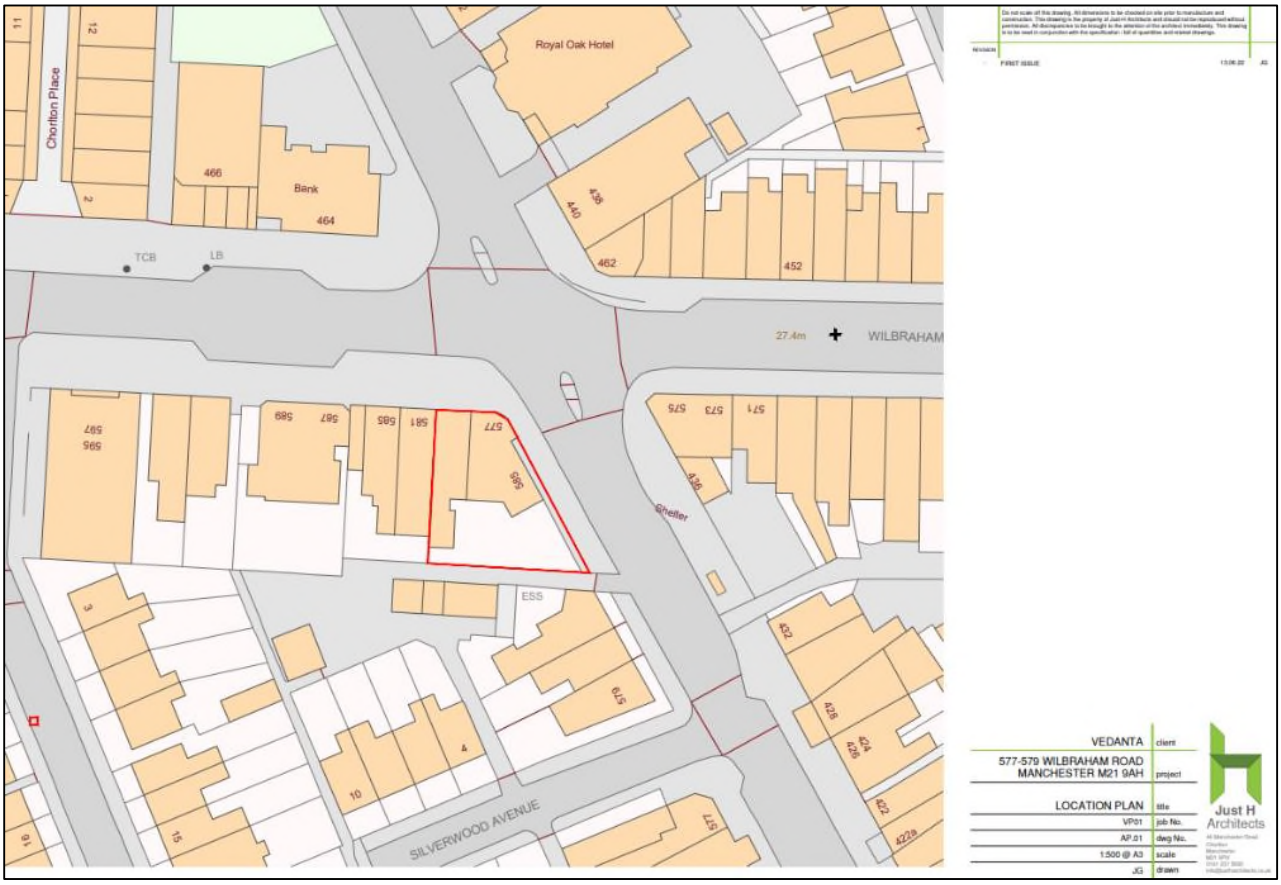
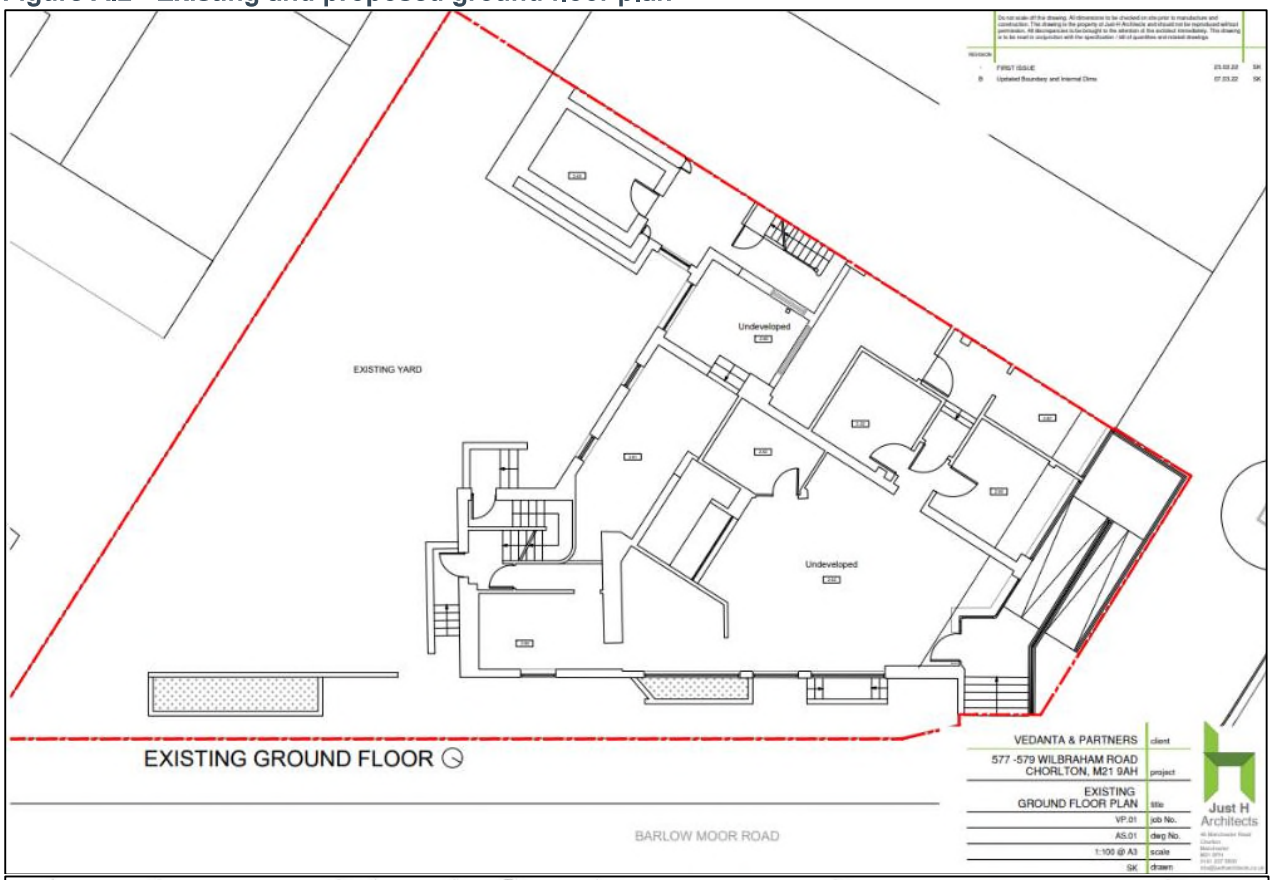


Figure A.2 - Existing and proposed ground floor plan



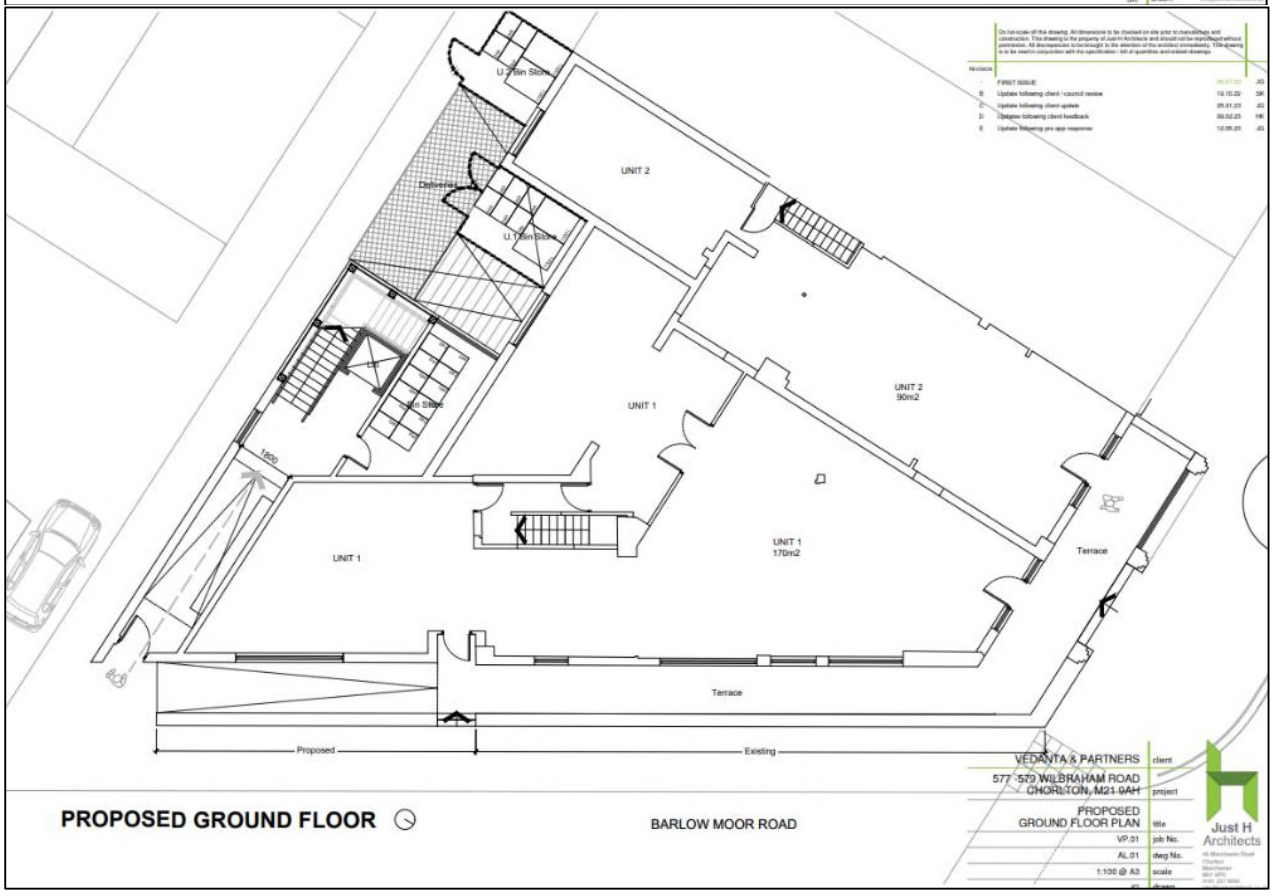
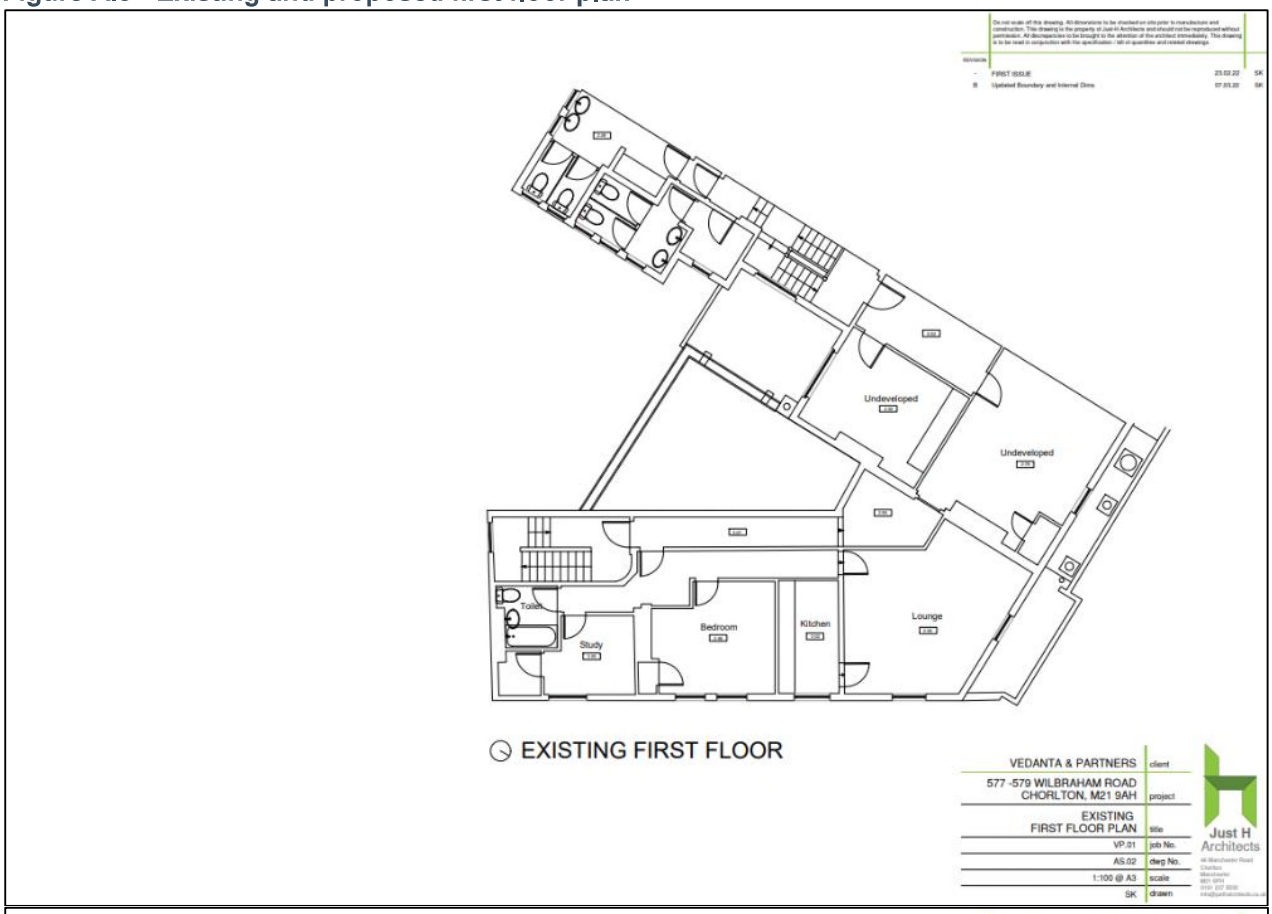


Figure A.3 - Existing and proposed first floor plan



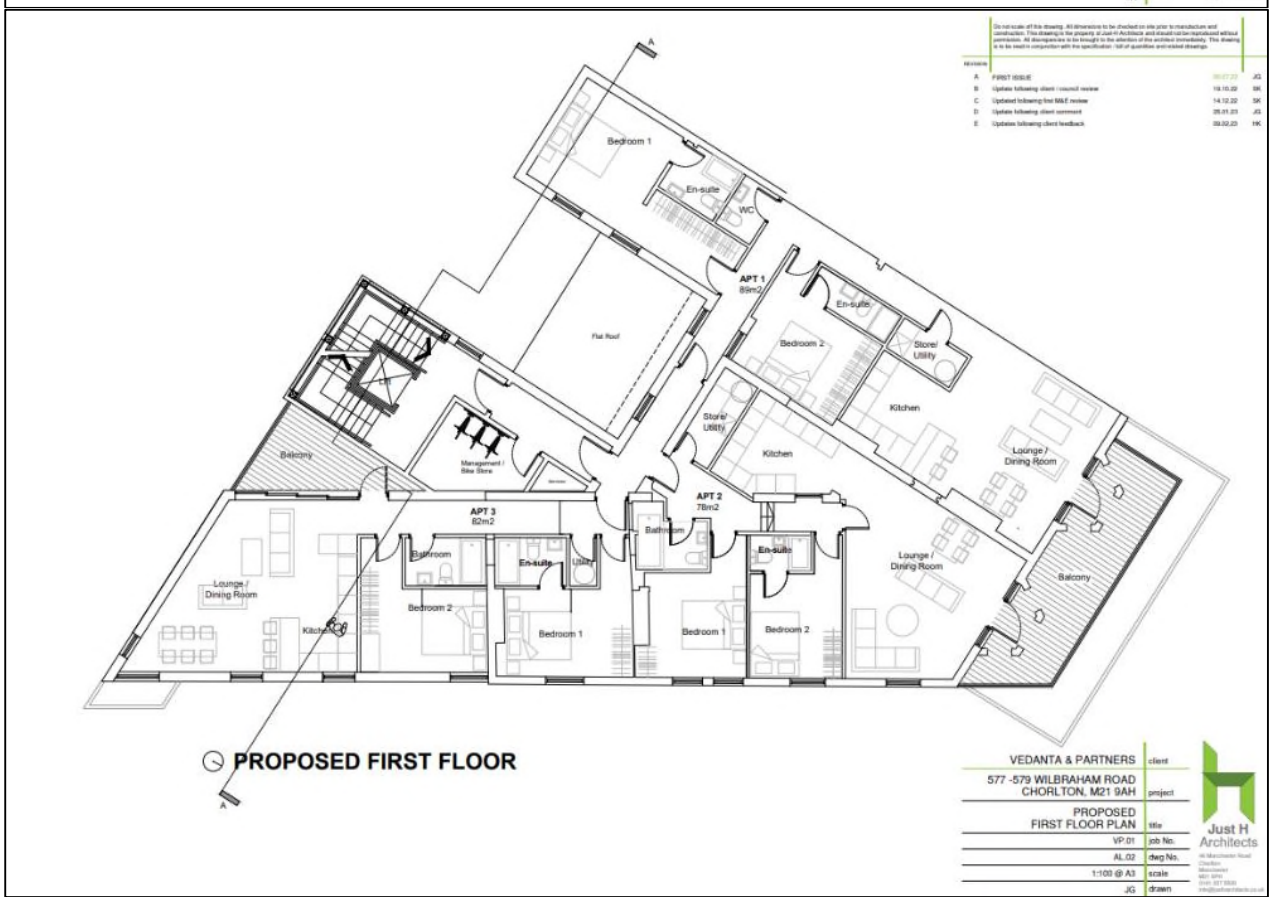


Figure A.4 - Existing and proposed second floor plan



Figure A.5 - Existing elevations





Figure A.6 - Proposed north elevation



Figure A.7 - Proposed rear elevation

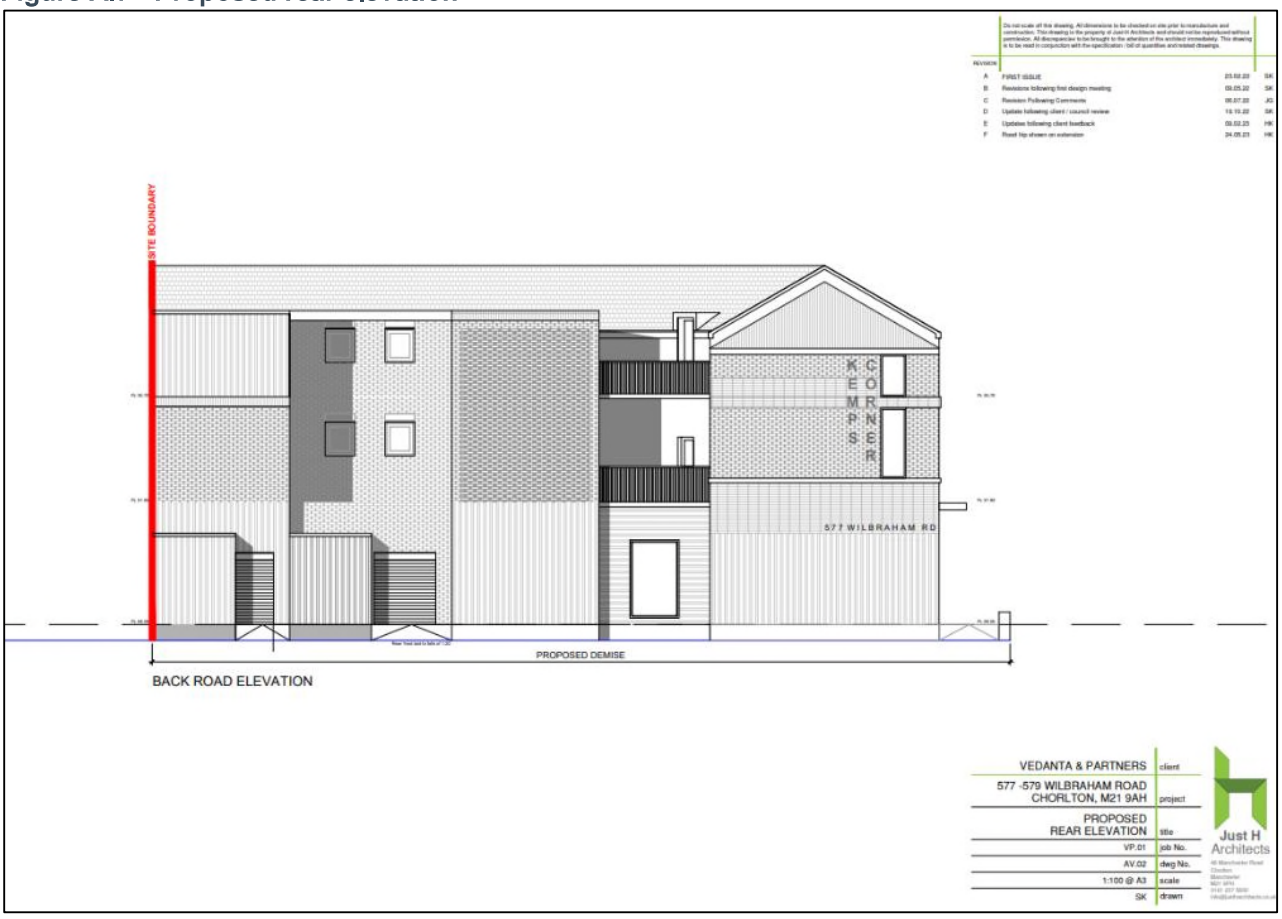
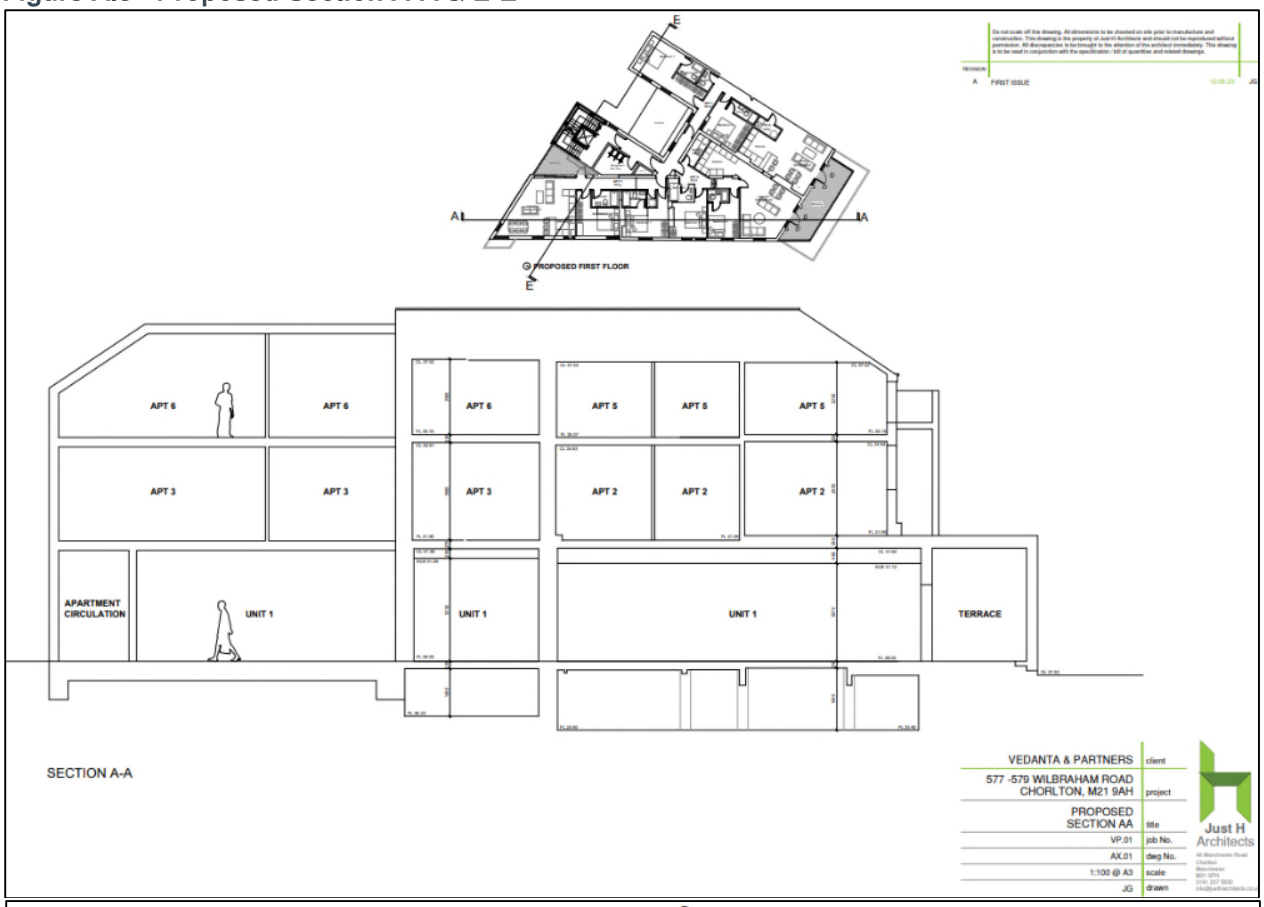
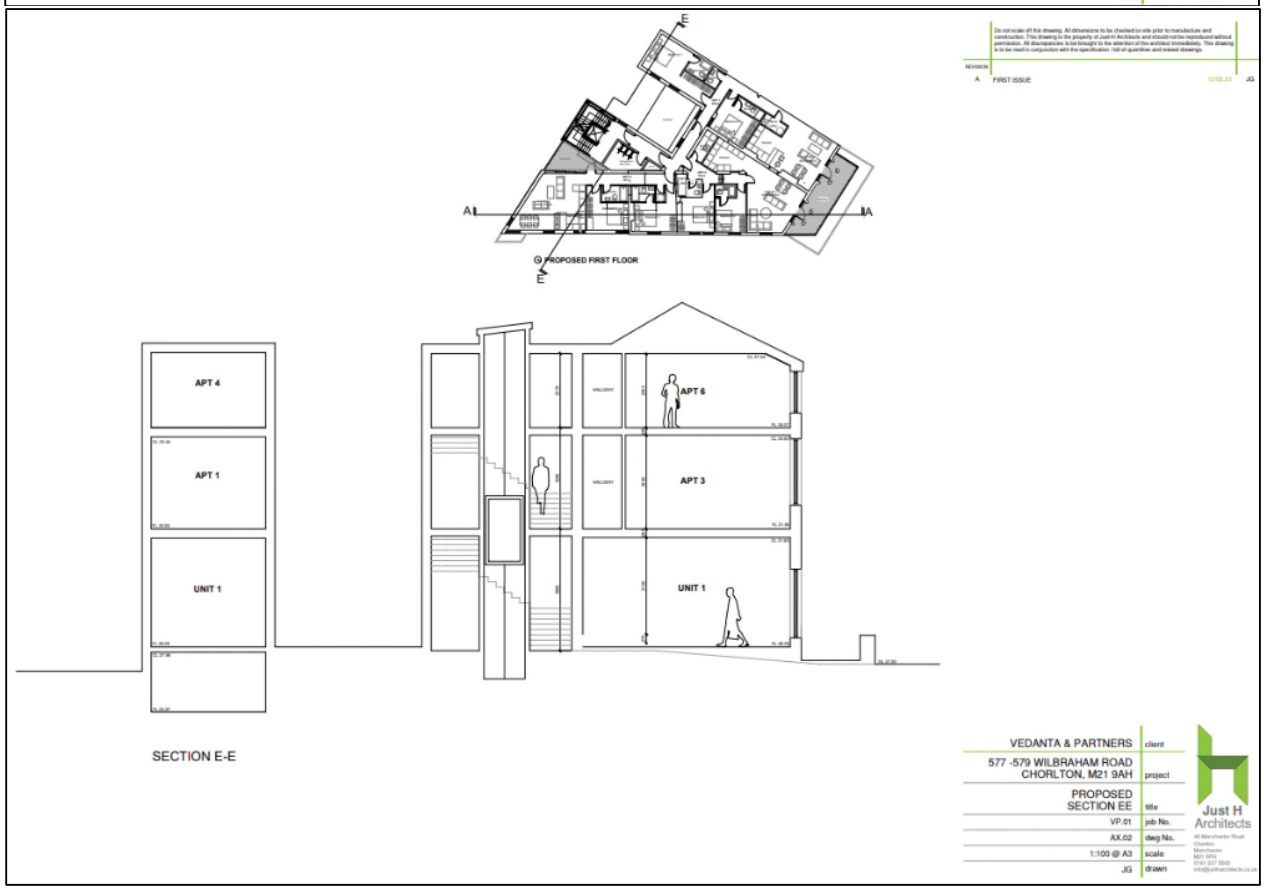


Figure A.8 - Proposed Section A-A & E-E





Appendix B
Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$Pa).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Equivalent continuous sound level - $L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
Maximum sound level - $L_{AFmax,T}$	The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of intermittent loud noises).
Background sound level - $L_{A90,T}$	The sound pressure level that is exceeded for 90% of the measurement time interval, T. $L_{A90,T}$ is often used to describe the 'background' sound level.
Habitable room	Any room used or intended to be used for sleeping, cooking, living or eating purposes (enclosed spaces such as bath or toilet facilities, service rooms, corridors, laundries, hallways, utility rooms or similar spaces are excluded from this definition).
R_w	The weighted sound reduction index expressed in dB. A single number quantity for airborne sound insulation rating.
Free-field level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other significant reflective surfaces. Generally as measured outside and away from buildings (>3.5metres).