Noise Insulation Scheme
Tarvington Close and Barnstaple Drive
Manchester
HRS Services Ltd.
HRS Ref: 126143 – AC - 1v1

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I. Revision History

Revision	Description	Date	Approved
1v1	First Issue	25/07/2017	TC

II. Executive Summary

HRS has been appointed to provide advice on façade insulation requirements for a proposed development at Tarvington Close and Barnstaple Drive, Manchester.

A baseline noise survey has been completed to assess the existing noise conditions across the undeveloped Site. Assessment of the measured noise levels against relevant guidance and the requirements of Planning Condition NSE4 indicates that the indoor ambient noise level (IANL) criteria are likely to be exceeded across the site should open windows be relied upon for ventilation.

It is recommended that the windows of the typically most noise sensitive spaces identified in NSE4 such as bedroom or living rooms, should ordinarily remain closed, with ventilation provided by alternative means such as standard trickle ventilators where appropriate. It is considered that opening windows for rapid purge ventilation would be acceptable in the short term, where the identified IANL criteria could be temporarily exceeded.

Based on this assessment it is anticipated that noise levels within external living areas will satisfy the requirements of NSE4 without any further mitigation.

In summary, a scheme of sound insulation incorporating closed windows using standard thermal double glazing units in conjunction with standard trickle ventilators have been assessed to be suitable to ensure that the indoor ambient noise level criteria of NSE4 can be satisfied.

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1. Introduction

1.1 HRS has been commissioned by Wilmott Dixon Construction (the Client) to undertake an assessment of external noise affecting the proposed development at Tarvington Close and Barnstaple Drive, Manchester (the Site) for the purposes of discharging Planning Condition NSE4 of the granted planning permission reference: 115900/VO/2017 which states:

> *NSE4*
> *Before the development commences a scheme for acoustically insulating the proposed residential accommodation against noise from Rochdale Road and Queens Road shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The approved noise insulation scheme shall be completed before any of the dwelling units are occupied.*
>
> *Noise survey data must include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The internal noise criteria are as follows:*
>
> *Bedrooms (night time - 23.00 - 07.00) 30 dB LAeq (individual noise events shall not normally exceed 45 dB LAmax,F by more than 15 times)*
> *Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq*
> *Gardens and terraces (daytime) 55 dB LAeq*

1.2 The proposals are for the development of up to 6 two-bedroom houses (Use Class C3 (a)) at Tarvington Close, with a further 2 two-bedroom houses at Barnstaple Drive, each with associated parking, landscape and boundary treatments. Indicative site layout plans are included as Appendix II, although at this stage in the development some details may be subject to change.

1.3 This document has been prepared for the sole use, benefit and information of the Client for the purposes set out, or instructions commissioning the works. The liability of HRS in respect of the information contained herein will not extend to any third party.

1.4 This report is limited to addressing the specific issues described and is based on information and drawings provided. Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to provide assistance, a glossary of terminology is included in Appendix I.

2. Relevant Acoustic Standards

Planning Guidance

IEMA Guidelines for Environmental Noise Assessment, 2014

2.1 The IEMA Guidelines for Environmental Noise Assessment[1] addresses the key principles of assessing noise effects and are applicable to all development proposals where noise effects may occur.

2.2 The guidance provides advice with regards to the collection of baseline noise data, prediction of noise levels and how noise should be assessed. The guidance recognises that the effect associated with a particular noise source will be dependent on a number of factors including but not limited to the sensitivity of the receptor, frequency and duration of the noise source and time of day. However, it stops short of providing specific assessment criteria which developments should achieve but instead suggests that the methodology adopted should be selected on a site by site basis with reference to relevant national and local standards.

BS 8233: Guidance on Sound Insulation and Noise Reduction for Buildings (2014)

2.3 BS 8233:2014[2] provides guidance for the control of noise in and around buildings. The guidelines recommend internal ambient noise criteria for a range of spaces. The criteria relevant to the proposed Development are presented as Table 1 below.

Table 1: BS 8233 Guideline noise levels for residential spaces

Activity	Location	Daytime $L_{Aeq,\ 16\ hour}$ (07:00 to 23:00)	Night-Time $L_{Aeq,\ 8\ hour}$ (23:00 to 07:00)
Resting	Living room	35 dB	Not applicable
Dining	Dining room / area	40 dB	Not applicable
Sleeping (daytime resting)	Bedroom	35 dB	30 dB

2.4 In consideration of external amenity spaces such as gardens balconies and terraces, the guidance provided in BS 8233 states:

2.5 "*For traditional external areas that are used for amenity space, such as gardens or 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*

1 Institute of Environmental Management & Assessment (2014): Guidelines for Environmental Noise Impact Assessment, IEMA

2 British Standards Institute. (2014): BS8233 'Guidance on sound insulation and noise reduction for buildings'. BSI

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".

World Health Organisation – Guidelines for Community Noise, 1999

2.6 The World Health Organisation (WHO) Guidelines for Community Noise[3] document provides guidance of a similar nature to BS 8233:2014, although it places more emphasis on the potential health effects associated with noise. Specifically, the document recommends internal and external noise levels that will provide an acoustic environment that is conducive to uninterrupted speech and sleep. Daytime noise limits aim to prevent the majority of the population being moderately or seriously annoyed by noise, whereas the night-time noise limits are intended to mitigate sleep disturbance. Table 2 presents a summary of the WHO guideline values.

Table 2: WHO Recommended Guideline Values for Living Spaces

Specific Environment	Critical Health Effects	Noise Level $L_{Aeq,T}$ (dB)	Time Base (hours)	L_{AFmax} (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	Not applicable
	Moderate annoyance, daytime and evening	50	16	Not applicable
Dwellings, indoors within bedrooms	Speech intelligibility and moderate annoyance, daytime and evening	35	16	Not applicable
	Sleep disturbance, night-time	30	8	45
Outside bedrooms (outdoor values)	Sleep disturbance, window open (outdoor values)	45	8	60

3 World Health Organisation. 1999. Guidelines for Community Noise. WHO

3. Baseline Noise Conditions

3.1 An ambient noise survey has been undertaken across the existing undeveloped site to assess prevailing noise levels to inform the appropriate design advice. A series of short term representative measurements were taken within a 24 hour period between 13th and 14th of June 2017, with additional night time measurements undertaken on Friday 16th of June 2017 in order to consider the potential noise contributions from a nearby public house.

3.2 All measurements were undertaken at 1.5m above ground level in free field conditions using class 1 sound level meters. Weather conditions during the attended monitoring periods were fine and dry, with wind speeds of < 5ms^{-1}. Figure 1 illustrates the approximate noise measurements positions.

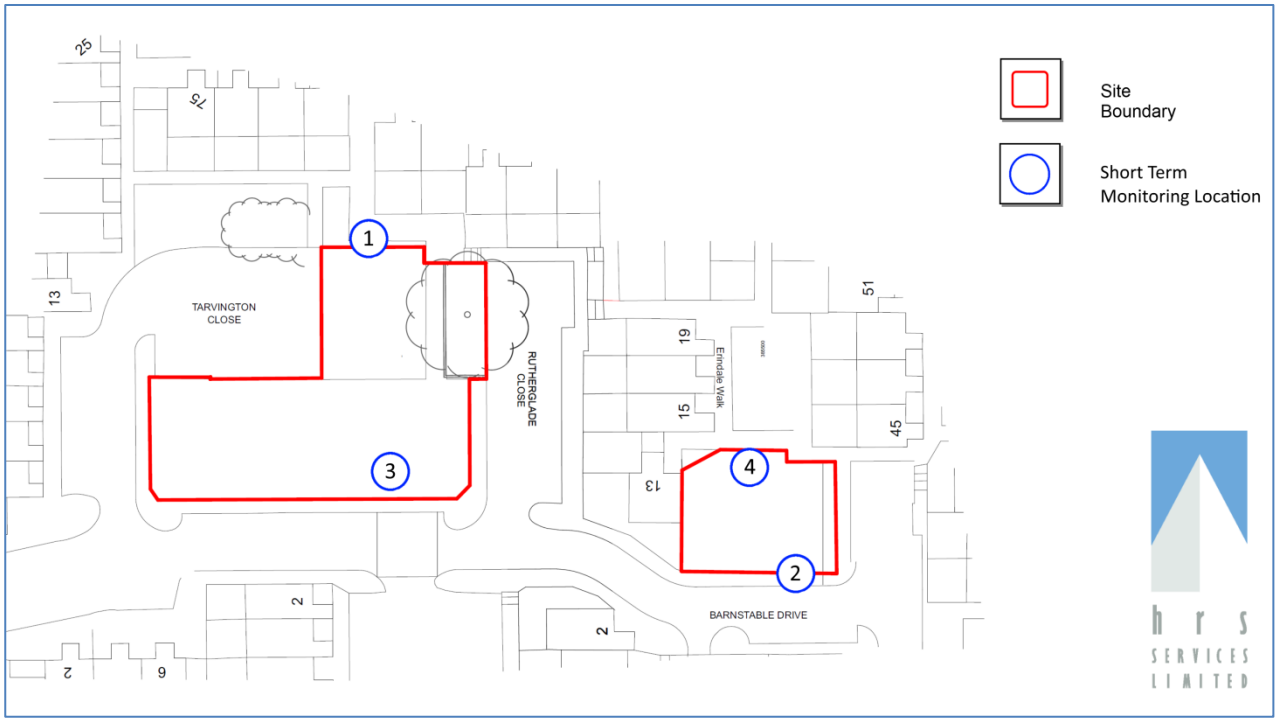


Figure 1: Site location and monitoring positions plan

3.3 During all attended monitoring periods, the prevailing noise climate was found to be predominantly influenced by road traffic noise from the surrounding road traffic network, with contributions from human activities, emergency vehicles and local wildlife (birdsong). Noise from The Valley Public House was not noted during the measured periods.

3.4

3.5 Table **3** presents a summary of the measured day, evening and night time noise levels, with detailed results presented as Appendix III.

Table 3: Summary of Measured Noise Levels

Position	Period[1]	$L_{Aeq,T}$ [2]	$L_{AF,max}$ [3]	$L_{A90,T}$ [4]
1	Daytime (07:00-19:00)	57	80	49
	Evening (19:00-23:00)	49	64	43
	Night (23:00-07:00)	48	65	42
2	Daytime (07:00-19:00)	53	73	50
	Evening (19:00-23:00)	49	68	45
	Night (23:00-07:00)	48	63	43
3	Evening (19:00-23:00)	47	69	40
	Night (23:00-07:00)	49	67	45
4	Daytime (07:00-19:00)	53	76	49
	Night (23:00-07:00)	46	66	41

Notes:

[1] Aggregate of short term measurements made within stated periods.

[2] Logarithmic average presented.

[3] 90th Percentile presented.

[4] Arithmetic average reported

4. Noise Impact Assessment

Internal Noise Levels

4.1 Planning Condition NSE4 provides noise limits for specific living spaces, however it does not specify an assessment methodology. The specified noise limits are equal to those recommended in BS 8233: 2014, therefore the assessment is based on the methodology outlined Annex G of this guidance document.

4.2 Noise levels for the day, evening and night time have been inferred from the measurements in

4.3

4.4 Table **3** which shows noise levels across the Site are expected to average between 53 to 57 dB $L_{Aeq,16hr}$ during the daytime, with noise levels during the evening at all locations of 49dB $L_{Aeq,\ 4hr}$. Night time noise levels are expected to be between 46 and 49dB $L_{Aeq,8hr}$.

4.5 With reference to the requirements of BS 8233 and Planning Condition NSE4, the required internal ambient noise levels (IANL) are likely to be exceeded by up to 7dB within dwellings should occupants choose to open windows on the worst affected façades, based on the guidance in BS 8233 which states:

4.6 *"If partially open windows were relied upon for background ventilation, the insulation (of the façade) would be reduced to approximately 15 dB."*

4.7 As such, alternative forms of ventilation are recommended to be installed allowing windows to remain closed, whilst still providing the required level of background ventilation to meet appropriate standards, allowing residents the option of opening windows for purge ventilation during which times the IANL criteria may temporarily be exceeded.

4.8 For the purposes of calculation the building envelope has been assumed to be of masonry construction. Alternative lightweight constructions may offer reduced sound insulation. If lightweight construction is proposed for the building envelope the specification may need to be reviewed to ensure suitable acoustic performance is achieved.

4.9 The roof construction details can affect the level of sound insulation provided by the building envelope. For the purposes of the calculations in this section a tile/slate roof with a minimum 12.5mm plasterboard ceiling and mineral wool insulation above the ceiling has been assumed.

4.10 With windows closed, standard thermal double glazing would be expected to afford up to 27 dB $R_w + C_{tr}$ insulation against airborne noise within dwellings. This would be sufficient to reduce noise levels within

dwellings to meet the IANL criteria outlined in Table 1, in conjunction with standard trickle ventilators. It should be noted that non-acoustic trickle vents may not be supplied with acoustic test data, but would typically be expected to provide a performance of approximately 25 – 30 dB $D_{n,e,w}$. The minimum $D_{n,e,w}$ performance of any ventilators selected should be confirmed prior to use, to ensure that the IANL criteria are satisfied.

4.11 External façades of living spaces are expected to be exposed to noise levels of > 50 dB $L_{Aeq,\ 16hr}$ during the day and > 45 dB $L_{Aeq,8hr}$ during the night, therefore standard trickle ventilators of cumulative sound insulation ≥ 25 dB $D_{n,e,w}$ should be installed to provide background ventilation without the requirement for residents to open windows. The choice of ventilator should be confirmed at the detailed design stage once the location and size of the windows and the number of ventilators as well as the façade construction have been confirmed, noting that for any given ventilator, the overall level of sound insulation shall decrease for multiple ventilators compared to the performance given for a single unit.

4.12 Regard shall also normally need be given to the ventilation guidance provided in Approved Document F[4] , however this is outside the scope of this document.

4.13 It may be necessary to provide provision of short term increased air flow for mitigation of summertime overheating, for which standard trickle vents may not provide sufficient airflow. In such circumstances it is common for higher internal noise levels to be tolerated to provide thermal comfort, and BS 8233 guidance may not be appropriate. Requirements would depend on the results of a thermal comfort assessment and depend on factors such as open area requirements and predicted duration of overheating, which is outside the scope of this report.

4.14 ProPG: Planning & Noise 'Professional Practice Guidance on Planning & Noise' jointly published by the Institute of Acoustics, ANC (Acoustics and Noise Consultants) and Chartered Institute of Environmental Health in May 2017 states:

4.15 *"Internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal LAeq levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable"……Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally."*

External Noise Levels

4.16 Measured noise levels across the existing, undeveloped Site resulting from road traffic were generally ≤ 55 dB $L_{Aeq,\ 15min}$ during the daytime. At measurement location 1, noise levels of up to 62 dB were recorded as a result of human activity (children playing on the green) in close proximity to the

[4] Department for Communities and Local Government: Approved Document F: Ventilation (2010, Incorporating 2010 and 2013 amendments. HMSO

measurement position throughout the measured period. Comparison to the measured daytime values at positions 2 and 4 indicates that noise levels would typically be expected to be ≤ 55 dB when averaged over a 16-hour daytime period, based on HRS' measured noise levels.

4.17 On this basis, further mitigation of external noise levels is not proposed as necessary to meet the requirements of NSE4, as it is expected that typical noise levels in this area would be comparable to those at positions 2 and 4 following completion of the development, which would result in the loss of the play area on which the noisy activities were occurring.

5. Conclusions

5.1 HRS has been appointed to provide advice on sound insulation requirements for a proposed development at Tarvington Close and Barnstaple Drive, Manchester.

5.2 A baseline noise survey has been completed to determine the existing noise conditions across the undeveloped Site. Assessment of the measured noise levels against the guidance outlined in BS 8233: 2014 and the requirements of Planning Condition NSE4 indicates that the identified indoor ambient noise level criteria (IANL) criteria are likely to be exceeded within habitable rooms across the site should open windows be relied upon for ventilation.

5.3 It is recommended that the windows of the noise sensitive spaces identified in NSE4 such as bedrooms or living rooms, should ordinarily remain closed, with ventilation provided by alternative means such as standard trickle ventilators. It is considered that opening windows for rapid purge ventilation would be acceptable in the short term, where the IANL criteria would temporarily be exceeded.

5.4 Mitigation of noise levels within external living areas (rear and front gardens) is not proposed based on HRS' measurements, as it is anticipated that the external noise levels will be ≤ 55dB $L_{Aeq,16hr}$ following completion of the Development, and would therefore satisfy the requirements of BS 8233 and NSE4.

5.5 In summary, based on HRS' noise survey and observations at the Development Site, a scheme of sound insulation incorporating closed windows using standard thermal double glazing units in conjunction with standard trickle ventilators would be suitable to ensure that the IANL criteria of NSE4 can be satisfied, provided that windows normally remain closed. It is considered that a temporary exceedance of the IANL is acceptable when opening windows for rapid purge ventilation.

Appendix I. Acoustic Glossary

Sound pressure level and the decibel, dB

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

Frequency and hertz, Hz

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

Frequency weighting

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

Noise indices

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

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

Sound level difference, *D*

The sound level difference between two internal spaces, or between internal and external spaces. The '*D*' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to describe an overall performance. Note that the '*D*' value will always describe an in-situ or on-site acoustic performance. All values are described using the decibel.

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

Sound reduction index, *R*

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

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

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

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

Reverberation time, *T* and T_{mf}

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

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

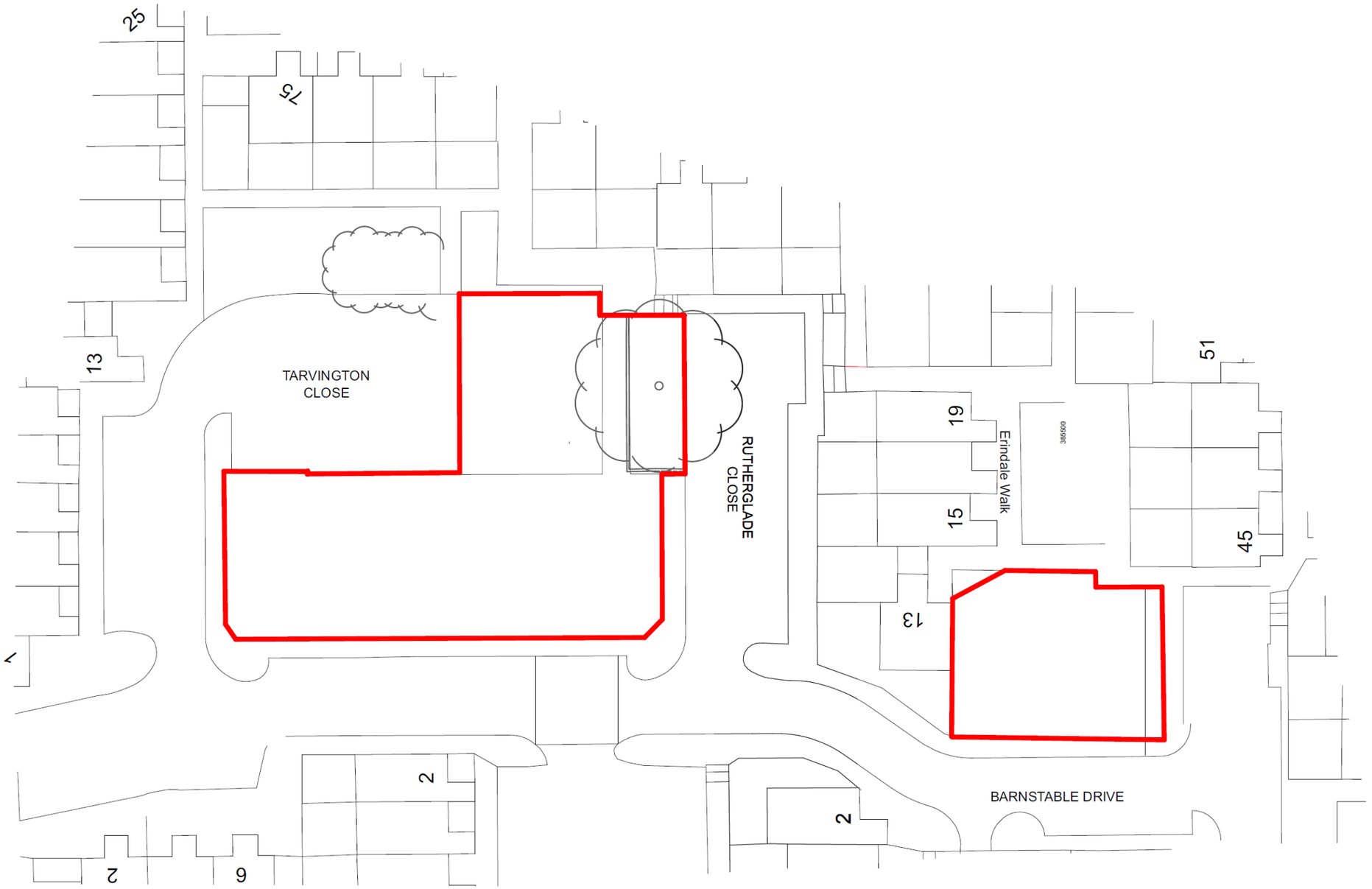
Noise rating, NR

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

Privacy

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

Appendix II. Indicative Site Location Plans



Appendix III. Baseline Noise Survey

Measurement location 1 – 13th June to 14th June 2017

Start Time	Elapsed Time	$L_{Aeq,T}$	L_{AFmax}	$L_{AF90,T}$
13/06/2017 15:36	00:08:16	52.8	65.1	49.1
13/06/2017 15:45	00:15:00	56.7	79.0	49.3
13/06/2017 16:15	00:14:41	54.7	73.2	49.4
13/06/2017 16:30	00:15:00	55.4	73.7	49.9
13/06/2017 16:45	00:15:00	58.6	79.7	49.8
13/06/2017 17:00	00:15:00	54.7	77.9	49.9
13/06/2017 17:15	00:11:46	59.0	88.7	50.0
13/06/2017 17:28	00:01:09	58.1	72.6	48.4
13/06/2017 17:30	00:15:00	61.7	77.7	51.4
14/06/2017 07:00	00:14:51	52.0	63.4	47.7
14/06/2017 07:15	00:15:00	52.3	61.0	48.7
14/06/2017 07:30	00:15:00	53.2	64.6	49.7
14/06/2017 07:45	00:15:00	52.5	63.0	49.2
13/06/2017 21:11	00:03:24	50.6	63.8	43.1
13/06/2017 21:15	00:15:00	50.4	63.2	45.1
13/06/2017 21:30	00:03:57	50.5	62.7	44.2
13/06/2017 22:02	00:12:31	48.0	61.9	41.4
13/06/2017 22:15	00:15:00	48.1	58.8	42.3
13/06/2017 22:48	00:11:06	47.3	58.3	41.2
13/06/2017 23:00	00:15:00	48.7	61.7	42.4
13/06/2017 23:37	00:15:00	47.4	64.9	39.4
14/06/2017 02:52	00:15:00	42.2	60.8	35.7
14/06/2017 03:27	00:15:00	47.3	72.8	37.9
14/06/2017 04:03	00:15:00	43.9	58.0	38.8
14/06/2017 04:18	00:15:00	44.2	58.7	39.4

Start Time	Elapsed Time	$L_{Aeq,T}$	L_{AFmax}	$L_{AF90,T}$
14/06/2017 04:33	00:15:00	45.2	59.4	39.8
14/06/2017 04:48	00:15:00	45.7	58.8	39.8
14/06/2017 05:03	00:15:00	46.1	63.7	40.5
14/06/2017 05:18	00:15:00	47.6	63.7	42.6
14/06/2017 05:33	00:15:00	49.4	63.4	45.1
14/06/2017 05:48	00:11:00	49.8	64.8	45.6
14/06/2017 05:59	00:00:11	46.0	49.8	44.8
14/06/2017 06:00	00:15:00	49.3	59.5	45.4
14/06/2017 06:15	00:15:00	51.5	59.7	47.4
14/06/2017 06:30	00:15:00	51.7	63.3	47.3
14/06/2017 06:45	00:14:59	52.1	63.8	47.8

Measurement location 2 – 13th June to 14th June 2017 and 16th June 2017

Start Time	Elapsed Time	$L_{Aeq,T}$	L_{AFmax}	$L_{AF90,T}$
13/06/2017 16:15	00:15:00	53.1	49.8	69.3
13/06/2017 17:16	00:15:00	52.1	49.6	64.9
13/06/2017 17:55	00:04:14	53.6	50.0	63.7
13/06/2017 18:00	00:15:00	54.9	50.6	72.9
13/06/2017 18:15	00:15:00	54.0	49.5	74.4
13/06/2017 18:30	00:15:00	53.4	49.7	70.4
13/06/2017 18:45	00:15:00	52.0	49.5	64.6
13/06/2017 19:00	00:00:03	51.7	51.2	53.6
14/06/2017 07:23	00:15:00	52.5	48.8	61.6
13/06/2017 21:36	00:08:44	50.6	44.7	68.2
13/06/2017 21:45	00:15:00	47.7	42.7	62.1
13/06/2017 22:00	00:01:08	46.5	43.2	49.4
13/06/2017 22:32	00:15:00	48.4	44.5	57.8
16/06/2017 20:44	00:15:00	50.7	47.7	59.4

Start Time	Elapsed Time	$L_{Aeq,T}$	L_{AFmax}	$L_{AF90,T}$
16/06/2017 21:54	00:15:00	49.0	45.5	68.1
16/06/2017 22:27	00:15:00	49.5	46.6	60.4
13/06/2017 23:19	00:15:00	48.0	44.0	62.0
13/06/2017 23:54	00:15:00	46.5	40.7	56.3
14/06/2017 03:09	00:15:00	42.8	37.2	61.0
14/06/2017 03:45	00:15:00	45.5	40.0	60.4
14/06/2017 04:36	00:15:00	45.5	40.6	54.7
14/06/2017 05:10	00:15:00	47.9	43.4	60.8
14/06/2017 05:41	00:15:00	50.2	46.6	60.8
14/06/2017 06:34	00:15:00	52.7	48.4	68.2
16/06/2017 23:16	00:15:00	49.2	45.6	58.4
16/06/2017 23:49	00:15:00	48.0	43.7	60.6

Measurement location 3 –14th June 2017 and 16th June 2017

Start Time	Elapsed Time	$L_{Aeq,T}$	L_{AFmax}	$L_{AF90,T}$
14/06/2017 02:53	00:15:00	43.0	34.6	63.8
14/06/2017 03:29	00:15:00	46.9	37.8	73.0
14/06/2017 04:02	00:15:00	42.9	38.4	59.9
16/06/2017 23:00	00:15:00	49.3	44.8	63.2
16/06/2017 23:33	00:15:00	48.2	42.8	63.0
16/06/2017 21:16	00:01:49	48.0	44.2	55.4
16/06/2017 21:37	00:15:00	49.4	45.1	68.3
16/06/2017 22:10	00:15:00	47.6	44.0	63.3
16/06/2017 22:49	00:10:37	49.5	45.9	60.2

Measurement location 4 –13th June to 14th June 2017

Start Time	*Elapsed Time*	$L_{Aeq,T}$	L_{AFmax}	$L_{AF90,T}$
13/06/2017 17:32	00:15:00	55.5	76.0	50.2
13/06/2017 17:47	00:15:00	52.1	61.9	49.4
13/06/2017 18:03	00:15:00	52.4	63.2	49.4
13/06/2017 18:19	00:15:00	54.2	77.1	48.8
13/06/2017 18:34	00:15:00	52.5	72.0	49.2
13/06/2017 18:50	00:15:00	51.6	68.5	48.6
14/06/2017 07:07	00:15:00	51.9	65.8	48.2
14/06/2017 07:39	00:15:00	52.4	63.4	49.2
14/06/2017 03:09	00:15:00	43.6	70.7	37.0
14/06/2017 03:45	00:15:00	45.8	61.2	39.6
14/06/2017 04:20	00:15:00	44.4	58.9	39.0
14/06/2017 04:52	00:15:00	45.3	58.0	40.6
14/06/2017 05:26	00:15:00	48.2	61.2	44.4
14/06/2017 05:57	00:15:00	49.0	59.5	45.6

Appendix IV. HRS Acoustic Credentials

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

HRS has been accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) since 2006 (Testing Laboratory Number 2587).
HRS meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

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

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

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

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

Appendix V. Report Conditions

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

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

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

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

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