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ELLERAY HALL SOCIAL CENTRE

SITE NOISE SURVEY AND RIBA STAGE 2/3 ACOUSTIC DESIGN

Client: Richmond and Wandsworth Council

Report Author: .....
Paul Cockram
Associate

Approved by: .....
Phillip Wash
Director

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Established 1996

THE GREEN BUSINESS CENTRE
THE CAUSEWAY
STAINES
MIDDLESEX
TW18 3AL

TELEPHONE: 01784 464404
FACSIMILE: 01784 465447
E MAIL: mail@aad.co.uk

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1.0 Introduction

1.1 It is proposed to redevelop the Elleray Hall Social Centre site in Teddington to make way for new housing. A new Elleray Hall will be constructed a short distance away from the current site. Applied Acoustic Design has been engaged to provide acoustic design guidance for the new hall building for RIBA stages 2 through to 5.

1.2 This report sets out the results of a noise survey completed at site and associated implications with respect to the external building fabric design. The report also provides acoustic design guidance to inform the general internal acoustic design strategy for RIBA Stages 2/3.

2.0 Site & Surroundings

2.1 The new hall will be created on an area of land shown in Appendix A, currently this is in use (in part) as a carpark. To the north, east and south of the site are residential buildings and to the west a public carpark. Commercial premises including a Tesco Metro are located to the northwest of the site.

2.2 Noise sources found to affect the site include local road traffic, fixed plant associated with nearby commercial properties and some local construction.

2.3 Noise Survey Details

2.4 The survey consisted of manual short-term measurements around the site and long-term unattended surveying using an automated environmental noise monitor, as detailed below.

2.5 Instrumentation: The following instruments were field checked for correct calibration prior and subsequent to use, with no calibration drift recorded:

Manual Measurements: Norsonic NOR118 s/n 0588

Unattended measurements: NTI XL2 Type 1 real time analyser s/n A2A-08108-E0

2.6 Period: Manual measurements were completed between 11:30 hrs and 12:30 hrs on the 9th March 2021. The unattended noise monitor operated continuously between 09:30 hrs on the 9th March 2021 to 09:45 hrs on the 12th March 2021.

2.7 Weather: The prevailing weather conditions during the manual survey period were dry and settled. Weather conditions during the automated noise monitoring period were also dry and settled initially on the 9th through to the 10th March. Historical weather data indicates from 19.00 hrs on the 10th March wind speeds were elevated to more than 5 m/s and remained significantly unsettled through to approximately 05.00 hrs on the 11th March. Weather conditions then appear to have calmed but remained relatively unsettled until approximately the 18:00 on the 11th March.

2.8 Site Noise Characteristics: The ambient and background noise levels at the site are influenced by local road traffic movements, and included the influence on nearby construction sites. During periods of unsettled weather, noise levels were elevated at the site. These periods were discarded in the assessment of typical site noise levels.

2.9 Future Noise Sources: No specific information is available on possible new noise sources in the locality. However, given that the site is in a developed residential area with commercial uses nearby it is anticipated that sources of noise are likely to remain similar in the future as currently exist at site.

2.10 Surveyor: Bernard Templeman MIOA

2.11 Location: Attended noise measurements were taken at three locations around the site. Long-term unattended noise monitoring was completed within a hoarded area on the site. The measurement locations are shown in Appendix A.

3.0 Noise Survey Results

3.1 Manual Noise Measurement

3.1.1 The results of manual noise measurements are summarised in Table 1 below. This data will be used to assess the sound insulation requirements for new building envelope elements e.g. windows and ventilators.

Table 1: Manual Measurement Results

Measurement Location	Time	$L_{Aeq,15min}$	L_{AFmax}
Location 1 – NE corner of site	11:45	44 dB	67 dB
Location 2 – South Boundary of Site	12:00	51 dB	75 dB
Location 3 – West side of North Lane directly opposite of site	12:15	57 dB	74 dB

3.2 Unattended Measurements

3.2.1 The unattended noise monitor was located on the western side of the site within a hoarded area. Results of unattended measurements are shown graphically in Appendix B. Typical daytime and night time noise levels measured are set out in Table 2. This data will be used in conjunction with measurement data in Table 1 to assess the sound insulation requirements of new building envelope elements e.g. windows and ventilators.

Table 2: Typical Daytime and Night Time Noise Levels

Period	Metric	Octave Band Centre Frequency in Hz								dBA
		63	125	250	500	1k	2k	4k	8k	
		Sound Pressure Level in dB re 2 x10^{-5} Pa								
Daytime	$L_{Aeq,16hr}$	65	57	52	48	47	44	38	30	52
Night Time	$L_{Aeq,8hr}$	49	42	40	37	36	33	32	24	41
	$L_{Amax,F}$	80	76	71	66	62	60	56	49	69

3.2.2 Measurements of background noise were assessed to determine typical daytime and night time noise levels. These are set out in Table 3 and will be used to set mechanical service plant noise limits with respect to the London Borough of Richmond upon Thames planning policy.

Table 3: Typical Background Noise Levels

Daytime, 07.00 hrs to 23.00 hrs, L_{A90}	Night time, 23.00 hrs to 07.00 hrs, L_{A90}
40 dB	31 dB

4.0 Building Use

4.1 Elleray Community Association operates the existing Elleray Hall Social Centre and indicate it provides a space for local residents to socialise and take part in a variety of organised activities between 09.30 hrs and 15.30 hrs. Outside of these hours the Centre is available for use by other organisations for teaching and recreational activities. Information provided indicates this includes activities that may use amplified music e.g. parties, dance etc.

4.2 It is assumed that the new Elleray Hall Social Centre will continue to cater for all current activities. Clive Chapman Architect's drawing ref. EHT-06A shows proposed room types within the new Elleray Hall building, these are summarised in Table 4 below along with activities that it is understood are likely to take place in each.

Table 4: Proposed Room Uses

Room Type	Likely Room Usage
Multipurpose Hall	• Lunch dining with between 40 to 50 people, • Event dining with 100+ people e.g. Christmas • Youth group activities e.g. Scout/guide meetings • Dance, Sport and Fitness classes • Potential use for weddings, music events, small theatre performances.
Specialist Rooms	Hairdresser, chiropody, interview space.
Quiet Room	Armchair seating for 5-6 people, reading room.
Lounge/café	Open plan, coffee mornings.
Activity Rooms	To be let by various groups e.g. Art groups, fitness, exercise, yoga, Pilates.
Office	Administration

4.3 The following acoustic factors will need to be taken into account for the proposed building envelope design.

- Reducing level of environmental noise intrusion to suitable levels within rooms of the new hall building
- Controlling levels of breakout noise from the hall to protect the amenity of nearby residential properties e.g. amplified music. This may be dictated by Richmond Council Planning requirements
- Controlling any mechanical services noise to third party noise sensitive buildings

4.4 In addition, the following acoustic factors will need to be taken into account for the design of the internal building fabric and finishes:

- Control of any mechanical service noise within rooms to suitable levels
- Provide suitable levels of sound insulation between adjacent rooms within the building
- Provide suitable control of reverberation time within each space

5.0 Mechanical Services Sound Limits

5.1 The proposed hall development site is located within the London Borough of Richmond and the Local Authority is Richmond Council. Planning guidance on sound limits for new mechanical services plant is set out in the Council's Supplementary Planning Document (SPD) *Development Control for Noise Generating and Noise Sensitive Development*.

5.2 Under section 6.2 the guidance notes that new mechanical services sound should be assessed using BS4142: 2014 *Methods for rating and assessing industrial and commercial sound*. The method compares the likely level of sound against existing background sound levels in the area. Typically, the lower the mechanical services sound level is in comparison to existing background sound level at noise sensitive receivers, then the less likely it is to cause disturbance and vice-versa. Noise sensitive receivers for this site will be the identified nearby residential dwellings.

5.3 The SPD also sets out Richmond Council's typical mechanical services sound limit as being 5 dB below the background sound level. Based on the background sound measurement completed at site this means applicable mechanical service sound limits at residential dwellings will be as follows.

Table 5: **Mechanical Services Sound Limits**

Assessment Location	**Daytime 07:00-23:00**	**Night 23:00-07:00**
1m from façades noise sensitive dwellings	35 dBA	26 dBA

5.4 It should be noted that the sound limits specified above assume that the plant will not display any impulsive or tonal character. If this is the case, the noise limits will be more stringent and will need to be revised.

5.5 The development site is relatively small and potential noise sensitive receivers - where the above limits will apply - is located nearby on three sides of the proposed building. No.21 North Lane to the north of the site is located closest at less than 10m from the north hall wing of the proposed building. Proposed fixed items of mechanical services plant should be located as far as practically possible from all housing and make use of any natural screening, e.g. the building itself, to reduce noise impact at surrounding the noise sensitive receivers.

6.0 Internal Building Fabric Design Criteria

6.1 Internal Noise Limits

6.1.1 Internal noise levels within the building will be influenced by noise ingress through the building façade and any mechanical services noise e.g. ventilation, heating, cooling. Relevant noise limits for spaces within Elleray Hall Social Centre are taken from *BB93 Acoustic Design of Schools: Performance Standards* and BS 8233: 2014 Guidance on Sound Insulation and noise reduction for buildings. Appropriate internal noise limits are as follows.

Table 6: Recommend Internal Noise Limits

Room Type	Internal Noise Limit
Multipurpose Hall	35 dB $L_{Aeq,30min}$
Specialist Rooms	40 dB $L_{Aeq,30min}$
Quiet Room	35 dB $L_{Aeq,30min}$
Lounge/café	40 - 45 dB $L_{Aeq,30min}$
Activity Rooms	40 dB $L_{Aeq,30min}$
Office	40 dB $L_{Aeq,30min}$
Kitchen	40 - 45 dB $L_{Aeq,30min}$

6.1.2 Average (L_{eq}) and maximum ($L_{max,F}$) external noise levels measured at site suggest that controlling environmental noise ingress to suitable levels within the new building should be achievable with typical proprietary building envelope construction elements, e.g. double glazed windows and passive trickle ventilators. While the site noise levels are generally low enough to allow windows to be open for ventilation and recommended internal limits be achieved, it is advised that open windows are not relied upon for permanent (background) ventilation. Noise measurements at site suggest that occasional high impulsive noise events can typically be expected, which are best controlled by ensuring windows are closed.

6.1.3 With reference to section 4.3, it may be necessary to enhance the sound insulation performance of the building façade in spaces where amplified music is an aspiration, and thus noise break-out to residential properties needs to be controlled. Based on the information on activity types set out in Table 4 this is most likely to apply to the Multi-purpose Hall.

6.2 Sound Insulation Performance

6.2.1 Sound insulation performance targets for the development are set in terms of:

- Room to room sound insulation performance i.e. the sound insulation that should be achieved onsite and demonstrated by way of testing at upon practical completion
- Laboratory rated sound insulation performances specific to a building element e.g. door, walls etc. A laboratory rated sound insulation performance is not the same as an onsite room to room performance.

6.2.2 Table 7 below sets out recommended sound insulation performances to be achieved between adjacent spaces

Table 7: Recommended Onsite Airborne Sound Insulation Performances between Spaces

Adjacency	Airborne Sound Insulation Performance
Quiet Room 05 to Specialist Room 06	$D_{nT,w}$ 45 dB
Specialist Room 07 to Specialist Room 06	$D_{nT,w}$ 45 dB
Activity Room 09 to Office/Admin 10	$D_{nT,w}$ 45 dB
Disable Toilet to Activity Room 08	$D_{nT,w}$ 45 dB
Ground Floor to 1st Floor Spaces	$D_{nT,w}$ 50 dB

6.2.3 Initial calculations suggest that walls/floors will need to provide the following laboratory rated sound insulation performance, assuming the building is likely to be a largely timber frame construction:

- R_w 55 dB Partitions to achieve $D_{nT,w}$ 45 dB between rooms
- R_w 60 dB Floor to achieve $D_{nT,w}$ 50 dB between ground and 1st floor spaces

6.2.4 For partitions that include entrance doors to rooms it is recommended that a construction with a laboratory rated airborne sound insulation performance of R_w 40 dB is used.

6.2.5 Entrance doors to rooms should have a laboratory rated sound insulation performance of R_w 30 dB or R_w 35 dB depending on use, see Appendix C.

6.2.6 It is recommended that a minimum room to room onsite impact sound insulation performance of $L'_{nT,w}$ 55 dB is achieved between ground and 1st floor spaces. This is likely to be succeeded where the separating floor construction includes an acoustically resilient flooring system.

6.2.7 Recommended sound insulation performance targets are shown on mark up drawings in Appendix C. Note that the achievement of the recommended sound insulation performance values given in Table 7 are also subject to appropriate construction details to minimise flanking noise transmission and close off any penetrations.

6.3 Reverberation Time Limits

6.3.1 Recommended reverberation times for spaces in the Elleray Hall are set out in Table 7 below, these are based on BB93 sound insulation requirements.

Table 7: Recommend Reverberation Time Limits

Room Type	Reverberation Time Limit
Multipurpose Hall	0.8 – 1.2s
Specialist Rooms	≤ 0.8s
Quiet Room	≤ 0.8s
Lounge/café	≤ 1.0s
Activity Rooms	≤ 1.0s
Office	≤ 0.8s

6.3.2 Reverberation times are likely to be achieved in rooms where at least 80% of the ceiling area is covered with a 'Class C' acoustically rated sound absorber e.g. mineral fibre ceiling tiles. For the Multipurpose Hall, sound absorbent wall panels should also be installed. Further guidance on suitable areas and types of sound absorbent finishes will be provided during Stage 3 and 4 design.

7.0 Rain Noise

7.1 Consideration should be given to the design of the roof with respect to rain noise. Where lightweight roofing systems are used, e.g. insulated panels and rooflights, then these give rise to significant rain drumming noise such that spaces within become too noisy to be used. If the preferred roofing system is relatively lightweight then additional material should be included to dampen rain noise. Further guidance on suitable areas and types of sound absorbent finishes will be provided during Stage 3 and 4 design.

8.0 Conclusions

8.1 A noise survey was completed at the proposed development site of Elleray Hall and an initial acoustic review of the proposed building completed.

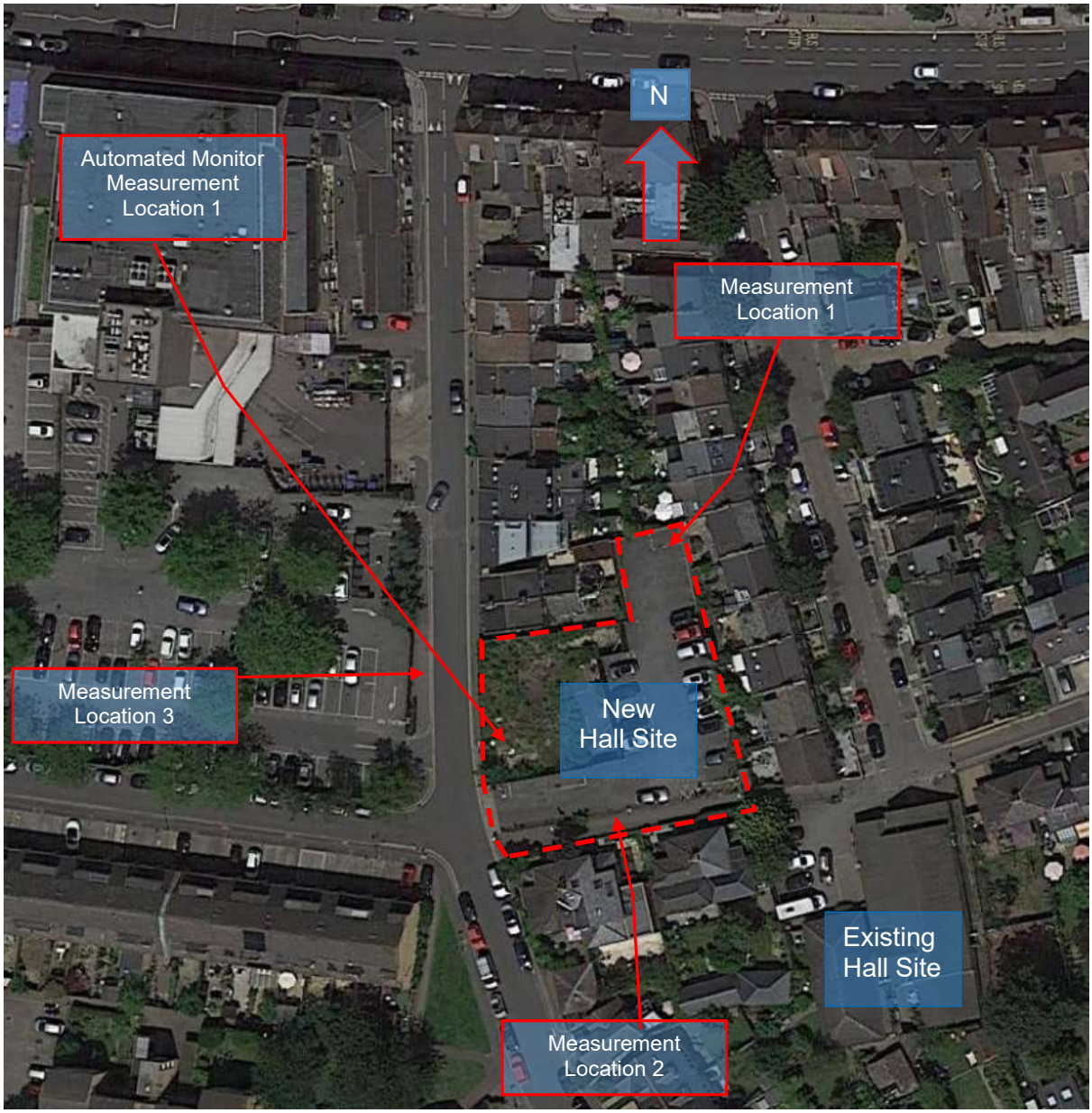
8.2 Measured ambient noise levels at the site are considered relatively low and will not set high sound insulation requirements for the external building fabric to achieve suitable internal noise levels. However, consideration on enhancing the building envelope sound insulation may be required for the Multi-purpose hall so that activities using amplified music held within do not cause an adverse noise impact on nearby residential amenity.

8.3 Natural ventilation will be suitable to achieve the required internal noise levels provided that windows can remain closed and that attenuated passive vents can be used.

8.4 Measured background noise level data have been used to set appropriate external plant sound limits in accordance with the Local Authority planning criteria. Consideration should be given to the location of proposed mechanical services plant to see that items are located as far as possible from all housing and make use of any natural screening.

8.5 A review of the room adjacencies has been completed and guidance on the sound insulation performance walls and floor has been provided, for further design development at RIBA Stage 3. In addition, outline guidance on reverberation control in spaces has been set out for consideration by the design team in order to refine internal sound absorbing finishes as the design progresses.

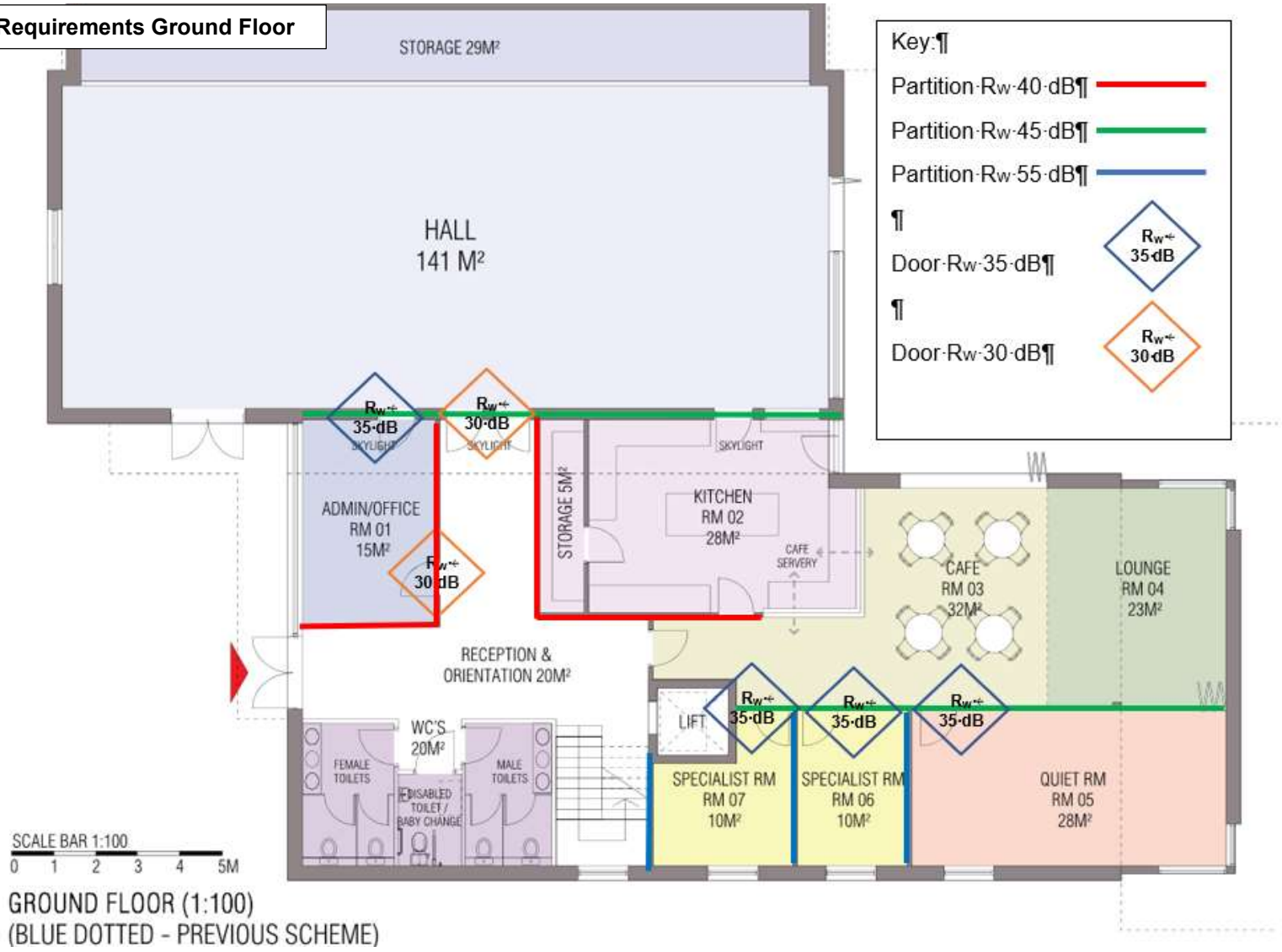
Appendix A Site Location and Measurement Locations



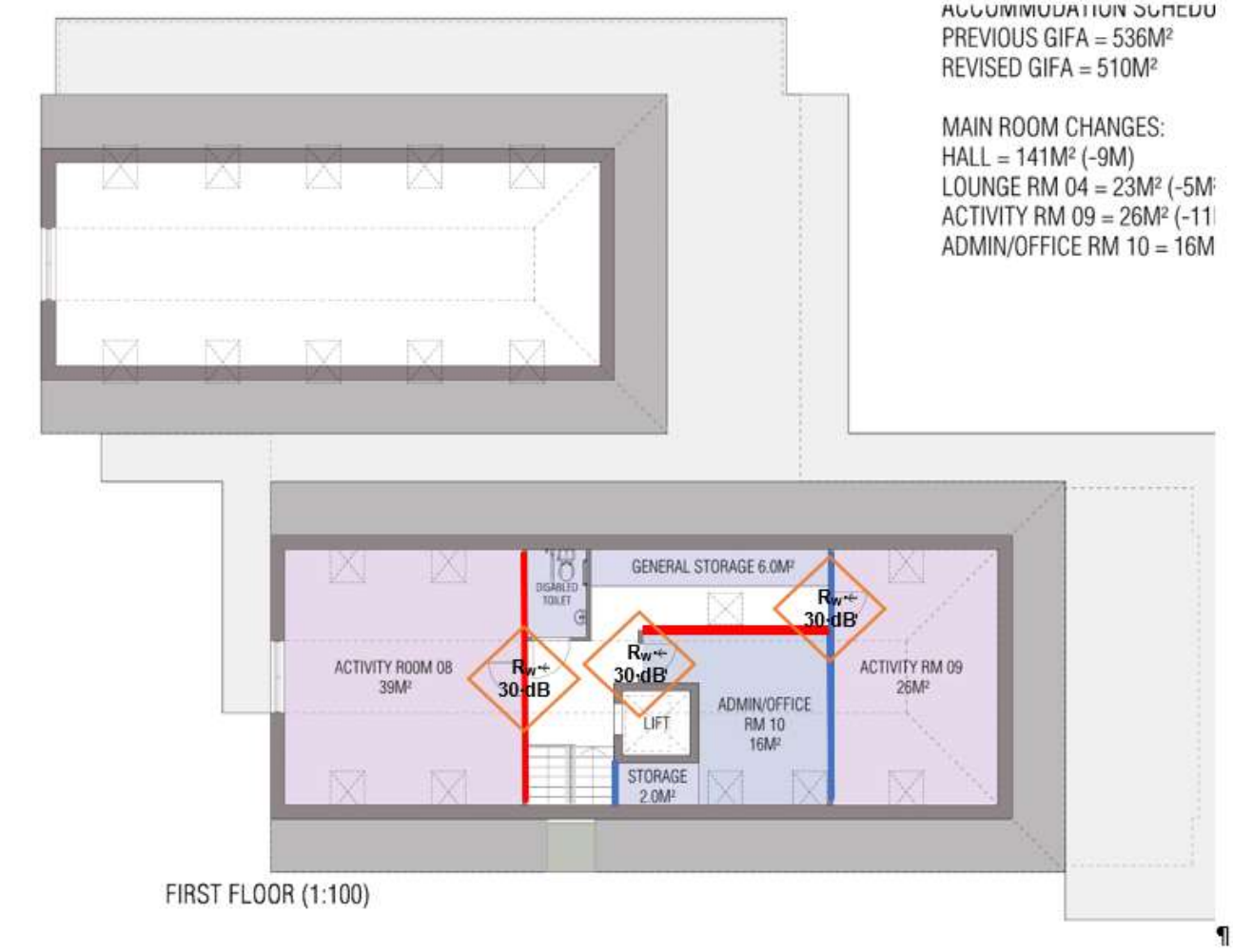
Appendix B Noise Survey Results

Appendix C Sound Insulation Mark Up Drawings

Sound Insulation Requirements Ground Floor



Sound·Insulation·Requirements·1st·Floor¶



Key:¶

Partition·Rw·40·dB¶

Partition·Rw·45·dB¶

Partition·Rw·55·dB¶

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Door·Rw·35·dB¶ Rw+ 35·dB

¶

Door·Rw·30·dB¶ Rw+ 30·dB

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Appendix D Glossary of Terms

Term	Description	Explanation
	Noise	Unwanted sound. In the explanation given below the words 'sound' and 'noise' can often be used interchangeably, depending on context.
dB	The decibel scale	The decibel (or dB) scale is the scale on which sound pressure levels are commonly measured. It is a logarithmic scale and is used for convenience to compress the audible range of sound pressures into a manageable range, from 0 dB to 140 dB. The zero of the scale, 0 dB, corresponds to the threshold of hearing, 0.00002 Pa, and the upper limit, 140 dB, corresponds to 20 Pa, the threshold of pain.
	Sound pressure	Sound is a disturbance or fluctuation in air pressure, and sound pressure, measured in pascals (Pa), is used as a measure of the magnitude of the sound. The human ear can detect sound pressures in the range from 0.00002 Pa to 20 Pa. This is an enormously wide range and so for convenience sound pressures are commonly measured on a decibel (dB) scale.
Lp	Sound pressure level	Instantaneous value of Sound Pressure Level (Lp).
f	Frequency	The frequency of a musical note is what gives it its pitch. It is the number of cycles of the fluctuating sound pressure which occur each second, and is measured in cycles per second, or Hertz (Hz). The human ear can detect frequencies in the range 20 to 20 000 Hz. Most sounds and noises are a mixture of all frequencies, called broad-band noise.
	Octave bands Octave band spectra	In order investigate the frequency content of broad band sounds, called its frequency spectrum, measurements of sound pressure are carried out over a range of frequency bands. The most common method is to split the audio frequency range into 8 or 9 octave bands. An octave is a frequency range from one particular frequency to double that frequency.
A	A-weighting	One of the three frequency weightings (A, C and Z) used in sound level meters, and defined in BS EN ISO 61672-1; a very widely used method of producing a single figure measure of a broad band noise which takes into account, in an approximate way at least, the frequency response of the human hearing system. The idea is that sound levels measured in this way should give an indication of the loudness of the sound.
f	Time weighting, fast	An averaging time used in sound level meters, and defined in BS EN ISO 61672-1.
$L_{Aeq,T}$	Equivalent continuous sound level	It represents a measure of the 'average' sound level over the measurement period. It corresponds to the steady level of sound which, over the same period of time, T, would contain the same amount of (A-weighted) sound energy as the time varying noise. Also known as the Average sound level. This is the most common method of measuring time varying noise, and within certain limits gives the best correlation with human response to noise, for example with annoyance.
$L_{Amax,T}$	Maximum sound pressure level	The instantaneous maximum sound pressure level, usually A-weighted, which occurred during the

		measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the LAeq,T value. The time weighting, F or S, must always be specified.
	Background noise	Ambient noise which remains at a given site when occasional and transient bursts of higher level ambient noise levels have subsided to typically low levels; it is the noise normally present for most of the time at a given site. It is usually described by the L_{A90} value.
$L_{A90,T}$	Background noise level	Defined in BS 4142 as the value of the A-weighted residual noise at the assessment position that is exceeded for 90 % of a given time interval, T, (i.e. $L_{A90,T)}$ measured using time weighting, F, and quoted to the nearest whole number of decibels. (Also see under residual noise). Background noise itself often varies with time and so the $L_{A90,T}$ is almost universally used as the best measure of the 'more or less always present' noise level which underlies short term variations from other sources of noise.
	Airborne sound	Sound which reaches the receiver after travelling from the source through the atmosphere.
T	Reverberation time	The time required for the steady sound pressure level in an enclosed space to decay by 60 dB, measured from the start of the decay
T20, T30	Reverberation time	The reverberation measured using certain types of instruments over a 20 dB or 30 dB part of a reverberation time decay curve.
R	Sound reduction index	A term which specifies, in decibels (dB), the airborne sound insulation performance of a building element such as a wall window or floor, and which is used in design calculations and predictions. It is measured, under laboratory test conditions, as defined in BS EN ISO 140-2:2010. It is measured in octave or third octave frequency bands, the usual range being from 100 Hz to 3150 Hz.
R_w	Weighted sound reduction index	A single figure overall value for the field sound insulation of a building element derived from the individual third octave band values of R' using a procedure defined in BS EN ISO 717-1:2013.
D_w	Weighted level difference	A single figure overall value derived from the individual third octave band values of level difference, D, using a procedure defined in BS EN ISO 717-1:2013.
D_{nT}	Standardized level difference	A field measurement of airborne sound insulation between two rooms in which the measured level difference, D, is corrected (or standardised) for receiving room characteristics (reverberation times). Usually measured in one third octave bands from 100 Hz to 3150 Hz. Defined in BS EN ISO 16283-1:2014.
$D_{nT,w}$	Weighted standardised level difference.	A single figure overall value for field sound insulation between two rooms derived from the individual third octave band values of standardized level difference, DnT, using a procedure defined in BS EN ISO 717-1:2013. Sound insulation performance requirements in the UK Building Regulations are specified in terms of values of $D_{nT,w}$ + Ctr