8.24 STABLE BLOCK & CAFE - NOISE IMPACT ASSESSMENT

Noise Impact Assessment

Marble Hill Stable Block Cafe

Twickenham

TW1 2NL

HRS Services Ltd.

HRS Ref: 124898 – AC - 1v2

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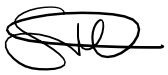
T Chaffer MIOA Senior Acoustic Consultant	S Murgia MIOA Head of Acoustics		17/03/2017

I. Revision History

Revision	Description	Date	Approved
1v1	First Issue	27/01/2017	SM
1v2	Update to proposed building plans	17/03/2017	SM

II. Executive Summary

HRS Services Ltd (HRS) has undertaken an environmental noise impact assessment for the proposed new Marble Hill Stable Block Cafe located within Marble Hill Park, Twickenham, based on a site noise survey undertaken by HRS in December 2016.

During the noise survey, the daytime noise climate observed to be affecting the site was noted to be controlled by distant road traffic and regular aircraft movements associated with planes approaching and departing Heathrow airport.

A noise propagation model of the site has been developed to assess noise transfer from the scheme based on maximum occupancy levels. Predicted average noise levels in adjacent residential garden areas have been assessed in relation to existing site ambient noise levels with noise impact predicted to range from 'no impact' in more screened garden areas, to 'slight impact' in more exposed garden areas. Noise impact would be expected to reduce when the café is below maximum occupancy levels.

Noise levels within garden areas of adjacent residential properties are predicted to be below the guidance levels outlined in BS 8233:2014, as referenced in '*London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development (SPD)'*.

Noise levels within adjacent residential properties have been considered based on their windows being partially open. Internal noise levels within dwellings based on HRS highest calculated noise emission levels from the proposed café activities are predicted to be within good practice levels outlined in BS8233:2014, as referenced in '*London Borough of Richmond upon Thames: SPD'*.

It is understood that café operational hours will normally be 08:30 – 17:00, however the possibility of occasional evening use of the café facilities has been considered. Based on the HRS noise survey, evening noise levels were found to be typically higher than lowest daytime noise level used to inform HRS' assessment. On this basis café use within in the evening period 18:00 – 23:00 is predicted to lead to average noise impact levels similar to the daytime assessment on the basis that aircraft movements are continuous throughout the evening period.

Maximum noise levels have been considered due to single maximum noise events associated with use of the proposed café such as furniture movements, raised voices, waste disposal etc. Maximum noise levels within gardens and at the facades of identified Noise Sensitive Receptors (NSR's) are predicted to be of the order of existing site maximum noise levels, which are currently controlled by regular airplane movements. Given the current site context of regular audible aircraft movements, and the expected regularity and duration of maximum noise events due to café operation, a significant impact is not expected.

HRS has proposed building services noise limits at identified noise sensitive receptors (NSRs) most exposed to the proposed scheme in line with guidance outlined in '*London Borough of Richmond upon Thames: SPD'*. It is recommended that external noise from new building services plant does not exceed 5 dB below the existing representative background noise level when assessed at the nearest noise sensitive receptors in line with BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound'*. BS 4142:2014 states that this is an indication of the specific sound source having a low impact.

Based on HRS' environmental noise assessment included within this report, HRS concludes that for the new development is expected to result in a 'low' to 'slight' noise impact upon identified noise sensitive properties.

III. Contents

1. Introduction

1.1 HRS Services Ltd (HRS) has been appointed by English Heritage to provide acoustic consultancy services for the proposed new Marble Hill Stable Block Cafe located within Marble Hill Park, Twickenham.

1.2 The proposed development involves expansion of the existing Marble Hill Stable Block café by means of a new build extension to the west of the existing building to provide a new café with internal and external facilities to cater for 140 dining covers.

1.3 The purpose of this report is to assess the existing site noise climate and consider noise impact from the proposed scheme on nearby noise sensitive properties receptors (NSR) in terms of both fixed building services plant and operational noise.

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

1.5 This report is limited to addressing the specific acoustic issues contained herein and is based on information and drawings provided by the client.

1.6 Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix III.

2. Site Description

2.1 The development site is located within Marble Hill Park in the London Borough of Richmond upon Thames. The existing stable block is located towards the western boundary of the park, adjacent to Montpellier Row.

2.2 The development proposals involve construction of a single storey extension to the west of the existing Stable Block providing a café, with associated kitchen and ancillary facilities. The extension will form a courtyard to the west of the existing Stable Block building.

2.3 Figure 1 shows an aerial view of the existing site overlaid with the proposed development scheme.

Figure 1: Aerial view of development site with extension proposal

2.4 The daytime noise climate at the site is noted to controlled distant road traffic noise from local roads, as well as regular aircraft movements associated with planes approaching and departing Heathrow airport. Additional noise sources were noted to be activity within Marble Hill park and visitors to the existing

Stable Block café, occasional vehicle movements on Montpellier Row and birdsong. It was noted during HRS' time on site that daytime maximum noise levels are controlled by aircraft movements, occurring at approximately 15 minute intervals.

2.5 The nearest identified noise sensitive receptors (NSR) are residential houses located on Montpellier Row to the west of the proposed development site. The closest is Southend House, a three storey residential dwelling with garden /external amenity areas located to the south of the main house bordering onto the proposed café development.

2.6 An existing gazebo building is located within the grounds of Southend House, approximately 9m west of the proposed café development, as indicated in Figure 1. HRS understands that this building does not currently have a residential use, however there is a possibility of future residential use of this building.

Development Proposals

2.7 HRS understands that the new café extension will provide an internal dining area for 50 customers with a kitchen to the north sized to cater for a maximum of 140 covers. Additional external seating will be provided to the east of the existing stable block building and under a canopy formed by the overhanging pitched roof of the proposed new Café building.

2.8 The geometry of the new extension will enclose the area to the west of the existing Stable Block to form a new courtyard which will contain the majority of external dining spaces. The new café building will therefore provide a physical noise barrier reducing noise transfer to NSR's located to the west. The proposed new building is to feature a mono pitched roof with sealed roof lights. Building plans used to inform this assessment are appended to this report.

2.9 HRS understands that the eastern and southern facades of the proposed new Café block are predominantly glazed panels, with alternative panels being openable such that 50% of the façade area may be open at peak times.

2.10 HRS understands that proposed opening times will be 08:30 – 17:00 seven days a week.

3. Noise Assessment Guidance and Criteria

Planning Guidance

3.1 The current planning guidance for the assessment of the potential environmental noise impact is outlined in the National Planning Policy Framework (NPPF). Whilst the NPPF does not set criteria that must be achieved, the NPPF states the following in relation to the appropriate control of potential noise impacts (paragraph 109)

3.2 *"The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…"*

Therefore the policy requires that new developments are not affected to an unacceptable degree by environmental noise.

Noise Policy Statement for England

3.3 The Noise Policy Statement for England (NPSE) provides further guidance on the Government's policy with regard to the potential impacts of noise. The NPSE states the aims of Government policy relating to noise are:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life"*

Table 1: Noise Policy Statement for England (NPSE) Effect Levels

NOEL	**No Observed Effect Level**	Level below which no detectable effect on health and quality of life due to noise
LOAEL	**Lowest Observed Adverse Effect Level**	Level above which adverse effects on health and quality of life due to noise
SOAEL	**Significant Observed Adverse Effect Level**	Level above which significant adverse effects on health and quality of life due to noise

3.4 The NPSE considers that the noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable. Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the policy required that:

3.5 *'…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development…This does not mean that such adverse effects cannot occur.'*

Planning Practice Guidance – Noise (PPGN)

3.6 The Noise section of the Planning Practice Guidance states that:

3.7 '*Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment.'*

3.8 In order to determine the noise impact the document states that planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider the following:

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

3.9 In identifying the overall effect of noise exposure PPGN is in line with the three noise levels given in the NPSE effect levels (as shown in the table above).

3.10 PPGN expands on the NPSE effect levels by providing a table summarising the noise exposure hierarchy:

Table 2: Planning Practice Guidance – Noise (PPGN) Exposure Hierarchy

Perception	Increasing Effect Level	Action
Not noticeable	No Observed Effect	No specific measures required
Noticeable and not Intrusive	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level	
Noticeable and Intrusive	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level	
Noticeable and disruptive	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Unacceptable Adverse Effect	Prevent

London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development

3.11 '*Development Control for Noise Generating and Noise Sensitive Development'* issued by London Boroughs of Hillingdon, Hounslow and Richmond Upon Thames in July 2014 provides planning guidance on acoustic design and requirements applicable to new noise sensitive and noise generating developments.

3.12 The guidance considers appropriate noise levels for new and existing noise sensitive residential properties, suggesting appropriate internal and external noise levels in line with those proposed within BS 8233:2014 '*Sound Insulation and Noise Reduction for Buildings*'.

3.13 With reference to new noise generating commercial developments, the guidance references assessment in line with BS4142:2014 *'Methods for rating and assessing industrial and commercial sound'*, and states that noise impact from relevant proposed industrial or commercial premises or plant with a BS 4142:2014 rating level $L_{Ar,Tr}$ at least 5 dB(A) below the background sound level would be "normally acceptable".

3.14 Details of BS 4142:2014 and its limitations of scope are outlined in section 3.25 below.

British Standard 8233:2014 – Sound Insulation and Noise Reduction for Buildings

3.15 HRS' suggested internal ambient noise level design criterion for the purposes of this assessment has been based on BS8233. This standard is commonly used as the basis for assessing the potential noise impact of the ambient noise climate on proposed residential development. Hence, if a development meets the recommendations of BS 8233:2014, HRS recommends that it could be considered as meeting the requirements of potential noise related planning conditions, subject to relevant authorities' agreement.

3.16 The BS8233 recommended criteria for internal ambient noise levels are shown in Table 3 below:

Table 3: BS8233 Indoor Ambient Noise Design Criteria

Activity	Location	Design Range $L_{Aeq,T}$ dB	
		07:00 - 23:00	23:00 - 07:00
Resting	Living room	35	-
Dining	Dining room/area	40	-
Sleeping (daytime resting)	Bedroom	35	30

3.17 For the purposes of this assessment, and based on the above, HRS propose the following noise criteria for control of external noise:

- Living rooms (07:00-23:00 hours): 35dB $L_{Aeq,T}$
- Bedrooms (23:00-07:00 hours): 30dB $L_{Aeq,T}$

3.18 In addition, World Health Organisation (WHO) guidelines recommend 'general daytime outdoor noise levels of less than 55 dB $L_{Aeq(16hour)}$ are desirable'. Whilst acknowledging these outdoor limits, BS 8233:2014 also states:

3.19 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 recognized that these guideline values are not achievable in all circumstances where development might be desirable.

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'

3.20 British Standard BS 4142, 'Methods for rating and assessing industrial and commercial sound', 2014 describes a method for assessing the likelihood of complaints from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc.). The assessment methodology is based upon determining a 'rating level' for the equipment being assessed, which is the level of noise from the item or items of plant being assessed (measured as $L_{Aeq,T}$).

3.21 The rating level is then compared with the underlying background noise level (measured as a L_{A90}) in the absence of noise from the item or items of plant being assessed.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 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. 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.

3.22 BS 4142:2014 states that a penalty should be added for any plant which gives rise to noise features that may increase disturbance such as tonal, impulsive or intermittent characteristics. With respect to the acoustic feature correction, BS 4142 states:

3.23 "*Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."*

3.24 Generally a rating penalty for a sound should be based on a subjective assessment of its characteristics.

3.25 It should be noted that BS 4142:2014 is not intended to be applied to the rating and assessment of sound from:

- recreational activities, including all forms of motorsport;
- music and other entertainment;
- construction and demolition;
- people;
- public address systems for speech

Operational Noise Impact

3.26 Consideration will need to be given to the potential for an adverse impact on the noise climate due to the operation of the new cafe. Similarly to a plant noise impact assessment in terms of noise, the impact of a development is considered relative to the existing noise climate and with particular reference to noise sensitive receptors.

3.27 The consultation draft '*Guidelines for Noise Impact Assessment*' published by the Institute of Environmental Management and Assessment and the Institute of Acoustics (2002) provides guidance on assessing the impact due to a change in environmental noise level, as outlined in Table 4.

Table 4: Typical interpretation of impact from a change in sound level

Noise Change (dB)	Impact Category
0	No Impact
0 - 3	Slight Impact
3 – 5	Moderate Impact
5 – 10	Substantial Impact
10 and more	Severe Impact

3.28 In addition, the glossary of '*Planning Policy Guidance 24: Planning and Noise'* (PPG 1994) states:

3.29 *"A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound."*

4. Noise Survey

4.1 Noise monitoring was undertaken by HRS in order to assess the existing site noise climate and background sound level. Noise monitoring equipment was located to the west of the existing Stable Block building, at the boundary wall separating Mable Hill park from Southend House. The microphone was mounted on a pole above to boundary wall at a height of approximately 3.5m, therefore measurements are considered to be free field.

4.2 A site plan indicating the noise measurement location is shown in Figure 2.

4.3 Noise survey results are summarised in Table 5. The full noise survey methodology and detailed results are included in Appendix I of this report.

Figure 2: Location of noise monitoring equipment

Table 5: Summary of HRS measured noise levels

Date	Time Period	dB $L_{Aeq,16\ hour}$	dB $L_{Aeq,15min}$	dB $L_{AFmax,\ 15min}$	dB $L_{AF90,\ 15min}$
16.12.2016	Daytime 15:00 – 23:00 hours	-	42 – 59	60 - 79	34 - 42
17.12.2016	Daytime 07:00 – 23:00 hours	51	38 – 66	50 – 79	31 – 43
18.12.2016	Daytime 07:00 – 23:00 hours	48	39 – 53	55 – 74	30 - 43
19.12.2016	Daytime 07:00 – 23:00 hours	54	41 – 60	54 – 84	35 - 46
20.12.2016	Daytime 07:00 – 14:00 hours	-	51 - 62	68 - 79	38 - 46

4.4 It is seen that the lowest daytime ambient level of 48 dB $L_{Aeq,16\ hours}$ was measured on Sunday 18th December. Analysis of 15 minute measurement periods also indicates that daytime noise levels during proposed café operational hours vary between 42 dB and 66 dB $L_{Aeq,\ 15\ mins}$. Table 6 outlines average daytime $L_{Aeq,T}$ noise levels for standard café operational hours, taken to be 08:00 – 18:00, as well as the range of $L_{Aeq,15min}$ and $L_{AFmax,15\ min}$ noise levels measured during these periods. Noise levels for the evening periods 18:00 – 23:00 have been assessed in the same manor.

Table 6: Summary of HRS measured daytime and evening noise levels

Date	Time Period	dB $L_{Aeq,T}$	dB $L_{Aeq,15min}$	dB $L_{AFmax,\ 15min}$
16.12.2016	Daytime 15:00 – 18:00 hours	54	47 - 59	66 – 77
	Evening 18:00 – 23:00 hours	53	42 - 58	60 - 78
17.12.2016	Daytime 08:00 – 18:00 hours	52	42 - 66	59 – 79
	Evening 18:00 – 23:00 hours	49	38 - 55	50 - 70
18.12.2016	Daytime 08:00 – 18:00 hours	47	43 - 51	55 – 74
	Evening 18:00 – 23:00 hours	49	39 - 53	60 - 69
19.12.2016	Daytime 08:00 – 18:00 hours	53	45 - 60	57 – 84
	Evening 18:00 – 23:00 hours	55	41 – 60	54 - 78
20.12.2016	Daytime 08:00 – 14:00 hours	57	52 - 62	68 - 79

4.5 The representative daytime background sound level has been assessed in line with guidance outlined in BS4142:2014 as 37dB $L_{A90,15mins.}$

5. Noise Impact Assessment

Customer Activity Noise

5.1 It is anticipated that the main noise source associated with the proposed new café will be from customers, predominantly those seated externally.

5.2 In order to assess average noise impact a three dimensional noise propagation model of the scheme has been created using SoundPLAN software (SoundPLAN essential version 3.0).

5.3 The model calculates noise transfer from sources associated with use of the new Cafe and calculates the noise propagation in accordance with ISO 9613-2:1996 '*Attenuation of sound during propagation outdoors'*. Facade reflections (up to third order) from modelled buildings have been included within the assessment.

5.4 The geometry of the model is outlined in Figure 3 below.

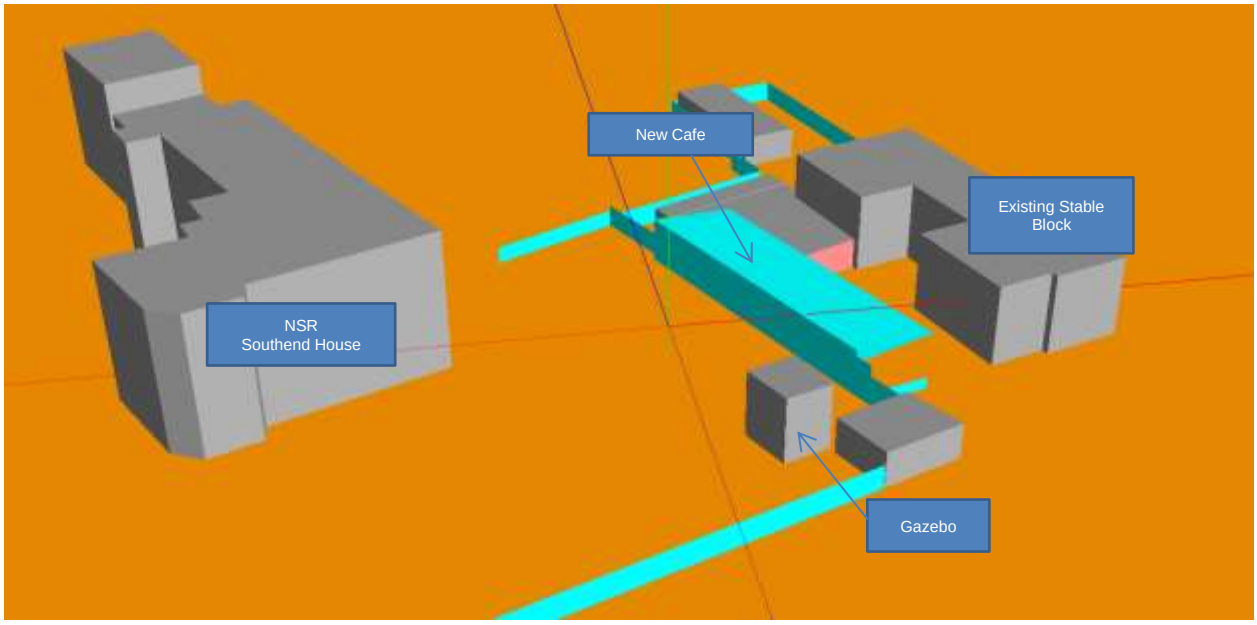


Figure 3: 3D view from noise propagation model

5.5 HRS understands that current proposals are to construct a new boundary wall to the south of the new café building adjacent to the external area, joining on to the existing boundary as shown in Figure 4. Current plans indicate the new boundary wall height to be 3.45m, which has been incorporated in HRS' noise propagation model.

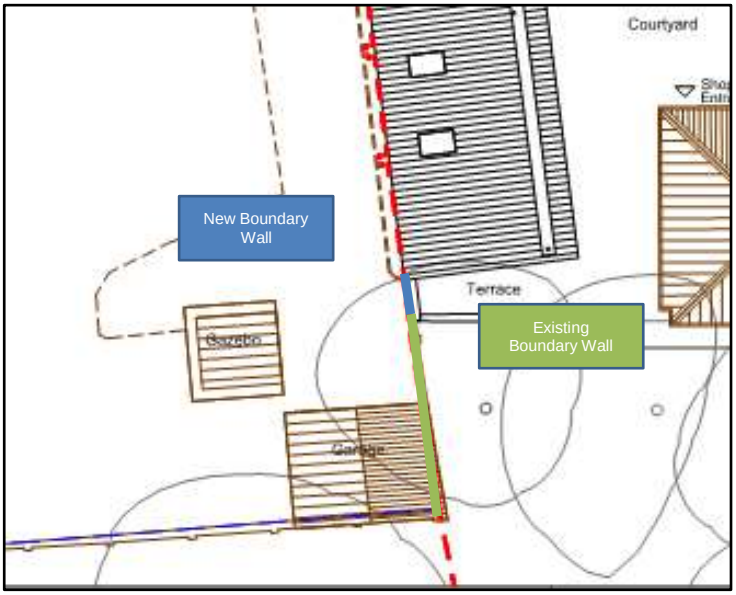


Figure 4: Southern boundary wall

5.6 Typical noise levels for a human voice have been taken from '*ANSI 3.5-1997. American National Standard – Methods for Calculation of the Speech Intelligibility Index, (1997).*', and are summarised in Table 7.

Table 7: ANSI 3.5-1997 sound power level for one speaker

	Octave Band Sound Power Level Hz, dB								dB(A)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Normal voice	45.0	55.0	65.3	69.0	63	55.8	49.8	44.5	68.4
Shouted	52.0	63.0	73.1	84.0	89.3	82.4	74.9	64.1	91.0

5.8 The model has been based on the worst case summer condition assuming maximum café occupancy of 140 customers, 60 seated internally and 80 seated externally. For internal customers a total internal reverberant noise level has been predicted based on 75% of the internal customers talking simultaneously with a 'normal voice' sound power level outlined in Table 7. The internal noise level within the Café is predicted to be 69 dB $L_{Aeq,T}$, which HRS considers typical for a busy daytime café.

5.9 The café building envelope is expected to mitigate noise break out from the café building. Skylights mounted within the roof are to be non-opening to limit noise egress through the roof structure.

5.10 Noise break out from the café has been considered by assuming that 50% area of the glazed facades to the southern and eastern building elevations are open to assess the worst case noise break out condition.

5.11 External noise has been modelled by treating external customers as point noise sources with a 'normal voice' sound power level as outlined in Table 7. HRS understands that the café kitchen is sized to serve

80 externally seated customers. Predicted noise levels are based on 75% of the external café customers talking simultaneously.

- 30 people on terrace area to south of café
- 20 people seated under canopy to the east of the café
- 30 people seated in terrace area to east of existing stable block
- Additional 20 people stood in courtyard

5.12 Figure 5 below shows the output from the noise propagation model in terms of predicted noise contours based on maximum occupancy of the café with courtyard glazing fully open. Assessment of predicted noise impact is made against the lowest daytime noise level (08:00 – 18:00) of 47 dB $L_{Aeq,10hours}$ measured on Sunday 18th December 2016.

5.13 Table 8 classifies the predicted noise levels incident upon NSR's in terms of a noise impact category following the methodology in Table 4.

Table 8: Interpretation of noise impact due to customer activity noise

Predicted Noise Level dB $L_{Aeq,T}$	Noise Change (dB)	Impact Category
≤ 37	0	No Impact
37 – 47	0 - 3	Slight Impact
47 - 51	3 – 5	Moderate Impact
51 - 57	5 – 10	Substantial Impact

5.14 It is seen that predicted highest average noise levels to garden areas of identified NSRs is generally significantly below the BS 8233:2014 and London Borough of Richmond upon Thames recommendation of ≤ 50 dB $L_{Aeq,T}$. The only area where this criterion is exceeded is along the boundary between the proposed café block and grounds of Southend house. This area forms a driveway connecting the house entrance to the garage building located on the southern boundary, and therefore is not considered to be particularly noise sensitive.

5.15 The main Southend House garden area is located to the south of the main building, where predicted noise levels are ≤ 37 dB $L_{Aeq,T}$, corresponding to an impact category of 'no impact'. Garden areas further to the east and directly in front of the eastern building façade are classified a 'slight impact'.

5.16 Due to reduced screening, noise levels at upper storeys of the Southend Façade are higher, with a maximum level of 41 dB $L_{Aeq,T}$ predicted, corresponding to a slight noise impact. BS8233:2014 states that the sound insulation due to a partially open window is approximately 15 dB, therefore daytime noise levels within Southend house assuming an open window are predicted to be within the BS8233:2014 good practice criteria outlined in Table 3.

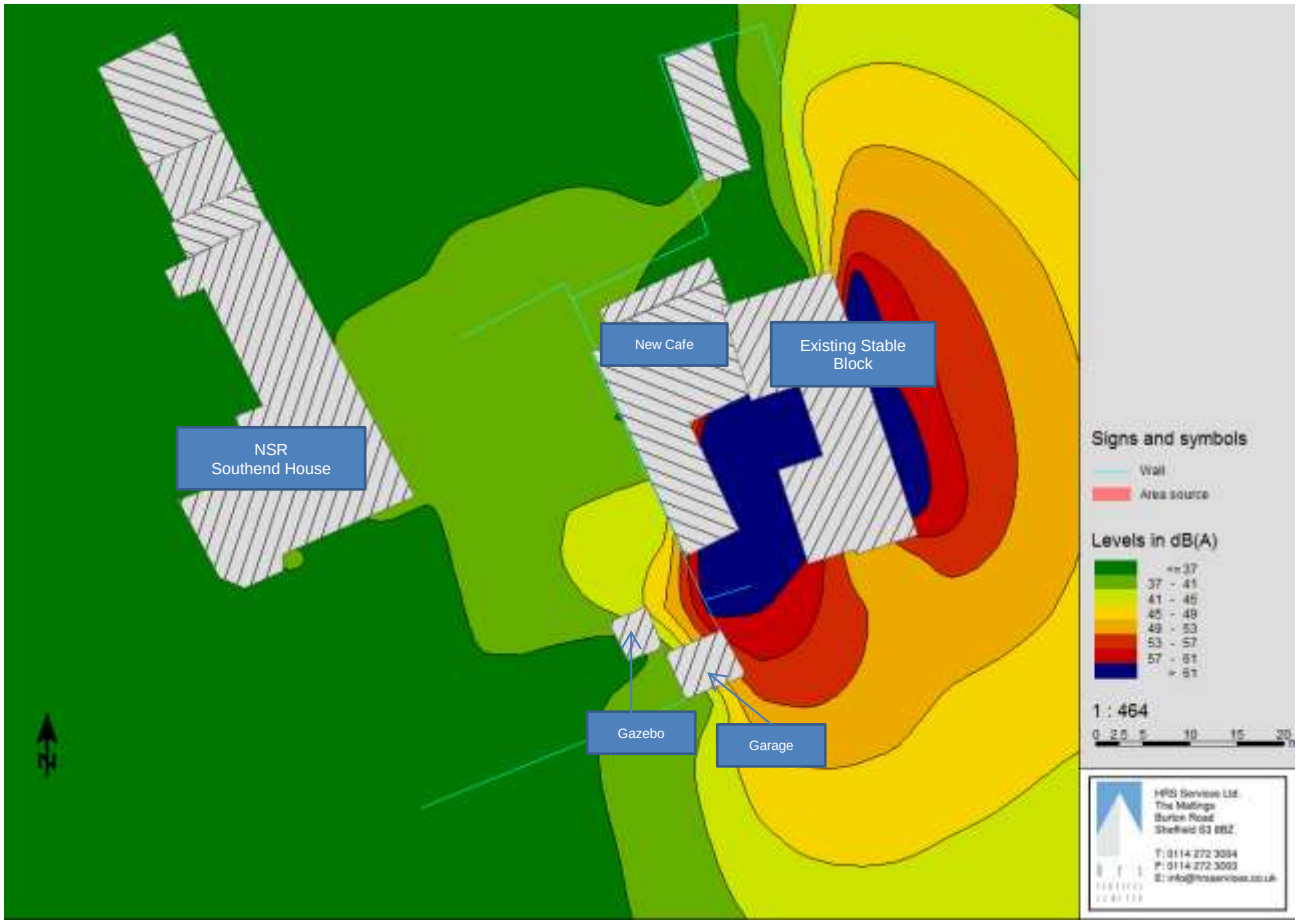


Figure 5: Noise contour output for maximum café occupancy (2m above ground level)

5.17 HRS understands that the Gazebo building within the grounds of Southend House currently has no residential use. Predicted maximum noise levels at the first floor window is predicted to be 49 dB $L_{Aeq,T}$; therefore if this property were to be converted to future residential use daytime internal noise levels would not be expected to exceed the BS8233:2014 good practice criteria outlined in Table 3.

5.18 Consideration has been given to the height of the new boundary wall to adjacent to the external terrace to the south of the new building. Noise impact assessment is based on a proposed height of 3.45m, however, should the height of the wall be reduced; noise impact on the Gazebo building would be expected to increase. Based on a wall height of 2.5m noise impact to garden areas of Southend house is not predicted to significantly increase, however predicted noise levels at the first floor window of the Gazebo building would increase by up to 2 dB, such that internal noise levels with a partially open window may exceed BS8233:2014 good practice daytime criteria by up to 1 dB.

5.19 PPG guidance states that a change in sound level of 3 dB(A) is the minimum perceptible under normal environmental conditions, therefore an excess of 1 dB is not considered to be noticeable; however it is recommended that to minimise potential noise impact on the upper stories of the Gazebo building the new boundary wall is constructed to the proposed height of 3.45m.

5.20 HRS understands that café operational hours are to be 08:30 – 17:00; however consideration has been given to potential use later into the evening. It is noted that evening noise levels considered at an ambient $L_{Aeq,5hour}$ between 18:00 and 23:00 hours are not significantly lower than the daytime 08:00 – 18:00 average ambient noise levels. The lowest measured evening ambient noise level was 49 dB $L_{Aeq,5hour}$ measured on the 17th and 18th December 2016. It is therefore concluded that should the café be used for occasional evening use, noise impact is predicted to be of a similar level to daytime use.

5.21 Assessment of customer noise has been undertaken assuming 'normal' speech noise levels. Calculations have been undertaken to assess the impact of occasional raised voices using the 'shouted' noise level outlined in Table 7, taken to be a maximum noise level for short duration events. Calculations assume 5 customers with 'shouting' noise level located within the courtyard and on the terrace area to the south of the café.

5.22 Calculations indicate that maximum noise levels within garden areas due to occasional customer raised voices or shouts will range up to 65 dB L_{AFmax}. Existing measured maximum noise levels ranged between 55 dB and 84 dB L_{AFmax}, typically attributed to aircraft movements, therefore maximum noise events due to customer activities are predicted to be of the order of existing site maximum noise levels.

Operational Activity Noise

5.23 HRS understands that external dining furniture selection is to consider control of noise generation from movements such as chair scrapes, dragging of tables or stacking, for example. It is anticipated that noise levels due to furniture movements would not normally exceed the noise levels used by HRS for the raised voice assessment above.

5.24 Bin stores are to be located within the service yard to the north of the proposed café. To reduce noise transfer, a three sided enclosure is to be formed with access from the east, forming a solid barrier between the bins and residential properties on Montpellier Row. Maximum noise levels due to activities such as loading bottle bins can typically have maximum noise levels of up to 100 dB L_{AFmax} at 1m from source. Based on this noise level, maximum noise levels at the most exposed façade areas of the identified NSR's is calculated to be ≤ 70 dB L_{AFmax}. This is in within the order of existing site measured maximum noise levels predominantly due to aircraft movements.

5.25 It is anticipated that activities within the services yard such waste handling will be of a limited duration. Given the relatively short duration and frequency of these events it is considered that overall noise impact will be limited. This can be further mitigated by appropriate operational management and staff awareness.

5.26 HRS understands that deliveries would be undertaken to the service yard to the north of the proposed café. Deliveries are to take place during daytime opening hours of 08:30 and 17:00. Given the expected low frequency of deliveries and noise screening provided by the proposed 2m high solid timber fence

surrounding the service yard, it is not expected that deliveries to the café would cause a significant noise impact.

Building Services External Noise

5.27 In line with guidance outlined in '*London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development'* it is recommended that external noise from new building services plant does not exceed 5 dB below the existing representative background noise level when assessed at the nearest noise sensitive receptor in line with BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*'. BS 4142:2014 states that this is an indication of the specific sound source having a low impact.

5.28 Based on HRS measured background noise survey data, assessment in accordance with BS 4142:2014 indicates that total emission levels for plant noise, including acoustic feature corrections where applicable, should not exceed the maximum Rating Level value provided in Table 9.

5.29 It is recommended that the relevant building services engineers are made aware of the proposed plant noise limits in order to inform plant unit specification and selection.

Table 9: BS 4142 Recommended maximum plant noise limits

Location	Daytime (07:00 – 23:00)	
	Representative background noise level range $L_{AF90,,T}$ (dB)	**BS 4142:2014 Rating Level $L_{Ar,Tr}$ (dB)**
Residential Dwellings on Montpellier Row including gardens	37	32

5.30 The Rating Level described above should be assessed in accordance with BS 4142:2014, including appropriate consideration of any tonal or impulsive characteristics of the proposed building services plant. It is prudent to ensure that building services noise is designed to be sufficiently below the recommended plant noise limit criteria such that the cumulative noise level from all sources does not exceed the stated target level.

5.31 HRS understands that new building services plant associated with the scheme comprises two condenser units located to the north of the new building in an enclosure formed of a timbre louvre to allow air flow. The kitchen is to be services by a supply air handling unit and extract fan, both contained within the building envelope and ducted to air supply and discharge louvres located on the northern building elevation. Atmosphere side attenuators are to be provided in order to control noise emissions such that the criterion in Table 9 is met.

6. Conclusions

6.1 HRS Services Ltd. has completed an environmental noise assessment for the proposed new Marble Hill Stable Block Cafe, based on HRS' noise survey carried out at the site during December 2016.

6.2 During the noise survey, the daytime noise climate observed to be affecting the site was noted to be controlled by distant road traffic noise from local roads, and regular aircraft movements associated with planes approaching and departing Heathrow airport. It was noted during HRS' time on site that daytime maximum noise levels are controlled by aircraft movements, occurring at approximately 15 minute intervals.

6.3 The predominant noise source associated with the proposed café development is expected to be noise from customers seated both internally and externally. A noise propagation model of the site has been developed to assess noise transfer from the scheme based on maximum occupancy levels and the all windows to the café building open, representation a 'worst case' assessment.

6.4 Predicted noise levels in adjacent residential garden areas have been assessed in relation to existing site ambient noise levels with noise impact predicted to range from 'no impact' in screened garden areas, to 'slight impact' in more exposed garden areas. Noise levels within garden areas are predicted to be below the guidance levels outlined in BS 8233:2014, as referenced in '*London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development (SPD)'*.

6.5 Noise levels within adjacent residential properties have been considered based on their windows being partially open. Internal noise levels within dwellings based on HRS highest calculated noise emission levels from the proposed café activities are predicted to be within good practice levels outlined in BS8233:2014, as referenced in '*London Borough of Richmond upon Thames: SPD'*.

6.6 It is understood that café operational hours will be 08:30 – 17:00, however the possibility of occasional evening use of the café facilities has been considered. Based on the HRS noise survey, evening noise levels were found to be typically higher than lowest daytime noise level used to inform HRS' assessment. On this basis café use within in the evening period 18:00 – 23:00 is predicted to lead to average noise impact levels similar to the daytime assessment on the basis that aircraft movements are continuous throughout the evening period.

6.7 Maximum noise levels have been considered due to single events such as customer shouts, waste handling, furniture movements etc. Maximum noise levels within gardens and at the facades of identified NSR's are predicted to be within the range of existing site maximum noise levels, currently controlled by regular airplane movements. Given the current noise climate with regular airplane

movements audible, and the expected regularity and duration of maximum noise events due to café operation, a significant impact is not expected.

6.8 HRS has proposed building services noise limits at identified noise sensitive receptors (NSRs) most exposed to the proposed scheme in line with guidance outlined in 'London Borough of Richmond upon Thames: Supplementary Planning Document - Noise Generating and Noise Sensitive Development' which related to a 'low' noise impact in line with BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound*'.

6.9 Based on HRS' environmental noise assessment included within this report, HRS concludes that for the new development is expected to result in a 'low' to 'slight' noise impact upon identified noise sensitive properties.

Appendix I. Noise Survey

Noise monitoring was carried out in order to assess the existing noise climate during the daytime and night-time periods. Measurements were taken between 16th and 20th December 2016.

Noise levels were measured using a UKAS calibrated 01dB Cube precision integrating sound level meter equipped with audio recording facility. Calibration checks were carried out both before and after the measurements with no significant variance observed, calibration certificates are available on request. Noise was measured in terms of broadband A-weighted indices and spectral terms to assist with the design of noise control measures.

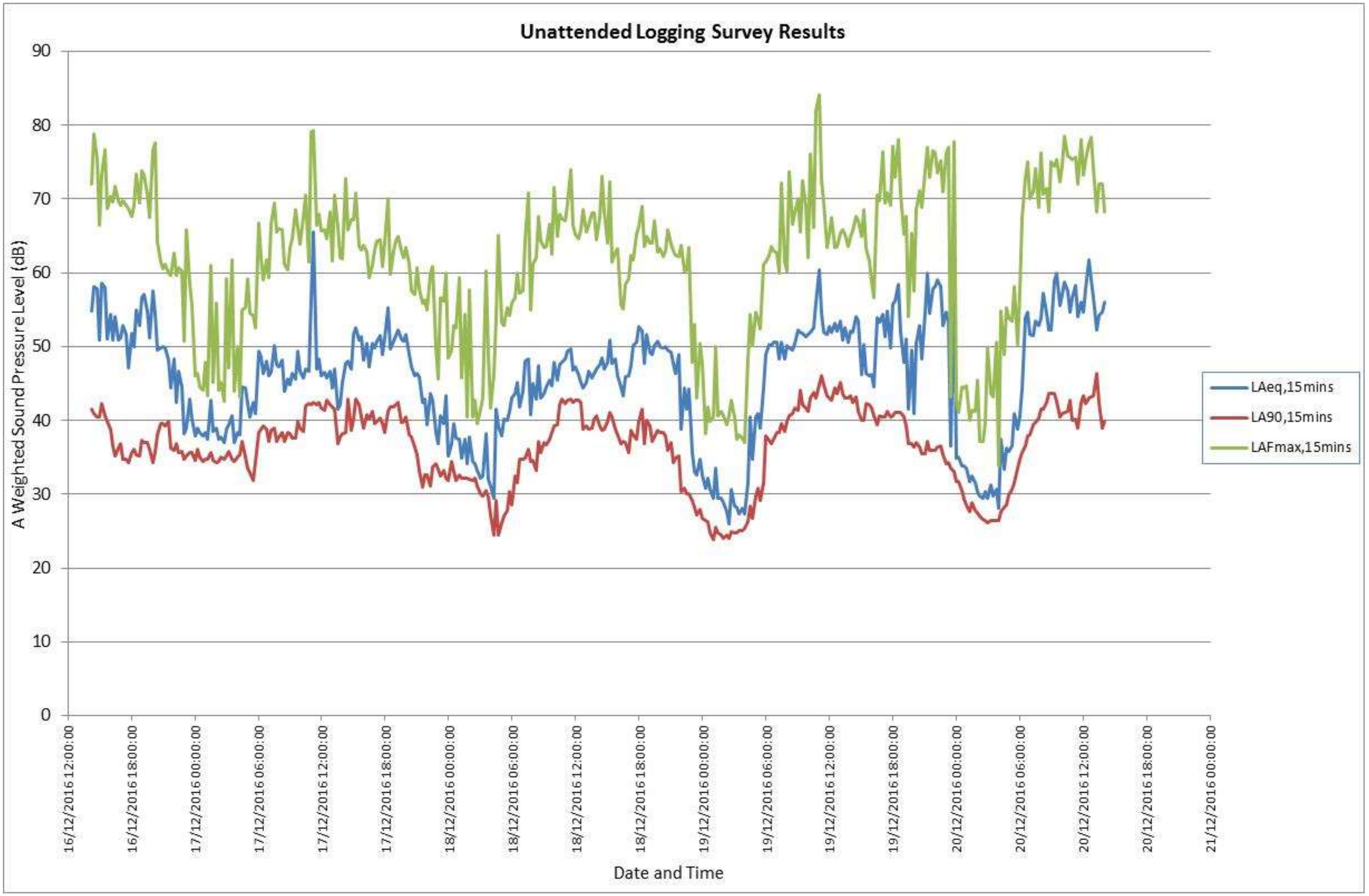
Weather conditions during HRS' site attendance on 16th and 20th December 2016 were dry and calm with wind speeds less than 5 m/s. HRS understands that weather during the cause of the unattended survey predominantly dry, with average and maximum wind speed less than 5 m/s. A weather summary for the nearest weather station located at Heathrow airport is summarised below, taken from www.wunderground.com.

Date	Mean Temperature (°C)	Average Wind Speed (m/s)	Max Wind Speed (m/s)	Precipitation (mm)
16.12.16	8	1.9	3.6	0
17.12.16	6	1.1	3.6	0
18.12.16	6	1.4	3.6	0
19.12.16	5	1.7	3.1	0.8
20.12.16	6	2.8	4.7	0

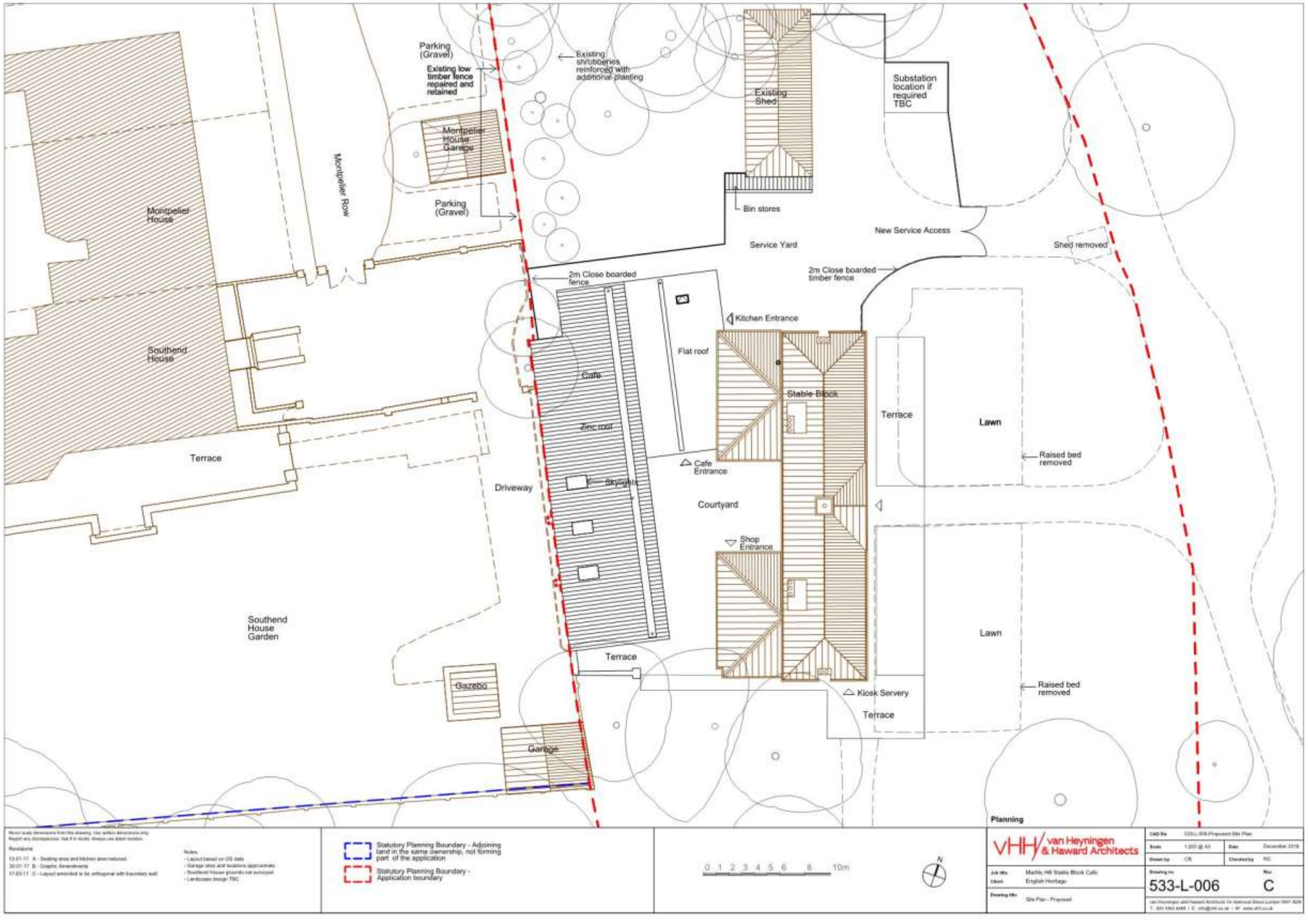
Noise monitoring equipment was located to the west of the existing Stable Block building, at the boundary wall separating Mable Hill park from Southend House. The microphone was mounted on a pole above to boundary wall at a height of approximately 3.5m, therefore measurements are considered to be free field. A photo of the location is included in Figure A1.

Noise monitoring equipment was set to measure all typical broadband noise indices in 15 minute logging periods, as well 1/3 octave spectral data. The noise monitor was installed on Friday 16th December 2016, and continued monitoring until Tuesday 20th December 2016.

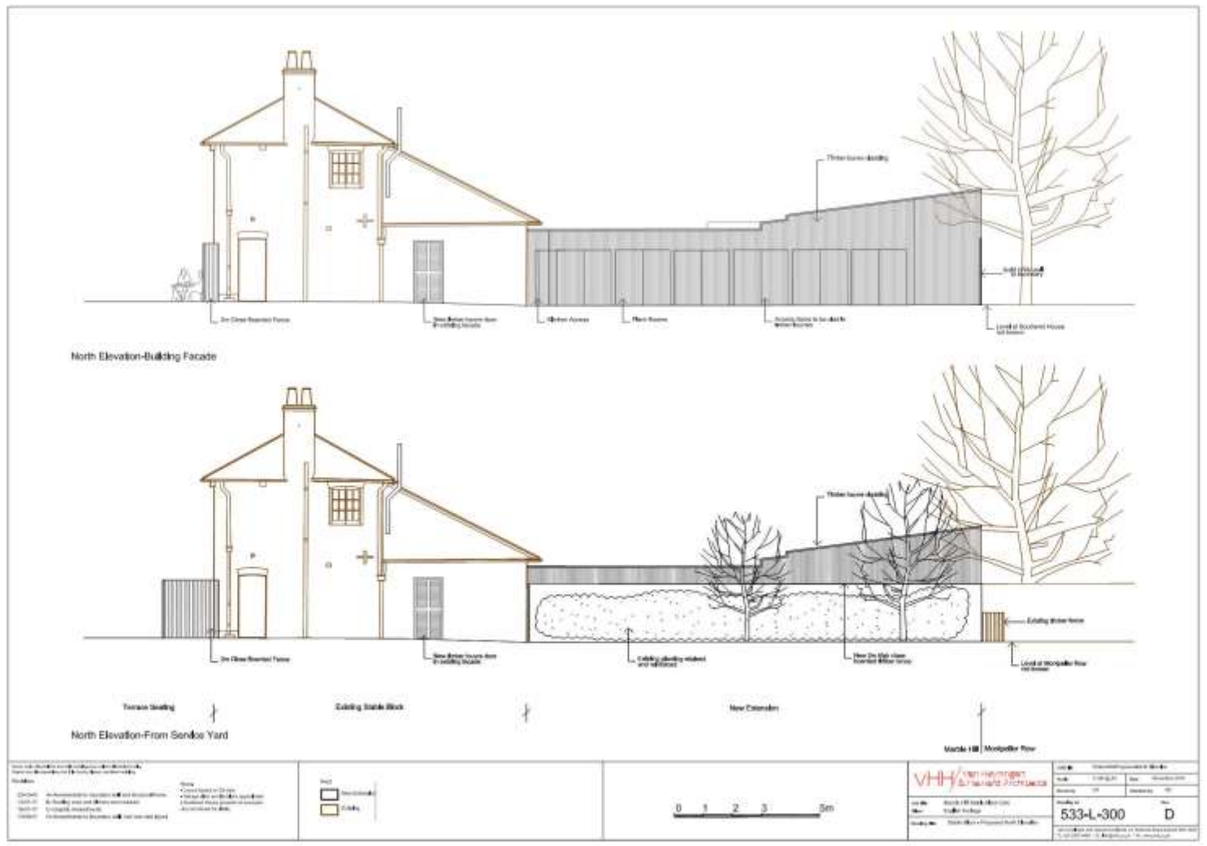
Figure A1: Noise monitoring equipment


Unattended Logging Survey Results
A Weighted Sound Pressure Level (dB)
90
80
70
60
50
40
30
20
10
0
16/12/2016 12:00:00
16/12/2016 18:00:00
17/12/2016 00:00:00
17/12/2016 06:00:00
17/12/2016 12:00:00
17/12/2016 18:00:00
18/12/2016 00:00:00
18/12/2016 06:00:00
18/12/2016 12:00:00
18/12/2016 18:00:00
19/12/2016 00:00:00
19/12/2016 06:00:00
19/12/2016 12:00:00
19/12/2016 18:00:00
20/12/2016 00:00:00
20/12/2016 06:00:00
20/12/2016 12:00:00
20/12/2016 18:00:00
21/12/2016 00:00:00
Date and Time
LAeq,15mins
LA90,15mins
LAFmax,15mins

Appendix II. Proposed Building Plans




DD
EE
Buffer Planting
Service Yard
0.04 Plant
0.05 Plant
0.06 Plant
0.03 Kitchen, Stores & Welfare 65m2
0.07 Plant 20.2m2
0.08 Office 14.5m2
0.13 Male WCs 7.9m2 4 m2
0.09 Female WC 21.7m2
0.10 AWC 4.1 m2
0.11 Store 2.7m2
0.12 WC Lobby 6.1m2
Staff WC 1.6m2
Store
0.02 Servery & Milling 66m2
CC
Courtyard 208m2
Final Exit
0.01 Seating 68m2
BB
AA
0.16 Store 13.5m2
0.15 Staff Welfare 13.6m2
0.17 Shop 50.9m2
0.18 Hatch 10m2
Kiosk (Serving Hatch)
Planning
VHH van Heyningen & Haward Architects
533-L-100
E
0 1 2 3 5m
N


North Elevation-Building Facade
North Elevation-From Service Yard
Timber louvre cladding
Existing timber fence
Terrace Seating
Existing Stable Block
New Extension
Marble Hill Montpellier Row
VHH van Heyningen & Haward Architects
533-L-300
D
0 1 2 3 5m

Appendix III. 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 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 Silvio Murgia, Head of Acoustics who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;

1. Holds an MSc in Applied Acoustics and a PgDip in Acoustics and Noise Control.
2. Has been HRS Head of Acoustics since 2006 and therefore has more than three year's relevant experience (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 Member of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed by Silvio Murgia 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.