ABBEY AREA PHASE 2 DEVELOPMENT, CAMDEN

Acoustic Assessment (Planning / Stage 3)

Reference: 9769.RP01.AAR.4
Prepared: 27 May 2020
Revision Number: 4

Wates
Wates House
Station Approach
Leatherhead
Surrey
KT22 7SW

Acoustic Assessment (Planning / Stage 3)

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	11 November 2019	Ignacio Alonso Senior Consultant (MSc, MIOA)	Robert Barlow Director (BSc, MIOA)
1	Amendment of Section 3.0	3 April 2020	Ignacio Alonso Senior Consultant (MSc, MIOA)	Robert Barlow Director (BSc, MIOA)
2	Updated to include plant noise assessment		Josh Evans Consultant (MSc, AMIOA)	Ignacio Alonso Senior Consultant (MSc, MIOA)
3	Stage 3	26 May 2020	Ignacio Alonso Senior Consultant (MSc, MIOA)	Robert Barlow Director (BSc, MIOA)
4	Stage 3 – Section 7.1	27 May 2020	Ignacio Alonso Senior Consultant (MSc, MIOA)	Robert Barlow Director (BSc, MIOA)

Terms of contract:

RBA Acoustics Ltd has prepared this report in accordance with our Acoustic Consultancy Brief 9769.ACB01.1.161019.IAM dated 16 October 2019 (inclusive of planning application report). RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

In line with our Environmental Policy, up to two hard copies of the report will be provided upon request. Additional copies of the report, or further hard copies of revised reports, would be subject to an administrative cost of £20.00 (+VAT) per copy.

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1.0 INTRODUCTION

The development of a new Community Centre and Health Centre is proposed as part of Abbey Area Phase 2 Development.

The site is located in the London Borough of Camden at the junction of Abbey Road and Belsize Road. To the south of the site is a railway line comprising six tracks of both east and west bound rail traffic within a cutting, with London Overground, Virgin and London Midland rail traffic.

The proposed development is adjacent to residential demises to the East and North.

This report is concerned with the following acoustic topics:

- External building fabric (noise break-in)
- External plant noise assessment
- Noise break-out from the community hall

RBA Acoustics have undertaken measurements of the prevailing noise conditions at the site. These measurements have allowed us to assess the acoustic requirements of the external building fabric elements and to provide recommendations with regards to plant noise control in line with the design criteria required by Camden Council.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 Background

Noise affecting the site was surveyed by RBA Acoustics in 2015 during works pertaining to a previous scheme. As the measurements were over 4 years old, additional spot measurements have been undertaken on site to obtain updated information regarding the noise environment of the site and check the validity of the 2015 measurements.

2.2 Survey Methodology

Spot 2019 Measurements

An attended noise survey of the prevailing background noise comprising sample periods of 15 minutes duration were undertaken over the following period:

- 10:00 hours to 14:00 hours Friday 18 October 2019.

Meteorological conditions throughout survey period were generally considered suitable for obtaining representative noise measurements, it being predominantly dry with little wind.

Measurements were made of the L_{A90} and L_{Aeq} noise levels over each 15 minute sample period. A brief explanation of the acoustic terminology used in this report is shown within Appendix A.

Unattended 'Long Term' 2015 Measurements

Unattended measurements over a 24 hour period were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes duration over the following period:

- Wednesday 11 March and Thursday 12 March 2015

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period, however the weather was generally considered satisfactory, it being predominantly dry with little wind.

2.3 Measurement Locations

To determine the existing noise climate around the site, measurements were undertaken at the following locations.

Positions 1-4 correspond to the 2019 Spot Measurements and are all measured in the free-field whereas Position 5 and 6 correspond to the unattended long terms 2015 measurements and are affected by façade reflections:

Position 1 – Abbey Road

Measurements were taken at the western site boundary with the microphone positioned approximately 3m from the edge of Abbey Road, approximately 1.5m above ground level. The prevailing noise climate was noted to mainly consist of vehicle movements on Abbey Road. Whilst all types of vehicle from cars to HGV's were noted to be using the road, buses pulling into a nearby bus stop dominated the noise climate at this position.

Position 2 – Abbey Road and Belsize Road Junction

Measurements were taken with the microphone set back approximately 8m from the edge of Belsize Road to the south of site, approximately 1.5m above ground level. The prevailing noise climate was noted to mainly consist of vehicle movements on the junction between Abbey Road and Belsize Road.

Position 3 – Belsize Road

Measurements were taken with the microphone positioned approximately 1.5m from the edge of Belsize Road to the east of site, approximately 1.5m above ground level. The prevailing noise climate was noted to mainly consist of vehicle movements on Belsize Road. It is notable that vehicle movements on this section of Belsize Road are less frequent than those near Positions 1 and 2.

Position 4 – Open Space

Measurements were taken with the microphone situated in the open space to the north of site, behind Snowman and Casterbridge Houses currently occupying the site. The prevailing noise climate was noted to mainly consist of distant traffic on Belsize Road and railway movements. Noise levels experienced at this location are thought to be representative of noise levels experienced at the residential receptors on Goldhurst Terrace, approximately 40m north of the measurement location.

Position 5 – Emminster House (Abbey Road)

An unattended microphone was fixed to an A-frame and positioned outside of a first floor window of Emminster House, overlooking Abbey Road approximately 16m from the edge of the road. The microphone was considered to be subject to façade reflection effects.

Position 6 – Casterbridge House (Junction of Belsize Road and Abbey Road)

An unattended microphone was positioned on the first floor veranda of Casterbridge House, overlooking the junction of Belsize Road and Abbey Road, approximately 15m from the edge of the road. The microphone was considered to be subject to façade reflection effects.

All measurement locations are shown on Site Plan SP1 in Appendix A

2.4 Instrumentation

The following equipment was used for the measurements.

Table 1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1406262	U31212	13 March 2021
Norsonic Pre Amplifier	1209	20487		
Norsonic ½" Microphone	1225	225566	31211	13 March 2021
Norsonic Sound Calibrator	1251	34429	U31210	13 March 2021
2No. positions between Wednesday 11 March and Thursday 12 March 2015				
01dB A&V Type 1 Sound Level Meter	Black Solo 01	60610	CE-DTE-T-13-PVE-69595	2 October 2015
01dB A&V Pre Amplifier	PRE 21 S	13676		
Gras ½" Microphone	MCE 212	153683		
01dB-Stell Calibrator	Cal 21	50441/910	CE-DTE-T-13-PVE-69606	2 October 2015
01dB A&V Type 1 Sound Level Meter	Blue Solo 01	60611	02003/2	26 September 2016
01dB A&V Pre Amplifier	PRE 21 S	13678		
01dB A&V ½" Microphone	MCE 212	84967		
01dB-Stell Calibrator	Cal 21	50441920	02003/1	26 September 2016

The sound level meters were calibrated both prior to and on completion of the surveys with no significant calibration drift observed.

2.5 Results

Spot 2019 Measurements

The measured L_{A90} and L_{Aeq} for each sample period is summarised in the following Table 2 below.

Table 2 – Measured Noise Levels

Measurement Position	Measurement Period	$L_{A90,\ 15\ mins}$ (dB)	$L_{Aeq,\ 15\ mins}$ (dB)
Position 1 – Abbey Road	10:00 – 11:00	59	68
	11:00 – 12:00	57	66
	12:00 – 13:00	58	67
	Minimum $L_{A90,15min}$ / Average L_{Aeq}	**57**	**67**
Position 2 – Abbey Road and Belsize Road Junction	10:00 – 11:00	55	63
	11:00 – 12:00	55	69
	12:00 – 13:00	57	62
	Minimum $L_{A90,15min}$ / Average L_{Aeq}	**55**	**66**
Position 3 – Belsize Road	10:00 – 11:00	54	65
	11:00 – 12:00	54	65
	12:00 – 13:00	55	66
	Minimum $L_{A90,15min}$ / Average L_{Aeq}	**54**	**65**
Position 4 – Park	10:00 – 11:00	50	60
	11:00 – 12:00	52	58
	12:00 – 13:00	53	58
	Minimum $L_{A90,15min}$ / Average L_{Aeq}	**50**	**59**

Unattended 'Long Term' 2015 Measurements

The noise levels measured are shown as time-histories on the attached Graphs 1-4 for Positions 5-6. Average spectral noise levels measured are shown on the attached Graphs 5-6 for Positions 5-6.

The lowest background L_{A90} noise levels measured and averaged L_{Aeq} noise levels measured are summarised below.

Due to the location of the microphone in these positions, noise levels have been reflection corrected (i.e. indicate façade incident noise level).

Table 3 – 2015 Environmental Survey Results

Measurement Position	Measurement Period	Minimum L_{90} (dBA)	Average L_{eq} (dBA)
Position 5 – Abbey Road	Daytime (07:00 – 19:00)	55	66
	Evening (19:00 – 23:00)	52	62
	Night-time (23:00 – 07:00)	34	59
	Plant Operating Period (07:00 – 00:00)	49	62
Position 6 – Junction of Abbey Road and Belsize Road	Daytime (07:00 – 19:00)	55	63
	Evening (19:00 – 23:00)	50	60
	Night-time (23:00 – 07:00)	38	57
	Plant Operating Period (07:00 – 00:00)	47	66

2.6 Proposed Building Location and Use

The proposed building location is indicated in Figure 1. As can be seen, the building is located at a significant distance from Abbey Road and also its junction with Belsize Road. The most relevant measurement locations with respect to this location are Positions 3 and 4 and are based on the measurements undertaken at these positions that the following sections are based upon. It is worth noting that the building use will be limited to the daytime. Despite this, we have also considered night-time levels for the sake of completion. These have been based on the 2015 noise measurements which provide a sufficient level of reliance specially as the building use is limited to daytime.

3.0 PLANNING CRITERIA

This section outlines the assessment criteria we anticipate Camden Council will require based upon their Planning Policy A4. Planning noise criteria are generally concerned with two main aspects; a) effect of proposed scheme on its surroundings and b) the effect the existing conditions on site may have over the proposed development.

With regards to a), in this instance, there are two main items to be considered, plant noise emissions and noise break out due to internal activities.

With regards to b) the main topics to be considered are existing external noise and vibration. Vibration is not considered an issue in this instance given the significant distance to the railway tracks and the relatively light road traffic supported by Belsize Road.

- Plant Noise Emission limits to protect existing residents are discussed in Section 3.3.
- Noise break-out due to internal activities and associated noise limits to protect existing residents are discussed in Section 3.4.
- External noise incident on the proposed scheme is discussed in Section 3.5.

3.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF), 2018, sets out the Government's planning policies for England. In respect of noise, Paragraph 180 of the NPPF states the following:

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
>
> *b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;*

3.2 Camden Local Plan 2017

The requirements of regarding noise and vibration as provided in Camden Local Plan 2017 are given below.

Policy A4 Noise and Vibration

The council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration (Appendix 3). We will not grant planning permissions for:

a. development likely to generate unacceptable noise and vibration impacts; or
b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

We will only grant permission for noise generating development, including any plant any machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phase of development.

Appendix 3 of the Camden Local Plan reads as follows:

The significance of noise impact varies dependent on the different noise sources, receptors and times of operation presented for consideration within a planning application. Therefore, Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice Guidance:

- *NOEL – No Observed Effect Level*
- *LOAEL – Lowest Observed Adverse Effect Level*
- *SOAEL – Significant Observed Adverse Effect Level*

Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:

- *Green – where noise is considered to be at an acceptable level.*
- *Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.*
- *Red – where noise is observed to have a significant adverse effect.*

3.3 Other Reference Documents

Camden Planning Guidance – Amenity

Consideration has also been given to the guidance within Chapter 6 of the document Camden Planning Guidance – Amenity dated March 2018 which in turn makes reference to the above policy noise limits. This report is in line with the guidelines given in Chapter 6.

Intend to Publish the London Plan

Policy D14 – Noise of the Intend to Publish The London Plan dated 2019 gives guidance on the management of noise of new developments. We would consider this report to address the applicable items of Policy D14.

3.4 Plant Noise Emission Criteria

Policy A4 of Camden Local Plan 2017 provides the following information regarding the required noise levels for proposed plant items:

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS4142) will be used. For such cases a 'Rating Level' of 10dB below background (15dB if tonal components are present) should be considered as the design criterion.

In line with the above requirements we would propose items of mechanical services be designed so that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise sensitive receptors:

Table 4 – Plant Noise Emission Limits

Location	L_{Aeq} Noise Level limit of all operating plant (dB) at 1m from the nearest noise sensitive façade	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Belsize Road façades	44[1]	28[3]
Goldhurst Terrace rear façades	40[2]	28[3]

[1] From Position 3
[2] From Position 4
[3] From Position 6

The nearest noise sensitive receptors are shown on Site Plan SP2 in Appendix C. The closest receptor is at approximately 24m from the plant area designated on the roof.

In line with the requirements of the Local Authority should the proposed plant be identified as having tonal features, the above limits should be reduced by 5dB.

The above limits would result in plant emission being in the NOEL (no observed effect level) category.

3.5 Entertainment Noise (Community Hall)

Camden Local Plan 2017 requires the following consideration to be made to noise from entertainment and leisure premises:

> *"Assessments for noise from entertainment and leisure premises must include consideration to amplified and unamplified music, human voices, footfall and vehicle movements and other general activity. Appropriate metrics must be used to measure and assess the noise impact including L_{Aeq} and L_{Amax} metrics and appropriate frequency spectrum. Planning Permission will not be granted in instances where it is not possible to achieve suitable and sufficient internal noise levels with reference to the most up to date and appropriate guidance within proposed noise sensitive receptors despite appropriate mitigation proposals due to the tonality of noise from existing entertainment venues."*

The general requirements of Camden Council for noise breakout from entertainment venues are outlined within Table D of the Camden Local Plan 2017. This relevant section from this table is reproduced in Table 5 for convenience.

Table 5 – Entertainment Noise Criteria - General

Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55 dB $L_{Aeq, 5min,}$ or 10 dB below $L_{Aeq, 5min}$ without entertainment noise
		Evening	The higher of 50 dB $L_{Aeq, 5min,}$ or 10 dB below $L_{Aeq, 5min}$ without entertainment noise
		Night	The higher of 45 dB $L_{Aeq, 5min,}$ or 10 dB below $L_{Aeq, 5min}$ without entertainment noise

In the case of Phase 2 the following limits are therefore applicable:

Table 6 – Entertainment Noise Criteria – Phase 2

Location	L_{Aeq} Noise Level limit for Entertainment Noise at 1m from the nearest noise sensitive façade		
	Daytime (07:00 – 19:00)	Evening (19:00 – 23:00)	Night-time (23:00 – 07:00)
Belsize Road façades	55[1]	50[2]	47[2]
Goldhurst Terrace rear façades	55[3]	50[2]	47[2]
Casterbridge House	55[3]	50[2]	47[2]

[1] From Position 3
[2] From Position 6

3.6 Internal Noise Levels from External Sources

British Standard 8233:2014

BS 8233:2014 *Guidance on Sound insulation and noise reduction for buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions.

The noise level values given are in terms of an average (L_{Aeq}) level.

The standard advises internal ambient noise levels for providing masking for acoustic privacy in shared spaces. A brief explanation of the acoustic terminology used in this report is shown in Appendix A attached.

Table 7 – BS 8233:2014 Indoor Ambient Noise Level Criteria – Community Centre

Objective / Activity	Typical Situations / Location	Design range $L_{Aeq,T}$ (dB)
Speech or Telephone Communications	Department Store Cafeteria, canteen, kitchen	50-55
	Corridor, Circulation Space	45-55
Typical noise levels for acoustic privacy in shared spaces	Open plan office	45-50
Study and Work Requiring Concentration	Staff/Meeting Room, Training Room	35-45
Listening	Place of worship, counselling, meditation	35-40

The standard also advises the following noise levels within spaces where acoustic privacy is important. The design range presented can be considered as providing both upper and lower noise level limits.

Table 8 – BS8233 Criteria for internal noise

Location	Design Range
Restaurant	40-55dBA
Open Plan Offices	45-50dBA
Public House	40-45dBA
Ballroom, banqueting hall	35-40dBA

With the above in mind, the following specific targets can be derived with regards to the Community Centre:

Table 9 – Internal Noise Level Criteria – Community Centre

Location	Design Range
Belsize Room, Garden Room	40-55dBA
Kitchen / Resource Room	50-55dBA
Hall	35-40dBA
Foyer / Reception	45-55dBA
Offices	35-45dBA
Nursery / Creche	35-40dBA

Health Technical Memorandum 08-01: Acoustics Department of Health (HTO 08-01: Acoustics)

This document provides recommendations on internal noise levels for noise intrusion from external sources applicable to Health Buildings. The values given are detailed below:

Table 10 – Heath Centre Internal Noise Criteria

Room Type	Example	Criteria for Noise Intrusion to be met inside the spaces from external sources (dB)
Small office-type spaces	Private offices, small treatment rooms, interview rooms, consulting rooms	40dB $L_{Aeq, 1hr}$
Circulation spaces	Corridors, hospital street, atria	55dB $L_{Aeq, 1hr}$
Public areas	Dining areas, waiting areas, playrooms	50dB $L_{Aeq, 1hr}$
Personal hygiene (public and staff)	Toilets, showers	55dB $L_{Aeq, 1hr}$
Large meeting rooms (>35m2 floor area)	Lecture theatres, meeting rooms, board rooms, seminar rooms, classrooms	35 dB $L_{Aeq, 1hr}$
Small meeting rooms (≤ 35m2 floor area)	Meeting rooms, seminar rooms, classrooms, board rooms	40dB $L_{Aeq, 1hr}$
Laboratories	Laboratories	45 dB $L_{Aeq, 1hr}$

Note on Rain Noise

The aforementioned document also provides recommendations regarding rain noise. Indoor ambient-noise levels during "heavy" rainfall (as defined in BS EN ISO 140-18) should not exceed the levels detailed in Table 8 by more than 20dBA or should not be more than 65dBA whichever is lower.

4.0 PLANT NOISE ASSESSMENT

Our assessment of the proposed rooftop plant has been based upon the following information:

4.1 Proposed Plant Items and Position of Units

Table 11 – Plant Information

Ref	Manufacturer/Model/Duty	Plant Type	Location
COND1-6	Mitsubishi CAHV-P500YA-HPB	Condensing Units	Roof
AHU 01	MA50/6/S	AHU	Roof
AHU 01 - HTM	MA50/6/S	AHU	Roof
MVHRs	Nuaire XBC45-H-NES	MVHR intake and discharge ducts	Ground Floor (internal)

4.2 Position of Units

The proposed units are all to be located on the roof of the development. The equipment positions are indicated on the site plan in Figures 2&3 in Appendix C.

4.3 Noise Levels

Information regarding the noise levels of the proposed plant has been provided by the manufacturers of the units. The associated plant noise levels are detailed as follows:

Table 12 – Plant Noise Levels

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
COND1-6	SPL at 1m	70	65	60	57	52	46	49	44
AHU 01 - Intake	SWL	81	86	82	82	82	79	77	74
AHU 01 - Exhaust	SWL	79	84	80	80	80	77	75	72
AHU 01 – HTM – Intake	SWL	80	85	81	81	81	78	76	73
AHU 01 – HTM - Exhaust	SWL	78	83	79	79	79	76	74	71
MVHR discharge (each unit)	In -duct SWL	82	75	79	65	66	66	60	58
MVHR intake (each unit)	In -duct SWL	77	69	69	58	58	56	48	39

Review of the octave band data provides no indication of any tonal characteristics associated with the proposed plant.

4.4 Location of Nearest Residential Windows

The closest residential receptors to the plant and their relevant criteria has been previously mentioned in Section 3.3. These are as follows.

Belsize Road rear façade

The closest residential windows to the plant have been identified as the 1st floor windows on the rear façade of 170 Belsize Road. These windows are at a distance of approximately 30m from the roof plant location and 5m from the MVHR closest duct termination.

Goldhurst Terrace rear façades

Nearby residential windows to the plant have been identified as the 1st floor windows on the south façade of the nearby residential properties of Goldhurst Terrace. These are at a distance of approximately 70m from the plant locations.

Casterbridge House

Nearby residential windows to the plant have been identified as being the 1st floor windows on the east façade of Casterbridge House. These are at a distance of approximately 53m from the plant locations.

4.5 Mitigation

In order to meet with the Local Authority requirements, the following mitigation measures are proposed:

Attenuation of AHUs

We also recommend that the attenuators are fitted to the atmospheric terminations of both AHUs. These attenuators should be capable of achieving the performance specification outlined below.

Table 14 – Attenuator Specification

Location	Example Configuration		Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
	Length (mm)	Free Area (%)	63	125	250	500	1k	2k	4k	8k
AHU 01 – Intake	900	30	5	10	16	25	34	34	29	22
AHU 01 – Exhaust	900	30	5	10	16	25	34	34	29	22
AHU 01 HTM – Intake	900	40	4	7	13	19	23	23	16	13
AHU 01 HTM – Exhaust	900	40	4	7	13	19	23	23	16	13
MVHR discharge	900	40	4	7	13	19	23	23	16	13
MVHR intake	600	50	1	2	7	10	11	9	8	7

4.6 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting noise levels from the proposed plant at the nearest residential windows, based on the information stated above, is summarised below.

- Source Term SPL / SWL
- Attenuator losses
- 20LogR Distance Attenuation
- Directivity

An example calculation sheet is attached for further information in Appendix B.

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 15 – Predicted Noise Levels

Operating Period	Receptor 1		Receptor 2		Receptor 3	
	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion
Daytime (07:00 – 23:00)	39	40	32	40	34	40
Night-time (23:00 – 07:00)*	<25	28	<25	28	<25	28

*Plant night operation is negligible at night due to the daytime use of the building

Noise from the proposed units is within the target criteria. Therefore, the proposals should be considered acceptable.

4.7 Roof Construction

There are two main acoustic issues with regards to the roof construction.

1) Airborne plant noise transfer to below
2) Structure-borne plant noise transfer associated to the plant vibration

Airborne plant noise transfer to below

The proposed roof construction provides limited sound reduction due mainly to the lightweight nature of the proposal.

We would recommend 2 elements underlined below are added to the roof construction proposed in order to achieve a suitable sound reduction.

Room side

- Rockfon medicare or plasterboard ceiling
- 50mm melamine absorptive foam in ceiling void
- Tata Steel Roof Deck – D100 – 100mm
- Plywood- 18mm
- 10mm cement particle board
- Hotmelt - 10mm
- Insulation - 220mm
- 20mm Drainage Board with filter fleece - 20mm
- Paving slabs

Plant side (roof)

The extent of the above is as follows:

- Melamine absorption in ceiling void – Rooms directly below AHUs and ASHP units (if rooms are partially below the VRVs/ASHPs, it is recommended to apply this treatment to the entire room).

- Cement board – To areas directly below the AHUs and ASHPs including approximately a 1m perimeter

Structure-borne plant noise - Vibration Control

We recommend the plant area structure is stiffened to reduce its static deflection under load at plant locations, the structure engineer should be made aware of this recommendation.

Notwithstanding the above we also recommend the ASHPs are mounted on 25mm deflection spring mounts and that the AHUs are mounted on 10mm deflection rubber footings (this is in addition to the internally mounted fan isolators).

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

4.8 Ground Floor Plantroom

Plant Items

The ground floor plant room is inclusive of:

- Pressurisation units
- Booster sets
- HWS return pumps
- HTG VT AND CT circulation pumps

Plant room wall

The plantroom wall is proposed as 215mm medium / dense blockwork. This is acoustically acceptable.

Structure-borne plant noise - Vibration Control

All plant items including a pump, e.g. pressurisation units, booster sets, HWS return pumps, HTG VT AND CT circulation pumps should include vibration mitigation elements between the unit and the structure on which they will be mounted (floors, walls, metal framework and pipework). In addition, flexible connectors should be employed between pumps and associated pipework in order to prevent pump vibration transferring into the pipework and ultimately the building structure.

4.9 Penetrations

All wall and floor penetrations made by the ductwork/pipework should be adequately acoustically treated.

The penetrations should not be oversized. The ductwork/pipework should not be in rigid contact with the floor slab/wall – the ductwork/pipework should be resiliently sleeved to prevent potential structure-borne vibration.

5.0 EXTERNAL BUILDING FABRIC ASSESSMENT

5.1 Background

Analyses of the external building fabric have been undertaken in order to ascertain the required acoustic performance of the glazing and other external fabric elements to achieve the project criteria.

5.2 Assumptions

Our external building fabric analyses have assumed the following:

(a) Drawings

The assessment has been based on the planning drawings as provided by Wates.

(b) Noise Levels

The assessment has been based on the measured noise levels as detailed in Section 2.0.

(c) Room Absorption

We have assumed internal spaces to have a hard floor finish and a suspended acoustically absorptive ceiling, meeting the reverberation control requirements provided later within this document. For the purposes of our analyses we have assumed the following absorption coefficients.

Table 16 – Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.08	0.08	0.08	0.10	0.15	0.20	0.20	0.20

(d) External Wall

At this stage the build-up of external non-glazed areas is not confirmed. It is likely a lightweight construction with an internal plasterboard lining will be adopted.

As such, we have assumed the following sound reduction indices (equating to an overall R_w of 46dB) for all non-glazed façade areas comprising the above construction:

Table 17– Non-Glazed SRIs

Assumed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
20	26	37	44	50	55	55	55

(e) Ventilation

We understand that where possible, the intent is to use natural ventilation via trickle ventilators and open windows. BS 8233:2014 indicates that the sound insulation of a window reduces to approximately 15dB when open. If open windows are to be relied upon for ventilation then the predicted internal noise level should be estimated on the basis of an open window.

Given the relatively quiet surroundings our calculations indicate that it would be possible to naturally ventilate all the spaces and still achieve the internal noise levels recommended herein except for the. However, any spaces deemed to generate noise levels in excess of 75-80dBA (i.e. the Hall) would require to have windows shut in order to ensure noise break-out is controlled to acceptable levels. Please refer to Section 7.0 for more information.

5.3 Glazing Specification & Guidance Constructions

The glazing performance specifications apply to the glazing package as a whole inclusive of glazing, louvres, spandrel panels, framing, opening lights, doors, seals, etc. The performance of the glazing system will depend on many factors such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc.

Our calculations indicate that adequate noise levels will be achieved in all areas with standard double glazing capable of achieving a weighted sound reduction, R_w, of 33dB.

This can be achieved by standard glazing configuration as simple as 4mm glass / 12mm space / 6mm glass. It should be noted that due to the necessity for security laminated glass on the ground (lower / accessible) floors, it is likely that the specifications will exceed those stated above in some locations.

Note on Roof-lights

Roof lights should achieve an acoustic performance R_w 33dB. This can be achieved by standard glazing configuration, e.g. 4mm glass / 12mm space / 6mm glass or any thicker configuration.

6.0 INTERNAL NOISE FROM MECHANICAL VENTILATION

Based on the CIBSE Guide and HTM 08-01 the following internal noise levels within areas are applicable. For Health Centre Areas the below approximation from BS8233 has been used.

NR≈dBA-6

Table 18 – Maximum Recommended Design Criteria

Room	Noise Rating
Belsize Room, Garden Room	NR35
Kitchen / Resource Room	NR35
Hall	NR35
Foyer / Reception	NR40
Nursery / Creche	NR30
Private offices, small treatment rooms, interview rooms, consulting rooms, laboratories, offices, rest room, meeting room	NR35
Corridors, atria, toilets	NR45
Waiting area	NR40

Room-side attenuators for roof AHUs anf ground floor MVHR should be selected to achieve the levels outlined in Table 18. The attenuator supplier should be made aware of the above requirements and size the attenuators accordingly.

When background noise levels are too high they can be disturbing and affect comfort in a space; when too low, speech privacy between spaces may be reduced. It is therefore important to tailor background noise levels appropriately.

It is also important that background noise has no attention catching characteristics, such as hums, whines, whistles and clicks. Where necessary, the services system will therefore need to be designed to provide a steady, broadband noise that does not attract attention but helps to mask occasional distracting noises from nearby spaces.

7.0 AMENITY NOISE

We have also given consideration to noise arising from activities associated to the amenity areas within the proposed development. The two main areas associated to this are the Community Hall and the courtyard.

7.1 Community Hall Noise Break-out

It is proposed to provide the Community Hall space ventilation by means of MVHRs without he need to rely on opening of windows.

Based upon the glazing, external wall constructions and specifications detailed within this report, our analyses indicate an overall level of approximately 90dBA should be achievable within the Hall without the likelihood of complaint during the operating hours (09:00-21:00h, Monday to Sunday) and all windows shut.

A level of 90dBA internally is considered a worst case assessment and as such the use of the Community Hall should not result in exceedance of the Local Authority criteria.

7.2 Other Considerations

Courtyard

In order to ensure noise generated through use of the external terrace is not problematic to nearby residents, it may be necessary to impose usage restrictions on the terrace. For example, this could include limiting the number of people able to use the terrace at any one time and limiting the hours over which the terrace can be used. Once typical usage of the terrace is known, a detailed review should be undertaken.

Outdoor Nursery Play Space

In order to ensure noise generated through use of the outdoor nursery space is not problematic to nearby residents, it may be necessary to impose usage restrictions on the space. For example, this could include limiting the number of people able to use the space at any one time and limiting the hours over which the space can be used.

8.0 CONCLUSION

Measurements of the existing noise levels around the Abbey Road Area redevelopment scheme in Camden have been undertaken. The results of the measurements have been used in order to determine atmospheric noise emission limits for building services plant at the premises in accordance with the requirements of Camden Council.

A detailed plant noise assessment has been undertaken and this is inclusive of specifications for noise and vibration mitigation measures which are intended to be included within the design to comply with Policy A4 of Camden Council.

In addition, the measured levels have been used to provide recommendation with regards to the external fabric and glazing elements of the proposed building.

Lastly, a preliminary assessment of amenity noise has been undertaken and general recommendation made.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level 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 L_{eq} value.

Appendix B – Example Calculation

Appendix B shows the example calculation of the resultant noise levels at residential receptor one from the proposed condensing units.

Parameter	Octave-band Noise Levels (dB) at Octave-band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
Mitsubishi CAHV-P500YA-HPB	70	65	60	57	52	46	49	44	59
Subtotal of 6 Units	78	73	68	65	60	54	57	52	67
Distance losses @ 24m	-30	-30	-30	-30	-30	-30	-30	-30	-30
Noise level at receiver	48	43	38	35	30	24	27	22	37

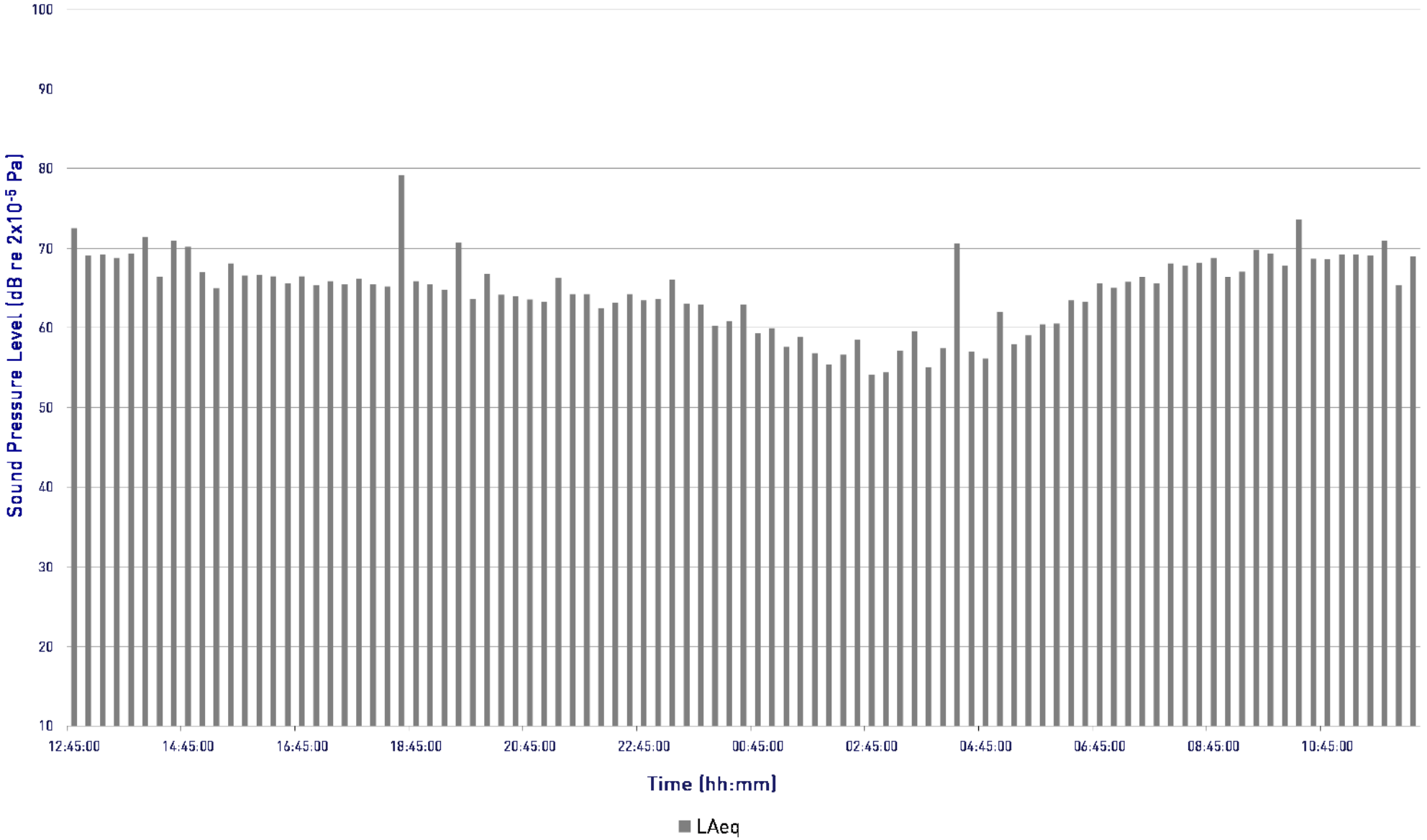
Appendix C – Graphs and Site Plan

Abbey Area Phase 2 Development, Camden

L_{Aeq} Time History

Measurement Position 5, Wednesday 11 March to Thursday 12 March 2015

Graph 1

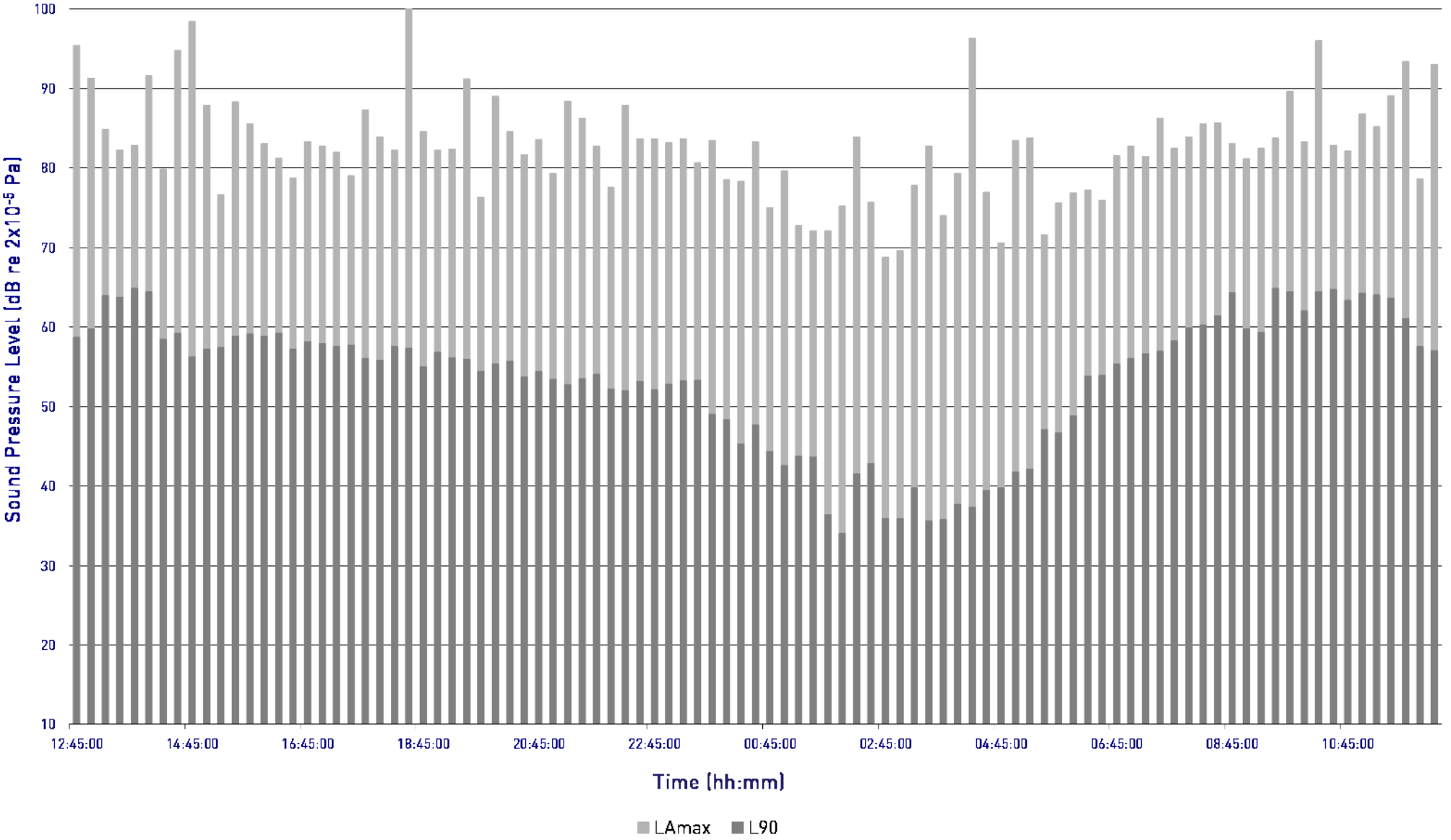


Abbey Area Phase 2 Development, Camden

L_{Amax} and L_{A90} Time History

Measurement Position 5, Wednesday 11 March to Thursday 12 March 2015

Graph 2

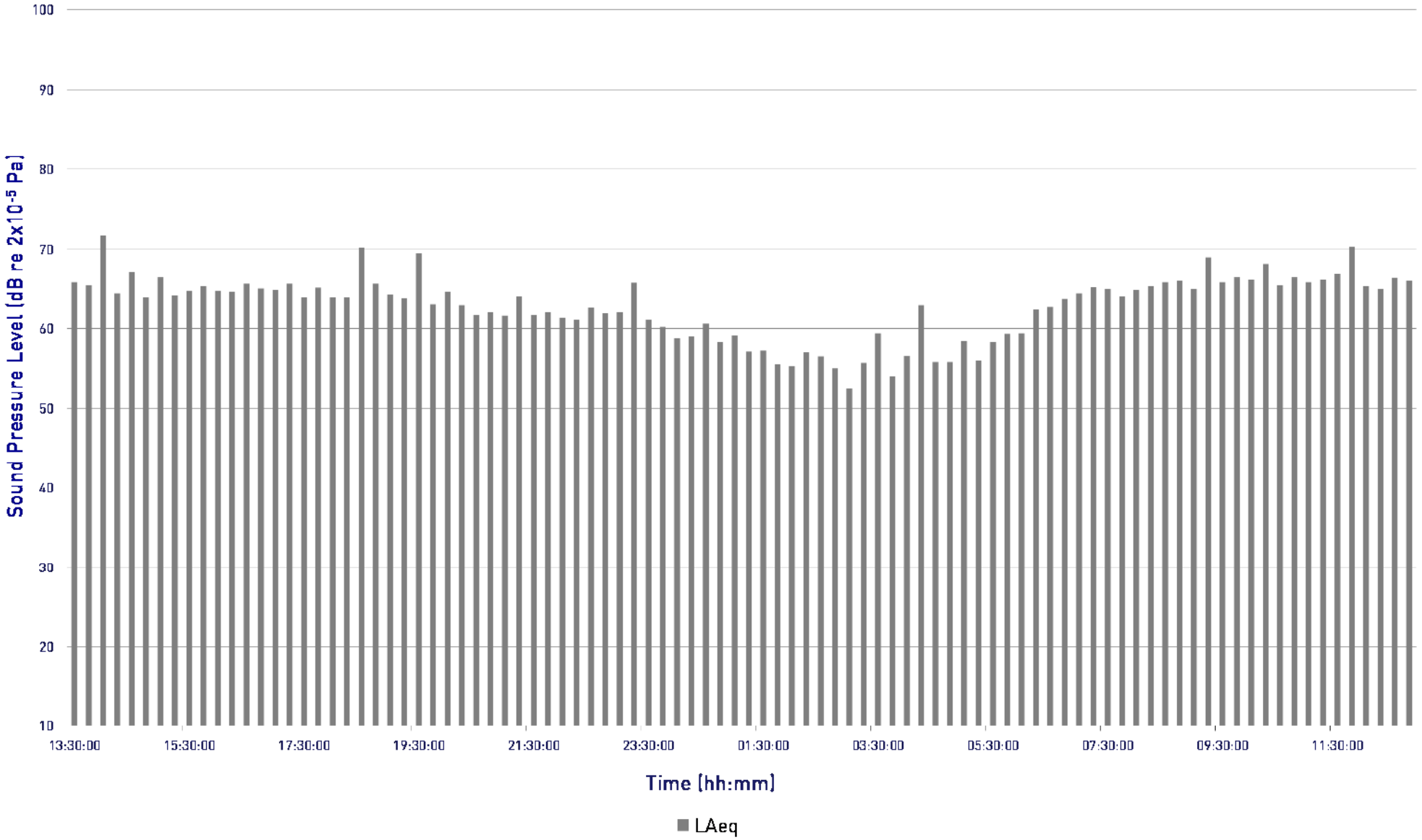


Abbey Area Phase 2 Development, Camden

L_{Aeq} Time History

Measurement Position 6, Wednesday 11 March to Thursday 12 March 2015

Graph 3

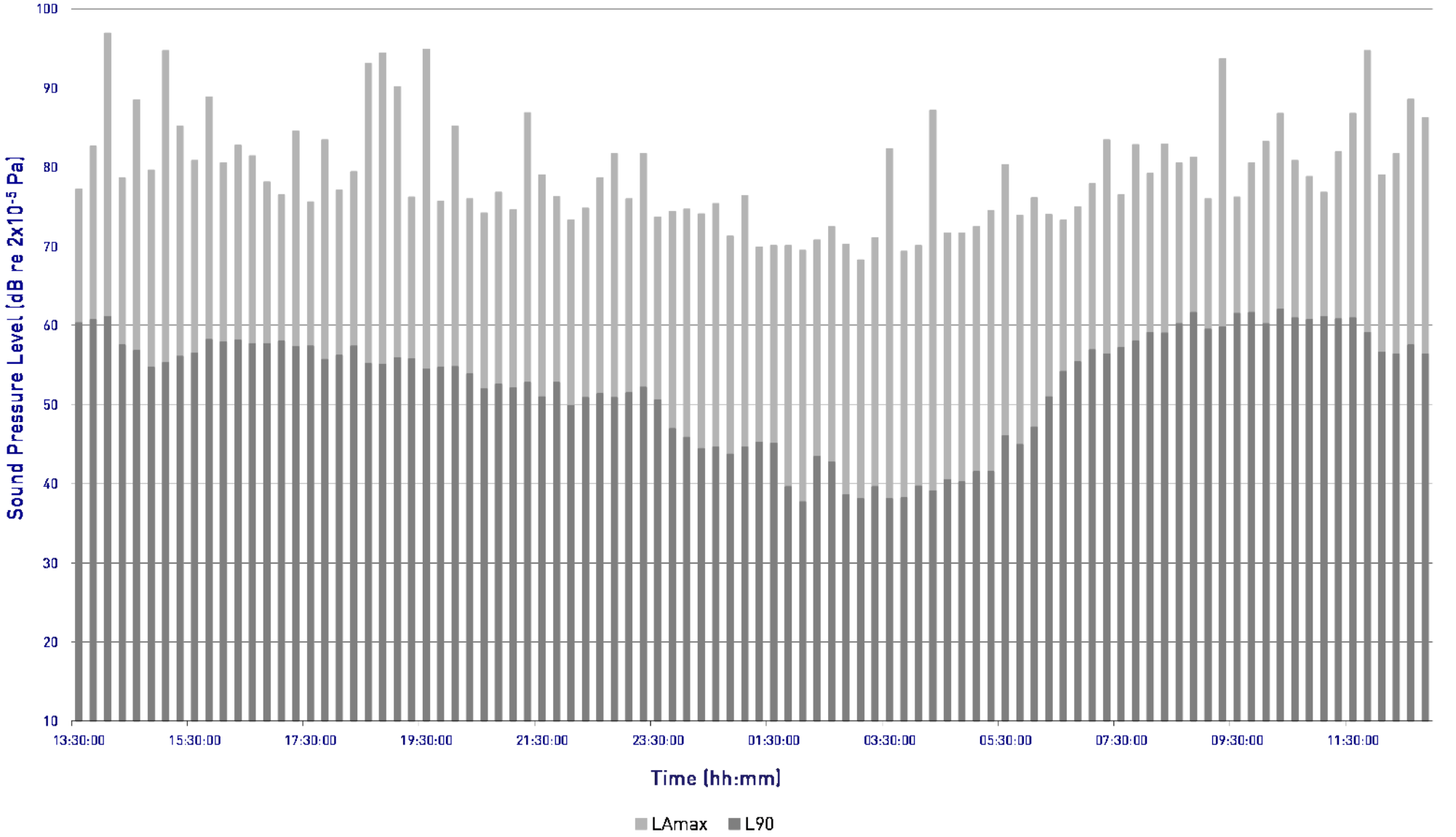


Abbey Area Phase 2 Development, Camden

L_{Amax} and L_{A90} Time History

Measurement Position 6, Wednesday 11 March to Thursday 12 March 2015

Graph 4

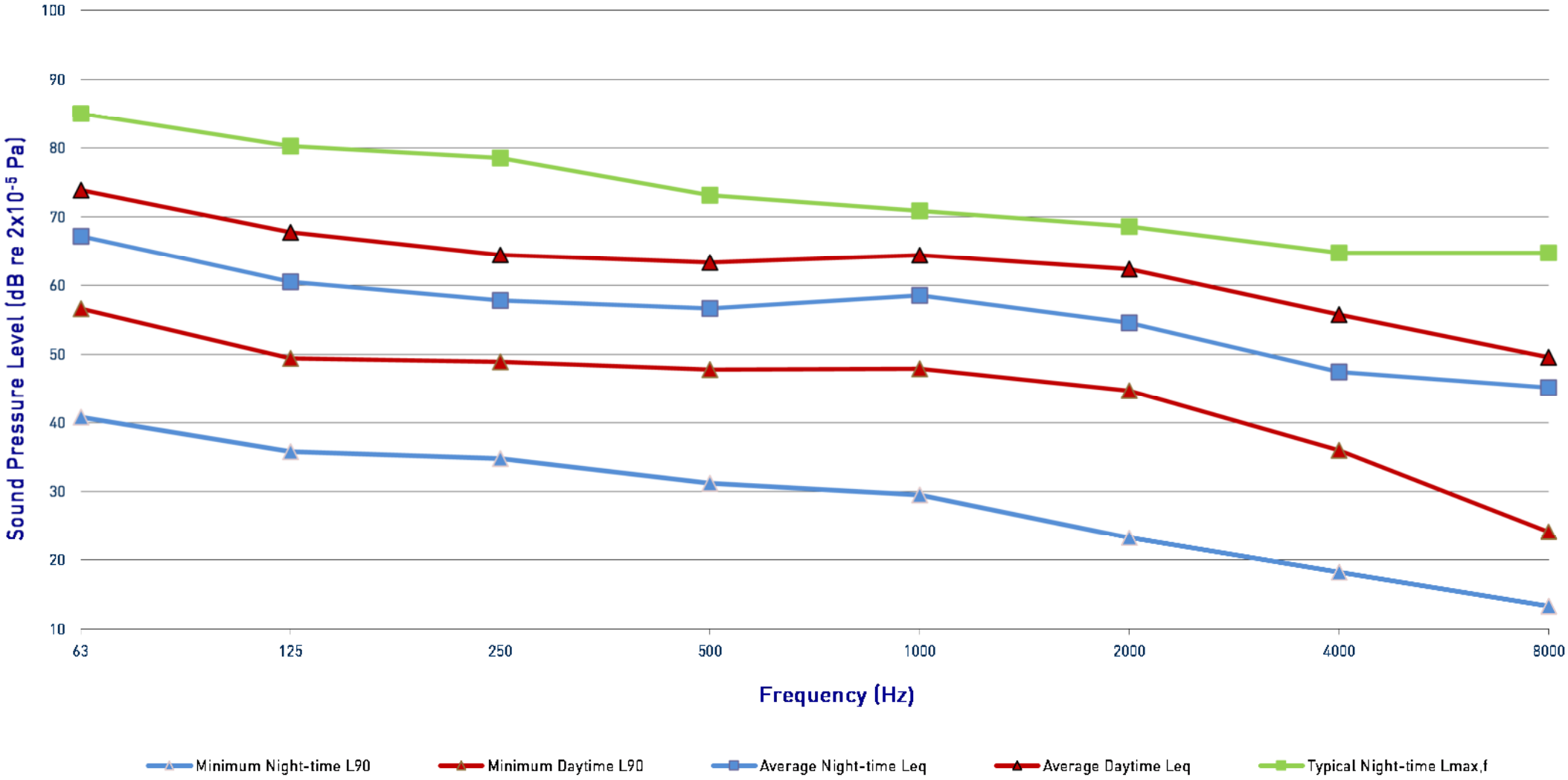


Abbey Area Phase 2 Development, Camden

Measured Noise Levels

Measurement Position 5, Wednesday 11 March to Thursday 12 March 2015

Graph 5

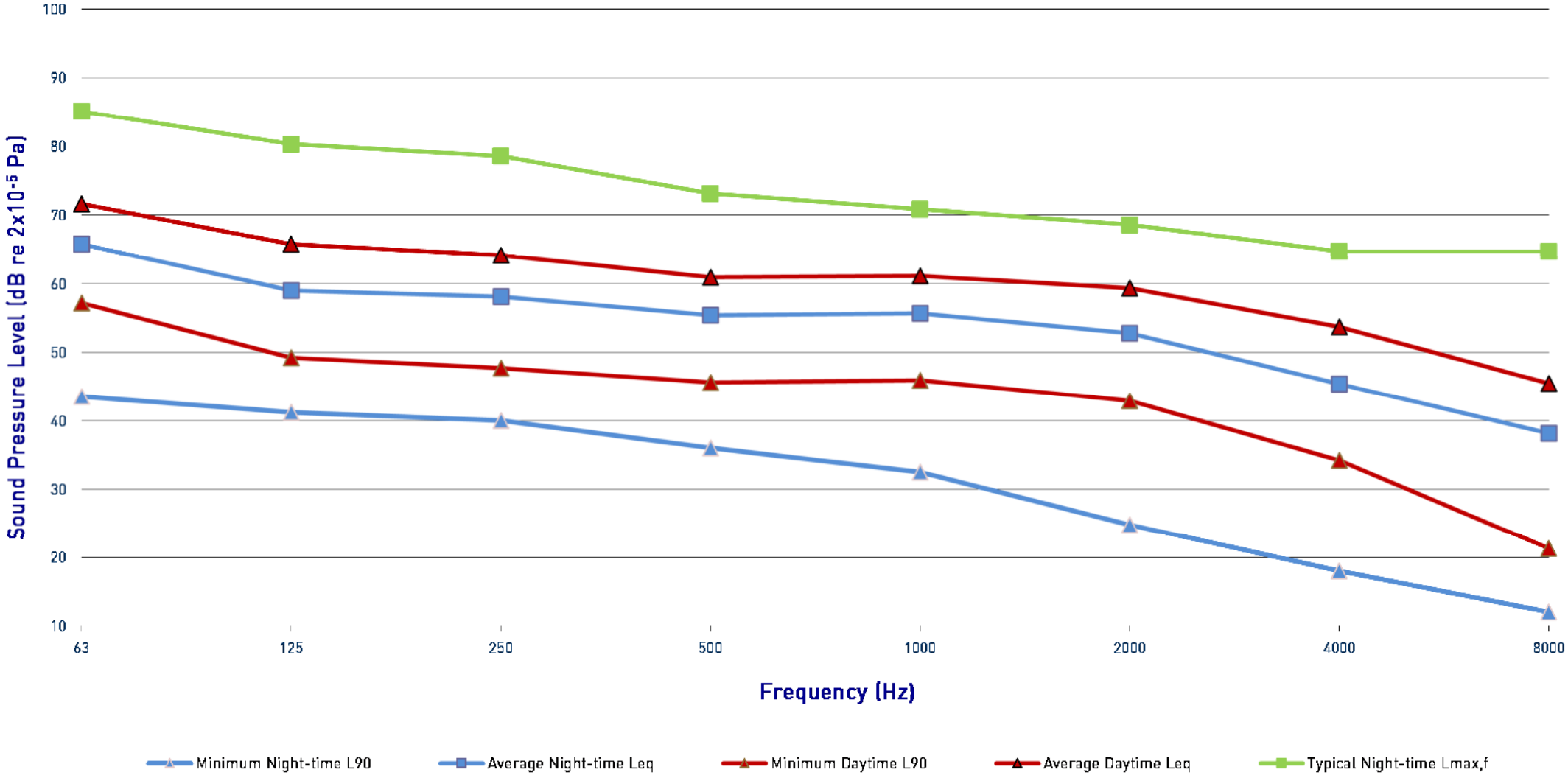


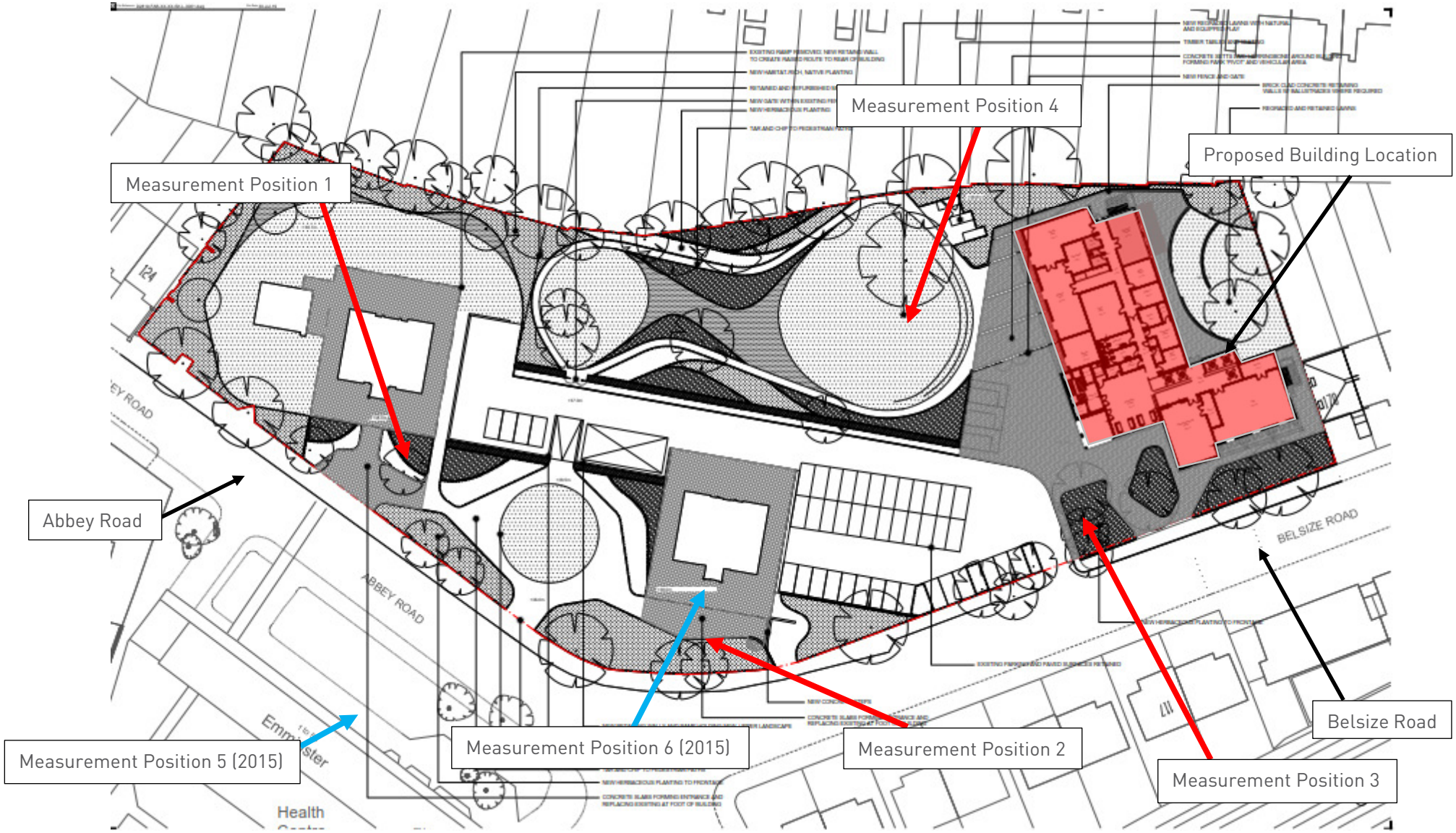
Abbey Area Phase 2 Development, Camden

Measured Noise Levels

Measurement Position 6, Wednesday 11 March to Thursday 12 March 2015

Graph 6





Abbey Area Phase 2 Development, Camden
Site Plan SP1
Project 9769

Figure 1
27 May 2020
Not to Scale

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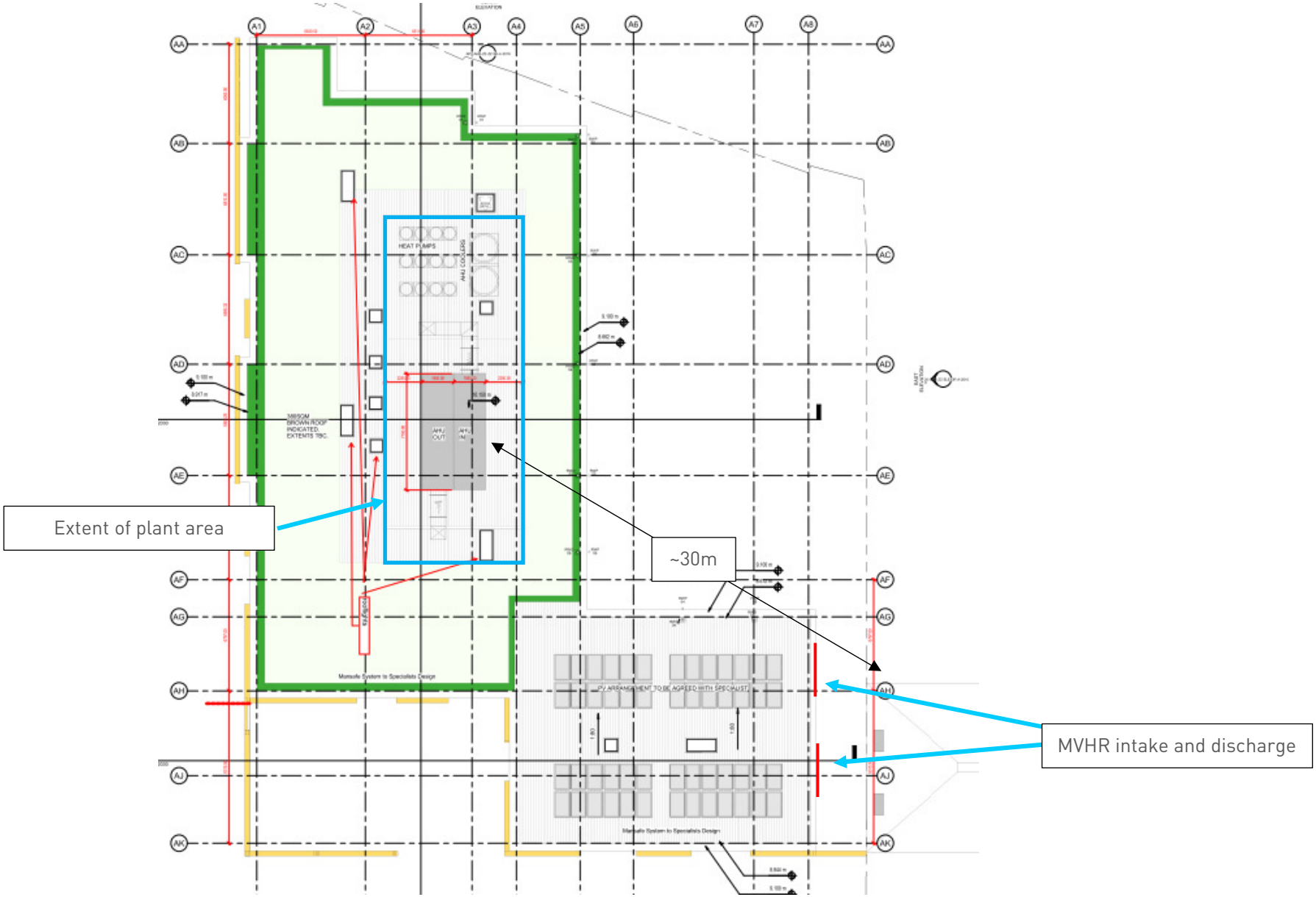
Abbey Area Phase 2 Development, Camden
Site Plan SP2
Project 9769

Figure 2
27 May 2020
Not to Scale

RBA ACOUSTICS



Abbey Area Phase 2 Development, Camden
Acoustic louvre extent
Project 9769

Figure 3
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Not to Scale

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Abbey Area Phase 2 Development, Camden
Photograph detailing Measurement Position 1
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Figure 4
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Abbey Area Phase 2 Development, Camden
Photograph detailing Measurement Position 2
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Figure 5
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Abbey Area Phase 2 Development, Camden
Photograph detailing Measurement Position 3
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Figure 6
27 May 2020
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Abbey Area Phase 2 Development, Camden
Photograph detailing Measurement Position 4
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Figure 7
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Not to Scale

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Abbey Area Phase 2 Development, Camden
Photograph detailing Measurement Position 5 (2015)
Project 9769

Figure 8
27 May 2020
Not to Scale

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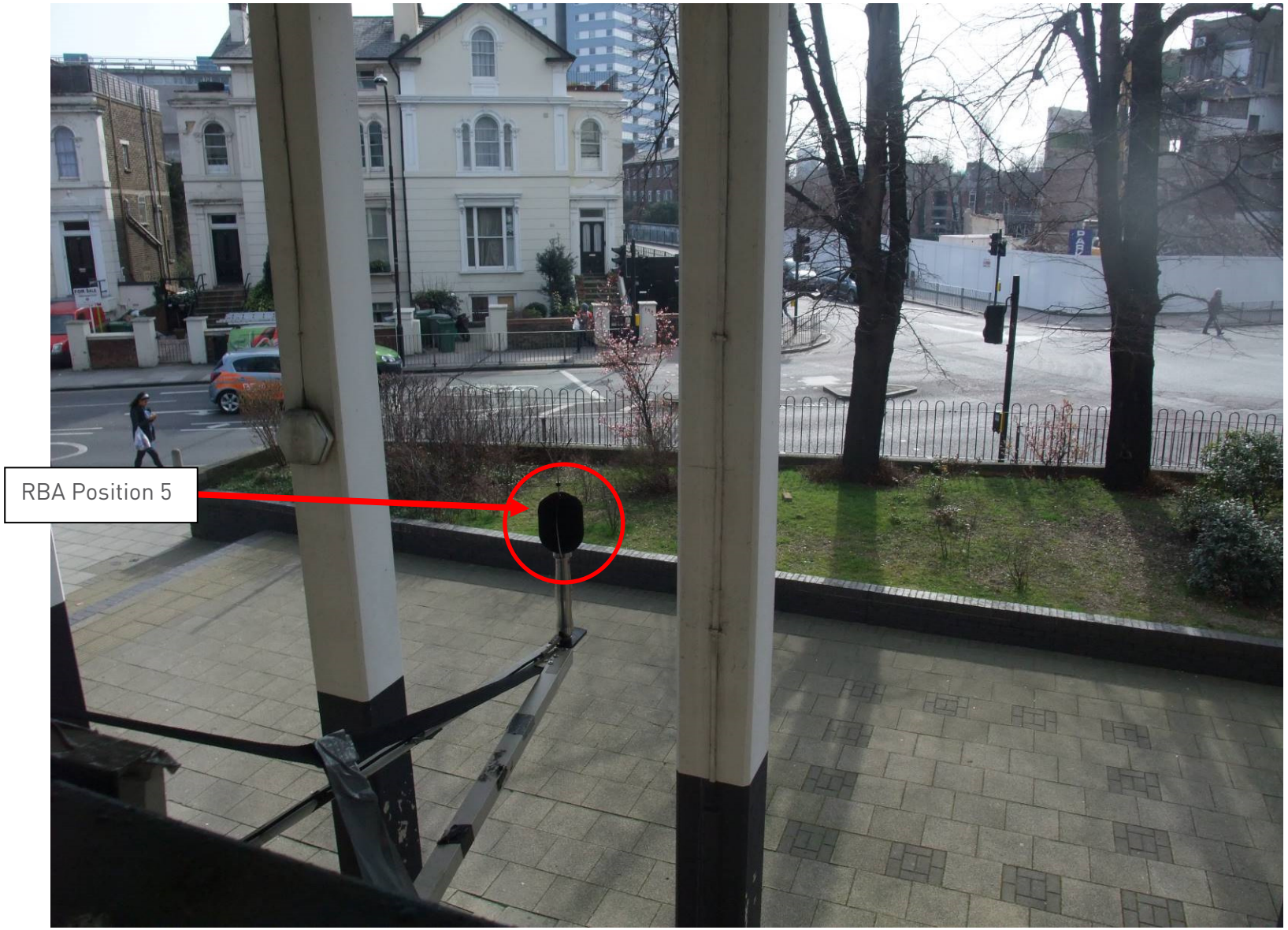

Abbey Area Phase 2 Development, Camden
Photograph detailing Measurement Position 6 (2015)
Project 9769

Figure 9
27 May 2020
Not to Scale

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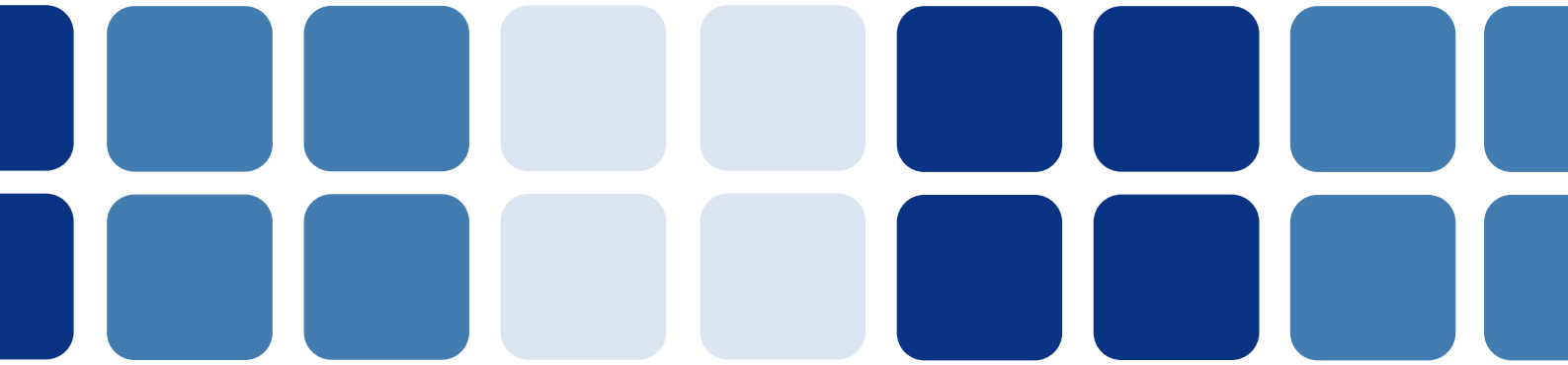

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