39A FITZJOHN'S AVENUE & LAND ADJACENT TO 46 MARESFIELD GARDENS, NW3

Acoustic Planning Assessment

Reference: 12334.RP01.APA.2
Prepared: 31 January 2024
Revision Number: 2

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	8 December 2023	Aaron Moroney	Torben Andersen
1	Minor amendments following comments from Montagu Evans	26 January 2024	Aaron Moroney	Torben Andersen
2	Introduction and conclusion wording amendments	31 January 2024	Aaron Moroney	Torben Andersen

Terms of contract:

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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 will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.

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1.0 INTRODUCTION

It is proposed to substantially demolish and redevelop the existing building at 39A Fitzjohn's Avenue for residential usage and build a new residential building on the land adjacent to 46 Maresfield Gardens. It is proposed for 39A to provide 2No. maisonettes and 2No. terraced houses of four storeys (with an additional basement/garden level), whilst it is proposed for a new-build block to be built on the land adjacent to 46 Maresfield Gardens, comprising a further 29 self-contained apartments with associated facilities, with five storeys above ground and a lower ground area.

An assessment has been carried out in relation to the noise levels likely to be incident on the proposed building façades. This report details the results of the noise survey and assesses the likelihood of internal noise levels being achieved which meet typically acceptable criteria for residential development.

RBA Acoustics has also been commissioned to undertake a vibration survey in order to ascertain whether the proposed dwellings are likely to be affected by train induced vibration from the Network Rail tunnels running beneath the site. This report presents the results of the vibration survey undertaken at the site and the associated BS 6472 assessment.

In addition, suitable plant noise emission criteria at noise sensitive receptors inside and outside of the development have been set, based upon the survey results, the likely requirements of the Local Authority. A considered and practical approach has been taken when setting criteria at receptors within the overall proposed development boundary, given the low existing background noise levels. At this stage, there is insufficient information available to undertake a detailed plant noise emission assessment. This can be undertaken when plant selections are available.

A summary of acoustic terminology is included in Appendix A.

2.0 SITE DESCRIPTION

The site is shown in relation to its surroundings in the site plan in Figure 1 (Appendix F).

The site is located in an area largely populated by residential and educational buildings and is bounded by Fitzjohn's Avenue to the east, Nutley Terrace to the south, Maresfield Gardens to the west and residential property to the north. Whilst the majority of adjacent buildings are residential, Lakefield Hospitality College is located across Maresfield Gardens to the west and the playground of North Bridge House Nursery (33 Fitzjohn's Avenue) is located across Nutley Terrace to the south. It is considered that all areas adjacent to the site boundaries are sensitive to noise, although only the areas to the north directly border the site, whilst areas on other edges are across the roads.

The assessments have been based on the information provided in the following drawings.

39A Fitzjohn's Avenue (CH+MRP Architects):

3169A_200b	Proposed Garden Level_Townhouses & Maisonette	Rev. D
3169A_201b	Proposed Ground Floor_Townhouses & Maisonette	Rev. D
3169A_202b	Proposed 1st Floor_Townhouses & Maisonette	Rev. D
3169A_203b	Proposed 2nd Floor_Townhouses & Maisonette	Rev. D
3169A_204b	Proposed 3rd Floor_Townhouses & Maisonette	Rev. D
3169A_350b	Proposed East Elevation_Townhouses & Maisonette	Rev. B
3169A_351b	Proposed South Elevation_Townhouses & Maisonette	Rev. B
3169A_352b	Proposed West Elevation_Townhouses & Maisonette	Rev. B
3169A_353b	Proposed North Elevation_Townhouses & Maisonette	Rev. B

Land adjacent to 46 Maresfield Gardens (Sergison Bates Architects):

325/4210d	Proposed LGF plan	Rev. D
325/4211d	Proposed GF plan	Rev. D
325/4212d	Proposed 01 plan	Rev. D
325/4213d	Proposed 02 plan	Rev. D
325/4214d	Proposed 03 plan	Rev. D
325/4215e	Proposed 04 plan	Rev. E
325/4216	Proposed Roof plan	Rev. -
325/4270c	Proposed west / south elevations	Rev. C
325/4271c	Proposed east / north elevations	Rev. C

3.0 PLANNING POLICY CONTEXT

3.1 National Planning Policy Framework

The Ministry for Levelling Up, Housing and Communities (December 2023) *National Planning Policy Framework* (NPPF), sets out the Government's planning policies for England. In respect of noise, Paragraphs 180, 191 and 193 of the NPPF state the following:

"180) Planning policies and decisions should contribute to and enhance the natural and local environment by:

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

191) 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.

193) Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

The above presents no quantitative guidance on a site's suitability for residential development and we have therefore, for the purposes of this assessment, referred to the following documents.

3.2 Noise Policy Statement for England

The Department for Environment Food and Rural Affairs (2010) *Noise Policy Statement for England* (NPSE) seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

The statement sets out the long-term vision of the government's noise policy, which is to "promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development".

This long-term vision is supported by three aims:

- 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 improvements of health and quality of life.

The long-term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

The Explanatory Note within the NPSE provides further guidance on defining "significant adverse effects" and "adverse effects" using the following concepts:

- No Observed Effect Level (NOEL) – the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) – the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) – the level above which significant adverse effects on health and quality of life occur.

The three aims can therefore be interpreted as follows:

- The first aim is to avoid noise levels above the SOAEL;
- The second aim considers situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur; and
- The third aim considers situations where noise levels are between the LOAEL and NOEL. In these circumstances, where possible, reductions in noise levels should be sought through the pro-active management of noise.

The NPSE recognises that it is not possible to have single objective noise-based measures which define the SOAEL, LOAEL and NOEL and that are applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, receptors and at different times of the day.

3.3 Planning Practice Guidance (Noise)

The Ministry of Housing, Communities and Local Government (2014) *Planning Practice Guidance (Noise)* (PPG(N)) "*advises on how planning can manage potential noise impacts in new development*" and provides guidelines that are in line with the NPPF. The guidance is an online resource and was last updated on 22 July 2019.

The PPG(N) states that local planning authorities should:

> *"take account of the acoustic environment and in doing so consider:*
>
> - *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."*

The guidance uses the same concepts of adverse effect levels as the NPSE, and these are provided in full in Table 1.

The guidance recognises that the use of the word "level" does not mean that a single number value will necessarily be appropriate in determining the effects of noise exposure. Rather, factors to be considered in determining whether noise is a concern can include the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative effects.

With particular regard to mitigating noise effects on residential development the PPG(N) highlights that effects may be partially offset if residents have access to a relatively quiet façade as part of their dwelling or a relatively quiet amenity space (private, shared or public).

Table 1 – Noise Exposure Hierarchy Table from PPG(N)

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not noticeable	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid through use of appropriate mitigation whilst taking into account the social and economic benefit
Unacceptable Observed Adverse Effect Level			
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent through use of appropriate mitigation

3.4 ProPG

The Association of Noise Consultants, the Institute of Acoustics and the Chartered Institute of Environmental Health (2017) *Professional Planning Guidance on Planning & Noise* (ProPG) provides guidance on a recommended approach to the management of noise within the planning system in England. Although the guide does not form part of government policy itself, it is referenced in PPG(N) as useful guidance.

ProPG encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

ProPG advocates a two stage approach to the early assessment of noise. Stage 1 involves the assessment of the noise climate at the development site against the Noise Risk Assessment scale provided in Table 2. The levels used in the assessment should be the result of environmental noise monitoring conducted at the site coupled with predictions of future free-field levels assuming *"no subsequent mitigation is to be included as part of the development proposal"*.

Table 2 – ProPG Noise Risk Assessment

Noise Risk	Indicative $L_{Aeq, period}$ Noise Levels (dBA)		Comments
	Daytime $L_{Aeq, 16\ hr}$ (07:00 – 23:00)	Night-time $L_{Aeq, 8\ hr}$ (23:00 – 07:00)	
Negligible	<50 dB	<40 dB	These noise levels indicate that the development site is likely to be acceptable, and the application need not normally be delayed on noise grounds.
Low	50 – 59 dB	40 – 49 dB	At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
Medium	60 – 69 dB	50 – 59 dB	As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
High	⩾ 70 dB	⩾ 60 dB	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

It should be noted that a site in the High noise risk category should not necessarily be refused planning permission on grounds of noise, but rather that the site will present more acoustic challenges and the importance of applying the principles of good acoustic design will increase. A site identified as in the negligible risk category are likely to be acceptable in terms of noise; sites in low, medium and high risk categories will require a further Stage 2 assessment to establish a recommendation.

Stage 2 of the ProPG approach considers four elements:

- Good acoustic design process: minimising unreasonable acoustic conditions and preventing unacceptable acoustic conditions
- Internal noise level guidelines: in line with guidance within BS 8233:2014 (or justified alternative)
- External Amenity Area Noise Assessment: in line with guidance within BS 8233:2014 (or justified alternative)
- Assessment of other relevant issues: assessment of outcomes in accordance with national and local planning policy to form part of a recommendation.

3.5 London Plan

The Greater London Authority (2021) *The London Plan* policies D13 Agent of Change and D14 Noise provide outline guidance for the assessment and approach to noise within London Boroughs. The Plan does not provide criteria to be achieved but does reference the guidance provided in BS 8233:2014 and BS 4142:2014+A1 2019.

Important to note is that the London Plan is increasingly being adopted by Local Authorities as a benchmark for good acoustic design.

3.6 Local Policy – London Borough of Camden

Policy A4 of the Camden Local Plan (2017) states the following:

> *"Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission 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 and 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 phases of development."*

In a similar vein to ProPG and PPG(N), the Local Policy also makes reference to the significance of noise impact in terms of adverse effect level (e.g., LOAEL = Lowest Observed Adverse Effect Level). Where applicable, the thresholds in Appendix 3 of the Local Plan will be made reference to in each individual assessment section.

3.7 Assessment Criteria Summary

Relevant planning documentation and guidance have been referred to in the above sub-sections and provide a starting point for assessing the acoustic suitability of the site. Quantitative criteria associated with noise and vibration for each aspect of the development will be outlined in further detail in the subsequent sections of this assessment. We have also referenced acoustic-related planning conditions for the adjacent site at 39 Fitzjohn's Avenue, as we would expect the same principles to be relevant for this site, given the proximity and also being of residential usage.

4.0 ENVIRONMENTAL NOISE SURVEY

4.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following period:

13:00 Thursday 24th to 13:00 Tuesday 29th November 2022.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during the site visits and weather reports for the area, conditions were partially considered suitable for obtaining representative noise measurements. For the majority of the survey, it was predominantly dry with little wind. However, there were a couple of periods of adverse weather conditions:

- Thursday afternoon (approx. 12:00-18:00 hours) – slightly higher wind speeds of around 7 m/s and light rainfall
- Late Saturday night / early Sunday morning (approx. 00:00-06:00 hours) – moderate rainfall

It is considered appropriate to exclude the data from Saturday night-time from the measurement analysis due to moderate rainfall. However, all other data has been included in the analysis as the weather conditions were largely considered appropriate for noise monitoring.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes.

4.2 Measurement Locations

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

Measurement Position 1 – East

A microphone was located at first floor level on the front (east) façade of the main building at 39 Fitzjohn's Avenue, approximately one metre from the building façade. As such, the measurement position is subject to reflections from the façade. The measurement position overlooks Fitzjohn's Avenue and is located close to the junction with Nutley Terrace.

The main noise source at this measurement position is considered to be road traffic pass-bys on Fitzjohn's Avenue, whilst background noise is generally more limited by more distant, ambient, screened road traffic noise. Noise levels at this measurement position are considered roughly representative of noise levels all along the eastern façade of 39 and 39A Fitzjohn's Avenue and levels at noise-sensitive receptors to the east of site.

Measurement Position 2 – Centre

A microphone was located at first floor level on the rear (west) façade of the main building at 39 Fitzjohn's Avenue, approximately one metre from the building façade. As such, the measurement position is subject to reflections from the façade. The measurement position overlooks the gardens to the rear of the property and is screened from any major noise sources.

The main noise source at this measurement position is considered to be screened road traffic pass-bys on Fitzjohn's Avenue and other surrounding roads. Similarly to Position 1, background noise is generally more limited by more distant, ambient, screened road traffic noise. Intermittent increase in noise levels from use of nearby playgrounds (North Bridge House Nursery at 33 Fitzjohn's Avenue (to the south across Nutley

Terrace) and St Mary's School Hampstead at 47 Fitzjohn's Avenue (to the north)) were noted whilst on site. Noise levels at this measurement position are considered roughly representative of noise levels along the majority of the rear façade of 39 and 39A Fitzjohn's Avenue, as well as noise levels towards the centre of the rear gardens and levels at noise-sensitive receptors to the north of site.

Measurement Position 3 – West

A microphone was located at ground floor level on the western boundary of the vacant land adjacent to 46 Maresfield Gardens, approximately two metres above ground level and attached to the perimeter fence, overlooking Maresfield Gardens.

The main noise source at this measurement position is considered to be more distant, ambient, screened road traffic noise, but intermittent increases in noise levels from use of nearby playgrounds (North Bridge House Nursery at 33 Fitzjohn's Avenue (to the south across Nutley Terrace) and St Mary's School Hampstead at 47 Fitzjohn's Avenue (to the north)) were noted whilst on site, as well as from road traffic pass-bys on Maresfield Gardens. Noise levels at this measurement position are considered roughly representative of noise levels along the western site boundary and levels at noise-sensitive receptors to the west of site.

Measurement Position 4 – South

A microphone was located at ground floor level on the southern boundary of the vacant land adjacent to 46 Maresfield Gardens, approximately two metres above ground level and attached to the perimeter fence, overlooking Nutley Terrace.

The main noise source at this measurement position is considered to be road traffic pass-bys on Fitzjohn's Avenue, whilst background noise is generally more limited by more distant, ambient, screened road traffic noise. Intermittent increases in noise levels from use of nearby playgrounds (North Bridge House Nursery at 33 Fitzjohn's Avenue (to the south across Nutley Terrace) and St Mary's School Hampstead at 47 Fitzjohn's Avenue (to the north)) were noted whilst on site, as well as from road traffic pass-bys on Maresfield Gardens. Noise levels at this measurement position are considered roughly representative of noise levels along the majority of the southern site boundary and levels at noise-sensitive receptors to the south of site.

The measurement positions are also illustrated on the site plan attached in Figure 2 and photos in Figures 3-6 (Appendix F).

4.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix D.

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

4.4 Results

The noise levels measured are shown as time-histories on the attached Graphs 1-8 (Appendix F).

The period averaged L_{Aeq} noise levels measured are summarised in Table 3, along with typical L_{AFmax} levels measured during the night-time. The typical L_{AFmax} levels are derived from the 10th highest L_{AFmax} (5-minute interval) on the worst-case night of all five nights (excluding Saturday due to heavy rainfall).

Table 3 – Measured Long Term Noise Levels

Measurement Position	Date	Sound Pressure Level $L_{Aeq, period}$ (dB)		Typical L_{AFmax} (dB)
		Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	
Measurement Position 1 (East)	Thursday 24th November 2022	66*	61	78
	Friday 25th November 2022	65	60	
	Saturday 26th November 2022	65	63**	
	Sunday 27th November 2022	66	59	
	Monday 28th November 2022	66	59	
	Tuesday 29th November 2022	68*	N/A	
	Overall (i.e., typical)	66	60	
Measurement Position 2 (Centre)	Thursday 24th November 2022	53*	46	59
	Friday 25th November 2022	51	43	
	Saturday 26th November 2022	49	48**	
	Sunday 27th November 2022	47	42	
	Monday 28th November 2022	50	38	
	Tuesday 29th November 2022	50*	N/A	
	Overall (i.e., typical)	50	43	
Measurement Position 3 (West)	Thursday 24th November 2022	56*	46	67
	Friday 25th November 2022	55	45	
	Saturday 26th November 2022	53	50**	
	Sunday 27th November 2022	54	46	
	Monday 28th November 2022	57	44	
	Tuesday 29th November 2022	56*	N/A	
	Overall (i.e., typical)	55	45	
Measurement Position 4 (South)	Thursday 24th November 2022	58*	50	73
	Friday 25th November 2022	58	48	
	Saturday 26th November 2022	56	53**	
	Sunday 27th November 2022	57	48	
	Monday 28th November 2022	61	46	
	Tuesday 29th November 2022	58*	N/A	
	Overall (i.e., typical)	58	48	

*Note that due to the set-up and collection times of the survey, the data for Thursday and Tuesday do not cover the full daytime period.
**Note that data collected during Saturday night has been excluded from the calculation of overall and typical L_{Aeq} and L_{AFmax} values due to rainfall.

The lowest background noise levels ($L_{A90,\ 15mins}$) at each measurement position are summarised in the following Table 2 below. This data can be used to set plant noise emission criteria for use in the assessment of noise emissions from any proposed plant at the development.

Table 4 – Measured Lowest $L_{A90,\ 15mins}$ Noise Levels

Measurement Position	Minimum $L_{A90,\ 15mins}$ Noise Level during period (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Measurement Position 1 (East)	42	33
Measurement Position 2 (Centre)	38	35
Measurement Position 3 (West)	35	32
Measurement Position 4 (South)	36	32

5.0 VIBRATION ASSESSMENT

5.1 Criteria

It is necessary to consider two sets of criteria when assessing train-induced vibration and its potential impact on dwellings. When assessing vibration generated by either surface or underground train movements, reference should be made to the following guidelines.

Vibration – BS 6472-1:2008

BS 6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration sources other than blasting provides guidance on predicting human response to vibration in buildings over the frequency range 0.5Hz to 80Hz.

BS 6472 is based on the evaluation of vibration measurements with regards to adverse comment from occupants, rather than criteria relating to health and safety or structural damage.

In terms of assessing what impact the perceptibility of structure-borne vibration has on a person the standard promotes the use of the vibration dose value (VDV). The VDV determines an overall dose value accounting for intermittent, impulsive or continuous vibration experienced by a person and rates the level in terms of subjective response. Table 5 details the relationship between vibration dose and human annoyance:

Table 5 – VDV Values

Place and Time	Low probability of adverse comment ($m/s^{-1.75}$)	Adverse comment possible ($m/s^{-1.75}$)	Adverse comment probable ($m/s^{-1.75}$)
Residential Buildings 16-hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential Buildings 8-hour night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

The above values can be used for both vertical and horizontal vibration, provided that they are calculated according to the appropriate frequency weightings.

Camden Local Plan

Appendix 3 of the Local Plan provides the following table with regards to vibration, as shown in Table 6.

Table 6 – Vibration Levels From Uses Such As Railways, Roads, Leisure and Entertainment Premises And/Or Plant Or Machinery At Which Planning Permission Will Not Normally Be Granted

Vibration Description and Location of Measurement	Period	Time	Vibration Levels (Vibration Does Values)
Vibration Inside Dwellings	Day and Evening	07:00 – 23:00 hours	0.2 to 0.4 VDV $m/s^{-1.75}$
	Night	23:00 – 07:00 hours	0.13 VDV $m/s^{-1.75}$

Under the Camden Local Plan, the criteria for the daytime period correlate with the levels for "low probability of adverse comment" under BS 6472, whilst the criteria for the night-time period is slightly more onerous than the upper threshold for "low probability of adverse comment". These more onerous criteria have been adopted for assessment.

5.2 Train Movements

It is noted that there are two Network Rail tunnels running beneath the site, between West Hampstead Thameslink and Kentish Town stations. The tunnels run roughly in parallel to Nutley Terrace and are located to the north and south of site, close to the site boundaries. There are frequent train movements beneath the site, of which comprise the following:

- Thameslink – stopping at both West Hampstead Thameslink and Kentish Town stations, running approximately every 15-minutes in each direction during the daytime
- Freight trains – passing both stations without stopping, frequency of service depends on demand
- Other operators – often passing one or both stations without stopping

When considering the total amount of trains passing in each direction, approx. 35-40 trains pass by within an hour during peak times. Even during the quietest periods in the night (02:00 – 04:00 hours), the Thameslink service still operates a night-service and freight trains still pass, totalling a few to several trains per hour during this period.

Track Conditions

The condition of the track is not currently known. We have requested details of this from Transport for London, but are yet to have a response.

5.3 Instrumentation

Full details of the equipment used are provided in Appendix C.

5.4 Measurement Methodology

Vibration measurements were undertaken for a number of passenger train movements at two measurement positions on 29 November 2022. The positions are described in detail below:

Vibration Position 1: Measurements were undertaken on the existing concrete hardstanding on site, close outside the entrance to 39A Fitzjohn's Avenue. This location is in the north-eastern corner of the site and is considered representative of relatively worst-case vibration transfer from the northernmost Network Rail tunnel mentioned, directly below.

Vibration Position 2: Measurements were undertaken on the existing concrete floor in a garden level room towards the rear of the main building at 39 Fitzjohn's Avenue. This location is in the south-eastern corner of the site and is considered to be representative of relatively worst-case vibration transfer from the southernmost Network Rail tunnel mentioned, directly below.

The approximate locations of the vibration measurement positions are shown on the Site Plan in Figure 2 in Appendix F.

Tri-axial measurements were undertaken at both positions.

5.5 Measurement Results

Table 7 presents the measured 15-minute VDV values, which can be used to predict the daytime and night-time exposure levels. Negligible levels of vibration were measured on the horizontal axes.

Table 7 – Measured $VDV_{b,15min}$ And $VDV_{b,15min}$

Measurement	Period (hh:mm)	Vertical $VDV_{b,15min}$ ($m/s^{-1.75}$)
Position 1	11:27 – 11:42	0.014
	11:43 – 11:58	0.014
	11:58 – 12:13	0.015
	12:13 – 12:28	0.014
Position 2	13:13 – 13:28	0.011
	13:29 – 13:44	0.010
	13:44 – 13:59	0.013
	14:00 – 14:15	0.011

5.6 Prediction Assumptions

Vibration levels presented in Graphs 9-10 are as measured externally on the concrete hardstanding towards the front of 39A Fitzjohn's Avenue for Position 1 and internally on the existing concrete floor at Garden Level to the rear of the main house at 39 Fitzjohn's Avenue for Position 2. In order to estimate the resultant vibration levels within the building we have made the following assumptions:

Prediction Procedures

Our calculations have been based on the following:

(i) Empirical prediction procedures as detailed within the following references:

- "A Prediction Procedure for Rail Transportation Ground-borne Noise and Vibration" – Nelson and Saurenman : Transportation Research Record 1143.
- "Handbook of Urban Rail Noise and Vibration Control" – Nelson, Saurenman, Wilson : US Department of Commerce – National Technical Information Services – February 1982.

(ii) Previous research undertaken by RBA Acoustics on building response to ground-borne vibration within a variety of different building frame types.

Proposed Building Structures

We have based our assessment on the following information received from Price & Myers.

Façade

It is understood that the existing building façade to 39A is to be retained, whilst the areas of new façade will be where the building is to be extended.

Substructure

Foundations will be piled for all blocks and houses.

Superstructure

Superstructure will be formed from in-situ concrete for lower levels and steelwork with timber joists at the uppermost level.

Should this information change during the course of the design RBA Acoustics should be notified.

5.7 Predicted Levels of Vibration

Measurements at Position 1 were taken on the concrete hardstanding externally and therefore, predictions have also included expected coupling loss and amplification factors offered by the building's sub structure and superstructure respectively. On the other hand, measurements at Position 2 were taken on the garden level concrete floor internally and predictions have therefore not included any coupling loss or amplification, as the conditions during measurement already account for this.

Tactile Vibration – Vibration Dose Values (VDVs)

Table 3 details the predicted Vibration Dose Values (VDVs) for both the daytime and night-time periods. Levels have been predicted within the first suspended residential floor slabs, which are generally acknowledged as having the highest levels of vibration. Only the vertical axis has been considered as the floor structures will vibrate predominantly in this axis. The predicted VDV levels are based on the

Table 8 – Predicted $Vdv_{b,Day}$ And $Vdv_{b,Night}$

Area in Proximity to	Period	Vertical VDV ($m/s^{-1.75}$)	BS 6472 Low Probability of Adverse Comment ($m/s^{-1.75}$)	Camden Local Plan Thresholds
Northern-most tunnels (Position 1)	Day	0.04 – 0.06	0.2 – 0.4	0.2 – 0.4
	Night	0.03 – 0.05	0.1 – 0.2	0.13
Southernmost tunnels (Position 2)	Day	0.03 – 0.04	0.2 – 0.4	0.2 – 0.4
	Night	0.02 – 0.03	0.1 – 0.2	0.13

Please note that vibration levels would typically decrease as one moves up through the building.

5.8 Discussion

Our calculations indicate that the Vibration Dose Values associated with train movements during both the day and night-time periods are below the thresholds for "low probability of adverse comment" as defined by BS 6472 and those outlined in the Camden Local Plan.

As such, we consider there to be a very low probability of adverse comment resulting from vibration.

6.0 EXTERNAL NOISE ASSESSMENT

6.1 Criteria

ProPG

As discussed in Section 3.4, ProPG provides an early indication of the likely suitability of a site for new residential development and provides a framework for considering good acoustic design. Section 3.4 outlines the noise level thresholds for varying levels of risk.

British Standard 8233:2014

With reference to noise levels in external amenity areas the following guidance is provided in BS 8233:2014:

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

The following relates specifically to balconies and terraces:

> *"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."*

6.2 ProPG Assessment

The acoustic survey has been used to determine the daytime and night-time L_{Aeq} noise levels at the different areas of site.

For the purposes of the ProPG assessment, the site has been categorised in to 4 zones: the eastern boundary, the centre of site, the western boundary and the southern boundary.

With reference to Section 3.4, the noise levels for each of the zones within the following Noise Risk categories as defined in ProPG for both daytime and night-time periods.

Table 9 – ProPG assessment

Zone	Noise Risk Category	
	Daytime	Night-time
East (MP1)	Medium	High
Centre (MP2)	Low	Low
West (MP3)	Low	Low
South (MP4)	Low	Low

As shown in the table above, the majority of areas can be classed as low risk of adverse effect in terms of noise for both the daytime and night-time periods. Only the eastern area of site (i.e., the front façade of 39A Fitzjohn's Avenue) are areas classed as medium to high risk. For the night-time, the eastern boundary is only marginally above the guideline limit for medium risk.

ProPG states that as noise levels increase, a good acoustic design process should be followed and demonstrated.

6.3 External Amenity Area Assessment

As shown in Figure 1 in Appendix F, there is a large allowance made for communal open space/external amenity to the north of the new building and the west of 39A, which is the most screened and distant area of site to the surrounding noise sources. We would consider this to be good acoustic design and noise levels (Daytime $L_{Aeq,16hour}$ of 50dB) have been measured to be low in this area, as per the ProPG assessment for Measurement Position 2. This meets the lower guideline limit of $L_{Aeq,16hour}$ 50dB as per the guidance in BS 8233, which is a positive indicator of good acoustic conditions.

Furthermore, the measurements on the western and southern site perimeters indicate daytime levels of $L_{Aeq,16hour}$ 55dB and 58dB respectively. Given that these measurement positions were on the site perimeter and unscreened from the nearest road (as they were above the fence line), these represent more than worst-case levels experienced on the amenity areas of site. Additional distance attenuation from Nutley Terrace and Maresfield Gardens, along with potential screening from the perimeter fencing, mean that noise levels on balconies should be within the BS 8233 upper limit of $L_{Aeq,16hour}$ 55dB for good external amenity and in many areas be below the lower limit of $L_{Aeq,16hour}$ 50dB on balconies and in lightwells at lower ground level.

7.0 EXTERNAL BUILDING FABRIC ASSESSMENT

7.1 Criteria

Planning Condition 15 for Adjacent Site

For the main house at 39 Fitzjohn's Avenue, Planning Condition 15 of the London Borough of Camden's Draft Decision Notice (Application ref: 2020/2169/P, dated 29 April 2022) stated the following:

> *"The noise level in rooms at the development hereby approved shall meet the noise standard specified in BS8233:2014 for internal rooms and external amenity areas.*
>
> *Reason: To ensure that the amenity of occupiers of the development site is not adversely affected by noise in accordance with policy A1 of the London Borough of Camden Local Plan 2017."*

In line with the above condition, we have referenced BS 8233:2014 and any other guidance documents that we consider appropriate for this assessment, which we also consider applicable for this development.

British Standard 8233:2014

British Standards Institution (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 achieving suitable resting and sleeping conditions within residential properties as set out in Table 10.

Table 10 – BS 8233:2014 Residential Criteria

Room	07:00 to 23:00	23:00 to 07:00
Living Rooms	35 dB $L_{Aeq,16hour}$	--
Dining Room/area	40 dB $L_{Aeq,16hour}$	--
Bedrooms	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

World Health Organisation Guidelines

WHO (2018) *Environmental Noise Guidelines for the European Region* sets out to define "*recommended exposure levels for environmental noise in order to protect population health*". The guidance document relates specifically to external noise levels, and recommends that "*all CNG* [WHO (1999) *Guidelines for Community Noise*] *indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid*". RBA therefore make reference to *Guidelines for Community Noise* for recommendations on internal noise levels.

Guidelines for Community Noise describes guideline levels that are "*essentially values for the onset of health effects from noise exposure*". A table of guideline values is included, relating to adverse health effects, defined as any temporary or long-term deterioration in physical, psychological, or social functioning that is associated with noise exposure. The following is an extract from Table 4.1: Guideline values for community noise in specific environments, as stated in the WHO document.

Table 11 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45

With reference to maximum noise levels the following guidance is provided within the WHO guidance:

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991) and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10-30s, SEL values of 55-60 corresponds to a L_{Amax} value of 45dB. Ten to 15 of these events during an 8 hour night-time implies a $L_{Aeq, 8h}$ of 20-25dB. This is 10-15dB below the $L_{Aeq, 8h}$ or 30dB for continuous night-time noise exposure, and shows that intermittent character of noise must be taken into account when setting night-time noise limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background of these events."*

Therefore, the frequency of occurrence of maximum noise events should not typically exceed 10-15 times in any night.

Summary

The project criteria adopted are therefore as follows:

Bedrooms	Night-time (23:00-07:00)	30 dB L_{Aeq} 45 dB $L_{Amax,f}$ (not normally exceeded)
Living Rooms	Daytime (07:00-23:00)	35 dB L_{Aeq}

7.2 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.

7.3 Assumptions

Our external building fabric analyses have assumed the following:

(a) Noise Levels

The assessment has been based on the measured noise levels as detailed in Section 4.4.

(b) Room Absorption

The calculations assume that bedrooms and living rooms are to have a hard floor finish with furnishings.

Details of the absorption coefficients assumed in the calculations are provided in Appendix B.

(c) External Wall

We understand that the external non-glazed areas are to comprise a brickwork external leaf and either internal drylining or blockwork.

As such, RBA have assumed the following sound reduction indices (equating to an overall R_w of 52 dB) for all non-glazed façade areas:

Table 12 – Sound Reduction Indices of Non-Glazed Elements

Assumed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
36	41	45	45	54	58	58	58

Should the proposals for non-glazed areas change, it is critical RBA are informed at the earliest opportunity as this could have a significant impact on the sound insulation performance requirements of the glazing systems.

(d) Ventilation

It is understood the chosen strategy is mechanical ventilation with heat recovery (MVHR).

It should be noted MVHR typically provides background ventilation only.

We understand windows are to be openable to provide purge ventilation and cooling during overheating. During those periods where windows are opened for purge/rapid ventilation, noise levels will naturally be increased internally.

7.4 Specification & Guidance Constructions

Appendix C details the sound reduction performance specification for the glazed elements of the external building fabric.

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.

Please note – *The glazing configurations described in Table 13 are given for costing purposes only. All window systems should be capable of meeting the performance specifications shown in Appendix C, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a window configuration will meet the performance specification.*

For guidance purposes RBA would typically expect the following glazing configurations to prove commensurate with achieving the sound insulation performance specifications detailed within Appendix C.

Table 13 – Guidance on Glazing Constructions

Glazing Type	Example Glazing Configuration
G1	Typical thermal double glazing with differing pane thicknesses (e.g., 4mm glass / 12mm cavity / 6mm glass)

It should be noted that due to the non-acoustic reasons (security, thermal or structural purposes), the specifications may exceed those stated above in some locations.

Given that the above glazing is suitable for the worst-affected areas of site, we would therefore consider it acoustically appropriate for the entire building.

8.0 PLANT NOISE EMISSION

8.1 Location of the Nearest Noise-Sensitive Receptors

Although plant selections and locations are yet to be determined, we have outlined the expected nearest noise sensitive receptors within and surrounding the site. Based on observations made on site and discussions with the design team we understand the nearest noise-sensitive receptors surrounding the site as follows:

Receptor 1 – Properties South of Development Site (existing receptors)

The closest noise-sensitive property to the south of the development site is considered to be the residential receptor at 8 Nutley Terrace. We consider this likely to be the closest existing noise-sensitive receptor to any proposed plant on the roof of the new building proposed on the land adjacent to 46 Maresfield Gardens.

Receptor 2 – Properties North of Development Site (existing receptors)

The closest noise-sensitive properties to the north of the development site are considered to be the residential receptor at 46 Maresfield Gardens and the receptor at 43-45 Fitzjohn's Avenue. We consider 46 Maresfield gardens likely to be the closest existing noise-sensitive receptor to any proposed plant on the roof of the new building proposed on the land adjacent to 46 Maresfield Gardens. It is not clear whether 43-45 Fitzjohn's Avenue is currently residential or commercial usage. At this stage, we have assumed residential usage, but commercial usage may allow for slightly relaxed criteria due to lower sensitivity. 43-45 Fitzjohn's Avenue is likely to be the closest existing receptor to any proposed plant for 39A Fitzjohn's Avenue.

Receptor 3 – 39 Fitzjohn's Avenue Main House (new receptor, adjacent development)

This receptor is to be located immediately adjacent to the proposed development site (to be developed as part of an adjacent project). This is therefore a new residential receptor that would likely not be exposed to the pre-development noise conditions for a long period of time.

Receptor 4 – 39A Fitzjohn's Avenue (new receptor, within development)

This receptor is located within the site and is to be served by plant proposed as part of the development. This would therefore be a new residential receptor that would be unfamiliar with the pre-development noise conditions.

Receptor 5 – Future Residential Building on Land Adjacent to 46 Maresfield Gardens (new receptor, within development)

This receptor is located within the site and is to be served by plant proposed as part of the development. This would therefore be a new residential receptor that would be unfamiliar with the pre-development noise conditions.

8.2 Criteria

The London Borough of Camden's Local Plan (2017) states the following in Appendix 3:

> *"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 Camden Local Plan | Appendices 347 commercial sound' (BS 4142) will be used. For such cases*

a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."

For the adjacent site (main house at 39 Fitzjohn's Avenue), we understand that Planning Condition 12 of the London Borough of Camden's Draft Decision Notice (Application ref: 2020/2169/P, dated 29 April 2022) stated that the lowest existing background should be used and that the reason is as follows:

"To ensure that the amenity of occupiers of the development site/surrounding premises is not adversely affected by noise from plant/mechanical installations/equipment in accordance with policy A1 of the London Borough of Camden Local Plan 2017."

The above requirements are very onerous given the low existing background noise levels measured. Furthermore, the reasoning for the above condition states "to ensure that the amenity of occupiers of the development site/surrounding premises is not adversely affected", which implies that the criteria should not only apply to existing receptors outside the site boundary but also new receptors on the development site, which make the criteria extremely challenging to achieve, given the inherently smaller distances from plant to receptor.

We would consider the criteria to be achievable at existing receptors outside of the larger development site boundary (i.e., all buildings except the main house at 39 Fitzjohn's Avenue, 39A Fitzjohn's Avenue and the new proposed residential building on the land adjacent to 46 Maresfield Gardens).

However, at buildings within the larger development site (all considered to be new receptors), we would suggest that the limits are relaxed, as we do not consider it feasible to meet the limits that would be set under these criteria without significant design challenges or unfeasible attenuation requirements.

8.3 Relaxed Plant Noise Limits

For receptors of buildings which the plant is serving (i.e., either 39A Fitzjohn's Avenue or the new building on the land adjacent to 46 Maresfield Gardens), we would suggest that relaxed limits of 5dB above the existing background level are appropriate, on the basis of the following contextual assessment, in accordance with BS 4142:

- The residential dwellings are to adopt mechanical methods of ventilation, thereby reducing the requirement for occupants to open windows and negating the need for 'inaudibility' outside a new residential window.
- The level of absolute external noise targeted under relaxed limits would still be fairly low.
- Even if windows were partially opened (assuming a typical 15dB reduction), internal noise resulting from plant associated with the development would be below BS8233 internal noise standards.
- The occupants of the building would directly benefit from the operation of the building services plant.
- There is no future occupant experience of current baseline noise levels and hence residents will not experience any change to the noise climate (and creeping background).

For receptors at adjacent buildings within the development (i.e., either 39 Fitzjohn's Avenue, 39A Fitzjohn's Avenue, or the new building on the land adjacent to 46 Maresfield Gardens), we would suggest that relaxed limits of 5dB below the existing background level are appropriate, on the basis of the following contextual assessment, in accordance with BS 4142:

- The level of absolute external noise targeted under relaxed limits would still be very low.
- Even if windows were partially opened (assuming a typical 15dB reduction), internal noise resulting from plant associated with the development would be below BS8233 internal noise standards.
- There is no future occupant experience of current baseline noise levels and hence residents will not experience any change to the noise climate (and creeping background).
- Only a slight relaxation (5dB) is suggested to the neighbouring proposed/to be refurbished buildings.

In line with the above suggested relaxations, RBA propose that 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 location:

Table 14 – Suggested Relaxed Plant Noise Emissions Levels

Receptor	Relevant Measurement Location*	Feasible Target	Max. Plant Noise Emissions Level L_{Aeq} during period (dB)	
			Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Receptor 1 – South of wider development site (existing)	MP4	10dB below background	26	22
Receptor 2 – North of wider development site (existing)	MP2	10dB below background	28	25
Adjacent receptor within the wider development site, but not served by the plant	MP2	5dB below background	33	30
Receptor within the building to be served by the plant	MP2	5dB above background	43	40

*May vary depending on exact receptor location

In line with BS 4142:2014 and the Local Plan, should the proposed plant be identified as having tonal characteristics, a further 5dB penalty should be subtracted from any of the above proposed noise emission limits.

It is worth noting that the above limits are still particularly challenging to achieve and will require attenuation specifications to be met when products are selected, without any resultant increase in source plant noise.

8.4 Assessment

At this early stage in the design, detailed plant selections have not been made. It is therefore not possible to undertake an assessment to determine compliance with the recommended noise limits.

Once such information is available, an assessment can be carried out to determine what, if any, attenuation measures are required to control noise emission to a suitable level. The above limits should be considered in the development of the building services design.

9.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site at 39A Fitzjohn's Avenue & land adjacent to 46 Maresfield Gardens. The measured noise levels are presented within this report. The resultant noise levels have been used in the assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to ProPG, BS 8233:2014, WHO Guidelines, BS 6472-1:2008, guidelines outlined in the London Borough of Camden Local Plan. Reference has also been made to planning conditions for the adjacent site, the existing main house at 39 Fitzjohn's Avenue, to which the criteria should also be considered relevant.

This assessment concludes that acceptable internal noise levels can be achieved using standard thermal double glazing.

Detailed vibration measurements have been undertaken at the site due to the presence of the Network Railway tunnels situated beneath the site. The vibration measurements have been analysed on an empirical basis to yield likely levels of tactile vibration within the proposed building. Our predictions indicate that the levels of vibration are likely to be imperceptible and comfortably within the guideline limits and should therefore be considered to be acceptable.

Plant noise emission limits have also been set in line with the requirements of the London Borough of Camden. Given the low existing background noise levels, we would not expect the typical criteria to be achievable at receptors within the Wider Site (i.e., 39 Fitzjohn's Avenue main house, 39A Fitzjohn's Avenue and Land adjacent to 46 Maresfield Gardens). Therefore, we have proposed relaxed criteria which we consider appropriate in terms of noise impact to receptors within the site boundary. Furthermore, we have devised such limits that are practical to ensure the mechanical design requirements are met. At this stage, there is insufficient information available to undertake a detailed plant noise emission assessment. This can be undertaken when plant selections are available.

In light of the above, we suggest planning permission should not be refused on the basis of environmental noise or vibration impact on the development, given that noise impact is expected to be controlled to an appropriate level with relatively standard measures.

Appendix A – Acoustic Terminology

A-weighting (e.g. dB(A))	A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people hear.
DeciBel (dB)	Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level.
$L_{eq,T}$	The level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{Aeq,T}$	The A-weighted level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
L_{An} (e.g. L_{A10}, L_{A90})	The sound level exceeded for n% of the time. E.g. L_{A10} is the A-weighted level exceeded for 10% of the time and as such can be used to represent a typical maximum level. Similarly, L_{A90} is the level exceeded for 90% of the measurement period, and is often used to describe the underlying background noise.
$L_{Amax,T}$	The instantaneous maximum A-weighted 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, e.g. sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the ambient level.
Octave band	A frequency band in which the upper limit of the band is twice the frequency of the lower limit.
1/3 Octave band	A frequency band which is one-third of an octave band.
R_w	A single number quantity which characterises the airborne sound insulation of a material or building element in a laboratory test.

Appendix B – Room Absorption Coefficients

For the purposes of the analyses RBA have assumed the absorption coefficients detailed in Table B1 for bedrooms and living rooms.

Table B1 – Bedroom and Living Room Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.20	0.22	0.22	0.22	0.23	0.27

Appendix C – External Building Fabric Acoustic Specification

External facade constructions and components, such as brise soleil, grilles, ventilators, curtain walling systems or other architectural features, are not to give rise to intrusive whistling, creaking, rattling or other noises as a result of wind or other climatic effects.

The Contractor shall take reasonable precautions to avoid unwanted noise including creaking, rattling and whistling being generated by the Contractors works when subject to environmental conditions (including wind) and thermal expansion over the life of the façade.

1.0 Window Sound Insulation Performance

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc. as appropriate) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 10140-2:2021:

Table C1 – Window Sound Insulation Performance Specification

Type	Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								R_w (dB)
	63	125	250	500	1k	2k	4k	8k	
G1	17	21	20	27	37	36	41	41	32

Note: R_w is the "overall weighted sound reduction index" tested in a laboratory.

N.B. as the internal noise criteria are expressed in overall terms, other frequency-specific performance levels may ultimately prove acoustically acceptable. Test data for representative samples of all glazing systems shall be submitted to RBA Acoustics for approval to demonstrate compliance with the above performance specifications.

2.0 Ventilator Sound Insulation Performance

Mechanical ventilation is proposed for the scheme, and therefore no specific acoustic performance requirements are applied in order to maintain the performance of the external building fabric.

Appendix D – Instrumentation

The following equipment was used for the measurements.

Table D1 – Equipment Calibration Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Svantek Accelerometer	SV84	K2309	1502190-1	1 April 2024
Sinus Measurement System	Apollo	11023	-	-
SINUS Acoustic Multi-channel Universal Real-time Analysis Instrument (SAMURAI)	-	-	-	-
Norsonic Type 1 Sound Level Meter	Nor140	1406971	U38866	2 September 2023
Norsonic Pre Amplifier	1209	21571		
GRAS ½" Microphone	40AF	207393	38865	2 September 2023
Norsonic Sound Calibrator	1251	35016	U38864	1 September 2023
Norsonic Type 1 Sound Level Meter	Nor140	1406970	U32886	05 October 2023
Norsonic Pre Amplifier	1209	21205		
Norsonic ½" Microphone	1225	271055	32885	05 October 2023
Norsonic Sound Calibrator	1251	35020	U32884	05 October 2023
Norsonic Type 1 Sound Level Meter	Nor140	1403127	U37031	11 February 2023
Norsonic Pre Amplifier1	1209A	12071		
Norsonic ½" Microphone	1225	41473	37030	11 February 2023
Norsonic Sound Calibrator	1251	31986	U37029	11 February 2023
Norsonic Type 1 Sound Level Meter	Nor140	1403226	U36698	5 January 2023
Norsonic Pre Amplifier	1209	12556	U36695	4 January 2023
Norsonic ½" Microphone	1225	25179		
Norsonic Sound Calibrator	1251	31988	U36696	4 January 2023

Appendix E – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation for more than 3 days)
4 – Serious (e.g. fracture, hospitalisation for more than 24 hours, incapacitation for more than 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiplying the two scores and is then used to determine the course of action.

Table E1 – Risk Ratings

Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Table E2 – Risk Assessment

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Acoustic doors - weight	Strain of neck, limbs or back	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Acoustic glazing - weight	Strain of neck, limbs or back. Fall from height.	Contractors	3	5	15	Provide sufficient manpower, lifting gear and structural support	1	5	5

L: Likelihood S: Severity R: Rating

Appendix F – Graphs and Site Plans

39 Fitzjohn's Avenue

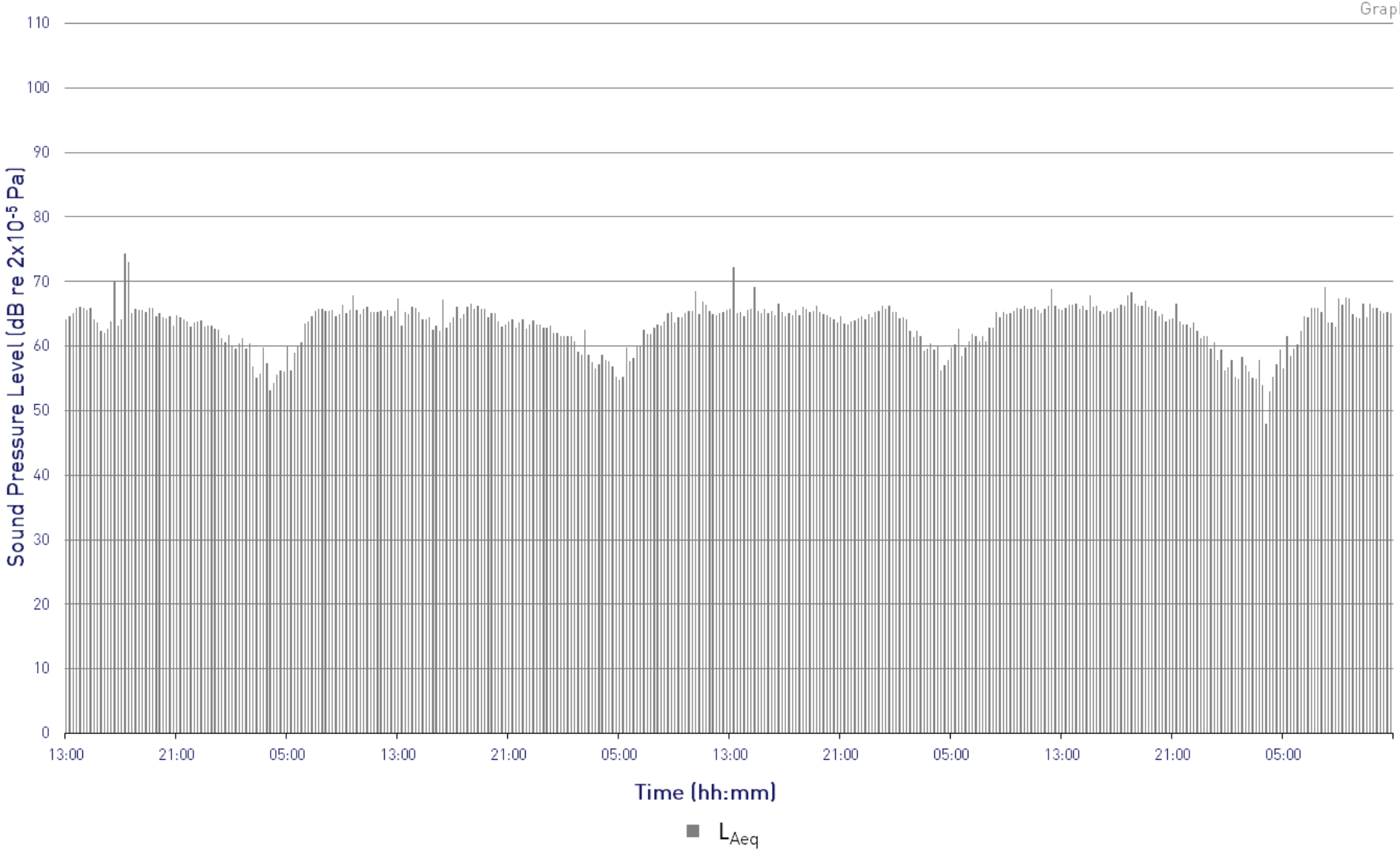
L_{Aeq} Time History

Measurement Position 1 - First Floor Level, Front Façade (East)

RBA ACOUSTICS

Project: 12333

Graph 1



39 Fitzjohn's Avenue

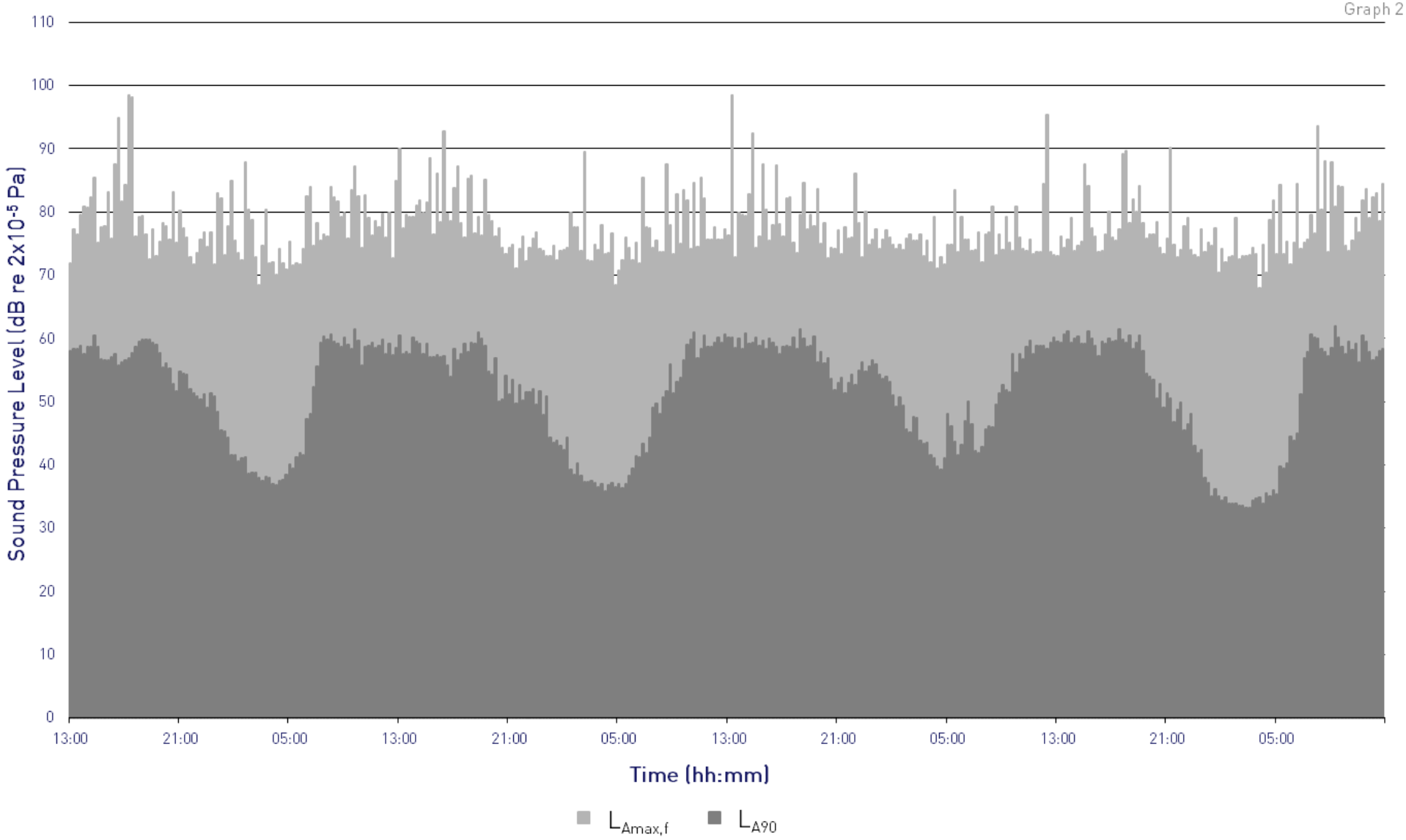
$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 1 - First Floor Level, Front Façade (East)

RBA ACOUSTICS

Project: 12333

Graph 2



39 Fitzjohn's Avenue

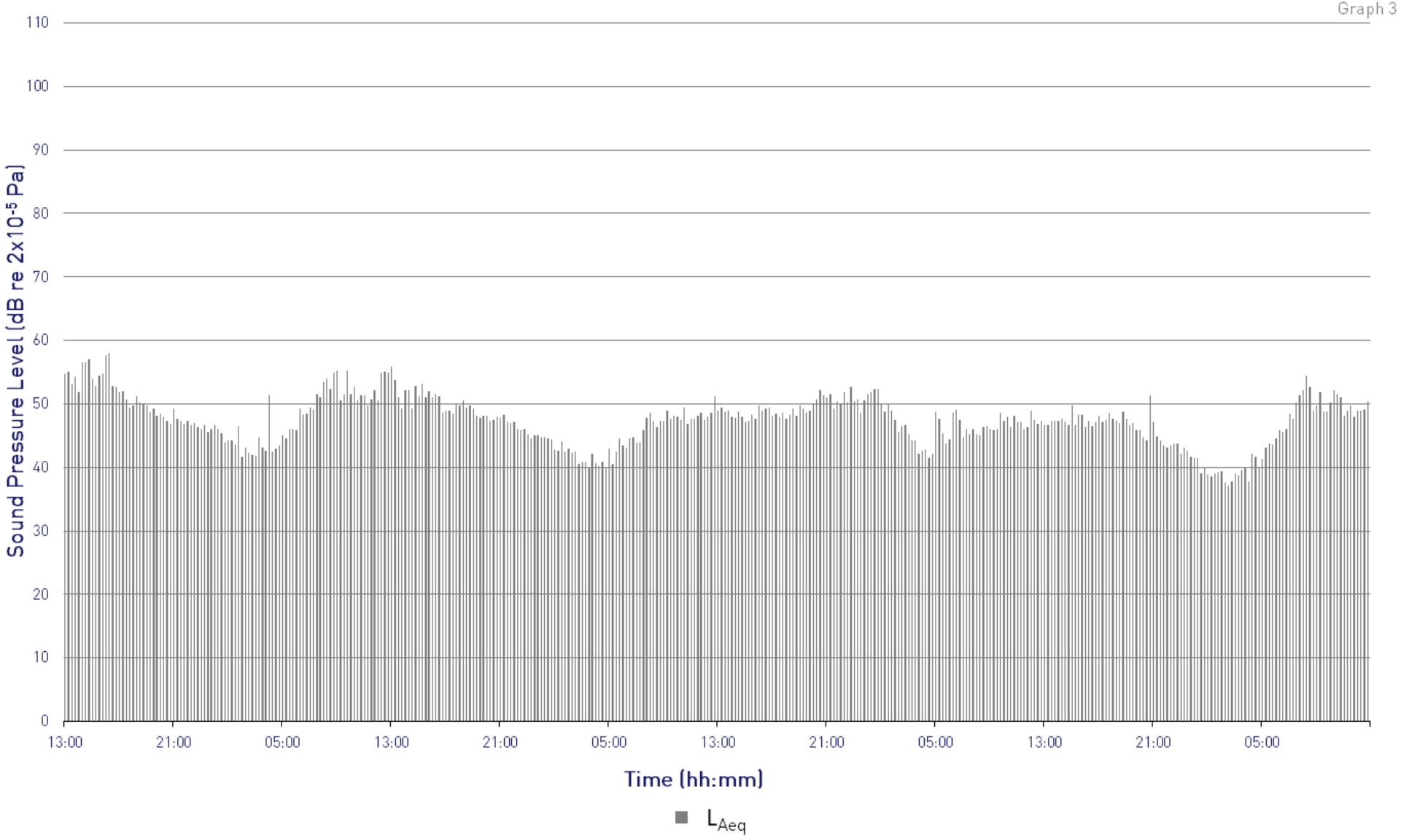
L_{Aeq} Time History

Measurement Position 2 - First Floor Level, Rear Façade (West)

RBA ACOUSTICS

Project: 12333

Graph 3



39 Fitzjohn's Avenue

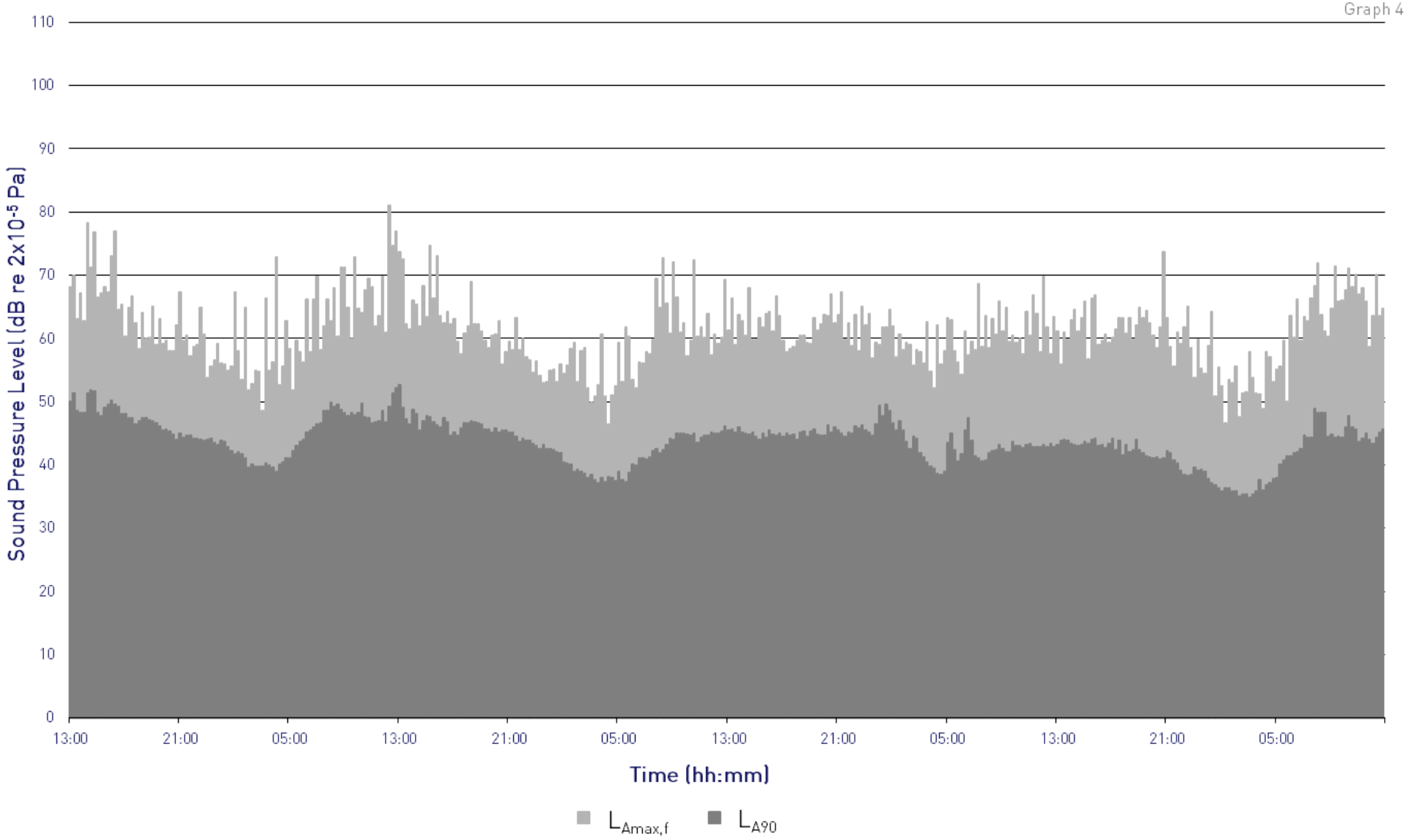
$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 2 - First Floor Level, Rear Façade (West)

RBA ACOUSTICS

Project: 12333

Graph 4



39 Fitzjohn's Avenue

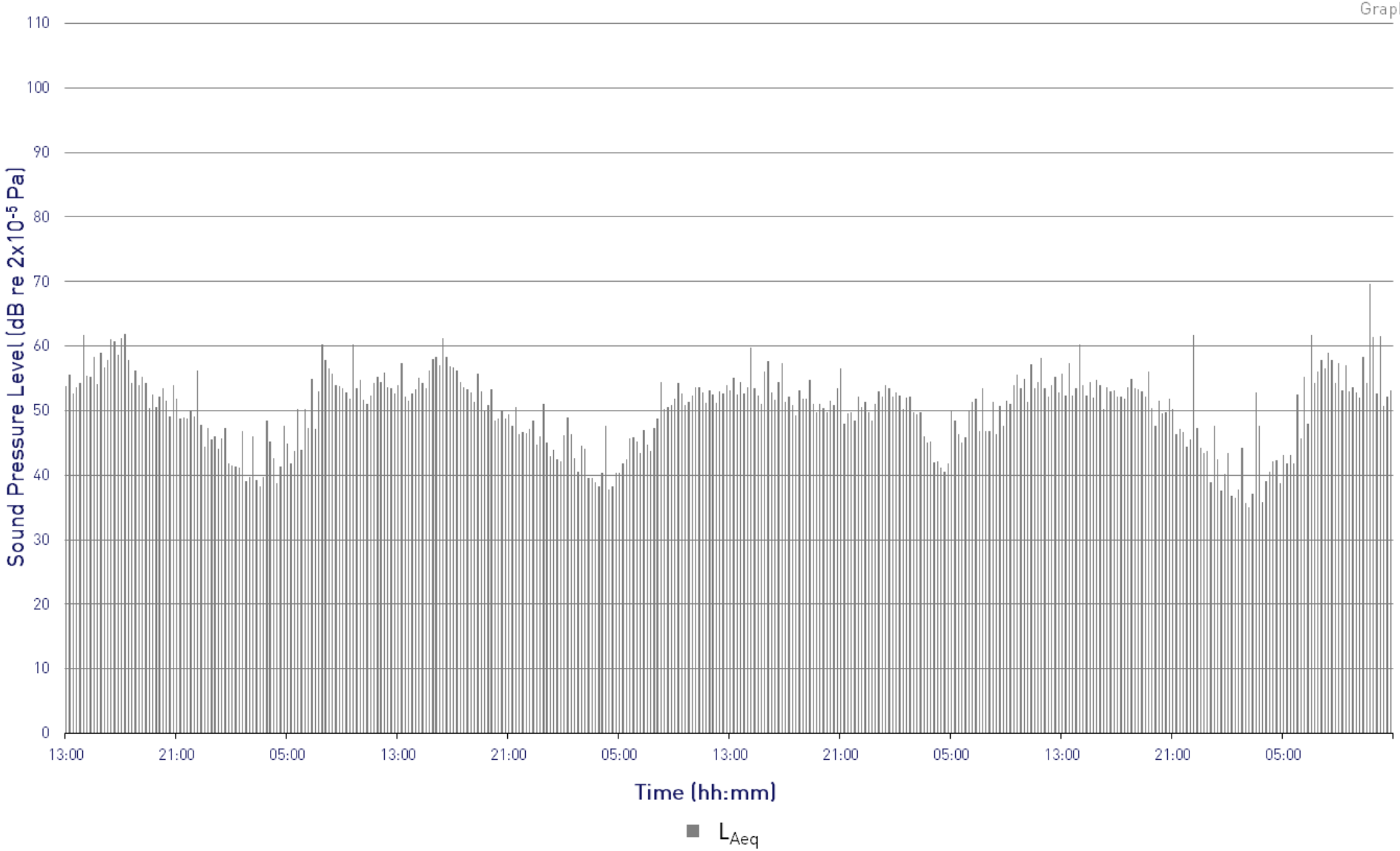
L_{Aeq} Time History

Measurement Position 3 - Ground Floor Level, Overlooking Maresfield Gardens (West)

RBA ACOUSTICS

Project: 12333

Graph 5



39 Fitzjohn's Avenue

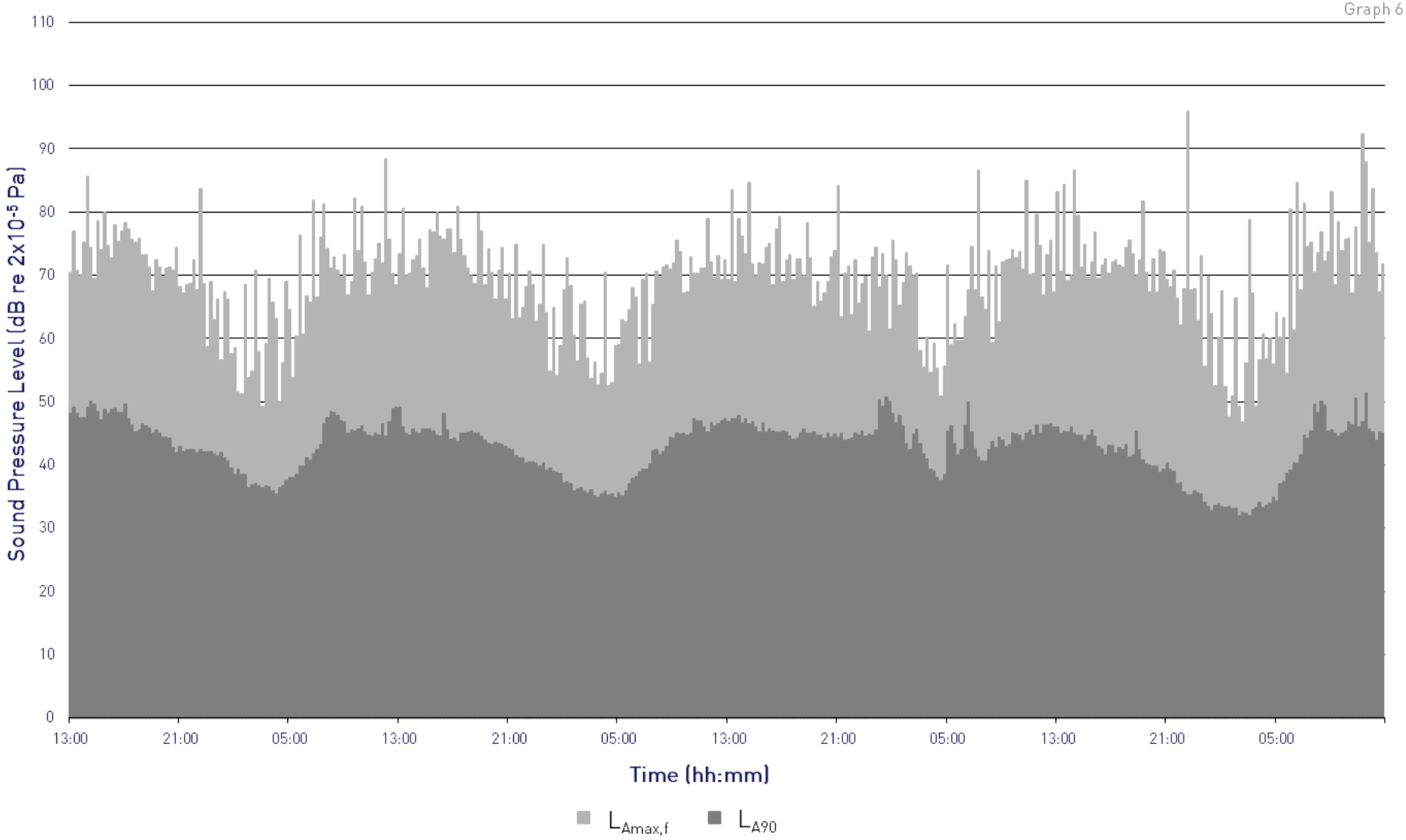
$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 3 - Ground Floor Level, Overlooking Maresfield Gardens (West)

RBA ACOUSTICS

Project: 12333

Graph 6



39 Fitzjohn's Avenue

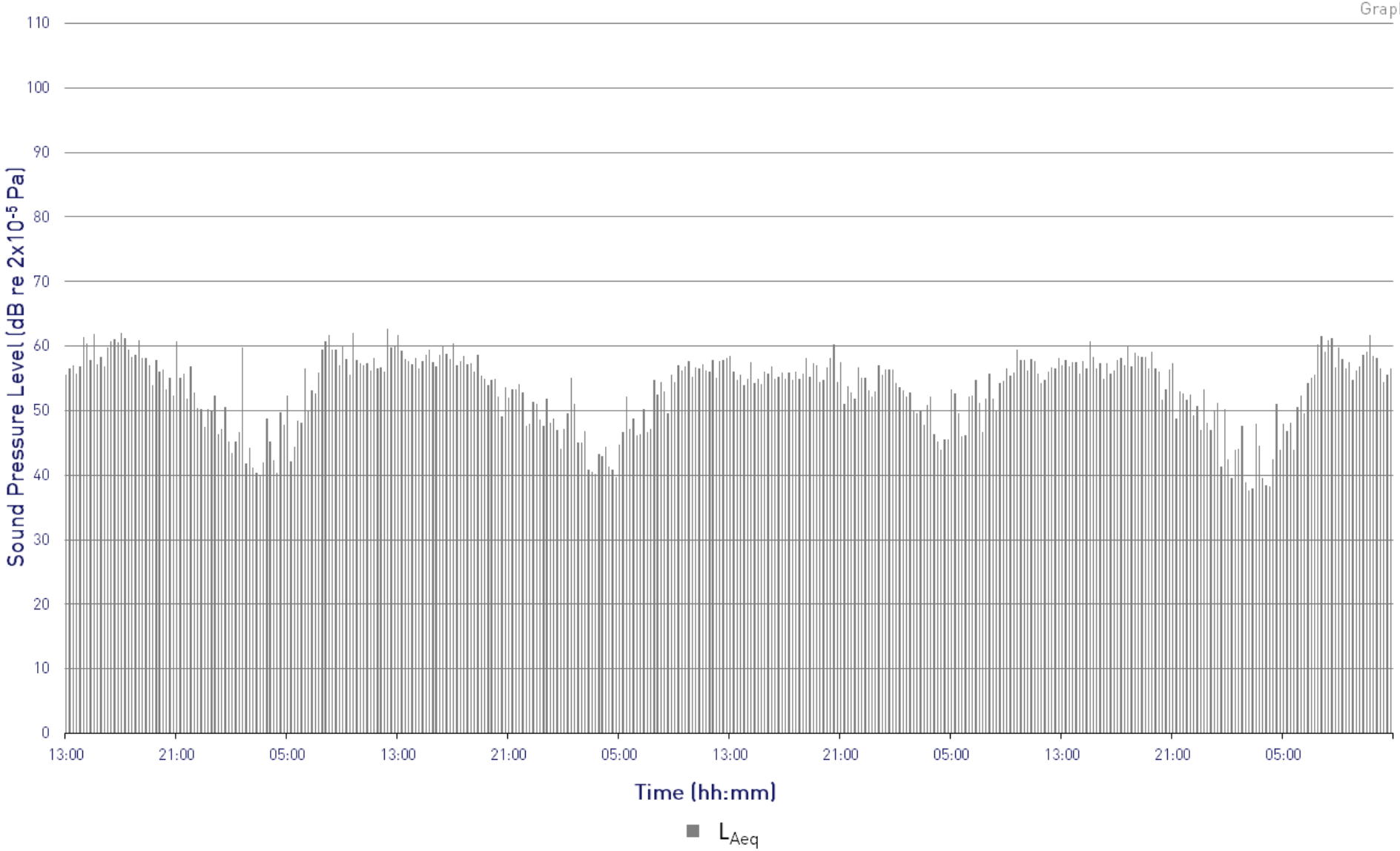
L_{Aeq} Time History

Measurement Position 4 - Ground Floor Level, Overlooking Nutley Terrace (South)

RBA ACOUSTICS

Project: 12333

Graph 7



39 Fitzjohn's Avenue

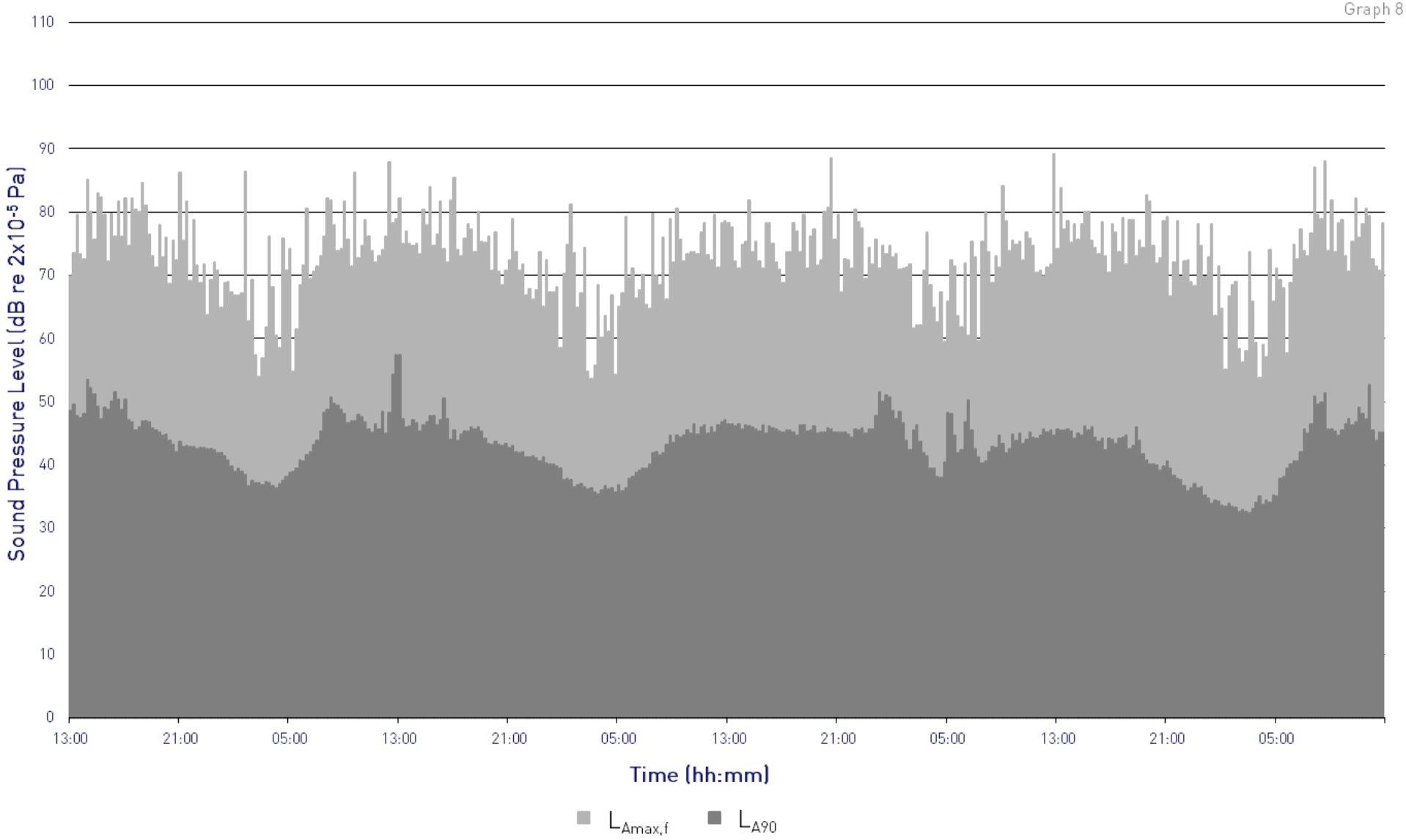
$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 4 - Ground Floor Level, Overlooking Nutley Terrace (South)

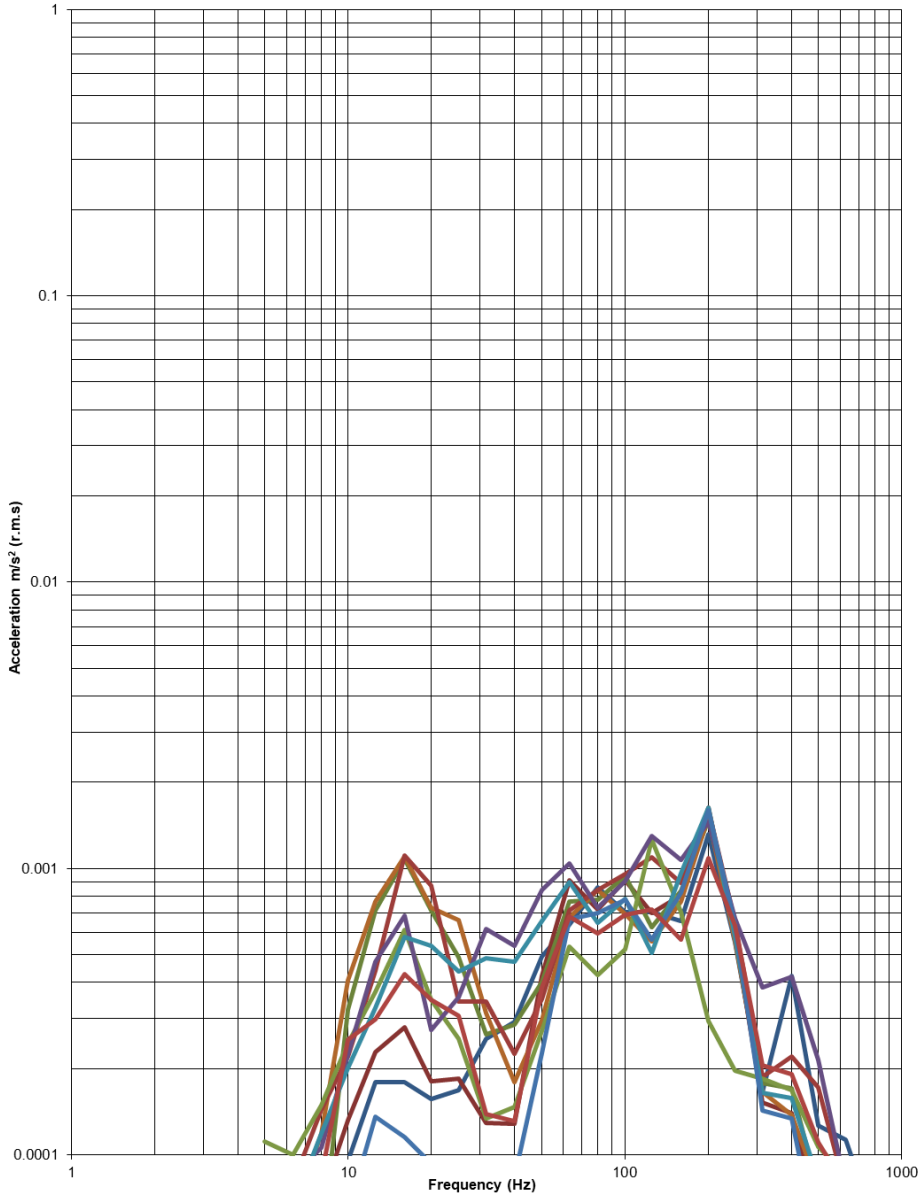
RBA ACOUSTICS

Project: 12333

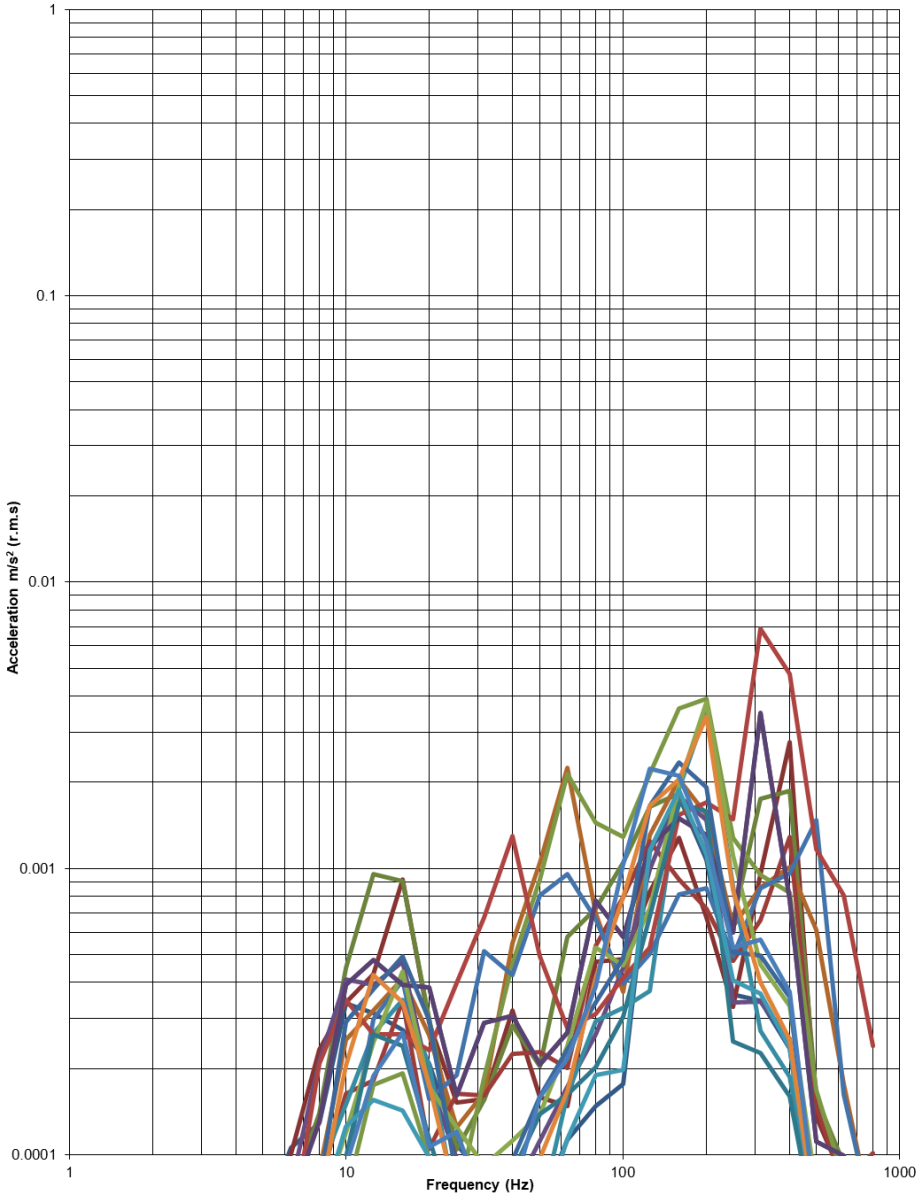
Graph 8



39A Fitzjohn's Avenue and land adjacent to 46 Maresfield Gardens
Position: 1
Graph 9: Vertical Axis



39A Fitzjohn's Avenue and land adjacent to 46 Maresfield Gardens
Position: 2
Graph 10: Vertical Axis



39A Fitzjohn's Avenue & Land Adjacent to 46 Maresfield Gardens, NW3

Site Plan

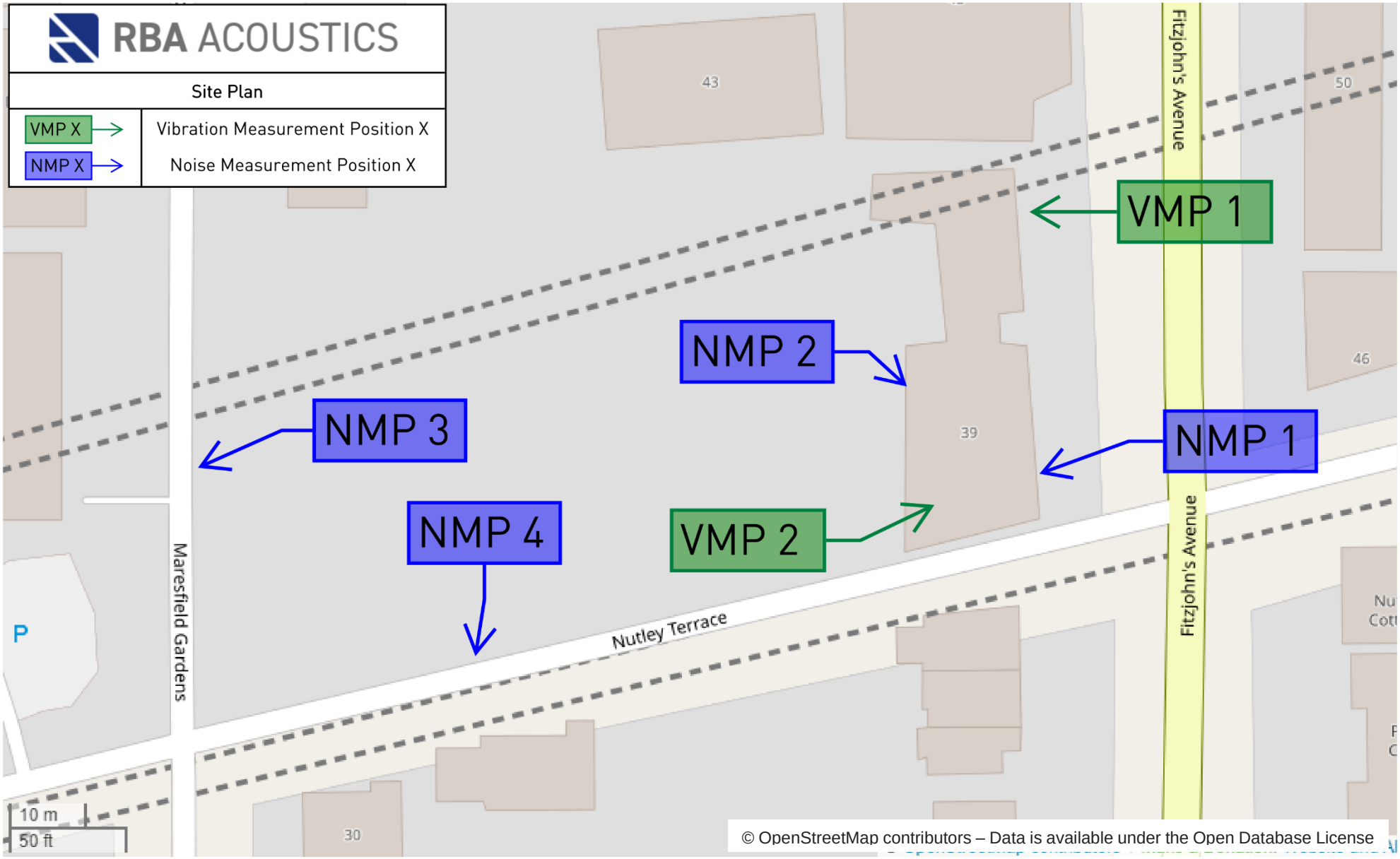
Project 12334

Figure 1

31 January 2024

Not to Scale

RBA ACOUSTICS



39A Fitzjohn's Avenue & Land Adjacent to 46 Maresfield Gardens, NW3

Site Plan with Measurement Positions

Project 12334

Figure 2

31 January 2024

Not to Scale

RBA ACOUSTICS

39A Fitzjohn's Avenue & Land Adjacent to 46 Maresfield Gardens, NW3

Photograph of Measurement Position 1

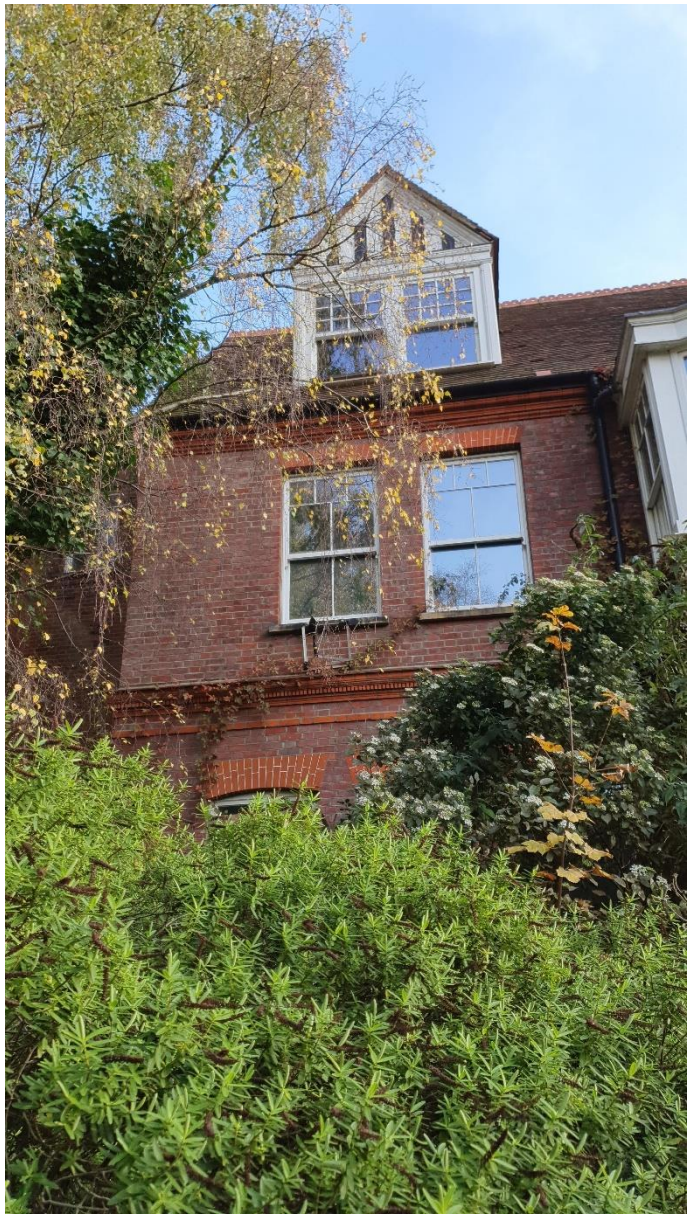
Project 12334

Figure 3

31 January 2024

Not to Scale

RBA ACOUSTICS



39A Fitzjohn's Avenue & Land Adjacent to 46 Maresfield Gardens, NW3

Photograph of Measurement Position 2

Project 12334

Figure 4

31 January 2024

Not to Scale

RBA ACOUSTICS

39A Fitzjohn's Avenue & Land Adjacent to 46 Maresfield Gardens, NW3

Photograph of Measurement Position 3

Project 12334

Figure 5

31 January 2024

Not to Scale

RBA ACOUSTICS

39A Fitzjohn's Avenue & Land Adjacent to 46 Maresfield Gardens, NW3

Photograph of Measurement Position 4

Project 12334

Figure 6

31 January 2024

Not to Scale

RBA ACOUSTICS

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