Report VA1698.170208.NIA

47 Albert Street, Camden

Environmental Noise Survey and Construction Noise Assessment

10 February 2017

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Contents

Attachments

1. Introduction

It is proposed to undertake works to the building structure at 47 Albert Street, Camden, including the demolition and relocation of a rear closet wing, a small extension of the existing basement beneath the front garden and internal refitting.

Venta Acoustics has been commissioned by Mr & Mrs Morgan to undertake an environmental noise survey to determine the pre-existing noise climate in the locality and predict the noise impact of the proposed works. This is to accompany the Construction Management Plan, as required by Camden Council.

2. Site Description

As illustrated on attached site plan VA1698/SP1, the site building forms part of a row of 4 and 5 storey terraces with small gardens to the rear, to the west of Albert Street in Camden .

To the south and west of the site are blocks of flats overlooking the rear garden with railway lines further beyond to the west.

The receivers likely to be most affected by noise from the proposed works are the immediate neighbours, 45 and 49 Albert Street, with the adjacent flat blocks (31-40 Mornington Street and 26 Mornington Terrace) being further away at approximately 20m and are likely to be affected to a lesser extent by the works.

3. Environmental Noise Survey

3.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Thursday 2nd February and Monday 6th February 2017 on the rear deck at the location shown in site plan VA1698/SP1. This locations was chosen to be representative of the background noise level at the surrounding dwellings without being unduly affected by façade reflections or screening.

Continuous 5-minute samples of the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were undertaken at the measurement location.

The weather during the survey period was had intermittent rains and winds with periods of calm between. The background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2007 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-12202-E0	42647-A2A-12202-E0	04/10/16
Larson Davis calibrator	CAL200	13069	42530-13069	09/06/16

Table 3.1 – Equipment used for the survey

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

3.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA1698/TH1-5.

The background noise level is determined by traffic on the local roads. The ambient noise climate has a significant contribution from the nearby railway. The noise levels during the Camden construction working hours for the site have been shown with the data plotted in a darker shade, with the hours outside of the construction hours shown in a paler shade.

The typical background and average ambient noise levels measured during the proposed site working hours:

Monitoring Period	Typical $L_{A90,5min}$	Typical $L_{Aeq,5min}$
Camden Weekday Construction hours (08:00 – 18:00 hours)	41 dB	50 dB
Camden Saturday Construction Hours (08:00-13:00 hours)	40 dB	51 dB

Table 1.1 – Typical background and average ambient noise levels

The L_{Amax} levels are generally between 60dB and 70dB with occasional events exceeding 70dB.

Ambient $L_{Aeq,5min}$ levels mostly remain in the low 50s and do not generally exceed 60dB.

4. Predicted Noise Impact

4.1 Proposed works

The proposed works include limited demolition and excavation, construction of new extensions, internal refurbishment, re-roofing and landscaping.

There will be a 2-month demolition, strip-out, excavation and foundations phase including demolition of the rear closet wing at ground and basement level, a 1.8m excavation into the garden and a small extension under the front garden (undertaken from within the basement level flat).

This will be followed by 2 months of concrete / steel superstructure works and then a 1 month construction of the rear extension at ground and basement level.

Early stages of the internal fitout works will occur during the external works.

It is proposed that all demolition, excavation and construction works will occur during Camden Council's standard hours of construction (08:00-18:00 hours, Monday – Friday and 08:00 – 13:00 hours Saturday). Furthermore, works identified as potentially having a high noise impact will be avoided on a Saturday.

Due to restricted site access, works will be limited to hand operated machinery. Excavation will be by hand and mixing / distribution of concrete will be by hand and using small cement mixers.

4.2 Predicted noise levels

Calculations have been undertaken to determine the likely worst case noise emissions at the most affected neighbours, 45 and 49 Albert Street, both of which share a party wall with 47 Albert Street. These calculations are summarised in Appendix B of this report.

For the purpose of the assessment all works have been assumed to be in the centre of the area of works. In reality some activities will be marginally closer but similarly some will be further away, and the scenario calculated is likely to be representative of anticipated 10-hour average L_{Aeq} noise levels. The 'on time' for activities has been assessed as between one hour and ten hours of continuous unbroken operation of plant at their noisiest condition depending on the typical plant usage

Source noise levels have been taken from manufactures' data for indicative plant or listings in BS5228-Part 1: 2009 *Code of practice for noise and vibration control on construction and open sites: Noise*.

4.2.1 Phase 1: Demolition/Excavation/Foundations (10 weeks)

The highest noise levels will primarily be generated during the demolition of the closet wing in the rear garden. Equipment likely to be used during this phase includes, but is not necessarily limited to, handheld breakers and demolition hammers, grinders, drills, saws to remove the existing decking and small hand tools.

The noise impact on the neighbouring dwellings will vary during this phase, being at a maximum while ground level walls and slabs are demolished, and reducing in level at basement level where the neighbours will benefit from screening provided by the building.

The average noise level over a 10 hour day is expected to be up to $L_{Aeq,10hr}$ 79dB during the demolition at ground floor level, with individual activities being up to L_{Aeq} 84dB for brief periods.

During demolition at basement level, the average noise level is expected to be up to $L_{Aeq,10hr}$ 67dB with individual activities being up to 72dB.

The external demolition works are expected to take place over a 3-4 week period, of which only a short duration will be at ground floor level.

Excavation works will be by hand and will generate limited noise. The use of radio outside the building will not be permitted.

In addition to the above, noise will also be generated by occasional events such as deliveries, erecting of hoarding and temporary structures. Because of their very short duration these will not add significantly to the predicted noise levels.

To mitigate noise, it is recommended that demolition works are undertaken as quickly as possible, particularly at ground floor level. This may require the use of additional equipment, slightly raising the noise level during the period, but significantly reducing the duration of the works. Liaison with the neighbours to communicate the impact and duration of these works is recommended. Consideration should be made of limiting these works to 'high noise hours' between 09:00-12:00 hours and 13:00-16:00 hours, although these can be amended through liaison with the neighbours to fit best with their lifestyles and schedules.

Where possible, demolition works, such as breaking of slabs, should be done internally before the building shell is demolished. The use of site hoarding and localised temporary screening to mitigate noise affecting the neighbours from the demolition activities may be considered, however, due to the neighbours having high level windows overlooking the enclosed garden, this is expected to be of limited benefit.

4.2.2 Phase 2: Concrete/Steel Superstructure (6-weeks)

During this phase noise will primarily be generated due to drilling, hammering and grinding steel works. Equipment likely to be used during this phase includes, but is not necessarily limited to, grinders, drills, welders and small hand tools.

The noise level will vary during these phase of works, expected to be at a maximum during the construction of the top of the ground floor extension with grinding of steel being the greatest expected noise source, with hammering being a quieter, although more frequent, high impact noise source.

In the worst case, the average noise level over a 10 hour day is expected to be up to $L_{Aeq,10hr}$ 79dB during this phase, dominated by potential grinding of steel, with other individual activities being up to L_{Aeq} 85dB for brief periods.

During works below ground floor level, the average noise level over a 10 hour day is expected to be up to $L_{Aeq,10hr}$ 69dB during this phase, dominated by potential grinding of steel, with other individual activities being up to L_{Aeq} 83dB for brief periods.

It is not expected that pumps or driven compactors will be used during concrete pours which will help control noise levels from site.

To mitigate noise, it is recommended that cutting and shaping of steel is undertaken off site as far as possible, and inside the building where required onsite. No grinding or cutting of steel should take place outside of the high noise impact hours. Use of hammers on steel should be minimised, with preference given to rubber mallets.

4.2.3 Phase 3: Envelope Works (3-weeks)

Intermittent noise sources are expected to include hammering, grinding, drilling and mechanical fixings. For the majority of works, these will be screened from the neighbouring dwellings by the existing and new building construction.

It is recommended that cutting of materials takes place within the building as far as possible.

The average noise level over a 10 hour day is expected to be up to $L_{Aeq,10hr}$ 67dB during the demolition at ground floor level, with individual activities being up to L_{Aeq} 78dB for brief periods during hammering.

4.2.4 Phase 4: Internal Refurbishment and Landscaping Works (12-weeks)

Noise during internal refurbishment is usually limited to structural noise and some breakout from the building.

The average external noise level over a 10 hour day is expected to be up to $L_{Aeq,10hr}$ 63dB during the demolition at ground floor level, with individual activities being up to L_{Aeq} 70dB for brief periods

4.2.5 Traffic/delivery noise

Deliveries and waste removal will be by skip lorry (up to 1 per day), 18T delivery lorry (up to 1 per day) and vans on the public road to the front of the site. These will be arranged and controlled to limit dwelling time to no more than an hour.

While the arrival and loading / off-loading of material on lorries is likely to be slightly higher than the typical traffic on Albert Street, the infrequent and short duration nature of this is not expected to have a significant noise impact.

Drivers will be asked to turn off their engines while loading / off-loading. Care will be taken during loading and off-loading to minimise dropping of material or other unnecessary noises.

5. Vibration

Vibration levels are expected to be at their highest during the breaking-out of basement level structures. Based on past experience of vibration measurements from demolition works, heavy breakers typically generate vibration levels of 3mm/s to 5mm/s P.P.V. in structures situated within several metres of the working area. Due to geometric spreading and geological attenuation, vibration will diminish rapidly with increasing distance. Although the vibration is likely to be perceptible in some areas of the neighbouring properties, the anticipated levels of ground-borne vibration are considered highly unlikely to cause cosmetic damage of structures. It is possible that the levels may give rise to re-radiated noise within the neighbouring residential premises. These works are expected to be relatively brief. Liaison with the neighbours prior to breaking out works is recommended to inform them of the possibility of tactile vibration.

The ground and basement level floor concrete slabs should be cut and separated around the perimeter to minimise noise and vibration transmission into adjacent dwellings.

6. Monitoring Regime

Due to the relatively small scale of the site and works, it is unlikely that long-term monitoring will be necessary for these works. Due to the close proximity of the site to neighbours and the limited space available, it is unlikely that a suitable position for semi-permanent monitoring will be available and a large number of false positive events will be logged.

As an alternative, and in the first instance, it is recommended that the site manager will be provided with a shop-bought digital sound level meter and given instruction on correct operation. The site manager will take noise measurements prior to and during noisy works, with records kept. This will provide opportunities to optimise mitigation for works and minimise noise break-out from site, thereby reducing noise levels as far as practicable.

Should measured noise levels be significantly higher than predicted, it may be necessary to employ an acoustician to attend site to undertake detailed measurements and provide practical advice on options to reduce noise levels.

Should this be considered insufficient, automated noise and/or vibration monitoring should be considered. Any proposed monitoring regime should be arranged subject to agreement with Camden Council.

6.1 Noise Monitoring

Prior to monitoring being undertaken, the acoustician would liaise with the council to agree the requirements, as well as possibilities of a MEMs microphone logging sound level meter rather than a Class 1 sound level meter, which would provide the same functionality but a significantly reduced cost, and would work using an e-mail alert system.

Class 1 integrating logging sound level meters will be installed with calibration verified (before and after) with a Class 1 acoustic calibrator. The instrumentation will have been fully calibrated by the manufacturer, or other approved body, as required by the relevant British Standard, with current calibration certificates available. The meters will be set to measure and store samples of various acoustic parameters such as L_{Aeq}, L_{A90}, L_{A10} and L_{Amax}. SMS alerts would be utilised and data would be downloaded remotely on a regular basis.

It is proposed that the meters are configured to log continuous 30-minute samples of noise throughout the working day, which will be used to calculate a 10-hour (daily) L_{Aeq}. Daily limits and short-term action levels will be agreed with the Council prior to the works.

6.2 Vibration Monitoring

Vibration monitoring will be undertaken with the use of a suitable seismograph, or similar, measuring the peak particle velocity [ppv] continuously over defined periods. The instrumentation will have been fully calibrated by the manufacturer, or other approved body, as required by the relevant British Standard, with current calibration certificates available. SMS alerts would be utilised and data would be downloaded remotely on a regular basis.

It is proposed that the meters are configured to log continuous 30-second samples of maximum ppv levels throughout the working day. Action levels will be agreed with the Council prior to the works.

7. General Mitigation and Management

The following key factors have been identified as determining the degree and type of mitigation required.

7.1 Liaison with Residents

The importance of maintaining good relations and communication channels between the Client, contractor and neighbours is considered to be a critical issue. In conjunction with effective communication of site activities and scheduling, liaison with local residents is essential in cultivating a positive attitude in the surrounding community.

Prior to, and throughout, the works, liaison with nearby residents will be one of the key elements for minimising potential impacts.

It is recommended that the Client engages with representatives of occupants of the nearby properties at the planning stage to discuss the upcoming works and identify any mutually agreeable periods for ‘noisy works’, should the proposed working hours generally recommended by Camden be not suitable for their requirements.

The periods when high impact works are scheduled should have consideration for the neighbours’ use of their properties, such as days when occupants work from home and scheduled special events such as parties, wakes, etc.

At the early stage, contact details should be provided, along with details of the works, likely durations of each stage of the works, and prior warning for any particularly noisy works anticipated.

During works, a dedicated telephone number and designated staff contact should be made available to respond to any complaints or queries, with a messaging service for ‘out of hours’ enquiries. Information on current and forthcoming activities should be made as freely available as possible.

7.2 Duration of Works

It is essential to cultivate an appropriate environment in which exposure to noise and/or vibration arising from the works can be best tolerated from the outset, minimising adverse community reaction.

Communication of information regarding the overall project duration is significant in controlling adverse community reaction.

7.3 Hours of Works

It is understood that the permitted hours for 'noisy works' are restricted to 8am to 6pm Monday to Friday and 8am to 1pm on Saturdays. In addition to the above permitted hours, it is proposed that further restrictions are placed on works deemed to be of 'high impact' in terms of the level of disturbance caused to neighbouring residents and businesses. This is to ensure that nearby occupiers have sufficient breaks from activities that have the potential to be particularly disruptive. The potential 'high impact' works have been identified in the attached calculations summary. The permitted hours for 'high impact' works are 9am to 12pm and 2pm to 5:30pm Monday to Friday, although these could be amended with consent from the neighbours and the Council.

These hours should be rigorously observed for any operations which are likely to generate noise levels noticeable by neighbouring residents. In addition, it may be necessary to undertake noisy works on an on/off basis, thereby providing neighbouring residents with some additional respite. Any exceptions deemed essential to the works which need to be authorised by Camden and must also be communicated with the residents.

It should be noted, however, that it is sometimes preferable to extend working hours for a limited period in order to quickly complete essential noisy operations rather than increase their duration, which might cause more annoyance. If this is to be the case, this would be agreed with the neighbours and the Council should be notified in advance.

7.4 Noise Characteristics

Some noisy activities are particularly intrusive due to tonal or impulsive characteristics which tend to draw more attention to their operation. A typical example of this is heavy duty percussive breakers. Awareness of these issues is important in liaison with local residents. Local temporary acoustic screening to these activities, as required, will significantly reduce the impact at the closest noise sensitive properties.

8. BS5228:2009

BS 5228: Part 1: 2009 *Code of practice for noise and vibration control on construction and open sites - Part 1: Noise* and BS 5228: Part 2: 2009 *Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration* provide information and advice on reducing impact of construction works on neighbouring properties.

Operatives on site should be trained to employ appropriate techniques to keep site noise to a minimum and should be effectively supervised to ensure that best working practice in respect of noise reduction is followed. This is not only to minimise the impact on neighbouring properties but also to safeguard the hearing of site operatives.

All site personal should:

- Be mindful of neighbours and the impact of noise on their amenity. A good relationship with neighbours from the beginning of a project often reduces the likelihood of complaints;
- Strictly comply with agreed working hours. This includes minimising noise when arriving at site and preparing for the day;
- Ensure the proper use and maintenance of tools and equipment;
- Always select the lowest noise tools available for the job;
- Turn off machinery when not in use;
- Position machinery and activities on site to reduce the emission of noise to the neighbourhood and to site personnel. Generally, tools should be positioned far from neighbours and in areas where they are hidden from neighbouring windows by walls or site hoarding;
- Avoid unnecessary noise when carrying out manual operations and when operating plant and equipment;
- Understand that sound with characters such as whining, clanging or screeching as well as sudden sounds such as from hammering have a greater impact on neighbours than continuous, un-identifiable sounds;
- Where equipment is likely to cause disturbance to neighbours, this should only be used during agreed “noisy working hours” and / or a temporary structure should be erected around the machine;
- Use hearing protection when working in noisy environments.

8.1 Contractor's Obligations

In addition to the above, the following general conduct should be adopted by the contractor, where practical, in order to minimise and manage noise and vibration impacts at neighbouring properties;

- Erect good quality imperforate hoarding or temporary mass barrier sheeting, such as Echo Barrier (or similar), fixed to Heras fencing, or similar, around any openings made in the facades to the maximum practicable height, allowing for stability, wind loading, etc.;

- At all times and subject to availability, select and use the quietest plant, machinery and vehicles appropriate for the task being undertaken. All vehicles and mechanical plant used for the purpose of the works will be fitted with effective exhaust silencers, maintained in good and efficient working order and operated in such a manner as to minimise noise emissions;

- Employ at all times the Best Practicable Means (BPM), as defined in Section 72 of the Control of Pollution Act 1974, to reduce noise (including vibration) to a minimum, with reference to the general principles contained in British Standard BS5228 (see below);

- Facilitate an early community involvement exercise with neighbours to establish and agree protected areas of their properties and then to continually update progress and forewarn of forthcoming scheduled noisy works. A member of onsite staff should be designated as community relations manager to maintain good communications with neighbours;

- Adopt and adhere to agreed 'on' and 'off' times for noisy works and/or vibration sources, if required to do so by the Council;

- If deemed necessary, undertake or employ an independent third party to undertake noise, vibration and dust monitoring at locations to be agreed with the Local Authority, with pre-set 'amber' and 'red' trigger levels and text message alerts to notify when and where they are exceeded. The Contractor should commit to stop work immediately if a 'red' alert is received and to investigate. Working procedures may then need to be reviewed and modified to prevent re-occurrence. Records of monitor data should be compiled and reported weekly to all relevant parties. The extent of monitoring required can be continually assessed and amended as found necessary or desirable;

- It may be appropriate to undertake some test works prior to the commencement of the project to demonstrate the likely levels of vibration in the neighbouring properties. Depending on the outcome of the exercise, alternative plant or adjustments to the working programme may need to be considered;

- Operate a 'considerate builder' type scheme in which a commitment is made, amongst others, to undertake proper maintenance of equipment and control use of radios on site, with due consideration to proximity of neighbours, and ensure that equipment is turned off when not in use.

9. Conclusion

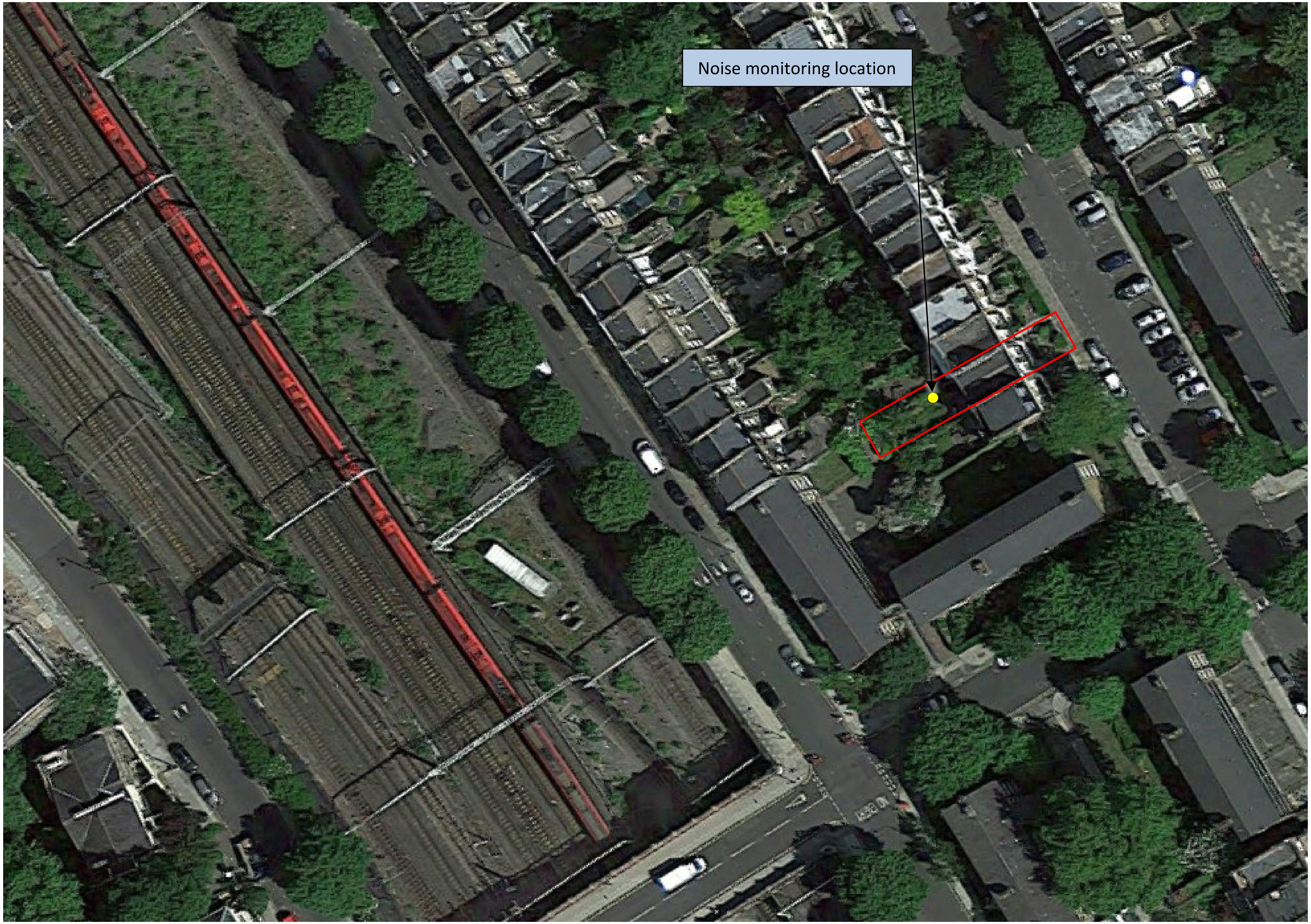
Small scale demolition and construction works are proposed at 47 Albert Street, Camden.

A baseline noise survey has been undertaken by Venta Acoustics to establish the pre-existing noise climate in the locality.

The proposed works have been reviewed and predicted noise emissions calculated. These indicate that noise levels will generally be below $L_{Aeq,10hr}$ 70dB except for short durations of the demolition and steel works.

Outline mitigation and Best Practical Means measures have been provided for the site as well as an overview of the recommendations of BS5228:2009 to assist in the training of site personal.

Steven Liddell MIOA


Noise monitoring location

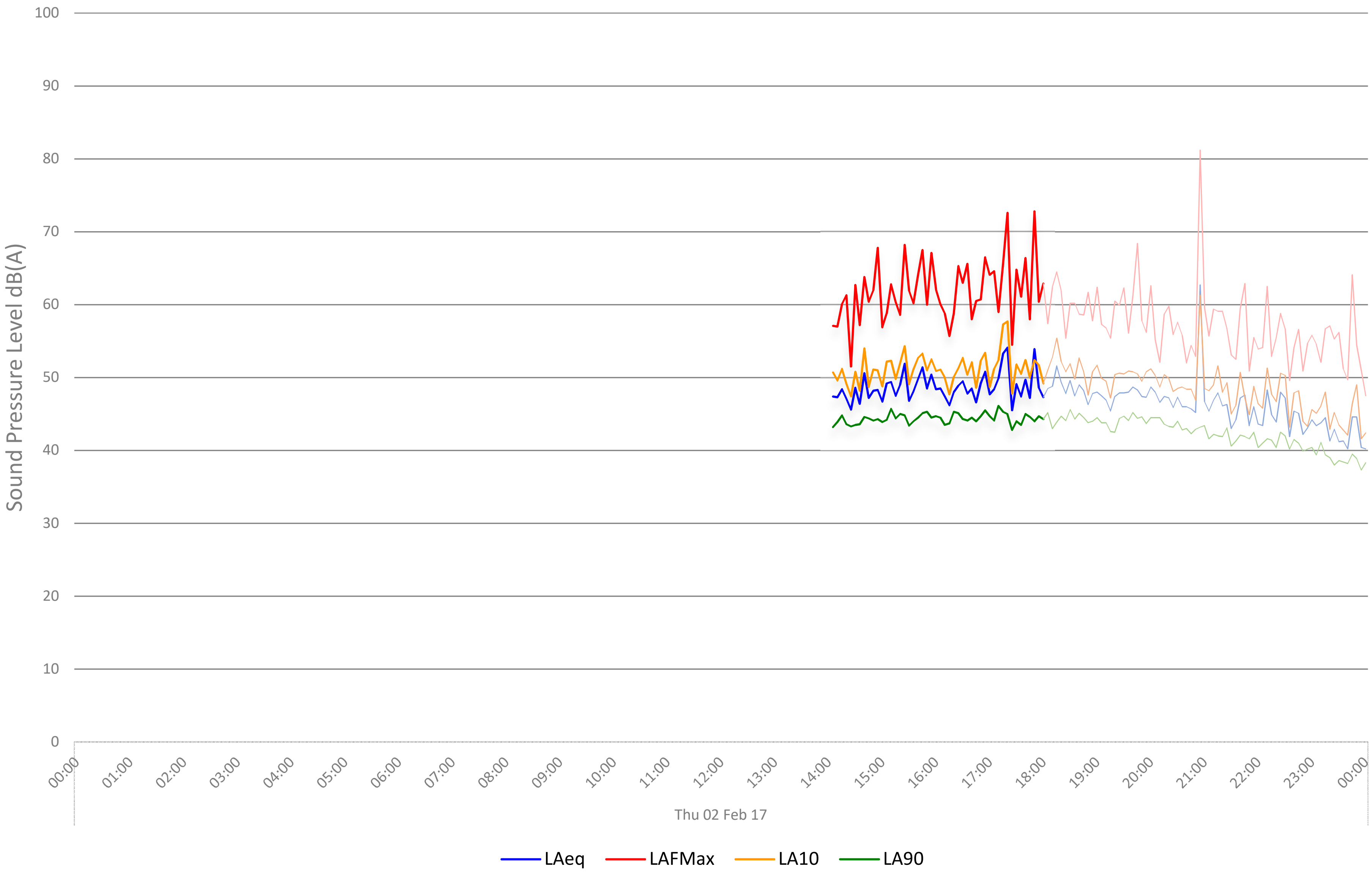
47 Albert Street, Camden

Environmental Noise Time History: 1

Rear Garden

Venta Acoustics

Figure VA1698/TH1

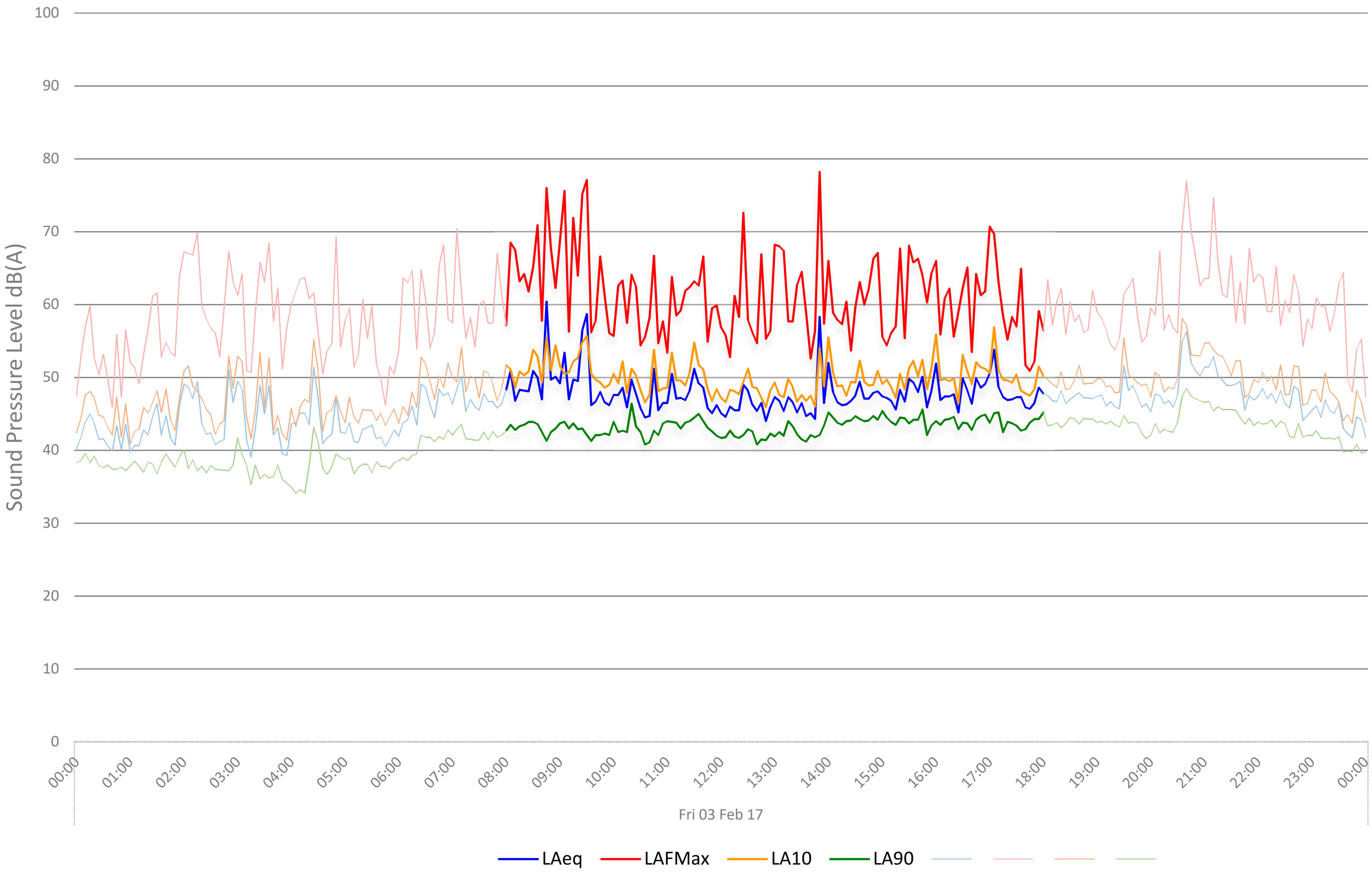


47 Albert Street, Camden

Environmental Noise Time History: 2

Rear Garden

Figure VA1698/TH2



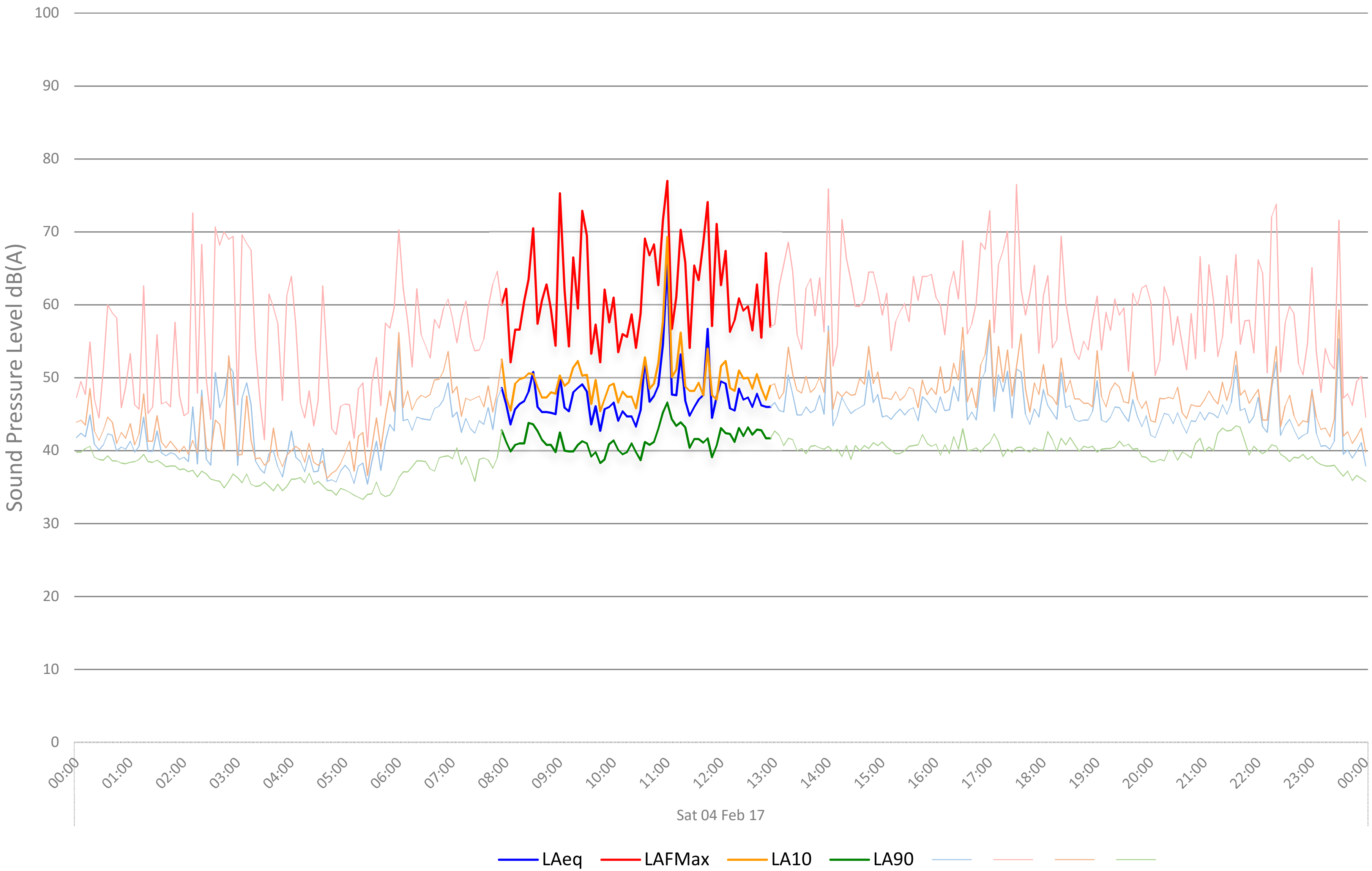
47 Albert Street, Camden

Environmental Noise Time History: 3

Rear Garden

Venta Acoustics

Figure VA1698/TH3



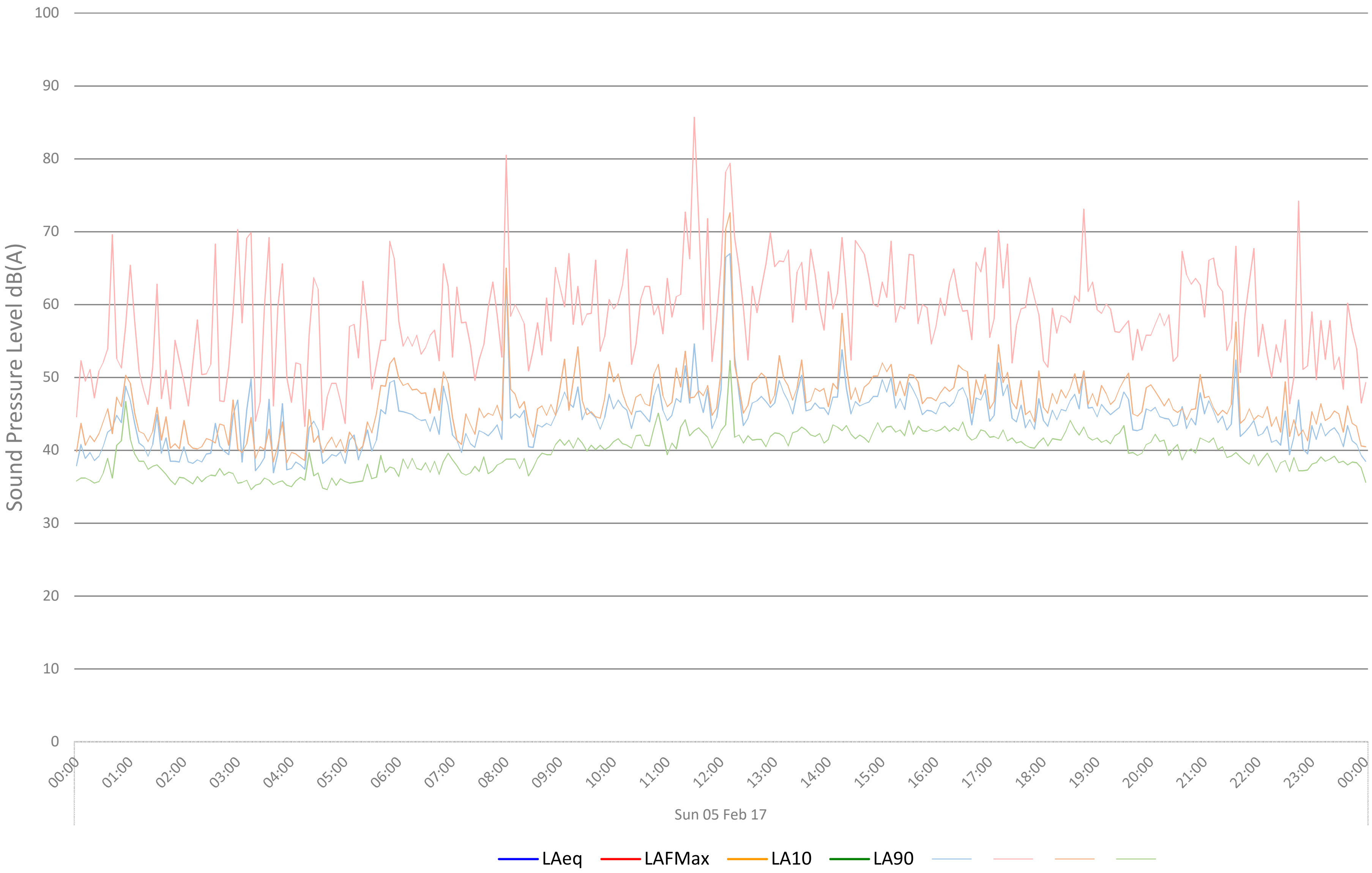
47 Albert Street, Camden

Environmental Noise Time History: 4

Rear Garden

Venta Acoustics

Figure VA1698/TH4

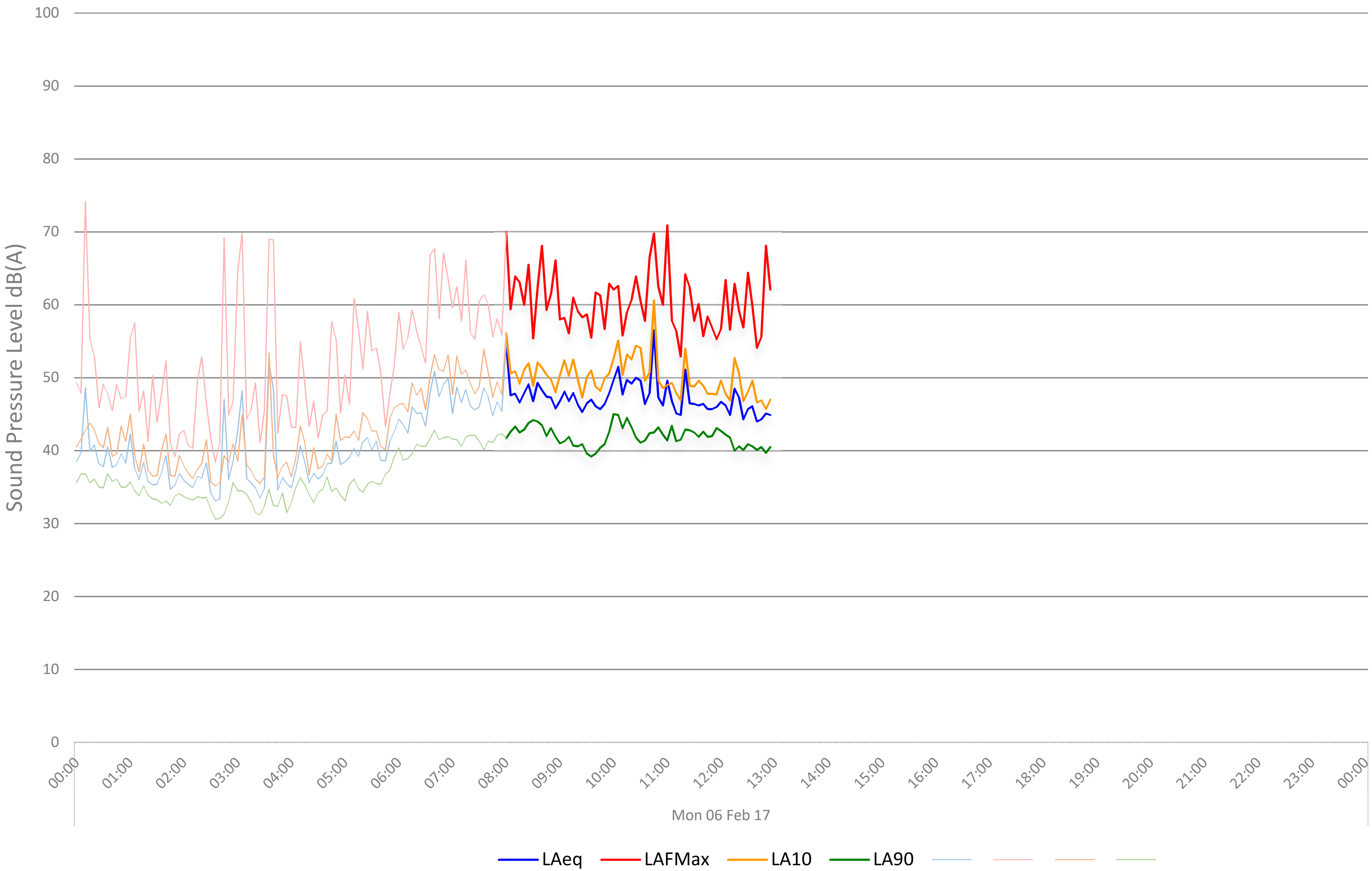


47 Albert Street, Camden

Environmental Noise Time History: 5

Rear Garden

Figure VA1698/TH5



APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	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 (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. 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 a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

APPENDIX B

VA1698 - 47 Albert St, Camden

Assessment to neighbouring properties - 45 & 49 Albert Street

Plant type	Sound Pressure Level	Adjustments					Noise Level at Receptor	Activity $L_{Aeq(10h)}$	High Impact?
		Distance to Receptor	Screening	Reflection	% on time (Ref 10h)	Number of plant			
	$L_{Aeq,T}$ dB	m	dB	dB	%		$L_{Aeq,T}$ dB	dB	
Phase 1: Demolition/Excavation/Foundations (10 weeks)									
Electric Saw	78dB @10m	5	0	0	10	1	84	74	YES
Makita HM 1213C SDS Max Demolition Hammer	67dB @10m	5	0	0	25	2	76	70	YES
AVT Breaker Makita HM 1810	76dB @10m	5	0	0	25	1	82	76	YES
Angle Grinder Makita GA 9020	69dB @10m	5	0	0	10	1	75	65	
Ground Floor Works Cumulative $L_{Aeq(10h)}$ Level								**79**	
Makita HM 1213C SDS Max Demolition Hammer (basement)	67dB @10m	7	-10	3	25	2	66	60	
AVT Breaker Makita HM 1810 (basement)	76dB @10m	7	-10	3	25	1	72	66	
Angle Grinder Makita GA 9020 (basement)	69dB @10m	7	-10	3	10	1	65	55	
Basement Level Works Cumulative $L_{Aeq(10h)}$ Level								**67**	
Phase 2: Concrete/Steel Superstructure (6-weeks)									
Grinder	87dB @10m	5	0	0	2	1	93	76	YES
Hammer Drill	70dB @10m	5	0	0	25	1	76	70	YES
Electric Welder	73dB @10m	5	0	0	10	1	79	69	
Hammering	79dB @10m	5	0	0	3	1	85	70	YES
Cordless Drill/Screwdriver	67dB @10m	5	0	0	20	2	76	69	
Ground Floor Works Cumulative $L_{Aeq(10h)}$ Level								**79**	
Grinder (basement level)	87dB @10m	7	-10	3	2	1	83	66	YES
Hammer Drill (basement level)	70dB @10m	7	-10	3	25	1	66	60	
Electric Welder (basement level)	73dB @10m	7	-10	3	10	1	69	59	
Hammering (basement level)	79dB @10m	7	-10	3	3	1	75	60	YES
Cordless Drill/Screwdriver (basement level)	67dB @10m	7	-10	3	20	2	66	59	
Ground Floor Works Cumulative $L_{Aeq(10h)}$ Level								**69**	

Plant type	Sound Pressure Level $L_{Aeq,T}$ dB	Adjustments: Distance to Receptor (m)	Adjustments: Screening (dB)	Adjustments: Reflection (dB)	Adjustments: % on time (Ref 10h) (%)	Adjustments: Number of plant	Noise Level at Receptor $L_{Aeq,T}$ dB	Activity $L_{Aeq(10h)}$ dB	High Impact?
Phase 3: Envelope Works (3-weeks)									
Paslode Nail Gun	73dB @10m	5	-10	0	2	2	72	55	
Grinder	87dB @10m	5	-20	0	5	1	73	60	
Hammering	79dB @10m	5	-10	0	5	2	78	65	
Hammer Drill	70dB @10m	5	-10	0	20	1	66	59	
							Ground Floor Works Cumulative $L_{Aeq(10h)}$ Level	**67**	
Phase 4: Internal Refurbishment and Landscaping Works (12-weeks)									
Paslode Nail Gun	73dB @10m	7	-20	0	10	2	59	49	
Grinder	87dB @10m	7	-20	0	10	1	70	60	
Hammering	79dB @10m	7	-20	0	20	2	65	58	
Hilti Cordless Drill/Screwdriver	67dB @10m	7	-20	0	20	3	55	48	
Electric Saw	78dB @10m	7	-20	0	5	1	61	48	
							Cumulative $L_{Aeq(10h)}$ Level	**63**	