SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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11 Netherhall Gardens

Residential planning noise report

55 Charterhouse Street, London EC1M 6HA
Piccadilly House, 49 Piccadilly, Manchester M1 2AP
16 West Terrace, South Queensferry EH30 9LL

T: +44 (0)20 7549 3500
T: +44 (0)161 771 2020
T: +44 (0)131 331 2020

post@sandybrown.com
www.sandybrown.com

Sandy Brown Associates LLP
Registered in England & Wales No. OC 307504

Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	27 Sep 12		Robert Burrell	Robin Hall

Summary

Sandy Brown Associates LLP (SBA) has been appointed to carry out an environmental noise survey at 11 Netherhall Gardens. The noise survey was performed between Friday 14 September 2012 and Tuesday 18 September 2012.

The lowest free-field background noise levels measured during the survey were $L_{A90,15}$ 43 dB during the daytime and $L_{A90,15}$ 37 dB at night.

The average ambient noise levels measured during the survey were $L_{Aeq,16h}$ 52 dB during the daytime and $L_{Aeq,8h}$ 47 dB at night.

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 41 dB during the daytime and L_{Aeq} 35 dB during the night.

An initial assessment of the proposed plant items shows that the London Borough of Camden's plant noise criteria can be achieved with appropriate attenuation measures.

Good sleeping and resting conditions in rooms can be achieved with good quality standard double glazing with trickle vents.

Contents

1 Introduction

Sandy Brown Associates LLP (SBA) has been commissioned by Bennett Construction Ltd to undertake an environmental noise survey and assessment in relation to planning for the proposed development at 11 Netherhall Gardens.

The purpose of the survey was to establish the existing ambient and background noise levels in the vicinity of the site and nearby noise sensitive premises.

The background noise levels measured during the survey are used as the basis for setting limits for noise emission from proposed building services plant. These limits are set in accordance with the requirements of the London Borough of Camden.

The facade sound insulation will be assessed in order to determine the necessary performance required to achieve appropriate internal noise levels for residences set in accordance with BS8233:1999 *Sound insulation and noise reduction for buildings – Code of Practice*, World Health Organisation and London Borough of Camden guidelines.

This report presents the noise survey methods, the results of the survey, specification of noise emission from building services plant and minimum sound insulation requirements for the building envelope.

2 Site description

2.1 The site and its surroundings

The site is located at 11 Netherhall Gardens. The site location in relation to its surroundings is shown in Figure 1.

The proposed development is to comprise nine apartments over five levels. The proposed building layout and the plant location are shown in Figure 2.

2.2 Adjacent premises

Directly to the north and south of the site are residential houses along Netherhall Gardens. There are also other residences to the west of the site.

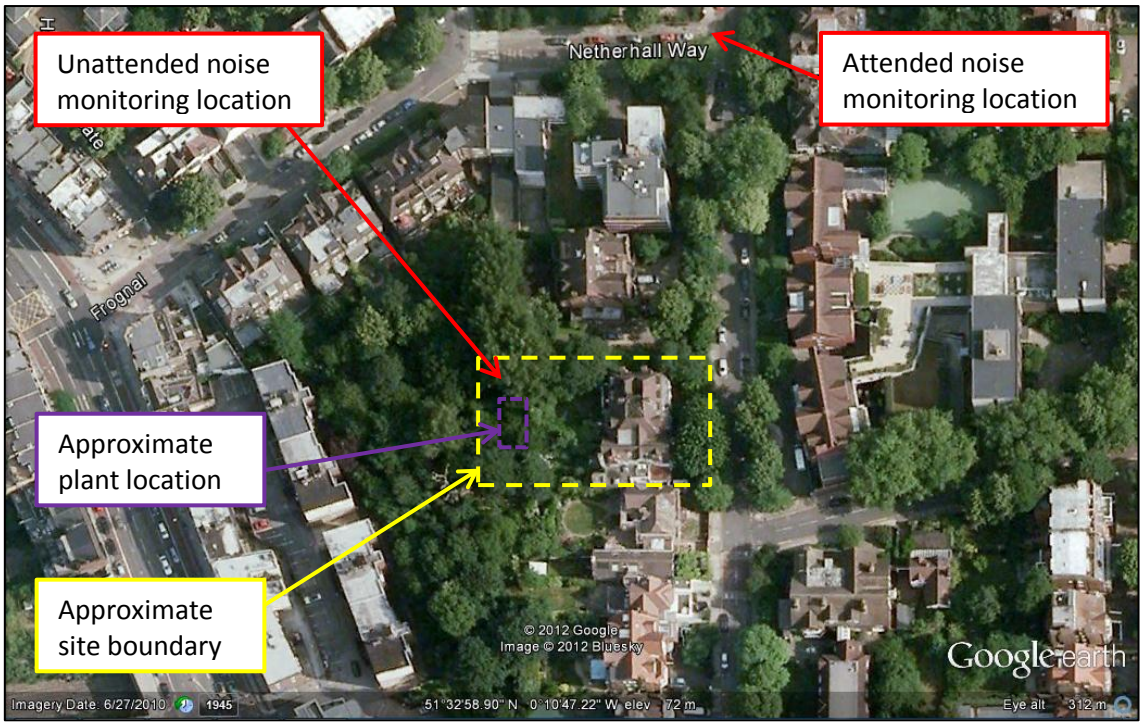


Figure 1 Site, noise monitoring locations and nearest noise sensitive residence (source, Google Earth)

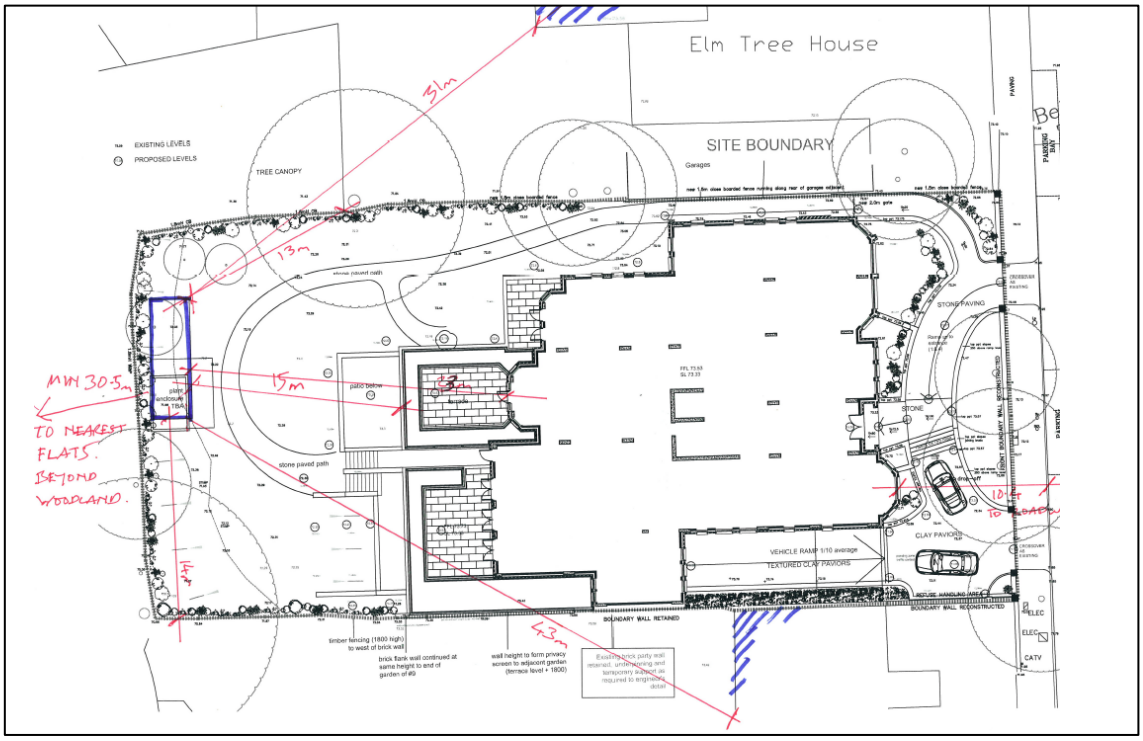


Figure 2 Proposed building layout and the plant location

3 Survey method

3.1 Unattended measurements

A four day unattended continuous noise logging survey was undertaken at the site to determine the existing background noise levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 15 minute periods between 12:49 on Friday 14 September 2012 and 11:19 on Tuesday 18 September 2012.

The microphone was positioned to the rear of the site at a height of approximately 1.5 m above ground level. Levels measured at this position are considered to free-field noise levels.

The measured noise levels at this location in the absence of noise from site activities are considered to be reasonably representative of those experienced by the nearest noise sensitive premise.

The unattended noise measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'.

3.2 Attended measurements

During the survey, construction works were being carried out at the site. In order to obtain equivalent noise levels unaffected by the construction site, measurements were undertaken at a position north of the site. It is considered that noise levels measured at this location are similar to those that are incident on the development site in the absence of construction noise. The measurement position is indicated in Figure 1 denoted by the letter 'S'.

Attended measurements were carried out on Tuesday 18 September 2012 over 15 minute periods.

The microphone was mounted on a tripod approximately 1.5 m above ground level and at least 3 m from any other reflective surface. Levels measured at this position are considered to free-field noise levels.

3.3 Equipment and procedure

The unattended and attended noise measurements were performed using a Rion type NL-52 sound level meter Calibration details of the equipment used during the noise surveys are provided in Appendix A.

The sound level meter and microphone were calibrated at the beginning and end of the measurements using its respective sound level calibrator. No significant deviation in calibration occurred.

3.4 Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{Amax,T}$ The A-weighted maximum sound pressure level that occurred during a given period. Measured using the fast time weighting in accordance with the requirements of BS 8233 : 1999.
- $L_{ASmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period measured with the slow time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background noise level.

The L_{A90} is considered most representative of the background noise level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg, L_{A90} to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

3.5 Weather Conditions

During the unattended noise measurements between Friday 14 September 2012and Tuesday 18 September 2012, weather reports for the area indicated that temperatures varied between 8°C at night and 22°C during the day. The wind speed was typically less than 5 m/s.

During the attended measurements carried out on Tuesday 18 September 2012, the weather was generally clear and dry and no rain occurred.

These weather conditions are considered suitable for representative measurements.

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of construction activities occurring on the 11 Netherhall Gardens site. Other noise sources included infrequent road traffic on Netherhall Gardens and distant traffic on Finchley Road.

4.2 Unattended measurement results

The results of the unattended noise measurements performed at the site are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix B of this report.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 1.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 14 September 2012	-	46
Saturday 15 September 2012	51	45
Sunday 16 September 2012	53	47
Monday 17 September 2012	66	49

Noise from construction activities are likely to have significantly affected the measured L_{Aeq} and L_{Amax} values at the unattended measurement position on Friday 14 September 2012, Monday 17 September 2012 and Tuesday 18 September 2012. Therefore it is not possible to be confident that the daytime L_{Aeq} and L_{Amax} values measured at this position on these days are representative of those when construction activities do not occur. Therefore, attended weekday measurements done in a location unaffected by site activities.

The minimum background noise levels measured during the unattended survey are given in Table 2.

Table 2 Minimum background noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Friday 14 September 2012	44	38
Saturday 15 September 2012	43	37
Sunday 16 September 2012	44	37
Monday 17 September 2012	46	41
Tuesday 18 September 2012	49	

The lowest background noise levels measured during the survey were $L_{A90,15min}$ 43 dB during the daytime and $L_{A90,15min}$ 37 dB at night.

The lowest measured background noise level was $L_{90,15min}$ which occurred during the daytime at 22:49 on Saturday 15 September 2012 and during the night time at 03:49 on Monday 17 September 2012. There was no construction activity on site when these noise levels were measured.

4.3 Attended measurement results

Attended measurements were performed at one location on Netherhall Gardens to the north of the site that was unaffected by noise from the site on Tuesday 18 September 2012. The sound pressure levels measured during these measurements are summarised in Table 3.

Table 3 Sound pressure levels from attended measurements

Start time	Sound pressure levels (dB)		
	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A90,15min}$
11:50	56	73	48
12:06	54	69	49
12:22	53	72	47

The dominant noise source at the measurement position was road traffic on Netherhall Gardens. The distance of the road from the measurement position was approximately 2 m. The proposed front façade of 11 Netherhall Gardens is to be set back from the road at a distance of approximately 10 m. The noise levels at the front façade of 11 Netherhall are likely to be similar to the free-field levels measured at this position.

5 Assessment criteria

5.1 NPPF and NPSE

The National Planning Policy Framework (NPPF) sets out the government planning requirements, and supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

'Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable*

restrictions put on them because of changes in nearby land uses since they were established; and
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

The NPSE states that its aims are as follows:

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

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.'*

As such, although neither of these documents sets out specific acoustic criteria for new residential development, the requirement to control both the effect of existing noise on the new development and the effect of noise from the development on the surroundings needs to be considered.

5.2 External noise levels – noise egress

5.2.1 Standard guidance

Standard guidance for noise emission from proposed new items of building services plant etc is given in BS4142: 1997 *Method for rating industrial noise affecting mixed residential and industrial areas*.

BS4142 provides a method for assessing noise from items such as building services plant against the existing background noise levels at the nearest noise sensitive receptors to assess the risk of complaints occurring.

BS4142 suggests that if the rating noise level is 10 dB or more higher than the existing background noise level, complaints are likely. If the rating level is 5 dB above the existing background noise level, it is considered of marginal significance. If the rating level is 10 dB or more below the existing background noise level, this is considered a positive indication that complaints are unlikely.

If the noise contains 'attention catching features' such as tones, bangs etc, these limits should be reduced by a further 5 dB.

5.2.2 Local Authority requirements

According to the London Borough of Camden Unitary Development Plan, plant noise limits should be set 5 dB below the existing background noise level, at the nearest noise sensitive premises, over the proposed hours of operation.

Figure 1 shows the buildings closest to the development site; Figure 2 shows the proximity of the proposed plant enclosure to the nearest neighbouring properties. The closest residence is approximately 30 metres from the site of the proposed plant.

5.3 Internal noise levels – noise ingress

5.3.1 Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS8233 *Sound insulation and noise reduction for buildings – Code of Practice*, and is also provided by the World Health Organisation (WHO). This guidance is shown in Table 4.

Table 4 Internal noise criteria for sleeping/resting

Internal space	Design range, L_{Aeq} (dB)		
	BS8233 "Reasonable"[1]	BS8233 "Good"[1]	WHO
Living rooms	40	30	30/35[2]
Bedrooms[3]	35	30	30[2]

[1] The design range given in BS8233 refers to criterion for "reasonable resting/sleeping conditions" in both living rooms and bedrooms. No time periods are specified.

[2] WHO does not differentiate between different types of living spaces, but recommends L_{Aeq} 30 dB in relation to sleep disturbance and L_{Aeq} 35 dB in relation to speech intelligibility. WHO provides a 16 hour time base when referring to speech intelligibility and an 8 hour time base when referring to sleep disturbance.

[3] BS8233 indicates that individual noise events should not normally exceed L_{Amax} 45 dB during night time, which is broadly in line with the guidance given by the WHO. However, Section 3.4 of the WHO guidelines suggests that good sleep will not generally be affected if internal levels of L_{Amax} 45 dB are not exceeded more than 10-15 times per night.

6 Plant noise assessment – noise egress

Free field noise levels were measured during the continuous noise logging survey. Therefore, the background façade noise levels (1 m from the facade) are taken to be3 dB higher than these.

Based on the above criterion in 5.2.2 and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the most affected windows of the nearest noise sensitive premises should not exceed the noise levels in Table 5.

Table 5 Plant noise limits at the nearest noise sensitive premises

Time of day	Maximum sound pressure level at noise sensitive premises, $L_{Aeq,T}$ (dB)
Daytime (07:00-23:00)	41
Night-time (23:00-07:00)	35

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit 5 dB below those set out above.

6.1 Assessment

Two EWAYQ064BAW Daikin air source heat pumps are to be installed in a masonry enclosure located as indicated in Figure 1 and Figure 2. The sound power performance data for the heat pumps is given in Table 4.

Table 4. octave frequency band sound pressure levels for air source heat pumps

Plant item	Octave frequency band sound power level (dB)							A-weighted sound power level (dB)
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
EWAYQ064BAW	87	83	83	78	71	66	65	83

The plant is approximately 30 m from the nearest residential window. Assuming hemispherical sound propagation outlined in BS EN ISO 3746, the calculated reduction in noise over the 30 m distance is 30 dB.

The calculated noise level at 1 metre from the worst effected façade without additional attenuation is L_{Aeq} 43 dB; to meet night time plant noise criterion given in Section 5.2.2 the plant noise level must be no greater than L_{Aeq} 35 dB. Therefore additional attenuation is required is the preferred plant is to be installed.

The calculations assumed that the heat pumps were located 1 m from the walls of their enclosure and that their acoustic centre was 0.5 m below the top of the enclosure walls. Also that there is no roof on the enclosure. It is reasonable to assume that the acoustic centre of each pump (the virtual location that is assumed to be the source of the noise generated) is 2/3rds of the pump's height above its base.

6.1.1 Mitigation option 1

To achieve the necessary attenuation by screening, the pumps' acoustic centres should be at least 2 m below the height of the enclosure walls or acoustic louvres should be used to attenuate the noise.

It may be expensive to excavate a deeper enclosure or to build its walls sufficiently high to give sufficient noise reduction.

6.1.2 Mitigation option 2

Acoustic louvres can provide sufficient reduction in noise breakout. Using IAC type SL-300 louvres to cover the top of the plant would reduce the plant noise sufficiently assuming that the acoustic centre of the heat pumps is 0.5 m below the top of the enclosure walls.

The calculated noise levels at the closest sensitive window to the plant enclosure with the two options for providing the necessary noise attenuation are given in Table 6. It should be noted that if the plant enclosure could have a substantial roof such as a concrete roof, the louvres could be located in the sides of the enclosure if this would allow the plant to operate efficiently.

Table 6 calculated noise level at nearest bedroom window with additional attenuation

Attenuation method	Sound pressure level at noise sensitive premises, $L_{Aeq,T}$ (dB
Mitigation option 1 - Walls 2 m above pump acoustic centre	35
Mitigation option 2 - Acoustic louvres	32

Appendix C gives details of the attenuation provided by the two options. Table C3 in Appendix C gives the sound reduction of the louvres to allow consideration of other suppliers louvres.

7 Facade sound insulation – noise ingress

This section discusses internal noise level criteria and assesses the required facade sound insulation performance. In principle, the required facade specification depends on two factors – the external noise levels at the site, and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS8233, which are set out in Section 5.3.

7.1 External noise levels

In order to allow an assessment of the worst case scenario, the highest noise levels provided in Table 1 have been used to assess noise ingress on at the rear of the property. Only data that has not been affected by the construction activities on site have been used.

The noise levels measured during the manned noise survey have been used to assess noise ingress on at the front of the property.

On this basis, the predicted external noise levels at the various facades of the proposed development are considered to be $L_{Aeq,16h}$ 56 dB during the daytime and $L_{Aeq,16h}$ 52 dB during the night time.

7.2 Facade sound insulation

To achieve the BS8233 'good' internal noise criteria given in section 5.3 for bedrooms and other living areas, the minimum facade sound insulation requirement is R'_w+C_{tr} 26 dB.

Table 7 sets out some examples of glazing build ups and ventilation strategies that could be employed to achieve the required sound insulation performance for the various elevations.

Table 7 Example glazing configurations and ventilation strategies

Sound insulation R'_w+C_{tr} (dB)	Example glazing configuration	Ventilation Strategy
≤10	6 mm/12 mm/6 mm	Open windows
10-15	6 mm/12 mm/6 mm	Limited open area opening windows
15-29	6 mm/12 mm/6 mm	Attenuated passive ventilation (eg, trickle vents)
30-32	6.4 mm/12 mm/6 mm	Attenuated passive ventilation
33-35	6.4 mm/12 mm/10 mm	High performance acoustically attenuated passive ventilation

The attenuation of sound provided by an open window is typically in the region of 10 to 15 dB when located in a solid facade, depending on the open area. As such, where the required facade sound insulation performance is less than R'_w+C_{tr} 10 dB, it is likely that opening windows can be used whilst achieving the necessary internal noise levels.

In areas where the necessary facade sound insulation is between R'_w+C_{tr} 10 and 15 dB, partially open windows may be used for ventilation purposes depending on the open area.

The performance required by each element will depend on the construction of the solid elements, the glazing specification, the relative areas of the solid and glazed elements, and the ventilation strategy (including the acoustic performance of the trickle ventilators and the number of ventilators required to serve individual rooms, if applicable).

The use of standard double glazing should achieve the minimum facade sound insulation requirement of R'_w+C_{tr} 26 dB.

8 Conclusion

The minimum measured free-field background noise levels were $L_{A90,15min}$ 43 dB during the day, and $L_{A90,15min}$ 37 dB during the night.

On the basis of the requirements of the London Borough of Camden, the relevant plant noise limits at 1 m from the worst affected existing noise sensitive premises would be L_{Aeq} 41 dB during the day and L_{Aeq} 35 dB during the night. These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be 5 dB more stringent than those set out above.

An initial assessment of the proposed plant items shows that the London Borough of Camden's plant noise criteria can be achieved with appropriate attenuation measures.

Good sleeping and resting conditions in rooms can be achieved with good quality standard double glazing with trickle vents.

Appendix A

Equipment calibration information

The calibration data for the equipment used during the survey is provided below.

Table B1 Equipment calibration data

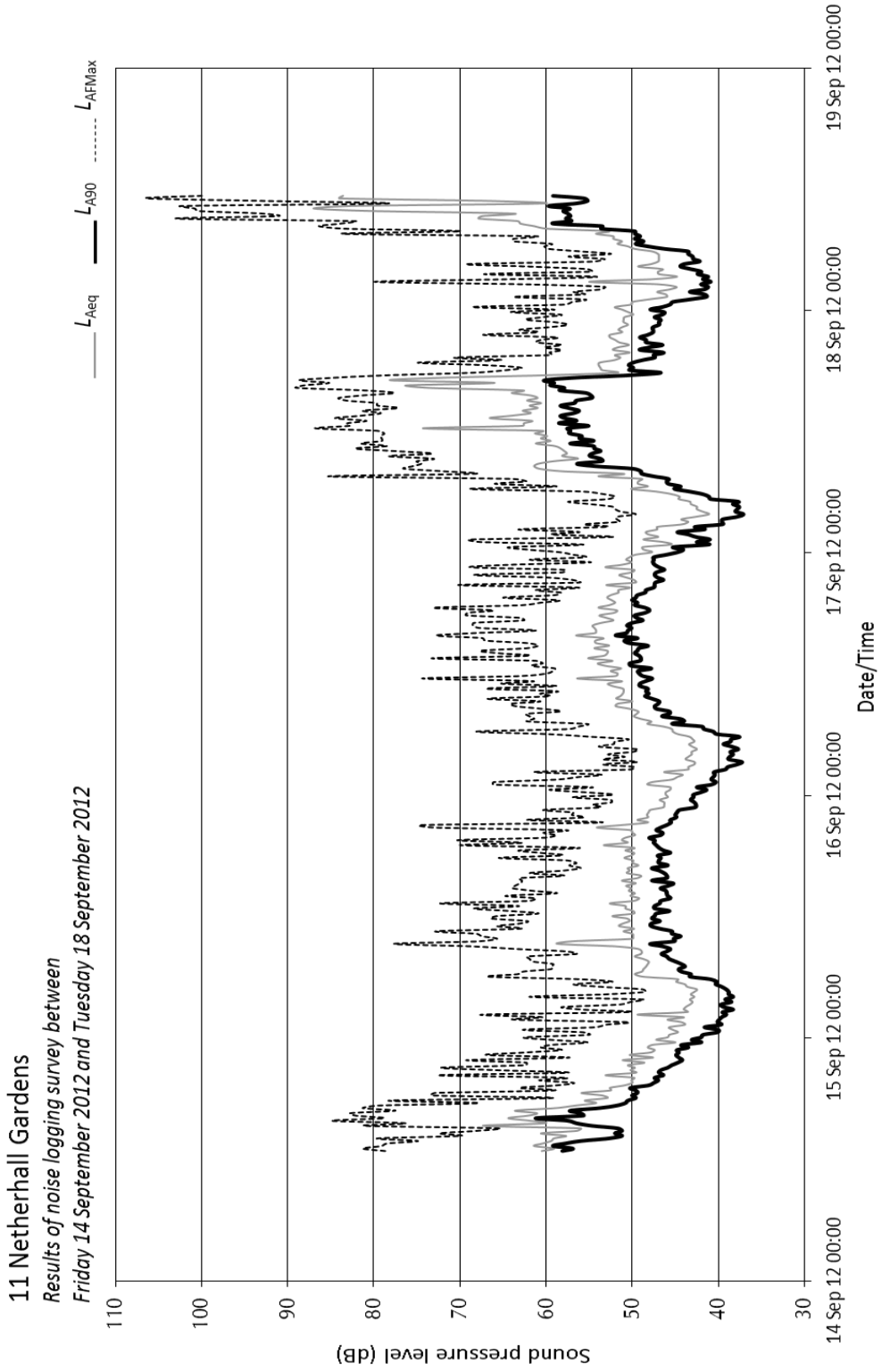
Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52 / 00320633	Rion	12/04/14	1204155
Microphone	UC-59 / 03382	Rion	12/04/14	1204155
Pre-amplifier	NH-25 / 10641	Rion	12/04/14	1204155
Calibrator	N7-74 / 34125430	Rion	12/04/14	1204151

The calibration certificates for the equipment stated above are available upon request.

Calibration of the sound level meter used for the measurement is traceable to national standards. The sound level meter and the respective measurement chain were calibrated at the beginning and end of the measurements using its respective sound level calibrator. No significant calibration deviation occurred.

Appendix B

Results of unattended measurements at 11 Netherhall Gardens


11 Netherhall Gardens
Results of noise logging survey between
Friday 14 September 2012 and Tuesday 18 September 2012
L_{Aeq}
L_{A90}
L_{AFMax}
Sound pressure level (dB)
110
100
90
80
70
60
50
40
30
14 Sep 12 00:00
15 Sep 12 00:00
16 Sep 12 00:00
17 Sep 12 00:00
18 Sep 12 00:00
19 Sep 12 00:00
Date/Time

Appendix C

External plant noise

Figure C1 Manufactures plant noise data

Models LWE=7°C / Tamb=35°C	125	250	500	1000	2000	4000	8000	Total (dBA) LwA
EW(A/Y)Q016BAW*	84	79	76	73	67	65	61	78
EW(A/Y)Q021BAW*	84	80	77	73	66	60	53	78
EW(A/Y)Q025BAW*	84	80	77	73	66	60	53	78
EW(A/Y)Q032BAW*	84	80	80	75	68	63	62	80
EW(A/Y)Q040BAW*	87	83	80	76	69	63	56	81
EW(A/Y)Q050BAW*	87	83	80	76	69	63	56	81
EW(A/Y)Q064BAW*	87	83	83	78	71	66	65	83

Table C1 Calculation of noise egress from proposed plant

	Octave band centre frequency (Hz)									
Calculation 1 - Proposed	63	125	250	500	1K	2K	4K	8K	(A)	Comments
Sound power level	-	87	83	83	78	71	66	65	83	EWAYQ064BAW
Correction for number of plant	3	3	3	3	3	3	3	3		2 Units
SWL >SPL correction	-8	-8	-8	-8	-8	-8	-8	-8		Hemi-spherical radiation
Distance Attenuation	-30	-30	-30	-30	-30	-30	-30	-30		Point source distance attenuation
Barrier Attenuation	-9	-11	-14	-17	-20	-23	-24	-24		Maekawa's equation (path difference = 0.841)
Façade correction	3	3	3	3	3	3	3	3		
Attenuation	0	0	0	0	0	0	0	0		
Total sound pressure level	-41	44	37	35	27	17	10	9	35	

Table C2 Calculation of noise egress with mitigation option 1 - Walls 2 m above pump acoustic centre

	Octave band centre frequency (Hz)									
Calculation 2 - Mitigation Option 1	63	125	250	500	1K	2K	4K	8K	(A)	Comments
Sound power level		87	83	83	78	71	66	65	83	EWAYQ064BAW
Correction for number of plant	3	3	3	3	3	3	3	3		2 Units
SWL >SPL correction	-8	-8	-8	-8	-8	-8	-8	-8		Hemi-spherical radiation
Distance Attenuation	-30	-30	-30	-30	-30	-30	-30	-30		Point source distance attenuation
Barrier Attenuation	-9	-11	-14	-17	-20	-23	-24	-24		Maekawa's equation (path difference = 0.841)
Façade correction	3	3	3	3	3	3	3	3		
Attenuation	0	0	0	0	0	0	0	0		
Total sound pressure level	-41	44	37	35	27	17	10	9	35	

Table C3 Calculation of noise egress with mitigation option 2- acoustic louvres

	Octave band centre frequency (Hz)									
Calculation 3 - Mitigation Option 2	63	125	250	500	1K	2K	4K	8K	(A)	Comments
Sound power level		87	83	83	78	71	66	65	83	EWAYQ064BAW
Correction for number of plant	3	3	3	3	3	3	3	3		2 Units
SWL >SPL correction	-8	-8	-8	-8	-8	-8	-8	-8		Hemi-spherical radiation
Distance Attenuation	-30	-30	-30	-30	-30	-30	-30	-30		Point source distance attenuation
Barrier Attenuation	-6	-6	-7	-9	-11	-13	-16	-19		Maekawa's equation (path difference = 0.09)
Façade correction	3	3	3	3	3	3	3	3		
Attenuation		-7	-10	-12	-18	-18	-14	-13		IAC SL-300 Acoustic Louvre
Total sound pressure level	-37	42	34	31	18	8	4	1	32	