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Project:

1 Norfolk Road

Title:

Plant Noise Impact Assessment



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1 INTRODUCTION

- 1.01 Environmental Equipment Corporation Limited has been commissioned by Mr Richard Lister to undertake a noise assessment of two condenser units to serve a residential dwelling at 1 Norfolk Road.
- 1.02 This noise assessment has been conducted in accordance with the policies and requirements of The London Borough of Camden Council (LBCC) and, in light of the ongoing Covid-19 restrictions in the UK, adopts the *Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments by the Association of Noise Consultants [ANC] and the Institute of Acoustics [IOA] Version 6* dated 12th January 2021.
- 1.03 This assessment includes a description of relevant metrics by which to determine the impact of proposed plant noise at the most affected noise sensitive receivers; this includes an assessment using LBCC's "traffic light system" as well as adopting guidance from National Planning Policy Framework, the World Health Organisation, and BS8233:2014.
- 1.04 This report is prepared solely for Mr Richard Lister. Environmental Equipment Corporation Limited accepts no responsibility for its use by any third party.

Note that the contents contained herein are produced for the purposes of review by relevant Planning Authority departments and do not constitute a detailed design or specification document to be used for the purposes of construction. Subsequent development of noise mitigation schemes shall engage EEC Ltd and the Project Design Team so as to support the conclusions of this report.

- 1.05 Whilst every effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in Appendix A.

2 SITE

2.01 This application is for proposed plant items to serve a residential house at 1 Norfolk Road. The external areas of the property are currently under construction and the proposal is to locate the mechanical services plant items on the ground-floor at the west elevation of the property. At this boundary there is a 2 m high solid brick wall.

The site is located in a residential area of St John's Woods London, NW8 6AX.

2.02 At present, 1 Norfolk Road is a detached three-storey residential house. The property is bound by the following:

- North – Gardens of adjacent residential properties of Queen's Grove;
- East – A residential property of 1a Norfolk Road;
- South – Norfolk Road and residential properties beyond; and
- West – A residential property of 2 Norfolk Road.

The boundaries of the site are indicated in Appendix B.

2.03 The most affected noise sensitive receptors to the proposed plant items are the first-floor windows in the eastern-elevation of 2 Norfolk Road. These windows will be less screened from the plant location than closer windows at ground floor level.

2.04 All other noise sensitive receptors are at a greater distance from the proposed location of the units, or are protected by more screening by the intervening structures, and as such will be subject to lower levels of noise from the proposed plant.

3 GUIDANCE

3.01 Local and National Planning Policy for London Borough of Camden Council (LBCC) is presented in Appendix C of this document.

Local Planning Policy & NPPF

3.02 LBCC's Local Plan outlines a framework within which the Authority assesses the acceptability of mechanical services noise as it affects existing residential amenity. Proposals are categorised using a traffic light system as follows:

- **Green** Where noise is considered to be at an acceptable level
(plant noise is -10dB with respect to the background noise level)
LOAEL
- **Amber** A range over which the impact of the noise could be considered adverse to varying degrees though maybe acceptable when considered in context
(plant noise ranges between -5dB to +5dB with respect to the background noise level)
LOAEL - SOAEL
- **Red** Where noise is observed to have a significant adverse effect
(plant noise is greater than 5dB above the background noise level)
SOAEL

3.03 Plant noise levels are assessed in accordance with *BS4142:2014: 'Methods for rating and assessing industrial and commercial sound'*.

3.04 It is noted that normally, where plant noise is 10 dB or more less than the background noise, this is usually considered as the NOEL (no observed effect level) rather than LOAEL (lowest observed adverse effect level). In the context of the background noise the LOAEL is commonly adopted as the point at which the introduction of a new noise would lead to a background increase greater than 1 dB, however such incremental changes are not generally perceptible in the general population so the impact of such a change would be considered to be 'minor' in the short term and 'negligible' in the long term.

World Health Organisation

- 3.05 Further guidance is offered by *World Health Organisation (WHO) 'Night Noise Guidelines for Europe – 2009'* which includes guidance on the effects of external night time noise on the population's health. Table 5.4 of that document (Included in Appendix C) outlines the health effects associated with different external average, yearly night time (2300 – 0700 hrs) noise levels based on levels outside of bedroom windows ($L_{\text{night,outside}}$).

For external levels up to 30 dB(A), although individual sensitivities and circumstances may differ, no substantial biological effects are observed. Thus, 30 dB(A) is also equivalent to the No Observed Effect Level (NOEL) for night noise.

BS8233:2014, 'Guidance on sound insulation and noise reduction for buildings'

- 3.06 *BS8233:2014 Guidance on sound insulation and noise reduction for buildings* offers guidance on internal noise levels in habitable rooms from external sources. Table 4 within that document, reproduced below, describes desirable internal ambient noise levels for dwellings.

Table 4 Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{\text{Aeq,16hour}}$	—
Dining	Dining room/area	40 dB $L_{\text{Aeq,16hour}}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{\text{Aeq,16hour}}$	30 dB $L_{\text{Aeq,8hour}}$

- 3.07 *BS8233:2014* also states that a typical loss for noise passing through a partially open window is 10 - 15 dB.

4 MEASUREMENTS

- 4.01 Environmental noise measurements were carried out over a weekday period, between 0930 hours on Tuesday 4th September 2018 and concluded 0830 hours the following day, to establish the noise levels at the site.

This survey was taken less than three years prior of writing this report which is considered within the typical validity period for background noise survey data. Ideally, more recent background noise data would be used for the purposes of this assessment, however, in-light of the ongoing Covid-19 Pandemic and Government lockdown restrictions active at the time of writing this report, it is considered that any noise data collected during this period is unlikely to be representative.

Subjective impressions on site, as well as interrogating more recent noise data collected in the vicinity by other acoustic consultancy practices, verify that the noise climate has not changed significantly, and the use of data presented in this report remains robust.

- 4.02 The survey methodology and results are set out below.
- 4.03 Noise measurements have been carried out at the following position, as shown in Appendix B and described as being located on the first-floor-level scaffolding on the western elevation of the property approximately 1.5 metres from the scaffold deck. The measurement was not located within 3.5 metres of any reflecting surfaces other than the mounting surface.
- 4.04 This position is considered to be representative of the nearest windows to the proposed plant items.

5 EQUIPMENT

5.01 The equipment used for the survey was as follows:-

- 01dB Metravib Black Solo Integrating Sound Level Meter conforming to Class 1 BS EN 61672, Type 1 BS EN 60804 & BS EN 60651: 1994;
- 01dB Metravib MCE 212 Condenser Microphone, PRE 21 S Pre-amp and Connecting Leads;
- 01dB Outdoor Microphone Kit; and
- a Tripod.

5.02 At the time of the survey, the equipment held UKAS or equivalent accreditation as follows (and relevant serial numbers)

Sound Level Meter 01dB Black Solo	Serial No.	65736
	Calibration Date	11 th August 2017
	Cal Certificate No.	U26342
½" MCE 212 Condenser Mic.	Serial No.	175307
	Calibration Date	11 th August 2017
	Cal Certificate No.	26341
Calibrator CAL 21	Serial No.	34634297
	Calibration Date	24 th October 2016
	Cal. Certificate No.	U22947

N.B. Copies of calibration certificates are available upon request.

5.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

6 RESULTS

6.01 The weather during the survey was suitable for noise measurement, it being dry with little wind for the duration of the survey.

Noise sources at the site included construction activity on site between the hours of 0730 to 1630. These noise sources are identified to impact the average L_{Aeq} but have not in any way affected the measured minimum L_{A90} as all activity and machinery noise ceased outside site hours.

Besides construction activity, noise sources included local and distant road traffic.

6.02 A list of the levels measured is included in Appendix D and represented graphically in Appendix E.

6.03 A summary of the time averaged ambient levels and lowest measured background levels over the measurement periods are shown in Table 6.1. The minimum L_{A90} is the lowest fifteen-minute measurement in the specified period.

Position	Period	Average $L_{Aeq,T}$ – dB	Minimum L_{A90} – dB
First-floor level at west of property	Day time (0700-1900 hrs)	64	46
	Evening (1900-2300 hrs)	50	43
	Night-time (2300-0700 hrs)	47	35

Table 6.1: Free-Field Measured Ambient and Lowest Background Noise Levels

7 PLANT NOISE IMPACT ASSESSMENT

7.01 It is proposed that two condenser units are installed at a walkway to the southwest of 1 Norfolk Road.

7.02 The proposed units have the following manufacturers stated noise levels:

Mitsubishi PUHY-P650YSNW-A: 86 dB(A) Sound Power level

Mitsubishi PUHZ-ZRP71KVA2: 48 dB(A) Sound Pressure Level at 1 m (heating mode)

Copies of the manufacturer's plant data sheets are included in Appendix F. The proposed units display none of the characteristics whereby an acoustic feature correction should be applied.

7.03 The PUHY-P650YSNW condenser unit will be housed within a purpose-built high-performance attenuated acoustic enclosure designed to reduce the peak noise emissions by 24 dB(A). The unit will also be set to operate with a low noise mode during the night time hours (2300 – 0700) reducing the maximum sound power level to 78 dB(A).

The PUHZ-ZRP71 condenser unit will be housed within an acoustic panelwork enclosure designed to reduce peak noise emissions by 16 dB(A).

The boundary wall opposite the installed condensers will include Class A acoustic wall lining.

7.04 Predicted noise levels have been calculated at the most affected noise sensitive windows, the first-floor eastern-elevation windows of 2 Norfolk Road.

7.05 Other residential receptors located further from the site will be subject to lower noise levels than those predicted at the above locations.

7.06 Tables 7.2 – 7.4 present the results of worst-case plant noise predictions at the worst-case locations.

Item	Noise Level		Notes
	Day/ Evening	Night	
<i>Mitsubishi PUHY-P650YSNW-A</i>	86 dB(A)	78 dB(A)	Sound Power Level
Bespoke high-performance noise control	- 24 dB		EEC attenuated acoustic enclosure
Barrier Effect	- 5 dB		Grazing line of sight to proposed plant location
Conformal area Losses over 6 metres	- 28 dB		Distance to most affected window
Reflections	+ 6 dB		Reverberant build up between building façade and boundary wall
Acoustic absorption	- 3 dB		Acoustic wall lining to boundary wall
Total Noise Level	32 dB(A)	24 dB(A)	2 Norfolk Road

Table 7.2: First-floor eastern-elevation windows of 2 Norfolk Road Plant Noise Calculation

Item	Noise Level	Notes
<i>Mitsubishi PUHZ-ZRP71KVA2</i>	48 dB(A)	Sound Pressure Level at 1 m
Noise control	- 16 dB	EEC acoustic panelwork enclosure
Barrier Effect	- 5 dB	Grazing line of sight to proposed plant location
Conformal area Losses over 6 metres	- 13 dB	Distance to most affected window
Reflections	+ 6 dB	Reverberant build up between building façade and boundary wall
Acoustic absorption	- 3 dB	Acoustic wall lining to boundary wall
Total Noise Level	17 dB(A)	2 Norfolk Road

Table 7.3: First-floor eastern-elevation windows of 2 Norfolk Road Plant Noise Calculation

Item	Noise Level	
	Day/ Evening	Night
<i>Mitsubishi PUHY-P650YSNW-A</i>	32 dB(A)	24 dB(A)
<i>Mitsubishi PUHZ-ZRP71KVA2</i>	17 dB(A)	17 dB(A)
Total Cumulative Plant Noise Level	32 dB(A)	25 dB(A)

Table 7.4: First-floor eastern-elevation windows of 2 Norfolk Road Plant Noise Calculation

- 7.07 Putting the above calculated plant noise into context using relevant guidance discussed in Section 3 of this report, the following should be considered.
- 7.08 Based on the standard requirements of LBCC and as described in sections 3.02 – 3.04, the LOAEL or **Green** rating is achieved when plant noise is at least 10 dB below the lowest measured background noise level in each time period.
- 7.09 In accordance with NPPF achieving 10 dB below the background equivalent to the NOEL.
- 7.10 As discussed in section 3.05, in accordance with the WHO ‘*Night Noise Guidelines for Europe – 2009*’ the NOEL equivalent is achieved when night time noise does not exceed 30 dB(A).
- 7.11 Adopting the most stringent interpretation of BS8233:2014 by assuming every room in the neighbouring property is a habitable bedroom with sound transmission losses through an open window limited to 10dB, in order to maintain internal ambient noise levels of 35 dB $L_{Aeq,16hr}$ (daytime/evening) and 30 dB $L_{Aeq,8hr}$ (night time) external noise must not exceed 45dBA and 40dBA during these respective periods.
- 7.12 The following table summarises the calculated plant noise emission levels for the day/evening and night time periods and compares them to the background noise and compliance with the relevant standards, guidance and policy discussed above.

Period	Measured Existing $L_{A90,T}$	Calculated Plant Noise Level at Receiver L_{eq}	LBCC rating system		WHO Guideline levels		BS8233 Noise Limit L_{Ar} (external)	
			Calculated noise relative to background	LBCC Rating	Guideline levels	Compliance	Guideline levels	Compliance
Day	46 dB	32 dB(A)	- 14 dB	Green	-	N/A	45 dB	✓
Evening	43 dB	32 dB(A)	- 11 dB	Green	-	N/A	45 dB	✓
Night	35 dB	25 dB(A)	- 10 dB	Green	30 dB	✓	40 dB	✓

Table 7.5: Plant noise compliance

7.13 Assuming that the proposed plant and noise control equipment and measures specified in section 7.03 are included in the installation, the below ratings are achieved at the most affected noise sensitive receptors:

Local Planning Policy In accordance with LBCC's policy the assessed noise levels would fall in to the category '**Green** - *Where noise is considered to be at an acceptable level (plant noise is -10dB with respect to the background noise level) LOAEL.*

NPPF In accordance with NPPF, the assessed noise would be classified as being below the No Observed Effect Level or NOEL.

WHO In accordance with the WHO, the assessed noise would be considered equivalent to the NOEL.

BS8233 In accordance with BS8233:2014 the assessed noise results in internal noise levels at most affected noise sensitive window that are suitable for sleeping or daytime resting between 0700 – 2300 hrs and sleeping or use as a bedroom between 2300 – 0700 hrs.

8 CONCLUSIONS

- 8.01 Mr Richard Lister has appointed Environmental Equipment Corporation Limited to undertake a noise assessment for two proposed condenser units to serve a residential dwelling at 1 Norfolk Road.
- 8.02 The assessment has been based on relevant metrics based on the requirements of the LBCC, and adopts guidance from National Planning Policy Framework, the World Health Organisation and British Standard BS8233:2014. This is based on an environmental noise survey conducted at the site over a mid-week period.
- 8.03 A noise assessment has been undertaken to evaluate the potential noise impact of the proposed condensers at the most affected existing residential receptors using guidance from relevant standards.
- 8.04 Plant noise ratings have been assessed based on the methodology contained in BS4142. Using the results of a background noise survey and based on the “traffic light” metric adopted by LBCC, the noise has been controlled and achieve a ‘Green’ rating.
- 8.05 Predictions have shown that the ‘Green’ rating is achieved at all assessment locations during all periods of the condenser’s proposed operation, assuming, noise control equipment and measures specified in section 7.03 are installed and implemented.
- 8.06 Assessing the site in accordance with the principles of the National Planning Policy Framework and the WHO has shown that predicted noise levels would be below the level at which no effects are observed to occur, the NOEL.
- 8.07 Assessing the noise ingress in through the neighbouring residential property windows, in accordance with BS8233:2014, has shown that predicted noise levels are sufficient to allow habitation for use of for sleeping or daytime resting between 0700 – 2300 hrs and sleeping or use as a bedroom between 2300 – 0700 hrs.
- 8.08 On the basis of this assessment it is considered that noise does not pose a material constraint to the operation of the condenser units.

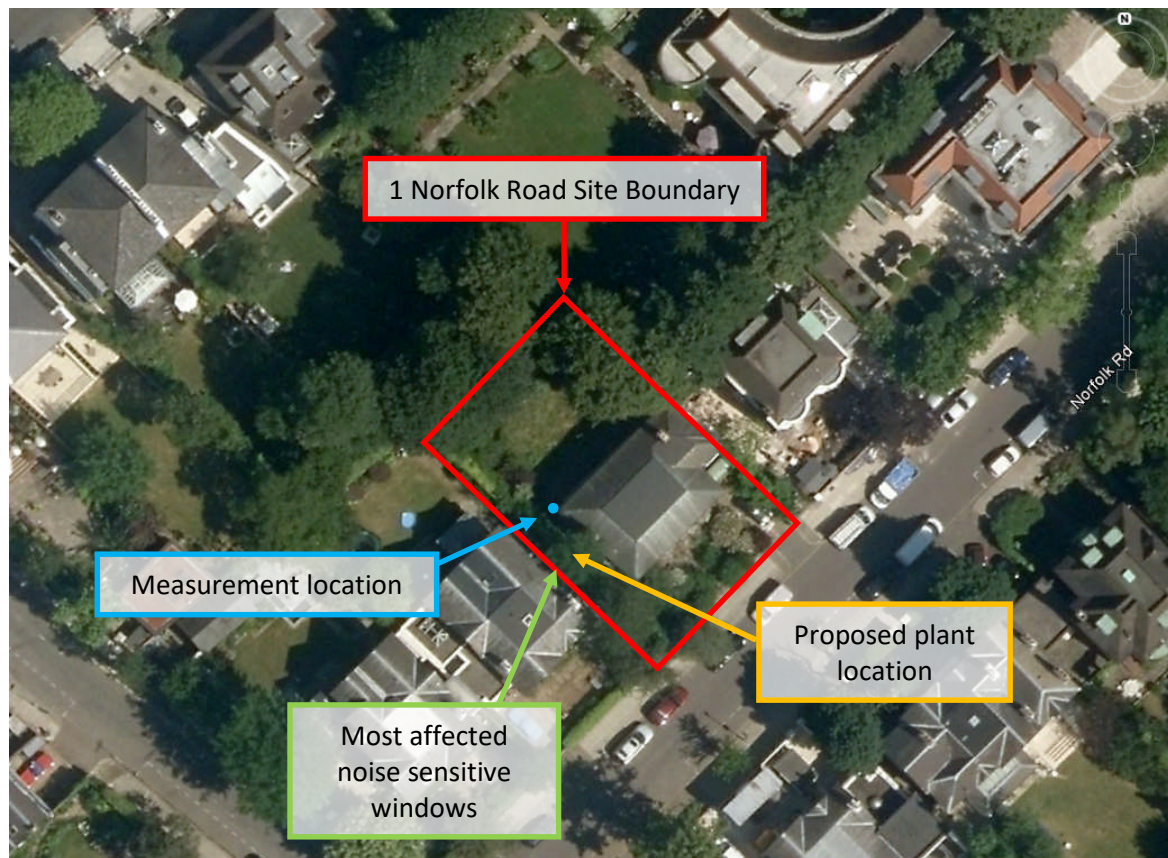
APPENDIX A
GLOSSARY OF TECHNICAL TERMS

ACOUSTIC TERMINOLOGY

Absorption Classes	The sound absorption of a material is rated from Class A to Class E, where Class A materials provide the highest level of sound absorption.
Ambient Noise Levels	Noise levels measured in the absence of noise requiring control, frequently measured to determine the situation prior to the additional of a new noise source.
dB	Decibel. The logarithmic unit of sound level.
dBA	A-weighted decibel. The A-weighting approximates the response of the human ear.
$D_{nT,w}$	Weighted standardized level difference. A single number quantity of the sound level difference between two rooms. $D_{nT,w}$ is typically used to measure the on-site sound insulation performance of a building element such as a wall, floor or ceiling. Measured in accordance with BS EN ISO 16283-1 and weighted in accordance with BS EN ISO 717-1.
$D_{n,e,w}$	The weighted element-normalized level difference. A single number rating of the sound reduction provided by a sound passing through an individual element. $D_{n,e,w}$ is typically used to define the sound insulation provided by ventilators. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Flanking	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4kHz, roughly equal to the range of frequencies on a piano.
Impact Sound	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
$L_{Aeq,t}$	The equivalent continuous sound level measured in dBA. This is commonly referred to as the average noise level. "t" is the interval time for the measurement which is most often 30 minutes when demonstrating compliance with BB93.
$L_{A90,t}$	The noise level exceeded for 90% of the measurement period, measured in dBA. This is commonly referred to as the background noise level.
$L'_{nT,w}$	Weighted, standardized impact sound pressure level. A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard "tapper" machine. The lower the $L'_{nT,w}$, the better the acoustic performance. Measured in accordance with BS EN ISO 140-7 and rated in accordance with BS EN ISO 717-2.
NR	Noise Rating. A single number rating which is based on the sound level in the octave bands 31.5Hz – 8kHz inclusive, generally used to assess noise from mechanical services in buildings.
Octave Band	Frequencies are often grouped together into octaves for analysis. Octave bands are labelled by their centre frequency which are: 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz and 4kHz.
Reverberation Time (T_{mf})	Reverberation time is used for assessing the acoustic qualities of a space. It is defined as the time it takes for an impulse to decay by 60dB. T_{mf} is the arithmetic average of the reverberation time in the mid frequency bands (500Hz, 1kHz and 2kHz).
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Sound Absorption	When sound hits a surface, some of the sound energy is absorbed by the surface material. Sound absorption refers to the ability of a material to absorb sound, rated from 0, complete reflection, to 1, complete absorption.
Sound Insulation	When sound hits a surface, some of the sound energy travels through the material. 'Sound insulation' refers to the ability of a material to prevent the travel of sound.
Structure-borne transmission	Transmission of sound energy as vibrations via the structure of a building.

APPENDIX B

**SITE PLAN
&
MEASUREMENT LOCATION**



APPENDIX C

**PLANNING POLICY
AND GUIDANCE**

PLANNING POLICY AND GUIDANCE

Planning Policy Camden Borough Council

London Borough of Camden's planning policy is set out in a range of documents that constitute its 'development plan'. This includes its Local Plan and Camden Planning Guidance (CPG) documents. The Local Plan was adopted on 3 July 2017 and has replaced the 'Core Strategy' and 'Camden Development Policy' documents; as the basis for planning decisions and future development in the borough. The CPG for amenity spaces has been adopted January 2021.

Policy A4 – *Noise and Vibration* outlines the following aims:

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

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.

Appendix 3 of the Local Plan outlines noise thresholds for both noise generating and noise sensitive developments and identifies three basic design criteria upon which the acceptability of any proposal is likely to be assessed:

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

In the context of National Planning Policy Framework and Noise Policy Statement for England, Camden Council consider the above criteria to fall into three associated categories in terms of their noise 'effects':

- | | |
|------------------|-------|
| • LOAEL | Green |
| • LOAEL to SOAEL | Amber |
| • SOAEL | Red |

Table C of Appendix 3 defines the target noise levels for mechanical services plant and machinery:

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL _{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L _{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL _{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.

National Planning Policy Framework and the Noise Policy Statement for England

The Ministry of Housing Communities and Local Government published the National Planning Policy Framework (NPPF) on July 2018 and upon its publication, presented the government's overarching planning policy on noise.

The NPPF contains three aims, which are set out at paragraph 180 in Section 15 of the document, titled *Conserving and enhancing the natural environment*:

"Planning policies and decisions 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 [See explanatory note to the Noise Policy Statement for England];*
- 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; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

The Department for Environment Food and Rural Affairs published the Noise Policy Statement for England (NPSE) in March 2010. The explanatory note of NPSE defines the following terms used in the NPPF:

"NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur."

The NPSE does not define any of the above effect levels numerically.

The NPSE presents the Noise Policy Aims as:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy and 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."*

It can be seen that the first two bullet points are similar to Section 11 of the NPPF, with a third aim that seeks to improve health and quality of life. The NPSE later expands on the Noise Policy Aims, stating:

2.23 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

2.24 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

2.25 This aim (the third aim), seeks where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

It is clear that noise described in the NPSE as SOAEL that would lead to significant adverse effects should be avoided, although there is no definition as to what constitutes a significant adverse effect. Similarly, noise should be mitigated where it is high enough to lead to adverse effects, termed the LOAEL, but not so high that it leads to significant adverse effects.

WHO HEALTH ORGANISATION GUIDELINES – Night Noise For Europe 2009

Table 5.4
Effects of different levels of night noise on the population's health²

Average night noise level over a year $L_{night, outside}$	Health effects observed in the population
Up to 30 dB	Although individual sensitivities and circumstances may differ, it appears that up to this level no substantial biological effects are observed. $L_{night, outside}$ of 30 dB is equivalent to the NOEL for night noise.
30 to 40 dB	A number of effects on sleep are observed from this range: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example children, the chronically ill and the elderly) are more susceptible. However, even in the worst cases the effects seem modest. $L_{night, outside}$ of 40 dB is equivalent to the LOAEL for night noise.
40 to 55 dB	Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.
Above 55 dB	The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases.

British Standard 4142

To assess the acceptability of the resultant noise levels we have consulted the relevant standards. BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' has been used to assess the likelihood any adverse impacts based on the resultant noise level from the new plant item, including any corrections for the character of the noise against the existing background noise level.

BS4142 gives guidance on assessing the likelihood of adverse impacts by calculating a 'rating level' of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the 'rating level' to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more is an indication of a significant adverse impact, depending on the context.
- A difference of +5dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background noise level, the less likely it is that the specific sound source will have an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low sound impact, depending on the context.

This assessment is carried out over a one hour period for the daytime and a fifteen minute period for the night-time. For the purposes of the standard it states that daytime and night-time are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq} .
- An additional correction shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention. The value for any tonal noise can be an addition of up to 6dB and for impulsive noise of up to 9dB.

BS 4142 goes onto state that:

'The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.'

BS4142 has been referenced in setting noise limits for any fixed plant proposed as part of the proposed development.

APPENDIX D

SURVEY RESULTS
(TABULAR)

EC 14048 - 1 Norfolk Road

Mr Richard Lister

Tabulated Noise data

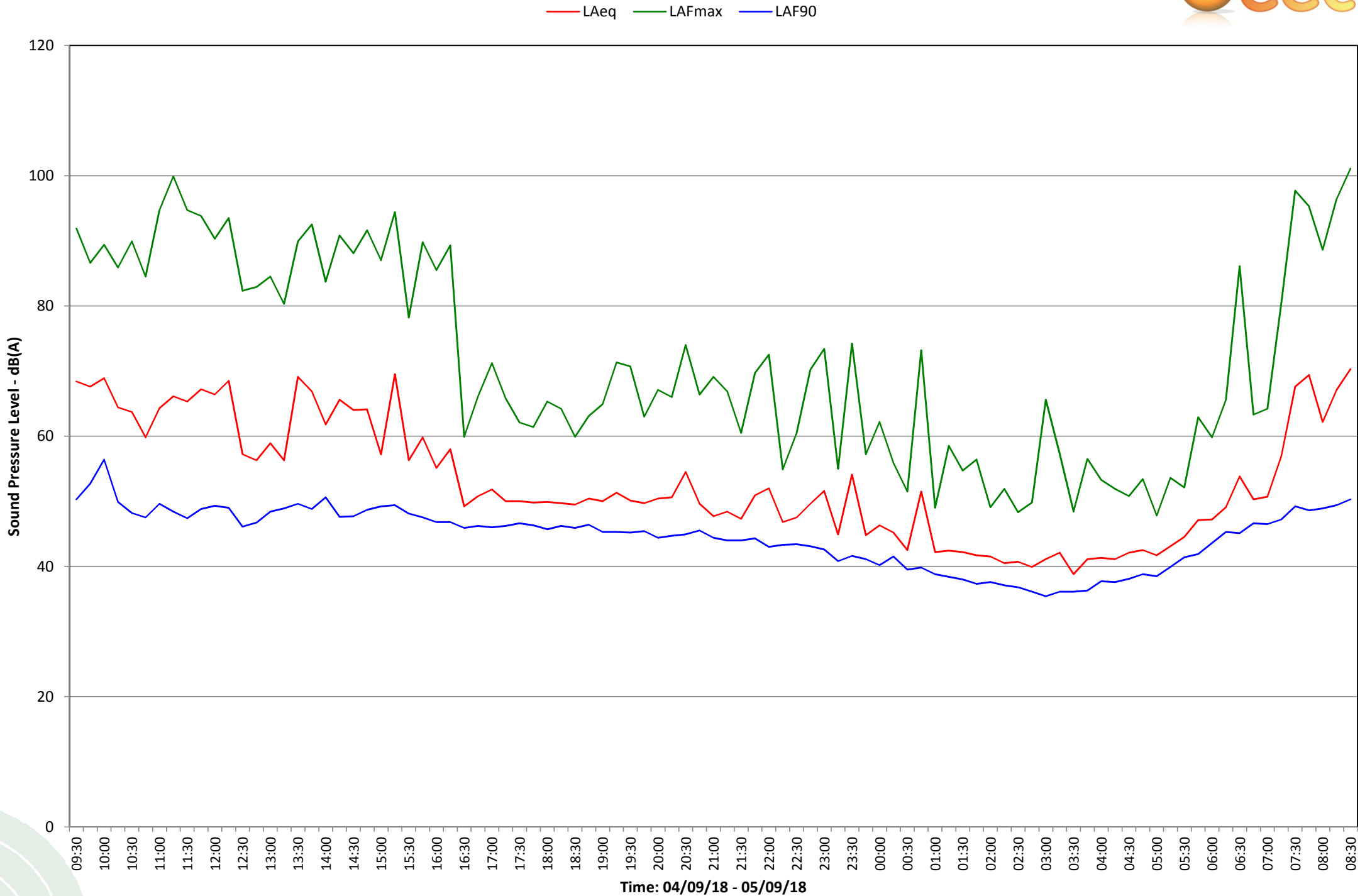
Sheet 1 of 1

Time	L _{Aeq}	L _{AMax}	L _{A90}
09:30	68	92	50
09:45	68	87	53
10:00	69	89	56
10:15	64	86	50
10:30	64	90	48
10:45	60	85	48
11:00	64	95	50
11:15	66	100	48
11:30	65	95	47
11:45	67	94	49
12:00	66	90	49
12:15	69	94	49
12:30	57	82	46
12:45	56	83	47
13:00	59	85	48
13:15	56	80	49
13:30	69	90	50
13:45	67	93	49
14:00	62	84	51
14:15	66	91	48
14:30	64	88	48
14:45	64	92	49
15:00	57	87	49
15:15	70	94	49
15:30	56	78	48
15:45	60	90	48
16:00	55	86	47
16:15	58	89	47
16:30	49	60	46
16:45	51	66	46
17:00	52	71	46
17:15	50	66	46
17:30	50	62	47
17:45	50	61	46
18:00	50	65	46
18:15	50	64	46
18:30	50	60	46
18:45	50	63	46
19:00	50	65	45
19:15	51	71	45
19:30	50	71	45
19:45	50	63	45
20:00	50	67	44
20:15	51	66	45
20:30	55	74	45
20:45	50	66	46
21:00	48	69	44
21:15	48	67	44

Time	L _{Aeq}	L _{AMax}	L _{A90}
21:30	47	61	44
21:45	51	70	44
22:00	52	73	43
22:15	47	55	43
22:30	48	61	43
22:45	50	70	43
23:00	52	73	43
23:15	45	55	41
23:30	54	74	42
23:45	45	57	41
00:00	46	62	40
00:15	45	56	42
00:30	43	52	40
00:45	52	73	40
01:00	42	49	39
01:15	42	59	38
01:30	42	55	38
01:45	42	56	37
02:00	42	49	38
02:15	41	52	37
02:30	41	48	37
02:45	40	50	36
03:00	41	66	35
03:15	42	57	36
03:30	39	48	36
03:45	41	57	36
04:00	41	53	38
04:15	41	52	38
04:30	42	51	38
04:45	43	53	39
05:00	42	48	39
05:15	43	54	40
05:30	45	52	41
05:45	47	63	42
06:00	47	60	44
06:15	49	66	45
06:30	54	86	45
06:45	50	63	47
07:00	51	64	47
07:15	57	80	47
07:30	68	98	49
07:45	69	95	49
08:00	62	89	49
08:15	67	96	49
08:30	70	101	50

APPENDIX E
SURVEY RESULTS
(GRAPHICAL)

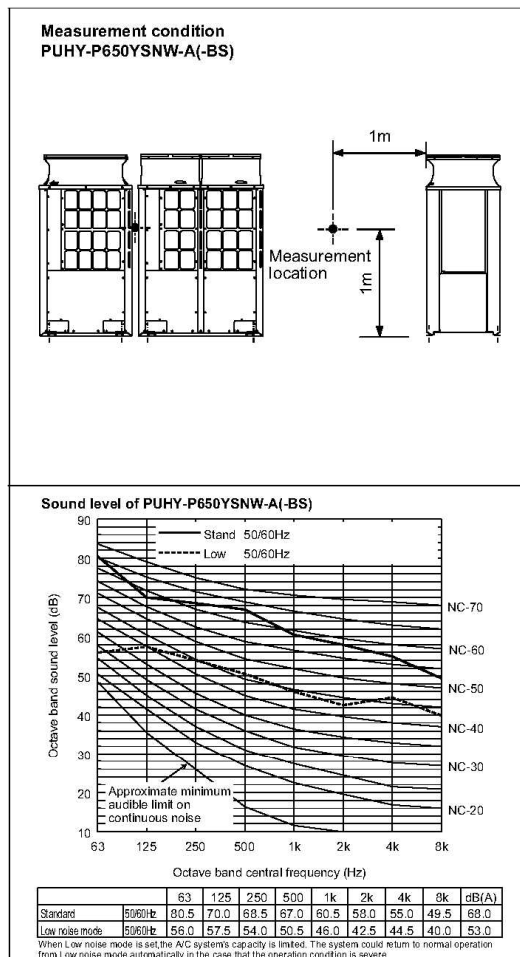
Noise Level Time History at 1 Norfolk Road



APPENDIX F
PUBLISHED PLANT NOISE DATA

5. SOUND LEVELS

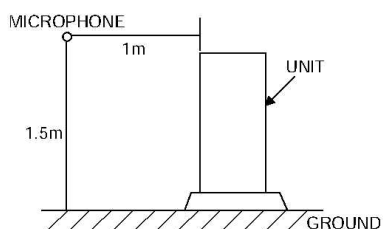
Y-Series



*Depending on the operation conditions, the unit generates noise caused by valve actuation, refrigerant flow, and pressure changes when operating normally. Please consider to avoid location where quietness is required.



5-3. NOISE CRITERION CURVES



PUHZ-ZRP60VHA
PUHZ-ZRP71VHA

MODE	SPL(dB)	LINE
COOLING	47	○—○
HEATING	48	●—●

