Date: 15 August 2019

Ref: 19177/001revA/ha

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171-173 GRAY'S INN ROAD

LONDON

WC1X 8UE

ENVIRONMENTAL NOISE SURVEY

& REPLACEMENT PLANT NOISE ASSESSMENT

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1.0 Introduction

1.1 An environmental noise level survey to determine prevailing background noise levels has been undertaken at the location of 171-173 Gray's Inn Road, London WC1X 8UE.

1.2 Noise level limits have been developed for the proposed mechanical services plant scheme, with regard to the planning policy requirements stipulated by the Local Authority.

1.3 Noise levels arising from the replacement mechanical services plant have been assessed and guidance regarding suitable noise control measures provided, where necessary.

2.0 Site Description

2.1 The site is currently a fully operational commercial building, which is proposed to be redeveloped. The redevelopment works include the addition of a new third floor and a single storey rear extension. Part of the redevelopment works include the replacement/relocation of existing mechanical services plant currently located at the rear of the building.

2.2 The site is bound by adjoining commercial buildings to the north west and south east, Gray's Inn Road to the east and Goodenough Club Hotel to the west. The nearest noise sensitive receptors has been identified as Goodenough Club Hotel, located on Mecklenburgh Square approximately 10m to the west of the site.

2.3 The replacement mechanical services plant will be sited one floor higher than the existing plant. Refer to Appendix 1 for site plan and the proposed mechanical services plant location.

3.0 Site Noise Survey

3.1 Instrumentation: NTI XL2-TA (Class 1) sound level meter (Serial No. AZA-10121-E0). This instrument was powered by an external battery and stored in a weather proof case. The instrument was checked for calibration prior and subsequent to use with a Larson Davis type CAL 250 calibrator whereupon no calibration drift was recorded. The instrument was used in accordance with manufacturer's instructions.

3.2 Location: The noise monitor was located at the rear of the building near the site boundary in the direction of the nearest noise sensitive premises. The microphone was fixed to staircase railings in line with the hotel windows which are approximately 9m to the west of the microphone location. See Appendix 1 for the measurement locations.

3.3 Periods: Noise level monitoring was continuous from approximately 12:30 hours on Friday 27th July 2019 until approximately 13:00 hours Tuesday 30th July 2019. The meter was configured to monitor noise levels continuously in fifteen-minute intervals.

3.4 Weather: The prevailing weather conditions over the survey period were calm and dry with a spell of moderate rain. The period of rain was not found to affect the result of the survey. Wind speed, although not recorded, was considered to be less than 5 m/s throughout the survey period.

3.5 Site Noise Characteristics: The background noise levels were dominated by the existing mechanical plant serving the site, plant associated with third party buildings and traffic noise from vehicle using the surrounding roads. There are two event periods that gave rise to higher than expected noise levels (Saturday 27/07/19 between 8:15am and 9:30am and Monday 29/07/19 between 6:30pm and 10:00pm). The noise analysis of these events suggests this was likely to be due to the operation of builder's machinery, which is considered to be atypical of the prevailing noise climate and therefore has been omitted from the assessment. Apart from the two identified events, it is considered that no unusual events occurred during the survey period. The data used for the assessment includes a fair representation of the noise levels in the area.

3.6 Surveyor: Adam Slaymark BEng (Hons)

3.7 Results: The results of the measurements are summarised below in Table 1 showing the recorded values of background noise (L_{A90} dB). Refer to Appendix 1 for the measurement location and Appendix 2 for the survey measurement data in graph form.

Table 1: Noise Measurement Results, dB ($2x10^5$ Pa)

Description	Typical Background Noise Level
Weekday daytime noise levels between 07:00 and 18:00	46 dB L_{A90} (15 minutes)
Evening and night-time noise levels between 18:00 and 07:00	43 dB L_{A90} (15 minutes)

3.8 Refer to Appendix 3 for glossary of terms

4.0 Plant Noise Criteria

4.1 The site falls into the jurisdiction of the London Borough of Camden. Their planning policies are set out in the Local Development Framework (LDF) document "*Camden Development Policies 2010-2025*". In particular Policy DP28 Noise and Vibration – Table on page 133 of the document. The requirements relevant to noise from mechanical services plant are set out below;

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL_{Aeq}

4.2 It is understood that the existing plant serving the site building was operational during the noise survey period, as confirmed by the occupiers (Goldblatts), who have stated that the plant operates between 08:00 and 18:00 on weekdays. However, with reference to Appendix 2, there is no correlation between measured levels and the unit turning on and off at these times. It is typical to expect to see noise levels step up and a step down during the on and off periods of the units, but this has not observed. This therefore indicates that the noise from the units does not dominate the noise climate and noise from third-party plant and the vehicles using the surrounding roads has a greater influence on the prevailing background noise levels at the nearest noise sensitive receiver.

4.3 The proposed mechanical services plant is proposed to operate on standard mode during office hours (between 07:00 and 18:00) and "setback" mode during the evening and night-time period (between 18:00 and 07:00).

4.4 Based on the above understanding, the proposed mechanical service plant must comply with the likely planning requirements set out by the London Borough of Camden. The residual plant noise level must be at least 5 dB lower than the background noise levels, and the appropriate limits are as follows:

Table 2: Plant Noise Limit Criteria

Period	Maximum Plant Noise Level
Daytime (07:00 to 18:00)	41 dB L_{Aeq}
Evening (18:00 to 07:00)	38 dB L_{Aeq}

4.5 If the proposed plant is likely to emit any distinguishable, discrete continuous notes (whine, hiss, screech, hum), or possess any distinct impulses (bangs, clicks, clatters, thumps), then the values of L_{Aeq} shown above must be reduced by 5 dB.

5.0 Plant Noise Assessment

5.1 It is understood that the proposed mechanical services plant will consist of two condensing units. The make, model numbers and noise data for each are set out in the tables below:

Table 3: Plant Noise Data – Condensing Units

Serving	Plant Item	octave band centre frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
		Sound Pressure Level, dB re 2 x 10^{-5} Pa								
Ground and First Floor	Mitsubishi PURY-P600YSNW-A, L_p at 1m	79	66	66	63	57	53	48	43	64
	Mitsubishi PURY-P600YSNW-A, Low Noise* L_p at 1m	58	56	51	49	43	38	36	37	50
Second and Third Floor	Mitsubishi PURY-P500YSNW-A, L_p at 1m	80	66	65	62	56	52	53	47	64
	Mitsubishi PURY-P500YSNW-A, Low Noise* L_p at 1m	56	55	45	45	38	35	41	42	48

* With reference to section 4.3, Mitsubishi condensers "low noise" mode is understood to be the "setback" operation employed for out of office hours use

5.2 Based on manufacturers' noise data, the proposed condensers are likely to contain a distinct and a distinguishable acoustic feature at the 63Hz frequency. On this basis the plant noise limit shown in Table 2 must be reduced further by 5 dB to achieve the following:

Table 4: Plant Noise Limit Criteria

Period	Maximum Plant Noise Level Limit at Nearest Noise Sensitive Facade
Daytime (07:00 to 18:00)	36 dB L_{Aeq}
Evening (18:00 to 07:00)	33 dB L_{Aeq}

5.3 On this basis, calculations show that the proposed condensers must be located within an acoustic enclosure. In order to comply with the London Borough of Camden planning requirements, the **acoustic enclosure must provide a minimum 23 dB A-weighted noise attenuation**. The specification of the enclosure will be subject to detail design.

5.4 Calculations have been performed to determine noise levels due to the operation of the proposed plant likely to arise at the nearest noise sensitive façades, which are shown in Appendix 1. Calculations use manufacturer's noise data with the proposed acoustic enclosure requirements for the condensers and corrections for screening, distance and façade reflections. The results are as follows:

Table 5: Plant Assessment to Rear Façade of Goodenough Club Hotel - Office Hours

Description	A-weighted Calculation Summary, dB
Mitsubishi PURY-P600YSNW-A, L_p at 1m	64
Mitsubishi PURY-P500YSNW-A, L_p at 1m	64
Total Condenser L_p at 1m	**67**
Building Reflection	3
Distance Attenuation 9m conformal	-14
Acoustic Enclosure *	-23
Façade Reflection	3
Total L_p at the Receiver during Office Hours, L_{Aeq}	**36**
Typical Background Noise Level during Office Hours, L_{A90}	**46**
Difference	**-10**

Table 6: Plant Assessment to Rear Façade of Goodenough Club Hotel - Out of Hours

Description	A-weighted Calculation Summary, dB
Mitsubishi PURY-P600YSNW-A, L_p at 1m – Low Noise	50
Mitsubishi PURY-P500YSNW-A, L_p at 1m – Low Noise	48
Total Condenser L_p at 1m	**52**
Building Reflection	3
Distance Attenuation 9m conformal	-14
Acoustic Enclosure *	-23
Façade Reflection	3
Total L_p at the Receiver during Out of Hours, L_{Aeq}	**21**
Typical Background Noise Level during Out of Hours, L_{A90}	**43**
Difference	**-22**

* A-weighted reduction based on actual effect of attenuation

5.5 The predicted replacement mechanical services plant noise level is equal to or more than 10 dB below the typical background noise level and therefore should be considered acceptable to the Local Authority.

6.0 Conclusion

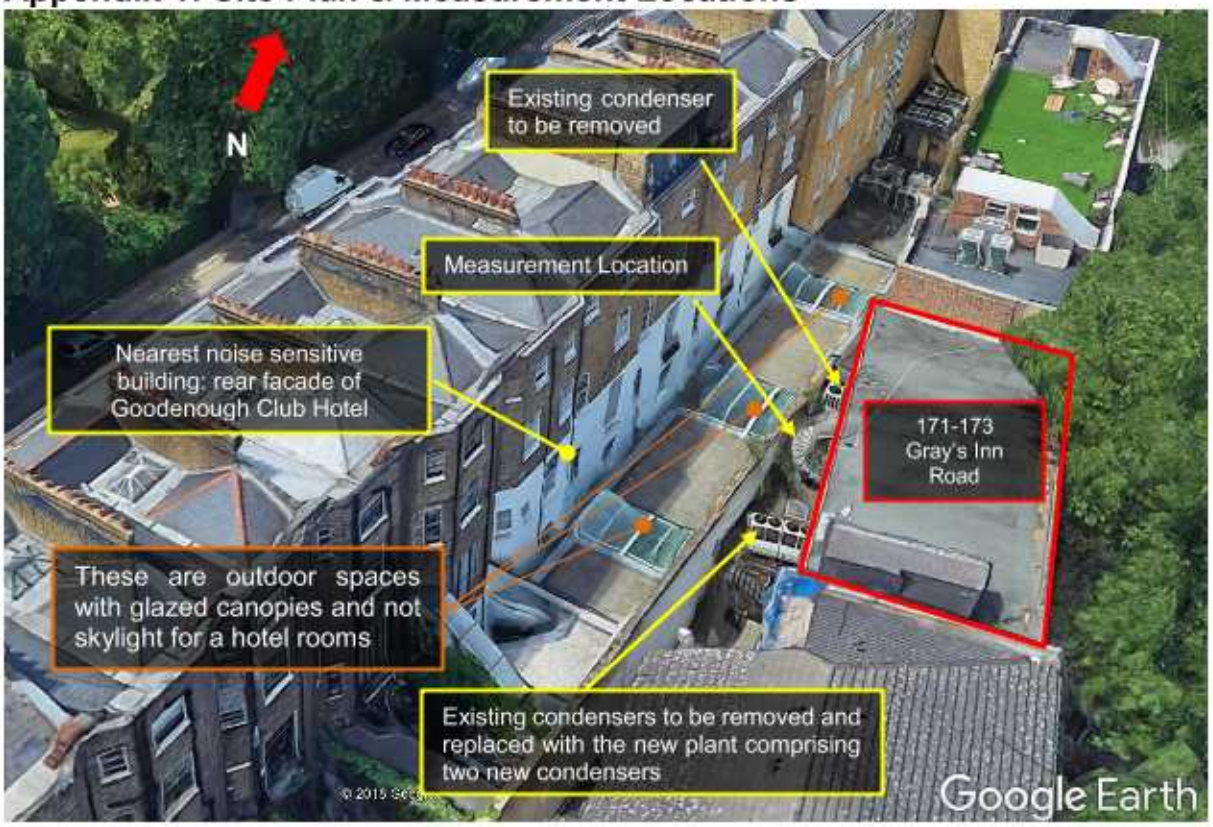
6.1 A noise survey at 171-173 Gray's Inn Road, London WC1X 8UE has been undertaken to establish prevailing levels of background noise at and around the site.

6.2 Noise level limits for proposed plant associated with the development have been derived based upon London Borough of Camden - policy DP28 Noise and Vibration requirements for plant and machinery.

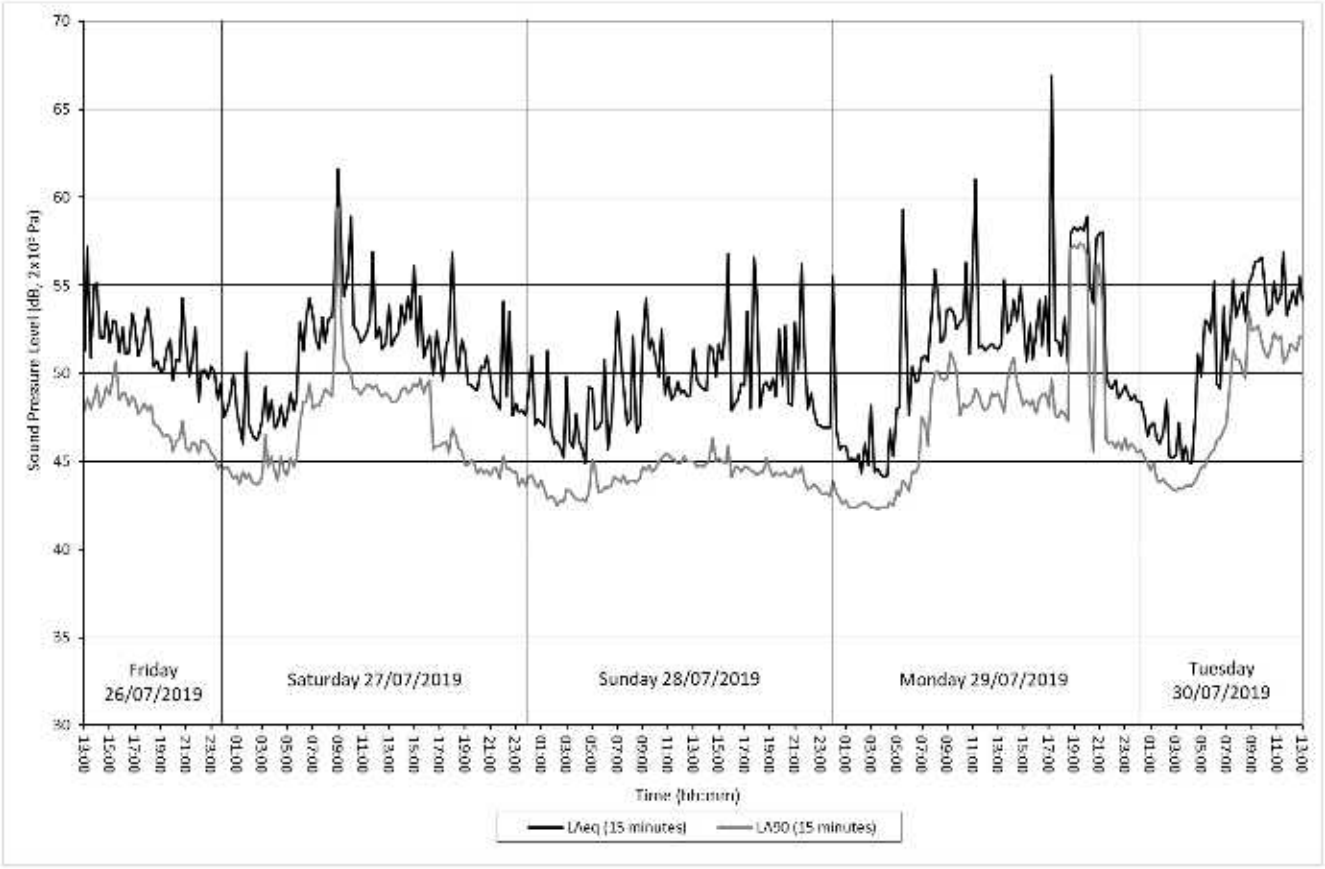
6.3 Calculations have been performed, based upon the information provided above, in order to determine the likely plant noise level at the nearest noise sensitive location.

6.4 Calculations predict the proposed mechanical services plant scheme should comply with London Borough of Camden planning requirements for operation during typical office hours (Monday to Friday between 07:00 and 18:00) and out of hours at low noise mode between 18:00 and 07:00 providing all condensers are located within an acoustic enclosure.

Appendix 1: Site Plan & Measurement Locations



Appendix 2: Noise Survey Results



Appendix 3: Glossary of Terms

Term	Description	Explanation
	Noise	Unwanted sound. In the explanation given below the words 'sound' and 'noise' can often be used interchangeably, depending on context.
dB	The decibel scale	The decibel (or dB) scale is the scale on which sound pressure levels are commonly measured. It is a logarithmic scale and is used for convenience to compress the audible range of sound pressures into a manageable range, from 0 dB to 140 dB. The zero of the scale, 0 dB, corresponds to the threshold of hearing, 0.00002 Pa, and the upper limit, 140 dB, corresponds to 20 Pa, the threshold of pain.
	Sound pressure	Sound is a disturbance or fluctuation in air pressure, and sound pressure, measured in pascals (Pa), is used as a measure of the magnitude of the sound. The human ear can detect sound pressures in the range from 0.00002 Pa to 20 Pa. This is an enormously wide range and so for convenience sound pressures are commonly measured on a decibel (dB) scale.
Lp	Sound pressure level	Instantaneous value of Sound Pressure Level (Lp).
	Sound power	The sound energy radiated per unit time by a sound source, measured in watts (W)
L_W	Sound power level	Sound power measured on a decibel scale: $L_W = 10\log(W/W_0)$, where W_0 is the reference value of sound power, 10^{-12} W.
f	Frequency	The frequency of a musical note is what gives it its pitch. It is the number of cycles of the fluctuating sound pressure which occur each second, and is measured in cycles per second, or Hertz (Hz). The human ear can detect frequencies in the range 20 to 20 000 Hz. Most sounds and noises are a mixture of all frequencies, called broad-band noise.
	Octave bands Octave band spectra	In order investigate the frequency content of broad band sounds, called its frequency spectrum, measurements of sound pressure are carried out over a range of frequency bands. The most common method is to split the audio frequency range into 8 or 9 octave bands. An octave is a frequency range from one particular frequency to double that frequency.
	Free-field	A free field sound level measurement is one which is unaffected by the presence of any sound reflecting surfaces. In an outdoor situation this is usually taken to mean with no sound reflecting surfaces within 3 m. of the source.
	Facade correction Factor	The difference between the façade level and the free field level (in the absence of the façade) is called the façade correction factor.
A	A-weighting	One of the three frequency weightings (A, C and Z) used in sound level meters, and defined in BS EN ISO 61672-1; a very widely used method of producing a single figure measure of a broad band noise which takes into account, in an approximate way at least, the frequency response of the human hearing system. The idea is that sound levels measured in this way should give an indication of the loudness of the sound.
L_A (dBA)	A- weighted sound pressure level	The value of the sound pressure level, in decibels, measured using an A-weighting electronic circuit built into the sound level meter. The vast majority of noise measurements are carried out in this way.
$L_{Aeq,T}$	Equivalent continuous sound level	It represents a measure of the 'average' sound level over the measurement period. It corresponds to the steady level of sound which, over the same period of time, T, would contain the same amount of (A-weighted) sound energy as the time varying noise. Also known as the Average sound level. This is the most common method of measuring time varying noise, and within certain limits gives the best correlation with human response to noise, for example with annoyance.

$L_{AN,T}$	Statistical percentile noise levels	$L_{AN,T}$ is the noise level, usually A-weighted, which is exceeded for N% of the measurement period, T. The most commonly used values are $L_{A10,T}$ used for the measurement and assessment of traffic noise, and $L_{A90,T}$, commonly used as a measure of background noise. $L_{A1,T}$ and $L_{A99,T}$ are also occasionally used to give an indication of the highest and lowest noise levels occurring during the measurement time interval.
	Background noise	Ambient noise which remains at a given site when occasional and transient bursts of higher level ambient noise levels have subsided to typically low levels; it is the noise normally present for most of the time at a given site. It is usually described by the L_{A90} value.
$L_{A90,T}$	Background noise level	Defined in BS 4142 as the value of the A-weighted residual noise at the assessment position that is exceeded for 90 % of a given time interval, T, (i.e. $L_{A90,T)}$ measured using time weighting, F, and quoted to the nearest whole number of decibels. (Also see under residual noise). Background noise itself often varies with time and so the $L_{A90,T}$ is almost universally used as the best measure of the 'more or less always present' noise level which underlies short term variations from other sources of noise.
	Specific Noise Source	The noise source under consideration when assessing the likelihood of adverse impact using BS4142:2014.
	Specific Noise Level	The value of $L_{Aeq,T}$ at the assessment position produced by the specific noise source, ref. BS4142:2014.
$L_{ar,Tr}$	Rating Level	The specific noise level, corrected to account for any characteristic features of the noise, by adding a rating penalty for any tonal, impulsive or irregular qualities, ref. BS4142:2014.
T_r	Reference time interval	Specified interval over which the specific sound level is determined, ref. BS4142:2014.
	Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound, ref. BS4142:2014.
$L_r = L_{Aeq,T}$	Residual Sound Level	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T, ref. BS4142:2014.