10 GATE STREET LONDON

Plant Noise Assessment

REPORT 8146/PNA
Prepared: 24 July 2017
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Plant Noise Assessment

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	24 July 2017	Carl Ruegger	Russell Richardson

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1.0 INTRODUCTION

It is proposed to install a new restaurant kitchen extract fan at 10 Gate Street, London. Camden Council requires consideration be given to atmospheric noise emissions from the proposed equipment at the nearest noise-sensitive windows of the development and for a plant noise impact assessment to be submitted in support of the planning application.

RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emissions in accordance with Camden Council's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

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

Wednesday 29 May to Thursday 30 May 2013

During the survey periods the weather conditions were generally appropriate for the noise measurement exercise, it being dry with light winds.

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

2.2 Measurement Locations

Position 1

Measurements were undertaken with the microphone positioned 1m outside a fourth floor window on the western façade of the building. The noise climate at this location was considered to be representative of the windows of the new flats on the floors above, there being the closest residential windows to the proposed plant discharge location at roof level. The prevailing noise climate was noted to be affected predominantly by road traffic noise from the Kingsway and High Holborn thoroughfares and noise from the existing plant of the surrounding buildings.

The measurement position is also illustrated on the attached Site Plan 8146/SP1.

2.3 Instrumentation

The following equipment was used for the measurements.

Table 8146/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
01dB A&V Type 1 Sound Level Meter	Black Solo 01	60610	CE-DTE-T-12-PVE-64835	7 December 2014
01dB A&V Pre Amplifier	PRE 21 S	13676		
Gras ½" Microphone	MCE 212	84948		
01dB-Stell Calibrator	Cal 21	50441910	U12030	13 September 2014

The sound level meter was calibrated both prior to and on completion of the survey with no calibration drift observed.

3.0 OPERATING HOURS

We understand the restaurant's opening hours are to be the same as existing, the longest of which are 12:00-23:30 hours, Monday to Saturday, and the plant will be operating during these hours only. Therefore these hours have been assumed in our assessment.

4.0 RESULTS

The noise levels at the measurement positions are shown as time-histories on the attached charts 8146/G1 and 8146/G2

In order to ensure a worst-case assessment the lowest background L_{A90} noise levels measured have been used in our analyses. The lowest L_{A90} and the period averaged L_{Aeq} noise levels measured are summarised below.

Table 8146/T2 – Measured Levels

Measurement Period	Position 1	
	L_{90} (dBA)	L_{eq} (dBA)
Daytime (07:00 – 23:00)	57	62
Night-time (23:00 – 07:00)	54	59
Operating Hours (12:00 – 23:30)	56	62

5.0 CRITERIA

5.1 Camden Council LDF

There are no specific numerical criteria within the pre-application advice document (Ref: SJH/JGP/DP3030 dated 20/12/12). From previous experience, the requirements of Camden Council are set out in their Local Development Framework (LDF) in Table E of DP28. Noise levels from new plant and machinery are confirmed as follows.

Table 8146/T3 – Camden Council Noise Thresholds

Noise description and Location of measurement	Period	Time	Noise Level
Noise at 1 metre external to a sensitive façade	Day, evening and night	00:00-24:00	5dB(A) <L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade	Day, evening and night	00:00-24:00	10dB(A) <L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade	Day, evening and night	00:00-24:00	10dB(A) <L_{A90}
Noise at 1 metre external to sensitive façade where L_{A90} >60dB	Day, evening and night	00:00-24:00	55dB L_{Aeq}

In line with BS 4142: 2014 and as illustrated within Table 8146/T3, should the proposed plant be identified as having intermittent or tonal characteristics, an additional 5 dB should be subtracted from any of the above proposed noise emission limits.

In addition to the above, Camden require consideration to be taken with regards to the Observable Adverse Effect Level of noise sources within the borough. Advice from an Environmental Health Officer for Camden Council on a recent project was as follows:

> *"BS 4142 states that if the rating level does not exceed the background noise level, then this is an indication of the specific sound source having a low impact, and a difference of +10 dB is likely to be an indication of a significant adverse impact. The advice regarding these impacts is dependent on the context and to account for this when determining the example values for LOAEL and SOAEL it will be assumed that the character of the residual background noise is different to the character of the specific noise from the proposed development, as such 10dB or below background should be achieved, (with 15 dB being achieved if the noise has a tonal element).*
>
> *These levels have been determined appropriate in the Camden context, to guard against future complaints once the development is in used, and, to protect against 'background noise creep', as required by Camden's Noise Strategy. 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. "*

Analysis of the proposed plant units illustrated that the noise spectra for this unit is of a similar profile to that for the measured background levels of the site (i.e. bland, uniform traffic noise type spectra). We therefore propose that a criteria of 5dB below the minimum background L_{A90} should be applied, as measured at 1m from the nearest noise-sensitive receptor, assuming there are no tonal characteristics.

In line with the above requirements we would propose items of mechanical services be designed so that cumulative atmospheric noise emissions from the plant discharge and breakout noise from the ducts do not exceed the following levels when assessed at the nearest noise-sensitive location:

- Operating Hours (12:00 - 23:30) L_{Aeq} 51 dB

6.0 ASSESSMENT OF ATMOSPHERIC NOISE

Our assessment has been based upon the following information:

6.1 Proposed Air Conditioning Unit

1No. Elta SLC 450/2-1AC Axial Fan

6.2 Position of Units/Duct Dimensions

We understand the equipment is to be located within the extract canopy of the restaurant kitchen and ducted externally, discharging at roof level. The duct is to comprise a 450mm diameter round duct, which is to run horizontally for approximately 3m internally before turning vertically and running externally adjacent to the stair-core up the building, to roof level.

6.3 Noise Levels

Octave-band sound power data for the proposed extract fan is not available from the manufacturer; however, duty information has been supplied, given below:

- Volume Flow Rate: 2.62 m^3/s
- Static Pressure: 171 Pa

This duty information has been used to calculate empirical in-duct sound power levels for use in the assessment, as shown in Table 8146/T4:

Table 8146/T4 – Manufacturer's Noise Levels

Unit	Parameter	Sound Power Level (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Elta SLC 450/2-1AC	Empir. Induct L_w	80	81	83	82	81	78	75	70

Review of the octave band data indicates there are no tonal characteristics associated with the proposed plant. Comparison of the empirical noise levels to manufacturer's data of similar type fans indicates this spectrum is typical.

6.4 Location of Nearest Residential Windows

The worst-affected residential windows to the plant are considered to belong to the fifth and sixth floor of the development on the western façade (shown on the attached Figures 8146/FP1 & 8146/FP2 and Elevation 8146/E), the closest of which is approximately 2.7m below the discharge location.

6.5 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting noise levels from the proposed restaurant extract unit at the nearest residential window, based on the information stated above, is summarised below.

- Source term in-duct SWL
- Duct losses
- Grille end reflections
- 20LogR distance attenuation
- Directivity
- Reflections
- Noise control measures

Screening via the building has not been included in this calculation in order to account for a worst-case assessment. Calculation sheets are attached for further information in Appendix B.

The results of the calculations indicate the following noise levels at the worst affected residential windows:

Table 8146/T5 – Measured Levels

Operating Period	Fifth Floor Windows	
	Prediction	Criterion
Operating Hours (12:00 – 23:30)	62	51

Noise from the unattenuated kitchen extract fan unit is above the target criterion. Therefore additional noise mitigation measures are required.

6.6 Mitigation

We recommend that the kitchen extract fan is fitted with an attenuator within the building before the ductwork rises externally up the building (to also reduce any potential breakout noise to the flat windows assessed in further in Section 7.0). The attenuator should be capable of achieving the performance levels detailed in the Table 8146/T6 below. An example attenuator capable of achieving this performance level is the manufacturer's (Elta) 1D-EP model.

Table 8146/T6 – Required Attenuator Insertion Loss

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
-4	-6	-8	-11	-18	-19	-17	-14

Adoption of an attenuator achieving the above insertion loss values should ensure that noise levels at the closest residential windows (of the fifth floor flat) are within the criterion. Noise levels will also therefore be acceptable at the closest residential windows not part of this development. Furthermore, the inevitable screening to the windows of the western façade is likely to reduce noise levels further.

7.0 ASSESSMENT OF BREAK-OUT NOISE TO FLATS

Our assessment of noise break-out from the ductwork to the new flats has been based upon the information detailed in Section 6.0 above and the following further information:

7.1 Proposed Duct and Other Constructions

The duct is to be of galvanised steel and round (450mm in diameter). The duct is to be concealed behind a perforated metal grid, the transmission loss of which is considered to be negligible.

7.2 Noise Levels

Extract fan noise levels are as detailed in Section 6.3.

7.3 Location of Nearest Residential Windows

The closest noise-sensitive residential windows of the flats on the western façade of the same building are approximately 2m horizontally from the ductwork, shown on the attached Figures 8146/FP1 & 8146/FP2.

7.4 Breakout Noise Emissions Criterion

In order to ensure the cumulative plant noise level does not exceed the criterion of 51 dBA L_{eq} at the worst-affected residential windows (the fifth floor windows), breakout noise should not exceed 43 dBA L_{eq} at this location, if an attenuator is fitted achieving the performance outlined in Section 6.6.

7.5 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting noise levels at the residential windows due to breakout noise from the proposed restaurant extract ductwork, based on the information stated above, is summarised below.

- Source Term in-duct SWL
- Attenuator insertion loss meeting performance requirements detailed in Section 6.6
- Duct losses
- Transmission loss of duct
- 10log(S/A) duct radiation area correction
- 10log(Q/S) line source attenuation (where Q =2 for hemispherical radiation)
- Screening via the building

Calculation sheets are attached for further information in Appendix B.

The results of the calculations indicate the following noise levels at the windows of the worst affected bedrooms:

Table 8146/T7 – Measured Levels

Operating Period	Fifth Floor Windows	
	Prediction	Criterion
Operating Hours (12:00 – 23:30)	39 dBA	43 dBA

Break-out noise from the ductwork to the flats should, therefore, achieve the target criterion, ensuring cumulative plant noise emissions do not exceed 51 dBA at any noise-sensitive windows, providing an attenuator achieving the outlined performance in Section 6.6 is fitted before the duct rises externally up the building façade, to the atmospheric side of the extract fan.

8.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to flats above the kitchen extract location in the same building.

We would typically advise that the extract fan be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

9.0 CONCLUSION

Measurements of the existing background noise levels at 10 Gate Street, London have been undertaken. The results of the measurements have been used in order to determine the required criteria for atmospheric noise emissions from the future plant installations.

The results of the assessment indicate atmospheric plant noise emissions and atmospheric break-out noise from the plant and ductwork are within the proposed criterion.

As such, noise emissions from the proposed plant installations should be considered acceptable and, subject to the inclusion of attenuation to the kitchen extract fan, will be in compliance with the guidelines set out under policy DP28 for noise emissions.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as 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 (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g L_{A10}, L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and 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 the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – Plant calculations

Received Atmospheric Noise Levels Summary at Fifth Floor Windows

Factor	63	125	250	500	1k	2k	4k	8k	dBA
Elta SLC 450/2-1AC (Empir. In-duct L_w)	80	81	83	82	81	78	75	70	
Duct Losses	-1	-1	-1	-1	-2	-2	-2	-2	
Grille End Reflection	-9	-5	-2	0	0	0	0	0	
Distance Loss (20logR, where R=2.7)	-9	-9	-9	-9	-9	-9	-9	-9	
Directivity	0	-1	-1	-3	-6	-9	-8	-8	
Hemispherical Radiation -11	-8	-8	-8	-8	-8	-8	-8	-8	
Total Received level without attenuator	53	57	62	62	56	51	48	43	62
Required Attenuator Insertion Loss	-4	-6	-8	-11	-18	-19	-17	-14	
Total Received Level with Example attenuator (dB)*	49	51	54	51	38	32	31	29	50

Please note: No rounding has been applied in the calculation until the final received noise level. Rounded noise levels are given here for clarity only.

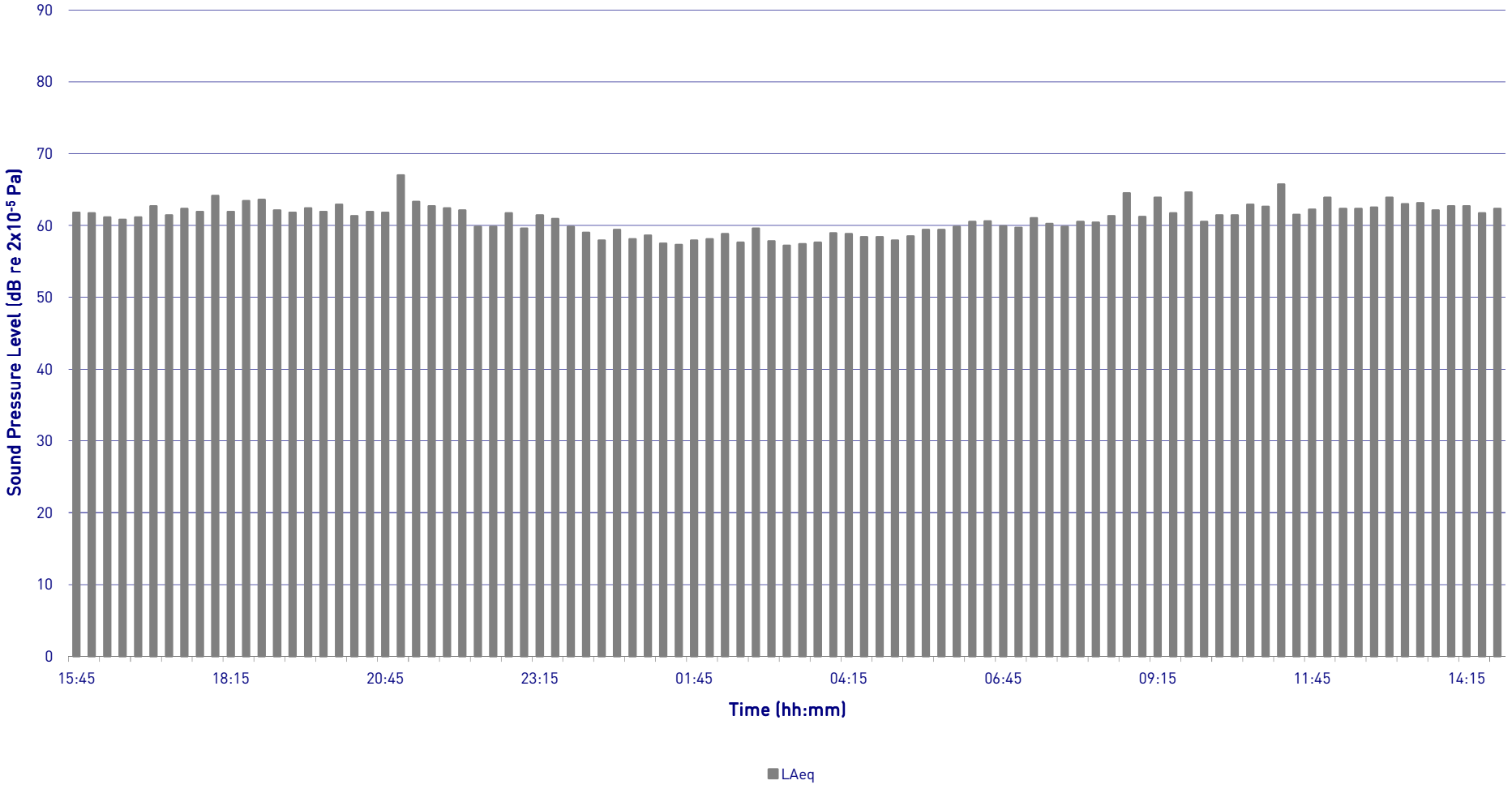
Received Breakout Noise Levels Summary at Fifth Floor Windows

Factor	63	125	250	500	1k	2k	4k	8k	dBA
Elta SLC 450/2-1AC (Empir. In-duct L_w)	81	78	85	82	85	83	80	76	
Duct Losses	-1	-1	-1	-1	-2	-2	-2	-2	
Required Attenuator Insertion Loss for Atmospheric Noise	-4	-6	-8	-11	-18	-19	-17	-14	
Duct Transmission Loss (450mm round long seam duct)	-47	-53	-37	-33	-33	-27	-25	-23	
10Log(S/A)	16	16	16	16	16	16	16	16	
Radiated Lw from ductwork is therefore:	45	34	55	52	48	51	52	53	
10Log(Q/S) Attenuation (where Q=2, r=2m)	-14	-14	-14	-14	-14	-14	-14	-14	
Line of sight screening	-5	-5	-5	-5	-5	-5	-5	-5	
Total Received Level (dB)*	26	15	36	33	29	32	33	34	39

Please note: No rounding has been applied in the calculation until the final received noise level. Rounded noise levels are given here for clarity only.

10 Gate Street, London WC2A
L_{Aeq} Time History - Position 1
Monday 29 April to Tuesday 30 April 2013

Graph 5579/G1



10 Gate Street, London WC2A
L_{A90} and L_{Amax} Time History - Position 1
Monday 29 April to Tuesday 30 April 2013

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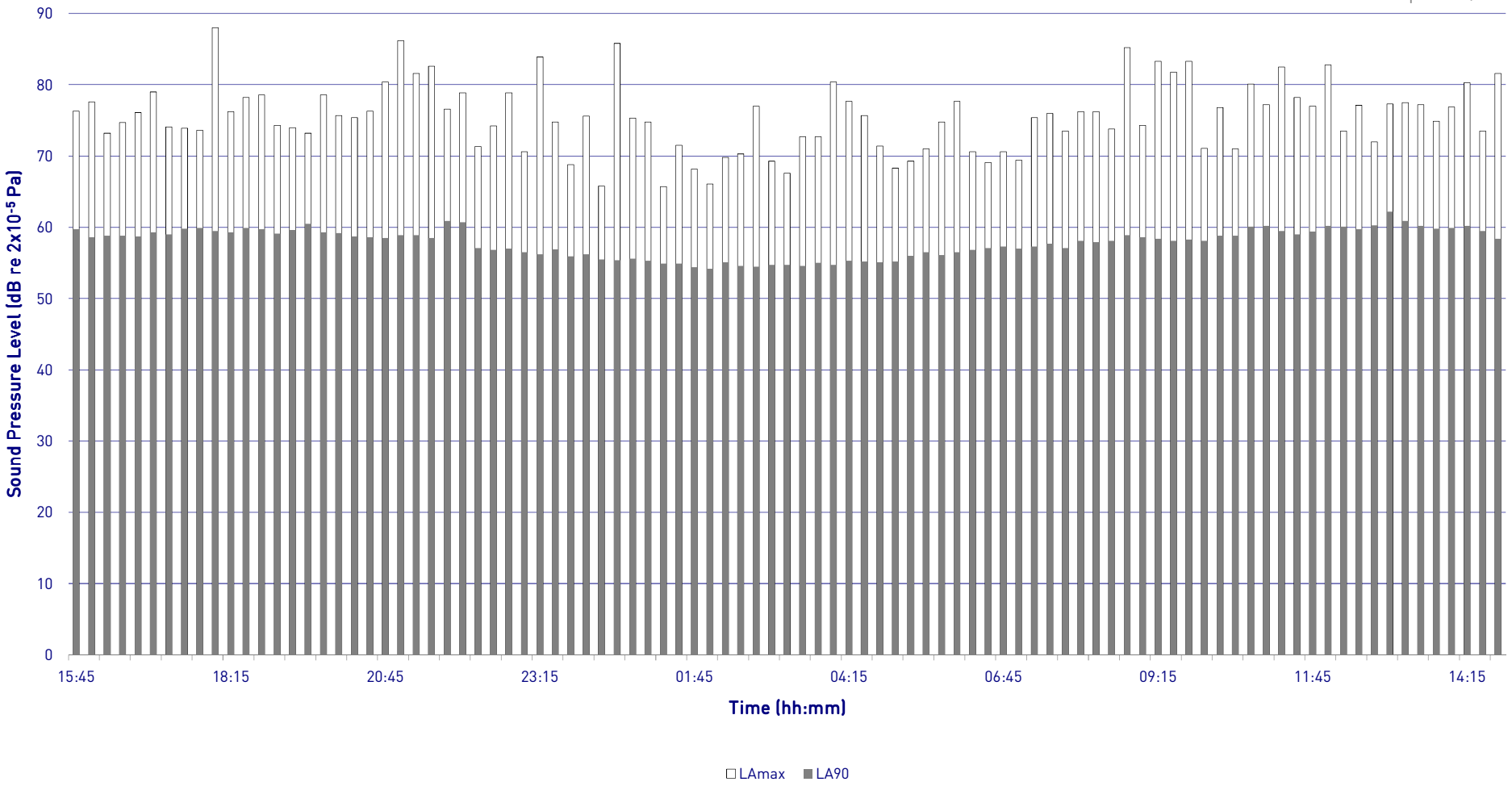
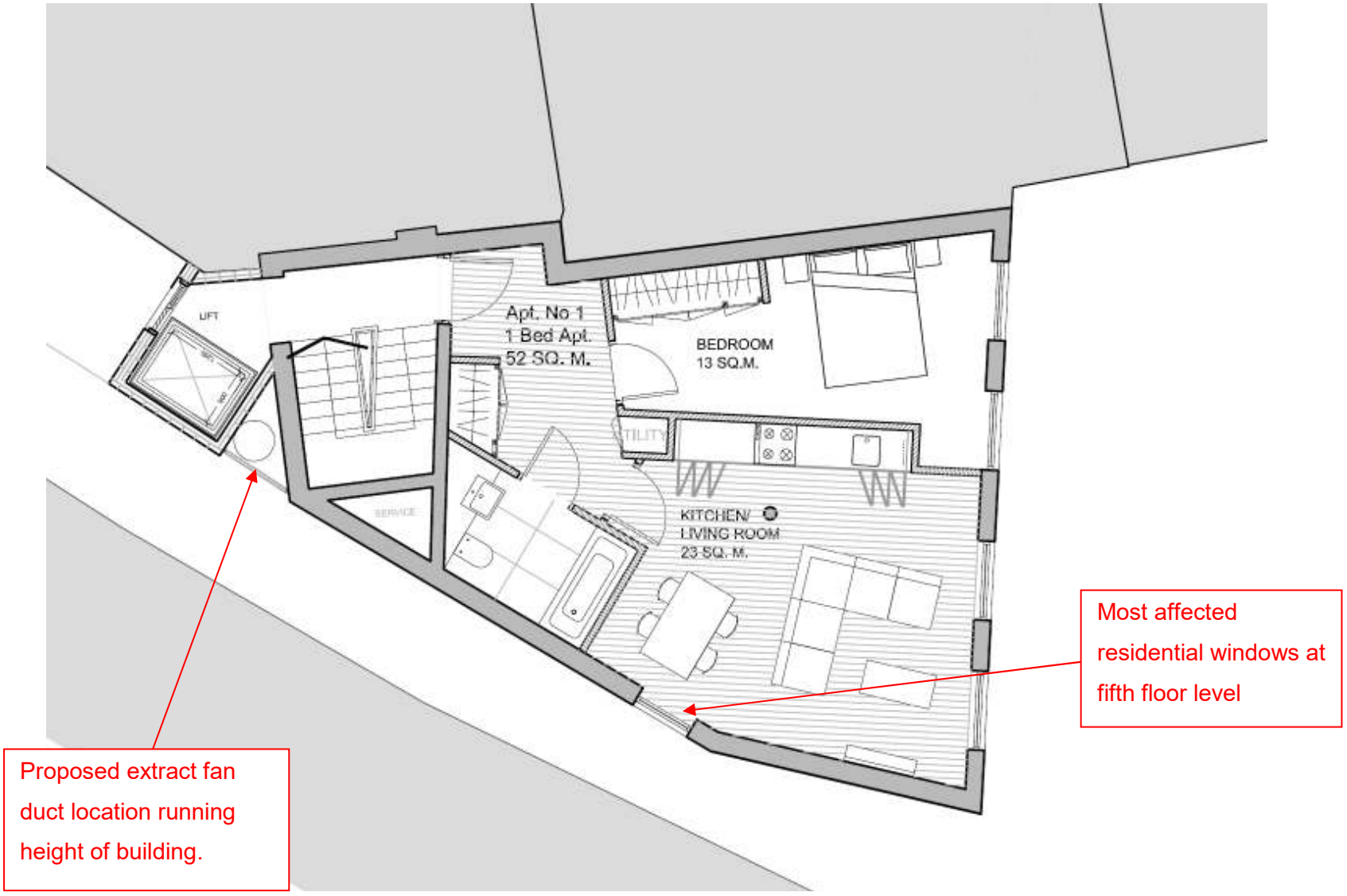
Graph 5579/G2





10 Gate Street, London

Floor plan showing layout for first to fifth floor flats, proposed duct location and residential window at fifth floor.

Figure 5579/FP1

24 July 2017

Not to Scale

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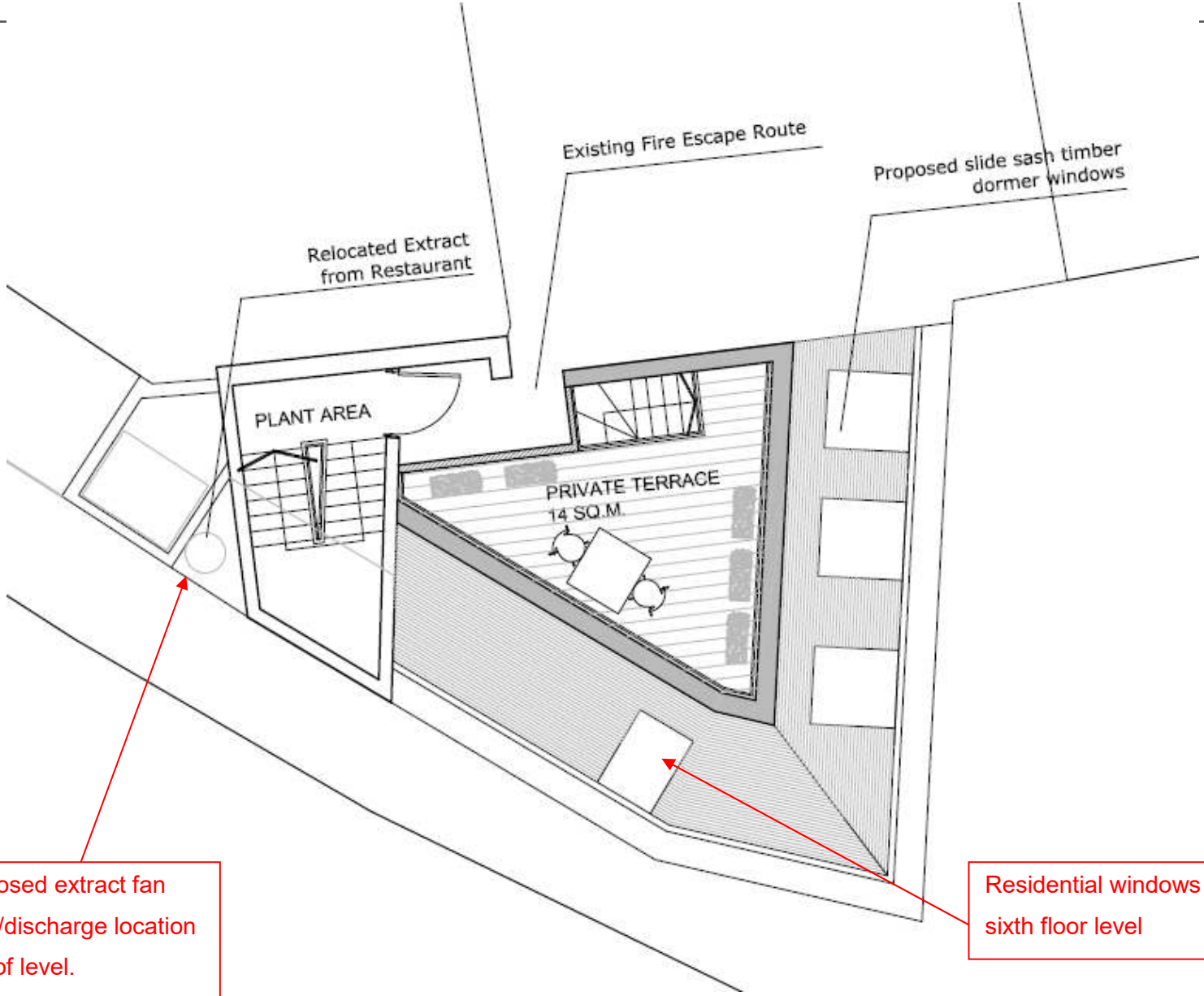

10 Gate Street, London

Plan showing layout for, duct location and residential windows at sixth floor level.

Figure 5579/FP2

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Not to Scale

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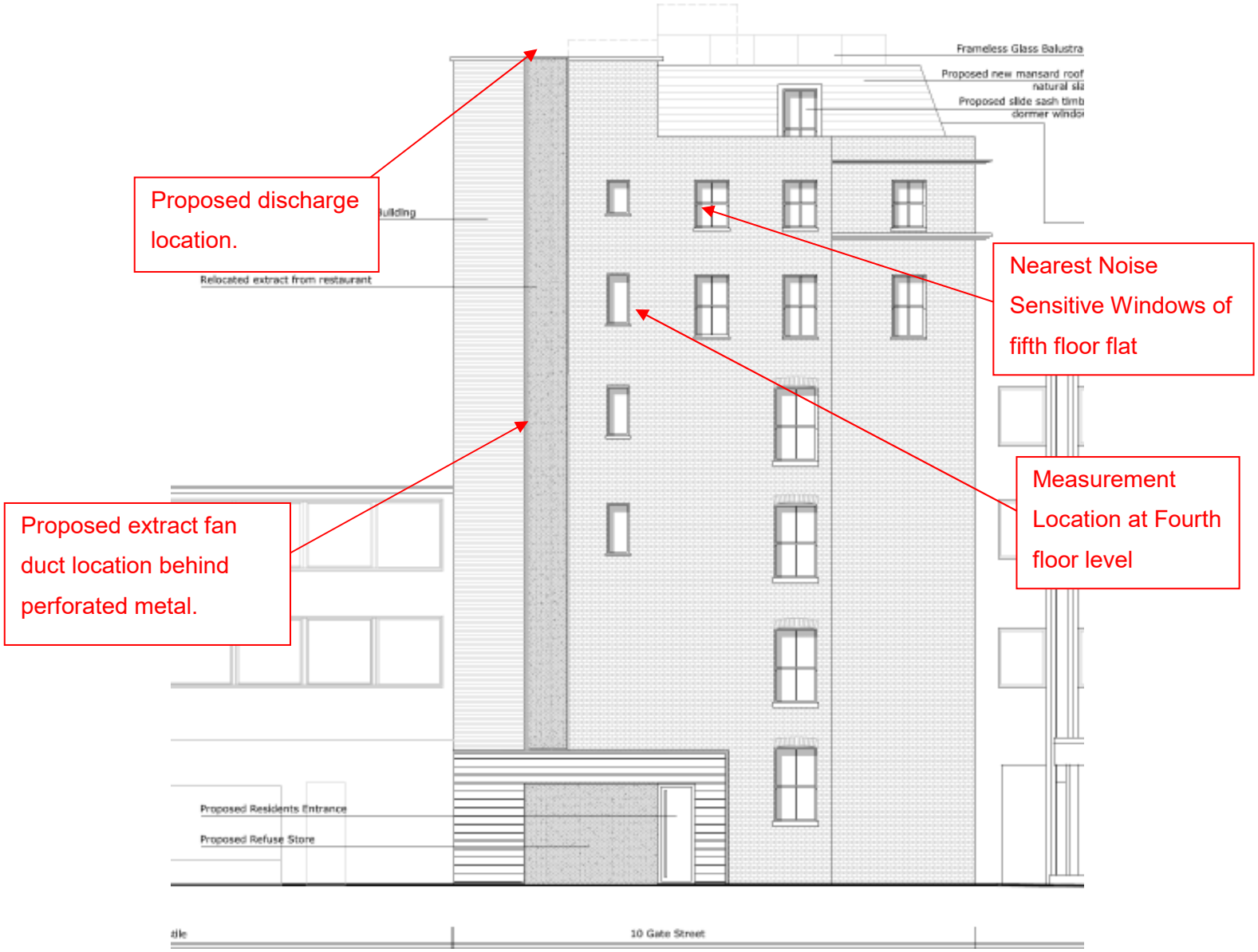

10 Gate Street, London

Western elevation showing layout for, duct location and residential windows at fifth floor level.

Site Plan 5579/SP1

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Not to Scale

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