147 WARDOUR STREET

Plant Noise Assessment

Reference: 12636.RP01.PNA.0
Prepared: 19 September 2023
Revision Number: 0

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33 Margaret Street
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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	19 September 2023	James Melville	Helen Sheldon

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The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines.

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1.0 INTRODUCTION

A new substation is proposed within a new rear annex at 147 Wardour Street, London W1F 8BN.

As part of the planning application, Westminster City Council requires consideration be given to atmospheric noise emissions from the proposed equipment at the nearest noise-sensitive property.

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 Westminster City Council's requirements.

This report presents the results of the noise measurements and provides the assessment.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

In accordance with the requirements of the Local Authority, monitoring of the prevailing background noise was undertaken over the following periods:

- 11:00 hours Wednesday 31st May to 11:30 hours Thursday 1 June 2023

Weather conditions throughout the survey were generally considered to be conducive to the measurement of environmental sound for the purposes of this assessment. Wind speeds were moderate but not considered to have adversely affected the results of the noise survey.

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

2.2 Measurement Location

Measurements were undertaken with the microphone located on the third-floor level terrace at the rear of the building, overlooking Wardour Mews. The microphone was positioned on a boom, which was attached to a railing bounding the terrace, at a height of approximately 11m above ground level, towards the west of the 151 Wardour Street building.

This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the proposed plant. The prevailing noise climate was noted to be dominated by the existing plant and pedestrian activity along Wardour Street and Wardour Mews, as well as occasional aircraft.

The measurement position is also illustrated on the site plan in Figure 1 and Figure 3 in Appendix B.

2.3 Instrumentation

Details of the instrumentation used to undertake the survey are provided in Appendix C.

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

3.0 RESULTS

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 1 – Measured Levels

Measurement Period	Lowest measured $L_{90, 15\ minutes}$ (dBA)	Average Measured $L_{eq, 15\ minutes}$ (dBA)
Daytime (07:00 – 19:00)	48	55
Evening time (19:00 – 23:00)	52	54
Night-time (23:00 – 07:00)	46	49

The noise levels at the measurement positions are shown as time-histories on the attached Graphs 1 to 2 in Appendix B.

4.0 PLANT NOISE EMISSION LIMITS

The requirements of the City of Westminster's Environmental Health Department regarding new building services plant are understood to be as follows.

"Any noise generated by the new building services plant should be designed to a level either 5dB or 10dB below the lowest background LA90 15 minute sample during operational hours, as measured 1m outside the nearest affected residential window."

Whether the criterion is a 5dB or 10dB reduction is dependent on the existing external noise levels at the nearest noise sensitive properties, at the quietest time during which the plant operates. If the measured $L_{Aeq, period}$ is found to be above the World Health Organisation (WHO) criteria, a reduction of 10dB is applied. A less stringent 5dB reduction is required where the existing $L_{Aeq, period}$ noise levels are currently below the WHO criteria.

The specific WHO guideline levels are detailed as follows:

- Daytime (07:00 – 19:00) $L_{Aeq, 12\ hours}$ 55dB
- Evening (19:00 – 23:00) $L_{Aeq, 4\ hours}$ 50dB
- Night-time (23:00 – 07:00) $L_{Aeq, 8hours}$ 45dB

The measured L_{Aeq} levels are all at or above the WHO criterion. As such, a plant noise emission limit of 10dB below the lowest measured L_{A90} is applicable.

In line with the above requirements, we would propose new items of mechanical services be designed so that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise sensitive location:

- Daytime (07:00 – 19:00) $L_{Aeq, 12\ hours}$ 38dB
- Evening (19:00 – 23:00) $L_{Aeq, 4\ hours}$ 42dB
- Night-time (23:00 – 07:00) $L_{Aeq, 8hours}$ 36dB

In line with BS 4142: 2014, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be subtracted from any of the above proposed noise emission limits.

It should be noted that the above requirements are applied at the nearest residential adjacencies and alternative criteria should be incorporated if there are also commercial properties affected by the proposed plant installations.

5.0 PLANT NOISE ASSESSMENT

This assessment has been based on the information provided to RBA by the project M&E Consultants and is described in the following sections.

5.1 Proposed Plant Items

We understand that there is no data available for the proposed 800kVA substation.

RBA Acoustics has previously measured noise levels associated with the operation of 800 kVA transformer and the measured reverberant sound pressure level data is detailed in Table 7.

Table 2 - Reverberant Sound Pressure Level (L_p) of Typical Transformer

Reverberant Lp (dB) Associated with Typical Transformer in Plant Room, Measured at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
60	55	52	51	48	44	33	19

The above noise levels correspond to an overall A-weighted sound pressure level of 53 dBA.

5.2 Plant Locations

The substation is proposed to be located within a plant room at the rear of 147 Wardour Street. The plant room is accessed through a louvred door on Wardour Mews at the rear of the site.

The equipment positions are indicated on the site plan in Figure 1 in Appendix E.

5.3 Location of the Nearest Noise-Sensitive Receptors

Based on observations made on site and discussions with the design team we understand the nearest noise-sensitive receptors to the proposed plant to be as follows:

Receptor 1 – The Shelter 25 Berwick Street

Receptor 1 is residential windows overlooking Wardour Mews at 25 Berwick Street. The receptor is approximately 19m from the proposed plant location.

Receptor 2 – 13 Wardour Mews

Receptor 1 is residential windows associated with 13 Wardour Mews. The receptor is approximately 23m from the proposed plant location.

The receptors are shown in the site plan in Figure 1 in Appendix E.

5.4 Calculation of Noise Levels at Nearest Noise-Sensitive Receptors

Our calculation method for predicting noise levels from the proposed plant at the nearest noise-sensitive receptors, based on the information above, is summarised below.

- Source Term SPL / SWL
- Distance Attenuation
- Directivity
- Reflections
- Screening

Calculation sheets are attached for further information in Appendix C.

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

Table 3 – Predicted Noise Levels

Operating Period	Noise Level (dB) at Receptor 1		Noise Level (dB) at Receptor 2	
	Prediction	Criterion	Prediction	Criterion
Daytime (07:00 – 23:00)	27	38	25	38
Evening (19:00 – 23:00)	27	42	25	42
Night-time (23:00 – 07:00)	27	36	25	36

Noise from the proposed plant installations is in line with the local authority criteria and therefore no further mitigation measures are recommended.

6.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that substations are appropriately acoustically isolated in line with the manufacturer's recommendations.

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.

7.0 CONCLUSION

RBA Acoustics has been appointed to undertake a noise impact assessment in relation to the proposal to install new items of plant on at 147 Wardour Street, London W1F 8BN.

The results of the assessment indicate atmospheric noise emissions from the proposed plant are within the criteria required by Westminster Council. As such, the proposed plant installations should be considered acceptable in terms of noise.

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 – Graphs and Site Plans

147 Wardour Street

L_{Aeq} Time History

Measurement Position 1

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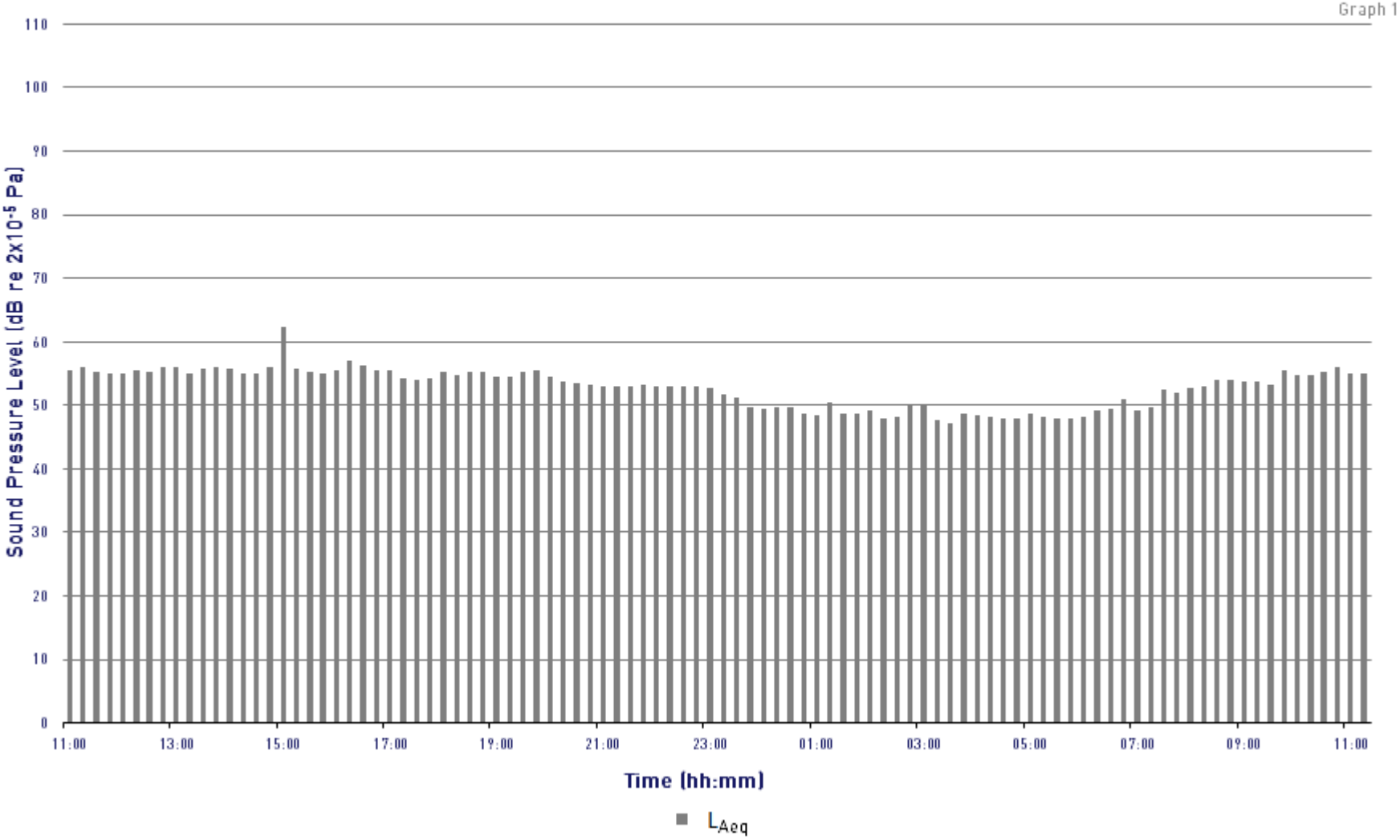
Graph 1



147 Wardour Street

$L_{Amax,f}$ and L_{A90} Time History

Measurement Position 1

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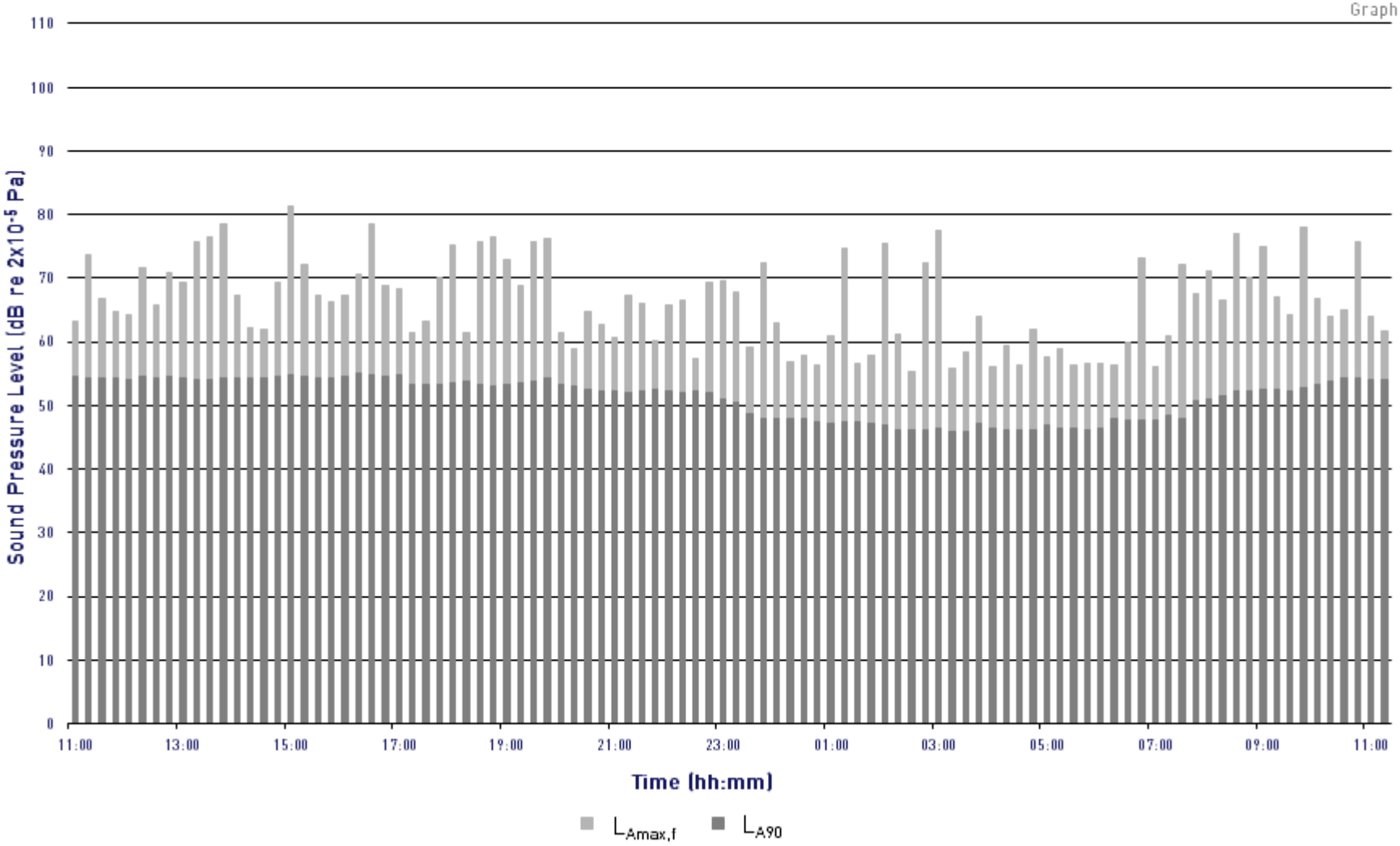
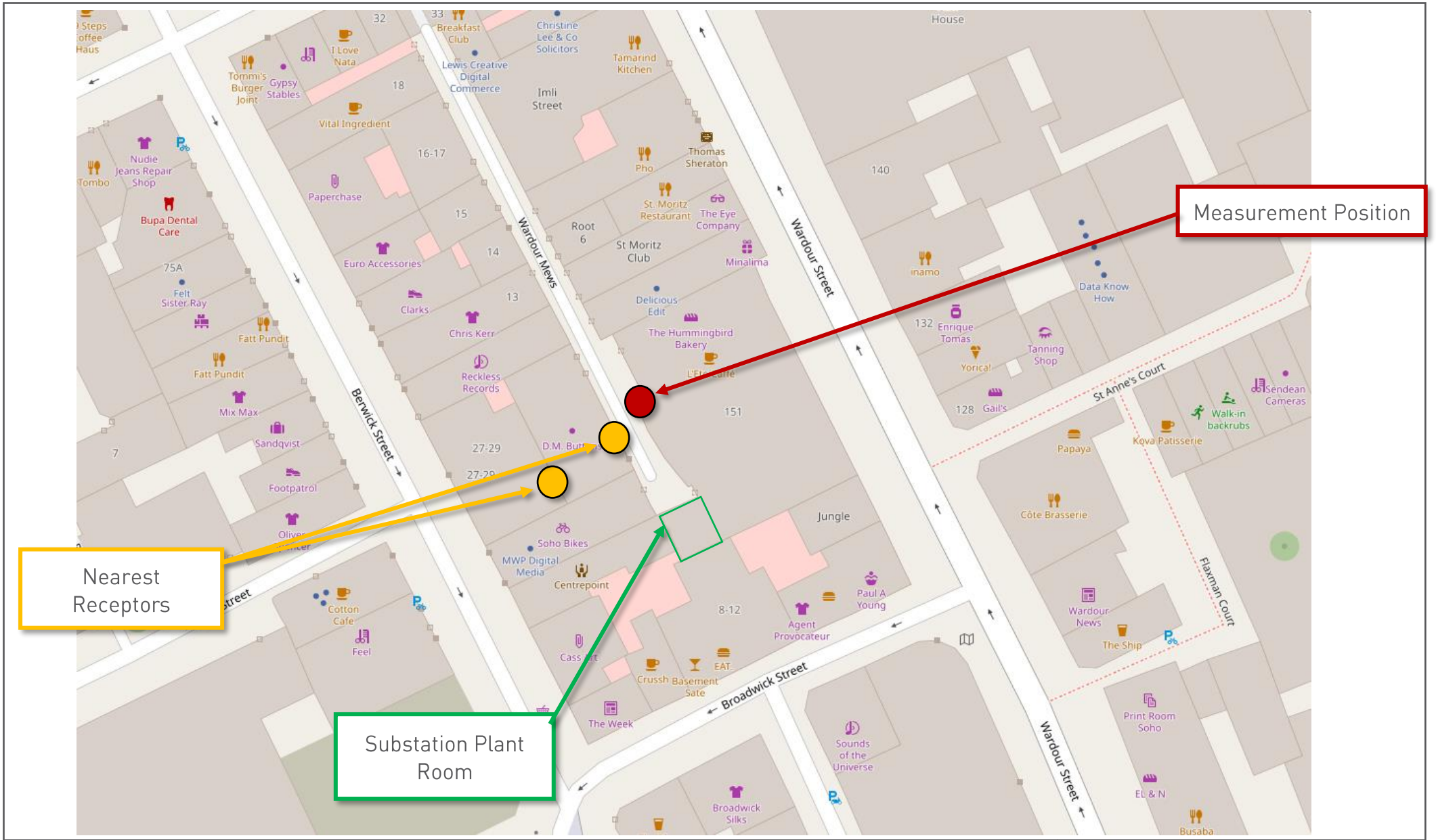
Graph 2





147 Wardour Street
Site Plan showing the measurement position
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Figure 1
19 September 2023
Not to Scale

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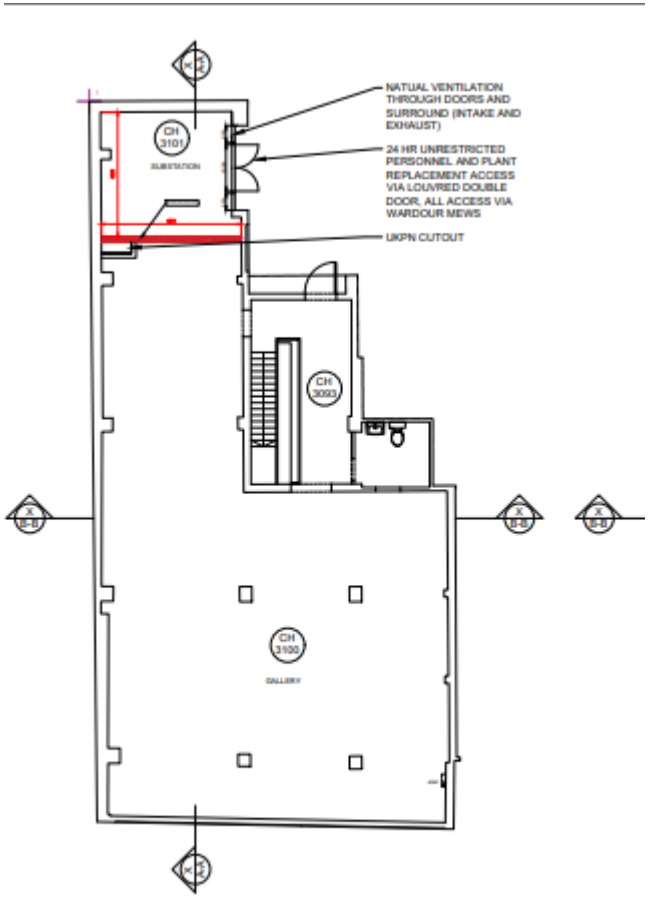

Ground Floor Plan

Scale - 1:100@A1

147 Wardour Street
Plant Layout
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Figure 2
19 September 2023
Not to Scale

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Appendix C – Plant Calculations

Table C1 – Example Calculation, Receptor 1 – The Shelter 25 Berwick Street

Parameter	Octave-band Noise Levels (dB) at Octave-band Centre Frequency (Hz)								dBA
	63	125	250	500	1000	2000	4000	8000	
Reverberant L_p (dB) in Plant Room	60	55	52	51	48	44	33	19	53
Distance losses @ 19m	26	26	26	26	26	26	26	26	-
Noise level at receiver	34	29	26	25	22	18	7	0	27

The louvred door is expected to provide negligible losses and has therefore been excluded from the above calculation, although in practice some losses will be experienced as a result of the louvred door within the overall plant room structure. As such, the above is considered to be a worst-case scenario and lower noise levels are expected in practice

Appendix C - Instrumentation

The following equipment was used for the measurements.

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1407477	U39227	19 October 2023
Norsonic Pre Amplifier	1209	22341		
Norsonic ½“ Microphone	1225	358196	39226	
Norsonic Sound Calibrator	1255	125525259	U39225	19 October 2023

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