RBA ACOUSTICS

60-70 SHORTS GARDENS & 14-16 BETTERTON STREET LONDON

Preliminary Plant Noise Assessment

REPORT 7431/PNA
Prepared: 29 March 2017
Revision Number: 1

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	16 March 2017	Pritham D'Souza	Andrew Heath
1	Comments from design team	29 March 2017	Pritham D'Souza	Andrew Heath

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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

It is proposed to redevelop the existing buildings located at 60-70 Shorts Gardens and 14-16 Betterton Street London WC1.

As part of the planning application, the Local Authority requires consideration be given to atmospheric noise emissions from the proposed rooftop plant equipment at the nearest noise-sensitive properties.

Preliminary plant selections have been made and an initial assessment of noise has been carried out in order to assess the viability of the scheme for planning purposes.

RBA Acoustics have undertaken measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emissions in accordance with the Local Authority's requirements. This report presents the results of the noise measurements, associated criteria and provides the required preliminary noise assessment.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 General

Continuous noise monitoring was undertaken at the re-development site between Wednesday 16th November and Monday 21st November 2016 in order to determine the corresponding noise levels over typical day and night-time periods. Some rain was noted to have occurred on a number of occasions though the effect of such occurrences appears to have had a negligible impact on the results and therefore conclusions and recommendations presented herein.

2.2 Measurement Locations

Position 1 – East elevation (Transformer Yard)

A microphone was positioned on an A-frame 1m outside of a first floor window overlooking the transformer yard to the east of 14-16 Betterton Street. The results at this measurement location are considered to be subject to façade reflection effects.

Position 2 – Betterton Street

A microphone was positioned on an A-frame 1m from the southern façade of the building at second floor level, overlooking Betterton Street. The results at this measurement location are also considered to be subject to façade reflection effects.

The measurement positions are considered to be representative of worst-case noise levels incident on the proposed residential aspects of the re-development.

The measurement positions are also illustrated on the attached Site Plan 7431/SP1.

2.3 Site Conditions

Since the measurements were unattended it is not possible to comment upon the noise climate at each measurement position over the entire monitoring period with absolute certainty. However, during our time on site it was noted that noise levels at Measurement Position 1 were dominated by plant noise from plant items located within the transformer yard.

At Measurement Position 2 it was noted that noise levels were affected predominantly by road traffic movements along Betterton Street and pedestrians passing the building.

2.4 Instrumentation

The following equipment was used for the measurements.

Table 7431/T1 – Equipment Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1405945	U21194	3 April 2018
Norsonic Pre Amplifier	1209	15800		
Norsonic ½" Microphone	1225	208218	21193	
Norsonic Sound Calibrator	1251	34057	U21192	
Norsonic Type 1 Sound Level Meter	Nor140	1406007	U21856	13 June 2018
Norsonic Pre Amplifier	1209	20043		
Norsonic ½" Microphone	1225	208146	21855	
Norsonic Sound Calibrator	1251	34127	U21854	

The sound level meters were calibrated both prior to and on completion of the survey with no calibration drifts observed.

3.0 RESULTS

The measured L_{Aeq}, L_{A90} and L_{Amax} 15 minute period levels are shown as time-histories on the attached Graphs 7431/G1-4. The averaged daytime and night-time L_{Aeq} noise levels (over the 5 day period) are summarised in the following Table 7431/T2 below.

Table 7431/T2 – Measured L_{Aeq} Noise Levels

Measurement Position	Measured $L_{Aeq, period}$ Noise Level (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1 – Transformer Yard	65	64
Position 2 – Betterton Street	64	59

The minimum background noise levels ($L_{A90, 15mins}$) at each measurement position are summarised in the following Table 7431/T3 below. This data can be used to set plant noise emission criteria for use in the assessment of noise emissions from any proposed plant at the development.

Table 7431/T3 – Measured Minimum $L_{A90, 15mins}$ Noise Levels

Measurement Position	Measured Minimum $L_{A90, 15mins}$ Noise Level during period (dB)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1 – Transformer Yard	49	49
Position 2 – Betterton Street	46	44

4.0 CRITERIA

The requirements of the Local Authority with regards to plant noise emissions are outlined in Planning Condition 5 (Application ref: 2012/1533/P for the development.

> *The level of noise emitted from the site shall not exceed 5dB above existing background noise level (LAeq) during the daytime and evening (0700-2300 hrs.) The noise level emitted from the site shall not exceed 3dB above existing background noise level during the night (2300-0700hrs.) The noise levels should be measured at one metre external to the nearest noise sensitive premises to the site. The noise level inside any living room or bedroom of the nearest noise sensitive premises shall not exceed existing noise levels when measured using Leq 5m (in the 63 Hz octave band measured using the 'fast' time constant) during the night. All noise measurements shall be taken according to BS4142:1990.*

We note that BS4142 has been superseded twice since 1990 with the latest version released in 2014.

Comment on Condition Wording

We note that Condition 5 differs in wording compared with Camden's typical plant noise criteria which requires plant to be designed to a more stringent limit of 5dB below the lowest measured background noise level.

Edward Davis (Environmental Health Officer – London Borough of Camden) has since commented to say that plant should indeed be designed to achieve this more typical 5 dB below background plant criteria. As such the following noise limits should be achieved at the nearest noise sensitive premises.

Table 7431/T4 – Plant Noise Emission Limits

Measurement Position	L_{Aeq} Noise Level limit of all operating plant (dB) at 1m from the nearest noise sensitive façade	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1 – Transformer Yard	44	44
Position 2 – Betterton Street	41	39

In line with BS 4142, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be applied to any of the above proposed noise emission limits in Table 7431/T4.

5.0 ASSESSMENT

Our assessment has been based upon the following preliminary information:

5.1 Indicative Plant Items

Typical number of units that would be required are as follows:

11 No. Daikin REYQ10T Condensers
3 No. Daikin RXYSQ4TV1 Condensers
1 No. Daikin RXYSQ6TV1 Condensers
1 No. Daikin RXYSQ5TV1 Condensers
2 No. Nuaire AVT4L-R Extract fans

5.2 Position of Units

The equipment is to be located in two general locations on the roof of 60-70 Shorts Gardens. These indicative positions are indicated on the attached Site Plan 7431/SP1.

5.3 Noise Levels

Information regarding the noise levels of the indicative plant selections are detailed as follows:

Table 7431/T5 – Octave Band Sound Power Levels

Unit	Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Daikin REYQ10T	Lw	-	81	78	77	73	69	63	58
Daikin RXYSQ4TV1	Lw	-	68	68	66	64	59	54	43
Daikin RXYSQ6TV1	Lw	-	69	69	67	66	63	59	48
Daikin RXYSQ5TV1	Lw	-	66	67	66	65	60	58	46
Nuaire AVT4L-R (Open Outlet))	Lw	71	66	69	69	66	62	56	49

Review of the octave band data concludes that there are no tonal characteristics associated with the proposed plant.

The Nuaire extract fans would typically be supplied with Nuaire AVT6-MSM-X 500mm matched silencers, which have the following acoustic performance.

Table 7431/T6 – Nuaire Silencers

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
3	3	7	9	11	8	8	6

It is proposed to surround the rooftop plant by a 150mm thickness, 2.3m high acoustic louvred screen as indicated on 7431/SP1. Our preliminary calculations for the indicative scheme have been based on the Caice SS150 Acoustic Louvre with the following acoustic performance.

Table 7431/T7 – Acoustic Louvres

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
3	4	6	10	12	13	13	14

There is an option for the rooftop top discharging condensers be set to run at 'Low Noise Level 2' setting which reduces the noise output by 4 dBA. We have assumed this setting for the preliminary assessment.

For the purpose of the preliminary assessment we have assumed the discharge of the condensers will be installed with silencers to achieve the following insertion loss.

Table 7431/T8 – Daikin Condenser

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
1	2	4	9	10	10	7	3

5.4 Location of Nearest Residential Windows

The closest residential windows to the plant are understood to be the newly proposed fourth and fifth floors of the 14-16 Betterton Street (on the western and eastern façade) and the windows on the south-facing side of 59 Shorts Gardens.

5.5 Calculation of Noise Levels at Nearest Residential Window

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

- Source Term SPL / SWL
- Acoustic Enclosure losses
- 20LogR Distance Attenuation
- Directivity

Example calculation sheets are attached for further information in Appendix B.

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

Table 7431/T9 – Predicted Noise Levels

Operating Period	14-16 Betterton Street (Windows on Western façade)		14-16 Betterton Street (Windows on Eastern façade)		59 Shorts Gardens	
	Prediction	Criterion	Prediction	Criterion	Prediction	Criterion
Daytime (07:00 – 23:00)	43 dB	44 dB	43 dB	44 dB	44 dB	44 dB

Adoption of the above enclosures and silencers would ensure that noise levels to the nearest noise sensitive properties for the indicative scheme are within the criteria required by Camden Council. This is a positive indication that the target noise levels can be achieved for the final scheme which will be re-reviewed when final plant selections are made.

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 condensing units and the AHU fans 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.

7.0 CONCLUSION

Measurements of the existing background noise levels at 14-16 Betterton 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.

A preliminary assessment has been undertaken based on indicative plant selections. The results of this preliminary assessment indicate that provided suitable mitigation measures are adopted atmospheric noise emissions from the proposed plant are predicted to satisfy the criteria required by Camden Council.

This is a positive indication that the target noise levels can be achieved for the final scheme which will be re-reviewed when final plant selections are made.

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

Predicted Noise Levels Example Calculation

Unit	L_p (dB)	Distance Loss (15m) (dB)	Directivity	Low noise mode	Acoustic Enclosure	Received Level (dBA)
Daikin REYQ10T	70	-23.5	-4	-4	-7	31.5

Received Noise Levels Summary

Plant Location	Unit	Predicted Receive Levels At Nearest Residential Window (14-16 Betterton Street- East facing window) [dBA]
East-end Plant Area	Daikin REYQ10T	33
	Daikin REYQ10T	33
	Daikin REYQ10T	33
	Daikin REYQ10T	32
	Daikin REYQ10T	32
	Daikin REYQ10T	32
	Daikin REYQ10T	31.5
	Daikin REYQ10T	31.5
	Daikin REYQ10T	31.5
	Daikin REYQ10T	31.5
	Daikin REYQ10T	31.5
	Daikin RXYSQ-5TV1	21
	Nuaire AVT4L-R (Inlet)	20
	Nuaire AVT4L-R (Outlet)	26
	Total Received Level (dBA)	43

Appendix C – CDM Considerations

The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Vibration Isolators	Injury to hands	Contractors	3	3	9	Care needs to be taken during adjustment. Follow manufacturers guidance	1	3	3
Attenuators/ Acoustic Lagging/ Acoustic Screens	Strain of neck, limbs or back.	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Attenuators/ Acoustic Lagging/ Acoustic Screens	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3

L: Likelihood
S: Severity
R: Rating

14-16 Betterton Street
Position 1 -First Floor Overlooking Transformer Yard
L_{Aeq} Time History
Wednesday 16 November to Monday 21 November 2016

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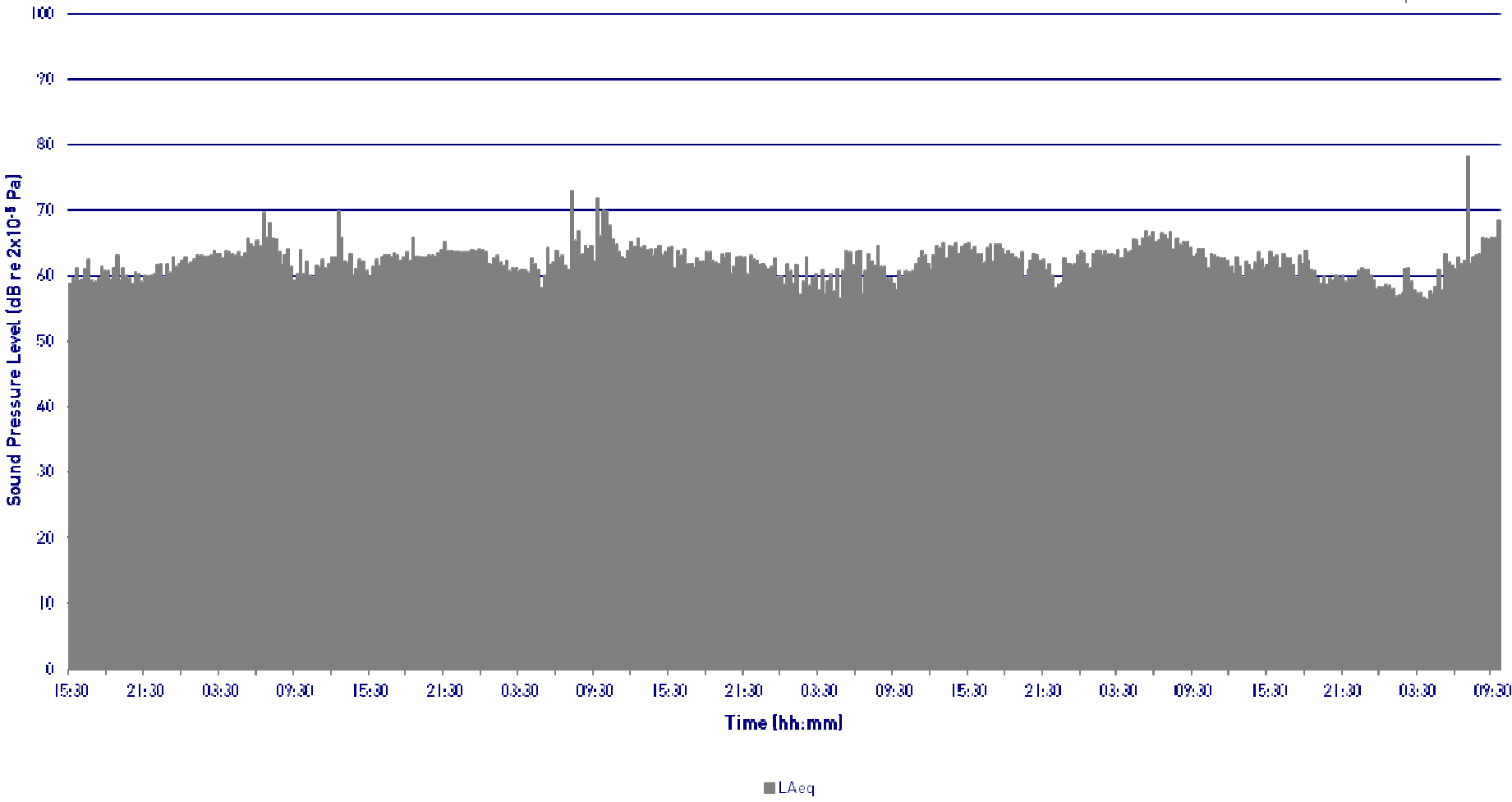
Graph 7431/G1



14-16 Betterton Street
Position 1 -First Floor Overlooking Transformer Yard
L_{A90} and L_{Amax} Time History
Wednesday 16 November to Monday 21 November 2016

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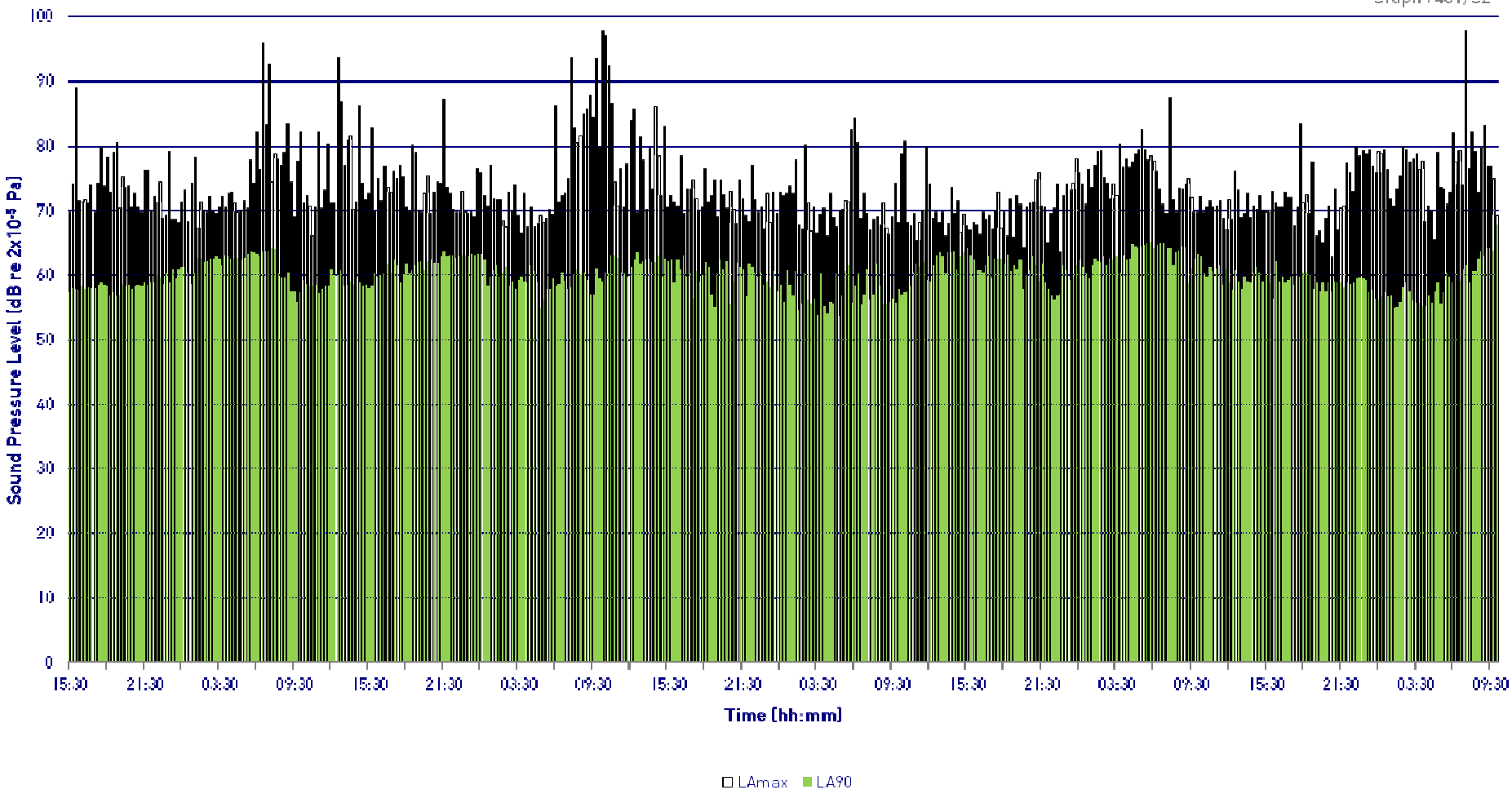
Graph 7431/G2



14-16 Betterton Street
Position 2 - Second Floor Overlooking Betterton Street
L_{Aeq} Time History
Wednesday 16 November to Monday 21 November 2016

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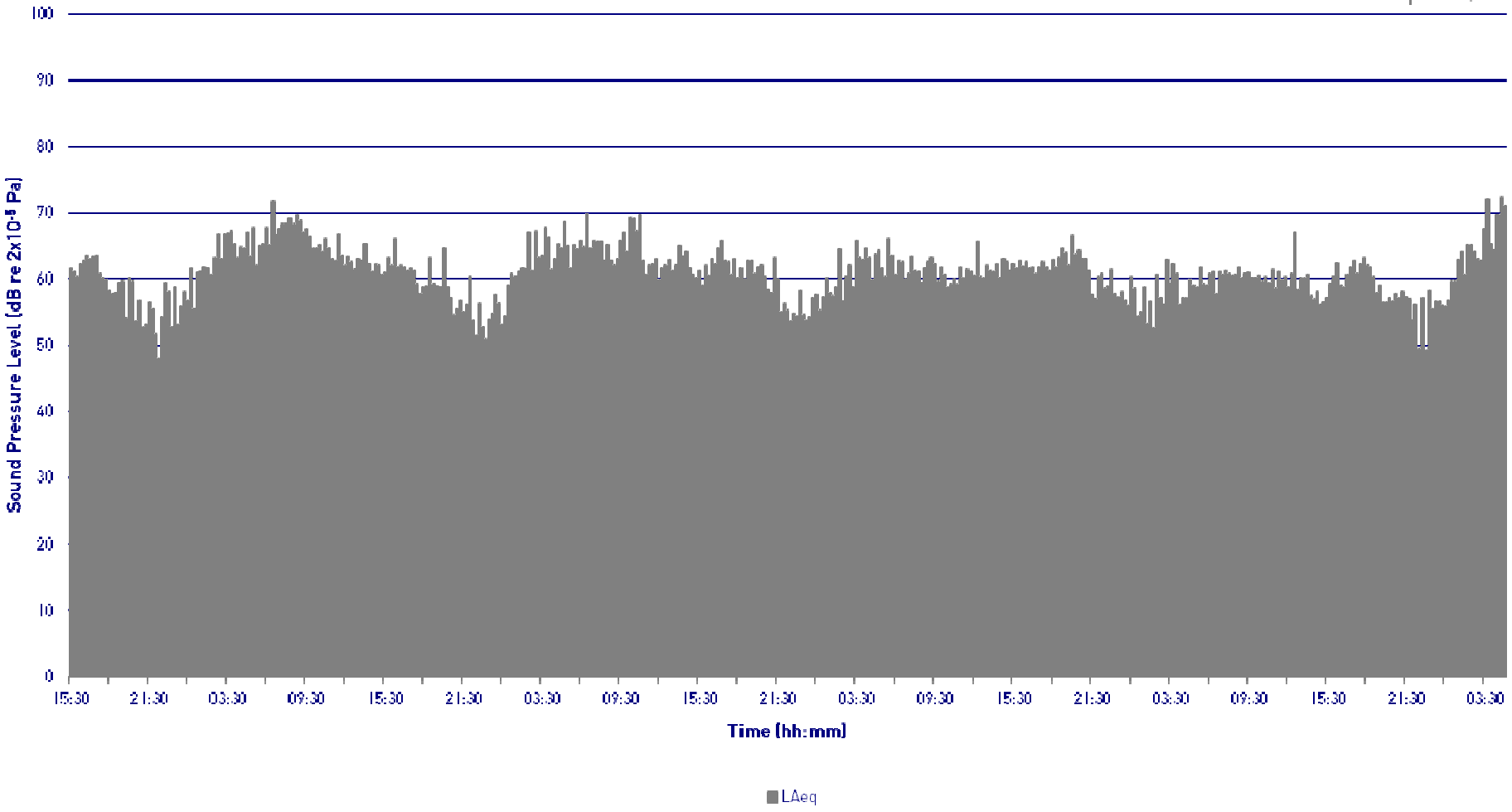
Graph 7431/G3



14-16 Betterton Street
Position 2 - Second Floor Overlooking Betterton Street
L_{A90} and L_{Amax} Time History
Wednesday 16 November to Monday 21 November 2016

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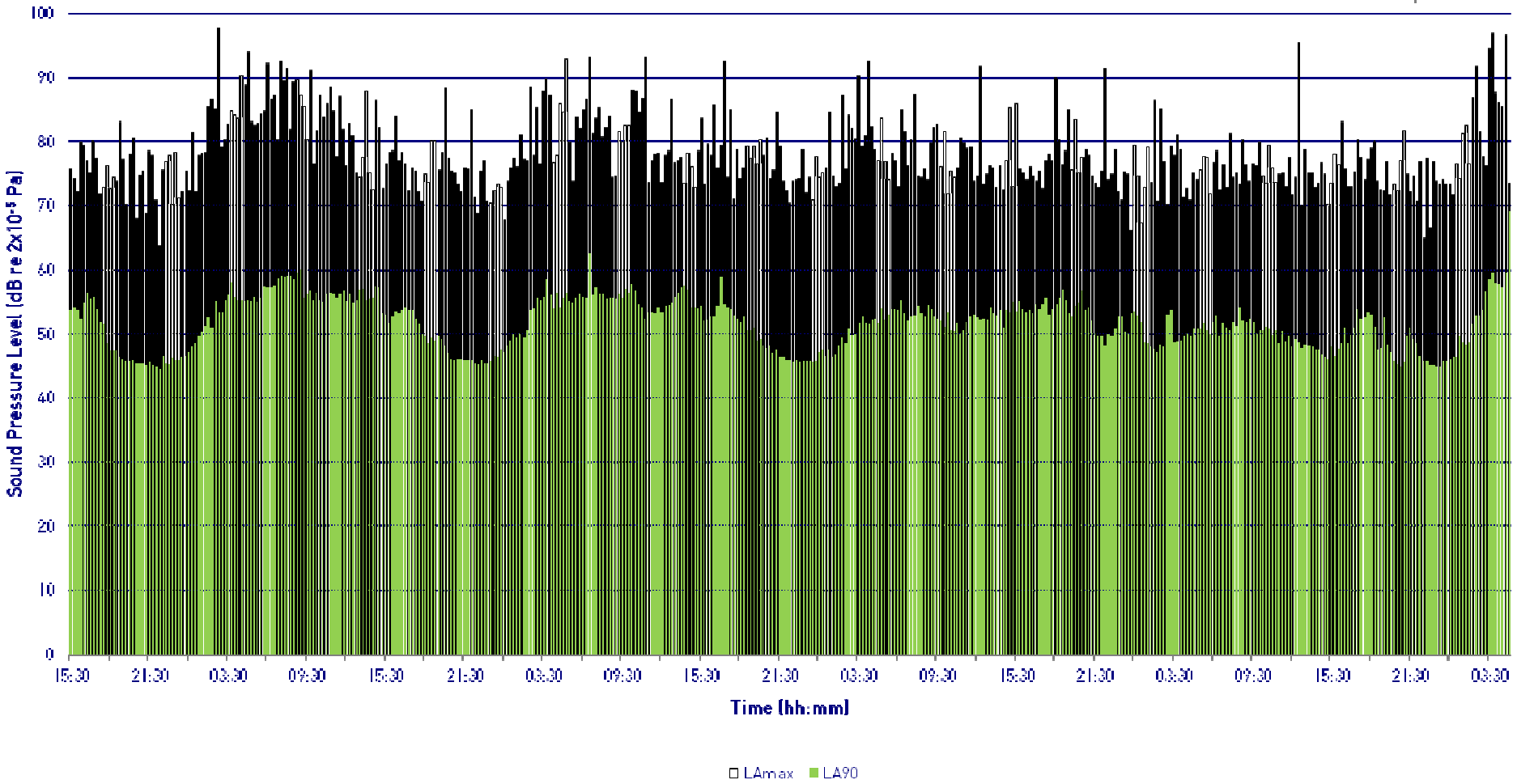
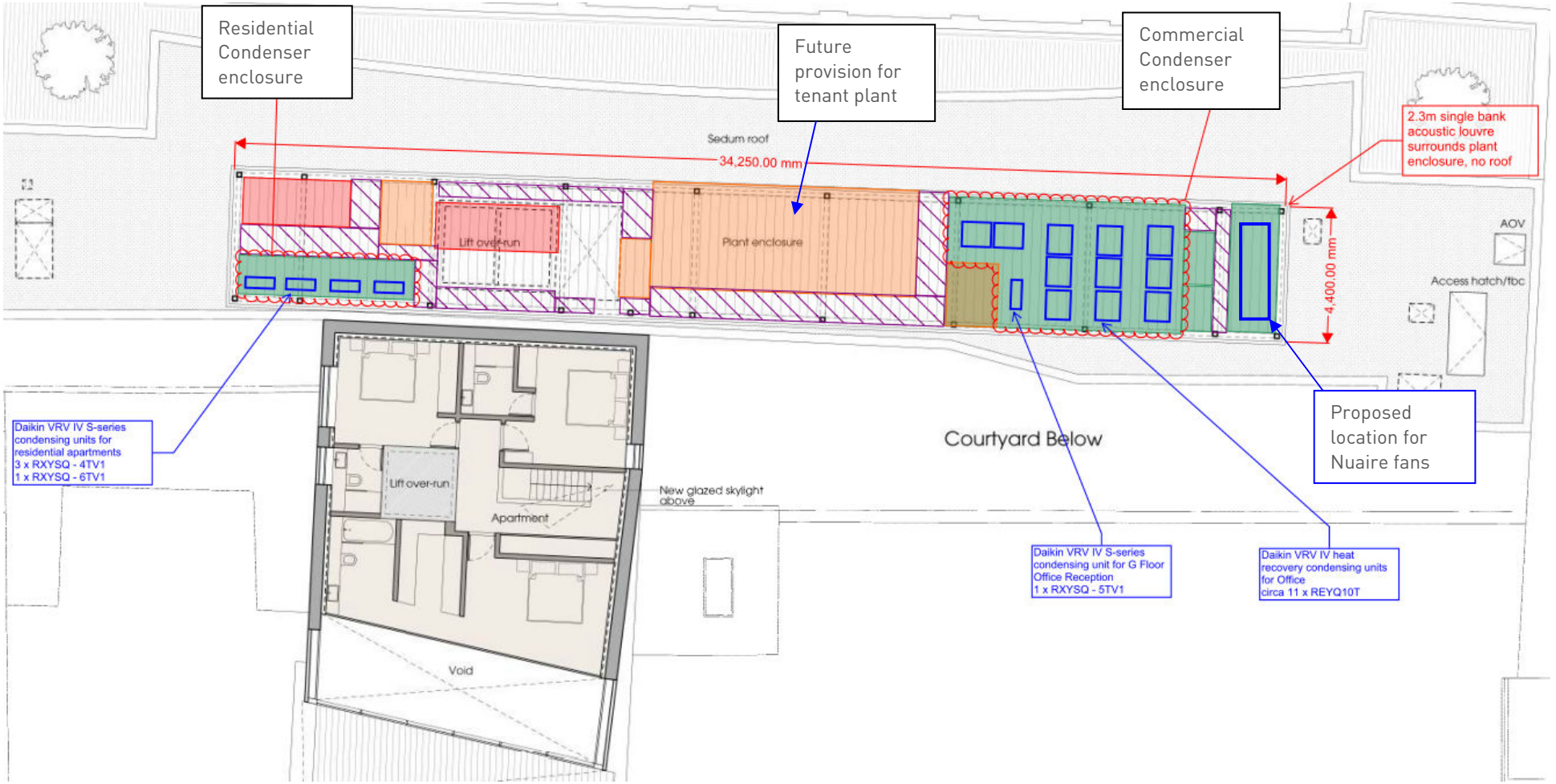
Graph 7431/G4





60-70 Shorts Gardens

Figure 7431/SP1

Rooftop Plan Showing Indicative Plant Locations

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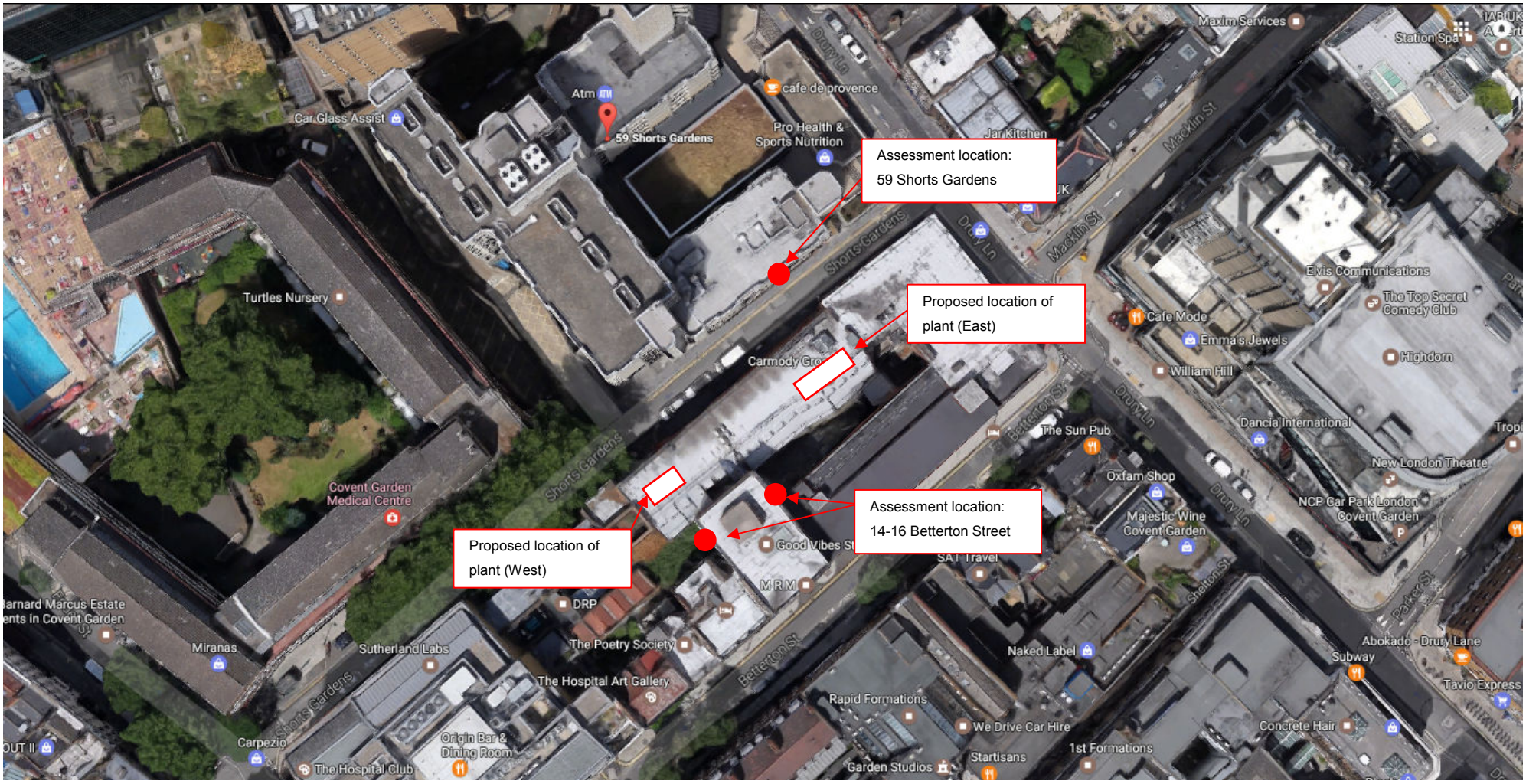

60-70 Shorts Gardens

Aerial Image showing Assessment Locations

Figure 7431/SP2

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