210 High Holborn
WC1V 7BZ

Plant Noise Survey

On behalf of

Charles D. Smith & Associates Ltd

Project Reference: 90483| Revision: 02 | Date: 11th February 2022
Revised: 17th February 2022

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Document Information

Project Name	:	**210 High Holborn**
Project Reference	:	**90483**
Report Title	:	**Plant Noise Survey Report**
Doc Reference	:	**90483/PNS/Rev2**
Date	:	**11th February 2022**

	Name	Qualifications	Initials	Date
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For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved
01	16/02/2022	Include night-time operation	ACM	NAC
02	17/02/2022	Minor amendment	DMB	ACM

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Appendices

1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Charles D Smith and Associates Ltd to determine noise emissions relating to 210 High Holborn in London.

1.2. NSL has attended site to undertake plant noise measurements in order to determine compliance with local authority requirements and conditions.

1.3. To assist with the understanding of this report a glossary of acoustic terms can be found in **Appendix A**. An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Site layout

2.1. 210 High Holborn a seven-storey terraced building along High Holborn.

2.2. External plant serving the building comprises two supply fans, two extract fans and a chiller all located on the roof at the rear of the building.

2.3. It is understood that the plant may operate at any time of the day or night.

3.0 Details of development proposals

3.1. Three new HVRF units will be located on the roof close to the High Holborn (northern) elevation. Three extract fan louvres and AHU supply and extract louvres will be located on the southern façade.

4.0 Nearest noise sensitive receptors

4.1. The nearest residential windows to the external plant are the flats behind the building to the south (Reference R1), the closest being approximately 10m from the nearest plant. These flats are screened from the rooftop plant by the building fabric and a 1.5m parapet wall. There is no screening between the proposed new louvres and the residential windows.

4.2. An aerial photograph showing the site and surrounding area, the nearest noise sensitive properties and the noise monitoring location used in this assessment is presented in **Appendix B**.

5.0 Existing noise climate

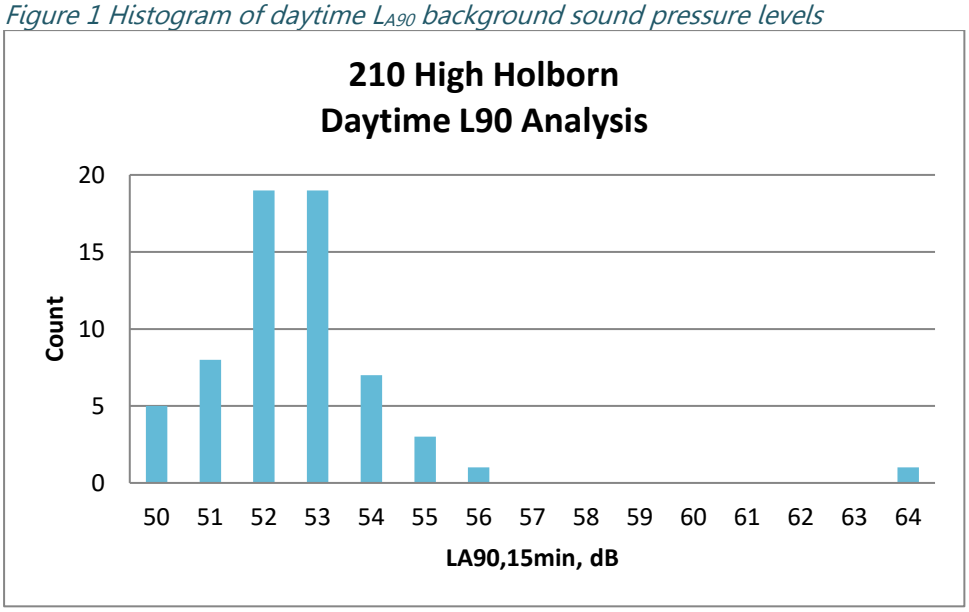
5.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.

5.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in **Appendix C**.

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{Aeq(15mins)}$	$L_{AFmax(15mins)}$	$L_{A10(15mins)}$	$L_{A90(15mins)}$
Daytime (07.00 – 23.00 hours)	57-74	72-99	60-75	50-64
Night-time (23.00 – 07.00 hours)	55-62	68-83	59-66	43-51

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



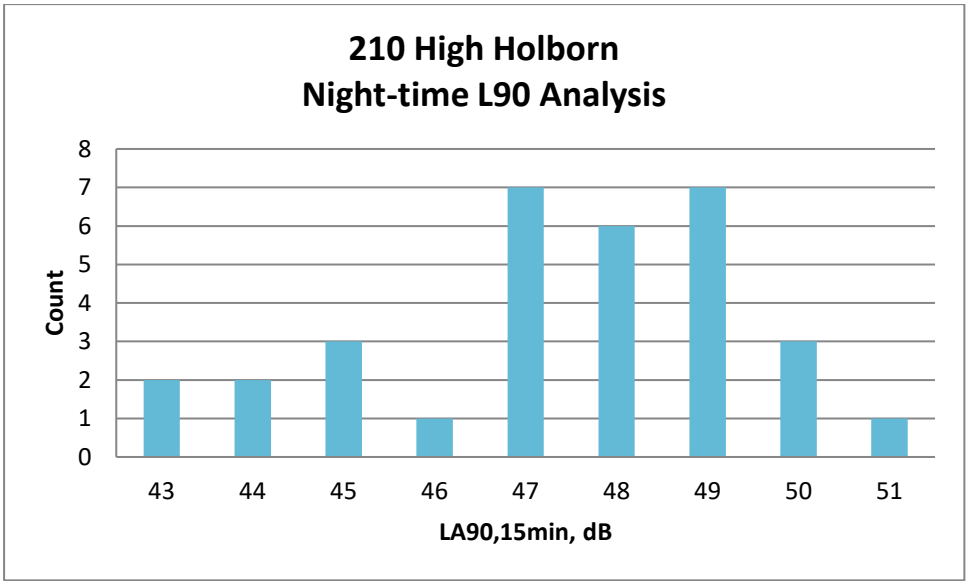
5.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} operational hours	
mean	53
modal	53
median	52

5.4. From the histogram analysis, 52dB has been selected to be a robust representation of the background noise level during the daytime period.

Figure 2 Histogram of night-time hours L_{A90} background sound pressure levels



5.5. Further statistical analysis has been carried out on the data and the mean and median values are shown in Table 3 below.

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} non-operational hours	
mean	47
modal	49
median	48

5.6. Again from the histogram analysis, 45dB has been chosen to be representative of the background sound level during the night-time period.

5.7. The representative background sound levels measured are therefore:

- 52dB L_{A90} during the daytime (07.00 – 23.00 hours)
- 45dB L_{A90} at night (23.00 – 07.00 hours).

6.0 Plant noise design criteria

London Borough of Camden

6.1. Section 6 of the Camden Planning Guidance Amenity, published March 2018, gives guidance on noise and vibration.

6.2. Clause 6.8 refers noise thresholds within Appendix 3 of the Local Plan and to refers to the principles of No observed effect level (NOEL), Lowest observable adverse effect level (LOAEL) and Significant observed adverse effect level (SOAEL) and defines their meanings. Specifically, in the context of this report, LOAEL is defined as:

> *The level above which changes in behaviour (e.g. closing windows for periods of the day) and adverse effects on health (e.g. sleep disturbance) and quality of life can be detected.*

6.3. SOEAL is defined as:

> *The level above which adverse effects on health and quality of life occur. This could include psychological stress, regular sleep deprivation and loss of appetite.*

6.4. Clause 6.27 states that:

> *Developments proposing plant, ventilation, air extraction or conditioning equipment and flues will need to provide the system's technical specifications to the council accompanying any acoustic report. "BS4142 Method for rating Industrial and Commercial Sound' contains guidance and standards which should also be considered within the acoustic report.*

6.5. Appendix 3 within the Camden Local Plan published 2017 states:

6.6. "A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."

6.7. Table C of the appendix states the criteria at which development related noise levels will be acceptable:

Table C: Noise levels applicable to proposed industrial and commercial development (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 88dBL_{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.*

BS 4142:2014 Methods for rating and assessing industrial and commercial sound

6.8. BS 4142:2014 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes "sound from fixed plant installations which comprise mechanical and electrical plant and equipment".

6.9. The procedure contained in BS 4142:2014 is to quantify the "specific sound level", which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07.00 to 23.00 hours, and night-time as 23.00 to 07.00 hours.

6.10. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective

methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.

6.11. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: "Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."

6.12. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: "Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."

6.13. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- *A difference of around +5 dB 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 sound level, the less likely it is that the specific sound source will have an adverse impact or a 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 impact, depending on the context.*

6.14. The standard does state that "adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

6.15. The standard goes on to note that: "Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

6.16. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

> *"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."*

6.17. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Summary of proposed criteria

6.18. Based on the typical requirements from the London Borough of Camden Council, it is considered appropriate for the plant noise level, to be at level that is at least 10dB below the representative L_{A90} background level at the nearest residential property.

6.19. Table 4 below presents the proposed plant noise specific noise level at the nearest residences:

Table 4 Proposed plant noise emissions level limits at nearest receptors

Period	1m from residential window
	Plant noise level, dB
Daytime (07:00 – 23:00 hours)	42
Night-time (23:00 – 07:00 hours)	35

7.0 Site Visit 1st February 2022

7.1. Noise Solutions Ltd attended site between 20.00 and 21.00 hours on 1st February 2022 to measure noise emissions from the installed plant.

External plant assessment

7.2. Measurements were undertaken to establish the sound level emissions from the external plant installed on the roof.

7.3. The all plant was switched off in order to measure the residual sound level. Each plant item was then switched on to measure the specific sound level in isolation. Measurements were taken over short time intervals to minimise the effects of transient noise sources such as passing vehicles. The measurements were taken 1m from the plant.

7.4. The measurements are shown in table 5 below:

Table 5 External plant sound pressure level survey results

Plant item	Sound pressure levels (dB)			
	Plant on	Plant off	Specific level	Specific level at R1
Toilet Supply	61	49	61	31
Toilet Extract	76	49	76	27
Office Extract	64	49	64	14
Office Supply	61	49	61	31
Chiller	65	49	64	27
Cumulative				35

7.5. The cumulative existing and proposed plant noise level at the most affected noise sensitive receptors have been predicted based on the measurements shown in Table 5 and the manufacturer's noise data for the proposed equipment. The assessment has taken into consideration distance attenuation, screening, directivity and reflections.

7.6. Table 6 summarises the results of the assessment at the most affected properties. All other nearby receptors benefit from increased distance/screening to the plant such that resulting noise levels will be lower than at the receptors considered. The full set of calculations can be found in **Appendix E**:

Table 6 Assessment of predicted rating levels at the nearest noise sensitive receptors

Receptor	Period	Predicted plant sound level at receptor, L_{Aeq} (dB)	Criterion (dB)	Difference
R1	Daytime (07.00 - 23.00 hours)	35	42	-7
	Night-time (23.00 - 07.00 hours)	35	35	0

7.7. The assessment is inclusive of suitable plant selection and attenuation to limit each fan, and the AHU intake and discharge to 36dB at 1m from each louvre.

Context and uncertainties

7.8. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:

- The assessment is undertaken at the nearest residential window. The impact on all other nearby residential windows will be lower due to screening and distance attenuation.

7.9. Where possible uncertainty in the above assessments has been minimised by taking the following steps:

- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
- Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method

8.0 Conclusions

8.1. Noise Solutions Ltd (NSL) has been commissioned by Charles D Smith and Associates Ltd to determine noise emissions relating to 210 High Holborn in London and to assess the impact of additional proposed plant.

8.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at a location representative of the noise climate outside the nearest noise sensitive receptors to the proposed site.

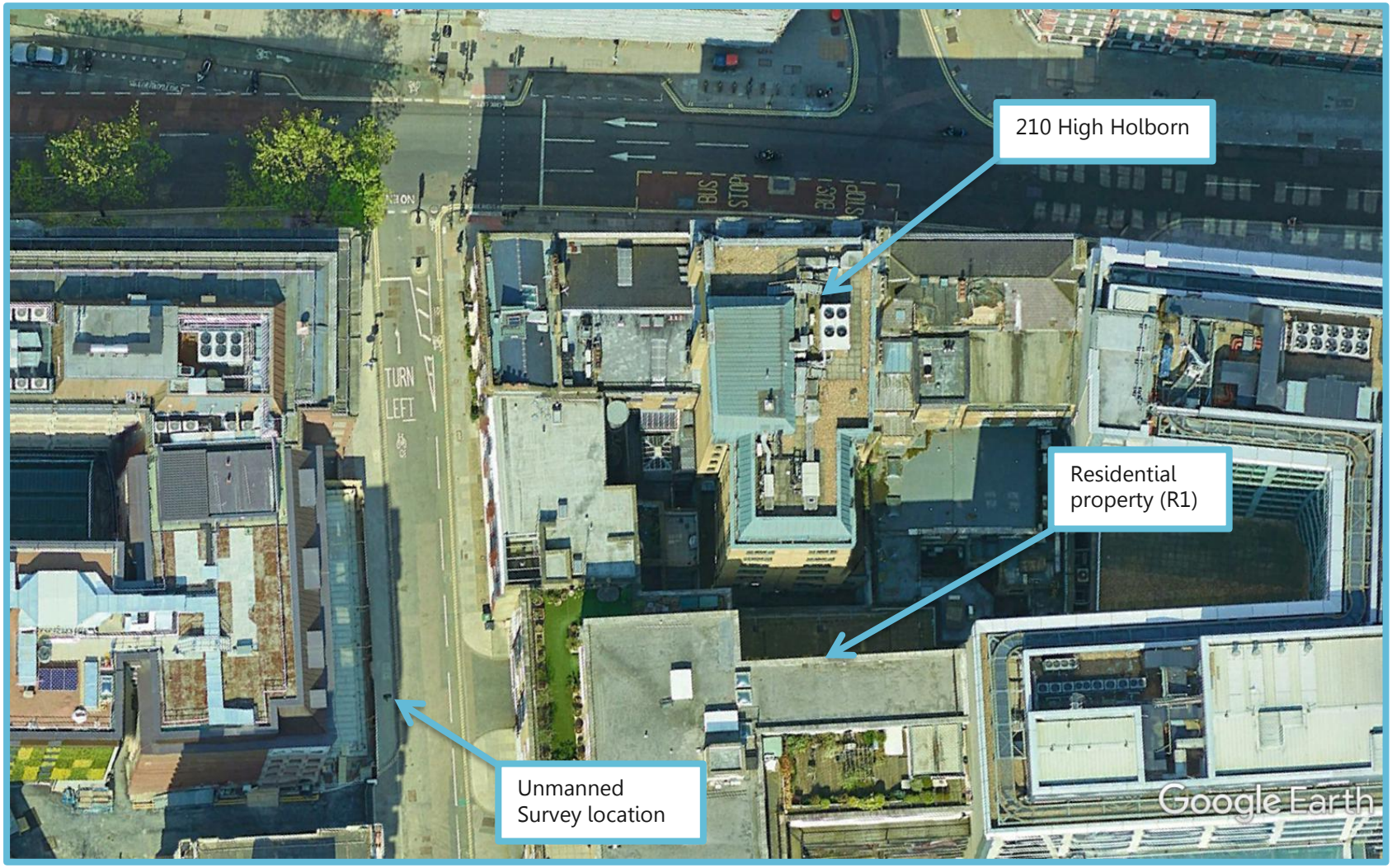
8.3. A plant noise survey has been undertaken to establish the sound emissions of the existing plant at the site.

8.4. The cumulative plant noise emission levels from the existing and proposed plant have been predicted at the most affect noise sensitive receptor locations and assessed taking into consideration the typical requirements of the London Borough of Camden Council. Therefore, the plant proposals should not be a reason for refusal of planning permission.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example.

Appendix B Aerial photograph site showing areas of interest



Photograph 1 Courtesy of Google Earth

Appendix C Environmental sound surveys

Details of sound surveys

C.1 Measurements of the existing background sound levels were undertaken between 11.30 hours on Thursday 10 February and 11.15 hours on Friday 11 February 2022.

C.2 The sound level meter was programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the noise survey.

Measurement positions

C.3 The sound level meter was positioned on a lamppost along Newton Street. The approximate location of the microphone during the survey is indicated on the plan in Appendix B. In accordance with BS 7445-2:1991 *'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use'*, the measurements were undertaken under facade conditions.

Equipment

C.4 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental sound pressure level survey

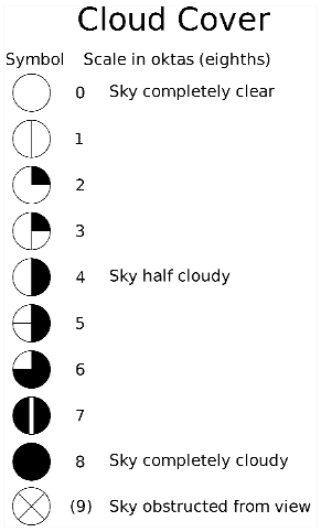
Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971 / 111625	18/06/2021	Factory conformation certificate
Condenser microphone	ACO Pacific 7052E / 80034		
Preamplifier	Svantek SV18 / 112630		
Calibrator	Rion NC-74 / 35094453	13/08/2021	1500814-1

Plant sound pressure level survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977/ 97446	12/02/2021	Factory conformation certificate
Condenser microphone	Microtech MK255 / 20194		
Preamplifier	Svantek SV12L / 106487		
Calibrator	Svantek SV 30A / 10847	30/06/2021	1500577-1

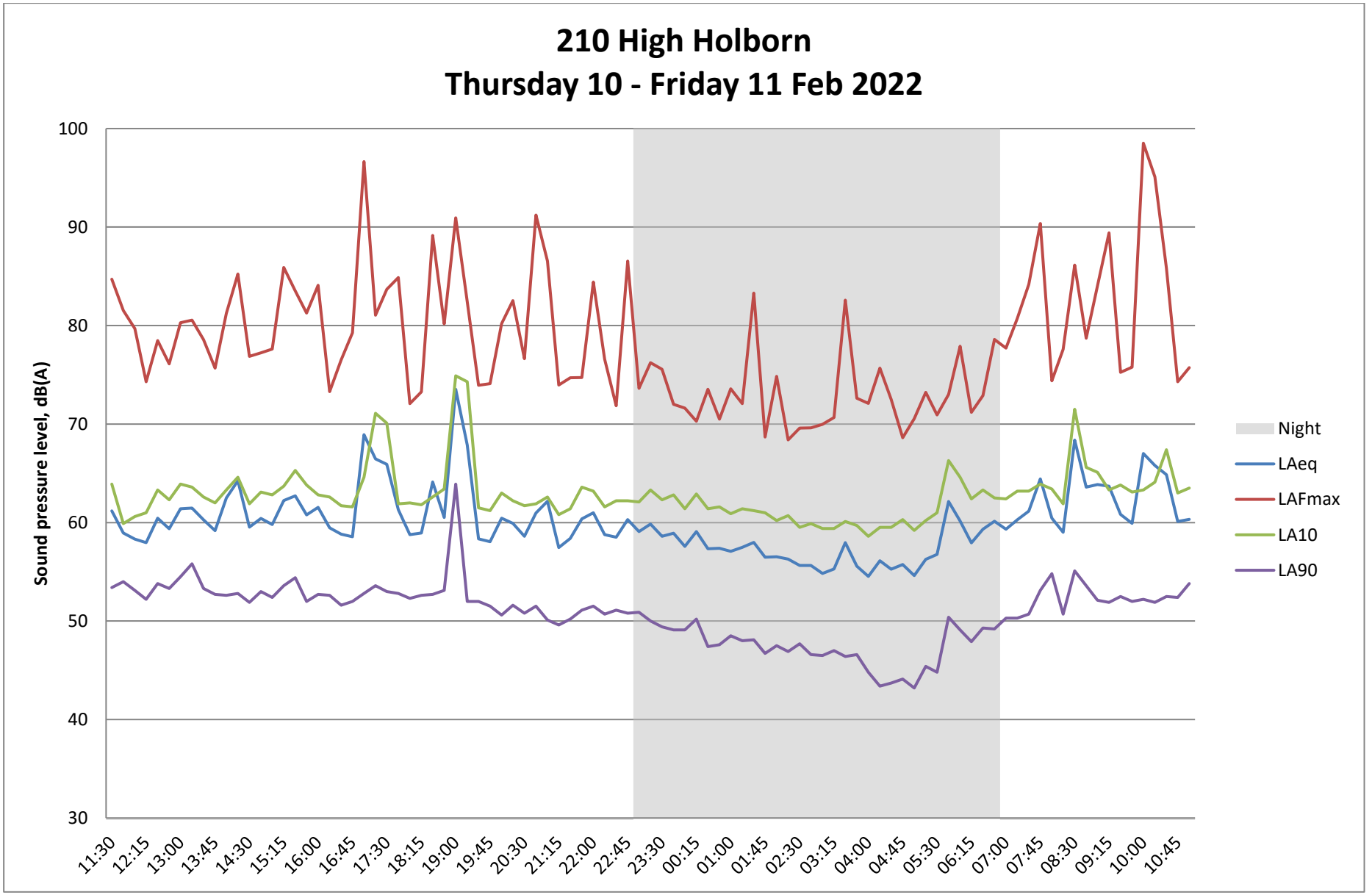
Weather Conditions

C.5 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the surveys.

Weather Conditions				
Measurement Location	**Date/Time**	**Description**	**Beginning of Survey**	**End of Survey**
As indicated on Appendix B	11.30 10/2/22 - 11.15 11/2/22	Temperature:	9	8
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	7	4
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	1	2
		Wind Direction	Southerly	Southerly
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

C.6 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The noise climate during the survey period was dominated by local road traffic. The results of the survey are presented in the table overleaf.


210 High Holborn
Thursday 10 - Friday 11 Feb 2022
Sound pressure level, dB(A)
100
90
80
70
60
50
40
30
11:30
12:15
13:00
13:45
14:30
15:15
16:00
16:45
17:30
18:15
19:00
19:45
20:30
21:15
22:00
22:45
23:30
00:15
01:00
01:45
02:30
03:15
04:00
04:45
05:30
06:15
07:00
07:45
08:30
09:15
10:00
10:45
Night
LAeq
LAFmax
LA10
LA90

Appendix D Proposed plant information and manufacturer published sound pressure levels

Plant Item	Make/Model	Quantity	Sound pressure level (dBA)
HPU G1	Mitsubishi/PURY-EM200 YNW-A	1	59 at 1m
HPU G2	Mitsubishi/PURY-EM200 YNW-A	1	59 at 1m
HPU 1st	Mitsubishi/PURY-EM250 YNW-A	1	61 at 1m

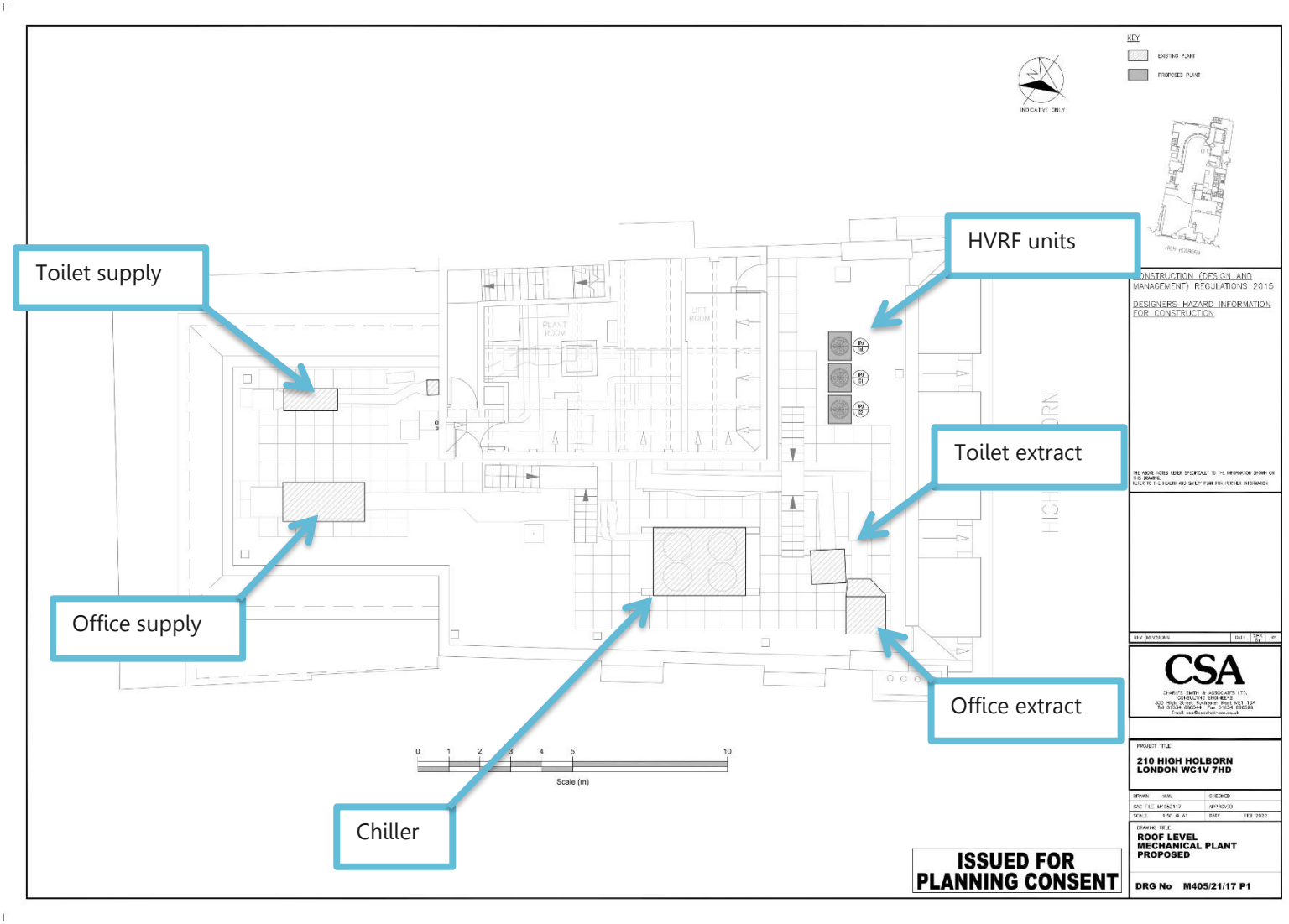
Appendix E Noise level predictions

Receptor R1 daytime and night-time

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	Plant sound pressure level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)			
Existing	See measurement information shown in Table 5						35
HPU G1	59	1	30	-30	0	-20	9
HPU G2	59	1	30	-30	0	-20	9
HPU 1st	61	1	30	-30	0	-20	11
EF1	36*	1	8	-18	0	0	18
EF2	36*	1	8	-18	0	0	18
EF3	36*	1	8	-18	0	0	18
AHU1 supply	36*	1	8	-18	0	0	18
AHU1 extract	36*	1	8	-18	0	0	18
	Cumulative sound pressure level (day and night)						**35**

* Plant noise limit at 1m from louvre

Appendix F Rooftop plant layout



Appendix G South elevation louvres