11-12 South Square Holborn, London

Environmental Noise Survey and Plant Noise Assessment Report

28324/PNA1

5 November 2020

For:
The Honourable Society of Gray's Inn

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

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Document Control

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Hann Tucker Associates

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Attachments

1.0 Introduction

A new plantroom has been proposed on the roof of 11-12 South Square.

Hann Tucker Associates (HTA) have therefore been commissioned to undertake an environmental noise survey and plant noise assessment in order to assist with a planning application to the Local Authority.

This report presents the methodology and findings of our noise survey and assessment in the context of national planning policies and the policy of the Local Authority.

2.0 Objectives

To inspect the site to familiarise ourselves with its layout and surroundings in order to identify suitable accessible locations for environmental noise measurements.

To establish by means of an unmanned 24 hour survey the existing $L_{Amax,}$ L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at up to two secure and accessible on-site positions, using fully computerised noise monitoring equipment.

Measurement procedures shall be in general accordance with British Standard BS 7445 “Description and measurement of environmental noise”.

Measurement procedures shall be in general accordance with those described in BS 4142: 2014, Method for rating industrial noise affecting mixed residential areas, published by the British Standards Institution.

The survey will enable noise emission limits from the development to be identified with reference to the requirements of the Local Authority and/or the application of BS 4142: 2014 and to minimise the possibility of noise nuisance to neighbours.

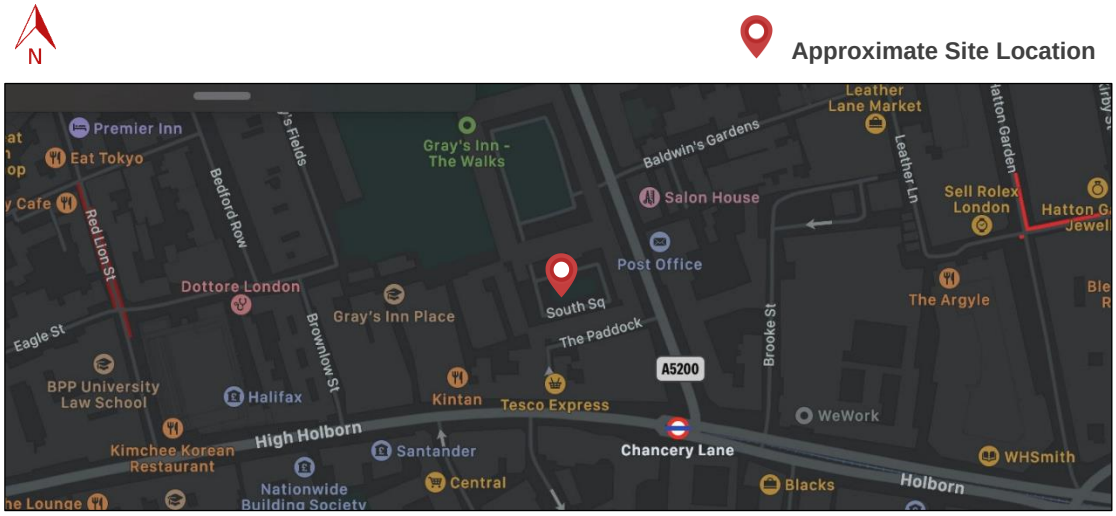
To assess the noise emissions from the proposed plant, based upon data with which we are provided, and comment upon the acceptability.

To advise on noise control measures if required with reference to the requirements of the Local Authority.

3.0 Site Description

3.1 Location

The site is located in 11-12 South Square in Holborn, London. The approximate location is shown in the Location Map below.



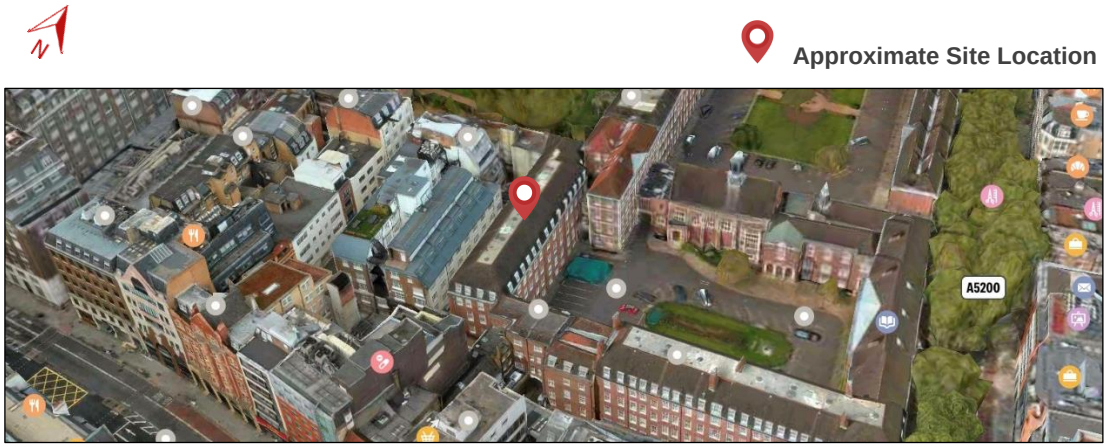
Location Map (©2020 Apple Maps)

The site falls within the jurisdiction of the London Borough of Camden.

3.2 Description

The site is located within a mixed residential and commercial area. The site comprises 5-storeys including ground and fronts onto a small enclosed square and car park. The A5200 is located approximately 70 metres to the east, High Holborn (A40) approximately 50 metres to the south and Fulwood Place approximately 40 metres to the west.

The site is shown in the Site Plan below.



Site Plan (©2020 Apple Maps)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Acoustic Standards and Guidelines

5.1 Local Authority Requirements

The site lies within the jurisdiction of the London Borough of Camden. Their advice regarding criteria for atmospheric noise emissions from building service plant is as follows:

5.1.1 Noise Sensitive Developments

The LB of Camden determines in Policy A4 of their Camden Local Plan (2017) that a noise sensitive development is that which, *"…includes housing, schools and hospitals as well as offices, workshops and open spaces…"*

5.1.2 Building Services Plant Noise Criteria

The site lies within the jurisdiction of the London Borough of Camden. Their policy stated within the *Camden Local Plan (2017)* regarding criteria for atmospheric noise emissions from building service plant is as follows:

"Table C: Noise levels applicable to proposed industrial and commercial developments (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 57dBLAmax*	*'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax*	*Rating 'Rating level' greater than 5dB above background and/or events exceeding 88dBLAmax*

5.2 BS 4142:2014

When setting plant noise emission criteria reference is commonly made to BS 4142: 2014 "*Methods for rating and assessing industrial and commercial sound".*

The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains "a tone, impulse or other characteristic" then various corrections can be added to the specific (source) noise level to obtain the "rating level".

BS 4142 states that: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:*

• *"Typically, the greater this difference, the greater the magnitude of the impact."*

• *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*

• *"A difference of around +5dB 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."

The determination of the "rating level" and the "background level" are both open to interpretation, depending on the context.

In summary it is not possible to set plant noise emission criteria purely on the basis of BS 4142:2014. It is reasonable to infer from the above, however, that a difference of around -5dB corresponds to "No Observed Effect Level" as defined in the Noise Policy Statement for England. It is also reasonable to infer from the above that if the plant noise rating level does not exceed the existing background noise level outside any noise sensitive residential window then the plant noise is of "low impact".

5.3 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	***Location***	***Desirable Internal Ambient Criteria***	
		07:00 - 23:00	***23:00 - 07:00***
Resting	*Living Rooms*	*35 dB $L_{Aeq,16hour}$*	-
Dining	*Dining Room/Area*	*40 dB $L_{Aeq,16hour}$*	-
Sleeping (Daytime Resting)	*Bedroom*	*35 dB $L_{Aeq,16hour}$*	*30 dB $L_{Aeq,8hour}$*

5.4 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

"Promote good health and a good quality of life through the effective management of noise

within the context of Government policy on sustainable development."

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

5.5 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised February 2019):

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

5.6 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on Noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

5.7 World Health Organisation Guidelines on Community Noise

BS8233:2014 is based upon the current World Health Organisation (WHO) guidance "*Guidelines on Community Noise".* A summary of the noise guidelines relevant to the proposed scheme is presented in the table below.

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

These WHO guidelines are based, in almost all cases, on the lower threshold below which the occurrence rates of any particular effect can be assumed to be negligible.

5.8 Statutory Noise Nuisance

There is no quantitative definition of statutory noise nuisance. It is generally accepted however, that if the plant noise level is at least 5dB (or 10dB if tonal) below the minimum background $L_{90(15minutes)}$ at 1m from the nearest noise sensitive residential window, then the risk of a statutory noise nuisance is avoided. By adopting this as a design criterion the guidance contained in BS 4142:2014 should also be complied with.

6.0 Survey Methodology

The survey was undertaken by J N. Tyler BSc(Hons), AMIOA.

6.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 15:00 hours on Tuesday 27 October 2020 to 11:00 hours on Thursday 29 October 2020.

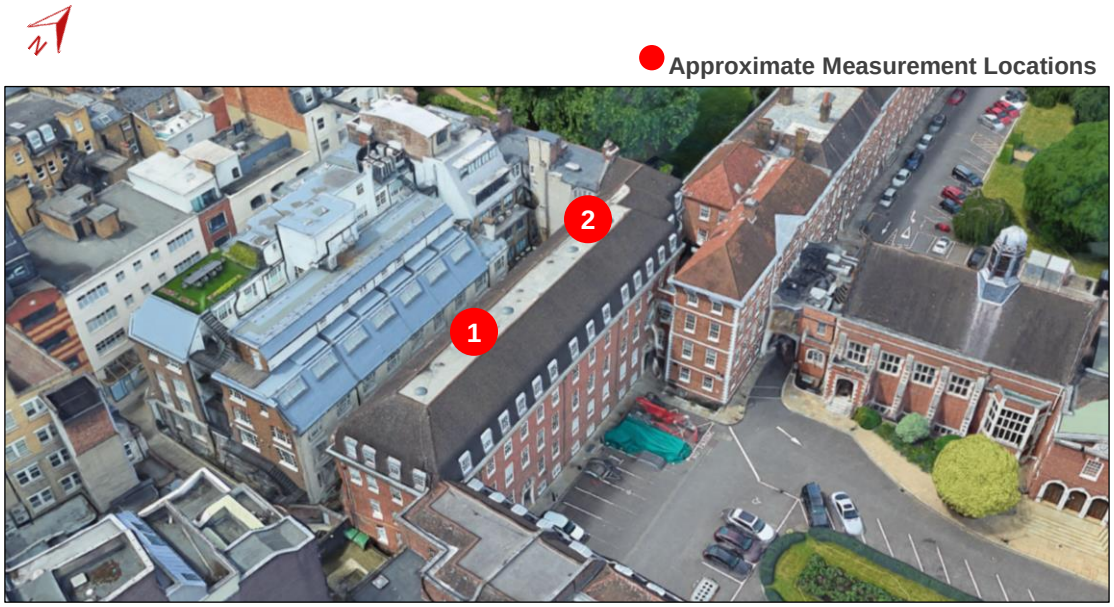
During the periods we were on site the wind conditions were calm and the sky was generally overcast. We understand that generally throughout the survey period the weather conditions remained the same. These conditions are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15-minute periods.

6.2 Measurement Positions

The noise level measurements were undertaken at two (2No.) positions as described in the table below.

Position No	Description
1	The microphone was attached to a pole on the south side of the roof overlooking the nearest noise sensitive receptor (NSR). The microphone was approximately 0.5 metres above noise level and therefore measurements will include local reflections.
2	The microphone was attached to a pole on the north side of the roof overlooking the nearest NSR. The microphone was approximately 0.5 metres above noise level and therefore measurements will include local reflections.



Plan Showing Measurement Positions (Imagery ©2020 Google; Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group; Map data ©2020 Google)

6.3 Instrumentation

The instrumentation used during the survey is presented in the Table below:

Description	Manufacturer	Type	Serial Number	Bi-Annual Calibration
Type 1 ½" Condenser Microphone	ACO Pacific	7052E	68293	Calibration on 13/09/2019
Preamp	Svantek	SV18	72276	Calibration on 13/09/2019
Type 1 Data Logging Sound Level Meter	Svantek	971	72538	Calibration on 13/09/2019

Description	Manufacturer	Type	Serial Number	Bi-Annual Calibration
Type 1 ½" Condenser Microphone	ACO Pacific	7052E	75560	Calibration on 31/10/2019
Preamp	Svantek	SV18	83547	Calibration on 31/10/2019
Type 1 Data Logging Sound Level Meter	Svantek	971	87087	Calibration on 31/10/2019

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant changes were found to have occurred (no more than 0.1dB).

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable.

Each microphone was fitted with a windshield.

7.0 Results

The results have been plotted on Time History Graphs 28324/TH1.1 and 28324/TH1.2 enclosed, presenting the 15 minute A-weighted (dBA) L_{90} and L_{eq} noise levels at each measurement position throughout the duration of the survey.

The typical (modal) $L_{A90\ (15\ min)}$ measurements recorded during the survey are presented in the table below:

Period Beginning	Typical (Modal) $L_{A90(15min)}$ Background Noise Level (dB re 2 x 10^{-5} Pa)			
	Position 1		Position 2	
	Daytime (07:00 – 23:00 hours) (dBA)	Night-Time (23:00 – 07:00 hours) (dBA)	Daytime (07:00 – 23:00 hours) (dBA)	Night-Time (23:00 – 07:00 hours) (dBA)
27/10/2020 15:00	48	43	45	42
28/10/2020 07:00	49	42	50	42
29/10/2020 07:00	49	-	51	-
Overall Modal	**49**	**42**	**50**	**42**

Note: The results presented above are as measured on site and therefore include local

reflections. For an estimation of free-field results subtract 3dB from the above table at each position.

8.0 Discussion Of Noise Climate

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately determine the individual noise sources or specific noise events that occurred throughout the survey duration. During the periods we were on site the dominant noise sources were noted to be traffic from the surrounding road network.

9.0 Plant Noise Emission Criteria

Building services plant external noise emission levels will need to comply with local authority requirements and statutory noise nuisance legislation.

The requirements imposed by the London Borough of Camden have been stated in Section 5.1 of this report.

On the basis of the above and the results of the environmental noise survey, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive residential window.

Noise Emission Limit (dBA)	
Daytime (07:00 – 23:00 hours) (dBA)	**Night-time (23:00 – 07:00 hours) (dBA)**
39	32

The above criteria are to be achieved with all of the proposed plant operating simultaneously.

If plant contains tonal or impulsive characteristics the external design criteria should be reduced by 5dBA.

10.0 Plant Noise Impact Assessment

The following sections detail the findings of our plant noise assessment and any required mitigation advice.

10.1 Project Proposals

We understand the proposed plant comprises the following.

HTA Ref.	Plant Description	Location	Qty
MVHR1	MVHR Unit	Building No. 11 – Roof Void	1
MVHR2	MVHR Unit	Building No. 12 – Roof Void	1
C1 & C2	Condensers	Building No. 12 – Open Roof Enclosure	2

We understand that the plant is to be operational during both daytime and night-time periods.

Our acoustic analyses is based on the following drawings provided by Ralph T. King & Associates.

Reference	Title	Date
MSK100	Third Floor & Roof Void Level Condenser Locations Option 1 – One Condenser Plantroom	October 2010

10.2 Plant Noise Data

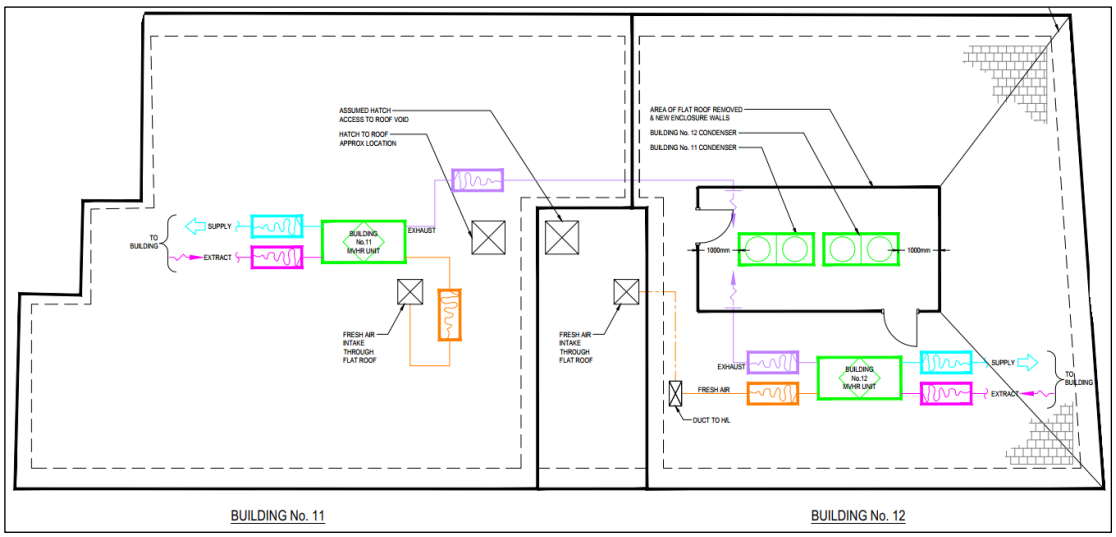
We understand the manufacturer's noise data for the equipment to be as follows:

Plant Description			Noise Level (dB) at Octave Band Centre Frequency (Hz) (L_p dB re $2x10^{-5}$ Pa; L_w dB re 10^{-12} W)								dBA
			63	125	250	500	1k	2k	4k	8k	
MVHR1 & 2	Inlet e1	L_w	36	41	53	49	48	37	<25	<25	56
	Outlet e2	L_w	56	63	75	77	73	69	65	62	81
	Inlet i1	L_w	38	47	57	51	53	39	31	<25	60
	Outlet i2	L_w	56	66	80	78	75	70	64	59	83
	Breakout	L_w	47	48	59	54	53	50	46	36	62
C1 & C2	Standard Cooling	L_p at 1m	79	66	66	63	57	53	48	43	64

In order for us to complete our assessment we require confirmation as to whether the condenser data provided is a sound pressure level or a sound power level.

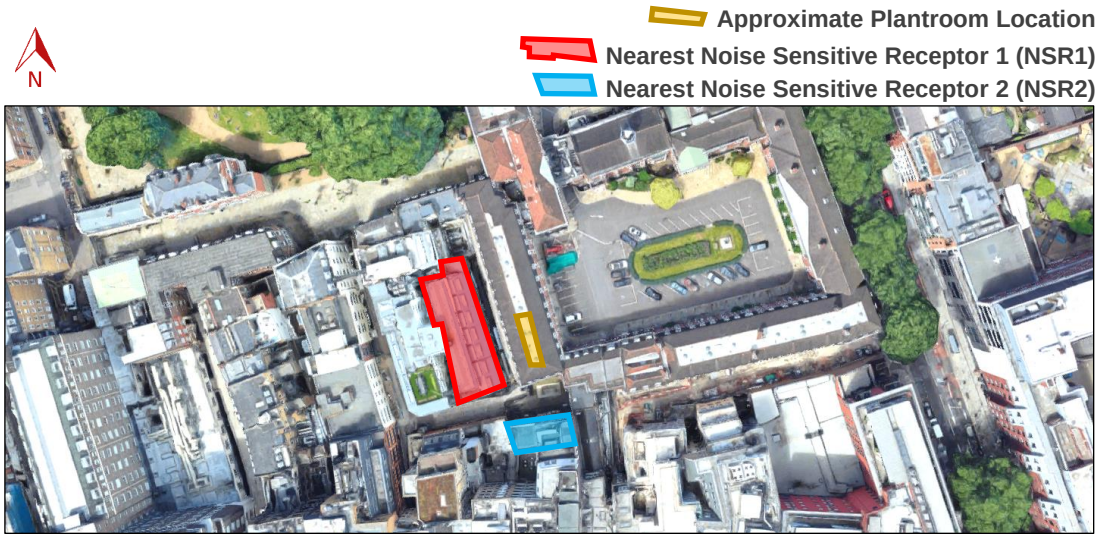
10.3 Location of Plant

The plantroom has been proposed to be on the roof of the site. The proposed site plan is presented below.



Third Floor & Roof Void Level Condenser Locations (Provided by Ralph T. King & Associates; Dated October 2020)

The following site plan presents the proposed plant location relative to the nearest noise sensitive receptors.



Location of Plant and NSR (Imagery ©2020 Google; Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group; Map data ©2020 Google)

10.4 Mitigation Measures

In order to control plant noise emissions in line with the proposed criteria, we would recommend the following mitigation measures.

10.4.1 MVHR Attenuators

We would recommend installing attenuators to the following plant ducts:

- MVHR1 (Building No. 11) – Inlet e1 (atmospheric side);
- MVHR2 (Building No. 12) – Inlet e1 (atmospheric side).

The attenuators should be capable of achieving the following insertion losses:

Insertion Loss (dB) for Attenuators at Octave Band Centre Frequency (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
4	8	14	21	27	27	21	16

The above insertion losses should be achievable with a 900mm attenuator with 35% free area.

Manufacturers will need to demonstrate compliance with the above insertion losses prior to installation. We will be happy to review any proposals.

A list of suitable suppliers for attenuators is presented in the Appendix.

10.4.2 Enclose Condensers

In order to control plant noise emissions in line with the proposed criteria, we recommend installing an acoustic enclosure around both condensers reducing their cumulative sound pressure level by at least 10dB.

The enclosed outer panels shall be constructed from galvanized sheet steel having a minimum thickness of 1.6mm and fixed at 300mm (max) centres. The enclosure inner panels shall be constructed from punch-perforated (round-hole) galvanised sheet steel facing, having a minimum thickness of 0.7mm fixed at 300mm (max) centres. Flattened-expanded (“Expamet”) sheet shall not be used, unless all edges of the sheet are mechanically fixed to the panel casing and galvanised steel cover strips are used to prevent rivet heads pulling through the perforated sheet (trapping the Expamet between two solid steel layers).

The inert, rot and vermin proof, non-hygroscopic and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 48kg/m3. This shall be faced with a glass fibre cloth, or other approved infill protection membrane. Panels shall be constructed and assembled so that no egress of the acoustic medium will occur under the operating conditions.

Doors, access panels, windows and ventilation ducts or electrical cable penetrations shall be treated so as to maintain the specified acoustic insulation of the assembled enclosure.

Demountable sections shall be designed to allow easy disassembly and reassembly by unskilled personnel without affecting the acoustic performance.

The supplier shall ensure that the assembled enclosure is designed and constructed to withstand site operating conditions such as wind and snow loads, roof mounted plant, etc., as appropriate, and if outside, to be suitably weatherproofed.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

A list of suitable suppliers for enclosures is presented in the Appendix.

10.5 Plant Noise Impact Assessment

The following sections present our predictions of atmospheric noise emissions from the plantroom louvres to the NSRs.

10.5.1 Nearest Noise Sensitive Receptor 1

The following tables summarise our predictions of atmospheric noise emissions from the plantroom louvres to NSR1.

Description		Noise Level (dB) at Octave Band Centre Frequency (Hz) (L_p dB re $2x10^{-5}$ Pa; L_w dB re 10^{-12} W)								dBA
		63	125	250	500	1k	2k	4k	8k	
MVHR1 – Outlet i2	Noise Level (L_w)	56	66	80	78	75	70	64	59	83
	Ductwork Correction	-9	-7	-5	-7	-10	-10	-10	-10	
	Sound Power Level at Grille	29	40	52	44	43	29	21	15	47
	Equivalent Sound Pressure Level at 1m	18	29	41	33	32	18	10	4	36
	Point Source Distance Correction (Approx. 10m)	-20	-20	-20	-20	-20	-20	-20	-20	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	1	12	24	16	15	1	<0	<0	19
MV	Noise Level (L_w)	36	41	53	49	47	37	25	25	56

	Ductwork Correction	-12	-9	-6	-7	-10	-10	-10	-10	
	Sound Power Level at Grille	44	54	69	70	63	59	55	52	70
	Equivalent Sound Pressure Level at 1m	33	43	58	59	52	48	44	41	59
	Proposed Attenuator	-4	-8	-14	-21	-27	-27	-21	-16	
	Barrier Correction	-8	-9	-12	-16	-20	-24	-25	-25	
	Distance Correction (Approx. 8m)	-18	-18	-18	-18	-18	-18	-18	-18	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	6	11	17	7	<0	<0	<0	<0	10
MVHR2 – Outlet i2	Noise Level (L_w)	56	66	80	78	75	70	64	59	83
	Ductwork Correction	-10	-7	-4	-5	-7	-7	-7	-7	
	Sound Power Level at Grille	28	40	53	46	46	32	24	18	49
	Equivalent Sound Pressure Level at 1m	17	29	42	35	35	21	13	7	38
	Distance Correction (Approx. 8m)	-18	-18	-18	-18	-18	-18	-18	-18	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	2	14	27	20	20	6	<0	<0	23
MVHR2 – Inlet e1	Noise Level (L_w)	36	41	53	49	47	37	25	25	56
	Ductwork Correction	-8	-5	-4	-4	-6	-6	-6	-6	
	Sound Power Level at Grille	48	58	71	73	67	63	59	56	73
	Equivalent Sound Pressure Level at 1m	37	47	60	62	56	52	48	45	62
	Proposed Attenuator	-4	-8	-14	-21	-27	-27	-21	-16	
	Barrier Correction	-8	-9	-12	-16	-20	-24	-25	-25	
	Distance Correction (Approx. 8m)	-18	-18	-18	-18	-18	-18	-18	-18	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	10	15	19	10	<0	<0	<0	<0	12
C1 to C2	Noise Level (L_p at 1m)	79	66	66	63	57	53	48	43	64
	Correction for 2No. Units	+3	+3	+3	+3	+3	+3	+3	+3	
	Acoustic Enclosure	-10	-10	-10	-10	-10	-10	-10	-10	
	Barrier Correction	-8	-9	-12	-16	-20	-24	-25	-25	
	Distance Correction (Approx. 8m)	-18	-18	-18	-18	-18	-18	-18	-18	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	49	35	32	25	15	7	1	<0	28
Cumulative Noise Level at NSR1		**49**	**35**	**34**	**27**	**22**	**10**	**3**	**<0**	**30**

Our calculations indicate that the cumulative plant noise emissions do not exceed the

requirements of the Local Authority (<32dBA) at NSR1.

10.5.2 Nearest Noise Sensitive Receptor 2

The following tables summarise our predictions of atmospheric noise emissions from the plantroom louvres to NSR2.

Description		Noise Level (dB) at Octave Band Centre Frequency (Hz) (L_p dB re $2x10^{-5}$ Pa; L_w dB re 10^{-12} W)								dBA
		63	125	250	500	1k	2k	4k	8k	
MVHR1 – Outlet i2	Noise Level (L_w)	56	66	80	78	75	70	64	59	83
	Ductwork Correction	-9	-7	-5	-7	-10	-10	-10	-10	
	Sound Power Level at Grille	29	40	52	44	43	29	21	15	47
	Equivalent Sound Pressure Level at 1m	18	29	41	33	32	18	10	4	36
	Point Source Distance Correction (Approx. 30m)	-30	-30	-30	-30	-30	-30	-30	-30	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	<0	2	14	6	5	<0	<0	<0	9
MVHR1 – Inlet e1	Noise Level (L_w)	36	41	53	49	47	37	25	25	56
	Ductwork Correction	-12	-9	-6	-7	-10	-10	-10	-10	
	Sound Power Level at Grille	44	54	69	70	63	59	55	52	70
	Equivalent Sound Pressure Level at 1m	33	43	58	59	52	48	44	41	59
	Proposed Attenuator	-4	-8	-14	-21	-27	-27	-21	-16	
	Barrier Correction	-8	-9	-12	-16	-20	-24	-25	-25	
	Distance Correction (Approx. 25m)	-28	-28	-28	-28	-28	-28	-28	-28	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	<0	1	7	<0	<0	<0	<0	<0	0
MVHR2 – Outlet i2	Noise Level (L_w)	56	66	80	78	75	70	64	59	83
	Ductwork Correction	-10	-7	-4	-5	-7	-7	-7	-7	
	Sound Power Level at Grille	28	40	53	46	46	32	24	18	49
	Equivalent Sound Pressure Level at 1m	17	29	42	35	35	21	13	7	38
	Distance Correction (Approx. 28m)	-29	-29	-29	-29	-29	-29	-29	-29	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	<0	3	16	9	9	<0	<0	<0	12
MVHR2 – Inlet e1	Noise Level (L_w)	36	41	53	49	47	37	25	25	56
	Ductwork Correction	-8	-5	-4	-4	-6	-6	-6	-6	
	Sound Power Level at Grille	48	58	71	73	67	63	59	56	73

	Equivalent Sound Pressure Level at 1m	37	47	60	62	56	52	48	45	62
	Proposed Attenuator	-4	-8	-14	-21	-27	-27	-21	-16	
	Barrier Correction	-8	-9	-12	-16	-20	-24	-25	-25	
	Distance Correction (Approx. 25m)	-28	-28	-28	-28	-28	-28	-28	-28	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	0	5	9	0	<0	<0	<0	<0	2
C1 to C2	Noise Level (L_p at 1m)	79	66	66	63	57	53	48	43	64
	Correction for 2No. Units	+3	+3	+3	+3	+3	+3	+3	+3	
	Acoustic Enclosure	-10	-10	-10	-10	-10	-10	-10	-10	
	Barrier Correction	-8	-9	-12	-16	-20	-24	-25	-25	
	Distance Correction (Approx. 25m)	-28	-28	-28	-28	-28	-28	-28	-28	
	Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
	Calculated Noise Level at Receptor (L_p at 1m)	39	25	22	15	5	<0	<0	<0	18
Cumulative Noise Level at NSR2		39	25	24	17	12	<0	<0	<0	20

Our calculations indicate that the cumulative plant noise emissions do not exceed the requirements of the Local Authority (<32dBA) at NSR2.

11.0 Conclusions

An environmental noise survey has been undertaken in order to establish the currently prevailing noise levels.

Measurement procedures have been performed in general accordance with British Standard BS 7445 “Description and measurement of environmental noise”.

Measurement procedures have been performed in general accordance with those described in BS 4142: 2014, Method for rating industrial noise affecting mixed residential areas, published by the British Standards Institution.

Noise emission limits from the development have been identified with reference to the requirements of the Local Authority and the application of BS 4142: 2014 and to minimise the possibility of noise nuisance to neighbours.

An assessment has been carried out to determine the plant noise emissions at the nearest noise sensitive window.

The assessment indicates that the proposed plant, in conjunction with the proposed mitigation, should be capable of achieving the proposed plant noise criteria at the nearest noise sensitive window and therefore achieves the requirements of the Local Authority.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

Sound Pressure Level (L_p) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

Sound Power Level (SWL or L_w) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

SUITABLE SUPPLIERS

of

ACOUSTIC ENCLOSURES

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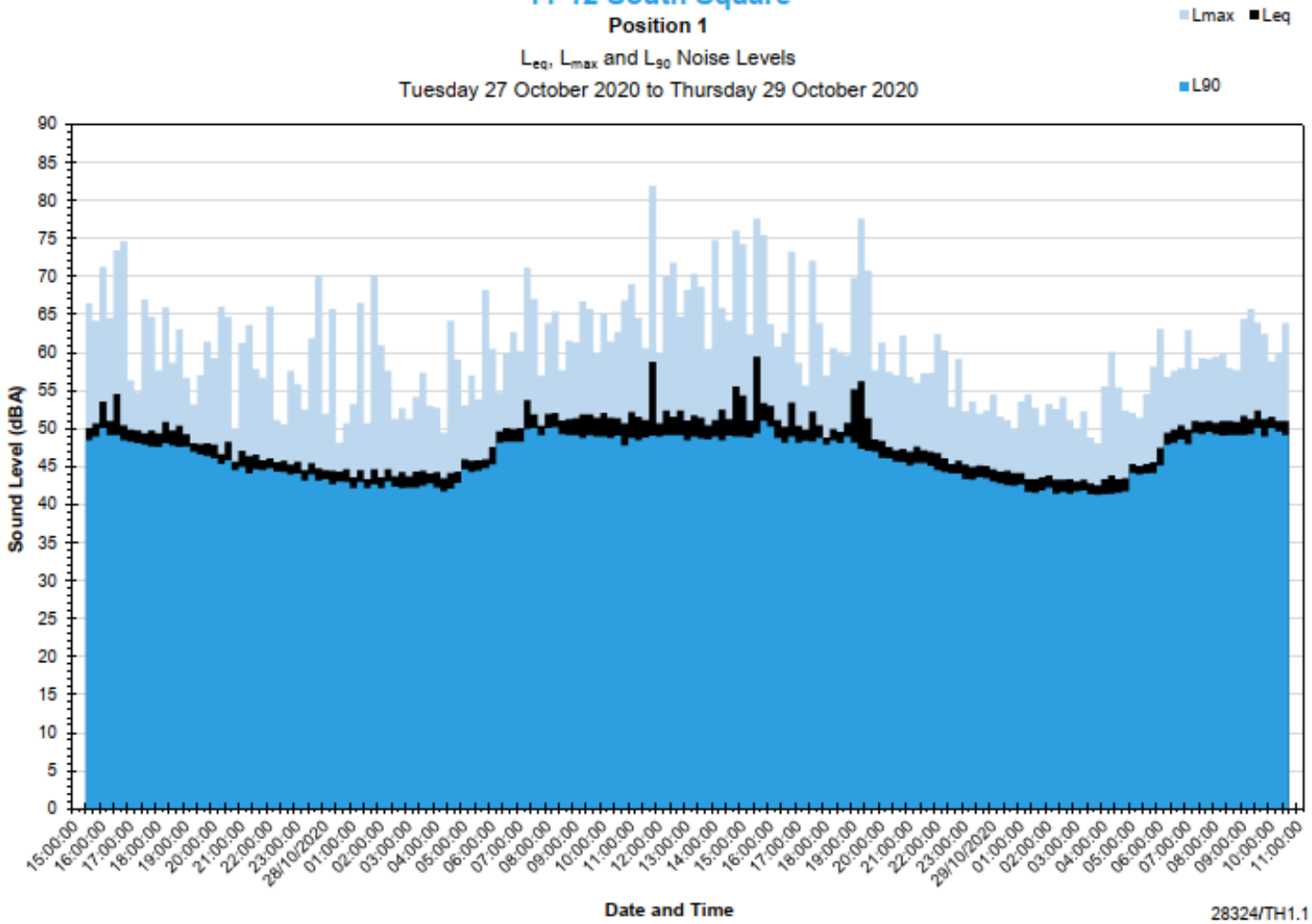
QuietStar Limited 1 Glen Road Fleet Hampshire GU51 3QS	01252 674327	Luke Willis

11-12 South Square

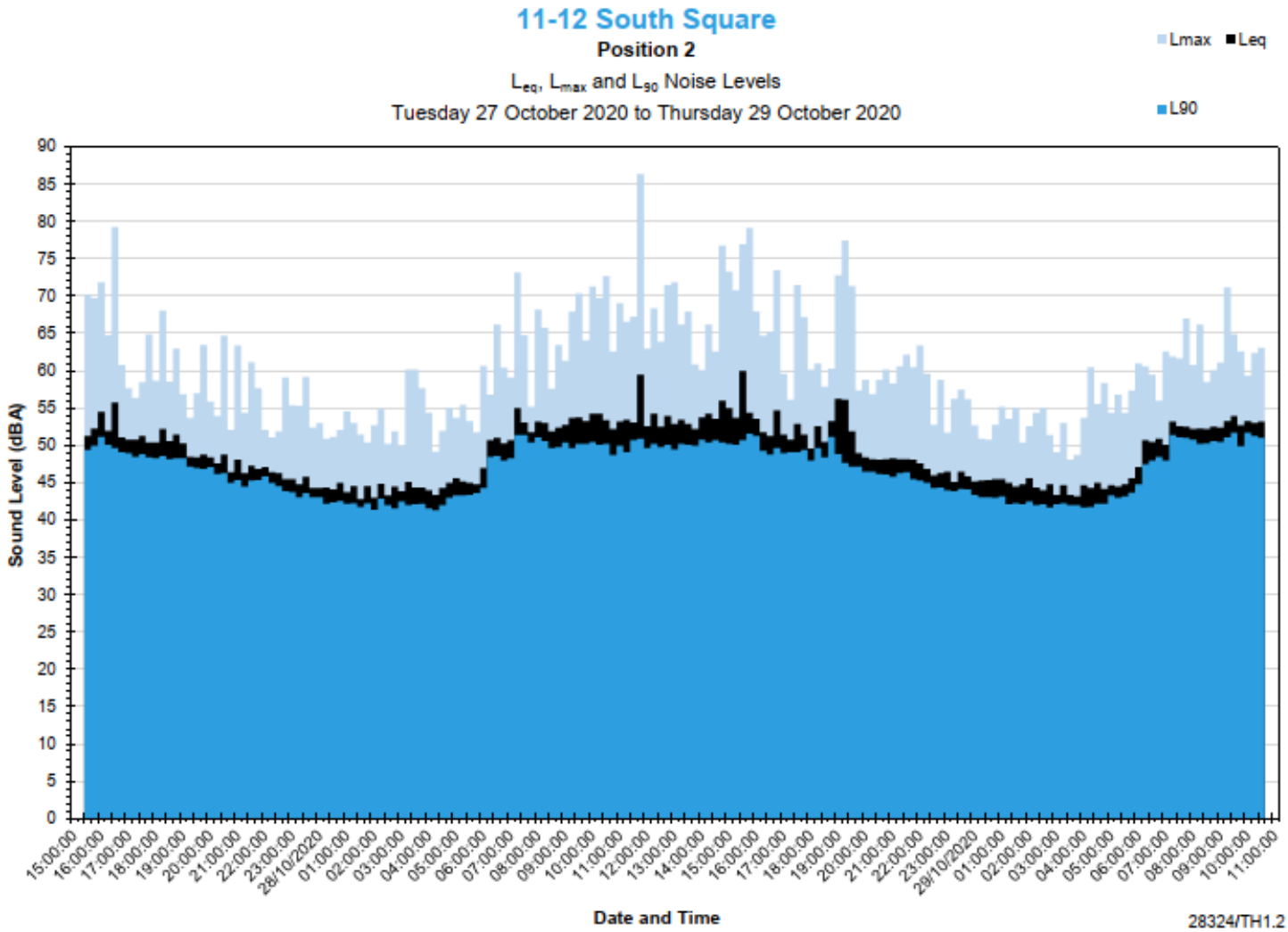
Position 1

L_{eq}, L_{max} and L_{90} Noise Levels

Tuesday 27 October 2020 to Thursday 29 October 2020



28324/TH1.1


11-12 South Square
Position 2
L_{eq}, L_{max} and L_{90} Noise Levels
Tuesday 27 October 2020 to Thursday 29 October 2020
Lmax
Leq
L90
Sound Level (dBA)
Date and Time
28324/TH1.2