12 Queen Square
London

Environmental Noise Survey and Plant Noise Assessment Report

26304/PNA1Rev4

02 April 2019

For:

M & O Building Contractors Ltd
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Hann Tucker Associates

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Document Control

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0	18/12/2018	First Issue	Rodrigo Espinosa-Garcia Principal Consultant MSc, BEng(Hons), AMIOA	Andrew Fermer Director BSc(Hons), MIOA
1	29/01/2019	Updated to include survey equipment at the nearest residential window	Rodrigo Espinosa-Garcia Principal Consultant MSc, BEng(Hons), AMIOA	Andrew Fermer Director BSc(Hons), MIOA
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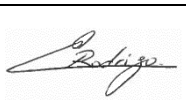
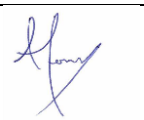
4	02/04/2019	Client's comments	 Rodrigo Espinosa-Garcia Principal Consultant MSc, BEng(Hons), AMIOA	 Andrew Fermer Director BSc(Hons), MIOA

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Contents

Attachments

1.0 Introduction

It is proposed at 12 Queen Square, in London, to undertake refurbishment works including the installation of new building services plant serving the development.

Hann Tucker Associates have therefore been commissioned to undertake a detailed environmental noise survey to determine the currently prevailing noise climate at the rear of the site, the results of which will be used in design assessments of proposed plant.

2.0 Objectives

To establish by means of a detailed survey (fully covering both daytime and night-time periods) the existing environmental noise levels at the rear of the development site.

The survey will enable noise emission limits from the development to be 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 by neighbours.

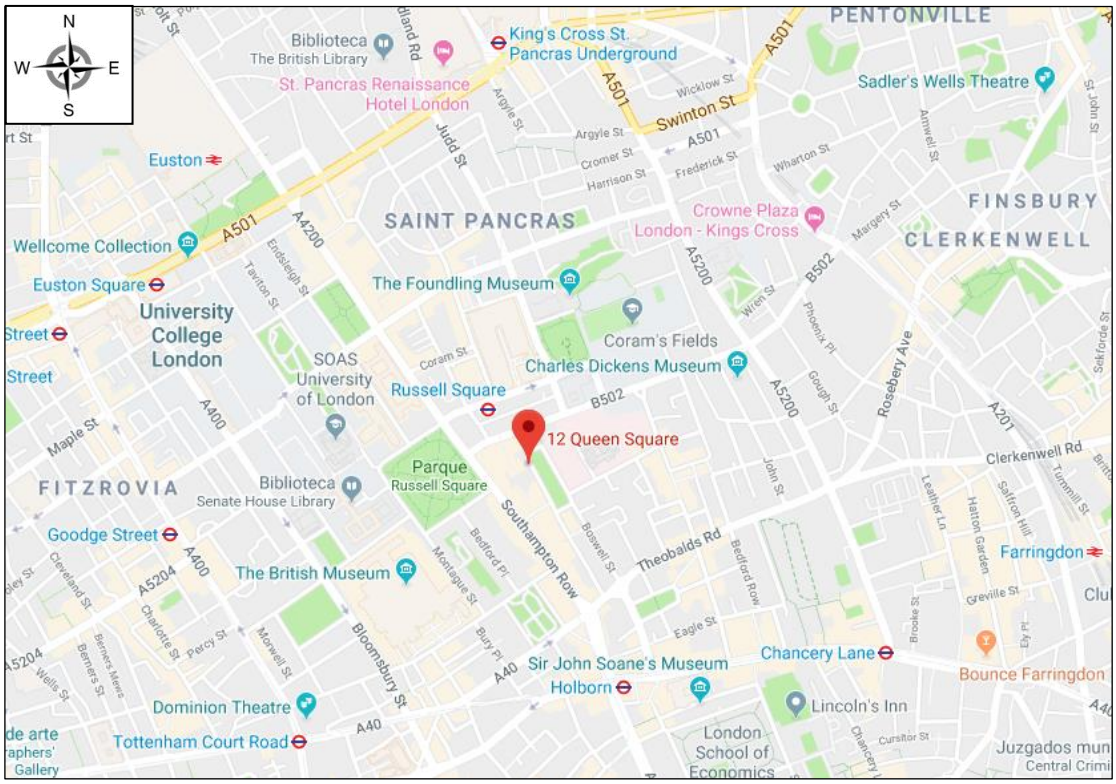
To assess the noise emissions from the proposed plant, based upon data with which we are provided, and comment upon the acceptability.

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 at 12 Queen Square, in London, and falls within the London Borough of Camden's jurisdiction. See following Location Map.



Location Map (maps.google.co.uk)

3.2 Description

The existing building is occupied by University College London and comprises a basement level plus ground floor and four upper storeys.

The site is bounded by Queen Square to the east and the adjacent buildings to the north and south (13 Queen Square and 8-11 Queen Square) are of similar nature to 12 Queen Square. To the west, at the rear of the site, there is a large court-yard shared by all the local buildings which we understand to be hotel, residential, commercial and retail.

See Site Plan below.

Site Plan (maps.google.co.uk)

4.0 Acoustic Terminology

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

5.0 Project Proposals

5.1 Proposed Plant

We understand it is proposed to replace 2No. existing Parker Hiross 090 chillers located on the rear first floor roof for 2No. new Parker Hiross 116 chillers in the same location, and to remove 3No. existing condensers.

5.2 Operating Hours

We understand that the above proposed plant could operate during daytime and night-time hours.

5.3 Location of Plant

We have been informed by M&O Building Contractors that the above building services plant proposed will be installed at the designated existing first floor roof plant area as highlighted in the following layout with a red square:

First floor roof plant area layout (maps.google.co.uk)

6.0 Acoustic Standards and Guidelines

6.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010. 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."

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 acknowledge 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 aims listed in paragraph (b) 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.

6.2 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised July 2018):

"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."

6.3 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

6.4 Local Authority Requirements

The site lies within London Borough of Camden's jurisdiction. Their advice regarding criteria for atmospheric noise emissions from building service plant is contained within their Local Plan, version June 2017 as follows:

Industrial and Commercial Noise Sources

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).

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 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{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.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.

On 26 June 2016 London Borough of Camden sent us an email confirming the following windows should be considered noise sensitive, *"housing, schools, hospitals, offices, workshops"*.

6.5 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".*

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.

6.6 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.

6.7 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 to 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 $L_{Aeq,8hour}$*

6.8 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 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.

7.0 Methodology

The survey was undertaken by Rodrigo Espinosa-Garcia MSc, BEng(Hons), AMIOA.

7.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 12:15 hours on Monday 14 January 2019 to approximately 12:15 hours on Wednesday 16 January 2019.

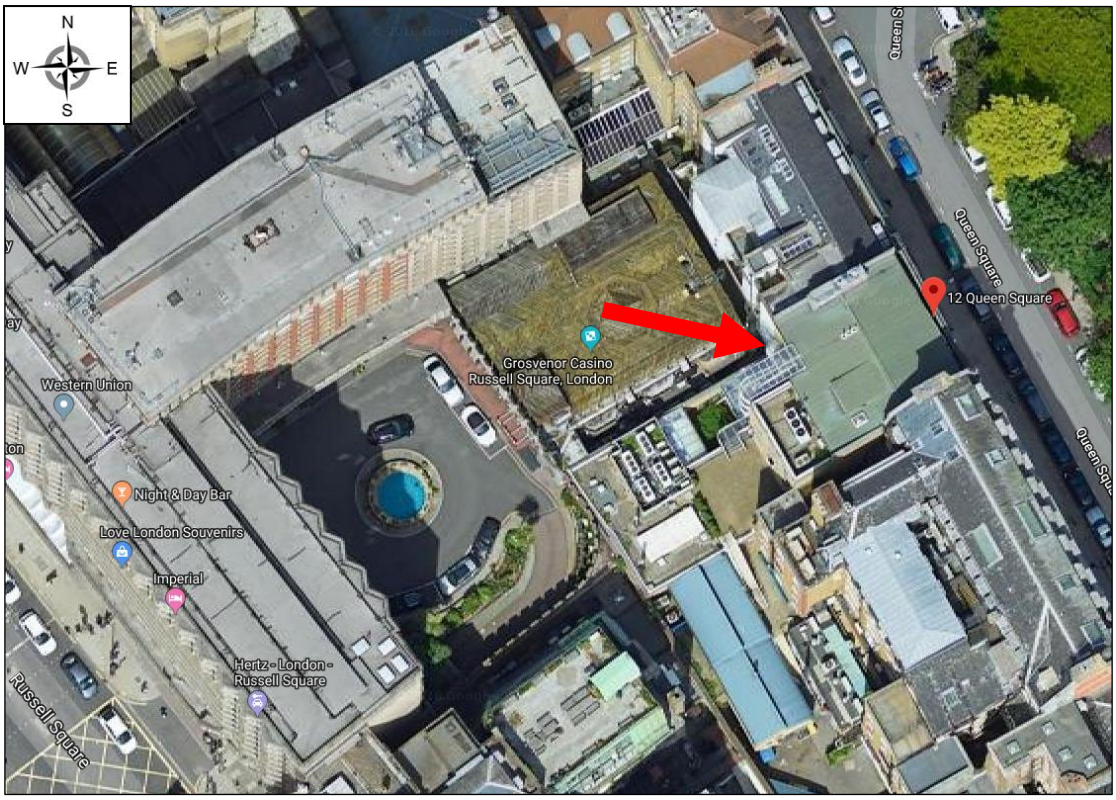
Owing to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However at the beginning and end of the survey period the wind conditions were moderate. The sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions were similar to this.

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

7.2 Measurement Position

The noise level measurements were undertaken at one position at the development site. The sound level meter was located at a third floor balcony at the rear of the site. The microphone was attached to a pole and this to the balustrade approximately seven and a half metres above the first floor roof level and approximately one metre from the façade.

The measurement position described above is indicated with a red arrow in the following site layout.



Plan Showing Unmanned Measurement Position (maps.google.co.uk)

7.3 Instrumentation

The instrumentation used during the survey is presented in the following table:

Description	Manufacturer	Type	Serial Number
Type 1 ½" Condenser Microphone	PCB	377B02	153843
Type 1 Preamp	Larson Davis	LXT1L	36051
Type 1 Data Logging Sound Level Meter	Larson Davis	LXT	4634
Type 1 Calibrator	Larson Davis	CAL200	3082

The 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 0.1 dB).

The sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. The microphone was fitted with a manufacturer windshield.

8.0 Results

The results have been plotted on Time History Graph 26304/TH1 enclosed presenting the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at the measurement position throughout the duration of the survey.

8.1 Measured L_{eq} Noise Levels

The measured daytime $L_{Aeq(16\text{-}hour)}$ and night-time $L_{Aeq(8\text{-}hour)}$ noise levels are presented in the table below.

Daytime (07:00 to 23:00 hours) and Night-time (23:00 to 07:00 hours) Measured L_{Aeq} Noise Levels (dBA re 2.0 x 10^{-5} Pa)		
Daytime $L_{Aeq(16\text{-}hour)}$	**Night-Time $L_{Aeq(8\text{-}hour)}$**	**Date**
64	63	14/01/2019 to 15/01/2019
65	63	15/01/2019 to 16/01/2019

8.2 Lowest Measured L_{90} Noise Levels

The following table presents the lowest measured L_{A90} background noise levels during the survey:

Daytime (07:00 to 23:00 hours) and Night-time (23:00 to 07:00 hours) Lowest Measured L_{A90} Noise Level (dB re 2 x 10^{-5} Pa)		
Daytime $L_{A90(16\text{-}hour)}$	**Night-Time $L_{A90(8\text{-}hour)}$**	**Date**
60	59	14/01/2019 to 15/01/2019
60	59	15/01/2019 to 16/01/2019

9.0 Discussion Of Noise Climate

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately describe the dominant noise sources, or specific noise events throughout the entire survey period. However at the beginning and end of the survey period the dominant noise sources were noted to be road traffic from Russell Square and existing plant serving local buildings.

10.0 Plant Noise Emission Criteria

On the basis of the aforementioned acoustic standards and guidance, together with the results of the environmental noise survey, we propose that the following plant noise emission criteria be achieved in the nearest garden 'used for main amenity' or at 1 metre from the nearest living room, dining room, or bedroom in the daytime, and at 1 metre from the nearest bedroom window at night-time with all plant operating simultaneously.

Plant Noise Emission Criteria (dB re $2x10^{-5}$ Pa)	
Daytime (07:00 – 23:00 hours)	**Night-time (23:00 – 07:00 hours)**
50dBA	49dBA

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

The above criteria are based on a level of 10dB below background in order to fall into Camden's 'Green' criteria for **dwellings**. Whilst we understand that Camden considers other uses noise sensitive, the Local plan states that the criteria is use dependent but does not define criteria that correspond to 'Green', 'Amber', or 'Red' for these other uses. We request that Camden clarify their policy in this respect. The criteria could be relaxed by 5dB in line with the 'Amber' criteria in Camden's Local Plan, which may be acceptable to Camden depending on 'the context of other merits of the development'. It should be noted that the above are subject to the final approval of the Local Authority.

11.0 Plant Noise Impact Assessment

We understand it is proposed to replace existing plant located on the rear first floor roof for new building services plant items in the same location. It is proposed to replace 2No. existing Parker Hiross 090 chillers for 2No. new Paker Hiross 116 chillers (1No. duty, 1No. standby basis).

Plant Description	Location	Qty	Plant Make	Model Number
Chiller	Rear first floor roof within existing acoustic screening	2	Parker Hiross	116

11.1 Plant Noise Data

The manufacturer's noise data received for the chiller model proposed is available as a single figure number and we understand this to be 58dBA. The manufacturer's technical documentation also states:

'3) referred to axial fan version in free field conditions at a distance of 10m from unit, measured on condenser side, 1m from ground'

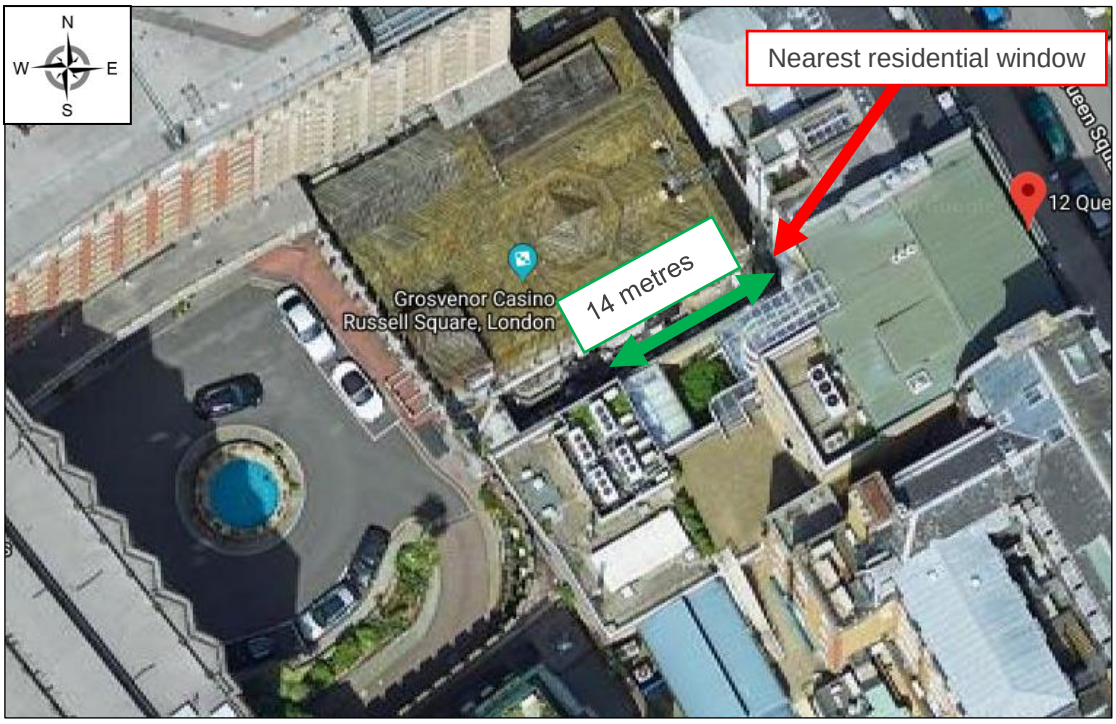
In order to undertake our plant noise assessment, a typical chiller noise spectrum has been used and equally adjusted to achieve the manufacturer single figure.

11.2 Cumulative Plant Noise Emissions

The cumulative plant noise emissions from all the proposed new plant items operating simultaneously should not exceed 49dBA at 1m from the nearest noise residential window, in line with the Local Authority requirements.

11.3 Nearest residential window

Based on our site inspections and following our onsite discussions with Peter Aston and Oliver Josephs, who gave us access to the external roof plant and the balcony, we understand the nearest residential window to the new building services plant to be located approximately 14 metres horizontally from the edge of the existing perimeter acoustic screening and two storeys above the rear first roof level where the exiting 4No. chillers are located. The location of this receptor, which we understand to be the adjacent window to the balcony used for our survey, is indicated in the following plan:



Plan Showing the nearest residential window from the new plant (maps.google.co.uk)

11.4 Plant Noise Impact Assessment

The following table presents our noise impact assessment for the new plant proposed, as described in Section 11.0, taking into account the effect of a 2510mm perimeter acoustic screening by installing the new plant items inside this.

	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Sound Pressure Level of 1No. Hiross 166 Chiller at 10m (See Section 11.1)	66	63	60	56	52	45	38	34	58
Distance Correction	-4	-4	-4	-4	-4	-4	-4	-4	-
Barrier Correction (see attached acoustic specification in Appendix B)	-4	-4	-2	0	0	0	0	0	-
Façade Correction	+3	+3	+3	+3	+3	+3	+3	+3	-
Calculated Cumulative Noise Level at Receptor	61	58	57	55	51	44	37	33	56

Our calculations indicate that, with the installation of an acoustic screen complying with the acoustic specification attached in Appendix B, cumulative noise levels from the proposed first floor roof plant would still exceed the requirements of the Local Authority outlined in Section 6.4 by 6dBA during the daytime and 7dBA during the night-time, and therefore would not be capable of achieving the plant noise emissions requirements at the nearest residential property, without the implementation of further suitable noise mitigation measures, which we understand is located approximately 14 metres horizontally from the edge of the existing perimeter acoustic screening and approximately two storeys vertically above the rear first floor roof.

12.0 Mitigation Measures

Our calculations indicate that the noise emissions from the proposed plant installation should be suitably attenuated in order to meet the requirements of the Local Authority outlined in Section 6.4. We recommend the following noise mitigation measures should be allowed for.

12.1 Acoustic Screening Specification

An acoustic screen complying with the acoustic specification attached in Appendix B should be installed around the perimeter of the plant area.

12.2 Chiller Attenuation

The chillers shall be supplied complete with acoustic treatment which shall achieve adequate levels of attenuation complying with the acoustic specification attached in Appendix C.

13.0 Vibration Isolation

Suitable vibration isolation mounts should be installed as per the manufacturer recommendations such that the Local Authority requirements are achieved.

14.0 Conclusions

A detailed daytime and night-time fully automated environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate at the nearest residential window from the proposed plant items. The results are presented herein.

Plant noise emission criteria has been set with reference to Local Authority requirements and proposed plant has been assessed.

With the implementation of the specified acoustic mitigation measures herein, our calculations indicate that based on the manufacturer's noise data provided, the combined noise emissions from the proposed new roof plant should be capable of achieving the requirements of the Local Authority during the daytime and night-time hours.

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.

L_p — Sound Pressure Level (SPL) 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).

L_w — Sound Power Level (SWL) 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).

Appendix B

12 Queen Square, London

Acoustic Specification for Acoustic Screen

Acoustic screening shall extend:

- continuously around the perimeter of the roof plant area (replacing the existing screening).
- 500mm above the highest part of the plant.

The screen shall be imperforate (solid) and have a minimum mass per unit area of at least 10kg/m^2. This could be achieved using two or more layers of a wide range of materials including, for example, plywood or equivalent sheeting board to a suitable thickness required to achieve the mass per unit area. All junctions should be staggered.

Doors, access panels and service penetrations shall be treated so as to maintain the acoustic performance of the assembled screen.

All junctions between the screen and adjacent structures shall be made good and sealed with a heavy grout and/or dense non-hardening mastic.

The complete structure shall be wind and weather resistant to standards agreed with the Client.

The exact design of the screen will be agreed with and approved by Hann Tucker Associates.

Appendix C

Acoustic Specification for Chillers

This specification is written on the basis that the maximum number of new chillers operating simultaneously 24 hours is 1No Parker Hiross 116.

The chillers shall be fitted with inverter drives (continuously variable speed fans) such that, whatever the prevailing duty, all fans operate at the minimum speed required.

The chillers shall be supplied complete with acoustic treatment which shall achieve adequate levels of attenuation to ensure that the following limiting sound pressure level is not exceeded when measured at a distance of 10m (free field over a reflecting plane) in any horizontal or vertical direction under any load conditions.

Duty/Time	Limiting Sound Pressure Level @ 10m
24 hours	49dBA

The above specified limiting sound pressure level is based upon typical chiller spectrum in the absence of manufacturer octave band data. It is acknowledged that alternative sound pressure level shapes may also comply with the Local Authority criteria but these would need to be reviewed, and agreed in writing, by ourselves.

Furthermore they shall not exhibit any significant tonal content.

No other measurement standard shall be permissible unless confirmed in writing by Hann Tucker Associates.

Exceedances in excess of the measurement tolerance for a Type 1 sound level meter shall constitute a failure.

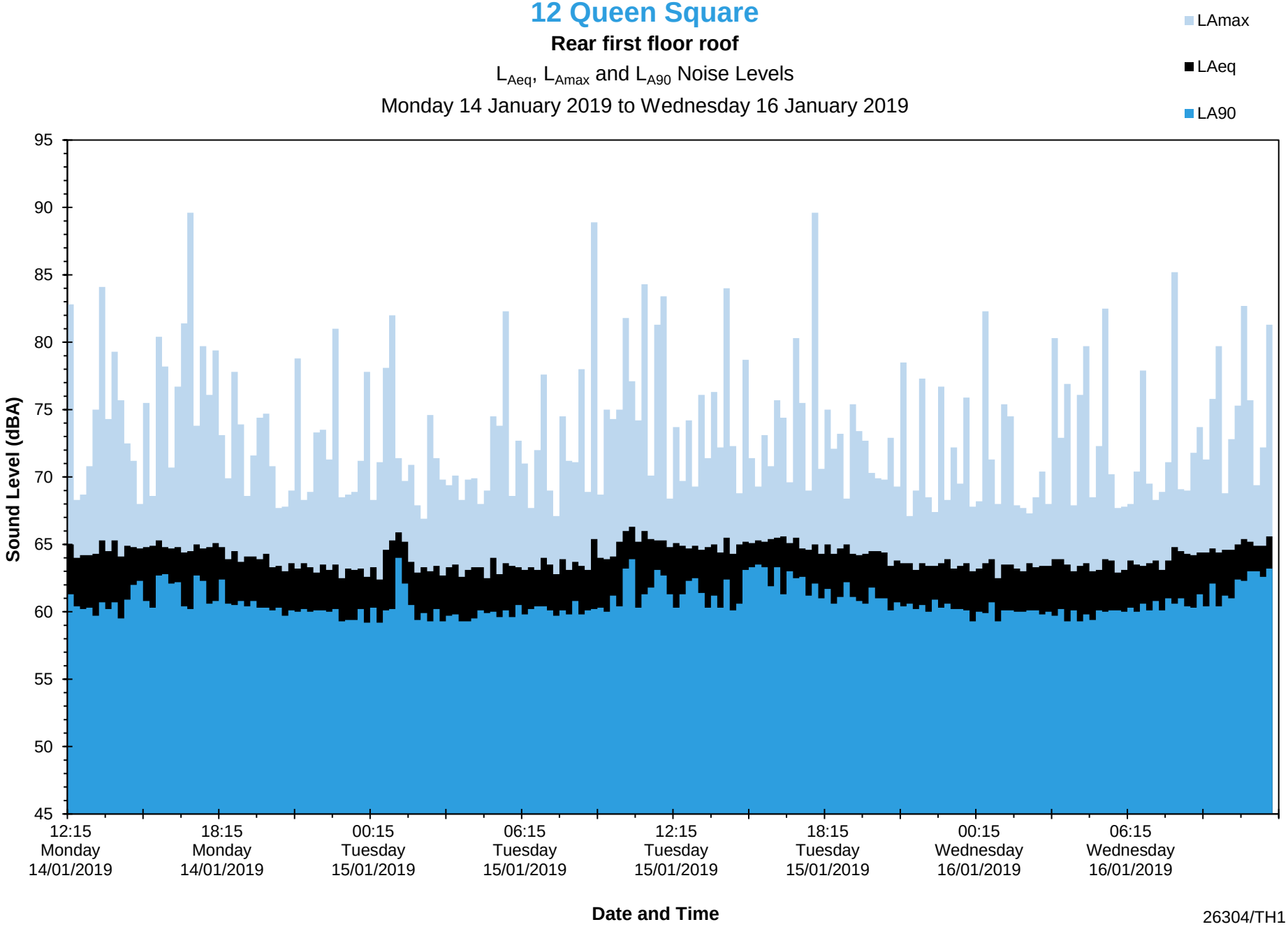
Any deviations from the above specification must be agreed by, and confirmed in writing to, Hann Tucker Associates.

12 Queen Square

Rear first floor roof

L_{Aeq}, L_{Amax} and L_{A90} Noise Levels

Monday 14 January 2019 to Wednesday 16 January 2019



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