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Project:

**Great Ormond Street Hospital -
Barclay House**

Title:

Plant Noise Assessment



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CONTENTS:

1	INTRODUCTION	1
2	SITE	1
3	GUIDANCE	3
4	MEASUREMENTS	4
5	EQUIPMENT	4
6	RESULTS	4
7	PLANT ASSESSMENT	5
8	CONCLUSIONS	5

APPENDIX A:	Glossary of Technical Terms
APPENDIX B:	Site location plan
APPENDIX C:	Planning Policy & Guidance
APPENDIX D:	Published Plant Setback Noise Data

1 INTRODUCTION

- 1.01 Environmental Equipment Corporation Limited has been commissioned by Collins Construction Plc to undertake a noise assessment of plant installed within an existing lightwell at Great Ormond Street Hospital.
- 1.02 This noise assessment has been conducted in accordance with the policies and requirements of London Borough of Camden Council (LBCC) and is based on a noise survey of the plant carried out at the site.
- 1.03 This assessment includes:
- the setting of plant noise limits in accordance with the requirements of London Borough of Camden and national planning policy, standards and guidance; and
 - the prediction of noise impacts at the worst affected noise sensitive receptors based on the proposed items of plant and their location.
- 1.04 This report is prepared solely for Collins Construction Plc. Environmental Equipment Corporation Limited accepts no responsibility for its use by any third party.
- 1.05 Whilst every effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in Appendix A.

2 SITE

- 2.01 Barclay House is located on the south east corner of Queens Square Gardens at the junction of Great Ormond Street and Boswell Street. The building comprises office space with laboratory

medicine facilities and shares a lightwell with Weston House located to the east of the site. An aerial view of the site location is included in Appendix B.

- 2.02 This application is for new mechanical services plant (four condensers and two air handling units) installed within the lightwell of the property as generally shown below. The plant is proposed to operate during daytime hours only.



Figure 1 : Plant location in lightwell and location of closest noise sensitive receptor

- 2.03 The condensers have been installed with acoustic discharge shrouds and will have a setback implemented to limit their noise output at peak times.
- 2.04 The closest noise sensitive receptors to the proposed plant items are the windows of Weston House, part of the Hospital and providing temporary accommodation for patient family members.

The rooms are mechanically ventilated with single glazed windows and provide a resting and sleeping amenity family members.

- 2.05 All other noise sensitive receptors are at a greater distance from the proposed location of the units, or are protected by more screening by the intervening structures, and as such will be subject to lower levels of noise.

3 GUIDANCE

- 3.01 Local and National Planning Policy is presented in Appendix C of this document.
- 3.02 A summary of the pertinent points relating to this application are presented below. In this instance the closest and most affected noise sensitive locations are part of the Hospital, the patient-family temporary accommodation rooms.

LBCC's Policy A4 Noise and Vibration includes the following:

"The Council will seek to ensure that noise and vibration is controlled and managed...

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3).

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity."

Appendix 3, Table C gives noise targets and criteria for 'proposed industrial and commercial developments (including plant and machinery)'. A footnote indicates that the targets are for dwellings.

****levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.**

The use of the premises in this instance is as an amenity space providing accommodation for transient occupants. Internal target noise levels for these spaces are outlined in Health and Technical Memorandum 08-01 - Acoustics. Table 1 of the document (*Criteria for noise intrusion from external sources*) gives internal target noise levels for family accommodation spaces

Table 1 Criteria for noise intrusion from external sources

Room type	Example	Criteria for noise intrusion to be met inside the spaces from external sources (dB)
Ward – single person	Single-bed ward, single-bed recovery areas and on-call room, relatives' overnight stay	40 $L_{Aeq, 1hr}$ daytime 35 $L_{Aeq, 1hr}$ night 45 $L_{Amax, 1hr}$ night

Figure 2 : Extract from Table 1, HTM08-01.

Target noise levels within the family accommodation should be limited to 40dBA for daytime occupation.

4 MEASUREMENTS

4.01 Operational plant noise levels were measured within the closest accommodation rooms at Weston House on 3rd March 2019. The survey methodology and results are set out below.

4.02 Noise measurements have been carried out as follows:

- 1m inside the window of the bedroom of apartment 4.7.
- All of the plant was set to operate simultaneously at full load in its noisiest mode (heating) in order to represent the worst case conditions.
- The AHU's were also operated in isolation to establish their contribution.
- Background noise levels were measured in the room with all of the new plant turned off.

5 EQUIPMENT

5.01 Equipment for the survey was as follows:-

- Brüel & Kjær type 2250 Integrating Sound Level Meter conforming to Class 1 BS EN 61672, Type 1 BS EN 60804 & BS EN 60651: 1994.
- Brüel & Kjær Condenser Microphone type 4189.
- Tripod.

5.02 The equipment holds current UKAS or equivalent accreditation and serial numbers as follows:

Sound Level Meter B&K2250	Serial No.	3007298
	Calibration Date	26 th May 2017
	Cal Certificate No.	U25660
½" Condenser Mic. B&K4189	Serial No.	2978645
	Calibration Date	26 th May 2017
	Cal Certificate No.	25659
Calibrator B&K4231	Serial No.	2389051
	Calibration Date	5 th December 2018
	Cal. Certificate No.	U30282

N.B. Copies of calibration certificates are available upon request.

5.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

6 RESULTS

6.01 The following table summarises the measured noise levels in the accommodation space:

Plant condition	Measured L _{Aeq}
All plant on (heating)	42 dB
AHU's only	32 dB
All plant off	31 dB

Table 6.1: Noise levels in Bedroom of 4.7 (windows closed)

6.02 Note the AHU's contribute relatively little to the overall noise levels inside the accommodation spaces.

7 PLANT ASSESSMENT

- 7.01 With respect to noise within the accommodation rooms, the condensers (4 No Mitsubishi PURY P550 YNW) are the dominant source and cause the design target of 40dBA to be exceeded.
- 7.02 An operational set back can be implemented to limit the peak noise output of the condensers. The first stage of setback limits the speed of the units fans and compressors to 85% and offers a reduction of 6.5dB for the size 550 units. A copy of the data table provided by Mitsubishi for the setback options is included in Appendix D.
- 7.03 Implementing the first stage setback to limit the peak operation of the units will reduce the noise levels within the accommodation in Weston House to 37dBA overall (condensers + AHU), within the 40dBA target guidelines for daytime occupation of patient family accommodation as outlined in HTM08-01.

8 CONCLUSIONS

- 8.01 Collins Construction Plc has appointed Environmental Equipment Corporation Limited to undertake a noise assessment of plant installed in a lightwell at Barclay House, Great Ormand Street Hospital
- 8.02 The assessment has been carried out in accordance with national planning guidance and the requirements of the LBCC and is based on a noise survey of the installed plant.
- 8.03 Plant noise limits have been set based on the requirements and policy guidance of LBCC. Targets have been set based upon relevant Health and Technical Memorandum standards in order to protect the amenity provided by the temporary accommodation spaces in Weston House.
- 8.04 Measurements and a review of the plant noise emissions have shown that the standards will be met providing the first stage of operational setback is implemented on all of the condensers.

APPENDIX A

GLOSSARY OF TECHNICAL TERMS

TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (SWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level a 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

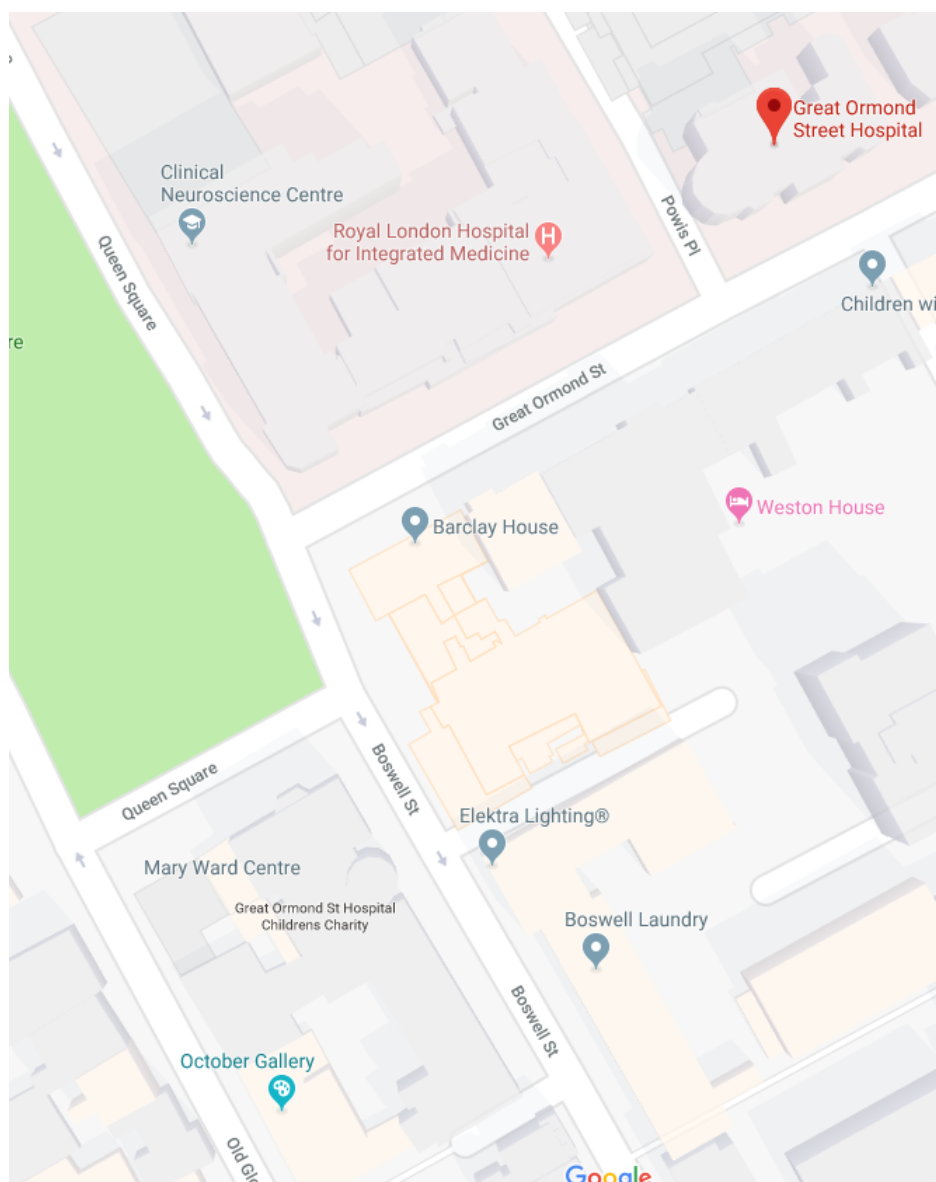
Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

L_{90} This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.

L_{10} This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

L_{eq} The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L_{eq} level tends to be dominated by the higher noise levels measured.

APPENDIX B
SITE LOCATION PLAN



Google Maps

quietly moving forward

APPENDIX C
PLANNING POLICY
AND GUIDANCE

PLANNING POLICY AND GUIDANCE

Planning Policy Camden Borough Council

London Borough of Camden's planning policy is set out in a range of documents that constitute its 'development plan'. This includes its **Local Plan** and proposed supplementary planning guidance (SPG's) documents. The Local Plan was adopted on 3 July 2017 and has replaced the 'Core Strategy' and 'Camden Development Policy' documents; as the basis for planning decisions and future development in the borough. The SPG's are in the process of being updated at time of writing (Sept 2017).

Policy A4 – *Noise and Vibration* outlines the following aims:

The Council will seek to ensure that noise and vibration is controlled and managed.

Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3).

We will not grant planning permission for:

- a. development likely to generate unacceptable noise and vibration impacts; or*
- b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.*

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to

minimise the impact on local amenity from deliveries and from the demolition and construction phases of development.

Appendix 3 of the Local Plan outlines noise thresholds for both noise generating and noise sensitive developments and identifies three basic design criteria upon which the acceptability of any proposal is likely to be assessed:

- Green – where noise is considered to be at an acceptable level.
- Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.
- Red – where noise is observed to have a significant adverse effect.

In the context of National Planning Policy Framework and Noise Policy Statement for England, Camden Council consider the above criteria to fall into three associated categories in terms of their noise ‘effects’:

- LOAEL Green
- LOAEL to SOAEL Amber
- SOAEL Red

Table C of Appendix 3 defines the target noise levels for mechanical services plant and machinery:

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 $L_{eq,5mins}$ 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.

National Planning Policy Framework and the Noise Policy Statement for England

The Ministry of Housing Communities and Local Government published the National Planning Policy Framework (NPPF) on July 2018 and upon its publication, presented the government's overarching planning policy on noise.

The NPPF contains three aims, which are set out at paragraph 180 in Section 15 of the document, titled *Conserving and enhancing the natural environment*:

"Planning policies and decisions 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 [See explanatory note to the Noise Policy Statement for England];*
- 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; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

The Department for Environment Food and Rural Affairs published the Noise Policy Statement for England (NPSE) in March 2010. The explanatory note of NPSE defines the following terms used in the NPPF:

“NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.”

The NPSE does not define any of the above effect levels numerically.

The NPSE presents the Noise Policy Aims as:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy and 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.”*

It can be seen that the first two bullet points are similar to Section 11 of the NPPF, with a third aim that seeks to improve health and quality of life. The NPSE later expands on the Noise Policy Aims, stating:

2.23 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

2.24 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that 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 (paragraph 1.8). This does not mean that such adverse effects cannot occur.

2.25 This aim (the third aim), seeks where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

It is clear that noise described in the NPSE as SOAEL that would lead to significant adverse effects should be avoided, although there is no definition as to what constitutes a significant adverse effect. Similarly, noise should be mitigated where it is high enough to lead to adverse effects, termed the LOAEL, but not so high that it leads to significant adverse effects.

British Standard 4142

To assess the acceptability of the resultant noise levels we have consulted the relevant standards. BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' has been used to assess the likelihood any adverse impacts based on the resultant noise level from the new plant item, including any corrections for the character of the noise against the existing background noise level.

BS4142 gives guidance on assessing the likelihood of adverse impacts by calculating a 'rating level' of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the 'rating level' to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more is an indication of a significant adverse impact, depending on the context.
- A difference of +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 noise level, the less likely it is that the specific sound source will have an adverse impact or 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 sound impact, depending on the context.

This assessment is carried out over a one hour period for the daytime and a fifteen minute period for the night-time. For the purposes of the standard it states that daytime and night-time are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq} .
- An additional correction shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention. The value for any tonal noise can be an addition of up to 6dB and for impulsive noise of up to 9dB.

BS 4142 goes onto state 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 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.'

BS4142 has been referenced in setting noise limits for any fixed plant proposed as part of the proposed development.

APPENDIX D

PLANT SETBACK NOISE REDUCTION DATA (Mitsubishi)

Chassis Size			S			L			XL	
	Fan Speed Setting	Capacity	P200	P250	P300	P350	P400	P450	P500	P550
PURY-P Cooling dBA reduction	100%	100%	0	0	0	0	0	0	0	0
	85%	90%	5	5	5.5	5	6	4.5	5.5	5.5
	70%	75%	9.5	9	9.5	8	10	9	8.5	9
	60%	70%	12	12	12.5	10.5	11	10	9	10.5
	50%	60%	13	14.5	14	13	12	11	9.5	11

Chassis Size			S			L			XL	
	Fan Speed Setting	Capacity	P200	P250	P300	P350	P400	P450	P500	P550
PURY-P Heating dBA reduction	100%	100%	0	0	0	0	0	0	0	0
	85%	90%	3.5	4	8	2	8	6	3	6.5
	70%	75%	6.5	5.5	12	6	13	12.5	6.5	10.5
	60%	70%	9	7.5	14.5	8.5	16.5	16	9	13
	50%	60%	15	13	17	12	17	17	11	16

