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ACOUSTICS PLANNING REPORT

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Audit sheet.

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RDSC UNIVERSITY COLLEGE LONDON

ACOUSTICS ACOUSTICS PLANNING REPORT – REV. 0

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Executive summary

There are proposals to introduce new mechanical plant as part of the Rare Dementia Support Centre fit-out at 25-26 Woburn Square, London.

An environmental sound survey has been undertaken which quantified the background sound levels experienced around the site and by neighbouring noise sensitive receptors.

An assessment of noise from the new mechanical plant has concluded that noise emissions will be lower than the existing background sound levels and will result in a low impact when assessed against relevant British Standards.

When comparing against London Borough of Camden policy, it is considered that the resultant impact aligns with the "Lowest Observed Adverse Effect level" (LOAEL).

On the basis of this assessment, noise is not expected to pose an obstacle in the granting of planning permission.

1. Introduction

University College London (UCL) is redeveloping 25-26 Woburn Square, London, WC1H OAA as the Rare Dementia Support Centre (RDSC).

The refurbishment will include spaces for meetings, social gatherings, counselling, seminar/education, along with facilities for support staff. In support of this redevelopment, the installation of additional mechanical plant has been proposed to supply the building.

This report has been prepared to support the planning application being made for the proposed installation of the mechanical plant at 25-26 Woburn Square, which will be supplying the proposed redevelopment. This report outlines the proposed mechanical plant and details an assessment of their potential impact on noise sensitive receptors in close proximity to the site.

A glossary of acoustic terminology is provided in Appendix A attached for ease of reference.

2. Planning Policy and Guidance

2.1 National Planning Policy.

Noise Policy Statement for England.

Noise Policy Statement for England (NPSE) (Department for Food and Rural Affairs, 2010) advises that noise impacts should be assessed on the basis of adverse and significant adverse effect but does not provide any specific guidance on assessment methods or noise limits.

NPSE introduces the concepts summarised in Table 1 that can be applied when considering the significance of noise impacts, which are applied by the World Health Organization.

The document advises that it is not possible to have 'a single objective noise-based measure... that is applicable to all sources of noise in all situations'. NPSE further advises that the sound level at which an adverse effect occurs is likely to be different for different noise sources, for different receptors at different times.

Effect Level	Description
No Observed Effect Level (NOEL)	This is the noise level below which no effect can be detected. In simple terms, below this level of noise, there is no detectable effect on health and quality of life due to the noise being assessed.
Lowest Observed Adverse Effect Level (LOAEL)	This is the level of noise above which adverse effects on health and quality of life can be detected.
Significant Observed Adverse Effect Level (SOAEL)	This is the level of noise above which significant adverse effects on health and quality of life occur.

Table 1: NPSE observed effect levels.

National Planning Policy Framework.

National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2023) sets out the Government's planning policies and how these are expected to be applied. In relation to noise and vibration, NPPF section 15 paragraphs 180, 191 and 193 are presented below:

'180. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e. preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instabilitv'

'191. 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;

and

c. limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

'193. 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.'

Planning Practice Guidance - Noise.

Online Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019) has been published online to provide greater details in relation to the relevance of noise to the planning process following the introduction of the NPPF and NPSE.

Under Noise, this guidance states, under the heading 'How can noise impacts be determined?', that the following should be considered by local authorities:

- *Whether or not a significant adverse effect is occurring or likely to occur;*
- whether or not an adverse effect is occurring or likely to occur; and
- whether or not a good standard of amenity can be achieved.'

In line with NPSE, this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation during the operation of the Proposed Development.

Further guidance on each of the various observed effect levels set out in NPSE is provided in the table contained within the section headed 'How can it be established whether noise is likely to be a concern?' which is reproduced below in Table 2.

It is important to note that no specific noise parameters are defined in the text.

Under the heading 'What factors influence whether noise could be a Concern?', the subjective nature of noise is discussed. It is stated that the relationship between noise levels and the impact on those affected is not simple, as this depends on how various factors combine in particular situations.

Response	Example of outcomes	Increasing effect level	Action
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse	Effect Level		
Present 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 Adv	erse Effect Level	1	
Present 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; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed A	dverse Effect Level	1	
Present and Disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep.	Significant Observed Adverse Effect Level	Avoid
	Quality of life diminished due to change in acoustic character of the area.		
Present and very Disruptive	Extensive and regular changes in behaviour and/or 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 harm, e.g. auditory and non- auditory.	Unacceptable Adverse Effect	Prevent

Table 2: PPG noise exposure hierarchy table of observed effects.

2.2 BS 4142: 2014 + A1: 2019 – Methods for rating & assessing industrial & commercial sound.

BS 4142:2014+A1:2019 provides guidance for assessing commercial operations and fixed building services plant noise. BS 4142 provides a method for indicatively rating the significance of noise impacts from industrial and commercial operations based on subtracting the pre-existing background sound level (LA90,T) from the rating level ($L_{Ar,Tr}$), which are both explained below. Nevertheless, to fully understand the likely noise impacts, the sound climate needs to be contextualised.

The background sound level represents the existing sound climate in the absence of impulse sounds (e.g., dogs barking). Background sound levels change with time, so accurately characterising background levels is an important factor in providing a worthwhile assessment. The standard does not give a strict method for determining representative background sound levels for assessment. However, it does state that "the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods." BS 4142 does also encourage separate assessments for daytime (07:00-23:00)

and night-time (23:00-07:00) periods. The nature of how background sound levels vary in the area and the existing sound sources defining the existing sound climate are key contextual considerations for the assessment.

Clause 8.1.4, which discusses the monitoring duration, states "there is no single background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed." As a note to this clause the following commentary is given with regards to determining representative background sound levels:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB), impulsivity (up to +9 dB), intermittency (+3 dB) and other sound characteristics (+3 dB), which may be determined either subjectively or objectively, if necessary.

By subtracting the background sound level from the rating level, the numerical difference can be used to provide an indication of the likely impact as follows:

- A difference of around +10 dB is likely to be an indication of a significant adverse impact, depending on context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context.
- A difference of +0 dB or less is an indication of the specific sound source having a low 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.

2.3 Camden Local Plan (2017)

Detailed in Camden City councils local plan is their guidance for the assessment and rating of industrial and commercial noise sources. Their guidance is outline below.

A relevant standard or guidance document should be referenced when determining values for LOAEL or 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.

Table C of the plan provides noise levels applicable to proposed industrial and commercial developments (including plant and machinery) in the context of the aforementioned LOAEL and SOAEL values. The table is detailed below:

Existing Noise sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Dwellings	Garden used for main amenity and Outside living or dining room or bedroom window (façade)	Daytime	'Rating level' 10dB below the background level	'Rating level' between 9 dB below and 5 dB above the background level	'Rating level' greater than 5 dB above the background level
Dwellings	Outside Bedroom window (façade)	Night-time	'Rating level' 10 dB below the background level and no events exceeding 57 dB LAmax	'Rating level' between 9 dB below and 5 dB above the background level or noise events between 57 dB and 88 dB LAmax	'Rating level' greater than 5 dB above the background level and/or events exceeding 88 dB LAmax

Table 3: Table C of Camden Local Plan 'Noise levels applicable to propose industrial and commercial developments (including plant and machinery)'

The Local Plan does recognise that these thresholds are technically relevant to residential demises, and where other building uses are present that alternative criteria may be appropriate.

3. Site context

3.1 Location

The proposed refurbishment is located at 25 and 26 Woburn Square, London. These two properties are adjacent to one another, internally linked, grade-2 listed, early Victorian 5-storey townhouses. They are set into a terrace of five buildings on the western side of Woburn Square.

Woburn Square generally houses University facilities, offices and other residential properties. Externally, there is no through road traffic, car parking spaces and an open fenced garden.

The nearest noise sensitive receptors to numbers 25 and 26 are the buildings directly to the rear at a distance of approximately 15m. These receptors consist of buildings occupied by University of London so will only be occupied during typical daytime hours. The remaining adjacent terrace properties to numbers 25 and 26 are understood to be owned by UCL (the owners of 25 and 26) and have therefore not been included as noise sensitive receptors.

3.2 External environmental noise

A noise measurement survey carried out at Woburn Square between Monday 15th April and Wednesday 24th April 2024 has quantified the external noise environment as summarised in Table 1 below. The noise survey details are provided in Appendix B attached.

Description of Measurement Parameter	Measu
Highest ambient daytime period (weekday)	57dB L
Highest ambient daytime period (weekend)	52dB L
Highest ambient night period (weekday)	49dB L
Highest ambient night period (weekend)	47dB L
Lowest consistent background, daytime period	42dB L
Lowest consistent background, night period	39dB L
Daytime typical statistical value LA01,T	75dB L

 * Indicates the value was taken from complete whole periods of measurement between 23:00 and 07:00 hours.

Table 4: Summary of external measured sound levels

4. Mechanical Plant Assessment

4.1 Proposed Mechanical Plant

The proposed mechanical plant consists of three relatively small VRF condensing units. The location and layout of the mechanical plant can be found in appendix C, with all three units being situated to the rear of the redevelopment, adjacent to the most south westerly point of the façade.

The proposed mechanical plant units and their associated plant noise levels are summarised in Table 5. Sound data is taken from manufacturer's datasheets provided by the project mechanical engineer.

Mechanical Plant Make and Model	Number of proposed plant units	Sound Pressure Level@ 1m (dB	
Mitsubishi Pury P200YKM3	2	57	
Daikin RXM35-R9	1	49	

Table 5: Proposed Mechanical Plant Details and Noise Emissions Values

To determine the likely mechanical plant noise levels at the closest noise sensitive receptors, calculations have been undertaken following the principles of outdoor propagation detailed in ISO 9613. For the purposes of the calculation, it has been assumed that there is no screening between the mechanical plant and the noise sensitive receptors, and all plant is operating at the same time.

A summary of the propagation calculations have been detailed below, with details of the individual and cumulative mechanical plant contributions at the noise sensitive receptors being outlined.

Calculation step	Daikin RXM35R9	PURY P200 (unit 1)	PURY P200 (unit 2)	
SPL @ 1m, dB	49	57	57	
Distance to the receptor, m	15			
Distance Attenuation (assuming point source propagation), dB	-23			
SPL at the receptors per item, dB	26	34	34	
Cumulative plant noise level at the receptors, dB		37		

Table 6: Mechanical plant noise propagation calculation to the closest noise sensitive receptors

ed Sound Level*
Aeq,16hour
Aeq,16hour
Aeq,8hour
Aeq,8hour
A90,15mins
A90,15mins
D1,15mins (or lower)
, daytime between 07:00 and 23:00 hours and at night

An assessment has been undertaken in line with BS 4142 to determine the likely impact at the closest noise sensitive receptors. This assessed value has then been compared to the Camden Plan RAG assessment system defined by the LOAEL and SOAEL values.

	Sound Pressure Level (dB)
Cumulative Plant Noise Level	37 dB L _{Aeq}
Character Correction	+0 dB
Plant Rating Level	37 dB Lar
Background Sound Level	42 dB La90
Difference of the Rating over the Background Sound Level dB	-5 dB
Camden Town Assessment Value	Amber (between LOAEL and SOAEL)

Table 7: Initial estimate of impacts as per BS 4142 and Camden Town Local Plan.

The initial estimate of impacts as per BS 4142 and Camden Town Local Plan assessment methodology suggests that the mechanical plant noise rating level will be lower than the lowest consistent background noise level during the day and falls within the Amber category of assessment for Camden Town, between the LOAEL and SOAEL.

Within BS4142, a difference of +0 dB or less is described as being an "indication of the specific sound source having a low impact, depending on the context". This would indicate, that while the plant rating level does fall within the Camden Town assessment method category of Amber (between LOAEL and SOAEL) it is likely that the mechanical plant noise will be of low impact to the noise sensitive receptors and is therefore considered to align more closely with LOAEL.

To provide further context to the estimation of impacts, the predicted mechanical plant rating noise level during operation hours (weekdays) will be approximately 15 dB below the highest 16hr ambient noise level measured during the survey. This would indicate that the mechanical plant noise is unlikely to be audible against the existing ambient noise level, and unlikely that the mechanical plant noise would be distinguishable against the ambient noise at the closest receptors.

For the above reasons it has been determined that the mechanical plant noise level at the closest noise sensitive receptors will be acceptable and will achieve the required criteria outlined in both NPSE and PPG such that no adverse effects will be caused.

Appendix A: Glossary of acoustics terminology

Sound.

Sound is physically a regular and order oscillation of air molecules that travels away from a source of vibration and creates fluctuating positive and negative acoustic pressure. When acoustic pressure acts on any solid object it causes microscopic deflections in the surface so that it can manifest in both air and structure.

Noise.

Noise is subjectively sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcome to the receiver.

Sound pressure level.

Sound pressure level is stated on many of the charts herein. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Decibel (dB).

The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Octave and Third Octave Bands.

The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

A-Weighting

The 'A' weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted value would be written as dB(A).

Equivalent continuous sound pressure level.

The equivalent continuous sound pressure level (L_{eq}) is a parameter defined as the equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal. The $L_{eq,T}$ can be seen to be an "average" sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an 'A' weighted noise level in dB(A). It is commonly used to describe all types of environmental noise sources.

Frequency.

Frequency is a term that is regularly used. It is the number of acoustic pressure fluctuations per second (also know is the 'pitch' of a sound). Hertz (Hz) is the unit normally employed to measure the frequency of sound, equal to cycles per second of acoustic pressure fluctuations. The frequency limits of audibility of a healthy human ear are generally accepted as being from 20 Hz to 20,000 Hz.

Background Noise Level L90.

The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameters. It is generally used to describe the prevailing background noise level or underlying noise level.

Noise Event Level L01.

The $L_{01,T}$ is a parameter defined as the sound pressure level exceeded for 1% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameters. It is generally used to describe the prevailing event noise levels.

Reverberation Time, T.

The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Airborne Single Number Quantity Weighting.

This is a weighting procedure defined in BS EN ISO 717, Part 1 for converting third octave band R, R', D and D_{nT} values to a single number quantity denoted as R_w , R'_w , D_w or $D_{nT,w}$. It is a decibel value.

Impact Single Number Quantity Weighting.

This is a weighting procedure defined in BS EN ISO 717, Part 2 for converting third octave L'_{nT} values to a single number quantity denoted as $L'_{nT,w}$. It is a decibel value.

Appendix B: Environmental noise survey

Location and duration

An automated sound level meter with a raised microphone was installed in the existing lower ground floor front lightwell as shown in Figure AppB-1 below. Sound levels were measured commencing at approximately 10:00 hours on Monday 15th April 2024 through to completion at approximately 16:30 hours on Tuesday 23rd April 2024.

Figure AppB-1: Location of sound level meter



The measurement position was a 'façade' type being within 3m of the existing upper ground floor level façade. The height of the microphone was approximately 2.5m above the pavement level on Woburn Square.

Equipment used

The sound level meter used was owned and operated by Hoare Lea LLP and is regularly calibrated by an accredited organisation externally and field calibrated upon set-up and collection. No significant drift in calibration was observed during the measurement period. The sound level meter system (System 53) installed comprised:

- Rion Sound Level Meter: NL-32 SN: 01161938
- Rion Pre-amplifier: NH-21 SN: 21976
- Rion Microphone: UC-53A SN: 311043
- External calibration date 22/09/2022
- External calibration certificate reference UCRT22/2153
- Rion Calibrator: NC-74 SN: 34172704
- External calibration date 04/08/2023
- External calibration certificate reference UCRT23/2030

Weather

The historical weather conditions recorded for central London (at the London City Airport weather station) during the duration of the measurements are summarised in Table AppB-1 below.

Table AppB-1: Summary of weather conditions

Date	Predominant Wind Direction	Mean Wind Speed m/s	Mean Temperature Degrees Celsius	Precipitation mm
Monday 15 th April 2024	Westerly	8.0	9.8	0
Tuesday 16 th April 2024	Westerly	6.7	10.0	0
Wednesday 17 th April 2024	Westerly	5.4	8.4	0
Thursday 18 th April 2024	North Westerly	4.8	9.5	0
Friday 19 th April 2024	North Westerly	5.4	10.4	0
Saturday 20 th April 2024	Northerly	4.8	7.8	0
Sunday 21 st April 2024	Northerly	3.6	8.3	0
Monday 22 nd April 2024	Northerly	2.7	7.5	0
Tuesday 23 rd April 2024	North Westerly	3.6	8.0	0 (light rain)

Measured sound levels

Figure AppB-2 provides a noise level time history for three measured parameters, the ambient noise $L_{Aeq,15minute}$ dB, the noise event level $L_{A01,15minute}$ dB and the $L_{A90,15minute}$ dB used to describe the underlying background noise.



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Figure AppB-2: External noise level time history



The ambient noise levels have been logarithmically averaged to determine daily (07:00 to 23:00 hours) and nightly (23:00 to 07:00 hours) values LAeq,16hour dB and LAeq,8 hours dB respectively. These are presented in Table AppB-2 below.

	Ambient sound pressure levels measured (dB) at position Lightwo			
Date	Day Time (07:00 - 23:00)	Night Time (23:00 - 07:00)		
	L _{Aeq, 16hr}	L Aeq, 8hr		
15/04/2024	63	49		
16/04/2024	54	47		
17/04/2024	54	47		
18/04/2024 54		48		
19/04/2024	53	47		
20/04/2024	51	47		
21/04/2024	52	47		
22/04/2024	57	45		
23/04/2024	56	#N/A		

Table AppB-2: Day and night overall ambient noise levels

Background noise measurements are presented following the statistical analysis approach of 'BS 4142 Methods for rating and assessing industrial and commercial sound:2014' (BS4142). The full measurement period has been processed as daytime (07:00 hours to 23:00 hours) and night (23:00 hours to 07:00 hours) histograms shown in Figure AppB-3 and Figure AppB-4 respectively. The lowest consistent daytime level, the 10th percentile value is LA90,15minute 42dB and at night is LA90,15minute 39dB.

Figure AppB-3: Daytime background noise levels







Appendix C: Mechanical Plant Information

Figure AppC-1: Mechanical Plant Locations (outlined in Red)



Figure AppC-2: Daikin RXM35R9 Plant Noise Data



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