BUROHAPPOLD ENGINEERING

Phase 2B - UCL, Institute of Education

Noise Impact Assessment

0035833

25 March 2020

Revision 02

Revision	Description	Issued by	Date	Checked
00	First issue	GD	06/03/20	PL
01	Minor amendments and proposed elevations added	GD	10/03/20	PL
02	Upadate to elevation drawing in Appendix	GD	25/03/20	PL

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Glossary

Term	Definition
Ambient Noise (as defined in BS 4142:2014)	Totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.
Background Noise (as defined in BS 4142:2014)	A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.
Decibel, dB	Commonly used unit used for the comparison of the powers of levels sound. Abbreviation dB. Is the unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is 2x10-5 N/m^2. The sound pressure level existing when microphone measured pressure is 2x10-5 N/m^2 is 0 dB, the threshold of hearing.
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
IANL – indoor ambient noise level	Table 1.1 in BB93 specifies the upper limit for indoor ambient noise levels within teaching areas. The design criteria is set for a 30-minute average level (i.e. $L_{Aeq,30mins}$). However, where there is negligible change in the noise level, BB93 states that a much shorter time period (e.g. $L_{Aeq,5min}$) can be used. BB93 also states that for rooms identified having limits of $L_{eq,30min}$ 35 dB(A) or less, the noise should not regularly exceed $L_{1,30min}$ 55 dB(A).
$L_{90,T}$ (& $L_{A90,T}$)	Sound pressure level exceeded for 90% of the measurement period. Referred to as background noise level.
$L_{Ar,T}$	Rating Noise Level (as defined in BS 4142:2014), the specific noise level plus any adjustment for the characteristic features of the noise.
$L_{eq,T}$ (& $L_{Aeq,T}$) - equivalent continuous noise level of a time-varying noise	Steady noise level which, over the period of time under consideration, contains the same amount of sound energy as the time-varying noise over the same period of time.
$L_{Fmax,T}$ (& $L_{AFmax,T}$)	The maximum sound pressure level measured during the measurement period T using the fast time constant.
L_p - sound pressure level	Sound pressure level, in decibels, of a sound is 20 times the logarithm to the base of 10 of the ratio of the sound pressure to the reference pressure. The reference pressure shall be explicitly stated and is defined by standard.
Noise Rating (NR)	Curves developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance. These can be compared to NC curves and also can be referred to equivalent dB(A) levels.
Specific Noise Level (as defined in BS 4142:2014)	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
Vibration	Force which oscillates about some specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm) or (rpm) and strokes per minute (spm). This is the number of oscillations which occurs in that time period. The amplitude is the magnitude or distance of travel of the force.

Term	Definition
Weightings (as defined in IEC 61672:2003):	A-Weighting: Frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.). C-Weighting: One of the frequency weightings corresponding to the 100-phon contour and the closest to the linear or un-weighted value.

1 Introduction

Buro Happold has been appointed by University College London (UCL) to provide acoustics consultancy on the proposed Phase 2B refurbishment works of the Institute of Education (IoE) building, 20 Bedford Way, London.

The scheme is understood to consist of open-plan offices, cellular offices, meeting rooms, social spaces, teaching spaces, meeting rooms, WCs and other associated spaces, located across Cores A, B and C of the existing building. It is understood that the scheme is to follow a design and build procurement route. The IoE building is bordered by Bedford Way to the east, Russell Square to the south, and Gordon Square to the north. The IoE building is surrounded by residential buildings, including a hotel to the east, as well as commercial offices and other academic buildings.

Whilst much of the design is currently under development, the aim of this report is to clarify the external plant noise limits and provide outline proposals for the mechanical plant which are part of the refurbishment works for Phase 2B. As such, this report focuses on the proposed Level 8 plant room located at the Core A-wing. Figure 1—1 below, shows core locations and Phase 2 refurbishment areas.

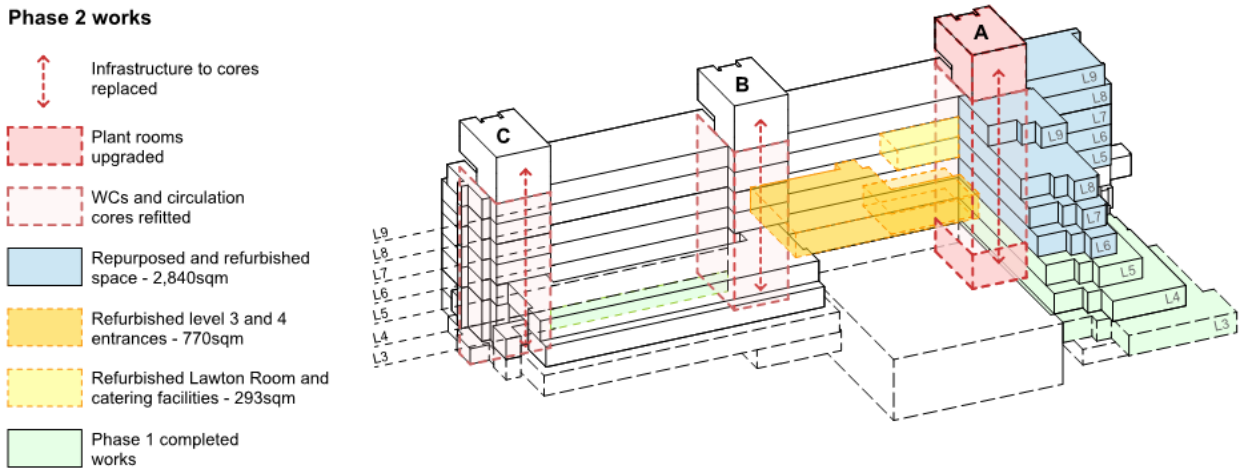


Figure 1—1: Drawing showing Phase 2 refurbishment areas and Cores locations

1.1 Reference Codes & Standards

This acoustic design report is informed by the following list of codes and standards:

1.1.1 BREEAM UK Refurbishment and Fit-out: 2014 – *Non-domestic buildings*:

- Pol 05 Reduction of noise pollution – up to 1 credit available:

  The noise levels from the new development, when measured at the nearest noise-sensitive receptor, are to be no more than 5 dB or 3 dB more than the background noise levels, for daytime (0700 - 2300) and night-time (2300 – 0700) respectively.

1.1.2 Camden Council Requirements - Planning Notice 2019/6386/P

Planning Notice 2019/6386/P for Phase 2A of the development was issued on 2 March 2020. It states that noise emitted from the proposed plant shall be controlled as follows:

4 (a) Where noise emitted from the proposed plant and machinery will not contain tones or will not be intermittent, the 'A' weighted sound pressure level

from the plant and machinery (including non-emergency auxiliary plant and generators) hereby permitted, when operating at its noisiest, shall not at any time exceed a value of 10 dB below the minimum external background noise, at a point 1 metre outside any window of any residential and other noise sensitive property, unless and until a fixed maximum noise level is approved by the Council.

(b) Where noise emitted from the proposed plant and machinery will contain tones or will be intermittent, the 'A' weighted sound pressure level from the plant and machinery (including non-emergency auxiliary plant and generators) hereby permitted, when operating at its noisiest, shall not at any time exceed a value of 15 dB below the minimum external background noise, at a point 1 metre outside any window of any residential and other noise sensitive property, unless and until a fixed maximum noise level is approved by the Council.

In all cases the background level should be expressed in terms of the lowest LA90, 15 mins during the proposed hours of operation. The plant-specific noise level should be expressed as LAeqTm, and shall be representative of the plant operating at its maximum.

Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policies A1 and A4 of the London Borough of Camden Local Plan 2017.

Figure 1—2: Camden Council planning notice for Phase 2A of the development

As such, it is understood that Camden Council requires that "acceptable" noise emissions from newly installed (non-tonal) plant should have a minimum target of 10 dB below the lowest measured background noise levels. As a result, the BREEAM criteria can be met by default when the Local Authority requirements are satisfied.

2 Site and External Noise Survey Results

2.1 Introduction

Buro Happold conducted external noise surveys on 4th October, 10th October and 8th December 2016 within the vicinity of the development site, relating to the design of the building and its associated services plant.

Surveys were undertaken in order to:

- Capture the existing background noise levels at nearby noise-sensitive (i.e. residential) receptors. This allows the specification of limiting noise levels for any externally located (or external terminations of) services plant, to see that mechanical plant noise emissions are in line with Council requirements.

2.2 Instrumentation

The acoustic survey was conducted using the instrumentation described in Table 2—1 below.

Table 2—1 Noise Survey Instrumentation

Description	Model No.	Serial No.
Handheld sound analyser	B&K 2250	3008216
Preamplifier	ZC 0032	22669
Condenser Microphone	B&K 4189	2983647
Brüel Kjær Acoustic Calibrator	B&K 4231	2438725
Handheld sound analyser	01dB Solo	203726
Preamplifier	PRE21S	14038
Condenser Microphone	MCE212	91389

All instrumentation had been laboratory calibrated (UKAS accredited) and certified within the last two years and traceable to National Standards. The instrumentation was field calibrated before and after the completion of the noise survey. No adjustments for instrumentation drift during the measurement period were required.

2.3 Weather

Weather details for the undertaken surveys are detailed below:

- 4th October 2016 – approx. 14-18°C, sunny with passing clouds and westerly winds between 14-17 mph;
- 10th October 2016 – approx. 7-13°C, sunny with passing clouds and southerly winds between 4-10 mph; and
- 8th December 2016 – approx. 12-13°C, sunny with passing clouds and northerly winds between 6-9 mph.

2.4 Measurement Methodology

The noise survey methodology undertaken provides a comprehensive and complete picture of how noise levels vary around the site throughout various times of the day and night. Measurement locations are detailed below and marked on an annotated aerial image in Figure 2—1.

- **Location 1** – Short term (manned) noise measurement, located on the eastern side of the institute on Bedford Way at approximately 1.5 metres above ground level;
- **Location 2** – Short term (manned) noise measurement, located on the southern side of the institute on Russell Square at approximately 1.5 metres above ground level;
- **Location 3** – Short term (manned) noise measurement, located on the western side of the institute on Thornaugh Street at approximately 1.5 metres above ground level;
- **Location 4** – Short term (manned) noise measurement, located on the northern side of the institute on Gordon Square at approximately 1.5 metres above ground level; and
- **Location 5** – Short term (manned) noise measurement, located near the centre of the western side of the institute 1.5 metres above ground level.

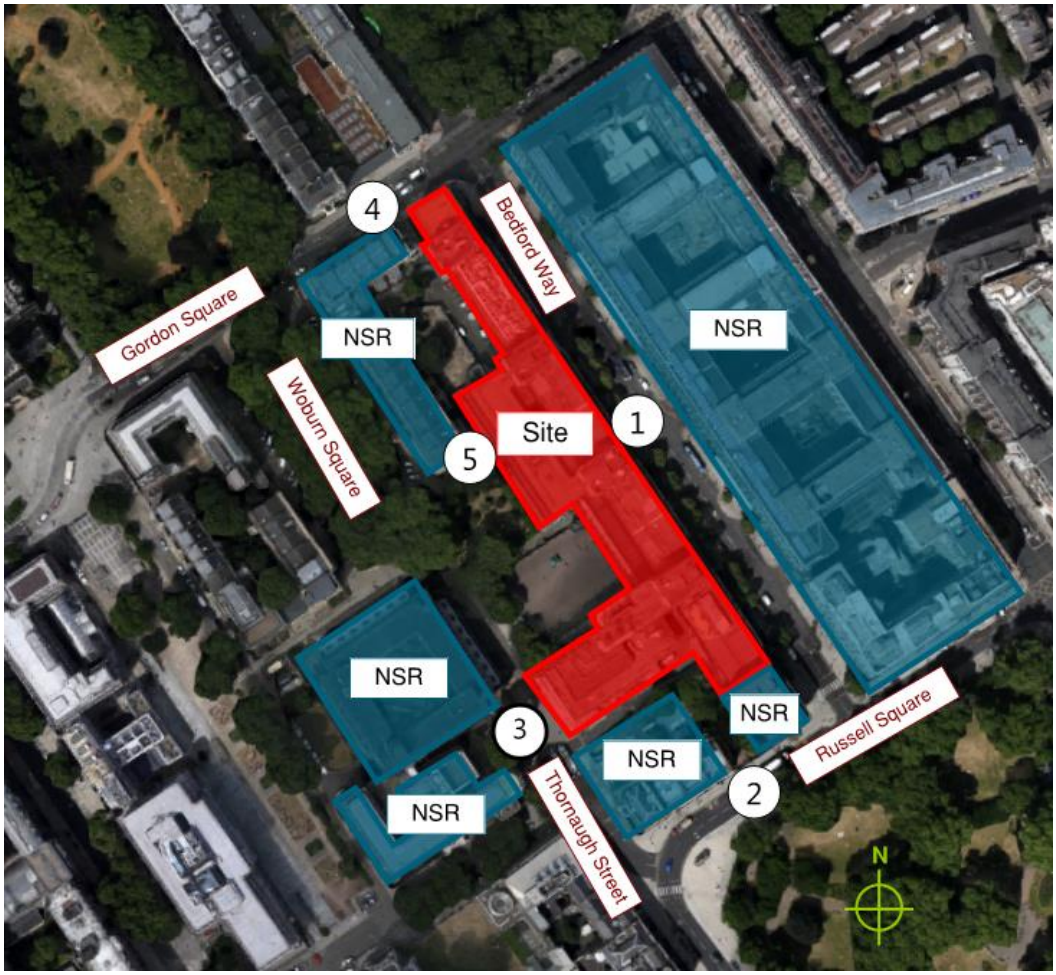


Figure 2—1: Site plan showing noise monitoring locations and noise-sensitive receptors (NSRs)

2.5 Noise Survey Results

As outlined in Section 1.1.1, Planning Notice 2019/6386/P states that noise emitted from the proposed plant and machinery shall not exceed 10 dB below the minimum external background noise level measured at 1 m outside any window of a noise-sensitive receiver. Therefore, the design levels reported in the table below are the lowest background noise level obtained at the various measurement positions.

Table 2—2: Noise survey results

Period	Start time	End time	Background sound level - $L_{A90,T}$ dB(A)	Comments
Location 1				
Day	04/10/2016 15:24	04/10/2016 15:40	57 dB	Medium traffic on the front road, students walking / talking
	04/10/2016 16:40	04/10/2016 16:55	59 dB	
	10/10/2016 17:40	10/10/2016 17:55	60 dB	Peak time, large number of pedestrians and cars, however traffic jam meant cars were at a standstill most of the time.
Design level			**57 dB**	
Location 2				
Day	04/10/2016 15:57	04/10/2016 16:12	59 dB	Traffic from Russell Square, buses and cars. Students talking / walking
	10/10/2016 17:58	10/10/2016 18:13	59 dB	High traffic, however at standstill most of the time.
Design level			**59 dB**	
Location 3				
Day	04/10/2016 16:13	04/10/2016 16:28	53 dB	No circulation, calm, few students walking / talking
	10/10/2016 18:34	10/10/2016 18:49	47 dB	Very calm, pedestrians and occasional cyclists.
Design level			**47 dB**	
Location 4				
Day	04/10/2016 16:29	04/10/2016 16:44	60 dB	Medium traffic, students talking / walking
	10/10/2016 18:16	10/10/2016 18:31	61 dB	High traffic, however mostly stopped at traffic lights.
Design level			**60 dB**	
Location 5				
Day	08/12/2018 16:38	08/12/2018 16:53	46 dB	No individual distinguishable noise sources were noted during the survey and the noise climate was subjectively noted to be quiet. Any noise from the adjacent construction site was excluded.
	08/12/2018 16:53	08/12/2018 17:08	46 dB	
	08/12/2018 17:08	08/12/2018 17:23	46 dB	
	08/12/2018 17:23	08/12/2018 17:38	46 dB	
Design level			**46 dB**	

2.6

2.6 Discussion

As can be seen from the results above, elevations that are immediately adjacent to Bedford Way, Russell Square and Gordon Square experience background noise levels of between $L_{A90,15mins}$ 57 - 60 dB(A). However, there is a considerable disparity to the 'rear' elevations, shielded from Bedford Way, Russell Square and Gordon Square by the building itself and all other façades, with these quieter locations experiencing background noise levels of between $L_{A90,15mins}$ 46 - 47 dB(A).

3 Plant Noise Break-Out Limits

3.1 Introduction

Any newly introduced external plant associated with the refurbishment works should be controlled to see that the Council requirements are achieved and that the noise impact upon existing noise-sensitive receivers is reduced.

This section of the report outlines Camden Council's mechanical plant noise limits, which are derived from the lowest background sound level measured at a location representative of the nearest noise sensitive receiver.

3.2 Design Criteria

Target values to limit the impact of noise break-out from noise-generating plant at nearby NSRs are detailed in Camden Councils guidelines shown in Section 1.1.2.

The design criteria are reproduced below for reference.

- The rating level ($L_{Ar,Tr}$ dB(A)) (calculated in accordance to BS 4142:2014+A1:2019) is at least 10 dB below the lowest background noise level ($L_{,A90,15mins}$ dB(A)) for the proposed operating period; and
- The rating level ($L_{Ar,Tr}$ dB(A)) (calculated in accordance to BS 4142:2014+A1:2019) is at least 15 dB below the lowest background noise level ($L_{,A90,15mins}$ dB(A)) for the proposed operating period should plant be identified as having "acoustic features" (e.g. intermittency, tonal characteristics, and impulsivity).

Individual plant items may need to be designed to a lower limit such that the overall total achieves the stated criteria above.

Since the requirements of the Local Authority with regards to limiting plant noise are more stringent, BREEAM criteria Pol 05 can automatically be met when the local planning requirements are satisfied.

3.3 Noise Sensitive Receptors

The following noise-sensitive receptors (NSRs) have been identified; these have been marked in blue on the annotated aerial image in Figure 3—1 below:

- Hotel rooms located adjacent to the eastern boundary of the IoE building on Bedford Way;
- Residential, commercial and academic buildings adjacent to the southern boundary of the IoE building on Russell Square; and
- Residential, commercial and academic buildings located adjacent to the western boundary of the IoE building on Thornhaugh Street and Woburn Square.

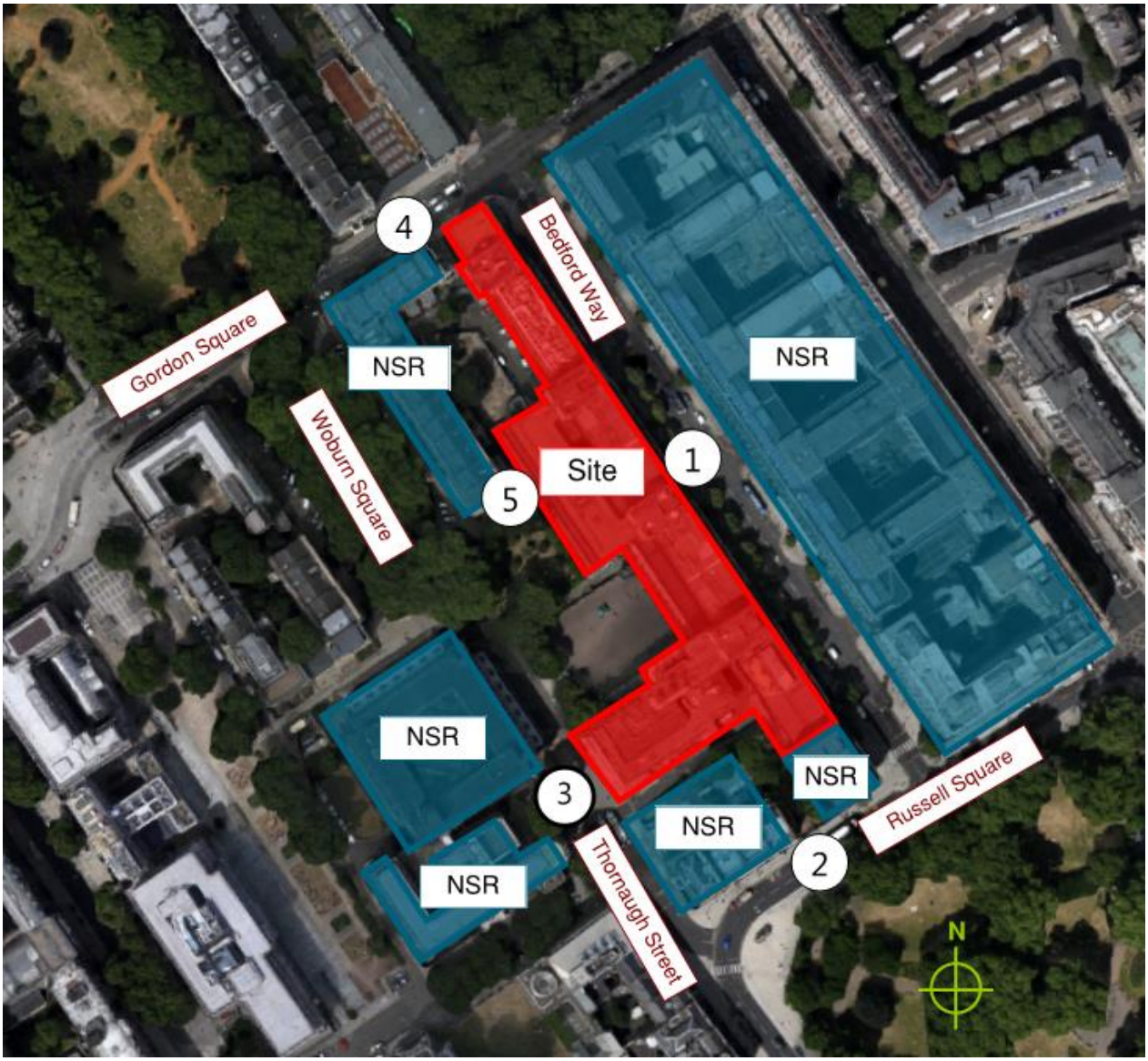


Figure 3—1: Site plan showing noise monitoring locations and noise-sensitive receptors (NSRs)

3.4 Plant Noise Limits at the Nearest NSRs

At this stage, specific plant locations and selections have not been finalised, and the most robust method in terms of controlling noise output will be to set limits for noise impact on existing noise-sensitive receptors (NSRs) in the vicinity of the site.

Camden Council requires the limiting, rating noise level of plant, $L_{Ar,T}$ dB(A), to be at least 10 dB below the lowest background sound level ($L_{A90,15min}$) when assessed at the nearest NSR.

Furthermore, the Camden Local Plan: 2017 states that plant identified as having "acoustic features" (e.g. intermittency, tonal characteristics, and impulsivity) should have a rating level ($L_{Ar,Tr}$ dB(A)) at least 15 dB below the lowest background noise level.

Based on the measured background sound levels taken during daytime hours (see Section 2.5), and in-line with design criteria (Section 3.2), limiting plant noise levels at the nearby noise sensitive receptors have been set in the table below. It is understood that the proposed mechanical plant and equipment will only be operating during the daytime period (07:00 – 23:00); therefore, only the daytime period is assessed.

Table 3—1: Limiting daytime (07:00 to 23:00 hours) plant noise levels at the nearest NSRs

Lowest measured existing background noise level ($L_{A90,15mins}$ dB(A))	**Cumulative plant noise limits from the proposed development: Max. L_{Ar} dB(A) @ 1 m from affected façade**	
	Plant without acoustic characteristics	**Plant with acoustic characteristics**
Bedford Way		
57	47	42
Russell Square		
59	49	44
Thornaugh Street		
47	37	32
Gordon Square		
60	50	45
Woburn Square		
46	36	31

Should any plant operating at night be considered at later stages, the assessment is to be completed for that period in a similar manner. For clarity, this means establishing the night-time background noise level $L_{A90,15mins,}$ and setting the cumulative noise limit, $L_{Ar,T}$ dB(A), in-line with the design criteria detailed above for all new plant as measured at the nearest NSR in terms of $L_{Aeq,T}$.

3.5 Outline Plant Proposals

It is understood a plant room has been proposed at the Core A wing on Level 8 as part of the Phase 2B Mechanical, Electrical and Plumbing (MEP) refurbishment programme. Appendix A shows the extent and location of proposed external Mechanical, Electrical and Plumbing (MEP) works during Phase 2 of the refurbishment programme. As part of the Stage 4 design process with the MEP Engineers, an assessment will be carried out to see that mechanical plant noise emissions are in-line with the requirements detailed in the Section above, once plant selections have been made.

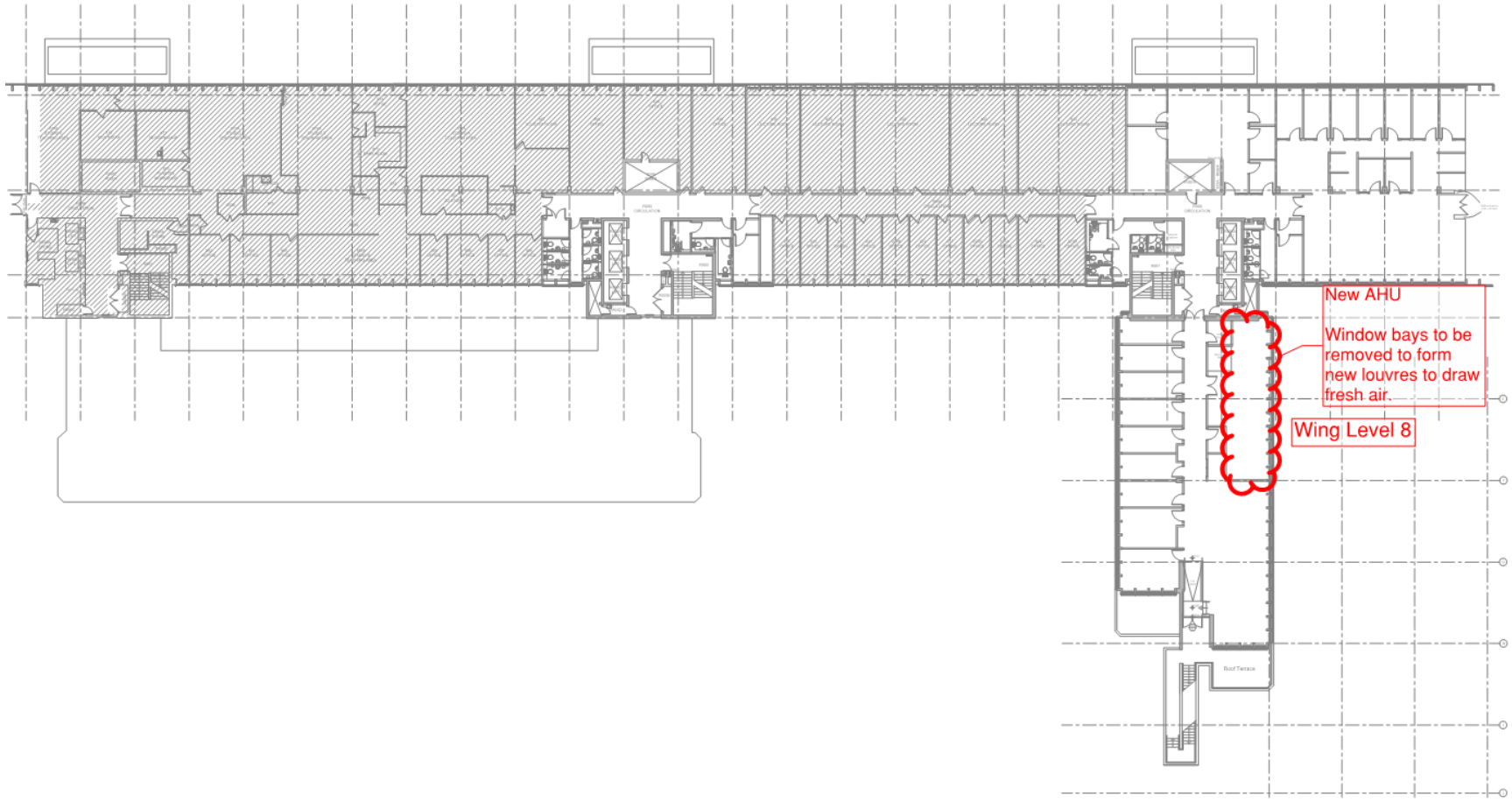
4 Conclusion

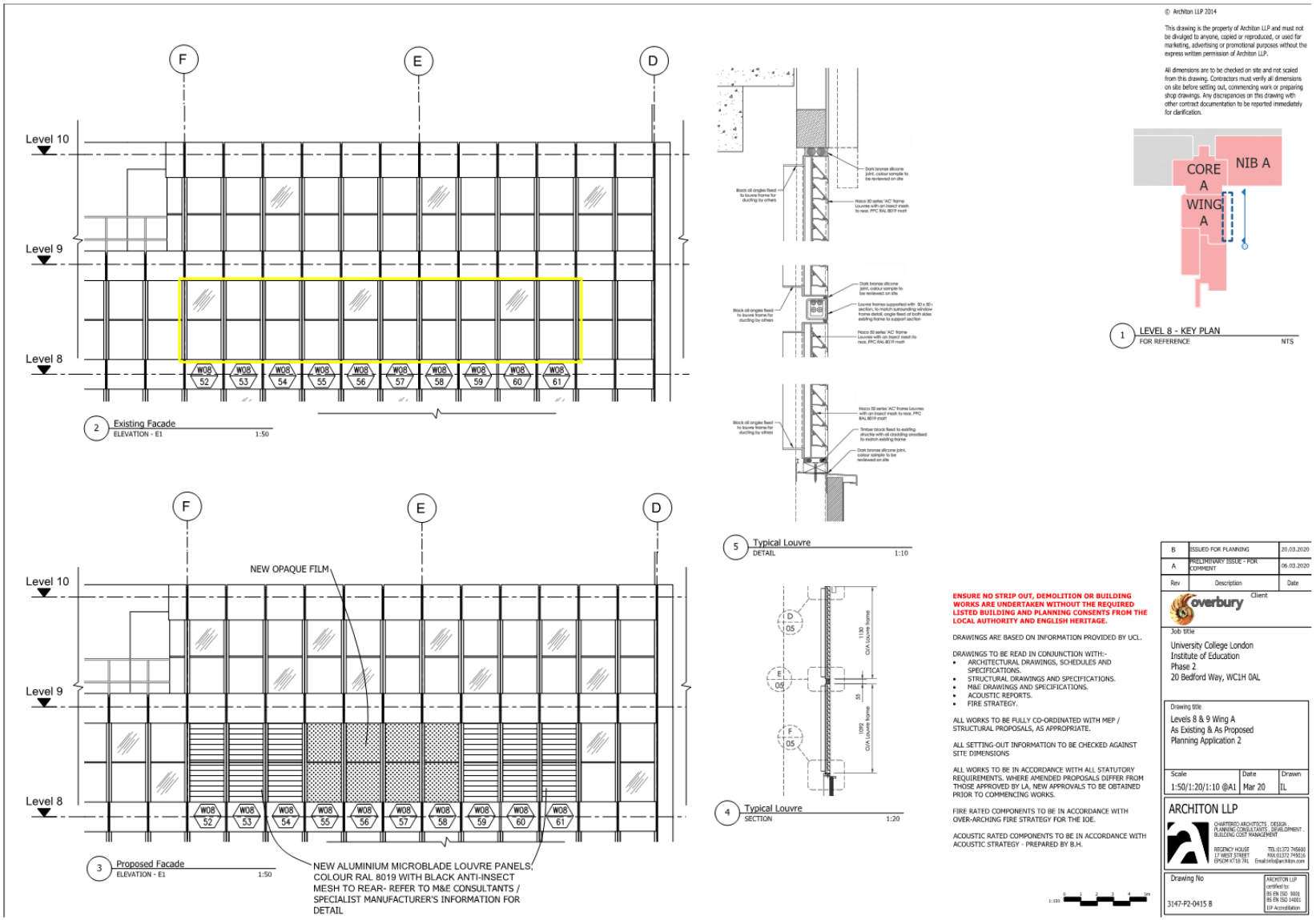
An acoustic survey was conducted in the vicinity of the development site to assess the existing noise climate. Analysis of the lowest measured background sound levels has been undertaken.

In accordance with Camden Council requirements, new plant noise emissions shall not exceed the lowest background sound level by more than 10 dB. In the absence of specific plant locations and selections, fixed plant noise limits have been identified at existing noise-sensitive receivers.

The proposed development is therefore considered suitable in terms of noise and planning, and acoustic concerns are not considered to represent any barrier to development.

Appendix A External Plant Locations





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