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AMERESCO

ACLAND BURGHLEY SCHOOL, LONDON NW5

PLANT NOISE ASSESSMENT

1 MARCH 2023

1768-AF-00001-04

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DOCUMENT REFERENCE: 1768-AF-00001-04

REVIEW AND AUTHORISATION			
Authored by Daniel Flood	**Position** Senior Consultant	**Signature**	**Date** 24/11/2022
Approved by Adrian Finn	**Position** Director	**Signature**	**Date** 24/11/2022

AMENDMENT HISTORY			
Issue	**Status**	**Description**	**Date**
01	Draft	Report issued	23/08/2022
02	2nd Issue	Updated calculations and mitigation recommendations	21/09/2022
03	3rd issue	Removal of eastern plant and change of western plant	24/11/2022
04	4th issue	Updated reference to plant location	01/03/2023

CONTENTS **PAGE NO.**

1. INTRODUCTION

1.1.1 Ameresco has commissioned AF Acoustics Ltd. to undertake a plant noise assessment for the proposed installation of 2 No. Air Source Heat Pumps (ASHP) to be installed at the Acland Burghley School, London NW5 1UJ.

1.2 Brief and Scope

1.2.1 The brief is to undertake a plant noise assessment for the proposed plant to be installed at the Acland Burghley School. to calculate the atmospheric noise emissions at the nearest receptors, in accordance with the requirements of Camden Council. If the proposed plant exceeds the local authority criteria, recommendations will be provided such that this can be achieved.

2. SITE DESCRIPTION

2.1 Location

2.1.1 Acland Burghley School is located in Tufnell Park, within the administrative jurisdiction of Camden Council.

2.1.2 The eastern school boundary is located on the well trafficked Dartmouth Park Hill. The properties in the immediate vicinity of the school are commercial on ground floor level, with residential units above. Further to the north, the properties are more residential in character.

2.1.3 The school is bordered to the north by Churchill Road, along its southwestern border by Ingestre Road and along the southern boundary by Burghley Road. All of these roads are residential in character.

2.1.4 The London Overground Gospel Oak to Barking Line runs beneath the northern section of site.

2.1.5 The ASHP units are proposed to be located beside the Music Block.

2.1.6 The site layout is shown in Figure 2.1.

2.1.7 The noise profile at the measurement locations consisted mainly of noise from traffic on the surrounding road network.

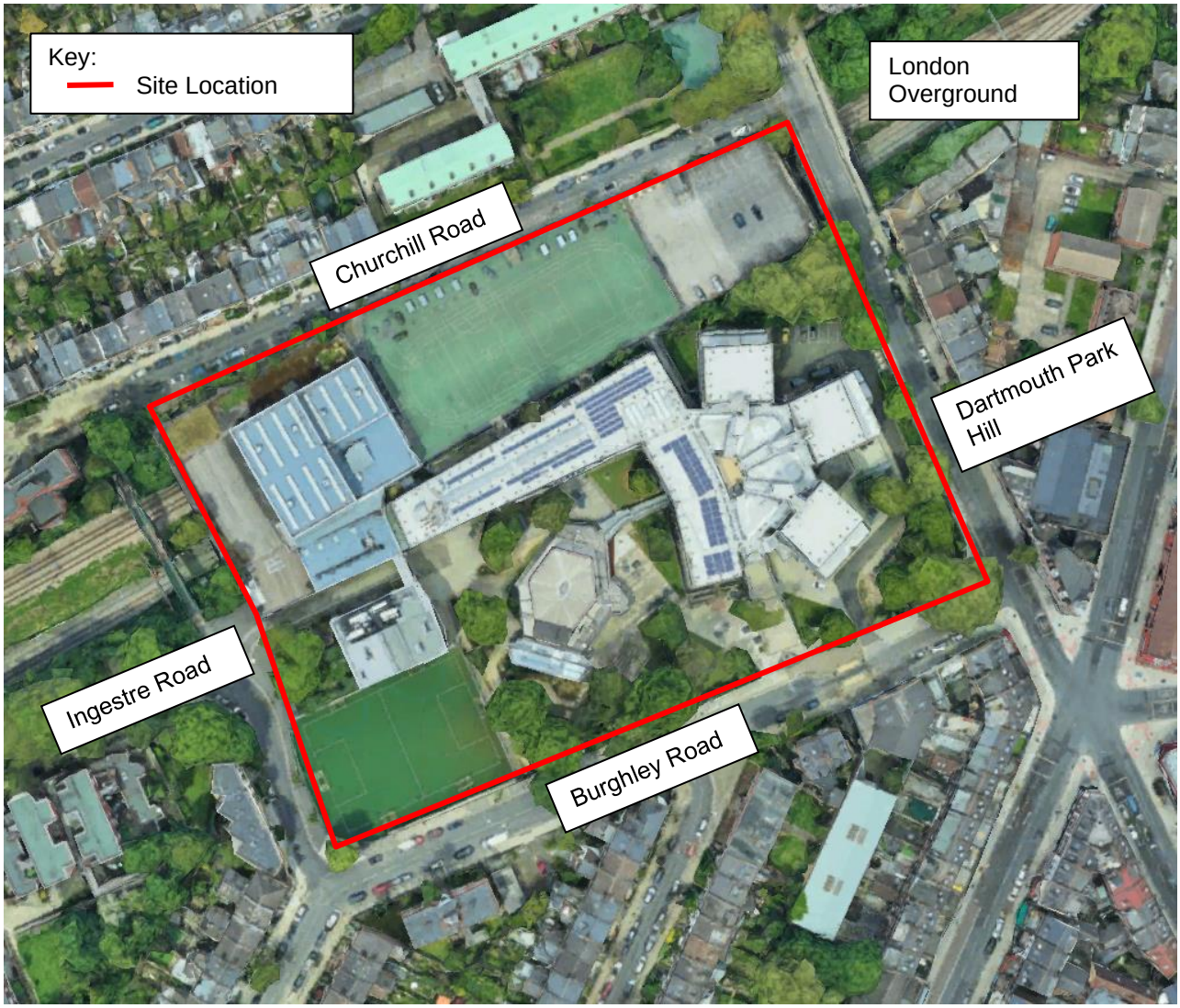

FIGURE 2.1: LOCATION MAP

3. GUIDANCE

3.1 British Standard 4142:2014

3.1.1 BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' describes methods for rating and assessing sound from "fixed installations which comprise mechanical and electrical plant and equipment", amongst other sources of noise.

3.1.2 The methodology contained within BS 4142:2014 uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

3.1.3 A summary of the approach set out within BS 4142:2014 is set out below:

- establish the specific sound level of the source(s);
- measure the representative background sound level, typically by measurement close to the receptor location;
- rate the specific sound level to account for any distinguishing characteristics;
- estimate the impact by subtracting the background sound level from the rating level; and
- consider the initial estimate of impact, in the context of the noise and its environment.

3.1.4 An initial estimate of the impact of the specific sound is obtained by subtracting the background sound level from the rating level. Using this approach, BS 4142 states:

> "Typically, the greater this difference, the greater the magnitude of impact
> *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context*
> A difference of around +5 dB 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."

3.1.5 Certain acoustic features can increase the significance of the impact over that expected from a basic comparison between specific sound level and the background sound level. These features include tonality and impulsivity, as well as additional characteristics and intermittency of the sound.

3.1.6 If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor.

3.1.7 The specific sound level is rated to account for distinguishing characteristics by using the penalties below:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

3.1.8 Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor.

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

3.1.9 For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

3.1.10 If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

3.1.11 If a subjective assessment is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

- 15 dB in the low frequency one-third octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency one-third octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency one-third octave bands (500 Hz to 10000 Hz)

3.1.12 If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

3.2 Local Authority Guidance – Camden Council - Policy A4 Noise and vibration

3.2.1 The Camden Local plan seeks to ensure that noise and vibration is controlled and managed. Noise and Vibration thresholds are provided, appended to the local plan documentation. The noise limits relating to industrial and commercial noise sources are reproduced below in Table 3.1.

3.2.2 The Local plan states that planning permission will not be granted 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.

3.2.3 It is also stated that Camden will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity.

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 57 dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57 dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88 dB L_{Amax}

TABLE 3.1: CAMDEN LOCAL PLAN INDUSTRIAL AND COMMERCIAL NOISE THRESHOLDS

4. NOISE SURVEY AND MEASUREMENTS

4.1 Unattended Noise Survey

4.1.1 An unattended noise survey was undertaken by Daniel Flood of AF Acoustics.

4.1.2 The duration of the survey was between 11:45 on Monday 25 July to 12:15 on Tuesday 26 July 2022.

4.1.3 Originally it was proposed to install ASHP at two locations on the school, on the east and the west of the site. This has now changed and only the ASHPs beside the Music Block are to be installed. Measurements were undertaken in the following locations:

Position 1 – Measurements were undertaken along the southwestern site boundary, close to Ingestre Road. The microphone was mounted on a tripod at a height of 1.5m above ground level. The noise environment was determined by intermittent road traffic on Ingestre Road and traffic on the surrounding road network. This measurement position was considered representative of the noise climate as experienced at the closest residential receptors to plant installation 1. The noise levels measured in this position are considered free field.

Position 2 – Measurements were undertaken towards the eastern boundary. The microphone was mounted on a tripod at a height of 1.5m above ground level. The noise environment was determined by road traffic on Dartmouth Park Hill. This measurement position was considered representative of the noise climate as experienced at the closest residential receptors to plant installation 2. The noise levels measured in this position are considered free field.

4.1.4 The measurement and plant locations are shown below in Figure 4.1.

4.1.5 Measurements were carried out in accordance with the requirements of BS 7445-2:1991 and ISO 1996-2:1987.

4.1.6 The sound level meter was calibrated both prior to and on completion of the survey, with no calibration drift observed. The microphones were fitted with windshields.

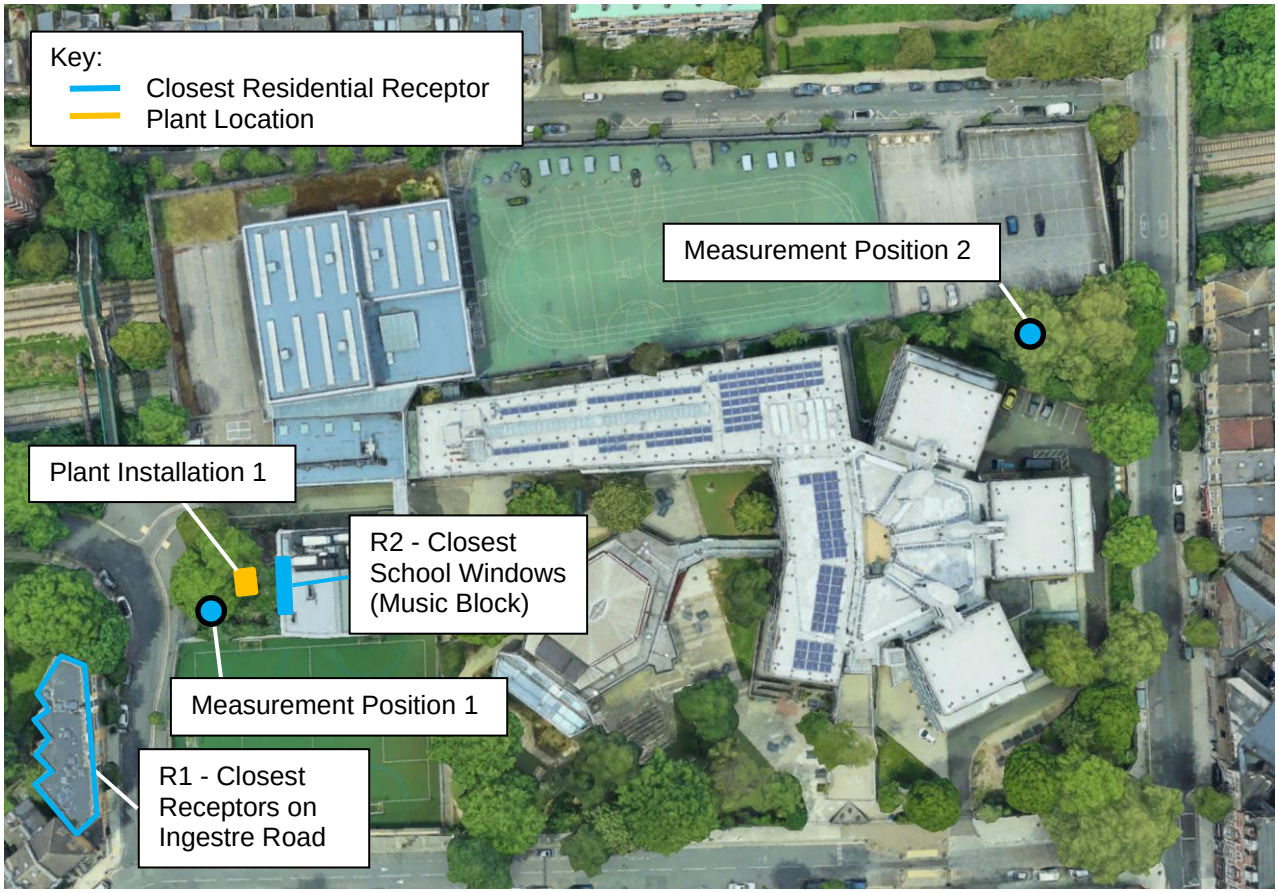

FIGURE 4.1: MEASUREMENT LOCATION

4.1.7 The equipment used is shown in Table 4.1.

Location	Name	Serial Number	Last Calibrated
Position 1	NTI Audio XL2-TA Class 1 Sound Level Meter	A2A-18530-E0	January 2021
	NTI Audio MA220 Pre-amplifier	9566	January 2021
	NTI Audio MC230A Microphone	A19842	January 2021
Position 2	Norsonic 118 Class 1 Sound Level Meter	31382	March 2022
	Norsonic 1206 Pre-amplifier	30416	March 2022
	Gras 40AF Microphone	150690	March 2022
All	Larson Davis Calibrator	18295	15 December 2020

TABLE 4.1: MEASUREMENT EQUIPMENT

4.2 Measurement Weather Conditions

4.2.1 The weather during the measurements was mainly dry and clear. The temperature ranged from 14 to 22°C. Average wind speeds remained below 3 ms^{-1}. The weather is deemed to have caused no significant effect during the measurement period.

4.3 Results

4.3.1 The results of the continuous noise monitoring survey are presented in graphical form in Figure A1 of Appendix A and summarised in Table 4.2.

4.3.2 The period averaged L_{Aeq} noise levels are presented below. The L_{A90} background noise level has been derived considering the most commonly occurring 15 minute period, whilst the $L_{Amax,F}$ is the maximum noise level measured.

Location	Time period	Measured Noise Levels (dB re 2.0 x 10^{-5} Pa)		
		$L_{Amax,F}$	$L_{Aeq,T}$	Typical $L_{A90,T}$
Position 1 - Western Site Boundary	Daytime (07:00 – 23:00)	83	55	40
	Nighttime (23:00 – 07:00)	74	47	29
	School Hours (08:00 – 17:00)	83	55	44
Position 2 – Eastern Site Boundary	Daytime (07:00 – 23:00)	90	57	47
	Nighttime (23:00 – 07:00)	77	50	37
	School Hours (08:00 – 17:00)	90	57	47

TABLE 4.2: SUMMARY OF UNATTENDED NOISE MEASUREMENTS

5. PLANT NOISE ASSESSMENT

5.1 Noise Rating Limit

5.1.1 The table below presents the maximum noise rating level which must not be exceeded at the noise sensitive receptor.

	Location	Measurement Period	Assessed Background Noise Level dB L_{A90}	Noise Rating Level Design Criteria	Plant Noise Rating Level Limit dB $L_{Ar,Tr}$
Western Site Boundary	R1 - 16 Ingestre Road	24 hour	29	-10dB below the typical background noise level – at night	19
	R2 - School - Music Block	08:00 – 17:00	44	Equal to the typical background noise level during school hours	44

TABLE 5.1: TARGET BACKGROUND NOISE LEVEL

5.2 Plant Noise Levels

5.2.1 Proposed for the western site boundary, close to the Music Block, are 2 No. Samsung AM140AXVAGH units.

5.2.2 The manufacturer's noise levels are presented in Table 5.2.

Plant	Parameter	Sound Level at Octave band Centre Frequency, dB							
		63	125	250	500	1000	2000	4000	8000
Mitsubishi CAHV-P500YB-HpB	L_p at 1m	66	64	63	62	58	51	46	38

TABLE 5.2: PLANT NOISE LEVELS

5.3 Location of Nearest Sensitive Receptors

Receptor 1 – 16 Ingestre Street

The closest residential windows with the potential to be affected by noise from the plant installation, along the western site boundary, have been identified as belonging to the second floor of 16 Ingestre Road. These are located at an approximate distance of 39m and will have direct line of sight to the plant.

Receptor 2 – Music Block

The closest school windows with the potential to be affected by noise from the western plant installation have been identified as belonging to the Music Block. These are located at a distance of approximately 7m, at a height of 5m

5.4 Calculated Noise Levels

5.4.1 Table 5.3 provides a summary of the calculated plant noise levels at the nearest noise sensitive receptors. The calculation sheets are presented in Appendix B.

Location	Assessment Period	Target Plant Noise Rating Level dB $L_{Ar,Tr}$	Calculated Plant Noise Rating Level dB $L_{Ar,Tr}$
R1 - 16 Ingestre Road	24 hour	19	37
R2 - School - Music Block	08:00 – 17:00	44	52

TABLE 5.3: PREDICTED NOISE AT NEAREST RESIDENTIAL RECEPTOR

5.4.2 A 3dB correction for intermittency has been added to the calculated noise level at each receptor in accordance with BS4142:2014. No additional correction factors have been added for tonality etc.

5.4.3 The proposed plant installations do not meet the requirements of Camden Council at the closest residential receptor, or the proposed AF Acoustics criterion at the closest school windows.

5.5 Mitigation

5.5.1 In order to meet the requirements of Camden Council, AF Acoustics recommends the plant installation along the western site boundary is enclosed by a screen of 2.4m in height. The screen should be solid, imperforate and have a minimum surface density of 15kg/m^2.

5.5.2 Predicted noise levels resulting from the installation of the barrier are presented below in Table 5.5.

Location	Assessment Period	Target Plant Noise Rating Level dB $L_{Ar,Tr}$	Calculated Plant Noise Rating Level dB $L_{Ar,Tr}$
R1 - 16 Ingestre Road	24 hour	19	19
R2 - School - Music Block	08:00 – 17:00	44	36

TABLE 5.4: PREDICTED NOISE AT NEAREST RESIDENTIAL RECEPTOR – WITH MITIGATION

5.5.3 The adoption of the above mitigation proposals is expected to see the plant noise levels achieve the requirements of Camden Council at the closest residential receptor, and should therefore be considered acceptable.

5.5.4 Meanwhile, plant noise levels at the closest school windows are predicted to achieve the proposed limits of being equal to the typical background noise levels during school hours, so should also be considered acceptable.

6. CONCLUSION

6.1.1 Ameresco has commissioned AF Acoustics Ltd. to undertake a plant noise assessment for the proposed installation of four Air Source Heat Pumps (ASHP) to be installed at the Acland Burghley School, London NW5.

6.1.2 It is proposed to install the plant beside the Music Block. A noise survey was undertaken at Acland Burghley School at two separate locations. The monitoring locations are considered representative of the prevailing noise environment at the closest noise sensitive receptors.

6.1.3 Plant noise emission criteria have been set at the nearest receptor based on the results of the noise survey and in conjunction with the national and local guidance.

6.1.4 Noise calculations based on the plant data have been undertaken to the nearest noise sensitive receptors.

6.1.5 The results of the assessment have been used to assess the impact of noise from the proposed plant at the nearest noise-sensitive receptors. The calculations show that additional noise mitigation is required.

6.1.6 An acoustic fence/barrier is proposed for the plant installation beside the Music Block. This should be 2.5m in height.

6.1.7 The adoption of the above mitigation will ensure that the predicted plant noise levels meet the requirements of Camden Council at the closest residential receptors, and should therefore be considered acceptable.

6.1.8 Finally, predicted plant noise levels at the closest school windows are also expected to achieve the proposed criterion.

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APPENDIX A: FIGURES

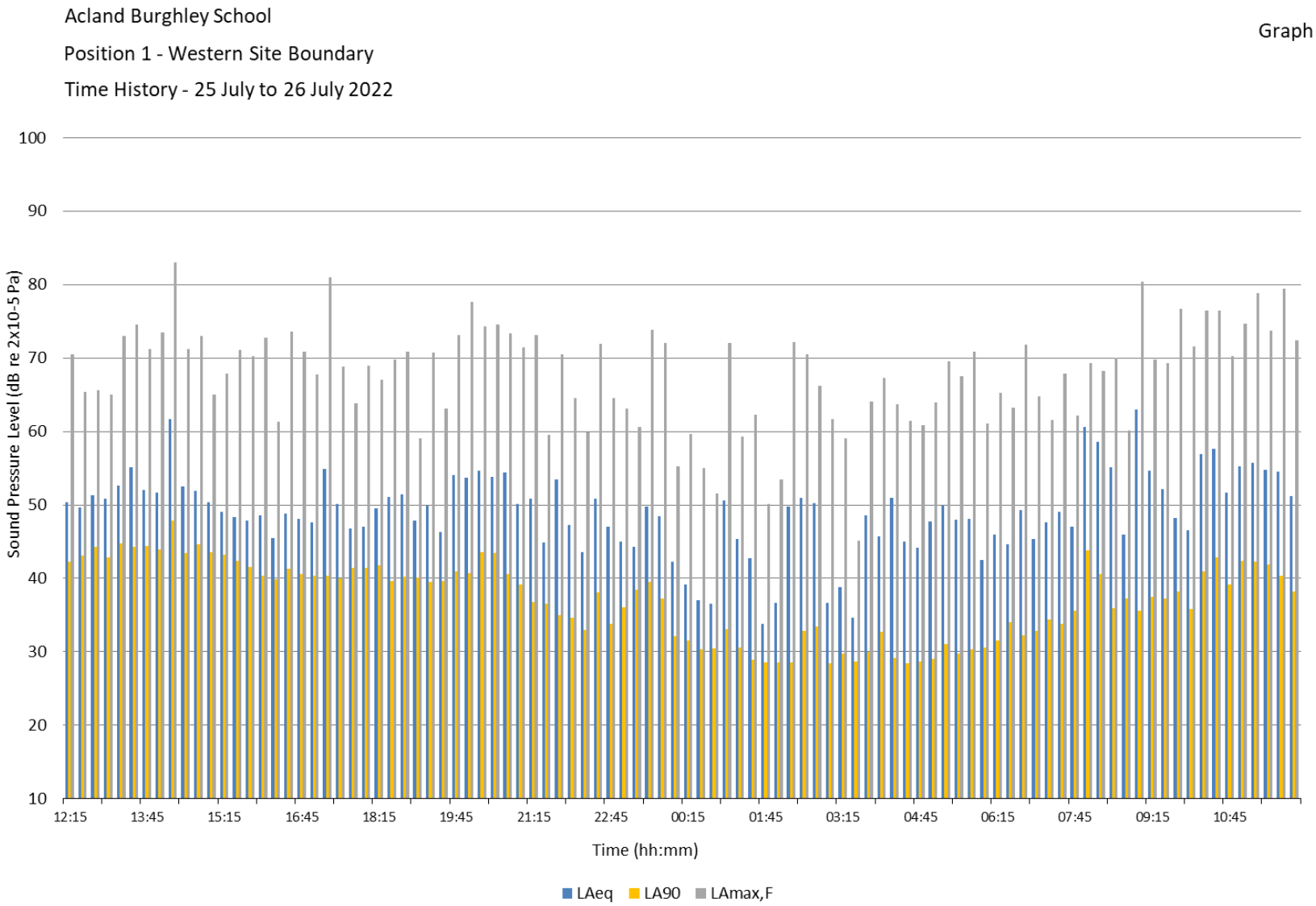

FIGURE A1: NOISE MEASUREMENT RESULTS – ACLAND BURGHLEY SCHOOL

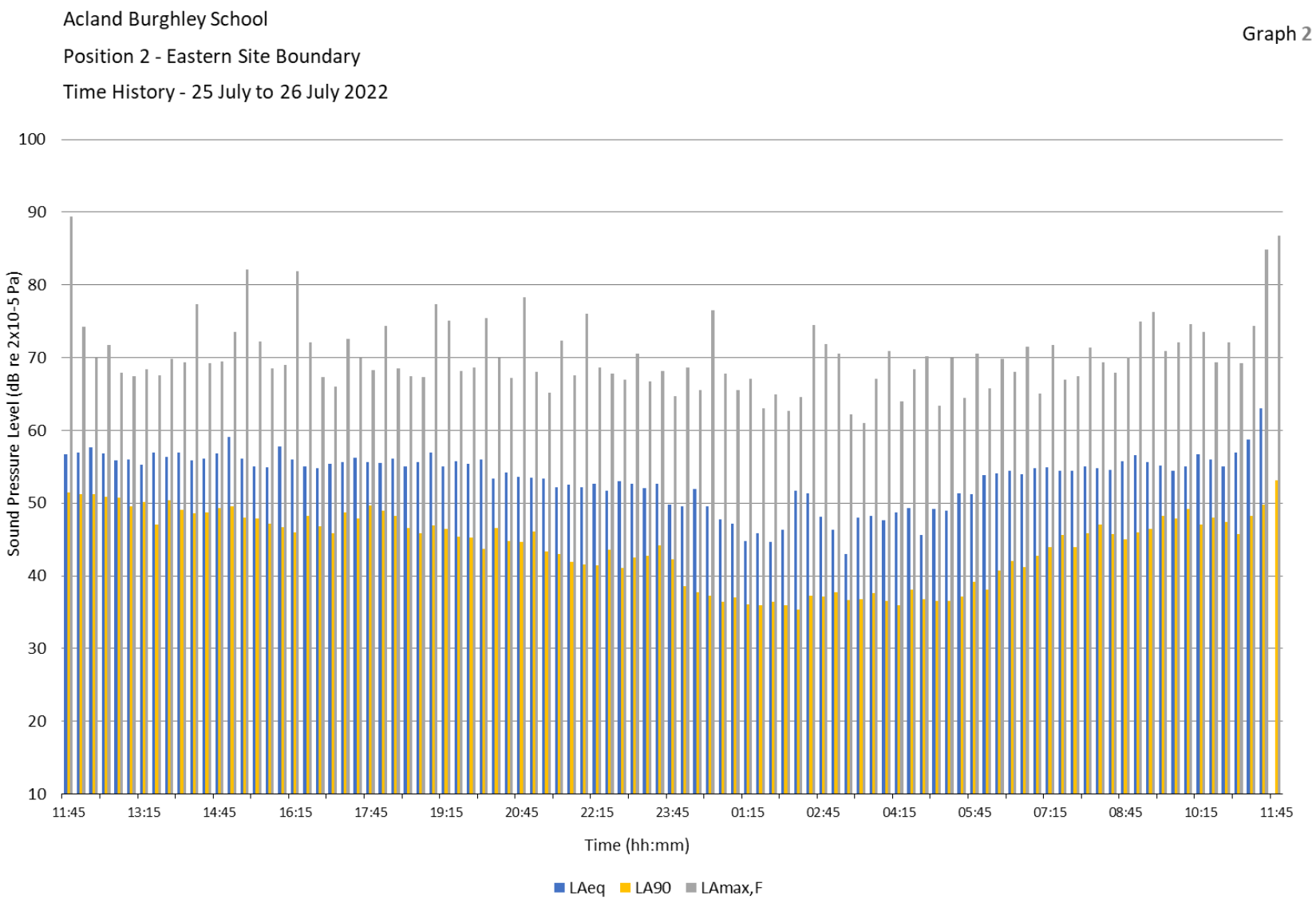

FIGURE A2: NOISE MEASUREMENT RESULTS – ACLAND BURGHLEY SCHOOL

APPENDIX B: TABLES

Job No.	Job Title			
1768	Acland Burghley School			
Date Created	By	Date Revised	Rev	Sheet
16 Aug 2022	AF	24 Nov 2022	6	
Date Reviewed	By	Review Type	Review Status	

Western Site Boundary Calcs - Mitigation / No Mitigation

No Mitigation		Rating/Broadband/Input			Octave Band Centre Frequency, Hz							
Item / Description		Rating	dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
CAHV-P500YB-HpB						66.0	64.0	63.0	62.0	58.0	51.0	46.0	38.0
2 units						3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Distance loss		38.5				-31.7	-31.7	-31.7	-31.7	-31.7	-31.7	-31.7	-31.7
Total at 18 Ingestre Road				34 (A)		37.3	35.3	34.3	33.3	29.3	22.3	17.3	9.3
CAHV-P500YB-HpB						66.0	60.0	66.0	60.0	52.0	50.0	56.0	48.0
2 units						3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Distance loss		7.0				16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9
Total at School window				49 (A)		52.1	46.1	52.1	46.1	38.1	36.1	42.1	34.1
With Mitigation													
CAHV-P500YB-HpB						66.0	64.0	63.0	62.0	58.0	51.0	46.0	38.0
2 units						3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Distance loss		38.5				31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
Barrier 2.4m						-7.9	-9.8	-12.2	-15.1	-18.0	-21.0	-24.0	-25.0
Total at 18 Ingestre Road				19 (A)		29.4	25.5	22.1	18.2	11.3	1.3	-6.7	-15.7
CAHV-P500YB-HpB						66.0	64.0	63.0	62.0	58.0	51.0	46.0	38.0
2 units						3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Distance loss		7.0				16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9
Barrier 2.4m						-6.7	-8.0	-10.0	-12.5	-15.4	-18.3	-21.3	-24.3
Total at School window				36 (A)		45.4	42.1	39.1	35.6	28.7	18.8	10.8	-0.2

TABLE B1: CALCULATIONS TO 16 INGESTRE ROAD AND MUSIC BLOCK

APPENDIX C: TERMINOLOGY RELATING TO NOISE

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20_{μ}Pa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power Level (Lw)	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).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by 20 $\log_{10}$ (s_1 / s_2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20_{μ}Pa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound
$L_{90,T}$	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.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
Specific Noise	The noise source under investigation for assessing the likelihood of complaints.
Rating Level	The specific noise level plus any adjustment for the characteristic features of the noise.
Free field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade	At a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX D: LIMITATIONS TO THE REPORT

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