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TEACHING BLOCK,

PARLIAMENT HILL SCHOOL, HIGHGATE ROAD, CAMDEN

ACOUSTIC COMMISSIONING REPORT

Report **10883-AC-01**

Prepared on 25 July 2019

Issued For:

Farrans Construction

Contents

List of Attachments

1.0 INTRODUCTION

Clement Acoustics has been commissioned by Farrans Construction to undertake an assessment of installed external plant systems at the recently constructed Teaching Block at Parliament Hill School, Highgate Road, Camden. A previously undertaken background noise survey was used to set noise emissions criteria in agreement with the planning requirements of the London Borough of Camden.

This report presents the noise impact measurements and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

As part of recent development works, condenser units, air handling units and ventilation fans have been installed for school use at the Teaching Block, Parliament Hill School, Highgate Road, Camden. The units are installed across the roof footprint as identified on the attached site plan.

The plant location is the existing school site, towards the southwest of the site. The closest residential property is located to the south of the Teaching Block, at a distance of 19 m to the closest Teaching Block roof edge.

3.0 NOISE EMISSIONS CRITERIA

3.1 Procedure

An environmental noise survey has previously been undertaken on site. The survey was undertaken in October 2018.

The survey methodology is detailed in Clement Acoustics Ltd report 10883-NIA-01 RevB. Based on the measured noise levels and local authority requirements, noise emissions criteria were set as shown In Table 3.1.

	Proposed Noise Emissions Criteria [10 dB below minimum background noise level]
Daytime (07:00 - 23:00)	36 dB(A)
Night-time (23:00 - 07:00)	Plant not Operational

Table 3.1: Set noise emissions criteria

It should be noted the criteria are based on achieving a level 10 dB below the minimum background noise level, which is considered suitably robust.

4.0 DISCUSSION

4.1 Measurement Procedure

The plant units were divided into groups, depending on the atmospheric noise emission location. The plant group locations are shown in the attached site plan. Plant was stated as being operated in a typically worst case mode by mechanical engineers on site.

A site visit was undertaken in order to take attended measurements of the installed plant units in operation, such that noise emissions could be measured and assessed.

Measurements were taken in single octave bands between 63Hz and 8kHz and lasted between 2 minutes and 3 minutes, depending on the fluctuation of background noise levels.

Measurements were undertaken close to the installed plant units in each group. It should be noted that meaningful measurements could not be obtained closer to the receiver location due to residual noise, including ongoing construction work, dominating the noise profile. All plant noise measurements were taken 1 m from the identified item of plant unless otherwise stated.

Due to the steady nature of the plant noise emissions, and the fluctuating nature of the ongoing construction works, measurements have been analysed in terms of the L90 background noise parameters, in accordance with the ANC Guidelines, Part 1.

For each plant group, the as installed noise emission from the loudest point of installed plant was calculated by logarithmically subtracting the measured background noise level in absence of plant noise, from the measured noise level with plant operating. Where numerous measurements were taken around a single item of plant, the loudest measured noise level is used as a source noise level in order to present a robust assessment.

The receiver noise level for each group of plant was then calculated by applying a distance correction to the closest window, with direct line of sight assumed.

The locations of the identified plant groups and measurements are shown in attached site plan 10883-AC-01-SP1.

4.2 Plant Group Results

Residual noise levels, taken in the absence of operational plant demonstrated background noise levels of L_{A90} 51 dB(A). This level will be used when calculating 'clean' plant noise levels as shown in the sections below.

Plant Group 1

Plant Group 1 comprises two large Air Handling Units, which are understood to serve the Sports Hall and Changing Rooms.

Both AHUs are NuAire Boxer Units, with the units, and atmospheric intake and exhaust terminations located on the roof in the position identified on the site plan.

Manual measurements and subjective observations made with the AHUs operational indicate that noise from Plant Group 1 is dominated by residual ambient noise levels, even during lulls in construction noise.

Measured and calculated noise levels are shown in Table 4.1.

Measurement Location	Comments on Plant Installation	Measured Noise Level $L_{A90,T}$	Calculated Plant Noise Level $L_{A90,T}$
Plant Group 1 – AHU Casing	Plant noise dominated by residual noise levels	45 dB(A)	-
Plant Group 1 – AHU Discharge		**47 dB(A)**	**47 dB(A)[1]**

Table 4.1: Measured ambient and calculated specific noise levels - Plant Group 1

[1] The measured noise levels close to Plant Group 1 are below the measured residual noise levels. The specific plant noise level is therefore assumed to be equal to that measured, in order to present a robust assessment.

With a calculated minimum distance separation of 40 m between Plant Group 1 and the receiver, the calculated noise emission level is 15 dB(A) due to the loudest measured point of Plant Group 1.

Plant Group 2

Plant Group 2 comprises a single Air Handling Unit. The as installed unit is a NuAire Unit, type XBC10-H-LCO-R. Measurements were taken of the fan casing, and discharge and intake terminations.

Manual measurements and subjective observations made with the AHU operational indicate that noise from Plant Group 2 was completely inaudible even close to the plant.

Measured and calculated noise levels are shown in Table 4.2.

Measurement Location	Comments on Plant Installation	Measured Noise Level $L_{A90,T}$	Calculated Plant Noise Level $L_{A90,T}$
Plant Group 2 – AHU Casing	Plant noise inaudible	48 dB(A)	-
Plant Group 2 – AHU Discharge		**53 dB(A)**	**49 dB(A)**
Plant Group 2 – AHU Intake		48 dB(A)	-

Table 4.2: Measured ambient and calculated specific noise levels - Plant Group 2

With a calculated minimum distance separation of 30 m between Plant Group 2 and the receiver, the calculated noise emission level is 19 dB(A) due to the loudest measured point of Plant Group 2.

Plant Group 3

Plant Group 3 comprises a single Air Extraction unit, driven by a Techtop motor. The motor and duct termination are located on the main roof.

Manual measurements and subjective observations made with the extraction unit operational indicate that noise from Plant Group 3 was audible close to the plant.

Measured and calculated noise levels are shown in Table 4.3.

Measurement Location	Comments on Plant Installation	Measured Noise Level $L_{A90,T}$	Calculated Plant Noise Level $L_{A90,T}$
Plant Group 3 – Extraction Duct and Motor	Plant noise audible	53 dB(A)	49 dB(A)

Table 4.3: Measured ambient and calculated specific noise levels - Plant Group 3

With a calculated minimum distance separation of 30 m between Plant Group 3 and the receiver, the calculated noise emission level is 19 dB(A) due to Plant Group 3.

Plant Group 4

Plant Group 4 also comprises a single Air Extraction unit, driven by a Techtop motor. The motor and duct termination are located on the main roof.

The unit in Plant Group 4 was not operational during our visit. However, it was observed to be identical to the unit in Plant Group 3. The at source noise level is therefore expected to be the same, i.e. $L_{A90,T}$ 49 dB(A)

With a calculated minimum distance separation of 25 m between Plant Group 4 and the receiver, the calculated noise emission level is 21 dB(A) due to Plant Group 4.

Plant Group 5

Plant Group 5 comprises a single rooftop fan servicing the Copy Rooms. The fan and duct termination are located on the main roof.

Manual measurements and subjective observations made with the extraction fan operational indicate that noise from Plant Group 5 was audible close to the plant.

Measured and calculated noise levels are shown in Table 4.4.

Measurement Location	Comments on Plant Installation	Measured Noise Level $L_{A90,T}$	Calculated Plant Noise Level $L_{A90,T}$
Plant Group 5 – Extraction Duct and Fan	Plant noise audible	61 dB(A)	61 dB(A)

Table 4.4: Measured ambient and calculated specific noise levels - Plant Group 5

With a calculated minimum distance separation of 30 m between Plant Group 5 and the receiver, the calculated noise emission level is 31 dB(A) due to Plant Group 5.

Plant Group 6

Plant Group 6 comprises a number of external condenser units (14 in total), installed on the main roof. Measurements were taken at several points around the operational units in order to encapsulate the worst case noise levels due to the group as a whole.

Manual measurements and subjective observations made with the condenser units operational indicate that noise from Plant Group 6 was audible close to the plant.

Measured and calculated noise levels are shown in Table 4.5.

Measurement Location	Comments on Plant Installation	Measured Noise Level $L_{A90,T}$	Calculated Plant Noise Level $L_{A90,T}$
Plant Group 6 – Location 1	Plant noise audible	53 dB(A)	-
Plant Group 6 – Location 2		53 dB(A)	-
Plant Group 6 – Location 3		50 dB(A)	-
Plant Group 6 – Location 4		**55 dB(A)**	**53 dB(A)**
Plant Group 6 – Location 5		53 dB(A)	-
Plant Group 6 – Location 6		52 dB(A)	-
Plant Group 6 – Location 7		53 dB(A)	-
Plant Group 6 – Location 8		50 dB(A)	-
Plant Group 6 – Location 9		48 dB(A)	-

Table 4.5: Measured ambient and calculated specific noise levels - Plant Group 6

With a calculated minimum distance separation of 25 m between Plant Group 6 and the receiver, the calculated noise emission level is 25 dB(A) due to the loudest measured point of Plant Group 6.

4.3 Cumulative Assessment

The cumulative receiver noise level has been calculated by logarithmically adding the contribution from the loudest point of each identified Plant Group. The calculated noise levels are summarised in Table 4.6.

Plant Group	Calculated Plant Noise Level $L_{A90,T}$, at Receiver
Plant Group 1	15 dB(A)
Plant Group 2	19 dB(A)
Plant Group 3	19 dB(A)
Plant Group 4	21 dB(A)
Plant Group 5	31 dB(A)
Plant Group 6	25 dB(A)
Cumulative Level due to All Groups	**32.8 dB(A)**

Table 4.6: Calculated Cumulative Receiver Noise Levels

As shown by comparing the cumulative level in Table 4.6 with the criterion summarised in Table 3.1, compliance with the established requirements is anticipated.

We are therefore satisfied that all rooftop plant and associated mitigation has been correctly installed and noise emission levels are not expected to be audible at surrounding residential windows.

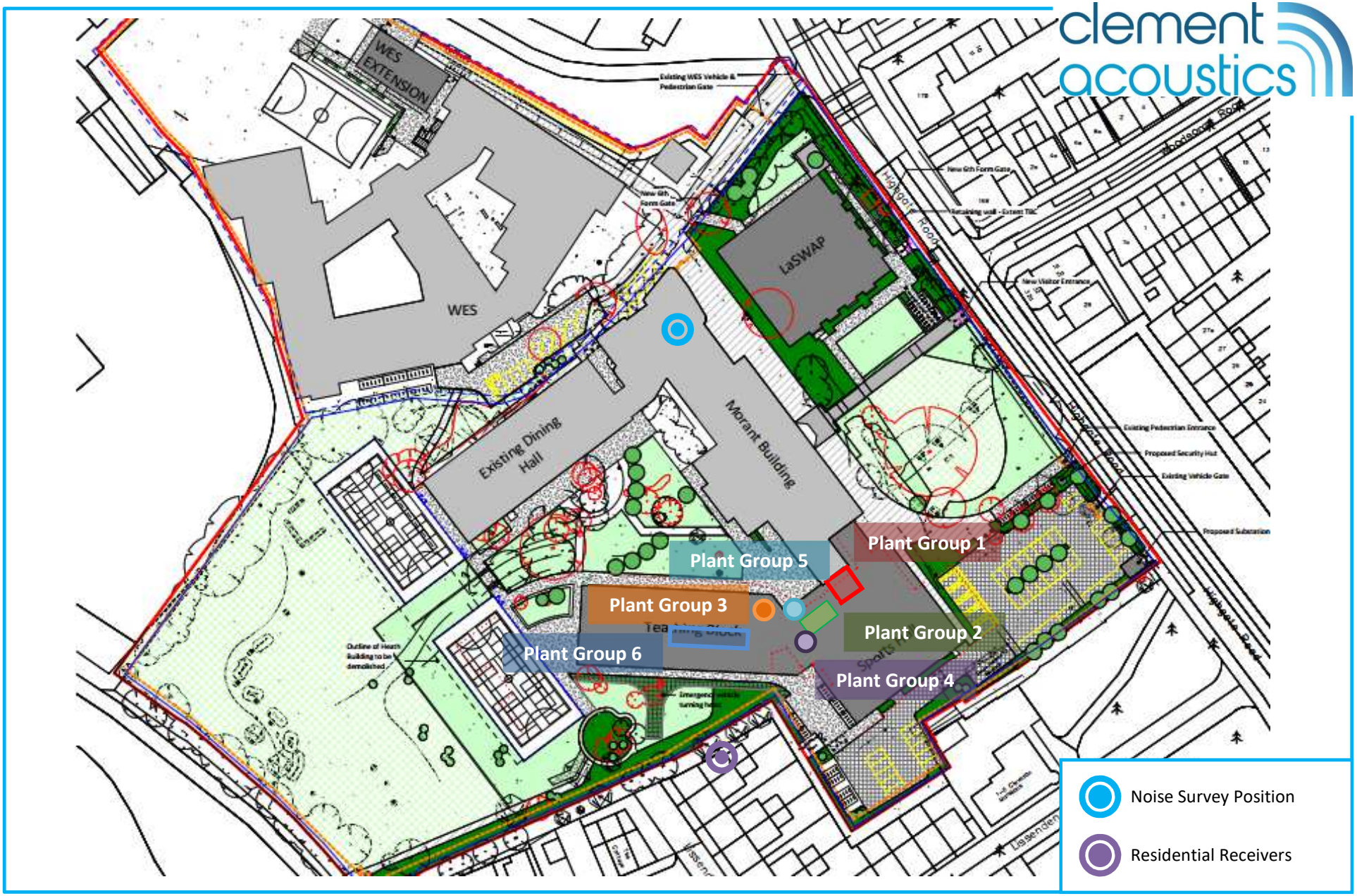
5.0 CONCLUSION

A noise impact assessment has been undertaken for installed plant units at the Teaching Block, Parliament Hill School, Highgate Road, Camden. A previously undertaken noise survey was used to set criteria for noise emissions in accordance with the requirements of the London Borough of Camden.

Manual measurements were then undertaken of the installed plant units in order to calculate noise levels at residential windows due to the plant installation.

Measurements and calculations show that noise emissions from the rooftop plant installation are expected to comply with the requirements of the Local Authority.

Report by	Checked by
Duncan Martin MIOA	**Andrew Thomas MIOA**



10883-AC-01-SP1 Indicative site plan indicating plant locations

Date: 25 July 2019

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.