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TEACHING BLOCK,

PARLIAMENT HILL SCHOOL, HIGHGATE ROAD, CAMDEN

NOISE IMPACT ASSESSMENT

Report **10883-NIA-01**

Prepared on 22 September 2017

Issued For:

Farrans Construction

New Cambridge House

Bassingbourn Road

Litlington nr Royston

SG8 0SS

committed to CSCS Platinum award

ISO 17025

ISO 9001

Institute of Acoustics sponsoring organisation

Contents

List of Attachments

1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Farrans Construction to assess a proposed plant installation at Parliament Hill School, Highgate Road, Camden in agreement with established noise emissions criteria.

This report presents the results of noise impact calculations and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

Current proposals are to install various ventilation and air conditioning plant to service proposed teaching spaces over lower ground, ground and 1st floors in the Teaching Block.

External plant units will be located on the main roof of the Teaching Block, with other internally located units ducted to external facades.

The Teaching Block is located towards the south of the school site, close to residential receivers.

The closest window to the proposed plant location is at a minimum distance of 20 m from plant located terminating on the closes facade.

3.0 NOISE CRITERIA

Environmental noise surveys were undertaken by Hoare Lea in September to October, 2013. These surveys were used to determine appropriate noise emissions criteria for plant installations, as detailed in report REP-1005073-TH-20140217-4.

For plant installations located at the Teaching Block, the noise emissions criterion was determined to be a level of 38 dB(A) at the nearest residential receiver during daytime hours.

As proposed plant units will only be used during school hours, assessing to the daytime criterion is considered suitably robust.

4.0 PROPOSED PLANT INSTALLATION

Proposed plant units have been grouped according to the location of external units, or the duct termination of internal units. The locations of each group are indicated on attached site plan 10883-SP1.

4.1 Plant Group 1

Plant Group 1 comprises two air handling units, servicing the sports hall and the toilets and changing rooms. The AHUs themselves are located externally, meaning the intake, discharge and casing breakout must be considered for each.

The manufacturer's specified noise emissions for Plant Group 1 units are as shown in Table 4.1.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
AHU 1 [Sports Hall]								
Supply Fan Casing Breakout	66	63	58	51	50	48	44	35
Supply Fan Intake	64	64	69	66	61	56	53	45
Extract Fan Casing Breakout	66	63	57	51	50	48	44	35
Extract Fan Exhaust	71	74	78	80	82	79	75	71
AHU 4 [WCs and Changing Rooms]								
Supply Fan Casing Breakout	64	58	55	49	47	44	39	30
Supply Fan Intake	58	58	64	63	56	47	39	29
Extract Fan Casing Breakout	66	59	57	51	50	46	41	33
Extract Fan Exhaust	71	70	78	80	82	77	72	69

Table 4.1: Manufacturer's Sound Power Levels - Plant Group 1

The proposed plant location is on the main roof in a louvred housing, in the location shown on indicative site plan 10883-SP1.

The plant location is approximately 25m from the residential window, with direct line of sight assumed.

4.2 Plant Group 2

Plant Group 2 comprises 3 condenser units and the ducted termination of an extract fan. Noise must be considered from the externally located condenser units and the ducted exhaust of the extract fan.

The manufacturer's specified noise emissions for Plant Group 2 units are as shown in Table 4.2.

	Noise Emission Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Condenser Units								
Mitsubishi Unit PURY-P600YSLM-A11	Overall Sound Power Level 89 dB(A)							
Mitsubishi Unit PKA-RP100KAL	Overall Sound Power Level 65 dB(A)							
Daikin Unit EMRQ16AAY1	Overall Sound Power Level 84 dB(A)							
Extract Fan [Prep Room R218]								
Chemical Extract Fan VB14	Overall Sound Pressure Level 56 dB(A) @ 3m							

Table 4.2: Manufacturer's Noise Emission Levels - Plant Group 2

The proposed plant location is on the main roof, in the location shown on indicative site plan 10883-SP1.

The plant location is approximately 25m from the residential window, with direct line of sight assumed.

4.3 Plant Group 3

Plant Group 3 comprises 4 identical MVHR units, each servicing an individual classroom. The units themselves are located internally, with exhaust and intake ducts to the external building facade at 1st floor level. Noise emissions from the exhaust and intake ducts will therefore be considered from each of the 4 MVHR units.

The manufacturer's specified noise emissions for Plant Group 3 units are as shown in Table 4.3.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire MVHR XBC 55 [4 Units in Group 3]								
Supply Fan Intake	66	59	60	48	49	46	38	26
Extract Fan Exhaust	71	66	69	56	57	56	51	48

Table 4.3: Manufacturer's Sound Power Levels - Plant Group 3

The proposed plant location is on the north facade of the Teaching Block, in the location shown on indicative site plan 10883-SP1.

The plant location is approximately 28m from the residential window, with a significant amount of screening provided by the Teaching Block building envelope.

4.4 Plant Group 4

Plant Group 4 comprises 3 identical MVHR units, each servicing an individual classroom. The units themselves are located internally, with exhaust and intake ducts to the external building facade at 1st floor level. Noise emissions from the exhaust and intake ducts will therefore be considered from each of the 3 MVHR units.

The manufacturer's specified noise emissions for Plant Group 4 units are as shown in Table 4.4.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire MVHR XBC 55 [4 Units in Group 3]								
Supply Fan Intake	66	59	60	48	49	46	38	26
Extract Fan Exhaust	71	66	69	56	57	56	51	48

Table 4.4: Manufacturer's Sound Power Levels - Plant Group 4

The proposed plant location is on the south facade of the Teaching Block, in the location shown on indicative site plan 10883-SP1.

The plant location is approximately 20m from the residential window, with direct line of sight assumed.

4.5 Plant Group 5

Plant Group 5 comprises 3 different MVHR units, each servicing an individual classroom. The units themselves are located internally, with exhaust and intake ducts to the external building facade at 1st floor level. Noise emissions from the exhaust and intake ducts will therefore be considered from each of the 3 MVHR units.

The manufacturer's specified noise emissions for Plant Group 5 units are as shown in Table 4.5.

	Sound Power Level (dB) in each Frequency Band							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Nuaire MVHR XBC 55 [1 Unit in Group 5]								
Supply Fan Intake	66	59	60	48	49	46	38	26
Extract Fan Exhaust	71	66	69	56	57	56	51	48
Nuaire MVHR XBC 65 [1 Unit in Group 5]								
Supply Fan Intake	64	64	57	51	49	44	33	0
Extract Fan Exhaust	70	70	64	60	57	54	46	40
Nuaire MVHR XBC 15 [1 Unit in Group 5]								
Supply Fan Intake	55	45	40	41	47	40	32	28
Extract Fan Exhaust	60	58	50	52	53	50	45	43

Table 4.5: Manufacturer's Sound Power Levels - Plant Group 5

The proposed plant location is on the south facade of the Teaching Block, in the location shown on indicative site plan 10883-SP1.

The plant location is approximately 20m from the residential window, with direct line of sight assumed.

5.0 PROPOSED MITIGATION

In order to demonstrate compliance with the set criterion shown in Section 3.0, certain mitigation measures will be required.

The required mitigation measures are discussed in the following sections. All mitigation measures should be installed in combination.

5.1 Acoustic Enclosure

An acoustic enclosure is required on each of the following units:

- Plant Group 1: Mitsubishi Unit PURY-P600YSLM-A11,
- Plant Group 1: Daikin Unit EMRQ16AAY1.

The two units can either be enclosed separately, or placed together in a single housing. The required spectral performance of the enclosure(s) is shown in Table 5.1. It should be noted that the spectral attenuation levels are calculated based on the assumed spectral content of noise emission levels.

	Required Attenuation (dB) in each Frequency Band							
Mitigation	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Louvred Enclosure	6	7	10	19	31	34	32	30

Table 5.1: Required Attenuation from Enclosure

5.2 Acoustic Screen

In addition to the enclosure detailed above, we would recommend introducing an acoustic barrier such that line of sight between Plant Group 2 Units (3 No. Condensers, 1 No. Extract Fan Termination) and residential receivers is completely blocked.

In order to maximise the attenuation provided by the surrounding screen, we would recommend the following advice is followed:

- The screen should completely block line of sight between Plant Group 2 units and residential windows,

- The screen should be formed of sufficiently dense material, minimum recommended density 20kg/m^2.
- The barrier should be constructed from the structural surface of the main roof, with no gaps around the foot of the barrier,
- If constructed from panels, an airtight seal should be formed at all junctions,

5.3 Attenuator Schedule

Finally, we would recommend installing attenuators on the atmosphere site of certain ducted plant units.

The ducted plant units requiring attenuation are as follows:

- AHU01 (Sports Hall): Intake and Exhaust,
- AHU04 (Toilets and Changing Rooms): Intake and Exhaust,
- All MVHR Units (Plant Groups 3, 4 and 5): Exhaust Only.

The required performance for each attenuator is shown in the Attenuator Schedule in Appendix C.

6.0 NOISE IMPACT ASSESSMENT

An assessment has been undertaken for the closest identified residential window, as shown in the site plan.

Taking into account all necessary acoustic corrections including corrections for distance, reflections and proposed mitigation, the resulting noise level at the modelled residential window would be as shown in Table 6.1. Cumulative calculations are shown in Appendix B.

Receiver	Operating Hours Criterion	Noise Level at Receiver [*due to plant installation*]
Residential Window	38 dB(A)	37 dB(A)

Table 6.1: Noise levels and criteria at receiver

As shown in Table 6.1 and Appendix B, the proposed plant installation would be expected to meet the set criterion, provided mitigation measures are installed as stated herein.

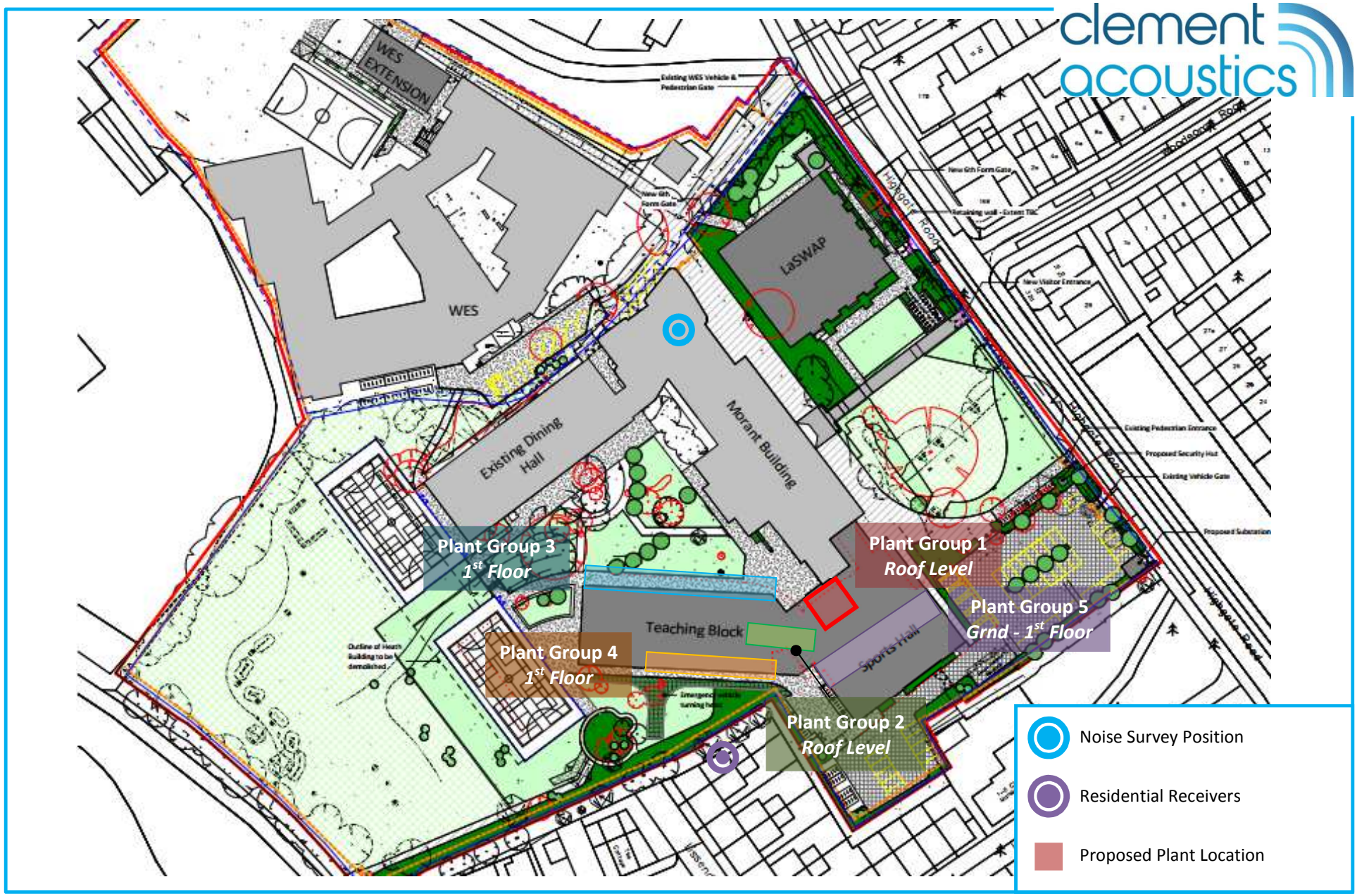
7.0 CONCLUSION

An noise impact assessment of proposed plant units has been undertaken for the Teaching Block at Parliament Hill School, Highgate Road, Camden. The results of a previously undertaken survey have enabled criteria to be set for noise emissions from the proposed plant in order to protect the amenity of nearby receivers.

A noise impact assessment has then been undertaken using manufacturer noise data to predict the noise levels due to the current proposal at nearby noise sensitive receivers.

Calculations show that noise emissions from the proposed plant units would meet the set requirements provided certain mitigation measures are installed.

Report by	Checked by
Duncan Martin MIOA	**John Smethurst MIOA**



10883-SP1 Indicative site plan indicating noise monitoring position and nearest noise sensitive receivers

Date: 22 September 2017

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.

APPENDIX B

10883

Parliament Hill School

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Nearest Residential Receiver

Source: Proposed plant installation

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Manufacturer provided sound pressure level at 1 metre									
Group 1 - AHU1 Extract	24	26	23	15	14	13	18	23	25
Group 1 - AHU1 Supply	20	23	26	19	13	12	13	7	22
Group 1 - AHU4 Extract	25	24	27	22	20	17	19	23	28
Group 1 - AHU4 Supply	14	17	21	16	8	3	0	0	17
Group 2 - Mitsubishi Unit PURY-P600YSLM-A11	41	41	37	29	11	2	0	0	32
Group 2 - Mitsubishi Unit PKA-RP100KAL	23	24	23	24	18	12	5	0	24
Group 2 - Daikin Unit EMRQ16AAY1	36	36	32	24	6	0	0	0	27
Group 2 - Chemical Extract Fan VB14	43	35	32	13	11	11	13	12	26
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 3 - Nuaire MVHR XBC 55 Extract	20	19	23	4	1	1	0	0	15
Group 3 - Nuaire MVHR XBC 55 Supply	12	11	18	6	5	0	0	0	12
Group 4 - Nuaire MVHR XBC 55 Extract	23	22	26	7	4	4	3	2	18
Group 4 - Nuaire MVHR XBC 55 Supply	20	19	26	14	13	8	0	0	20
Group 4 - Nuaire MVHR XBC 55 Extract	23	22	26	7	4	4	3	2	18
Group 4 - Nuaire MVHR XBC 55 Supply	20	19	26	14	13	8	0	0	20
Group 4 - Nuaire MVHR XBC 55 Extract	23	22	26	7	4	4	3	2	18
Group 4 - Nuaire MVHR XBC 55 Supply	20	19	26	14	13	8	0	0	20
Group 5 - Nuaire MVHR XBC 55 Extract	25	24	26	8	6	7	6	5	19
Group 5 - Nuaire MVHR XBC 55 Supply	22	21	26	15	15	11	3	0	21
Group 5 - Nuaire MVHR XBC 65 Extract	24	28	21	12	6	5	1	0	17
Group 5 - Nuaire MVHR XBC 65 Supply	20	26	23	18	15	9	0	0	21
Group 5 - Nuaire MVHR XBC 15 Extract	14	16	7	4	2	1	0	0	9
Group 5 - Nuaire MVHR XBC 15 Supply	11	7	6	8	13	5	-3	-7	15
Sound pressure level at receiver	**46**	**44**	**42**	**33**	**26**	**23**	**23**	**27**	**37**

Design Criterion	**38**

BS 8233 ASSESSMENT CALCULATION

Receiver: Inside Nearest Residential Window

Source: Proposed plant installation

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound pressure level outside window	46	44	42	33	26	23	23	27	37
Minimum attenuation from partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**31**	**29**	**27**	**18**	**11**	**8**	**8**	**12**	**22**

Design Criterion	**30**

10883: Parliament Hill
APPENDIX C: ATTENUATOR SCHEDULE

Revision: 0	Date: 21/09/2017	Comments: None											
Attenuator Ref.	Description	No. Of	Dimensions (mm)			Max Pressure Drop Pa	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
			W	H	L		63	125	250	500	1k	2k	4k	8k
01	AHU 01 – Extract (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		1500*	60	5	11	21	33	37	36	27	18
02	AHU 01 – Supply (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		900*	60	2	4	9	15	17	14	10	8
03	AHU 04 – Extract (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		1200*	60	4	9	17	26	31	30	23	16
04	AHU 04 – Supply (Atmospheric Side)	1	Sized to not exceed maximum pressure drop		900*	60	2	4	9	15	17	14	10	8
05-14	Atmospheric Extract Connection for All MVHR Units	10	Sized to not exceed maximum pressure drop		900*	60	2	4	9	15	17	14	10	8

*Indicative Lengths