CONABEARE ACOUSTICS

ENVIRONMENTAL ACOUSTIC IMPACT ASSESSMENT

Highgate Mental Health Centre,
Dartmouth Park Hill,
London
N19 5NX

Proposed Plant

Reference : CS8478-01
Revision : Revision A
Status : Planning Issue
Issue Date: 2nd March 2022

Prepared By:

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CONTENTS

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Revision & Changes Log

Revision	Date	Comments/Summary of changes	Amended By:
A	14-02-2022	Assessment Update	SJM
B	02-03-2022	Mitigation Measures Changed	SJM

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1 Introduction

Conabeare Acoustics Limited have been commissioned by Bianco Sale Limited to undertake an Acoustic Survey and BS4142:2014 assessment in relation to noise emissions of proposed plant at Highgate Mental Health Centre, Dartmouth Park Hill, London N19 5NX for planning purposes.

The Survey was undertaken by Stuart Metcalfe MIOA who has been practicing in Building Services Acoustics and Noise Control Engineering for in excess of 30 years, is a Member of the Institute of Acoustics (MIOA) and is a Director at Conabeare Acoustics Ltd.

2 Acoustic Criteria

BS4142:2014 Methods for rating and assessing industrial and commercial sound.

BS4142:2014 gives a method for rating sound from industrial and commercial sources affecting people inside or outside dwellings or premises used for residential purposes.

An initial estimate of the significance of the sound from the industrial/commercial nature can be assessed by subtracting the measured background noise level from the rating level (this is the specific sound level of the source with any corrections or penalties for distinctive acoustic characteristics).

Typically, the greater the difference, the greater the magnitude of the impact.

The site is located within the London Borough of Camden demise which has adopted the National Planning Policy Guidelines and as such References and evaluations are to be made to the National Planning Policy Framework 2012 (NPPF) and the Noise Policy Statement for England 2010 (NPSE).

There are several key phrases within the NPSE aims and these are discussed below. “Significant adverse” and “adverse”

NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected. Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

This Camden requirement for noise exposure are detailed in the Local Plan Appendix 3: Noise thresholds which is reproduced thus;

Industrial and Commercial Noise Sources

A relevant standard or guidance document should be referenced when determining values for LOAEL and 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. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Table C: *Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)*

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 57dB$_{LAmax}$*	*'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB $_{LAmax}$*	*'Rating level' greater than 5dB above background and/or events exceeding 88dB$_{LAmax}$*

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.

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3 Plant Location and Measurement Position

The site is located on Dartmouth Park Hill in the Highgate District in North West London.

The site is bordered by Waterlow Park to the North, Highgate Cemetery to the West, Dartmouth Park Hill to the East, and Lulot Gardens to the South.

The closest sound sensitive façades are adjudged to be the residential facades within the Centre itself which are at a distance of approximately 5 metres from the proposed plant location.

Fig. 1 - View of Property Looking North

Fig. 2 - View of Property Looking West

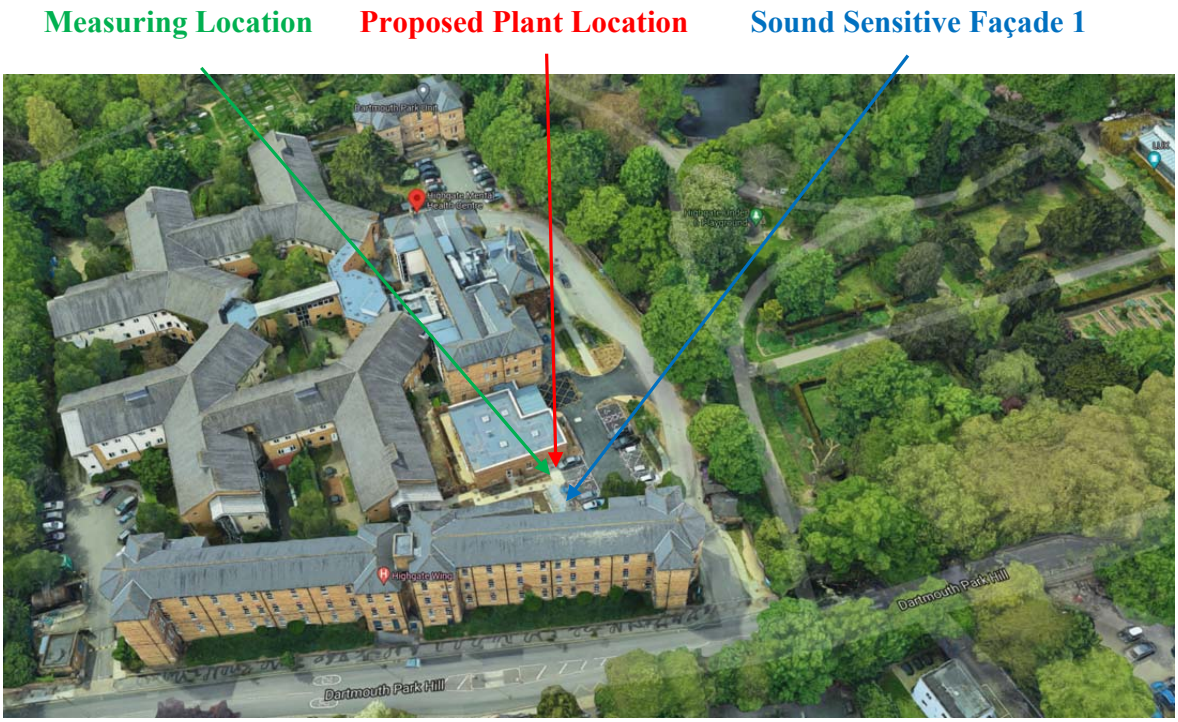

Fig 3 – Measuring Location looking towards nearest sound sensitive façade

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4 Existing Noise Climate

The area is generally a mixture of commercial and residential premises with transportation noise from the area being adjudged to be the dominant background noise source during the survey period.

5 Noise Survey

5.1 Measurements

The Survey commenced at approximately 08:45 hours on Monday 15th November 2021 until approximately 08:30 hours on Tuesday 16th November 2021.

The Analyser was programmed to record 15 minute sampling periods over the survey duration.

The microphone was located on a balustrade at approximately 1.8 metres above a reflecting plane.

The measurements and their interpretation are in accordance with BS 7445: Parts 1 and 2. All readings are Sound Pressure Levels (Lp) in dB (re 20µPa).

5.2 Weather during Survey Period

The weather was cool and mostly dry throughout the measuring period. The weather did not, in our opinion, adversely influence the readings obtained.

5.3 Instrumentation

The instrumentation used was a Type 1 Larson Davis LxT Sound Expert Sound Level Analyser confirming to IEC 651-1979 Type 1, EN60651 Type 1 and IEC 804-1985 Type 1, EN60804 Type 1.

- **Larson Davis LxT Sound Level Analyser, Serial Number 025445.**
- **Larson Davis PRMLxT1L Preamplifier, Serial Number 055664.**

The Sound Analyser and Preamplifier were calibrated on 5th March 2020, Certificate Number 15766.

The additional following equipment was also used

- **Larson Davis type CAL200 Calibrator, Serial Number 17720 calibrated on 19th February 2020, Certificate Number 2020002312.**
- **Extension Cable**

Field calibration checks were made using the Calibrator and no significant drift was noted against the Calibration level of 114.0dB ± 0.2dB at 1000Hz ± 0.2%.

5.4 Survey Results

The following is a summary of the Background Noise Levels (L_{A90}) levels recorded in Daytime, Evening and Night-time Periods

- $L_{A90,15min}$ 35.6dB(A) between 07:00 hours to 19:00 hours.
- $L_{A90,15min}$ 33.2dB(A) between 19:00 hours to 23:00 hours.
- $L_{A90,15min}$ 30.6dB(A) between 23:00 hours to 07:00 hours.

6 Assessment Methodology: BS4142:2014+A1:2019

The BS 4142:2014+A1:2019 methodology involves predicting or measuring the specific sound level from the source in question and applying rating penalties for acoustic character features such as tonality, impulsivity or irregularity.

This rated sound level is then compared to the existing typical L_{A90} background sound level. Impacts are assessed as follows:

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

It is also considered appropriate to consider other pertinent sources of guidance. The following sections consider absolute criteria advocated by both the World Health Organisation: 1999: “Guidelines for Community Noise” and BS 8233:1999: “Sound insulation and noise reduction for buildings – Code of practice”.

World Health Organisation: 1999: “Guidelines for Community Noise”

This document provides a review of the effects of noise and a description of the principles of the WHO health criteria and guidelines for Community Noise.

The effects of noise in dwellings are identified as sleep disturbance, annoyance and speech interference. For bedrooms, the critical effect is sleep disturbance. The indoor guideline value for continuous noise in bedrooms is 30 dB L_{Aeq}. To enable casual conversation indoors during the daytime, the sound level of the interfering noise should not exceed 35 dB L_{Aeq}.

Table 1 of the document summarises the guideline values for community noise in specific environments and includes the noise indices to be adopted. Significantly, the corresponding time base to be used for the assessment is also included.

The relevant extracts of Table 1 are reproduced thus:

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax fast [dB]
Dwelling, indoors	Speech intelligibility & moderate annoyance daytime & evening	35	16	45
	Sleep disturbance, night-time	30	8	

This level should be a cumulative level from all plant running normally and makes allowance for any tonal or intermittent noise from the plant.

BS8233:2014

BS 8233: 2014 – "Guidance on sound insulation and noise reduction for buildings" provides information on achieving internal acoustic environments appropriate to their functions.

As part of this document, recommendations are given to the internal noise levels which are commensurate with achieving acceptable resting, dining and sleeping conditions within residential properties. The values given are generally in terms of an L_{Aeq} level although reference is also made with regards to maximum noise levels, although no criterion is specified in this recently revised version of the standard.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35dB $L_{Aeq\ 16\ hours}$	-
Dining	Dining Room	40dB $L_{Aeq\ 16\ hours}$	-
Sleeping	Bedroom	35dB $L_{Aeq\ 16\ hours}$	30dB $L_{Aeq\ 8\ hours}$

It is generally accepted that a partially open window will provide a level difference of 15dB and therefore the guideline levels to achieve 30dBA within a bedroom would indicate a level of 45dBA directly outside a bedroom window would be acceptable.

Noise Change (dBA)	Category
0	No Impact
0.1 to 2.9	Slight Impact
3.0 to 4.9	Moderate Impact
5.0 to 9.9	Substantial Impact
10.0 and above	Severe Impact

7 Noise Assessment

The objective of any specification limiting new noises should therefore be to ensure that sound emission from the new building services plant and any other new sources, in particular, should not materially add to the existing sound climate.

We understand that the operating hours for the plant will be potentially on a 24 hour basis and as such we would recommend setting a target level at 1 metre from the nearest residential facades as below;

7.1 Plant Noise Emissions Criteria

$L_{Aeq,15min}$ 35dB(A) – 24 hours.

This level is 5dBA ***ABOVE*** the measured Background Level at the nearest noise sensitive façade and will provide *LOAEL – Lowest Observed Adverse Effect Level to SOAEL – Significant Observed Adverse Effect*.

This will give an AMBER rating on the Camden Council Table.

A level of 5dBA above the background level has been chosen due to the very low measured background noise levels.

This will ensure that the internal noise levels recommend by WHO and BS8233:2014 are maintained based upon a loss through the windows of 15dB as detailed within BS8233:2014.

7.2 Proposed Plant

The proposed plant being assessed is as detailed below;

- Split DX Unit Mitsubishi PUZ-ZM35VKA2
- HVRF Unit Mitsubishi PURY-EM500YNW
- Air Source Heat Pump 1 Mitsubishi PUZ-HWM140VHA
- Air Source Heat Pump 2 Mitsubishi PUZ-HWM140VHA
- Air Source Heat Pump 3 Mitsubishi PUZ-HWM140VHA
- MVHR 02 Nuaire XBC55-H-LAT

7.3 Plant Locations

The DX, HVRF and ASHP units are to be located within the plant compound with the MVHR units located within the new building.

MVHR2 has ducts terminating via louvres through the building façade for air intake and exhaust. The other units terminate through the roof.

7.4 Plant Noise Levels

The manufacturers sound spectrum is reproduced below.

Item	Model	Ref	Sound Level (dB) at Octave Band Centre Frequency (Hz)								
			63	125	250	500	1k	2k	4k	8k	dBA
DX01	PUZ-ZM35VKA2	Lp@1m	58	51	45	44	40	37	32	31	46
HVRF01	PURY-EM500YNW	Lp@1m	77	68	66	61	56	54	51	44	64
ASHP01	PUZ-HWM140VHA	Lp@1m	57	58	54	51	48	43	39	35	53
ASHP02	PUZ-HWM140VHA	LP@1m	57	58	54	51	48	43	39	35	53
ASHP03	PUZ-HWM140VHA	Lp@1m	57	58	54	51	48	43	39	35	53
MVHR02	XBC55-H-LAT Intake	Lw	76	69	70	58	59	56	48	36	65
MVHR02	XBC55-H-LAT Exhaust	Lw	81	76	79	66	67	66	61	58	74

We have detailed the noise levels for the above equipment, to the nearest sound sensitive façade, as well as the proposed mitigating measures, within our calculation sheets as below.

Acoustic Feature Correction

We have allowed for a 3dB Acoustic Correction Feature for the sound sensitive façade.

No allowance has been made for tonal noise as no items of plant are considered to be tonal in nature.

The DX, HVRF and ASHP units are considered to be intermittent in nature and therefore a 5dB penalty has been applied for these units.

Distance Attenuation

The distance loss is shown on our calculation sheets.

Barrier Attenuation

None allowed as there is direct line of site from the duct termination to the sound sensitive facade.

Un-mitigated Noise Levels

The combined noise level for all items of plant with no mitigating measures, and with all suitable allowances made, will be 57dBA at 1 metre from the nearest sound sensitive façades.

These combined noise levels are 26dB in excess of the measured Background Level at the nearest noise sensitive façade and will provide *SOAEL – Significant Observed Adverse Effect Level.*

This is the level above which adverse effects on health and quality of life can be detected.

Our attached calculation sheet details the plant item noise levels and proposed mitigating measures. With the proposed mitigating measures installed the resultant noise level will meet the proposed target level.

As such the resultant noise level with the mitigating measures installed can be categorised as having *LOAEL – Lowest Observed Adverse Effect Level to SOAEL – Significant Observed Adverse Effect.*

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8 Recommendations

HVRF Unit

We would recommend that this unit will have intake and exhaust attenuators fitted which will require the following minimum acoustic performance.

Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)

63	125	250	500	1k	2k	4k	8k
10	16	28	41	54	52	39	28

The attenuators will be 900mm long and ducted directly to the unit. These will need to be sized to have a total pressure loss of 30Pa.

HVRF, DX and ASHP Units

We would also recommend that these units are located behind an acoustic panel screen which will require the following minimum acoustic performance.

Sound Reduction Index (dB) at Octave Band Centre Frequencies (Hz)

63	125	250	500	1k	2k	4k	8k
18	20	25	35	41	47	45	40

The screen will have approximate overall dimensions of 7500mm wide x 1500mm deep x 3400mm high overall.

MWHR 02

The MWHR will be positioned will be positioned internally to the building. We have assessed the air paths and have suggested mitigating measures which are discussed below.

Intake Air

We would recommend that an intake attenuator is fitted which will have the following minimum acoustic performance.

Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)

63	125	250	500	1k	2k	4k	8k
8	13	23	33	41	40	29	21

The attenuator is envisaged to be 900mm long x 350mm wide x 350mm high with 28% free area. The pressure loss over the attenuator would need to be less than 40Pa based upon duct to duct conditions.

Exhaust Air

We would recommend that an intake attenuator is fitted which will have the following minimum acoustic performance.

Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
8	13	23	33	41	40	29	21

The attenuator is envisaged to be 900mm long x 350mm wide x 350mm high with 28% free area. The pressure loss over the attenuator would need to be less than 40Pa based upon duct to duct conditions.

Existing Extract Fan

The existing Extract Fan is positioned internally to the building. We have assessed the air path and have suggested mitigating measures which are discussed below.

Exhaust Air

We would recommend that an exhaust attenuator is fitted which will have the following minimum acoustic performance.

Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
5	7	15	29	35	33	21	18

The attenuator is envisaged to be 200mm diameter x 1000mm long straight through circular attenuator. The pressure loss over the attenuator would need to be less than 10Pa based upon duct to duct conditions.

Our calculations as below indicate that if the proposed mitigating measures are introduced then the resulting noise level at the nearest sound sensitive façades will be 37dBA based upon all units running.

This will therefore ensure that internal noise levels will meet WHO and BS8233 guidelines.

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9 Conclusion

A background Noise Survey was carried during a typical day and night-time period at a location representative of the nearest sound sensitive receivers.

A target noise level with respect to proposed plant L_{Aeq} levels has been proposed however this should, as a matter of course, be checked with the Local Authority.

An assessment in line with BS4142:2014 has been carried out and mitigating measures proposed.

It is deemed that the resultant noise level should be acceptable to the Local Authority subject to the proposed mitigation being incorporated into the works.

CS8478 - Highgate Mental Health Centre, Dartmouth Park Hill, London N19 5NX

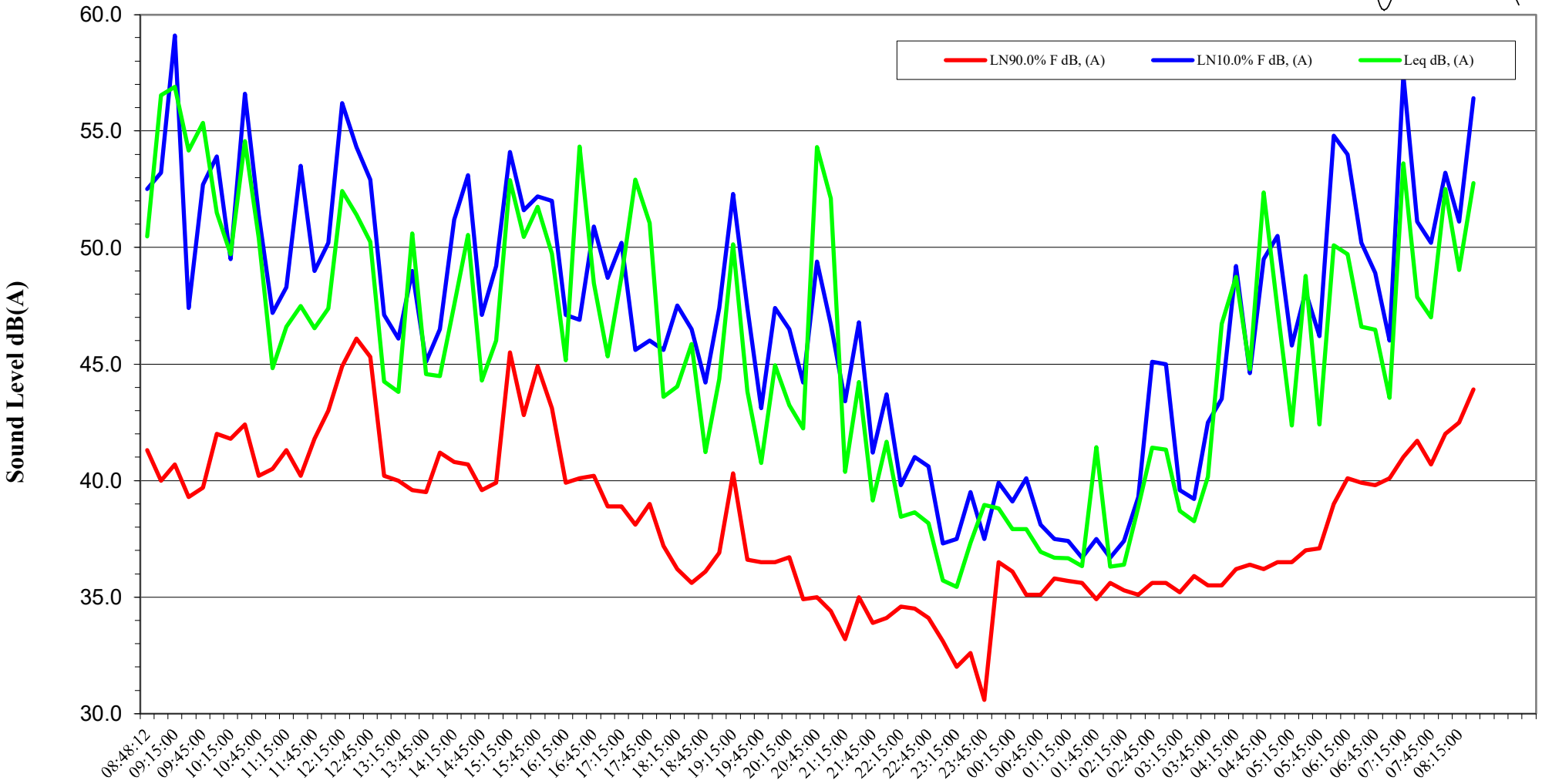
- Period result profile -

Overload occurred	No
Low battery occurred	No
Pause was used	No
Frequency weighting	A
Band	Broadband
Period time	15 min
Periods too short for LNs	No
First period listed	1 : 96
Measurement Description	
Start	15/11/2021 08:48:12
Stop	16/11/2021 08:30:54
Duration	23:42:42.4
Run Time	23:42:42.4
Pause	0:00:00.0
Pre Calibration	15/11/2021 8:46:15

Period number	Date	Time	LN90.0% F	LN10.0% F	Leq
			dB, (A)	dB, (A)	dB, (A)
1	15/11/2021	08:48:12	41.3	52.5	50.5
2	15/11/2021	09:00:00	40.0	53.2	56.5
3	15/11/2021	09:15:00	40.7	59.1	56.9
4	15/11/2021	09:30:00	39.3	47.4	54.2
5	15/11/2021	09:45:00	39.7	52.7	55.3
6	15/11/2021	10:00:00	42.0	53.9	51.5
7	15/11/2021	10:15:00	41.8	49.5	49.7
8	15/11/2021	10:30:00	42.4	56.6	54.6
9	15/11/2021	10:45:00	40.2	51.4	50.4
10	15/11/2021	11:00:00	40.5	47.2	44.8
11	15/11/2021	11:15:00	41.3	48.3	46.6
12	15/11/2021	11:30:00	40.2	53.5	47.5
13	15/11/2021	11:45:00	41.8	49.0	46.5
14	15/11/2021	12:00:00	43.0	50.2	47.4
15	15/11/2021	12:15:00	44.9	56.2	52.4
16	15/11/2021	12:30:00	46.1	54.3	51.4
17	15/11/2021	12:45:00	45.3	52.9	50.2
18	15/11/2021	13:00:00	40.2	47.1	44.2
19	15/11/2021	13:15:00	40.0	46.1	43.8
20	15/11/2021	13:30:00	39.6	49.0	50.6
21	15/11/2021	13:45:00	39.5	45.1	44.6
22	15/11/2021	14:00:00	41.2	46.5	44.5
23	15/11/2021	14:15:00	40.8	51.2	47.5
24	15/11/2021	14:30:00	40.7	53.1	50.5
25	15/11/2021	14:45:00	39.6	47.1	44.3
26	15/11/2021	15:00:00	39.9	49.2	46.0
27	15/11/2021	15:15:00	45.5	54.1	52.9
28	15/11/2021	15:30:00	42.8	51.6	50.5
29	15/11/2021	15:45:00	44.9	52.2	51.7
30	15/11/2021	16:00:00	43.1	52.0	49.7
31	15/11/2021	16:15:00	39.9	47.1	45.2
32	15/11/2021	16:30:00	40.1	46.9	54.3
33	15/11/2021	16:45:00	40.2	50.9	48.5
34	15/11/2021	17:00:00	38.9	48.7	45.3
35	15/11/2021	17:15:00	38.9	50.2	48.8
36	15/11/2021	17:30:00	38.1	45.6	52.9
37	15/11/2021	17:45:00	39.0	46.0	51.0
38	15/11/2021	18:00:00	37.2	45.6	43.6
39	15/11/2021	18:15:00	36.2	47.5	44.0
40	15/11/2021	18:30:00	35.6	46.5	45.9

Period number	Date	Time	LN90.0% F	LN10.0% F	Leq
			dB, (A)	dB, (A)	dB, (A)
41	15/11/2021	18:45:00	36.1	44.2	41.2
42	15/11/2021	19:00:00	36.9	47.4	44.4
43	15/11/2021	19:15:00	40.3	52.3	50.1
44	15/11/2021	19:30:00	36.6	47.4	43.8
45	15/11/2021	19:45:00	36.5	43.1	40.8
46	15/11/2021	20:00:00	36.5	47.4	44.9
47	15/11/2021	20:15:00	36.7	46.5	43.2
48	15/11/2021	20:30:00	34.9	44.2	42.2
49	15/11/2021	20:45:00	35.0	49.4	54.3
50	15/11/2021	21:00:00	34.4	46.7	52.1
51	15/11/2021	21:15:00	33.2	43.4	40.4
52	15/11/2021	21:30:00	35.0	46.8	44.2
53	15/11/2021	21:45:00	33.9	41.2	39.1
54	15/11/2021	22:00:00	34.1	43.7	41.7
55	15/11/2021	22:15:00	34.6	39.8	38.4
56	15/11/2021	22:30:00	34.5	41.0	38.6
57	15/11/2021	22:45:00	34.1	40.6	38.2
58	15/11/2021	23:00:00	33.1	37.3	35.7
59	15/11/2021	23:15:00	32.0	37.5	35.5
60	15/11/2021	23:30:00	32.6	39.5	37.3
61	15/11/2021	23:45:00	30.6	37.5	38.9
62	16/11/2021	00:00:00	36.5	39.9	38.8
63	16/11/2021	00:15:00	36.1	39.1	37.9
64	16/11/2021	00:30:00	35.1	40.1	37.9
65	16/11/2021	00:45:00	35.1	38.1	36.9
66	16/11/2021	01:00:00	35.8	37.5	36.7
67	16/11/2021	01:15:00	35.7	37.4	36.7
68	16/11/2021	01:30:00	35.6	36.7	36.3
69	16/11/2021	01:45:00	34.9	37.5	41.4
70	16/11/2021	02:00:00	35.6	36.7	36.3
71	16/11/2021	02:15:00	35.3	37.4	36.4
72	16/11/2021	02:30:00	35.1	39.3	38.9
73	16/11/2021	02:45:00	35.6	45.1	41.4
74	16/11/2021	03:00:00	35.6	45.0	41.3
75	16/11/2021	03:15:00	35.2	39.6	38.7
76	16/11/2021	03:30:00	35.9	39.2	38.2
77	16/11/2021	03:45:00	35.5	42.5	40.2
78	16/11/2021	04:00:00	35.5	43.5	46.7
79	16/11/2021	04:15:00	36.2	49.2	48.7
80	16/11/2021	04:30:00	36.4	44.6	44.8
81	16/11/2021	04:45:00	36.2	49.5	52.4
82	16/11/2021	05:00:00	36.5	50.5	47.4
83	16/11/2021	05:15:00	36.5	45.8	42.4
84	16/11/2021	05:30:00	37.0	48.1	48.8
85	16/11/2021	05:45:00	37.1	46.2	42.4
86	16/11/2021	06:00:00	39.0	54.8	50.1
87	16/11/2021	06:15:00	40.1	54.0	49.7
88	16/11/2021	06:30:00	39.9	50.2	46.6
89	16/11/2021	06:45:00	39.8	48.9	46.5
90	16/11/2021	07:00:00	40.1	46.0	43.5
91	16/11/2021	07:15:00	41.0	57.4	53.6
92	16/11/2021	07:30:00	41.7	51.1	47.9
93	16/11/2021	07:45:00	40.7	50.2	47.0
94	16/11/2021	08:00:00	42.0	53.2	52.5
95	16/11/2021	08:15:00	42.5	51.1	49.0
96	16/11/2021	08:30:00	43.9	56.4	52.8

CS8478 - Highgate Mental Health Centre, Dartmouth Park Hill, London N19 5NX



15th November 2021 to 16th November 2021 - Time

CONABEARE ACOUSTICS

Glossary of Terms

L_{A90} The sound pressure level in dB(A) which is exceeded for 90% of the time and is taken to be the effective lowest background sound level for the period by such methods of sound rating as that recommended in BS4142:2014. It will also be used as a basis for selecting limiting sound levels from new plant by Local Planning Authorities when setting Planning Consent Conditions.

L_{Aeq} The "equivalent continuous sound level" for the measuring period, defined as the level in dBA which, if held constant over the measuring period, would produce the same amount of sound energy as does the actual varying ambient sound level. It is a measure of the amount of sound energy affecting the site from sources other than new plant or operations.

L_{A10} The sound level exceeded for 10% of the time over the sample period. Originally used as a measure of subjective reaction to traffic noise in particular, it can also be taken as an indication of the practical maximum sound level that the building envelope will have to protect against.

dBA Describes measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dBA broadly agree with people's assessment of loudness. A change of 3dBA is the minimum perceptible under normal conditions, and a change of 10dBA corresponds roughly to halving or doubling the loudness of a sound.

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CONABEARE ACOUSTICS

Project: CS8477 - Highgate Mental Health Centre, Dartmouth Park Hill, London N19 5NX
Client : Bianco Sale Limited
Revision: Original
Date : 14th February 2022

Item **Calculation 01 - Proposed Plant Unmitigated - Target Level - 35dBA - 24 Hours**

				63	125	250	500	1k	2k	4k	8k	dBA
DX01	**DX Unit - Atmospheric Noise**											
	Unit Lp - Mitsubishi PUZ-ZM35VKA2 - Manufacturers Data at 1 metre			**58**	**51**	**45**	**44**	**40**	**37**	**32**	**31**	**46**
	Additional Distance to Listener	7	m	-17	-17	-17	-17	-17	-17	-17	-17	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Condensing Unit Only			**52**	**45**	**39**	**38**	**34**	**31**	**26**	**25**	**40**
HVFR01	**HVFR Unit - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PURY-EM500YNW - Manufacturers Data at 1 metre			**77**	**68**	**66**	**61**	**56**	**54**	**51**	**44**	**64**
	Additional Distance to Listener	6	m	-16	-16	-16	-16	-16	-16	-16	-16	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener Condensing Unit Only			**69**	**60**	**58**	**53**	**48**	**46**	**43**	**36**	**56**
ASHP01	**Air Source Heat Pump - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PUZ-HWM140VHA - Manufacturers Data at 1 metre			**57**	**58**	**54**	**51**	**48**	**43**	**39**	**35**	**53**
	Additional Distance to Listener	6	m	-16	-16	-16	-16	-16	-16	-16	-16	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener ASHP Only			**49**	**50**	**46**	**43**	**40**	**35**	**31**	**27**	**45**
ASHP02	**Air Source Heat Pump - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PUZ-HWM140VHA - Manufacturers Data at 1 metre			**57**	**58**	**54**	**51**	**48**	**43**	**39**	**35**	**53**
	Additional Distance to Listener	6	m	-16	-16	-16	-16	-16	-16	-16	-16	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener ASHP Only			**49**	**50**	**46**	**43**	**40**	**35**	**31**	**27**	**45**
ASHP03	**Air Source Heat Pump - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PUZ-HWM140VHA - Manufacturers Data at 1 metre			**57**	**58**	**54**	**51**	**48**	**43**	**39**	**35**	**53**
	Additional Distance to Listener	6	m	-16	-16	-16	-16	-16	-16	-16	-16	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener ASHP Only			**49**	**50**	**46**	**43**	**40**	**35**	**31**	**27**	**45**
MVHR02	**MVHR - Atmospheric Noise - Intake**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lw - Nuaire XBC55-H-LAT - Manufacturers Data			**76**	**69**	**70**	**58**	**59**	**56**	**48**	**36**	**65**
	Duct Losses			0	0	0	-1	-1	-1	-1	-1	
	End Reflection			-6	-2	0	0	0	0	0	0	
	Directivity (45 degrees)			4	3	3	3	2	2	2	1	
	Distance to Listener	12	m	-33	-33	-33	-33	-33	-33	-33	-33	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener MVHR Intake Only			**47**	**43**	**46**	**33**	**33**	**30**	**22**	**9**	**40**
MVHR02	**MVHR - Atmospheric Noise - Exhaust**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lw - Nuaire XBC55-H-LAT - Manufacturers Data			**81**	**76**	**79**	**66**	**67**	**66**	**61**	**58**	**74**
	Duct Losses			-1	-1	-3	-15	-16	-10	-8	-8	
	End Reflection			-6	-2	0	0	0	0	0	0	
	Directivity (45 degrees)			4	4	4	5	5	5	5	5	
	Distance to Listener	8	m	-30	-30	-30	-30	-30	-30	-30	-30	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener MVHR Exhaust Only			**54**	**53**	**56**	**32**	**32**	**37**	**34**	**31**	**48**
	Cumulative Noise Level - Plant Noise only			**69**	**62**	**61**	**54**	**50**	**48**	**44**	**38**	**57**

Target Level 35dBA

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CONABEARE ACOUSTICS

Project: CS8477 - Highgate Mental Health Centre, Dartmouth Park Hill, London N19 5NX
Client : Bianco Sale Limited
Revision: Revision A
Date : 28th February 2022

Calculation 02 - Proposed Plant with Mitigation - Target Level - 35dBA - 24 Hours

Item				63	125	250	500	1k	2k	4k	8k	dBA
DX01	**DX Unit - Atmospheric Noise**											
	Unit Lp - Mitsubishi PUZ-ZM35VKA2 - Manufacturers Data at 1 metre			**58**	**51**	**45**	**44**	**40**	**37**	**32**	**31**	**46**
	Additional Distance to Listener	8	m	-19	-19	-19	-19	-19	-19	-19	-19	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Acoustic Screening			**-9**	**-11**	**-14**	**-17**	**-19**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**41**	**32**	**23**	**19**	**13**	**9**	**4**	**3**	**22**
HVFR01	**HVFR Unit - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PURY-EM500YNW - Manufacturers Data at 1 metre			**77**	**68**	**66**	**61**	**56**	**54**	**51**	**44**	**64**
	Additional Distance to Listener	7	m	-17	-17	-17	-17	-17	-17	-17	-17	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Attenuator Insertion Loss - KSD5020 - 900mm Long			**-10**	**-16**	**-28**	**-41**	**-54**	**-52**	**-39**	**-28**	
	Acoustic Screening			**-8**	**-10**	**-13**	**-15**	**-18**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**50**	**33**	**16**	**-4**	**-25**	**-27**	**-17**	**-13**	**25**
ASHP01	**Air Source Heat Pump - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PUZ-HWM140VHA - Manufacturers Data at 1 metre			**57**	**58**	**54**	**51**	**48**	**43**	**39**	**35**	**53**
	Additional Distance to Listener	7	m	-17	-17	-17	-17	-17	-17	-17	-17	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Acoustic Screening			**-9**	**-11**	**-14**	**-17**	**-19**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**39**	**38**	**31**	**25**	**20**	**14**	**10**	**6**	**28**
ASHP02	**Air Source Heat Pump - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PUZ-HWM140VHA - Manufacturers Data at 1 metre			**57**	**58**	**54**	**51**	**48**	**43**	**39**	**35**	**53**
	Additional Distance to Listener	7	m	-17	-17	-17	-17	-17	-17	-17	-17	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Acoustic Screening			**-9**	**-11**	**-14**	**-17**	**-19**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**39**	**38**	**31**	**25**	**20**	**14**	**10**	**6**	**28**
ASHP03	**Air Source Heat Pump - Atmospheric Noise**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lp - Mitsubishi PUZ-HWM140VHA - Manufacturers Data at 1 metre			**57**	**58**	**54**	**51**	**48**	**43**	**39**	**35**	**53**
	Additional Distance to Listener	7	m	-17	-17	-17	-17	-17	-17	-17	-17	
	Source Location			0	0	0	0	0	0	0	0	
	Acoustic Feature Correction for Intermittent Noise			5	5	5	5	5	5	5	5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Acoustic Screening			**-9**	**-11**	**-14**	**-17**	**-19**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**39**	**38**	**31**	**25**	**20**	**14**	**10**	**6**	**28**
MVHR02	**MVHR - Atmospheric Noise - Intake**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lw - Nuaire XBC55-H-LAT - Manufacturers Data			**76**	**69**	**70**	**58**	**59**	**56**	**48**	**36**	**65**
	Duct Losses			0	0	0	-1	-1	-1	-1	-1	
	End Reflection			-6	-2	0	0	0	0	0	0	
	Directivity (45 degrees)			4	3	3	3	2	2	2	1	
	Distance to Listener	12	m	-33	-33	-33	-33	-33	-33	-33	-33	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Façade Effect			3	3	3	3	3	3	3	3	
	Acoustic Screening			**-9**	**-11**	**-14**	**-17**	**-19**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**38**	**32**	**32**	**16**	**14**	**10**	**2**	**-11**	**25**
MVHR02	**MVHR - Atmospheric Noise - Exhaust**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
	Unit Lw - Nuaire XBC55-H-LAT - Manufacturers Data			**81**	**76**	**79**	**66**	**67**	**66**	**61**	**58**	**74**
	Duct Losses			-1	-1	-3	-15	-16	-10	-8	-8	
	End Reflection			-6	-2	0	0	0	0	0	0	
	Directivity (45 degrees)			4	4	4	5	5	5	5	5	
	Distance to Listener	8	m	-30	-30	-30	-30	-30	-30	-30	-30	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Façade Effect			3	3	3	3	3	3	3	3	
	Acoustic Screening			**-9**	**-11**	**-14**	**-17**	**-19**	**-20**	**-20**	**-20**	
	Resultant Lp with Mitigating measures			**45**	**42**	**42**	**15**	**13**	**17**	**14**	**11**	**34**
	Cumulative Noise Level with Mitigating Measures			**52**	**46**	**43**	**30**	**26**	**22**	**18**	**14**	**37**

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ACSL
Acoustic Calibration Services Limited

CERTIFICATE OF CALIBRATION

Model: LD LxT1LC1 **Serial Number:** 025445

Organisation: Conabeare Acoustics Limited, 11 Chilton Enterprise Centre, Station Road, Theale, Berkshire RG7 4AA

Job Number: 2806 **Customer Order Reference:** 10588

The Sound Level Meter was assessed for conformance with International Standard BS EN 61672-3:2006 as modified by TPS 49 Edition 1. The manufacturer claims Class 1 accuracy conformance and it was against these requirements that all the results were evaluated.

The sound level meter was fitted with a PCB 377B02 Serial No. 304334 measurement microphone, a LD PRMLxT1L preamplifier Serial No. 055664 and an unmarked 12 ft microphone extension cable. The microphone was replaced with a suitable input device in order to apply electrical signals to the preamplifier.

A B&K 4231 Acoustic Calibrator Serial No: 2705996 was utilised in establishing the initial acoustic calibration setting.

The sound level meter passed all tests carried out with no deviations from Class 1 specification, in accordance with the modified BS EN 61672-3:2006.

The sound level meter should be set to read **113.8dB** when used with the associated acoustic calibrator, microphone, preamplifier and 12 ft microphone extension cable, as detailed above at reference atmospheric pressure.

All ACSL's calibration instrumentation is fully traceable to National Standards. The acoustic references are calibrated by laboratories which are UKAS accredited for the purpose.

Certificate No: **15766** ***Signature:***
Date of Issue: **5th March 2020** ***Print Name:*** **Trevor Lewis**

Calibration Certificate

Certificate Number 2020002312

Customer:
PC Environmental Ltd.
Unit 5,Claylands Park Claylands Road
Bishops Waltham
Southampton,SO32 1QD,United Kingdom

Model Number	CAL200	***Procedure Number***	D0001.8386		
Serial Number	17720	***Technician***	Scott Montgomery		
Test Results	**Pass**	***Calibration Date***	19 Feb 2020		
Initial Condition	As Manufactured	***Calibration Due***			
		Temperature	23	°C	± 0.3 °C
Description	Larson Davis CAL200 Acoustic Calibrator	***Humidity***	32	%RH	± 3 %RH
		Static Pressure	100.9	kPa	± 1 kPa

Evaluation Method The data is aquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 µPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2017 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Agilent 34401A DMM	08/15/2019	08/15/2020	001021
Larson Davis Model 2900 Real Time Analyzer	04/02/2019	04/02/2020	001051
Microphone Calibration System	03/04/2019	03/04/2020	005446
1/2" Preamplifier	09/17/2019	09/17/2020	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/06/2019	08/06/2020	006507
1/2 inch Microphone - RI - 200V	05/21/2019	05/21/2020	006510
Pressure Transducer	06/24/2019	06/24/2020	007310