

Air Source Heat Pumps Chorlton Manchester

Plant Sound
Assessment Report
0989/PSA1

20 October 2022

For:

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1.0 Introduction

Lighthouse Acoustics has been appointed by Nexus Planning Limited to undertake an environmental sound survey in the vicinity of the proposed installation sites, Chorlton, Manchester and to assess atmospheric plant noise emission levels from the proposed heat pump units.

The survey methodology, results and assessments are presented in this report.

2.0 Objectives

To establish the Local Authority's acoustic requirements for the proposed 166No. heat pump units.

To visit site to undertake a detailed environmental sound survey in order to establish existing environmental sound levels in the vicinity of the 166No. residential properties to be served by the proposed heat pumps.

To undertake an assessment of atmospheric sound emissions from the proposed 166No. heat pump units upon the nearest noise sensitive receptors and to propose mitigation measures where required in order to achieve the requirements of the Local Authority.

3.0 Site Description

The residential properties to be served by the proposed heat pumps are situated on Marham Close, Terrington Close, Wishaw Square, Castlefield Walk, Cressfield Way, Pinetop Close, Sandstone Way, Foxbench Walk and Brookstone Close in Chorlton, Manchester and comprise existing 2 storey buildings.

The proposed 166No. heat pump units are typically proposed on (or in close proximity to) the external façade of the residential property which each unit serves.

The nearest noise sensitive receptors are the neighbouring residential properties.

The Metrolink tramline is situated approximately 100m to the north east of the site, Princess Road (A5103) is situated approximately 400m to the south east of the site and Mauldeth Road West is situated approximately 300m to the north west of the site.

The site plan below indicates the residential properties to be served by the proposed heat pumps (highlighted in blue), the extent of the site and the surrounding environment.



Site plan indicating the extent of the site and the surrounding environment

4.0 Local Authority Requirements

With regard to noise and vibration from fixed plant/equipment, Section 3.6.1.5.1 of the Planning & Noise Technical Guidance document (dated December 2015) produced by Manchester City Council states the following:

"The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate that:

Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location."

5.0 Environmental Sound Survey

5.1 Measurements

Due to the scale of the site and the lack of secure locations to install automated monitoring equipment, manned measurements were undertaken during periods when background sound levels may typically be expected to be at their lowest for the daytime, evening and night-time periods.

Fully manned environmental sound measurements were undertaken between 10:30 and 11:30 hours on Wednesday 28 September 2022, 22:00 and 23:00 hours on Thursday 29 September 2022 and 01:00 and 02:00 hours on Friday 30 September 2022. During these periods the L_{Amax} , L_{Aeq} and L_{A90} sound pressure levels were measured over consecutive 5 minute periods.

5.2 Weather Conditions

During the daytime survey period the wind conditions were calm (<1m/s) and the sky was scattered cloud. There was no rainfall and road surfaces were dry. The temperature was approximately 13°C.

During the evening survey period the wind conditions were calm (<1m/s) and the sky was clear. There was no rainfall and road surfaces were dry. The temperature was approximately 10°C.

During the night-time survey period the wind conditions were calm (<1m/s) and the sky was clear. There was no rainfall and road surfaces were dry. The temperature was approximately 7°C.

The weather conditions during the survey periods are therefore considered to be suitable for undertaking measurements of sound levels.

5.3 Measurement Positions

Environmental sound levels were measured at nine positions on-site as described in the table below.

Position	Description
A	Microphone situated on Marham Close at 1.2m above ground level in free field conditions
B	Microphone situated on Terrington Close at 1.2m above ground level in free field conditions
C	Microphone situated on Wishaw Square at 1.2m above ground level in free field conditions
D	Microphone situated on Castleford Walk at 1.2m above ground level in free field conditions
E	Microphone situated between Cressfield Way and Pinetop Close at 1.2m above ground level in free field conditions
F	Microphone situated on Foxbench Walk at 1.2m above ground level in free field conditions
G	Microphone situated on Brookstone Close at 1.2m above ground level in free field conditions
H	Microphone situated on Sandstone Way at 1.2m above ground level in free field conditions
I	Microphone situated on Arrowfield Road at 1.2m above ground level in free field conditions

The measurement positions are shown on the site plan below.



Site plan showing measurement positions

The measurement positions were selected in order to assess typical environmental sound levels representative of those at the nearest noise sensitive receptors across the site.

5.4 Equipment

The following equipment was used to undertake the environmental sound survey.

Equipment	Manufacturer	Model	Serial No.	Calibration Date
Class 1 Sound Level Meter	Brüel & Kjær	2250	2626230	26/10/2020
Preamplifier	Brüel & Kjær	ZC-0032	21309	26/10/2020
Microphone	Brüel & Kjær	4189	2621208	26/10/2020
Windscreen	Brüel & Kjær	UA-1650	-	-
Class 1 Sound Calibrator	Casella	120/1	3864878	02/11/2021

Field calibration checks were performed on the sound level meter prior to and on completion of the survey and were found to be within acceptable tolerance limits.

5.5 Results

The results of the environmental sound survey are presented in the Table overleaf.

Position	Period	L _{Amax,5min} (dB)	L _{Aeq,5min} (dB)	L _{A90,5min} (dB)
A	Daytime	59	47	41
	Evening	52	43	40
	Night-time	47	43	40
B	Daytime	69	49	38
	Evening	51	43	40
	Night-time	44	39	38
C	Daytime	61	46	40
	Evening	51	45	42
	Night-time	48	43	41
D	Daytime	65	46	41
	Evening	52	45	42
	Night-time	46	39	37
E	Daytime	59	42	38
	Evening	47	40	39
	Night-time	40	36	35
F	Daytime	55	42	37
	Evening	46	42	40
	Night-time	50	39	38
G	Daytime	74	55	46
	Evening	62	47	39
	Night-time	66	47	38
H	Daytime	53	40	37
	Evening	54	41	40
	Night-time	48	41	38
I	Daytime	71	55	40
	Evening	53	47	45
	Night-time	48	43	40

5.6 Discussion of Sound Climate

During the daytime survey period the dominant sound source was that of distant road traffic from the surrounding road network. Frequent tram pass-by's from the tramline to the north east of the site and occasional aircraft flyovers also contributed towards the measured sound climate along with birdsong.

During the evening survey period the dominant sound source was that of distant road traffic from the surrounding road network. Frequent tram pass-by's from the tramline to the north east of the site and occasional aircraft flyovers also contributed towards the measured sound climate.

During the night-time survey period the dominant sound source was that of distant road traffic from the surrounding road network.

6.0 Atmospheric Plant Sound Emission Limits

Based on the lowest representative daytime, evening and night-time L_{A90,5min} background sound levels measured during the environmental sound survey and the requirements of the Local Authority, cumulative atmospheric plant sound emissions should not exceed the following limits at the nearest existing noise sensitive receptors.

Receptor	L _{Aeq} Cumulative Atmospheric Plant Sound Emission Limits (dB) at Nearest Noise Sensitive Receptor		
	Daytime (07:00–19:00)	Evening (19:00–23:00)	Night-time (23:00–07:00)
Noise Sensitive	32	34	30

The above limits are subject to final approval by Manchester City Council.

7.0 Plant Sound Emission Assessment

7.1 Plant Sound Data

Atmospheric building services sound levels have been assessed based on the manufacturers sound data received for the proposed 166No. heat pump units (understood to all be the same model) which indicates octave band sound data as detailed in the table below.

Daikin EDLA04EV3

Mode	Sound Pressure Level at 1m (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Heating	49	52	42	44	37	33	25	16	44
Heating More Quiet	43	44	42	41	35	28	23	17	41

Whilst it is not possible to assess plant irregularity or impulsiveness based on manufacturer's sound data, BS 4142: 2014 provides an objective method for assessing the audibility of tones in sound. The one-third octave method states that if the level of a one third octave band exceeds the level of both adjacent one third octave bands by the following amounts, then a tonal component may be identified as present:

- 15dB in the low-frequency one-third-octave bands (25Hz to 125Hz);
- 8dB in the mid-frequency one-third-octave bands (160Hz to 400Hz);
- 5dB in the high-frequency one-third-octave bands (500Hz to 10kHz).

However, one third octave band sound data is rarely available from manufacturers as is the case in this instance.

By applying the same principal to the octave band sound data in the tables above, a review indicates that these items are unlikely to exhibit a tonal component. As such, no character correction has been applied to the specific sound level for these items.

Should one third octave band sound data become available a revised assessment should be undertaken.

7.2 Operating Hours

It is understood that the proposed 166No. heat pump units have the potential to operate 24 hours a day. During the daytime and evening periods they will operate in Heating Mode and during the night-time period they will operate in Heating More Quiet Mode.

In order to undertake a worst case assessment, it is assumed that the proposed 166No. heat pump units will operate for the full 1 hour daytime/evening and 15 minute night-time assessment periods.

7.3 Plant Locations

It is understood that the proposed 166No. heat pump units are typically proposed on (or in close proximity to) the external façade of the residential property which each unit serves.

7.4 Nearest Noise Sensitive Receptors

It is understood that the nearest noise sensitive receptors are the windows of the neighbouring residential properties situated at various distances from the proposed 166No. heat pump units.

Based on the above it is proposed to achieve the cumulative atmospheric plant sound emissions limits at the windows of the neighbouring residential properties.

7.5 Sound Model

In order to accurately assess the atmospheric plant sound emissions from the proposed plant items a three dimensional model of the immediate surroundings has been created using SoundPLAN sound mapping software.

The calculation method used by the software takes into account all standard acoustic corrections such as distance propagation, ground absorption, reflections and screening.

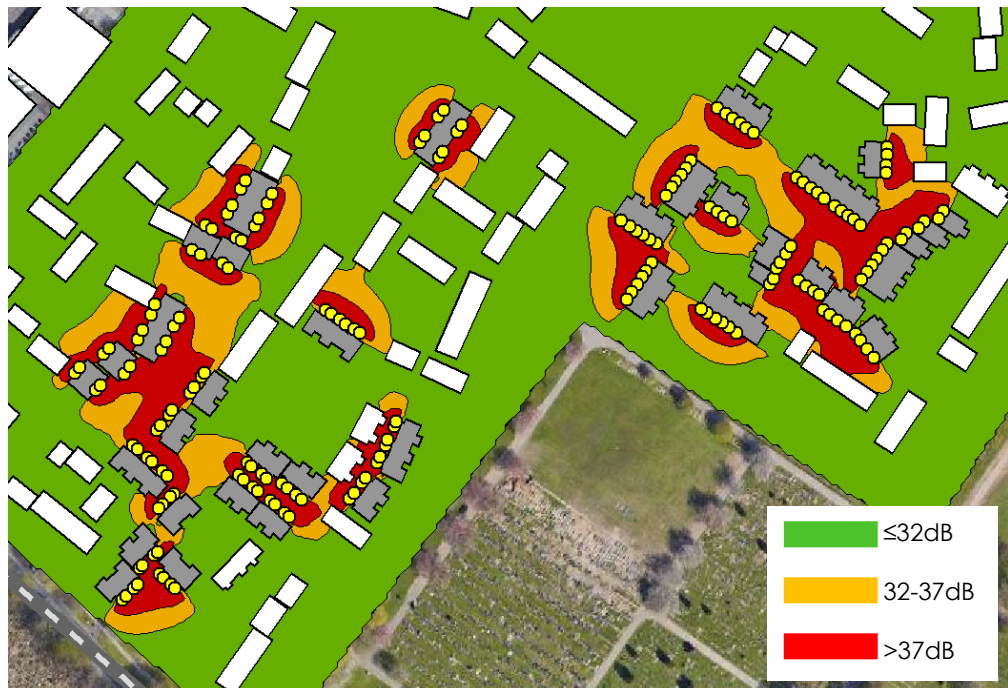
The 3D image of the model shown below indicates the positions of the proposed 166No. heat pump units (yellow spheres), the residential properties being served by the proposed 166No. heat pump units (grey properties) and the nearest noise sensitive receptors (white properties).



View looking north indicating the positions of the plant items in relation to the nearest noise sensitive receptors

7.6 Daytime Assessment

The soundmap below indicates the daytime L_{Aeq} atmospheric plant sound emission levels across the site at 1.8m above ground level.

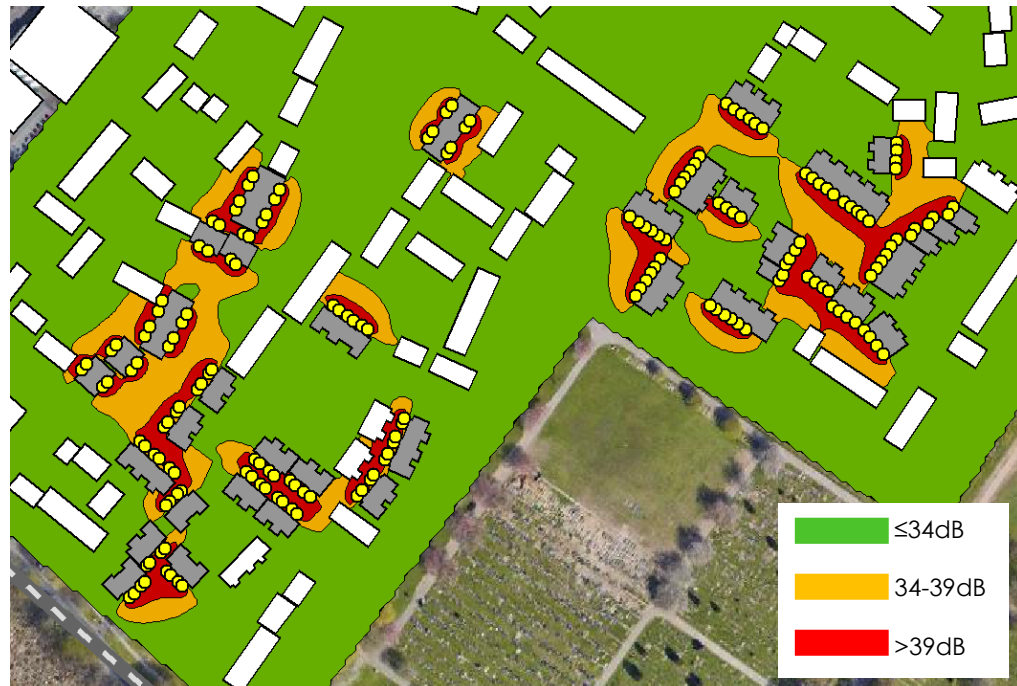


Sound map indicating the daytime L_{Aeq} atmospheric plant sound emission levels at 1.8m above ground level

As can be seen, the daytime L_{Aeq} atmospheric plant sound emission levels are likely to exceed the daytime cumulative atmospheric plant sound emission limit of 32dB at the nearest noise sensitive receptors.

7.7 Evening Assessment

The soundmap below indicates the evening L_{Aeq} atmospheric plant sound emission levels across the site at 1.8m above ground level.

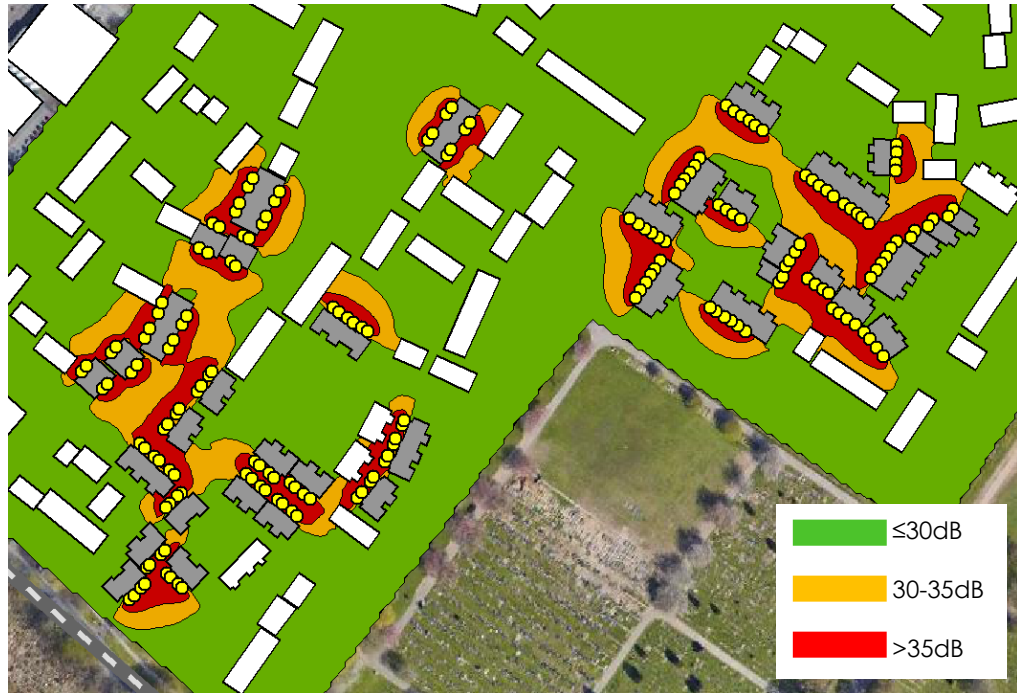


Sound map indicating the evening L_{Aeq} atmospheric plant sound emission levels at 1.8m above ground level

As can be seen, the evening L_{Aeq} atmospheric plant sound emission levels are likely to exceed the evening cumulative atmospheric plant sound emission limit of 32dB at the nearest noise sensitive receptors.

7.8 Night-time Assessment

The soundmap below indicates the night-time L_{Aeq} atmospheric plant sound emission levels across the site at 1.8m above ground level.



Sound map indicating the night-time L_{Aeq} atmospheric plant sound emission levels at 1.8m above ground level

As can be seen, the night-time L_{Aeq} atmospheric plant sound emission levels are likely to exceed the night-time cumulative atmospheric plant sound emission limit of 32dB at the nearest noise sensitive receptors.

7.9 Mitigation Measures

In order to attenuate atmospheric plant sound emission levels to achieve the cumulative atmospheric plant sound emission limits at the nearest noise sensitive receptors each of the proposed 166No. heat pump units will need to be situated within an acoustic enclosure which can provide a minimum of 10dB attenuation.



Image of a typical acoustic enclosure for a heat pump unit

Proposals for the acoustic enclosure should be forwarded for review acoustically.

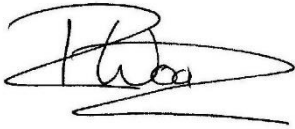
8.0 Conclusion

The Local Authority's acoustic requirements for the proposed 166No. heat pump units have been established.

A detailed environmental sound survey has been undertaken in order to establish existing environmental sound levels in the vicinity of the 166No. residential properties to be served by the proposed heat pumps.

An assessment of atmospheric sound emissions from the proposed 166No. heat pump units upon the nearest noise sensitive receptors has been undertaken.

The assessment indicates that atmospheric plant sound emissions from the proposed 166No. heat pump units are likely to achieve the requirements of the Local Authority at the nearest noise sensitive receptors with the incorporation of the proposed mitigation measures.

A handwritten signature in black ink, appearing to read 'Robin Wood', with a stylized, sweeping underline.

Robin Wood
LIGHTHOUSE ACOUSTICS