BEECH JACKSON PARTNERSHIP LTD

PROPOSED AIR SOURCE HEAT PUMP

CLEMENT COURT, TOXTETH STREET, MANCHESTER

NOISE IMPACT ASSESSMENT

R2141-REP01A-JW

9 January 2023

RED ACOUSTICS LIMITED Unit 8 Cable Court, Pittman Way, Preston, PR2 9YW
T 01772 722 182 **F** 01772 722 451 info@redacoustics.co.uk www.redacoustics.co.uk
Registered Company Number 6460126

red acoustics

REPORT DETAILS

Project	Proposed Air Source Heat Pump Clement Court Toxteth Street, Manchester
Client	Beech Jackson Partnership Limited The Old Courthouse 15 - 17 Freckleton Street Kirkham Lancashire PR4 2SN
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Issued By	Johnathan Whittle BSc (Hons), Pg. Dip. IOA AMIOA MCIEH Red Acoustics Limited Unit 8 Cable Court Pittman Way Preston PR2 9YW T: 01772 722182 F: 01772 722451 M: 07715 653281 jwhittle@redacoustics.co.uk
Signed	J. Whittle
Checked by	Simon Webster BEng. (Hons.) MIOA
Signed	Simon Webster

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SUMMARY

Red Acoustics has been commissioned by Beech Jackson Partnership Ltd to provide an assessment of noise impact from the proposed installation of an Air Source Heat Pump (ASHP) unit at the existing retirement housing facility at Clement Court, Toxteth Street, Manchester.

The existing noise climate has been assessed at a position representative of the nearest noise sensitive dwellings and target noise levels set in line with published guidance and Manchester City Council criteria.

This report presents the results of noise propagation predictions at the proposed location based on manufacturer supplied plant noise and enclosure insertion loss data.

Recommendations have been made to enable suitable noise mitigation options to be selected and based on the proposed inclusion of an acoustic enclosure to the proposed plant, impact is predicted to be low for the proposed plant operation.

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1.0 INTRODUCTION

Red Acoustics has been commissioned by Beech Jackson Partnership Ltd to provide an assessment of noise impact from the proposed installation of an Air Source Heat Pump (ASHP) unit at the existing retirement housing facility at Clement Court, Toxteth Street, Manchester.

Red Acoustics has been commissioned by Beech Jackson Partnership Ltd to conduct the following assessments:

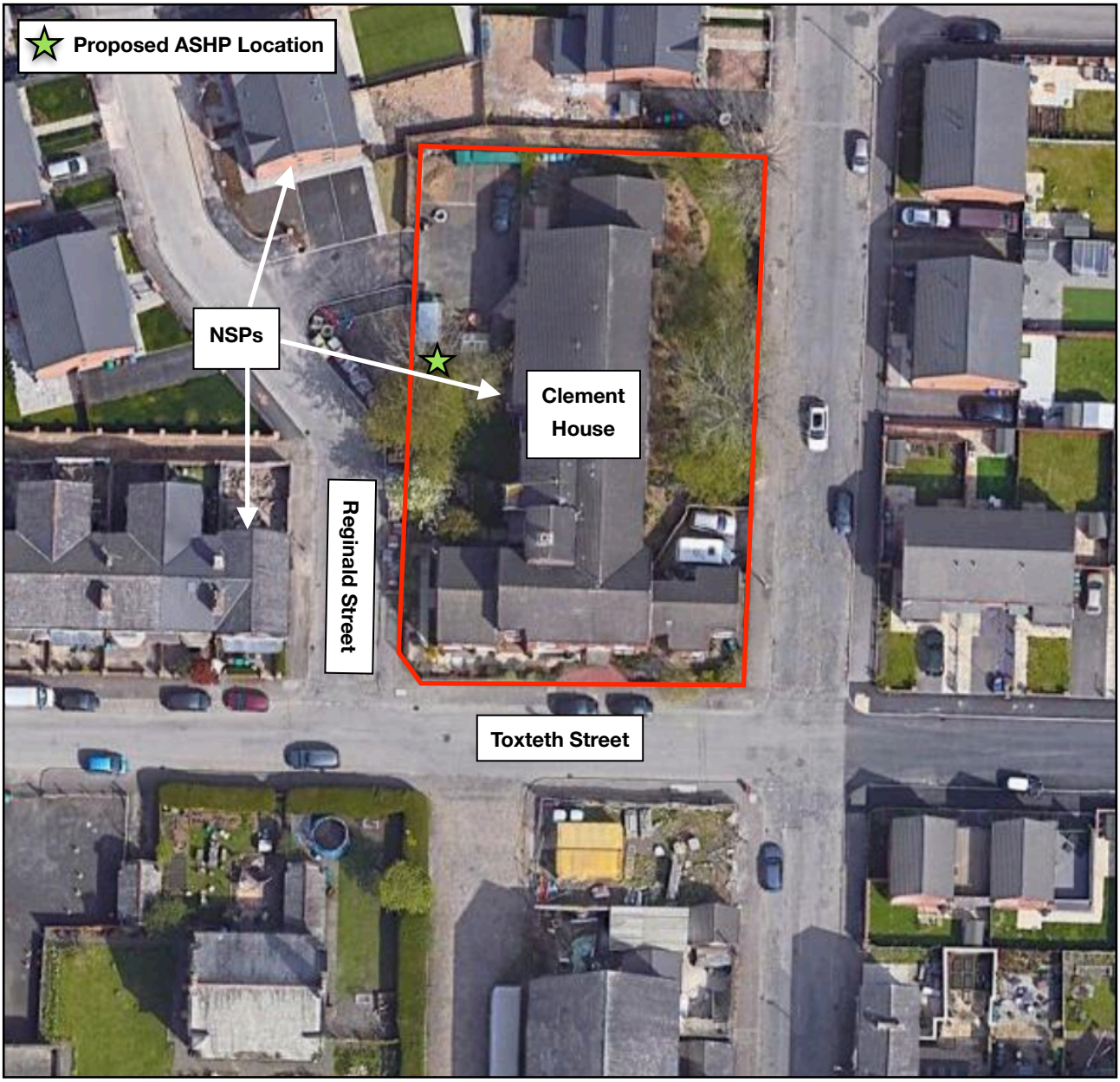
- Assess the existing background noise climate at a position representative of nearby noise sensitive receptors.
- Based on the measured existing background sound levels, determine target noise limits for the proposed externally mounted ASHP unit.
- Prepare a 3D computer noise propagation model to predict the impact of environmental noise from the proposed ASHP installation.
- Advise as necessary on the level of mitigation required to achieve target limits to enable approval to be sought from the Local Planning Authority for installation of the proposed AHSP unit.

This report presents the results of an environmental noise survey and details an assessment of environmental noise impact from the proposed installation.

2.0 DETAILS OF THE PROPOSED DEVELOPMENT

The proposed plant installation is to be located within the garden area of the existing retirement homes development at Clement House, Toxteth Street, Manchester. The site location and proposed ASHP location is shown in Figure 2.1 below.

Figure 2.1: Site Location in Relation to Surroundings



The location for the proposed installation of an Air Source Heat Pump unit is shown in Figure 2.1 above. The nearest noise sensitive properties are located within the Clement House development itself though the site is surrounded by residential properties on Toxteth Street and Reginald Street. The location of the nearest noise sensitive properties are also shown in Figure 2.1 above.

Proposed ASHP Unit

The proposal is to install a free standing Mitsubishi Electric QAHV-N560YA-HBP Monoblock Air Source Heat Pump. The proposed ASHP will only strictly operate during the daytime period (07:00 - 23:00), night-time hot water use will be supplied by pre-heated tank supply only.

In order to assess the potential for noise impact to the surrounding environment, manufacturer supplied Octave Band Sound Power Level data has been used. Table 2.1 below presents the supplied data.

Table 2.1: Octave Band Sound Power Source Data

	Octave Band Sound Power Level dB, L_w								
Operating Condition	63	125	250	500	1k	2k	4k	8k	dBA
Winter Operation	85	72	73	71	67	63	58	53	73

For the purpose of the assessment, worst case winter operation has been selected from the supplied manufacturer sound power data.

Following initial assessment of noise impact from the proposed ASHP unit and subsequent discussion with the client, an acoustic enclosure has been recommended. This is discussed further below. It is therefore proposed that an enclosure with the following manufacturer supplied octave band insertion loss is to be installed:

Table 2.2: Octave Band Insertion Loss - Proposed Allaway Acoustics Acoustic Enclosure

	Octave Band Sound Insertion Loss, dB							
Acoustic Enclosure	63	125	250	500	1k	2k	4k	8k
Allaway Acoustics Enclosure	3	6	12	18	20	17	14	10

3.0 PLANNING POLICY & DESIGN TARGETS

Planning Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF[1]) was updated in 2021 and sets out the Government's planning policies for England and how these should be applied. Where issues of noise impact are relevant the NPPF provides guidance. In paragraph 174 it states that planning policies and decisions should contribute to and enhance the natural and local environment by:

'preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of noise pollution'.

Paragraph 185 also advises:

'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development - and avoid noise giving rise to significant adverse impacts on health and quality of life'.

The NPPF also refers to the 2010 DEFRA publication, the Noise Policy Statement for England (NSPE) which reinforces and supplements the NPPF guidance.

Noise Policy Statement for England

The Noise Policy Statement for England[2] (NPSE) sets out the long term vision of promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development. This vision is supported by the following aims:

- Avoid Significant adverse impacts on health and quality of life.
- Mitigate and minimise adverse impacts on health and quality of life.
- Where possible, contribute to the improvement of health and quality of life.

The NPSE describes the following levels at which noise impacts may be identified:

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[1] National Planning Policy Framework. Ministry of Housing, Communities & Local Government (2021)

[2] Noise Policy Statement for England - Department for Environment, Food & Rural Affairs (2010)

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

According to the explanatory notes in the statement, where a noise level falls between LOAEL and a level which represents SOAEL then:

'all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur'.

Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) - Noise[3] is an online www.gov.uk resource (last updated 2019) to provide additional guidance on the NPPF. It discusses:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur and;*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the NPSE, the PPG references the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, inline with the NPSE, no objective noise levels are provided although the PPG states that:

'the subjective nature of noise means that there is not a simple relationship between noise levels and impact on those effected. This will depend on how various factors combine in any particular situation'

Table 3.1 below summarises the PGG noise expose hierarchy.

[3] Planning Practice Guidance on Noise (https://www.gov.uk/guidance/noise--2). Ministry of Housing, Communities & Local Government

Table 3.1: Explanation of Noise Exposure Hierarchy - PPG

Perception	Examples of Outcomes	Increasing Effect Levels	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

British Standard 4142

BS 4142:2014+A1:2019[4] presents methods for rating and assessing the potential impact of commercial and industrial sound upon noise sensitive receptors. In order to assess impact using BS 4142, the Rating Level of the new sound source is compared with the existing contextual Background Sound Level.

- Typically, the greater this difference, the greater the magnitude of the 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.

The Rating Level is determined by assessing the Ambient Sound Level, distinguishing the Specific Sound Level from the Residual Sound Level and applying any sound specific penalties for acoustic features that would subjectively cause the sound to be perceived differently.

The Specific Sound Level of the commercial / industrial sound source is determined by either; measurement or calculation with regard to the appropriate reference time interval (for daytime or night-time periods). The standard requires separate analysis for daytime and night-time periods, evaluating the Rating Level over an appropriate reference time interval (T_r) of: 1hr for daytime (07:00 - 23:00 hrs) and 15min for night time (23:00 - 07:00 hrs). The Specific Sound Level is defined as equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, *T* (determined either by calculation or deducting the measured Residual Sound Level from the measured Ambient Sound Level).

'Ambient sound' is defined as the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far (The ambient sound comprises the residual sound and the specific sound when present).

'Residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

[4] BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

Where appropriate, a rating penalty can be applied to the specific sound level to account for the character of the sound, namely: tonality, impulsivity and intermittency. Such acoustic feature corrections can be added together linearly.

Tonality can be determined objectively (using adjacent third octave band analysis or the Joint Nordic method) or subjectively as described below:

- +2dB penalty: Just perceptible
- +4dB penalty: Clearly perceptible
- +6dB penalty: Highly perceptible

Impulsivity can be determined objectively (using Fast Fourier Transform analysis) or subjectively as described below:

- +3dB penalty: Just perceptible
- +6dB penalty: Clearly perceptible
- +9dB penalty: Highly perceptible

Where intermittency is present, a +3dB penalty can be applied. Where the acoustic feature characteristics are neither tonal nor impulsive, but are clearly distinguishable against the residual sound, a +3dB penalty can be applied.

Manchester City Council Guidance

Manchester City Council has published comprehensive guidance in relation to noise impact due to new development. The MCC Planning and Noise Technical Guidance document was updated in October 2022 and discusses the assessment of environmental noise from new development of plant items in the vicinity of nearby noise sensitive uses. The published guidance forms the basis for the decision making process when assessing planning applications within the Council's boundaries and provides design targets. With regard to fixed plant items the guidance states:

'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 (LAeq) below the typical background (LA90) level at the nearest noise sensitive location'.

The guidance further states that the assessment of impact from fixed plant items should be undertaken in accordance with the guidance in BS4142:2014+A12019 and the assessment advice within the MCC guidance document.

4.0 ENVIRONMENTAL NOISE SURVEY

Environmental Noise Survey

In order to determine the prevailing environmental noise levels at the site, representative unmanned measurements were taken during the period between 24th and 28th October 2022. The measurement location used during the survey is shown in Figure 4.1 below. This position was selected to provide a measurement at a position which is representative of background noise levels for the nearest noise sensitive receptors.

Figure 4.1: Noise Measurement Location

During the measurement periods, the noise climate for the site was driven by local road traffic noise. Figure 4.2 below shows the broadband noise survey data at the monitoring position. Figure 4.3 shows the noise survey data for a typical 24 hour period. The measured data shown has been used to determine the typical daytime background sound level.

Figure 4.2: Broadband Noise Survey Data

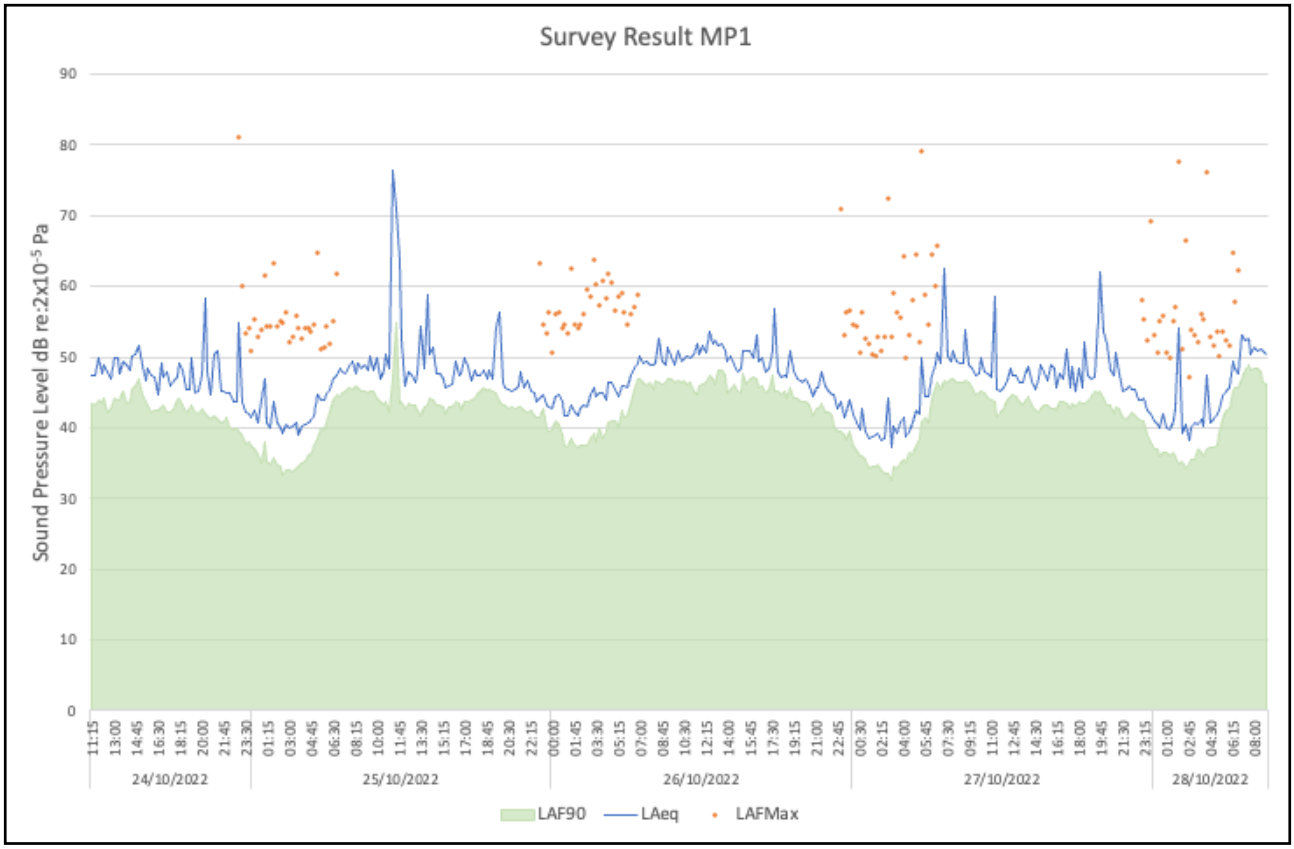
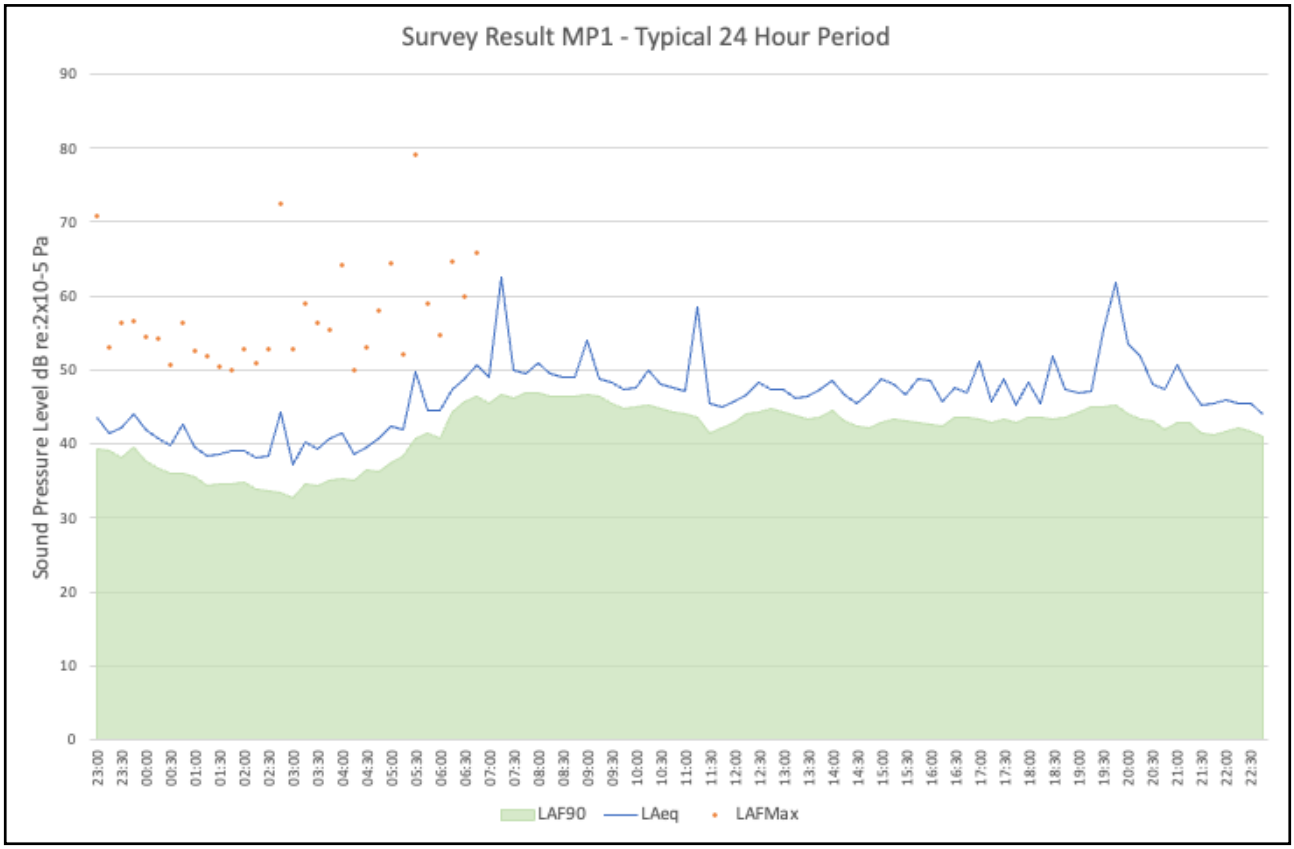


Figure 4.3: Broadband Noise Survey Data (Typical 24 Hour Period)



An assessment of predicted noise impact on the nearby residential receptors is presented is section 5.0 below.

Based on the measured survey data, Table 4.1 below identifies the recommended L_{Aeq} plant noise limits for the proposed installation at the nearest noise sensitive receptors. The assessments are based on the typical measured $L_{A90,15min}$ during the relevant daytime period and Manchester City Council guidance.

Daytime noise targets are presented as it is proposed that the plant will not operate 24 hours. It is proposed that the plant will operate during the daytime period only with the target presented below.

Table 4.1: Plant Noise Limits at Nearest Noise Sensitive Facade

	Measured Noise Levels & Target Noise Limits	
	Day Time (07:00 - 23:00)	
Location	Typical Measured L_{A90}, dB	Target Noise Limit, dB L_{Aeq}
Nearest Noise Sensitive Facade	43	≤ 38

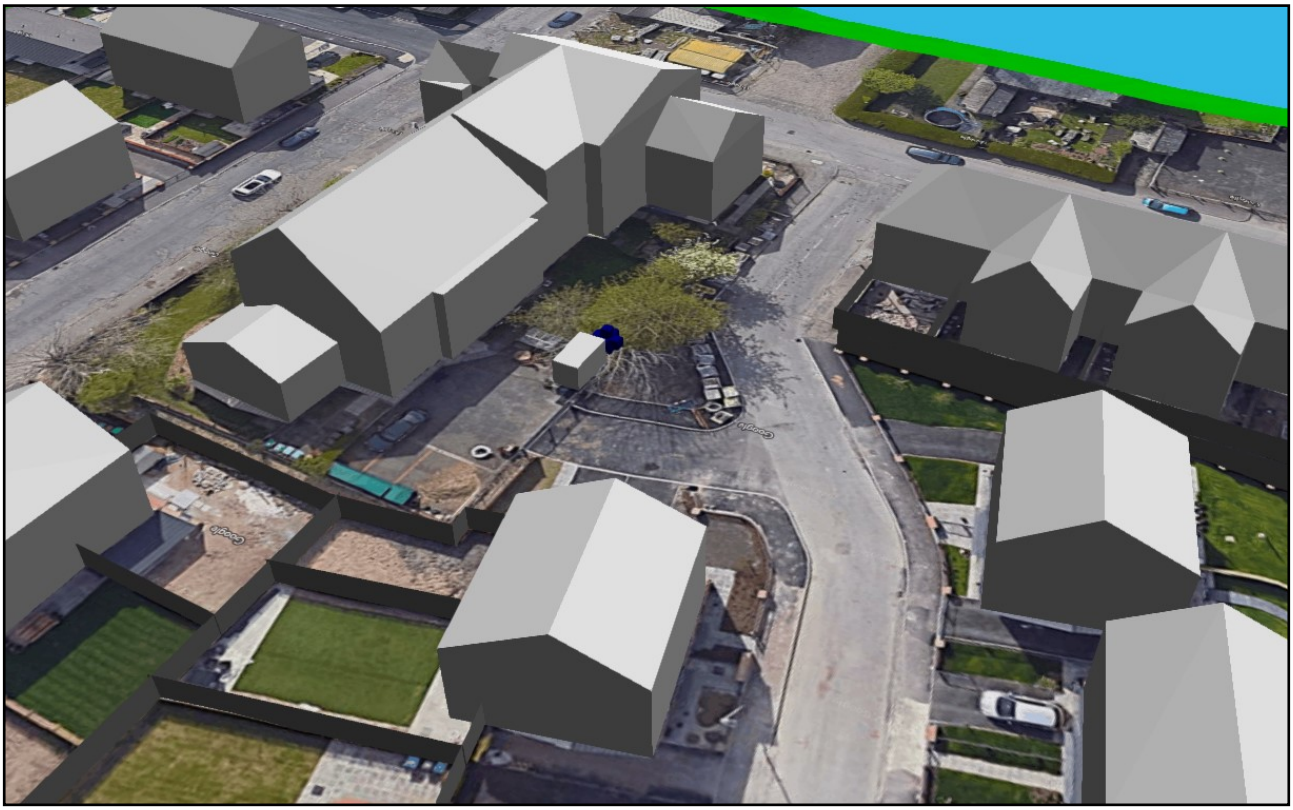
5.0 CADNAA NOISE PROPAGATION MODELLING

To predict noise levels from the proposed Air Source Heat Pump installation to the surrounding environment and the nearest noise sensitive receptors, the latest version of CadnaA 3D noise propagation modelling software has been used, which implements the calculation procedure specified within ISO9613-2.

The model has been generated using the manufacturer supplied noise source sound power data presented in Section 2.0 along with the insertion loss provided by the proposed acoustic enclosure. The modelling of the surrounding environment was undertaken by modelling the existing buildings and the surroundings using Google Earth imagery and site inspection notes with ground heights set using 1m digital terrain height data obtained from the DEFRA data services platform.

Noise propagation is predicted from the proposed location of the ASHP installation with ground set to fully reflective to represent hard ground and 4 orders of reflection set within the model. Noise impact is predicted to all facades of the nearby noise sensitive uses with the closest being the Clement Court development which the proposed plant will serve. A screenshot of the CadnaA noise model constructed is shown in Figure 5.1 below.

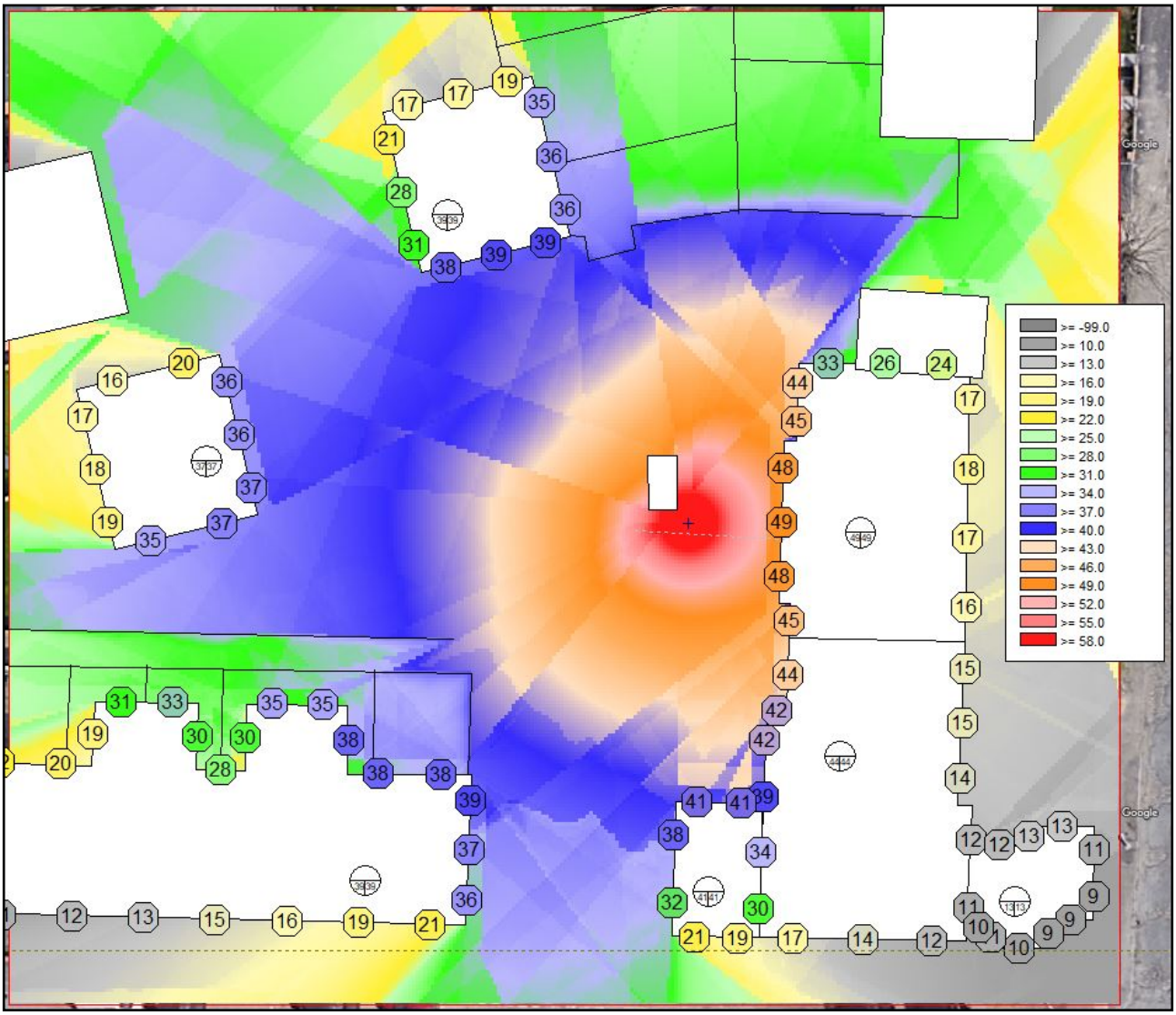
Figure 5.1: CadnaA Noise Propagation Model 3D View



The results of the noise propagation modelling are presented below. Figure 5.2 below shows the grid prediction at ground floor level without the introduction of an acoustic enclosure and shows the highest predicted facade levels for the nearest noise sensitive dwellings.

The predicted level represents the Specific Sound Level in terms of BS4142:2014+A1:2019. It can be seen in Figure 5.2 below that the highest predicted Specific Sound Level at the nearest residential facade is 49dBA without acoustic mitigation.

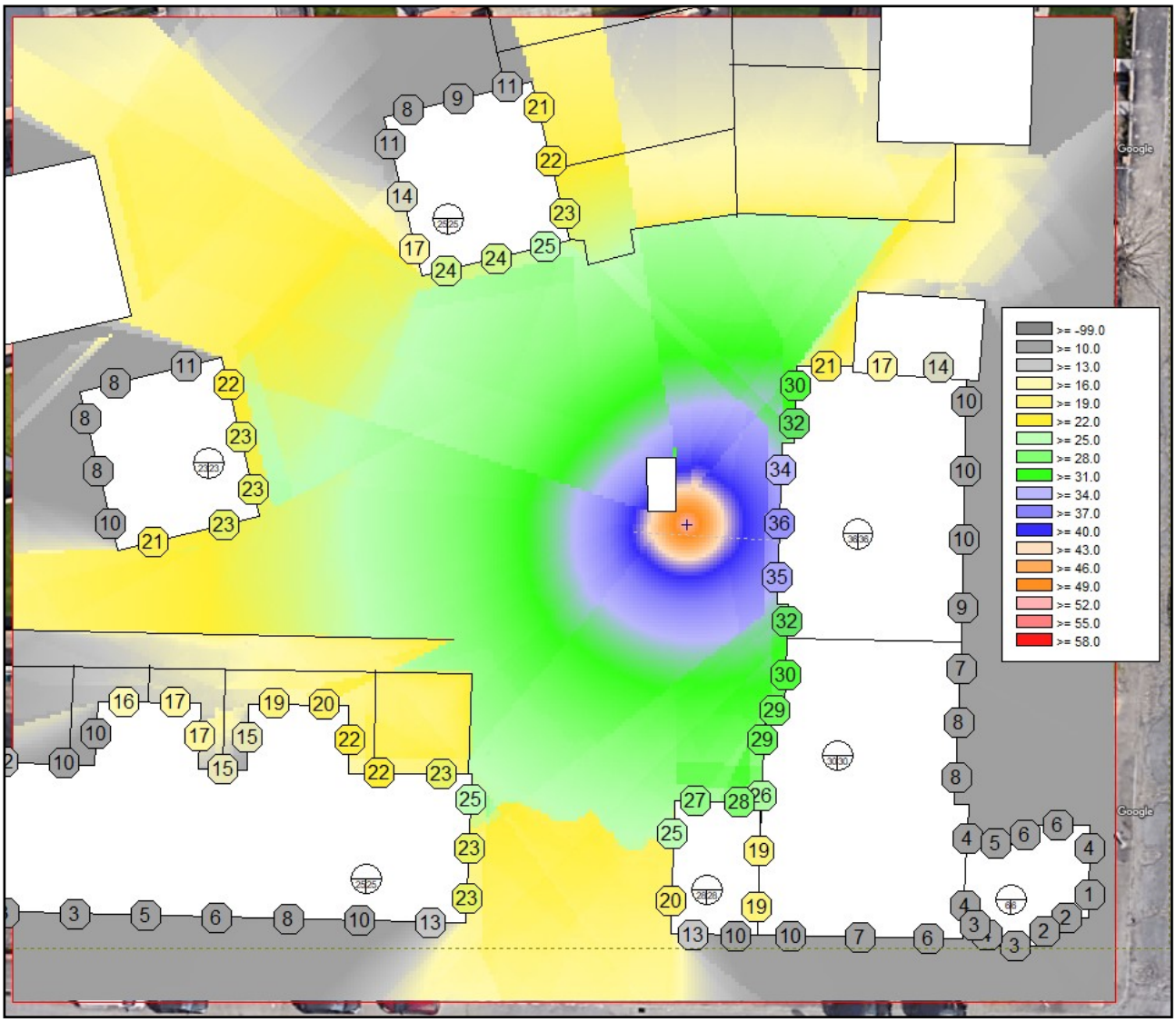
Figure 5.2: CadnaA Noise Propagation Prediction (dBA) (No Acoustic Mitigation Present)



As a result of the initial assessment results shown in Figure 5.2 above, it has been advised that acoustic mitigation measures be explored to achieve a rating level below the recommended target outlined in Table 4.1 above. Acoustic enclosure options have therefore been explored to enable the proposed ASHP to function correctly while providing sufficient insertion loss to achieve the target noise levels. The current proposal now includes an acoustic enclosure with the octave band insertion loss presented in Table 2.2 above.

Figure 5.3 below shows the grid prediction at ground floor level with the introduction of the proposed acoustic enclosure and shows the highest predicted facade levels for the nearest noise sensitive dwellings. It can be seen that the highest predicted Specific Sound Level at the nearest residential facade is now 36dBA with the proposed acoustic mitigation.

Figure 5.3: CadnaA Noise Propagation Prediction (dBA) (With Proposed Acoustic Enclosure)



6.0 BS4142 PLANT NOISE IMPACT ASSESSMENT

To undertake an impact assessment on the proposed development in accordance with BS4142, measured data at the proposed development site has been employed to determine the existing Background Sound Level. Manufacturer supplied sound power and insertion loss data as presented in Table 2.1 has been used within the CadnaA noise propagation model to predict the impact of the Specific Sound Level to the nearest NSPs. Table 6.1 below presents the BS4142 assessment. As the plant operates during the daytime period (07:00 - 23:00hrs), the Rating Level has been rated against the typical measured $L_{A90,15min}$ Background Sound Level during the daytime period.

Table 6.1: BS4142 Assessment Table

	Period (07:00 - 23:00)	Comments
Ambient Sound Level	NA	Prediction method to be used
Residual Sound Level	NA	Prediction method to be used
Specific Sound Level	36dBA	Predicted from plant sound power data and insertion loss data
Corrections	None	No corrections for character necessary as the specific sound is not expected to be readily perceivable at the NSPs
Rating Level dB	36dBA	
Typical Existing Back-ground $L_{A90,t}$	43dBA	
Difference	-7dBA	
Target	-5dBA	
Comments	Rating level is below target	
Conclusion	Low impact - No additional mitigation proposed	

7.0 CONCLUSION

The results of the CadnaA noise propagation model, based on the manufacturer supplied noise data for the proposed ASHP unit and acoustic enclosure show that the target noise levels will be met for the proposed daytime period operational hours with the proposed acoustic mitigation in place.

No additional mitigation is proposed at this stage.

APPENDIX A:
NOISE MEASUREMENT DETAILS

Location

Clement Court, Toxteth Street, Manchester

Survey & Noise Egress Assessment Date

24 - 28 October 2022 - Background Noise Survey

Survey Conducted By

Johnathan Whittle BSc (Hons), Pg. Dip. IOA AMIOA MCIEH

Red Acoustics Limited, Unit 8 Cable Court, Pittman Way, Preston PR2 9YW

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Instrumentation

Table A1: List of Instrumentation Used

Equipment Description	Type Number	Manufacturer	Serial Number	Date of Last Calibration	Calibration Certificate Number	Calibration Due
Sound Level Meter	CR:171B Type 1	Cirrus	G300554	02-Dec-21	166932	02-Dec-23
Microphone	MK:224	Cirrus	211606D	02-Dec-21	166932	02-Dec-23
Preamplifier	MK:170	Cirrus	599	02-Dec-21	166931	02-Dec-23
Sound Calibrator	CR:515 Type 1	Cirrus	59153	12-Aug-22	1503025-7	12-Aug-23

Methodology

Before and after the measurements the sound level meter was check calibrated to an accuracy of ±0.3dB using the sound calibrator. The calibrator produces a sound pressure level of 114 dB re 2x10-5 Pa @ 1kHz.