Philip Dunbavin Acoustics Ltd
3 Bridgewater Court
Barsbank Lane
Lymm
WA13 0ER

ACOUSTIC CONSULTANTS

NOISE IMPACT ASSESSMENT

PARK INN, CHEETHAM HILL ROAD, MANCHESTER

ISSUE 04

REPORT REFERENCE NO. J005265-8183-JM-04

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Tel: 01925 759380 Email: enquiries@pdaltd.com

Registered Number 2302847 England
Registered Office: 3 Bridgewater Court, Barsbank Lane, Lymm WA13 0ER

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Client Address:	Company Address:
Suite 4 Cadman House 2-16 Wharf Road Sale Cheshire M33 2AF	PDA Ltd 3 Bridgewater Court Barsbank Lane Lymm Cheshire WA13 0ER

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	Name	Position
Prepared By	Joe Meadows BEng (Hons) AMIOA	Graduate Consultant
Checked By	Max de Salis PhD CEng MIOA	Director / Principal

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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.

CONTENTS

1.0 SUMMARY 4
2.0 SITE DESCRIPTION 5
3.0 NOISE ASSESSMENT CRITERIA 6
3.1 National Planning Policy Framework 6
3.2 Planning Practice Guidance – Noise 7
3.3 Manchester City Council – Planning and Noise – Technical Guidance 2022 8
3.3.1 Noise and Vibration from fixed plant/ equipment 8
3.4 BS 4142:2014 + A1:2019 8
3.5 World Health Organisation Guidelines for Community Noise 10
4.0 SURVEY DETAILS AND RESULTS 11
4.1 Environmental Noise Survey 11
4.2 Noise Sources 12
4.3 Measurement Results 12
4.3.1 Environmental Noise 12
5.0 IMPACT ASSESSMENT 13
5.1 Modelling 13
5.2 Plant Enclosure 16
5.3 Context 19
5.3.1 Absolute sound levels 19
5.3.2 Character and Level of the Residual Sound 19
5.3.3 Mitigation to Dwellings 19
5.4 Final impact assessment 19
6.0 BS 4142 ASSESSMENT UNCERTAINTY 20
7.0 CONCLUSIONS 20

APPENDIX A – NOISE SURVEY DATA CHARTS

APPENDIX B - DEFINITION OF ACOUSTIC TERMS

1.0 SUMMARY

PDA Ltd was commissioned by PSK Design Ltd to carry out a noise impact assessment on the proposed plant installation at Park Inn, Cheetham Hill Road, Manchester. The assessment has covered the noise impact on nearby residential receivers from the proposed plant installation.

The proposed plant installation consists of 16 air conditioning (AC) units and 4 air source heat pumps (ASHP) units on the roof of Park Inn, Cheetham Hill Road, Manchester.

It is understood that the maximum sound power output of each specified ASHP is 81 dB(A), and each specified AC unit is 84 dB(A). It is understood that various models of AC units are to be installed, however the frequency spectrum of one proposed model (Toshiba MMY-MAP1606FT8P) has been used in our assessment. We have been given a frequency spectrum of the previous version of the proposed ASHP unit, which we have been informed has a very similar sound profile to the proposed unit. Again the frequency spectra for the finally selected units will need to be checked against the assumed frequency spectra.

With no mitigation to the plant, the predicted noise levels at the worst affected residential receiver during the daytime (07:00-23:00) is 51 dBA, and during the night-time (23:00-07:00) is 45 dBA (based on all units running at full 100% duty during the daytime and 50% during the night-time) which comparing to the background levels of 54 dBA and 42 dBA during the daytime and night-time periods respectively, does not achieve the criteria of ≥ 5 dB below the typical background sound level set out by Manchester City Council during night-time hours.

With the installation of a 2m high enclosure around the AC plant and a 2m high enclosure around the ASHP plant as described within Section 5.2, the predicted noise level incident upon the worst effected residential receiver is reduced to 42 dBA during the daytime, and 36 dBA during the night-time, which meets both the criteria for ‘low impact’ set out in BS4142:2014+A1:2019 and the ≥5 dB below background requirement set out by ‘Manchester City Council – Planning and Noise – Technical Guidance 2022’.

2.0 SITE DESCRIPTION

The proposed plant installation consists of 16 air conditioning units and 4 air source heat pumps units on the roof of Park Inn, Cheetham Hill Road, Manchester.

The development site is immediately bordered by Cheetham Hill Road to the west. The site is located in a densely developed area neighboured by residential developments to the North and East.

An aerial photo of the location of the site (outlined in red) and surrounding local area is shown in Figure 1 below.



Figure 1. Location with site outlined

3.0 NOISE ASSESSMENT CRITERIA

3.1 National Planning Policy Framework

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in June 2019 and July 2021. With regard to Noise the Framework states the following;

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 soil, air, water or noise pollution or land instability.*

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 the quality of life;*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

The terms '*significant adverse impact*' and '*adverse impact*' are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE) which states;

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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.

The notes also offer an explanation of the term 'adverse impacts' as follows;

… refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise. A summary is reproduced in Section 3.2 below, and the full document

is published at https://www.gov.uk/guidance/noise--2. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

The National Planning Policy Framework also states:

> *Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*
>
> *The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.*

3.2 Planning Practice Guidance – Noise

In March 2014 (updated July 2019) the UK Government published further guidance on the assessment of noise for planning purposes in the form of the on-line publication, Planning Practice Guidance on noise (http://www.gov.uk/guidance/noise--2). This document offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL. The relevant section is reproduced in the table below;

Table 1. Planning Practice noise level guidance

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. 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			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			

Perception	Examples of Outcomes	Increasing Effect Level	Action
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

It is notable from the above planning guidance that development should not normally be permitted above Significant Observed Adverse Effect Levels, and should aim to minimise other Adverse Effect Levels (below SOAEL but above LOAEL). However, it is clear that noise is permitted to approach and/or exceed the Lowest Observed Adverse Effect Level, providing that noise is mitigated and reduced to a minimum.

3.3 Manchester City Council – Planning and Noise – Technical Guidance 2022

In June 2022, Manchester City Council (MCC) published an updated guidance document '*Planning & Noise – Technical* Guidance' in order to provide help and advice in relation to noise in a planning context to encourage good acoustic design. The documentation outlines what is expected in relation to current practice and policy with the ambition that new developments achieve the highest possible standards without compromising the health and well being of people that live and work within the City of Manchester.

3.3.1 Noise and Vibration from fixed plant/ equipment

The technical guidance provided by the MCC also provides guidance on the installation of fixed plant/ equipment in regards to design which demonstrates that the resultant noise level at a noise sensitive receiver should be negligible and not give rise to complaints. The guidance discusses the following criteria which aims to achieve this:

> *'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'.*

3.4 BS 4142:2014 + A1:2019

The effect of industrial noise on the nearest noise sensitive residences is assessed in accordance with BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'. This will include noise break-out from the industrial and commercial units and noise from external plant.

The standard describes a method of determining the level of a noise of commercial nature, together with procedures for assessing the impact of such a noise outside nearby noise sensitive areas.

The standard may be thought of as a procedure for comparing the noise from commercial sources with background noise levels in the absence of the commercial noise and determining the likely impact of the noise on noise sensitive areas.

In accordance with BS 4142 the background noise level is the typical A-weighted sound pressure level at the assessment position that is exceeded for 90% of a given time interval (L_{A90}). The specific noise

level is the equivalent continuous (L_{Aeq}) sound pressure level at the assessment position produced by the noise source over a given time interval.

Certain acoustic features can increase the impact over that expected from a simple comparison between the specific noise level and the background level. Where such features are present, these are taken into account by adding 'penalties' to the specific noise level.

This correction is applied based on whether the following features occur or are expected to be present. The correction values can either be determined subjectively, or by various objective measurement procedures.

- The noise contains a distinguishable, discrete, continuous tone (whine, hiss, screech, hum, etc.). 0 – 6 dB penalty
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps). 0 – 9 dB penalty.
- The noise is irregular enough to attract attention. 0 – 3 dB penalty.
- Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

From the addition of the above penalties where appropriate the rating level is established, this being the value that is compared with the background noise. Note that corrections for impulsivity and tonality may be added arithmetically where both are present and likely to affect perception within the same reference period. However, if any single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics.

According to BS 4142 an initial estimate of the impact is given based on the rating level as follows:

- a rating level 10 dB(A) or more above the background is an indication of significant adverse impact, depending on the context.
- a rating level 5 dB(A) above the background is an indication of an adverse impact, depending on the context.
- where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

BS4142 indicates that the noise source should be evaluated over the appropriate time interval which is as follows:

- 1h during the day (07:00 – 23:00)
- 15 min during the night (23:00 – 07:00)
- The above initial assessment may then be modified depending on the context, to take into account;
- The absolute level of the sound.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

1. Façade insulation treatment

2. Ventilation and / or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and

3. Acoustic screening

3.5 World Health Organisation Guidelines for Community Noise

BS 4142:2014+A1:2019 states within Section 11 that in order to assess the impact of a sound the context ought to be taken into account, and that this should include the absolute level of the sound. It is also stated that, "*where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night*."

The relevant criteria with respect to the absolute level of sounds affecting residences are the criteria of the World Health Organisation Guidelines for Community Noise.

World Health Organisation guidelines for community noise give noise levels for critical health effects of indoor and outdoor living spaces as follows;

Table 2 – WHO guidelines for community noise criteria

Environment	Critical health effect	Criterion
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35 dB $L_{Aeq,\ 16\ hours}$
Outdoor living areas	Few moderately annoyed, daytime and evening	50 dB $L_{Aeq,\ 16\ hours}$
	Few seriously annoyed, daytime and evening	55 dB $L_{Aeq,\ 16\ hours}$
Inside bedrooms	Sleep disturbance (night-time)	30 dB $L_{Aeq,\ 8\ hours}$ 45 dB L_{Amax}
Outside bedrooms	Sleep disturbance (night-time)	45 dB $L_{Aeq,\ 8\ hours}$

4.0 SURVEY DETAILS AND RESULTS

4.1 Environmental Noise Survey

An ambient noise survey was carried out at site in a location which was deemed to be representative of the noise climate for the closest residential receivers while remaining shielded from the existing plant operating on the roof. The measurement location can be seen in Figure 2 below.

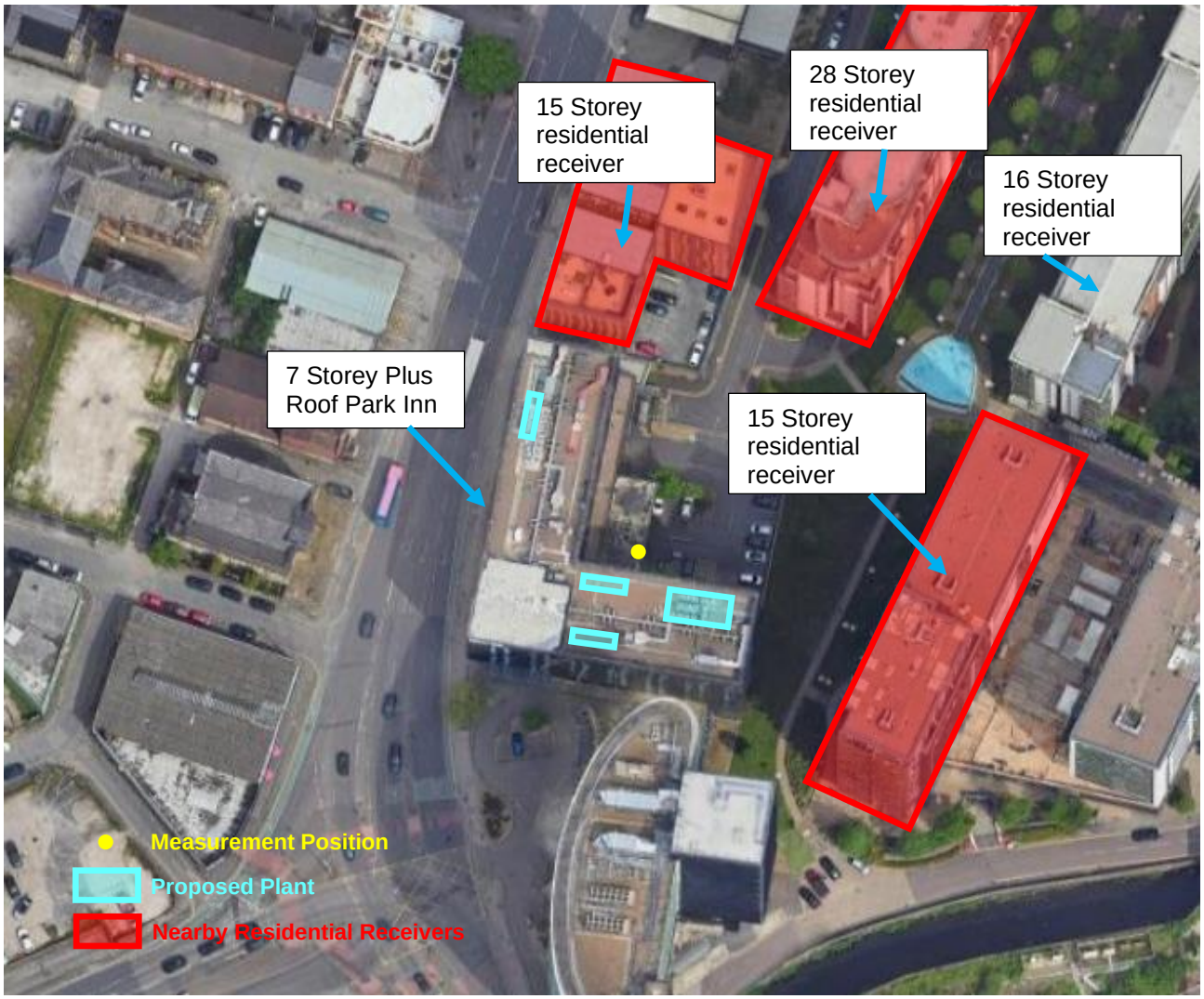


Figure 2. Noise Surveys Monitoring Positions

The noise level survey was undertaken at the site from 11:30 hours Tuesday 29th October to 11:00 hours Thursday 31st October 2024. The periods measured were deemed to be representative of day and night-time hours. Long-term measurements were taken at one position across the existing site, as shown in the figure above. Measurements were made by Joe Meadows of PDA Ltd. Measurements were of continuous 15-minute samples. The noise survey was conducted using 1 no. NTi XL2 sound level meter for which calibration certificates are held.

The NTi XL2 has a Class 1 frequency response as per BS EN 61672-1:2003. For all surveys the sound level meters were field calibrated both before and after the measurement period, during which time no significant deviation from the calibrated level was observed. The sound level meter was fitted with a microphone windshield at all times.

The background sound level was taken on an external terrace at one storey height with the microphone of the sound level meters was mounted on a pole 1.5m above floor level and at least 3m from surrounding structures and can be assumed to be a free field measurement. All measurements were undertaken with a fast time-weighting and broadband statistics were measured throughout. In addition, octave band frequency spectra and audio were recorded.

Weather

Weather conditions varied throughout the survey however typical conditions were as followed:

Temperature- 9-14°C
Wind - 0.4-4m/s, (Westerly)
Rain - Light

4.2 Noise Sources

While attending site the ambient noise climate at the measurement position was noted to include audible noise contribution from the water feature on New Century Pk, with road traffic noise from Cheetham Hill Road to the West of the site also being audible.

4.3 Measurement Results

4.3.1 Environmental Noise

Full measurement charts are provided in Appendix A of this report. A summary of the results is given below:

Table 3. Summary of environmental noise measurements

Position	Time Period (hh:mm)	Duration (hh:mm)	$L_{Aeq,T}$ (dB)	Typical Background Sound Level L_{A90} (dB)[1]
1	Day 29/10/2024 11:30 – 23:00 30/10/2024 07:00 – 23:00 31/10/2024 07:00 – 11:00	27:30	57	54
	Night 29-30/10/2024 23:00 – 07:00 30-31/10/2024 23:00 – 07:00	16:00	47	42

Notes:
1 Typical background sound level has been derived by taking the modal value.

5.0 IMPACT ASSESSMENT

The assessment of impact has been carried out in accordance with the methods of BS 4142:2014 + A1:2019.

5.1 Modelling

We have been informed that the maximum sound power output of the specified air source heat pumps is 81 dB(A), with the model being an AquaSnap 61 AQ 140 P as per the details below:

AquaSnap 61AQ	Overall Dimensions (LxlxH)	Operating Weight (kg)	Sound Power at full load A7W35 (dB(A))	SCOP 35
040P	1815x1145x2045	600	75	4.00
050P	1815x1145x2045	600	76	4.00
060P	1815x1145x2045	600	77	4.29
070P	1815x1145x2045	600	*78*	*4.15*
080P	1815x2267x2045	1200	78	4.00
100P	1815x2267x2045	1200	79	4.00
120P	1815x2267x2045	1200	80	4.29
140P	1815x2267x2045	1200	*81*	*4.15*

We have been informed that several Toshiba Air Conditioning units have been specified, with our assessment being based on the Toshiba MMY-MAP1606FT8P. The maximum power output of the specified air conditioning unit is 84 dB(A), with the model being as per the details below:

Toshiba Air Conditioning - VRF Data Sheet

MMY-MAP1606FT8P
Three-pipe SHRMe - Super Heat Recovery Condensing Unit



Features

- Dual setpoint for more precision
- ESEER increased to >8
- UK-SEER achievable to >10
- New 4 series flow box with 50 m run
- New 4- and 6-port multi-flow boxes

Technical Data

Model reference		MMY-MAP1606FT8P
Nominal cooling	kW	45.0
Nominal heating	kW	50.0
Capacity code		16
Min./max. capacities connectable	kW	36.00/60.75
Power input (cool/heat)	kW	13.9/12.2
SEER/ESEER Value (Office Profile)		7.62/8.17
SCOP/ESCOP Value (Office Profile)		4.62/4.82
Starting current	A	1
Running current (cool/heat)	A	21.81/19.14
MCA (minimum circuit amps)	A	40.6
MOCP (maximum overcurrent protection)	A	50.0
Power supply	V-ph-Hz	380/415-3-50
Interconnecting cable		2-core screened 1.5 mm
Sound power (cool/heat)	dB(A)	83/84
Sound pressure (cool/heat)	dB(A)	61/62
Standard air flow	m^3/h	17300
Standard air flow	l/s	4806
External static pressure	Pa	40
Maximum indoor units connectable		36
Dimensions (H x W x D)	mm	1830 x 1600 x 780
Unit weight	kg	377
R410A refrigerant base charge	kg	11

Note: The electrical installation needs to meet current electrical regulations BS7671:2018 the 18th Edition of the IET regulations.

We have been given frequency spectra for the above AC unit, as well as for the previous version of the proposed ASHP unit, which we have been informed has a very similar sound profile to the proposed unit. The used spectra is as shown in Table 4 below.

Table 4 – AC + ASHP Unit Reference Frequency Spectrum

Model	63	125	250	500	1000	2000	4000	8000
Toshiba MMY-MAP1606FT8P (AC)	58	62	63	62	57	49	38	36
Previous Version of Proposed (ASHP)	-	86	81	79	75	71	67	-

The spectra above have subsequently been normalized to an overall sound power level of 81 dB(A) for the ASHP units, and 84 dB(A) for the AC units for use in our assessment.

Based on the available data the ASHP unit sound sources were modelled at 1.5m above roof height, i.e. ¾ of the total ASHP height so that the noise source is weighted towards the top. The AC units were also modelled at the same height as the ASHP units, approximately ¾ of the unit height. We have been informed that during the night-time period (23:00-07:00), both the ASHP and AC units will run at a maximum of 50% duty, with a maximum of 50% of the AC units operating. As such, in the absence of further information, a 3dB reduction has been applied to their sound powers within the model during this period.

The sound propagation from the proposed plant to the worst affected nearby residences (identified as the developments off (1) Cheetham Hill Rd, (2) Fernie St, (3) New Century Pk, and (4) Colenso Way) was modelled using SoundPLAN propagation modelling software using the calculation method of ISO 9613:2 “Acoustics – Attenuation of sound during propagation outdoors – general method of calculation.” For the daytime period (07:00-23:00), each ASHP unit was modelled as a point source with a sound power of 81 dB(A), and each AC unit was modelled as a point source with a sound power of 84 dB(A) by normalising the spectra detailed in Table 4, 1.5m above roof level. For the night-time period (07:00-23:00), each ASHP unit was modelled as a point source with a sound power of 78 dB(A), and 50% of the AC units were removed, while each remaining unit was modelled as a point source with a sound power of 81 dB(A) by normalising the spectra detailed in Table 4, 1.5m above roof level. The topographical data for the site and surrounding area is taken from DEFRA terrain height data. Levels at each receiver read as ‘Floor Level | Noise Level’. A ground absorption coefficient of 0 has been used to consider the predominantly hard surfaces of roads, hard standing, etc. Noise level incident upon the nearby residential receivers has been calculated at 1.5m above ground level and 2.8m for each additional floor. The receiver locations have been calculated at the worst-case façades for. The results of the propagation model are shown in Figures 3 and 4 below:

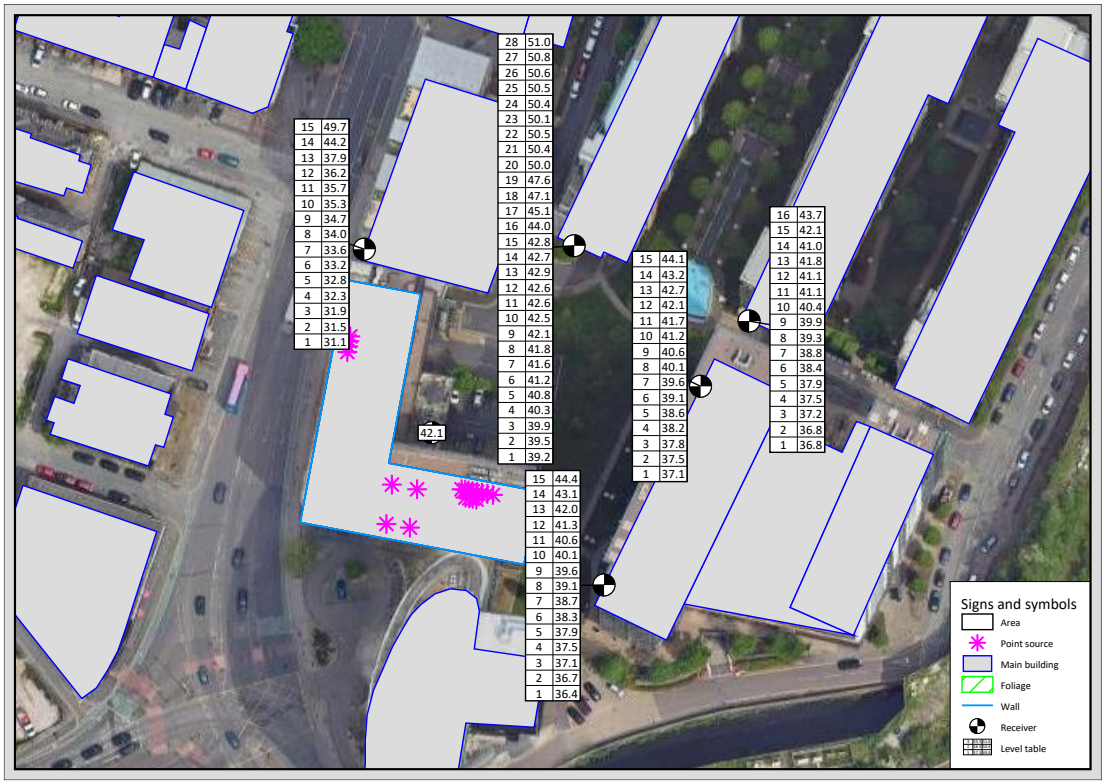


Figure 3 – Results of SoundPlan model (daytime)

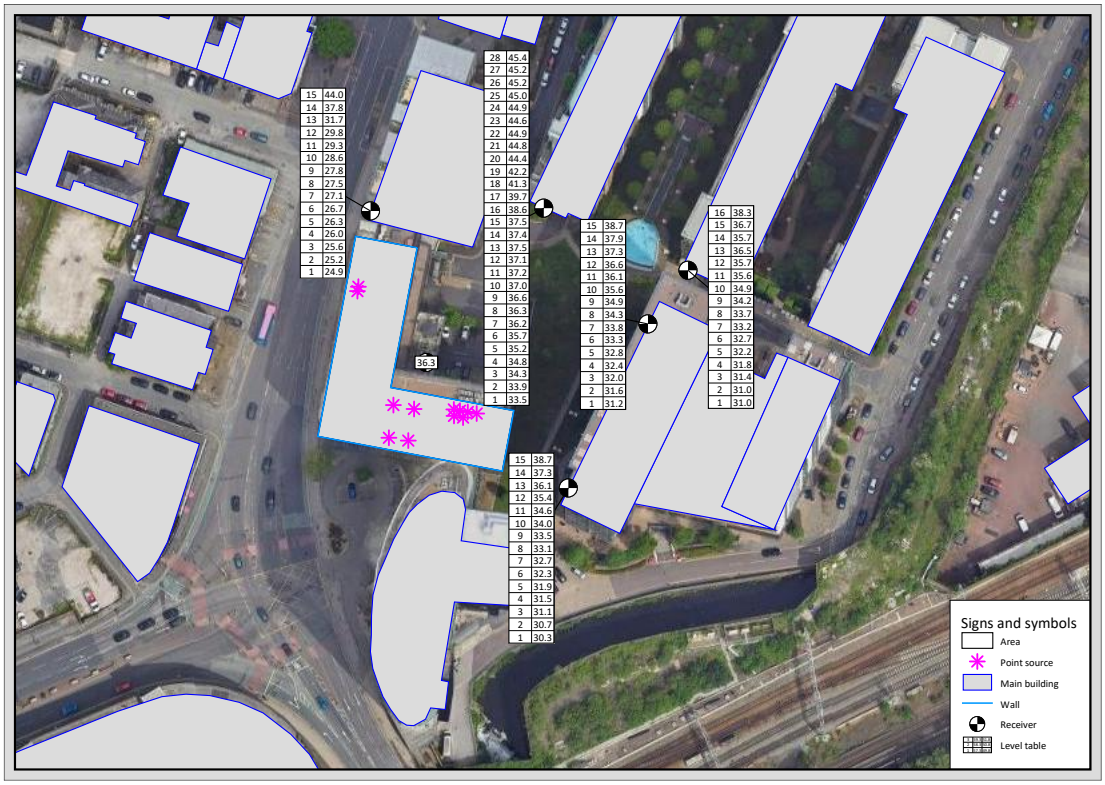


Figure 4 – Results of SoundPlan model (night-time)

With regard to the results in Figures 3 and 4, we would note that BS4142:2014 indicates that to obtain the required sound rating level then a feature correction should be applied if the noise sources are impulsive, tonal or is irregular enough to attract attention. However, in our experience modern plant equipment does not tend to be tonal, impulsive or significantly irregular and therefore, we would not consider it appropriate to apply a feature correction. As such the sound pressure levels given in Figures 3 and 4 can be considered to be equivalent to sound rating levels.

On the above bases, comparing the worst case rating level from Figure 3 of 51 dB(A) during the day with the background level of 54 dB(A) during the day, and the worst case rating level of 45 dB(A) from Figure 4 with the background level of 42 dB(A) during the night, this gives a rating level of -3 dB and +3 dB compared to background sound level day and night respectively for the most affected residences to the North-West of the Park Inn.

We would note that the rating level in the figure is greatest at receivers on the higher floors. However, the existing background sound level on these higher floors is also likely to be greater than on the lower floors due to the more elevated residences being unshielded from the existing plant on the roof of the Park Inn Hotel, which is likely a large contributor to the background level at higher locations. Notwithstanding this, our comparative assessment conservatively utilises the measured background sound level recorded at first floor level as a baseline.

5.2 Plant Enclosure

Introducing a 2m high solid fence enclosure around the AC plant units, and a 2m high solid fence enclosure around the ASHP plant units, at an estimated distance of 1m from the units, with absorption treatment on the plant side to give a reflection loss of 8 dB, at an estimated distance of 1m from the plant, reduces the predicted worst case rating level to 42 dB(A) during the daytime, and 36 dB(A) during the night-time. Comparing with the measured background levels of 54 dB(A) during the day, and 42dB(A) during the night, this gives a rating level of -12 dB and -6 dB compared to the background sound levels for daytime and night-time periods respectively.

The fence should be of minimum 10 kg/m^2 surface mass and be imperforate with no gaps **including at the threshold.** Please note that this will need to be checked for compliance with spacing requirements around the ASHP and AC units to achieve the required airflow to the units.

Details of locations of the proposed enclosures and the noise levels at residential receivers are shown in Figures 5 and 6 below.

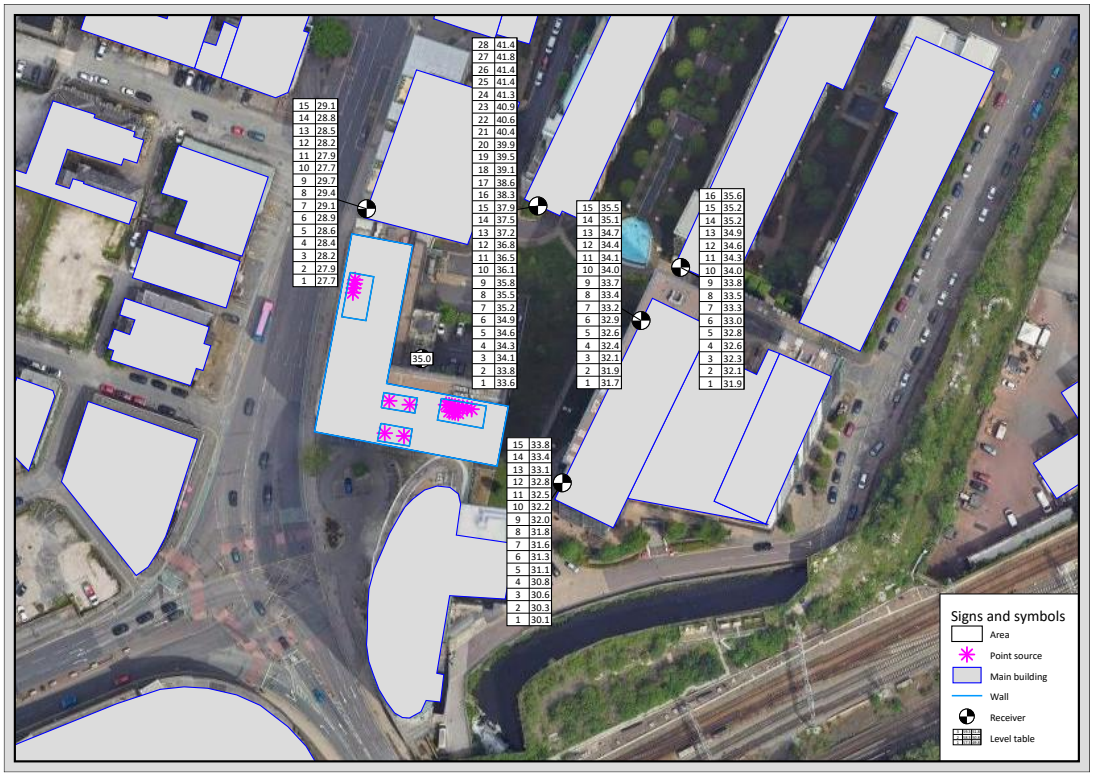


Figure 5 - SoundPlan model including enclosures (daytime)

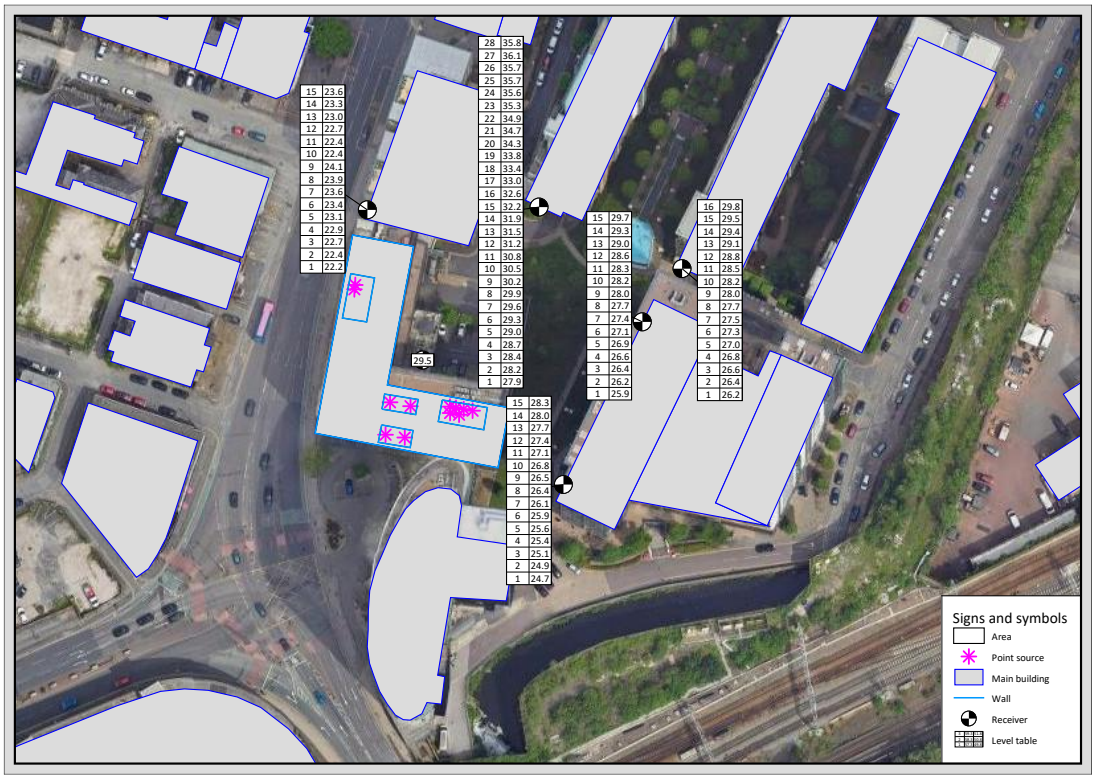


Figure 6 - SoundPlan model including enclosures (night-time)

BS 4142:2014+A1:2019 states that 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 predicted rating sound levels including for the shielding as specified meets the criteria for 'low impact' set out in BS4142:2019, depending on context, and the ≥5 dB below background requirement set out by 'Manchester City Council – Planning and Noise – Technical Guidance 2022', as detailed in sections 3.4 and 3.3 respectively.

5.3 Context

BS4142:2014+A1:2019 indicates that the initial estimate of impact should be modified to take into account all pertinent factors, including the absolute level of the sound, the character and level of the residual sound, the sensitivity of the receptor and whether dwellings will already incorporate design measures that secure good internal and / or outdoor acoustic conditions.

5.3.1 Absolute sound levels

Based on our measurements, the worst-case noise level due to the proposed plant during the daytime is predicted to be 51 dB(A), and 42 dB(A) with mitigation. The latter is comfortably below the 50 dB threshold criterion for 'Moderate annoyance' during the daytime and evening, from WHO Guidelines for Community Noise (See Section 3.5). This is based on all plant units running at full 100% duty. During the night-time, the worst-case noise level is predicted to be 48 dB(A), and 36 dB(A) with mitigation. The latter is comfortably below the 45 dB $L_{Aeq\ 8\ hour}$ threshold criterion for 'Sleep disturbance" outside bedrooms during the nighttime, from WHO Guidelines for Community Noise (See Section 3.5).

5.3.2 Character and Level of the Residual Sound

Based on our predictions sound emanating from the proposed plant installation is unlikely to be significantly audible for much of the time. With regard to the existing character of the residual sound at the site, at lower elevations this is contributed to by the water feature on New Century Park, and distant traffic noise, whilst the existing sound character at higher elevations is likely to have contribution from the existing plant on the roof of the Park Inn. If / when audibility occurs this is likely to be at higher elevations where the existing sound / noise climate will already have contributions from plant noise. As such on this basis noise emission from the proposed plant would not be considered out of character with the existing sound / noise climate.

5.3.3 Mitigation to Dwellings

The basic initial assessment in accordance with BS 4142 does not consider mitigation to the residential building envelope and assumes that the commercial sound has been introduced to an existing unmitigated residential building.

In this case, it would be assumed that the surrounding sensitive residences would have acoustic treatment to reflect their city centre location and existing plant, including existing installations on the Park Inn roof. Such treatments would serve to reduce the impact of any noise emissions from the proposed plant installations still further.

5.4 Final impact assessment

With the proposed enclosures around the plant, the initial impact assessment during both daytime and night-time periods is of low impact, depending on context. When context is taken into account, the impact assessment remains low. The predicted specific sound level of the proposed plant units sound levels is more than 5dB below the background sound level as stated in 'Manchester City Council – Planning and Noise – Technical Guidance 2022'.

6.0 BS 4142 ASSESSMENT UNCERTAINTY

Uncertainty in Measurements

The instrumentation used for the background sound level assessment conforms to Class 1 accuracy in accordance with IEC 61672. In addition, the instrumentation has been calibrated to national standards and were field calibrated at the time of the measurements. We would therefore consider that the effect of uncertainty on the measurement of background sound and ambient sound would be minimal.

Uncertainty in Calculation Method

Manufacturer's data has been used to determine the overall dB(A) sound power levels of each ASHP unit. Furthermore, in the absence of available data, we have made what we consider to be a conservative assumption that the overall dB(A) sound power levels of each AC unit will not exceed that from each ASHP units. The frequency spectrum of the air conditioning units have been taken from manufacturers data of a similar, but not identical units. The sound propagation has been calculated in accordance with the accepted method of ISO 9613:2. In terms of the attenuation during propagation the method of ISO 9613:2 is reasonably conservative giving sound levels for a reasonably 'worst case' down-wind propagation. As such the assessment of impact is likely to be reasonably worst case and hence the assessment of likely impact on nearby residences is robust.

7.0 CONCLUSIONS

PDA Ltd was commissioned by PSK Design Ltd to carry out a noise impact assessment on the proposed plant installation at Park Inn, Cheetham Hill Road, Manchester. The assessment has covered the noise impact on nearby residential receivers from the proposed plant installation.

The proposed plant installation consists of 16 air conditioning (AC) units and 4 air source heat pumps (ASHP) units on the roof of Park Inn, Cheetham Hill Road, Manchester.

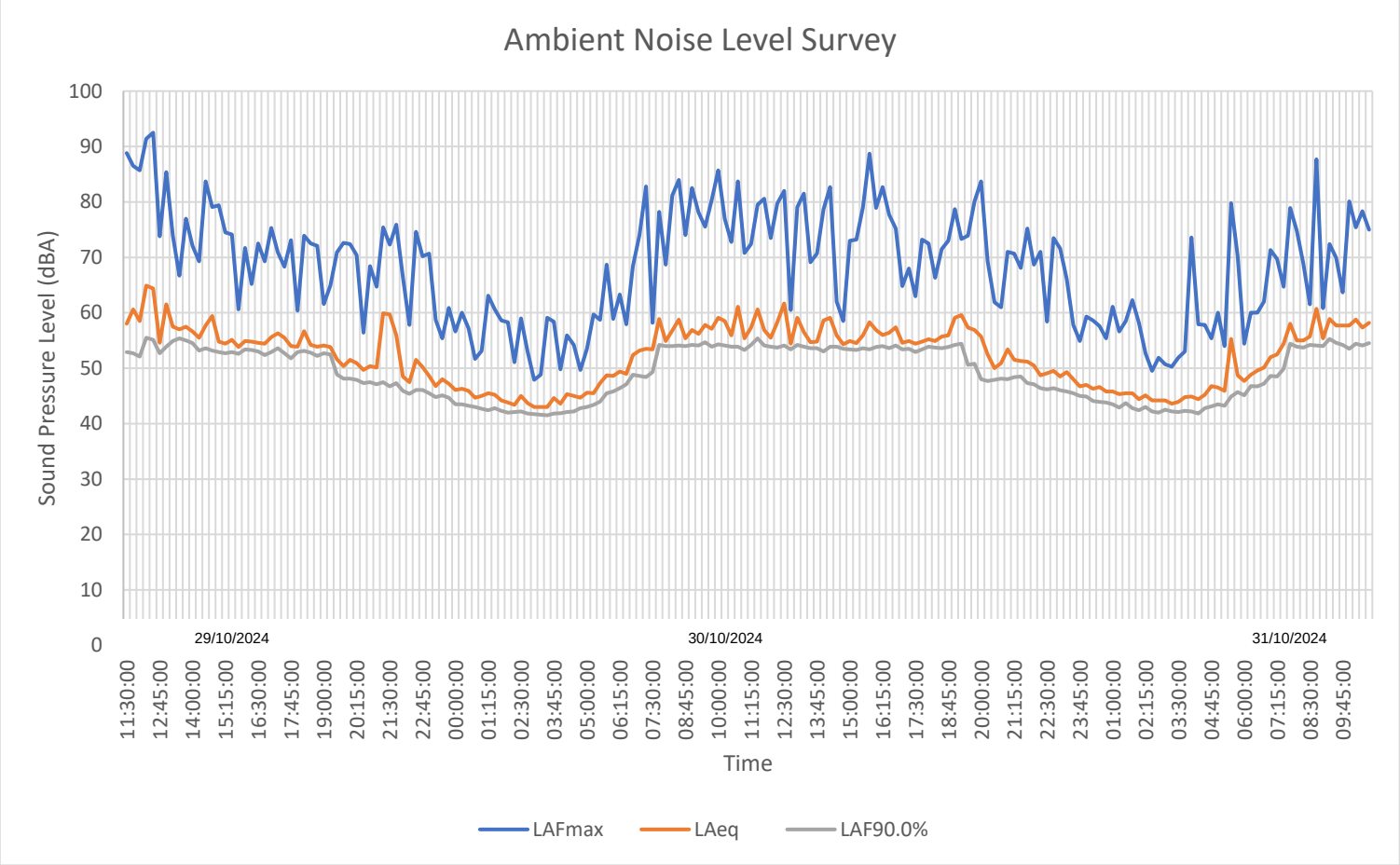
It is understood that the maximum sound power output of each specified ASHP is 81 dB(A), and each specified AC unit is 84 dB(A). It is understood that various models of AC units are to be installed, however the frequency spectrum of one proposed model (Toshiba MMY-MAP1606FT8P) has been used in our assessment. We have been given a frequency spectrum of the previous version of the proposed ASHP unit, which we have been informed has a very similar sound profile to the proposed unit. Again the frequency spectra for the finally selected units will need to be checked against the assumed frequency spectra.

With no mitigation to the plant, the predicted noise levels at the worst affected residential receiver during the daytime (07:00-23:00) is 51 dBA, and during the night-time (23:00-07:00) is 45 dBA (based on all units running at full 100% duty during the daytime and 50% during the night-time) which comparing to the background levels of 54 dBA and 42 dBA during the daytime and night-time periods respectively, does not achieve the criteria of ≥ 5 dB below the typical background sound level set out by Manchester City Council during night-time hours.

With the installation of a 2m high enclosure around the AC plant and a 2m high enclosure around the ASHP plant as described within Section 5.2, the predicted noise level incident upon the worst effected residential receiver is reduced to 42 dBA during the daytime, and 36 dBA during the night-time, which meets both the criteria for 'low impact' set out in BS4142:2014+A1:2019 and the ≥5 dB below background requirement set out by 'Manchester City Council – Planning and Noise – Technical Guidance 2022'.

APPENDIX A – NOISE SURVEY CHARTS

Figure 7. Ambient Noise Level Survey Chart



APPENDIX B – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB $L_{Aeq.}$ Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq}. It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB $L_{An.}$ It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) $L_{max,}$ dB $L_{Amax,}$ etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq}, L_{90}, L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.