



Linley House

Noise Survey and Plant Noise Assessment

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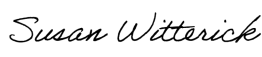
Client: Ardmac

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REVISION HISTORY

Revision	Date	Revision Details	Author	Checked
R01	1/10/2021	Original Issue	Matt Jones MEng AMIOA	Ben Tomlin BSc MIOA
R01A	12/10/2021	Updated following client comments	Matt Jones MEng AMIOA	Susan Witterick BSc MIOA
R01B	14/01/2022	Addition of BS 4142 Assessment	Angela Lamacraft MSc IEng MIOA	Susan Witterick BSc MIOA
R01C	04/02/2022	Inserted roof layout	Angela Lamacraft MSc IEng MIOA	Susan Witterick BSc MIOA
R01D	19/04/2022	Include acoustic jackets	 Angela Lamacraft MSc IEng MIOA	 Susan Witterick BSc MIOA

1 INTRODUCTION

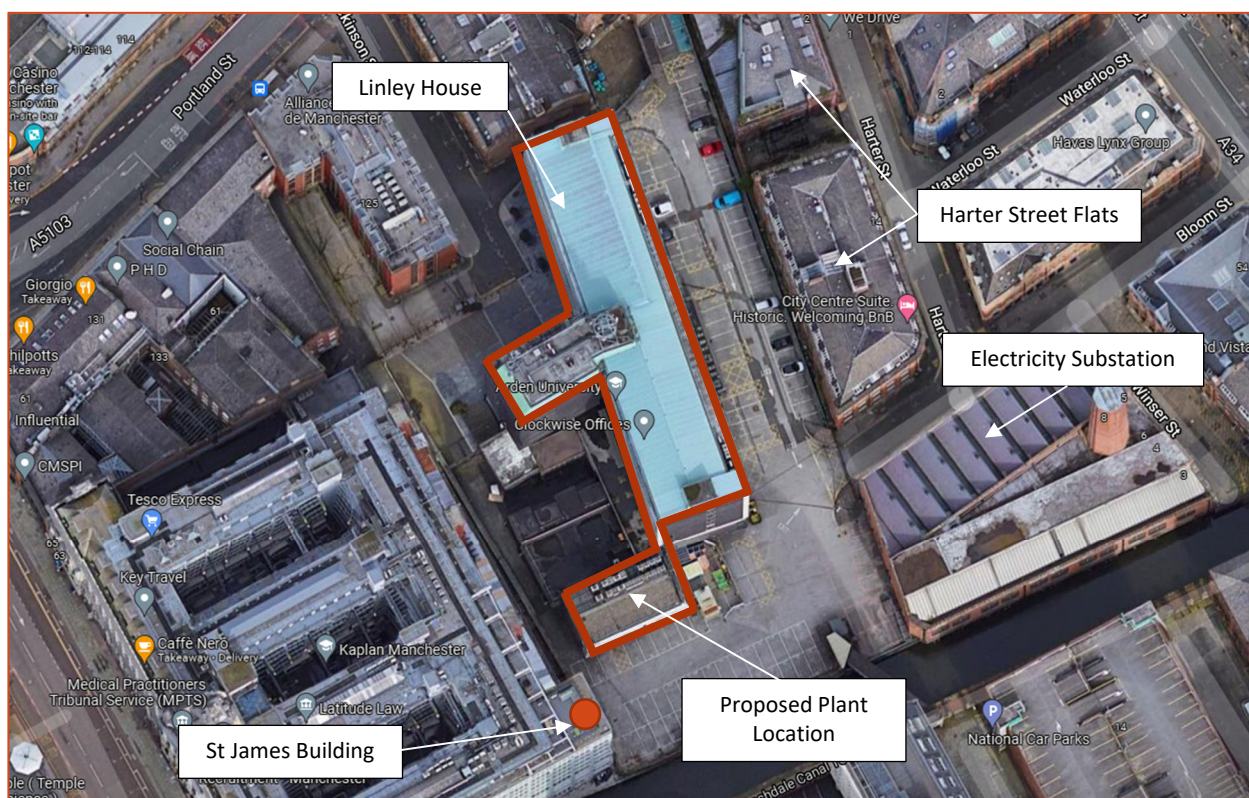
- 1.1 dBx Acoustics has been appointed by Ardmac on behalf of Castleforge Partners to undertake a noise survey and plant noise assessment for the proposed new external building services plant at Linley House, Manchester.
- 1.2 Linley House is proposed to be renovated and the new external plant forms a part of the renovation. The client has provided the models and location of the proposed plant.
- 1.3 A Glossary of Acoustic Terminology is presented in Appendix A.

2 SITE DESCRIPTION

Site Description

- 2.1 Linley House is located in Manchester City Centre, with a site entrance on Dickinson Street and an exit on Bloom Street. To the east of the site lie apartment and office buildings on Harter Street, with Rochdale Canal to the south. Offices on Dickinson Street and in St James Building lie to the north and west respectively.
- 2.2 Figure 1 illustrates the location of the site boundary, the proposed plant location and the nearest noise sensitive receptors (NSRs).

Figure 1: Site Boundary and Nearby Noise Sensitive Properties



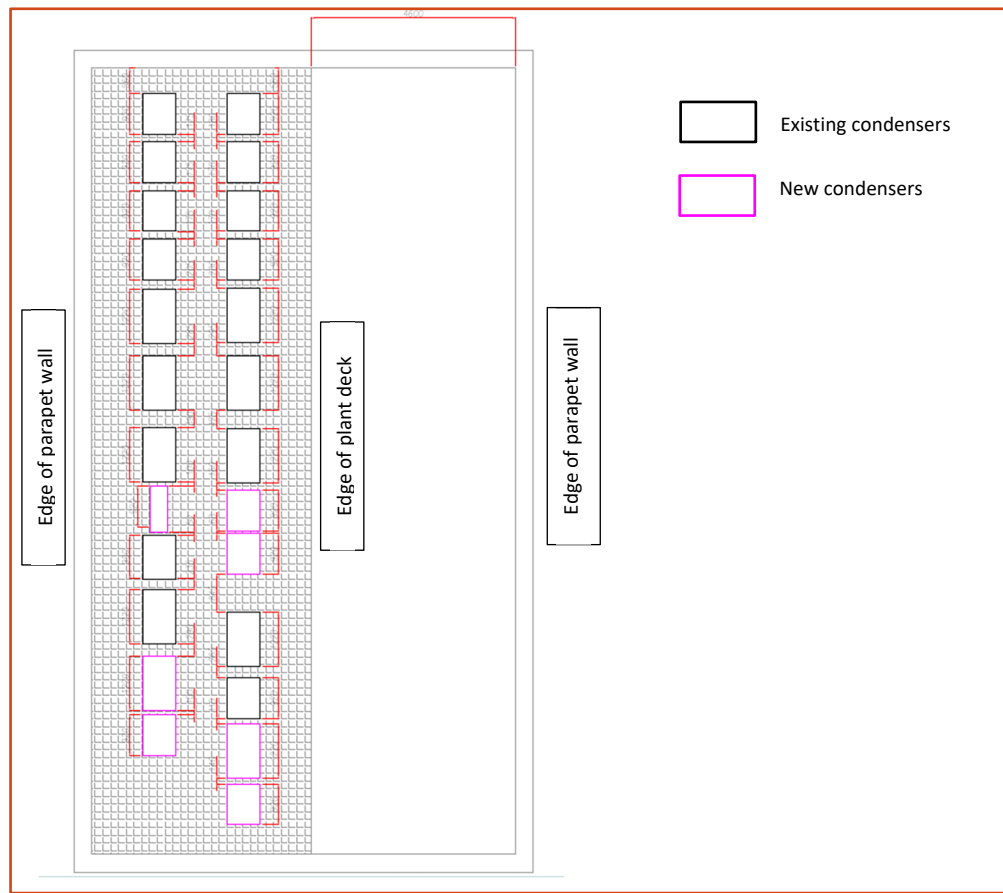
Nearby Noise Sensitive Receptors

- 2.3 The site is surrounded by a mixture of commercial and residential developments. The nearest NSRs to the proposed plant are the flats on Harter Street, which are 20 m to the east of Linley House. St. James office building is 25 m to the west. Offices are also located on Winsor Street, however, an electricity substation is situated between the proposed plant and these offices, therefore they have not been included within the noise impact assessment. The receptors are indicated on Figure 1.

Proposed Development

- 2.4 Linley House is being renovated and there will be new building services plant associated with the development. Figure 2 provides the layout of the rooftop equipment, as provided by Ardmac on 1st February 2022.

Figure 2: Roof Layout



2.5 More detail is provided in Section 6.

3 BASIS OF NOISE ASSESSMENT

Local Authority

- 3.1 The site falls within the boundary of Manchester City Council (MCC).

Manchester City Council – Planning & Noise Technical Guidance (December 2015)

- 3.2 This document sets out Manchester City Council's requirements with regard to current guidance and policy, with the aspiration that new developments achieve the highest standards without compromising the health and wellbeing of residents.

- 3.3 With regards to building services plant, MCC's guidance document 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 BS 4142 rating level (see below) of 5 dB L_{Aeq} below the typical background L_{A90} level at the nearest noise sensitive location."

BS 4142:2014 – Methods for Rating and Assessing Industrial and Commercial Sound

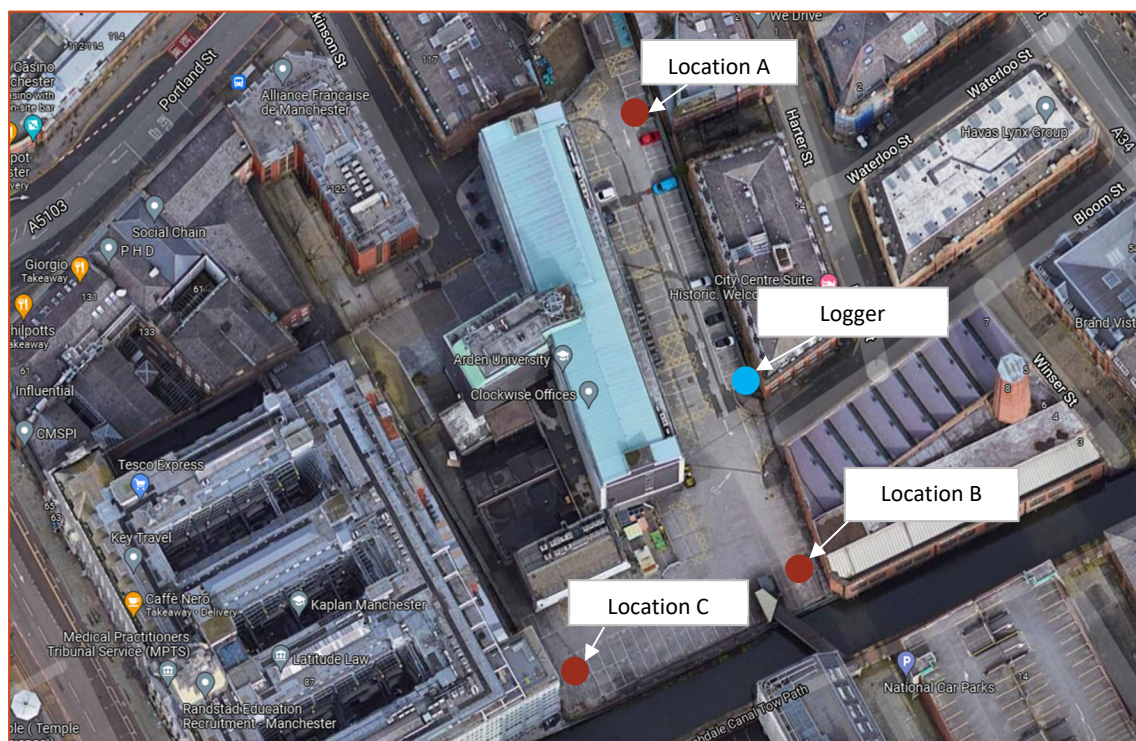
- 3.4 BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating is determined and compared with the existing local Background Sound Level.
- 3.5 The Rating Level (dB $L_{Ar,Tr}$) is evaluated from the Specific Noise Level by including several, cumulative corrections to account for factors such as distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristics.
- 3.6 BS 4142:2014 seeks to determine a "representative" Background Sound Level, stating that
- “...the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”.
- 3.7 The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:
- 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.

4 NOISE SURVEY

Methodology

- 4.1 dBx Acoustics has undertaken noise measurements at the site to establish the existing ambient, background and maximum noise levels affecting the site and its surroundings.
- 4.2 An attended environmental noise survey was undertaken on Wednesday 29th September 2021 at Locations A, B and C, as indicated on Figure 2.
- 4.3 In addition, unattended measurements were logged from approximately 16:00h Friday 24th September 2021 to approximately 13:00h on Wednesday 29th September 2021. However, the data from 13:00h on Saturday 25th to Wednesday 29th September 2021 has been excluded due to unsuitable weather conditions.
- 4.4 These noise measurement locations were selected to measure noise levels representative of those at the nearest NSRs.
- 4.5 Attended measurements were undertaken in accordance with BS 7445-1:2003 '*Description and Measurement of Environmental Noise*', with microphones located at approximately 1.5 m above the local ground level and at least 3.5 m away from reflective surfaces other than the ground, which is therefore considered to be in free-field conditions.
- 4.6 Unattended measurements were taken at approximately 2 m above ground level and 1 m from the façade of the flats on Harter Street. These measurements were therefore taken in façade conditions and 3 dB has been subtracted to correct to free-field noise levels.
- 4.7 Figure 3 illustrates the approximate noise measurement locations.

Figure 3: Noise Monitoring Locations



Equipment

- 4.8 The equipment used during the environmental noise survey is detailed in Table 1.

Table 1: Equipment Used in the Environmental Noise Survey

Equipment	Attended Measurements (Manufacturer & Part No./ Serial Number)	Unattended Measurements (Manufacturer & Part No./ Serial Number)
Sound Level Meters	NOR140/1405619	Cirrus CR:171C/G300656
Pre-amplifiers	NOR 1209/15526	Cirrus Pre-amp/9136F
Microphones	NOR 1225/168247	MK:224/211733D
Calibrators	NOR1251/33827	Cirrus CR:515/87921

- 4.9 The sound level meters were calibrated before and after measurements, with no significant drift recorded. An accredited laboratory calibrated the equipment not more than two years prior to the measurements being made, with the exception of the calibrators, which had been calibrated not more than one year prior to the survey.

Weather Conditions

- 4.10 Weather conditions were mixed across the unattended measurement period. Rain occurred from 13:00h on Saturday 25th September 2021 until the end of the measurement period, therefore the unattended measurements taken after the rain started have been excluded. Weather conditions from around 16:00h on Friday 24th September to 13:00h on 25th September were generally suitable for environmental measurements, with light cloud cover and wind speeds of less than 4 m/s.
- 4.11 Weather conditions during the attended noise measurements were suitable for environmental measurements with full cloud cover, but no rain, and wind speeds of less than 4 m/s.

5 ENVIRONMENTAL NOISE SURVEY RESULTS

- 5.1 Ambient noise across the site was dominated by distant road traffic, with background noise caused by distant plant. Maximum noise events were due to vehicle movements in the car park.
- 5.2 A summary of the attended noise levels measured at noise monitoring Locations A, B and C are presented in Table 2. All measurements were 15 minutes in duration.

Table 2: Summary of Measured Attended Noise Levels

Location - Receptor (Figure 2)	Period (yyyy/mm/dd hh:mm)	Ambient Noise Level (dB $L_{Aeq,15mins}$)	Maximum Noise Level (dB L_{AFmax})	Background Noise Level (dB $L_{A90, 15mins}$)
A – Harter Street flats	(2021/09/29 14:00)	59	72	55
	(2021/09/29 14:45)	58	73	53
	(2021/09/29 15:30)	55	65	52
B – Winsor Street Offices	(2021/09/29 14:15)	56	76	53
	(2021/09/29 15:00)	55	77	52
	(2021/09/29 15:45)	54	67	52
C – St James Building	(2021/09/29 14:30)	53	69	51
	(2021/09/29 15:15)	53	70	52
	(2021/09/29 16:00)	53	66	52

- 5.3 Table 3 summarises the measured unattended noise levels. A -3 dB correction has been applied to calculate the free-field noise levels from the façade measurements. The full measurements are shown graphically in Appendix B.

Table 3: Measured Unattended Noise Levels

Date	Period (hhmm – hhmm)	Ambient Noise Level (dB $L_{Aeq,15mins}$)	Highest Maximum Noise Level (dB $L_{A1,15mins}$)	Lowest Background Noise Level (dB $L_{A90, 15mins}$)	Typical Background Noise Level (dB $L_{A90, 15mins}$)
24/09/2021	Day (1600 – 2300)	54	84	49	50
	Night (2300 – 0700)	51	80	48	50
25/09/2021	Day (0700 – 1300)	58	85	47	47

- 5.4 It is understood that the offices at St James Building are generally unoccupied during the night-time period, therefore only daytime background noise measurements were considered necessary at these locations. The noise survey data demonstrates very little variation between the day and night time noise levels across the site.

- 5.5 Using the measured attended and unattended noise levels, and using the statistical analysis methodology described in BS 4142, the typical daytime and night-time background noise levels have been determined and are provided in Table 4.

Table 4: Background Sound Levels used in the Assessment

Receptor	Typical Daytime Background Noise Level (dB L _{A90,1h})	Typical Night-time Background Noise Level (dB L _{A90,15mins})
Harter Street Flats	50	50
St James Building (Offices)	51	Not required

6 BUILDING SERVICES NOISE EMISSIONS

External Plant Noise Assessment

- 6.1 As described in Section 3, MCC require that noise from all new items of building services plant is at least 5 dB below the typical background noise level at the nearby NSRs.
- 6.2 The proposed external plant items, as advised by Ardmac, are summarised in Table 5. The client has advised that the plant will operate at a maximum capacity of 70%, therefore the noise data for 75% capacity (the nearest capacity for which noise data is available) has been used within the noise assessment.

Table 5: External Plant Items

Item Reference	Number of Units	Manufacturer	Model Number	A-Weighted Sound Power Level (dB L _{WA}) Heating per Unit		Total A-Weighted Sound Power Level (dB L _{WA}) Heating	
				Heating	Cooling	Heating	Cooling
OU1	3	Mitsubishi	PURY-P400YNW-A1 ¹	71	69	76	74
OU2	1	Mitsubishi	PURY-P250YNW-A1 ¹	64	65	64	65
OU3	1	Mitsubishi	PUHZ-ZM250YKAR2 ²	68	67	68	67
Total						77	75

Note 1: 75% Capacity

Note 2: This item does not operate at varying capacities.

- 6.3 The noise levels in Table 5 for the PURY-P400YNW-A1 and PURY-P250YNW-A1 units include the sound reduction provided by Ambient Acoustics Ltd 'top only' kits obtained from the manufacturer's data provided by Ardmac. Table 6 provides a summary of the performance of the 'top only' acoustic kits.

Table 6: Sound Reduction of Ambient Acoustics Ltd 'Top Only' Kits

Item	Sound Reduction (dB) in Octave Band Centre Frequency (Hz)								A-Weighted Level
	63	125	250	500	1000	2000	4000	8000	
Acoustic Jackets (Top Only)	-2	-2	-2	-4	-5	-5	-4	-3	-4

- 6.4 It is anticipated that the fixed plant will not be acoustically impulsive, but that it may have tonality that is 'just perceptible' at the NSRs and may be intermittent, therefore acoustic character corrections totalling 5 dB have been applied to the specific sound level.
- 6.5 The BS 4142 assessment for the new plant at each of the nearby noise sensitive receptors is summarised in Table C.1 of Appendix C. The screening effect of the building of Linley House has been included within the calculations for the Harter Street Flats.

- 6.6 Table C.1 indicates that the MCC criterion of 5 dB below background sound level is met at the Harter Street flats and the St James Building offices, when the plant is operating in a typical worst-case capacity.

Discussion of Context

- 6.7 The site is located in an inner-city area. The nearest NSRs are already exposed to many sources of commercial noise, therefore the installation of the proposed plant does not change the character of the area.

Discussion of Uncertainty

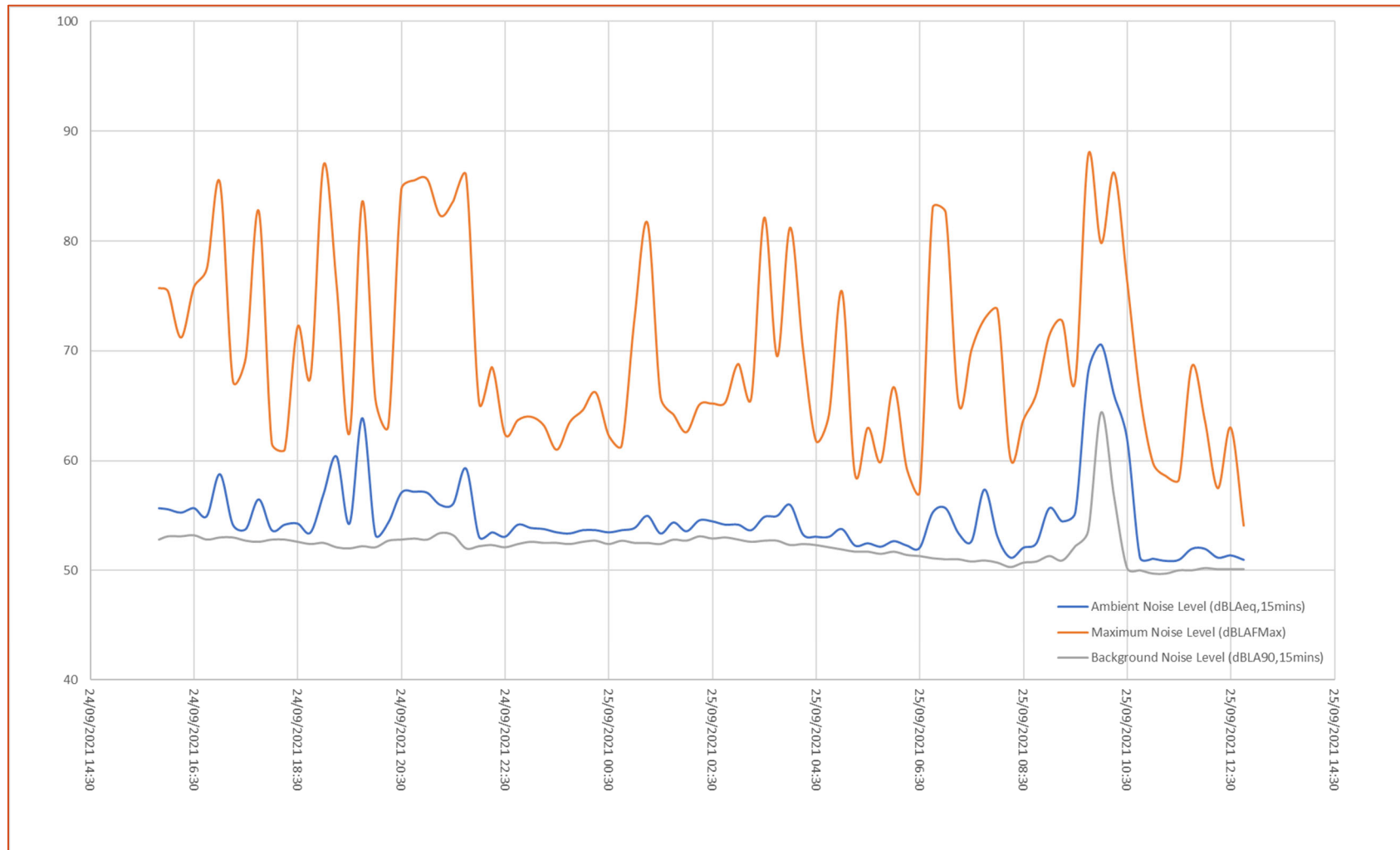
- 6.8 The noise measurements were undertaken on typical weekdays and a weekend day, therefore the measured ambient and background sound levels can be considered to be representative of the typical noise climate during operation of the proposed plant.
- 6.9 Uncertainty in calculations has been minimised by considering the typical worst-case operating scenario of the proposed plant.

7 SUMMARY AND CONCLUSION

- 7.1 dBx Acoustics Ltd has been appointed by Ardmac on behalf of Castleforge Partners to undertake a noise survey and plant noise assessment for the proposed external building services plant at Linley House, Manchester.
- 7.2 A noise survey was undertaken across the site to determine existing noise levels affecting the nearby noise sensitive receptors.
- 7.3 Based on the measured noise levels and plant noise data provided by the client, it is predicted that Manchester City Council's standard plant noise limit will be achieved at the nearest residential and commercial receptors when the external plant is operating at a typical worst-case capacity.
- 7.4 Taking the above into account, noise should not be a limiting factor in any planning application.

APPENDIX A: GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is 2×10^{-5} N/m ² . The sound pressure level existing when microphone measured pressure is 2×10^{-5} N/m ² is 0 dB, the threshold of hearing.
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A-weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{Aeq,T}$	Equivalent continuous level of A-weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T. $L_{A90,T}$ represents the background sound level.
L_{AFmax}	The instantaneous maximum A-weighted sound pressure level, measured with a fast time weighting.
$L_{Ar,Tr}$	The rating level: the equivalent continuous A-weighted sound pressure level, plus any adjustment for the characteristic features of the sound.

APPENDIX B: UNATTENDED MEASURED NOISE LEVELS

APPENDIX C: BS 4142 ASSESSMENT

Table C.1: BS 4142 Assessment

Results	Harter Street Flats (Residential)		St James Building (Offices)		Relevant Clauses of BS 4142:2014	Commentary
	Heating	Cooling	Heating	Cooling		
Background Sound Level (dB $L_{A90,T}$)	50	50	51	51	8.1, 8.2	The typical background sound level for the period being assessed
Specific Sound Level (dB $L_{Aeq,Tr}$)	27	25	41	39	7	Predicted specific noise level
Acoustic Feature Correction	5	5	5	5	9.2	Acoustic feature correction of +2 dB for tonality and +3 dB for intermittency
Rating Level (dB $L_{Ar,Tr}$)	32	30	46	44	9.1	Specific Sound Level + Acoustic Feature Correction
Excess of Rating over Background Sound Level (dB)	-18	-20	-5	-7	11	
	Indication of a low noise impact according to BS 4142	Indication of a low noise impact according to BS 4142	Indication of a low noise impact according to BS 4142	Indication of a low noise impact according to BS 4142	11	
	Meets the MCC plant noise criteria	Meets the MCC plant noise criteria	Meets the MCC plant noise criteria	Meets the MCC plant noise criteria		