Barnsley Academy

ASHP Noise Impact Assessment

dBx Acoustics Ltd
Beehive Mill
Jersey Street
Manchester
M4 6JG
0161 711 0320

24040-R02B-JT

Client: United Learning Trust

Date: 18/07/2024

TABLE OF CONTENTS

REVISION HISTORY

Revision	Date	Revision Details	Author	Checked
R02	14/06/2024	Original issue	Susan Witterick BSc MIOA	Ben Tomlin BSc MIOA
R02A	17/06/2024	Added assessment to Academy facade	Susan Witterick BSc MIOA	
R02B	18/07/2024	Updated to assess new ASHP location	Joseph Tony Joseph Tony (Jul 18, 2024 10:45 GMT+1) Joseph Tony BTech MIOA	Ben Tomlin Ben Tomlin BSc MIOA

1 INTRODUCTION

1.1 dBx Acoustics has been appointed by the United Learning Trust to carry out a noise survey and noise impact assessment for the proposed installation of air source heat pumps (ASHP) at Barnsley Academy, Farm Road, Kendray S70 3DL.

1.2 Two different potential locations are under consideration for the ASHPs. This report presents the results of a noise survey carried out at the site, and an assessment of the noise impact from the proposed units based on the two proposed locations.

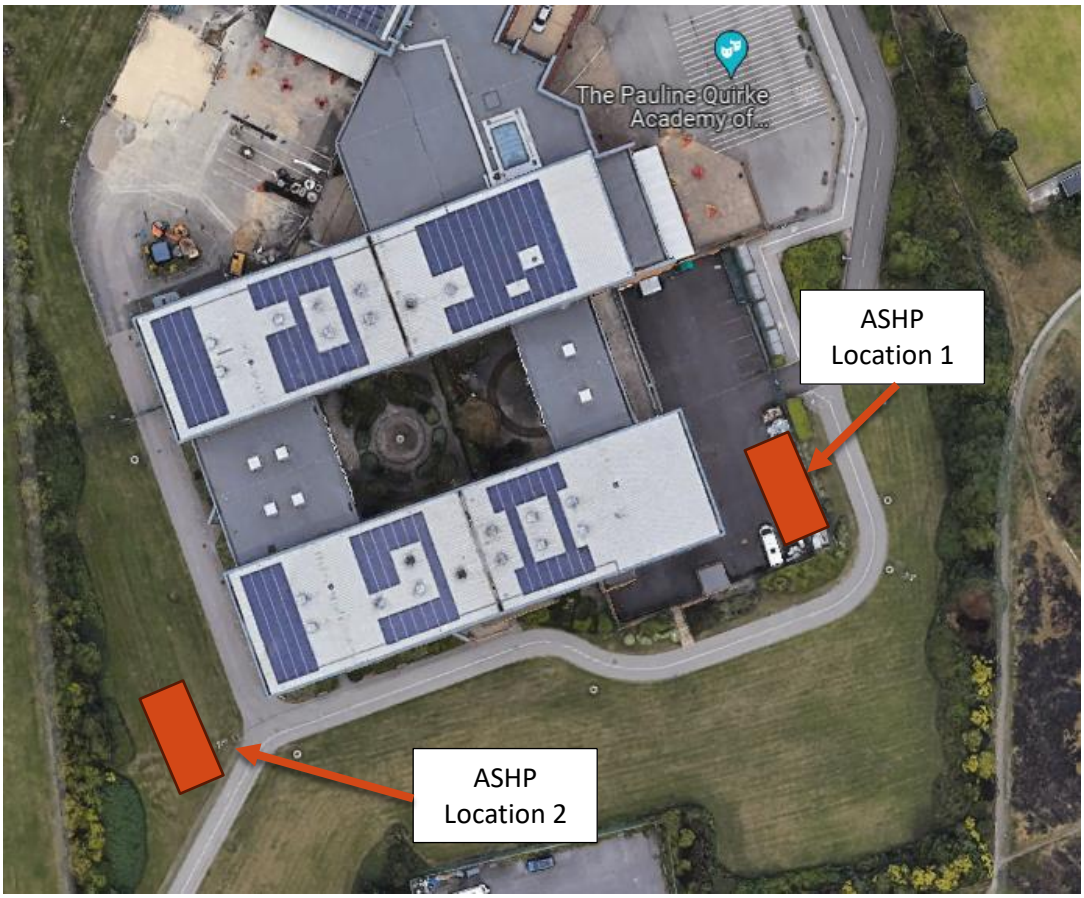
1.3 A glossary of acoustic terminology is provided in Appendix A to assist the reader.

2 DESIGN PROPOSAL

2.1 Three Clade Rowan SN 360/240 ASHPs and two Strebel S-ASX-VP 100 ASHPs are to be installed within a compound to the south east of Barnsley Academy. The location is indicated in Figure 1, below.

2.2 It is understood that five ASHPs will operate from Monday to Friday during the daytime (07:00h-23:00h). One or two Clade Rowan SN 360/240 ASHPs will operate from Monday to Friday during 06:30-07:00h.

Figure 1: Proposed ASHP Location



2.3 The closest noise sensitive receptors (NSRs) are on Monkspring to the south of the Academy, approximately 90m from the proposed ASHP Location 1 and 74m from Location 2.

3 BASIS OF NOISE ASSESSMENT

3.1 The noise impact assessment is based on the following:

- Local Authority requirements;
- BS4142:2014 'Methods for Rating and Assessing Commercial Sound';
- Building Bulletin 93 (BB93).

Local Authority Requirements

3.2 The Site lies within the jurisdiction of Barnsley Metropolitan Borough Council (BMBC).

3.3 BMBC has no standard planning condition with regard to the BS4142 rating level, $dBL_{Ar,Tr}$, for new plant.

3.4 Accordingly, for this project in order for the plant to have a low impact on the nearby noise sensitive receptors (dependent on the context), the intent is that the rating level should not exceed the background sound level.

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

3.5 BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating Level is determined and compared with the existing local Background Sound Level.

3.6 The Rating Level ($dBL_{Ar,Tr}$) is evaluated from the Specific Noise Level by including cumulative corrections to account for factors such as distinguishable tone, impulsivity, intermittency or other readily distinguishable sound characteristics.

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 +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5dB 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.

Building Bulletin (BB93)

3.8 Building Bulletin 93 presents the upper limits for indoor ambient noise levels (IANLs) inside classrooms.

3.9 BB93 recommends a maximum IANL of 45dB$L_{Aeq,T}$ for a naturally ventilated practical teaching space.

4 NOISE SURVEY

Methodology

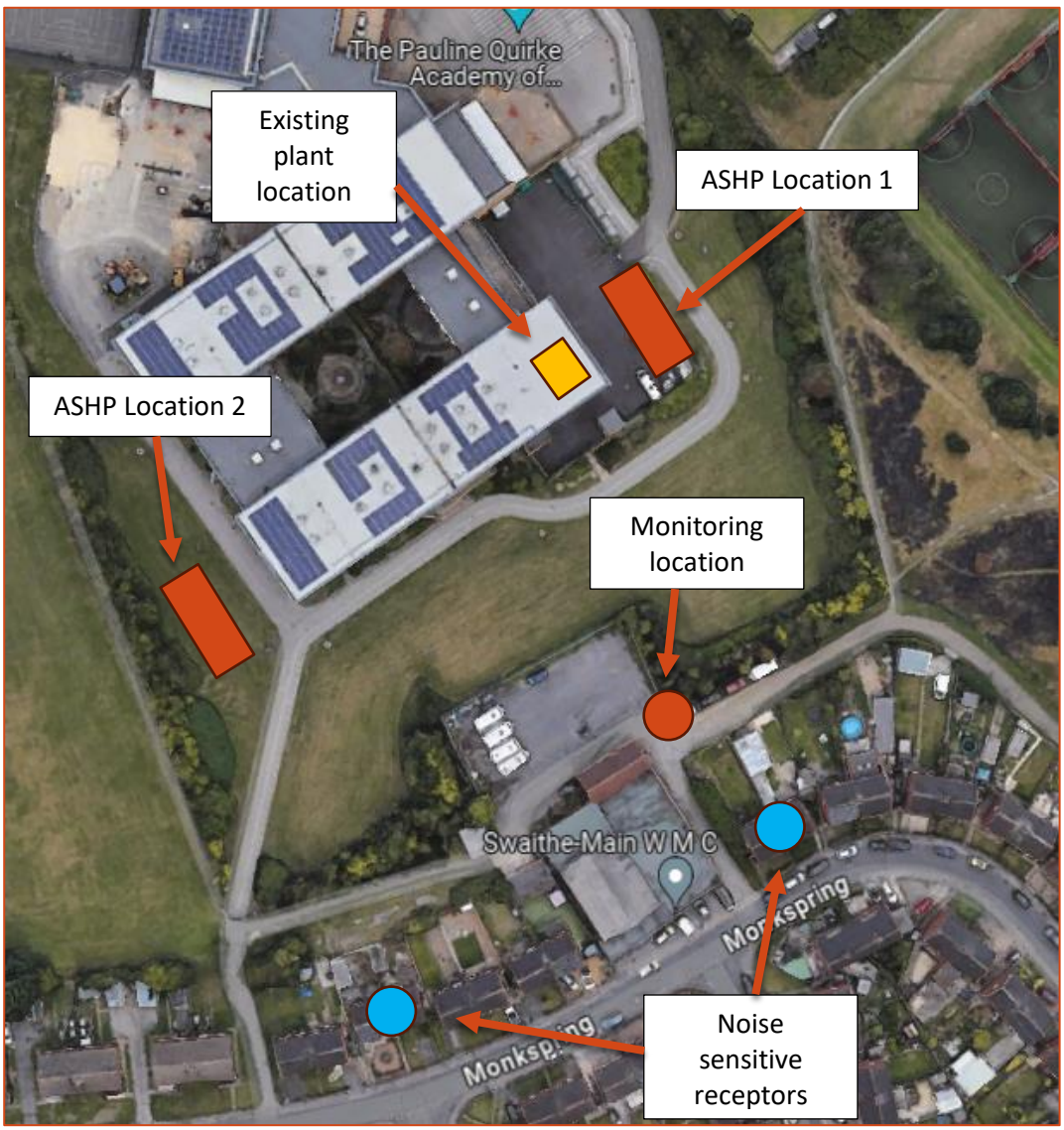
4.1 dBx Acoustics has undertaken noise measurements at the site to establish the existing ambient and background noise levels.

4.2 Long term noise monitoring was undertaken between Friday 26th April and Tuesday 30th April 2024, to measure the typical background noise levels currently experienced by the nearby noise sensitive receptors.

4.3 All measurements were undertaken in accordance with BS 7445-1:*2003 Description and Measurement of Environmental Noise*, with microphones located at approximately 2 metres above the local ground level and at least 3.5 metres away from reflective surfaces other than the ground which can be considered as in free field conditions.

4.4 The measurements were undertaken at the location identified in Figure 2, below. The monitoring location was selected to be representative of the noise climate at the nearby noise sensitive receptors.

Figure 2: Noise Monitoring Location



Noise Sources

4.5 The prevailing noise sources affecting the measurements were road traffic noise from the surrounding road network, with occasional vehicle movements in the Academy car park.

4.6 An existing compressor unit located 55 metres north of the monitoring location was operational but was not noticeable during the daytime period.

Weather Conditions

4.7 Weather conditions during the measurement period were cold to mild (0°C to 9°C) with scattered clouds on Friday 26th and Saturday 27th. Weather conditions were warmer (6°C to 13°C) with scattered clouds on Sunday 28th, with light rain on Sunday morning which is not believed to have affected the measurements.

4.8 Wind speeds were within suitable parameters for the measurement of environmental noise (i.e. generally under 5ms^{-1}). The microphone was protected with a windshield for the duration of the survey.

Equipment

4.9 The equipment used during the environmental noise survey is detailed in Table 1, below.

Table 1: Equipment Used in the Environmental Noise Survey

Equipment	Manufacturer & Part No.	Serial Number	Calibration Date	Certificate Number
Meter	CR:171C	G300656	24/10/2023	201279
Pre-Amp	MV:200F	9136F		
Microphone	MK:224	215619A		
Calibrator	CR:515	87921		06083/3

4.10 The sound level meter was 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 calibrator, which had been calibrated not more than one year prior to the survey.

5 ENVIRONMENTAL NOISE SURVEY RESULTS

5.1 The noise levels measured during the environmental noise survey are summarised in Table 2, below. Full measurement data are available on request.

Table 2: Continuous Noise Monitoring Results

Date	Period	Typical Background Noise Level, $dBL_{A90,T}$
Friday 26th April 2024 to Saturday 27th April 2024	Daytime (14:30h-23:00h)	45
	Night-Time (23:00h-07:00h)	32
Saturday 27th April 2024 to Sunday 28th April 2024	Daytime (07:00h-23:00h)	46
	Night-Time (23:00h-07:00h)	33
Sunday 28th April 2024 to Monday 29th April 2024	Daytime (07:00h-23:00h)	40
	Night-Time (23:00h-07:00h)	34
Monday 29th April 2024 to Tuesday 30th April 2024	Daytime (07:00h-23:00h)	48
	Night-Time (23:00h-07:00h)	33

5.2 The typical background noise levels have been determined using the statistical analysis methodology described in *BS 4142*.

5.3 Appendix B of this report presents a time history graph showing the ambient and background noise levels measured.

5.4 The units will not operate overnight (23:00h-06:30h), but may operate during 06:30h–07:00h, Monday to Friday. The background noise levels measured during Monday 29th April 2024 and Tuesday 30th April 2024 from 06:30h–07:00h were in the order of 45-46$dBL_{A90,15minutes}$.

6 PLANT NOISE EMISSION LIMITS

6.1 In order to mitigate noise impact to the nearest noise sensitive receptors, the intent is that noise from the ASHP installation should be controlled to achieve a BS4142:2014 rating level $L_{Ar,Tr}$ of no higher than the existing background noise level.

6.2 All five ASHPs will operate from Monday to Friday during the daytime (07:00h-23:00h). One or Two Clade Rowan SN 360/240 ASHPs will operate from Monday to Friday during 06:30-07:00h.

6.3 The units are understood to be not operational during the weekends (Saturdays and Sundays).

6.4 Based on the results of the noise survey, and the proposed operational hours, the noise limits to which fixed building services plant should adhere have been determined, and are presented in Table 3.

Table 3: Plant Noise Emission Limits (Monkspring)

Period	Typical Background Noise Level, $dBL_{A90,T}$	Plant Noise Emission Limit ($dBL_{Ar,Tr}$)
Daytime (07:00h-23:00h)	45	45
Night-time (06:30h-07:00h)	45	45

6.5 In order to meet the BB93 indoor ambient noise level limit of $45dBL_{Aeq,T}$ in a naturally ventilated practical teaching space, assuming that windows are open to provide ventilation, noise from the ASHP compound should ideally not exceed $61dBL_{Aeq,T}$ when assessed at the building façade.

7 PROPOSED ASHP UNITS – MANUFACTURER'S NOISE DATA

7.1 Three Clade Rowan SN 360/240 ASHPs and two Strebel S-ASX-VP 100 ASHPs are to be installed.

7.2 For the Clade units, both a standard and low-noise model are available as shown in Figure 3. The low-noise model is proposed for this site.

7.3 The manufacturer's noise data for these units is presented in Figures 3 and 4, below.

Figure 3: Manufacturer's Noise Data, Clade Rowan

Noise Data

	Standard			1D silencers		
Model	Sound Power	Sound Pressure at 1m	Sound Pressure at 10m	Sound Power	Sound Pressure at 1m	Sound Pressure at 10m
Rowan SN 240/160	83.8	64.5	51.4	79.7	60.4	47.2
Rowan SN 360/240	85.6	65.3	52.9	81.5	61.2	48.8
Rowan SN 480/320	86.8	65.8	53.9	82.7	61.7	49.8
Rowan SN 600/400	87.8	66.1	54.7	83.7	62	50.6

Figure 4: Manufacturer's Noise Data, Strebel

Strebel S-ASX-VP Technical Data

Model		60	70	80	90	100
Power supply	V-p-Hz	400 - 3 - 50				
Compressor type		Scroll with Vapour Injection (EVI)				
No. compressors/No. refrigerant circuits	Qty	2/1				
Plant heat exchanger type		Stainless steel brazed plates				
Source heat exchanger		Finned Coil				
Fans		Axial				
No. fans	Qty	3			4	
Hydraulic fittings		2" M				
Operating Weight	kg	725	738	746	898	911
Maximum power input	kW	29.0	34.4	38.6	42.4	47.4
Low Noise Acoustic Setting						
Sound power level	dB(A)	76	77	77	78	78
Sound pressure at 1 metre	dB(A)	59	59	60	60	61
Sound pressure at 5 metres	dB(A)	49	50	50	51	52
Sound pressure at 10 metres	dB(A)	44	45	45	46	47

The acoustic data performances are referred to units operating in heating mode at nominal conditions A7W35.

The sound power level is measured in accordance to ISO 3744 standard.

The sound pressure level is calculated according to ISO 3744 and is referred to a distance of 1/5/10 metres form the external surface of the unit.

8 PLANT NOISE IMPACT ASSESSMENT

Proposed ASHP Location 1

8.1 Calculations have been undertaken to predict the specific sound level arising at the NSRs from the operation of the proposed units based at ASHP Location 1. It has been assumed that the AHSP compound will be an open palisade fence construction.

8.2 The closest NSRs are approximately 90m from the location 1.

8.3 The predicted specific sound level is 40dB$L_{Aeq,T}$ when assessed at the façade of the housing on Monkspring, for all units operating simultaneously ,which represents the worst-case scenario for daytime operation (07:00h-23:00h).

8.4 The predicted specific sound level is 38dB$L_{Aeq,T}$ when assessed at the façade of the housing on Monkspring, for two Clade Rowan low-noise units operating simultaneously which represents a worst-case scenario for night-time operation (06:30h-07:00h).

8.5 This calculation is based on noise levels received at first floor windows which do not benefit from acoustic screening from the close boarded timber garden fences.

8.6 The above predicted specific noise levels are 5dB and 7dB lower than the existing background noise level measured during the daytime and the night-time respectively.

8.7 On this basis, it can be seen that no additional mitigation will be required to meet the requirements of the Local Authority.

8.8 On this basis, a BS4142 assessment is presented for the daytime and night-time operational scenarios in Table 4, below.

Table 4: BS4142 Assessment at Monkspring – ASHP Location 1

Item	Calculation	Relevant Clause	Comments
Measured background sound level - daytime	$45dBL_{A90,\ 1hr}$	8.3	The typical background sound level measured during the daytime period (07:00-23:00h).
Measured background sound level – night-time	$45dBL_{A90,\ 15min}$	8.3	The typical background sound level measured during the night-time period (06:30-07:00h).
Specific sound level - Daytime	$40dBL_{Aeq,\ 1hr}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Specific sound level – Night-time	$38dBL_{Aeq,\ 15min}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Assessment made during the daytime and night-time periods so reference period is 1 hour and 15 minutes respectively		7.2	-
Acoustic Feature Correction	+3dB	9.2	Potential for acoustically distinct characteristics
Rating Level- Daytime	$43dBL_{Ar,\ Tr}$	9.2	The predicted Rating Level during the daytime period.
Rating Level- Night-time	$41dBL_{Ar,\ Tr}$	9.2	The predicted Rating Level during the night-time period.
Excess of Rating Level over background sound level - daytime	-2dB	11	-
Excess of Rating Level over background sound level -night-time	-4dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level does not exceed the measured typical background level. This is an indication of the development having a low impact.
Uncertainty of the assessment	Minor	10	Background sound level based on repeatable measurements. The predicted Rating Level is based on established prediction methodologies.

8.9 The context of the assessment is based on the residential receptors currently being subject to noise from building services associated with Barnsley Academy.

8.10 On this basis, no adverse impact on residential amenity would be anticipated due to the proposed installation of the ASHP units.

External Amenity

8.11 BS 8233: 2014 and the World Health Organisation (WHO) document 'Guidelines for Community Noise: 1999' present guidance for external noise levels within outdoor amenity areas of residential properties to be within 55dB$L_{Aeq,16h}$.

8.12 The predicted noise level within the residential gardens arising from ASHP operation, including a -5dB screening correction for the timber fences, is 35dB$L_{Aeq,T}$.

8.13 As such no adverse effect on external amenity is anticipated, even with a worst case scenario of all ASHPs operating simultaneously.

Academy Façade

8.14 With the proposed ASHP units, the predicted plant noise level at the Academy façade is 58dB$L_{Aeq,T}$.

8.15 In order to meet the BB93 indoor ambient noise level limit of 45dB$L_{Aeq,T}$ in a naturally ventilated practical teaching space, assuming that windows are open to provide ventilation, noise from the ASHP compound should not exceed 61dB$L_{Aeq,T}$ when assessed at the building façade.

8.16 On this basis, no adverse impact on teaching and learning is anticipated as a result of the proposed ASHP installation.

Proposed ASHP Location 2

8.17 Calculations have been undertaken to predict the specific sound level arising at the NSRs from the operation of the proposed units based on ASHP Location 2. It has been assumed that the AHSP compound will be an open palisade fence construction.

8.18 The closest NSRs are approximately 74m from the proposed ASHP location 2.

8.19 The predicted specific sound level is 42dB$L_{Aeq,T}$ when assessed at the façade of the housing on Monkspring, for all units operating simultaneously which represents a worst-case scenario for daytime operation (07:00h-23:00h).

8.20 The predicted specific sound level is 40dB$L_{Aeq,T}$ when assessed at the façade of the housing on Monkspring, for two Clade Rowan low-noise units operating simultaneously which represents a worst-case scenario for night-time operation (06:30h-07:00h).

8.21 This calculation is based on noise levels received at first floor windows which do not benefit from acoustic screening from the close boarded timber garden fences.

8.22 The above predicted specific noise levels is 3dB and 5dB lower than the existing background noise level measured during the daytime and the night-time respectively.

8.23 On this basis, it can be seen that no additional mitigation will be required to meet the requirements of the Local Authority.

8.24 On this basis, a BS4142 assessment is presented for the daytime and night-time operational scenarios in Table 5, below.

Table 5: BS4142 Assessment at Monkspring – ASHP Location 2

Item	Calculation	Relevant Clause	Comments
Measured background sound level - daytime	$45dBL_{A90,\ 1hr}$	8.3	The typical background sound level measured during the daytime period (07:00-23:00h).
Measured background sound level – night-time	$45dBL_{A90,\ 15min}$	8.3	The typical background sound level measured during the night-time period (06:30-07:00h).
Specific sound level - Daytime	$42dBL_{Aeq,\ 1hr}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Specific sound level – Night-time	$40dBL_{Aeq,\ 15min}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Assessment made during the daytime and night-time periods so reference period is 1 hour and 15 minutes respectively		7.2	-
Acoustic Feature Correction	+3dB	9.2	Potential for acoustically distinct characteristics.
Rating Level- Daytime	$45dBL_{Ar,\ Tr}$	9.2	The predicted Rating Level during the daytime period.
Rating Level- Night-time	$43dBL_{Ar,\ Tr}$	9.2	The predicted Rating Level during the night-time period.
Excess of Rating Level over background sound level - daytime	0dB	11	-
Excess of Rating Level over background sound level -night-time	-2dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level does not exceed the measured typical background level. This is an indication of the development having a low impact.
Uncertainty of the assessment	Minor	10	Background sound level based on repeatable measurements. The predicted Rating Level is based on established prediction methodologies.

8.25 The context of the assessment is based on the residential receptors currently being subject to noise from building services associated with Barnsley Academy.

8.26 On this basis, no adverse impact on residential amenity would be anticipated due to the proposed installation of the ASHP units.

External Amenity

8.27 BS 8233: 2014 and the World Health Organisation (WHO) document 'Guidelines for Community Noise: 1999' present guidance for external noise levels within outdoor amenity areas of residential properties to be within 55dB$L_{Aeq,16h}$.

8.28 The predicted noise level within the residential gardens arising from ASHP operation, including a -5dB screening correction for the timber fences, is 39dB$L_{Aeq,T}$.

8.29 As such no adverse effect on external amenity is anticipated, even with a worst case scenario of all ASHPs operating simultaneously.

Academy Façade

8.30 With the proposed ASHP units, the predicted plant noise level at the Academy façade is 58dB$L_{Aeq,T}$.

8.31 In order to meet the BB93 indoor ambient noise level limit of 45dB$L_{Aeq,T}$ in a naturally ventilated practical teaching space, assuming that windows are open to provide ventilation, noise from the ASHP compound should ideally not exceed 61dB$L_{Aeq,T}$ when assessed at the building façade.

8.32 On this basis, no adverse impact on teaching and learning is anticipated as a result of the proposed ASHP installation.

9 CONCLUSION

9.1 dBx Acoustics Ltd has been appointed by United Learning Trust to undertake a noise survey and noise impact assessment for the proposed installation of ASHP units at Barnsley Academy.

9.2 An attended noise survey has been undertaken at the site at a location representative of the nearby noise sensitive receptors.

9.3 Based upon the manufacturers data for the plant intended for the development, an assessment of operational plant noise levels at the nearest sensitive receptors has been undertaken based on Location 1 and Location 2.

9.4 A BS4142:2014 assessment of noise from the proposed plant at the residential receptors have been undertaken which indicates a low likelihood of adverse impact.

9.5 Noise levels arising within the residential gardens due to operation of the ASHP have been assessed. No adverse impact on external amenity is anticipated.

9.6 Noise levels arising at the Academy façade have been assessed. No adverse impact on teaching and learning activity is anticipated.

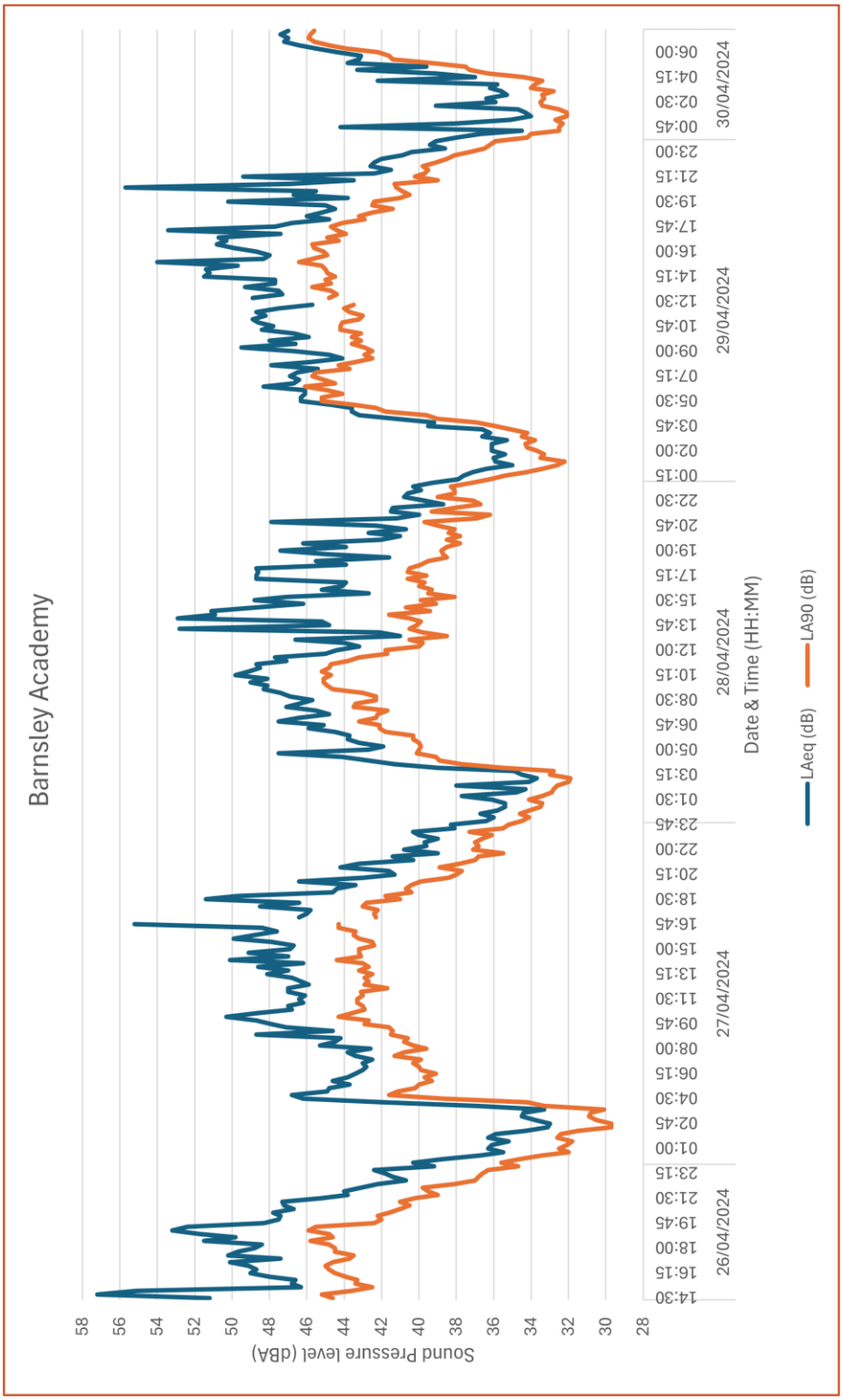
9.7 Taking the above into account, noise should not be a limiting factor in any planning application.

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 (Lp) the reference quantity is 2x10-5 N/m2. The sound pressure level existing when microphone measured pressure is 2x10-5 N/m2 is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
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.
$L_{eq,T}$	Equivalent continuous level of 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.
$L_{Aeq,T}$	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.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
L_{Fmax}	The instantaneous maximum sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
L_{AFmax}	The instantaneous maximum A weighted sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
$L_{Ar,Tr}$	The rating level: the equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor *T,* often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example, a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
STI	**Speech Transmission Index**, Metric ranging between 0 and 1 representing the transmission quality of speech with respect to intelligibility by a speech transmission channel
R	**Sound Reduction Index,** the laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
R_w	**Weighted Sound Reduction Index**, a single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
D_w	**Weighted Level Difference**, the weighted level difference between a pair of rooms, stated as a single figure.

D_{nT}	**Standardised Level Difference,** a frequency-dependent measurement of airborne sound insulation, calculated using the following formula: $D_{nT} = L_1 - L_2 + 10\log(T/T0)$ dB Where: L_1 is the energy-averaged sound pressure level due to the pink noise source measured in the source room using a sweep technique. L_2 is the energy-averaged sound pressure level measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (= 0.5s for dwellings).
$D_{nT,w}$	**Weighted Standardised Level Difference,** a single-figure value of airborne sound insulation performance, derived according to procedures in BS EN ISO 717-1, based on the D_{nT} values at different frequencies (100-3150 Hz third octave bands).
$D_{n,F,w}$	**Weighted, Normalised Flanking Level Difference,** the normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
D_{ne}	**Normalised Element Level Difference**. The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
$D_{n,e,w}$	**Weighted, Normalised Element Level Difference**. The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	**Spectrum Adaptation Term** , a correction term applied to the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$) in accordance with BS EN ISO 717-1. Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking or moving furniture on a floor structure.
L_{nT}	**Standardised Impact Sound Pressure Level,** a frequency dependent measurement of impact sound insulation, calculated using the following formula: $L_{nT} = L_1 + 10\log(T/T0)$ dB Where: L1 is the mean sound pressure level due to the tapping machine measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T30 measured in seconds). T_o is the reference reverberation time (0.5s for dwellings)
$L'_{nT,w}$	**Weighted Standardised Impact Sound Pressure Level,** a single-figure value (@ 500 Hz) of impact sound insulation, performance, derived according to BS EN ISO 717-2, based on the L_{nT} values at different frequencies (100Hz- 3150 Hz third octave bands).
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
NR	The **Noise Rating level**. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.

APPENDIX B – TIME HISTORY GRAPH



24040-R02B-JT Barnsley Academy ASHP Assessment

Final Audit Report 2024-07-18

Created:	2024-07-18
By:	Ben Tomlin (ben@dbxacoustics.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAzFC2RLMK2Hh--Rj6xgomtE1xeU-RGfgd

"24040-R02B-JT Barnsley Academy ASHP Assessment" History

Document created by Ben Tomlin (ben@dbxacoustics.com)
2024-07-18 - 9:34:54 AM GMT

Document emailed to joseph@dbxacoustics.com for signature
2024-07-18 - 9:35:16 AM GMT

Email viewed by joseph@dbxacoustics.com
2024-07-18 - 9:39:31 AM GMT

Signer joseph@dbxacoustics.com entered name at signing as Joseph Tony
2024-07-18 - 9:45:07 AM GMT

Document e-signed by Joseph Tony (joseph@dbxacoustics.com)
Signature Date: 2024-07-18 - 9:45:09 AM GMT - Time Source: server

Agreement completed.
2024-07-18 - 9:45:09 AM GMT