

Plantation School

Noise Impact Assessment of New Roof Top Plant

Prepared by:	Paul Knowles (MIOA)
Checked by:	Warren King (MIOA)

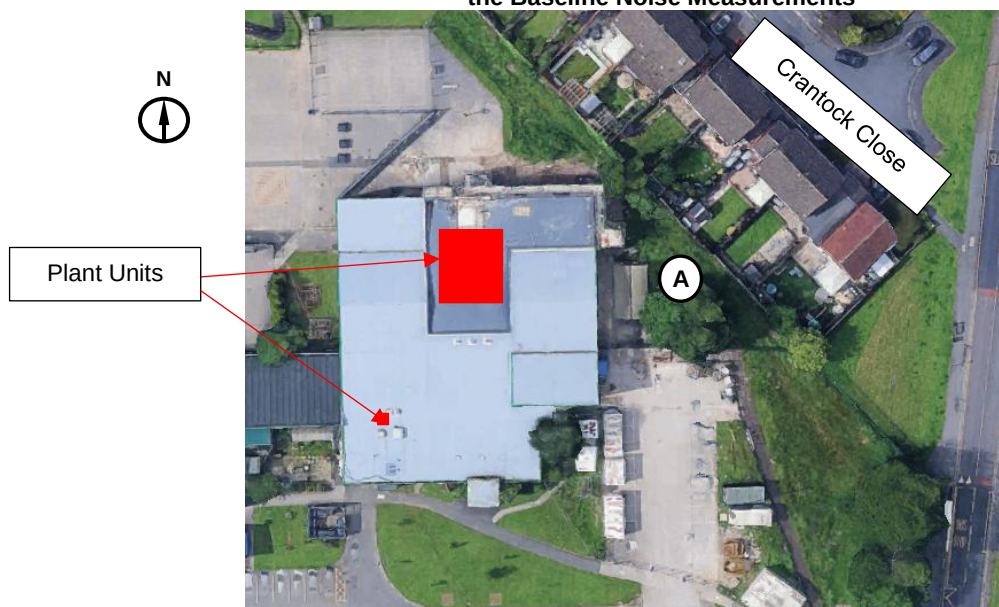
1.0 Introduction and Site Description

- 1.1 Acoustic and Engineering Consultants Ltd (AEC) has been appointed by Knowsley Council, to assess the potential impact of noise emitted by the new roof top plant serving the refurbished school, on nearby residential properties.
- 1.2 This report presents the background noise levels measured on-site, relevant guidance and Local Authority requirements, sets a noise level limit to be achieved by the plant, and assesses the proposed plant.
- 1.3 Acoustic terminology is discussed in brief in Appendix A.

Site Description

- 1.4 The nearest noise sensitive receptors are located on Crantock Close, to the north east, and are presented in Figure 1.1, below.

Figure 1.1 – Site Plan showing Location of the new Plant, the Nearest Noise Sensitive Receptors and the Baseline Noise Measurements



Imagery @2025 Google, Imagery @2025 Infoterra Ltd & Bluesky, Maxar Technologies, The Geoinformation Group, Map Data @2025

2.0 Criteria

- 2.1 Noise from external plant is assessed using guidance presented in BS4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*' (BS4142). BS4142 describes methods for rating and assessing industrial and commercial sound by comparing the calculated 'rating level' from the plant against the existing baseline background sound level, as assessed at the nearest noise sensitive receptor(s).
- 2.2 A 'rating level' ($dB_{Ar,Tr}$) is obtained by applying a character correction to the 'specific noise level' ($dB_{Aeq,Tr}$) of a noise source (e.g. extract system). The correction is applied if the noise has a defined acoustic character such as being tonal, impulsive, distinctive or intermittent in nature.
- 2.3 The magnitude of the correction is dependent on the character of the noise source and its level of perceptibility at the receiver. A correction of between 0 to +6dB and 0 to +9dB can be applied if the noise source is tonal or impulsive, respectively. Where the specific sound has characteristics, which are neither tonal nor impulsive but are distinctive against the residual sound climate or if the specific sound is intermittent in nature, a +3dB penalty can be applied.
- 2.4 When assessing the potential noise impacts, 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 or a significant adverse impact. This relationship is presented in Figure 2.1, below.
- 2.5 With regard to undertaking the assessment, BS4142 indicates that the context of the sound must be taken into consideration.

Figure 2.1 – Assessment of the Impacts

Scale	Magnitude of Rating Level over Background Noise Level, dB	BS4142 Comments*
	> 10dB	The greater this difference, the greater the magnitude of the significant adverse impact.
	10dB	Likely to be an indication of a significant adverse impact.
	5dB	Likely to be an indication of an adverse impact.
	0dB	Indication of a low impact.
	< 0dB	The lower the rating is below background, the greater the indication of a low impact.

***Please note that these are all dependent on the context of the site and noise source(s).**

- 2.6 In addition to the above, BS4142 also states that where background noise levels are low, absolute noise levels may be as or more relevant than the difference between the rating level and background sound level

3.0 Existing Noise Climate and Assessment of Roof Top Plant

Baseline Noise Levels

- 3.1 An attended noise level survey was undertaken by AEC between 0830h and 0900h on Friday 9th May 2025 at a location representative of the houses on Crantock Close, identified as A on Figure 1.1, above.
- 3.2 All measurements were undertaken under free-field conditions and in general accordance with BS7445-1: 2003 'Description and measurement of environmental noise. Guide to quantities and procedures'. A full measurement procedure for the survey is presented in Table B.1 of Appendix B.
- 3.3 During the noise survey, the ambient and background noise levels due to sources not associated with the school were around 45dBL_{Aeq,T} and 39dBL_{A90,T}. The noise climate during the measurement period was due to distant road traffic.

Assessment of Roof Top Plant

- 3.4 There are four items of plant which have been installed on the roof. Three heat recovery units (HRU) and a kitchen extract fan. All of the items of plant have been installed and were operating during the noise survey. Measurements were undertaken at 1m from each item of plant, with the exception of the kitchen extract fan which was measured at a distance of 8m.
- 3.5 The measured noise levels are presented in Table 3.1, below. For simplicity, the levels corrected to 5m have also been included in the table.

Table 3.1 – Measured Plant Noise Levels

Unit	Sound Pressure Level, dB	Distance from Source	Corrected to 5m, dB
HRU/01 Hall	52	1	38
HRU/02 Toilets	61	1	47
HRU/03 Dance/Music	51	1	37
Kitchen Extract	66	8	70

- 3.6 There is direct line of sight between all items of plant and a property on Crantock Close, with the exception of the kitchen extract fan which is screened by the pitch of the roof.
- 3.7 The resultant specific noise level has been determined external to the properties on Crantock Close, based on distance attenuation and screening where appropriate. The calculation is presented in Table 3.2, below.

Table 3.2 – Resultant Specific Noise Level external to Crantock Close

Unit	Sound Pressure Level, dB at 5m	Distance		Screening Attenuation, dB	Resultant Specific Noise Level, dBL _{Aeq,T}
		m	Attenuation, dB		
HRU/01 Hall	38	25	-14	0	24
HRU/02 Toilets	47	20	-12	0	35
HRU/03 Dance/Music	37	25	-14	0	23
Kitchen Extract	66	65	-23	-10	37
Total Specific Noise Level					39

- 3.8 A daytime BS4142 assessment of plant noise is presented in Table 3.3. The assessment is based on a 1-hour period, in accordance BS4142.
- 3.9 It is understood that the HRUs only operate during typical school hours (0900-1530h), while the kitchen extract only operates during the lunch hour. Therefore, the BS4142 assessment should be considered a worst-case assessment.

**Table 3.3 – BS4142 Assessment of Delivery Noise Levels,
Daytime – (1hr. Assessment Period)**

Details	Level	Commentary
Measured Ambient Sound Level, $L_{Aeq,T}$	$L_{Aeq} = 45\text{dB}$	Specific sound source not operating.
Measured Background Sound Level, L_{A90}	$L_{A90 (1h)} = 39\text{dB}$	Specific sound source not operating.
Specific Sound Level	$L_{Aeq (1h)} = 39\text{dB}$	Calculated based all the plant operating simultaneously.
Acoustic feature correction	+3dB	+3dB acoustic character correction as the noise from the plant is distinctive.
Rating Level, $L_{Ar,Tr}$	$(39 + 3) \text{ dB} = 42\text{dB}$	
Excess of rating over background sound level	$(42 - 39) \text{ dB} = 3\text{dB}$	Assessment indicates that where the rating level exceeds the background by 3dB this is an indication of a low adverse impact.
Uncertainty of the assessment	Not significant	The measurements of the baseline noise levels excluded school activities and are representative of the noise climate in the area.

- 3.10 The above assessment indicates that the rating noise during the worst-case 1 hour period when all items of plant are operating, the rating noise level would be 3dB above background. Which indicates a low adverse impact.
- 3.11 However, during the school hours when the kitchen extract fan is not operating, noise from the plant would be 3dB lower and would not exceed the background noise level even with a character correction, indicating a low impact. In addition, the ambient and background noise levels were measured without any contribution from school activities. During the lunch hour when the kitchen extract fan is operating, children would be outside playing and the ambient and background noise levels would be higher than those reported.
- 3.12 Further to the above assessment of noise levels, BS4142 indicates that the context of the noise levels should be taken into consideration. Noise from the operation of all of the plant units is not continuous throughout the day and results in a low adverse impact for 1 hour a day when the school is in use. It should therefore not be assessed in the same way as an industrial unit which could operate continuously throughout the day.

WHO and BS8233: 2014

- 3.13 Table 4.1 of the World Health Organisation (WHO) '*Guidelines for Community Noise*', 1999 (WHO Guidelines) provides internal and external noise levels for specific environments that indicate the thresholds for onset of moderate and serious annoyance for the daytime period.
- 3.14 The WHO guidelines assume that the attenuation of external to internal noise levels provided by a window partially open for ventilation is -15dB.
- 3.15 The guidelines were translated into UK practice through BS8233:1999 which has since been superseded by BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS8233) describes which provides guideline values for internal ambient noise levels for dwellings.

- 3.16 In addition, BS8233 states that for traditional areas that are used as an amenity space, such as gardens and patios, it is desirable that ambient noise levels do not exceed 50dBL_{Aeq,16h} during the daytime, with an upper limit of 55dBL_{Aeq,16h}.
- 3.17 A summary of the recommended internal and external noise levels is shown in the following Table 3.4.

Table 3.4 – Recommended Daytime Noise Levels

Location	Daytime (0700 – 2300h) dBL_{Aeq, 16h}
Indoor - Living Room (Resting)	35
Indoor - Dining Room/Area	40
Bedroom (Daytime resting)	35
Outdoor living area (Limit to avoid serious annoyance, daytime and evening)	55
Outdoor living area (Limit to avoid moderate annoyance, daytime and evening)	50

- 3.18 The recommended criteria would generally apply to external noise as it affects the internal acoustic environment and should relate to noise levels within the space during normal hours of occupation.
- 3.19 Based on the worst case predicted external noise level of 39dBA, and assuming that a partially open window provides -15dB attenuation from outside to inside, the resultant internal noise level would be 24dBA.
- 3.20 The predicted noise levels associated with the use of the proposed development are significantly below the recommended internal and external noise levels for the daytime period in accordance with the guidance provided in BS8233.
- 3.21 Therefore, based on the above, it is considered that noise from the new roof top plant would result in a low adverse impact when there was no noise from school activities.

APPENDIX A – Acoustic Terminology in Brief

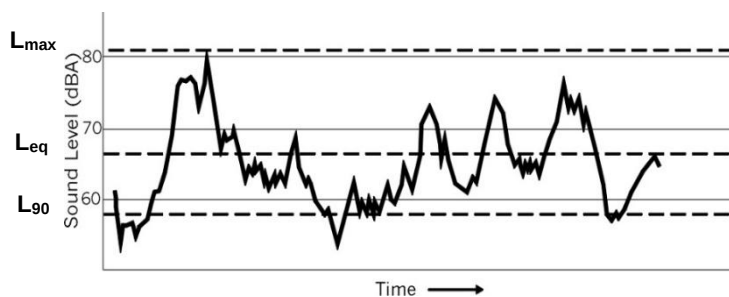
General

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (Hz), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most noise is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The dBA weighting emphasizes or reduces the importance of certain frequencies within the audible range

Sound / Noise Units

The figure below shows an example of sound level varying with time. Because of this variation over time the same period of noise can be described by several different levels. The most common of these are described below.



Commonly Used Descriptors for Sound / Noise

$L_{Amax,F/S}$	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.
$L_{Aeq,T}$	The equivalent continuous (A-weighted) sound level. It may be thought of as the "average" sound level over a given time, T. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises. It can be considered as the "ambient" noise level.
$L_{A90,T}$	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe the "background" noise.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
Ambient Sound Level, $L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level, L_{A90}	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.
Rating Level, $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound
Residual Sound, $L_{Aeq,T}$	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.
Specific Sound Level, $L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, r.

APPENDIX B – Noise Survey Details

Table B.1 – Environmental Measurement Procedure

Date & Time of Survey:	0830h to 0900h on Friday 9 th May 2025.					
Personnel:	Paul Knowles (AEC).					
Equipment Used:	B&K 2260 Real Time Analyser (AEC Kit 2).					
Calibration:	The sound level analyser, which conforms to BS EN 61672-1: 2013 ' <i>Electroacoustics – Sound level meters - Part 1 Specifications</i> ' for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.					
Weather Conditions:	Date	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	09.05.25	Day	Dry	15°C	N and 2m/s	0%
Measurement Locations:	Measurements were undertaken at a single location Identified as A on Figure 1.1 and described below. A – On the grass 3m from the fence of 12 Crantock Lane.					
Measurement Details:	Measurements were undertaken under free-field conditions over various periods in terms of L_{eq} , L_{90} , and L_{max} .					
Measured Data:	Full octave band centre frequency data was obtained for all measurements.					