Uppingham School

Plant Noise Assessment

Report 28AE.RP.1.1 // 29 January 2024

prepared for

Uppingham School
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Contents

1.0 Introduction

1.1 A new boarding house is proposed at Uppingham School, Oakham. As part of these works, a noise assessment for the proposed plant equipment to service the building is required.

1.2 A noise survey has been undertaken on site to determine the existing noise climate at the nearest noise sensitive receptors. The survey results have been used to set plant noise limits in line with the relevant standards.

1.3 This report details an assessment of noise emissions from the proposed plant strategy to the nearest noise sensitive receptors.

2.0 Site Description

2.1 The site is found at the Meadhurst School House associated with Uppingham School at 11 Ayston Road, Uppingham, Oakham LE15 9RL. The site and its surrounds can be seen on the image below with the approximate building footprint shown.

Aerial photo showing the site and proposed new building position

Proposed Student Accomodation Footprint

Image courtesy of Google Maps

2.2 Residential property is located on Johnson Road (not pictured above) to the west and on Ayston Road to the east. bounding the site to the north and south are further grounds associated with the Meadhurst site.

2.3 Ayston Road is the main road in and out of Uppingham and runs along the eastern border of the site.

2.4 The site is within the jurisdiction of Rutland County Council (RCC).

3.0 Planning Context

3.1 The relevant national planning policy and guidance is set out within **Appendix B** of this document, the key principle being to ensure that the proposed development does not give rise to significant adverse noise effects.

3.2 Rutland County Council have requested that a noise impact assessment be undertaken to support the planning application.

3.3 As the services scheme is to serve a residential premises, it will not operate on any strict schedule, and instead is expected to be used on an ad-hoc basis. In light of this, a 24-hour night time plant noise limit will apply.

3.4 When considering noise emissions from plant, it is normal to follow guidance within BS 4142:2014 + A1:2019[1]. The document describes how to assess the noise impact on existing dwellings as a result of any new mechanical services associated with the proposed document. It has been drawn from as appropriate to inform this assessment.

3.5 BS 4142 sets out that the rating level, $L_{A,Tr}$ is determined by considering the noise emissions from a plant item and adjusting the specific level to account for the acoustic characteristics of the noise. Acoustic feature corrections can be made to account for the tonality, impulsivity, intermittency and other characteristics present in the resultant sound at the assessment position. The magnitude or appropriateness of any correction will depend both on the type of noise source and the context in which it is perceived.

3.6 The higher the excess of rating level over background noise level, the greater the likelihood of an adverse noise impact. BS 4142:2014 gives the following guidance:

> *'Typically, the greater this difference, the greater the magnitude of the impact.*
>
> *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'*

3.7 In the case of mechanical services noise, this is a constant noise source operating for much of the day and night, and also inherently amenable to noise control. We would therefore typically recommend that plant noise at existing residences should be designed to a rating level 5 dB below the existing representative L_{A90} background noise levels recorded during the relevant time period.

3.8 Section 11(1) of BS 4142 states however:

[1] BS 4142:2014 + A1:2019 – Methods for rating and assessing industrial and commercial sound

'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.'

3.9 Considering this point, we would recommend a plant noise emission limit of 30 dB(A), so as to set a pragmatic and achievable limit. This limit should apply 1 metre from the facade of any affected residential building.

3.10 The resultant noise at the assessment position should not have any tonal or intermittent character that would otherwise attract attention to it.

3.11 To put the recommended limit of 30 dB(A) in context, allowing for a typical loss of 13 dB(A) from a partially open window would result in noise levels below 20 dB(A) inside any residences exposed to this level of external plant noise.

3.12 Internal noise levels below 20 dB(A) are more than 10 dB(A) below the guideline internal noise level of 30 dB $L_{Aeq,8h}$ suggested in BS8233:2014 as being appropriate or bedrooms to provide suitable conditions for sleeping.

3.13 With regard to noise from fixed mechanical services installation and in light of the above, we will set background noise limits to 5 dB below the measured representative background noise levels or where low, as described in **section 3.9**, set the background noise limit to 30dB(A). It is deemed that this will allow for a robust assessment and ensure that adverse impacts at the nearest noise sensitive receptors are not experienced as a result of the introduction of the scheme's mechanical services installation.

3.14 Full details of the BS 4142:2014 + A1:2019 methodology can be found in **Appendix B** at the end of this document.

4.0 Noise Survey

4.1 A noise survey was undertaken at the site at two positions (denoted as 'MP1' and 'MP2' on the image overleaf). Measurements were undertaken at position MP1 between 1345 on Monday 6th November and 0400 on Wednesday 8th November and at MP2 between 1345 on Monday 6th November and 2230 on Wednesday 8th November 2023.

4.2 Noise measurements were taken at two locations chosen to be representative of noise sensitive receivers most affected by the proposed plant items. These positions were occupied by unattended noise loggers running throughout the survey duration.

Aerial photo showing noise measurement positions (MP)

Proposed Student Accomodation Footprint

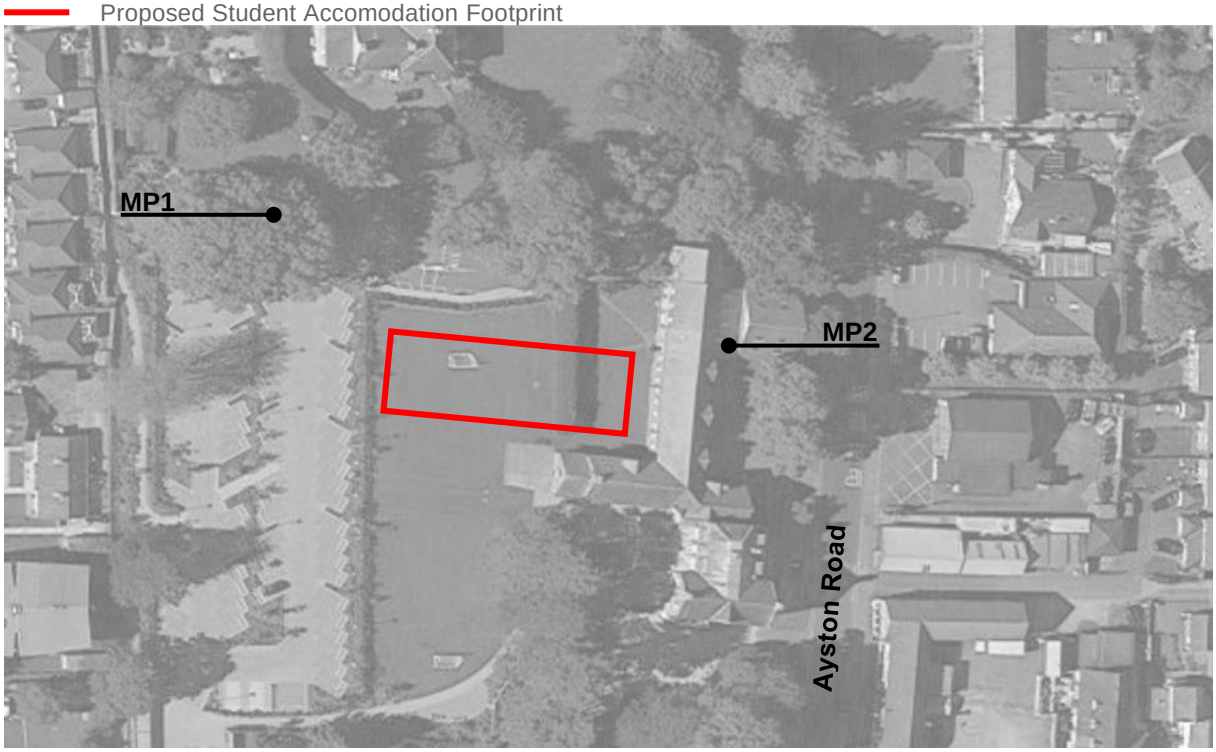


Image courtesy of Google Maps

4.3 The microphone at MP1 was located at roughly 2 m above local ground level to the northern edge of the rear car park, in a free field position. The microphone at MP2 was located on a flat roof overlooking the front car park at roughly 1.5 m above first floor level, in a free field position. These positions are described in more detail in **Appendix A** of this document.

4.4 The time history graphs illustrating the noise levels measured at positions MP1 and MP2 over the duration of the noise survey can be seen in **Appendix A** at the end of this document.

4.5 The representative background noise levels[2] captured over the full 24-hour period (understood to be the period in which the plant is to be operational) have been set out in **Table 1**.

Table 1 Representative measured background noise levels

Location	**Representative Measured Background Noise Level, $L_{A90,T}$ dB**
	Operating Period (24-hours)
MP1 – Rear of site	37
MP2 – Front of site	31

4.6 The existing noise climate at MP1 was controlled by road traffic noise from local and distant roads. At MP2 the existing noise climate was controlled by existing plant and road traffic noise from Ayston Road.

[2] Typical L_{A90} background noise levels quoted at the highest single values where the cumulative total of $L_{A90,15min}$ values in the relevant time period equals ≤ 25%.

Plant Noise Limits

4.7 Based on the guidance set out within **section 3.0** BS 4142:2014+A1:2019 (included within **Appendix B**), the plant noise emission limits (in terms of rating levels) to apply at the nearest noise sensitive receptors have been set out in the following table.

Table 2 Plant noise emission limits

Location	**Noise Emission Limit, $L_{Ar,Tr}$ dB**
	Operating Period (24-hours)
AP1 – Residence on Johnson Road, 1st floor window	32
AP2 – Residence on Ayston Road, ground floor bungalow window	30

4.8 These limits are to apply to all plant items running simultaneously at full design duty across the full 24-hour period and are to apply at 1 metre from the outside of the nearest noise sensitive receptors to the proposed plant.

4.9 Any plant with a tonal component or other distinctive feature out of character with the existing environment would be subject to a further penalty.

5.0 Plant Noise Assessment

Proposed Installation

5.1 **Table 3** outlines the proposed plant items to be installed.

Table 3 Proposed mechanical plant installation

Item	**Reference Code**	**Manufacturer**	**Type**
Air Handling Unit	AHU 01	*Swegon*	Global F RX
Air Source Heat Pumps	ASHP 01	*Mitsubishi*	CAHV
	ASHP 02	*Mitsubishi*	CAHV
	ASHP 03	*Mitsubishi*	CAHV
	ASHP 04	*Mitsubishi*	QAHV
	ASHP 05	*Mitsubishi*	QAHV
Substation	SUB 01	*Schneider Electric*	500 KvA
Hybrid Ventilation Unit	HVU01	*Monodraught*	HVR Zero x+
	HVU02	*Monodraught*	HVR Zero x+
	HVU03	*Monodraught*	HVR Zero x+
	HVU04	*Monodraught*	HVR Zero x+
	HVU05	*Monodraught*	HVR Zero x+

5.2 All units are expected to have the potential to run 24-hours daily.

5.3 The unit positions have been taken from *Max Fordham* mechanical services drawings and the *Livingston Eyre Associates* Drawing 4403-LEA-00-00-DR-L-1001 (dated: 26/01/2024).

Assessment Methodology

5.4 The assessment has been based on manufacturer's noise data for each plant item.

5.5 On the basis that the plant items are serving the proposed boarding house it is reasonable that the assessment should be undertaken to the nearest noise sensitive windows not affiliated with the new boarding house.

5.6 Noise emissions from the proposed plant installation have been considered to the nearest noise sensitive receivers, as described below and shown in the following image.

- AP1: Closest residential window on Johnson Road facing east towards the site;
- AP2: Closest residential window on Ayston Road facing west towards the site.

Aerial photo showing noise measurement (MP) and assessment positions (AP)

Proposed Student Accomodation Footprint

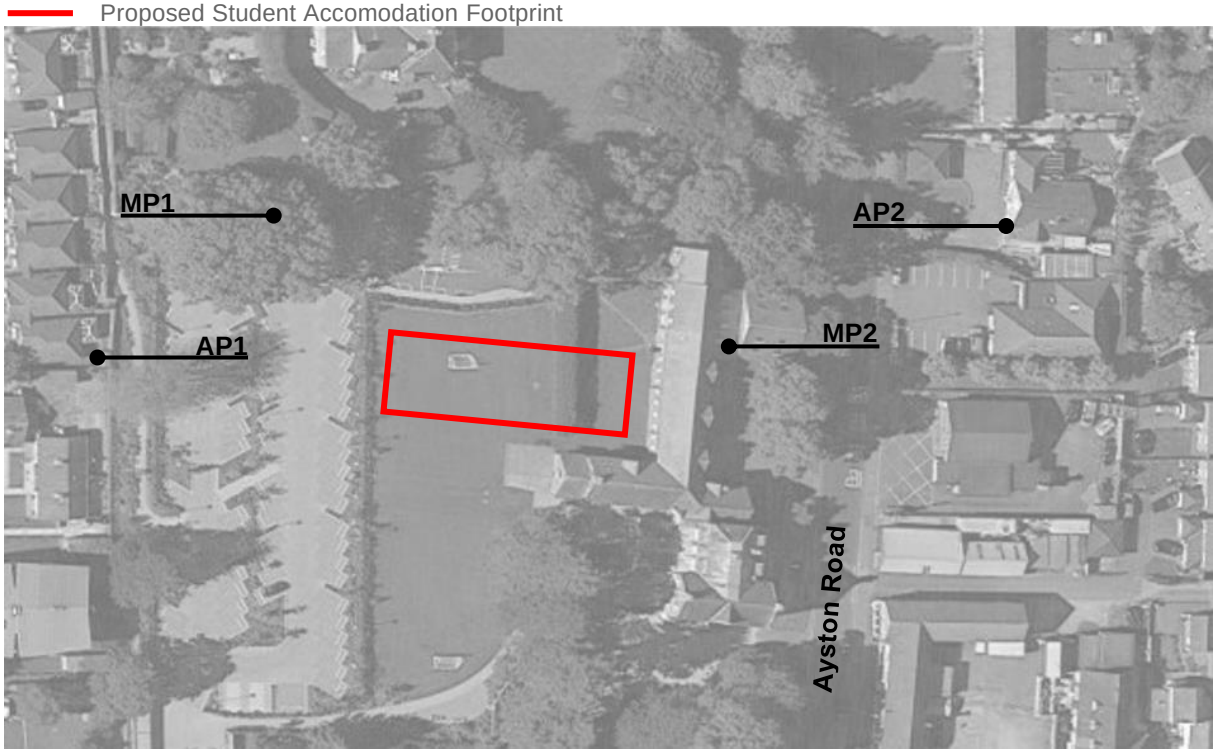


Image courtesy of Google Maps

5.7 Levels of plant noise have been calculated at the assessment positions by correcting for radiation, screening and distance losses where appropriate. Calculation sheets are not included for the sake of brevity but can be provided upon request.

Mitigation Measures

5.8 It is recommended that mitigation is installed to AHU01 and all ASHP for the scheme. The acoustic performance of these should meet the insertion losses outlined in **Table 4** in each octave band as a minimum.

5.9 The exhaust and fresh air intake ducts of the roof mounted AHU 01 are to be fitted with silencers provided by the manufacturer. These have been taken into account within the assessment and are set out within **Table 4** for reference.

5.10 The mitigation required for the ASHPs should take the form of a barrier and acoustic enclosures surrounding the units, with their atmospheric terminations being attenuated by an acoustic louvre (expected to be a 300 mm deep high attenuation acoustic louvre).

5.11 The barrier will surround the proposed ASHP plant area. The barrier is of a solid masonry construction with no gaps or holes within the section of the barrier facing the residences to the west. It is proposed that the barrier is 2.85m in height.

5.12 The enclosure in its entirety (including the termination louvre) should meet the minimum insertion loss requirements set out within **Table 4** below.

Table 4 Required insertion losses for atmospheric side in-duct attenuators

Attenuator reference	**Location**	**Minimum Required Insertion Loss (dB) at Octave Band Centre Frequency (Hz)**							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
ATT-AHU01	AHU 01 *Exhaust duct* *Fresh air intake duct*	7	15	24	39	45	40	23	17
ATT-ASHP	ASHP *Acoustic enclosures*	5	7	10	12	14	16	13	12

5.13 The insertion losses outlined in **Table 4** are to be met in each octave band. Any attenuator manufacturer should be able to provide evidence that these insertion losses can be met.

5.14 In-duct attenuators should be mounted internally, as close to the fans as possible to avoid break out noise from the attenuator casing or ducting.

5.15 All plant items should be mounted on anti-vibration mounts and fans should have flexible ductwork to control structure-borne sound transmission.

Results

5.16 With the above barrier and mitigation measures in place, the following plant noise levels are predicted at the nearest noise sensitive receivers.

Table 5 Noise emission levels at the nearest noise sensitive receivers

Location	**Assessed Rating Noise Level, $L_{Ar,Tr}$ dB (Limit)**
	Open Period (0600-2200)
AP1 – Residence on Johnson Road	28 (32)
AP2 – Residence on Ayston Road	24 (30)

6.0 Conclusions

6.1 A new boarding house is proposed at Uppingham School, Oakham. As part of these works, a noise assessment for the proposed plant equipment to service the building is required.

6.2 An unattended noise survey was undertaken at the site in order to set noise emission limits for the proposed scheme. An assessment of noise emissions has concluded that mitigation in the form of in-duct attenuators, provided by the manufacturer, and enclosures are required.

6.3 With the specified mitigation measures in place, plant noise limits set in line with BS 4142:2014+A1:2019 will be met at the nearest noise sensitive receivers.

Appendix A: Noise Survey

Details and results of the environmental noise survey

A noise survey was undertaken at the site at two positions (denoted as 'MP1' and 'MP2' on the image overleaf). Measurements were undertaken at position MP1 between 1345 on Monday 6th November and 0400 on Wednesday 8th November and at MP2 between 1345 on Monday 6th November and 2230 on Wednesday 8th November 2023. The meters had been left on site for an extended period and ran until the batteries were depleted.

Noise measurements were taken at two locations chosen to be representative of noise sensitive receivers most affected by the proposed plant items. These positions were occupied by unattended noise loggers running throughout the survey duration.

Aerial photo showing noise measurement positions (MP)

Proposed Student Accomodation Footprint

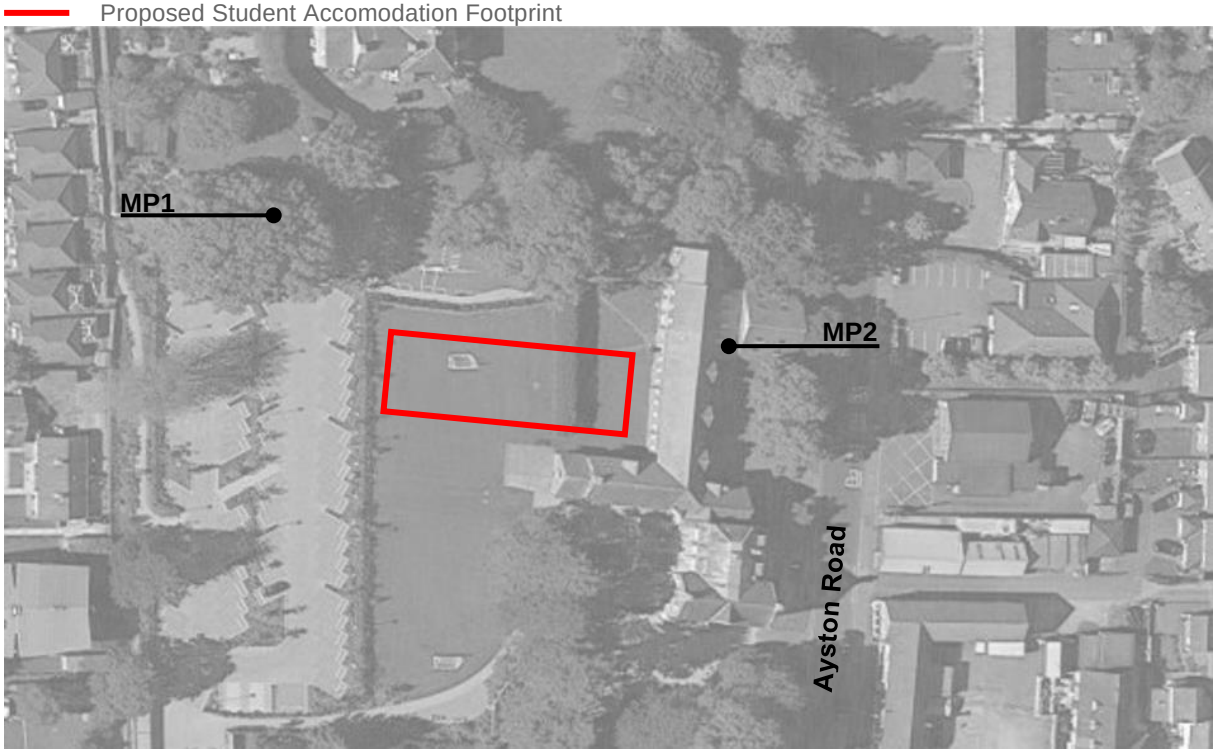


Image courtesy of Google Maps

Measurements of the L_{Aeq}, L_{Amax} and L_{A90} indices were recorded over consecutive 15-minute periods for the duration of the survey. A detailed summary of measurement positions MP1 and MP2 is set out in the table overleaf.

Measurement location

Location	Detail
MP1	Microphone at roughly 2 m above local ground to the northern edge of the rear car park, in a free field position. Measurements were unattended. The existing noise climate was controlled by distant road traffic.
MP2	Microphone on a flat roof overlooking the front carpark at roughly 1.5 m above first floor level, in a free field position. Measurements were unattended. The existing noise climate was controlled by local plant and road traffic on Ayston Road to the east.

Noise measurements were made using the equipment set out within the following table. The sound level meters were fitted within weatherproof enclosures and the meters were calibrated both before and after the survey in to confirm an acceptable level of accuracy. No significant drift was noted to have occurred.

Measurement equipment

Location	Item	Detail
MP1	Sound level analyser	*Norsonic* 140
	Outdoor microphone kit	*Norsonic* 1255
	Acoustic calibrator	*Norsonic* 1216
MP2	Sound level analyser	*Svantek* 971A
	Outdoor microphone kit	*Svantek* SA 271A
	Acoustic calibrator	*Svantek* SV33B

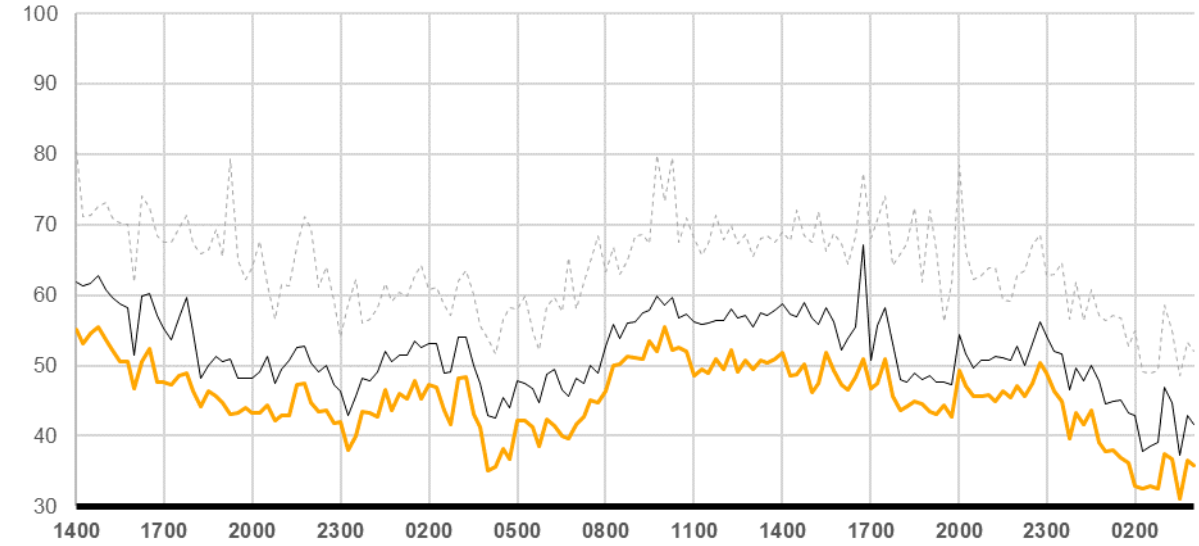
The weather conditions when setting up and collecting the noise survey equipment were overcast and cool with a light breeze with dry roads. Historical weather data[3] shows that suitable weather conditions prevailed throughout the survey period.

The time history graphs overleaf present the measured noise levels at positions MP1 and MP2 throughout the survey duration.

[3] https://www.wunderground.com/

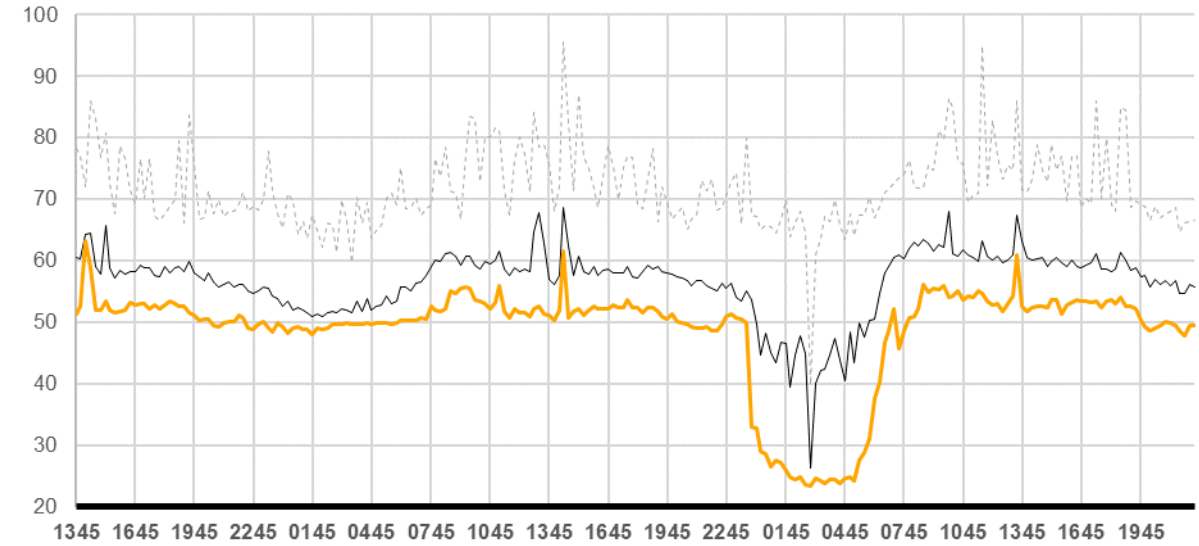
Noise Measurement Results at Position MP1

$L_{Aeq,15min}$, $L_{Amax,f}$, and $L_{A90,15min}$ in terms of sound pressure (dB, x-axis) against time (hhmm, y-axis).



Noise Measurement Results at Position MP2

$L_{Aeq,15min}$, $L_{Amax,f}$, and $L_{A90,15min}$ in terms of sound pressure (dB, x-axis) against time (hhmm, y-axis).



Appendix B: Planning Policy and Guidance

British Standard BS 4142

British Standard 4142:2014+A1:2019 (Methods for rating and assessing industrial and commercial sound) states in section 1.1:

> *"This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:*
>
> *a) sound from industrial and manufacturing processes;*
>
> *b) sound from fixed installations which comprise mechanical and electrical plant and equipment;*
>
> *c)sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and*
>
> *d)sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from fork-lift trucks, or that from train or ship movements on or around an industrial and/or commercial site.*
>
> *The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident."*

The standard states its applications as,

> *"This standard is applicable to the determination of the following levels at outdoor locations:*
>
> *a) rating levels for sources of sound of an industrial and/or commercial nature; and*
> *b) ambient, background and residual sound levels,*
>
> *for the purposes of:*
>
> *1) investigating complaints;*
> *2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and*
> *3) assessing sound at proposed new dwellings or premises used for residential purposes."*

BS 4142 sets out a daytime assessment period of 1 hour and night time period of 15 minutes. The assessment methodology requires that a "specific level" from a given noise source is determined considering these time periods. Character corrections should be added if the noise has tonality, impulsivity, intermittency or other such characteristics; this gives the "rating level" of a given noise source. The level of the correction is based upon how the noise is perceived, as set out in the standard.

The rating level of noise, $L_{Ar,\,Tr}$, for the relevant assessment period is the calculated noise level at the nearest receiver location, adjusted to take into account the acoustic characteristic of the noise. Acoustic feature corrections can be made to account for tonality, impulsivity, intermittency and other characteristics present in the resultant sound at the receiver position. The magnitude or appropriateness of any correction will depend both on the type of noise source and the context in which it is perceived. Similarly, in accordance with BS 4142, the period of time for which an individual noise source is active during the relevant reference time period will also be considered in establishing the rating level.

It will also be necessary to consider the existing noise climate and what sound sources contribute to it. For example, where a noise generating activity is proposed adjacent to an existing similar noise generating site, the impact of the new noise source would be less than if it were to be planned in a location where its character and type is different to and more noticeable than any existing noise source nearby.

With regard to the background sound level against which the rating level is compared, the standard states the following:

> *"In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."*

The periods of interest over a 24 hour day are usually related to day time activities (07:00-23:00h) and night time (23:00-07:00h). However the standard makes the following statement:

> *"Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes. Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods."*

Therefore, the periods of time which can be considered as 'waking up' and 'falling asleep' stages, for example 06:00h to 07:00h and 23:00h to 24:00h, may need to be considered independently. Alternative periods may also be identified where breakdown beyond the standard day and night time analysis will be necessary, for example where background sound levels are shown to be regularly elevated.

Once the rating level at each receptor has been calculated, reference can be made to the following commentary in BS 4142 in relation to conducting an initial assessment of the impact, based on the difference between the rating level of the noise source and the pre-existing background sound level.

> *"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.*
>
> *NOTE 1 More than one assessment might be appropriate.*
>
> *a) Typically, the greater this difference [between industrial site noise rating level and baseline background level], 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.*

NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

In situations where background sound levels are low, it is important to again consider context, rather than simply basing an assessment of impact on a difference in noise level, as suggested above. With regards to context in relation to absolute noise levels, the standard states the following:

'1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

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.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.'

British Standard BS 4142:2014 does not set out guidance for what constitutes low background noise levels. Instead, it can be inferred from the World Health Organisation Night Guidelines for Europe (2009) that a noise level of ≥30 dB $L_{night,outside}$ is not likely to give rise to any substantial observed noise effects.

Although the above criterion relates to an 8-hour period between 2300 and 0700 (i.e. the night time), the application of the criterion to any given 15 minute period during the night time (or one hour if applied to the daytime) effectively makes the criterion more stringent.

Taking into account the above therefore, it is suggested that noise limits for mechanical services plant equipment should be set with a lower threshold of 30 dB $L_{Ar,Tr}$. Noise levels equal to or below this threshold figure would not be expected to give rise to substantial observed effects (i.e. the impact would be low).

From the above, it can be inferred that ensuring noise emissions from a given site or activity do not exceed noise limits set at a level 5 dB above the representative background noise levels at a given receptor (or at the 30 dB $L_{Ar,Tr.}$ threshold where background sound level are low) will provide an indication that noise adverse effect will not occur.