parkerjones acoustics

The Creamery, Aber-Arad

Dairy Partners Limited

Noise Impact Assessment

8th August 2023
First Issue

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Revision History

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First Issue	First issued version of the report	**Chris Parker-Jones** Director and Acoustic Consultant BSc (Hons) MSc MIOA	8th August 2023

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Executive Summary

This document, a Noise Impact Assessment (NIA), has been written to assess the level of noise emissions generated by the site on noise-sensitive receptors (NSRs) in the surrounding area.

The level of impact is determined by assessing against several guidelines including BS 4142:2014 and the *"Environmental Permitting: H3 Guidance"*.

PJA has conducted multiple assessments and BAT Noise Audit's at the site since 2020, recognising that the factory is the most significant contributor to background noise levels in the area, but is also a facility which has been operating since 1932.

These assessments have included several multi-day surveys at the site boundary close to the nearest dwellings. However, this assessment is slightly different in that an attempt is made to determine the *true* representative background sound level, measured at a surrogate location, to identify what background sound levels may be *if* the factory were not there. It has not been possible to determine this *true* level previously as the factory is in constant operation and it is not possible to completely switch off all plant.

In summary, background levels reach minimum values of around 23 – 24 dB $L_{A90,15min}$ at all times and modal values during the day of 33 dB.

Exact specific noise levels and thus rating levels from the site are very hard to determine due to the variable nature of its operation and the sheer amount of plant and vehicles that are present. At most, specific noise levels from fixed plant only (i.e., plant such as the chillers, ETP, pumps, cooling tower, etc) that operate continuously, are up to around 51 dB at the site boundary with NSR 1, 49 dB at the boundary close to NSR 2, and 37 dB at NSR 3. With rating level penalties, the rating levels are around 57 dB, 53 dB, and 39 dB respectively.

BS 4142 indicates that a rating level that is 10 dB above the background sound level is an indicator of a likely significant adverse impact, depending on the context.

In this case, rating levels when compared against background sound levels if the factory were not generating any noise, are as much as 33 dB above the minimum background sound (at the site boundary with NSR 1). It would also be around 24 dB above the modal background sound level during the daytime.

This finding is not a surprise given the complaints the site has had against it, and the findings of all previous assessments. But it should also be considered in context, given that the site is not a new noise source, it is a facility which has been operating since 1932.

The levels above are a worst-case and are based on monitoring positions on the site boundary, not in the gardens or out of the windows of the receptors themselves. Nonetheless, if they were to be monitored in the curtilage of the receptors, PJA would still anticipate rating levels to be far above background sound levels.

Contents

1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed by Dairy Partners Limited to undertake a Noise Impact Assessment to assess the level of noise emissions generated by the site (The Creamery, Aber-Arad, Newcastle Emlyn, SA38 9DQ) on noise-sensitive receptors (NSRs) in the surrounding area.

The NIA has been produced in accordance with:

- the Environment Agency (EA) publication *'Environmental; permitting: H3 Horizontal Guidance for Noise Part 2 – Noise Assessment and Control'* document. It is understood that these guidelines are also adopted by Natural Resources Wales (NRW);
- BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*', which assesses the risk of adverse impact of noise pollution from a sound source (or sources) of a commercial or industrial nature (i.e., mechanical/electrical plant);

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in Appendix A.

2.0 Site and Development Description

The site is located at grid reference SN 31539 40206 in Aber-Arad, Newcastle Emlyn, with the main entrance to the site off the B4333 along the south boundary. The facility is on the outskirts of the town with residential receptors along the south and west boundaries, with some slightly further to the north. In the wider sense, the dairy site is adjoined by commercial premises to its northeast (builders' yard) and west (Antur Teifi Business Park). To its east is positioned a residential dwelling, with further then located to the south, separated from the creamery by the public highway (B4333).

The development is a dairy processing facility that produces cheese (and has done since 1932), operating for 24 hours a day, 365 days a year, with many items of plant running continuously throughout this. This includes heavy goods vehicles coming in and out of site around the clock, and an average batch cycle of approximately 35 hours (28 hours production, 7 hours cleaning). The site includes a range of production and service buildings, circulation and hard standing storage areas, as well as other areas used in the general management of product and waste derived from the process undertaken at the plant.

The location of the site and the nearest 'noise-sensitive receptors' (NSRs) are shown in Figure 2.1. These receptors, on the south, east, and western boundaries, are the most exposed to noise. Dwellings are situated to the north/north-west, but noise is generated on the south and east side of the site and thus these are considered to be well screened from noise compared to those receptors highlighted in the figure.

A site plan of the facility is shown in Figure 2.2.

Figure 2.3 shows the wider area and the location of the baseline monitoring position, in a 'surrogate location', as described in Section 4.0.

Figure 2.1 – Aerial view of the site and surrounding area

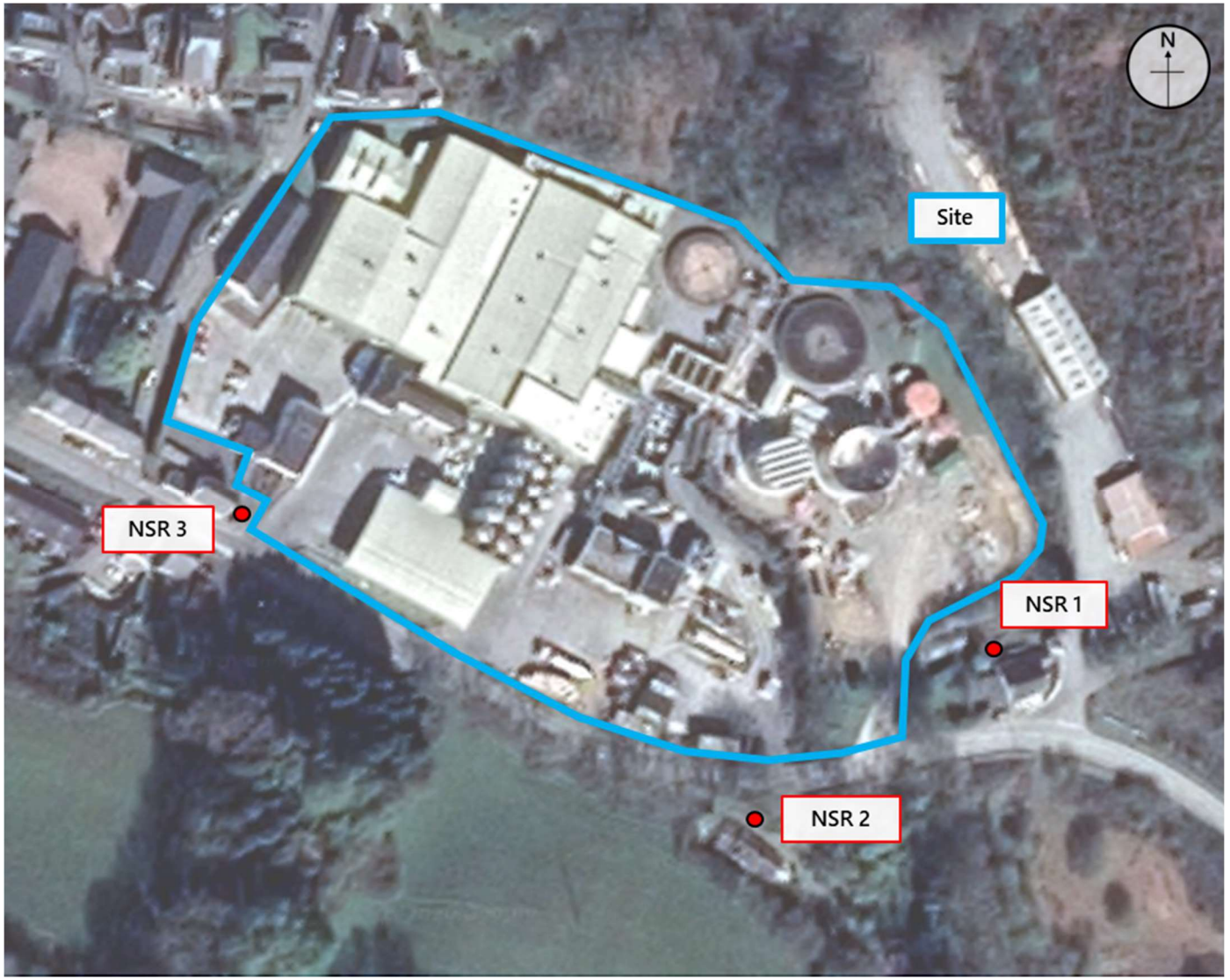


Figure 2.2 – Site plan

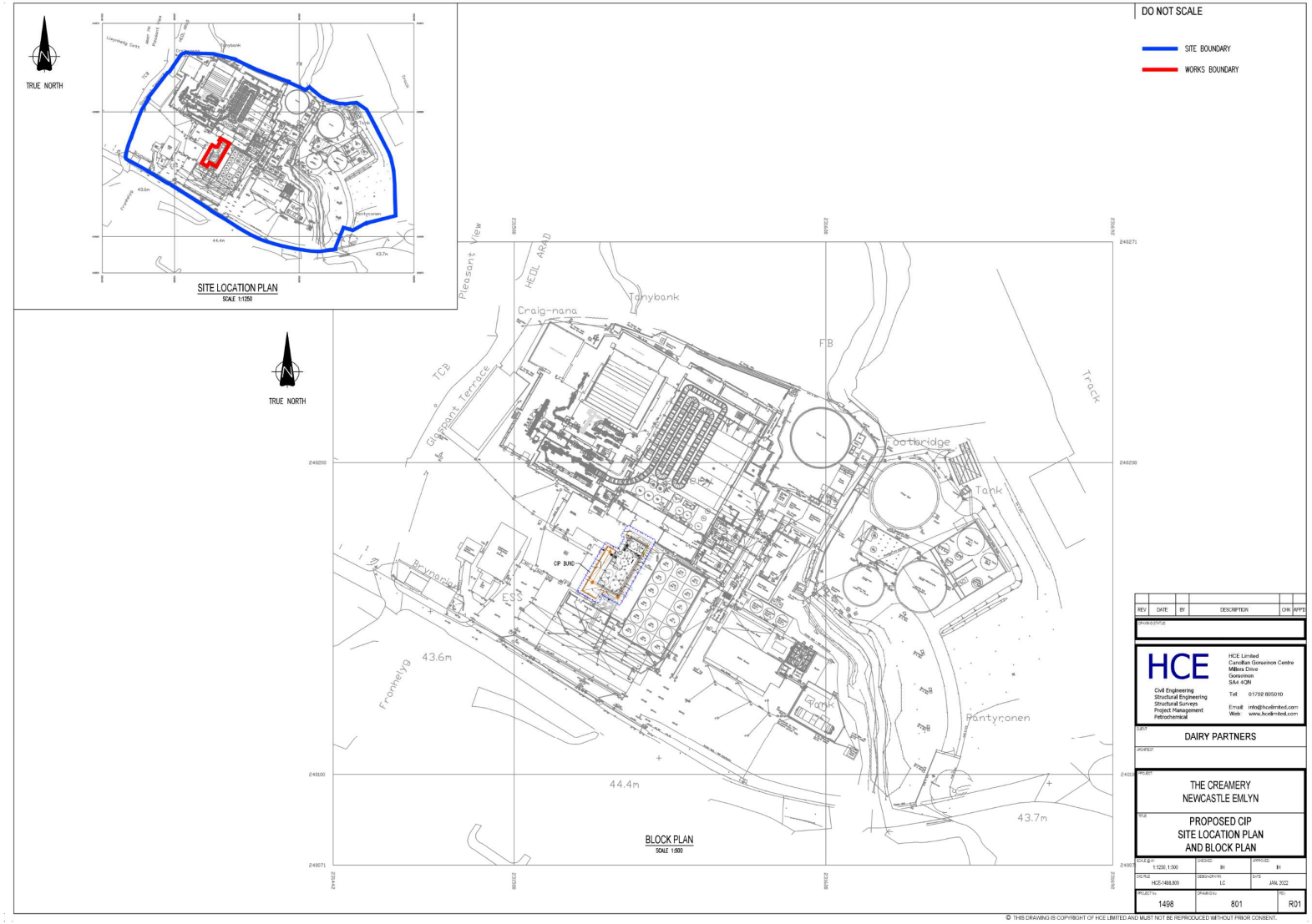


Figure 2.3 – Location of the surrogate monitoring position

3.0 Guidelines and Standards

3.1 Horizontal Guidance Note for Noise Assessment and Control

The purpose of the *Horizontal Guidance Note for Noise Assessment and Control* is to provide supplementary information, relevant to all sectors, to assist in preventing and minimising emissions of noise as described in the Sector Guidance Notes (or the General Sector Guidance Note).

The guidance is in two parts:

Part 1 – Regulation and Permitting – outlines the main considerations relating to the setting of Permit conditions and subsequent regulation of noise. Part 1 is aimed primarily at the information needs of regulators.

Part 2 – Noise Assessment and Control – describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. Outline methods of noise control are provided such as:

- use of inherently quieter processes;
- selection of inherently quiet plant or "low-noise options";
- site layout to maximise natural screening, screening by buildings and separation distances;
- the orientation of directional noise sources away from sensitive receptors; and
- noise barriers or bunding.

3.2 BS 4142:2014

BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

The method is based on assessing the predicted noise emissions from plant against the existing background sound levels at NSRs. The predicted emissions are termed as a 'rating level', which is the specific sound level from plant, plus 'penalties' which account for whether the noise has distinguishing characteristics such as tonality, intermittency, impulsivity, or is generally distinguishable from the ambient noise environment. Such features may attract attention and be considered annoying, hence sounds with these qualities should be penalised over sounds at the same specific noise level which is less intrusive.

Appendix B explains the methodology in further detail.

4.0 Baseline Noise Survey

PJA has attended the site to conduct a baseline noise survey between Thursday the 20th and Monday the 24th of July 2023, inclusive of the weekend. The results have been used to determine a representative background sound level at nearby residential receptors in accordance with BS 4142:2014.

Given that it has been impossible on previous site visits to determine a 'true' background sound level (without influence from noise emissions from the facility) through measuring at the site boundaries close to the nearest dwellings, this assessment has been based upon monitoring conducted at a 'surrogate' location.

Figure 2.3 shows the location of this surrogate position, with a sound level meter and microphone installed on a tripod at a height of approximately 1.5m above ground, within the wooded area, overlooking the main road.

This location was chosen for several reasons. Firstly, to be within around 10m of the B4333, which is the main noise source (other than the factory) that affects baseline noise levels at the receptors, which are a similar distance back from this road. Secondly, it needed to be a sufficient distance away from the factory so that noise emissions from it were imperceptible. And finally, this appeared to be a discrete position that could be safely accessed, without trespassing.

The sound level meter was set to log noise levels over continuous 15-minute averaging periods with a 1-second time history rate. The monitoring equipment was left unattended for the majority of the survey except for a short period around the installation and collection of the equipment.

The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' – i.e., emergency services sirens;
- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – or noise levels from continuous noise sources such as plant; and
- $L_{A10,T}$: The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level' and a good representation of traffic noise contributions.

Appendix C contains further information on the methodology of the survey, including photographs taken from site; the equipment used; and the weather conditions at the time of the survey.

Noise levels at the monitoring location are dominated by road traffic along the B4333.

A graph of the measured noise levels across the entire monitoring period is given in Figure 4.1 overleaf.

Table 4.1 summarises the results across the daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods respectively, accumulated across the several days that the survey spanned over.

It can be seen that minimum values of 24 dB $L_{A90,15min}$ and 23 dB during the daytime and night-time periods are reached.

Table 4.1 – Summary of measured noise levels

Time Period	Parameter	Maximum	Minimum	Logarithmic Average	Mean Average	Modal Average	Median Average
Daytime (07:00 – 23:00)	$L_{Aeq,15min}$ (dB)	59	39	53	52	50	52
	$L_{AFMax,15min}$ (dB)	81	58	N/A	68	63	68
	$L_{A90,15min}$ (dB)	50	24	N/A	35	33	34
Night-time (23:00 – 07:00)	$L_{Aeq,15min}$ (dB)	55	32	47	44	45	44
	$L_{AFMax,15min}$ (dB)	80	44	N/A	64	62	64
	$L_{A90,15min}$ (dB)	51	23	N/A	31	24	29

Figure 4.1 – Graph of measured noise levels from the surrogate monitoring position

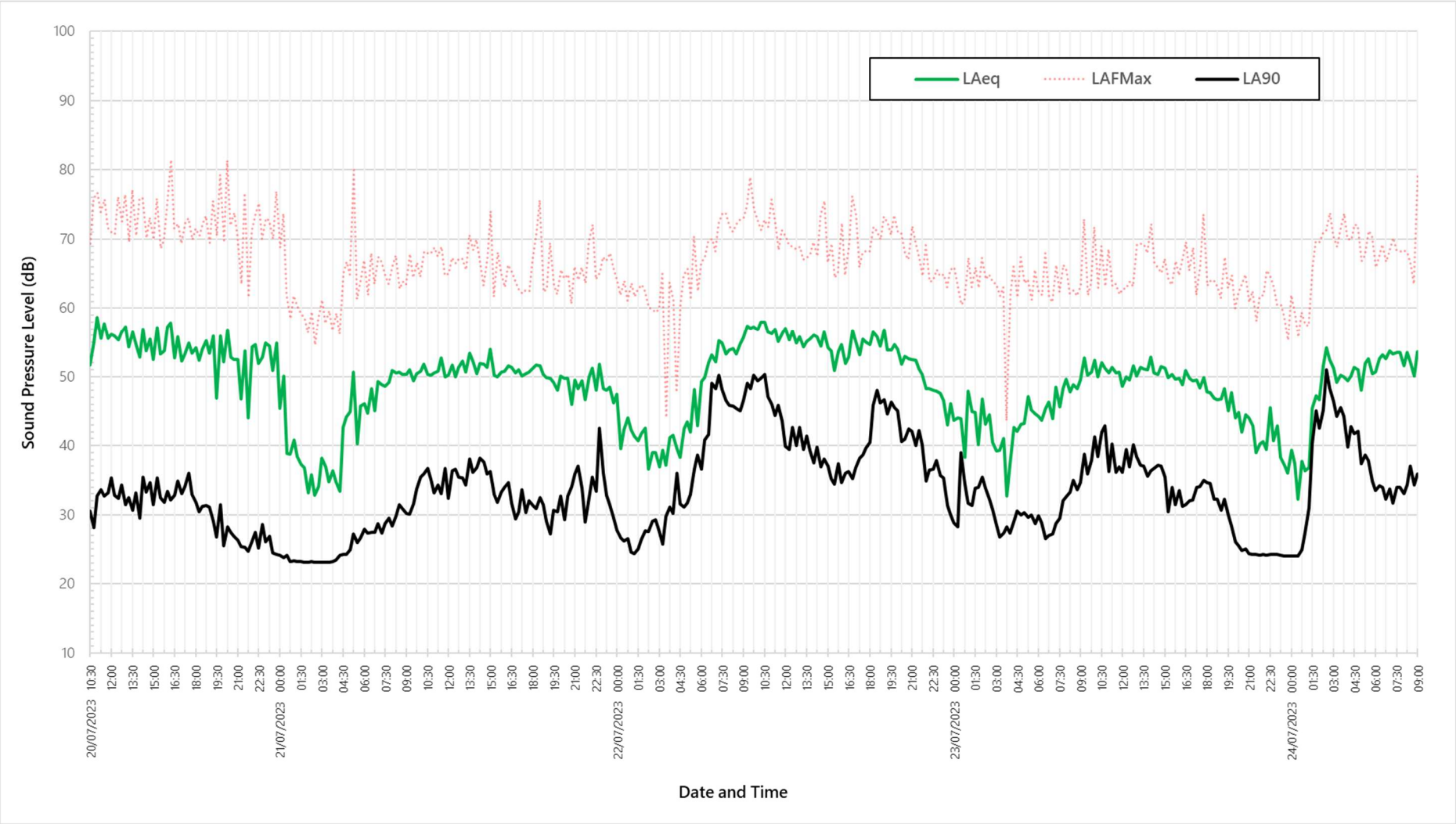
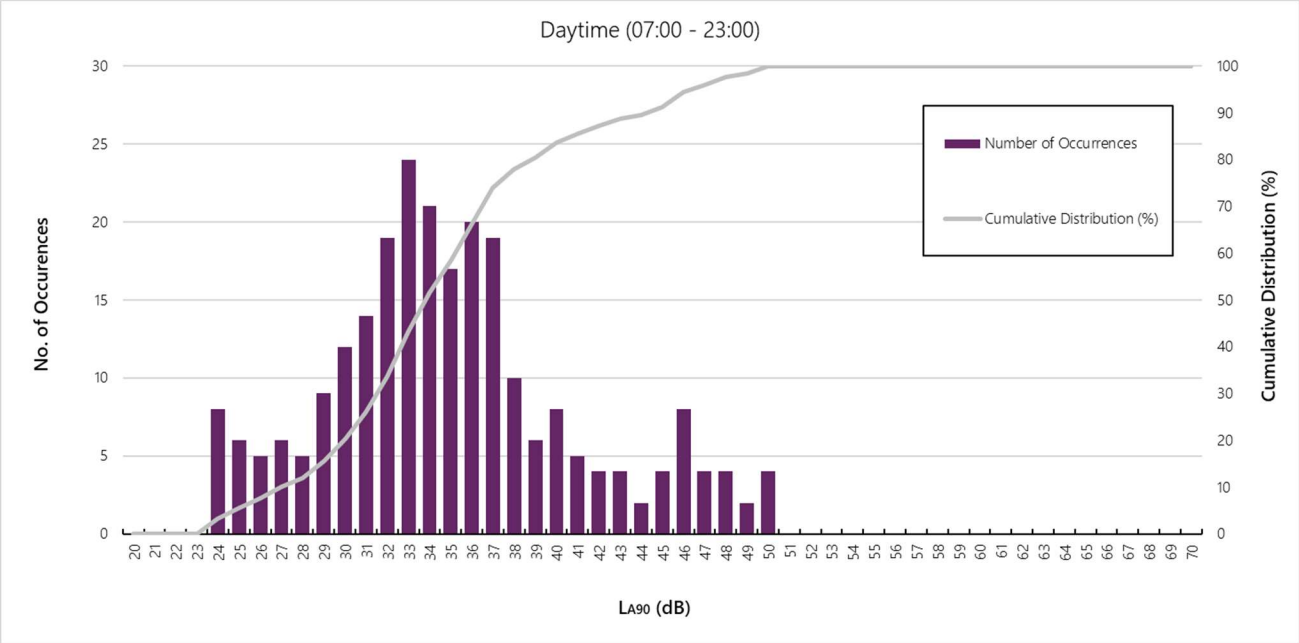
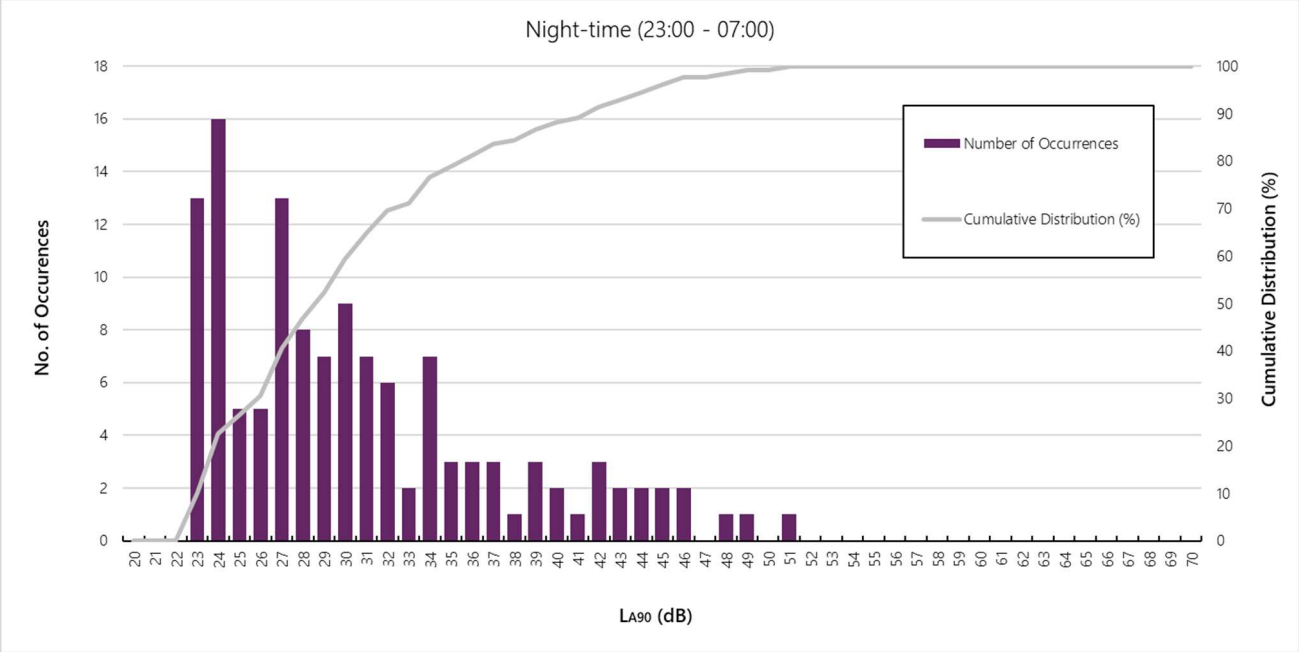


Figure 4.2 – Histograms of measured L_{A90} values from the noise survey





5.0 Assessment

The assessment has been undertaken in accordance with BS 4142:2014+A1:2019. The following summarises the main steps of action in the assessment method:

- a representative background sound level $L_{A90,Tr}$ is determined based upon the results of the environmental noise survey;
- the specific sound level L_s generated by the proposed plant is predicted outside of the windows of neighbouring noise-sensitive windows in the area;
- the rating level $L_{Ar,Tr}$ is determined by the application of any 'penalties' which adjust for characteristic features of the sound which may be perceptible and potentially cause annoyance at each NSR;
- the predicted rating level $L_{Ar,Tr}$ is compared to the $L_{A90,Tr}$ and the guidance of BS 4142 and other residential noise guidelines.

5.1 Background Sound Levels

In accordance with BS 4142:2014, the predicted rating level should be assessed against a 'representative' background sound level. This is commonly determined through the results of a baseline sound survey, as has been done here.

BS 4142:2014 states that *"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."* BS 4142:2014 further states that *"a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value"*.

As a worst-case assessment, it is appropriate to take the minimum values of $L_{A90,15min}$ measured during the survey to be the representative background sound level – as listed in Table 5.1.

Table 5.1 – Derived representative background sound level $L_{A90,T}$ at nearby NSRs

Noise-Sensitive Receptor (NSR)	Period	Representative Background Sound Level L_{A90} (dB)
1m outside of the windows of neighbouring noise-sensitive buildings / 1.5m above ground within the boundary of residential properties	Daytime (07:00 to 23:00)	24
	Night-time (23:00 – 07:00)	23

5.2 Predicted Noise Emissions

PJA has conducted several noise monitoring exercises and noise audits for the facility since September 2020. This includes the most recent version of the BAT (Best Available Techniques) audit, issued alongside this report issued in July 2023. For brevity, this report will reference the noise predictions detailed within that report.

As shown in that report and its previous iterations, it is difficult to determine the exact specific noise levels from the site, given the variable nature of its operation, with numerous items of fixed plant, machinery, and vehicles operating, at different times of day and night, and at variable loads/capacities.

In terms of fixed plant, i.e., plant which is near continuous in operation, it appears that specific noise levels ($L_{Aeq,15min}$) vary between around 44 dB and 51 dB at the south east boundary close to NSR 1, and similar levels of around 43 to 49 dB at the south site boundary close to NSR 2. At NSR 3 this appears to be significantly lower, but still around maximums of 37 dB.

Emissions from vehicles can be significantly higher, i.e., around 65 dB at NSR 3 from idling Milk Tankers, and similar levels at NSR 1 from ETP tankers idling and pumping. The alarm system from the LNG tankers, when occasionally refilled, can reach similar levels at NSR 2.

Intermittent plant, such as the Boiler House Pressure Valve Release, can reach around 50 – 54 dB at NSRs 1 and 2.

Thus, it is exceptionally difficult to determine one single specific noise level emission at each receptor. The levels above are also based on monitoring positions on the site boundary, not in the gardens or out of the windows of the receptors themselves, and hence should be considered a worst-case.

If considering fixed plant only, PJA suggest as a worst-case that the upper levels of these ranges are used, i.e., 51 dB $L_{Aeq,15min}$ at NSR 1, 49 dB at NSR 2, and 37 dB at NSR 3 – occurring during the daytime.

In accordance with BS 4142:2014, a rating level penalty should be applied to the specific noise level to obtain the rating level should the noise contain distinctive characteristics such as tonality, impulsivity, intermittency, or is generally distinguishable from other noise sources.

PJA suggests that a highly perceptible tonal quality can be heard due to the chiller compound at NSR 1, thus a 6 dB penalty should apply. At NSRs 2 and 3, this tonal quality is less perceptible, hence 4 dB and 2 dB penalties are applied respectively.

The noise from fixed plant is not considered impulsive, or noticeably intermittent, so no further penalties are applied to these sources.

Table 5.2 summarises the predicted rating levels against the representative background sound level during the day (the minimum of which is only 1 dB higher than at night).

Table 5.2 – Predicted rating levels outside nearby NSRs

Noise-Sensitive Receptor	Specific Sound Level $L_{Aeq,Tr}$ (dB)	Penalty (dB)	Rating Level $L_{Ar,Tr}$ (dB)	Background Sound Level $L_{A90,Tr}$ (dB)	Difference (dB)
NSR 1	51	+6	57	24	+33
NSR 2	49	+4	53		+29
NSR 3	37	+2	39		+15

5.3 Level of Impact

BS 4142 indicates that a rating level that is 10 dB above the background sound level is an indicator of a likely significant adverse impact, depending on the context.

In this case, rating levels when compared against background sound levels if the factory were not generating any noise, are as much as 33 dB above the minimum background sound. It would also be around 24 dB above the modal background sound level during the daytime.

This finding is not a surprise given the complaints that the site has had against it, and the findings of all previous assessments. But it should also be considered in context, given that the site is not a new noise source, it is a facility which has been operating since 1932.

The levels above are a worst-case and are based on monitoring positions on the site boundary, not in the gardens or out of the windows of the receptors themselves. Nonetheless, if they were to be monitored in the curtilage of the receptors, PJA would still anticipate rating levels to be far above background sound levels.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2x10-5 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4000Hz (4kHz). This is roughly equal to the range of frequencies on a piano. Frequency is often divided into ('first') octave bands for analysis, with the range above considered within 7 octave bands with centre frequencies at 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz and 4 kHz. 'Third' octave bands split this further into smaller frequency bands. This is typically only referenced in assessment of tonality of a noise source by identifying peaks (tones) in the frequency spectrum, i.e., when applying a rating penalty for tonality within a BS 4142:2014 assessment.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{A10,T}$	The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level';
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.

A.2 – Subjective Changes in Noise Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B - BS 4142:2014

BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

B.1 - Definitions

BS 4142:2014 provides the following definitions which are relevant at this pre-construction stage of assessment:

- **Background Sound Level, $L_{A90,T}$:** A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given 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.
- **Reference Time Interval, T_r:** Specified interval over which the specific sound level is determined. This is 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).
- **Specific Sound Level, $L_s = L_{Aeq,Tr}$:** Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
- **Specific Sound Source:** Sound source being assessed.

The BS 4142:2014 definition of sound of an industrial and/or commercial nature includes "*sound from fixed installations which comprise mechanical and electrical plant and equipment*". The scope of BS 4142:2014 is not intended for sound from the passage of vehicles on public roads; people; and 'other sources falling within the scopes of other standards or guidance'.

B.2 - Specific Sound Level

The specific sound level L_s is the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r, of 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).

B.3 - Rating Level

The rating level $L_{Ar,Tr}$ is the specific sound level L_s plus any 'penalties' which account for the characteristic features of the sound.

BS 4142:2014 provides the following with respect to the application of penalties to account for *"the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention"*.

- ***Tonality*** *– For sound ranging from not tonal to predominantly tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for*

a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;

- ***Impulsivity –*** *A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible;*
- ***Intermittency*** *– When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied; and*
- ***Other Sound Characteristics*** *– Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

PJA consider the word 'perceptible' to be important, and variable depending on the context of a site. For example at a site with a relatively high background sound level of 50 dB(A), an 'impulsive' sound source with a specific sound level of 30 dB(A) at a NSR is unlikely to be perceptible and should probably not be penalised.

B.4 - Background Sound Level

BS 4142:2014 states that *"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."* BS 4142:2014 further states that *"a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value"*. Hence BS 4142:2014 does not provide a 'black and White' method of obtaining the assessment level for background sound $L_{A90,T}$. Note that it is standard practice that the $L_{A90,T}$ is determinable from the results of a baseline sound survey conducted at positions representative of sound levels at the nearest or worst affected NSRs.

B.5 - Assessment of Adverse Impact

The assessment of adverse impact contained in BS 4142:2014 is undertaken by comparing the rating level $L_{Ar,Tr}$, to the measured representative background sound level $L_{A90,T}$ outside the sensitive receptor location. The significance of the impact of an industrial or commercial sound source depends on both the margin by which the rating level $L_{Ar,Tr}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. It is therefore essential to place the sound in context.

But in general, *"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."* However, if the rating level does exceed the background sound level, "a difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context", and "a difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on the context."

Appendix C – Noise Survey Methodology

C.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

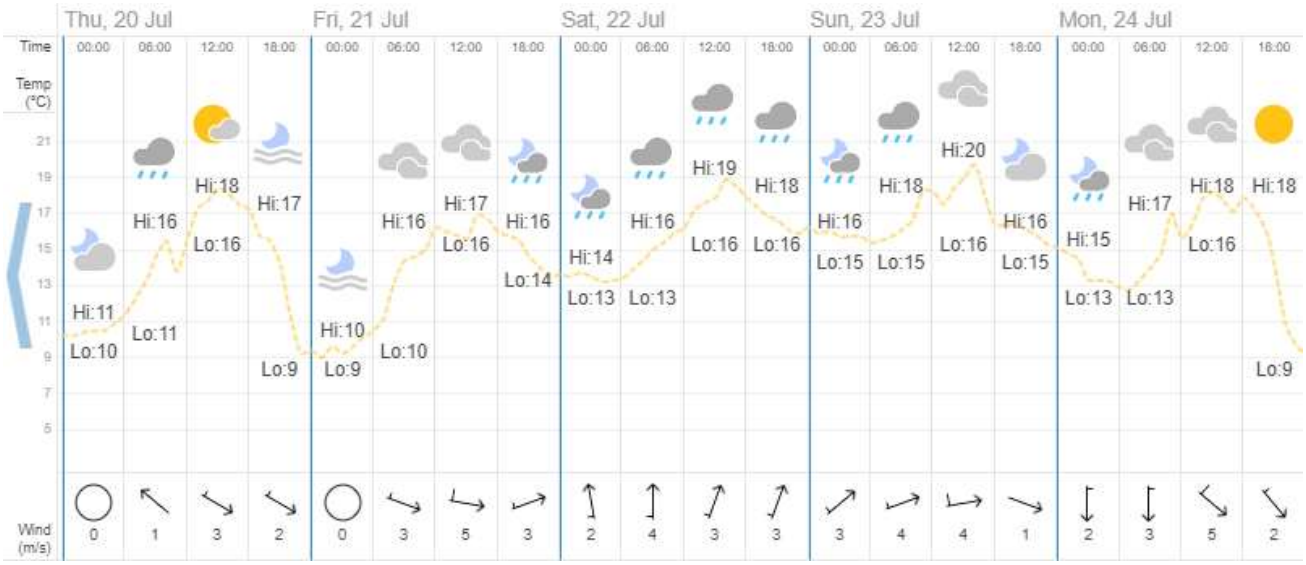
Table C.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
SVAN 949 Class 1 Sound Level Meter	9719	Nov-21	Nov-23
SV22 Class 1 Microphone	4011862	Nov-21	Nov-23
Cirrus CRL511E Class 1 Acoustic Calibrator	035235	May-23	May-24

C.2 – Meteorological Conditions

During the survey, weather conditions included intermittent periods of rain. Wind speeds were generally mild up to a maximum of 5 ms^{-1}. The microphone was fitted with a weather protection kit/windshield. These weather conditions are suitable for the measurement of environmental noise in accordance with BS 7445 '*Description and Measurement of Environmental Noise*'. The weather conditions are sourced from https://www.timeanddate.com/weather/@2641676/historic?month=7&year=2023.

Figure C.1 – Meteorological conditions during the survey



C.3 – Photos

Figure C.2 – Photographs of the monitoring position

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