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NEWFIELDS FARM, PROPOSED BATTERY ENERGY STORAGE SYSTEM
NOISE IMPACT ASSESSMENT

On behalf of:

Newfields BESS Ltd

Report No: P23-129-R02v3
March 2025

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1.0 INTRODUCTION

1.1 Hepworth Acoustics Ltd was commissioned by Newfields BESS Ltd to carry out a noise impact assessment in connection with a planning application for a new battery energy storage system (BESS) at land on Newfields Farm in Wetley Rocks, Staffordshire.

1.2 An aerial view of the site within the context of the local area is shown in Figure 1. There is an existing residential property at Newfields Farm, which is located immediately to the south of the proposed BESS facility. This dwelling is also within the same land ownership parcel as the BESS site area and is currently occupied by tenants.

1.3 The nearest dwellings with no association to the site is Greenfields Farm around 200m to the west, as well as dwellings on Rownall Road which are approximately 310m to the south as highlighted in Figure 1.

1.4 The closest dwellings to the north are at least 580m away, there are some buildings within the electricity substation site, but these are not considered to be noise sensitive receptors.

1.5 The proposals are for the installation of an energy storage system, as shown in Figure 2, that will include the following plant:

- 1 x 132kV Transformer/Substation
- 24 x Power Inverters (fitted with acoustic kits)
- 48 x Energy Storage Containers (back to back pairs fitted with acoustic kits)

1.6 Whilst the plant will be 'live' for 24 hours a day, the functioning window is a fraction of this time. This is because energy will be imported and stored in the batteries when supply exceeds demand. The batteries take a short amount of time to charge which is approximately two hours. This period is variable and can occur during the daytime or night, although, on most days it is anticipated to begin in early afternoon when solar farms are producing large amounts of excess energy and demand is reduced.

1.7 The energy storage batteries will then discharge at peak demand, which is typically around during morning before people go to work and early evening. The sound created is proportionate to the current running through the equipment at the time, and the resultant cooling from fans, during the evening and night will be reduced as the air temperature is lower and thus less cooling is necessary.

1.8 The ‘worst-case’ sound levels will only be generated for a small part of the day. Outside of this, sound level emissions from the equipment will be considerably lower. Nevertheless, our assessment includes the potential for batteries to charge during the day or night.

1.9 This noise impact assessment has included the following:

- An inspection of the site and immediate surrounding area;
- A baseline noise survey to quantify the existing prevailing noise climate in the area;
- A computerised noise model predicting the noise levels from the proposed plant;
- Assessment of the potential noise impact at the nearest dwellings; and,
- Recommendations for noise mitigation measures.

1.10 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 POLICY & GUIDANCE

National Planning Policy Framework (NPPF) December 2024

2.1 The National Planning Policy Framework (NPPF) December 2024 states the following relevant paragraphs with respect to noise and planning:

Paragraph 187

"*Planning policies and decisions should contribute to and enhance the natural and local environment by:*

… e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. …"

Paragraph 198

"*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[65];

British Standard 4142:2014+A1:2019

2.2 British Standard 4142:2014+A1:2019, '*Methods for rating and assessing industrial and commercial sound*', referred to hereafter as BS 4142, is appropriate guidance for assessing the potential noise impact from proposed new industrial/commercial noise sources, including mechanical and electrical plant.

2.3 BS 4142 requires a Rating Level ($L_{Ar,Tr}$) calculated from the operation of the noise source to be compared with the Background Sound Level ($L_{A90,T}$) which is measured in the absence of the noise

source, evaluated over a 1-hour period for daytime operations and 15-minute period for night-time operations.

2.4 The Rating Level ($L_{Ar,Tr}$) is based on the Specific Sound Level (L_{Aeq}) attributed to the operating noise source, with 'character corrections' added for sound sources where 'certain acoustic features can increase the significance of impact'.

2.5 The character correction applied to the Specific Sound Level in order to obtain the Rating Level can take into account tonality, intermittency, impulsivity and characteristics otherwise distinctive against the prevailing noise climate in the area. The applicable character corrections apply depending on how perceptible the characteristics are anticipated to be at the assessment location.

2.6 An initial estimate of the potential noise impact from the operating noise source is determined by comparing the difference between the rating level and the Background Sound Level.

2.7 Regarding the outcome of the initial estimate, BS 4142 states that:

- Typically, the greater this difference, the greater the magnitude of 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; and,
- The lower the Rating Level is relative to the measured background level, the less likely it is that the operation will have an adverse impact or a significant adverse impact. Where the Rating Level is does not exceed the Background Sound Level, this is an indication of the specific sound source having low impact, depending on the context.

2.8 BS 4142 states that all pertinent factors must be taken into account regarding the context in which the noise occurs, including:

- The absolute level of sound.
- The character and level of the residual sound compared to the specific sound; and,
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that ensure good internal and/or outdoor acoustic conditions such as acoustic screening.

2.9 Regarding background sound levels, BS 4142 requires that "values are reliable and suitably represent the particular circumstances and periods of interest… the objective is not simply to ascertain a lowest measured background sound level, *but rather to quantify what is typical during particular time periods*".

British Standard 8233:2014

2.10 British Standard 8233: 2014 '*Guidance on sound insulation and noise reduction for buildings*', referred to as BS 8233 hereafter, provides guidelines on design criteria for acceptable noise levels within residential accommodation for the daytime (07:00-23:00) and night-time (23:00-07:00) periods, as summarised in Table 1.

Table 1: BS 8233 Recommended Acoustic Design Criteria for New Dwellings [dB]

Activity	Location	Indoor Noise Levels	
		Daytime (07:00-23:00)	Night-time (23:00-07:00)
Resting	Living room	35 $L_{Aeq,16hr}$	-
Dining	Dining room / area	40 $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 $L_{Aeq,16hr}$	30 $L_{Aeq,8hr}$

2.11 BS 8233 also states that, "where development is considered necessary or desirable … the internal target levels [i.e. those in Table 1] may be relaxed by up to 5dB and reasonable internal conditions still achieved".

2.12 Regarding outdoor living areas, BS 8233 states that "it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments."

2.13 BS 8233 clarifies that the above guidance and levels in Table 1 relate to noise without specific character (e.g. noise that does not have a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content) and that where such characteristics are present, lower noise limits might be appropriate. However, no specific lower guideline values are provided for noise with specific characteristics.

2.14 It should be understood that BS 8233 is guidance for appropriate acoustic conditions for new residential developments rather than assessment of industrial/commercial noise sources and has been referenced in this report to provide context for the absolute noise levels.

3.0 BASELINE NOISE SURVEY

3.1 Automated noise monitoring was carried out at two locations over a 24-hour period commencing at 14:00 on Thursday 14th November until 13:00 on Friday 15th November 2024, to quantify the prevailing background noise levels representative of the nearest noise sensitive receptors to the proposed BESS. The noise monitoring locations are shown in Figure 1 and summarised below:

- Location A – Newfields Farm
- Location B – Greenfields Farm

3.2 The noise survey measurements were carried out in consecutive 15-minute periods at a microphone height of 1.4m above the ground in 'free-field' conditions. The measurement microphones were also fitted with windshields.

3.3 Calibration checks were carried out both before and after the noise survey, with no deviation in calibration levels.

3.4 Full details of the equipment used for the noise survey, the weather conditions and the full noise survey results, are shown in Appendix II.

3.5 Weather conditions during the noise survey were suitable for sound pressure level measurements, being dry with low winds and moderate cloud coverage.

3.6 A summary of the noise survey results, split into daytime (07:00-23:00) and night-time (23:00-07:00) periods is shown in Table 2.

Table 2: Summary of Baseline Noise Survey Results [dB]

	Term	Values	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Location A Newfields Farm	$L_{Aeq,T}$ 'Residual'	Range	35-51	30-39
		Logarithmic Mean	41	36
	$L_{A90,T}$ 'Background'	Range	32-42	29-37
		Mean	35	34
		Mode	35	34
Location B Greenfields Farm	$L_{Aeq,T}$ 'Residual'	Range	32-53	28-38
		Logarithmic Mean	41	33
	$L_{A90,T}$ 'Background'	Range	29-41	26-33
		Mean	34	30
		Mode	33	31

3.7 The noise survey results in Table 2 represent moderate levels of noise. The main noise source in the area was found to be from the nearby electricity substation to the north, which include a clear low frequency hum, as well as distant road traffic noise.

4.0 NOISE IMPACT ASSESSMENT

Noise Emissions Data

4.1 The applicant has provided us with noise emission data for the components of the energy storage systems that are to be installed at the site, as follows in Table 3.

Table 3: Sound Power Level Noise Source Emission Data [dB L_w]

Description	Data Source	Value at Octave Band Centre Frequency [Hz]								A
		31.5	63	125	250	500	1k	2k	4k	8k	
Site Transformer *	Transformer 33kV/132kV-100MVA	82	80	97	88	78	71	63	59	53	**84**
Battery Energy Storage System	20ft Container fitted with acoustic kit **	46	57	61	66	71	76	71	67	59	**79**
Power Inverter	MV grid-connected inverters fitted with acoustic kit **	45	60	70	73	73	72	72	65	54	**79**

* Octave band spectrum taken from in-situ measurements. Hepworth Acoustics has previously taken noise measurements of a transformer and adjusted to match the broadband A-weighted sound level from the Data, as no spectral data was provided.

4.5 For comparison the previously proposed energy storage cabinets were formed by 10 individual SCHALLSCHUTZ Consulting (CUBE6BA04) “Energy Storage Cubes” each with a sound power level of 74 dB L_w. Therefore, each storage cabinet had a sound power level of 84 dB L_w. The alternative proposed containers are therefore 5 dB quieter.

4.6 The invertors now are 6 dB quieter than the previously specified Power Electronics (GEN3) models as they are also fitted with the manufacturers acoustic kit.

4.7 For the Transformer, the sound power level in Table 3 is based on in-situ measurements Hepworth Acoustics has previously taken of an electrical transformer on a similar site.

4.8 The energy storage container proposals are designed for 80% operation at an ambient temperature of 30°C, based on the specifications of the self-contained shipping container. Since ambient temperatures would rarely exceed 30°C, except on the hottest days of the year, the cooling equipment would only need to operate at this level of duty under such conditions and are thus considered a worst case scenario.

4.9 Noise emission data for both the Battery Energy Storage System and Inverter has been provided by the Applicant for use in the assessment.

Computerised Noise Model

4.10 We have developed a detailed computerised noise model using CadnaA 3D noise modelling software to calculate the noise levels at the nearest dwellings from the proposed energy storage site.

4.11 The noise model has been built using the octave band source sound power levels in Table 3 to ensure that low frequency noise propagation is taken into account.

4.12 The noise emissions from the site have been calculated on the basis of all of the active plant operating over the daytime period to represent a worst-case scenario.

4.13 Given the operating dynamics of the plant discussed in paragraphs 1.7-1.9, the energy storage system is not anticipated to operate at full capacity during the night-time. On this basis we have assumed that the night-time operating capacity would be 50%.

4.14 The model has been developed based on '*OS Terrain 5*' and '*OS Local Vector Map'* data for the area.

4.15 The model takes into account distance attenuation of sound to the nearest dwellings, ground absorption (negligible in this case), two orders of reflections and acoustic screening.

4.16 The initial noise model results, in the absence of any noise mitigation measures, are shown in the noise contour plots at the first-floor level in Figures 3 and 4, for the daytime and night-time respectively.

Initial BS 4142 Assessment without Mitigation

4.17 Based on the results of the baseline noise survey summarised in Table 2, we have adopted representative background noise levels of 35 dB L_{A90} for the daytime and 34 dB L_{A90} for the night for Location A and 33 dB L_{A90} for the daytime and 31 dB L_{A90} for the night at Location B.

4.18 The corrections for discernible acoustic characteristics from the noise emissions are evaluated based on their perceptibility at the assessment locations within the context of the residual noise climate. Whilst there is not anticipated to be any intermittent (i.e. noticeable on/off) nor impulsive

components, we have included a +2 dB correction for potential low level tonal components within the residual noise climate at the assessment locations.

4.19 The results of the initial BS 4142 numerical assessment are shown in Table 4 for the assessment Locations: A and B, which are shown in Figure 1.

Table 4: BS 4142 Numerical Assessment at Nearest Dwellings [dB]

Description	Location A Newfields Farm		Location B Greenfields Farm	
	Daytime	Night-time	Daytime	Night-time
Specific sound level [$L_{Aeq,T}$]	36	33	32	28
Character correction	+2	+2	+2	+2
Rating level [$L_{Ar,Tr}$]	38	5	34	31
Background sound level [$L_{A90,T}$]	35	34	33	31
Excess of rating over background	+3	+1	+1	0
Potential impact	A	L/A	L/A	L

"L" denotes 'Low'. "A" denotes 'Adverse'. "S" denotes 'Significant adverse'.

4.20 The initial BS 4142 numerical assessment in the absence of any noise mitigation measures shown in Table 4 indicates that the potential unmitigated noise impact from the site could range from a 'low' noise impact to a 'adverse' noise impact, but not amounting to a 'significant adverse' noise impact.

4.21 Therefore, noise mitigation measures are considered appropriate to control the noise to within a practicable minimum.

Recommended Noise Mitigation Measures

4.22 The recommended noise mitigation scheme is shown in Figure 5. As can be seen acoustic barriers of 3m in height are recommended to provide sufficient acoustic screening. The construction of the barrier can be in the form of acoustic fencing or earth bunding or a combination of the two.

4.23 For where acoustic fencing is proposed the noise model included the acoustic absorption coefficients for a Heras Noise Reducer HA absorptive acoustic barrier which were supplied by the manufacturer, as shown in Table 5.

Table 5: Heras Noise Reducer HA - Sound Absorption Coefficient Data

Sound Absorption Coefficient [α] at Octave Band Centre Frequency [Hz]						α_w	dB *DL*α
125	250	500	1k	2k	4k		
0.15	0.54	0.92	1	1	0.96	0.85	11

4.24 Any proprietary absorptive acoustic barrier can be installed at the locations and heights shown in Figure 5, as long as they provide the following minimum specifications:

- Minimum mass per unit area of 15 kg.m^{-2}. However, most proprietary acoustic barriers will have a surface density noticeably greater than this minimum.
- Minimum sound absorption performance equivalent to or greater than the values shown in Table 5.
- The absorptive acoustic barrier must be a solid sealed construction with no holes or gaps.
- The absorptive acoustic barrier must be properly installed with the base of the barrier sealed into the ground along the base.
- Junctions between any lengths of the absorptive acoustic barrier must also be properly sealed with no holes or gaps.
- BS 4142 Assessment with Mitigation

4.25 We have recalculated the noise model including the acoustic barriers recommended above and shown in Figure 5. The noise model results including noise mitigation measures are shown in the noise contour plots at the first-floor level in Figures 6 and 7, for the daytime and night-time respectively.

4.26 Based on the noise model calculations the recommended noise mitigation scheme is anticipated to provide up to at least 5 dBA of acoustic screening for the most exposed dwellings.

4.27 The results of the BS 4142 numerical assessment including noise mitigation measures are shown in Table 6 for the following reference assessment locations L1 and L2, which are shown in Figure 1.

Table 6: BS 4142 Numerical Assessment at the Nearest Dwellings - with Noise Mitigation [dB]

Description	L1		L2	
	Daytime	Night-time	Daytime	Night-time
Specific sound level [$L_{Aeq,T}$]	31	28	32	29
Character correction	+2	+2	+2	+2
Rating level [$L_{Ar,Tr}$]	33	30	34	31
Background sound level [$L_{A90,T}$]	35	34	33	31
Excess of rating over background	-2	-4	-2	0
Potential impact	L	L	L	L

"L" denotes 'Low'. "A" denotes 'Adverse'. "S" denotes 'Significant adverse'.

4.28 The calculated BS 4142 noise rating levels from the proposed energy storage facility are below the adopted background sound level measured close to the nearest dwellings. The BS 4142 assessment with noise mitigation measures indicates that the potential noise impact is now low.

4.29 In terms of a BS 4142 assessment the conclusion is that there would not be any adverse impact during both the daytime and night-time at the nearest dwellings. Indeed, the calculated rating levels are at or below the lowest measured background noise levels during both the daytime and night.

4.30 It is also noted that the calculated noise levels from the development outside the nearest dwellings will be well below the guideline value for outdoor amenity spaces and, taking into account a minimum outside to inside sound insulation of 10 dB for a typical dwelling with windows open for ventilation, well within the internal noise criteria for both daytime and night-time periods as set out in BS 8233.

4.31 We therefore conclude that the proposed development would not result in any unacceptable harm to residential amenity by reason of noise disturbance.

5.0 SUMMARY & CONCLUSION

5.1 Hepworth Acoustics Ltd was commissioned by Newfields BESS Ltd to carry out a noise impact assessment in connection with a planning application for a new energy storage site at land on Newfields Farm in Wetley Rocks, Staffordshire.

5.2 A baseline noise survey has been carried out at locations representative of the nearest dwellings, to quantify the existing prevailing noise climate in the area.

5.3 Hepworth Acoustics have prepared a computerised noise model based on manufacturer/supplier noise emission data and the proposed layout plan for the site. The noise model is based on the anticipated noise emissions with the proposed plant operating simultaneously.

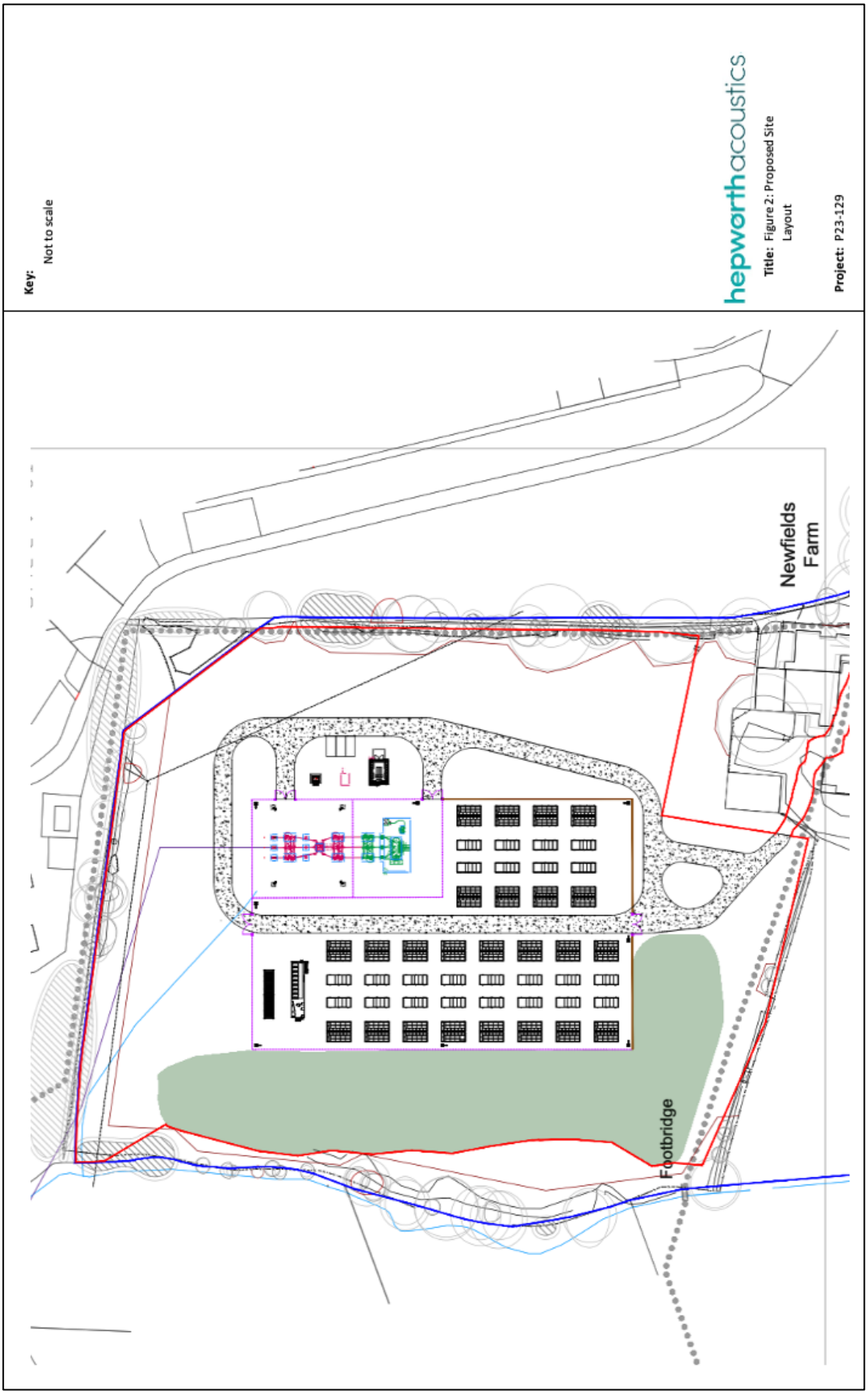
5.4 The actual noise emissions from the proposed site are expected to be significantly lower than the modelled noise levels for the vast majority of the time. This is because the modelling is based on a worst-case scenario, assuming all plant operates simultaneously at full capacity. In practice, operational demand will vary, and it is unlikely that all equipment will be running at maximum output at any given time. Additionally, the modelling accounts for cooling fans operating under ambient temperatures of 30°C, which is significantly higher than typical conditions experienced in the UK. Given that cooling demand is temperature-dependent, the need for fan operation will be substantially lower under normal UK climate conditions, further reducing actual noise emissions compared to the modelled predictions.

5.5 A robust noise mitigation scheme has been recommended, providing a reduction in the potential noise impact from the proposed equipment. The potential noise impact has been assessed in line with BS 4142 taking into account the relevant context, particularly the very low absolute levels of noise.

5.6 It is considered that with the recommended noise mitigation scheme in place, the noise impact from the proposed energy storage site taking into account the context of the low absolute noise levels would be ‘low’ in terms of BS 4142 categories and would not give rise to any adverse/significant adverse noise impacts in line with NPPF policy.

5.7 Therefore, there is no reason with respect to noise why the proposed site should not be granted planning permission, in line with relevant guidelines and policy.

Title: Figure 1: Site Location & Noise Measurement Positions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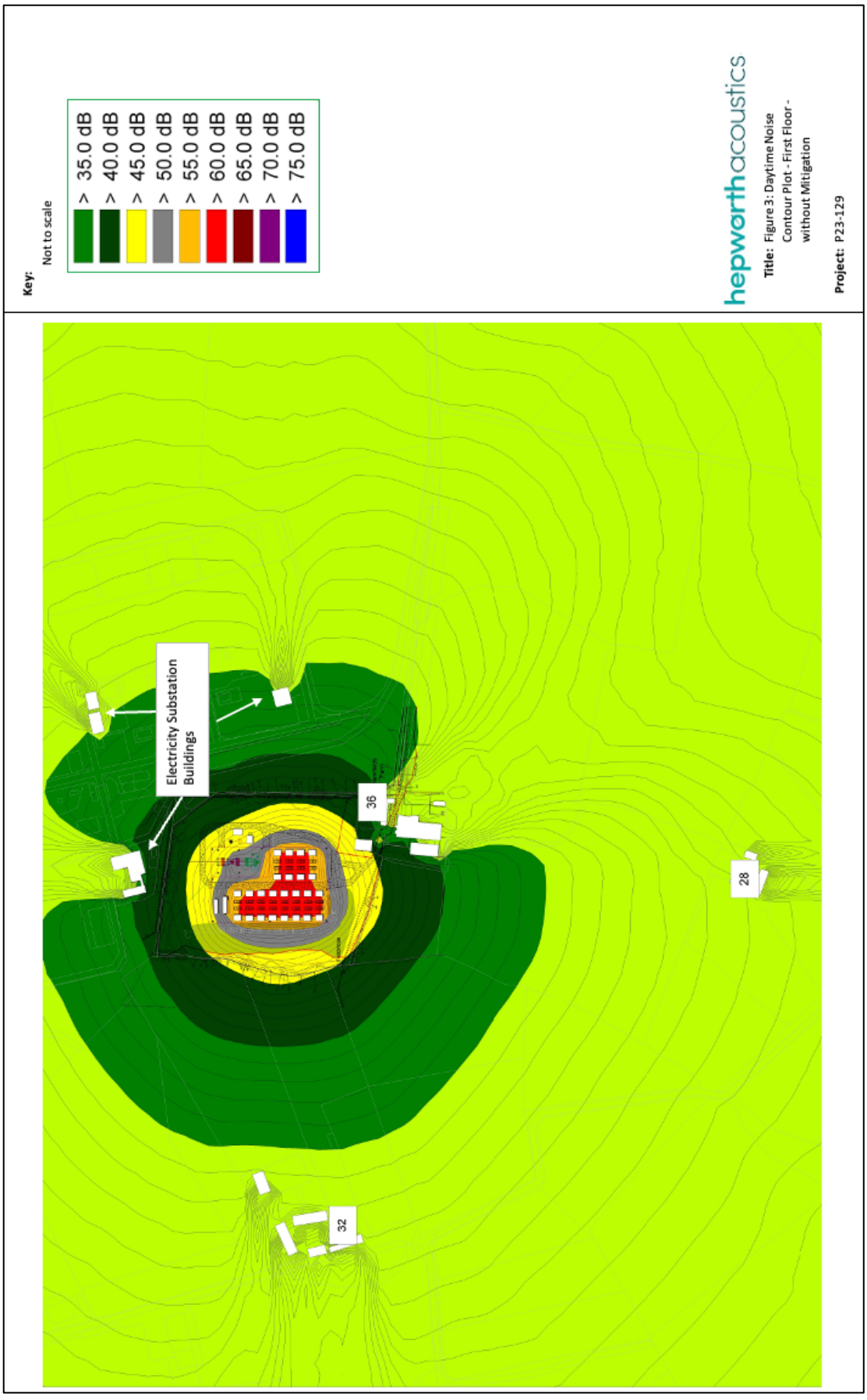
hepworthacoustics
Title: Figure 2: Proposed Site Layout
Project: P23-129
Newfields Farm
Footbridge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hepworthacoustics
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Project: P23-129
Electricity Substation Buildings
36
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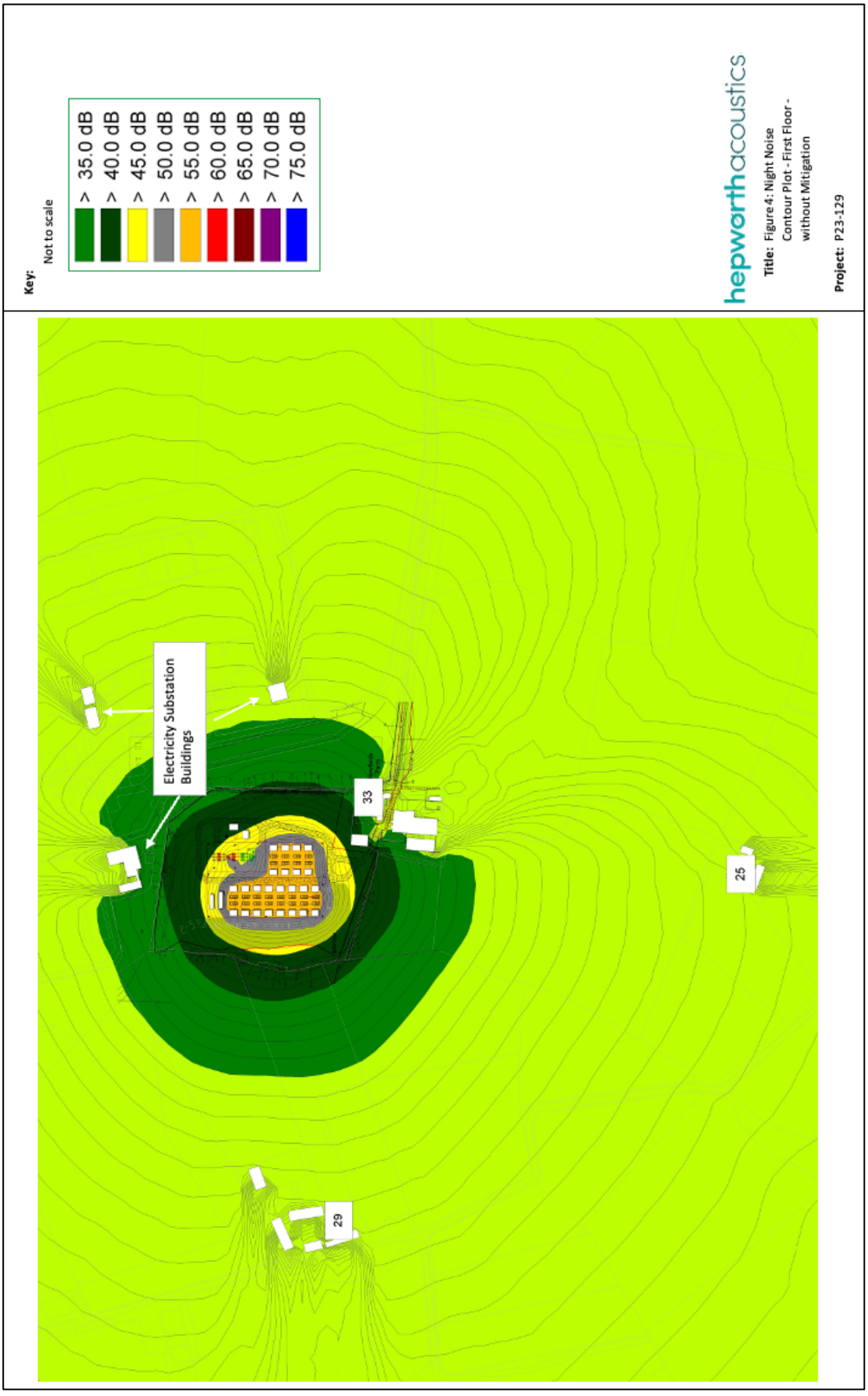
32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Project: P23-129
Electricity Substation Buildings
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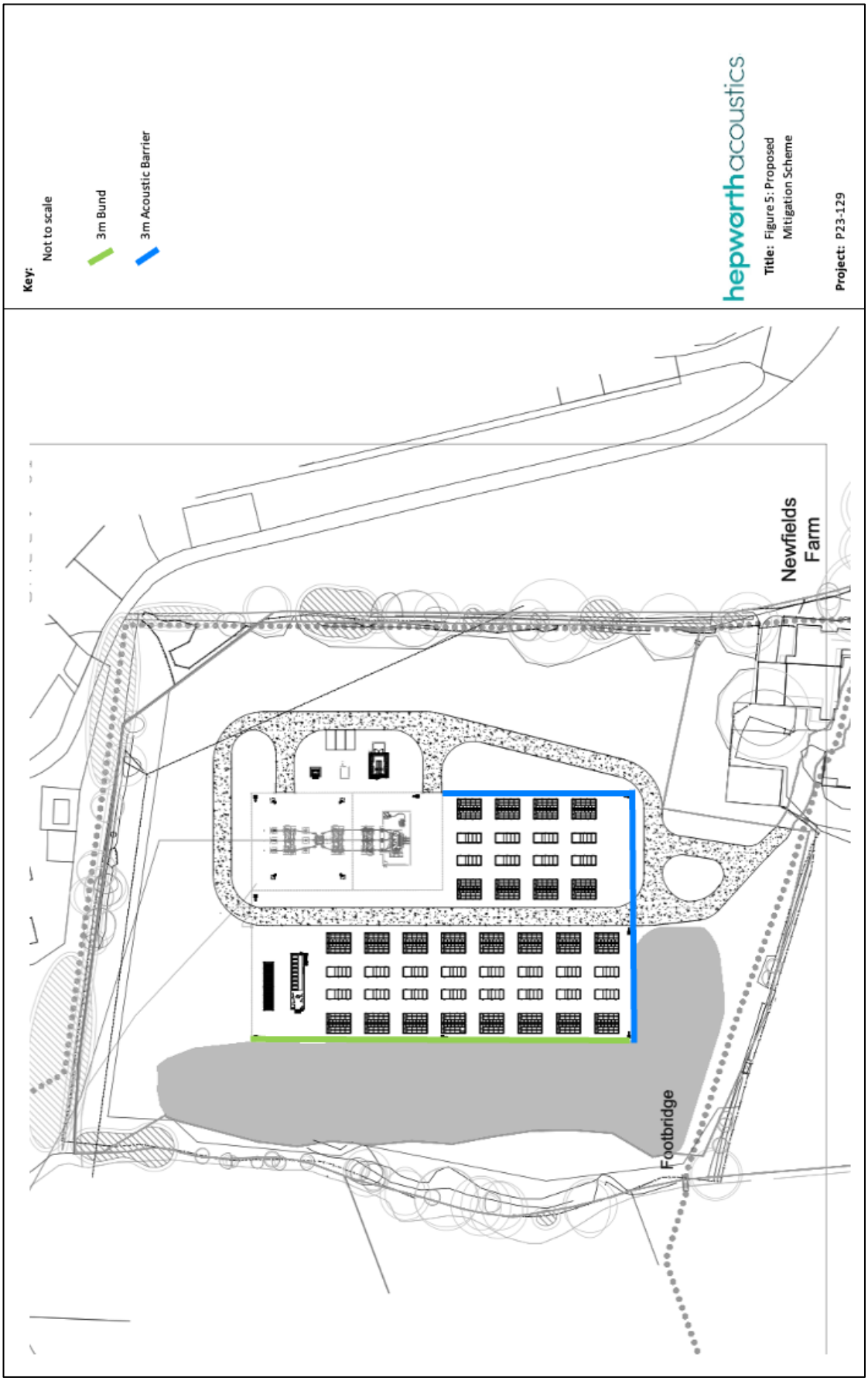
29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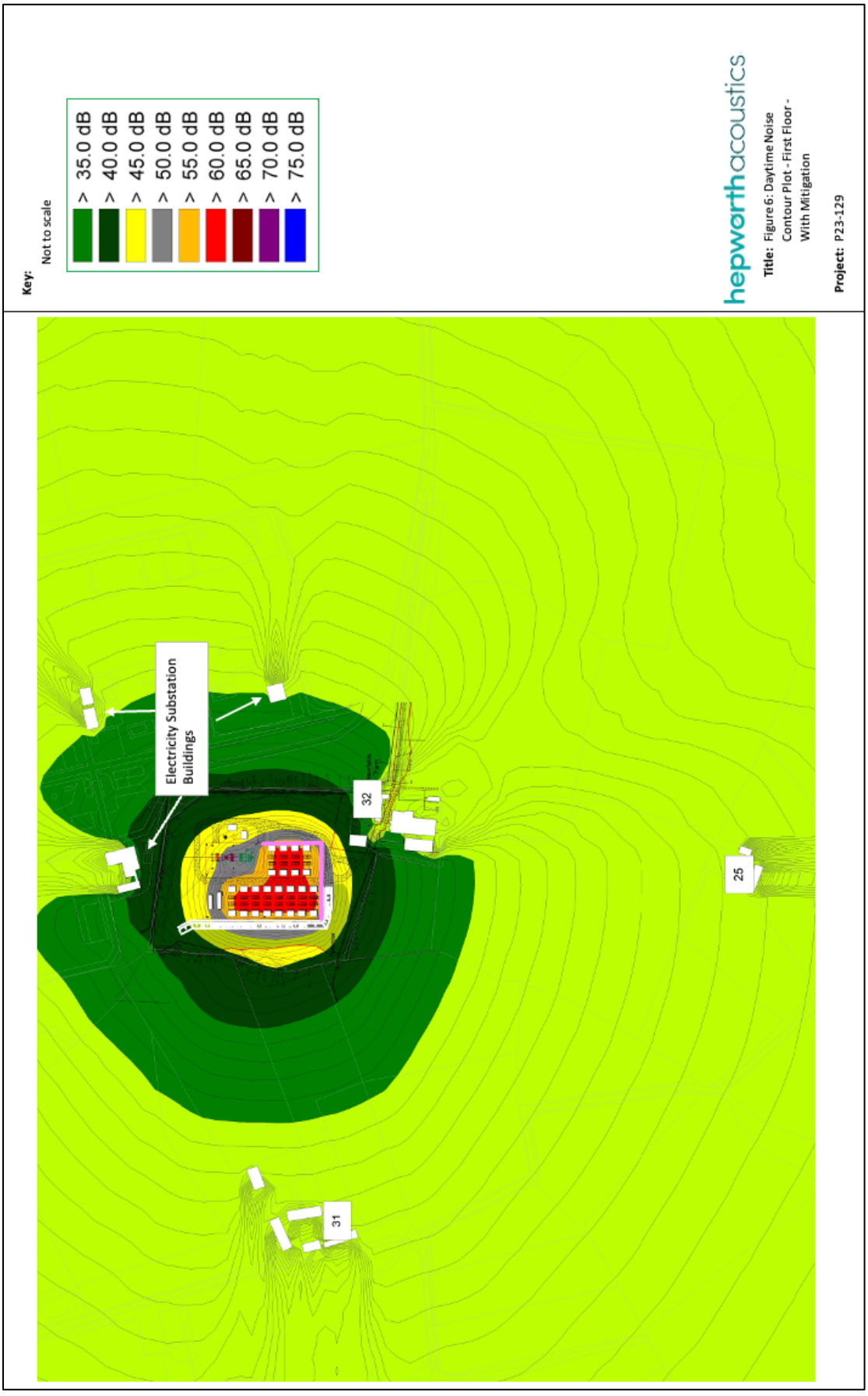
Project: P23-129
Newfields Farm
Footbridge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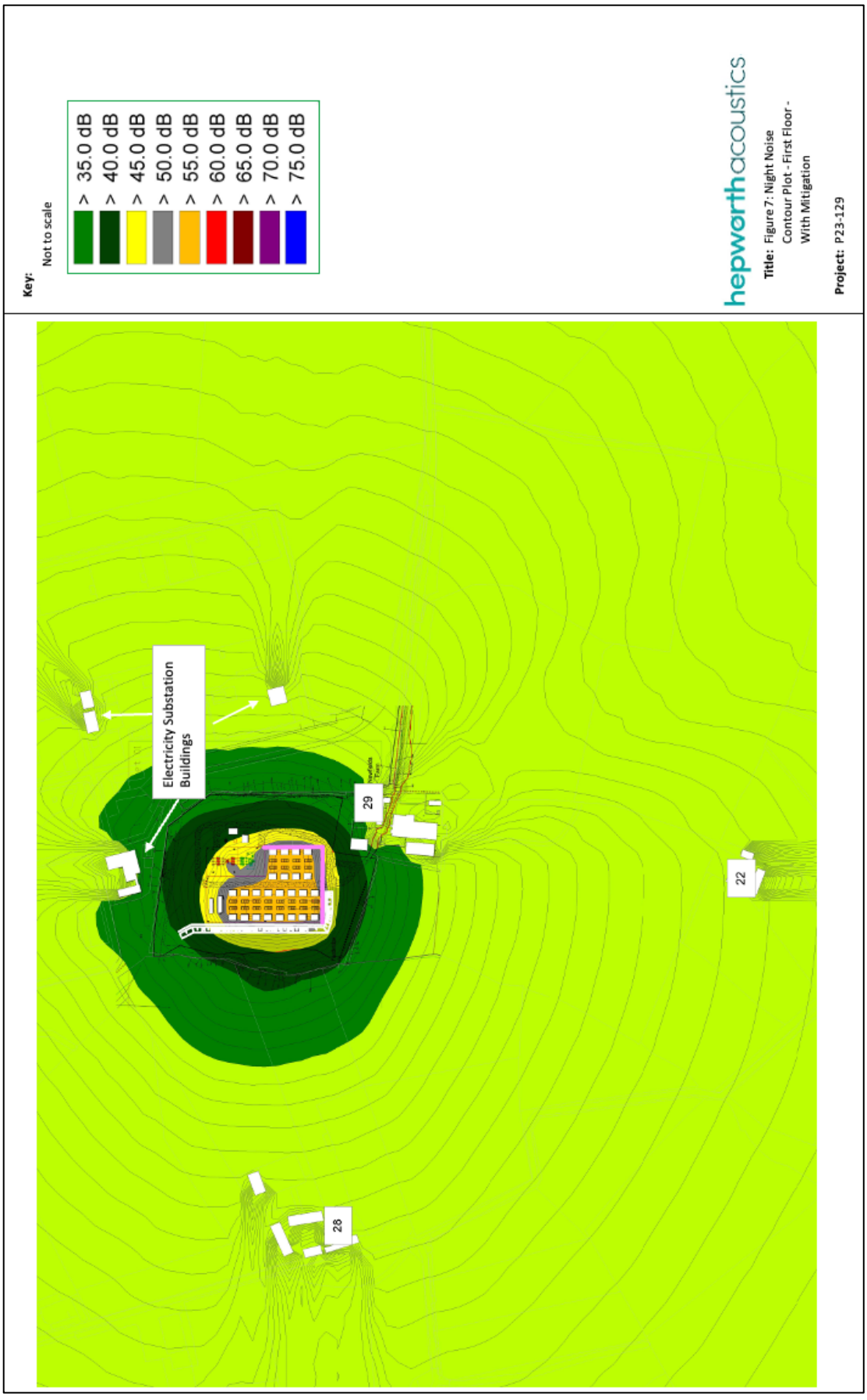
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Title: Figure 7: Night Noise Contour Plot - First Floor - With Mitigation
Project: P23-129
Electricity Substation Buildings
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Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The indices used in this report are described below.

L_w This is the 'Sound Power Level' which is a logarithmic ratio between a sound power quantity and the human threshold of hearing.

L_{wA} This is the A-weighted 'Sound Power Level', which is the Sound Power Level (L_w) adjusted to account for the average human hearing response at difference frequencies for a given sound power range.

$L_{Aeq,T}$ This is the A-weighted 'Equivalent Continuous Sound Level' which is an average of the total sound pressure measured over a specified time period. In other words, $L_{Aeq,T}$ is the level of a steady sound which has the same total (A-weighted) sound pressure as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for most forms of environmental noise.

L_{Amax} This is the 'Maximum A-weighted Sound Level' that was measured during the monitoring period. L_{Amax} used in this report refers throughout to L_{Amax} measured using the fast time weighting of the sound level meter, $L_{Amax,f}$.

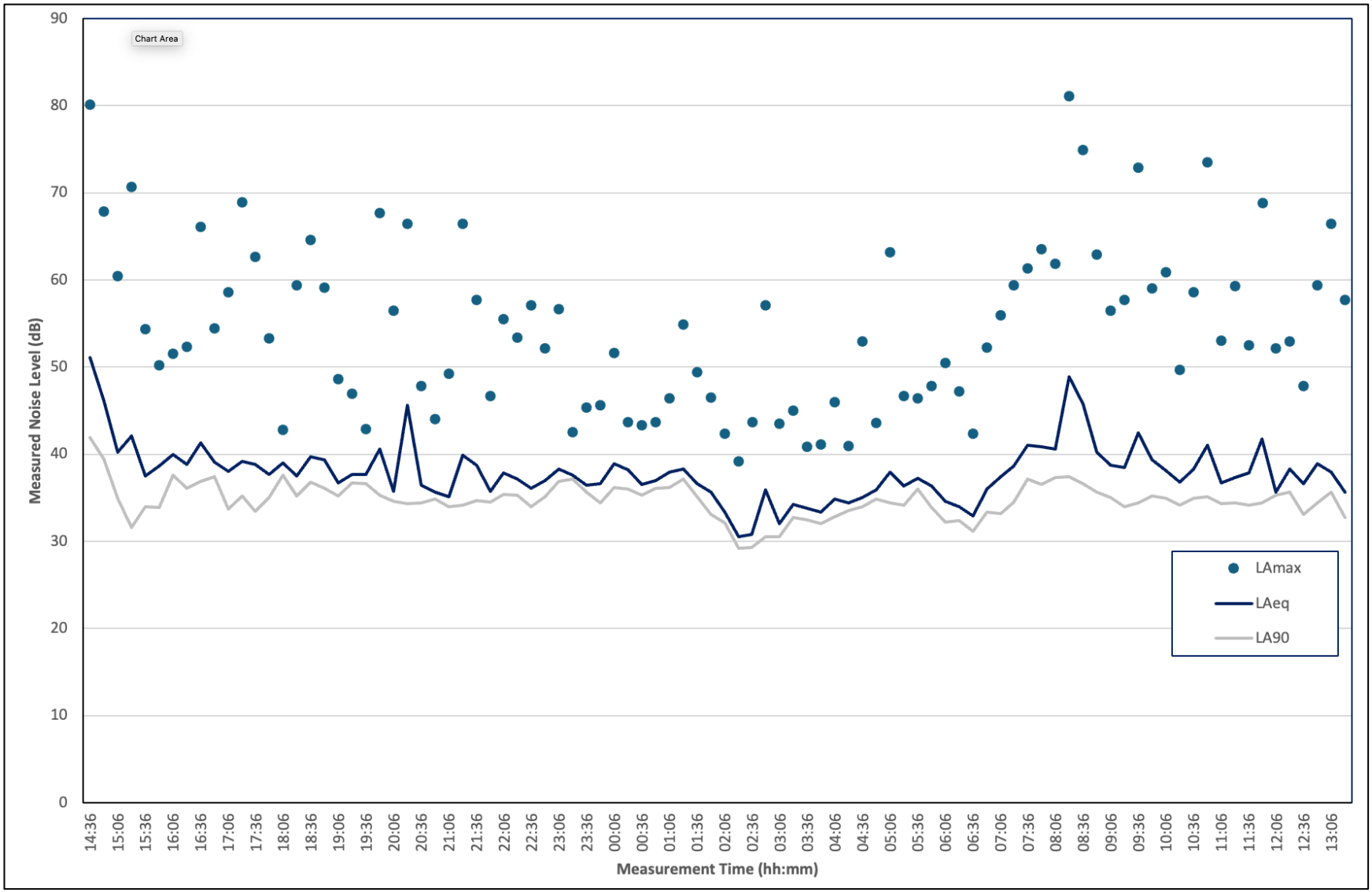
$L_{A90,T}$ This is the A-weighted sound level exceeded for 90% of a measurement time period. $L_{A90,T}$ is used as a measure of background sound level.

$L_{Ar,Tr}$ This is an A-weighted value most commonly used in BS 4142 assessments, which is the sound level of the noise source under assessment, at the assessment location, evaluated over the reference assessment period (T_r) and includes numerical adjustments for the characteristic features of the sound.

Appendix II: Noise Survey Results

Date:	14 Thursday 14th November - Friday 15th November 2024
Equipment:	NTi Audio XL2-TA 'Class 1' sound analyser (SN: A2A-20228-E0) Rion NL-52 'Class 1' sound analyser (SN: 1121401) Both with outdoor kits and windshields
Weather:	Thursday: During the daytime the weather was dry and the temperature was 10°C, with light winds around 2.2 m/s. The sky was overcast (8 oktas) of cloud cover.. At night the temperature was 5°C. light winds with overcast skies Friday**:** The weather was dry with temperatures of approximately 9°C, light winds 2 m/s. The sky remained overcast with 8 oktas of cloud cover.

Location A: Newfields Farm



Location B: Greenfields Farm