Subject: SMD 2025 0388 Noise/EHO discussions

Hi Chris,

Please find attached the updated noise assessment report for New Buildings, prepared following the recent comments from Environmental Health.
The report has been reviewed and updated to address the points raised. In particular, the table issue referred to in the EHO comments has been checked and corrected. This related to the "Totals" row in Table 3 and appears to have arisen as a formatting/copying issue when transferring information between documents. The relevant assessment inputs, methodology and findings have otherwise been reviewed, and the correction does not alter the conclusions of the assessment.
The report also includes some additional clarification regarding the assessment criteria. We note the EHO's comments regarding the use of BS 8233. While BS 8233 is primarily framed around the assessment of existing noise affecting new residential development, BS 4142 does refer to the need to consider noise in absolute terms as part of the overall assessment context. In this case, BS 8233 is considered to provide an appropriate reference point for that purpose, alongside the BS 4142 assessment.

In response to the EHO's comments, including those relating to the NPPF guidelines, the report has also been expanded to address potential additional mitigation. Given the current stage of the proposals, some matters are
necessarily based on assumed or indicative parameters. The updated report therefore explains how further mitigation can be secured through the detailed design and procurement process, including careful consideration of layout and placement in key areas.
On that basis, we trust the updated report addresses the comments raised and provides a suitable basis for Environmental Health to review the position further.
Please let me know if you or the EHO require anything further.

Many thanks.

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hepworth acoustics

PROPOSED SOLAR FARM AT NEW BUILDINGS FARM, STONE

NOISE ASSESSMENT

On behalf of:
New Buildings Solar Farm Ltd

PROPOSED SOLAR FARM AT NEW BUILDINGS FARM, STONE

NOISE ASSESSMENT

Report number	Prepared by	Prepared for
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Version	Date	Author	Checked by	Notes
1	07.04.26	G Bowland BSc MIOA Technical Director	D Quinn BSc FIOA Managing Director	Initial issue
2	21.04.26	G Bowland BSc MIOA Technical Director	D Quinn BSc FIOA Managing Director	Minor corrections
3	09.06.26	G Bowland BSc MIOA Technical Director	D Quinn BSc FIOA Managing Director	Corrections to 'Total' row on Table 3

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1. INTRODUCTION

1.1 Hepworth Acoustics was commissioned by New Buildings Solar Farm Ltd to carry out a noise impact assessment in connection with a proposed solar farm development on land at New Buildings Farm, Cresswell Road, Hilderstone, Stone, Staffordshire.

1.2 The site is currently open farmland formed of a number of fields within a wider rural environment, surrounded by other farmland that is interspersed with residential properties.

1.3 The site location is shown in Figure 1 and the proposed development layout is shown in Figure 2.

1.4 The proposal is essentially for solar panel modules across the development area, with associated equipment.

1.5 In terms of potential noise generating equipment, the system will comprise a proliferation of string inverters, which are relatively small box-sized units, each mounted to the underside of selected solar panels, as well as nine solar transformers, which are somewhat larger container-sized units. The proposed solar plant will have the potential to operate during sunlight hours only.

1.6 A main substation incorporating a 132kV power transformer is also proposed.

1.7 For the string inverters, at this stage, the design is based on the Huawei SUN2000-330KTL string inverter model. Based on Huawei published noise emissions data, the reference source noise level for this model is 75dB L_{pA} at 1m per inverter when operating at full capacity.

1.8 We understand that the solar equipment may operate at full capacity during peak periods, which will be in the middle of the daytime on warm/hot summer days. When the equipment is running at a lower capacity, due to a lower intensity of sunlight, e.g. during cooler months, or during the earlier and later part of daylight hours at any time of year, when the angle of incidence of sun rays will be lower, a lower level of noise output is expected. This is because the inverter produces less power and generates less heat when sunlight is lower or temperatures are cooler, so its cooling fans run more slowly or switch off, reducing noise.

1.9 Based on data for similar comparable string inverters, the unit may be expected to operate with noise levels about 7dB below peak when operating at about 70% capacity.

1.10 At this stage, precise quantities and locations of string inverters are yet to confirmed. Consequently, this assessment is based on an estimated number of units derived from a comparison with other solar development schemes, where a similar inverter type is proposed, scaled according to relative areas of solar panel coverage. On this basis, it has been assumed for assessment purposes that up to 150 of the relevant Huawei units will be required. This is considered to be a cautious estimate, i.e. it is likely that fewer will suffice.

1.11 In terms of locations, broadly speaking the inverters will be distributed fairly evenly across the site area and we understand there will be reasonable scope to select precise string inverter locations strategically to optimise noise control.

1.12 For assessment purposes, noting that the proposed development layout in Figure 2 identifies a total of 22 numbered 'fields', we have allocated a proportionate number of string inverters per field based on relative area. A notional 'average' source location towards the centre of each 'field' has been taken for assessment purposes.

1.13 Regarding the proposed solar transformers, at this stage, the design is based all but one of the units being the Huawei STS 6000k-H1, for which the manufacturer's quote a reference source noise level is 70dB $\underline{L}_{pA}$ at 1m. The remaining unit (the most westerly of those proposed) will be the Huawei STS 3000k-H1, for which the reference source noise level is 64dB $\underline{L}_{pA}$. The locations for the proposed solar transformers are identified on the proposed development layout in Figure 2.

1.14 The proposed substation is to be located towards the northwest area of the site, as identified on the proposed development layout in Figure 2. For the main 132kV power transformer, no specific equipment selection has been made as yet (which is usual at this stage for this generic piece of apparatus). Accordingly, source data has been assumed based on the upper end of the usual range for comparable transformer units. This has hence been taken as a reference level of 77dBA at 1m.

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

2. ACOUSTIC CRITERIA

NPPF / NPSE

2.1 The *National Planning Policy Framework* (NPPF), December 2024, states at paragraph 187 that "*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 … noise pollution …*".

2.2 Paragraph 198 states that "*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 …*".

2.3 The Noise Policy Statement for England (NPSE) 2010, as referred to the in NPPF, includes three aims:

- Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
- Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.4 However, there is as yet no specific guidance on numerical acoustic assessment/design criteria for proposed new housing developments provided in the NPPF, accompanying Technical Guidance document, National Planning Practice Guidance 'Noise', nor the NPSE.

BS 4142

2.5 British Standard 4142: 2014 +A1:2019, *Methods for rating and assessing industrial and commercial sound* provides methods for rating and assessing sound of an industrial nature from industrial or commercial premises.

2.6 This requires the sound from a specific source (in L_{Aeq}) to be compared with the existing background sound level (L_{A90}) outside residential locations. The standard also puts weight on the importance on the context in which the sound will occur.

2.7 The noise 'rating' level ($L_{Ar,T}$) is derived based on the 'specific' L_{Aeq} sound level attributable to the operation with an 'acoustic feature' penalty added for any sound sources which give rise to tonal, impulsive, intermittent, or other characteristics readily distinctive against the residual acoustic environment.

2.8 BS 4142 stipulates that impacts should be assessed over a reference time interval 'T' of 1-hour during the daytime (0700-2300hrs) and 15-minutes during the night-time (2300-0700hrs).

2.9 An initial estimate of the impact of the operation is determined by subtracting the background level from the 'rating' level. BS 4142 states that:

- 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
- 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

2.10 Where the initial estimate of the impact needs to be modified due to the context, BS 4142 states that all pertinent factors should be taken into account in determining whether the initial estimate of the impact needs to be modified, including:

- The absolute level of noise, including "*where background noise levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds background. This is especially true at night*"
- The character and level of the residual noise
- The sensitivity of the receptor noise survey

2.11 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". It is also stated that "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"*. .

BS 8233

2.12 British Standard 8233: 2014 Guidance on sound insulation and noise reduction for buildings, which carries the full weight of an adopted British Standard recommends guidance on design criteria for acceptable noise levels within residential accommodation. BS 8233 guidelines for the daytime (0700-2300hrs) and night-time (2300-0700hrs) periods are summarised in Table 1.

Table 1: BS 8233 Recommended Acoustic Design Criteria

Activity	Location	Internal Noise Levels	
		Daytime 0700-2300hrs	Night-time 2300-0700hrs
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 B $L_{Aeq,8hr}$

2.13 It is noted that BS 8233 states in its Scope that the Standard "*does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building*". Notwithstanding this BS 4142 references the use of BS 8233 in this regard stating that: "*In addition to the rating/background sound level comparison… the primary concern is the potential for disturbance of residents who could be sleeping with open bedroom windows. Other guidance, such as BS8233, might also be applicable in this instance*."

2.14 BS 8233 clarifies that the above guidance relates only to noise without specific character (e.g. such as that which has 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.

2.15 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*".

2.16 Regarding outdoor living areas, Clause 7.7.3.2 of BS 8233 states that "*it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T,}$ with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments*".

3. BASELINE NOISE SURVEY

3.1 Continuous baseline residual / background noise monitoring was undertaken in sequential 15-minute samples at three locations, identified in Figure 1 as Monitoring Locations 1, 2 and 3.

3.2 The noise monitoring was carried out at Monitoring Location 1 using a NTi Audio XL2-TA 'Class 1' sound analyser (serial no. A2A-20259-E0) over the period 1700hrs on Tuesday 22 August 2023 until 1400hrs on Wednesday 23 August 2023.

3.3 The noise monitoring was carried out at Monitoring Location 2 using a Rion NA-28 'Class 1' sound analyser (serial no. 00960036) over the period 1500hrs on Tuesday 22 August 2023 until 1330hrs on Wednesday 23 August 2023. However, data recorded from 0745hrs onwards was corrupted due to interference from large birds which resulted in the measurement microphone being knocked the ground and the windshield removed. Nonetheless, adequate valid data was recorded at this location for assessment purposes prior to this event. Only the valid data is considered herein.

3.4 The noise monitoring was carried out at Monitoring Location 3 using a Norsonic 140 'Class 1' integrating sound level meter (serial no. 1406529) over the period 1500hrs on Tuesday 22 August 2023 until 1300hrs on Wednesday 23 August 2023.

3.5 Calibration checks were carried out to all equipment using a Norsonic Acoustic Calibrator, Type 1251 (serial no. 20804) before and after the survey, and no variation in calibration level was observed

3.6 The Monitoring Locations were selected on a pragmatic basis to provide a suitably representative assessment of the general noise climate in locations representative of the nearest residences to the proposed development as well as those in the wider environs.

3.7 All measurement microphones were fitted with windshields and mounted at 1.5m above local ground in free-field conditions.

3.8 The weather during the monitoring was dry with light winds of speeds typically below 3m/s, of mixed but predominantly south-westerly direction.

3.9 The data has been analysed and summarised for each location into the relevant periods of the 'day', 'evening' and 'night'. Noting that the solar equipment will not be operational over the approximate period 2100-0500hrs, which will be in darkness (or very low sun) even in midsummer, this has been based on a 'day' period of 0700-1900hrs, an 'evening' period of 1900-2100hrs and a 'night' period of 0500-0700hrs.

3.10 The baseline noise levels are summarised in Table 2.

Table 2: Summary of Baseline Noise Monitoring Results

		Day (0700-1900hrs)			Evening (1900-2100hrs)			Night (0500-0700hrs)		
		Monitoring Location			Monitoring Location			Monitoring Location		
		1	2	3	1	2	3	1	2	3
$L_{Aeq,T}$ 'residual'	Range	45-51	34-47	34-47	39-49	31-39	36-44	42-49	32-41	31-47
	Log. average	48	40	40	45	36	40	46	38	42
$L_{A90,T}$ 'background'	Range	38-46	30-36	27-37	34-40	29-32	29-32	33-43	29-36	27-35
	Mean	42	33	31	38	30	30	38	33	32
	Mode	44	33	33	40	29	30	35	33	33

3.11 At Monitoring Location 1 the measured noise levels were sometimes influenced by existing farming activities around the site. However, at other times, and more broadly at Monitoring Locations 2 and 3, the measured noise levels were due to general rural environmental noise.

3.12 More generally, from our experience of similar sites, it is inevitable that there will be some variation in ambient and background noise levels in the environs of the site, resulting from fluctuations in meteorological conditions, including wind direction, as well as day-to-day and seasonal variations in local agricultural activities. Nonetheless, it is also very clear that ambient and background noise levels around the site can be very low. At such times, i.e. when the noise environment is less affected by local noise sources in closer proximity, and hence is due to more general distance noise, it will also be the case that broadly equivalent noise levels will prevail over the wider general vicinity.

3.13 Based on the foregoing, the subsequent assessment of potential noise impacts at any nearby residences is based upon representative noise levels, taken from the mean and modal values, at Noise Monitoring Locations 2 and 3, at which the lowest measured baseline levels were recorded. This is to ensure a robust and cautious assessment in all cases.

4. PREDICTED NOISE EMISSIONS

4.1 Calculations have been undertaken in order to determine potential worst-case noise levels attributable to the proposed development at the nearest existing residential locations.

4.2 The assessment locations considered are those identified in Figure 1 as Assessment Locations A - I.

4.3 As set out in Section 1, the worst-case reference noise levels for the proposed equipment are as follows:

- String Inverter: 75dB L_{pA} at 1m per unit at 100% power
  68dB L_{pA} at 1m per unit at 70% power
- Solar Transformer #1: 64dB L_{pA} at 1m
- Solar Transformer #2-9: 70dB L_{pA} at 1m
- Substation: 77dB L_{pA} at 1m

4.4 Based on the anticipated operational profile of the equipment and prior experience of similar sites, we have assumed for the purpose of this assessment that string inverter operation at 100% power is possible in conducive conditions during the assessment daytime period, i.e. 0700-1900hrs, but that this would be limited to 70% power during the assessment evening (1900-2100hrs) and night-time (0500-0700hrs) periods, and hence applicable source data for the string inverter units have been used for those periods.

4.5 The locations of all plant have been assumed on the basis described in Section 1.

4.6 The string inverters will be mounted to the underside of the solar panels, and hence will generally not be visible from off-site locations, such that there will be an inherent acoustic screening provision. Furthermore, there will be significant potential acoustic screening effects from the surrounding solar panels, depending upon precise string inverter locations and relative orientation to Assessment Locations. In places, there will be significant acoustic screening effects due to topographical features, where landform interrupts line-of-sight between individual noise sources and Assessment Locations. Soft ground attenuation of noise will also be a factor, firstly noting the open space below the panels, and the potential effect of this on acoustic screening, as well as more generally in propagation terms.

4.7 To account for the uncertainties in acoustic screening / soft ground attenuation effects, calculations have been undertaken based on very conservative 5dBA overall noise reduction per string inverter / 'field'. For most noise sources, with their relative orientation to Assessment Locations, this reduction is likely to be significantly better.

4.8 For the nine proposed solar transformer units, in the absence of clear information relating to noise emissions during reduced power operation, the stated emissions values based on 100% power have been used to ensure a cautious assessment. Also, no acoustic screening / soft ground attenuation effects have been considered with regard to transformer noise.

4.9 Calculations have been carried out accounting for distance corrections from each individual source/ 'field' location to each Assessment Location. Noting the corrections already outlined above, this has been based on a calculation of propagation over hard ground. Also, no account is taken of acoustic screening affects due to physical structures immediately around the Assessment Locations, which will potentially reduce noise in sensitive areas, in some cases.

4.10 The predicted worst-case noise levels on the basis set out above are summarised in Table 3 for the daytime situation, and in Table 4 for the evening / night-time situation.

Table 3: Predicted Worst-case Noise Levels at Nearest Dwellings – Day

	ID No.	No. of Units	Noise Level dB $L_{Aeq,T}$									
			Ref. Noise at 1m	Assessment Location								
				A	B	C	D	E	F	G	H	I
String Inverter 'Field'	1	13	68	31	20	29	21	16	14	17	21	22
	2	10	68	27	21	25	20	15	13	16	20	20
	3	9	68	24	21	23	21	16	13	16	19	18
	4	15	68	26	24	24	22	18	16	20	22	22
	5	3	68	18	17	16	14	10	9	13	16	15
	6	3	68	17	19	15	15	11	9	14	15	14
	7	7	68	24	19	21	17	13	12	16	21	21
	8	11	68	24	20	21	18	15	14	18	26	24
	9	6	68	18	26	17	19	15	13	19	18	15
	10	10	68	18	34	17	21	19	17	23	19	16
	11	4	68	13	30	12	16	15	14	21	14	11
	12	8	68	15	32	14	19	19	19	24	16	14
	13	2	68	8	23	8	15	14	13	17	9	7
	14	2	68	9	27	9	15	15	13	16	9	7
	15	1	68	5	21	5	11	12	10	12	6	4
	16	3	68	9	22	9	14	17	17	19	10	8
	17	3	68	10	22	10	13	13	15	25	12	9
	18	5	68	12	24	11	15	16	18	26	14	11
	19	13	68	15	27	15	20	22	24	28	17	14
	20	5	68	12	21	11	14	15	18	31	14	11
	21	6	68	12	21	11	15	16	21	28	14	11
	22	9	68	13	22	12	17	18	25	28	15	12
Solar Transformer	1	1	64	16	2	14	3	-2	-4	-1	3	5
	2	1	70	15	11	14	11	6	4	6	9	9
	3	1	70	13	13	12	10	6	4	8	11	9
	4	1	70	13	11	11	8	5	4	8	14	11
	5	1	70	9	20	8	11	8	6	11	10	7
	6	1	70	5	21	5	10	11	10	14	7	4
	7	1	70	5	16	4	8	10	12	16	6	3
	8	1	70	5	14	4	7	8	11	20	7	4
	9	1	70	4	12	3	6	8	14	18	6	3
132kV Transformer			77	27	16	27	17	11	9	12	15	18
			TOTAL =	**36**	**40**	**35**	**32**	**30**	**31**	**37**	**32**	**31**

Table 4: Predicted Worst-case Noise Levels at Nearest Dwellings – Evening / Night-time

	ID No.	No. of Units	Noise Level dB $L_{Aeq,T}$									
			Ref. Noise at 1m	Assessment Location								
				A	B	C	D	E	F	G	H	I
String Inverter 'Field'	1	13	68	24	13	22	14	9	7	10	14	15
	2	10	68	20	14	18	13	8	6	9	13	13
	3	9	68	17	14	16	14	9	6	9	12	11
	4	15	68	19	17	17	15	11	9	13	15	15
	5	3	68	11	10	9	7	3	2	6	9	8
	6	3	68	10	12	8	8	4	2	7	8	7
	7	7	68	17	12	14	10	6	5	9	14	14
	8	11	68	17	13	14	11	8	7	11	19	17
	9	6	68	11	19	10	12	8	6	12	11	8
	10	10	68	11	27	10	14	12	10	16	12	9
	11	4	68	6	23	5	9	8	7	14	7	4
	12	8	68	8	25	7	12	12	12	17	9	7
	13	2	68	1	16	1	8	7	6	10	2	0
	14	2	68	2	20	2	8	8	6	9	2	0
	15	1	68	-2	14	-2	4	5	3	5	-1	-3
	16	3	68	2	15	2	7	10	10	12	3	1
	17	3	68	3	15	3	6	6	8	18	5	2
	18	5	68	5	17	4	8	9	11	19	7	4
	19	13	68	8	20	8	13	15	17	21	10	7
	20	5	68	5	14	4	7	8	11	24	7	4
	21	6	68	5	14	4	8	9	14	21	7	4
	22	9	68	6	15	5	10	11	18	21	8	5
Solar Transformer	1	1	64	16	2	14	3	-2	-4	-1	3	5
	2	1	70	15	11	14	11	6	4	6	9	9
	3	1	70	13	13	12	10	6	4	8	11	9
	4	1	70	13	11	11	8	5	4	8	14	11
	5	1	70	9	20	8	11	8	6	11	10	7
	6	1	70	5	21	5	10	11	10	14	7	4
	7	1	70	5	16	4	8	10	12	16	6	3
	8	1	70	5	14	4	7	8	11	20	7	4
	9	1	70	4	12	3	6	8	14	18	6	3
132kV Transformer			77	27	16	27	17	11	9	12	15	18
			TOTAL =	**31**	**33**	**30**	**26**	**24**	**25**	**31**	**26**	**25**

5. NOISE ASSESSMENT

5.1 Based on the results of the baseline noise survey and the predicted worst-case noise levels from the development, a set of 'initial estimate' assessments of the potential noise impact of the development, as per BS 4142 guidelines, has been undertaken.

5.2 Due to the low predicted noise levels at the Assessment Locations (even accounting for the highly cautious predictions as described) it is not considered that any acoustic feature penalties are warranted in line with BS 4142. Although individual items of proposed equipment will have potential intermittent characteristics, in reality, individual units will switch in or out independently of each other, such that these steps would not be noticeable at the Assessment Locations.

5.3 Representative background noise levels have been adopted as described in Section 3.

5.4 The 'initial estimate' assessments are summarised in Table 5.

Table 5: Initial BS 4142 Assessments

Assessment Period	Assessment Parameter dB	Assessment Location								
		A	B	C	D	E	F	G	H	I
'Day' (0700 - 1900hrs)	Specific Level, $L_{Aeq,T}$	36	40	35	32	30	31	37	32	31
	Acoustic Feature Correction	0	0	0	0	0	0	0	0	0
	Rating Level, $L_{Ar,T}$ [A]	36	40	35	32	30	31	37	32	31
	Background Level, $L_{A90,T}$ [B]	33	33	33	33	33	33	33	33	33
	Difference: [A] minus [B]	**3**	**7**	**2**	**-1**	**-3**	**-2**	**4**	**-1**	**-2**
'Evening' (1900 - 2100hrs)	Specific Level, $L_{Aeq,T}$	31	33	30	26	24	25	31	26	25
	Acoustic Feature Correction	0	0	0	0	0	0	0	0	0
	Rating Level, $L_{Ar,T}$ [A]	31	33	30	26	24	25	31	26	25
	Background Level, $L_{A90,T}$ [B]	30	30	30	30	30	30	30	30	30
	Difference: [A] minus [B]	**1**	**3**	**0**	**-4**	**-6**	**-5**	**1**	**-4**	**-5**
'Night' (0500 - 0700hrs)	Specific Level, $L_{Aeq,T}$	31	33	30	26	24	25	31	26	25
	Acoustic Feature Correction	0	0	0	0	0	0	0	0	0
	Rating Level, $L_{Ar,T}$ [A]	31	33	30	26	24	25	31	26	25
	Background Level, $L_{A90,T}$ [B]	32	32	32	32	32	32	32	32	32
	Difference: [A] minus [B]	**-1**	**1**	**-2**	**-6**	**-8**	**-7**	**-1**	**-6**	**-7**

5.5 In broad summary, the 'initial estimate' assessments indicate that, in most scenarios, the predicted worst-case plant rating levels will be no more than 2dB above the assessment background level. In accordance with BS 4142, this is an "*indication of the specific sound source having a low impact, depending on the context*."

5.6 The exceptions to this are, firstly, at Assessment Locations A and G, whereat the predicted worst-case plant rating levels are shown to be potentially 3-4dB above the assessment background level during the day period only, but remaining at no more than 1dB above background at all other times. Therefore at these locations the potential worst-case impact will be tending towards an *"adverse impact, depending on the context"* during the day, but will be nonetheless a "*low impact depending on the context*" during the evening and night.

5.7 At Assessment Location B, the predicted worst-case plant rating levels are shown to be potentially 7dB above the assessment background level during the day period only, and 3dB above the assessment background level during the evening, but remaining no more than 1dB above background at all other times. Therefore at this location the potential worst-case impact will be of an *"adverse impact, depending on the context"* during the day, but <u>not</u> amounting to a significant adverse impact, and will also be tending towards *"adverse impact, depending on the context"* in the evening, but will be nonetheless a "*low impact, depending on the context*" during the night.

5.8 Importantly, where the initial estimate of the impact needs to be modified due to the context, BS 4142 states that all pertinent factors should be taken into account.

5.9 In this case, one critical contextual element to consider is the 'absolute' level of noise. In particular the BS 4142 guideline that "*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 background. This is especially true at night*".

5.10 It is certainly the case here that assessment background levels and rating levels are low for all scenarios considered, even based on the worst-case assumptions adopted. As such, it should be properly appreciated that while there may be certain scenarios where predicted plant rating levels may exceed background sound level (i.e. in terms of a 'relative' assessment) this is substantially because background levels are especially low, and in these cases the 'absolute' plant rating levels are themselves nonetheless very low. This of course inherently limits any potential for adverse impact.

5.11 To note also the final part of the excerpt in paragraph 5.9 relating to the night-time (which is of greatest relevance here, that being the only period wherein any potential for significant adverse impact is identified, based on the 'initial' BS 4142 assessment) this is the case because occupants of any nearby residences would generally be expected to be inside during the night-time, such that the external noise assessment may carry less relevance.

5.12 For this assessment, the worst-case predicted noise levels attributable to the proposed development do not exceed 40dB L_{Aeq}, for the day period, and are therefore at least 10dB better than the 'desirable' level for external noise in outdoor living areas, as per BS 8233, and lower still for most Assessment Locations. For the evening situation, when baseline residual and background sound levels are lower, the predicted plant levels are also lower; not exceeding 33dB L_{Aeq} and hence at least 18dB better than the BS 8233 'desirable' level for outdoor living areas.

5.13 In terms of internal noise at the residences, it is generally accepted that a noise reduction of up to 15dB (outside to inside) is achievable via a partially open window. On this basis, internal noise levels at residences, attributable to the proposed development, would not exceed 25dB $L_{Aeq,T}$, even with windows open. This level is 10dB better than the recommended internal daytime noise level limit (applicable to the day and evening periods), as per BS 8233 at the worst-case Assessment Location, but will be somewhat lower at locations and commensurately 7dB lower at all locations during the evening compared to the day period.

5.14 During the night-time, based on the worst-case predicted plant levels for this period, internal noise levels would be no more than 18dB $L_{Aeq,T}$, even with windows open, and again lower still in most locations. This worst-case level is 12dB better than the recommended internal night-time noise level limit.

5.15 With regard to the above consideration of 'absolute' noise levels, it is noted that the cited BS 8233 guidelines relate only to noise without specific character and that where characteristics are present, "*lower noise limits might be appropriate*". For this assessment, it has been discussed that no distinctly noticeable characteristics are anticipated, however in any case here the predicted noise levels are shown to be substantially lower than the BS 8233 guidelines limits, to an extent that easily offsets any potential for impacts relating to perceptible acoustic characteristics, even with windows open.

5.16 The predicted internal noise levels at residences are therefore well within suitable 'absolute' noise level limits.

5.17 Based on the foregoing, considering both the initial assessment of impact and the relevant contextual factors, in line with BS 4142 and other relevant guidelines, no unacceptable noise impact, and consequently no harm to residential amenity, is anticipated as a result of proposed development.

5.18 Nonetheless, although the above conclusion is true based on the full BS 4142 assessment, properly accounting for contextual factors as well as the initial assessment, it is appropriate in line with the provision of the NPPF to "*mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development*".

5.19 The noise predictions herein show that the overall noise levels at the Assessment Locations (and most notably based on the above at Assessment Locations B and G) are primarily due to the proposed string inverters in the nearest 'field' or 'fields' to respective Assessment Location.

5.20 As has been noted, in the absence of details at this stage of precise quantities and locations for the string inverters, the assessment has been based on a cautiously estimated number and distribution of string inverter units, derived from a comparison with other solar development schemes. A notional 'average' source location towards the centre of each 'field' has been taken for assessment purposes. As also described herein, to account for the uncertainties in acoustic screening / soft ground attenuation effects, calculations have been undertaken based on very conservative 5dBA overall noise reduction per string inverter / 'field'.

5.21 However, again as already stated, for most noise sources, with their relative orientation to Assessment Locations, this reduction is likely to be significantly better.

5.22 Indeed, it is considered that there is ample scope to ensure an increased level of acoustic screening provision in key areas of the site, by design.

5.23 Therefore, notwithstanding the earlier stated conclusions based on the full assessment, if considered necessary to control plant noise levels to ensure a 'low' noise impact based simply on the BS 4142 initial assessment (i.e. separate to consideration of contextual factors, and again notably at Assessment Locations B and G) then this will be readily achievable by way of careful placement of string inverters, especially in areas close to those locations.

5.24 As described, the string inverters are relatively small box-sized units, mounted to the underside of selected solar panels, and hence this arrangement can be used alongside careful layout design to maximise the use of the solar panels as effective acoustic barriers for string inverter noise.

5.25 This measure, along with maximising the separation distance between the closest Assessment Locations and string inverters within the nearest field, may be readily employed to achieve a further 5dB reduction or better, by comparison to conservative assessment assumptions.

5.26 However, given that the assessment is cautiously based on outline specifics, it is not suitable or feasible to consider the detailed application of these noise mitigation recommendations at this stage; rather this will come during the detailed design / procurement stage.

5.27 Nonetheless, it is recommended that suitable noise control for the development may be enshrined and enforced for planning purposes by way of a suitably worded planning condition. In this case, based on the background noise levels at the site, it is recommended that plant noise emissions are conditioned so as not to exceed 36dB $L_{Ar,Tr}$ during the day period (0700-1900hrs), 33dB $L_{Ar,Tr}$ during the evening period (1900-2100hrs) period, and 35dB $L_{Ar,Tr}$ during the night period (0500-0700hrs).

6. SUMMARY

6.1 Hepworth Acoustics was commissioned by New Buildings Solar Farm Ltd to carry out a noise impact assessment in connection with a proposed solar farm development on land at New Buildings Farm, Cresswell Road, Hilderstone, Stone, Staffordshire.

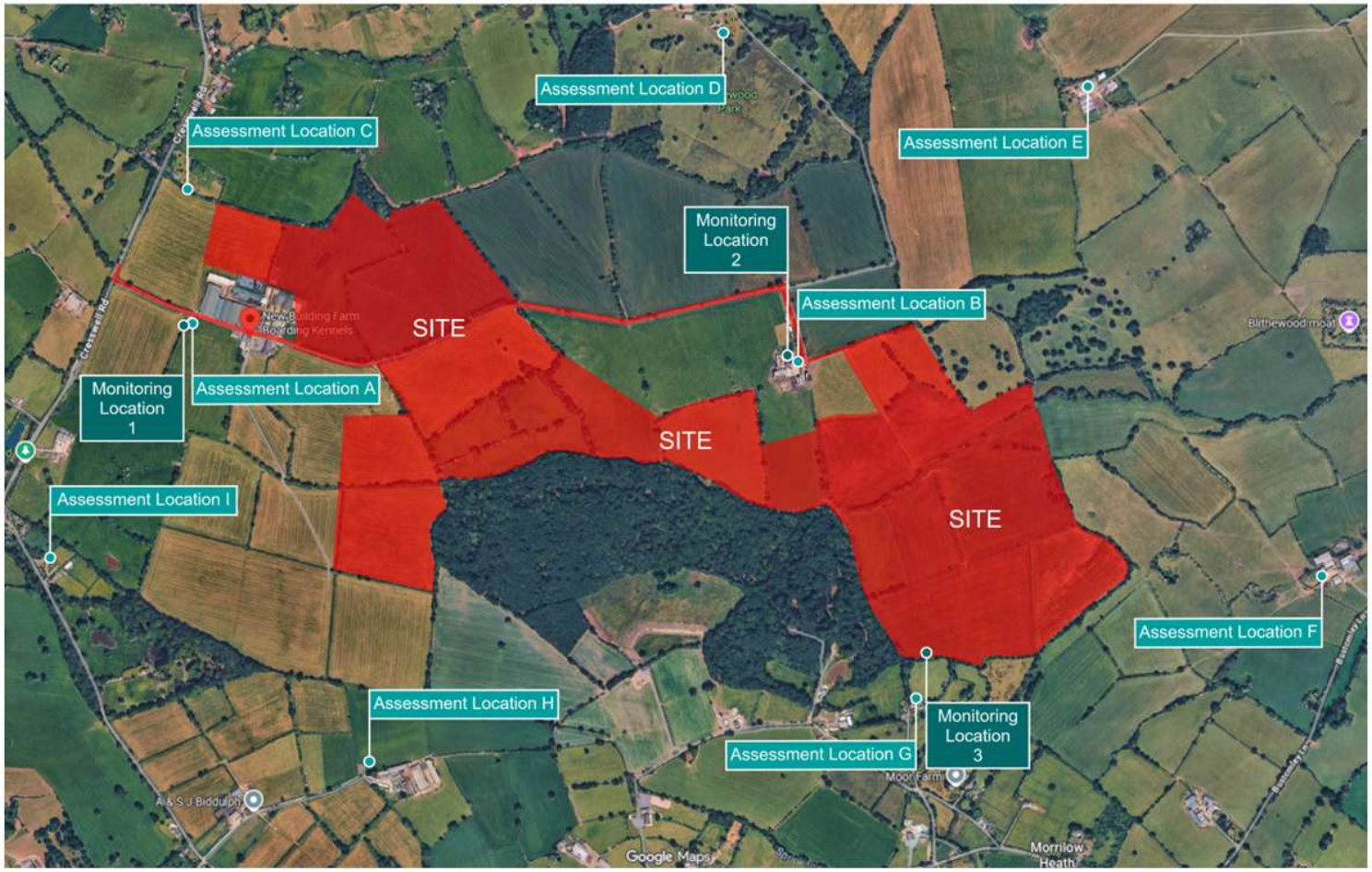
6.2 A baseline noise survey has been undertaken at locations representative of the nearest residential properties to the proposed development to determine prevailing background and residual noise levels.

6.3 Predictions of likely worst-case noise levels at the nearest residential locations to the development have been undertaken.

6.4 An assessment has been undertaken of the likely noise impact in accordance with relevant British Standard guidelines.

6.5 It has been concluded that, in line with BS 4142 and associated guidelines, no unacceptable noise impact, and hence no harm to residential amenity by reason of noise, is anticipated as a result of proposed development.

6.6 Nevertheless, there will be additional scope during the detailed design / procurement stage to maximise the use of layout and positioning of noise sources to optimise noise mitigation and control. To this end, recommendations have been provided for use of a suitably worded planning condition to enshrine and enforce control of noise emissions for planning purposes.



Key:

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Project: P23-261

Ref: **Figure 1**

Title: Site Location

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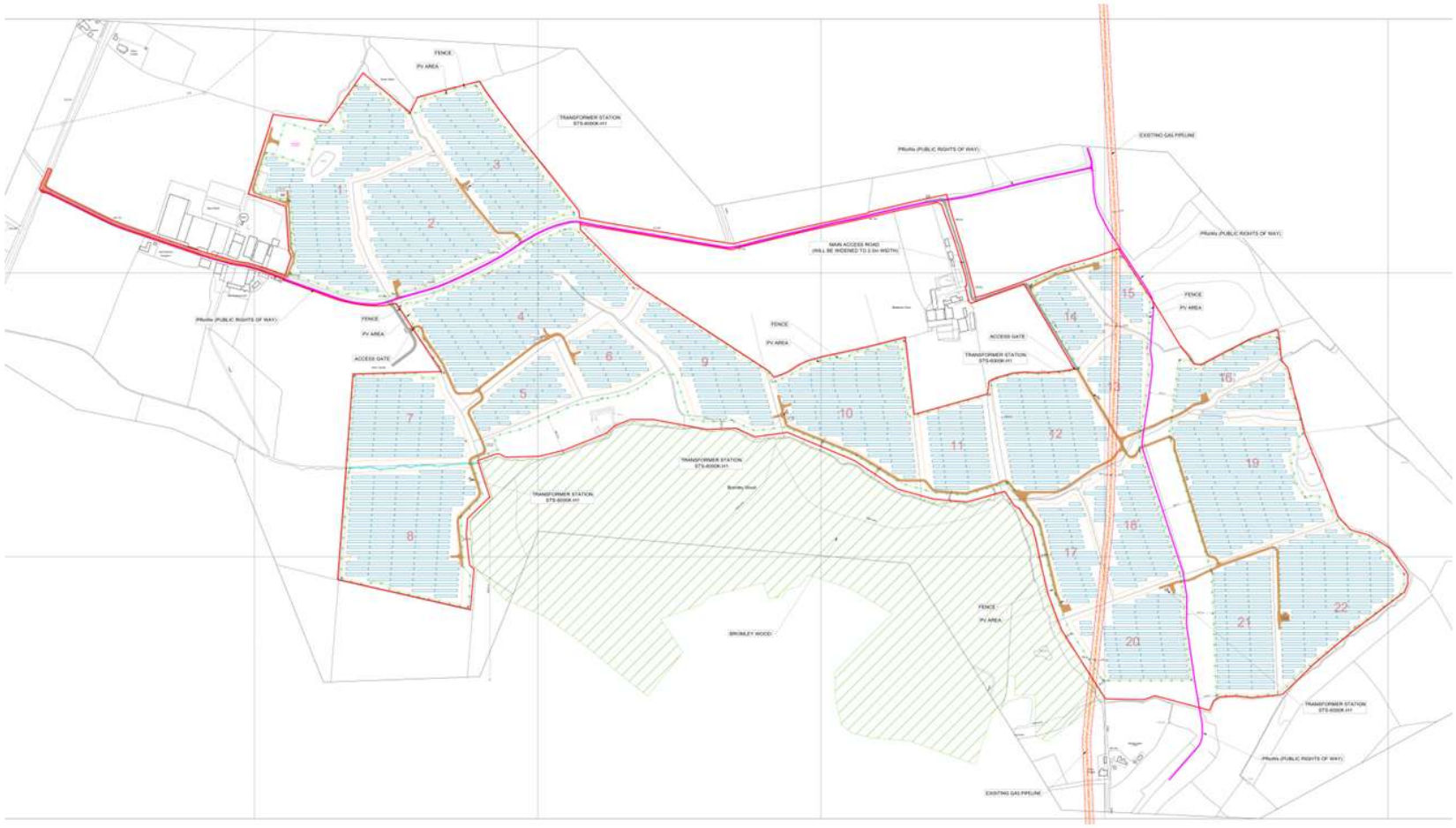

Key:

	FENCE		BROMLEY WOOD
	PV AREA		ACCESS GATE
	INTERNAL ROAD		TRANSFORMER STATION - STS-6000K-H1
	MAIN ACCESS ROAD		TRANSFORMER STATION - STS-3000K-H1
	APPLICATION SITE BOUNDARY		PV MODULE STRUCTURE 2x30 @30°
	EXISTING GAS PIPELINE		PV MODULE STRUCTURE 2x15 @30°
	PRoWs (PUBLIC RIGHTS OF WAY)		CCTV CAMERAS

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Project: P23-261

Ref: **Figure 2**

Title: Proposed Development Layout

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APPENDIX A: ACOUSTICS 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. There are also a number of ways to describe sound insulation performance.

The indices used in this report are described below:

L_p **Sound Pressure Level:** A logarithmic ratio between a squared sound pressure quantity and the square of the human threshold of hearing ($2x10^{-5}$ Pa). This relates to the sound level at a specific position at a single point in time.

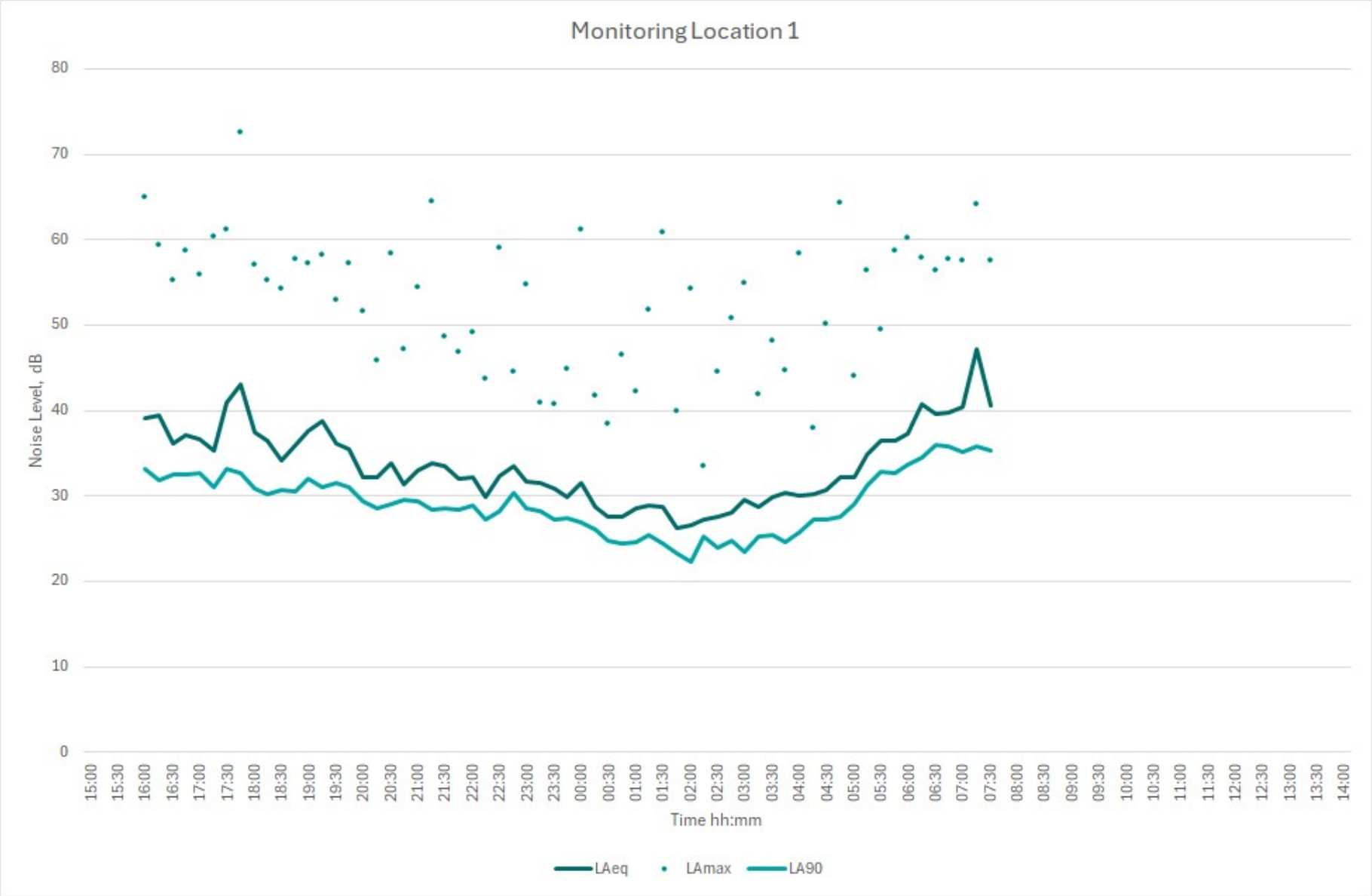
L_{pA} **A-weighted Sound Pressure Level:** The Sound Pressure Level (L_p) with the frequency spectrum adjusted to account for the average human hearing response at difference frequencies for a moderate sound pressure range.

$L_{Aeq,T}$ **A-weighted Equivalent Continuous Sound Level:** An average of the total sound pressure measured over a specified time period (T). 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.

$L_{A90,T}$ **A-weighted 90 Percentile Level:** The A-weighted sound level exceeded for 90% of a measurement time period (T). $L_{A90,T}$ is generally used as a measure of Background Sound Level.

$L_{Ar,Tr}$ **Rating Level:** 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 B: NOISE SURVEY RESULTS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70
60
50
40
30
20
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17:30
18:00
18:30
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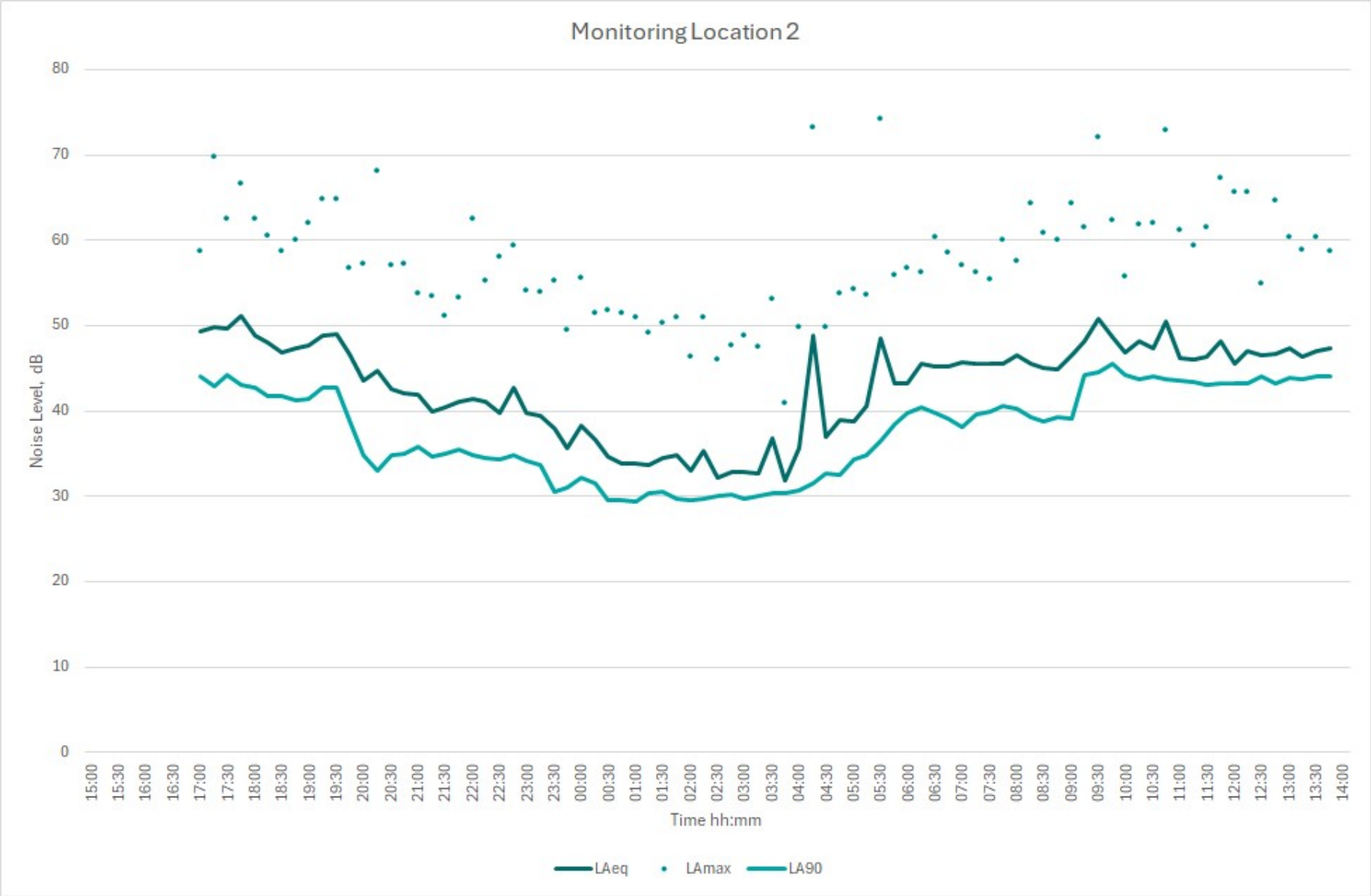
Time hh:mm
LAeq
LAmax
LA90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Noise Level, dB
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17:30
18:00
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Time hh:mm
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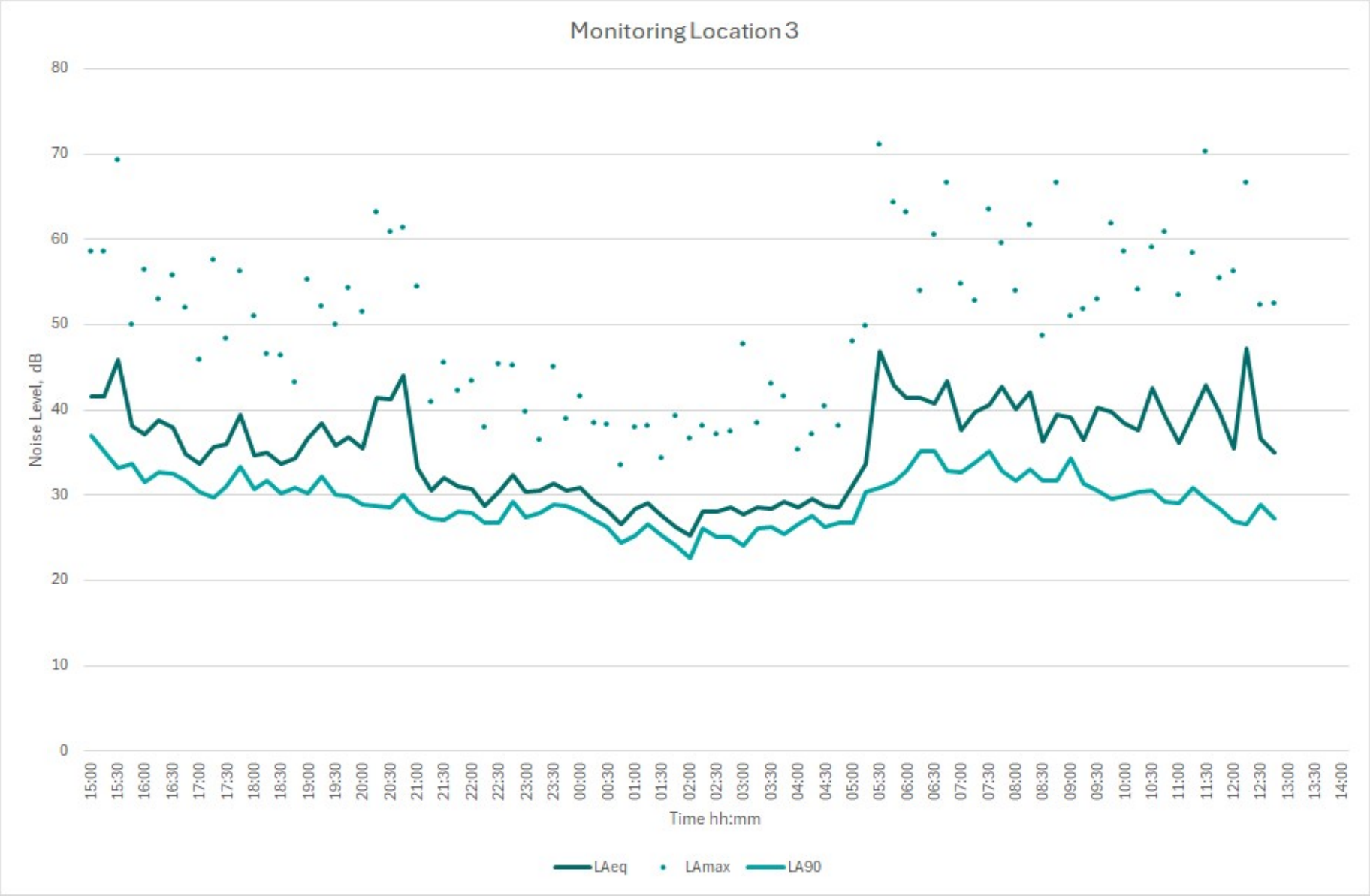
LAmax
LA90


Monitoring Location 3
Noise Level, dB
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30
20
10
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17:00
17:30
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