HOB LANE SOLAR FARM
NOISE IMPACT ASSESSMENT

VERSION 4.0

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Hob Lane Solar Farm Ltd

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1 INTRODUCTION

Metrica Environmental Consulting Ltd ('Metrica') has been commissioned by Belltown Power on behalf of Hob Lane Solar Farm Ltd ('the Client') to undertake a Noise Impact Assessment in relation to the proposed Solar Farm at Hob Lane ('the proposed development'), located on land north and south of Rake Lane, Dunham-on-the-Hill, Cheshire ('the Site').

The aim of this assessment is to assess the operational noise generated by the Development against relevant guidance, and incorporating mitigation measures as necessary to ensure the amenity of residents surrounding the proposed development is not unreasonably impacted.

2 DEVELOPMENT OVERVIEW

The proposed development is located in a semi-rural area and is bound to the north and west by the M56 and A5117. The Chester to Helsby rail line is located 450 m from the southeastern boundary, and the Stanlow refinery is located approximately 1.3 km to the west of the proposed development. As such, the local acoustic environment will be dominated by noise from the nearby major transport links and industrial premises.

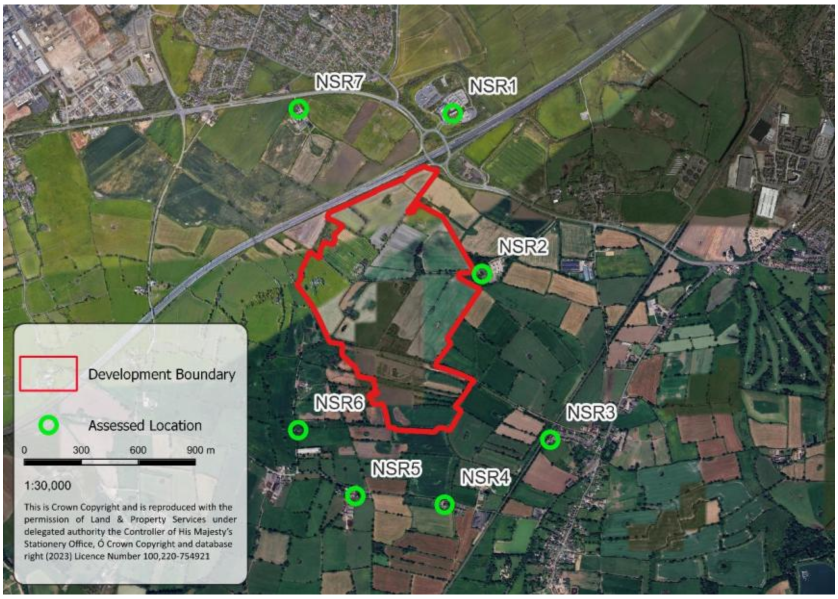
The nearest large settlements are Ellesmere Port and Chester, located approximately 4 km to the northwest and southwest, respectively.

A number of individual noise sensitive receptors (NSRs) are located in the nearby area, the closest of which is Maryburgh Caravan Park (NSR2 – as shown in Figure 1 overleaf) which lies directly adjacent to the proposed development's access road from the A5117 to the northeast of the Site.

Noise-emitting sources to be installed as part of the proposed development include the inverter substations and associated 33 kV transformers.

Figure 1 (overleaf) details the Site location in relation to the closest NSRs; the proposed site layout is presented in Appendix 1.

Figure 1: NSR Locations



3 GUIDANCE

The following guidance and standards are pertinent to the assessment:

- The National Planning Policy Framework (NPPF)[1];
- The Noise Policy Statement for England (NPSE)[2]; and
- NR Curves – ISO 1996-1:2016 (en) *Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures*[3].

3.1 THE NATIONAL PLANNING POLICY FRAMEWORK

The NPPF sets out the Government's planning policies for England, providing a framework within which local policies can be developed. The key principle of the NPPF is a presumption in favour of sustainable development. With regards to noise, the NPPF states that sustainable development can be achieved by:

- Avoiding noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigating and reducing to a minimum any potential adverse impacts resulting from noise from new development, including through the use of conditions; and

[1] National Planning Policy Framework, Ministry of Housing Communities and Local Government, December 2024

[2] Noise Policy Statement for England, Defra, March 2010

[3] ISO 1996-1:2016 (en) Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures

- Identifying and protecting areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

3.2 THE NOISE POLICY STATEMENT FOR ENGLAND

The NPSE sets out the purpose of noise policy, together with the Government's Noise Policy Vision and Aims, consistent with the NPPF.

The aims of the NPSE require that:

- Significant adverse effects on health and quality of life are avoided, while taking into account the guiding principles of sustainable development;
- Adverse impacts on health and quality of life are mitigated or minimised; and
- Where possible, noise management should seek to improve health and quality of life within the context of Government policy on sustainable development.

Paragraph 2.24 of the NPSE states that in relation to minimising and mitigating adverse impacts:

> *"…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."*

3.3 NR CURVES

Noise Rating (NR) curves were developed by the International Organisation for Standardisation[4] (ISO) to determine acceptable indoor sound environment for hearing preservation, speech intelligibility, and annoyance. NR curves serve as a standardised way to measure and specify noise within buildings / occupied spaces, taking into account the frequency content of the noise.

To obtain an NR rating level, the noise spectrum is compared to a series of unweighted (dB) octave-band values. The resulting NR level is that which is entirely above the predicted noise level spectrum. Table 1 below presents the octave band levels for NR20 which is typically used for the assessment of internal noise within bedrooms during night-time periods. Similarly, NR25 is typically used for daytime periods within residential properties.

Table 1: NR Curve Levels for NR 25 and NR20

	Octave Band Frequencies (Hz)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
	Octave Band Noise Level dB(Z)							
NR20	51	39	31	24	20	17	14	13
NR25	55	44	35	29	25	22	20	18

[4] ISO 1996-1:2016(en) Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures.

4 METHODOLOGY AND ASSESSMENT CRITERIA

Given the proximity to the M56, A5117 and industrial premises, background noise levels in the vicinity of the proposed development will be high. In addition, based on our substantial experience, solar developments typically emit relatively low levels of noise, particularly during night-time periods. As such, a proportionate assessment has been undertaken, whereby noise at the nearest receptors will be assessed against the NR criteria specified in Section 3 of this report.

5 NOISE MODELLING

In terms of noise emitting equipment, the proposed development consists of 14x array inverter substations, which include both inverters and 33kV transformers.

Additional infrastructure includes storage containers, switchgear / metering equipment and solar panels. These elements will emit no / negligible levels of noise and therefore have not been considered further as part of this assessment.

5.1 NOISE EMISSION DATA

The sound power levels of the plant included in the noise model are included in Table 2. The plant ultimately selected for construction would be subject to a procurement process; therefore, this assessment considers candidate plant, typical of that likely to be installed. The actual equipment to be installed will be selected / designed to achieve the limits in the planning conditions.

Table 2: Equipment Sound Power Levels

	Sound Power Level, dB, LwA	Octave Band Centre Frequency, Hz, dB(A)							
		63	125	250	500	1000	2000	4000	8000
Inverter Substations	86	60	65	72	69	68	76	85	76

The level of noise emitted by the proposed development will be relative to both the intensity of light incident upon the solar panels and the air temperature. It is therefore anticipated that noise from the proposed development will be negligible for much of the time, particularly during night-time periods. However, as a worst-case approach, all plant is assumed to be operating simultaneously, at full power, during both daytime and night-time periods. This approach is therefore highly conservative.

5.2 MODELLING PARAMETERS

The sound level at the nearest NSRs has been calculated in SoundPlan software, using the environmental noise propagation model ISO 9613-2:2024 - Acoustics, *'Attenuation of sound during propagation outdoors – Part 2: General method of calculation'*.

The ISO 9613-2 method predicts the level of sound at a receptor by taking the octave-band sound power level spectrum of the source and applying a number of attenuation factors that determine the resulting rating level at the receptor location. The following parameters were used in the prediction model and are considered to provide a conservative prediction of the noise levels likely to be experienced in practice:

Commented [RL1]: Should we add a sentence explaining that the transformers considered would likely be quieter than the inverters in this instance, and therefore only the inverter sound power levels are included here (assuming I've interpreted this correctly)?
Is the combined noise of them both together considered at all? Or is that what is in this table?

Commented [MS2R1]: As discussed, noise from the transformers is generally negligible when compared to the inverters. Previously the report referred to inverter stations, I've now updated this to inverter substations to align fully with the final layout.

As noted in the tables below, we have a lot of headroom. So if units louder than 86 dBA are selected, we should still have enough headroom to make them work

- Atmospheric conditions of 10°C and 70% relative humidity;
- A ground factor of G= 1 (soft ground);
- A receiver height of 1.5 m (representative of ground floor windows) and 4m (representative of first floor windows);
- All plant operating simultaneously at full capacity;
- Includes local terrain and buildings; and
- Inverter substations have been inputted into the noise model as point sources at 2.4 m high.

Commented [RL3]: Only the inverter sound power levels are included in the table above - are the transformers included in the assessment as well?

Commented [MS4R3]: As discussed, the sound power level includes both the inverter and transformer.

I updated this list to remove reference to the transformer. I also updated the inverter station heights such that they are in line with the elevations provided.

Grid references for the nearest NSRs are provided in Table 3, as presented in Figure 1. On the basis that noise levels are found to be acceptable at these locations, they will also be acceptable at other NSRs located further from the proposed development.

Table 3: Assessed Receptors

Receptor Name	Easting	Northing
NSR 1 (Days Inn by Wyndham Chester East)	346583	374888
NSR 2 (Maryburgh Caravan Park)	346736	374043
NSR 3 (56 Talbot Road)	347096	373170
NSR 4 (Orchard Mead)	346539	372828
NSR 5 (Moss House Farm)	346070	372874
NSR 6 (Cottage Farm)	345769	373220
NSR 7 (The Woodlands Place)	345772	374911

6 ASSESSMENT OF IMPACT

As outlined in Section 4, noise from operation of the proposed development at the closest receptors has been assessed against NR25 and NR20 for daytime and night-time periods respectively.

The assessment accounts for an open window attenuation of 15 dB, which is taken from research undertaken by Napier University[5]. The research shows that typical attenuation of slightly open or tilted windows ranges from 14 dB to 19 dB on average. A conservative 15 dB attenuation has been applied for the purposes of this assessment.

Tables 4 – 7 present the predicted noise level on the façade of NSRs at a height of 4m, where the worst-case predictions were made, the resulting internal noise level accounting for a 15 dB reduction, and the headroom between the predicted internal noise levels and assessment criteria of NR20 and NR25. Negative values indicate that the predicted noise level is below the respective limit.

[5] NANR116: 'Open/Closed Window Research – Sound Insulation Through Ventilated Domestic Windows: Napier University 2007

Table 4: NSR1 NR Assessments

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	33	17	16	12	7	9	3	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	13	3	2	-4	-7	-8	-16	-19
Difference to NR20	-38	-36	-29	-28	-27	-25	-30	-32
Difference to NR25	-42	-41	-33	-33	-32	-30	-36	-37

Table 5: NSR2 NR Assessments

NSR2	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	38	23	21	18	14	18	20	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	18	9	7	2	0	1	1	-19
Difference to NR20	-33	-30	-24	-22	-20	-16	-13	-32
Difference to NR25	-37	-35	-28	-27	-25	-21	-19	-37

Table 6: NSR3 NR Assessments

NSR3	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	32	14	14	10	5	6	0	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	12	0	0	-6	-9	-11	-19	-19
Difference to NR20	-39	-39	-31	-30	-29	-28	-33	-32
Difference to NR25	-43	-44	-35	-35	-34	-33	-39	-37

Table 7: NSR4 NR Assessments

NSR4	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	33	15	14	11	6	9	4	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	13	1	0	-5	-8	-8	-15	-19
Difference to NR20	-38	-38	-31	-29	-28	-25	-29	-32
Difference to NR25	-42	-43	-35	-34	-33	-30	-35	-37

Table 8: NSR5 NR Assessments

NSR4	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	33	15	14	11	7	9	3	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	13	1	0	-5	-7	-8	-16	-19
Difference to NR20	-38	-38	-31	-29	-27	-25	-31	-32
Difference to NR25	-42	-43	-35	-34	-32	-30	-36	-37

Commented [RL5]: These results are uniformly higher (less negative) than the previous version. I assume this is factoring in the combined noise emitted by the inverters and transformers at each location around the site?
If so, I think this method needs to be described in the section above, and a line added to table 2 showing the assumed sound power levels from the transformers as well
Let me know if I've misunderstood something!

Commented [RL6R5]: Similarly, is there a reason the 8000 Hz band isnt included in this version? Is there no noise anticipated at that pitch?

Commented [MS7R5]: I've updated these figures again (slightly) to account for the inverter heights presented in the elevation drawings - previously these were measured at a height of 1.5m.

The original predictions had applied a correction to the low frequency bands which is typically applied to predictions, but isn't applicable in this case. I picked this up during the previous report update but should have included a note explaining that the predictions between the two versions weren't directly comparable.

With regards to the predictions at 8k, you are correct; I took out the levels at 8k as the predicted façade levels were below 0. However, so that the predictions are in line with the emission data presented in Table 2 I've added these back in.

Table 9: NSR6 NR Assessments

NSR4	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	34	15	15	12	7	10	2	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	14	1	1	-4	-7	-7	-17	-19
Difference to NR20	-37	-38	-30	-28	-27	-24	-31	-32
Difference to NR25	-41	-43	-34	-33	-32	-29	-36	-37

Table 10: NSR7 NR Assessments

NSR4	Octave Band Centre Frequency, Hz, dB(Z)							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Predicted Façade Level, dB	32	13	13	10	5	6	0	0
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	12	-1	-1	-6	-9	-11	-19	-19
Difference to NR20	-40	-40	-32	-30	-29	-28	-33	-32
Difference to NR25	-44	-45	-36	-35	-34	-33	-39	-37

As can be seen, the predicted levels at the closest, and therefore all receptors are substantially lower than the internal criterion of NR20 for night-time and NR25 for daytime. It is therefore considered that the proposed development is acceptable in terms of noise.

6.1 UNCERTAINTY

Modelling of the proposed plant has been undertaken on a worst-case basis, assuming all plant is operating at maximum power at all times. In addition, predicted noise levels are substantially below the assessment criteria at all NSRs, and as such, any uncertainties inherent in the assessment will have no material effect on the findings of the assessment.

6.2 SUGGESTED PLANNING CONDITION

The assessment considers the likely noise level of the proposed development based on candidate plant. Source noise levels of individual items of plant will vary as the final plant specifications are determined during a commercial tendering process.

As such, it is appropriate to set noise limits at the nearest noise sensitive receptors based on the assessment criteria in this report. This allows appropriate levels of protection to be allocated to the nearest receptors, whilst providing sufficient flexibility in the design and specification of plant during the tendering process.

Accordingly, the following planning condition to control operational noise effects is proposed:

1. *During daytime periods (0700 – 2300), noise from the Development shall not exceed NR25, as detailed in BS8233:2014 within a habitable room of any noise sensitive dwelling either existing or consented at the time of this consent. During night-time periods (2300 – 0700), noise from the Development shall not exceed NR20, as detailed in BS8233:2014 within a habitable room of any noise sensitive dwelling either existing or consented at the time of this consent.*

7 CONCLUSION

Metrica was commissioned to undertake a Noise Impact Assessment of the proposed Hob Lane Solar Farm development.

An assessment of noise has been undertaken in accordance with a methodology and assessment criteria deemed suitable to meet national planning policy. Worst case predicted noise levels arising from the proposed development have been found to be substantially below the assessment criteria, and on this basis, noise due to the operation of the proposed development has been found to be acceptable.

8 GLOSSARY OF TERMS

Decibel (dB): The decibel is the basic unit of noise measurement. It relates to the cyclical changes in pressure created by the sound and operates on a logarithmic scale, ranging upwards from 0 dB. 0 dB is equivalent to the normal threshold of hearing at a frequency of 1000 Hertz (Hz). Each increase of 3 dB on the scale represents a doubling of the Sound Pressure, and is typically the minimum noticeable change in sound level under typical listening conditions.

dB(A): Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hz), and less sensitive at lower and higher frequencies. The A weighted noise level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

Frequency: The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

$L_{A90,t}$: This term is used to represent the A-weighted sound pressure level that is exceeded for 90% of a period of time, t. This is used as a measure of the background noise level.

$L_{Aeq,t}$: This term is known as the A-weighted equivalent continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

Sound pressure (P): The fluctuations in pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2 x 10-5 Pa.

APPENDIX 1: DEVELOPMENT LAYOUT