# Teffont BESS

# Noise Assessment

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## 1 INTRODUCTION

1.1 Entran Ltd has been commissioned to undertake an assessment pertaining to potential noise arising from the Power Conversion Systems (PCS) associated with the proposed Battery Energy Storage System (BESS) facility at Teffont.

1.2 The assessment has been undertaken to support a planning application to be submitted to Wiltshire Council and considers sound from the proposed plant items in the context of the existing sound levels in the area.

1.3 The assessment considers the potential impacts on the nearest sensitive receptors in the vicinity of the proposed site in accordance with the most relevant national and local standards and guidelines.

1.4 Details of the site, including plant quantities and expected usage, have been compiled based on information provided by the applicant and are understood to be representative of the proposed items.

1.5 This report is necessarily technical in nature and contains terminology relating to acoustics and noise. Therefore, a glossary together with a brief introduction to the subject of noise has been provided in Appendix A.

1.6 Additionally, BS 4142:2014 recognises that the context of a sound is important when defining the potential for subjective nuisance. The word “sound” is therefore used as opposed to “noise” to describe any sound assessed in the context of the BS 4142 assessment.

## 2 SITE DESCRIPTION

2.1 The proposed site is located in Teffont, approximately 350m south of Hindon Road and immediately south of an existing electricity substation. The surrounding area is largely grassland with sporadic residential dwellings.

2.2 The nearest residential receptor is situated approximately 40m east of the site, beyond the substation access road, and is owned by the land owner/applicant. Further receptors are situated between 300-600 m from the site within the surrounding area. The site location, including proposed plant item locations and nearest identified receptors are identified in Figure 1 below. Further details of the proposed plant items are provided within chapter 5 of this report.

**Figure 1: Site and Proposed Plant Item Location Plan, and Identified Receptors**



## 3 ASSESSMENT METHODOLOGY

### National Policy

***National Policy: National Planning Policy Framework 2021***

3.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England. It attempts to summarise in a single document all previous national planning policy advice. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.

3.2 Under Section 15; Conserving and enhancing the natural environment, the following is stated in paragraph 174:

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

3.3 The NPPF goes on to state in paragraph 185 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 potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *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;*
>
> *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*

***British Standard BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound***

3.4 British Standard BS 4142:2014+A1:2019 *Methods for Rating and Assessing Industrial and Commercial Sound* is intended to be used for the assessment of whether sound of industrial and/or commercial nature is likely to give rise to complaints from people residing in nearby dwellings. BS 4142 states that such sound can include:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and,
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

3.5 The procedure contained in BS 4142 for assessing the likelihood of complaints is to compare the measured or calculated sound level from the source in question, the *'specific sound level'*, at the assessment position with the background sound level. Where sound contains acoustic features, such as tonality, impulsivity or other noticeable characteristics then a correction is added to the specific sound to obtain the '*rating level*' that reflects the contextual setting of the site.

3.6 To assess the likelihood of complaints, the measured background sound level is subtracted from the rating level. BS 4142 states:

*'Typically, the greater this difference, the greater the magnitude of the impact;*

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

3.7 Subclause 11 within BS 4142 also states that the absolute sound level may be more appropriate than the exceedance over the background for an acoustic environment where the background and rating sound levels are low.

3.8 Within the context of the assessment, a background sound level 30 dB or below and rating level of 35 dB or below are considered to be low. Absolute thresholds will be adopted from the guidance provided within BS 8233. Reference will also be made as to the excess over the extant measured residual sound levels.

***British Standard BS 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings (BS 8233)***

3.9 The scope of BS 8233 is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use rather than to assess the effect of changes in the external noise climate.

3.10 This Standard suggests suitable internal noise levels within different types of buildings, including residential dwellings. It suggests that an internal noise level of 30 dB $L_{Aeq, T}$ within bedrooms is a 'desirable' standard. For living areas during the daytime, the standard recommends 35 dB $L_{Aeq, T}$ as a desirable standard for resting.

***The Institute of Environmental Management & Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (2014)***

3.11 The Institute of Environmental Management and Assessment (IEMA) have published the '*Guidelines for Environmental Noise Impact Assessment*'. The guidelines are applicable to noise impact assessment for any scale of development proposal, including core principles to achieve effectively integration with the EIA, and provide advice on the issues that need to be considered in a noise impact assessment and whether the appropriate conclusions are being reached. The factors include:

- The appropriateness of the noise parameters used for the situation;
- The reference time period used in making the assessment;
- The level, character and frequency content of the noise sources under investigation; and,
- How the predicted noise levels relate to relevant Standards and guidelines.

3.12 The guidelines also recommend that the assessor should determine the degree of impact based on evidence derived from the assessment.

***The Professional Practice Guidance on Planning and Noise (2017)***

3.13 The '*Professional Practice Guidance on Planning and Noise'* (ProPG) was produced by a Working Group consisting of representatives of the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH) to provide acoustical practitioners with guidance on the management of noise within the planning system in England.

3.14 The reparation of the ProPG acknowledges and reflects the Government's overarching NPSE, the NPPF and Planning Practice Guidance (including PPG-Noise), as well as other authoritative sources of guidance. It provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, aims to:

- advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- encourage the process of good acoustic design in and around new residential developments;
- outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- promote appropriate noise exposure standards; and,
- assist the delivery of sustainable development.

## 4 ENVIRONMENTAL SOUND MEASUREMENTS

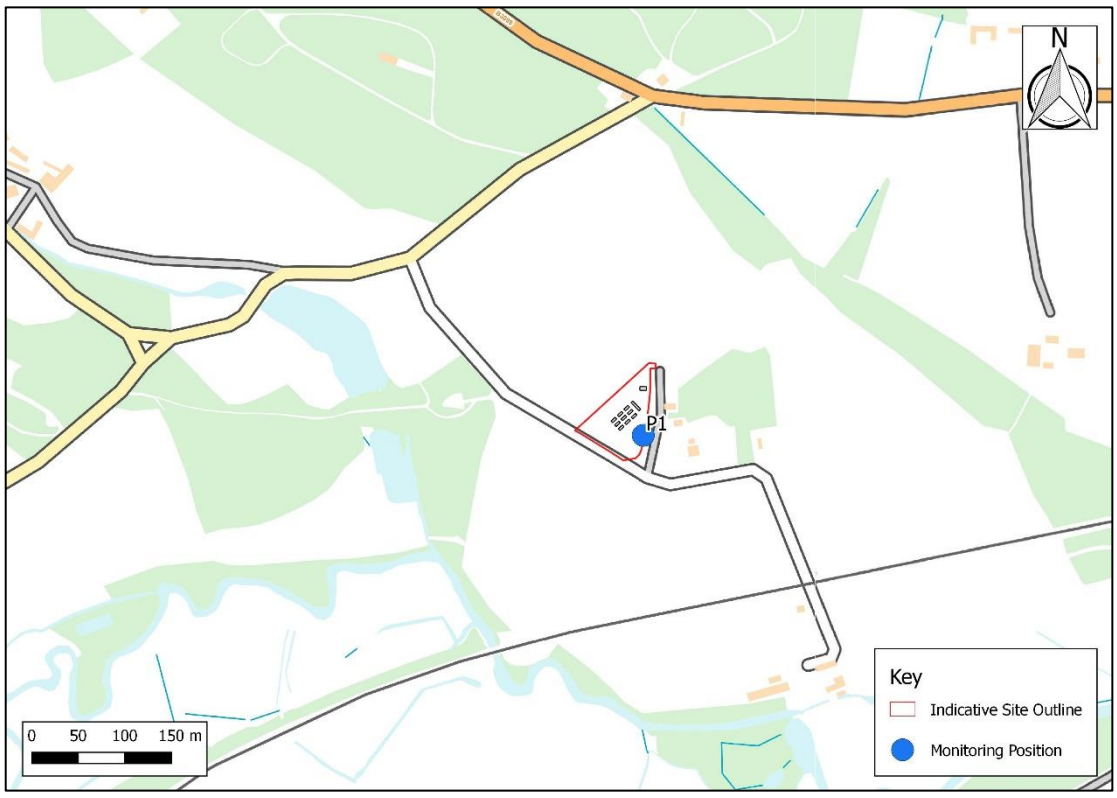
4.1 Existing conditions in the vicinity of the site have been determined by an environmental survey conducted between 7th and 15th October 2022.

4.2 The nearest residential receptor is situated approximately 40m east of the development. The closest receptors that may potentially be affected by the proposed plant items are situated approximately 300m to the south east and north of the development.

4.3 The dominant source at the monitoring position was noted to be distant road traffic in the surrounding area. Rail movements on the West of England Main Line were also perceptible, with train horns sounding when passing the level crossing. Trains are noted to pass approximately every 30 minutes between 05:45 and 01:30. The dominant source at receptors to the north is likely to be road traffic on the adjacent road links and distant road traffic in the surrounding area.

4.4 The monitoring position, P1, is presented in Figure 2.

**Figure 2: Unattended Monitoring Position**




4.5 A summary of the unattended survey is provided in Table 1.

**Table 1: Summary of Noise Survey**

| Date | Day Time (07:00 - 23:00) | | | Night-time (23:00 - 07:00) | | |
|---|---|---|---|---|---|---|
| | $L_{Amax,F}$ | $L_{Aeq,T}$ | $L_{A90,T}$ | $L_{Amax,F}$ | $L_{Aeq,T}$ | $L_{A90,T}$ |
| 07/10/2022 | 79.7 | 48.9 | 36.2 | 73.7 | 35.4 | 23.5 |
| 08/10/2022 | 68.0 | 38.8 | 29.9 | 55.4 | 29.4 | 22.9 |
| 09/10/2022 | 82.6 | 43.6 | 32.5 | 68.4 | 36.8 | 25.3 |
| 10/10/2022 | 77.3 | 44.4 | 33.8 | 67.4 | 34.6 | 22.8 |
| 11/10/2022 | 82.1 | 45.2 | 29.8 | 61.5 | 32.7 | 22.6 |
| 12/10/2022 | 76.1 | 43.6 | 35.1 | 68.7 | 38.6 | 32.3 |
| 13/10/2022 | 75.6 | 41.2 | 29.4 | 71.2 | 34.1 | 22.9 |
| 14/10/2022 | 80.3 | 43.3 | 30.5 | 65.3 | 34.6 | 24.1 |
| 15/10/2022 | 84.4 | 49.5 | 40.1 | - | - | - |
| *Cumul.* | 84.4 | 45.4 | 33.0 | 73.7 | 35.2 | 24.6 |

*Maximum levels represent the highest $L_{Amax,F}$ sound level during the given period.*
*The period $L_{Aeq,T}$ is obtained from the logarithmic average of measured sound levels.*
*The period $L_{A90,T}$ is obtained from the average of the measured sound levels.*

4.6 The unattended monitoring was undertaken to allow assessment in accordance with BS 4142 and to determine the likelihood of adverse effects relating to the proposed plant items.

4.7 Background sound levels have been obtained by statistical analysis during day and night-time periods. The adopted background sound levels are presented in Table 2 and are presented graphically in Appendix B.

**Table 2: Background Sound Levels for Assessment Periods**

| Time Period | Background Sound Level, $L_{A90,T}$, dB re. $2x10^{-5}$ Pa. |
|---|---|
| Day (07:00 - 23:00) | 30 |
| Night (23:00 - 07:00) | 22 |

4.8 All measurements were undertaken by competent individuals with experience in environmental monitoring. Measurements were obtained in accordance with the principles of BS 7445: 2003: '*Description and measurement of environmental noise'* and following the guidance given in BS 4142.

4.9 All acoustic measurement equipment used during the surveys conformed to Type 1 specification of British Standard 61672: 2003: *Electroacoustics. Sound level meters. Part 1 Specifications.* The microphone was positioned at 1.8 m above roof level and in free-field conditions. The microphone was fitted with a protective windshield and situated in a weatherproof case. The weather conditions during the survey are not considered to have affected the survey.

## 5 ASSESSMENT

5.1 The potential impacts of the proposed development have been determined by calculation of $L_{Aeq,T}$ sound levels during the operation of the proposed plant items.

5.2 Sound emission levels from the proposed development have been calculated using predictive computer noise modelling. The noise modelling software (Cadna-A) uses algorithms based on ISO 9613 'Attenuation of sound during outdoor propagation' to predict noise levels generated at receiver locations by potentially noisy sources.

5.3 The operation of the proposed plant items is assessed for the day 07:00 – 23:00 and night-time 23:00 – 07:00 periods. The identified background sound levels are below 30 dB $L_{A90,T}$ during both the day and night-time periods. Therefore, in accordance with BS 4142, consideration of absolute sound levels is likely to be more relevant than the margin by which the rating levels exceed the background.

5.4 The residential criteria as provided within BS 8233 can be considered for evaluation of the absolute sound levels. The BS 8233 criterion is provided for day and night-time periods of 16-hour and 8-hour. It is considered appropriate to apply these criterion values to the BS 4142 calculated specific level within this assessment context. This provides threshold values of 35 and 30 dB $L_{Aeq,T}$ for internal noise levels during the day and night-time periods.

5.5 The excess of rating over background has also been presented in addition to the absolute levels to ensure a comprehensive presentation of calculated noise levels.

5.6 Information pertaining to the proposed plant items has been obtained from Private Energy Partners. The proposed BESS will include 6 no. storage batteries, 3 no. PCS, 1 no/ DNO building and 1 no. HV/LV substation building. The dimensions provided for the on-site items are presented in Appendix B.

5.7 It is understood that the potentially noise emitting plant items associated with the proposed development are the 33 kV inverters, which will be housed within bespoke PCS enclosures. The exact specification is not yet finalised and the attenuation afforded by the enclosures has therefore been assumed using a cautious consideration.

5.8 Acoustic enclosures can typically achieve broadband sound reduction values in excess of 25 dB $R_{W.}$ For the purpose of this assessment, the enclosures are assumed to achieve a broadband sound reduction of at least 15 dB $R_W$. The enclosures will be fitted with attenuated

louvres, which will also be specified to achieve 15 dB $R_W$ as a minimum. It is understood that there are no other potentially noisy sources envisaged at this stage.

5.9 The inverters will operate during both day and night-time periods (during periods of generation as well as when stored electricity is exported to the power grid). For the purpose of this assessment the inverters are assumed to run at full duty. Actual operational levels may be lower and calculated sound levels would therefore be lower than those presented within this assessment.

5.10 The sources have been modelled based on information provided by the applicant and calibrated within the modelling software to achieve the specified sound pressure level, for an equivalent inverter, of 76.6 dB $L_{Aeq,T}$ at 1m from the face of the PCS units.

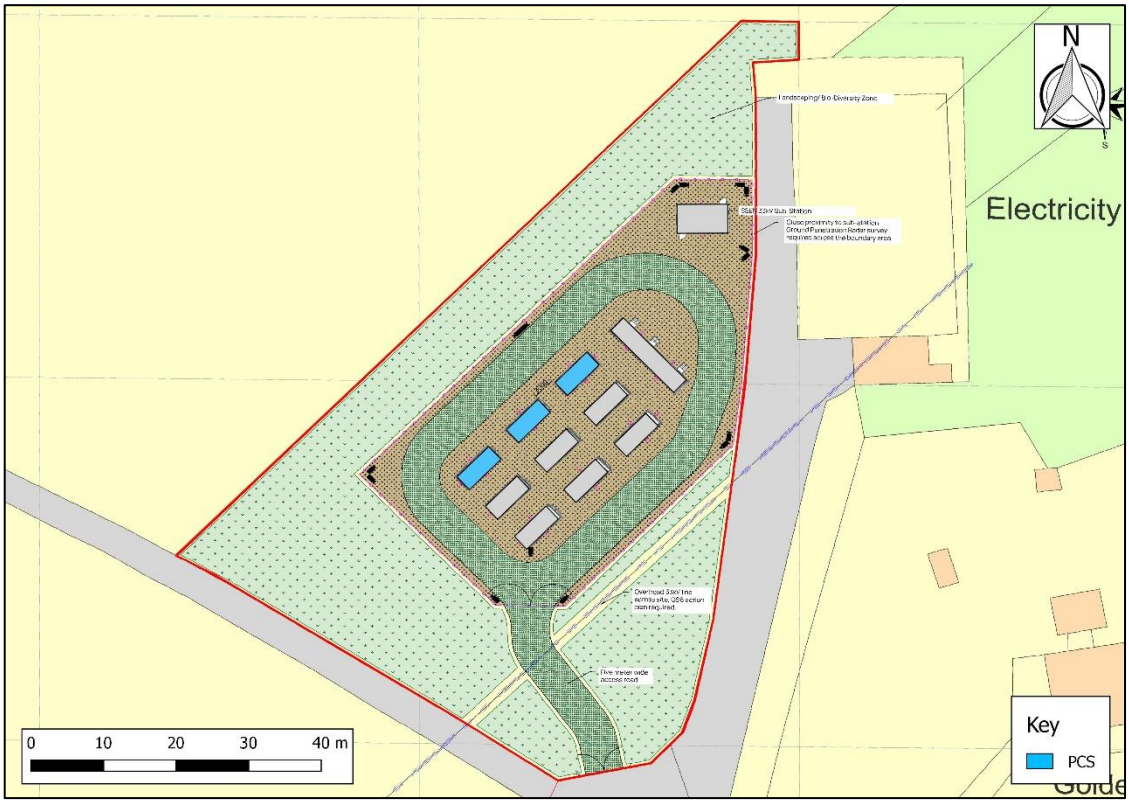
5.11 A summary of the modelled source sound power data is provided in Table 3. The resultant octave band source spectrums are presented in Appendix C.

**Table 3: Source Sound Power Levels**

| Plant Item | Sound Power Level, $L_{WA}$ |
|---|---|
| INGECON SUN 3Power C Series inverter | 73.7 |

5.12 The proposed plant items will be sited within the proposed compound on an area of hardstanding. The ground height within the hardstanding area will be graded to an absolute height of 96.2 m. The proposed plant item locations are presented in Figure 3.

**Figure 3: Source Positions**




5.13 The calculated specific sound levels are presented in Table 4.

**Table 4: Calculated Specific Sound Levels**

| Receptor | Specific Level, $L_{Aeq,T}$ |
|---|---|
| R1 | 29 |
| R2 | 11 |
| R3 | 14 |
| R4 | 15 |
| R5 | 9 |
| R6 | 7 |

Absolute Sound Levels

5.14 The calculated specific levels fall below 30 dB and meet the BS 8233 criteria for habitable rooms without any consideration of façade reduction.

5.15 A reduction of 15 dB is typically afforded by a partially open window, as detailed within BS 8233. With consideration to this reduction the specific levels would fall further below the absolute criteria. The specific level at R1 provides an internal value of 14 dB $L_{Aeq,T}$ with the reduction of 15 dB due to partially open windows. Ambient noise levels are therefore likely to be sufficiently low that adverse impacts are unlikely.

5.16 The calculated specific sound levels, resultant internal sound levels with consideration to the typical reduction due to open windows, and excess over the BS 8233 threshold criteria are presented in Table 5.

**Table 5: Consideration of Specifics Sound Levels Against BS 8233 Criteria**

| Receptor | Specific Level, $L_{Aeq,T}$ | Internal Ambient Sound Level $L_{Aeq,T}$ | Excess of Rating Level Over Background, dB |
|---|---|---|---|
| **Day** | | | |
| R1 | 29 | 14 | -21 |
| R2 | 11 | 0 | -35 |
| R3 | 14 | 0 | -35 |
| R4 | 15 | 0 | -35 |
| R5 | 9 | 0 | -35 |
| R6 | 7 | 0 | -35 |
| **Night** | | | |
| R1 | 29 | 14 | -16 |
| R2 | 11 | 0 | -30 |
| R3 | 14 | 0 | -30 |
| R4 | 15 | 0 | -30 |
| R5 | 9 | 0 | -30 |
| R6 | 7 | 0 | -30 |

Excess of Rating Over Background

5.17 BS 4142 requires that an acoustic feature correction is applied, where applicable, to the specific sound level in order to obtain a rating level $L_{Ar,Tr}$ at the identified receptor. Any correction is applied in order to consider the effect of additional acoustic characteristics present in the source of interest. The correction is applied based on tonality, impulsivity and intermittency that may be perceptible at the receptor location. A correction may also be applied where these features may not be present but the sound may still be distinctive at the receptor.

5.18 A 3 dB correction has been applied to the specific sound level at R1 during both day and night-time periods to account for the possible perceptibility over the background.

5.19 Specific sound levels at calculation receptors R2 - R6 fall below both the identified background sound level and the measured ambient sound level. The calculated specific levels are therefore unlikely to be perceptible at the receptor locations. Therefore, no correction to account for potential acoustic features is identified as required.

5.20 The calculated specific sound levels, resultant rating levels and excess over the identified background sound levels are presented in Table 6.

**Table 6: Calculation of Rating Sound Levels and BS 4142 Assessment**

| Receptor | Specific Level, $L_{Aeq,T}$ | Acoustic Feature Correction | Rating Level $L_{Ar,Tr}$ | Excess of Rating Level Over Background, dB |
|---|---|---|---|---|
| **Day** | | | | |
| R1 | 29 | 3 | 32 | 2 |
| R2 | 11 | 0 | 11 | -19 |
| R3 | 14 | 0 | 14 | -16 |
| R4 | 15 | 0 | 15 | -15 |
| R5 | 9 | 0 | 9 | -21 |
| R6 | 7 | 0 | 7 | -23 |
| **Night** | | | | |
| R1 | 29 | 3 | 32 | 10 |
| R2 | 11 | 0 | 11 | -11 |
| R3 | 14 | 0 | 14 | -8 |
| R4 | 15 | 0 | 15 | -7 |
| R5 | 9 | 0 | 9 | -13 |
| R6 | 7 | 0 | 7 | -15 |

5.21 The resultant rating level at R1 exceeds the daytime background sound level by +2 dB. The resultant rating level exceeds the background sound level by +10 dB during the night-time. BS 4142 identifies that the lower the rating level, relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.

5.22 Rating levels at receptors R2 - R6 fall below the identified background sound levels during the day and night-time periods. BS 4142 indicates that where the rating level does not exceed the background sound level the impact of the specific sound level is likely to be low.

5.23 It is noted that the above indications should not be considered in isolation of the given context and reference should also be made to the absolute levels when determining the likelihood of impacts.

Uncertainty

5.24 The assessment scenario considered within this report is based on the assumptions of external plant items presented within this assessment, as provided by the applicant. Any changes to these assumptions, such as revised design, would require assessment based on the specific plant items and site details.

5.25 The modelled scenario is considered to represent a worst-case consideration, with a reduction of 15 dB adopted for the PCS enclosures. The enclosures are likely to achieve a composite sound reduction of at least 20 dB $R_W$ and the excess over background would fall lower than calculated within this cautious assessment.

5.26 No consideration of internal absorption has been undertaken within the calculations. Acoustic panelling typically affords a high level of absorption, which may reduce the internal level within the PCS enclosures and in turn reduce the calculated sound levels.

5.27 The calculation of the specific level is based on available information and source data from the applicant, as detailed within this report, and is understood to be representative of a worst-case consideration of the sources that would be installed at the proposed site.

5.28 Background and ambient levels at northern receptors are likely to be higher than those adopted for the purpose of this assessment. Increase background and ambient sound levels would reduce the calculated sound levels at the receptors to the north.

## 6 MITIGATION

6.1 Mitigation measures are inherent within the design of the proposed BESS. The PCS will comprise acoustic enclosures to reduce sound arising from the site. The PCS enclosures will be sited to the north-west of the site to employ screening from the battery enclosures and reduce sound levels at the nearest residential receptor.

6.2 The adopted assessment methodology indicates that significant effects are unlikely, with consideration to the context. Additionally, the enclosures will be specified to achieve a greater reduction than adopted for this cautious consideration and calculated rating levels would therefore be reduced.

6.3 In addition to the bespoke PCS enclosures, it would be prudent to ensure that inverters are selected with consideration to the manufacturers sound emission data to further reduce the level of sound arising from the site.

## 7 CONCLUSIONS

7.1 An assessment has been undertaken for the potential impacts attributable to the sound arising from the proposed solar storage facility in Teffont.

7.2 The information as detailed within this report has been used to calculate the likely sound levels at the nearest receptors.

7.3 Due to the low background and residual sound levels, consideration of absolute criteria has been identified as relevant for the purpose of this assessment. Calculated specific levels arising from the proposed plant items have been assessed against absolute criteria. The standard consideration against the background sound level has also been presented.

7.4 Calculated sound levels fall below the absolute threshold at all receptors during day and night-time periods. Rating levels at R2 - R6 fall below the background sound levels during day and night-time periods. With consideration to the information and calculations as presented within this assessment impacts are unlikely.

7.5 Rating levels at R1 exceed the adopted background sound levels. However, consideration against the absolute criteria shows that suitable internal habitable sound levels are likely to be attained and that resultant impacts would be unlikely. With consideration to the existing context, and with reference to subclause 11 of BS 4142, significant adverse impacts are unlikely.

## APPENDIX A – INTRODUCTION TO NOISE

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB.

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs. For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest.

In the UK, traffic noise is measured as the $L_{A10}$, the noise level exceeded for 10% of the measurement period. The $L_{A90}$ is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, $L_{Aeq}$. This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 5 minutes during the night. The noise levels are commonly symbolised as $_{A90(1hour)}$ and $L_{A90(5mins)}$. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

**Table A1: Glossary of Terms**

| Term | Definition |
|---|---|
| Decibel (dB) | A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. |
| A-weighting, dB(A) | The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies. |
| Noise Level Indices | Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out. |
| $L_{eq,T}$ | A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. |
| $L_{max,F}$ | A noise level index defined as the maximum noise level during the period T. $L_{max}$ is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall $L_{eq}$ noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response. |
| $L_{90,T}$ | A noise level index. The noise level exceeded for 90% of the time over the period T. $L_{90}$ can be considered to be the 'average minimum' noise level and is often used to describe the background noise. |
| Free-Field | Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m |
| Ambient Noise Level | The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$). |
| Residual Noise Level | The ambient noise remaining at a given position in a given situation when specified sources are suppressed to a degree such that they do not contribute to the ambient noise level ($L_{Aeq,T}$) |
| Specific Noise Level | The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source (the noise source under investigation) over a given time interval ($L_{Aeq,T}$) |
| Rating Noise Level | The specific noise level plus any adjustment for the characteristic features of the noise ($L_{Ar,Tr}$). |

## APPENDIX B – GRAPHICAL REPRESENTATION OF MEASUREMENT RESULTS

**Figure B1: Statistical Analysis of Background Sound Levels**

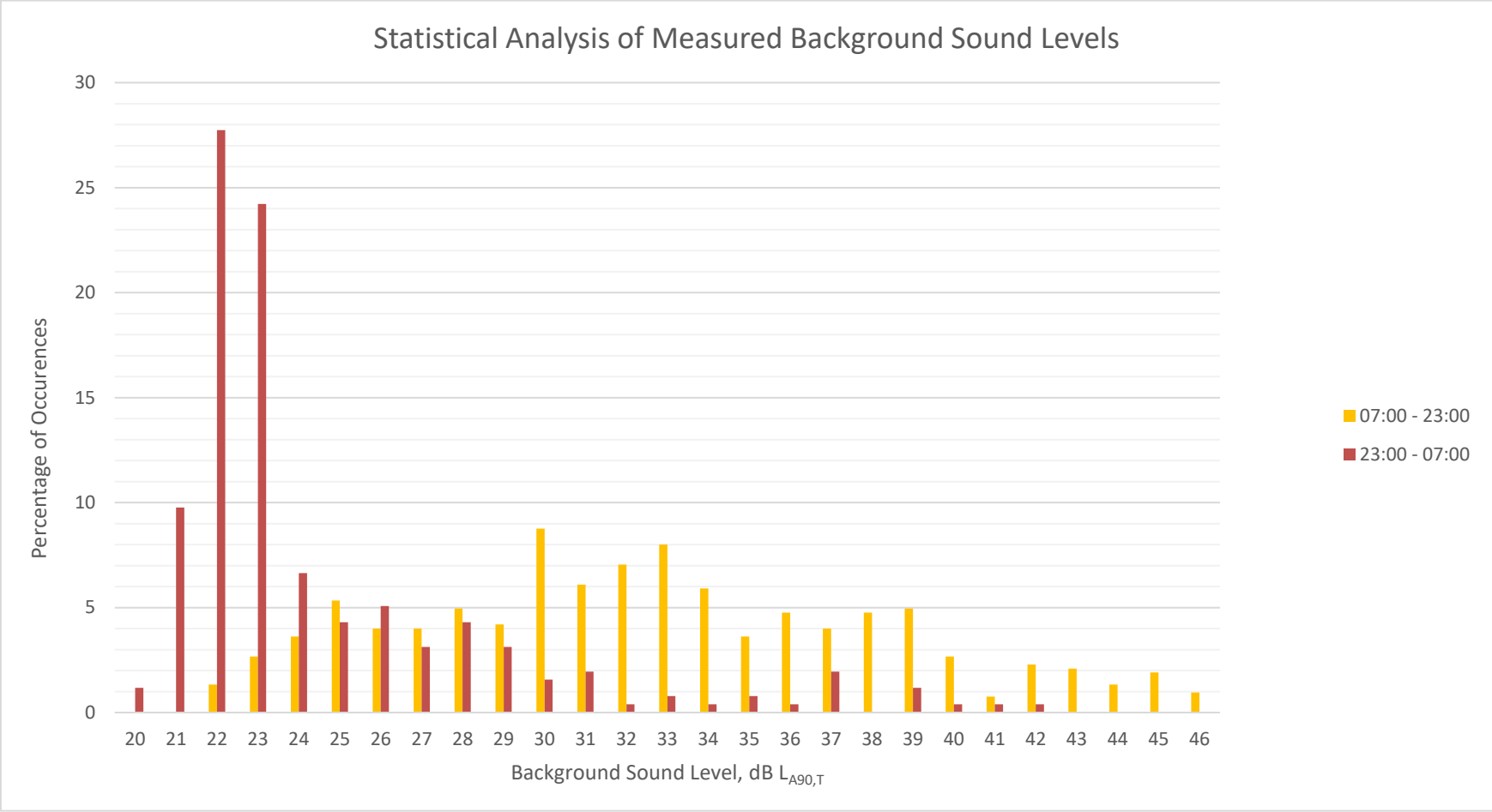


**Figure B2: PCS/Battery Enclosure Dimensions**

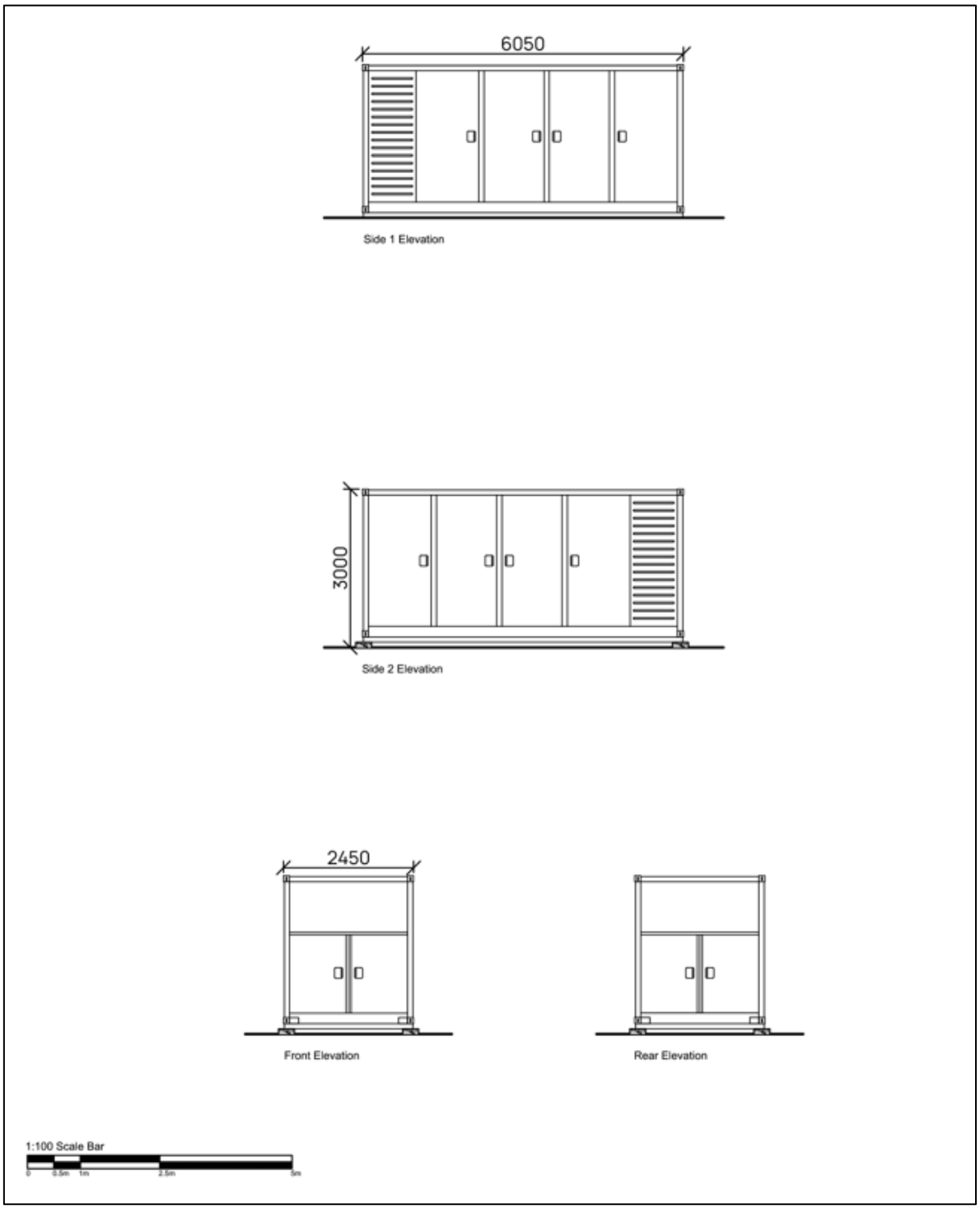


**Figure B3: DNO Building Dimensions**

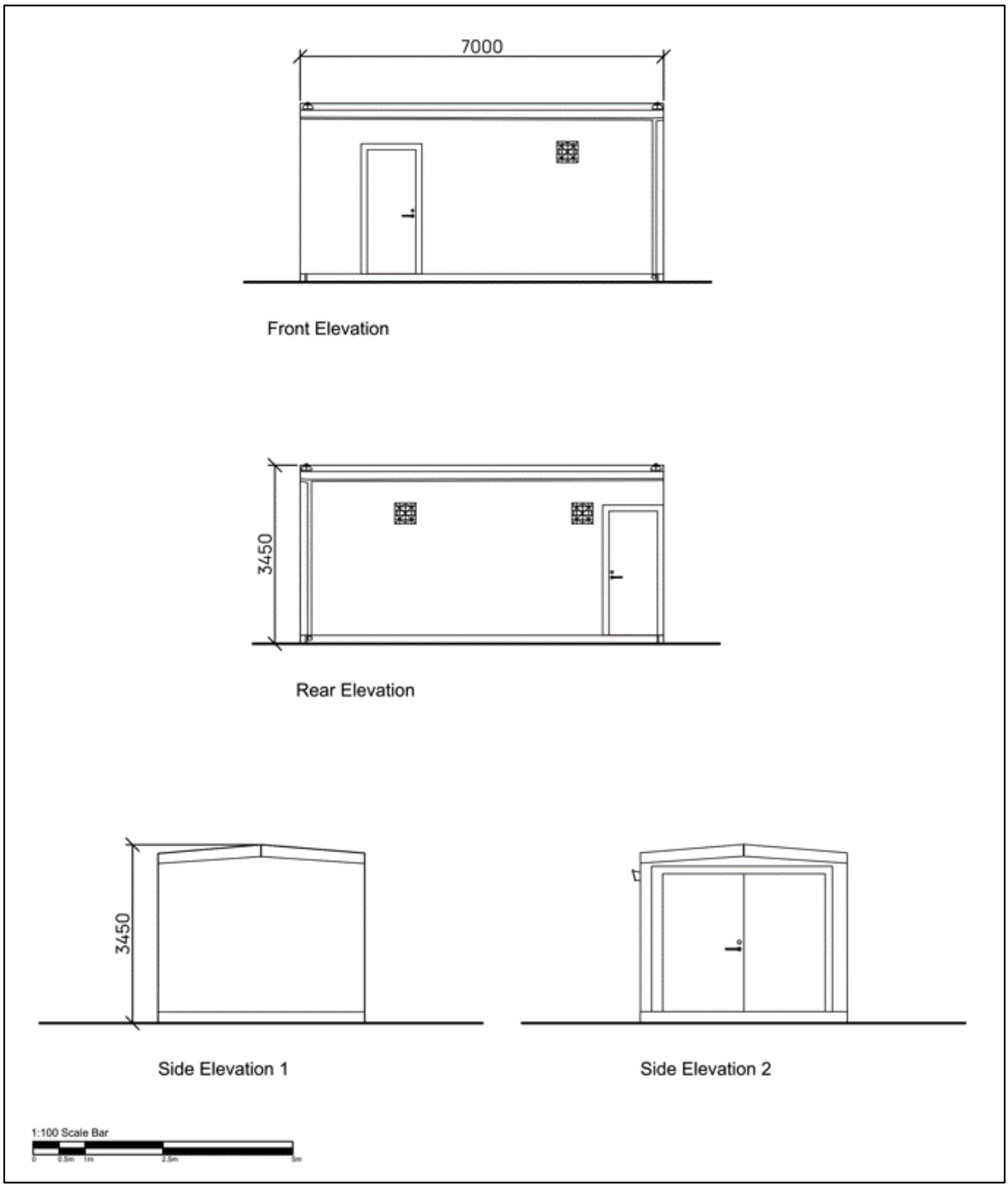
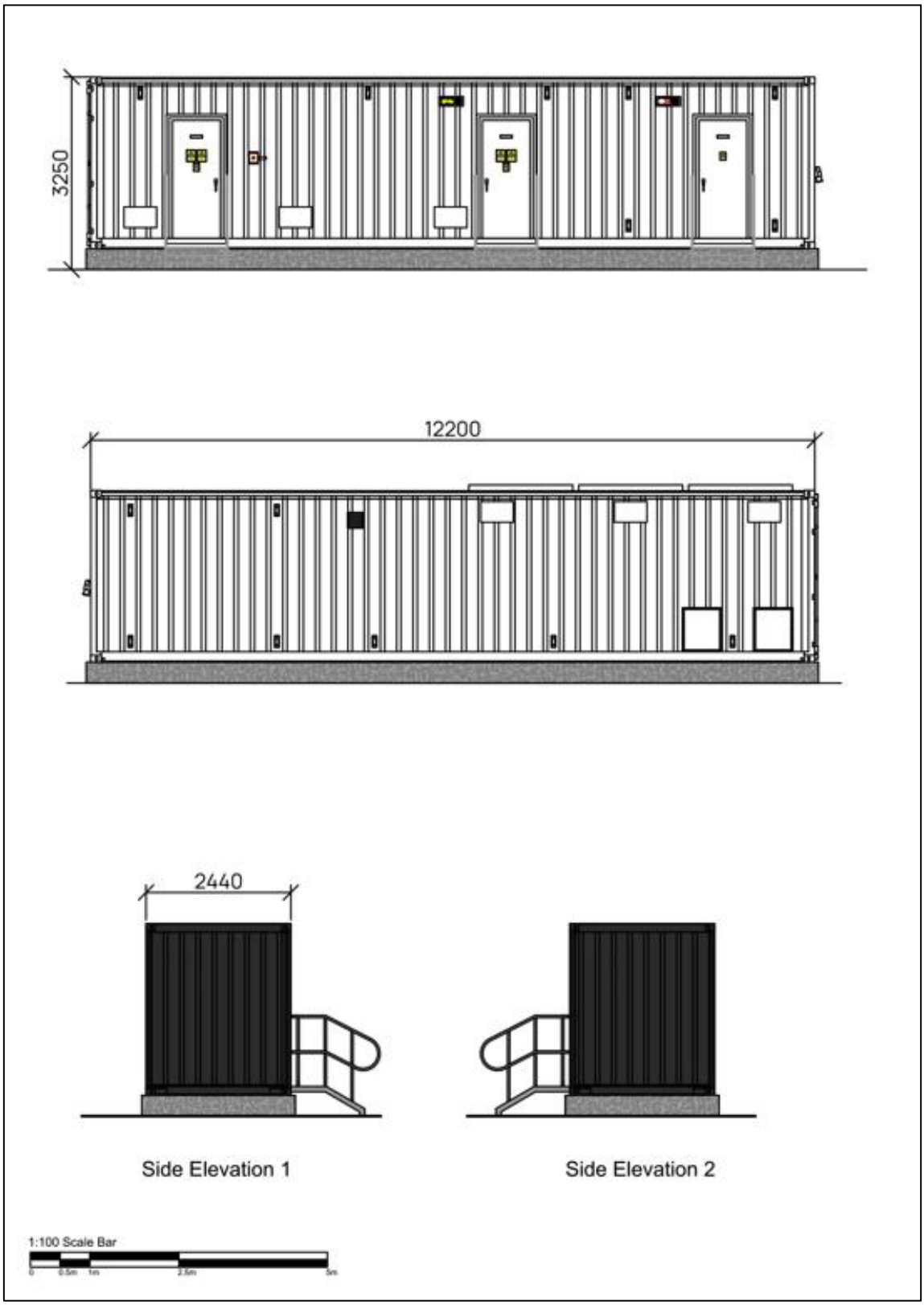


**Figure B4: HV/LV Building Dimensions**



## APPENDIX C – TABLES

**Figure C1: Octave Band Plant Sound Power Levels**

| Plant Item | Octave Band Sound Power Level, dBA | | | | | | | | $L_{WA}$ | Quantity |
|---|---|---|---|---|---|---|---|---|---|---|
| | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | | |
| INGECON SUN 3Power C Series inverter | 68.9 | 72.3 | 70.0 | 69.6 | 67.9 | 66.3 | 66.2 | 56.8 | 73.7 | 3 |