



ARCUS

NOISE IMPACT ASSESSMENT SWANSEA NORTH ENERGY MANAGEMENT FACILITY

FOR STATKRAFT UK LTD

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1 INTRODUCTION

Arcus Consultancy Services Ltd (Arcus) has been commissioned by Statkraft UK Ltd ('the Applicant') to undertake a noise assessment in relation to the development of an energy management facility ('the Development') located on agricultural land to the east of the existing Swansea substation ('the Site').

The aim of this assessment is to determine the existing acoustic climate, predict the sound levels due to the operation of the Development, and to assess these levels against relevant guidance.

Where appropriate, mitigation measures have been recommended to ensure that the amenity of residents in the locality of the Development is not unreasonably impacted by the Development.

2 DEVELOPMENT OVERVIEW

The Development is intended to provide services supporting the flexible operation of the National Grid and decarbonisation of electricity supply e.g. by balancing electricity supply and demand. The Development will import and export electricity but will not generate any additional electricity. The proposed batteries will store surplus electricity to be fed into the grid when required, while the energy management modules will reduce fluctuations, thus improving stability and reducing the risk of power failures.

The Development consists of a compound containing a number of custom-designed shipping containers housing arrays of lithium ion batteries, two Energy Management Modules ('EMMs'), and associated plant including cooling plant, inverters and transformers.

The Development is situated immediately northeast of an existing large-scale electrical substation, and immediately southwest of the Abergelli Gas Fired Generating Station, which was consented in September 2019 and is currently awaiting construction.

A figure detailing the Development layout is presented in Appendix 1.

3 RELEVANT GUIDANCE

The following guidance and standards are pertinent to the assessment:

- Planning Policy Wales¹;
- Technical Advice Note (TAN) 11: Noise²; and
- BS 4142:2014+A1:2019 Method for Rating and Assessing Industrial and Commercial Sound.

3.1 Planning Policy Wales

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales the Welsh Government.

3.2 Technical Advice Note 11: Noise

TAN 11: Noise is a Welsh Government document that provides guidance on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development. Some guidance is provided on the assessment

¹ Planning Policy Wales, Edition 10. Welsh Government (2018)

² Technical Advice Note 11: Noise. Welsh Government (1997)

of noise from a variety of sources, but this guidance generally refers to other documents for methods of assessment and criteria.

With regard to the assessment of noise from commercial and industrial developments, the assessment methodology and criteria specified in BS 4142 are recommended.

3.3 BS 4142:2014+A1:2019

BS 4142:2014+A1:2019 ('BS 4142') describes methods for rating and assessing sound in order to provide an indication of its likely impact upon nearby premises (typically residential dwellings).

The specific sound emitted from the Development (dB, L_{Aeq}) is rated by taking into account both the level and character (i.e. tonal elements, impulsivity, intermittency and distinctiveness) of the sound. This is achieved by applying appropriate corrections to the specific sound level externally at the receptor location, which gives the rating level of the sound in question. This is then assessed against the existing prevailing background sound level (dB, L_{A90}) at that location in order to determine a likely level of impact.

The level by which the rating level exceeds the prevailing background sound level indicates the following potential impacts:

- A difference of 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
- Where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

When considering the level of impact, BS 4142:2014 emphasises the importance of the context in which a sound occurs. The standard therefore takes great care in the use of the words "sound" and "noise". Sound can be measured by a sound level meter or other measuring system, whereas noise is related to a human response and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive.

4 CONSULTATION AND ASSESSMENT CRITERIA

Consultation was undertaken with the Environmental Health Department of Swansea Council to agree the assessment methodology and assessment criteria.

It was agreed that the assessment should be undertaken in accordance with BS 4142, and an assessment criterion limiting the Rating level of the Development to no more than 5 dB above the prevailing daytime and night-time background sound level would be applied.

It was noted that a thorough BS 4142 background sound survey was undertaken in 2018 for the Abergelli Generating Station, and given the proximity of the Development to this facility, monitoring was undertaken at the Development's most noise-sensitive receptors. In light of this, it was agreed that the background sound levels identified in the Abergelli Generating Station Environmental Statement³ would be suitable for use in this assessment.

5 IDENTIFICATION OF NOISE-SENSITIVE RECEPTORS

Figure 1 shows the location of the Development relative to the closest noise-sensitive receptors. Provided that noise from the Development does not exceed the assessment criteria at these receptors, the effects at more distant receptors would also be acceptable. It should be noted that since the 2018 Abergelli Generating Station ES, two additional dwellings receptors have been constructed approximately 150 m southwest of Abergelli Farm, and have therefore been considered in this assessment.

³ AECOM (2018). Abergelli Gas Fired Generating Station, Chapter 7, Table 7-15.

Figure 1: Location of Development and Assessed Receptors



6 BACKGROUND SOUND LEVELS

Table 1 presents the daytime and night-time background sound levels for each assessed receptor, as taken from the Abergelli Generating Station ES.

With regard to the new build dwellings at Abergelli, background sound levels measured at Abergelli Farm are considered to be representative of these additional receptors. In practice, given that these new dwellings are located closer to trees and the existing electrical substation than Abergelli Farm itself, it is likely that background levels at the new build dwellings will be higher than the measured levels. Therefore, background sound levels measured at Abergelli Farm have also been applied to the new build dwellings.

Table 1: Background Sound Levels

| Receptor Location | Background Sound Level, dB, L _{A90} | |
|-----------------------|--|------------|
| | Daytime | Night-time |
| Abergelli Farm | 40 | 36 |
| Abergelli (New Build) | 40 | 36 |
| Lletty'r Morfil Farm | 43 | 38 |
| Maes-eglwys | 36 | 35 |

7 CONTEXTUAL FACTORS

The Development is located between an existing large-scale substation and the consented Abergelli Generating Station, and is therefore considered to fit well within the context of the local environment.

8 NOISE MODELLING

The specific sound level⁴ at the façade of the nearest noise-sensitive properties has been calculated in SoundPlan 7.4 noise modelling software at a height of 1.5 m, using the environmental noise propagation model ISO 9613-2:1996⁵.

The primary sources of sound from the Development are the Energy Management Modules ('EMMs'), EMM cooling plant, inverters and transformers. The Client has provided sound pressure levels for EMMs, EMM cooling plant, and transformers. For the purposes of noise modelling, and with the exception of the EMMs, these have been converted to sound power levels, and an appropriate octave-band spectrum applied, taken from Arcus' library of similar plant.

It is understood that the EMMs are a new, emerging technology; no detailed frequency spectrum is currently available from the manufacturer for these units. Therefore, and as recommended in ISO 9613-2, noise from the EMMs has been modelled at a frequency of 500 Hz.

Whilst unlikely to be a significant contributor to overall sound levels, additional emission data for the battery container AC plant and inverters has been taken from Arcus' library of similar plant, in the interest of conservatism.

The sound emission data for each item of plant is presented in Table 2.

Table 2: Plant Emission Data

| Octave-Band Frequency (Hz) | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | Total |
|--|--|-----|-----|-----|----|----|----|----|-------|
| | Sound Power Level, dB, L _{WA} | | | | | | | | |
| Battery Container AC plant (each) | 58 | 68 | 62 | 66 | 68 | 68 | 66 | 59 | 75 |
| EMM Cooling Plant Array (per array) | 63 | 80 | 89 | 89 | 87 | 88 | 85 | 82 | 95 |
| Inverters (each) | 52 | 69 | 78 | 78 | 76 | 77 | 74 | 71 | 84 |
| Transformers (each) | 67 | 82 | 88 | 94 | 91 | 87 | 82 | 63 | 97 |
| EMM (sound pressure level @ 1m - each) | - | - | - | 90 | - | - | - | - | 90 |

The two EMM modules will be housed within a single building. For the purposes of modelling, the sound pressure level incident upon interior of the building's facades is estimated at 90 dB, L_{Aeq}. The EMM building construction and acoustic performance is detailed in Table 3.

A noise map showing the resulting predicted specific levels (i.e. noise levels prior to any rating corrections) is presented in Appendix 2.

⁴ The sound level produced by a source, without corrections for acoustic features as discussed in Section 3.3.

⁵ ISO 9613-2:1996 Acoustics; Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

Table 3: EMM Building Acoustic Performance

| Octave-Band Frequency (Hz) | 125 | 250 | 500 | 1k | 2k | 4k | Total |
|---|--|-----|-----|----|----|----|-------|
| | Acoustic Attenuation, dB, R _w | | | | | | |
| Sides: dual-skin 1 mm corrugated steel with mineral wool core | 20 | 29 | 42 | 48 | 56 | 57 | 42 |
| Roof: dual-skin 1 mm corrugated steel | 18 | 23 | 33 | 43 | 48 | 39 | 36 |

8.1 Rating Level Corrections

BS 4142 states that corrections should be applied in order to account for certain acoustic features which have the potential to increase the level of noise impact at nearby dwellings.

The four acoustic features to be considered in the application of rating corrections are as follows:

- Impulsivity: No impulsive characterises are anticipated;
- Tonal Elements: The Client has confirmed that the EMMs will be non-tonal, and the sound of the cooling plant and inverters will be broadband. Whilst some tonality may be expected from the transformers, any such tonality is likely to be masked by the Development's other plant, and is highly unlikely to be perceptible at receptors;
- Intermittency: The plant will not operate with defined on/off periods, and as therefore not considered to be intermittent;
- Distinctiveness: Due to the elevated levels of existing background sound, and the Development's position between an existing large-scale substation and the Abergelli Generating Station, the Development is unlikely to have a character which differs substantially from that of the existing environment.

In light of the above, no Rating Level corrections are considered necessary; the Rating Levels are therefore the same as the Specific Levels.

9 ASSESSMENT OF IMPACT

An assessment of the likely impact has been made based upon the difference between the rating levels and prevailing background levels for daytime and night-time periods, as detailed in Table 4.

Table 4: Assessment of Impact

| Receptor Location | Specific Level, dB, L _{Aeq} | Rating Level, dB(A) | Background Sound Level, dB, L _{A90} | | Difference, dB | |
|-----------------------|--------------------------------------|---------------------|--|------------|----------------|------------|
| | | | Daytime | Night-time | Daytime | Night-time |
| Abergelli Farm | 37 | 37 | 40 | 36 | -3 | +1 |
| Abergelli (New Build) | 41 | 41 | 40 | 36 | +1 | +5 |
| Lletty'r Morfil Farm | 37 | 37 | 43 | 38 | -6 | -1 |
| Maes-eglwys | 40 | 40 | 36 | 35 | +4 | +5 |

As Table 2 shows, predicted levels are compliant with the assessment criterion agreed with the Environmental Health Department of Swansea Council, and are therefore acceptable. It is anticipated that noise levels due to the Development would be controlled through a suitably wording planning condition, a suggestion for which is provided below:

When assessed in accordance with BS 4142:2014+A1:2019, the Rating level of noise due to the Development shall not exceed the existing background noise level by more than 5 dB at any dwelling either consented or constructed at the time of this consent.

9.1 Uncertainty

Modelling has been undertaken assuming all plant is operating simultaneously, and at full power. Noise emission data has been taken from information provided by the Client, and supplemented with additional data from Arcus' library of similar plant. As a newly-emerging technology, noise levels emitted by the EMMs in particular are yet to be confirmed. However, in the event that the EMMs are found to have a noise emission level greater than presented in this report, the EMM building will be acoustically enhanced to ensure sound levels at noise-sensitive receptors remains within the assessment criteria.

Overall, it is considered that the assumptions made in this assessment are likely to result in an over-prediction of noise levels in practice, and that the uncertainties inherent in the assessment will not have a significant impact on the outcome of the assessment.

10 CONCLUSION

An assessment of noise due to the Development has been undertaken in accordance with BS 4142:2014+A1:2019, and found to be within the assessment criterion agreed with Swansea Council during both daytime and night-time periods. It is anticipated that noise due to the Development will be controlled through a suitably wording planning condition, a suggestion for which has been provided in Section 9.

11 GLOSSARY OF TERMS

Background Sound: The background sound level is the underlying level of noise present at a particular location for the majority (usually 90%) of a period of time.

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.

L_{AFmax}: The maximum A-weighted sound pressure level measured over a given period, with a fast time weighting.

Noise: Unwanted sound. May refer to both natural (e.g. wind, birdsong etc.) and artificial sounds (traffic, industrial noise, aircraft etc.).

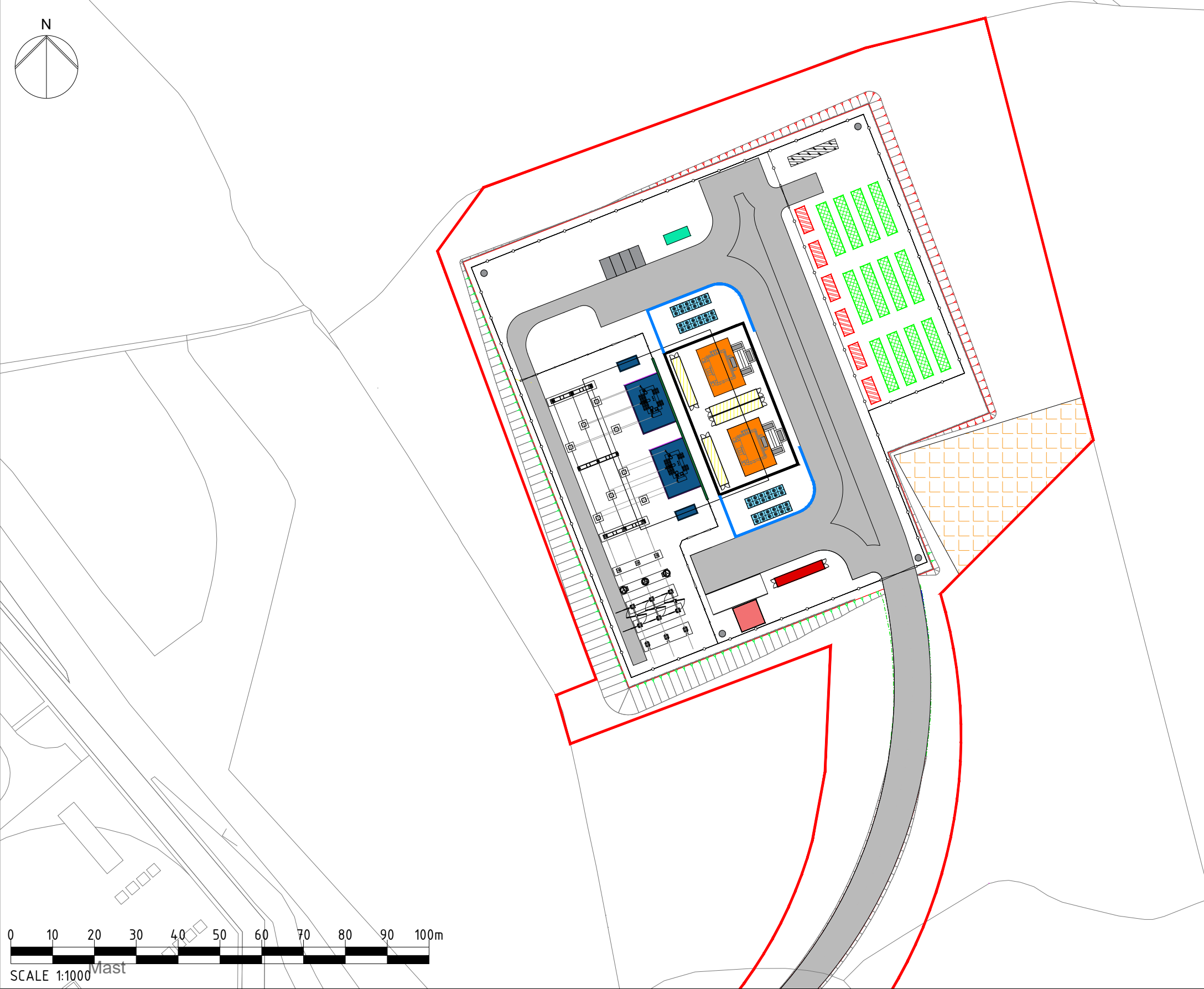
Rating Level: Sound levels which have been corrected for certain acoustic features, as required under BS4142 methodology.

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

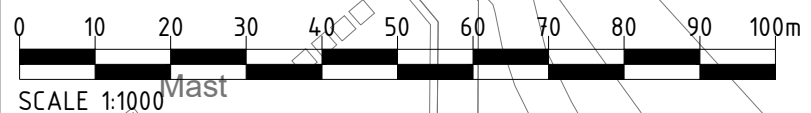
Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2×10^{-5} Pa.

Specific Level: In terms of BS4142 methodology, the specific level is the sound level produced by a source, without corrections for acoustic features.

APPENDIX 1 – DEVELOPMENT LAYOUT



- KEY:**
- SITE BOUNDARY (5.53 Hectares)
 - 2.40m HIGH WELDMESH FENCING
 - BATTERY (12.9m x 2.44 x 2.59m)
 - INVERTER (6.1m x 2.44m x 2.59m)
 - TRANSFORMER
 - LV SWITCH HOUSE (12.9m x 2.44m x 3.0m)
 - E-HOUSE (ENCLOSED IN BUILDING 20.7m x 36.7m x 10.0m TO ROOF PITCH)
 - COOLER (9.6m x 2.4m x 2.5m)
 - PROPOSED TRACK AREAS
 - MAIN CONTROL ROOM (6.1m x 2.44m x 3.0m)
 - ENERGY MANAGEMENT SYSTEM (ENCLOSED IN BUILDING 20.7m x 38.6m x 10.0m TO ROOF PITCH)
 - EMERGENCY DIESEL GENERATOR (6.0m x 6.0m)
 - BUILDING (20.7m x 38.6m x 10.0m TO ROOF PITCH)
 - SWITCHGEAR CONTAINER (12.2m x 2.44m x 3.0m)
 - TEMPORARY LAYDOWN
 - FIRE STOP WALL (36.2m X 0.4m x 10.0m)
 - ABERGELLI CORRIDOR
 - 6m SECURITY COLUMN
 - 4m HIGH WALL



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APPENDIX 2 – NOISE MAP

