HIGH MATHERNOCK BESS

NOISE IMPACT ASSESSMENT

VERSION 2

Updates from Version 1:

- Description of development changed to describe reduction of battery units from 87 to 60
- Site layout drawing changed showing reduce footprint; from 3.1ha to 2.7ha
- Project description changed to describe change to Canadian Solar battery units
- Operational Noise Impacts changed to describe range of cooling fan speeds at varying ambient temperatures and the resulting daytime (35°C ambient temperature) and nighttime (25°C ambient temperature) noise scenarios (p17)
- Complete noise assessment changed to reflect battery type and site layout changes
- Addition of daytime and nighttime noise contour plot (Appendix D)

Conclusion including Cumulative Conclusion

Main Conclusions from Section 9, Summary, (p31), listed below:

- "*The BS 4142 assessment concluded that operational noise from the Proposed Development would not result in an adverse impact at any noise sensitive receptors.*"
- *"The cumulative BS 4142 assessment concluded that operational noise from the Proposed Development and Auchentiber BESS would not result in an adverse impact at any noise sensitive receptors."*

A specialist energy consultancy

Noise Impact Assessment

High Mathernock Battery Energy Storage System (BESS)

Harmony HM Ltd.

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1 Introduction

1.1 Overview

TNEI was commissioned by Harmony HM Ltd (henceforth referred to as 'the Client') to undertake an Environmental Noise Impact Assessment (NIA) in support of the Section 36 planning application for the proposed High Mathernock Battery Energy Storage (BESS) development (henceforth referred to as 'the Proposed Development').

The Proposed Development is located approximately 4 km northwest of the village of Kilmacolm, Inverclyde at approximate Ordnance Survey coordinates 232087, 671421. The Proposed Development site is currently undeveloped agricultural/pastural land. The local area around the site is semi-rural in nature, predominantly consisting of agricultural and pastural land, with a number of residential properties located nearby in various directions.

The aims of this NIA are to:

- Identify potential noise sensitive receptors in the vicinity of the Proposed Development;
- Describe the existing noise environment around the noise sensitive receptors;
- Identify the dominant sound sources associated with the operation of the Proposed Development;
- Calculate the likely levels of operational noise at the nearest noise sensitive receptors to determine the noise impacts associated with the development; and,
- Indicate any requirements for mitigation measures, if required, to provide sufficient levels of protection for nearby receptors.

All work undertaken to produce this report has been carried out by past and present members of the TNEI Environment and Engineering Team, all of whom were affiliated with the Institute of Acoustics (IOA) when the works were undertaken. Specifically, the following members of staff have been involved in the project:

- Will Conway, Tech IOA, BSc (Hons): **Baseline Sound Level Survey**
- Tom Suddaby, AffIOA, BA (Hons): **Noise propagation modelling, assessment and reporting**
- Andrew Birchby, MIOA, MEng, IOA Postgraduate Diploma in Acoustics and Noise Control: **Quality Assurance**

1.2 Nomenclature

Please note the following terms and definitions, which are used throughout this report;

- **Emission** refers to the noise level emitted from a noise source, expressed as either a sound power level or a sound pressure level;
- **Immission** refers to the sound pressure level received at a specific location from a noise source;
- **Rating Level** refers to the immission level after consideration of the character of the sound. The Rating Level is the Immission Level plus any required character corrections, if this is deemed necessary.
- **SWL** indicates the sound power level in decibels (dB);
- **SPL** indicates the sound pressure level in decibels (dB);

- **NML** (Noise Monitoring Location) refers to any location where noise levels have been measured;
- **NSRs** (Noise Sensitive Receptors) are all identified receptors that are sensitive to noise; and;
- **NAL** (Noise Assessment Location) refers to any location where the immission levels are calculated and assessed.

All figures referenced within the report can be found in Appendix D.

Unless otherwise stated, all noise levels refer to free field levels i.e. noise levels without influence from any nearby reflective surfaces.

All grid coordinates refer to British National Grid Eastings and Northings.

2 Project Description

A BESS principally consists of three main elements: batteries, inverters, and Medium Voltage (MV) transformers. Groups of batteries are connected into an inverter, which converts between Direct Current (DC) and Alternating Current (AC). The inverter is then connected to a Medium Voltage (MV) transformer.

A BESS development is made up of several battery, inverter and MV Transformer units. Sometimes the inverter and MV transformers can be combined into a single unit. Collectively the inverter and MV transformer is referred to as a Power Conversion System (PCS).

The MV transformers will ultimately be connected to the grid network, typically through one or two High Voltage (HV) transformers, although these are not always located within the BESS site itself, sometimes utilising existing HV transformers located within a nearby substation.

2.1 Proposed Layout

The Proposed Development site is within an agricultural field. The ground underneath the Proposed Development will be levelled off and a 6 m high retaining wall will be built around the north-eastern edge of the site.

An indicative layout for the Proposed Development is included in Appendix A. The candidate plant for the layout is based on an E-STORAGE solution by Canadian Solar, which uses a layout configuration consisting of battery containers and separate combined PCS units.

The Proposed Development also includes a 400 kV Substation, comprising of two HV transformers.

Based on the candidate plant layout, the primary sound sources considered within this assessment are:

- Fan Cooled Double Battery units, 60 of,
- PCS Units, 60 of, and
- HV Transformers, 2 of.

The sound level output of any auxiliary infrastructure included as part of the Proposed Development, for example, switch gear or auxiliary transformers, will be insignificant in comparison to the primary sound sources detailed above. Accordingly, no other items of plant have been considered within this assessment.

2.2 Study Area

Noise Sensitive Receptors (NSRs) are properties that are sensitive to noise and, therefore, require protection from nearby noise sources. The study area for the assessment of environmental noise is usually defined through the identification of the closest NSRs to the development.

The assessment of noise attributable to the Proposed Development considers the nearest NSRs only, on the assumption that if sound levels at the closest receptors are deemed acceptable, then sound levels at NSRs at greater distances from the Proposed Development should also be within acceptable levels.

The nearest identified NSRs, which have a high level of sensitivity, are existing residential properties located at varying distances in all directions from the Proposed Development Site. The curtilage of the closest residential receptor is approximately 400 m to the southeast of the nearest noise emitting plant. Other residences are located between 670 m and 1,650 m away in all directions from the site.

The closest NSRs to the Proposed Development are scattered residential dwellings and farmhouses that surround the site. The study area, which contains all receptors that have been considered within the assessment is detailed in Figure 1 (Appendix D).

3 Methodology

3.1 Calculation Method

3.1.1 ISO 9613-2:2024

To predict the noise immission levels attributable to the Proposed Development, a noise propagation model was created using the propriety noise modelling software, CadnaA. Within the software, complex models can be produced to simulate the propagation of noise according to a range of international calculation standards.

For this assessment noise propagation was calculated in accordance with ISO9613-2:2024 *Acoustics — Attenuation of sound during propagation outdoors: Engineering method for the prediction of sound pressure levels outdoors* (1), using the following input parameters;

- Temperature is assumed to be 10°C and relative humidity as 70%;
- A ground attenuation factor of 1 (soft ground) has been used except for specific areas of developed ground (including the development area and nearby roads) which are modelled with a ground attenuation factor of 0 (hard ground); and
- Receiver heights have been set to 4 m to represent the height of a first-floor bedroom window. Noise levels at 1.5 m, which would be more typical of ground floor/garden level, would be slightly lower.

3.1.2 Uncertainties and Limitations

The noise propagation model is designed to give a good approximation of the specific sound level and the contribution of each individual sound source; however, it is expected that measured levels are unlikely to be matched exactly with modelled values. As such, the following limitations in the model should be considered:

- In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night. These conditions are favourable to noise propagation;
- The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for;
- The model assumes all sound sources are operating continuously and simultaneously.

With due regard to the above, noise level predictions are likely to be higher than what will occur during normal operation.

Note that the modelled sound sources represent candidate plant and an associated site layout. The location, operating conditions, number of, and noise output of individual items of plant may vary from what is presented in this report after final plant specification, which cannot be undertaken without a tendering process that would occur after planning consent has been granted. As such, it is expected that an additional noise impact assessment will be undertaken upon final specification of plant.

3.2 Legislation and Policy Context

At a national level, the relevant policy is PAN 1/2011 (PAN) *Planning and Noise* (2) and the associated Technical Advice Note (TAN) *Assessment of Noise* (3). With regards to the assessment of

environmental noise, Appendix 1 of the TAN describes a number of standards and guidelines that may be referred to, such as British Standards (BS) 4142 and 8233.

3.3 Assessment Method

A number of standards and guidelines are available for the assessment of environmental noise from proposed new developments or activities on residential receptors.

There are no fixed noise level limits for industrial noise in the UK, and consideration of the context in which the noise generation occurs is considered with more importance than simply meeting an absolute noise level to determine the likelihood of an adverse impact. This form of assessment is set out in British Standard (BS) *4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound* (4), hereafter referred to as BS 4142.

3.3.1 BS 4142 Assessment Method

The BS 4142 form of assessment is based on the predicted or measured levels of an assessed sound source compared to the measured background sound levels without the specific sound source present and uses, *"outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident".*

In reference to the existing baseline conditions i.e. before any proposed development, BS 4142 uses the following terms:

- **Residual Sound Level:** The sound level of all noise sources in an area, except the sound source to be assessed, over a given time interval, t. Described using the metric $L_{Aeq(t)}$.
- **Background Sound Level:** This is also the sound level of all noise sources in an area except the sound source to be assessed, however, it is quantified by determining the sound level that is exceeded for 90% of the given time interval. Described using the metric $L_{A90(t)}$.

The next two noise metrics (below) represent noise attributable to the proposed development only.

- **Specific Sound Level:** The equivalent continuous A-weighted sound pressure level (SPL) produced by the specific sound source at the assessment location over a given reference time interval, i.e. the sound level of just the sound source to be assessed. Described using the metric $L_{Aeq(t)}$.
- **Rating Level:** The Specific Sound Level adjusted for the characteristics of the sound. The Rating Level is calculated by adding a character correction(s), if required, to the Specific Sound Level when the sound source contains audible characteristics at the receptor location, such as tonal, impulsive or intermittent components. Described using the metric, $L_{Aeq(t)}$.

The final noise metric represents the future noise level during the operational phase of a proposed development and can be thought of as the 'Total Sound' i.e. the existing baseline + the proposed development.

- **Ambient Sound Level:** Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far i.e. the sound level of all noise sources in an area, including the sound source to be assessed. Described using the metric, $L_{Aeq(t)}$.

BS 4142, Section 11, requires that the assessment considers the context in which the sound occurs, and as such there is no definitive pass/fail element to the standard. Rather, the assessment outcome is an indication as to the likelihood for adverse impact.

Additional guidance on the BS 4142 assessment methodology is provided in the Association of Noise Consultants' (ANC) BS 4142: Technical Note (5), which has been authored by the ANC Good Practice Working Group (ANC, 2020). The guide is "*designed to assist readers with a reasonable interpretation and application of BS 4142 as a whole.*"

The BS4142 assessment is a two-stage process. Initially, an estimate of the impact is made by subtracting the measured Background Sound Level from the calculated or measured Rating Level. The second part of the assessment is to then consider the context in which the sound occurs, which may modify the findings of the initial estimate.

The standard states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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."

For the second stage of the assessment there are many elements of context that can be considered. The following list[1], which is not exhaustive, gives some examples that could be relevant to the assessment:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound;
- whether specific sound insulation and noise control measures have already been incorporated into a receptor (which would lower the sensitivity of the receptor);
- former uses, at or close to the site;
- the legitimacy of the industrial use, e.g. planning permissions or environmental permits;
- implementation of best practicable means for a given process or activity; and
- whether the Rating Level represents typical levels, realistic worst case, unlikely worst case etc.

3.3.2 Guideline Noise Levels

It is acknowledged that some Local Planning Authorities refer to fixed guideline noise levels for different receptor types, which can be useful to assess noise impacts on non-residential receptors or to provide additional context during the BS 4142 qualitative assessment stage. In particular, it is noted that BS 8233 *Guidance on Sound Insulation and Noise Reduction for Buildings* (6) is often referred to, however, BS 8233 is a standard that provides advice on how to design buildings with regards to internal acoustics, rather than for the assessment of external environmental noise and rather than

[1] Examples of contextual issues to consider can be found in the BS4142 standard, the ANC BS 4142 Technical Note and Method Implementation Document (MID) for BS 4142 (8).

provide guidance on acceptable industrial noise levels, BS 8233 states; "*Where industrial noise affects residential or mixed residential areas, the methods for rating the noise in BS 4142 should be applied.*".

Accordingly, the assessment of noise levels for residential receptors is undertaken in accordance with BS 4142 only.

4 Baseline Sound Level Survey

4.1 Monitoring Locations

TNEI undertook a baseline sound level survey to characterise the different noise environments at the nearest NSRs and determine representative daytime and night-time background sound levels. To this end, baseline monitoring was undertaken between the 8th and 21st of March 2023 at four Noise Monitoring Locations (NMLs), which are detailed in Table 4.1 and shown on Figure 1 (Appendix D).

Table 4.1: Noise Monitoring Locations

NML		BNG Coordinates	
ID	**Descriptor**	**Eastings**	**Northings**
NML01	Located adjacent to High Mathernock Farm	232441	671073
NML02	Located within field approximately 350 m to the south of Auchentiber Road	231574	671314
NML03	Located within field approximately 550 m to the west of Auchenbothie Road and Crosshill Road	233226	672075
NML04	Located adjacent to Auchentiber Farm	231131	672026

4.2 Survey Equipment

All measurements were made with sound level meters (SLMs) mounted approximately 1.2 m above the ground and away from nearby reflective surfaces i.e., building façades, fences etc. Photographs of the NMLs are included in Appendix B.

The noise monitoring equipment consisted of four Rion NL-52 SLMs fitted with appropriate environmental wind shields. All noise monitoring equipment (calibrator, SLM and microphones) used for the study are categorised as Class 1, as specified in IEC 61672-1 *'Electroacoustics. Sound level meters. Specifications'* (7). The equipment was calibrated on-site at the beginning and end of each measurement period, with no significant deviations noted. Appendix B contains the equipment and laboratory calibration details for the SLMs and microphones.

The SLMs were set to log in 15-minute measurement periods throughout the survey. It is noted that often a 1-hour logging period is reported for the daytime and 15-minute period is used for night-time, however, this is typically for short duration attended surveys and it is not possible to set SLMs to switch logging period durations midway through an unattended, longer duration survey. Accordingly, a 15-minute option was selected as night-time periods are typically the most sensitive. In this regard the Association of Noise Consultants (ANC) publication '*BS 4142:2014+A1:2019 Technical Note*' states;

"BS 4142 is not prescriptive about the length of background sound measurement periods, only noting that the duration used should be adequate to represent the situation but not normally less than 15 minutes" and, "In this context, any measurement time interval is considered acceptable under the terms of BS 4142, providing the assessor can justify that it appropriately represents the background sound climate."

Given that the survey ran for several days, the measured data obtained does appropriately represent the background sound climate.

4.3 Meteorological Conditions

Meteorological data was collected with a Kestrel portable weather station and two tipping bucket rain gauges.

Prior to analysis the measured data was filtered for wind and rain conditions, which may result in higher-than-normal sound levels. In this respect BS4142 states;

"Record the weather conditions that could affect measurements. Monitor wind speed at the measurement location, using an anemometer, and record the wind speed together with the wind direction. Exercise caution when making measurements in poor weather conditions such as wind speeds greater than 5 m/s."

Accordingly, a conservative approach has been taken and all data recorded during wind speeds above 3 m/s or during periods of precipitation have been removed from the datasets, as well as the 15 minutes immediately preceding and 60 minutes immediately following any recorded precipitation events. Appendix B provides a series of charts, including time series graphs, which detail the measured meteorological data alongside the measured background sound levels. The Field Data Sheets (FDS) from the baseline noise survey are also provided in Appendix B.

4.4 Existing Noise Environment

Subjective observations made during the installation and collection of equipment, noted the following:

- At NML01, the soundscape consisted of birdsong, wind induced foliage rustle, road traffic noise from Auchentiber Road and tractors coming and going from High Mathernock farm.
- At NML02, the soundscape consisted of birdsong, wind induced foliage rustle and sheep bleating.
- At NML03, the soundscape was dominated by wind induced foliage rustle. A small watercourse was identified nearby but was not audible at the monitoring location.
- At NML04, the soundscape was dominated by wind induced foliage rustle, cattle lowing and dogs barking at the farm.

Table 4.2 presents the derived representative Background Sound level and the Residual Sound Level for daytime and night-time at each NML.

The Background Sound Levels were determined with reference to the time-history charts, statistical analysis charts and distribution analysis charts included in Appendix B, following the guidance presented within the ANC technical note and BS 4142, which states:

"A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or modal value."

The Residual Sound Levels were determined through consideration of the range, mean and modal values of the daytime and night-time measured $L_{Aeq,t}$ values.

Table 4.2: Measured Sound levels

NAL	Background Sound Level, dB $L_{A90(15mins)}$		Residual Sound Level, dB $L_{Aeq(15mins)}$	
	Day	Night	Day	Night
NML01	35	33	41	36
NML02	33	31	38	34
NML03	35	32	40	35
NML04	33	30	40	36

5 Operational Noise Impacts

5.1 Modelling of Noise Sources

The noise model considers all of the primary sound sources detailed within Section 2 of the report. The following section describes how each sound source has been incorporated into the noise model.

All sound sources are assumed to be operating concurrently and continuously. As discussed below, some of the plant is proposed to operate at different levels during the day and the night, however within each period the sources are assumed to be operating with a constant sound level output.

Noise modelling is based on candidate plant typical for the size and class of the Proposed Development. It should be noted that final plant specifications may vary during the final tendering process.

All noise modelling data is shown within Appendix C.

5.1.1 Fan Cooled Battery Units

The candidate battery unit for the Proposed Development is the E-STORAGE CSI-SolBank-S-5016-2h, fan cooled using a Kelvin/BTMS-600-ES chiller. The cooling fans associated with the installed chiller are the dominant noise source, the chiller is located at one end of the battery unit and as a result, noise is primarily emitted from this façade.

One-third octave band sound power level (SWL) data was provided to TNEI by the Applicant and is available for a range of fan speeds which correspond to varying ambient temperatures. The Applicant has confirmed that a fan speed of 80% and 60% should be assumed for the day and night-time, which have a broadband SWL of 80.6 dBA and 73.3 dBA, respectively. It is TNEI's understanding that an 80% fan speed is appropriate for an ambient temperature of 35°C and that a 60% fan speed is appropriate for an ambient temperature of 25°C.

Each battery unit has therefore been modelled as a cuboid with one façade (where the chiller unit is located) modelled as an area source. A daytime and night-time scenario have been modelled using the relevant SWL data as discussed above. The relevant datasheet is provided within Appendix C and the octave band SWL data is summarised in Table 5.1 below.

5.1.2 PCS Units

The candidate PCS unit for the Proposed Development is the E-STORAGE MVSkid – 5160 – UK. The cooling fan within the PCS unit is the dominant noise source and noise is generally emitted from the unit uniformly. One-third octave band sound pressure level (SPL) data at 1 m from the PCS unit was provided to TNEI by the Applicant, which was then used to calculate the SWL of the unit.

During the day, the overall SWL of the unit with fans operating at 80% is 75.3 dBA, and during the night-time, with fans operating at 60% the overall SWL of each unit is 71.8 dBA.

Each PCS unit has been modelled as a cuboid with the four vertical façades and the top modelled as area sources. A daytime and night-time scenario have been modelled using the relevant SWL data as discussed above. The relevant datasheet is provided within Appendix C and the octave band SWL data is summarised in Table 5.1 below.

5.1.3 HV Transformer

Two HV Grid Transformers are anticipated to be located within the 400 kV substation compound and a candidate ABB transformer has been selected for use within the noise model.

Each transformer has been modelled as a cuboid with the four vertical facades and the top modelled as area sources such that the broadband SWL for the overall unit equates to 88.2 dBA. The relevant datasheet is provided within Appendix C and the octave band SWL data is summarised in Table 5.1 below.

5.1.4 Source Noise Levels

Table 5.1 presents the octave band sound power levels (SWL) used in the noise model for each noise source.

Table 5.1: Octave Band Sound Power Levels of Modelled Noise Sources, dBA

Noise Source	Broad band	Octave band, Hz							
	dBA	63	125	250	500	1000	2000	4000	8000
Battery Unit 80% *	80.6	49.0	72.2	71.5	72.4	74.3	74.3	70.3	60.9
Battery Unit 60% *	73.3	47.1	65.7	62.3	64.8	67.8	67.1	61.9	49.8
PCS Unit 80% *	75.3	22.4	31.1	38.9	53.8	63.1	70.0	72.4	65.6
PCS Unit 60% *	71.8	32.4	37.4	40.0	49.3	58.6	67.0	69.5	55.1
HV Transformer *	88.2	64.4	79.7	82.4	82.7	81.7	75.4	71.4	65.0
* indicates a noise source that has been modelled using one third octave band data									

5.2 Incorporation of Additional Mitigation Measures

Acoustic barriers have been included in the design to reduce noise immission levels at the closest NSRs. Specifically, the noise model includes a 5 m acoustic fence which will be situated between the two site entrances along the northern and eastern boundary of the Proposed Development, as well as along the western edge of the 400 kV Substation compound. The model also includes a 10 m blast wall which will be situated between the two HV Transformers. The locations of the acoustic fences and the blast wall are detailed on the layout within Appendix A, and can be seen in Figure 2 and Figure 3 in Appendix D.

5.3 Calculated Immission Levels

Noise immission levels have been calculated at ten Noise Assessment Locations (NALs), which have been selected to represent the closest NSRs to the Proposed Development. Each NAL has been set on the side of the property facing the Proposed Development. The NALs are detailed in Table 5.2 alongside its associated representative NML. The NALs are also shown on Figure 2 and Figure 3 in Appendix D.

Table 5.2: Noise Assessment Locations (NALs)

Noise Assessment Location		BNG Coordinates		Representative NML
NAL ID	NAL Descriptor	Eastings	Northings	
NAL01	High Auchenleck Farm	233229	672767	3
NAL02	Cunston	233436	672172	3
NAL03	Priestside Cottage	233104	671215	1
NAL04	High Mathernock Farm	232519	671167	1
NAL05	Loganwood House	232439	671088	1
NAL06	Horsecraigs	231864	670648	1
NAL07	Auchenfoyle Farm A	231224	670947	2
NAL08	Auchenfoyle Farm B	231149	671040	2
NAL09	Gryfe Lea	230881	671369	4
NAL10	Auchentiber	231031	671978	4

The immission levels (Specific Sound Level) have been calculated assuming all plant is operating continuously and concurrently.

The noise immission levels are detailed in Table 5.3 and are also illustrated as a noise contour plots shown in Figure 2 (Daytime) and Figure 3 (Night-time) of Appendix D.

Table 5.3: Calculated Immission Levels

Noise Assessment Location		Immission Level, dB $L_{Aeq(t)}$	
NAL	NAL Descriptor	Daytime	Night-time
NAL01	High Auchenleck Farm	15	11
NAL02	Cunston	17	13
NAL03	Priestside Cottage	20	17
NAL04	High Mathernock Farm	35	30
NAL05	Loganwood House	35	30
NAL06	Horsecraigs	31	25
NAL07	Auchenfoyle Farm A	29	23
NAL08	Auchenfoyle Farm B	29	23

Noise Assessment Location		Immission Level, dB $L_{Aeq(t)}$	
NAL	**NAL Descriptor**	**Daytime**	**Night-time**
NAL09	Gryfe Lea	23	19
NAL10	Auchentiber	23	18

6 Noise Impact Assessment (BS 4142)

6.1 BS 4142 Rating Level

To assess the immission levels in accordance with BS 4142, the Specific Sound Level must be converted into a Rating Level. The Rating Level allows for character corrections to be added to account for particular characteristics of the sound that may be perceived as more annoying. In particular, the Rating Level considers tonality, impulsivity and intermittency of the sound, as well other sound characteristics that are neither tonal, impulsive, or intermittent, but are otherwise readily distinctive against the residual acoustic environment.

Note: Character corrections consider the noise at the receiver location, not the source location.

6.1.1 Tonality

With regards to tonality, BS 4142 states:

'For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.'

Electrical plant such as power transformers are inherently tonal at source, typically in the 100 Hz frequency band. BS 4142 corrections, however, are only applied if the noise characteristics are present at the receptor location, not at the source location. Consideration of the predicted one third octave levels at the closest receptors indicate that tonality will not be noticeable from any plant. As such, no tonal character correction has been applied.

6.1.2 Impulsivity

With regards to impulsivity, BS 4142 states:

'A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible.'

Impulsivity is not considered to be a relevant sound characteristic of a BESS as when operational, the noise level will be predictable and consistent.

6.1.3 Intermittency

The intermittency of the sound source needs to be considered when it has identifiable on/off conditions with regards to intermittency, BS 4142 states:

'If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.'

As with impulsivity, intermittency is not considered to be a relevant sound characteristic in this case. Once operational, noise levels may fluctuate by a small amount over long periods of time, but no step changes in noise level are anticipated.

6.1.4 Other Sound Characteristics

With regards to other sound characteristics, BS 4142 states:

'Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.'

Based on TNEI's understanding and experience of this type of plant, we do not anticipate any additional sound characteristics that would be considered readily distinctive against the residual acoustic environment.

6.1.5 Calculation of the Rating Level

With due regard to the above, no character corrections are required. Therefore, the BS 4142 Rating Levels are equal to the Specific Sound Levels.

6.2 BS 4142 Stage 1 Assessment – Initial Estimate of Impact

Stage 1 of the assessment compares the Rating Levels against the Background Sound Level, as detailed in Table 6.1.

Table 6.1: BS 4142 Initial Estimate of Impact

NAL		Rating Level (dB $L_{Aeq,t}$)		Background Sound Level (dB $L_{A90,15min}$)		Difference (+/-) (dB)	
ID	Descriptor	Day	Night	Day	Night	Day	Night
NAL01	High Auchenleck Farm	15	11	35	32	-20	-21
NAL02	Cunston	17	13	35	32	-18	-19
NAL03	Priestside Cottage	20	17	35	33	-15	-16
NAL04	High Mathernock Farm	35	30	35	33	0	-3
NAL05	Loganwood House	35	30	35	33	0	-3
NAL06	Horsecraigs	31	25	35	33	-5	-8
NAL07	Auchenfoyle Farm A	29	23	33	31	-4	-8
NAL08	Auchenfoyle Farm B	29	23	33	31	-5	-8
NAL09	Gryfe Lea	23	19	33	30	-10	-11
NAL10	Auchentiber	23	18	33	30	-10	-12

The Rating Level is less than, or equal to, the Representative Background Sound Level at all NALs during both the daytime and night-time periods. This is an *"indication of the specific sound source having a low impact, depending on the context*."

6.3 BS 4142 Stage 2 Assessment – Consideration of Context

Although there are other elements of context that may be relevant to the assessment, BS 4142 requires the following three contextual elements to be considered:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and the level of the specific sound; and
- the sensitivity of the receptor.

Each of these is considered in turn below, alongside other contextual elements that are relevant for the Proposed Development.

6.3.1 Context: Absolute Level of Sound

BS 4142 suggests that in instances where the existing sound environment is considered either particularly low or particularly high then absolute levels may be more relevant than the initial estimate of impact. The standard states:

"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 the background. This is especially true at night."

The ANC BS 4142 Technical Note provides additional guidance on this, providing indicative values that could be used to describe 'low' background sound levels and 'low' rating levels. Specifically, the Technical Note states:

"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB LA90, and low rating levels as being less than about 35 dB LAr,Tr".

In this case the background sound levels are in the low to mid 30's (dB $L_{A90(15mins)}$) during the daytime and night-time, and therefore are considered to be 'low'.

The Rating Levels are similarly considered to be 'low', being no more than 35 dB $L_{Aeq,t}$. In this case, the ANC Technical Note suggests that the initial estimate of impact may be modified by the low rating and background sound levels, and notes that what may otherwise constitute a significant adverse impact may be considered acceptable due to this modifying factor. As such, **consideration of the absolute level of sound does not materially change the initial estimate of impact for both day and night-time periods.**

6.3.2 Context: Character and Level of Residual Sound

The character and level of the residual sound should be compared to the character and level of the specific sound, and consideration given to whether the specific sound would be incongruous within the existing environment.

The Residual Sound Level at all locations, as reported in Table 4.2, is at least 6 dB higher than the Specific Sound Level at all NALs.

Table 6.2 compares the Specific Sound Levels with the Residual Sound Level, and also indicates the estimated level of change.

Table 6.2: Residual (Existing) and Ambient (Future) Sound Levels, dB $L_{Aeq(15mins)}$

NAL		Specific Sound Level (dB $L_{Aeq,t}$)		Residual Sound Level (dB $L_{Aeq,15min}$)		Ambient Sound Level		Change (+/-)	
ID	Descriptor	Day	Night	Day	Night	Day	Night	Day	Night
NAL01	High Auchenleck Farm	15	11	40	35	40	35	0	0
NAL02	Cunston	17	13	40	35	40	35	0	0
NAL03	Priestside Cottage	20	17	41	36	41	36	0	0
NAL04	High Mathernock Farm	35	30	41	36	42	37	1	1
NAL05	Loganwood House	35	30	41	36	42	37	1	1
NAL06	Horsecraigs	31	25	41	36	41	36	0	0
NAL07	Auchenfoyle Farm A	29	23	38	34	39	34	1	0
NAL08	Auchenfoyle Farm B	29	23	38	34	39	34	1	0
NAL09	Gryfe Lea	23	19	40	36	40	36	0	0
NAL10	Auchentiber	23	18	40	36	40	36	0	0

At all NALs except for NAL04, NAL05, NAL07 and NAL08 the Specific Sound Level is at least 10 dB below the Residual Sound Level and therefore noise from the BESS would not contribute to the Ambient Sound Level at these locations. This can be seen in Table 6.2 where there is no change in noise level.

At NAL04, NAL05, NAL07 and NAL08, the Specific Sound Level is less than 10 dB below the Residual Sound Level. This results in a +1 dB change to the Ambient Sound Level during the daytime at all four NALs, and at NAL04 and NAL05 during the night-time. It's noted that a 3 dB change in noise level is widely accepted as being just perceptible to humans, therefore the +1 dB change that is predicted at NAL04, NAL05, NAL07 and NAL08 is not anticipated to be noticeable.

The Proposed Development would operate with a continuous and relatively low sound level, which is not expected to be readily distinctive against the residual acoustic environment.

As such, **consideration of the character and level of residual sound does not materially change the initial estimate of impact for both day and night-time periods.**

6.3.3 Context: Sensitivity of Receptor

BS 4142 suggests that the sensitivity of the receptor may be lessened if design measures that secure good internal and/or outdoor acoustic conditions are already implemented within the receptor. An

example of this could be where a residential building has been fitted with non-openable windows in an already high noise environment. This is not relevant to this assessment, where it is assumed that all nearby NSRs do not incorporate any specific noise control measures. As such**, the sensitivity of the receptor remains high and this contextual element does not materially affect the initial estimate of impacts for both day and night-time periods.**

6.3.4 Context: Candidate Plant and Limitations of Noise Modelling

As detailed in Section 5.1, the candidate Battery and PCS units have been modelled assuming that the cooling systems are operating at 80% fan speed during the daytime and 60% fan speed during the night-time, which correspond to ambient temperatures of 35°C and 25°C, respectively. This demonstrates a worst case scenario as the ambient temperature at the site are anticipated to be significantly lower than this for the majority of the year, meaning that the fans would likely operate at a lower speed and emit lower noise levels. With due consideration of this, and the limitations discussed in Section 3.1.2, the noise model is expected to overpredict the immission level at all NALs. As such, **this does not materially change the initial estimate of impact for both day and night-time periods.**

6.4 BS 4142 Assessment Conclusion

Stage 1 of the assessment indicated that there would be no adverse impact at any NAL, depending on the context. Detailed considerations of the context, specifically, the absolute level of the sound, the character and level of residual sound and the assumptions within the noise model, supports the initial estimate of impact.

Accordingly, the **BS 4142 assessment concludes that there would be no adverse impacts on residential receptors from the operation of the Proposed Development.**

7 Cumulative Impacts

7.1 Auchentiber Road BESS Development

Located less than 50 m to the west of the Proposed Development is the consented 700 MW Auchentiber Road BESS development (Inverclyde Council Planning Reference 23/0001/EAA). A NIA[2] was submitted in support of the planning application for this development, which presents a BS 4142 assessment and concludes that *'…the predicted level of noise impact, at all Receptors, from the Development is sufficiently low enough and as such, noise should not be deemed to be a determining factor in the granting of planning permission for this Development.'* Tables 11 and 12 of the Auchentiber Road BESS NIA Report display the calculated BS 4142 Rating Levels for the Daytime and Night-time periods respectively.

Auchentiber Road BESS was granted planning consent in September 2024[3]. With regards to operational noise limits, planning condition *19. (2)* within the Decision Notice states that:

"Noise from all operational activities within the Development site shall not exceed 31 dB LAr,Tr as measured and assessed within the external amenity area of any noise sensitive property and in accordance with BS 4142:2014 Methods for rating and assessing industrial and commercial sound."

Planning condition *19. (6)* then states that:

"Prior to the operation of the battery energy storage system hereby consented a revised Noise Impact Assessment (NIA) shall be submitted to and approved in writing by the Planning Authority. The NIA report shall include details of the specified plant to be installed and any required noise control measures to ensure that operational noise levels from the Development will be below the noise level limits detailed in this condition."

7.2 Cumulative Assessment

With regards to the above, a cumulative BS 4142 assessment has been undertaken against the representative background sound levels presented within this NIA.

As a revised NIA is not yet available, TNEI have considered a worst case scenario and assumed that Rating Levels from Auchentiber Road BESS are equal to the 31 dBA noise limit at the receptors with the greatest predicted Rating Levels, which are Auchenfoyle Farm during the daytime and Loganwood House during the night-time. As reported in Tables 11 and 12 of the Auchentiber Road BESS NIA Report, the highest calculated Rating Levels are 26 dBA during the daytime and 30 dBA during the night-time. The Rating Levels at all NALs have therefore been increased by 5 dB during the day and 1 dB during the night such that they are equal to the 31 dBA noise limit at Auchenfoyle Farm and Loganwood House during these periods, respectively. It is noted that the highest calculated Rating Level from the Proposed Development is also predicted at Loganwood House (NAL05), so this is the key receptor with regards to cumulative operational noise.

Table 7.1 below shows the results of the cumulative assessment, in which the Proposed Development's BS 4142 Rating Levels have been logarithmically added together with the BS 4142 Rating Levels (+5 dB during the day and +1 dB during the night as explained above) presented for the operation of the Auchentiber BESS Development. Cumulative levels are presented at NALs which are common to both assessments only, as shown below:

[2] NIA Report Authored by Professional Consult Ltd, dated 14th November 2023, document reference 21.151.1.R2

[3] Page 20 and 21 of the Scottish Government Decision Notice, dated 11th September 2024

Table 7.1: Cumulative Noise Impact Assessment Results

Noise Assessment Location		TNEI High Mathernock BESS Calculated BS 4142 Rating Level, dBA		Auchentiber Road BESS Calculated BS 4142 Rating Level (+5dB Day, +1 dB Night), dBA		Cumulative BS 4142 Rating Level, dBA		TNEI Representative Background Sound Level, dBA		Margin between Cumulative BS 4142 Rating Level and TNEI Representative Background Sound Level, dB	
TNEI NAL ID	Equivalent Auchentiber Road NAL ID	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
NAL01	*N/A	15	11	-	-	-	-	35	32	-	-
NAL02	*N/A	17	13	-	-	-	-	35	32	-	-
NAL03	*N/A	20	17	-	-	-	-	35	33	-	-
NAL04	*N/A	35	30	-	-	-	-	35	33	-	-
NAL05	R5	35	30	30	31	36	34	35	33	1	1
NAL06	R4	31	25	29	29	33	30	35	33	-2	-3
NAL07	R3	29	23	31	29	33	30	33	31	0	-1
NAL08	R3	29	23	31	29	33	30	33	31	0	-1
NAL09	R2	23	19	29	23	30	24	33	30	-3	-6
NAL10	R1	23	18	25	24	27	25	33	30	-6	-5

*Noise Immission Levels were not predicted at these locations within the Auchentiber Road BESS NIA. However, it can be seen in Figure 2 and Figure 3 in Appendix D that NAL01-03 are located to the east of the Proposed Development, whereas Auchentiber Road BESS is located to the west. Given the margin between the Rating Levels due to the Proposed Development and the Background Sound Levels at NAL01-03, and their location relative to Auchentiber Road BESS, the cumulative Rating Levels would also be below the Background Sound Levels at these NALs. The cumulative Rating Levels at NAL04 are expected to be less than, or equal to, the Rating Levels at NAL05 which is slightly closer to both developments and therefore represents the worst case of these two NALs.

As can be seen above, the maximum cumulative BS 4142 Rating Level is less than or equal to the representative background sound level during day and night-time periods at all NALs, except at NAL05. During both day and night-time periods, the maximum exceedance of the representative background sound level at NAL05 is 1 dB, which remains less than the 5 dB exceedance threshold that is *'an indication of an adverse impact, depending on the context*'. Further consideration of the context

discussed in Section 6.3, and considering that Auchentiber BESS is assumed to be operating at the noise limit at this receptor (which in reality may not be the case), further supports that there is no indication of an adverse impact. As such, cumulative noise from the two schemes is not anticipated to result in adverse impacts at the nearby noise sensitive receptors.

8 Discussion and Draft Planning Condition

The assessment has considered predicted noise levels from the Proposed Development based on candidate plant and an indicative site layout. As such, the predicted noise levels presented in this report, or the noise levels at source, should not be used to specify particular noise level limits.

Rather, it is more appropriate to establish noise level limits with regards to the existing sound levels in the area (as assessed by BS 4142). This allows appropriate levels of protection to be allocated to the nearest receptors, giving comfort to residents and the Local Authority, whilst providing the developer with sufficient flexibility in finalising any design and specification elements for the Proposed Development.

Accordingly, should the Proposed Development be granted consent, TNEI propose the following planning condition wording could be used:

'The Rating Level of sound (as defined in British Standard 4142:2014+A1:2019) associated with the operation of the development, when determined externally under free-field conditions, shall not exceed the Rating Levels detailed in Table 1 below.

The Rating Level limits apply to all dwellings existing or consented at the time of this consent. Where a dwelling is not listed in Table 1, noise limits are to be selected from Table 1 by an independent acoustics consultant, by identifying the dwelling that is most likely to experience a similar background noise environment to that of the unlisted dwelling.'

Table 1: Proposed Noise Limits

Time Period	*Receptor*	*Grid ref*		*Background sound level – LA90,T dB*	*Noise Limit – Rating Level – LAr,Tr dB*
		Eastings	*Northings*		
Daytime (07:00 – 23:00)	*High Auchenleck Farm*	*233291*	*672779*	*35*	*40*
	Cunston	*233456*	*672186*	*35*	*40*
	Priestside Cottage	*233232*	*671207*	*35*	*40*
	High Mathernock Farm	*232518*	*671121*	*35*	*40*
	Loganwood House	*232466*	*671057*	*35*	*40*
	Horsecraigs	*231856*	*670638*	*35*	*40*
	Auchenfoyle Farm A	*231202*	*670948*	*33*	*38*
	Auchenfoyle Farm B	*231153*	*670992*	*33*	*38*
	Gryfe Lea	*230876*	*671338*	*33*	*38*
	Auchentiber	*231020*	*672014*	*33*	*38*

Night-time (23:00 – 07:00)	*High Auchenleck Farm*	*233291*	*672779*	*32*	*37*
	Cunston	*233456*	*672186*	*32*	*37*
	Priestside Cottage	*233232*	*671207*	*33*	*38*
	High Mathernock Farm	*232518*	*671121*	*33*	*38*
	Loganwood House	*232466*	*671057*	*33*	*38*
	Horsecraigs	*231856*	*670638*	*33*	*38*
	Auchenfoyle Farm A	*231202*	*670948*	*31*	*36*
	Auchenfoyle Farm B	*231153*	*670992*	*31*	*36*
	Gryfe Lea	*230876*	*671338*	*30*	*35*
	Auchentiber	*231020*	*672014*	*30*	*35*

9 Summary

A BS 4142 assessment has been undertaken considering the nearest residential receptors to the Proposed Development.

In order to inform the assessment, TNEI undertook a baseline sound level survey at four locations for a period of 2 weeks. The baseline survey was carried out at locations representative of all of the nearest Noise Sensitive Receptors.

A noise propagation model was produced in accordance with ISO 9613-2:2024 to calculate the likely maximum noise levels attributable the Proposed Development that may be incident upon the nearest NSRs.

Consideration of the character of the noise immission levels was used to determine a BS 4142 Rating Level, which was then compared to the measured baseline sound levels to estimate the impacts. This was then modified, as required, after consideration of the context of the Proposed Development and the local area. The BS 4142 assessment concluded that operational noise from the Proposed Development would not result in an adverse impact at any noise sensitive receptors.

A cumulative operational noise assessment was also undertaken to determine whether the Proposed Development and the nearby Auchentiber BESS, which has been granted planning consent, can operate concurrently without any adverse impacts on nearby receptors. The cumulative BS 4142 assessment concluded that operational noise from the Proposed Development and Auchentiber BESS would not result in an adverse impact at any noise sensitive receptors.

10 References

1. **International Organization for Standardization (ISO).** *Acoustics — Attenuation of sound during propagation outdoors — Part 2: Engineering method for the prediction of sound pressure levels outdoors.* Geneva : ISO, 2024. ISO 9613-2:2024.

2. **The Scottish Government.** *PAN 1/2011 Planning and Noise.* Scotland : The Crown, 2011.

3. —. *Technical Advice Note (TAN) 'Assessment of Noise'.* Scotland : The Crown, 2011.

4. **British Standards Institution (BSI).** *Methods for rating and assessing industrial and commercial sound.* London : BSI, 2019. BS 4142:2014+A1:2019.

5. **Association of Noise Consultants (ANC).** *BS 4142:2014+A1:2019 Technical Note. Version 1.0.* London : ANC, 2020.

6. **British Standards Institution (BSI).** *Guidance on sound insulation and noise reduction for buildings.* London : BSI, 2014. BS 8233:2014.

7. **International Electrotechnical Commission (IEC).** *Electroacoustics – Sound level meters – Part 1: Specifications.* Geneva : IEC, 2013. IEC 61672-1:2013.

8. **Environment Agency, Natural Resources Wales and Northern Ireland Environment Agency,.** *Method Implementation Document (MID) for BS 4142.* London : Environment Agency, 2023.

Appendix A – Proposed Development Details

- Indicative site layout drawing

High Mathernock BESS Version 2 - Proposed Site Layout

10 m 40 m 70 m

Harmony HM Ltd 2025

Appendix B – Baseline Survey Data

- Images at NM01
- Images at NM02
- Image at NM03
- Images at NM04
- BS 4142 baseline analysis charts
- Field Data Sheets (FDS)
- SLM calibration certificates

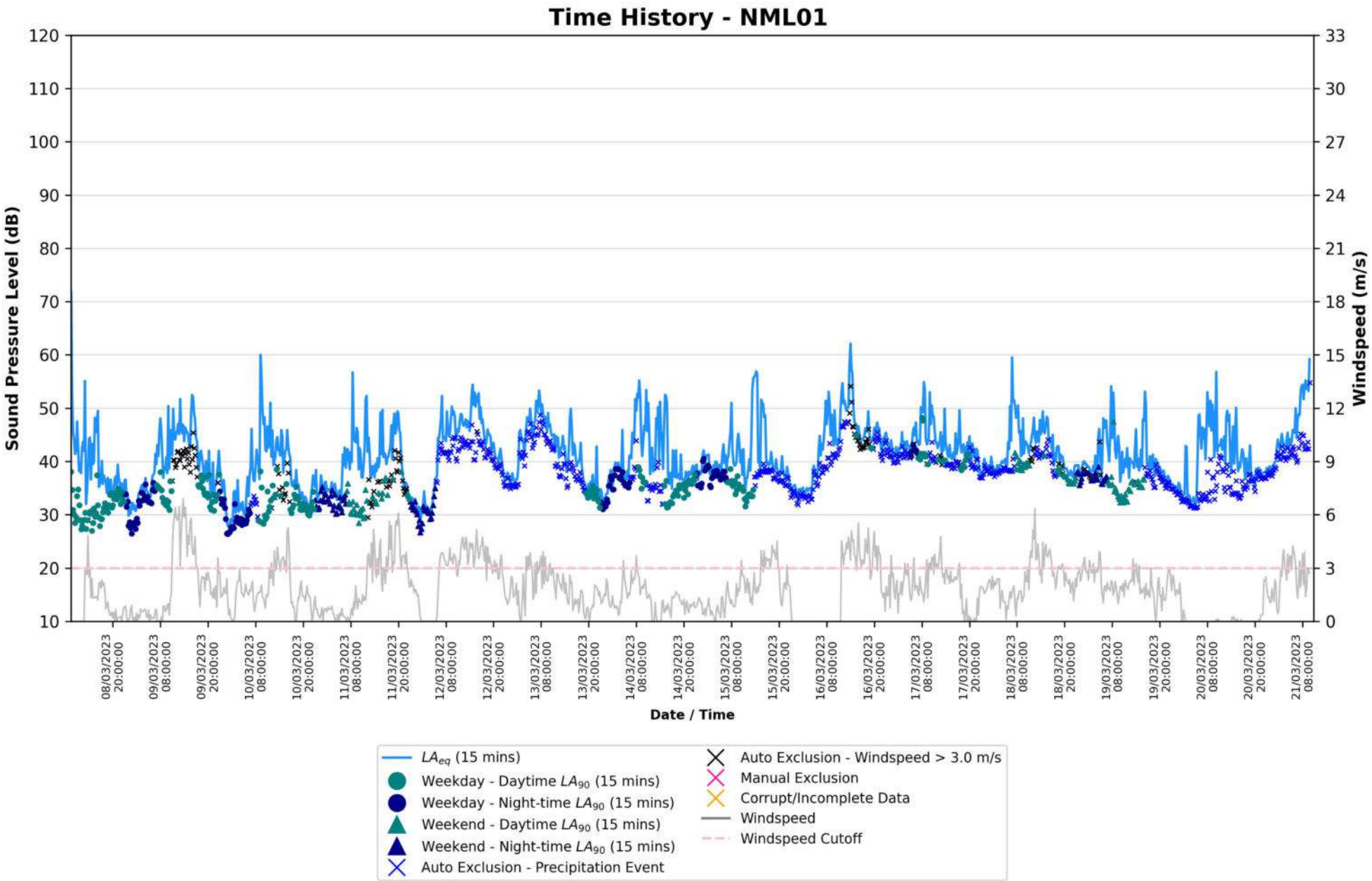
Images taken at NML01

Images taken at NML02

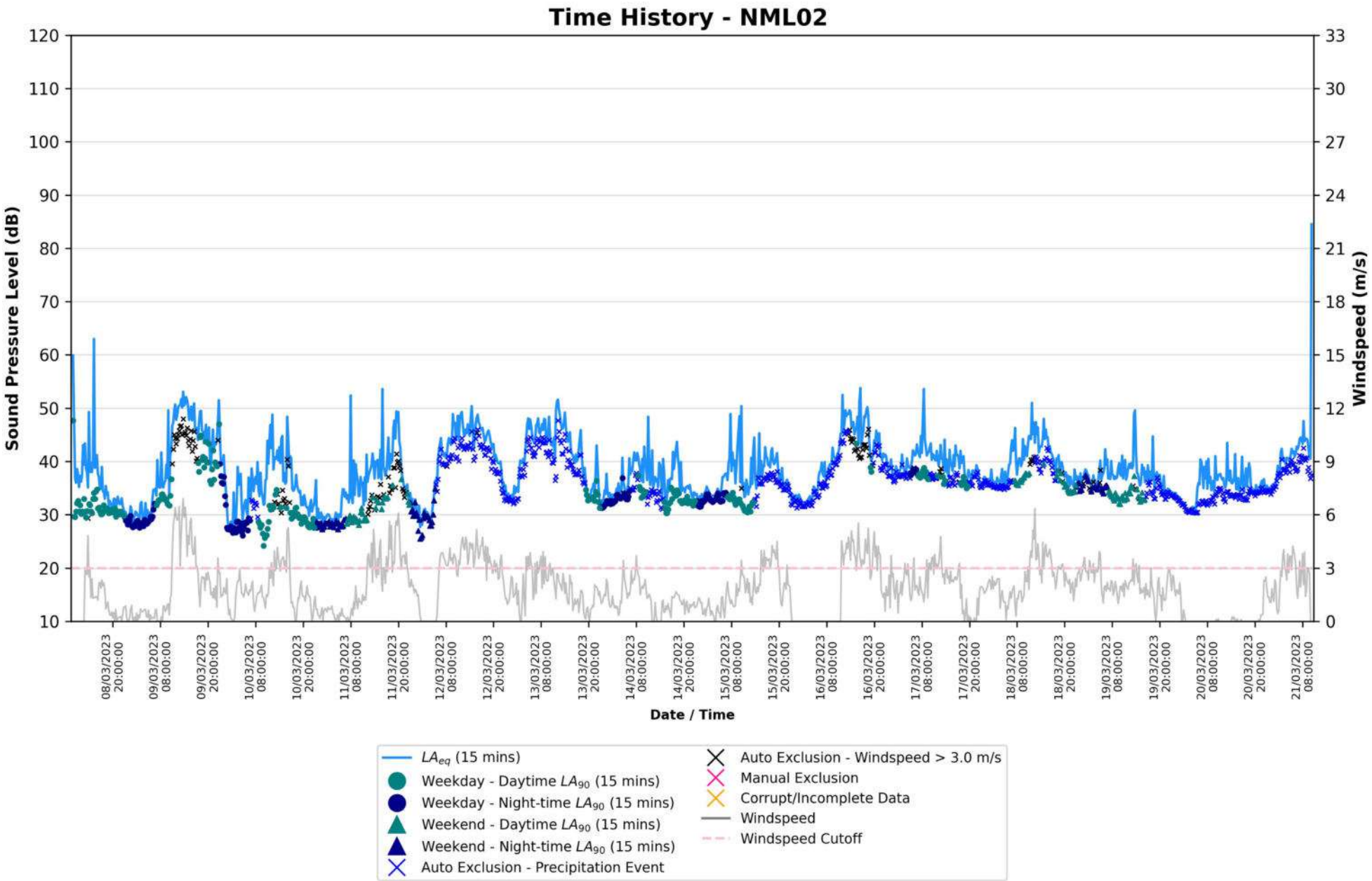
Image taken at NML03

Images taken at NML04

15768 - High Mathernock BESS - Measured Sound Levels:



15768 - High Mathernock BESS - Measured Sound Levels:



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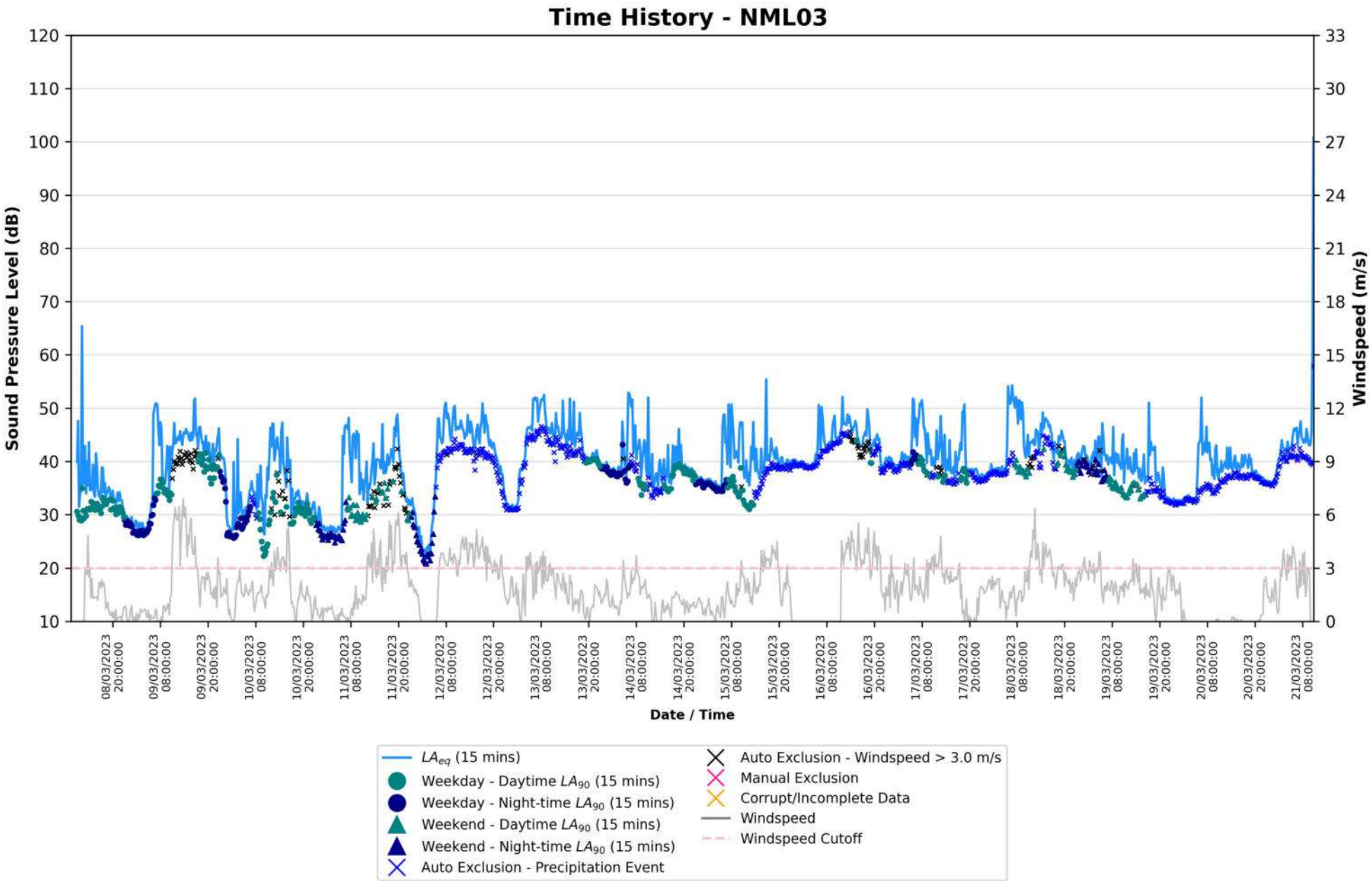

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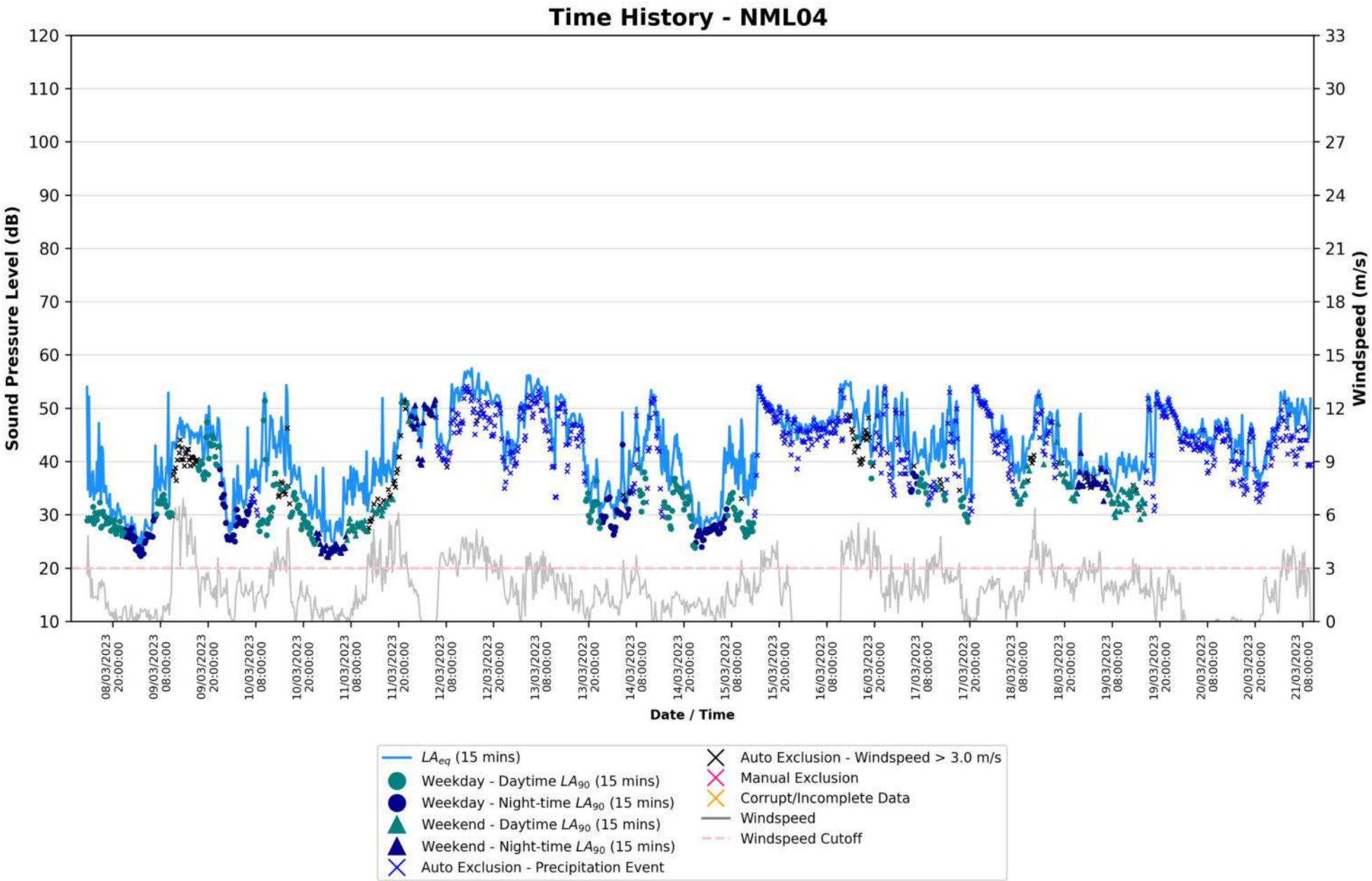

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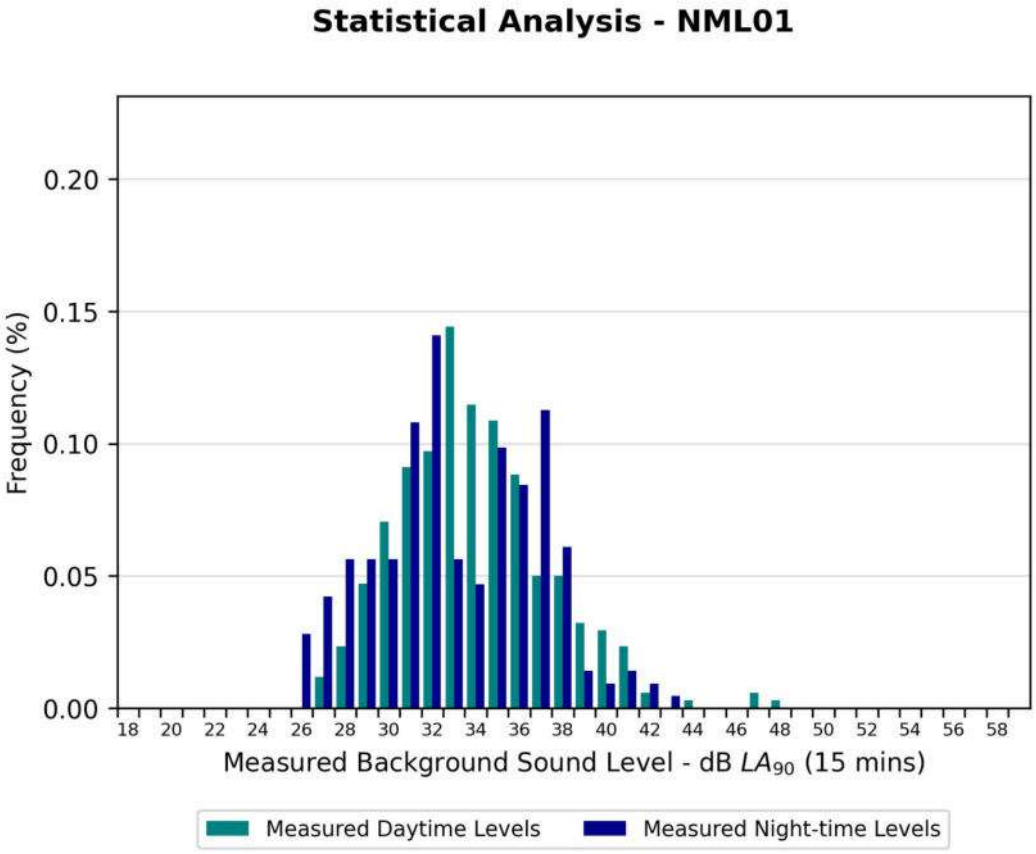

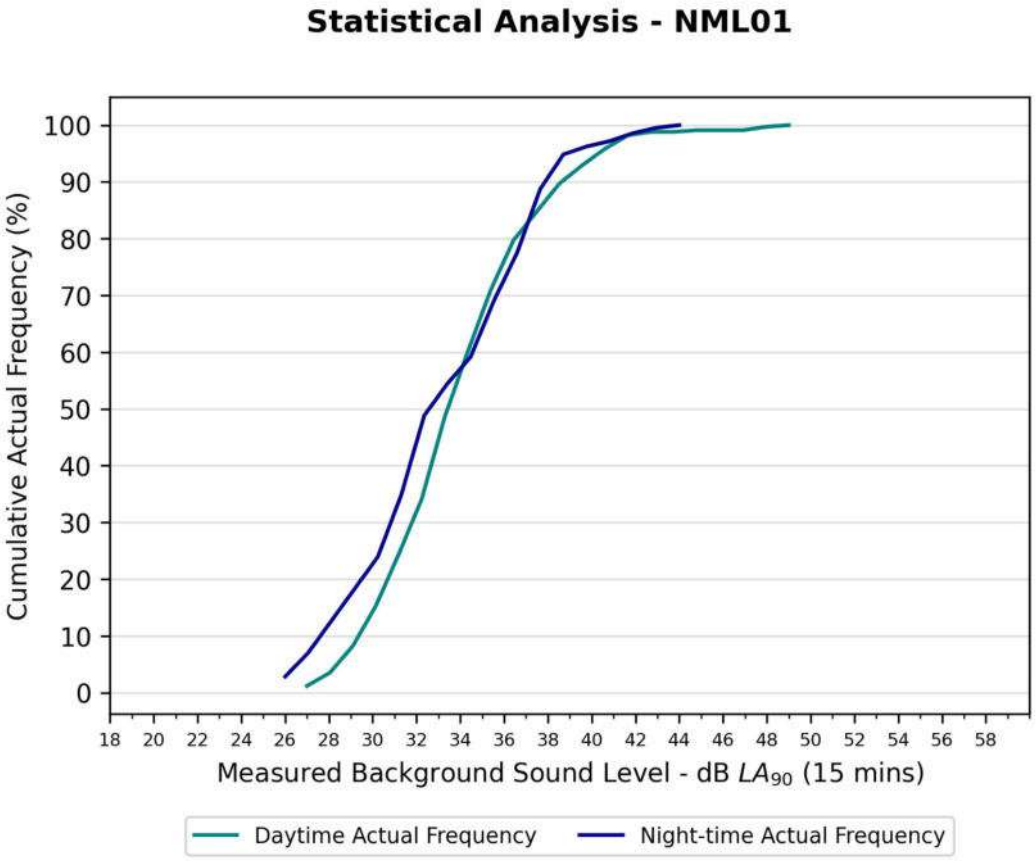

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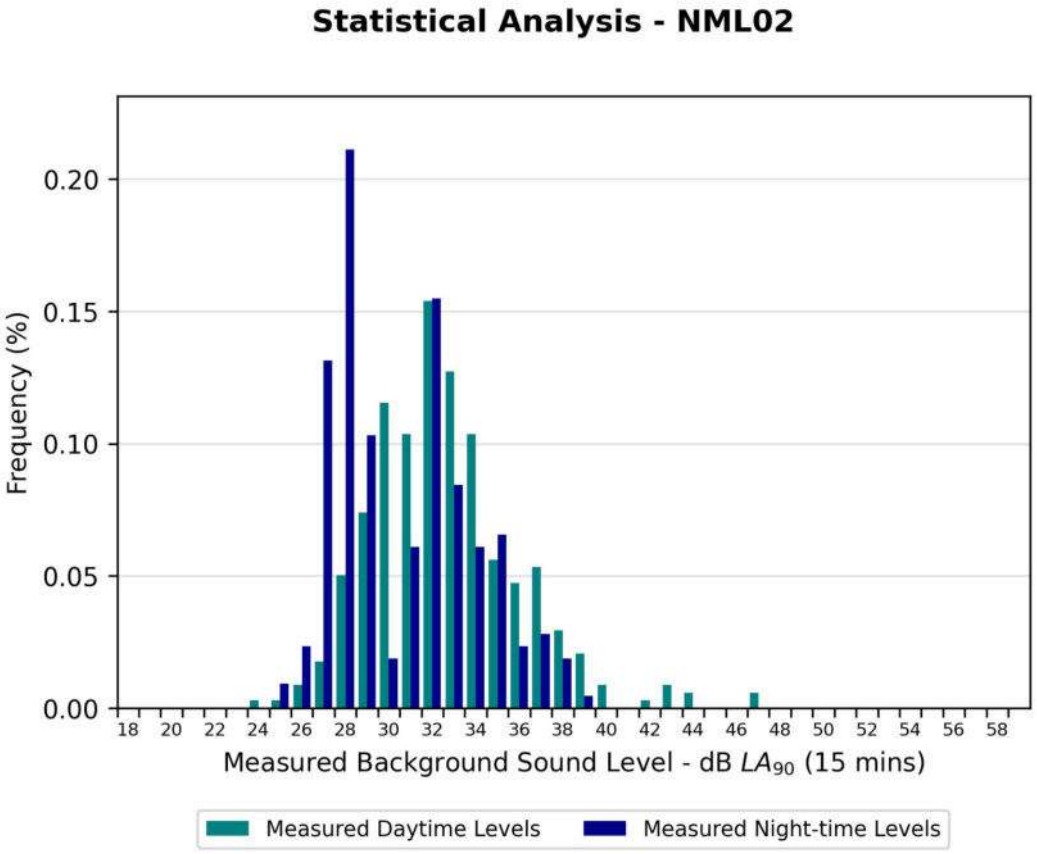

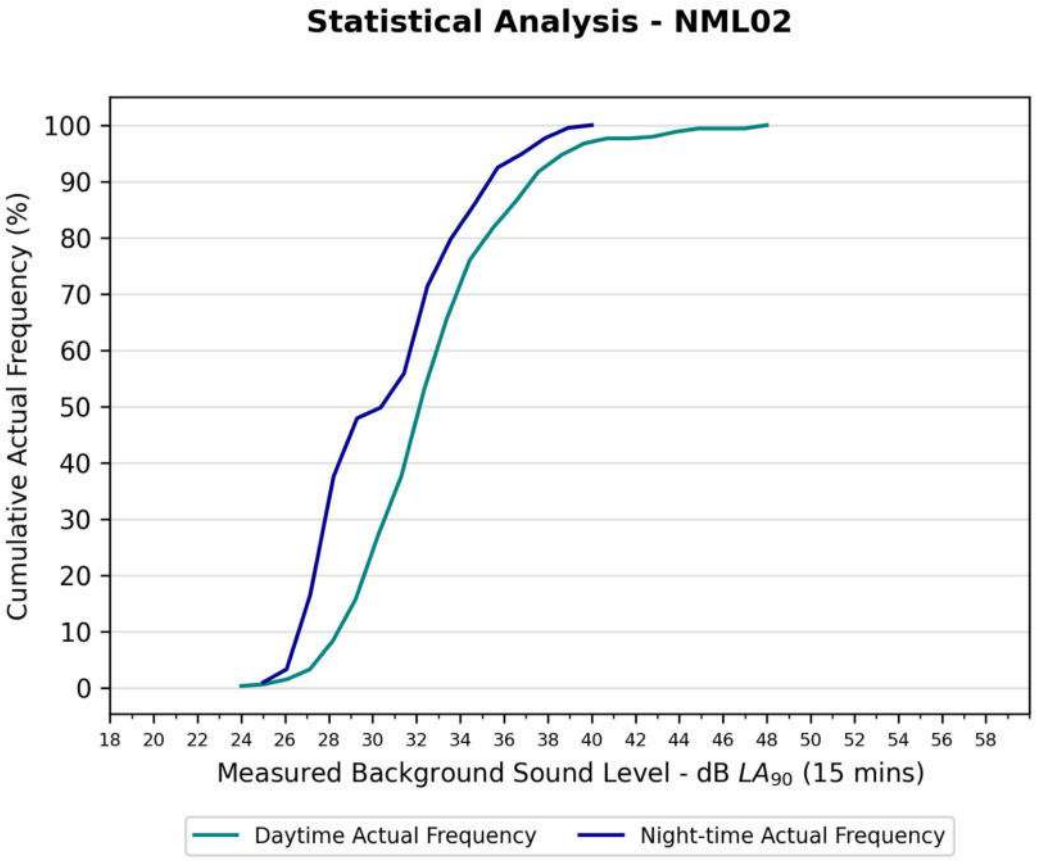

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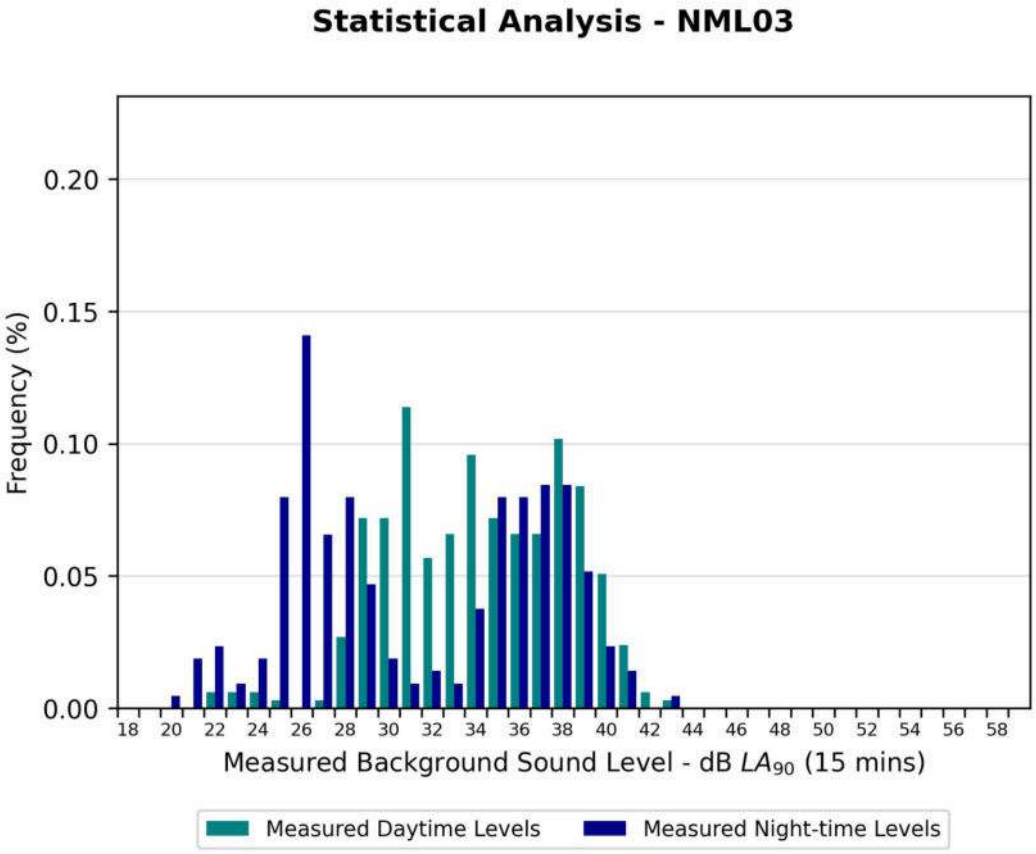

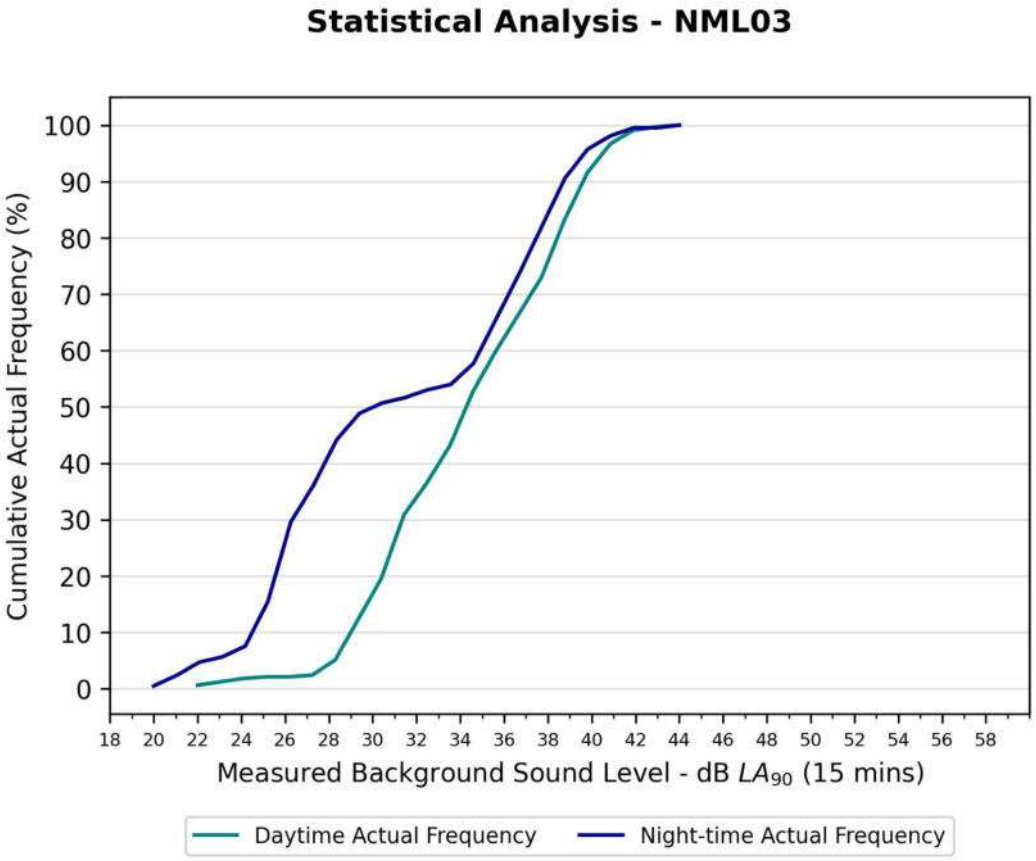

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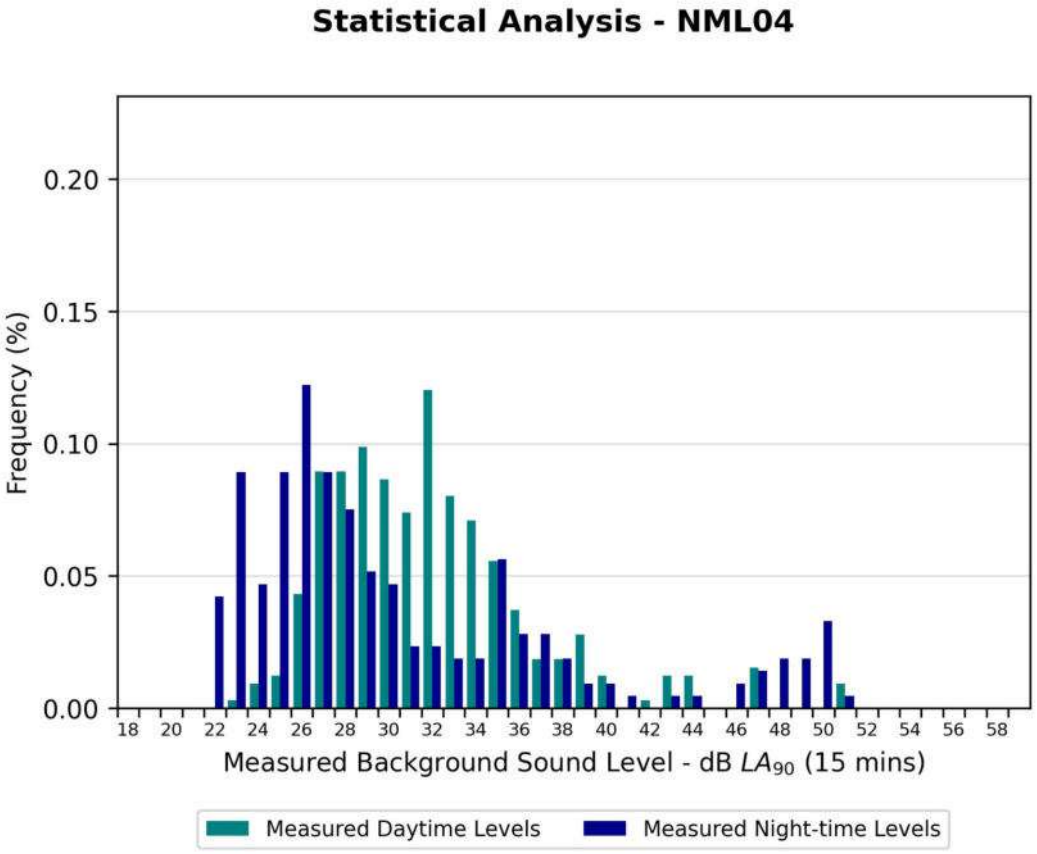

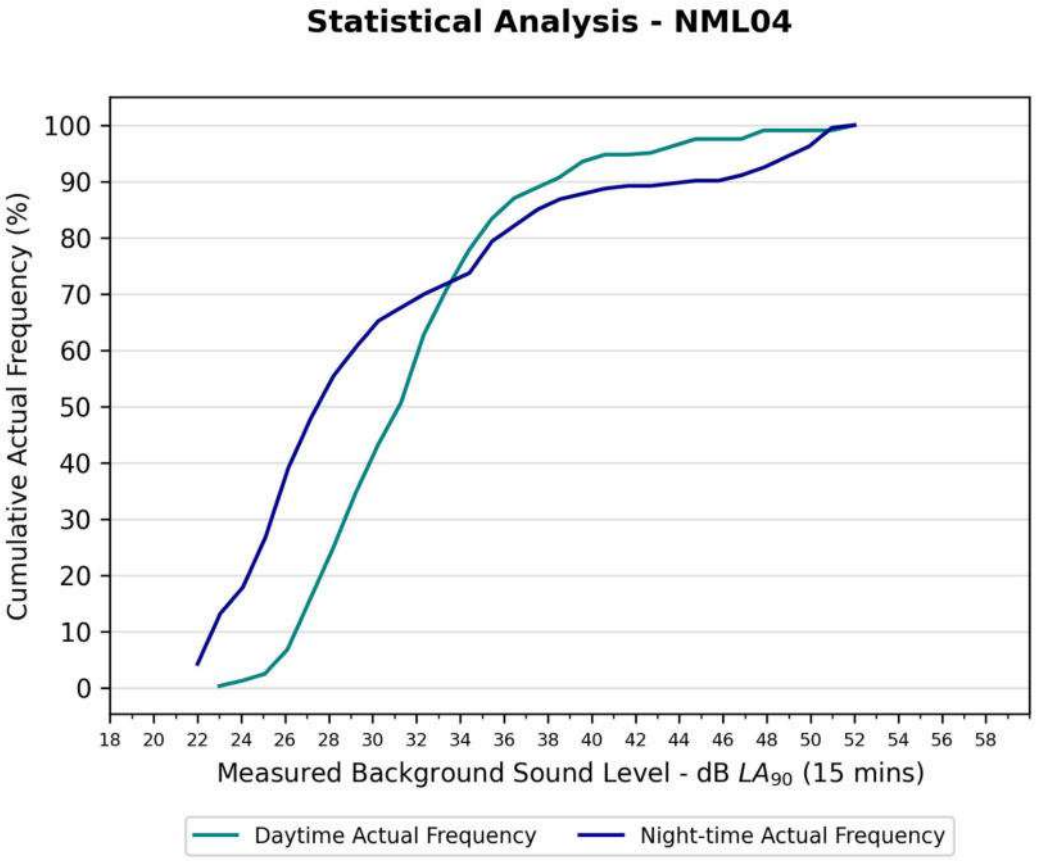

Project Nb.& Name	15768 – High Mathernock BESS
Client	Harmony HM Ltd

MONITORING LOCATION DETAILS

NML Nb. and Name	NML01
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of the nearest NSRs located to the south, southeast and east of the Proposed Development X: 232441 Y: 671073

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM58	NL-52	00721000	05/09/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/WC	0101	08/03/2023 09:45	21/03/2023 09:45	94.0	93.9	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Cars on road audible when passing, but road quite quiet - Birdsong also - Wind induced noise from vegetation dominant
	DECOMMISSIONING - Quite windy - Prominent noise from wind induced noise from vegetation - Tractors also heard

Project Nb.& Name	15768 – High Mathernock BESS
Client	Harmony HM Ltd

MONITORING LOCATION DETAILS

NML Nb. and Name	NML02
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of the nearest NSRs located to the southwest and west of the Proposed Development X: 231574 Y: 671314

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM59	NL-52	00721001	05/09/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/WC	0201	08/03/2023 10:00	21/03/2023 10:21	94.0	93.7	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Birdsong and vegetation rustle dominant - Sheep bleating - Watercourse nearby, but not audible
	DECOMMISSIONING - Quite windy - Wind induced noise dominant

Project Nb.& Name	15768 – High Mathernock BESS
Client	Harmony HM Ltd

MONITORING LOCATION DETAILS

NML Nb. and Name	NML03
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of the nearest NSRs located to the northeast of the Proposed Development X: 233226 Y: 672075

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM60	NL-52	00721002	05/09/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/WC	0301	08/03/2023 11:00	21/03/2023 10:45	94.0	94.0	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Wind and wind induced vegetation rustle dominant - Watercourse nearby, but not audible
	DECOMMISSIONING - Quite windy - Wind induced noise dominant

Project Nb.& Name	15768 – High Mathernock BESS
Client	Harmony HM Ltd

MONITORING LOCATION DETAILS

NML Nb. and Name	NML04
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of the nearest NSRs located to the west of the Proposed Development X: 231131 Y: 672026

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM61	NL-52	00721060	12/10/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/WC	0401	08/03/2023 13:30	21/03/2023 10:07	94.0	93.9	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Wind and wind induced vegetation rustle dominant - Cattle and dogs heard faintly from nearby farm
	DECOMMISSIONING - Quite windy - Wind induced noise dominant - Cattle and dogs also heard

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 21 March 2022

Certificate Number: UCRT22/1402

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	TNEI Floor 7 80 St. Vincent Street Glasgow G2 5UB
Order No.	5001
Test Procedure	Procedure TP 14 Calibration of Sound Calibrators (60942:2017)
Description	Acoustic Calibrator

Identification

Manufacturer	*Instrument*	*Model*	*Serial No.*
Rion	Calibrator	NC-75	35002724

Public evidence of Type Approval Yes Approved by PTB

The calibrator has been tested as specified in Annex B of IEC 60942:2017. As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2017.

ANV Job No.	UKAS22/03202
Date Received	18 March 2022
Date Calibrated	21 March 2022

Previous Certificate

Dated	04 February 2021
Certificate No.	UCRT21/1160
Laboratory	0653

Measurements

The sound pressure level generated by the calibrator (averaged over a 20 to 25 second period) in its WS2 configuration was measured five times (rotating the calibrator on the microphone each time) by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below.

The frequency of the sound from the calibrator was measured five times over a 20 to 25 second period and the average frequency calculated.

The total distortion + noise of the sound from the calibrator was measured, using a rejection filter distortion factor meter, five times over a 20 to 25 second period and the average distortion + noise calculated.

Test Microphone

Manufacturer	*Type*
Brüel & Kjær	4134

Nominal Setting dB / Hz	Mean Level dB rel 20 µPa	Frequency	Distortion + Noise
94 / 1000	93.97 ± 0.10	1000.00 ± 0.12Hz	(0.12 ± 0.02) %

Environmental conditions during tests	Start	End		
Temperature	23.44	23.38	± 0.30	°C
Humidity	35.6	35.8	± 3.0	%RH
Ambient Pressure	101.740	101.736	± 0.030	kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

Note: Calibrator adjusted prior to calibration? NO

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
None

Calibrated by: C. Hirlav R 1

END

SLM58

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**05 September 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF092203**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00721000
Preamplifier	Rion	NH-25	22106
Microphone	Rion	UC-59	21938

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 05 September 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖷 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

SLM[redacted]59

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**05 September 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF092202**

	Manufacturer	Type	Serial Number
Sound Level Meter	Rion	NL-52	00721001
Preamplifier	Rion	NH-25	22107
Microphone	Rion	UC-59	21939

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 05 September 2022

B. Bogdan

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SLM [redacted]60

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**05 September 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF092201**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00721002
Preamplifier	Rion	NH-25	22108
Microphone	Rion	UC-59	21941

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 05 September 2022

B. Bogdan

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MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**12 October 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF102205**

	Manufacturer	Type	Serial Number
Sound Level Meter	Rion	NL-52	00721060
Preamplifier	Rion	NH-25	22166
Microphone	Rion	UC-59	22048

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 12 October 2022

B. Bogdan

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Appendix C – Noise Modelling Data

- ABB Grid Transformer Report
- SolBank 3.0 Noise Test Report
- String PCS Noise Test Report

Sound Level

Serial No.: 1ZPL001134582

Measurement Details	
Measurement Standard	IEC 60076-10:2016
Measurement Method	Sound Intensity Method
Measurement Procedure	Walk around
Frequency Resolution	⅓ Octave Band
Acoustic Filter Function	A-weighted

Measurement Instruments	Manufacturer	Type	Serial No.
Sound Level Meter	Briel & Kjaer	2270	3023666
Sound Level Meter Calibration	Briel & Kjaer	4297	3082325

X The equipment used has been laboratory calibrated in accordance with manufacturers recommendations and field calibrated before and after each measurement session.

Test Program

Test #	No-Load condition [%]	Load condition [%]	Tap position	Number of fans	Number of pumps	Frequency [Hz]	Distance [m]	Prescribed contour [m]	Height [m]	Surface area [m²]	Surface measure [dB]	Top oil temperature [°C]	Guarantee [dB(A)]	Sound Pressure Level [dB(A)]
1	100		11	0		50	1.0	31.1	5.2	193	22.9			54.0
2	100		11	8		50	2.0	37.5	5.2	270	24.3			63.4
3		100	11	0		50	1.0	31.1	5.2	193	22.9			56.1
4		100	11	8		50	2.0	37.5	5.2	270	24.3			63.5
5														
6														
7														
8														
1+4	100	100		8			2.0						70.0	63.8

Standard: IEC 60076-10
Test Date 16/08/2021
Test Engineer Kamil Maliński

Sound Level

Serial No. : 1ZPL001134582

Measurement 1

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation	Frequency	Distance	Prescribed contour	Height	Surface area	Surface measure	Top oil temperature	Guarantee
[%]	[kV]	[%]	[A]				[Hz]	[m]	[m]	[m]	[m²]	[dB]	[°C]	[dB(A)]
100	33			11	0		50	1	31.1	5.2	192.8	22.9		

Measurement duration: 85 s

	Frequency	L_{pA0}		L_{pA0}	$L_{pA0} - L_{pA0}$	Pressure Intensity Correction	L_{pA}	L_{WA}
	[Hz]	[dB(A)]		[dB(A)]	[dB(A)]		[dB(A)]	[dB(A)]
Total Sound Level		**54.0**	**1**	**57.3**	**3.3**	**A**	**54.0**	**76.9**
Octave Band	63	15.5	1	23.3	7.8	A	16.8	39.6
	125	36.6	1	39.9	3.2	A	36.6	59.5
	250	53.3	1	56.2	2.9	A	53.3	76.1
	500	44.5	1	47.5	3.0	A	44.5	67.3
	1000	33.4	1	40.3	6.8	A	33.4	56.3
	2000	28.8	1	40.1	11.3	A	28.8	51.6
	4000	31.3	1	40.8	9.5	A	31.3	54.1
	8000	34.6	1	43.3	8.7	A	34.6	57.4
⅓ Octave Band	50	13.3	1	13.5	0.3	A	13.3	36.1
	63	14.2	1	16.0	1.8	A	14.2	37.0
	80	10.9	-1	21.8	10.9	A	0.0	0.0
	100	35.6	1	37.5	1.9	A	35.6	58.4
	125	24.6	1	34.3	9.6	A	24.6	47.5
	160	28.4	1	31.6	3.2	A	28.4	51.3
	200	40.3	1	43.4	3.1	A	40.3	63.1
	250	38.0	1	41.2	3.1	A	38.0	60.9
	315	52.9	1	55.8	2.9	A	52.9	75.8
	400	38.4	1	41.1	2.7	A	38.4	61.2
	500	40.8	1	43.9	3.1	A	40.8	63.7
	630	39.6	1	42.7	3.1	A	39.6	62.5
	800	30.9	1	36.3	5.4	A	30.9	53.7
	1000	28.6	1	35.3	6.7	A	28.6	51.4
	1250	24.3	1	34.8	10.5	A	24.3	47.1
	1600	24.1	1	35.3	11.2	A	24.1	47.0
	2000	23.8	1	35.5	11.7	A	23.8	46.7
	2500	24.1	1	35.1	11.0	A	24.1	46.9
	3150	25.6	1	35.9	10.4	A	25.6	48.4
	4000	26.7	1	36.1	9.3	A	26.7	49.6
	5000	27.1	1	36.1	9.0	A	27.1	49.9
	6300	28.4	1	37.5	9.2	A	28.4	51.2
	8000	30.1	1	39.1	9.1	A	30.1	52.9
	10000	30.7	1	38.9	8.1	A	30.7	53.6

Case A: Applies, if the total P-I index is $\Delta L \leq 4$ dB. Then it follows $L_{pA} = L_{pA0}$ for both the total sound level and sound levels of the individual frequency bands.

Case B: Applies, if the total P-I index is 4 dB < $\Delta L \leq 8$ dB. Then it follows $L_{pA} = L_{pA0} - 4$ dB for both the total sound level and sound levels of the individual frequency bands.

Sound Level

Serial No. : 1ZPL001134582

Measurement 2

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation	Frequency	Distance	Prescribed contour	Height	Surface area	Surface measure	Top oil temperature	Guarantee
[%]	[kV]	[%]	[A]				[Hz]	[m]	[m]	[m]	[m²]	[dB]	[°C]	[dB(A)]
100	33			11	8		50	2	37.5	5.2	270.0	24.3		

Measurement duration: 95 s

	Frequency	L_{WA0}		L_{pA0}	$L_{pA0} - L_{WA0}$	Pressure Intensity Correction	L_{pA}	L_{WA}
	[Hz]	[dB(A)]		[dB(A)]	[dB(A)]		[dB(A)]	[dB(A)]
Total Sound Level		**63.4**	**1**	**65.6**	**2.2**	**A**	**63.4**	**87.7**
Octave Band	63	33.4	1	34.1	0.7	A	33.4	57.8
	125	47.7	1	49.2	1.5	A	47.7	72.0
	250	58.5	1	60.3	1.9	A	58.5	82.8
	500	58.5	1	60.7	2.2	A	58.5	82.8
	1000	57.2	1	59.6	2.4	A	57.2	81.5
	2000	50.6	1	53.3	2.6	A	50.6	74.9
	4000	46.7	1	49.8	3.0	A	46.7	71.0
	8000	41.6	1	46.1	4.6	A	41.6	65.9
⅓ Octave Band	50	26.8	1	27.3	0.5	A	26.8	51.1
	63	24.0	1	23.6	-0.4	A	24.0	48.3
	80	31.7	1	32.6	0.9	A	31.7	56.0
	100	39.9	1	41.4	1.5	A	39.9	64.2
	125	43.6	1	45.0	1.4	A	43.6	67.9
	160	44.2	1	45.7	1.5	A	44.2	68.5
	200	49.2	1	50.9	1.7	A	49.2	73.5
	250	52.1	1	53.7	1.6	A	52.1	76.4
	315	56.6	1	58.6	2.0	A	56.6	80.9
	400	52.8	1	55.1	2.2	A	52.8	77.2
	500	52.8	1	55.1	2.3	A	52.8	77.1
	630	55.1	1	57.2	2.2	A	55.1	79.4
	800	54.1	1	56.5	2.4	A	54.1	78.4
	1000	52.1	1	54.5	2.3	A	52.1	76.5
	1250	50.0	1	52.5	2.6	A	50.0	74.3
	1600	47.7	1	50.3	2.6	A	47.7	72.0
	2000	45.3	1	48.0	2.7	A	45.3	69.6
	2500	43.6	1	46.3	2.7	A	43.6	67.9
	3150	42.7	1	45.6	2.9	A	42.7	67.0
	4000	42.3	1	45.4	3.1	A	42.3	66.6
	5000	40.6	1	43.7	3.1	A	40.6	64.9
	6300	37.9	1	41.9	4.0	A	37.9	62.2
	8000	36.3	1	41.1	4.8	A	36.3	60.6
	10000	35.9	1	41.0	5.1	A	35.9	60.3

Case A: Applies, if the total P-I index is $\Delta L \leq 4$ dB. Then it follows $L_{pA} = L_{pA0}$ for both the total sound level and sound levels of the individual frequency bands.

Case B: Applies, if the total P-I index is 4 dB $< \Delta L \leq 8$ dB. Then it follows $L_{pA} = L_{pA0} - 4$ dB for both the total sound level and sound levels of the individual frequency bands.

Sound Level

Serial No. : 1ZPL001134582

Measurement 3

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation	Frequency	Distance	Prescribed contour	Height	Surface area	Surface measure	Top oil temperature	Guarantee
[%]	[kV]	[%]	[A]				[Hz]	[m]	[m]	[m]	[m²]	[dB]	[°C]	[dB(A)]
		100	262.43	11	0		50	1	31.1	5.2	192.8	22.9		

Measurement duration: 85 s

	Frequency	L_{WA0}		L_{pA0}	$L_{pA0} - L_{WA0}$	Pressure Intensity Correction	L_{pA}	L_{WA}
	[Hz]	[dB(A)]		[dB(A)]	[dB(A)]		[dB(A)]	[dB(A)]
Total Sound Level		**56.1**	**1**	**58.1**	**2.1**	**A**	**56.1**	**78.9**
Octave Band	63	40.3	1	46.7	6.4	A	40.3	63.2
	125	55.0	1	56.5	1.5	A	55.0	77.9
	250	47.0	1	49.4	2.4	A	47.0	69.9
	500	39.9	1	43.3	3.4	A	39.9	62.7
	1000	37.9	1	42.2	4.3	A	37.9	60.7
	2000	39.0	1	43.1	4.1	A	39.0	61.9
	4000	28.6	1	38.2	9.6	A	28.6	51.4
	8000	18.4	1	31.5	13.1	A	18.6	41.4
⅓ Octave Band	50	40.2	1	46.5	6.4	A	40.2	63.0
	63	24.6	1	30.1	5.6	A	24.6	47.4
	80	21.0	1	29.3	8.3	A	21.0	43.9
	100	49.0	1	51.8	2.8	A	49.0	71.8
	125	38.9	1	41.0	2.1	A	38.9	61.7
	160	53.7	1	54.6	0.9	A	53.7	76.5
	200	42.2	1	44.7	2.5	A	42.2	65.1
	250	39.7	1	42.0	2.3	A	39.7	62.5
	315	43.9	1	46.2	2.3	A	43.9	66.7
	400	37.4	1	40.5	3.1	A	37.4	60.3
	500	33.8	1	37.6	3.8	A	33.8	56.7
	630	32.4	1	36.3	3.8	A	32.4	55.3
	800	31.9	1	35.3	3.4	A	31.9	54.8
	1000	32.2	1	37.2	5.0	A	32.2	55.0
	1250	34.7	1	38.9	4.3	A	34.7	57.5
	1600	37.3	1	40.7	3.3	A	37.3	60.2
	2000	31.3	1	37.0	5.7	A	31.3	54.1
	2500	30.8	1	36.0	5.2	A	30.8	53.6
	3150	25.5	1	34.7	9.1	A	25.5	48.4
	4000	24.1	1	33.6	9.5	A	24.1	46.9
	5000	20.2	1	31.3	11.1	A	20.2	43.0
	6300	17.3	1	28.7	11.4	A	17.3	40.2
	8000	12.5	1	26.4	13.9	A	12.5	35.3
	10000	2.9	-1	23.9	21.0	A	0.0	0.0

Case A: Applies, if the total P-I index is $\Delta L \leq 4$ dB. Then it follows $L_{pA} = L_{pA0}$ for both the total sound level and sound levels of the individual frequency bands.

Case B: Applies, if the total P-I index is 4 dB < $\Delta L \leq 8$ dB. Then it follows $L_{pA} = L_{pA0}$ - 4 dB for both the total sound level and sound levels of the individual frequency bands.

Sound Level

Serial No. : 1ZPL001134582

Measurement 4

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation	Frequency	Distance	Prescribed contour	Height	Surface area	Surface measure	Top oil temperature	Guarantee
[%]	[kV]	[%]	[A]				[Hz]	[m]	[m]	[m]	[m²]	[dB]	[°C]	[dB(A)]
		100	262.43	11	8		50	2	37.5	5.2	270.0	24.3		

Measurement duration: 89 s

	Frequency	L_{uA0}		L_{pA0}	$L_{pA0} - L_{uA0}$	Pressure Intensity Correction	L_{uA}	L_{WA}
	[Hz]	[dB(A)]		[dB(A)]	[dB(A)]		[dB(A)]	[dB(A)]
Total Sound Level		**63.5**	**1**	**65.5**	**2.0**	**A**	**63.5**	**87.8**
Octave Band	63	40.1	1	43.3	3.2	A	40.1	64.4
	125	55.3	1	56.9	1.6	A	55.3	79.6
	250	56.9	1	58.6	1.7	A	56.9	81.2
	500	58.3	1	60.4	2.1	A	58.3	82.6
	1000	57.4	1	59.6	2.2	A	57.4	81.7
	2000	51.1	1	53.5	2.4	A	51.1	75.4
	4000	47.0	1	49.3	2.3	A	47.0	71.3
	8000	39.9	1	41.6	1.8	A	39.9	64.2
⅓ Octave Band	50	39.4	1	42.7	3.3	A	39.4	63.8
	63	23.1	1	28.0	4.9	A	23.1	47.4
	80	30.8	1	33.5	2.6	A	30.8	55.1
	100	47.6	1	50.6	2.9	A	47.6	71.9
	125	44.2	1	45.9	1.7	A	44.2	68.5
	160	54.1	1	55.3	1.2	A	54.1	78.4
	200	49.4	1	50.9	1.6	A	49.4	73.7
	250	52.1	1	53.6	1.6	A	52.1	76.4
	315	53.7	1	55.6	1.9	A	53.7	78.0
	400	52.7	1	54.8	2.1	A	52.7	77.0
	500	52.6	1	54.7	2.1	A	52.6	76.9
	630	54.9	1	56.9	2.1	A	54.9	79.2
	800	54.3	1	56.6	2.3	A	54.3	78.6
	1000	52.3	1	54.4	2.1	A	52.3	76.7
	1250	50.2	1	52.6	2.4	A	50.2	74.5
	1600	48.0	1	50.5	2.5	A	48.0	72.4
	2000	45.9	1	48.2	2.3	A	45.9	70.2
	2500	44.2	1	46.3	2.1	A	44.2	68.5
	3150	43.2	1	45.5	2.3	A	43.2	67.5
	4000	42.6	1	45.0	2.4	A	42.6	66.9
	5000	40.5	1	42.6	2.1	A	40.5	64.8
	6300	37.2	1	39.4	2.1	A	37.2	61.5
	8000	34.5	1	35.9	1.4	A	34.5	58.8
	10000	32.1	1	33.0	0.9	A	32.1	56.4

Case A: Applies, if the total P-I index is $\Delta L \leq 4$ dB. Then it follows $L_{uA} = L_{uA0}$ for both the total sound level and sound levels of the individual frequency bands.

Case B: Applies, if the total P-I index is 4 dB $< \Delta L \leq 8$ dB. Then it follows $L_{uA} = L_{uA0}$ - 4 dB for both the total sound level and sound levels of the individual frequency bands.

Sound Level

Serial No. : 1ZPL001134582

Combination of sound level measurements

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation
[%]	[kV]	[%]	[A]			
100	33	100	262.43		8	

Frequency	Measurement 1 Sound Power Level	Measurement 4 Sound Power Level		Combined Sound Power Level
[Hz]	[dB(A)]	[dB(A)]		[dB(A)]
Total Sound Level	76.9	87.8		**88.2**
63	39.6	64.4		**64.4**
125	59.5	79.6		**79.6**
250	76.1	81.2		**82.3**
500	67.3	82.6		**82.7**
1000	56.3	81.7		**81.7**
2000	51.6	75.4		**75.4**
4000	54.1	71.3		**71.4**
8000	57.4	64.2		**65.0**
50	36.1	63.8		**63.8**
63	37.0	47.4		**47.8**
80	0.0	55.1		**55.1**
100	58.4	71.9		**72.1**
125	47.5	68.5		**68.6**
160	51.3	78.4		**78.4**
200	63.1	73.7		**74.1**
250	60.9	76.4		**76.5**
315	75.8	78.0		**80.1**
400	61.2	77.0		**77.1**
500	63.7	76.9		**77.1**
630	62.5	79.2		**79.3**
800	53.7	78.6		**78.6**
1000	51.4	76.7		**76.7**
1250	47.1	74.5		**74.5**
1600	47.0	72.4		**72.4**
2000	46.7	70.2		**70.2**
2500	46.9	68.5		**68.5**
3150	48.4	67.5		**67.6**
4000	49.6	66.9		**67.0**
5000	49.9	64.8		**64.9**
6300	51.2	61.5		**61.9**
8000	52.9	58.8		**59.8**
10000	53.6	56.4		**58.2**

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation
[%]	[kV]	[%]	[A]			

Frequency				Combined Sound Power Level
[Hz]				[dB(A)]
Total Sound Level				
63				
125				
250				
500				
1000				
2000				
4000				
8000				
50				
63				
80				
100				
125				
160				
200				
250				
315				
400				
500				
630				
800				
1000				
1250				
1600				
2000				
2500				
3150				
4000				
5000				
6300				
8000				
10000				

Noise Measurement Test Report

CSI-SolBank-S-5016-2h

2024.11.1

Version	Date	Content Revision	Drafted/Revised by	Reviewed by	Approved by
A	2024.4.18	Initial	Zhangcheng.Cao		
B	2024.10.22	Update the chiller parameter vs. battery output power	Zhangcheng.Cao		
C	2024.11.1	Update the chiller parameter vs. battery output power	Zhangcheng.Cao		

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Noise Measurement Test Report

String PCS System Model：MVSkid – 5160 - UK

2024.12.4

Version	Date	Content Revision	Drafted/Revised by	Reviewed by	Approved by
1.0	2024.12.4	Initial	Zhangcheng Cao，Guojun Zhang	Joe Zhang	

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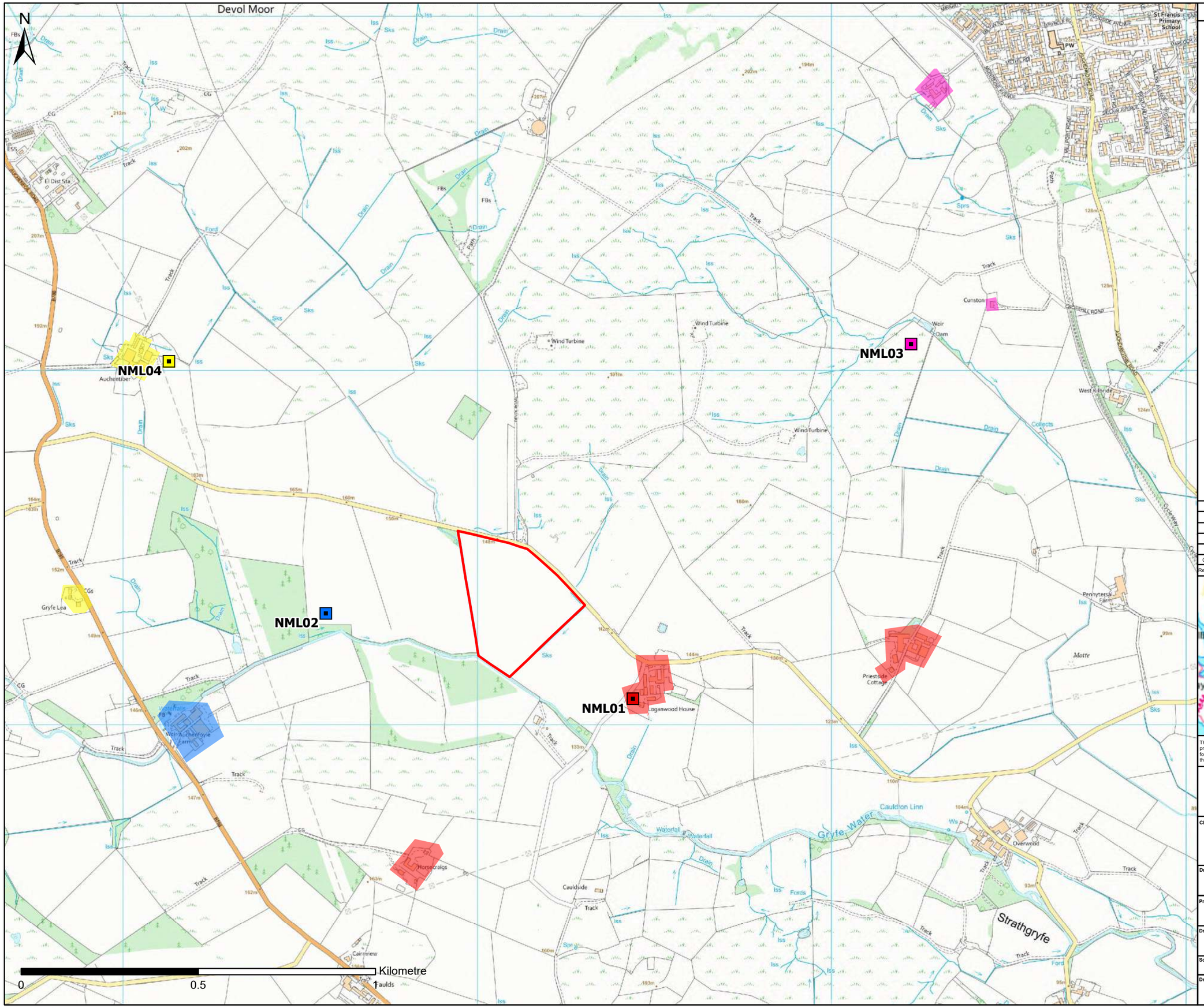
Appendix D – Figures

- Figure 1: Noise Study Area
- Figure 2: Daytime Noise Contour Plot
- Figure 3: Night-time Noise Contour Plot



LEGEND

- Red Line Boundary

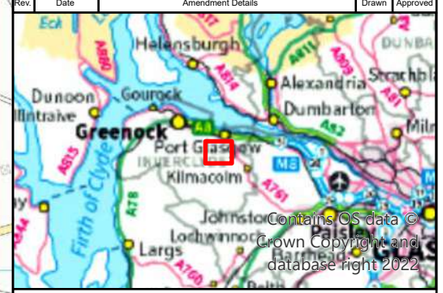
Noise Monitoring Locations (NMLs)

- NML01
- NML02
- NML03
- NML04

Noise Sensitive Receptors (NSRs)

- NSRs Represented by NML01
- NSRs Represented by NML02
- NSRs Represented by NML03
- NSRs Represented by NML04

Rev.	Date	Amendment Details	Drawn	Approved
0	23/10/2025	FIRST ISSUE	TS	AB



tnei

Client

HARMONY HM LTD

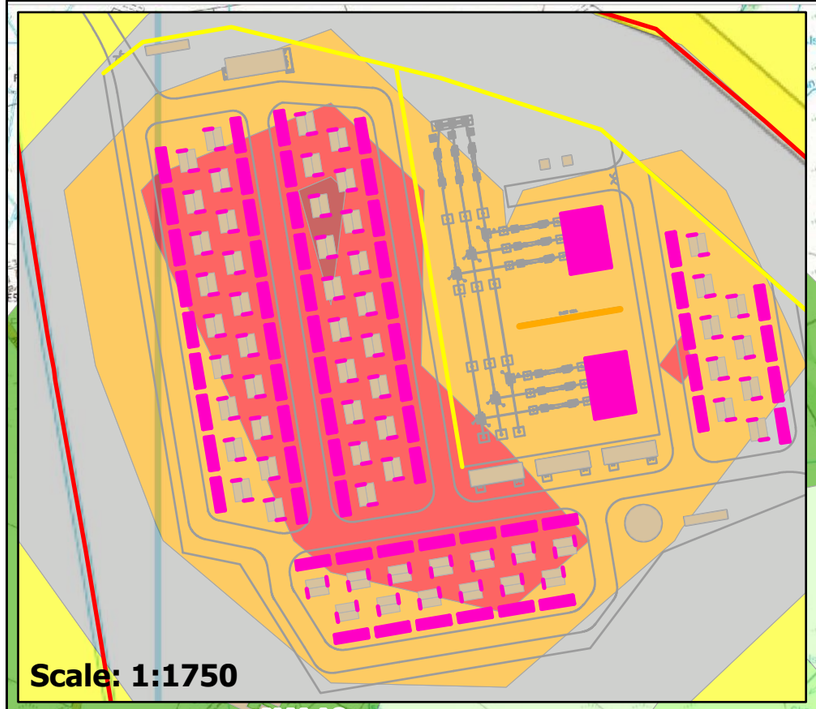
Drawing Status: FOR PLANNING

Project Title: HIGH MATHERNOCK BESS

Drawing Title: FIGURE 1: NOISE STUDY AREA

Scale:	Original Size:	Spatial Reference:
1:10,000	A3	British National Grid

Drawing Number: 17663-002



NAL01
NAL02
NAL03
NAL04
NAL05
NAL06
NAL07
NAL08
NAL09
NAL10

20
25
30
35
40
45
50

Kilometre
0
0.5
1

LEGEND

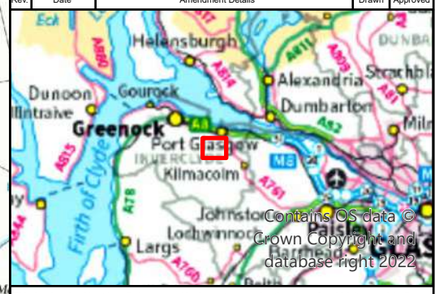
- Red Line Boundary
- Noise Assessment Locations (NALs)
- Modelled Noise Sources
- Acoustic Barrier
- Blast Wall
- Modelled Buildings
- Site Layout

Predicted Noise Levels (dBA)

20 - 25	50 - 55
25 - 30	55 - 60
30 - 35	60 - 65
35 - 40	65 - 70
40 - 45	
45 - 50	

Noise contours modelled in accordance with ISO 9613 Part 2:2024 at a height of 4 m and displayed on a 50 m by 50 m grid.
All noise sources assumed to be operating concurrently.
All levels shown as dB LAeq(t)

Rev.	Date	Amendment Details	Drawn	Approved
0	23/10/2025	FIRST ISSUE	TS	AB



tnei

Client
HARMONY HM LTD

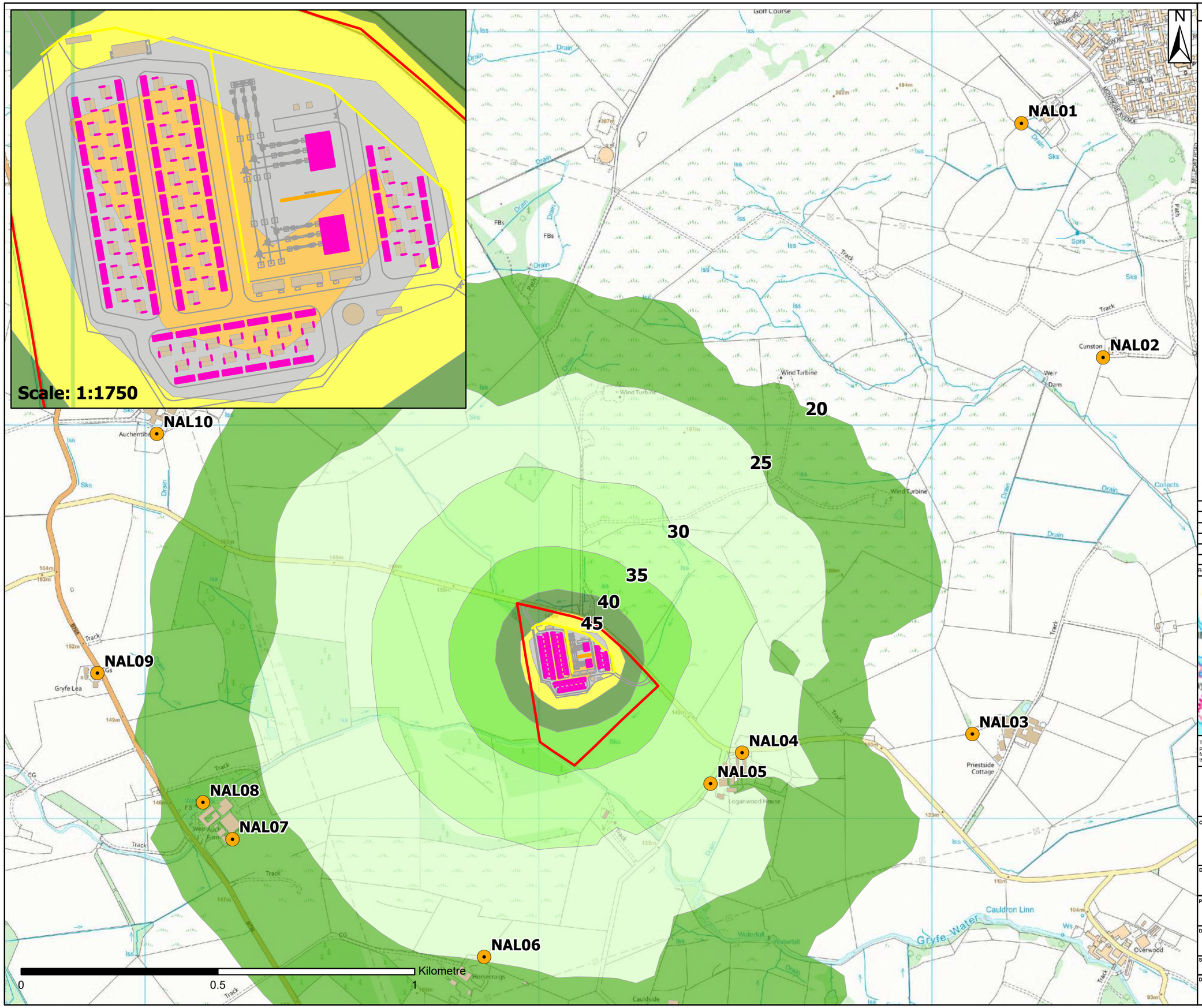
Drawing Status:
FOR PLANNING

Project Title:
HIGH MATHERNOCK BESS

Drawing Title:
FIGURE 2: DAYTIME NOISE CONTOUR PLOT

Scale:	Original Size:	Spatial Reference:
1:9,000	A3	British National Grid

Drawing Number:
17663-003



LEGEND

- Red Line Boundary
- Noise Assessment Locations (NALs)
- Modelled Noise Sources
- Acoustic Barrier
- Blast Wall
- Modelled Buildings
- Site Layout

Predicted Noise Levels (dBA)

20 - 25	40 - 45
25 - 30	45 - 50
30 - 35	50 - 55
35 - 40	55 - 60

Noise contours modelled in accordance with ISO 9613 Part 2:2024 at a height of 4 m and displayed on a 50 m by 50 m grid.
All noise sources assumed to be operating concurrently.
All levels shown as dB LAeq(t)

Rev.	Date	Amendment Details	Drawn	Approved
0	23/10/2025	FIRST ISSUE	TS	AB

tnei

Client
HARMONY HM LTD

Drawing Status:
FOR PLANNING

Project Title:
HIGH MATHERNOCK BESS

Drawing Title:
FIGURE 3: NIGHT-TIME NOISE CONTOUR PLOT

Scale:	Original Size:	Spatial Reference:
1:9,000	A3	British National Grid

Drawing Number:
17663-004