Shaneragh Battery Energy Storage System

Acoustic Assessment

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Contents

Revision History

Issue	Date	Name	Latest changes	File References
01	28/10/2024	Lucy Connor	First Created	05577-8604988 05577-7995128

1 Introduction

This report provides an assessment of the acoustic impact of the proposed Shaneragh Battery Energy Storage System (the 'Proposed Development'), in terms of operational impacts. One Associate and two Members of the Institute of Acoustics have been involved in its production. Details of their experience and qualifications can be found in **Appendix A**.

An assessment of the sound generated by the site has been undertaken in accordance with BS 4142:2014 + A1:2019 'BS 4142 Methods for Rating and Assessing Industrial & Commercial Sound' [1]. The assessment has been put into further context in terms of guidance published by the World Health Organisation 'Guidelines for Community Noise' [2] and BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' [3].

2 Planning Policy, Guidance & Standards

2.1 Noise Policy Statement for Northern Ireland (NPSNI)

The Noise Policy Statement for Northern Ireland (NPSNI) [4] sets out the long-term vision of Government noise policy which is to: '1. Avoid or mitigate significant adverse impacts on health and quality of life; 2. Mitigate and minimise adverse impacts on heath and quality of life; and 3. Where possible, contribute to the improvement of health and quality of life.'. In order to weigh noise impacts against the economic and social benefits of the activity under consideration, the NPSNI defines three categories of effect levels:

- No Observed Effect Level (NOEL) - noise levels below this have no detectable effect on health and quality of life.
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and,
- Significant Observed Adverse Effect Level (SOAEL) - the level above which effects on health and quality of life become significant.

2.2 Strategic Planning Policy Statement for Northern Ireland (SPPS)

The SPPS for Northern Ireland [5] provides current policy regarding planning matters, referencing the NPSNI discussed above for further information. The document references noise throughout in respect of development that could generate noise and the positioning of new residential development near to existing noise generating facilities. Specific guidance is provided within Annex A of the document where it is stated that planning authorities '… should seek to reach balanced decisions that consider noise issues alongside other relevant material considerations, including the wider benefits of the particular proposal'.

2.3 Fermanagh and Omagh Local Development Plan 2030 – Plan Strategy

In March 2023, Fermanagh and Omagh District Council introduced the Local Development Plan 2030: Plan Strategy [6]. This planning strategy provides a 'plan-led policy framework for making day-to-day decisions to help the Council deliver sustainable development'. It states throughout the need for demonstrating that there will be no unacceptable adverse impact on residential properties with regards to noise. Whilst this strategy does not give any specific guidance for assessing potential acoustic impact of a battery storage site, it references the SPPS which discusses the use of the NPSNI for assessing similar such projects.

2.4 BS 4142 Methods for Rating and Assessing Industrial & Commercial Sound

BS 4142:2014+A1:2019 describes methods for rating and assessing sound of an industrial or commercial nature. Outdoor sound levels are used to assess the likely effects on people who might be inside or outside a residential property via the comparison of the pre-existing background sound levels with the predicted/modelled sound associated with the introduction of a particular development, known as the 'rating' level, which also accounts for any distinguishing characteristics of the emitted sound.

To determine a value for the background sound level at a specific assessment point, a series of measurements are made at a location at, or representative of, a dwelling or receptor of interest. The standard requires that the background sound measurements (dB $L_{A90,\,T}$ - the sound level exceeded for 90% of the time, or the lowest 10 % of sound, for the reference time period, T) should be measured during times when the sound source in question could or will be operating and that the individual measurement intervals should not normally be less than 15-minutes in length. The objective is then to determine a justifiable representative background sound level for time periods of interest via statistical analysis and/or observations of the data set collected. The standard states that the representative background sound level '… should not automatically be assumed to be either the minimum or modal value'.

The 'rating' level is defined as the 'specific' sound level (dB L_{Aeq} - the equivalent continuous sound level) plus any corrections for the presence tones (i.e., whines, whistles, or hums), impulsive character (i.e., banging, crashing, or tapping), intermittency, or other sound characteristics (distinctiveness against the residual acoustic environment) in the sound generated by the source in question. In instances where the sound is unlikely to have a specific character at the assessment location then the rating level can be assumed to equal to the 'specific' sound level. Where corrections are required, a number of decibels are added to the specific sound level to determine the rating level.

The defined representative background sound level(s) and rating level(s) are then compared to determine the possible impact whilst also considering the context in which the industrial or commercial sound source occurs in relation to other sound sources and the existing character of the area. **Table 1** provides a summary of expected impacts when comparing background sound levels and rating levels. These criteria relate well with the categories defined by the NPSNI.

Table 1 - BS 4142 Assessment Criteria

Rating Level	BS 4142 Assessment
Below background	Indicates low impact, depending on the context
<5 dB above background	Indicates minor impact, depending on the context
≥5 dB above background	Indicates adverse impact, depending on the context
≥10 dB above background	Indicates significant adverse impact, depending on the context

Further to the above, it may not be appropriate or proportionate to undertake a full assessment in accordance with the BS 4142 standard, particularly when the sound level associated with the new source is particularly low at neighbouring receptors and/or is expected to be much lower than the existing background sound levels. The previous version of BS 4142 [7] stated that this version of the standard is not appropriate for use in instances where background and rating sound levels are very low and that '… background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low'.

2.5 World Health Organisation Guidelines for Community Noise

The World Health Organisation (WHO) Guidelines for Community Noise recommend sound levels intended to minimise health impacts. In practice the guidelines specify absolute limits for sound levels in specific environments. The guidance informs many standards and general guidance relating to the protection of external and internal amenity in relation to the impacts of sound.

The guidelines state that overall internal night-time sound levels should not be above 30 dB L_{Aeq} within bedrooms such that people may sleep with minimal disturbance while the windows are open and it is stated that this corresponds to an external night-time noise level of 45 dB L_{Aeq}, when assuming a 15 dB attenuation in noise levels externally to internally. Furthermore, the guidance recommends that daytime external noise levels should not exceed 50 dB L_{Aeq} to protect the majority of people from being moderately annoyed and that levels '…during the evening and night should be 5–10 dB lower than during the day'.

2.6 BS 8233 Guidance on Sound Insulation and Noise Reduction for Buildings

British Standard BS 8233:2014 provides information on the design of buildings to ensure they have internal acoustic environments appropriate to their functions. The standard specifies guideline indoor ambient sound levels for buildings for different activities, locations and times of day and states that it is desirable that these guideline values are not exceeded. Therefore, in practice the guidelines specify absolute limits for sound levels in specific environments. Informed by WHO Guidelines for Community Noise, the most conservative applicable values specified are those conducive to sleeping or daytime resting in a house bedroom where the internal sound level should not exceed 30 dB $L_{Aeq,\ 8\ hour}$ at night. If a 15 dB reduction is assumed for attenuation through an open window, then a maximum outdoor sound level of 45 dB $L_{Aeq,\ 8\ hour}$ is applicable.

2.7 Local Guidance & Consultation

Fermanagh & Omagh District Council have no specific prescriptive planning guidance relating to operational sound impacts. However, the Environmental Health Officer (EHO) representing the council was consulted as to the extent of assessment required for the Proposed Development.

A representative of RES contacted the EHO with details of the proposed assessment methodology, as set out within the documents referenced above, suggesting that a background sound survey would be required in accordance with BS 4142 (see **Section 2.4**). In response, the EHO representing the council requested that the survey be sufficient in duration to ensure the data is representative and asked that cumulative impacts from nearby existing and proposed infrastructure be considered.

3 Methodology

3.1 Overview

An assessment in accordance with BS 4142:2014+A1:2019 has been undertaken in order to determine the acoustic impact of the Proposed Development. This approach is consistent with the guidance discussed in **Section 2**.

3.2 Baseline Conditions

In order to complete a BS 4142 assessment of the Proposed Development, the background sound level at the times when the new sound source is intended to be operational should be measured. The background sound level is defined as the A-weighted sound pressure level that is exceeded for 90 % of the measurement time interval T, or $L_{A90,T}$.

Measurements should be made at a location that is representative of the assessment locations, the time interval should be sufficient to obtain a representative value, and the duration should be long enough to reflect the range of background sound levels over the period of interest.

Precautions should be taken to minimise the influence on the results from sources of interference. Weather conditions that may affect the measurements should be recorded and an effective wind shield used to minimise turbulence at the microphone.

A statistical analysis, following the example given by BS 4142, should be used to determine an appropriate background sound level for the analysis from the range of results obtained.

3.3 Propagation

A sound propagation model of the Proposed Development and the surroundings has been developed using CadnaA[1] noise modelling software. The ISO 9613-2 [8] propagation model is referenced by BS 4142 as a validated methodology and shall be used to predict the specific sound levels due to the Proposed Development at nearby residential properties, incorporating various assumptions and factors which are considered appropriate for use here:

- The various sound-emitting equipment to be installed as part of the Proposed Development have been modelled as point sources with various heights (see **Table 2**), taken from manufacturer documentation.
- Soft ground conditions have been applied (i.e., a ground factor of 1) as representative of the farmland surrounding the Proposed Development.
- The receptors have been assigned a height of 4 m above ground level.
- Atmospheric attenuation corresponding to a temperature and relative humidity of 10˚C and 70% respectively, as defined within ISO 9613-1 [9], which represents relatively low levels of sound absorption in the atmosphere.
- The topography of the site and surroundings has been included within the model.

Table 2 - Sound Source Heights (m)

Equipment	Height (m)
Inverter	1.25
Small Transformer	1.25
Grid Transformer	1.5
Battery Energy Storage System	1.45

The effect of surface features such as buildings, trees or other objects is not included in the model. There is a level of conservatism built into the model as a result of the adoption of these settings.

ISO 9613-2 is a downwind propagation model. Where conditions less favourable to sound propagation occur, such as when the assessment locations are crosswind or upwind of the proposed development, the sound levels would be expected to be less, and the downwind predictions presented here would be regarded as conservative, i.e., greater than those likely to be experienced in practice.

[1] https://www.datakustik.com/

4 Baseline Data

4.1 Survey Details

Baseline sound levels were determined in a survey undertaken by RES between 2nd July 2024 and 8th July 2024. The survey positions are shown on the map in **Figure** 1 (**Appendix B**).

Two Rion NL-52 sound level meters were used. The meters are certified as meeting IEC 61672-1 [10] Class 1 precision standards. The microphone was approximately 1.2 m above ground level and an outdoor wind shield supplied by the manufacturer was used.

The sound level meters were placed away from reflective surfaces and vegetation as shown in the photos in **Appendix C**. The equipment was field calibrated at the start and end of the survey. A drift of 0.1 dBA was detected, which is appropriate. Both sound level meters had been subject to laboratory calibration traceable to national standards within the previous 24 months and the sound calibrator within the previous 12 months. The calibration dates and references are provided in **Table 3**.

Table 3 - Instrumentation Records

	Meter 1	Meter 2
Type	Rion NL-52	Rion NL-52
Serial No.	00610207	00732144
Calibration Certificate No.	UCRT24/1086	*UCRT24/1272*
Date of Issue	17-Jan-2024	19-Feb-2024
Microphone Serial No.	24815	05336
Preamp Serial No.	10201	32172
Calibrator type	Rion NC-74	Rion NC-74
Calibrator Serial No.	34851904	34851904
Calibrator Cert. No.	UCRT24/1039	UCRT24/1039

At both locations during the survey, the background acoustic environment was dominated by semi-regular traffic sounds from the nearby main road (A32). Additional sound sources included occasional bird song and farm animal sounds along with distant agricultural work sounds. At location 2, trees could be heard lightly blowing in the wind during survey set up and decommission.

Data which was recorded during wind speeds exceeding 5 m/s or during periods of rainfall were excluded from the analysis. The weather data was obtained from publicly available sources[2].

[2] https://wow.metoffice.gov.uk/
https://www.wunderground.com/

4.2 Survey Results

Time series recorded during the survey at each location are shown in **Appendix B, Figures 2 & 3.** The average residual (dB $L_{Aeq,\ 15mins}$) and background (dB $L_{A90,\ 15mins}$) sound levels measured during day and night-time at each location are shown in **Table 4**.

In accordance with BS 4142:2014+A1:2019, representative background sound levels need to be determined from statistical analysis of measured L_{A90} levels. Histograms of measured background sound levels are shown in **Appendix B, Figures 4, 5, 6 & 7**, and derived representative background sound levels are shown in **Table 4**.

Table 4 - Survey Results

Survey Location	Residual Sound Level, dB $L_{Aeq,\ 15\ min}$		Background Sound Level, dB $L_{A90,\ 15\ min}$	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Daytime (07:00-23:00)	Night-time (23:00-07:00)
1	37	32	31	22
2	37	32	32	23

This report presents an assessment at the 13 most relevant affected receptors. Location 2 is representative of the receptors to the northeast and east of the site. The receptors to the south, west and southeast of the site are most suitably represented by the data gathered at Location 1.

The receptors are shown in **Figure 8** in **Appendix B**. The property IDs, coordinates, as well as representative measured acoustic data for each property are presented in **Table 5**. The coordinate system used is the Irish National Grid TM65 (EPSG 29902).

Table 5 - Baseline Data

Property ID	X/m	Y/m	Background Sound Level, dB L_{A90}		Residual Sound Level, dB L_{Aeq}	Residual Sound Level, dB L_{Aeq}
			Daytime	Night-time	Daytime	Night-time
H1	240187	365559	32	23	32	37
H2	240227	365405	32	23	32	37
H3	240249	365449	32	23	32	37
H4	239679	365095	32	23	32	37
H5	239262	364543	31	22	32	37
H6	238943	364580	31	22	32	37
H7	238876	364848	31	22	32	37
H8	239402	364309	31	22	32	37
H9	239641	364444	31	22	32	37
H10	239670	365800	32	23	32	37
H11	239992	365567	32	23	32	37
H12	240156	364464	31	22	32	37
H13	240379	364674	31	22	32	37

5 Assessment

The sound emissions from the Proposed Development have been predicted, and compliance with the criteria set out in **Section 2** has been assessed.

5.1 Sound Generating Equipment

The main sources of sound within the Proposed Development are the 29 Power Conversion System (PCS) units. There are also 29 MV transformers located with every inverter. There are 116 BESS units which also generate sound. There is a grid transformer within the substation which is also a sound source. The equipment is assessed as being operational at all times.

The sound power level data for representative equipment to be installed as part of the Proposed Development are provided in **Table 6**. The source levels associated with the inverter/PCS, transformer and BESS units at the Proposed Development are based on the expected maximum sound output for anticipatory units, as advised as appropriate by candidate manufacturers, and/or historical source information where appropriate. The propagation modelling therefore represents a conservative scenario and actual sound levels would be expected to be lower when the site is not operating at maximum capacity.

Table 6 – Overall Sound Power Levels, dB L_{WA}

Equipment	Sound Power Level, dB L_{WA}
PCS	80
MV Transformer	76
Grid Transformer	96
BESS	68

The results of the predictions at the various residences surrounding the Proposed Development are shown in **Section 5.3**.

5.2 Acoustic Feature Correction

The sound emitted by the various equipment to be introduced as part of the Proposed Development can have distinctive tonal character (i.e. a whine, whistle or hum). Under the subjective method described in BS 4142, a correction of 2 dB has been applied to account for this feature. However, the assessed specific and rating sound levels detailed in **Section 5.3** are particularly low and, in most instances, potential tonal component in the sound emitted from the various plant may well be masked by existing sources of background/ambient sound in the area.

5.3 Predicted Acoustic Impact

Predicted rating levels at nearby properties during the daytime are detailed in **Table 7.** The rating level is then compared to the background sound levels from **Table 4** to provide an initial estimate of impact at each residential location. An illustrative sound footprint for the proposed development is provided in **Appendix B**. The predicted maximum specific sound level at any house during the day is 30 dB $L_{Aeq,\ Tr}$, and consequently the maximum rating level at any house is 32 dB $L_{Ar,\ Tr}$, accounting for the 2 dB tonality penalty.

The resulting estimated impact is described as 'negligible' if the rating level is 10 dB or more below the background sound level; 'low' if less than or equal to the background sound level; 'minor' if not more than 5 dB above; 'moderate' if not more than 10 dB above and 'major' if more than 10 dB above. These criteria compare to the categories as defined by the NPSNI (see **Section 2.1**), with rating levels less than or equal to background sound level representing the NOEL, 5 dB above background representing the LOAEL and 10 dB above background the SOAEL, notwithstanding the caveats regarding the appropriateness of BS 4142 as an assessment approach (i.e. in instances where existing background and rating levels are low, see **Section 2.4**).

Table 7 - BS 4142 Assessment Results

Property ID	Rating Level, dB L_{Ar}	Background Level, dB L_{A90}		Rating vs Background, dB L_{A90}	
		Daytime	Night-time	Daytime	Night-time
H1	21	32	23	-11	-2
H2	22	32	23	-10	-1
H3	21	32	23	-11	-2
H4	32	32	23	0	9
H5	29	31	22	-2	7
H6	28	31	22	-3	6
H7	31	31	22	0	9
H8	25	31	22	-6	3
H9	27	31	22	-4	5
H10	24	32	23	-8	1
H11	24	32	23	-8	1
H12	21	31	22	-10	-1
H13	20	31	22	-11	-2

The assessment indicates that the initial estimate of impact from the Proposed Development at the nearest neighbouring residences are negligible-to-low during the day and low-to-moderate during the night. However, the predicted sound levels and adopted background sound levels are particularly low, to the point at which the 1997 version of BS 4142 considered the standard was not appropriate for use. As a result, a further assessment has been undertaken by comparing the overall expected external and internal ambient sound levels with guidance provided by the WHO (see **Section 2.5**)

and criteria supplied within BS 8233 (see **Section 2.6**) to provide further context and basis of assessment.

The predicted specific sound levels due to the Proposed Development are added to the adopted ambient/residual sound levels for daytime and night-time periods to determine the total external ambient sound level at each residence. The projected internal sound levels are determined by assuming a 15 dB reduction externally to internally for a room with an open window, as assumed within the guidance provided by the World Health Organisation.

The resultant levels, as shown in **Table 8**, indicate that overall sound levels are greater than 10 dB below the WHO/BS 8233 values (i.e. 50 & 45 dB L_{Aeq} externally and 35 & 30 dB L_{Aeq} internally for daytime and night-time periods respectively).

Table 8 - WHO & BS 8233 Assessment

Property ID	Specific Level, dB L_{Aeq}	Existing Ambient Sound Level, dB L_{Aeq}	Total External Ambient Sound Level, dB L_{Aeq}	Total Overall Internal Sound Level, dB L_{Aeq}
		Daytime		
H1	19	37	37	22
H2	20	37	37	22
H3	19	37	37	22
H4	30	37	38	23
H5	27	37	37	22
H6	26	37	37	22
H7	29	37	38	23
H8	23	37	37	22
H9	25	37	37	22
H10	22	37	37	22
H11	22	37	37	22
H12	19	37	37	22
H13	18	37	37	22
		Night-time		
H1	19	32	32	17
H2	20	32	32	17
H3	19	32	32	17
H4	30	32	34	19
H5	27	32	33	18
H6	26	32	33	18
H7	29	32	34	19
H8	23	32	32	17
H9	25	32	33	18
H10	22	32	32	17
H11	22	32	32	17

H12	19	32	32	17
H13	18	32	32	17

Based on the modelling assumptions and assessment results presented here, the sound emitted by the Proposed Development can be considered to have 'No Observed Effect Level' (NOEL), see **Section 2.1**, and no specific action is required to further mitigate operational sound associated with the introduction of the site.

6 Cumulative Assessment

6.1 Cumulative Sites Considered

Planning applications have been submitted for the construction and operation of a battery energy storage system (reference LA10/2023/1932/F) which is located approximately 500m to the East of the Proposed Development. A noise impact assessment report [11] has been submitted as part of the planning application for that development. This noise impact assessment includes a cumulative assessment with a nearby synchronous condenser (reference LA10/2022/1079/F) and substation. Therefore, these have also been considered for this assessment.

Predicted specific and rating levels for each cumulative site in isolation are stated in the noise impact assessment for the nearby BESS site. Five properties are considered in the report, NSR1-NSR5, which correspond to properties H2, H5, H9, H12, and H13, as defined above.

6.2 Cumulative Acoustic Impact

A cumulative assessment has been undertaken to account for the combined acoustic impact of the Proposed Development and cumulative sites whilst operating together.

There are five common receptors which can be considered using the information provided for the cumulative sites, H2, H5, H9, H12, and H13. A cumulative specific level is calculated by adding the predicted specific levels from all developments at each of the five common receptors, see **Table 9**.

Table 9 - Cumulative Specific Levels, dB L_{Aeq}

Property ID	Proposed Development	BESS (LA10/2023/1932/F)	Synchronous Condenser (LA10/2022/1079/F)	Substation	Cumulative Levels
H2	20	25	18	21	28
H5	27	18	12	22	29
H9	25	20	14	25	29
H12	19	16	12	19	23
H13	18	17	11	17	23

The cumulative rating level is then determined by adding an appropriate tonality penalty. The noise impact assessment for the cumulative sites uses a penalty of 5 dB for the equipment modelled whereas the tonality penalty for the Proposed Development is 2 dB. The appropriate penalty is added based on which site is the dominant sound source for each receiver, see **Table 10**.

Note that the dominant sound source for H5 and H13 is the Proposed Development, therefore the associated specific predicted levels for these houses will receive a tonality penalty of 2 dB. For the remaining receivers in the assessment, the dominant sound sources are the cumulative sites therefore the specific predicted levels will have a tonality penalty of 5 dB for H2, H9, H12.

Table 10 - BS 4142 Cumulative Assessment

Property ID	Cumulative Rating Level, dB L_{Ar}	Background Level, dB L_{A90}		Cumulative Rating vs Background, dB L_{A90}	
		Daytime	Night-time	Daytime	Night-time
H2	33	32	23	1	10
H5	31	31	22	0	9
H9	34	31	22	3	12
H12	28	31	22	-3	6
H13	25	31	22	-6	3

The cumulative assessment indicates that the predicted impacts are low-to-minor during the day and minor-to-major at night. However, due to the low background levels particularly at night, under the strict application of the BS 4142 assessment methodology, an assessment against the WHO and BS 8233 criteria is more appropriate here.

The resultant levels, as shown in **Table 11**, indicate that overall levels remain greater than 10 dB below the WHO/BS 8233 values (i.e., 50 & 45 dB L_{Aeq} externally and 35 & 30 dB L_{Aeq} internally for daytime and night-time periods respectively).

Table 11 - WHO & BS 8233 Cumulative Assessment

Property ID	Cumulative Specific Sound Level, dB L_{Aeq}	Existing Ambient Sound Level, dB L_{Aeq}	Total External Ambient Sound Level, dB L_{Aeq}	Total Overall Internal Sound Level, dB L_{Aeq}
		Daytime		
H2	28	37	37	22
H5	29	37	38	23
H9	29	37	38	23
H12	23	37	37	22
H13	23	37	37	22
		Night-time		
H2	28	32	33	18
H5	29	32	34	19
H9	29	32	34	19
H12	23	32	33	18
H13	23	32	32	17

Overall, based on the modelling assumptions and assessment results presented here, the sound emitted by the Proposed Development, operating in isolation and in a cumulative context, can be considered to have 'No Observed Effect Level' (NOEL), see **Section 2.1**, and no specific action is required to further mitigate operational sound associated with the introduction of the site. As a result,

it is considered that the site should not be refused planning permission on the grounds of potential sound levels emitted by the development proposals.

An illustrative sound contour plot for the Proposed Development can be found in **Figure 8**, **Appendix B.**

The amenity of nearby residents can be protected by the imposition of a planning condition relating to sound. A suggested appropriate form of wording for such a condition is provided in **Appendix D**.

7 Conclusions

An assessment of the acoustic impact of the proposed Shaneragh Battery Energy Storage System has been undertaken in accordance with BS 4142:2014+A1:2019, WHO, and BS 8233. The results indicate that the sound emitted by the Proposed Development, operating in isolation and in a cumulative context, can be considered to have 'No Observed Effect Level' (NOEL) in terms of government policy and guidance provided within the NPSNI during the daytime and night-time.

8 References

[1] The British Standards Institution, *Methods for rating and assessing industrial and commercial sound, BS 4142:2014+A1:2019,* 2014 (Amended 2019).

[2] World Health Organisation, *Guidelines for Community Noise,* March 1999.

[3] The British Standards Institution, *Guidance on sound insulation and noise reduction for buildings, BS 8233:2014,* 2014.

[4] Department of the Environment, "Noise Policy Statement for Northern Ireland," September 2014.

[5] Department of the Environment, "Strategic Planning Policy Statement for Northern Ireland (SPPS)," September 2015.

[6] Fermanagh & Omagh District Council, "Local Development Plan 2030 - Plan Strategy," 2023.

[7] The British Standards Institution, Method for rating industrial noise affecting mixed residential and industrial areas, BS 4142:1997, 1997.

[8] International Organisation for Standardisation, *Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation ISO 9613-2:1996,* 1996.

[9] International Organisation for Standardisation , Acoustics - Attenuation of Sound During Propagation Outdoors - Part 1: Calculation of Absorption of Sound by the Atmosphere ISO 9613-1:1993, 1993.

[10] International Electrotechnical Commission, "Electroacoustics - Sound level meters - Part 1: Specifications," 30 September 2013.

[11] Fitzsimons Walsh Environmental Ltd., "Environmental Noise Assessment LA10/2023/1932/F," 2023.

9 Appendices

9.1 Appendix A – Experience & Qualifications

Table A.1 - Author

Name	Lucy Connor
Experience	Acoustic Specialist, Renewable Energy Systems, 2024-Present
Qualifications	AMIOA, Associate Member of the Institute of Acoustics MSc Acoustics and Music technology, University of Edinburgh BSc Mathematics and Statistics, University of Strathclyde

Table A.2 - Checker

Name	Stuart Hill
Experience	Senior Acoustic Specialist, RES, 2024-Present Senior Acoustic Consultant, Mabbett, 2022-2024 Senior Environmentalist (Acoustics), Amey, 2021-2022 Associate Consultant – Acoustics, Noise & Vibration, SLR Consulting, 2017-2020 Technical Analyst/Senior Acoustic Analyst, RES, 2013-2017
Qualifications	MIOA, Member of the Institute of Acoustics MInstP, Member of the Institute of Physics MSc Principles and Applications of Radiation in Industry, the Environment and Medicine, University of St Andrews BEng Electronics Engineering, University of Aberdeen

Table A.3 - Approver

Name	Dr Jeremy Bass
Experience	Head of Specialist Services/Senior Technical Manager, Renewable Energy Systems, 2000-Present Technical Analyst/Senior Technical Analyst, Renewable Energy Systems, 1990-2000 Foreign Exchange Researcher, Mechanical Engineering Laboratory, Tsukuba, Japan, 1989-1990 Research Associate, Energy Research Unit, Rutherford Appleton Laboratory, 1986-1989
Qualifications	MIOA, Member of the Institute of Acoustics MInstP, Member of the Institute of Physics PhD, The Potential of Combined Heat & Power, Wind Power & Load Management for Cost Reduction in Small Electricity Supply Systems, Department of Applied Physics, University of Strathclyde BSc Physics, University of Durham

9.2 Appendix B – Figures

9.2.1 Background Sound Monitoring Locations

Figure 1 - Background Sound Monitoring Locations

9.2.2 Measured Time Series Plot

Figure 2 - Time Series of Measurements Taken at Location 1

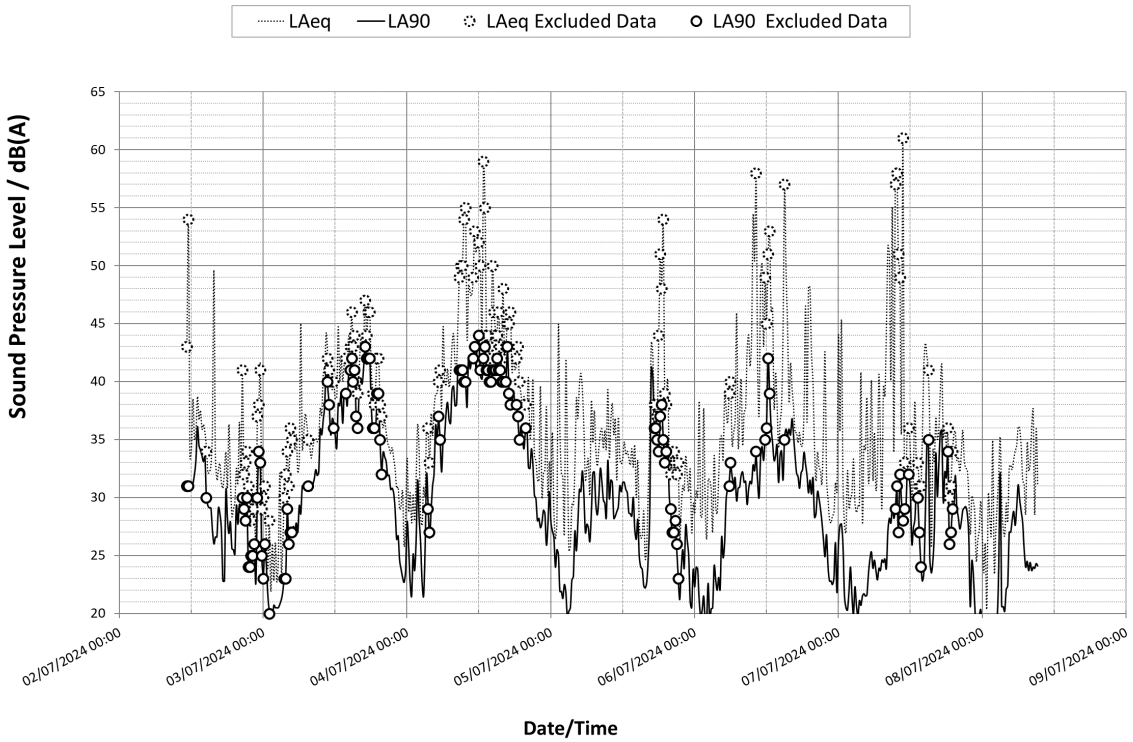
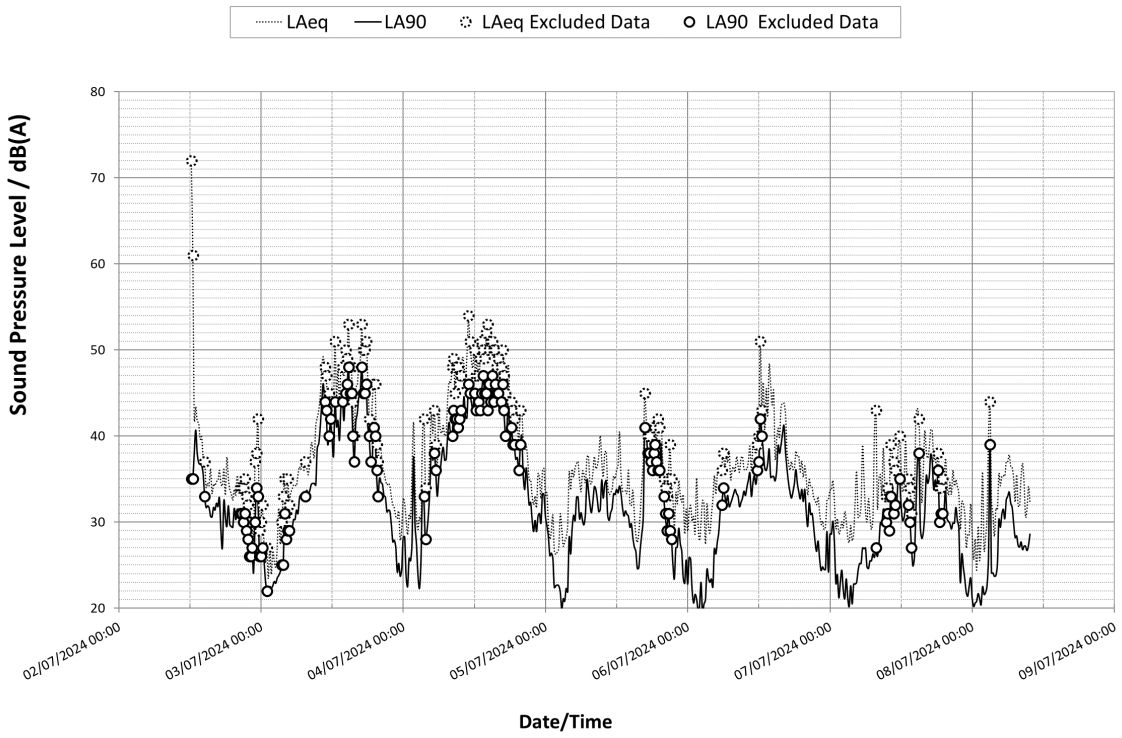


Figure 3 - Time Series of Measurements Taken at Location 2



9.2.3 Histograms of Background Sound Levels

Figure 4 - Histogram of Daytime $L_{A90,\ 15\ Min}$, dB, Measured During Daytime at Measurement Position 1.

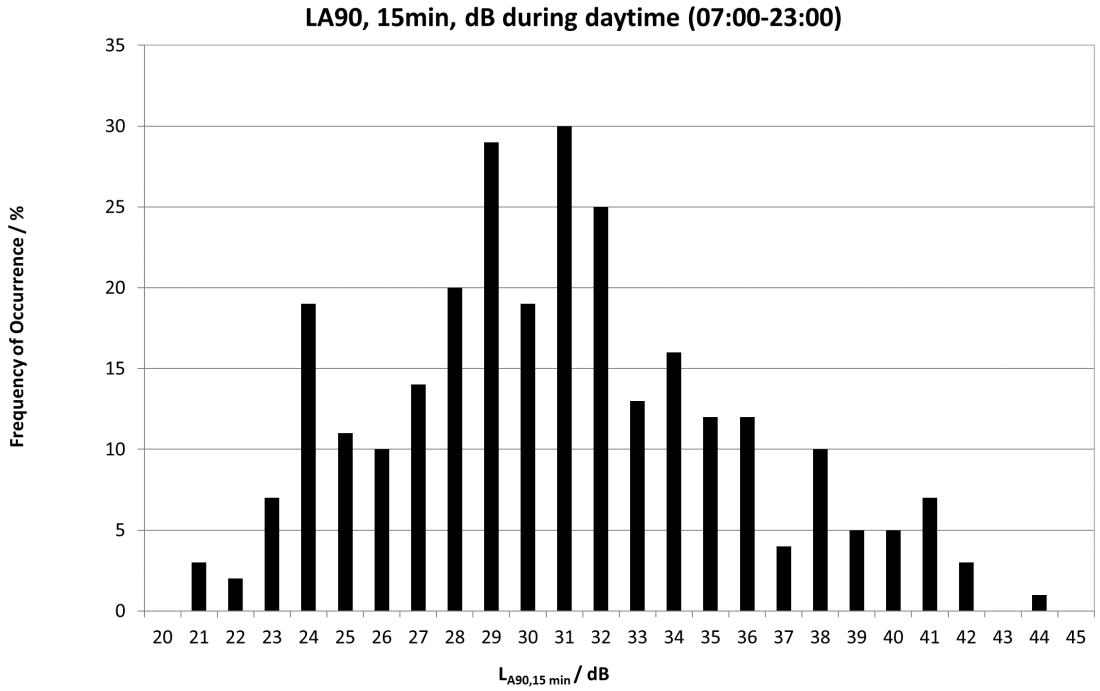


Figure 5 - Histogram of Night-Time $L_{A90,\ 15\ Min}$, dB, Measured During Night-Time at Measurement Position 1.

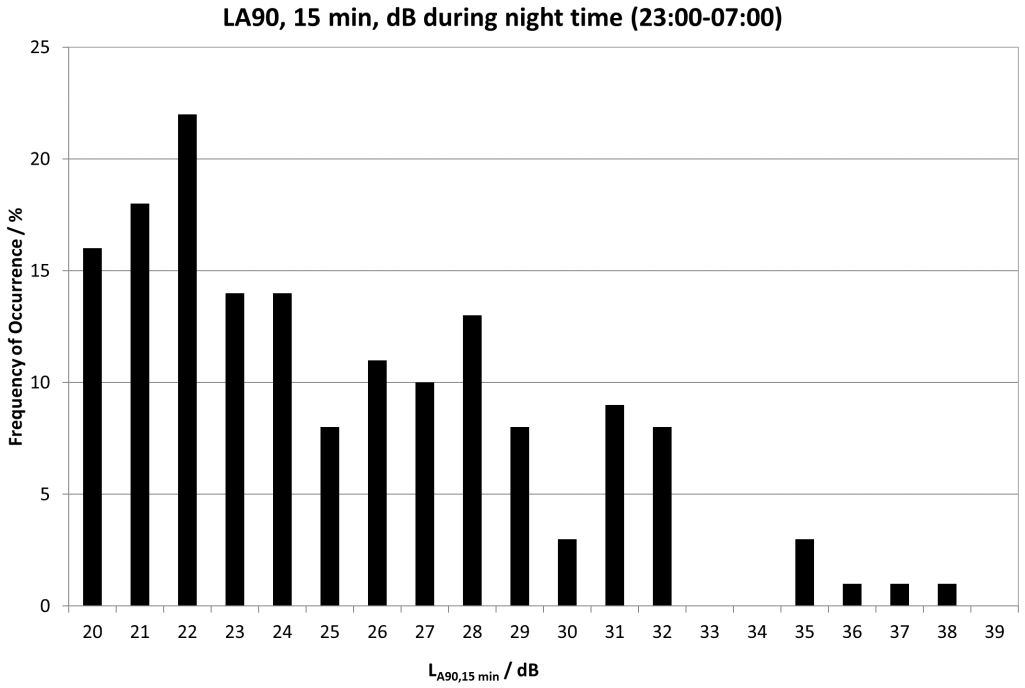


Figure 6 - Histogram of Daytime $L_{A90,\ 15\ Min}$, dB, Measured During Daytime at Measurement Position 2.

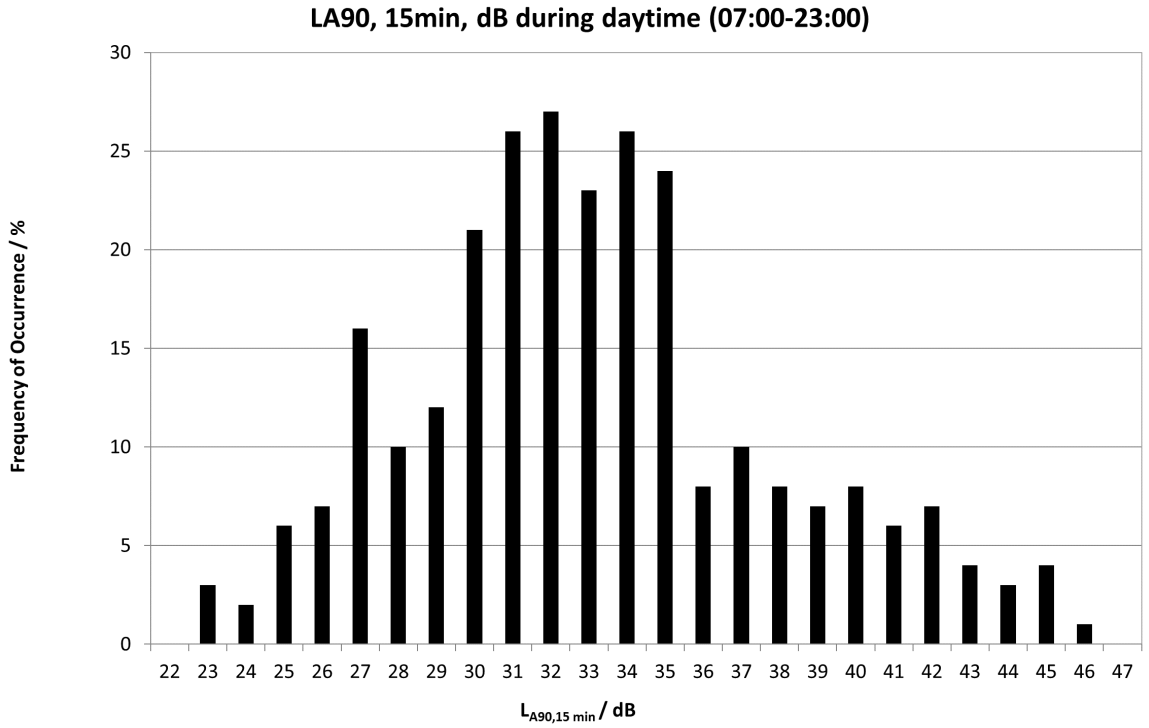
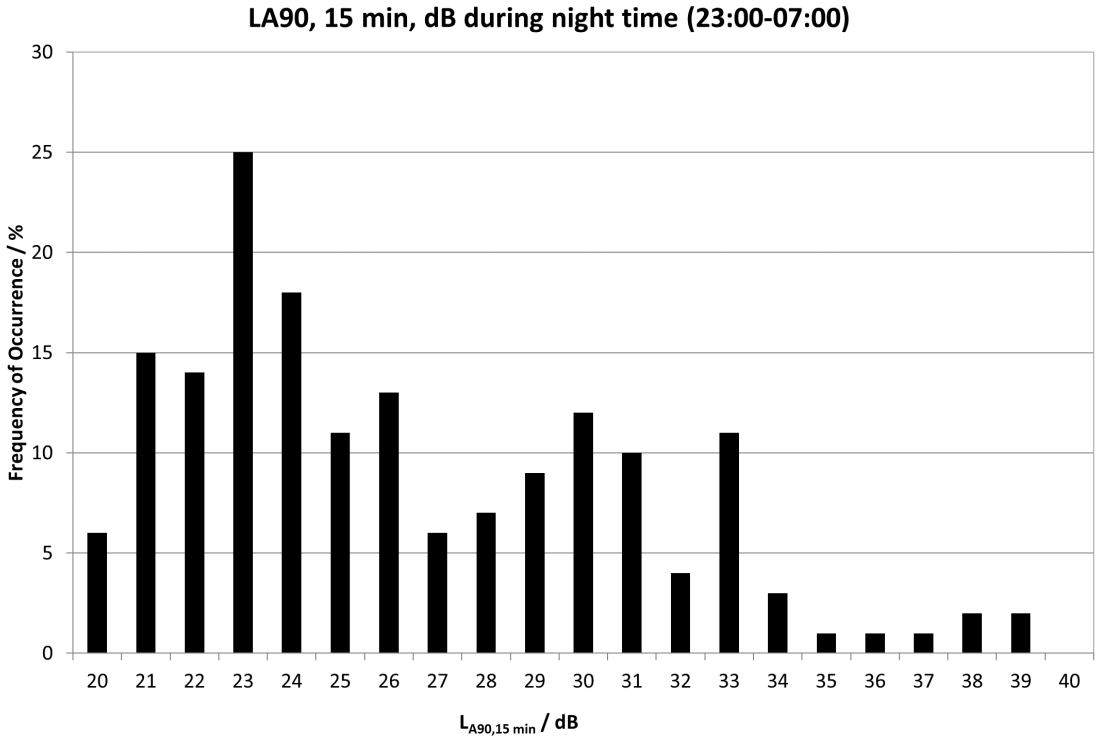
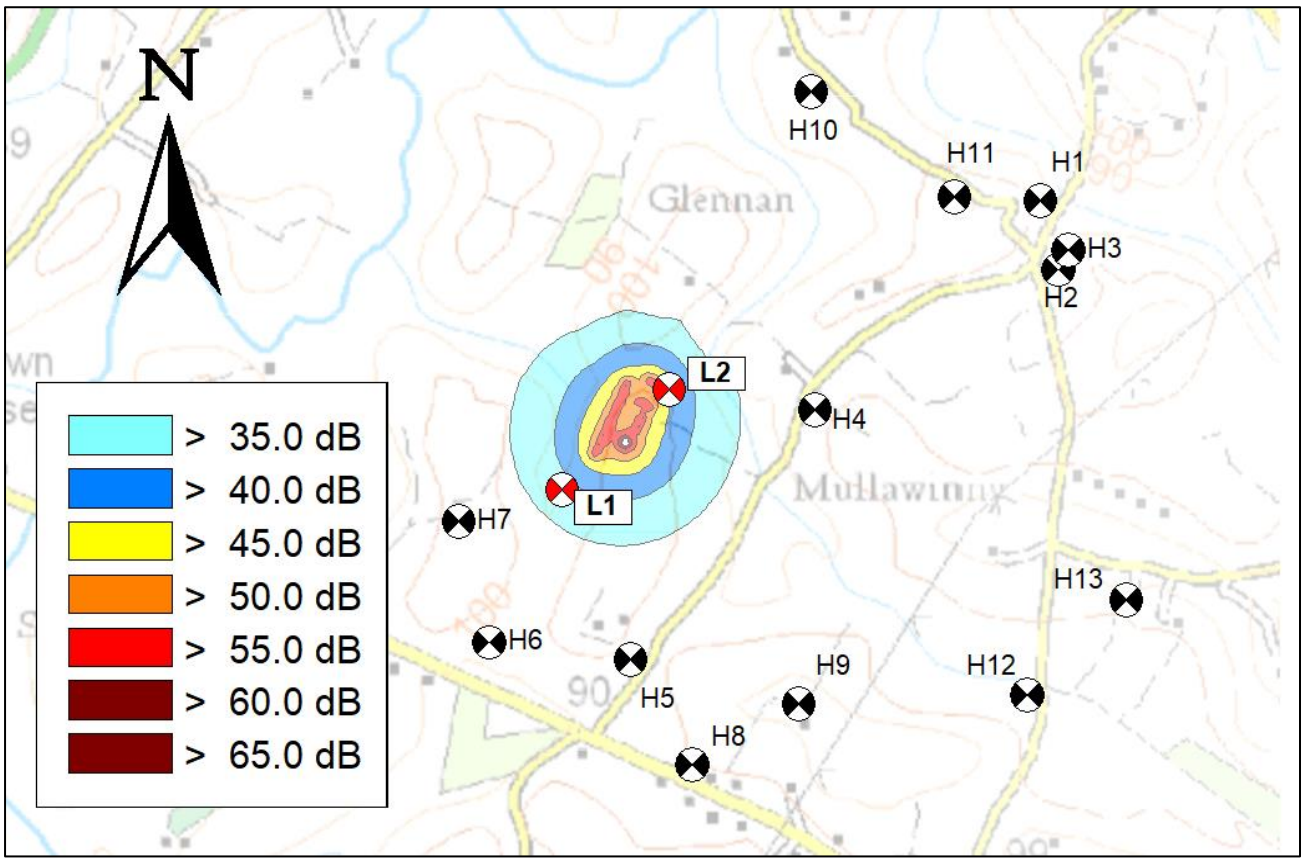


Figure 7 - Histogram of Night-Time $L_{A90,\ 15\ Min}$, dB, Measured During Night-Time at Measurement Position 2



9.2.4 Predicted Acoustic Footprint

Figure 8 - Predicted operational acoustic footprint of the site ($L_{Aeq,T}$ dB)



9.3 Appendix C – Survey Photos

Figure 9 - Background Sound Monitor at Location 1

Figure 10 - Background Sound Monitor at Location 2

9.4 Appendix D - Suggested Planning Condition Wording

The Shaneragh Battery Energy Storage System shall be designed and operated to ensure that the rating sound level, determined using the BS 4142:2014 + A1:2019 methodology external to an existing residence, shall not exceed 40 dB LAr or the background sound level plus 5 dB, whichever is the greater, for both daytime and night-time periods.