Magheralin Solar Farm

Acoustic Impact Assessment

Ref	05215-6581126

Revision History

Issue	Date	Name	Latest changes	Document number
01	04/10/2023	Artem Khodov	First Created	05215-6553326

Contents

1 Introduction

This report contains an assessment of the acoustic impact of the proposed Magheralin Solar Farm, in terms of operational impacts. Three Members of the Institute of Acoustics have been involved in its production. Details of their experience and qualifications can be found in Appendix A.

The scope includes determining the baseline and predicting sound levels due to the proposed development in order to assess the level of impact in accordance with relevant planning guidance.

2 Planning Policy, Guidance & Standards

2.1 Noise Policy Statement for Northern Ireland (NPSNI)

The Noise Policy Statement for Northern Ireland (NPSNI) [1] 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 - 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 [2] 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 Planning Policy Statement 18 (PPS 18) - Renewable Energy

Planning Policy Statement 18 - Renewable Energy [3] '… sets out the [Department of Environments'] planning policy for development that generates energy from renewable resources and that requires the submission of a planning application. In addition the PPS encourages the integration of renewable energy technology and greater application of the principles of Passive Solar Design in the design, siting

and layout of new development'. The document points to the Best Practice Guidance to PPS 18 for further information.

2.4 Best Practice Guidance to PPS18 - Renewable Energy

The introduction to the current Best Practice Guidance to PPS 18 [4], as amended in 2019, states that the '… guidance contained in Best Practice Guidance to PPS 18 - Renewable Energy will continue to have effect (where relevant) unless and until such guidance is updated, revised or replaced by new Departmental guidance on this planning issue'. The guidance details the potential impacts associated with a variety of renewable energy development, with noise impacts from wind energy development being considered in some details and the assessment methodology detailed within BS 4142:2014+A1:2019 [5] (as discussed below in section 2.5) being referenced in respect of noise associated with planned biomass facilities. There is no suggested assessment methodology for determining impacts associated with solar facilities, presumably due to the relative infancy of this kind of development in Northern Ireland. However, based on experience, the BS 4142:2014+A1:2019 assessment methodology would also apply in this respect.

2.5 British Standard BS 4142

British Standard BS 4142:2014+A1:2019 describes methods for rating and assessing sound of an industrial or commercial nature in order to provide an indication of the likely impact of sound on people at nearby sensitive properties. The standard recognizes the importance of the context in which a sound occurs and provides for factors where an assessment against absolute limits (as defined by alternative guidance in sections 2.6 and 2.7 below) may be more relevant to assess the likely impact of sound.

2.6 World Health Organisation Guidelines for Community Noise

The World Health Organisation (WHO) Guidelines for Community Noise [6] recommend sound levels intended to minimise health impacts. In practice the guidelines specify absolute limits for sound levels in specific environments.

2.7 British Standard BS 8233

British Standard BS 8233:2014 [7] 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.

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 proposal, 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

The ISO 9613-2 [8] propagation model shall be used to predict the specific sound levels due to the proposed development at nearby sensitive receptors, which in this instance are comprised of residential properties. The propagation model takes account of sound attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10 ˚C and 70 % respectively.

Ground effects are also taken into account by the propagation model, with a ground factor of 0.5 adopted to reflect a mix of hard and porous ground between the site and the assessment locations. A 1.5 m receiver height shall be used. The effect of surface features such as buildings and trees shall not be 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 lower, and the downwind predictions presented here would be regarded as conservative. This provides a robust assessment of the worst case scenario.

3.4 Assessment

Once the specific sound levels due to the proposed new sound source have been predicted, the rating level of the sound can be calculated. The rating level is then compared to the existing background sound level to determine the level of impact. The rating level is obtained by adding any penalties due to character that may be applicable to the predicted specific sound level.

Table 1 details how the difference between the rating level and background sound level is used to come to a judgement about the level of impact under BS 4142, although it is noted that any assessment is context specific. 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

Depending upon the diurnal variation in the background sound level, and the times when the proposed new sound source is scheduled to operate, it may be appropriate to undertake separate assessments for certain times of day, e.g. day and night.

4 Baseline Data

4.1 Details of the survey

Baseline sound levels were determined in an extended continuous survey undertaken by RPS between 1 June 2023 and 7 June 2023. The survey positions are shown on the map in Figure 1 (Appendix B).

Three Rion NL-52 sound level meters were used. The meters are certified as meeting IEC 61672-1 [9] 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 campaign. Maximum detected drift was 0.2 dB which is appropriate. All instrumentation had been subject to laboratory calibration traceable to national standards within the previous 12 months, with the calibration dates and references provided in Table 2.

Table 2 - Instrumentation Records

	Meter 1	Meter 2	Meter 3
Type	Rion NL-52	Rion NL-52	Rion NL-52
Serial No.	00687041	00320643	00586907
Calibration Certificate No.	UCRT23/1248	UCRT23/1425	UCRT23/1520
Date of Issue	21/02/2023	28/03/2023	17/04/2023
Microphone Serial No.	13559	03392	22729
Preamp Serial No.	87196	10651	87026
Calibrator type	Rion NC-74	Rion NC-74	Rion NC-74
Calibrator Serial No.	34536109	34536109	34536109
Calibrator Cert. No.	UCRT23/1384	UCRT23/1384	UCRT23/1384

During the survey at location 1 the background acoustic environment was dominated by traffic on Springhill Rd. Additional sound sources included birds, and occasional impulses from Huhtamaki Fiber – this is not expected to affect the L_{A90} levels. At location 2 the background acoustic environment was dominated by distant traffic and bird song. At location 3 the dominant sound source was constant traffic on Dromore Rd.

Weather conditions during the survey were such that interference with the results would not be expected. A weather station was used to measure meteorological conditions during the survey. Wind speed measured at microphone height did not exceed 5 m/s during the survey. There was no rain during the survey, and the temperatures ranged between 14°C and 20°C.

4.2 Survey results

Time histories recorded during the survey at each location are shown in Appendix B.2. The average residual sound levels ($L_{Aeq,\ 15mins}$) measured during day and night time at each location are shown in Table 3.

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.3, and derived representative background sound levels are shown in Table 3.

Table 3 - Survey Results

Survey location	Residual Sound Level, $L_{Aeq,\ 15\ min,}$ dB		Background Sound Level, $L_{A90,\ 15\ min,}$ dB	
	Daytime (07:00-23:00)	Night time (23:00-07:00)	Daytime (07:00-23:00)	Night time (23:00-07:00)
1	41	38	35	26
2	53	47	47	35
3	69	58	48	31

The measured background sound levels at position 3 are dominated by traffic on Dromore Rd. As a result, the measurements taken at survey location 3 are considered to be representative of the receptors located close to Dromore Rd.

The background sound levels representative of the houses located to the north of the site, nearby to Springhill Rd and Huhtamaki Fiber were measured at position 1. Levels measured at position 2 are considered to be representative of all other houses.

This report presents an assessment at the 45 most relevant affected receptors.

The houses used for the assessment are shown in Figure 11 in Appendix B.4. The house numbers, coordinates, as well as representative measured acoustic data for each house are presented in Table 4. The coordinate system used is the Irish Transverse Mercator (EPSG 2157).

Table 4 - Baseline Data

House ID	X/m	Y/m	Day Background Sound Level / L_{A90} dB	Night Background Sound Level / L_{A90} dB	Day Residual Sound Level / L_{Aeq} dB	Night Residual Sound Level / L_{Aeq} dB
H01	711571	857899	35	26	41	38
H02	712008	856715	47	35	53	47
H05	711631	858021	35	26	41	38
H09	711523	857875	35	26	41	38
H11	711147	857770	35	26	41	38
H15	712713	856151	48	31	69	58
H18	711166	857986	35	26	41	38
H20	711502	857694	35	26	41	38
H22	711327	857414	48	31	69	58
H24	712382	856797	47	35	53	47
H25	712217	857670	35	26	41	38
H27	712217	857670	35	26	41	38
H28	711649	858055	35	26	41	38
H29	712359	855783	47	35	53	47
H34	711111	857887	35	26	41	38
H35	711082	857932	35	26	41	38
H37	711751	856373	48	31	69	58
H42	711201	857698	35	26	41	38
H43	712217	857670	35	26	41	38
H44	712217	857670	35	26	41	38
H46	712873	855920	48	31	69	58
H47	712349	856355	48	31	69	58
H52	711663	858124	35	26	41	38
H54	712217	857670	35	26	41	38
H55	712217	857670	35	26	41	38
H57	711133	857826	35	26	41	38
H59	712360	855697	47	35	53	47
H62	712503	856336	48	31	69	58
H64	711792	856388	48	31	69	58
H65	711619	857958	35	26	41	38
H69	711167	857995	35	26	41	38
H70	711169	857722	35	26	41	38
H71	712554	857052	47	35	53	47
H77	711721	856468	48	31	69	58
H79	711530	856520	48	31	69	58
H82	711151	857970	35	26	41	38
H83	711985	856641	47	35	53	47
H84	711673	857989	35	26	41	38
H86	712747	856122	48	31	69	58

House ID	X/m	Y/m	Day Background Sound Level / L_{A90} dB	Night Background Sound Level / L_{A90} dB	Day Residual Sound Level / L_{Aeq} dB	Night Residual Sound Level / L_{Aeq} dB
H89	712187	856445	48	31	69	58
H90	711561	857855	35	26	41	38
H95	712736	856033	48	31	69	58
H97	711356	857246	48	31	69	58
H98	711368	857012	48	31	69	58

5 Assessment

5.1 Sound generating equipment

The main sources of sound within the proposed development are the 9 inverters located at the solar substations. There are also MV transformers located next to each inverter. There is no grid transformer proposed on the site. The inverters will be operating during daytime periods only when the solar farm is generating power. The MV transformers are assessed as being operational at all times.

Acoustic emission data for the proposed equipment is detailed in Table 5. The data corresponds to the maximum acoustic emission for each device as advised by the manufacturer. Predictions based on this data therefore represent the worst case and the sound levels would be expected to be less when the site is not operating at maximum capacity.

Table 5 - Acoustic Emission Data

Equipment	Sound Power Level, dB(A)
Solar substation (inverter only)	93
Solar substation (MV transformer only)	79

5.2 Acoustic Feature Correction

In accordance with BS 4142:2014+A1:2019 penalties can be applied to the predicted specific sound level to achieve the rating level at receptor. The penalties can be applied for “attention catching features” such as tonality, impulsivity, intermittency, and other distinguishable characteristics.

The cumulative impact of sound from all the solar substations on nearby receivers has been assessed in third octaves in accordance with the method provided in Annex C of BS 4142:2014+A1:2019. Results of this assessment show that at all considered receptors the sound generated by the proposed equipment will not contain tones.

The broadband sound generated by the proposed equipment is not expected to be intermittent or impulsive, due to the equipment operating consistently. Changes to sound pressure levels due to load changes will be gradual and will not result in attention catching characteristics.

As a result the rating level will be equal to the specific sound level.

5.3 Predicted acoustic impact

Predicted rating levels at nearby properties are detailed in Table 6 for day and night time periods respectively. The rating level is then compared to the background sound levels from Table 4 to give the potential impact at each location, results of this are also shown in Table 6. Illustrative sound footprints for the proposed development showing the predicted specific sound level during both day and night-time periods are provided in Appendix B. The predicted maximum specific sound level at any house is 37 dB $L_{Aeq,\ Tr}$, and consequently the maximum rating level at any house is 37 dB $L_{Ar,\ Tr}$.

Table 6 - BS 4142 Assessment Results

House ID	Rating Level, dB $L_{Ar, Tr}$		Rating vs Background, dB		Potential Impact	
	Daytime (07:00-23:00)	Night time (23:00-07:00)	Daytime (07:00-23:00)	Night time (23:00-07:00)	Daytime (07:00-23:00)	Night time (23:00-07:00)
H01	35	22	0	-4	Minor	Low
H02	36	23	-11	-12	Low	Low
H05	33	20	-2	-6	Low	Low
H09	37	24	2	-2	Minor	Low
H11	32	19	-3	-7	Low	Low
H15	32	19	-16	-12	Low	Low
H18	36	23	1	-3	Minor	Low
H20	32	19	-3	-7	Low	Low
H22	30	17	-18	-14	Low	Low
H24	31	18	-16	-17	Low	Low
H25	34	21	-1	-5	Low	Low
H27	34	21	-1	-5	Low	Low
H28	33	20	-2	-6	Low	Low
H29	34	21	-13	-14	Low	Low
H34	33	20	-2	-6	Low	Low
H35	32	19	-3	-7	Low	Low
H37	30	17	-18	-14	Low	Low
H42	32	19	-3	-7	Low	Low
H43	34	21	-1	-5	Low	Low
H44	34	21	-1	-5	Low	Low
H46	27	14	-21	-17	Low	Low
H47	32	19	-16	-12	Low	Low
H52	32	19	-3	-7	Low	Low
H54	34	21	-1	-5	Low	Low
H55	34	21	-1	-5	Low	Low
H57	33	20	-2	-6	Low	Low
H59	32	19	-15	-16	Low	Low
H62	34	21	-14	-10	Low	Low
H64	31	18	-17	-13	Low	Low
H65	34	21	-1	-5	Low	Low
H69	36	23	1	-3	Minor	Low
H70	31	18	-4	-8	Low	Low
H71	31	18	-16	-17	Low	Low
H77	32	19	-16	-12	Low	Low
H79	30	17	-18	-14	Low	Low
H82	35	22	0	-4	Minor	Low
H83	35	23	-12	-12	Low	Low

House ID	Rating Level, dB $L_{Ar, Tr}$		Rating vs Background, dB		Potential Impact	
	Daytime (07:00-23:00)	Night time (23:00-07:00)	Daytime (07:00-23:00)	Night time (23:00-07:00)	Daytime (07:00-23:00)	Night time (23:00-07:00)
H84	33	20	-2	-6	Low	Low
H86	32	18	-16	-13	Low	Low
H89	31	19	-17	-12	Low	Low
H90	35	22	0	-4	Minor	Low
H95	35	22	-13	-9	Low	Low
H97	30	17	-18	-14	Low	Low
H98	30	17	-18	-14	Low	Low

BS 4142 recognizes the importance of the context in which a sound occurs. It states that the impact depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

BS 4142 states that absolute levels may be more relevant than the margin by which the rating level exceeds the background sound level in circumstances where the background sound levels and rating levels are low. The previous version of BS 4142 [10] provides numerical values for this and states that "*background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low*".

The representative background sound level at some houses is $L_{A90, 15\ min}$ 26 dB (measurement location 1) at night. This background sound level is considered to be low and the rating levels at these houses during night time are also very low, therefore in accordance with BS 4142 an assessment against absolute limits is more relevant for these houses during night time.

A level of conservatism has been built into the assessment to compensate for the potential impact of uncertainty. The predicted specific sound levels presented in this assessment, and the sound footprints shown in Figure 11 and Figure 12, reflect this. 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.

5.3.1 Assessment of impact based on absolute levels

An assessment based on absolute levels is undertaken at the houses where representative night time background sound level is $L_{A90, 15\ min}$ 26 dB (measurement location 1), as this is more appropriate given the low background levels and rating levels. The Guidelines for Community Noise produced by the WHO along with BS 8233:2014 are suggested as being appropriate.

The WHO Guidelines for Community Noise recommend sound levels intended to minimise health impacts in specific environments. At dwellings the Guidelines for Community Noise recommend that outside sound levels should not exceed L_{Aeq} 45 dB so that people may sleep with the windows open and not be disturbed.

BS 8233:2014 provides 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. The most conservative values specified are those conducive to sleeping or daytime resting in a house bedroom where the internal sound level should not exceed $L_{Aeq,\ 8\ hour}$ 30 dB at night. If a 15 dB reduction is assumed for attenuation through an open window, then these limits are consistent with the outdoor limits specified by the WHO Guidelines for Community Noise.

The predicted specific sound levels due to the proposed development at night are equivalent to the rating levels from Table 6 (details of potential penalties for acoustic features are shown in Section 5.2). These specific sound levels at each house where the representative night time background sound level is $L_{A90,\ 15\ min}$ 26 dB are compared to the WHO target value for night time periods in Table 7.

Table 7 - WHO Assessment Results - Night

House ID	Specific Sound Level, dB L_{Aeq}	Limit, dB L_{Aeq}	Margin
	Night time (23:00-07:00)	Night time (23:00-07:00)	Night time (23:00-07:00)
H01	22	45	-23
H05	20	45	-25
H09	24	45	-21
H11	19	45	-26
H18	23	45	-22
H20	19	45	-26
H25	21	45	-24
H27	21	45	-24
H28	20	45	-25
H34	20	45	-25
H35	19	45	-26
H42	19	45	-26
H43	21	45	-24
H44	21	45	-24
H52	19	45	-26
H54	21	45	-24
H55	21	45	-24
H57	20	45	-26
H65	21	45	-24
H69	23	45	-23
H70	18	45	-27
H82	22	45	-23
H84	20	45	-25
H90	22	45	-23

As Table 7 shows, the limits are met by a significant margin (greater than 10 dB) at all assessed houses, therefore no adverse impacts are predicted to occur during the night time.

6 Conclusion

An assessment of the acoustic impact of the proposed Magheralin solar farm has been undertaken in accordance with BS 4142:2014+A1:2019.

During the daytime at all houses the predicted impact is low or minor. No adverse impacts are predicted to occur during the daytime.

At night, at the houses where the background sound levels are sufficiently high to warrant an assessment considering the margin by which the rating level exceeds the background sound level, the predicted impact is low. At the other houses where the night time background sound levels are low, BS 4142 states that an assessment against absolute limits may be more appropriate. An additional assessment against absolute limits, in line with WHO guidance and BS 8233, demonstrates that such limits are met at all the properties where the night time background sound levels are considered low. Therefore no adverse impacts are predicted to occur at any houses during the night time.

7 References

[1] Department of the Environment, “Noise Policy Statement for Northern Ireland,” September 2014.

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

[3] Department of the Environment, “Planning Policy Statement 18 'Renewable Energy',” Belfast, August 2009.

[4] Department for Infrastructure, “Best Practice Guidance to PPS 18 'Renewable Energy',” 01 August 2009.

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

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

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

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

[9] International Electrotechnical Commission, “Electroacoustics - Sound level meters - Part 1: Specifications,” 30 September 2013.

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

Appendix A Experience and Qualifications

Author:

Name	Artem Khodov
Experience	Senior Acoustic Analyst, Renewable Energy Systems, 2023-Present Senior Acoustic Engineer, Sandy Brown Ltd, 2021-2022 Acoustic Engineer, Sandy Brown Ltd, 2017- 2021
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Checker:

Name	Peter Brooks
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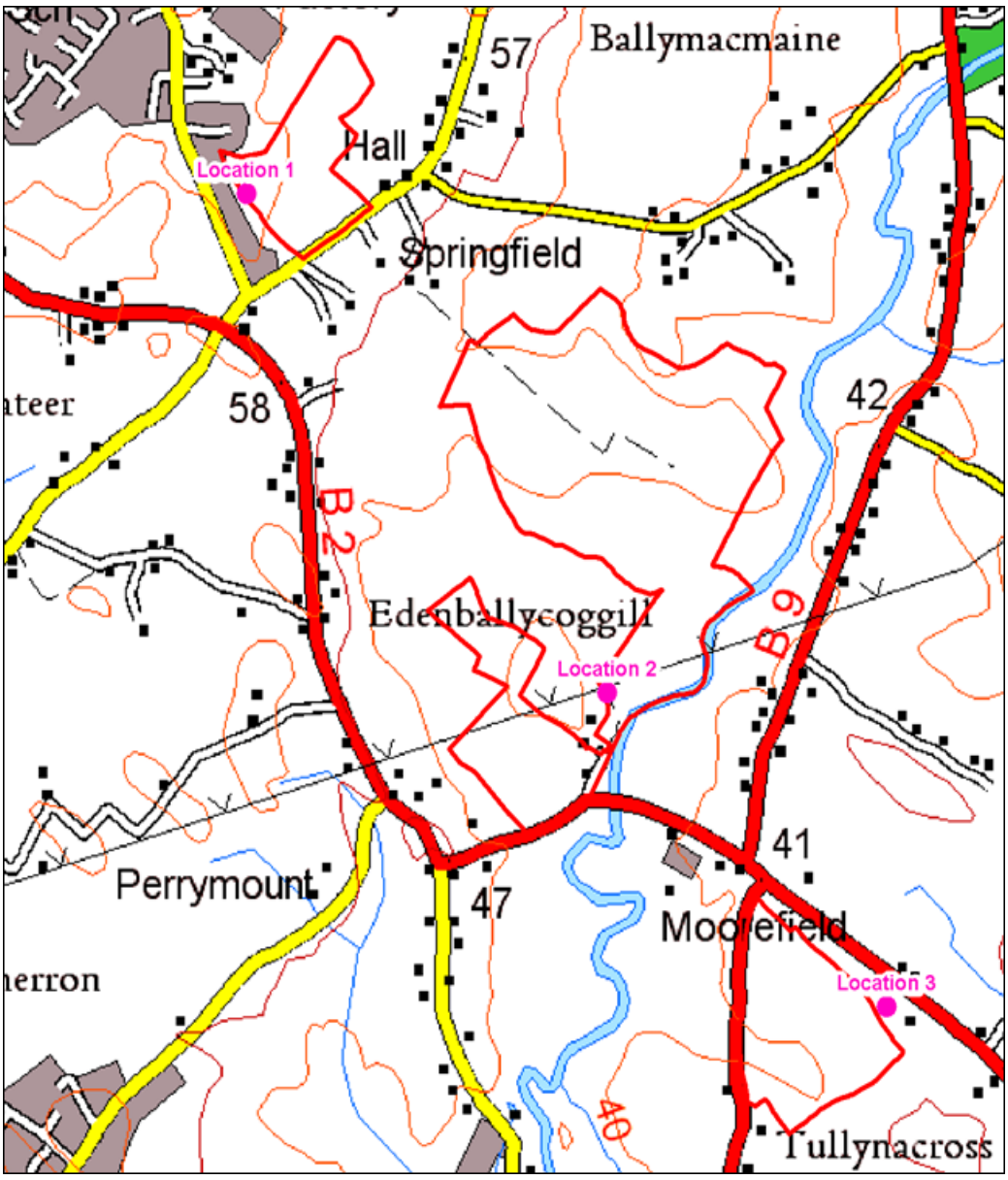
Approver:

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

Appendix B Figures

B.1 Background sound monitoring locations

Figure 1 - Background Sound Monitoring Locations



B.2 Measured time histories

Figure 2 - Time History of Measurements Taken at Location 1

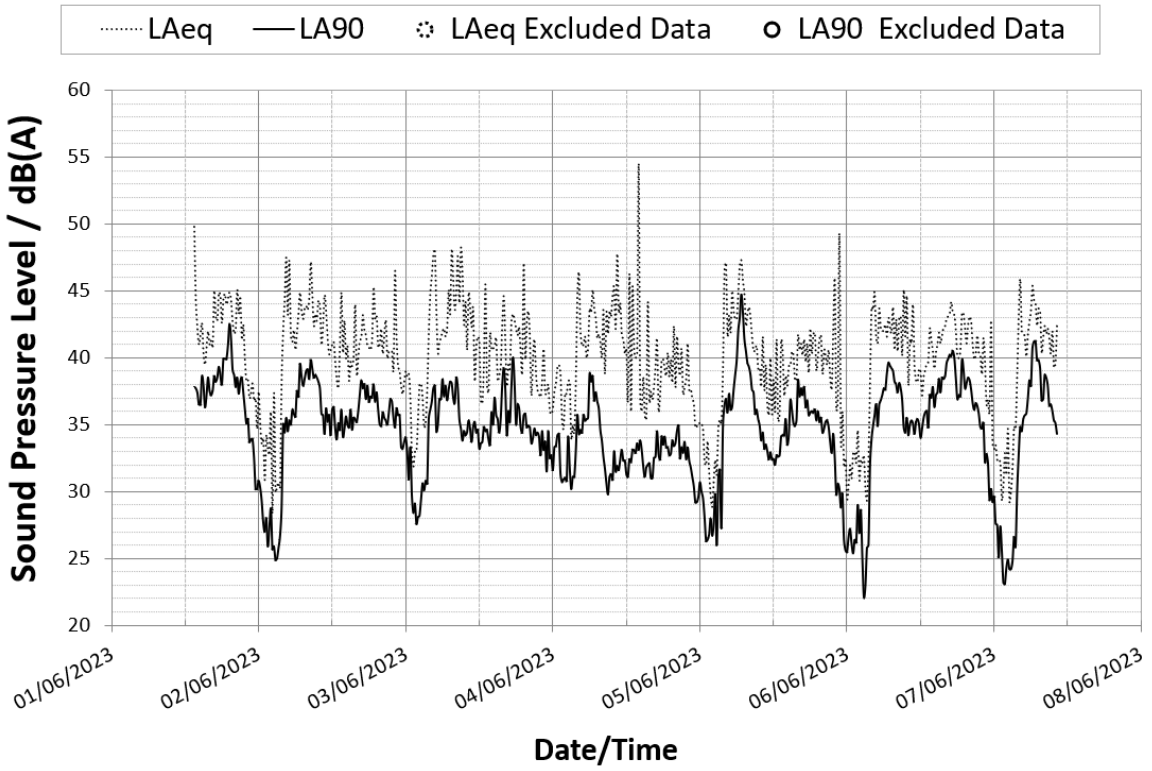


Figure 3 - Time History of Measurements Taken at Location 2

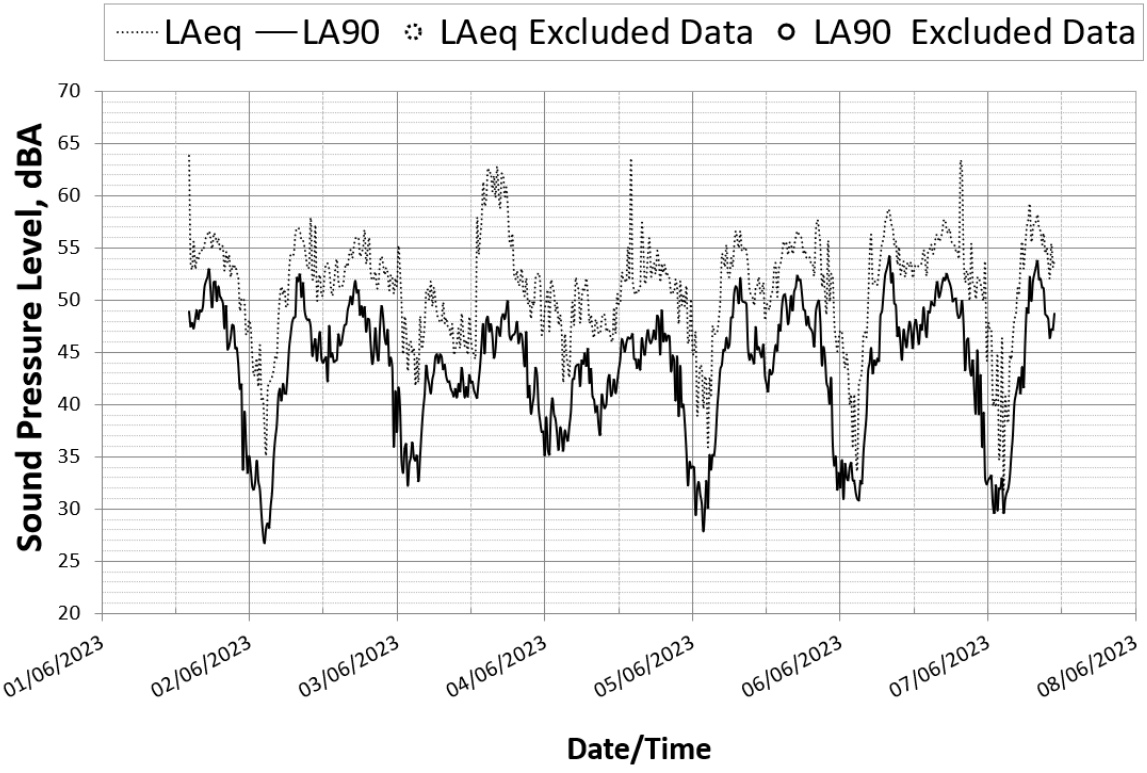
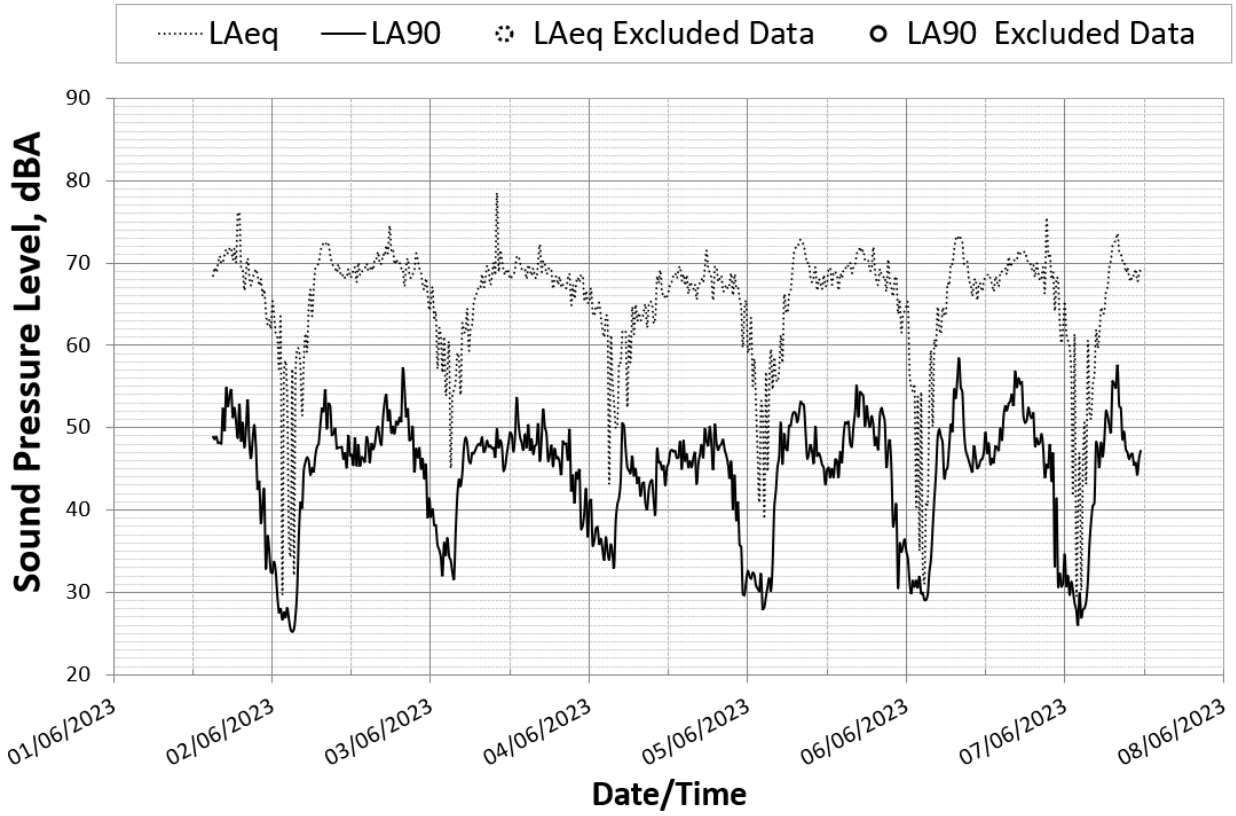


Figure 4 - Time History of Measurements Taken at Location 3



B.3 Histograms of background sound levels

B.3.1 Monitoring position 1

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

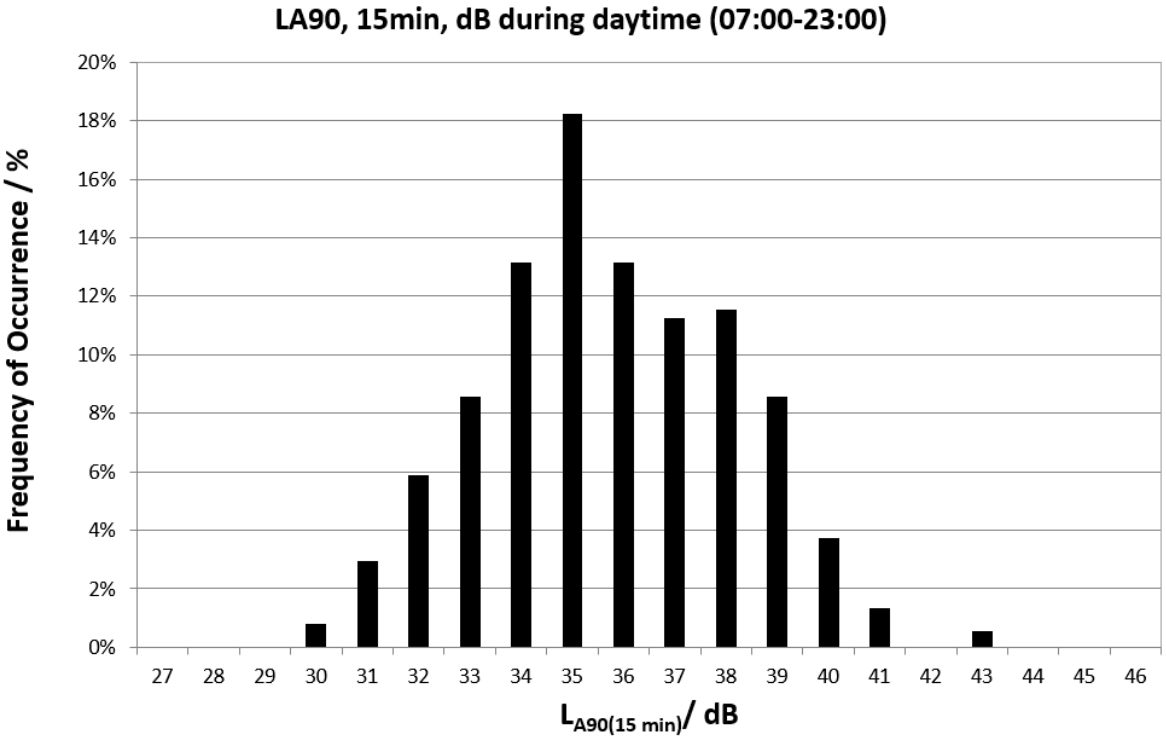
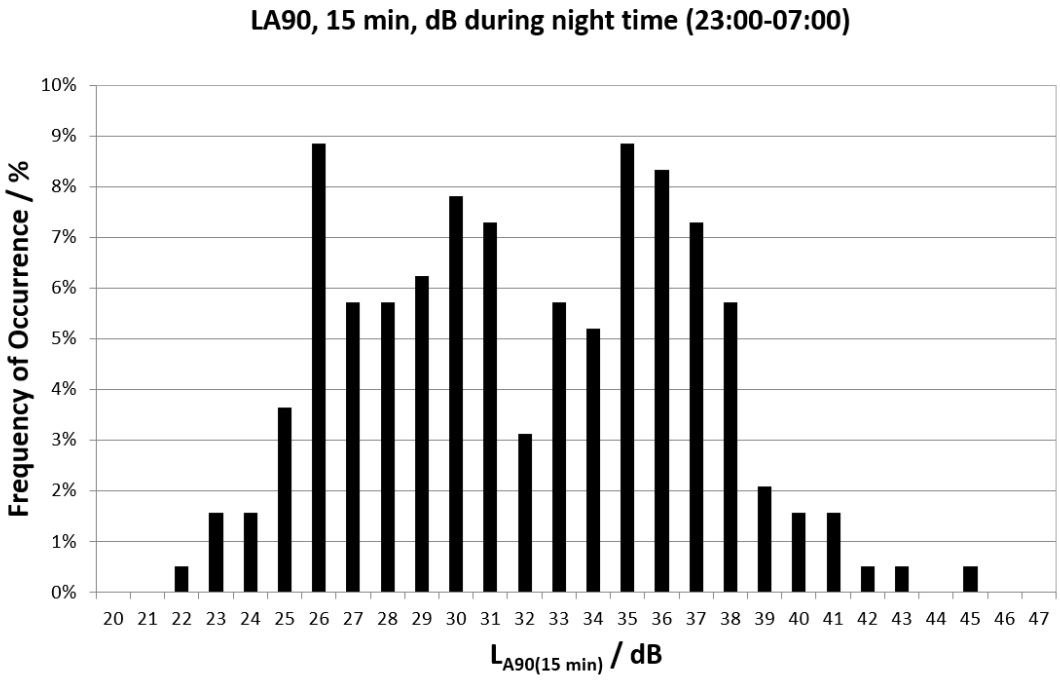


Figure 6 - Histogram of Night Time $L_{A90,\ 15\ Min}$, dB, Measured During Night Time at Measurement Position 1.



B.3.2 Monitoring position 2

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

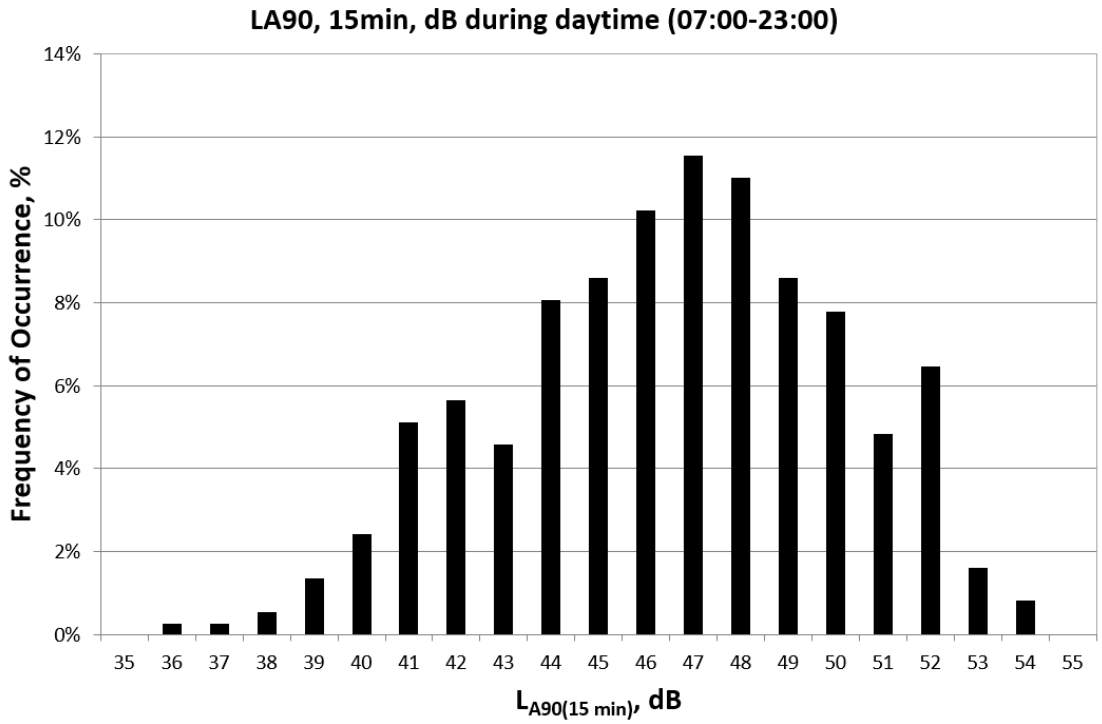
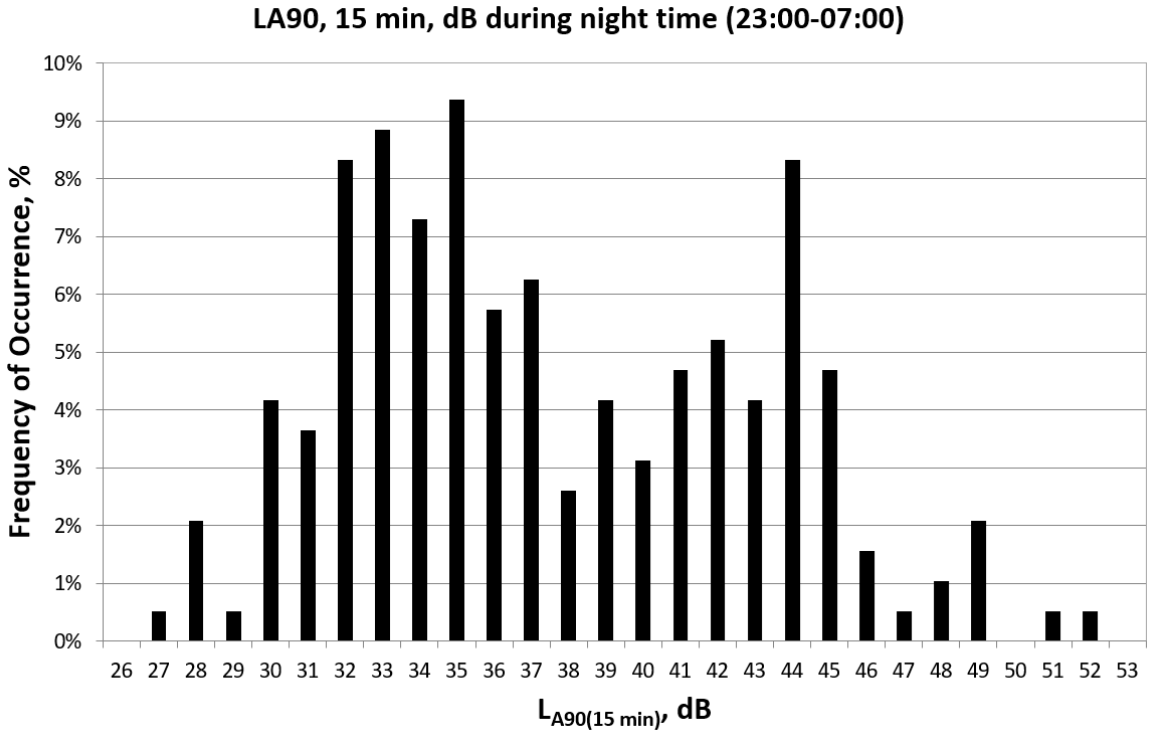


Figure 8 - Histogram of Night Time $L_{A90,\ 15\ Min}$, dB, Measured During Night Time at Measurement Position 2



B.3.3 Monitoring position 3

Figure 9 - Histogram of Daytime $L_{A90,\ 15\ Min}$, dB, Measured During Daytime at Measurement Position 3

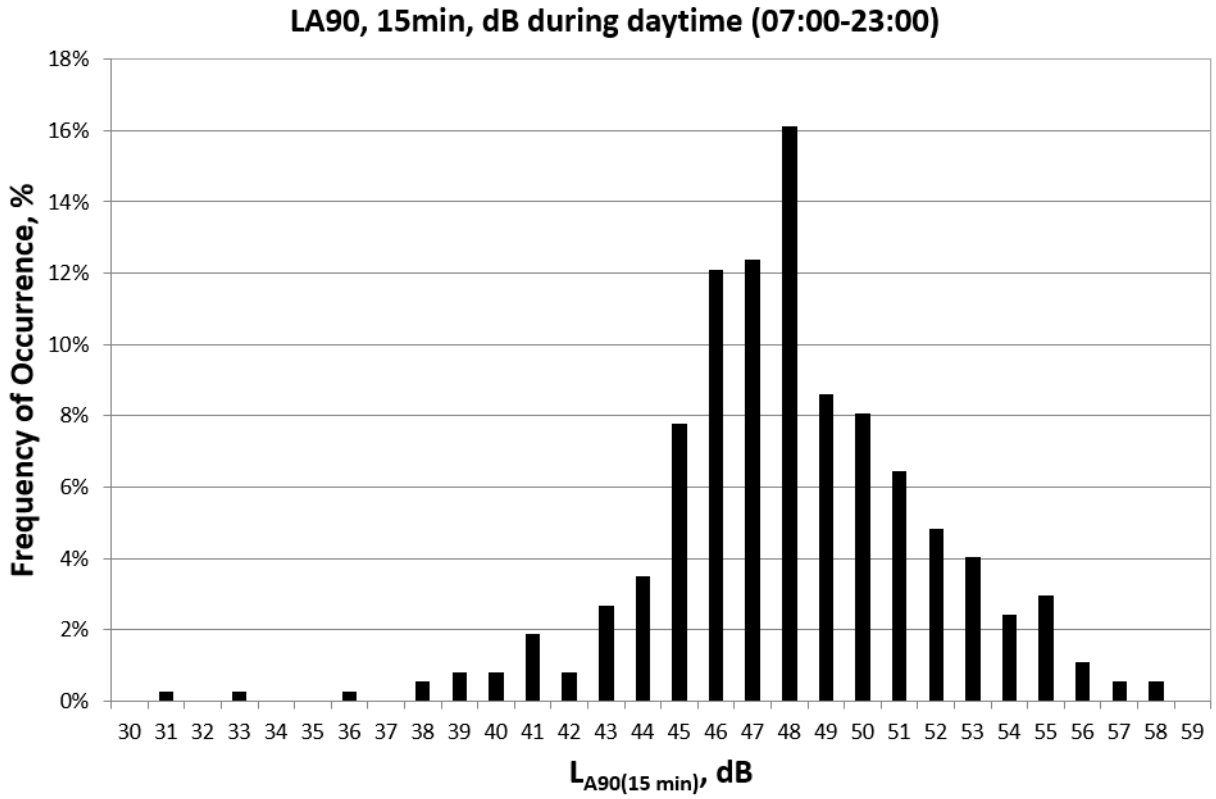
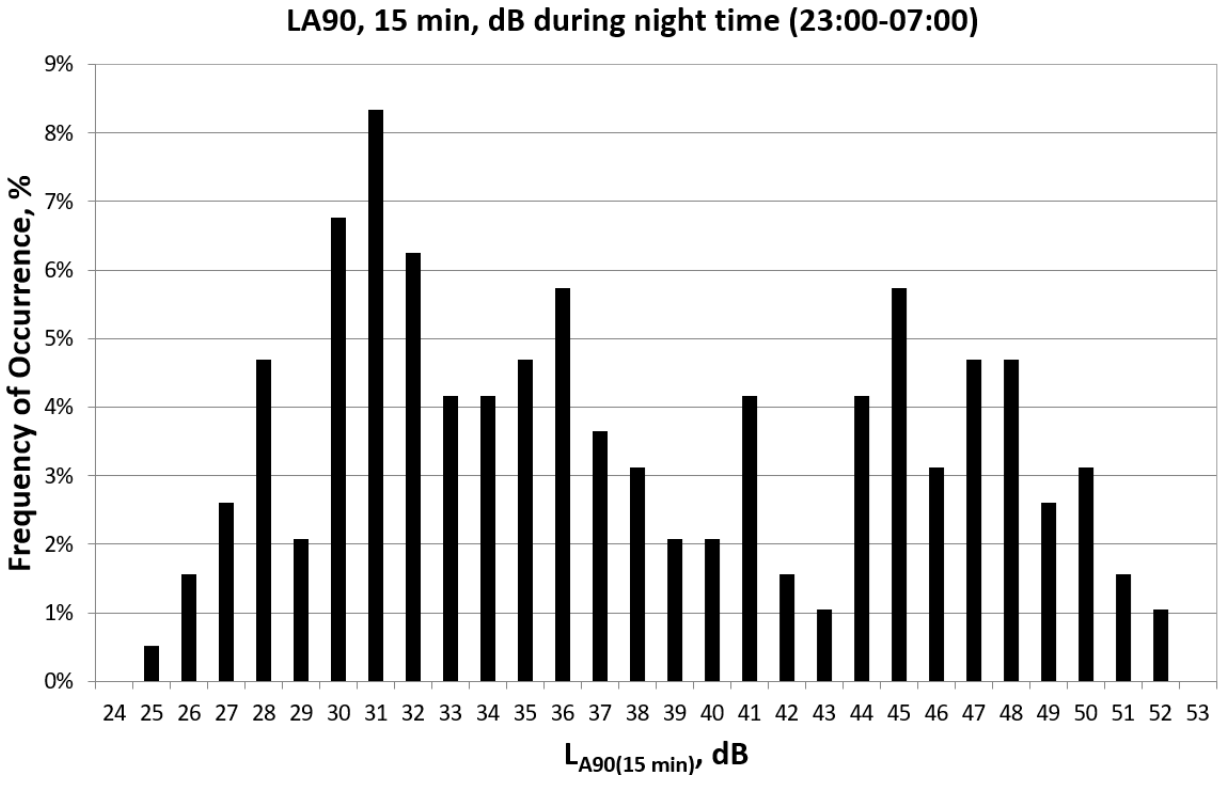


Figure 10 - Histogram of Night Time $L_{A90,\ 15\ Min}$, dB, Measured During Night Time at Measurement Position 3



B.4 Predicted acoustic footprint

Figure 11 - Predicted operational acoustic footprint of the site during the day ($L_{Aeq,Tr}$ dB)

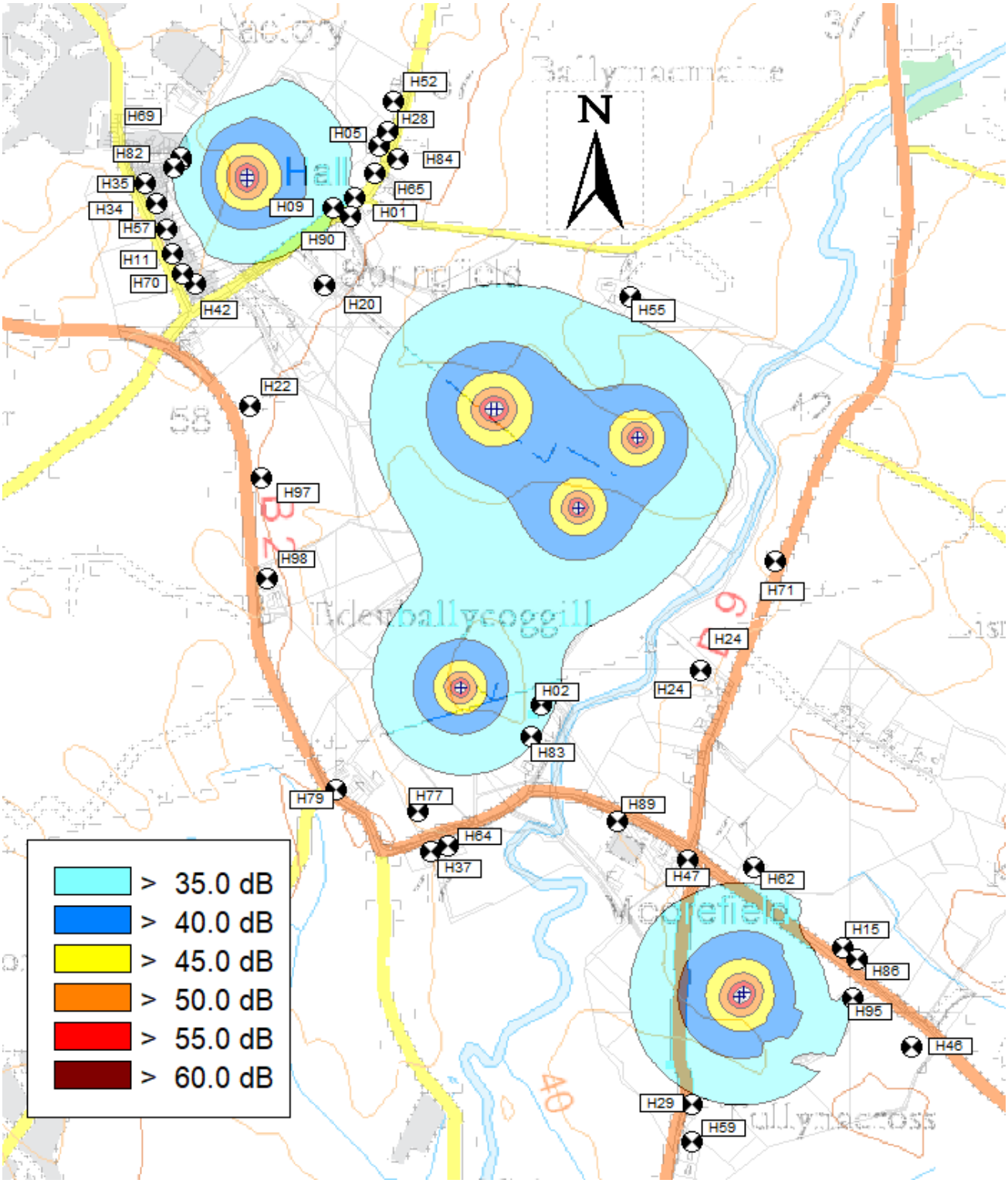
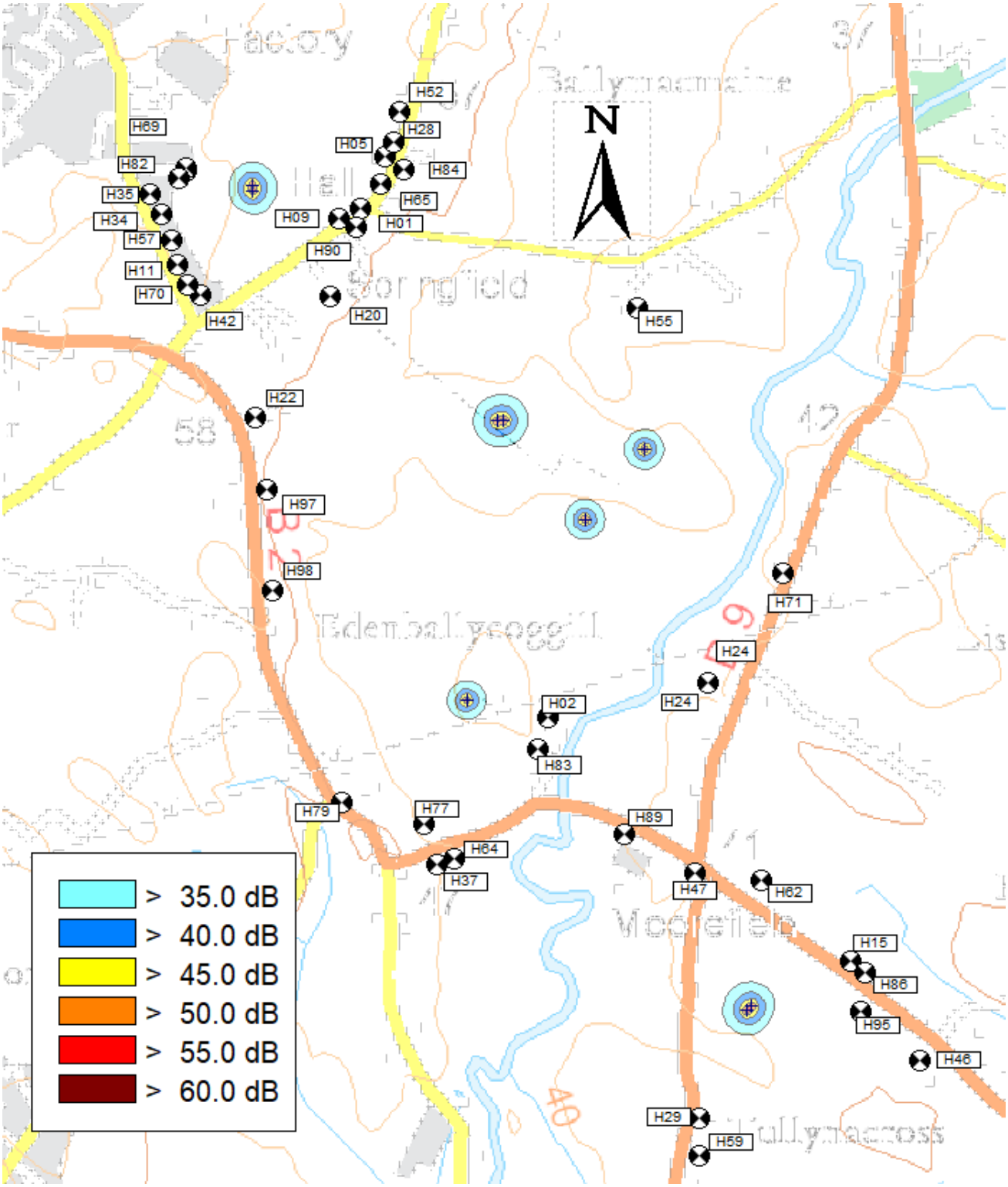


Figure 12 - Predicted operational acoustic footprint of the site at night ($L_{Aeq,Tr}$ dB)



Appendix C Photos

C.1 Background sound survey positions

Figure 13 - Background Sound Monitor at Location 1

Figure 14 - Background Sound Monitor at Location 2

Figure 15 - Background Sound Monitor at Location 3

Appendix D Suggested Planning Condition Wording

The facility shall be designed and operated to ensure that the rating level shall be less than the background sound level plus 5 dB(A) during the day and at night outside the nearest residential properties (as identified in RES report 05215-6581126 dated 04/10/2023) when determined in accordance with BS 4142:2014+A1:2019.