



Assessment of Acoustic Impact for the Proposed Coolshamrock 110 kV Substation.

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Revision History

Issue	Date	Author(s)	Nature & Location of Change	Reference
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CONTENTS

1.0	INTRODUCTION & SCOPE	1
2.0	METHODOLOGY	1
2.1	<i>Propagation</i>	1
2.2	<i>Assessment</i>	1
3.0	ASSESSMENT	2
3.1	<i>Assessment of the substation</i>	2
3.2	<i>Cumulative assessment of the substation and solar site</i>	3
4.0	CONCLUSIONS	3
APPENDIX A - EXPERIENCE & QUALIFICATIONS		4
APPENDIX B - FIGURES		5

1.0 INTRODUCTION & SCOPE

This report contains an assessment of the acoustic impact of the proposed 110 kV Coolshamrock substation. 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 predicting sound levels due to the proposed development in order to assess whether they meet the relevant limits.

2.0 METHODOLOGY

2.1 Propagation

The ISO 9613-2¹ propagation model shall be used to predict the specific sound levels due to the proposed development at nearby 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 4 m receiver height shall be used. Flat terrain shall be assumed and the effect of surface features such as buildings, trees and the solar panels shall not be included in the model. There is a degree 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 experienced in practice.

2.2 Assessment

The Guidance Note for Noise Action Planning², issued by the Environmental Protection Agency in 2009, refers to guidance produced under the auspices of the World Health Organisation (WHO)³. The Guidelines for Community Noise recommend sound levels intended to minimise health impacts in specific environments.

At dwellings the WHO Guidelines for Community Noise recommend that outside sound levels should not exceed 45 dB L_{Aeq} so that people may sleep with the windows open and not be disturbed. During the daytime the sound level should not exceed 50 dB L_{Aeq} to protect the majority of people from being moderately annoyed. The predicted sound levels due to the proposed development shall be assessed against these limits.

In addition to the Guidelines for Community Noise the WHO subsequently published the Night Noise Guidelines⁴. These guidelines are described as complementary to the Guidelines for Community Noise and recommend a limit of 40 dB $L_{night, outside}$. This is a yearly average night time sound level so could potentially be exceeded on some nights of the year such that it isn't necessarily inconsistent with the Guidelines for Community Noise if the sound levels do not exceed 45 dB L_{Aeq} on those nights. The predicted sound levels from the proposed development shall also be assessed against the limit recommended by the Night Noise Guidelines.

¹ "Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation", International Organisation for Standardisation 1996

² "Guidance Note for Noise Action Planning", Environmental Protection Agency, July 2009

³ "Guidelines for Community Noise", World Health Organisation, March 1999

⁴ "Night Noise Guidelines for Europe", World Health Organisation, 2009

3.0 ASSESSMENT

3.1 Assessment of the substation

The main source of sound within the proposed development is the 110 kV grid transformer located in the substation compound.

Acoustic emission data for the proposed equipment is detailed in Table 1. The data corresponds to the maximum acoustic emission for the grid transformer 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 isn't operating at maximum capacity.

Table 1 - Acoustic Emission Data

Equipment	Sound Pressure Level at 1m, dB L _{Aeq}
Grid Transformer	82

Predicted sound levels at nearby properties are detailed in Table 2. An illustrative sound footprint for the proposed development is provided in Figure 1 (see Appendix B). The maximum predicted sound level due to the proposed development is 25 dB L_{Aeq}.

Table 2 - Predicted Sound Pressure Levels at Nearby Properties

House ID	ITM X, m	ITM Y, m	Prediction, dB L _{Aeq}
H15	540345	674123	22
H32	539888	675269	17
H55	540587	674819	17
H79	539499	675009	20
H98	538984	674463	21
H102	539486	673896	25

The limits recommended by the WHO Guidelines for Community Noise are met by significant margins of 25 dB(A) during the day and 20 dB(A) at night. The limit recommended by the WHO Night Noise Guidelines is met by a margin of 15 dB(A), noting that this is a conservative assessment as the maximum predicted sound level is being compared to an annual average limit.

A level of conservatism, in the form of propagation model settings which are expected to result in predicted sound levels greater than those experienced for the majority of the time in practice, has been built into the assessment to compensate for the potential impact of uncertainty.

3.2 Cumulative assessment of the substation and solar site

The main sources of sound within the development are the 110 kV grid transformer located in the proposed substation along with eight solar inverters and associated transformers located at four inverter hardstandings in the solar site. The inverters are assumed to be continuously operating as a worst case.

Acoustic emission data for the equipment is detailed in Table 3.

Table 3 - Acoustic Emission Data

Equipment	Sound Pressure Level at 1m, dB L _{Aeq}
Solar Inverter & Transformer	79
Grid Transformer	82

Predicted sound levels at nearby properties for the cumulative effect of the Coolshamrock solar site and grid transformer are detailed in Table 4. An illustrative sound footprint for the proposed development is provided in Figure 2 (see Appendix B). The maximum predicted sound level due to the proposed development is 30 dB L_{Aeq}.

Table 4 - Predicted Sound Pressure Levels at Nearby Properties

House ID	ITM X, m	ITM Y, m	Prediction, dB L _{Aeq}
H15	540345	674123	28
H32	539888	675269	26
H55	540587	674819	25
H79	539499	675009	28
H98	538984	674463	26
H102	539486	673896	30

The limits recommended by the WHO Guidelines for Community Noise are met by significant margins of 20 dB(A) during the day and 15 dB(A) at night. The limit recommended by the WHO Night Noise Guidelines is met by a margin of 10 dB(A), noting that this is a conservative assessment as the maximum predicted sound level is being compared to an annual average limit.

The predicted sound levels due to the proposed development are low enough that sound levels from other sources would need to be significantly (i.e. ≥ 10 dB) greater in order for the limits recommended by the WHO to be exceeded. In this hypothetical scenario the sound levels due to the proposed development would be insignificant in comparison to those from other sources and therefore would not contribute meaningfully to any exceedance of the limit.

A level of conservatism, in the form of propagation model settings which are expected to result in predicted sound levels greater than those experienced for the majority of the time in practice, has been built into the assessment to compensate for the potential impact of uncertainty.

4.0 CONCLUSIONS

The assessments of the acoustic impact of the proposed Coolshamrock 110 kV substation and cumulative proposed 110 kV substation and solar site have been undertaken. The results show that relevant limits would be met during both day and night-time periods.

APPENDIX A - EXPERIENCE & QUALIFICATIONS

Authors:

Name	Peter Brooks
Experience	Senior Acoustic Analyst, Renewable Energy Systems, 2022-Present Acoustic Consultant, Arcus Consultancy Services, 2021-2022 Director, 343 Acoustics, 2019-2021 Lead Acoustic Engineer, Tymphany, 2017-2019 Research and Development Engineer, SEAS Fabrikker, 2014-2017 Acoustic Engineer, Premium Sound Solutions, 2011-2013
Qualifications	AMIOA, Associate Member of the Institute of Acoustics PGCert Environmental Acoustics, University of Salford BSc (Hons) Audio Technology, University of Salford

Name	Amber Binney
Experience	Junior Acoustic Analyst, Renewable Energy Systems, June 2023-Present
Qualifications	SMIOA, Student Member of the Institute of Acoustics BEng, 1 st & 2 nd years, Acoustical and Audio Engineering, University of Salford

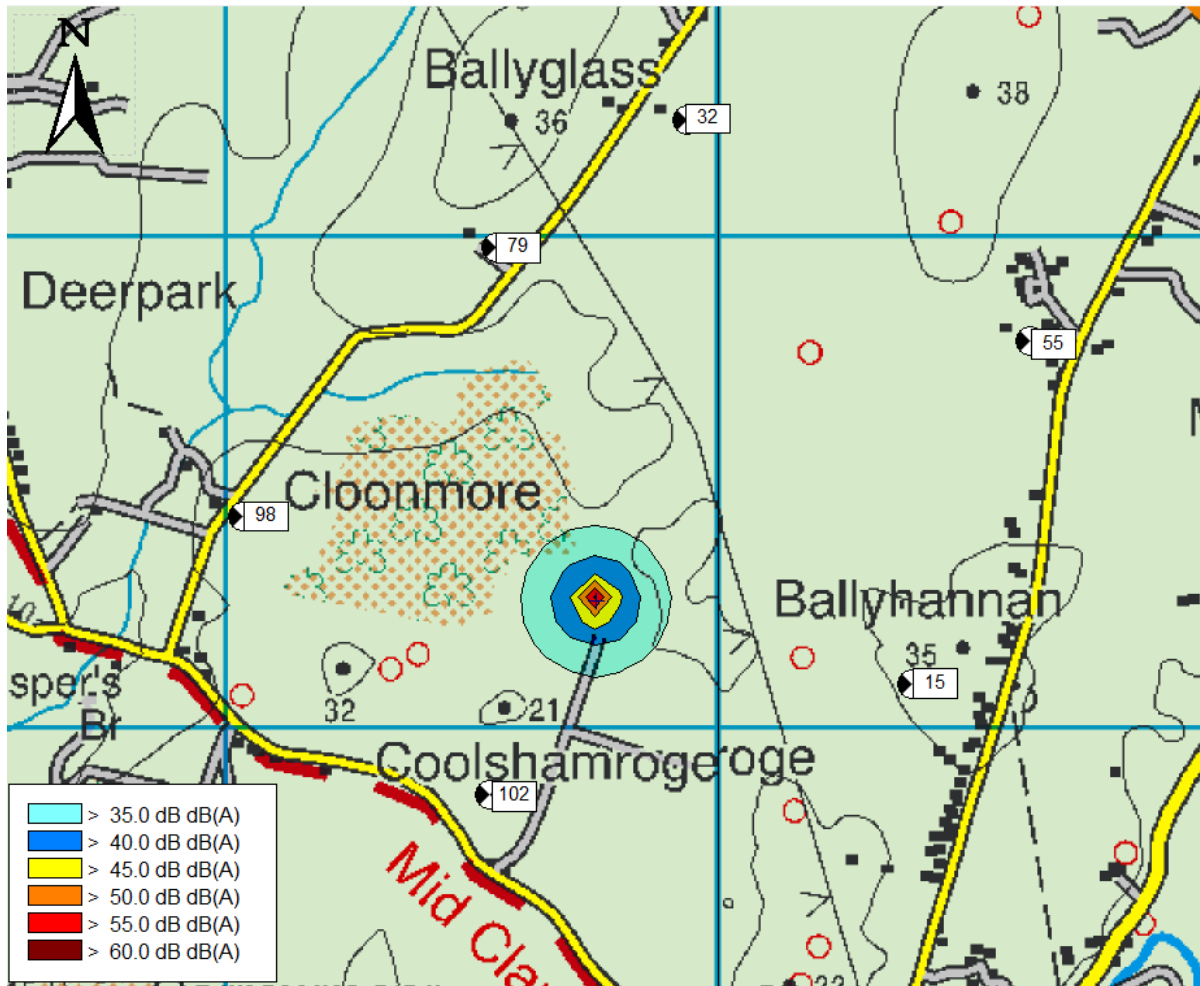
Checker/Approver:

Name	Mike Craven
Experience	Senior Acoustic Analyst, Renewable Energy Systems, 2023-Present Principal Acoustic Consultant, Hayes McKenzie Partnership Limited (HMPL), 2019-2022 Senior Acoustic Consultant, HMPL, 2013-2019 Acoustic Consultant, HMPL, 2011-2013 Acoustic Consultant, URS/Scott Wilson, 2008-2011 Acoustic Consultant, HMPL, 2004-2008
Qualifications	MIOA, Member of the Institute of Acoustics BSc Audio Technology, University of Salford

APPENDIX B - FIGURES

Figure 1 - Predicted Sound Footprint

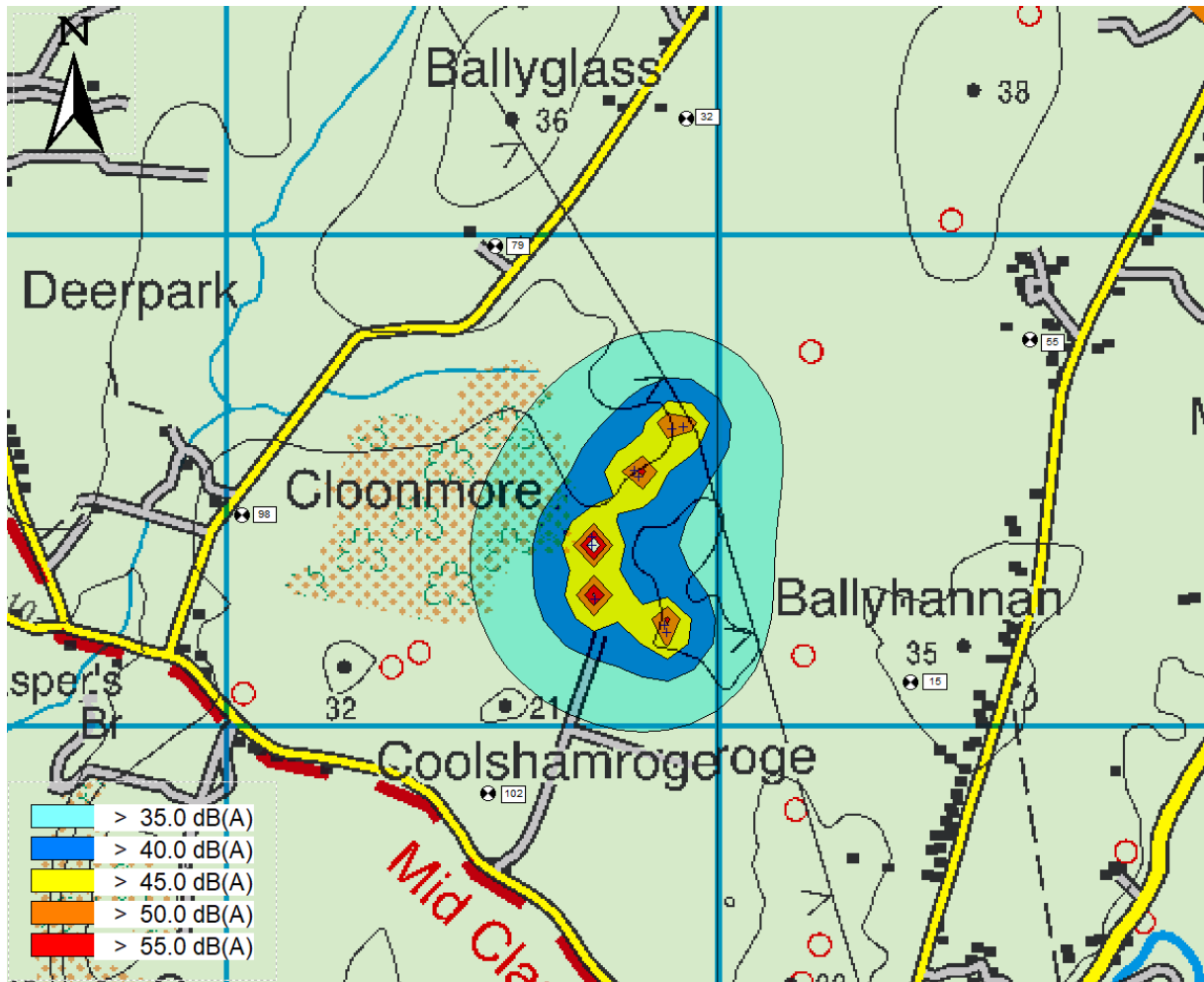
The L_{Aeq} descriptor has been used
Grid intervals at 1 km



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Figure 2 - Cumulative Predicted Sound Footprint

The L_{Aeq} descriptor has been used
Grid intervals at 1 km



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