# 8

# Noise

## Introduction

10.10 This Chapter provides an updated assessment of the expected sound levels resulting from the operation of the revised Proposed Development on neighbouring residents.

10.11 An assessment of the cumulative sound levels resulting from the Proposed Development operating at the same time as various other planned, consented and operational developments in the vicinity of the site is also provided.

10.12 The Chapter also addresses comments made as part of a consultation response provided by Mid & East Antrim Borough Council (MEABC) in relation to Chapter 10 of the original EIA Report.

10.13 The assessment provided herein incorporates minor amendments to the prediction methodology for the purposes of assessing cumulative impacts due to newly planned / consented development in the area; provides further rationale and narrative as to the assessment approach; provides revised criteria for assessing overall cumulative noise levels; incorporates revised proposed condition noise limits for the Unshinagh scheme (based on the predicted noise levels from the scheme and with due regard to the resultant cumulative operational noise levels).

10.14 This chapter is supported by the following:

- FEI Figure 10.1 – Predicted Noise Footprint due to Proposed Wind Farm;
- FEI Technical Appendix 10.1 - Assessment of Energy Storage Facility;
- FEI Technical Appendix 10.2 – Charts; and
- FEI Technical Appendix 10.3 – Suggested Planning Conditions.

10.15 The Technical Appendices 10.2-10.6 supporting the original acoustic assessment within EIA Report May 2022 remain applicable to this chapter.

10.16 Figures and Technical Appendices are referenced in the text where relevant.

### Statement of Authority

10.17 This assessment has been undertaken by Renewable Energy Systems Ltd (RES) (hereafter referred to as 'the Applicant'), with two in-house Members of the Institute of Acoustics involved in its production. The Applicant has undertaken acoustic impact assessments for every one of its UK wind farm development applications since 2000. The Applicant has also conducted acoustic assessments and reported to several local planning authorities on operational wind energy projects, including taking measurements on newly constructed wind farms, to ensure compliance with planning conditions.

## Scope of Further Environmental Information

10.18 To ensure adequate assessment of the operational noise from the revised Proposed Development, the following steps have been taken, in accordance with relevant guidance detailed in Chapter 10, Paragraphs 10.17 to 10.28 of the EIA Report May 2022.

- The baseline noise conditions at each of the nearest residential properties to the Proposed Development were established by way of representative background noise surveys which are supplemented by data obtained from documents provided for other consented development in the area;
- The assessment criteria are derived appropriately in relation to the background noise levels explained above;
- The levels at the nearest residential properties from the operation of the Proposed Development are predicted using an appropriate sound propagation model which adopts the assumptions specified within the GPG. The models considers the locations of the wind turbines; the intervening terrain; and the stated noise emission characteristics of the wind turbines; and,
- The assessment compares the predicted wind farm noise levels with the assessment criteria. Significant effects would not be expected if the predicted noise levels are less than the ETSU-R-97 limits and significant where predicted levels are above the limits. In the rare instances where wind farm noise levels are above the relevant criteria, suitable controls are suggested in the form of appropriate planning condition noise limits which can be met via a precautionary curtailment strategy.

10.19 All methodology relating to construction noise is described in full in Chapter 10, Paragraph 10.51 of the original EIA Report and remain relevant to this chapter. The only changes to the construction program will be for a reduced number of activities, plant and vehicles due to the reduced number of turbines to be constructed. Therefore, no further assessment has been undertaken for construction noise as the predicted noise levels for construction activities will be less than the values presented in the original EIA Report which represent a conservative basis of assessment.

## Legislative Framework & Guidance

10.20 The assessment of the revised Proposed Development is assessed in line with guidance set out in Chapter 10, Paragraphs 10.17 to 10.28 of the EIA Report May 2022. There have been no relevant changes in planning policy or guidance which will affect the outcome of the assessment since the original application was submitted.

10.21 The Strategic Planning Policy Statement[3] (SPSS), Edition 2 (2025) continues to recognise ETSU-R-97 and the IOA (GPG)[4] as standard methodology for the assessment and rating of noise from wind energy developments in Northern Ireland.

[3] The Strategic Planning Policy Statement (SPPS), Planning for Sustainable Development, Department for Infrastructure, Edition 2, 2025.

[4] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise', Institute of Acoustics, May 2013. Available at: https://www.ioa.org.uk/publications/wind-turbine-noise

## Consultation

10.22 Details of the consultation undertaken to inform this FEI are outlined in **FEI Table 10.1.**

**FEI Table 10.1 - Acoustic Assessment Consultation**

| Consultee | Nature and Purpose of Consultation | Response | Date of Consultation |
|---|---|---|---|
| Mid & East Antrim Borough Council (MEABC) | Email to MEABC detailing the proposed assessment methodology for the revised Proposed Development and supporting FEI. Confirmation was sought on the suitability of the proposed methodology and which cumulative sites in the vicinity of the Proposed Development should be included in the cumulative assessment.<br>It was stated that planning permissions for some of the cumulative wind turbines which were assessed in the original acoustic assessment were now over 5 years old and as such, those permissions have 'timed out'. It was proposed that the following single turbines be included in the cumulative assessment (Planning Ref: LA02/2021/0604/F, LA02/2021/0606/F, G/2011/0550/F and LA02/2023/1884/F). | No response received | 20/08/2025 |
| MEABC | A follow up email was sent to MEABC for confirmation that the proposed methodology was acceptable. | The EHO from MEABC responded to confirm that the original email had been forwarded to their line manager, for action. | 04/09/2025 |
| MEABC | Further email sent to MEABC to confirm acceptance of the proposed acoustic assessment. | No response received | 31/10/2025 |

10.23 MEABC provided a consultation response[5] to the EIA supporting the original planning application (LA02/2021/1205/F) for the Proposed Development. The document included

[5] MEABS Environmental Services, Consultation response in respect of Planning Application (LA02/2021/1205/F), 1st July 2022, Dr Chris Jordan

a review of the original noise assessment provided in Chapter 10 of the EIA Report May 2022 and outlined a number of points to be addressed. These are listed and responded to below.

a) Reliance on Met Office Radar Data – MEABC stated:

- *Paragraph 10.62 states, "The rain gauge became blocked during the survey so Met Office Radar data has been used between 20/05/21 – 28/05/21.*
- *Paragraph 2.7.2 of the Institute of Acoustics 'A Good Practice Guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise' (IOA GPG) states, "Other sources such as Met Office weather radar may provide rainfall information, but must be used with care as it may provide only a limited spatial or temporal coverage of the site."*
- *It is recognised that technology may have improved since the drafting of the IOA GPG approximately a decade ago, however, it is requested that the applicant confirm the robustness of the Met Office Radar data relied upon."*

RES Response:

- Met radar data was purchased by RES from the Met Office on 15th June 2021 (Met Office Order Ref: 042531/GH/Q2). Details of the Service: The provision of the hourly rainfall totals from radar, for the period 26/04/2021 to 11/06/2021, centred on location of National Grid Reference: 325939E, 414912N.
- The supplied data was checked and QC'd by a Senior Technical Analyst & Wind Resource Manager at RES and clarifications were sought via emails on the 28th & 29th June 2021, determining that the timestamp format is "end" and that the entry of -999 means the data is missing.
- The rain data was further analysed by a RES Acoustic Specialist to determine the time period where the onsite rain gauge was blocked. The purchased Met Office data was validated against the onsite data and merged to give a complete rainfall profile for the survey period.
- RES is confident that the quality of the rainfall data purchased from the Met Office is fit for purpose and can be relied upon to supplement the data collected via the rainguage.

b) Residential Properties – MEABC stated:

- *From reviewing grid co-ordinates as stated within Table 10.8 'Location of Residential Properties and Distances to Nearest Proposed Turbine' MEABC PPHWB was unable to identify a number of properties on either OSNI, the Planning Portal NI or from a site visit. For example:*

| *House ID* | *House Name* | *Co-ordinates* | |
|---|---|---|---|
| | | *X (m)* | *Y (m)* |
| *H9* | *68 Slane Road* | *326194* | *412894* |
| *H37* | *H37* | *323714* | *411918* |
| *H45* | *H45* | *326574* | *412194* |

*In addition, it is noted that planning permission LA02/2020/0251/O + LA02/2021/0115/RM for a residential dwelling was not considered (currently under construction). This dwelling may be the nearest to cumulative turbine C1 (G/2013/0377/F) and hence the controlling property.*

RES Response:

- The nearest residential properties have been reviewed since the original application, the most up to date address database has been used for identifying residential properties. This, combined with the latest aerial imagery and site visits by RES employees have ensured the most robust data. The house layout now includes the additional property referenced in the consultation response (H42).

c) Sound Power Level of Candidate Wind Turbine – MEABC stated:

- *The Applicant has based predicted noise impacts on a candidate wind turbine, a Vestas V136 4.2MW with a hub height of 112m. The Applicant is requested to provide a copy of the manufactures data as referenced "Performance Specification V136- 4.0/4.2 MW 50/60 Hz, Vestas, Document ID: 0067-7065 V06, 2018-05-02."*

RES Response:

- A copy of the manufactures data as referenced will be supplied. The document will be submitted separately to this report to ensure confidentiality of the document and for non-disclosure agreement (NDA) requirements.

d) Construction Noise – MEABC stated:

- *It is noted that predicted construction noise levels temporarily exceed 65 dB(A) at H19 and H25. Paragraph 10.1019 notes, "the temporary exceedance of the 65 dB(A) daytime target level … can be mitigated by the use of acoustic barriers if necessary." MEABC PPHWB would request that the Applicant provide a construction noise monitoring protocol which will regularly monitor noise levels at H19 and H25 during periods when construction noise is likely to be highest. If construction noise levels exceed 65 dB(A), mitigation measures should be put in place to reduce the noise impact to below 65 dB(A).*

RES Response:

- The construction noise assessment indicates that predicted noise levels may temporarily exceed 65 dB(A) at the nearest residential property, however the modelling is very conservative and assumes all major construction plant operating concurrently, at maximum sound power levels, and located at the closest point on the property boundary. Such conditions are extremely unlikely to occur in practice, as construction activities are phased, plant is dispersed across the working area, and equipment rarely operates simultaneously at full output. Consequently, actual noise levels experienced at the property will be considerably lower than those predicted under the particularly conservative scenario provided within the EIA supporting the original application. Nevertheless, in the event of any noise-related issues occuring in practice, an investigation will be carried out to understand the scale of the impact and if necessary, appropriate

noise control measures will be explored further. If substantiated noise complaints persist after the implementation of further mitigation measures, noise monitoring would be undertaken at the property to verify construction noise levels and ensure that the 65 dB(A) threshold is not exceeded.

e) Cumulative Noise Impacts – MEABC stated:

- *Table 10.25 presents "A-weighted Sound Power Levels (dB(A) re1pW) plus Uncertainty for Single Turbines". With respect to cumulative wind turbine 'A1' G/2012/0219/F – Vergnet GEV 32/275, it is noted that the sound power level data presented in Table 10.25 does not appear to include a correction for uncertainty. MEABC PPHWB are also aware that complaints have been received with respect to excessive amplitude modulation from Vergnet GEV 32/275 turbines due to the downwind nature of the turbine design. It is noted that no comment or correction for the potential of excessive amplitude modulation for the Vergnet GEV 32/275 has been presented within the cumulative impact assessment. With respect to cumulative wind turbine 'B1' G/2014/0227/F – Norwin N29, it is noted that the frequency spectrum as presented in Table 10.26 does not mirror that of the noise impact assessment submitted in support of planning application G/2014/0227/F. However, planning permissions from cumulative wind turbines A1, B1 and C1 are now over 5 years old and hence unless a material start has been made, such permissions have 'timed out'. The applicant may wish to review the cumulative impact assessment further to confirming if any cumulative wind turbines have 'timed out'.*

RES Response:

f) Following a review of the cumulative wind turbine data, it was noted that planning permission for turbines A1 and B1 has expired. Consequently, these turbines have been removed from the assessment, and no further response is required in relation to this query.Battery Storage – MEABC stated:

- *Appendix 10.1 presents the acoustic assessment with respect to the proposed BESS. Predicted noise impacts note a noise level significantly under the background noise level and hence 'low impact'. In terms of human health impacts as a consequence of a fire, the Applicant's risk assessment confirms, "The nearest residential dwelling to the BESS at Unshinagh is 1295m mitigating any risk to local properties or their occupiers".*

RES Response:

- No response or action required.

## Methodology

### Baseline Determination

10.24 The methodology for establishing baseline conditions specific to the Proposed Development is described in full in Chapter 10, Paragraphs 10.31 - 10.36 of the EIA Report May 2022 and remains relevant to this FEI.

10.25 Baseline information has also been taken from documents supporting the planning applications for the neighbouring consented single turbine (C1) at Carnlough Road (Planning Ref. LA02/2023/1884/F). This information has been used to inform the cumulative assessment.

### Operational Noise Limits

10.26 The methodology for deriving the relevant noise limits is described in full in Paragraphs 10.45 - 10.50 of Chapter 10 - EIA Report May 2022 and remains relevant to this FEI.

10.27 ETSU-R-97 states that different limits should be applied during daytime and night-time periods. The daytime limits are intended to preserve outdoor amenity, while the night-time limits are intended to minimise sleep disturbance. The general principle is that the noise limits should be based on existing background noise levels, except where these are considered to be low, in which case a fixed limit may be applied. The limits are summarised at **FEI Table 10.2**, where $L_B$ is the average background $L_{A90,10min}$ as a function of wind speed.

10.28 During daytime periods and at low background noise levels, a lower fixed limit of 35-40 dB $L_{A90}$ is applicable. The exact value is dependent upon factors including the number of nearby dwellings, the effect of the noise limits on energy produced and the duration and level of exposure.

**FEI Table 10.2 - Permissible Noise Criteria**

| Time of Day | Definition |
|---|---|
| Quiet Daytime | 35-40 dB(A) for $L_B$ less than 30-35 dB(A)<br>$L_B$ + 5 dB, for $L_B$ greater than 30-35 dB(A) |
| Night-time | 43 dB(A) for LB less than 38 dB(A)<br>LB + 5 dB, for LB greater than 38 dB(A) |

### Noise Propagation

10.29 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[6], this being identified as most appropriate for use in such rural sites[7].

10.30 The methodology for modelling noise propagation is described in full in Chapter 10, Paragraphs 10.37 - 10.44 of the EIA Report May 2022 and remains relevant to this FEI.

10.31 Additionally, rather than making a conservative assumption that properties are always downwind of the wind farm, a more detailed assessment, which incorporates the effects of wind direction has been undertaken. This accounts for the fact that noise levels at a property will be less when the property is crosswind or upwind of the development. The

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

[7] A Critical Appraisal of Wind Farm Noise Propagation', ETSU Report W/13/00385/REP, January 2000

directional attenuation factors applied, as shown in **FEI Table 10.3**, are consistent with the recommendations of the IOA GPG, with reductions in noise of around 2 dB when a receiver is crosswind, and up to 10 dB when a receiver is upwind of a particular turbine. The IOA GPG states that upwind reductions in level will only come into play gradually at distances of between 5 and 10 tip heights. As a result, the stated attenuation factors applied have been adjusted by the distance between the sources and receivers accordingly.

**FEI Table 10.3 - Directional Attenuation**

| Direction offset from downwind (°) | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directional attenuation factor, dB | 0 | 0 | 0 | 2 | 6.7 | 9.3 | 10 | 9.3 | 6.7 | 2 | 0 | 0 |

10.32 The locations of the turbines which make up the Proposed Development, and four neighbouring single turbine developments – Planning Ref: LA02/2023/ 1884/F (consented), Planning Ref: LA02/2021/0604/F (operational), Planning Ref: LA02/2021/0606/F (operational) and Planning Ref: G/2011/0550/F (operational) are provided in **FEI Table 10.4** and **FEI Table 10.5** and shown in **FEI Figure 10.1**. The co-ordinates for these cumulative sites are taken from publicly available information.

10.33 Since the submission of the original assessment the planning consents for turbines A1, B1 and F1 as detailed in Table 10.22 of the EIA Report May 2022 are now over 5 years old and such permissions have 'timed out' and have not been included in this revised assessment as a result. The remaining turbines, known as C1, D1, E1 and G1, are considered in this assessment.

10.34 The status of turbine C1 has changed since the original assessment for Unshinagh wind farm. An updated planning submission (Planning Ref. LA02/2023/1884/F) for turbine C1, submitted in October 2023, has since gained planning consent.

10.35 The Noise Impact Assessment Report[8] (NIAR) submitted in support of the above application did not include an assessment of the turbine operating at the same time as the Proposed Development, despite Section 2.1 of the NIAR stating that "*A cumulative noise impact assessment has also been undertaken to assess all existing, permitted and proposed wind turbines within 2 Km of the proposed Directwind EWT DW54 900 kW 54m rotor diameter wind turbine*". Several of the Unshinagh turbines were within a 2km radius of turbine C1 and, since the proposed Unshinagh wind farm was ahead of the turbine C1 application in the planning queue, it would be normally be expected that a cumulative assessment be undertaken and reported under these circumstances.

[8] Single Wind Turbine & BESS Development, Carnlough Road, Broughshane. Noise Impact Assessment Report. Prepared by AONA Environmental Consulting Ltd., October 2023

**FEI Table 10.4 - Updated Location of Proposed Wind Turbines**

| Wind Turbine | Co-ordinates (EPSG 29902) | | Wind Turbine | Co-ordinates (EPSG 29902) | | Wind Turbine | Co-ordinates (EPSG 29902) | |
|---|---|---|---|---|---|---|---|---|
| | X (m) | Y (m) | | X (m) | Y (m) | | X (m) | Y (m) |
| T1 | 326489 | 416258 | T5 | 325948 | 415318 | T10 | 325003 | 413201 |
| T3 | 326190 | 415813 | T6 | 325717 | 415843 | T11 | 324561 | 412887 |
| T4 | 325672 | 416289 | T8 | 325114 | 413941 | T14 | 325503 | 415369 |

**FEI Table 10.5 - Location of Neighbouring Single Turbines**

| Wind Turbine ID | Planning Reference | Co-ordinates (EPSG 29902) | |
|---|---|---|---|
| | | X (m) | Y (m) |
| C1 | LA02/2023/1884/F | 324007 | 411517 |
| D1 | LA02/2021/0604/F | 328344 | 412221 |
| E1 | LA02/2021/0606/F | 328199 | 412208 |
| G1 | G/2011/0550/F | 322599 | 409718 |

10.36 The locations of the nearest residential properties to the turbines have been determined by inspection of relevant maps, address databases and via site visits. More residential properties may have been identified but have not been considered critical to this assessment and/or may be adequately represented by another residential property. The locations considered are listed in **FEI Table 10.6** and are also shown in **FEI Figure 10.1**.

**FEI Table 10.6 - Updated Location of Residential Properties**

| House ID | House Name | Co-ordinates (EPSG 29902) | | Distance (m) | Nearest Turbine |
|---|---|---|---|---|---|
| | | X (m) | Y (m) | | |
| H5 | 22 Slane Road | 325142 | 411868 | 1173 | T11 |
| H6 | 50 Killycarn Road | 323688 | 411880 | 1333 | T11 |
| H7 | 54 Killycarn Road | 323827 | 412064 | 1103 | T11 |
| H10 | 57 Slane Road | 326493 | 412942 | 1512 | T10 |
| H13 | 64B Slane Road | 326575 | 413545 | 1513 | T8 |
| H16 | 72A Slane Road | 326958 | 413839 | 1791 | T5 |
| H17 | 72 Slane Road | 326948 | 413945 | 1699 | T5 |
| H21 | 147A Ballymena Road | 327226 | 414631 | 1451 | T5 |
| H23 | 4 Gartford Lane | 326933 | 415144 | 1000 | T3 |
| H31 | 25 Drumourne Road | 327476 | 416927 | 1192 | T1 |
| H33 | 20 Drumourne Road | 327289 | 417329 | 1337 | T1 |
| H34 | Ballymena Road | 327213 | 415466 | 1073 | T1 |
| H35 | Ballymena Road | 327415 | 415880 | 1000 | T1 |
| H42 | Carnlough Road | 323975 | 411133 | 1849 | T11 |
| H43 | 246 Carnlough Road | 323789 | 411238 | 1821 | T11 |

| House ID | House Name | Co-ordinates (EPSG 29902) | | Distance (m) | Nearest Turbine |
|---|---|---|---|---|---|
| | | X (m) | Y (m) | | |
| H60 | 6 Slane Road | 324382 | 411409 | 1489 | T11 |

10.37 The candidate turbine model for the Proposed Development is the Vestas V136 4.2MW, with a hub-height of 112 m and serrated trailing edge (STE) blade modifications. The turbine model for the consented single turbine, C1, is the EWT 900 kW D54 with a hub height of 40 m, the turbine model for the operational single turbines D1 & E1 is the Vestas V29, both with a hub-height of 30 m, the turbine model for the operational single turbine, G1, is the Aircon 10kW with a hub-height of 15 m.

10.38 The sound power information for the candidate turbine to be installed at Proposed Development is taken from the manufacturer's performance specification. The manufacturer has identified these values as warranted such that some margin may have already been incorporated. Nevertheless, and as a conservative measure, 2 dB has been added to the stated levels.

10.39 Furthermore, it is possible to run the V136 4.2MW turbine in a variety of operational modes which may be implemented for numerous parameters not limited to wind speed, direction and time. The source noise levels for a variety of the noise modes which could be implemented at the wind farm, including for the applied uncertainty discussed earlier, are shown in **FEI Table 10.7**. The overall sound power levels over a range of standardised 10 m height wind speeds for the turbine models considered as part cumulative assessment are also shown.

10.40 The source noise information for the turbines at each of the cumulative sites (C1, D1, E1 & G1) are taken from information supporting the various planning applications for each development and incorporate the relevant uncertainties stated for each.

10.41 **FEI Table 10.8** shows the octave band noise levels corresponding to the sound power levels at 8ms$^{-1}$ for each respective turbine model, as also based on manufacturer's specifications, as provided separately, and including for the relevant uncertainty.

**FEI Table 10.7 - Sound Power Levels, dB $L_{WA}$**

| Turbine | Standardised 10m Height Wind Speed, ms$^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Vestas V136 4.2MW - 112 m hub height** | | | | | | | | | | |
| Unrestricted | 93.8 | 97.5 | 102.5 | 105.6 | 105.9 | 105.9 | 105.9 | 105.9 | 105.9 | 105.9 |
| SO1 | 93.8 | 97.5 | 102.2 | 103.8 | 103.8 | 104.0 | 104.0 | 104.0 | 104.0 | 104.0 |
| SO2 | 93.8 | 97.5 | 101.1 | 101.4 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 | 101.5 |
| SO11 | 93.8 | 96.2 | 98.0 | 99.7 | 100.9 | 101.2 | 101.2 | 101.2 | 101.2 | 101.2 |
| SO12 | 93.8 | 96.6 | 99.6 | 101.5 | 101.9 | 101.9 | 101.9 | 101.9 | 101.9 | 101.9 |
| SO13 | 93.1 | 94.2 | 95.4 | 97.4 | 98.6 | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 |
| **Single Turbine Schemes** | | | | | | | | | | |
| EWT 900 kW D54 | 97.6 | 97.6 | 97.6 | 99.5 | 100.9 | 102.4 | 104.3 | 104.6 | 105.0 | 105.0 |
| Vestas V29 | 98.1 | 98.1 | 98.5 | 98.9 | 99.3 | 99.7 | 100.1 | 100.5 | 100.9 | 101.3 |
| Aircon 10kW | 80.0 | 80.0 | 80.8 | 81.6 | 82.4 | 83.2 | 84.0 | 84.8 | 85.6 | 86.4 |

**FEI Table 10.8 - Octave Band Sound Power Levels, dB $L_{WA}$**

| Turbine & (ID) | Overall dB, $L_{WA}$ | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Vestas V136 4.2MW | 105.9 | 87.0 | 94.6 | 99.2 | 101.0 | 99.9 | 95.9 | 89.0 | 79.2 |
| EWT 900 kW D54 (C1) | 102.4 | 82.1 | 89.5 | 95.5 | 97.4 | 96.4 | 92.6 | 87.9 | 80.3 |
| Vestas V29 (D1 & E1) | 99.7 | 78.4 | 85.7 | 90.5 | 95.3 | 94.3 | 91.6 | 83.6 | 73.0 |
| Aircon 10kW (G1) | 83.2 | 61.9 | 68.3 | 70.8 | 71.8 | 77.5 | 80.7 | 62.2 | 49.8 |

10.42 The turbine models are assumed not to have any tonal noise output that would attract a penalty at neighbouring residences as per the requirements of ETSU-R-97. Nevertheless, a warranty or guarantee would be obtained from the potential turbine manufacturer which limits the level of tonal noise associated with the operation of the individual turbines (or the site as a whole), should the site be granted planning consent, and a finalised turbine model is procured. This would also help to provide appropriate recourse with the turbine manufacturer should a tonal character be present in the noise generated by the site.

## Baseline Conditions

10.43 Chapter 10 of the EIA Report May 2022 provides full details as to the methodology and results of background noise surveys undertaken at various properties neighbouring the development.

10.44 **FEI Table 10.9 FEI Table 10.9** shows the derived average background noise levels over a range of standardised 10 m height wind speeds and for 'quiet' daytime (18:00 – 23:00 weekdays, 13:00 – 23:00 on Saturdays and 07:00 to 23:00 on Sundays) and night-time (23:00- 07:00) periods respectively. These tables are reproduced from Table 10.5 and Table 10.6 of the EIA Report May 2022. The levels are supplemented by background noise information submitted as part of planning applications related to the turbine known as C1 as detailed below.

10.45 An application for a single turbine approximately 360 m Northeast of 245 Carnlough Road, Broughshane was submitted in October 2013 (Planning Ref. G/2013/0377/F). A Noise Assessment[9] was undertaken in support of this application which included details of background noise monitoring undertaken near to 245 Carnlough Road (245 CR), from 25th October - 1st November 2014. The data was analysed in accordance with ETSU-R-97 and the IOA GPG. Although this turbine was originally gained planning consent, it was never constructed and consequently 'timed out' after 5 years. Information from this original application was used to inform the previous cumulative assessment for the Proposed Development.

10.46 A further single turbine application on the same parcel of land (Planning Ref. LA02/2023/1884/F) was submitted and consented in October 2023. The Noise Assessment[8] submitted in support of this application utilised the results of the background noise

[9] Noise Assessment, Proposed Single Wind Turbine 360m Northeast of 245 Carnlough Road, Broughshane. Prepared by KRM Acoustics, 26th November 2014

monitoring undertaken in support of the previous 2013 planning application discussed above.

10.47 The background noise survey was undertaken at a location to the south of the Proposed Development and the derived prevailing background noise levels are considered representative of the properties in the vicinity of C1 due to the relative proximity of this turbine to the neighbouring dwellings and the resultant dominating influence of noise from the turbine as compared with that from Proposed Development. As a result, the cumulative assessment presented here uses the background sound associated with the consented C1 turbine in place of the measured sound levels from survey location H6 (i.e. used as representative of H5, H6, H7, H42, H43 & H60, see **FEI Figure 10.1**). The values have been accepted by MEABC in their consideration of the single turbine and are considered appropriate for use here, as part of the cumulative assessment.

10.48 The assessments supporting turbine C1 applications do not expressly detail the prevailing background sound levels, they only detail the ETSU-R-97 limits for 4 $ms^{-1}$ - 12 $ms^{-1}$ based on the collected noise and wind monitoring data. As a result, RES has undertaken an analysis of the survey data presented in Appendix 3 of the noise report submitted in support of the original C1 application using the methods set out within ETSU-R-97 (i.e. using a 2$^{nd}$ order polynomial regression best fit trendline to determine the prevailing backgrounds sound levels over a range of measured 10 m height wind speeds for quiet daytime and night-time hours) to order to ensure the data is robust.

10.49 The resultant ETSU-R-97 noise limits align with those values presented at 4 $ms^{-1}$ – 12 $ms^{-1}$ in Table 5 of the report[8] for planning application LA02/2023/1884/F.

10.50 The wind speed information used for the C1 assessment works was taken from measurements directly made at 10 m height whereas typical assessments require the use of standardised 10 m height wind speed references. The IOA GPG states that *"...when a baseline noise survey has been referenced to measured 10 m data, it is necessary to apply corrections to account for wind shear effects"* and that *"...the background noise data can be corrected based on measured wind shear values – this involves shifting the background noise data to the right along the wind speed axis (increased wind speeds for a given background level)"*. Section 4.5.4 of the IOA GPG states that by applying a fixed correction to the background noise data the following factors would be added to the wind speed reference - *"1 m/s for turbine hub heights of up to 30 m, 2 m/s for hub heights of up to 60 m and 3 m/s for hub heights of more than 60 m"*. Since the C1 turbine has a proposed hub height of 40 m, the background noise data has been shifted to the right along the wind speed axis by 2 m/s (i.e. the measured sound levels at 1 m/s are now referenced to the 3 m/s and so on up to 12 m/s). The various assessments submitted in support of the C1 turbine applied a similar correction to the predicted noise levels rather than the prevailing background noise levels, essentially relating all results to directly measured 10 m height wind speeds, as an alternative basis of assessment.

10.51 The wind speeds range used for the assessment is for standardised 10 m height wind speeds of 3 to 12 $ms^{-1}$. Below these wind speeds, the turbines will not be operating or be at 'cut-in'. where rotational speeds will be such that the resultant noise impact is very low and no significant impacts would be expected. Above these wind speeds, as stated in ETSU-R-97, reliable measurements of background and turbine noise are difficult to make.

However, if a wind farm meets the noise criteria at the wind speeds presented, it is most unlikely that it would cause any greater loss of amenity at higher wind speeds due to increasing background noise levels masking wind farm generated noise.

**FEI Table 10.9 – Background Noise Levels, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Quiet Daytime** | | | | | | | | | | |
| H6 | 26.6 | 27.1 | 27.8 | 28.6 | 30.0 | 32.0 | 34.8 | 38.6 | 43.6 | 43.6 |
| H16 | 30.1 | 30.7 | 31.6 | 32.8 | 34.3 | 36.2 | 38.5 | 41.2 | 44.4 | 44.4 |
| H23 | 30.0 | 31.0 | 32.4 | 34.2 | 36.3 | 38.9 | 41.8 | 45.0 | 48.7 | 48.7 |
| H33 | 33.6 | 33.9 | 34.2 | 34.8 | 35.7 | 37.0 | 38.9 | 41.6 | 45.0 | 45.0 |
| 245 CR | 28.5 | 29.7 | 30.9 | 32.0 | 33.0 | 34.0 | 34.9 | 35.8 | 36.6 | 37.3 |
| **Night-time** | | | | | | | | | | |
| H6 | 21.0 | 21.6 | 22.5 | 23.9 | 25.5 | 27.6 | 29.9 | 32.7 | 35.8 | 35.8 |
| H16 | 25.6 | 26.0 | 27.0 | 28.5 | 30.5 | 32.9 | 35.7 | 38.6 | 41.7 | 41.7 |
| H23 | 27.1 | 27.7 | 29.1 | 31.0 | 33.4 | 36.2 | 39.2 | 42.4 | 45.6 | 45.6 |
| H33 | 26.8 | 27.6 | 28.9 | 30.6 | 32.7 | 35.0 | 37.4 | 40.0 | 40.0 | 40.0 |
| 245 CR | 28.3 | 29.5 | 30.6 | 31.5 | 32.4 | 33.2 | 34.0 | 34.6 | 35.1 | 35.6 |

10.52 The daytime and night-time noise limits presented in Table 10.13 and Table 10.14 respectively of the EIA Report May 2022 remain unchanged and are still relevant to this Chapter. The lower daytime, upper daytime and night-time noise limits, including the 245 Carnlough Road (245 CR) location, are reproduced and provided in **FEI Table 10.10.**

**FEI Table 10.10 – ETSU-R-97 Noise Limits, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Lower Daytime** | | | | | | | | | | |
| H6 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H16 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H23 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H33 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| 245 CR | 35.0 | 35.0 | 35.9 | 37.0 | 38.0 | 39.0 | 39.9 | 40.8 | 41.6 | 42.3 |
| **Upper Daytime** | | | | | | | | | | |
| H6 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| H16 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H23 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H33 | 40.0 | 40.0 | 40.0 | 40.0 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| 245 CR | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.8 | 41.6 | 42.3 |
| **Night-time** | | | | | | | | | | |
| H6 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H16 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H23 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H33 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| 245 CR | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |

10.53 The derived noise limits are assigned to each of the assessment locations identified in **FEI Table 10.11** based on the relative proximity of the monitoring location to the assessment locations. Where there is ambiguity in this respect, the noise limits are applied on a basis that is considered conservative.

**FEI Table 10.11 - Application of Noise Limits**

| House ID | House Name | Co-ordinates (EPSG 29902) | | Applied Noise Limit |
|---|---|---|---|---|
| | | X (m) | Y (m) | |
| H5 | 22 Slane Road | 325142 | 411868 | H6 / 245 CR |
| H6 | 50 Killycarn Road | 323688 | 411880 | H6 / 245 CR |
| H7 | 54 Killycarn Road | 323827 | 412064 | H6 / 245 CR |
| H10 | 57 Slane Road | 326493 | 412942 | H16 |
| H13 | 64B Slane Road | 326575 | 413545 | H16 |
| H16 | 72A Slane Road | 326958 | 413839 | H16 |
| H17 | 72 Slane Road | 326948 | 413945 | H16 |
| H21 | 147A Ballymena Road | 327226 | 414631 | H23 |
| H23 | 4 Gartford Lane | 326933 | 415144 | H23 |
| H31 | 25 Drumourne Road | 327476 | 416927 | H33 |
| H33 | 20 Drumourne Road | 327289 | 417329 | H33 |
| H34 | Ballymena Road | 327213 | 415466 | H23 |
| H35 | Ballymena Road | 327415 | 415880 | H23 |
| H42 | Carnlough Road | 323975 | 411133 | H6 / 245 CR |
| H43 | 246 Carnlough Road | 323789 | 411238 | H6 / 245 CR |
| H60 | 6 Slane Road | 324382 | 411409 | H6 / 245 CR |

10.54 **FEI Table 10.12** shows the corresponding lower daytime, upper daytime and night-time noise limits at the residential assessment locations considered here when assessing the Proposed Development in isolation.

**FEI Table 10.12 - Overall ETSU-R-97 Isolative Noise Limits, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Lower Daytime** | | | | | | | | | | |
| H5 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H6 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H7 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H10 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H13 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H16 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H17 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H21 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H23 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H31 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H33 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H34 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H35 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H42 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H43 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H60 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| **Upper Daytime** | | | | | | | | | | |
| H5 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| H6 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| H7 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| H10 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H13 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H16 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H17 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H21 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H23 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H31 | 40.0 | 40.0 | 40.0 | 40.0 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H33 | 40.0 | 40.0 | 40.0 | 40.0 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H34 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H35 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H42 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| H43 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| H60 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 43.6 | 48.6 | 48.6 |
| **Night-time** | | | | | | | | | | |
| H5 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H6 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H7 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H10 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H13 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H16 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H17 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H21 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H23 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H31 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| H33 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| H34 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H35 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H42 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H43 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H60 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |

10.55 As specified in **Paragraph 10.47**, for the cumulative assessment, the derived background sound levels for the consented single turbine, C1, are used in place of measured sound levels from survey location H6 as specified in **FEI Table 10.9.**

10.56 **FEI Table 10.13** shows the corresponding lower daytime, upper daytime and night-time noise limits at the residential assessment locations considered here. These limits are intended to apply to the cumulative impact of operational noise from the Proposed Development and the other existing, planned or permitted development near the site to determine whether the combined operation of the sites would be acceptable under current planning guidance.

10.57 Furthermore, ETSU-R-97 suggests that the absolute lower noise limits may be increased up to 45 dB $L_{A90}$ if the occupant has a financial involvement in the wind farm. Within the scope of the cumulative assessment, property H43 has been identified as a financially involved receptor of the consented single turbine C1, therefore both daytime and night-time fixed limits have been increased to 45 dB(A) at this location.

**FEI Table 10.13 - Overall ETSU-R-97 Cumulative Noise Limits, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Lower Daytime** | | | | | | | | | | |
| H5 | 35.0 | 35.0 | 35.9 | 37.0 | 38.0 | 39.0 | 39.9 | 40.8 | 41.6 | 42.3 |
| H6 | 35.0 | 35.0 | 35.9 | 37.0 | 38.0 | 39.0 | 39.9 | 40.8 | 41.6 | 42.3 |
| H7 | 35.0 | 35.0 | 35.9 | 37.0 | 38.0 | 39.0 | 39.9 | 40.8 | 41.6 | 42.3 |
| H10 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H13 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H16 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H17 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H21 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H23 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H31 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H33 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H34 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H35 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H42 | 35.0 | 35.0 | 35.9 | 37.0 | 38.0 | 39.0 | 39.9 | 40.8 | 41.6 | 42.3 |
| H43 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 |
| H60 | 35.0 | 35.0 | 35.9 | 37.0 | 38.0 | 39.0 | 39.9 | 40.8 | 41.6 | 42.3 |
| **Upper Daytime** | | | | | | | | | | |
| H5 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.8 | 41.6 | 42.3 |
| H6 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.8 | 41.6 | 42.3 |
| H7 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.8 | 41.6 | 42.3 |
| H10 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H13 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H16 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H17 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H21 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H23 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H31 | 40.0 | 40.0 | 40.0 | 40.0 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H33 | 40.0 | 40.0 | 40.0 | 40.0 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H34 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H35 | 40.0 | 40.0 | 40.0 | 40.0 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H42 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.8 | 41.6 | 42.3 |
| H43 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 |
| H60 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.8 | 41.6 | 42.3 |
| **Night-time** | | | | | | | | | | |
| H5 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H6 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H7 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H10 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H13 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H16 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H17 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H21 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H23 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H31 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| H33 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| H34 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H35 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H42 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H43 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 | 45.0 |
| H60 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |

## Assessment of Potential Effects

### Isolative Assessment

10.58 **FEI Table 10.14** shows the updated predicted sound levels from the revised Proposed Development at the nearest residential properties at each wind speed considered.

10.59 **FEI Figure 10.1** shows an updated sound contour plot associated with the revised Proposed Development at a standardised 10 m height wind speed of 8 $ms^{-1}$.

**FEI Table 10.14 - Predicted Sound Levels, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H5 | 21.1 | 24.8 | 29.8 | 32.9 | 33.2 | 33.2 | 33.2 | 33.2 | 33.2 | 33.2 |
| H6 | 18.8 | 22.5 | 27.5 | 30.6 | 30.9 | 30.9 | 30.9 | 30.9 | 30.9 | 30.9 |
| H7 | 20.5 | 24.2 | 29.2 | 32.3 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 |
| H10 | 20.6 | 24.3 | 29.3 | 32.4 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 |
| H13 | 21.9 | 25.6 | 30.6 | 33.7 | 34.0 | 34.0 | 34.0 | 34.0 | 34.0 | 34.0 |
| H16 | 20.5 | 24.2 | 29.2 | 32.3 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 |
| H17 | 20.9 | 24.6 | 29.6 | 32.7 | 33.0 | 33.0 | 33.0 | 33.0 | 33.0 | 33.0 |
| H21 | 21.4 | 25.1 | 30.1 | 33.2 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 |
| H23 | 25.3 | 29.0 | 34.0 | 37.1 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 |
| H31 | 20.0 | 23.7 | 28.7 | 31.8 | 32.1 | 32.1 | 32.1 | 32.1 | 32.1 | 32.1 |
| H33 | 18.2 | 21.9 | 26.9 | 30.0 | 30.3 | 30.3 | 30.3 | 30.3 | 30.3 | 30.3 |
| H34 | 24.3 | 28.0 | 33.0 | 36.1 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 |
| H35 | 23.3 | 27.0 | 32.0 | 35.1 | 35.4 | 35.4 | 35.4 | 35.4 | 35.4 | 35.4 |
| H42 | 15.8 | 19.5 | 24.5 | 27.6 | 27.9 | 27.9 | 27.9 | 27.9 | 27.9 | 27.9 |
| H43 | 15.9 | 19.6 | 24.6 | 27.7 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 |
| H60 | 18.0 | 21.7 | 26.7 | 29.8 | 30.1 | 30.1 | 30.1 | 30.1 | 30.1 | 30.1 |

10.60 **FEI Table 10.15** shows the margin by which the predicted operational noise levels meet the lower daytime, upper daytime and night-time noise limits set out at **FEI Table 10.13** and demonstrates that overall levels are well below the minimum limiting requirements of ETSU-R-97 (i.e. the lower daytime and night-time levels by a minimum of 1.8 dB).

**FEI Table 10.15 - Proposed Development Margin of Compliance, dB**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Lower Daytime** | | | | | | | | | | |
| H5 | -13.9 | -10.2 | -5.2 | -2.1 | -1.8 | -3.8 | -6.6 | -10.4 | -15.4 | -15.4 |
| H6 | -16.2 | -12.5 | -7.5 | -4.4 | -4.1 | -6.1 | -8.9 | -12.7 | -17.7 | -17.7 |
| H7 | -14.5 | -10.8 | -5.8 | -2.7 | -2.4 | -4.4 | -7.2 | -11.0 | -16.0 | -16.0 |
| H10 | -14.5 | -11.4 | -7.3 | -5.4 | -6.6 | -8.5 | -10.8 | -13.5 | -16.7 | -16.7 |
| H13 | -13.2 | -10.1 | -6.0 | -4.1 | -5.3 | -7.2 | -9.5 | -12.2 | -15.4 | -15.4 |
| H16 | -14.6 | -11.5 | -7.4 | -5.5 | -6.7 | -8.6 | -10.9 | -13.6 | -16.8 | -16.8 |
| H17 | -14.2 | -11.1 | -7.0 | -5.1 | -6.3 | -8.2 | -10.5 | -13.2 | -16.4 | -16.4 |
| H21 | -13.6 | -10.9 | -7.3 | -6.0 | -7.8 | -10.4 | -13.3 | -16.5 | -20.2 | -20.2 |
| H23 | -9.7 | -7.0 | -3.4 | -2.1 | -3.9 | -6.5 | -9.4 | -12.6 | -16.3 | -16.3 |
| H31 | -18.6 | -15.2 | -10.5 | -8.0 | -8.6 | -9.9 | -11.8 | -14.5 | -17.9 | -17.9 |
| H33 | -20.4 | -17.0 | -12.3 | -9.8 | -10.4 | -11.7 | -13.6 | -16.3 | -19.7 | -19.7 |
| H34 | -10.7 | -8.0 | -4.4 | -3.1 | -4.9 | -7.5 | -10.4 | -13.6 | -17.3 | -17.3 |
| H35 | -11.7 | -9.0 | -5.4 | -4.1 | -5.9 | -8.5 | -11.4 | -14.6 | -18.3 | -18.3 |
| H42 | -19.2 | -15.5 | -10.5 | -7.4 | -7.1 | -9.1 | -11.9 | -15.7 | -20.7 | -20.7 |
| H43 | -19.1 | -15.4 | -10.4 | -7.3 | -7.0 | -9.0 | -11.8 | -15.6 | -20.6 | -20.6 |
| H60 | -17.0 | -13.3 | -8.3 | -5.2 | -4.9 | -6.9 | -9.7 | -13.5 | -18.5 | -18.5 |
| **Upper Daytime** | | | | | | | | | | |
| H5 | -18.9 | -15.2 | -10.2 | -7.1 | -6.8 | -6.8 | -6.8 | -10.4 | -15.4 | -15.4 |
| H6 | -21.2 | -17.5 | -12.5 | -9.4 | -9.1 | -9.1 | -9.1 | -12.7 | -17.7 | -17.7 |
| H7 | -19.5 | -15.8 | -10.8 | -7.7 | -7.4 | -7.4 | -7.4 | -11.0 | -16.0 | -16.0 |
| H10 | -19.4 | -15.7 | -10.7 | -7.6 | -7.3 | -8.5 | -10.8 | -13.5 | -16.7 | -16.7 |
| H13 | -18.1 | -14.4 | -9.4 | -6.3 | -6.0 | -7.2 | -9.5 | -12.2 | -15.4 | -15.4 |
| H16 | -19.5 | -15.8 | -10.8 | -7.7 | -7.4 | -8.6 | -10.9 | -13.6 | -16.8 | -16.8 |
| H17 | -19.1 | -15.4 | -10.4 | -7.3 | -7.0 | -8.2 | -10.5 | -13.2 | -16.4 | -16.4 |
| H21 | -18.6 | -14.9 | -9.9 | -6.8 | -7.8 | -10.4 | -13.3 | -16.5 | -20.2 | -20.2 |
| H23 | -14.7 | -11.0 | -6.0 | -2.9 | -3.9 | -6.5 | -9.4 | -12.6 | -16.3 | -16.3 |
| H31 | -20.0 | -16.3 | -11.3 | -8.2 | -8.6 | -9.9 | -11.8 | -14.5 | -17.9 | -17.9 |
| H33 | -21.8 | -18.1 | -13.1 | -10.0 | -10.4 | -11.7 | -13.6 | -16.3 | -19.7 | -19.7 |
| H34 | -15.7 | -12.0 | -7.0 | -3.9 | -4.9 | -7.5 | -10.4 | -13.6 | -17.3 | -17.3 |
| H35 | -16.7 | -13.0 | -8.0 | -4.9 | -5.9 | -8.5 | -11.4 | -14.6 | -18.3 | -18.3 |
| H42 | -24.2 | -20.5 | -15.5 | -12.4 | -12.1 | -12.1 | -12.1 | -15.7 | -20.7 | -20.7 |
| H43 | -24.1 | -20.4 | -15.4 | -12.3 | -12.0 | -12.0 | -12.0 | -15.6 | -20.6 | -20.6 |
| H60 | -22.0 | -18.3 | -13.3 | -10.2 | -9.9 | -9.9 | -9.9 | -13.5 | -18.5 | -18.5 |
| **Night-time** | | | | | | | | | | |
| H5 | -21.9 | -18.2 | -13.2 | -10.1 | -9.8 | -9.8 | -9.8 | -9.8 | -9.8 | -9.8 |
| H6 | -24.2 | -20.5 | -15.5 | -12.4 | -12.1 | -12.1 | -12.1 | -12.1 | -12.1 | -12.1 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H7 | -22.5 | -18.8 | -13.8 | -10.7 | -10.4 | -10.4 | -10.4 | -10.4 | -10.4 | -10.4 |
| H10 | -22.4 | -18.7 | -13.7 | -10.6 | -10.3 | -10.3 | -10.3 | -10.9 | -14.0 | -14.0 |
| H13 | -21.1 | -17.4 | -12.4 | -9.3 | -9.0 | -9.0 | -9.0 | -9.6 | -12.7 | -12.7 |
| H16 | -22.5 | -18.8 | -13.8 | -10.7 | -10.4 | -10.4 | -10.4 | -11.0 | -14.1 | -14.1 |
| H17 | -22.1 | -18.4 | -13.4 | -10.3 | -10.0 | -10.0 | -10.0 | -10.6 | -13.7 | -13.7 |
| H21 | -21.6 | -17.9 | -12.9 | -9.8 | -9.5 | -9.5 | -10.7 | -13.9 | -17.1 | -17.1 |
| H23 | -17.7 | -14.0 | -9.0 | -5.9 | -5.6 | -5.6 | -6.8 | -10.0 | -13.2 | -13.2 |
| H31 | -23.0 | -19.3 | -14.3 | -11.2 | -10.9 | -10.9 | -10.9 | -12.9 | -12.9 | -12.9 |
| H33 | -24.8 | -21.1 | -16.1 | -13.0 | -12.7 | -12.7 | -12.7 | -14.7 | -14.7 | -14.7 |
| H34 | -18.7 | -15.0 | -10.0 | -6.9 | -6.6 | -6.6 | -7.8 | -11.0 | -14.2 | -14.2 |
| H35 | -19.7 | -16.0 | -11.0 | -7.9 | -7.6 | -7.6 | -8.8 | -12.0 | -15.2 | -15.2 |
| H42 | -27.2 | -23.5 | -18.5 | -15.4 | -15.1 | -15.1 | -15.1 | -15.1 | -15.1 | -15.1 |
| H43 | -27.1 | -23.4 | -18.4 | -15.3 | -15.0 | -15.0 | -15.0 | -15.0 | -15.0 | -15.0 |
| H60 | -25.0 | -21.3 | -16.3 | -13.2 | -12.9 | -12.9 | -12.9 | -12.9 | -12.9 | -12.9 |

### Cumulative Assessment

10.61 An initial assessment was undertaken in order to determine the maximum predicted operational noise levels due to each of the single turbines at the residential properties considered in the assessment. The predicted noise levels for each of the D1, E1 & G1 turbines was less than 25 dB $L_{A90}$ at all the properties considered in this assessment. Below 25 dB $L_{A90}$, the contributions to cumulative noise levels from the single turbines will be negligible. Therefore, the single turbines, D1, E1 & G1 are not included in the cumulative assessment, only turbine C1 is included.

#### *C1 - LA02/2023/ 1884/F Planning Conditions & Predicted Noise Levels*

10.62 Planning consent for the C1 turbine (Planning Reference: LA02/2023/1884/F) was approved in October 2023 subject to conditions relating to operational noise. Condition 2 of the consent documentation states that *'The level of noise emissions from the permitted wind turbine (including the application of any Tonal Penalty when calculated in accordance with the procedures described on pages 104 - 109 of ETSU-R-97 and any Amplitude Modulation penalty when calculated in accordance with the procedures described in condition 5) shall not exceed the values set out in Table 1 below. Noise limits for any dwellings which lawfully exist, or have planning permission for construction, at the date of this consent but are not listed in Table 1 shall be represented by the physically closest location listed in Table1, unless otherwise agreed by Mid and East Antrim Borough Council'.*

10.63 The noise limits referred to as part the condition are shown in **FEI Table 10.16** for reference and includes the corresponding RES House ID for each of the properties listed to enable comparison with the overall assessment provided here on a consistent basis.

**FEI Table 10.16 – C1 (LA02/2023/ 1884/F) Condition Noise Limits, dB $L_{A90}$**

| House & RES (ID) | Measured 10 m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 246 Carnlough Road (H54) | - | 35.5 | 36.9 | 38.4 | 40.4 | 40.7 | 41.1 | 41.2 | 41.2 | 41.2 |
| 246 Carnlough Road (H43) | - | 35.5 | 36.9 | 38.4 | 40.4 | 40.7 | 41.1 | 41.2 | 41.2 | 41.2 |
| 250 Carnlough Road (H56) | - | 34.3 | 35.7 | 37.2 | 39.2 | 39.5 | 39.9 | 40.0 | 40.0 | 40.0 |
| 248a Carnlough Road (H42) | - | 34.7 | 36.1 | 37.6 | 39.6 | 39.9 | 40.3 | 40.4 | 40.4 | 40.4 |
| 248 Carnlough Road (H57) | - | 34.2 | 35.6 | 37.1 | 39.1 | 39.4 | 39.8 | 39.9 | 39.9 | 39.9 |
| 2 Slane Road (H58) | - | 33.9 | 35.3 | 36.8 | 38.8 | 39.1 | 39.5 | 39.6 | 39.6 | 39.6 |
| 6 Slane Road (H60) | - | 34.8 | 36.2 | 37.7 | 39.7 | 40.0 | 40.4 | 40.5 | 40.5 | 40.5 |
| 50 Killycarn Road (H6) | - | 32.5 | 34.0 | 35.5 | 37.4 | 37.8 | 38.2 | 38.3 | 38.3 | 38.3 |
| 47 Killycarn Road (H53) | - | 32.2 | 33.6 | 35.1 | 37.1 | 37.4 | 37.8 | 37.9 | 37.9 | 37.9 |
| 20 Mullindreen Road (H52) | - | 31.7 | 33.1 | 34.7 | 36.6 | 36.9 | 37.3 | 37.5 | 37.5 | 37.5 |

10.64 The planning condition limits are consistent with the noise predictions provided within the assessment submitted in support of the planning application for the turbine[10]. The noise predictions for turbine C1 in Table 3 of the supplementary information[11] submitted for the planning application have been referenced to the measured wind speed at a height of 10 m by subtracting 2 $ms^{-1}$ from the wind speed reference used in the turbine predictions. To ensure consistency of wind speed references in relation to those used for the analysis of the background noise data for turbine C1, which has been corrected for wind shear conditions as detailed in **Paragraph 10.50** of this FEI, the predicted noise levels have been shifted to the right along the wind speed axis by 2 $ms^{-1}$, effectively relating the levels to standardised 10 m height wind speeds rather than the measured 10 m height wind speed reference in the documentation supporting the C1 planning application. This also enables comparison with the levels generated by the Proposed Development on a more consistent basis, notwithstanding the difference in hub-heights for the Proposed Development and the cumulative scheme.

10.65 The RES predicted noise levels for Turbine C1 are within 0.1 dB of those specified as part of the operational noise condition at the majority of residences and overestimates the impact at residence (H60) by 0.3 dB, which has been corrected back to directly reference the planning condition values.

10.66 For other properties in the Unshinagh house layout which are not included in the turbine C1 assessment, the RES noise predictions would be expected to be within 0.1 dB of the turbine C1 predictions. **FEI Table 10.17** shows the maximum predicted turbine noise levels associated with the turbine C1 development for any given wind direction (i.e., downwind), incorporating the assumptions and uncertainties detailed in **Paragraphs 10.30 to 10.32.**

[10] Planning Permission - Planning Application Re: LA02/2023/1884/F, Date of Application: 19 October 2023

[11] Planning Application Re: LA02/2023/1884/F - Proposed Wind Turbine at Carnlough Road, Broughshane. Ref: ENV-9036 - HHT Renewables Carnlough Road, Broughshane Noise RFI Letter, 27th November 2023

**FEI Table 10.17 – C1 Predicted Noise Levels, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H5 | 21.3 | 21.3 | 21.3 | 23.2 | 24.6 | 26.1 | 28.0 | 28.3 | 28.7 | 28.7 |
| H6 | 30.6 | 30.6 | 30.6 | 32.5 | 34.0 | 35.5 | 37.4 | 37.8 | 38.2 | 38.3 |
| H7 | 29.0 | 29.0 | 29.0 | 30.9 | 32.3 | 33.8 | 35.7 | 36.0 | 36.4 | 36.4 |
| H10 | 9.6 | 9.6 | 9.6 | 11.5 | 12.9 | 14.4 | 16.3 | 16.6 | 17.0 | 17.0 |
| H13 | 8.0 | 8.0 | 8.0 | 9.9 | 11.3 | 12.8 | 14.7 | 15.0 | 15.4 | 15.4 |
| H16 | 6.2 | 6.2 | 6.2 | 8.1 | 9.5 | 11.0 | 12.9 | 13.2 | 13.6 | 13.6 |
| H17 | 6.0 | 6.0 | 6.0 | 7.9 | 9.3 | 10.8 | 12.7 | 13.0 | 13.4 | 13.4 |
| H21 | 3.8 | 3.8 | 3.8 | 5.7 | 7.1 | 8.6 | 10.5 | 10.8 | 11.2 | 11.2 |
| H23 | 3.3 | 3.3 | 3.3 | 5.2 | 6.6 | 8.1 | 10.0 | 10.3 | 10.7 | 10.7 |
| H31 | -1.3 | -1.3 | -1.3 | 0.6 | 2.0 | 3.5 | 5.4 | 5.7 | 6.1 | 6.1 |
| H33 | 1.1 | 1.1 | 1.1 | 3.0 | 4.4 | 5.9 | 7.8 | 8.1 | 8.5 | 8.5 |
| H34 | 2.0 | 2.0 | 2.0 | 3.9 | 5.3 | 6.8 | 8.7 | 9.0 | 9.4 | 9.4 |
| H35 | 0.8 | 0.8 | 0.8 | 2.7 | 4.1 | 5.6 | 7.5 | 7.8 | 8.2 | 8.2 |
| H42 | 32.8 | 32.8 | 32.8 | 34.7 | 36.1 | 37.6 | 39.6 | 39.9 | 40.3 | 40.4 |
| H43 | 33.6 | 33.6 | 33.6 | 35.5 | 36.9 | 38.4 | 40.4 | 40.7 | 41.1 | 41.2 |
| H60 | 32.8 | 32.9 | 32.9 | 34.8 | 36.2 | 37.7 | 39.7 | 40.0 | 40.4 | 40.5 |

### *Overall Cumulative Assessment*

10.67 **FEI Table 10.18** shows the maximum predicted turbine noise levels associated with the Unshinagh development and the C1 turbine, for any given wind direction, incorporating the assumptions and uncertainties detailed in **Paragraphs 10.30 to 10.32.**

**FEI Table 10.18 – Predicted Overall Cumulative Levels, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H5 | 24.2 | 26.4 | 30.4 | 33.3 | 33.7 | 34.0 | 34.3 | 34.4 | 34.5 | 34.5 |
| H6 | 30.9 | 31.2 | 32.3 | 34.7 | 35.7 | 36.8 | 38.3 | 38.6 | 38.9 | 39.0 |
| H7 | 29.6 | 30.2 | 32.1 | 34.7 | 35.5 | 36.2 | 37.4 | 37.6 | 37.9 | 37.9 |
| H10 | 20.9 | 24.5 | 29.4 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H13 | 22.1 | 25.7 | 30.6 | 33.7 | 34.0 | 34.1 | 34.1 | 34.1 | 34.1 | 34.1 |
| H16 | 20.7 | 24.3 | 29.2 | 32.3 | 32.6 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 |
| H17 | 21.0 | 24.6 | 29.6 | 32.7 | 33.0 | 33.0 | 33.0 | 33.0 | 33.0 | 33.0 |
| H21 | 21.5 | 25.2 | 30.1 | 33.2 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 | 33.5 |
| H23 | 25.3 | 29.0 | 34.0 | 37.1 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 |
| H31 | 20.0 | 23.7 | 28.7 | 31.8 | 32.1 | 32.1 | 32.1 | 32.1 | 32.1 | 32.1 |
| H33 | 18.2 | 21.9 | 26.9 | 30.0 | 30.3 | 30.3 | 30.3 | 30.3 | 30.3 | 30.3 |
| H34 | 24.3 | 28.0 | 33.0 | 36.1 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 | 36.4 |
| H35 | 23.4 | 27.1 | 32.0 | 35.1 | 35.4 | 35.4 | 35.5 | 35.5 | 35.5 | 35.5 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H42 | 32.9 | 33.0 | 33.4 | 35.5 | 36.7 | 38.0 | 39.9 | 40.2 | 40.5 | 40.6 |
| H43 | 33.7 | 33.8 | 34.1 | 36.2 | 37.4 | 38.8 | 40.6 | 40.9 | 41.3 | 41.4 |
| H60 | 33.0 | 33.2 | 33.8 | 36.0 | 37.1 | 38.4 | 40.1 | 40.4 | 40.8 | 40.9 |

10.68 The predicted margins between the overall maximum cumulative noise levels shown at **FEI Table 10.18** and the defined overall cumulative noise limits shown at **FEI Table 10.13** are provided at **FEI Table 10.19**. A positive number indicates that predicted noise levels may be above the limits, subject to various caveats discussed later.

**FEI Table 10.19 – Margin of Cumulative Compliance, dB**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Lower Daytime** | | | | | | | | | | |
| H5 | -10.8 | -8.6 | -5.5 | -3.7 | -4.3 | -5.0 | -5.6 | -6.4 | -7.1 | -7.8 |
| H6 | -4.1 | -3.8 | -3.6 | -2.3 | -2.3 | -2.2 | -1.6 | -2.2 | -2.7 | -3.3 |
| H7 | -5.4 | -4.8 | -3.8 | -2.3 | -2.5 | -2.8 | -2.5 | -3.2 | -3.7 | -4.4 |
| H10 | -14.2 | -11.2 | -7.2 | -5.3 | -6.5 | -8.4 | -10.7 | -13.4 | -16.6 | -16.6 |
| H13 | -13.0 | -10.0 | -6.0 | -4.1 | -5.3 | -7.1 | -9.4 | -12.1 | -15.3 | -15.3 |
| H16 | -14.4 | -11.4 | -7.4 | -5.5 | -6.7 | -8.5 | -10.8 | -13.5 | -16.7 | -16.7 |
| H17 | -14.1 | -11.1 | -7.0 | -5.1 | -6.3 | -8.2 | -10.5 | -13.2 | -16.4 | -16.4 |
| H21 | -13.5 | -10.8 | -7.3 | -6.0 | -7.8 | -10.4 | -13.3 | -16.5 | -20.2 | -20.2 |
| H23 | -9.7 | -7.0 | -3.4 | -2.1 | -3.9 | -6.5 | -9.4 | -12.6 | -16.3 | -16.3 |
| H31 | -18.6 | -15.2 | -10.5 | -8.0 | -8.6 | -9.9 | -11.8 | -14.5 | -17.9 | -17.9 |
| H33 | -20.4 | -17.0 | -12.3 | -9.8 | -10.4 | -11.7 | -13.6 | -16.3 | -19.7 | -19.7 |
| H34 | -10.7 | -8.0 | -4.4 | -3.1 | -4.9 | -7.5 | -10.4 | -13.6 | -17.3 | -17.3 |
| H35 | -11.6 | -8.9 | -5.4 | -4.1 | -5.9 | -8.5 | -11.3 | -14.5 | -18.2 | -18.2 |
| H42 | -2.1 | -2.0 | -2.5 | -1.5 | -1.3 | -1.0 | 0.0 | -0.6 | -1.1 | -1.7 |
| H43 | -11.3 | -11.2 | -10.9 | -8.8 | -7.6 | -6.2 | -4.4 | -4.1 | -3.7 | -3.6 |
| H60 | -2.0 | -1.8 | -2.1 | -1.0 | -0.9 | -0.6 | 0.2 | -0.4 | -0.8 | -1.4 |
| **Upper Daytime** | | | | | | | | | | |
| H5 | -15.8 | -13.6 | -9.6 | -6.7 | -6.3 | -6.0 | -5.7 | -6.4 | -7.1 | -7.8 |
| H6 | -9.1 | -8.8 | -7.7 | -5.3 | -4.3 | -3.2 | -1.7 | -2.2 | -2.7 | -3.3 |
| H7 | -10.4 | -9.8 | -7.9 | -5.3 | -4.5 | -3.8 | -2.6 | -3.2 | -3.7 | -4.4 |
| H10 | -19.1 | -15.5 | -10.6 | -7.5 | -7.2 | -8.4 | -10.7 | -13.4 | -16.6 | -16.6 |
| H13 | -17.9 | -14.3 | -9.4 | -6.3 | -6.0 | -7.1 | -9.4 | -12.1 | -15.3 | -15.3 |
| H16 | -19.3 | -15.7 | -10.8 | -7.7 | -7.4 | -8.5 | -10.8 | -13.5 | -16.7 | -16.7 |
| H17 | -19.0 | -15.4 | -10.4 | -7.3 | -7.0 | -8.2 | -10.5 | -13.2 | -16.4 | -16.4 |
| H21 | -18.5 | -14.8 | -9.9 | -6.8 | -7.8 | -10.4 | -13.3 | -16.5 | -20.2 | -20.2 |
| H23 | -14.7 | -11.0 | -6.0 | -2.9 | -3.9 | -6.5 | -9.4 | -12.6 | -16.3 | -16.3 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H31 | -20.0 | -16.3 | -11.3 | -8.2 | -8.6 | -9.9 | -11.8 | -14.5 | -17.9 | -17.9 |
| H33 | -21.8 | -18.1 | -13.1 | -10.0 | -10.4 | -11.7 | -13.6 | -16.3 | -19.7 | -19.7 |
| H34 | -15.7 | -12.0 | -7.0 | -3.9 | -4.9 | -7.5 | -10.4 | -13.6 | -17.3 | -17.3 |
| H35 | -16.6 | -12.9 | -8.0 | -4.9 | -5.9 | -8.5 | -11.3 | -14.5 | -18.2 | -18.2 |
| H42 | -7.1 | -7.0 | -6.6 | -4.5 | -3.3 | -2.0 | -0.1 | -0.6 | -1.1 | -1.7 |
| H43 | -11.3 | -11.2 | -10.9 | -8.8 | -7.6 | -6.2 | -4.4 | -4.1 | -3.7 | -3.6 |
| H60 | -7.0 | -6.8 | -6.2 | -4.0 | -2.9 | -1.6 | 0.1 | -0.4 | -0.8 | -1.4 |
| **Night-time** | | | | | | | | | | |
| H5 | -18.8 | -16.6 | -12.6 | -9.7 | -9.3 | -9.0 | -8.7 | -8.6 | -8.5 | -8.5 |
| H6 | -12.1 | -11.8 | -10.7 | -8.3 | -7.3 | -6.2 | -4.7 | -4.4 | -4.1 | -4.0 |
| H7 | -13.4 | -12.8 | -10.9 | -8.3 | -7.5 | -6.8 | -5.6 | -5.4 | -5.1 | -5.1 |
| H10 | -22.1 | -18.5 | -13.6 | -10.5 | -10.2 | -10.2 | -10.2 | -10.8 | -13.9 | -13.9 |
| H13 | -20.9 | -17.3 | -12.4 | -9.3 | -9.0 | -8.9 | -8.9 | -9.5 | -12.6 | -12.6 |
| H16 | -22.3 | -18.7 | -13.8 | -10.7 | -10.4 | -10.3 | -10.3 | -10.9 | -14.0 | -14.0 |
| H17 | -22.0 | -18.4 | -13.4 | -10.3 | -10.0 | -10.0 | -10.0 | -10.6 | -13.7 | -13.7 |
| H21 | -21.5 | -17.8 | -12.9 | -9.8 | -9.5 | -9.5 | -10.7 | -13.9 | -17.1 | -17.1 |
| H23 | -17.7 | -14.0 | -9.0 | -5.9 | -5.6 | -5.6 | -6.8 | -10.0 | -13.2 | -13.2 |
| H31 | -23.0 | -19.3 | -14.3 | -11.2 | -10.9 | -10.9 | -10.9 | -12.9 | -12.9 | -12.9 |
| H33 | -24.8 | -21.1 | -16.1 | -13.0 | -12.7 | -12.7 | -12.7 | -14.7 | -14.7 | -14.7 |
| H34 | -18.7 | -15.0 | -10.0 | -6.9 | -6.6 | -6.6 | -7.8 | -11.0 | -14.2 | -14.2 |
| H35 | -19.6 | -15.9 | -11.0 | -7.9 | -7.6 | -7.6 | -8.7 | -11.9 | -15.1 | -15.1 |
| H42 | -10.1 | -10.0 | -9.6 | -7.5 | -6.3 | -5.0 | -3.1 | -2.8 | -2.5 | -2.4 |
| H43 | -11.3 | -11.2 | -10.9 | -8.8 | -7.6 | -6.2 | -4.4 | -4.1 | -3.7 | -3.6 |
| H60 | -10.0 | -9.8 | -9.2 | -7.0 | -5.9 | -4.6 | -2.9 | -2.6 | -2.2 | -2.1 |

10.69 The assessment shows that, using the assumptions detailed above, overall cumulative noise levels are predicted to meet the overall requirements of ETSU-R-97 at all locations with the exception of H60, where predicted levels are marginally above the lower and upper daytime noise limits by 0.2 and 0.1 dB respectively. Instances where predicted noise levels are shown to be close to or marginally above the overall daytime noise limits are generally a result of the proximity of the small turbine C1 to some of the assessment locations.

10.70 The Proposed Development results in predicted noise levels at H60 that are around 10 dB below the predicted noise levels for turbine C1 at 9 $ms^{-1}$ and consequently would not make an appreciable difference in the overall cumulative noise level and the exceedance is not expected to occur in practice as a result and partly due to the level of uncertainty applied to the turbine source noise levels. Nevertheless, a curtailment strategy could be devised to further ensure the marginal exceedance would not occur in practice.

## Proposed Planning Conditions

10.71 Proposed planning condition limits for all properties considered are provided in **FEI Table 10.20**. The levels are based on the predicted noise levels for the site, as shown in **FEI Table 10.14**, but with a nominal uncertainty/margin applied which is reduced in instances where there is a risk that overall levels would exceed the requirements of ETSU-R-97. The proposed limits for both daytime and night-time periods are the same with the exception of H42 & H60.

10.72 The limits will require slight precautionary curtailment of a turbine or turbines to be installed as part of the Proposed Development, as discussed further at **Paragraphs 10.82 & 10.83**, to ensure the marginal risk of turbine noise levels being above the overall requirements of ETSU-R-97 is minimised.

10.73 This approach is considered to tally with the expectations of the Local Planning Authorities (LPAs) in respect of preferred/favoured approach to consenting in respect of operational noise, leaves some room for micro-siting and allows for some flexibility in the potential turbine model to be installed at the Proposed Development.

**FEI Table 10.20 – Proposed Unshinagh Planning Condition Limits, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Daytime** | | | | | | | | | | |
| H5 | 27.1 | 30.8 | 33.8 | 35.4 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 |
| H6 | 24.8 | 28.5 | 31.5 | 33.1 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 |
| H7 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H10 | 26.6 | 30.3 | 33.3 | 34.9 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 |
| H13 | 27.9 | 31.6 | 34.6 | 36.2 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 |
| H16 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H17 | 26.9 | 30.6 | 33.6 | 35.2 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 |
| H21 | 27.4 | 31.1 | 34.1 | 35.7 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| H23 | 31.3 | 35.0 | 38.0 | 39.6 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 |
| H31 | 26.0 | 29.7 | 32.7 | 34.3 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 |
| H33 | 24.2 | 27.9 | 30.9 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H34 | 30.3 | 34.0 | 37.0 | 38.6 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 |
| H35 | 29.3 | 33.0 | 36.0 | 37.6 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| H42 | 21.8 | 25.5 | 28.5 | 30.1 | 30.4 | 30.4 | 29.4 | 29.4 | 29.4 | 29.4 |
| H43 | 21.9 | 25.6 | 28.6 | 30.2 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 |
| H60 | 24.0 | 27.7 | 30.7 | 32.3 | 32.6 | 32.6 | 28.2 | 28.2 | 28.2 | 28.2 |
| **Night-time** | | | | | | | | | | |
| H5 | 27.1 | 30.8 | 33.8 | 35.4 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 |
| H6 | 24.8 | 28.5 | 31.5 | 33.1 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 |
| H7 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H10 | 26.6 | 30.3 | 33.3 | 34.9 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H13 | 27.9 | 31.6 | 34.6 | 36.2 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 |
| H16 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H17 | 26.9 | 30.6 | 33.6 | 35.2 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 |
| H21 | 27.4 | 31.1 | 34.1 | 35.7 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| H23 | 31.3 | 35.0 | 38.0 | 39.6 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 |
| H31 | 26.0 | 29.7 | 32.7 | 34.3 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 |
| H33 | 24.2 | 27.9 | 30.9 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H34 | 30.3 | 34.0 | 37.0 | 38.6 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 |
| H35 | 29.3 | 33.0 | 36.0 | 37.6 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| H42 | 21.8 | 25.5 | 28.5 | 30.1 | 30.4 | 30.4 | 30.4 | 30.4 | 30.4 | 30.4 |
| H43 | 21.9 | 25.6 | 28.6 | 30.2 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 |
| H60 | 24.0 | 27.7 | 30.7 | 32.3 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 |

10.74 The maximum predicted cumulative turbine noise levels, assuming that the proposed Unshinagh development is operating right up to the proposed condition limits are shown at **FEI Table 10.21.**

**FEI Table 10.21 – Cumulative Noise Levels Incorporating Proposed Planning Condition Limits, dB $L_{A90}$**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Daytime** | | | | | | | | | | |
| H5 | 28.1 | 31.2 | 34.0 | 35.6 | 36.0 | 36.1 | 36.4 | 36.4 | 36.5 | 36.5 |
| H6 | 31.6 | 32.7 | 34.1 | 35.8 | 36.7 | 37.6 | 38.9 | 39.1 | 39.4 | 39.5 |
| H7 | 30.9 | 32.7 | 34.6 | 36.3 | 36.9 | 37.5 | 38.4 | 38.6 | 38.8 | 38.8 |
| H10 | 26.7 | 30.4 | 33.3 | 34.9 | 35.2 | 35.3 | 35.3 | 35.3 | 35.3 | 35.3 |
| H13 | 28.0 | 31.6 | 34.6 | 36.2 | 36.5 | 36.5 | 36.6 | 36.6 | 36.6 | 36.6 |
| H16 | 26.6 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.2 | 35.2 | 35.2 |
| H17 | 26.9 | 30.6 | 33.6 | 35.2 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 |
| H21 | 27.4 | 31.1 | 34.1 | 35.7 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| H23 | 31.3 | 35.0 | 38.0 | 39.6 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 |
| H31 | 26.0 | 29.7 | 32.7 | 34.3 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 |
| H33 | 24.2 | 27.9 | 30.9 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H34 | 30.3 | 34.0 | 37.0 | 38.6 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 |
| H35 | 29.3 | 33.0 | 36.0 | 37.6 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| H42 | 33.1 | 33.5 | 34.2 | 36.0 | 37.1 | 38.4 | 40.0 | 40.3 | 40.6 | 40.7 |
| H43 | 33.9 | 34.2 | 34.8 | 36.6 | 37.8 | 39.1 | 40.8 | 41.1 | 41.5 | 41.6 |
| H60 | 33.4 | 34.0 | 34.9 | 36.7 | 37.8 | 38.9 | 40.0 | 40.3 | 40.7 | 40.7 |
| **Night-time** | | | | | | | | | | |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H5 | 28.1 | 31.2 | 34.0 | 35.6 | 36.0 | 36.1 | 36.4 | 36.4 | 36.5 | 36.5 |
| H6 | 31.6 | 32.7 | 34.1 | 35.8 | 36.7 | 37.6 | 38.9 | 39.1 | 39.4 | 39.5 |
| H7 | 30.9 | 32.7 | 34.6 | 36.3 | 36.9 | 37.5 | 38.4 | 38.6 | 38.8 | 38.8 |
| H10 | 26.7 | 30.4 | 33.3 | 34.9 | 35.2 | 35.3 | 35.3 | 35.3 | 35.3 | 35.3 |
| H13 | 28.0 | 31.6 | 34.6 | 36.2 | 36.5 | 36.5 | 36.6 | 36.6 | 36.6 | 36.6 |
| H16 | 26.6 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.2 | 35.2 | 35.2 |
| H17 | 26.9 | 30.6 | 33.6 | 35.2 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 |
| H21 | 27.4 | 31.1 | 34.1 | 35.7 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| H23 | 31.3 | 35.0 | 38.0 | 39.6 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 |
| H31 | 26.0 | 29.7 | 32.7 | 34.3 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 |
| H33 | 24.2 | 27.9 | 30.9 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H34 | 30.3 | 34.0 | 37.0 | 38.6 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 |
| H35 | 29.3 | 33.0 | 36.0 | 37.6 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| H42 | 33.1 | 33.5 | 34.2 | 36.0 | 37.1 | 38.4 | 40.1 | 40.4 | 40.7 | 40.8 |
| H43 | 33.9 | 34.2 | 34.8 | 36.6 | 37.8 | 39.1 | 40.8 | 41.1 | 41.5 | 41.6 |
| H60 | 33.4 | 34.0 | 34.9 | 36.7 | 37.8 | 38.9 | 40.5 | 40.7 | 41.1 | 41.1 |

10.75 The margins between the predicted cumulative turbine noise levels shown in **FEI Table 10.21**, assuming that the Proposed Development is operating right up to the proposed planning condition limits, and the overall cumulative limits are provided in **FEI Table 10.22**. This shows that predicted turbine noise levels are expected to meet the night-time and lower daytime ETSU-R-97 limits at all locations with the exception of H23, H42 and H60 where levels are marginally above the lower daytime limits and below the upper daytime limits. These levels would be considered acceptable under the remit of ETSU-R-97 given the relatively low number of properties affected and considering the overall generating capacity of the site.

**FEI Table 10.22 – Margin of Compliance with Cumulative Noise Limits, dB**

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Lower Daytime** | | | | | | | | | | |
| H5 | -6.9 | -3.8 | -1.9 | -1.4 | -2.0 | -2.9 | -3.5 | -4.4 | -5.1 | -5.8 |
| H6 | -3.4 | -2.3 | -1.8 | -1.2 | -1.3 | -1.4 | -1.0 | -1.7 | -2.2 | -2.8 |
| H7 | -4.1 | -2.3 | -1.3 | -0.7 | -1.1 | -1.5 | -1.5 | -2.2 | -2.8 | -3.5 |
| H10 | -8.4 | -5.3 | -3.3 | -2.9 | -4.1 | -5.9 | -8.2 | -10.9 | -14.1 | -14.1 |
| H13 | -7.1 | -4.1 | -2.0 | -1.6 | -2.8 | -4.7 | -6.9 | -9.6 | -12.8 | -12.8 |
| H16 | -8.5 | -5.5 | -3.4 | -3.0 | -4.2 | -6.1 | -8.4 | -11.0 | -14.2 | -14.2 |
| H17 | -8.2 | -5.1 | -3.0 | -2.6 | -3.8 | -5.7 | -8.0 | -10.7 | -13.9 | -13.9 |
| H21 | -7.6 | -4.9 | -3.3 | -3.5 | -5.3 | -7.9 | -10.8 | -14.0 | -17.7 | -17.7 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H23 | -3.7 | -1.0 | 0.6 | 0.4 | -1.4 | -4.0 | -6.9 | -10.1 | -13.8 | -13.8 |
| H31 | -12.6 | -9.2 | -6.5 | -5.5 | -6.1 | -7.4 | -9.3 | -12.0 | -15.4 | -15.4 |
| H33 | -14.4 | -11.0 | -8.3 | -7.3 | -7.9 | -9.2 | -11.1 | -13.8 | -17.2 | -17.2 |
| H34 | -4.7 | -2.0 | -0.4 | -0.6 | -2.4 | -5.0 | -7.9 | -11.1 | -14.8 | -14.8 |
| H35 | -5.7 | -3.0 | -1.4 | -1.6 | -3.4 | -6.0 | -8.9 | -12.1 | -15.8 | -15.8 |
| H42 | -1.9 | -1.5 | -1.7 | -1.0 | -0.9 | -0.6 | 0.1 | -0.5 | -1.0 | -1.6 |
| H43 | -11.1 | -10.8 | -10.2 | -8.4 | -7.2 | -5.9 | -4.2 | -3.9 | -3.5 | -3.4 |
| H60 | -1.6 | -1.0 | -1.0 | -0.3 | -0.2 | -0.1 | 0.1 | -0.5 | -0.9 | -1.6 |
| **Upper Daytime** | | | | | | | | | | |
| H5 | -11.9 | -8.8 | -6.0 | -4.4 | -4.0 | -3.9 | -3.6 | -4.4 | -5.1 | -5.8 |
| H6 | -8.4 | -7.3 | -5.9 | -4.2 | -3.3 | -2.4 | -1.1 | -1.7 | -2.2 | -2.8 |
| H7 | -9.1 | -7.3 | -5.4 | -3.7 | -3.1 | -2.5 | -1.6 | -2.2 | -2.8 | -3.5 |
| H10 | -13.3 | -9.6 | -6.7 | -5.1 | -4.8 | -5.9 | -8.2 | -10.9 | -14.1 | -14.1 |
| H13 | -12.0 | -8.4 | -5.4 | -3.8 | -3.5 | -4.7 | -6.9 | -9.6 | -12.8 | -12.8 |
| H16 | -13.4 | -9.8 | -6.8 | -5.2 | -4.9 | -6.1 | -8.4 | -11.0 | -14.2 | -14.2 |
| H17 | -13.1 | -9.4 | -6.4 | -4.8 | -4.5 | -5.7 | -8.0 | -10.7 | -13.9 | -13.9 |
| H21 | -12.6 | -8.9 | -5.9 | -4.3 | -5.3 | -7.9 | -10.8 | -14.0 | -17.7 | -17.7 |
| H23 | -8.7 | -5.0 | -2.0 | -0.4 | -1.4 | -4.0 | -6.9 | -10.1 | -13.8 | -13.8 |
| H31 | -14.0 | -10.3 | -7.3 | -5.7 | -6.1 | -7.4 | -9.3 | -12.0 | -15.4 | -15.4 |
| H33 | -15.8 | -12.1 | -9.1 | -7.5 | -7.9 | -9.2 | -11.1 | -13.8 | -17.2 | -17.2 |
| H34 | -9.7 | -6.0 | -3.0 | -1.4 | -2.4 | -5.0 | -7.9 | -11.1 | -14.8 | -14.8 |
| H35 | -10.7 | -7.0 | -4.0 | -2.4 | -3.4 | -6.0 | -8.9 | -12.1 | -15.8 | -15.8 |
| H42 | -6.9 | -6.5 | -5.8 | -4.0 | -2.9 | -1.6 | 0.0 | -0.5 | -1.0 | -1.6 |
| H43 | -11.1 | -10.8 | -10.2 | -8.4 | -7.2 | -5.9 | -4.2 | -3.9 | -3.5 | -3.4 |
| H60 | -6.6 | -6.0 | -5.1 | -3.3 | -2.2 | -1.1 | 0.0 | -0.5 | -0.9 | -1.6 |
| **Night-time** | | | | | | | | | | |
| H5 | -14.9 | -11.8 | -9.0 | -7.4 | -7.0 | -6.9 | -6.6 | -6.6 | -6.5 | -6.5 |
| H6 | -11.4 | -10.3 | -8.9 | -7.2 | -6.3 | -5.4 | -4.1 | -3.9 | -3.6 | -3.5 |
| H7 | -12.1 | -10.3 | -8.4 | -6.7 | -6.1 | -5.5 | -4.6 | -4.4 | -4.2 | -4.2 |
| H10 | -16.3 | -12.6 | -9.7 | -8.1 | -7.8 | -7.7 | -7.7 | -8.3 | -11.4 | -11.4 |
| H13 | -15.0 | -11.4 | -8.4 | -6.8 | -6.5 | -6.5 | -6.4 | -7.0 | -10.1 | -10.1 |
| H16 | -16.4 | -12.8 | -9.8 | -8.2 | -7.9 | -7.9 | -7.9 | -8.4 | -11.5 | -11.5 |
| H17 | -16.1 | -12.4 | -9.4 | -7.8 | -7.5 | -7.5 | -7.5 | -8.1 | -11.2 | -11.2 |
| H21 | -15.6 | -11.9 | -8.9 | -7.3 | -7.0 | -7.0 | -8.2 | -11.4 | -14.6 | -14.6 |
| H23 | -11.7 | -8.0 | -5.0 | -3.4 | -3.1 | -3.1 | -4.3 | -7.5 | -10.7 | -10.7 |
| H31 | -17.0 | -13.3 | -10.3 | -8.7 | -8.4 | -8.4 | -8.4 | -10.4 | -10.4 | -10.4 |
| H33 | -18.8 | -15.1 | -12.1 | -10.5 | -10.2 | -10.2 | -10.2 | -12.2 | -12.2 | -12.2 |
| H34 | -12.7 | -9.0 | -6.0 | -4.4 | -4.1 | -4.1 | -5.3 | -8.5 | -11.7 | -11.7 |

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| H35 | -13.7 | -10.0 | -7.0 | -5.4 | -5.1 | -5.1 | -6.3 | -9.5 | -12.7 | -12.7 |
| H42 | -9.9 | -9.5 | -8.8 | -7.0 | -5.9 | -4.6 | -2.9 | -2.6 | -2.3 | -2.2 |
| H43 | -11.1 | -10.8 | -10.2 | -8.4 | -7.2 | -5.9 | -4.2 | -3.9 | -3.5 | -3.4 |
| H60 | -9.6 | -9.0 | -8.1 | -6.3 | -5.2 | -4.1 | -2.5 | -2.3 | -1.9 | -1.9 |

10.76 Charts are provided for three properties (H23, H42 & H60) with the smallest margins to the cumulative noise limits in **FEI Technical Appendix 10.2.** The daytime and night-time charts also show the proposed planning condition limits and the effect of their use adopting them as part of the overall cumulative noise assessment along with the predicted noise levels for Unshinagh and turbine C1.

10.77 A mitigation strategy, using the noise modes shown at **FEI Table 10.7**, can be applied to one or more of the closest turbines to absolutely ensure that operational noise levels are not above the proposed limits for certain standardised 10 m height wind speeds and directions to ensure that both the proposed noise conditions specifically for Unshinagh and the overall cumulative noise limits can be met.

10.78 Such a curtailment strategy has not been supplied/detailed here as the required reduction in operational noise levels is considered relatively trivial and the assumed turbine to be installed at the site is only one candidate in a range of potential models. The condition limits will have the desired effect in restricting the levels of operational noise from the development regardless of the specific turbine model that could be installed.

10.79 A proposed wording for a planning condition that would restrict operational noise associated with the Unshinagh development is provided at **FEI Technical Appendix 10.3**. This includes the suggested limiting values in **FEI Table 10.20.**

10.80 In the event that the turbine C1 is not constructed and does not become operational, alternative noise limits are provided for Unshinagh operating in isolation in **FEI Technical Appendix 10.3**. These proposed noise limits are taken from the overall noise limits as stated in **FEI Table 10.13**.

## Mitigation

10.81 Predicted operational noise levels associated with the introduction of the Proposed Development in isolation, as shown at **Paragraphs 10.49 - 10.53** and at **FEI Table 10.14** and **FEI Table 10.15**, meet the limiting requirements of ETSU-R-97 in all instances. As a result, operational noise mitigation is not required to reduce the potential operational noise impacts under this scenario.

10.82 Predicted cumulative operational noise levels associated with the introduction of the Proposed Development, operating at the same time as the single turbine C1, as shown at **FEI Table 10.18**, marginally exceed the limiting requirements of ETSU-R-97 by a small fraction of a Decibel at one property during the daytime. As a result, a very precautionary mitigation / curtailment strategy can be applied and secured via the imposition of the suggested planning controls / conditions.

## Assessment of Residual Effects

10.83 The operational acoustic assessment demonstrates that predicted noise levels from the Proposed Development at residential properties do not exceed the derived noise limits across all wind speeds for the isolative scenario detailed at **Paragraphs 10.49 – 10.53** and at **FEI Table 10.14** and **FEI Table 10.15.**

10.84 The cumulative assessment shows that overall cumulative noise levels are predicted to meet the overall requirements of ETSU-R-97 at all locations with the exception of H60, where predicted levels are marginally above upper daytime noise limits by 0.1 dB and is not expected to occur in practice. Nevertheless, planning condition limits are proposed that limit the sound generated by the proposed development and ensure that this would not occur in practice.

10.85 The conclusions above should not be interpreted to mean that operational noise would be inaudible (or masked by background noise) under all conditions, but that the levels of turbine noise are acceptable under ETSU-R-97 and associated guidance.

## Summary

10.86 An assessment of the expected noise levels resulting from the Unshinagh wind farm, including the potential for cumulative operational noise effects, has been undertaken. The assessment follows the principles and guidance contained within ETSU-R-97 and the GPG.

10.87 The works are intended to supplement and provide revision to the information provided within the noise assessment submitted in support of the planning application for the Proposed Development.

10.88 The assessment indicates that there is a marginal risk and the cumulative noise levels could be above the overall limiting requirements of ETSU-R-97 at one residence surrounding the development and cumulative sites. As a result, planning controls have been proposed such that the introduction of the Proposed Development would result in noise levels that meet the overall limiting requirements of ETSU-R-97.

10.89 The adoption of the proposed noise limits will allow for a range of turbine models to be installed at the site and is considered to fit in with the typical consenting requirements of the local planning authority in terms of operational noise from wind farms.

10.90 Alternative noise limits for Unshinagh in isolation are provided in the event that the cumulative turbine C1 is not constructed.

10.91 The construction noise assessment was not updated and predicted noise levels from the original acoustic assessment are still relevant to this FEI. Construction noise levels are predicted to temporarily exceed construction noise criteria at nearby properties although appropriate mitigation measures have been identified.

10.92 The potential impact of the Proposed Development, along with the mitigation proposed and any residual impact, is summarised in **FEI Table 10.23.**

**FEI Table 10.23: Summary of Potential Impacts, Mitigation and Residual Impacts**

| Potential Impact | Mitigation Proposed | Means of Implementation | Outcome/ Residual Impact |
|---|---|---|---|
| Operation | | | |
| Potential impact on residential amenity due to operational noise | Impact is deemed to be acceptable as the wind farm in isolation meets noise limits specified by relevant guidance. Cumulatively, there is a minor exceedance of the noise limits specified by relevant guidance.<br><br>Additional mitigation measures are required due to identified significant effect | A noise curtailment strategy would be implemented to ensure a reduction in operational noise levels in the event that the C1 turbine becomes operational. | Not significant |
| Construction | | | |
| Potential for noise to be created during general construction activities and by construction traffic | Due regard for 'best practicable means' (defined by Section 72 of the Control of Pollution Act 1974)<br><br>A range of noise mitigation measures are proposed for the construction phase in accordance with measures outlined in BS 5228-1:2009<br><br>Site operations to be limited to 0700-1900 Monday to Friday and 0800-1300 Saturday with possible exceptions during turbine erection and commissioning, concrete delivery/pouring and periods of emergency work | Noise mitigation measures would be implemented as part of the Construction and Environmental Management Plan which would be required to be agreed as a condition of consent | Not significant |

## FEI Technical Appendix 10.1: Energy Storage Facility Assessment

10.93 The assessment for the energy storage facility has been updated as the proposed site has been relocated. An acoustic assessment in accordance with BS 4142:2014 + A1:2019[12] has been undertaken in order to determine the acoustic impact due to the operation of this part of the Development.

10.94 The baseline data adopted is that recorded at a wind speed of 1 $ms^{-1}$ during the background sound measurement surveys made to inform the acoustic assessment of operational noise from the proposed wind farm which correspond to the worst case, or quietest, levels.

10.95 The main sources of sound within the development are the four inverters, four transformers and air conditioning for the Energy Storage Systems (ESS). The four ESS units are expected to be continuously charging and discharging. If there are any rest periods for the inverters these are likely to be infrequent, and the Heating Ventilation and Air Conditioning systems (HVAC) would still be functioning.

10.96 Acoustic emission data for the proposed equipment is detailed in **FEI Table 10.1.1**. 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 isn't operating at maximum capacity. The amount of the time that this is the case is unknown at this stage as it depends upon which services the site is used to provide.

**FEI Table 10.1.1: Acoustic Emission Data**

| Equipment | Sound Pressure Level at 1m, dB $L_{Aeq}$ |
|---|---|
| PCS unit (Inverter & transformer) | 79 |
| ESS unit HVAC | 78 |

10.97 Predicted specific sound levels due to the proposed energy storage facility at the seven nearest residential properties, calculated using the ISO 9613-2[13] propagation model, are detailed in **FEI Table 10.1.2**. A sound footprint for the energy storage facility is shown in **FEI Figure 10.1.1**.

10.98 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.

10.99 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 has been used. The effect of surface features such as buildings and trees has not been considered. There is a degree of conservatism built into the model as a result of the adoption of these settings.

10.100 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

[12] "Methods for rating and assessing industrial and commercial sound", The British Standards Institution 2019

[13] International Organisation for Standardisation (Edition 2, 2024) ISO 9613-2:2024 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors.

proposed energy storage facility, the predicted sound levels would be expected to be less and the downwind predictions presented here would be regarded as conservative.

**FEI Table 10.1.2: Predicted Specific Sound Levels**

| House ID | Sound Pressure Level, dB $L_{Aeq}$ |
|---|---|
| H10 | 18 |
| H13 | 24 |
| H16 | 24 |
| H17 | 25 |
| H21 | 22 |
| H23 | 22 |
| H34 | 18 |

10.101 The sound emitted by the inverter cooling fans and HVAC units can have distinctive character. A correction of 2 dB has been applied in the event that tones are just perceptible at the assessment locations. This is a conservative measure as it may not be the case in practice.

10.102 The results of an acoustic assessment at the property where the predicted sound level is largest relative to the background sound level, H17, are shown in **FEI Table 10.1.3**.

**FEI Table 10.1.3: BS 4142 Assessment Results**

| Results | Day | Night |
|---|---|---|
| Residual sound level | 45 dB $L_{Aeq,\ 16\ hour}$ | 35 dB $L_{Aeq,\ 16\ hour}$ |
| Background sound level | 30 dB $L_{A90,\ 10\ min}$ | 26 dB $L_{A90,\ 10\ min}$ |
| Predicted specific sound level | 25 dB $L_{Aeq}$ | |
| Acoustic feature correction | 2 dB | |
| Rating sound level | 27 dB $L_{Aeq}$ | |
| Excess of rating level over background | -3 dB | +1 dB |
| Predicted ambient sound level | 45 dB $L_{Aeq,\ 16\ hour}$ | 35 dB $L_{Aeq,\ 16\ hour}$ |
| Conclusion | Low impact | Low impact |

10.103 The proposed energy storage facility is predicted to have a low impact during both day and night-time periods as the rating sound level is below the existing background sound level during the day and exceeds by 1 dB at night-time.

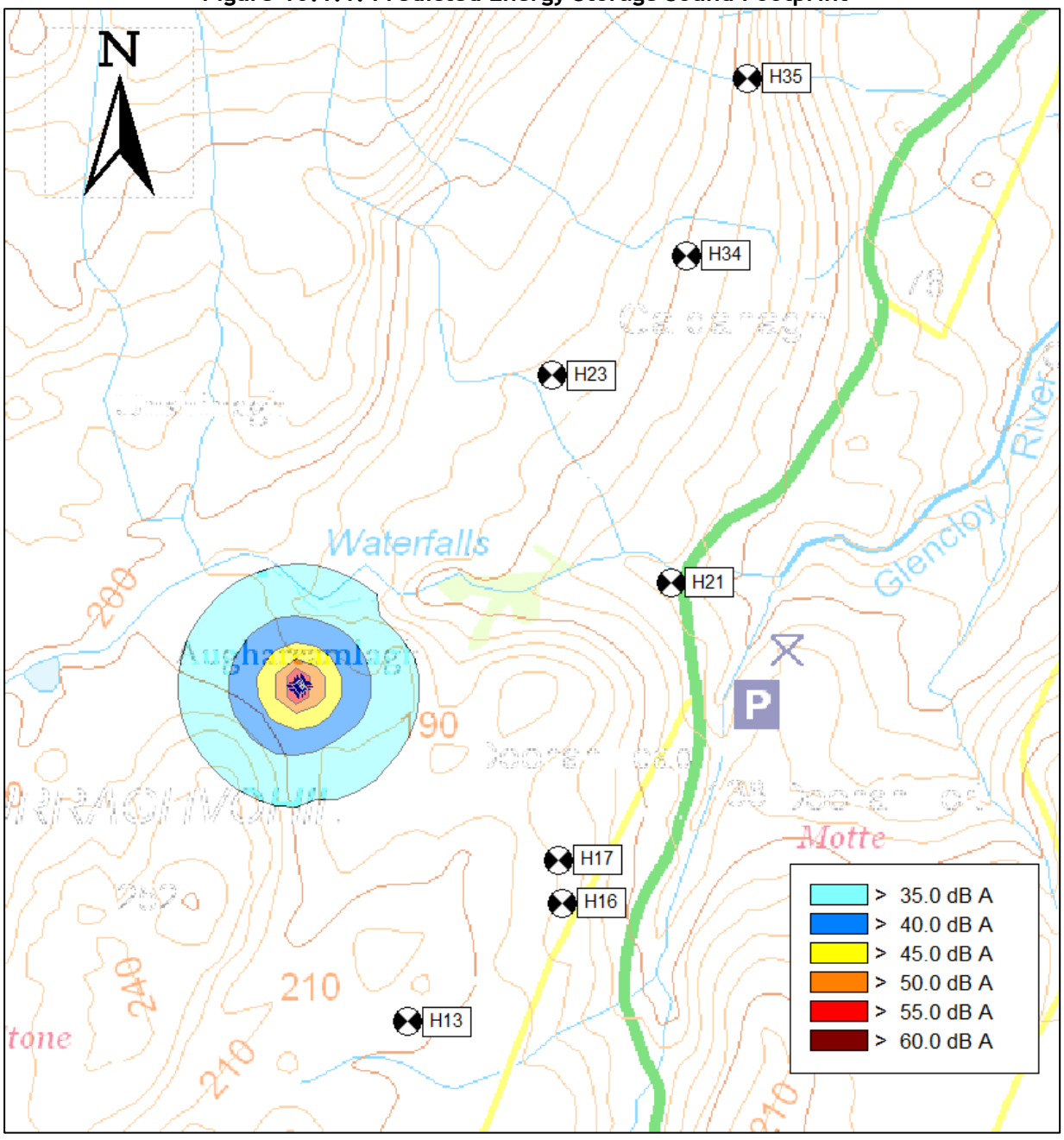
10.104 There is expected to be no change in either the daytime ambient sound level or the ambient sound level at night due to the introduction of the energy storage facility, consistent with it having a low impact.

10.105 The sound associated with the introduction of the BESS facilities will be very different in nature to that generated by the turbines forming the main part of the site and for which different assessment criteria and methodologies apply respectively. As a result, a comparative cumulative noise assessment is not strictly possible or appropriate.

10.106 In conclusion, the acoustic assessment shows that the impact due to the operation of the proposed energy storage facility is predicted to be low during both day and night-time periods such that no adverse impacts would be expected.

10.107 Sound emitted during construction of the energy storage facility, including that due to associated traffic flows, is not predicted to exceed the criteria specified in BS 5228-1:2009[14] such that significant effects would not be anticipated.

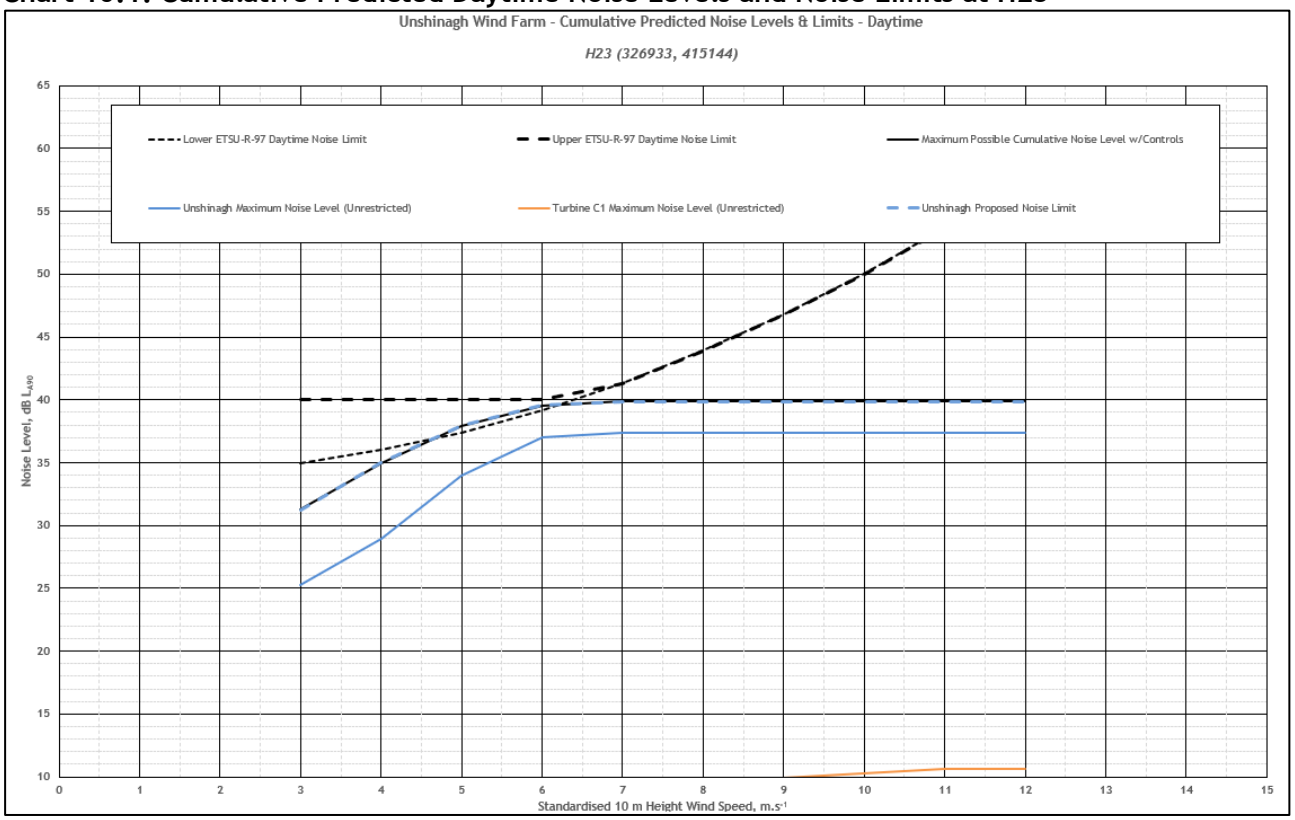
**Figure 10.1.1: Predicted Energy Storage Sound Footprint**



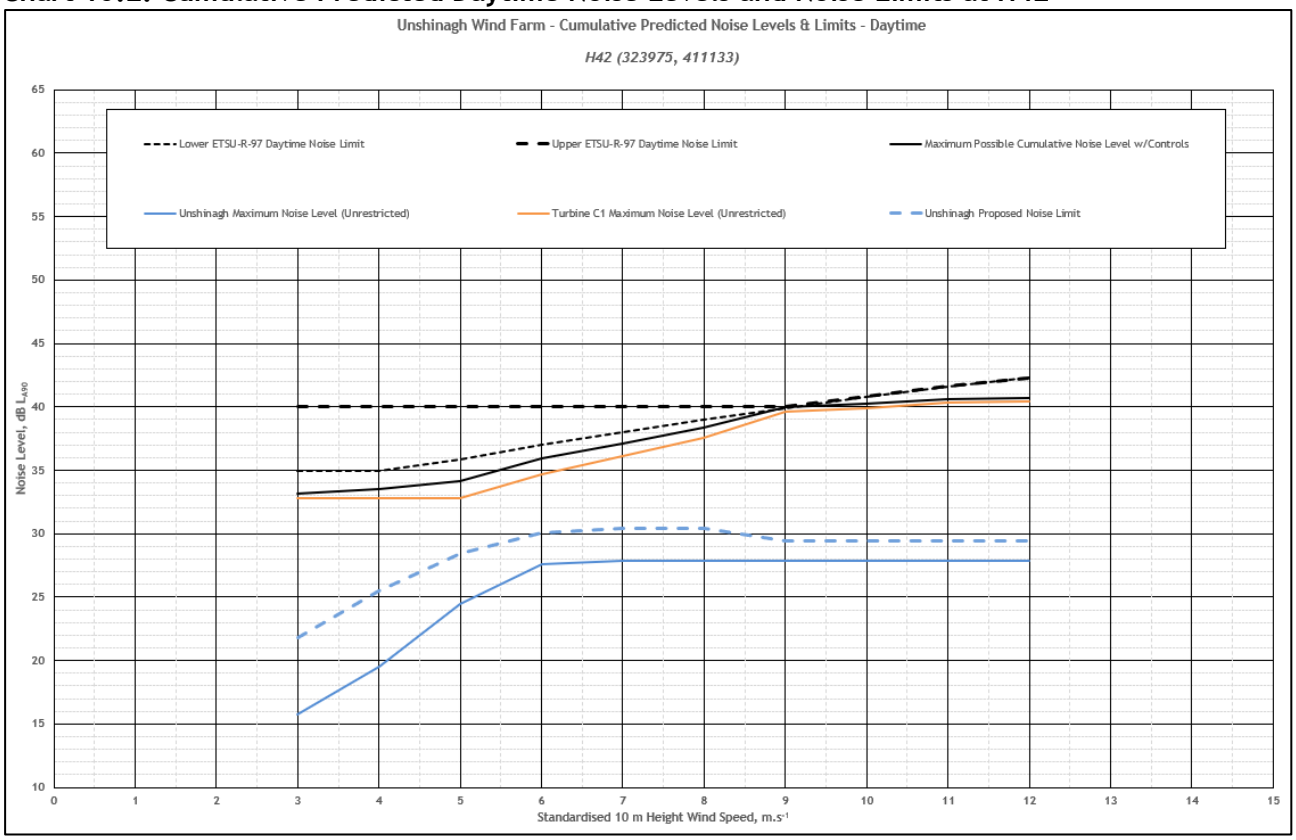

[14] 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009

# FEI Technical Appendix 10.2: Charts

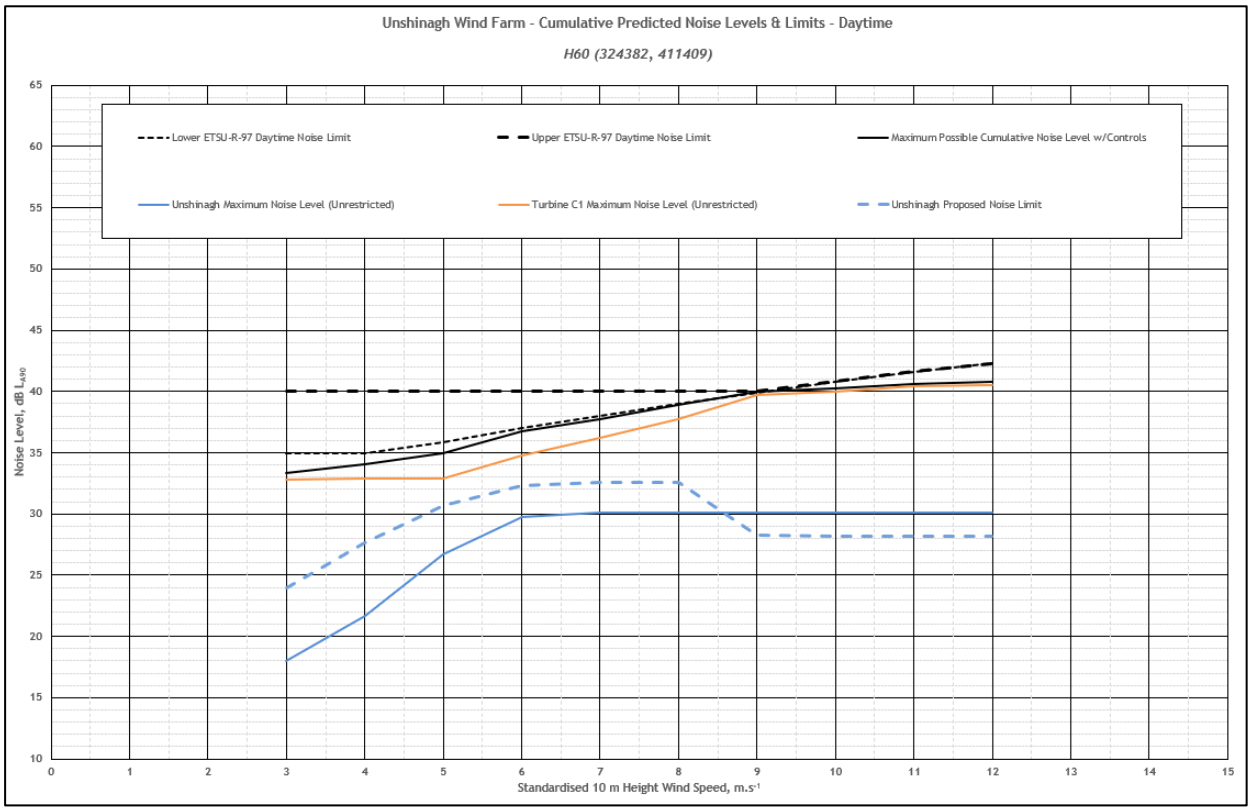
## Chart 10.1: Cumulative Predicted Daytime Noise Levels and Noise Limits at H23



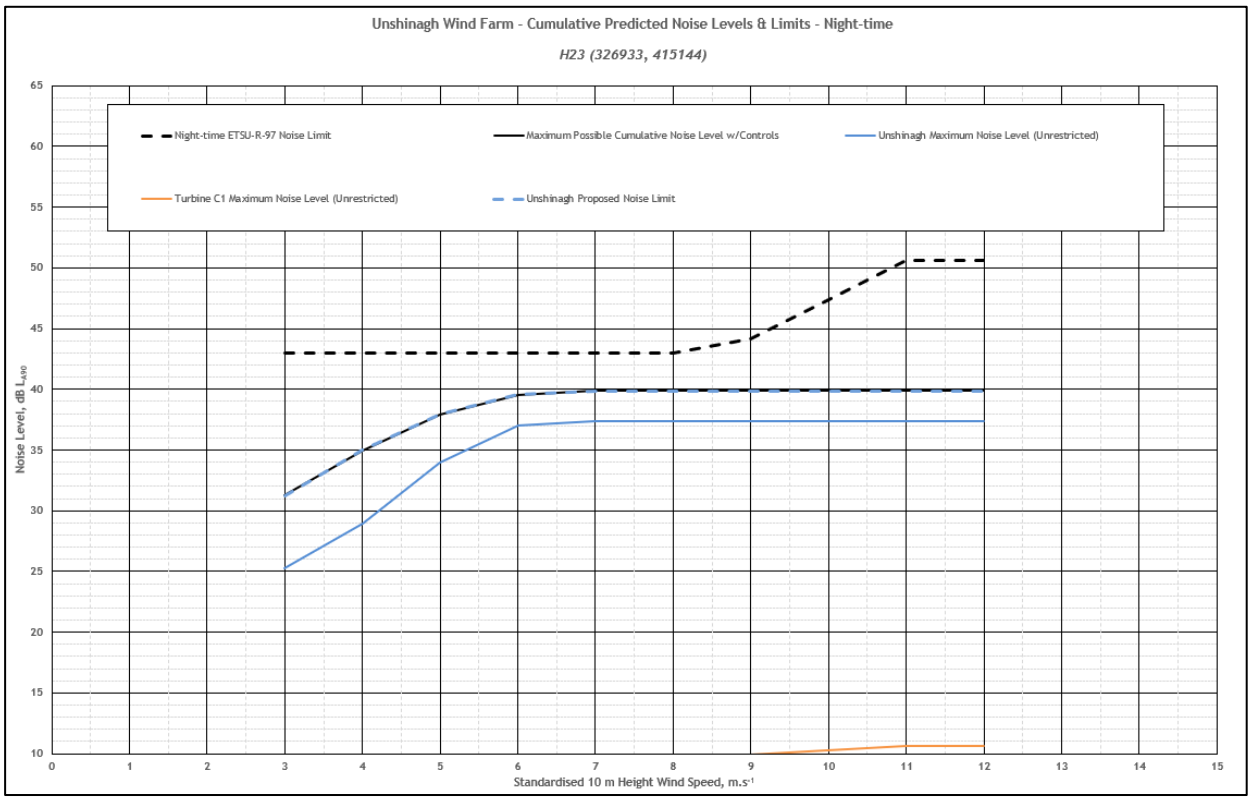

## Chart 10.2: Cumulative Predicted Daytime Noise Levels and Noise Limits at H42



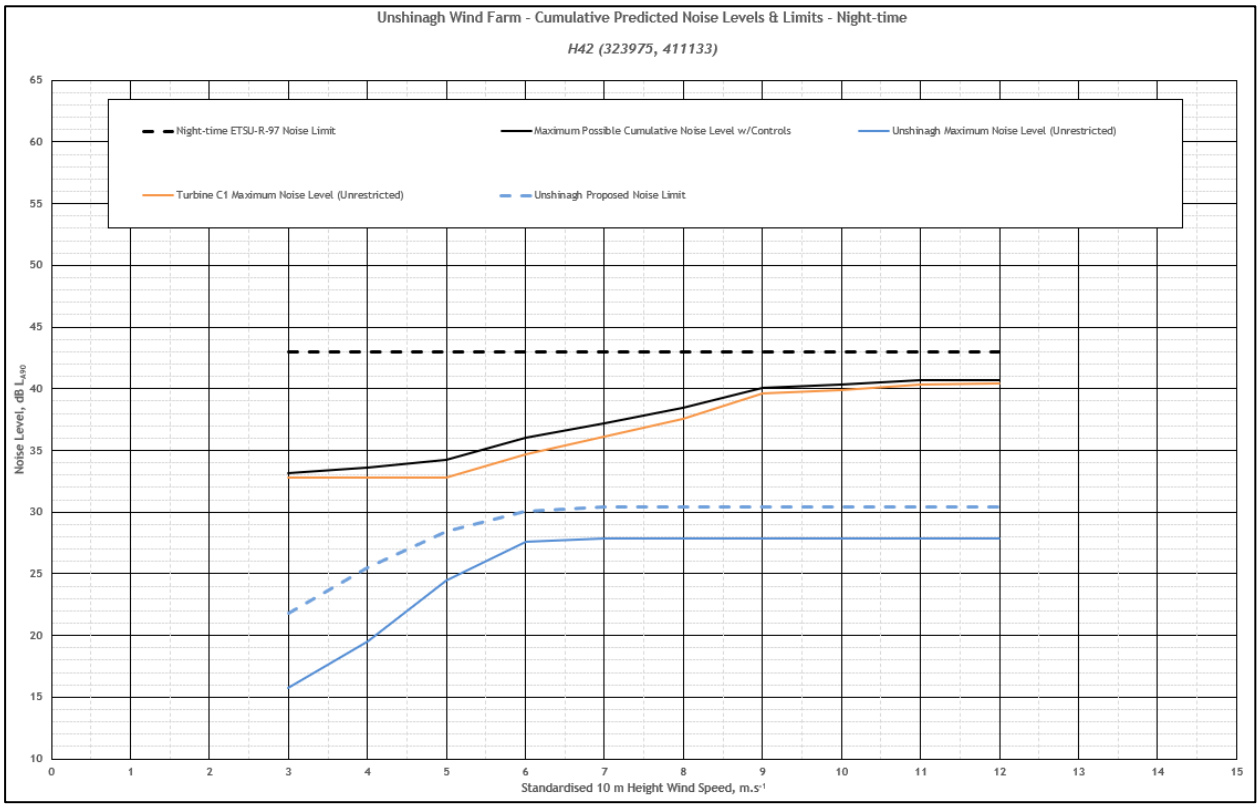
## Chart 10.3: Cumulative Predicted Daytime Noise Levels and Noise Limits at H60



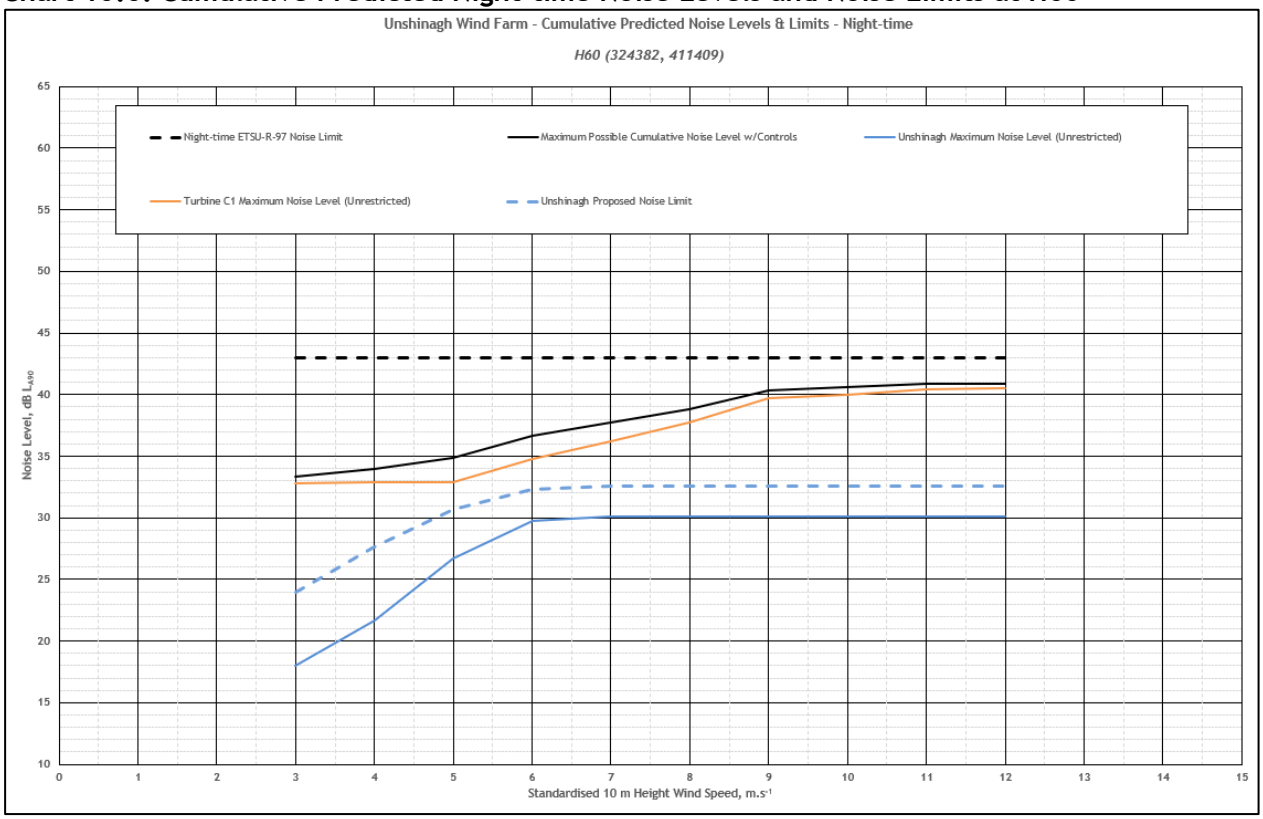

## Chart 10.4: Cumulative Predicted Night-time Noise Levels and Noise Limits at H23



## Chart 10.5: Cumulative Predicted Night-time Noise Levels and Noise Limits at H42




## Chart 10.6: Cumulative Predicted Night-time Noise Levels and Noise Limits at H60



# FEI Technical Appendix 10.3: Suggested Planning Condition

## Introduction

In the event that the Proposed Development is successful in gaining planning consent, the decision notice would likely contain appropriately worded noise conditions.

Such conditions will provide a degree of protection to nearby residents should noise from the Proposed Development cause disturbance. To that end, presented below are a set of relevant, precise and enforceable conditions that RES suggest as appropriate. The form of condition wording suggested has been used for many wind farm developments and the final conditions attached to the consent would be according to the discretion of the decision maker.

## Draft Planning Condition

The rating level of noise immissions from the combined effects of the wind turbines (including the application of any tonal penalty) when determined in accordance with the attached Guidance Notes (to this condition), shall not exceed the values for the relevant integer wind speed, set out in, or derived from, the Tables attached to this condition at any dwelling which is lawfully existing or has planning permission at the date of this consent and:

a. The Company shall continuously log power production, wind speed and wind direction, all in accordance with Guidance Note 1(d). These data shall be retained for a period of not less than 24 months. The Company shall provide this information in the format set out in Guidance Note 1(e) to the Planning Authority on its request, within 14 days of receipt in writing of such a request.

b. No electricity shall be exported until the Company has submitted to the Local Planning Authority for written approval a list of proposed independent consultants who may undertake compliance measurements in accordance with this condition. Amendments to the list of approved consultants shall be made only with the prior written approval of the Local Planning Authority.

c. Within 21 days from receipt of a written request from the Local Planning Authority following a complaint to it from an occupant of a dwelling alleging noise disturbance at that dwelling, the Company shall, at its expense, employ a consultant approved by the Planning Authority to assess the level of noise immissions from the wind farm at the complainants' dwelling in accordance with the procedures described in the attached Guidance Notes. The written request from the Local Planning Authority shall set out at least the date, time and location that the complaint relates to and any identified atmospheric conditions, including wind direction, and include a statement as to whether, in the opinion of the Local Planning Authority, the noise giving rise to the complaint contains or is likely to contain a tonal component.

d. The assessment of the rating level of noise immissions shall be undertaken in accordance with an assessment protocol that shall, prior to the commencement of any measurements, have been submitted to and approved in writing by the Local Planning Authority. The protocol shall include the proposed measurement location identified in accordance with the Guidance Notes where measurements for compliance checking purposes shall be undertaken and also the range of meteorological and operational conditions (which shall include the range of wind speeds,

wind directions, power generation and times of day) to determine the assessment of rating level of noise immissions. The proposed range of conditions shall be those which prevailed during times when the complainant alleges there was disturbance due to noise, having regard to the written request of the Planning Authority under paragraph (c), and such others as the independent consultant considers likely to result in a breach of the noise limits.

e. Where a dwelling to which a complaint is related is not listed in the tables attached to these conditions, the Company shall submit to the Local Planning Authority for written approval proposed noise limits selected from those listed in the tables to be adopted at the complainant's dwelling for compliance checking purposes. The proposed noise limits shall be those limits selected from the Tables specified for a listed location which is the geographically nearest dwelling to the complainant's dwelling, unless otherwise agreed with the Local Planning Authority due to location-specific factors.

f. The Company shall provide to the Local Planning Authority the independent consultant's assessment of the rating level of noise immissions undertaken in accordance with the Guidance Notes within 2 months of the date of the written request of the Local Planning Authority for compliance measurements to be made under paragraph (c), unless the time limit is extended in writing by the Local Planning Authority. Unless otherwise agreed in writing by the Local Planning Authority, the assessment shall be accompanied by all data collected for the purposes of undertaking the compliance measurements, such data to be provided in the format set out in Guidance Note 1(e) of the Guidance Notes with the exception of audio data which shall be supplied in the format in which it is recorded. The instrumentation used to undertake the measurements shall be calibrated in accordance with Guidance Note 1(a) and certificates of calibration shall be submitted to the Local Planning Authority with the independent consultant's assessment of the rating level of noise immissions.

g. Where a further assessment of the rating level of noise immissions from the wind farm is required pursuant to Guidance Note 4(c), the Company shall submit a copy of the further assessment within 21 days of submission of the independent consultant's assessment pursuant to paragraph (d) above unless the time limit has been extended in writing by the Local Planning Authority.

Table 1: Proposed Unshinagh Planning Condition Noise Limits, dB $L_{A90}$

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Daytime** | | | | | | | | | | |
| H5 | 27.1 | 30.8 | 33.8 | 35.4 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 |
| H6 | 24.8 | 28.5 | 31.5 | 33.1 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 |
| H7 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H10 | 26.6 | 30.3 | 33.3 | 34.9 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 |
| H13 | 27.9 | 31.6 | 34.6 | 36.2 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 |
| H16 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H17 | 26.9 | 30.6 | 33.6 | 35.2 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 |
| H21 | 27.4 | 31.1 | 34.1 | 35.7 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| H23 | 31.3 | 35.0 | 38.0 | 39.6 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 |
| H31 | 26.0 | 29.7 | 32.7 | 34.3 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 |
| H33 | 24.2 | 27.9 | 30.9 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H34 | 30.3 | 34.0 | 37.0 | 38.6 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 |
| H35 | 29.3 | 33.0 | 36.0 | 37.6 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| H42 | 21.8 | 25.5 | 28.5 | 30.1 | 30.4 | 30.4 | 29.4 | 29.4 | 29.4 | 29.4 |
| H43 | 21.9 | 25.6 | 28.6 | 30.2 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 |
| H60 | 24.0 | 27.7 | 30.7 | 32.3 | 32.6 | 32.6 | 28.2 | 28.2 | 28.2 | 28.2 |
| **Night-time** | | | | | | | | | | |
| H5 | 27.1 | 30.8 | 33.8 | 35.4 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 | 35.7 |
| H6 | 24.8 | 28.5 | 31.5 | 33.1 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 | 33.4 |
| H7 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H10 | 26.6 | 30.3 | 33.3 | 34.9 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 | 35.2 |
| H13 | 27.9 | 31.6 | 34.6 | 36.2 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 | 36.5 |
| H16 | 26.5 | 30.2 | 33.2 | 34.8 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 | 35.1 |
| H17 | 26.9 | 30.6 | 33.6 | 35.2 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 | 35.5 |
| H21 | 27.4 | 31.1 | 34.1 | 35.7 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| H23 | 31.3 | 35.0 | 38.0 | 39.6 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 | 39.9 |
| H31 | 26.0 | 29.7 | 32.7 | 34.3 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 | 34.6 |
| H33 | 24.2 | 27.9 | 30.9 | 32.5 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 |
| H34 | 30.3 | 34.0 | 37.0 | 38.6 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 | 38.9 |
| H35 | 29.3 | 33.0 | 36.0 | 37.6 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 | 37.9 |
| H42 | 21.8 | 25.5 | 28.5 | 30.1 | 30.4 | 30.4 | 30.4 | 30.4 | 30.4 | 30.4 |
| H43 | 21.9 | 25.6 | 28.6 | 30.2 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 |
| H60 | 24.0 | 27.7 | 30.7 | 32.3 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 | 32.6 |

Table 2: Alternative Proposed Unshinagh Planning Condition Noise Limits, dB $L_{A90}$

| House ID | Standardised 10m Height Wind Speed, $ms^{-1}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Daytime** | | | | | | | | | | |
| H5 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H6 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H7 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H10 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H13 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H16 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H17 | 35.1 | 35.7 | 36.6 | 37.8 | 39.3 | 41.2 | 43.5 | 46.2 | 49.4 | 49.4 |
| H21 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H23 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H31 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H33 | 38.6 | 38.9 | 39.2 | 39.8 | 40.7 | 42.0 | 43.9 | 46.6 | 50.0 | 50.0 |
| H34 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H35 | 35.0 | 36.0 | 37.4 | 39.2 | 41.3 | 43.9 | 46.8 | 50.0 | 53.7 | 53.7 |
| H42 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H43 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| H60 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 37.0 | 39.8 | 43.6 | 48.6 | 48.6 |
| **Night-time** | | | | | | | | | | |
| H5 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H6 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H7 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H10 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H13 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H16 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H17 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.6 | 46.7 | 46.7 |
| H21 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H23 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H31 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| H33 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 45.0 | 45.0 | 45.0 |
| H34 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H35 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 44.2 | 47.4 | 50.6 | 50.6 |
| H42 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H43 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |
| H60 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 | 43.0 |

Note to Table 2: Alternative noise limits have been provided in the event that the cumulative single turbine, C1 (Planning Ref: LA02/2023/ 1884/F) is not constructed and does not become operational.

**Table 3: Co-Ordinate Locations of the Dwellings Listed at Table 1 & 2**

| House ID | Coordinates (EPSG 29902) | | House ID | Coordinates (EPSG 29902) | |
|---|---|---|---|---|---|
| | 3 | 4 | | 6 | 7 |
| H5 | 325142 | 411868 | H23 | 326933 | 415144 |
| H6 | 323688 | 411880 | H31 | 327476 | 416927 |
| H7 | 323827 | 412064 | H33 | 327289 | 417329 |
| H10 | 326493 | 412942 | H34 | 327213 | 415466 |
| H13 | 326575 | 413545 | H35 | 327415 | 415880 |
| H16 | 326958 | 413839 | H42 | 323975 | 411133 |
| H17 | 326948 | 413945 | H43 | 323789 | 411238 |
| H21 | 327226 | 414631 | H60 | 324382 | 411409 |

Note to Table 3: The geographical coordinate references are provided for the purpose of identifying the general location of dwellings to which a given set of noise limits applies.

## Guidance Notes

These notes are to be read with and form part of the noise condition. They further explain the condition and specify the methods to be employed in the assessment of complaints about noise immissions from the wind farm. The rating level at each integer wind speed is the arithmetic sum of the wind farm noise level as determined from the best-fit curve described in Guidance Note 2 of these Guidance Notes and any tonal penalty applied in accordance with Guidance Note 3. Reference to ETSU-R-97 refers to the publication entitled "The Assessment and Rating of Noise from Wind Farms" (1997) published by the Energy Technology Support Unit (ETSU) for the Department of Trade and Industry (DTI).

**Guidance Note 1**

a) Values of the $L_{A90,10\text{-minute}}$ noise statistic should be measured at the complainant's property, using a sound level meter of EN 60651/BS EN 60804 Type 1, or BS EN 61672 Class 1 quality (or the equivalent UK adopted standard in force at the time of the measurements) set to measure using the fast time weighted response as specified in BS EN 60651/BS EN 60804 or BS EN 61672-1 (or the equivalent UK adopted standard in force at the time of the measurements). This should be calibrated in accordance with the procedure specified in BS 4142:1997 (or the equivalent UK adopted standard in force at the time of the measurements). Measurements shall be undertaken in such a manner to enable a tonal penalty to be applied in accordance with Guidance Note 3.

b) The microphone should be mounted at 1.2 – 1.5 metres above ground level, fitted with a two-layer windshield or suitable equivalent approved in writing by the Local Planning Authority, and placed outside the complainant's dwelling. Measurements should be made in "free field" conditions. To achieve this, the microphone should be placed at least 3.5 metres away from the building facade or any reflecting surface except the ground at the approved measurement location. In the event that the consent of the complainant for access to his or her dwelling to undertake compliance measurements is withheld, the wind farm operator shall submit for the written approval of the Planning Authority details of the proposed alternative representative measurement location prior to the

commencement of measurements and the measurements shall be undertaken at the approved alternative representative measurement location.

c) The $L_{A90,10\text{-minute}}$ measurements should be synchronised with measurements of the 10-minute arithmetic mean wind and operational data logged in accordance with Guidance Note 1(d), including the power generation data from the turbine control systems of the wind farm.

d) To enable compliance with the conditions to be evaluated, the wind farm operator shall continuously log arithmetic mean wind speed in metres per second and wind direction in degrees from north at hub height for each turbine, and at any on site meteorological mast(s), if available, together with the arithmetic mean power generated by each turbine, all in successive 10-minute periods. All 10-minute arithmetic average mean wind speed data measured at hub height shall be 'standardised' to a reference height of 10 metres as described in ETSU-R-97 at page 120 using a reference roughness length of 0.05 metres. It is this standardised 10 metre height wind speed data, as determined from whichever source is agreed in writing with the Local Planning Authority as being most appropriate to the noise compliance measurements being undertaken, which is correlated with the noise measurements determined as valid in accordance with Guidance Note 2, such correlation to be undertaken in the manner described in Guidance Note 2. All 10-minute periods shall commence on the hour and in 10-minute increments thereafter. months.

e) Data provided to the Local Planning Authority in accordance with the noise condition shall be provided in comma separated values in electronic format.

f) A data logging rain gauge shall be installed in the course of the assessment of the levels of noise immissions. The gauge shall record over successive 10-minute periods synchronised with the periods of data recorded in accordance with Note 1(d).

**Guidance Note 2**

a) The noise measurements shall be made so as to provide not less than 20 valid data points as defined in Guidance Note 2 (b).

b) Valid data points are those measured in the conditions specified in the agreed written protocol under paragraph (d) of the noise condition but excluding any periods of rainfall measured in the vicinity of the sound level meter. Rainfall shall be assessed by use of a rain gauge that shall log the occurrence of rainfall in each 10-minute period concurrent with the measurement periods set out in Guidance Note 1.

c) For those data points considered valid in accordance with Guidance Note 2(b), values of the $L_{A90,10\text{-minute}}$ noise measurements and corresponding values of the 10- minute standardised ten metre height wind speed, as derived from the site measured wind speed source(s) agreed in writing with the Planning Authority in accordance with Guidance Note 1(d), shall be plotted on separate XY charts for each wind direction considered, with noise level on the Y-axis and the standardised mean wind speed on the X-axis. A least-squares, "best fit" curve of an order deemed appropriate by the independent consultant (but which may not be higher than a fourth order) should be fitted to the data points and define the wind farm noise level at each integer speed and direction.

**Guidance Note 3**

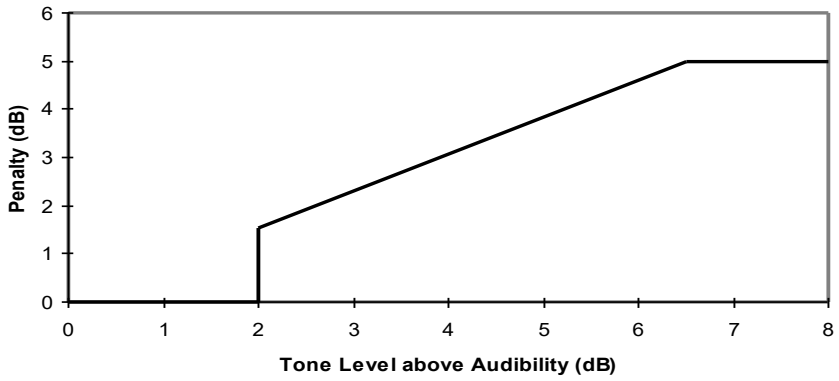
a) Where, in accordance with the approved assessment protocol under paragraph (d) of the noise condition, noise immissions at the location or locations where compliance measurements are being undertaken contain or are likely to contain a tonal component, a tonal penalty is to be calculated and applied using the following rating procedure.

b) For each 10-minute interval for which $L_{A90,10\text{-minute}}$ data have been determined as valid in accordance with Guidance Note 2 a tonal assessment shall be performed on noise immissions during 2 minutes of each 10-minute period. The 2-minute periods should be spaced at 10-minute intervals provided that uninterrupted uncorrupted data are available ("the standard procedure"). Where uncorrupted data are not available, the first available uninterrupted clean 2-minute period out of the affected overall 10-minute period shall be selected. Any such deviations from the standard procedure, as described in Section 2.1 on pages 104-109 of ETSU-R-97, shall be reported.

c) For each of the 2-minute samples the tone level above or below audibility shall be calculated by comparison with the audibility criterion given in Section 2.1 on pages 104-109 of ETSU-R-97.

d) The average tone level above audibility shall be calculated for each wind speed bin, each bin being 1 metre per second wide and centred on integer wind speeds, for each wind direction. Samples for which the tones were below the audibility criterion or no tone was identified, a value of zero audibility shall be substituted.

e) The tonal penalty for each wind speed bin is derived from the margin above audibility of the tone according to the figure below.




**Guidance Note 4**

a) If a tonal penalty is to be applied in accordance with Guidance Note 3 the rating level of the turbine noise at each wind speed and wind direction is the arithmetic sum of the measured noise level as determined from the best fit curve described in Guidance Note 2 and the penalty for tonal noise as derived in accordance with Guidance Note 3 at each integer wind speed and wind direction within the range specified by the Local Planning Authority in its written protocol under paragraph (d) of the noise condition.

b) If no tonal penalty is to be applied, then the rating level of the turbine noise at each wind speed and wind direction is equal to the measured noise level as determined from the best fit curve described in Guidance Note 2.

c) In the event that the rating level is above the limit(s) set out in the Tables attached to the noise conditions or the noise limits for a complainants' dwelling approved in accordance with paragraph (e) of the noise condition, the independent consultant shall undertake a further assessment of the rating level to correct for background noise so that the rating level relates to wind turbine noise immission only.

d) The wind farm operator shall ensure that all necessary wind turbines in the development are turned off for such period as the independent consultant requires to undertake any further noise measurements required under Guidance Note 4(c). If the number of turbines to be turned off are less than the total number of turbines on the site, then this shall be agreed in advance with the Planning Authority.

e) To this end, the steps in Guidance Note 2 shall be repeated with the required number of turbines shutdown in accordance with Guidance Note 4(d) in order to determine the background noise (L3) at each integer wind speed within the range requested by the Planning Authority in its written request under paragraph (c) and the approved protocol under paragraph (d) of the noise condition.

f) The wind farm noise (L1) at this speed shall then be calculated as follows where L2 is the measured level with turbines running but without the addition of any tonal penalty:

$$L_1 = 10 \log\left[10^{L_2/10} - 10^{L_3/10}\right]$$

g) The rating level shall be re-calculated by arithmetically adding the tonal penalty (if any is applied in accordance with Note 3) to the derived wind farm noise L1 at that integer wind speed and wind direction.

h) If the rating level after adjustment for background noise contribution and adjustment for tonal penalty (if required in accordance with Guidance Note 3 above) at any integer wind speed and wind direction lies at or below the values set out in the Tables attached to the conditions or at or below the noise limits approved by the Planning Authority for a complainant's dwelling in accordance with paragraph (e) of the noise condition then no further action is necessary. If the rating level at any integer wind speed and wind direction exceeds the values set out in the Tables attached to the conditions or the noise limits approved by the Local Planning Authority for a complainants' dwelling in accordance with paragraph (e) of the noise condition, then the development fails to comply with the conditions.

## Figures

**FEI Figure 10.1: Predicted Noise Footprint due to Proposed Wind Farm**