

Chapter 11: Noise and Shadow Flicker

11.1. EXECUTIVE SUMMARY.....	1
11.2. INTRODUCTION.....	2
11.3. SCOPE OF NOISE ASSESSMENT.....	2
11.4. CONSULTATION ON NOISE	3
11.5. NOISE ASSESSMENT METHODOLOGY	4
11.6. CONSENTED DEVELOPMENT NOISE EIAR BASELINE	4
11.7. SUMMARY OF NOISE EFFECTS PREDICTED & MITIGATION MEASURES SUGGESTED FOR THE CONSENTED DEVELOPMENT	4
11.8. REVISED ASSESSMENT OF NOISE EFFECTS FOR THE PROPOSED VARIED DEVELOPMENT	5
11.9. REVISED NOISE MITIGATION MEASURES FOR THE PROPOSED VARIED DEVELOPMENT...	6
11.10.COMPARISON OF NOISE EFFECTS OF THE PROPOSED VARIES DEVELOPMENT WITH THE EFFECTS OF THE CONSENTED DEVELOPMENT	6
11.11.CONCLUSION OF NOISE ASSESSMENT	6
11.12.CONSIDERATION OF SHADOW FLICKER.....	7
11.13.REFERENCES.....	7

Tables

TABLE 11.1: THC SCOPING RESPONSE	3
TABLE 11.2: CANDIDATE WIND TURBINE MODEL (V162 7.2MW) MAXIMUM NOISE EMISSION LEVELS	5
TABLE 11.3: PREDICTED OPERATIONAL NOISE LEVELS.....	6

Figures

- Figure 11.1: Noise Sensitive Receptors
- Figure 11.2: Shadow Flicker

11.1. Executive Summary

- 11.1.1. The Proposed Varied Development relates to an increase in tip height of the proposed turbines from 180m to up to 230m, compared to the Consented Development and a minor increase in the nominal rotor diameter from 158m to 163m.
- 11.1.2. Maximum noise emission levels are unlikely to change significantly. There would be no change to construction or decommissioning activities or locations. The Scoping Report submitted to the ECU in May 2025 (refer to **Technical Appendix 3.1: Scoping Report**) therefore proposed to scope out assessment of noise during construction, operational and decommissioning phases.
- 11.1.3. The Highland Council (THC) response to the Scoping Report confirmed that construction noise and vibration could be scoped out but requested an updated operational noise assessment to demonstrate that the Proposed Varied Development would comply with the Consented Development's conditioned noise limit. Therefore, an assessment of predicted noise levels for the Proposed Varied Development has been carried out in relation to the consented development's conditioned noise limit.
- 11.1.4. The assessment has been carried out in accordance with ETSU-R-97 and the Institute of Acoustics Good Practice Guide (IOA GPG) as required by the consultation responses and in accordance with current Government Policy and best practice.
- 11.1.5. The operational noise assessment considered the worst-case of four potential turbine models and concluded that the Proposed Varied Development would comply with the Consented Development's conditioned noise limit.
- 11.1.6. In conclusion, operational noise effects, including cumulative effects, are considered to be **not significant**.
- 11.1.7. The assessment has demonstrated that the Proposed Varied Development complies with the noise limits set out in Condition 30 of the Consented Development, therefore it is considered that no amendments will be required to the wording of this Condition. For the wording of this condition, refer to **Annex 2, Part 1** of the Consented Development S36C decision letter¹.
- 11.1.8. In terms of Shadow Flicker and as stated in the applicant's Scoping Report this was previously scoped out of the 2021 EIAR for the Consented

¹ The Section 36 Bhlaraidh Wind Farm Extension decision letter containing details of Condition 30 can be found here: [Scottish Government - Energy Consents Unit - Application Details](#)

Development and no change is expected as a result of Proposed Varied Development. THC's consultation response to the Scoping Report (refer to **Chapter 3 – EIA Methodology, Appendix 3.2: Scoping Opinion**) stated that a detailed assessment is not required, but that shadow flicker should still be considered within the EIAR submission.

- 11.1.9. Consideration is therefore given to shadow flicker in this chapter assessment, and the effects are considered to be **not significant**.

11.2. Introduction

- 11.2.1. This chapter of the EIAR firstly presents an assessment of the likely noise effects of the Proposed Varied Development and secondly it will consider the impact of shadow flicker.

11.3. Scope of Noise Assessment

- 11.3.1. The Proposed Varied Development Scoping Report proposed to scope out assessment of noise during construction, operational and decommissioning phases.
- 11.3.2. The Proposed Varied Development relates to an increase in tip height of the proposed turbines from 180m to up to 230m, compared to the Consented Development and an increase in the nominal rotor diameter from 158m to 163m. Maximum noise emission levels are unlikely to change significantly. The scoping opinion and THC's Scoping response requested that an operational noise assessment is undertaken in accordance with ETSU-R-97 and the associated IOA GPG to demonstrate that the limits set in Condition 30 of the Consented Development's Section 36 consent notice can still be met. The operational noise limits (at any noise sensitive location existing at the time of the consent) are as follows:
- Bhlaraidh, 29dB LA90,10mins
 - Levishie, 32dB LA90,10mins
 - Achnaconeran, 31dB LA90,10mins.
- 11.3.3. Noise limits in Condition 30 are set 2dB above the maximum predicted noise level which was set out in the **2022 Additional Information Report (AIR), Chapter 11 – Noise (Tables 11.3 and 11.4)**, as agreed in consultation with The Highland Council's Environmental Health Department (THC EHD) (July 2022).
- 11.3.4. Noise and vibration from both construction and decommissioning are also not expected to increase for the Proposed Varied Development in comparison with the Consented Development. This is because both the construction process,

and the transport and plant vehicles the project intends to use, are not expected to substantially change.

11.4. Consultation on Noise

- 11.4.1. THC EHD provided a Scoping Response via email in July 2025 (refer to **Appendix 3.3: Further Scoping Consultation**). **Table 11.1 of this chapter** below details the comments contained within this response, and how these are addressed within this assessment.

Table 11.1: THC Scoping Response

Comment	SSE Response
The applicant will be required to submit a noise assessment with regard to the operational phase of the development. The assessment should be carried out in accordance with ETSU-R-97 “The Assessment and Rating of Noise from Wind Farms” and the associated Good Practice Guide published by the Institute of Acoustics and should demonstrate that the conditioned limits in 21/04080/S36 will be met.	The assessment below presents an updated assessment of predicted operational noise levels for the Proposed Varied Development against the noise limit in the Consented Development’s Consent Conditions.
It is understood that the initial noise assessment for 21/04080/S36 took two other wind farms into account in terms of cumulative noise. Subsequent to that decision, other developments have been proposed in the area however, the relevant applications and noise assessments would have considered cumulative noise based on the conditioned limits for 21/04080/S36. Therefore, it is agreed that further cumulative noise assessment can be scoped out.	Acknowledged, no action required.
Amplitude Modulation, operational vibration, infrasound, and low frequency noise can also be scoped out from further assessment.	Acknowledged, no action required.
Given the separation distances to noise sensitive receptors, the need for a detailed construction noise assessment can be scoped out. It is expected that the developer/contractor will employ the best practicable means to reduce the impact of noise from construction activities. The applicant will be required to submit a scheme demonstrating how this will be implemented in a Construction and Environmental Management Plan (CEMP) or similar document.	Acknowledged - a revised (Construction Environmental Management Plan) CEMP will be submitted to THC prior to the commencement of works on site.
Given the separation distance from the substation to the nearest noise sensitive receptors the need for a separate substation noise assessment can be scoped out.	Acknowledged, no action required.

- 11.4.2. The scope of the assessment is therefore limited to the assessment of operational noise effects against the noise limit specified in Condition 30 of the Consented Development.

11.5. Noise Assessment Methodology

- 11.5.1. The operational noise effects of the Proposed Varied Development have been assessed in accordance with the relevant requirements of both 'The Assessment and Rating of Wind Turbine Noise' (ETSU-R-97) and 'A Good Practice Guide to the Application of ETSU-R-97 to the Assessment and Rating of Wind Turbine Noise' (the IOA GPG).
- 11.5.2. It was previously agreed with THC EHD that noise limits at the identified noise assessment locations within the EIA should be set 2dB above the maximum predicted noise level. Consequently, in accordance with the IOA GPG, this assessment compares the maximum predicted noise level with the noise limits stated within planning condition 30.

11.6. Consented Development Noise EIAR Baseline

- 11.6.1. **2021 EIAR, Volume 4, Technical Appendix 11.1: Operational Noise Report (June 2021)**, identified noise sensitive receptors and noise assessment areas. A baseline, background noise survey was carried out at these locations, however, the results of which are not required to determine whether the noise limits stated in planning condition 30 can be met. Nevertheless, the results of the background survey remain valid.
- 11.6.2. **2022 AIR Chapter 11: Noise** identified the Total Noise Limits (Which are noise limits applicable to all wind farms in the area) and the Site-Specific Noise Limits (for the Proposed Development only).
- 11.6.3. It is acknowledged in THC Scoping Response that any subsequent applications and noise assessments have considered cumulative noise based on the noise limits stated in planning condition 30. Therefore, no further cumulative noise assessment is required.

11.7. Summary of Noise Effects Predicted & Mitigation Measures suggested for the Consented Development

- 11.7.1. No significant noise effects were identified during construction, operation (including cumulatively) or decommissioning of the Consented Development

and therefore no specific noise or vibration mitigation measures were deemed to be necessary.

11.8. Revised Assessment of Noise Effects for the Proposed Varied Development

- 11.8.1. Four potential candidate turbine models were compared to determine which had the potential to generate the highest levels of operational noise at the nearest noise-sensitive receptors, i.e., at distance of approximately 2.4 to 3.6km, specifically:
- Vestas V162 6.2MW
 - Vestas V162 7.2MW
 - Vestas V150 6.0MW
 - Nordex N163 6.8MW
- 11.8.2. Taking into account frequency spectra and appropriate additions for uncertainty, in line with the IOA GPG, it was found that the Vestas V162 7.2MW was likely to result in the highest operational noise levels at the nearest noise sensitive receptors.
- 11.8.3. **Table 11.2** details the maximum noise emissions of this turbine model, which have been used in the assessment of likely operational noise effects. An uncertainty addition of 2dB² has been applied in modelling, in accordance with the IOA GPG recommendations.

Table 11.2: Candidate Wind Turbine Model (V162 7.2MW) Maximum Noise Emission Levels

Octave Band Centre Frequency, Hz	63	125	250	500	1000	2000	4000	8000	Overall
Sound Power Level, dB(A)	90.6	97.4	98.8	98.6	99.6	99.4	94.8	83.4	106.3

² Not included in the values shown in in Table 11.2

11.8.4. **Figure 11.1: Noise Receptors** shows noise contour lines based on the above candidate turbine model and the location of the nearest noise-sensitive receptors.

11.8.5. **Table 11.3 below** details the predicted operational noise levels due to the Proposed Varied Development at the nearest noise sensitive receptors as shown in **Figure 11.1** in comparison to the limits specified in planning condition 30.

Table 11.3: Predicted Operational Noise Levels

Name	Maximum Predicted Operational Noise Level, dB, $L_{A90,10min}$	Noise Limit, dB, $L_{A90,10min}$
Bhlaraidh	26.8	29.0
Levishie	29.3	32.0
Achnaconeran	28.8	31.0

11.8.6. Operational noise effects from the Proposed Varied Development are predicted to be below the noise limit and therefore considered to be not significant.

11.9. Revised Noise Mitigation Measures for the Proposed Varied Development

11.9.1. No mitigation measures are required in relation to operational noise and vibration effects of the Proposed Varied Development.

11.9.2. As with the Consented Development, during construction the Contractor will, where necessary, employ the best practicable means to reduce the impact of noise and vibration from construction activities and any such measures would be detailed within the CEMP.

11.10. Comparison of Noise Effects of the Proposed Varied Development with the Effects of the Consented Development

11.10.1. The significance of noise effects is unchanged from that of the Consented Development.

11.11. Conclusion of Noise Assessment

11.11.1. The operational noise effects of the Proposed Varied Development have been predicted and assessed in accordance with ETSU-R-97 and the IOA GPG and compared to the Consented Development's noise limit. It was found that

operational noise levels would be within the consented noise limit, and it was therefore concluded that such effects would be **not significant**.

11.12. Consideration of Shadow Flicker

- 11.12.1. The Scottish Government's Online Planning Guidance for Onshore wind Turbines³ states that shadow flicker is unlikely to be a problem where there is at least 10 rotor diameters separation between turbines and dwellings.
- 11.12.2. THC's consultation response (**Chapter 3: EIA Methodology, Appendix 3.2: Scoping Opinion** of the EIAR) stated that if there are no properties within 11 rotor diameters between turbines and dwellings, then a detailed shadow flicker assessment is not required, but shadow flicker should still be considered within the submission.
- 11.12.3. **Figure 11.2: Shadow Flicker** illustrates the shadow flicker buffer zone (11x 163m rotor diameter) and shows the nearest dwellings to the proposed turbine locations of the Proposed Varied Development. The buffer zone extends to a distance of 1,793m (11 x the largest proposed rotor diameter of 163m). It can be seen that no dwellings are located within 11 rotor diameters of a turbine, and therefore shadow flicker effects are considered to be **not significant**.

11.13. References

ETSU-R-97 The Assessment and Rating of Noise from Wind Turbines, Energy Technology Support unit for the DTI, 1996.

A Good Practice guide to the Application of ETSU-R-97 to the Assessment and Rating of Wind Turbine Noise, Institute of Acoustics, May 2013.

Bhlaraidh Wind Farm Extension, Environmental Assessment Report, Chapter 11: Noise and Vibration, August 2021.

Bhlaraidh Extension Wind Farm, Additional Information Report, March 2022.

³ [Onshore wind turbines: planning advice - gov.scot](https://www.gov.scot/publications/onsite-planning-guidance-for-onshore-wind-turbines/pages/11.aspx)