Orsted Onshore Ireland Midco Limited

9: MEMORANDUM RESPONSE TO SUBMISSIONS RECEIVED

NOISE AND VIBRATION

Proposed Oatfield Wind Farm Project, Co. Clare: ABP Case No. ABP-318782-24

June 2024

CONTENTS

1 NOISE AND VIBRATION 1
1.1 Introduction 1
1.2 Statement of authority 1
2 REGULATORY & PRESCRIBED BODIES 2
2.1 Clare County Council 2
3 GENERAL PUBLIC 3
3.1 Theme 1: Infrasound, vibration, low frequency and health 3
3.2 Theme 2: Amplitude modulation (AM) 4
3.3 Theme 3: Noise levels 5
3.4 Theme 4: Public paths and tranquillity 6
3.5 Theme 5: Cumulative effects 6
3.6 Theme 6: Broadford and Kilbane National School and Sunyata Buddhist Centre 7
3.7 Theme 7: Autism and noise sensitivity 8
3.8 Theme 8: Construction noise including traffic 9
3.9 Theme 9: Comparison with other wind farms 9
3.10 Theme 10: Propagation across a valley 9
3.11 Theme 11: Impact on horses 10
3.12 Theme 12: Measured background noise levels 10
3.13 Theme 13: Corrections within the EIAR 11
3.14 Theme 14: Reduced noise operational modes 13

TABLES

Table 3.1: Assessment at Sunyata Buddhist Centre - Proposed Development – comparison between predicted noise levels and lowest derived noise limits (derived from location 6, negative numbers indicate the predictions are below the noise limits) 8
Table 3.2: Assessment at property H4 (no financial involvement) - Proposed Development – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits) 12
Table 3.3: Assessment at property H4 (no financial involvement) - Proposed Development and Knockshanvo Wind Farm (indicative cumulative levels) – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits) 12
Table 3.4: Assessment at property H606 (no financial involvement) - Proposed Development – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits) 13
Table 3.5: Assessment at property H606 (no financial involvement) - Proposed Development and Knockshanvo Wind Farm (indicative cumulative levels) – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits) 13

FIGURES

Figure 3.1: Sound pressure (A-weighted dB or dB(A)) scale and indicative noise levels 5

1 NOISE AND VIBRATION

1.1 Introduction

The following memorandum has been prepared to address submissions received during the observations and submissions period associated with the Oatfield Wind Farm Planning Application. The planning application for the aforementioned Proposed Development was submitted to An Bord Pleanála on 22nd December 2023 (ABP Case Number: ABP-318782-24). The period for submissions and observations was 22nd December 2023 to 19th February 2024.

This is memorandum number 9 in the Oatfield Wind Farm submission response documentation, which addresses common themes identified within the discipline of Noise and Vibration (corresponding to **Chapter 13 of the EIAR**, submitted as part of the planning application made to An Bord Pleanála).

Reference is made to the submission response on Traffic and Transport (memorandum no. 12 of the submission response documentation, hereafter referred to as **memorandum no. 12**).

Responses to common themes in submissions received from regulatory & prescribed bodies are presented in Section 2, and responses to submissions received from the general public are presented in Section 3.

1.2 Statement of authority

The memorandum was written by Matthew Cand of Hoare Lea LLP (HL). Matthew (Dipl. Eng., PhD, MIOA) is a full member of the UK Institute of Acoustics. He is an Associate Director at Hoare Lea LLP who has responsibility for running the environmental noise group, which has a focus on Environmental Impact Assessments (EIAs). He has over 18 years' experience in the assessment of environmental acoustics and has conducted more than 70 noise assessments for EIA of wind farms. Matthew is an expert in the assessment of wind farm noise and is one of the authors of the UK Institute of Acoustics Good Practice Guide (IOA, 2013). He has also been engaged as expert witness at planning inquiries and noise nuisance cases.

2 REGULATORY & PRESCRIBED BODIES

2.1 Clare County Council

The report from Clare County Council does not raise specific adverse concerns in relation to the noise assessment (refer to **EIAR Chapter 13 Noise and Vibration**) which was undertaken in line with the applicable 2006 Wind Energy Development Guidelines (WEDG). The response also notes that, under CDP 11.47 of the County's Development plan, that an appropriate balance should be struck between renewable energy generation and the residential amenity of neighbours of the development. Both the 2006 WEDG and the ETSU-R-97 guidelines referenced in **EIAR Chapter 13 Noise and Vibration** (hereafter referred to as **EIAR Chapter 13**) provide an effective and recognised way of achieving this balance in practice.

The response also suggests that consideration should also be given to the latest World Health Organisation (WHO) Guidelines. This is considered in Section 3.1 below which explains that the guidance referenced in the in **EIAR Chapter 13** is broadly consistent with the WHO guideline recommendations.

Although Section 2.6 of the Council's submission notes general concerns from Elected Members regarding noise from the Proposed Development adversely affecting residential neighbours within 2 km of the proposed turbines, **EIAR Chapter 13** has presented a detailed assessment which considered these impacts in detail and concluded that no significant effects would arise. Measures were also proposed to control noise levels from the turbines at neighbouring properties through suitable planning conditions.

3 GENERAL PUBLIC

3.1 Theme 1: Infrasound, vibration, low frequency and health

Several submissions have raised concerns regarding low frequency noise or infrasound from wind turbines and associated effects this may have on health. There is misleading information circulating on the internet with regard to this particular topic. This topic was however considered in **EIAR Chapter 13**, specifically Annex A of **Appendix 13.1** included a detailed discussion of this topic and concluded that:

> *"Whilst it is known that infrasound can have an adverse effect on people (potential adverse health impacts are listed by the World Health Organisation as stress, irritation, unease, fatigue, headache, possible nausea and disturbed sleep), these effects can only come into play when the infrasound reaches a sufficiently high level. This is a level above the threshold of audibility. However, all available information from measurements on current wind turbines reveals that the level of infrasound emitted by these wind turbines lies below the threshold of human perception."*

Examples of additional recent research includes a study[1] in Japan which determined that infrasound from wind turbines was inaudible and below relevant applicable criteria. An Australian study funded by the National Health and Medical Research Council of Australia (NHMRC), was also recently published in the Environmental Health Perspectives (EHP) journal, published[2] by the United States National Institute of Environmental Health. The study considered the effects, including in particular on sleep, to exposing people to 72 hours of infrasound (designed to simulate a wind turbine infrasound signature). The study was based on a highly robust double-blind randomised controlled study (rather than anecdotal evidence) and concluded that:

> *"Our findings did not support the idea that infrasound causes WTS [Wind Turbine Syndrome][3]. High level, but inaudible, infrasound did not appear to perturb any physiological or psychological measure tested in these study participants."*

This additional study therefore further corroborates the growing international consensus on this topic as reported in the EIAR. Unfortunately, misleading information on this topic continues to circulate and create unwarranted concerns.

One response referenced a paper on the effect of noise from wind turbines and effects on heart rate[4], but this had key methodological flaws, for example, it does not control for confounding factors such as noise from a nearby road and domestic sources.

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[1] Shimada A, Nameki M (2017), Evaluation of Wind Turbine Noise in Japan, 12th ICBEN Congress on Noise as a Public Health Problem.

[2] Marshall et. al., The Health Effects of 72 Hours of Simulated Wind Turbine Infrasound: A Double-Blind Randomized Crossover Study in Noise-Sensitive, Healthy Adults. Environmental Health Perspectives (EHP), 131(3) March 2023.

[3] The publication explains that some authors "have proposed that people who live in the vicinity of wind turbines suffer from wind turbine syndrome [WTS] with dizziness, sleep disturbance, and other symptoms. The causes of this syndrome have been the subject of substantial international controversy. Proponents have contended that the symptoms that compose this syndrome are caused by low frequency sub audible infrasound generated by wind turbines."

[4] Chiu, CH., Lung, SC.C., Chen, N. et al. Effects of low-frequency noise from wind turbines on heart rate variability in healthy individuals. Sci Rep 11, 17817 (2021).

Several responses also reference the 2018 World Health Organisation (WHO) guidelines[5]: These reviewed a wide body of evidence on health and noise in relation to wind turbines but did not provide any recommendations on infrasound or low-frequency noise, but instead recommended control of wind turbine noise in terms of A-weighted[6] noise levels (as done in the EIAR).

The main health effect identified in the WHO review was annoyance[7], and as a result the WHO guidelines included a "conditional" recommendation to control noise to 45 dB L_{den} (the conditional nature was due to uncertainties in the data on which to base the recommendation). When considering the L_{den} metric used in the WHO and how it was interpreted in relation to the studies referenced as a basis for this recommendation (with associated uncertainties), the noise levels of 35 to 40 dB L_{A90} referenced in the 2006 WEDGS or the UK ETSU-R-97 guidelines can be considered broadly consistent with the WHO recommendations.

In relation to the potential for sleep disturbance, the WHO 2018 review did not identify clear evidence of health effects and therefore did not make recommendations for night-time noise guidelines. There is no clear evidence for significant sleep disturbance effects from wind turbine noise at levels not exceeding 43 dB L_{A90} (which is the lower limit set in the 2006 WEDG or ETSU-R-97 guidelines).

Annex A of **Appendix 13.1** also explains that levels of vibration produced in the ground from operational wind turbines are imperceptible to humans and are therefore unlikely to be associated with any effects for receptors around the wind farm.

3.2 Theme 2: Amplitude modulation (AM)

As discussed in **EIAR Chapter 13**, although some instances of increased AM (outside what is generally expected from a normal wind farm) have been observed in some specific cases, the relevance of this and any control which could be applied is still subject to some discussion, and there is no definitive guidance as to the appropriate assessment of atypical AM noise in current Irish planning guidelines. It is also not considered possible to predict its occurrence. Should any complaint arise in relation to the wind farm during the Operational Period, the complaint will be fully investigated by the Applicant and appropriate action will be taken. The limits considered above have however been determined on the basis of wind turbine noise including some AM character (or "swish"): As discussed in the following section, the corresponding noise limits are relatively stringent.

[5] World Health Organization Regional Office for Europe, Environmental Noise Guidelines for the European Region, 2018.

[6] Human hearing sensitivity at low frequency and high frequency decreases and the A-weighting is used to reflect this sensitivity.

[7] Annoyance is the most common community response in a population exposed to environmental noise in general. Whilst not typically considered a health effect under the more commonly used definition of physiological health, the WHO defines health as "*a state of complete physical, mental and social well-being*" hence why annoyance is considered under this remit. However, annoyance is also known to be influenced by a wide range of non-acoustic factors such as personal and situational variables (as discussed in Annex A of Appendix 13.1).

3.3 Theme 3: Noise levels

Under the 2006 WEDG or ETSU-R-97 guidelines, noise levels are set to provide an appropriate balance between the impact of operational noise from wind farms on residential amenity and the provision of renewable energy generation, under current local planning and energy policies.

Figure 3.1 below shows the decibel scale ranging from approximately 0 dB(A) (the threshold of hearing) to 120 dB(A) (the threshold of pain). In order to provide some context as to the significance of the noise levels for the Proposed Development, Figure 3.1 shows some examples of typical sound levels associated with various different everyday sources. For comparison, wind farm noise levels from the Proposed Development at closest located residential neighbours most typically lie in the range from 35 to 40 dB(A), which provides a useful context.

It is therefore not the case that high noise levels will be experienced from the turbines of the Proposed Development and although audible at times at some of the closest locations (depending on a range of factors), the noise levels experience at neighbouring noise-sensitive properties would be comparable to the range of noise levels in the existing noise environment.

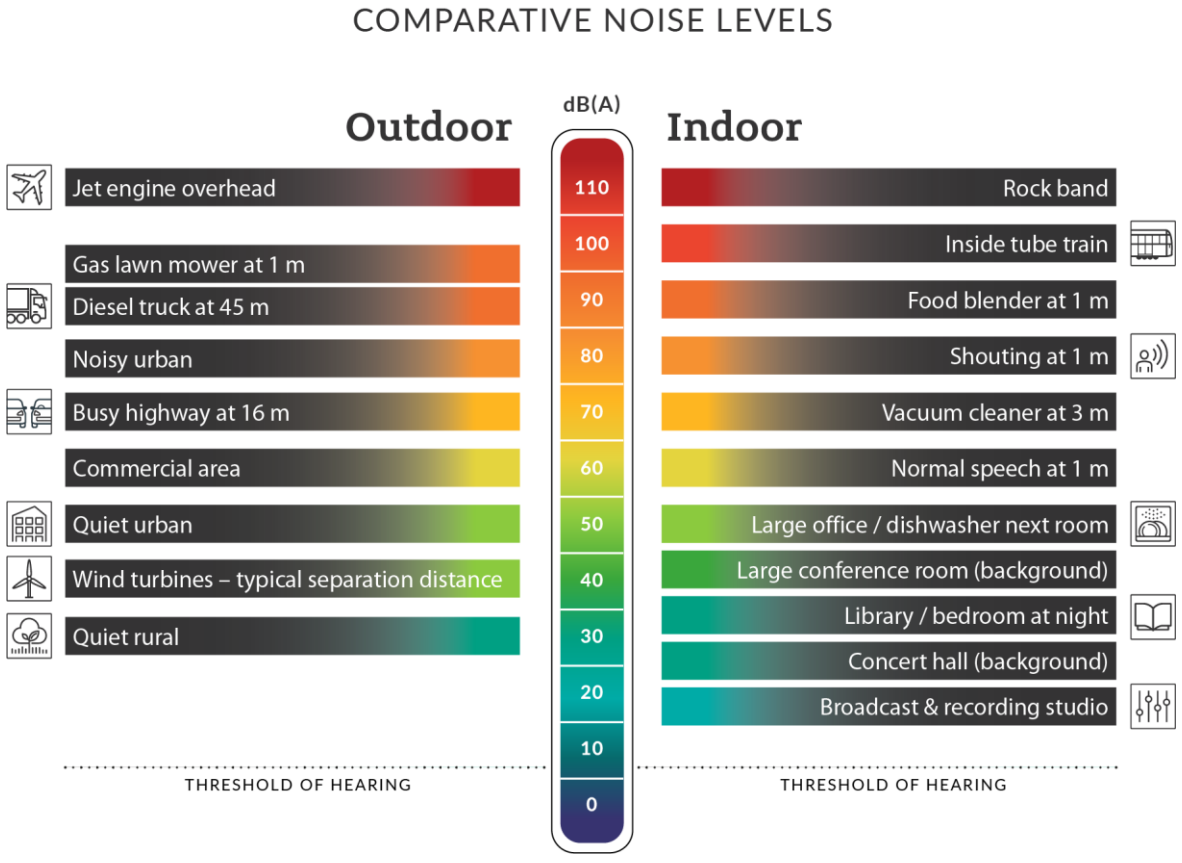

Figure 3.1: Sound pressure (A-weighted dB or dB(A)) scale and indicative noise levels

In relation to the sound power levels from the turbines, a level of more than 100 dB(A) does not represent the level of noise actually likely to be experienced by any receptor around the Proposed Development. The sound power level represents the total acoustic energy emitted by the source, but noise levels even a short distance from the turbines

are several orders of magnitude lower, as illustrated in Figure 13.1 of **EIAR Chapter 13**, which shows that predicted levels even in proximity of the turbines are around 50 dB(A) and decrease to 40 dB and less at neighbouring residential properties.

Sections 3.4 and 3.5 of this memorandum considers the actual noise levels and their significance for neighbouring receptors including the Broadford and Kilbane National School and walkers in the 12 O'Clock Hills.

3.4 Theme 4: Public paths and tranquillity

Concerns were expressed regarding noise affecting users of public paths such as those of the 12 O'Clock Hills. The noise assessment in **EIAR Chapter 13** considered residential properties as these are considered highly noise-sensitive and these remain the focus of guidelines such as the 2006 WEDG or ETSU-R-97. There is limited guidance in Ireland or the UK which applies to non-residential external amenity areas such as parks or walking paths, but these are generally considered less noise-sensitive due to the transient nature of their use. Levels of 55 dB(A) are sometimes considered as a potential guidance level in this context as they are referenced as a threshold for serious annoyance for "outdoor living areas" (see Table A1 in Annex A of **Appendix 13.1** of the EIAR) in WHO guidance (although this applies to private amenity such as gardens rather than transient use of outdoor spaces).

For users of these public paths, the turbine noise could be audible in places and for some of the time at varying levels. It would increase with higher wind speeds which also result in higher natural, wind–related background noise levels, which will provide a degree of masking. Figure 13.1 of **EIAR Chapter 13** shows that predicted levels, even in proximity of the turbines, would be up to around 50 dB(A); below the suggested WHO criteria discussed above. As such, wind turbine noise will be another source of noise in the environment experienced by users of these paths but would not be at levels such that significant impacts such as speech interference would be expected[8]. The addition of the Proposed Development will add to the 'soundscape' of the area. Whether this is judged to be negative or positive will be highly subjective, depending partly on its level and its character but also on the predisposition of the listener towards the source and their expectations of the area.

During the quietest time periods, when conditions are relatively still and which are most readily associated with tranquillity, the turbines will either not be operating or would be operating at a very low speed, and therefore relatively lower noise levels. Furthermore, even during windier periods, the audible contribution of turbine noise would only be evident under a specific range of wind speeds and wind directions, rather than longer term intrusion frequently introduced by other sources such as transportation.

3.5 Theme 5: Cumulative effects

At the time of writing, the planning application for the Knockshanvo Wind Farm had not been submitted for planning and for which no finalised detailed information is yet available. The planning application Knockshanvo Wind Farm will have to consider the cumulative impacts from this Proposed Development, for which all relevant information

[8] As illustrated in Figure 1, typical noise levels associated with speech are in the region of 60 dB(A) or more.

has been submitted in the planning system. **EIAR Chapter 13** for the Proposed Development presented an indicative noise assessment, although this was not strictly necessary, in order to be helpful and provide an indication if cumulative impacts were likely to be significant or not.

The proposed outline of noise control through specific noise limits for each of the specific wind farms (should both be consented) represents current good practice and would be enforced in practice through planning conditions for each of the separate wind farms.

It will be the responsibility of the Knockshanvo Wind Farm to demonstrate how it considers that suitable noise levels can be achieved in practice through the cumulative operation of both sites, but this is considered feasible based on the initial assessment undertaken within **EIAR Chapter 13**.

3.6 Theme 6: Broadford and Kilbane National School and Sunyata Buddhist Centre

As shown in Figure 13.1 of **EIAR Chapter 13,** both the Broadford and Kilbane National school and the Sunyata Buddhist Centre are located clearly outside the study area for noise (35 dB L_{A90} contour). This means that noise levels are considered low in relation to the applicable guidelines and not likely to lead to any significant effects regardless of existing noise levels at these properties. Comparison with the noise level scale of Figure 3.1 above also provides useful context. These locations were therefore not assessed in detail as they fall outside of the study area even when accounting for their potential high sensitivity to noise.

At these more distant locations the sound of the wind farm is likely to be much less audible, and noise from the wind farm will tend to become similar to or lower than typical background noise levels (at comparable wind speeds). See also comments about soundscape and tranquillity.

Predicted operational noise levels from the Proposed Development at the Sunyata Buddhist Centre do not exceed 31 dB L_{A90}: This is 9 dB or more below the lowest noise limits derived in the assessment of **EIAR Chapter 13** (see Table 3.1 below). This illustrates why a detailed assessment of this property was scoped out. Whilst the Sunyata Buddhist Centre is located closer to the turbine locations likely to be proposed for the Knockshanvo Wind Farm, it will be for the application for that wind farm to undertake a more detailed assessment of this property, including potential cumulative impacts together with the Proposed Development.

Table 3.1: Assessment at Sunyata Buddhist Centre - Proposed Development – comparison between predicted noise levels and lowest derived noise limits (derived from location 6, negative numbers indicate the predictions are below the noise limits)

Wind speed (standardised, m/s)	4	5	6	7	8	9	10	11	12
Predicted Turbine Noise	22.7	26.9	30.2	30.9	31.0	31.0	31.0	31.0	31.0
Day-time limit	40.0	40.0	40.0	40.0	40.0	40.0	40.1	42.9	46.1
Day-time limit margin	-17.3	-13.1	-9.8	-9.1	-9.0	-9.0	-9.1	-11.8	-15.1
Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Night-time limit margin	-20.3	-16.1	-12.8	-12.1	-12.0	-12.0	-12.0	-12.0	-12.0

Predicted worst-case noise levels outside the school would be lower than 30 dB L_{A90} (see Figure 13.1, **EIAR Chapter 13**). Accounting for a reduction of at least 10 dB from the building façade (even with windows opened), predicted noise levels within classrooms will be substantially lower than the requirements for noise levels for the educational requirements at the school even taking into account its special educational needs provision[9]. Higher background noise levels are likely to be experienced at the school from road traffic on the R465/R466 than at the properties surveyed in the assessment of the Proposed Development.

3.7 Theme 7: Autism and noise sensitivity

Hyperacusis[10], a high sensitivity to noise, is common in persons affected by Autism Spectrum Disorder (ASD): People affected by this symptom will tend to react more strongly to noise than the general population. Although personal reactions to noise sources vary, the levels of no more than 40 dB(A) predicted at noise-sensitive locations around the Proposed Development can be compared in Figure 3.1 to the range of noise levels typically experienced in the existing noise environment for context.

Loud or impulsive noise sources such as electric machines, fireworks, shouting or sirens (with typically measured levels of 70 to 90 dB(A)) which are known to trigger acute reactions in persons affected by hyperacusis have substantially higher noise levels (by

[9] The BB93 Guidance (UK Department for Education, February 2015, "Acoustic design of schools, performance standards") recommends levels of no more than 30-40 dB within classrooms depending on their usage, with the lower end of the scale recommended for students with special hearing/communication needs or recording studios.

[10] References reviewed included:

An Observational Study of Classroom Acoustical Design and Repetitive Behaviors in Children With Autism. Shireen M. Kanakri, Mardelle Shepley, Louis G. Tassinary, James W. Varni and Haitham M. Fawaz. Environment and Behavior 2017, Vol. 49(8) 847 –873.

Understanding Sound Sensitivity in Individuals with Autism Spectrum Disorders. Lillian N. Stiegler and Rebecca Davis. Focus on Autism and Other Developmental Disabilities, 25(2) 67 –75.

Auditory Hypersensitivity in Children with Autism Spectrum Disorders, Lucker J. Focus on Autism and Other Developmental Disabilities 28(3) 184 –191.

several orders of magnitude). It is important to understand the noise levels from the proposed wind turbines in this context.

There is no clear evidence that hyperacusis sufferers are more sensitive to certain sound frequencies, but in any case, noise from modern wind turbines is not known to have particular low-frequency character compared to other existing sources such as distant aircraft or road traffic.

3.8 Theme 8: Construction noise including traffic

Several responses have raised concerns regarding noise associated with different construction activities and the potential for significant effects identified in **EIAR Chapter 13**, however, the same chapter considers mitigation measures to manage and reduce these impacts in a standard manner, such that residual temporary effects are not significant. These measures will be implemented through the Construction and Environmental Management Plan (CEMP), which is to be secured through planning conditions.

A review of the traffic assessment for the Proposed Development has identified that the anticipated worst-case traffic volumes during the construction period will be 96 trips per day rather than 76 trips per day as previously assumed. Refer to **memorandum no. 12** for further information. This would represent a marginal increase from the assumptions set out in **EIAR Chapter 13**. However, the worst-case associated increase in the day-time average noise level during the construction period for properties along the construction traffic route would still remain below 3 dB. This would still correspond to a minor impact based on the relevant UK Design Manual for Roads and Bridges (DMRB, Highways Agency, 2019) guidance and therefore, remain a short-term minor temporary reversible adverse effect.

Similarly, the cumulative impacts associated with the construction of the Fahybeg Onshore Wind Farm would not increase beyond a minor impact at most, particularly as the peak traffic periods are unlikely to coincide in practice for both developments.

The previous construction management measures would therefore also remain applicable.

3.9 Theme 9: Comparison with other wind farms

Several responses mention the experiences reported by residents near other wind farms, but these are not necessarily comparable to the Proposed Development in terms of their design or applicable noise limits, so no further comment is deemed relevant.

3.10 Theme 10: Propagation across a valley

The noise model which was used to predict noise from the Proposed Development, in line with applicable good practice, took into account terrain effects including potential enhanced propagation across a valley (“concave ground”): See Section 5.4 in **Appendix 13.1** of **EIAR Chapter 13.**

3.11 Theme 11: Impact on horses

Available research[11] shows that the hearing of horses is less sensitive than human hearing at most frequencies except the high frequency range of 8 kHz and above. These high frequencies dissipate very rapidly with distance and so the contribution of wind turbines in this region for the surrounding area would be negligible. Although horses may react to impulsive or relatively loud sounds, the character and nature of wind turbine noise is such that no significant disturbance is expected for riders passing by the wind farm.

3.12 Theme 12: Measured background noise levels

Concerns were raised regarding the monitoring location installed at location 6 regarding an opened land drain in proximity to the monitoring location. Noise from running water was not noted as a particularly feature of the location when installed. Furthermore, if measurements had been affected by running water, this would likely have been apparent in the charts showing measured noise levels for the location (with relatively constant noise levels as a function of wind speed) and this was not the case. Therefore, the measurements are not considered to have been affected by atypical levels of noise from running water.

The monitor at Location 6 was moved to an alternative location in close proximity to the original position at the start of the monitoring but this did not affect the conclusions of the noise assessment.

The applicable guidelines do not require that turbine noise levels do not exceed existing noise levels at all, as this would be excessively restrictive for renewable energy developments. This is not necessary in any case given the low absolute levels of noise associated with the Proposed Development, when considering relevant 2006 WEDG and ETSU-R-97 guidelines and the available research such as that set out in the WHO 2018 guidelines. This does not mean that “nuisance” is likely, as this would be based on a wide range of considerations, not only the level of the noise.

The use of the L_{A90} noise indicator is clearly supported in the 2006 WEDG and ETSU-R-97 guidelines as representative of turbine noise given its nature and the risk of corruption in noise readings for other metrics. The size of the turbines mainly affects the wind reference which needs to be used in relation to the baseline noise monitoring, and the method followed in this regard is in line with applicable good practice (see Section 13.5 of **EIAR Chapter 13** and Annex F of **Appendix 13.1**).

Although wind turbine noise would not follow the same diurnal pattern as other noise sources associated with human activity, such as road traffic, it is not appropriate to describe it as “constant”, as it would be strongly related to wind speed and wind direction: With little or no noise produced in low wind conditions, turbine noise being masked in high winds and reduced noise levels experienced in upwind conditions, as described in **EIAR Chapter 13**.

Measurement Location 2 was installed at H38, as access was sought at several other neighbouring non-involved locations in this vicinity, but was refused. In any case, the choice of location was still considered representative of the locality with respect to sources of noise in the area such as vegetation and local traffic. Although levels

[11] Heffner H and Heffner R, “the hearing ability of horses”, Equine practice, Vol 5, #3, March 1983.

measured at Location 2 are marginally higher at low wind speeds than those measured at the other locations, they remain around 30 dB L_{A90} at low wind speeds, which is low in absolute terms (see Figure 3.1 above) and consistent with those which are measured in similar rural areas.

The noise monitor at Location 4 is only used to represent the property at which it was installed (H39), as confirmed in Table 3 of **Appendix 13.1** in **EIAR Chapter 13.**

3.13 Theme 13: Corrections within the EIAR

3.13.1 Non-technical summary

In Section 3.1.3 ('Mitigation and Residual Effects') of the **Non-Technical Summary** (**EIAR volume 1**) the last paragraph describes noise mitigation measures in relation to "house 17" and reduced noise operation for turbines "T6, T8 and T9": This paragraph was inserted in error and should be ignored. Section 3.8.3 of the Non-Technical Summary however clearly sets out the relevant mitigation measures proposed in the assessment of **EIAR Chapter 13**. See comments in Section 3.14 below on reduced noise operational modes.

3.13.2 Correction on involved dwellings

It should be noted that property H4 and H606 are not associated / involved with the Proposed Development as was assumed in the original EIAR. This does not however alter the conclusions of the assessment of operational noise from the Proposed Development.

Table 3.2 presents an updated operational noise assessment from the Proposed Development which confirms that the predicted levels are also below the derived noise limits at this property without assuming an increased limit for financially involved locations.

Table 3.3 then presents an indicative cumulative assessment with the Knockshanvo Wind Farm on the same basis as presented in **EIAR Chapter 13**. This indicates a potential for predicted cumulative noise levels marginally in excess of the derived day-time noise limits at some wind speeds, by less than 1 dB. This is unlikely to be perceptible in practice and may not arise in any case, as the predictions assume downwind predictions from all turbines on both wind farms simultaneously (as discussed in **EIAR Chapter 13**). The cumulative noise assessment in the application for the Knockshanvo Wind farm will need to demonstrate how operational noise levels can be controlled in practice at this property and other neighbouring locations such that acceptable cumulative noise levels, together with the Proposed Development, can be achieved in practice.

Table 3.2: Assessment at property H4 (no financial involvement) - Proposed Development – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits)

Wind speed (standardised, m/s)	4	5	6	7	8	9	10	11	12
Predicted Turbine Noise	29.7	34.0	37.5	38.3	38.4	38.4	38.4	38.4	38.4
Day-time limit	40.0	40.0	40.0	40.0	40.0	40.0	40.1	42.9	46.1
Day-time limit margin	-10.3	-6.0	-2.5	-1.7	-1.6	-1.6	-1.7	-4.5	-7.7
Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Night-time limit margin	-13.3	-9.0	-5.5	-4.7	-4.6	-4.6	-4.6	-4.6	-4.6

Table 3.3: Assessment at property H4 (no financial involvement) - Proposed Development and Knockshanvo Wind Farm (indicative cumulative levels) – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits)

Wind speed (standardised, m/s)	4	5	6	7	8	9	10	11	12
Predicted Turbine Noise	31.8	36.4	39.6	40.2	40.4	40.6	40.7	40.7	40.7
Day-time limit	40.0	40.0	40.0	40.0	40.0	40.0	40.1	42.9	46.1
Day-time limit margin	-8.2	-3.6	-0.4	0.2	0.4	0.6	0.6	-2.2	-5.4
Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Night-time limit margin	-11.2	-6.6	-3.4	-2.8	-2.6	-2.4	-2.4	-2.4	-2.4

Property H606 was also subsequently confirmed not to be financially involved with the Proposed Development (contrary to what was set out in **EIAR Chapter 13**). The assessment presented below in Table 3.4 and

Table 3.5 demonstrates that, when assuming the property is not financially involved, the same conclusions can be reached as for the other properties considered. Predicted levels for the Proposed Development remain below the derived noise limits at this property. When considering an indicative cumulative assessment with the Knockshanvo Wind Farm on the same basis as presented in the **EIAR Chapter 13**,

Table 3.5 shows either compliance with the derived limits or a negligible excess no more than 0.3 dB(A), which would be considered negligible.

Table 3.4: Assessment at property H606 (no financial involvement) - Proposed Development – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits)

Wind speed (standardised, m/s)	4	5	6	7	8	9	10	11	12
Predicted Turbine Noise	31.8	36.0	39.0	39.6	39.7	39.7	39.7	39.7	39.7
Day-time limit	40.0	40.0	40.0	40.0	40.0	41.3	44.6	48.0	51.3
Day-time limit margin	-8.2	-4.0	-1.0	-0.4	-0.3	-1.6	-4.9	-8.3	-11.6
Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.4	46.9	49.8
Night-time limit margin	-11.2	-7.0	-4.0	-3.4	-3.3	-3.3	-3.7	-7.1	-10.1

Table 3.5: Assessment at property H606 (no financial involvement) - Proposed Development and Knockshanvo Wind Farm (indicative cumulative levels) – comparison between predicted noise levels and derived noise limits (negative numbers indicate the predictions are below the noise limits)

Wind speed (standardised, m/s)	4	5	6	7	8	9	10	11	12
Predicted Turbine Noise	32.2	36.5	39.6	40.1	40.3	40.3	40.3	40.3	40.3
Day-time limit	40.0	40.0	40.0	40.0	40.0	41.3	44.6	48.0	51.3
Day-time limit margin	-7.8	-3.5	-0.4	0.1	0.3	-1.0	-4.3	-7.7	-10.9
Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.4	46.9	49.8
Night-time limit margin	-10.8	-6.5	-3.4	-2.9	-2.8	-2.7	-3.1	-6.5	-9.5

3.14 Theme 14: Reduced noise operational modes

As noted in Section 13.6.3 of **EIAR Chapter 13**, the operational noise assessment assumed: "*use of a reduced noise operational mode ("SO2") for turbines 2 and 4 of the Proposed Development. For other turbine models, different operational restrictions (or none at all) may be required to achieve a similar conclusion*." This is because the assessment was based on a robust candidate model (Vestas V150) as a worst-case, and the V150 had noisier noise emissions than other turbine models considered such as the Nordex N133 and N149.

The effect of the noise-reduced modes for these 2 turbines is to achieve a reduction in maximum noise levels of around 1 dB(A) at the nearest properties, which is only marginal. Such small differences in noise levels would be difficult to perceive in practice.

Similarly, the impact of operating in these noise-reduced modes would only be marginal. In practice, such operational mitigation may only be required in some wind conditions to meet the derived noise limits, and this will further reduce the associated power losses.