

11 NOISE

11.1 INTRODUCTION

This chapter considers the potential noise and vibration effects of the proposed Drumnahough Wind Energy project during construction and operation, presenting a summary of the detailed assessment contained within the Hoare Lea Technical Report included as Appendix J-1 in EIAR Volume 3. The Drumnahough Wind Farm for which planning permission is being sought is hereafter referred as the 'proposed development'. This chapter is supported by **Figure 11-1**.

This chapter has been prepared with reference to information contained within **Chapter 2: Project Description** and EIAR Volume 3 **Appendix H-1: Traffic & Transportation Assessment**.

11.1.1 Scope of assessment

11.1.1.1 Effects Assessed in Full

The following effects of the proposed project have been assessed in full:

- The effect of on-site construction activity noise at the assessment properties shown in **Figure 11-1** during construction of the proposed development.
- The effect of construction traffic noise on local roads during construction of the proposed development.
- The potential effect of noise during operation of the proposed development, including cumulatively with Meentycat Wind Park, Culliagh, Cark, Meentycat Cark Extension and Meenbog Meentycat Extension Wind Farms.

11.1.1.2 Effects Scoped Out

Based on the desk-based work undertaken, the professional judgement of the authors and experience from other relevant projects and policy guidance or standards, the following effects have been 'scoped out' of detailed assessment:

- The results of previous research detailed in Annex A of **Appendix J-1** (EIAR Volume 3) has demonstrated that vibration resulting from the operation of wind farms is imperceptible at typical separation distances. Therefore, vibration effects during operation do not warrant detailed assessment and have not been considered further as part of this chapter.
- The nature of works and distances involved in the construction of a wind farm are such that the risk of significant effects relating to ground borne vibration are very low (excluding blasting). Occasional momentary vibration can arise when heavy vehicles pass dwellings along the site access route at very short separation distances, but again this is not sufficient to constitute a risk of significant impacts in this instance, because of the short-term nature of the vibration impacts and as existing traffic is causing similar levels. Accordingly, vibration impacts do not warrant detailed assessment and are therefore not discussed further in this assessment.
- Traffic associated with turbine element delivery will be very limited in volume and travel at relatively low speed and therefore does not constitute a risk of significant impacts and is not discussed further in this assessment.

11.1.2 Methodology

11.1.2.1 Legislation and Guidance

The 2006 Wind Energy Development Guidelines (WEDG, ref. 11-1) from the Department of the Environment, Heritage and Local Government (DoEHLG) include some recommendations on noise. They require that an appropriate balance is achieved between power generation and noise impact.

The guidance essentially proposes limits of 45 dB(A) or 5dB above the background, subject to lower limits of 35-40 dB(A) for day-time periods or 43 dB(A) at night which may apply in low noise environments. Whilst subject to a degree of interpretation, these guidelines appear based on the ETSU-R-97 recommendations which apply in the UK (ref 11-2) and which are described in further detail below. These more detailed UK guidelines, and related good practice measures, will therefore be referenced when applying the (still extant) 2006 WEDGs in the assessment of the proposed development. More recently (December 2019), revised Wind Energy Development Guidelines have been published in draft form only at this stage.

ETSU-R-97 has become the accepted standard for wind energy developments within the UK. Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in an Institute of Acoustics Good Practice Guide (IOA GPG, ref. 11-3) has also been referenced and applied.

11.1.2.2 Consultation

Prior to undertaking the background surveys, a summary of the proposed monitoring locations and of the assessment methodology was forwarded to Donegal County Council for comment, and no adverse comments were received. This consultation was based on a preliminary project layout which was of a similar form to the layout currently proposed, although proposed turbine locations have subsequently changed.

11.1.2.3 Study Area

The study area for the assessment of operational noise includes the noise-sensitive residential properties nearest to the proposed turbines. The locations considered are shown on **Figure 11-1**, and they are located at distances of approximately one to 2.5 km from the turbines of the proposed development.

The locations of the residential properties assessed are detailed in **Table 11-1** below (and in **Appendix J-1 EIAR Volume 3**), indicated by the Irish Grid (IG) coordinates. The assessment of construction noise and construction traffic noise has also considered these dwellings.

It should be noted that the receptor coordinates listed in **Table 11.1** have been selected to be representative of external amenity spaces associated with the various properties, on a conservative basis. As such, these may not be the same as coordinates given in other parts of this Environmental Impact Assessment Report (EIAR), which could refer to property centre points or boundaries, and therefore the approximate distances may also vary. This list of receptor locations is also not intended to be exhaustive but sufficient to be representative of operational noise levels typical of those receptors closest to the proposed development.

Table 11-1: Noise Assessment Locations

Property	Easting (IG)	Northing (IG)	Approximate Distance to Closest Turbine (m)	Closest Turbine (ID)	Survey location?
H01	206271	408262	2460	9	
H02	205126	408294	2095	9	Yes
H03	205058	407957	1750	9	
H04	204782	407792	1590	9	Yes
H05	204724	407758	1560	9	
H06	203582	406753	985	10	Yes
H07	203217	406627	1110	11	
H08	202245	404662	1610	12	
H09	203062	404519	1130	12	
H10	202732	404181	1590	12	Yes

11.1.2.4 Desk Based Research and Data Sources

The following data sources have informed the assessment:

- Mapping data concerning the locations of all noise sensitive receptors in the vicinity of the Site;
- Manufacturer data (dated 30/06/2019) for the SG-5.0-145 Siemens Gamesa 5.0 Megawatt (MW) turbine, chosen as the noisiest out of 4 potential candidate turbine models within the dimensions of the proposed turbines (with rotor diameters of between 133 and 145 m) as set out in EIAR Volume 3 **Appendix J-1**; and
- Location and characteristics of the different wind farms considered in the cumulative assessment, as provided by SSE.

11.1.2.5 Methodology for Assessing Construction Noise Effects

Detailed guidance on construction noise and its control is provided by British Standard BS 5228-1 'Code of practice for noise and vibration control on construction and open sites' (2009, amended 2014, ref. 11-4). Analysis of construction noise impacts has been undertaken in accordance with the methodologies outlined in this standard, which provides methods for predicting construction noise levels on the basis of reference data for the emissions of typical construction plant and activities. These methods include the calculation of construction traffic along access tracks and haul routes, and construction activities at fixed locations including the bases of turbines, temporary construction compounds, and the substation. The construction noise assessment has been based on worst-case assumptions for noise emissions for the types of plant typically used during the proposed construction works, using information presented in BS 5228-1.

BS 5228-1 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels and example criteria which may be considered when assessing effect significance.

Similarly, BS 5228-2 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration.

The predictions of construction noise were made using the methodology of BS 5228 and representative emission levels based on the types and number of equipment typically associated with key phases of constructing a windfarm. The predictions used conservative assumptions, such as considering when each activity would be closest to the neighbouring properties, and assuming the plant would operate for between 75% and 100% of the working day, on a conservative basis. This would represent the upper sound emission level during the day and actual noise levels are likely to be lower. Furthermore, the calculation has assumed there were no screening effects and the ground cover was 50% hard, therefore representing a conservative prediction as it will neglect most of the sound absorption likely to be experienced for propagation above agricultural land or forest.

Predicted noise level from the expected construction traffic on existing roads has been calculated using the relevant methodology in BS5228 based on the information provided in EIAR Volume 3 **Appendix H-1: Traffic and Transportation Assessment**. For roads with substantial levels of existing traffic, reference is made to the accepted UK prediction methodology provided by 'Calculation of Road Traffic Noise' (CRTN, ref. 11-8). Further details of the construction noise assessment methodology are included in EIAR Volume 3 **Appendix J-1**.

The noise-sensitive locations considered for the construction noise assessment include those closest to the proposed turbines and those considered in the operational noise assessment: see **Table 11.1**. All residential dwellings located alongside the proposed site access track and the construction traffic route were also considered, with specific consideration of specification properties detailed in EIAR Volume 3 **Appendix J-1**.

If blasting is employed at on-site borrow pits, this may generate ground-borne vibration and airborne pressure waves or "air overpressure". In accordance with the guidance in BS 6472-2: 2008, ground vibration caused by these operations would be considered acceptable if peak particle velocity (PPV) levels, at the nearest sensitive locations, do not exceed 6 mm/s for 95% of all blasts measured over any 6 month period, and no individual blast exceeds a PPV of 10 mm/s.

The transmission and magnitude of ground vibrations associated with blasting operations at borrow pits are subject to many complex influences including charge type and position, and importantly, the precise nature of the ground conditions (material composition, compaction, discontinuities) at the source, receiver, and at every point along all potential ground transmission paths. Clearly any estimation of such conditions is subject to considerable uncertainty, thus limiting the utility of predictive exercises. Because of the difficulties in predicting noise and air overpressure resulting from blasting operations at the proposed borrow pits, these activities will be controlled through:

- the use of good practice during the setting and detonation of charges;
- restriction on the hours of blasting; and
- a management and potential monitoring plan (if considered necessary) which will be agreed in consultation with Donegal Co. Council.

11.1.2.6 Methodology for Assessing Operational Noise Effects

The assessment of operational noise effects has been carried out in accordance with the guidance set out in the 2006 WEDGs from the Department of the Environment, Heritage and Local Government (DoEHLG, Ref. 11-6). As described in more detail in EIAR Volume 3 **Appendix J-1**, the noise limits for operational wind turbine noise recommended in the WEDGs are consistent with those set out in UK ETSU-R-97 document, which is the accepted standard for such proposed developments within the UK and is commended in current UK planning policy.

More recently (December 2019), revised Wind Energy Development Guidelines have been published, but these are currently in draft status.

Noise limits are defined in terms of the $L_{A90,10\text{min}}$ noise indicator (a definition of the $L_{A90,10\text{min}}$ index is given in EIAR Volume 3 **Appendix J-1**, Annex A). The WEDGs prescribes separate day-time limits and night-time limits which are determined in part based on measured baseline background noise levels. In the absence of details in the WEDG, the more detailed guidance in ETSU-R-97 and associated good practice documents (see above) will be referenced.

The exact model of turbine to be used at the proposed development will be the result of a future tendering process and therefore an indicative turbine model, the Siemens-Gamesa SG-5.0-145 5 MW, has been assumed for the operational noise assessment. This model was determined to both fit the proposed turbine dimension parameters and also provide a representation of the upper end of the noise emission levels for the range of turbines models which may be installed, therefore representing an effective worst-case assumption.

To undertake the assessment of noise impact in accordance with the methodology in ETSU-R-97, the following steps are required:

- Specify the number and locations of the wind turbines and other windfarms to be included in the assessment;
- Determine the day-time and night-time noise limits from the measured background noise levels at the nearest neighbours (see above);
- Specify the type and noise emission characteristics of the wind turbines;
- Calculate noise immission levels from the operation of the turbines associated with the proposed windfarm as well as the contribution to cumulative noise immission levels from other nearby windfarms as a function of Site wind speed at the nearest neighbours; and
- Compare the calculated windfarm noise immission levels with the derived noise limits and assess in relation to the derived noise limits.

In this assessment, the term 'noise emission' relates to the sound power level actually radiated from each wind turbine, whereas the term 'noise immission' relates to the sound pressure level (the perceived noise) at any receptor location due to the combined operation of all wind turbines on the site.

The derived noise limits relate to the total noise occurring at a dwelling due to the combined noise of all operational wind turbines. The assessment therefore needs to consider the combined operational noise of the proposed development with other windfarms in the area to be satisfied that the combined cumulative noise levels are within the derived criteria.

Further details of the operational noise assessment, including details of the noise output of the candidate turbine and the calculation parameters on which predictions have been based, can be found in EIAR Volume 3 **Appendix J-1**. This includes both the proposed development as well as the cumulative wind farms considered. Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in an Institute of Acoustics Good Practice Guide (IOA GPG) has also been referenced.

11.1.2.6.1 Low Frequency Noise, Vibration and Amplitude Modulation

Low frequency noise and vibration resulting from the operation of wind farms are all issues that have been attracting a certain amount of attention over recent years. Consequently, EIAR Volume 3 **Appendix J-1** includes a detailed discussion of these topics. In summary of the information provided therein, modern turbines do not emit perceptible levels of infrasound and vibration at typical separation distances and therefore this does not require further specific assessment.

Annex A of **Appendix J-1** in EIAR Volume 3 also discusses the most recently published research on the subject of wind turbine blade swish or Amplitude Modulation (or AM). This summarises relatively recent research undertaken on some instances of increased AM outside what is generally expected from a normal wind farm. This is still subject to some discussion, and there no definitive guidance as to the appropriate assessment of atypical AM noise in current Irish planning guidelines. The limits considered above have however been determined on the basis of wind turbine noise including some AM character.

11.1.2.7 Noise from the substation and energy storage

The likely noise emissions from the proposed substation and energy storage equipment will also be considered in relation to existing baseline noise levels and related guidance such as the Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (ref 11-7) issued by the Environmental Protection Agency (EPA).

11.1.3 Assessment Criteria

11.1.3.1 Construction noise

Example significance criteria provided in Annex E of BS 5228-1 suggest that, in relatively quiet rural areas, construction activities (or construction traffic) associated with daily noise levels in excess of 65 dB L_{Aeq} during the weekday daytime hours (07:00 – 19:00) would represent a significant effect. Conversely, noise levels below this level of 65 dB L_{Aeq} would not represent a significant effect. Table 1 in **Appendix J-1** in EIAR Volume 3 sets out more detailed effect criteria: for construction activities lasting 4 weeks or more, levels of below 60 or 65 dB L_{Aeq} would correspond to negligible and minor effect respectively and would not be significant. Noise levels of more than 65 or 75 dB L_{Aeq} would correspond to moderate and major effect respectively which would be significant.

Changes in traffic noise can be assessed using the relevant guidance in the UK Design Manual for Roads and Bridges (DMRB, ref. 11-9), with short-term changes associated with the construction period of less than 1 dB(A) corresponding to a negligible impact.

11.1.3.2 Operational noise

The acceptable limits for wind turbine operational noise are defined in the WEDG. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby noise sensitive properties lie below the derived noise limits. The satisfaction of these criteria can lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, the wind farm noise may be audible. However, noise levels at the properties in the vicinity of the wind farm will still be within levels considered acceptable under relevant guidelines.

For noise associated with the proposed substation and energy storage equipment, the relevant EPA guidelines described above set out a series of stringent noise limit for commercial/industrial type noise of 35 to 45 dB L_{Ar}^1 (for night and day-time periods respectively) in areas of low background noise.

11.1.4 Statement on Limitations and Difficulties Encountered

No significant difficulties were encountered in preparing the assessment. As is standard practice, the assessment of operational noise is based on a candidate turbine model, but this was chosen on a reasonable worst-case basis. Similarly, to account for uncertainties in the exact equipment and activities associated with the construction, worst-case assumptions were made in this regard.

11.2 EXISTING RECEIVING ENVIRONMENT

The baseline noise environment in the area surrounding the proposed development is of low population density and is typically dominated by 'natural' noise sources such as wind disturbed vegetation and birdsong and farm animals. Other sources of noise include intermittent local road and agricultural vehicle movements in the area. Some properties experience noise from existing turbines in the area and are considered in further detail in the cumulative assessment below.

11.2.1 Field survey

A background noise survey has been undertaken in line with the ETSU-R-97 methodology. In addition, technical guidance on current good practice on the application of ETSU-R-97, as described in the Institute of Acoustics (IOA) Good Practice Guide (GPG) has also been referenced and applied.

The following field surveys were carried out to inform the assessment, as discussed in EIAR Volume 3 **Appendix J-1**:

- The background noise monitoring exercise was conducted from 09/07/2019 to 01/10/2019 at four locations (see Table 11.1), over a period of approximately six weeks at H02 and H04, 12 weeks at H06 and three weeks at H10. The differences in measurement durations at these properties are due to property access difficulties. The total survey period was in excess of the minimum of one week required by ETSU-R-97, and the extent of the data collected, and range of wind conditions obtained are compliant with the IOA GPG requirements, as detailed in EIAR Volume 3 **Appendix J-1**.
- The measured noise levels were related to wind speed measurements from a temporary LIDAR wind monitoring system, taken at heights of 90 and 100 metres located on the site of

¹ Rated noise level, based on the L_{Aeq} level with a correction to account for the character of the noise in some cases.

the proposed development, which were processed to determine wind speeds at heights representative of the hub height of the proposed turbines – 95 m. The derived hub height wind speeds were then expressed at ten metres height as required in ETSU-R-97, to provide a suitable reference to determine the prevailing background noise level during the quiet daytime and night-time periods. This therefore incorporates site-specific wind shear effects in accordance with the preferred method described in the IOA, as set out in detail in Annex F of EIAR Volume 3 **Appendix J-1**.

- Data from all survey locations was also inspected to identify periods which may have been influenced by rainfall or atypical sources. This analysis was undertaken in accordance with the method described in the IOA GPG, as detailed in EIAR Volume 3 **Appendix J-1**.

The measured baseline noise levels are considered consistent with those that would be expected in a rural environment.

Following analysis of this data, noise limits were determined on the basis of these background levels at all properties, in accordance with the method set out in Section 11.1.2.6 above: see **Tables 4 and 5** in EIAR Volume 3 **Appendix J-1**. The noise limits have been set either at the prevailing measured background level plus 5 dB, or at a fixed lower limit of 40 and 43 dB(A) for day and night-time periods respectively. These minimum noise limits were selected as consistent with the 2006 WEDG guidelines when taking into account the more detailed guidance of ETSU-R-97. EIAR Volume 3 **Appendix J-1** considers the choice of applicable day-time limit in further detail taking into account factors including the number of affected properties, the duration and level of exposure and generation capacity of the proposed development.

11.2.2 Do-Nothing Scenario

In the do-nothing scenario, the local noise environment is likely to remain broadly similar to the current baseline situation.

11.3 LIKELY SIGNIFICANT EFFECTS

11.3.1 Construction Phase

Predicted worst-case noise levels at relevant noise-sensitive receptors for each of the key activities during construction of the proposed development are presented in Table 6 of EIAR Volume 3 **Appendix J-1**. The proposed construction activities would occur at relatively large distances from the residential properties considered, such that the resulting predicted noise levels would not exceed 50 dB L_{Aeq} . Based on the guidance set out in BS 5228-1 and summarised in Section 11.1.2.5 above, this would represent negligible impacts.

In addition to onsite activities, construction-related traffic passing to and from the proposed development site would also represent a potential source of noise to surrounding properties. EIAR Volume 3 **Appendix H-1: Traffic & Transportation Assessment** has identified a worst-case traffic associated with construction of 12 heavy vehicles per hour. Although this traffic may pass in relative proximity to some dwellings, using the prediction methodology in BS 5288, the associated noise levels at these properties predicted in EIAR Volume 3 **Appendix J-1** will not exceed 65 dB L_{Aeq} , corresponding to a minor impact.

EIAR Volume 3 **Appendix J-1** also considers the effect of the peak construction traffic on noise for properties adjacent to the N13 and N15: the predicted increase in traffic noise calculated using the CRTN method is less than 1 dB(A), which corresponds to a negligible effect based on the relevant criteria in the UK DMRB guidance.

In conclusion, noise from construction activities has been assessed and is predicted to result in a temporary negligible to minor impact which is not significant.

11.3.2 Operational Phase

The predictions of operational noise for the proposed development in isolation at the noise-sensitive locations of **Table 11.1** are detailed in **Table 9** of **Appendix J-1** EIAR Volume 3 -these varied between 22 and 30 dB(A) at low wind speeds and 35 to 40 dB(A) at high wind speeds. This is illustrated in **Figure 11-1**.

The detailed assessment of **Tables 10 and 11** of EIAR Volume 3 **Appendix J-1** then demonstrated that these predicted noise levels comply with the noise limits derived from the baseline survey and described above (**Tables 4 and 5** in EIAR Volume 3 **Appendix J-1**) at all properties and all locations, assuming the use of reduced noise operational mode for some of the turbines of the proposed development. For other turbine models, no operational restrictions may be required to achieve a similar conclusion. This means that the operational noise levels from the proposed development are considered acceptable in line with relevant noise limits and are therefore not significant.

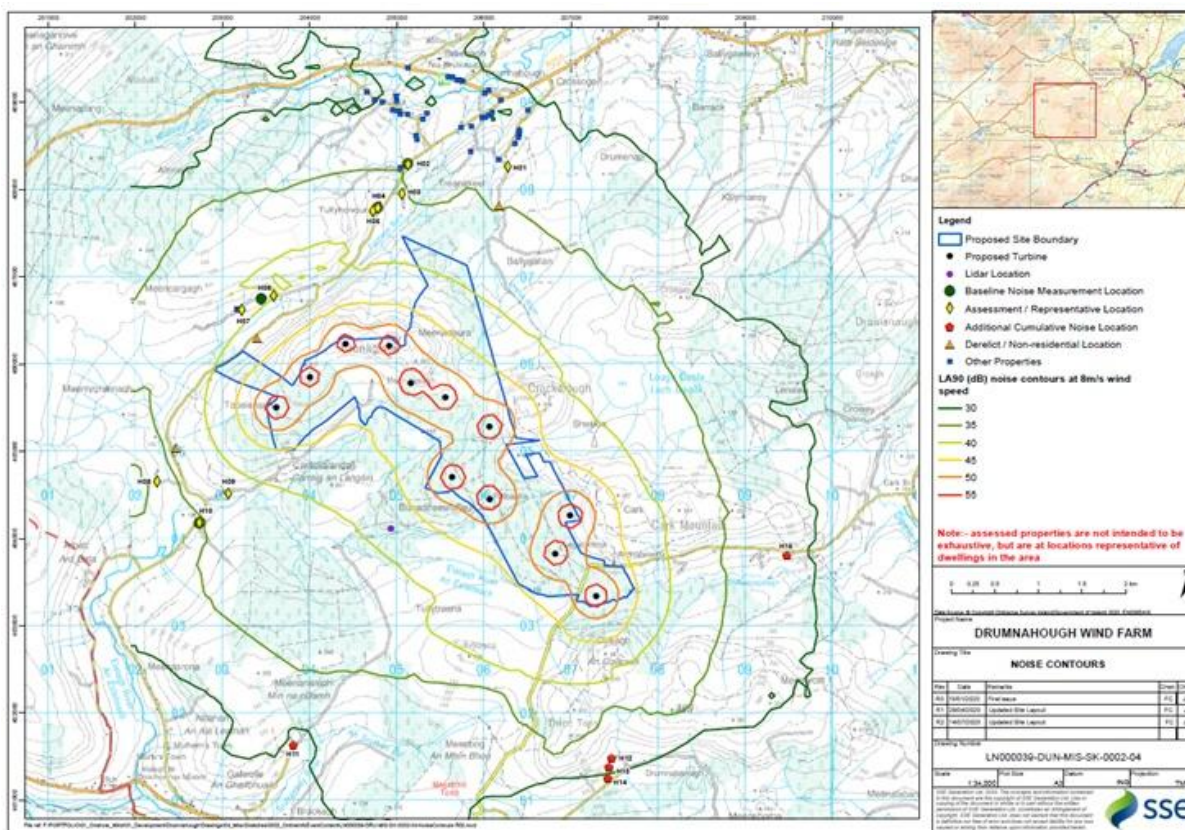


Figure 11-1 Noise Contours

11.3.2.1 Substation and energy storage

The main noise sources associated with the substation are likely to be the power transformers and their cooling fans. Battery storage facilities also have a combination of electrical plant as well as temperature control equipment.

Given the separation distance between the substation and battery storage area and the nearest residential properties, the associated noise levels at these properties will be of less than 30 dB LAeq due to separation distances involved. This would be clearly below the most stringent noise limit of 35 dB LAeq recommended in the NG4 guidance for classified installations, even accounting for the potential character of the noise, and would be comparable to existing background noise levels currently experienced during quiet periods. Therefore, no specific mitigation measures are considered to be required in this instance.

11.3.3 Decommissioning Phase

De-commissioning is likely to result in less noise than during construction, and therefore be associated with minor effects at most which is not significant.

11.3.4 Risk of major accidents and disasters

These considerations are not relevant to the present chapter.

11.3.5 Cumulative effects

No cumulative construction activities would occur in sufficient proximity to generate potentially significant cumulative construction effects.

Table 13 of EIAR Volume 3 **Appendix J-1** then set out predicted operational noise levels from other wind farms in the area including Meentycat Wind Park, Culliagh, Cark, Meentycat Cark Extension and Meenbog Meentycat Extension Wind Farms. Predictions were made at the properties of Table 11.1 as well as four additional properties located closer to the other wind farms considered in this cumulative analysis. Other, more distant wind farms (such as the consented Lenalea Wind Farm) were not considered as their potential noise contribution was considered negligible, due to the large distances involved.

A comparison of these results with predictions for the proposed development in isolation shows that, in many cases, the contribution from the proposed development is either more than 10dB below that from other schemes, or that the contribution from other scheme is 10dB below that from the proposed development: in line with good practice guidance, cumulative effects can therefore be considered relatively negligible at these properties.

For the other properties considered, **Table 14** of EIAR Volume 3 **Appendix J-1** sets out cumulative predicted operational noise levels. These predictions assume that all receptors are downwind of all wind turbines, which is conservative in many cases. The detailed assessment set out in **Tables 15 and 16** of EIAR Volume 3 **Appendix J-1** compares these predicted cumulative noise levels with the derived noise limits. The assessment demonstrates that the derived noise limits are predicted to be achieved at all wind speeds and locations cumulatively with the neighbouring schemes considered.

In conclusion, cumulative operational noise levels including all neighbouring schemes are considered acceptable in line with relevant noise limits and are therefore not significant.

11.4 MITIGATION

11.4.1 Construction Phase

To reduce the potential effects of construction noise, the following types of mitigation measures are proposed:

- Those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the site will be limited to the hours 07:00 to 19:00 Monday to Friday and 07:00 to 14:00 on Saturdays. Turbine deliveries would only take place outside these times with the prior consent of the Council and the Police. Those activities that are unlikely to give rise to noise audible at the site boundary will continue outside of the stated hours.
- All construction activities shall adhere to good practice as set out in BS 5228.
- All equipment will be maintained in good working order and any associated noise attenuation such as engine casing and exhaust silencers shall remain fitted at all times.
- Where flexibility exists, activities will be separated from residential neighbours by the maximum possible distances.
- A site management regime will be developed to control the movement of vehicles to and from the proposed development site.

- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to restrict the duration of the higher magnitude levels.

The potential noise and vibration effects of blasting operations will be reduced according to the guidance set out in the relevant Standards and discussed below:

- Blasting, if required, should take place under strictly controlled conditions and in consultation with the relevant authorities, at regular times within the working week, that is, Mondays to Fridays, between the hours of 10.00am and 16.00pm. Blasting on Saturday mornings should be a matter for negotiation between the contractor and the local authorities;
- Vibration levels at the nearest sensitive properties are best controlled through on-site testing processes carried out in consultation with the Local Authorities. This site testing-based process would include the use of progressively increased minor charges to gauge ground conditions both in terms of propagation characteristics and the level of charge needed to release the requisite material. The use of onsite monitoring at neighbouring sensitive locations during the course of this preliminary testing can then be used to define upper final charge values that will ensure vibration levels remain within the criteria set out previously, as described in BS 5228-2 and BS 6472-2 2008;
- Blasting operations shall adhere to good practice as set out in BS 5228-2 in order to control air overpressure

11.4.2 Operational Phase

The selection of the final turbine to be installed at the site will be made on the basis of ensuring relevant noise limits are achieved at the surrounding properties. EIAR Volume 3 **Appendix J-1** includes specific noise limits for the proposed development in **Tables 18 and 19** which are reproduced as **Tables 11-2 and 11-3** below. They were determined such that compliance of the proposed development operating in isolation with these specific noise limits would maintain the conclusion of the cumulative assessment set out above and result in cumulative levels which do not exceed the derived noise limits.

Table 11-2 Specific Day-time Noise Limits for the proposed development in Isolation (L_{A90} , dB)

Property	Standardised 10 m Wind Speed (m/s)								
	4	5	6	7	8	9	10	11	12
H01	39	39	39	39	40	42	42	42	42
H02	39	39	39	39	41	42	42	42	42
H03	40	40	40	40	41	43	45	47	50
H04	40	40	40	40	41	43	45	47	50
H05	40	40	40	40	41	43	45	47	50
H06	40	40	40	40	40	43	47	50	50
H07	40	40	40	40	40	43	47	50	50
H08	39	39	39	39	39	39	41	44	47
H09	39	39	39	39	39	39	41	44	47
H10	39	39	39	39	39	39	42	44	47

Table 11-3 Specific Night-time Noise Limits for the proposed development in Isolation (L_{A90} , dB)

Property	Standardised 10 m Wind Speed (m/s)								
	4	5	6	7	8	9	10	11	12
H01	42	42	42	42	42	42	42	42	42
H02	42	42	42	42	42	42	43	43	43
H03	42	42	42	42	42	42	43	44	45
H04	42	42	42	42	42	42	43	44	45
H05	42	42	42	42	42	42	43	44	45
H06	43	43	43	43	43	44	48	53	59
H07	43	43	43	43	43	44	48	53	59
H08	42	42	42	42	42	42	42	43	43
H09	42	42	42	42	42	42	42	42	42
H10	42	42	42	42	42	42	42	43	43

11.4.2.1 Monitoring

It is proposed that if planning consent is granted for the proposed development, conditions attached to the planning consent should include the requirement that, in the event of a noise complaint, noise levels resulting from the operation of the wind farm are measured in order to demonstrate compliance with the conditioned noise limits (**Tables 11-2 and 11-3**). Such monitoring should be done in full accordance with ETSU-R-97, relevant good practice as set out in the IOA GPG and include penalties for characteristics of the noise such as tonality (if present).

11.4.3 Decommissioning Phase

Similar mitigation measures would be employed as for the construction phase.

11.5 RESIDUAL IMPACTS

11.5.1 Construction Phase

The adoption of the identified mitigation measures would reduce the potential noise and vibration effects during construction. Comparing the predicted noise levels to the range of background noise levels measured around the proposed development suggests that the noisier construction activities could be audible at various times throughout the construction phase. However, based on the considerations presented above, the associated effects would still be negligible to minor temporary adverse and therefore not significant.

11.5.2 Operational Phase

The basis of the WEDG guidelines is to define acceptable noise limits thought to offer reasonable protection to residents in areas around windfarm developments. At some locations under some wind conditions and for a certain proportion of the time, noise from the proposed development may be audible; however, operational noise immission levels are acceptable in terms of the relevant guidance for the assessment of windfarm noise, and therefore considered not significant.

11.5.3 Decommissioning Phase

De-commissioning is likely to result in less noise than during construction, and therefore be associated with minor temporary adverse effects at most which is not significant

11.6 CONCLUSION

The construction noise assessment has determined that whilst noise from some activities may be audible at various times throughout the construction programme, associated noise levels remain within acceptable guidelines such that their temporary effects are considered minor at most and not significant.

De-commissioning is likely to result in less noise than during construction, and therefore be associated with minor effects at most which is not significant.

Operational noise from the wind farm has been assessed in accordance with the methodology set out in the WEDGs. This document provides a robust basis for assessing the operational noise of a wind farm. Reference was also made to additional detailed guidance in ETSU-R-97 and current good practice.

Applying the derived noise limits at the assessment locations it has been demonstrated that both the day- and night-time noise limits can be satisfied at all properties across all wind speeds. This outcome may be achieved through use of turbine constraints applied to some of the proposed development turbines.

This assessment has been based on the use of robust sound emission data for the Siemens-Gamesa SG-5.0-145 wind turbine which is typical of the upper end of noise emissions for the range of turbines which may be considered for this site, and assuming downwind propagation, representing worst-case assumptions.

The cumulative effects of operational noise from all other neighbouring schemes wind farms was considered and was either negligible or such that predicted levels remained below the applicable noise limits.

Finally, suitable conditions have been proposed to control this in practice. Operational noise levels are therefore acceptable and not significant.

REFERENCES

- Ref. 11-1: Wind Energy Development Guidelines (WEDG) from the Department of the Environment, Heritage and Local Government (DoEHLG), 2006.
- Ref. 11-2: ETSU-R-97, the Assessment and Rating of Noise from Wind Farms, Final Report for the Department of Trade & Industry (UK), September 1996. The Working Group on Noise from Wind Turbines.
- Ref. 11-3: A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, UK Institute of Acoustics, May 2013
- Ref. 11-4. British Standard (BS) 5228:2009-A:2014 'Code of practice for noise and vibration control on construction and open sites. Part 1: noise (BS 5228-1) and part 2: vibration (BS 5228-2).
- Ref. 11-5: BS 6472-2 (2008): Guide to evaluation of human exposure to vibration in buildings - Part 2: Blast-induced vibration.
- Ref. 11-6: Wind Energy Development Guidelines (WEDG) from the Department of the Environment, Heritage and Local Government (DoEHLG), 2006.
- Ref. 11-7: Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), Environmental Protection Agency, Office of Environmental Enforcement, Ireland (2016).
- Ref. 11-8: Calculation of Road Traffic Noise, HMSO Department of Transport (UK), 1988.
- Ref. 11-9: Design Manual for Roads and Bridges (DMRB). LA 111 Noise and Vibration, Nov 2019. The Highways Agency, Transport Scotland, Transport Wales, The Department for Regional Development (Northern Ireland) (UK).