Chapter 10: Noise and Vibration

Contents

10. Noise

10.1 Introduction

10.1.1 This chapter considers the potential effects of the proposed Revised Larbrax Wind Farm ('the Proposed Development') on noise and vibration. It details the likely significant effects of the construction and operation of the Proposed Development on identified nearby Noise Sensitive Receptors (NSRs), through the production of a Noise Impact Assessment (NIA). The Proposed Development comprises up to four wind turbines with maximum tip heights of 149.9 m.

10.1.2 This NIA was undertaken by TNEI Services Ltd. See **Technical Appendix 1.1: Statement of Expertise** for further details.

10.1.3 The specific objectives of this chapter are to:

- Describe the baseline following a noise survey which measured existing background noise levels;
- Describe the construction and operational assessment methodology and significance criteria used in completing the impact assessment;
- Describe the likely significant noise effects (including cumulative effects);
- Describe the mitigation measures proposed to address likely significant noise effects (if required); and
- Assess the residual effects remaining following the implementation of mitigation (if required).

10.1.4 This chapter is supported by the following figures which can be found in **Volume 3a of the EIA Report**:

- **Figure 10.1: Construction Noise Assessment and Noise Monitoring Locations**; and
- **Figure 10.2: Operational Noise Assessment and Noise Monitoring Locations**.

10.1.5 This chapter summarises the findings of the accompanying Construction Noise Report (**Technical Appendix 10.1**) and Wind Farm Operational Noise Report (**Technical Appendix 10.2**), both of which contain more detailed and technical information. These reports are referred to throughout this chapter and can be found in **Volume 4: Technical Appendices**.

10.2 Assessment Methodology

Legislation, Policy and Guidance

Legislation

10.2.1 This assessment is carried out in accordance primarily with the principles contained within the following legislation:

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scottish Government, 2017)[1]; and
- Control of Pollution Act 1974 (HM Government, 1974)[2].

Policy

10.2.2 This assessment is carried out in accordance primarily with the principles contained within the following policy:

- National Planning Framework 4, (Scottish Government, 2023)[3]; and
- Onshore Wind Policy Statement 2022 (Scottish Government, 2022)[4].

1 Scottish Government (2023). The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017

2 HM Government. Control of Pollution Act 1974 Chapter 40. London: Her Majesty's Stationery Office, 1974

3 Scottish Government (2023). National Planning Framework 4

4 Scottish Government (2014). Onshore wind: policy statement 2022 [Online] Available From https://www.gov.scot/publications/onshore-wind-policy-statement-2022/ [Accessed 30th August 2024]

Guidance

10.2.3 This assessment is carried out in accordance with the principles contained within the following documents:

- Planning Advice Note (PAN) 1/2011: 'Planning and Noise' (Scottish Government, 2011) [5];
- Web Based Renewables Advice: 'Onshore Wind Turbines' (Scottish Government, 2014)[6];
- BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments - Noise'[7];
- ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (NWG, 1996)[8]; and
- Institute of Acoustics (IOA) 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG, 2013)[9]; and
- ISO 9613-2:1996 'Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation' (ISO, 1996)[10].

Consultation

10.2.4 An EIA Scoping Report was submitted to DGC in September 2023 (ref. 23/2032/SCO). Within the Scoping Report was the suggested approach to the noise assessment.

10.2.5 Whilst no formal Scoping Opinion was received from DGC; the Environmental Health Department at DGC provided a response to the Scoping Report in a letter dated 20th April 2024. Consideration has been given to that response as detailed in **Table 10.1**.

Table 10.1: Consultation responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
DGC	Consultation response issued by Environmental Health Department in response to the Scoping Report	The Environmental Health Department at DGC stated: *'In relation to the above application, I have no objections in principle however, until a site-specific impact assessment has been carried out with regard to noise, potential for impact on private water supplies etc we would be unable to comment fully as to the expected impacts*.'	The construction noise assessment has been undertaken in accordance with BS5228. The operational noise assessment has been undertaken in accordance with ETSU-R-97 and the IOA GPG.

Study Area

10.2.6 The study area for the assessment of construction and operational noise includes the noise-sensitive receptors (NSRs) closest to the proposed locations of the construction works and the wind turbines. The NSRs were identified following a desk-based assessment.

10.2.7 To assess potential impacts from construction noise, a total of five NSRs were selected and defined as Construction Noise Assessment Locations (CNALs). These are shown in **Table 10.2** below and on **Figure 10.1**.

5 Scottish Government (2011). PAN 1/2011 Planning and Noise Scotland

6 Scottish Government (2014) Web Based Renewables Advice: 'Onshore Wind Turbines' [Online] Available From https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ [Accessed 30th September 2023]

7 British Standard BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 1: Noise

8 The Working Group on Noise from Wind Turbines (1996). ETSU-R-97 The Assessment and Rating of Noise From Wind Farms. UK: Energy Technology Support Unit

9 IOA (2013). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'. UK: Institute of Acoustics.

10 ISO (1996). ISO 9613-2:1996 Acoustics – Attenuation of Sound during Propagation Outdoors: Part 2 – General Method of Calculation. Geneva: International Organization for Standardisation.

Table 10.2: Construction Noise Assessment Locations (CNALs)

Construction Noise Assessment Locations (CNALs)	Easting	Northing
CNAL1 - Meikle Larbrax	197605	560443
CNAL2 - Meikle Larbrax Cottages	197773	560984
CNAL3 - Larbrax Lodge	198211	561552
CNAL4 - Glenvallagh Cottage	198177	562887
CNAL5 - Greenburn	197342	563086

10.2.8 For the operational wind farm noise assessment, a total of sixteen NSRs were selected and labelled as Noise Assessment Locations (NALs) as shown in **Table 10.3:** below and on **Figure 10.2.**

Table 10.3: Operational Wind Farm Noise Assessment Locations (NALs)

Noise Assessment Locations (NALs)	Easting	Northing	Elevation (m AOD)	Approximate Distance to Nearest Proposed Development Turbine (m)	Representative NML Used
NAL1 - Meikle Larbrax	197605	560443	48	1165 (T1)	NML3
NAL2 - Meikle Larbrax Cottages	197773	560984	59	916 (T1)	NML3
NAL3 - Larbrax Lodge	198211	561552	71	1253 (T1)	NML2
NAL4 - Glenvallagh Cottage	198177	562887	70	1766 (T2)	NML4
NAL5 - Greenburn	197342	563086	70	1187 (T4)	NML1
NAL6 - Meikle Galdenoch	197360	563228	70	1258 (T4)	NML1
NAL7 - Drumwhistley (FI with Proposed Development)	197279	563335	70	1237 (T4)	NML1
NAL8 - Galdenoch Mill Cottage	197336	563472	64	1360 (T4)	NML1
NAL9 - Little Galdenoch Farm	197835	563477	77	1794 (T4)	NML1
NAL10 - Knocknain Cottages	197382	563807	63	1609 (T4)	NML1
NAL11 - The Potting Shed (FI with Knocknain turbine)	197414	564246	62	1959 (T4)	NML1
NAL12 - Knocknain (FI with Knocknain turbine)	197445	564255	64	1985 (T4)	NML1
NAL13 - High Mark Farm (FI with High Mark turbine)	196651	564434	69	1794 (T4)	NML1
NAL14 - High Mark Cottages	196904	564585	67	2012 (T4)	NML1
NAL15 - Auchnotteroch (FI with Auchnotteroch turbine)	199461	560558	100	2639 (T1)	NML3
NAL16 - Pinewood	198931	559540	90	2717 (T1)	NML3

** Please note the distances to nearest turbines quoted above may differ from those reported elsewhere. Distances for the noise assessment are taken from the nearest turbine to the closest edge of the amenity area (usually the garden). In addition, the grid references vary due to the exact assessment location at a given property.*

10.2.9 The NALs represent the closest NSRs to the proposed wind turbine locations, although some NALs have been selected to assess NSRs further away near other wind turbines. This is due to a number of small to medium sized turbines located in the vicinity of the Proposed Development.

10.2.10 The nearby wind turbines considered for cumulative effects as part of the operational noise assessment are detailed in **Table 10.4**: below and are also shown on **Figure 10.2**

Table 10.4: Nearby Wind Turbines considered for the Operational Wind Farm noise assessment

Wind Farm	No. of Turbines	Status	Make and Model of Turbine	Hub Height (m)
Knocknain	1	Consented (to replace an existing operational turbine)	EWT DW54 900 kW	37
High Mark	2	Operational	WES 80 kW	18
High Auchneel	1	Operational	WES 80 kW	18
Auchnotteroch	1	Operational	WES 80 kW	18
Glaik Hill	1	Operational	WES LW30 250 kW	30

10.2.11 Furthermore, in regard to existing small wind turbines in the area, it has been assumed that, should the Proposed Development obtain planning permission, the three operational turbines at Meikle Galdenoch and the two operational turbines at Meikle Larbrax will be decommissioned. This assumption is consistent with the original noise assessment undertaken for the Consented Larbrax Wind Farm. Therefore, these two sets of turbines have not been considered within the cumulative noise assessment.

Desk Based Research and Data Sources

10.2.12 The assessment was informed by data sources such as Google Earth Aerial Imagery, OS Terrain 50 height data and was complemented by site visit as part of the noise survey. The noise data used for noise predictions was provided by wind turbine manufacturers or alternative reliable sources such as BS5228 for construction plant.

Field Survey

10.2.13 A noise survey was carried out as part of the assessment. Background noise monitoring was undertaken for the purposes of establishing existing noise levels in the area for a wide range of wind speed and direction and for setting noise limits relative to existing levels in accordance with ETSU-R-97. Data was recorded over the period 9th November 2021 to the 12th January 2022 at four locations – Noise Monitoring Locations (NMLs) 1-4 as shown in **Figure 10.2**. The measured data from these NMLs was analysed in accordance with Section 5.2.3 (approach 2) of the IOA GPG to remove the any potential turbine noise from the measured data. Full details pertaining to the background noise survey are presented within Section 5.2 of **Technical Appendix 10.2**.

Assessing Significance

Construction Noise Methodology

10.2.14 The assessment does not consider in detail the noise impacts associated with decommissioning, as the plant and activities used for this phase are assumed to be similar in nature (and noise output) to those in the construction noise phase. Accordingly, if noise levels during the construction phases are acceptable, they should also be acceptable during decommissioning.

10.2.15 The construction noise assessment was undertaken using guidance contained in BS5228: Part 1 2009+A1:2014 (BS5228). The prediction of construction noise levels was undertaken using the propagation method of calculation

presented in ISO9613:1996 (International Standards Organisation, 1996), together with published noise data for appropriate construction plant. To undertake an assessment of the construction noise impact, the following steps have been undertaken:

- Identify noise sensitive receptors near potential construction activities and select representative Construction Noise Assessment Locations (CNALs);
- Identify applicable threshold of significant effects from BS5228;
- Predict noise levels for various construction noise phases;
- Compare predicted noise levels against the applicable threshold;
- Where necessary, develop suitable mitigation measures to minimise any significant adverse effects during the construction phase; and, if required
- Assess any residual adverse effects taking into account any identified mitigation measures.

10.2.16 Construction of the Proposed Development will be undertaken in several successive phases. During each phase the plant and equipment, and the associated onsite movements, will influence the noise generated. The selection of plant and equipment to be used will be determined by the main contractor and detailed arrangements for onsite management will be decided at that time. This assessment has therefore been based upon a typical selection of plant for a wind farm project of this size – see **Annex 2** of **Technical Appendix 10.1**. In view of this, the plant has been modelled operating at the closest point to each receptor for a given activity in each construction phase whereas in reality only certain plant will be working at the closest point.

10.2.17 The core hours for construction activity will likely be between the hours of 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday, however, the assessment also considers construction works outside of these hours. No scheduled construction is anticipated during the night-time, although, there may be a requirement for some plant to be operational during night-time, for example, a portable generator to provide lighting.

10.2.18 **Chapter 4: Development Description** describes the outline tasks that will be undertaken during the construction period, which is estimated to last 12 months. For the purposes of the construction noise assessment, noise modelling has been undertaken for 12 core hours scenarios (one scenario per month) and one additional scenario for night-time. Construction noise sources for any given scenario will generally comprise a mix of both moving and static sources. Mobile sources include mobile construction plant (excavators, dozers, dumpers etc) and Heavy Goods Vehicles (HGVs), while static construction plant could include generators, lighting rigs and pumps. Static equipment is usually located at a fixed location for an extended period of time.

10.2.19 For much of the working day the noise associated with construction activities will be less than predicted, as the assessment has assumed all equipment is constantly operating at full power and is located at the closest point to each receptor, whereas in practice equipment load and precise location varies.

Construction Noise Significance Criteria

10.2.20 The criteria adopted for this assessment are based on Annex E part E.3.2 of BS 5228-1:2009+A1:2014 and detailed in **Table 10.5**: below:

Table 10.5: Construction Noise Assessment Significance Criteria

Significance of Effect	Criteria Thresholds	
	Criteria Met	Criteria Exceeded
Category A Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)	≤65 dB $L_{Aeq, 12\ hr}$	>65 dB $L_{Aeq, 12\ hr}$
Category A Evenings and Weekends	≤50 dB $L_{Aeq, 12\ hr}$	>50 dB $L_{Aeq, 12\ hr}$

Significance of Effect	Criteria Thresholds	
	Criteria Met	Criteria Exceeded
Category A Night time (23:00 – 07:00)	≤45 dB $L_{Aeq, 12\ hr}$	>45 dB $L_{Aeq, 12\ hr}$

10.2.21 It should be noted that exceedance of the limit does not in itself indicate a significant effect, rather, the standard states 'If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.

Operational Wind Farm Noise Methodology

10.2.22 In Scotland, Planning Advice Note PAN 1/2011 'Planning and Noise' references ETSU-R-97 and the associated 'Onshore Wind Turbines' web-based planning advice states:

'The Report, "The Assessment and Rating of Noise from Wind Farms" (Final Report, Sept 1996, DTI), (ETSU-R-97), describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available. This gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable burdens on wind farm developers, and suggests appropriate noise conditions.'

10.2.23 The web-based document then refers to the Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 (IOA GPG) as a source, which provides:

'significant support on technical issues to all users of the ETSU-R-97 method for rating and assessing wind turbine noise, and should be used by all IOA members and those undertaking assessments to ETSU-R-97. The Scottish Government accepts that the guide represents current industry good practice.'

10.2.24 The wind farm operational noise assessment has been undertaken in accordance with ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' and the IOA GPG. ETSU-R-97 provides a robust basis for determining acceptable noise limits for wind farm developments. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties would be below the noise limits derived in accordance with ETSU-R-97.

10.2.25 Limits differ between daytime and night-time periods. The daytime criteria are based upon background noise levels measured during the 'quiet periods of the day' comprising:

- All evenings from 18:00 to 23:00;
- Saturday afternoons from 13:00 to 18:00; and
- All day Sunday 07:00 to 23:00.

10.2.26 For the avoidance of doubt, the limits set based upon the background data collected during the quiet daytime period would apply to the entire daytime period (07:00 – 23:00).

10.2.27 Night-time periods are defined as 23:00 to 07:00 with no differentiation made between weekdays and weekends.

10.2.28 ETSU-R-97 recommends that wind farm noise for the daytime periods should be limited to 5 dB(A) above the prevailing background or a fixed minimum level (FML) within the range 35 - 40 dB $L_{A90,10min}$, whichever is the higher. The precise choice of criterion level within the range 35 - 40 dB(A) depends on a number of factors, including:

- The number of dwellings in the neighbourhood of the wind farm (relatively few dwellings suggest a figure towards the upper end);
- The effect of noise limits on the number of kWh generated (larger sites tend to suggest a higher figure) and;
- The duration and level of exposure to any noise.

10.2.29 Following a review of the guidance in ETSU-R-97, the three factors listed above, as well as a review of the noise limits for other wind turbine developments in the surrounding area, the 'Total ETSU-R-97 Noise Limits' for the Proposed Development operating in conjunction with other cumulative developments has been set at 40 dB(A) or background plus 5 dB whichever is the greater. Further detail of this selection is presented in **Section 6.7** of **Technical Appendix 10.2**. This 'Total' limit relates to noise from all wind farm developments (as detailed in **Table 10.4** plus the Proposed Development) in the area.

10.2.30 The daytime Site Specific Noise Limits (SSNL) have been derived based on a lower FML of 35 dB(A), or background plus 5 dB whichever is the greater whilst taking account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other schemes (as detailed in **Table 10.4**). Where wind turbine immission from the other wind turbines at a given receptor were found to be at least 10 dB below the Total ETSU-R-97 Noise Limit, it is considered that they will be using a negligible proportion of the limit, as such it was considered appropriate to allocate the entire noise limit to the Proposed Development. For the receptors where turbine predictions were found to be within 10 dB of the Total ETSU-R-97 Noise Limit, apportionment of the Total ETSU-R-97 Noise Limits was undertaken in accordance with current good practice.

10.2.31 For night-time periods the recommended limits are 5 dB(A) above prevailing background or a fixed minimum level of 43 dB LA90,10min, whichever is higher whilst taking account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other schemes.

10.2.32 The exception to the setting of both the daytime and night time fixed minimum on the noise limits occurs where a property occupier has a Financial Involvement (FI) in the wind farm development where the fixed minimum limit can be increased to 45 dB(A) or a higher permissible limit above background during the daytime and night time periods. For the purposes of this assessment, it has been assumed that there is one FI property with the Proposed Development, two properties FI with Knocknain Wind Turbine, one property FI with High Mark two small wind turbines, and one property FI with Auchnotteroch small wind turbine – see **Table 10.3**.

10.2.33 In addition to ETSU-R-97, the recommendations included in the IOA GPG have been considered in the noise assessment.

10.2.34 The exact model of turbine to be installed on the Site will be the result of a future tendering process should consent be granted. Achievement of the SSNLs determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Development. The Nordex N133 4.8 MW, with Serrated Blades and a hub height of 83.4 m has been chosen as the candidate turbine for this assessment and is considered to be representative of the type of turbine that could be installed. All the other turbines modelled in the cumulative assessment are summarised in **Table 10.4** above.

10.2.35 Noise predictions have been undertaken using the propagation model contained within Part 2 of International Standard ISO 9613-2, 'Acoustics – Attenuation of sound during propagation outdoors'. The model calculates on an octave band basis, attenuation due to geometric spreading, atmospheric absorption, and ground effects. The noise model was set up to provide realistic noise predictions, including mixed ground attenuation (G=0.5), atmospheric attenuation relating to 70% Relative Humidity and 10ºC temperature and a receiver height of 4 m.

10.2.36 Typically wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so the effect of wind direction on predicted noise levels have been considered in noise predictions (mostly applicable for cumulative noise predictions).

10.2.37 In line with the IOA GPG (2013), an assessment has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and the NALs. Propagation across a valley (concave ground) increases the number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Terrain screening effects (barrier corrections) act as blocking points, subsequently reductions in sound levels at a given receptor can potentially be observed.

10.2.38 More information relating to all the parameters for operational noise discussed above and on other topics such as Amplitude Modulation (AM) and Low Frequency Noise (LFN) has been provided in the **Technical Appendix 10.2**. There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and at time of writing there is no agreed methodology which can be used to predict the occurrence of AM or an agreed methodology that can be used to determine whether the effects of AM, should it occur, are likely to be significant.

Cumulative Operational Noise

10.2.39 Due to the single turbine developments within the vicinity, and the need for the Proposed Development to be able to operate within the total noise limits alongside other turbines, a cumulative noise assessment was undertaken and was part of the operational noise assessment from the outset. The assessment was completed in accordance with the relevant cumulative guidance contained within the IOA GPG (2013).

10.2.40 The operational noise assessment has been undertaken in three separate stages as follows:

- Stage 1 – establish the Total ETSU-R-97 Noise Limits for each Noise Assessment Location (NAL) using the measured background noise levels to derive new limits;
- Stage 2 – undertake noise modelling to determine whether noise predictions from the Proposed Development on its own are within 10 dB of the noise predictions from other wind turbines within the area for each NAL. Where turbine predictions are within 10 dB then a cumulative noise assessment has been undertaken for that NAL (and where not the NAL has been scoped out); and
- Stage 3 – derive the SSNLs for the Proposed Development (through apportioning the Total ETSU-R-97 Noise Limits with other turbines which are within 10 dB of the noise predictions (at each applicable NAL) and compare the noise predictions from the Proposed Development on its own against the SSNLs.

10.2.41 The aim of the operational noise assessment therefore is to establish the Total ETSU-R-97 Noise Limits, determine the likely impacts of the Proposed Development and other schemes at the nearest NSRs, derive SSNLs through apportionment of the noise limits with other cumulative developments, and demonstrate that the Proposed Development could operate in compliance with its own SSNLs.

Operational Noise Significance Criteria

10.2.42 PAN 1/2011 'Planning and Noise' provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. PAN 1/2011 refers to the Web-based planning advice on renewable technologies for Onshore Wind Turbines which states that ETSU-R-97 should be used to assess and rate noise from wind energy developments. ETSU-R-97 does not define significance criteria but describes a framework for the measurement of wind farm noise and gives indicative noise levels considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development. Achievement of ETSU-R-97 derived noise limits ensures that wind turbine noise will comply with current Government guidance.

10.2.43 The use of the term 'significance' in this Chapter in relation to operational wind turbine noise refers to compliance / non-compliance with the ETSU-R-97 derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in ETSU-R-97, then the noise effects are deemed **not significant** in the context of the EIA Regulations. Any breach of the ETSU-R-97 derived noise limits due to the Proposed Development is deemed to result in a **significant** effect in the context of the EIA Regulations.

Assessment Assumptions and Limitations

10.2.44 Assumptions on construction scenarios and the plant used for the noise modelling, assuming a worst-case approach – see **Technical Appendix 10.1**. Although the assessment of construction noise is based on general assumptions set out in **Technical Appendix 10.1,** these are considered to be precautionary, and, realistically, noise levels are likely to be lower than predicted for much of the construction period.

10.2.45 A candidate wind turbine has been used for predictions of operational wind farm noise from the Proposed Development. The final model of wind turbine to be used may differ from that presented here, however the operational noise levels from the Proposed Development would have to comply with the noise limits imposed within the noise condition attached to any planning permission granted. No other assumptions or data gaps have been identified.

10.2.46 Whilst some limitations due to the assumptions made have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant noise and vibration effects.

10.3 Existing Conditions

Baseline Noise Survey

10.3.1 A baseline noise survey was undertaken in accordance with the guidance contained within ETSU-R-97 and current good practice (IOA GPG) to understand the existing conditions at nearby NSRs. The Proposed Development is located within a rural location where existing background noise levels at the NSRs are generally considered to be low. The predominant noise sources in the area include wind induced noise (wind passing through vegetation and around buildings), sea noise, local watercourses, agricultural noise and birdsong.

10.3.2 Sound level meters were installed at four Noise Monitoring Locations (NMLs). The NMLs are detailed in **Table 10.6**: below and are shown on **Figure 10.2.**

Table 10.6: Noise Monitoring Locations

Noise Monitoring Location (NML)	Easting	Northing
NML1 - Greenburn	197351	563069
NML2 – Larbrax Lodge	198219	561600
NML3 – Larbrax Cottages	197866	560928
NML4 – Cairnhapple House	198237	562791

10.3.3 More information on the NMLs, the survey and data analysis can be found in **Technical Appendix 10.2**.

Current Baseline

10.3.4 **Table 10.7**: and **Table 10.8**: provide a summary of the background noise levels measured during the monitoring period for the ETSU-R-97 quiet daytime and night time periods.

Table 10.7: Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (dB(A))

Noise Monitoring Location (NML)	Wind Speeds (ms-1) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1 - Greenburn	24.9*	24.9	25.5	26.8	28.7	31.1	33.9	36.9	40.2	43.5	46.8	50.0
NML2 – Larbrax Lodge	24.7*	24.7*	24.7*	24.7	26.8	29.2	31.7	34.3	36.9	39.5	42.0	42.0*
NML3 – Larbrax Cottages	28.2	28.2	28.4	28.9	29.7	30.7	32.1	33.7	35.6	37.8	40.3	43.0
NML4 – Cairnhapple House	22.2	22.2	22.7	24.2	26.4	29.2	32.2	35.5	38.6	41.6	44.1	46.0

** Flatlined where derived minimum occurs at lower wind speeds.*

Table 10.8: Summary of Prevailing Background Noise Levels during Night Time Periods (dB(A))

Noise Monitoring Location (NML)	Wind Speeds (ms-1) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1 - Greenburn	25.1*	25.1*	25.1	27.0	29.3	31.9	34.7	37.5	40.4	43.2	45.9	48.4
NML2 – Larbrax Lodge	20.6	20.6	23.4	26.6	30.0	33.3	36.2	38.5	39.9	40.2	40.2	40.2*
NML3 – Larbrax Cottages	26.7	26.7	27.8	29.1	30.5	32.0	33.6	35.2	36.7	38.1	39.4	40.5

Noise Monitoring Location (NML)	Wind Speeds (ms-1) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML4 – Cairnhapple House	20.4	20.4	21.8	23.8	26.3	29.2	32.3	35.5	38.6	41.6	44.2	46.5

** Flatlined where derived minimum occurs at lower wind speeds.*

10.4 Implications of Climate Change for Existing Conditions

10.4.1 It is possible that noise propagation and resulting noise immission levels could change over the life of the Proposed Development due to climate change (as noise attenuation is influenced by air temperature, relative humidity and ground conditions). However, this is unlikely to be significant and noise limits are set based on current background noise levels in the absence of wind farm noise and would be set for the lifetime of the project. The operator would be required to meet them for the duration of the planning permission.

10.5 Future Baseline in the Absence of the Proposed Development

10.5.1 There are no other known current or predicted future processes that are likely to change the future baseline conditions in the absence of the Proposed Development.

10.6 Embedded Design Mitigation

10.6.1 Throughout the design process the layout of the Proposed Development was reviewed to optimise wind turbine numbers and locations, subject to a wide range of identified constraints inclusive of noise which was fully considered throughout the EIA process. Each layout modification was 'reviewed' by undertaking noise predictions to ensure noise limits could be met. The site design process therefore satisfactorily minimised any increase in ambient noise levels at two levels: firstly, through several iterations of site specific design and secondly, at a higher level, through the use of ETSU-R-97 itself which provides a robust basis for determining appropriate noise limits.

10.7 Good Practice Measures

10.7.1 A range of good practice measures would be detailed in a Construction Environmental Management Plan (CEMP) and employed to minimise noise impacts.

10.7.2 Good site practices would be implemented to minimise effects. Section 8 of BS5228 recommends a number of simple control measures as summarised below that would be employed onsite during construction:

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- Ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the Site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid peak traffic times;
- Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use;
- Ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Instruct that machines would be shut down between work periods or throttled down to a minimum;
- Regularly maintain all equipment used onsite, including maintenance related to noise emissions;
- Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and

- Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.

10.8 Micrositing

10.8.1 A 100 m micrositing distance is proposed. It should be noted that the need to include a concave ground profile correction and/or barrier correction may change depending on the final location of the turbines (following micrositing) and the final turbine hub height chosen. Nevertheless, turbine noise levels will have to meet the noise limits established in this assessment regardless of any increases and decreases in noise propagation caused by topography. Should planning permission be granted, the need to apply a concave ground profile/ barrier correction will need to be considered by the Applicant prior to the final selection of a turbine model for the Site.

10.9 Scope of the Assessment

Effects Assessed in Full

10.9.1 The EIA Scoping process, baseline conditions and professional judgement have identified the following effects for detailed assessment:

- Potential impact of construction noise from the Proposed Development at the identified CNALs (**Table 10.2**); and
- Potential impact of operational noise from the wind turbines at nearby NALs (**Table 10.3**) (including considering potential cumulative impact with other nearby operational wind turbines).

Effects Scoped Out

10.9.2 On the basis of the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following effects have been 'scoped out' of detailed assessment, as proposed in the EIA Scoping Report:

- It is generally considered that decommissioning noise effects will be similar in nature to those during construction and as such, a specific assessment of the decommissioning phase has not been undertaken.
- Given the nature of construction activities proposed and the relative distances from residential receptors, the risk of ground borne vibration impacting on residential receptors is considered very low, as such it is not proposed that a vibration assessment be undertaken and that a vibration assessment is scoped out.
- NALs have been scoped out whereby predictions of the Proposed Development are >10 dB below the cumulative noise predictions (excluding the Proposed Development) and therefore the Proposed Development is deemed to be non-contributory to the total cumulative turbine noise levels i.e. the Proposed Development does not need a share of the total noise budget.
- Based on current good practice on wind farm noise and available studies, it is not considered necessary to carry out specific assessments of low frequency noise and amplitude modulation (AM). However, the most relevant and latest information on these topics is discussed in **Technical Appendix 10.2**.
- As part of the Proposed Development, a small 10 MW Battery Energy Storage System (BESS) and associated substation will be located near T2 at least 1 km away from any NSR. Operational noise levels from the BESS and substation are expected to be low at such distance, and on that basis the operational noise effects from the BESS have been scoped out.
- Offsite construction vehicles amount to small increases of HGV movements per hour over the course of a typical 12-hour shift and as such the small temporary increase in traffic will not have a significant noise impact at receptors found along local roads and no further assessment was undertaken.

10.10 Assessment of Effects

Construction Effects

Predicted Construction Effects

10.10.1 **Table 10.9** below shows the predicted construction noise levels at all CNALs for all assessment scenarios. Further details of the modelling and assessment can be found in **Technical Appendix 10.1**.

Table 10.9: Construction Noise Impact Assessment

Construction Noise Assessment Locations (CNALs)	Scenario												
	1	2	3	4	5	6	7	8	9	10	11	12	13-night
CNAL1 - Meikle Larbrax	34	34	33	27	34	32	31	28	23	23	25	21	9
CNAL2 - Larbrax Cottages	36	37	36	30	33	32	32	31	25	25	28	23	12
CNAL3 - Larbrax Lodge	37	44	43	30	36	36	34	32	29	26	32	23	14
CNAL4 - Glenvallagh Cottage	35	38	37	29	34	35	34	32	30	24	31	25	18
CNAL5 - Greenburn	39	40	40	32	34	37	37	35	30	29	31	27	13

10.10.2 At all locations, the measured ambient noise levels are relatively low when considering calm wind conditions as required by BS 5228. The ambient noise levels at low wind speeds (< 5m/s) at four NMLs were below the category A values. As such the assessment criteria is the category A threshold values (see **Table 10.5**), which are the most stringent.

10.10.3 For all CNALs the predicted noise levels for all modelled scenarios are well below the Category A daytime threshold value of 65 dBA and the evening and weekend threshold of 55 dBA. Similarly, the predicted night-time scenario (13-night) noise levels are well below the night-time threshold value of 45 dBA.

Predicted Construction Effects

10.10.4 No significant effects are anticipated during the construction phase of the Proposed Development at the CNALs.

Committed Additional Mitigation

10.10.5 No significant construction noise effects are predicted, therefore no additional mitigation is proposed.

Residual Construction Effects

10.10.6 Predicted construction noise levels are below the assessment criteria at all receptors, for all phases of construction. Due to the low background noise levels at some locations and depending on the location of any temporary construction activities, some elements of construction noise may be audible at the closest residential receptor for certain periods during the construction phases. However, with or without the good practice construction measures outlined above, there will be no significant residual effects from construction noise at the CNALs.

Operational Effects

Predicted Operational Effects

Setting the Total ETSU-R-97 Noise Limits (Stage 1)

10.10.7 Based on the prevailing background noise levels, the Total ETSU-R-97 Noise Limits (applicable for all wind turbines in the area) have been established for each of the NALs selected for the cumulative assessment (further detail of this selection is presented in **Section 6.5** of **Technical Appendix 10.2**). The Total ETSU-R-97 Noise Limits are as detailed in **0** and **0** below.

Table 10.10: Total ETSU-R-97 Noise Limit - applicable to the daytime period

NAL	Wind Speed (ms^{-1}) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Meikle Larbrax	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.6	42.8	45.3	48.0
NAL2 - Larbrax Cottages	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.6	42.8	45.3	48.0
NAL3 - Larbrax Lodge	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	44.5	47.0	47.0
NAL4 - Glenvallagh Cottage	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5	43.6	46.6	49.1	51.0
NAL5 - Greenburn	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
NAL6 - Meikle Galdenoch	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
NAL7 – Drumwhistley (FI with Proposed Development)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2	48.5	51.8	55.0
NAL8 - Galdenoch Mill Cottage	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
NAL9 - Little Galdenoch Farm	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
NAL10 - Knocknain Cottages	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
NAL11 - The Potting Shed (FI with Knocknain turbine)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2	48.5	51.8	55.0
NAL12 - Knocknain (FI with Knocknain turbine)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2	48.5	51.8	55.0

Table 10.11: Total ETSU-R-97 Noise Limit – applicable to the night time period

NAL	Wind Speed (ms^{-1}) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Meikle Larbrax	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.1	44.4	45.5

NAL	Wind Speed (ms^{-1}) as standardised to 10 m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL2 - Meikle Larbrax Cottages	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.1	44.4	45.5
NAL3 - Larbrax Lodge	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.5	44.9	45.2	45.2	45.2
NAL4 - Glenvallagh Cottage	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.6	49.2	51.5
NAL5 - Greenburn	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
NAL6 - Meikle Galdenoch	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
NAL7 - Drumwhistley(FI with Proposed Development)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.4	48.2	50.9	53.4
NAL8 - Galdenoch Mill Cottage	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
NAL9 - Little Galdenoch Farm	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
NAL10 - Knocknain Cottages	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
NAL11 - The Potting Shed (FI with Knocknain turbine)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.4	48.2	50.9	53.4
NAL12 - Knocknain (FI with Knocknain turbine)	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.4	48.2	50.9	53.4

Predicting the Likely Effects and the Requirement for a Cumulative Noise Assessment (Stage 2)

10.10.8 A comparison has been undertaken of the predicted wind turbine noise immission levels from the Proposed Development against the predictions of all other schemes at all of the NALs in order to calculate whether predictions are within 10 dB of each other. All turbines have been assumed to be operating in full unconstrained mode. These predictions and the result of the comparison showed that a cumulative noise assessment was required at NALs 1 – 12.

10.10.9 **10.10.9** and **0** below summarise the results of the cumulative noise assessment. It should be noted that the noise data was not available for the cumulative noise predictions for some nearby small turbines for lower wind speeds, therefore no cumulative predictions are included in some low wind speeds. The results show that the predicted cumulative wind turbine noise immission levels meet the Total ETSU-R-97 Noise limits under all conditions at all

NALs during both day-time and night-time (shown as negative exceedance values). As such, there will be **no significant cumulative operational effects**.

Table 10.12: ETSU-R-97 Compliance Table – Likely Cumulative Noise - Daytime

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Meikle Larbrax	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.6	42.8	45.3	48
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	27.8	31.5	32.1	32.2	32.4	32.5	32.6	32.7
	Exceedance Level	-	-	-	-	-12.2	-8.5	-7.9	-7.8	-8.2	-10.3	-12.7	-15.3
NAL2 - Meikle Larbrax Cottages	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.6	42.8	45.3	48
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	29.9	33.9	34.5	34.5	34.6	34.6	34.6	34.7
	Exceedance Level	-	-	-	-	-10.1	-6.1	-5.5	-5.5	-6	-8.2	-10.7	-13.3
NAL3 - Larbrax Lodge	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	44.5	47	47
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	27.7	31.7	32.3	32.3	32.4	32.5	32.5	32.5
	Exceedance Level	-	-	-	-	-12.3	-8.3	-7.7	-7.7	-9.5	-12	-14.5	-14.5
NAL4 - Glenvallagh Cottage	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.5	43.6	46.6	49.1	51
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	26.7	30.2	30.9	31.1	31.5	31.7	31.8	31.8
	Exceedance Level	-	-	-	-	-13.3	-9.8	-9.1	-9.4	-12.1	-14.9	-17.3	-19.2
NAL5 - Greenburn	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	30.8	34.2	34.8	35.1	35.6	35.8	35.9	36.0
	Exceedance Level	-	-	-	-	-9.2	-5.8	-5.2	-6.8	-9.6	-12.7	-15.9	-19.0
NAL6 - Meikle Galdenoch	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	30.6	33.7	34.5	34.9	35.5	35.8	35.9	36.0
	Exceedance Level	-	-	-	-	-9.4	-6.3	-5.5	-7.0	-9.7	-12.7	-15.9	-19.0
NAL7 - Drumwhistley (FI with Proposed Development)	Total Noise Limit: ETSU-R-97 L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2	48.5	51.8	55.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	31.1	34.0	34.8	35.4	36.2	36.5	36.6	36.7
	Exceedance Level	-	-	-	-	-13.9	-11	-10.2	-9.6	-9.0	-12.0	-15.2	-18.3
NAL8 - Galdenoch Mill Cottage	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	30.4	33.4	34.3	35.2	36.1	36.5	36.6	36.6
	Exceedance Level	-	-	-	-	-9.6	-6.6	-5.7	-6.7	-9.1	-12.0	-15.2	-18.4

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL9 - Little Galdenoch Farm	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	28.6	31.3	32	32.6	33.4	33.8	34	34.1
	Exceedance Level	-	-	-	-	-11.4	-8.7	-8	-9.3	-11.8	-14.7	-17.8	-20.9
NAL10 - Knocknain Cottages	Total Noise Limit: ETSU-R-97 L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.9	45.2	48.5	51.8	55
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	32.7	35.1	36.4	37.6	38.9	39.5	39.5	39.5
	Exceedance Level	-	-	-	-	-7.3	-4.9	-3.6	-4.3	-6.3	-9	-12.3	-15.5
NAL11 - The Potting Shed (FI with Knocknain turbine)	Total Noise Limit: ETSU-R-97 L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2	48.5	51.8	55
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	34	35.4	36.4	37.6	39.1	39.7	39.9	40.1
	Exceedance Level	-	-	-	-	-11	-9.6	-8.6	-7.4	-6.1	-8.8	-11.9	-14.9
NAL12 - Knocknain (FI with Knocknain turbine)	Total Noise Limit: ETSU-R-97 L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2	48.5	51.8	55
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	33.7	35.1	36.1	37.2	38.6	39.3	39.5	39.6
	Exceedance Level	-	-	-	-	-11.3	-9.9	-8.9	-7.8	-6.6	-9.2	-12.3	-15.4

Table 10.13: ETSU-R-97 Compliance Table – Likely Cumulative Noise – Night-time

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Meikle Larbrax	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.1	44.4	45.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	27.8	31.5	32.1	32.2	32.4	32.5	32.6	32.7
	Exceedance Level	-	-	-	-	-15.2	-11.5	-10.9	-10.8	-10.6	-10.6	-11.8	-12.8
NAL2 - Meikle Larbrax Cottages	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.1	44.4	45.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	29.9	33.9	34.5	34.5	34.6	34.6	34.6	34.7
	Exceedance Level	-	-	-	-	-13.1	-9.1	-8.5	-8.5	-8.4	-8.5	-9.8	-10.8
NAL3 - Larbrax Lodge	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.5	44.9	45.2	45.2	45.2
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	27.7	31.7	32.3	32.3	32.4	32.5	32.5	32.5
	Exceedance Level	-	-	-	-	-15.3	-11.3	-10.7	-11.2	-12.5	-12.7	-12.7	-12.7
NAL4 - Glenvallagh Cottage	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.6	49.2	51.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	26.7	30.2	30.9	31.1	31.5	31.7	31.8	31.8

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Exceedance Level	-	-	-	-	-16.3	-12.8	-12.1	-11.9	-12.1	-14.9	-17.4	-19.7
NAL5 - Greenburn	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	30.8	34.2	34.8	35.1	35.6	35.8	35.9	36.0
	Exceedance Level	-	-	-	-	-12.2	-8.8	-8.2	-7.9	-9.8	-12.4	-15.0	-17.4
NAL6 - Meikle Galdenoch	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	30.6	33.7	34.5	34.9	35.5	35.8	35.9	36.0
	Exceedance Level	-	-	-	-	-12.4	-9.3	-8.5	-8.1	-9.9	-12.4	-15.0	-17.4
NAL7 - Drumwhistley (FI with Proposed Development)	Total Noise Limit: ETSU-R-97 L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	31.1	34	34.8	35.4	36.2	36.5	36.6	36.7
	Exceedance Level	-	-	-	-	-13.9	-11	-10.2	-9.6	-9.2	-11.7	-14.3	-16.7
NAL8 - Galdenoch Mill Cottage	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	30.4	33.4	34.3	35.2	36.1	36.5	36.6	36.6
	Exceedance Level	-	-	-	-	-12.6	-9.6	-8.7	-7.8	-9.3	-11.7	-14.3	-16.8
NAL9 - Little Galdenoch Farm	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	28.6	31.3	32	32.6	33.4	33.8	34	34.1
	Exceedance Level	-	-	-	-	-14.4	-11.7	-11	-10.4	-12	-14.4	-16.9	-19.3
NAL10 - Knocknain Cottages	Total Noise Limit: ETSU-R-97 L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	32.7	35.1	36.4	37.6	38.9	39.5	39.5	39.5
	Exceedance Level	-	-	-	-	-10.3	-7.9	-6.6	-5.4	-6.5	-8.7	-11.4	-13.9
NAL11 - The Potting Shed (FI with Knocknain turbine)	Total Noise Limit: ETSU-R-97 L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	34	35.4	36.4	37.6	39.1	39.7	39.9	40.1
	Exceedance Level	-	-	-	-	-11	-9.6	-8.6	-7.4	-6.3	-8.5	-11	-13.3
NAL12 - Knocknain (FI with Knocknain turbine)	Total Noise Limit: ETSU-R-97 L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.4	48.2	50.9	53.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	33.7	35.1	36.1	37.2	38.6	39.3	39.5	39.6
	Exceedance Level	-	-	-	-	-11.3	-9.9	-8.9	-7.8	-6.8	-8.9	-11.4	-13.8

Operational Phase – Derivation of SSNLs for the Proposed Development (Stage 3)

10.10.10 In order to protect residential amenity, in accordance with ETSU R-97, all wind farms (including the Proposed Development) should operate within the Total ETSU-R-97 Noise Limits, as demonstrated in Stage 2 above. This stage 3 is an additional step to consider the fact that nearby wind farms/turbines may have the right to operate at higher levels than 'likely' predictions and also to consider potential noise conditions applicable to the Proposed Development on its own.

10.10.11 SSNLs have been calculated as an apportionment of the Total ETSU-R-97 noise limits with other nearby turbines which share the total noise budget. The modelling done for any apportionment assumes that all nearby wind turbines considered are operating and with wind blowing from behind the existing turbines towards the receptors (downwind), which can lead to an assumed situation where at the same time an NAL will be in upwind conditions from the Proposed Development. Because the SSNL are intended to be tested in downwind (not upwind), these are very much worst-case assumptions when setting the SSNLs.

10.10.12 The SSNLs and noise predictions for the Proposed Development on its own are summarised in **Table 10.14** and **Table 10.15,** and details of how these have been derived are included at Section 6.6 of **Technical Appendix 10.2.** The results show that the predicted wind turbine noise emission levels from the candidate in full mode meet the SSNLs under all conditions and at all NALs for both daytime and night-time periods (shown as negative exceedance values). The candidate turbine was chosen as it is considered to be representative of the type of turbine that could be installed at the Site. There are a number of wind turbine makes and models that may be suitable for the Proposed Development, should the proposal receive planning permission the final choice of turbine would be subject to a competitive tendering process. The final choice of turbine would have to meet the noise limits.

10.10.13 As such **no significant operational effects** are predicted for the Proposed Development.

Table 10.14: SSNLs Compliance Table – Daytime

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Meikle Larbrax	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.7	37.1	38.7	40.4	42.7	45.2	47.9
	Predicted Proposed Development Noise L_{A90}	-	-	20.3	21.5	27.0	31.2	31.7	31.7	31.7	31.7	31.7	31.7
	Exceedance Level	-	-	-14.7	-13.5	-8.0	-4.5	-5.4	-7.0	-8.7	-11.0	-13.5	-16.2
NAL2 - Meikle Larbrax Cottages	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.7	37.1	38.7	40.4	42.7	45.2	47.9
	Predicted Proposed Development Noise L_{A90}	-	-	22.9	24.1	29.6	33.8	34.4	34.4	34.4	34.4	34.4	34.4
	Exceedance Level	-	-	-12.1	-10.9	-5.4	-1.9	-2.7	-4.3	-6.0	-8.3	-10.8	-13.5
NAL3 - Larbrax Lodge	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.0	36.7	39.3	41.8	44.5	47.0	47.0
	Predicted Proposed Development Noise L_{A90}	-	-	20.7	21.9	27.4	31.6	32.1	32.1	32.1	32.1	32.1	32.1
	Exceedance Level	-	-	-14.3	-13.1	-7.6	-3.4	-4.6	-7.2	-9.7	-12.4	-14.9	-14.9
NAL4 - Glenvallagh Cottage	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.0	37.2	40.3	43.5	46.5	49.1	51.0
	Predicted Proposed Development Noise L_{A90}	-	-	18.6	19.8	25.3	29.5	30.1	30.1	30.1	30.1	30.1	30.1
	Exceedance Level	-	-	-16.4	-15.2	-9.7	-5.5	-7.1	-10.2	-13.4	-16.4	-19.0	-20.9
NAL5 - Greenburn	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	36.1	38.9	41.5	44.9	48.4	51.7	55.0
	Predicted Proposed Development Noise L_{A90}	-	-	22.4	23.6	29.1	33.3	33.9	33.9	33.9	33.9	33.9	33.9
	Exceedance Level	-	-	-12.6	-11.4	-5.9	-2.8	-5.0	-7.6	-11.0	-14.5	-17.8	-21.1
NAL6 - Meikle Galdenoch	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	36.1	38.9	41.4	44.9	48.3	51.7	55.0

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Predicted Proposed Development Noise L_{A90}	-	-	21.5	22.7	28.2	32.4	33.0	33.0	33.0	33.0	33.0	33.0
	Exceedance Level	-	-	-13.5	-12.3	-6.8	-3.7	-5.9	-8.4	-11.9	-15.3	-18.7	-22.0
NAL7 – Drumwhistley (FI with Proposed Development)	Site Specific Noise Limit L_{A90}	45.0	45.0	45.0	45.0	44.9	44.8	44.7	44.6	44.7	48.2	51.7	54.9
	Predicted Proposed Development Noise L_{A90}	-	-	21.4	22.6	28.1	32.3	32.9	32.9	32.9	32.9	32.9	32.9
	Exceedance Level	-	-	-23.6	-22.4	-16.8	-12.5	-11.8	-11.7	-11.8	-15.3	-18.8	-22.0
NAL8 - Galdenoch Mill Cottage	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	36.1	38.9	41.0	44.6	48.2	51.7	54.9
	Predicted Proposed Development Noise L_{A90}	-	-	20.0	21.2	26.7	30.9	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-15.0	-13.8	-8.3	-5.2	-7.4	-9.5	-13.1	-16.7	-20.2	-23.4
NAL9 - Little Galdenoch Farm	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	36.1	38.9	41.5	44.9	48.4	51.7	55.0
	Predicted Proposed Development Noise L_{A90}	-	-	18.1	19.4	24.9	29.0	29.6	29.6	29.6	29.6	29.6	29.6
	Exceedance Level	-	-	-16.9	-15.6	-10.1	-7.1	-9.3	-11.9	-15.3	-18.8	-22.1	-25.4
NAL10 - Knocknain Cottages	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	36.1	36.7	38.9	43.5	47.6	51.4	54.8
	Predicted Proposed Development Noise L_{A90}	-	-	18.4	19.6	25.1	29.3	29.9	29.9	29.9	29.9	29.9	29.9
	Exceedance Level	-	-	-16.6	-15.4	-9.9	-6.8	-6.8	-9.0	-13.6	-17.7	-21.5	-24.9
NAL11 - The Potting Shed (FI with Knocknain turbine)	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	38.5	41.8	45.0
	Predicted Proposed Development Noise L_{A90}	-	-	14.2	15.4	20.9	25.1	25.7	25.7	25.7	25.7	25.7	25.7
	Exceedance Level	-	-	-20.8	-19.6	-14.1	-9.9	-9.3	-9.3	-9.5	-12.8	-16.1	-19.3
NAL12 - Knocknain (FI with Knocknain turbine)	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.2	38.5	41.8	45
	Predicted Proposed Development Noise L_{A90}	-	-	15.7	16.9	22.4	26.6	27.2	27.2	27.2	27.2	27.2	27.2
	Exceedance Level	-	-	-19.3	-18.1	-12.6	-8.4	-7.8	-7.8	-8	-11.3	-14.6	-17.8

Table 10.15: SSNLs Compliance Table – Night-time

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Meikle Larbrax	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	42.9	42.9	42.9	43.0	44.3	45.4
	Predicted Proposed Development Noise L_{A90}	-	-	20.3	21.5	27.0	31.2	31.7	31.7	31.7	31.7	31.7	31.7
	Exceedance Level	-	-	-22.7	-21.5	-16.0	-11.8	-11.2	-11.2	-11.2	-11.3	-12.6	-13.7
NAL2 - Meikle Larbrax Cottages	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	42.9	42.9	42.9	43.0	44.3	45.4
	Predicted Proposed Development Noise L_{A90}	-	-	22.9	24.1	29.6	33.8	34.4	34.4	34.4	34.4	34.4	34.4
	Exceedance Level	-	-	-20.1	-18.9	-13.4	-9.2	-8.5	-8.5	-8.5	-8.6	-9.9	-11.0
NAL3 - Larbrax Lodge	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.5	44.9	45.2	45.2	45.2
	Predicted Proposed Development Noise L_{A90}	-	-	20.7	21.9	27.4	31.6	32.1	32.1	32.1	32.1	32.1	32.1
	Exceedance Level	-	-	-22.3	-21.1	-15.6	-11.4	-10.9	-11.4	-12.8	-13.1	-13.1	-13.1
	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	42.9	42.9	42.9	43.5	46.5	49.2	51.5

Location		Wind Speed (ms^{-1}) as standardised to 10 m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL4 - Glenvallagh Cottage	Predicted Proposed Development Noise L_{A90}	-	-	18.6	19.8	25.3	29.5	30.1	30.1	30.1	30.1	30.1	30.1
	Exceedance Level	-	-	-24.4	-23.2	-17.7	-13.4	-12.8	-12.8	-13.4	-16.4	-19.1	-21.4
NAL5 - Greenburn	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.9	42.8	42.8	42.7	45.1	48.1	50.8	53.3
	Predicted Proposed Development Noise L_{A90}	-	-	22.4	23.6	29.1	33.3	33.9	33.9	33.9	33.9	33.9	33.9
	Exceedance Level	-	-	-20.6	-19.4	-13.8	-9.5	-8.9	-8.8	-11.2	-14.2	-16.9	-19.4
NAL6 - Meikle Galdenoch	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.8	42.8	42.7	42.6	45.1	48.0	50.8	53.3
	Predicted Proposed Development Noise L_{A90}	-	-	21.5	22.7	28.2	32.4	33.0	33.0	33.0	33.0	33.0	33.0
	Exceedance Level	-	-	-21.5	-20.3	-14.6	-10.4	-9.7	-9.6	-12.1	-15.0	-17.8	-20.3
NAL7 – Drumwhistley (FI with Proposed Development)	Site Specific Noise Limit L_{A90}	45.0	45.0	45.0	45.0	44.9	44.8	44.7	44.6	44.9	47.9	50.7	53.3
	Predicted Proposed Development Noise L_{A90}	-	-	21.4	22.6	28.1	32.3	32.9	32.9	32.9	32.9	32.9	32.9
	Exceedance Level	-	-	-23.6	-22.4	-16.8	-12.5	-11.8	-11.7	-12.0	-15.0	-17.8	-20.4
NAL8 - Galdenoch Mill Cottage	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.8	42.6	42.5	42.3	44.8	47.9	50.7	53.3
	Predicted Proposed Development Noise L_{A90}	-	-	20.0	21.2	26.7	30.9	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-25.0	-23.8	-18.2	-13.9	-13.2	-13.1	-13.3	-16.4	-19.2	-21.8
NAL9 - Little Galdenoch Farm	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.9	42.8	42.8	42.7	45.1	48.0	50.8	53.3
	Predicted Proposed Development Noise L_{A90}	-	-	18.1	19.4	24.9	29.0	29.6	29.6	29.6	29.6	29.6	29.6
	Exceedance Level	-	-	-24.9	-23.6	-18.0	-13.8	-13.2	-13.1	-15.5	-18.4	-21.2	-23.7
NAL10 - Knocknain Cottages	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.4	42.1	41.6	40.9	43.7	47.3	50.4	53.1
	Predicted Proposed Development Noise L_{A90}	-	-	18.4	19.6	25.1	29.3	29.9	29.9	29.9	29.9	29.9	29.9
	Exceedance Level	-	-	-24.6	-23.4	-17.3	-12.8	-11.7	-11.0	-13.8	-17.4	-20.5	-23.2
NAL11 - The Potting Shed (FI with Knocknain turbine)	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.4	38.2	40.9	43.4
	Predicted Proposed Development Noise L_{A90}	-	-	14.2	15.4	20.9	25.1	25.7	25.7	25.7	25.7	25.7	25.7
	Exceedance Level	-	-	-20.8	-19.6	-14.1	-9.9	-9.3	-9.3	-9.7	-12.5	-15.2	-17.7
NAL12 - Knocknain (FI with Knocknain turbine)	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.4	38.2	40.9	43.4
	Predicted Proposed Development Noise L_{A90}	-	-	15.7	16.9	22.4	26.6	27.2	27.2	27.2	27.2	27.2	27.2
	Exceedance Level	-	-	-19.3	-18.1	-12.6	-8.4	-7.8	-7.8	-8.2	-11	-13.7	-16.2

Committed Additional Mitigation

10.10.14 No significant operational effects are predicted, therefore no additional mitigation measures are required.

Residual Operational Effects

10.10.15 The results of the noise assessment show that the predicted wind turbine noise levels would meet the SSNLs under all conditions and at all locations for both daytime and night time periods, without specific mitigation (i.e. no other mitigation beyond the layout design as part of the EIA, which fully considered noise).

10.10.16 At some locations, under some wind conditions and for a certain proportion of the time operational wind farm noise would be audible; however, it would be at an acceptable level in relation to the ETSU-R-97 guidelines and there would be **no significant operational residual effects**.

Cumulative Effects During Construction

10.10.17 The construction noise assessment has shown that predictions for the Proposed Development on its own are well below the BS5228 threshold during proposed core hours of work, therefore there are sufficient margins at nearby receptors for other construction work to occur simultaneously in the area. Also, it is very unlikely that other significant projects will be constructed at the same time as the Proposed Development with major noise sources operating near the CNALs on the same day. As such, no cumulative noise effects are anticipated.

10.10.18 It was found that without mitigation there would be no significant cumulative construction noise effects. As such there would be no **significant residual cumulative effects** during the construction phase.

Cumulative Effects During Operation

10.10.19 The operational wind farm noise assessment has taken into consideration cumulative impacts with other existing nearby wind turbines, as described in the above assessment. The cumulative operational noise assessment shows that the Proposed Development can operate concurrently within the total noise limits with the nearby relevant schemes, and therefore no significant cumulative operational noise effects are predicted.

10.10.20 It was found that without mitigation there would be no significant cumulative operational noise effects. As such, there would be **no residual significant operational cumulative effects.**

10.11 Summary of Significant Effects

10.11.1 The assessment has found that there will be no significant construction and operational (including cumulative) effects associated with the Proposed Development. Additional good practice measures have been proposed to further minimise construction related noise at the CNALs, and these measures will be contained within the CEMP.

Glossary/Abbreviations

Table 10.15: Glossary

Term in Full	Abbreviation	Meaning
Amplitude Modulation	AM	Amplitude Modulation
Association of Noise Consultants	ANC	Association of Noise Consultants
Above Ordnance Datum	AOD	Above Ordnance Datum
British Standard	BS	British Standard
Construction Noise Sensitive Location	CNAL	Construction Noise Sensitive Location
Decibel	dB	Decibel
Energy Consents Unit	ECU	Energy Consents Unit
Environmental Health Officer	EHO	Environmental Health Officer
Environmental Impact Assessment	EIA	Environmental Impact Assessment
Environmental Impact Assessment Report	EIAR	Environmental Impact Assessment Report
Financial Involvement	FI	Financial Involvement
Fixed Minimum Limit	FML	Fixed Minimum Limit
Good Practice Guidance	GPG	Good Practice Guidance
Gigawatts	GW	Gigawatts
hectare	ha	hectare
Institute of Acoustics	IOA	Institute of Acoustics
Low Frequency Noise	LFN	Low Frequency Noise
metre	m	metre
Megawatt	MW	Megawatt
Noise Assessment Location	NAL	Noise Assessment Location
Noise Monitoring Location	NML	Noise Monitoring Location
Noise Sensitive Receptor	NSR	Noise Sensitive Receptor
Noise Working Group	NWG	Noise Working Group
Planning Advice Note	PAN	Planning Advice Note
Site Specific Noise Limit	SSNL	Site Specific Noise Limit
Total ETSU-R-97 Noise Limit	TNL	Total ETSU-R-97 Noise Limit
World Health Organisation	WHO	World Health Organisation
The Applicant		Ørsted

Term in Full	Abbreviation	Meaning
Amplitude Modulation		A variation in noise level over time; for example, observers may describe a 'whoosh whoosh' sound, which can be heard close to a wind turbine as the blades sweep past.
Background Noise		The noise level rarely fallen below in any given location over any given time period, often classed according to daytime and night time periods. The LA90 indices (see below) is often used to represent the background noise level.
Daytime Hours		07:00 to 23:00 every day
Decibel		The ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. A logarithmic scale is used in noise level measurements because of this wide range. The scale used is the decibel (dB) scale which extends from 0 to 140 decibels (dB) corresponding to the intensity of the sound level.
Directivity		The property of a sound source that causes more sound to be radiated in one direction than another.
EIA Regulations		The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.
Environmental Impact Assessment		Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to of the likely significant environmental effects arising from a proposed development.
Environmental Impact Assessment Report		A document describing the environmental effects of the Proposed Development and produced in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation.
Ground Effects		The modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver. Described using the term 'G', and ranges between 0 (hard), 0.5 (mixed) and 1 (soft).
Lw		Is the sound power level. It is a measure of the total noise energy radiated by a source of noise and is used to calculate noise levels at a distant location. The LWA is the A-weighted sound power level.
Leq		Is the equivalent continuous sound level and is the sound level of a steady sound with the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient noise encompassing all noise at a given time. The LAeq,T is the A-weighted equivalent continuous sound level over a given time period (T).
L90		Index represents the noise level exceeded for 90 percent of the measurement period and is used to indicate quieter times during the measurement period. It is often used to measure the background noise level. The LA90,10min is the A-weighted background noise level over a ten-minute measurement sample
Night time Hours		ETSU-R-97 defines the night time hours as 23.00 to 07.00 every day.
Noise emission		The noise energy emitted by a source (e.g. a wind turbine).

Term in Full	Abbreviation	Meaning
Noise immission		The sound pressure level received at a given location (e.g. the nearest dwelling).
Proposed Development		The proposed Revised Larbrax Wind Farm as described in Chapter 4 of this EIAR.
Proposed Development Site		The project development area within the Site boundary as shown in Figures 10.1 and 10.2
Quiet Daytime Hours		ETSU-R-97 defines the quiet daytime hours as 18.00 to 23.00 Monday to Friday, 13.00 to 23.00 on Saturdays and 07.00 to 23.00 on Sundays.
Standardised Wind Speed		A wind speed measured at a height different than 10 m (generally measured at the turbine hub height) which is expressed to a reference height of 10 m using a roughness length of 0.05 for standardisation purpose (in accordance with the IEC 61400-11 standard).
Wind Shear		The change in the relationship between wind speed at different heights.