Chapter 9 Noise

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9 Noise

9.1 Executive Summary

9.1.1 This chapter considers potential noise effects associated with the construction, operation and decommissioning of the Proposed Development and the 2011 Permitted Development (refer to **Chapter 1 and 4**).

9.1.2 Planning permission is sought for the construction, operation and decommissioning of the Proposed Development.

9.1.3 The assessment of noise impacts comprised the following:

- Consultation with Shetland Islands Council (SIC) Environmental Health Department;
- Characterisation of the baseline noise environment;
- Assessment of noise effects due to construction activities, construction traffic, operation of wind turbines and operation of other non-turbine fixed plant; and
- Evaluation of predicted levels against derived criteria.

9.1.4 Noise effects from construction, including on-site activities and construction traffic, were found to be not significant. Noise effects from fixed non-turbine plant have been determined to be not significant.

9.1.5 No potential vibration effects have been identified and consideration of vibration has therefore been scoped out.

9.1.6 Predicted wind turbine noise levels associated with operation of the Proposed Development meet derived noise limits at all identified representative Noise Sensitive Receptors (NSRs) without the requirement for mitigation. Noise effects due to operation of wind turbines have therefore been determined to be not significant.

9.2 Introduction

9.2.1 This chapter considers the potential noise effects of the Proposed Development and the 2011 Permitted Development on receptors sensitive to noise during the construction, operational and decommissioning phases.

9.2.2 This chapter has assessed the Proposed Development and the 2011 Permitted Development as defined in **Chapter 4** of this EIA Report.

9.2.3 Planning permission was granted in 2012 (planning reference 2011/224/PPF) for the construction and operation of three wind turbines at Luggie's Knowe. One of these turbines was constructed and has been operational since 2015. However, the remaining two permitted turbines and associated infrastructure have not been constructed due to engineering reasons. The Proposed Development will replace the two unbuilt, previously permitted turbines with one turbine with a total installed capacity up to 5 MW.

9.2.4 The Proposed Development also includes for a 14.9 MW Battery Energy Storage Site (BESS).

9.2.5 This assessment has been prepared by Gregor Massie BEng (Hons), MSc, AMIOA of ITPEnergised with oversight from Simon Waddell BSc (Hons) MIOA.

Scope of Assessment

9.2.6 The scope of this assessment has comprised the following:

- scoping consultation with SIC Environmental Health Department;

- evaluation of noise effects associated with construction of the Proposed Development;
- evaluation of noise effects associated with operation of the Proposed Development;
- specification of appropriate mitigation, where necessary; and
- evaluation of residual effects.

9.2.7 Given the separation distances involved (>800 m), vibration associated with construction and operation of the Proposed Development at the closest sensitive receptors will be negligible, therefore vibration has been scoped out of further assessment.

9.2.8 Traffic flows associated with the operational phase of the Proposed Development will be negligible (on average <1 vehicle movement per day), therefore operational road traffic noise has been scoped out of further assessment. This chapter considers the potential noise effects of the Proposed Development on receptors sensitive to noise during the construction phase and the operational phase.

9.2.9 This chapter is supported by the following figures and technical appendices:

- **Figure 9.1** – NSRs and 35 Decibel (dB) Contour
- **Figure 9.2** – Cumulative Study Area
- **Appendix 9.1** – Records of Correspondence
- **Appendix 9.2** – Turbine Source Noise Terms
- **Appendix 9.3** – Predicted Noise Levels

Glossary of Noise Terms

9.2.10 This chapter uses the following terms throughout:

A Weighting - A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise;

Broadband - A single value representing the overall level from all of the frequencies contained within the sound.

dB(A) - Decibels A weighted;

$L_{Aeq,t}$ - Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB with 'A' weighting and commonly referred to as the 'ambient' level;

L_{A10} - The noise level exceeded for 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis;

L_{A90} - The noise level exceeded for 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis and commonly referred to as the 'background' level;

SPL - Sound Pressure Level; and

SWL - Sound Power Level.

9.3 Legislation, Policy and Guidelines

Legislation

9.3.1 For a development of this nature, there is no specific all-encompassing legislation relating to noise. Noise legislation, where it does exist, tends to be either EU-derived and focussed on specific items of noise-emitting plant or on more general nuisance, such as that addressed by the provisions of the Environmental Protection Act 1990 (UK Government, 1990 and Control of Pollution Act 1974 (UK Government, 1974).

Environmental Protection Act 1990

9.3.2 Section 79 of the Act defines statutory nuisance with regard to noise and determines that local planning authorities have a duty to detect such nuisances in their area.

9.3.3 The Act also defines the concept of "Best Practicable Means" (BPM):

- 'practicable' means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;
- the means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures;
- the test is to apply only so far as compatible with any duty imposed by law; and
- the test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances.

9.3.4 Section 80 of the Act provides local planning authorities with powers to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence.

Control of Pollution Act 1974

9.3.5 Section 60 of the Act provides powers to Local Authority Officers to serve an abatement notice in respect of noise nuisance from construction works.

9.3.6 Section 61 provides a method by which a contractor can apply for 'prior consent' for construction activities before commencement of works. The 'prior consent' is agreed between the Local Authority and the contractor and may contain a range of agreed working conditions, noise limits and control measures designed to minimise or prevent the occurrence of noise nuisance from construction activities. Application for a 'prior consent' is a commonly used control measure in respect of potential noise impacts from major construction works.

9.3.7 In lieu of any specific legislation, assessing the effect of such a development during the construction, operational and decommissioning phases must draw on information from a variety of sources. Therefore, this assessment makes reference to a number of British Standards, official planning policy and advice notes and national guidance.

Planning Policy

Scottish Government Online Planning Advice: Planning Advice Note 1/2011 and Technical Advice Note

9.3.8 Published in March 2011 and last updated in 2014, Planning Advice Note 1/2011 (Scottish Government (2014b)) (PAN 1/2011) provides advice on the role of the planning system in helping to prevent and limit adverse effects of noise. Information and advice on noise assessment methods are provided in the accompanying Technical Advice Note: Assessment of Noise (Scottish Government (2011b)) (TAN). Included within the PAN document and the accompanying TAN are details of the legislation, technical standards and codes of practice for specific noise issues.

9.3.9 With regard to noise from wind turbines, paragraph 29 of PAN 1/2011 states the following:

"There are two sources of noise from wind turbines – the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise is related to engineering design. Aerodynamic noise varies with rotor design and wind speed and is generally greatest at low speeds. Good acoustical design and siting of turbines is essential to minimise the potential to generate noise. Web based planning advice on renewable technologies for onshore wind turbines provides advice on 'The Assessment and Rating of Noise from Wind Farms' (ETSU R 97) published by the former Department of Trade and Industry (DTI) and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise."

9.3.10 With regard to appropriate assessment methods, the 'web-based planning advice' referred to in PAN 1/2011 is contained in an online document entitled 'Onshore wind turbines', published by the Scottish Government (updated 2014). The document is summarised in the corresponding section below, and also refers to the use of ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (The Working Group on Noise from Wind Turbines, 1996) assessment guidance (discussed in **paragraphs 9.3.16 to 9.3.28).**

9.3.11 The Institute of Acoustics (IoA) has since published 'a Good Practice Guide to the application of ETSU-R-97 for the assessment rating of turbine noise' (IoA, 2013). The Scottish Government accepts that the guide represents current industry good practice.

9.3.12 With regards to the assessment and control of noise from construction sites the use of the British Standard (BS) 5228: 2009 (Part 1) is discussed. BS 5228 has been superseded by BS 5228 1:2009+A1:2014: 'Code of practice for noise and vibration control on construction and open sites, Noise' (British Standards Institute (BSi.), 2009/2014). The standard is summarised in paragraphs 9.3.44 to 9.3.50. Of relevance to the assessment of development generated road traffic noise, it is stated that a change of 3 dB(A) is the minimum perceptible under normal conditions, and that a change of 10 dB(A) corresponds roughly to a halving or doubling of the perceived loudness of a sound.

9.3.13 Neither PAN 1/2011 nor the associated TAN provide specific guidance on the assessment of noise from fixed plant, but the TAN includes an example assessment scenario for 'New noisy development (incl. commercial and recreation) affecting a noise sensitive building', which is based on BS 4142:1997: Method for rating industrial noise affecting mixed residential and industrial areas. This BS has been superseded by BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (BSi, 2019). The standard is summarised in **paragraphs 9.3.34 to 9.3.40**.

9.3.14 In summary, national planning policy on the assessment of operational noise impacts from wind farms stipulates the use of the ETSU-R-97 assessment method and application of the IoA Good Practice Guide (IoA GPG), whilst construction noise should be assessed with reference to BS 5228 1:2009+A1:2014. These guidance documents, and others relevant to the assessment of possible noise impacts generated by the Proposed Development, are summarised below.

Guidance

9.3.15 Cognisance has been taken of the following best practice guidelines and guidance.

ETSU-R-97: The Assessment and Rating of Noise from Windfarms (ETSU)

9.3.16 As referenced for use in PAN/2011 this document was written by a Noise Working Group including developers, noise consultants and environmental health officers, set up in 1995 by the Department of Trade and Industry through Energy Technology Support Unit (ETSU).

9.3.17 ETSU presents a consensus view of the Working Group and was prepared to present a common approach to the assessment of noise from wind turbines. The document states that noise from wind turbines or wind farms should be assessed against site specific noise limits.

9.3.18 Noise limits are typically derived based on a series of acceptable fixed minimum limits and based on an allowable exceedance above the prevailing background noise level, including consideration of a variety of different prevailing wind speed conditions. Alternatively, a simplified approach may be followed when predicted levels fall below 35 dB. In this case simplified ETSU fixed noise limits of 35 dB (daytime &night-time) can be applied across the full range of operational wind speeds. The noise limits should be derived for external areas used for relaxation, or areas where a quiet noise environment is highly desirable. Separate limits are required for night-time and daytime periods. Night-time limits are derived drawing upon measured night-time background noise levels, whilst daytime limits are derived drawing upon the background noise levels arising during 'quiet daytime' periods.

9.3.19 Night-time is defined as the period between 23:00 and 07:00 hours, whilst quiet daytime periods are defined as:

- 18:00 to 23:00 hours on all days;
- 13:00 to 18:00 hours on Saturdays and Sundays; and
- 07:00 to 13:00 hours on Sundays.

9.3.20 For daytime, the suggested limits are 5 dB above the prevailing background noise level determined during quiet daytime periods, or 35 to 40 dB(A), whichever is the higher. The absolute criterion between the 35 to 40 dB(A) range is selected taking account of:

- the site environs (e.g. number of local receptors);
- the energy generation capacity (e.g. number of kWh that can be generated) of the proposed development; and
- the associated duration and level of exposure.

9.3.21 During night-time, the suggested limits are 5 dB above the prevailing night-time background noise level or 43 dB(A), whichever is the higher. The absolute criterion for the night-time is higher than that for the daytime, as the derivation of this limit is based on preventing sleep disturbance within a building whereas for the daytime, limits are based on occupation of external spaces used for relaxation.

9.3.22 It is required that the prevailing background noise levels be determined in terms of the $L_{A90,10min}$ noise index for both quiet daytime and night-time periods, for wind conditions ranging from 2 metres per second (m/s) to 12 m/s.

9.3.23 The noise limits are calculated by undertaking a regression analysis of the $L_{A90,10min}$ noise levels and the prevailing average wind speed for the same 10 minute period, when measured or determined at 10 m above ground at the location of the proposed turbines. The allowable limit is then defined at +5 dB above the average noise level at each wind speed (as defined by the regression analysis), or the absolute noise level lower limit, whichever is the higher (assuming no financial involvement within the scheme).

9.3.24 Where a property has a financial involvement in the scheme, the document allows a relaxation of the derived noise limits, stating that *"It is widely accepted that the level of disturbance or annoyance caused by a noise source is not only dependent upon the level and character of noise but also the receiver's attitude towards the noise source in general. If the residents at the noise-sensitive properties were financially involved in the project, then higher noise limits will be appropriate'. The guidance goes on to state that it is 'recommended that both the day and night-time lower fixed limits can be increased to 45 dB(A) and the consideration should be given to increasing the permissible margin above background where the occupier of the property has some financial involvement in the windfarm".* The amount by which the permissible margin above background can be relaxed is not specified, but the allowable relaxation to 45 dB(A) of the lower limits is an increase of (at least) 5 dB during the daytime and 2 dB during the night-time, so similar levels of relaxation might also be applied to the background related element of the noise level limits.

9.3.25 The ETSU guidance states that the derived limits should be applied to noise from the proposed wind farm or turbines in terms of the $L_{A90,T}$ index, and that the $L_{A90,T}$ of the wind farm noise is typically 1.5 to 2.5 dB less than the $L_{Aeq,T}$ measured over the same period.

9.3.26 The derived noise limits are applicable to both the aerodynamic (e.g. 'blade swish') and mechanical (e.g. generator related) components of wind farm noise.

9.3.27 Where noise from the wind farm is tonal, a correction of between 2 and 5 dB is to be applied to the wind farm noise. Guidance is provided on how to determine the level of correction required, but typically, for proposed developments, the need for any applicable correction is confirmed by the independent wind turbine-specific noise tests, following standard test procedures, provided by manufacturers.

9.3.28 It is stated within this document that *"The Noise Working Group is of the opinion that absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question. It is clearly unreasonable to suggest that, because a wind farm was constructed in the vicinity in the past which resulted in increased noise levels at some properties, that residents of those properties are now able to tolerate still higher noise levels. The existing wind farm should not be considered as part of the prevailing background noise"*. Accordingly, where an existing wind farm contributes to the prevailing background noise levels, it is necessary to either include for the contribution of this wind farm when comparing against the allowable noise limit or correct for this contribution when deriving a limit applicable to the proposed development acting alone.

Good Practice Guide to the Application of ETSU-R-97 (IoA GPG)

9.3.29 The IoA GPG presents the report of a noise working group assembled in response to a request from the former Department of Energy & Climate Change (DECC). The guide is intended to represent current good practice in applying the ETSU-R-97 method to assessing the noise impact of wind turbine developments with a power rating of over 50 kW.

9.3.30 In addition to detailed consideration of various issues and factors concerned with current 'state of the art' knowledge of UK wind turbine noise assessment, a series of 'summary boxes' (SBs) highlighting key guidance points are included.

9.3.31 The SBs provide clarification and updated guidance on a range of matters relating to ETSU R-97 noise assessments, including consultation with relevant stakeholders, background noise survey methodology, noise survey data analysis, derivation of noise limits, noise prediction model input data, algorithms and parameters, cumulative impact assessment procedures, assessment reporting, planning conditions and amplitude modulation. A set of supplementary guidance notes (SGNs) also form part of the publication and include further specific detail for different technical areas.

9.3.32 The detail of the IoA GPG has been considered in the preparation of this assessment. Some of the key considerations relevant to this assessment are summarised as follows:

- Calculations of predicted wind turbine noise may be carried out using ISO 9613-2: Acoustics – Attenuation of Sound during Propagation Outdoors (International Organization for Standardization, 1996); preferred receptor heights, meteorological and ground absorption input parameters for this calculation procedure are given.
- Turbine sound power level source data should include appropriate uncertainty corrections. Guidance is given for determining when such uncertainty corrections have been inherently included in turbine source emission data.
- A correction for topographic screening of a maximum -2 dB may be applied where there is no line of sight between the turbine (tip) and the receptor (4 m above ground level).
- A correction for constructive reflection within valleys of +3 dB should apply where concave topography is determined to lie between the turbine and the receptor point.
- 'Excess amplitude modulation' (i.e., where the wind turbine noise has higher variability with momentary time than the 2 – 3 dB(A) considered within ETSU-R-97) is still the subject of research; current practice (at the time of publishing of the IoA GPG) in relation to determining applications for wind turbine developments is to not impose a planning condition specific to this phenomenon.

9.3.33 In addition to the above, the IoA GPG confirms that the ETSU-R-97 noise level limits should be applied cumulatively and provides guidance on appropriate assessment methods for a variety of different cumulative scenarios. These scenarios include 'concurrent applications', 'existing wind farm permitted with less than total ETSU-R-97 limits', 'existing wind farms permitted to the total ETSU-R-97 limits currently operating', and 'permitted wind farms permitted to total ETSU-R-97 limits but not yet constructed'.

BS 4142:2014+A1:2019 – Methods for Rating and Assessing Industrial and Commercial Sound (BS4142)

9.3.34 BS 4142 is applicable for use in the assessment of control building / substation and transformer noise. It sets out a method for rating and assessing sound of an industrial and/or commercial nature, including 'sound from fixed installations which comprise mechanical and electrical plant and equipment'.

9.3.35 The assessment procedure contained within BS 4142 requires that initially the 'rating level' ($L_{Ar,Tr}$) that is (or would be) generated by the source under assessment is determined, externally, at the assessment location. Where this source does not include any acoustic features, such as tonality, impulsivity or intermittency etc., then the rating level ($L_{Ar,Tr}$) equals the specific sound level (L_s), which is the sound pressure level produced by the source using the $L_{Aeq,T}$ noise index. Where the source under assessment does include acoustic characteristics, then a series of corrections are added to the specific sound level to determine the rating level. The degree of correction applied to determine the rating level depends upon the results of either subjective or objective appraisals.

9.3.36 The background sound level at the assessment location, measured using the $L_{A90,T}$ index, is then subtracted from the rating level. The result provides an indication of the magnitude of impact, where the greater the difference, the greater the magnitude of impact.

9.3.37 The following guidance is presented with regard to the difference between the rating and background levels:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

9.3.38 It can be seen from the above that the degree of impact is also dependent upon the context in which the sound arises. Factors that are considered with respect to context include: the absolute level of sound, and the character and level of the residual sound (that in absence of the source under assessment) compared to the character and level of the specific sound.

9.3.39 With regard to the absolute level, it is stated, amongst other points, that "where background sound levels and rating levels are low, absolute levels might be as, or more relevant than the margin by which the rating level exceeds the background. This is especially true at night".

9.3.40 The ANC technical note refers to the 1997 version of BS 4142 which stated that rating levels below 35 dB and background noise levels below 30 dB(A) were considered to be "very low".

Design Manual for Roads and Bridges (DMRB)

9.3.41 DMRB (Highways Agency, 1989) provides standards and advice regarding the assessment, design and operation of roads in the UK. DMRB provides screening criteria, by which percentage changes in traffic flow can be related to a predicted change in road traffic noise. The guidance also provides significance criteria, by which the percentage of people adversely affected by traffic noise can be related to the total noise level due to road traffic, or the increase over an existing level.

9.3.42 A previous iteration of DMRB provides screening criteria whereby a change in noise level of 1 $dBL_{A10,18hr}$ is equivalent to a 25 % increase or 20 % decrease in traffic flow, and a change in noise level of 3 $dBL_{A10,18hr}$ is equivalent to a 100 % increase or 50 % decrease in traffic flow. Despite this text coming from a previous version of DMRB the general relationship still holds true.

9.3.43 The threshold criteria used for traffic noise assessment during the daytime is a permanent change in magnitude of 1 $dBL_{A10,18hr}$ in the short term (i. e., on opening) or a 3 $dBL_{A10,18hr}$ change in the long term (typically 15 years after project opening). For night time noise impacts, the threshold criterion of a 3 $dBL_{night,outside}$ noise change in the long term should also apply but only where an $L_{night,outside}$ greater than 55 dB is predicted in any scenario.

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

9.3.44 Part 1 of BS 5228:2009+A1:2014 sets out techniques to predict the likely noise effects from construction works, based on detailed information on the type and number of plant items being used, their location and the length of time they are in operation.

9.3.45 The noise prediction methods can be used to establish likely noise levels in terms of the $L_{Aeq,T}$ over the core working day. This standard also documents a database of information, including previously measured sound pressure level data for a variety of different construction plant undertaking various common activities.

9.3.46 Three example methods are presented for determining the significance of construction noise impacts. In summary, these methods adopt either a series of fixed noise level limits, are concerned with ambient noise level changes as a result of the construction operations or a combination of the two.

9.3.47 With respect to absolute fixed noise limits, those detailed within Advisory Leaflet 72: 1976: 'Noise control on building sites' are presented. These limits are presented according to the nature of the surrounding environment, for a 12-hour working day. The presented limits are:

- 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise; and
- 75 dB(A) in urban areas near main roads and heavy industrial areas.

9.3.48 The above noise level limits are applicable at the façade of the receptor in question (not free field).

9.3.49 The standard goes on to provide methods for determining the significance of construction noise levels by considering the change in the ambient noise level that would arise as a result of the construction operations. Two example assessment methods are presented, these are the 'ABC method' as summarised within Error! Reference source not found. and the '5 dB(A) change' method as described in **paragraph 9.3.50**.

Table 9.1 – Example threshold of potential significant effect at dwellings (construction noise) – ABC method

Assessment Category and Threshold Value Period	**Threshold Value, in Decibels (dB) ($L_{Aeq,T}$)**		
	Category (A)	**Category (B)**	**Category (C)**
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends (D)	55	*60*	*65*

Assessment Category and Threshold Value Period	Threshold Value, in Decibels (dB) ($L_{Aeq,T}$)		
	Category (A)	Category (B)	Category (C)
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3: Applied to residential receptors only

A) Category A: threshold values to use when ambient levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.

D) 19.00-23.00 weekdays, 13.00-23.00 Saturdays and 07.00-23.00 Sundays

9.3.50 With respect to the '5 dB(A) change' method, the guidance states:

"Noise levels generated by construction activities are deemed to be significant if the total noise (pre construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB L_{Aeq}, from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact."

9.4 Consultation

9.4.1 **Table 9.2** provides details of consultations undertaken with relevant regulatory bodies, together with action undertaken by the Applicant in response to consultation feedback. Records of correspondence are provided in **Appendix 9.1**.

Table 9.2 – Consultation Responses

Consultee	Consultation Response	Applicant Action
Email 27th September 2021. Consultation with SIC Environmental Health Officer (EHO).	The EHO agreed to scope out baseline survey on the basis that the simplified ETSU limits of 35 dB (daytime and night-time) would be used. The EHO stated that for cumulative assessment, an assessment of all turbines in the development	No further action

Consultee	Consultation Response	Applicant Action
	area should be undertaken to ensure there is no cumulative breach of the 35 dB limit. The EHO agreed with the proposed approach to construction noise.	

9.4.2 The 2011 Permitted Development currently operates against a flat noise limit of 35 dB L_{A90} at the nearest properties.

9.5 Assessment Methods and Significance Criteria

Consultation

9.5.1 Details of consultation with SIC are provided in **Section 9.4**. Consultation was undertaken in September & October 2021.

Study Area

9.5.2 The study area for this assessment has been informed by maps and aerial images of the Proposed Development site and its surroundings, as well as site visits undertaken during other works. A sample of the NSRs closest to the Proposed Development, and therefore potentially worst-affected, have been identified and adopted for the evaluation of noise impacts. These have been selected to represent a geographic spread across the local area. NSRs identified are either single dwellings or representative of a group or cluster of dwellings.

9.5.3 Determination of the study area for a wind farm typically requires that the 35 dBL_{A90} noise contour is predicted; NSRs which lie beyond the contour are assumed to meet the most stringent ETSU noise limit and are therefore scoped out and discounted from further consideration. NSRs which are identified within the 35 dBL_{A90} noise contour are scoped in, and noise impacts are assessed further.

9.5.4 The 35 dBL_{A90} operational noise contour for the Proposed Development in isolation (i.e. without cumulative developments) at the wind speed at which the proposed turbines generate their maximum sound power level, is shown in **Figure 9.1**. This predicted contour includes a blanket +3 dB correction for concave topography and is intended only as a screening tool.

9.5.5 **Figure 9.1** shows that the area surrounding the Proposed Development is sparsely inhabited; there are no identified properties within the 35 dB contour and 3 NSRs slightly outside the 35 dB noise contour. The representative NSRs considered in the assessment are listed in **Table 9.3**.

Table 9.3 – Representative NSRs

NSR Name	NSR ID	Grid Reference (OSGB)	
		Easting	Northing
Smokewall	NSR1	444572	1145351
South Califf	NSR2	444864	1145630
Califf	NSR3	444924	1145729
Gremista Farm	NSR4	446194	1143186

NSR Name	NSR ID	Grid Reference (OSGB)	
		Easting	Northing
Gremista Road	NSR5	446425	1143290
College	NSR6	446656	1143460
Gremista Road North	NSR7	446772	1143524
North Califf	NSR8	444910	1146180
Dwelling between North Califf & Pilibreck	NSR9	445021	1146585
Pilibreck	NSR10	445083	1146901

9.5.6 The identified NSRs are the closest properties in each direction from the Proposed Development.

Construction Phase Noise

On-site Construction Activities; Method of Prediction

9.5.7 No detailed breakdown of the construction schedule and plant for the Proposed Development is currently available. Drawing on our experience of previous wind farm developments, the following assumptions have been made in the prediction of construction noise:

Working hours

- 07.00-18.00 Monday – Friday;
- 07.00-12.00 Saturdays; and
- No working Sundays and Bank holidays.

Construction Plant

Phase 1 – Access tracks and turbine hardstanding

- 2 x Backhoe mounted rock breaker (BS 5228 Table C5, Item 1)
- 2 x tracked mobile crusher (BS 5228 Table C9, Item 14)
- 4 x road wagons (BS 5228 Table C11, Item 4)
- 1 x 35T excavator (BS 5228 Table C6, Item 7)
- 2 x 6T dump trucks (BS 5228 Table C4, Item 3)
- 1 x 12T bulldozer (BS 5228 Table C2, Item 13)
- 1 x 12T roller (BS 5228 Table C2, Item 38)

Phase 2 – Turbine bases

- 1 x 35T excavator (BS 5228 Table C6, Item 7)
- 1 x concrete pump (BS 5228 Concrete pump)
- 2 x cement trucks (BS 5228 Table C4, Item 27)

Phase 3 – Turbine installation

- 1 x 400T crane (BS 5228 Table C4, Item 38)
- 1 x road wagon (BS 5228 Table C11, Item 4)

Other assumptions

- all plant has been assumed to operate continuously (100 % utilisation) throughout the working hours;
- all plant has been placed at the closest approach of construction works to the closest NSR;
- noise levels have been predicted in accordance with the BS 5228 prediction method; and
- construction plant has been assumed to have an effective height of 2 m above local ground level.

Derivation of Construction Phase Noise Limits

9.5.8 The predicted site preparation / construction noise levels have been assessed based on noise level criteria determined following a worst-case interpretation of the guidance contained within BS 5228. As detailed within **Section 9.3**, BS 5228 details three example methods for determining the significance of potential construction noise impacts. With regard to the presented absolute noise level criteria (example method 1), following a worst-case approach, the lowest absolute noise level criterion for the daytime period (07:00 to 19:00) is 70 dB(A) façade, (equivalent to 67 dB(A) free field), which is stated to apply in rural areas.

9.5.9 Following the ABC assessment method, the most stringent assessment criterion (Category A), applies during the daytime (07:00 to 19:00 weekdays and 07:00 to 13:00 Saturdays) where the prevailing ambient noise levels are below 65 dB $L_{Aeq,T}$. Where Category A applies, the allowable noise levels arising from site construction noise is 65 dB(A). Assuming an average ambient noise level of 49 dB(A), the allowable 'construction only' noise level is 65 dB(A) $L_{Aeq,T}$.

9.5.10 With regards to the 5 dB(A) change method, the allowable construction noise level during the daytime is 65 dB(A), or higher where the resulting ambient noise level change would be less than +5 dB(A). Accordingly, the most stringent allowable 'construction only' noise level following this approach is 65 dB(A). With regard to the above, it can be seen that applying the ABC method or the 5 dB change method gives rise to the most stringent daytime construction noise level criteria of 65 dB $L_{Aeq,T}$.

9.5.11 Criteria have been derived drawing on the above and are provided in

9.5.12 **Table** 9.5 within the Impact Magnitude section below.

Operational Phase Noise

General Method of Prediction

9.5.13 A detailed noise model has been prepared for the site and surrounding area, including the identified representative NSRs. This model was prepared using the CadnaA® noise modelling software. The model was set to use the ISO 9613 prediction method, which includes prescribed methods for accounting for the effects of geometric divergence, ground absorption, and atmospheric absorption, in accordance with the requirements of ETSU-R-97 and the IoA GPG.

9.5.14 The predicted operational noise levels are downwind at all NSRs and predicted noise levels will benefit from directional effects and can therefore be considered worst-case in this regard.

9.5.15 The noise model was configured to ensure noise level predictions in compliance with the IoA GPG, including the following:

- Ground absorption: G = 0.5 and G = 0 (propagation over water);

- Uncertainty factor of +2 dB was added to the turbine noise source terms;
- Receptor Height: 4 m;
- A correction from $L_{Aeq,T}$ to L_{A90},T of -2 dB was applied;
- No acoustic screening from buildings or topography was included in the calculated noise levels (worst-case);
- Temperature: 10 °C; and
- Humidity: 70 %.

9.5.16 The requirement to apply valley corrections and topographic screening corrections was determined with reference to the IoA GPG. Valley corrections have been determined on a turbine-by-turbine basis for all identified NSRs using proprietary software within Geographic Information System (GIS) software. Where topographic screening has been determined to be applicable, no valley correction has been applied, since it is assumed that if the turbine is not visible at the NSRs, then any concavity determined to lie between the turbine and the NSR will not result in constructive acoustic reflections.

9.5.17 It has been determined that a +3 dB correction for concave topography applies at NSR1, NSR2, NSR3, NSR7, NSR8 and NSR9 for all turbines. All turbines are visible at all NSRs therefore no topographic screening corrections have been applied.

Cumulative Noise

9.5.18 Operational noise predictions include noise from the Proposed Development and the 2011 Permitted Development.

9.5.19 A review was undertaken of existing and proposed wind energy developments in the vicinity of the site, using information available on the SIC planning portal and in consultation with Environmental Health. This review has been completed to identify those developments which have the potential to give rise to a cumulative noise impact when operating simultaneously with the Proposed Development. The results of this desk-based review have been used to inform the assessment of operational turbine noise. All developments within 5km of the Proposed Development were included.

9.5.20 A cumulative noise contour which shows the areas where cumulative effects may occur is presented in **Figure 9.2**. The contour includes predicted levels from the Proposed Development, the 2011 Permitted Development and all developments within 5km of the Proposed Development.

Assessment of Potential Effect Significance

9.5.21 The impact magnitude and effect significance have been determined following the criteria described in the assessment of potential effect significance section below.

Baseline Noise Survey

9.5.22 As there are no NSRs within the 35 dB contour this assessment adopts the 'simplified ETSU' approach (**paragraph 9.3.25**) and no baseline noise survey has been undertaken.

9.5.23 The baseline noise environment has been characterised by desk study and a site visit. The noise environment is typical of a remote, rural environment in which anthropogenic noise is a minor contributor and noise from natural sources including bird calls, the wind, wind-blown vegetation and waves from the North Sea, are the primary control on baseline noise levels. Anthropogenic noise is anticipated to be limited to noise from the nearby industrial estate, road traffic and the 2011 Permitted Development.

Receptor Sensitivity

9.5.24 Appropriate significance criteria have been adopted from guidance contained within TAN to PAN 1/2011. The receptor sensitivity is the same during the construction, operational and decommissioning phases of the Proposed Development. These are presented within **Table 9.4**

Table 9.4 – Noise Receptor Sensitivity Criteria

Receptor Sensitivity	Description	Examples
High	Receptors where people or operations are particularly susceptible to noise.	Residential, quiet outdoor recreational areas, schools and hospitals.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance.	Offices and restaurants.
Low	Receptors where distraction or disturbance from noise is minimal.	Buildings not occupied, factories and working environments with existing levels of noise.

9.5.25 Only residential (high sensitivity) receptors are considered in this assessment.

Impact Magnitude – Construction Noise

9.5.26 The construction noise impact magnitude has been determined according to the threshold levels provided in

9.5.27 **Table** 9.5 derived from guidance contained within BS 5228:2009+A1:2014.

Table 9.5 – Evaluation criteria for noise from construction activities (predicted façade level), weekday daytimes (08:00 – 18:00) and Saturdays 08:00 – 12:30

Difference (d) between predicted construction noise level and applicable limit, dB	Impact magnitude
d ≥+5	High
0 ≤ d < +5	Medium
-10 ≤ d < 0	Low
<-10	Negligible

Impact Magnitude – Construction Traffic Noise

9.5.28 DMRB states that *"In the period following a change in traffic flow, people may find benefits or disadvantages when the noise changes are as small as 1 dB(A) – equivalent to an increase in traffic flow of 25% or a decrease in flow of 20%. These effects last for a number of years"*, whilst PAN1/2011

advises that a change of 3 dB(A) is the minimum perceptible under normal conditions. Criteria for the evaluation of road traffic noise effects based on these changes are provided in **Table 9.6.**

Table 9.6 – Impact Magnitude Scale – Noise from Construction Traffic

Increase (i) over existing road traffic noise level due to construction traffic flows, dB	Impact magnitude
i ≥+5	High
3 ≤ i < +5	Medium
1 ≤ i < +3	Low
0 ≤ i < +1	Negligible

Impact Magnitude – Operational Wind Turbine Noise

9.5.29 The impact magnitude scale for operational noise has been derived according to the margin of compliance (or exceedance) of the ETSU-R-97 noise limits and is provided in **Table 9.7**.

Table 9.7 – Impact Magnitude Scale – Wind Turbine Noise

Difference (d) between predicted turbine noise level and applicable noise limit, dB	Impact magnitude
d ≥+5	High
0 ≤ d < +5	Medium
-10 ≤ d < 0	Low
<-10	Negligible

Impact Magnitude - Fixed (Non-turbine) Plant Noise

9.5.30 For noise from any fixed (non-turbine) plant such as the substation, it is appropriate to determine significance criteria based on the guidance contained within BS 4142, i.e., by consideration of the difference between the rating level from the plant noise and the prevailing background sound level, but also with respect to context and the resulting sound levels in absolute terms.

9.5.31 The impact magnitudes associated with noise generated from fixed plant are presented in **Table 9.8**.

Table 9.8 – Impact Magnitude Scale – Fixed (Non-turbine Plant Noise)

Difference between Rating Level ($L_{Ar,Tr}$) and Background Sound Level (L_{A90})	BS4142 Guidance	Impact Magnitude
≥+10	Indication of significant adverse impact	High

Difference between Rating Level ($L_{Ar,Tr}$) and Background Sound Level (L_{A90})	BS4142 Guidance	Impact Magnitude
+5	Indication of adverse impact	Medium
0	Indication of low Impact	Low
-10	-	Negligible
Where the rating level ($L_{Ar.Tr}$) is below 35 dB the impact magnitude is classified as 'Negligible' regardless of the relationship to the background noise level. *+ indicates rating level above background noise level* *- indicates rating level below background noise level*		

Effect Significance

9.5.32 The effect significance has been determined by consideration to both the receptor sensitivity and the impact magnitude according to the matrix detailed in **Table 9.9** which is derived from that presented in **Chapter 2, Table 2.1** of the EIA Report.

Table 9.9 – Effect Significance Matrix

Impact Magnitude	Receptor Sensitivity		
	High	**Medium**	**Low**
High	Major	Moderate	Minor
Medium	Moderate	Minor	Negligible
Low	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible

9.5.33 This assessment considers that effects with a significance of '**moderate**' and '**major**' are significant and effects with a significance of '**negligible**' and '**minor**' are not significant.

Requirements for Mitigation

9.5.34 Consideration has been given to available mitigation measures to reduce adverse effects. Where mitigation measures are detailed, these are committed to by the Applicant and have been determined through professional judgement and the implementation of best practice.

Assessment of Residual Effect Significance

9.5.35 Residual effects have been assessed following the methodologies described above but taking into account the committed mitigation measures.

Limitations to Assessment

9.5.36 Detailed information on techniques and equipment for the construction phase of the Proposed Development is not currently available. Consequently, appropriate and robust assumptions have been made regarding the nature of likely construction activities and plant, and noise predictions made accordingly. It is therefore anticipated that predicted noise levels represent the "worst case" potential construction noise levels.

9.5.37 The assessment of operational impacts associated with the proposed wind turbine has been undertaken adopting source noise levels for the candidate turbine model, which is the Vestas V136 4MW with a hub height of approximately 82 m. The existing operational turbine is an Enercon E82 and source noise levels for this turbine have also been adopted for the assessment of operational impacts. Following completion of the tendering process, it is possible that the precise turbine make / model adopted and / or the operational mode will change from that adopted within the assessment. It should be noted, however, that the final turbine model chosen will be selected to ensure compliance with the derived noise level limits.

9.6 Baseline Conditions

Description of Baseline Noise Environment

9.6.1 The baseline noise environment was dominated by the wind and wave noise from the North Sea. Noise from the nearby industrial estate was occasionally audible. Bird calls were also audible. In a rural environment such as this, background levels are assumed to be relatively low and are likely to be below 35 dB during the night time period.

Adopted Noise Limits

Construction and Decommissioning Noise Limits

9.6.2 As the baseline noise environment is rural, with a distinctive lack of anthropogenic noise, it is reasonable to assume that the baseline ambient level is below 65 dB during the daytime period. The construction phase noise limit for weekday daytimes and Saturdays, in accordance with the ABC method provided in BS 5228, is therefore Category A; 65 dB $L_{Aeq,T.,}$

Operational Noise Limits – Fixed Non-Turbine Plant

9.6.3 Operational noise limits for fixed non-turbine plant, such as the proposed BESS facility, transformers and substations, have been derived in accordance with BS 4142. The ANC technical note on BS 4142 states that in a previous version of BS 4142 background sounds levels of less than 30 dB and rating levels less than 35 dB are considered 'very low'. The technical note suggests that similar values would not be unreasonable in the context of the more recent version of the standard. It is therefore proposed to set a conservative target rating level of 35 dB for the night-time period.

9.6.4 This assessment adopts the rating level noise limit of 35 dB at any identified NSR, considered to be a very low rating level. The BESS facility will be located 150 metres to the north of the existing turbine. Other fixed non-turbine plant will be located in the existing compound which is currently situated on the hardstanding of the existing turbine. The closest receptor to the fixed-non turbine plant is 1.4 km away, at this distance noise from any fixed non-turbine plant is expected to be inaudible.

Operational Noise Limits – Wind Turbine Noise

9.6.5 The assessment adopts the noise limits for wind turbine noise in the ETSU-R-97 guidance for wind energy developments. The guidance states that *'where it can be demonstrated that the predicted levels of wind turbine noise would not exceed 35 dB L_{A90} at a property, then no background noise survey is required. A simplified operational noise condition will be sufficient to protect those properties where turbine noise is predicted not to exceed 35 dB L_{A90}.'*

9.6.6 The operational noise limits in this assessment do not vary with wind speed or background noise levels and are 'flat', in accordance with the simplified ETSU method. This approach has been agreed with SIC Environmental Health. The noise limits for all NSRs are as follows:

- Daytime fixed minimum limit – 35 dB; and
- Night-time fixed minimum limit – 35 dB

9.7 Standard Mitigation

Construction Phase

9.7.1 The following good practice measures will be implemented during construction to limit unnecessary noise:

- avoid unnecessary revving of engines and switching off plant when not required (i.e. no idling);
- haul routes to be kept well maintained, with no steep gradients;
- minimising the drop height of materials during delivery to, and movement around, site;
- starting up plant and vehicles sequentially, rather than all together;
- specification of plant with white-noise or directional reversing alarms, rather than beeper type alarms;
- where possible, selection of quiet / noise reduced plant;
- vehicles accessing the site will have regard to the normal operating hours of the site and the location of nearby NSRs. Transport of bulk components may take place outside of these specified hours. Advance warning of any works out-with the normal working hours will be provided to SIC Environmental Health Officer (EHO) and local residents; and
- use and siting of equipment will be considered such that noise is minimised. For example, any generators or powered cabins within the construction compound will be sited such that noise from the generator exhaust is directed away from the closest NSRs, and cabins and other infrastructure are used to screen noise from such plant wherever possible.

Operational Phase

Fixed (Non-Turbine) Plant Noise

9.7.2 Noise from non-turbine operational plant will comprise noise from the proposed BESS facility and existing substation compound, which currently supplies the 2011 Permitted Development. The items of plant and sound power levels are unknown; however, this assessment assumes that installed plant meets appropriate non-turbine noise limits.

9.7.3 We note that a sound power level (SWL) of 94 dB(A) for batteries and inverters would enable a noise limit derived in accordance with BS4142 to be met. This sound power level is considered a worst case scenario; it is considered highly unlikely that SWLs of batteries and inverters would exceed 94 dB(A).

9.8 Receptors Brought Forward for Assessment

9.8.1 The NSRs considered in this assessment are provided in **Table 9.3** and shown in **Figure 9.1**.

9.9 Potential Effects

Construction Phase

Construction Traffic

9.9.1 Construction traffic noise will be of short duration and can be limited by implementation of appropriate controls during the construction phase. Construction traffic noise is therefore expected to be of limited significance and has therefore been scoped out of further assessment.

On-site Construction

9.9.2 Predicted levels for the three modelled construction scenarios are provided and evaluated in **Table 9.10**. The predicted levels are considered to represent a 'worst-case' scenario and actual levels are expected to be lower.

Table 9.10 – Evaluation of worst-case construction phase noise levels at closest NSRs

Scenario (Closest NSR)	Predicted Level, $dBL_{Aeq,T}$	Comparison with noise limit (predicted level minus noise limit), dB
Construction of access tracks (NSR3)	44.2	-20.8
Construction of turbine base (NSR6)	39.7	-25.3
Installation of turbine (NSR6)	40.3	-24.7

9.9.3 At the identified NSRs, predicted worst-case noise levels due to construction activities meet the derived noise limits by a margin of 20.8 dB or more. With reference to **Table 9.7** the impact magnitude is negligible, therefore with reference to **Table 9.9** the effect significance is **negligible** and is therefore not significant.

Operational Phase

Fixed (Non-Turbine) Plant Noise

9.9.4 The Proposed Development will be supplied by the existing substation compound supplying the 2011 Permitted Development. The compound will generate noise, which may potentially be tonal in nature. A 14.9 MW BESS facility is proposed 150 m north of the existing turbine. No details are currently available on the source noise levels of plant from the compound or the BESS facility, and it is therefore considered appropriate that suitable noise control limits be set to which any such ancillary plant items will be required to conform. The noise limits apply to the rating level, which includes any corrections for acoustic characteristics, such as tonality and intermittency, in accordance with the BS 4142 method.

9.9.5 This assessment adopts the rating level noise limit of 35 dB at any identified NSR. Provided that the noise limit is met by all non-turbine plant, including the BESS facility and substation, with reference to Error! Reference source not found. the impact magnitude will be low. At high sensitivity NSRs, the resultant effect significance will be minor and therefore not significant.

Wind Turbine Noise

9.9.6 Predicted noise levels due to operation of the Proposed Development and the 2011 Permitted Development are provided in **Table 9.11** across the range 4 m/s – 12 m/s.

Table 9.11 – Predicted Wind Turbine Noise Levels due to Proposed Development and the 2011 Permitted Development

NSR ID	Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
	Predicted noise level, dBL_{A90}								
NSR1	23.1	26.3	29.9	31.1	31.6	31.6	31.6	31.6	31.6
NSR2	25.2	28.3	31.9	33.2	33.7	33.7	33.7	33.7	33.7
NSR3	25.7	28.7	32.4	33.6	34.2	34.1	34.2	34.2	34.2
NSR4	17.0	20.7	24.3	25.3	25.7	25.7	25.7	25.7	25.7
NSR5	17.6	21.3	24.9	25.9	26.3	26.3	26.3	26.3	26.3
NSR6	18.5	22.2	25.8	26.8	27.2	27.2	27.2	27.2	27.2
NSR7	18.7	22.5	26.0	27.1	27.4	27.4	27.4	27.4	27.4
NSR8	24.4	27.3	31.0	32.3	32.9	32.9	32.9	32.9	32.9
NSR9	23.7	26.4	30.1	31.5	32.1	32.1	32.1	32.1	32.1
NSR10	22.6	25.3	29.0	30.4	31.0	31.0	31.0	31.0	31.0

Assessment of Wind Turbine Noise

9.9.7 The predicted noise levels due to the Proposed Development and the 2011 Permitted Development are evaluated against the applicable noise limits in **Table 9.12**. The predicted levels are evaluated against the noise limits graphically in **Appendix 9.3**, Chart 1.

Table 9.12 – Evaluation of Compliance with Noise Limit at NSRs – Proposed Development and the 2011 Permitted Development

NSR ID	Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
	Comparison with noise limit (predicted level minus noise limit), dB								
Daytime / Night-time period – Simplified ETSU Noise Limit (35 dB)									
NSR1	-11.9	-8.7	-5.1	-3.9	-3.4	-3.4	-3.4	-3.4	-3.4
NSR2	-9.8	-6.7	-3.1	-1.8	-1.3	-1.3	-1.3	-1.3	-1.3

NSR ID	Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
	Comparison with noise limit (predicted level minus noise limit), dB								
NSR3	-9.3	-6.3	-2.6	-1.4	-0.8	-0.9	-0.8	-0.8	-0.8
NSR4	-18.0	-14.3	-10.7	-9.7	-9.3	-9.3	-9.3	-9.3	-9.3
NSR5	-17.4	-13.7	-10.1	-9.1	-8.7	-8.7	-8.7	-8.7	-8.7
NSR6	-16.5	-12.8	-9.2	-8.2	-7.8	-7.8	-7.8	-7.8	-7.8
NSR7	-16.3	-12.5	-9.0	-7.9	-7.6	-7.6	-7.6	-7.6	-7.6
NSR8	-10.6	-7.7	-4.0	-2.7	-2.1	-2.1	-2.1	-2.1	-2.1
NSR9	-11.3	-8.6	-4.9	-3.5	-2.9	-2.9	-2.9	-2.9	-2.9
NSR10	-12.4	-9.7	-6.0	-4.6	-4.0	-4.0	-4.0	-4.0	-4.0

9.9.8 Predicted noise levels meet the derived noise limits at all NSRs, for all wind speeds, both during the daytime and the night time period. The lowest levels of compliance occur from 8 m/s to 12m/s. The broad-band sound power level of the candidate turbine and the existing turbine are the same from 8 m/s to 12 m/s.

9.9.9 A comparison showing the increase in predicted levels due to the Proposed Development against predicted levels from the 2011 Permitted Development is shown in **Appendix 9.3**.

Summary of Significance

9.9.10 At all NSRs predicted noise levels meet the derived noise limits at all wind speeds, both during the daytime and the night-time period by a margin of at least 0.8 dB. With reference to **Table 9.7** the impact magnitude ranges from negligible to low, therefore with reference to **Table 9.9** the effect significance is **negligible** to **minor** and is therefore not significant.

Decommissioning

9.9.11 The Applicant will either apply to re-power or decommission the Proposed Development after the operational lifespan of 25 years has ceased. It is anticipated that the mitigation required and the significance of the residual effects of decommissioning the Proposed Development will be similar to, or less than, those identified within this chapter for the construction phase.

9.10 Additional Mitigation

9.10.1 No significant effects have been identified; therefore, no specific additional mitigation is required.

9.10.2 Final turbine selection will be undertaken with a view to achieving compliance. This assessment has been undertaken using the Vestas V136 candidate turbine (see **Appendix 9.2**). Should an alternative turbine be procured, it will be selected on the basis that compliance with the adopted noise limits is maintained. A warranty covering the noise emissions of the selected turbine will be obtained from the turbine supplier/manufacturer.

9.10.3 Following first operation of the Proposed Development, should any exceedances of noise limits attributable to the Proposed Development be identified, the Applicant will put in place an operational noise management plan, such that noise limits are met.

9.11 Residual Effects

Construction Phase

No requirement for specific additional mitigation (beyond good practice measures) has been determined for the construction phase, therefore no additional mitigation is proposed, and residual effects remain unchanged, and are therefore not significant.

Operational Phase

Fixed Non-Turbine Plant

9.11.1 No additional mitigation is required for fixed non-turbine plant, therefore residual effects remain unchanged, and are therefore not significant.

Noise from Wind Turbines

9.11.2 Following selection and procurement of the final turbine it is expected that operational wind turbine noise levels will meet the derived noise limits at all NSRs across the full range of wind speeds, both during the daytime and the night-time periods. With reference to **Table 9.8** the resultant impact magnitude at all NSRs will be low, therefore with reference to **Table 9.9** the effect significance will be minor, and noise effects will therefore be not significant.

9.12 Assessment of Cumulative Effects

9.12.1 No cumulative effects are anticipated during the construction phase, and cumulative noise effects are therefore considered to be not significant.

9.12.2 Predictions of operational noise levels have included noise from the Proposed Development and the 2011 Permitted Development. Predicted noise levels meet the noise limits at all NSRs, for all wind speeds, during the daytime and night-time period.

9.12.3 **Figure 9.2** shows the cumulative noise contour of operational wind farms that are within 5 km of the Proposed Development. The areas where cumulative effects occur are uninhabited, and therefore cumulative effects have been determined to be not significant.

9.13 Conclusion

9.13.1 This chapter has considered potential noise effects associated with construction and operation of the Proposed Development. Operational noise effects included noise from the 2011 Previously Permitted Development. No potential vibration effects have been identified and consideration of vibration has therefore been scoped out.

9.13.2 The assessment of noise comprised consultation with SIC, qualitative characterisation of the baseline noise environment, assessment of construction traffic noise effects, prediction of noise levels associated with construction activities, operational wind turbines and operation of other non-turbine fixed plant, and evaluation of predicted levels against derived criteria.

9.13.3 Baseline noise levels in the study area are typically dominated noise from natural sources, including bird calls, the wind, wind-blown vegetation and waves from the North Sea. Anthropogenic noise sources including noise from the industrial estate, road traffic and the 2011 Permitted Development are minor contributors to total noise levels.

9.13.4 Predicted noise levels associated with construction activities meet threshold noise levels set out in the relevant guidance at all identified representative NSRs, during weekday daytimes and Saturday mornings. Noise effects from construction activities are therefore not significant.

9.13.5 The predicted change in road traffic noise levels associated with construction traffic is not significant.

9.13.6 Noise limits have been derived for non-turbine fixed plant associated with operation of the Proposed Development. Items of fixed plant will be specified such that they meet the derived noise limits at all representative NSRs. Noise effects from fixed plant are therefore not significant.

9.13.7 Predicted wind turbine noise levels associated with operation of the Proposed Development and the 2011 Previously Permitted Development meet derived day and night-time noise limits at all the identified representative NSRs, for all wind speeds. Noise effects due to operation are therefore not significant.

Table 9.13 – Summary of Effects

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect		Comparison in Residual Effect Significance from 2011 Permitted Development
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse	
Construction						
Noise from road traffic	Negligible	N/A	Implementation of good practice during construction works, including traffic management plan	Negligible	N/A	No change in significance
Noise from construction activities	Negligible	N/A	Implementation of good practice during construction works	Negligible	N/A	No change in significance
Operation						
Noise from fixed non-turbine plant	Negligible	N/A	Selection of plant which complies with specified maximum sound power level, or installation of appropriate acoustic enclosure where plant sound power level is above maximum specified, such that the derived noise limits are met.	Negligible	N/A	No change in significance
Noise from wind turbines at all NSRs	Negligible	N/A	None required	Negligible	N/A	No change in significance

9.14 References

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