Chapter 13: Noise

Contents

13 Noise

13.1 Executive Summary

13.1.1 Bow Acoustics have been commissioned to undertake a noise assessment for the construction and operation of the Proposed Development. Noise will be emitted by equipment and vehicles used during construction and decommissioning of the Proposed Development and by the turbines and substation during operation. The level of noise emitted by the sources and the distance from those sources to the receiver locations are the main factors determining levels of noise at receptor locations.

Construction Noise

13.1.2 Construction noise has been assessed by a desk-based study of a potential construction programme of 18 months and by assuming the Proposed Development is constructed using standard and common methods. Noise levels have been calculated for receiver locations closest to the areas of work and compared with guideline and baseline values. Construction noise, by its very nature, tends to be temporary and highly variable and therefore much less likely to cause adverse effects. Factors including the restrictions of hours of working have been taken into consideration. It is concluded that noise generated through construction activities would be of minor significant effect.

Operational Noise

13.1.3 Operational turbines emit noise from the rotating blades as they pass through the air. This noise can sometimes be described as having a regular 'swish'. The amount of noise emitted tends to vary depending on the wind speed. When there is little wind the turbine rotors will turn slowly and produce lower noise levels than during high winds when the turbine reaches its maximum output and maximum rotational speed. Background noise levels at nearby properties will also change with wind speed, increasing in level as wind speeds rise due to wind in trees and around buildings, etc.

13.1.4 Noise levels from the operation of the turbines have been predicted for those locations around the area most likely to be affected by noise. Surveys have been performed to establish existing baseline noise levels at three locations. Noise limits have been derived from data about the existing noise environment following the method stipulated in national planning guidance. Predicted noise levels take full account of the potential combination of the noise from the Proposed Development along with Clyde and Extension Wind Farm (operational), Glenkerie (operational) and Extension Wind Farm (consented), Grayside Wind Farm (in planning) and Whitelaw Brae Wind Farm (consented).

13.1.5 Other, more distant wind farms were not considered as they do not make an acoustically relevant contribution to cumulative noise levels.

13.1.6 Predicted operational noise levels have been compared to the limit values to demonstrate that turbines of the type and size which would be installed can operate within the limits so derived. It is concluded therefore that operational noise levels from the Proposed Development will be within levels recommended in national guidance for wind energy schemes.

13.2 Introduction

13.2.1 This chapter considers the likely significant effects of the Proposed Development on neighbouring noise sensitive receptors (NSRs) in respect of noise. It details the construction, operational and decommissioning noise assessment resulting from the Proposed Development.

13.2.2 The noise assessment was undertaken by, and the chapter has been authored by Richard Carter, a director of Bow Acoustics. Richard (C.Eng, B.Eng(Hons) MIOA) is a Chartered Acoustics Engineer and a full member of the Institute of Acoustics with over 18 years' experience in the assessment of environmental noise, 13 years of which specialised in wind turbine noise.

13.3 Legislation, Policy and Guidelines

13.3.1 The relevant legislation, policy and guidance documentation that have been taken into consideration during this assessment are detailed below.

Legislation

<u>Environmental Protection Act 1990</u>

13.3.2 The Environmental Protection Act 1990 (EPA) provides powers to control noise where a statutory noise nuisance exists. Section 80 of the EPA states that where a statutory nuisance exists, or is likely to occur or reoccur, then the responsible Local Authority shall serve a notice requiring the abatement of the nuisance; or prohibiting its occurrence or reoccurrence, as well as requiring any such steps as may be necessary to abate the nuisance including a specification of the timescales in which to take such action.

Section 82 of the EPA provides an individual subject to a statutory nuisance the right to make representations to the courts and for the courts to take such action, as may be appropriate, against the originator of that nuisance such that the nuisance is abated.

Planning Policy

13.3.3 Chapter 4 describes the national and local policy background relevant to the Proposed Development referring to the Development Plan consisting of the provisions of the National Planning Framework 4 (NPF4) and the SBC Local Development Plan (LDP). Specific references to noise are discussed as follows.

13.3.4 National Planning Framework 4

13.3.5 Policy 11 of NPF4 states that any renewable development will require project design and mitigation to demonstrate how impacts such as residential amenity have been addressed, which includes potential amenity effects in relation to noise immissions.

Scottish Borders Council Local Development Plan

13.3.6 Policy ED9: Renewable Energy Development of the LDP advises that noise must be considered when assessing impacts from wind energy proposals. Reference is given to ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, as the appropriate guidance document for such assessments.

Planning Advice Note PAN 1/2011

13.3.7 PAN 1/2011 provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. PAN1/2011 provides general advice on a range of noise related planning matters, including references to noise associated with both construction activities and operational wind farms. In relation to operational noise from wind farms, paragraph 29 states that:

13.3.8 *"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."*

13.3.9 PAN 1/2011 advises the preference to control construction noise through the Control of Pollution Act 1974 and the Pollution Prevention Control Act 1999, over the use of planning conditions.

Planning Advice Note PAN50

13.3.10 PAN50 gives guidance on the environmental effects of mineral working. The main document summarises the key issues with regard to various environmental effects relating to surface mineral extraction and processing including road traffic, blasting and noise.

Onshore Wind Turbines: Planning Advice

13.3.11 The Scottish Government's Onshore Wind Turbine web-based guidance document [accessed March 2024] provides further advice on noise from wind turbines. It too confirms that ETSU-R-97 should be followed to assess and rate noise from wind turbines until such a time an update is available. Further reference is made to the Institute of Acoustics 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG) as current industry good practice and the appropriate document to be used by all IOA members and those undertaking assessments to ETSU-R-97.

Onshore Wind Policy Statement

13.3.12 The Scottish Government issued their Onshore Wind Policy Statement in December 2022 which sets a target of 20 GW of installed onshore wind capacity in Scotland by 2030. Section 3.7 discusses noise from wind turbines and how it should be assessed. It too confirms that ETSU-R-97 and the IOA GPG should be followed to assess and rate noise from wind turbines until such a time as new guidance is produced.

Assessment of Noise: Technical Advice Note

13.3.13 The Scottish Government's Assessment of Noise: Technical Advice Note provides guidance aimed to assist in the technical evaluation of noise assessment and the significance of impact. This document refers to the web-based planning advice and ETSU-R-97 when assessing noise from wind turbines.

Guidance

ETSU-R-97

13.3.14 As introduced above, the ETSU report ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) is endorsed by national planning policy as the appropriate guidance document for the assessment of noise from wind turbines. The basic aim of ETSU-R-97 is to provide indicative noise levels thought to offer reasonable protection to wind farm neighbours without placing unreasonable restrictions on wind farm developments, or adding unduly to the costs and administrative burdens on wind farm developers or local authorities.

13.3.15 ETSU-R-97 recommends that the acceptability of wind farm noise should be assessed relative to existing background noise levels at nearby properties. It recognises that both background noise and wind turbine noise vary with wind speed and suggests that noise from wind turbines should be limited to 5 dB above the background noise at all times. It does however also suggest absolute lower fixed limits of between 35 and 40 dB L_{A90} for daytime and 43 dB L_{A90} for night-time. The limits advised in ETSU-R-97 apply to the total wind turbine noise at a receptor location and not just to one proposed wind farm.

13.3.16 An increased noise limit of 45 dB L_{A90}, or background noise plus 5 dB, whichever is greater, is suggested for both daytime and night-time periods for properties where the occupier has financial involvement in the wind farm.

13.3.17 Where noise at the nearest property is limited to 35 dB L_{A90} up to wind speeds of 10 m/s, then it need not be considered in the noise assessment, as protection of the amenity of these properties can be controlled through a simplified noise limit.

13.3.18 Where the need for a background noise survey is required, ETSU-R-97 provides guidance on the appropriate positioning, equipment, and duration of survey.

Institute of Acoustics' Good Practice Guide to ETSU-R-97

13.3.19 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' was published by the Institute of Acoustics in 2013. This document provides guidance on noise assessment of wind turbines above 50 kW, reflecting the original principles within ETSU-R-97. The IOA GPG contains six Supplementary Guidance Notes that covers data collection, data processing, wind turbine sound power levels, wind shear, post completion measurements and propagation over water for onshore.

13.3.20 The IOA GPG does not replace the limits within ETSU-R-97, but it does provide good practice guidance on the use of ETSU-R-97 in relation to background noise surveys and on the prediction of wind turbine noise. This is on the proviso that the appropriate input parameters and correction factors are used for the prediction of wind turbine noise, as follows:

- downwind propagation;
- a receptor height of 4 m;
- atmospheric conditions of 10 °C and 70 % humidity;
- a ground absorption factor of G = 0.5; and
- turbine noise emission levels which include a margin for uncertainty.

13.3.21 The guidance document has been endorsed, on behalf of Scottish Government, for use on wind turbine noise assessments.

ISO 9613-2

13.3.22 ISO 9613-2: 1996 'Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation' provides a robust prediction method for calculating the noise levels at receiver locations, endorsed by the IOA GPG as method to use when calculating wind turbine noise propagation.

13.3.23 It is noted that at the time of calculation the 1996 version of ISO 9613-2 was current and that a revised version has been subsequently issued in January 2024. At the time of writing noise modelling software are still implementing the 1996 version and the changes to the 2024 version are likely to alter the calculated results by a fraction of one decibel and as such will not affect the assessment.

British Standard 5228

13.3.24 For detailed guidance on construction noise and its control, the Technical Advice Note refers to British Standard BS 5228 'Noise control on construction and open sites', Parts 1 to 4 but confirms that the updated version of this standard, published in January 2009 is relevant when used within the planning process. The 2009 version consolidates all previous parts of the standard into BS 5228-1: 2009 (amended 2014) (BS 5228-1) for airborne noise and BS 5228-2: 2009 (amended 2014) (BS 5228-2) for ground borne vibration. These updated versions have therefore been adopted as the relevant versions upon which to base this assessment.

13.3.25 BS 5228-1 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels and example criteria which may be considered when assessing impact magnitude. Similarly, BS 5228-2 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration.

Calculation of Road Traffic Noise

13.3.26 The former Department of Transport and Welsh Office memorandum Calculation of Road Traffic Noise (CRTN) published in 1988 sets out standard methods and procedures to predict and measure road traffic noise. These procedures were primarily intended to enable entitlement under the Noise Insulation Regulations to be determined, but they also provide guidance appropriate to the calculation of traffic noise for more general applications.

13.4 Consultation

13.4.1 The Environmental Health Officer (EHO) at the SBC and their appointed noise consultant, Carmichael Acoustics, were consulted throughout the assessment. An initial consultation letter was issued to SBC on 16 February 2023 that set out an overview of the assessment method and potential noise survey locations. The response from Carmichael Acoustics, dated 13 March 2023, confirms agreement on the approach and clarifies the expectation for some aspects of the assessment. These points were followed up in a letter dated 11 May 2023 together with confirmed background noise survey locations and an invitation to attend the survey setup. No response was received to that letter. Shortly after background noise monitoring equipment was installed an email providing details of the equipment and locations was issued to SBC and Carmichael Acoustics on 19 June 2023. No response was received to that email. Table 13.1 summarises the points raised during the consultation.

Table 13.1 – Consultation

Consultee and Date	Point Raised by Bow Acoustics (for the Applicant)	Response on behalf of SBC	Further Comment by Bow Acoustics
SBC, 16 February 2023	NSRs identified.	Carmichael Acoustics letter dated 13 March 2023 confirmed these to be appropriate.	NSRs considered in the assessment reflect those agreed. These are discussed from paragraph 13.5.3 and Table 13.2 lists thoses included.
SBC, 16 February 2023	Building marked as Hopehead is not a dwelling or rented out for people to stay for an extended period of time. It should not be included as an NSR.	Carmichael Acoustics letter dated 13 March 2023 advises that this is a planning issue If Hopehead can be used as a dwelling without applying for permission, then it should be included as an NSR.	Further consultation took place between SLR and SBC planning department and no definitive answer was available. Paragraph 13.5.5 and paragraph 13.5.32 discusses this matter further.
SBC, 16 February 2023	Background noise data measured as part of the noise assessment for Whitelaw Brae Wind Farm will be used to inform noise limits for this assessment at the same locations.	Carmichael Acoustics letter dated 13 March 2023 confirmed these to be reasonable.	Noise limits set in this assessment at Whitelaw Brae Wind Farm measurement locations are in line with the agreed approach. Paragraph 13.6.14 discusses this further.
SBC, 16 February 2023	Two background noise measurement locations were identified, subject to landowner consent to gain access.	Carmichael Acoustics letter dated 13 March 2023 agreed with the two locations and requested that monitoring at Hopehead may be necessary if it is to be considered as an NSR.	Consent was only given for one of the two locations, a suitable alternative was selected for the other. Hopehead was included as a survey location. The noise survey is discussed from paragraph 13.5.6.
SBC, 16 February 2023	Any measured noise data will be reviewed against wind direction to ensure noise from any existing wind turbines is not captured.	Carmichael Acoustics letter dated 13 March 2023 noted that wind direction will have to be considered when analysing background data. Any analysis must include sufficient detail to allow a review of the analysis.	This is discussed further in paragraph 13.5.34. All measured noise data was inspected for extraneous noise, which included filtering on a wind direction basis.
SBC, 16 February 2023	The assessment will include cumulative input from any wind farm predicted to have a noise level within 10 dB of the Proposed Development at the same NSR and the total noise is 35 dB L_{A90} or greater.	Carmichael Acoustics letter dated 13 March 2023 confirmed this approach to be appropriate.	The approach to cumulative noise follows the agreed approach. Paragraph 13.5.1 discusses this further and confirms which wind farms are included.
SBC, 16 February 2023	Items scoped out the assessment: – Eskdalemuir Seismic Array impact assessment;	Carmichael Acoustics letter dated 13 March 2023 did not object to any of the items	The assessment does not include any of the agreed scoped out items. Construction noise has

Consultee and Date	Point Raised by Bow Acoustics (for the Applicant)	Response on behalf of SBC	Further Comment by Bow Acoustics
	– Low frequency noise and infrasound assessment; – Amplitude modulation; – Road traffic noise during the operation of the Proposed Development; and – Construction and operational vibration.	scoped out. Also added: – Construction noise can be controlled under the control of Pollution Act, 1974; – If blasting is proposed it will need to be considered; and – Contruction traffic noise would normally require assessment.	been assessed, see from paragraph 13.9.1. Blasting is discussed in paragraphs 13.5.16, 13.5.17 and 13.7.4. Construction traffic noise has been assessed, paragraph 13.9.4 discusses this further.
SBC, 11 May 2023	The information required to confirm if Hopehead can be used as a dwelling without permission is not available. Therefore, attempt will be made to survey background noise levels at this location.	No response received from SBC or Carmichael Acoustics.	Background noise measurements were carried out at Hopehead. The noise survey is discussed from paragraph 13.5.6.
SBC, 11 May 2023	Dwelling that agreed access for the background noise survey were identified.	No response received from SBC or Carmichael Acoustics.	Background noise measurements were carried out at three locations. The noise survey is discussed from paragraph 13.5.6.
SBC, 11 May 2023	Noise levels from existing wind turbines at the potential survey locations provided. Details of the directional filtering discussed.	No response received from SBC or Carmichael Acoustics.	This is discussed further in paragraph 13.5.34. All measured noise data was inspected for extraneous noise, which included filtering on a wind direction basis.
SBC, 19 June 2023	Summary of background survey locations provided with coordinates, plans, photographs, calibration details, serial numbers and a description of the soundscape observed.	No response received from SBC or Carmichael Acoustics.	The information contained within the consultation is included in the EIA Report and appendices. The only exception are the installation photographs taken at NML1, Menzion Farm, as these are not included in the EIA Report at the request of the resident.

13.5 Assessment Methodology and Significance Criteria

Study Area

13.5.1 The study area for the assessment of operational noise is shown on Figure 13.1 and has been defined in accordance with the IOA GPG to include NSRs where noise immission levels from the Proposed Development are predicted to be within 10 dB of those from other relevant wind energy developments, and the predicted cumulative wind farm noise immission level is greater than 35 dB $L_{A90,10min}$, at up to 10 m/s wind speed. Other wind energy developments that meet this criterion are:

- Clyde Wind Farm (Planning references: CL/08/0714 & CL/04/0850);
- Clyde Wind Farm Extension (Planning reference: 12/01114/S36);
- Glenkerie Wind Farm (Planning reference (07/02478/FUL);
- Glenkerie Wind Farm Extension (Planning reference: 13/00552/FUL);
- Grayside Wind Farm (Planning references: 20/01071/NECON & 22/00681/NECON); and
- Whitelaw Brae Wind Farm (Planning reference: 20/00789/S36).

13.5.2 Note that in the above, and subsequently in this assessment, the term 'noise emission' relates to the sound power level actually radiated from each wind turbine, whereas the term 'noise immission' relates to the sound pressure level (the perceived noise) at any receptor location due to the combined operation of all wind turbines on the Proposed Development. All wind farm noise immission levels in this report are presented in terms of the L_{A90} noise indicator in accordance with the recommendations of the ETSU-R-97 report, obtained by subtracting 2 dB(A) from the calculated L_{Aeq} noise levels based on the turbine sound power levels.

13.5.3 The NSRs considered in the assessment are listed in Table 13.2 and shown on Figure 13.2. Table 13.2 also provides the coordinates of the NSRs and their distance to the nearest turbine within the Proposed Development. The assessment has included locations representative of other, more distant locations, and does not consider every dwelling within the study area. This is in line with current best practice.

Table 13.2 – NSRs within the Assessment

ID	Name	Easting	Northing	Distance to nearest turbine, m	Nearest turbine ID
NSR01	Menzion Farm	309114	623612	1030	T7

NSR02	Oliver Farm	309472	624414	1102	T7
NSR03	Oliver Bank	309587	624444	1198	T6
NSR04	The Toll House	309631	624436	1242	T6
NSR05	Lilybank	309788	624318	1415	T7
NSR06	Oliver House	309816	624863	1353	T6
NSR07	The Bield	309976	624782	1515	T6
NSR08	Riverview	310040	624814	1578	T6
NSR09	Tweedholm Cottage	310035	624843	1572	T6
NSR10	Carngorm	310069	624906	1607	T6
NSR11	Glenbreck	306097	621533	2661	T2
NSR12	Hawkshaw	307537	622436	1371	T2
NSR13	Craiglaw	308793	620978	2969	T1

13.5.4 The list of NSRs included in the assessment is shorter than those agreed during the consultation as any that did not meet the criterion for the study area, as set out in paragraph 13.5.1 have subsequently been removed.

13.5.5 In addition to the dwellings listed in Table 13.2, Hopehead is a building situated just over 1 km north of the nearest proposed turbine and is used infrequently by groups of people as a temporary overnight stay. It is not a dwelling and is only accessible via a 4 km (2.5 mile) private farm track and it does not have any designated outdoor amenity area. Notwithstanding this, it is recognised that when it is in use it will be potentially sensitive to noise, particularly overnight.

Site Visit

13.5.6 A background noise survey was carried out at three noise measurement locations (NML) around the site, as shown on Figure 13.2 and listed in Table 13.3. The locations were chosen in consultation with SBC and were based on the preliminary turbine layout provided as part of the Scoping Report for the Proposed Development and with due regard to the operational wind turbines in the area. The monitoring locations are in line with that discussed with SBC prior to the monitoring being undertaken as being representative of the background noise environment for the nearest residences to the Proposed Development. Minor alterations have been made as compared with that originally proposed, following visits to the area where the most appropriate locations could be determined and, in some cases, due to access issues. SBC were informed of the final survey locations.

Table 13.3 – Background Noise Measurement Locations

ID	Name	Easting	Northing	Distance to nearest operational turbine, m
NML1	Menzion Farm	309115	623629	3.6 km (Glenkerie)
NML2	Oliver House	309734	624824	2.8 km (Glenkerie)
NML3	Hopehead	307950	625787	1.5 km (Glenkerie)

13.5.7 Full details of the background survey and measurement locations is provided in Technical Appendix 13.1. The background noise monitoring exercise was conducted over a period of approximately four weeks. The equipment used for the survey comprised three Rion NL 52 logging sound level meters and a Davis tipping-bucket rain gauge. All sound level meters were enclosed in environmental cases and continuous logging at the required ten-minute averaging periods. Outdoor enhanced windshield systems were used to reduce wind induced noise on the microphones and provide protection from rain. These windshield systems were supplied by the sound level meter manufacturer and maintain the required performance of the whole measurement system when fitted. The environmental enclosures provided an installed microphone height of approximately 1.2 m to 1.5 m above ground level, consistent with the requirements of ETSU-R-97 and the IOA GPG.

13.5.8 The sound level meters were located on the Proposed Development side of the dwelling where possible, never closer than 3.5 m from the façade of the property and as far away as was practical from obvious atypical localised sources of noise such as running water, trees or boiler flues.

13.5.9 All measurement systems were calibrated on their deployment on 14 June 2023 and upon collection of the equipment on 12 July 2023. No acoustically important (>0.5 dB(A)) drifts in calibration were found to have occurred on any of the systems.

13.5.10 The sound level meters logged the $L_{A90,10min}$ and $L_{Aeq,10min}$ noise levels continuously over the survey period, using Greenwich Mean Time (GMT) time reference. Wind data was measured by the SoDAR unit installed on the site, which also logged using the same 10-minute periods and GMT reference. The rain gauge also logged using GMT reference and was installed at NML2 Oliver House.

13.5.11 In accordance with the GPG guidance, the ten metres height wind speed data required by ETSU-R-97 was derived (or 'standardised') from measurements made at heights representative of the hub heights of the proposed turbines. This therefore accounts for potential effect of site-specific wind shear. Wind speeds were measured using the SoDAR at multiple heights, including 120 m and 140 m. Values of wind speed at a standardised height of ten metres were calculated from those measured by the SoDAR unit ('standardised wind speed').

13.5.12 The SoDAR wind monitor was installed by trained and experienced technicians from Carbon 2050 Ltd, an appropriate expert within the field, in an area with no obstructions that could affect the data (location NGR 308335 624661). The SoDAR remained in good working condition throughout the survey. The installation report for the SoDAR is included in Technical Appendix 13.5.

Assessment of Potential Effect Significance

Construction Noise and Vibration

13.5.13 BS 5888-1 has been used as the appropriate reference for the method of calculation and assessment of construction noise effects. At this stage of a development it is not feasible to accurately specify exact construction techniques or locations where construction activity is likely to take place. Therefore, various assumptions have been made based on best practice and typical wind farm construction projects. The calculation follows Annex F of BS 5228-1 and assumes the following:

- plant is operational for 100 % of the working day;
- there would be no screening effects;
- propagation over mixed ground (50 % hard 50 % soft); and
- construction activity is assumed to occur at a single point from receiver (closest point to the nearest receiver to represent a worst case).

13.5.14 Table 13.4 lists the key construction activities, the associated types of plant normally involved, and the expected worst-case sound power level over a working day for each activity.

Table 13.4 – Construction Plant Sound Power Levels

Task	Total Sound Power Level dB L_{WA}	Details of Plant or Equipment
Construct temporary site compound	118	Excavator, dump truck, pumping concrete, delivery lorries
Construct site tracks	118	Excavators, dump trucks, tippers, bulldozers, vibrating roller
Construct substation	112	Excavator, concrete mixing lorry, delivery lorries
Construct crane hard standings	116	Excavator, concrete mixing lorry, dump trucks
Construct turbine foundations	121	Piling Rig, excavators, dump trucks, concrete mixing lorries, mobile cranes, diesel water pumps, pneumatic hammers, compressors, vibratory pokers
Erect turbines	121	Cranes, turbine delivery vehicles, articulated lorries for crane movement, generators, torque guns
Reinstate crane bases	116	Excavator, dump truck
Borrow pit quarrying	127	Primary and secondary stone crushers, excavators, screening systems, pneumatic breakers, conveyors
Forestry felling around tracks and turbines	115	Harvesters and forwarders, characterised by saw noise diesel engine noise emissions commonly associated with tractors and excavation noise

13.5.15 The calculated construction noise levels are compared with absolute noise limits for temporary construction activities which are commonly regarded as providing an acceptable level of protection from the short-term noise levels associated with construction activities, based on guidance from BS 5228-1.

13.5.16 Rock extraction from borrow pits by means of blasting operations could be required and has been included in the assessment. Blasting operations can generate airborne pressure waves or ‘air overpressure’ which contains both audible (approximately 20 Hz to 20k Hz) and infrasonic pressure waves (<20 Hz), which, although outside the range of human hearing, can sometimes be felt. The relevant guidance documents advise controlling air overpressure with good practices during the setting and detonation of charges as opposed to absolute limits on the levels produced; therefore, no absolute limits for air overpressure or noise from blasting can be presented in the assessment. Other site activity associated with quarrying, such as stone crushing and the operation of plant including excavators, breakers and conveyors have been included in the noise assessment.

13.5.17 In accordance with the guidance in BS 6472 and PAN50, ground vibration caused by blasting operations will be considered acceptable if peak particle velocity (PPV) levels, at the nearest sensitive locations, do not exceed 6 mm/s for 95 % of all blasts measured over any 6-month period, and no individual blast exceeds a PPV of 12 mm/s.

13.5.18 Separate consideration is also given to the possible noise effects of construction-related traffic passing to and from the site along local surrounding roads. In considering potential noise levels associated with construction traffic movement on public roads, reference is made to the accepted UK prediction methodology provided by CRTN.

13.5.19 Road traffic data have been provided for roads used by construction vehicles which represents the Average Annual Weekday Total (AAWT) two-way flows for the worst-case period of construction. The full prediction given in CRTN results in an absolute road traffic noise level at a receiver location. For the

purpose of this assessment the change in road traffic noise is of concern and not the absolute level. This has been achieved by calculating the Basic Noise Level (BNL) with corrections for heavy vehicles and low flow as described in CRTN. This is considered acceptable to provide a reasonable estimate of the likely change in road traffic noise.

13.5.20 The peak of construction in terms of vehicular movements is reported in Chapter 12: Site Access, Traffic and Transport to occur in month four. Chapter 12 provides 2029 baseline traffic flow data, without construction vehicles in Table 12.8, and 2029 plus construction traffic flow data in Table 12.10. These show an increase in road traffic during the peak month on eight road links to be between 0% and 6%.

Operational Noise

13.5.21 ETSU-R-97 provides a robust basis for assessing impacts of operational noise from wind turbines. Noise limits for wind farm developments are derived from background measurements and fixed values, and wind turbine immission levels are calculated for the NSRs in the assessment. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby NSRs lie below the noise limits derived in accordance with ETSU-R-97. The principle method for assessing operational wind turbine noise set out in ETSU-R-97 calculates immission from, and sets noise limits for, all wind turbines in a given area.

13.5.22 An important component of the calculation of noise immission level is the selection of an appropriate wind turbine. The IOA GPG notes that most sites at the planning stage will not have selected a preferred turbine, therefore a representative candidate turbine should be selected to provide appropriate noise levels. Once noise levels have been predicted at the potentially affected properties, compliance with noise limits can be assessed and design advice provided if compliance with the limits is considered unlikely.

13.5.23 The Vestas V162 7.2 MW turbine with a hub height of 119 m and equipped with trailing edge serrations has been selected as the candidate turbine for this assessment, as discussed further in paragraph 13.5.55. The manufacturer's noise emission data[1] has been provided directly at hub height wind speeds and excludes any margin for uncertainty, and as such an additional 2 dB has been included in the sound power levels in this assessment, as detailed in Table 13.5.

Table 13.5 – Vestas V162 7.2 MW Overall Noise Emission Data

Detail	Wind Speed at Hub Height, m/s										
	≤5	6	7	8	9	10	11	12	13	14	15
Sound Power Level, dB L_{WA} including 2 dB uncertainty.	96.0	97.0	100.3	103.5	106.1	106.6	106.7	106.8	107.0	107.3	107.5

13.5.24 Vestas have also supplied the octave band frequency spectrum equivalent to the maximum sound power level[2], detailed in Table 13.6. The values specified in Table 13.6 also include 2 dB uncertainty.

Table 13.6 – Vestas V162 7.2 MW Octave Band Frequency Noise Emission Data

Detail	Octave Band Centre Frequency, Hz								
	63	125	250	500	1000	2000	4000	8000	(A)
Sound Power Level, dB L_{WA} including 2 dB uncertainty.	91.1	98.7	101.9	102.1	100.4	95.8	88.2	77.4	107.5

13.5.25 In addition to the proposed turbines, turbines within other nearby wind farms, as listed in paragraph 13.5.1, have been included in the assessment. Details of the sound power levels used for all wind turbines is included in Technical Appendix 13.2. Each of the other wind farms have the potential to produce a higher noise immission level than the calculated value, up to their consented noise limit. Therefore, it is important to consider the likely maximum noise immission level each wind farm could produce at each of the NSRs. The difference between the calculated and the likely maximum noise immission values is the uplift applied to that development. The IOA GPG provides guidance on this and offers several methods to determine an appropriate uplift value.

13.5.26 For the other wind farms included in the assessment an uplift has been included. Where possible, an uplift of 2 dB has been applied. For the case of Whitelaw Brae Wind Farm, a minimum 1 dB margin was reported[3] and therefore, it is not possible to include a 2 dB uplift due to a controlling property. In accordance with the IOA GPG Whitelaw Brae Wind Farm therefore has a 1 dB uplift. Table 13.7 summaries the relevant information for the other wind energy developments included in the assessment.

[1] Vestas Wind Systems (2022) Document 0114-3777 Performance Specification EnVentus V162-7.2 MW 50/60 Hz, V4
[2] Vestas Wind Systems (2023) Document 0116-1715_03 Third Octave Band Emission EnVentus V162-7.2 MW 50/60 Hz
[3] 20/00789/S36 Further Environmental Information Chapter 11, Table 11.2: -1 dB margin shown at H2 Badlieu at 8 m/s

Table 13.7 – Wind Turbine Information for Other Wind Energy Developments in the Study Area

Wind Farm	Status	Wind Turbine Type	Uplift Applied, dB(A)
Clyde	Operational	Siemens 93 2.3 MW	2
Clyde Extension	Operational	Siemens SWT101 3.2 MW	2
Glenkerie	Operational	Vestas V80 2.0 MW	2
Glenkerie Extension	Approved	Vestas V80 2.0 MW	2
Grayside	In planning	Vestas V150 5.6 MW	2
Whitelaw Brae	Approved	Vestas V117 4.2 MW	1

13.5.27 The ISO 9613-2 model has been used to calculate the noise immission levels at the NSRs as advised in the IOA GPG. The model accounts for the attenuation due to geometric spreading, atmospheric absorption, and barrier and ground effects and assumes the following parameters:

- octave band data which accounts for the sound frequency characteristics of the turbines;
- receiver height of 4 m above local ground;
- mixed ground (G=0.5);
- an air absorption based on a temperature of 10°C and 70 % relative humidity;
- attenuation due to terrain screening has been limited to a maximum of 2 dB(A); and
- in situations of propagation above concave ground, a correction of +3 dB was added.

13.5.28 The above method is consistent with the recommendations of the IOA GPG. The IOA GPG also allows for directional effects to be taken into account within the noise modelling which can reduce the noise immission level at a receptor. However, predictions have been made assuming downwind propagation from every turbine to every receptor at the same time as a worst case.

13.5.29 Separate noise limits apply for the daytime and night-time, chosen to protect a property's external amenity and to prevent sleep disturbance indoors, respectively. Noise limits comprise the greater of two elements:

- a lower fixed value; and
- a derived relative value equal to the prevailing background curve plus 5 dB(A).

13.5.30 As set out in paragraph 13.3.15, the lower fixed portion of the daytime noise limit should lie within the range of 35 dB L_{A90} and 40 dB L_{A90}. In the case of the Proposed Development, there are very few NSRs that would be downwind of the turbines under the prevailing south-westerly wind direction. In addition, the overall ETSU-R-97 noise limit applies to the cumulative wind turbine noise, as advised above, and given the number of wind turbines in the area and their conditioned noise limits, a value for the fixed portion of the daytime noise limit of 40 dB L_{A90} has been applied as appropriate. This maintains the principle adopted in the planning consent for the neighbouring Whitelaw Brae Wind Farm (15/00020/S36).

13.5.31 During the night-time period, the fixed portion of the noise limit has been set to 43 dB L_{A90}.

13.5.32 There are two exceptions to the lower fixed portion of the noise limit discussed above. The first is when a property occupier has a financial involvement in the wind farm development; however, in the case of the Proposed Development there are none. The second exception is Hopehead discussed in paragraph 13.5.5. The applicable noise limit is based on protecting amenity overnight, for which ETSU-R-97 advises an appropriate value of 43 dB L_{A90}. For this location only, the fixed portion of the overall ETSU-R-97 noise limit has been set to 43 dB L_{A90} for both the daytime and night-time periods.

13.5.33 The prevailing background curve is derived from noise data, using the $L_{A90,\ 10min}$ parameter, measured at a representative location of a receptor and wind data measured at a location that is representative of the proposed wind turbines. Data measured during the ETSU-R-97 'quiet periods of the day' inform the daytime prevailing background curve. These quiet periods are: weekdays between 18:00 and 23:00, Saturdays between 13:00 and 23:00 and all day on Sundays (07:00 to 23:00). Data measured between 23:00 and 07:00 inform the night-time prevailing background curve.

13.5.34 Data displaying evidence of being influenced by extraneous sources such as boiler flues, localised plant or watercourses were excluded. Periods of rainfall, including 30 minutes after were also excluded. Also data were inspected for the influence of noise from operational wind turbines under certain wind conditions, as set out in Table 13.8, and excluded where such evidence was found. As a precaution when the predicted immission level from existing wind turbines was about 25 dB L_{A90} or greater, the downwind sectors have been included for review.

Table 13.8 – Background Survey Wind Directional Data Filtering

Survey Location	Wind Conditions	Details
NML1 Menzion Farm	Direction 160° – 20°	Inspect for evidence of wind turbine noise. In the downwind sector of Clyde

	and ≥ 6 m/s	Wind Farm Extension predicted level of 25 dB – 28 dB L_{A90}. Glenkerie Wind Farm predicted levels of < 23 dB L_{A90}.
NML2 Oliver House	Direction 160° – 110° and ≥ 6 m/s	Inspect for evidence of wind turbine noise. In the downwind sector of Clyde Wind Farm Extension (24 dB L_{A90}) and Glenkerie Wind Farm (26 dB L_{A90})
NML3 Hopehead	Direction 270° – 90° all wind speed	Inspect for evidence of wind turbine noise. In the downwind sector of Glenkerie Wind Farm (29 dB – 34 dB L_{A90}).
	Direction 180° – 90° and ≥ 6 m/s	Inspect for evidence of wind turbine noise. In addition to the above, in the downwind sector of Clyde Wind Farm Extension (25 dB – 28 dB L_{A90}).

Substation and Battery Storage

13.5.35 In addition to operational noise from the turbines, noise from the operation of the substation and battery energy storage system (BESS) has been assessed. The main noise sources associated with the substation and BESS are likely to be the power transformers, battery enclosures and their cooling fans. The transformer and battery enclosure noise is generally fairly constant, once energised, whereas the cooling fans operate as needed, depending on load and ambient temperature. The noise from the transformers is usually tonal in nature with most energy contained within discrete frequency components at 100 Hz and harmonics thereof. Battery enclosures and other BESS plant are less likely to have a noise which is tonal in nature. The cooling fans are likely to be broadband in nature but switch on and off.

13.5.36 The proposed substation and BESS are located approximately 900 m from the nearest residential property, Hawkshaw. The specifications of the transformers likely to be used for the substation are not defined at this stage; therefore, it is assumed that there will be two transformers, each with a sound power level of 85 dB(A), based on experience of typical installations for wind farms of this scale. The BESS is likely to have up to 12 battery enclosures, each with a sound power level of 77 dB(A).

13.5.37 The operational noise from the substation and BESS has been predicted at the nearest residential property following the methodology set out in ISO 9613-2. The substation operational noise level predictions have been undertaken using a receiver height of four metres above local ground level, mixed soft and hard ground (G=0.5) and an air absorption based on a temperature of 10°C and 70 % relative humidity. No allowance has been included for screening provided by terrain or intervening buildings.

13.5.38 In accordance with the method described in BS 4142 a correction, based on professional judgement, for the potential acoustic features has also been included to provide the 'rating level'. Corrections can be applied for tonal, impulsive and / or intermittent characteristics that have the potential to lead to increased awareness of a sound. As a precaution, +2 dB has been included for a tone that is just perceptible. The 'rating level' is compared against the typical background noise levels to estimate the likely impact. An essential part of the BS 4142 assessment is to consider the context of the development in the surrounding area, which has been taken into account through the consideration of several factors including the absolute level of the noise, as discussed further in paragraph 13.5.44.

Assessment of Effect Significance

Sensitivity

13.5.39 Most of the relevant NSRs within the assessment area are dwellings, which are of high sensitivity. This applies to both construction and operational noise. As discussed in paragraph 13.5.5, Hopehead is not a dwelling and has only very occasional overnight use. For this reason this receptor has reduced sensitivity and it would not be appropriate to apply a high degree of sensitivity. Therefore, this receptor is considered to be of medium sensitivity to noise.

Magnitude

13.5.40 BS 5228-1 informative Annex E provides example criteria that may be used to consider the magnitude of any construction noise impacts. The criteria do not represent mandatory limits but rather a set of example approaches intended to reflect the type of methods commonly applied to construction noise. The example methods are presented as a range of possible approaches (both facade and free field noise levels, hourly and day-time averaged noise levels) according to the ambient noise characteristics of the area in question, the type of development under consideration, and the expected hours of construction activity. In broad terms, the example criteria are based on a set of fixed limit values which, if exceeded, may result in a large impact unless ambient noise levels (i.e. regularly occurring levels without construction) are sufficiently high to provide a degree of masking of construction noise.

13.5.41 Based on the range of guidance values set out in BS 5228 Annex E and PAN50, the following impact assessment scale has been derived. The values have been chosen in recognition of the relatively low ambient noise typically observed in rural environments. The presented criteria have been normalised to free-field day time noise levels occurring over a time period, T, equal to the duration of a working day on site. BS 5228 1 Annex E provides varied definitions for the range of day time working hours which can be grouped for equal consideration. The values presented in Table 13.9 have been chosen to relate to day time hours from 07:00 to 19:00 on weekdays, and 07:00 to 13:00 on Saturdays.

Table 13.9 – Magnitude Criteria for Construction Noise

Magnitude	Noise Level dB $L_{Aeq, T}$		Description
	4 weeks or more	Up to 4 weeks	
High	> 75	> 85	Trigger level for noise insulation works, or costs thereof, as set out in E.4 of BS 5228-1.
Medium	> 65 and ≤ 75	> 75 and ≤ 85	Most stringent threshold values for potential significant effects given in Annex E of BS 5228-1 for example methods relevant to Proposed Development is exceeded.
Low	> 55 and ≤ 65	> 65 and ≤ 75	Noise is likely to be audible, but unlikely to change behaviour. Of BS 5228-1 thresholds not exceeded.
Negligible	≤ 55	≤ 65	At least 10 dB below the most stringent criteria provided in of BS 5228-1.

13.5.42 When considering the impact of short-term changes in traffic noise associated with the construction activities on existing roads in the vicinity of the Proposed Development, reference can be made to the criteria set out in the Design Manual for Roads and Bridges (DMRB), as summarised in Table 13.10. The change in noise level is calculated using the CRTN methodology to compare HGV corrected BNL with and without construction traffic, as described in paragraph 13.5.19.

Table 13.10 – Magnitude Criteria for Construction Traffic Noise

Magnitude	Definition
High	Change in HGV corrected BNL of 5 dB or greater
Medium	Change in HGV corrected BNL of at least 3 dB and less than 5 dB
Low	Change in HGV corrected BNL of at least 1 dB and less than 3 dB
Negligible	Change in HGV corrected BNL of less than 1 dB

13.5.43 Operational noise effects have been determined following ETSU-R-97 and the IOA GPG, which if they do not exceed noise limits derived following the same guidance, whilst potentially adverse, are considered to be not significant in EIA terms.

13.5.44 Noise from the operation of the substation and BESS has been assessed using the methodology in BS 4142, which compares the 'rating level' from the specific source with typical baseline background noise levels in the context of the development. An important factor when considering the context is the absolute level of sound, where it is stated in BS 4142 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."*

13.5.45 The standard offers no guidance about what background and rating levels are considered low; however, the 1997 version of the standard stated that background sound levels below around 30 dB L_{A90}, and rating levels below around 35 dB L_{Ar}, were considered very low and therefore outside the scope of the assessment method.

13.5.46 Table 13.11 sets out the magnitude of criteria for operational noise impacts from the substation, based on the above considerations.

Table 13.11 – Magnitude Criteria for Substation Operational Noise

Magnitude	Definition
High	Rating level exceeds background by 10 dB or more, and is greater than 35 dB
Medium	Rating level exceeds background by 5 dB to 10 dB, and is greater than 35 dB
Low	Rating level exceeds background, by a maximum of 5 dB, or is less than 35 dB
Negligible	Rating level equal to, or less than, background and less than 35 dB

Significance

13.5.47 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed in Table 13.12. As discussed in paragraph 13.5.39, all residential receptors have an equal sensitivity of 'High' and Hopehead has 'Medium' sensitivity. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 13.12 – Significance Criteria

Magnitude of impact	Significance of effect for receptor sensitivity	
	High sensitivity	Medium sensitivity
High	Major	Moderate
Medium	Moderate	Minor
Low	Minor	Minor

Magnitude of impact	Significance of effect for receptor sensitivity	
	High sensitivity	Medium sensitivity
Negligible	Negligible	Negligible

13.5.48 The assessment of the significance of effects from operational and cumulative wind turbine noise is made as follows, with reference to ETSU-R-97 and Scottish Planning Guidance:

- where operational and cumulative noise levels at receptors are below the relevant ETSU-R-97 noise limits, this is determined to be adverse but 'not significant'; and
- where operational and cumulative noise levels at receptors are above the relevant ETSU-R-97 noise limits, this is determined to be adverse and 'significant'.

Requirements for Mitigation

13.5.49 Where construction noise impacts have been identified to potentially result in a significant effect, mitigation will be required. Standard mitigation for construction noise is discussed further in paragraphs 13.7.3 and 13.7.4. Additional mitigation can be specified to control specific construction activities, if identified to be necessary.

13.5.50 As set out in paragraph 13.5.43, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby NSRs lie below the noise limits derived in accordance with ETSU-R-97 and the IOA GPG. Where the wind farm noise immission level exceeds the noise limit at a NSR, additional mitigation will be required.

13.5.51 As part of the ongoing Proposed Development design refinement, where exceedances of noise limits have been identified, turbines have been moved wherever practicable to a location to reduce operational wind turbine noise to a level below the limit.

Assessment of Residual Effect Significance

13.5.52 Where additional mitigation has been specified to be required, the residual effect is assessed in accordance with the significance criteria specified above in paragraphs 13.5.47 and 13.5.48.

Cumulative Assessment

13.5.53 Operational cumulative noise effects are considered as an inherent part of the assessment methodology detailed in this Chapter. Therefore, a separate cumulative assessment is not required for operational noise, but is included for construction noise.

Limitations to Assessment

13.5.54 For construction noise and vibration, predicted noise levels are based on assuming standard machinery and equipment are used and that these are operated in the way intended by their manufacturers. It is also assumed, on a precautionary basis, that these items of equipment are all used at the closest point of the proposed works area to each of the receptor locations. These are considered to be a precautionary assumption, with noise/vibration levels lower than predicted for much of the construction period.

13.5.55 For operational noise, the exact model of turbine to be used at the site would be the result of a future tendering process and therefore, an indicative turbine model (Vestas V162 7.2 MW) has been assumed for the operational noise assessment. The turbine model assumed is considered representative of the upper end of the range of noise emissions for turbines which may be installed at the site. For the other wind farms included in the assessment, robust assumptions of the potential noise emissions which may be allowed for that site under its consent were considered in line with current good practice.

13.5.56 Noise emissions for all wind turbines were considered on a robust basis by the addition of 2 dB uncertainty. In addition, consideration has been given to any further uplift that could be applied to the neighbouring wind farms to allow an increase to the calculated noise immission levels should the respective planning condition permit.

13.5.57 For the operational substation, although the final equipment selection and installation arrangements are not known, the assessment is based upon experience of similar schemes and typical associated noise emission levels.

13.6 Baseline Conditions

13.6.1 Technical Appendix 13.1 provides details of the background noise survey locations and the noise climates experienced there. The noise climate at all survey locations can be described as fairly typical for rural amenity with distant road traffic audible, natural noises such as birds, wind disturbed vegetation and livestock, with occasional distant aircraft.

13.6.2 Technical Appendix 13.3 shows the range of wind conditions experienced during the noise survey period. During the quiet daytime and night-time periods a good spread of data was obtained up to wind

speeds of 10 m/s. The wind was observed to be directed from the south-west for the majority of the survey period, consistent with the typical prevailing wind direction for the UK.

13.6.3 Technical Appendix 13.3 also shows the results of the background noise measurements at each of the three survey locations. The background noise data is presented in terms of $L_{A90,10min}$ background noise levels plotted as a function of standardised wind speed. Two graphs are shown for each location, one for quiet daytime periods and the other for night-time periods, both derived in accordance with ETSU-R-97.

13.6.4 Background noise data measured at Menzion Farm and Oliver House showed no evidence of wind turbine noise. When data were excluded during the downwind sector of the nearby operational wind turbines, as detailed in Table 13.8, the resulting prevailing background noise level showed a slight increase when compared to the level with these data were included. Therefore, as a worst case there were no directional data exclusions at these locations.

13.6.5 Similarly, the background noise data measured at Hopehead did not show any evidence of wind turbine noise. However, during the visits to this location only, noise from the wind turbines within Glenkerie Wind Farm was observed at a low level when all other noise sources were suppressed. Furthermore, the predicted immission levels from Glenkerie Wind Farm at this location exceeded 30 dB L_{A90} at higher wind speeds, increasing the likelihood of their contribution to the overall measured background noise levels. Therefore, as a precaution data measured during conditions when downwind of Glenkerie Wind Farm were excluded. Data measured when downwind of Clyde Wind Farm Extension were not excluded as it was not audible and predicted levels from this wind farm were much lower at this location.

13.6.6 The background noise survey was conducted during a time of year when in the UK dawn chorus noise can be pronounced. Evidence was found that the measured night-time prevailing background noise levels were elevated during the early morning period. Therefore, data measured during the period between 04:00 hours and 07:00 hours has been excluded from all the locations as a precautionary worst case.

13.6.7 ETSU-R-97 requires that any data affected by rainfall be excluded from the analysis. The rain gauge installed during the noise survey period was used to exclude those periods where rain was indicated.

13.6.8 In addition to the impact noise on surrounding vegetation and the sound level meter itself, in some environments rainfall can result in appreciable changes in background sound levels, for example as a result of wet roads which increase tyre noise emissions or dissipating flow noise in watercourses and drainage systems. The monitoring locations were also positioned as far as practically possible from any residential drainage systems, and water courses to minimise any associated noise influence. Based on the above, rainfall is considered to have a limited effect on background sound levels. A period of 30 minutes after rainfall was recorded to stop was also excluded to minimise any further atypical levels of elevated background due to these effects.

13.6.9 The measured background noise data may also have been increased by other extraneous sources or atypical events. Time histories of the noise levels at each survey location were therefore inspected to look for any atypical relationships when compared to the wind speeds present during that time. Any elevated levels found in this way were excluded. The trend of the data when plotted against wind speed was also inspected to look for atypical relationships or outliers within the dataset (particularly at low wind speeds) which were excluded. Any data removed from the analysis in this way is indicated on the graphs included in Technical Appendix 13.3 as red squares. The analysis and filtering of the data was therefore undertaken in accordance with current good practice as set out in the IOA GPG.

13.6.10 The current soundscape at NSRs located around the site was noted to be typical for a rural environment, described by a mixed of natural sounds such as wind induced vegetation, birdsong and animal activity together with occasional distant aircraft and localised sources from human activity and distant or local road traffic.

13.6.11 For the case of Hopehead only, and in addition to the above observations, wind turbine noise was very faintly audible when all other noises were supressed. Additionally, if stood south of the Hopehead building, watercourse noise was audible from Coomb Burn that flows to within approximately 30 m of the building. No watercourse noise was audible at the measurement location which was north of Hopehead building and approximately 75 m from the Coomb Burn.

13.6.12 Following removal of extraneous data points, as described above, best fit lines were generated using a polynomial fit of a maximum of 4th order, as summarised in Table 13.13 and Table 13.14, for the quiet daytime and night-time respectively. As advised above, background noise data was measured during windspeed of up to 10 m/s, so data is provided in Table 13.13 and Table 13.14 up to this value. For locations where data is limited at higher wind speeds, the background noise level for the highest included wind speed has been used to inform the noise limit at this point and all wind speeds above. The use of such data caps is in accordance with the GPG.

Table 13.13 – Quiet Daytime Measured Background Noise Levels

Survey Location	Background Noise Level, dB L_{A90}, for Standardised Wind Speed, m/s						
	4	5	6	7	8	9	10
NML1 Menzion Farm	32	33	35	36	38	40	42
NML2 Oliver House	33	34	36	37	38	40	42
MNL3 Hopehead	25	26	28	30	32	33	35

Table 13.14 – Night-time Measured Background Noise Levels

Survey Location	Background Noise Level, dB L_{A90}, for Standardised Wind Speed, m/s						
	4	5	6	7	8	9	10
NML1 Menzion Farm	29	30	31	33	34	35	37
NML2 Oliver House	31	31	32	32	33	34	34
MNL3 Hopehead	25	26	27	27	28	29	29

13.6.13 The overall ETSU-R-97 noise limits used in the assessment of the Proposed Development at the NSRs are set out in the Table 13.15 for the quiet daytime and Table 13.16 for the night-time periods. As discussed in paragraphs 13.5.30 to 13.5.32 the fixed portion of the limit is set to 40 dB L_{A90} during the day and 43 dB L_{A90} during the night-time at all occupied dwellings, and for Hopehead, the fixed portion of the limit is set to 43 dB L_{A90} for both the day and night-time. All windspeeds are standardised values.

13.6.14 In addition to the three 2023 measurement locations discussed in this chapter, noise limits have been set at three further NSRs as part of the Whitelaw Brae Wind Farm planning consent: NSR11 Glenbreck, NSR12 Hawkshaw and NSR13 Craiglaw. For Glenbreck and Hawkshaw, the Whitelaw Brae Wind Farm consented noise limits relate to the overall ETSU-R-97 noise level from all wind turbines, which at the time of consent included Clyde Wind Farm and Clyde Wind Farm Extension. The consented noise limits at Craiglaw relate to Whitelaw Brae Wind Farm only. Table 13.15 and Table 13.16 show the overall ETSU-R-97 noise limits for all locations; therefore, the limit at Craiglaw during the daytime has been set to the greater of 40 dB L_{A90} or the consented limit for Whitelaw Brae only.

Table 13.15 – Daytime Overall ETSU-R-97 Noise Limits for Survey Locations

Survey Location	Overall ETSU-R-97 Noise Limit, dB L_{A90}, for Standardised Wind Speed, m/s						
	4	5	6	7	8	9	10
NML1 Menzion Farm	40	40	40	41	43	45	47
NML2 Oliver House	40	40	41	42	43	45	47
MNL3 Hopehead	43	43	43	43	43	43	43
Glenbreck	40	41	41	42	42	42	42
Hawkshaw	40	40	40	40	40	40	40
Craiglaw	40	40	40	42	43	44	44

Table 13.16 – Night-time Overall ETSU-R-97 Noise Limits for Survey Locations

Survey Location	Overall ETSU-R-97 Noise Limit, dB L_{A90}, for Standardised Wind Speed, m/s						
	4	5	6	7	8	9	10
NML1 Menzion Farm	43	43	43	43	43	43	43
NML2 Oliver House	43	43	43	43	43	43	43
MNL3 Hopehead	43	43	43	43	43	43	43
Glenbreck	43	43	43	43	43	43	43
Hawkshaw	43	43	43	43	43	43	43
Craiglaw	43	43	43	43	45	48	48

13.7 Standard Mitigation

13.7.1 Noise levels were calculated for progressive configurations of the Proposed Development and compared against the derived noise limits. Advice was provided to the design team, including confirmation that noise levels for the final layout complied with the ETSU-R-97 criteria, mainly due to the large separation distances involved.

13.7.2 In terms of operational noise generated by the Proposed Development, the turbine considered here includes for trailing edge serrations which have the effect of reducing source noise levels as compared with turbine blades which do not have such modifications. Turbines of the size and scale considered for the Proposed Development typically include this feature as a matter of course, and it is expected that the actual turbine for potential installation as the site, should planning consent be granted, will have similar blade modifications. Nevertheless, noise associated with the operation of the Proposed Development will be required to meet any consented (planning condition) noise limits in this respect, regardless of the specific design of turbine, and appropriate due diligence and/or further planning submissions will be required to ensure that this is the case.

13.7.3 To reduce the potential impacts of construction noise, the following good practice measures are proposed and where appropriate are to be included in the Construction Environmental Management Plan (CEMP):

- Those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the site will be limited to the hours 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. Turbine deliveries will only take place outside these times with the prior consent of SBC and the Police. Those activities that are unlikely to give rise to noise audible at the site boundary will continue outside of the stated hours.
- All construction activities shall adhere to good practice as set out in BS 5228-1.
- All equipment will be maintained in good working order and any associated noise attenuation such as engine casing and exhaust silencers shall remain fitted at all times.
- Where flexibility exists, activities will be separated from residential neighbours by the maximum practicable distances.
- A site management regime will be developed to control the movement of vehicles to and from the Proposed Development site.
- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to restrict the duration of the higher magnitude levels.

13.7.4 If blasting is used at the proposed borrow pits, the following additional measures would also be implemented through the CEMP:

- blasting should take place under controlled conditions with the agreement of SBC;
- good practices during the setting and detonation of charge should be followed, in order to control air overpressure, in line with guidance set out in PAN50 and BS 5228-2; and
- vibration levels at the nearest sensitive properties are best controlled through on-site testing processes, with progressively increased charges, carried out in consultation with SBC. Ground vibration caused by blasting operations at the nearest sensitive locations, should not exceed 6 mm/s for 95 % of all blasts measured over any 6-month period, and no individual blast exceeding a PPV of 12 mm/s.

13.7.5 An outline CEMP is provided in Technical Appendix 3.1.

13.8 Receptors Brought Forward for Assessment

13.8.1 The selection of the NSRs is discussed from paragraph 13.5.3 and those included in the assessment are set out in Table 13.2. For each of these NSRs appropriate noise limits have been applied based on Table 13.15 and Table 13.16 for the daytime and night-time respectively. The use of the data in this way is justified by the comparable terrain and the dominant influence of natural sources on background noise levels throughout the area, particularly at increased wind speeds. This approach is consistent with the guidance provided by ETSU-R-97 and current good practice as set out in the IOA GPG.

13.8.2 Table 13.17 and Table 13.18 present the overall ETSU-R-97 noise limits for all the assessment locations. These limits apply to the total wind turbine noise from all wind farms and not just the Proposed Development.

Table 13.17 – Daytime Overall ETSU-R-97 Noise Limits for Assessment Locations

Assessment Location	Overall ETSU-R-97 Noise Limit, dB L_{A90}, for Standardised Wind Speed, m/s						
	4	5	6	7	8	9	10
NSR01 Menzion Farm	40	40	40	41	43	45	47
NSR02 Oliver Farm	40	40	41	42	43	45	47
NSR03 Oliver Bank	40	40	41	42	43	45	47
NSR04 The Toll House	40	40	41	42	43	45	47
NSR05 Lilybank	40	40	40	41	43	45	47
NSR06 Oliver House	40	40	41	42	43	45	47
NSR07 The Bield	40	40	41	42	43	45	47
NSR08 Riverview	40	40	41	42	43	45	47
NSR09 Tweedholm Cottage	40	40	41	42	43	45	47
NSR10 Carngorm	40	40	41	42	43	45	47
NSR11 Glenbreck	40	41	41	42	42	42	42
NSR12 Hawkshaw	40	40	40	40	40	40	40
NSR13 Craiglaw	40	40	40	42	43	44	44
NSR14 Hopehead	43	43	43	43	43	43	43

Table 13.18 – Night-time Overall ETSU-R-97 Noise Limits for Assessment Locations

Assessment Location	Overall ETSU-R-97 Noise Limit, dB L_{A90}, for Standardised Wind Speed, m/s						
	4	5	6	7	8	9	10
NSR01 Menzion Farm	43	43	43	43	43	43	43
NSR02 Oliver Farm	43	43	43	43	43	43	43
NSR03 Oliver Bank	43	43	43	43	43	43	43
NSR04 The Toll House	43	43	43	43	43	43	43
NSR05 Lilybank	43	43	43	43	43	43	43
NSR06 Oliver House	43	43	43	43	43	43	43
NSR07 The Bield	43	43	43	43	43	43	43
NSR08 Riverview	43	43	43	43	43	43	43
NSR09 Tweedholm Cottage	43	43	43	43	43	43	43
NSR10 Carngorm	43	43	43	43	43	43	43
NSR11 Glenbreck	43	43	43	43	43	43	43
NSR12 Hawkshaw	43	43	43	43	43	43	43
NSR13 Craiglaw	43	43	43	43	45	48	48
NSR14 Hopehead	43	43	43	43	43	43	43

13.9 Potential Effects

Construction

13.9.1 Table 13.19 sets out the predicted construction noise levels at the NSR situated closest to each of the construction tasks. It must be emphasised that these predictions only relate to the noise level occurring during the time when the activity is closest to the referenced property. In many cases the separating distances will be considerably greater for the majority of the construction period and the predictions are therefore the worst-case periods of the construction phase.

Table 13.19 – Predicted Construction Noise Levels

Task	Nearest NSR	Minimum distance to nearest NSR, m	Predicted upper construction noise level, dB L_{Aeq}
Construct temporary site compound	NSR12 Hawkshaw	890	48
Construct site tracks	NSR02 Oliver Farm	740	49
Construct substation	NSR12 Hawkshaw	890	42
Construct crane hard standings	NSR01 Menzion Farm	1020	44
Construct turbine foundations	NSR01 Menzion Farm	1020	49
Erect turbines	NSR01 Menzion Farm	1020	49
Reinstate crane bases	NSR01 Menzion Farm	1020	41
Borrow pit quarrying	NSR01 Menzion Farm	920	56
Forestry felling	NSR02 Oliver Farm	740	43

13.9.2 The predicted worst case construction noise level from borrow pit quarrying is 56 dB L_{Aeq} at NSR01 Menzion Farm. This is based on the shortest distance to the closest proposed borrow pit, A. If plant is located at this shortest distance for a period of less than four weeks this would equate to a negligible impact (Table 13.9). If continued extraction and rock processing is assumed at borrow pit A for a period of four weeks or longer, there would be a low impact at NSR01. All other construction noise impacts would be of negligible magnitude.

13.9.3 A low magnitude of impact at a high sensitive receptor equates to an adverse effect of **minor** significance.

13.9.4 In addition to on-site activities, construction traffic passing to and from the site will also represent a potential source of noise to surrounding properties. Traffic flow data, as reported in Chapter 12, has been used to confirm the likely type and number of vehicles using the nearby roads for cases with and without construction traffic, as summarised in Table 13.20.

Table 13.20 – Changes in Road Traffic Noise Due to Construction Vehicles

Link	2029 Baseline (no construction)			2029 with construction traffic			Change in BNL, dB
	Total Traffic	% HGV	BNL, dB	Total Traffic	% HGV	BNL, dB	
A701, Broughton	1349	9.4	58.7	1378	10.9	59.2	0.5
A701, Site Access	1069	9.6	60.8	1133	12.0	61.6	0.8
A701, north-west of Moffat	1386	7.3	62.5	1421	7.8	62.7	0.3
A701, south-west of Moffat	6719	4.8	66.3	6748	4.9	66.3	0.1
A74(M), near Newton Wamphray NB	17962	33.4	78.2	17970	33.4	78.2	0.0
A74(M), near Newton Wamphray SB	17947	32.8	78.2	17956	32.8	78.2	0.0
A74(M), south of Crawford NB	19086	32.9	78.5	19093	32.9	78.5	0.0
A74(M), south of Crawford SB	19075	32.2	78.4	19080	32.2	78.4	0.0

13.9.5 A maximum predicted increase of 0.8 dB in road traffic noise is predicted during the busiest month for the number of construction vehicles. This would equate to a negligible impact (Table 13.10).

13.9.6 A negligible magnitude of impact at a high sensitive receptor equates to an effect of negligible significance.

Operation

13.9.7 ETSU-R-97 requires consideration of cumulative wind turbine noise levels when assessing against appropriate noise limits. Table 13.21 presents the total wind turbine noise immission levels of the Proposed Development with the wind farms listed in Table 13.7, calculated at each of the NSRs for the given standardised wind speed range 4 m/s to 12 m/s. The results include 2 dB uncertainty added to all wind turbine emission levels and a further uplift, as specified in Table 13.7, added to neighbouring wind farms to allow for an increase to the calculated noise immission levels should the respective planning condition permit. Further detail about the calculated noise immission levels from each neighbouring wind farm is provided in Technical Appendix 13.4.

Table 13.21 – Overall Wind Turbine Noise Immission Levels

Assessment Location	Overall Wind Turbine Noise Immission, dB L_{A90}, for Standardised Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
NSR01 Menzion Farm	30	34	38	39	40	40	40	40	40
NSR02 Oliver Farm	30	33	37	38	38	39	39	39	39
NSR03 Oliver Bank	29	32	36	37	38	38	38	38	38
NSR04 The Toll House	29	32	36	37	37	38	38	38	38
NSR05 Lilybank	28	31	35	36	36	37	37	37	37
NSR06 Oliver House	29	32	35	36	36	36	37	37	37
NSR07 The Bield	28	31	34	35	36	36	36	36	36
NSR08 Riverview	28	31	34	35	35	36	36	36	36
NSR09 Tweedholm Cottage	28	31	34	35	35	36	36	36	36
NSR10 Carngorm	28	31	34	35	35	35	36	36	36
NSR11 Glenbreck	30	34	38	40	40	40	40	40	40
NSR12 Hawkshaw	29	34	38	39	40	40	40	40	40
NSR13 Craiglaw	28	32	36	38	38	38	38	38	38
NSR14 Hopehead	35	37	39	40	41	41	41	41	41

13.9.8 When comparing the overall wind turbine noise emission level (Table 13.21) with the ETSU-R-97 noise limits for the daytime (Table 13.17) and night-time (Table 13.18) in can be seen that the immission level does not exceed the limit for any receptor or any wind speed. As the ETSU-R-97 noise limits are not exceeded, operational noise effects are considered to be not significant (as per paragraph 13.5.48). For those dwellings located further away, operational wind turbine noise from the Proposed Development would be of negligible impact and therefore also be not significant.

Substation and BESS

13.9.9 Operational noise from the substation and BESS for the Proposed Development at the nearest NSR, NSR12 Hawkshaw, is calculated to be 22 dB. When including a potential +2 dB penalty for the character of the noise, the resulting 'rating level' would be of 24 dB. Background noise measurements were measured at Hawkshaw for Whitelaw Brae Wind Farm EIA. The lowest typical background noise at this location was reported to be 23 dB at low wind speeds during the night-time[4]. When assessed against the criteria derived in Table 13.11, this would correspond to a low noise impact on a highly sensitive receptor, and therefore result in a **minor** effect which is not significant.

Decommissioning

13.9.10 Upon decommissioning of the Proposed Development, the wind turbines would be disassembled and all above ground components would be separated and removed off-site for reuse or recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. These activities would be undertaken during daytime hours, and noise, which would be of a lesser impact than for construction, will be controlled through the relevant guidance and standards in place at the time of decommissioning. There would be no borrow pit activity associated with the decommissioning phase; therefore, as all other construction noise impacts would be negligible and not significant, decommissioning noise would also be not significant.

13.9.11 Site access tracks could be in use for purposes other than the operation of the proposed development by the time the decommissioning of the Proposed Development is to be considered, and therefore it may be more appropriate to leave the site access tracks in situ for future use. If the tracks were not required in the future for any other useful purpose, they could be removed where required. This would involve removing hard core material and placement of topsoil. The impact is expected to be less than that during the construction stage and therefore negligible.

13.9.12 It is proposed that the underground cable will be cut back and it will remain in-situ. The works associated with the cutting back of the underground cable will have a negligible noise impact.

13.9.13 All decommissioning activities would therefore be of negligible impact, which upon a high sensitive receptor equates to an effect of **negligible** significance.

13.10 Additional Mitigation and Enhancement

13.10.1 The construction noise impacts have been predicted accounting for standard mitigation specified in paragraph 13.7.3. As confirmed in paragraph 13.9.3, the predicted impacts correspond to a temporary minor adverse effect. Therefore, no additional mitigation will be required during this phase.

13.10.2 Cumulative operational noise levels associated with the Proposed Development operating at the same time as the other wind energy developments listed in Table 13.7 will meet the requirements of ETSU-R-97. Planning condition noise limits will be imposed on the Proposed Development, which take into account the other wind energy developments, such that overall noise levels will not breach the overall requirements of ETSU-R-97. Satisfactory control of cumulative noise immission levels would be achieved through enforcement of the individual consent limits for each of the individual wind farms. For the Proposed Development, the site specific noise limits are set out in Table 13.22. These limits have been derived from the remainder of the overall ETSU-R-97 noise limits when the uplifted total noise from all other wind energy developments (as listed in Table 13.7) is subtracted from the lower of the daytime and night-time noise limits.

Table 13.22 – Site Specific Noise Limits for the Proposed Development Only

Assessment Location	Overall Wind Turbine Noise Immission, dB L_{A90}, for Standardised Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
NSR01 Menzion Farm	39	39	39	41	43	43	43	43	43
NSR02 Oliver Farm	40	40	40	41	43	43	43	43	43
NSR03 Oliver Bank	40	40	40	41	43	43	43	43	43
NSR04 The Toll House	40	40	40	41	43	43	43	43	43
NSR05 Lilybank	40	39	39	41	43	43	43	43	43
NSR06 Oliver House	40	40	40	41	43	43	43	43	43
NSR07 The Bield	40	40	40	41	43	43	43	43	43
NSR08 Riverview	40	40	40	42	43	43	43	43	43
NSR09 Tweedholm Cottage	40	40	40	41	43	43	43	43	43
NSR10 Carngorm	40	40	40	42	43	43	43	43	43
NSR11 Glenbreck	38	38	38	38	38	38	38	38	38
NSR12 Hawkshaw	36	36	36	36	36	36	36	36	36
NSR13 Craiglaw	38	38	38	40	42	43	43	43	43
NSR14 Hopehead	41	41	41	41	41	41	41	41	41

[4] Table 11.5, Chapter 11, Whitelaw Brae Wind Farm EIA Report 15/00020/S36

13.11 Residual Effects

Construction

13.11.1 As discussed above, noise resulting from the construction of the Proposed Development is expected to meet typical noise limits for activities of this type without any specific mitigation being required, corresponding to a temporary **minor** adverse effect. As a result, the residual effect remains as not significant.

Operation

13.11.2 The operational noise assessment indicates that predicted turbine noise levels, based on the installation of an appropriate candidate turbine, can meet the requirements of ETSU-R-97 without the requirement for mitigation/curtailment. Appropriate control measures can be put in place through the imposition of planning conditions which will enforce this in practice.

13.11.3 At some locations, under some wind conditions and for a certain proportion of the time, the wind farm noise may be audible, which represents an adverse noise effect. However, the noise effect associated with the operation of the Proposed Development is considered to be not significant.

13.11.4 The operational noise assessment of the substation and BESS confirms there would be a **minor** adverse effect which would not be significant.

13.12 Cumulative Assessment

13.12.1 There is a possibility that the construction programme for Glenkerie Wind Farm Extension and the Proposed Development could overlap. Further consideration has been given to the potential cumulative impacts. The only NSR situated between these two developments is NSR14 Hopehead. The construction noise impacts from the Proposed Development alone are summarised in Table 13.23, using the method set out in paragraph 13.5.13. It should be noted that the intervening ridgeline situated between NSR14 and the Proposed Development would in practice offer significant screening to the majority of construction noise; however as a worst case, no screening is included.

Table 13.23 – Predicted Construction Noise Levels – NSR14 Hopehead, Proposed Development only

Task	Minimum distance to NSR14, m	Predicted upper construction noise level, dB L_{Aeq}
Construct temporary site compound	2360	38
Construct site tracks	1130	45
Construct substation	2360	32
Construct crane hard standings	1050	44
Construct turbine foundations	1050	49
Erect turbines	1050	49
Reinstate crane bases	1050	40
Borrow pit quarrying	1280	53
Forestry felling	920	41

13.12.2 The noise generated during the construction of Glenkerie Wind Farm Extension is likely to be comparable to the Proposed Development. However, as NSR14's nearest turbine to Glenkerie Wind Farm Extension is just over 1.7 km, compared to just over 1 km for the Proposed Development, the construction noise levels experienced at NSR14 would be lower for Glenkerie Wind Farm Extension than those predicted for the Proposed Development.

13.12.3 Table 13.23 confirms the highest predicted noise level during the construction of the Proposed Development is 53 dB during borrow pit quarrying. This assumes the operation of Borrow Pit C, which is closest to NSR14, this level reduces when Borrow Pit A or Borrow Pit B are in use. Assuming a simplistic worst case that Glenkerie Wind Farm Extension produces the same level of noise at NSR14 at the same time as Borrow Pit C quarrying works at the Proposed Development, the cumulative construction noise would be 56 dB. If this level of cumulative noise is sustained for a worst-case period of four weeks or more, then this equates to a low impact (see Table 13.9), upon a medium sensitive receptor giving a temporary **minor** adverse effect, which is not significant.

13.12.4 There are no other known construction projects that will result in any additional noise being received at neighbouring properties during the potential construction phase of the Proposed Development.

13.12.5 Cumulative operational noise effects are considered as an inherent part of the assessment methodology. Cumulative operational noise effects from the turbines when operating alongside other relevant wind energy developments in the area, as listed in Table 13.7, has been incorporated into the assessment of the Proposed Development set out above. It was concluded that the cumulative operational noise levels at residential properties remain acceptable in line with ETSU-R-97 and are therefore not significant.

13.13 Summary

13.13.1 This chapter has presented an assessment of the impacts of construction and operational noise from the Proposed Development on the residents of nearby dwellings.

13.13.2 Several residential properties have been selected as being representative of the closest located properties to the Proposed Development. Noise assessments have been undertaken at these properties by comparing predicted construction and operational noise levels with relevant assessment criteria. In the case of construction noise, relevant assessment criteria are in the form of absolute limit values derived from a range of environmental noise guidance. In relation to operational noise, the limits have been derived from the existing background noise levels at three surrounding properties, as derived from measurements made over approximately four weeks at each location.

13.13.3 The construction noise assessment has determined that associated levels are expected to be audible at various times throughout the construction programme but remain within acceptable limits such that their temporary impacts are considered of **minor** significant effect.

13.13.4 Operational noise from the wind farm has been assessed in accordance with the methodology set out in ETSU R 97, 'The Assessment and Rating of Noise from Wind Farms'. This document provides a robust basis for assessing the operational noise of a wind farm as recommended by Scottish planning policy. The assessment process set out in ETSU-R-97 includes cumulative operational noise from other wind energy developments in the area. The assessment of operational noise includes Clyde and Extension Wind Farm, Glenkerie and Extension Wind Farm, Grayside Wind Farm and Whitelaw Brae Wind Farm.

13.13.5 It has been demonstrated that both the daytime and night-time noise limits can be satisfied at all assessment properties across all wind speeds. This assessment has been based on the use of the manufacturer's warranted sound power data for the Vestas V162 7.2 MW wind turbine which is typical of the type and size of turbine which may be considered for this site, and assuming worst case downwind propagation.

13.13.6 In summary, the overall levels of construction noise are considered to represent a **minor** significant effect. At some locations under some wind conditions and for a certain proportion of the time, the Proposed Development noise may be audible; however, operational noise immission levels comply with the criteria of the guidance commended by planning policy for the assessment of wind farm noise. Operational noise from the substation and BESS are considered to represent a **minor** significant effect.

13.14 References

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