VOLUME 2 – CHAPTER 14: NOISE AND VIBRATION

CONTENTS

14. NOISE AND VIBRATION

14.1 Introduction

14.1.1 This chapter considers the potential effects of the proposed Hurlie 400 kV substation on noise and vibration. The assessment includes the potential effects upon on noise sensitive receptors (NSRs) during both the construction and operation of the Proposed Development. The evaluation of the baseline has been made through a combination of desk-based study, field survey and consultation.

14.1.2 The specific objectives of the study are as follows:

- Identify the NSRs in the vicinity of the Proposed Development;
- Describe how consultation has informed the scope of the assessment;
- Describe the assessment methodology and significance criteria used in the assessment;
- Describe and define the baseline noise environment;
- Identify the dominant sound sources associated with the operation and construction of the Proposed Development;
- Calculate and assess the potential direct and indirect impacts on NSRs; and
- Indicate any requirements for mitigation measures, if applicable, to provide sufficient levels of protection for all NSRs.

14.1.3 This chapter presents information relevant to the Hurlie 400 kV substation. It should be read in conjunction with **Chapter 3: Description of the Proposed Development** (**Volume 2**) of the EIA Report for full details of the Proposed Development and **Chapter 13: Traffic and Transport**.

14.1.4 This chapter is necessarily technical in nature; a glossary of acoustic terminology is included in **Appendix 14.1: Acoustic Glossary**.

14.1.5 Additional information which supports this chapter is presented in the following appendices:

- Appendix 14.2 Calibration Certificates;
- Appendix 14.3 Baseline Noise Monitoring; and
- Appendix 14.4 Construction Noise Impact Assessment.

14.1.6 The following terminology will be referred to throughout this chapter:

- Site: all land within the planning application (red line) boundary (**Figure 1.1: Site Location**); and
- Proposed Development: The infrastructure including the platform, bays, control buildings, access tracks, drainage and landscape features and temporary construction compounds (see Section 3.3 in **Chapter 3: Description of the Proposed Development**);

14.2 Scope of the Assessment

Effects Assessed in Full

14.2.1 The EIA Scoping process, baseline conditions and professional judgement has identified the following direct, indirect and cumulative effects for detailed assessment:

- Direct effects during construction on noise;
- Direct effects from construction traffic on noise and vibration;
- Direct effects during operation on noise;
- Indirect effects during operation on noise and vibration;
- Cumulative effects during construction on noise; and
- Cumulative effects during operation on noise.

14.2.2 The assessment scenarios used in this assessment are the fully operational Proposed Development and when construction traffic on local roads is at its peak.

Effects Scoped Out

14.2.3 On the basis of the desk-based work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following effects have been 'scoped out' of detailed assessment, as proposed in the EIA Scoping Report and confirmed in the Scoping Opinion issued by Aberdeenshire Council (**Appendix 6.2: Scoping Opinion**).

- Noise from operational maintenance; and
- Operational vibration.

14.2.4 Operational maintenance works (**Section 3.11: Future Maintenance of the Substation**) required will be short-term and intermittent and are not expected to give rise to significant effects relating to noise and vibration. Therefore, noise from operational maintenance is not expected to adversely impact NSRs and has not been assessed further.

14.2.5 There are no known vibrational issues associated with the operation of the Proposed Development at nearby NSRs. Therefore, vibration due to operation is not expected to adversely impact NSRs and has not been assessed further.

Study Area

14.2.6 The Study Area is an area extending 1,500 m from the Site for which all desk-based and field data were gathered to inform the assessment presented in this chapter.

14.2.7 The Study Area around the Site is semi- rural in nature, predominantly consisting of forestry and agricultural land, but with a small number of residential properties located in all directions surrounding the Proposed Development. There is existing electrical infrastructure consisting of Fetteresso Substation.

14.2.8 Potential NSRs comprise inhabited premises where humans may experience the effects scoped into the assessment. The nearest groups of residential NSRs are isolated properties to the north and east of the Site around Mergie. Other NSR clusters isolated properties are located to the south and southeast of the Site.

14.3 Assessment Methodology

Legislation, Policy and Guidance

Legislation

14.3.1 The following legislation, policy and guidance documents of relevance have been considered in undertaken the assessment of effects of noise from the Proposed Development:

- The Control of Pollution Act, 1974 (COPA) - Section 60 of the Control of Pollution Act enables Local Authority officers to serve a notice in respect of noise nuisance from construction works, instructing the contractor to minimise nuisance to neighbouring properties through specific conditions. Section 61 of the Control of Pollution Act provides a method by which a contractor can apply to the Local Authority for prior consent to undertake construction works in advance of their commencement. If consent is given, the application is exempt from any enforcement action under Section 60 of the same act.
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

Policy

14.3.2 The following policies of relevance to the assessment have been considered:

Planning Advice Note (PAN) 1/2011: 'Planning and Noise[1]

14.3.3 Published in March 2011, PAN 1/2011 provides advice on the role of the planning system in helping to prevent and limit adverse effects of noise (Scottish Government, 2011). Information and advice on noise assessment methods are

[1] Planning Advice Note: Planning and noise (PAN 1/2011, The Scottish Government, 2011

provided in the accompanying Technical Advice Note (TAN): Assessment of Noise. Included within the PAN document and the accompanying TAN are details of the legislation, technical standards, and codes of practice for specific noise issues.

14.3.4 Neither PAN 1/2011 nor the associated TAN provides 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 British Standard (BS) 4142:1997: Method for rating industrial noise affecting mixed residential and industrial areas. In 2014, BS4142:1997 was replaced with BS4142:2014: Methods for rating and assessing industrial and commercial sound.

Guidance

14.3.5 This assessment is carried out in accordance with the principles contained within the following documents.

British Standard 5228-1:2009 +A1:2014 (BS5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites[2]

14.3.6 Guidance on the prediction and assessment of noise and vibration from construction sites is provided in BS5228 2009 +A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise. BS5228-1 provides recommended limits for noise from construction sites.

14.3.7 The construction noise impact assessment (CNIA) will be carried out according to the ABC method specified in Table E.1 of BS5228-1, in which NSRs are classified in categories A, B or C according to their measured or estimated background noise level.

14.3.8 Traffic noise due to heavy goods vehicles on haul roads will be considered as part of the construction noise impact assessment.

14.3.9 Part 2: Vibration. BS5228-2 provides recommended limits for vibration from construction sites. The construction vibration impact assessment (CVIA) will be carried out against the guidance on effects of vibration levels specified in Table B.1 of BS5228-2. The level of vibration ranging from 0.14 $mm.s^{-1}$ to 10 $mm.s^{-1}$ indicates where vibration may be perceptible however acceptable, or intolerable.

British Standard 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound (BS4142)[3]

14.3.10 British Standard 4142 describes methods for rating and assessing the following:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

14.3.11 The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

14.3.12 The specific sound level of the noise source being assessed is corrected, by the application of corrections for acoustic features. The British Standard effectively compares and rates the difference between the rating level and the typical background sound level in the absence of the noise source being assessed.

14.3.13 The British Standard advises that the time interval, *T*, of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) when the noise source in question is likely to operate or is proposed to operate in the future.

[2] British Standard 5228: Code of practice for noise and vibration control on construction and open sites (BS 5228), BSI, 2009, amended 2014

[3] British Standard 4142: Methods for rating and assessing industrial and commercial sound (BS 4142), BSI, 2014, Amended 2019

14.3.14 Comparing the rating level with the background sound level, BS4142 states:

- *"Typically, the greater this difference, the greater the magnitude of impact.*
- *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."

14.3.15 BS4142 places a strong emphasis on context when considering any assessment outcome. Section 11 states 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."* The standard does not specify thresholds below which background sound and rating levels should be considered low. However, the Association of Noise Consultants guidelines for the use of BS4142 states:

"BS4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS4142 defined very low background sound levels as being less than about 30 dB LA90, and low rating levels as being less than about 35 dB Lar."

ISO 9613-2:2024, Acoustics — Attenuation of sound during propagation outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors

14.3.16 This document specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level (as described in ISO 1996-series) under meteorological conditions favourable to propagation from sources of known sound emission.

14.3.17 The operational noise impact assessment will be based on a 3D digital model of the Proposed Development and Study Area to industry standard in in accordance with ISO 9613-2.

BS 8233:2014[4] and Noise Rating Curves

14.3.18 British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings provides guidance for the control of noise in and around buildings. The guidance provided within BS8233:2014 is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

14.3.19 British Standard 8233:2014 includes appropriate internal and external noise level criteria which are applicable to dwellings exposed to steady-state external noise sources. It is stated in BS8233:2014 that it is desirable for internal ambient noise level not to exceed the criteria which are set out in **Table 14: Summary of Internal Ambient Noise Level Criteria for Dwellings from BS 8233:2014.**

Table 14.14-1: Summary of Internal Ambient Noise Level Criteria for Dwellings from BS 8233:2014

Activity	Location	07:00 to 23:00 Hours, i.e. Daytime	23:00 to 07:00 Hours, i.e. Nighttime
Resting	Living Room	35 dB LAeq,16 hour	-
Dining	Dining Room/Area	40 dB LAeq,16 hour	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq,16 hour	30 dB LAeq,8 hour

14.3.20 Noise Rating (NR) curves were developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance.

[4] British Standard 8233: Guidance on sound insulation and noise reduction for buildings (BS 8233), BSI, 2014

14.3.21 The noise rating curves for different sound pressure levels are plotted as acceptable sound pressure levels at different frequencies. Acceptable sound pressure level varies with the room and the use of it. Different curves are obtained for each type of use. Each curve is referenced by a NR number as set out in **Table 14.14-2: Noise Rating Descriptions**.

Table 14.14-2: Noise Rating Descriptions

Noise Rating	Application
NR 20	Quiet rural area for protection of amenity
NR 25	Concert halls, broadcasting and recording studios, churches
NR 30	Private dwellings, hospitals, theatres, cinemas, conference rooms
NR 35	Libraries, museums, court rooms, schools, hospitals operating theatres and wards, flats, hotels, executive offices
NR 40	Halls, corridors, cloakrooms, restaurants, night clubs, offices, shops
NR 45	Department stores, supermarkets, canteens, general offices
NR 50	Typing pools, offices with business machines
NR 60	Light engineering works
NR 70	Foundries, heavy engineering works

14.3.22 The NR curve NR 20 equates to a similar total noise level of 30 dB(A), and therefore is an appropriate consideration in respect to indoor noise levels as specified in BS8233:2014.

NANR116 – Open/closed window research: sound insulation through ventilated domestic windows

14.3.23 The insulation of an open window has been generally accepted as being 10-15 dBA although its precision and effect on opening style, open area and window size, are not readily available. A programme of laboratory measurements has been undertaken by the Building Performance Centre at Napier University on behalf of the Department for Environment, Food and Rural Affairs, in order to quantify the sound insulation provided by a variety of window types, opening styles, areas of opening and ventilator devices.

Design Manual for Roads and Bridges LA 111 Noise and Vibration

14.3.24 Ground borne vibration can result from construction works and may lead to perceptible levels of vibration within nearby properties, which can at higher levels cause annoyance to residents. In extreme cases, cosmetic or structural building damage can occur; however, the levels of vibration required for such an impact are very rare.

14.3.25 The Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration document provides guidelines for the assessment and management of noise and vibration impacts associated with road projects. The guidance sets out the requirements for assessing noise and vibration impacts from road schemes, ensuring that these impacts are identified, quantified, and managed appropriately.

Road Research Laboratory (TRL) Research Report 246 – Traffic Induced Vibrations in Buildings

14.3.26 This report summarises studies of the effects of these vibrations on people, buildings and equipment and includes results from other relevant investigations. The first section describes the nature of the problem as revealed by questionnaire surveys and details the methods for predicting the degree of disturbance likely to be caused by both airborne and ground-borne vibrations. The effects of vibration on sensitive equipment and critical tasks are also considered. The second section reports on a number of investigations into the effects of traffic vibration on buildings. Studies included a fatigue test on a vacant property, comparisons of structural defects in houses exposed to high levels of vibration with similar properties exposed to relatively low levels, and case studies of heritage buildings adjacent to heavily trafficked roads. It is concluded that although traffic vibration can cause nuisance to occupants there is no evidence to support the assertion that traffic vibration can also cause significant damage to buildings.

Calculation of road Traffic Noise (CRTN) 1988

14.3.27 The CRTN memorandum describes the standard UK procedure for the measurement and calculation of road traffic noise. According to the memorandum, the procedures are necessary 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 e.g. environmental appraisal of road schemes, highway design and land use planning.

TGN (E) 322 – Operational Audible Noise Assessment Process for Overhead Lines (OHL).

14.3.28 National Grid has derived a procedure to assess the impact of OHL noise in both dry and rainy conditions – *TGN (E) 322 – Operational Audible Noise Assessment Process for Overhead Lines*.

14.3.29 The assessment procedure adopted here follows TGN (E) 322, and has been conducted in the following stages:

- the outcome of the Tier 1 assessment will determine whether the 'worst case' wet noise impact is predicted to be acceptable, or whether further assessment is required;
- the outcome of the Tier 2 assessment will determine whether the combined wet and dry noise impact is acceptable, or whether further assessment is required;
- the outcome of the Tier 3 assessment will determine whether the noise impact is acceptable, whether the noise needs to be mitigated and minimized or whether the noise is unacceptable; and
- the Tier 3 assessment takes account of existing background sound levels in the area and the influence of noise levels due to rainfall.

Construction Noise and Vibration

14.3.30 The methodology and detailed results of the construction noise impact assessment are presented in **Appendix 14.4: Construction Noise Impact Assessment.**

Consultation

14.3.31 In undertaking the assessment, consideration has been given to the consultation responses which has been undertaken as detailed in

14.3.32 Table 14-3: Summary of Consultation. A full summary of consultation is provided in

Table 14-3: Summary of Consultation.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Aberdeenshire Council 24 May 2024	Pre-Application Advice	The applicant may be requested to provide a methodology for a noise impact assessment to be agreed by the Environmental Health Service prior to the undertaking of a noise impact assessment for the application. Once any noise impact assessment has been submitted, it will be subject to review by the Environmental Health Service to consider the potential impact of The Proposed Development on nearby receptors. Only then, will suitable planning conditions be considered. Construction Noise -the matter of Construction Noise is usually sufficiently controlled through adherence to practical and specific measures within a	Methodology of the assessment with be provided prior to assessment.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		Construction Environment Management Plan (CEMP). A Construction Noise Impact Assessment is unlikely to be required but remains an option for major projects where construction noise is likely to be a major concern. Such assessment should adhere to BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration control on Construction and Open Sites. Where essential and unavoidable out-of-hours works present a risk of noise emissions and disturbance outside of the accepted times they are subject to this Service's Out-of-Hours Work Request/application Protocol which is administered by the Planning Service who should be contacted for further details if required.	
Aberdeenshire Council 25 June 2024	Pre-Application Advice	The assessor outlined the standards and guidance used within the assessment were stated: • British Standard 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound (BS 4142) • Planning Advice Note (PAN) 1/2011: 'Planning and Noise' • National Grid Technical Report TR(E)564 (2021) – Development of a Method for Assessing the Impact of Noise from Overhead Lines (New Build, Reconductoring, Diversion and Uprating); • TGN(E)322 – Operational Audible Noise Assessment Process For Overhead Lines • British Standard 5228-1:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites The assumed noise criteria for the site was stated. • *Operational noise of the project does not result in over +4 dB excess above*	Aberdeenshire Council responded stating that to confirm that the methodology contained in the letter from LUC dated 13 June 2024 in respect of their proposed Noise Impact Assessment would meet the requirements of our service and should enable us to determine our response in respect of the noise impact of the proposed development.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		background in a BS 4142 assessment (including relevant penalties). • *Where background noise at night is low (below 30 dBA), an indoor noise rating of NR20 is to be achieved assuming propagation through a partially opened window.* • *Construction noise meets Category A requirements specified in in Table E.1 of BS5228-1* • *Construction vibration will be carried out against the guidance on effects of vibration levels specified in Table B.1 of BS5228-2.* The method and locations of baseline data collection were communicated.	
Aberdeenshire Community Consultation 10-13 June 2024	PAC2 Consultation	Community and Health Concerns Concerns over noise pollution were frequently mentioned during consultation, with respondents worried about the impact on local residents' living conditions. The potential for increased noise levels due to the substation and associated infrastructure developments is seen as detrimental to the quality of life and well-being of the community.	Noise has been assessed appropriately using standards and guidance and conservative methods.
Aberdeenshire Council 12 August 2024	Scoping Response	**Environment and Infrastructure Services – Environmental Health** has considered existing water supplies, noise and dust and is satisfied that having looked at the proposed methodologies contained in the Hurlie 400 kV Substation Scoping Report (**See Appendix 6.1**) that there should be sufficient information provided to make a Noise assessment.	Noise has been assessed appropriately using standards and guidance and conservative methods.
Aberdeenshire Council 11 September	Scoping Opinion	The council had no comment regarding Noise and is generally satisfied with the EIA approach and methodology.	Noise has been assessed appropriately using standards and guidance and conservative methods.

Desk Based Research and Data Sources

14.3.33 The following data sources have informed the assessment:

- Ordnance Survey OS Terrain 50 data – implementation into 3D operational noise model; and

- Ordnance Survey OS AddressBase.

Field Survey

14.3.34 The following field surveys were carried out to inform the assessment:

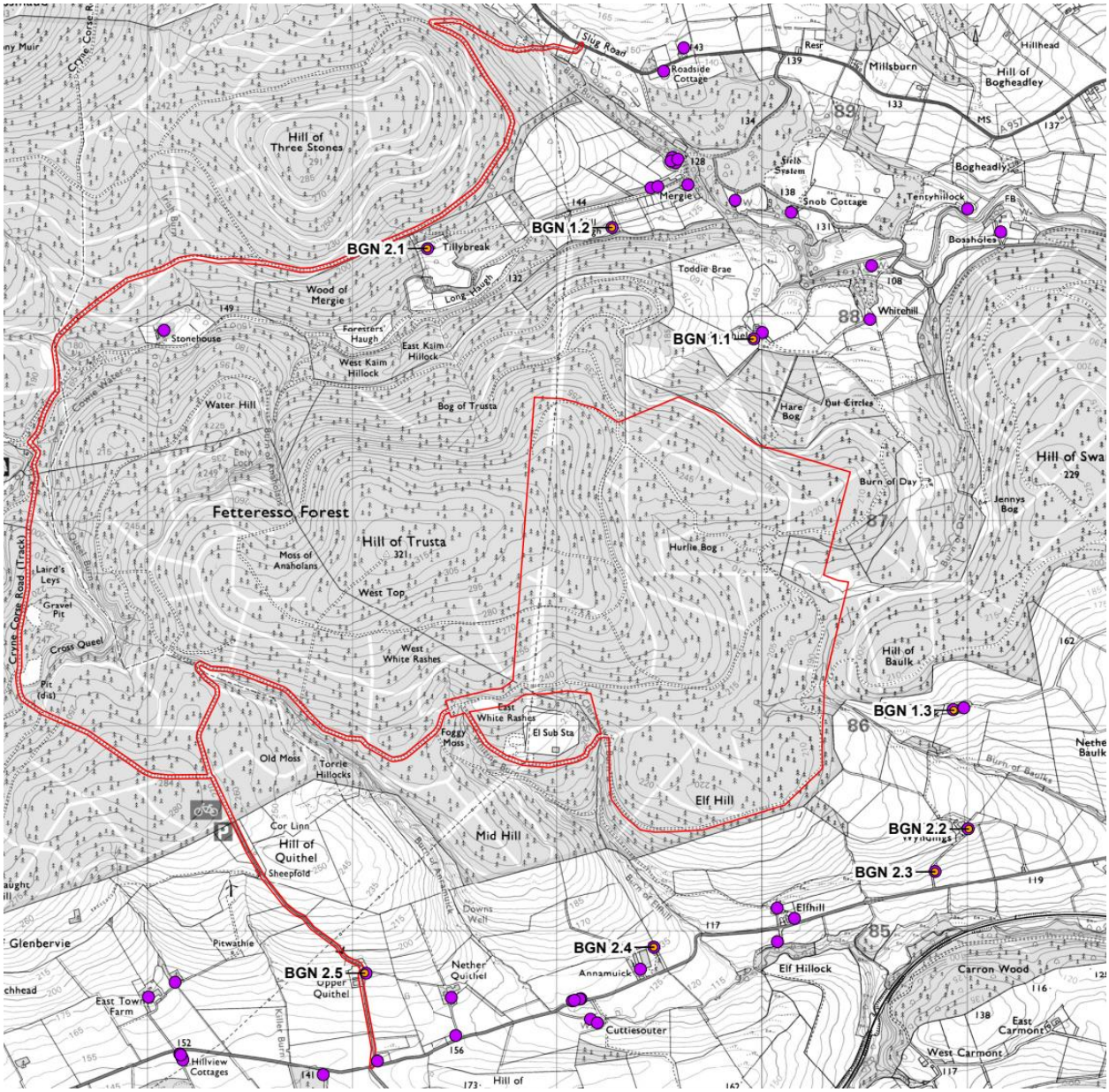
- Noise monitoring has been undertaken in the Study Area to determine the existing prevailing noise environment
- AddressBase data, detailed maps, and aerial photographs of the area surrounding the Proposed Development were examined and nearby NSRs were identified. This is presented in **Figure 14.1 - Noise Study Area**.
- Free-field long term monitoring equipment was installed at identified NSRs on 23rd April 2024 and decommissioned on 10th May 2024. Permission for land access was sought prior to the deployment of equipment. The unattended measurements consist of constant monitoring over the defined time period, the data is then processed to LA90(15minutes) as per BS4142.
- Attended spot measurements were also conducted at several additional locations in the Study Area. The attended spot measurements consisted of a single 15-minute measurement conducted to BS4142 standard, taken on public land nearby to other NSRs of interest. These were conducted during quiet nighttime conditions at 23:00 on 23rd April 2024 until 01:00 on 24th April 2024, and represent a conservative baseline noise level to help understand the nature of the surrounding environment, and supplement the long-term measured data.

14.3.35 Representative NSRs, and measurement positions are detailed in **Table** 14-4: **14.4: Noise Sensitive Receptors** and **Plate 14:1: Measurement Locations** shows the location of these NSRs and corresponding monitoring locations relative to the Site. This information is also presented in **Figure 14.2: Noise Measurement Locations**.

Table 14-4: Noise Sensitive Receptors

Location ID#	Easting	Northing	Measurement Period
BGN 1.1	379958	787888	Installed 23rd April 2024 and decommissioned on 10th May 2024
BGN 1.2	379268	788432	
BGN 1.3	380937	786077	
BGN 2.1	378367	788330	23:00 on 23rd April 2024 until 01:00 on 24th April 2024
BGN 2.2	381010	785498	
BGN 2.3	380845	785289	
BGN 2.4	379473	784921	
BGN 2.5	378062	784795	

Plate 14:1: Measurement Locations



14.3.36 Measurements were conducted using Rion NL-52 sound level meters which were spot calibrated with a Rion NC-74 calibrator, before, during and after the measurement campaign. The sound level meters were housed in protective cases for all weather conditions and used to conduct long-term measurements. Calibration certificates can be found in **Appendix 14.2: Calibration Certificates**.

14.3.37 The parameters measured during the background noise (BGN) monitoring campaign include the following:

- LAeq (15 minutes);
- LAeq (15 minutes) one-third octave band spectrum;
- LA90 (15 minutes); and
- LA90 (15 minutes) one-third octave band spectrum.

14.3.38 As the survey was based on long-term unattended measurements, a meteorological station was also installed to monitor for weather conditions. The station was deployed at BGN 1.1 and is deemed to be representative of the entire Study Area. Meteorological conditions such as wind and rain will affect background noise conditions and have possible effects on noise propagation. Measurements were conducted every 15 minutes to coincide with the measured noise data as per the requirements of BS4142.

Determining Sensitivity of Receptors and Magnitude of Change

14.3.39 The sensitivity of the NSR is estimated in its current state prior to any change implied by the Proposed Development. The level of sensitivity is determined according to existing regulations and guidance, societal value, and vulnerability for the change. By the combination of the assessed value of these three components, the NSRs' sensitivity can be classified as Low, Medium or High **(Table 14.5: Evaluation of Receptor Sensitivity).**

Table 14.5: Evaluation of Receptor Sensitivity

Level of Sensitivity	Definition
Low	Receptors where distraction or disturbance from noise is minimal. For example: • Buildings not occupied during working hours. • Factories and working environments with existing high noise levels. • Sports grounds when spectator noise is a normal part of the event. • Night Clubs.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance. For example: • Offices. • Bars/Cafes/Restaurants where external noise may be intrusive. • Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls).
High	Receptors where people or operations are particularly susceptible to noise. • Residential, including private gardens where appropriate. • Quiet outdoor areas used for recreation. • Conference facilities. • Theatres/Auditoria/Studios. • Schools during the daytime. • Hospitals/residential care homes. • Places of worship.

14.3.40 All NSRs considered in this assessment are residential in nature, with a semi-rural baseline noise environment. Therefore, the sensitivity of all NSRs is **High**.

14.3.41 The magnitude of change at a given receptor can be interpreted as the degree of alteration experienced by the receptor as a consequence of the impact, impact magnitude is calculated on a case-by-case basis for each NSR and classified as **No Change**, **Negligible**, **Low**, **Medium**, or **High** as described in **Table 14.6: Descriptions for Magnitude of Change**.

Table 14.6: Descriptions for Magnitude of Change

Descriptors for Magnitude of Change	Descriptor
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or element.
No change	No loss or alteration of characteristics, features or elements; no observable impact.

Construction Noise

14.3.42 The criteria provided for the ABC method detailed in BS5228-1 to determine the category and threshold limits of NSRs are shown in **Table 14.7: Construction Noise Impact Assessment Criteria**.

Table 14.7: Construction Noise Impact Assessment Criteria

Assessment category and threshold value period	Threshold value, LAeq (dB)		
	Category A	Category B	Category C
Nighttime	45	50	55
Evenings and weekends	55	60	65
Daytime and Saturdays	65	70	75

14.3.43 Nighttime is defined to be between 23:00 and 07:00. Evenings and weekends are defined to be 19:00 – 23:00 on weekdays, 13:00 – 23:00 on Saturdays and 07:00 – 23:00 on Sundays. Daytime is defined to be 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays.

14.3.44 The NSR is defined as Category A if the ambient noise levels (rounded to the nearest 5 dB) are less than those stated for Category A. This is true for the Study Area, as detailed in **Section 14.4**, and therefore the Proposed Development will be assessed to Category A thresholds.

14.3.45 Working hours proposed are from 7 am to 7 pm, 7 days per week (See **Chapter 3**, paragraph 3.5.2), therefore the Category A 55 dB limit has been adopted to ensure a conservative assessment takes place.

14.3.46 The guidance has been applied to The World Health Organisation (WHO) concepts of lowest observable adverse effect level (LOAEL), this is the level above which adverse effects on health and quality of life can be detected, and the significant observable adverse effect level (SOAEL); this is the level above which significant adverse effects on health and quality of life occur. The LOAEL is relative to background noise, the SOAEL threshold level has been determined from Category A of **Table 14.7: Construction Noise Impact Assessment Criteria.** The magnitude of impact at receptors can be determined from **Table 14.8: Construction Noise - Magnitude of Change at Receptors**.

Table 14.8: Construction Noise - Magnitude of Change at Receptors

Magnitude of Change	Descriptor
No Change/Negligible	Below LOAEL (<BGN)
Low	Above or equal to LOAEL and below SOAEL (BGN-55 dB(A))
Medium	Above or equal to SOAEL and below SOAEL + 5dB (55-60 dB(A))
High	Above or equal to SOAEL + 5dB (>60 dB(A))

14.3.47 Construction traffic for local haul roads and Site access are incorporated to the BS5228-1:2009, however additional criteria extend to construction traffic on highways. **Table 14.9: Construction Traffic - Magnitude of Impact at Receptors** shows noise impact criteria for the assessment of changes to road traffic noise due to the addition of Proposed Development related construction traffic, with reference from Table 3.17 of DMRB, LA 111 Noise and Vibration.

Table 14.9: Construction Traffic - Magnitude of Impact at Receptors

Magnitude of Change	Traffic Noise Level Change
No Change	x < 0
Negligible	0.1= x < 0.9

Magnitude of Change	Traffic Noise Level Change
Low	1.0 = x < 2.9
Medium	3 = x < 4.9
High	x > 5

14.3.48 In accordance with the EIA Regulations construction noise and construction traffic noise shall be defined as a significant effect where it is determined that a **High** or **Medium** magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; and/or
- a total number of days exceeding 40 in any 6 consecutive months.

Operational Noise

14.3.49 Information from the rating level, the background sound level, and the stated impacts from a BS4142 assessment have been converted into representative impact magnitudes, detailed in **Table 14.10: BS 4142:2014 Impact Magnitude**.

Table 14.10: BS 4142:2014 Impact Magnitude

Impact Magnitude	Excess Above Background (dB)	Definition
No Change	x < 0	Impact to the receptor is immeasurable, undetectable or within the range of normal natural background variation.
Negligible	0= x < 3	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.
Low	3 = x < 5	
Medium	5 = x < 10	A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
High	x = 10	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

14.3.50 The assessment within BS4142 is a context-based, as is stated in the definitions of determining impact. There is no theoretical limit to how the context can or should influence the impact assessment, but any alteration of the conclusions of an assessment due to the context should be sufficiently explained and justified for the specific circumstances in question. Section 11 of BS4142: "*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.*" The assessor will include consideration of additional for internal noise levels during nighttime periods, where it is less likely that the external amenity is in use, and the preservation of internal conditions and the reduction of potential sleep disturbance is of more concern. For nighttime conditions, operational noise shall constitute a significant effect only where it is determined that a **High** impact magnitude, or **Medium** magnitude only while also exceeding the internal noise limits of 30 dB(A) set out in BS8233, or exceeds NR20 criteria.

Construction Vibration

14.3.51 Vibration levels that are felt and perceived as annoying or uncomfortable generally fall below levels that cause structural damage but can still impact human comfort and perception. Criteria for received vibration are taken from Table B.1 in BS5228-2 and shown in **Table 14.11: Construction Vibration Impact Assessment Criteria**. Vibration is measured as peak particle velocity (PPV).

Table 14.11: Construction Vibration Impact Assessment Criteria

Impact Magnitude	Vibration Level, Peak Particle Velocity (PPV)	Effect

Negligible	<0.3 mm·s^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
Low	>0.3 mm·s^{-1}	Vibration might be just perceptible in residential environments.
Medium	>1.0 mm·s^{-1}	It is likely that vibration of this level in residential environments will cause complaints but can be tolerated if prior warning and explanation have been given to residents.
High	>10 mm·s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

14.3.52 Levels that could potentially cause structural damage are significantly higher. For example, according to the British Standards (BS7385-2:1993) and other guidelines, structural damage could become a concern at vibration levels above 10 mm/s PPV, depending on the type of structure and its condition.

Assessing Significance

14.3.53 The predicted significance of the effect was determined through the recommendations in TAN 2011 and based on professional judgement, considering both sensitivity and magnitude of change as detailed in **Table 14.12: Matrix for Determination of Significance of Effects**. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 14.12: Matrix for Determination of Significance of Effects

Significance		Level of Receptor Sensitivity		
		Low	Medium	High
Magnitude of Change	High	Minor/Moderate	Moderate/Major	Major
	Medium	Minor	Moderate	Moderate/Major
	Low	Negligible/Minor	Minor	Minor/Moderate
	Negligible	Neutral/Slight	Neutral/Minor	Minor
	No change	Neutral	Neutral	Neutral

14.3.54 The level of significance and its relevance to the decision making process is explained as follows:

- **Very Large**: These effects represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective;
- **Major**: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance;
- **Moderate**: These effects, if adverse, while important, are not likely to be key decision making issues;
- **Minor**: These effects may be raised but are unlikely to be of importance in the decision making process; and
- **Neutral**: No effect, not significant, noise need not be considered as a determining factor in the decision making process.

Assessment Assumptions and Limitations

14.3.55 Estimated noise emissions from the construction of the Proposed Development have been based on the assessor's experience of previous projects of a similar nature. No specific information has been provided by the Principal Contractor at the time of writing. There is always a degree of uncertainty when conducting assessments on developments in the planning stage and these uncertainties occur in calculation, rounding, and baseline levels used. This assessment considers conservative assumptions to produce a worst-case assessment. This ensures that, in practicality, noise levels would be expected to be lower than the assessment details, and uncertainty is reduced as far as reasonably possible.

14.3.56 Modelled sound sources represent candidate plant only. The noise output of individual items of plant may vary from what is presented in this chapter after final plant specification. The assessment assumes all sound sources are operating continuously, simultaneously and at maximum noise output. In reality, not all sources will be operating at maximum noise level all of the time and operational noise levels may be lower than are presented in this chapter.

14.3.57 The sound level output of any auxiliary infrastructure is considered insignificant in comparison to the primary sound sources detailed in this chapter. Accordingly, no other items of plant have been considered within the assessment.

14.3.58 Unless otherwise stated, all sound levels refer to free field levels i.e. sound levels without influence from any nearby reflective surfaces.

14.3.59 In practice, there is no “single” background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment in this chapter is a representative average and therefore is representative of the period being assessed.

14.3.60 Daytime noise levels were not measured at some NSR locations have been represented by the lowest measured daytime noise level at other NSRs from long-term unattended monitoring. This is deemed conservative and appropriate for assessment purposes.

14.3.61 In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources. Propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night. The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for in the model; therefore, the modelled results are considered worst-case.

14.3.62 Whilst some information gaps have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects on noise and vibration.

14.4 Baseline Conditions

Summary of Baseline

14.4.1 The baseline environment in the Study Area semi- rural in nature, predominantly consisting of forestry and agricultural land, but with a small number of residential properties located in all directions surrounding the Proposed Development. The existing Fetteresso Substation located to the south/west of the Proposed Development.

14.4.2 Detailed baseline noise data results are presented in **Appendix 14.3 Baseline Noise Monitoring**. A summary of the results from the baseline noise monitoring campaign are presented in **Table 14.13: Summary of Background Noise Measurement Results** and their locations are shown in **Figure 14.2: Noise Measurement Locations**.

Table 14.13: Summary of Background Noise Measurement Results

Location	LA90 (dB) (Nighttime)
BGN 1.1	29
BGN 1.2	31
BGN 1.3	24
BGN 2.1	36
BGN 2.2	26
BGN 2.3	26
BGN 2.4	25
BGN 2.5	27

14.4.3 In general, the background data indicates relatively low noise levels at night, with no particular dominant sources other than low level background traffic, and wind interaction with foliage. The results of the baseline noise survey show that NSRs in the vicinity of the Proposed Development have a noise environment quantified between 24 – 29 dB LA90 during nighttime periods from unattended monitoring. The results of attended monitoring show results between 25 dB and 27 dB LA90. There is an outlier at BGN point 2.1 with a higher noise level of 36 dB LA90, this is due to a dominant noise source of running water near this location. No noise from the existing Fetteresso Substation was audible at the monitoring locations.

Future Baseline in the Absence of the Proposed Development

14.4.4 In the absence of the Proposed Development, it is likely that the land will continue under the same land use and the character of the Site is therefore likely to continue as an actively managed commercial forest. The landscape and visual amenity of the study area is likely to be influenced by a number of 'forces for change'. Forces for change are those factors affecting the evolution of the landscape and which may, consequently, affect the perception of the study area in the near or distant future. Although prediction of these is necessarily speculative, those of particular relevance are discussed below.

14.4.5 Settlements are likely to continue to locally change the nature of the area. A number of small unrecognised settlements are located in close proximity to each other, with potential future expansion of settlements potentially resulting in merged settlements and further development of individual houses across the rural area.

14.4.6 Further reinforcement and extension of the electricity transmission network, predominantly to connect further renewable energy generation, is likely to occur within the study area, for example additional OHLs connecting to the existing Fetteresso Substation.

14.4.7 Wind farm development is a clear force for change and is likely to continue. **Figure 5.1: Cumulative Developments** illustrates the operational, consented and proposed wind farms across the study area, which include a number of domestic wind turbines of varying heights and rotor diameters. As farmers diversify income and seek opportunities to generate energy for domestic and commercial use, interest in this type of development may continue, alongside development of larger wind farms on uplands and forestry land.

14.4.8 Therefore, it is likely that a steady increase in background noise levels can be assumed due to the increase in development in the area. The assessment performed to existing baseline noise conditions is therefore a appropriate assessment and will result in a worst-case assessment. The increase in potential noise from other electrical infrastructure projects raises the importance of cumulative effects to be sufficiently assessed.

Implications of Climate Change for Baseline Conditions

14.4.9 The summary of the relevant climate change projections using the UK Climate Change Projections 2018 (UKCP18) are:

- Temperatures are projected to increase, particularly in summer;
- Winter rainfall is projected to increase and summer rainfall is most likely to decrease;
- Heavy rain days (rainfall greater than 25mm) are projected to increase, particularly in winter;
- Near surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant effects of winds; however, the increase in wind speeds is projected to be modest; and
- An increase in frequency of winter storms over the UK.

14.4.10 Changes to the baseline noise levels may occur to due to these changes weather conditions due to greater rain and higher windspeeds, however in the context of the EIA and noise and vibration impact assessment this would be deemed as immeasurable or irrelevant.

14.5 Mitigation and Monitoring

Embedded Mitigation

14.5.1 Topic specific embedded mitigation (mitigation achieved through design) is outlined below in **Table 14.14: Embedded Mitigation**.

Table 14.14: Embedded Mitigation

Mitigation Measure	Project Stage/Timing	Responsibility
NV1 – Specification of Low Noise Equipment	Detailed Design / Procurement	Applicant
NV2 – Natural topography screening	Detailed Design	Applicant

14.5.2 NV1 Specification of Low Noise Equipment - Various strategies are available to mitigate noise from operational noise equipment, mostly involving mitigation at source. The Applicant will secure suitably low noise equipment during procurement with a targeted noise specification for vendors. Where procuring equipment with an inherently low sound power output is not possible, enclosing equipment either fully or partially in an acoustic enclosure is able to achieve the same result. The exact specification will be determined during the detailed design phase of the Proposed Development. It is expected that further noise modelling and calculation will be conducted, and an updated noise impact assessment based on the final design of the Site to ensure compliance with noise limits. The principal of 'As low as reasonably practicable' (ALARP) should be applied during the detailed design phase of the project where possible. Additional measures could include, but not limited to:

- Specification of low noise units;
- Housing any external equipment within enclosures buildings;
- Noise barriers to target propagation from specific noise sources;
- Use of an active fan system with variable speed drive;
- Use of liquid to liquid cooling; and/or
- A system with a larger number of fans operating at lower duty.

14.5.3 NV2 – Natural screening provided by the site surroundings and topography. Applied Mitigation

Table 14.15: Applied Mitigation

Mitigation Measure	Project Stage/Timing	Responsibility
NV3 – Construction traffic would access the Site via the A90/Aberdeen West Peripheral Route, the A90 and the B9077, joining the A957 Slug Road northwest of the Site. Smaller vehicles may access the Site via the Slug Road southeast (via west Stonehaven) and from the Auchenblae road south of the Site, but would be small (LGVs, construction personnel) and low in number.	Planning	Principal Contractor
NV4 – Construction Noise Management Plan	Pre-Construction Phase	Principal Contractor

14.5.4 For its new infrastructure projects in recent years, the Applicant has developed and effectively implemented a suite of General Environmental Management Plans (GEMPs) which prescribe good environmental management practices. In addition, the Applicant has developed a Consents and Environment Specification which prescribes environmental management principles which Contractors are required to meet under the terms of the Principal Contract. The Specification includes management plans that the Contractor is required to prepare and implement, including a Construction Environmental Management Plan (CEMP), and subsidiary plans including a construction noise management plan (CNMP) and a construction transport management plan (CTMP). In preparing these Plans, the Contractor will be required to incorporate any additional management measures identified through the EIA as necessary to avoid or reduce significant residual effects (i.e., "additional mitigation").

14.5.5 The CNMP will be carried out in accordance with the guidance, procedures and best practice outlined in BS5228-1. The CNMP will be embedded within the Construction Environmental Management Plan (CEMP) as the Applicant requires of the Principal Contractor through a condition of contract (See **Chapter 3**, paragraph 3.8.2). The details of the CNMP will be agreed with Aberdeenshire Council prior to the commencement of construction works and is expected to be secured by an appropriately worded planning condition. Procedures within the CNMP will include:

- Minimising the noise as much as is reasonably practicable at source;
- Attenuation of noise propagation (see Paragraph 14.5.7);
- Carrying out identified high noise level activities at a time when they are least likely to cause a nuisance to residents; and
- Providing advance notice of unavoidable periods of high noise levels to Aberdeenshire Council and residents likely to be impacted.

14.5.6 In order to maintain low impact on the noise environment, consideration will be given to attenuation of construction noise at source by means of the following:

- Giving due consideration to the effect of noise, in selection of construction methods;
- Avoidance of vehicles waiting or queuing, particularly on public highways or in residential areas with their engines running;
- Scheduling of deliveries to arrive during daytime hours only. Care should be taken to minimise noise while unloading delivery vehicles;
- Ensure plant and equipment are regularly and properly maintained;
- Fit and maintain silencers to plant, machinery, and vehicles where appropriate and necessary;
- Operate plant and equipment in modes of operation that minimise noise, and power down plant when not in use;
- Use electrically powered plant rather than diesel or petrol driven, where this is practicable; and
- Work typically not to take place outside of hours defined in the construction schedule.

14.5.7 Consideration will be given to the attenuation of construction noise in the transmission path by means of the following:

- Locate plant and equipment liable to create noise as far from NSRs as is reasonably practicable or use natural land topography to reduce line of sight noise transmission;
- Noise screens, hoardings and barriers should be erected where appropriate and necessary to shield high-noise level activities; and
- Provide lined acoustic enclosures for equipment such as static generators and, when applicable, portable generators, compressors and pumps.

14.5.8 As part of an overall construction noise management plan, it is recommended that the Contractor informs all neighbouring residents who are likely to be affected of the proposed timescales and the intended site operations.

14.5.9 The CNMP is to be established and ensure that the noise limit thresholds of BS5228 are not exceeded at NSRs as defined in **Table 14.7: Construction Noise Impact Assessment Criteria**. A noise monitoring programme will be established during construction works to ensure limits at nearby NSRs are maintained through the various phases of work.

14.6 Assessment of Likely Significant Effects - Construction

14.6.1 The assessment of effects identified above is based on the project description as outlined in **Chapter 3: Description of the Proposed Development**. Unless otherwise stated, potential effects identified are considered to be adverse.

Predicted Construction Effects

On-Site Construction Noise

14.6.2 A draft construction schedule with planned activities and proposed equipment has been provided by the Principal Contractor. This information is presented in **Table 14.16: Assumed Construction Activity Sequence.**

Table 14.16: Assumed Construction Activity Sequence

Construction Activity Phase	Estimated Programme Duration	Typical Plant
Phase 1 – Forestry Clearence	October 2025 – December 2025	3x Forwarder
		3x Harvester
		3x Woodchipper
		3x Tracked Excavator
		3x Chainsaw 70 cc greater
		3x Chainsaw less than 70
		3x Forestry mulcher
Phase 2 - Site Access & Clearance Form access roads, Initial establishment CDM compound, Install initial site works drainage, Clear site (including soils & stone storage areas)	April 2026 - July 2026	6x Artic. Dump Truck (ADT) (40T)
		3x 30T tracked excavator
		3x 20T GPS dozers
		1x 22T tracked excavator
		2x 8T mini-digger (drainage, etc.)
		2x Forestry mulcher
		1x 9T dumper
		1x 18t Drum Roller
		1x Diesel generator (site cabins) (2T)
Phase 3 - Compound Construction Form main compound Form satellite compound Install wider site works drainage	May2026 - July 2026	2x 8T mini-digger (drainage, etc.)
		2x 22T excavators
		2x 18T Drum Roller
		2x 9T dumpers
		2x Diesel generator (site cabins) (2T)
		1x Telescopic Crane
Phase 4 - Bulk Earthworks & Platform Formation Principal cut and fill earthworks Stone blasting, processing & grading Main platform formation & levelling	July 2026 - July 2027	Blast team w 20T/ 125mm diameter drill rig (possibly x2)
		3x 30T tracked excavator
		1x 40T tracked excavator
		Rock crusher/ screener (90T)
		Rock crusher/ screener (38T)
		2x Diesel surface water pump (4")
		4x Artic. Dump Truck (ADT) (40T)
		3x 20T GPS dozers
		2x 18T Drum Roller
Phase 5 - Platform Civil Works	May 2027 - July 2028	Concrete mixer truck (26T)
		2x 22T excavators

Construction Activity Phase	Estimated Programme Duration	Typical Plant
AIS Foundations Drainage Services Internal Substation Roads Security Fencing Permanent SuDS Basins		2x 9T dumpers
		2x 8T mini-digger
		1x 18T Asphalt paver
		2x Telehandler (4T)
		1x Compressor
		Skips - transport (wagon)
Phase 6 - Building Construction Phase 7 - Building Fit-out Phase 8 - Primary Installations Primary equipment, structures & transformers – delivery, installation & building fit-out	May 2027 - June 2028	1x 22T excavator
		1x Telescopic Crane - Building construction - assume 50T
		1x Lifting boom lorry (6T)
		4x Telehandler (4T)
		4x Lifting Platform (MWEP)
		Skips - transport (wagon)

14.6.3 Each activity is analysed to determine the percentage of the construction time each piece of equipment is being used and how many are in use. Using this information, a total equivalent noise level at 10 m for each activity is calculated.

14.6.4 The dispersion of this total noise level is then modelled. The distance between source and receiver has been defined from the planning application boundary, which gives rise to an extremely conservative worst-case assessment. The attenuation of noise over distance has been calculated over mixed hard and soft ground to the method presented in BS5228. Given the dominance of soft ground in the area surrounding the Proposed Development, this is slightly conservative. The effects of barriers or topographical screening have not been considered as a conservative approach.

14.6.5 Vehicle movements along access tracks have also been assessed. The proposed construction route reported in **Chapter 13: Traffic and Transport** have been used as the basis for the assessment. Access tracks have been assessed as haul routes in accordance with BS5228 and noise levels incorporated into overall construction noise assessment, using a peak number of HGV movements of 6 per hour. Named routes have been assessed separately using CRTN calculations.

Detailed descriptions of the methodology and results of the construction noise impact assessment are presented in **Appendix 14.4 – Construction Noise Impact Assessment** which show the predicted plant activities, assumed plant items, their assumed quantities, their assumed utilisation, and associated noise levels at a distance of 10 m.

14.6.6 The construction noise impact assessment identifies that a robust CNMP is required to ensure BS5228 criteria is met. An example strategy has been implemented to demonstrate the feasibility of control measures through the following action:

14.6.7 Carrying out identified high noise level activities at a time when they are least likely to cause a nuisance to residents; and

14.6.8 The following high noise activities in Table 14. have been identified, which are required to be performed during daytime hours. Daytime is defined to be 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays.

Table 14.17: Construction Activities Mitigation Requirements

Construction Activity Phase	Typical Plant
Phase 1 – Forestry Clearance	3x Woodchipper
	3xForestry mulcher
	6x Artic. Dump Truck (ADT) (40T)

Phase 2 - Site Access & Clearance Form access roads, Initial establishment CDM compound, Install initial site works drainage, Clear site (including soils & stone storage areas)	2x Forestry mulcher
Phase 4 - Bulk Earthworks & Platform Formation Principal cut and fill earthworks Stone blasting, processing & grading Main platform formation & levelling	Blast team w 20T/ 125mm diameter drill rig (possibly x2)
	Rock crusher/ screener (90T)
	Rock crusher/ screener (38T)
	4x Artic. Dump Truck (ADT) (40T)

14.6.9 It is indicated no further specific measures are required to meet the 55 dB(A) limit. The results also indicate that when all operating equipment active the 65 dB(A) daytime limit is not exceeded at any NSRs.

14.6.10 The assessment has been performed assuming all plant and equipment is operating at the same time. With the implementation of a robust CNMP, it is predicted that construction noise is likely to result in **Low** magnitude, with a receptor sensitivity of **High** would result in a **Minor/Moderate** effect. Due to the conservatism of the assessment methodology, an overall impact of **Minor** can be determined, which therefore is **Not Significant**.

Construction Traffic Noise

14.6.11 Construction related traffic impacts on named roads reported in **Chapter 13: Traffic and Transport** have been assessed by calculating the relative increase in road traffic noise level adjacent to public roads used by construction traffic. The standard UK calculation method CRTN was used to calculate the noise level, at a nominal distance of 10 m from each road, using baseline traffic flows and also accounting for the addition of construction traffic as reported in **Chapter 3: Description of the Proposed Development** and **Chapter 10: Traffic and Access**. The details of the assessment are included in **Appendix 14.4 Construction Noise Impact Assessment** and assumptions are deemed conservative.

14.6.12 The 24-hour average daily traffic flows have been converted to 18-hour traffic flows for the purposes of the noise calculation as is required by CRTN. Noise levels for the future baseline 2028 traffic scenario are presented in **14.18: Predicted 2028 Traffic Flow Noise** for both cars and Heavy Goods Vehicles (HGVs).

Table 14.18: Predicted 2028 Traffic Flow Noise

Site Ref.	Survey Location	18hr Cars	18hr HGV	18hr Total	HGVs (%)	Noise Level (L_{10})
1	A957 Slug Road	892	307	1198	26%	78.8
2	A93 Peterculter	5944	742	6686	11%	84.6
3	A93 Banchory	3437	482	3919	12%	82.4
4	A90 North of Stonehaven	11935	1628	13563	12%	87.8
5	A90 Kingsford	4934	1628	6561	25%	86.1
6	A90 South of Stonehaven	18070	4774	22844	21%	91.1
7	B9077	3094	146	3241	5%	80.5

14.6.13 Noise levels including peak construction traffic are presented in **Table 14.19: Peak Construction Traffic Flow** where the change in noise levels and impact magnitude have been determined.

Table 14.19: Peak Construction Traffic Flow Noise

Site Ref.	Survey Location	18hr Cars	18hr HGV	18hr Total	HGVs (%)	Noise Level (L_{10})	Change (dB)	Impact magnitude
1	A957 Slug Road	1040	361	1401	26%	79.5	0.7	Negligible
2	A93 Peterculter	6003	744	6747	11%	84.6	0	No Change
3	A93 Banchory	3459	482	3941	12%	82.4	0	No Change
4	A90 North of Stonehaven	11935	1629	13564	12%	87.8	0	No Change
5	A90 Kingsford	4994	1630	6623	25%	86.2	0.1	Negligible
6	A90 South of Stonehaven	18078	4775	22853	21%	91.1	0	No Change
7	B9077	3124	199	3323	6%	80.7	0.2	Negligible

14.6.14 The traffic noise levels are predicted to have a maximum **Negligible** impact magnitude, with a receptor sensitivity of **High** which would have **Minor** effect and therefore **Not Significant**.

Construction Vibration and Blasting

14.6.15 Construction activities resulting in vibration are largely unknown at time of writing, therefore, the worst-case parameters will be assumed for vibration. The vibration due to piling taking place at the Site has been assessed for impact on the closest receptor (NSR 1.1 at 409 metres from the nearest point to the Site). If the assessment passes at the closest receptor, it will pass at all others. The parameters that affect resultant vibration from piling are shown in **Table 14.20: Groundborne Vibration Parameters from Mechanised Construction Works**.

Table 14.20: Groundborne Vibration Parameters from Mechanised Construction Works

Vibration Parameter	Range
Maximum amplitude of drum vibration, in millimetres (mm),	Between 0.4 and 1.72 mm
Pile toe depth, in metres (m),	Between 1 and 27 m
Vibrating roller drum width, in metres (m)	Between 0.75 and 2.2 m
Number of vibrating drums	1 or 2
Slope distance from the pile toe or tunnel crown, in metres (m)	Depends on distance between source and receiver and pile toe depth
Nominal hammer energy, in joules (J)	Between 1.5 and 85 kJ
Potential energy of a raised tamper, in joules (J)	Between 1 and 12 MJ
Distance measured along the ground surface, in metres (m)	409 metres for closest NSR

14.6.16 **Table 14.21: Ground Borne Vibration Results from Foundation Works at NSR 1** shows the worst-case results of the ground borne vibration due to piling. Vibratory compaction, percussive piling, and dynamic compaction have been calculated in the case these activities will take place.

Table 14.21: Ground Borne Vibration Results from Foundation Works at NSR 1.1

Vibration Operation	Resultant PPV (mms-1)	Magnitude of Change
Vibratory Compaction (Steady State)	0.03	Negligible
Vibratory Compaction (Start Up and Run Down)	0.10	Negligible
Percussive Piling	0.02	Negligible
Vibratory Piling	0.01	Negligible

14.6.17 In the worst case, all operations are predicted **Negligible**, therefore, the effect for construction vibration is **Minor** and **Not Significant**.

14.6.18 Blasting is a construction activity known to cause potential noise and vibration impacts. Blasting plans are largely unknown at time of writing however, recommendations can be made on blasting management. Air overpressure caused by blasting activities can be compared to an equivalent wind speed as shown in **Table 14.22: Comparison Between Wind Speed and Air Overpressure Equivalents**.

Table 14.22: Comparison Between Wind Speed and Air Overpressure Equivalents

Wind Speed	Equivalent air Overpressure
Constant wind of 5 m/s, Beaufort Scale 3, Gentle Breeze	120 dB
Constant wind of 8 m/s, Beaufort Scale 4, Moderate Breeze	130 dB
Constant wind of 20 m/s, Beaufort Scale 8, Gale	140 dB

14.6.19 If blasting should take place, then groundborne vibration as a result of the operations shall not exceed a peak particle velocity of [6 mm/sec][10 mm/sec] in 95% of all blasts measured over any period of [6 months] and no individual blast shall exceed a peak particle velocity of [12 mm/sec] as measured at vibration sensitive buildings. The result will be the maximum of three measurements taken in a perpendicular direction to the ground surface.

14.6.20 Practical measures, including good blast design, that have been found to reduce air overpressure and/or vibration are:

- Taking particular care with the development of faces and with trial blasts as anomalous vibration levels might be produced when there is no free face to relieve the energy produced;
- Ensuring appropriate burden to avoid over or under confinement of the charge;
- Accurate setting out and drilling;
- Appropriate charging;
- Appropriate stemming with appropriate material such as sized gravel or stone chippings;
- Using delay detonation to ensure smaller maximum instantaneous charges (MICs);
- Using decked charges and inhole delays;
- Blast monitoring to enable adjustment of subsequent charges;
- Designing each blast to maximize its efficiency and reduce the transmission of vibration; and
- Avoiding the use of exposed detonating cord on the surface in order to minimise air overpressure.

14.6.21 A full assessment of potential blasting activities is expected by the Principal Contractor. However, with appropriate blasting practices in place, and additional measures such only conducting blasting during daytime hours with local residents being informed of the activities, any impact is likely to be **Low**, resulting in a **Minor** effect that is **Not Significant**.

Additional Mitigation

14.6.22 No specific additional mitigation is required. It is assumed the CNMP described in **Table 14.15: Applied Mitigation** will suitably control noise levels.

Residual Construction Effects

14.6.23 Taking into account the embedded and applied mitigation measures described in NV3 and NV4 of **Table 14.15: Applied Mitigation**above, the residual construction effects are predicted to fall below the construction noise limits of 65 dB during daytime conditions and 55 dB during evening and weekend conditions. No night-time working is scheduled, and any requirements for night-time working would be agreed with Aberdeenshire Council and local community before commencing.

14.6.24 Implementing these measures would result in **Low** impact magnitude, with a receptor sensitivity of **High** which would have **Minor** effect and therefore **not significant**.

14.7 Assessment of Likely Significant Effects - Operation

Predicted Operational Effects

14.7.1 A detailed model of the Proposed Development and the Study Area has been constructed using the sound propagation model, SoundPLAN 9, which takes into account geometric spreading, topography, screening, meteorological conditions and detailed information regarding the sources of noise, to predict noise levels at specific points (e.g. NSRs) allowing for analysis of the predicted impact of the Proposed Development for NSRs.

14.7.2 Within the planning application boundary, resolution of the digital ground model for the landscaping and design has been considered (see NV2 in **Table 14.14: Embedded Mitigation**). Outwith the Site, elevation data to a resolution of 50 m has been used to create a digital ground model, this is appropriate due to the distances from source to receiver.

14.7.3 Propagation was modelled using ISO 9613-2[5], with the following parameters:

- Ground absorption: 0.0 on paved surfaces, 0.6 elsewhere;
- Receiver height: 1.5 m above ground / floor;
- Temperature: 10°C; and
- Relative humidity: 70 %.

14.7.4 It has been assumed that the Applicant will specify low noise equipment during procurement (see NV1 in **Table 14.14: Embedded Mitigation**) with a target noise specification for vendors. (**Table 14.18**) The target specification for main equipment (transformers and reactors) has been assumed as not exceed a sound power level (SWL) of 89 dB(A) as a maximum, which is consistent with current procurement policies. Equipment should be procured using the principal of ALARP. Where procuring equipment with an inherently low sound power output is not possible, enclosing equipment either fully or partially in an acoustic enclosure is able to achieve the same result.

14.7.5 The equipment and associated noise levels within the model are presented in **Table 14.23: Equipment and Input Noise Levels.**

Table 14.23: Equipment and Input Noise Levels

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Super Grid Transformer (SGT) 400/33kV	2	External	89
SGT Cooling	2	External	86
Synchronous Condenser	2	Internal	92

5 ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, ISO, 15 December 1996.

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Synchronous Compensators Transformer (TX)	2	External	89
Synchronous Compensators TX Cooling	2	External	86
Synchronous Compensator (Start up TX)	2	External	83
Synchronous Compensator (Auxiliary TX)	2	External	84
Synchronous Compensator Cooler	2	External	95
400 kV Shunt Reactor	2	External	85
Shunt Reactor Cooling	2	External	84

14.7.6 The model assumes all sound sources are operating continuously, simultaneously and at maximum noise output. In reality, not all sources will be operating at maximum noise level all of the time and operational noise levels are therefore likely to be lower than are presented in the assessment in this chapter.

14.7.7 Noise level predictions have been carried out to establish the specific noise levels at the nearest NSR to the Proposed Development. The levels predicted by the model relate to the outdoor ground floor façade of the NSR considered. Predicted received operational noise levels are presented in **Table 14.24: Predicted Operational Noise Levels.**

Table 14.24: Predicted Operational Noise Levels

Location	Modelled Specific Noise (dB[A])
NSR 1.1	19.1
NSR 1.2	14.8
NSR 1.3	22.7
NSR 2.1	13.7
NSR 2.2	12.0
NSR 2.3	13.8
NSR 2.4	16.1
NSR 2.5	9.5

14.7.8 The modelled noise levels are presented in **Figure 14.3 - Noise Contours**. The predicted operational levels at NSRs due to the Proposed Development have been compared with background noise levels and assessed in accordance with BS4142.

14.7.9 It is a requirement of BS4142 that, when assessing the impact of noise with a tonal component, the noise emitted from the specific sound source is subject to a rating level penalty. Transformers and other electrical equipment associated with substation developments emit noise at frequencies of twice the normal operating current frequency due to magnetostriction of the transformer core. In the UK the supply current frequency is 50 Hz, which results in 100 Hz and harmonics thereof being produced by the transformer. The nature of the noise generation mechanism results in tonal noise being emitted. The noise is continuous and consistent depending on the electrical load of the equipment and therefore is not expected to have any impulsive characteristics.

14.7.10 Analysis of the data suggest that cooling systems of the synchronous compensator are dominant with a broadband noise spectrum which will mask the tonality of other electrical equipment. As a conservative assessment, a 4 dB tonal penalty has been applied for 'perceptible tone' due the presence of potential 100 Hz and harmonics due to the operation of electrical equipment.

14.7.11 A BS4142 assessment has been conducted during daytime conditions, using predicted noise with cooling systems active. The results are presented in **Table 14.25: BS 4142 Noise Impact Assessment**.

Table 14.25: BS 4142 Noise Impact Assessment

Location	Modelled Specific Noise (dB[A])	Rating Level	BGN	Excess
NSR 1.1	19.1	23.0	29	-6.0
NSR 1.2	14.8	19.0	31	-12.0
NSR 1.3	22.7	27.0	24	3
NSR 2.1	13.7	18.0	24	-6.0
NSR 2.2	12.0	16.0	36	-20.0
NSR 2.3	13.8	18.0	26	-8.0
NSR 2.4	16.1	20.0	26	-6.0
NSR 2.5	9.5	14.0	25	-11.0

14.7.12 The results indicate that the excess at all NSRs is below background noise, except at NSR 1.3 with a maximum 3 dB excess. The operational noise BS4142 assessment predicts Low impact magnitude, with a receptor sensitivity of High which would have Minor/Moderate effect. Due to the conservative assumptions within the assessment and all excess attributed to the application of a conservative tonal penalty, the overall effect is considered Minor and therefore Not Significant.

14.7.13 Additional consideration is given to internal noise levels. The external façade levels are converted into internal noise levels by applying a correction for attenuation through a property wall or window (closed and open windows having different corrections). Impacts are assessed by comparing the predicted (corrected) internal noise levels against the assessment thresholds in Table 4 of BS8233, i.e., 30 dB LAeq,8hr at nighttime. In addition, octave band levels should meet an NR20 rating.

14.7.14 The external noise levels and spectra have been considered at each NSR. An external to internal noise calculation has been performed on the basis of a partially open window for the nearest receptor. The small element parameter level difference (Dn,e) has been assumed from NANR116: Sound Insulation through Ventilated Domestic Windows. The level difference values are taken from a window opening of 200k mm^2 presented in **Table 14.26: Level Difference Through a Partially Open Window NANR116.**

Table 14.26: Level Difference Through a Partially Open Window NANR116

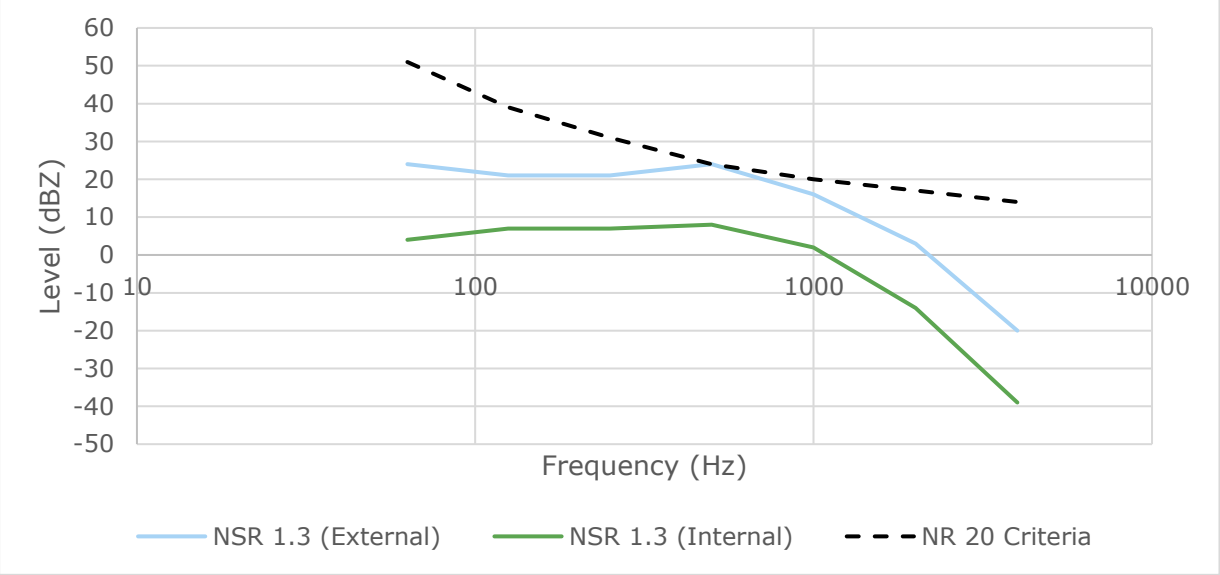
Opening Size	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Dn,e
200k (mm2)	20	14	14	16	14	17	19	16

14.7.15 The results of the internal noise assessment presented in **Table 14.27: Predicted Internal Noise Levels** and presented graphically in **Plate 14.2: Predicted Internal Noise Levels** show internal noise levels both fall below an NR20 criteria and overall levels are below 30 dB(A). Internal noise levels are therefore assessed as **Negligible** impact, which is **Minor** effect and **Not Significant**.

Table 14.27: Predicted Internal Noise Levels

Receiver	Level (dBZ)							Level (d
	63	125	250	500	1000	2000	4000	Total
NSR 1.3 (External)	24	21	21	24	16	3	-20	22.9
NSR 1.3 (Internal)	4	7	7	8	2	-14	-39	7.5
NR 20 Criteria	51	39	31	24	20	17	14	-

Plate 14.2: Predicted Internal Noise Levels



Additional Mitigation

14.7.16 Embedded mitigation detailed in NV 1 of **Table 14.14: Embedded Mitigation** is sufficient to reduce noise levels within accepted guidance. No specific additional mitigation is required as no significant effects are predicted.

Residual Operational Effects

14.7.17 The assessment predicts **No Change** impact magnitude, with a receptor sensitivity of **High** which would have **Neutral** effect and therefore **Not Significant**. An updated noise impact assessment should be conducted during detailed design, with specific manufacturer data for plant equipment and apparatus.

14.8 Assessment of Likely Significant Effects - Decommissioning

14.8.1 Decommissioning effects are unlikely to be of greater magnitude than construction effects assuming the correct environmental controls being in place. Therefore, on this basis, effects are not assessed in detail.

14.9 Assessment of Likely Cumulative (In-Combination) Effects

Introduction

14.9.1 The assessment of cumulative effects on noise and vibration is based upon consideration of the effects of the Proposed Development on the setting of statutory designations and non-statutory designations within 3 km of the Proposed Development, in addition to the likely effects of other developments that are either consented or proposed (at the application stage). Operational and under construction developments are considered to form part of the baseline setting and are addressed as such in the assessment of the Proposed Development.

The assessment takes into account the relative scale of the identified developments, their distance from the affected assets, and the potential degree of impact of the various developments under consideration. Professional judgment has been applied to determine those most likely to have adverse impacts on noise and vibration.

14.9.2 **Table 14.28: Cumulative Assessment: Associated SSEN Transmission Development** provides a cumulative assessment of the Proposed Development with the Associated SSEN Transmission Development defined in **Chapter 1: Introduction** and shown in **Figure 5.1: Cumulative Developments**.

14.9.3 **Table 14.29: Cumulative Assessment: Other SSEN Transmission Developments** and **Table 14.29: Cumulative Assessment: Other Third Party Developments** provide a cumulative assessment of the Proposed Development with other reasonable, foreseeable SSEN Transmission and 3rd party developments as shown in **Figure 5.1: Cumulative Developments**.

Table 14.28: Cumulative Assessment: Associated SSEN Transmission Development

Cumulative Project	Construction Noise	Construction Vibration	Operational Noise
Proposed Kintore to Tealing 400kV OHL (LT455)	It has been concluded that there will be no significant adverse effects upon NSRs during the construction of the Proposed Development with the application of Applied Mitigation. Construction of OHLs are typically short duration compared to that of the substation. This Associated SSEN Transmission Development, will be subject to its own CNMP which will mitigate any potential risks, therefore it is assumed that there is no potential for significant cumulative effects at NSRs.	It has been concluded that the Proposed Development will not have significant adverse effects upon sensitive receptors as a result of construction vibration. The nature of the construction	The proposed Kintore to Tealing 400kV OHL would represent an additional source of noise in the Study Area. An energised electrical OHL can be the source of an audible phenomenon known as 'corona discharge'. This is a limited electrical breakdown of the air in the vicinity of the OHL conductors. Such corona discharge can be the source of audible noise, experienced as a crackling sound accompanied sometimes by a low frequency hum. These noise levels are present in 275 kV OHLs and are more likely to be prominent in 400 kV OHLs, depending on the conductor type. The highest noise levels generated by an OHL usually occur during rain when water droplets, collecting on the surface of the conductor, can initiate corona discharge. The number of droplets that collect, and hence the amount of noise, depends on the rate of rainfall. The noise levels of the Proposed Development are negligible at NSRs and therefore unlikely that there will be significant cumulative effects.

Table 14.29: Cumulative Assessment: Other SSEN Transmission Developments

Cumulative Project	Construction Noise	Construction Vibration	Operational Noise
Fetteresso 132kV substation extension	No specific data is available for the project. However, it is indicated that the construction schedules overlap, therefore there is the potential for cumulative impact. This Other SSEN Transmission Development, will be subject to its own CNMP which will mitigate any potential risks, therefore it is assumed that there is no potential for significant cumulative effects at NSRs.	No specific data is available for the project. It is indicated that the construction schedules overlap, however, as vibration levels from the Proposed Development are so low it is unlikely that there will be significant cumulative effects. This Other SSEN Transmission Development, will be subject to its own CVMP which will mitigate any potential risks	No specific data is available for the project. This Other SSEN Transmission Development, will be subject to its own assessment which will mitigate any potential risks – considering the impact of know cumulative developments when sufficient information is available. However, given the extension would involve a new 132kV and 400kV transformer, and that the procurement approach defined earlier in this Chapter would be adopted,

Cumulative Project	Construction Noise	Construction Vibration	Operational Noise
			it is very unlikely that, when combined, noise at NSRs would be noticeable greater than with the Proposed Development alone, and cumulative effects are therefore considered unlikely.
Network Rail Drumlithie	As above.	As above	As above
Future Fetteresso wind farm connection	No specific data is available for the project, and it is unknown if the construction schedule will overlap. This Other SSEN Transmission Development, will be subject to its own CNMP which will mitigate any potential risks, therefore it is assumed that there is no potential for significant cumulative effects at NSRs.	No specific information is available for the project and it is unknown if the construction schedule will overlap. However, as vibration levels from the Proposed Development are so low it is unlikely that there will be significant cumulative effects.	As above
Fiddes 132kV replacement	As above	As above	As above
Glendye Wind Farm Grid Connection	As above	As above	As above
SSEN Transmission Offshore Grids Project	As above	As above	As above

Table 14.30: Cumulative Assessment: Other Third Party Developments

Cumulative Project	Construction	Construction vibration	Operation
Bowdun Offshore Wind Farm Onshore Cable Connection	Construction schedules are not indicated to overlap, therefore the cumulative construction noise is not significant.	Construction schedules are not indicated to overlap, therefore the cumulative construction vibration is not significant.	No specific data is available to date. A detailed noise assessment is indicated to be conducted during the EIA with sufficient mitigation – it is reasonable to assume noise levels would be no greater than the Proposed Development Effects of operational noise on NSRs unlikely to be significant.
"Fetteresso windfarm	As above	As above	The operational noise impacts of windfarms are assessed in different conditions to substation noise. Substation noise is assessed using BS4142 – which is during low windspeed conditions that give the lowest background noise.

Cumulative Project	Construction	Construction vibration	Operation
			Windfarm noise has a cut in wind speed around 4/5 ms, and noise from the turbines increased in high winds. In high windspeeds, background noise is also significantly increased. In low windspeeds, the Proposed Development would be dominant, as there is no contribution from the windfarm. The Proposed Development has been assessed as Negligible impact on nearby NSRs. In high windspeeds, the windfarm noise would become dominant, combined with the impacts of the Proposed Development lessened due to an increase in background noise. Therefore, there is no risk for the Proposed Development to have cumulative impacts with the operation of the windfarm and is **not significant**.
Quithel 50mW BESS	The scoping report for the project states: 'Noise generated from traffic transporting the components and construction materials to the Site would be managed with a suitable route and timing of traffic agreed with the Highway Authorities as required. No significant effects are anticipated. Construction noise would be managed through the adoption of best practice measures incorporated within a Construction Environmental Management Plan which would be provided prior to the start of construction. Impacts would be temporary during a construction period of up to 12 months. Separation distances that would exist between construction activities and residential properties, coupled with its temporary nature and existing background noise levels, mean that construction noise would not be expected to result in significant effects. As no significant effects are predicted form the project, the likely cumulative impacts is considered not significant.	As above	The scoping report states the following: 'Background noise levels will have already been influenced by local road traffic, operation of the nearby Fetteresso Substation and, to a lesser extent, by existing noise from agricultural activity within the local area. Acceptable noise limits, set in the context of the existing noise environment, would not be exceeded during operation of the Proposed Development. Careful design and consideration of the guidance within BS4142 would ensure that operation of the Proposed Development would result in no significant effects.' The project commits to a noise impact assessment, and mitigation that will result in no excess above BS4142 criteria. As no significant effects are predicted from The Proposed Development, the likely cumulative effects are also considered not significant.
Craigneil Wind Farm	As above	As above	As above

14.10 Summary of Significant Effects

14.10.1 **Table 14.31: Summary of Significant Effects** below summarises the predicted residual effects of the Proposed Development on Noise and Vibration prior to and following the application of additional mitigation.

Table 14.31: Summary of Significant Effects

Predicted Effects	Significance Prior to Additional Mitigation	Mitigation	Significance of Residual Effects Following Additional Mitigation
Construction	Not significant - Potential significant effects from construction will be mitigated with applied mitigation from a CNMP.	N/A	Not significant
Operation	Not significant - Potential significant effects from construction will be mitigated with embedded mitigation from securing low noise equipment.	N/A	Not significant
Cumulative (Associated SSEN Transmission Development)	Construction – potential significant effect from coincidental construction phases.	CNMP. As these developments are SSEN Transmission projects, there is greater potential for a coordinated noise management approach.	Not significant
	Operation – not significant	N/A	Not significant
Cumulative (Other Third Party Developments)	Not significant - Potential significant effects from construction will be mitigated with applied mitigation from a CNMP.	N/A	Not significant