CHAPTER 15 – NOISE AND VIBRATION

Figures (Volume 3 of this EIA Report)

Figure 15.1: Noise Sensitive Receptors (NSRs)

Visualisations (Volume 4 of this EIA Report)

There are no visualisations are associated with this Chapter.

Appendices (Volume 5 of this EIA Report)

Appendix 15.1: Acoustic Terminology

Appendix 15.2: Noise Sensitive Receptors (NSRs)

Appendix 15.3: Construction Activities

Appendix 15.4: Construction Noise Impact Assessment

Appendix 15.5: Operational Noise Impact Assessment

15 Noise and Vibration

15.1 Introduction

15.1.1 This Chapter considers the potential effects, including cumulative effects, of noise and vibration during the construction and operation of the Proposed Development at Noise Sensitive Receptors (NSRs) within the Study Area. Where likely significant effects are predicted, appropriate mitigation measures are proposed, and the significance of predicted residual effects are assessed.

15.1.2 This Chapter (and its associated Figures and Appendices) is not intended to be read as a standalone assessment and reference should be made to the introductory chapters of this EIA Report (**Chapters 1-6**) and the following:

- **Chapter 3: Project Description** for full details of the Proposed Development;
- **Chapter 12: Forestry**;
- **Chapter 13: Transport**; and
- **Chapter 16: Cumulative Assessment**.

15.1.3 The objectives of this Chapter are to:

- describe the assessment methodology and significance criteria used in the assessment;
- identify NSRs in the vicinity of the Proposed Development;
- describe and define the baseline noise environment;
- identify the dominant sound sources associated with the construction and operation of the Proposed Development;
- predict the potential impacts on NSRs; and
- indicate any requirements for mitigation measures, if applicable, to provide sufficient levels of protection for all NSRs.

15.1.4 This Chapter was prepared and overseen by experienced acoustic consultants at Wood PLC, with appropriate memberships of the Institute of Acoustics (IOA), and experience of EIAs in the context of energy grid developments. Consultants involved are documented in **Chapter 5: EIA Process and Methodology**.

15.1.5 This Chapter is necessarily technical in nature so, to assist the reader, a glossary of acoustic terminology is included in **Appendix 15.1: Acoustic Terminology**.

15.1.6 This Chapter considers both noise arising from construction operations, as well as noise arising from the OHL infrastructure itself during its operation. In summary of the types of operational noise that can arise, an energised electrical overhead line 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. While OHL conductors are designed and constructed to minimise corona discharge, surface irregularities such as damage, attached raindrops, insects and other types of contamination can increase local electric field strength beyond the inception level for local corona discharge at these sites. Such corona discharge can be the source of audible noise, a crackling sound accompanied sometimes by a low frequency hum.

15.1.7 The highest noise levels generated by an OHL usually occur during light 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. Mist or fog can also cause corona discharge from droplets condensing on and attaching to the conductor surface. Sometimes, after a prolonged spell of dry weather, conductors can become contaminated with accumulated dust particles and other materials on which corona discharge can occur and audible noise can be generated. Later rain showers have the effect of washing the conductors clean of such debris.

15.1.8 An OHL may also produce 'aeolian noise'. Aeolian noise is caused by wind blowing over a structure resulting in vibration that matches the natural frequency of the structure, or vortex shedding on the surface of a structure. It is difficult to assess aeolian noise and there is currently not a standardised method to predict this type of noise. This type of noise is usually infrequent and depends on wind velocity and direction. Embedded mitigation in **paragraph 15.4.4** details how these potential effects can be reduced.

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

- **Appendix 15.1: Acoustic Terminology**;
- **Appendix 15.2: Noise Sensitive Receptors**;
- **Appendix 15.3: Construction Activities**;
- **Appendix 15.4: Construction Noise Impact Assessment**; and
- **Appendix 15.5: Operational Noise Impact Assessment**.

15.2 Scope of Assessment and Methodology

Scope of the Assessment

Effects Assessed in Full

15.2.1 The scope of this assessment is to quantify the noise and vibration impacts on NSRs that are predicted from the construction and operational phases (including cumulative effects) of the Proposed Development and to evaluate the significance of the effects following mitigation.

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

- effects during construction of noise and vibration;
- effects during operation of noise;
- cumulative effects during construction of noise and vibration; and
- cumulative effects during operation of noise.

15.2.3 The assessment scenarios used for this topic will be during construction and for the fully operational development.

Effects Scoped Out

15.2.4 On the basis of the desk-based assessment 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 (**Appendix 6.1: Scoping Report**) and confirmed in the Scoping Opinion (**Appendix 6.2: Scoping Opinion**) (as detailed in **Table 15.5**).

- There are no sources of operational vibration associated with the Proposed Development at nearby NSRs. Therefore, vibration due to operation is not expected to adversely impact receptors and has not been assessed further.
- Any operational maintenance works 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 receptors and has not been assessed further.

Study Area

15.2.5 The Study Area for the assessment of noise and vibration encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in this Chapter. The Study Area comprises 2,312 nearby NSRs in proximity to the Proposed Development. NSRs were compiled from AddressBase data, detailed maps, and aerial photographs of the area surrounding the Proposed Development. NSRs 1 to 908 are within 500 m of the nearest point to the Proposed OHL Alignment Limit of Deviation (LoD) for the Proposed Development, and are assessed for operational noise. 500 m was chosen based on the author's experience ensuring all potentially impacted NSRs are be considered in the assessment. Beyond this distance, operational effects are negligible. Additional NSRs (909 to 2,312) are included to account for construction works which are due to take place greater than 500 m from the Proposed OHL Alignment LoD (e.g. access tracks, tower dismantling etc.). All NSRs (1 to 2,312) are assessed for construction effects where relevant (within 500 m of proposed works). Construction effects for NSRs outside of the study area are already addressed by NSRs within 500 m.

15.3 Methodology for the Assessment of Impacts

Legislation, Standards and Guidance

15.3.1 The assessment of construction noise has complied with the following standards and guidance.

Legislation

15.3.2 This assessment was carried out in accordance with the principles contained within the following legislation:

The Control of Pollution Act, 1974 (COPA) (Great Britain, 1974)

15.3.3 Section 60 of COPA 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 COPA 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.

Policy

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

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

15.3.5 Published in March 2011, this document provides advice on the role of the planning system in helping to prevent and limit adverse effects of noise. Information and advice on noise assessment methods are provided in the accompanying Technical Advice Note (TAN): Assessment of Noise[2]. Included within the PAN document and the accompanying TAN are details of the legislation, technical standards, and codes of practice for specific noise issues.

15.3.6 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 (including 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[3]. This BS has been replaced with BS 4142:2014: Methods for rating and assessing industrial and commercial sound[4].

[1] The Scottish Government (2011). Planning Advice Note: Planning and noise (PAN 1/2011). Available at: https://www.gov.scot/publications/planning-advice-note-1-2011-planning-noise/
[2] The Scottish Government (2011). Technical Advice Note: Assessment of noise (TAN 2011). Available at: https://www.gov.scot/publications/technical-advice-note-assessment-noise/
[3] UK Government (1997). British Standard 4142: Method for rating industrial noise affecting mixed residential and industrial areas (BS 4142), BSI, 1997. Available at: https://knowledge.bsigroup.com/products/method-for-rating-industrial-noise-affecting-mixed-residential-and-industrial-areas
[4] UK Government (2014). British Standard 4142: Methods for rating and assessing industrial and commercial sound (BS 4142), BSI, 2014, Amended 2019. Available at: https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound

Guidance

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

BS 5228-1/2:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites[5][6]

15.3.8 Guidance on the prediction and assessment of noise and vibration from construction sites is provided in BS 5228 2009 +A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites.

15.3.9 Part 1: Noise. BS 5228-1 provides recommended limits for noise from construction sites. The Construction Noise Impact Assessment (CNIA) has been carried out according to the ABC method specified in Table E.1 of BS 5228-1 (**Table 15.6**), in which NSRs are classified in categories A, B or C according to their measured or estimated background noise level.

15.3.10 Part 2: Vibration. BS 5228-2 provides recommended limits for vibration from construction sites. The Construction Vibration Impact Assessment (CVIA) has been carried out against the guidance on effects of vibration levels specified in Table B.1 of BS 5228-2. 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.

15.3.11 Potential of heavy goods vehicle (HGV) vibration on receptors along haul roads will be predicted using the procedures in Transport and Road Research Laboratory (TRL) Research Report 246 – Traffic Induced Vibrations in Buildings. The predictive method in Section 3.4.4 of TRL 246 is used. The expected value of maximum vertical peak particle velocity (PPV) at a building foundation can be calculated as:

$$PPV = 0.028\, a \left(\frac{v}{48}\right) t\, p \left(\frac{r}{6}\right)^{x}$$

15.3.12 Where a = maximum height or depth of the surface defect in mm, v = expected speed of HGV in km/h and t = ground scaling factor (Table 7 of TRL 246). If the surface defect occurs in one wheel path only, then p = 0.75, otherwise, p = 1, r = distance of foundation from the defect in metres, and x = power factor obtained from Table 7 from TRL 246 for most appropriate soil type. Chalk rock has been selected for this assessment. The ground scaling factor is 0.1 and power factor is -1.08.

Design Manual for Roads and Bridges LA 111 Noise and Vibration[7]

15.3.13 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.

15.3.14 The DMRB LA 111 guidance provides a method of assessing the noise and vibration due to construction traffic on existing roads. The magnitude of impact caused by construction traffic is determined by the increase in noise level from existing background noise levels. Vibration levels are assessed to absolute limits. This has been used to assess the HGV movements on roads.

15.3.15 During any time period, the significance of the effect is defined by the lowest observable adverse effect level (LOAEL) and significant observable adverse effect level (SOAEL).

[5] UK Government (2009). British Standard 5228-1: Code of practice for noise and vibration control on construction and open sites – Noise (BS 5228-1), BSI, 2009, Amended 2014. Available at: https://www.leicestershire.gov.uk/sites/default/files/field/pdf/2021/9/14/TG17-BSI-Code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-Part1.pdf
[6] UK Government (2009). British Standard 5228-2: Code of practice for noise and vibration control on construction and open sites - Vibration(BS 5228-2), BSI, 2009, Amended 2014. Available at: https://www.leicestershire.gov.uk/sites/default/files/field/pdf/2021/9/14/TG18-BSI-Code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-Part2.pdf
[7] Transport Scotland (2019). Design Manual for Roads and Bridges (DMRB), LA 111 Noise and Vibration. Available at: https://www.standardsforhighways.co.uk/tses/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364?inline=true

TGN(E)322 – Operational Audible Noise Assessment Process for Overhead Lines[8]

15.3.16 National Grid Electricity Transmission (NGET) 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. The guidance of BS 4142: 2014 can also be used to assess the impact of the noise from a specific industrial source at NSR.

15.3.17 The procedure requires that a series of assessments are conducted in tiers.

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

- The outcome of the Tier 1 assessment determines whether the 'worst case' wet noise impact is predicted to be acceptable, or whether further assessment is required. Only the wet noise is assessed to a certain limit (34 dB(A);
- The outcome of the Tier 2 assessment determines whether the combined wet and dry noise impact is acceptable, or whether further assessment is required. Historical rain data in the region is used to calculate the mean annual wet hours and new criteria for a 'combined' wet and dry noise level. The mean annual wet hours is used to find the percentage of wet weather, which will determine how often wet noise occurs and conversely, the percentage of dry noise. Using the formula for combined wet and dry noise criteria in Appendix D of TGN(E)322, this results in a range for adverse impacts of 36.7 dB(A) to 46.7 dB(A). Where the combined wet/dry noise falls below 36.7 dB(A), the NSR will be assessed to experience 'No Adverse Impacts' and OHL noise is deemed acceptable, and no further action is necessary. Where the combined wet/dry noise is within this range, the NSRs falls into the Adverse Impacts category. TGN(E)322 suggests that NSRs in this category should be considered to proceed to Tier 3 given the scale and cost of noise mitigation associated with minimising the noise. If the combined wet/dry noise is above 46.7 dB(A), then the NSR falls into the Significant Adverse Impact category and must proceed to Tier 3;
- the outcome of the Tier 3 assessment determines whether the noise impact is acceptable, whether the noise needs to be mitigated and minimised or whether the noise is unacceptable;
- the Tier 3 assessment takes account of existing background sound levels in the area and noise levels due to rainfall;
- the attended collection of night-time background noise levels at NSRs, or groups of such NSRs, within approximately 500 m of the centreline of the OHL during suitable dry weather conditions, before construction;
- allowance for the effects of rainfall on BGN (TGN(E)322 considers fog – an atypical condition – to produce lower noise levels than in rain but is still referred to as 'wet noise');
- prediction of contribution from conductors; and
- determination of total excess at the most likely rain rate.
- In Tier 3, a 6 dB tonal penalty is added to the wet noise predicted in Tier 1 to determine a rating level. The 6 dB tonal penalty is aligned with the BS 4142 objective method for assessing the audibility of tones, where 6 dB is the maximum penalty. The excess wet figure is derived by comparing the total noise with penalty (rating) to the background noise level for the appropriate Miller Curve rating at each receptor at a rain rate of 1 mm/hr. Miller curve descriptions are provided in **Table 15.1**. This rating level is then compared to the background noise level measured which must be adjusted for rainfall.
- A dry noise rating is also determined by adding a tonal penalty of 3 dB to the dry noise level. The excess dry figure is compared to a background noise level in dry conditions. TGN(E)322 states that dry noise is less annoying than wet noise, hence the lower penalty.

[8] National Grid (2021). Technical Guidance Note TGN(E)322: Operational Audible Noise Assessment Process for Overhead Lines. Available at: https://nsip-documents.planninginspectorate.gov.uk/published-documents/EN020024-000178-5.3.14H%20Appendix%2014H%20National%20Grid%20Technical%20Guidance%20Note%20TGN(E)322%20(2021).pdf

15.3.19 Tier 3 requires that the background noise (BGN) at NSRs within a set distance from the Proposed Development be measured during quiet night times and in dry conditions with little wind. The nature of the ground surface around the sensitive receptors is noted so that the contribution to background noise of the surface noise attributable to the rainfall can be derived from empirically derived curves (Miller curves). The logarithmic sum of the measured BGN and the empirically derived contribution for rainfall is adopted as the BGN level, in rainy conditions, against which to compare the predicted received noise from the OHL. Using the parameters provided in TGN(E)322 the likelihood of an adverse impact can be assessed.

Table 15.1: Miller Curve Description

Miller Curve	Description
R-1	Essentially bare, porous ground (that is ploughed field or snow-covered ground), no standing puddles or water. Relatively small-leafed ground cover vegetation, such as grass lawn, meadow, hayfield shortly after mowing, field of small-leaf plants.
R-2	Non-porous, hard, bare ground or pavement, falling raindrops splash on thin layers of puddles of collected water; or in or beside wooded area of deciduous trees without leaves or with only small leaves; or in or beside wooded area of coniferous trees or evergreens having needles rather than leaves; or thin-leafed ground cover of crop, such as hay, clover, or grain.
R-3	A few small, fully leafed deciduous trees 15 to 30 m or a few large, fully leafed trees 30 m to 90 m distance.
R-4	Large area of fully leafed trees or large-leafed crops or vegetation, such as corn starting 15 m to 30 m distance.
R-5	Large area of fully leafed trees or large-leafed crops or vegetation surrounding the area of interest.

15.3.20 While foggy conditions are associated with a low background noise level, the TGN(E)322 guidance defines noise in these conditions as 'wet noise'. If the Tier 1 or Tier 2 assessment screens out NSRs that are not affected by the wet noise, then the background noise level does not need to be considered in the assessment.

15.3.21 The excesses and magnitudes of impact are explained in the following section describing BS 4142.

BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound (BS 4142)[9]

15.3.22 BS 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.

15.3.23 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.

15.3.24 In accordance with the assessment methodology, the specific sound level (LAeq,T) of the noise source being assessed is corrected, by the application corrections for acoustic features, such as tonal qualities and / or distinct impulses, to give a "rating level" (LAr,Tr). The BS effectively compares and rates the difference between the rating level and the typical background sound level (LA90,T) in the absence of the noise source being assessed.

[9] UK Government (2014). British Standard 4142: Methods for rating and assessing industrial and commercial sound (BS 4142), BSI, 2014, Amended 2019. Available at: https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound

15.3.25 BS 4142 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.

15.3.26 Comparing the rating level with the background sound level, BS 4142 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.*"

BS 8233:2014[10] and Noise Rating Curves

15.3.27 BS 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 the document 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. It has been requested by the Aberdeenshire Council to consider indoor noise, hence the assessment to BS 8223:2014.

15.3.28 The guidance provided includes appropriate internal and external noise level criteria which are applicable to dwellings exposed to steady-state external noise sources. It is stated in the BS that it is desirable for internal ambient noise level not to exceed the criteria set out in **Table 15.2.**

Table 15.2: 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. Night time
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

15.3.29 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. The primary standards that reference NR curves include; ISO 1996-1:2016, ISO 717-1:2013, and BS 8233:2014.

15.3.30 The NR 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 15.3**.

Table 15.3: 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

[10] UK Government (2014). British Standard 8233: Guidance on sound insulation and noise reduction for buildings (BS 8233), BSI, 2014. Available at: https://knowledge.bsigroup.com/products/guidance-on-sound-insulation-and-noise-reduction-for-buildings

Noise Rating	Application
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

15.3.31 The NR curve NR20 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 BS 8233. NR 20 has been selected for this assessment as the majority of NSRs are in a quiet rural area.

15.3.32 The guidance documents described above help inform the following assessments:

- BS 5228-1/2 has been used to assess potential effects of construction noise and vibration due to static equipment.
- DMRB LA111 has been used to assess potential effects of construction noise due to traffic.
- TGN(E)322 has been used to assess potential effects of operational noise of the OHLs.
- BS 4142 has been used in the Tier 3 assessment of TGN(E)322.
- BS 8233 has been used for the assessment of internal noise due to the operation of the Proposed Development.

Assessment Methodology

Construction Noise

15.3.33 A desk-based CNIA has been prepared for the purpose of assessing the effects of the works on NSRs within the Study Area. This assessment has been produced in line with British Standard 5228-1:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites

15.3.34 The proposed working hours of the construction activities are outlined in **Table 15.4**. At the time of writing, it is not known the exact start and end date of each activity for a specific location. Therefore, the sequence of activities is shown. The typical noise levels for construction equipment for each activity are identified in Annex C of BS 5228-1. 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 is calculated. The dispersion of this total noise level is then modelled, accounting for distance and ground absorption.

Table 15.4: Construction Schedule

Contract Works	Proposed Working Hours
Vegetation Clearance and Felling	During British Summer Time (30 Mar to 26 Oct) Every day 07:00 – 19:00 During Greenwich Mean Time (26 Nov to 29 March) Every day 07:00 – 18:00
Access and Enabling	
Foundations	
Tower Erection	
Stringing	
Dismantling	
Reinstatement	

15.3.35 From the outlined construction schedule above, it is expected that the majority of construction works will occur during weekday daytime hours; however, it is possible that some work will also extend into daytime evenings, Saturday afternoons, and Sunday hours as categorised in BS 5228.

15.3.36 To calculate the potential construction noise levels from the work sites for the Proposed Development, information about the proposed construction activities is needed. The Principal Contractor will be responsible for developing the detailed construction methodology and associated plant requirements following contract award, however, **Appendix 15.3: Construction Activities** shows plant activities, assumed plant items, their assumed quantities, their assumed utilisation, and associated noise levels at a distance of 10 m, taken from BS 5228. By combining the items' noise levels (LA,eq at 10 m (dB)) with the amount of time each will be running (utilisation) and their quantity, the total equivalent noise can be calculated for each row. These are then logarithmically summed to give a total value for the construction noise at 10 m.

15.3.37 To ensure a worst-case assessment, it has been assumed that all works within the phases will take place simultaneously for the indicated percentage of the working hours.

15.3.38 The total equivalent noise level at 10 m for each activity can be used in a propagation calculation to find the specific noise at each receptor.

15.3.39 For the construction assessment, the distance to NSRs is determined from the NSR location to the nearest proposed tower location. A secondary worst-case assessment is conducted to account for the potential change in alignment within the LoD. The towers and alignment can move up to 100 m from the Proposed OHL Alignment whilst maintaining a minimum of 45 m to any NSRs to allow for the Operational Corridor (OC). Additionally, a special larger LoD around the NP2-10A and NP2-11A towers has been accounted for. Therefore, the secondary worst-case assessment uses the distance to the closest tower assuming worst-case tower locations within the LoD. The full extent of the LoD (145 m around suspension towers and the alignment, and 200 m around angle towers) could be used for construction works on a temporary basis, however, the average activity over the working period will be at the geometric centre of the construction area, which is the designed tower location, and therefore noise is calculated for Foundations, Tower Erection, Stringing with Conductor, Dismantling, and Reinstatement phases assuming the works take place at the tower location. The felling noise is calculated based on closest distance to an area identified for felling. The noise from the access tracks, platforms and general civils phase is calculated based on the shortest distance to an access track.

15.3.40 Towers are assumed to be no closer than 45 m from any NSR to maintain the OC requirement.

15.3.41 This attenuation has been calculated over mixed hard and soft ground to the F.2.3.2 method in BS 5228. 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.

15.3.42 Construction traffic is also assessed. Both local haul roads and site access are assessed using proposed vehicle movements and incorporated into the main BS 5228 assessment, using distance from the haul route and NSRs as inputs. Separately, construction traffic on main roads has been assessed using DMRB LA 111 methods, using input information from **Chapter 13: Transport**.

15.3.43 In line with best practice (BS 5228-1), a Construction Noise Management Plan (CNMP) is typically developed by the Principal Contractor prior to starting the construction works (outlined in **Table 15.4**). The details of the CNMP will be agreed with the Local Authority and is expected to be secured by an appropriately worded consent condition.

Construction Vibration

15.3.44 A desk-based construction vibration appraisal assessment has been prepared for the purpose of assessing the effects of the works on NSRs within the study area. This appraisal has been produced in line with British Standard 5228-2:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites.

15.3.45 BS 5228-2 provides recommended limits for vibration from construction sites. The Construction Vibration Impact Assessment (CVIA) has been carried out against the guidance on effects of vibration levels specified in Table B.1 of BS 5228-2. 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.

15.3.46 Construction activities that induce vibration are likely to be limited to potential piling activities if required at foundations. As a worst-case assessment, all towers are assumed to require piled foundations works for this section of the assessment. The formulae for the prediction of groundborne vibration due to piling is taken from Table E.1 in BS 5228-2.

Operational Noise

15.3.47 A desk-based operation noise impact assessment has been prepared to determine the potential impacts on NSRs within the study area. There are differences in assessment methods for dry and wet conditions. Dry noise is assessed by indicating the excess of rating level over background. During wet conditions, the noise output from OHLs varies according to the number and size of rain droplets accumulated on the surface of the conductors. Therefore, there is a strong relationship between the rainfall rate and the noise output from an OHL. Background noise levels also increase with rainfall rate, such that during very heavy rain, OHL noise is generally masked by the noise due to rainfall. For these reasons, an alternative noise assessment method to deal with rain-induced noise is required.

15.3.48 The external rain-induced noise levels are assessed using the methodology developed by National Grid and detailed in their Technical Guidance Note TGN(E)322. The assessment is performed in tiers and proceeds to the next tier if further assessments are required. Initially in Tier 1, only the wet noise is assessed to a certain limit (**Table 15.10**). At Tier 2, the percentage split of wet and dry noise is assessed, historical rain data in the region is used to calculate the mean annual wet hours and a 'combined' wet and dry noise level is assessed to a threshold (**Table 15.11**). If Tier 3 is required, the excess wet figure is derived by comparing the total noise to the background noise level for the appropriate Miller Curve rating at each receptor at a rain rate of 1 mm/hr.

15.3.49 For the purposes of the operational assessment, the distance to NSRs will be to the nearest point on the Proposed OHL Alignment Centreline. A secondary scenario has been assessed as if the towers proposed are moved a maximum of 100 m due to the LoD (unless otherwise larger due to special LoD around towers NP2-10A and NP2-11A). It is assumed that no tower is less than 45 m from an NSR.

Consultation

15.3.50 Full details of the consultation process and responses are included in **Chapter 6: Scope and Consultation** and associated appendices, with specific responses relating to noise and vibration summarised in **Table 15.5.**

Table 15.5: Consultation Responses

Organisation	Type of Consultation	Response	How response has been considered
The Highland Council	Pre-application advice (17 July 2024) Scoping Response (22 August 2024)	In relation to constriction noise, planning conditions are not usually used to control the impact of construction noise as similar powers are available to the Local Authority under Section 60 of COPA. However, as the Proposed Development will include significant construction works and sections of the OHL are in close proximity to noise sensitive properties, with one section being only 100 metres, there is potential for significant disturbance from construction noise.	Construction noise and vibration is assessed to BS 5228-1 and BS 5228-2 respectively. Therefore, construction noise is assessed to 55 dB limits to be in accordance with the Evening and Weekends limit, as per BS 5228-1. Construction traffic is assessed in accordance with BS 5228-1 for local haul roads and site access, and in line with DMRB LA

Organisation	Type of Consultation	Response	How response has been considered
		The Applicant will also need to ensure that the EIA contains a construction noise / vibration assessment. The assessment should be carried out by a competent person, in accordance with BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites'. The noise assessment will also require to include an assessment of the impact of noise from construction traffic. If piling is required in locations close to residential properties, this can also result in significant disturbance. In addition to nuisance, one of the most common concerns about piling is the perceived risk of structural damage. In relation to operational noise, due to the close proximity of some of the sections of OHL to residential and noise sensitive properties, the applicant will be required to submit a detailed noise assessment undertaken by a competent person.	111 for impacts on the strategic road network. An operational noise impact assessment has been conducted in line with TGN(E)322.
Moray Council	Scoping Opinion (25 July 2024)	Construction phase - The need to control noise, vibration, dust and artificial lighting will be an important consideration. This may best be covered by the provision of a Construction Environmental Management Plan (CEMP), and include controls over times of construction. It is understood that borrow pits may be required and the need to control any blasting activities to manage vibration will be a relevant consideration. It is understood anticipated hours of construction and 7am to 7pm 7 days (summer months), with a shortened working day of 7am to 5pm in winter months. Operational phase - this Section has noted and agreed the scope of the operational noise assessment by the appointed noise consultants.	Construction noise and vibration is assessed to BS 5228-1 and BS 5228-2 respectively. Control measures will be implemented in a CEMP. It is noted that the project proposes to operate from 7am to 6pm during the winter months, which differs from the 7am to 5pm operating hours stated in the scoping opinion.
Aberdeenshire Council	Scoping Response (8 August 2024)	The Environmental Health Service has considered the scoping report and would generally have no objection to the approach suggested. However, this service is in receipt of noise complaints from existing 400 kV OHL and additionally internal noise criteria would be required. This should be agreed with Environmental Health alongside noise limits for the suggested approaches as stated in the scoping report.	Internal noise will be considered for the worst effected receptors and assessed to BS 8233 and NR 20 criteria.

Determining Baseline

15.3.51 Baseline noise measurements are required to determine background noise (BGN) levels for the Tier 3 assessment of TGN(E)322. BGN levels are ascertained by conducting free-field attended spot measurements. The field survey consists of free-field attended spot measurements at each noise sensitive receptor using a class-1 sound level meter. This background noise level would be used as a baseline for the operational noise impact assessment for dry and wet conditions at Tier 3.

15.3.52 A field survey was not required for this assessment, due to the outcome of the Tier 1 TGN(E)322 operational noise assessment, as shown in **Appendix 15.5: Operational Noise Impact Assessment**. No noise sensitive receptors proceed to Tier 2 or 3 and therefore background noise is not required. Background noise is also not required for the construction noise impact assessment, using the ABC method of BS 5228, and assuming all NSRs fall into the most conservative A category.

15.3.53 Some field surveys were conducted in early stages of the project, when the Proposed OHL Alignment was not finalised, however the results of the final calculation found that these were not required and therefore baseline surveys were subsequently not included in this EIA Report.

Determining Receptor Sensitivity

15.3.54 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. The definition of receptor sensitivity is outlined in TGN(E)322. Prior to detailed assessment, all NSRs considered in this assessment are assumed to be residential in nature. Therefore, the sensitivity is assumed as Medium unless otherwise specified.

Identification of Sensitive Receptors

15.3.55 Potential NSRs were processed from AddressBase data (published June 2025) and cross-checked with satellite imagery. Additional consented but not yet built receptors were provided by the Applicant and added to the assessment. All potential receptors from this combined dataset that fall within 500 m of the Proposed Development are considered in the construction noise and vibration assessment and operational noise assessment. This resulted in the identification of 2,312 NSRs. NSRs 1 to 908 were within 500 m of the Proposed OHL Alignment LoD, NSRs 909 to 2,312 were greater than 500 m from the Proposed OHL Alignment LoD but were within 500 m of planned construction works.

15.3.56 For the operational noise assessment, according to the Electrical Power Research Institute (EPRI) method, recommended by the TGN(E)322, an OHL passes a Tier 1 assessment of TGN(E)322 if the wet noise falls below 34 dB(A) at that receptor, assuming a medium sensitivity for residential receptors. No vulnerable subgroups of High sensitivity (as defined in TGN(E)322 to include hospitals and pre-schools, care homes and hospices) have been identified. It was calculated that the wet noise from the proposed conductor Triple Araucaria, is predicted to produce 34 dB(A) of wet noise up to a distance of 26 m. Adding a buffer of 10 m, for variances in property size, meant that addresses up to 36 m from the Proposed Development would fail at Tier 1 and progress to Tier 2.

15.3.57 The 2,312 NSRs are detailed in Appendix 15.2: Noise Sensitive Receptors (NSRs) and shown in Volume 3, Figure 15.1: Noise Sensitive Receptors (NSRs).

Kellas Alternative Alignment

15.3.58 There are no additional NSRs located within 500 m of the Kellas Alternative Alignment LoD or within 500 m of planned construction works. Therefore a separate assessment of the Kellas Alternative Alignment is not required.

Determining Impact Magnitude

15.3.59 The impact magnitude has been assessed for both the construction noise and vibration in addition to the operational noise. These methods to determine impact magnitude of either High, Medium, Low, or Negligible are described in the following sections.

Construction Noise

15.3.60 The noise criteria provided for the ABC method detailed in BS 5228-1 are shown in **Table 15.6**.

Table 15.6: Construction Noise Impact Assessment Criteria

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

15.3.61 To determine the threshold value and noise limit to which the construction noise is assessed against, the periods must be defined and categories identified. Night-time is defined as between 23:00 and 07:00. Evenings and weekends are defined as 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.

15.3.62 The NSR is defined as Category A if the ambient baseline noise levels (rounded to the nearest 5 dB) are less than those stated for Category A. This is true for the study area, given the rural setting and to ensure that the assessment is conservative, therefore the NSRs of the Proposed Development has been assessed to Category A thresholds.

15.3.63 As indicated by the **Chapter 3: Project Description**, work is expected to take place seven days a week. It is likely that the majority of construction works will occur during daytime periods, however, construction may be required to extend into evening periods and weekends. It is not known what activities within each phase will take place at what times. Therefore, the 55 dB(A) limit has been adopted in this case to ensure a conservative assessment takes place. While work is expected to take place between 7:00 and 18:00 every day during GMT (extended to 19:00 during BST), construction activity will take place within the hours of Daytime and Saturdays, therefore the noise is also assessed to a 65 dB limit in the case that noisier work is prioritised then rather than Saturday afternoons or Sundays.

15.3.64 With a worst-case noise limit of 55 dB(A) identified from BS 5228-1, the following magnitude of impact at receptors can be determined and is presented in **Table 15.7**.

Table 15.7: Construction Noise – Impact Magnitude

Impact Magnitude	Construction Noise Level (dB(A))	
	Evenings and Weekends (55 dB Limit)	Daytime and Saturdays (65 dB Limit)
Negligible	< BGN	< BGN
Low	BGN to 55	BGN to 65
Medium	56 to 60	66 to 70
High	> 60	>70

15.3.65 Excess over the 55 dB limit will result in **Medium** impact magnitude. Excess of 5 dB or more over the noise limit will result in **High** impact magnitude. For the daytime assessment the 55 dB(A) limit is replaced with 65 dB(A).

15.3.66 Construction traffic for local haul roads and site access are incorporated within the BS 5228-1 assessment, however additional criteria extend to construction traffic on highways. **Table 15.8** 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 15.8: Construction Traffic Noise – Impact Magnitude

Magnitude of Change	Traffic Noise Level Change (dB(A))
Negligible	0.1 to 0.9
Low	1.0 to 2.9
Medium	3 to 4.9
High	> 5

15.3.67 According to LA 111, a change in construction traffic noise levels above 3 dB is considered to be a Major impact if occurring for more 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 six consecutive months.

Construction Vibration

15.3.68 Vibrations, even of very low magnitude, can be perceptible to people and can interfere with the satisfactory conduct of certain activities, e.g. delicate procedures in hospital operating theatres, use of very sensitive laboratory weighing equipment. Vibration nuisance is frequently associated with the assumption that, if vibrations can be felt, then damage is inevitable; however, considerably greater levels of vibration are required to cause damage to buildings and structures. Vibrations transmitted from site activities to the neighbourhood can, therefore, cause anxiety as well as annoyance, and can disturb sleep, work or leisure activities.

15.3.69 Criteria for annoyance due to construction vibration due to access tracks and foundation works are taken from Table B.1 in BS 5228-2 and shown in **Table 15.9**. Vibration is measured as peak particle velocity (PPV).

Table 15.9: Construction Vibration – Impact Magnitude Thresholds

Impact Magnitude	Vibration Level, Peak Particle Velocity (PPV) $mm \cdot s^{-1}$	Effect
Negligible	<0.3	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 – 0.9	Vibration might be just perceptible in residential environments.
Medium	1 - 10	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	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

15.3.70 Excess over the 10 $mm \cdot s^{-1}$ criteria will result in **High** impact magnitude. Construction vibration between the 1 $mm \cdot s^{-1}$ and 10 $mm \cdot s^{-1}$ threshold will result in **Medium** impact magnitude. Below 1 $mm \cdot s^{-1}$ will result in **Low** impact magnitude. Below 0.3 $mm \cdot s^{-1}$ is **Negligible**.

Operational Noise

15.3.71 The impact of operational noise is approached as a tired assessment in TGN(E)322.

15.3.72 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. Predicted free field wet noise levels at the external façade of the NSR are compared against the Tier 1 noise criteria outlined in **Table 15.10**.

Table 15.10: Operational Noise – Tier 1 Criteria

Use	No Adverse Impact - Screened Out	Tier 2 Assessment Required
Vulnerable subgroups	< 29 dB(A)	≥ 29 dB(A)
Residential	< 34 dB(A)	≥ 34 dB(A)
Schools and Hotels	< 39 dB(A)	≥ 39 dB(A)

15.3.73 Where the predicted wet noise levels fall into the 'No Adverse Impact' category in **Table 15.10**, the noise from the OHL is acceptable. Receptors falling into this category are screened out of further assessment and no further action or assessment is necessary, impact can be considered **Negligible**.

15.3.74 A Tier 2 Assessment shall be carried out where predicted Wet Noise levels exceed the 'No Adverse Impact' Category. A Tier 2 assessment considers the combined dry and wet noise contribution through logarithmic calculation to determine new noise criteria. The combined noise criteria are presented in **Table 15.11**. Historical rain data in the region has been used to calculate the mean annual wet hours from the period of 01 June 2014 to 01 December 2024. 11487 wet hours of rain were recorded over a period of 78,585 hours at Lentran, resulting in a wet percentage of 14.6%. If combined noise is above 36.7 dBA, NSRs proceed to a Tier 3 assessment.

Table 15.11: Operational Noise – Tier 2 Criteria

Use	No Adverse Impact	Adverse Impact	Significant Adverse Impact
Vulnerable subgroups	< 31.7 dB(A)	31.7 - 41.7 dB(A)	> 41.7 dB(A)
Residential	< 36.7 dB(A)	36.7 - 46.7 dB(A)	> 46.7 dB(A)
Schools and Hotels	< 41.7 dB(A)	41.7 - 51.7 dB(A)	> 51.7 dB(A)

15.3.75 Where the predicted combined wet / dry noise level falls into the 'No Adverse Impact' category in a Tier 2 assessment, impacts can be considered **Low** and effects **Negligible**.

15.3.76 Where the predicted combined wet / dry noise level falls into the 'Significant Adverse Impact' category in a Tier 2 assessment, TGN(E)322 states a Tier 3 assessment will be necessary. As a conservative approach, this assessment also proceeds to Tier 3 where 'Adverse Impacts' are identified at Tier 2.

15.3.77 The outcome of the Tier 3 assessment will determine whether the noise impact is acceptable, whether the noise needs to be mitigated and minimised or whether the noise is unacceptable.

15.3.78 The Tier 3 assessment takes account of existing background sound levels in the area and noise levels due to rainfall. The Tier 3 Assessment requires the impact of Dry Noise and Wet Noise to be assessed separately using two different methods which are based on the principles of BS 4142. The two methods differ in that the Dry Noise assessment requires the determination of the existing baseline sound level, whilst for the Wet Noise assessment, it is necessary to predict the increase in background sound levels due to rainfall.

15.3.79 Magnitude criteria can be quantitative using standards from BS 4142. The impact magnitude is worked out on a case-by-case basis for each NSR and classified as Negligible, Low, Medium, or High. Information from the rating level, the background sound level, and the stated impacts from a BS 4142 assessment have been converted into representative impact magnitudes, detailed in **Table 15.12**.

Table 15.12: Operational Noise – Tier 3

Impact Magnitude	Definition	Tier 1 Criteria for Magnitude of Impact	Tier 2 Criteria for Magnitude of Impact	TGN(E)322 Tier 3 Criteria for Magnitude of Impact (Difference between OHL Rating Noise Level and Background Sound Level)
Negligible	Impact to the receptor is immeasurable, undetectable or within the range of normal natural background variation.	<34 dBA wet noise	<36.7 dBA combined wet and dry noise	Low Impact ≤ 0 dB
Low	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	>34 dBA, further assessment required at Tier 2	>36.7 dBA, further assessment required at Tier 3	Minor Impact 0 to 4 dB
Medium	A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.			Adverse Impact 5 to 9 dB
High	A difference of around +10 dB or more is likely to be an indication of a **Significant** adverse impact, depending on the context.			Significant Adverse Impact ≥ 10 dB

Determining Significance of Effect

15.3.80 After assessing the sensitivity of the NSR in its baseline state, and then the impact magnitude of the noise likely to affect the NSR, an estimate of the effect significance can be derived by applying a calculation matrix.

15.3.81 The measure of significance is the key output of the impact assessment process and drives the requirement for mitigation measures to be applied during operation to offset or reduce potential project generated effects.

15.3.82 The effect was determined based on the significance matrix presented in TGN(E)322 and based on professional judgement, considering both sensitivity and magnitude of change as detailed in **Table 15.13** below. Resulting effects of **Moderate** and **Major** impacts are considered **Significant** under the EIA Regulations and require mitigation.

Table 15.13: Significance of Effect Matrix

Significance of Effect		Sensitivity of Receptor			
		High	Medium	Low	Negligible
Impact Magnitude	High	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

Limitations and Assumptions

15.3.83 Estimated noise emissions from the Proposed Development's construction noise activities and plant items have been extracted from Annex C in BS 5228-1. Where equipment has been proposed that cannot be extracted from BS 5228-1, information of source noise levels is taken from projects of a similar nature. This assessment considers conservative assumptions with the aim to produce a worst-case assessment. The assumptions include a direct path from source to receiver with no screening or change in terrain level. The ground factor is assumed as a mix of both hard and soft terrain. The assessment assumes equipment is producing the maximum sound power level for the entire time it is assumed as operational according to the construction schedule. In practice, noise levels during construction would be expected to be lower than the assessment details.

15.3.84 Two scenarios are assessed in this Chapter. The first is where the noise is assessed as if the Proposed Development is built as designed. The second is where the noise is assessed as if the towers proposed are moved a maximum of 100 m (unless otherwise more due to the special LoD around towers NP2-10A and NP2-11A) to address potential future changes in tower positions as a result of micrositing within the LoD.

15.3.85 There will be periods just after rainfall or during foggy conditions where there is some noise emission from the OHL, although these levels are less than those during rain according to TGN(E)322. These periods where background noise is less than those in during periods of rainfall are not accounted for in the assessment as there no standardised methodology or procedure. The number of droplets, and hence the noise level, will depend primarily on the rate of rainfall. Historical studies determined that hum inception typically occurs at a rainfall rate of approximately 1 mm/hr. Hum inception is the point at which during rainfall the low-frequency humming component of corona discharge noise becomes noticeable. This hum induces a tonal component of the noise, which is represented by a 6 dB tonal penalty at Tier 3 of a TGN(E)322 assessment.

15.3.86 There is a degree of uncertainty when conducting assessments on developments in the planning stage. These uncertainties occur in calculation, rounding, and baseline levels used. Assumptions include a flat terrain between OHL centreline and NSR. In Tier 1 and 2 of the TGN(E)322 assessment, no acoustic absorption due to the ground is included to ensure a worst-case assessment. The calculation for OHL conductor noise uses the EPRI method of calculation which assumes a moderately aged conductor, which is appropriate for the assessment of the Proposed Development for the lifetime of its operation.

15.3.87 There is no standardised method to reliably predict or assess for the potential aeolian noise impacts. Therefore, aeolian noise is not assessed within this Chapter. However, the impacts of such noise should be anticipated and mitigated where possible in the design of the Proposed Development. It will be ensured that components such as insulators and dampers are used that have no known history of producing high aeolian noise.

15.3.88 The assessments are based on information available at the time of publication, any changes to design or specification of the Proposed Development that may lead to increased adverse effects would require re-assessment.

15.3.89 The perception and impact of noise is subjective. However, the standard methodologies aim to assess noise objectively.

15.3.90 Whilst some information is subject to change such as the construction activities, 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.

15.4 Assessment of Likely Significance of Effects

Embedded Mitigation

15.4.1 Topic specific embedded mitigation (mitigation achieved through design) is outlined below.

Operational Noise

15.4.2 The proposed conductor type, Triple Araucaria, has been selected for use on the Proposed Development, which is a low noise producing conductor at 400 kV.

15.4.3 Permanent towers and conductors are not proposed to be located within 45 m of NSRs, beyond this distance, the conductor produces relatively low noise. The purpose and key driver of the routeing is to avoid proximity to NSRs such as residential properties.

15.4.4 Aeolian noise is caused by wind blowing through the conductors and/or structures. This type of noise is usually infrequent and depends on wind velocity and direction. Wind must blow steadily and perpendicular to the lines to set up an aeolian vibration, which can produce resonance if the frequency of the vibration matches the natural frequency of the line. Design of the conductors will implement best practice. Dampers will be attached to the lines to minimise aeolian vibration and therefore aeolian noise. It will be ensured that no components are used that have a known history to produce high aeolian noise.

Predicted Construction Noise Impacts

15.4.5 A desk-based construction noise appraisal has been prepared for the purpose of assessing the effects of the works on any nearby residents. This appraisal has been produced in line with BS 5228-1:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites.

15.4.6 Construction noise is assessed to a 55 dB limit in the case that work takes place during Saturday afternoons or Sundays (Evening and Weekends). Results are also presented as assessed to a 65 dB limit, as the majority of works are to be scheduled during daytime periods.

15.4.7 All NSRs (1 to 2,312) were included in this construction assessment with noise levels calculated for all NSRs within 500 m of the construction work location.

15.4.8 Detailed results are shown in Appendix 15.4: Construction Noise Impact Assessment.

15.4.9 A summary of predicted impacts from construction noise are presented in **Table 15.14** and **Table 15.15**. A count of Medium and High impacts for each phase of work are included for both "Daytime and Saturdays" and "Evenings and Weekends" hours.

15.4.10 **Table 15.14** includes the summary of results for all construction phases based on distances to the proposed location for each phase of work.

Table 15.14: Construction Noise Impact Results – Proposed Development

Phase	Daytime and Saturdays (65 dB limit)		Evenings and Weekends (55 dB limit)	
	Medium Impacts (65 dB Limit)	High Impacts (70 dB Limit)	Medium Impacts (55 dB Limit)	High Impacts (60 dB Limit)
Vegetation Clearance and Felling	101	54	112	408
Access and Enabling	147	249	910	799
Foundations	13	0	367	126
Tower Erection	5	0	300	65
Stringing	27	0	407	243
Dismantling	8	5	39	36
Reinstatement	10	1	41	29

15.4.11 The highest noise producing phases are access and enabling, and tower erection where almost all NSRs considered have **Medium** impacts or higher during evening and weekend periods.

15.4.12 The assessment shows a significant reduction of impacts when assessing to the 65 dB daytime limit, compared to the 55 dB evening and weekend limit. Careful consideration of specific construction activities is required during evening and weekend periods.

15.4.13 The assessment predicts a maximum **High** impact magnitude for all work phases during evening and weekend periods. The assessment predicts **High** impact magnitude for all work phases other than stringing during daytime activities. With a NSR sensitivity of **Medium** the effect is considered **Major** and therefore **Significant**.

15.4.14 Some phases of work could change locations due to tower movement within the LoD. NSRs have also been assessed based worst case tower position within the LoD. A summary of the results for the three construction phases effected by tower movement, have been presented in **Table 15.15**.

Table 15.15: Construction Noise Impact Results – Proposed Development Including OHL Alignment LoD

Phase	Daytime and Saturdays (65 dB limit)		Evenings and Weekends (55 dB limit)	
	Medium Impacts (65 dB Limit)	High Impacts (70 dB Limit)	Medium Impacts (55 dB Limit)	High Impacts (60 dB Limit)
Foundations	84	36	356	333
Tower Erection	67	20	319	255
Stringing	127	51	434	445

15.4.15 The impacts when considering the LoD increase compared to only considering the Proposed OHL Alignment, due to a decrease in distance from source and receiver. The assessment predicts a maximum **High** impact magnitude for all work phases during evening and weekend periods. The assessment predicts **High** impact magnitude for all work phases (other than reinstatement) during daytime activities. With a NSR sensitivity of **Medium** the effect is considered **Major** and therefore **Significant**.

15.4.16 As a worst-case assumption, noise from Access and Enabling works has been calculated using the distance from the NSR to the nearest point on an access track. It is not likely that all the equipment proposed by the OHL Contractors will be used for the entire day at the respective nearest point to the NSR. In reality, the equivalent average sound pressure level over the working day will be much lower, while activities are also expected to be short-term.

15.4.17 Calculating construction noise propagation in accordance with BS 5228 (**paragraph 15.3.38**), it was determined that during Daytime and Weekend hours, **Medium** impacts are experienced up to around 250 m, and **High** impacts are predicted up to around 140 m. This is based on the loudest phases of construction, Stringing and Access and Enabling (92dB at 10m from the towers and access tracks respectively). Other phases will only experience impacts at shorter distances due to lower source sound power levels.

15.4.18 Construction related traffic and transport impacts for main access routes 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 Calculation of Road Traffic Noise (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 13: Transport**.

15.4.19 The average 18-hour traffic flows, HGV movements, and average vehicle speed reported in **Chapter 13: Transport** have been used for the purposes of the noise calculation as is required by CRTN. Noise levels for the baseline and baseline + construction traffic scenarios are presented in for both cars and HGVs. Location numbers in **Table 15.16** are defined road sections from **Chapter 13: Transport**.

15.4.20 Where surveyed average vehicles were not available a conservative average speed was taken as the speed limit for the road.

Table 15.16: Summary of Calculation of Road Traffic Noise Results

Road Section	Mean Speed (mph)	2026 Baseline Vehicles per 18h	2026 Baseline HGVs per 18h	% HGV Baseline	2026 Baseline + Development Vehicles per 18h	2026 Baseline + Development HGVs per 18h	% HGV Future	Noise Level Baseline (dB)	Noise Level Future (dB)	Increase (dB)	Impact
HC-C1106-01	26	229	1	0.44	455	151	33.19	N/A	N/A	N/A	NEGLIGIBLE
HC-U1604-01	33	286	7	2.45	512	158	30.86	N/A	N/A	N/A	NEGLIGIBLE
HC-C1108-01	33	422	7	1.66	648	157	24.23	N/A	N/A	N/A	NEGLIGIBLE
HC-A833-01	53	2935	44	1.50	3161	194	6.14	66	67	1.2	LOW
HC-A862-01	60	4206	117	2.78	4433	267	6.02	69	70	0.9	NEGLIGIBLE
HC-A862-02	60	4290	75	1.75	4517	225	4.98	69	70	0.8	NEGLIGIBLE
HC-C1102-01	60	460	6	1.30	687	156	22.71	N/A	N/A	N/A	NEGLIGIBLE
HC-A862-03	60	5059	73	1.44	5285	223	4.22	70	70	0.8	NEGLIGIBLE
HC-A862-04	60	17486	445	2.54	17712	596	3.36	75	75	0.3	NEGLIGIBLE
HC-A8082-01	40	15492	421	2.72	15719	572	3.64	71	71	0.3	NEGLIGIBLE
HC-B861-01	46	2275	14	0.62	2502	164	6.55	63	65	1.8	LOW
HC-C1068-01	34	222	6	2.70	448	156	34.82	N/A	N/A	N/A	NEGLIGIBLE
HC-B851-02	40	674	10	1.48	900	161	17.89	N/A	N/A	N/A	NEGLIGIBLE
HC-C1056-01	27	124	3	2.42	351	153	43.59	N/A	N/A	N/A	NEGLIGIBLE
HC-B9090-01	60	1542	222	14.40	1769	373	21.09	67	68	1.4	LOW
HC-B9090-03	60	2583	344	13.32	2847	502	17.63	69	70	0.9	NEGLIGIBLE
HC-A939-01	49	994	11	1.11	1258	169	13.43	N/A	64	N/A	NEGLIGIBLE
MC-A940-01	47	1138	43	3.78	1364	193	14.15	62	64	2.5	LOW
MC-B9011-01	60	5068	389	7.68	5293	538	10.16	71	71	0.5	NEGLIGIBLE
MC-B9010-02	39	290	5	1.72	516	155	30.04	N/A	N/A	N/A	NEGLIGIBLE
MC-A941-01	60	19950	288	1.44	20176	439	2.18	76	76	0.2	NEGLIGIBLE

Road Section	Mean Speed (mph)	2026 Baseline Vehicles per 18h	2026 Baseline HGVs per 18h	% HGV Baseline	2026 Baseline + Development Vehicles per 18h	2026 Baseline + Development HGVs per 18h	% HGV Future	Noise Level Baseline (dB)	Noise Level Future (dB)	Increase (dB)	Impact
MC-A941-02	54	6125	219	3.58	6351	369	5.81	70	71	0.5	NEGLIGIBLE
MC-B9103-02	59	1191	9	0.76	1418	160	11.28	63	66	2.6	LOW
MC-B9015-01	54	1329	153	11.51	1555	303	19.49	65	66	1.7	LOW
MC-U22E-01	60	37	7	18.92	264	157	59.47	N/A	N/A	N/A	NEGLIGIBLE
MC-B9016-01	52	2492	79	3.17	2756	237	8.60	66	67	1.4	LOW
AC-B9022-01	60	1353	29	2.14	1587	181	11.41	64	66	2.2	LOW
AC-A97-01	60	1895	95	5.01	2130	246	11.55	66	68	1.5	LOW
AC-B9001-02	50	799	32	4.01	1040	184	17.69	N/A	64	N/A	NEGLIGIBLE
AC-B9170-01	60	2346	65	2.77	2587	218	8.43	67	68	1.4	LOW
AC-B9170-02	44	969	28	2.89	1233	186	15.09	N/A	63	N/A	NEGLIGIBLE
AC-A948-01	60	931	66	7.09	1195	224	18.74	N/A	66	N/A	NEGLIGIBLE
AC-A981-01	60	1380	90	6.52	1644	248	15.09	65	67	2.0	LOW
AC-B9106-01	53	543	7	1.29	807	164	20.32	N/A	N/A	N/A	NEGLIGIBLE
AC-B9030-01	51	466	7	1.50	730	165	22.60	N/A	N/A	N/A	NEGLIGIBLE
AC-A950-02	60	2242	200	8.92	2506	357	14.25	67	69	1.2	LOW
AC-A950-03	60	6394	845	13.22	6658	1003	15.06	73	73	0.3	NEGLIGIBLE

15.4.21 Impacts for all the sections are predicted as either low or negligible and therefore not significant. Change in road traffic noise was unable to be accurately calculated for several location locations (noted with N/A in the table) this is because the traffic volume is below 1000 vehicles per 18h. Traffic volume this low are not likely to produce significant effects, so these are assumed to be negligible (see **Chapter 13: Transport** for description of site references).

Construction Vibration

15.4.22 A desk-based construction vibration appraisal has been prepared for the purpose of assessing the effects of the works (any foundation piling) on any nearby residents. This appraisal has been produced in line with BS 5228-2:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites.

15.4.23 Construction vibration activities and parameters associated with equipment specified in **Appendix 15.4: Construction Noise Impact Assessment** are largely unknown at time of writing, therefore, the worst-case parameters have been assumed for vibration due to foundation excavation and piling. The parameters that affect resultant vibration from piling are shown in **Table 15.17.**

Table 15.17: 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 (MJ)	Between 1 and 12 MJ

15.4.24 **Table 15.18** shows the worst-case results of the groundborne vibration with distances from the works. This considers two scenarios of the distance to the nearest tower of the Proposed OHL Alignment (NSR 84 at Tower BC4-5B) and Proposed OHL Alignment including the LoD (NSR at 45 m from a tower). Vibratory compaction, percussive piling, and vibratory piling have been calculated in the case these activities will take place.

Table 15.18: Groundborne Vibration Results from Foundation Works

Vibration Operation	Proposed Towers (NSR 84, 106 m from Tower BC4-5B		Proposed Towers Including LoD (NSR 45 m from Tower)	
	Resultant PPV (mms^{-1})	Magnitude of Impact	Resultant PPV (mms^{-1})	Magnitude of Impact
Vibratory Compaction (Steady State)	0.22	Negligible	0.77	Low
Vibratory Compaction (Start Up and Run Down)	0.48	Low	1.44	Medium
Percussive Piling	0.11	Negligible	0.32	Low
Vibratory Piling	0.09	Negligible	0.29	Negligible

15.4.25 All impacts, except for the potential vibratory compaction start up and run down (**Medium**), for potential vibration works have been assessed as **Low** or **Negligible**. This has assumed worst-case parameters, therefore in reality, the vibration is likely to be lower in impact magnitude. The impact is reduced to **Low** by the one of the following measures:

- increasing the distance to tower to 60 m, however if this cannot be avoided,
- reducing the number of vibrating drums to one
- reducing maximum amplitude of drum vibration to 1.35 mm

15.4.26 In the worst case, the Low vibration activities might be just perceptible in residential environments, therefore, the significance of effect for construction vibration is **Minor** and **Not Significant**.

15.4.27 It should be noted that construction works would be short-term in nature. Within BS 5228 it states that although **Medium** impacts are likely to cause complaints in residential environments, it can usually be tolerated if prior warning and explanation have been given to residents. Therefore, with the implementation of a CEMP these effects will be **Not Significant**.

Predicted Operational Noise Impacts

15.4.28 There are differences in assessment methods for dry and wet conditions. Dry noise is assessed by indicating the excess of rating level over background. During wet conditions, the noise output from OHLs varies according to the number and size of rain droplets accumulated on the surface of the conductors. Therefore, there is a strong relationship between the rainfall rate and the noise output from an OHL. Background noise levels also increase with rainfall rate, such that during very heavy rain, OHL noise is generally inaudible. For these reasons, an alternative noise assessment method to deal with rain-induced noise is required. The external rain-induced noise levels are assessed using the methodology developed by National Grid and detailed in their Technical Guidance Note TGN(E)322.

15.4.29 The excess wet figure is derived by comparing the total noise to the background noise level for the appropriate Miller Curve rating at each receptor at a rain rate of 1 mm/hr.

15.4.30 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.

15.4.31 Due to the lack of standardised quantitative prediction method for the assessment of potential aeolian noise impacts, a summary has been produced. While aeolian noise is possible under specific wind conditions, its occurrence is typically infrequent and it cannot be accurately assessed. Wind must be incident on the insulators or dampers of the OHL at certain direction and speed for the aeolian noise to be induced. If the wind is too low there will be no noise induced. If the wind is too high, then background noise is raised and aeolian noise impacts are less likely to be Significant. While aeolian noise may be audible several hundred metres from a tower, these specific conditions of wind conditions are not likely to be frequent enough to cause adverse noise impacts. Therefore, the focus is on anticipating and mitigating potential aeolian noise through appropriate design measures for the Proposed Development. It will be ensured that components such as insulators and dampers are used that have no known history of producing high aeolian noise.

15.4.32 The corona-induced audible noise of the OHL in rainfall has been calculated using the EPRI[11] method as recommended in TGN(E)322. Noise emissions at distances up to 500 m of the Triple Araucaria conductor have been calculated. The external rain-induced noise levels have been assessed using the TGN(E)322 methodology developed by National Grid.

[11] Electrical Power Research Institute (2005). EPRI AC Transmission Line Reference Book – 200 kV and Above, Third Edition, Final Report, 2005, Electrical Power Research Institute. Available at: https://www.epri.com/research/products/000000003002029583

15.4.33 In conducting calculations according to the EPRI method, recommended by the TGN(E)322, an OHL passes a Tier 1 assessment of TGN(E)322 if the wet noise falls below 34 dB(A) at that receptor. The conductor that has been selected for the Proposed Development is Triple Araucaria. It was calculated that the wet noise from the Triple Araucaria conductor is predicted to produce 34 dB(A) of wet noise up to a distance of 27 m.

15.4.34 The shortest distance using the LoD distance is 45 m (minimum clearance from receptor to OHL centerline), with a wet noise level of 32.3 dB(A). Therefore, the impact can be considered **Negligible**, with a receptor sensitivity of **Medium** the effect is determined as **Negligible** and therefore is **not significant**.

15.4.35 A full table of detailed results is presented in **Appendix 15.5: Operational Noise Impact Assessment**.

Internal Noise Assessment

15.4.36 At the request of Aberdeenshire Council, an internal noise impact assessment has been included. According to Table 4 of BS 8233, the indoor ambient noise levels in the night time should not exceed 30 dB LAeq,8hr. In addition, octave band levels should meet an NR20 rating for night time and NR25 rating for daytime.

15.4.37 The external noise levels and spectra have been considered at the closest receptor, at a distance worst case distance of 45 m from the centreline (assuming towers move a maximum distance within the LoD). An external to internal noise calculation has been performed on the basis of a partially open window for the nearest receptors. If NR limits are met at the closest receptors, then the limits will be met at all other receptors. 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 15.19.**

Table 15.19: 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 (mm^2)	20	14	14	16	14	17	19	16

15.4.38 Internal noise NR criteria are presented in **Table 15.20**.

Table 15.20: Internal Noise Rating Criteria

Criteria	Internal Level (dB(Z))						
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
NR 25	55	44	35	29	25	22	20
NR 20	51	39	31	24	20	17	14

15.4.39 The results of the internal noise assessment for the Proposed Development at the nearest NSR are presented in **Table 15.21**.

Table 15.21: Predicted Internal Noise Levels

Location	Total External Wet Noise Level (dB(A))	Internal Level (dB(Z))							Total Internal Noise Level (dB(A))
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
NSR at 45 m	31.5	-3.1	3.2	12.7	-2.0	2.2	1.6	0.5	9.0

15.4.40 The results above show that for the Proposed Development, the internal noise level at the closest NSRs meet the 30 dB limit as well as falling below the NR 20 and NR 25 curves, therefore it is predicted that the internal noise level at all NSRs will fall below these levels. The internal noise levels at NSRs 45 m from the Proposed Development are assessed as **Minor** and **Not Significant** and therefore all other NSRs are assessed as **Minor** and **Not Significant**.

Kellas Alternative Alignment

15.4.41 As there are no additional NSRs associated with the Kellas Alternative Alignment, no additional construction or operational noise impacts are predicted.

15.5 Additional Mitigation

Construction Phase

15.5.1 The construction noise impact assessment indicates potentially **Significant** impacts that require mitigation. The assessment highlights the requirements to carefully considered the activities required outwith daytime hours. Due to the assessment being performed on worst case assumed information at this stage, a detailed construction noise assessment with CNMP, in accordance with the guidance and procedures outlined in BS 5228-1, will be conducted by the Principal Contractor.

15.5.2 Where construction activities occur during Saturday afternoons and Sundays, and noise levels are assessed to reach 55 dB, mitigation measures outlined in **Table 15.22** and the CNMP will be applied. The noisiest activities will be restricted to Daytime and Saturday working hours to allow assessment against the 65 dB threshold. These restrictions will be clearly defined in the CNMP.

15.5.3 For NSRs still assessed to be impacted, noise compliance measurements will be undertaken during peak activities to ensure emissions remain within permitted limits. Where exceedances are identified, further mitigation will be implemented.

15.5.4 At NSRs where moderate impacts remain, further detailed mitigation will be identified and incorporated into the CNMP. These NSRs are shown in **Appendix 15.4**: **Construction Noise Impact Assessment**.

Table 15.22: Additional Mitigation - Construction

Reference	Description
NV1	**CNMP** - Prior to construciton, the Principal Contractor will set out proactive strategies to manage and minimise the noise and vibration impacts generated by construction. Mitigation measures such as the control of the noise source levels, controlling the noise transmission path via noise barriers, time management and managing operational times of equipment when not in use will be implemented where necessary. This will also include community engagement and stakeholder management plans to ensure legal compliance with COPA. The CNMP is expected to be embedded within the CEMP, and is to form the primary mitigation for construction activities. Procedures could include where necessary and practicable: • minimising the noise as much as is reasonably practicable at source; • attenuation of noise propagation by the addition of acoustic absorptive screens or barriers within the site; • carrying out identified high noise level activities at a time when they are least likely to cause a nuisance to residents; andproviding advance notice of unavoidable periods of high noise levels to residents. 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:

Reference	Description
	• 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. Delivery vehicles should follow routes that minimise use of residential roads; • ensure plant and equipment are regularly and properly maintained. All plant should be situated to sufficiently minimise noise impact at nearby properties; • 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 • working typically not to take place outside of hours defined in the construction schedule. 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 portable generators. Consideration will be given to the parameters affecting vibratory compaction if towers will be between 45 m and 60 m from a NSR. Reduction of drums and vibration amplitude will reduce impacts to Low and effects to Not Significant. The CEMP should also include best practice mitigation for vibratory impact with the implementation of a construction vibration management plan (CVMP), as defined in BS 5228-2.
NV2	**LoD Restriction** - Construction noise is predicted to exceed 65 dB where towers may move the maximum distance from the Proposed OHL Alignment within the LoD during all construction phases except stringing (towers could move up to 100 m closer to NSRs within the LoD and more around the NP2-10A and NP2-11A towers). Prior to any further changes being made to the Proposed Development within the LoD, a change control process would be undertaken to ensure that there is no unacceptable increase in adverse impacts as a result of the change. This process is managed via the Applicant's internal process 'Change Request Procedure for Project Design Parameters Controlled by Consent Limitations (PR-NET-ENV-503)' as detailed in **Chapter 3: Project Description**.
NV3	**Community Engagement** - Prior to and during construction, communities would be informed of the programme of construction activities and a Community Liaison contact would be appointed to deal with any community queries or feedback. These would be detailed in the CNMP to be agreed with the relevant Local Authority.
NV4	**Equipment Curtailment** – During felling, access / enabling, foundation, and tower erection, the active time of the noisiest equipment will be reduced to maintain worst-case levels at or below 65 dB at

Reference	Description
	receptors. If noise levels exceed acceptable thresholds, the Principal Contractor will be provided with site-specific mitigation requirements for inclusion in the CNMP. This may involve detailed scheduling of high-noise equipment such as saws, breakers, crushers and wheeled loaders, particularly at locations identified in **Appendix 15.4: Construction Noise Impact Assessment**. The simultaneous operation of the following equipment in conjunction with other noise-generating machinery and the utilisation over the working day should be managed to minimise noise impacts from each phase in the Daytime and Saturdays threshold period: • Felling: chainsaws, and wood chipper • Access: excavator, crusher, wheeled loader, and SI rig • Foundations: saw, or piling rigs • Tower Erection: wheeled loaders • Stringing: joint press, and telehandler Following the curtailment of this equipment during felling, foundations, tower erection, and stringing, 94% of receptors will not experience significant impacts for each phase. Access impacts are slightly higher but are expected to be extremely short-term. The elimination of concurrent use of the noisiest equipment in each phase will effectively eliminate the significant impacts of all but 6% of NSRs. This will be managed through the CNMP.
NV5	**Duration of Works** – The construction noise in general will be very short-term, maintaining this duration will ensure construction noise impacts are minimised.

Operational Phase

15.5.5 No additional mitigation is proposed for operational noise, as the impacts are assessed as **Not Significant**. This applies to any receptor, regardless of sensitivity, with a minimum of 45 m distance to the OHL centreline.

15.6 Residual Effects

Construction Phase

15.6.1 The information used in this assessment is accurate at time of writing. It is recommended that this assessment is reviewed and updated as necessary by the Principal Contractors if significant changes in construction equipment take place. It is expected that with the implementation of a CNMP, where activity near locations of significant impacts can be microsited in terms of active operational time of equipment and increased community engagement to detail the duration of works, any remaining impacts can be eliminated. Therefore, it is predicted that construction noise would result in **Minor** impact at worst and therefore is **Not Significant**.

Operational Phase

15.6.2 The assessment predicts all 908 NSRs with **Negligible Effect** from the operation of the Proposed Development. If the alignment is moved to the worst case within the LoD, this also results in **Negligible Effect** at all 908 NSRs. The outcome of the assessment predicts that residual noise would be **Negligible** and **Not Significant.**

15.7 Assessment of Cumulative Effects

15.7.1 The following assessment has been undertaken in line with the methodology in **Chapter 5: EIA Process and Methodology, Section 5.5 Cumulative Effects**.

15.7.2 The individual topic based technical chapters of this EIA Report consider the cumulative effects of the Proposed Development with other existing or future committed developments that have the potential to result in significant cumulative effects in combination with those resulting from the Proposed Development. Within each technical chapter (**Chapters 7-15**) the following staged approach has therefore been taken:

- Stage 1: the Proposed Development has been assessed cumulatively with the associated Scottish and Southern Electricity Networks (SSEN) Transmission developments listed in **Chapter 5: EIA Process and Methodology, Table 5.2** to understand the likely significant effects of the wider network transmission upgrade as a whole on that topic; and
- Stage 2: an in combination cumulative assessment has been undertaken with the remaining cumulative developments listed in **Appendix 5.1: Cumulative Developments** to determine the overall potential for in-combination cumulative effects.

In-combination Effects: Stage 1 – Associated SSEN Transmission Network Upgrades

15.7.3 The developments listed in **Table 15.23** below are those which form part of the wider network transmission upgrade project (Stage 1) as discussed in **Chapter 2: Project Need** and are therefore linked to the Proposed Development.

Table 15.23: Cumulative Assessment: Stage 1 Developments

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
Fanellan substation	A new 400 kV substation and converter station located in the Beauly area.	Awaiting Decision	Adjacent	The construction of the cumulative development has the potential to have a cumulative noise impact due to the equipment and increased traffic. If the construction works are coincidental, a detailed CNMP must be updated to include working times, activities and a schedule. There is the potential for activities that are associated with the construction of the cumulative development that take place concurrently to raise the noise above either the 65 dB daytime noise limit or the 55 dB evening and weekend limit at the Proposed Development NSRs. Therefore, it is possible for cumulative construction noise to result in **Major** effect which is **Significant**. Cumulative construction noise is required to be controlled through an updated assessment by the Principal Contractors, and a CNMP. Therefore, with the appropriate mitigation, in the form of reducing equivalent sound pressure level over the working day, residual effects are likely to be **Minor** and **Not Significant**. Fanellan Substation is expected to be a source of operational noise in the Study Area associated with the Proposed Development. The Proposed Development is assessed for worst-case noise in wet conditions. In these conditions, the background noise is raised due to rainfall, therefore, operational noise from Fanellan Substation will be less prominent. The worst-case noise effects of Fanellan Substation are assessed in dry conditions, during which noise from the Proposed Development is negligible. Several NSRs are located in the overlapping study areas of the Proposed Development and Fanellan Substation. The predicted noise levels between the two developments has been compared in wet and dry conditions. Due to the high background noise during wet (rain) conditions, and the very low noise from the Proposed Development during dry conditions, no increase in impacts is predicted.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
				Cumulative operational noise has been assessed as having **Minor** effects. Therefore, cumulative noise in dry and wet conditions is **Not Significant**.
Greens substation	A new 400 kV substation located 2.5 km southeast of Cuminestown.	Awaiting Decision	Adjacent	Cumulative construction noise as for Fanellan substation. Cumulative construction noise is required to be controlled through an updated assessment by the Principal Contractors, and a CNMP. Therefore, with the appropriate mitigation, in the form of reducing equivalent sound pressure level over the working day, residual effects are likely to be **Minor** and **Not Significant**. Greens 400 kV substation is expected to be a source of operational noise in the Study Area associated with the Proposed Development. The Proposed Development is assessed for worst-case noise in wet conditions. In these conditions, the background noise is raised due to rainfall, therefore, operational noise from Greens 400 kV substation will be less prominent. The worst-case noise effects of Greens 400 kV substation are assessed in dry conditions, during which noise from the Proposed Development is negligible. An NSR is located in the overlapping study areas of the Proposed Development and Greens 400 kV substation. The predicted noise levels between the two developments has been compared in wet and dry conditions. Due to the high background noise during wet (rain) conditions, and the very low noise from the Proposed Development during dry conditions, no increase in impacts is predicted. Cumulative operational noise has been assessed as having **Minor** effects. Therefore, cumulative noise in dry and wet conditions is **Not Significant**.
Netherton Hub	A new strategic development near Flushing and Longside that consists of a 400 kV substation, 132 kV substation, a HVDC switching station, two HVDC converter stations and a spares warehouse and operations base.	Awaiting Decision	Adjacent	Cumulative construction noise as for Fanellan substation. Netherton Hub is expected to be a source of operational noise in the Study Area associated with the Proposed Development. The Proposed Development is assessed for worst-case noise in wet conditions. In these conditions, the background noise is raised due to rainfall, therefore, operational noise from Netherton Hub will be less prominent. The worst-case noise effects of Netherton Hub are assessed in dry conditions, during which noise from the Proposed Development is negligible. An NSR is located in the overlapping study areas of the Proposed Development and Netherton Hub. The predicted noise levels between the two developments has been compared in wet and dry conditions. Due to the high background noise during wet (rain) conditions, and the very low noise from the Proposed Development during dry conditions, no increase in impacts is predicted. Cumulative operational noise has been assessed as having **Minor** effects. Therefore, cumulative noise in dry and wet conditions is **Not Significant**.

In-combination Effects: Stage 2 – Other Developments

15.7.4 The developments listed in **Table 15.24** below are those which form the remaining cumulative developments (Stage 2) listed in **Appendix 5.1: Cumulative Developments.**

Table 15.24: Cumulative Assessment: Stage 2 Developments

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
Knocknagael BESS	Construction and operation of a 200 MW Battery Energy Storage System (BESS) comprising two BESS and one substation compounds, associated infrastructure, site access, and landscaping.	Consultation	Adjacent	The construction of the cumulative development has the potential to have a cumulative noise impact due to the equipment and increased traffic. If the construction works are coincidental, a detailed CNMP must be updated to include working times, activities and a schedule. There is the potential for activities that are associated with the construction of the cumulative development that take place concurrently to raise the noise above either the 65 dB daytime noise limit or the 55 dB evening and weekend limit at the Proposed Development NSRs. Therefore, it is possible for cumulative construction noise to result in **Major** effect which is **Significant**. Cumulative construction noise is required to be controlled through an updated assessment by the Principal Contractors, and a CNMP. Therefore, with the appropriate mitigation, in the form of reducing equivalent sound pressure level over the working day, residual effects are likely to be **Minor** and **Not Significant**. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Beauly BESS	Construction and operation of a BESS along with associated infrastructure and ancillary works, earthworks, access, drainage, landscaping and biodiversity enhancements.	Consultation	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Beauly to Denny Overhead Line Diversion	Permanent diversion of approximately 1.7 km of new 400 kV OHL and the removal of a section of	Pre-Application	Adjacent	Cumulative construction noise as for Knocknagael BESS. The noise from the proposed Beauly to Denny OHL has been estimated at the closest NSR, and the total cumulative noise

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	existing Beauly-Denny 400 kV OHL.			predicted. NSR 14 is the closest NSR to the Beauly to Denny OHL (200 m) where wet noise is approximately 37 dB. NSR 14 is 363 m from the Proposed Development as a worst case, where wet noise is predicted to be approximately 16 dB. The noise due to the Proposed Development is predicted to have no notable increase in noise. Cumulative operational noise at this NSR and all other NSRs predicts **Negligible** impact.
Spittal to Loch Buidhe to Beauly 400 kV Project	A new overhead line approximately 170 km in length from Spittal to Beauly.	Scoping	Adjacent	Cumulative construction noise as for Knocknagael BESS. The noise from the proposed Spittal to Loch Buidhe to Beauly OHL has been estimated at the closest NSR (NSR 9), which is over 500 m from the closest point on the line, where wet noise is approximately 12 dB. NSR 9 is 270 m from the Proposed Development as a worst case, where wet noise is predicted to be approximately 19.5 dB. The noise due to the Proposed Development is predicted to have no increase in noise that would cause an impact (total noise is below 34 dB). Cumulative operational noise at this NSR and all other NSRs predicts **Negligible** impact.
Western Isles HVDC UGC	80 km of onshore underground HVDC cable from Dundonnell to a mainland HVDC Converter Station near Beauly.	Permitted Development	~0.2 km Northwest	Cumulative construction noise as for Knocknagael BESS. No operational noise is expected from an underground cable, therefore no cumulative operational noise is **negligible**.
Beauly BESS	Erection and operation of BESS up to 49.9 MW, substations, switchgear and control buildings, landscaping, fencing and ancillary infrastructure.	Under Consideration	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Kilmorack Substation	Construction of 132 kV replacement substation, platform, plant and machinery, access, laydown/work compound area(s),	Under Consideration	~0.7 km Northwest	Cumulative construction noise as for Knocknagael BESS. Kilmorack Substation is expected to be a source of noise in the Study Area associated with the Proposed Development. The Proposed Development is assessed for worst-case noise in wet conditions. In these conditions, the background noise is raised due to rainfall,

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	drainage, landscaping, and other ancillary works.			therefore, operational noise from Kilmorack Substation will be less prominent and likely to have a **negligible** impact on NSRs when considered cumulatively with the operational noise from the Proposed Development. These cumulative receptors are unlikely to exceed wet background noise with contributions from Kilmorack Substation and the Proposed Development. The worst-case noise effects of Kilmorack Substation are assessed in dry conditions, where noise from the Proposed Development is negligible. Therefore, cumulative noise in dry and wet conditions is **not significant**.
Beauly Substation	Reinforcement and Extension of existing 132 kV substation, including decommissioning and replacement of key equipment including provision of three new transformers with noise enclosures, associated platform extension and GIS building, access, landscaping and ancillary work.	Application Permitted	Adjacent	Cumulative construction noise as for Knocknagael BESS. Beauly Substation is expected to be a source of noise in the Study Area associated with the Proposed Development. The Proposed Development is assessed for worst-case noise in wet conditions. In these conditions, the background noise is raised due to rainfall, therefore, operational noise from Beauly Substation will be less prominent and likely to have a **negligible** impact on NSRs when considered cumulatively with the operational noise from the Proposed Development. These cumulative receptors are unlikely to exceed wet background noise with contributions from Beauly Substation and the Proposed Development. The worst-case noise effects of Kilmorack Substation are assessed in dry conditions, where noise from the Proposed Development is negligible. Therefore, cumulative noise in dry and wet conditions is **not significant**.
Cairn Duhie Wind Farm Redesign	Erection and operation of windfarm for a period of 35 years, comprising of 16 wind turbines with maximum blade tip height of 149.9 m.	Approved by Scottish Ministers	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed Wind Farm will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the Wind Farm development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the Wind Farm would be low and considered to have **Negligible** impact.
Aigas Substation	Construction of 132 kV replacement substation, platform, plant and machinery, access, laydown / work compound area(s),	Under Consideration	~1.7 km Northwest	At this distance there will be no cumulative construction or operational noise impacts.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	drainage, landscaping, and other ancillary works.			
Balmore Wind Farm	EIA Scoping request for the erection and operation of a wind farm, comprising up to 8 wind turbines.	Pre Application Complete	~2.2 km Southwest	At this distance there will be no cumulative construction or operational noise impacts.
Ballach Wind Farm	Erection and Operation of a Wind Farm for a period of 35 years, comprising 36 turbines with a maximum blade tip height of 200 m and 230 m, along with a BESS and ancillary infrastructure.	Pre-Application	~4.7 km Northwest	At this distance there will be no cumulative construction or operational noise impacts.
Inverness College Campus	Phase 2 of Inverness Campus comprising 70,000 sqm of Commercial (Class 4) floorspace, 8,000 sqm of Hotel (Class 7) floorspace, 3,000 sqm of Ancillary (Class 1/3/10) floorspace and 2,500 sqm of Academic (Class 10) floorspace associated infrastructure and landscaping	Scoping	~4.7 km North	At this distance there will be no cumulative construction or operational noise impacts.
Carn Na Saobhaidh Wind Farm	The proposed development would consist of up to 29 wind turbines with a maximum blade tip height of up to 200 m & an associated BESS.	Pre-Application	~5.7 km South	At this distance there will be no cumulative construction or operational noise impacts.
Ourack Wind Farm	Erection and operation of a windfarm comprising 18 wind	Consented	~6.7 km Southeast	At this distance there will be no cumulative construction or operational noise impacts.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	turbines of up to 180 m to blade tip height, BESS, control building, substation, access tracks, three borrow pits, cabling, off-site road improvements on the A939 at Castle Grant and Dava Bridge and ancillary infrastructure.			
Lynemore Wind Farm	Erection and operation of a wind farm for a period of 50 years, comprising up to 14 wind turbines with a maximum blade tip height of 200 m, BESS, access tracks, borrow pit, substation, control building, and ancillary infrastructure.	Consultation	~7.3 km South	At this distance there will be no cumulative construction or operational noise impacts.
Tom Nan Clach Wind Farm Extension	Erection and Operation of a windfarm for a period of 40 years, comprising of seven wind turbines.	Approved by Scottish Ministers	~9 km South	At this distance there will be no cumulative construction or operational noise impacts.
Fairburn Wind Farm Extension	Proposal to construct and operate an extension to the existing 40 MW Fairburn Wind Farm at the Fairburn Estate.	Scoping Application Decision Issued	~9 km Northwest	At this distance there will be no cumulative construction or operational noise impacts.
Kellas Drum Windfarm	A wind farm comprising up to 8 turbines to a maximum tip height of 149.9m, associated tracks, substation & control building, meteorological mast, 2 borrow pits, temporary construction compound	Awaiting Decision	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed Wind Farm will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the Wind Farm development less likely to have an impact on the relevant receptors.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	and 30 MW energy storage compound.			Therefore, cumulative impacts due to the Wind Farm would be **low** and considered to have **Negligible** impact.
Berry Burn Wind Farm	Extension of the operational Berry Burn Wind Farm (to be known as Berry Burn Wind Farm Extension) for up to nine turbines at a height of up to 149.9 metres. Total installed generating capacity for the combined operational windfarm and the proposed extension would equal up to 104.5 MW.	Consented	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed Wind Farm will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the Wind Farm development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the Wind Farm would be **low** and considered to have **Negligible** impact.
Gibston Farm BESS	Construction and operation of a 349 MW Battery Energy Storage System (BESS) with associated infrastructure including access roads, sub-station buildings, supporting equipment, fencing, drainage and landscaping.	Awaiting Decision	~1.5km West	At this distance there will be no cumulative construction or operational noise impacts. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Rosarie Quarry	Part retrospective permission for construction of agricultural road initial hard rock mineral extraction and mineral processing and construction of temporary junction. Part new application for hard rock quarry processing area new access junction and creation of	Scoping	~4.9km West	At this distance there will be no cumulative construction or operational noise impacts.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	ecological/biodiversity buffer and associated ancillary quarry infrastructure (including but not limited to office wheel wash perimeter bunding welfare and landscaping)			
Teindland Wind Farm	An onshore wind farm comprising circa 17 turbines to a tip height of up to 200 m.	Scoping	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed Wind Farm will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the Wind Farm development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the Wind Farm would be **low** and considered to have **Negligible** impact.
Blackmuir Quarry	Hard rock quarry and mineral processing area extraction area 1.99 Ha.	Permitted	~1.2km West	At this distance there will be no cumulative construction or operational noise impacts.
Blackhills Wind Farm	Proposed wind farm comprising of up to eight turbines, 200 m in height, each with a generating capacity of up to 7.2 MW, associated infrastructure and BESS with 20 MW capacity, giving a total Site capacity of up to 77.6 MW.	Scoping	~0.43km Southeast	The construction of the cumulative development has the potential to have a cumulative noise impact due to the equipment and increased traffic. If the construction works are coincidental, a detailed CNMP must be updated to include working times, activities and a schedule. There is the potential for activities that are associated with the construction of the cumulative development that take place concurrently to raise the noise above either the 65 dB daytime noise limit or the 55 dB evening and weekend limit at the Proposed Development NSRs. Therefore, it is possible for cumulative construction noise to result in **Major** effect which is **Significant**. Cumulative construction noise is required to be controlled through an updated assessment by the Principal Contractors, and a CNMP. Therefore, with the appropriate mitigation, in the form of reducing equivalent sound pressure level over the working day, residual effects are likely to be **Minor** and **Not Significant**.
Corshellach Energy Storage	Installation of an energy storage facility including battery enclosures	Permitted	Adjacent	Cumulative construction noise as for Knocknagael BESS.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
	power conversion units transformer substation grid connection infrastructure vehicular access and associated works.			Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Drum Farm Energy Storage	Installation of an energy storage facility including battery enclosures power conversion units, transformers, substations, grid, connection infrastructure, vehicular access and associated works.	Permitted	~0.3km West	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Cairdshill Quarry	Quarry extension.	Permitted	~1.2km West	At this distance there will be no cumulative construction or operational noise impacts.
Keith Battery Storage	Battery Energy storage system and associated infrastructure.	Permitted	~0.5km West	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Blackhillock Battery Storage	Section 36 consent with deemed planning permission for a Battery Electricity Storage Facility at Land approximately 400 m southeast of Blackhillock Substation, Keith, Moray.	Consented	~0.8km West	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
Elchies (Rothes III) Wind Farm Grid Connection works	New electric line installed above ground with a voltage of 132 kV or more between Rothes III Wind Farm on-site substation, and Blackhillock Substation at Keith. Two sections of underground cable (UGC) are anticipated. The first is at the western end of the connection for approximately 500 m as it would leave Rothes III Wind Farm on-site substation. The second section of UGC is on final approach to the connection point at Blackhillock substation in the east (1080 m in length) - both permitted developments.	Application	~2.7km West	At this distance there will be no cumulative construction or operational noise impacts. No operational noise is expected from underground cables or a 132kV OHL, therefore no cumulative operational noise is **negligible**.
Marchfield Quarry	Establish a sand and gravel quarry.	Permitted	~2.2km North	At this distance there will be no cumulative construction or operational noise impacts.
Cairds Hill Wind Farm	Erect four wind turbines three of which are up to 180 m to blade tip height and one up to 149.9 m blade tip height associated and ancillary infrastructure includes hardstanding areas for each turbine location onsite access tracks an electrical substation and buried cables temporary laydown areas and a temporary construction compound.	Awaiting Decision	~2.3km West	At this distance there will be no cumulative construction or operational noise impacts.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
Dykeside Farm Quarry	Proposed sand and gravel quarry.	Awaiting Decision	~4.3km Northwest	At this distance there will be no cumulative construction or operational noise impacts.
Aultmore Wind Farm Redesign	Erect 16 wind turbines up to 200 m (generating around 105.6 MW) and associated infrastructure and includes a battery storage facility of up to 50 MW.	Under Consideration	~5.3km Northeast	At this distance there will be no cumulative construction or operational noise impacts.
Greens Underground Cable Connection	Approx. 3 km of 400 kV underground cable from the proposed Greens 400 kV Substation to the existing New Deer Substation.	Permitted Development	Adjacent	Cumulative construction noise as for Knocknagael BESS. No operational noise is expected from an underground cable, therefore no cumulative operational noise is **negligible**.
Netherton Hub 400 kV OHL Connection to New Deer and Peterhead – Tie-in	Construction of up to 5.5 km of new OHL and removal of up to 4 km of existing OHL, to tie the existing 400 kV OHL into the proposed Netherton Hub	Pre-Application	Adjacent	Cumulative construction noise as for Knocknagael BESS. Operational noise from the Proposed Development is **Negligible** at all receptors. In the absence of detailed conductor specifications and final alignment information for the OHL connection, it is not currently possible to undertake a full cumulative assessment. However, based on the available information and the **Negligible** contribution from the Proposed Development, cumulative noise effects are considered to be **Not Significant** at the time of assessment.
Netherton Hub 400 kV OHL Connection to New Deer and Peterhead – Rebuild	Construction of approx. 6.5 km of new OHL, connecting the proposed Netherton Hub to Peterhead.	Pre-Application	Adjacent	Cumulative construction noise as for Knocknagael BESS. Operational noise from the Proposed Development is **Negligible** at all receptors. There are also no NSRs within the overlap of the study area between the Proposed Development and the preliminary route options. Therefore, cumulative noise from this development is likely to be **Not Significant**.
Stromar Offshore Wind Farm Onshore Works	Scoping stage for onshore aspects including onshore export cables to connect to offshore export cables at landfall, and a new onshore substation / converter station.	Scoping	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed substation will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the substation development less likely to have an impact on the relevant receptors.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
				No operational noise is expected from underground cables, therefore no cumulative operational noise. Therefore, cumulative impacts due to the Stromar Offshore Wind Farm Onshore Works would be **low** and considered to have **Negligible** impact.
Muir Mhor Onshore Works	Onshore Transmission Infrastructure for Muir Mhor Offshore Wind Farm including formation of onshore landfall point, laying of underground cables, erection of substation, and associated works to connect to the transmission grid.	Awaiting Decision	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed substation will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the substation development less likely to have an impact on the relevant receptors. No operational noise is expected from underground cables, therefore no cumulative operational noise. Therefore, cumulative impacts due to the Muir Mhor Onshore Works would be **low** and considered to have **Negligible** impact.
Caledonia Offshore Wind Farm Onshore Works	Onshore Transmission Infrastructure for Caledonia Offshore Wind Farm including formation of onshore landfall point, laying of underground cables, erection of 2 co-located substation, and associated works to connect to the transmission grid.	Awaiting Decision	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed substation will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the substation development less likely to have an impact on the relevant receptors. No operational noise is expected from underground cables, therefore no cumulative operational noise. Therefore, cumulative impacts due to the Caledonia Offshore Wind Farm Onshore Works would be **low** and considered to have **Negligible** impact.
Spittal - Peterhead UGC	Approximately 15 km of osnhore underground cable.	Permitted Development	Adjacent	Cumulative construction noise as for Knocknagael BESS. No operational noise is expected from an underground cable, therefore cumulative operational noise is **negligible**.
EGL3 UGC	Approximately 10 km of onshore underground cable.	Permitted Development	Adjacent	Cumulative construction noise as for Knocknagael BESS. No operational noise is expected from an underground cable, therefore cumulative operational noise is **negligible**.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
New Deer 2 Battery Energy Storage System	Consultation under Section 36 of the Electricity Act 1989 for the Installation of Battery Energy Storage System (BESS) with an Installed Capacity of up to 400MW and Associated Infrastructure	Awaiting decision	Adjacent	Cumulative construction noise as for Knocknagael BESS. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Abbotshaugh Energy Storage	Consultation under Section 36 of the Electricity Act 1989 for the Installation of Battery Energy Storage System (BESS) with an Installed Capacity of up to 500MW and Associated Substation and Infrastructure	Awaiting decision	~1.2km South	At this distance there will be no cumulative construction or operational noise impacts. Worst-case results from the proposed BESS site will occur in dry conditions, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. Therefore, cumulative impacts due to the BESS would be **low** and considered to have **Negligible** impact.
Buchan Offshore Wind Farm Onshore Works	Scoping stage for onshore aspects including the landfall, onshore cable route corridor, onshore substation and onshore cable circuits.	Scoping	~1.8km East	At this distance there will be no cumulative construction or operational noise impacts.
Greenvolt Onshore Works	National Development for Formation of Onshore Landfall Point, Laying of Underground Cable and Erection of Substation	Approved	Adjacent	The construction of the cumulative development has the potential to have a cumulative noise impact due to the equipment and increased traffic. If the construction works are coincidental, a detailed CNMP must be updated to include working times, activities and a schedule. There is the potential for activities that are associated with the construction of the cumulative development that take place concurrently to raise the noise above either the 65 dB daytime noise limit or the 55 dB evening and weekend limit at the Proposed Development NSRs. Therefore, it is possible for cumulative construction noise to result in **Major** effect which is **Significant**. Cumulative construction noise is required to be controlled through an updated assessment by the Principal Contractors, and a CNMP.

Development Name	Description	Status	Distance from Proposed Development	Cumulative Assessment
				Therefore, with the appropriate mitigation, in the form of reducing equivalent sound pressure level over the working day, residual effects are likely to be **Minor** and **Not Significant**.
Whitestones Solar Project	Installation of a 9.9 MW Ground Mounted Solar Photovoltaic Array and Associated Infrastructure	Awaiting decision	~4.2km North	At this distance there will be no cumulative construction or operational noise impacts.
Hill of Stoneyfield Wind Farm	Erection of 3 Wind Turbines (Hub Height 83m, Total Height 149.9m), Substation, Formation of Access Track and Associated Infrastructure	Awaiting decision	~5km South	At this distance there will be no cumulative construction or operational noise impacts.
Glens Of Foudland Wind Farm Bainshole	Formation of Windfarm Comprising 21 Wind Turbines, Transformers, Access Tracks, Substation Building and Compound and Wind Monitoring Mast	Approved	~6km South	At this distance there will be no cumulative construction or operational noise impacts.
Salamander Offshore Wind Farm	Installation of BESS with an Installed Capacity of 180 MW and Associated Infrastructure	Awaiting decision	~7.1km Northeast	At this distance there will be no cumulative construction or operational noise impacts.

Existing Operational OHLs

15.7.5 There are several existing OHLs that produce operational noise in wet conditions. These include:

- Beauly – Knocknagael 275 kV;
- Knocknagael - Dallas / Knocknagael – Berryburn and Dallas - Blackhillock / Berryburn - Blackhillock 275 kV;
- Blackhillock – Rothienorman 400 kV;
- Blackhillock – Kintore 275 kV; and
- Peterhead – New Deer 400 kV.

15.7.6 A cumulative operational noise assessment has been undertaken for the Proposed Development in the context of existing OHLs in the area. The assessment considers the potential for combined noise levels from multiple overhead lines to affect nearby NSRs.

15.7.7 To determine whether an NSR requires further assessment for operational noise, a threshold of 34 dB(A) of wet noise must be exceeded (Tier 1 of TGN(E)322 assessment).

15.7.8 The minimum individual contribution required from two cumulative lines to exceed the 34 dB(A) threshold is 31 dB(A). Therefore, zones were identified around each line within which predicted noise levels are equal to or exceed 31 dB(A).

15.7.9 The Proposed Development does not generate noise levels equal to or exceeding 31 dB(A) at any NSR where other OHLs also produce at least 31 dB(A). 34 dB(A) is the logarithmic sum of two sound pressure levels of 31 dB(A). If the sound pressure level is less than 31 dB(A) from both OHLs then the sum will be less than 34 dB(A) and therefore will not proceed to a Tier 2 assessment and the resultant noise will be assessed as **Not Significant**.

15.7.10 It is predicted that no NSRs will experience an increase in noise due to the Proposed Development that are not already influenced by existing OHLs. The Proposed Development is sufficiently distant from NSRs in the Study Area such that its contribution to cumulative noise levels at these locations is **Negligible**.

15.8 Summary and Conclusions

15.8.1 **Table 15.25** provides a summary of the impacts and significance of effects on sensitive receptors from the Proposed Development.

Table 15.25: Summary of Predicted Impacts and Residual

Likely Significant Effect	Effect Significance (Pre-Mitigation)	Additional Mitigation	Residual Effect
Construction Noise	Significant	CNMP – Measures to include to reduce noise levels at source from equipment, reduce active time of noisiest equipment over the working hours, reduce quantity of simultaneous equipment, and prioritise noisiest activities during daytime hours. Only essential works to be conducted during evening and weekend periods. Good community relations and prior warning to specific noisy activities increase tolerance.	Not Significant
Construction Vibration	Not Significant	N/A	Not Significant
Operational Noise	Not Significant	N/A	Not Significant