SSEN Transmission

Bingally 400 / 132 kV Substation

Environmental Appraisal

Volume 1

February 2025

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13. NOISE AND VIBRATION

13.1 Introduction

13.1.1 With reference to **Volume 1, Chapter 1 Introduction and Background, Section 1.1.10**, this Voluntary EA has been prepared based on the structure and assessment methodology of an EIA. This overall report, however, is a Voluntary EA Report and is not carried out under the EIA Regulations.

13.1.2 This EA chapter presents the assessment of potential noise and vibration effects during the construction and operational phases of the Proposed Development. The effects from operational vibration and the decommissioning phase have been scoped out due to the nature and life span of the Proposed Development – the operational plant and equipment for this type of development would not produce perceptible vibration at receptors. The assessment has been undertaken following guidelines set out in the IEMA publication "Guidelines for Environmental Impact Assessment" (IEMA Guidelines)[1], relevant British Standards, planning policy and guidance.

13.1.3 The following potential effects may result from construction of the Proposed Development:

- Noise and vibration impacts during which could affect existing nearby noise sensitive receptors (NSRs); these include activities:
  - in proximity to the proposed substation site; and
  - along the access track connecting the A831 to the proposed substation site.
- Noise impacts from changes in public road traffic noise levels at NSRs in proximity to routes used by construction traffic.

13.1.4 The following potential effects may result from the operation of the Proposed Development:

- Noise impacts during the operational phase which could affect existing nearby NSRs in relation to 24/7 operation of the equipment on-site.

13.1.5 This chapter is supported by the following Figures and Technical Appendices:

- **Volume 2, Appendix A**;
  - **Figure 13-1 Site Plan and Sound Source Locations;**
  - **Figure 13-2 Baseline Survey Monitoring Locations;**
  - **Figure 13-3 Predicted Construction Noise Levels; and**
  - **Figure13-4 Predicted Operational Noise Levels in the 100Hz One-Third Octave Band Unweighted.**
- **Volume 3, Appendix L Acoustic Terminology;**
- **Volume 3, Appendix M Background Sound Noise Level Survey;**
- **Volume 3, Appendix N Comparison of Predicted Construction Traffic Levels on Link 1 in all months;** and
- **Volume 3, Appendix O Noise Model Configuration.**

13.2 Legislation and Policy

Relevant Legislation

13.2.1 The provisions of Sections 60 and 61 of the Control of Pollution Act 1974[2] offer protection to those living in the vicinity of construction sites.

1 Institute of Environmental Management & Assessment (IEMA), 2014. Guidelines for Environmental Noise Impact Assessment.

2 UK Government, 1974. The Control of Pollution Act (CoPA) 1974.

13.2.2 Section 60 enables a local authority to serve a notice specifying noise control requirements which may include:

- Plant or machinery that is or is not to be used;
- Hours of working; and
- Levels of noise or vibration that can be emitted.

13.2.3 Section 61 relates to prior consent and is for situations where a contractor or developer approaches the local authority before work starts, to obtain prior approval for the methods to be used and any noise and vibration control techniques that may be required.

13.2.4 The term 'Best Practicable Means' (BPM) is defined in Section 72 of the Control of Pollution Act 1974, where 'practicable' means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications.

National Planning Policy

National Planning Framework 4 (NPF4)[3]

13.2.5 NPF4 is Scotland's national spatial strategy. It outlines spatial principles, regional priorities, national developments, and planning policies. NPF4 replaces NPF3[4] and Scottish Planning Policy. This comprehensive framework aims to create sustainable, liveable, and productive places, aligning with the United Nations Sustainable Development Goals[5] and Scotland's national outcomes[6].

NPF4 Policy 11 states that:

> *"a) Development proposals for all forms of renewable, low-carbon and zero emissions technologies will be supported. These include:*
>
> *i. wind farms including repowering, extending, expanding and extending the life of existing wind farms;*
> *ii. enabling works, such as grid transmission and distribution infrastructure;*
> *iii. energy storage, such as battery storage and pumped storage hydro;*
> *iv. small scale renewable energy generation technology;*
> *v. solar arrays;*
> *vi. proposals associated with negative emissions technologies and carbon capture; and*
> *vii. proposals including co-location of these technologies.";*

It later states:

> "*e)* In addition, project design and mitigation will demonstrate how the following impacts are addressed:
>
> *i. impacts on communities and individual dwellings, including, residential amenity, visual impact, noise and shadow flicker;"*

[3] Scottish Government (2023). National Planning Framework 4 (NPF4)

[4] Scottish Government (2014). National Planning Framework 3 (NPF3)

[5] United Nations (2015). Sustainable Development Goals. Available at: https://sdgs.un.org/goals.

[6] The Scottish Parliament (2022). National Outcomes. Available at: https://www.parliament.scot/chamber-and-committees/committees/current-and-previous-committees/session-6-constitution-europe-external-affairs-and-culture-committee/business-items/national-outcomes.

Planning Advice Note PAN 1/2011: Planning and Noise[7] and Technical Advice Note TAN: Assessment of Noise[8]

13.2.6 Current national guidance on noise is contained in Planning Advice Note (PAN) 1/2011 Planning and Noise (The Scottish Government, 2011). In para 2 PAN 1/2011 states that it *"promotes the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth."*

13.2.7 Part 3 of PAN 1/2011 states *"The Environmental Noise (Scotland) Regulations 2006 transposed the European Directive 2002/49/EC (the Environmental Noise Directive) into Scottish law. This requires Scottish Ministers and airport authorities to manage noise through a process of strategic noise mapping and noise action plans. In the areas affected by the Regulations, planning authorities have a role in helping to prevent and limit the adverse effects of environmental noise."*

13.2.8 It is understood there are no Noise Action Plans in proximity to the Proposed Development.

13.2.9 A Technical Advice Note (TAN 2011) (The Scottish Government, 2011) accompanies PAN 1/2011 and provides technical guidance on noise assessment.

Local Planning Policy

13.2.10 The Highland Council (THC) Environmental Health Officer (EHO) was initially contacted on 28th May 2024 for discussion and input to the background sound level monitoring survey and assessment methodology. The following information was requested by the EHO;

The noise assessment should include the following:

- *A description of the proposed development in terms of noise sources*
- *A plan showing the location of noise sources, noise sensitive premises and survey measurement locations.*
- *A survey of the background ($L_{A90,T}$); ambient noise ($L_{Aeq,T}$), and 1/3rd octave band spectrum levels to determine the existing noise levels at sensitive receptors. Monitoring locations must be agreed beforehand with the Council's Environmental Health Service.*
- *A prediction of noise levels at noise sensitive premises.*
- *A description of any noise mitigation methods that will be employed including the calculated effect of mitigation.*
- *The raw data and equations used in the calculations must be made available on request.*
- *The assessment should demonstrate compliance with the following requirements:*
- *Noise arising from the development, when measured and/or calculated as an L_{Zeq}, 5min, in the 100 Hz one third octave frequency band must not exceed 30 dB, at the curtilage of any noise sensitive premises.*
- *The Rating Level of noise arising from this development as determined in accordance with BS 4142 Methods for Rating and Assessing Industrial and Commercial Sound, shall not exceed XXdB(A)* at the curtilage of any noise sensitive receptor.*
- *(*As determined by an approved background survey)*
- *With regard to construction noise, the recommended working hours for audible noise are 8am to 7pm Mon-Fri and 8am to 1pm on Saturdays. For work within these periods, we*

7 Scottish Government. (2011). PAN 1/2011, Planning Advice Note, Planning and Noise.

8 Scottish Government. (2011). Technical Advice Note – Assessment of Noise.

would accept a scheme demonstrating how the best practicable means will be employed to minimise the impact of noise. For audible work out-with these times, a detailed construction noise assessment would require to be submitted.

Chapter Specific Guidance

13.2.11 The following documents have been referred to as part of this assessment. Further details about the documents can be found in the Guidance and Standards subsection below.

- BS 7445-1:2003 – 'Description and Measurement of Environmental Noise'[9];
- BS 5228-1:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites- Part 1: Noise'[10];
- BS 5228-2: 2009+A1:2014 – 'Code of practice for Noise and Vibration control on construction and open sites. Vibration'[11];
- BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting[12];
- 'Calculation of Road Traffic Noise' (CRTN)[13];
- Noise Advisory Council (NAC) A guide to measurement and prediction of the Equivalent Continuous Sound Level, Leq.[14];
- Design Manual for Road and Bridges (DMRB) LA 111 (Revision 2) 'Noise and Vibration'[15]
- BS4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound'; and
- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'[16].

13.3 Assessment Methodology and Significance Criteria

13.3.1 This section discusses the specific guidance and assessment criteria, provides further detail on the scope of the assessment and outlines limitations and assumptions made in undertaking the assessment.

Scope of the Assessment

13.3.2 The assessment considers the effects during multiple phases of the Proposed Development lifespan as identified in **Volume 1, Chapter 3 Description of the Proposed Development**. The assessed phases include construction and operation only as there is no foreseeable expectation that the site will be decommissioned, however it is expected that decommissioning impacts would be no worse than those predicted for the construction phase.

13.3.3 The scope of this assessment is to identify the significance of the potential effects identified within the Study Area defined in the next section. Based on this a structure for the assessment methodology for the Proposed Development is presented as follows:

- Construction Phase Impacts at NSRs from:
  - Airborne and ground borne noise and vibration from activities within the site boundary.
  - Changes in airborne traffic noise levels from the surrounding road network.

[9] British Standards Institution, 2003. BS 7445-1:2003 – 'Description and Measurement of Environmental Noise'

[10] British Standards institute, 2014. BS 5228-1:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites- Part 1: Noise'

[11] British Standards Institution, 2014. BS 5228-2: 2009+A1:2014 – 'Code of practice for Noise and Vibration control on construction and open sites. Vibration'

[12] British Standards Institution, 2008. BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.

[13] Department of Transport/Welsh Office, 1988. Calculation of Road Traffic Noise (CRTN).

[14] Noise Advisory Council, 1978. 'A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}'.(NAC)

[15] Highways Agency, Transport Scotland, Welsh Government, and the Department for Regional Development in Northern Ireland, 2020. DMRB HD LA111 Rev 2, Design Manual for Roads and Bridges, Volume 11, Noise and Vibration.

[16] British Standards Institution, 2014. BS 8233 – Guidance on sound insulation and noise reduction for buildings.

- Operational Phase Impacts at NSRs from:
  - Airborne noise from activities within the site boundary.

13.3.4 Changes in road traffic flows on surrounding roads during the operational phase of the Proposed Development are not included in the scope of this assessment as the number of vehicles would be negligible compared to existing flows on the surrounding road network; see **Volume 1, Chapter 11 Traffic and Transport**. In addition, low frequency noise during operation is included following discussion with the EHO due to potential audible tonal components at NSRs that substations typically emit.

13.3.5 The temporal scope of this assessment therefore includes consideration of the construction and operational phases of the Proposed Development.

13.3.6 The spatial scope of the assessment is described at the end of **Section 13.3**.

13.3.7 Potential airborne noise impacts on ecological receptors are considered within **Volume 1, Chapter 8 Ecology** and **Volume 1, Chapter 9 Ornithology.**

Study Area

13.3.8 The extent of the Study Area has been defined to include the closest NSRs / communities in each direction from the proposed Bingally substation and access track with reference to **Volume 2, Appendix A**, **Figure 13-1** and those that may be affected by changes in road traffic flows during the construction phase of the Proposed Development as described below:

- Construction Noise: The construction noise assessment Study Area is typically 300 m (based on BS 5228-1 guidance[10]) from the works, however the construction noise Study Area has been extended beyond this to include the closest NSRs to the construction works from the Main Site and access track.
- Construction Vibration: NSRs within 100 m from the closest construction activity within the red line boundary with the potential to generate vibration have been considered.
- Construction Traffic: The Study Area extent is based on the traffic links in the transport model (as discussed in **Volume 1, Chapter 11 Traffic and Transport** and as shown on **Volume 3, Figure 12-1**). In order to better quantify the number of potential adverse effects at receptors along one of the road links that would be used by construction traffic, address points that are within a buffer of 1km of the A831 Drumnadrochit, which is referred to as Link 1 in this chapter, are considered
- Operational Noise: The Study Area extends to the closest NSRs to the Main Site (see **Volume 3, Appendix A, Figure 13-1**).

Sensitive Receptors

13.3.9 The NSRs closest to part of the Proposed Development have been identified, as shown in **Volume 2, Appendix A, Figure 13-1** which are all residential receptors. The properties selected for baseline monitoring include the closest properties to the proposed access track and substation site, Glass House and Challenger Lodge respectively.

Table 13-1 Identified Key Sensitive Receptors

NSR Number	Receptor Name	Relevant Noise Source	Easting	Northing	Monitoring Location ID
NSR1	Glass House	Access Track (400 m)	234476	831447	M1
NSR2	Birchwood House	Access Track (770 m)	233726	830796	M2

NSR3	Challenger Lodge	Access Track (1.14 km) & Substation (1.6 km)	229853	825981	M3
NSR4	The Sawmill	Access Track (1.15 km) & Substation (1.61 km)	229931	826100	M4
NSR5	Hilton Lodge	Substation (1.78 km)	228445	824527	M5
NSR6	Guisachan Cottage	Access Track (1.6 km)	230224	826903	M6
NSR7	Plodda Cottage	Substation (2.27 km)	227955	824594	M7
NSR8	The Fank	Access Track (582 m)	231389	826966	--
* Only properties at which baseline monitoring was undertaken have been assigned a monitoring location ID for brevity in referencing.					

Guidance and Standards

BS 5228-1: 2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise[10] (with 2014 amendment)

13.3.10 Advice is provided by British Standard BS 5228-1:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' with respect to noise assessment and mitigation (BS 5228).

13.3.11 BS 5228 contains a noise emission database for individual construction plant, their associated activities, and methods of working. Unless noise level data is available from manufacturers, the BS 5228 database is used when predicting noise levels associated with various construction activities.

13.3.12 With regard to acceptable noise levels, BS 5228 provides guidance within Annex E including the 'ABC Method', which enables the identification of potentially significant effects at dwellings. This proposes Threshold Values, in terms of the $L_{Aeq,T}$, as a function of baseline sound levels at the receptors, as shown in **Table 13-2** below.

Table 13-2 Example Threshold of Potential Significant Effect at Dwellings

Assessment Category and Threshold Value Period	Threshold Value $L_{Aeq,T}$ dB(A) façade		
	Category A (a)	Category B (b)	Category C (c)
Night-time (23:00 – 07:00)	45	50	55
Evenings and Weekends (d)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

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

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

NOTE 3: Applies to residential receptors only.

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

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

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

(d) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.

13.3.13 For the appropriate period (night, evening / weekend, day), the baseline ambient sound level is determined at each NSR and rounded to the nearest 5 dB. The appropriate Threshold Value is then determined. The total construction noise level is then compared with this Threshold Value. If the total noise level exceeds the Threshold Value, then a potentially significant effect is deemed to occur.

BS 5228 2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration[11] (with 2014 amendments)

13.3.14 BS 5228-2:2009 addresses the need for the protection against vibration for persons living in the vicinity of construction sites and recommends procedures for vibration control. BS 5228-2:2009 recommends that:'.... *it is considered more appropriate to provide guidance in terms of the PPV (Peak Particle Velocity), since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage*'.

13.3.15 BS 5228-2:2009 provides empirical formulae relating resultant PPV for vibratory compaction, percussive and vibratory piling, dynamic compaction, the vibration of stone columns and tunnel boring operations.

13.3.16 **Table 13-3** (adapted from Table B.1, BS 5228-2:2009) details PPV levels and their potential effect on humans and provides a semantic scale for description of vibration impacts on human receptors.

Table 13-3 Guidance on Effects of Vibration Levels

Vibration Level (PPV mm/s)	Effect
0.14 to 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.
0.3 to < 1	Vibration might be just perceptible in residential environments.
1.0 to <10	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
>= to 10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

13.3.17 BS 5228-2:2009 provides the following criteria which are the maximum vibration levels to which underground services should be subjected:

- Maximum PPV for intermittent or transient vibrations 30 mm/s; and
- Maximum PPV for continuous vibrations 15 mm/s.

13.3.18 It goes on to state that “even a PPV of 30 mm/s gives rise to a dynamic stress which is equivalent to approximately 5 % only of the allowable working stress in typical concrete and even less in iron or steel.”

BS 6472-1: 2008. Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting[12]

13.3.19 BS 6472-1: 2008 provides guidance on the effects of human exposure to whole body vibration inside buildings, from internal sources such as footsteps or machinery, or external sources such as road traffic or railways. It specifically excluded consideration of blasting which is covered in BS 6472-2:2008. This Standard provides guidance on the levels of vibration that are likely to give rise to varying degrees of ‘adverse comment’.

13.3.20 The vibration criteria are given in terms of the vibration dose value (VDV) indicator. The VDV is given by the fourth root of the time integral of the fourth power of the acceleration after it has been frequency-weighted. BS 6472-1:2008 states that the VDV is the best indicator to use when assessing human response to whole body vibration inside buildings.

13.3.21 The criteria contained within BS 6472-1:2008 are provided in **Table 13-4**.

Table 13-4 VDV Criteria from BS 6472 1:2008[12]

Place and time	Low probability of adverse comment m/s1.75	Adverse comment possible m/s1.75	Adverse comment probable m/s1.75
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

13.3.22 For offices and workshops, multiplying factors of two and four respectively should be applied to the above vibration dose value ranges for a 16 h day.

13.3.23 Vibration dose values below the ranges in **Table 13-4** are rated as 'adverse comment not expected' and vibration above the ranges in **Table 13-4** are rated as 'adverse comment very likely'.

13.3.24 These criteria apply to both the vertical and horizontal axes of vibration, although the two directions use different frequency weighting in the calculation of the VDV. The vertical direction uses the W_b weighting, while the horizontal axes use the W_d weighting. The definitions of the frequency weightings are given in BS 6472-1:2008.

13.3.25 The Standard also states that if the direction of the vibration is dominated by a single axis, it is only necessary to assess the vibration response in respect to the dominant axis.

Design Manual for Roads and Bridges LA111 Noise and Vibration (Revision 2), Transport Scotland, 2020[15] & Calculation of Road Traffic Noise (CRTN), Dept. for Transport, Welsh Office, 1998[13] & NAC, A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level $L_{eq,}$ 1978[14].

13.3.26 The Proposed Development will affect traffic flows on existing roads in the area within and surrounding the Site during construction - refer to **Volume 1, Chapter 11 Traffic and Transport**. This preliminary assessment focuses on the impact at existing residential properties located alongside the existing local road network.

13.3.27 Construction traffic noise has been assessed by considering the increase in traffic flows during the construction works, following the guidance of CRTN[13] and DMRB[15].

13.3.28 18-hour (06:00 - 24:00) Annual Average Weekday Traffic (AAWT) data have been provided for the construction years, indicating totals 'with' and 'without' construction traffic, on a monthly basis. Basic Noise Level (BNL) calculations have been undertaken to predict the change in noise level between the 'with' and 'without' scenarios where flows are greater than 1000, in order to determine if any existing roads are predicted to be subject to a potentially significant change in 18-hour traffic flows.

13.3.29 The NAC prediction method detailed in the document *'A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}'* is applicable for prediction of noise level from low traffic flows. i.e. < 1000 vehicles per 18-hour where CRTN is not valid. This has been used as necessary to supplement the CRTN calculations.

BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'[17]

13.3.30 BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The method compares the *rating level* of the sound source under consideration with the *background sound level* in the vicinity of residential locations. The relevant parameters are as follows:

- *ambient sound level*, L_a, $L_{Aeq,T}$ dB – defined in the standard as the "equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far, at the assessment location over a given time interval, T. The *ambient sound* comprises the residual sound and the *specific sound* when present";
- *residual sound level*, L_r, $L_{Aeq,T}$ dB – defined in the standard as the "equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T', where the residual sound is the '*ambient sound* remaining at the assessment location when the *specific sound source* is suppressed to such a degree that it does not contribute to the am*bient sound*";

[17] British Standards Institution, 2014. BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'.

- *background sound level* – $L_{A90,T}$ – defined in the Standard as the "A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels";
- *specific sound level* – *L*s ($L_{Aeq,Tr}$) – the "equivalent continuous A-weighted sound pressure level produced by the *specific sound source* at the assessment location over a given reference time interval, Tr"; and
- *rating level* – $L_{Ar,Tr}$ – the "*specific sound level* plus any adjustment made for the characteristic features of the sound", as follows:
  - *Up to 6 dB for tonal characteristics, Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible;*
  - *Up to 9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible;*
  - *If intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied; and*
  - *Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.*

13.3.31 When comparing the background and the rating sound levels, the standard states that:

- *"Typically, the greater the 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 upon the context;*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context; and*
- *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 upon the context."*

13.3.32 Importantly, as indicated above, BS 4142 requires that the *rating level* of the sound source under assessment be considered in the context of the environment when defining the overall significance of the impact. The standard suggests that in assessing the context, all pertinent factors should be taken into consideration, including the following:

- *"The absolute level of sound;*
- *The character and level of the residual sound compared to the character and level of the specific sound; and*
- *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions."*

13.3.33 BS 4142:2014[17] states that a one-hour assessment period is considered during the day and a 15-minute assessment period at night as required.

<u>BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'[16]</u>

13.3.34 BS 8233:2014 provides guidance for the control of noise in and around buildings. It provides design guidance for noise generated inside or outside the building including noise level

criteria and control measures, and a methodology for calculating internal noise levels depending on the performance of the building fabric.

13.3.35 Of relevance to this assessment, for “steady external noise sources” it provides guideline values for internal ambient noise levels within dwellings. These are reproduced in **Table 13-5.**

Table 13-5 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Consultation Undertaken To Date

13.3.36 In relation to noise and vibration the THC EHO was contacted prior to undertaking surveys and their feedback has been detailed in the Local Planning Policy section above (**Section 13.2**).

13.3.37 A local consultation event was arranged where a number of residents had queries about noise in general. A number of residents were identified as willing to allow unattended monitoring equipment at their property to aid the assessment.

Method of Baseline Data Collation

13.3.38 Long-term and short-term baseline sound monitoring has been undertaken with liaison with the EHO prior to commencing surveys. The monitoring locations are shown on **Volume 2, Appendix A**, **Figure 13-2**.

13.3.39 Measurements have been conducted in accordance with the principles of BS 7445-1:2003 ‘Description and Measurement of Environmental Noise Part 1: Guide to Quantities and Procedures’[9] and BS 4142:2014[17].

13.3.40 Long-term measurements have been undertaken in 15 minute logging intervals for parameters $L_{Aeq,}$ L_{A90} and L_{AMAX} as minimum over the relevant time period. Short term measurements have been undertaken in 1 second intervals.

13.3.41 Any periods with windspeeds exceeding 5 m/s and periods of rainfall are excluded from the results based on observation while in the region and from public weather data sources.

13.3.42 Baseline conditions are discussed in the section below.

Determining Magnitude of Change and Sensitivity of Receptors

13.3.43 The following subsections set out how magnitude of change is determined by combining magnitude of impact and receptor sensitivity.

13.3.44 Receptor sensitivity in this assessment has been assigned based on the example definitions provided in Technical Advise Note[8] refer to **Table 13-6**.

Table 13-6 Sensitivity/Value of Receptors

Sensitivity/ value of resource/ receptor	Description	Examples of receptor usage
Very High	Receptors where noise or vibration will significantly affect the function of a receptor.	• Auditoria/studios; • Specialist medical/teaching centres, or laboratories with highly sensitive equipment.
High	Receptors where people or operations are particularly susceptible to noise or vibration. Sensitive ecological receptors known to be vulnerable to the effects of noise or vibration.	• Residential; • Quiet outdoor areas used for recreation; • Conference facilities; • Schools/educational facilities in the daytime; • Hospitals/residential care homes; • Libraries.
Medium	Receptors moderately sensitive to noise or vibration where it may cause some distraction or disturbance	• Offices; • Restaurants/retail; • Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf).
Low	Receptors where distraction or disturbance of people from noise or vibration is minimal	• Residences and other buildings not occupied during working hours; • Factories and working environments with existing high noise levels; • Sports grounds when spectator or noise is a normal part of the event.

13.3.45 Non-residential receptors are not considered here as none were identified as being potentially affected by construction or operational phases of the Proposed Development.

13.3.46 The following terminology has been used in the assessment to define noise and vibration effects:

- Adverse - detrimental or negative effects to an environmental resource or receptor;
- Neutral - effects to an environmental resource or receptor that are neither adverse nor beneficial; or
- Beneficial - advantageous or positive effect to an environmental resource or receptor.

13.3.47 The effect resulting from each individual potential impact type above has been classified according to the magnitude of the impact and the sensitivity or value of the affected receptor using the matrix presented in **Table 13-7** but where necessary also considering the context of the acoustic environment.

Table 13-7 Classification of Effects

Sensitivity/ value of resource/ receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Minor
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

13.3.48 Where adverse or beneficial effects have been identified, these have been assessed against the following significance scale, derived using the matrix presented in **Table 13-7**:

- Negligible – imperceptible effect of no significant consequence;
- Minor – slight, very short or highly localised effect of no significant consequence;
- Moderate – limited effect (by extent, duration or magnitude), which may be considered significant; or
- Major – considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

13.3.49 For the purposes of this assessment, Negligible and Minor effects are considered to be Not Significant, whereas Moderate and Major effects are considered to be Significant.

Construction Noise – Site Works

13.3.50 The magnitude of the impact of the construction noise is based on the difference between the likely construction noise level at the receptor and the Threshold Value for potentially significant effects derived using the methodology in BS 5228-1:2009[10] in **Table 13-2**, as shown in **Table 13-8**.

Table 13-8 Construction Noise Magnitude of Impact for Residential Receptors

Construction and Demolition Sound Level above Threshold Value (dB)	Magnitude of Impact
Exceedance of ABC Threshold Value by ≥ +5 dB	High
Exceedance of ABC Threshold Value by up to +5 dB	Medium
Equal to or below the ABC Threshold Value by up to -5 dB	Low
Below the ABC Threshold Value by ≥ -5 dB	Very Low

Construction Noise – Daytime Construction Works Traffic on the Public Highways

13.3.51 The Proposed Development has the potential to affect traffic flows on existing roads in the area within and surrounding the Site during construction, as referred to in **Volume 1, Chapter 11 Traffic and Transport**. This assessment focuses on the impact at existing residential properties located alongside the existing local road network.

13.3.52 Construction traffic noise has been assessed by considering the increase in traffic flows during the construction works, following the guidance of CRTN[13] and DMRB[15]. Where flows of less than 1000 are predicted for both the future baseline and future baseline with development construction traffic the method presented by the NAC is used instead as CRTN is not considered appropriate.

13.3.53 18-hour (06:00 – 24:00) AAWT data have been approximated using the 24-hour Annual Average Daily Traffic (AADT) obtained for the construction programme on a monthly basis 'with' and 'without' construction traffic. AADT includes weekends and in over a whereas AAWT does not. Where links are border line Significant Adverse this implication of this difference will be considered in further detail as appropriate.

13.3.54 The predicted level difference between 'with' and 'without' construction traffic scenarios determines if any existing roads are predicted to be subject to a potentially significant change in 18-hour traffic flows. BNL calculations have been undertaken to predict the change in noise level between the 'with' and 'without' scenarios.

13.3.55 The criteria for the assessment of traffic noise changes arising from Proposed Development construction works have been taken from Table 3.17 of DMRB[15] and are provided in **Table 13-9.** The magnitude descriptors in parentheses are provided to align with the descriptors used in this assessment.

Table 13-9 Construction Traffic Noise Criteria

Magnitude of Impact	Change in traffic noise level LA10,18hr dB
Major (High)	≥ 5
Moderate (Medium)	≥3 to <5
Minor (Low)	≥1 to <3
Negligible (Very low)	<1

13.3.56 An increase in road traffic flows of 25 % (where the traffic speed and composition remain consistent) equates to an approximate increase in road traffic noise of 1 dB L_A. A doubling of traffic flow would be required for an approximate increase in 3 dB L_A.

13.3.57 It is generally accepted that changes in noise levels of 1 dB L_A or less are imperceptible, and changes of 1 to 3 dB L_A are not widely perceptible. Consequently, at the selected road traffic noise receptors the magnitude of the predicted change in noise levels uses the scale shown in **Table 13-9** with respect to construction traffic.

Construction Vibration – Impact on Humans and Buildings

13.3.58 Vibration due to construction activities has the potential to result in adverse impacts at nearby NSRs. The transmission of ground-borne vibration is highly dependent on the nature of the intervening ground between the source and receptor and the activities being undertaken. BS 5228-2: 2009+A1:'2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites - Vibration'[11] provides data on measured levels of vibration for various construction works, with particular emphasis on piling. Impacts are considered for both damage to buildings and annoyance to occupiers.

13.3.59 **Table 13-10** details Peak Particle Velocity (PPV) vibration levels and provides a semantic scale for the description of demolition and construction vibration effects on human receptors, based on guidance contained in BS 5228-2[11].

Table 13-10 Construction Vibration Threshold at Residential Dwellings (Humans Only)

Peak particle velocity (PPV) level	Description	Magnitude of impact
>= 10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High

Peak particle velocity (PPV) level	Description	Magnitude of impact
1.0 to < 10 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	Medium
0.3 to < 1.0 mm/s	Vibration might be just perceptible in residential environments.	Low
0.14 to < 0.3 mm/s	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.	Very low

13.3.60 For residential receptors and other high sensitivity receptors (not buildings), a PPV of 1.0 mm/s, is the level at which construction vibration can be tolerated with warning and is taken in this assessment as the threshold at which adverse effects are potentially significant.

13.3.61 At receptors above a PPV of 1.0 mm/s, further consideration of whether an effect is significant is undertaken using professional judgement, taking account of the duration and frequency of the effect, as well as the time of day/evening/night that the effect would be experienced.

13.3.62 At this stage and in the absence of specific information on likely construction activities and plant, indicative information has been provided and used to undertake a qualitative assessment based upon professional judgement. Given the significant distance to and/or planned activities near receptors, no significant vibration is expected to result from the proposed construction activities within the Main Site or Access Track.

13.3.63 In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far more than those that may cause annoyance. Consequently, if vibration levels are controlled to those relating to annoyance (i.e. 1.0 mm/s), then it is highly unlikely that buildings will be damaged by construction vibration levels. On this basis cosmetic damage at buildings is not considered in any further detail within this assessment.

Operational Noise

13.3.64 **Table 13-11** illustrates the adopted magnitude of impact scale used in this assessment based upon the numerical level difference. For BS 4142[17] assessment purposes, for a residential receptor, a significant adverse effect is set at a rating level above the background sound level of +10 dB, while the level at which adverse effect occurs is +5 dB, although the consideration of context (including the absolute level of the sound under consideration) can vary the overall classification of effects.

Table 13-11 Magnitude of Impact for Industrial Noise

Magnitude of Impact	BS 4142[17] Descriptor	Rating Level – Background Sound Level (dB)
High	No BS 4142 descriptor for this magnitude level	+14/> =15
Medium / High	No BS 4142 descriptor for this magnitude level	+12/+13
Medium	Indication of a significant adverse effect, depending upon context	+9/+10/+11

Magnitude of Impact	BS 4142[17] Descriptor	Rating Level – Background Sound Level (dB)
Low Medium	No BS 4142 descriptor for this magnitude level	+7/+8
Low	Indication of an adverse effect, depending upon context	+4/+5/+6
Very low/Low	No BS 4142 descriptor for this magnitude level	+2/+3
Very Low	Indication of low impact, depending upon context	≤ 0/+1

Limitations and Assumptions

13.3.65 The following sources of information that define the Proposed Development have been reviewed and form the basis of the assessment of likely significant noise and vibration effects:

- Baseline sound monitoring survey data;
- Access track construction plant, equipment and indicative activities (provided by the SSEN Transmission);
- Construction noise data referenced from BS 5228[10];
- Indicative concept layout plans for the proposed substation site;
- Items of plant including sound power level data for the proposed Bingally Substation. This has been supplemented with a representative transformer frequency spectrum data to facilitate an assessment at 100 Hz;
- AADT traffic data (refer to **Volume 1, Chapter 11 Traffic and Transport**);
- Ordnance Survey (OS) mapping of the Proposed Development and surrounding area; and
- Topographical data (Light Detection and Ranging (LIDAR) data) and aerial photography.

13.3.66 In order to ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the EA has been undertaken adopting reasonable worst-case assumptions, where necessary.

13.3.67 The following are the robust but reasonable worst-case scenario assumptions (maximum / minimum) parameters for the purposes of the noise assessment with regard to construction of the Proposed Development:

- 24-hour AADT has been used to represent the 18-hour AAWT flows for calculating a preliminary basic noise level from construction traffic on the public road network. It is expected that this assumption will provide a robust assessment of potential effects. Where effects are considered Significant Adverse on a given road link, a more detailed consideration of the effect difference between AADT and AAWT on the link will be undertaken as needed;
- The construction equipment list has matched with specific items listed within the appendices of BS 5228-1[10], selecting the worst-case assumption where multiple options where available;
- Sound pressure levels at sensitive receptors in relation to the preparatory works for the access track have been undertaken using the assumption that the plant and equipment required is located at the closest approach to the assessment location representing the key sensitive receptors. In practice the equipment will be spatially distributed along the track and works will move along the track as progress is made, gradually moving towards and away from any given receptor; and
- Based on the information provided in BS 5228-1[10] Appendix B.1, it is likely that the embedded measures can provide up 5 to 10 dB of further reductions of construction noise

levels at sensitive receptors. These potential construction noise level reductions have not been included in the quantitative assessment that follows as a conservative approach.

13.3.68 The following assumptions have been made for the Proposed Development operational stage:

- Baseline sound surveys were carried out continuously over 7 days which is considered to be an adequate time span to obtain representative baseline data, although some variation can occur in both ambient activities and prevailing weather beyond this period, possibly due to atypical conditions. Weather conditions during the surveys were fair and suitable for environmental surveys. During periods of wind with speeds outside of the suitable range, or during precipitation, data have been excluded from the data used for the assessment. Therefore, environmental surveys uncertainties raising the potential background sound level and informing the operational sound assessment have been reduced to a minimum or removed and are not considered significant;
- The proposed substation site has been modelled as a hard standing with point sources representing the proposed transformers; and
- The screening or barrier interference effects of ground topography, equipment, building or vegetation including trees have not been included in the prediction of sound levels at noise sensitive receptors.

13.4 Baseline Conditions

13.4.1 The acoustic environment at all NSRs is consistent with a rural area that is remote and generally free from continuous road traffic, commercial or industrial related sounds. The area is covered by tall trees which often determine the background levels as vegetation blows in the breeze along with other natural sounds. Glass House is adjacent to a main through road in the area and therefore experiences greater contribution from road traffic, but movements on this road are not continuous and at night would be infrequent and sporadic at most. Otherwise at these receptors everyday non-nature sounds are most likely to arise from domestic activities. The River Glass passes through the area as well as various burns which can generate noise particularly after prolonged periods of heavy rainfall. These can be the dominant source of noise when wind speeds are low for any receptors in proximity to these, i.e. including but not limited to the Sawmill and Plodda Cottage.

13.4.2 A baseline noise survey was undertaken in the area and focussed on properties with a monitoring location ID indicated in **Table 13-12.**

13.4.3 The sound level meters were programmed to log L_{Aeq}, $L_{Amax,}$ and L_{A90} values, and third-octave band spectral levels over the 15-minute measurement period – except for the attended measurements at Glass House and Birchwood House. The attended measurements logged the same values but over a 5-minute measurement period.

13.4.4 A summary of the measured levels is provided in **Table 13-12** for each receptor for the durations indicated. **Volume 3, Appendix M Background Sound Noise Level Survey** contains more detailed information about the baseline survey including equipment, noise level time histories and measured noise level each day in the day (0700-1900) evening (1900-2300), day-evening (0700 – 2300) and night (2300 – 0700) periods and excluded periods due to weather and atypical events where as appropriate.

Table 13-12 A summary of the measured sound levels at the monitoring locations in the 0700-1900 and 2300-0700 periods.

NSR Number	Receptor Name	Reference Period	Reference Duration	$L_{Aeq,15min}$	Mean $L_{A90,15min}$	Mode $L_{A90,15min}$
NSR1	Glass House	Day	1 hr (10:30 – 11:30)	60	38	38

NSR Number	Receptor Name	Reference Period	Reference Duration	$L_{Aeq,15min}$	Mean $L_{A90,15min}$	Mode $L_{A90,15min}$
		Night	-	-	-	
NSR2	Birchwood House	Day	1 hr (12:00 – 13:00)	71	33	33
		Night	-	-	-	
NSR3	Challenger Lodge	Day	7 days (0700-1900)	58	39	35
		Night	6 nights (2300-0700)	44	35	33
NSR4	The Sawmill	Day	7 days (0700-1900)	50	39	39
		Night	6 nights (2300-0700)	43	38	37
NSR5	Hilton Lodge	Day	7 days (0700-1900)	57	37	35
		Night	6 nights (2300-0700)	42	35	39
NSR6	Guisachan Cottage	Day	7 days (0700-1900)	57	38	36
		Night	6 nights (2300-0700)	47	33	29
NSR7	Plodda Cottage	Day	7 days (0700-1900)	48	40	38
		Night	6 nights (2300-0700)	43	41	40

13.5 Assessment of Effects, Mitigation and Residual Effects

Construction Phase

13.5.1 Construction work of any type that involves heavy plant activity will generate noise, which may result in complaints if appropriate scheduling and control of works is not exercised. Noise levels generated by construction activities and experienced by NSRs, depends upon a number of variables, the most significant of which are:

- The level of noise generated by plant or equipment used on-site, generally expressed as the sound power level;
- The periods of operation of the plant on the Site, known as its ‘on-time’;
- The distance between the noise source and the NSR; and,
- The attenuation of sound due to ground absorption, air absorption and barrier / screening effects.

13.5.2 To evaluate noise effects during the construction phases it is necessary to have knowledge of the variables listed above. Construction Contractors may use different working methods and plant to achieve the same ends. An accurate construction noise and vibration effect assessment is not possible until after the appointment of an approved Construction Contractor with knowledge of the exact working routine and plant schedule to be implemented.

13.5.3 Activities generating construction related noise and vibration that have the potential to cause disturbance at sensitive receptors have been identified as follows:

- Preparatory works relating to the access track;
- The use of the access track by construction vehicles accessing the proposed substation site;
- Works at the proposed substation site; and
- Construction related vehicles on the surrounding road network

13.5.4 The use of construction plant and the likely effect from its use is determined using the guidance detailed in BS 5228[1011] part one in relation to noise and part two for vibration. Where necessary, mitigation methods may be required to attenuate noise to acceptable levels at NSRs. Should complaints be received from local residents, THC would determine whether BPM is being applied. Should this not be the case, action under the Control of Pollution Act 1974[2] may be taken.

13.5.5 The following sections first discuss the planned construction hours, embedded mitigation measures and then present an assessment of potential effects, comments on mitigation measures and finally the predicted residual effects for the construction phase of the Proposed Development.

Construction Hours

13.5.6 Construction activities would typically be undertaken during “standard hours” namely weekday daytimes (07:00 to 19:00) and Saturdays (07:00 to 13:00) plus some level of flexibility allowed for some activities that cannot be stopped or paused subject to THC approval. However, to comply with the THC requirements, construction related activities likely to generate noticeable noise or vibration will be limited to the hours (08:00 to 19:00) and Saturdays (08:00 to 13:00).

13.5.7 Some works would need to take place outside of normal working hours, if they do not give rise to unacceptable noise impacts (this would be where they do not exceed site noise limits).

Embedded Mitigation

13.5.8 Measures to mitigate noise and vibration would be implemented during the Proposed Development construction phase to minimise impacts at local residential receptors and ecological receptors, particularly with respect to activities required outside of normal working hours. Mitigation included in the CEMP and Construction Traffic Management Plan (CTMP) (**Volume 4, Appendix K Transport Statement**) includes but is not to be limited to:

- Avoiding high intensity activities outside of standard hours when in close proximity to NSRs, these activities should be planned for standard hours where practical;
- Abiding by any agreed construction noise limits at nearby NSRs;
- Avoidance of working in the more sensitive evening and night times where possible;
- Ensuring that processes are in place to minimise noise before works begin and ensuring that BPM are being achieved throughout the construction programme;
- Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible;
- Hydraulic techniques for breaking to be used in preference to percussive techniques where practical;
- Use of rotary bored rather than driven piling techniques where this is possible;
- Off-site pre-fabrication where practical;

- All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use;
- All contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2)[1011];
- Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials within the Site to be conducted in such a manner as to minimise noise generation;
- Where possible, the noisiest items of plant would be located the furthest distance from the nearby NSRs. Plant known to emit noise strongly in one direction would, where practicable, be orientated so that the noise is directed away from NSRs;
- Machines such as cranes that may be in intermittent use would be shut down between work periods or would be throttled down to a minimum. Machines would not be left running unnecessarily;
- Appropriate routing of construction traffic on public roads and along access tracks, to minimise noise level increase;
- Consultation with THC and local residents to advise of potential noisy works that are due to take place when they may be considered a cause of disturbance; and
- Noise complaints should be monitored, reported to the contractor and immediately investigated.

13.5.9 Regular communication with the local community throughout the construction period would also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise may occur during specific operations, and providing lines of communication where complaints can be addressed. A communication plan would be included in the Final CEMP as required.

13.5.10 The appointed Principal Contractor would be encouraged to be a member of the 'Considerate Constructors Scheme'[18].

13.5.11 As mentioned above, a Final CEMP would be prepared prior to works commencing, including setting out provisions to ensure that noise and vibration impacts relating to construction activities are minimised based on the measures outlined above. To assist in the preparation of the Final CEMP and CTMP, a detailed noise and vibration assessment would be undertaken, if required, once the Principal Contractor is appointed to identify specific mitigation measures for the Proposed Development (including construction traffic).

13.5.12 Based on the information provided in BS 5228-1[10] Appendix B.1 it is likely that the embedded measures can provide up 5 to 10 dB of further reductions of construction noise levels at sensitive receptors. These potential construction noise level reductions have not been included in the quantitative assessment that follows as a conservative approach.

<u>Assessment of Effects – Noise from Preparatory Access Track Works (and setup of Temporary Compound 5)</u>

13.5.13 In order to predict the levels at NSRs from vehicle movements on the access track, the methodology provided within BS5228-1[10] for predicting noise levels from the use of haul roads has been used.

13.5.14 The following list of plant and equipment within **Table 13-13** has been provided by the SSEN Transmission in relation to the preparation of the access track during the Earthworks stage. The equipment has been matched with specific items listed within the appendices of BS 5228-1, selecting the worst-case assumption where multiple options where available.

[18] Considerate Contractors Scheme, n.d. Available at: https://www.considerateconstructors.com/.

13.5.15 The total A-weighted sound power level is also provided for one of each time with on-time correction included and for all items accounting for the quantity of items.

Table 13-13 A table of plant and equipment sound power levels for the access track preparatory works

ID	Plant & Equipment Description	Sound Power Level dB L_{wA}	On Time %	On Time Corrected Sound Power Level dB L_{wA}	Quantity	On Time and Quantity Corrected Sound Power Level dB L_{wA}	BS5228 Reference
AT1	50t Excavator	114	80 %	113	2	116	c.1.13
AT2	30t Excavator	100	80 %	99	3	104	c.2.15
AT3	20t Excavator	104	80 %	103	2	106	c.2.21
AT4	Crushing Plant	112	80 %	111	2	114	c1.14
AT5	Loading shovel	104	80 %	103	2	106	c.6.34
AT6	Artic. Dumper Truck	109	80 %	108	12	119	c.4.1
AT7	Dozer D4	97	80 %	96	2	99	c.2.25
AT8	Dozer D6	105	80 %	104	5	111	c.2.19
AT9	Tractor	107	80 %	106	2	109	c.4.75
AT10	Roller	101	80 %	100	3	105	c.2.38
Total Sound Power Level dBA (1 of each item)				117			
Total Sound Power Level dBA (all items)						122	

13.5.16 The construction noise level associated with the preparation of the access track (and preparation Temporary Compound 5) has been predicted using BS 5228-1[10] calculation methodology using the total sound power levels ("one of each item" and "all items") in **Table 13-13** and the distance to the access track (refer to **Table 13-14**). Therefore, for this assessment it is assumed that all the plant and equipment is active simultaneously over the on-time and located at the closest approach to each receptor at height of 1.5 m which are both conservative assumptions. In practice, equipment will be spread out and likely operating for less than the specified on-time. Screening from land topology has been included calculations however screening from vegetation is not included.

Table 13-14 Predicted Construction Noise Levels at Receptors during Preparatory Access Tracks Works

NSR Number	Receptor Name	Distance to Access Track (m)	"One of Each Item" Active Predicted Access Track Level during Earthworks	"All Items" Active Predicted Access Track Level during Earthworks dB $L_{Aeq,T}$
NSR1	Glass House	400	52	57
NSR2	Birchwood House	770	36	41

NSR Number	Receptor Name	Distance to Access Track (m)	"One of Each Item" Active Predicted Access Track Level during Earthworks	"All Items" Active Predicted Access Track Level during Earthworks dB $L_{Aeq,T}$
NSR3	Challenger Lodge	1140	31	36
NSR4	The Sawmill	1150	30	35
NSR6	Guisachan Cottage	1600	35	40
NSR8	The Fank	582	44	49

13.5.17 The construction noise level from the preparation of Temporary Compound 5 has been predicted at the nearest receptors (NSR1 & NSR2) assuming the same plant list as used for the proposed access track construction, totalling 122 dB L_{WA} see **Table 13-13**, as a conservative approach. The predicted levels at NSR1 & NSR2 are 51 dB $L_{Aeq,12hr}$ and 50 dB $L_{Aeq,12hr}$ respectively attributed from the construction of Temporary Compound 5 only. Note therefore if this work was undertaken in parallel with the proposed access track construction it would not be predicted to exceed the 65 dB $L_{Aeq,12hr}$ day-time threshold value for construction noise levels at receptors.

13.5.18 In the daytime construction period (0700 – 1900), it is apparent from **Table 13-14** that even when considering the closest receptor, Glass House (and its nearby properties) and with all construction plant and equipment active at the closest approach (400 m) the predicted construction noise level would be lower than the most stringent Category A Threshold Value in the day-time of 65 dB $L_{Aeq,12hr.}$

13.5.19 In the evening construction period (1900 - 2300), it is also apparent from **Table 13-14** that that the "All Items" active scenario results in only one exceedance (of 1dB) of the Category A Threshold Value of 55 dB $L_{Aeq,4h}$ which occurs at Glass House. When considering the "One of Each Item" scenario there are no exceedances of the evening limit. This scenario is considered a closer representation of construction activity in a single area along the proposed access track as assuming all equipment is active and located at the same location throughout as single evening is robust worst-case scenario but an unrealistic representation of likely practice.

13.5.20 It is understood that evening construction activities generating the highest noise emissions would only take place where works cannot be completed within day-time period.

13.5.21 With reference to **Table 13-7** and **Table 13-8** the magnitude of impact in the daytime and evening periods is Low which for a high sensitivity receptor is classified as a Minor adverse effect which is Not Significant.

<u>Assessment of Effects – Noise from Vehicle Movements on the proposed Access Track</u>

13.5.22 The assumed traffic flows per day in the peak month using the proposed access track associated with the Proposed Development only is 604 vehicle movements of which 226 are HGV movements as produced by the projects traffic and transport consultants based on information provided by SSEN Transmission.

13.5.23 A 3D noise model of the site has been prepared including land topography. The non-HGV and HGV movements in a daily period have been modelled and used to predict a worst case 12 hour day-time and 4 hour evening construction noise level from access track movements specifically based on 10 km/h vehicle speed as shown in **Table 13-15**. The presented noise

levels at NSRs are based on the worst-case peak month of HGV / non-HGV construction traffic on Link 1 (see **Table 13-15** and **Volume 2, Appendix A, Figure 12-1** for Link 1), and as a further, likely exaggerated, worst-case the predicted levels assume that all construction traffic movements occur within a peak 1-hour period, within the 12-hour / 4-hour working day / evening.

13.5.24 The day / evening split of the daily vehicles has been calculated on the assumption that the vehicles flow rate will be steady over the 16-hour period (0700 to 2300).

Table 13-15 BS5228-1 Predicted Access Track traffic noise levels at receptors during the Peak Month for construction traffic flows

NSR Number	Receptor Name	Distance to Access Track (m)	Daytime Predicted Access Track Traffic Noise Levels dB $L_{Aeq,12hr}$			Evening Predicted Access Track Traffic Noise Levels dB $L_{Aeq,12hr}$		
			Non-HGV	HGV	Day Total	Non-HGV	HGV	Eve. Total
NSR1	Glass House	400	41	50	50	36	45	46
NSR2	Birchwood House	770	31	41	42	27	37	37
NSR3	Challenger Lodge	1140	30	39	40	25	35	35
NSR4	The Sawmill	1150	31	41	41	27	36	37
NSR6	Guisachan Cottage	1600	37	46	46	32	41	41
NSR8	The Fank	582	39	49	49	35	44	45

13.5.25 In the daytime construction period (0700- 1900), it is apparent from **Table 13-15** that predicted traffic levels are more than 5 dB below the Category A Threshold Value of 65 dB $L_{Aeq,12h}$ at all receptors.

13.5.26 In the evening construction period (1900 - 2300), it is also apparent from **Table 13-15** that predicted traffic levels are more than 5 dB below the Category A Threshold Value of 55 dB $L_{Aeq,4h}$ at all receptors.

13.5.27 With reference to **Table 13-7** and **Table 13-8** the magnitude of impact in the daytime and evening periods is Very Low which for a high sensitivity receptor is classified as a **Negligible Effect** which is **Not Significant**.

Assessment of Effects – Noise from construction of the proposed substation site

13.5.28 The closest receptors to the proposed substation site are Challenger Lodge (1.6 km) and Hilton Lodge (1.78 km) in different directions. BS 5228[10] is intended for prediction of noise levels up to a distance of 300 m and less for vibration.

13.5.29 On this basis a detailed quantitative assessment of construction is considered not proportionate to the potential risk for causing annoyance and disturbance from construction activities at the proposed substation site specifically.

13.5.30 The implementation of the embedded mitigation measures and adherence to the construction periods as discussed previous, will ensure that the Magnitude of Impact at the proposed substation site remains Very Low during construction which for a high sensitivity receptor is classified as a **Negligible** which is **Not Significant**.

Assessment of Effects – Vibration from within Proposed Development Site

13.5.31 Considering the distances to sensitive receptors (see **Table 13-16**) and / or the nature of the planned construction activities adverse vibration impacts for buildings or people are unlikely to occur. A detailed vibration assessment is not required.

13.5.32 On this basis and with reference to **Table 13-7** and **Table 13-10** vibration levels at sensitive receptors have magnitude of impact no worse than Very Low which is a **Negligible** effect and **Not Significant**.

Assessment of Effects – Vehicles on the Public Network

13.5.33 The potential changes in road traffic noise during the construction phase of the Proposed Development have been considered for each road link in **Volume 1**, **Chapter 11 Traffic and Transport** defined study area. These links are shown in **Volume 2, Appendix A, Figure 11-1.**

13.5.34 Construction traffic data is available for the following parameters for each road link, for the 47-month programme starting in September 2025, for both the “future baseline” and “future baseline + development construction traffic” scenarios:

- Annual Average Daily Traffic (AADT);
- Percentage HGV; and
- Vehicle speed (km/h).

13.5.35 AAWT flows are usually used to calculate the BNL, however in the absence of this information, AADT data has been used to determine the relative change in road traffic noise levels on each road link during construction.

13.5.36 In **Table 13-16** the change in predicted BNL is determined for the peak month (September 2027), as a worst-case. **Volume 3, Appendix N Comparison of Predicted Construction Traffic Levels** on Link 1 in all months presents the change in BNL for Link 1 through all 47 months, providing a further breakdown of potential impacts on this most affected link.

Table 13-16 Predicted change in road traffic noise level during construction for High Sensitivity Receptors in the Peak Month (Sept 2027)

Link #	Link Name	Future Baseline				Future Baseline + Development Traffic				Change in BNL, dB	Magnitude of Impact / initial Significance of Effect
		AAWT	% HGV	SPEED (km/h)	Predicted BNL dB LAeq**	AAWT	% HGV	SPEED (km/h)	Predicted BNL dB LAeq**		
1	A831 Drumnadrochit to Site Access	654	0.3	80	54.0	1254	18.2	80	60	6.0	HIGH / MAJOR
2	A831 Site Access - Cannich	665	0.3	68	52.6	1043	0.2	68	54.5	1.9	LOW / MINOR
3	A831 Cannich Village	672	0.9	45	50.3	1050	0.6	45	52.1	1.8	LOW / MINOR
4*	A831 North of Cannich	430	0.8	53	52.5	808	0.6	53	55.2	2.7	LOW / MINOR
5	Main Street Cannich to Fasnakyle Power Station	719	0.6	34	49.4	1097	0.4	34	51.1	1.7	LOW / MINOR

* Link 4 BNL are both below 1000 and were therefore calculated using the NAC method which gives an Leq value directly.

** All Links except Link 4 were calculated using CRTN BNL to get $L_{A10,18hr}$ and then converted to $L_{AEq,16hr}$. However, the low flow correction applied to each calculated BNL has been appropriately capped at 1000 AADT flow (i.e. for flows with <1000 AADT flow, the low flow correction component of the BNL for a flow of 1000 AADT has been applied).

13.5.37 The outcome of this assessment of predicted change in road traffic noise level to Developments construction traffic in the peak month phase highlights a potential range of adverse effects from **Minor (Not Significant)** to **Major (Significant)**.

13.5.38 Link 4 is identified as having a Low Magnitude of Impact even in the peak month, which is **Minor adverse effect (Not Significant)** for a high sensitivity (residential) receptors living in close proximity to the road, according to **Table 13-7** and **Table 13-9.**

13.5.39 Link 2 is identified as having a Low Magnitude of Impact in the peak month, which would be classified as a **Minor adverse effect (Not Significant).** However, there are no sensitive human receptors adjacent to this link and therefore there are no resulting adverse effects.

13.5.40 Links 3 and 5 are identified as having a **Low Magnitude of Impact** in the peak month, which would be classified as a **Minor adverse effect (Not Significant).** There are a number of residential and other potentially sensitive receptors along these links through Cannich, some close to the road. However, the level of change is Minor adverse in the peak construction traffic month, and not all receptors would be subject to the predicted noise level change as suggested by the BNL, due to the masking effect of noise from other area and community sources (natural and man-made), and therefore it is considered that the changes overall would have a typically Very Low to Low Magnitude of Impact when considering the whole construction programme, resulting in a **Negligible to Minor significance of effect (Not Significant)**.

13.5.41 On this basis of the peak month assessment being the worst-case, Links 2 to 5 are not considered in further detail.

13.5.42 With respect to construction traffic flows S on the A831 between Drumnadrochit and the Site Access, a potential High Magnitude of Impact is predicted, potentially resulting in a Major effect in the peak month at high sensitivity receptors in the vicinity, based upon the predicted BNL change.

13.5.43 However, the effect experienced at sensitive receptors in the vicinity of the road will be affected by a number of factors, including their distance from the road. The BNL calculations have therefore been refined to include the distance and typical ground conditions between the road edge and the sensitive receptors based upon an average propagation height of H = 1 and absorbent ground factor I = 0.75, where I = 1 would correspond to 100 % absorbent ground cover. The resultant levels likely remain exaggerated as they take no account of topography or screening (i.e. from walls, barriers, buildings, landform etc), but will provide a better indication of potential road traffic noise level change.

13.5.44 With reference to **Appendix N (Comparison of Predicted Construction Traffic Levels on Link 1 in all months)** Development construction road traffic on Link 1 during months 1 to 14 and months 42 to 47 is predicted result in a road traffic noise level change of < 3 dB and therefore all receptors in the vicinity of Link 1 are predicted to experience a Low Magnitude of Impact at worst during these months. For High Sensitivity (i.e. residential) receptors this is classified as **Minor adverse effect (Not Significant)** at worst, according to **Table 13-7** and **Table 13-9**.

13.5.45 During Months 15 to 41 the predicted change in road traffic noise level at sensitive receptors along Link 1 is ≥ 3 dB. This period includes the peak month (Month 25) for which a High Magnitude of Impact has already been identified. The predicted change is shown below in **Table 13-17** for these months together with the resulting Magnitude of Impact and potential Significance of Effect classifications.

Table 13-17 The predicted change in road traffic noise level for Link 1 and the initial Magnitude of Impact and potential Significance during months 15 to 41.

Month #	Future Baseline Predicted Road Traffic Noise Level ($L_{Aeq,16hr}$)	Future Baseline + Development Traffic Predicted Road Traffic Noise Level ($L_{Aeq,16hr}$)	Predicted Road Traffic Noise Level Change	Initial Magnitude of Impact / Potential Significance of Effect
Month 15	53.8	56.8	3.1	Medium / Moderate
Month 16	53.8	57.0	3.2	Medium / Moderate
Month 17	53.8	57.5	3.7	Medium / Moderate
Month 18	53.8	58.1	4.3	Medium / Moderate
Month 19	53.8	58.3	4.5	Medium / Moderate
Month 20	53.8	58.5	4.7	Medium / Moderate
Month 21	53.8	58.9	5.1	High / Major
Month 22	53.8	58.8	5.0	High / Major
Month 23	53.8	58.8	5.0	High / Major
Month 24	53.8	58.7	4.9	High / Major
Month 25	53.8	59.8	6.0	High / Major
Month 26	53.8	59.7	5.9	High / Major
Month 27	53.8	59.5	5.8	High / Major
Month 28	53.8	59.3	5.5	High / Major
Month 29	53.8	59.2	5.4	High / Major
Month 30	53.8	58.5	4.7	High / Major
Month 31	53.8	58.0	4.3	Medium / Moderate
Month 32	53.8	57.8	4.0	Medium / Moderate
Month 33	53.8	57.9	4.1	Medium / Moderate
Month 34	53.8	57.5	3.7	Medium / Moderate
Month 35	53.8	57.5	3.7	Medium / Moderate
Month 36	53.8	57.5	3.7	Medium / Moderate
Month 37	53.8	57.5	3.7	Medium / Moderate
Month 38	53.8	57.6	3.9	Medium / Moderate
Month 39	53.8	57.6	3.9	Medium / Moderate
Month 40	53.8	57.7	3.9	Medium / Moderate
Month 41	53.8	57.6	3.8	Medium / Moderate

13.5.46 However, the assessment of potential Significance of Effect is based upon the change in road traffic noise in isolation. This does not consider the ambient sound level at receptors, particularly those set further back from the road, which will be affected by other area and community sources (natural and man-made) and which in practice will help to mask some of the predicted change in road traffic noise level close to the road.

13.5.47 To provide context regarding the number of sensitive receptors that may experience Significant adverse effects due to an increase in construction road traffic noise levels on Link

1, Ordnance Survey AddressBase data has been used to identify all sensitive receptors within a 50 m buffer around the link. The following sensitive receptors have been identified based on address point data:

- 93 residential receptors (High Sensitivity);
- 8 non-residential but noise sensitive receptors
  - 5 Hotels / Accommodation (High Sensitivity); and
  - 3 Other (such as cemeteries, place of worship, village halls) (Medium or Lower Sensitivity).

13.5.48 To provide some additional context to the potential Significant effects during months 15 to 41, the predicted 16 hour equivalent sound pressure level at each receptor has been compared to the level of 55 dB $L_{Aeq,16hr}$ for gardens and other outdoor living areas as quoted in WHO *Community Noise Guidelines*[19] and BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*[16] as appropriate for residential external amenity. This approach has been taken in the absence of detailed baseline sound level data at the identified Link 1 sensitive receptors.

13.5.49 Exceedance of the 55 dB $L_{Aeq,16hr}$ does not occur at Link 1 sensitive receptors that are 15 m or more from Link 1. Eight receptors in total are located within 15 m from the road, which include six residential dwellings, one holiday rental property and one place of worship. Road traffic noise levels of up to approximately 60 dB $L_{Aeq,16hr}$ are predicted at one of the properties for a maximum period of three months.

13.5.50 On the basis of the above further assessment of the potential construction road traffic noise impacts and effects at sensitive receptors within the close vicinity of Link 1, considering both the noise level change and absolute predicted noise levels, a total of eight sensitive receptor properties located within approximately 15 m of the road are considered to experience **temporary Moderate/Major Adverse Significance of Effects**. At properties at greater distance, the overall Significance of Effect is considered likely to be lower at **Minor Adverse effects** throughout the construction programme.

Description of Effects

13.5.51 The previous subsections have presented the potential magnitude of effects and the resulting significance of effect for each of the noise sources with the potential to cause annoyance or disturbance at sensitive receptors. **Table 13-18** summarises the magnitude of impact outcomes. As the worst affected receptors are all residential receptors the sensitivity is High with reference to **Table 13-6**, the significance of effect is also classified on this basis with reference to **Table 13-7**.

[19] World health Organisation, 1999. Guidelines for Community Noise. Available at: https://www.who.int/publications/i/item/a68672.

Table 13-18 Construction Phase Initial Magnitude of Effect and Potential Significance Classification

Receptor	Description of Effect	Initial Magnitude of Impact without Mitigation	Significance of Effect
Construction Phase			
All NSRs	Day-time and evening Construction Noise from Preparatory Access Track Works	Low	Minor (Not Significant)
All NSRs	Day-time and evening Noise from Construction Vehicle Movements on the Access Track	Very Low	Negligible (Not Significant)
All NSRs	Construction Noise from the Substation	Very Low	Negligible (Not Significant)
All NSRs	Construction Vibration from within the site boundary	Very Low	Negligible (Not Significant)
All NSRs near Link 2 to Link 5 any month	Construction Vehicles on the Public Network	Very Low to Low	Negligible to Minor (Not Significant)
All NSRs near Link 1 during month 1 to 14 and 42 to 47	Construction Vehicles on the Public Network	Low at worst	Minor at worst (Not Significant)
NSRs >15 m from Link 1 during months 15 to 41	Construction Vehicles on the Public Network	Very Low to Low	Negligible to Minor (Not Significant)
Total 8 NSRs <15 m from Link 1 during months 15 to 41	Construction Vehicles on the Public Network	Medium to High	Moderate to Major (Significant)

Mitigation During Construction

13.5.52 Potentially Moderate to Major effects have been identified at 8 address points representing noise sensitive receptors between months 15 to 41 which are located within 15 m of Link 1. No specific mitigation measures have been proposed beyond the embedded mitigation measures previously outlined which would be considered as part of the preparation of the Final CEMP and CTMP.

13.5.53 Methods of reducing road traffic noise impacts from Link 1 have been considered, but are not considered practical or possible including considering the required number vehicle movements:

- Over a longer period of time; and / or
- Over multiple routes

Residual Effect

13.5.54 **Table 13-19** below summarises the residual construction noise and vibration effects from the Proposed Development.

13.5.55 During the construction phase of the Proposed Development residual construction effects are predicted to be **Not Significant** in relation to noise and vibration from:

- Preparatory access track works;
- The use of the access track as a haul road;

- The construction of the proposed substation site;
- On public roads during months 1 to 14 and 42 to 47; and
- On public roads during months 15 to 41 beyond 15 m from Link 1.

13.5.56 During the construction phase of the Proposed Development residual construction effects are predicted to be **potentially Significant** based on the quantitative assessment in relation to noise from the additional construction traffic on public highways on Link 1 at properties located at eight address points during months 15 to 41 at 15 m or less from the carriageway.

13.5.57 It is useful to also consider the context of existing and predicted noise levels at properties close to the Link 1 and especially those with facades or amenity spaces in the order of 15 m from the carriageway as follows:

- Note that predictions have assumed that there is no screening present currently, which may not be the case in practice and therefore, sound levels may be lower;
- Community consultation would be planned to provide early engagement with residents regarding the predicted increase in road traffic noise levels due to the additional construction traffic. It is important to note that the greatest potential effects identified would be temporary over Months 15-41;
- It is possible that residents at potentially affected properties have become accustomed to road traffic noise and may be less sensitive to temporary increases in traffic flows especially when it is communicated prior to the works;
- The majority of the movements are planned to be during weekday daytime hours when more residents are likely to be away from their homes, when compared to night-time hours and at weekends;
- The predicted change in the 18-hour road traffic noise levels would be gradual as the construction programme progresses, rather than an abrupt change on day one;
- The assessment of each receptor on Link 1 has also considered a comparison of the predicted level at the receptor with the 55 dBA external threshold for amenity spaces. The address point data used to determine receptor distances from Link 1 can be positioned anywhere within the vicinity of the property or properties it represents. As it is not typical for the amenity spaces for resting (garden) to be positioned at the worst façade it is likely that the location of the amenity space used by residents will be away from the roads and possibly shielded by the building itself. This means that noise levels in amenity spaces at properties closest to Link 1 are likely to be lower than predicted; and
- Where the building façade is the most sensitive part of the property (in terms of potential effects on residents residing within the property) it is useful to consider the predicted levels; the BNLs (which is at 10 m from the carriageway), are provided in **Table 13-17** for the ‘Future Baseline + Development Traffic’ in each month from Link 1 and approximately 60 dBA at worst. BS8233:2014 provides guidance for designing buildings to achieve acceptable indoor and outdoor acoustic conditions. In Living Rooms and Bedrooms for daytime resting the recommended target noise level is 35 dB $L_{Aeq,T.}$ An outside to inside reduction of ~60 dBA to 35 dBA is readily achievable from a closed standard double glazed window.

13.5.58 On the basis of the above context considerations, and actual effects of the change in road traffic noise levels on residents during construction are likely to be lower than Major and Moderate effects predicted.

Table 13-19 Summary of Construction Residual Effects

Receptor	Description of Effect	Initial Magnitude of Impact without Mitigation	Additional Mitigation	Residual Effects	Significance
All NSRs	Day-time and evening Construction Noise from Preparatory Access Track Works and preparation of Temporary Compound 5	Low	None Required	Low	Minor (Not Significant)
All NSRs	Day-time and evening Noise from Construction Vehicle Movements on the Access Track	Very Low		Very Low	Negligible (Not Significant)
All NSRs	Construction Noise from the Substation	Very Low		Very Low	Negligible (Not Significant)
All NSRs	Construction Vibration from within the site boundary	Very Low		Very Low	Negligible (Not Significant)
All NSRs near Link 2 to Link 5 any month	Construction Vehicles on the Public Network	Very Low to Low		Very Low to Low	Negligible to Minor (Not Significant)
All NSRs near Link 1 during month 1 to 14 and 42 to 47	Construction Vehicles on the Public Network	Low at worst		Low at worst	Minor at worst (Not Significant)
NSRs >15 m from Link 1 during months 15 to 41	Construction Vehicles on the Public Network	Very Low to Low		Very Low to Low	Negligible to Minor (Not Significant)
Total 8 NSRs <15 m from Link 1 during months 15 to 41	Construction Vehicles on the Public Network	Medium to High	None Available	Medium to High	Moderate to Major at worst but likely lower in practice see contextual factors in **Section 13-3013.5.57**(Significant)

Operational Phase

13.5.59 The operational phase of the proposed substation site has the potential to produce audible noise beyond the site boundary.

13.5.60 The key noise generating plant has been identified as two SGT, see **Volume 2, Appendix A**, **Figure 13-1** with the following sound power level characteristics:

- 95 dBA at 100 % load; and

- 88 dBA at 50 % load (which is considered as normal and expected usage by the SSEN Transmission).

13.5.61 **Table 13-20** outlines the following transformer spectrum including a peak in the 100 Hz, 200 Hz and 400 Hz one-third octave bands has been corrected to meet the broadband levels given above for 50 % load; as this represents normal operational characteristics.

Table 13-20 Unweighted One-Third Octave Sound Power Level Frequency Spectrum of single SGT at 50 % Load

One-Third Octave Frequency Band (Hz) Sound Power Level dB L_{wA} at 50 % Load													
31.5	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**
5	5	73	71	81	101	82	74	93	74	75	88	75	76
800	**1k**	**1.25k**	**1.6k**	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**	L_{wA}	$L_{w,z}$
75	71	70	66	58	57	53	50	49	46	46	50	88	102

13.5.62 The operation of the Proposed Development is assumed to be 24/7 and therefore the night-time period is the most sensitive period when *background sound levels* are lower and residents are trying to sleep. This assessment therefore focuses on the night-time only and assumes that meeting the EHO criteria in night-time will also satisfy the day-time criteria.

Assessment of Operational Noise against BS4142[17]

13.5.63 To undertake the BS 4142 assessment the *specific sound level*, *rating level* and *background sound level* are required at each assessment location.

13.5.64 The assessment is based on the difference between the representative *background sound level* and the predicted *rating level*, $L_{Ar,Tr}$ dB (i.e. the *specific sound level* $L_{Aeq,Tr}$ plus any character correction) at the NSR. Positive differences indicate an excess of the *rating level* over the *background sound level*.

13.5.65 The *specific sound level* at each NSR is predicted using the 3D model prepared in CadnaA 2023 MR2 based on the following:

- Sound propagation calculation for the operational phase have been undertaken in accordance with ISO 9613-2:1996 Acoustics — *Attenuation of sound during propagation outdoors, Part 2: General method of calculation*[20]*;*
- The proposed substation site ground has been assigned as hard ground, representing hard standing areas;
- Ground topography of the surrounding area is included in the noise model and has been assigned as soft ground, predominantly representing the vegetation in the area;
- Contribution from the two SGT have been represented in the 3D noise model using two point sources in the centre of the proposed substation site with a height of 4m;
- Each SGT has been assigned a sound power level representing the 50% load (88 dBA) and the spectrum given in **Table 13-20**;
- Screening and barrier interference effects provided by other plant and equipment is not included in the 3D noise model; and
- Predictions of specific sound at NSRs are external free-field first floor operational sound levels.

[20] International Organisation for Standardisation (1996). Acoustics — Attenuation of sound during propagation outdoors, Part 2: General method of calculation

13.5.66 The predicted *specific sound level* at each of the NSRs closest to the proposed substation site are provided in **Table 13-21**.

Table 13-21 Predicted Specific Sound Level $L_{Aeq,T}$ at the closest NSRs to the Proposed Substation Site

	NSR3		NSR4		NSR5		NSR7	
	$L_{Aeq,\ T}$	100 Hz $L_{Zeq,5min}$	$L_{Aeq,\ T}$	100 Hz $L_{Zeq,5min}$	$L_{Aeq,\ T}$	100 Hz $L_{Zeq,\ 5min}$	$L_{Aeq,\ T}$	100 Hz $L_{Zeq,5min}$
First Floor specific sound level dB	2	18	7	22	7	22	5	20

13.5.67 Comparing the predicted *specific sound levels* to the surveyed *background sound levels* it can be seen that at all NSRs that the operational sound level is predicted to be well below the *background sound level* at each assessment location regardless of the analysis method used to determine a representative L_{A90}.

13.5.68 On this basis the *specific sound level* would likely be masked by other environmental sounds in the area and as such unlikely to be audible at NSRs. Therefore, it is assumed, based on similar plant items that sound of a tonal, impulsive or intermittent nature will not be significantly audible and a character correction has not been added into the assessment and therefore the *rating level* is equal to the *specific sound level*.

13.5.69 Considering a BS4142[17] assessment, comparing the *rating level* during the night-time to the measured equivalent noise levels and *background sound levels* given in **Table 13-12**, impacts at all NSRs are categorised as “Low depending on the context”. This is because the predicted excess *rating levels* over *background sound levels* at all NSRs is ≤0 dB with reference to **Table 13-11**. This outcome is also applicable in the day-time where *background sound levels* are be comparable or higher than the night-time under the same meteorological conditions due to the presence of nature and community related sounds.

13.5.70 Considering the context of the outcome, the difference between the *specific sound level* and the measured sound levels in the area is very large. The predicted *specific sound levels* suggest that it is unlikely that the SGT’s would be audible at NSRs.

13.5.71 Furthermore, for night-time sources the WHO Guidelines[19] recommend a night-time (23:00 to 07:00) 8-hour sound level of 30 dB L_{Aeq} inside bedrooms (for a reasonably steady sound source) to avoid sleep disturbance which is already comfortably met externally.

13.5.72 The EHO has specifically requested consideration of the 100 Hz band and that noise from the Proposed Development, when measured and/or calculated as an $L_{Zeq,\ 5min}$, in the 100 Hz one third octave frequency band must not exceed 30 dB, at the curtilage of any noise sensitive premises.

13.5.73 It is apparent from the predicted unweighted 100 Hz one-third octave band levels at NSRs, as presented in **Table 13-21**,that transformer operational noise is expected to comply comfortably with the criteria set by the EHO. For reference the 100 Hz band unweighted noise contours and presented in **Volume 2, Appendix A, Figure 13-4** – sensitive properties within the green are predicted to be compliant with the EHO criteria at 100 Hz. There are no sensitive receptors in the red areas.

Description of Effects

13.5.74 The assessment of operational noise associated with two SGT has been undertaken against BS 4142 and by considering the 100 Hz component.

13.5.75 With reference to **Table 13-7** and **Table 13-11** the magnitude of impact in the daytime and night-time periods is Very Low which for a high sensitivity (residential) receptor is classified as a **Negligible effect** which is **Not Significant**.

Mitigation During Operation

13.5.76 The assessment of the operational phase has identified that no specific mitigation is required.

Residual Effect

13.5.77 **Table 13-22** summarises the construction residual effects of the Proposed Development.

Table 13-22 Summary of Operational Residual Effects

Receptor	Description of Effect	Effect without Mitigation	Additional Mitigation	Residual Effects	Significance
All NSRs	Daytime and night-time operational noise of the transformers within the substation site.	Very Low	None Required	Very Low	Negligible (Not Significant)

Cumulative Effects

13.5.78 An assessment of potential cumulative impacts and effects to occur as a result of the Proposed Development with other known committed developments in the study area is presented in **Chapter 15 Cumulative Effects.**

13.5.79 With respect to potential cumulative construction and operational sound from the committed developments and the activities within the Site, given the nature, distance separation and / or programme timings, significant cumulative noise effects are not anticipated.

13.5.80 It is however worth noting that the construction vehicles associated with the Proposed Development using the access track and Link 1 have the potential to combine with the construction traffic related to the OHL installation.

13.5.81 The cumulative construction traffic flows for the proposed Bingally Substation and OHL have been reviewed in the peak month for HGV vehicles and all vehicle type. The effect of adding the OHL related construction vehicles is negligible as the number of vehicles required in relation to the substation is substantially more. On this basis the cumulative effects are negligible but the underlying **Moderate and Major adverse** effects in relation to Link 1 still remain, see **Table 13-19**.

13.6 Summary

13.6.1 This chapter has identified potential for activities in relation to the Proposed Development construction and operational phases to have an adverse effect on identified sensitive receptors such as contributing to annoyance or disturbance.

13.6.2 During construction phase the residual effects (see **Table 13-19**) of most activities are predicted to be **Not Significant** in relation to noise and vibration from:

- Preparatory access track works;
- The use of the access track as a haul road;
- The construction of the proposed substation site;
- On public roads during months 1 to 14 and 42 to 47; and
- On public roads during month 15 to 41 beyond 15m from Link 1.

13.6.3 During months 15 to 41 there are eight noise sensitive receptors that have potentially Moderate or Major residual adverse effects which are **Significant** and these are less than 15 m from Link 1 which is the primary planned route to reach the site from outside the immediate area. Alternative routes through Cannich have been considered but would likely result in a greater number of adverse effects. Other types of additional and effective mitigation could not be identified, however embedded mitigation includes early liaison with those potentially affected.

13.6.4 During operational phase activity at the Proposed Development will be minimal, however two SGTs will be operational on a 24/7 basis. Based on the predicted sound pressure levels at the closest receptors it is expected that residual effects would have a **Very Low Magnitude of Impact** and for **High Sensitivity** (residential) receptors this would be a **Negligible effect** and **Not Significant**.