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Volume 7E Proposed Development (Onshore) Appendices

Appendix 8-4 Method of Assessment

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Acronyms and Abbreviations

AAWT	Annual Average Weekday Traffic
BNL	Basic Noise Level
BS	British Standard
dB	Decibels
DMRB	Design Manual for Roads and Bridges
EIAR	Environmental Impact Assessment Report
HGV	Heavy Goods Vehicles
HDD	Horizontal Directional Drilling
m	Metre
NR	Noise Rating
NSR	Noise Sensitive Receptor
ONEC	Onshore Export Cable Corridor
PPV	Peak Particle Velocity

1 Introduction

1.1.1.1 This appendix provides the detailed method followed throughout the assessment provided within Volume 5, Chapter 8: Airborne Noise and Vibration. This appendix is structured as follows:

- Overall method – The assessment of potential impacts arising from the construction and operational phases has been undertaken separately;
- Prediction methods;
- Derivation of evaluation criteria;
- Evaluation against criteria;
- Derivation of impact magnitude; and
- Determination of effect significance.

2 Overall Method

2.1 Construction Method

2.1.1.1 The appropriate method for predicting and evaluating noise impacts is provided in British Standard BS5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites – Part 1 (Noise) and Part 2 (Vibration) (BS5228) (BSI, 2014a[1]; BSI, 2014b[2]), a summary of which is provided in Volume 7E, Appendix 8-1: Summaries of Relevant Policy and Guidance. BS5228[1,2] and its technical appendices includes a prediction method, source noise terms for a range of construction plant and activities and sets out threshold criteria (noise limits).

2.1.1.2 This assessment has considered noise impacts from construction activities along the Onshore Export Cable Corridor (ONEC), at the Landfall Site and Onshore Substation Site.

2.2 Operational Method

2.2.1.1 The evaluation of operational noise in this assessment has drawn on Noise Rating (NR) criteria provided in British Standard BS8233:2014 Guidance on sound insulation and noise reduction for buildings (BSI, 2019b[3]) and also the method provided in British Standard (BS)4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (BS4142) (BSI, 2019a[4]) A summary of the pertinent sections of these standards is provided in Appendix 8-1: Summaries of Relevant Policy and Guidance.

2.2.1.2 Electrical plant within the Onshore Substation Site is the only expected source of noise during the operational phase. No noise is expected along the ONEC or at the Landfall Site during the operational phase, except associated with infrequent and short-duration maintenance works. The assessment has therefore considered noise impacts at the closest residential Noise Sensitive Receptors (NSR) as identified in Figure 8-4.1 within this document, Volume 7E, Appendix 8-4: Method of Assessment.

3 Prediction Methods

3.1 Construction Prediction Method - Noise

3.1.1.1 Prediction has been undertaken within noise modelling software CadnaA in accordance with the method provided in BS5228[1,2].

3.1.1.2 Outline stages of construction works have been provided by Caledonia Offshore Wind Farm Limited (the Applicant); these have been used to develop maximum design scenarios of construction plant and activities. The scenarios represent the stages of works expected to generate the highest levels of construction noise, making appropriate conservative assumptions and drawing on experience of construction works on similar projects. Noise levels from other scenarios will therefore be lower and the resultant impacts will be lesser.

3.1.1.3 Construction works along the ONEC have been predicted at incremental distances from the specific activity, given that the exact route and work locations will not be finalised until detailed design. Noise impacts from works along the ONEC have therefore been determined according to the necessary stand-off distance for daytime, evenings and weekends and night-time criteria to be met.

3.1.1.4 Noise levels have been predicted at specific NSRs for proposed works at the Onshore Substation Site, since the approximate distances between the works and the NSRs will not change; however, the construction programme and activities here are also outline only and may be subject to future amendment at the detailed design stage.

3.1.1.5 Construction plant and activities have been modelled as point sources at the closest likely distance of approach to NSRs, spaced assuming a minimum separation distance between plant items of 10 metres (m) across a generic work site. The model assumes no topographic screening between the work site and NSRs.

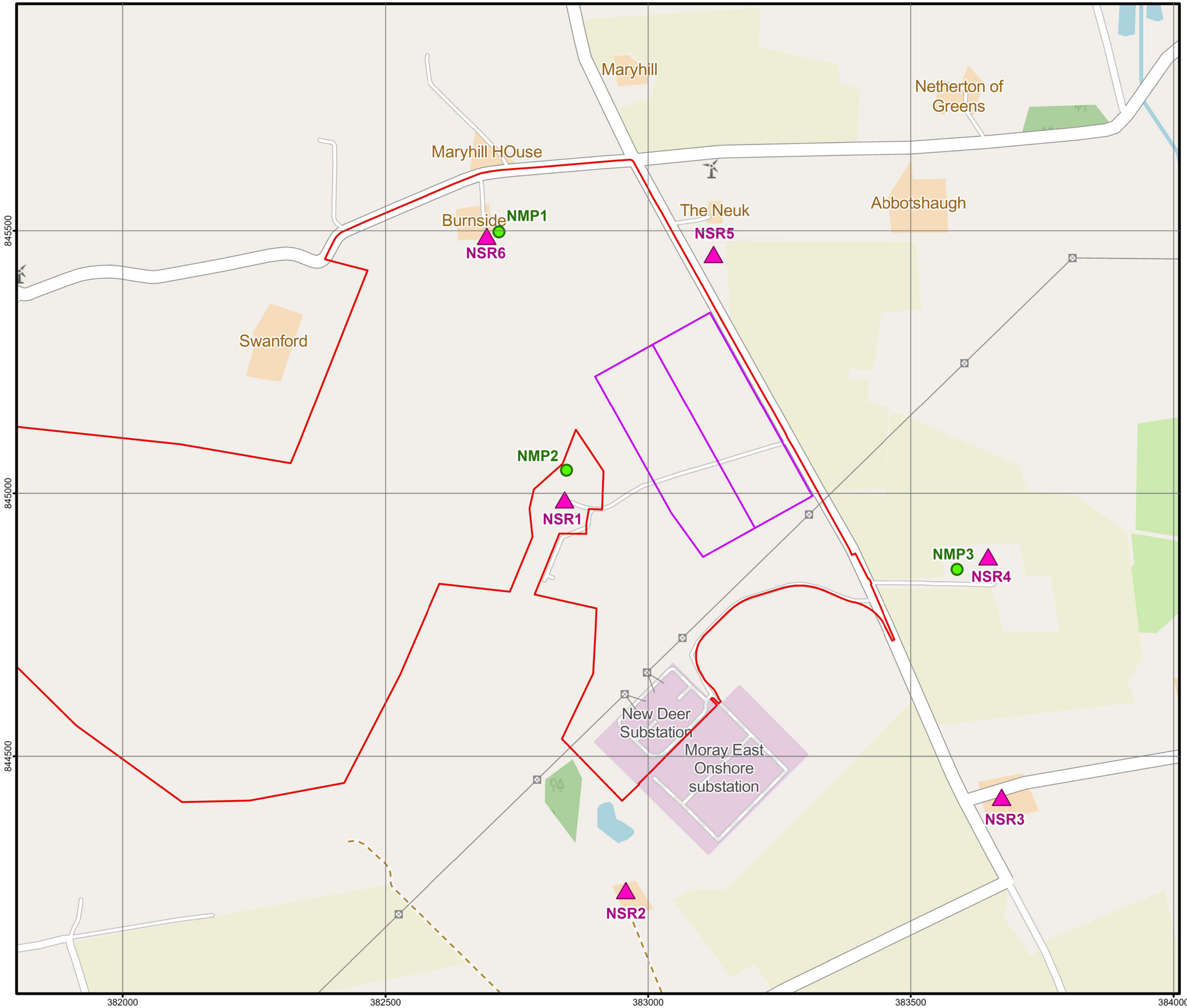
3.1.1.6 The approach outlined above considers the likely worst-case scenario; actual construction noise levels may be lower. The assumptions made are expected to be sufficiently robust that they are representative of the construction scenario with the greatest impact, whether this is concurrent, sequential or enabling.

3.1.1.7 The assessment has considered the construction periods provided in Table 3-1. The assumed plant for each scenario is listed, along with the representative sound power level and reference to tables provided in BS5228[1,2] from which octave band sound power levels have been derived. Assumed on-times of plant are also provided. All plant items have been modelled at a representative effective height of 2m above ground level.

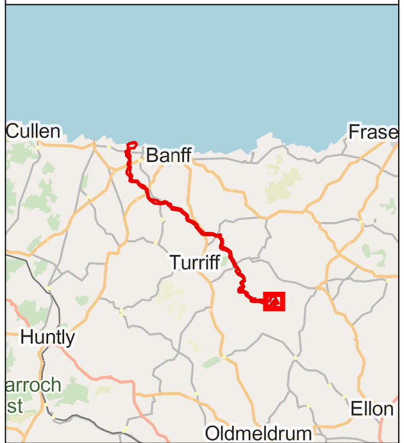
3.1.1.8 Embedded mitigation specified in Section 8.5.6 of Volume 5, Chapter 8: Airborne Noise and Vibration has been included within the predictions of construction phase noise from Horizontal Directional Drilling (HDD)[i] compounds, including at the Landfall location.

3.1.1.9 For construction activities at the Onshore Substation Site (refer to Period 3, Period 4, Period 5 and Period 6 in Table 3-1), the noise sources have been placed within the setting of the substation, at the closest likely approach to the closest NSRs. This has therefore required placement of each assemblage of plant in the northernmost corner, the easternmost corner and mid-way along the western site boundary. While modelling the plant assemblages simultaneously in three locations within the Onshore Substation Site risks triple-counting the construction phase noise level, in practice the contributions of the more distant work sites are negligible at the closest NSRs.

[i] This assessment has considered HDD, however, other trenchless technologies may be deployed. Noise impacts from these are likely to be similar to HDD or lesser and similar mitigation measures would therefore be considered. Trenchless crossing techniques such as Horizontal Directional Drilling are hereafter referred to as 'HDD'.



- Onshore Transmission Infrastructure Red Line Boundary
- Indicative Onshore Substation
- Noise Sensitive Receiver (NSR)
- Noise Monitoring Position (NMP)



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REV	DATE	DOC STATUS	ORIGIN	REVIEW	APP
03	20/08/2024	Approved	CW	JN	GS
02	30/07/2024	For Review	CW	JN	GS
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CALEDONIA Offshore Wind Farm

ARUP

CONTRACTOR DRAWING NO: UKCAL1_ARP_WNF_ENV_MAP_00709

CONTRACTOR REV: 03

GEODETIC PARAMETERS: OSGB36 / British National Grid (EPSG:27700)

DRAWING TITLE

Figure 8-4.1: Baseline Survey Noise Monitoring Positions and Representative NSRs

STATUS: Approved

SCALE: 1:10,000

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3.1.1.10 The noise models of the Onshore Substation Site have included attenuation provided by the existing topography of the terrain between the Onshore Substation Site and the NSRs.

Table 3-1: Construction phase scenarios

Period	Plant item and BS5228[1,2] reference	Number of items	Sound power level, Decibels (dB) (A)	Assumed on time (%)
Onshore Substation Site				
Period 1 Site establishment – establishing contractor compound and securing site boundary	Mobile crane C4.39	1	105	50
	Road wagon C6.21	3	109	20
	Telescopic handler C2.35	1	99	50
	Generator C8.24	1	87	100
Period 2 Civil enabling works – topsoil stripping and formation of bunds, subsoil excavation to form level platform	Bulldozer C2.11	1	107	50
	Articulated dump trucks C1.11	2	108	50
	Excavator C2.14	2	107	50
	Generator C4.84	1	102	50
	Mobile crane C4.39	1	105	50
Period 3 Civil construction works – breaking out rock and piling (if required)	Crusher C1.14	1	117	50
	Wheeled Loader C2.28	1	105	50
	Excavator C2.14	2	107	50
	Breaker mounted on excavator C9.13	1	123	50

Period	Plant item and BS5228[1,2] reference	Number of items	Sound power level, Decibels (dB) (A)	Assumed on time (%)
Period 4 Substation construction works – construction and installation of building and plant foundations, infrastructure trenches, roads and hardstanding areas, building superstructures	Excavator C2.14	1	107	50
	Mobile crane C4.39	1	105	50
	Telescopic handler C2.35	1	99	50
	Concrete pump and concrete mixer truck C4.28	1	103	50
	Concrete mixer truck C4.27	1	107	50
	Road roller C5.19	1	108	50
	Road wagon C6.21	3	109	20
	Hand held welder C3.31	2	101	20
	Hand held circular saw C4.70	1	119	20
	Generator C4.84	1	102	100
Period 5 Installation and commissioning - plant and equipment installation and commissioning	Mobile crane C4.39	1	105	50
	Road wagon C6.21	3	109	20
	Hand held welder C3.31	2	101	20
	Telescopic handler C2.35	1	99	50
	Generator C4.84	1	102	100

Period	Plant item and BS5228[1,2] reference	Number of items	Sound power level, Decibels (dB) (A)	Assumed on time (%)
Period 6 Landscaping – remediation works and planting of trees and shrubs for visual mitigation	Excavator C2.14	1	107	50
	Dump truck C1.11	2	108	50
	Lorry C2.34	2	108	100
Landfall Site and ONEC				
Period 7 Establish primary construction compounds and site access points, site preparation including fencing and haul road construction	Mobile crane C4.39	1	105	50
	Road wagon C6.21	3	109	20
	Telescopic handler C2.35	1	99	50
	Generator C4.84	1	102	100
Period 8 Horizontal Directional Drilling (HDD) – large work site (2 drill rigs operating simultaneously)	Dump truck C1.11	1	108	20
	Excavator C2.14	1	107	20
	Drilling Rig C2.14	2	105	100
	Cement truck discharging C4.18	1	103	20
	Generator C4.84	3	102	100
	Mud pump C2.45	1	88	100
	Concrete pump C4.29	1	108	20
	Drilling fluid recovery system C4.29	1	114	100

Period	Plant item and BS5228[1,2] reference	Number of items	Sound power level, Decibels (dB) (A)	Assumed on time (%)
Period 9 Pulling cables	Dump truck C1.11	1	108	20
	Excavator C2.14	1	107	50
	Conveyor roller C10.23	2	71	100
	Water pump C2.11	1	88	100
	Generator C4.84	1	102	100
	Conveyor drive unit C10.20	1	95	100
	Winch C10.20	1	110	100
Period 10 Jointing Bay Construction	Dump truck C1.11	2	108	20
	Excavator C2.14	3	107	20
	Bulldozer C2.12	1	109	100
	Cement truck discharging C4.18	1	103	20
	Lorry C2.34	1	108	100
	Water pump C2.11	1	88	100
	Concrete pump C4.29	1	108	30
Period 11 Open Trenching	Excavator C2.14	2	107	50
	Bulldozer C2.12	1	107	50

Period	Plant item and BS5228[1,2] reference	Number of items	Sound power level, Decibels (dB) (A)	Assumed on time (%)
	Wheeled loader C2.28	1	104	50
	Generator C4.84	1	102	100
	Dump truck C1.11	2	108	50
Period 12 Removal of haul road, reseeding	Excavator C2.14	1	107	50
	Dump truck C1.11	2	108	50
	Lorry C2.34	2	108	100
Period 13 Testing and commissioning, demobilisation of construction compounds.	Lorry C2.34	2	108	100
	Telescopic handler C2.35	1	99	50

3.1.1.11 In Period 8, the assumed size of the HDD drill pad, based on the approximate 10m separation distances between plant items, is 30m by 40m. In practice, the size of the drill pad will depend on the length of the HDD crossing being drilled, however, the pad size assumed is expected to represent a likely worst-case scenario.

3.1.1.12 It is expected that only one HDD rig will operate at any given work site. Period 8 considers two operational rigs with an on-time of 100%, plus associated ancillary plant, and may therefore be considered a worst-case scenario, with actual noise levels from HDD activities likely to be marginally lower. By far the highest source level of HDD plant is the drill fluid recovery system, therefore reducing the assumed number of HDD rigs operating will only have a marginal effect on the overall noise level arising from the drill pad. Embedded mitigation has been specified for HDD works.

3.1.2 Construction Phase Source Evaluation - Vibration

3.1.2.1 Ground conditions within the Onshore Substation Site are currently unknown, therefore it is possible that piling or breaking out of shallow rock may be required. Of these two scenarios, it is more likely that breaking out and removal of shallow rock would be required, based on geological information from nearby locations.

3.1.2.2 If removal of shallow rock is required, the most appropriate method will be selected once ground investigation has been undertaken. Weak material may be extracted using a toothed excavator bucket, while stronger material may require the use of a hydraulic breaker mounted on an excavator or blasting.

3.1.2.3 Vibration levels arising from use of a breaker or toothed bucket would attenuate rapidly with increasing distance from the vibration source, such that these would be negligible at the closest NSRs to the Onshore Substation Site.

3.1.2.4 Should blasting be required, this assessment assumes that an appropriately qualified blasting engineer would design the charges such that appropriate criteria are met, and that this would be a condition of the planning consent. No prediction of blasting vibration has therefore been undertaken.

3.1.2.5 Operation of drilling rigs and ancillary equipment at construction compounds along the ONEC is not expected to produce significant vibration impacts, provided an appropriate stand-off distance is maintained between work sites and NSRs.

3.1.2.6 Vibration levels decay very rapidly with distance from a source (BS 5228-2:2009+A1:2014[1,2]). A representative example of trenchless (HDD) technology given within BS 5228-2:2009+A1:2014 is for boring through silts overlying sandstone with a Peak Particle Velocity (PPV) of 8mm/s at 4.5m from the source, decreasing to a PPV of 2.7mm/s at 7m from the source and 1.8mm/s at 12m from the source.

3.1.2.7 Research carried out by Reilly C. et al (Vibrations due to horizontal directional drilling in Lucan Formation rock and Dublin Boulder Clay, Conference Paper, Civil Engineering Research in Ireland, 2020[5]) reported vibration levels of less than 1mm/s PPV at distances of 9m from drilling through Lucan Formation rock overlain by Dublin Boulder Clay.

3.1.2.8 Given the expected distances between sources of vibration during the construction works along the ONEC and the NSRs (an expected minimum of 10m) PPV levels would be below the criteria outlined in BS5228 (refer to Paragraph 1.3.1.8 within Volume 7E, Appendix 8-1: Summaries of Relevant Policy and Guidance) at the NSRs and would therefore be negligible.

3.2 Operational Prediction Method

3.2.1.1 Prediction has been undertaken within noise modelling software CadnaA in accordance with the method provided in ISO 9613: Attenuation of Sound During Propagation Outdoors, Part 1 and Part 2 (International Organization for Standardization [ISO], 1993[6]; ISO, 2024[7]). The assumptions and modelling methods adopted are provided below.

3.2.1.2 The parameters for operational noise sources are provided in Table 3-2. At this stage in the design process, warranted source levels are not available. In place of site-specific data, worst-case assumptions have been made regarding source levels based on historical data.

3.2.1.3 Sources within buildings are calculated based on worst-case sound power levels for internal plant and take into account the building dimensions. The predictions assume that buildings will be constructed from double thickness sheet profiled steel. Details of the buildings, including louvred openings and vents, will be clarified at detailed design stage. The adopted levels are rounded to the nearest integer dB.

Table 3-2 Modelled operational phase noise sources – Onshore Substation Site

Substation equipment	Modelling method	Number of items	Sound power level, dB(A)	Applied spectrum
Harmonic filter 275kV	Point source	3	80	HF400kVReverb
Harmonic filter 275kV	Building: area and vertical area sources	9	71	HF400kVReverb
Harmonic filter 400kV	Point source	9	80	HF400kVReverb
Harmonic filter 400kV	Building: area and vertical area sources	3	71	HF400kVReverb
Transformer coolers	Point source	4	80*	Fan
Shunt reactor	Building: area and vertical area sources	8	80	Shunt Reactor
Transformer	3D object: area and vertical area sources	4	85	Primary transformer
Transformer	Building: area and vertical area sources	2	72	Primary transformer
* indicates assumed attenuation				

3.2.1.4 Noise arising from the Onshore Substation Site has been predicted at NSRs and reported both as A-weighted broad-band levels for evaluation in accordance with BS4142 criteria[4] and as un-weighted octave band data for the evaluation against NR criteria.

3.2.1.5 All NSRs have been included within the model at a height of 4m above local topography, representative of a first-floor bedroom window.

3.2.1.6 Where internal noise levels are reported, these have been calculated by applying octave band specific attenuation representative of a partially open window, as shown in Table 3-3 as detailed in NANR116 (The Building Performance Centre, 2007[8]).

Table 3-3: Octave band attenuation provided by a partially open window

	Octave Bend Level, dB							
Frequency, Hz	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Attenuation by transmission via window with 200,000mm^2 opening	20	14	14	16	14	17	19	10*
*Note that no value is quoted for 8,000 Hz, therefore this assessment has adopted a value of 10 dB, equivalent to the lowest expected value for broad-band attenuation. The actual attenuation at 8,000 Hz is likely to be substantially greater.								

3.3 Cumulative Evaluation of Operational Phase Noise

3.3.1.1 As agreed with Aberdeenshire Council Environmental Health, the Proposed Development (Onshore) has been evaluated against the NR20 criterion within NSRs. The predicted octave band data has been evaluated at each NSR for the Proposed Development (Onshore) operating in isolation and operating cumulatively with existing and proposed developments within the study area.

3.3.1.2 The operational noise assessment includes consideration of the adjacent Green Volt, New Deer and Moray East substations. Potentially cumulative noise effects arising from other developments further from the Onshore Substation Site have been scoped out.

3.3.1.3 Cumulative developments have not been modelled in this assessment, instead, cumulative levels reported in the noise chapter of the Green Volt planning application and supporting Environmental Impact Assessment Report (EIAR) have been used to determine likely cumulative noise levels at NSRs. The process followed is described as follows:

- Spectral (octave band) predictions are provided in the Green Volt EIAR considering the proposed Green Volt substation and existing New Deer and Moray East substations;

- The Green Volt spectral predictions consider only one NSR; NSR3 Upper Mains of Asleid;
- A-weighted broad-band predicted levels are provided in the Green Volt EIAR for multiple NSRs in the study area;
- The predicted spectral data provided in the Green Volt EIAR is provided as A--weighted octave band levels (rather than unweighted) and evaluated against an A-weighted NR20 criterion curve;
- The reported A-weighted octave band data reported in the Green Volt EIAR has been converted to linear data by adding the A-weighting correction at each octave band;
- The spectral shape of the predicted cumulative noise from existing and proposed substations has been applied to reported A-weighted broad-band noise levels;
- The predicted octave band levels from the Proposed Development (Onshore) were logarithmically summed with the derived spectral data obtained from the Green Volt EIAR for each NSR to derive cumulative octave band data at NSRs; and
- The cumulative octave band internal noise level within NSRs has been derived by applying the octave band attenuation spectrum provided in Table 3-3.

3.4 Derivation of Evaluation Criteria

3.4.1 Construction Phase Evaluation Criteria

Construction Activities

3.4.1.1 Noise impacts arising from construction works have been evaluated using the criteria provided in BS5228[1,2]. BS5228[1,2] and the ABC method are outlined in Volume 7E, Appendix 8-1: Summaries of Relevant Policy and Guidance.

3.4.1.2 The location of construction compounds and the ONEC have yet to be determined, therefore undertaking baseline noise measurements along the approximately 37 kilometre length ONEC was not feasible. Instead, an appraisal of the baseline noise environment was undertaken by site visit and a review of maps and aerial imagery.

3.4.1.3 The noise environment was determined to be rural and quiet, with little anthropogenic noise, therefore the lowest (most stringent) Category A threshold values have been adopted as noise limits for the construction phase. The adopted noise limits are provided in Table 3-4.

Table 3-4: Adopted construction phase noise limits

Period	Time	Category A Noise limit, dB$L_{Aeq,T}$
Weekday daytime and Saturday mornings	07:00 – 19:00 weekdays 07:00 – 13:00 Saturdays	65
Evenings and weekends	19:00 – 23:00 weekdays 13:00 – 23:00 Saturdays 07:00 – 23:00 Sundays	55
Night-time	23:00 – 07:00 all days	45

3.4.1.4 Where predicted construction phase noise levels exceed the adopted noise limits at NSRs, this assessment considers that the resultant noise impacts will be significant.

3.4.1.5 Where predicted construction phase noise levels meet the adopted noise limits at NSRs, this assessment considers that the resultant noise impacts will be not significant.

Construction Phase Road Traffic

Construction Traffic Noise

3.4.1.6 Following the method provided in Design Manual for Roads and Bridges (DMRB), LA 111 Noise and vibration (DMRB, 2020[9]) an initial screening assessment was carried out to assess the potential for an increase in baseline noise level of 1 dB(A) or more as a result of the addition of construction traffic to existing traffic levels. Traffic flows associated with the operational phase will be negligible, therefore evaluation of road traffic noise impacts considers only the construction phase.

3.4.1.7 An increase of 25% to traffic flows may be expected to result in an increase of 1 dB(A) or greater, however, construction traffic will comprise predominantly Heavy Goods Vehicles (HGV) which are noisier than non-HGV traffic. This assessment has therefore adopted a lower (more stringent) screening criterion of 10% increase in total traffic flows.

3.4.1.8 Traffic flows on the roads (links) surrounding the Proposed Development (Onshore) were provided by the traffic consultants (Arup) as Annual Average Weekday Traffic (AAWT) for the following scenarios:

- Baseline traffic flow; and
- Baseline traffic flow plus construction traffic.

3.4.1.9 Any links with a predicted total increase in traffic volume of 10% or less were identified and screened out of further assessment, since the change in the Basic Noise Level (BNL) would be less than 1dB(A) and therefore negligible.

3.4.1.10 The next stage of the screening process comprised simple modelling of links where the projected increase in total traffic flow is greater than 10% but less than 25%, considering the links with the greatest percentage increase in HGV traffic. Predictions of the $L_{A10,18hour}$ noise index were carried out in accordance with the method provided in Calculation of Road Traffic Noise (Department of Transport- Welsh Office, 1988[10]). within noise prediction software CadnaA, using the projected traffic flows and HGV composition. Where modelling predictions indicated that the BNL of the link would increase by 1 dB(A) or less, these links have been screened out of further consideration.

3.4.1.11 Where the predictions indicated an increase in the BNL of greater than 1 dB(A), a more detailed assessment has been undertaken, considering the criteria provided in DMRB[9] and reproduced in Table 3-5. The thresholds for differentiating the criteria are taken from DMRB[9] for short-term impacts and are an indication of the relative change in ambient noise as a result of the Proposed Development (Onshore).

Table 3-5: Magnitude criteria for relative change due to road traffic (short term)

Change in Noise Level, $dBL_{A10,18hour}$	Impact Magnitude
Less than 1.0	Negligible
1.0 – 2.9	Low
3.0 – 4.9	Medium
5.0+	High

Construction Traffic Vibration

3.4.1.12 Paragraph 3.32 of DMRB LA 111[9] states that:

"PPVs [peak particle velocity] in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s. Normal use of a building such as closing doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to those from road traffic"

3.4.1.13 Consideration of construction traffic vibration has therefore been excluded from this assessment.

3.4.2 Operational Evaluation Criteria

3.4.2.1 The assessment of operational noise has been carried out for the Onshore Substation Site, as it is the only noise source associated with the operational phase.

3.4.2.2 Noise from fixed commercial or industrial plant is most commonly assessed using British Standard BS4142[4]. BS4142[4] describes a method of determining the level of sound of an industrial source and the existing representative background sound level. The assessment method uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

3.4.2.3 BS4142[4] incorporates a requirement for the assessment of uncertainty in environmental sound measurements and introduces the concepts of "significant adverse impact" rather than likelihood of complaints (which was the focus of previous versions of the standard). Common principles with the previous editions are consideration of sound characteristics, time of day and frequency of occurrence.

3.4.2.4 As summarised in Volume 7E, Appendix 8-1: Summaries of Relevant Policy and Guidance, BS4142[4] determines the impact associated with the commercial/industrial noise source being assessed by the degree to which the rating level from the source exceeds the representative background level. The context in which the noise occurs/will occur is also required by the standard.

3.4.2.5 Where the prevailing background level is low, BS4142[4] provides that absolute (fixed) criteria may be more relevant than the noise level of the source relative to the background. Through discussions with Aberdeenshire Council Environmental Health (refer to Volume 7E, Appendix 8-2: Summary of Noise Consultation) it has been agreed that the primary evaluation criteria for the operational phase will be compliance both individually and cumulatively with NR criterion NR20. The criterion will apply within residential properties (NSRs) surrounding the Onshore Substation Site, assuming propagation via a partially open window. In addition, with reference to paragraph 1.3.2.7 within Volume 7E, Appendix 8-1: Summaries of Relevant Policy and Guidance, this assessment adopts a rating level limit of 35dB where representative background levels are objectively low (≤30dBL_{A90}).

3.4.2.6 This assessment has therefore determined the significance of effect by evaluation against the NR20 criterion and a rating level limit of 35dB. Where predicted standalone and cumulative noise levels meet NR20 and the rating level meets 35dB, noise effects will be not significant. Where predicted standalone and cumulative noise levels exceed NR20 and/or the rating level exceeds 35dB, noise effects will be significant.

3.4.2.7 With regard to the acoustic feature corrections provided in BS4142[4], this assessment notes the following:

- There are no items of fixed electrical plant with impulsive characteristics under typical operating conditions. Switchgear can have impulsive characteristics, however, this would only occur during abnormal operation of the grid, comprising a small number of events per year. No impulsivity correction has therefore been applied;
- The Onshore Substation Site will typically operate continuously for the full 24 hours each day, with no expected stops/starts to the fixed electrical plant, therefore, no intermittency penalty correction is expected to be applicable. While fans on individual items of plant are likely to stop and start according to cooling requirements, these are not expected to have an audible characteristic at NSRs due to masking from continuous plant noise and from the residual noise environment. No intermittency correction has therefore been applied;
- Whilst it is known that the sound emissions (i.e. sound level emitted at source) from transformers typically contain a significant proportion of their acoustic energy at 100 Hz and harmonics, this tonal characteristic may also be masked by other noise from the substation (e.g. cooling equipment). This will be understood in more detail at the detailed design stage post-consent, at which stage mitigation will be applied where possible. Should these items be enclosed, the building will be specified such that any such tones are attenuated across the building envelope. A precautionary +2 dB correction for tonality which is 'just audible' at NSRs has therefore been applied to the specific level to derive the rating level; and
- The noise environment at NSRs within the study area will include, to a varying extent, noise from existing electrical infrastructure. No correction has therefore been applied within the assessment for noise with a character which is otherwise readily discernible against the residual noise environment.

4 References

[1] BSI (2014a) 'BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'. BSI. London

[2] BSI (2014b) 'BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'. BSI. London

[3] BSI (2019b) 'BS8233:2014 Guidance on sound insulation and noise reduction for buildings'. BSI. London

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