Technical Appendix 10.1: Construction Noise Report

This page is intentionally blank.

Quality Assurance

TNEI Services Ltd and TNEI Africa (PTY) Ltd operate an Integrated Management System and is registered with The British Assessment Bureau as being compliant with ISO 9001(Quality), ISO 14001 (Environmental) and ISO 45001 (Health and Safety).

Disclaimer

This document is issued for the sole use of the Customer as detailed on the front page of this document to whom the document is addressed and who entered into a written agreement with TNEI. All other use of this document is strictly prohibited and no other person or entity is permitted to use this report unless it has otherwise been agreed in writing by TNEI. This document must be read in its entirety and statements made within may be based on assumptions or the best information available at the time of producing the document and these may be subject to material change with either actual amounts differing substantially from those used in this document or other assumptions changing significantly. TNEI hereby expressly disclaims any and all liability for the consequences of any such changes. TNEI also accept no liability or responsibility for the consequences of this document being relied upon or being used for anything other than the specific purpose for which it is intended, or containing any error or omission which is due to an error or omission in data used in the document that has been provided by a third party.

Any information provided by third parties that is included in this report has not been independently verified by TNEI and as such TNEI accept no responsibility for its accuracy and completeness. The Customer should take appropriate steps to verify this information before placing any reliance on it.

Executive Summary

TNEI Services Limited (TNEI) was commissioned by Appin Wind Farm Limited. ('the Applicant') to undertake predictions of noise levels associated with the construction of the proposed Appin Wind Farm (hereafter referred to as the 'Proposed Development'). The noise predictions were used to assess the potential impact of noise attributable to the construction of the Proposed Development on the occupiers of nearby noise sensitive receptors.

The noise impact assessment was undertaken using guidance contained in BS 5228: Part 1 2009+A1:2014 *'Noise and vibration control on construction and open sites- Noise'* and the calculation methodology in ISO 9613:2024 *'Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors'*, together with noise data for appropriate construction plant.

Nine residential receptors neighbouring the Proposed Development were identified as the nearest properties located to the proposed construction activities on the Site. Predictions have been made assuming that all items of plant are operating continually throughout the assessment period to provide a worst-case scenario. In addition, the noise model assumes that noise sources would be located within the most likely activity areas closest to the receptors, whereas in reality plant would move around the Site and only a proportion of the plant may be operating at any one time. As such, the predictions are inherently likely to over-predict the actual sound levels that are likely to be experienced.

The results show for all Construction Noise Assessment Locations (CNALs) the predicted noise levels for all scenarios are below the weekday and Saturday daytime threshold value of 65 dBA. However, at CNAL5 and CNAL6 noise levels will be equal to, or above, the evening and weekend 55 dBA threshold levels in Scenario 2. Whilst this is unlikely to result in a significant impact, as duration of exposure will be limited, construction activities relating to access track construction will not be undertaken in proximity to these properties outwith normal daytime working hours (Mon-Fri 07:00 – 19:00 and Saturday 07:00 – 13:00)[1]. Accordingly, the assessment concludes that there would be no significant construction noise impacts.

[1] Note that under the Standard Onshore Wind Farm Conditions working on Saturday is permitted up to 16.00 when not in proximity to properties

Contents

TABLES

ANNEXES

1 Introduction

1.1 Brief

1.1.1 TNEI Services Ltd was commissioned by LUC on behalf of Appin Wind Farm Limited ('the Applicant') to undertake a construction noise assessment for the proposed Appin Wind Farm (hereinafter referred to as 'the Proposed Development'). The following steps summarise the noise assessment process:

- Establish typical ambient noise levels at sensitive receptors located closest to the anticipated construction activities, and derive appropriate noise threshold levels in accordance with BS5228-1:2009 +A1:2014 (1);
- Undertake predictions of activity noise from different construction phases that would be incident at the nearest sensitive receptors;
- Compare the predicted noise levels with the derived threshold values; and
- Identify any requirements for mitigation measures, if needed.

1.2 Nomenclature

1.2.1 The following terms and definitions are used throughout this report;

- **Emission** refers to the sound level emitted from a sound source, expressed as either a sound power level or a sound pressure level;
- **Immission** refers to the sound pressure level received at a specific location from a noise source(s);
- **SWL** indicates the sound power level in decibels (dB);
- **SPL** indicates the sound pressure level in decibels (dB);
- **NSR** (Noise Sensitive Receptor) are identified receptors that are sensitive to noise;
- **NML** (Noise Monitoring Location) refers to any location where baseline or specific noise levels have been measured; and
- **CNAL** (Construction Noise Assessment Location) refers to any location where the noise immission levels are calculated and assessed.

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

1.3 Site Description

1.3.1 The site is located approximately 6.2 km north of Moniaive and 14.8 km east of Carsphairn within Dumfries and Galloway. The approximate OS Grid Reference for the centre of the Site is 272887, 597709 and the proposed layout is shown on Figure A1.1 (Annex 1).

1.3.2 The Site would be accessed through an improved entrance access from the C35s public road. Construction noise impacts from vehicles and plant improving and using the existing access track is considered in this assessment, alongside anticipated construction activities occurring across the Site, the extent of which is denoted by the Site Boundary on Figure A1.1.

1.3.3 Construction of the Proposed Development would require felling, upgrading of the existing access track and the laying of new tracks across the Site, establishing two construction compounds, the opening up of three borrow pits, excavation of turbine foundations, concrete batching, construction of turbine bases, installation of turbines, and the construction and installation of a substation and other infrastructure. EIA Report **Chapter 4**: Description of Proposed Development can be referred to for a detailed description of the Proposed Development and the construction requirements.

1.3.4 Construction is anticipated to last for 18 months. An indicative construction timetable is shown as Table 1.1. Activities denoted with blue cells have been included in the noise assessment. Activities denoted with grey cells have not been considered within the assessment, as they are not expected to generate high levels of noise.

Table 1.1: Indicative Construction Timetable

Task	Month																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Mobilisation & compounds																		
Access & Site Tracks																		
Crane Hardstanding																		
Turbine Foundations																		
On-site Cabling																		
Substation civils work																		
Substation construction																		
Turbine Delivery																		
Turbine Erection																		
Commissioning and Testing																		
Site Reinstatement																		

1.3.5 TNEI has undertaken noise propagation modelling for months 1, 2, 3, 4, 5-7, 8-9, 10, 11-12, and 13, on the assumption that activities undertaken during these periods would generate the highest noise levels. Although no construction activities are expected to occur during the

night-time, an additional night-time scenario has also been modelled to consider any potential noise from the operation of generators and other plant that may be required to be left on over-night.

2 Noise Planning Policy and Guidance

2.1 Overview of Noise Planning Policy and Guidance

2.1.1 In assessing the potential noise impacts from the construction of the Proposed Development, the following guidance and policy documents have been considered:

- Planning and Advice Note (PAN) 1/2011 'Planning and Noise' (2);
- Technical Advice Note (TAN) 'Assessment of Noise' (3); and
- BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Noise'.

2.2 National Legislation and Planning Policy

2.2.1 The overarching UK legislation in respect of construction noise is the Control of Pollution Act 1974 (COPA74) (4), which is used to control the noise impacts of construction works. Specifically, Section 60 allows the Council to impose restrictions on construction works, including specifying the plant allowed to be used, hours of activity or the setting of noise levels that may be emitted from a site.

2.2.2 At national level the relevant policy documents are Planning Advice Note (PAN) 1/2011 – *'Planning and Noise*,' and the associated *Technical Advice Note (TAN) – 'Assessment of Noise'*.

2.2.3 PAN 1/2011 provides little guidance in respect of construction noise, other than recommending that the use of planning conditions is not the preferred method for controlling temporary construction noise. Specifically, the document states:

'32. While planning conditions can be used to limit noise from temporary construction sites, it is most effectively controlled through the Control of Pollution Act 1974 (COPA74) and the Pollution and Prevention Control Act 1999 for relevant installations. Notice can be served in advance of works and site conditions set to control activities.'

2.2.4 BS 5228:1997 'Noise and vibration control on construction and open sites. Code of practice for basic information and procedures for noise and vibration control' parts 1 to 5 (5) (BSI, 1997) is the approved Code of Practice under COPA74 (4), however, it is the 2009 version of the Standard which should be used for Environmental Impact Assessments (EIA) and planning applications. In this regards the TAN states:

'However, under Environmental Impact Assessments and for planning purposes i.e. not in regard to the Control of Pollution Act 1974, the 2009 version of BS 5228 is applicable. The 2009 version of the standard consists of Parts 1 and 2 for noise and vibration respectively.'

2.3 Relevant Guidance

2.3.1 The BS 5228:2009 standard provides useful guidance on practical noise control. Part 1 provides recommendations for basic methods of noise control including sections on community relations, training, occupational noise effects, neighbourhood nuisance and project supervision. The annexes provide information on noise sources, noise calculation procedures, mitigation measures and their effectiveness.

2.3.2 Part 1 also contains sound power level data for a variety of construction plant. This data was obtained from field measurements of actual plant operating on construction and open sites in the United Kingdom and is therefore appropriate to use as source level data for construction noise predictions.

2.3.3 The 2009 version of BS 5228 was subject to an additional update in 2014. Accordingly, the construction noise assessment in this chapter has been undertaken in accordance with BS 5228 1:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites. Noise'*, (BSI, 2009), hereinafter referred to as BS 5228.

3 Potential Impacts

3.1 Construction Noise Sources

3.1.1 Noise levels from construction activities would vary continually over time, as activities and plant start and stop and move around the Site. To assess the potential impacts of construction noise a worst-case scenario is considered where all construction plant and activities are assumed to be working continually and in activity locations closest to the nearest NSRs.

3.2 Construction Phases

3.2.1 Although an indicative timetable has been provided, a specific construction schedule has not been determined at this stage. **Chapter 4: Description of the Proposed Development** does, however, provide descriptions of some of the likely construction activities that would be undertaken and the type of plant that would be used.

3.2.2 It is also noted that construction activities are likely to be limited to between 07:00 and 19:00 on weekdays and 07:00 – 16:00 on Saturdays. No working would be undertaken on Sundays or Public Holidays without prior agreement with Dumfries and Galloway Council (DGC).

3.2.3 For safety reasons, exceptions to the proposed working hours may be required for some activities, for example abnormal load deliveries, concrete deliveries during foundation pours, the lifting of the turbine components and emergency works.

3.2.4 Similarly, concrete pouring for an individual turbine foundation must take place continuously and so the activity will only cease when the pour has been completed. Additionally, turbine erection can only occur during periods of low wind speeds and therefore lifting operations may need to be scheduled outwith the above hours. Accordingly, the assessment considers noise levels that could occur during evenings and weekends, as well as normal weekday daytimes.

3.2.5 A series of construction scenarios have been modelled, which consider the variation in noise levels that would occur throughout the construction period. The scenarios are based on the combination of construction tasks detailed in the indicative timetable (Table 1.1 of this report), Chapter 4: Description of Proposed Development, and TNEI's knowledge and experience of similar sites and construction schedules.

3.2.6 The assessment does not consider the noise impacts associated with decommissioning, as the plant and activities used for that phase are assumed to be similar in nature (and noise output) to those already considered in the modelled construction scenarios. Accordingly, if noise levels during the construction phases are acceptable, they should also be acceptable during decommissioning.

4 Methodology

4.1 Methodology for the Prediction of Noise

4.1.1 To predict the noise immission levels attributable to the construction of the Proposed Development, noise propagation models are produced using the propriety noise modelling software CadnaA. Within the software, complex models can be used to simulate the propagation of noise according to a range of international calculation standards.

4.1.2 Noise immission levels (dB $L_{Aeq(t)}$) have been predicted in accordance within ISO 9613:2024 *'Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors'*. (6)

4.1.3 The ISO 9613 propagation model was chosen in preference to the calculation method presented in BS 5228, primarily because of some of the significant distances from source to receptor evident on this site. Specifically, BS 5228 notes in F 2.2.2.2, that at distances over 300 m noise predictions using the BS 5228 methodology should be treated with caution, especially where a soft ground correction factor has been applied because of the increasing importance of meteorological effects; whereas ISO 9613-2 provides equations that have been validated up to 1,000 m.

4.1.4 The ISO 9613 model can take account of the following factors that influence sound propagation outdoors:

- geometric divergence;
- air absorption;
- reflecting obstacles;
- screening;
- vegetation; and
- ground reflections.

4.1.5 The model uses the octave band sound power output of the proposed plant as its acoustic input data, and calculates on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects.

4.1.6 For the purposes of this assessment, all noise level predictions have been undertaken using a receiver height of 1.5 m above local ground level. Soft ground (G=1) attenuation has been assumed at all locations except for water bodies, construction compounds, turbine bases and similar areas of hardstanding, which have been modelled with a ground attenuation of G=0 (hard ground). Air absorption based on a temperature of 10°C and 70 % relative humidity has been assumed.

4.2 Limitations of the Noise Model

4.2.1 The noise propagation models are intended to give a good approximation of the specific noise level and the contribution of each individual source. However, it is expected that actual levels are unlikely to be matched exactly with modelled values and the following limitations in the model should be considered:

- In accordance with ISO 9613-2, all assessment locations are modelled as downwind of all noise sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night;
- The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for;
- Unless specifically stated, the models assume all noise sources are operating continuously and simultaneously, estimating a worst-case source noise level; and
- All mobile plant assumed to be working on tracks (excavators, dozers, rollers etc) have been modelled as moving point sources along their anticipated movement paths and the sound power level of the source is effectively averaged out across the length of the entire line. This will give an approximation of the overall noise levels from mobile plant at receptor locations; however, in reality noise levels would fluctuate as construction plant and activities move around in their activity areas.

4.3 Assessing Construction Noise Effects

4.3.1 Annex E, part E.3.2 of BS 5228 provides methods for assessing the significance of construction noise effects and Table E.1 of BS 5228 (represented here as Table 4.1) contains an example of significance criteria that can be used to assess construction activities.

Table 4.1: Example of Threshold of Potential Significant Effect at Dwellings ($dB_{(A)}$)

Assessment Category and Threshold Value Period	Threshold Value $L_{Aeq,T}$ dB		
	Category $A_{(A)}$	Category $B_{(B)}$	Category $C_{(C)}$
Night-Time (23:00 – 07:00)	45	50	55
Evenings[(D)] (19:00 – 23:00 weekdays) and Weekends (13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)	65	70	75

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

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

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

(D) 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays.

4.3.2 The values detailed in Table 4.1 can be considered thresholds for the construction noise levels (quantified using the L_{Aeq} noise metric). The threshold level in each category is to be used where the existing noise level at each location, rounded to the nearest 5 dB, is below the level given for a particular time of day. BS5228 provides the following advice regarding the threshold levels:

"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: Applied to residential receptors only."

4.3.3 Therefore, the assessment of construction noise reflects a specific noise threshold for the locality (set relative to the existing ambient noise levels) for a particular period of the day, rather than an absolute noise level.

4.3.4 It should be noted that exceedance of the limit does not in itself indicate a significant effect, rather, the standard states *"If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect".*

4.4 Study Area

4.4.1 Noise Sensitive Receptors (NSRs) are properties, people or fauna that are sensitive to noise and, therefore, may require protection from nearby noise sources. The Study Area for the noise assessment has been defined through the identification of the closest NSRs to the Proposed Development and a representative set of Construction Noise Assessment Locations (CNALs) have been identified to represent the closest residential receptor or group of receptors.

4.4.2 The CNALs are defined using the closest NSRs to the Proposed Development on the assumption that if noise levels are within acceptable levels at the closest receptors, then it is reasonable to assume they will also be acceptable at more distant locations.

4.4.3 Table 4.2 details the CNALs considered within the assessment, which are also shown in Figure A1.1 in Annex A.

Table 4.2: Construction Noise Assessment Locations

NSR Name	CNAL	Coordinates	
	ID	Eastings	Northings
Shinnelhead	CNAL1	272939	599143
High Appin	CNAL2	274653	597276
Benbuie	CNAL3	271050	596140
Blairoch	CNAL4	270713	596545
Meikle Auchrae	CNAL5	264610	594564

NSR Name	CNAL	Coordinates	
	ID	Eastings	Northings
Strathanna Farm	CNAL6	264554	595860
Auchrae	CNAL7	265168	596543
Crigengillan	CNAL8	263693	594821
Cairnhead (Bothy)	CNAL9	270144	597209

4.5 Baseline Noise Levels

4.5.1 Baseline noise level monitoring was undertaken as part of the operational noise assessment undertaken for the Proposed Development.

4.5.2 At all locations the ambient sound levels were below the Category A Threshold Values, as detailed in Table 4.1

4.6 Construction Noise Level Thresholds

4.6.1 Having due regard to the existing ambient noise levels at NSRs around the Proposed Development, the BS5228 Category A Threshold Values have been considered for the construction noise assessment for all time periods.

4.6.2 Accordingly, the assessment is made against the following noise level limits for all CNALs;

- Daytime weekdays 07:00 – 19:00: 65 dB $L_{Aeq\ (12\ hours)}$
- Saturday (morning) 07:00 – 13:00: 65 dB $L_{Aeq\ (6\ hours)}$
- Evenings (weekdays) 19:00 – 23:00: 55 dB $L_{Aeq\ (4\ hours)}$
- Saturday 13:00 – 23:00: 55 dB $L_{Aeq\ (10\ hours)}$
- Sundays 07:00 – 23:00: 55 dB $L_{Aeq\ (16\ hours)}$
- Night time 23:00 – 07:00: 45 dB $L_{Aeq\ (8\ hours)}$

5 Noise Impact Assessment

5.1 Modelling of Individual Sound Sources

5.1.1 Noise immission levels associated with individual noise sources would vary throughout the construction period, as construction activities, plant and locations vary. For much of the working day the noise associated with construction activities would be less than predicted, as the assessment assumes all equipment is continually operating at full power and in activity locations closest to the NSRs, whereas in practice, equipment load and precise location will vary. This approach has been adopted to represent a worst-case assessment.

5.1.2 At this stage a detailed plant list is not available, therefore, a generic plant list based upon experience of similar projects has been used. All modelled noise sources and associated sound power level (SWL) and sound pressure level (SPL) data is included in Annex B: Noise Model Data.

5.1.3 For felling activities broadband noise level data for a harvester, a forwarder and a skidder has been taken from *Noise Hazards in Forestry Operations and Selection of Personal Protective Equipment* (7) (Forestry Commission). No octave band data is available therefore modelling has been undertaken using the 500 Hz octave band data, as recommended in ISO 9613. Noise levels for the Harvester and Forwarder are actually given at the operator position inside a Q Cab, so to estimate external levels, 10 dB has been added to the quoted level and a sound power level for each item of plant calculated within CadnaA, assuming the quoted sound pressure levels (SPLs) have been measured at a distance of 1 m.

5.1.4 For all other construction activities, source noise level data is taken from Annex C of BS 5228, which provides octave band SPL levels for a wide variety of construction plant and activities.

5.1.5 Construction noise sources for any given activity will generally comprise a mix of both moving and static sources. Mobile sources include mobile construction plant and Heavy Goods Vehicles (HGVs), while static construction plant could include generators, lighting rigs and pumps.

5.1.6 For both mobile and static plant, activity noise levels would be transient in nature due to changes in location, on/off periods, and fluctuations of load on any individual machine.

5.1.7 All static items of plant and activities have been modelled as single point sources. All mobile plant (excavators, dozers, dumpers etc.) have been modelled as either a moving point source (line source) along their anticipated movement paths or as a stationary point source located at the closest point of its anticipated work area to any given CNAL.

5.2 Modelling of Construction Activities.

5.2.1 Noise propagation modelling has been undertaken considering the key activities that are likely to occur throughout the construction period. Details of the items of plant assumed to be operating in each modelled scenario, as well as noise data for each modelled noise source, are included in Annex B: Noise Model Data.

5.2.2 The modelled scenarios are detailed in Table 5.1.

Table 5.1: Summary of Construction Activities

Scenario	Description of Modelled Activities
Scenario 1 (Month 1)	Construction compound activity, including the use of generators for power and unloading and loading of materials.
	Felling is being undertaken within the borrow pit area 1, along the new access track proximate to Meikle Auchrae, along the new access track within the Auchrae and Manquhill Management Fell area, at the location of T4, at the location of T7, the eastern borrow pit area, and proximate to the construction compounds.
Scenario 2 (Month 2)	Compound activity modelled as per Scenario 1.
	Operation of the borrow pit 1 for extraction of aggregate is underway. Concrete batching is also occurring at this location.
	Upgrades/ construction of the primary access track. The new track proximate to Meikle Auchrae is also under construction.
	Widening of the junction leading to the main access track, proximate to Strahanna Farm.
	Substation civils works begins.
Scenario 3 (Month 3)	Compound activity modelled as per Scenario 1.
	Operation of borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring at the easternmost borrow pit.
	Upgrade and construction of the access track leading to T1.
	Construction of the crane hardstands at T1 – T3.
	Substation civils works is underway.
Scenario 4 (Month 4)	Compound activity modelled as per Scenario 1.
	Operation of borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring at the easternmost borrow pit.
	Upgrade and construction of the access track leading to substation and construction compounds.
	Construction of the crane hardstands at T4.
	Substation civils works is underway.
	Pouring of turbine foundations at T1 – T3.
	Substation construction is occurring
Scenario 5 (Month 5 – 7)	Compound activity modelled as per Scenario 1.
	Operation borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring at the easternmost borrow pit.

Scenario	Description of Modelled Activities
	Upgrade and construction of the access track leading from the substation to T5 and T9.
	Construction of the crane hardstands at T5 – T8.
	Pouring of turbine foundations at T4.
	Substation construction is occurring
Scenario 6 (Month 8 – 9)	Compound activity modelled as per Scenario 1.
	Operation of borrow pits 2 and 3 for extraction of aggregate is underway. Concrete batching is also occurring at the easternmost borrow pit.
	Construction of the crane hardstands at T9.
	Pouring of turbine foundations at T5 – T8.
	Substation construction is occurring
	There are turbine deliveries along the main access track.
Scenario 7 (Month 10)	Compound activity modelled as per Scenario 1.
	Operation of borrow pits 2 and 3 pits for extraction of aggregate is underway. Concrete batching is also occurring at the easternmost borrow pit.
	Pouring of turbine foundations at T9.
	Substation construction is occurring
	There are turbine deliveries along the main access track.
Scenario 8 (Month 11 – 12)	Compound activity modelled as per Scenario 1.
	Substation construction is occurring
	There are turbine deliveries along the main access track.
Scenario 9 (Month 13)	Compound activity modelled as per Scenario 1.
	Substation construction is occurring
	There are turbine deliveries along the main access track.
	Turbine erection at T1 and T6 – T8.
Scenario 10 (Night time)	Generators for the welfare facilities and lighting within one of the construction compounds.

5.3 Calculated Noise Immission Levels.

5.3.1 Table 5.2 presents the calculated noise immission levels at each CNAL for all modelled scenarios.

Table 5.2: Predicted Construction Noise Immission Levels, dB $L_{Aeq(t)}$

CNAL	Scenarios									
	S1, Month 1	S2, Month 2	S3, Month 3	S4, Month 4	S5, Month 5 – 7	S6, Month 8 - 9	S7, Month 10	S8, Month 11 – 12	S9, Month 13	S10, Night
CNAL1 - Shinnelhead	27	25	35	35	36	36	34	27	34	15
CNAL2 - High Appin	32	33	41	42	41	41	41	34	37	24
CNAL3 - Benbuie	20	20	38	38	38	38	38	22	33	nil
CNAL4 - Blairoch	21	22	42	42	43	43	42	24	33	nil
CNAL5 - Meikle Auchrae	49	62	nil	nil	nil	nil	37	37	37	nil
CNAL6 - Strathanna Farm	37	55	nil	nil	nil	nil	32	32	32	nil
CNAL7 - Auchrae	34	47	nil	nil	nil	nil	24	24	24	nil
CNAL8 - Crigengillan	31	41	nil	nil	nil	nil	25	25	25	nil
CNAL9 - Cairnhead (Bothy)	24	28	33	34	36	35	35	29	35	11

5.3.2 For all CNALs the predicted noise levels for all scenarios are below the weekday and Saturday daytime threshold value of 65 dBA.

5.3.3 At CNAL5 and CNAL6 noise levels have been calculated to be equal to, or above, the evening and weekend 55 dBA threshold levels in during month 2, however, this is unlikely to result in a significant impact, as duration of exposure will be limited. Nonetheless, construction activities relating to access track construction will not be undertaken in proximity to these

properties outwith normal daytime working hours (Mon-Fri 07:00 – 19:00 and Saturday 07:00 – 13:00).[2]

5.3.4 No construction activities are proposed during the night-time, however, a night-time scenario (Scenario 10) is included in the assessment in case of generator usage at night. The predicted noise levels for this scenario are comfortably below the night-time 45 dB(A) threshold level.

[2] Note that under the Standard Onshore Wind Farm Conditions working on Saturday is permitted up to 16.00 when not in proximity to properties

6 Noise Mitigation Measures

6.1.1 No significant effects resulting from construction noise are predicted. Nevertheless, good practice during construction is recommended and will be presented in an Outline Construction Environmental Management Plan (CEMP) (Technical Appendix 4.1) to minimise any potential noise impacts.

6.1.2 The core hours for the proposed works will be normal construction hours 07:00 to 19:00 Monday to Friday and 07:00 to 16:00 Saturday. There will be no working on Sundays and Public Holidays, however, it should be noted that out of necessity some activity outside of the core hours could arise, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair weather windows for concrete deliveries, the erection of turbine blades and the erection and dismantling of cranes. If occasional work is undertaken outside of core hours, especially during construction of access tracks at the site entrance, this should be agreed in advance with DGC.

6.1.3 Where possible, working during the evening and weekends should be avoided on the site access track close to CNAL 5 and 6.

6.1.4 Good site practices for construction of the Proposed Development will be implemented. Section 8 of BS5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that can be employed onsite:

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- Ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid peak traffic times;
- Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use;
- Ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Instruct that machines would be shut down between work periods or throttled down to a minimum;
- Regularly maintain all equipment used on site, including maintenance related to noise emissions;
- Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and
- Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.

7 Summary

7.1.1 The noise impact assessment has considered the existing noise environment at local residential receptors in order to determine appropriate noise threshold levels for construction activities.

7.1.2 Noise propagation modelling has been undertaken in accordance with ISO 9613-2:2024 and the anticipated noise immission levels presented for scenarios likely to occur throughout the construction period of the Proposed Development. The modelled scenarios consider the 'noisiest' activities that are likely to occur during the construction period and the modelling assumes that the construction activities are occurring at locations within the Site that are closest to the NSRs.

7.1.3 The predicted levels are below the Category A Daytime, and Evening and Weekend Threshold Levels, as detailed within BS 5228:2009, for all receptors except CNAL5 and CNAL6, where predicted levels are greater than, or equal to, the Evening and Weekend threshold during month 2. Whilst this is unlikely to result in a significant impact, as duration of exposure will be limited, construction activities relating to access track construction will not be undertaken in proximity to these properties outwith normal daytime working hours (Mon-Fri 07:00 – 19:00 and Saturday 07:00 – 13:00)[3].

7.1.4 Accordingly, construction noise impacts are below the indicator for a potential significant effect, nevertheless, good practice during construction is recommended following guidance in BS 5228.

7.1.5 The assessment concludes that construction noise levels would remain below the indicator for a potential significant effect.

[3] Note that under the Standard Onshore Wind Farm Conditions working on Saturday is permitted up to 16.00 when not in proximity to properties

8 References

1. **British Standards Institute.** *Code of practice for noise and vibration control on construction and open sites. Noise.* UK : BSI, 2014. BS 5228-1:2009+A1:2014 .

2. **The Scottish Government.** *PAN 1/2011 Planning and Noise.* Scotland : The Crown, 2011.

3. —. *Technical Advice Note (TAN) 'Assessment of Noise'.* Scotland : The Crown, 2011.

4. **HM Government.** *Control of Pollution Act 1974 Chapter 40.* London : Her Majesty's Staionery Office, 1974.

5. **Institute, British Standards.** BS 5228:1997 'Noise and vibration control on construction and open sites. Code of practice for basic information and procedures for noise and vibration control' parts 1 to 5. *1997.*

6. **(ISO), International Organisation for Standardisation.** *Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors.* Geneva : ISO, 2024. ISO 9613-2:2024.

7. **Forestry Commission.** *Noise Hazards in Forestry Operations and Selection of Personal Protective Equipment.* Edinburgh : The Crown, 2003.

Annex A – Figure

N

CNAL1 - Shinnelhead
CNAL2 - High Appin
CNAL3 - Benbuie
CNAL4 - Blairoch
CNAL5 - Meikle Auchrae
CNAL6 - Strathanna Farm
CNAL7 - Auchrae
CNAL8 - Crigengillan
CNAL9 - Cairnhead (Bothy)

T1
T2
T3
T4
T5
T6
T7
T8
T9

Colt Hill
Lamgarroch
Blackcraig Hill
Conrick Hill
Mullwhanny
Green Hill or Bail Hill
Patie's Cleuch
Conrick Burn
Gold Cleuch

Kilometre
0 0.5 1

LEGEND

- Construction Noise Assessment Locations (CNALs)
- Red Line Boundary
- Proposed Turbines
- Temporary Hardstanding Area
- Permanent Hardstand for Main Crane
- Turbine Bases
- Borrow Pits
- Substation
- Temporary Construction Compound
- Upgraded Track
- New Track
- Extent of Earthworks
- Temporary felling
- Permanent Felling
- Auchrae and Manquhill Management Fell

Rev.	Date	Amendment Details	Drawn	Approved
0	01/04/2025	FOR PLANNING	EH	AD

tnei

Client: Statkraft

Drawing Status: FOR PLANNING

Project Title: APPIN WIND FARM

Drawing Title: FIGURE A1.1: CONSTRUCTION NOISE STUDY AREA

Scale:	Original Size:	Spatial Reference:
1:37,500	A3	British National Grid

Drawing Number: 14711-013

Annex B – Noise Model Data

Modelled Construction Noise Scenarios – Noise Sources

Noise Source Activity	Assumed Working Location	Plant (BS 5228 Reference)	Data Source
Scenario 1 (Month 1)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Felling	Within the western borrow pit area, along the new access track proximate to Meikle Auchrae, along the new access track within the Auchrae and Manquhill Management Fell area, at the location of T4, at the location of T7, the eastern borrow pit area, and proximate to the construction compounds (point source, 7 of)	Harvester Forwarder Skidder	Noise Hazards in Forestry Operations and Selection of Personal Protective Equipment
Scenario 2 (Month 2)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Operation of the borrow pit	Westernmost borrow pit (point source, 1 of)	Excavator mounted rock breaker (C9.12) Tracked semi-mobile crusher (C9.15) Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14)	BS 5228-1:2009+A1:2014
Concrete Batching	Westernmost borrow pit (point source, 1 of)	Water pump (diesel) (C4.88) Concrete mixer truck (C4.20)	BS 5228-1:2009+A1:2014
Upgrades to the site access tracks	Main access track to the site (line source, 1 of), widening of the main site access junction on Lorg Road (point source, 1 of), and construction of the new track proximate to Meikle Auchrae (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Construction of substation foundations	Proposed substation (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014

Scenario 3 (Month 3)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Operation of the borrow pit	Two main borrow pits (point source, 2 of)	Excavator mounted rock breaker (C9.12) Tracked semi-mobile crusher (C9.15) Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14)	BS 5228-1:2009+A1:2014
Concrete Batching	Easternmost borrow pit (point source, 1 of)	Water pump (diesel) (C4.88) Concrete mixer truck (C4.20)	BS 5228-1:2009+A1:2014
Upgrades to the site access tracks	Access track to the substation (line source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Construction of substation foundations	Proposed substation (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014
Construction of turbine hardstands	Hardstands at T1 – T3 (point source, 3 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Scenario 4 (Month 4)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Operation of the borrow pit	Two main borrow pits (point source, 2 of)	Excavator mounted rock breaker (C9.12) Tracked semi-mobile crusher (C9.15) Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14)	BS 5228-1:2009+A1:2014
Concrete Batching	Easternmost borrow pit (point source, 1 of)	Water pump (diesel) (C4.88) Concrete mixer truck (C4.20)	BS 5228-1:2009+A1:2014

Upgrades to the site access tracks	Access track to the substation (line source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Construction of substation foundations	Proposed substation (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014
Construction of turbine hardstands	Hardstands at T4 (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Construction of Turbine Foundations	Turbine foundations T1 – T3 (point source, 3 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014
Construction of substation	Proposed substation (point source, 1 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014
Scenario 5 (Month 5 - 7)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Operation of the borrow pit	Two main borrow pits (point source, 2 of)	Excavator mounted rock breaker (C9.12) Tracked semi-mobile crusher (C9.15) Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14)	BS 5228-1:2009+A1:2014
Concrete Batching	Easternmost borrow pit (point source, 1 of)	Water pump (diesel) (C4.88) Concrete mixer truck (C4.20)	BS 5228-1:2009+A1:2014
Upgrades to the site access tracks	Access track to T5 and T9 (line source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014

Construction of turbine hardstands	Hardstands at T5 – T8 (point source, 4 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Construction of Turbine Foundations	Turbine foundations T4 (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014
Construction of substation	Proposed substation (point source, 1 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014
Scenario 6 (Month 8 - 9)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Operation of the borrow pit	Two main borrow pits (point source, 2 of)	Excavator mounted rock breaker (C9.12) Tracked semi-mobile crusher (C9.15) Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14)	BS 5228-1:2009+A1:2014
Concrete Batching	Easternmost borrow pit (point source, 1 of)	Water pump (diesel) (C4.88) Concrete mixer truck (C4.20)	BS 5228-1:2009+A1:2014
Construction of turbine hardstands	Hardstands at T9 (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Vibratory roller (C5.20)	BS 5228-1:2009+A1:2014
Construction of Turbine Foundations	Turbine foundations at T5 – T8 (point source, 4 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014
Construction of substation	Proposed substation (point source, 1 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014
Scenario 7 (Month 10)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86)	BS 5228-1:2009+A1:2014

		Wheeled Excavator (C4.10)	
Operation of the borrow pit	Two main borrow pits (point source, 2 of)	Excavator mounted rock breaker (C9.12) Tracked semi-mobile crusher (C9.15) Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14)	BS 5228-1:2009+A1:2014
Concrete Batching	Easternmost borrow pit (point source, 1 of)	Water pump (diesel) (C4.88) Concrete mixer truck (C4.20)	BS 5228-1:2009+A1:2014
Construction of Turbine Foundations	Turbine foundations at T9 (point source, 1 of)	Dumper (C4.3) Dozer (C2.12) Tracked Excavator (C2.14) Concrete mixer truck + truck mounted concrete pump + boom arm (C4.32)	BS 5228-1:2009+A1:2014
Construction of substation	Proposed substation (point source, 1 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014
Turbine deliveries	Main access track (line source, 1 of)	Road lorry (full) (C6.21)	BS 5228-1:2009+A1:2014
Scenario 8 (Months 11 - 12)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Construction of substation	Proposed substation (point source, 1 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014
Turbine deliveries	Main access track (line source, 1 of)	Road lorry (full) (C6.21)	BS 5228-1:2009+A1:2014
Scenario 9 (Month 13)			
Operation of temporary construction compounds	Temporary construction compounds (point source, 2 of)	Diesel Generator (C.84) Diesel Generator (C.86) Wheeled Excavator (C4.10)	BS 5228-1:2009+A1:2014
Construction of substation	Proposed substation (point source, 1 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014
Turbine deliveries	Main access track (line source, 1 of)	Road lorry (full) (C6.21)	BS 5228-1:2009+A1:2014
Turbine erection	Erection of T1 and T6 – T8 (point source, 4 of)	Road lorry (full) (C6.21) Mobile telescopic crane (C4.45)Mobile telescopic crane (C4.45)	BS 5228-1:2009+A1:2014

Scenario 12 (Night)			
Operation of temporary construction compound	Temporary construction compound (point source, 1 of)	Diesel Generator (C.84) Diesel Generator (C.86)	BS 5228-1:2009+A1:2014

Noise Source Library – Sound Power Levels

Name	BS 5228 Reference	31.5	63	125	250	500	1k	2k	4k	8k	A	lin	Source
Harvester	-					103					103		Harvester Forwarder Skidder
Forwarder	-					101					101		Noise Hazards in Forestry Operations and Selection of Personal Protective Equipment
Skidder	-					108					108		Noise Hazards in Forestry Operations and Selection of Personal Protective Equipment
Dozer	C2.12	-	113	102	104	101	100	106	90	84	109	115	BS 5228-1:2009+A1:2014
Tracked Excavator	C2. 14	28	113	106	105	105	101	99	96	91	107	115	BS 5228- 1:2009+A1:2014
Dumper	C4. 3	28	112	109	102	101	100	96	89	87	104	115	BS 5228- 1:2009+A1:2014
Wheeled Excavator	C4 .10	28	92	88	91	92	90	85	79	73	94	98	BS 5228- 1:2009+A1:2014
Concrete mixer truck	C4.20	28	111	102	94	97	98	106	88	83	108	113	BS 5228- 1:2009+A1:2014
Concrete mixer truck + truck mounted concrete pump + boom arm	C4. 32	28	101	101	105	104	100	98	93	90	106	110	BS 5228- 1:2009+A1:2014
Mobile telescopic crane	C4. 45	28	118	109	106	102	105	104	97	89	109	119	BS 5228- 1:2009+A1:2014
Diesel generator	C4. 84	28	103	100	104	98	97	93	84	75	102	108	BS 5228- 1:2009+A1:2014
Diesel generator	C4. 86	28	106	99	94	90	87	83	84	77	94	107	BS 5228- 1:2009+A1:2014
Water pump (diesel)	C4.88	28	98	93	94	92	92	91	84	74	96.7	102	BS 5228- 1:2009+A1:2014
Vibratory roller	C5. 20	28	118	110	101	100	98	93	87	82	103	119	BS 5228- 1:2009+A1:2014
Road lorry (full)	C6. 21	28	124	110	102	101	1025	100	99	92	109	124	BS 5228- 1:2009+A1:2014
Excavator mounted rock breaker	C9. 12	28	119	117	113	117	115	115	112	108	121	125	BS 5228- 1:2009+A1:2014
Tracked semi-mobile crusher	C9. 15	28	119	119	116	115	113	111	106	96	118	124	BS 5228- 1:2009+A1:2014