

7. Noise

7.1 Introduction

- 7.1.1 This chapter assesses the potential effects on noise sensitive receptors (NSRs) surrounding the Development Site as a result of the Proposed Development. This chapter should be read in conjunction with **Chapter 4: Description of the Proposed Development** of the EIA Report.
- 7.1.2 Noise can have an influence on the environment and on the quality of life enjoyed by individuals and communities. Noise is often therefore an important consideration in the determination of planning applications. This assessment considers the likely noise effects predicted to arise during the construction, operation and decommissioning of the Proposed Development.
- 7.1.3 Following a summary of relevant policy and legislation, this chapter describes the adopted assessment methodology, the overall baseline conditions from a noise specific viewpoint and scope of the assessment. This chapter includes an assessment of construction and operational noise from the Proposed Development (decommissioning is also considered qualitatively).
- 7.1.4 While the final choice of turbine for the Proposed Development will follow a competitive tendering process, the candidate turbine considered for the purposes of this noise assessment is the Siemens Gamesa SG155-6.6, with a maximum height to blade tip of 200 meters (m).
- 7.1.5 This chapter is accompanied by the following appendices and figures:
- Appendix 7A: Cumulative Wind Farm Noise Assessment;
 - Appendix 7B: Example Planning Condition;
 - Figure 7.1: Receptor Locations; and
 - Figure 7.2: Wind Farm Noise Contours.

7.2 Limitations of this Assessment

- 7.2.1 No limitations relating to noise have been identified that affect the robustness of the assessment of potentially **significant** effects as a result of the Proposed Development.

7.3 Policy and Legislation

Legislative Framework

- 7.3.1 For a development of this nature, there is no specific all-encompassing legislation relating to the standard associated with noise emission / noise impact. Noise legislation, where it does exist, tends to be either European Commission (EC)-derived and focused on specific items of noise-emitting plant or on more general nuisance, such as that addressed by the provisions of the Environmental Protection Act 1990.

- 7.3.2 In lieu of any specific legislation, assessing the effect of such a development during the construction, operational and decommissioning phases must draw on information from a variety of sources. This assessment, therefore, makes reference to a number of British Standards, official planning guidance notes and national guidance.

Planning Policy and Assessment Guidance

- 7.3.3 The key national guidance document, which provides guidelines on the assessment of noise in Scotland, is Planning Advice Note 1/2011 (PAN 1/2011; Scottish Government, 2011). PAN 1/2011 does not aim to provide a definitive source of guidance on noise issues; however, it does set out the range of noise issues that determining authorities need to be aware of in formulating development plans and making decisions on planning applications. With regards to the noise effects of wind farms it states:
- *'Good acoustical design and siting of turbines is essential to minimise the potential to generate noise'.*
- 7.3.4 The web-based renewables advice referred to within PAN 1/2011 gives specific advice in relation to noise emanating from onshore wind turbines, stating:
- *'The Report, 'The Assessment and Rating of Noise from Wind Farms' (Energy Technology Support Unit: ETSU-R-97) describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available. This gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable burdens on wind farm developers, and suggest appropriate noise conditions.'*
- 7.3.5 The Onshore Wind: Policy Statement 2022 (Scottish Government, 2022) refers to ETSU-R-97 (The Working Group on Noise from Wind Turbines, 1996), stating:
- *'[t]he Assessment and Rating of Noise from Wind Farms' (Final Report, Sept 1996, DTI), (ETSU-R-97) provides the framework for the measurement of wind turbine noise, and all applicants are required to follow the framework and use it to assess and rate noise from wind energy developments... Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants and used to assess and rate noise from wind energy developments.'*
- 7.3.6 Consequently, the assessment methodology contained within ETSU-R-97 has been adopted for assessing wind farm noise. The advice presented in the ETSU-R-97 Guidance was produced by the Working Group on Noise from Wind Turbines, a body comprising a number of interested parties including, amongst others, wind farm operators, Environmental Health Officers, acoustic consultants, and legal experts. The assessment approach was developed to address the shortcomings of other standards in addressing wind farm noise.
- 7.3.7 Table 7.1 details the planning policy and guidance relevant to this noise assessment.

Table 7.1 Relevant planning policy and assessment guidance

Policy / Guidance Reference	Policy / Guidance Issue	Considered in Section
National Planning Policy		

Policy / Guidance Reference	Policy / Guidance Issue	Considered in Section
Planning Advice Note 1/2011	PAN 1/2011 provides general guidance and advice on the role of the planning system in helping to prevent and limit the adverse effects of noise.	Whole chapter
Onshore Wind: Policy Statement 2022	Chapter 3: Environmental Considerations: Achieving Balance and Maximising Benefits, in particular Section 3.7, advocates the use of ETSU-R-97 as the framework for the measurement and assessment of noise from wind energy developments.	Whole chapter
National Planning Framework 4 (NPF4) (2023)	The NPF4 Energy Policy Intent is: <i>'To encourage, promote and facilitate all forms of renewable energy development onshore and offshore. This includes energy generation, storage, new and replacement transmission and distribution infrastructure and emerging low-carbon and zero emissions technologies including hydrogen and carbon capture utilisation and storage (CCUS).'</i> The NPF4 Health and Safety Policy Intent is: <i>'To protect people and places from environmental harm, mitigate risks arising from safety hazards and encourage, promote and facilitate development that improves health and wellbeing.'</i> The following policies relate to noise and wind farms: Policy 11 a) <i>'Development proposals for all forms of renewable, low-carbon and zero emissions technologies would be supported. These include:</i> i. <i>wind farms including repowering, extending, expanding and extending the life of existing wind farms;</i> b) <i>In addition, project design and mitigation would demonstrate how the following impacts are addressed:</i> ii. <i>impacts on communities and individual dwellings, including, residential amenity, visual impact, noise and shadow flicker.'</i> Policy 23 a) <i>'Development proposals that are likely to raise unacceptable noise issues would not be supported. The agent of change principle applies to noise sensitive development. A Noise Impact Assessment may be required where the nature of the proposal or its location suggests that significant effects are likely.'</i>	Whole chapter
Local Planning Policy		

Policy / Guidance Reference	Policy / Guidance Issue	Considered in Section
Argyll and Bute Local Development Plan 2 (2024)	The Local Development Plan 2 (LDP2) policy relevant to this chapter is Policy 30 – The Sustainable Growth of Renewables. This Policy states: <i>“The Council will support renewable energy developments where these are consistent with the principles of sustainable development and it can be adequately demonstrated that there would be no unacceptable significant adverse effects, whether individual or cumulative, on local communities [...]”</i> And: <i>“All applications for wind turbine developments will be assessed against the following criteria:</i> <i>• [...]</i> <i>• Impacts on communities and individual dwellings, including visual impact, residential amenity, noise and shadow flicker.”</i>	Whole chapter
Guidance Relating to Construction Noise		
BS5228:2009+A1:2014 Noise control on construction and open sites' Part 1: Noise (BS 5228-1:2009+A1:2014; British Standards Institution, 2014).	Detailed guidance on assessing noise from construction sites.	Section 7.7 to 7.10 and 7.14
Calculation of Road Traffic Noise (CRTN; HMSO, 1988).	CRTN provides methodology for predicting noise levels due to road traffic.	Section 7.10
Design Manual for Roads and Bridges (DMRB) LA111: Noise and Vibration	Provides guidance on the assessment of impacts from noise and vibration that may result from road projects.	Section 7.10
Guidance Relating to the Assessment of Noise from Wind Farms		
ETSU-R-97, 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines.	Information and advice to developers and planners on the environmental assessment of noise from wind turbines. The guidance offers a framework for the measurement of wind farm noise and gives indicative noise levels that offer a reasonable degree of protection to wind farm neighbours.	Section 7.7 to 7.11 and 7.14
Institute of Acoustics (IoA) 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IoA GPG)	A good practice guide produced by a noise working group setup by the IoA presenting current good practice in the application of ETSU-R-97 assessment methodology for wind turbine developments above 50kW.	Section 7.7 to 7.11 and 7.14

7.4 Data Gathering Methodology

- 7.4.1 The Study Area for the cumulative impact assessment is based on a radius of 10 km from the Proposed Development. Within the 10km Study Area, other wind farm developments, including those that are consented but not built, or at planning stage, have been considered as part of the assessment of effects. **Table 7.2** below outlines the identified wind farms for inclusion within the operational phase noise assessment. Full detail of the sources and information used for the operational phase noise assessment are provided in **Appendix 7A**.
- 7.4.2 There are two operational turbines at Blarghour Farm which are located approximately 6.2km from the Development Site. Taking into consideration the power rating of these turbines, i.e. less than 50kW, and the distance of the turbines from the Development Site, it is considered that they would not contribute to the overall turbine noise levels at common receptors. The Blarghour Farm turbines have not been considered further as part of the cumulative noise assessment.

Table 7.2 Cumulative wind developments

Wind development name	Status	Number of turbines	Assumed turbine type	Approximate distance from Proposed Development (km)
An Suidhe Part 1	Operational	9	Enercon E44/900	0.5
An Suidhe Part 2	Operational	14	Enercon E48/800	0.5
A' Chruach ¹	Operational	21	Senvion MM92/2050*	2.6
A' Chruach extension ¹	Consented	2	Senvion MM100	3.5
Blarghour ²	Consented	17	Vestas V117	5.8
An Càrr Dubh	In Planning	13	Siemens Gamesa SG155-6.6	3.2
Glasvaar	In Planning	8	Vestas V136	5.8

¹ A' Chruach Wind Farm is to utilise both Senvion MM100 and MM92 turbine models. As the placement of the exact turbines is unknown, all turbines have been assumed to be MM100 as a worst-case scenario.

² In 2021, consent was granted for a 17 turbine wind farm development (application reference WIN-130-4). Since then, a planning application to vary the Section 36 consent has been submitted but is yet to be determined. The variation proposed to reduce the number of turbines from 17 to 14. The inclusion of the consented development is therefore considered to be a worst-case scenario.

- 7.4.3 Further non-turbine related information sources that informed the assessment are listed in **Table 7.3**.

Table 7.3 Other Data Sources

Organisation	Data provided
Google	Aerial Imagery
Ordnance Survey	OS Terrain 50 data

Turbine data

- 7.4.4 The Proposed Development comprises 22 wind turbines with a hub height of 122.5 m. The location of the turbines is presented in **Table 4.2** within **Chapter 4: Description of the Proposed Development** of the EIA Report and illustrated within **Figure 4.1**.
- 7.4.5 A range of turbine models would be appropriate for the Proposed Development. The final turbine selection will follow a competitive tendering process and thus the actual model of turbine installed at the Development Site may differ from that upon which the assessment has been based. However, the final choice of turbine will be required to comply with the noise criterion levels which have been established within the noise assessment for the Proposed Development.
- 7.4.6 While the final choice of turbine is not confirmed, a candidate turbine suitable for use at the Development Site has been selected. The candidate turbine used for the purposes of this assessment is the Siemens Gamesa SG155-6.6, modelled on full power. **Table 7.4** below provides the candidate turbine sound power level referenced to 10m height with a +2dB uncertainty correction included, whilst **Table 7.5** shows the octave band sound power levels (the table illustrating that sound power levels are not higher than the 10m/s screening wind speed).

Table 7.4 Sound power levels used for Proposed Development turbines (+2dB uncertainty correction)

Candidate turbine	Sound power levels (dB L_{WA}) at standardised 10m height wind speed (V_{10}) ms^{-1}								
	4	5	6	7	8	9	10	11	12
Siemens Gamesa SG 155-6.6	100.4	105.2	107.0	107.0	107.0	107.0	107.0	107.0	107.0

Table 7.5 Octave band sound power levels used for Proposed Development turbines at different wind speeds (+2dB uncertainty correction)

Wind speed (m/s)	Sound power levels (dB L_{WA}) at standardised 10m height wind speed (V_{10}) ms^{-1} by octave band (Hz)							
	63	125	250	500	1000	2000	4000	8000
4	80.0	87.4	92.0	94.3	94.1	94.4	87.8	72.8
5	84.8	92.2	96.8	99.1	98.9	99.2	92.6	77.6
6	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4
7	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4
8	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4
9	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4
10	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4
11	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4
12	86.6	94.0	98.6	100.9	100.7	101.0	94.4	79.4

7.5 Overall Baseline

- 7.5.1 The majority of the Development Site is used for commercial forestry operations, within Eredine Forest (western area of the Development Site) and Brenchoillie Forest (eastern area of the Development Site). The potential noise source noted in the area is the occasional traffic along the local roads, such B840, A816, A819, and A83.
- 7.5.2 The closest operational wind farms to the Proposed Development are An Suidhe Wind Farm, located to the north of the Development Site; and A'Chruach Wind Farm, located to the south of the Development Site, within Kilmichael Forest.
- 7.5.3 The nearest residential property to the turbines is Kirn Lodge, which is located north-west from the Development Site along the B840 route, just south of the Eredine Village. Kirn Lodge is located approximately 2.5km to the north-west of the closest turbine on the Development Site.
- 7.5.4 A noise survey has not been conducted for this assessment as the criteria for both the construction and operation (i.e. screening assessment as set out in paragraph 7.6.5) are based on absolute noise limits.
- 7.5.5 Given the rural nature of the Site, it is not anticipated that existing noise levels within the vicinity of the Proposed Development would be subject to significant changes. It is noted that two proposed wind farms, Blarhgour and An Càrr Dubh as set out in **Table 7.2**, are to be located to the north of the Proposed Development. However, computer noise modelling

indicates that these wind farms would currently have **no significant** contributory effects on the noise environment at assessed NSRs.

7.6 Consultation

7.6.1 **Table 7.6** provides a summary of the consultation activities undertaken in support of the preparation of this assessment.

Table 7.6 Summary of Consultation Undertaken

Body / Consultation	Type of Consultation	Date Received	Summary of Outcome of Discussions	Actions
Scottish Government Energy Consents Unit (ECU)	Scoping Opinion	31 May 2023	- It is recommended that the final list of receptors in respect of noise assessment should be agreed following discussion between the Company and Argyll and Bute Council. - The noise assessment report should include information as per Table 6.1 of the IoA GPG.	- Sufficiently covered by addressing Argyll and Bute Council's request to include Gallanach as a receptor of the operational phase assessment. - The noise assessment report should include information as per Table 6.1 of the IoA GPG.

7.7 Scope of the Assessment

Study Area

7.7.1 The study area to determine noise sensitive receptors has been defined as a 3km zone extending from the site boundary and a desk study used to identify the relevant concerns. Cumulative impact considerations have been drawn from a 10km zone extending from the site boundary.

Identification of Sensitive Receptors

7.7.2 A desk study of Ordnance Survey mapping for the site and surrounding area identified the noise-sensitive receptors in the immediate vicinity of the Proposed Development. The assessment focuses on the closest residential receptors in each direction from the Development Site within the Study Area, as summarised in **Table 7.7**.

7.7.3 These NSRs are shown on **Figure 7.1** and considered high sensitivity.

Table 7.7 Noise sensitive receptors within 3km of the Proposed Development

Ref.	Property Name	Easting	Northing	Approximate Distance to Nearest Proposed Development Turbine (km)
R1	Gallanach	197506	699441	3.0
R2	Brenachaille	201735	702501	2.7
R3	Braleckan House	202133	702599	2.8
R4	Auchindrain	203113	703209	3.0
R5	Killeen Farmhouse	204918	704514	3.8
R6	Claonairigh House	205463	704804	4.1
R7	Kirn Lodge	196909	709039	2.5
R8	Eredine Village	196994	709240	2.7
R9	Eredine house	196823	709507	3.0
R10	Sobrachan	195609	707139	2.6
R11	Braevallich	195543	707490	2.9
R12	Old Farmhouse	196004	707812	2.6

Scoped out of Further Assessment

Substation and Battery Storage Facility

- 7.7.4 A new substation and battery storage facility are included as part of the Proposed Development. As illustrated in **Figure 4.1** within **Chapter 4: Description of the Proposed Development**, the proposed location of the substation is located approximately 375 m to the north of Turbine 8 and the battery storage facility is approximately 375m to the north-west of Turbine 8.
- 7.7.5 There will be a minimum distance of approximately 3.5km between the proposed substation and battery storage facility and the nearest NSRs. **No significant** noise related effects are, therefore, likely as a result of the separation distance between the substation and battery storage facility and the nearest NSRs.

7.8 Environmental measures

Construction and Decommissioning Noise

- 7.8.1 It is recognised that the nature of construction noise is inherently temporary. Human receptors will generally tolerate higher impacts where it is known that they will only be present for a limited time period. Several safeguards exist to minimise the effects of construction noise, and it is anticipated that these would be implemented, where necessary, during the construction of the turbines and associated infrastructure. These safeguards include:
- The various EC Directives and UK Statutory Instruments that limit noise emissions of a variety of construction plant;
 - Guidance set out in BS 5228-1:2009 which covers noise control on construction sites; and
 - The powers that exist for local authorities under Section 60 of the Control of Pollution Act 1974 to control environmental noise on construction sites.
- 7.8.2 In addition, the adoption of Best Practicable Means (as defined in Section 72 of the Control of Pollution Act 1974) is usually the most effective way to control noise from construction sites. Such measures where appropriate will include the following:
- Any compressors brought on to site to be silenced or sound reduced models fitted with acoustics enclosures.
 - All pneumatic tools to be fitted with silencers or mufflers.
 - The majority of deliveries to be programmed to arrive during normal working hours only.
 - Care to be taken when unloading vehicles to minimised noise. Delivery vehicles to be routed so as to minimise disturbance to local residents.
 - Delivery vehicles to be prohibited from waiting within or in the vicinity of the site with their engines running.
 - All plant items to be properly maintained and operated according to manufacturers' recommendations in such a manner as to avoid causing excessive noise.
 - All plant to be sited so that the noise impact at nearby noise-sensitive is minimised.
 - Local hoarding, screens or barriers to be erected as necessary to shield particularly noisy activities.
 - For the purposes of this EIA Report, construction activities have been assumed to take place between 07:00 to 19:00 hours on weekdays (Monday to Friday). For Saturdays, assumed hours will be between 07:00 to 19:00 during summer months, and 07:00 to 17:00 in winter months. Quiet onsite working activities (for example electrical commissioning) have been assumed to extend outside the core working times noted (where required). Working hours may be reduced at times due to seasonal or weather restrictions. Some works such as delivery of the components of turbines may take place outside the core working hours to reduce disturbance to other users of the road network. Work outside these hours is not usual, though if required to meet specific demands (e.g., during foundation pours, tower erection and highly weather dependent activities), where possible permission for short term extensions to these hours would be sought from Argyll and Bute Council (ABC) as required.

- 7.8.3 It is noteworthy that some measures to reduce noise from construction sites (such as reducing the numbers of plant operating at a given time) can extend the required duration of the works. In some cases, it is more desirable that the works are completed in as short a duration as possible, albeit with increased noise levels, in order that adverse noise impacts are not unnecessarily prolonged for the sake of relatively small reductions in noise.
- 7.8.4 The above measures will be included in a Construction Environmental Management Plan (CEMP) that will be issued and agreed with the Contractor conducting the works.

Operational Noise

- 7.8.5 As shown in **Section 7.10**, **no significant** noise effects have been identified, based on the candidate turbines utilised for this assessment and therefore specific mitigation measures are not considered necessary.
- 7.8.1 The various measures available for the control of noise impact from wind turbines include the following:
- Selection of appropriate turbines;
 - Selection of appropriate turbine locations; and
 - Use of turbine management schemes, e.g. to use noise-reducing operating modes under certain wind conditions.
- 7.8.2 It should be noted that the final turbine selection will be subject to a tendering process. Accordingly, the final turbine selection will be made to ensure that the noise level limits detailed within this chapter will not be exceeded.

7.9 Assessment Methodology

Overview of Construction and Decommissioning Noise Assessment Procedure

Construction Noise

- 7.9.1 For construction phase emissions, it is standard industry practice to refer to the guidance relating to acceptability presented within BS 5228-1:2009+A1:2014.
- 7.9.2 The appropriate noise limit for a project in an area such as the Development Site would be 65dB $L_{Aeq, 12h}$ (or $L_{Aeq, T}$) during the weekday daytime period (i.e. 07:00-19:00 Monday to Friday and 07:00-13:00 on Saturdays) and 55dB $L_{Aeq, T}$ during a Saturday daytime period (13:00-19:00). This aligns with Category A threshold values shown in **Table 7.8** (i.e. baseline ambient noise levels during the weekday daytime period are assumed to be below 65dB when rounded to the nearest 5dB and below 55dB during the Saturday daytime period). **Table 7.8** is Table E.1 from BS 5228-1:2009+A1:2014.

Table 7.8 Example of threshold of potential significant effect at dwellings

Assessment category and threshold value period	Threshold value, in decibels (dB) ($L_{Aeq,T}$)		
	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 3dB due to site noise.

NOTE 3 Applied 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 and 07:00 – 23:00 Sundays.

7.9.3 The weekday and Saturday daytime limits are applicable to all construction activities taking place on-site, including all fixed and mobile plant associated with the Proposed Development, and including the movement of Heavy Good Vehicles (HGVs) on-site.

Decommissioning Noise

7.9.4 For impact assessment purposes, it is assumed that the Proposed Development will be decommissioned at the end of its operational life. Typically, decommissioning noise should be generally less or, at worst, similar to that experienced during the construction period. It is therefore assumed that noise effects relating to the decommissioning of the Proposed Development would be no more significant than those experienced during construction; provided similar restrictions on working hours and transport routes are applied. Therefore, a specific assessment of the decommissioning noise has not been undertaken on the basis that the same conclusions and mitigation of the construction assessment would apply to decommissioning.

Overview of Operational Noise Assessment Procedure

7.9.5 ETSU-R-97 Guidance (The Working Group on Noise from Wind Turbines, 1996) advises (Paragraph 3, page 4) within the context of wind energy:

- ‘The planning system must therefore seek to control the environmental impacts from a wind farm whilst at the same time recognising the national and global benefits that

would arise through the development of renewable energy sources and not be so severe that wind farm development is unduly stifled.'

- 7.9.6 The EIA Regulations require that all likely 'significant' effects are identified. For the purposes of this assessment, the determination of effect significance for the operation of the Proposed Development is based upon compliance with the applicable noise limit, i.e. breach of the noise limits indicates a 'significant' effect, whereas compliance with noise limits indicates a 'not significant' effect. Noise levels exceeding the ETSU-R-97 Guidance (The Working Group on Noise from Wind Turbines, 1996) noise limits would require further consideration with a view to appropriate mitigation being identified.
- 7.9.7 ETSU-R-97 Guidance (The Working Group on Noise from Wind Turbines, 1996) provides a simplified approach for the cases with a large separation distance between turbines and the nearest properties. Where the predicted operational noise at receptors (including other existing, consented or proposed wind farms) is limited to $L_{A90,10min}$ of 35dB in wind speeds up to 10ms^{-1} at 10m height (wind speeds are referenced to a 10m measurement height (V10) on the wind farm site), then no further assessment is necessary.

7.10 Assessment of Effects

Construction Noise

Direct Effects

- 7.10.1 Construction noise effects are normally of a temporary nature and result from both moving and static sources. Assessment allows the temporary impact of construction noise to be understood and for suitable mitigation measures to be identified to minimise any potential significant adverse effects.
- 7.10.2 During the construction period, a range of different activities could take place within the Development Site. The site layout illustrated in **Figure 4.1** within **Chapter 4: Description of the Proposed Development** indicates there will be a minimum distance of approximately 1.5km between the proposed work areas and the nearest NSRs and construction noise is therefore likely to result in **no significant** effects. To account for the worst-case scenario, construction noise assessment has been undertaken based on construction works including piling. The results are assessed against criteria provided in BS 5228-1:2009+A1:2014 Annex E and presented in **Table 7.10**.
- 7.10.3 The precise construction methodology for the Proposed Development will not be finalised until such time as a construction contractor is commissioned, and, as such, the actual plant to be used is unknown. The plant given in **Table 7.9** is based upon a worst-case scenario of impact piling using hydraulic hammer rig data located in Appendix C of BS 5228-1:2009+A1:2014.

Table 7.9 Construction Plant Source Data

Plant	BS 5228-1:2009+A1:2014 reference	dB $L_{Aeq,T}$ at 10m	Number of plants	Total Sound Power Level L_{WA} dB(A)
Hydraulic hammer rig	Table C.3 Item 1	89	1	117

- 7.10.4 Predictions of noise emissions have been carried out for impact piling using the plant in **Table 7.9**, assuming that the plant would operate at the point of the closest turbine to each receptor. It has been assumed within the calculations that all plant would operate 100% of the time during the hours of working or the purpose of a worst-case assessment.
- 7.10.5 Whilst other plant would also be on-site during the impact piling works, it is anticipated that all other plant used in conjunction with the piling rig and for other construction activities would be no greater than the hydraulic hammer rig and would therefore not change the overall results.
- 7.10.6 The predicted noise levels during construction are given in **Table 7.10**.

Table 7.10 Construction noise assessment

Receptor	Approximate Distance from the closest turbine (km)	Predicted dB $L_{Aeq, T}$
R1 – Gallanach	3.0	32.1
R2 – Brenachaille	2.7	33.2
R3 - Braleckan House	2.8	32.8
R4 – Auchindrain	3.0	32.1
R5 - Killeen Farmhouse	3.8	29.5
R6 - Claonairigh House	4.1	28.7
R7 - Kirn Lodge	2.5	34.1
R8 - Eredine Village	2.7	33.2
R9 - Eredine house	3.0	32.1
R10 – Sobrachan	2.6	33.6
R11 – Braevallich	2.9	32.4
R12 - Old Farmhouse	2.6	33.6

- 7.10.7 The noise predictions shown in **Table 7.10** confirm that the minimum noise guideline value of 65dB(A) for weekday daytime and 55dB(A) for Saturday daytime quoted in BS 5228-1:2009+A1:2014 would not be exceeded at any of the identified receptor should impact piling be used (i.e. the worst-case construction activity in terms of noise emission). On this basis, the effect of construction noise upon the closest assessed NSRs is considered to be **not significant**.
- 7.10.8 Typically, decommissioning noise should be generally less or, at worst, similar to that experienced during the construction period. Therefore, the effect of decommissioning noise upon the closest assessed NSRs is also considered to be **not significant**.

Indirect Effects

- 7.10.9 Traffic noise due to construction can give rise to significant effects for NSRs lining the construction traffic route. **Chapter 13: Traffic and Transport** of the EIA Report identifies the following construction traffic movements during the peak construction period and is therefore, considered to be a worst-case scenario: a maximum total average daily flow of 92 HGVs (including arrivals and departures from site), which is equivalent to a flow rate of 8 vehicles per hour, assuming a 12-hour working day.
- 7.10.10 As reported in **Chapter 13: Traffic and Transport**, there would be an 2% increase in the total flow of vehicles on the A83, at worst, during the peak construction period of the development. The change in sound levels as a result of temporary construction traffic movements on the A83 during the construction phase of Proposed Development would result in a 0.5dB increase at worst. A change in noise level of less than 1dB would not be considered perceptible and, therefore, in accordance with the guidance provided in DMRB (Highways England et al., 2020) the potential impact of temporary construction traffic movements on the A83 is considered to be negligible.
- 7.10.11 Access to the Proposed Development off the A83 will utilise the existing access for An Suidhe Wind Farm. From leaving the A83, part of the proposed access route will pass within 250m of Willow Cottage and Killean Farmhouse, which would experience an increase in traffic flow greater than 100%. However, the existing baseline flow is low as it is associated with forestry operations and access to An Suidhe Wind Farm, such that the calculation and assessment methods presented within CRTN and DMRB (Highways England et al., 2020) are not suitable, i.e. a flow of less than 50 vehicles per hour or 1000 vehicles per 18-hour period. It would therefore be appropriate to assess the significance of noise based on the criteria outlined in **Table 7.8**, in line with BS 5228-1:2009 + A1:2014. Whilst the construction traffic movements are likely to increase the ambient noise levels along the access route of the Proposed Development, it is unlikely that the addition of a maximum of 92 HGV movements a day during peak construction would result in noise levels at residences exceeding the threshold criteria outlined in **Table 7.8**. Therefore, indirect effects from traffic associated with the Proposed Development are not considered further within this assessment.

Operational Noise

Research Background

- 7.10.12 Operational, wind turbines emit two types of noise – mechanical noise and aerodynamic noise. The main sources of mechanical noise are from internal components housed within the nacelle, such as the gearbox and generator. Mechanical noise from a modern wind turbine is negligible, as the nacelles are insulated to reduce noise emissions and the various mechanical components housed within it are acoustically isolated to prevent structure-borne noise.
- 7.10.13 Aerodynamic noise occurs from the movement of the blades passing through the air. At higher wind speeds, aerodynamic noise is usually masked by the increasing sound of wind blowing through trees and around buildings. The level of masking determines the perceived audibility of the wind farm. Operational noise impact assessments establish the relationship between wind turbine noise and the natural masking noise and assesses levels against established standards.

- 7.10.14 In May 2013, the IoA GPG (IoA, 2013) was published. The IoA GPG was produced, and peer reviewed by a number of noise consultants who act on behalf of both developers and opponents of wind farms, some of whom sat on the ETSU-R-97 Noise Working Group.
- 7.10.15 The use of the IoA GPG in the assessment of wind turbine noise has been endorsed by Scottish Government. John Swinney MSP, then Cabinet Secretary for Finance, Employment and Sustainable Growth, stated in a letter to the IoA on 29th May 2013:
- *'In view of the careful, expert work and consultation that has informed the Good Practice Guide, I am happy to accept that it represents current industry good practice.'*
- 7.10.16 The IoA GPG does not examine the noise limits set out within the ETSU-R-97 Guidance as that is a matter for Government. However, it does present good practice in the application of its methodology for wind developments greater than 50kW. The assumptions listed in the section below are all confirmed within the IoA GPG as the correct approach to modelling wind turbine noise emissions.
- 7.10.17 The IoA GPG confirms that the ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors' calculation standard can be used to make realistic predictions of noise from onshore wind turbines during worst-case propagation conditions (i.e. including the long-distance effects of downwind conditions and temperature inversions). A number of the parameters that are required as input for the International Organization for Standardization: ISO 9613-2 calculations are specified in the IoA GPG to ensure that accurate worst-case predictions are achieved, including receiver height, ground factor and atmospheric conditions; this guidance has been followed in preparing the model.
- 7.10.18 The ISO 9613-2 model allows sound pressure levels to be predicted for either short-term downwind conditions or long-term averages based on the prevailing winds. It should be noted that only downwind propagation is considered in this assessment (i.e. wind blowing from each proposed turbine in all directions towards every receptor). Of course this cannot occur in reality, since, when the wind at a given altitude is blowing directly towards one general area of receptors, it cannot also (at the same altitude) be blowing directly towards receptors located on the opposite side of the noise source(s) under consideration. It follows that for a given receptor located between the proposed development and the considered cumulative developments, downwind conditions for one development will result in upwind conditions from the other. Therefore, the model provides a conservative estimate of noise impacts; noise levels are likely to be lower than predicted under upwind or crosswind conditions.
- 7.10.19 In line with the IoA GPG, the model used in this assessment was based upon that found in ISO 9613-2. The model considered:
- geometric divergence (attenuation with distance);
 - air absorption;
 - barriers (including buildings or topography);
 - screening (including vegetation); and
 - ground absorption and reflection.

Operational Noise Modelling for the Proposed Development

- 7.10.20 For the purpose of this assessment, noise level predictions have been based upon the following assumed model parameters, all of which are advocated within the IoA GPG (IoA, 2013).

- a receiver height of 4m above local ground level – to represent the height of a typical bedroom window;
- mixed ground ($G = 0.5$) – this represents a ground cover that has equal amounts of fully reflective and fully absorptive character. For the purposes of this assessment, mixed ground represents a ground cover that is as equally absorptive of noise as it is reflective;
- air absorption based on a temperature of 10°C and 70% relative humidity;
- $L_{A90, 10min}$ is 2dB less than $L_{Aeq, 10min}$ for wind farm noise;
- a maximum 2dB limit on all topographical screening; and
- predicted turbine noise levels inclusive of any 'concave ground effect' correction (discussed below).

7.10.21 The ETSU-R-97 assessment requires inclusion of other existing wind farms likely to produce noise levels within 10dB of those from the Proposed Development. Where it has been demonstrated that the Proposed Development is likely to produce noise levels at least 10dB lower than those of an existing or proposed development, then the impact of the Proposed Development upon cumulative noise emissions (i.e., the noise levels at the receiver position) at that receptor is considered negligible. This approach is advocated within the IoA GPG (IoA, 2013). The developments considered are discussed in **Section 7.4** and **Appendix 7A**.

7.10.22 The IoA GPG recommends that a noise correction should be applied in circumstances where the intervening terrain height between a proposed wind development and sensitive receptors drops away significantly. The correction is to account for the effective decrease in ground absorption at higher propagation paths. Where a 'concave ground effect' is shown to occur, a correction of 3dB (or 1.5dB if a ground absorption factor of 0 is being used) is applied to the overall predicted noise level at receptors.

Assessment of Proposed Development Wind Turbine Noise Impact

7.10.23 **Table 7.11** presents the predicted noise levels at receptor locations from the Proposed Development. The results are shown diagrammatically in **Figure 7.2**. The predictions are based on downwind conditions for all receptors from all wind farms.

Table 7.11 Predicted Turbine Noise Levels at Identified Receptors $L_{A90,T}$

Receptors	Derived Noise Limit (dB $L_{A90, 10mins}$)	Standardised 10m height wind speed (V_{10}) ms^{-1}								
		4	5	6	7	8	9	10	11	12
R1 – Gallanach	35	16.7	21.5	23.3	23.3	23.3	23.3	23.3	23.3	23.3
R2 – Brenachaille	35	20.5	25.3	27.1	27.1	27.1	27.1	27.1	27.1	27.1
R3 - Braleckan House	35	19.5	24.3	26.1	26.1	26.1	26.1	26.1	26.1	26.1
R4 – Auchindrain	35	18.3	23.1	24.9	24.9	24.9	24.9	24.9	24.9	24.9
R5 - Killean Farmhouse	35	15.1	19.9	21.7	21.7	21.7	21.7	21.7	21.7	21.7
R6 - Claonairigh House	35	14.0	18.8	20.6	20.6	20.6	20.6	20.6	20.6	20.6
R7 - Kirn Lodge	35	19.9	24.7	26.5	26.5	26.5	26.5	26.5	26.5	26.5
R8 - Eredine Village	35	19.5	24.3	26.1	26.1	26.1	26.1	26.1	26.1	26.1
R9 - Eredine house	35	18.7	23.5	25.3	25.3	25.3	25.3	25.3	25.3	25.3
R10 – Sobrachan	35	22.3	27.1	28.9	28.9	28.9	28.9	28.9	28.9	28.9
R11 – Braevallich	35	21.3	26.1	27.9	27.9	27.9	27.9	27.9	27.9	27.9
R12 - Old Farmhouse	35	21.8	26.6	28.4	28.4	28.4	28.4	28.4	28.4	28.4

7.10.24 The predicted noise levels have been compared against the derived noise limit of 35dB $L_{A90, mins}$ when assessed in accordance with the simplified assessment methodology in ETSU-R-97. The results are given in **Table 7.12**. A negative value represents compliance, a positive value represents an exceedance.

Table 7.12 Turbine Noise Compliance, dB

Receptors	Derived Noise Limit (dB L _{A90, 10mins})	Standardised 10m height wind speed (V ₁₀) ms ⁻¹								
		4	5	6	7	8	9	10	11	12
R1 – Gallanach	35	-18.3	-13.5	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7	-11.7
R2 – Brenachaille	35	-14.5	-9.7	-7.9	-7.9	-7.9	-7.9	-7.9	-7.9	-7.9
R3 - Braleckan House	35	-15.5	-10.7	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9
R4 – Auchindrain	35	-16.7	-11.9	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1
R5 - Killean Farmhouse	35	-19.9	-15.1	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3	-13.3
R6 - Claonairigh House	35	-21	-16.2	-14.4	-14.4	-14.4	-14.4	-14.4	-14.4	-14.4
R7 - Kirn Lodge	35	-15.1	-10.3	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5
R8 - Eredine Village	35	-15.5	-10.7	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9
R9 - Eredine house	35	-16.3	-11.5	-9.7	-9.7	-9.7	-9.7	-9.7	-9.7	-9.7
R10 – Sobrachan	35	-12.7	-7.9	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1	-6.1
R11 – Braevallich	35	-13.7	-8.9	-7.1	-7.1	-7.1	-7.1	-7.1	-7.1	-7.1
R12 - Old Farmhouse	35	-13.2	-8.4	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6	-6.6

7.10.25 The results in **Table 7.12** show that there are no exceedances of the 35 dB noise limit. Therefore, effects resulting from the operation of the Proposed Development would be **not significant**.

- 7.10.26 The derived wind turbine noise limit for the Proposed Development of 35dB $L_{A90,10mins}$ could be controlled via suitable planning condition. An example planning condition have been included in **Appendix 7B**. This assessment indicates that compliance with such a condition would be practicable.

7.11 Assessment of Cumulative Effects

Assessment of Cumulative Wind Turbine Noise Impact

- 7.11.1 The results of the comparison of the predicted cumulative turbine noise levels at a standardised wind speed of 10m/s (i.e. worst-case sound power level data) with the derived cumulative noise limits are shown in **Table 7.13**.

Table 7.13 Predicted Turbine Noise Levels at Identified Receptors at 10m/s $L_{A90,T}$

Receptors	Cumulative Noise Limit (dB $L_{A90, 10mins}$)	Standardised 10m height wind speed (ms^{-1})
R1 – Gallanach	40	27.4
R2 – Brenachaille	40	28.3
R3 - Braleckan House	40	27.5
R4 – Auchindrain	40	26.8
R5 - Killean Farmhouse	40	25.2
R6 - Claonairigh House	40	24.5
R7 - Kirn Lodge	40	29.7
R8 - Eredine Village	40	29.6
R9 - Eredine house	40	29.0
R10 – Sobrachan	40	30.1
R11 – Braevallich	40	29.4
R12 - Old Farmhouse	40	29.9

- 7.11.2 The results in Table 10.21 show that the predicted cumulative wind turbine noise levels are below the ETSU-R-97 noise limits. Therefore, effects resulting from the operation of the Proposed Development would be **not significant**.
- 7.11.3 Sound levels presented are worst-case scenario, taking into account the following conservatisms in the noise assessment:

- predictions are based on downwind conditions for all receptors from all wind farms. In reality, this scenario cannot occur due to the positioning of the turbines of the wind farm sites considered relative to the residential properties assessed.
- a maximum 2dB limit on all topographical screening has been applied, as per ETSU-R-97 methodology. However, the sound pathway from some turbines to receptors are significantly obstructed by large hill masses, likely to result in reductions of noise by more than 2dB.

7.12 Residual Effects

- 7.12.1 No exceedances of the identified absolute noise thresholds have been predicted. As such, **no significant** residual noise effects as a result of the Proposed Development would occur.

7.13 Conclusions of Significance Evaluation

- 7.13.1 No exceedances of the identified absolute noise thresholds have been predicted. As such, **no significant** noise effects as a result of the Proposed Development would occur.

7.14 Implementation of Environmental Measures

Construction and Decommissioning Noise

- 7.14.1 Construction noise is transient in nature and can generally be controlled by following standard industry practices, applying best practicable means and using modern, well-maintained and serviced items of plant.
- 7.14.2 **No significant** noise effects are expected during the construction and decommissioning phases, and no specific mitigation is required with regard to construction noise. However, general guidance for controlling construction noise is given in BS 5228-1:2009+A1:2014. As good practice, the following embedded mitigation measures concerning construction noise would be implemented:
- restricted hours of working for most HGV movements (07:00 to 19:00 Monday to Friday, 07:00 - 13:00 Saturdays) to avoid sensitive periods. Where possible any requirement to work outside these periods would only occur through prior agreement with Argyll and Bute Council (for example turbine erection requires low wind speed conditions and may require longer working hours if conditions are poor at the time);
 - all construction activities would be undertaken in accordance with good practice as set out in BS 5228-1:2009+A1:2014;
 - all employees on the construction site would be advised of quieter methods of operating plant and tools, and to report any damage to noise control measures as soon as they are identified;
 - where practicable, for any particular activity, suitable plant, machinery and working practices would be adopted. All equipment would be maintained in good working order and would be fitted with appropriate noise controls at all times (e.g. silencers, mufflers and/or acoustic hoods); and
 - construction plant capable of generating significant noise and vibration levels would be operated in a manner to minimise the duration of the higher magnitude levels.

Operational Noise

- 7.14.3 As shown in **Section 7.10**, **no significant** noise effects have been identified based on the candidate turbines utilised for this assessment and therefore the Proposed Development should be considered acceptable in terms of the operational noise.

7.15 References

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