

14. Noise

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14. Noise

14.1. Summary

- 14.1.1. The Consented Development comprises 17 wind turbines, whilst the Proposed Varied Development comprises 11 wind turbines with an increased tip height. Other proposed changes include amendments to the access track layout and an increase in the capacity of the Battery Energy Storage System (BESS) from 6 MW to 50 MW. With regards to noise, the changes to the wind turbine layout and candidate wind turbine modelled, and the increase in the capacity of the BESS, are what have been re-assessed in detail.
- 14.1.2. A wind turbine operational noise assessment has been undertaken in accordance with ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' and the Institute of Acoustics Good Practice Guide (IOA GPG). Total ETSU-R-97 Noise Limits (also referred to as cumulative noise limits) have been established for all wind farms in the area by re-using existing baseline noise levels and relevant fixed minimum criteria. Potential cumulative noise impacts were considered in detail with the nearby wind farms of Quantans Hill (in planning, adjacent to the west) and Windy Rig (operational, further to the north).
- 14.1.3. Predicted cumulative operational noise levels indicate that for noise sensitive receptors neighbouring the Proposed Varied Development, cumulative wind turbine noise (from the Proposed Varied Development, Quantans Hill and Windy Rig) would meet the Total ETSU-R-97 Noise Limits at all Noise Assessment Locations (NALs).
- 14.1.4. To consider the possibility that the nearby Quantans Hill Wind Farm is consented and built out, a sharing of the Total ETSU-R-97 Noise Limits between the Proposed Varied Development and Quantans Hill has been calculated, and as a result, a set of Site Specific Noise Limits (SSNLs) have been derived for this scenario. A second set of SSNLs has been calculated for the scenario where Quantans Hill is not consented. Predictions for the Proposed Varied Development operating in isolation would exceed these SSNLs (with and without Quantans Hill) during the daytime at two NALs, but would meet the SSNLs at the other NALs and at all NALs during the night. As such, additional mitigation has been identified to reduce the noise levels from the Proposed Varied Development during the daytime, such that the SSNLs would be met at all NALs based on the candidate turbine being considered. The wind turbine operational noise assessment therefore concludes that there would be no significant effects.
- 14.1.5. Due to the planning status of Quantans Hill, there is potential that that scheme is refused planning consent, or it is consented but not built, therefore, for the purposes of drafting noise related planning conditions for the Proposed Varied Development, two sets of noise limits are proposed (with and without Quantans Hill) as outlined below:
- Quantans Hill is consented and built – In this scenario, the Site Specific Noise Limits detailed within **Tables 14.11** and **14.12** would apply for the Proposed Varied Development.

- Quantans Hill is not consented – In this scenario, the Site Specific Noise Limits detailed within **Tables 14.13** and **14.14** would apply for the Proposed Varied Development.

- 14.1.6. Operational noise from the co-located BESS and substation (which forms part of the Proposed Varied Development as a whole) has also been assessed in accordance with the guiding principles set out in BS 4142. The BESS and substation operational noise assessment concludes that there would be no significant effects.
- 14.1.7. Any noise impacts from construction and decommissioning will be temporary and have already been assessed in the previous EIA Report (Infinergy, 2018) and in the Additional Environmental Information (AEI) Report for the Consented Development (Infinergy, 2019) as having no significant effect. There are no substantial changes to the Proposed Varied Development that suggest this would change. The access tracks would remain within the same pattern of development and would be shorter in length. Whilst some turbines have moved, they remain within the same pattern of development. The construction timetable would be similar to that assessed for the Consented Development (approximately 24 months with a core 16 month period as opposed to 21 months). It is suggested that core hours of work for the construction of the Proposed Varied Development and a Construction Environment Management Plan (CEMP) are conditioned, which is consistent with the approach already taken for the Consented Development.
- 14.1.8. A comparison of the conclusions from the Consented Development and the Proposed Varied Development are included in Table 14.1.

Table 14.1 – Summary of Conclusions – Proposed Varied Development and Consented Development

2018 Section 36 Application, supported by Additional Environmental Information I (2019) and Additional Environmental Information II (2021) - the Consented Development	2026 Section 36C Application - the Proposed Varied Development
The EIA concluded no significant operational noise impact.	Unchanged conclusions.
The EIA concluded no significant construction / decommissioning noise impact.	Unchanged conclusions.

14.2. Introduction

- 14.2.1. This Chapter has been prepared by TNEI Services Ltd to consider the potential noise effects of the Proposed Varied Development. It details the likely significant noise effects of the construction, operation and decommissioning of the Proposed Varied Development on identified nearby receptors (i.e. residential dwellings).

- 14.2.2. The site of the Proposed Varied Development remains the same as the Consented Development and is located approximately 5 km to the east of Carsphairn and 10 km north of St John's Town of Dalry, in northern Dumfries and Galloway.
- 14.2.3. The Consented Development comprises 17 wind turbines, with a maximum blade tip height of 125 m to 149.9 m and, in comparison, the Proposed Varied Development comprises 11 wind turbines, each up to 220 m blade tip height. There are other proposed changes such as amendments to the access track layout and an increase in the capacity of the BESS from 6 MW to 50 MW (refer to **Chapter 4** for a detailed description of the Proposed Varied Development). With regards to noise, the changes to the wind turbine layout and candidate wind turbine modelled, and the increase in the capacity of the BESS, are the key noise considerations that have been re-assessed in detail. These changes will mostly impact operational noise.
- 14.2.4. The potential operational noise impact from the Proposed Varied Development's wind turbines and BESS has been assessed in detail. Other topics, such as noise and vibration from the construction and decommissioning phases of the wind turbines are discussed, however they have not been assessed in detail as no significant changes are anticipated in relation to construction and decommissioning. References are made for these topics, however, to the findings of the original EIA Reports for the Consented Development where appropriate.
- 14.2.5. This Chapter is supported by the following figures and appendices:
- **Figure 14.1:** Noise Assessment Study Area;
 - **Figure 14.2:** BESS and Substation Noise Contour Plot;
 - **Appendix 14.1:** Wind Turbine Coordinates and Noise Data;
 - **Appendix 14.2:** Noise Prediction Graphs;
 - **Appendix 14.3:** Noise Limit Sharing principles between Proposed Varied Development and Quantans Hill; and
 - **Appendix 14.4:** Wind Shear adjustments to background noise levels.

14.3. Legislation, Policy and Guidelines

- 14.3.1. This assessment is carried out in accordance with the principles contained within the following legislation, policy and guidelines:
- National Planning Framework 4 (NPF4) (Scottish Government, 2023);
 - Planning Advice Note (PAN) 1/2011: 'Planning and Noise' (Scottish Government, 2011);
 - Online Onshore Wind: Policy Statement (Scottish Government, 2022);
 - ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (Noise Working Group, 1996);

- 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, 2013);
- British Standard BS 4142:2014+A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound';
- Association of Noise Consultants (ANC). BS 4142:2014+A1:2019 Technical Note. Version 1.0. London: ANC, 2020; and
- ISO 9613-2:2024 'Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors' (ISO, 2024).

14.3.2. NPF4 Policy 11 – Energy states that renewable energy projects must be able to demonstrate how any noise impacts on communities have been addressed through the project's design and any associated mitigation. Policy 23 – Health and Safety outline how *'development proposals that are likely to raise unacceptable noise issues will not be supported'* and states that *'a Noise Impact Assessment may be required where the nature of the proposal or its location suggests that significant effects are likely.'*

14.3.3. The Scottish Government's online Onshore Wind: Policy Statement 2022 (published on 21 December 2022) states in Section 3.7 that in relation to operational wind farm noise:

'The 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.'

14.3.4. The Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG, May 2013) provides guidance on background data collection, data analysis and limit derivation, noise predictions, cumulative issues, reporting requirements and other matters such as noise related planning conditions. The scope of the document as set out in Section 1.2 is:

'This guide presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine developments above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published. The noise limits in ETSU-R-97 have not been examined as these are a matter for Government.'

14.3.5. The IOA GPG main document also refers to six Supplementary Guidance Notes and where applicable these have also been considered in this report.

14.3.6. The guidance contained within ETSU-R-97 and the IOA GPG has therefore been used to assess and rate the operational noise immission from the Proposed Varied Development. These are the same standards and principles as previously used in the Consented Development's noise assessment (EIA Report Chapter 14). Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties would be below the noise limits derived in accordance with ETSU-R-97.

- 14.3.7. Guidance in respect of assessing industrial noise, which is relevant to the operation of the BESS and substation, is given in Planning Advice Note (PAN) 1/2011: 'Planning and Noise,' which states that it can be difficult to assess due to its variable character and that it should be assessed over different time periods, for example day and night, as background noise levels will fluctuate over time.
- 14.3.8. The PAN itself does not present any noise level limits or specific assessment methods, however, guidance on the assessment of general environmental noise is included in the TAN.
- 14.3.9. Whilst the TAN does not include a prescriptive assessment methodology for industrial noise, it does present a framework that should be considered during the planning application process for both a proposed noise generating development (for example, an industrial development) and a new noise sensitive development (for example, a new housing development).
- 14.3.10. The framework is separated into five stages, as follows:
- Stage 1: Initial Process – Identify the Noise Sensitive Receptors (NSRs) and assign them a level of sensitivity;
 - Stage 2: Quantitative Assessment - Determine the change in noise climate and assign a Magnitude of Impact;
 - Stage 3: Qualitative Assessment - "The aim of the qualitative assessment is to provide additional information which may support the outcome under the quantitative assessment or indicate that the classification of the magnitude of the noise impact needs to be modified."
 - Stage 4: Level of Significance – Assign a level of significance of effect depending on the sensitivity of the receptor; and
 - Stage 5: Decision Process – Consider the level of significance of effect alongside the number of receptors affected.
- 14.3.11. Appendix 1 of the TAN refers to a number of technical standards and guidelines that can be referred to, to support the NIA. Of specific relevance to this assessment is BS 4142:1997 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas, which has since been updated to BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound (hereafter referred to as BS 4142).

14.4. Update on Wind Farm Noise Guidance in the UK

- 14.4.1. In February 2023, WSP published 'A review of noise guidance for onshore wind turbines' ('WSP BEIS report'). The report, which was subsequently re-issued as version 5 in September 2023, was commissioned by (the former) UK Government Department for Business, Energy & Industrial Strategy (BEIS). The primary aim of the review was to make a recommendation on whether, in view of government policies on noise and Net Zero, and

available evidence, the existing guidance requires updating. The WSP BEIS report concluded that:

'the guidance would benefit from further review and updating of the aspects identified. This could be supported by currently available evidence, which is summarised in this report. However, the study has also highlighted gaps in the state of knowledge, which should be addressed by further research, to support any updates to the guidance.'

- 14.4.2. A series of recommendations were made regarding further research whilst some additional suggestions are included regarding the development of new or updated guidance. The following recommendation is included on page 26 of the WSP BEIS report:

'the separation of the 'policy position' (addressing the balance between controlling noise impact and enabling renewable energy development), 'technical guidance' (application of the assessment approach), and 'technical justification' (the supporting evidence) into discrete, linked documents'

- 14.4.3. The WSP BEIS report notes at the outset that 'Any views expressed within it do not necessarily represent the views of the UK government or the governments of any of the devolved administrations'. The report does state on page 25 that:

'Consideration should be given to including a clear position statement in guidance confirming the intended policy balance between protection from noise impact, and enabling of renewable energy development (to achieve Net Zero), linked with the wider policies that underpin the government approach to noise management.'

- 14.4.4. The topic of Other Amplitude Modulation (OAM), or also called Excess Amplitude Modulation (EAM), was considered in the WSP BEIS report. The report notes that a metric to rate OAM for operational wind farms provides a suitable approach to measure and quantify OAM (whilst noting that work is ongoing to refine the approach) but also highlights that further work is required to develop a robust mechanism for controlling OAM that could be incorporated into a planning condition. In relation to the potential adoption of a penalty scheme to control OAM the WSP BEIS report notes on page 208 that:

'In practice, the details of applying such a penalty scheme are complicated by the complexities of wind turbine sound measurements. These often involve a considerable amount of data filtering and data aggregation to address the practical difficulties of measuring a highly variable source, which is often also at a level that is relatively low compared with other, fluctuating residual sounds present in the acoustic environment. Such details will need to be carefully considered in further study, and the example planning condition proposed by a group of IOA members in 2017 505 should be considered as a starting point.'

- 14.4.5. In June 2024, the UK Government Department for Energy Security and Net Zero (DESNZ) awarded a contract to Noise Consultants Limited to update ETSU-R-97. A draft update of new guidance 'Assessment and Rating of Wind Turbine Noise' (2025) was published for consultation on 4th July 2025. There is no confirmed date for the publication of final guidance. Given the draft status of the guidance and the recommendations included on the front page of the draft document itself, the consultation draft has not been considered

in this assessment. This is in line with the Onshore Wind Policy Statement 2022, which refers to a potential update and states:

'The Scottish Government is aware that the UK Government has been considering the extent to which ETSU-R-97 may require updating to ensure it is aligned with the potential effects from more modern turbines. The Scottish Government supports this work and we anticipate the results of a short-term review project in due course.'

'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.'

14.4.6. Furthermore, the Scottish Government has developed standard noise conditions for windfarms. The final version of the document was issued on 25th February 2025 and was called 'Standard onshore wind conditions – section 36 consent and deemed planning permission: form and guidance'. Regarding noise conditions, it broadly follows the standard conditions from the IOA GPG and no specific wording relating to OAM is included.

14.4.7. Until further study suggested in the WSP BEIS October 2022 report is completed, and additional guidance is published on OAM, the approach set out in the IOA GPG Section 7.2.1 remains valid:

'The evidence in relation to "Excess" or "Other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM.'

14.4.8. Within the latest research and evidence on OAM, there is no available method to assess the potential occurrence or significance of OAM at a specific site when at the planning stage and when no wind turbines are operating.

14.4.9. Despite the upcoming research or guidance mentioned above, none are in finalised form at the time of writing. As stated in **Section 14.3.6**, the guidance contained within ETSU-R-97 and the IOA GPG has therefore been used to assess and rate the operational noise immission from the Proposed Varied Development. These are the same standards and principles as previously used in the Consented Development's noise assessment (EIA Report Chapter 14).

14.5. Consultation

14.5.1. An EIA Scoping Report was submitted to the Energy Consents Unit (ECU) in July 2024 (ref. ECU00005137). Within the Scoping Report was an outline of the suggested approach to the noise assessment.

14.5.2. A Scoping Opinion was received in October 2024 which contained comments from Dumfries and Galloway Council (DGC) acting as a consultee to the ECU. The Environmental Health Department at DGC provided a Scoping Opinion under reference 24/1563/ENQ. Subsequently in January 2025 TNEI sent a direct consultation letter to one of the Environmental Health Officers (EHO) at DGC to provide an update on the

assumptions being made for the noise assessment. Consideration has been given to the scoping and consultation responses as detailed in **Table 14.2** below.

Table 14.2 – Summary of Noise Scoping and Consultation Responses

Consultee	Key Consultee Comments	Application Action
Dumfries and Galloway Council – Scoping Response by Environmental Health (Nov. 2024)	No objection in principle on noise grounds but a full assessment in accordance with ETSU-R-97 must be undertaken.	This noise assessment provides details of the noise assessment undertaken in accordance with ETSU-R-97 and current good practice for operational noise. The Environmental Health Department was also sent details of some of the key assumptions adopted for operational noise in January 2025, with no response received to date.
	Request for a method statement for construction noise to be provided within the EIA for approval by DGC which outlines mitigation measures.	It is suggested that core hours of work are kept consistent with the current consent and mitigation measures will include the use of good practice during construction to minimise noise. This will be set out in a Construction Environmental Management Plan (CEMP). An outline CEMP is submitted as part this EIA Report (Appendix 4.1). The Environmental Health Department was also sent the above suggestion amongst further details for construction noise (i.e. duration will be less than Current Consent) in January 2025, with no response received to date.

14.6. Assessment Methodology and Significance Criteria

Study Area

- 14.6.1. The study area for this noise assessment includes the noise-sensitive receptors (NSRs) located closest in all directions to the proposed wind turbine locations. The NSRs identified are all residential dwellings and are identical to the ones already assessed for the Consented Development¹. Some of the NSRs identified are also in close proximity to the nearby proposed Quantans Hill.
- 14.6.2. Quantans Hill is a live Section 36 application (ECU00003399) for a wind farm immediately to the west of the Proposed Varied Development site and has been considered in detail within the cumulative noise assessment. Windy Rig is relatively distant to the north but was considered in the previous operational wind farm noise assessment for the Consented Development, so it is also considered for within the cumulative noise assessment.
- 14.6.3. **Figure 14.1** shows the identified NSRs surrounding the Proposed Varied Development.
- 14.6.4. **Figure 14.1** also shows the Noise Monitoring Locations (NMLs) from the baseline survey reported in the noise assessment for the Consented Development.
- 14.6.5. Fourteen Noise Assessment Locations (NALs) are also shown on **Figure 14.1**. The NALs represent the points at which noise levels have been calculated and assessed. The NALs have been selected as representative of the closest and/or most sensitive NSRs in the area.
- 14.6.6. The NALs, and their associated representative NML, are detailed in **Table 14.3**. The label "FI" implies Financial Involvement is assumed.

Table 14.3 – Noise Assessment Locations

NAL ID	NAL Name	Easting	Northing	NML used to Represent Background Noise Levels
NAL1	Moorbrock, Game Keepers Cottage (potential to be FI with Windy Rig but assumed not FI as worst-case)	263007	596471	NML7
NAL2	Strahanna Farm	264528	595864	NML7

¹ Noting that some of the associated coordinates for the NSRs have been updated to ensure they are at the curtilage of the property closest to the wind turbines.

NAL ID	NAL Name	Easting	Northing	NML used to Represent Background Noise Levels
NAL3	Craigengillan Cottage	263627	594936	NML6
NAL4	Craigengillan	263690	594831	NML6
NAL5	Blackmark	265283	591700	NML1
NAL6	Stroanpatrick	264299	591953	NML1
NAL7	Smittons	263281	591688	NML1
NAL8	1 Muirdrochwood	261849	591156	NML2
NAL9	2 Muirdrochwood	261813	591141	NML2
NAL10	Marscalloch Cottage	260382	591387	NML4
NAL11	Nether Loskie	260027	591748	NML4
NAL12	Furmiston (FI with Quantans Hill)	260326	592328	NML3
NAL13	Marbrack Farm (FI with Quantans Hill)	259729	593306	NML5
NAL14	Marbrack Cottage (FI with Quantans Hill)	259648	593236	NML5

Desk Study

- 14.6.7. The assessment includes noise predictions informed by data sources such as Google Earth Aerial Imagery, topographical data and manufacturer noise levels. The noise data used for noise predictions was provided by wind turbine manufacturers.

Field Surveys

- 14.6.8. A noise survey was carried out as part of the previous noise assessment for the Consented Development and the resulting background noise levels have been re-used, this is detailed in the Scoping Report and below in **Section 14.7**.

Assessment of Likely Effect Significance (Wind Turbine Noise)

- 14.6.9. Overall, the aim of the operational wind turbine noise assessment is to:
- Set 'Total ETSU-R-97 Noise Limits' (also called cumulative noise limits) for all wind farms in the area, re-using existing baseline noise levels and relevant fixed minimum criteria;
 - Undertake new noise predictions for the Proposed Varied Development, and cumulative predictions considering the nearby wind farms of Quantans Hill and Windy Rig,
 - Present a comparison of the newly predicted noise levels with the predictions for the Consented Development; and
 - Calculate and suggest 'Site Specific Noise Limits' (SSNLs) for conditioning, specific for the Proposed Varied Development on its own, and considering two scenarios: One where the nearby Quantans Hill is consented and built out, and one scenario where Quantans Hill is not consented.
- 14.6.10. The wind turbine operational noise assessment has been undertaken in accordance with ETSU-R-97 and the IOA GPG. ETSU-R-97 provides a robust basis for determining acceptable noise limits for wind farm developments. ETSU-R-97 recommends that wind farm noise for the daytime periods should be limited to 5 dB(A) above the prevailing background or a fixed minimum level (FML) within the range 35 - 40 dB LA90,10min, whichever is the higher. And for the night-time period that it should be limited to 5 dB(A) above the prevailing background or a fixed minimum level (FML) of 43 dB LA90,10min, whichever is the higher. For Financially Involved properties the FML is raised to 45 dB for both daytime and night-time.
- 14.6.11. Given the cumulative context and the Quantans Hill Section 36 application, the ETSU-R-97 fixed minimum criteria of daytime has been based on the same 40 dB value as used in Quantans Hill and which was agreed by DGC Environmental Health in March 2021 (as documented in the Quantans Hill Environmental Impact Assessment (EIA) Report noise chapter [Natural Power, 2023]) which states:
- "Hayes McKenzie wrote to Dumfries and Galloway Council on 5th March 2021 to describe the proposed approach to the assessment. It was proposed that, to simplify the assessment, cumulative noise would be assessed against a flat 40 dB LA90 noise limit, (except where noise limits applied to consented schemes are already higher than this). At locations that are financially involved with the development, a 45 dB LA90 cumulative noise limit would be applied."*
- 14.6.12. The Total Noise Limits derived for the Proposed Varied Development are based on the full ETSU criteria which is related to background levels or fixed minimums whichever is

the greatest. The Total Noise Limits and fixed minimum criteria used in this assessment are summarised as follows:

- Daytime Without Financial Involvement: 40 dB or Background +5 dB;
- Night-time Without Financial Involvement: 43 dB or Background +5 dB; and
- Daytime & Night-time with Financial Involvement: 45 dB or Background +5 dB.

- 14.6.13. Following an assessment of cumulative noise predictions against Total Noise Limits, this assessment goes a step further and suggests SSNLs to be used for the potential conditioning of the Proposed Varied Development Variation on its own (with and without Quantans Hill). If Quantans Hill is consented and built there would be a requirement to share the Total Noise Limits due to the presence of receptors in close proximity to both the Proposed Varied Development and Quantans Hill. Windy Rig is further away, and it was found that predictions from Windy Rig are at least 10 dB below the Total Noise Limits at all NALs, implying that Windy Rig does not require a portion of the TNL. For the purposes of deriving the SSNL for the Proposed Varied Development, the daytime SSNL is restricted from exceeding the limit that would apply to the Proposed Varied Development in isolation i.e. the greater of Background +5 dB or a fixed minimum limit of 35 dB (the lower end of the range allowed under ETSU-R-97).
- 14.6.14. For noise predictions, the Nordex N163/6.X 7 MW with Serrated Blades and a hub height of 138.5 m has been chosen as the candidate turbine, it is considered to be representative of the type of turbine that could be installed. The exact model of turbine to be installed on the site will be the result of a future tendering process should consent be granted. Achievement of the limits determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Varied Development. All the other turbines modelled in the cumulative assessment and also the turbines assumed for the Consented Development are detailed in **Appendix 14.1**.
- 14.6.15. Noise predictions have been undertaken using the propagation model contained within Part 2 of International Standard ISO 9613-2:2024, 'Acoustics – Attenuation of sound during propagation outdoors'. The model calculates on an octave band basis, attenuation due to geometric spreading, atmospheric absorption, and ground effects. The noise model was set up to provide realistic noise predictions, including mixed ground attenuation ($G=0.5$), atmospheric attenuation relating to 70 % Relative Humidity and 10 °C temperature and a receiver height of 4 m.
- 14.6.16. Typically wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so the effect of wind direction on predicted noise levels have been considered in noise predictions (mostly applicable for cumulative noise predictions).
- 14.6.17. In line with the IOA GPG (2013), an assessment of topography has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and the NALs. Propagation across a valley (concave ground) increases the number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Terrain screening effects

(barrier corrections) act as blocking points, subsequently reductions in sound levels at a given receptor can potentially be observed. The result of the topographical corrections applied are shown in tabular form in **Appendix 14.1**.

- 14.6.18. The use of the term 'significance' in this Chapter in relation to operational wind turbine noise refers to compliance / non-compliance with the ETSU-R-97 derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in ETSU-R-97, then the noise effects are deemed not significant in the context of the EIA Regulations. Any breach of the ETSU-R-97 derived noise limits due to the Proposed Varied Development is deemed to result in a significant effect in the context of the EIA Regulations.

Assessment of Likely Effect Significance (BESS and Substation Noise)

- 14.6.19. There are no fixed noise level limits for industrial noise in the UK, and consideration of the context in which the noise generation occurs is considered with more importance than simply meeting an absolute noise level limit, to determine the likelihood of an adverse impact. This form of assessment, which echoes the five-stage approach set out in the TAN, is set out in BS 4142.
- 14.6.20. The assessment is based on the predicted levels of the assessed sound source compared to the existing background sound levels. It uses, "outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident".
- 14.6.21. In reference to the existing baseline conditions i.e. the environment before any proposed development occurs, BS 4142 uses the following terms:
- **Residual Sound Level:** The sound level of all noise sources in an area, except the sound source to be assessed, measured over a given time interval, t . Described using the metric $L_{Aeq}(t)$.
 - **Background Sound Level:** This is also the sound level of all noise sources in an area except the sound source to be assessed, however, it is quantified by determining the sound level that is exceeded for 90% of the given time interval. Described using the metric $LA_{90}(t)$.
- 14.6.22. The next two noise metrics represent noise attributable to a proposed development, in this case the BESS and substation, only.
- **Specific Sound Level:** The equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, i.e. the sound level of just the sound source to be assessed. Described using the metric $L_{Aeq}(t)$.
 - **Rating Level:** The Specific Sound Level adjusted to consider the characteristics of the sound. The Rating Level is calculated by adding a character correction(s), if required, to the Specific Sound Level, when the sound source contains audible characteristics

such as tonal, impulsive or intermittent components at the receptor location. Described using the metric, LAeq(t).

- 14.6.23. The final noise metric represents the future noise level during the operational phase of a proposed development and can be thought of as the 'Total Sound' i.e. the existing baseline + the proposed development.
- **Ambient Sound Level:** Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far i.e. the sound level of all noise sources in an area, including the sound source to be assessed. Described using the metric, LAeq(t).
- 14.6.24. It is important to note that the descriptors detailed above relate to the BS 4142 assessment standard only. Care should be taken whilst reading this chapter, as other standards use similar terminology in different situations. For example, the descriptor 'Background Sound Level' used in BS 4142, is similar to the 'Background Noise Level' used in ETSU-R-97, however, the reported levels are derived in different manners and cannot be used interchangeably. Both the BS 4142 background sound level and the ETSU-R-97 background noise level are derived from the same baseline dataset but are calculated and reported in a different manner.
- 14.6.25. BS 4142 requires that the assessment considers the context in which the sound occurs, and as such there is no definitive pass/fail element to the standard. Rather, the assessment outcome is an indication as to the likelihood for adverse impact.
- 14.6.26. The BS 4142 assessment is a two-stage process. Initially, an estimate of the impact is made by subtracting the measured Background Sound Level from the Rating Level, and in this regard the standard states:
- 14.6.27. *"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following...*
- a) Typically, the greater this difference, the greater the magnitude of the impact.*
 - b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
 - c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*
- 14.6.28. The second part of the assessment is to then consider the context in which the sound occurs, which may modify the findings of the initial estimate. There are many elements of

context that can be considered, and the following list, which is not exhaustive, gives some examples that could be relevant to the assessment:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound;
- whether specific sound insulation and noise control measures have already been incorporated into a receptor (which would lower the sensitivity of the receptor);
- former uses, at or close to the site;
- the legitimacy of the industrial use, e.g. planning permissions or environmental permits;
- implementation of best practicable means for a given process or activity; and,
- whether the Rating Level represents typical levels, realistic worst-case levels, unlikely worst-case levels etc.

14.6.29. Additional guidance on the BS 4142 assessment methodology is provided in the Association of Noise Consultants' (ANC) BS 4142: Technical Note, which has been authored by the ANC Good Practice Working Group. The guide is "designed to assist readers with a reasonable interpretation and application of BS 4142 as a whole."

Sensitivity of Receptors and Magnitude of Impact

- 14.6.30. BS 4142 is for the assessment of residential receptors only. TAN 1/2011 Table 2.1 provides examples of the sensitivities of various receptor types. For residential receptors, these are classified as having a high level of sensitivity.
- 14.6.31. BS 4142 does not define significance criteria; rather it describes a framework for the measurement of noise and provides a method to determine the likelihood of adverse impact through a qualitative assessment.
- 14.6.32. With regards to qualitative assessments, the TAN states; "The initial step in carrying out a qualitative assessment is to understand what impact the noise will have on the amenities associated with the NSR in regard to the perception of noise," and Table 2.5 of the TAN; 'Example of Assigning Descriptors for Qualitative Impacts from Noise on Residential Properties' can be used to help define the magnitude of impact for residential receptors specifically.
- 14.6.33. TAN Table 2.5 has been replicated here as **Table 14.4** with additional context added (in italics) to align it with the BS 4142 qualitative assessment outcome, which was published after the publication of the TAN.

Table 14.4 – Magnitude of Impact for Residential Receptors (BESS Noise)

Perception	Criteria of Descriptor	Descriptor for Qualitative Magnitude of impact
Noticeable (Very disruptive)	BS 4142 indication of significant adverse impact. Significant changes in behaviour and / or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation / awakening; loss of appetite, significant, medically definable harm.	Major
Noticeable (Disruptive)	BS 4142 indication of adverse impact. Causes an important change in behaviour and / or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	Moderate
Noticeable (Mildly intrusive)	No BS 4142 indication of an adverse impact. Noise can be heard and may cause small changes in behaviour and / or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. Potential for non-awakening sleep disturbance. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Minor
Just Noticeable (Non-intrusive)	BS 4142 Rating Level less than measured background sound levels. Noise can be heard but does not cause any change in behaviour or attitude, e.g. increasing volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Negligible
Not noticeable	BS 4142 Rating Level more than 10 dB below the measured background sound levels.	No Impact

Significance of Effects

- 14.6.34. **Table 14.5** details how the significance of effects from operational noise are determined, with due regard to **Table 14.4**.
- 14.6.35. **Note:** Level of significance is derived for high sensitivity residential receptors only. No other receptor types have been identified or lower sensitivities considered, on the assumption that if noise levels are acceptable for the most sensitive receptors, they will also be acceptable for receptors with lower levels of sensitivity.

Table 14.5 – Level of Significance for High Sensitivity Receptors (BESS noise)

Magnitude of Impact	Level of Significance
Major	Major
Moderate	Moderate
Minor	Minor
Negligible	Negligible
Significant operational noise effects are defined as Moderate or Major .	

Mitigation and Enhancement

- 14.6.36. The candidate turbine is modelled in full operational mode in the main assessment, if noise limits are exceeded noise mitigation measures are available through the use of low noise modes.

Assessment of Residual Effect Significance

- 10.5.15. Following noise mitigation, it is expected that operational wind turbine noise would meet noise limits and as such that there would be no significant residual effect.

Assessment of Cumulative Effects

- 14.6.37. The operational wind turbine noise assessment has taken account of the potential cumulative impacts with other existing or proposed nearby wind farms.

Limitations to Assessment

- 14.6.38. A candidate wind turbine has been used for predictions of operational wind turbine noise from the Proposed Varied Development. The final model of wind turbine to be used may differ from that presented here, however the operational noise levels from the Proposed Varied Development would have to comply with the noise limits imposed within the noise

condition attached to any planning consent. No other assumptions or data gaps have been identified.

14.7. Baseline Conditions

- 14.7.1. The site is located in a rural location with large areas of forestry, hills and valleys in the immediate surroundings. There are a relatively small number of scattered residential properties around the site, which have been considered as NSRs.
- 14.7.2. **Figure 14.1** shows the seven NMLs from the noise monitoring undertaken for the Consented Development. The baseline noise levels measured at the 7 NMLs were standardised to 10 m height wind speeds in accordance with ETSU-R-97. These noise levels were used as a reference to set the noise limits found in Condition 29 of the ECU decision letter dated 21 August 2023 for the Consented Development and have therefore been used here again to set Total ETSU-R-97 Noise Limits.
- 14.7.3. Wind turbine noise assessments consider the background noise levels to quantify the noise environment in the absence of wind turbine noise. There are no significant known or anticipated changes in the local area that would change background noise levels from those measured in 2014 (i.e. no new major roads or industrial developments). Quantans Hill has also not presented any new baseline levels in its recent planning submission (Natural Power, 2023). As such, it is judged that the baseline levels presented for the Consented Development application can be re-used to set limits for the Proposed Varied Development.
- 14.7.4. The background noise levels measured in 2013/2014 were referenced to wind speeds at 91.5 m height standardised to 10 m height in the EIA and AEI for the Consented Development. These have been adjusted using site-specific wind shear to account for the proposed increased hub height of 138.5 m.
- 14.7.5. The wind shear coefficients indicative of the difference in wind speed between 80.7 m and 138.5 m have been calculated based on analysis of measured mast data and the results of a Computational Fluid Dynamics (CFD) study. The measured data used is from two 80 m masts which measured data between May 2019 and March 2023 at heights of 40 m, 61.5 m and 80.7 m at locations (262316, 595065) (M1) and (261474, 592737) (M2). The mast data was inputted into a CFD model and wind shear coefficients of 0.278 at night and 0.249 during the day have been estimated for this site for heights of between 80.7 m and 138.5 m. The same wind shear coefficients have been assumed for between heights of between 91.5 m and 138.5 m and **Appendix 14.4** shows how these wind shear coefficients have been used to adjust the background noise levels accordingly.
- 14.7.6. The ETSU-R-97 background noise curves for each NML are shown in **Table 14.6** for Quiet Daytime and **Table 14.7** for Night-time.

Table 14.6 – Background Noise Levels Quiet Daytime

NML	Wind Speeds (m/s) as Standardised to 10 m Height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1- Smittons	29.0	30.0	31.0	32.0	33.0	33.9	34.9	35.9	37.0	38.1	39.4	40.8
NML2- 1 Muirdrochwood	21.1	22.6	24.1	25.9	28.0	30.1	32.3	34.4	36.4	38.2	39.6	40.6
NML3- Furmiston	24.5	26.6	28.7	30.9	33.1	35.2	37.4	39.5	41.5	43.4	45.2	46.8
NML4- Nether Loskie	29.9	30.9	31.9	32.9	33.9	34.9	35.9	36.9	38.1	39.3	40.5	41.9
NML5- Marbrack	31.7	33.3	34.9	36.5	38.2	39.9	41.7	43.5	45.3	47.2	49.2	51.3
NML6- Craigengillan Cottage	37.0	37.8	38.6	39.4	40.2	41.0	41.9	42.9	44.0	45.2	46.6	48.2
NML7- Moorbrock	26.4	27.8	29.2	30.8	32.5	34.3	36.1	37.8	39.4	40.8	41.9	42.7

Table 14.7 – Background Noise Levels Night-time

NML	Wind Speeds (m/s) as Standardised to 10 m Height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1- Smittons	29.3	30.0	30.7	31.5	32.4	33.4	34.4	35.5	36.6	37.9	39.2	40.5
NML2- 1 Muirdrochwood	20.6	21.8	23.1	24.7	26.7	28.9	31.2	33.6	35.9	38.1	40.0	41.6
NML3- Furmiston	25.3	26.4	27.4	28.9	30.7	32.8	35.1	37.5	39.8	42.2	44.4	46.3
NML4- Nether Loskie	31.1	31.7	32.2	32.9	33.8	34.7	35.7	36.7	37.7	38.8	39.8	40.8
NML5- Marbrack	32.5	33.3	34.0	35.3	36.9	38.7	40.8	43.0	45.1	47.2	49.1	50.8

NML	Wind Speeds (m/s) as Standardised to 10 m Height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML6- Craigengillan Cottage	37.0	37.6	38.3	39.1	40.0	41.0	42.0	43.2	44.4	45.8	47.2	48.6
NML7- Moorbrock	29.1	29.7	30.2	31.2	32.4	33.8	35.4	37.0	38.6	40.0	41.3	42.4

- 14.7.7. To inform BESS and substation operational noise assessment the BS 4142 representative background sound levels have been derived from the same dataset by calculating the average noise level for wind speeds up to and including 4 m/s, as reported in **Tables 14.6 and 14.7**. These are presented in **Table 14.8**. This will provide a conservative estimate of the background sound level during the daytime as the dataset only includes for measured baseline levels during ETSU-R-97 Quiet Daytime, whereas a BS 4142 assessment would typically consider the range of noise levels measured between 07:00 and 23:00 each day.

Table 14.8 – BS 4142 Representative Background Sound Levels, dB LA90_(10mins)

NML	Daytime 07:00 – 23:00	Night-time 23:00 – 07:00
NML1- Smittons	31	30
NML2- 1 Muirdrochwood	23	23
NML3- Furmiston	28	27
NML4- Nether Loskie	31	32
NML5- Marbrack	34	34
NML6- Craigengillan Cottage	38	38
NML7- Moorbrock	29	30

Impacts Scoped Out of Assessment

- 14.7.8. The term infrasound can be defined as the frequency range below 20 Hz, while low frequency noise (LFN) is typically in the frequency range 20 – 200 Hz. Wind turbines do not produce significant levels of infrasound or LFN. As such, the assessment of infrasound and LFN from operational wind turbines has been scoped out of the EIA.

- 14.7.9. In the context of wind turbine noise, Amplitude Modulation (AM) describes a variation in noise level over time; for example, observers may describe a 'whoosh whoosh' sound, which can be heard close to a wind turbine as the blades sweep past. AM of aerodynamic noise is an inherent characteristic of wind turbine noise and was noted in ETSU-R-97. The acoustics community, however, has sought to make a distinction between the AM discussed within ETSU-R-97, which is expected at most wind farms and as such may be considered as 'Normal Amplitude Modulation' (NAM), to the atypical AM that has sometimes been heard at some wind farms, hereinafter referred to as 'Other Amplitude Modulation' (OAM).
- 14.7.10. OAM is used to describe an unusual feature of aerodynamic noise from wind turbines, where a greater than normal degree of regular fluctuation in sound level occurs at blade passing frequency, typically about once per second. At present, there exists no agreed method of predicting the occurrence of OAM and on that basis AM has been scoped out of the EIA.
- 14.7.11. Any impact from on-site construction and decommissioning noise is temporary and was already assessed in the current consent as having no significant effect. There are no substantial changes to the Proposed Varied Development that suggest this would change. The access tracks would remain at similar locations and would be shorter in length. Whilst some turbines have moved, they remain with the same pattern of development. The construction timetable would be similar to that assessed for the Consented Development (approximately 24 months with a core 16 month period as opposed to 21 months). As such construction and decommission noise and vibration has not been re-assessed, however standard mitigation measures are proposed in **Section 14.8**.
- 14.7.12. Similarly, any off-site construction works for the Abnormal Load route (i.e. turbine transfer area) would be localised, have a short duration and be relatively non-invasive (i.e. no piling or deep excavation anticipated). The works would be such, that there is no reasonable prospect of a significant effect and it was not assessed further. Standard mitigation measures during construction as proposed in **Section 14.8** would also apply.
- 14.7.13. As with the Consented Development, the proposed Lorg Wind Farm 132 kV Grid Connection, which passes through the Proposed Varied Development site between T5 and T6, has been scoped out of cumulative noise assessment given the significant separation distance between the two schemes and noise sensitive properties (with the nearest NSR is over 1.7 km from T5 and T6).

14.8. Standard Mitigation

- 14.8.1. Throughout the design process of the Proposed Varied Development the layout was reviewed by undertaking noise predictions to ensure noise limits could be met. The site design process therefore satisfactorily minimised any potential noise impact firstly, through several iterations of site-specific design and secondly, at a higher level, through the use of ETSU-R-97 itself which provides a robust basis for determining appropriate noise limits.
- 14.8.2. For construction noise and vibration, it is suggested that core hours of work are conditioned in the same way as the current consent and mitigation measures will be

implemented through the adoption of good practice during construction to minimise noise. Such measures are provided in BS 5228 and the main measures for this Proposed Varied Development are outlined in the outline CEMP appended to this EIA Report (**Appendix 4.1**). The provision of a CEMP is in accordance with the approach already taken for the Consented Development. An indicative construction schedule is also included in **Chapter 4** of this EIA Report.

14.9. Potential Effects (Wind Turbine Noise)

- 14.9.1. Based on background noise levels and fixed minimum limits, the Total Noise Limits (applicable for all wind turbines in the area) have been established for each of the NALs. **Table 14.9** and **Table 14.10** below summarise the Total Noise Limits as well as the cumulative noise predictions (Proposed Varied Development, Quantans Hill [QH] and Windy Rig [WR]) and resulting exceedances. All values are in dB using noise metric LA90, negative values indicate that limits are met.

Table 14.9 – Cumulative Noise Results - Daytime

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height									
		4	5	6	7	8	9	10	11	12	
NAL1-Moorbrock, Game Keepers Cottage (assumed not FI with WR as worst-case)	Total Noise Limit	40.0	40.0	40.0	41.1	42.8	44.4	45.8	46.9	47.7	
	Predicted Cumulative Noise	30.2	35.0	39.0	39.8	39.8	39.8	39.8	39.8	39.8	
	Exceedance Level	-9.8	-5.0	-1.0	-1.3	-3.0	-4.6	-6.0	-7.1	-7.9	
NAL2-Strahanna Farm	Total Noise Limit	40.0	40.0	40.0	41.1	42.8	44.4	45.8	46.9	47.7	
	Predicted Cumulative Noise	24.2	29.0	33.0	33.8	33.8	33.8	33.8	33.8	33.8	
	Exceedance Level	-15.8	-11.0	-7.0	-7.3	-9.0	-10.6	-12.0	-13.1	-13.9	
NAL3-Craigengillan Cottage	Total Noise Limit	44.4	45.2	46.0	46.9	47.9	49.0	50.2	51.6	53.2	
	Predicted Cumulative Noise	29.7	34.5	38.5	39.3	39.3	39.3	39.3	39.3	39.3	
	Exceedance Level	-14.7	-10.7	-7.5	-7.6	-8.6	-9.7	-10.9	-12.3	-13.9	
NAL4-Craigengillan	Total Noise Limit	44.4	45.2	46.0	46.9	47.9	49.0	50.2	51.6	53.2	
	Predicted Cumulative Noise	29.1	33.9	37.9	38.6	38.7	38.7	38.7	38.7	38.7	
	Exceedance Level	-15.3	-11.3	-8.1	-8.3	-9.2	-10.3	-11.5	-12.9	-14.5	
NAL5-Blackmark	Total Noise Limit	40.0	40.0	40.0	40.0	40.9	42.0	43.1	44.4	45.8	
	Predicted Cumulative Noise	22.1	27.0	30.9	31.6	31.6	31.6	31.6	31.6	31.6	
	Exceedance Level	-17.9	-13.0	-9.1	-8.4	-9.3	-10.4	-11.5	-12.8	-14.2	
NAL6-Stroanpatrick	Total Noise Limit	40.0	40.0	40.0	40.0	40.9	42.0	43.1	44.4	45.8	
	Predicted Cumulative Noise	23.3	28.1	32.1	32.7	32.8	32.8	32.8	32.8	32.8	
	Exceedance Level	-16.7	-11.9	-7.9	-7.3	-8.1	-9.2	-10.3	-11.6	-13.0	
NAL7-Smittons	Total Noise Limit	40.0	40.0	40.0	40.0	40.9	42.0	43.1	44.4	45.8	
	Predicted Cumulative Noise	26.7	31.5	35.5	36.2	36.2	36.2	36.2	36.2	36.2	
	Exceedance Level	-13.3	-8.5	-4.5	-3.8	-4.7	-5.8	-6.9	-8.2	-9.6	
NAL8-1 Muirdrochwood	Total Noise Limit	40.0	40.0	40.0	40.0	40.0	41.4	43.2	44.6	45.6	
	Predicted Cumulative Noise	27.3	32.1	36.1	36.7	36.7	36.7	36.7	36.7	36.7	
	Exceedance Level	-12.7	-7.9	-3.9	-3.3	-3.3	-4.7	-6.5	-7.9	-8.9	

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height									
		4	5	6	7	8	9	10	11	12	
NAL9-2 Muirdrochwood	Total Noise Limit	40.0	40.0	40.0	40.0	40.0	41.4	43.2	44.6	45.6	
	Predicted Cumulative Noise	27.1	31.9	35.9	36.5	36.5	36.5	36.5	36.5	36.5	
	Exceedance Level	-12.9	-8.1	-4.1	-3.5	-3.5	-4.9	-6.7	-8.1	-9.1	
NAL10-Marscalloch Cottage	Total Noise Limit	40.0	40.0	40.0	40.9	41.9	43.1	44.3	45.5	46.9	
	Predicted Cumulative Noise	26.4	31.3	34.8	35.3	35.3	35.3	35.3	35.3	35.3	
	Exceedance Level	-13.6	-8.7	-5.2	-5.6	-6.6	-7.8	-9.0	-10.2	-11.6	
NAL11-Nether Loskie	Total Noise Limit	40.0	40.0	40.0	40.9	41.9	43.1	44.3	45.5	46.9	
	Predicted Cumulative Noise	27.3	32.2	35.6	36.0	36.1	36.1	36.1	36.1	36.1	
	Exceedance Level	-12.7	-7.8	-4.4	-4.9	-5.8	-7.0	-8.2	-9.4	-10.8	
NAL12-Furmiston (FI with QH)	Total Noise Limit	45.0	45.0	45.0	45.0	45.0	46.5	48.4	50.2	51.8	
	Predicted Cumulative Noise	32.2	37.1	40.4	40.8	40.8	40.8	40.8	40.8	40.8	
	Exceedance Level	-12.8	-7.9	-4.6	-4.2	-4.2	-5.7	-7.6	-9.4	-11.0	
NAL13-MarbrackFarm (FI with QH)	Total Noise Limit	45.0	45.0	45.0	46.7	48.5	50.3	52.2	54.2	56.3	
	Predicted Cumulative Noise	33.5	38.4	41.5	41.8	41.8	41.8	41.8	41.8	41.8	
	Exceedance Level	-11.5	-6.6	-3.5	-4.9	-6.7	-8.5	-10.4	-12.4	-14.5	
NAL14-Marbrack Cottage (FI with QH)	Total Noise Limit	45.0	45.0	45.0	46.7	48.5	50.3	52.2	54.2	56.3	
	Predicted Cumulative Noise	33.0	37.9	41.1	41.4	41.4	41.4	41.4	41.4	41.4	
	Exceedance Level	-12.0	-7.1	-3.9	-5.3	-7.1	-8.9	-10.8	-12.8	-14.9	

Table 14.10 – Cumulative Noise Results – Night-time

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height								
		4	5	6	7	8	9	10	11	12
NAL1-Moorbrock, Game Keepers Cottage (assumed not FI with WR as worst-case)	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.6	45.0	46.3	47.4
	Predicted Cumulative Noise	30.2	35.0	39.0	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-12.8	-8.0	-4.0	-3.2	-3.2	-3.8	-5.2	-6.5	-7.6
NAL2-Strahanna Farm	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.6	45.0	46.3	47.4
	Predicted Cumulative Noise	24.2	29.0	33.0	33.8	33.8	33.8	33.8	33.8	33.8
	Exceedance Level	-18.8	-14.0	-10.0	-9.2	-9.2	-9.8	-11.2	-12.5	-13.6
NAL3-Craigengillan Cottage	Total Noise Limit	44.1	45.0	46.0	47.0	48.2	49.4	50.8	52.2	53.6
	Predicted Cumulative Noise	29.7	34.5	38.5	39.3	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-14.4	-10.5	-7.5	-7.7	-8.9	-10.1	-11.5	-12.9	-14.3
NAL4-Craigengillan	Total Noise Limit	44.1	45.0	46.0	47.0	48.2	49.4	50.8	52.2	53.6
	Predicted Cumulative Noise	29.1	33.9	37.9	38.6	38.7	38.7	38.7	38.7	38.7
	Exceedance Level	-15.0	-11.1	-8.1	-8.4	-9.5	-10.7	-12.1	-13.5	-14.9
NAL5-Blackmark	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Cumulative Noise	22.1	27.0	30.9	31.6	31.6	31.6	31.6	31.6	31.6

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height								
		4	5	6	7	8	9	10	11	12
	Exceedance Level	-20.9	-16.0	-12.1	-11.4	-11.4	-11.4	-11.4	-12.6	-13.9
NAL6-Stroanpatrick	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Cumulative Noise	23.3	28.1	32.1	32.7	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-19.7	-14.9	-10.9	-10.3	-10.2	-10.2	-10.2	-11.4	-12.7
NAL7-Smittons	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Cumulative Noise	26.7	31.5	35.5	36.2	36.2	36.2	36.2	36.2	36.2
	Exceedance Level	-16.3	-11.5	-7.5	-6.8	-6.8	-6.8	-6.8	-8.0	-9.3
NAL8-1 Muirdrochwood	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.1	45.0	46.6
	Predicted Cumulative Noise	27.3	32.1	36.1	36.7	36.7	36.7	36.7	36.7	36.7
	Exceedance Level	-15.7	-10.9	-6.9	-6.3	-6.3	-6.3	-6.4	-8.3	-9.9
NAL9-2 Muirdrochwood	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.1	45.0	46.6
	Predicted Cumulative Noise	27.1	31.9	35.9	36.5	36.5	36.5	36.5	36.5	36.5
	Exceedance Level	-15.9	-11.1	-7.1	-6.5	-6.5	-6.5	-6.6	-8.5	-10.1
NAL10-Marscalloch Cottage	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.8	44.8	45.8
	Predicted Cumulative Noise	26.4	31.3	34.8	35.3	35.3	35.3	35.3	35.3	35.3
	Exceedance Level	-16.6	-11.7	-8.2	-7.7	-7.7	-7.7	-8.5	-9.5	-10.5
NAL11-Nether Loskie	Total Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.8	44.8	45.8
	Predicted Cumulative Noise	27.3	32.2	35.6	36.0	36.1	36.1	36.1	36.1	36.1
	Exceedance Level	-15.7	-10.8	-7.4	-7.0	-6.9	-6.9	-7.7	-8.7	-9.7
NAL12-Furmiston (FI with QH)	Total Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	47.2	49.4	51.3
	Predicted Cumulative Noise	32.2	37.1	40.4	40.8	40.8	40.8	40.8	40.8	40.8
	Exceedance Level	-12.8	-7.9	-4.6	-4.2	-4.2	-4.2	-6.4	-8.6	-10.5
NAL13-Marbrack Farm (FI with QH)	Total Noise Limit	45.0	45.0	45.0	45.8	48.0	50.1	52.2	54.1	55.8
	Predicted Cumulative Noise	33.5	38.4	41.5	41.8	41.8	41.8	41.8	41.8	41.8
	Exceedance Level	-11.5	-6.6	-3.5	-4.0	-6.2	-8.3	-10.4	-12.3	-14.0
NAL14-Marbrack Cottage (FI with QH)	Total Noise Limit	45.0	45.0	45.0	45.8	48.0	50.1	52.2	54.1	55.8
	Predicted Cumulative Noise	33.0	37.9	41.1	41.4	41.4	41.4	41.4	41.4	41.4
	Exceedance Level	-12.0	-7.1	-3.9	-4.4	-6.6	-8.7	-10.8	-12.7	-14.4

- 14.9.2. The results show that the predicted cumulative wind turbine noise levels meet the Total Noise Limits (TNL) under all wind speeds at all NALs during both the daytime and night-time periods. As such, there would be no significant cumulative operational noise effects.
- 14.9.3. Furthermore, the results from **Table 14.9** and **Table 14.10** are presented in graphical form in Graphics 1.1 to 1.14 of **Appendix 14.2**. The graphics also includes further information such as a break-down of predictions from the Proposed Varied Development on its own, the Consented Development on its own and the nearby wind farms of Quantans Hill and Windy Rig on their own.

- 14.9.4. On the graphics the predictions of the Proposed Varied Development can be compared to the Consented Development.
- 14.9.5. The graphics also show that Windy Rig predictions at the receptor NAL1-Moorbrock, Game Keepers Cottage (the closest to Windy Rig) are more than 10 dB below the Total Noise Limits. Windy Rig is therefore not contributing significantly at any of the NALs and no detailed sharing of limits with Windy Rig is required. In other words, if any logarithmic subtraction was undertaken of the TNL minus Windy Rig predictions (as per the method used in the Consented Development noise assessment), it would result in the SSNL calculated for the Proposed Varied Development being equal to the TNL.
- 14.9.6. Sharing of the noise limits with Quantans Hill would be required in the event that the scheme is consented and built, due to its proximity to the Proposed Varied Development and the location of properties between both schemes. A set of suggested principles by which the noise limit can be shared are provided in **Appendix 14.3**.
- 14.9.7. The SSNLs have been calculated by sharing the TNL with Quantans Hill using the principles outlined in **Appendix 14.3** in the event that the scheme is consented and built. The SSNLs and noise predictions for the Proposed Varied Development on its own are summarised in **Table 14.11** and **Table 14.12** and also presented in graphical form as Graphics 2.1 to 2.14 in **Appendix 14.2**.

Table 14.11 – Site Specific Noise Limits (SSNL) Results when Quantans Hill is Consented and Built - Daytime

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height								
		4	5	6	7	8	9	10	11	12
NAL1-Moorbrock, Game Keepers Cottage (assumed not FI with WR as worst-case)	SSNL Noise Limit	35.8	37.5	39.3	41.1	42.8	44.4	45.8	46.9	47.7
	Predicted Proposed Varied Development on its own	29.6	34.5	38.6	39.3	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-6.2	-3.0	-0.7	-1.8	-3.5	-5.1	-6.5	-7.6	-8.4
NAL2-Strahanna Farm	SSNL Noise Limit	35.8	37.5	39.3	41.1	42.8	44.4	45.8	46.9	47.7
	Predicted Proposed Varied Development on its own	23.2	28.1	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-12.6	-9.4	-7.2	-8.3	-10.0	-11.6	-13.0	-14.1	-14.9
NAL3-Craigengillan Cottage	SSNL Noise Limit	44.4	45.2	46.0	46.9	47.9	49.0	50.2	51.6	53.2
	Predicted Proposed Varied Development on its own	29.2	34.1	38.1	38.8	38.8	38.8	38.8	38.8	38.8
	Exceedance Level	-15.2	-11.1	-7.9	-8.1	-9.1	-10.2	-11.4	-12.8	-14.4
NAL4-Craigengillan	SSNL Noise Limit	44.4	45.2	46.0	46.9	47.9	49.0	50.2	51.6	53.2
	Predicted Proposed Varied Development on its own	28.6	33.4	37.5	38.2	38.2	38.2	38.2	38.2	38.2
	Exceedance Level	-15.8	-11.8	-8.5	-8.7	-9.7	-10.8	-12.0	-13.4	-15.0
NAL5-Blackmark	SSNL Noise Limit	37.0	38.0	38.9	39.9	40.9	42.0	43.1	44.4	45.8
	Predicted Proposed Varied Development on its own	21.0	25.9	29.9	30.6	30.6	30.6	30.6	30.6	30.6

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height								
		4	5	6	7	8	9	10	11	12
	Exceedance Level	-16.0	-12.1	-9.0	-9.3	-10.3	-11.4	-12.5	-13.8	-15.2
NAL6-Stroanpatrick	SSNL Noise Limit	37.0	38.0	38.9	39.9	40.9	42.0	43.1	44.4	45.8
	Predicted Proposed Varied Development on its own	22.5	27.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
	Exceedance Level	-14.5	-10.6	-7.4	-7.7	-8.7	-9.8	-10.9	-12.2	-13.6
NAL7-Smittons	SSNL Noise Limit	37.0	38.0	38.9	39.9	40.9	42.0	43.1	44.4	45.8
	Predicted Proposed Varied Development on its own	26.1	30.9	35.0	35.7	35.7	35.7	35.7	35.7	35.7
	Exceedance Level	-10.9	-7.1	-3.9	-4.2	-5.2	-6.3	-7.4	-8.7	-10.1
NAL8-1 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.7	31.5	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-8.3	-3.5	0.5	-1.0	-3.1	-5.1	-6.9	-8.3	-9.3
NAL9-2 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.4	31.3	35.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-8.6	-3.7	0.2	-1.3	-3.4	-5.4	-7.2	-8.6	-9.6
NAL10-Marscalloch Cottage	SSNL Noise Limit	37.0	37.0	37.0	37.9	38.9	40.1	41.3	42.5	43.9
	Predicted Proposed Varied Development on its own	23.3	28.1	32.2	32.9	32.9	32.9	32.9	32.9	32.9
	Exceedance Level	-13.7	-8.9	-4.8	-5.0	-6.0	-7.2	-8.4	-9.6	-11.0
NAL11-Nether Loskie	SSNL Noise Limit	37.0	37.0	37.0	37.9	38.9	40.1	41.3	42.5	43.9
	Predicted Proposed Varied Development on its own	22.8	27.6	31.7	32.4	32.4	32.4	32.4	32.4	32.4
	Exceedance Level	-14.2	-9.4	-5.3	-5.5	-6.5	-7.7	-8.9	-10.1	-11.5
NAL12-Furmiston	SSNL Noise Limit	35.9	38.0	38.0	38.0	38.0	39.5	41.4	43.2	44.8
	Predicted Proposed Varied Development on its own	26.2	31.1	35.1	35.8	35.8	35.8	35.8	35.8	35.8
	Exceedance Level	-9.7	-6.9	-2.9	-2.2	-2.2	-3.7	-5.6	-7.4	-9.0
NAL13-Marbrack Farm	SSNL Noise Limit	35.0	35.0	35.0	36.7	38.5	40.3	42.2	44.2	46.3
	Predicted Proposed Varied Development on its own	23.6	28.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-11.4	-6.6	-2.5	-3.5	-5.3	-7.1	-9.0	-11.0	-13.1
NAL14-Marbrack Cottage	SSNL Noise Limit	35.0	35.0	35.0	36.7	38.5	40.3	42.2	44.2	46.3
	Predicted Proposed Varied Development on its own	23.2	28.0	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-11.8	-7.0	-2.9	-3.9	-5.7	-7.5	-9.4	-11.4	-13.5

Table 14.12 – Site Specific Noise Limits (SSNL) Results when Quantans Hill is Built – Night-time

NAL	Parameter	Wind Speeds (m/s) as standardised to 10 m height								
		4	5	6	7	8	9	10	11	12
NAL1-Moorbrock, Game Keepers Cottage (assumed not FI with WR as worst-case)	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.6	45.0	46.3	47.4
	Predicted Proposed Varied Development on its own	29.6	34.5	38.6	39.3	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-13.4	-8.5	-4.4	-3.7	-3.7	-4.3	-5.7	-7.0	-8.1
NAL2-Strahanna Farm	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.6	45.0	46.3	47.4
	Predicted Proposed Varied Development on its own	23.2	28.1	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-19.8	-14.9	-10.9	-10.2	-10.2	-10.8	-12.2	-13.5	-14.6
NAL3-Craigengillan Cottage	SSNL Noise Limit	44.1	45.0	46.0	47.0	48.2	49.4	50.8	52.2	53.6
	Predicted Proposed Varied Development on its own	29.2	34.1	38.1	38.8	38.8	38.8	38.8	38.8	38.8
	Exceedance Level	-14.9	-10.9	-7.9	-8.2	-9.4	-10.6	-12.0	-13.4	-14.8
NAL4-Craigengillan	SSNL Noise Limit	44.1	45.0	46.0	47.0	48.2	49.4	50.8	52.2	53.6
	Predicted Proposed Varied Development on its own	28.6	33.4	37.5	38.2	38.2	38.2	38.2	38.2	38.2
	Exceedance Level	-15.5	-11.6	-8.5	-8.8	-10.0	-11.2	-12.6	-14.0	-15.4
NAL5-Blackmark	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Proposed Varied Development on its own	21.0	25.9	29.9	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-22.0	-17.1	-13.1	-12.4	-12.4	-12.4	-12.4	-13.6	-14.9
NAL6-Stroanpatrick	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Proposed Varied Development on its own	22.5	27.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
	Exceedance Level	-20.5	-15.6	-11.5	-10.8	-10.8	-10.8	-10.8	-12.0	-13.3
NAL7-Smittons	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Proposed Varied Development on its own	26.1	30.9	35.0	35.7	35.7	35.7	35.7	35.7	35.7
	Exceedance Level	-16.9	-12.1	-8.0	-7.3	-7.3	-7.3	-7.3	-8.5	-9.8
NAL8-1 Muirdrochwood	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.1	45.0	46.6
	Predicted Proposed Varied Development on its own	26.7	31.5	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-16.3	-11.5	-7.4	-6.7	-6.7	-6.7	-6.8	-8.7	-10.3
NAL9-2 Muirdrochwood	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.1	45.0	46.6
	Predicted Proposed Varied Development on its own	26.4	31.3	35.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-16.6	-11.7	-7.7	-7.0	-7.0	-7.0	-7.1	-9.0	-10.6
NAL10-Marscalloch Cottage	SSNL Noise Limit	40.0	40.0	40.0	40.0	40.0	40.0	40.8	41.8	42.8
	Predicted Proposed Varied Development on its own	23.3	28.1	32.2	32.9	32.9	32.9	32.9	32.9	32.9
	Exceedance Level	-16.7	-11.9	-7.8	-7.1	-7.1	-7.1	-7.9	-8.9	-9.9
	SSNL Noise Limit	40.0	40.0	40.0	40.0	40.0	40.0	40.8	41.8	42.8

NAL	Parameter	Wind Speeds (m/s) as standardised to 10 m height								
		4	5	6	7	8	9	10	11	12
NAL11-Nether Loskie	Predicted Proposed Varied Development on its own	22.8	27.6	31.7	32.4	32.4	32.4	32.4	32.4	32.4
	Exceedance Level	-17.2	-12.4	-8.3	-7.6	-7.6	-7.6	-8.4	-9.4	-10.4
NAL12-Furmiston	SSNL Noise Limit	38.0	38.0	38.0	38.0	38.0	38.0	40.2	42.4	44.3
	Predicted Proposed Varied Development on its own	26.2	31.1	35.1	35.8	35.8	35.8	35.8	35.8	35.8
	Exceedance Level	-11.8	-6.9	-2.9	-2.2	-2.2	-2.2	-4.4	-6.6	-8.5
NAL13-Marbrack Farm	SSNL Noise Limit	35.0	35.0	35.0	35.8	38.0	40.1	42.2	44.1	45.8
	Predicted Proposed Varied Development on its own	23.6	28.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-11.4	-6.6	-2.5	-2.6	-4.8	-6.9	-9.0	-10.9	-12.6
NAL14-Marbrack Cottage	SSNL Noise Limit	35.0	35.0	35.0	35.8	38.0	40.1	42.2	44.1	45.8
	Predicted Proposed Varied Development on its own	23.2	28.0	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-11.8	-7.0	-2.9	-3.0	-5.2	-7.3	-9.4	-11.3	-13.0

- 14.9.8. The results show that the predicted noise immission from the Proposed Varied Development operating on its own (with the selected candidate model in full mode) exceed the SSNLs at two NALs (8 & 9) at one wind speed (6 m/s) during daytime periods. As such, additional mitigation is proposed in order to reduce the noise immission from the Proposed Varied Development in these conditions. The predicted noise immission from the Proposed Varied Development meet the SSNLs under all other conditions and at all other NALs for both daytime and night-time periods.
- 14.9.9. The candidate turbine was chosen as it is considered to be representative of the type of turbine that could be installed at the site. There are a number of wind turbine makes and models that may be suitable for the Proposed Varied Development, should the proposal receive planning permission the final choice of turbine would be subject to a competitive tendering process. The final choice of turbine would have to meet the SSNLs. It is recommended that the SSNLs listed in **Tables 14.11 and 14.12** above are adopted in the planning conditions of the Proposed Varied Development for the scenario where the nearby Quantans Hill is consented and built.
- 14.9.10. For the scenario where the nearby Quantans Hill is not consented, SSNLs for the Proposed Varied Development have been derived based on the fixed minimum limits applicable to the Proposed Varied Development in isolation i.e. 35 dB during daytime periods and 43 dB at night and with no financial involvement assumptions for properties FI with Quantans Hill. The resulting SSNLs are detailed in **Table 14.13** and **Table 14.14** for daytime and night-time periods. The SSNLs are also presented in graphical form as Graphics 3.1 to 3.14 in **Appendix 14.2**.

Table 14.13 – Site Specific Noise Limits (SSNL) Results when Quantans Hill is not Consented - Daytime

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height								
		4	5	6	7	8	9	10	11	12
NAL1-Moorbrock, Game Keepers Cottage (assumed not FI with WR as worst-case)	SSNL Noise Limit	35.8	37.5	39.3	41.1	42.8	44.4	45.8	46.9	47.7
	Predicted Proposed Varied Development on its own	29.6	34.5	38.6	39.3	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-6.2	-3.0	-0.7	-1.8	-3.5	-5.1	-6.5	-7.6	-8.4
NAL2-Strahanna Farm	SSNL Noise Limit	35.8	37.5	39.3	41.1	42.8	44.4	45.8	46.9	47.7
	Predicted Proposed Varied Development on its own	23.2	28.1	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-12.6	-9.4	-7.2	-8.3	-10.0	-11.6	-13.0	-14.1	-14.9
NAL3-Craigengillan Cottage	SSNL Noise Limit	44.4	45.2	46.0	46.9	47.9	49.0	50.2	51.6	53.2
	Predicted Proposed Varied Development on its own	29.2	34.1	38.1	38.8	38.8	38.8	38.8	38.8	38.8
	Exceedance Level	-15.2	-11.1	-7.9	-8.1	-9.1	-10.2	-11.4	-12.8	-14.4
NAL4-Craigengillan	SSNL Noise Limit	44.4	45.2	46.0	46.9	47.9	49.0	50.2	51.6	53.2
	Predicted Proposed Varied Development on its own	28.6	33.4	37.5	38.2	38.2	38.2	38.2	38.2	38.2
	Exceedance Level	-15.8	-11.8	-8.5	-8.7	-9.7	-10.8	-12.0	-13.4	-15.0
NAL5-Blackmark	SSNL Noise Limit	37.0	38.0	38.9	39.9	40.9	42.0	43.1	44.4	45.8
	Predicted Proposed Varied Development on its own	21.0	25.9	29.9	30.6	30.6	30.6	30.6	30.6	30.6
	Exceedance Level	-16.0	-12.1	-9.0	-9.3	-10.3	-11.4	-12.5	-13.8	-15.2
NAL6-Stroanpatrick	SSNL Noise Limit	37.0	38.0	38.9	39.9	40.9	42.0	43.1	44.4	45.8
	Predicted Proposed Varied Development on its own	22.5	27.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
	Exceedance Level	-14.5	-10.6	-7.4	-7.7	-8.7	-9.8	-10.9	-12.2	-13.6
NAL7-Smittons	SSNL Noise Limit	37.0	38.0	38.9	39.9	40.9	42.0	43.1	44.4	45.8
	Predicted Proposed Varied Development on its own	26.1	30.9	35.0	35.7	35.7	35.7	35.7	35.7	35.7
	Exceedance Level	-10.9	-7.1	-3.9	-4.2	-5.2	-6.3	-7.4	-8.7	-10.1
NAL8-1 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.7	31.5	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-8.3	-3.5	0.5	-1.0	-3.1	-5.1	-6.9	-8.3	-9.3
NAL9-2 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.4	31.3	35.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-8.6	-3.7	0.2	-1.3	-3.4	-5.4	-7.2	-8.6	-9.6
NAL10-Marscalloch Cottage	SSNL Noise Limit	37.9	38.9	39.9	40.9	41.9	43.1	44.3	45.5	46.9
	Predicted Proposed Varied Development on its own	23.3	28.1	32.2	32.9	32.9	32.9	32.9	32.9	32.9
	Exceedance Level	-14.6	-10.8	-7.7	-8.0	-9.0	-10.2	-11.4	-12.6	-14.0

NAL	Parameter	Wind Speeds (m/s) as Standardised to 10 m Height								
		4	5	6	7	8	9	10	11	12
NAL11-Nether Loskie	SSNL Noise Limit	37.9	38.9	39.9	40.9	41.9	43.1	44.3	45.5	46.9
	Predicted Proposed Varied Development on its own	22.8	27.6	31.7	32.4	32.4	32.4	32.4	32.4	32.4
	Exceedance Level	-15.1	-11.3	-8.2	-8.5	-9.5	-10.7	-11.9	-13.1	-14.5
NAL12-Furmiston	SSNL Noise Limit	35.9	38.1	40.2	42.4	44.5	46.5	48.4	50.2	51.8
	Predicted Proposed Varied Development on its own	26.2	31.1	35.1	35.8	35.8	35.8	35.8	35.8	35.8
	Exceedance Level	-9.7	-7.0	-5.1	-6.6	-8.7	-10.7	-12.6	-14.4	-16.0
NAL13-Marbrack Farm	SSNL Noise Limit	41.5	43.2	44.9	46.7	48.5	50.3	52.2	54.2	56.3
	Predicted Proposed Varied Development on its own	23.6	28.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-17.9	-14.8	-12.4	-13.5	-15.3	-17.1	-19.0	-21.0	-23.1
NAL14-Marbrack Cottage	SSNL Noise Limit	41.5	43.2	44.9	46.7	48.5	50.3	52.2	54.2	56.3
	Predicted Proposed Varied Development on its own	23.2	28.0	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-18.3	-15.2	-12.8	-13.9	-15.7	-17.5	-19.4	-21.4	-23.5

Table 14.14 – Site Specific Noise Limits (SSNL) results when Quantans Hill is not Consented – Night-time

NAL	Parameter	Wind Speeds (m/s) as standardised to 10 m height								
		4	5	6	7	8	9	10	11	12
NAL1-Moorbrock, Game Keepers Cottage (assumed not FI with WR as worst-case)	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.6	45.0	46.3	47.4
	Predicted Proposed Varied Development on its own	29.6	34.5	38.6	39.3	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-13.4	-8.5	-4.4	-3.7	-3.7	-4.3	-5.7	-7.0	-8.1
NAL2-Strahanna Farm	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.6	45.0	46.3	47.4
	Predicted Proposed Varied Development on its own	23.2	28.1	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-19.8	-14.9	-10.9	-10.2	-10.2	-10.8	-12.2	-13.5	-14.6
NAL3-Craigengillan Cottage	SSNL Noise Limit	44.1	45.0	46.0	47.0	48.2	49.4	50.8	52.2	53.6
	Predicted Proposed Varied Development on its own	29.2	34.1	38.1	38.8	38.8	38.8	38.8	38.8	38.8
	Exceedance Level	-14.9	-10.9	-7.9	-8.2	-9.4	-10.6	-12.0	-13.4	-14.8
NAL4-Craigengillan	SSNL Noise Limit	44.1	45.0	46.0	47.0	48.2	49.4	50.8	52.2	53.6
	Predicted Proposed Varied Development on its own	28.6	33.4	37.5	38.2	38.2	38.2	38.2	38.2	38.2
	Exceedance Level	-15.5	-11.6	-8.5	-8.8	-10.0	-11.2	-12.6	-14.0	-15.4
NAL5-Blackmark	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Proposed Varied Development on its own	21.0	25.9	29.9	30.6	30.6	30.6	30.6	30.6	30.6

NAL	Parameter	Wind Speeds (m/s) as standardised to 10 m height								
		4	5	6	7	8	9	10	11	12
	Exceedance Level	-22.0	-17.1	-13.1	-12.4	-12.4	-12.4	-12.4	-13.6	-14.9
NAL6-Stroanpatrick	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Proposed Varied Development on its own	22.5	27.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
	Exceedance Level	-20.5	-15.6	-11.5	-10.8	-10.8	-10.8	-10.8	-12.0	-13.3
NAL7-Smittons	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	45.5
	Predicted Proposed Varied Development on its own	26.1	30.9	35.0	35.7	35.7	35.7	35.7	35.7	35.7
	Exceedance Level	-16.9	-12.1	-8.0	-7.3	-7.3	-7.3	-7.3	-8.5	-9.8
NAL8-1 Muirdrochwood	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.1	45.0	46.6
	Predicted Proposed Varied Development on its own	26.7	31.5	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-16.3	-11.5	-7.4	-6.7	-6.7	-6.7	-6.8	-8.7	-10.3
NAL9-2 Muirdrochwood	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.1	45.0	46.6
	Predicted Proposed Varied Development on its own	26.4	31.3	35.3	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-16.6	-11.7	-7.7	-7.0	-7.0	-7.0	-7.1	-9.0	-10.6
NAL10-Marscalloch Cottage	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.8	44.8	45.8
	Predicted Proposed Varied Development on its own	23.3	28.1	32.2	32.9	32.9	32.9	32.9	32.9	32.9
	Exceedance Level	-19.7	-14.9	-10.8	-10.1	-10.1	-10.1	-10.9	-11.9	-12.9
NAL11-Nether Loskie	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.8	44.8	45.8
	Predicted Proposed Varied Development on its own	22.8	27.6	31.7	32.4	32.4	32.4	32.4	32.4	32.4
	Exceedance Level	-20.2	-15.4	-11.3	-10.6	-10.6	-10.6	-11.4	-12.4	-13.4
NAL12-Furmiston	SSNL Noise Limit	43.0	43.0	43.0	43.0	43.0	44.8	47.2	49.4	51.3
	Predicted Proposed Varied Development on its own	26.2	31.1	35.1	35.8	35.8	35.8	35.8	35.8	35.8
	Exceedance Level	-16.8	-11.9	-7.9	-7.2	-7.2	-9.0	-11.4	-13.6	-15.5
NAL13-Marbrack Farm	SSNL Noise Limit	43.0	43.0	43.7	45.8	48.0	50.1	52.2	54.1	55.8
	Predicted Proposed Varied Development on its own	23.6	28.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-19.4	-14.6	-11.2	-12.6	-14.8	-16.9	-19.0	-20.9	-22.6
NAL14-Marbrack Cottage	SSNL Noise Limit	43.0	43.0	43.7	45.8	48.0	50.1	52.2	54.1	55.8
	Predicted Proposed Varied Development on its own	23.2	28.0	32.1	32.8	32.8	32.8	32.8	32.8	32.8
	Exceedance Level	-19.8	-15.0	-11.6	-13.0	-15.2	-17.3	-19.4	-21.3	-23.0

- 14.9.11. The results show that the predicted noise immission from the Proposed Varied Development operating on its own (with the selected candidate model in full mode) exceed the SSNLs at two NALs (8 & 9) at one wind speed (6 m/s) during daytime periods. As such, additional mitigation is proposed in order to reduce the noise immission from the Proposed Varied Development in these conditions. The predicted noise immission from

the Proposed Varied Development meet the SSNLs under all other conditions and at all other NALs for both daytime and night-time periods.

- 14.9.12. The candidate turbine was chosen as it is considered to be representative of the type of turbine that could be installed at the site. There are a number of wind turbine makes and models that may be suitable for the Proposed Varied Development, should the proposal receive planning permission the final choice of turbine would be subject to a competitive tendering process. The final choice of turbine would have to meet the SSNLs. It is recommended that the SSNLs listed in **Tables 14.13 and 14.14** above are adopted in the planning conditions of the Proposed Varied Development for the scenario where the nearby Quantans Hill is not consented.

14.10. Potential Effects (BESS and Substation Noise)

- 14.10.1. A BESS principally consists of three main elements: batteries, inverters, and Medium Voltage (MV) transformers. Groups of batteries are connected into an inverter, which converts between Direct Current (DC) and Alternating Current (AC). The inverter is then connected to a MV transformer.
- 14.10.2. A BESS development is made up of several battery, inverter and MV Transformer units. Sometimes the inverter and MV transformers can be combined into a single unit. Collectively the inverter and MV transformer is referred to as a Power Conversion System (PCS).
- 14.10.3. The MV transformers will ultimately be connected to the grid network, typically through one or two High Voltage (HV) transformers. In this case an HV Transformer would be installed, which would also be used for the Wind Turbines.
- 14.10.4. Noise modelling is based on candidate plant typical for the size and class of the Proposed BESS and Substation. It should be noted that final plant specifications may vary during the final tendering process. The candidate plant used for the assessment is based on a 50MW CATL solution, which comprises individual battery containers and combined PCS units and the primary sound sources considered within this assessment are:
- CATL EnerC+ Battery Units, 84 no.;
 - SMA UP PCS units, 21 no.; and
 - ABB HV transformer, 1 no.
- 14.10.5. The sound level output of any auxiliary infrastructure included as part of the Proposed BESS and Substation, for example, switch gear or auxiliary transformers, will be insignificant in comparison to the primary sound sources detailed above. Accordingly, no other items of plant have been considered within this assessment.
- 14.10.6. The noise model assumes all sound sources are operating concurrently, continually and with a constant sound level output.

- 14.10.7. The model assumes that 84 of the CATL EnerC+ battery units (42 pairs of) will be installed within the BESS compound. Each unit houses a series of batteries, which themselves do not make any noise, and a chiller. The chiller, which is the primary sound source, is mounted at one end of the unit and noise propagates directionally from this point. Noise propagation from the rest of the unit is expected to be low.
- 14.10.8. Each unit was modelled as a cuboid, with one façade (where the chiller is situated) modelled as an area source. Each area source has a broadband Sound Power Level (SWL) of 85 dBA, which is the maximum SWL reported within the product datasheet for the unit without a sound attenuation cover. This represents the worst case scenario with the unit operating at 79.5 % fan speed operating in ambient temperatures up to 25 °C. One third octave band data has been provided to TNEI under a Non-Disclosure Agreement (NDA), which has been included in the noise model but cannot be included within this report. TNEI would, however, be happy to discuss this data in more detail with the Planning Authority if required.
- 14.10.9. The noise model assumes that 21 PCS will be installed within the BESS compound, with each PCS servicing two pairs of battery units. The candidate PCS modelled in this assessment is the SMA 3950 UP-XT 3 stack device without a silencer kit. The unit utilises fan cooling, which draws air in through the top of the inverter section and passes this through the unit and out at the base. The air inlet runs the full length of the unit and noise propagation is expected to be fairly uniform across all sides of the unit.
- 14.10.10. The modelled PCS represents the loudest of the SMA UP models available, however, the actual unit that is installed may have a lower noise output, depending on final specifications. Each PCS has been modelled as a cuboid with five area sources (one for each façade and one for the top) and the broadband SWL for the overall unit equates to 93 dBA. Again, the one third octave data for these units is covered by a NDA.
- 14.10.11. One HV Grid Transformer will be located within the substation compound and a candidate ABB transformer has been selected for use within the noise model. Each transformer has been modelled as a cuboid with five area sources (one for each façade and one for the top) and the broadband SWL for the overall unit equates to 88 dBA.
- 14.10.12. **Table 14.15** presents the octave band sound power levels (SWL) used in the noise model for each noise source.

Table 14.15 – BESS and Substation Sound Power Levels (SWL dBA)

Noise Source	Broadband dBA	Octave band, dBA							
		63	125	250	500	1000	2000	4000	8000
CATL Battery Unit*	85	Under NDA							
SMA Up MV Inverter*	93	Under NDA							

Noise Source	Broadband dBA	Octave band, dBA							
HV Grid Transformer*	88	64	80	82	83	82	75	71	65
* indicates a noise source that has been modelled with 1/3 octave band data									

- 14.10.13. The immission levels (Specific Sound Level) have been calculated assuming all plant is operating continuously and concurrently. The model assumes, as a worst case, that noise levels do not fluctuate and remain the same throughout the daytime and night-time assessment periods.
- 14.10.14. The noise immission levels are detailed in **Table 14.16** and are also illustrated as a noise contour plot shown in **Figure 14.2**.

Table 14.16 – Calculated BESS and Substation Specific Sound Levels, dBA

NAL		Specific Sound Level	
ID	Descriptor	Day	Night
NAL01	Moorbrock, Game Keepers Cottage	17	17
NAL02	Strahanna Farm	18	18
NAL03	Craigengillan Cottage	24	24
NAL04	Craigengillan	24	24
NAL05	Blackmark	14	14
NAL06	Stroanpatrick	15	15
NAL07	Smittons	19	19
NAL08	1 Muirdrochwood	12	12
NAL09	2 Muirdrochwood	11	11
NAL10	Marscalloch Cottage	13	13
NAL11	Nether Loskie	13	13
NAL12	Furmiston (FI with Quantans Hill)	16	16
NAL13	Marbrack Farm (FI with Quantans Hill)	15	15

NAL		Specific Sound Level	
ID	Descriptor	Day	Night
NAL14	Marbrack Cottage (FI with Quantans Hill)	15	15

- 14.10.15. To assess the immission levels in accordance with BS 4142, the Specific Sound Level must be converted into a Rating Level. The Rating Level allows for character corrections to be added to account for particular characteristics of the sound that may be perceived as more annoying. In particular, the Rating Level considers tonality, impulsivity and intermittency of the sound, as well other sound characteristics that are neither tonal, impulsive, or intermittent, but are otherwise readily distinctive against the residual acoustic environment. Note: Character corrections consider the noise at the receiver location, not the source location.
- 14.10.16. Tonality: With regards to tonality, BS 4142 states: *'For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.'*
- 14.10.17. Electrical plant can often be tonal at source, however, BS 4142 corrections, are only applied if the noise characteristics are present at the receptor location. In this instance, the highest predicted noise level in any single third octave band is only 8 dBA (at NAL13 at 250 Hz), which is significantly lower than the background noise level and no tonality would be perceptible. As such, no tonal character correction is required.
- 14.10.18. Impulsivity: With regards to impulsivity, BS 4142 states: *'A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.'*
- 14.10.19. Impulsivity is not considered to be a relevant sound characteristic of a BESS or substation, as when operational, the noise level will be predictable and consistent.
- 14.10.20. Intermittency: The intermittency of the sound source needs to be considered when it has identifiable on/off conditions with regards to intermittency, BS 4142 states: *'If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.'*
- 14.10.21. As with impulsivity, intermittency is not considered to be a relevant sound characteristic in this case. Once operational, noise levels may fluctuate by a small amount over long periods of time, but no step changes in noise level are anticipated.
- 14.10.22. With regards to other sound characteristics, BS 4142 states: *'Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though*

otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.'

- 14.10.23. Based on TNEI's understanding and experience of this type of plant, it is not anticipated that any additional sound characteristics would be considered readily distinctive against the residual acoustic environment.
- 14.10.24. With due regard to the above, no character corrections are required. Therefore, the BS 4142 Rating Levels are equal to the Specific Sound Levels.
- 14.10.25. Stage 1 of the assessment compares the Rating Levels against the Background Sound Level, as detailed in **Table 14.17**.

Table 14.17 – BS 4142 Initial Estimate of Impact

NAL		Rating Level		Background sound level		Difference (+/-)	
ID	Descriptor	Day	Night	Day	Night	Day	Night
NAL01	Moorbrock, Game Keepers Cottage	17	17	29	30	-12	-14
NAL02	Strahanna Farm	18	18	29	30	-11	-12
NAL03	Craigengillan Cottage	24	24	38	38	-14	-14
NAL04	Craigengillan	24	24	38	38	-14	-14
NAL05	Blackmark	14	14	31	30	-16	-16
NAL06	Stroanpatrick	15	15	31	30	-15	-15
NAL07	Smittons	19	19	31	30	-12	-12
NAL08	1 Muirdrochwood	12	12	23	23	-12	-11
NAL09	2 Muirdrochwood	11	11	23	23	-12	-11
NAL10	Marscalloch Cottage	13	13	31	32	-18	-19
NAL11	Nether Loskie	13	13	31	32	-19	-19
NAL12	Furmiston (FI with Quantans Hill)	16	16	28	27	-12	-11
NAL13	Marbrack Farm (FI with Quantans Hill)	15	15	34	34	-19	-19

NAL		Rating Level		Background sound level		Difference (+/-)	
ID	Descriptor	Day	Night	Day	Night	Day	Night
NAL14	Marbrack Cottage (FI with Quantans Hill)	15	15	34	34	-19	-19

- 14.10.26. At all of the NALs the Rating Level is below the Representative Background Sound Level, which is an "indication of the specific sound source having a low impact, depending on the context."
- 14.10.27. BS 4142 requires the following three contextual elements to be considered:
- the absolute level of the sound;
 - the character and level of the residual sound compared to the character and the level of the specific sound; and
 - the sensitivity of the receptor.
- 14.10.28. In this case the absolute level of sound is particularly low and only exceeds 20 dB at two NALs. The character of the sound would be a continuous, fluctuating level, which would not be incongruous with the existing residual sound environment. Consideration of the absolute level of sound and the residual sound environment does not, therefore, materially affect the initial estimate of impacts.
- 14.10.29. BS 4142 suggests that the sensitivity of the receptor may be lessened if design measures that secure good internal and/or outdoor acoustic conditions are already implemented within the receptor. An example of this could be where a residential building has been fitted with non-openable windows in an already high noise environment. This is not relevant to this assessment, where it is assumed that all nearby NSRs do not incorporate any specific noise control measures. As such, sensitivity of the receptor remains high and this contextual element also does not materially affect the initial estimate of impacts.
- 14.10.30. Detailed consideration of the context suggests that the initial estimate of impact does not need to be adjusted. Accordingly, the BS 4142 assessment concludes that the level of impact from the operation of the Proposed BESS and Substation would be low.

14.11. Additional Mitigation and Enhancement

- 14.11.1. Significant effects are predicted from the operation of the wind turbines at two NALs during daytime periods when the predicted noise immission from the Proposed Varied Development is compared to the SSNLs; therefore additional mitigation measures are required. These additional mitigation measures would take the form of mode management whereby some turbines would operate in low noise mode to reduce the noise levels from the Proposed Varied Development in order to meet the limit. This would only be required

for certain wind directions at a standardised 10 m wind speed of 6 m/s based on the candidate turbine. Depending on the final turbine selected for the Site, blade type and confirmation of final warranted levels from the chosen manufacturer, mode management may or may not be required. It is anticipated that noise limits would be secured by an appropriately worded planning condition.

- 14.11.2. No mitigation measures are proposed or required for the BESS and Substation.

14.12. Existing Planning Conditions

- 14.12.1. Annex 2 of the Shepherds' Rig Wind Farm (the Consented Development) Decision Letter outlines the Conditions attached to the Deemed Planning Permission. Condition 29 relates to operational noise and the wording is in accordance with the IOA GPG suggested wording and is also similar to the February 2025 Scottish Government set of standard conditions for onshore wind developments. It would be appropriate to utilise a similar condition for the Proposed Varied Development, with new values reflecting this assessment.

14.13. Residual Effects

- 14.13.1. The results of the wind turbine noise assessment show that the predicted noise levels from the Proposed Varied Development based on the candidate turbine will exceed the daytime SSNLs at two NALs. Should this turbine be installed, additional mitigation in the form of mode management would be used to reduce the noise levels in order to meet the limit for the wind speeds and wind directions where required.
- 14.13.2. A comparison of the mitigated noise levels and the daytime SSNLs at NALs 8 and 9 is shown in **Table 14.18** for the scenario where Quantans Hill is consented and built. It can be seen that the SSNLs are met at all wind speeds with mitigation in place. The results are also shown in Graphics 4.1 to 4.2 of **Appendix 14.2**.

Table 14.18 – Site Specific Noise Limits (SSNL) Results with Mitigation in Place when Quantans Hill is Consented and Built – Daytime

NAL	Parameter	Wind Speeds (m/s) as standardised to 10 m height								
		4	5	6	7	8	9	10	11	12
NAL8-1 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.7	31.5	35.1*	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-8.3	-3.5	0.0	-1.0	-3.1	-5.1	-6.9	-8.3	-9.3
NAL9-2 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.4	31.3	35.1*	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-8.6	-3.7	0.0	-1.3	-3.4	-5.4	-7.2	-8.6	-9.6

*Mode managed

- 14.13.3. A comparison of the mitigated noise levels and the daytime SSNLs at NALs 8 and 9 is shown in **Table 14.19** for the scenario where Quantans Hill is not consented. It can be seen that the SSNLs are met at all wind speeds with mitigation in place. The results are also shown in Graphics 4.1 to 4.2 of **Appendix 14.2**.

Table 14.19 – Site Specific Noise Limits (SSNL) results with Mitigation in Place when Quantans Hill is not Consented – Daytime

NAL	Parameter	Wind Speeds (m/s) as standardised to 10 m height								
		4	5	6	7	8	9	10	11	12
NAL8-1 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.7	31.5	35.1*	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-8.3	-3.5	0.0	-1.0	-3.1	-5.1	-6.9	-8.3	-9.3
NAL9-2 Muirdrochwood	SSNL Noise Limit	35.0	35.0	35.1	37.3	39.4	41.4	43.2	44.6	45.6
	Predicted Proposed Varied Development on its own	26.4	31.3	35.1*	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-8.6	-3.7	0.0	-1.3	-3.4	-5.4	-7.2	-8.6	-9.6

*Mode managed

- 14.13.4. At some locations, under some wind conditions and for a certain proportion of the time operational wind turbine noise would be audible; however, it would be at an acceptable level in relation to the ETSU-R-97 guideline noise limits and there would be no significant effect from operational wind turbine noise.
- 14.13.5. The difference between the BS 4142 Rating Levels and the Background Sound Levels for daytime and night-time at all NALs is more than 10 dB. With due regard to **Table 14.4** the Magnitude of Impact is No Impact and the Level of Significance, with due regard to **Table 14.5**, is Negligible.
- 14.13.6. The assessment concludes that there would be no significant effects from the operation of the wind turbines or the BESS and substation.

14.14. Cumulative Assessment

- 14.14.1. The operational wind turbine noise assessment has taken into consideration the cumulative impacts with other existing and proposed wind farms, as described in the above assessment. The cumulative operational noise assessment shows that the Proposed Varied Development can operate concurrently with the nearby identified wind farms of Quantans Hill and Windy Rig, and therefore no significant cumulative operational noise effects are predicted.
- 14.14.2. The level of noise from the BESS is so low at all NALs that it would not increase the overall noise level when considering the cumulative operation of the BESS and wind turbines.

14.15. Summary

- 14.15.1. A noise assessment was undertaken to determine the likely significant noise effects from the operational phase of the Proposed Varied Development on nearby NSRs, all of which were identified as residential properties. The Consented Development comprises 17 wind turbines and the Proposed Varied Development comprises 11 wind turbines with a taller blade tip height. There are other proposed changes, however in regard to noise, the changes to the wind turbine layout and candidate wind turbine and the increase in the capacity of the BESS are the key noise considerations that have been re-assessed in detail.
- 14.15.2. Quantans Hill Wind Farm is a live Section 36 application immediately to the west and has been considered in detail in regard to cumulative noise. Windy Rig is relatively distant to the north but was considered in the previous operational wind farm noise assessment for the Consented Development, so it is also considered in the cumulative assessment.
- 14.15.3. The wind turbine operational noise assessment has been undertaken in accordance with ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' and the IOA GPG. Total ETSU-R-97 Noise Limits (also called cumulative noise limit) have been established for all wind farms in the area by applying a wind shear correction to the previously established baseline noise levels and identifying relevant fixed minimum criteria.
- 14.15.4. Predicted cumulative operational noise levels indicate that for noise sensitive receptors neighbouring the Proposed Varied Development, cumulative wind turbine noise (the Proposed Varied Development, Quantans Hill and Windy Rig) would meet the Total ETSU-R-97 Noise Limits at all Noise Assessment Locations.
- 14.15.5. Due to the current status of Quantans Hill Wind Farm (in planning), a potential sharing of the Total ETSU-R-97 Noise Limits has been considered between the Proposed Varied Development and Quantans Hill. The resulting SSNLs can be adopted should Quantans Hill Wind Farm be consented and built. SSNLs have also been derived for the scenario where Quantans Hill is not consented. Predictions for the Proposed Varied Development on its own without additional mitigation would exceed the SSNLs at two NALs during daytime periods. Additional mitigation in the form of mode management has been identified which would reduce the predicted noise levels such that the SSNLs would be met in both scenarios. As such, the detailed operational noise assessment concludes that there is no significant effect predicted.
- 14.15.6. Predictions of wind turbine noise from the Proposed Varied Development have been undertaken in accordance with good practice using a candidate wind turbine, the Nordex N163/6.X 7 MW with Serrated Blades and with a hub height of 138.5 m. The wind turbine model was chosen in order to allow a representative assessment of the noise impacts. Should the Proposed Varied Development receive consent, the final choice of wind turbine would be subject to a competitive tendering process. The final choice of wind turbine would, however, have to meet the limits presented in the noise assessment.
- 14.15.7. The adoption of appropriate noise related limits within the planning conditions would ensure that the Proposed Varied Development could operate concurrently with other operational wind farm developments in the area and would also ensure that the Proposed

Varied Development's individual contribution could be measured and enforced if required. Given the status of Quantans Hill, two approaches to noise conditioning have been considered (with and without Quantans Hill) within the assessment and it is recommended that they also form part of the suggested noise related planning conditions:

- Quantans Hill is consented and built – In this scenario, the Site Specific Noise Limits detailed within **Tables 14.11** and **14.12** would apply for the Proposed Varied Development.
- Quantans Hill is not consented – In this scenario, the Site Specific Noise Limits detailed within **Tables 14.13** and **14.14** would apply for the Proposed Varied Development.

- 14.15.8. A noise propagation model in accordance with ISO 9613-2:2024 was produced that predicted the noise immission levels attributable to the BESS and substation based on an indicative layout and candidate plant that is typical for this type and class of BESS and Substation development.
- 14.15.9. The baseline data collected for the operational wind turbine noise assessment has been used to determine representative background sound levels and used to inform the BS 4142 assessment.
- 14.15.10. The predicted Rating Levels from the BESS and substation (based on a candidate plant layout and specification) are more than 10 dB below the background sound levels and the BS 4142 assessment concludes that there would be a low impact. This translates to an EIA assessment outcome of a Negligible Level of Significance.
- 14.15.11. Any impact from construction and decommissioning noise and vibration is temporary and was already assessed in the current consent as having no significant effect. There are no substantial changes to the Proposed Varied Development that suggest this would change. The access tracks would remain at similar locations, and the construction timetable would also be similar. It is suggested that core hours of work and a CEMP are kept consistent with the approach already taken for the Consented Development.

Table 14.20 – Summary of Effects

Description of Effect	Significance of Potential Effect		Mitigation and/or Enhancement Measure	Significance of Residual Effect		Change to Consented Development Conclusion
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse	
Construction						
Noise from construction activities at residential receptors	Not significant	N/A	Implementation of CEMP and core construction hours.	Not significant	N/A	None
Operation						
Noise from operational wind turbines at residential receptors	Significant	N/A	Mode management would be required to meet the SSNLs for the candidate turbine. The planning conditions should contain appropriate noise limits which the final turbine chosen for installation would have to meet.	Not significant	N/A	None
Noise from operational BESS and substation at residential receptors	Not significant	N/A	None	Not significant	N/A	None
Decommissioning						

Description of Effect	Significance of Potential Effect		Mitigation and/or Enhancement Measure	Significance of Residual Effect		Change to Consented Development Conclusion
	Significance	Beneficial/Adverse		Significance	Beneficial/Adverse	
Noise from decommission activities at residential receptors	Not significant	N/A	Same as for construction noise.	Not significant	N/A	None

Table 14.21 – Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	Significance of Cumulative Effect	
			Significance	Beneficial/Adverse
Residential receptors between both the Proposed Development and Quantans Hill.	Cumulative Wind turbine Noise	Quantans Hill	Not significant	N/A
Residential receptors between both the Proposed Development and Windy Rig.	Cumulative Wind turbine Noise	Windy Rig	Not significant	N/A
Residential receptors	Cumulative wind turbine and BESS noise	Proposed Development	Not significant	N/A

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Abbreviations

Abbreviations	Definition
EIA	Environmental Impact Assessment
AM	Amplitude Modulation
dB	Decibel
EHO	Environmental Health Officer
FI	Financial Involvement

FML	Fixed Minimum Limit
GPG	Good Practice Guidance
IOA	Institute of Acoustics
LFN	Low Frequency Noise
MW	Megawatts
NAL	Noise Assessment Location
NML	Noise Monitoring Location
SSNL	Site Specific Noise Limit
TNL	Total Noise Limit