

11. Noise

11.1 Introduction

- 11.1.1 This chapter of the ES addendum assesses changes to the likely significant effects of the Proposed Development with respect to noise, taking into account the proposed amendments to the approved development. As the chapter only sets out changes of relevance it should be read in conjunction with Chapter 11: Noise of the 2019 ES⁸⁸. The chapter should also be read in conjunction with the development description and planning policy provided in **Chapters 1-6** of this ES addendum.

11.2 Limitations of this assessment

- 11.2.1 The limitations of the assessment remain unchanged since the 2019 ES.

11.3 Policy and legislative context

- 11.3.1 The relevant planning policy, legislative context and technical guidance remains materially unchanged since the 2019 ES. TAN 8⁸⁹ and 'A Noise Action Plan for Wales 2013 – 2018'⁹⁰ have been withdrawn. The replacement document for the latter is the 'Noise and soundscape action plan 2018-2023'⁹¹, but this has no advice specifically regarding wind turbine noise. Future Wales: The National Plan 2040⁹² provides the national development framework up to 2040 and refers to the protection from noise through planning throughout, including renewables. However, none of these changes and additions has a material effect on the assessment methodology.

11.4 Data gathering methodology

Desk study

- 11.4.1 The information within this ES addendum is largely based upon data used within the 2014 ES⁹³, the exception being data for the candidate wind turbine. Sources of information used for the noise assessment are listed in **Table 11.1**.

⁸⁸Wood. Foel Trawsnant Wind Farm Amended Scheme: Environmental Statement. Doc ref 40217rr066i1. 2019.

⁸⁹Welsh Assembly Government, Technical Advice Note (TAN) 8, 'Renewable Energy'. 2008.

⁹⁰Welsh Government, A Noise Action Plan for Wales 2013 – 2018, 2013.

⁹¹Welsh Government, Noise and soundscape action plan 2018 – 2023, 2018. Available online at: <https://gov.wales/sites/default/files/publications/2019-04/noise-and-soundscape-action-plan.pdf> [Accessed 4th May 2022].

⁹²Welsh Assembly Government (2021). Future Wales. The National Plan 2040, 2020. Available online at: <https://gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf> Accessed on 28 January 2022].

⁹³Amec. Foel Trawsnant Wind Farm Environmental Statement. Doc ref. 24311rr073i1. 2014.

Table 11.1 Sources of information

Source	Data
Turbines	'Octave sound power levels, Nordex N133/4.8. Revision 1.' Nordex (2018)
Types	'Octave sound power levels, Nordex N117/3000 – Standard Mode. Revision 3.' Nordex (2015)

Survey work

- 11.4.2 The description of the survey work undertaken for the assessment remain unchanged since the 2019 ES (Chapter 11).

Turbine data

- 11.4.3 It is understood that the proposed candidate turbines for the development will be the Nordex N117 at 86.5m hub height with a rotor diameter of 117m, and the Nordex N133 at 78.5m hub height with a rotor diameter of 133m. The proposed turbines are identified in Figure 11.1.
- 11.4.4 The approach to the determination of the sound levels from nearby existing and consented turbines, to inform the assessment of cumulative wind farm noise, remains unchanged since the 2019 ES.
- 11.4.5 Noise data indicating the overall sound powers of the turbines forming part of the Proposed Development, which have been used to inform the assessment, are provided in Table 11.2.

Table 11.2 Wind turbine data

Wind Farm Site	Wind Turbine	Sound power levels (dBA L _w) per wind speed (m/s)								
		4	5	6	7	8	9	10	11	12
Foel Trawsnant	Nordex N117*	97.0	101.5	103.5	104.5	105.0	105.0	105.0	105.0	105.0
Foel Trawsnant	Nordex N133**	95.5	101	105.2	107.5	107.5	107.5	107.5	107.5	107.5

* Based on the closest available data, being a hub height of 91 m.

** Based on the closest available data, being a hub height of 78 m.

- 11.4.6 All turbine sound levels have a 2dB uncertainty correction added (on top of the above) to data provided from manufacturer sheets as the sound data provided were not warranted or guaranteed and did not include any correction for uncertainty. Spectral sound power levels of the proposed turbines at wind speeds of 7 m/s at a reference height of 10m are provided in **Table 11.3**.

Table 11.3 Wind turbine spectrum data

Wind Turbine	Sound power level, dBA L _w , per octave band, Hz, at wind speed at 10 m of 7 m/s								
	31.5	63	125	250	500	1K	2K	4K	8K
Nordex N117	73.9	83.5	90.2	95.1	96.6	99.1	98	95.9	86.1
Nordex N133	76.8	87.5	94.6	99.4	101.8	102.4	99.9	92.4	80.1

11.5 Overall baseline

- 11.5.1 The assessment of baseline conditions remains unchanged since the 2019 ES.

11.6 Consultation

- 11.6.1 Wood consulted with Neath Port Talbot County Borough Council (NPTCBC) on 10 March 2022 to agree an approach to the assessment of noise effects from the Proposed Development. From a noise perspective the proposed changes considered by this application include:
- proposals to deliver and construct 8 of the 11 turbines approved;;
 - the reduction in hub height; and
 - the expected lower noise emissions of the new candidate turbine (Nordex N133 and Nordex 117) when compared to that considered for the 2019 ES.
- 11.6.2 It was agreed that the likely outcome was a reduction in predicted noise levels from the wind farm, and hence no additional significant noise effects. This is likely to be influenced by the margin of difference in the noise levels at the worst affected receptor and will correspond with the difference between the noise emission data for the candidate turbine considered by the 2019 ES and the latest candidate turbine. Changes to the blade diameter could result in changes in the aerodynamic noise of the turbine type. However, the final design is required to meet the noise limits set out in the 2019 ES (11 turbine layout) approved as part of planning permission P2014/0825 (approved on 25 November 2021) and will be ensured through turbine selection.
- 11.6.3 It was requested that an update to the noise modelling was undertaken to confirm the above, with reporting in a chapter of the ES addendum.

11.7 Scope of the assessment

- 11.7.1 In general, the scope of the assessment remains unchanged since the 2019 ES. However, turbines T3, T4 and T7 no longer form part of the Proposed Development.

11.8 Environmental measures embedded into the Proposed Development

- 11.8.1 There has been no change to the environmental measures embedded within the Proposed Development since the 2019 ES.

11.9 Assessment methodology

- 11.9.1 There have been no changes to the assessment methodology since the 2019 ES.

11.10 Assessment of noise effects

Predicted effects and their significance

- 11.10.1 Noise levels have been predicted for the closest residential properties to the Proposed Development. The assessment tables for Foel Trawsant Wind Farm, and for Foel Trawsant Wind

Farm plus other nearby wind turbines, present the following information for each wind speed for each of the nine properties considered:

- Values of the background noise curve at the integer wind speeds, measured and adjusted for wind shear;
- The noise limits derived from the background noise curve, in accordance with the ETSU-R-97⁹⁴ and the Institute of Acoustics (IoA) Good Practice Guide (GPG)⁹⁵;
- The predicted turbine noise levels, based on worst-case downwind noise propagation and inclusive of any 'valley effect' penalty at receptors and assuming turbines are operating simultaneously; and
- The margin by which the predicted turbine noise, inclusive of any 'canyon effect penalty', meets the noise limits at each wind speed using the worst-case downwind noise predictions (negative values indicate the predicted noise levels are lower than the noise limits).

Foel Trawsnant Wind Farm

11.10.2 Assessments of wind turbine noise due to the operation of the Proposed Development are presented for daytime in **Table 11.4** and for night-time in **Table 11.5**.

Table 11.4 Noise Assessment – Daytime

Noise Parameter, dB L _{A90,10 m}	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	26.2	30.9	34.0	35.9	36.1	36.1	36.1	36.1	36.1
Margin Under Noise Limit	-13.9	-9.7	-7.0	-5.5	-5.6	-6.0	-6.2	-6.5	-6.7
R2 – Pen y lan									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	27.4	32.0	34.8	36.6	36.9	36.9	36.9	36.9	36.9
Margin Under Noise Limit	-12.7	-8.6	-6.2	-4.8	-4.8	-5.2	-5.4	-5.7	-8.6
R3 – Sunnyview									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	24.5	29.4	33.0	35.1	35.2	35.2	35.2	35.2	35.2
Margin Under Noise Limit	-12.1	-7.4	-4.2	-2.8	-3.6	-4.7	-6.1	-7.7	-9.6
R4 – Teras Griffiths									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	25.0	29.9	33.4	35.5	35.6	35.6	35.6	35.6	35.6

⁹⁴ Department of Trade and Industry (1996). ETSU-R-97 The Assessment and Rating of Noise from Wind Farms.

⁹⁵ Institute of Acoustics (2013). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise.

Noise Parameter, dB L _{A90,10m}	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
Margin Under Noise Limit	-11.6	-6.9	-3.8	-2.4	-3.2	-4.3	-5.7	-7.3	-9.2
R5 – Hendre Owen Farm									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.5
Wind Farm Turbine Noise	28.7	33.9	37.9	40.2	40.2	40.2	40.2	40.2	40.2
Margin Under Noise Limit	-16.3	-11.1	-7.1	-4.8	-4.8	-4.8	-4.8	-4.8	-5.3
R6 – Ty'n-y Pant Farm									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.1
Wind Farm Turbine Noise	31.3	36.7	40.8	43.1	43.1	43.1	43.1	43.1	43.1
Margin Under Noise Limit	-13.7	-8.3	-4.2	-1.9	-1.9	-1.9	-1.9	-1.9	-4.0
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	48.7	49.3	50.0	50.9	51.7	52.6	53.4	54.1	54.7
ETSU-R-97 Derived Noise Limit	53.7	54.3	55.0	55.9	56.7	57.6	58.4	59.1	59.7
Wind Farm Turbine Noise	32.4	37.7	41.8	44.1	44.1	44.1	44.1	44.1	44.1
Margin Under Noise Limit	-21.3	-16.6	-13.2	-11.8	-12.6	-13.5	-14.3	-15.0	-15.6
R8 – Tycanol									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	36.5	37.0	37.6	38.6	39.8	41.2	42.9	44.9	47.1
Wind Farm Turbine Noise	29.5	34.8	38.9	41.2	41.2	41.2	41.2	41.2	41.2
Margin Under Noise Limit	-7.0	-2.2	1.3	2.6	1.4	0.0	-1.7	-3.7	-5.9
R9 – Neuadd-wen									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	39.3	39.6	40.1	40.7	41.4	42.2	43.2	44.3	45.5
Wind Farm Turbine Noise	29.6	34.9	39.0	41.2	41.2	41.2	41.2	41.2	41.2
Margin Under Noise Limit	-9.7	-4.7	-1.1	0.5	-0.2	-1.0	-2.0	-3.1	-4.3

Table 11.5 Noise Assessment – Night-time

Noise Parameter, dB L _{A90,10m}	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	26.2	30.9	34.0	35.9	36.1	36.1	36.1	36.1	36.1
Margin Under Noise Limit*	-16.8	-12.1	-9.0	-7.1	-6.9	-6.9	-6.9	-6.9	-8.4
R2 – Pen y lan									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	27.4	32.0	34.8	36.6	36.9	36.9	36.9	36.9	36.9
Margin Under Noise Limit	-15.6	-11.0	-8.2	-6.4	-6.1	-6.1	-6.1	-6.1	-7.6

Noise Parameter, dB LA90,10m	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
R3 – Sunnyview									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	24.5	29.4	33.0	35.1	35.2	35.2	35.2	35.2	35.2
Margin Under Noise Limit	-18.5	-13.6	-10.0	-7.9	-7.8	-7.8	-7.8	-7.8	-7.8
R4 – Teras Griffiths									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	25.0	29.9	33.4	35.5	35.6	35.6	35.6	35.6	35.6
Margin Under Noise Limit	-18.0	-13.1	-9.6	-7.5	-7.4	-7.4	-7.4	-7.4	-7.4
R5 – Hendre Owen Farm									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.0
Wind Farm Turbine Noise	28.7	33.9	37.9	40.2	40.2	40.2	40.2	40.2	40.2
Margin Under Noise Limit	-16.3	-11.1	-7.1	-4.8	-4.8	-4.8	-4.8	-4.8	-5.8
R6 – Ty'n-y Pant Farm									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.4
Wind Farm Turbine Noise	31.3	36.7	40.8	43.1	43.1	43.1	43.1	43.1	43.1
Margin Under Noise Limit	-13.7	-8.3	-4.2	-1.9	-1.9	-1.9	-1.9	-1.9	-4.3
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	49.0	49.3	49.8	50.4	51.2	52.3	53.8	55.7	58.0
ETSU-R-97 Derived Noise Limit	54.0	54.3	54.8	55.4	56.2	57.3	58.8	60.7	63.0
Wind Farm Turbine Noise	32.4	37.7	41.8	44.1	44.1	44.1	44.1	44.1	44.1
Margin Under Noise Limit	-21.6	-16.6	-13.0	-11.3	-12.1	-13.2	-14.7	-16.6	-18.9
R8 – Tycanol									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4
Wind Farm Turbine Noise	29.5	34.8	38.9	41.2	41.2	41.2	41.2	41.2	41.2
Margin Under Noise Limit	-13.5	-8.2	-4.1	-1.8	-1.8	-1.8	-1.8	-3.8	-6.2
R9 – Neuadd-wen									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.2	44.5	46.0
Wind Farm Turbine Noise	29.6	34.9	39.0	41.2	41.2	41.2	41.2	41.2	41.2
Margin Under Noise Limit	-13.4	-8.1	-4.0	-1.8	-1.8	-1.8	-2.0	-3.3	-4.8

- 11.10.3 The results in Table 11.4 show slight exceedances of the ETSU-R-97 limits at R8 - Tycanol and R9 – Neuadd-wen, to the north of the development site, when wind speeds at 10m are between 6 to 8m/s. The results in Table 11.5 indicate that no exceedance of the ETSU-R-97 limits are predicted during the night-time.

- 11.10.4 Based on the above, the assessment indicates that at receptors R8 and R9, during the daytime, noise from the wind farm would give rise to a significant effect, and that, for all other receptors and times of day, operation noise from the wind farm would give rise to effects that are not significant. Additional mitigation to reduce noise from the wind farm such that significant effects are avoided at all receptors is considered in Section 11.11.

Cumulative noise from Foel Trawsnant Wind Farm plus other nearby wind turbines

- 11.10.5 As the candidate turbine has changed since the 2019 ES, an update to the assessments of cumulative wind turbine noise due to the operation of Proposed Development and other nearby wind turbines presented in that document has been undertaken, and are presented for daytime in **Table 11.6** and for night-time in **Table 11.7**. The other nearby wind turbines include Ffynnon Oer Wind Farm, Pen y Cymoedd Wind Farm, and Llynfi Afan Renewable Energy Park⁹⁶.

Table 11.6 Cumulative Noise Assessment – Daytime

Noise Parameter, dB L _{A90,10m}	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	29.9	32.6	35.1	36.7	37.0	37.3	37.7	37.7	37.7
Margin Under Noise Limit	-10.2	-8.0	-5.9	-4.7	-4.7	-4.8	-4.6	-4.9	-5.1
R2 – Pen y lan									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	29.7	33.1	35.4	37.1	37.4	37.7	38.0	38.0	38.0
Margin Under Noise Limit	-10.4	-7.5	-5.6	-4.3	-4.3	-4.4	-4.3	-4.6	-4.8
R3 – Sunnyview									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	31.0	32.8	35.0	36.5	36.8	37.5	38.2	38.2	38.2
Margin Under Noise Limit	-5.6	-4.0	-2.2	-1.4	-2.0	-2.4	-3.1	-4.7	-6.6
R4 – Teras Griffiths									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	31.1	33.2	35.2	36.9	37.2	37.7	38.5	38.5	38.5
Margin Under Noise Limit	-5.5	-3.6	-2.0	-1.0	-1.6	-2.2	-2.8	-4.4	-6.3
R5 – Hendre Owen Farm									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.5
Wind Farm Turbine Noise	36.6	38.0	40.0	41.6	41.9	42.7	43.6	43.6	43.6
Margin Under Noise Limit	-8.4	-7.0	-5.0	-3.4	-3.1	-2.3	-1.4	-1.4	-1.9
R6 – Ty'n-y Pant Farm									

⁹⁶ Further details on the general approach to inter-project cumulative effects are discussed in **Chapter 17**

Noise Parameter, dB L _{A90,10m}	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.1
Wind Farm Turbine Noise	34.8	38.0	41.4	43.5	43.6	43.8	44.1	44.1	44.1
Margin Under Noise Limit	-10.2	-7.0	-3.6	-1.5	-1.4	-1.2	-0.9	-0.9	-3.0
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	48.7	49.3	50.0	50.9	51.7	52.6	53.4	54.1	54.7
ETSU-R-97 Derived Noise Limit	53.7	54.3	55.0	55.9	56.7	57.6	58.4	59.1	59.7
Wind Farm Turbine Noise	35.5	38.9	42.4	44.5	44.5	44.7	45.1	45.1	45.1
Margin Under Noise Limit	-18.2	-15.4	-12.6	-11.4	-12.2	-12.9	-13.3	-14.0	-14.6
R8 – Tycanol									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	36.5	37.0	37.6	38.6	39.8	41.2	42.9	44.9	47.1
Wind Farm Turbine Noise	33.7	36.6	39.7	41.7	41.9	42.1	42.5	42.5	42.5
Margin Under Noise Limit	-2.8	-0.4	2.1	3.1	2.1	0.9	-0.4	-2.4	-4.6
R9 – Neuadd-wen									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	39.3	39.6	40.1	40.7	41.4	42.2	43.2	44.3	45.5
Wind Farm Turbine Noise	35.9	37.9	40.4	42.1	42.4	42.9	43.6	43.6	43.6
Margin Under Noise Limit	-3.4	-1.7	0.3	1.4	1.0	0.7	0.4	-0.7	-1.9

Table 11.7 Cumulative Noise Assessment – Night-time

Noise Parameter, dB L _{A90,10m}	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	29.9	32.6	35.1	36.7	37.0	37.3	37.7	37.7	37.7
Margin Under Noise Limit	-13.1	-10.4	-7.9	-6.3	-6.0	-5.7	-5.3	-5.3	-6.8
R2 – Pen y lan									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	29.7	33.1	35.4	37.1	37.4	37.7	38.0	38.0	38.0
Margin Under Noise Limit	-13.3	-9.9	-7.6	-5.9	-5.6	-5.3	-5.0	-5.0	-6.5
R3 – Sunnyview									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	31.0	32.8	35.0	36.5	36.8	37.5	38.2	38.2	38.2
Margin Under Noise Limit	-12.0	-10.2	-8.0	-6.5	-6.2	-5.5	-4.8	-4.8	-4.8
R4 – Teras Griffiths									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0

Noise Parameter, dB LA90,10m	Standardised 10 m wind speed quoted by manufacturer (m/s)								
	4	5	6	7	8	9	10	11	12
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	31.1	33.2	35.2	36.9	37.2	37.7	38.5	38.5	38.5
Margin Under Noise Limit	-11.9	-9.8	-7.8	-6.1	-5.8	-5.3	-4.5	-4.5	-4.5
R5 – Hendre Owen Farm									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.0
Wind Farm Turbine Noise	36.6	38.0	40.0	41.6	41.9	42.7	43.6	43.6	43.6
Margin Under Noise Limit	-8.4	-7.0	-5.0	-3.4	-3.1	-2.3	-1.4	-1.4	-2.4
R6 – Ty'n-y Pant Farm									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.4
Wind Farm Turbine Noise	34.8	38.0	41.4	43.5	43.6	43.8	44.1	44.1	44.1
Margin Under Noise Limit	-10.2	-7.0	-3.6	-1.5	-1.4	-1.2	-0.9	-0.9	-3.3
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	49.0	49.3	49.8	50.4	51.2	52.3	53.8	55.7	58.0
ETSU-R-97 Derived Noise Limit	54.0	54.3	54.8	55.4	56.2	57.3	58.8	60.7	63.0
Wind Farm Turbine Noise	35.5	38.9	42.4	44.5	44.5	44.7	45.1	45.1	45.1
Margin Under Noise Limit	-18.5	-15.4	-12.4	-10.9	-11.7	-12.6	-13.7	-15.6	-17.9
R8 – Tycanol									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4
Wind Farm Turbine Noise	33.7	36.6	39.7	41.7	41.9	42.1	42.5	42.5	42.5
Margin Under Noise Limit	-9.3	-6.4	-3.3	-1.3	-1.1	-0.9	-0.5	-2.5	-4.9
R9 – Neuadd-wen									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.2	44.5	46.0
Wind Farm Turbine Noise	35.9	37.9	40.4	42.1	42.4	42.9	43.6	43.6	43.6
Margin Under Noise Limit	-7.1	-5.1	-2.6	-0.9	-0.6	-0.1	0.4	-0.9	-2.4

- 11.10.6 The results in Table 11.6 show slight exceedances of the ETSU-R-97 limits at R8 – Tycanol and R9 – Neuadd-wen, to the north of the development site, when wind speeds at 10 m are between 6 to 10 m/s, with the greatest exceedance at R8 of 3.1 dB when wind speeds are 7 m/s. The results in Table 11.7 indicate a slight exceedance of the ETSU-R-97 limits at R9 – Neuadd-wen, during the night-time, of 0.4 dB when wind speeds are 10 m/s.
- 11.10.7 Based on the above, the assessment indicates that at receptors R8 and R9, during the daytime, and at R9 during the night-time, cumulative noise from the Proposed Development and other nearby wind turbines would give rise to a significant effect, and that, for all other receptors and times of day, cumulative noise from wind turbines would give rise to effects that are not significant. Additional mitigation to reduce noise from the wind farm such that significant effects are avoided at all receptors is considered in Section 11.11.

11.11 Consideration of additional mitigation or compensation

- 11.11.1 An analysis of potential mitigation options to avoid the significant effects identified was undertaken based on manufacturer's data indicating the reduction in total sound power of the N133 wind turbines with different operating modes. The analysis was undertaken with reference to the results of the assessment of cumulative wind turbine noise, and then cross checked with the results of the assessment of the Proposed Development only. A summary of the results of the analysis are provided in **Table 11.8** below.

Table 11.8 Summary of results of mitigation investigation

Scenario	Turbine operating mode, per turbine			Max. exceedance, dB	Max. attenuation achieved, dB
	T5	T6	T11		
Daytime (6 m/s)	Mode 8	Mode 9	Mode 8	2.1	2.4
Daytime (7 m/s)	Mode 5	Mode 10	Mode 8	3.1	3.6
Daytime (8 m/s)	Mode 3	Mode 9	Mode 1	2.1	2.5
Daytime (9 m/s)	Mode 0	Mode 4	Mode 4	0.9	1.1
Daytime (10 m/s)	Mode 0	Mode 2	Mode 3	0.4	0.6
Night-time (10 m/s)	Mode 0	Mode 2	Mode 3	0.4	0.6

- 11.11.2 The results **Table 11.8** indicate that, with the reduced power operating modes provided to turbines T5, T6 and T11, significant effects will be avoided when combining the sound from the operational Proposed Development and that of other nearby turbines.

11.12 Conclusions of significance evaluation

- 11.12.1 Exceedances of limits have been identified through modelling and assessment of the Proposed Development assuming a worst case scenario that all receptors are downwind of all turbines. The results of the assessment indicate that, in consideration of Proposed Development only, significant effects are anticipated at receptors R8 and R9 during the daytime, and effects are not significant at all other receptors and times of day. Regarding the results of the assessment of the cumulative scenario, the assessment indicates that, significant effects are anticipated at receptors R8 and R9 during the daytime and at R9 during the night-time, and effects are not significant at all other receptors and times of day.
- 11.12.2 Analysis of the attenuation that may be achieved by the implementation of lower operational power modes for the turbines with the greater sound power, the N133 turbines, indicates that the significant effects identified in the assessment may be avoided and reduced such that they are not significant. The mitigation package achieving the necessary attenuation is detailed in Table 11.8.

11.13 Implementation of environmental measures

- 11.13.1 Whilst the candidate turbine may change, the assessment indicates that residential amenity of surrounding areas would be protected by an appropriately worded planning condition based on ETSU-R-97 limits as stipulated within **Section 11.10**. Compliance of these limits can be proven with measurements taken at residential receptor locations once the wind farm is operational.