Technical Appendix 11.1: Background Noise Survey

Contents

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Background Noise Survey

A background noise survey was carried out between 07 November and 03 December 2024, to determine appropriate ETSU-R-97 limits for the Proposed Development. To ensure the prevailing background acoustic environment was adequately characterised, the survey was conducted at three locations (Stronsaul Cottages, Glenkin Cottage, Chromain Cottage) chosen to be representative of the nearest noise sensitive receptors.

Subsequent layout iterations resulted in Chromain Cottage, and all receptors to the east, falling outside of a 35dB(A) contour. It was therefore deemed appropriate to constrain immission levels at this receptor with reference to the simplified ETSU-R-97 limit of 35dB(A). Therefore, the background data was not required.

Details of the two measurement positions (MP) referenced in the assessment are provided below.

Monitoring Position Details

MP1 – Stronsaul Cottages

Image 1 - Noise monitoring position at Stronsaul Cottages (MP1)

The acoustic environment was noted to consist of foliage and small bird noise as well as audibility of a water course located at the edge of the property landholding. The noise kit location was selected to be a sufficient distance from the nearby water course to minimise its influence on measured sound levels. Rainfall in the area was noted to be within normal levels for the time of year, both prior and during the survey, therefore any contributions of water course noise should be considerd typical of the prevailing noise environment.

Details of the monitoring equipment used at this location are shown in **Table 1**.

Table 1 - List of equipment used at MP1

Equipment List		Calibration Date
Sound Level Meter (IEC 61672-1 Class 1):	Rion NL-53 SN: 00830432	24/05/2024
Acoustic Calibrator (IEC 60942 Class 1):	Rion NC-74 SN: 34494275	08/05/2024
Microphone:	Rion UC-59 SN: 23976	24/05/2024
Tripod:	Single integrated pole	
Wind Shield:	Rion WS-15 double skinned wind shield	
Tripod/measurement GPS position:	E213083, N679853	
Nearest reflecting elements & distances from microphone:	N/A	

MP2 – Glenkin Cottage

Image 2 - Noise monitoring position at Glenkin Cottage (MP2)

The acoustic environment was similar to MP1 with audible foliage and small birds but the location is more distant from the water course to the north. The noise kit location was again selected to minimise contributions from water course noise.

Details of the monitoring equipment used at this location are shown in **Table 2**.

Table 2 - List of equipment used at MP2

Equipment List		Calibration Date
Sound Level Meter (IEC 61672-1 Class 1):	Rion NL-53 SN: 00741263	23/10/2024
Acoustic Calibrator (IEC 60942 Class 1):	Rion NC-74 SN: 34494275	08/05/2024
Microphone:	Rion UC-59 SN: 25846	23/10/2024
Tripod:	Single integrated pole	
Wind Shield:	Rion WS-15 double skinned wind shield	
Tripod/measurement GPS position:	E212917, N679899	
Nearest reflecting elements & distances from microphone:	N/A	

Metrological Data Collection

A LiDAR unit was installed at GPS position 213711, 677749 within the Planning Application Boundary. This location was selected based on site accessibility and the scoping layout for the Proposed Development. Through design iterations the proposed turbines were removed/repositioned to optimise the site layout. This resulted in the LiDAR being positioned at a higher altitude than the final EIA layout. Consequently, the resulting noise limits are marginally more conservative (lower) than they would be if the LiDAR was located at a location representative of the repositioned turbines which are now at a lower altitude. The measurement position of the LiDAR is shown below in Image 3, along with both the scoping and EIA turbine layouts.

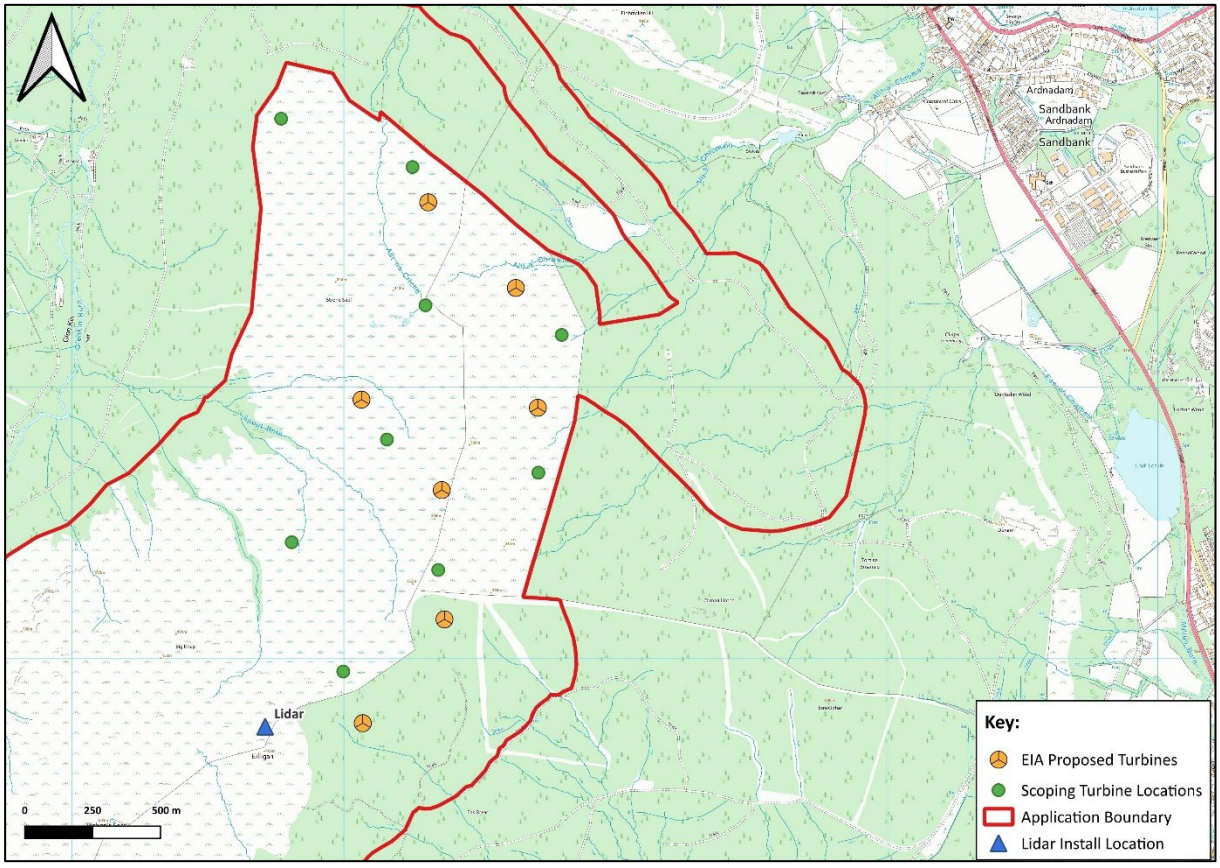


Image 3: Lidar monitoring position

Wind speed and directions were logged at 10-minute averages during the monitoring period. Data sets were logged in GMT. A Davis rain gauge was installed at MP3 and measured rainfall in 0.2mm increments; the total being logged for each 10-minute period. Precipitation data was also derived from the met data logged by the lidar. When rainfall was recorded, those periods, along with periods occurring during the 10-minute period before and after, were flagged and removed if they coincided with atypical values.

Table 3 shows the specific details of the meteorological instruments used in the assessment.

Table 3 - Metrological instrument details

Instrument model/type	Measurement Height (m)	Serial No.
ZX 300 LiDAR	124	ZX1987
Davis II / Rain Gauge	0	N/A

Data Exclusions

Under ETSU-R-97 guidelines, data must be removed if they are likely to have been affected by rain or are: ‘considered atypical of the noise environment which normally prevails at the property’. Care was taken to ensure that noise monitoring equipment was placed at an appropriate distance to minimise any potential influence from watercourses. Excluded data are shown on the relevant scatter plots.

Data is also excluded if a noise logger exhibits unacceptable calibration drift between battery changes or over the survey period as a whole. A drift of more than 0.5dB between battery changes or from the calibration value taken at the time of deployment would be deemed unacceptable. No calibration drift greater than 0.5dB was detected during the monitoring period.

Atypical noise levels were identified during the assessment period 24/11/24 – 25/11/24 and were subsequently excluded from data analysis. Metrological data was reviewed for this period which highlighted that heavy rainfall combined with wind speeds of over 14 m/s, were observed. Given the proximity of the monitoring locations to Glenkin Burn, it can be deduced that high precipitation rates resulted in increased volumes of water flowing through the burn and consequently, elevated typical background noise levels in the area. These exclusions are illustrated across both monitoring locations, shown in Graph 3, Graph 4 and Graph 5.

In accordance with the IOA GPG, where a noise curve increases at lower wind speeds, the lowest background noise level has been fixed at the minima shown for low wind speeds. A minima of 32.6dB(A) for wind speeds 4 & 5 m/s during quiet-daytime and 32.4dB(A) for wind speeds 4 & 5 m/s during night-time assessment periods has been applied at Stronsaul Cottages. At Glenkin Cottage, a minima of 28.8dB(A) for wind speeds 4 & 5 m/s during quiet-daytime and 28.2dB(A) for wind speeds 4 & 5 m/s has been applied.

After exclusions, a minimum of ~288 data were available for analysis for each of the datasets collected.

Synchronisation

Time synchronisation between all data sets was confirmed using correlations and time series plots. Noise levels were plotted against wind speeds on scatter graphs; their relationship was established using polynomial trend lines of third or fourth order. The order of the polynomial used was selected to provide the optimal fit to the data.

Wind Shear

To standardise the wind speeds measured by the Lidar at hub height (124m), the 'Log Law' equation was used with a standard roughness length, z, of 0.05m.

Equation 1 - Log Law

$$U_1 = U_2 \cdot \frac{In(\frac{H_1}{z})}{In(\frac{H_2}{z})}$$

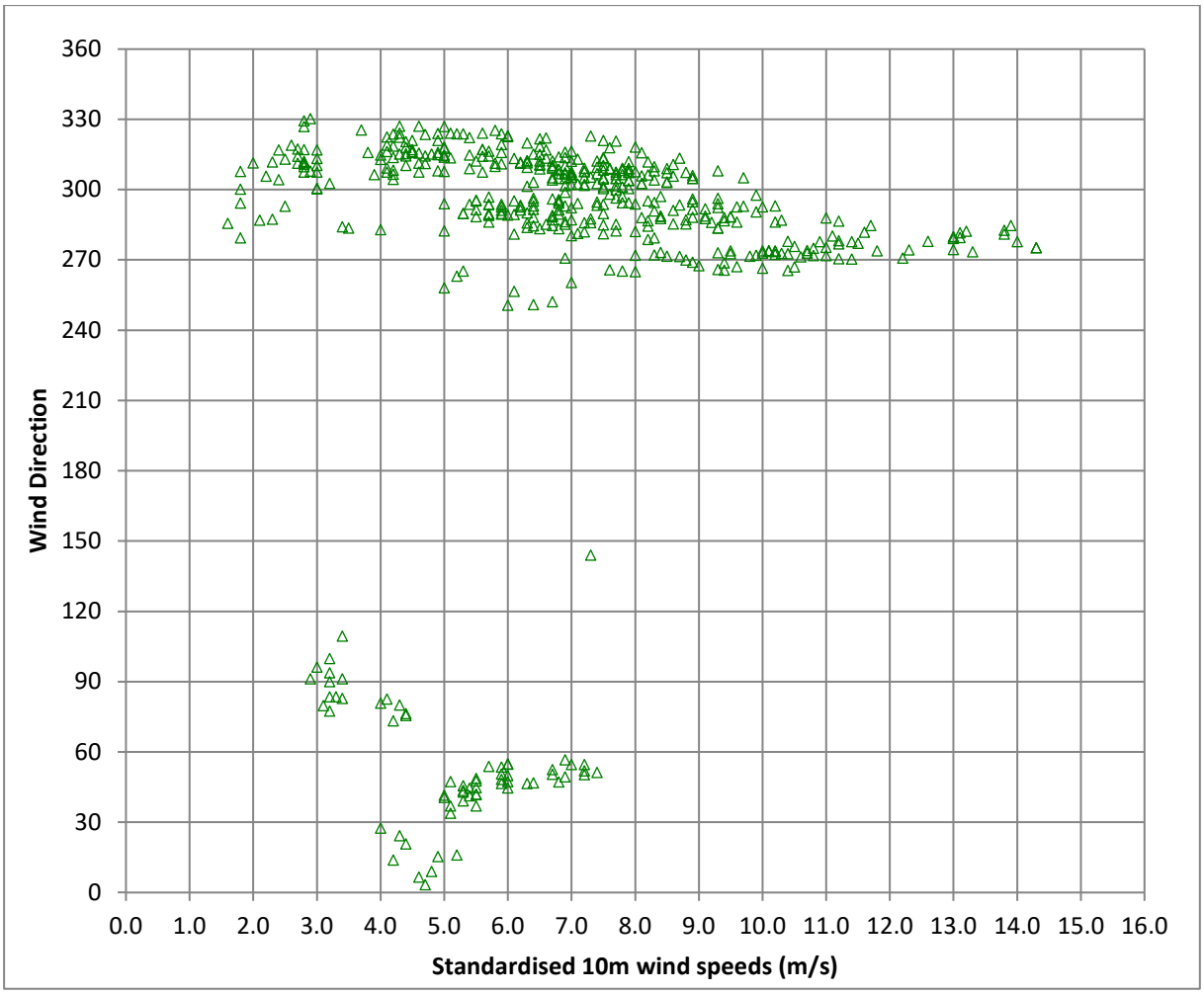
Where:
H_1 is the height of the wind speed to be calculated (V_{10})
H_2 is the height of the measured wind speed
U_1 is the wind speed to be calculated (V_{10})
U_2 is the measured wind speed
Z is the roughness length

Survey Results

The results of the survey are presented below for both ETSU-R-97 quiet daytime and night-time periods at each measurement location.

Wind Data

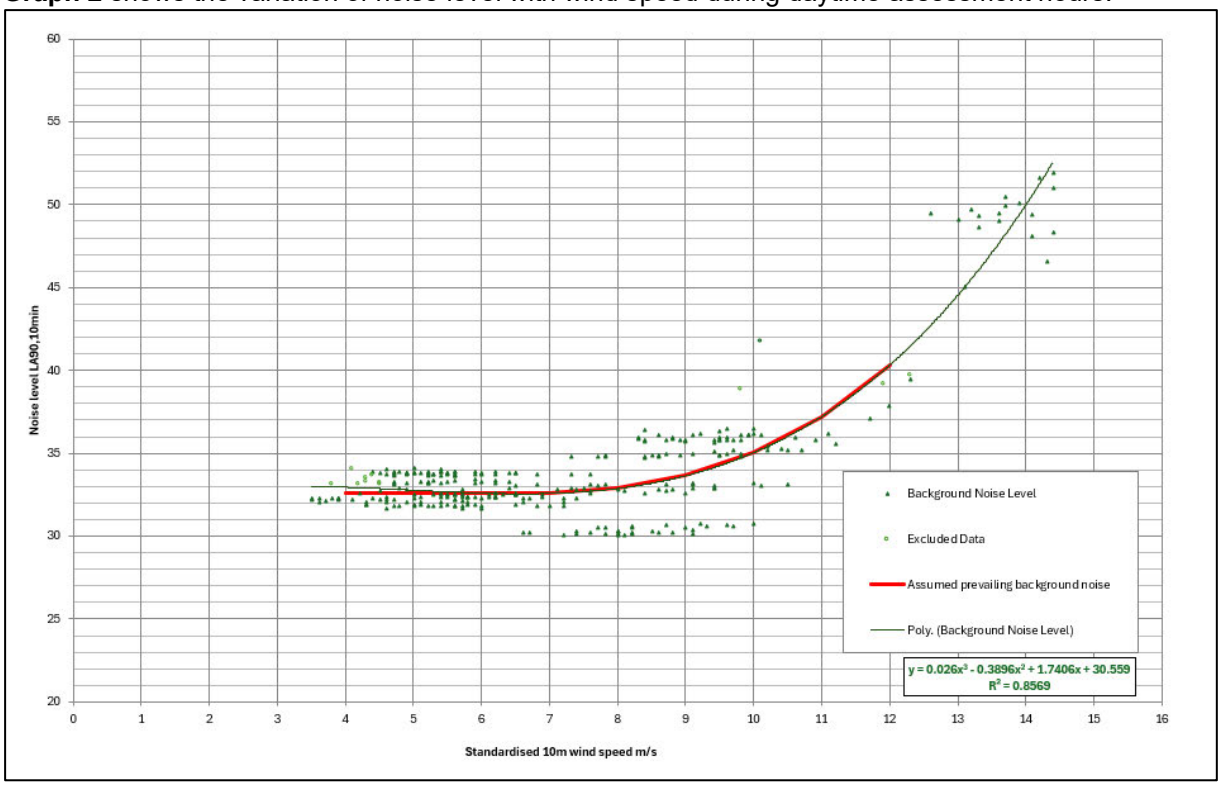
Graph 1 shows all 10-minute average wind speeds logged during the monitoring period for both daytime and night-time assessment hours (18:00 – 07:00), plotted by direction. The prevailing winds for the area are predominantly north-westerlies, represented on the graph.



Graph 1 - Standardised 10m windspeeds by direction

MP1 – Stronsaul Cottages

Graph 2 shows the variation of noise level with wind speed during daytime assessment hours.

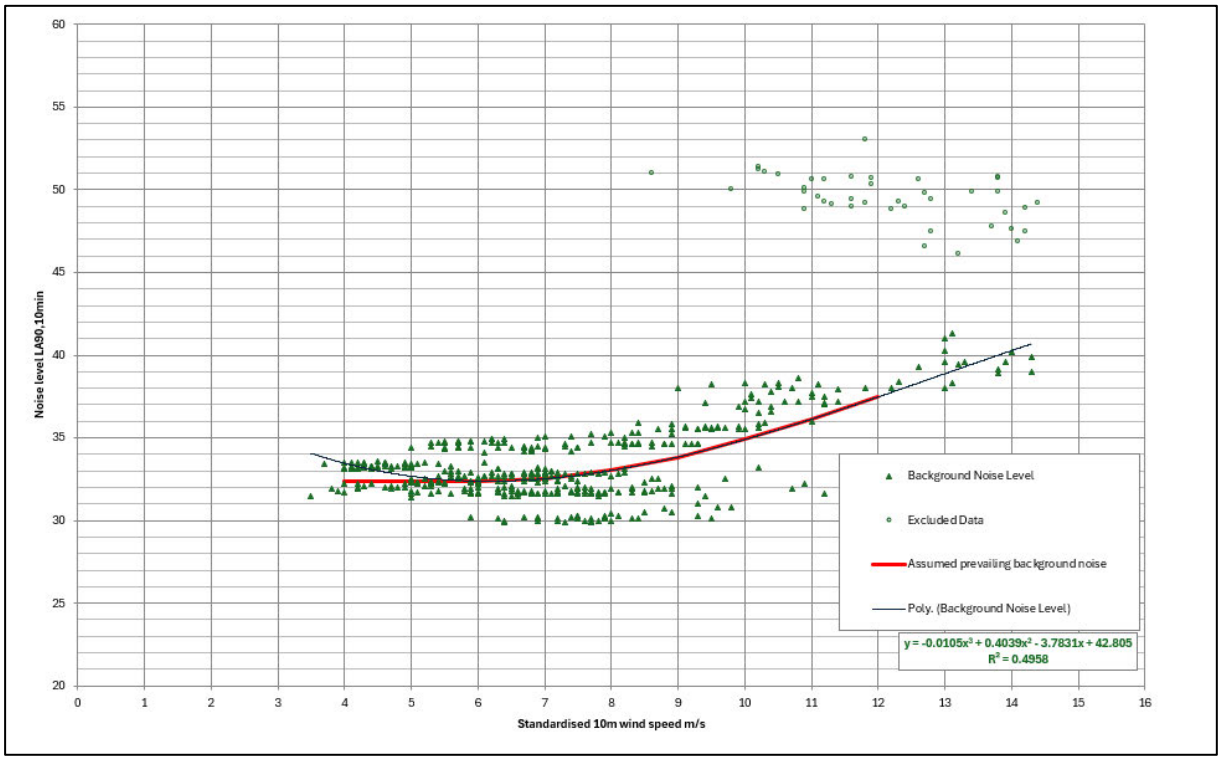


Graph 2 - Variation of noise level with wind speed during daytime assessment hours at MP1

Tabulated levels are shown below in **Table 4**.

Table 4 – MP1 tabulated results for daytime assessment hours

Daytime Background Noise Results										
Standardised wind speed	**m/s**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Number of values (Plotted)	(298)	16.0	63.0	60.0	31.0	33.0	38.0	29.0	7.0	3.0
Standard Deviation	dB	0.4	0.8	0.7	1.1	2.2	2.1	1.7	1.0	1.0
Average value $L_{A90,10min}$	dB(A)	33.0	32.8	32.6	32.6	32.9	33.6	35.0	37.2	40.3
Assumed prevailing background level $L_{A90,\ 10min}$	dB(A)	32.6	32.6	32.6	32.6	32.9	33.6	35.0	37.2	40.3



Graph 3 - Variation of noise level with wind speed during night-time assessment hours at MP1

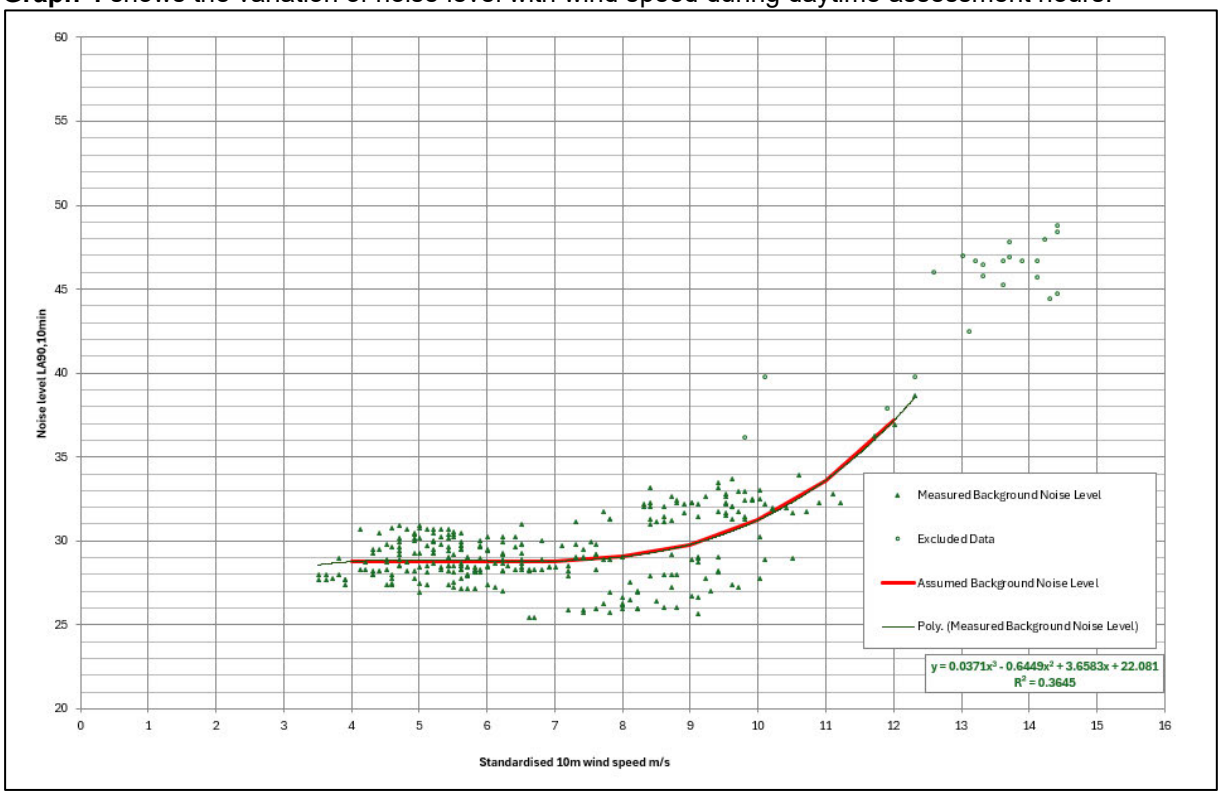
Tabulated levels are shown below in **Table 5**.

Table 5 – MP1 tabulated results for night-time assessment hours

Night-time Background Noise Results										
Standardised wind speed	**m/s**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Number of values (Plotted)	(448)	37.0	55.0	81.0	93.0	73.0	41.0	29.0	18.0	6.0
Standard Deviation	dB	0.6	0.8	1.3	1.3	1.7	2.0	2.2	2.2	3.0
Average value $L_{A90,10min}$	dB(A)	33.5	32.7	32.4	32.5	33.0	33.8	34.9	36.1	37.5
Assumed prevailing background level $L_{A90,\ 10min}$	dB(A)	32.4	32.4	32.4	32.5	33.0	33.8	34.9	36.1	37.5

MP2 – Glenkin Cottage

Graph 4 shows the variation of noise level with wind speed during daytime assessment hours.

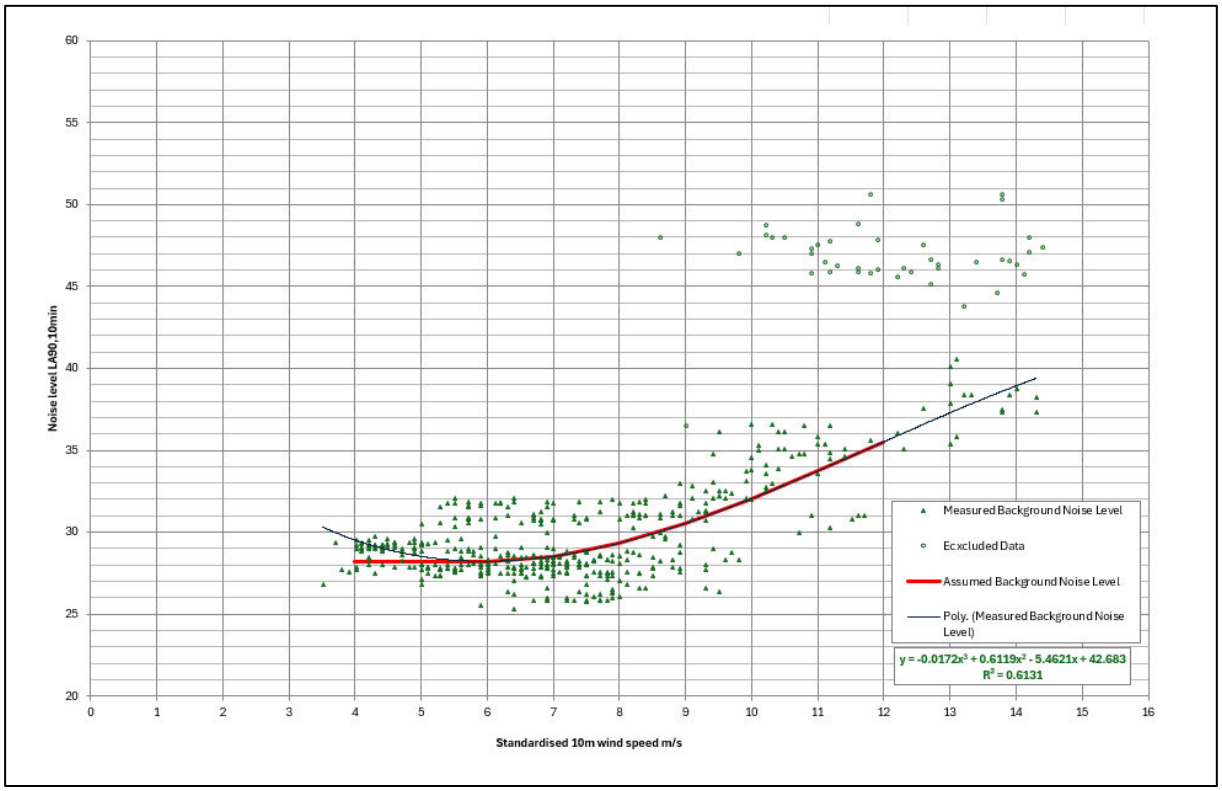


Graph 4 - Variation of noise level with wind speed during night-time assessment hours at MP2

Tabulated levels are shown below in **Table 6**.

Table 6 – MP2 tabulated results for daytime assessment hours

Daytime Background Noise Results										
Standardised wind speed	**m/s**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Number of values (Plotted)	(288)	22.0	65.0	60.0	31.0	33.0	38.0	29.0	7.0	3.0
Standard Deviation	dB	0.9	1.1	1.0	1.5	2.3	2.4	1.6	1.4	1.0
Average value $L_{A90,10min}$	dB(A)	28.8	28.9	28.8	28.8	29.1	29.8	31.2	33.6	37.2
Assumed prevailing background level $L_{A90,\ 10min}$	dB(A)	28.8	28.8	28.8	28.8	29.1	29.8	31.2	33.6	37.2



Graph 5 - Variation of noise level with wind speed during night-time assessment hours at MP2

Tabulated levels are shown below in **Table 7**.

Table 7 – MP2 tabulated results for night-time assessment hours

Night-time Background Noise Results										
Standardised wind speed	**m/s**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Number of values (Plotted)	(447)	37.0	55.0	81.0	93.0	73.0	40.0	29.0	18.0	6.0
Standard Deviation	dB	0.7	1.0	1.7	1.5	1.9	1.9	2.5	1.9	2.3
Average value $L_{A90,10min}$	dB(A)	29.5	28.5	28.2	28.5	29.3	30.5	32.0	33.7	35.5
Assumed prevailing background level $L_{A90,\ 10min}$	dB(A)	28.2	28.2	28.2	28.5	29.3	30.5	32.0	33.7	35.5

Calibration Certificates

ANV MEASUREMENT SYSTEMS

CERTIFICATE OF CALIBRATION

ilac-MRA UKAS CALIBRATION 0653

Date of Issue: 24 May 2024

Certificate Number: UCRT24/1782

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory [redacted]

K. Mistry

Customer	Green Cat Renewables Ltd 4th Floor 80 St Vincent Street Glasgow G2 5UB
Order No.	21395
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-53	00830432
	Rion	Firmware		01.02
	Rion	Pre Amplifier	NH-25	33384
	Rion	Microphone	UC-59	23976
	Rion	Calibrator	NC-75	34334830
		Calibrator adaptor type if applicable		NC-75-022

Performance Class	1
Test Procedure	TP 10. SLM 61672-3:2013
	Procedures from IEC 61672-3:2013 were used to perform the periodic tests.
Type Approved to IEC 61672-1:2013	No
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013
Date Received	23 May 2024 ANV Job No. UKAS24/05394
Date Calibrated	24 May 2024

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 23 October 2024

Certificate Number: UCRT24/2407

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

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Approved Signatory [redacted]

B. Bogdan

Customer: Green Cat Renewables Ltd
Suite 4
80 St. Vincent Street
Glasgow
G2 5UB

Order No. 21953

Description: Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification:

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NL-53	00741263
Rion	Firmware		01.02
Rion	Pre Amplifier	NH-25	34218
Rion	Microphone	UC-59	25846
Rion	Calibrator	NC-75	34334830
	Calibrator adaptor type if applicable		NC-75-022

Performance Class: 1

Test Procedure: TP 10. SLM 61672-3:2013
Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013: No
If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received: 18 October 2024 ANV Job No. UKAS24/10749

Date Calibrated: 23 October 2024

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		