Crudine Ridge Wind Farm

Noise Compliance Testing

S3736.2C7

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sonus.

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GLOSSARY AND ABBREVIATIONS

Term	Definition
A weighting	Frequency adjustment representing the response of the human ear.
Background noise level	The noise level represented by the L_{A90} in the absence of intermittent noise such as vehicles and wind gusts.
dB	Linear (unweighted) sound pressure or power level in decibels.
dB(A)	A weighted noise or sound pressure or power level in decibels.
L_{A90}	The A-weighted sound pressure level exceeded for 90% of the measurement period.
Nominated Receptor	An Associated or Non-Associated dwelling identified in Section 3.2 of the Noise Guarantee
WTG	Wind Turbine Generator
Wind Farm	Crudine Ridge Wind Farm
Non-Associated Dwelling	A residential dwelling where the owner does not have a commercial agreement with the wind farm developer and/or operator.
Associated Dwelling	A residential dwelling where the owner has a commercial agreement with the wind farm developer and/or operator.

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1 INTRODUCTION

The Noise Guarantee for the Crudine Ridge Wind Farm (the **Wind Farm**) require a post-construction assessment of operational noise be conducted. A Noise Compliance Test Plan (the **NCTP**), with Sonus reference S3736C19 (dated May 2018), provides the procedure for the post-construction noise assessment consistent with the Project Approval Conditions, which are consistent with the New South Wales *Wind Energy: Noise Assessment Bulletin for State significant wind energy development December 2016* (the **Bulletin**). The Project Approval Conditions relevant to operational noise are detailed in Appendix A.

Sonus has been engaged by GE Renewable Energy to conduct the post-construction assessment as required under the NCTP.

This report summarises the assessment of operational noise levels at four residential locations selected in accordance with the NCTP. The assessment includes analysis of noise monitoring at the residential locations, intermediate locations between the residence and Wind Farm and near-field locations around example turbines. The assessment also includes an assessment of the special audible characteristics of tonality and low frequency in accordance with the NCTP, as well as an assessment of the noise produced by ancillary infrastructure on the project site.

2 NCTP TEST METHOD

The NCTP establishes a methodology to determine compliance in accordance with the Project Approval Conditions as well as the New South Wales *Wind Energy: Noise Assessment Bulletin for State significant wind energy development December 2016* (**the Bulletin**). The NCTP provides four logging locations where noise levels from operation of the Wind Farm are to be measured. The locations are consistent with those identified in the NCTP. Three of the locations (CR19, CR28 and HER03) are at Non-Associated Dwellings. The remaining location (HER15) is an Associated location.

The following table provides co-ordinates of the four residential logging locations.

Table 1: *Residential logging locations*

Receiver	Type	Associated	Coordinates (WGS 84 Zone 55H)	
			Northing	Easting
CR19	House	No	6351470	752139
CR28	House	No	6349290	750058
HER03	House	No	6341500	745093
HER15	Shed	Yes	6344300	741221

Where the Wind Farm is shown to be compliant with the noise criteria at the above logging locations, the Wind Farm is compliant with the Project Approval Conditions and the Bulletin in accordance with the NCTP.

For locations CR19, CR28 and HER03 the noise criteria are consistent with those listed in the Project Approval Conditions. For HER15, the criteria are based on the 45 dB(A) base noise level for an Associated location. The following table summarises the criteria for the compliance monitoring locations:

***Table 2**: Criteria*

Receiver	Criteria at integer Hub Height Wind Speeds [dB(A)]													
	3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
CR19	35	35	35	35	35	35	36	37	38	40	42	44	47	47
CR28	35	35	35	35	35	35	35	35	36	38	41	43	45	45
HER03	35	35	35	35	35	35	35	36	38	39	40	41	41	41
HER15	45	45	45	45	45	45	45	45	45	45	45	45	45	45

In accordance with the NCTP, near-field and intermediate testing were conducted for the purpose of determining the character of noise (tonality) from the turbines and enabling noise from other sources to be excluded from the data analysis. The testing was conducted at locations where the noise from other sources in the environment was minimised (in comparison to the noise level from wind turbines) and therefore the results can assist in determining compliance at the residential logging locations when the noise from turbines is masked by other sources.

3 NEAR-FIELD AND INTERMEDIATE MEASUREMENTS

3.1 Near-field Measurements

Near-field measurements were conducted at two representative turbines (A04 and A10) in general accordance with *IEC61400-11 Edition 3.0 (2012)* (**IEC61400-11**) on 11 March 2022. The results of the measurements in the near-field have been analysed to determine the presence of any tones in accordance with the Bulletin and, if any, the frequencies at which they occur.

Where tonality is identified in the near-field measurements, there is the potential for the characteristic to be present at residential locations and a further assessment is required.

3.1.1 Data Collection

Noise measurements were made using Class 1 *Rion* NL-52, NATA calibrated, sound level meters equipped with one-third octave band analysers. The sound level meters were calibrated before and after the measurements using a Class 1 *Rion* NC-74 calibrator (serial number 35094478), with negligible drift observed.

The measurements were taken in the proximity of two representative turbines, A04 and A10. The WTGs operated at power outputs ranging from cut-in to rated power during the monitoring period. The measurement

locations are provided in Table 3 along with the serial number of the sound level meters used, and the downwind direction to the relevant WTG. The calibration certificates are provided in Appendix B.

Table 3: *Near-field measurement locations*

WTG	Sound Level Meter Serial Number	Coordinates (WGS 84 Zone 55H)		Slant Distance (m)	Downwind Direction (˚)
		Easting	Northing		
A04	00710426	750634	6356012	188	105
A10	00598175	751061	6355409	191	94

A secondary wind shield was used for each sound level meter and was positioned over the microphone. The following figure shows an example of the near-field monitoring setup used.

Figure 1: *Typical example of near-field monitoring setup*

The insertion loss of the secondary wind shield has been measured and is summarised in the following table.

Table 4: *Secondary wind shield insertion loss*

1/3-octave band (Hz)	20	25	31.5	40	50	63	80	100	125	160
Insertion loss (dB)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.5	-0.3	-0.6	-0.2	-0.3
1/3-octave band (Hz)	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**
Insertion loss (dB)	-0.3	0.1	0.3	1.2	2.0	2.7	1.9	0.9	1.1	2.1
1/3-octave band (Hz)	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**		
Insertion loss (dB)	1.5	2.1	2.5	2.3	2.5	2.7	3.1	3.6		

3.1.2 Tonality Assessment

An assessment has been made considering the special audible characteristic of tonality at the near-field locations in accordance with Appendix 4 of the Project Approval (which is equivalent to the Bulletin), based on the data measured in general accordance with *IEC61400-11*.

The level of tonality for each integer wind speed has been determined based on the measured one-third octave bands at each wind speed across the monitoring period. This identified a number of potential tones at varying frequencies. Audio recordings for the periods where these tones were identified were then consulted to determine whether the tone in question was associated with the operation of the wind turbine. This further investigation identified a number of tones present in the noise profile of the turbine that were associated with its operation. Two tones were identified with the potential to be audible at residences, as shown in the table below:

Table 5: *Identified tones and wind speeds*

Location	Frequency Band	Windspeed
A04	1.25 kHz	7 and 9 m/s
	2.5 kHz	3 and 4 m/s
A10	1.25 kHz	5, 6, 7 and 8 m/s
	2.5 kHz	5, 6, 7, 8 and 9 m/s

In accordance with the NCTP and based on the above, tonality has been considered at the residential logging locations for frequencies of 1.25 kHz at wind speeds of 5m/s to 9m/s (inclusive), and for 2.5 kHz at 3m/s to 9m/s (inclusive). This assessment is detailed in Section 4.3.1.

It is noted that although potential tones were found at higher frequencies, there is no potential for these to be audible at residences, given the high atmospheric absorption at these frequencies.

3.1.3 Highest Noise Emission

An assessment of the wind speed at which the noise level reaches a plateau was conducted at the near-field locations. The assessment was conducted based on downwind periods only, corresponding to wind directions within ±15 degrees from the downwind direction to the nearest WTG (noted in Table 3 above). If the noise at the residential logging locations continues to increase at wind speeds above the wind speed of the plateau, this will indicate that the noise is from sources other than the turbines (most commonly wind in trees for high wind speed conditions). The figure and table below show the results of this assessment for WTG A10. WTG A10 was chosen as the location with the most valid data points.

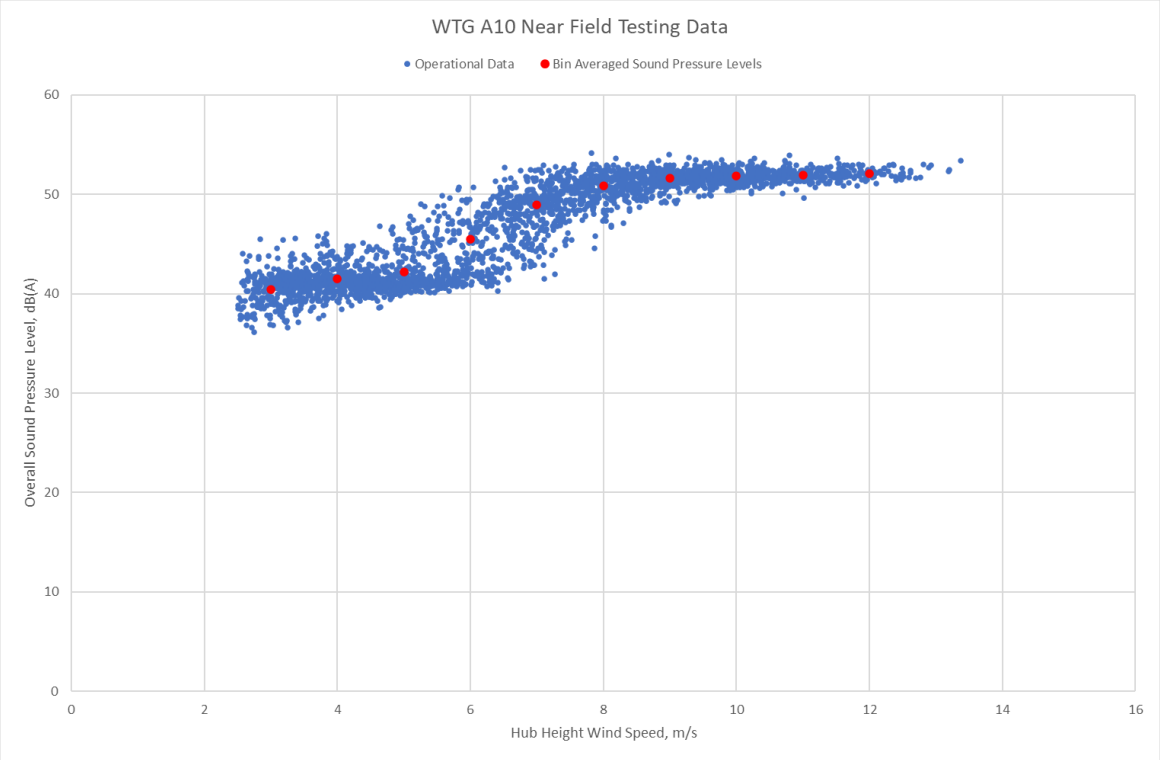

Figure 2: *WTG A10 near-field measurement data*

Table 6: *WTG A10 measured sound pressure levels*

Integer Wind Speed	Sound Pressure Level
3m/s	40 dB(A)
4m/s	42 dB(A)
5m/s	42 dB(A)
6m/s	45 dB(A)
7m/s	49 dB(A)
8m/s	51 dB(A)
9m/s	52 dB(A)
10m/s	52 dB(A)
11m/s	52 dB(A)
12m/s	52 dB(A)

As can be seen from the above, the noise level of the turbine reaches at plateau at 9m/s and remains consistent above this wind speed. As such, the noise at residential locations from the turbines should not increase above 9m/s. Where an increase is seen for these wind speeds, the increase in noise cannot be attributed to that of the Wind Farm.

3.2 Intermediate Measurements

The NCTP recommends that the noise level from the Wind Farm be measured simultaneously at the residential logging locations as well as intermediate locations, which:

- are between the Wind Farm and residence being assessed; and,
- have a higher Wind Farm noise level to background noise level ratio (the noise level from the Wind Farm is more likely to be measurable above the level of background noise).

Data filtering may remove time periods where noise data collected at an intermediate position confirms that the source of the noise at a residential logging location is not the wind turbines. For example, noise data collected in a particular 10-minute interval at a residential logging location may be removed:

- if the noise measured in the same period at the intermediate position (closer to the turbines) is at a lower level; or
- if the frequency content of the noise at the receptor is not consistent with the frequency content at the intermediate position.

The intermediate measurement positions were located within paddocks between each residence and the closest WTG.

The noise level was measured at the intermediate locations using a combination of *Rion* NL-42 and NL-21 Class 2, NATA calibrated, sound level meters. The coordinates of the intermediate locations and the serial numbers of the sound level meters used are provided in the following table and the calibration certificates are attached in Appendix B.

Table 7: *Intermediate logging locations and serial numbers*

Intermediate Logging Location	Coordinates (WGS 84 Zone 55H)		Sound Level Meter Serial Number
	Easting	Northing	
CR19 Intermediate	750940	6352287	01000229
CR28 Intermediate	749319	6350520	01298929
HER03 Intermediate	744087	6341875	00877043
HER15 Intermediate	742041	6343907	01298930

The impact of the intermediate location measurements is discussed further in Section 4.

3.2.1 Intermediate Validation Point

In accordance with the NCTP, a publicly accessible intermediate point has been identified to allow future validation of the noise model. None of the intermediate locations used for the monitoring were able to be placed within public property, as such an additional location has been identified for this purpose. The coordinates of the publicly accessible intermediate point (adjacent to Hill End Road) are provided in Table 8 below. This location has also been overlaid on a noise contour plan in Figure 3.

Table 8: *Publicly accessible intermediate validation point co-ordinates*

Location	Coordinates (WGS 84 Zone 55H)	
	Easting	Northing
Intermediate validation point	743020	6342131

4 RESIDENTIAL NOISE MONITORING

The noise levels (L_{A90}) at each of the residential logging locations were measured continuously in 10-minute intervals for the period between 26 January and 29 March 2022, which resulted in at least 6 weeks of data, not affected by operational constraints on the Wind Farm. The table below outlines the periods when the noise monitoring took place.

Table 9: *Residential logging periods*

Residential Logging Location	Noise Monitoring Period	Six Weeks of Data
CR19	24/01/2022 – 12/03/2022	✓
CR28	25/01/2022 – 17/03/2022	✓
HER03	25/01/2022 – 29/03/2022	✓
HER15	25/01/2022 – 29/03/2022	✓

The residential logging locations were selected such that they were consistent with those locations where pre-construction background monitoring was undertaken. These locations have also been overlaid on a noise contour plan in Figure 3.

At each of the residential logging locations, noise monitoring equipment was placed at a position equivalent to the background noise logging location used prior to construction of the Wind Farm. Generally, this position was on the Wind Farm side of the dwelling and at least 5m from the building facade, to remove the effects of large reflecting surfaces. A photograph of the noise logging equipment at each residential logging location is provided in Appendix C.

In addition to the noise logging, local wind speed and rainfall logging was conducted at 2 locations (CR28 and HER03). The rainfall data and the measured wind speed at the microphone height were used to identify periods where data might have been adversely affected by local weather. For locations where the local weather logging equipment was not deployed, data from the closest weather logger has been used in the analysis.

At each of the residential logging locations, a combination of *Rion* NL-52 or NL-42, NATA calibrated, Class 1 or 2 sound level meters with a noise floor of less than 20 dB(A) were deployed. The serial numbers of the sound level meters used are provided in the following table and the calibration certificates are provided in Appendix B.

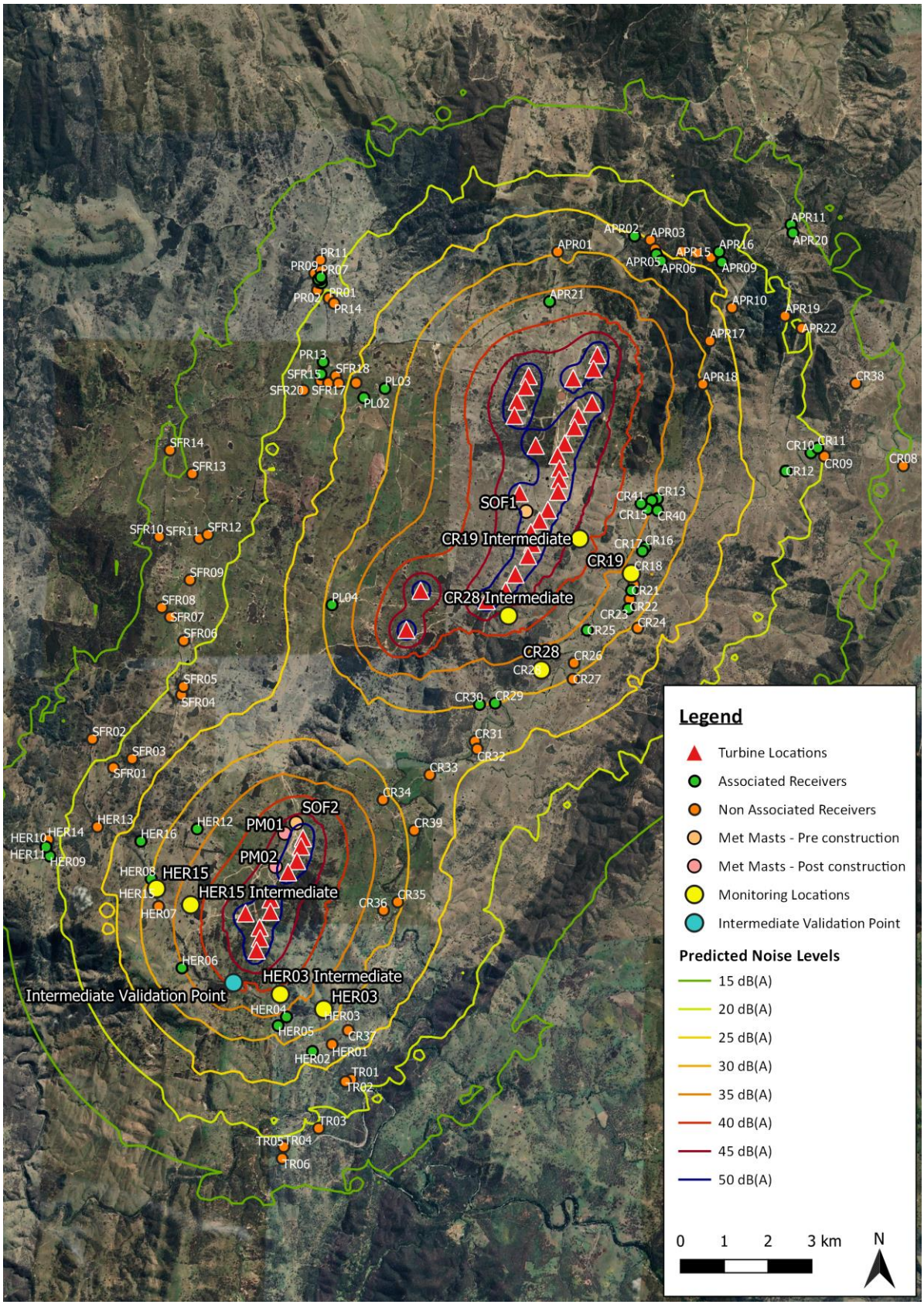

Figure 3: *Noise contours and residential logging locations*

Table 10: *Residential logging locations and serial numbers*

Residential Logging Location	Coordinates (WGS 84 Zone 55H)		Sound Level Meter Serial Number
	Easting	Northing	
CR19	752139	6351470	00320656
CR28	750058	6349290	00510393
HER03	745093	6341500	00710394
HER15	741221	6344300	00510392

The sound level meters were calibrated before and after the background noise monitoring regime with a Class 1 *Rion* NC-74 calibrator (with serial number 35094478) and each microphone was fitted with a *Rion* WS-15 all-weather wind shield.

During the noise monitoring regime, wind speed and direction were monitored at two permanent meteorological masts (PM01 and PM02) located around the Wind Farm. To facilitate comparison of the post-construction noise monitoring results with the criteria derived based on the pre-construction noise monitoring, the wind speed and direction data collected at PM01 was used as the basis for modelling wake free wind speed and direction data at the locations of the two pre-construction meteorological masts (SOF1 and SOF2) which have since been decommissioned. The data set at these two locations (SOF1 and SOF2) was provided for a height corresponding to the hub height of the turbines (91.5 metre) to facilitate this analysis. The locations of the meteorological masts are provided below:

Table 11: *Mast locations*

Mast Location	Coordinates (WGS 84 Zone 55H)	
	Easting	Northing
Pre-construction Mast SOF1	749710	6352918
Pre-construction Mast SOF2	744453	744453
Operational Mast PM01	744189	6345551
Operational Mast PM02	743979	6344790

4.1 Data Analysis

The NCTP allows noise from other sources to be removed as follows:

- By filtering out time periods:
    - affected by rain, hail, or wind based on a weather logger placed at an equivalent location to one of the noise loggers. Data is adversely affected where precipitation occurs in a 10-minute period either side of the period in question or where a wind speed of 5 m/s is exceeded for 90% of a 10-minute period;
    - when sufficient WTGs have not been connected to the grid to influence the measured level during the current 10-minute period;
    - considered abnormal, such as during local construction or maintenance activities; and,
    - where the wind direction is not within 45° either side of the direct line between the nearest WTG and the relevant receiver (if sufficient data points can be collected using this method).

In accordance with the NCTP, further data filtering may remove time periods or frequency content where noise data collected at a near-field or intermediate position confirms that the source of the noise at a receptor is not the wind turbines. Noise data collected in a particular 10-minute interval at a receptor were removed:

- if the noise measured in the same period at the intermediate position (closer to the turbines) was at a lower level; or
- if the wind farm was not a significant noise source in the recorded digital audio at residences.

Following the removal of the data as described above and the application of any relevant penalties for special audible characteristics (refer below), the remaining noise data were correlated with the hub height wind speed data for each residential logging location. As the post construction regression curves demonstrate compliance with the noise criteria at all receptor locations no further calculation of the derived wind farm noise was conducted.

The following table provides the number of valid data points following removal of adverse data and identifies the wind mast which has been used for the correlations at each testing location.

Table 12: *Number of valid data pairs and relevant wind mast*

Testing Location	Total Data Points Collected	Filtered for:				Total Data Points Removed	Valid Data Points	Relevant Mast
		Local Wind/Rain	Downwind Only	Wind Speed	Inter-mediate Location			
CR19	**6709**	324	6003	348	3014	**6488**	**221**	SOF1
CR28	**7321**	324	6908	679	1144	**6992**	**329**	SOF1
HER03	**9088**	337	8285	840	518	**8508**	**580**	SOF2
HER15	**9025**	340	2439	830	3829	**5969**	**3056**	SOF2

Second and third order regression analyses were performed on the correlations to determine the noise levels at each wind speed and to facilitate a comparison with the criteria. In all cases, the coefficient of determination (R^2) for the third order regression was higher than that of the corresponding second order regression. The R^2 values for the regression analyses at each location are provided in Table 13 below.

Where the regression demonstrates that the criteria are achieved at all integer wind speeds, the noise from the wind farm has been deemed to comply with the criteria at this location.

Table 13: *Second order and third order R^2 values*

Testing Location	Coefficients of Determination (R^2)	
	Second Order	Third Order
CR19	0.1713	**0.1802**
CR28	0.2539	**0.2540**
HER03	0.3865	**0.3916**
HER15	0.1019	**0.1142**

4.2 Residential Noise Monitoring Results

The correlation graphs with the regression curve and criteria are provided in Figure 4 to Figure 7 below. Time traces showing the measured level, hub-height wind speed at the nearest met mast and the total power output of the wind farm at each residential monitoring location are provided in Appendix D. The measured noise levels and criteria for each integer hub height wind speed from 3m/s to 12m/s have also been tabulated below.

In accordance with the Bulletin, compliance checking should be conducted based on a minimum of 2,000 data points, including a minimum of 500 points representative of the worst-case wind direction (i.e. downwind from

the nearest WTG's). In circumstances where it is impractical to collect 500 downwind data points due to the prevailing wind conditions, the Bulletin States that *"data collection should continue for up to six weeks and the valid data collected in this period shall be deemed to be an acceptable quantity in terms of worst case wind direction"*.

Due to the prevailing wind direction at the Wind Farm, it was not possible to collect 500 data points at three of the residential monitoring locations, despite more that 6,000 total data points being collected over a monitoring period exceeding six weeks at each location.

Review of historical meteorological data (including data collected by the on-site met masts during the pre-construction noise monitoring and long-term data from the nearest Bureau of Meteorology (**BOM**) station at Mudgee) indicates that the wind conditions encountered during the monitoring program are typical for the locality, and as such it would be impractical to conduct monitoring of a sufficient duration to collect 500 data points at each location. In such circumstance, the Bulletin deems the quantity of data collected to be acceptable.

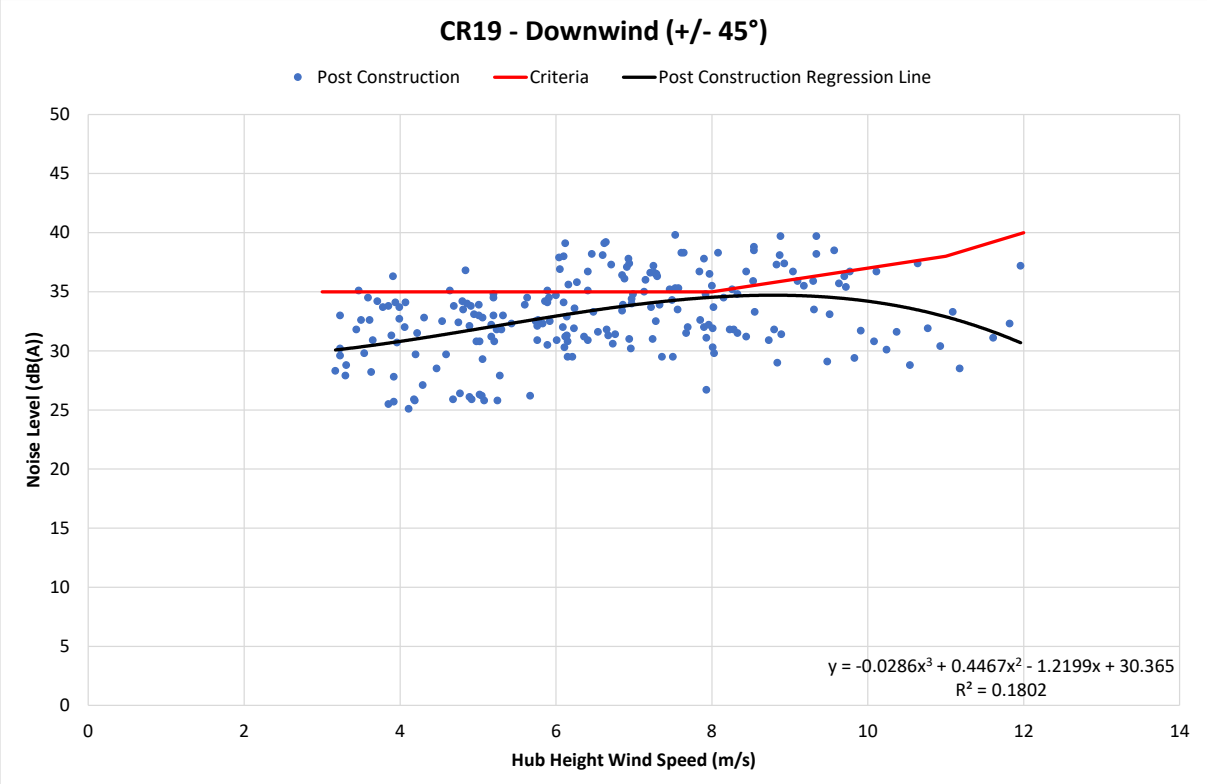

Figure 4: *Criteria and post construction regression curve for CR19 (Downwind +/- 45°)*

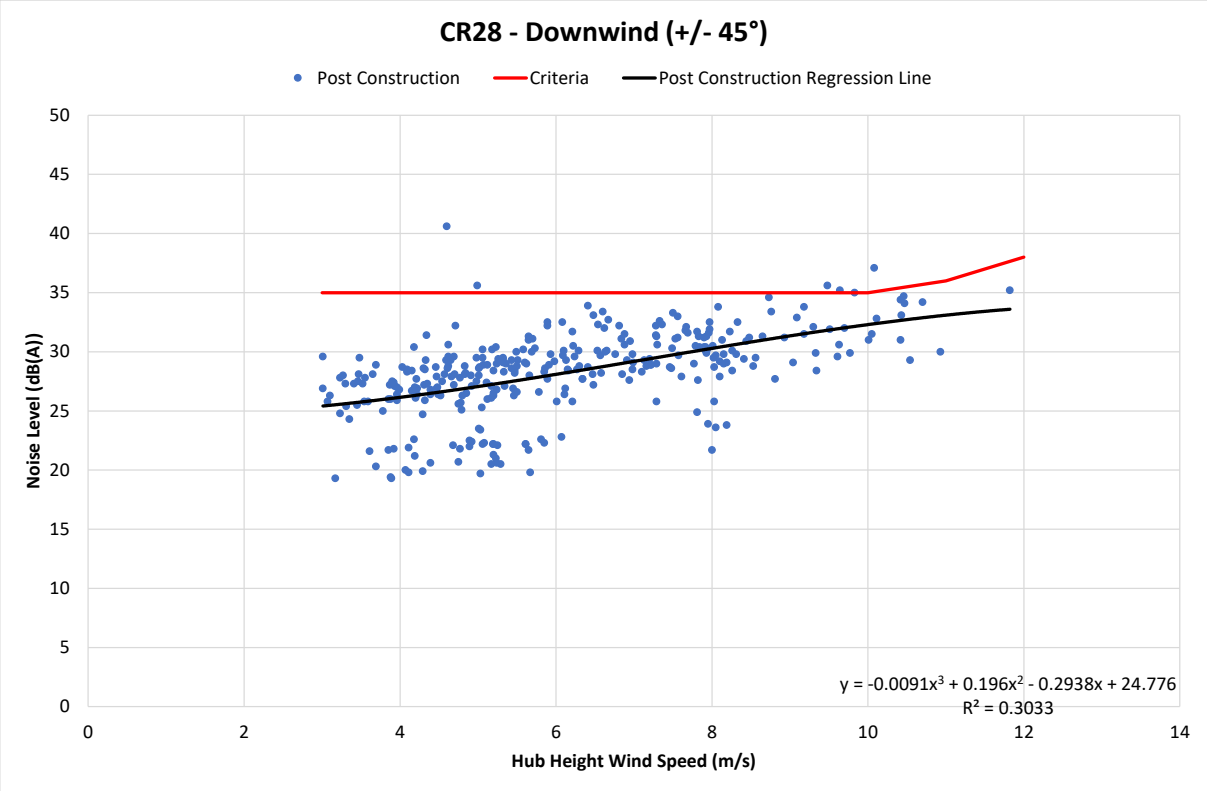

Figure 5: *Criteria and post construction regression curve for CR28 (Downwind +/- 45°)*

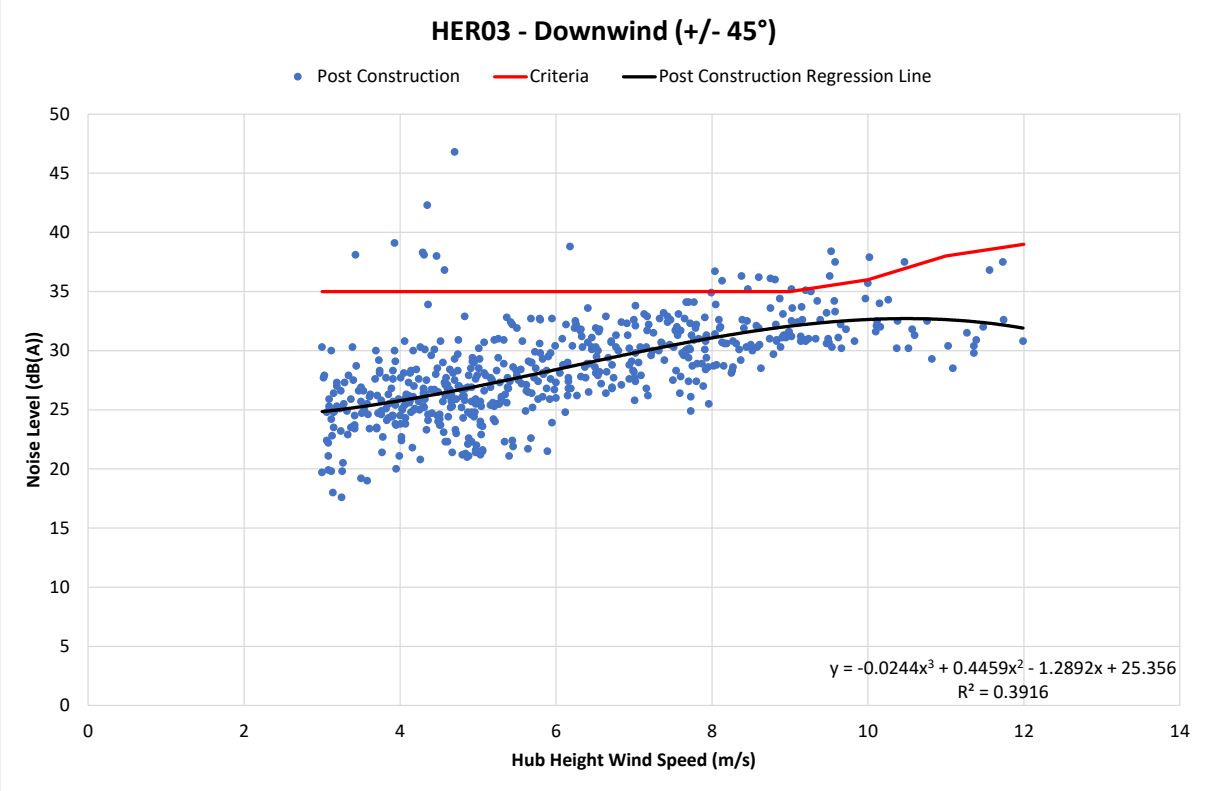

Figure 6: *Criteria and post construction regression curve for HER03 (Downwind +/- 45°)*

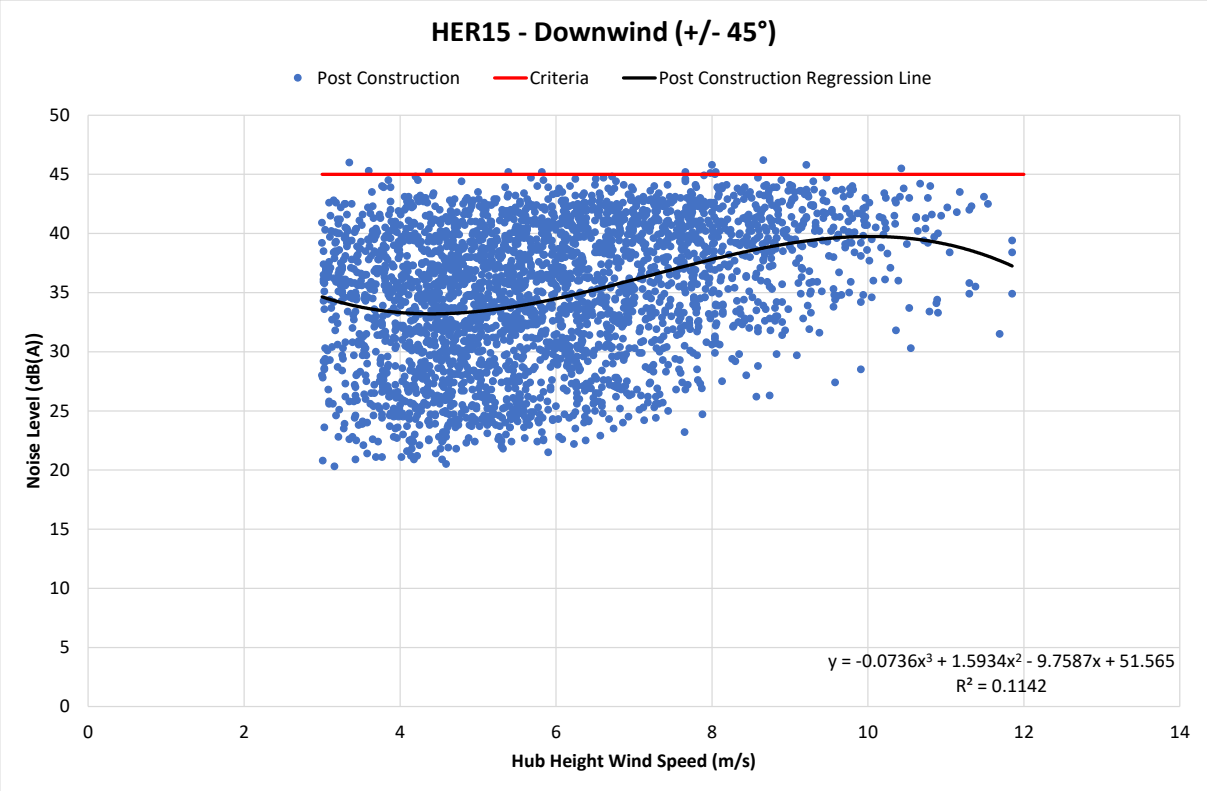

Figure 7: *Criteria and post construction regression curve for HER15 (Downwind +/- 45°)*

Table 14*: Criteria and measured levels*

Receiver		Criteria and Measured Levels at integer Hub Height Wind Speeds [dB(A)]									
		3	4	5	6	7	8	9	10	11	12
CR19	Criteria	35	35	35	35	35	35	36	37	38	40
	Measured	30	31	32	33	34	35	35	*	*	*
CR28	Criteria	35	35	35	35	35	35	35	35	36	38
	Measured	25	26	27	28	29	30	31	32	*	*
HER03	Criteria	35	35	35	35	35	35	35	36	38	39
	Measured	25	26	27	28	30	31	32	33	33	*
HER15	Criteria	45	45	45	45	45	45	45	45	45	45
	Measured	35	33	33	34	36	38	39	40	39	*

* No valid downwind data recorded.

It is noted that there was insufficient downwind data at all residential logging locations for higher wind speeds, being 10m/s and above. The near-field measurements, however, showed that the noise output of the turbines does not increase above 9m/s. Therefore, as the criteria continue to increase above 9m/s, it can be inferred that where the noise level complies at a wind speed of 9m/s or above, it will also comply with the higher criteria for greater wind speeds where there may not be sufficient data.

The results indicate that the measured noise levels are no greater than the project criteria at all wind speeds from cut-in to 12m/s when considering only the noise from the Wind Farm, as determined using the filtering processes defined in the NCTP. The Wind Farm is therefore compliant with the noise criteria subject to the assessment of special audible characteristics.

4.3 Special Audible Characteristics

4.3.1 Tonality

Tones were identified in the noise profile of the turbine as part of the near-field testing. As such, further testing for tonality was undertaken as part of the residential noise monitoring regime. As per the NCTP, the closest non-associated residence where permission was granted to place noise logging equipment was considered, being CR28. The specific frequencies and wind speeds where audible tones were found during the near-field testing were investigated further at this residence. For each wind speed where tones were identified, the number of potential tones were compared to the total number of valid data points at that wind speed. The results of this comparison can be seen in the table below. It is noted that this contains all potential tones identified at this residence, potentially including some that are not associated with the wind farm.

Table 15: *Tonal percentage per wind speed*

Wind Speed	Frequency Band	
	1.25 kHz	2.5 kHz
3 m/s	-	0%
4 m/s	-	0%
5 m/s	2.5%	3.7%
6 m/s	3.9%	0%
7 m/s	0%	0%
8 m/s	4.0%	0%
9 m/s	0%	0%

Table 15 above shows that while there are some tones present at this residence for the same wind speeds and frequencies as those identified in the near-field testing, they are relatively rare occurrences when considering the full monitoring period. As per the NCTP, a penalty is only applicable for excessive tonality where the tone is present for more than 10% of the period at a particular wind speed. As this is not the case for any frequency or wind speed, it can therefore be determined that excessive tonality is not present at residences and no penalty is warranted in this case.

4.3.2 Low Frequency Noise

An assessment of the low frequency content has been conducted in accordance with the procedure outlined in the NCTP. The assessment is required to be conducted:

- At the Non-Associated residential logging location where the highest noise level is predicted;
- At the integer wind speed where the difference between the predicted noise level and the project criteria is the least;
- Conducted under a downwind condition at night;
- Over a 10-minute interval with the wind farm operational;
- Collecting at least 5 measurement intervals where the wind farm is audible;
- Comparing the C-weighted L_{90} noise level with the criterion of 60 dB(C);

The C-weighted L_{90} noise level was not recorded at the residential logging locations, so the C-weighted L_{eq} value has been used for the purpose of this assessment. It should be noted that the L_{90} value will always be lower than the L_{eq} value, so where the criteria are met when considering the L_{eq} value, they will also be met when considering the L_{90} value.

The Non-Associated residential logging location with the highest predicted noise level is CR19. The smallest difference between the predicted level and the relevant criteria occurs at wind speeds of 8m/s and 9m/s, where the difference is 2 dB(A) in both cases. The assessment has therefore considered both of these wind speeds further under downwind conditions.

Under downwind conditions at night, the highest measured L_{eq} value at residential logging location CR19 was 51 dB(C) (irrespective of the wind speed). This is below the night criterion of 60 dB(C), thereby indicating that there is no significant low frequency component to the noise from the turbines in this case. As such, no penalty is warranted for a low frequency special audible characteristic.

4.4 Ancillary Infrastructure

In accordance with the NCTP, noise from the substation was measured at an intermediate distance between the substation and the closest residence during normal operation. The result of the measurement was used to predict the noise at the closest associated (APR21) and non-associated (APR18) dwellings, 2.2 kilometres and 3.3 kilometres from the substation respectively.

Noise from the substation was measured during normal operation on 29 March 2022, using a *Rion* NL-42 Class 2 sound level meter with serial number 00510392. The calibration was checked before and after the measurement using a *Rion* NC-74 calibrator with serial number 35094478 (calibration certificates are provided in Appendix B).

A noise level of 42dB(A) was measured at a distance of 100 metres from the substation. This level included the influence of other noise sources in the vicinity of the substation (most notably the nearest WTGs) and is therefore considered an overestimate of the noise from the ancillary equipment.

Based on the measured level, noise levels of 15dB(A) and 12dB(A) are predicted at the nearest associated (APR21) and non-associated (APR18) residences, respectively, using a simple geometric spreading model (lower noise levels are predicted at other dwellings further from the substation). These levels comfortably achieve the noise level of 35dB(A) nominated in the NCTP and would most likely result in noise from the substation being inaudible at the nearest dwellings. Note that the geometric spreading model is conservative as it does not include the influence of air absorption, shielding by terrain and other factors which also contribute to the attenuation of noise.

Based on the above, noise from the substation is therefore deemed to be in compliance with the Project Approval Conditions.

5 CONCLUSION

A post-construction assessment of operational noise for the Crudine Ridge Wind Farm has been completed in accordance with the Project Approval Conditions and the Noise Compliance Test Plan.

This report has been prepared to summarise the results of this analysis and to provide further information regarding the methodology behind the assessment.

The results of the analysis show that the residential logging locations meet the relevant criteria of the Project Approval Conditions when assessed in accordance with the NCTP. Therefore, the Wind Farm can be considered to be in compliance with the Project Approval Conditions and the Bulletin.

An assessment of special audible characteristics has also been completed, indicating that there is no excessive component of tonality or low frequency to the noise profile of the turbines and no penalty is therefore warranted for such characteristics.

The noise produced by the ancillary infrastructure on the site has also been assessed and will easily achieve the criterion required as per the Project Approval Conditions.

It can therefore be determined that the Crudine Ridge Wind Farm complies with all noise related provisions of the Project Approval, as indicated by the assessment contained within this report.

APPENDIX A - Project Approval Conditions

The Project Approval Conditions relevant to the operational noise from the wind turbines are as follows:

Operational Noise Criteria – Wind Turbines

11. *The Applicant shall ensure that the noise generated by the operation of wind turbines does not exceed the relevant criteria in Table 4 at any non-associated residence.*

Table 4: Noise criteria dB(A)

Residence No	***Criteria (dB(A)) with Reference to Hub Height Wind Speed (m/s)***													
	3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
APR2, 3, 4, 5, 6, 7, 8, 9,10 CR15	35	35	35	35	35	36	38	39	41	42	44	46	48	48
CR16, 18, 19, 20, 21, 24	35	35	35	35	35	35	36	37	38	40	42	44	47	47
CR26, 27, 28	35	35	35	35	35	35	35	35	36	38	41	43	45	45
CR32, 33, 34, 35, 36	35	35	35	35	35	35	37	40	42	45	47	50	52	55
CR37, HER3, 4, TR1, 2, 3, 4, 5, 6	35	35	35	35	35	35	35	36	38	39	40	41	41	41
HER10, 11, 13	35	35	35	35	37	39	41	43	45	46	46	46	46	46
PL1, 2, PR1, 3, 4, 9, 10, 11, SFR1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19	35	35	35	35	35	37	39	41	43	44	46	46	46	46
All other non-associated residences	The higher of 35 dB(A) or the existing background noise level ($L_{A90\ (10\text{-}minute)}$) plus 5 dB(A)													

Noise generated by the operation of the wind turbines is to be measured in accordance with the relevant requirements of the South Australian Environment Protection Authority's Wind Farms – Environmental Noise Guidelines 2009 (or its latest version), as modified by the provisions in Appendix 4. If this guideline is replaced by an equivalent NSW guideline, then the noise generated is to be measured in accordance with the requirements in the NSW guideline.

Noise Monitoring

13. *Within 3 months of the commencement of operations, unless otherwise agreed by the Secretary, the Applicant shall:*

(a) undertake noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and

(b) submit a copy of the monitoring results to the Department and the EPA.

14. *The Applicant shall undertake further noise monitoring of the development if required by the Secretary.*

APPENDIX 4

NOISE COMPLIANCE ASSESSMENT

PART A: SOUTH AUSTRALIAN WIND FARMS: ENVIRONMENTAL NOISE GUIDELINES 2009 (MODIFIED)

South Australian *Wind Farms: Environmental Noise Guidelines 2009* (Modified) refers to the South Australian EPA document modified for use in NSW. The modifications are as follows:

Tonality

The presence of excessive tonality (a special noise characteristic) is consistent with that described in *ISO 1996.2: 2007 Acoustics — Description, measurement and assessment of environmental noise – Determination of environmental noise levels* and is defined as when the level of one-third octave band measured in the equivalent noise level $L_{eq(10minute)}$ exceeds the level of the adjacent bands on both sides by:

- 5dB or more if the centre frequency of the band containing the tone is in the range 500Hz to 10,000Hz;
- 8dB or more if the centre frequency of the band containing the tone is in the range 160 to 400Hz; and/or
- 15dB or more if the centre frequency of the band containing the tone is in the range 25Hz to 125Hz.

If tonality is found to be a repeated characteristic of the wind turbine noise, 5 dB(A) should be added to measured noise levels from the wind farm. If tonality is only identified for certain wind directions and speeds, the penalty is only applicable under these conditions. The tonal characteristic penalty applies only if the tone from the wind turbine is audible at the relevant receiver. Absence of tone in noise emissions measured at an intermediate location is sufficient proof that the tone at the receiver is not associated with the wind farm's operation. The assessment for tonality should only be made for frequencies of concern from 25 Hz to 10 KHz and for sound pressure levels above the threshold of hearing (as defined in *ISO 389.7: 2005 Acoustics - Reference zero for the calibration of audiometric equipment - Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions*).

Low Frequency Noise

The presence of excessive low frequency noise (a special noise characteristic) [i.e. noise from the wind farm that is repeatedly greater than 65 dB(C) during the day time or 60 dB(C)) during the night time at any relevant receiver] will incur a 5 dB(A) penalty, to be added to the measured noise level for the wind farm, unless a detailed internal low frequency noise assessment demonstrates compliance with the proposed criteria for the assessment of low frequency noise disturbance (UK Department for Environment, Food and Rural Affairs (DEFRA, 2005)) for a steady state noise source.

Notes:

- *For the purposes of these conditions, a special noise characteristic is defined as a repeated characteristic if it occurs for more than 10% of an assessment period. This equates to being identified for more than 54 minutes during the 9 hour night from 10pm – 7am, or for more than 90 minutes during the 15 hour day from 7am – 10pm. This definition refers to verified wind farm noise only.*
- *The maximum penalty to be added to the measured noise level from the wind farm for any special noise characteristic individually or cumulatively is 5 dB(A).*
- *Notwithstanding conditions F7 and F8 of this project approval, the noise limits specified under these conditions do not apply to any residence where a noise agreement is in place between the Proponent and the owner(s) of those residences in relation to noise impacts and / or noise limits. For this condition to take effect, the noise agreements shall satisfy the relevant requirements of Guidelines for Community Noise (WHO, 1999).*

PART B: NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions – Wind Turbines

1. The noise criteria in Table 4 of the conditions are to apply under all meteorological conditions.

Applicable Meteorological Conditions – Other Facilities

2. The noise criteria in condition 15 are to apply under all meteorological conditions except the following:

(a) wind speeds greater than 3 m/s at 10 m above ground level; or

(b) temperature inversion conditions between 1.5ºC and 3ºC/100m and wind speeds greater than 2 m/s at 10m above ground level; or

(c) temperature inversion conditions greater than 3ºC/100m.

APPENDIX B – Calibration Certificates

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name	:	**Sound Level Meter, Class 1**
Model	:	**NL-52** **S/No.** : **00710426**
Date of Calibration	:	**September, 01, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.
K. Ikeda
Manager, Quality Control Department

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM 29615

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-25	**Serial No:**	00598175
Mic. Type:	UC-59	**Serial No:**	15519
Pre-Amp. Type:	NH-25	**Serial No:**	98387

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1011	hPa ±1 hPa	**Date of Receipt :**	24/05/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	25/05/2021
Relative Humidity	55	% ±5%	**Date of Issue :**	25/05/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.1 Rev.2.0 14/04/2021

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 2**

Model : **NL-42** **S/No.** : **01000229**

Date of Calibration : **January, 12, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.
K. Ikeda
Manager, Quality Control Department

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM30669

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298929
Mic. Type:	UC-52	**Serial No:**	127248
Pre-Amp. Type:	NH-21	**Serial No:**	31524

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1004	hPa ±1 hPa	**Date of Receipt :**	23/09/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	23/09/2021
Relative Humidity	39	% ±5%	**Date of Issue :**	23/09/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kiett

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Unit 14, 22 Hudson Ave, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT10.11 Rev.2.0 14/04/2021

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C20319

Client Details	Sonus Pty Ltd 17 Ruthven Ave Adelaide SA 5000
Equipment Tested/ Model Number :	Rion NL-21
Instrument Serial Number :	00877043
Microphone Serial Number :	116416
Pre-amplifier Serial Number :	24441

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	23.3°C	**Ambient Temperature :**	23.3°C
Relative Humidity :	50.3%	**Relative Humidity :**	50.3%
Barometric Pressure :	100.8kPa	**Barometric Pressure :**	100.8kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	Max Moore
Calibration Date :	28 May 2020	**Report Issue Date :**	1 Jun 2020

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 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 requirements of IEC 61672-1:2013 because 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 requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement -

		Environmental Conditions	
Acoustic Tests			
125Hz	*±0.13dB*	*Temperature*	*±0.2°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±2.4%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests	*±0.10dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

PAGE 1 OF 1

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM 29998

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Rion		
Type No:	NL-21	**Serial No:**	01298930
Mic. Type:	UC-52	**Serial No:**	127249
Pre-Amp. Type:	NH-21	**Serial No:**	31525

Owner: Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000

Tests Performed: IEC 61672-3:2013

Comments: All Tests passed for Class 2. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1006	hPa ±1 hPa	**Date of Receipt :**	07/07/2021
Temperature	25	°C ±1° C	**Date of Calibration :**	08/07/2021
Relative Humidity	36	% ±5%	**Date of Issue :**	08/07/2021

Acu-Vib Test Procedure: AVP10 (SLM) based on IEC 61672-3.

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Level 1, 418A Elizabeth Street., Surry Hills NSW 2010 AUSTRALIA
Ph: (02) 8218 0570 email: service@natacoustic.com.au website: www.natacoustic.com.au
A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

Certificate of Calibration
Sound Level Meter

Calibration Date	12/02/2021	Job No	RB856	Operator	AH
Client Name	SONUS PTY LTD				
Client Address	17 RUTHVEN AVE, ADELAIDE, SA, 5000				

Test Item

Instrument Make	RION	Model	NL-52	Serial No	#00320656
Microphone Make	RION	Model	UC-59	Serial No	#04575
Preamplifier Make	RION	Model	NH-25	Serial No	#10664
Ext'n Cable Make	Nil	Model	N/A	Serial No	N/A
Accessories	Nil			Firmware	2.0

SLM Type	1
Filters Class	N/A

Environmental Conditions	Measured	
	Start	End
Air Temp. (°C)	23.3	23.0
Rel. Humidity (%)	57.7	56.2
Air Pressure (kPa)	100.1	99.9

Applicable Standards:
Periodic tests were performed in accordance with procedures from IEC 61672-3 :2013 and IEC 61260-3 :2016

Applicable Work Instruction:
RWi-08 SLM & Calibrator Verification

Laboratory Equipment :
B&K4226 Multifunction Acoustic Calibrator SN 2288472
Agilent Function Generator Model 33220A SN MY43004013
Agilent Digital Multimeter Model 34401A SN MY41004386

Traceability:
The results of the tests and measurements included in this document are traceable via the test methods described under each test, and by the use of the above equipment, which has been calibrated by NATA accredited calibration facilities.
This document shall not be reproduced, except in full.

Scope:
This certificate is issued on the basis that the instrument complies with the manufacturer's specification.
See "Sound Level Meter Verification - Summary of Tests" page for an itemised list of results for each test.

Uncertainty:
The uncertainty is stated at a confidence level of 95% using a k factor of 2.

Calibration Statement:
The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013 and IEC 61260-3:2016, 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 and IEC 61260-1:2014 because (a) evidence was not publicly available, from an independent testing organization 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 IEC 61260-1:2014 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 and IEC 61260-3:2016 cover only a limited subset of the specifications in IEC 61672-1:2013 and IEC 61260-1:2014.

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number 14966

Accredited for compliance with ISO/IEC 17025 - Calibration

Authorized Signatory:

Print Name: Ariel Michael Date: 15/02/2021

Template Document Name: RQT-05 (rev 72) SLM ISO Verification

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 2**

Model : **NL-42** **S/No.** : **00510393**

Date of Calibration : **June, 08, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Okeda

Manager, Quality Control Department

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 1**

Model : **NL-52** **S/No.** : **00710394**

Date of Calibration : **August, 20, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Ikeda

Manager, Quality Control Department

RION CO., LTD.

3-20-41 Higashimotomachi Kokubunji Tokyo 185-8533
Phone:042(359)7888, Facsimile:042(359)7442

Certificate of Calibration

Name : **Sound Level Meter, Class 2**

Model : **NL-42** **S/No.** : **00510392**

Date of Calibration : **June, 08, 2021**

We hereby certify that the above product was tested and calibrated according to the prescribed Rion procedures, and that it fulfills specification requirements.
The measuring equipment and reference devices used for testing and calibrating this unit are managed under the Rion traceability system and are traceable according to official Japanese standards and official standards of countries belonging to the International Committee of Weights and Measures.

RION CO., LTD.

K. Ikeda

Manager, Quality Control Department

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Acoustic Calibration & Testing Laboratory
Level 1, 418A Elizabeth Street., Surry Hills NSW 2010 AUSTRALIA
Ph: (02) 8218 0570 email: service@natacoustic.com.au website: www.natacoustic.com.au
A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

Certificate of Calibration
Sound Level Calibrator

Calibration Date 12/02/2021 Job No RB856 Operator AH
Client Name SONUS PTY LTD
Client Address 17 RUTHVEN AVE, ADELAIDE, SA, 5000

Test Item

Calibrator Make RION Model NC-74 Serial No #35094478
Accessories N/A

Class (1 or 2)	1

Environmental Conditions	Measured	
	Start	End
Temperature (degC)	23.6	23.6
Rel. Humidity (%)	58.4	58.4
Air Pressure (kPa)	100.3	100.28

Applicable Standards:
IEC 60942:2017 "Electroacoustics - Sound calibrators"

Applicable Work Instruction:
RWi-08 SLM & Calibrator Verification

Laboratory Equipment :
GRAS Power Module type 12AK SN 1551616
GRAS 1/2" Pressure Microphone 40AD SN 252620 and preamplifier SN 292045
B&K4226 Multifunction Acoustic Calibrator SN 2288472
Agilent Digital Multimeter Model 34401A SN MY41004386
Audio Tester AUDT30 v3.0 software
Behringer UCA222 USB Audio Interface U-Control

Traceability:
The results of the tests and measurements included in this document are traceable via the test methods described under each test, and by the use of the above equipment, which has been calibrated by NATA accredited calibration facilities.
This document shall not be reproduced, except in full.

Scope:
This certificate is issued on the basis that the instrument complies with the manufacturer's specification.
See "Sound Level Calibrator Verification - Summary of Tests" page for an itemised list of results for each test.

Uncertainty:

Calibration Statement:
The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organization responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2017.

NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory Number 14966

Accredited for compliance with ISO/IEC 17025 - Calibration

Authorized Signatory:

Print Name: Ariel Michael Date: 15/02/2021

APPENDIX C – Residential Logging Location Photographs

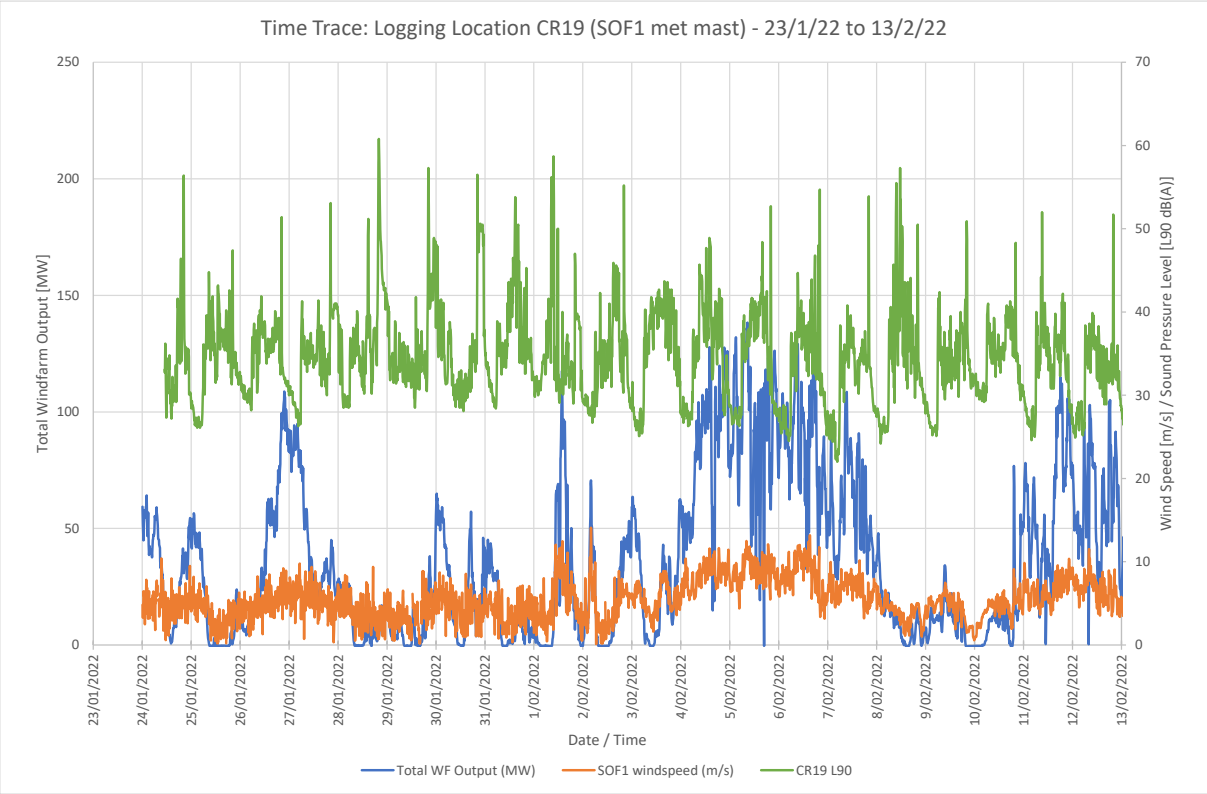
Figure 8: *Noise logger (right) and local weather logger (left) at CR19*

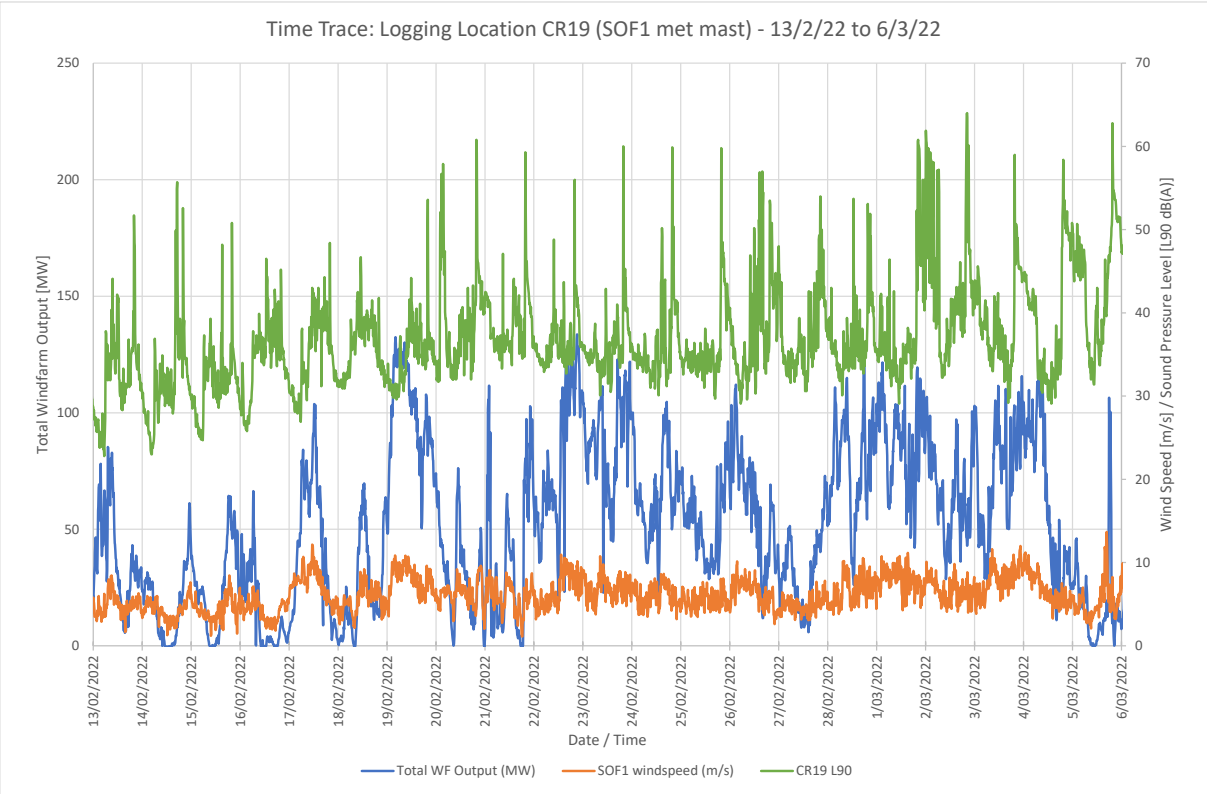
Figure 9: *Noise logger at CR28*

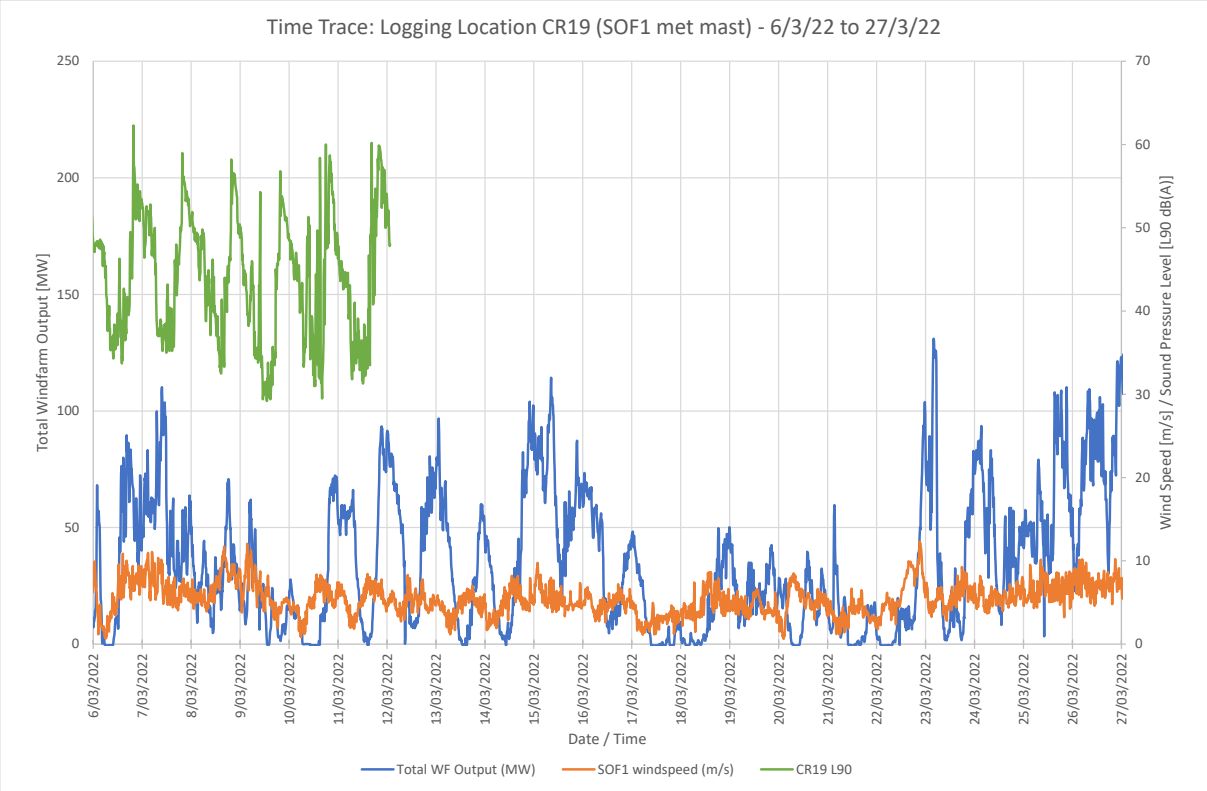
Figure 10: *Noise logger at HER03*

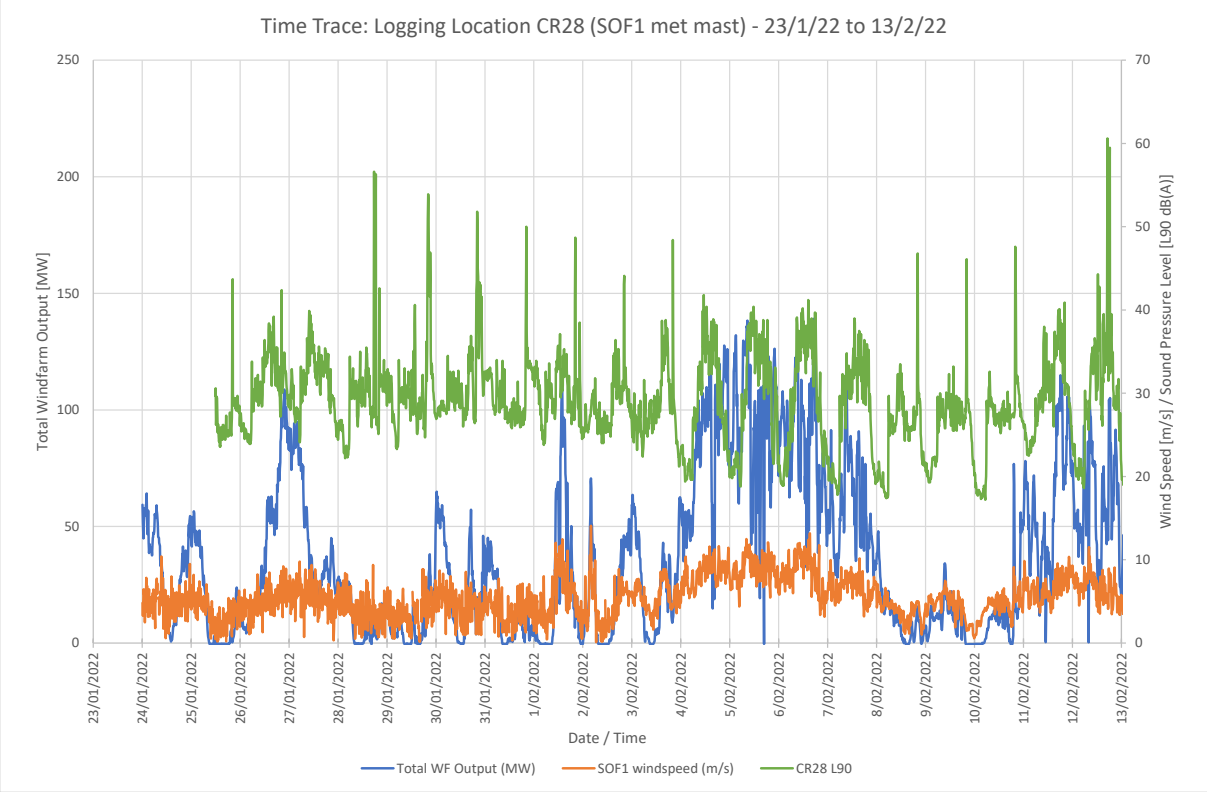
Figure 11: *Noise logger at HER15*

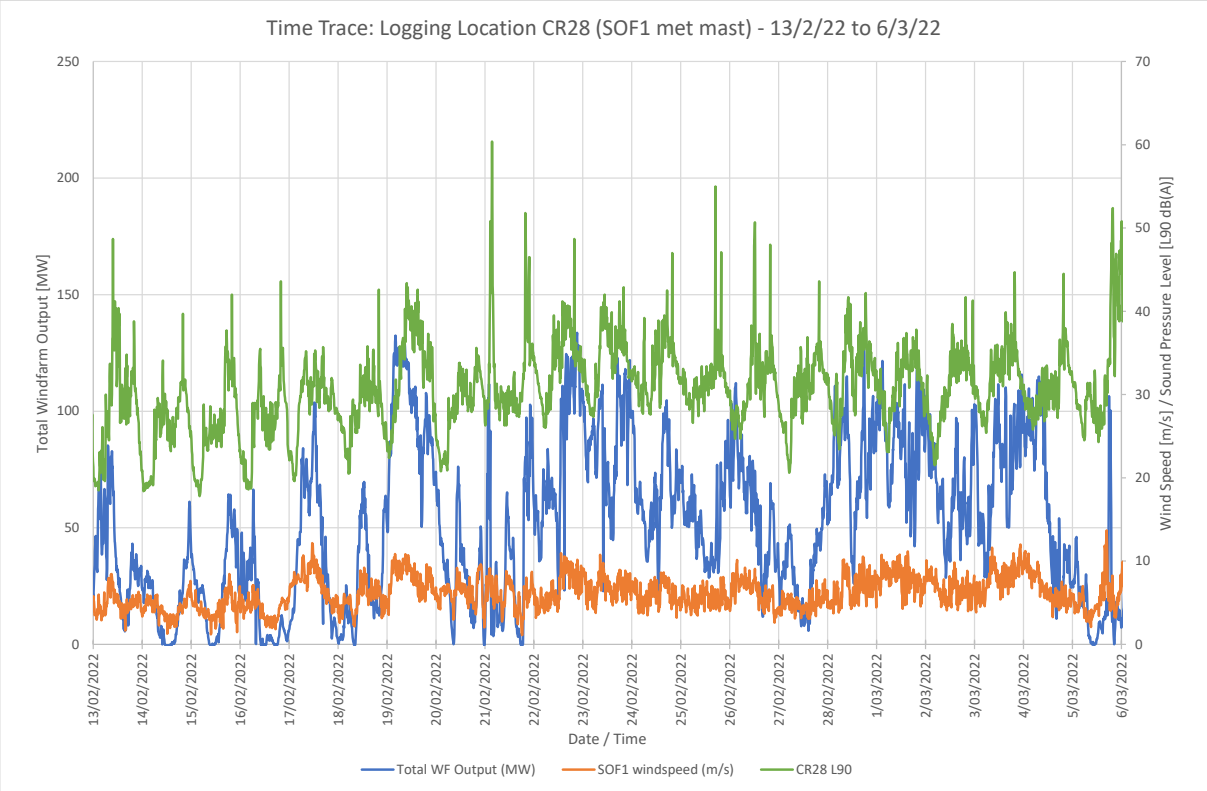
APPENDIX D – Time Traces

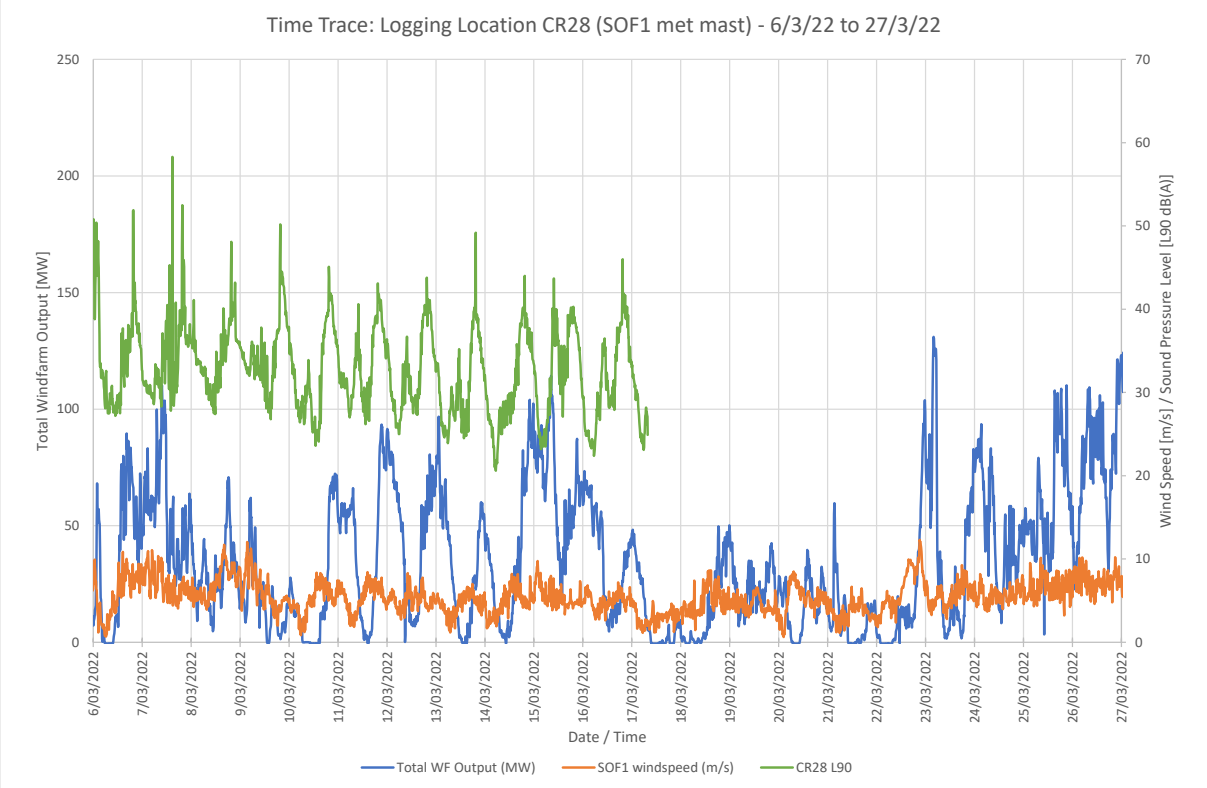


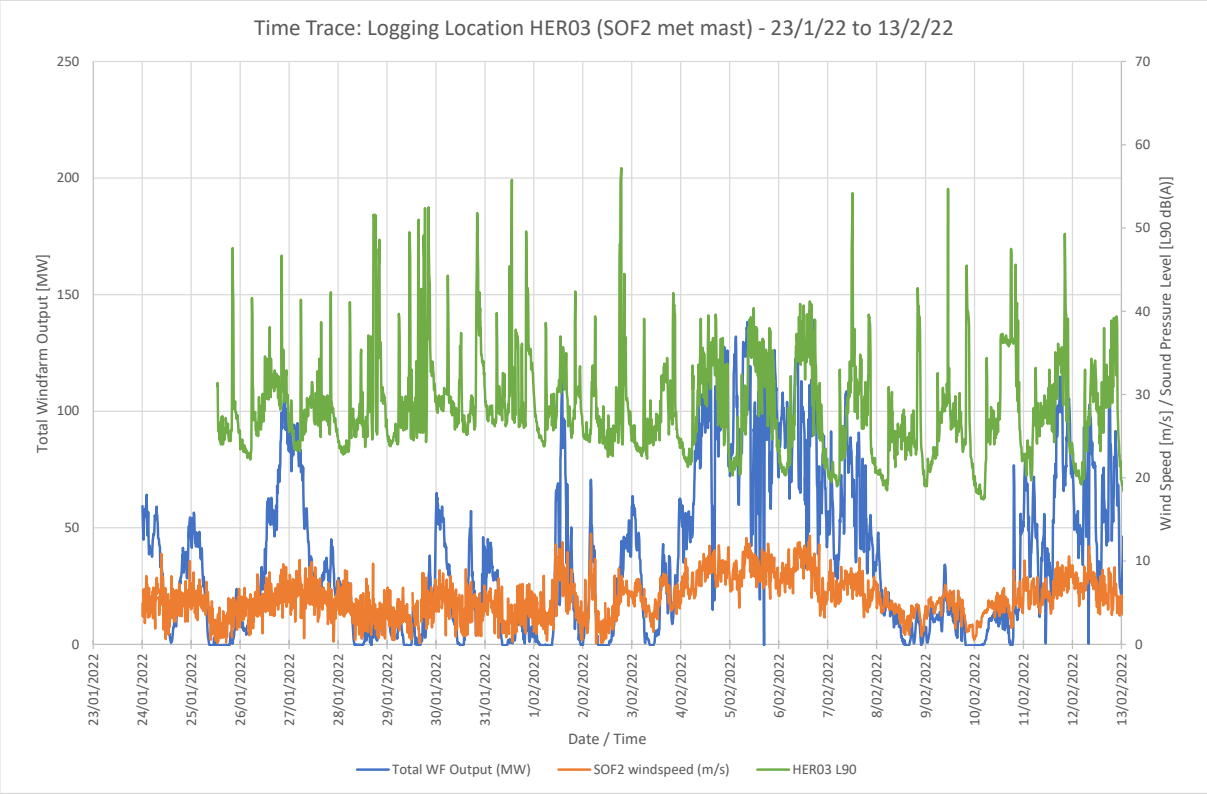


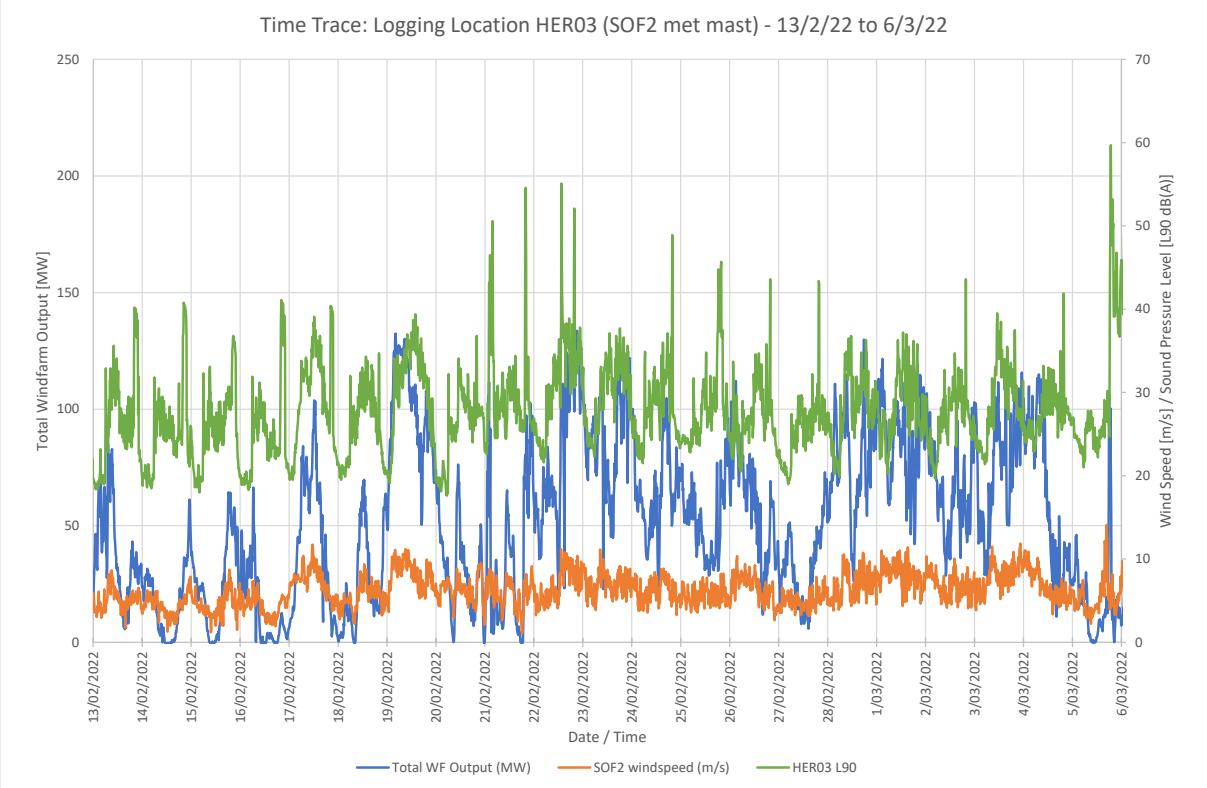

Time Trace: Logging Location CR19 (SOF1 met mast) - 6/3/22 to 27/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF1 windspeed (m/s)
CR19 L90

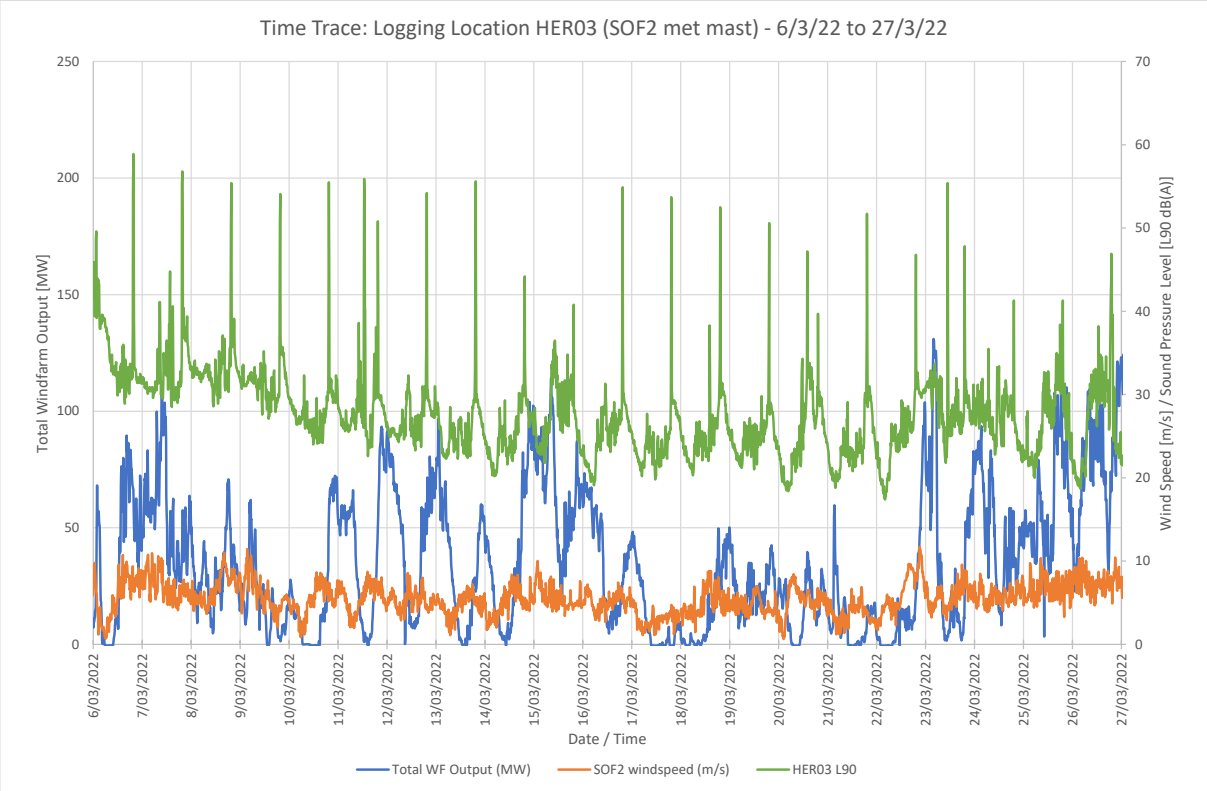

Time Trace: Logging Location CR28 (SOF1 met mast) - 23/1/22 to 13/2/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF1 windspeed (m/s)
CR28 L90

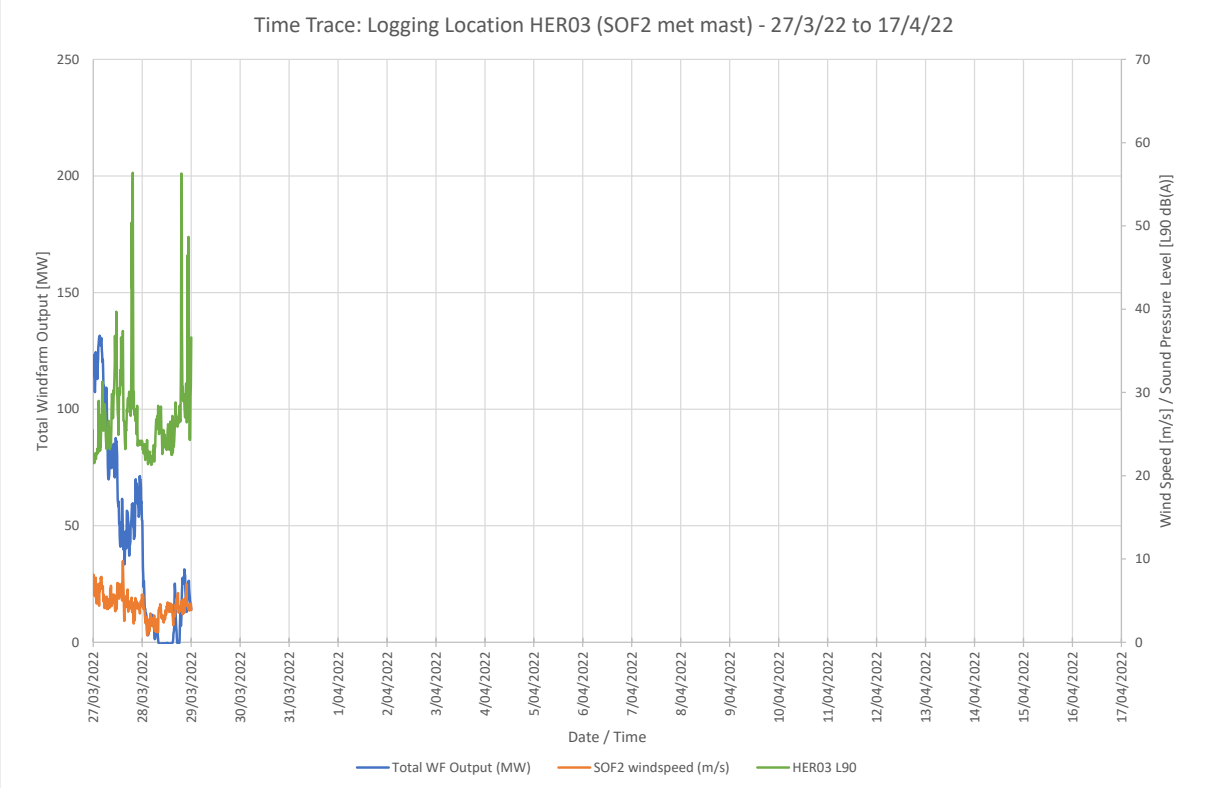

Time Trace: Logging Location CR28 (SOF1 met mast) - 13/2/22 to 6/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF1 windspeed (m/s)
CR28 L90

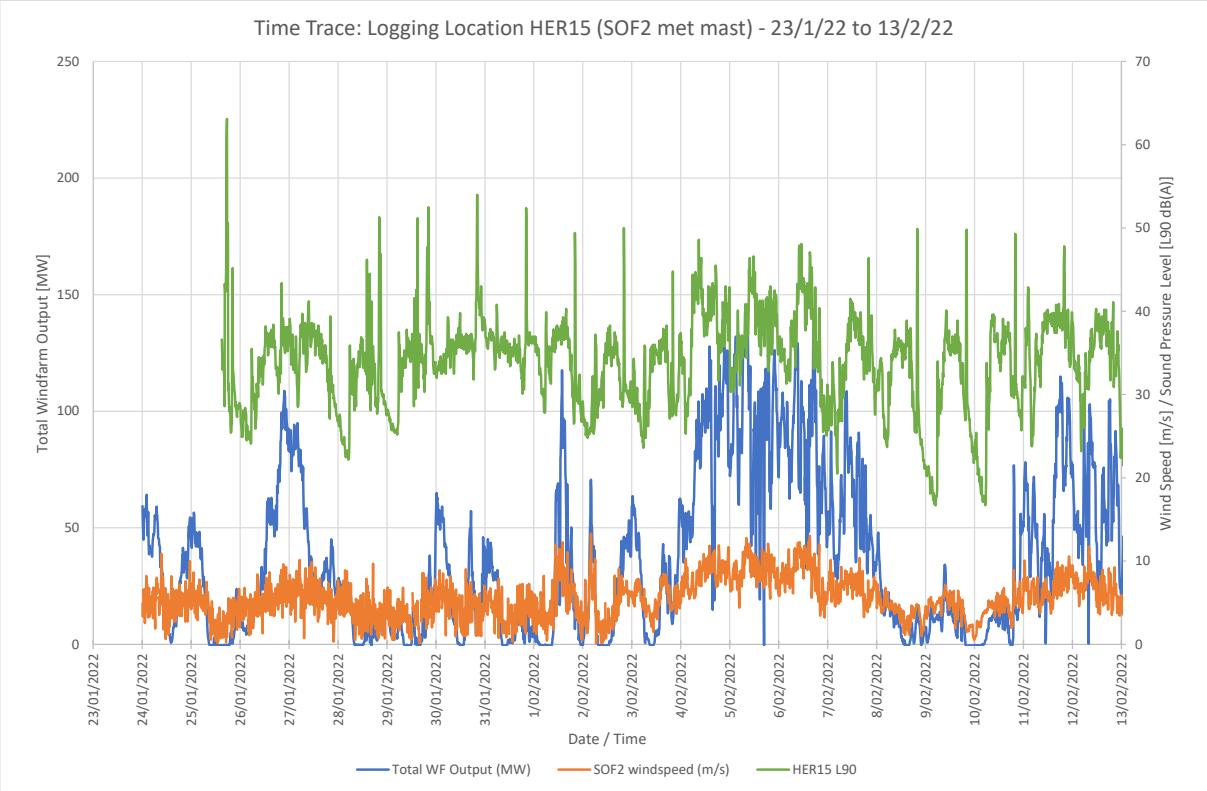

Time Trace: Logging Location CR28 (SOF1 met mast) - 6/3/22 to 27/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF1 windspeed (m/s)
CR28 L90

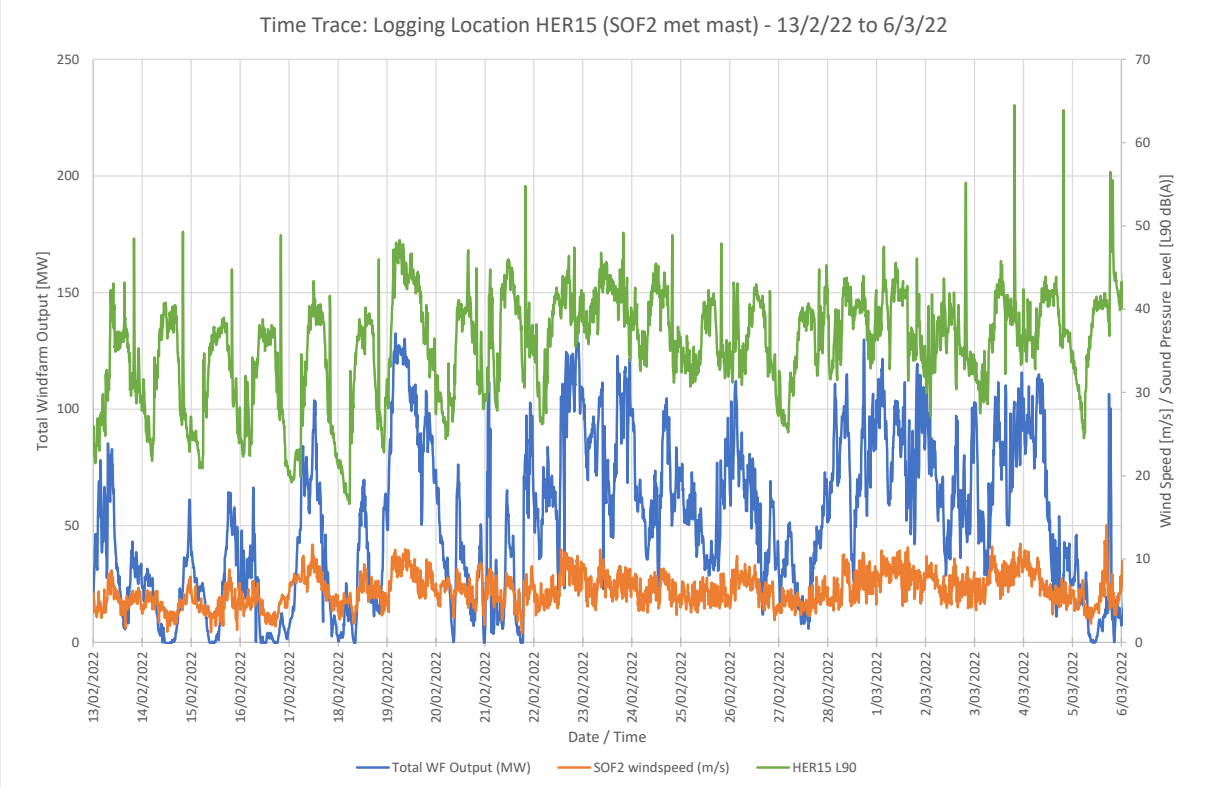

Time Trace: Logging Location HER03 (SOF2 met mast) - 23/1/22 to 13/2/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER03 L90

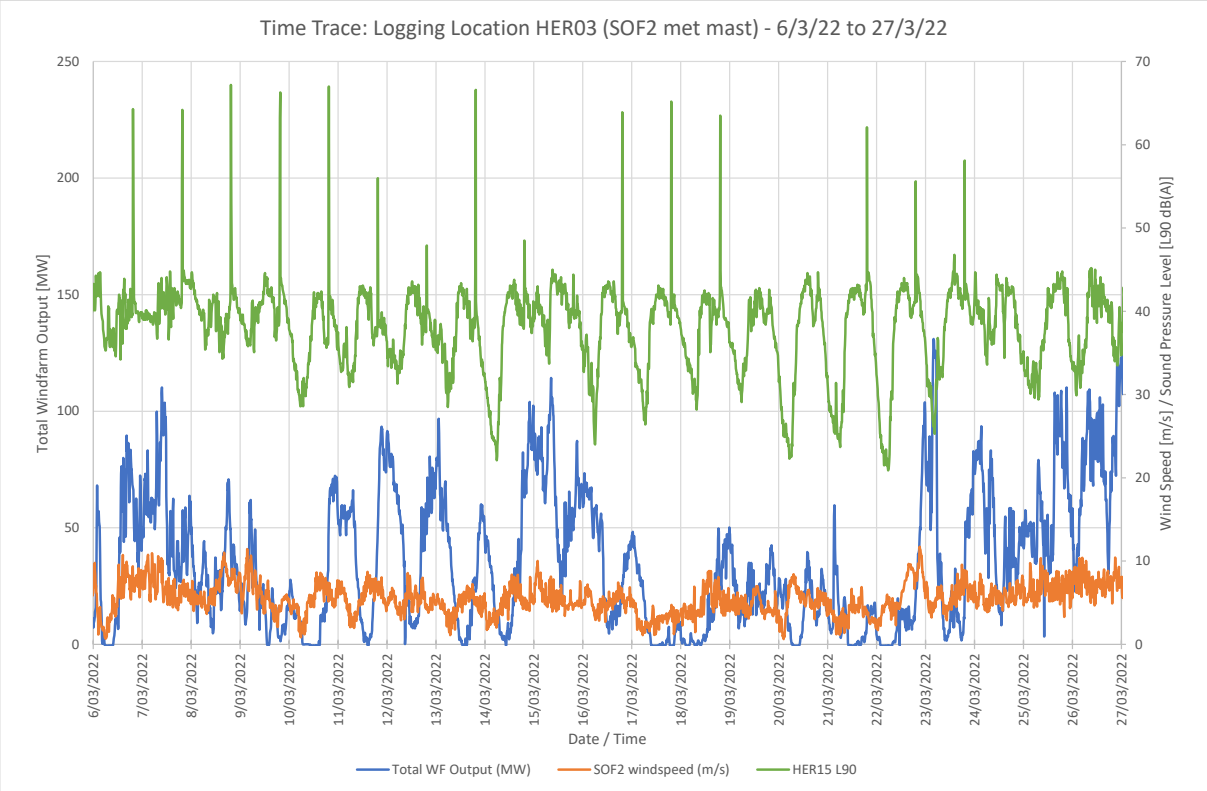

Time Trace: Logging Location HER03 (SOF2 met mast) - 13/2/22 to 6/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER03 L90

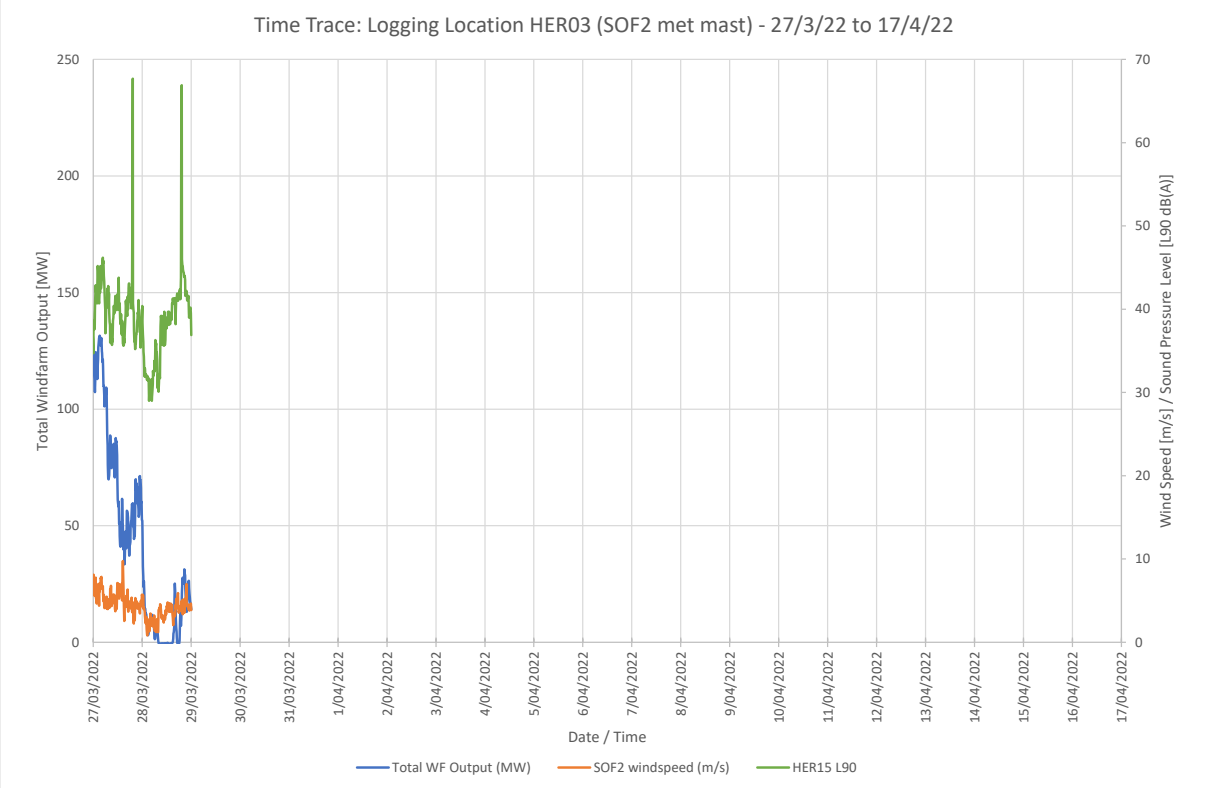

Time Trace: Logging Location HER03 (SOF2 met mast) - 6/3/22 to 27/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER03 L90


Time Trace: Logging Location HER03 (SOF2 met mast) - 27/3/22 to 17/4/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER03 L90


Time Trace: Logging Location HER15 (SOF2 met mast) - 23/1/22 to 13/2/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER15 L90


Time Trace: Logging Location HER15 (SOF2 met mast) - 13/2/22 to 6/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER15 L90


Time Trace: Logging Location HER03 (SOF2 met mast) - 6/3/22 to 27/3/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER15 L90


Time Trace: Logging Location HER03 (SOF2 met mast) - 27/3/22 to 17/4/22
Total Windfarm Output [MW]
Wind Speed [m/s] / Sound Pressure Level [L90 dB(A)]
Date / Time
Total WF Output (MW)
SOF2 windspeed (m/s)
HER15 L90