LAL LAL WIND FARM - ELAINE

Post-construction Noise Assessment

Prepared for:

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c/- Res Australia Pty Limited
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Lal Lal Wind Farms Nom Co Pty Limited ACN 625 768 774 (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
640.11872-R04-v2.0	31 October 2023	Gustaf Reutersward	Aaron McKenzie	Gustaf Reutersward
640.11872-R04-v1.9	14 June 2023	Gustaf Reutersward	Aaron McKenzie	Gustaf Reutersward
640.11872-R04-v1.8	2 June 2023	Gustaf Reutersward	Aaron McKenzie	Gustaf Reutersward
640.11872-R04-v1.7	27 June 2022	Gustaf Reutersward	Aaron McKenzie	Gustaf Reutersward
640.11872-R04-v1.6	23 March 2022	Gustaf Reutersward	Aaron McKenzie	Gustaf Reutersward

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 Introduction

SLR Consulting was engaged by Lal Lal Wind Farms Nom Co Pty to complete an assessment of the noise emissions of Lal Lal Wind Farm, which comprises of a total of 60 Vestas V136-3.8MW turbines with serrated trailing edge (38 in Yendon and 22 in Elaine).

The objective of the noise assessment was to measure and assess the noise levels from the wind farm in accordance with the Noise Compliance Test Plan (NCTP) which forms endorsed conditions 24 and 25 of the Planning Permit ref: Planning Permit No. PL-SP/05/0461-2 amended 12 April 2022.

This report documents the methodology and results of the noise compliance assessment which has been performed based on noise monitoring conducted between March 2021 and May 2021.

The wind farm is electrically and mechanically complete and has been released by the market operator to generate at full power however it has not reached practical completion. As a result for extended periods during the monitoring the Yendon portion of the wind farm not been able to operate at full capacity due to on-going maintenance and other extensive works on site which has reduced the turbine availability on site as well as grid outages.

The turbines of the Yendon and Elaine portions of the wind farm are separated by over 10 km and there are no compliance critical receptors located in the intervening land which would be influenced by cumulative noise from both portions. Owing to a number of extended turbine outages in the Yendon portion, and to avoid further delay, it has been determined that a reasonable approach to the compliance assessment of Lal Lal Wind Farm would be to consider the Yendon and Elaine portions separately in this instance.

This report covers the assessment of the Elaine portion of the wind farm.

2 Conditions of Consent

Conditions 22 to 27 of the Lal Lal Wind Farm Consent set out the relevant noise-related requirements for the operation of the wind farm. The relevant sections of the Conditions of Consent are reproduced below.

NOISE LIMITS

22. Construction of the wind energy facility must comply with noise criteria specified in the EPA *Noise Control Guidelines, Construction and Demolition Site Noise*, Publication 1254, October 2008 at any dwelling existing on land in the vicinity of the proposed wind energy facility as at the date of the issue of this permit to the satisfaction of the Minister for Planning.

23. Except as provided below in this condition, the operation of the wind energy facility must comply with New Zealand Standard 6808:2010, Acoustics – Wind Farm Noise (the Standard) at any noise sensitive location existing as at 20 March 2017 to the satisfaction of the Minister for Planning.

    In determining compliance, the following requirements apply:

    a) The operator must ensure that at any wind speed, wind farm sound levels, determined in accordance with the Standard at noise sensitive locations (as defined in the Standard) do not exceed a noise limit of 40dB LA90,10min or background (LA90,10min) plus 5dB, whichever is greater;

    b) Compliance must be assessed separately for all-time and night time. For the purpose of this requirement, night time is defined as 10.00pm to 7.00am; and

    c) Where special audible characteristics, including tonality, impulsive sound or excessive amplitude modulation occur, the measured noise level with the identified special audible characteristics will be modified by applying a penalty of up to + 6 dB L90 in accordance with section 5.4 of the Standard.

    The limits specified in this condition do not apply if an agreement has been entered into with any landowner waiving the limits. Evidence of the agreement must be provided to the satisfaction of the responsible authority upon request, and be in a form that applies to the land for the life of the wind energy facility.

NOISE COMPLIANCE ASSESSMENT

24. Before the development starts, a noise compliance testing plan must be prepared by a suitably qualified acoustics expert to the satisfaction of the Minister for Planning.

25. The noise compliance testing plan must be accompanied by a report from an auditor accredited under the *Environment Protection Act 1970* with the auditor's opinion on the methodology contained in the noise compliance testing plan.

When approved, the noise compliance testing plan will be endorsed by the Minister for Planning and will then form part of this permit.

The use must be carried out in accordance with the noise compliance testing plan to the satisfaction of the Minister for Planning.

For the purposes of determining compliance, the following requirements apply:

a) Acoustic compliance reports shall be prepared by a suitably qualified and experienced independent acoustic engineer to demonstrate compliance with the noise limits specified in the Standard.

b) Noise assessment positions must be located according to the Standard, and shown on a map.

c) A final compliance report must be submitted to the Minister for Planning after a 12-month period following full operation of the facility.

d) The final compliance report must be accompanied by a report from an auditor accredited under the *Environment Protection Act 1970* with the auditor's opinion on the methodology and results contained in the noise compliance testing plan.

e) Compliance reports must be publicly available and published on the wind farm operator's website.

f) Following facility commissioning, all complaints shall be managed following procedures set out in the noise complaints management plan.

NOISE COMPLIANCE ENFORCEMENT

26. For the purposes of complaints evaluation, the following requirements apply:

    a) Post installation sound levels shall, where practical, be measured at the same locations where the background sound levels were determined (GPS coordinates and a map showing these locations are to be provided).

    b) If a non-compliance with condition 23 is detected, or an acoustic investigation is required under the noise complaint investigation and response plan endorsed under condition 26, an independent assessment report must be prepared by a suitably qualified and experienced independent acoustic engineer to:

        - identify the weather or operational conditions associated with the complaint / breach.
        - analyse the uncertainty and confidence levels in the monitoring, and the steps taken to reduce uncertainty.
        - target assessment to identify the cause and remediation actions.
        - submit a remediation plan to the satisfaction of the Minister for Planning outlining the investigation process, complainant communications, actions and timelines to resolve the complaint/breach.
        - if the complaint is not resolved through the processes outlined above, the Minister for Planning may request an independent peer review at the cost of the permit holder and on/off shut down testing to resolve uncertainty.

c) Following the initial post-construction reporting process, additional independent assessment may be requested by the Minister for Planning at any time, where complaints are received and are considered to reasonably warrant investigation.

d) If investigations indicate special audible characteristics are potentially occurring, procedures outlined in Appendix B of the Standard should be applied.

27. Before the first wind turbine is commissioned, the permit holder must prepare a Noise Complaint Investigation and Response Plan to the satisfaction of the Minister for Planning. The approved plan must be published on the wind farm operator's website.

The plan shall be designed in accordance with the Australian/New Zealand Standard AS/NZS 10002:2014 – *Guidelines for complaint management in organisations* and include:

- a process of investigation to resolve a complaint.
- a requirement that all complaints will be recorded in an incidents register.
- how contact details will be communicated to the public.
- telephone number and email contact for complaints and queries.
- details of the appropriate council contact telephone number and email address (where available).
- a table outlining complaint information for each complaint received, including:
  - the complainant's name.
  - any applicable property reference number if connected to a background testing location.
  - the complainant's address.
  - a receipt number for each complaint which is to be communicated to the complainant.
  - the time, prevailing conditions and description of the complainant's concerns including the potential incidence of special audible characteristics.
  - the processes of investigation to resolve the complaint.

A report including a reference map of complaint locations, and outlining complaints, investigation and remediation actions is to be provided on an annual basis to the satisfaction of the Minister for Planning.

The register and complaints response process shall continue for the duration of the operation of the wind energy facility and must be made available to the Minister for Planning on request.

The wind energy facility operator must implement and comply with the Approved Noise Complaint, Investigation and Response Plan for the duration of the operation of the wind energy facility.

3 Noise Monitoring Locations

The subject noise monitoring covered in this report was completed at the reference receptor locations in **Table 1** and are shown in **Figure 1** below.

Table 1 Noise Monitoring Locations

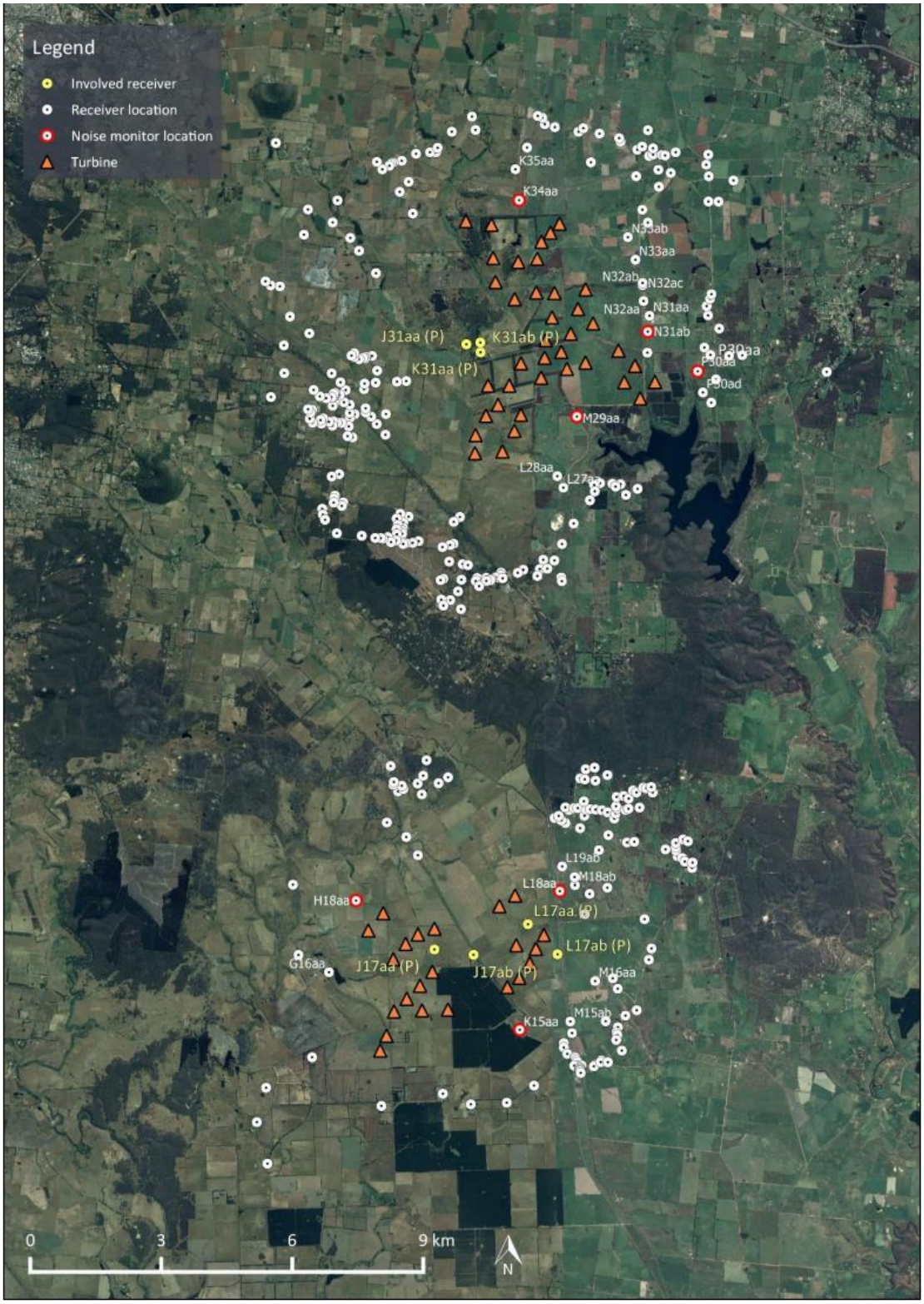
Reference Receptor	Approx. UTM Coordinate (Zone 55 H)		Approx distance to nearest WTG
K15aa	5815534 m S	236990m E	1.0 km
H18aa	5818510 m S	233207m E	0.7 km
L18aa	5818705 m S	237913 m E	1.0 km

4 Previous Measurements

Previous baseline noise surveys and analysis was conducted at seven receiver locations in 2016 and 2017 as detailed in the Marshall Day Report - *Lal Lal Wind Farm Background Noise Monitoring* (ref: 001 R01 20170649) (2018 LLWFBNM Report) dated 1 March 2018 and are shown in **Figure 1** below.

Between July and November 2019 SLR undertook further background monitoring at Location K15aa with the objective of collecting representative pre-operational baseline conditions for this location where in the earlier 2016 and 2017 monitoring campaigns the data had been unduly influenced by extraneous noise sources. The updated baseline regressions curve for this receptor are documented in SLR report *Lal Lal Wind Farm Compliance Baseline Noise Monitoring* (ref: 640.11872-R01).

Figure 1 Baseline monitoring locations (ref: LLWFBNM Report)

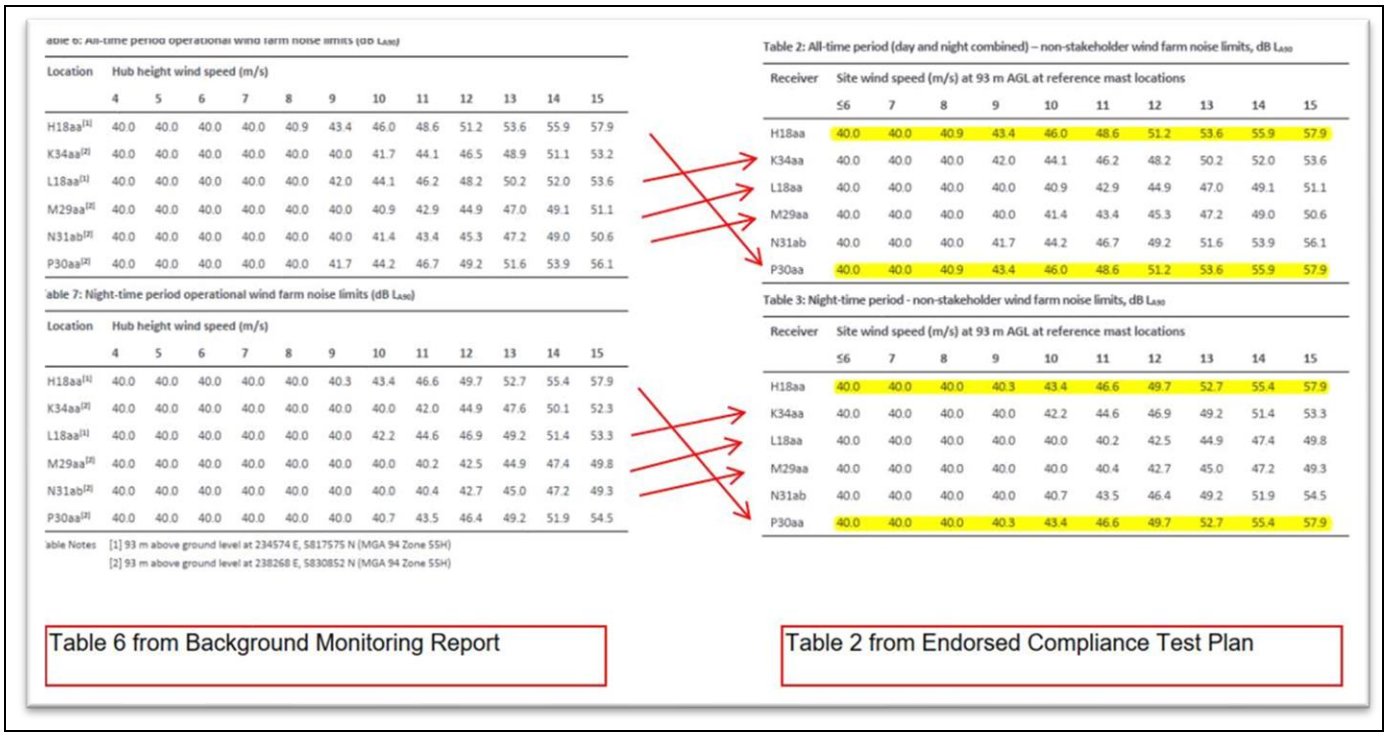


5 Noise Limit

SLR discovered that the noise limits stated in Table 2 of Endorsed Condition 24 and 25 the MDA Report *Lal Lal Noise Compliance Test Plan* ref: 003 R03 20170649 (NCTP) and those shown in Table 6 the MDA Report *Lal Lal Wind Farm Background Noise Monitoring* ref:001 R01 20170649 (Background Report) are inconsistent.

With a closer review as shown in the figure below, it is likely that the numbers were incorrectly transferred from the Background Report to the NCTP by looking at the red arrows, furthermore, some numbers seem to be doubled up (see highlighted). This has been confirmed by Marshall Day Acoustics.

Figure 2 Noise Limit - Background Report vs NCTP



able 6: All-time period operational wind farm noise limits (dB L_{A90})

Location	Hub height wind speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa[1]	40.0	40.0	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9
K34aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	41.7	44.1	46.5	48.9	51.1	53.2
L18aa[1]	40.0	40.0	40.0	40.0	40.0	42.0	44.1	46.2	48.2	50.2	52.0	53.6
M29aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.9	42.9	44.9	47.0	49.1	51.1
N31ab[2]	40.0	40.0	40.0	40.0	40.0	40.0	41.4	43.4	45.3	47.2	49.0	50.6
P30aa[2]	40.0	40.0	40.0	40.0	40.0	41.7	44.2	46.7	49.2	51.6	53.9	56.1

able 7: Night-time period operational wind farm noise limits (dB L_{A90})

Location	Hub height wind speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa[1]	40.0	40.0	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9
K34aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	42.0	44.9	47.6	50.1	52.3
L18aa[1]	40.0	40.0	40.0	40.0	40.0	40.0	42.2	44.6	46.9	49.2	51.4	53.3
M29aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.2	42.5	44.9	47.4	49.8
N31ab[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.4	42.7	45.0	47.2	49.3
P30aa[2]	40.0	40.0	40.0	40.0	40.0	40.0	40.7	43.5	46.4	49.2	51.9	54.5

able Notes [1] 93 m above ground level at 234574 E, 5817575 N (MGA 94 Zone 55H)
[2] 93 m above ground level at 238268 E, 5830852 N (MGA 94 Zone 55H)

Table 6 from Background Monitoring Report

Table 2: All-time period (day and night combined) – non-stakeholder wind farm noise limits, dB L_{A90}

Receiver	Site wind speed (m/s) at 93 m AGL at reference mast locations									
	≤6	7	8	9	10	11	12	13	14	15
H18aa	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9
K34aa	40.0	40.0	40.0	42.0	44.1	46.2	48.2	50.2	52.0	53.6
L18aa	40.0	40.0	40.0	40.0	40.9	42.9	44.9	47.0	49.1	51.1
M29aa	40.0	40.0	40.0	40.0	41.4	43.4	45.3	47.2	49.0	50.6
N31ab	40.0	40.0	40.0	41.7	44.2	46.7	49.2	51.6	53.9	56.1
P30aa	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9

Table 3: Night-time period - non-stakeholder wind farm noise limits, dB L_{A90}

Receiver	Site wind speed (m/s) at 93 m AGL at reference mast locations									
	≤6	7	8	9	10	11	12	13	14	15
H18aa	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9
K34aa	40.0	40.0	40.0	40.0	42.2	44.6	46.9	49.2	51.4	53.3
L18aa	40.0	40.0	40.0	40.0	40.0	40.2	42.5	44.9	47.4	49.8
M29aa	40.0	40.0	40.0	40.0	40.0	40.4	42.7	45.0	47.2	49.3
N31ab	40.0	40.0	40.0	40.0	40.7	43.5	46.4	49.2	51.9	54.5
P30aa	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9

Table 2 from Endorsed Compliance Test Plan

It is clear that the limits contained in Table 6 the Background Report are technically correct with respect to NZS6808. The compliance assessment carried out in this subject report will be against the limits contained in Table 6 the Background Report.

Notwithstanding, the above it should be noted that:

- the NCTP limits are correct for H18aa
- the NCTP limits are approximately 3 dBA too low for L18aa
- The NCTP didn't include limits for K15aa, which have been established on subsequent baseline monitoring.

The measured compliance margins in **Section 10** have been assessed against:

- the correct NZS 6808 noise limits in **Table 5** through **Table 8**
- the NCTP limits for L18aa in **Table 9** through **Table 12.**

6 Noise Measurement Methodology

Environmental noise loggers were installed at the assessment locations and configured in accordance with the *Lal Lal Wind Farm Noise Compliance Test Plan* (NCTP) dated 23 January 2018 (ref. 003 R03 20170649), which were endorsed to comply with the condition 24 and 25 of Lal Lal Windfarm Planning Permit PL-SP/05/0461/C.

The requirements specified in the NCTP and correspondent methodologies of this compliance monitoring survey are summarised in the **Table 2**.

Table 2 Summary of assessment methodology

Test Plan requirements	This assessment methodology
Operational noise measurement locations	
The measurements shall not occur within 3.5 m of a vertical reflecting surface	The updated background noise monitoring undertaken for location K15aa completed in 2019 was completed in a position approximately 100 metres to the north of the residential dwelling. This position was selected to eliminate extraneous noise influence from household mechanical plant which had interfered with two previous attempts to collect baseline data at this receptor. The compliance monitoring location was consistent with the 2019 background monitoring position.
The measurements shall occur within 20 m of the dwelling	
The measurements shall occur as close as practically possible to the location of the background noise monitoring	
Operational noise measurement procedures - Acoustic data	
The measurements shall comprise unattended monitoring for the measurement durations defined in Section 4.3 of the NCTP	The monitoring was completed over approximately 8 weeks from 9/3/2021 to 8/5/2021.
A-weighting - The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.	A-frequency weighting has been measured and used in the assessment
The LA90 noise level shall be determined in consecutive ten (10) minute intervals synchronised with the interval commencing on the hour and each 10-minute increment following the start of each hour	Noise loggers were configured as required.
All noise measurements shall be conducted using low noise floor (≤ 20 dB) instrumentation that is certified to Class 1 standards (highest standard of instrumentation for field measurements) in accordance with IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Specifications	Brüel & Kjær 2250 Sound Level Meter (SLM) was placed in the vicinity of the residence; refer to **Table 3** for equipment serial numbers. Calibration was completed with a Brüel & Kjær Type 4231 Sound Level Calibrator (S/N 30077429).
The independent (laboratory) calibration date of the sound level measurement instrumentation must be within 2 years of the measurement period, as specified in Section 5.5 of Australian Standard AS 1055-1:1997 Acoustics – Description and measurement of environmental noise – Part 1: General Procedures	All acoustic instrumentation had been calibrated by a NATA accredited laboratory and held current certificates of calibration at the time of the monitoring. Details of the acoustic instruments used at each reference location are presented in **Table 3.**

Test Plan requirements	This assessment methodology
Microphones shall be fitted with enhanced wind shield systems (enlarged primary wind shields or secondary wind shields) designed on the basis of the guidance contained in the UK Institute of Acoustics publication A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise dated May 2013 (the IOA GPG)	B&K 2250 Sentinel units were used with a microphone positioned at approximately 1.5 m above ground level and fitted with 150 mm-diameter G.R.A.S. outdoor microphone windscreen on the design recommendations detailed in the UK IOA good practice guide.
Subject to the consent of the residents, two (2) minute uncompressed audio recordings shall be obtained for every ten (10) minute interval of the survey. The sampling rate for audio recordings shall be sufficient to allow assessment of tonality, if required, across the frequency range 10-5000 Hz	Noise loggers configured as required.
Instantaneous one-third octave band sound pressure levels (fast response) shall be recorded in 100 ms intervals to enable an analysis of amplitude modulation if required.	Noise loggers configured as required.
Operational noise measurement procedures - Site wind speeds	
Site wind speeds shall be collected in ten (10) minute intervals throughout the noise measurement period. The timing of each ten (10) minute interval shall be synchronised with the interval commencing on the hour and each 10-minute increment following the start of each hour.	A meteorological mast at Yendon was installed at -37.633961^0,144.053090^0. The anemometer 1 of the meteorological mast collected wind speed and direction data at 93m AGL for the whole period of this noise compliance survey
This data shall be used to determine the wind speed at 93 m AGL (the reference wind speed height) corresponding to free-field conditions (i.e. free from turbine wake effects) at the reference mast locations listed in Table 4 of Section 3.0 (and any other reference mast locations used for additional background noise monitoring conducted prior to commencement of operation of the wind farm).	A meteorological mast at Elaine was installed at -37.748301°, 143.983628° The anemometer 1 of the meteorological mast collected wind speed and direction data at 93m AGL for the whole period of this noise compliance survey. Wake free wind speed data was derived from the above reference locations by the projects wind engineers (Aurecon) using an appropriate analytical technique, as outlined in **Appendix E.**
Wind speeds at 93 m AGL which are determined from wind speed measurements at heights below 93 m shall be determined using the procedures outlined in the IOA GPG Supplementary Guidance Note 4: Wind Shear, or an alternative method deemed appropriate by the wind engineer responsible for the supply of the data	Not applicable
Operational noise measurement procedures – Other data	
Local wind speeds	A Vaisala weather station was also installed with each noise logger to log local wind speeds and rainfall for data exclusion
Rainfall	

Test Plan requirements	This assessment methodology
Site operational data	SCADA operational & power generation data collected during the monitoring period was provided by RES Australia
Attended observations of SACs	Attended subjective listening test observations are documented in **Appendix B**

7 Data validity screening

A valid data set was obtained by excluding data intervals in accordance with NCTP which includes the following criteria:

- Periods of local rain;
- Hub height wind speed exceeding 20 m/s;
- Hub height wind speed below cut-in wind speed (3 m/s).
- The measured sound frequencies (one-third octave bands) in each 10-minute interval are used to identify periods that are significantly affected by bird or insect noise. The 10-minute interval data is identified as being potentially influenced by extraneous noise when both of the following conditions are satisfied:
    - the highest A-weighted one-third octave band noise level is within 5 dB of the broadband A-weighted background noise level for that interval; and
    - the identified one-third octave band A-weighted noise level is greater than a level of 20 dB L_{A90}.
- when one or more WTGs critical to wind farm noise level at each receptor was not operating.

7.1 Relevant Turbines

On this last point the full data set was filtered to ensure the compliance data set for each receptor only included periods when wind farm noise was effectively equivalent to a fully operational facility. This was achieved by:

- Using SCADA power generation data collected during the monitoring period to determine which WTGs were generating power and therefore operating during each interval.
- Checking a list of “relevant turbines” that is unique for each reference receptor location, to determine if any critical turbines were unavailable or operating atypically. If relevant turbines were not operating in a particular 10-minute interval, then that interval was flagged as invalid and not included in the compliance assessment. The “relevant turbines” list for each receptor was evaluated in two slightly different ways.
    1. as defined in the NCTP Appendix G. The NCTP technique to screen for atypical wind farm operation ensures that if any or all of the non-relevant turbines were to not operate during a given measurement period, the predicted reduction in total noise level would be 0.1 dB or less and would therefore be inconsequential to the assessment outcome. This relevant turbine screening method shall be referred to as the NCTP method.
    2. Using SoundPLAN noise model predicted results to determine if the difference between the predicted noise level with all wind turbines operating and the predicted noise level with only the actual operating turbines was typically less than 0.5 dBA. If any or all of the non-relevant turbines were to not operate during a given measurement period, the reduction in total noise level would be 0.5 dB or less and would therefore generally be inconsequential to the assessment outcome. This relevant turbine screening method shall be referred to as the 0.5 dB method.

The NCTP method is considered a very conservative approach, and due to the significant number of turbine outages for rectification and maintenance purposes experienced during the monitoring period, a large amount of the collected data was deemed invalid.

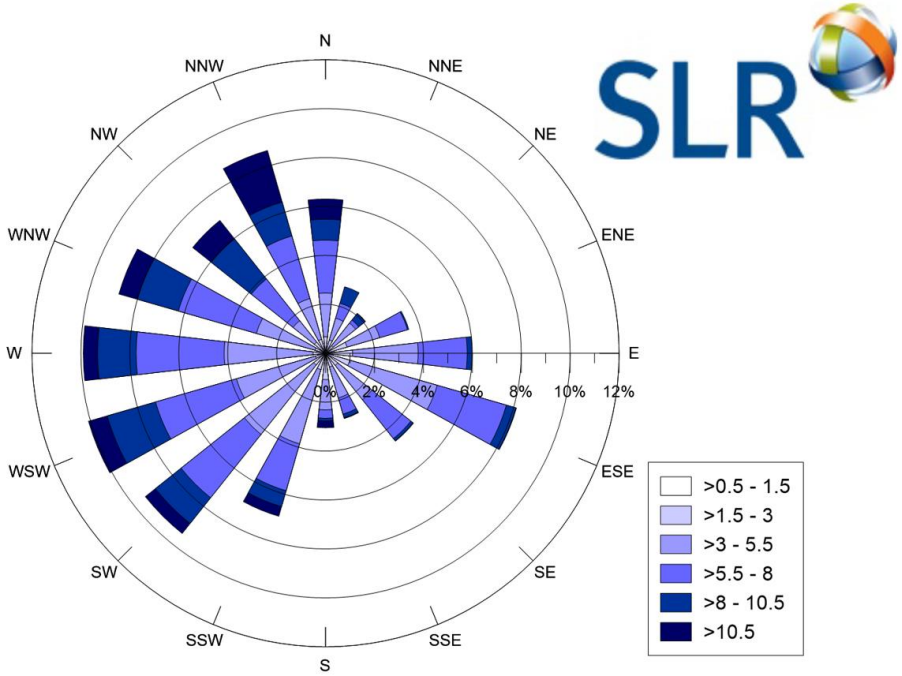
The re-interpretation of this requirement via the 0.5dB method is marginally less conservative, however, given the large amount of turbine outages and the corresponding lack of robust data sets provide by the NCTP method detailed above, it is considered appropriate in order to facilitate an assessment. The 0.5 dB interpretation has been used on other wind farm projects and utilises the same logic as considered by NZS 6808 in explanatory note C7.6.3. for on-off testing.

Appendix F presents the "relevant turbines" for each reference receptor and both screening methods in a tabulated form. Results using both of the methods have been presented in **Section 10.1.1** and **Section 10.1.2** respectively.

Table 3 Measurement details for each location

Location	Period	Duration	Noise Logger Model / Serial #	Weather Station Model / Serial #	Total No. of monitoring intervals	Total No. of valid data points analysed	
						NCTP method	0.5 dB method
K15aa	9/3/2021 to 13/5/2021	~ 54 days	B&K 2250 #3011882	Vaisala N2340038	7771 (All Time) 2921 (Night Only)	878 (All Time) 369 (Night Only)	3423 (All Time) 1033 (Night Only)
H18aa	9/3/2021 to 13/5/2021	~ 54 days	B&K 2250 #3011836	Vaisala N2430028	7766 (All Time) 2856 (Night Only)	810 (All Time) 441 (Night Only)	3538 (All Time) 1706 (Night Only)
L18aa	9/3/2021 to 13/5/2021	~ 54 days	B&K 2250 #3006994	Vaisala J1250018	7766 (All Time) 2921 (Night Only)	988 (All Time) 340 (Night Only)	3423 (All Time) 1033 (Night Only)

Figure 3 Wind conditions during the survey period



8 Assessment of Special Audible Characteristics

8.1 Introduction

In general accordance with NCTP an assessment has been undertaken to establish whether the noise emissions from the wind farm exhibit any special audible characteristics (SACs).

8.2 Special Audible Characteristics

NZ 6808:2010 describes that wind turbines sound levels with special audible characteristics (SACs) shall be adjusted by arithmetically adding a penalty of up to +6 dB to the measured level to account for the adverse subjective response likely to be aroused by sounds containing such characteristics.

The document details that: "Sound that has special audible characteristics, such as tonality or impulsiveness, is likely to cause adverse community response at lower sound levels, than sound without such characteristics. Subjective assessment can be sufficient in some circumstances to assess special audible characteristics." Such that the initial test is subjective, to be followed up by an objective test if required.

The initial subjective evaluation therefore would focus on identifying any distinct noise character from the wind farm that contained:

1. Clearly audible tones
2. Impulses; and
3. Modulation of sound levels.

Tones occur where the sound under consideration has energy concentrated at a certain frequency (pitch), like a single note on a musical instrument.

Impulse sound, if present, would be heard as banging or thumping noises from the wind farm.

Modulation of sound level (amplitude modulation) is where the sound from the wind farm exhibits a regularly varying level greater than that characteristic of 'normal' wind turbine operation. 'Normal' wind turbine operation is generally acknowledged as including some minor amplitude modulation due to 'swishing' noise from the blades.

8.3 Subjective Attended Observations

In accordance with Appendix B1 of NZS 6808:2010, subjective attended observations of the wind farm noise were undertaken at each reference location, as well as a number of intermediary locations, in order to determine if the noise from the wind farm exhibits any special audible characteristics that may require a penalty adjustment to be applied or warrant rectification works.

Each subjective assessment of the wind farm noise was conducted by a professional acoustic engineer (grade Member of the Australian Acoustical Society), as per the process below:

1. An acoustic engineer listened to the sound at the reference location for a minimum period of 10 minutes;
2. As far as practical, the listening position was the same as the noise logger position used for measurement of the 'A'-weighted sound pressure levels;

3. The sounds at the reference location were noted, including any sound from the wind farm and any SACs due to the wind farm;
4. The local weather and wind conditions at the reference locations during the assessment period were noted subjectively;
5. Attended observation surveys were completed during deployment and retrieval of the monitoring equipment as well as during an interim visit and included day-time, night-time and early morning periods and a variety of wind farm operational states under differing meteorological conditions (e.g. wind speed, wind direction and wind shear).

A summary of the attended subjective listening survey notes is included in **Appendix D.**

8.3.1 Subjective assessment findings

The listening survey notes in **Appendix D** wind farm noise detail that at some times and survey locations, there was an audible and discernible "hum" character. Additional listening tests at intermediary and positions close to turbines confirmed that the source of the hum was from turbines. The use of a spectrogram application on a handheld device confirmed the frequency of the hum was typically between 280 Hz to 400 Hz and was dependent upon turbine rotation speed / wind speed.

No other significant SACs were observed in the listening surveys.

On the basis of the observed audible "hum" character and in accordance with the NCTP and NZS 6808:2010 an objective assessment for tonality is required.

8.3.2 Objective assessment of tonality

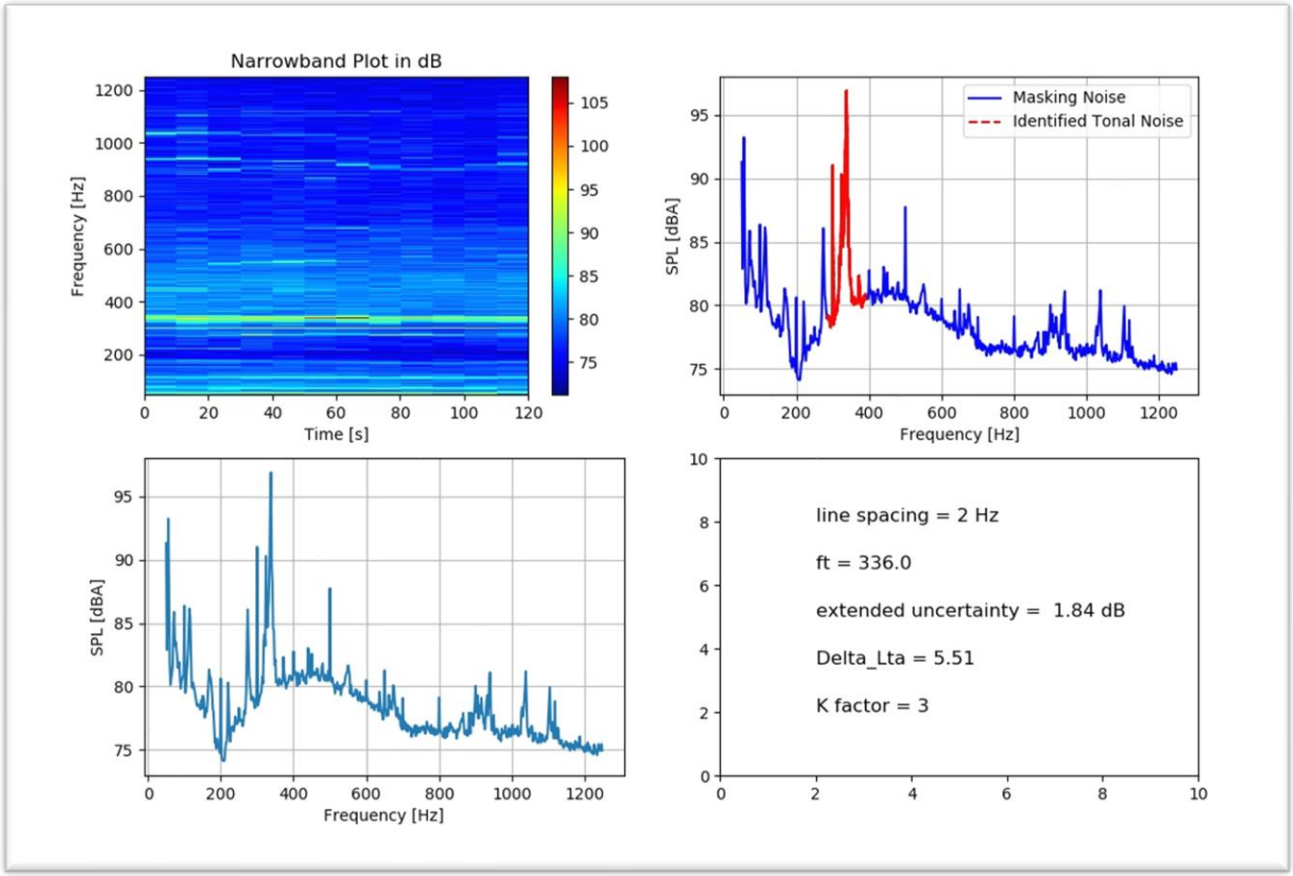
For all intervals that were identified in the Valid Data Screening process (see **Section 7**) the recorded audio (48kHz, 16-bit, 2 min duration per 10 min measurement, WAV format) was analysed using a narrow band tonality procedure as required by the NCTP, namely:

- International Standard ISO 1996-2:2017 *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels* 2017 (ISO 1996-2:2017) where,
- the narrow band method defined in ISO 1996-2:2017 Annex J *Objective method for assessing the audibility of tones in noise — Engineering method* (Annex J) is to be used, which directly references:
- that tonal audibility levels are to be determined in accordance with ISO/PAS 20065:2016 *Acoustics - Objective method for assessing the audibility of tones in noise – Engineering Method* (ISO/PAS 20065:2016).

Intervals that had been screened and identified as non-valid (e.g. affected by rain or excessive insect noise or whilst relevant WTGs weren't operating), were not assessed for tonality as such intervals would not be included in the compliance assessment in any case.

Automated signal processing scripts were used to generate twelve 10 second narrow band spectra for each valid data interval. Each spectrum had a frequency investigation range between 50 Hz and 1250 Hz with a 2 Hz line spacing. Using the method described in ISO/PAS 20065:2016 and ISO 1996-2:2017, the script determined all relevant metrics including dominant tone frequency, tonal mean audibility, extended uncertainty and any K factor penalty. Furthermore, a summary graphic of the narrow band spectrum and any identified tones as well as a coloured spectrogram were stored for each analysed record to assist in identification and confirmation that the tone was wind farm related and not a false positive from another extraneous source.

Figure 4 Example of tonality summary graphic



All intervals in which a tone of sufficient audibility was identified had the requisite K factor penalty arithmetically added to the measured L_{A90} for that interval.

The statistical distribution of valid intervals in which tonality was identified and a penalty applied is summarised in **Table 4** and example summary graphics for which an interval identified with a significant tone present for each receptor is included in **Appendix B.**

Table 4 Tonality penalty statistical distribution of valid intervals

Receptor	Assessment Period	K factor penalty						
		+ 0 dB	+ 1 dB	+2 dB	+3 dB	+4 dB	+5 dB	+6 dB
NCTP method								
K15aa	All-time	95.8%	1.9%	0.8%	0.9%	0.2%	0.2%	0.1%
	Night Only	95.1%	2.4%	0.5%	0.5%	0.5%	0.5%	0.3%
L18aa	All-time	87.4%	4.4%	3.5%	2.2%	1.7%	0.3%	0.4%
	Night Only	78.5%	6.5%	6.5%	5.0%	3.5%	0.0%	0.0%
H18aa	All-time	94.4%	1.7%	2.2%	1.4%	0.2%	0.0%	0.0%
	Night Only	90.0%	2.9%	4.1%	2.5%	0.5%	0.0%	0.0%
0.5 dB method								
K15aa	All-time	83.7%	5.8%	3.9%	3.4%	2.2%	0.7%	0.4%
	Night Only	79.4%	5.2%	4.5%	4.5%	4.1%	1.4%	0.9%
L18aa	All-time	76.9%	6.3%	6.0%	4.6%	4.1%	1.3%	0.8%
	Night Only	71.4%	6.5%	7.2%	5.8%	6.2%	1.5%	1.4%
H18aa	All-time	78.3%	5.5%	5.7%	5.1%	4.2%	1.1%	0.1%
	Night Only	74.5%	6.4%	6.3%	6.3%	5.3%	1.1%	0.1%

9 Compliance Assessment

The NZS 6808:2010 expects a minimum of 10 days of continuous monitoring to be completed and typically a set of at least 1,440 valid data points during for analysis. As a consequence of the valid data screening process (See **Section 7**) the number of valid data points was generally 810 – 990 points for all-time periods and 340 – 440 points for night-only period despite the noise monitoring campaign extending for approximately 60 days, which represents approximately 11% of the total number of intervals monitored. When the less stringent 0.5 dB screening method was applied approximately 45% of the total number of intervals monitored were valid.

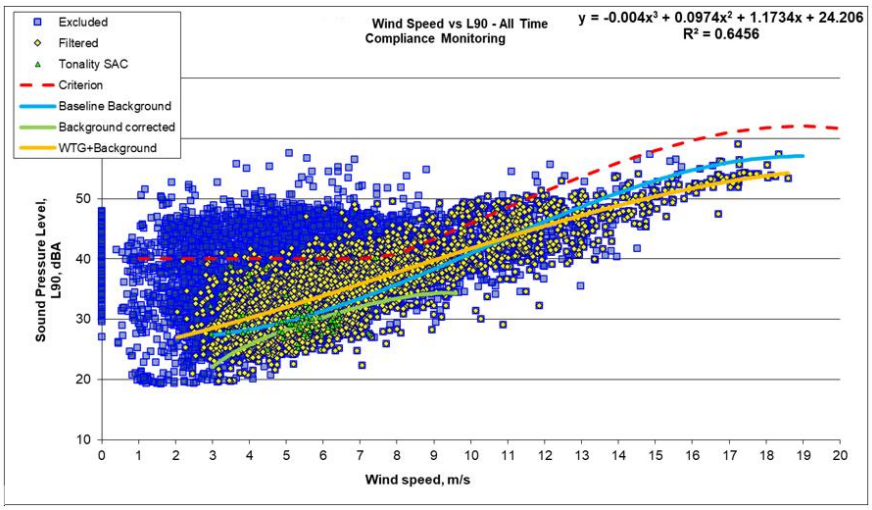
In accordance with the planning permit, the data sets are considered for both:

- all periods: 0000 to 2400 hours, and
- night periods: 2200 to 0700 hours.

The assessment process can be summarised as follows:

1. The Original full data set (refer **Figure 5** blue dots) and the Filtered valid data set (refer **Figure 5** yellow dots) are plotted against the derived wake free hub height wind speed to obtain a L_{A90} sound pressure level versus wind speed characteristic for each location.
2. A trend line of best fit for the filtered data set is then determined using a cubic polynomial (refer **Figure 5** yellow line), which represents the *wind farm + background noise.*
3. The trend line, from (1) above, is then corrected to remove the influence of ambient background noise by logarithmically subtracting the previously collected *background noise* regression trend line (refer **Figure 5** blue line). The resulting background corrected trend line represents the *wind farm only noise* (refer **Figure 5** green line). At higher wind speeds where background noise dominates over wind farm noise, and a result of logarithmic subtraction, the green line would tend to asymptote to 0 dBA. Consequently, *wind farm only noise* has only been calculated for wind speeds where the *wind farm + background* noise is more than 1 dB higher than the *background noise* regression trend line.
4. The *wind farm only noise* (refer **Figure 5** green line) is then compared with the noise limit (refer **Figure 5** dashed red line) to determine compliance at each receptor. The resulting difference between them is referred to as the *compliance margin*.

Figure 5 Example compliance assessment graph



10 Results

As discussed in **Section 5,** as a result of a transcription error there is an inconsistency in the NZS 6808 limits presented in the Background Report and the planning permit limits contained in the NCTP.

Notwithstanding, the above it should be noted that:

- the limits in the NCTP are correct for H18aa
- the limits in the NCTP are approximately 3 dBA too low for L18aa
- The NCTP didn't include limits for K15aa, which have been established on subsequent baseline monitoring.

This report focusses primarily on the technically correct NZS 6808 limits. The inconsistency only affects receptor L18aa and this receptor is evaluated against the planning permit limits contained in the NCTP separately in **Section 10.2**.

10.1 NZS 6808 noise limit assessment

The data was collected as outlined in **Section 6,** screened for validity as outlined in **Section 7** and evaluated for SACs as outlined in **Section 8.** The compliance assessment was completed as outlined in **Section 9.**

The results of the analysis for screening as per the NCTP method are presented in **Section 10.1.1.**

The results of the analysis for screening as per the 0.5 dB method are presented in **Section 10.1.2.**

10.1.1 NCTP screening method

A summary table showing the compliance margin is shown in **Table 5** and **Table 6**. Refer to **Appendix B** for detailed summaries for each site.

Table 5 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa	11.3	10.3	9.1	7.8	7.5	9.4	-	-	-	-	-	-
K15aa	6.6	5.4	4.4	3.5	4.3	5.6	7.6	-	-	-	-	-
L18aa	15.8	14.3	12.8	11.1	9.8	11.1	-	-	-	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

Table 6 Compliance margin – Night Only

Site	Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa	10.6	10.5	9.8	8.7	7.4	6.4	9.0	-	-	-	-	-
K15aa	8.9	8.3	7.4	6.4	5.2	4.0	2.9	3.4	4.8	6.9	10.5	-
L18aa	10.3	10.5	10.7	11.0	12.0	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

10.1.2 0.5 dB screening method

A summary table showing the compliance margin is shown in **Table 7** and **Table 8**. Refer to **Appendix C** for detailed summaries for each site.

Table 7 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa	14.3	11.8	9.8	8.1	7.6	9.3	-	-	-	-	-	-
K15aa	7.2	5.7	4.2	2.7	2.6	3.1	4.0	5.7	8.9			
L18aa	8.6	7.9	7.9	9.2	-	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L_{90}, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

Table 8 Compliance margin – Night Only

Site	Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
H18aa	13.8	11.8	10.0	8.3	6.8	6.1	9.3	-	-	-	-	-
K15aa	10.3	8.6	7.1	5.7	4.4	3.3	2.5	3.4	5.2	7.8	12.5	-
L18aa	7.7	8.0	8.6	9.9	-	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L90, 10 minute Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

10.2 NCTP noise limit assessment

The inconsistency in the NZS 6808 limits presented in the Background Report and the planning permit limits contained in the NCTP only affects receptor L18aa and this receptor is evaluated against the planning permit limits contained in the NCTP.

10.2.1 NCTP screening method

A summary table showing the compliance margin is shown in **Table 9** and **Table 10**.

Table 9 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
L18aa	15.8	14.3	12.8	9.1	6.6	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L90, 10 minute. Cells containing dashes are cases where the compliance measurement did not sufficiently exceed the background measurement.

Table 10 Compliance margin – Night Only

Site	Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
L18aa	10.3	10.5	10.7	9	8.8	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L90, 10 minute. Cells containing dashes are cases where the background measurement exceeded the compliance measurement.

10.2.2 0.5 dB screening method

A summary table showing the compliance margin is shown in **Table 11** and **Table 12**.

Table 11 Compliance margin

Site	Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
L18aa	7.9	7.5	7.8	7.1	-	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L90, 10 minute. Cells containing dashes are cases where the background measurement exceeded the compliance measurement.

Table 12 Compliance margin – Night Only

Site	Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	15
L18aa	6.9	7.2	7.7	6.8	-	-	-	-	-	-	-	-

Note: All noise measurements are dBA, L90, 10 minute. Cells containing dashes are cases where the background measurement exceeded the compliance measurement.

11 Conclusion

The noise emissions from the Elaine section of Lal Lal Wind Farm have been assessed in accordance with the NCTP which were endorsed to comply with the condition 24 and 25 of Lal Lal Wind Farm Planning Permit PL-SP/05/0461/C.

Unattended noise compliance monitoring was undertaken for a period of approximately 60 days between 9 March 2021 to 8 May 2021 to at the three reference receivers K15aa, H18aa and L18aa.

During the survey period subjective assessment listening surveys were completed and it was observed that at some times and survey locations, there was an audible and discernible "hum" character in the noise emissions from turbines. No other special audible characteristics were observed in the listening surveys.

The collected data was screened to obtain a valid data set by excluding data intervals in accordance with NCTP to remove periods of local rain, periods of wind outside the operating wind speed range, periods adversely affected by extraneous insect or frog noise, or when one or more WTGs critical to wind farm noise level at each receptor was not operating. On this last point the data set was screened in two slightly different ways, the NCTP method, and the slightly less conservative 0.5 dB method which provides a higher number of valid data points.

On the basis of the observed audible "hum" character and in accordance with the NCTP an objective assessment for tonality was completed on the recorded audio samples for all valid intervals, in accordance with ISO/PAS 20065:2016. All intervals in which a tone of sufficient audibility was identified had the requisite K factor penalty arithmetically added to the measured L_{A90} for that interval.

The NCTP method screened valid data set yielded less than the 1440 points recommended by NZS 6808, however, the assessment still indicates that all receptors comply with their relevant NZS 6808 noise criteria and the planning permit noise limits. The result infers a minimum margin of compliance at H18aa, K15aa and L18aa respectively of approximately 8 dBA, 3 dBA and 10 dBA for all time and 6 dBA, 3 dBA and 10 dBA for night only.

The 0.5 dB method screened valid data set yielded more than the 1440 points recommended by NZS 6808 and the assessment still indicates that all receptors comply with their relevant NZS 6808 noise criteria and the planning permit noise limits. The result infers a minimum margin of compliance at H18aa, K15aa and L18aa respectively of approximately 8 dBA, 3 dBA and 8 dBA for all time and 6 dBA, 3 dBA and 8 dBA for night only.

It is clear that these margins are sufficiently large (e.g. > 0.5 dB) such that all locations would still indicate a clear compliance even if all non-relevant turbines had been non functioning for the entire survey period.

With respect to the differences identified in the noise limits between the NCTP and the Baseline Report (refer **Section 5**), it is clear that the margin of compliance at L18aa is more than sufficient to account for the approximate 3 dBA discrepancy caused by the transcription error between the limits in the NCTP and the Baseline Report for this location. That is to say that the compliance monitoring confirms that the limit presented in the NCTP are met by an approximate 7 dBA margin as a minimum at L18aa.

APPENDIX A

Glossary

Term	Description
'A' weighted	A frequency adjustment which represents how humans hear sounds.
ABL	Assessment Background Level. The single-figure background level representing each assessment period (day, evening and night). Defined in the *Noise Policy for Industry*.
Ambient noise level	The all-encompassing sound associated with an environment or area.
Background creep	The incremental increase in background noise levels over time as new developments are built in an area.
dB	Decibel
dBA	'A' weighted decibel
DW	The weighted level difference between two rooms, that is, the on-site sound insulation between two spaces.
Facade affected	A monitoring location which is influenced by facade reflections. Measurements at facades are typically taken at a distance of 1 m away and the measured noise level generally regarded as being +2.5 dB higher than 'free field'.
Free field	A monitoring location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise.
Hz	Hertz
Impulsive noise	Noise with a high peak of short duration, or sequence of peaks.
Intermittent noise	Noise which varies in level with the change in level being clearly audible
L_{90} , L_{10}, etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
L_{AE} (or SEL)	Sound Exposure Level. This is the constant sound level that has the same amount of energy in one second as the original noise event.
LA_{eq}	The 'A' weighted equivalent noise level. It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
L_{Amax}	The A' weighted maximum sound pressure level of an event.
Term	Description
Low frequency	Noise containing energy in the low frequency range.
L_P or SPL	Sound Pressure Level
Lw or SWL	Sound Power Level
Noise logger	A self-contained, battery powered item of equipment that is used to measure noise levels over several days.
Noise reduction	The difference in sound pressure level between any two areas.
NR noise rating	Single number evaluation of the background noise level in a space. The NR level is typically around 5 to 6 dB below the 'A' weighted noise level.
Octave-band	A frequency band where the highest frequency is twice the lowest frequency.
Offensive noise	Noise that is considered harmful or which interferes unreasonably with affected receivers.
PNTL	Project Noise Trigger Levels. Target noise levels for a particular noise generating development.
RBL	Rating Background Level. The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. Defined in the *Noise Policy for Industry*.
Steady state noise	Noise which remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Time weighting	Sound level meters can be set to 'fast' or 'slow' response. 'Fast' corresponds to a 125 ms time constant and 'slow' corresponds to a 1 second time constant.
Tonality	Noise containing a prominent frequency.
Transmission loss (or sound transmission loss or sound reduction index)	A test which rates the sound transmission properties of a wall, floor or roof construction.

APPENDIX B

Compliance Assessment

NCTP method screening

Location K15aa

Location K15aa is located to the south of the Elaine portion of the Lal Lal Wind Farm, approximately 1 km from the nearest WTG. The monitoring location is shown in **Figure 6**.

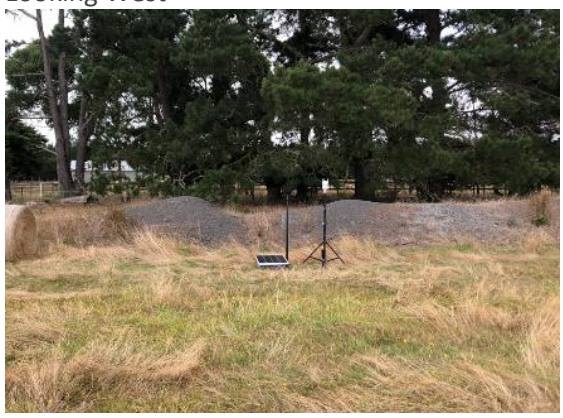
Figure 6 K15aa measurement location

Looking North

Looking East

Looking South

Looking West



Measurement

Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 7** and **Figure 8**. **Table 15** and **Table 16** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from the supplementary baseline noise monitoring conducted by SLR (ref: 640.11872-R01-v1.1, dated 16/02/2021).

Figure 7 K15aa compliance results - all time

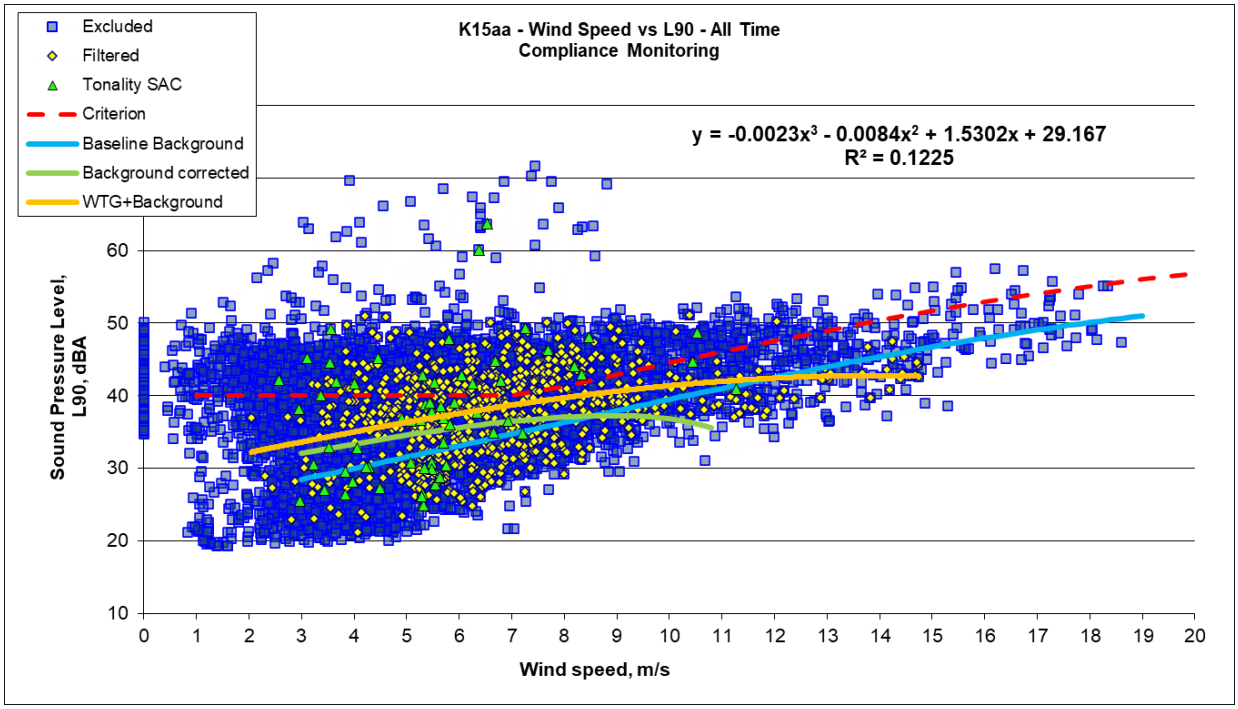


Figure 8 K15aa compliance results – night only

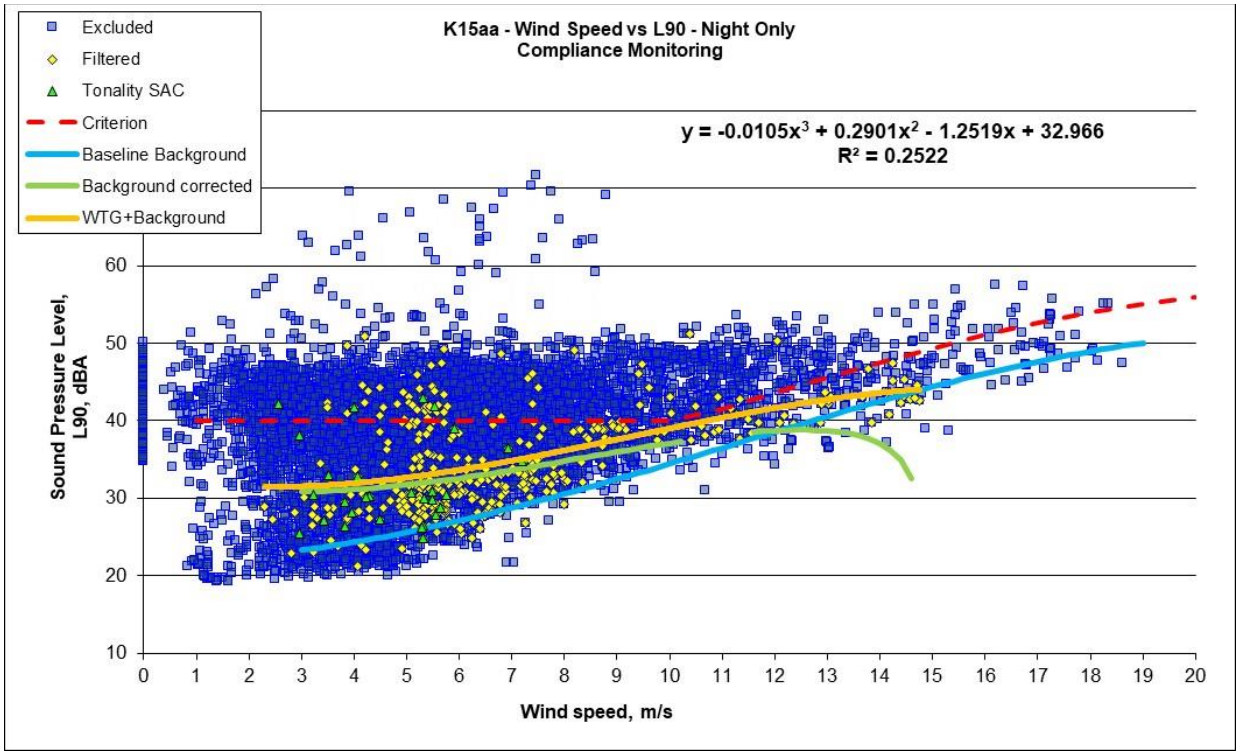


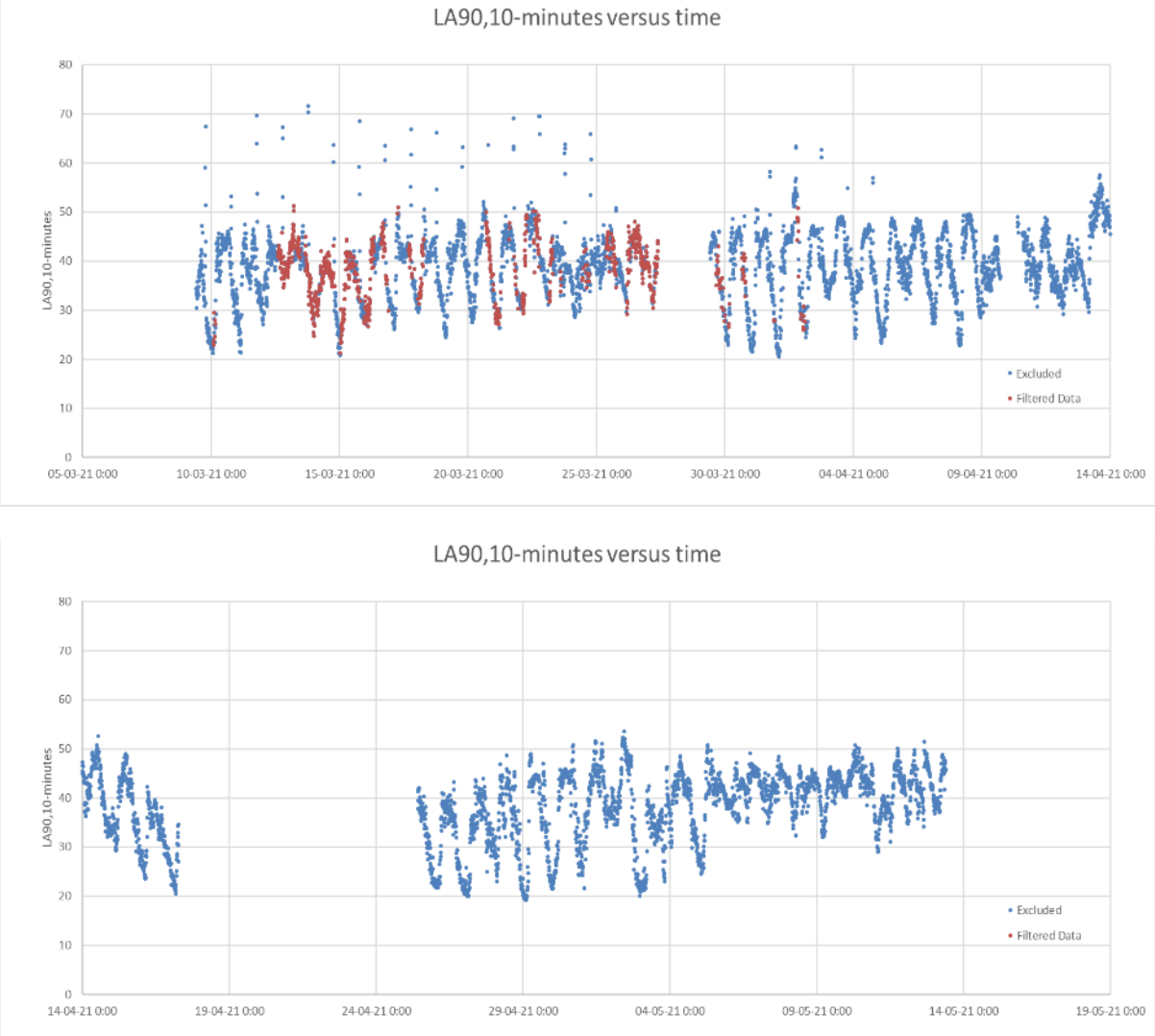
Table 13 K15aa compliance results – all time

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	30.0	31.5	33.1	34.7	36.3	37.9	39.5	41.0	42.5	44.0	45.4	46.7
Consent limit, dBA	40.0	40.0	40.0	40.0	41.3	42.9	44.5	46.0	47.5	49.0	50.4	51.7
Background + WTG, dBA	35.0	36.3	37.6	38.7	39.7	40.6	41.4	42.0	42.4	42.7	42.7	42.6
Corrected WTG noise, dBA	33.4	34.6	35.6	36.5	37.1	37.3	36.8	-	-	-	-	-
Compliance Margin, dBA	6.6	5.4	4.4	3.5	4.3	5.6	7.6	-	-	-	-	-

Table 14 K15aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	24.3	25.6	27.1	28.7	30.5	32.5	34.5	36.5	38.5	40.6	42.5	44.4
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.5	43.5	45.6	47.5	49.4
Background + WTG, dBA	31.9	32.7	33.6	34.8	36.2	37.6	39.0	40.4	41.6	42.7	43.6	44.1
Corrected WTG noise, dBA	31.1	31.7	32.6	33.6	34.8	36.0	37.1	38.1	38.7	38.7	37.0	-
Compliance Margin, dBA	8.9	8.3	7.4	6.4	5.2	4.0	2.9	3.4	4.8	6.9	10.5	-

Figure 9 Time history of measured LA90,10-minutes at K15aa



Location H18aa

Location H18aa is to the north-west of the Elaine portion of Lal Lal Wind Farm, approximately 600m from the nearest WTG. The monitoring location is shown in **Figure 10**.

Figure 10 H18aa measurement location

Looking North

Looking East

Looking South

Looking West

★ Measurement

☆ Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 11** and **Figure 12**. **Table 15** and **Table 16** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 11 H18aa compliance results - all time

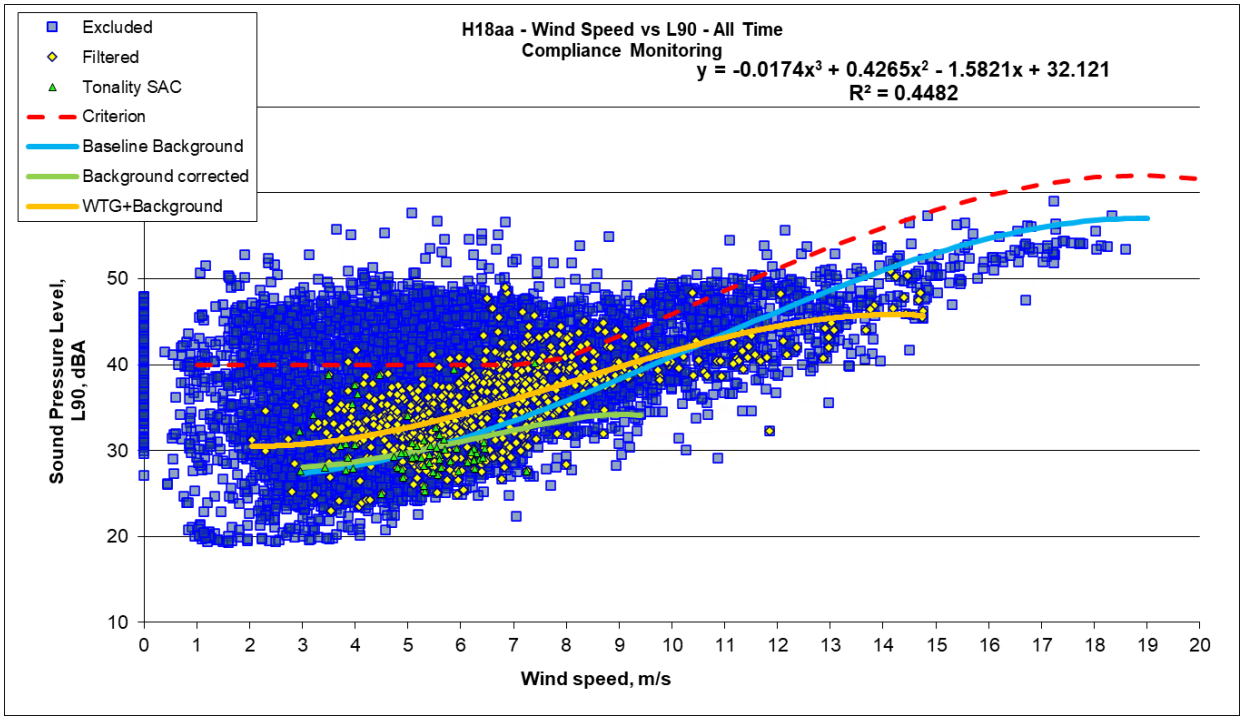


Figure 12 H18aa compliance results – night only

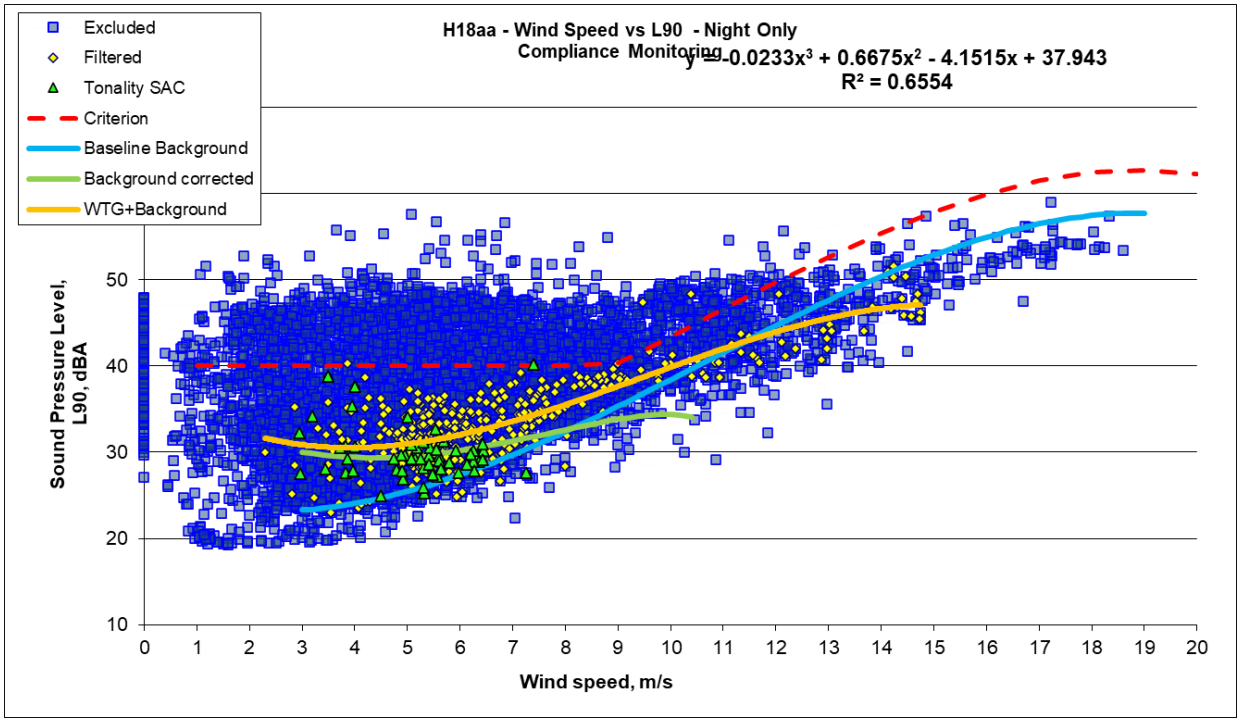


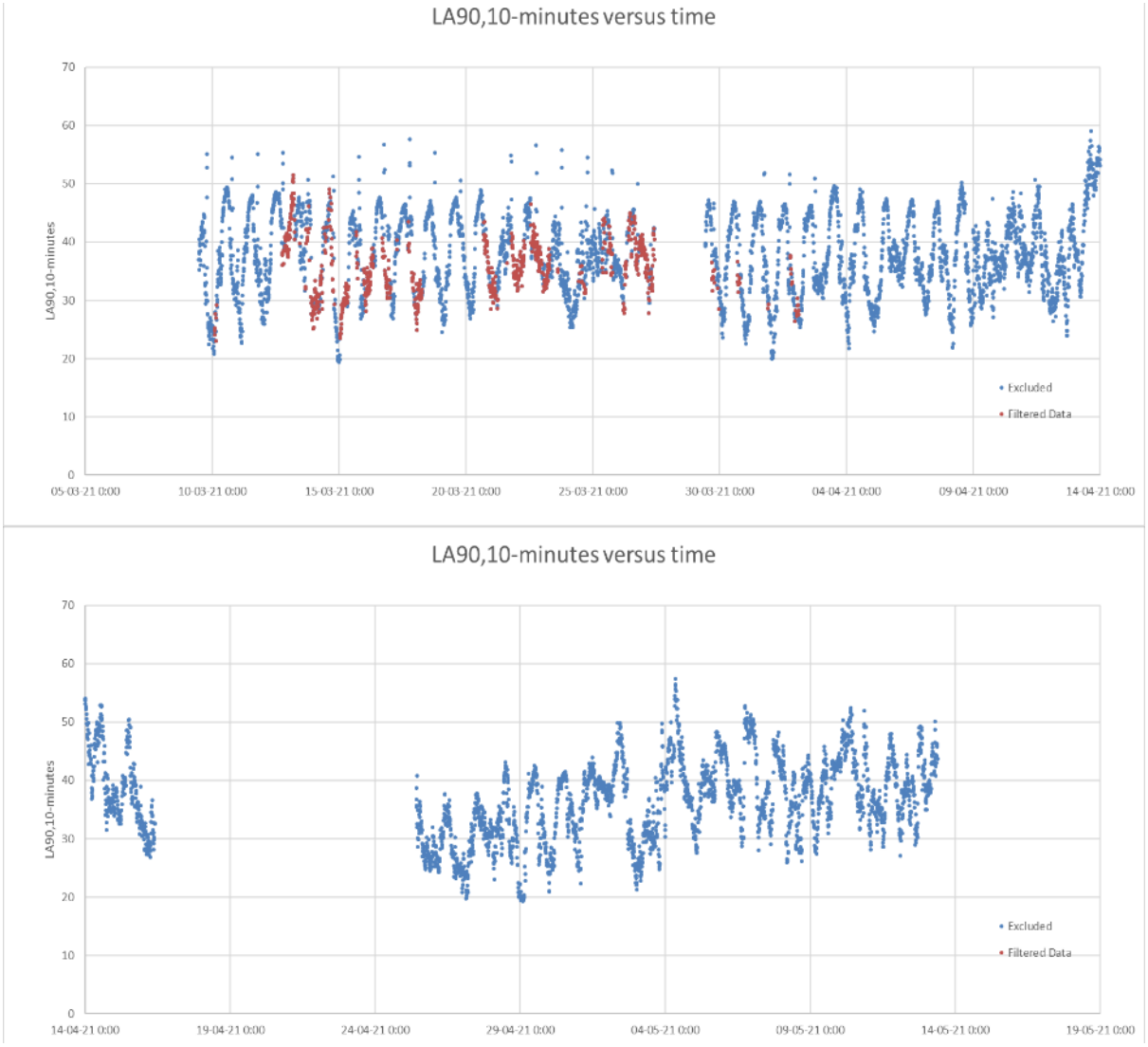
Table 15 H18aa compliance results – all time

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	28.3	29.7	31.5	33.6	35.9	38.4	41.0	43.6	46.2	48.6	50.9	52.9
Consent limit, dBA	40.0	40.0	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9
Background + WTG, dBA	31.5	32.7	34.2	36.0	37.9	39.7	41.5	43.2	44.5	45.4	45.8	45.6
Corrected WTG noise, dBA	28.7	29.7	30.9	32.2	33.4	34.0	-	-	-	-	-	-
Compliance Margin, dBA	11.3	10.3	9.1	7.8	7.5	9.4	-	-	-	-	-	-

Table 16 H18aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	24.1	25.5	27.4	29.7	32.4	35.3	38.4	41.6	44.7	47.7	50.4	52.9
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9
Background + WTG, dBA	30.5	31.0	32.0	33.6	35.5	37.6	39.9	42.0	44.0	45.6	46.7	47.2
Corrected WTG noise, dBA	29.4	29.5	30.2	31.3	32.6	33.9	34.4	-	-	-	-	-
Compliance Margin, dBA	10.6	10.5	9.8	8.7	7.4	6.4	9.0	-	-	-	-	-

Figure 13 Time history of measured LA90,10-minutes at H18aa



Location L18aa

Location L18aa is located to north-east of the Elaine portion of Lal Lal Wind Farm, approximately 1 km from the nearest WTG. The monitoring location is shown in **Figure 14**.

Figure 14 L18aa measurement location

Looking North

Looking East

Looking South

Looking West

★ Measurement

☆ Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 15** and **Figure 16. Table 17** and **Table 18** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 15 L18aa compliance results - all time

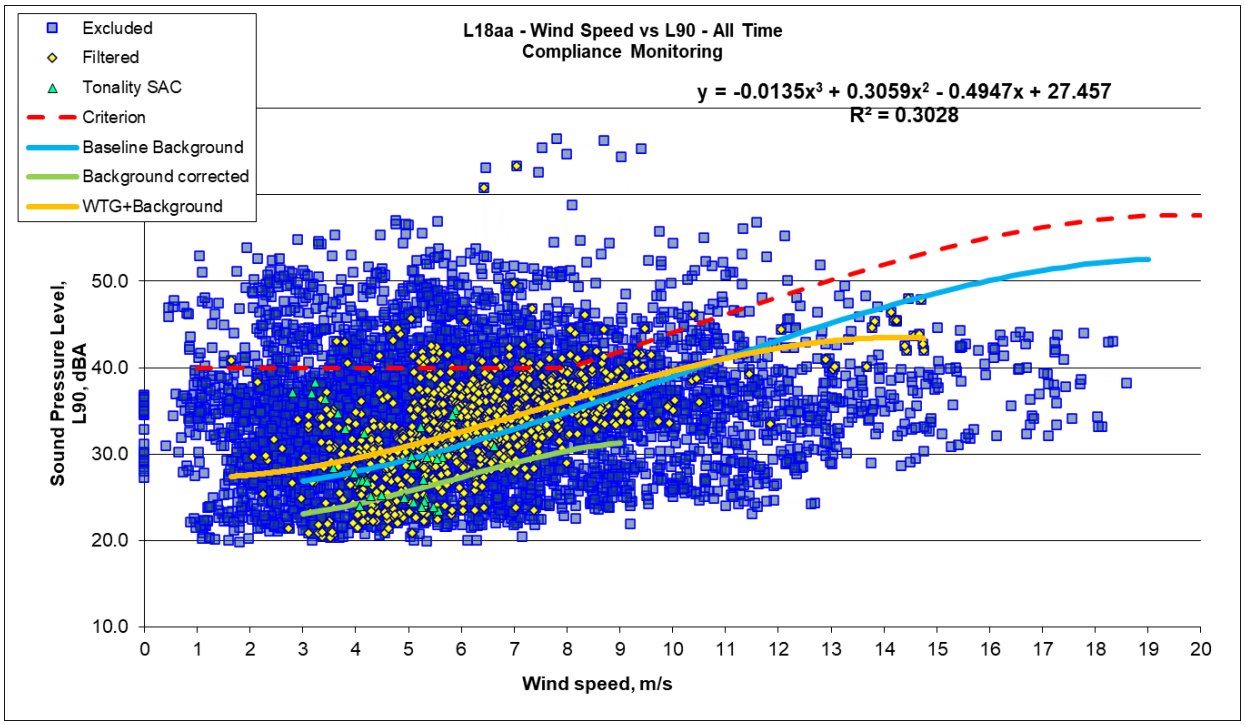


Figure 16 L18aa compliance results – night only

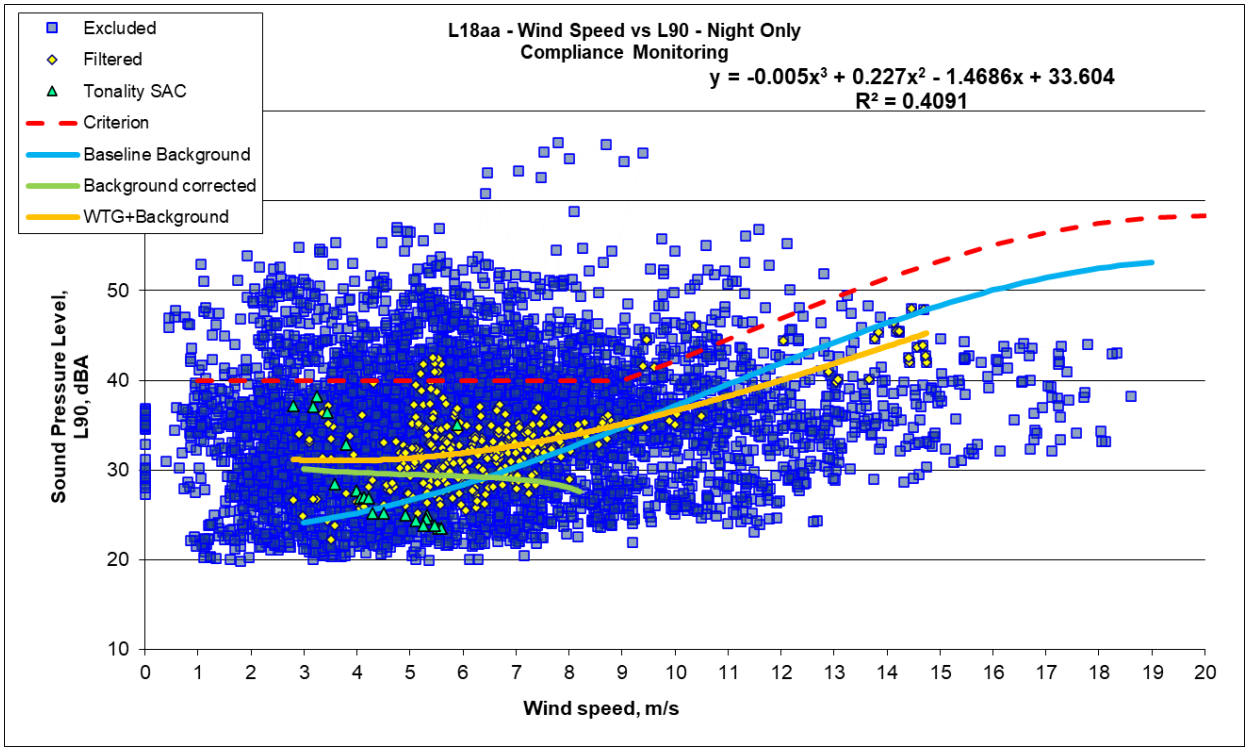


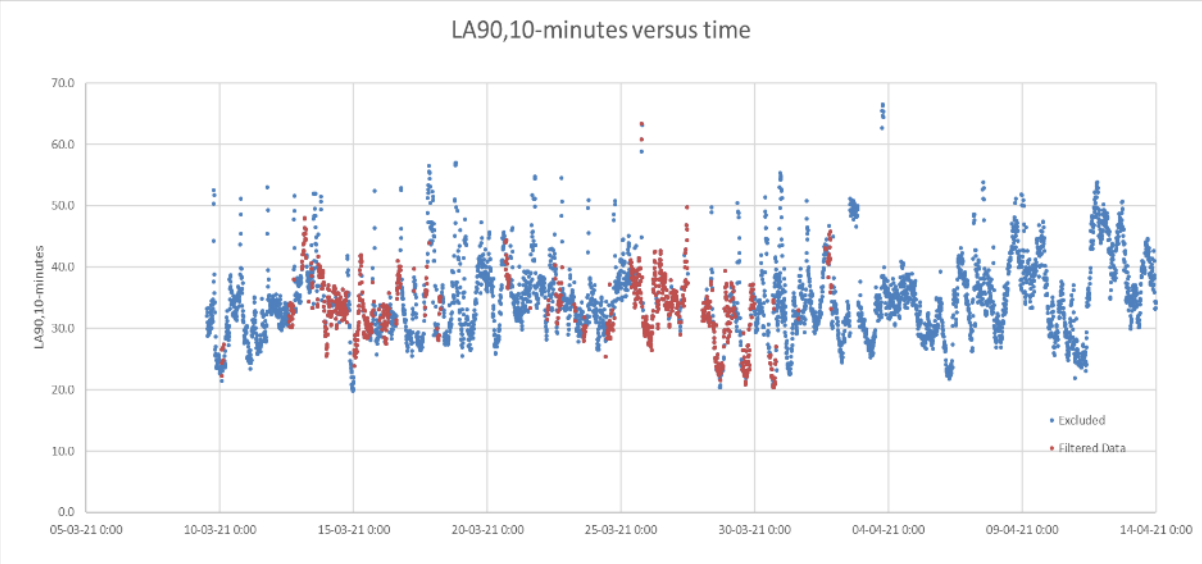
Table 17 L18aa compliance results – all time

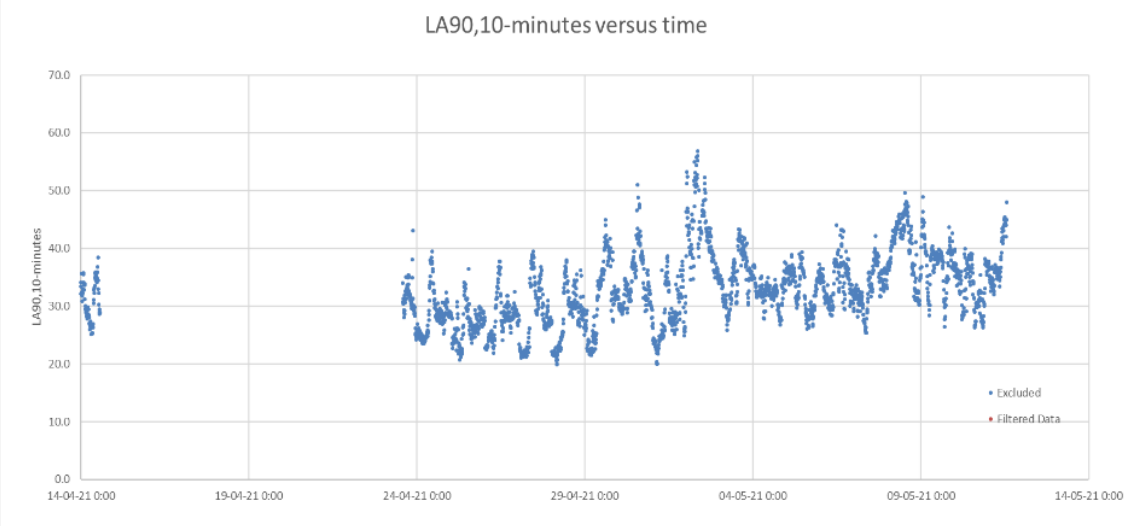
Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	28.0	29.4	31.1	32.9	34.9	37.0	39.1	41.2	43.2	45.2	47.0	48.6
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	42.0	44.1	46.2	48.2	50.2	52.0	53.6
Background + WTG, dBA	29.5	30.9	32.6	34.4	36.2	37.9	39.6	41.1	42.3	43.1	43.5	43.3
Corrected WTG noise, dBA	24.2	25.7	27.2	28.9	30.2	30.9	-	-	-	-	-	-
Compliance Margin, dBA	15.8	14.3	12.8	11.1	9.8	11.1	-	-	-	-	-	-

Table 18 L18aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	25.2	26.6	28.4	30.3	32.5	34.8	37.2	39.6	41.9	44.2	46.4	48.3
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	42.2	44.6	46.9	49.2	51.4	53.3
Background + WTG, dBA	31.0	31.3	31.9	32.7	33.8	35.1	36.6	38.2	40.0	41.9	43.8	45.7
Corrected WTG noise, dBA	29.7	29.5	29.3	29.0	28.0	-	-	-	-	-	-	-
Compliance Margin, dBA	10.3	10.5	10.7	11.0	12.0	-	-	-	-	-	-	-

Figure 17 Time history of measured LA90,10-minutes at L18aa





APPENDIX C

Compliance Assessment

0.5 dB method screening

Location K15aa

Location K15aa is located to the south of the Elaine portion of the Lal Lal Wind Farm, approximately 1 km from the nearest WTG. The monitoring location is shown in **Figure 6**.

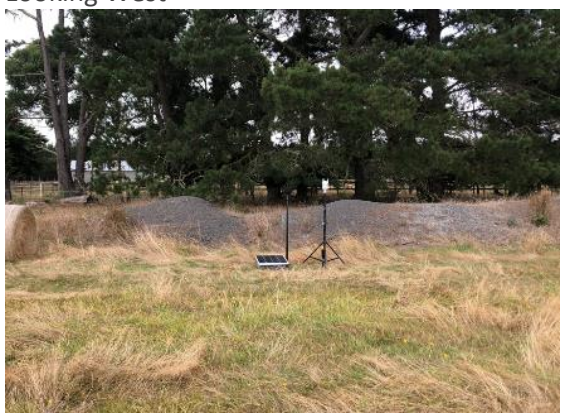
Figure 18 K15aa measurement location

Looking North

Looking East

Looking South

Looking West



Measurement

Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 7** and **Figure 8**. **Table 15** and **Table 16** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from the supplementary baseline noise monitoring conducted by SLR (ref: 640.11872-R01-v1.1, dated 16/02/2021).

Figure 19 K15aa compliance results - all time

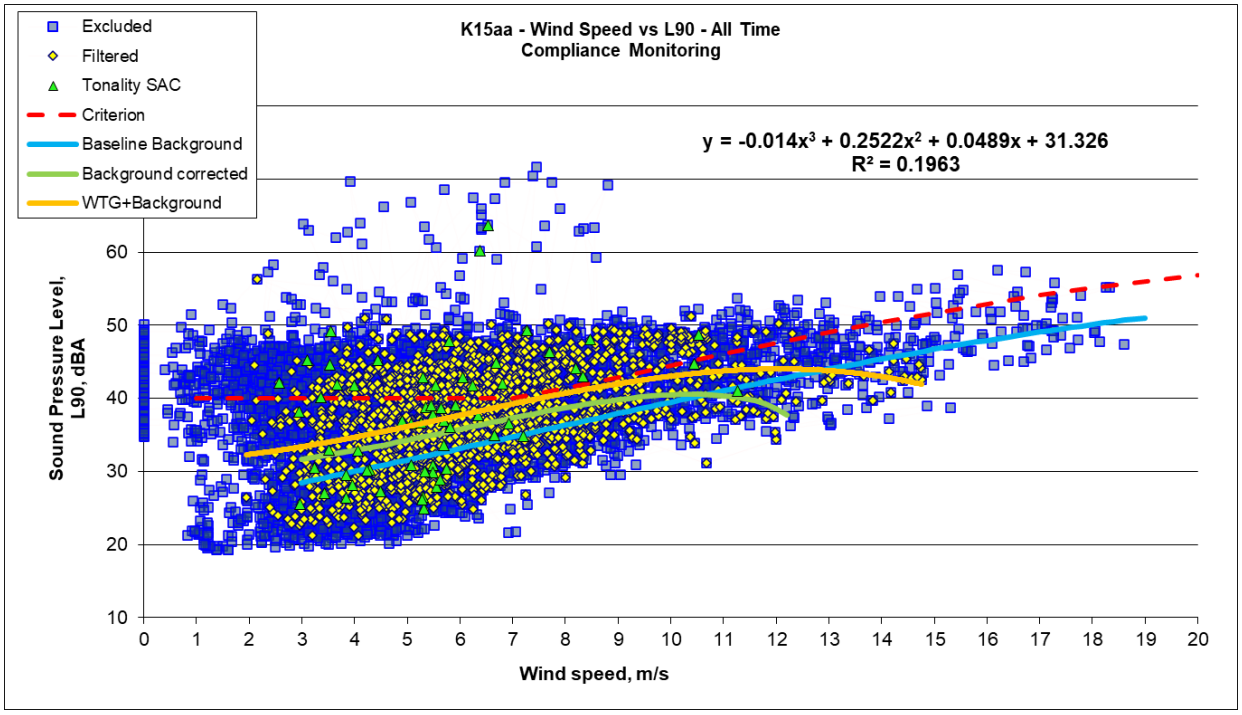


Figure 20 K15aa compliance results – night only

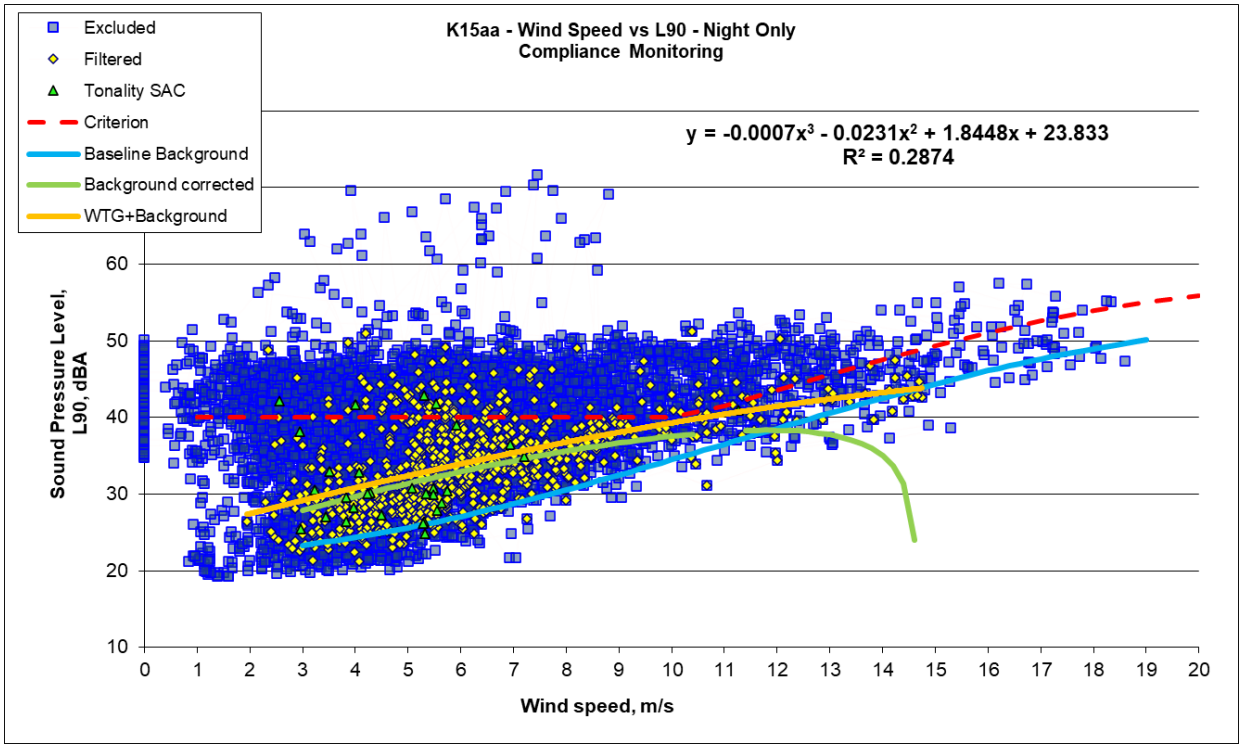


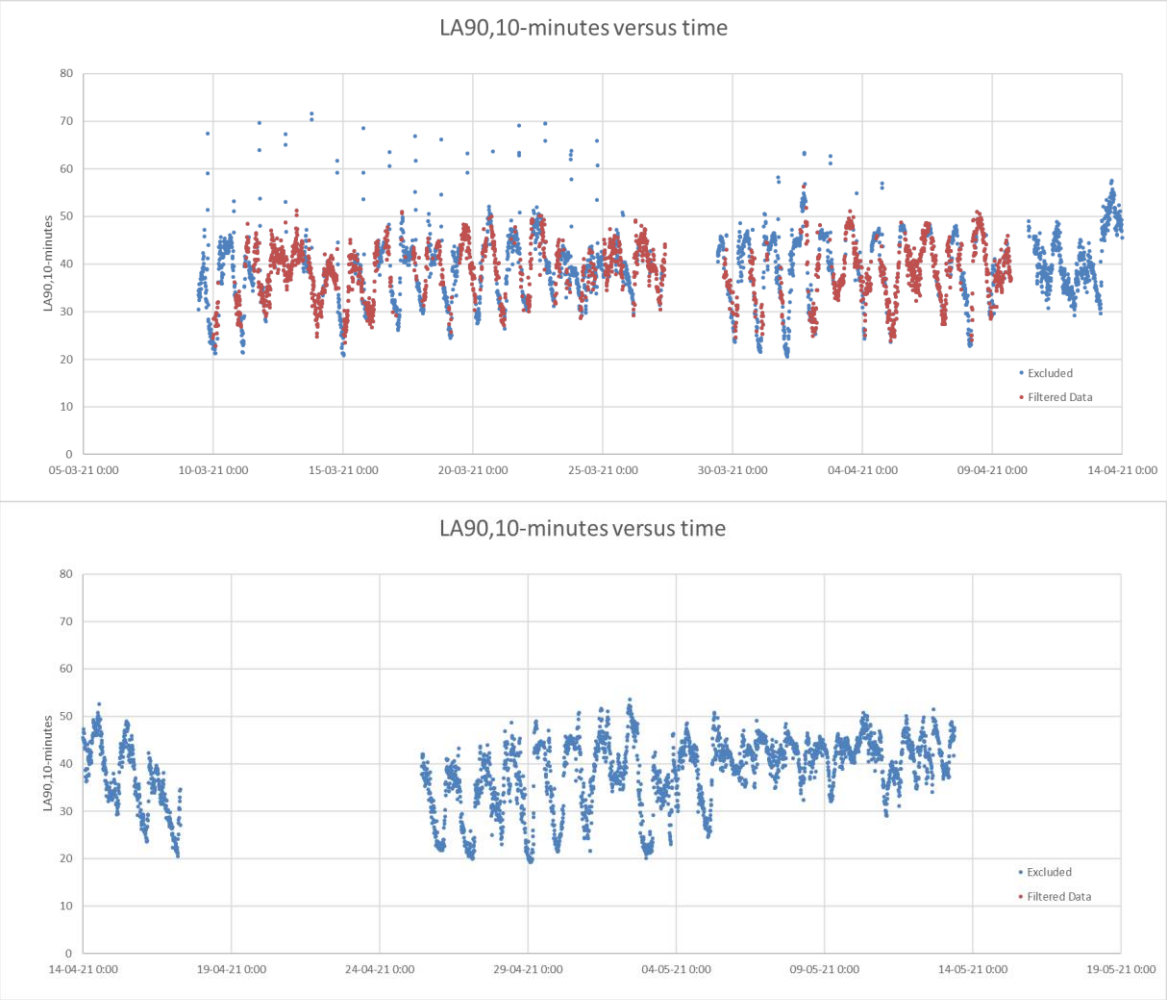
Table 19 K15aa compliance results – all time

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	30.0	31.5	33.1	34.7	36.3	37.9	39.5	41.0	42.5	44.0	45.4	46.7
Consent limit, dBA	40.0	40.0	40.0	40.0	41.3	42.9	44.5	46.0	47.5	49.0	50.4	51.7
Background + WTG, dBA	34.7	36.1	37.7	39.2	40.7	42.0	43.0	43.7	44.0	43.8	43.0	41.5
Corrected WTG noise, dBA	32.8	34.3	35.8	37.3	38.7	39.8	40.5	40.4	38.6	-	-	-
Compliance Margin, dBA	7.2	5.7	4.2	2.7	2.6	3.1	4.0	5.7	8.9	-	-	-

Table 20 K15aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	24.3	25.6	27.1	28.7	30.5	32.5	34.5	36.5	38.5	40.6	42.5	44.4
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.5	43.5	45.6	47.5	49.4
Background + WTG, dBA	30.8	32.4	33.9	35.4	36.8	38.1	39.3	40.4	41.4	42.4	43.2	44.0
Corrected WTG noise, dBA	29.7	31.4	32.9	34.3	35.6	36.7	37.5	38.1	38.3	37.7	35.1	-
Compliance Margin, dBA	10.3	8.6	7.1	5.7	4.4	3.3	2.5	3.4	5.2	7.8	12.5	-

Figure 21 Time history of measured LA90,10-minutes at K15aa



Location H18aa

Location H18aa is to the north-west of the Elaine portion of Lal Lal Wind Farm, approximately 600m from the nearest WTG. The monitoring location is shown in **Figure 10**.

Figure 22 H18aa measurement location

Looking North

Looking East

Looking South

Looking West

★ Measurement

☆ Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 11** and **Figure 12**. **Table 15** and **Table 16** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 23 H18aa compliance results - all time

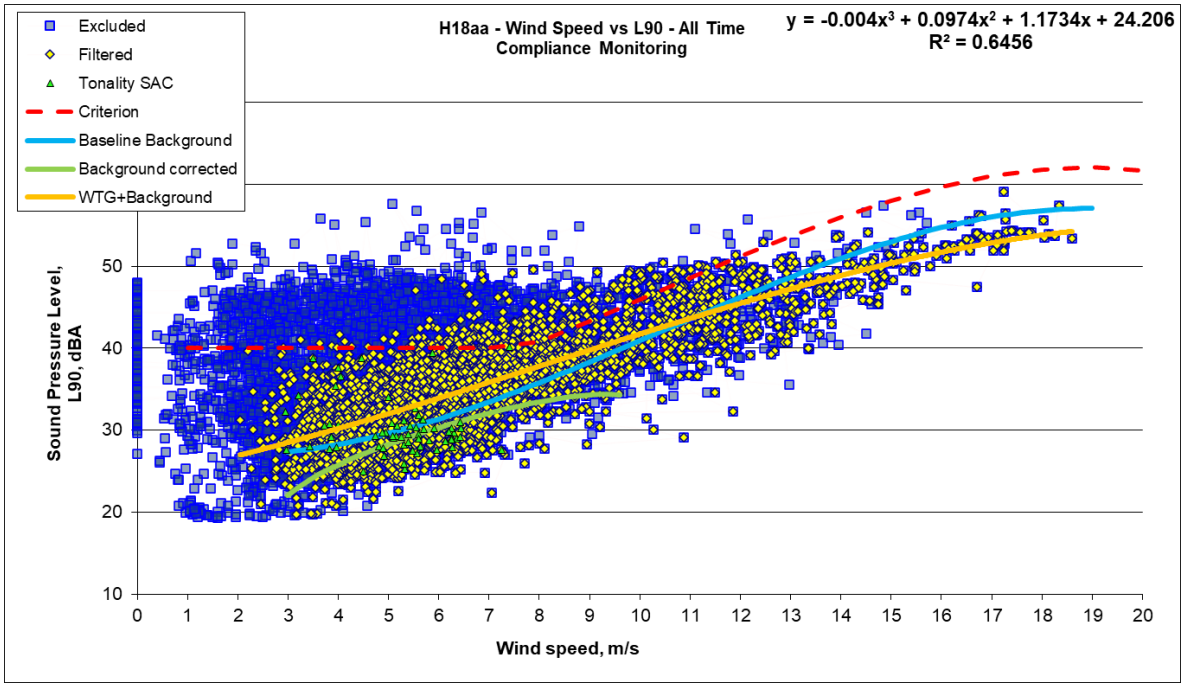


Figure 24 H18aa compliance results – night only

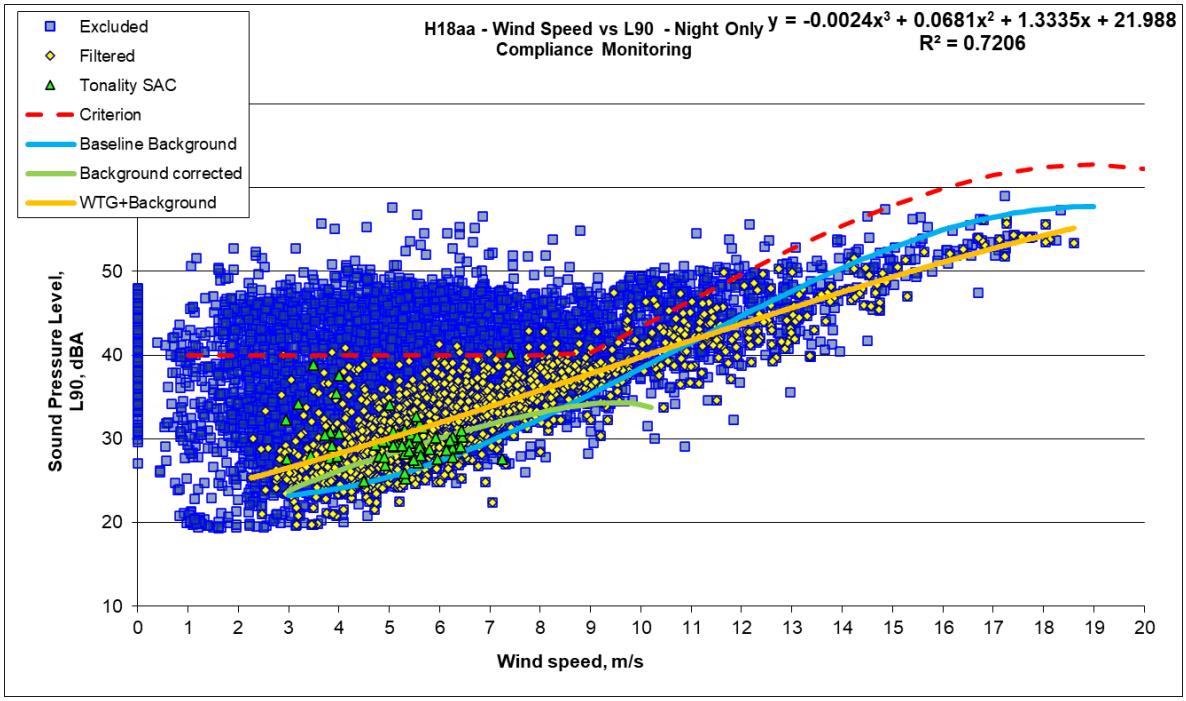


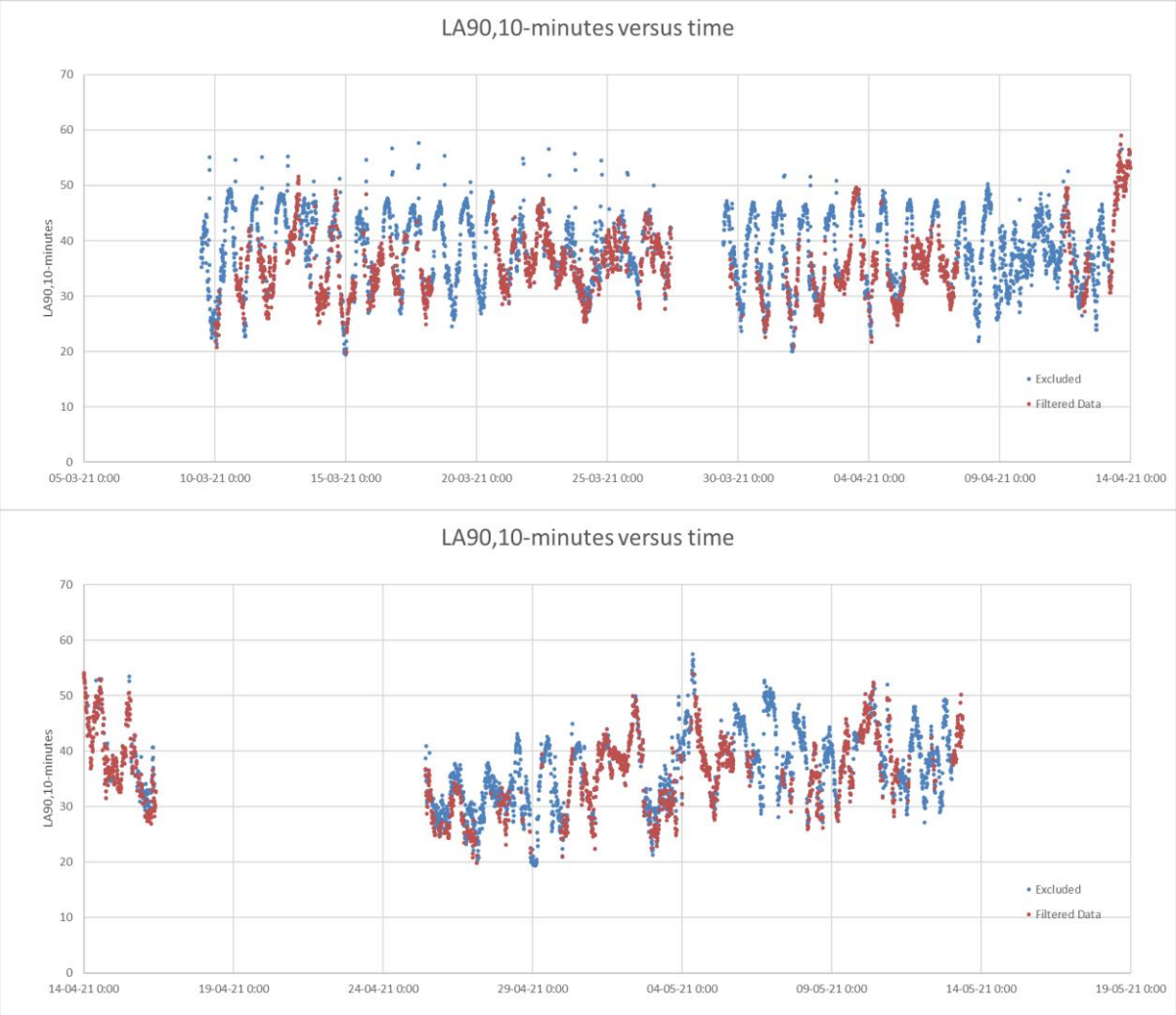
Table 21 H18aa compliance results – all time

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	28.3	29.7	31.5	33.6	35.9	38.4	41.0	43.6	46.2	48.6	50.9	52.9
Consent limit, dBA	40.0	40.0	40.0	40.0	40.9	43.4	46.0	48.6	51.2	53.6	55.9	57.9
Background + WTG, dBA	30.2	32.0	33.9	35.8	37.8	39.8	41.7	43.6	45.5	47.2	48.9	50.4
Corrected WTG noise, dBA	25.7	28.2	30.2	31.9	33.3	34.1	-	-	-	-	-	-
Compliance Margin, dBA	14.3	11.8	9.8	8.1	7.6	9.3	-	-	-	-	-	-

Table 22 H18aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	24.1	25.5	27.4	29.7	32.4	35.3	38.4	41.6	44.7	47.7	50.4	52.9
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	40.3	43.4	46.6	49.7	52.7	55.4	57.9
Background + WTG, dBA	28.3	30.1	31.9	33.9	35.8	37.8	39.8	41.8	43.7	45.6	47.5	49.3
Corrected WTG noise, dBA	26.2	28.2	30.0	31.7	33.2	34.2	34.1	-	-	-	-	-
Compliance Margin, dBA	13.8	11.8	10.0	8.3	6.8	6.1	9.3	-	-	-	-	-

Figure 25 Time history of measured LA90,10-minutes at H18aa



Location L18aa

Location L18aa is located to north-east of the Elaine portion of Lal Lal Wind Farm, approximately 1 km from the nearest WTG. The monitoring location is shown in **Figure 14**.

Figure 26 L18aa measurement location

Looking North

Looking East

Looking South

Looking West

★ Measurement

☆ Receptor

The results of the compliance noise monitoring, showing the original data points, filtered data points with a third order regression and the noise emission from WTG regression are shown in **Figure 15** and **Figure 16. Table 17** and **Table 18** presents the summary tables of results for all time and night only periods respectively. Note that noise limits were extracted from 2018 LLWFBNM Report.

Figure 27 L18aa compliance results - all time

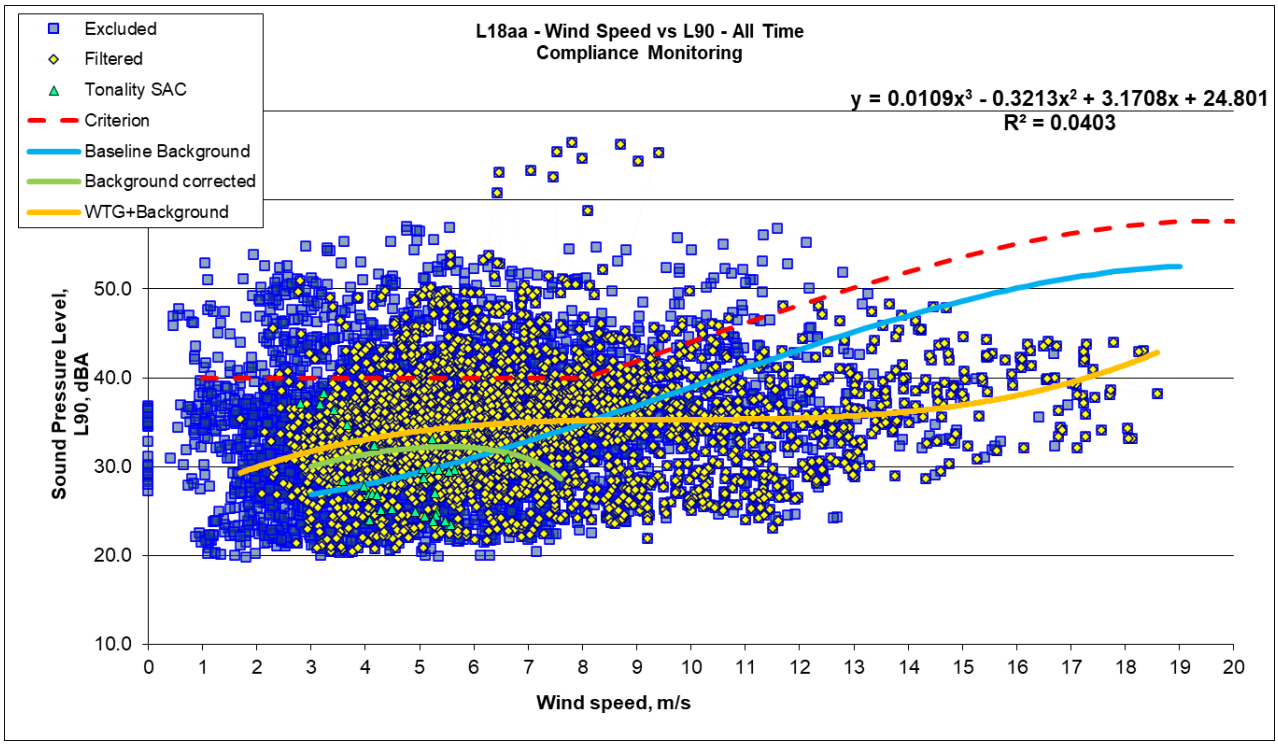


Figure 28 L18aa compliance results – night only

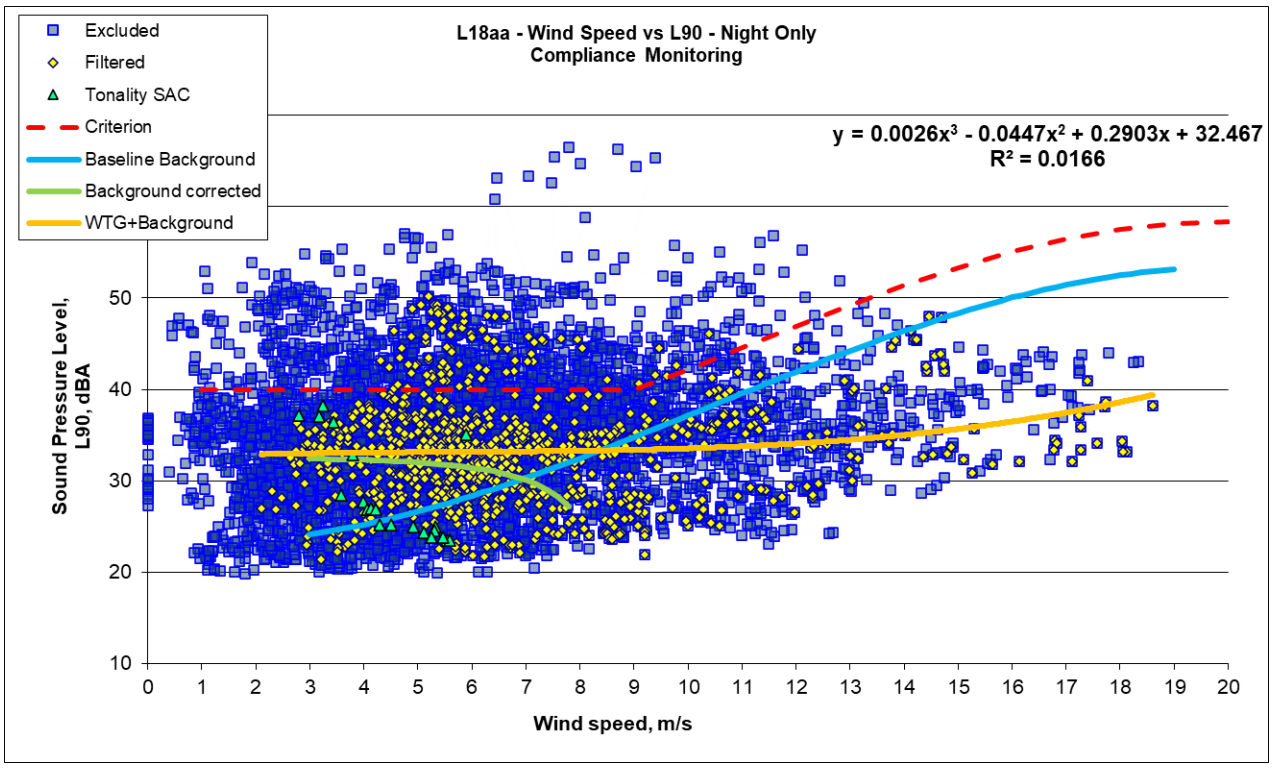


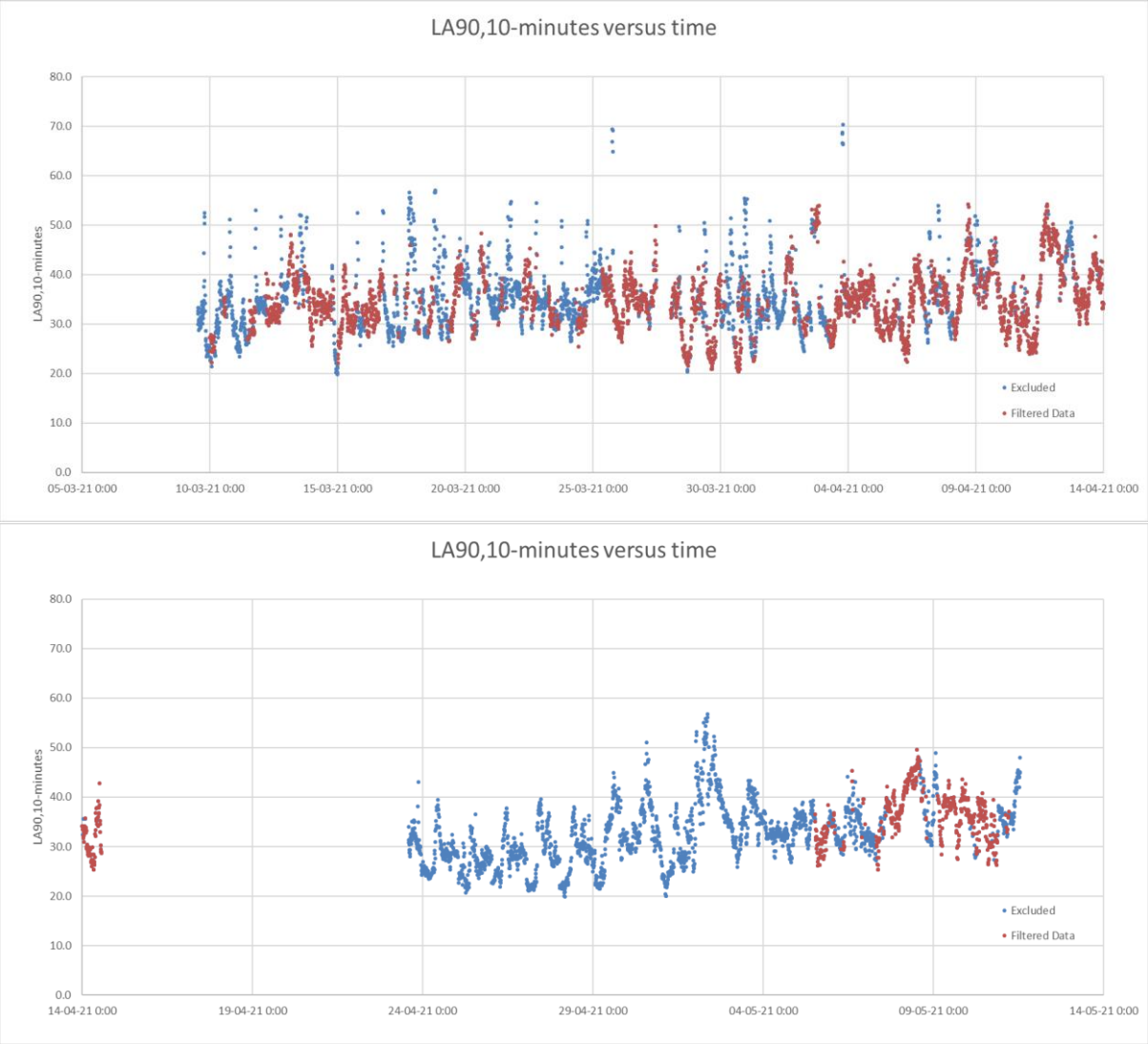
Table 23 L18aa compliance results – all time

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	28.0	29.4	31.1	32.9	34.9	37.0	39.1	41.2	43.2	45.2	47.0	48.6
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	42.0	44.1	46.2	48.2	50.2	52.0	53.6
Background + WTG, dBA	33.0	34.0	34.6	35.0	35.2	35.3	35.3	35.3	35.5	35.7	36.2	36.9
Corrected WTG noise, dBA	31.4	32.1	32.1	30.8	-	-	-	-	-	-	-	-
Compliance Margin, dBA	8.6	7.9	7.9	9.2	-	-	-	-	-	-	-	-

Table 24 L18aa compliance results – night only

Wind speed (m/s)	4	5	6	7	8	9	10	11	12	13	14	15
Background (baseline), dBA	25.2	26.6	28.4	30.3	32.5	34.8	37.2	39.6	41.9	44.2	46.4	48.3
Consent limit, dBA	40.0	40.0	40.0	40.0	40.0	40.0	42.2	44.6	46.9	49.2	51.4	53.3
Background + WTG, dBA	33.1	33.1	33.2	33.2	33.3	33.4	33.5	33.8	34.1	34.5	35.0	35.7
Corrected WTG noise, dBA	32.3	32.0	31.4	30.1	-	-	-	-	-	-	-	-
Compliance Margin, dBA	7.7	8.0	8.6	9.9	-	-	-	-	-	-	-	-

Figure 29 Time history of measured LA90,10-minutes at L18aa

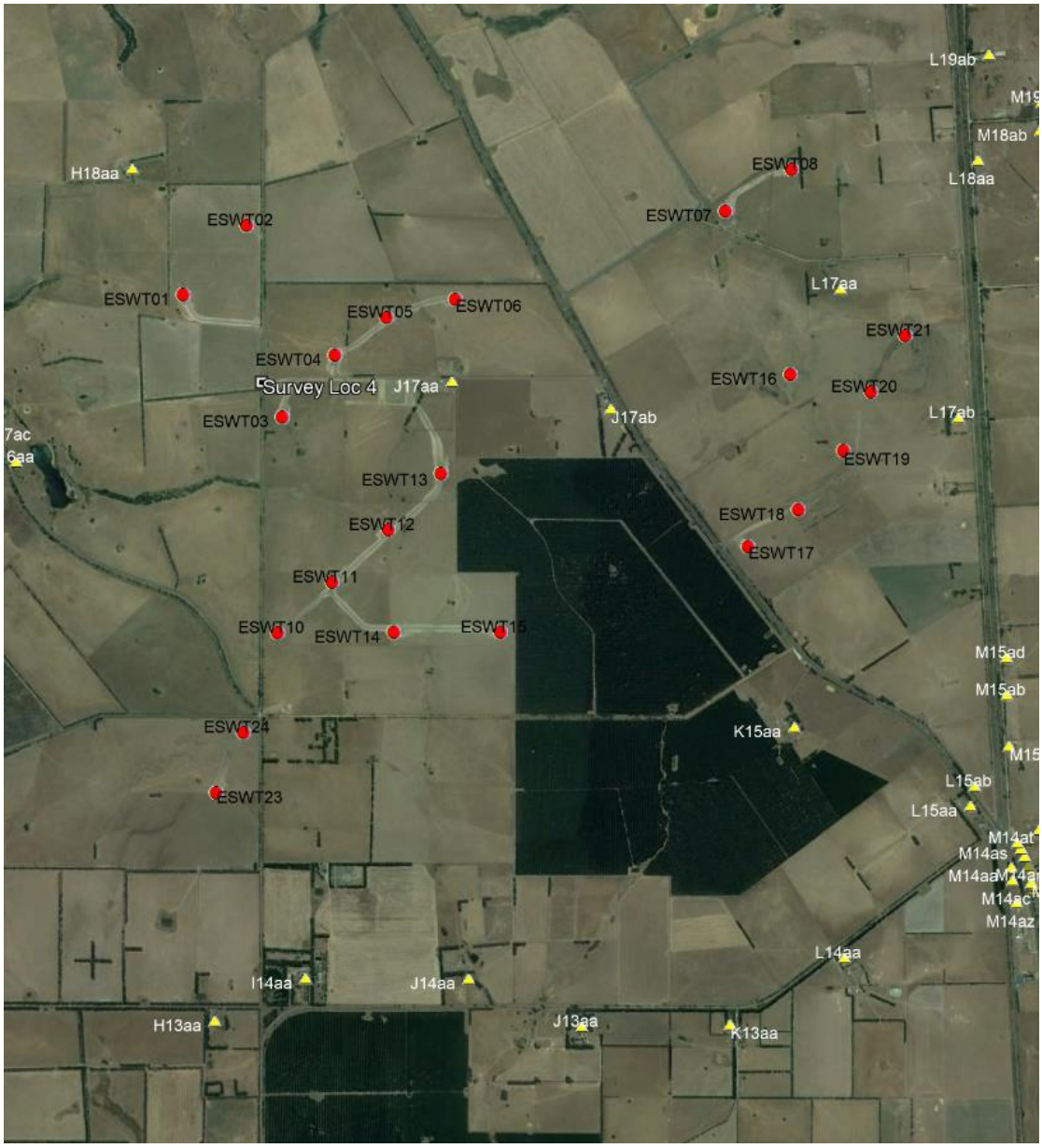


APPENDIX D

Attended subjective listening surveys

Figure 30 receptor & survey locations - Yendon

Figure 31 receptor & survey locations - Elaine



Location, Date/Time, Weather Conditions	Listening test observations
K15aa 9 March 2021 : 10.30am – 11.15am Overcast, occasional light drizzle Local wind W 1-2m/s Temperature 11^{0}C HH wind ~4.9m/s@212°	Passing traffic on Midland Hwy Insects Bird calls Wind Farm occasionally audible between cars Very faint hum ~330Hz Wind farm at cusp of cut-in, some WTGs start/stop
H18aa 9 March 2021 : 11.30am – 12.15pm Cloudy & overcast, occasional light drizzle Wind WSW calm-3m/s Temperature 17^{0}C HH wind ~5.4m/s@210°	Birds Insects Occasional dog barks Nearest WTG is off Other WTG's faintly audible Slight hum ~340Hz….280Hz
L18aa 9 March 2021 : 13. 50pm – 14:15pm Partly cloudy & part sunny Wind WSW 2-4 m/s Temperature 18^{0}C HH wind ~5.2m/s@205°	Insects Crows and other birds Distant train / loco pass-by WTG's barely audible Slight hum ~280 – 400 Hz
M29aa 9 March 2021 : 14:30-14-50pm Partly cloudy & part sunny Wind SW 1-4 m/s Temperature 15^{0}C HH wind ~5.3m/s@220°	Wind in trees Birds and insects Water booster pump cycling on with tonality 207Hz - 420Hz etc. Nearest WTG is off Wind farm inaudible

Location, Date/Time, Weather Conditions	Listening test observations
N31ab 9 March 2021 : 15:10-15:30pm Partly cloudy & part sunny Wind SW 1-3 m/s Temperature 17^{0}C HH wind ~6.2m/s@203°	traffic Insects & distant birds Wind farm just audible Faint hum ~360Hz Some aero swish
K34aa 9 March 2021 : 16:30-17:00pm Partly cloudy & part sunny Wind S 2-5 m/s Temperature 16^{0}C HH wind ~5.5m/s@207°	Insects Birds distant plane Wind farm just audible - aero Occasional slight hum ~410-460Hz
Loc #1 – Yendon Egerton Road @ Yendon WF entrance drive Nearest WTG = YSWT21 @550m 9 March 2021 : 22:20-22:30pm Cloudy 11^{0}C Wind SSE 2-3 m/s HH wind ~3.5m/s@164°	Insects Passing car Wind in trees on opposite side road Wind farm audible – aero swish dominant Some hum occasionally audible ~360 Hz & 1000 Hz
Loc #2 – Yendon Egerton Road @ Yendon WF entrance drive Nearest WTG = YSWT32 @100m 9 March 2021 : 22:35-22:45pm Cloudy 11^{0}C Wind SSE 2-3 m/s HH wind ~3m/s@150°	Wind farm audible – aero swish dominant Some hum occasionally audible ~340 Hz & 970 Hz

Location, Date/Time, Weather Conditions	Listening test observations
Loc #3 – McGuigans Road @ end of drive to N31ab Nearest WTG = YSWT32 @100m 9 March 2021 : 23:00-23:10pm Cloudy 11^{0}C Wind SSE 2-3 m/s HH wind ~3m/s@147^o	Insects Wind farm audible – aero swish dominant Some hum occasionally audible ~350 Hz - 280 Hz Occasional brake release
Loc #4 – Horsehill Road Nearest WTG = ESWT03 @200m 10 March 2021 : 5:30-7:00am overcast and light drizzle 8^{0}C Wind SE calm to 2 m/s HH wind ~5.2m/s@110^o	Insects Birds, crows magpie etc. Wind Farm seems to be below cut-in wind speed All WTG's on Elaine in very slow rotation. Some faint hum just discernible
Loc #5 – Harris Road @ Falls Reserve car park Nearest WTG = YSWT27 @1625m 10 March 2021 : 7:50am-8:00am Part sunny 8^{0}C Wind SE <1 m/s HH wind ~5.2m/s@110^o	Insects Birds Passing car Wind farm inaudible
M29aa 10 March 2021 : 8:05am - 8:15am Part sunny 13^{0}C wind SE <1 m/s HH wind ~5.2m/s@110^o	Passing car Tractor & muck-spreader working nearby Birds 3 nearest WTGs off Wind farm inaudible

Location, Date/Time, Weather Conditions	Listening test observations
Loc #3 – McGuigans Road @ end of drive to N31ab Nearest WTG = YSWT32 @100m 10 March 2021 : 8:30am - 8:40am Temperature 9^{0}CWind SE <3-5 m/s HH wind ~6.2m/s@110^o	Distant traffic Some insects Birds All nearest WTGs are on Some mild aero swishing only, no hum evident
Loc #6 – McGuigans Road, near N33ab and N34ac Nearest WTG = YSWT16 @1660m 10 March 2021 : 8:50am - 9:00am Temperature 9^{0}C Wind SE <3-4 m/s HH wind ~6.2m/s@110^o	Wind in foliage Birds Upwind of all operational WTGs Wind farm inaudible
Loc #7 – Old Racecourse Road, near K34aa 10 March 2021 : 9:25am - 9:35am Part sunny 10^{0}C Wind SE <1-2 m/s HH wind ~5.9m/s@110^o	Birds Some insects Wind in foliage Wind farm audible – mainly aero swish No discernible hum

Location, Date/Time, Weather Conditions	Listening test observations
Loc #8 – Duggans Lane, near Yenda electrical substation Transformers ~70m to west Nearest WTG = YSWT30 @200m 10 March 2021 : 9:45am - 9:55am Part sunny 10^{0}C Wind SE <1-2 m/s HH wind ~6.2m/s	Wind in trees & grass Substation only just audible over background noise Mild hum, no significant tones
M29 aa 10 March 2021 : 10:00am -10:10am Part sunny 11^{0}C Wind SSE 3-4 m/s HH wind ~6m/s	Wind in trees & grass Wind farm mostly inaudible Occasionally just audible aero swish only
Loc #5 – Harris Road @ Falls Reserve car park Nearest WTG = YSWT27 @1625m 10 March 2021 : 10:45am -10:55am Part sunny 11^{0}C Wind SSE 3-4 m/s HH wind ~4.9m/s	Wind in foliage insects Birds Wind farm just audible Distant aeroplane character, no hum evident
L18aa – Settlement Road 10 March 2021 : 11:10am -11:20am Part sunny 16^{0}C Wind SE 3-5 m/s HH wind ~5.1m/s	Wind in foliage birds Nearest 3 WTGs operating Wind farm faintly audible in lulls - aero swish Occasionally very faint hum

Location, Date/Time, Weather Conditions	Listening test observations
K15aa – Midland Hwy 10 March 2021 : 11:30am -11:40am Part sunny 17^{0}C Wind SE 3-5 m/s HH wind ~5.2m/s	Wind in trees & grass Midland Hwy traffic Nearest 3 WTGs operating Wind farm inaudible
H18aa – Midland Hwy 10 March 2021 : 12:00am -12:10am Part sunny 17^{0}C Wind SE 3-5 m/s HH wind ~4.8m/s	Wind in trees & grass Insects Birds Distant plane in sky Nearest WTG operating, 2nd nearest stopped Wind farm inaudible
K15aa Wednesday, 31 March 2021 11:00am – 11:10am 1/8 cloud 10^{0}C No wind HH wind ~2.9m/s@153^o	Noise was dominated by traffic on Midland Hwy, birds and insect. Noise from wind turbine was inaudible.
H18aa Wednesday, 31 March 2021 11:20am – 11:30am 1/8 cloud 10^{0}C Northernly wind 1-2m/s HH wind ~3.6m/s@200^o	Wind in trees & grass Insects Wind farm just audible, could just hear a slight hum. No other noise characteristics.
L18aa Wednesday, 31 March 2021 12:15am – 12:25am 1/8 cloud 11^{0}C Northernly wind 1-2m/s HH wind ~3m/s@185^o	Birds Wind farm just audible, a faint hum as in the previous measurement could be heard. Ambient noise is low ~ 32-33 LAeq. The hum sounds like distant traffic.

Location, Date/Time, Weather Conditions	Listening test observations
K34aa Wednesday, 31 March 2021 12:50am – 1:00pm 1/8 cloud Northernly wind 0-1m/s HH wind ~2m/s@195°	Just audible hum, which sounded like distant machinery noise. Other noise like insects, birds, cows.
N31ab Wednesday, 31 March 2021 3:35pm – 3:45pm 1/8 cloud Northernly wind 1-2m/s HH wind ~3.1m/s@180°	Background noise dominated by insect, bird with LAeq 46-47. Distant traffic and plane passby. Wind farm just audible with slight hum Popping noise due to yaw brake could be heard when the ambient noise quiet down.
A wind turbine near N31ab Wednesday, 31 March 2021 5:10pm – 5:20pm 2/8 cloud No wind HH wind ~3.1m/s@180°	The wind turbine turned quite slow ~15 sec/round but hum was audible, same as heard in other locations
A wind turbine near N31ab Wednesday, 31 March 2021 5:20pm – 5:31pm 2/8 cloud Northernly wind 2-3m/s HH wind ~3.1m/s@180°	Ambient noise was dominated by insect, bird The noise from wind turbine was only faintly audible if focussed. Wind turbine rotated by 10s/round. AC was off during the measurement.
K15aa Friday 11 June 2021 10:50am – 11:00am Overcast Wind southernly 1-2m/s HH wind ~12.1m/s@216°	Noise was dominated by passing traffic on Midland Hwy, insects and bird. No audible wind farm noise, wind turbines turned at ~0.1 Hz.

Location, Date/Time, Weather Conditions	Listening test observations
K34aa Friday 11 June 2021 12:20am – 12:30am Cloudy, Wind southernly 4-5m/s HH wind ~12.7m/s@205°	Noise was dominated by birds, insects and wind noise from nearby tree foliage. Nearest 3 WTG was off. Other WTG's inaudible.
N31ab Friday 11 June 2021 1:40pm - 1:50pm Cloudy, Wind southernly 2-3m/s HH wind ~13.5m/s@210°	Downwind from wind turbines. Dominated by traffic and birds. Wind turbine was not audible.
M29aa Friday 11 June 2021 2:25pm – 2:30pm Cloudy, Wind southernly 1-2m/s HH wind ~10.3m/s@200°	Noise was dominated by birds, winds, insects and traffic. The dominated noise power was coming from the south (opposite side to the wind turbines) Turbine is inaudible. A slight hum could be heard but couldn't determine the source.
L18aa Friday 11 June 2021 3:50pm – 4:00pm Cloudy, 20 Wind west-southernly 1-2m/s HH wind ~7.4m/s@225°	Birds, dogs and insect. Wind farm only audible when the wind quieted down, a slight hum could be heard. The hum didn't sound very tonal
H18aa Friday 11 June 2021 4:45pm – 4:55pm Cloudy, 20 Wind east-southernly 0-1m/s HH wind ~7.9/s@218°	Noise was dominated by Midland Highway traffic, birds and insect. Noise from the turbines was not audible

APPENDIX E

Wake free wind speed derivation

Aurecon Australasia Pty Ltd
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Memorandum

To	**Felix Rohde** **Lal Lal Wind Farms Nom Co Pty Ltd**	From	**Simon Faulkner**
Copy		Reference	**503228**
Date	**2021-09-10**	Pages (including this page)	**2**
Subject	**Wind data for noise monitoring at Lal Lal Wind Farm**		

Aurecon was requested to provide wind data to be used in the noise modelling for Lal Lal Wind Farm. The wind data needs to include the freestream (wake-free) wind speed and generally to be representative of the closest turbine locations to each noise receptor. However, in this case the wind data needs to be equivalent to the data measured at the pre-construction masts, for consistency with the processing of the background noise data that was collected prior to the construction of the wind farm.

The pre-construction masts have been removed and new masts have been installed in different locations for the purpose of power curve testing and wind farm operations. These masts are free of turbine wake for some wind directions, but not all, and therefore the data set needs to be adjusted to remove the wake effect. The site is fairly flat and wind resource does not vary significantly between these mast and turbine locations, so data from the new power curve test masts can be used without adjustment related to flow modelling (terrain).

The process to remove the effect of wake, ie adjust the mast data to free-stream equivalent, was:

- Check the provided data and remove incorrect or invalid data, apply any other adjustments as required (eg some Elaine direction data needed to be adjusted by 180°)
- Select turbines near to each mast and obtain nacelle wind speed data (this data is adjusted in the SCADA to approximate free-stream equivalent as confirmed by comparison to the mast data)
- Remove wake-affected data from the mast and turbine data (on a directional basis ie remove data when the wind direction is such that the data is affected by wake from a nearby turbine)
- Average the unaffected mast and turbine wind speed data to provide un-waked data for all wind directions (this process gives higher wind speeds and also increased data coverage).

Figure 1 and Figure 2 show the met. masts, turbines used (yellow highlight ESWT01, 02, YSWT32, 36, 38, 39, 40), and the approximate pre-construction mast locations (green circles).

The requested data covers two periods: 30/10/2020 – 01/12/2020 inclusive and 09/03/2021 to 15/05/2021 inclusive. The wind data produced included mast wind speed, mast direction, and adjusted free-stream wind speed, and also turbine wind speeds and directions for reference.

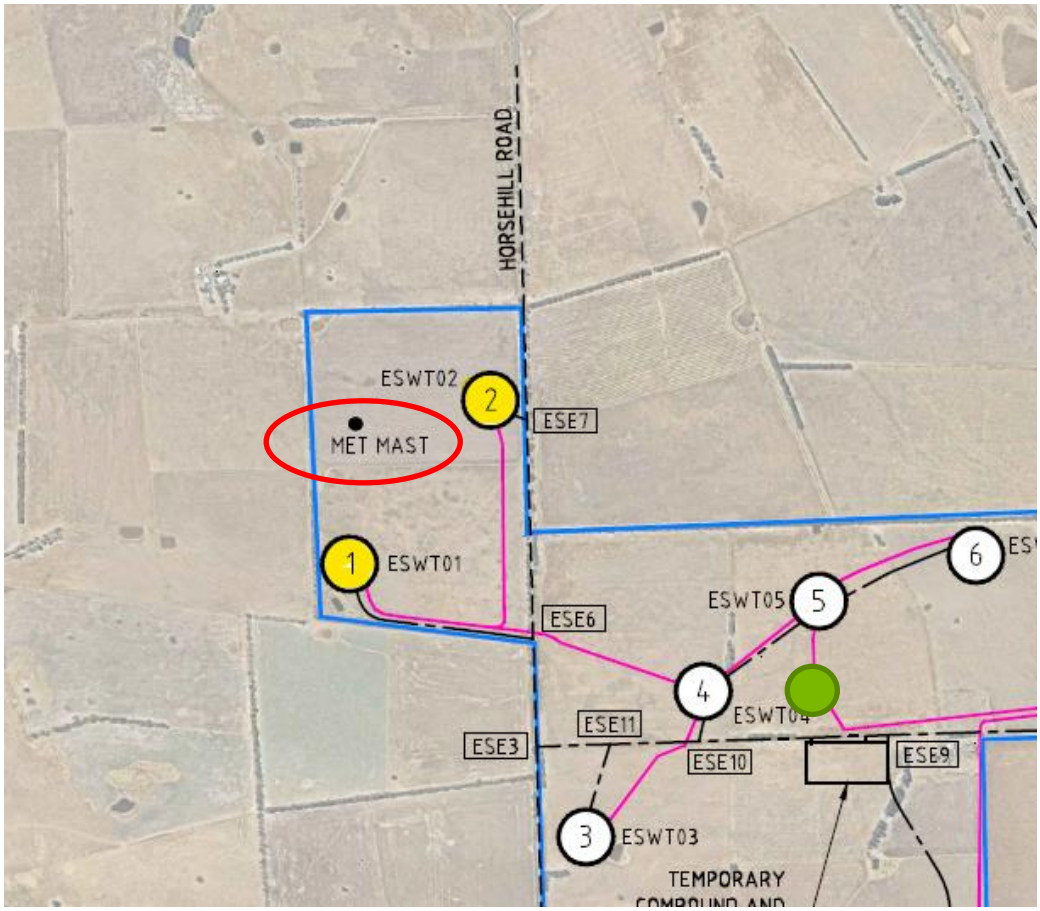


Figure 1 Elaine mast and turbines (approx. pre-construction mast location shown in green)

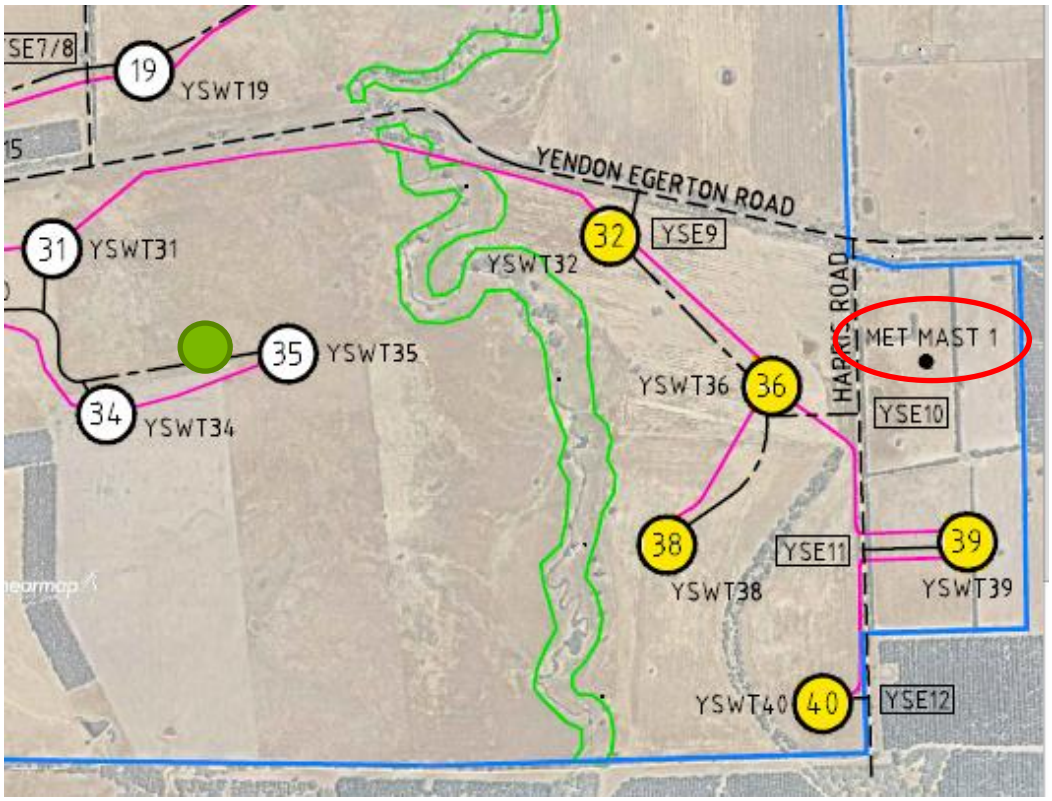


Figure 2 Yendon mast and turbines (approx. pre-construction mast location shown in green)

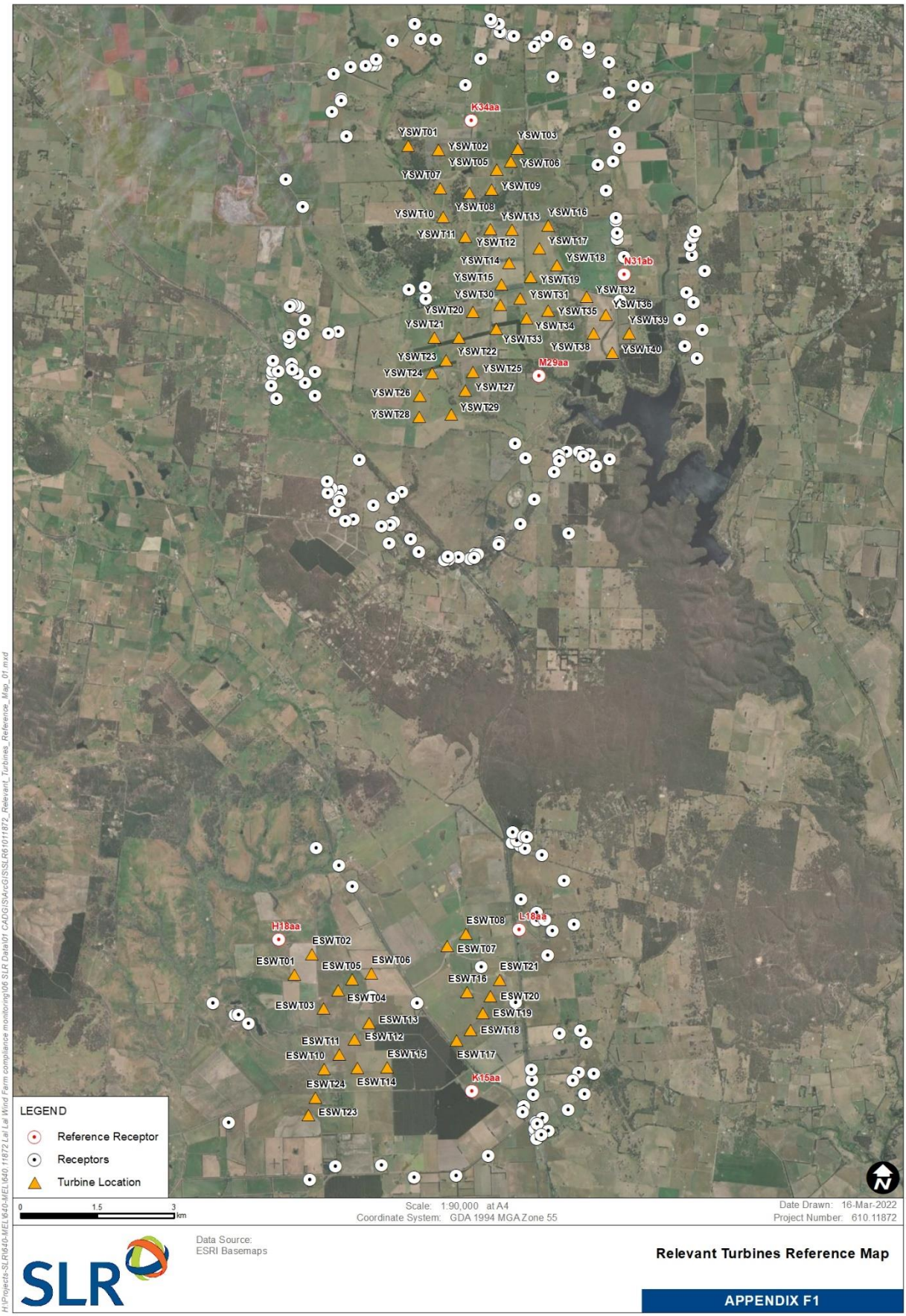
APPENDIX F

Relevant Turbines Table

	Elaine receptors												Yendon receptors											
Turbine	NCTP 0.1dB method						0.5 dB method						NCTP 0.1dB method						0.5 dB method					
	H18aa		K15aa		L18aa		H18aa		K15aa		L18aa		M29aa		N31ab		K34aa		M29aa		N31ab		K34aa	
ESWT01	YES	0.8	YES	4.2	YES	4.5	YES	0.8	NO	4.2	NO	4.5	NO	12.7	NO	15.2	NO	17.1	NO	12.7	NO	15.2	NO	17.1
ESWT02	YES	0.7	NO	4.1	YES	4.1	YES	0.7	NO	4.1	NO	4.1	NO	12.2	NO	14.7	NO	16.7	NO	12.2	NO	14.7	NO	16.7
ESWT03	YES	1.6	YES	3.3	YES	4.1	NO	1.6	NO	3.3	NO	4.1	NO	13.1	NO	15.6	NO	17.7	NO	13.1	NO	15.6	NO	17.7
ESWT04	YES	1.5	YES	3.3	YES	3.7	YES	1.5	NO	3.3	NO	3.7	NO	12.7	NO	15.1	NO	17.3	NO	12.7	NO	15.1	NO	17.3
ESWT05	YES	1.6	YES	3.2	YES	3.4	NO	1.6	NO	3.2	NO	3.4	NO	12.4	NO	14.8	NO	17.0	NO	12.4	NO	14.8	NO	17.0
ESWT06	YES	1.9	YES	3.0	YES	3.0	NO	1.9	NO	3.0	NO	3.0	YES	12.2	NO	14.6	NO	16.8	NO	12.2	NO	14.6	NO	16.8
ESWT07	YES	3.3	YES	2.9	YES	1.4	NO	3.3	NO	2.9	YES	1.4	YES	11.3	NO	13.6	NO	16.2	NO	11.3	NO	13.6	NO	16.2
ESWT08	YES	3.7	YES	3.1	YES	1.0	NO	3.7	NO	3.1	YES	1.0	YES	11.0	NO	13.3	NO	16.0	NO	11.0	NO	13.3	NO	16.0
ESWT10	YES	2.7	YES	2.9	YES	4.7	NO	2.7	NO	2.9	NO	4.7	NO	14.2	NO	16.7	NO	18.8	NO	14.2	NO	16.7	NO	18.8
ESWT11	YES	2.5	YES	2.7	YES	4.3	NO	2.5	NO	2.7	NO	4.3	NO	13.9	NO	16.3	NO	18.5	NO	13.9	NO	16.3	NO	18.5
ESWT12	YES	2.5	YES	2.5	YES	3.9	NO	2.5	YES	2.5	NO	3.9	NO	13.5	NO	15.9	NO	18.2	NO	13.5	NO	15.9	NO	18.2
ESWT13	YES	2.4	YES	2.4	YES	3.5	NO	2.4	YES	2.4	NO	3.5	NO	13.1	NO	15.5	NO	17.8	NO	13.1	NO	15.5	NO	17.8
ESWT14	YES	3.0	YES	2.3	YES	4.2	NO	3.0	YES	2.3	NO	4.2	NO	14.0	NO	16.4	NO	18.7	NO	14.0	NO	16.4	NO	18.7
ESWT15	YES	3.3	YES	1.7	YES	3.7	NO	3.3	YES	1.7	NO	3.7	NO	13.9	NO	16.2	NO	18.6	NO	13.9	NO	16.2	NO	18.6
ESWT16	YES	3.8	YES	1.9	YES	1.6	NO	3.8	YES	1.9	YES	1.6	YES	12.2	NO	14.4	NO	17.1	NO	12.2	NO	14.4	NO	17.1
ESWT17	YES	4.0	YES	1.0	YES	2.5	NO	4.0	YES	1.0	NO	2.5	NO	13.1	NO	15.4	NO	18.1	NO	13.1	NO	15.4	NO	18.1
ESWT18	YES	4.2	YES	1.2	YES	2.2	NO	4.2	YES	1.2	NO	2.2	NO	12.9	NO	15.1	NO	17.8	NO	12.9	NO	15.1	NO	17.8
ESWT19	YES	4.3	YES	1.6	YES	1.8	NO	4.3	YES	1.6	NO	1.8	NO	12.5	NO	14.7	NO	17.5	NO	12.5	NO	14.7	NO	17.5
ESWT20	YES	4.3	YES	1.9	YES	1.4	NO	4.3	YES	1.9	YES	1.4	NO	12.2	NO	14.4	NO	17.2	NO	12.2	NO	14.4	NO	17.2
ESWT21	NO	4.4	YES	2.3	YES	1.1	NO	4.4	YES	2.3	YES	1.1	YES	11.9	NO	14.0	NO	16.9	NO	11.9	NO	14.0	NO	16.9
ESWT23	YES	3.5	YES	3.2	YES	5.5	NO	3.5	NO	3.2	NO	5.5	NO	15.2	NO	17.6	NO	19.8	NO	15.2	NO	17.6	NO	19.8
ESWT24	YES	3.2	YES	3.1	YES	5.2	NO	3.2	NO	3.1	NO	5.2	NO	14.8	NO	17.2	NO	19.4	NO	14.8	NO	17.2	NO	19.4
YSWT01	NO	15.8	NO	18.6	NO	15.5	NO	15.8	NO	18.6	NO	15.5	YES	5.2	YES	4.9	YES	1.3	NO	5.2	NO	4.9	YES	1.3
YSWT02	NO	15.8	NO	18.5	NO	15.4	NO	15.8	NO	18.5	NO	15.4	YES	4.9	NO	4.4	YES	0.9	NO	4.9	NO	4.4	YES	0.9
YSWT03	NO	16.2	NO	18.5	NO	15.3	NO	16.2	NO	18.5	NO	15.3	YES	4.5	YES	3.2	YES	1.1	NO	4.5	NO	3.2	YES	1.1
YSWT05	NO	15.7	NO	18.1	NO	14.9	NO	15.7	NO	18.1	NO	14.9	YES	4.1	YES	3.2	YES	1.1	NO	4.1	NO	3.2	YES	1.1
YSWT06	NO	15.9	NO	18.3	NO	15.1	NO	15.9	NO	18.3	NO	15.1	YES	4.2	YES	3.1	YES	1.1	NO	4.2	NO	3.1	YES	1.1
YSWT07	NO	15.1	NO	17.7	NO	14.6	NO	15.1	NO	17.7	NO	14.6	YES	4.2	YES	4.0	YES	1.5	NO	4.2	NO	4.0	YES	1.5
YSWT08	NO	15.1	NO	17.6	NO	14.5	NO	15.1	NO	17.6	NO	14.5	YES	3.8	YES	3.4	YES	1.4	NO	3.8	NO	3.4	YES	1.4
YSWT09	NO	15.3	NO	17.7	NO	14.5	NO	15.3	NO	17.7	NO	14.5	YES	3.8	YES	3.1	YES	1.4	NO	3.8	NO	3.1	YES	1.4
YSWT10	NO	14.5	NO	17.2	NO	14.1	NO	14.5	NO	17.2	NO	14.1	YES	3.6	YES	3.7	YES	2.0	NO	3.6	NO	3.7	NO	2.0
YSWT11	NO	14.3	NO	16.8	NO	13.6	NO	14.3	NO	16.8	NO	13.6	YES	3.1	YES	3.2	YES	2.3	NO	3.1	NO	3.2	NO	2.3
YSWT12	NO	14.5	NO	16.9	NO	13.8	NO	14.5	NO	16.9	NO	13.8	YES	3.0	YES	2.8	YES	2.2	NO	3.0	NO	2.8	NO	2.2
YSWT13	NO	14.7	NO	16.9	NO	13.7	NO	14.7	NO	16.9	NO	13.7	YES	2.9	YES	2.4	YES	2.3	NO	2.9	NO	2.4	NO	2.3
YSWT14	NO	14.0	NO	16.3	NO	13.1	NO	14.0	NO	16.3	NO	13.1	YES	2.3	YES	2.3	YES	2.9	NO	2.3	NO	2.3	NO	2.9
YSWT15	NO	13.6	NO	15.8	NO	12.7	NO	13.6	NO	15.8	NO	12.7	YES	1.9	YES	2.4	YES	3.3	YES	1.9	NO	2.4	NO	3.3
YSWT16	NO	15.0	NO	17.0	NO	13.8	NO	15.0	NO	17.0	NO	13.8	YES	3.0	YES	1.8	YES	2.6	NO	3.0	YES	1.8	NO	2.6
YSWT17	NO	14.5	NO	16.6	NO	13.4	NO	14.5	NO	16.6	NO	13.4	YES	2.5	YES	1.7	YES	2.8	NO	2.5	YES	1.7	NO	2.8
YSWT18	NO	14.3	NO	16.3	NO	13.1	NO	14.3	NO	16.3	NO	13.1	YES	2.2	YES	1.3	YES	3.3	NO	2.2	YES	1.3	NO	3.3
YSWT19	NO	13.9	NO	16.0	NO	12.8	NO	13.9	NO	16.0	NO	12.8	YES	1.9	YES	1.8	YES	3.3	YES	1.9	YES	1.8	NO	3.3
YSWT20	NO	12.9	NO	15.3	NO	12.2	NO	12.9	NO	15.3	NO	12.2	YES	1.8	YES	3.1	YES	3.8	YES	1.8	NO	3.1	NO	3.8
YSWT21	NO	12.2	NO	14.8	NO	11.7	NO	12.2	NO	14.8	NO	11.7	YES	2.2	YES	3.9	YES	4.3	NO	2.2	NO	3.9	NO	4.3
YSWT22	NO	12.3	NO	14.8	NO	11.7	NO	12.3	NO	14.8	NO	11.7	YES	1.7	YES	3.5	YES	4.3	YES	1.7	NO	3.5	NO	4.3
YSWT23	NO	11.8	NO	14.3	NO	11.3	NO	11.8	NO	14.3	NO	11.3	YES	1.8	YES	3.9	YES	4.7	YES	1.8	NO	3.9	NO	4.7
YSWT24	NO	11.5	NO	14.1	NO	11.0	NO	11.5	NO	14.1	NO	11.0	YES	2.1	YES	4.2	YES	5.0	YES	2.1	NO	4.2	NO	5.0
YSWT25	NO	11.8	NO	14.1	NO	11.0	NO	11.8	NO	14.1	NO	11.0	YES	1.3	YES	3.5	YES	4.9	YES	1.3	NO	3.5	NO	4.9
YSWT26	NO	11.0	NO	13.7	NO	10.7	NO	11.0	NO	13.7	NO	10.7	YES	2.4	YES	4.7	YES	5.5	NO	2.4	NO	4.7	NO	5.5
YSWT27	NO	11.4	NO	13.7	NO	10.6	NO	11.4	NO	13.7	NO	10.6	YES	1.5	YES	3.9	YES	5.3	YES	1.5	NO	3.9	NO	5.3
YSWT28	NO	10.6	NO	13.3	NO	10.2	NO	10.6	NO	13.3	NO	10.2	YES	2.5	YES	4.9	NO	5.9	NO	2.5	NO	4.9	NO	5.9
YSWT29	NO	10.8	NO	13.3	NO	10.2	NO	10.8	NO	13.3	NO	10.2	YES	1.9	YES	4.4	YES	5.8	NO	1.9	NO	4.4	NO	5.8
YSWT30	NO	13.2	NO	15.4	NO	12.3	NO	13.2	NO	15.4	NO	12.3	YES	1.6	YES	2.5	YES	3.7	YES	1.6	NO	2.5	NO	3.7
YSWT31	NO	13.4	NO	15.6	NO	12.4	NO	13.4	NO	15.6	NO	12.4	YES	1.6	YES	2.1	YES	3.6	YES	1.6	YES	2.1	NO	3.6
YSWT32	NO	14.0	NO	15.7	NO	12.5	NO	14.0	NO	15.7	NO	12.5	YES	1.8	YES	0.9	YES	4.1	NO	1.8	YES	0.9	NO	4.1
YSWT33	NO	12.7	NO	15.0	NO	11.8	NO	12.7	NO	15.0	NO	11.8	YES	1.2	YES	2.7	YES	4.1	YES	1.2	NO	2.7	NO	4.1
YSWT34	NO	13.1	NO	15.2	NO	12.0	NO	13.1	NO	15.2	NO	12.0	YES	1.2	YES	2.1	YES	4.0	YES	1.2	NO	2.1	NO	4.0
YSWT35	NO	13.4	NO	15.4	NO	12.1	NO	13.4	NO	15.4	NO	12.1	YES	1.3	YES	1.6	YES	4.0	YES	1.3	YES	1.6	NO	4.0
YSWT36	NO	13.8	NO	15.5	NO	12.2	NO	13.8	NO	15.5	NO	12.2	YES	1.8	YES	0.9	YES	4.6	YES	1.8	YES	0.9	NO	4.6
YSWT38	NO	13.4	NO	15.0	NO	11.8	NO	13.4	NO	15.0	NO	11.8	YES	1.4	YES	1.3	YES	4.8	YES	1.4	YES	1.3	NO	4.8
YSWT39	NO	13.7	NO	15.2	NO	11.9	NO	13.7	NO	15.2	NO	11.9	YES	2.0	YES	1.2	NO	5.2	YES	2.0	YES	1.2	NO	5.2
YSWT40	NO	13.2	NO	14.7	NO	11.5	NO	13.2	NO	14.7	NO	11.5	YES	1.5	YES	1.6	YES	5.3	YES	1.5	YES	1.6	NO	5.3

Notes: table shows distance to WTG in km

YES = WTG is a relevant WTG for that receptor


K34aa
YSWT01
YSWT02
YSWT03
YSWT05
YSWT06
YSWT07
YSWT09
YSWT08
YSWT10
YSWT13
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YSWT17
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YSWT22
M29aa
YSWT24
YSWT25
YSWT27
YSWT26
YSWT29
YSWT28
H18aa
L18aa
ESWT08
ESWT02
ESWT07
ESWT01
ESWT05
ESWT06
ESWT21
ESWT16
ESWT04
ESWT20
ESWT03
ESWT19
ESWT13
ESWT18
ESWT11
ESWT12
ESWT10
ESWT15
ESWT17
K15aa
ESWT24
ESWT14
ESWT23
LEGEND
Reference Receptor
Receptors
Turbine Location
0
1.5
3
km
Scale: 1:90,000 at A4
Coordinate System: GDA 1994 MGA Zone 55
Date Drawn: 16-Mar-2022
Project Number: 610.11872
Data Source:
ESRI Basemaps
Relevant Turbines Reference Map
APPENDIX F1
H:\Projects-SLR\640-MEL\640.11872 Lal Lal Wind Farm compliance monitoring\06 SLR Data\01 CAD\GIS\ArcGIS\SLR\611872_Relevant_Turbines_Reference_Map_01.mxd

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