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Acoustics 

HEXHAM WIND FARM
BACKGROUND NOISE MONITORING
Rp 003 R01 20190086 | 8 October 2025

Project: **HEXHAM WIND FARM**

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1.0 INTRODUCTION

This report presents the background noise monitoring assessment and results for Hexham Wind Farm (the wind farm) which is proposed to be developed by Hexham Wind Farm Pty Ltd (the proponent).

The background noise monitoring was commissioned by the proponent to characterise the ambient noise environment at receivers in the vicinity of the wind farm, as specified in the scoping requirements¹.

This report documents the survey method and the results of the background noise monitoring which would be used to derive noise limits to assess the wind farm's operational compliance. The results of the measurements would also be referenced during the compliance monitoring phase of the wind farm as an indication of potential background noise levels contributing to the compliance measurements.

Throughout this report, the term receiver is used to identify any dwelling existing on land in the vicinity of the wind farm.

Acoustic terminology used throughout this report is presented Appendix A.

The coordinates of the 109 wind turbine layout associated with the wind farm are detailed in Appendix B.

¹ *Scoping Requirements for Hexham Wind Farm Environment Effects Statement* published by Minister for Transport and Planning in September 2024

2.0 BACKGROUND NOISE SURVEY & ANALYSIS METHOD

The background noise survey and analysis has been conducted in accordance with the following:

- New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by Victorian Government's *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Guidelines).
- supplementary guidance contained in 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 (UK Institute of Acoustics guidance).

EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024 (Technical Guideline) has also been considered where relevant.

This section of the report presents:

- an overview of the survey method
- details of the selected noise monitoring locations
- a summary of the data analysis procedures.

2.1 Monitoring locations

NZS 6808 provides detailed procedural guidance for conducting background noise monitoring, including identification of the locations where monitoring is warranted, based on the predicted noise levels associated with the wind farm, detailed in the environmental noise & vibration assessment². The noise modelling results demonstrate that predicted noise levels are between 35 and 40 dB L_{A90} for 3 non-stakeholder receivers (D299, D620 and D622). In accordance with NZS 6808, background noise monitoring is therefore recommended to be undertaken at selected receivers.

It is noted that consent to undertake background noise monitoring was not granted at 2 of the 3 non-stakeholder receivers where wind turbine noise levels were predicted higher than 35 dB L_{A90}.

Considering the location of the 2 receivers where consent to monitor was not granted, suitable alternative receivers were not available.

For community engagement purposes, the proponent also requested that additional, voluntary, noise monitoring be undertaken at 7 other non-stakeholder receivers at which predicted noise levels are below 35 dB L_{A90}. However, consent to undertake background noise monitoring was not granted at one of these additional receivers.

Based on the above, background noise monitoring was carried out from 5 June to 20 July 2023 at 7 receivers, listed in Table 1 and illustrated in Figure 1.

At each of the receivers where noise monitoring was undertaken, the choice of location relative to the dwelling was made based on the range of considerations specified in NZS 6808. The following specific considerations were factored:

- The noise monitor is located on the proposed wind farm side of the dwelling, where applicable.
- The noise monitor is located at least 3.5 m away from the dwelling and any significant vertical reflecting structures.
- The noise monitor is located as far as practical from taller vegetation at each dwelling and any obvious sources of extraneous noise.

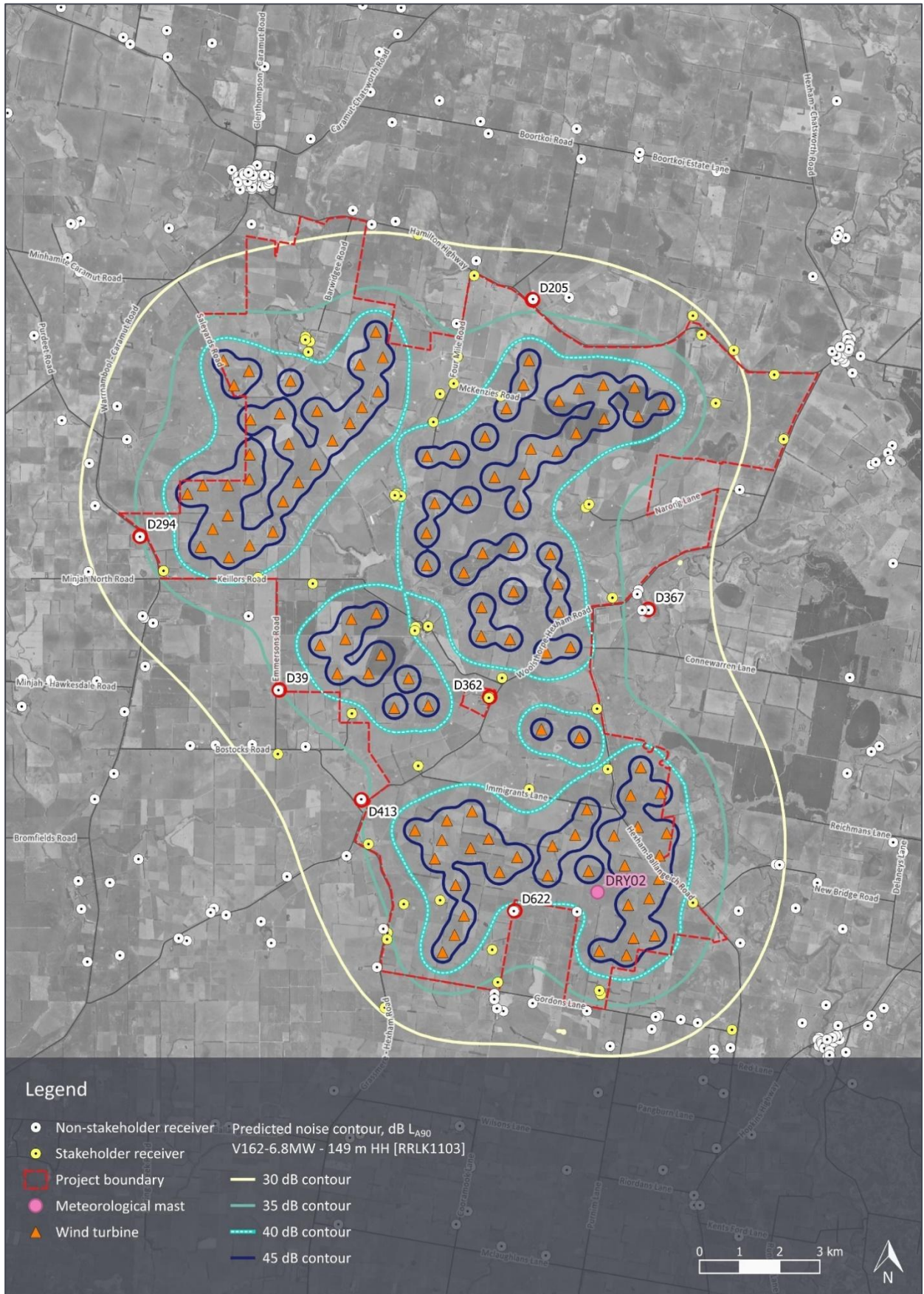
² MDA Report Rp 002 20190086 *Hexham Wind Farm – Environmental noise & vibration assessment*, dated 8 October 2025

Table 1: Background noise monitoring locations

Receiver	Nearest wind turbine	Approximate distance from nearest wind turbine, m	Direction to nearest wind turbine
D39	T25	1,525	Northeast
D205	T72	1,535	South
D294	T2	1,532	East
D362	T43	1,530	West
D367	T83	2,160	Southwest
D413	T39	1,550	Southeast
D622	T63	1,031	Northwest

Coordinates and photographs for the noise monitoring locations are provided in Appendix F through Appendix L.

Figure 1: Monitoring locations relative to the wind farm



2.2 Survey description

The background noise survey comprised unattended monitoring over a number of weeks to measure sound levels for a range of environmental conditions. Site wind speeds and local weather conditions were simultaneously recorded throughout the survey, along with periodic audio samples, to enable the relationship between background noise levels and site wind speeds to be assessed.

The key elements of the background noise survey are summarised in Table 2 below.

Table 2: Summary of key elements of background noise survey

Item	Description
Monitoring locations	Seven locations as described in Section 2.1 and Appendix F through Appendix L.
Monitoring period	<p>5 June to 20 July 2023 equating to approximately 6 weeks at each location.</p> <p>The duration was chosen to satisfy the guidance of NZS 6808 which indicates the measurements should be made for a representative range of wind speeds and directions for the site, and that a minimum of 1,440 individual 10-minute measurements, equivalent to 10 days of monitoring is normally required to obtain a satisfactory range.</p> <p>A 6-week survey period is recommended by the Technical Guideline.</p>
Sound level meters	<p>Class 1 automated sound loggers (most accurate class rating for field usage).</p> <p>Microphones mounted at approximately 1.5 m above ground level and fitted with enhanced wind shielding systems based on the design recommendations detailed in the UK Institute of Acoustics guidance.</p> <p>See equipment specifications and calibration records in Appendix C.</p>
Noise measurement data	<p>A-weighted average and statistical sound pressure levels.</p> <p>One-third octave band frequency noise levels and a brief audio sample every 10 minutes to aid the identification of extraneous noise influences.</p>
Local wind speed and rainfall data	<p>A weather station was installed beside one of the noise monitoring locations to concurrently record rainfall and wind speeds at microphone height.</p> <p>This data was recorded to identify periods when local weather conditions may have resulted in excessive extraneous noise at the microphone (i.e. rainfall).</p>
Site wind speed data	<p>Hub height wind speeds for correlating background noise levels with site wind speeds.</p> <p>Site wind speed data was sourced from the site met mast, which extends to a height of 120 m above ground level (AGL) and is located at 642090 E, 5779958 N (MGA2020 zone 54).</p> <p>Hub height wind speed data (149 m AGL) was provided by the proponent, based on analysis using site-specific wind shear calculations, as documented in Appendix D.</p>

2.3 Data analysis

The analysis of the survey data has been conducted in accordance with the NZS 6808. This analysis broadly involves:

- collating the measured noise levels, site wind speeds and local weather data into a single dataset
- filtering the data set to remove measurement results affected by extraneous or atypical noise
- filtering the data for the range of site wind speeds in which the turbines are expected to operate
- filtering the data where necessary to account for site wind directions
- plotting a chart of noise levels versus wind speeds and determining the line of best fit to the data.

A summary of the key steps in the analysis of the data is presented in Table 3.

Table 3: Background noise data analysis

Process	Description
Data collation	<p>Time stamps for each source of measurement data are reviewed to clarify start or end times and measurement time zone.</p> <p>Measured noise levels, site wind speeds and local weather conditions are then collated for each 10-minute measurement interval.</p>
Local weather data filtering	<p>10-minute intervals are identified and filtered from the analysis if rainfall was identified for any ten-minute measurement interval</p>
Extraneous noise filtering	<p>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 sounds.</p> <p>10-minute intervals have been identified, and filtered from the analysis, when the following conditions³ are satisfied, as suggested in the Technical Guideline:</p> <ul style="list-style-type: none"> • 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}.
Time periods	<p>Consistent with common practice for wind farm noise assessments in Victoria, the background noise levels have been separately analysed for the all-time (day and night combined) and night period.</p> <p>As such, the data sets are considered for the following separate periods:</p> <ul style="list-style-type: none"> • All-time period: no restriction on hours (i.e. data during day and night hours included) • Night period: 2200 to 0700 hours

³ Griffin, D., Delaire, C., & Pischedda, P. (2013). Methods of identifying extraneous noise during unattended noise measurements. *20th International Congress of Sound & Vibration*.

Process	Description
Regression analysis	<p>Two datasets are plotted on a chart of noise levels versus wind speeds:</p> <ul style="list-style-type: none"> • All data points that have been removed from the analysis using the above processes • The filtered dataset comprising all retained measurement data <p>The chart of filtered noise levels versus wind speed is reviewed to determine if there are any distinctive trends or gaps in the data which could warrant separation of the measurement results into subgroups (e.g. subgroups for time of day or wind direction).</p> <p>A line of best fit is determined for the filtered data and, where applicable, any subgroups of the filtered data. The line of best fit is determined using a regression analysis of the range of noise levels and wind speeds or, where necessary, analysis of noise levels at individual wind speeds.</p>

In addition to the filtering detailed above, the data was filtered at receiver D39 to exclude most of the day period (0800 – 1800 hrs on 23 June 2023, and 0900 - 1800 hrs on 26 and 28 June 2023). During these times, uncharacteristically high noise levels were caused by nearby operation of machinery which was evidenced by review of audio samples.

3.0 SURVEY & ANALYSIS RESULTS

This section presents a summary of the background noise measurement results, analysed in accordance with the method described in Section 2.3.

The tabulated data presented in Table 4 and Table 5 summarises the derived background noise levels for the all-time and night-time periods respectively.

The background noise levels at receiver D622 are only presented for information due to:

- Survey undertaken while the property was still under development
- Calibration drift between deployment and retrieval was marginally over the requirement of AS 1055:20184.

As such, background noise monitoring is recommended to be repeated at receiver D622 prior to construction of the Project, once development is completed.

The measured background noise levels exhibit variations which are consistent with rural areas and are characterised by lower background noise levels during the night period. This is particularly evident during periods of lower wind speeds near ground level, and consequently lower background noise levels from wind disturbance or vegetation.

The data in these tables is provided for the key wind speeds relevant to the assessment of wind farm noise. The results for all surveyed wind speeds are illustrated in the graphical data provided for each receiver in Appendix F to Appendix L.

Table 4: All-time period – background noise levels, dB L_{A90}

Location	Hub height wind speed, m/s ^[1]												
	3	4	5	6	7	8	9	10	11	12	13	14	15
D39	.. ^[2]	28.4	28.4	28.9	29.7	30.9	32.3	34.0	35.9	37.9	40.0	42.2	44.4
D205	.. ^[2]	.. ^[2]	33.3	33.4	33.8	34.5	35.4	36.5	37.7	39.1	40.5	42.0	43.6
D294	27.9	28.2	28.8	29.6	30.7	32.0	33.5	35.1	36.8	38.5	40.3	42.0	43.7
D362	.. ^[2]	29.5	29.7	30.2	31.1	32.1	33.5	35.0	36.6	38.4	40.3	42.3	44.3
D367	.. ^[2]	29.6	29.8	30.2	30.8	31.6	32.6	33.8	35.2	36.6	38.2	39.8	41.5
D413	.. ^[2]	28.0	28.1	28.4	29.1	30.1	31.3	32.8	34.4	36.1	37.9	39.8	41.7
D622 ^[3]	27.5	27.8	28.1	28.6	29.2	29.9	30.6	31.5	32.5	33.6	34.8	36.0	37.4

1 DRY02 met mast – 149 m above ground level at 642090 E, 5779958 N (MGA2020 zone 54)

2 Regression lines indicate an increase of background noise levels as hub height wind speed decreases. As this feature is deemed to be an artifact of the regression analysis process due to the large scatter of points at low hub height wind speeds, the regression lines have been truncated at their lowest values.

3 Data at this location is presented for information only

⁴ AS 1055:2018 *Acoustics – Acoustics—Description and measurement of environmental noise*

Table 5: Night-time period – background noise levels, dB L_{A90}

Location	Hub height wind speed, m/s ^[1]												
	3	4	5	6	7	8	9	10	11	12	13	14	15
D39	.[2]	.[2]	22.8	22.8	23.6	24.9	26.8	29.0	31.5	34.3	37.2	40.0	42.8
D205	.[2]	.[2]	26.9	26.9	27.4	28.3	29.6	31.2	33.0	35.1	37.2	39.4	41.6
D294	21.9	21.9	22.4	23.4	24.8	26.5	28.5	30.6	32.9	35.3	37.7	40.1	42.3
D362	.[2]	.[2]	23.9	24.2	25.0	26.4	28.1	30.2	32.5	35.0	37.6	40.3	42.9
D367	.[2]	.[2]	.[2]	24.5	24.7	25.4	26.6	28.1	29.9	32.0	34.3	36.7	39.2
D413	.[2]	.[2]	.[2]	23.4	23.6	24.5	25.9	27.8	30.0	32.4	35.0	37.7	40.4
D622 ^[3]	.[2]	.[2]	24.1	24.2	24.6	25.3	26.2	27.4	28.9	30.5	32.2	34.1	36.0

- 1 DRY02 met mast – 149 m above ground level at 642090 E, 5779958 N (MGA2020 zone 54)
- 2 Regression lines indicate an increase of background noise levels as hub height wind speed decreases. As this feature is deemed to be an artifact of the regression analysis process due to the large scatter of points at low hub height wind speeds, the regression lines have been truncated at their lowest values.
- 3 Data at this location is presented for information only

4.0 SUMMARY

During the background noise monitoring survey, noise and atmospheric conditions were measured at 7 locations, one meteorological mast and one local weather station in the vicinity of the proposed Hexham Wind Farm.

The survey and analysis have been carried out on the basis of:

- New Zealand Standard 6808:2010 *Acoustics – The assessment and measurement of sound from wind turbine generators* (NZS 6808), as required by Victorian Government's *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023
- supplementary guidance contained in 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.
- EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024 (Technical Guideline)

The results of the background survey provide a representation of the typical noise levels in the vicinity of the wind farm:

- The collected data have been analysed to derive background noise levels in accordance with NZS 6808.
- The derived background noise levels can be used to derive noise limits.
- The derived background noise levels would be referenced during the compliance monitoring phase of the wind farm as an indication of potential background noise levels contributing to the compliance measurements.

Background noise monitoring is recommended to be repeated at receiver D622 prior to construction of the Project, once development is completed.

APPENDIX A GLOSSARY OF TERMINOLOGY

The basic quantities used within this document to describe noise adopt the conventions outlined in ISO 1996-1:2016 *Acoustics - Description measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures*. Accordingly, all frequency weighted sound pressure levels are expressed as decibels (dB) in this report. For example, sound pressure levels measured using an “A” frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.

Term	Definition	Abbreviation
A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an “A” frequency weighting are expressed as dB L _A . Alternative ways of expressing A-weighted decibels are dBA or dB(A).	See discussion above this table.
A-weighted 90 th centile	The A-weighted pressure level that is exceeded for 90 % of a defined measurement period. It is used to describe the underlying background sound level in the absence of a source of sound that is being investigated, as well as the sound level of steady, or semi steady, sound sources.	L _{A90}
Decibel	The unit of sound level.	dB
Hertz	The unit for describing the frequency of a sound in terms of the number of cycles per second.	Hz
Octave band	The interval between one frequency and its double. Sound is divided into octave bands for analysis. The typical octave band centre frequencies are 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz and 4 kHz.	-
Sound pressure level	A measure of the level of sound expressed in decibels.	L _p

APPENDIX B WIND TURBINE COORDINATES

The following table sets out the coordinates of the 109 wind turbine layout of the wind farm as detailed in the environmental noise & vibration assessment.

Table 6: Turbine coordinates – MGA2020 zone 54

Turbine	Easting, m	Northing, m	Terrain elevation, m	Turbine	Easting, m	Northing, m	Terrain elevation, m
T1	631,862	5,789,892	140	T56	638,761	5,779,376	130
T2	632,189	5,788,567	140	T57	639,187	5,786,346	130
T3	632,249	5,790,102	140	T58	639,196	5,787,069	130
T4	632,896	5,788,310	140	T59	639,225	5,788,415	130
T5	632,492	5,789,014	140	T60	639,284	5,791,318	128
T6	632,757	5,793,217	150	T61	639,372	5,781,293	130
T7	632,869	5,789,355	137	T62	639,523	5,790,309	125
T8	632,873	5,790,105	139	T63	639,642	5,780,462	130
T9	633,021	5,792,595	150	T64	639,817	5,792,027	126
T10	633,395	5,792,955	146	T65	639,906	5,786,269	130
T11	633,409	5,790,257	134	T66	639,995	5,787,460	130
T12	633,412	5,788,608	140	T67	639,997	5,788,566	122
T13	633,415	5,790,877	140	T68	640,086	5,780,835	130
T14	633,434	5,791,745	140	T69	640,119	5,789,579	120
T15	633,994	5,788,945	132	T70	640,243	5,792,613	127
T16	634,165	5,791,895	140	T71	640,267	5,790,395	123
T17	634,247	5,789,702	140	T72	640,381	5,793,222	128
T18	634,388	5,791,137	140	T73	640,430	5,791,017	123
T19	634,432	5,792,713	134	T74	640,688	5,784,019	130
T20	634,625	5,790,182	139	T75	640,811	5,785,939	126
T21	635,053	5,790,627	139	T76	640,848	5,780,377	130
T22	635,097	5,791,963	136	T77	640,911	5,788,393	120
T23	635,169	5,786,125	135	T78	640,967	5,781,114	130
T24	635,477	5,791,222	136	T79	641,088	5,790,964	121
T25	635,600	5,785,413	130	T80	641,092	5,787,655	130
T26	635,801	5,786,272	132	T81	641,126	5,786,951	129
T27	635,912	5,791,654	131	T82	641,130	5,792,211	124
T28	635,949	5,786,772	130	T83	641,417	5,786,072	117
T29	636,159	5,793,118	130	T84	641,535	5,781,388	130
T30	636,214	5,792,054	130	T85	641,559	5,791,409	122
T31	636,377	5,785,415	130	T86	641,626	5,792,524	124
T32	636,561	5,793,934	130	T87	641,644	5,783,822	130
T33	636,576	5,786,914	130	T88	641,827	5,782,024	122
T34	636,617	5,792,446	130	T89	641,865	5,780,489	123

Turbine	Easting, m	Northing, m	Terrain elevation, m	Turbine	Easting, m	Northing, m	Terrain elevation, m
T35	636,699	5,785,879	130	T90	642,134	5,778,497	120
T36	636,733	5,793,295	130	T91	642,235	5,792,609	127
T37	637,019	5,784,553	130	T92	642,252	5,791,766	124
T38	637,377	5,785,295	130	T93	642,500	5,781,366	120
T39	637,537	5,781,504	130	T94	642,854	5,779,642	119
T40	637,841	5,790,833	130	T95	642,812	5,778,390	120
T41	637,825	5,788,915	130	T96	642,769	5,780,627	114
T42	637,831	5,788,114	124	T97	642,917	5,782,371	110
T43	637,866	5,784,612	130	T98	642,987	5,778,816	120
T44	638,029	5,789,662	130	T99	643,011	5,792,556	130
T45	638,032	5,780,797	130	T100	643,104	5,791,828	128
T46	638,224	5,778,462	130	T101	643,093	5,781,585	112
T47	638,334	5,781,749	130	T102	643,169	5,783,075	110
T48	638,525	5,778,891	127	T103	643,378	5,779,806	115
T49	638,542	5,790,877	130	T104	643,517	5,778,880	120
T50	638,554	5,780,139	130	T105	643,623	5,780,292	111
T51	638,922	5,781,056	130	T106	643,666	5,782,434	110
T52	638,753	5,787,932	130	T107	643,741	5,792,131	130
T53	638,209	5,781,257	130	T108	643,636	5,780,873	110
T54	638,840	5,789,732	130	T109	643,815	5,781,428	110
T55	638,959	5,781,972	130				

APPENDIX C SURVEY INSTRUMENTATION

Table 7: Sound level measurement instrumentation summary

Item	Description
Equipment type	Automated/unattended integrating sound levels
Make & model	01dB CUBE
Instrumentation class	Certified to Class 1 (precision grade) standards in accordance with IEC 61672.1-2019 ⁵
Instrumentation noise floor	Less than 20 dB
Time synchronisation	Internal GPS clocks
Wind shielding	Enhanced wind shielding system based on the design recommendations detailed in the UK Institute of Acoustics guidance. The system comprises an inner solid primary wind shield and an outer secondary large diameter hollow wind shield

⁵ IEC 61672.1-2019: *Electroacoustics — Sound level meters, Part 1: Specifications*

Table 8: Sound level meter installation records

Noise monitoring location	System	Unit serial number	Microphone serial number	Independent calibration date ^[1]	Calibration drift ^[2,3]	Measurement start date	Measurement end date
D39	01dB CUBE	10421	260714	13/05/2022	+0.19 dB	05/06/2023	20/07/2023
D205	01dB CUBE	10422	224301	12/04/2023	-0.29 dB	05/06/2023	20/07/2023
D294	01dB CUBE	10423	207216	05/04/2023	-0.10 dB	05/06/2023	20/07/2023
D362	01dB CUBE	10517	161870	12/04/2023	+0.04 dB	08/06/2023	20/07/2023
D413	01dB CUBE	11289	292400	22/02/2022	-0.02 dB ^[4]	05/06/2023	20/07/2023
D367	01dB CUBE	10515	161881	18/01/2023	-0.78 dB	05/06/2023	20/07/2023
D622	01dB CUBE	10520	224328	11/01/2023	+1.22 dB ^[5]	05/06/2023	20/07/2023

1 Independent (laboratory) calibration date to be within 2 years of measurement period as per AS 1055:2018⁶

2 Difference between reference level checks during deployment and collection of instruments

3 Calibration drift should be lower than 1 dB as specified in AS 1055:2018

4 Calibration drift based on difference between deployment and interim check calibration only as the unit could not be calibrated during retrieval due to battery issue

5 Calibration drift marginally higher than the requirement of AS 1055:2018. Background noise levels at this location are presented for information only.

Table 9: Wind speed measurement instrumentation

Wind speeds	Description
Local wind speeds	Vaisala WTX 520 weather station (serial number K1850003) positioned at Receiver D413.
Site wind speeds	Third party owned and operated system comprising one meteorological mast with anemometry up to 120 m above ground level. Coordinates: 642090 E, 5779958 N (MGA2020 zone 54) Further information provided in Appendix D.

⁶ AS 1055:2018 *Acoustics – Acoustics—Description and measurement of environmental noise*

APPENDIX D SITE WIND SPEED DATA DERIVATION

This appendix reproduces correspondence provided by the proponent on 22 August 2023 documenting the process used to derive the 149 m AGL wind speeds required to analyse the measured background noise data.

Extrapolation method to estimate the 149m hub height wind speed was made using wind analysis software WindPRO. The program allows users to synthesize a new dataset at the desired height based on the measured data loaded into the workspace. A shear matrix is created and contains shear values in several bins: monthly bins (yearly variation), hour bins (daily variations) and directions. The final shear matrix is calculated from Weibull fitted mean wind speeds in each bin. Wind speed data is taken from the 60,80,100 and, 120m measured time series.

APPENDIX E SUMMARY OF BACKGROUND NOISE LEVEL DERIVATION

Table 10: Regression equation coefficients – All-time period

Regression equation coefficients for background noise equation of best fit						
$L_{A90} = ax^3+bx^2+cx+d$, where x = windspeed in m/s						
Location	a	b	c	d	R ²	Valid wind speed range, m/s
D39	-0.0078	0.3303	-2.4727	33.5189	0.46	4-19
D205	-0.0052	0.2330	-1.9446	37.8153	0.32	5-19
D294	-0.0061	0.2286	-1.0994	29.3059	0.48	3-19
D362	-0.0055	0.2466	-1.6857	32.6580	0.49	4-19
D367	-0.0037	0.1850	-1.3135	32.1747	0.45	4-19
D413	-0.0059	0.2618	-1.9581	32.0314	0.52	4-19
D622 ^[1]	-0.0002	0.0569	-0.1329	27.4029	0.44	3-19

1 Data at this location is presented for information only

Table 11: Regression equation coefficients – Night period

Regression equation coefficients for background noise equation of best fit						
$L_{A90} = ax^3+bx^2+cx+d$, where x = windspeed in m/s						
Location	a	b	c	d	R ²	Valid wind speed range, m/s
D39	-0.0162	0.6395	-5.5123	36.4049	0.76	5-19
D205	-0.0110	0.4552	-4.0431	37.1481	0.65	5-19
D294	-0.0103	0.3778	-2.2300	25.4191	0.67	3-19
D362	-0.0121	0.4933	-4.0146	33.1287	0.76	5-19
D367	-0.0104	0.4680	-4.5648	37.2848	0.76	6-19
D413	-0.0153	0.6323	-6.0350	40.1297	0.73	6-19
D622 ^[1]	-0.0055	0.2698	-2.4214	30.1654	0.76	5-19

1 Data at this location is presented for information only

APPENDIX F RECEIVER D39 DATA

F1 Receiver D39 noise monitor

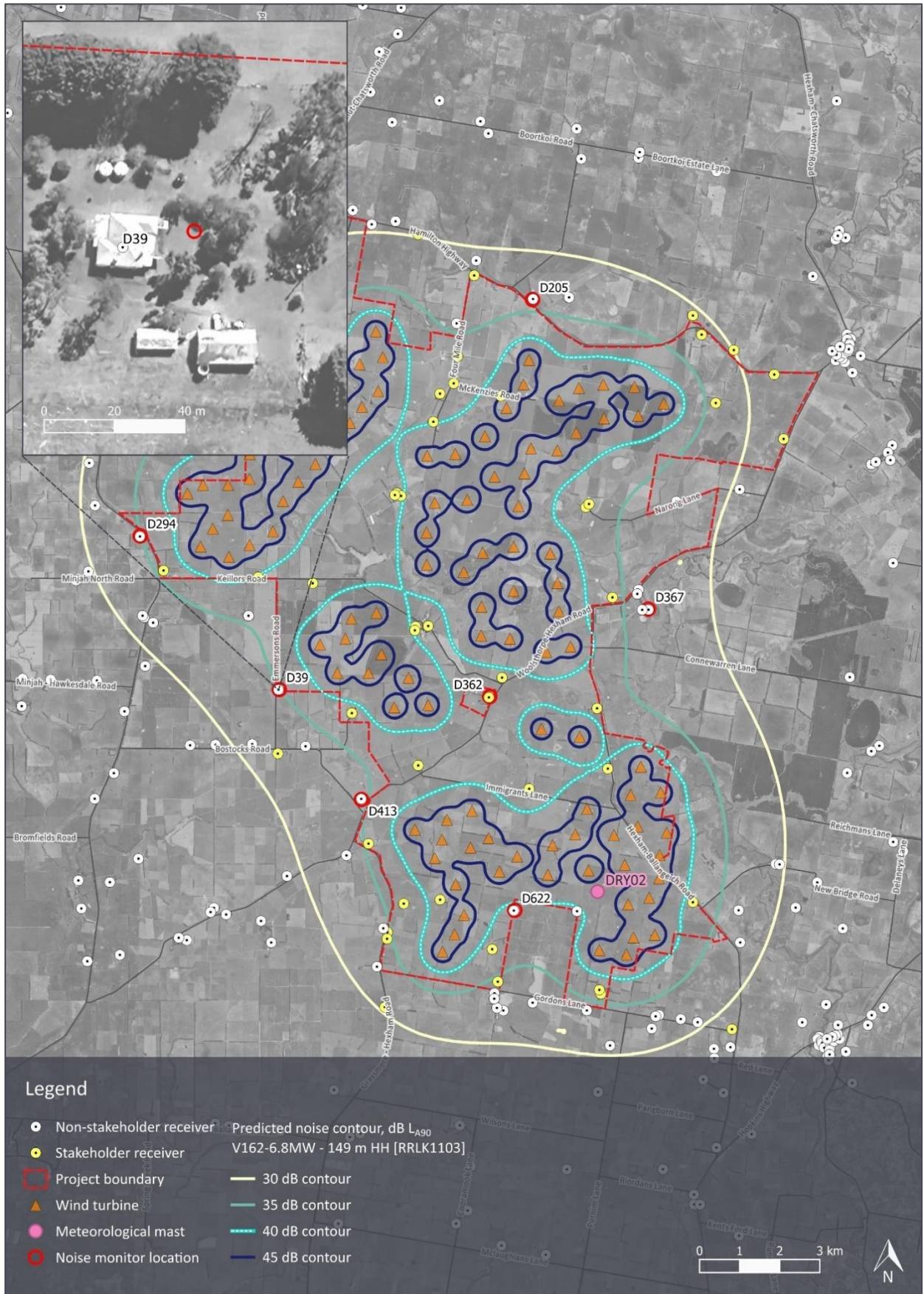
Table 12: Receiver D39 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	635,516	5,784,996
Background noise monitoring location	634,153	5,785,000

Table 13: Receiver D39 monitor installation photos



Figure 2: Receiver D39 - dwelling and noise monitor locations



F2 Receiver D39 measurement data summary

Table 14: Receiver D39 – background noise level analysis summary

Item	All-time period	Night period
Number of data points collected	5,310	1,987
Number of data points removed	2,036	831
Number of data points for analysis	3,274	1,156

Figure 3: Receiver D39 noise level and wind speed time history

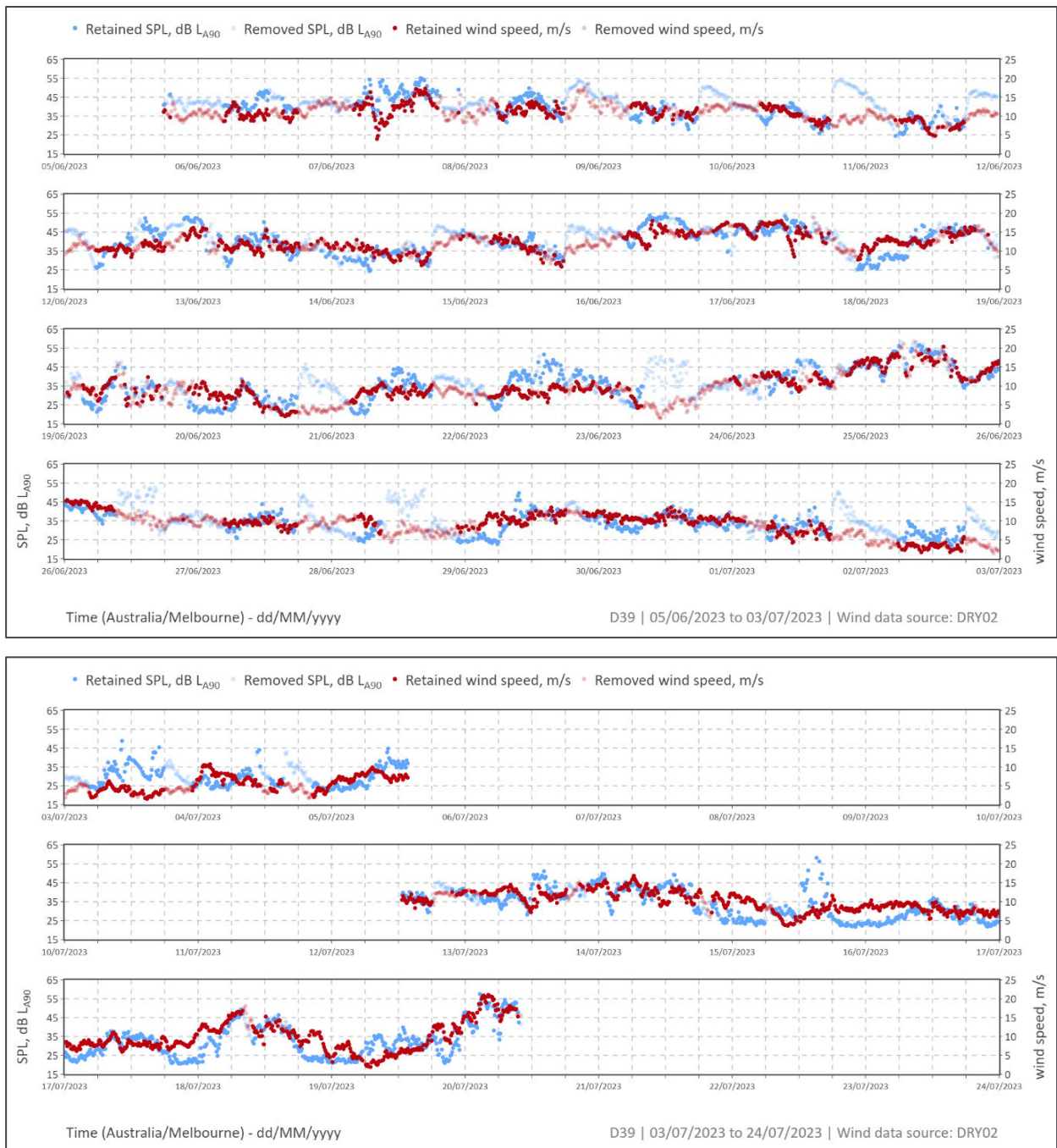


Figure 4: Receiver D39 background noise levels – All-time period

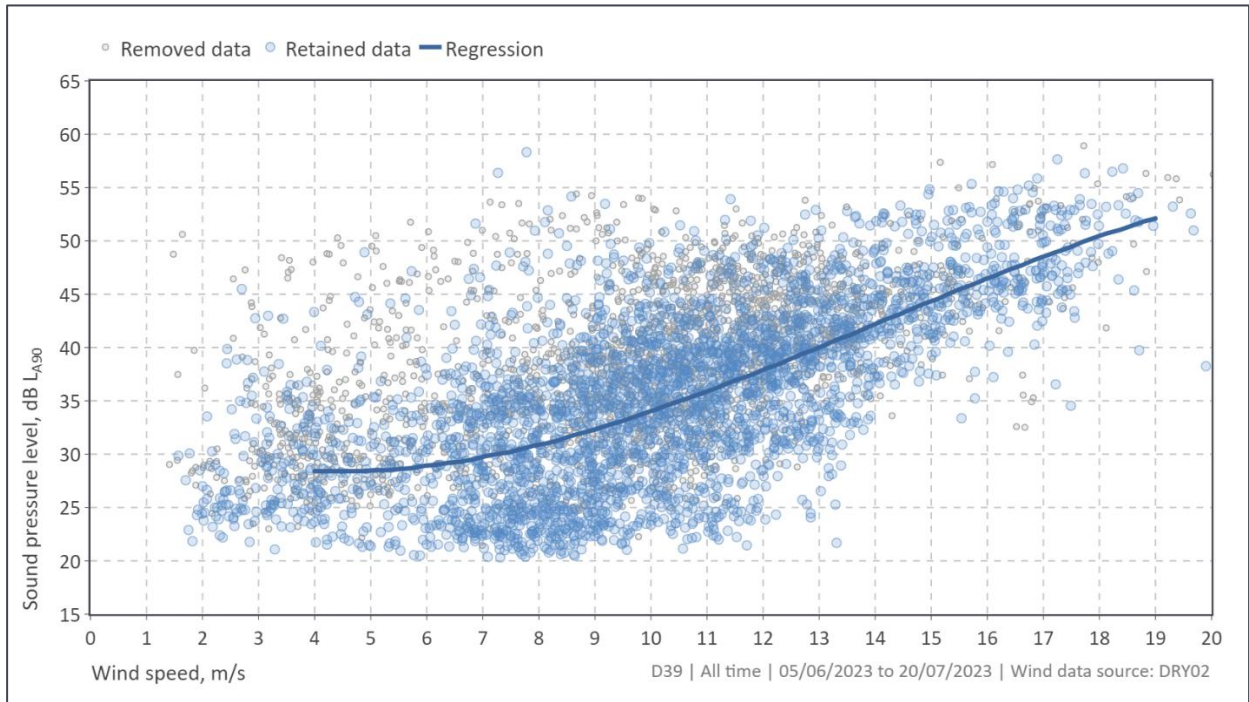
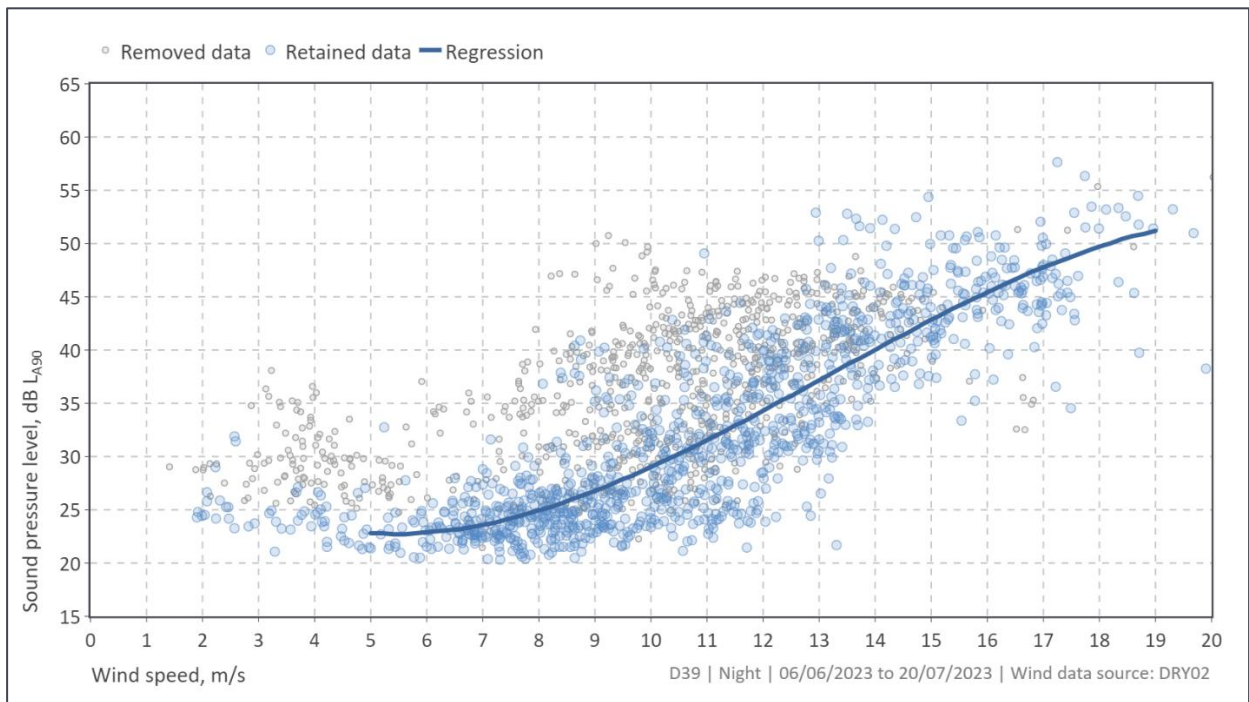


Figure 5: Receiver D39 background noise levels – Night period



APPENDIX G RECEIVER D205 DATA

G1 Receiver D205 noise monitor

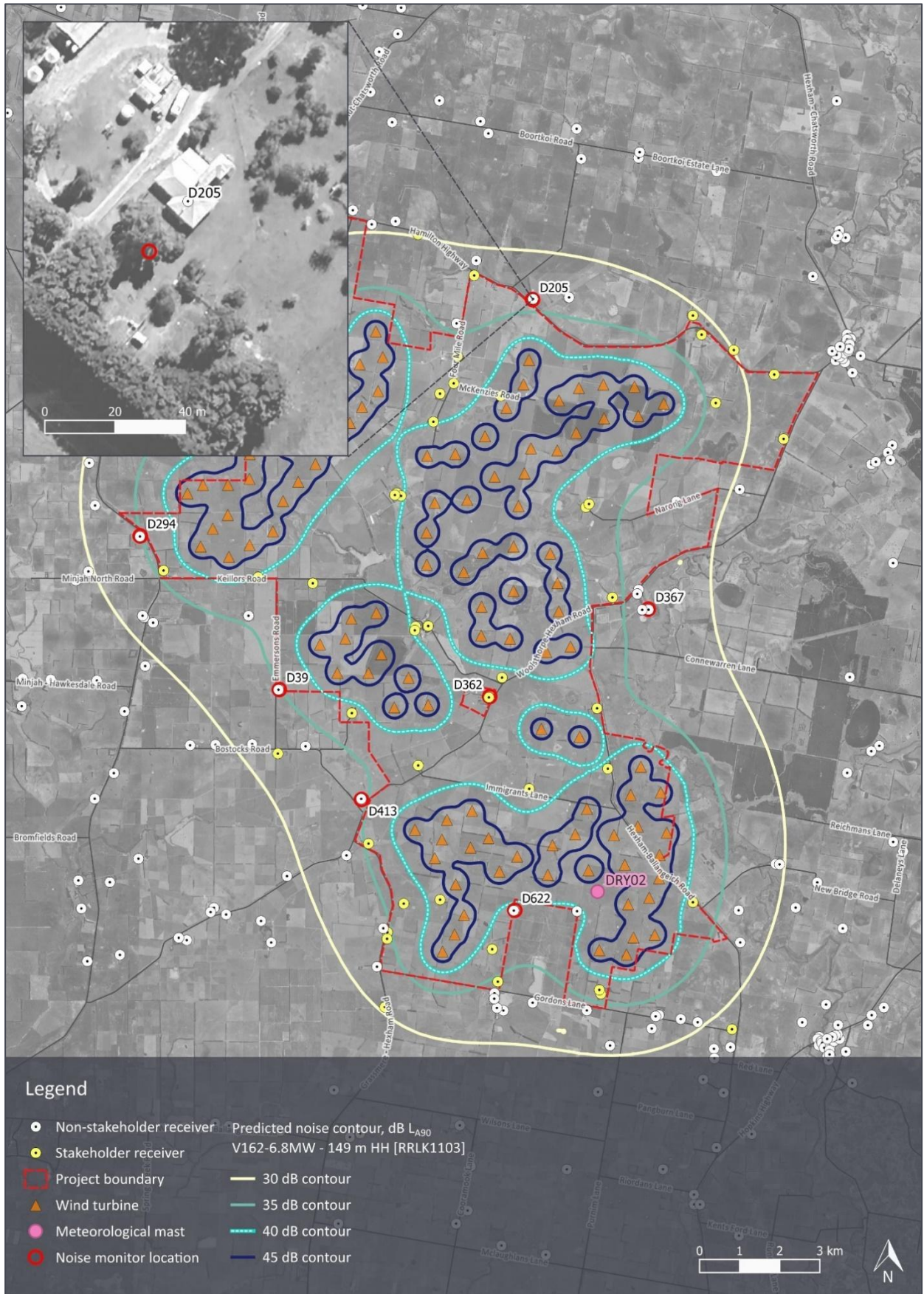
Table 15: Receiver D205 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	640,481	5,794,744
Background noise monitoring location	640,470	5,794,730

Table 16: Receiver D205 monitor installation photos



Figure 6: Receiver D205 - dwelling and noise monitor locations



G2 Receiver D205 measurement data summary

Table 17: Receiver D205 – background noise level analysis summary

Item	All-time period	Night period
Number of data points collected	6,312	2,350
Number of data points removed	1,989	861
Number of data points for analysis	4,323	1,489

Figure 7: Receiver D205 – noise level and wind speed time history

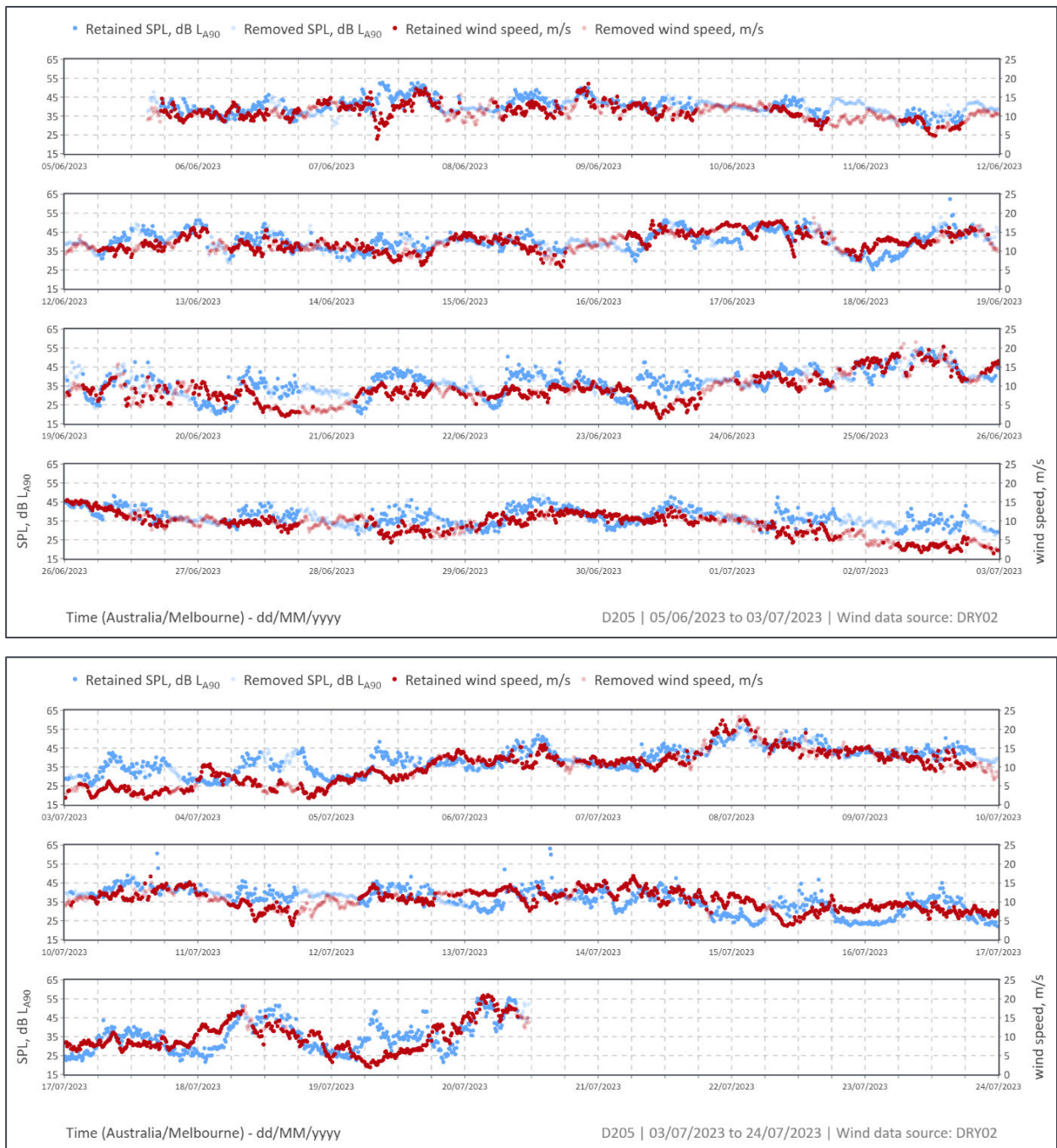


Figure 8: Receiver D205 background noise levels – All-time period

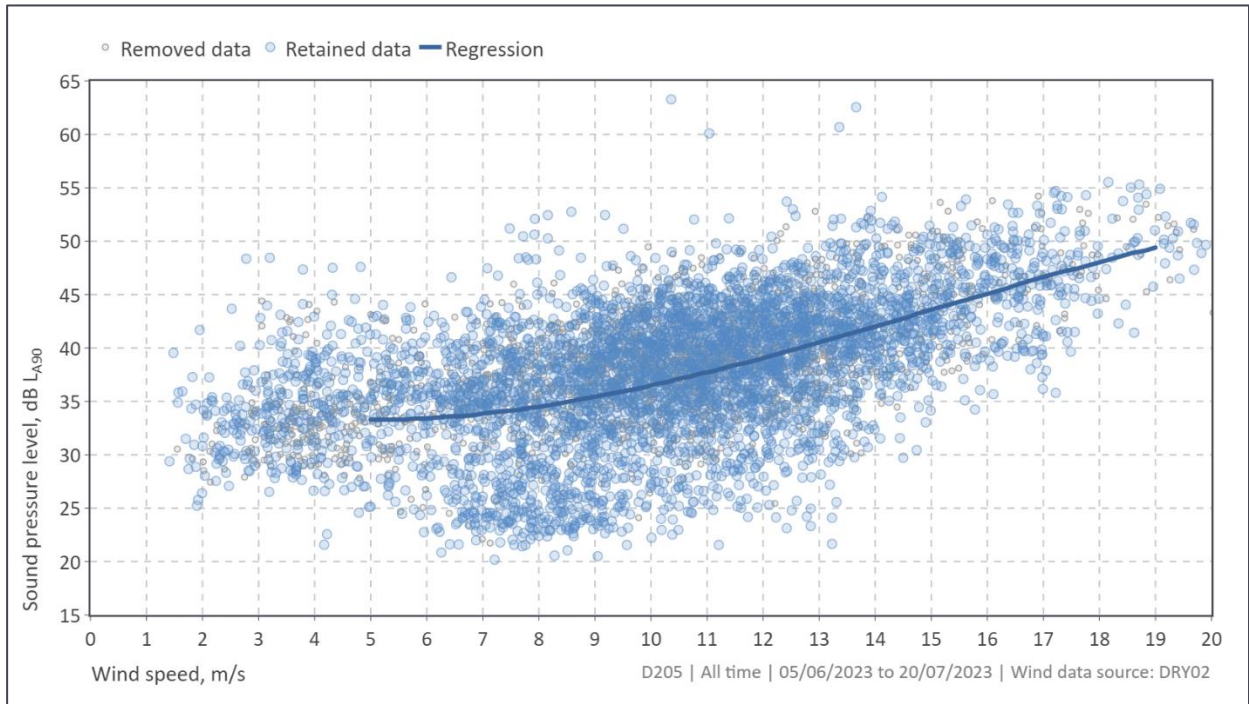
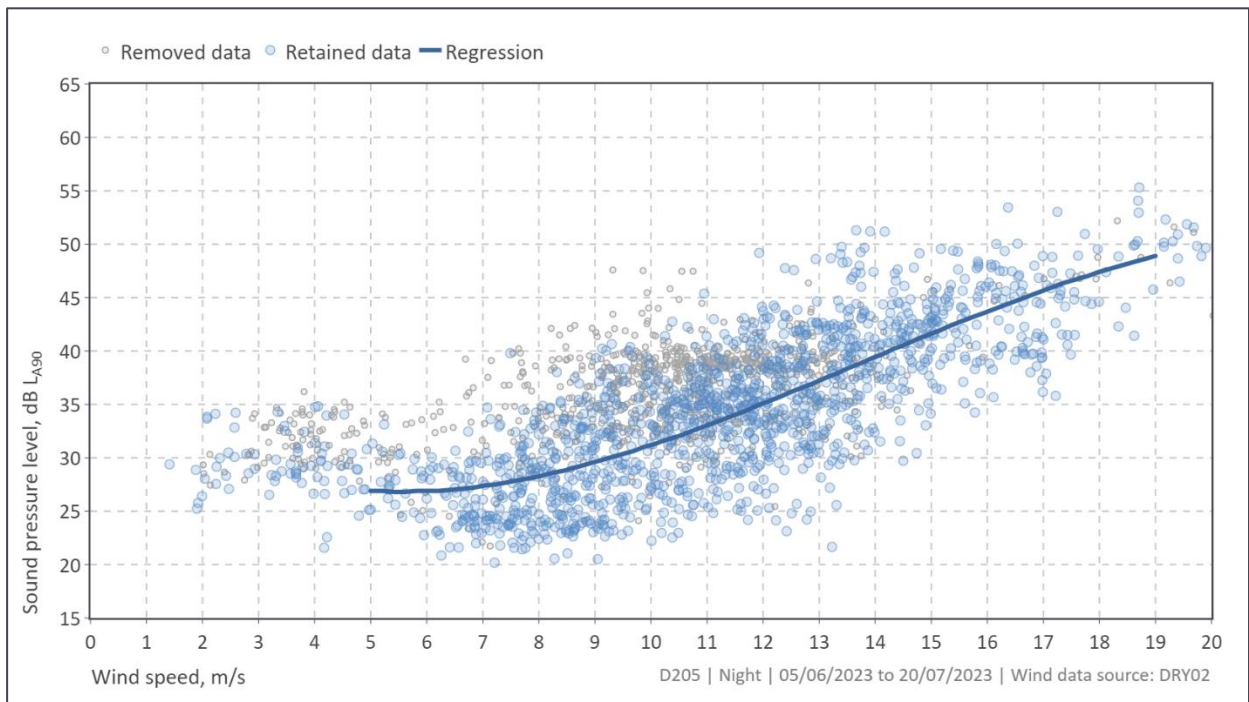


Figure 9: Receiver D205 background noise levels – Night period



APPENDIX H RECEIVER D294 DATA

H1 Receiver D294 noise monitor

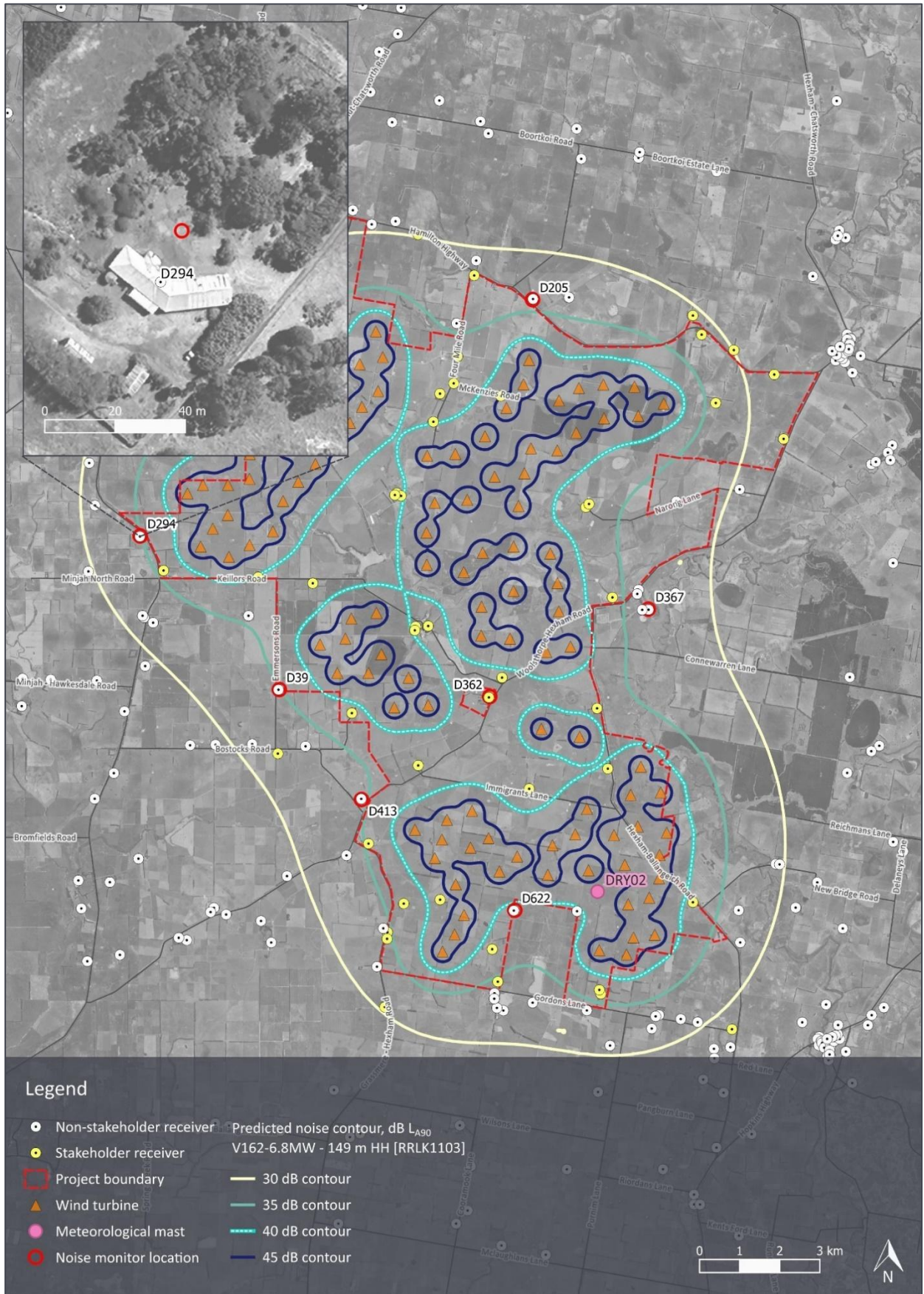
Table 18: Receiver D294 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	630,677	5,788,818
Background noise monitoring location	630,683	5,788,833

Table 19: Receiver D294 monitor installation photos



Figure 10: Receiver D294 - dwelling and noise monitor locations



H2 Receiver D294 measurement data summary

Table 20: Receiver D294 – background noise level analysis summary

Item	All-time period	Night period
Number of data points collected	6,339	2,368
Number of data points removed	2,653	1,330
Number of data points for analysis	3,686	1,038

Figure 11: Receiver D294 – noise level and wind speed time history

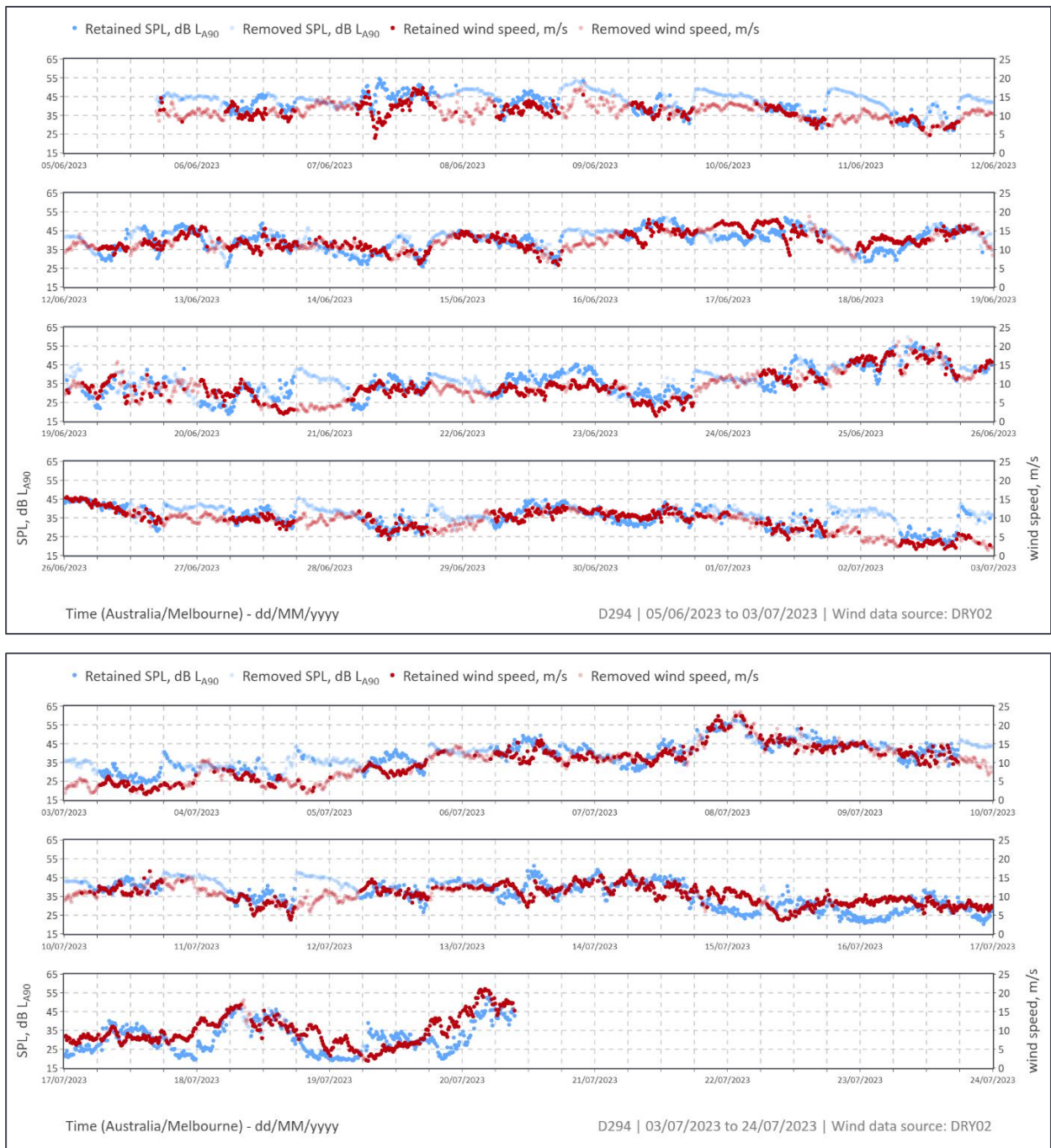


Figure 12: Receiver D294 background noise levels – All-time period

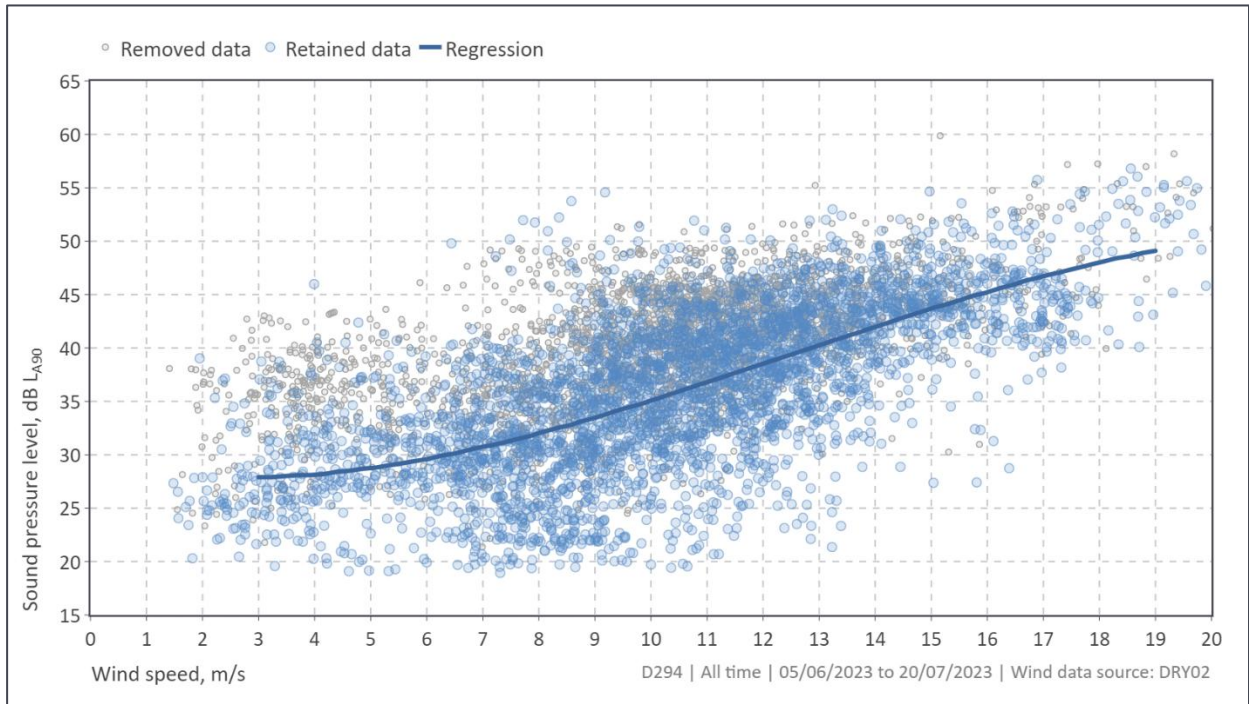
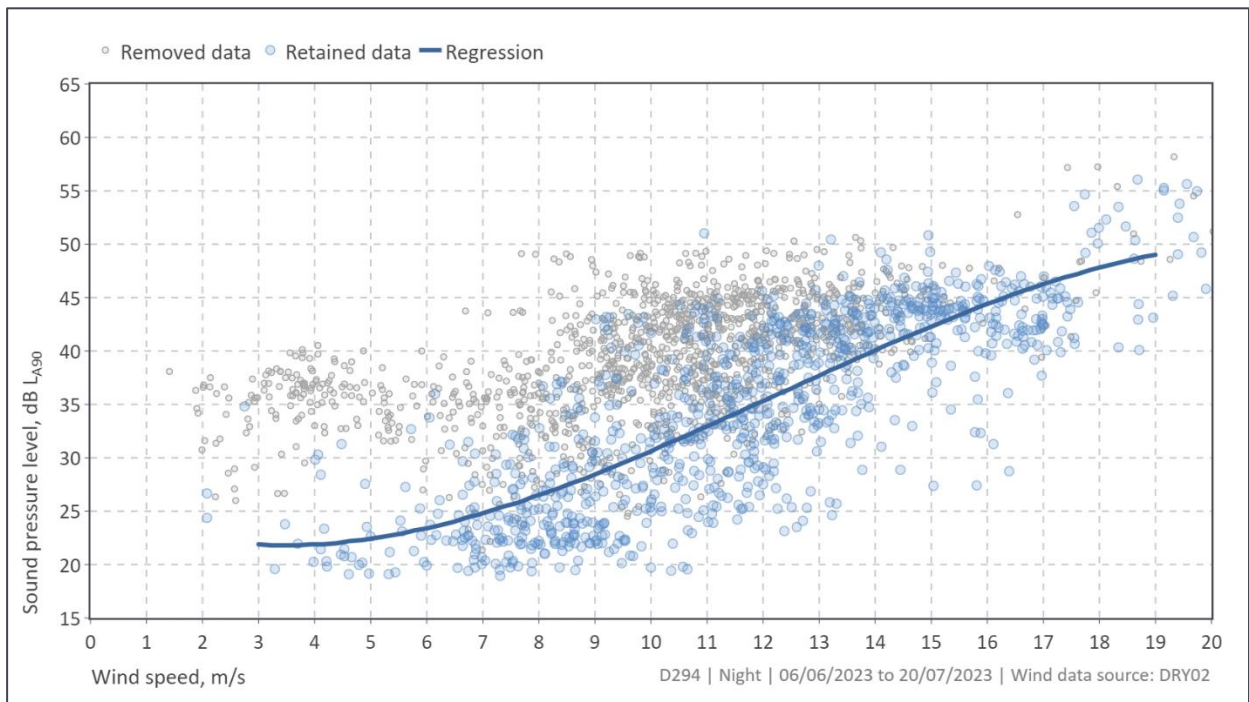


Figure 13: Receiver D294 background noise levels – Night period



APPENDIX I RECEIVER D362 DATA

I1 Receiver D362 noise monitor

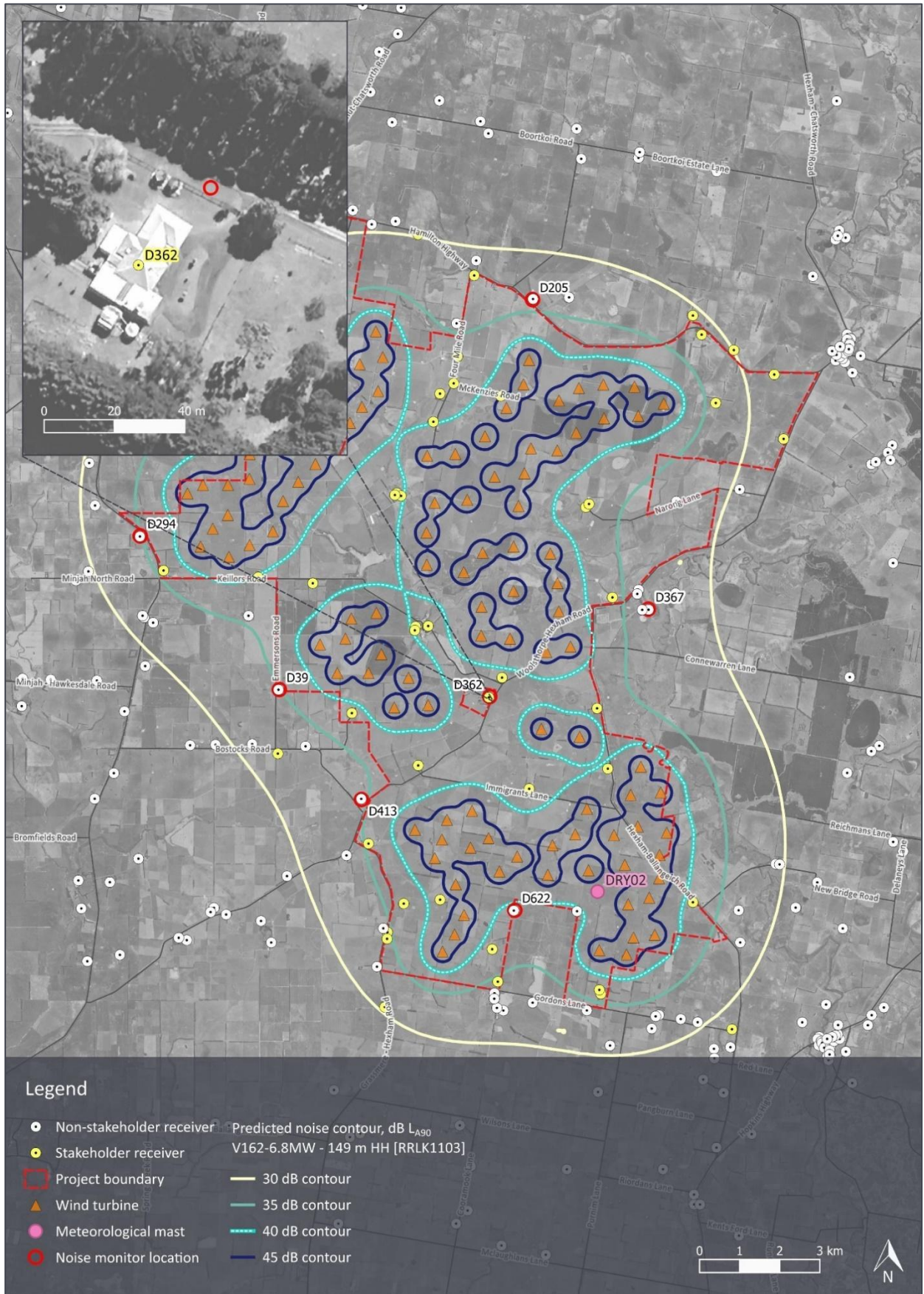
Table 21: Receiver D362 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	639,380	5,784,803
Background noise monitoring location	639,401	5,784,825

Table 22: Receiver D362 monitor installation photos



Figure 14: Receiver D362 - dwelling and noise monitor locations



I2 Receiver D362 measurement data summary

Table 23: Receiver D362 – background noise level analysis summary

Item	All-time period	Night period
Number of data points collected	5,916	2,187
Number of data points removed	1,672	675
Number of data points for analysis	4,244	1,512

Figure 15: Receiver D362 – noise level and wind speed time history

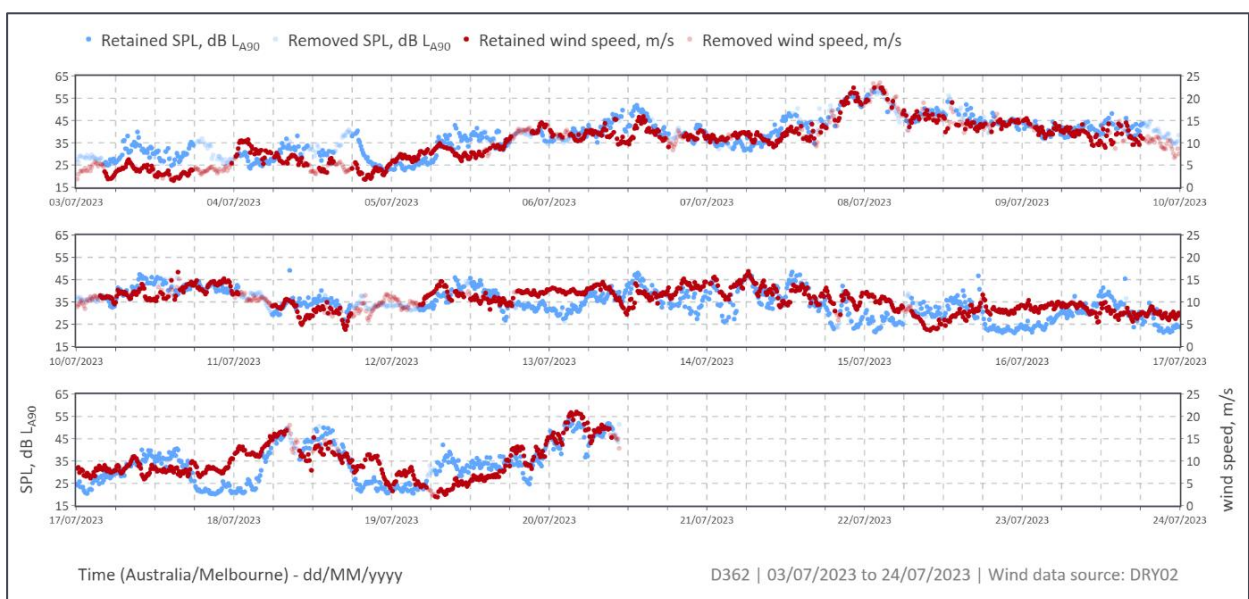
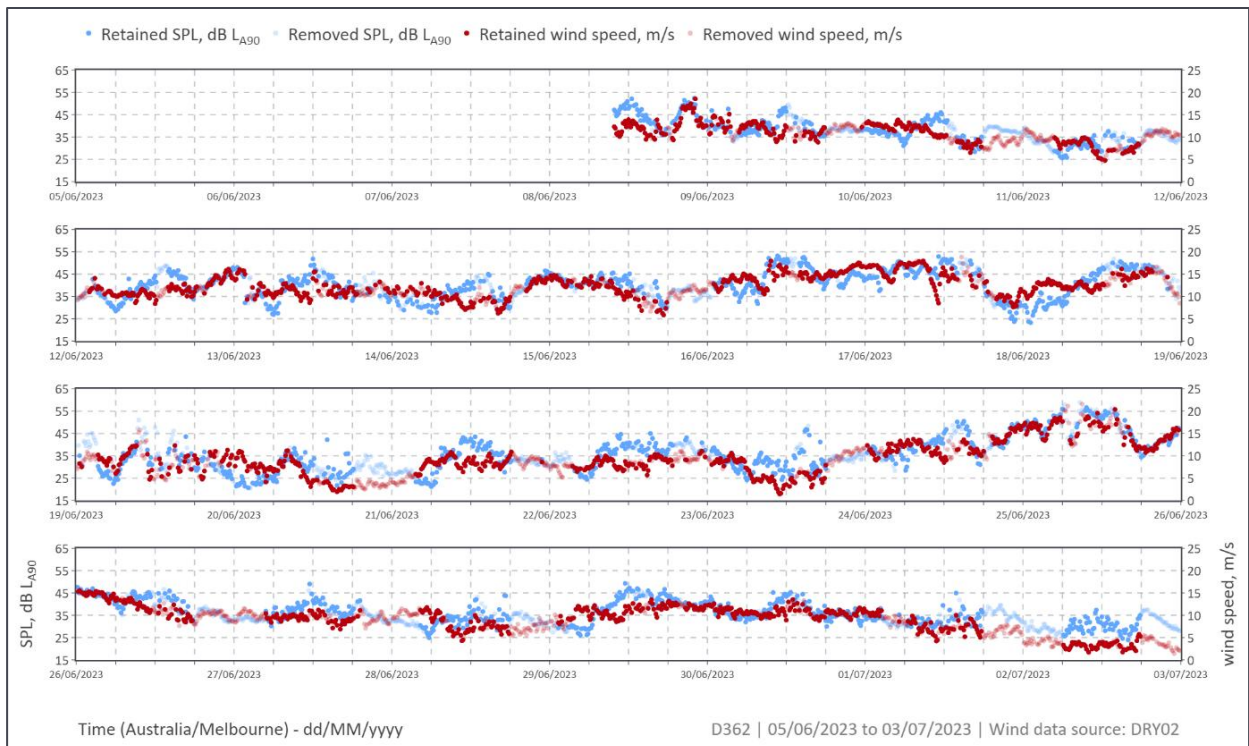


Figure 16: Receiver D362 background noise levels – All-time period

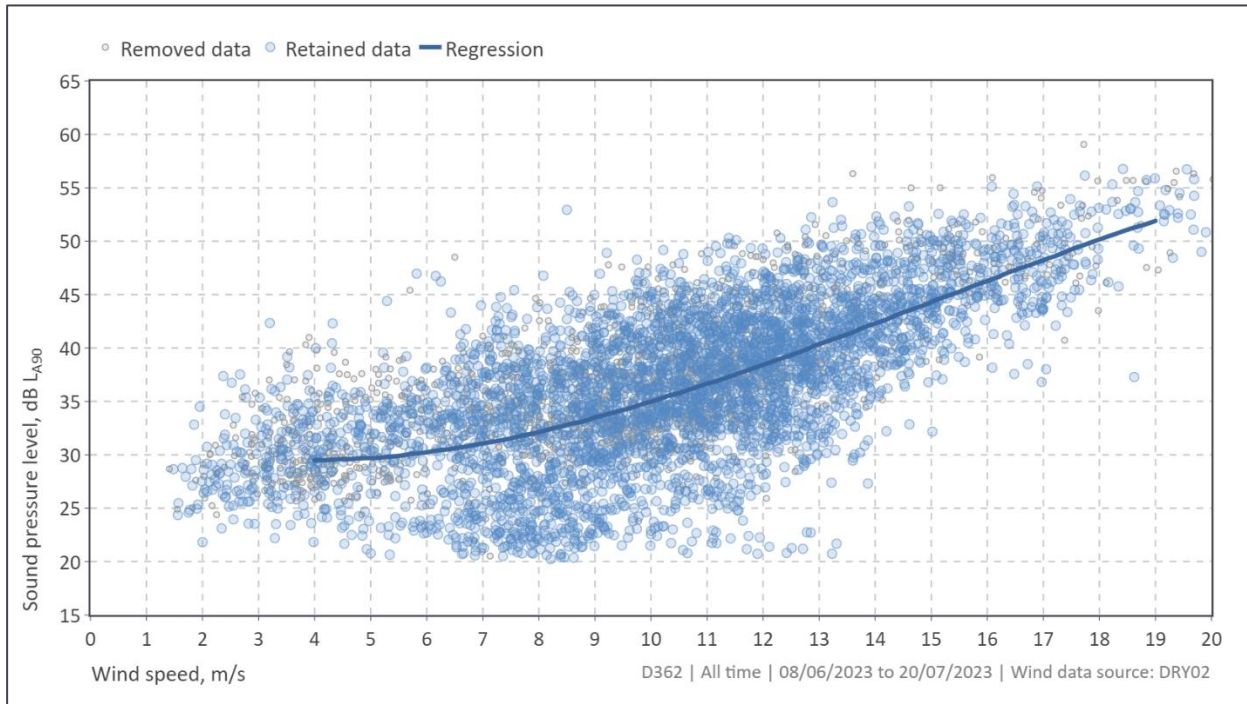
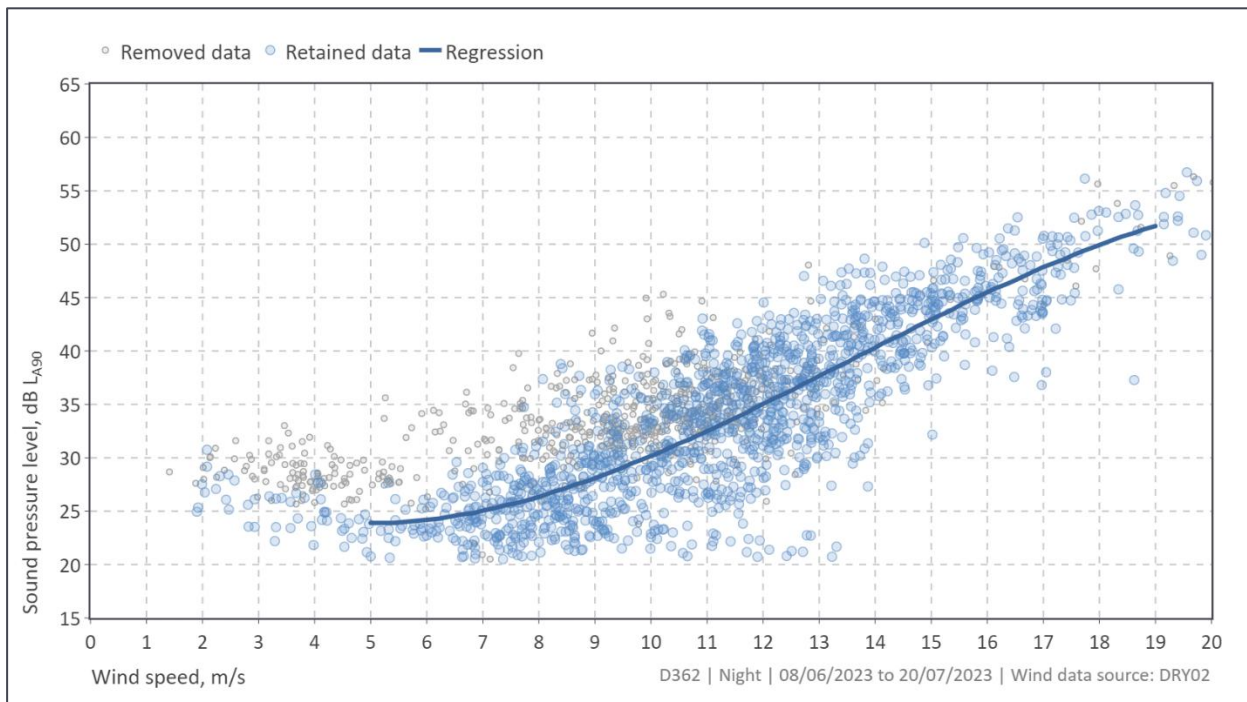


Figure 17: Receiver D362 background noise levels – Night period



APPENDIX J RECEIVER D367 DATA

J1 Receiver D367 noise monitor

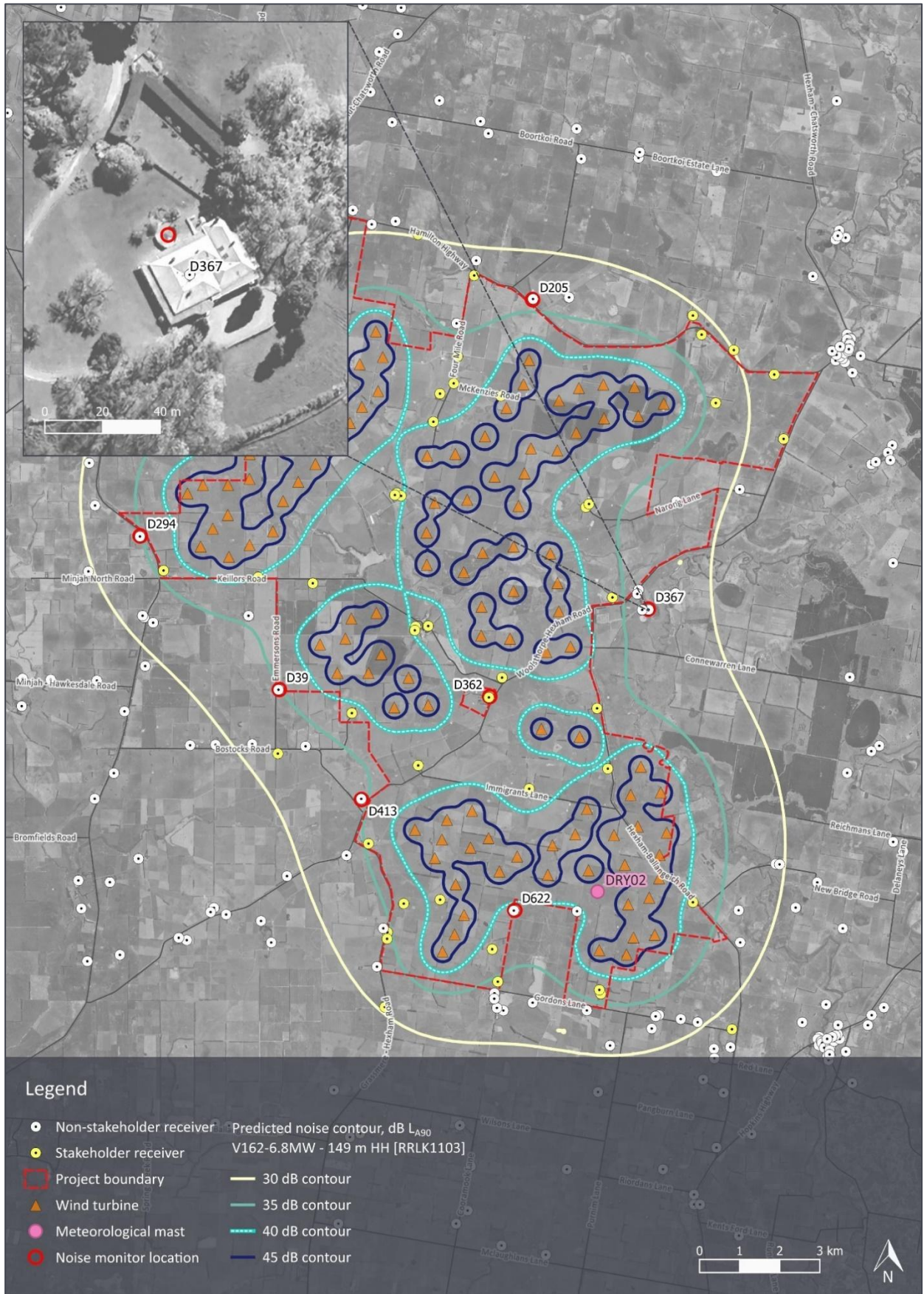
Table 24: Receiver D367 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	643,362	5,786,992
Background noise monitoring location	643,359	5,787,004

Table 25: Receiver D367 monitor installation photos



Figure 18: Receiver D367 - dwelling and noise monitor locations



J2 Receiver D367 measurement data summary

Table 26: Receiver D367 – background noise level analysis summary

Item	All-time period	Night period
Number of data points collected	6,321	2,352
Number of data points removed	2,739	1,370
Number of data points for analysis	3,582	982

Figure 19: Receiver D367 – noise level and wind speed time history

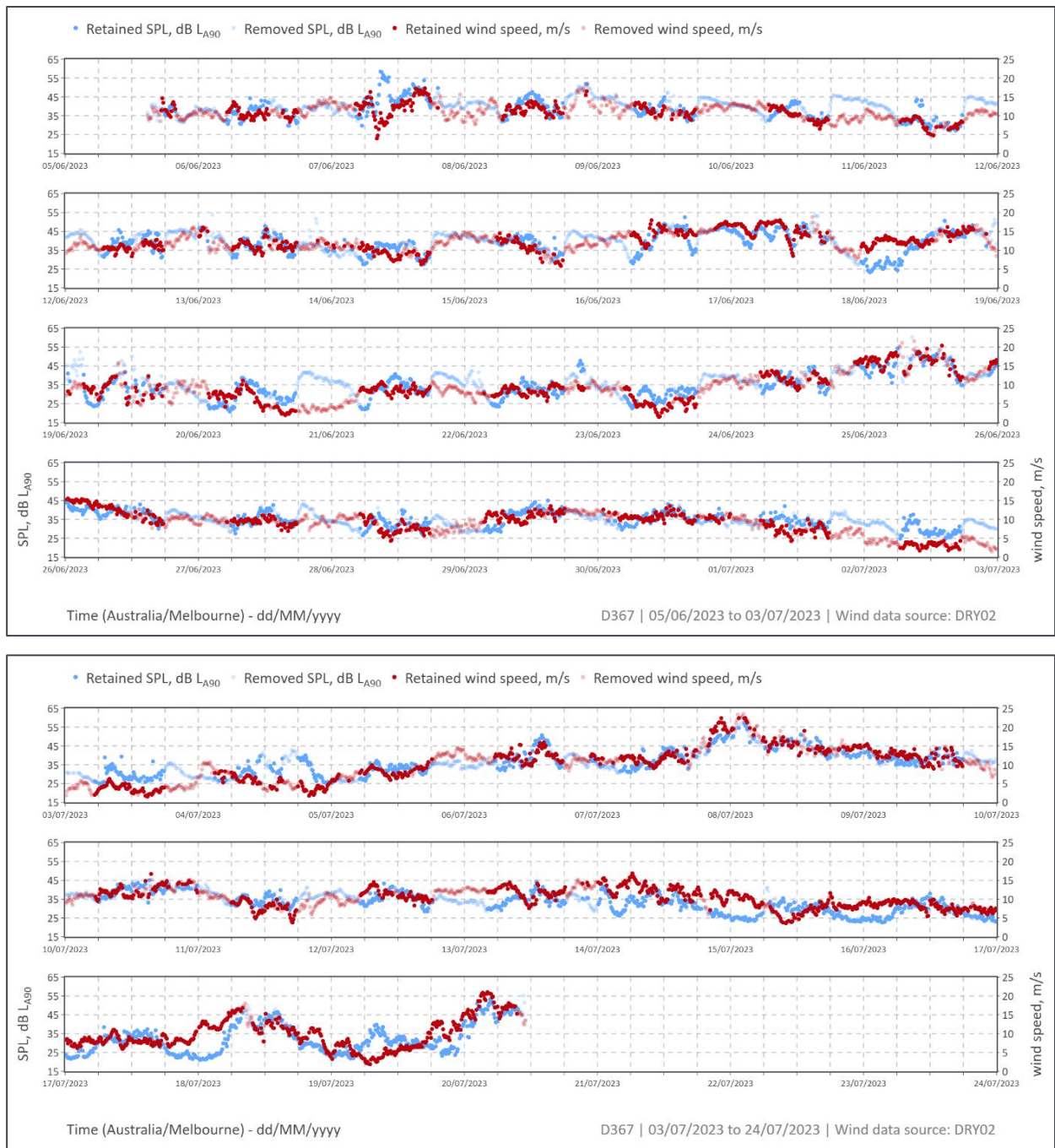


Figure 20: Receiver D367 background noise levels – All-time period

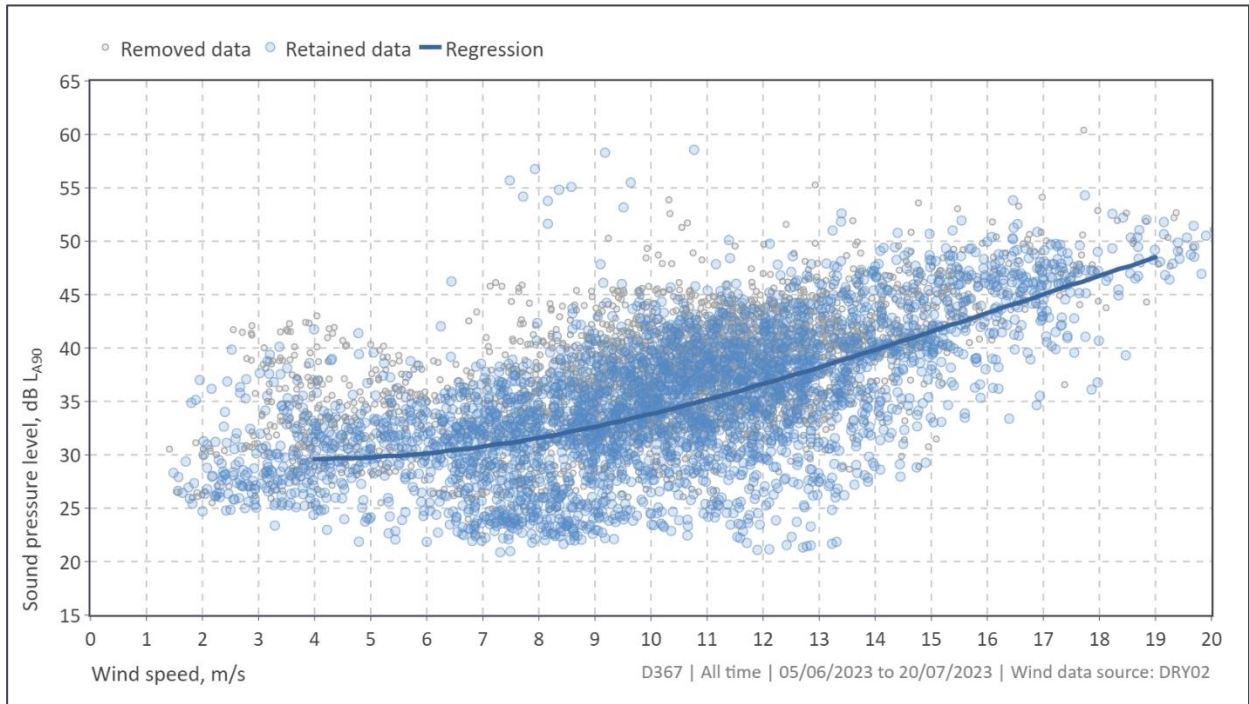
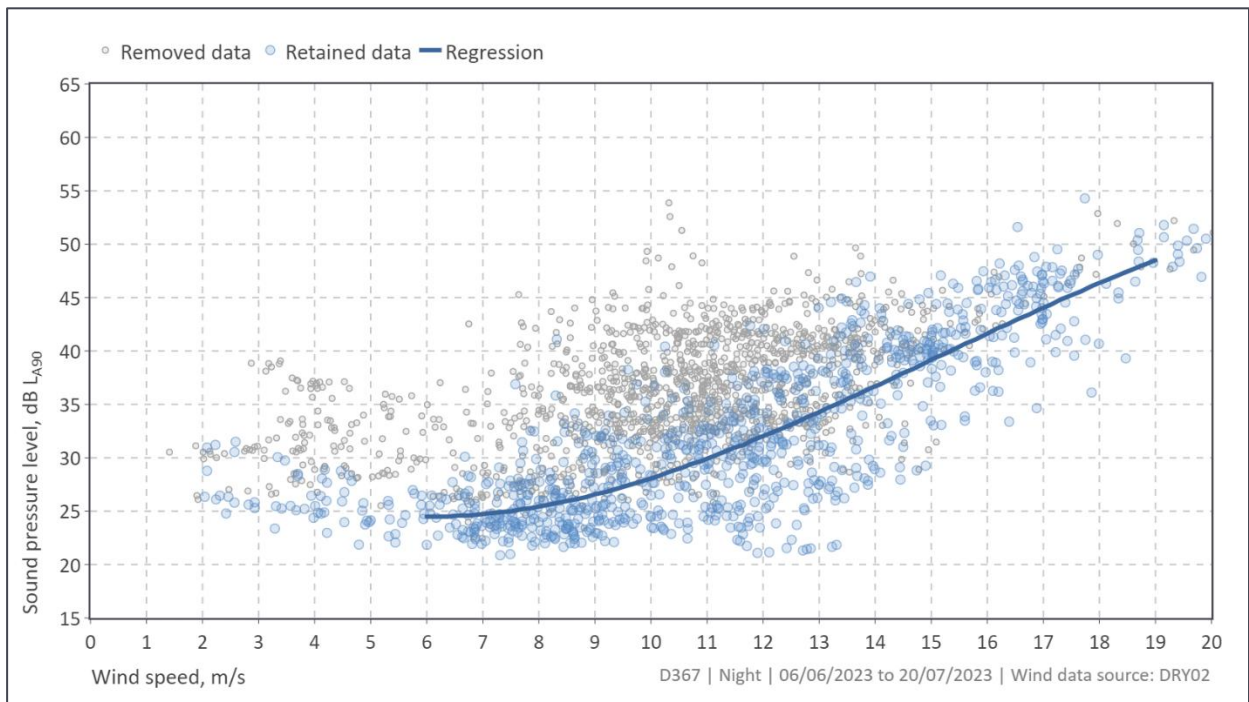


Figure 21: Receiver D367 background noise levels – Night period



APPENDIX K RECEIVER D413 DATA

K1 Receiver D413 noise monitor

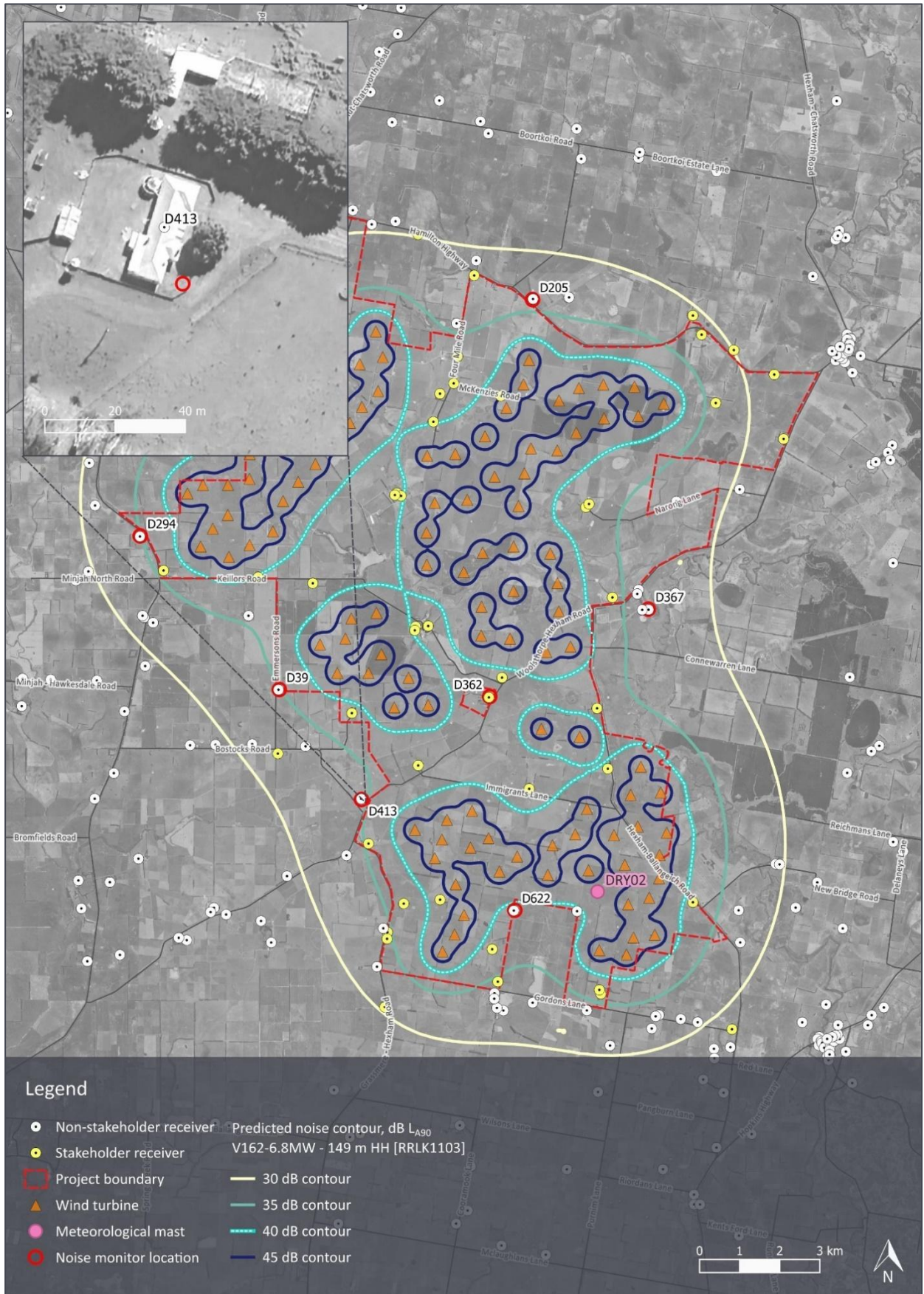
Table 27: Receiver D413 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	636,197	5,782,273
Background noise monitoring location	636,202	5,782,257

Table 28: Receiver D413 monitor installation photos



Figure 22: Receiver D413 - dwelling and noise monitor locations



K2 Receiver D413 measurement data summary

Table 29: Receiver D413 – background noise level analysis summary

Item	All-time period	Night period
Number of data points collected	6,308	2,363
Number of data points removed	2,968	1,522
Number of data points for analysis	3,340	841

Figure 23: Receiver D413 – noise level and wind speed time history

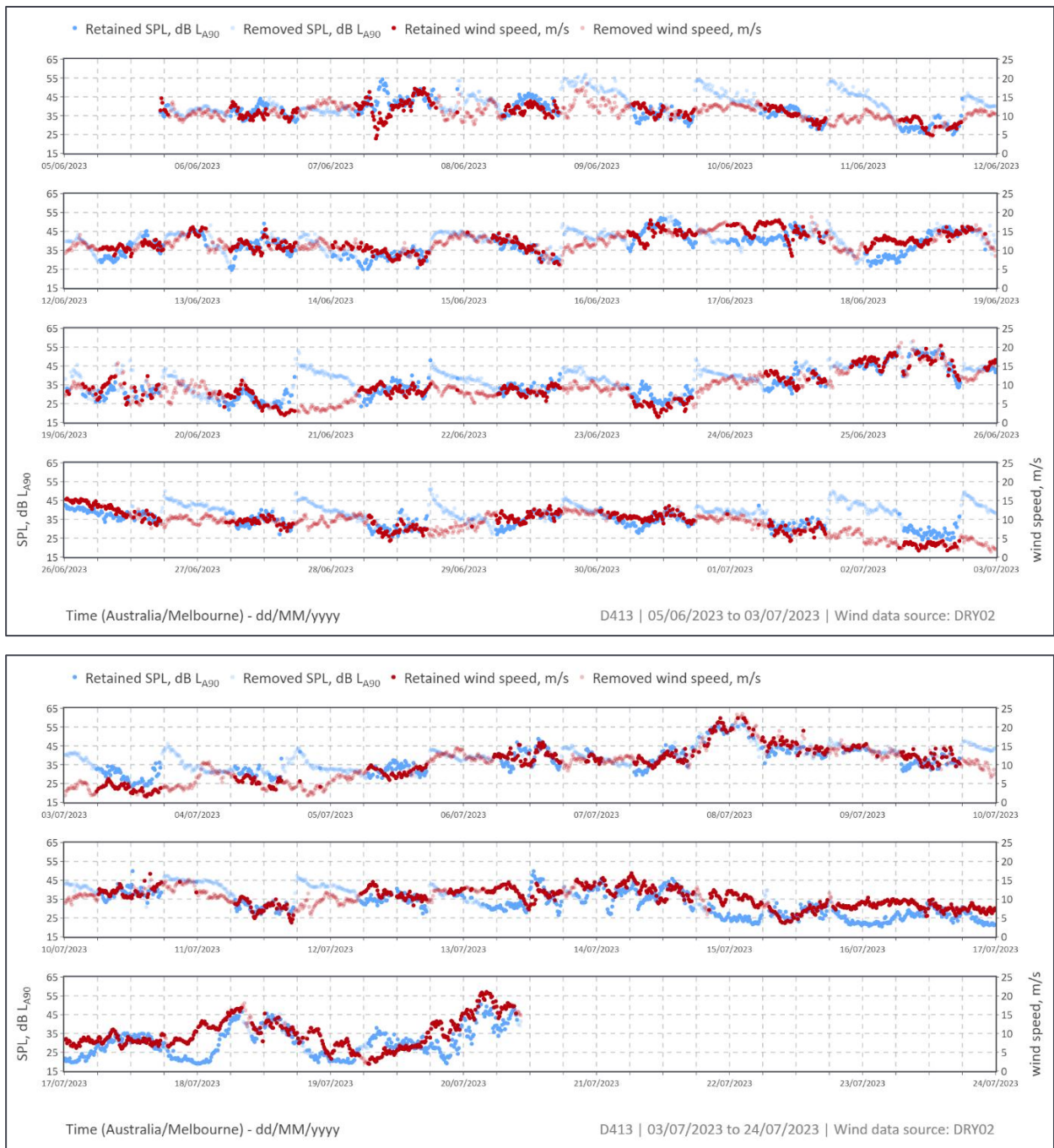


Figure 24: Receiver D413 background noise levels – All-time period

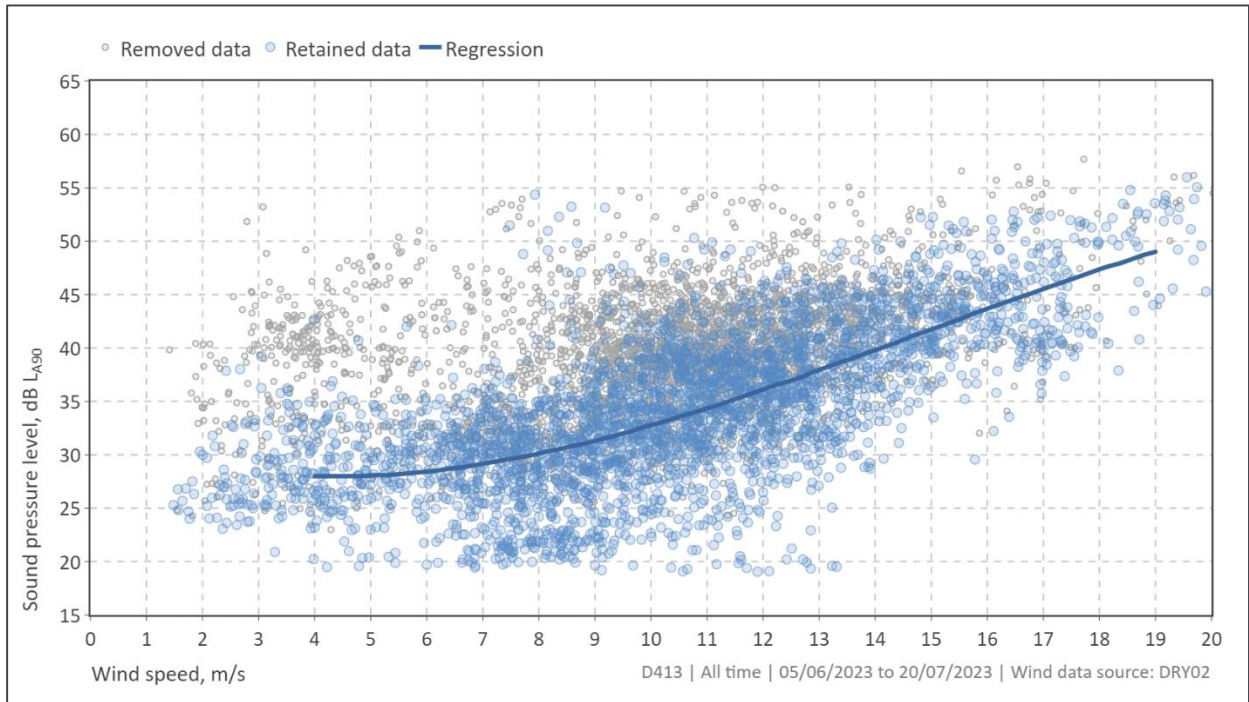
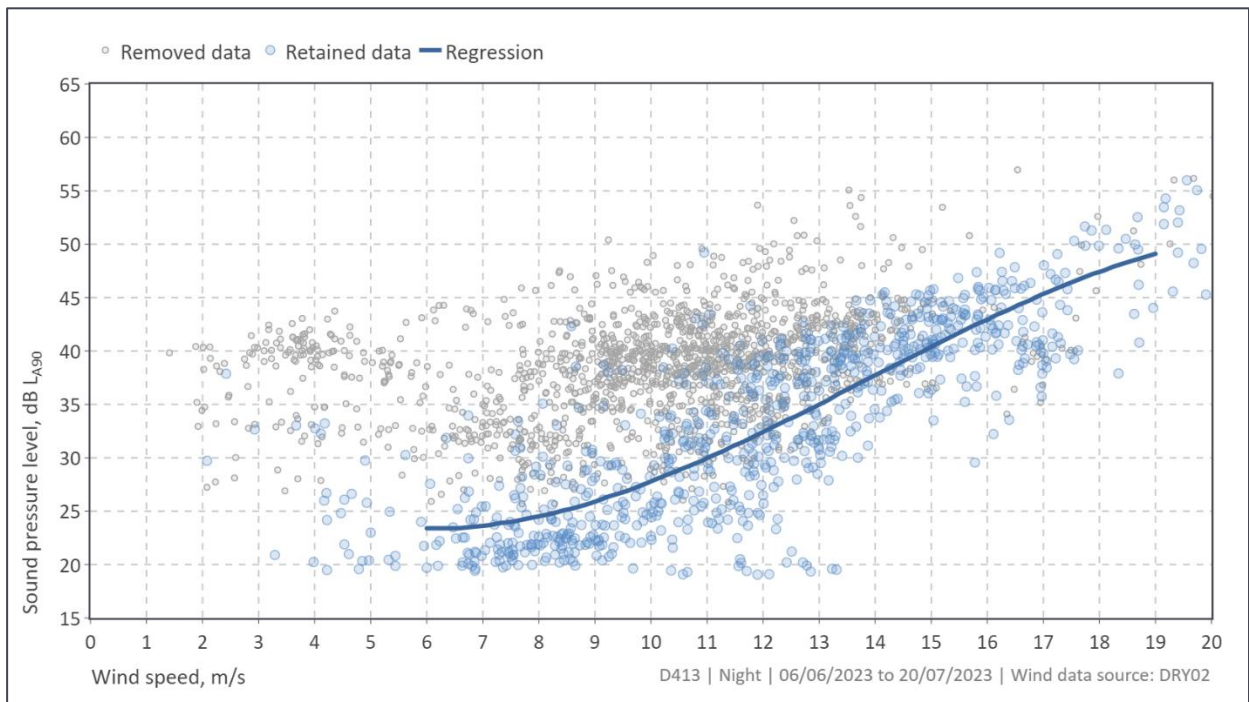


Figure 25: Receiver D413 background noise levels – Night period



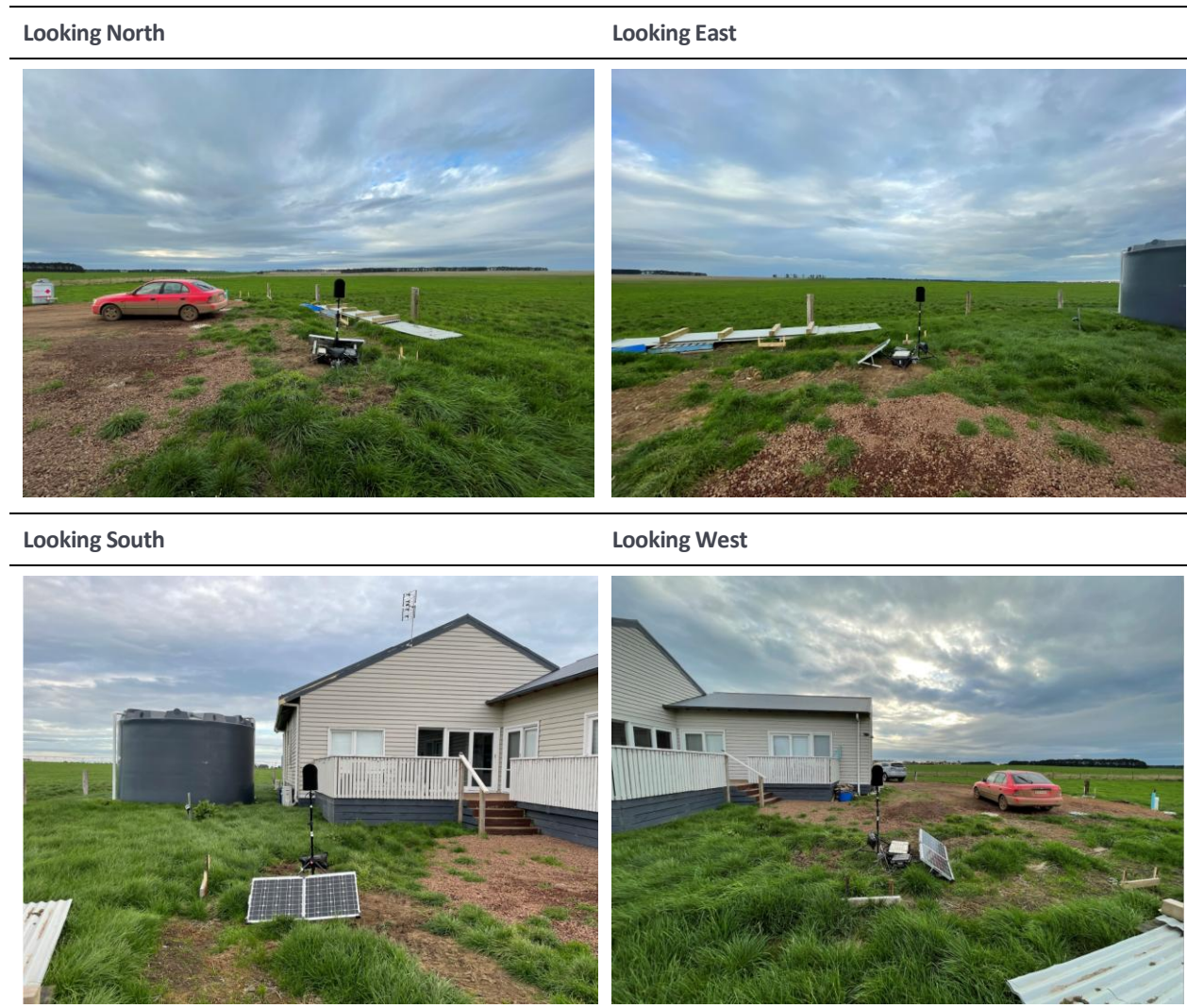
APPENDIX L RECEIVER D622 DATA

L1 Receiver D622 noise monitor

Table 30: Receiver D226 noise monitor coordinates - MGA 2020 zone 54

Location	Easting	Northing
Dwelling location	640,002	5,779,485
Background noise monitoring location	640,026	5,779,494

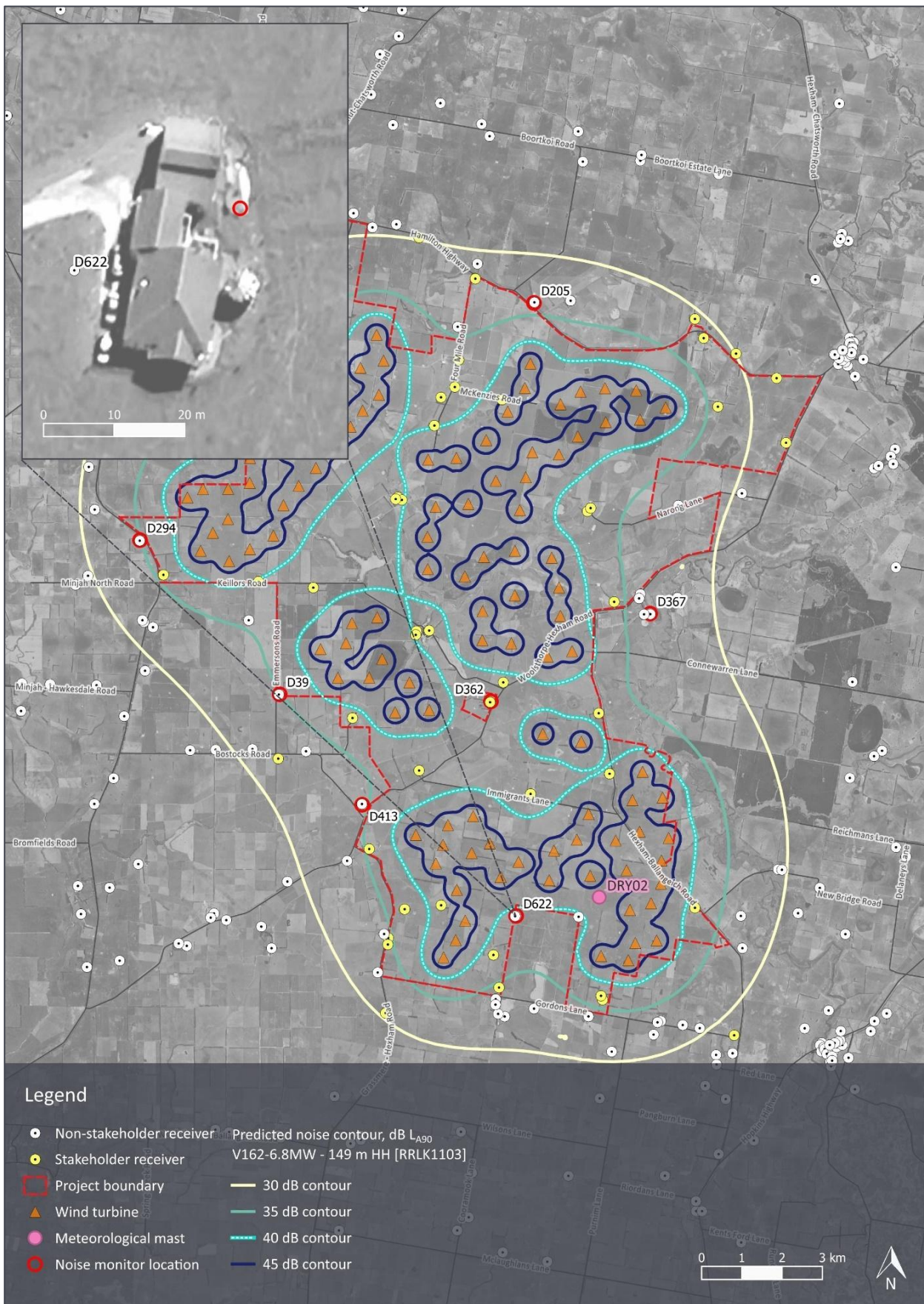
Table 31: Receiver D622 monitor installation photos



Note: Comparison of photos taken at site during deployment and more recent aerial imagery indicates that a new extension to the house, adjacent to the noise monitoring location has been constructed since the survey.

Considering the property was still under development during the survey, background noise monitoring is recommended to be repeated at this location prior to construction of the Project, once development is completed.

Figure 26: Receiver D622 - dwelling and noise monitor locations

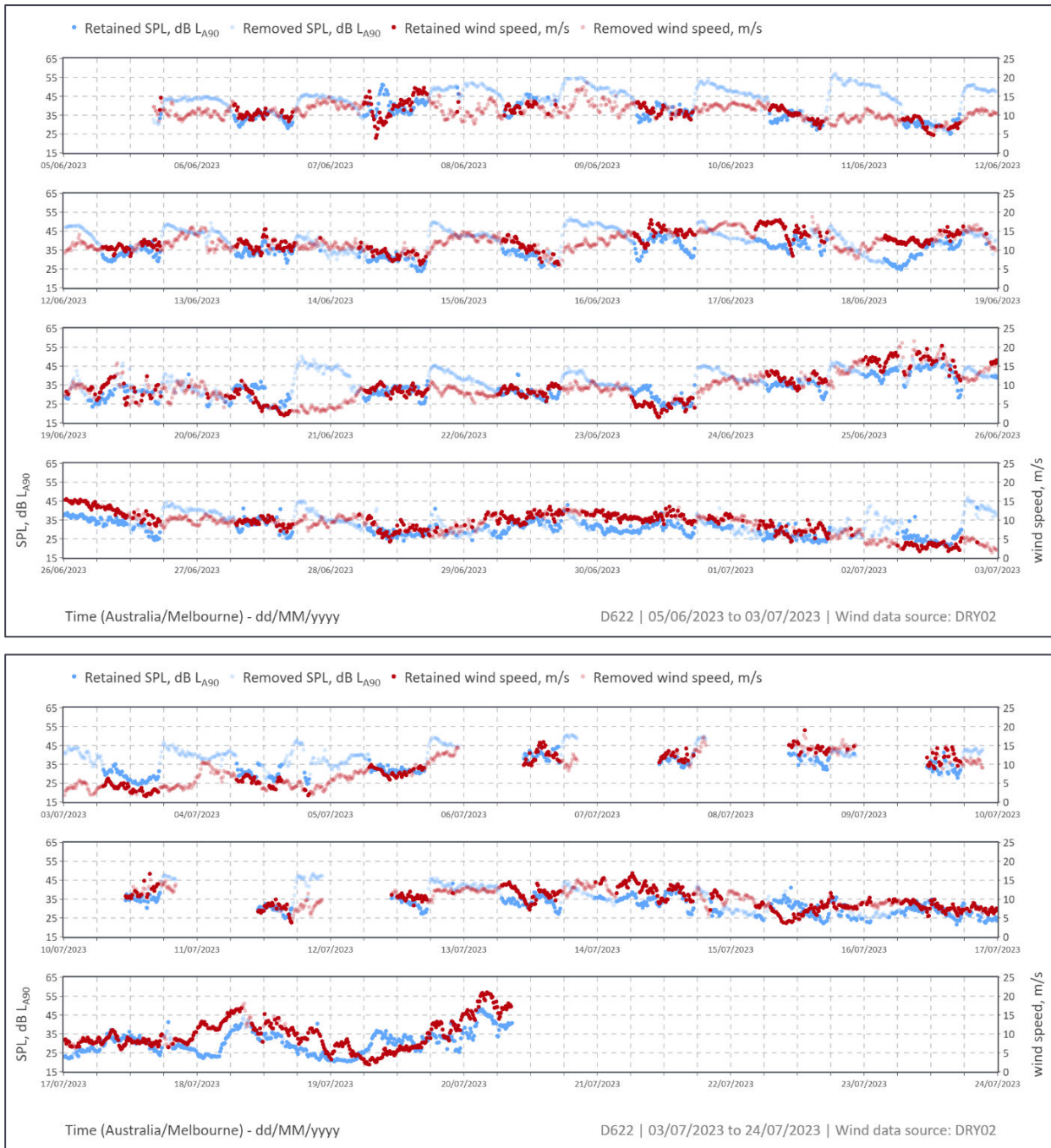


L2 Receiver D622 measurement data summary

Table 32: Receiver D622 – background noise level analysis summary

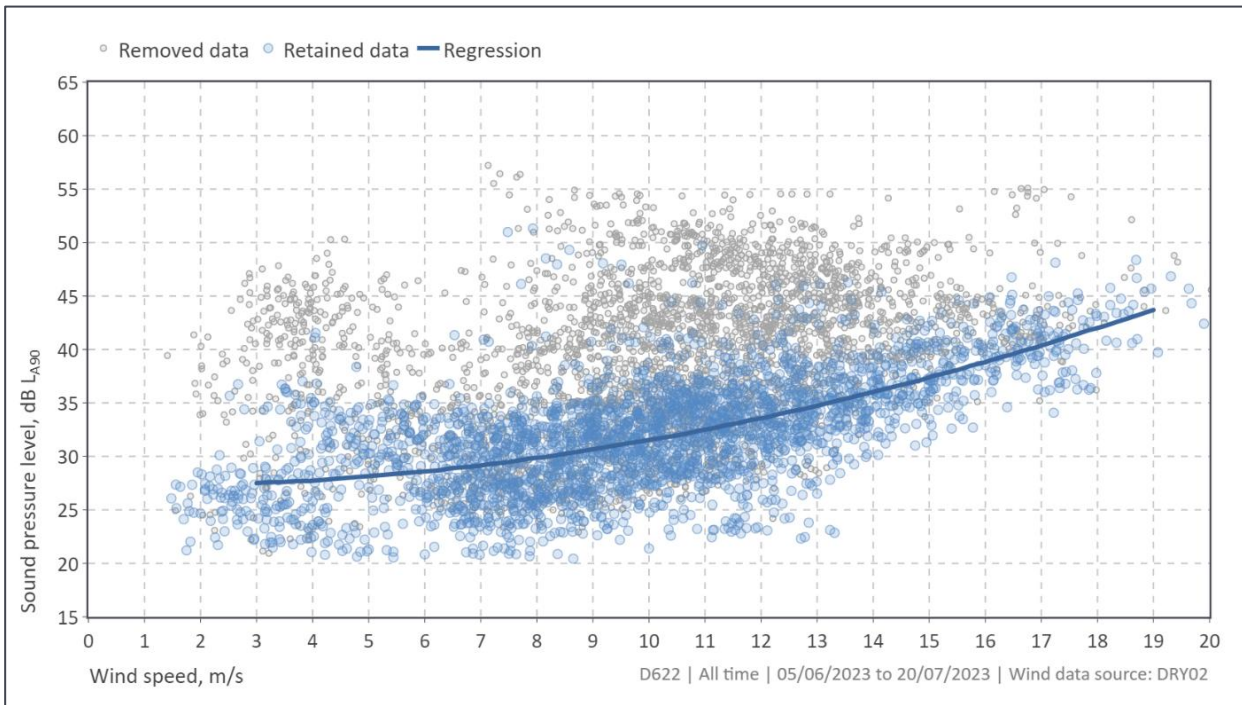
Item	All-time	Night period
Number of data points collected	5,780	2,008
Number of data points removed	3,016	1,476
Number of data points for analysis	2,764	532

Figure 27: Receiver D622 – noise level and wind speed time history ^[1]



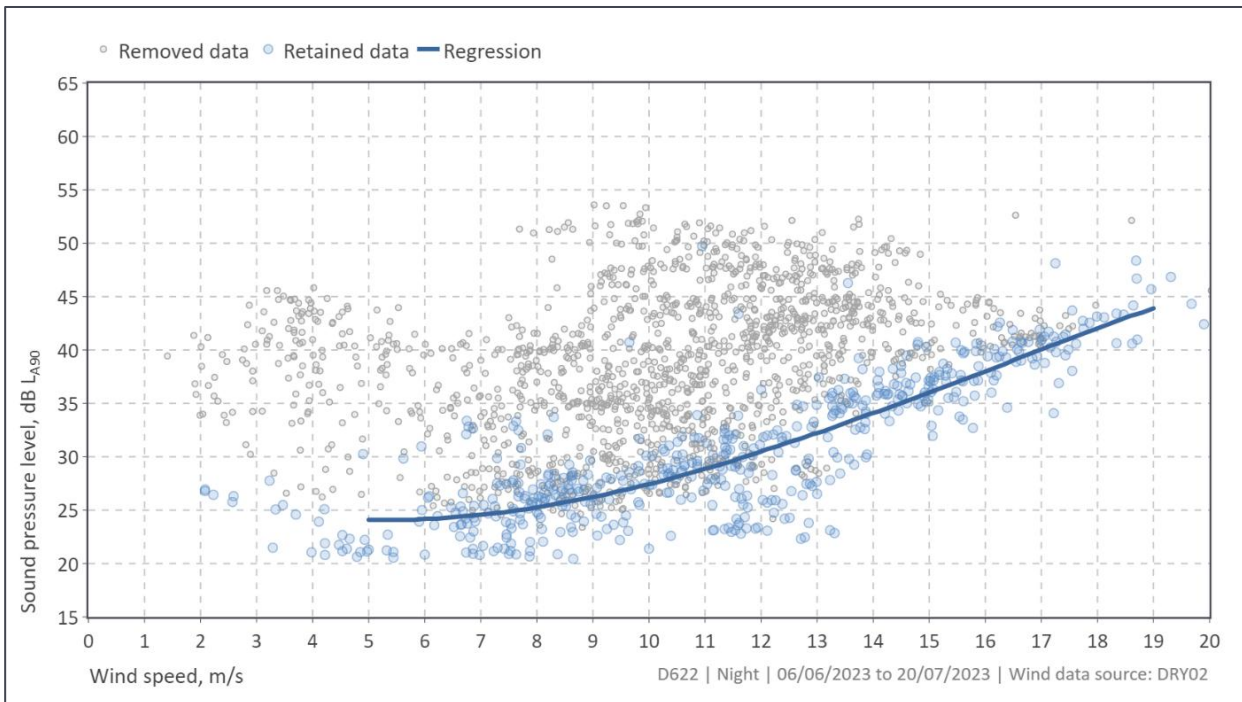
1 Data at this location is presented for information only

Figure 28: Receiver D622 background noise levels – All-time [1]



1 Data at this location is presented for information only

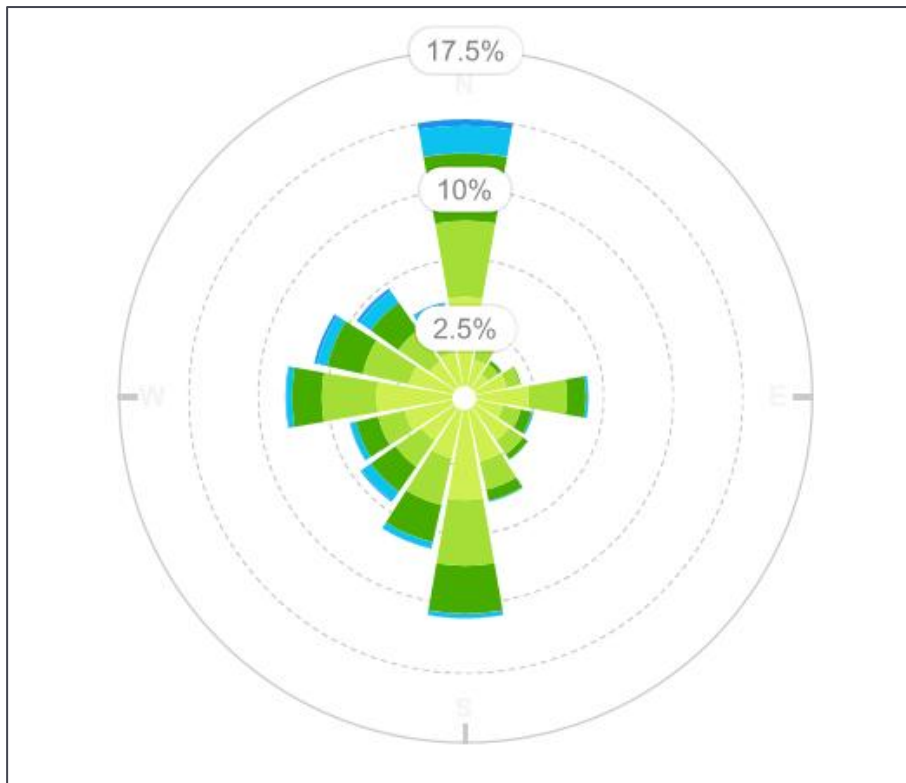
Figure 29: Receiver D622 background noise levels – Night period [1]



1 Data at this location is presented for information only

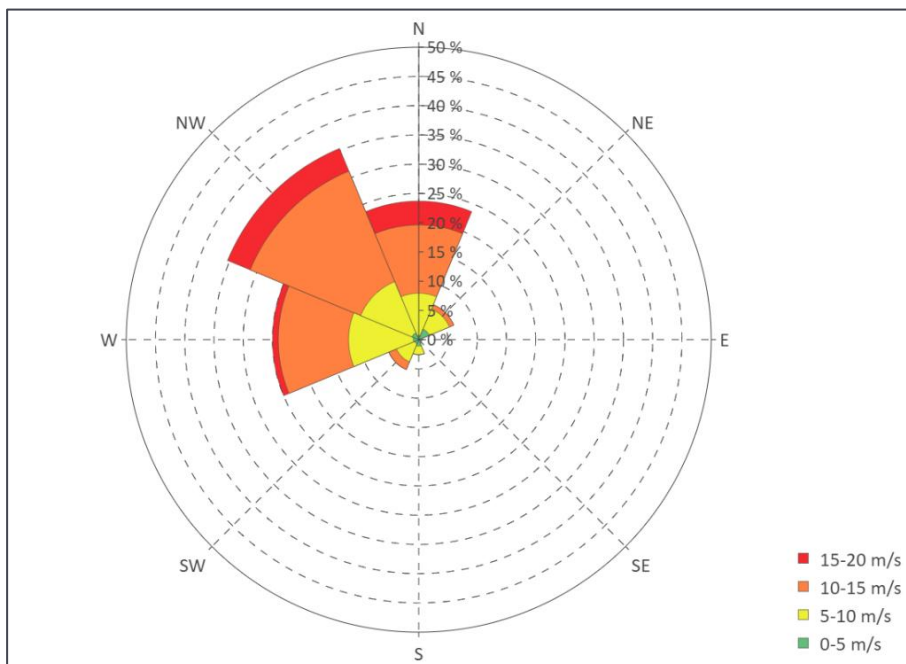
APPENDIX M WIND ROSE

M1 Wind rose – annual average



Bureau of Meteorology Mortlake Racecourse Station 5-year average (October 2019 to October 2024)
Data courtesy of willyweather.com

M2 Wind rose - background noise survey period



Project meteorological mast (5 June to 20 July 2024)

APPENDIX N DOCUMENTATION

Section 8.2 of NZS 6808 specifies the information to be included in a background noise measurement and assessment report. The information requirements, and the report section(s) where the information has been provided, are detailed below.

Table 33: NZS 6808 reporting requirements for background noise monitoring

Section 8.3 subclause	Reporting requirement	Report section
(a)	Description of the sound monitoring equipment including any ancillary equipment	Section 2.2 and Appendix F through Appendix L
(b)	The location of sound monitoring positions	Section 2.1 and Appendix F through Appendix L
(c)	Description of the anemometry equipment including the height AGL of the anemometer	Section 2.2
(d)	Position of wind speed measurements	Section 2.2
(e)	Time and duration of monitoring period	Section 2.2
(f)	Averaging period for both sound and wind speed measurements	Section 2.3
(g)	Atmospheric conditions: the wind speed and direction at the wind farm position and rainfall shall be recorded	Appendix M. Additional data available upon request.
(h)	Number of data pairs measured (wind speed in m/s, background sound in L_{90})	Appendix F through Appendix L
(i)	Description of the regression analysis	Section 2.2 and Appendix E
(j)	Graphical plots showing the data scatter and the regression curves	Appendix F through Appendix L