

Liverpool Range Wind Farm

Mod-3 Application

Predictive Noise Impact Assessment

S5891C40

May 2026

sonus.

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EXECUTIVE SUMMARY

A noise impact assessment for the Liverpool Range Wind Farm (the LRWF) was prepared by SLR Consulting in March 2014, and amended in February 2017, and was used to obtain the initial approval (the Original Development), which was granted in March 2018 (Development Consent SSD 6696). Sonus subsequently prepared an updated noise impact assessment in July 2023 which informed a modification of the project (the Mod-1 Development) in October 2024. The LRWF was modified again (the Mod-2 Development) and approved in October 2025 (SSD-6696-Mod-2). SSD-6696-Mod-2 allows for up to 185 wind turbines with a maximum blade tip height of 215m above ground level (the Approved Development).

A further modification to the Approved Development is proposed, as the Mod-3 Application, and will comprise the following changes:

- A reduction in the number of wind turbines to 173.
- Revised locations for some of the 173 wind turbines.
- Revised locations for the ancillary infrastructure, including on-site collector substations.
- Revised potential concrete batch plant locations.

Scope of Assessment

An updated noise impact assessment has been prepared for the Mod-3 Application considering its material changes and includes:

- Assessment of potential noise impacts associated with the operation of the proposed turbines, including worst-case or highest noise level assumptions/conditions.
- Comparative assessment of worst-case potential noise impacts resulting from the operation of wind turbines between the approved and proposed projects.
- Assessment of potential noise impacts associated with the operation of the ancillary infrastructure, particularly the on-site collector substations.
- Assessment of potential noise impacts from construction activities at the proposed concrete batch plant locations.

The assessment of other potential noise impacts where no material changes are proposed, such as from construction traffic, other construction activities, and blasting, have not been updated. These sections from the previous assessments remain current.

Wind Turbine Predicted Noise Levels

Appropriate criteria for the assessment of wind turbine noise have been determined in accordance with the Development Consent (Schedule 3, Condition 10) and the Department of Planning, Housing and Infrastructure *Wind Energy Guideline – Technical Supplement for Noise Assessment*. The criteria are based on background noise levels measured between 2020 and 2025. The representative criteria determined based on these background noise measurements can be seen in the following table.

Representative Location	Noise Criterion [dB(A)] per Hub Height (129m) Wind Speed										
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s
C2-3	35	35	35	35	36	37	39	40	41	42	45
C4-9	35	35	35	35	35	35	35	35	35	35	37
D7-4	38	38	39	38	39	39	39	39	39	41	41
H7-1	35	35	35	35	35	35	35	35	38	39	42
G6-3	35	35	35	35	36	35	37	37	39	40	43
D4-6	35	35	35	35	35	35	35	35	35	35	37
C6-3	35	35	35	35	35	37	36	37	36	40	43
D6-1	35	35	35	35	35	35	35	35	37	39	42
D6-2	35	35	35	35	36	36	36	37	39	42	44
D6-3	35	35	35	35	36	36	36	36	37	40	43
D7-2	35	35	35	35	35	35	35	35	35	38	41
D7-5	35	36	37	38	38	38	38	39	42	45	46
E3-3	35	35	35	35	35	35	36	36	38	39	41
E5-1	37	37	36	37	37	38	38	38	40	41	42
E5-2	35	35	35	35	35	35	36	37	38	40	41
E5-5	35	35	35	35	35	36	36	37	39	42	43
E5-6	35	35	35	35	35	35	35	35	37	40	41
E10-1	35	35	35	35	35	35	36	40	42	42	44
F2-4	35	35	35	35	35	35	35	35	35	35	36

The noise impact assessment has predicted the noise levels from the operation of the proposed wind turbine layout with Vestas V172 7.2MW wind turbine generators. The predictions have used the ISO 9613-2:2024 noise propagation model, which assumes meteorological conditions which are favourable to noise propagation. The results of the noise predictions indicate that the relevant noise criteria will be achieved at all non-associated residences, and the proposed Mod-3 changes will result in either a reduction or negligible increase in potential noise levels compared to the Approved Development. The highest predicted noise level at a non-associated residence is 35 dB(A) at Residence C4-9 for wind speeds of 10 m/s and above.

An assessment of tonality and low frequency noise was also completed in accordance with the requirements of the *Wind Energy Guideline – Technical Supplement for Noise Assessment*. The one third octave band sound power levels were reviewed and do not indicate that a penalty for tonality will be warranted. The highest predicted C-weighted noise level at a non-associated residence was 57 dB(C), which is below the 60 dB(C) screening criterion. It was therefore determined that no penalties should apply for these characteristics in relation to wind turbine noise. Consideration was also given to the noise at nearby national parks in accordance with the requirements of the *Wind Energy Guideline – Technical Supplement for Noise Assessment*. It was found that the relevant criterion will be easily achieved at all locations within nearby national parks, which are at least 4.5km away from the nearest turbine.

Ancillary Infrastructure Predicted Noise Levels

The predicted noise levels from ancillary infrastructure have been assessed against the requirements of the Development Consent (Schedule 3, Condition 11) with reference to the *NSW Noise Policy for Industry*. A 5 dB(A) penalty for noise character has been conservatively applied for tonal noise associated with the substation transformers. The CONCAWE noise model was used to predict the noise under the worst-case weather conditions for noise propagation. The highest predicted noise level at a non-associated residence for the noise from ancillary infrastructure was less than 15 dB(A) at the outdoor area associated with Residence 2, thus easily achieving the relevant criteria.

Concrete Batch Plant Predicted Noise Levels

The predicted noise levels from the operation of the proposed concrete batch plants have been assessed against the requirements of the *Interim Construction Noise Guideline*, as referenced by the Development Consent (Schedule 3, Condition 6). The assessment conservatively considered all proposed concrete batch plants operating concurrently. A maximum of ten are likely to operate at any one time. The predictions used the CONCAWE noise propagation model under the worst-case weather conditions and included a 5 dB(A) penalty for annoying noise character. The highest predicted noise level at a non-associated residence for the noise from concrete batch plants was 29 dB(A) at Residence C6-3, which will achieve the relevant criteria.

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GLOSSARY

AGL	Above ground level
Ambient noise level	The noise level with the presence of all existing noise sources in the environment
Applicant	Tilt Renewables Australia Pty Ltd as trustee for Liverpool Range Wind Farm Project Trust
Approved Development	The currently approved Liverpool Range Wind Farm Project as modified under Development Consent SSD 6696 on 30 October 2025 (SSD-6696-Mod-2) providing for the construction, operation and decommissioning of up to 185 wind turbines and ancillary infrastructure
Associated residence	Any residence located on land hosting infrastructure or where the Applicant has a negotiated agreement in place with the landowner in relation to impacts associated with the Approved Development, allowing higher noise levels
A-weighting	Frequency adjustment applied to measured noise levels to replicate the frequency response of the human ear
Background noise level	The ambient noise level in the absence of intermittent noise sources
Bulletin	NSW Wind Energy: Noise Assessment Bulletin AB02 (EPA/DPE, 2016)
CONCAWE	The oil companies' international study group for conservation of clean air and water – Europe, 'The propagation of noise from petrochemical complexes to neighbouring communities', May 1981
Conditions of Consent	Consolidated conditions of Development Consent SSD 6696 (as modified) which authorise and regulate the Approved Development
C-weighting	Frequency adjustment applied to measured noise levels to indicate low frequency content
dB(A)	A-weighted noise in decibels
dB(C)	C-weighted noise in decibels
Department	The Department of Planning, Housing and Infrastructure
Development Consent	Development Consent SSD 6696 (as modified) granted under Section 4.38 of the NSW Environmental Planning and Assessment Act 1979 on 30 October 2025 (SSD-6696-Mod-2)
Equivalent noise level	Energy averaged noise level
ICNG	Interim Construction Noise Guideline (DECC, 2009)
Indicative Project Layout	The refined wind farm layout as part of the Mod-3 Application
Intermittent noise sources	Noise caused by infrequently occurring events such as from aircraft, dogs barking, mobile farm machinery, and occasional vehicle movements
ISO 9613-2:2024	ISO 9613-2 Second Edition 2024-01 Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors
L _{A90, time period}	A-weighted noise level exceeded for 90% of the defined time period measured in decibels, representing the background noise level for the defined time period
L _{Aeq, time period}	A-weighted equivalent noise level over a defined time period, measured in decibels
Liverpool Range Wind Farm (LRWF) Project	The development being undertaken by the Applicant to construct, operate and decommission a wind farm and associated infrastructure
Mod-3 Application	The Mod-3 Application reflects the current proposed Indicative Project Layout design refinements to the Approved Development, including revised internal transmission line alignment, micro-siting and relocation of wind turbines, inclusion of communication towers and updated access track alignments. It proposes to remove the approved External Transmission Line between the wind farm's connection substation and the approved connection point at Ulan, as access rights have been granted by the NSW Government to connect LRWF into the Central West Orana Renewable Energy Zone Transmission Line. This connection will now occur within the connection substation on-site off Rotherwood Road

Non-associated residence	Any residence on privately-owned land where the landowner has not reached a financial or in-kind agreement with the Applicant in relation to the Approved Development, where standard noise levels must be achieved
NPfl	NSW Noise Policy for Industry (EPA, 2017)
NSW	New South Wales
Original Development	The original Liverpool Range Wind Farm Project as approved in March 2018 under Development Consent SSD 6696 to allow for the construction, operation and decommissioning of up to 267 wind turbines with a maximum tip height of 165m and associated infrastructure including a transmission line with an indicative capacity of 330 kV from within the wind farm to the approved connection point at Ulan
OSOM	Over size over mass vehicles
Previous Assessment	Sonus report “S5891C20”, dated July 2023
RBL	Rating Background Level
Residence	Any dwelling in existence at the date of submission of this report, or a dwelling that is either the subject of a development consent or a development application that was lodged but not yet determined at the date of submission of this report
RNP	NSW Road Noise Policy (DECCW, 2011)
SA Guidelines	Wind farms environmental noise guidelines (SA EPA, 2009 and updated 2021)
SLR Assessment	SLR Consulting reports “640.10487-R1”, dated 12 March 2014, and “640.10487-R2”, dated 3 February 2017
Sound power level	A measure of the sound energy emitted from a source of noise
SSD	State Significant Development
Technical Supplement	Wind Energy Guideline – Technical Supplement for Noise Assessment (DPHI, 2024)
Wind Turbine Generator	Turbines used for the generation of electricity by wind, including the tower, nacelle, hub, blades and associated components
Worst-case	Conditions resulting in the highest noise level at residences

1 INTRODUCTION

The Liverpool Range Wind Farm (the **LRWF Project**) is located approximately 6kms to the east of Coolah in central New South Wales (**NSW**).

Tilt Renewables Australia Pty Ltd, as trustee for the Liverpool Range Wind Farm Project Trust (the **Applicant**), is seeking to modify the existing State Significant Development (**SSD**) Consent (SSD 6696, as modified) for the LRWF Project through assessment by the *Department of Planning, Housing and Infrastructure* (the **Department**).

The LRWF Project was initially approved in March 2018 and has since been modified twice on 23 October 2024 and 30 October 2025 (the **Approved Development**). The Approved Development consists of up to 185 turbines with a maximum blade tip height of 215m above ground level (**AGL**). The noise related provisions of the Approved Development are provided in Appendix A.

A number of noise impact assessments have previously been completed for the LRWF Project, with the most recent assessment being prepared in response to submissions for the Approved Development. This assessment was summarised in the Sonus report with reference “S5891C20”, dated July 2023 (the **Previous Assessment**). Reference is also made to the assessments completed by SLR Consulting in 2014 and updated in 2017 associated with the Original Development (the **SLR Assessment**).

Following a layout review and design optimisation process, several key changes to the Approved Development are now proposed (the **Mod-3 Application**), as follows:

- A reduction in the number of wind turbines to 173.
- Revised locations for some of the 173 wind turbines.
- Revised locations for the ancillary infrastructure, including on-site collector substations.
- Revised potential concrete batch plant locations.

The coordinates of the proposed turbine, substation, and concrete batch plant locations are provided in Appendix B. The coordinates of the closest residences and their status (associated or non-associated) are provided in Appendix C.

2 DEVELOPMENT CONSENT CONDITIONS

The Development Consent's conditions include objective noise and vibration criteria and form the basis for the predictive noise impact assessment. The relevant conditions are briefly summarised below.

2.1 Wind Turbine Operational Noise

Schedule 3, Condition 10 of the Development Consent requires that noise levels associated with the operation of the wind turbines must not exceed the provided criteria at any non-associated residence. The required criteria are the higher of 35 dB(A) or the existing background noise level ($L_{A90(10\text{-minute})}$) plus 5 dB(A) for each integer wind speed, measured at hub height, from cut-in to rated wind turbine generator power, at any non-associated residence. Appropriate noise criteria have been determined in accordance with this condition and are detailed in Section 3.5 of this report.

Condition 10 also requires that the noise generated by the operation of the wind turbines is to be measured and adjusted for tonality and low frequency noise in accordance with the relevant requirements of the Department's *Wind Energy: Noise Assessment Bulletin* (2016) (the **Bulletin**) or its latest version. The Department has since released the Department's *Wind Energy Guideline – Technical Supplement for Noise Assessment* (the **Technical Supplement**) which is taken to be the latest version of the Bulletin and therefore the appropriate document for any assessment.

Condition 10 notes that these criteria do not apply to residences where the applicant has an agreement to generate higher noise levels (associated residences).

While not specifically addressed in the Development Consent, the Technical Supplement also provides criterion for passive recreation areas in national parks. This criterion states that the predicted noise level, when adjusted for tonality and low frequency noise, should not exceed an L_{eq} of 50 dB(A) for wind speeds of 4 m/s or the cut-in wind speed, whichever is higher.

2.2 Ancillary Infrastructure

Schedule 3, Condition 11 of the Development Consent sets out specific noise level criterion for the operation of ancillary infrastructure for the LRWF Project. This requires that the noise from ancillary infrastructure operation does not exceed 35 dB(A) L_{Aeq} (15-minute) at any non-associated residence. No specific criterion is provided for associated residences.

The condition also requires the noise to be measured in accordance with the requirements of the *NSW Noise Policy for Industry* (the **NPfI**) or its equivalent. The NPfI requires that a correction factor be applied to the measured level if the assessed noise is found to have a character that has the potential to be annoying, such as tonality, modulation, or dominant low frequency content.

2.3 Construction Noise

Schedule 3, Conditions 6, 7, and 7A of the Development Consent relate to the noise from construction and decommissioning activities from the LRWF Project. These conditions requires that the applicant minimise the noise of the development, including any associated traffic noise and ensure that the noise is managed in accordance with the best practice requirements outlined in the *Interim Construction Noise Guideline (2009)* (the **ICNG**).

The conditions provide hours within which works should be conducted (unless agreed upon otherwise by the Planning Secretary). The hours are as follows:

- 7:00am to 6:00pm Monday to Friday;
- 8:00am to 1:00pm Saturdays; and
- at no time on Sundays and NSW public holidays.

As per the conditions, it is noted that the following construction activities may be undertaken outside these hours without approval of the Planning Secretary:

- activities that are inaudible at non-associated residences;
- the delivery of materials requested by the NSW Police Force or other authorities for safety reasons; or
- emergency work to avoid the loss of life, property and/or material harm to the environment.

Condition 7A provides requirements to vary the above hours with the approval of the Planning Secretary.

The Approved Development and the Mod-3 Application turbine and ancillary infrastructure layouts have been compared and the distance to the nearest non-associated residence from these locations is no greater for the Mod-3 Application than the Approved Development. It is therefore expected that there will be no greater impact from construction activity at turbine and ancillary infrastructure sites on the nearby non-associated residences as part of the Mod-3 Application.

Notwithstanding the above, 19 potential temporary construction compound locations, which may include a concrete batch plant, are now proposed for possible use during construction. The maximum number of locations that will be used during construction is up to ten. An updated assessment has therefore been made of these batch plant locations. It is noted that a maximum of ten concrete batch plants will be operational at any one time, however as a conservative approach, this assessment has considered concrete batch plants operating concurrently at all temporary construction compound locations.

The noise level from operation of the concrete batch plants has been predicted and compared against criteria determined in accordance with the ICNG, as referenced by the Development Consent conditions. The ICNG places an emphasis on implementing “feasible” and “reasonable” noise reduction measures and does not set mandatory objective criteria, rather it provides “management levels” based on the existing background noise environment.

The Rating Background Level (**RBL**), as defined in the NPfI, is used to determine the management levels. The RBL is determined from the lower tenth percentile of the measured background noise levels (L_{A90} (15-minute)) in the environment, effectively representing the quietest periods of the environment. The NPfI also notes that a minimum RBL applies. For this assessment, the minimum RBL has been used, that is, a level of 35 dB(A) during the day and a level of 30 dB(A) during the evening and night. It is noted that the minimum RBL typically applies in a rural environment such as this.

The ICNG framework to address construction activity has been reproduced in Table 1. The recommended hours from the ICNG are noted to match the hours required in accordance with the Development Consent conditions. The predicted noise levels from concrete batching activities have been compared to these management levels. It is noted that works outside the hours specified in the Development Consent are not expected to be frequent, however are allowed without further approval where they are inaudible at non-associated residences.

Table 1: ICNG Noise Management Levels

Time of Day	Management Level L_{Aeq} (15-minute)	How to Apply
Recommended standard hours: Monday to Friday: 7:00am to 6:00pm Saturday: 8:00am to 1:00pm No work on Sundays or NSW public holidays	Noise affected RBL + 10 dB = 45 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured L_{Aeq} (15-minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. - The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. - Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near dwellings). - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB = 35 dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

2.4 Traffic Noise

The Development Consent requires that the wind farm developer provide noise mitigation measures to specific residences in the vicinity of the LRWF Project upon written request to mitigate noise from construction traffic. Schedule 3, Condition 5 lists four non-associated residences where additional noise mitigation measures are to be implemented on written request. Example mitigation measures are also listed and include double glazing, insulation, fencing, and/or air conditioning.

Three of the identified residences (D7-3, E7-1, E9-3) were noted in the SLR Assessment as being less than 50m from a public road proposed to be used during construction. Residence D7-4 is noted to be set back approximately 60m from a public road proposed to be used during construction and has expressed concerns relating to traffic associated with the LRWF Project. The SLR Assessment established the appropriate criterion as 55 dB(A) in accordance with the *NSW Road Noise Policy (2011)* (the **RNP**).

The SLR Assessment for the Original Development assessed traffic noise based on approximately 300 vehicle movements per day. As part of the Mod-3 Application some minor changes are proposed to the traffic route. This consists of removing the public road upgrades and most of the use of Turee Vale Road. The removal of this access route will slightly increase the proportion of traffic using the other access routes. However, due to a longer construction program, improved cluster staging, and a redistribution of construction activities, the overall level of traffic on the remaining routes will be less than that previously approved. As such, there have been no updates to the traffic noise assessment, and the findings of the SLR Assessment for the Original Development are considered to still be relevant.

It is also noted that two of the residences identified in the Development Consent as eligible for noise mitigation measures, D7-3 and D7-4, are located on Turee Vale Road. As there is no longer the potential for traffic noise impacts along this road, additional noise mitigation should not be required. The other two identified residences, E7-1 (Rotherwood Road) and E9-3 (Vinegaroy Road), are noted to still be along planned access routes.

It is understood that over size over mass (**OSOM**) vehicles used for the delivery of large components may be required to travel overnight to reduce traffic and safety impacts. While this may result in traffic noise occurring outside of the hours required under Schedule 3, Condition 7 of the Development Consent, this condition also allows for the delivery of materials to occur outside of these hours if required for safety reasons. Therefore, if OSOM vehicles are required to travel at night, this will still be in accordance with the requirements of the Development Consent.

2.5 **Blasting**

Schedule 3, Conditions 8 and 9 of the Development Consent specify that any blasting activity associated with the LRWF Project must achieve the criteria reproduced in Table 2 and only occur between these hours:

- 9:00am to 5:00pm Monday to Friday.
- 8:00am to 1:00pm on Saturdays.

No blasting is allowed at any time on Sundays or NSW public holidays.

Table 2: Blasting Criteria

Location	Airblast Overpressure [dB(Lin Peak)]	Ground Vibration [mm/s]	Allowable Exceedance
Any non-associated residence	120	10	0%
	115	5	5% of the total number of blasts or events over a rolling period of 12 months

The SLR Assessment noted that blasting may be required in some circumstances for the excavation of turbine foundations. The smallest separation distance between a wind turbine and the closest non-associated residence (2.3km to Residence C6-3) is not proposed to be reduced as a result of the Mod-3 Application. Based on this, it is expected that no greater impact from blasting activity can result at a non-associated residence from the Mod-3 Application and the condition remains valid.

3 BACKGROUND NOISE MONITORING

Contemporary background noise monitoring has previously been conducted at 19 locations in the vicinity of the proposed wind farm over three separate periods between 2020 and 2025. The background noise monitoring was conducted in accordance with the Bulletin and the Technical Supplement, as was relevant at the time of the noise monitoring. The noise monitoring locations are provided in Table 3 and highlighted in Figure 1.

Table 3: Background Noise Monitoring Locations

Monitoring Location	Coordinates (UTM WGS84 55 H)		Monitoring Period
	Easting	Northing	
C2-3	764158	6490343	13/10/2020 – 27/11/2020
C4-9	764350	6480591	13/10/2020 – 27/11/2020
D7-4	768496	6469772	13/10/2020 – 27/11/2020
H7-1	785148	6465087	14/10/2020 – 27/11/2020
G6-3	783754	6473512	14/10/2020 – 27/11/2020
D4-6	768408	6481476	02/08/2023 – 12/09/2023
C6-3	763902	6471239	12/02/2025 – 25/03/2025
D6-1	769205	6472223	13/02/2025 – 26/03/2025
D6-2	769454	6471620	13/02/2025 – 26/03/2025
D6-3	769442	6471867	13/02/2025 – 26/03/2025
D7-2	767481	6468175	12/02/2025 – 18/03/2025
D7-5	769561	6469189	12/02/2025 – 25/03/2025
E3-3	774839	6485074	13/02/2025 – 26/03/2025
E5-1	773109	6475192	13/02/2025 – 26/03/2025
E5-2	773097	6475080	13/02/2025 – 26/03/2025
E5-5	774522	6478267	13/02/2025 – 26/03/2025
E5-6	774589	6478053	13/02/2025 – 26/03/2025
E10-1	771891	6453007	12/02/2025 – 25/03/2025
F2-4	776431	6492342	13/02/2025 – 26/03/2025

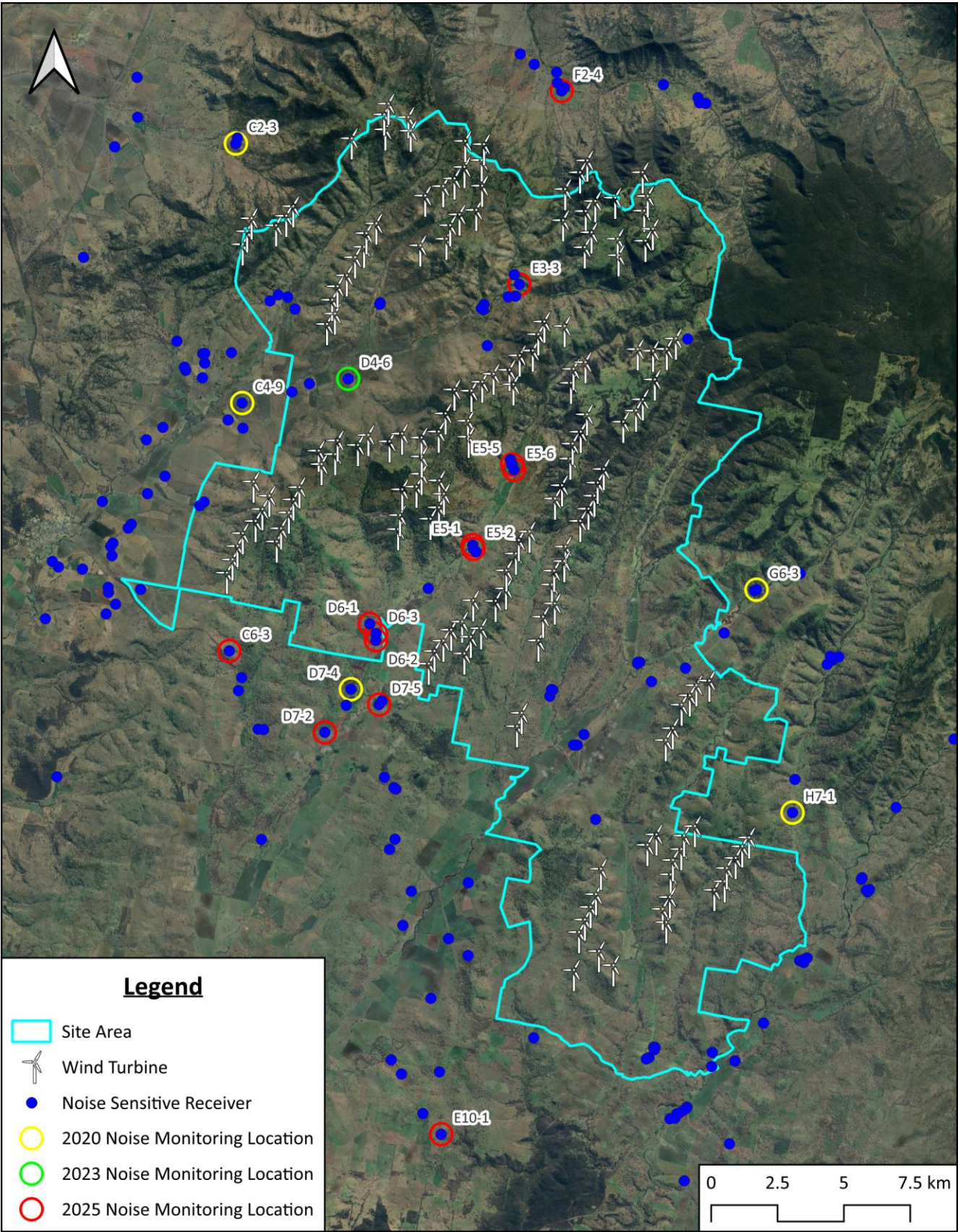


Figure 1: Background Noise Monitoring Locations

3.1 Equipment

A noise logger was positioned on the wind farm side of each dwelling between 5m and 30m from the dwelling in accordance with the South Australian EPA document *Wind farms environmental noise guidelines* (2009, updated 2021) (the **SA Guidelines**), as referenced by the Technical Supplement. As the wind interaction with large trees can generate noise, particularly at higher wind speeds, the noise logger was also placed at an equivalent distance to large trees as the dwelling is from those trees.

The background noise was measured in 10-minute intervals using a combination of Rion Class 1 and Class 2 sound level meters with a noise floor of less than 20 dB(A), calibrated at the beginning and the end of the period with a Rion NC-74 or Rion NC-75 calibrator, with no significant drift observed. The microphones were positioned approximately 1.5m above ground level and fitted with Rion WS-15 double layer all weather windshields. An example of a typical on-site setup is shown in Figure 2.



Figure 2: Typical Monitoring Location Setup

3.2 Hub Height Wind Speed

During the background noise monitoring regimes, the wind speed was measured in 10-minute intervals at a number of locations around the wind farm site. Table 4 provides the relevant wind speed measurement location for each noise monitoring location, as provided by DNV. The wind data were sheared to a hub height of 129m before being provided to Sonus. Times where wind speed data were missing have been excluded from analysis.

Table 4: Closest Wind Measurement Location for Each Noise Monitoring Location

Monitoring Location	Wind Monitoring Equipment
C2-3	LVP07
C4-9	LVP01
D7-4	LVP01
H7-1	ZX_Fujin_01
G6-3	ZX_Fujin_01
D4-6	WLS7_7167_01
C6-3	LVP01
D6-1	LVP13
D6-2	LVP13
D6-3	LVP13
D7-2	LVP13
D7-5	LVP13
E3-3	LVP09
E5-1	ZX_Hurukan_01
E5-2	ZX_Hurukan_01
E5-5	LVP12
E5-6	LVP12
E10-1	WLS7_7093_02
F2-4	LVP09

3.3 Data Analysis

During the background noise monitoring periods, local wind and rain at the microphone location (approximately 1.5m above ground level) were measured using “Rainwise” wind and rain loggers positioned at various locations around the wind farm site.

The rainfall and wind speed data measured at ground level were used to determine the periods when local weather may have affected the background noise measurements. Data were excluded when any rainfall was measured in a period or the periods either side of the period in question, and/or when the measured wind speed at the microphone height exceeded 5 m/s for more than 90% of the measurement period. For locations where local weather was not measured, the conditions at the nearest weather monitoring location have been taken as representative.

Any data for hub height wind speeds below the cut-in wind speed and above the wind speed of rated power of the turbine were also removed, that is any data for a hub height wind speed less than 3 m/s or greater than 13 m/s. In addition, data points when equipment was being set up or collected have also been removed. Intermittent noise sources, such as the noise from dogs barking or passing cars, are inherently excluded as the $L_{A90, 10\text{-minute}}$ measured considers only the level of noise that is exceeded for 90% of the 10-minute time period.

The measured noise levels during the 2025 period were noted to be higher than expected for a rural area such as this. Upon review of audio recordings associated with the noise monitoring, it was found that the measurements were dominated by the noise from insects for the majority of the measurement period at all measurement locations. The noise from insects was primarily concentrated at high frequencies (3.15kHz and above). Previous noise predictions for the noise from the LRWF Project indicate that the noise from the wind farm will not be dominant in these frequencies, and therefore these frequencies are not important for determining noise criteria. As such, the noise contribution from frequencies of 3.15kHz and above to the overall noise level have been removed and the overall noise level ($L_{A90, 10\text{-minute}}$) recalculated. This adjusted noise data has then been used to perform all further analysis.

After the data removal procedure, the following number of data points remained for each of the monitoring locations, as shown in Table 5. A downwind direction is considered to be the worst-case wind direction and is defined in the SA Guidelines as a wind direction spread of 45° on either side of the direct line between the nearest wind turbine and the relevant receiver.

Table 5: Data Points per Monitoring Location

Monitoring Location	Monitoring Period	Total Data Points	Total Downwind Data Points	Total Data Points After Filtering
C2-3	13/10/2020 – 27/11/2020	6461	1999	4949
C4-9	13/10/2020 – 27/11/2020	6451	1310	4812
D7-4	13/10/2020 – 27/11/2020	6455	2458	4807
H7-1	14/10/2020 – 27/11/2020	6372	943	4797
G6-3	14/10/2020 – 27/11/2020	6372	754	4790
D4-6	02/08/2023 – 12/09/2023	5907	1670	4889
C6-3	12/02/2025 – 25/03/2025	5888	1296	3830
D6-1	13/02/2025 – 26/03/2025	5899	3456	4256
D6-2	13/02/2025 – 26/03/2025	5892	3436	4254
D6-3	13/02/2025 – 26/03/2025	5898	3461	4258
D7-2	12/02/2025 – 18/03/2025	4895	673	3519
D7-5	12/02/2025 – 25/03/2025	5890	747	4307
E3-3	13/02/2025 – 26/03/2025	5894	2596	4660
E5-1	13/02/2025 – 26/03/2025	5888	591	4461
E5-2	13/02/2025 – 26/03/2025	5887	637	4461
E5-5	13/02/2025 – 26/03/2025	5897	523	4345
E5-6	13/02/2025 – 26/03/2025	5897	505	4345
E10-1	12/02/2025 – 25/03/2025	5902	627	4753
F2-4	13/02/2025 – 26/03/2025	5892	2586	4655

3.4 Background Noise Correlation

Following the data removal, the background noise data collected at each monitoring location were correlated with the sheared wind speed at 129m above ground level for each 10-minute period. The correlated noise data were then split into wind speed bins as required by the SA Guidelines. Each wind speed bin is generally 1 m/s wide and is centred on the integer wind speeds between the cut-in wind speed and the wind speed of rated power. The arithmetic average noise level for each wind speed bin was then determined to give the background noise level at each integer wind speed. The data and the resultant average noise levels are shown on the figures in Appendix D.

Table 6 summarises the background noise level for each integer wind speed at a hub height of 129m between 3 m/s and 13 m/s.

Table 6: Background Noise Levels ($L_{A90, 10min}$) at Monitoring Locations

Monitoring Location	Background Noise Level [dB(A)] per Hub Height (129m) Wind Speed										
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s
C2-3	29	29	30	30	31	32	34	35	36	37	40
C4-9	28	28	28	29	29	29	29	28	29	30	32
D7-4	33	33	34	33	34	34	34	34	34	36	36
H7-1	28	28	28	29	29	29	30	30	33	34	37
G6-3	30	30	30	30	31	30	32	32	34	35	38
D4-6	23	23	23	24	25	26	25	25	26	27	32
C6-3	28	28	28	29	30	32	31	32	31	35	38
D6-1	28	29	29	30	29	30	29	30	32	34	37
D6-2	27	28	30	30	31	31	31	32	34	37	39
D6-3	27	28	29	30	31	31	31	31	32	35	38
D7-2	25	25	26	27	26	26	27	27	29	33	36
D7-5	30	31	32	33	33	33	33	34	37	40	41
E3-3	28	28	29	29	30	30	31	31	33	34	36
E5-1	32	32	31	32	32	33	33	33	35	36	37
E5-2	28	28	29	30	29	30	31	32	33	35	36
E5-5	30	30	30	30	30	31	31	32	34	37	38
E5-6	28	26	27	27	27	28	29	30	32	35	36
E10-1	24	24	25	26	27	29	31	35	37	37	39
F2-4	26	25	26	27	27	27	27	28	29	29	31

3.5 Wind Turbine Criteria

The Technical Supplement provides limits for noise to be achieved at each relevant non-associated receiver. The base noise limits are provided for each integer wind speed between the cut-in wind speed and wind speed of rated power for the wind turbine. It is noted that the Technical Supplement does not contain criteria for associated residences. The Technical Supplement requires the following:

The predicted equivalent noise level ($L_{Aeq, 10min}$), adjusted for tonality and low-frequency noise, should not exceed 35 dB(A) or the background noise ($L_{A90, 10min}$) by more than 5 dB(A), whichever is greater, at all relevant receivers for wind speed from cut-in to rated power of the wind turbine generator and each integer wind speed in between.

For residences where background noise monitoring was not conducted, the background noise monitoring location that best represents the residence, when considering factors such as distance, elevation, and level of vegetation, has been chosen. The representative monitoring location for each residence can be seen in Appendix C. Based on the background noise measurements, applicable criteria have been determined for non-associated receivers based on the representative monitoring locations. The resultant criteria can be seen in Table 7.

Table 7: Non-Associated Residence Noise Criteria

Representative Location	Applicable Residence ID	Noise Criterion [dB(A)] per Hub Height (129m) Wind Speed										
		3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s
C2-3	C2-3, C2-4, 3, 4, 6, 8, 9, 14	35	35	35	35	36	37	39	40	41	42	45
C4-9	B5-6, B5-7, B6-4, B6-10, C4-1, C4-2, C4-3, C4-4, C4-5, C4-6, C4-7, C4-9, C5-1, C5-2, C5-3, C5-4, C5-5, C5-6, C5-9, 30, 31, 32	35	35	35	35	35	35	35	35	35	35	37
D7-4	D7-3, D7-4	38	38	39	38	39	39	39	39	39	41	41
H7-1	G9-3, H7-1, H7-2, H7-3, H7-4, H7-5, H7-6, H7-7, H7-8, H8-1, H8-2, H8-3, H8-4, H8-5, H9-1, H9-2, H9-3, H9-4, 1	35	35	35	35	35	35	35	35	38	39	42
G6-3	G6-2, G6-3, G6-4, H6-1, H6-2, H6-3, H6-4, H6-5	35	35	35	35	36	35	37	37	39	40	43
D4-6	-	35	35	35	35	35	35	35	35	35	35	37
C6-3	B6-7, B6-8, B6-9, B6-11, B6-12, C6-3, C6-4, C7-1, 33	35	35	35	35	35	37	36	37	36	40	43
D6-1	-	35	35	35	35	35	35	35	35	37	39	42
D6-2	-	35	35	35	35	36	36	36	37	39	42	44
D6-3	-	35	35	35	35	36	36	36	36	37	40	43
D7-2	C7-2, D7-1, E8-5, E9-2, E9-4, 15, 16, 17, 18, 27	35	35	35	35	35	35	35	35	35	38	41
D7-5	D7-7, E7-1, E7-2, 2	35	36	37	38	38	38	38	39	42	45	46
E3-3	-	35	35	35	35	35	35	36	36	38	39	41
E5-1	-	37	37	36	37	37	38	38	38	40	41	42
E5-2	-	35	35	35	35	35	35	36	37	38	40	41
E5-5	-	35	35	35	35	35	36	36	37	39	42	43
E5-6	-	35	35	35	35	35	35	35	35	37	40	41
E10-1	E9-3, E10-1, F9-1, G10-1, G10-2, G10-3, G10-4, G10-5, G10-7, G10-8, G10-9, G10-10, 19, 20, 21, 29	35	35	35	35	35	35	36	40	42	42	44
F2-4	F2-1, F2-2, F2-3, F2-4, F2-5, G2-1, 10, 11, 12, 13	35	35	35	35	35	35	35	35	35	35	36

4 ASSESSMENT

Updates to the Previous Assessment for the Approved Development have been made where changes have been proposed. Where there are no proposed changes to a component of the LRWF Project as part of the Mod-3 Application, the results of the Previous Assessment for the Approved Development will remain valid.

4.1 Wind Turbine Layout and Details

The noise from the revised wind farm layout of up to 173 turbines has been predicted based on the Vestas V172 7.2MW turbine and a 129m hub height. The proposed coordinates of the wind turbines are provided in Appendix B.

The sound power levels for the candidate Vestas V172 7.2MW turbine under the Normal Operating Mode with serrated blade edges are summarised in Appendix E. Serrated blade edges are designed to optimise airflow and reduce noise. The sound power levels are based on the provided manufacturer's specification. Specifications typically include an inherent allowance for uncertainty, so no further adjustment for uncertainty has been included in the assessment.

4.1.1 Special Noise Characteristics

The Technical Supplement prescribes a penalty adjustment of up to 5 dB(A) (added to the measured or predicted noise level) for the presence of repeated and excessive tonality and/or low frequency noise. Such a feature is considered to be repeated and excessive where it occurs for more than 10% of an assessment period, such as for more than 144 minutes in a 24-hour period. Excessive tonality and low frequency are determined as follows:

Tonality

The Technical Supplement references the methodology described in *ISO 1996-2:2017 Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*, specifically *Annex K – Objective method for assessing the audibility of tones in noise – Survey method*. Excessive tonality is present at a particular one-third octave band level if the band level exceeds the adjacent bands on both sides by at least:

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

The penalty for tonality only applies if the tone from the wind farm is audible at the receiver location. The absence of a tone at an intermediate location will be sufficient to demonstrate that the wind farm noise at the relevant receiver location is not tonal in nature.

The provided one-third octave band data demonstrated that no penalty for the presence of tonal characteristics is warranted for this assessment.

Low Frequency Noise

To determine whether the noise contains excessive low frequency noise, the overall C-weighted noise level is reviewed as part of an initial screening assessment. Where the noise from the wind farm is greater than 60 dB(C), low frequency noise could be a characteristic. Where there is the possibility that low frequency noise may be a concern, a more detailed assessment can be conducted in accordance with the method outlined in the Technical Supplement, which is a modification of the method provided in the NPfI.

4.2 Ancillary Infrastructure Layout and Details

The Mod-3 Application proposes to construct up to six collector substations and one connection substation (Substation F) across seven locations within the wind farm site. The locations of the proposed substations can be seen in Appendix B. The main noise sources at the substations will be the transformer(s). Each substation will have one or two transformers of various ratings, the details of which can be seen in Table 8. It is understood that a static synchronous compensator is also proposed to be installed at the substations, however such units are significantly quieter than the transformers, and will therefore not significantly contribute to the overall noise level.

Table 8: Substation Transformer Quantities and Capacities

Substation ID	Quantity of Transformers	Transformer Rating per unit (MVA)
Substation A	1	200
Substation B	1	250
Substation C	1	250
Substation D_POC1	2	200
Substation D_POC2	1	200
Substation E	2	250
Substation F	2	200

The sound power levels for the above transformers have been derived from the *Australian Standard AS 60076.10:2023 Power transformers, Part 10: Determination of sound levels (IEC 60076-10:2016 (ED. 2.0) MOD)*. The octave band sound power levels assumed for the transformers can be seen in Table 9. For the purpose of these predictions, it has been assumed that all seven substation locations will be constructed and operated concurrently.

Table 9: Transformer Sound Power Levels

Equipment	Sound Power Level [dB(A)] for each Octave Band Centre Frequency [Hz]								Total Sound Power Level [dB(A)]
	63	125	250	500	1000	2000	4000	8000	
Transformer 200 MVA	77	85	92	95	87	84	77	73	98
Transformer 250 MVA	79	87	94	97	89	86	79	75	100

4.3 Concrete Batch Plant Layout and Details

The Mod-3 Application includes 19 options for concrete batch plant locations, as provided in Appendix B.

The equipment and activities on site will vary throughout the LRWF Project, depending on various stages of construction, the required processes, and the specific equipment used. It is noted that of the 19 potential batch plant locations, not all of them will operate at any one time. It is expected that a maximum of ten locations may operate concurrently at any one time. Notwithstanding, the predictions have been made based on the conservative assumption that all potential batch plant locations will operate concurrently.

The noise level used for the predictions of the concrete batch plant noise is based on previous measurements of similar activities at other wind farms. Based on these noise measurements, a sound power level of 118 dB(A) has been considered at each potential batch plant location.

4.4 Noise Propagation Models

4.4.1 Wind Turbine Noise Model

The predictions of environmental noise from the operation of the wind turbines have been made using the *ISO 9613-2 Second Edition 2024-01 Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO 9613-2:2024)* noise propagation model. This is noted to be the contemporary version of the noise model used in the Previous Assessment for the Approved Development and the SLR Assessment for the Original Development. The sound propagation model considers the following influences:

- The sound power levels and locations of noise sources.
- The separation distances between noise sources and receivers.
- The topography of the area.
- The influence of the absorption provided by the ground.
- The air absorption.
- The meteorological conditions.

ISO 9613-2:2024 provides a methodology for predicting noise levels under meteorological conditions favourable to noise propagation. It is known as a downwind model, based on the conservative assumption of a residence being downwind (resulting in the highest noise level) of all wind turbines simultaneously. To conservatively model the worst-case (i.e. highest) noise impacts at residences, the following model inputs have been used:

- Humidity of 80%.
- Air Pressure of 1013.3 mbar.
- Temperature of 10°C.
- Shielding from barriers and terrain limited to 3 dB(A).
- 50% acoustically hard ground and 50% acoustically soft ground.
- Receiver height of 4m.

4.4.2 Ancillary Infrastructure & Concrete Batch Plant Noise Model

The predictions of environmental noise from ancillary infrastructure and concrete batching activities have been based on the *oil companies' international study group for conservation of clean air and water – Europe, 'The propagation of noise from petrochemical complexes to neighbouring communities', (1981) (CONCAWE)* noise propagation model. The CONCAWE system divides meteorological conditions into six separate “weather categories”, depending on wind speed, wind direction, time of day, and level of cloud cover. Weather Category 1 provides the weather conditions associated with the “lowest” propagation of noise, while Weather Category 6 provides “worst-case” (i.e., highest noise level) conditions. Weather Category 4 provides “neutral” weather conditions for noise propagation (that is, conditions which do not account for the effects of temperature inversions or wind on propagation). Like the ISO 9613-2:2024 model, the CONCAWE model used also uses the conservative assumption that the residence is downwind from all noise sources simultaneously.

To conservatively model the worst-case noise impact at residences, the following model inputs have been used in the predictions:

- Humidity of 80%.
- Temperature of 10°C.
- Weather Category 6 (night with no clouds and wind in the direction from the noise source to the residence under consideration).
- Shielding from barriers and terrain limited to 2 dB(A).
- Acoustically soft ground to reflect the pastoral nature of the land.
- Receiver height of 1.5m.

5 RESULTS

5.1 Wind Turbine Noise

The noise levels from the wind turbine operation at all noise sensitive receivers in the vicinity of the LRWF Project have been predicted for each hub height integer wind speed. It is noted that the highest sound power level for the proposed turbine occurs at 10 m/s, meaning that the predicted noise level will be the same for higher wind speeds. The predicted noise levels for associated and non-associated residences can be seen in Table 10 and Table 11, respectively, for all locations where greater than 25 dB(A) is predicted at high wind speeds. The predicted noise levels for all other residences can be seen in Appendix F. It is noted that the predicted noise levels are for the concurrent operation of the proposed 173 wind turbines only and do not include the noise from other sources such as the substations. Other noise sources are assessed separately in the subsequent sections.

Table 10: Predicted Noise Levels at Associated Residences

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds							
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10+ m/s
C4-8	28	29	29	30	32	33	32	34
C5-7	29	30	30	31	33	34	35	36
C5-8	29	30	30	31	33	35	35	37
C5-10	29	29	29	31	32	34	33	35
C6-1	25	26	26	27	29	30	30	31
D4-1	31	31	31	33	34	36	36	38
D4-2	31	32	32	33	35	36	37	38
D4-3	31	32	32	33	35	36	37	38
D4-4	32	32	32	34	35	37	38	39
D4-5	31	31	31	32	34	36	36	37
D4-6	32	32	32	34	35	37	38	39
D4-7	33	33	33	35	36	38	39	40
D4-8	33	33	33	35	36	38	39	40
D4-9	32	32	32	33	35	37	37	39
D4-10	30	30	30	32	33	35	35	37
D6-1	30	30	31	32	33	35	35	37
D6-2	30	30	31	32	33	35	35	37
D6-3	30	30	31	32	33	35	35	37

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds							
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10+ m/s
D7-2	26	26	27	28	29	30	29	31
D7-5	28	28	28	30	31	33	32	34
D7-6	28	29	29	30	32	33	33	35
E2-1	25	26	26	27	29	30	29	31
E3-2	31	31	31	33	34	36	36	38
E3-3	31	31	31	33	34	36	36	38
E4-1	31	31	32	33	35	36	36	38
E4-2	31	31	32	33	34	36	36	38
E4-3	31	31	32	33	34	36	36	38
E4-4	33	33	33	35	36	38	39	40
E4-5	31	31	31	33	34	36	36	38
E4-6	31	31	32	33	34	36	36	38
E5-1	34	34	34	35	37	39	40	41
E5-2	33	34	34	35	37	39	39	41
E5-3	33	33	33	34	36	38	38	40
E5-4	32	33	33	34	36	38	38	40
E5-5	32	33	33	34	36	38	38	40
E5-6	32	33	33	34	36	38	38	40
E6-1	32	33	33	34	36	38	38	40
E6-2	33	33	33	35	36	38	39	40
F6-1	30	30	30	32	33	35	35	36
F6-2	30	30	31	32	33	35	35	37
F6-3	30	30	31	32	33	35	35	37
F6-4	30	30	30	32	33	35	35	37
F7-1	30	31	31	32	34	35	36	37
F7-2	30	31	31	32	34	36	36	38
F7-3	30	31	31	32	34	36	36	38
F7-4	30	30	31	32	33	35	35	37
F7-5	30	30	30	32	33	35	35	36
F7-6	30	30	30	32	33	35	35	36
F8-1	30	30	30	32	33	35	35	36
F9-2	25	26	26	27	29	30	30	32
F9-3	25	26	26	27	29	30	30	32

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds							
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10+ m/s
F9-4	26	26	26	28	29	31	30	32
F9-5	26	26	26	28	29	30	30	32
F9-6	25	26	26	27	29	30	30	32
F9-7	26	26	26	28	29	30	30	32
G4-1	33	33	33	34	36	38	39	40
G6-1	30	30	31	32	34	35	36	37
G9-1	22	23	23	24	25	27	26	28
G9-2	23	23	24	25	26	28	27	29

Table 11: Predicted Noise Levels at Non-Associated Residences

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
	3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
B5-6	24	35	25	35	25	35	26	35	28	35	29	35	28	35	30	35
B5-7	25	35	25	35	25	35	27	35	28	35	29	35	28	35	30	35
B6-4	23	35	24	35	24	35	25	35	27	35	28	35	26	35	28	35
B6-7	24	35	24	35	24	35	26	35	27	35	28	37	27	36	29	37
B6-8	24	35	25	35	25	35	26	35	27	35	29	37	28	36	29	37
B6-9	24	35	24	35	25	35	26	35	27	35	29	37	28	36	29	37
B6-10	24	35	25	35	25	35	26	35	28	35	29	35	28	35	30	35
B6-11	24	35	24	35	25	35	26	35	27	35	29	37	28	36	30	37
B6-12	21	35	22	35	22	35	24	35	25	35	26	37	24	36	26	37
C2-3	26	35	26	35	26	35	28	35	29	36	30	37	30	39	32	40
C2-4	25	35	26	35	26	35	27	35	29	36	30	37	29	39	31	40
C4-1	26	35	27	35	27	35	28	35	30	35	31	35	30	35	32	35
C4-2	26	35	27	35	27	35	28	35	30	35	31	35	30	35	32	35
C4-3	26	35	27	35	27	35	28	35	30	35	31	35	30	35	32	35
C4-4	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-5	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-6	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
	3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
C4-7	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-9	28	35	29	35	29	35	30	35	32	35	33	35	33	35	35	35
C5-1	25	35	26	35	26	35	27	35	28	35	30	35	29	35	31	35
C5-2	25	35	26	35	26	35	27	35	29	35	30	35	29	35	31	35
C5-3	26	35	26	35	27	35	28	35	29	35	30	35	29	35	31	35
C5-4	26	35	26	35	27	35	28	35	29	35	31	35	30	35	32	35
C5-5	26	35	27	35	27	35	28	35	29	35	31	35	30	35	32	35
C5-6	26	35	26	35	27	35	28	35	29	35	31	35	30	35	32	35
C5-9	28	35	28	35	29	35	30	35	31	35	33	35	32	35	34	35
C6-3	27	35	27	35	28	35	29	35	30	35	32	37	31	36	33	37
C6-4	26	35	27	35	27	35	28	35	29	35	31	37	30	36	32	37
C7-1	26	35	26	35	26	35	28	35	29	35	30	37	29	36	31	37
C7-2	25	35	25	35	26	35	27	35	28	35	29	35	28	35	30	35
D7-1	25	35	25	35	26	35	27	35	28	35	29	35	28	35	30	35
D7-3	27	38	27	38	27	39	29	38	30	39	31	39	31	39	32	39
D7-4	28	38	28	38	28	39	30	38	31	39	32	39	32	39	34	39
D7-7	27	35	27	36	28	37	29	38	30	38	31	38	30	38	32	39
E7-1	26	35	27	36	27	37	28	38	30	38	31	38	30	38	32	39
E7-2	26	35	27	36	27	37	28	38	30	38	31	38	30	38	32	39
E8-5	24	35	24	35	24	35	26	35	27	35	28	35	26	35	28	35
E9-2	22	35	23	35	23	35	24	35	25	35	27	35	25	35	27	35
E9-3	22	35	23	35	23	35	24	35	25	35	26	35	25	36	27	40
E9-4	25	35	25	35	26	35	27	35	28	35	29	35	28	35	30	35
E10-1	21	35	21	35	21	35	23	35	24	35	25	35	23	36	25	40
F2-1	25	35	26	35	26	35	27	35	29	35	30	35	29	35	31	35
F2-2	26	35	26	35	26	35	27	35	29	35	30	35	30	35	31	35
F2-3	26	35	26	35	27	35	28	35	29	35	31	35	30	35	32	35
F2-4	26	35	27	35	27	35	28	35	30	35	31	35	31	35	32	35
F2-5	26	35	27	35	27	35	28	35	29	35	31	35	30	35	32	35

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
	3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
F9-1	24	35	24	35	25	35	26	35	27	35	29	35	28	36	30	40
G2-1	24	35	25	35	25	35	26	35	27	35	29	35	28	35	30	35
G6-2	27	35	27	35	28	35	29	35	30	36	32	35	31	37	33	37
G6-3	25	35	26	35	26	35	27	35	28	36	30	35	28	37	30	37
G6-4	26	35	26	35	26	35	28	35	29	36	30	35	29	37	31	37
G9-3	24	35	24	35	25	35	26	35	27	35	28	35	27	35	29	35
G10-1	21	35	21	35	22	35	23	35	24	35	25	35	24	36	26	40
G10-2	21	35	22	35	22	35	23	35	24	35	26	35	24	36	26	40
G10-3	21	35	22	35	22	35	23	35	24	35	26	35	24	36	26	40
G10-4	21	35	22	35	22	35	23	35	24	35	26	35	24	36	26	40
G10-5	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-7	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-8	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-9	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-10	21	35	21	35	21	35	23	35	24	35	25	35	23	36	25	40
H6-1	23	35	24	35	24	35	25	35	27	36	28	35	26	37	28	37
H6-2	22	35	22	35	23	35	24	35	25	36	26	35	25	37	27	37
H6-3	22	35	22	35	23	35	24	35	25	36	26	35	24	37	26	37
H6-4	22	35	23	35	23	35	24	35	25	36	26	35	25	37	27	37
H6-5	22	35	23	35	23	35	24	35	25	36	27	35	25	37	27	37
H7-1	26	35	26	35	26	35	27	35	29	35	30	35	30	35	32	35
H7-2	24	35	25	35	25	35	26	35	28	35	29	35	29	35	30	35
H7-3	21	35	21	35	21	35	23	35	24	35	25	35	23	35	25	35
H8-1	23	35	24	35	24	35	25	35	26	35	28	35	27	35	29	35
H8-2	24	35	24	35	25	35	26	35	27	35	29	35	28	35	30	35
H8-3	24	35	25	35	25	35	26	35	27	35	29	35	28	35	30	35
H8-4	23	35	24	35	24	35	25	35	26	35	28	35	27	35	29	35
H8-5	23	35	24	35	24	35	25	35	27	35	28	35	27	35	29	35
H9-1	25	35	25	35	25	35	27	35	28	35	30	35	29	35	31	35

Residence ID	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
	3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
H9-2	25	35	25	35	25	35	27	35	28	35	29	35	29	35	31	35
H9-3	25	35	25	35	25	35	27	35	28	35	30	35	29	35	31	35
H9-4	24	35	24	35	25	35	26	35	27	35	29	35	28	35	30	35
1	23	35	23	35	24	35	25	35	26	35	28	35	27	35	29	35
2	25	35	25	36	26	37	27	38	28	38	29	38	28	38	30	39
3	23	35	23	35	24	35	25	35	26	36	27	37	25	39	27	40
4	22	35	22	35	23	35	24	35	25	36	26	37	24	39	26	40
6	21	35	22	35	22	35	23	35	24	36	25	37	23	39	25	40
8	21	35	21	35	22	35	23	35	24	36	25	37	24	39	26	40
9	22	35	22	35	23	35	24	35	25	36	26	37	25	39	26	40
10	23	35	24	35	24	35	25	35	26	35	28	35	26	35	28	35
11	23	35	24	35	24	35	25	35	27	35	28	35	27	35	29	35
12	24	35	24	35	24	35	26	35	27	35	28	35	27	35	29	35
13	23	35	24	35	24	35	25	35	27	35	28	35	27	35	29	35
14	22	35	22	35	23	35	24	35	25	36	26	37	24	39	26	40
15	25	35	26	35	26	35	27	35	28	35	29	35	28	35	30	35
16	25	35	25	35	26	35	27	35	28	35	29	35	27	35	29	35
17	24	35	24	35	24	35	26	35	27	35	28	35	26	35	28	35
18	23	35	23	35	24	35	25	35	26	35	27	35	25	35	27	35
19	20	35	21	35	21	35	23	35	24	35	25	35	22	36	24	40
20	21	35	21	35	21	35	23	35	24	35	25	35	22	36	24	40
27	22	35	23	35	23	35	25	35	26	35	27	35	24	35	26	35
29	21	35	21	35	21	35	23	35	24	35	25	35	22	36	25	40
30	22	35	23	35	23	35	25	35	26	35	27	35	25	35	27	35
31	22	35	23	35	23	35	24	35	25	35	27	35	25	35	27	35
32	24	35	25	35	25	35	26	35	28	35	29	35	28	35	30	35

Based on the above, the highest predicted noise level from the proposed wind turbines at a non-associated residence is 35 dB(A) at Residence C4-9 for wind speeds of 10m/s and greater. As such, the relevant noise criteria determined in accordance with the Development Consent and the Technical Supplement will be achieved at all non-associated residences. Noise contours of the predicted noise levels at the worst-case wind speed of 10 m/s are provided in Appendix G. The highest predicted C-weighted noise level at a non-associated residence is 57 dB(C) at Residence C4-9, which is below the level of 60 dB(C) specified in the Technical Supplement. No penalty for low frequency noise is therefore considered warranted.

As noted in Section 3.5, the Technical Supplement does not provide any objective noise criteria for the noise levels at associated residences. The applicable noise level at these residences is governed by the agreements between the applicant and the landowners, the details of which can be provided independently of this report. Notwithstanding, it is noted that the highest noise level predicted at an associated residence is 41 dB(A) at E5-1. A level of 60 dB(C) is also predicted at this location, indicating that an adjustment for low frequency noise is not required. The SA Guidelines, which are referenced by the Technical Supplement, suggest a criterion of 45 dB(A) for associated residences, which is noted to align with the recommendations of the World Health Organisation. This criterion will be achieved at all associated residences.

While not specifically required in accordance with the Development Consent, the Technical Supplement also provides criterion for passive recreation areas in national parks. This criterion applies only to national parks, not other protected areas such as state conservation areas, and applies to designated recreation areas when in use. The predicted noise level, when adjusted for tonality and low frequency noise, should not exceed an L_{eq} of 50 dB(A) for a wind speed of 4 m/s or the cut-in wind speed, whichever is higher. The cut-in wind speed for the proposed candidate turbine is 3 m/s, therefore the appropriate wind speed to assess potential impacts on national parks is 4 m/s. The predicted noise levels at the passive recreation areas within the nearby national park can be seen in Table 12.

Table 12: Predicted Noise Levels at National Park Passive Recreation Areas

Passive Recreation Area	Predicted Noise Level [dB(A)]	Passive Recreation Area	Predicted Noise Level [dB(A)]
Bald Hill Creek Camping	26	On Ground Lookout - Norfolk Falls	25
Barracks Day Use	25	On Ground Lookout - Shepherds Peak	16
Brackens Hut	24	On Ground Lookout - Talbragar	19
Brackens Hut	24	Orchard/Cecil's Trail	18
Brackens Hut Camping	24	Overflow Camping	25
Brackens Hut Day Use	24	Pinnacle Lookout	24
Bradford's Hut	18	Rocky Creek Day Use	24
Bradford's Hut	18	Site of Air Crash	19
Breeza Day Use	16	Stock Trough (7m long)/Bradford's Hut	18
Bundella Day Use	24	Stock Trough/Cecil's Trail	18
Cattel Creek Day Use	17	Stockyard/Brackens Hut	24
Cecil's Trail	18	Stockyard/Joes Hut	25
Cox's Creek Camping	26	Talbragar River Day Use	20
Cox's Creek Sawmill Ruins	25	The Barracks Camping	25
Dip Run/Joes Hut	24	The Pines East Camping	24
Joes Hut	24	The Pines West Camping	24
Joes Hut	24	The Snow Gums Day Use	17
Norfolk Falls Day Use	26	Toilet/Bradford's Hut	18
On Ground Lookout - Breeza Lookout	16	Viewing Platform - Norfolk Falls	26
On Ground Lookout - Bundella	24	Windmill/Cecil's Trail	18

The highest predicted noise level, for a wind speed of 4 m/s, at a passive recreation area within the nearby national park is 26 dB(A) at Norfolk Falls (with 26 dB(A) also predicted at Bald Hill Creek Camping, Cox's Creek Camping, and Viewing Platform – Norfolk Falls). This will easily achieve the 50 dB(A) criterion determined in accordance with the Technical Supplement. The C-weighted predicted noise level is also 55 dB(C), meaning that an adjustment for low frequency noise is not required. It can therefore be determined that the relevant criterion for national parks will be achieved in all cases for the noise from wind turbine operation. Noise Contours of the predicted noise levels for a wind speed of 4 m/s can be seen in Appendix G.

5.2 Comparative Analysis

The predicted wind turbine operation noise levels for the Mod-3 Application have been compared to the results for the Approved Development included in the Previous Assessment. Table 13 provides the results from both assessments and notes the difference between the two. For non-associated residences where there has been an increase in noise level, this has been shaded as **GREY**. It is noted that only residences where the noise level is predicted to be greater than 20 dB(A) for the Mod-3 Application have been included in this analysis. For reference, subjectively a difference of 1-2 dB(A) is often described as not noticeable and a difference of 3 dB(A) as just noticeable¹.

Table 13: Change in Wind Turbine Predicted Noise Levels: Approved Project vs Mod-3 Project

Residence ID	Status	Approved Project	Mod-3 Project	Difference	Residence ID	Status	Approved Project	Mod-3 Project	Difference
B5-6	Non-Associated	30	30	0	F6-2	Associated	36	37	1
B5-7	Non-Associated	30	30	0	F6-3	Associated	37	37	0
B6-4	Non-Associated	-	28	-	F6-4	Associated	37	37	0
B6-7	Non-Associated	29	29	0	F7-1	Associated	37	37	0
B6-8	Non-Associated	30	29	-1	F7-2	Associated	38	38	0
B6-9	Non-Associated	30	29	-1	F7-3	Associated	38	38	0
B6-10	Non-Associated	30	30	0	F7-4	Associated	37	37	0
B6-11	Non-Associated	30	30	0	F7-5	Associated	37	36	-1
B6-12	Non-Associated	26	26	0	F7-6	Associated	37	36	-1
C2-3	Non-Associated	31	32	1	F8-1	Associated	37	36	-1
C2-4	Non-Associated	30	31	1	F9-1	Non-Associated	30	30	0
C4-1	Non-Associated	32	32	0	F9-2	Associated	32	32	0
C4-2	Non-Associated	32	32	0	F9-3	Associated	32	32	0
C4-3	Non-Associated	32	32	0	F9-4	Associated	32	32	0
C4-4	Non-Associated	33	33	0	F9-5	Associated	32	32	0
C4-5	Non-Associated	33	33	0	F9-6	Associated	32	32	0
C4-6	Non-Associated	33	33	0	F9-7	Associated	32	32	0
C4-7	Non-Associated	33	33	0	F11-1	Associated	23	22	-1
C4-8	Associated	35	34	-1	F11-2	Associated	-	23	-
C4-9	Non-Associated	35	35	0	G2-1	Non-Associated	30	30	0

¹ Bies, DA, Hansen, CH and Howard, CQ 2018, *Engineering Noise Control*, 5th edn, CRC Press, Boca Raton.

Residence ID	Status	Approved Project	Mod-3 Project	Difference	Residence ID	Status	Approved Project	Mod-3 Project	Difference
C5-1	Non-Associated	31	31	0	G4-1	Associated	42	40	-2
C5-2	Non-Associated	31	31	0	G6-1	Associated	37	37	0
C5-3	Non-Associated	32	31	-1	G6-2	Non-Associated	32	33	1
C5-4	Non-Associated	32	32	0	G6-3	Non-Associated	29	30	1
C5-5	Non-Associated	32	32	0	G6-4	Non-Associated	29	31	2
C5-6	Non-Associated	32	32	0	G9-1	Associated	27	28	1
C5-7	Associated	37	36	-1	G9-2	Associated	28	29	1
C5-8	Associated	37	37	0	G9-3	Non-Associated	30	29	-1
C5-9	Non-Associated	35	34	-1	G10-1	Non-Associated	26	26	0
C5-10	Associated	36	35	-1	G10-2	Non-Associated	26	26	0
C6-1	Associated	32	31	-1	G10-3	Non-Associated	26	26	0
C6-3	Non-Associated	35	33	-2	G10-4	Non-Associated	26	26	0
C6-4	Non-Associated	33	32	-1	G10-5	Non-Associated	26	26	0
C7-1	Non-Associated	32	31	-1	G10-7	Non-Associated	26	26	0
C7-2	Non-Associated	30	30	0	G10-8	Non-Associated	26	26	0
D4-1	Associated	38	38	0	G10-9	Non-Associated	25	26	1
D4-2	Associated	39	38	-1	G10-10	Non-Associated	25	25	0
D4-3	Associated	39	38	-1	H6-1	Non-Associated	27	28	1
D4-4	Associated	39	39	0	H6-2	Non-Associated	25	27	2
D4-5	Associated	38	37	-1	H6-3	Non-Associated	25	26	1
D4-6	Associated	39	39	0	H6-4	Non-Associated	-	27	-
D4-7	Associated	41	40	-1	H6-5	Non-Associated	-	27	-
D4-8	Associated	41	40	-1	H7-1	Non-Associated	31	32	1
D4-9	Associated	39	39	0	H7-2	Non-Associated	29	30	1
D4-10	Associated	-	37	-	H7-3	Non-Associated	-	25	-
D6-1	Associated	39	37	-2	H7-4	Non-Associated	-	23	-
D6-2	Associated	38	37	-1	H7-5	Non-Associated	-	23	-
D6-3	Associated	38	37	-1	H7-6	Non-Associated	-	23	-
D7-1	Non-Associated	29	30	1	H7-7	Non-Associated	-	23	-
D7-2	Associated	32	31	-1	H7-8	Non-Associated	-	23	-
D7-3	Non-Associated	33	32	-1	H8-1	Non-Associated	28	29	1
D7-4	Non-Associated	34	34	0	H8-2	Non-Associated	-	30	-
D7-5	Associated	35	34	-1	H8-3	Non-Associated	-	30	-

Residence ID	Status	Approved Project	Mod-3 Project	Difference
D7-6	Associated	35	35	0
D7-7	Non-Associated	32	32	0
E2-1	Associated	31	31	0
E3-2	Associated	39	38	-1
E3-3	Associated	39	38	-1
E4-1	Associated	38	38	0
E4-2	Associated	38	38	0
E4-3	Associated	38	38	0
E4-4	Associated	41	40	-1
E4-5	Associated	38	38	0
E4-6	Associated	39	38	-1
E5-1	Associated	41	41	0
E5-2	Associated	40	41	1
E5-3	Associated	40	40	0
E5-4	Associated	40	40	0
E5-5	Associated	40	40	0
E5-6	Associated	40	40	0
E6-1	Associated	40	40	0
E6-2	Associated	41	40	-1
E7-1	Non-Associated	31	32	1
E7-2	Non-Associated	31	32	1
E8-5	Non-Associated	28	28	0
E9-2	Non-Associated	27	27	0
E9-3	Non-Associated	26	27	1
E9-4	Non-Associated	31	30	-1
E10-1	Non-Associated	-	25	-
F2-1	Non-Associated	31	31	0
F2-2	Non-Associated	31	31	0
F2-3	Non-Associated	32	32	0
F2-4	Non-Associated	32	32	0
F2-5	Non-Associated	32	32	0
F6-1	Associated	36	36	0

Residence ID	Status	Approved Project	Mod-3 Project	Difference
H8-4	Non-Associated	-	29	-
H8-5	Non-Associated	-	29	-
H9-1	Non-Associated	31	31	0
H9-2	Non-Associated	-	31	-
H9-3	Non-Associated	-	31	-
H9-4	Non-Associated	-	30	-
1	Non-Associated	29	29	0
2	Non-Associated	30	30	0
3	Non-Associated	25	27	2
4	Non-Associated	26	26	0
6	Non-Associated	25	25	0
8	Non-Associated	24	26	2
9	Non-Associated	25	26	1
10	Non-Associated	28	28	0
11	Non-Associated	28	29	1
12	Non-Associated	28	29	1
13	Non-Associated	28	29	1
14	Non-Associated	26	26	0
15	Non-Associated	30	30	0
16	Non-Associated	29	29	0
17	Non-Associated	28	28	0
18	Non-Associated	27	27	0
19	Non-Associated	23	24	1
20	Non-Associated	24	24	0
21	Non-Associated	22	22	0
27	Non-Associated	26	26	0
29	Non-Associated	24	25	1
30	Non-Associated	27	27	0
31	Non-Associated	27	27	0
32	Non-Associated	30	30	0
33	Non-Associated	22	22	0

The above table shows that the predicted noise levels at most receivers showed the same or a decrease in noise level at the nearby noise sensitive receivers. While the predicted noise levels have increased at some locations, this is by a small margin that will typically not be noticeable or will be barely noticeable. Despite the small increases in noise levels at some locations, the relevant criteria are achieved at all locations. It can therefore be seen that noise impacts will remain the same for the Mod-3 Application.

5.3 Cumulative Wind Turbine Operational Noise

There are other renewable energy projects proposed to be located in the vicinity of the LRWF Project. The nearest other wind farm is the Valley of the Winds Wind Farm, which is proposed to be located approximately 13km away, on average, noting that some turbines may be as close as approximately 10km from the closest turbine in the Mod-3 Application. The SA Guidelines, referenced by the Technical Supplement, provide criteria for each project, rather than criteria to be achieved cumulatively from all projects. That is, the assessment of cumulative noise impacts from other wind farm developments is not required. Consideration has, however, been given to the cumulative noise from the Valley of the Winds Wind Farm. The acoustic assessment for the Valley of the Winds Wind Farm has been reviewed and the noise contours compared to those for the LRWF Project. There are no residences that will be exposed to a noise level of 30 dB(A) or higher from both projects simultaneously. It is also expected that where one wind farm achieves the most onerous noise criterion of 35 dB(A), the contribution of the other wind farm will not increase the level above 35 dB(A). Based on the above, no cumulative noise impacts associated with other wind farms are predicted.

It should be noted that the contours compared above assume that the residences are downwind from both wind farms at the same time, which is not possible in practice. This means that the contribution of one wind farm will be significantly less than the other, dependent on the wind direction.

5.4 Ancillary Infrastructure Noise

The noise levels at the nearby noise sensitive receivers have been predicted from the operation of the proposed substations based on the layout and details provided in Section 4.2. Transformers at substations have the potential to exhibit tonality and, as such, a 5 dB(A) correction factor may be applicable at some locations. As a conservative approach, this penalty has been applied at all locations and for all periods.

The highest predicted noise level at a non-associated residence is less than 15 dB(A) at Residence C2-4, inclusive of a penalty for annoying noise character. This will easily achieve the 35 dB(A) criterion applicable in accordance with the Development Consent. The criterion will therefore be easily achieved at all non-associated residences. Noise contours of the predicted noise levels are shown in Appendix H.

The highest predicted noise level at an associated residence is 29 dB(A) at Residence F8-1. The noise levels at all other associated residences will be less than this. It is noted that there are no noise criteria for the operation of ancillary infrastructure at associated residences, and as such the predicted noise level has been provided for information only.

5.5 Concrete Batch Plant Noise

The noise levels at the nearby noise sensitive receivers have been predicted from the operation of the proposed concrete batch plants based on the layout and details provided in Section 4.3. As required by the ICNG, the predictions have included a 5 dB(A) penalty for annoying noise character.

The highest predicted noise level at a non-associated residence is 29 dB(A) at Residence C6-3. This will achieve the applicable criterion of 35 dB(A) in accordance with the ICNG at this and all other non-associated residences.

The highest predicted noise level at an associated residence is 47 dB(A) at residence F8-1. It is noted that there are no noise criteria for construction activities at associated residences, and as such the predicted noise level has been provided for information only. As F8-1 is an associated receiver, it is assumed that a higher noise level would be agreeable, and therefore the higher predicted noise level is deemed acceptable. Table 14 contains the associated residences where the predicted noise level is greater than or equal to 25 dB(A).

Table 14: Concrete Batch Plant Predicted Noise Levels at Associated Residences

Residence ID	Prediction	Residence ID	Prediction	Residence ID	Prediction	Residence ID	Prediction
C5-7	32	D4-9	30	E4-6	35	F6-3	27.7
C5-8	32	D4-10	25	E5-1	31	F6-4	30.1
C5-10	25	D6-1	25	E5-2	31	F7-1	46.7
C6-1	27	D6-2	25	E5-3	35	F7-2	45
D4-1	34	D6-3	26	E5-4	34	F7-3	44.4
D4-2	36	E3-2	41	E5-5	34	F7-4	36.9
D4-3	38	E3-3	38	E5-6	34	F7-5	37.1
D4-4	38	E4-1	32	E6-1	31	F7-6	36.8
D4-5	27	E4-2	32	E6-2	31	F8-1	47.4
D4-6	28	E4-3	32	F6-1	28	G4-1	25
D4-7	41	E4-4	34	F6-2	28	G6-1	24.8
D4-8	41	E4-5	35				

Noise contours of the predicted noise levels from concrete batching activities can be seen in Appendix I. It is noted that the noise levels provided above are considered to be the worst-case (highest noise level) based on the conservative assumption that all proposed locations will operate concurrently. If approved, not all locations will operate concurrently, resulting in lower noise levels at some residences.

6 CONCLUSION

A predictive noise impact assessment has been made of the proposed modification application associated with the Liverpool Range Wind Farm.

The noise associated with the operation of wind turbines and site substations, construction activity, and traffic generation associated with the Approved Development has previously been assessed and was granted approval subject to specific conditions.

A Mod-3 Application is now proposed, generally consisting of a reduction in wind turbine numbers and alternate locations for some wind turbines, substations, and concrete batch plants.

Noise predictions have been made for the operation of wind turbines, the operation of substations, and the operation of concrete batch plants against criteria determined in accordance with the Development Consent and other referenced guidelines. While some changes are proposed to the access routes as part of the Mod-3 Application, due to other optimisations to the access routes, these changes will not result in an increase in traffic noise. No updates have therefore been made to the predictions of traffic noise. The noise from other construction activities, including blasting, have not changed and therefore these predictions have also not been updated. The predictions indicate that the relevant criteria will be achieved at all non-associated residences in all cases.

In addition to the assessment against the Development Consent, a comparative assessment of the wind turbine operational noise levels has been made. The predicted noise levels at residences from the operation of wind turbines at the revised turbine locations will typically stay the same or decrease, but some may increase by a small margin that is typically not noticeable or barely noticeable.

Based on the assessment, the Mod-3 Application will not result in any noise levels exceeding the relevant criteria at the nearby residences. That is, the changes in turbine location, substation location, and concrete batch plant locations will satisfy the existing Development Consent.

APPENDIX A: NOISE RELATED DEVELOPMENT CONSENT CONDITIONS

NOISE

Additional Mitigation Upon Request

5. For the duration of the period of construction, upon receiving a written request from the owner of the residence listed in Table 2, the Applicant shall implement additional noise mitigation measures (such as double glazing, insulation, fencing and/or air conditioning) at the residence in consultation with the owner. These measures must be reasonable and feasible and directed towards reducing the noise impacts of construction traffic associated with the development on the residence.

If within 3 months of receiving this request from the owner, the Applicant and the owner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the [Planning](#) Secretary for resolution.

Table 2: Residence subject to noise mitigation upon request agreement

Residence	Lot/DP
D7-3	141/750744
D7-4	143/750744
E7-1	22/1157809
E9-3	171/750771

Note: To identify the residence referred to in Table 2, see the applicable tables and figures in Appendix 2.

Construction & Decommissioning Noise

6. The Applicant must:
- minimise the noise of the development, including any associated traffic noise; and
 - ensure that the noise generated by any construction or decommissioning activities is managed in accordance with the best practice requirements outlined in the *Interim Construction Noise Guideline* (DECC, 2009), or its latest version.
7. Unless the [Planning](#) Secretary agrees otherwise, the Applicant must only undertake [works associated with the pre-construction accommodation camp and accommodation camp, pre-construction minor works, road upgrades, construction, demolition, upgrading or decommissioning activities \(excluding blasting\)](#) between:
- 7 am to 6 pm Monday to Friday;
 - 8 am to 1 pm Saturdays; and
 - at no time on Sundays and NSW public holidays.

The following construction activities may be undertaken outside these hours without the approval of the [Planning](#) Secretary:

- activities that are inaudible at non-associated residences;
- the delivery of materials requested by the NSW Police Force or other authorities for safety reasons; or
- emergency work to avoid the loss of life, property and/or material harm to the environment.

- 7A. The hours of construction activities specified in condition 7 of Schedule 3 may be varied with the prior written approval of the [Planning](#) Secretary. Any request to alter the hours of construction must be:
- considered on a case-by-case or activity-specific basis;

- (b) accompanied by details of the nature and justification for activities to be conducted during the varied construction hours;
- (c) accompanied by written evidence that appropriate consultation with potentially affected sensitive receivers and notification of Councils (and other relevant agencies) has been or will be undertaken;
- (d) accompanied by evidence that all feasible and reasonable noise mitigation measures have been put in place; and
- (e) accompanied by a noise impact assessment consistent with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009), or its latest version.

Blasting

8. The Applicant may only carry out blasting on site between 9 am and 5 pm Monday to Friday and between 8 am to 1 pm on Saturday. No blasting is allowed on Sundays or public holidays.
9. The Applicant must ensure that any blasting carried out on site does not exceed the criteria in Table 3.

Table 3: Blasting criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Any non-associated residence	120	10	0%
	115	5	5% of the total number of blasts or events over a rolling period of 12 months

Operational Noise Criteria – Wind Turbines

10. The Applicant must ensure that the noise generated by the operation of wind turbines does not exceed the higher of 35 dB(A) or the existing background noise level ($L_{A90(10-minute)}$) plus 5 dB(A) for each integer wind speed, measured at hub height, from cut-in to rated wind turbine generator power, at any non-associated residence.

Noise generated by the operation of the wind turbines is to be measured in accordance with the relevant requirements of the Department's *Wind Energy: Noise Assessment Bulletin* (2016) (or its latest version). The noise generated by the operation of the wind turbines must also be adjusted for tonality and low frequency noise in accordance with the Department's *Wind Energy: Noise Assessment Bulletin* (2016) (or its latest version).

However, these criteria do not apply if the Applicant has an agreement with the relevant owner/s of these residences to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Operational Noise Criteria – Ancillary Infrastructure

11. The Applicant must ensure that the noise generated by the operation of ancillary infrastructure does not exceed 35 dB(A) $L_{Aeq(15 minute)}$ at any non-associated residence.

Noise generated by the operation of ancillary infrastructure is to be measured in accordance with the relevant requirements of the *NSW Noise Policy for Industry* (or its equivalent).

Operational Noise Monitoring

12. Within 6 months of the commencement of operations (or the commencement of operation of a cluster of turbines, if the development is to be staged), the Applicant must:
 - (a) undertake noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and
 - (b) submit a copy of the monitoring results to the Department and the EPA.
13. The Applicant must undertake further noise monitoring of the development if required by the [Planning Secretary](#).

APPENDIX B: PROJECT COORDINATES

Table 15: Proposed Wind Turbine Coordinates

Turbine Id	Coordinates (GDA 94 MGA 55)		Turbine Id	Coordinates (GDA 94 MGA 55)		Turbine Id	Coordinates (GDA 94 MGA 55)	
	Easting	Northing		Easting	Northing		Easting	Northing
A01	764395	6485856	D09	765682	6474642	E20	776059	6473018
A02	764566	6486347	D10	765845	6475139	E21	776142	6473540
A03	764734	6486837	D11	766139	6475735	E22	776168	6472306
A04	765656	6486572	D12	766309	6476228	E23	776175	6476262
A05	766042	6486930	D61	766540	6476693	E24	776440	6476764
A06	766305	6487292	D60	768745	6478282	E25	776573	6474450
A10	768509	6489854	D16	767264	6478069	E26	776528	6473903
A14	769778	6490192	D20	767373	6477562	E28	776754	6477770
A15	769735	6490756	D24	767886	6477938	E29	776779	6480629
A16	769896	6491160	D25	767978	6478452	E31	776840	6478334
A17	770647	6490652	D26	769137	6478659	E32	776872	6481152
A18	770735	6490140	D27	769937	6478419	E33	777129	6475419
B01	767578	6482848	D28	770260	6475107	E34	777145	6478782
B02	767769	6483759	D29	770329	6475637	E35	777324	6481409
B03	767876	6483241	D30	770415	6476610	E36	777382	6479439
B04	767974	6484270	D31	770407	6478713	E37	777437	6475879
B05	768323	6484685	D32	770951	6476712	E38	777662	6476368
B06	768637	6485367	D33	771141	6478562	E39	777775	6476873
B07	768977	6485758	D34	771142	6477196	E40	778013	6477377
B08	769063	6486275	D35	771149	6477849	E43	778750	6479161
B09	769439	6486642	D36	771479	6475499	E44	779229	6479579
B10	771094	6485814	D37	771799	6475929	E45	779295	6481897
B11	771282	6487691	D38	771789	6478789	E46	779488	6480005
B13	771959	6488049	D39	771812	6476945	E47	779939	6480757
B14	772082	6486063	D40	772049	6479474	E48	779873	6481837
B16	772225	6486573	D41	771987	6476441	E50	780393	6481908
B18	772386	6488339	D42	772383	6480375	E51	780733	6482299
B19	772575	6486981	D43	772898	6479196	F01	776889	6458473
B20	772763	6488773	D44	772920	6478594	F02	777082	6459906

Turbine Id	Coordinates (GDA 94 MGA 55)		Turbine Id	Coordinates (GDA 94 MGA 55)		Turbine Id	Coordinates (GDA 94 MGA 55)	
	Easting	Northing		Easting	Northing		Easting	Northing
B21	772792	6489753	D45	773024	6480329	F03	777300	6460378
B24	773205	6487150	D46	773434	6480669	F04	777516	6460852
B25	773412	6489029	D47	773859	6480969	F05	777720	6461336
B26	773426	6488064	D48	774458	6481117	F06	777833	6459189
B27	773499	6489632	D49	774609	6480573	F07	777907	6462293
C01	776480	6486763	D50	774844	6481662	F08	778377	6458656
C02	776559	6487939	D51	775337	6481845	F09	779661	6463196
C04	777120	6488571	D52	775546	6482463	F10	780000	6463589
C05	777296	6485742	D53	775773	6482940	F11	780236	6460777
C06	777334	6487106	D54	776508	6482764	F12	780354	6467149
C07	777395	6489018	E01	771416	6470032	F13	780373	6460277
C08	777554	6486307	E02	771629	6470509	F14	780537	6462083
C09	777694	6487486	E03	771969	6470899	F15	780509	6461227
C11	778445	6487615	E04	772259	6471314	F16	780618	6467598
C12	778539	6486066	E05	772757	6470418	F17	780622	6462624
C13	778573	6485443	E06	772674	6471619	F20	780939	6463035
C14	779481	6488571	E07	772999	6471049	F21	780950	6468486
C15	779541	6487122	E08	773091	6472423	F22	781043	6463544
C16	779588	6485988	E09	773389	6471369	F24	781449	6463904
C17	779674	6487676	E10	773935	6472399	F25	781257	6468836
C18	779863	6486436	E11	774330	6472871	F26	781507	6469220
D01	763804	6473463	E12	774342	6473553	F28	781995	6469394
D02	764014	6473964	E13	774702	6474187	F30	782186	6461498
D03	764199	6474469	E14	774745	6467671	F31	782572	6461822
D04	764399	6474953	E15	774810	6474694	F32	782652	6462320
D05	764809	6476904	E16	774919	6468176	F33	782987	6462702
D06	764885	6475414	E17	775216	6475016	F34	783238	6463140
D07	765139	6475865	E18	775553	6470907	F35	783496	6463474
D08	765404	6476369	E19	775725	6471804			

Table 16: Proposed Substation Coordinates

Substation ID	Coordinates (GDA 94 MGA 55)	
	Easting	Northing
A	768565	6490138
B	770598	6487264
C	777210	6486476
D_POC1	769583	6478458
D_POC2	772712	6480388
E	776724	6475007
F	778481	6465832

Table 17: Proposed Concrete Batch Plant Coordinates

Concrete Batch Plant ID	Coordinates (GDA 94 MGA 55)	
	Easting	Northing
A Cluster 1	766217	6487417
A Cluster 2	769630	6491166
B Cluster 1	768231	6485068
B Cluster 2	773211	6487014
B Cluster 3	768074	6485033
B Cluster 4	773094	6489855
B Cluster 5	775170	6486725
C Cluster 1	777823	6486325
D Cluster 1	763933	6474344
D Cluster 2	771395	6478474
D Cluster 3	774578	6480893
D Cluster 4	766250	6476070
E Cluster 1	777066	6475239
E Cluster 2	777231	6480994
E Cluster 3	773412	6471976
E Cluster 4	777008	6478032
E Cluster 5	774969	6469343
F Cluster 1	778184	6465690
F Cluster 2	779494	6467072

APPENDIX C: NOISE SENSITIVE RECEIVER INFORMATION

Table 18: Noise Sensitive Receiver Locations and Status

Receiver ID	Associated	Coordinates (GDA 94 MGA 55)		Representative Logging Location	Receiver ID	Associated	Coordinates (GDA 94 MGA 55)		Representative Logging Location
		Easting	Northing				Easting	Northing	
B5-6	No	759412	6475153	C4-9	F6-2	Yes	779289	6470778	G6-3
B5-7	No	759494	6475274	C4-9	F6-3	Yes	779360	6470786	G6-3
B6-4	No	758347	6474295	C4-9	F6-4	Yes	779804	6470050	G6-3
B6-7	No	759236	6472605	C6-3	F7-1	Yes	775970	6469502	E5-2
B6-8	No	759315	6473604	C6-3	F7-2	Yes	776035	6469752	E5-2
B6-9	No	759330	6473411	C6-3	F7-3	Yes	776084	6469736	E5-2
B6-10	No	759459	6474801	C4-9	F7-4	Yes	776870	6467660	D7-5
B6-11	No	759597	6472970	C6-3	F7-5	Yes	777002	6467659	D7-5
B6-12	No	756948	6472420	C6-3	F7-6	Yes	777255	6468058	D7-5
C2-3	No	764134	6490350	C2-3	F8-1	Yes	777698	6464852	H7-1
C2-4	No	764191	6490559	C2-3	F9-1	No	775364	6456611	E10-1
C4-1	No	761908	6482895	C4-9	F9-2	Yes	779611	6455812	E10-1
C4-2	No	762190	6481915	C4-9	F9-3	Yes	779714	6455866	E10-1
C4-3	No	762238	6481795	C4-9	F9-4	Yes	779892	6456264	E10-1
C4-4	No	762874	6481513	C4-9	F9-5	Yes	779898	6456207	E10-1
C4-5	No	762878	6482423	C4-9	F9-6	Yes	779913	6456165	E10-1
C4-6	No	762958	6482067	C4-9	F9-7	Yes	779942	6456248	E10-1
C4-7	No	762958	6482433	C4-9	F11-1	Yes	777112	6448701	E10-1
C4-8	Yes	763965	6482463	C4-9	F11-2	Yes	776880	6449020	E10-1
C4-9	No	764371	6480560	C4-9	G2-1	No	780254	6492574	F2-4
C5-1	No	760070	6475843	C4-9	G4-1	Yes	781170	6482977	E3-3
C5-2	No	760190	6475987	C4-9	G6-1	Yes	781085	6470560	G6-3
C5-3	No	760755	6479176	C4-9	G6-2	No	782545	6471883	G6-3
C5-4	No	760800	6477141	C4-9	G6-3	No	783765	6473517	G6-3
C5-5	No	761379	6479642	C4-9	G6-4	No	783684	6473479	G6-3
C5-6	No	761460	6477801	C4-9	G9-1	Yes	782075	6455530	H7-1
C5-7	Yes	762771	6476691	C4-9	G9-2	Yes	782098	6456061	H7-1
C5-8	Yes	762934	6476829	C4-9	G9-3	No	782953	6455739	H7-1
C5-9	No	763840	6479921	C4-9	G10-1	No	780504	6453557	E10-1

Receiver ID	Associated	Coordinates (GDA 94 MGA 55)		Representative Logging Location
		Easting	Northing	
C5-10	Yes	764398	6479612	C4-9
C6-1	Yes	760542	6473529	C6-3
C6-3	No	763886	6471207	C6-3
C6-4	No	764351	6470201	C6-3
C7-1	No	764232	6469712	C6-3
C7-2	No	764972	6468258	D7-2
D4-1	Yes	765422	6484412	C4-9
D4-2	Yes	765727	6484644	D4-6
D4-3	Yes	766088	6484562	D4-6
D4-4	Yes	766362	6484106	D4-6
D4-5	Yes	766906	6481291	D4-6
D4-6	Yes	768370	6481475	D4-6
D4-7	Yes	769558	6484285	D4-6
D4-8	Yes	769576	6484342	D4-6
D4-9	Yes	769800	6482050	D4-6
D4-10	Yes	766248	6480979	C4-9
D6-1	Yes	769184	6472228	D6-1
D6-2	Yes	769411	6471608	D6-2
D6-3	Yes	769414	6471866	D6-3
D7-1	No	765177	6468242	D7-2
D7-2	Yes	767488	6468138	D7-2
D7-3	No	768296	6469155	D7-4
D7-4	No	768469	6469763	D7-4
D7-5	Yes	769535	6469184	D7-5
D7-6	Yes	769644	6469327	D7-5
D7-7	No	769734	6466440	D7-5
E2-1	Yes	774854	6493728	F2-4
E3-2	Yes	774634	6485402	E3-3
E3-3	Yes	774826	6485037	E3-3
E4-1	Yes	773390	6484129	E3-3
E4-2	Yes	773466	6484080	E3-3
E4-3	Yes	773492	6484278	E3-3

Receiver ID	Associated	Coordinates (GDA 94 MGA 55)		Representative Logging Location
		Easting	Northing	
G10-2	No	780694	6453578	E10-1
G10-3	No	780764	6453747	E10-1
G10-4	No	780852	6453776	E10-1
G10-5	No	780994	6453869	E10-1
G10-7	No	781115	6453948	E10-1
G10-8	No	781147	6453997	E10-1
G10-9	No	782749	6452613	E10-1
G10-10	No	781042	6451214	E10-1
H6-1	No	785415	6474126	G6-3
H6-2	No	786626	6470853	G6-3
H6-3	No	786868	6470984	G6-3
H6-4	No	786555	6471002	G6-3
H6-5	No	786431	6470699	G6-3
H7-1	No	785125	6465108	H7-1
H7-2	No	785215	6466360	H7-1
H7-3	No	789028	6465304	H7-1
H7-4	No	791211	6467882	H7-1
H7-5	No	792405	6466307	H7-1
H7-6	No	792380	6466148	H7-1
H7-7	No	792378	6466065	H7-1
H7-8	No	792250	6465666	H7-1
H8-1	No	787952	6462116	H7-1
H8-2	No	787748	6462652	H7-1
H8-3	No	787724	6462596	H7-1
H8-4	No	788030	6462204	H7-1
H8-5	No	787910	6462182	H7-1
H9-1	No	785676	6459623	H7-1
H9-2	No	785560	6459569	H7-1
H9-3	No	785550	6459452	H7-1
H9-4	No	785394	6459522	H7-1
1	No	784030	6457169	H7-1
2	No	772896	6462462	D7-5

Receiver ID	Associated	Coordinates (GDA 94 MGA 55)		Representative Logging Location
		Easting	Northing	
E4-4	Yes	773616	6482725	E3-3
E4-5	Yes	774406	6484563	E3-3
E4-6	Yes	774681	6484593	E3-3
E5-1	Yes	773065	6475200	E5-1
E5-2	Yes	773092	6475057	E5-2
E5-3	Yes	774485	6478428	E5-5
E5-4	Yes	774532	6478237	E5-5
E5-5	Yes	774556	6478244	E5-5
E5-6	Yes	774620	6478043	E5-6
E6-1	Yes	771386	6473570	E5-2
E6-2	Yes	773187	6474948	E5-2
E7-1	No	770093	6466051	D7-5
E7-2	No	770164	6465993	D7-5
E8-5	No	772152	6460352	D7-2
E9-2	No	771488	6458097	D7-2
E9-3	No	771812	6455325	E10-1
E9-4	No	772890	6459717	D7-2
E10-1	No	771875	6452971	E10-1
F2-1	No	775382	6493341	F2-4
F2-2	No	776225	6493044	F2-4
F2-3	No	776258	6492638	F2-4
F2-4	No	776417	6492338	F2-4
F2-5	No	776525	6492461	F2-4
F6-1	Yes	779283	6470731	G6-3

Receiver ID	Associated	Coordinates (GDA 94 MGA 55)		Representative Logging Location
		Easting	Northing	
3	No	758387	6486058	C2-3
4	No	759561	6490229	C2-3
6	No	760407	6492846	C2-3
8	No	767239	6496313	C2-3
9	No	769214	6496315	C2-3
10	No	773403	6496066	F2-4
11	No	781559	6492082	F2-4
12	No	781619	6491887	F2-4
13	No	781847	6491866	F2-4
14	No	760429	6491342	C2-3
15	No	770132	6464103	D7-2
16	No	769929	6463721	D7-2
17	No	770748	6462141	D7-2
18	No	770430	6460856	D7-2
19	No	770376	6455246	E10-1
20	No	769991	6455780	E10-1
21	No	767051	6454899	E10-1
27	No	765098	6464095	D7-2
29	No	771186	6453755	E10-1
30	No	757439	6474376	C4-9
31	No	757214	6474584	C4-9
32	No	759097	6476849	C4-9
33	No	757379	6466459	C6-3

APPENDIX D: BACKGROUND NOISE AND WIND SPEED CORRELATION GRAPHS

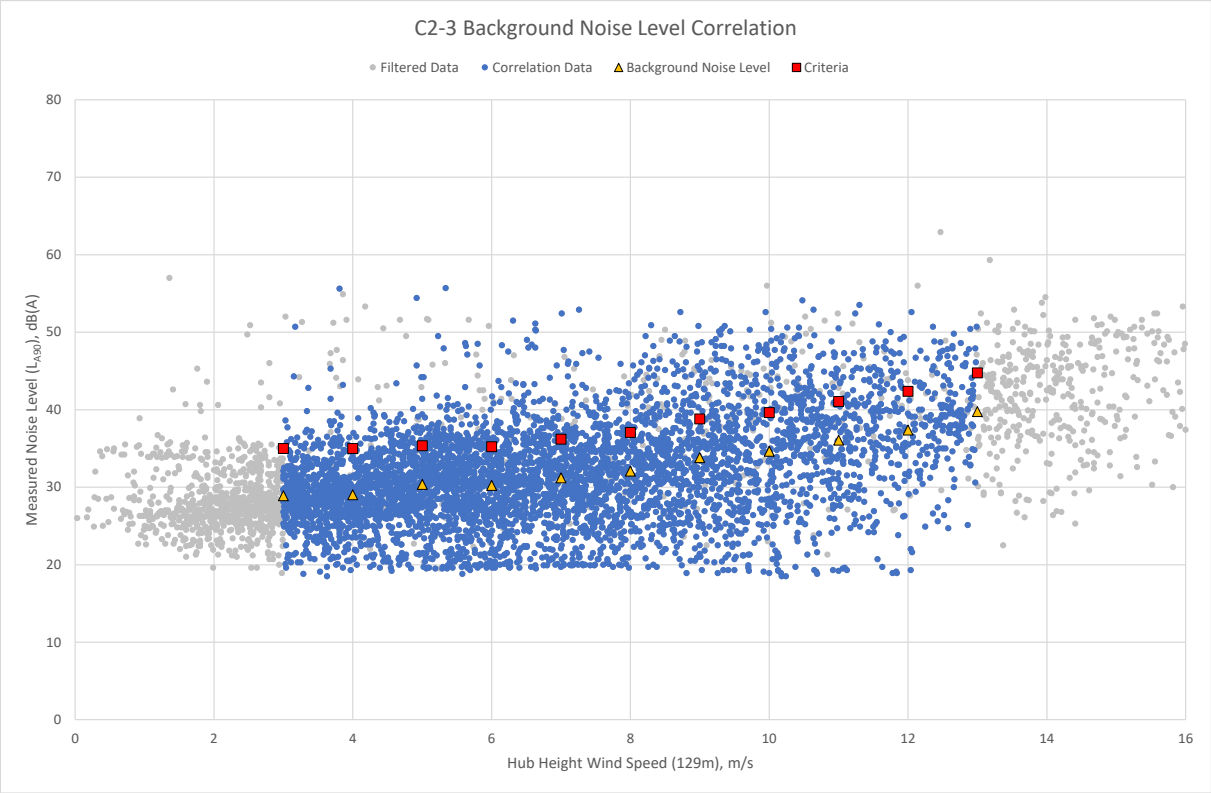


Figure 3: C2-3 Background Noise Level Correlation Graph

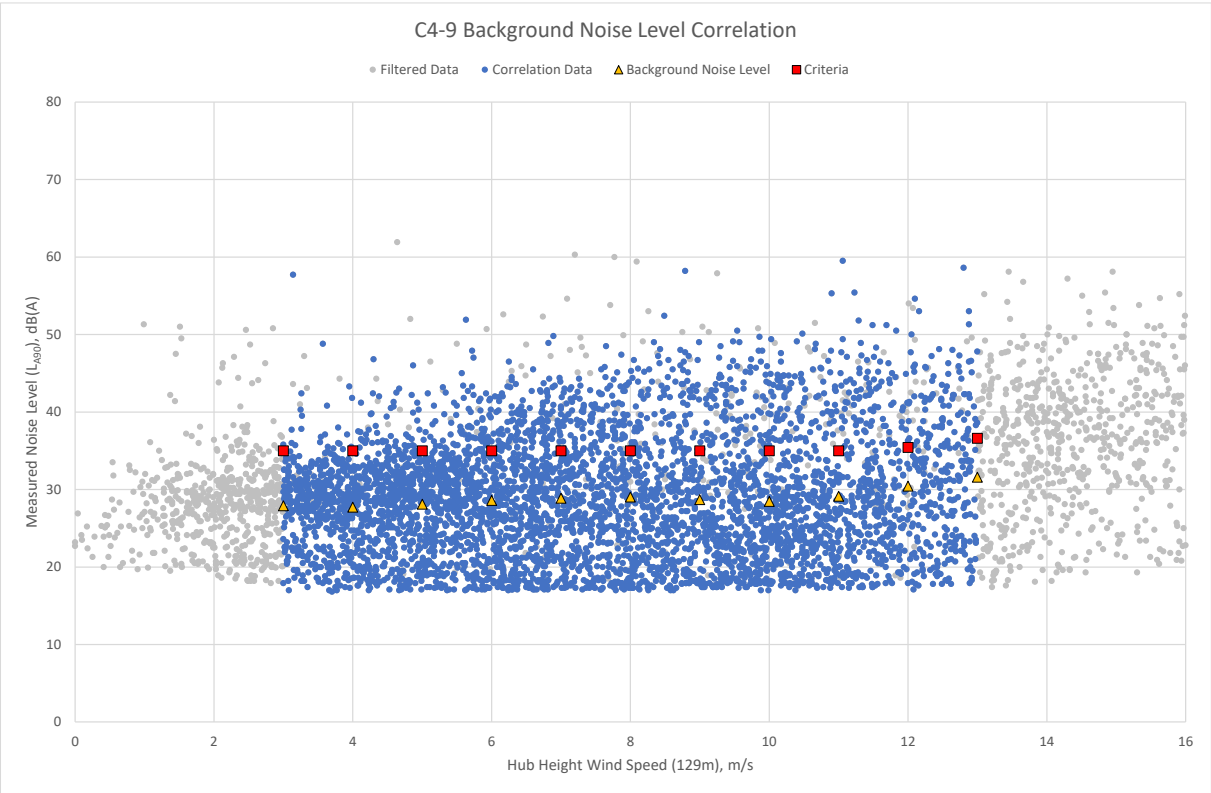


Figure 4: C4-9 Background Noise Level Correlation Graph

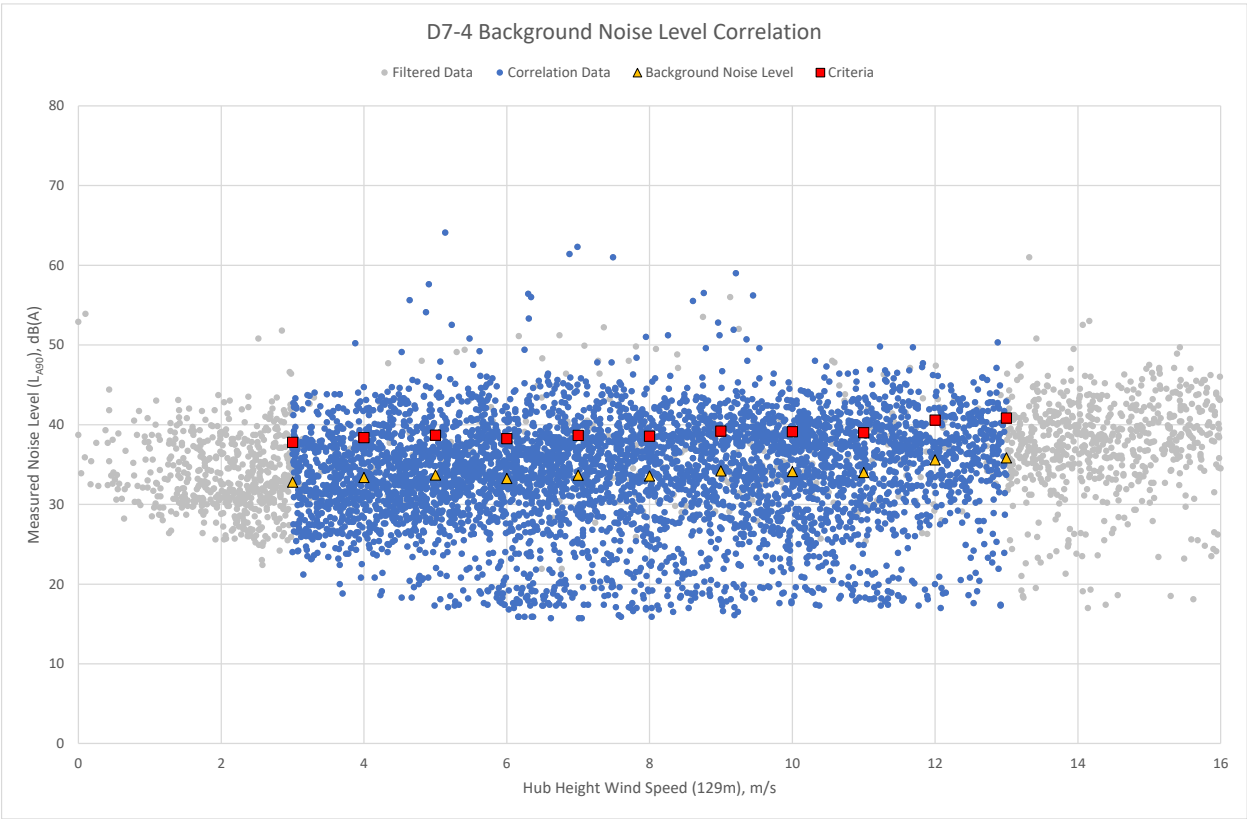


Figure 5: D7-4 Background Noise Level Correlation Graph

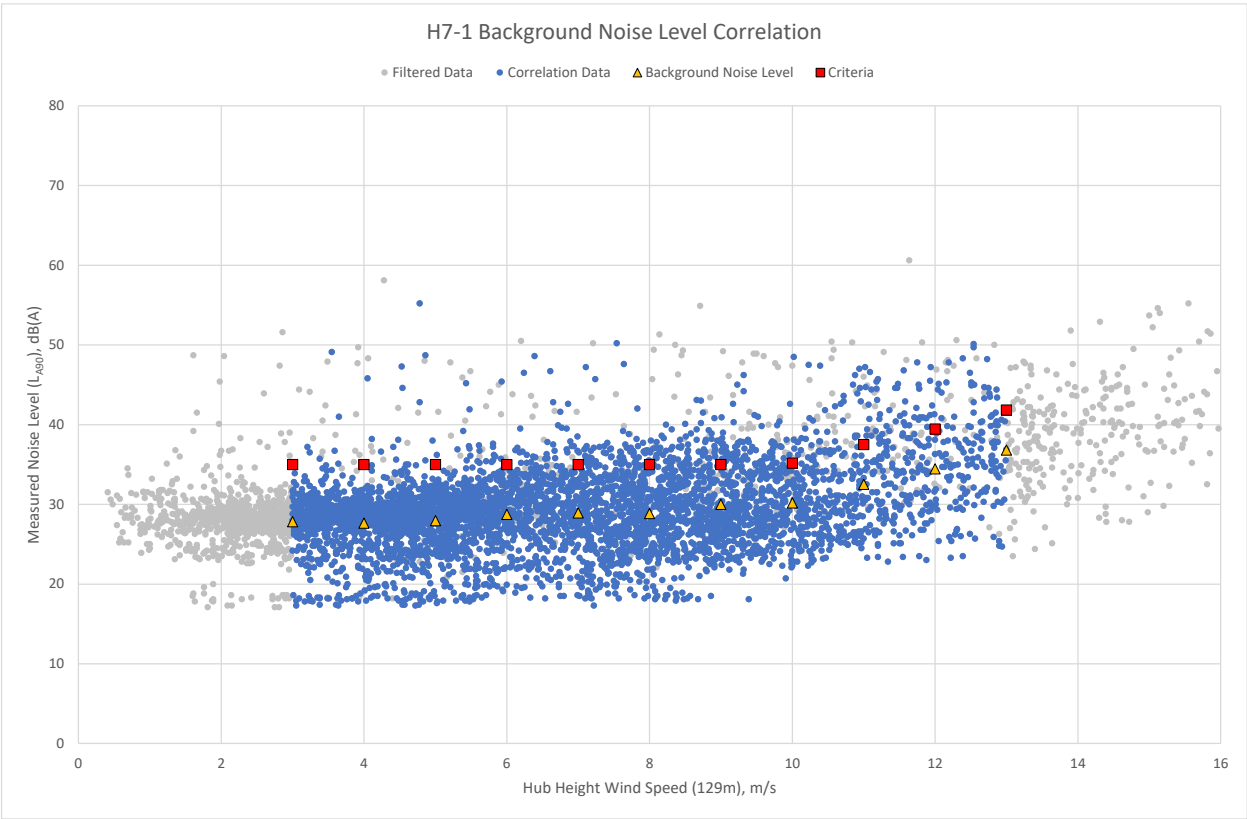


Figure 6: H7-1 Background Noise Level Correlation Graph

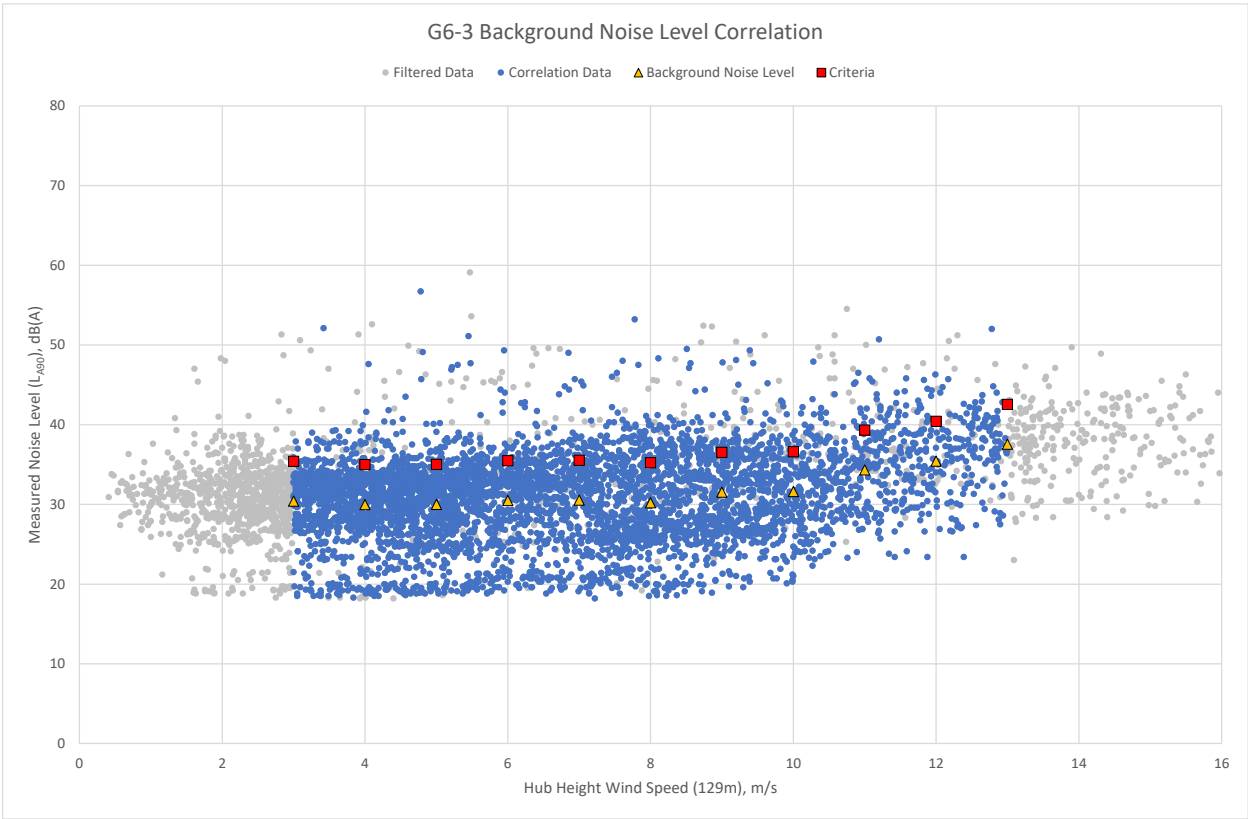


Figure 7: G6-3 Background Noise Level Correlation Graph

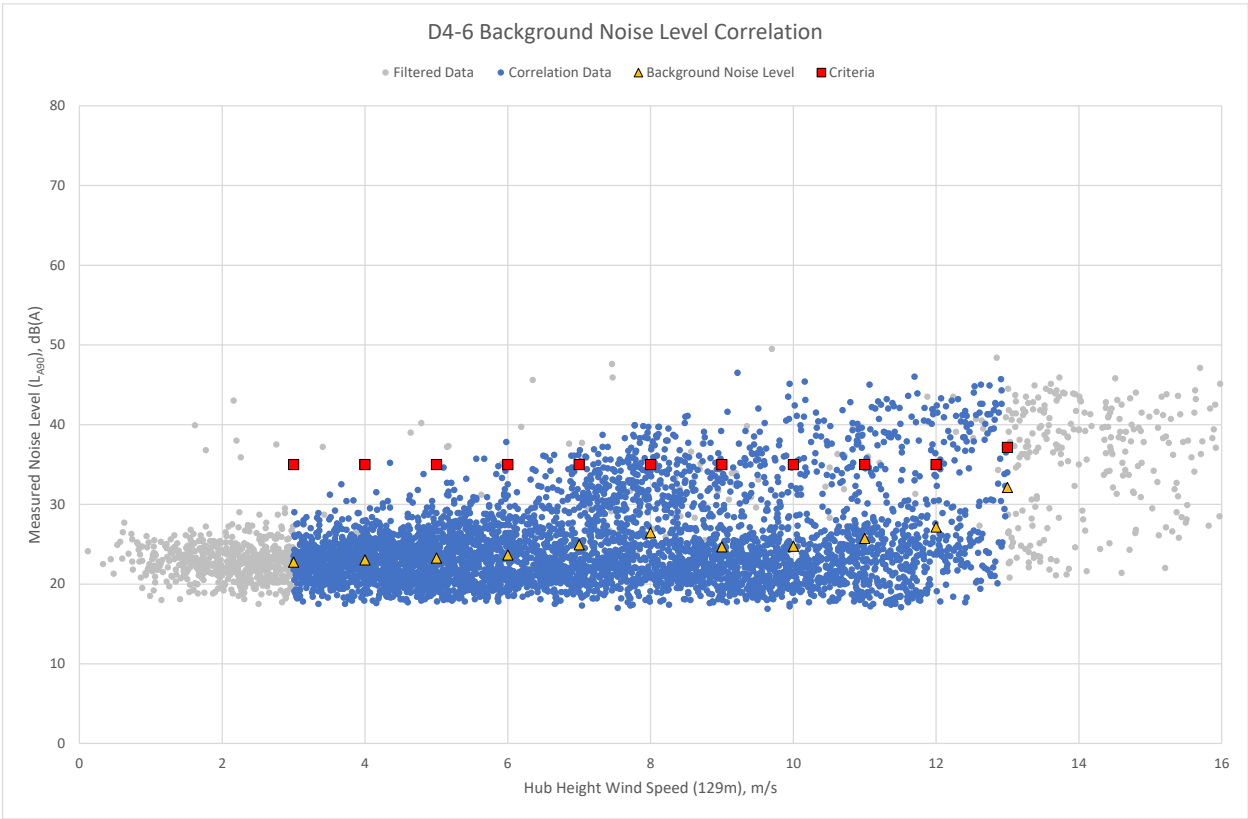


Figure 8: D4-6 Background Noise Level Correlation Graph

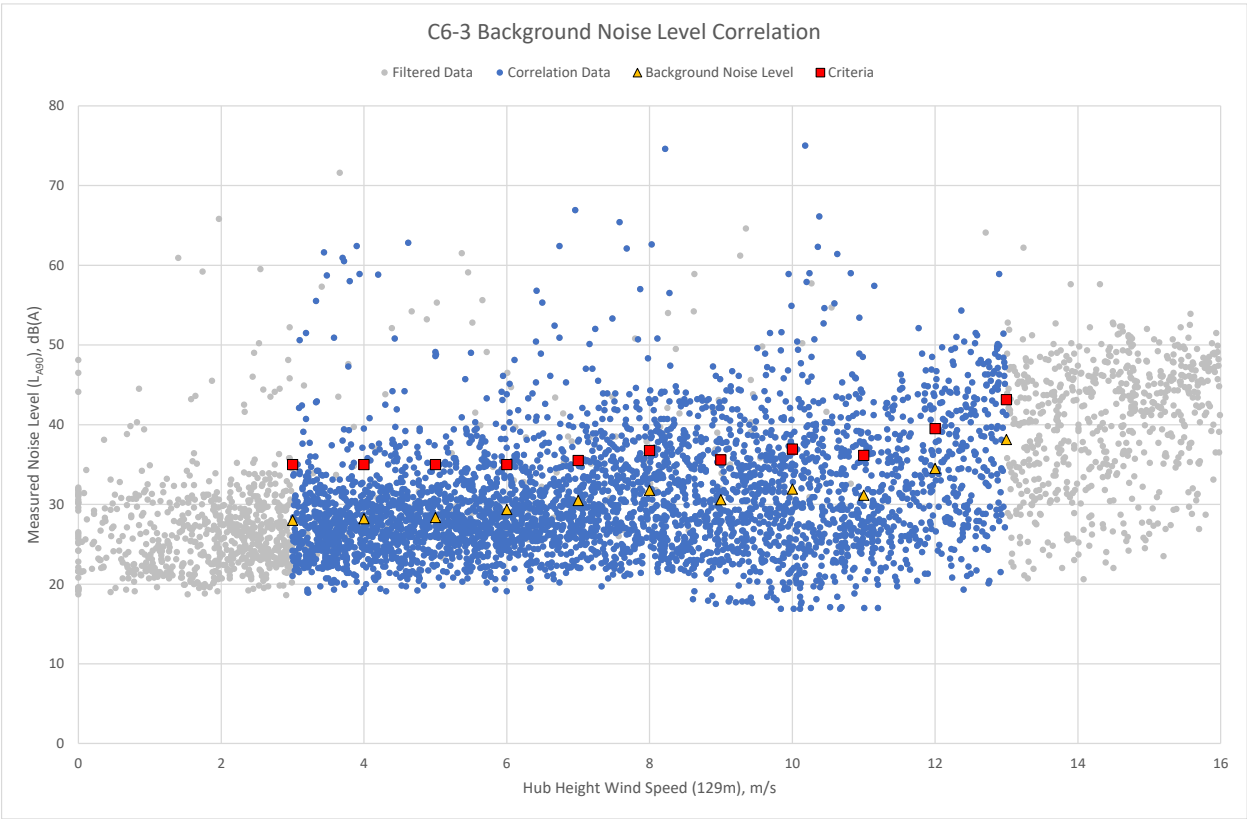


Figure 9: C6-3 Background Noise Level Correlation Graph

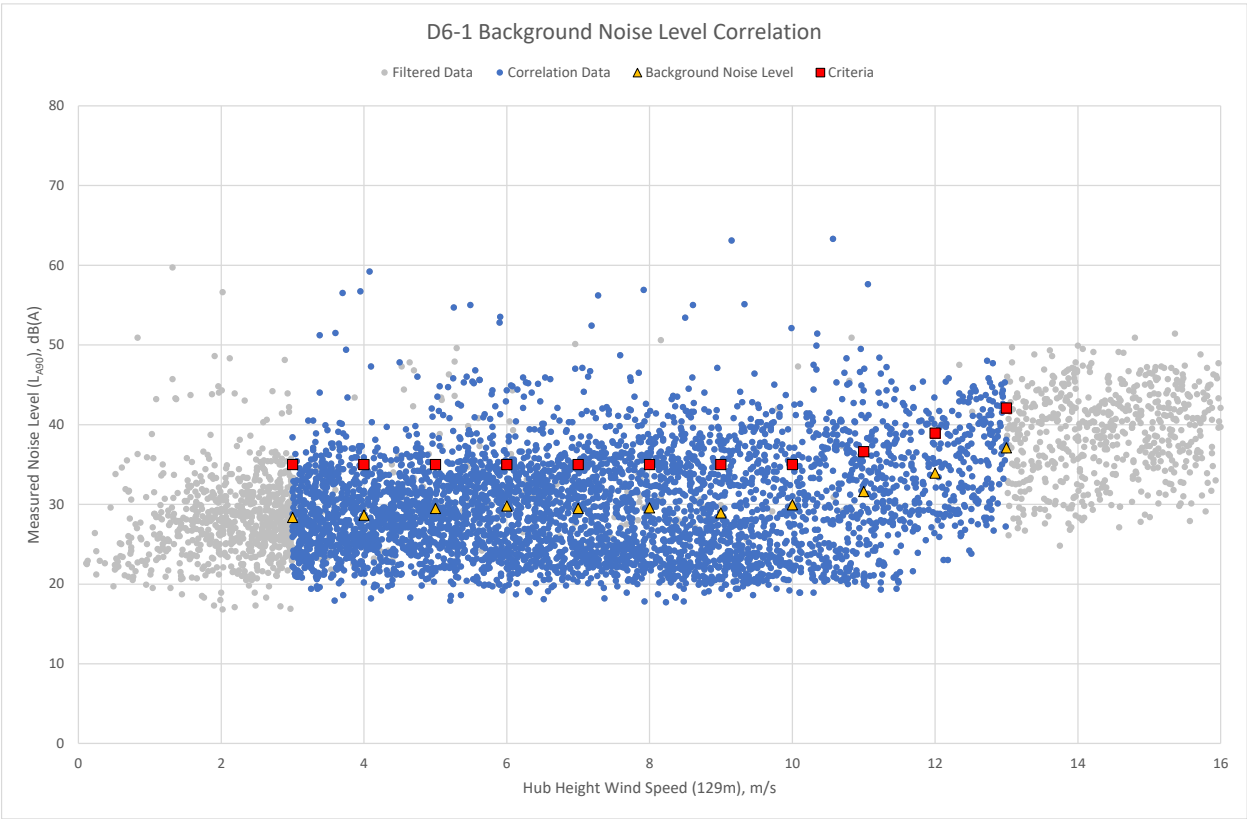


Figure 10: D6-1 Background Noise Level Correlation Graph

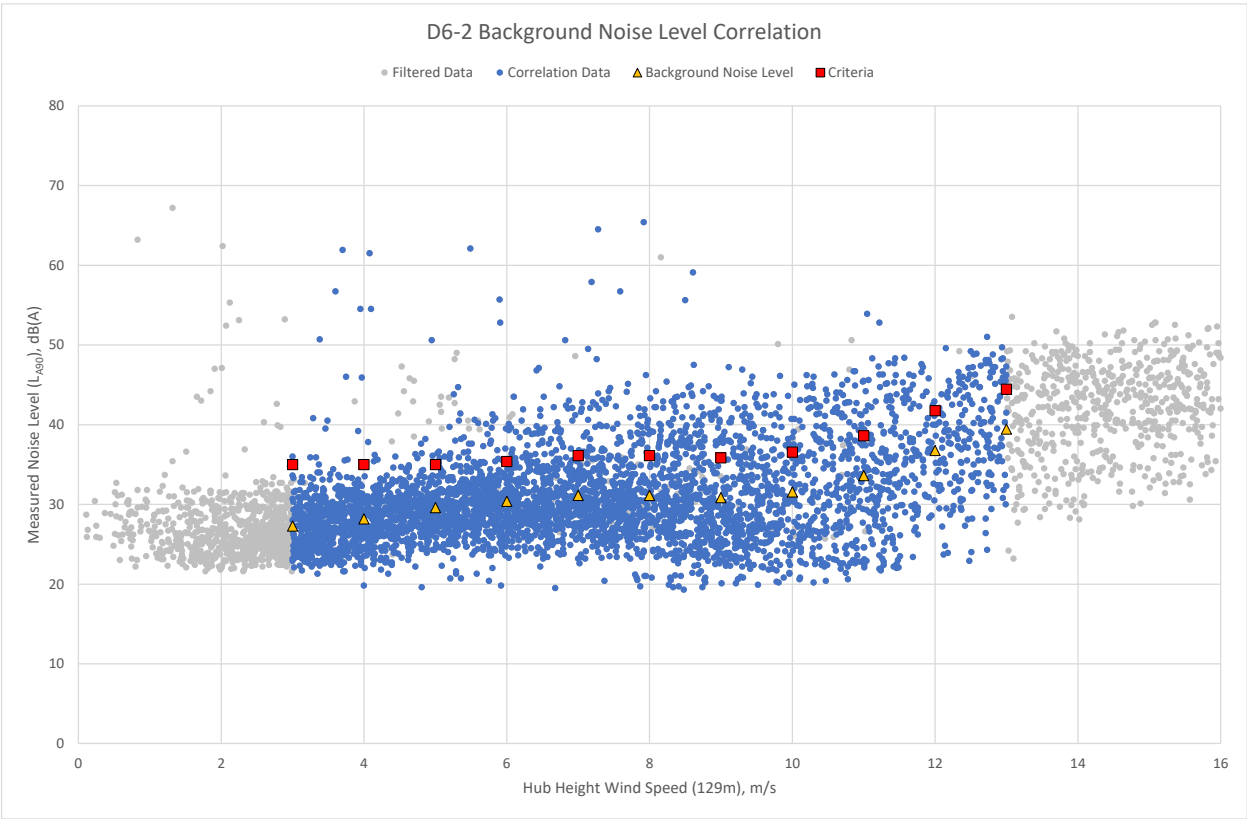


Figure 11: D6-2 Background Noise Level Correlation Graph

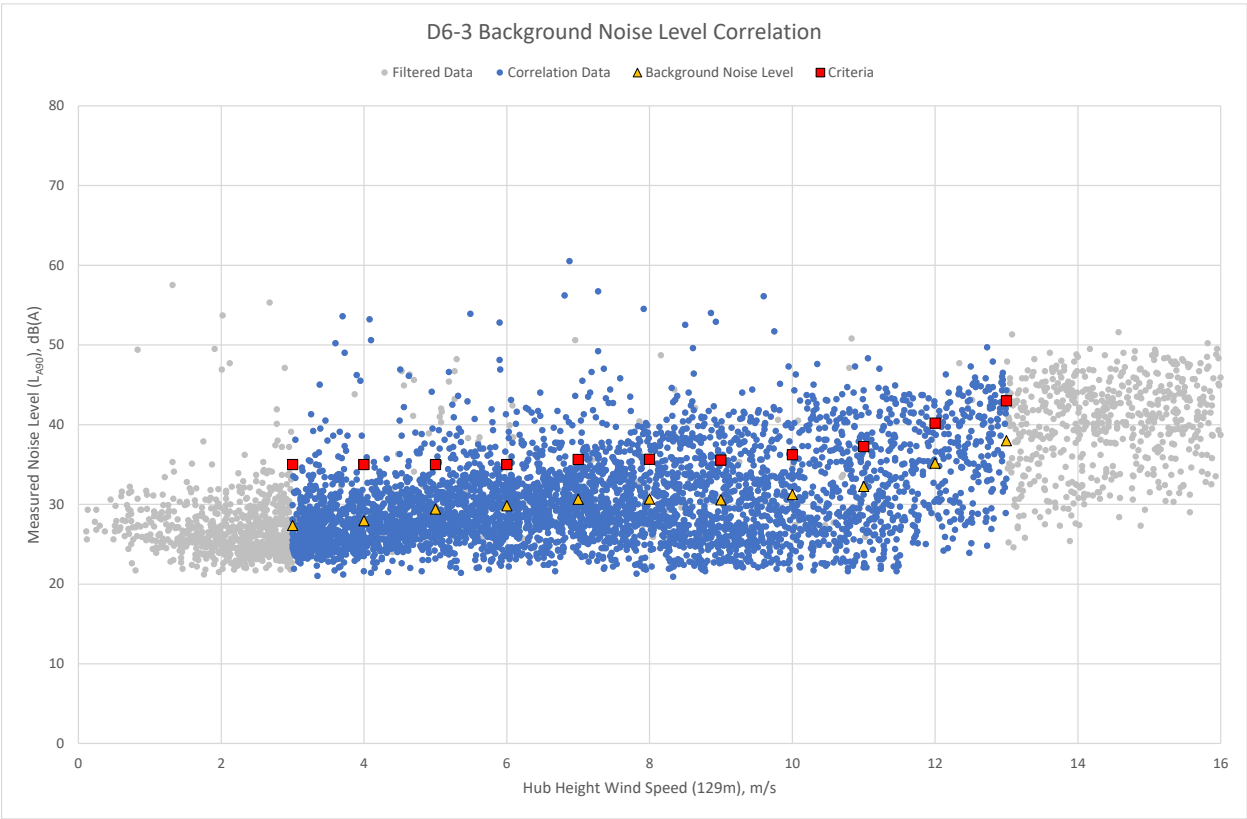


Figure 12: D6-3 Background Noise Level Correlation Graph

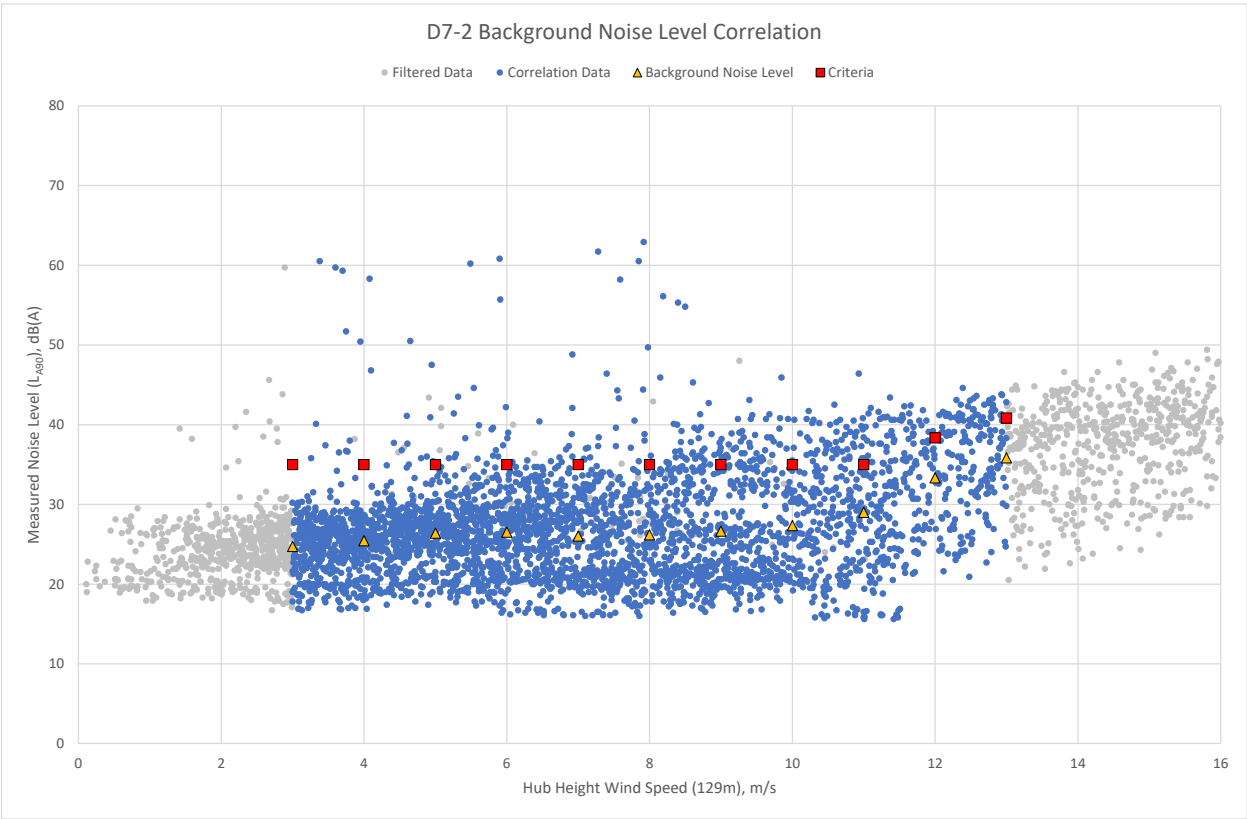


Figure 13: D7-2 Background Noise Level Correlation Graph

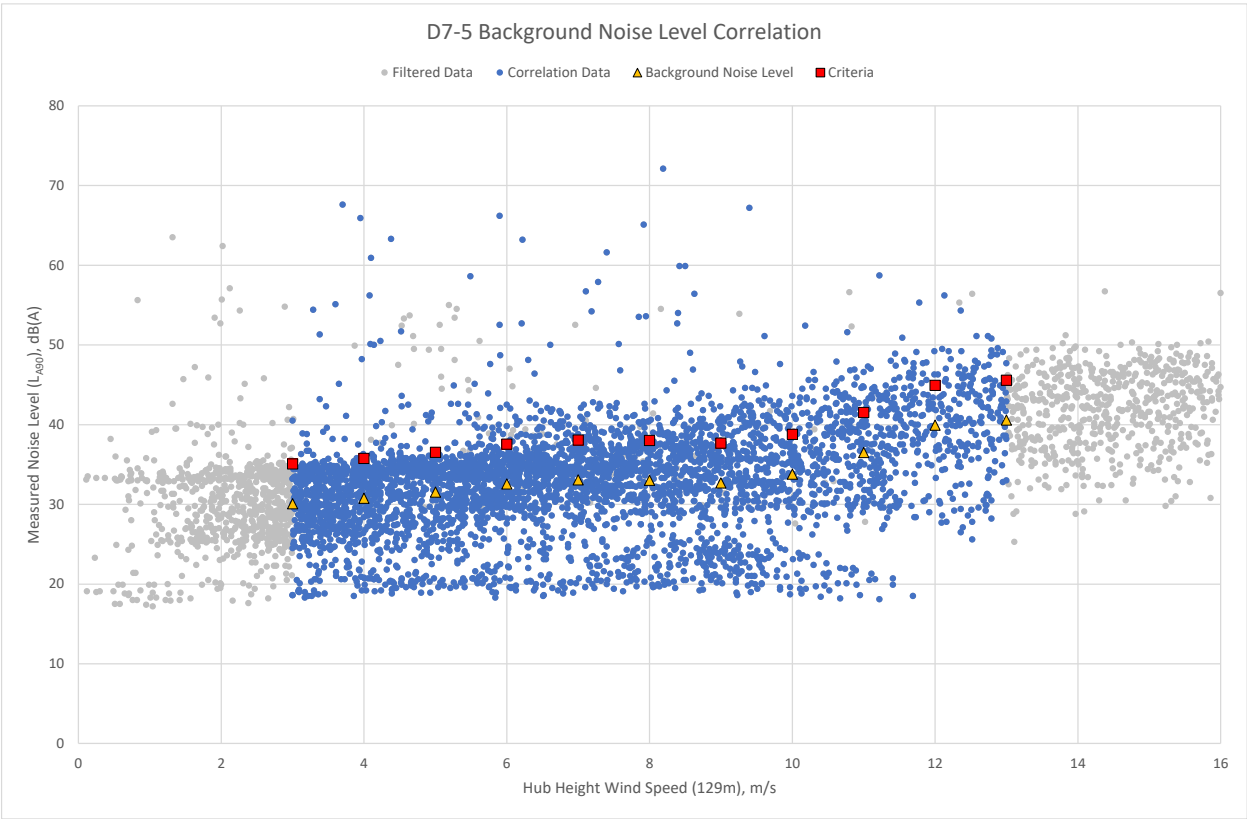


Figure 14: D7-5 Background Noise Level Correlation Graph

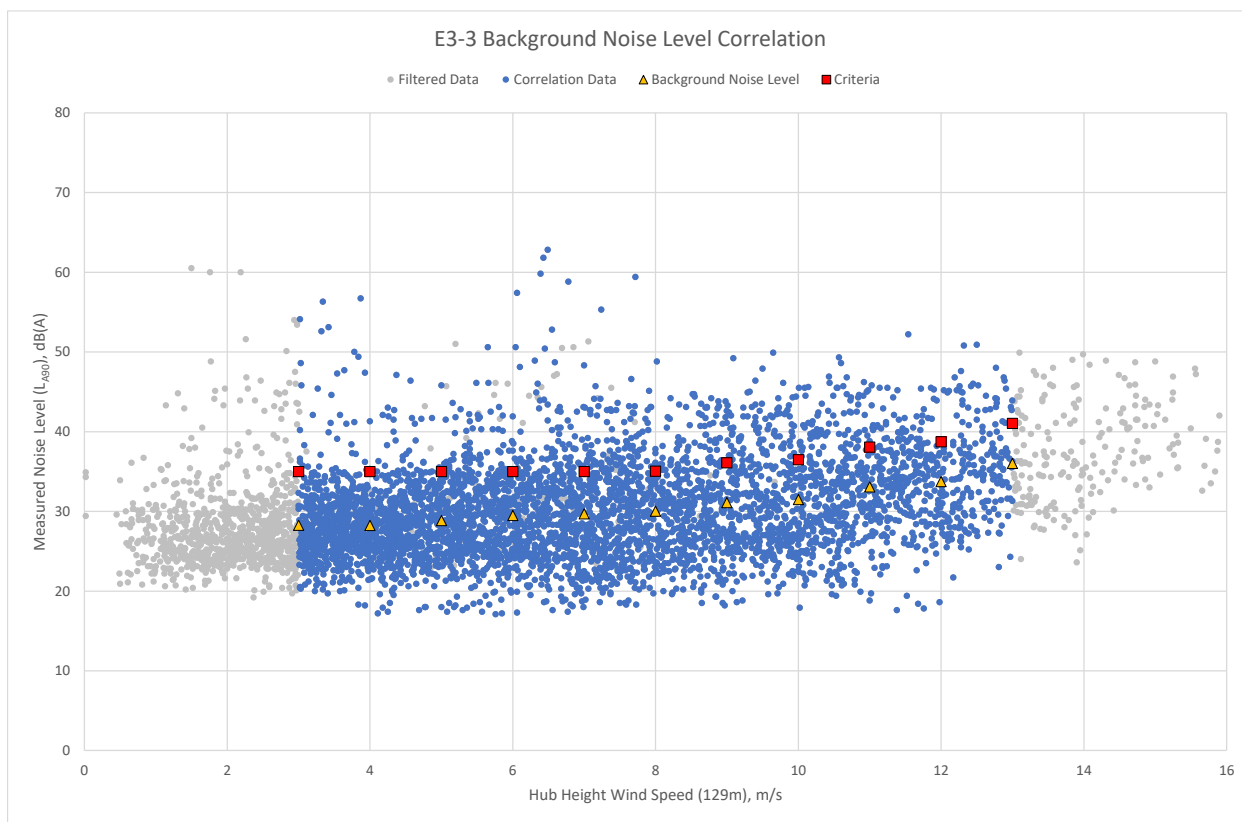


Figure 15: E3-3 Background Noise Level Correlation Graph

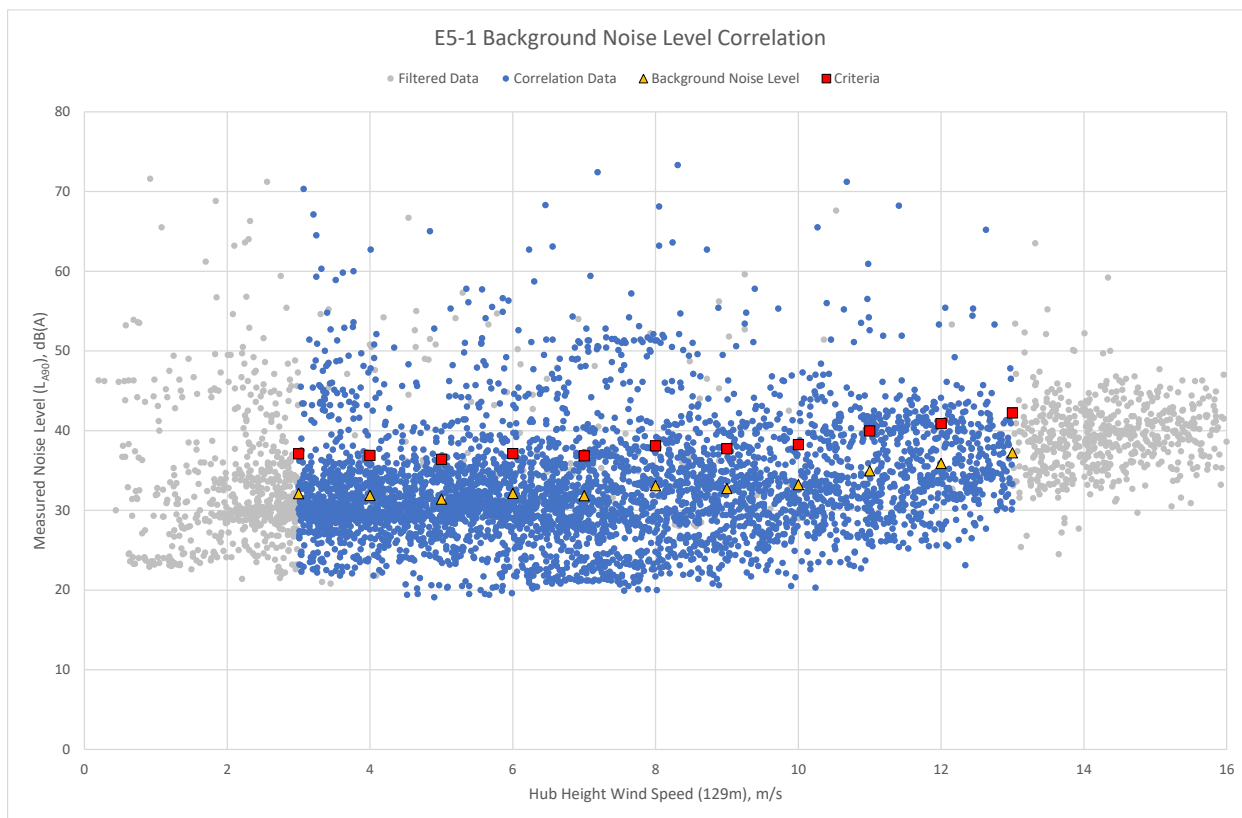


Figure 16: E5-1 Background Noise Level Correlation Graph

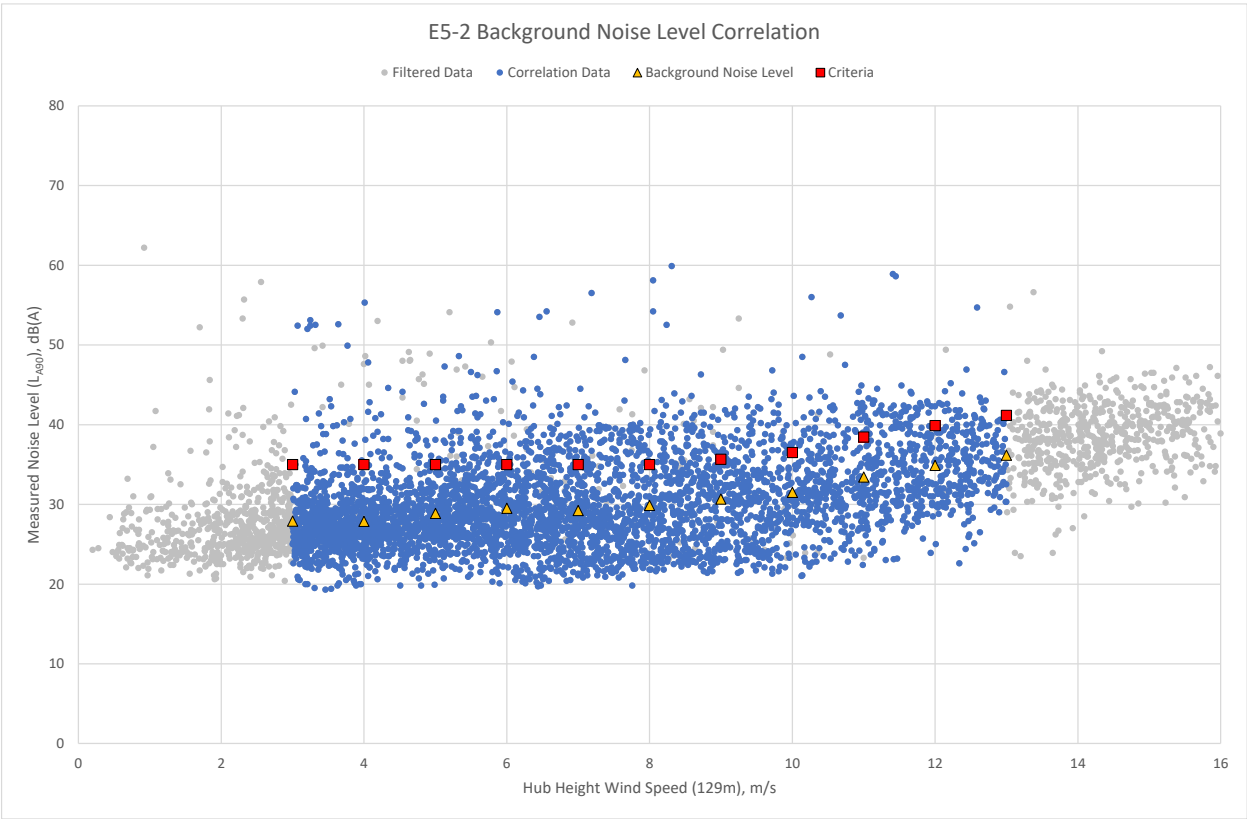


Figure 17: E5-2 Background Noise Level Correlation Graph

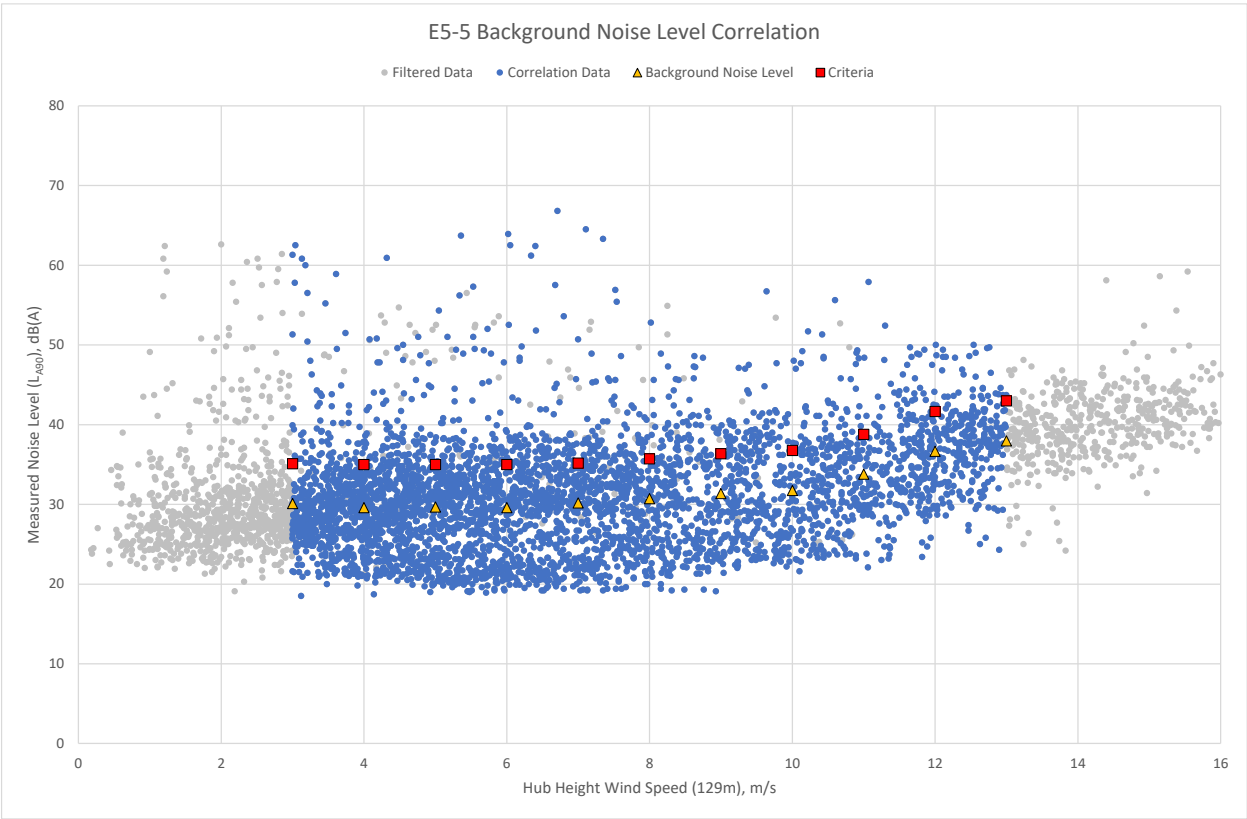


Figure 18: E5-5 Background Noise Level Correlation Graph

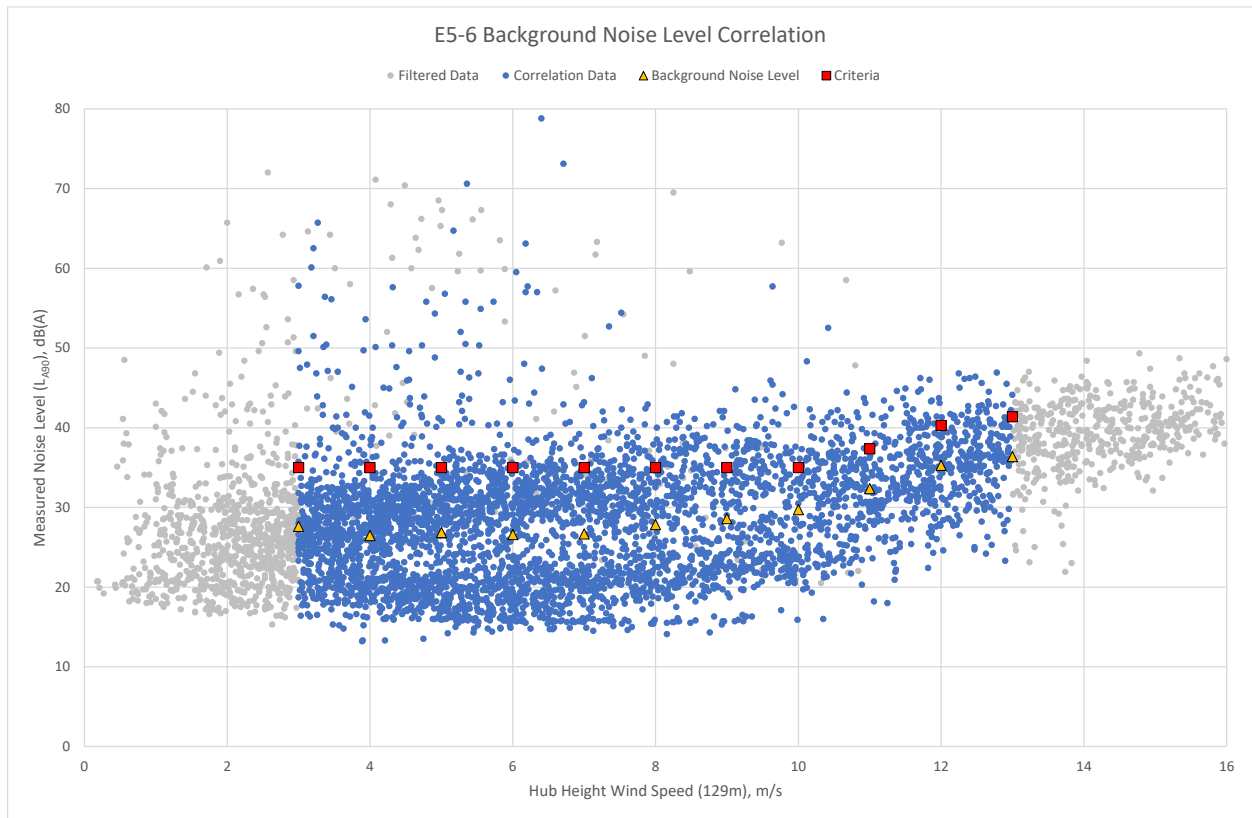


Figure 19: E5-6 Background Noise Level Correlation Graph

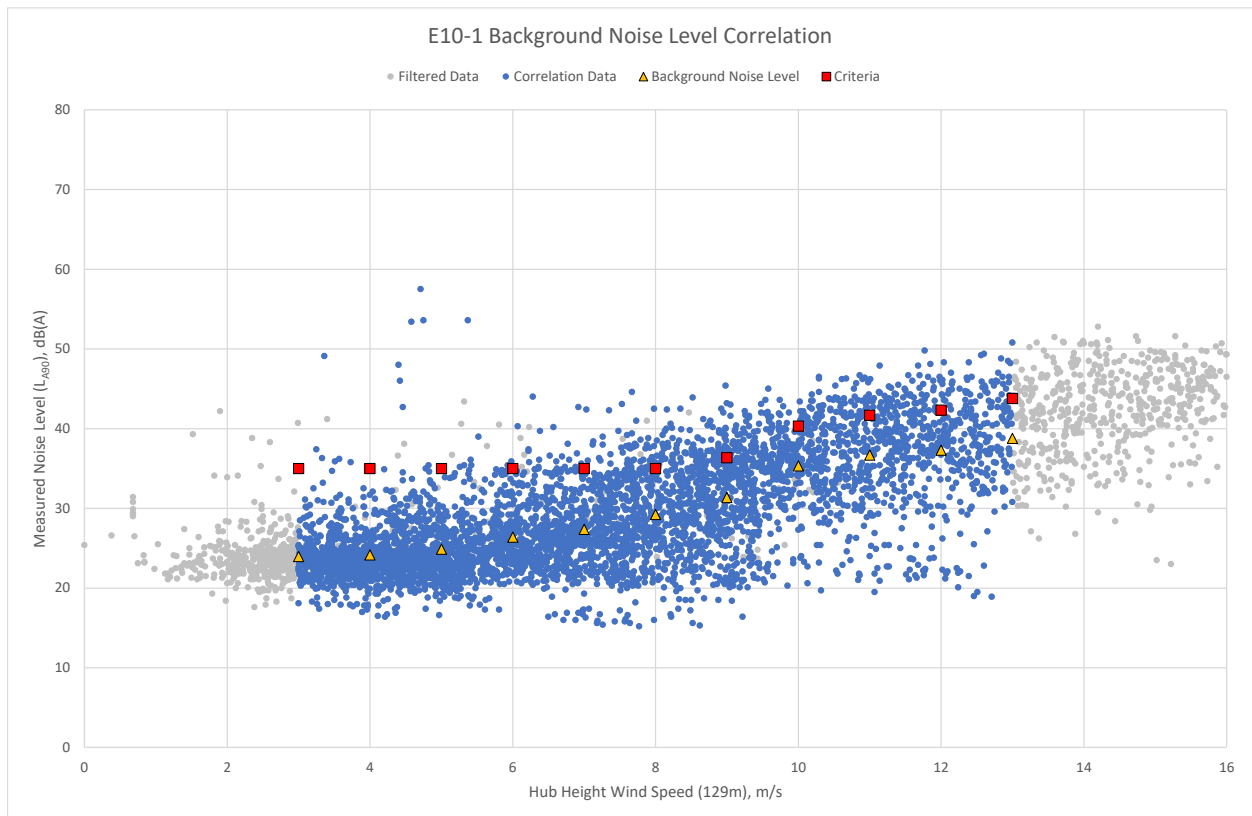


Figure 20: E10-1 Background Noise Level Correlation Graph

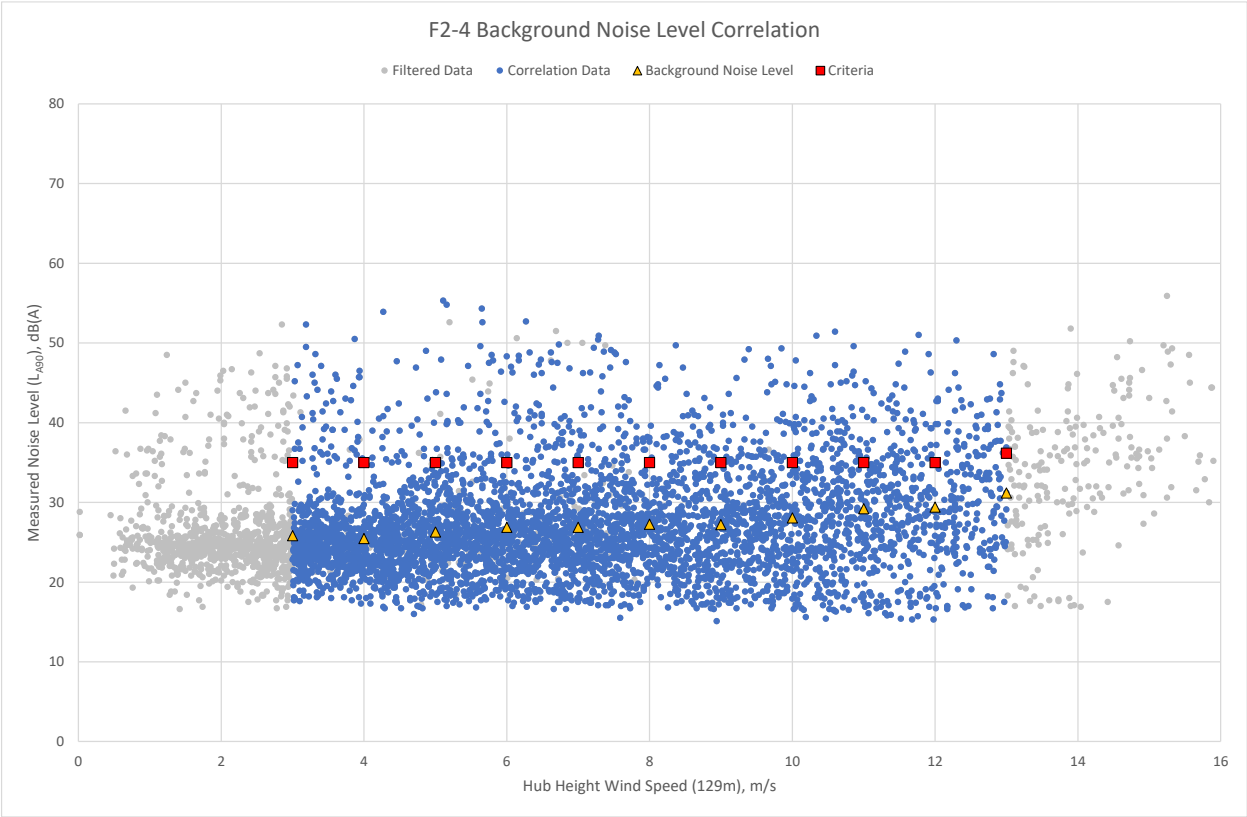


Figure 21: F2-4 Background Noise Level Correlation Graph

APPENDIX E: WIND TURBINE SOUND POWER LEVELS

Table 19: Wind Turbine Sound Power Level Data

Sound Power Level [dB(A)] for each One-third Octave Band Centre Frequency	Hub Height (129m) Wind Speed [m/s]										
	3	4	5	6	7	8	9	10	11	12	13
10 Hz	32.1	31.9	33.7	36.2	45.1	45.9	47.2	48.8	48.8	48.8	48.8
12.5 Hz	37.0	37.5	39.2	41.4	49.7	50.6	51.8	53.4	53.4	53.4	53.4
16 Hz	41.9	43.0	44.6	46.6	54.2	55.2	56.4	58.1	58.1	58.1	58.1
20 Hz	46.7	48.6	50.0	51.7	58.7	59.9	61.0	62.7	62.7	62.7	62.7
25 Hz	51.9	54.9	56.1	56.9	63.9	65.4	66.4	67.9	67.9	67.9	67.9
31.5 Hz	56.7	60.5	61.6	62.1	68.5	70.0	71.0	72.6	72.6	72.6	72.6
40 Hz	61.3	65.0	66.1	67.3	71.9	73.4	74.6	76.4	76.4	76.4	76.4
50 Hz	78.3	78.9	79.3	80.6	81.4	82.3	78.7	81.0	81.0	81.0	81.0
63 Hz	84.0	84.5	84.9	86.2	86.7	87.5	82.3	84.9	84.9	84.9	84.9
80 Hz	85.0	85.5	85.9	87.1	87.9	88.8	84.8	87.2	87.2	87.2	87.2
100 Hz	86.1	86.5	87.0	88.0	89.3	90.3	87.7	89.7	89.7	89.7	89.7
125 Hz	87.1	87.5	88.0	88.9	90.6	91.8	90.3	92.0	92.0	92.0	92.0
160 Hz	85.8	86.3	86.7	87.7	89.9	91.4	91.8	93.6	93.6	93.6	93.6
200 Hz	85.4	85.9	85.8	87.2	89.6	91.8	93.9	95.7	95.7	95.7	95.7
250 Hz	86.4	86.4	85.6	87.3	89.9	92.7	95.4	97.2	97.2	97.2	97.2
315 Hz	85.6	85.4	84.2	86.3	89.2	92.3	95.2	96.9	96.9	96.9	96.9
400 Hz	85.0	84.5	83.2	85.4	88.3	91.5	94.1	95.8	95.8	95.8	95.8
500 Hz	85.1	84.5	83.0	85.3	88.2	91.5	93.8	95.4	95.4	95.4	95.4
630 Hz	85.1	84.5	83.6	86.0	89.0	92.3	94.6	95.6	95.6	95.6	95.6
800 Hz	85.2	84.8	84.8	87.4	90.5	93.7	96.0	96.2	96.2	96.2	96.2
1 kHz	85.2	84.9	85.4	88.1	91.3	94.5	96.8	96.4	96.4	96.4	96.4
1.25 kHz	84.6	84.3	85.0	87.7	90.9	94.3	96.8	96.0	96.0	96.0	96.0
1.6 kHz	84.1	84.1	84.9	87.3	90.5	94.3	97.0	95.5	95.5	95.5	95.5
2 kHz	83.4	83.5	84.6	86.8	90.2	94.1	96.9	95.2	95.2	95.2	95.2
2.5 kHz	81.2	80.9	82.0	84.3	88.5	92.1	95.0	94.6	94.6	94.6	94.6
3.15 kHz	78.5	77.6	78.6	81.2	86.8	89.8	92.8	94.8	94.8	94.8	94.8
4 kHz	76.3	75.0	76.1	78.7	85.1	87.8	90.9	94.3	94.3	94.3	94.3
5 kHz	72.5	70.7	71.8	73.9	80.4	83.6	86.5	90.0	90.0	90.0	90.0
6.3 kHz	68.0	65.4	66.4	67.5	73.9	78.1	80.5	83.7	83.7	83.7	83.7
8 kHz	64.3	61.1	62.1	62.6	69.2	73.9	76.1	79.4	79.4	79.4	79.4
10 kHz	60.6	56.8	57.9	57.8	64.5	69.7	71.6	75.2	75.2	75.2	75.2
Sound Power Level [dB(A)]	97.6	97.6	97.7	99.5	102.2	105	107.1	107.8	107.8	107.8	107.8

APPENDIX F: WIND TURBINE OPERATION PREDICTED NOISE LEVELS

Table 20: Wind Turbine Operation Predicted Noise Levels

Residence ID	Residence Status	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
		3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
		Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
B5-6	Non-Associated	24	35	25	35	25	35	26	35	28	35	29	35	28	35	30	35
B5-7	Non-Associated	25	35	25	35	25	35	27	35	28	35	29	35	28	35	30	35
B6-4	Non-Associated	23	35	24	35	24	35	25	35	27	35	28	35	26	35	28	35
B6-7	Non-Associated	24	35	24	35	24	35	26	35	27	35	28	37	27	36	29	37
B6-8	Non-Associated	24	35	25	35	25	35	26	35	27	35	29	37	28	36	29	37
B6-9	Non-Associated	24	35	24	35	25	35	26	35	27	35	29	37	28	36	29	37
B6-10	Non-Associated	24	35	25	35	25	35	26	35	28	35	29	35	28	35	30	35
B6-11	Non-Associated	24	35	24	35	25	35	26	35	27	35	29	37	28	36	30	37
B6-12	Non-Associated	21	35	22	35	22	35	24	35	25	35	26	37	24	36	26	37
C2-3	Non-Associated	26	35	26	35	26	35	28	35	29	36	30	37	30	39	32	40
C2-4	Non-Associated	25	35	26	35	26	35	27	35	29	36	30	37	29	39	31	40
C4-1	Non-Associated	26	35	27	35	27	35	28	35	30	35	31	35	30	35	32	35
C4-2	Non-Associated	26	35	27	35	27	35	28	35	30	35	31	35	30	35	32	35
C4-3	Non-Associated	26	35	27	35	27	35	28	35	30	35	31	35	30	35	32	35
C4-4	Non-Associated	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-5	Non-Associated	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-6	Non-Associated	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-7	Non-Associated	27	35	28	35	28	35	29	35	30	35	32	35	31	35	33	35
C4-8	Associated	28	-	29	-	29	-	30	-	32	-	33	-	32	-	34	-
C4-9	Non-Associated	28	35	29	35	29	35	30	35	32	35	33	35	33	35	35	35
C5-1	Non-Associated	25	35	26	35	26	35	27	35	28	35	30	35	29	35	31	35
C5-2	Non-Associated	25	35	26	35	26	35	27	35	29	35	30	35	29	35	31	35
C5-3	Non-Associated	26	35	26	35	27	35	28	35	29	35	30	35	29	35	31	35
C5-4	Non-Associated	26	35	26	35	27	35	28	35	29	35	31	35	30	35	32	35
C5-5	Non-Associated	26	35	27	35	27	35	28	35	29	35	31	35	30	35	32	35
C5-6	Non-Associated	26	35	26	35	27	35	28	35	29	35	31	35	30	35	32	35
C5-7	Associated	29	-	30	-	30	-	31	-	33	-	34	-	35	-	36	-
C5-8	Associated	29	-	30	-	30	-	31	-	33	-	35	-	35	-	37	-
C5-9	Non-Associated	28	35	28	35	29	35	30	35	31	35	33	35	32	35	34	35
C5-10	Associated	29	-	29	-	29	-	31	-	32	-	34	-	33	-	35	-
C6-1	Associated	25	-	26	-	26	-	27	-	29	-	30	-	30	-	31	-
C6-3	Non-Associated	27	35	27	35	28	35	29	35	30	35	32	37	31	36	33	37
C6-4	Non-Associated	26	35	27	35	27	35	28	35	29	35	31	37	30	36	32	37
C7-1	Non-Associated	26	35	26	35	26	35	28	35	29	35	30	37	29	36	31	37
C7-2	Non-Associated	25	35	25	35	26	35	27	35	28	35	29	35	28	35	30	35
D4-1	Associated	31	-	31	-	31	-	33	-	34	-	36	-	36	-	38	-
D4-2	Associated	31	-	32	-	32	-	33	-	35	-	36	-	37	-	38	-
D4-3	Associated	31	-	32	-	32	-	33	-	35	-	36	-	37	-	38	-
D4-4	Associated	32	-	32	-	32	-	34	-	35	-	37	-	38	-	39	-
D4-5	Associated	31	-	31	-	31	-	32	-	34	-	36	-	36	-	37	-
D4-6	Associated	32	-	32	-	32	-	34	-	35	-	37	-	38	-	39	-
D4-7	Associated	33	-	33	-	33	-	35	-	36	-	38	-	39	-	40	-
D4-8	Associated	33	-	33	-	33	-	35	-	36	-	38	-	39	-	40	-
D4-9	Associated	32	-	32	-	32	-	33	-	35	-	37	-	37	-	39	-
D4-10	Associated	30	-	30	-	30	-	32	-	33	-	35	-	35	-	37	-
D6-1	Associated	30	-	30	-	31	-	32	-	33	-	35	-	35	-	37	-
D6-2	Associated	30	-	30	-	31	-	32	-	33	-	35	-	35	-	37	-
D6-3	Associated	30	-	30	-	31	-	32	-	33	-	35	-	35	-	37	-

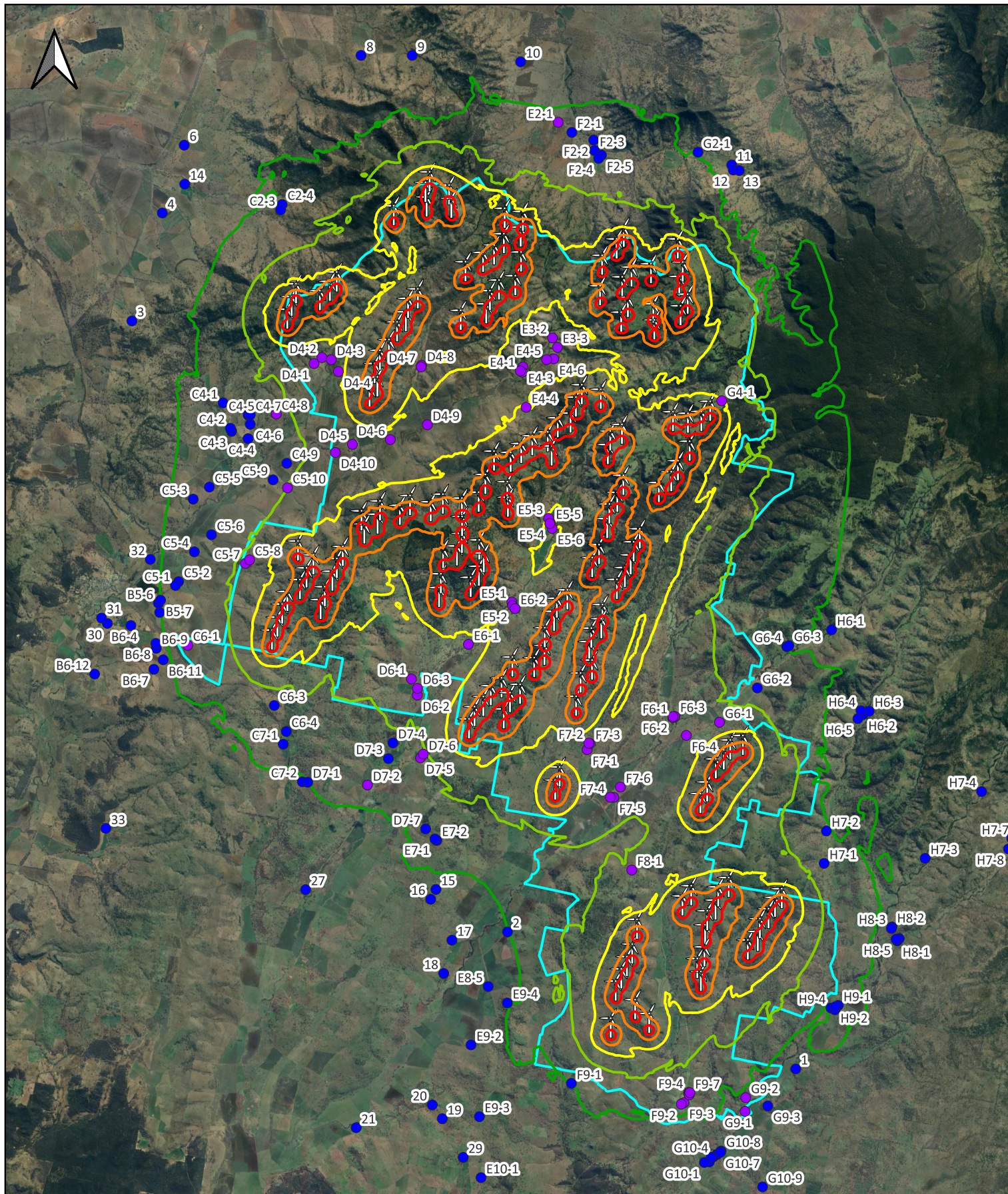
Residence ID	Residence Status	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
		3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
		Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
D7-1	Non-Associated	25	35	25	35	26	35	27	35	28	35	29	35	28	35	30	35
D7-2	Associated	26	-	26	-	27	-	28	-	29	-	30	-	29	-	31	-
D7-3	Non-Associated	27	38	27	38	27	39	29	38	30	39	31	39	31	39	32	39
D7-4	Non-Associated	28	38	28	38	28	39	30	38	31	39	32	39	32	39	34	39
D7-5	Associated	28	-	28	-	28	-	30	-	31	-	33	-	32	-	34	-
D7-6	Associated	28	-	29	-	29	-	30	-	32	-	33	-	33	-	35	-
D7-7	Non-Associated	27	35	27	36	28	37	29	38	30	38	31	38	30	38	32	39
E2-1	Associated	25	-	26	-	26	-	27	-	29	-	30	-	29	-	31	-
E3-2	Associated	31	-	31	-	31	-	33	-	34	-	36	-	36	-	38	-
E3-3	Associated	31	-	31	-	31	-	33	-	34	-	36	-	36	-	38	-
E4-1	Associated	31	-	31	-	32	-	33	-	35	-	36	-	36	-	38	-
E4-2	Associated	31	-	31	-	32	-	33	-	34	-	36	-	36	-	38	-
E4-3	Associated	31	-	31	-	32	-	33	-	34	-	36	-	36	-	38	-
E4-4	Associated	33	-	33	-	33	-	35	-	36	-	38	-	39	-	40	-
E4-5	Associated	31	-	31	-	31	-	33	-	34	-	36	-	36	-	38	-
E4-6	Associated	31	-	31	-	32	-	33	-	34	-	36	-	36	-	38	-
E5-1	Associated	34	-	34	-	34	-	35	-	37	-	39	-	40	-	41	-
E5-2	Associated	33	-	34	-	34	-	35	-	37	-	39	-	39	-	41	-
E5-3	Associated	33	-	33	-	33	-	34	-	36	-	38	-	38	-	40	-
E5-4	Associated	32	-	33	-	33	-	34	-	36	-	38	-	38	-	40	-
E5-5	Associated	32	-	33	-	33	-	34	-	36	-	38	-	38	-	40	-
E5-6	Associated	32	-	33	-	33	-	34	-	36	-	38	-	38	-	40	-
E6-1	Associated	32	-	33	-	33	-	34	-	36	-	38	-	38	-	40	-
E6-2	Associated	33	-	33	-	33	-	35	-	36	-	38	-	39	-	40	-
E7-1	Non-Associated	26	35	27	36	27	37	28	38	30	38	31	38	30	38	32	39
E7-2	Non-Associated	26	35	27	36	27	37	28	38	30	38	31	38	30	38	32	39
E8-5	Non-Associated	24	35	24	35	24	35	26	35	27	35	28	35	26	35	28	35
E9-2	Non-Associated	22	35	23	35	23	35	24	35	25	35	27	35	25	35	27	35
E9-3	Non-Associated	22	35	23	35	23	35	24	35	25	35	26	35	25	36	27	40
E9-4	Non-Associated	25	35	25	35	26	35	27	35	28	35	29	35	28	35	30	35
E10-1	Non-Associated	21	35	21	35	21	35	23	35	24	35	25	35	23	36	25	40
F2-1	Non-Associated	25	35	26	35	26	35	27	35	29	35	30	35	29	35	31	35
F2-2	Non-Associated	26	35	26	35	26	35	27	35	29	35	30	35	30	35	31	35
F2-3	Non-Associated	26	35	26	35	27	35	28	35	29	35	31	35	30	35	32	35
F2-4	Non-Associated	26	35	27	35	27	35	28	35	30	35	31	35	31	35	32	35
F2-5	Non-Associated	26	35	27	35	27	35	28	35	29	35	31	35	30	35	32	35
F6-1	Associated	30	-	30	-	30	-	32	-	33	-	35	-	35	-	36	-
F6-2	Associated	30	-	30	-	31	-	32	-	33	-	35	-	35	-	37	-
F6-3	Associated	30	-	30	-	31	-	32	-	33	-	35	-	35	-	37	-
F6-4	Associated	30	-	30	-	30	-	32	-	33	-	35	-	35	-	37	-
F7-1	Associated	30	-	31	-	31	-	32	-	34	-	35	-	36	-	37	-
F7-2	Associated	30	-	31	-	31	-	32	-	34	-	36	-	36	-	38	-
F7-3	Associated	30	-	31	-	31	-	32	-	34	-	36	-	36	-	38	-
F7-4	Associated	30	-	30	-	31	-	32	-	33	-	35	-	35	-	37	-
F7-5	Associated	30	-	30	-	30	-	32	-	33	-	35	-	35	-	36	-
F7-6	Associated	30	-	30	-	30	-	32	-	33	-	35	-	35	-	36	-
F8-1	Associated	30	-	30	-	30	-	32	-	33	-	35	-	35	-	36	-
F9-1	Non-Associated	24	35	24	35	25	35	26	35	27	35	29	35	28	36	30	40
F9-2	Associated	25	-	26	-	26	-	27	-	29	-	30	-	30	-	32	-
F9-3	Associated	25	-	26	-	26	-	27	-	29	-	30	-	30	-	32	-

Residence ID	Residence Status	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
		3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
		Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
F9-4	Associated	26	-	26	-	26	-	28	-	29	-	31	-	30	-	32	-
F9-5	Associated	26	-	26	-	26	-	28	-	29	-	30	-	30	-	32	-
F9-6	Associated	25	-	26	-	26	-	27	-	29	-	30	-	30	-	32	-
F9-7	Associated	26	-	26	-	26	-	28	-	29	-	30	-	30	-	32	-
F11-1	Associated	19	-	19	-	20	-	21	-	22	-	23	-	20	-	22	-
F11-2	Associated	19	-	19	-	20	-	21	-	22	-	23	-	21	-	23	-
G2-1	Non-Associated	24	35	25	35	25	35	26	35	27	35	29	35	28	35	30	35
G4-1	Associated	33	-	33	-	33	-	34	-	36	-	38	-	39	-	40	-
G6-1	Associated	30	-	30	-	31	-	32	-	34	-	35	-	36	-	37	-
G6-2	Non-Associated	27	35	27	35	28	35	29	35	30	36	32	35	31	37	33	37
G6-3	Non-Associated	25	35	26	35	26	35	27	35	28	36	30	35	28	37	30	37
G6-4	Non-Associated	26	35	26	35	26	35	28	35	29	36	30	35	29	37	31	37
G9-1	Associated	22	-	23	-	23	-	24	-	25	-	27	-	26	-	28	-
G9-2	Associated	23	-	23	-	24	-	25	-	26	-	28	-	27	-	29	-
G9-3	Non-Associated	24	35	24	35	25	35	26	35	27	35	28	35	27	35	29	35
G10-1	Non-Associated	21	35	21	35	22	35	23	35	24	35	25	35	24	36	26	40
G10-2	Non-Associated	21	35	22	35	22	35	23	35	24	35	26	35	24	36	26	40
G10-3	Non-Associated	21	35	22	35	22	35	23	35	24	35	26	35	24	36	26	40
G10-4	Non-Associated	21	35	22	35	22	35	23	35	24	35	26	35	24	36	26	40
G10-5	Non-Associated	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-7	Non-Associated	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-8	Non-Associated	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-9	Non-Associated	21	35	22	35	22	35	23	35	25	35	26	35	24	36	26	40
G10-10	Non-Associated	21	35	21	35	21	35	23	35	24	35	25	35	23	36	25	40
H6-1	Non-Associated	23	35	24	35	24	35	25	35	27	36	28	35	26	37	28	37
H6-2	Non-Associated	22	35	22	35	23	35	24	35	25	36	26	35	25	37	27	37
H6-3	Non-Associated	22	35	22	35	23	35	24	35	25	36	26	35	24	37	26	37
H6-4	Non-Associated	22	35	23	35	23	35	24	35	25	36	26	35	25	37	27	37
H6-5	Non-Associated	22	35	23	35	23	35	24	35	25	36	27	35	25	37	27	37
H7-1	Non-Associated	26	35	26	35	26	35	27	35	29	35	30	35	30	35	32	35
H7-2	Non-Associated	24	35	25	35	25	35	26	35	28	35	29	35	29	35	30	35
H7-3	Non-Associated	21	35	21	35	21	35	23	35	24	35	25	35	23	35	25	35
H7-4	Non-Associated	19	35	19	35	20	35	21	35	22	35	23	35	21	35	23	35
H7-5	Non-Associated	19	35	19	35	20	35	21	35	22	35	23	35	20	35	23	35
H7-6	Non-Associated	19	35	19	35	20	35	21	35	22	35	23	35	20	35	23	35
H7-7	Non-Associated	19	35	19	35	20	35	21	35	22	35	23	35	20	35	23	35
H7-8	Non-Associated	19	35	19	35	20	35	21	35	22	35	23	35	21	35	23	35
H8-1	Non-Associated	23	35	24	35	24	35	25	35	26	35	28	35	27	35	29	35
H8-2	Non-Associated	24	35	24	35	25	35	26	35	27	35	29	35	28	35	30	35
H8-3	Non-Associated	24	35	25	35	25	35	26	35	27	35	29	35	28	35	30	35
H8-4	Non-Associated	23	35	24	35	24	35	25	35	26	35	28	35	27	35	29	35
H8-5	Non-Associated	23	35	24	35	24	35	25	35	27	35	28	35	27	35	29	35
H9-1	Non-Associated	25	35	25	35	25	35	27	35	28	35	30	35	29	35	31	35
H9-2	Non-Associated	25	35	25	35	25	35	27	35	28	35	29	35	29	35	31	35
H9-3	Non-Associated	25	35	25	35	25	35	27	35	28	35	30	35	29	35	31	35
H9-4	Non-Associated	24	35	24	35	25	35	26	35	27	35	29	35	28	35	30	35
1	Non-Associated	23	35	23	35	24	35	25	35	26	35	28	35	27	35	29	35
2	Non-Associated	25	35	25	36	26	37	27	38	28	38	29	38	28	38	30	39
3	Non-Associated	23	35	23	35	24	35	25	35	26	36	27	37	25	39	27	40
4	Non-Associated	22	35	22	35	23	35	24	35	25	36	26	37	24	39	26	40



Residence ID	Residence Status	Predicted Noise Level [dB(A)] at Hub Height (129m) Integer Wind Speeds															
		3 m/s		4 m/s		5 m/s		6 m/s		7 m/s		8 m/s		9 m/s		10+ m/s	
		Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria	Prediction	Criteria
6	Non-Associated	21	35	22	35	22	35	23	35	24	36	25	37	23	39	25	40
8	Non-Associated	21	35	21	35	22	35	23	35	24	36	25	37	24	39	26	40
9	Non-Associated	22	35	22	35	23	35	24	35	25	36	26	37	25	39	26	40
10	Non-Associated	23	35	24	35	24	35	25	35	26	35	28	35	26	35	28	35
11	Non-Associated	23	35	24	35	24	35	25	35	27	35	28	35	27	35	29	35
12	Non-Associated	24	35	24	35	24	35	26	35	27	35	28	35	27	35	29	35
13	Non-Associated	23	35	24	35	24	35	25	35	27	35	28	35	27	35	29	35
14	Non-Associated	22	35	22	35	23	35	24	35	25	36	26	37	24	39	26	40
15	Non-Associated	25	35	26	35	26	35	27	35	28	35	29	35	28	35	30	35
16	Non-Associated	25	35	25	35	26	35	27	35	28	35	29	35	27	35	29	35
17	Non-Associated	24	35	24	35	24	35	26	35	27	35	28	35	26	35	28	35
18	Non-Associated	23	35	23	35	24	35	25	35	26	35	27	35	25	35	27	35
19	Non-Associated	20	35	21	35	21	35	23	35	24	35	25	35	22	36	24	40
20	Non-Associated	21	35	21	35	21	35	23	35	24	35	25	35	22	36	24	40
21	Non-Associated	18	35	19	35	19	35	21	35	22	35	23	35	20	36	22	40
27	Non-Associated	22	35	23	35	23	35	25	35	26	35	27	35	24	35	26	35
29	Non-Associated	21	35	21	35	21	35	23	35	24	35	25	35	22	36	25	40
30	Non-Associated	22	35	23	35	23	35	25	35	26	35	27	35	25	35	27	35
31	Non-Associated	22	35	23	35	23	35	24	35	25	35	27	35	25	35	27	35
32	Non-Associated	24	35	25	35	25	35	26	35	28	35	29	35	28	35	30	35
33	Non-Associated	19	35	19	35	20	35	21	35	22	35	23	37	20	36	22	37

APPENDIX G: WIND TURBINE OPERATION PREDICTED NOISE LEVEL CONTOURS



LIVERPOOL RANGE WIND FARM

Predicted Noise Level Contours
Wind Turbine Operation - 10m/s

ISO 9613-2:2024

Project Number: S5891

Legend

- Non-Associated Residence
- Associated Residence
- ✶ Wind Turbine
- Site Boundary

Predicted Noise Level

- 30 dB(A)
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)

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0 2.5 5 7.5 km

LIVERPOOL RANGE WIND FARM

Predicted Noise Level Contours
Wind Turbine Operation - 4m/s

ISO 9613-2:2024

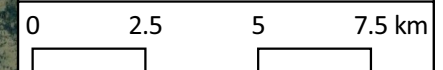
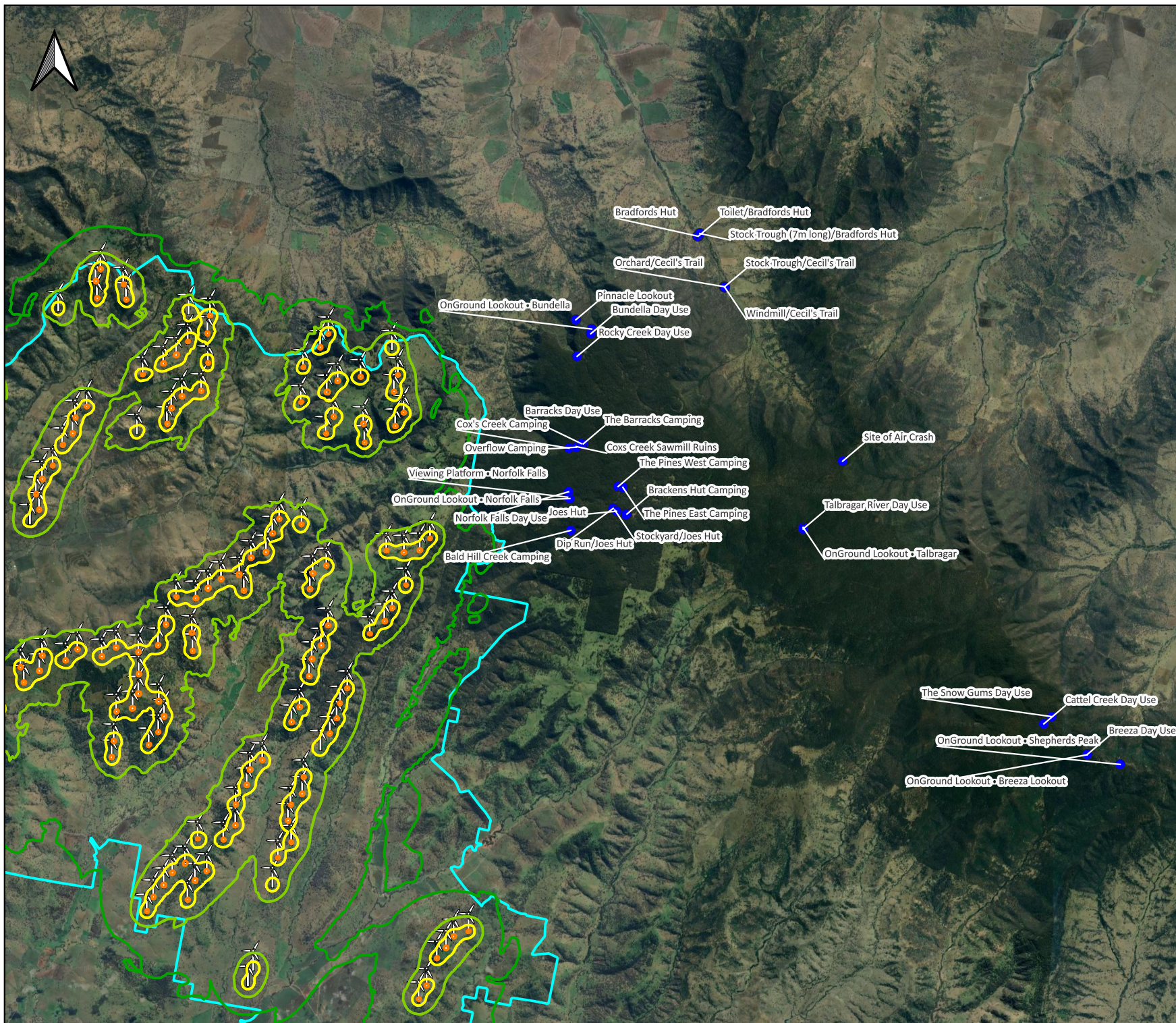
Project Number: S5891

Legend

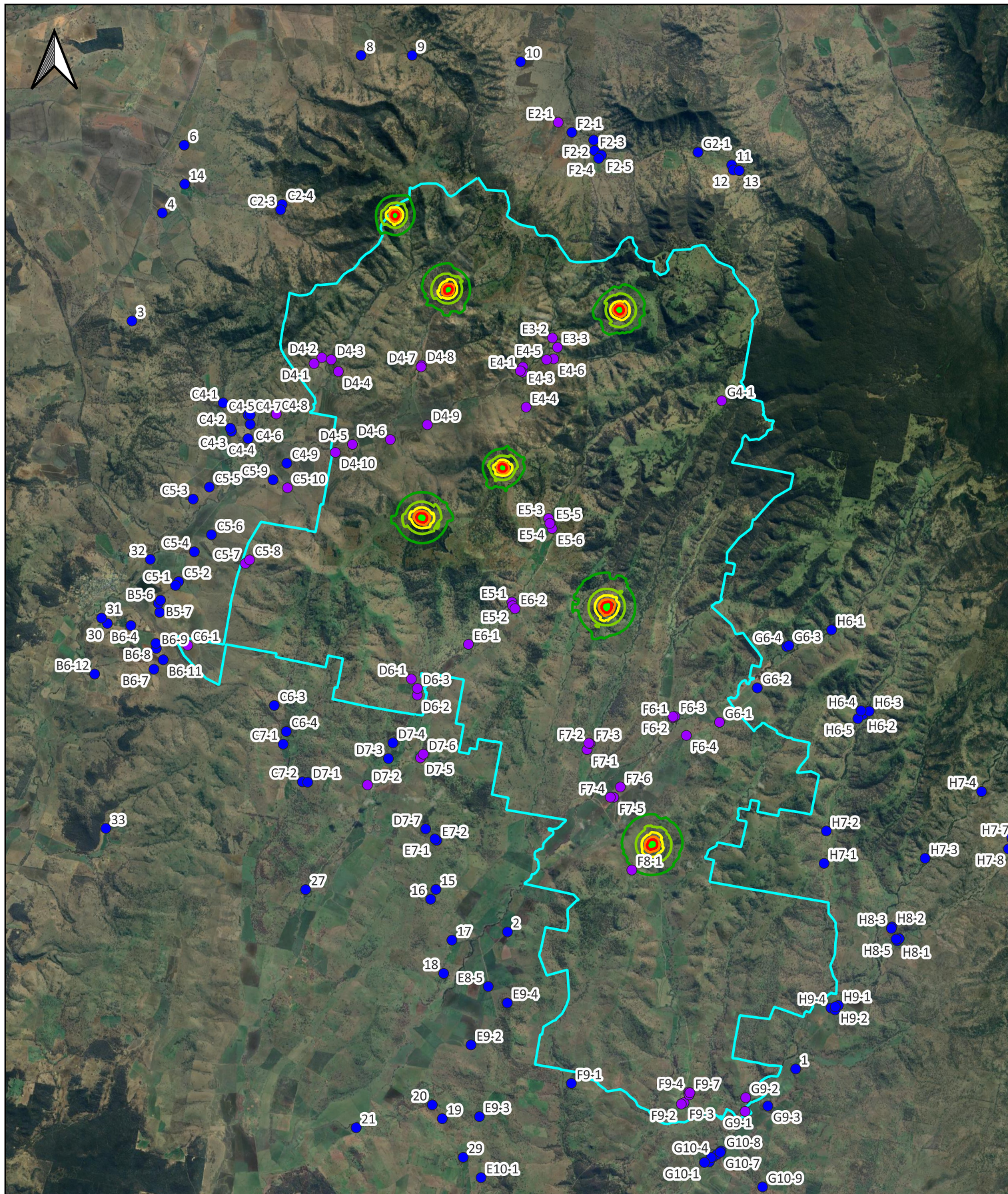
- National Park Area
-  Wind Turbine
- Site Boundary

Predicted Noise Level

- 30 dB(A)
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)



APPENDIX H: ANCILLARY INFRASTRUCTURE PREDICTED NOISE LEVEL CONTOURS



LIVERPOOL RANGE WIND FARM

Predicted Noise Level Contours
Substation Operation

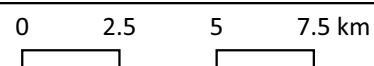
CONCAWE Category 6

Project Number: S5891

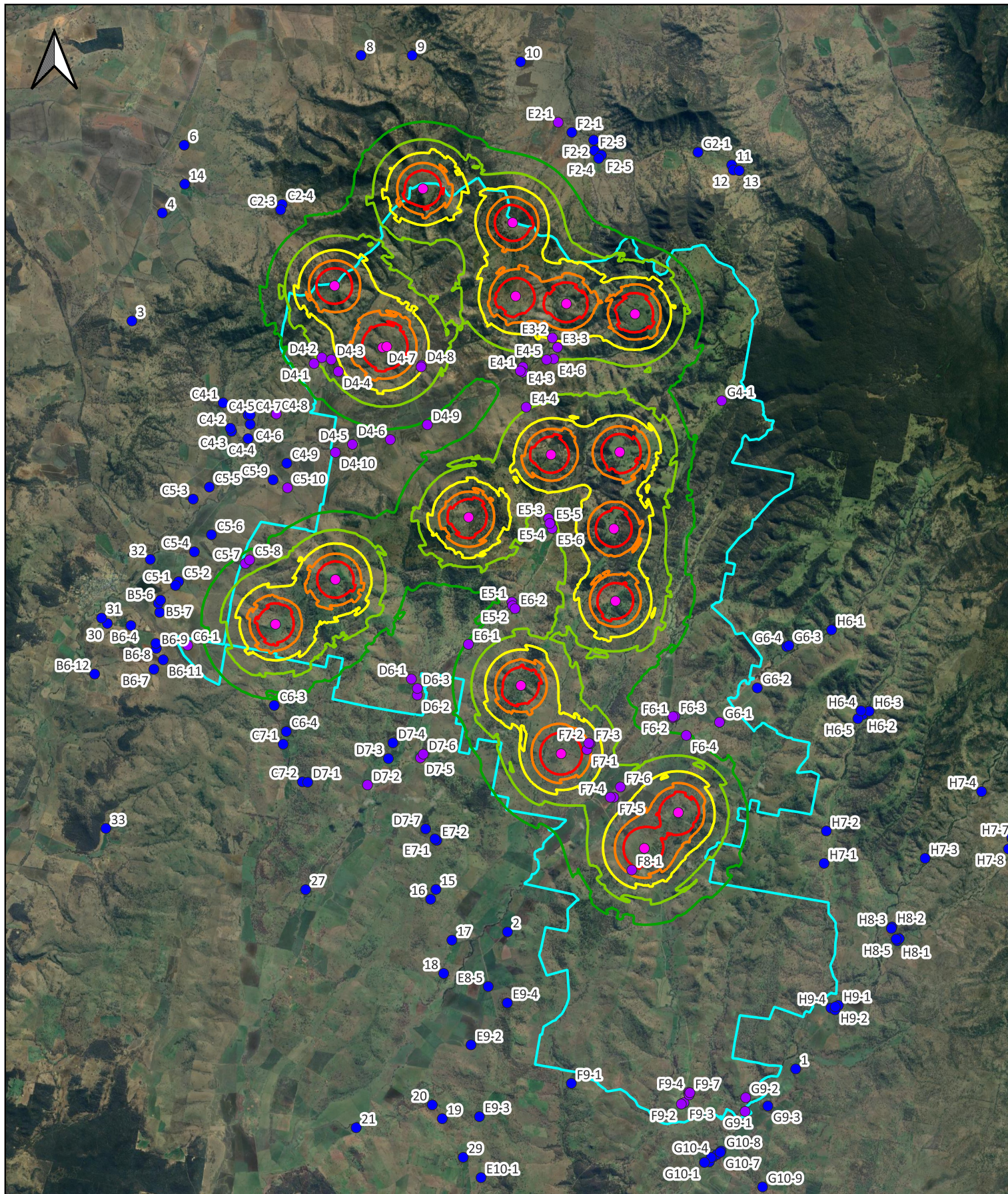
Legend

● Non-Associated Residence	Predicted Noise Level
● Associated Residence	— 30 dB(A)
● Substation	— 35 dB(A)
□ Site Boundary	— 40 dB(A)
	— 45 dB(A)
	— 50 dB(A)

sonus.



APPENDIX I: CONCRETE BATCH PLANT PREDICTED NOISE LEVEL CONTOURS



LIVERPOOL RANGE WIND FARM

Predicted Noise Level Contours
Concrete Batch Plant Operation

CONCAWE Category 6

Project Number: S5891

Legend

- Non-Associated Residence
- Associated Residence
- Concrete Batch Plant
- Site Boundary

Predicted Noise Level

- 30 dB(A)
- 35 dB(A)
- 40 dB(A)
- 45 dB(A)
- 50 dB(A)

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0 2.5 5 7.5 km