Prepared for
Ausgrid
ABN: 78 508 211 731

AECOM

Noise and Vibration Impact Assessment

Rothbury Battery Energy Storage System

25-Mar-2026
Rothbury Battery Energy Storage System
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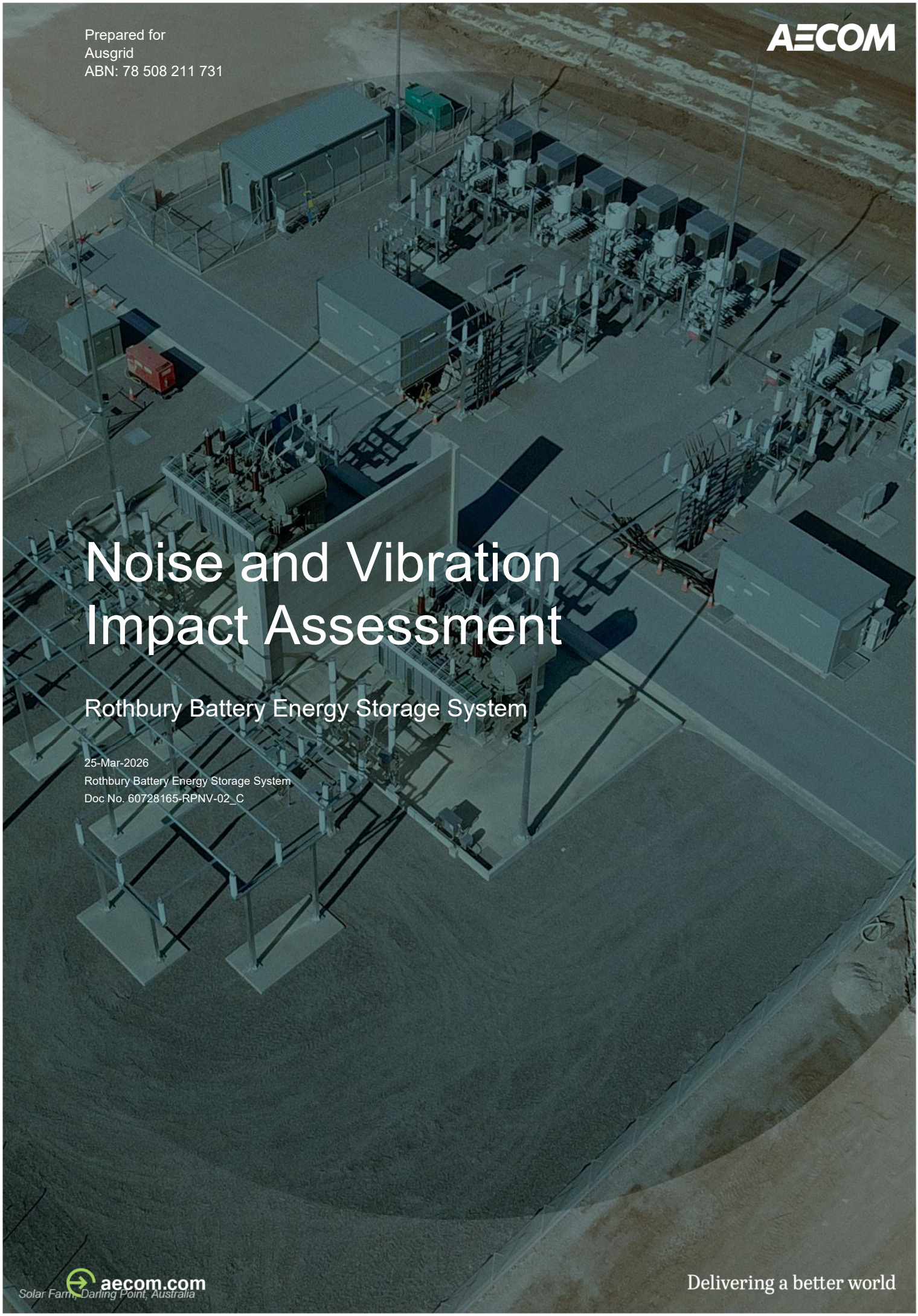

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Noise and Vibration Impact Assessment

Rothbury Battery Energy Storage System

Client: Ausgrid

ABN: 78 508 211 731

Prepared by

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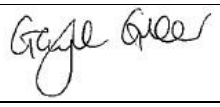
C	25-Mar-2026	Final report	Gayle Greer Technical Director - Acoustics	

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Glossary of terms and abbreviations

Term	Definition
Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Decibel [dB]	The measurement unit of sound.
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1 kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB(A) increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB(A) increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: 0 dB(A) Threshold of human hearing 30 dB(A) A quiet country park 40 dB(A) Whisper in a library 50 dB(A) Open office space 70 dB(A) Inside a car on a freeway 80 dB(A) Outboard motor 90 dB(A) Heavy truck pass-by 100 dB(A) Jack hammer / subway train 110 dB(A) Rock concert 115 dB(A) Limit of sound permitted in industry 120 dB(A) 747 take off at 250 metres.
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Insertion loss	Reduction in noise by inserting a barrier between the source and receiver.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.

Term	Definition
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	Construction noise: The period from 7:00 am to 6:00 pm Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Road traffic noise: The period from 7:00 am to 10:00 pm every day of the week.
Evening	Construction noise: The period from 6:00 pm to 10:00 pm Monday to Sunday and Public Holidays. Road traffic noise: Not applicable.
Night	Construction noise: The period from 10:00 pm to 7:00 am Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays. Road traffic noise: The period from 10:00 pm to 7:00 am every day of the week.
Standard construction hours	Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays and public holidays
Assessment background level [ABL]	The overall background level for each day, evening and night period for each day of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the entire length of noise monitoring.
Noise management level [NML]	The level which represents the point above which there may be some community reaction to noise.

1.0 Introduction

Ausgrid proposes to construct, operate and maintain a battery energy storage system (BESS) with a maximum power output capacity of up to 135 megawatt (MW) at the existing Rothbury Zone Substation (the Project). The Project would provide storage and firming capacity to the National Electricity Market (NEM), which would increase the stability of the electricity network. The Project would also provide ancillary frequency control services. In doing so, the Project would support the transition of the NEM from largely fossil fuel generation to renewable energy, contributing to New South Wales' and Australia's decarbonisation targets.

AECOM Australia Pty Ltd (AECOM) has been commissioned to undertake a noise and vibration impact assessment for the Project. The assessment considers noise and vibration arising from the construction and operation of the Project.

1.1 Project overview

The Project comprises a BESS facility that would store energy from the grid, releasing it during high demand periods. The Project would also perform other ancillary services for the grid. Key features of the Project would include:

- Construction, operation and maintenance of a BESS with a maximum power output capacity of up to 135 MW over a four-hour duration (i.e. up to 540 MWh energy capacity)
- Up to 148 containerised battery units and associated infrastructure, including inverters and up to 37 medium voltage (MV) transformers
- A 33 kV underground cable connection to the existing Rothbury Zone Substation
- A combined switch room and control room building
- Six ring main units (RMUs)
- An operation and maintenance (O&M) building
- A warehouse to store equipment and other materials or plant related to maintaining the BESS
- One auxiliary transformer
- A backup diesel generator
- Onsite car parking spaces
- Other ancillary infrastructure including fire suppression, stormwater management, boundary security fencing, noise barriers, lighting and CCTV.

Once constructed, the Project would operate 24 hours a day, seven days a week primarily as an unmanned facility. The Project would be managed remotely and staffed during planned and unplanned maintenance periods.

1.2 Site description

The Project is proposed within Lots 1 and 2, DP1318566, to the west of the existing Rothbury Zone Substation (the site). The site address is 1309 Wine Country Drive, Rothbury, NSW 2320. The Project is located within the Cessnock City Council Local Government Area and is located on land zoned 'RU2 Rural Landscape' under the *Cessnock Local Environment Plan 2011*. The main land uses surrounding the site are vineyards and pastureland. There are also residences and serviced accommodation premises located near the site. These serviced accommodation premises have been conservatively assessed as residential in this report. The closest residential dwelling is located south of the site along Old North Road, approximately 180 metres away.

The Project location is shown in Figure 1-1.

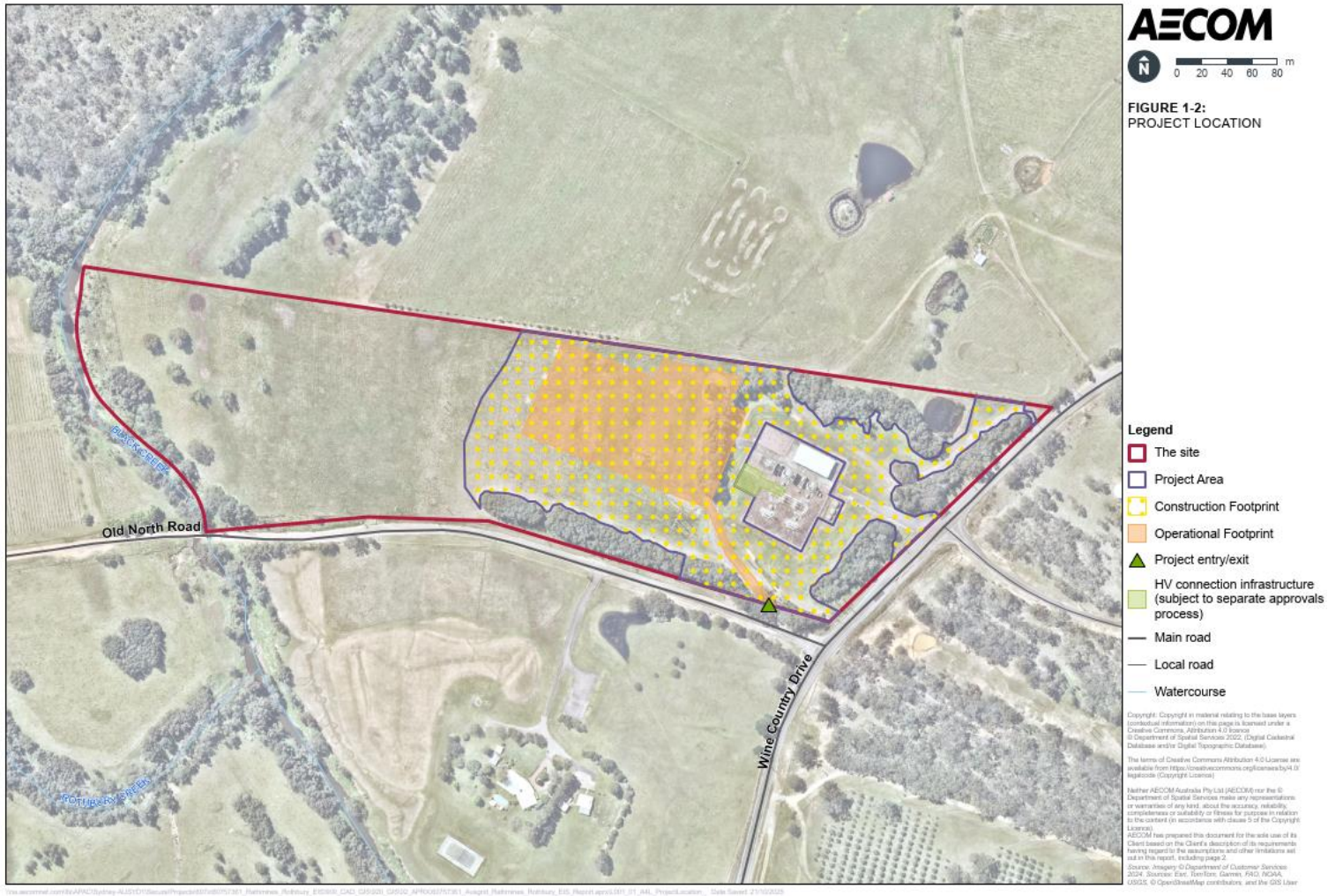


Figure 1-1 Project location

1.3 Purpose of this report

1.3.1 Assessment objectives

The objectives of this noise and vibration impact assessment are to:

- Identify nearby noise-sensitive receivers potentially impacted by the construction and operation of the Project
- Undertake ambient noise monitoring to determine the relevant construction noise management levels and operational project noise trigger levels for identified sensitive receivers
- Identify potential noise and vibration arising impacts from the construction and operation of the Project
- Outline mitigation measures, if required, relating to noise and vibration during the construction and operational phases of the Project.

1.3.2 Report structure

This report is structured as follows:

- Section 1.0 introduces the Project and the purpose of this noise and vibration impact assessment
- Section 2.0 provides a summary of the existing acoustic environment
- Section 3.0 and Section 4.0 present the relevant construction and operational noise criteria respectively
- Section 5.0 details the assessment for construction noise impacts
- Section 6.0 details the assessment for operational noise impacts
- Section 7.0 describes the management measures identified to mitigate potential Project impacts.

1.4 Secretary's Environmental Assessment Requirements (SEARs)

SEARs for the Project are presented in Table 1-1 and have informed the preparation of this noise and vibration impact assessment.

Table 1-1 SEARs - noise

Relevant SEARs	
Noise	**Where addressed**
The EIS must address the following specific matters: Noise – including an assessment of the construction noise impacts (including impacts from proposed road upgrades) of the development in accordance with the *Interim Construction Noise Guideline* (ICNG), operational noise impacts in accordance with the *NSW Noise Policy for Industry* (2017), assess traffic noise having regard to the *NSW Road Noise Policy* (DECCW, 2011) and cumulative noise impacts (considering other developments in the area), including (where appropriate):	The assessment presented in this report is in accordance with the relevant guidelines as detailed in Section 1.5.
• Details of noise monitoring survey, background noise levels and amenity noise levels at the most-affected residential receivers;	Details of noise monitoring measurements, construction noise criteria and operational noise criteria are presented in Section 2.0 to Section 4.0.

Relevant SEARs	
Noise	**Where addressed**
• Identification of impacts associated with construction, site emission and traffic generation at noise affected sensitive receivers, including the provision of operational noise contours;	The noise impact assessments for the worst case construction and operational scenarios are detailed in Section 5.0 and Section 6.0 respectively. Noise contours for the construction and operational assessments are presented in Appendix B and Appendix C respectively.
• An assessment of 'worst case' noise emission scenarios during periods of discharging and charging;	
• Consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area; and	A review of annoying characteristics is presented in Appendix D. Discussion of meteorological conditions is presented in Section 6.1.2.
• Details of the likely daily charging/discharging load profile, manufacturer specifications for plant and equipment and noise source inventory (including intensity, quantity, location, directivity and frequency information);	Equipment specifications, sound power levels, equipment layout and charging/discharging load profile for the BESS are detailed in Section 6.2.
• Details and analysis of effectiveness of proposed management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration impacts following application of these mitigation measures and details of any proposed compliance monitoring programs.	Noise and vibration mitigation and management measures are outlined in Section 7.0, including an analysis of their likely effectiveness. Proposed monitoring is also outlined in Section 7.0.

1.5 Relevant guidelines

Construction

- *Interim Construction Noise Guideline,* Department of Environment and Climate Change, NSW (DECC 2009)
- *Assessing Vibration: a technical guideline,* Department of Environment and Conservation (DEC 2006)
- *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* (TfNSW 2023)
- *NSW Road Noise Policy,* Department of Environment, Climate Change and Water NSW (DECCW 2011).

Operation

- *NSW Protection of the Environment Operations Act 1997* (POEO Act 1997)
- *NSW Noise Policy for Industry*, NSW Environment Protection Authority (EPA 2017)
- *NSW Road Noise Policy,* Department of Environment, Climate Change and Water NSW (DECCW, 2011).

2.0 Existing acoustic environment

2.1 Assessment receivers

The closest residential receivers are located approximately 198 m south of the site on Old North Road, and 217 m east of the site on Blackburn Close. There are no commercial or industrial receivers in the vicinity of the site.

There are 28 residential receivers located within 1 km of the site. The receivers selected for modelling consist of residential dwellings. These receiver locations, along with their land use classification (as defined in the *Noise Policy for Industry*), are presented in Table 2-1 and shown in Figure 2-1.

Table 2-1 Assessment receiver locations

Receiver	Distance from Project area (metres)	Address	Land use classification
R1	217	2 Blackburn Close, Lovedale	Residential
R2	415	803 Old North Road, Rothbury	Residential[1]
R3	272	1337 Wine Country Drive, Rothbury	Residential
R4	198	864 Old North Road, Rothbury	Residential[2]
R5	453	1294 Wine Country Drive, Lovedale	Residential
R6	710	Lot 2 DP848702, Rothbury	Residential
R7	237	1338 Wine Country Drive, Rothbury	Residential
R8	319	39 Blackburn Close, Lovedale	Residential

Notes:

1. *The winery and residence at 803 Old North Road, Rothbury, has conservatively been assessed together as one sensitive receiver.*
2. *This property is listed as a guest house/hotel, but it has been conservatively assessed as residential in this report.*

Compliance with the relevant criteria at the nearest receivers outlined in Table 2-1 means compliance at other residential receivers located further away.

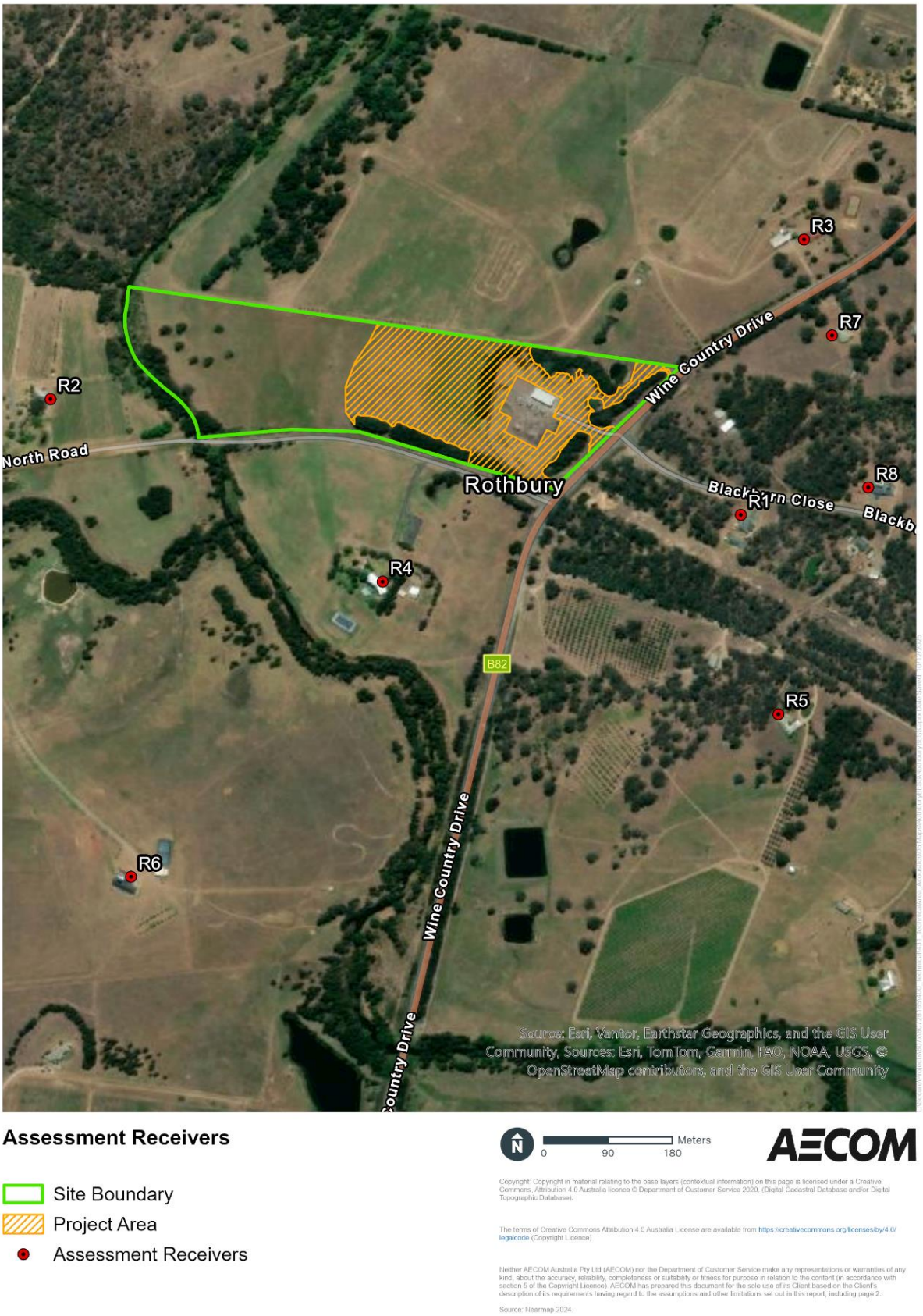


Figure 2-1 Assessment receiver locations

2.2 Noise measurement methodology

Long term unattended and short term attended measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of AS IEC 61672.1-2004 *Electroacoustics - Sound level meters - Specifications* and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

2.2.1 Unattended noise measurement methodology

Unattended noise measurements were conducted with a Rion NL-52 noise logger at 1309 Wine Country Drive, from 4 April 2024 to 24 April 2024. Figure 2-2 shows the unattended noise logging location.

In accordance with the EPA's NSW *Noise Policy for Industry*, noise data over the monitoring period affected by adverse weather conditions or extraneous noise events were excluded from the monitoring data. The *Noise Policy for Industry* advises that data may be affected where adverse weather, such as wind speeds higher than 5 m/s or rain, occurs. Weather data was acquired from the Bureau of Meteorology's Newcastle Nobbys weather station (station number 094774).

The logger measured the noise levels over the sample period and determined L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels of the noise environment. The $L_{A1,}$ L_{A10} and L_{A90} noise levels are the levels exceeded for 1%, 10% and 90% of the measurement period respectively. The L_{A90} is taken as the background level. The L_{A1} is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The L_{A90} noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the *Noise Policy for Industry*. The ABL is established by determining the lowest ten-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.

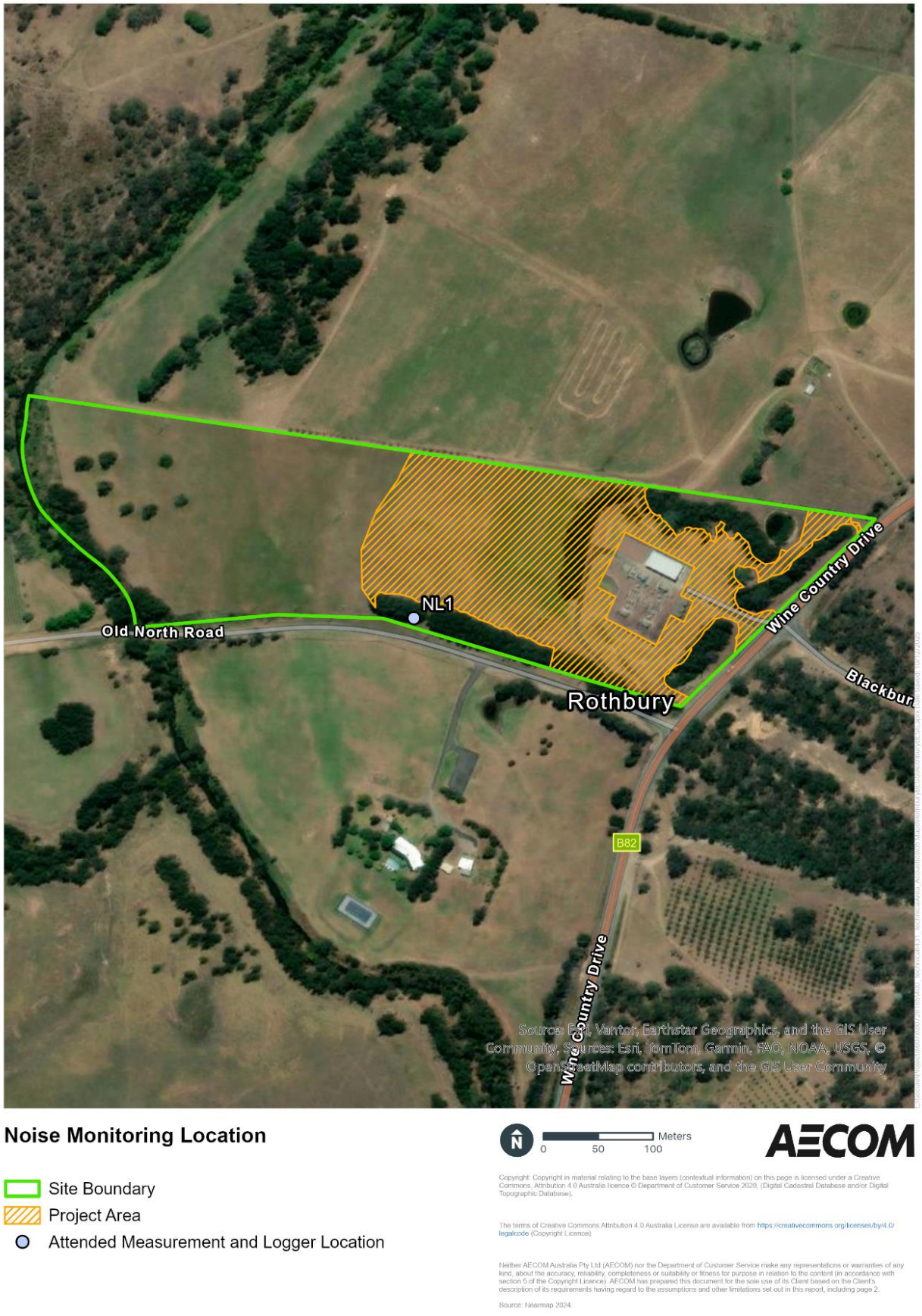


Figure 2-2 Noise monitoring location

2.2.2 Attended noise measurement methodology

Attended noise measurements were conducted at the unattended monitoring location on 24 April 2024, during the daytime period. The measurement was conducted over a 15-minute period. Weather conditions were clear on the day of monitoring, with very light winds.

Attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter. The sound level meter used is designated as a Class 1 instrument and has accuracy suitable for laboratory and field use. The sound level meter was calibrated before and after the measurements with no drift in calibration exceeding ±0.5 dB.

2.3 Noise measurement results

2.3.1 Unattended noise measurement results

Table 2-2 presents the existing overall representative L_{Aeq} ambient noise level and the background L_{A90} noise levels for the day, evening and night-time periods, in accordance with the *Noise Policy for Industry.* The overall representative L_{Aeq} noise levels were determined by logarithmically averaging each assessment period for the entire monitoring period.

Some periods of noise logging were excluded due to adverse weather. The data were processed in accordance with Fact Sheet B of the *Noise Policy for Industry*.

The results for each day and the graphical noise logging results are presented in Appendix A. The existing acoustic environment is generally defined by road traffic noise from Wine Country Drive and Old North Road.

Table 2-2 Existing background (L_{A90}) and ambient (L_{Aeq}) noise levels

Noise logger ID	Location	L_{A90} rating background level, dB(A)			Log average noise (ambient) L_{Aeq} levels dB(A)		
		Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
NL1	1309 Wine Country Drive, southern boundary	35	(42) 35[2]	34	53	50	45

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.*
2. *Measured evening RBL in brackets. According to the Noise Policy for Industry, the community generally expects greater control of noise during the more sensitive evening period than during the less sensitive daytime period. Therefore, the evening RBL has been set to be equal to the daytime RBL.*

2.3.2 Attended noise measurements

The results of the attended noise monitoring are presented in Table 2-3. The daytime measurement indicates that residential receivers are not heavily affected by road traffic noise.

Table 2-3 Attended noise measurements

Location	Date and time	L_{Aeq} dB(A)	L_{A90} dB(A)	Comments
1309 Wine Country Drive, southern boundary	24/04/2024 12:22pm	45	35	Distant road traffic noise on Wine Country Drive, 38-41 dB(A). Bird noise and light cicada noise. Small truck passby on Old North Road, 56-62 dB(A). Car passbys on Old North Road, 51-62 dB(A).

Refer to Figure 2-2 for the unattended and attended noise logging location.

3.0 Construction noise criteria

3.1 Construction noise

The *Interim Construction Noise Guideline* is a NSW EPA document that sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It presents assessment approaches tailored to the scale of the construction and identifies practices to minimise noise impacts. As the Project is expected to continue for a period of more than three weeks, a quantitative assessment, based on worst-case construction scenarios, has been carried out for construction works.

Noise levels resulting from construction activities that are predicted at noise sensitive receivers (e.g. residences, schools, hospitals, places of worship and active recreation areas) are compared to the noise management levels (NMLs) determined in accordance with the *Interim Construction Noise Guideline*. Where an exceedance of the NMLs is predicted, the *Interim Construction Noise Guideline* advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially affected residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details should they wish to make a complaint.

If construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

The *Interim Construction Noise Guideline* defines what is feasible and reasonable as follows:

- Feasible – a work practice or abatement measure is feasible if it is capable of being put into practice and is practical to build given project constraints such as safety and maintenance requirements
- Reasonable – selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic, and environmental effects, including the cost of the measure.

The construction NMLs for residential land uses are detailed in Section 3.1.1 below. These NMLs will be used to guide the management of construction noise throughout construction.

3.1.1 Residential receivers

Guidance for setting construction NMLs for residential receivers is summarised in Table 3-1.

Table 3-1 *Interim Construction Noise Guideline* residential noise management levels

Time of day	NML, $L_{Aeq,15min}$, dB(A)[1]	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	'Noise affected' level RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq,15\ min}$ 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 work, the expected noise levels and duration, as well as contact details.
	'Highly noise Affected' level 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: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences) 2. 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' level RBL + 5 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 still more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community • The *Interim Construction Noise Guideline* provides guidance on negotiating agreements.

Notes:

1. *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicted noise levels is at the most noise-affected point within 30 metres of the residence.*

Table 3-2 presents the NMLs applicable to residential receivers nearby to this development.

Table 3-2 Construction noise management levels, $L_{Aeq,15min}$ - Residential receivers

Standard hours (RBL + 10)	Outside standard hours (RBL + 5)		Highly noise affected level
Day	Evening	Night	
45 dB(A)	40 dB(A)	39 dB(A)	75 dB(A)

The *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* sets out community perceptions of construction noise dependent upon the level of exceedance of the RBLs and NMLs. These are presented in Table 3-3.

Table 3-3 Community perception of construction noise

Perception	dB(A) above RBL	dB(A) above NML – Standard hours	dB(A) above NML – Out of hours
Noticeable	5 – 10	0	0 - 5
Clearly audible	11 – 20	0 - 10	6 – 15
Moderately intrusive	21 – 30	11 – 20	16 – 25
Highly intrusive	> 30	> 20	> 25

3.1.2 Construction road traffic

Noise from construction traffic on public roads is not covered by the *Interim Construction Noise Guideline*. However, the *Interim Construction Noise Guideline* does refer to the *Road Noise Policy* for the assessment of noise arising from traffic on public roads.

In accordance with the *Road Noise Policy*, to assess noise impacts from construction traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. Where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criteria, then noise mitigation should be considered for those receivers affected. The road category specific criteria are presented in Table 3-4 below.

Table 3-4 Road traffic noise assessment criteria

Road category	Type of land use	Assessment criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 dB(A)	$L_{Aeq,9hr}$ 55 dB(A)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hr}$ 55 dB(A)	$L_{Aeq.1hr}$ 50 dB(A)

4.0 Operational noise criteria

4.1 Environment Protection Authority – NSW Noise Policy for Industry

Operational industrial noise has the potential to affect nearby noise sensitive receivers. The *Noise Policy for Industry* sets out a procedure to determine project noise trigger levels relevant to a development. If it is predicted that the development is likely to result in noise levels which exceed the project noise trigger levels at existing noise sensitive receivers, then mitigation measures need to be considered to reduce the predicted noise level.

The assessment procedure for industrial noise sources has two components that must be satisfied:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for residences and other land uses.

Both components are assessed at the most affected point on or within the property boundary of the noise sensitive receiver site. These project noise trigger levels apply to environmental noise emissions from any plant installed as part of the Project, and for residential receivers, represent the lower of the intrusive or amenity criteria.

4.1.1 Intrusive noise impacts

The *Noise Policy for Industry* states that the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (L_{Aeq} level), measured over a 15-minute period, does not exceed the background noise level measured by more than 5 dB. The RBL is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the *Noise Policy for Industry*.

The Project intrusive noise criteria are shown in Table 4-1 (based on unattended noise measurements conducted at the NL1 location).

Table 4-1 Recommended $L_{Aeq,15\ min}$ intrusive noise criteria levels from industrial noise sources

Time of day[1]	RBL ($L_{A90,15min}$)	Intrusive criterion RBL + 5 ($L_{Aeq,15min}$)
Day	35	40
Evening	(42) 35[2]	40
Night	34	39

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.*
2. *Measured evening RBL in brackets. According to the NPfI, the community generally expects greater control of noise during the more sensitive evening period than during the less sensitive daytime period. Therefore, the evening RBL has been set to be equal to the daytime RBL.*

4.1.2 Protecting noise amenity

To limit continuing increases in noise levels from the application of the intrusiveness level alone, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the recommended amenity noise levels specified in Table 2.2 of the *Noise Policy for Industry*.

The relevant amenity criteria are shown in Table 4-2.

Table 4-2 Recommended L_{Aeq} amenity noise levels from industrial noise sources

Type of receiver	Time of day	Recommended $L_{Aeq,15min}$ noise level dB(A)
Residence - Suburban	Day	55
	Evening	45
	Night	40

Table 4-3 presents the suburban amenity noise levels for residential receivers. As per the *Noise Policy for Industry*, the Project amenity level is converted to a 15-minute period by adding 3 dB(A).

Table 4-3 Project amenity noise levels for residential receivers from industrial sources

Time of day[1]	Suburban amenity L_{Aeq} noise level $L_{Aeq,15min}$, dB(A)	Suburban amenity criterion noise level + 3 $L_{Aeq,\ 15min}$, dB(A)
Day	55	58
Evening	45	48
Night	40	43

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.*

4.1.3 Project specific noise criteria

A summary of the noise trigger levels for the Project is presented in Table 4-4.

Table 4-4 Project specific noise levels

Receiver	Period[1]	RBL ($L_{A90,15min}$)	Intrusive criterion ($L_{Aeq,15min}$)	Amenity criterion ($L_{Aeq,15min}$)[2]	Project specific noise criteria, ($L_{Aeq,15min}$)[3]
Residential	Day	35	40	58	40
	Evening	35	40	48	40
	Night	34	39	43	39

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.*
2. *As per the Noise Policy for Industry, the project amenity level is converted to a 15-minute period by adding 3 dB(A).*
3. *Project specific noise levels determined as the lowest of the intrusive and amenity criteria.*

4.1.4 Applying the Noise Policy for Industry to existing sites

Section 6.1 of the *Noise Policy for Industry* acknowledges that many existing industrial sites were designed for higher noise emission levels than the Project noise trigger levels noted in Table 4-4 above. Industrial sites may have existed before any noise-sensitive developments occurred in the area or may have been designed before noise control legislation was introduced.

The *Noise Policy for Industry* notes there is no 'one-size-fits-all' approach to determine noise impacts from existing industry. However, it notes that the following governing principles should be applied when determining the Project noise trigger levels and/or assessment requirements for existing industry:

"The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Where an existing industry has been in operation for more than 10 years and existing site operations exceed the project amenity noise level, the project amenity noise level may be adopted as the project noise trigger level to assess existing, and existing plus proposed site operations, as relevant.

Where a development proposal involves a discrete process, and premises-wide mitigation has or is to be considered outside of the development proposal, a project noise trigger level for noise from new/modified components (not the whole site) of the operation may be set at 10 dB(A) or more below existing site noise levels or requirements. This approach means that the increase in noise from the whole site is minimised and provides scope for existing components to achieve noise reductions over time".

An assessment of existing operations presented in Section 6.2.1 shows that existing noise levels are currently below the relevant Project noise trigger levels in Section 4.1.3 above. Therefore, the Project noise trigger levels were used as the basis for determining any reasonable and feasible control measures for the operation of the Project.

4.1.5 Tonality and *Noise Policy for Industry* modifying factors

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level.

Fact Sheet C in the *Noise Policy for Industry* sets out corrections for annoying characteristics. The corrections are to be applied having regard to:

- The contribution noise level from the premises when assessed/measured at a receiver location
- The nature of the noise sources and its characteristics.

Table 4-5 presents the annoying characteristic corrections potentially applicable to the Project.

Table 4-5 Modifying factor corrections (*Noise Policy for Industry* Factsheet C, Table C1)

Factor	Assessment/ measurements	When to apply	Correction[1]	Comments
Tonal	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500-10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160-400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25-125 Hz	5 dB[2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.

Factor	Assessment/ measurements	When to apply	Correction[1]	Comments
Low - frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10-160 Hz	Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: where any of the one-third octave noise levels in Table C2[4] are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB(A) positive adjustment applies for the daytime period.	2 or 5 dB[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for the UK Department for Environment, Food & Rural Affairs (DEFRA) fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Notes:

1. *Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.*
2. *Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.*
3. *Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.*
4. *Table C2 is reproduced as Table 4-6.*

Table 4-6 presents the low frequency noise thresholds from the *Noise Policy for Industry*.

Table 4-6 One-third octave low-frequency noise thresholds (*Noise Policy for Industry* Factsheet C Table C2)

Hz/dB(Z)	One-third octave L_{Zeq},15min threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

4.1.6 Maximum noise level assessment

The *Noise Policy for Industry* requires the potential for sleep disturbance to be assessed by considering maximum noise levels events during the night-time period.

Where the subject development/premises night-time noise levels at a residential location exceed the following screening levels a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB(A), whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB(A), whichever is the greater.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance criteria required for compliance for the nearest noise sensitive residential receivers are presented in Table 4-7.

Table 4-7 Night-time sleep disturbance screening levels

Location	Measured night-time RBL, $L_{A90,15min}$ dB(A)	Sleep disturbance screening levels for compliance, dB(A)	
		$L_{Aeq,15min}$	$L_{AF,max}$
Residential receivers	34	40	52

The Project is proposed to operate during all periods of the day. Noise from the battery units and other equipment on-site is predicted to be steady-state and non-impulsive and therefore $L_{AF,max}$ noise levels are likely to be very similar to the $L_{Aeq,15min}$ noise levels. Given this, compliance to the EPA's Project noise trigger levels will imply compliance to sleep disturbance criteria for these steady-state noise sources.

4.2 Operational road traffic noise criteria

To assess noise impacts from increases in operational traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels will increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. Where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those receivers affected.

4.3 Operational vibration

The Project is not expected to generate operational vibration as the operation would not involve vibration generating activities that would create significant vibration levels at nearby sensitive receivers or adjacent properties. Therefore, an assessment of the operational vibration impacts is not required.

5.0 Construction noise assessment

5.1 Construction noise modelling scenarios

Table 5-1 provides a summary of the construction noise scenarios, including the proposed construction plant/equipment for each scenario and their associated sound power levels (SWL). The construction scenarios for the construction of the Project are as follows:

- Scenario 1 – Enabling works
- Scenario 2 – Structural, civil, mechanical and electrical works
- Scenario 3 - Commissioning
- Scenario 4 – Finishes and demobilisation.

For the construction noise assessment, only the three noisiest construction scenarios were assessed:

- Scenario 1 – Enabling works
- Scenario 2 – Structural, civil, mechanical and electrical works
- Scenario 4 – Finishes and demobilisation.

The three noisiest scenarios were assessed as standard hours construction work. All major construction work is expected to be completed during standard hours only.

Electrical fit-outs inside the control room and battery units may be carried out during out-of-hours periods. These works, which would mainly be conducted using hand tools, are unlikely to be noisy and would be unlikely to result in exceedances at nearby sensitive receivers. Therefore, this scenario has not been considered.

Table 5-1 Construction assessment stages and scheduling

Phase	Construction stage	Equipment	SWL per unit, dB(A)
Scenario 1	Enabling works	Excavator (5 t)	102
		Front end loader	104
		Truck – dump	110
		Grader	114
		Truck – road	108
		Compactor	101
		Truck – water	113
		Light vehicle (4WD)	103
		Bulldozer	111
		Tub grinder/mulcher	116[1]
		Chainsaws	114[2,3]
		Diesel generator	103
Scenario 2	Structural, civil, mechanical and electrical works	Hand tools	94
		Crane – franna	97[2]
		Vibratory roller	109
		Diesel generator	103
		Pump – concrete	109

Phase	Construction stage	Equipment	SWL per unit, dB(A)
		Front end loader	104
		Bobcat	104
		Truck – dump	110
		Excavator (5t)	102
		Grader	114
		Compactor	101
		Vibratory roller	109
		Truck – water	113
		Truck – road	108
		Truck – concrete	109
		Elevated work platform	97
		Grinder	105[2,3]
		Saw – concrete	118[1,2,3]
		Backhoe	111
		Light vehicle (4WD)	103
Scenario 3	Commissioning	Diesel generator	103
		Crane – franna	97[2]
		Light vehicle (4WD)	103
		Elevated work platform	97
Scenario 4	Finishes and demobilisation	Backhoe	111
		Compactor	101
		Truck – water	113[1]
		Light vehicle (4WD)	103

Notes:

1. *For modelling purposes, the SWL of the loudest piece of equipment in each scenario will represent the overall SWL of the scenario/activity.*
2. *Sound powers are time weighted (i.e. expected utilisation percentage per 15 minute period) in accordance with the following:*
    a. *Concrete saw; chainsaw; grinder – 33%*
    b. *Franna – 75%*
3. *Equipment with special audible characteristics, likely to cause annoyance due to tonality, low frequency noise, impulsive or intermittent noise events. Penalty of +5 dB included in the sound power level.*

5.2 Noise modelling methodology

Noise levels due to the construction activities shown in Section 5.1 have been predicted at nearby noise sensitive receivers using SoundPLAN 8.2 noise modelling software. The noise model was created to represent ‘reasonable’ worst-case periods of construction works. The following features were included in the noise model:

- Ground topography
- Ground absorption and reflection

- Receivers
- Construction noise sources.

It is noted that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant/equipment in operation during the measurement and also the location of the plant/equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction plant/equipment moves around the site.

5.2.1 Construction modelling assumptions

The following assumptions have been made in modelling all construction noise scenarios:

- Plant/equipment is assumed to be operating at the site boundary at the closest point to each receiver, in order to present the worst-case scenario for each receiver. In reality, the plant/equipment would only be at the closest point to each receiver for limited periods
- Neutral atmospheric conditions, i.e. relatively calm, no wind.

5.3 Predicted construction noise levels

Construction noise levels at the identified residential receivers have been assessed against the standard hours NMLs. The level of impact may change depending on the final construction methodology and further assessment would be undertaken at a later stage, if required.

Construction noise contours, calculated at 1.5 m above ground level, are presented in Appendix B. Table 5-2 presents the construction noise modelling results for residential receivers.

Table 5-2 Predicted construction noise levels with highlighted exceedances – standard hours

Receiver	Standard hours NML, dB(A)	Highly affected level, dB(A)	Construction phase		
			Enabling works	Structural, civil, mechanical and electrical works	Finishes and demobilisation
R1	45	75	**58**	**58**	**56**
R2	45	75	**55**	**53**	**52**
R3	45	75	**56**	**56**	**53**
R4	45	75	**60**	**59**	**57**
R5	45	75	**49**	**50**	**47**
R6	45	75	45	**46**	42
R7	45	75	**58**	**56**	**55**
R8	45	75	**54**	**54**	**51**

The results above show that construction noise levels are predicted to exceed the NMLs during standard hours at all receivers during the assessed construction scenarios except at R6 during Scenario 1 and Scenario 4. The largest exceedance is up to 15 dB(A) at R4 during Scenario 1. There are no receivers predicted to be 'highly affected' for the construction scenarios assessed.

Construction noise mitigation measures are presented in Section 7.1.

5.4 Construction traffic assessment

The predicted construction traffic volumes required for the Project during the peak construction period include the following:

- Up to 134 light vehicles per day (up to 268 movements)
- Average of 20 heavy vehicles per day (up to 40 movements).

The resultant noise level change on Wine Country Drive and Old North Road from additional construction traffic volumes is presented in Table 5-3 and was found to be no more than 2 dB(A) at residential receivers along both roads.

Table 5-3 Existing traffic flows and additional construction traffic flows

Period	Road	Existing traffic[1]		Additional traffic		Relative noise increase, dB(A)
		Light vehicle movements	Heavy vehicle movements	Light vehicle movements	Heavy vehicle movements	
Day (7 am-10 pm)	Wine Country Drive	31,892	5,841	268	40	0.0
Day (7 am - 10 pm)	Old North Road	1,850	157	268	40	0.8

Notes:

1. *The existing traffic volumes have been extracted from traffic count data in the period 15 – 21 October 2025, provided by Trans Traffic Survey.*

5.5 Construction vibration assessment

From the indicative construction equipment listed in Table 5-1, vibration-intensive equipment, such as a vibratory roller, is proposed to be used during construction. However, as the nearest sensitive receiver is located approximately 198 m from the Project area, any cosmetic damage and/or human discomfort resulting from vibration at the nearest sensitive receivers would be unlikely. This is based on the minimum working distances (up to 25 m for cosmetic damage, and up to 100 m for human comfort) in Appendix D of the *Construction Noise and Vibration Guideline (Public Transport Infrastructure)*. Therefore, a detailed construction vibration assessment is not deemed necessary.

5.6 Cumulative construction impacts

Simultaneous construction projects near the Project have the potential to increase noise levels at nearby sensitive receivers. Subject to equipment lead times and availability, the construction of the Project is anticipated to occur from late 2026 through to mid-2028. The following proposals are located near the Project:

- Huntlee New Town Stage 2
- Sunshine Estate Battery Energy Storage System.

The closest boundary (southern boundary) of the Huntlee New Town Stage 2 concept plan is located approximately 2 km from the Project area and is unlikely to result in any cumulative impacts on the noise levels at sensitive receivers. The Sunshine Estate BESS is located adjacent to the Project, at 1337 Wine Country Drive, Rothbury.

Construction timeframes for both proposals are currently unknown. Once development timelines have been confirmed for the proposals, an assessment may be undertaken during the detailed design phase to understand any potential cumulative noise impacts.

Generally, in cases where noisy construction activities may occur at the same time in close proximity to each other, it is possible that predicted noise levels may increase by up to 3 dB(A). It should be noted

that where a receiver is affected by noise from two concurrent projects, it is likely that noise levels from one would be dominant, and therefore overall noise levels would increase only slightly, if at all.

6.0 Operational noise assessment

The operational noise sources that have the potential to affect nearby receivers include the battery units, inverters, transformers and diesel generator.

6.1 Modelling methodology

6.1.1 General modelling assumptions

Noise levels due to the operational activities at the site were predicted at nearby noise sensitive receivers using SoundPLAN version 8.2 (industry standard) noise modelling software. The operational noise levels were predicted using an implementation of the CONCAWE propagation algorithm with both neutral and noise-enhancing meteorological conditions.

6.1.2 Modelling conditions

The noise modelling includes:

- Neutral and noise-enhancing meteorological conditions
- Ground topography
- Buildings and structures
- An example battery unit noise data source, modelled as a vertical area source
- Transformers behaving as point sources
- Ground absorption.

The noise model considers significant noise sources and locations, screening effects, receiver locations, ground topography and noise attenuation due to geometrical spreading, air absorption, ground absorption and the effects of the prevailing weather conditions. All predicted noise levels are free-field levels, assessed at the most affected point within the residential boundary – 1.5 m above ground level for one-storey receivers, and 4.5 m above ground level for two-storey receivers.

6.2 Modelled operational scenario

The location, quantity, and specification of equipment is subject to change during the detailed design stage. This operational noise assessment should be treated as a proof of concept for the overall noise levels generated by the Project, and the type of equipment to be installed.

6.2.1 Existing operational scenario

No audible noise was observed from the existing Rothbury Zone Substation during attended measurements. Local road traffic noise made it difficult to determine the noise contribution from the substation. Hence, previously tested sound power levels of the substation transformers were used in modelling the existing substation noise. A high-voltage (HV) transformer would be installed at the existing substation. As the HV transformer would be operational before the construction and operation of the Project, it was included in the modelling of the existing substation noise. The existing sources and their sound power levels are presented in Table 6-1 below.

Table 6-1 Existing plant items sound power levels

Plant item/operation	Sound power level, L_{Aeq}, dB(A)
Existing Tx1 – P0759D	71
Existing Tx1 – P0759C	72
HV Transformer	90

6.2.2 Future operational scenario

To assess a reasonable worst-case operational scenario, modelling assumes that all of the proposed equipment within the site would operate at full capacity, 24 hours per day, seven days per week. This is

a conservative assumption as time periods where equipment would generate the highest noise levels are not known and therefore this methodology ensures that operational noise impacts are not underpredicted.

Compliance with the night-time Project noise trigger level would demonstrate compliance for all residential receivers during all periods of the day.

The operational equipment is generally categorised as steady-state or quasi steady-state noise sources which typically produce continuous and consistent noise levels.

To achieve the stated capacity for the Project, it is expected that the electrical equipment would be required in the following numbers:

- Up to 148 battery enclosures, including inverters
- Up to 37 medium voltage (MV) transformers.

The Project layout is shown in Figure 6-1.

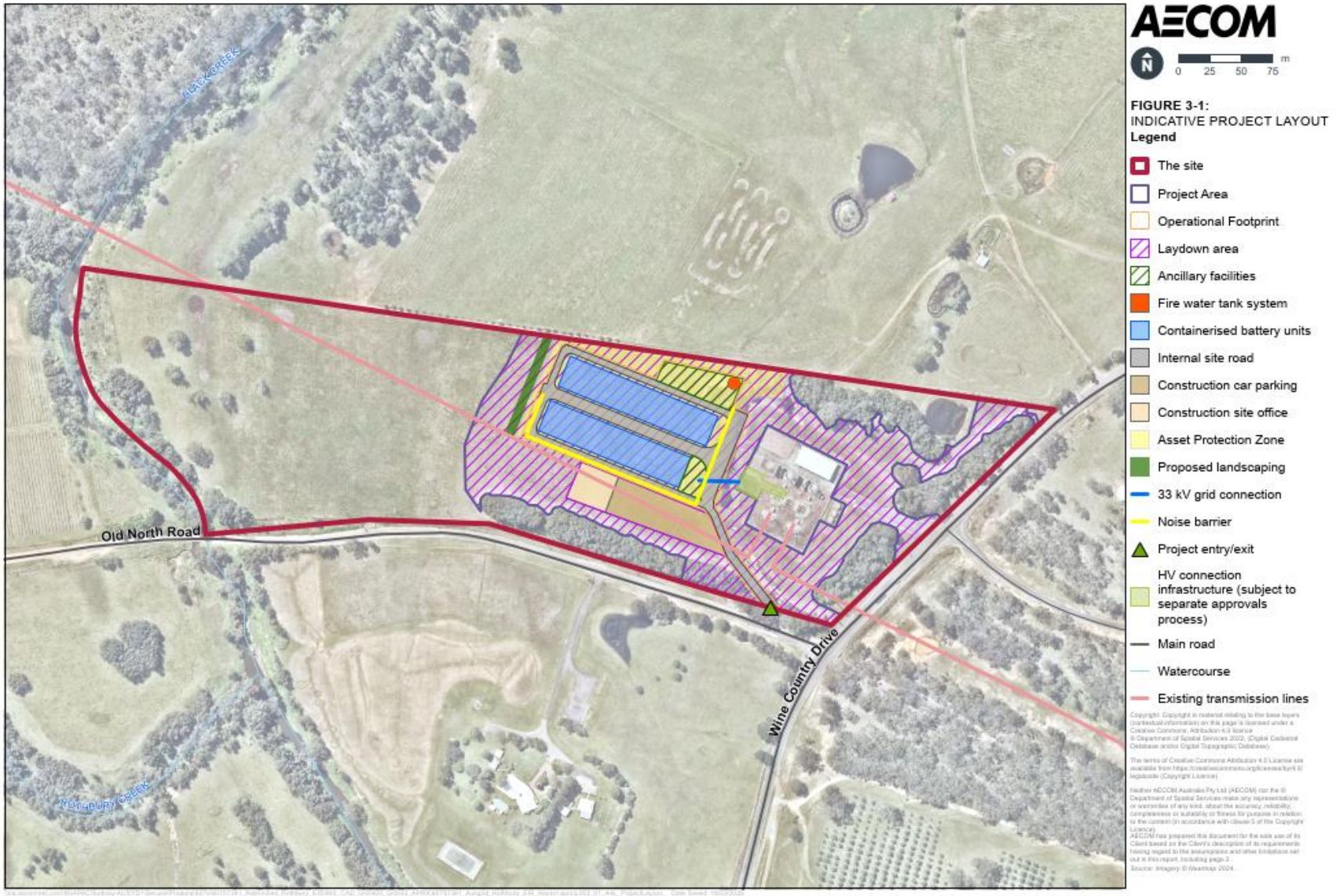


Figure 6-1 Indicative Project layout

Sound power level inputs for the BESS electrical equipment presented in Table 6-2 were taken from AECOM's database and used in the noise modelling. The equipment was assumed to be operating continuously for an entire 15-minute assessment period.

Table 6-2 Plant items sound power levels

Plant item/operation	Number of items	Sound power level, L_{Aeq}, dB(A)
Battery unit (4-hour 5 fan configuration)	148	95 (100% duty cycle)
MV transformer	37	77

The likely load profile for the battery units would comprise charging during the day and discharging in the evening peak period. If there is a network incident or high demand from the grid, the charging and discharging profile would change to periods outside of these times.

The future operational noise model also included a backup diesel generator within the BESS site. The backup diesel generator will only activate during emergency shut-down periods, e.g. during lightning events when there is no power and the battery units would be disabled. The generator would only power essential control room operations for emergency use and not provide power to the battery units.

The only instance where the diesel generator and BESS will both be in operation is during routine maintenance testing of the generator for up to an hour in duration, which would only be undertaken during the daytime period. According to the *Noise Policy for Industry*, a single-event continuous noise for a period of 15 minutes to an hour is given an allowable exceedance of 5 dB(A) of the project noise trigger level during the daytime period.

6.2.3 Maximum noise levels

In AECOM's experience, L_{Amax} sound power levels of electrical equipment are typically not greater than 5 dB above L_{Aeq} sound power levels. Given that the sleep disturbance criterion is 13 dB(A) less stringent than the Project noise trigger level, compliance with the Project noise trigger level would result in compliance with the sleep disturbance criteria. Therefore, no further consideration has been given to the sleep disturbance assessment.

6.3 Existing operational noise levels

Existing operational noise levels were predicted at nearby sensitive receivers using the methodology outlined in Section 6.1, and the inputs from Section 6.2.1 under noise enhancing conditions. This scenario has been assessed against the Project amenity noise levels shown in Section 4.1.2 in accordance with Section 4.1.3 to determine the suitability of using the Project noise trigger levels for future compliance.

Table 6-3 Existing operational noise levels

Receiver	Project amenity noise levels, $L_{Aeq,15min}$, dB(A)	Predicted noise levels, dB(A)	Exceedance, dB(A)
R1	39	< 20	-
R2	39	< 20	-
R3	39	< 20	-
R4	39	< 20	-
R5	39	< 20	-
R6	39	< 20	-
R7	39	< 20	-
R8	39	< 20	-

The one third octave noise levels at the worst affected residential receivers were assessed against the modifying factor criteria in Table 4-5 and were not found to be tonal or low frequency dominant.

6.3.1 Discussion of results

The results in Table 6-3 indicate that existing noise emissions from the Rothbury Zone Substation are currently compliant with the Project amenity noise levels. As a result, the future operation of the Project should be assessed against the Project noise trigger levels in accordance with Section 6.1 of the *Noise Policy for Industry*.

6.4 Predicted operational noise levels – with mitigation

For the unmitigated operational scenario, predicted operational noise levels exceed the project specific noise criteria at the majority of assessment receivers, with the highest exceedances occurring during the night-time period.

To mitigate the operational impact on nearby sensitive receivers, noise barriers in proximity to the battery units were considered and are presented in Figure 6-2. The barriers extend partially along the western boundary and completely enclose the southern and eastern boundaries of the battery units. The barriers have a maximum height of 8 metres. To prevent additional reflections added by the proposed noise barrier, the noise barrier is required to be lined with absorptive material on the internal sides facing the Project equipment.

A number of mitigation measures were considered to reduce noise impacts to the identified receivers. Table 6-4 below presents the noise mitigation measures considered and whether they were found to be feasible and reasonable or not.

Table 6-4 'Feasible and reasonable' mitigation decision-making matrix

Mitigation option	Feasible mitigation test	Reasonable mitigation test	Justification for adopting or disregarding this option
Mitigation at source			
Option 1: Layout of site optimised to reduce noise emissions	Feasible to an extent considering operational constraints such as access to battery units	Reasonable due to: • Reduction in source noise levels • Total cost of noise mitigation	Adopted
Option 2: Reducing site activities during the night-time	Feasible	Not reasonable as viability of the site is significantly reduced.	Not adopted
Mitigation in the transmission path to the receiver			
Option 1: Noise barrier located on the western, southern and eastern boundaries	Feasible	Reasonable	Adopted
Option 2: Additional noise barriers located within the site between battery units.	Feasible to an extent considering operational constraints such as access to battery units	Not reasonable due to: • Incompatibility with operational requirements	Not adopted
Mitigation at the receiver			
Option 1: Provision of mechanical ventilation to allow windows to remain closed.	Feasible	Not reasonable due to: • Total cost of noise mitigation versus acoustic benefit	Not adopted

Figure 6-2 Proposed noise barrier

Operational noise contours for the mitigated scenario are also provided in Appendix C.

Predicted noise levels from the Project with the proposed noise barriers in place are presented in Table 6-5. Noise levels would be slightly lower under neautral weather conditions than those presented in Table 6-5. The one third octave noise levels at the worst affected residential receiver were assessed and the noise levels were found to not contain tonal or low frequency characteristics. The one third octave noise levels at each assessed receiver are presented in Appendix D.

Table 6-5 Predicted operational noise levels - Barrier mitigation

Receiver	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)			Predicted L_{Aeq} noise levels, dB(A)[1]			Exceedance, dB(A)		
	Day (with generator)	Day and Evening	Night	Day (with generator)	Day and Evening	Night	Day (with generator)	Day and Evening	Night
R1	45[1]	40	39	41	41	41	-	1[2]	2[2]
R2				39	39	39	-	-	-
R3				40	40	40	-	-	1[2]
R4				40	39	39	-	-	-
R5				37	37	37	-	-	-
R6				30	29	29	-	-	-
R7				40	40	40	-	-	1[2]
R8				38	38	38	-	-	-

Notes:

1. *A +5 dB(A) is applied to the daytime project noise trigger level due to the diesel generator being a single-event noise source of 15 minute – 1 hour duration, in accordance with the Noise Policy for Industry.*
2. *In accordance with the Noise Policy for Industry, exceedances of up to 2 dB(A) are considered negligible if all feasible and reasonable noise mitigation measures have been considered. They would not be discernible to the average listener and therefore would not warrant receiver-based treatments or controls.*

6.4.1 Discussion of results

With the barrier mitigation, predicted operational noise levels comply with the Project noise trigger levels at most assessed receivers during the daytime, evening and night-time. There is a minor exceedance of 1 dB(A) at receiver R1 during the day and evening, and at R3 and R7 during the night-time. Receiver R1 also experiences an exceedance of 2 dB(A) during the night-time. Exceedances up to 2 dB(A) are represent a minor impact that would be barely perceptible. Exceedances up to 2 dB(A) are considered negligible if all feasible and reasonable noise mitigation measures have been considered (as in Table 6-4), in accordance with the *Noise Policy for Industry*.

6.5 Operational road traffic noise

Periodic maintenance staff and contractors are expected to visit the site however the site will primarily remain unmanned. Minimal traffic movement generation is expected as a result of the operation of the Project. Therefore, noise impacts arising from operational traffic need not be considered any further as an increase of more than 2 dB(A) would not occur.

7.0 Mitigation measures

7.1 Construction noise mitigation measures

7.1.1 Construction Noise Management Plan

A construction noise management plan (CNMP) would be developed and implemented for the Project. The CNMP would include feasible and reasonable safeguards to manage noise emissions from the Project and complaints received in relation to construction noise. The CNMP should include, as a minimum, the following:

- Identification of nearby residences and other sensitive land uses
- Description of approved hours of work
- Description and identification of all construction activities, including work areas, equipment, and duration
- Description of what work practices (generic and specific) would be applied to minimise noise
- A complaints handling process
- Noise monitoring procedures
- Overview of community consultation required for identified high impact work.

Construction work should be planned and carried out during standard construction hours wherever possible. Table 7-1 presents a summary of the standard mitigation measures which should be considered as mitigation measures within the CNMP where feasible and reasonable.

Table 7-1 Transport *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* standard mitigation measures

Action required	Safeguard details
Management measures	
Implement stakeholder consultation measures	Periodic notification (e.g. letterbox drop and website notification) detailing night-time works, with the exception of emergency works and electrical fitout works, at least seven days prior to the commencement of works.
Site inductions	All employees, contractors and subcontractors would receive an environmental induction.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines.
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise levels would be scheduled during less sensitive time periods as far as practicable. This would include the use of concrete saws, grinders, chainsaws, and mulchers.
Equipment selection	Quieter construction methods should be used where feasible and reasonable (e.g. rubber wheeled instead of steel tracked plant). Equipment would be regularly inspected and maintained to ensure it is in good working order.
Maximum noise levels	The noise levels of plant and equipment would have operating sound power or sound pressure levels that would meet the predicted noise levels.

Action required	Safeguard details
Rental plant and equipment	Noise emissions would be considered as part of the selection process.
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers would be maximised. Plant used intermittently would be throttled down or shut down. Plant and vehicles would be turned off when not in use. Noise-emitting plant would be directed away from sensitive receivers where reasonable and feasible.
Plan work site and activities to minimise noise	Traffic flow, parking and loading/unloading areas would be planned to minimise reversing movements within the site. Truck drivers would be advised of designated vehicle haulage routes, parking locations, acceptable delivery hours or other relevant practices (i.e. minimising the use of engine brakes, and no extended periods of engine idling).
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) would be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries would occur as far as possible from sensitive receivers. Dedicated loading/unloading areas would be shielded if close to sensitive receivers. Delivery vehicles would be fitted with straps rather than chains for unloading, wherever possible.
Silencers on mobile plant	Where possible, noise from mobile plant would be reduced through additional fittings including: • Residential grade mufflers • Silencing air parking brake engagement.
Construction related traffic	Vehicle movements would be routed away from sensitive receivers and scheduled during less sensitive times where possible. The speed of vehicles would be limited, and the use of engine compression brakes would be minimised. On-site storage capacity would be maximised to reduce the need for truck movements during sensitive times.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources would be enclosed or shielded to the greatest extent possible whilst ensuring that the occupational health and safety of workers is maintained.

7.1.2 Noise monitoring plan

7.1.2.1 Location

To verify compliance, attended measurements are recommended to be undertaken at the commencement of Project operation. In addition, attended measurements should be made in response to any complaints.

7.1.2.2 Procedure

The attended measurements will be conducted in accordance with the procedures outlined in Australian Standard AS 1055 *Acoustics – Description and measurement of environmental noise* and in accordance with methods outlined in the NSW *Noise Policy for Industry*. The following points should be followed when conducting noise monitoring:

- A field calibration should be conducted before and after measurements
- The sound level meters must be set to an A-weighting and Fast
- The sound level meters sample period should be set to 15 minutes
- The following descriptors should be measured as a minimum: $L_{A1,}$ L_{Aeq} and L_{A90}, and
- Measurements should be conducted a minimum of 3 metres from the nearest façade and/or solid fence/wall. If it is not possible to do this, corrections for façade reflection should be applied to the measurement results.

7.1.2.3 Equipment

All acoustic instrumentation employed throughout the monitoring programme will comply with the requirements of AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications. All sound level meters must have current calibration certificate from a NATA accredited laboratory in accordance with NATA guidelines. Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dB.

7.1.2.4 Reporting

The following information must be included in the monitoring report:

- Field calibration results (before and after measurements)
- Measurement times and dates
- Qualitative description of the noise environment during the measurements
- L_{A1}, L_{Aeq} and L_{A90} levels
- Meteorological conditions during the measurements; and
- Estimation/measurement of noise contributions from any other major noise sources.

7.1.2.5 Record keeping

A system of records which provides full documentation of all noise monitoring results, complaint handling and responses to non-compliances should be maintained.

7.1.3 Community consultation and complaints handling

Sensitive receivers impacted by noise levels from the Project during construction activities should be notified periodically at least seven days prior to the commencement of works.

The information provided to the receivers would include:

- Programmed times and locations of construction work
- The hours of proposed work
- Construction noise and vibration mitigation measures being implemented on site.

Community consultation regarding construction noise and vibration would be detailed in the CNMP for the construction of the Project and would include a 24-hour hotline and complaints management process.

8.0 Conclusion

A construction and operational Noise and Vibration Impact Assessment has been completed for the Project.

Nearby noise sensitive receivers were identified. Attended and unattended noise measurements were completed to characterise the existing noise environment. The measured noise levels were used to establish operational Project noise trigger levels and construction noise management levels in accordance with the *Noise Policy for Industry* and *Interim Construction Noise Guideline* respectively.

Construction noise impacts were assessed at nearby noise sensitive receivers. Predicted construction noise levels were above the applicable noise management levels for all receivers during the three assessed construction scenarios, except at R6 during enabling works and during the finishes and demobilisation stage. The largest exceedance was up to 15 dB(A) at receiver R4 during structural, civil, mechanical and electrical works. The use of vibration intensive equipment is proposed for the construction of the Project but is unlikely to generate any vibration impacts to sensitive receivers.

A Construction Environmental Management Plan (CEMP) should be developed for the Project and implemented prior to commencement of construction activities. The EMP would include a CNMP, which would include all feasible and reasonable safeguards to manage the noise emissions from the site and any complaints which may occur due to construction noise. Implementation of the mitigation measures described would aim to manage noise impacts where feasible.

Operational noise sources for the Project include battery units, inverters and transformers. Operational noise from the site was modelled and compared against established Project noise trigger levels. The noise sources for the Project were predicted to exceed the Project noise trigger levels with no mitigation measures implemented.

With 8 m high noise barriers placed on the eastern, southern and western boundaries of the Project, the noise levels at all assessed receivers would comply with the daytime, evening and night-time Project noise trigger levels. There is a minor exceedance of 1 dB(A) at receiver R1 during the day and evening, and at R3 and R7 during the night-time. There is also an exceedance of 2 dB(A) at R1 during the night-time. Exceedances up to 2 dB(A) are considered negligible as all feasible and reasonable noise mitigation measures have been considered.

The impact of both construction and operational traffic noise generated by the Project is considered acceptable according to the NSW EPA's *Road Noise Policy.*

Appendix A

Unattended Noise Monitoring Results

Noise Logger Report

1309 Wine Country Drive, Rothbury

Item	Information
Logger Type	NL-52
Serial number	164394
Address	1309 Wine Country Drive, Rothbury
Location	1309 Wine Country Drive, Rothbury
Facade / Free Field	Free Field
Environment	Bird and cicada noise. Distant traffic noise on Wine Country Drive, 38-41 dB. Car passbys on Old North Road, 51-62 dB.

Measured noise levels

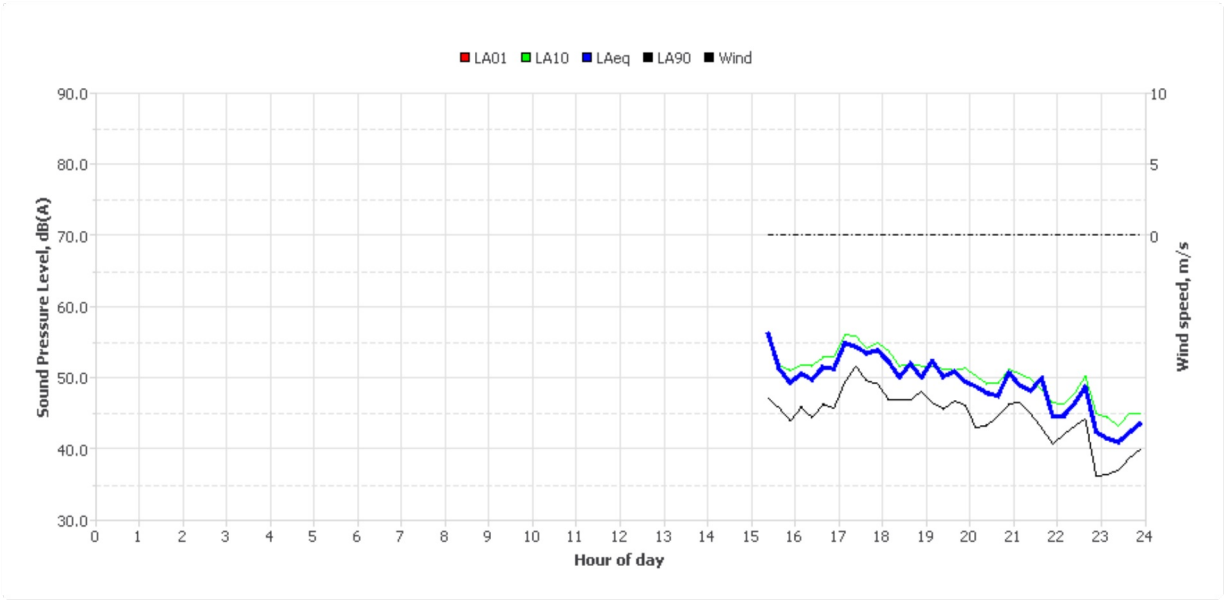
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu Apr 4 2024	53	50	45	-	43	-	51	45
Fri Apr 5 2024	52	52	47	44	44	40	52	47
Sat Apr 6 2024	48	53	46	36	43	40	50	46
Sun Apr 7 2024	47	50	45	36	39	40	49	45
Mon Apr 8 2024	49	51	43	33	42	39	50	43
Tue Apr 9 2024	50	45	43	-	-	34	50	43
Wed Apr 10 2024	53	49	46	-	38	-	52	46
Thu Apr 11 2024	50	49	46	35	40	28	50	46
Fri Apr 12 2024	49	50	45	35	40	28	50	45
Sat Apr 13 2024	50	49	45	34	-	32	49	45
Sun Apr 14 2024	48	50	42	32	42	30	48	42
Mon Apr 15 2024	49	49	45	32	41	31	49	45
Tue Apr 16 2024	50	49	44	34	42	34	49	44
Wed Apr 17 2024	50	48	49	37	-	-	50	49
Thu Apr 18 2024	55	49	44	35	40	35	54	44
Fri Apr 19 2024	50	50	45	34	42	31	50	45
Sat Apr 20 2024	51	50	44	-	-	-	51	44
Sun Apr 21 2024	49	49	47	-	45	-	49	47
Mon Apr 22 2024	50	51	45	39	43	39	50	45
Tue Apr 23 2024	48	51	44	33	42	34	49	44
Wed Apr 24 2024	49	-	45	-	-	-	49	45
Summary	**51**	**50**	**45**	**35**	**42**	**34**	**50**	**45**

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

1309 Wine Country Drive, Rothbury

Thursday, 04 Apr 2024



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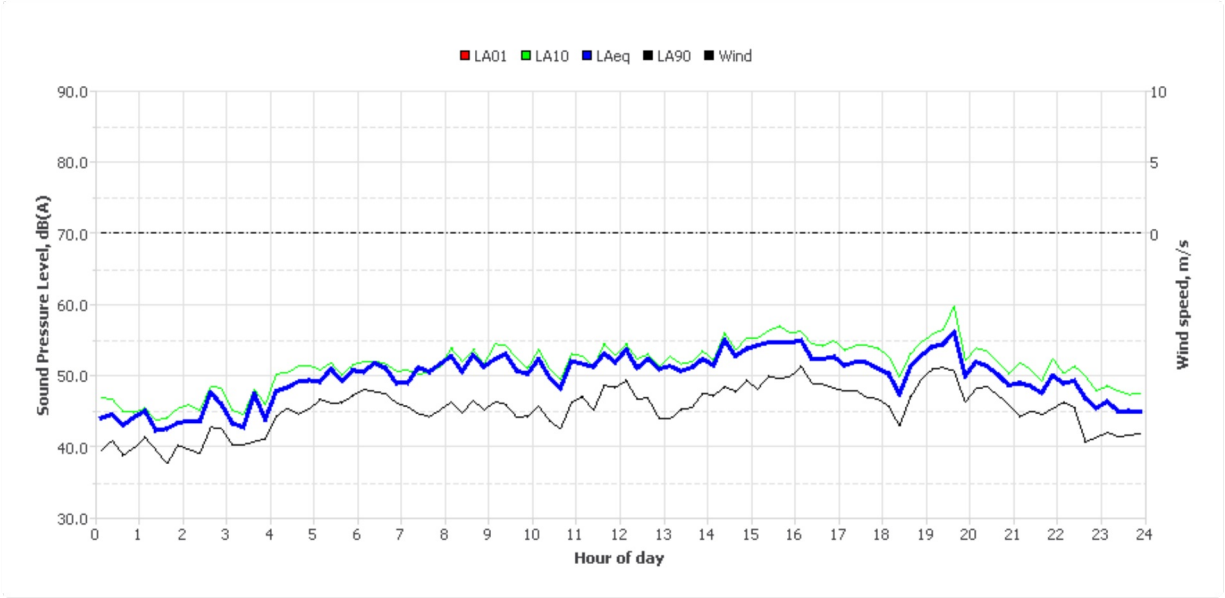

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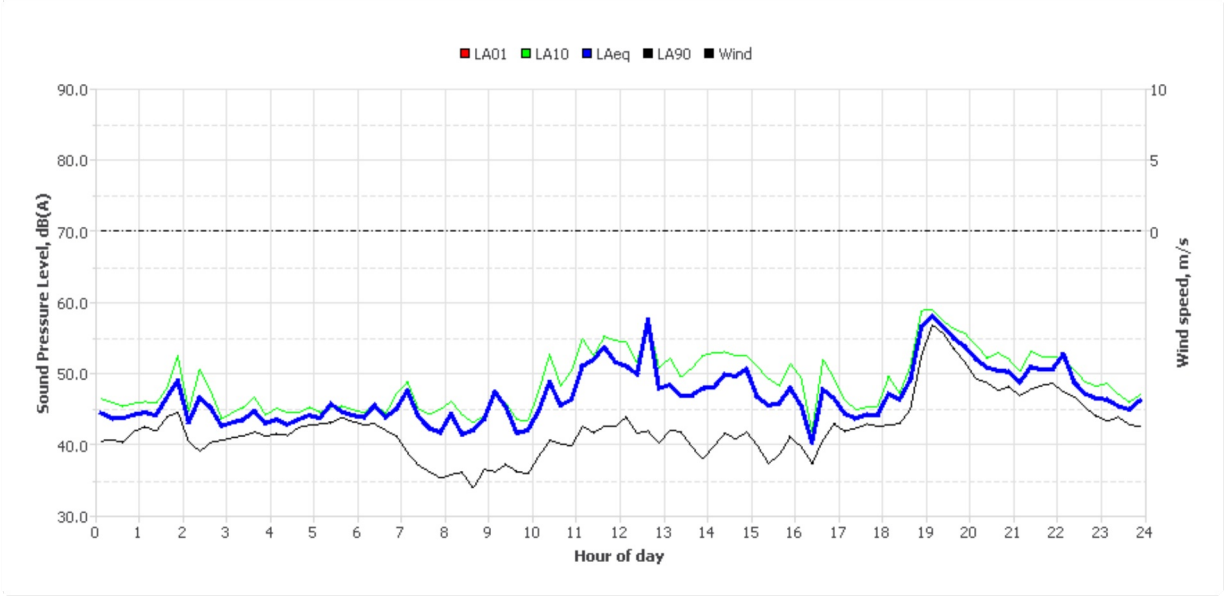

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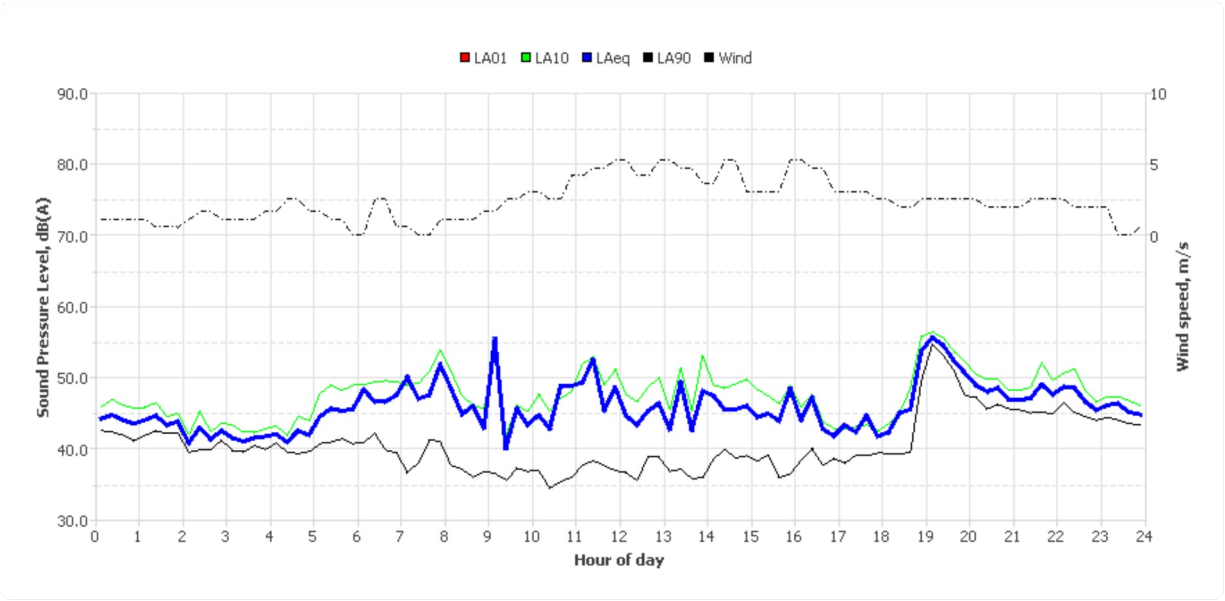

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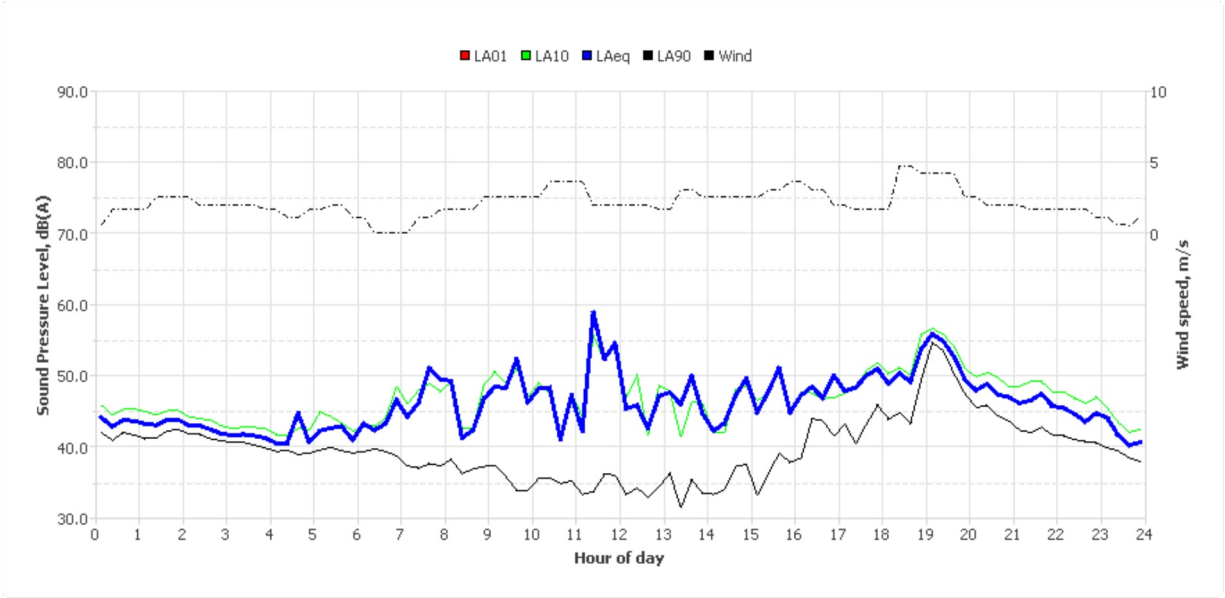

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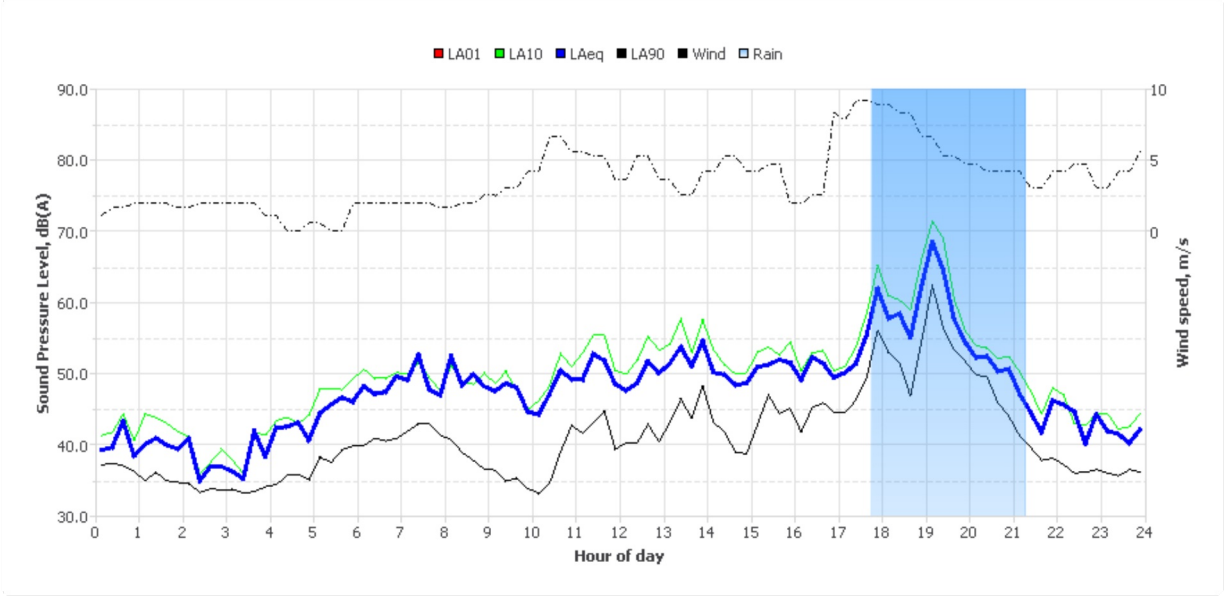

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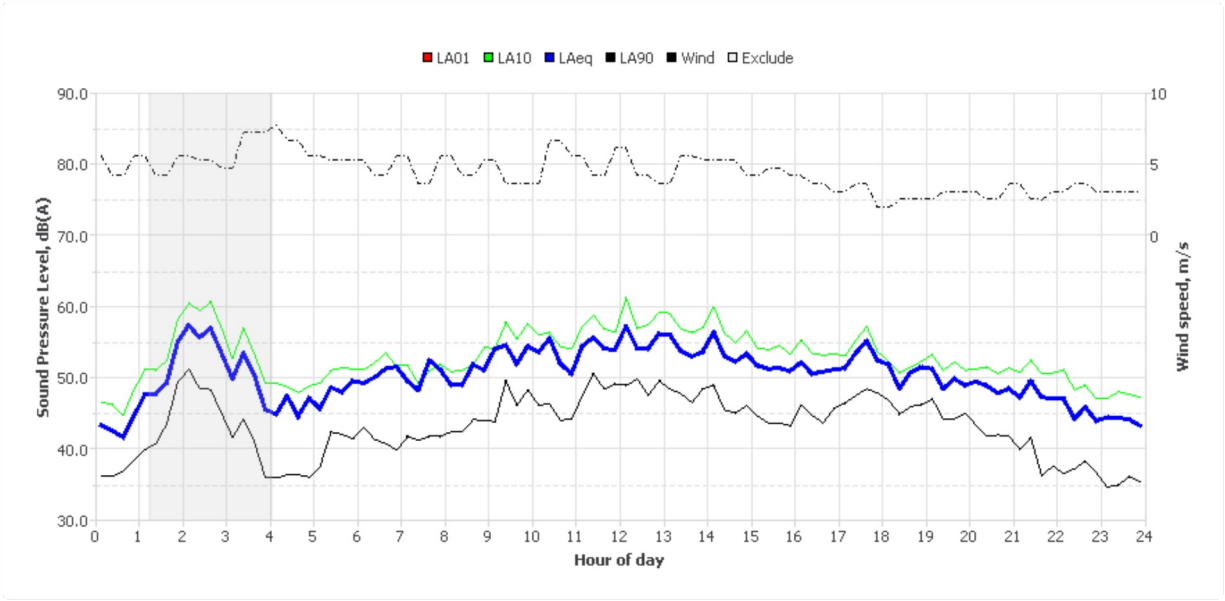

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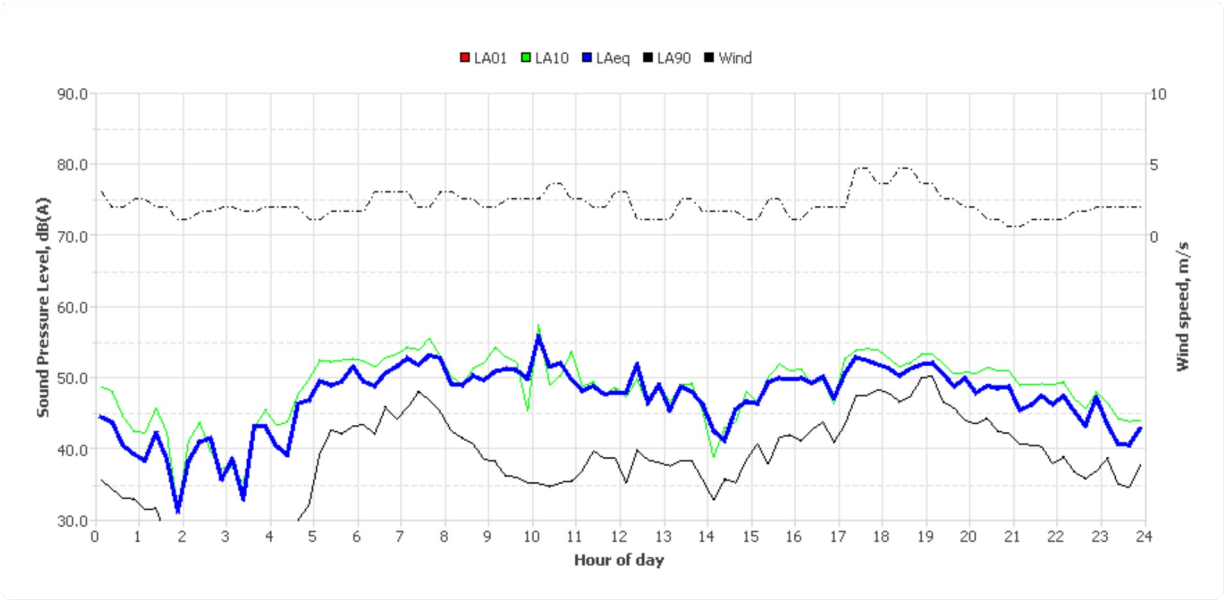

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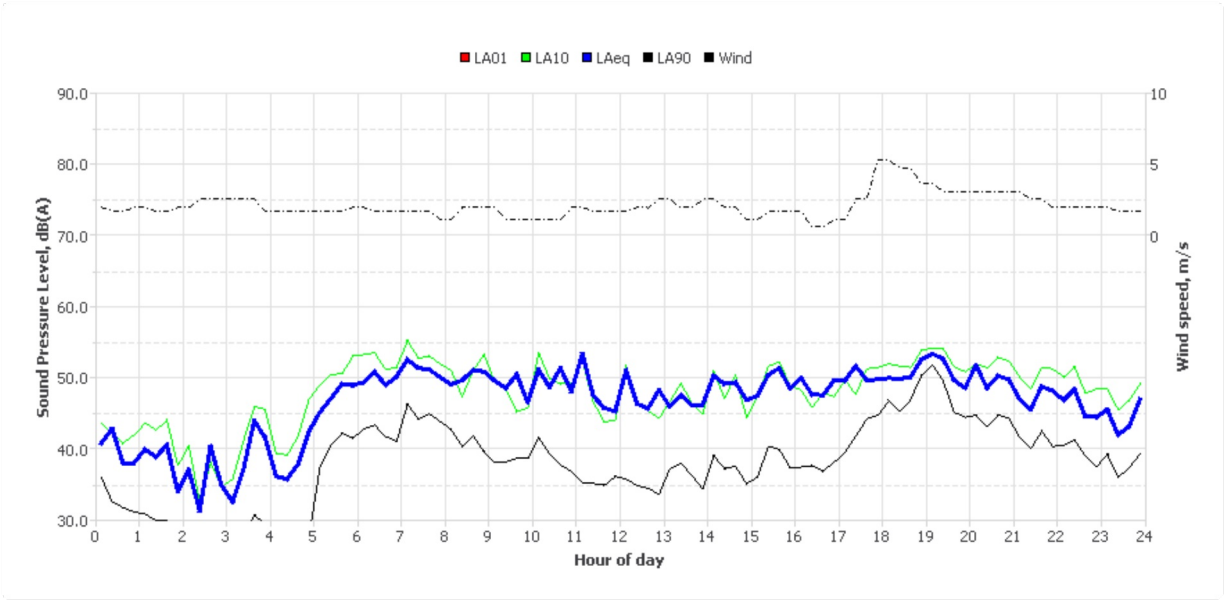

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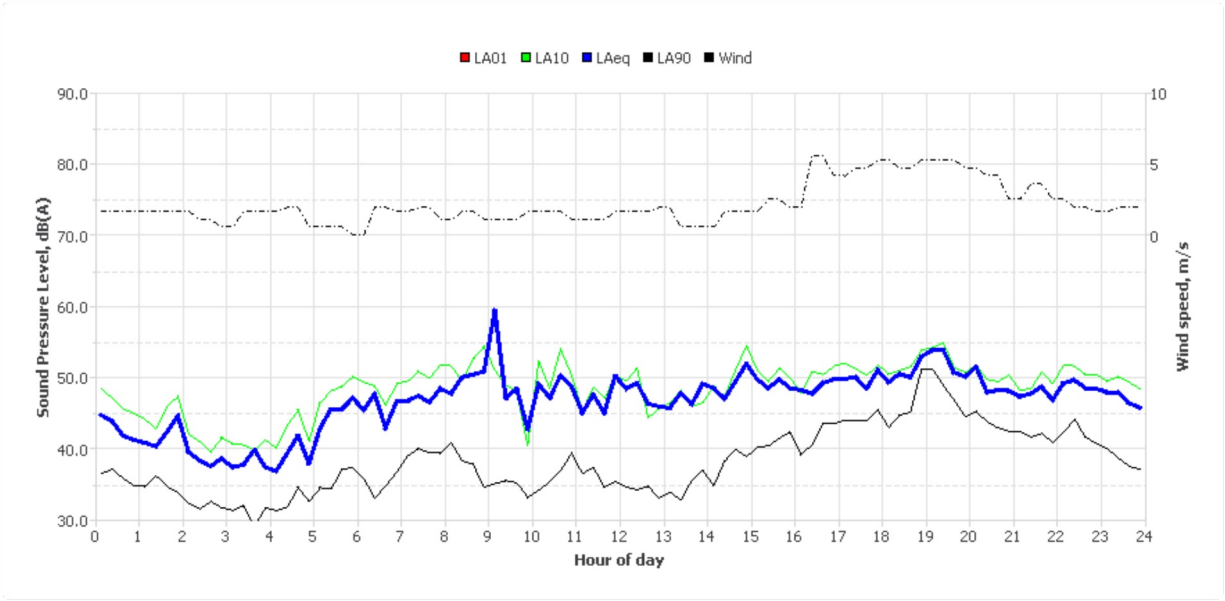

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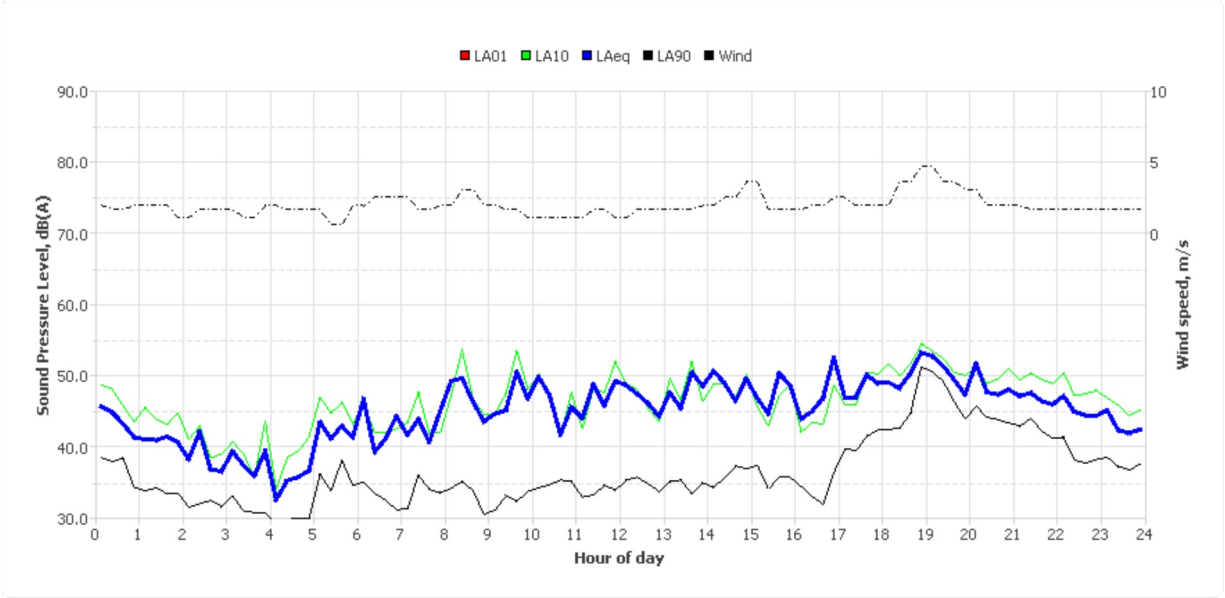

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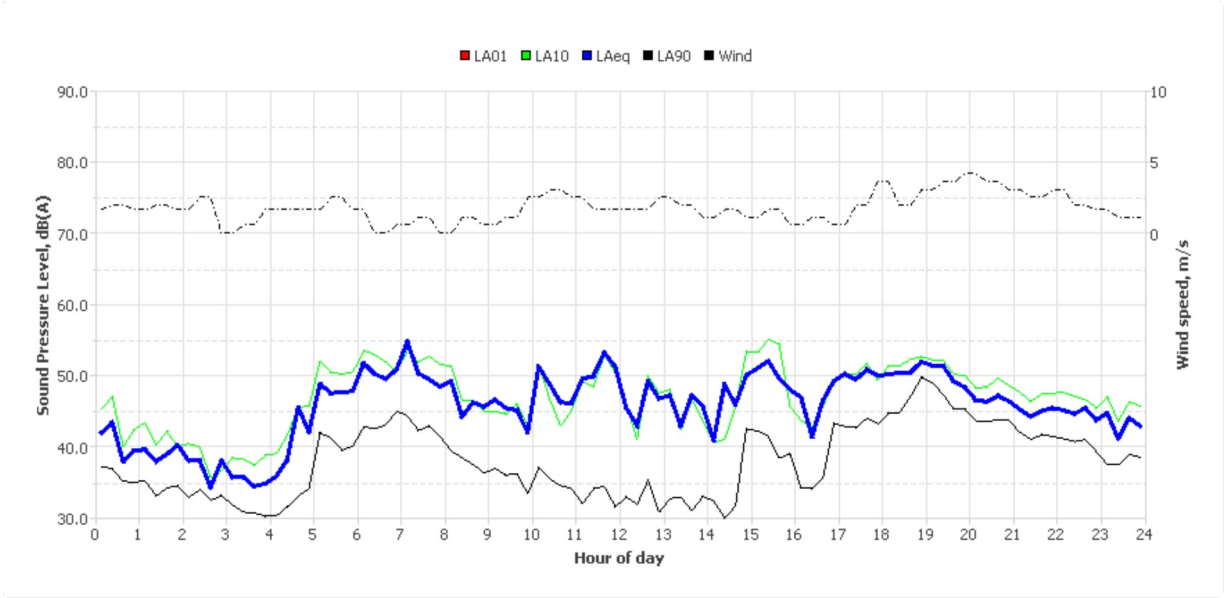

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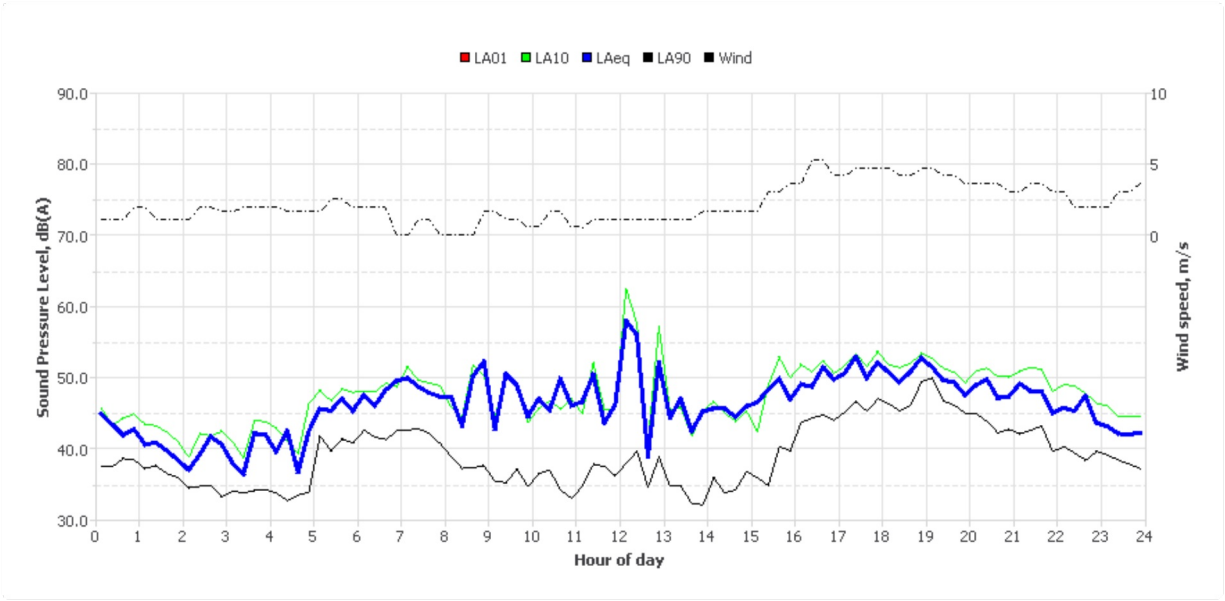

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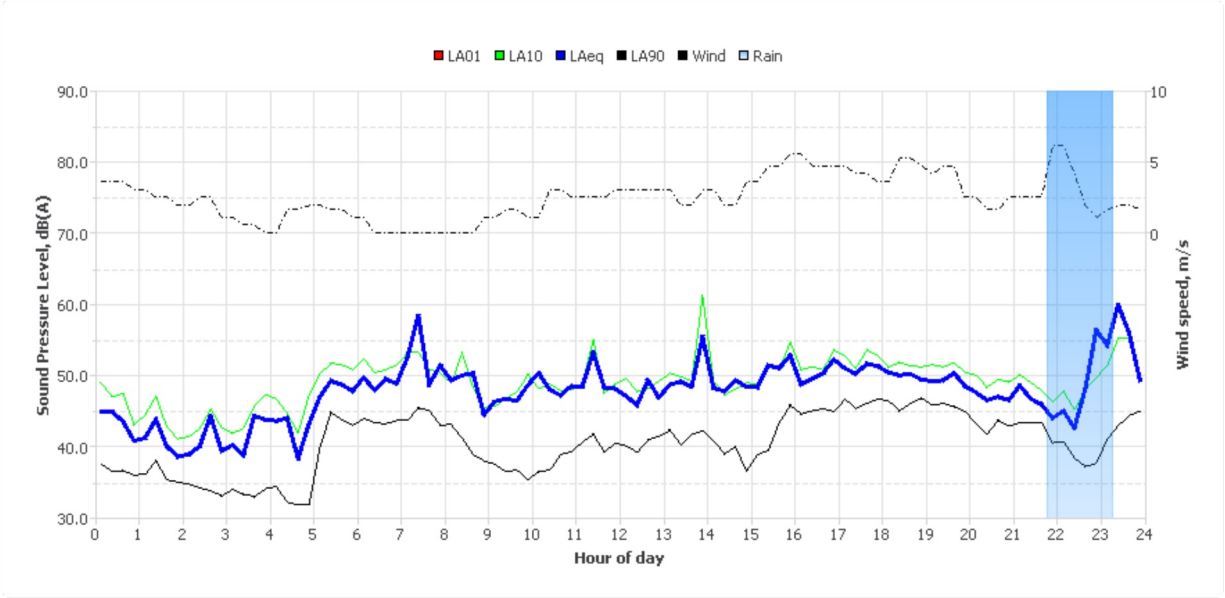

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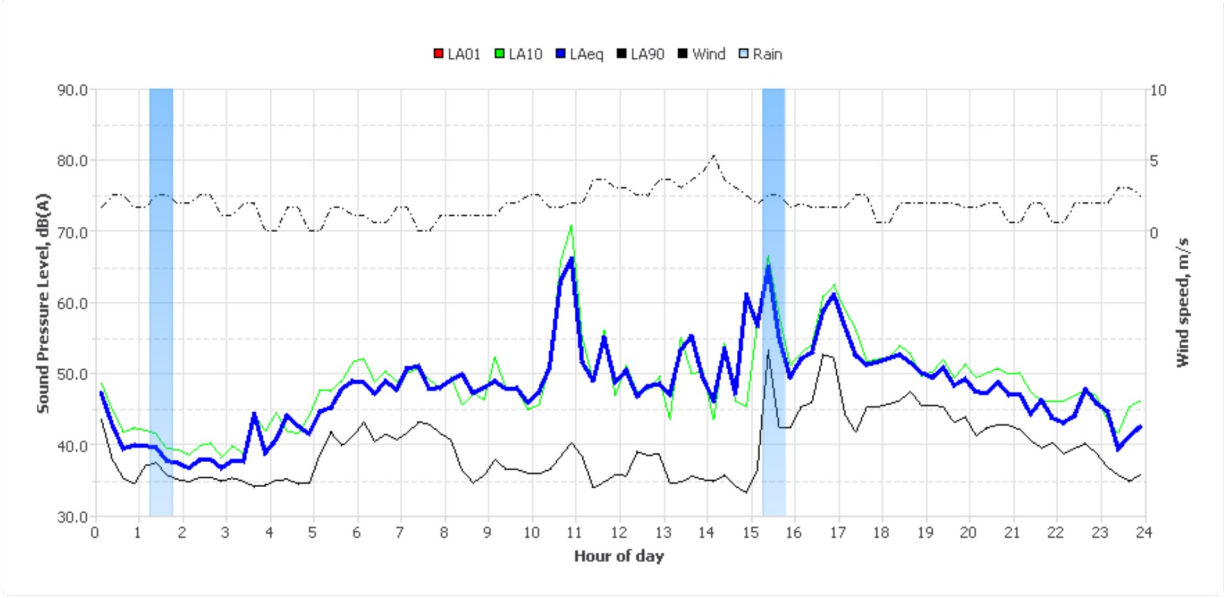

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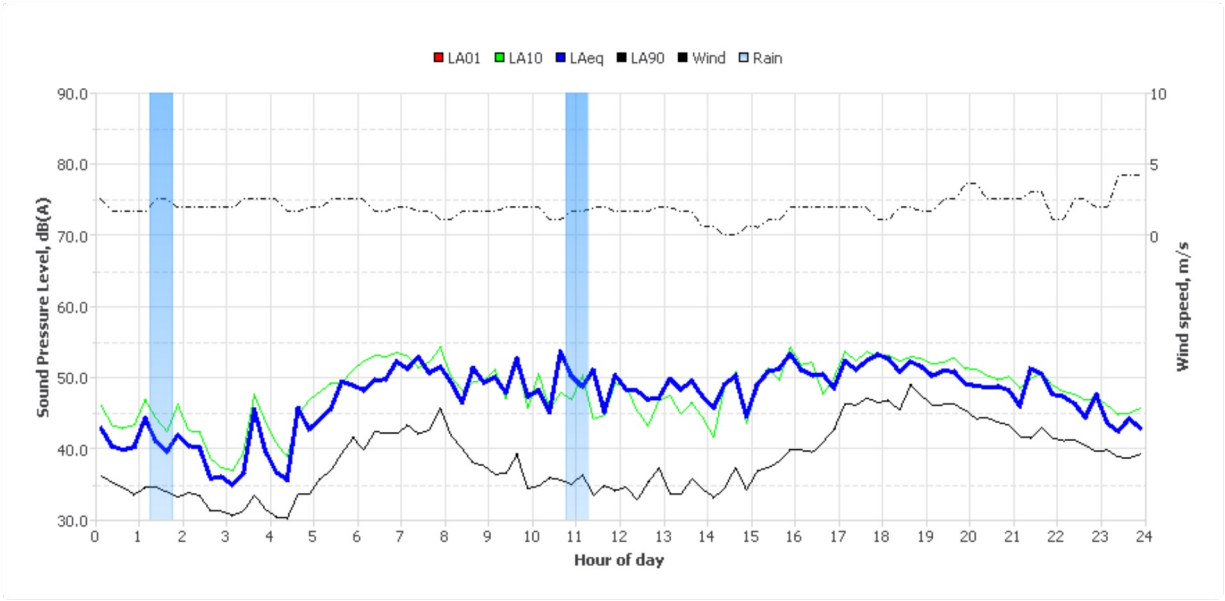

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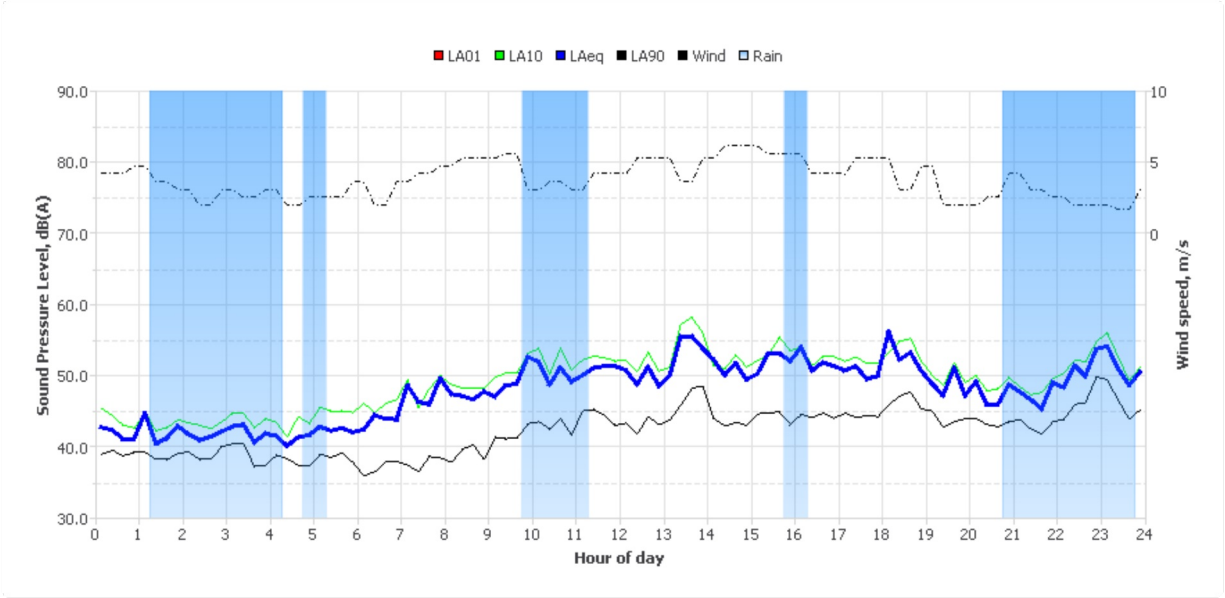

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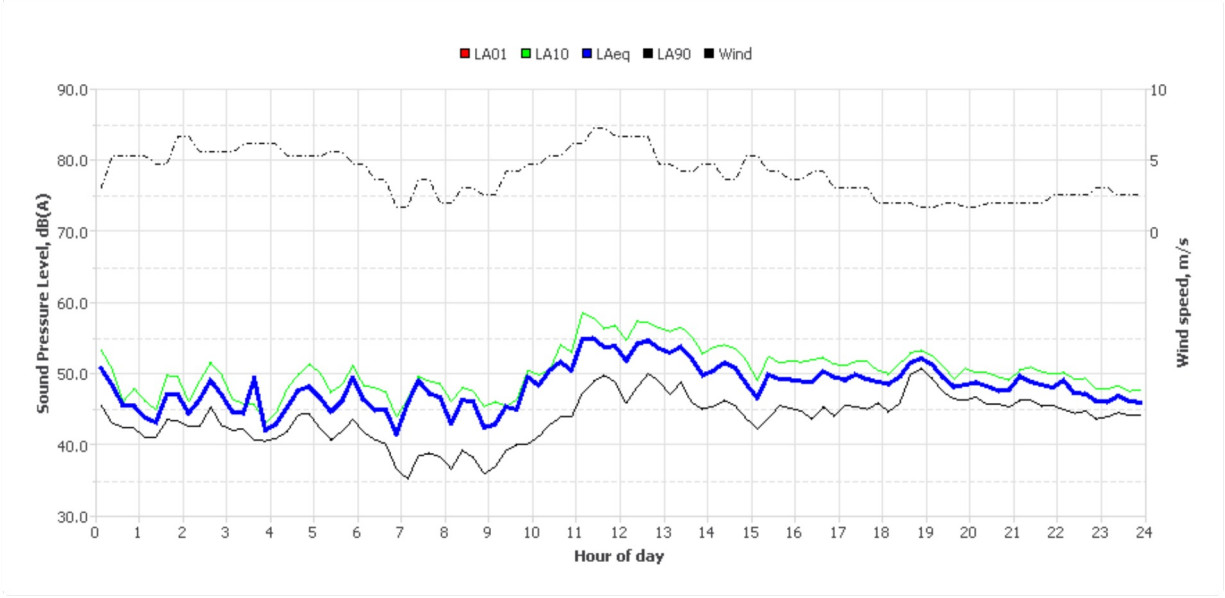

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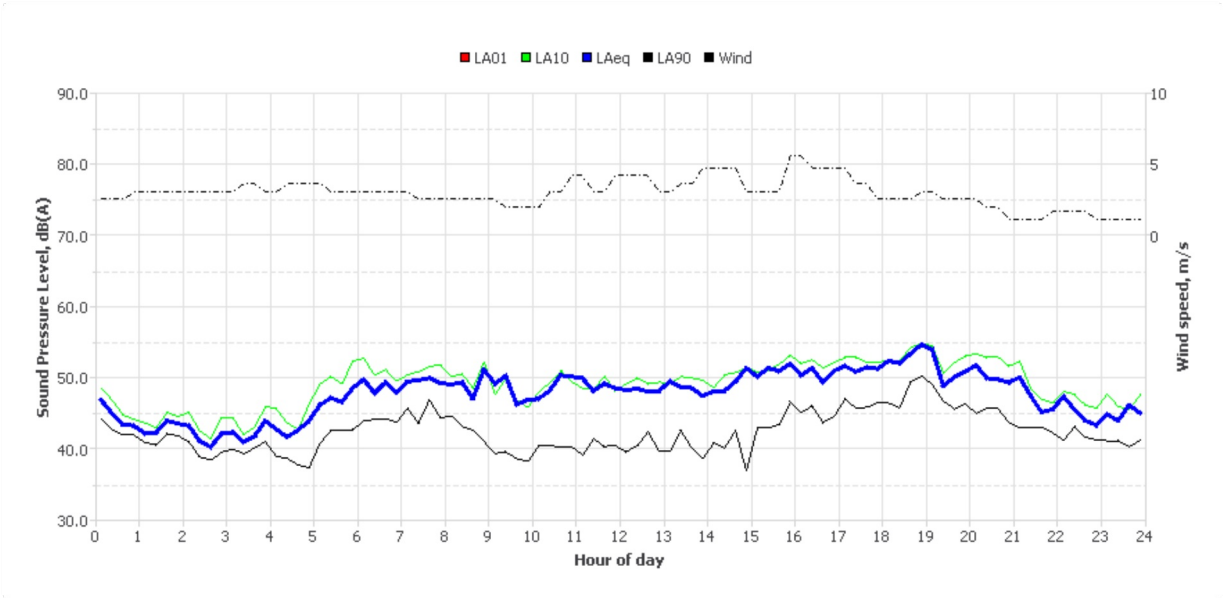

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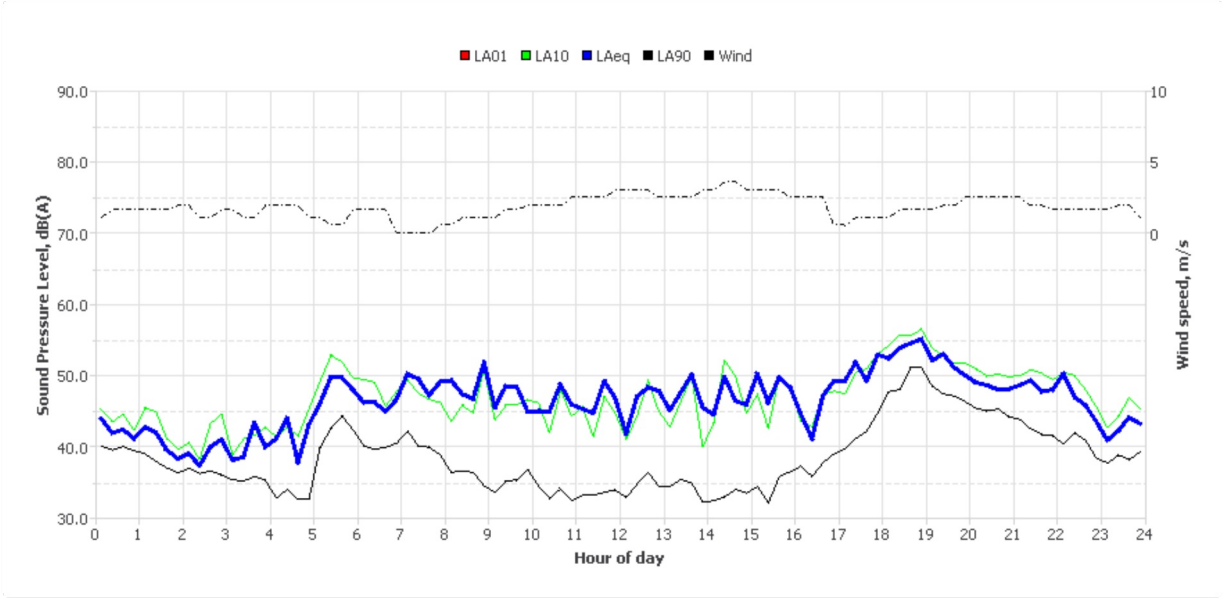

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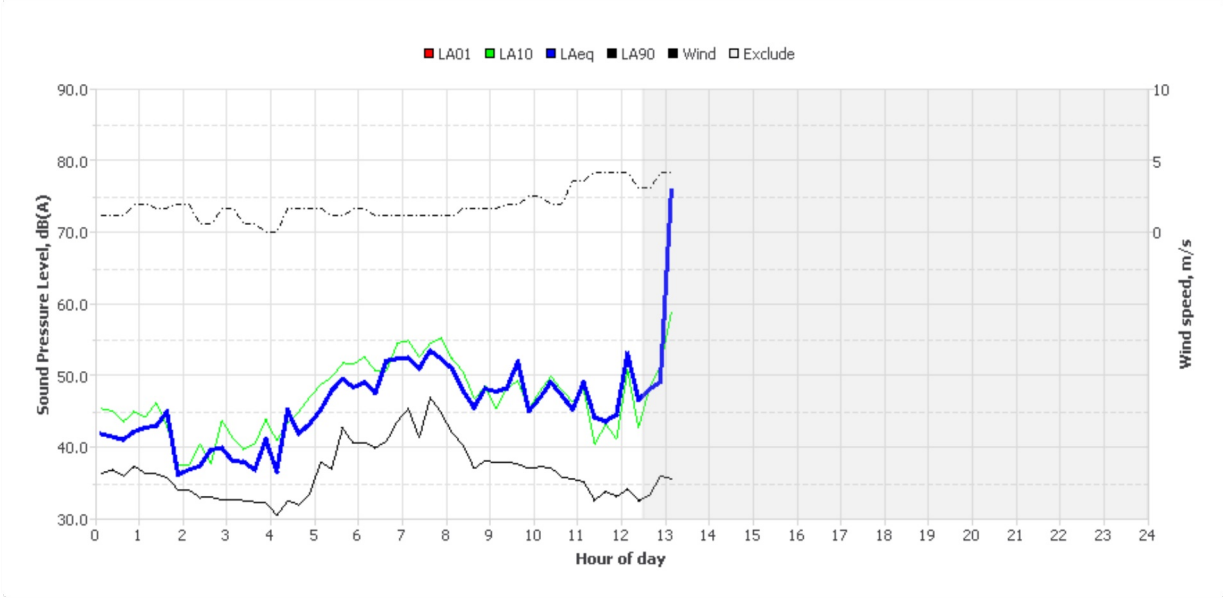
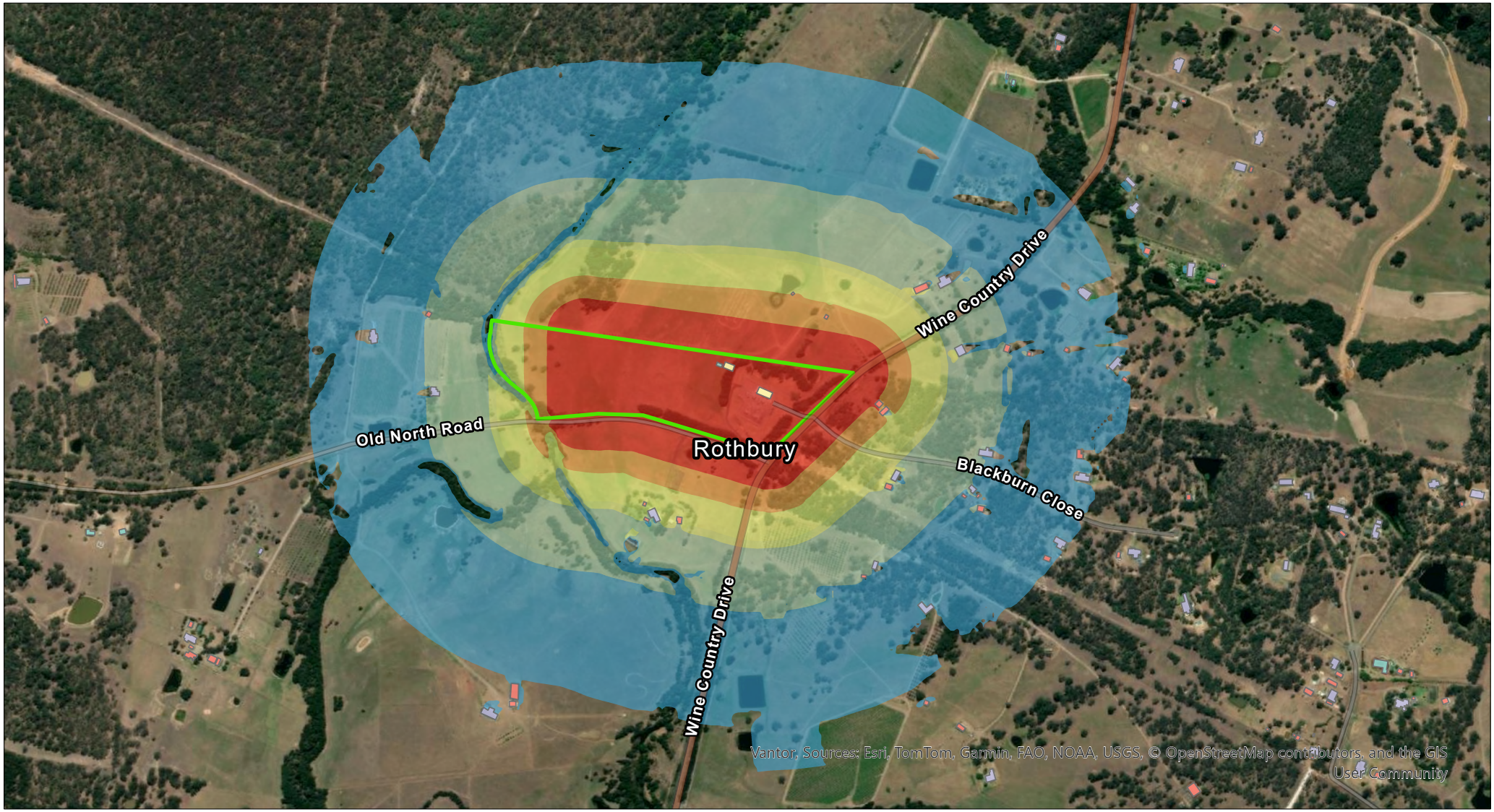


Appendix B

Construction Noise Contour Maps



Rothbury Battery Energy Storage System - Construction Noise Contours
Scenario 1 - Enabling Works

Noise contours are shown 1.5 metres above ground level

Site Boundary

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level, $L_{Aeq,15min}$ dB(A)

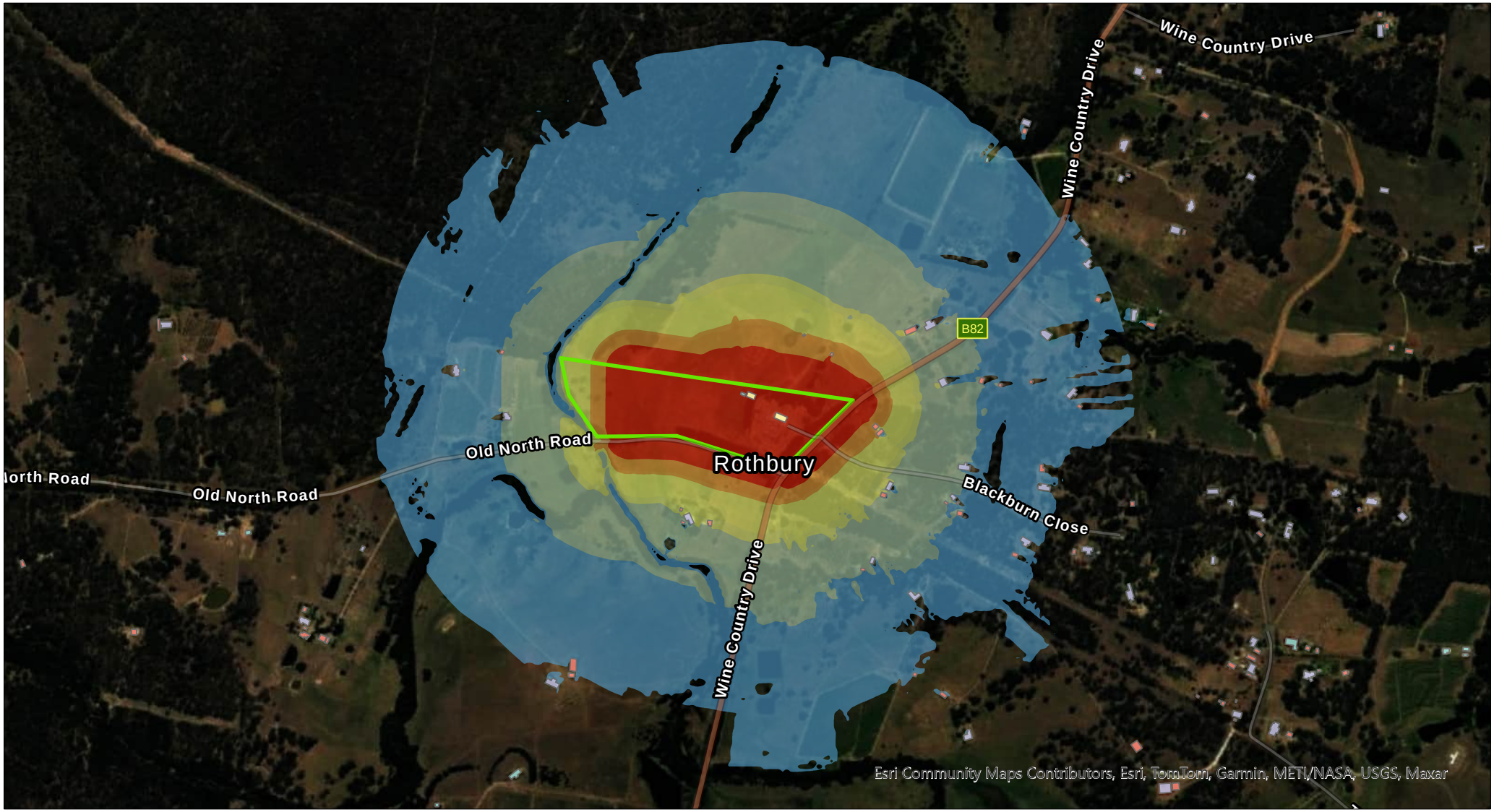
46 - 51
52 - 57
58 - 63
64 - 69
70 - 75

N

0 160 320 Meters

AECOM

Source: Nearmap 2024



Rothbury Battery Energy Storage System - Construction Noise Contours
Scenario 2 - Structural, Civil, Mechanical and Electrical Works

Noise contours are shown 1.5 metres above ground level

Site Boundary

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level, $L_{Aeq,15min}$ dB(A)

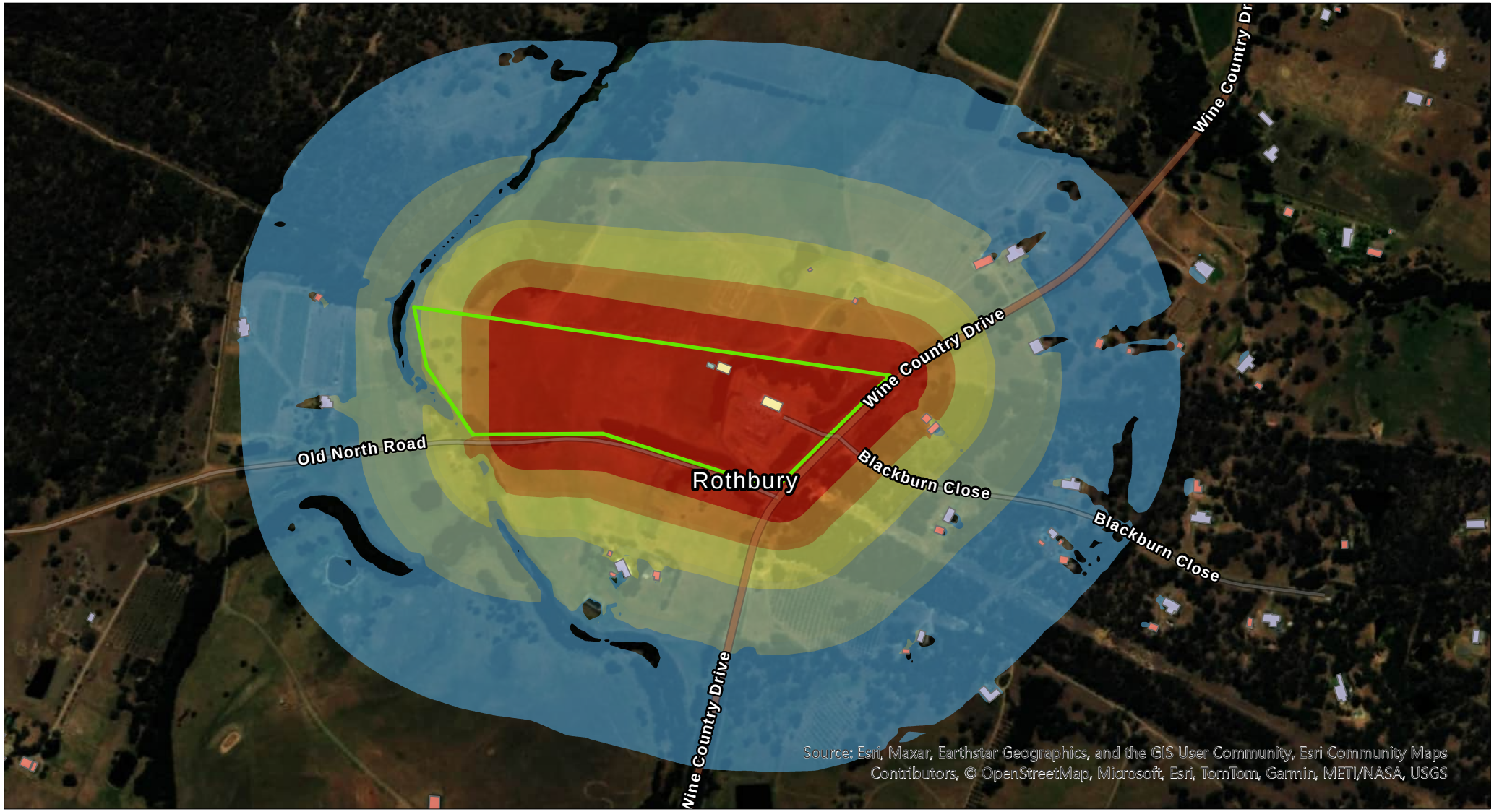
46 - 51 | 52 - 57 | 58 - 63 | 64 - 69 | 70 - 75

N

0 200 400 Meters

AECOM

Source: Nearmap 2024



Rothbury Battery Energy Storage System - Construction Noise Contours
Scenario 4 - Finishes and Demobilisation

Noise contours are shown 1.5 metres above ground level

Site Boundary

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level, $L_{Aeq,15min}$ dB(A)

46 - 51
52 - 57
58 - 63
64 - 69
70 - 75

N

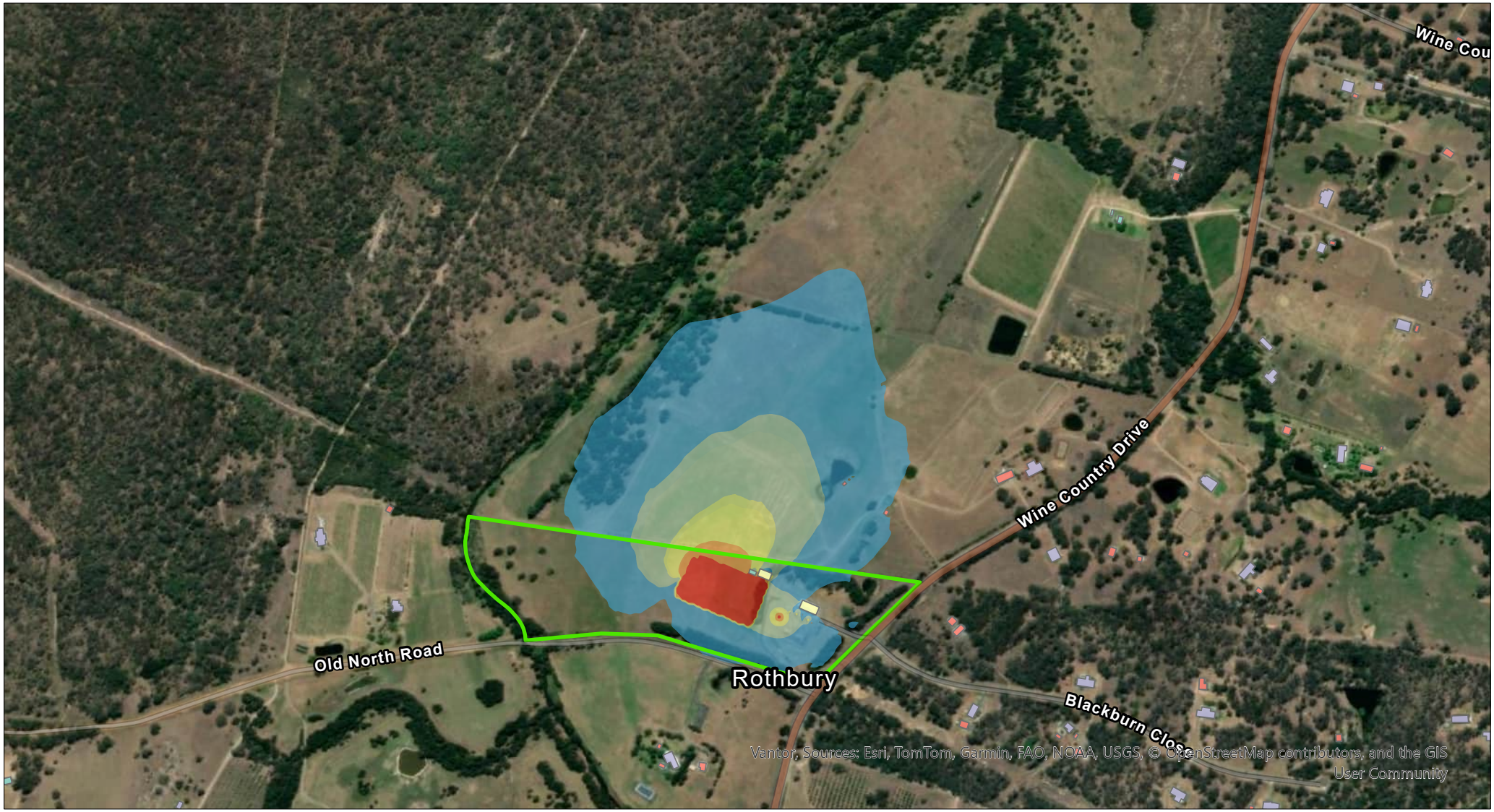
0 120 240 Meters

AECOM

Source: Nearmap 2024

Appendix C

Operational Noise Contour Maps



Rothbury Battery Energy Storage System - Operational Noise Contours Day (Generator Testing) - With Mitigation

Noise contours are shown 1.5 metres above ground level

Site Boundary

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level, $L_{Aeq,15min}$ dB(A)

46 - 51 | 52 - 57 | 58 - 63 | 64 - 69 | 70 - 75

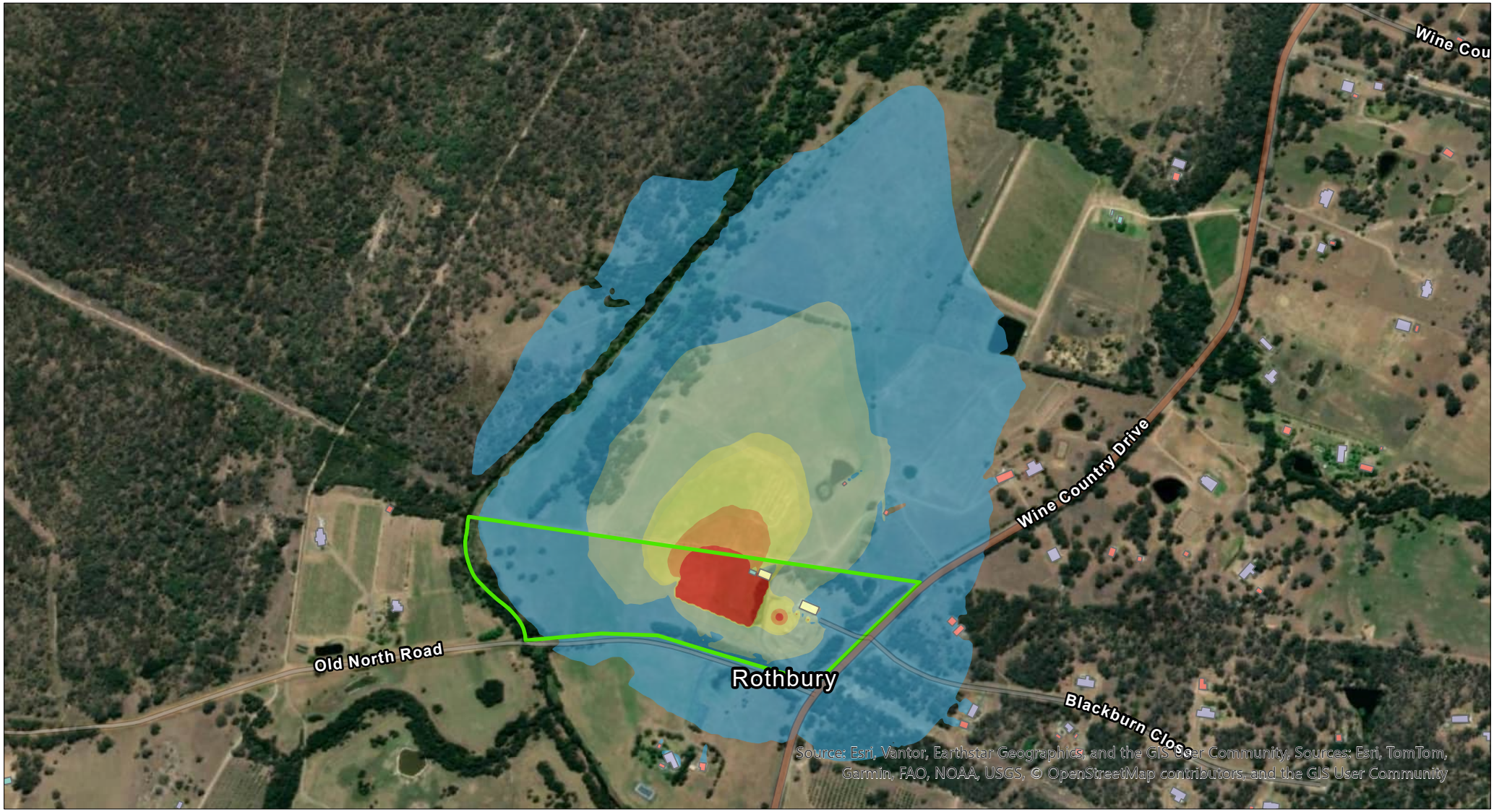
Note: Contours have been calculated under adverse weather conditions.

N

0 130 260 Meters

AECOM

Source: Nearmap 2024



Rothbury Battery Energy Storage System - Operational Noise Contours Day/Evening - With Mitigation

Noise contours are shown 1.5 metres above ground level

Site Boundary

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level, $L_{Aeq,15min}$ dB(A)

41 - 46 | 47 - 52 | 53 - 58 | 59 - 64 | 65 - 70

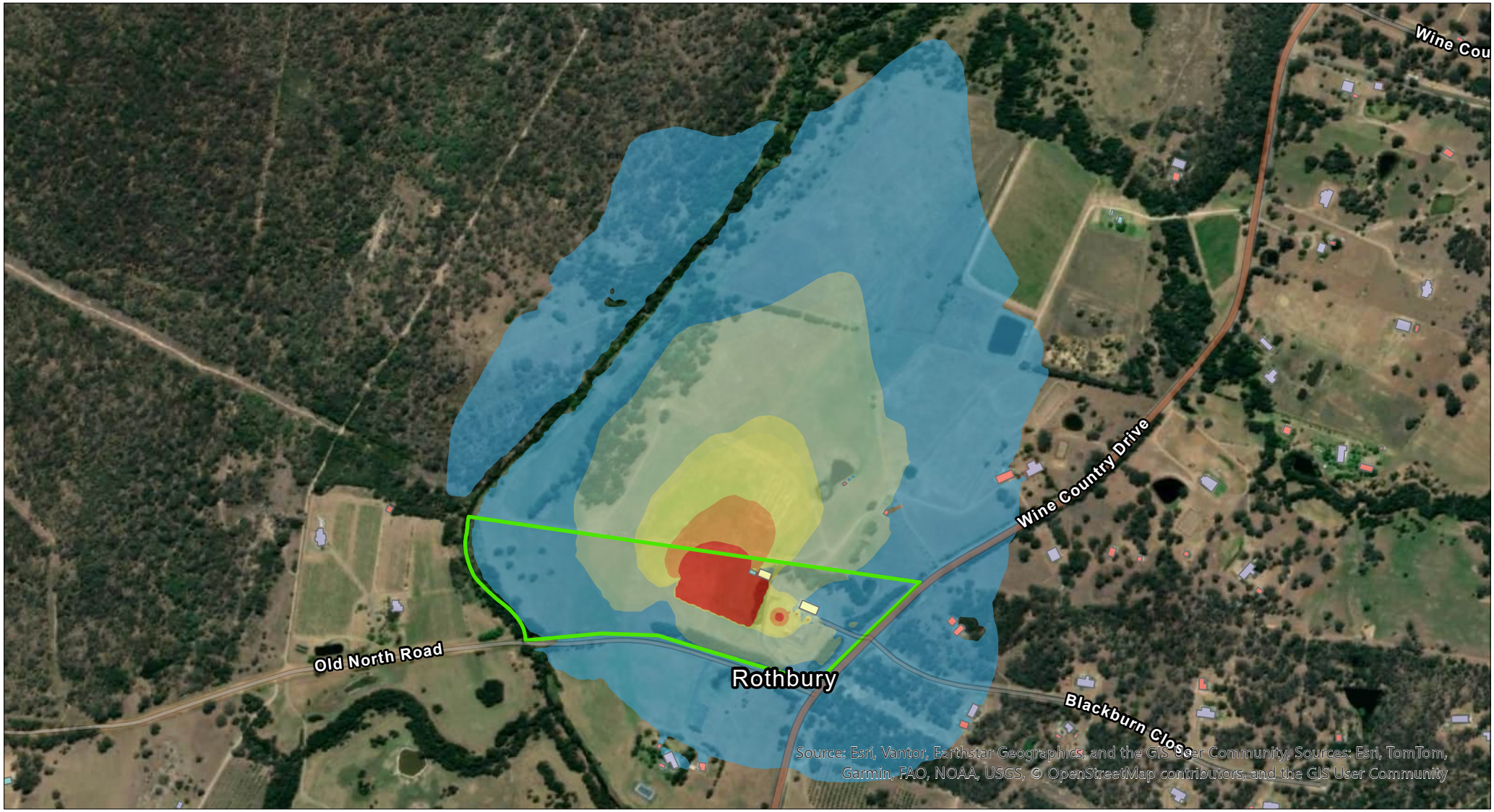
N

0 130 260 Meters

AECOM

Source: Nearmap 2024

Note: Contours have been calculated under adverse weather conditions.



Rothbury Battery Energy Storage System - Operational Noise Contours Night - With Mitigation

Noise contours are shown 1.5 metres above ground level

Site Boundary

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level, $L_{Aeq,15min}$ dB(A)

40 - 45 | 46 - 51 | 52 - 57 | 58 - 63 | 64 - 69

N

0 130 260 Meters

AECOM

Source: Nearmap 2024

Note: Contours have been calculated under adverse weather conditions.

Appendix D

One Third Octave Noise Levels

Location	Frequency, Hz																										Overall level	
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	dB(A)	dB(C)
Daytime (generator in operation), with mitigation																													
R1 – 2 Blackburn Close, Lovedale	-	8	26	16	12	23	38	31	24	26	29	33	39	34	30	31	33	31	29	27	23	21	15	9	-	-	-	41	44
R2 – 803 Old North Road, Rothbury	-	-	16	5	1	11	42	34	24	21	27	29	37	32	29	30	31	29	27	25	22	19	12	6	-	-	-	39	45
R3 – 1337 Wine Country Drive, Rothbury	-	4	22	11	6	17	36	29	22	22	26	30	38	33	30	31	33	31	29	27	24	21	14	8	-	-	-	40	43
R4 – 864 Old North Road, Rothbury	-	9	27	17	13	24	44	36	27	28	29	34	38	32	29	30	31	29	28	26	24	22	17	13	5	-	-	40	47
R5 – 1294 Wine Country Drive, Lovedale	-	4	22	12	7	18	33	26	19	21	24	29	36	31	27	28	29	27	25	22	18	14	6	-	-	-	-	37	41
R6 – Lot 2 DP848702, Rothbury	-	-	15	4	-	10	32	24	16	16	18	23	30	24	20	20	21	18	15	12	7	2	-	-	-	-	-	30	36
R7 – 1338 Wine Country Drive, Rothbury	-	4	22	12	7	17	36	29	22	22	27	30	38	33	30	31	32	30	28	26	23	19	12	6	-	-	-	40	43
R8 – 39 Blackburn Close, Lovedale	-	5	23	13	9	19	35	27	21	23	26	30	37	31	28	29	30	28	25	23	19	15	8	1	-	-	-	38	42

Location	Frequency, Hz																										Overall level	
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	dB(A)	dB(C)
All assessment periods, with mitigation																													
R1 – 2 Blackburn Close, Lovedale	-	8	26	16	12	23	32	28	24	26	29	33	39	34	30	31	33	31	29	27	23	21	15	9	-	-	-	40	44
R2 – 803 Old North Road, Rothbury	-	-	16	5	1	11	27	26	21	20	26	29	37	32	29	30	31	29	27	25	22	18	12	6	-	-	-	39	41
R3 – 1337 Wine Country Drive, Rothbury	-	4	22	11	6	17	29	26	22	21	26	30	38	33	30	31	33	31	29	27	24	21	14	8	-	-	-	40	43
R4 – 864 Old North Road, Rothbury	-	9	27	17	13	24	34	30	26	27	29	34	38	32	28	30	31	29	28	26	24	22	17	12	5	-	-	39	43
R5 – 1294 Wine Country Drive, Lovedale	-	4	22	12	7	18	27	23	19	21	24	29	36	31	27	28	29	27	25	22	18	14	6	-	-	-	-	37	40
R6 – Lot 2 DP848702, Rothbury	-	-	15	4	-	10	22	19	15	16	18	23	29	24	20	20	21	18	15	12	7	2	-	-	-	-	-	29	33
R7 – 1338 Wine Country Drive, Rothbury	-	4	22	12	7	17	28	26	22	22	27	30	38	33	30	31	32	30	28	26	23	19	12	6	-	-	-	40	42
R8 – 39 Blackburn Close, Lovedale	-	5	23	13	9	19	28	24	20	23	26	30	37	31	28	29	30	28	25	23	19	15	8	1	-	-	-	38	41