Appendix H

Noise and Vibration Assessment

Great Western Battery

Noise and Vibration Impact Assessment

Great Western Battery

02-Feb-2022

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Noise and Vibration Assessment

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Executive Summary

Neoen Australia Pty Ltd (Neoen) is seeking development consent to construct, operate and maintain a large-scale Battery Energy Storage System (BESS) of approximately 500 megawatts (MW) and up to 1000 megawatt-hour (MWh) at Brays Lane, Wallerawang, NSW, as well as a new transmission line that would connect the BESS to the existing Transgrid 330 kilovolt (kV) substation at Wallerawang (the Project). The Project is considered State Significant Development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) as it satisfies the requirements of Clause 8 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

Construction of the Project will take approximately 12 months to complete. Construction works for the Project would involve:

- Enabling works and prefabrication
- Civil, structural, mechanical and electrical works
- Installation of transmission line
- Commissioning
- Finishes and demobilisation.

During operation, the Project would be an unmanned facility that is managed remotely. Between five to six employees would be required to attend the Site periodically for maintenance activities. The BESS is expected to operate on a 24 hour per day, seven days per week basis and is expected to undergo approximately one charge and discharge cycle per day, averaging 365 full cycles per year. The Project has an initial design life of 20 years with components anticipated to be replaced or upgraded, as and if required with potential to extend the life beyond 20 years.

The Site is in the suburb of Wallerawang, located at 173 Brays Lane (DP751651 Lot 4), part of the Lithgow City Council Local Government Area (LGA). Wallerawang is located approximately 110 km north west of Sydney, 14 km northwest of Lithgow adjacent to the Great Western Highway.

The area surrounding the Site predominantly comprises agricultural, industrial and rural residential land uses. The township of Wallerawang is located about 1.4 km south of the Site (measured from the Wallerawang Post Office) and approximately 800 m from the closest point of the transmission line corridor. The Site and the transmission line corridor are together referred to as the Project Area. A number of industrial, extractive industry and electricity generating land uses are located in the vicinity of the Project Area.

Construction noise impacts were modelled to determine the potential noise impacts at nearby noise sensitive receivers and compared against the NSW EPA's Interim Construction Moise guideline (ICNG) (DECC 2009), Noise Management Levels for construction scenarios. The modelling showed that some residential noise sensitive receivers are predicted to exceed the construction noise management levels during the day. In general, the construction of the Project is expected to comply with the noise management levels during the Project's construction during standard construction hours. None of the construction is expected to result in noise levels which exceed the 'highly noise affected' level of 75 dB(A) for noise sensitive receivers.

The noise from traffic generated by the construction activities to and from the Project Area are considered acceptable according to the NSW EPA's *Road Noise Policy*.

Operational noise from the Site was also modelled and compared against established project noise trigger levels. A 10 m noise barrier with sound absorptive lining was assumed around the battery packs and the HV transformers. Results of the noise modelling showed that the operation of the BESS complies with the established project noise trigger levels at most residential receivers, however marginal exceedances of the trigger levels have been predicted for three residential receives under both standard and noise-enhancing meteorological conditions. Recommendations for at-property noise mitigation measures to be considered for these three receivers have been made.

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

1.0 Introduction

1.1 Project description

1.1.1 Project overview

Neoen Australia Pty Ltd (Neoen) is seeking development consent to construct, operate and maintain a large-scale Battery Energy Storage System (BESS) of approximately 500 megawatts (MW) and approximately 1000 megawatt-hour (MWh) at 173 Brays Lane, Wallerawang, NSW (the Site), as well as a new transmission line that would connect the BESS to the existing Transgrid 330 kilovolt (kV) substation at Wallerawang (the Project). The Site and the transmission line corridor are together referred to as the Project Area.

The Project is located in the Central Tablelands of NSW, in the suburb of Wallerawang, about 110 km west of Sydney. Wallerawang is located in the Lithgow City Council Local Government Area (LGA). The regional context of the Project location is shown on **Figure 1-1**.

The Project is considered State Significant Development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) as it satisfies the requirements of Clause 8 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

Key components of the Project are shown on **Figure 1-2** and would include:

- Site establishment, including installation of fencing, environmental controls, grading and other civil works
- Establishment of a new driveway and access road (up to 10 m wide), located at the south-western boundary of the Site, providing access to the Site from Brays Lane
- Establishment of an internal access road
- Construction of a permanent car parking area with spaces for up to eight light vehicles
- Construction of two permanent operations and management (O&M) buildings, including staff amenities
- Construction of new switch rooms and control room
- Construction of new 33/330 kV substation on the Site (including outdoor switchgear (up to 330 kV) and transformers)
- A 10 m buffer (or Asset Protection Zone (APZ)) would be established around all battery storage infrastructure. This buffer area would comprise non-combustible ground cover with no vegetation present
- Construction of stormwater controls (including swales)
- Installation of two 45 kilolitre metal water tanks
- Provision of fire alert equipment
- A 400 kilovolt ampere (kVA) diesel generator with a 24 hour tank capacity would be stored at the Site (at one of the O&M buildings) for use during operation or use in case of an emergency
- Construction of lighting and installation of security devices around the perimeter of the BESS compound
- Establishment of noise walls, landscaping and screening vegetation
- Upgrades to the Wallerawang 330 kV substation switchyard
- Connection to the existing potable water supply and the 11 kV transmission line in Brays Lane
- Subdivision of Lot 4 DP 751651 to separate the existing residence in the south east portion of the lot from the proposed BESS facility.

Figure 1-1
Regional context of the Project Location

Legend
- Site boundary
- Transgrid 330 kV Wallerawang Substation
- The Project Area
- State Forest
- NPWS Reserve
- Watercourse
- Primary road

Figure 1-1 Regional context of the Project location

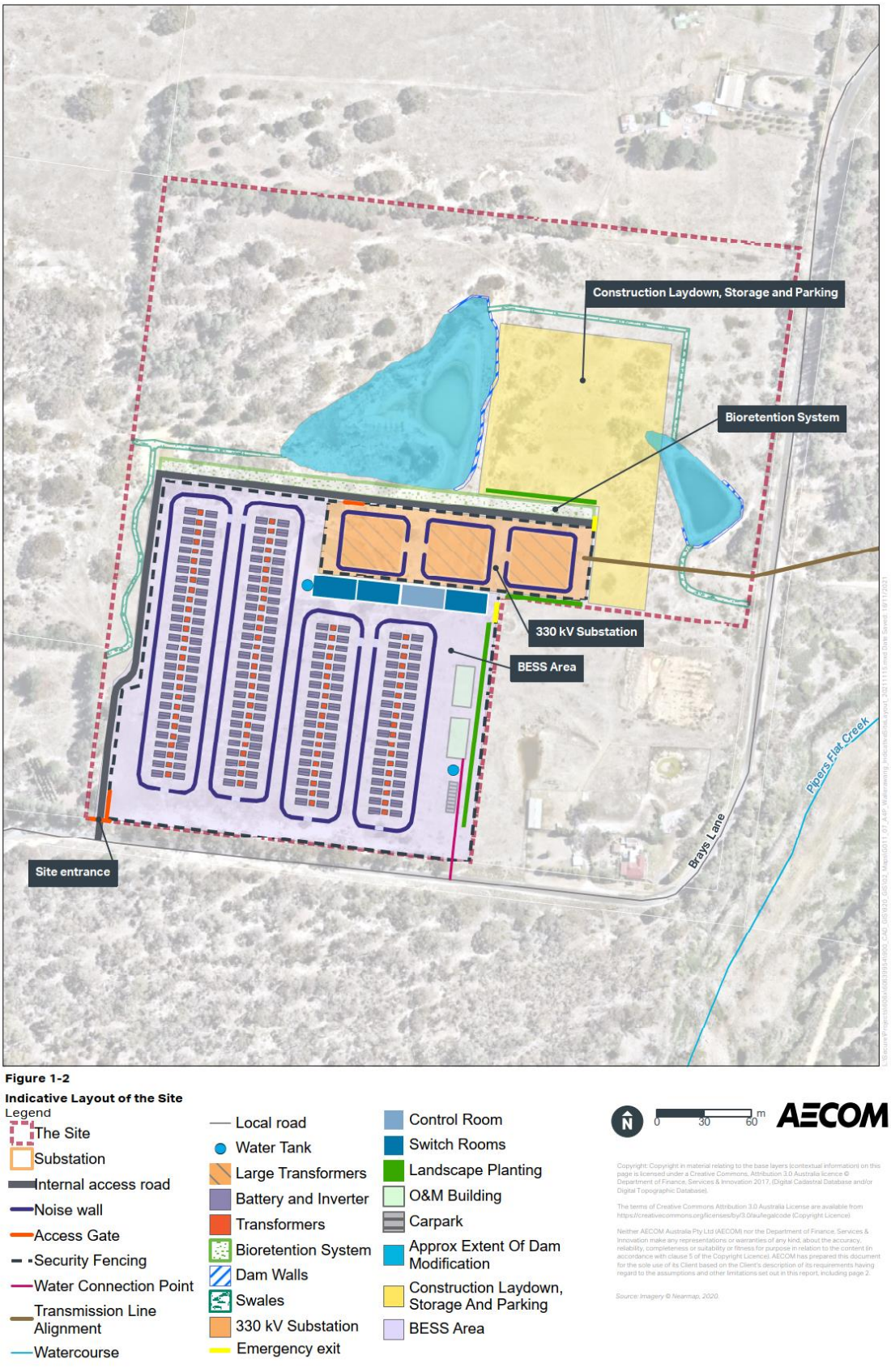


Figure 1-2 Indicative Site layout

1.1.2 Construction

Construction of the Project will take approximately 12 months to complete. Construction works for the Project would involve:

- Enabling works and prefabrication
- Civil, structural, mechanical and electrical works
- Installation of transmission line
- Commissioning
- Finishes and demobilisation.

A construction laydown, stockpiling and parking area would also be provided on the Site.

Up to 250 construction workers would be required at the busiest peak of construction for a period of about two months. Outside of this peak time, an average of about 50 workers a day would be required. These workers would be preferentially sourced locally where appropriate skill sets are economically available.

The construction activities would be primarily carried out during standard construction hours, as defined by the NSW Environment Protection Authority's (EPA) Interim Construction Noise Guideline (2009), being:

- 7am to 6pm, Monday to Friday
- 8am to 1pm, Saturdays
- No work on Sundays or public holidays.

While it is anticipated that work would primarily take place during standard construction hours, some works may be required to be undertaken outside of standard hours. Where this would be required, this would occur Monday to Saturday, 6am to 6pm. Where work outside of standard hours may be required, the noisiest works would be scheduled to occur during standard hours listed above.

On average, the peak construction of the Project would require up to 50 light vehicles, and 20 heavy vehicles per day. Oversized and over mass vehicles are expected to be required to deliver large pre-fabricated elements for the construction of the Project. This is likely to include about eight (8) over-sized vehicles to transport the transformers and prefabricated structures to the Site.

1.1.3 Operation

The BESS is expected to operate on a 24 hour per day, seven days per week basis and is expected to undergo approximately one charge and discharge cycle per day, averaging 365 full cycles per year.

The Project has an initial design life of 20 years with components anticipated to be replaced or upgraded, as required with the potential to extend the life beyond 20 years.

The Project would be an unmanned facility that is managed remotely. Between five to six employees would be required to attend the Site periodically for maintenance activities.

Areas within the Site not required for the operation of the BESS facility would be rehabilitated to as close to its existing condition as practical. This remaining land would be fenced with stock fencing or similar. The BESS itself would be surrounded by security fencing and all access to the BESS would be controlled through a secure access point off Brays Lane.

Lot 4 DP 751651 would be subdivided to separate the existing rural residential use of the Lot from the proposed BESS. Following subdivision of the Lot, the area occupied by the BESS would be up to 7 hectares (ha) in size. The remaining 9.5 ha would be returned to the existing property owner for rural residential use.

1.2 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARs) relating to construction and operational noise and vibration, and where these requirements are addressed in this technical report, are outlined in **Table 1-1**.

Table 1-1 SEARs addressed within the technical report

Secretary's Environmental Assessment Requirements	Where addressed
The EIS must address the following specific matters:	
• Noise - including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG),	• **Section 5.0**
• operational noise impacts in accordance with the NSW Noise Policy for Industry (2017), cumulative noise impacts (considering other developments in the area), and	• **Section 6.0**
• a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.	• **Section 5.5**

1.3 Purpose and scope of this technical report

The scope of the noise and vibration impact assessment is to:

- Determine the existing background noise levels at the closest residential receiver location in accordance with the NSW *Noise Policy for Industry* (NPfI)
- Determine the construction noise and vibration management levels applicable to the identified sensitive receivers in accordance with the EPA's *Interim Construction Noise Guideline* (ICNG) and Assessing Vibration: A Technical Guideline (AVTG)
- Determine equipment to be used, schedule of construction activities and location of construction activities
- Provide a construction noise and vibration assessment that considers the likely construction noise and vibration levels in accordance with the ICNG and AVTG and determines the likely noise impacts of additional traffic on identified sensitive receivers in accordance with the EPA's NSW *Road Noise Policy* (RNP)
- Determine the industrial project noise trigger levels applicable to identified residential sensitive receivers and other nearby receivers in accordance with the EPA's NPfI
- Establish operational scenarios applicable to the Project
- Provide an operational noise and vibration assessment that presents the predicted noise emission levels from the operation of the Project and compares them against the established project noise trigger levels
- Predict any increase in road traffic noise levels due to vehicular movements associated with the operation of the Project, in accordance with the RNP
- Determine feasible and reasonable noise and vibration mitigation for the construction and operational stages, where required.

2.0 Existing noise environment

2.1 Description of the Project Area

The area that would be required to construct the Project (including the BESS, the new transmission line, and part of the Transgrid 330 kV Wallerawang substation) is collectively referred to as the Project Area and is shown on **Figure 1-1**. The Project Area is in the suburb of Wallerawang, part of the Lithgow City Council Local Government Area (LGA). Wallerawang is located approximately 110 km north west of Sydney, 14 km northwest of Lithgow adjacent to the Great Western Highway. The Project Area is located approximately 1 km north of the town of Wallerawang.

The Site is located at 173 Brays Lane, Wallerawang NSW, 2854 (Lot 4 Deposited Plan (DP) 751651). The Site includes the majority of the Lot except for the residential land use and immediate surrounding land in the south east portion of the lot. It is proposed that Lot 4 DP 751651 (the Lot) would be subdivided as part of the Project to delineate the existing residential land use at the south east portion of the lot from the proposed BESS. Following subdivision of the Lot, the BESS facility would be up to 7 hectares (ha) in size. The existing residential and agricultural land use would occupy an area of about 9.5 ha. The BESS would only occupy a portion of the total area of the Site, as shown on **Figure 1-2**.

The Site is located nearby the Transgrid Wallerawang 330 kV substation, which at its closest point, is about 1.25 km south east from the Site. The substation is located at Lot 91 of DP 1043967. The substation is located on freehold land owned by Electricity Transmission Ministerial Holding Corporation (ETMHC) and operated by Transgrid.

The new transmission line for the Project would be located on land that is currently owned and / or managed privately, by Transport for NSW / John Holland Rail, Lithgow City Council, and Transgrid. The new transmission line would connect the BESS to the Transgrid Wallerawang 330 kV substation. The new transmission line would exit from the eastern boundary of the Site, crossing Brays Lane and entering into the vegetated area to the east of Brays Lane. From here, it would travel in a north easterly direction, before passing under Pipers Flat Creek and into the existing rail corridor where it would travel south east along the rail corridor (including its crossing of Main Street) to connect to the north western portion of the Transgrid Wallerawang 330 kV substation.

2.1.1 Surrounding land uses

The area surrounding the Project predominantly comprises agricultural, industrial and rural residential land uses.

Rural residences in the land surrounding the Site typically consist of very low-density single dwellings or homesteads, which are often set back some distance from the road, and several hundred metres from the nearest neighbour. The nearest rural residential receiver for the Project is located approximately 65 m east of the Site and approximately 135 m south of the proposed transmission line.

The township of Wallerawang is located about 1.4 km south of the Site (measured from the Wallerawang Post Office) and approximately 800 m from the closest point of the transmission line corridor. Residential properties within the township of Wallerawang generally comprise low to medium density housing. Commercial receivers are also scattered across the town including hotels, cafes, property managers and offices. Wallerawang Public School and two places of worship are close to the Project Area, including St John the Evangelist Church (about 30 m from the transmission line) and the Church of the Scared Heart. St John the Evangelist Church is a locally listed heritage item.

In contrast to these residential, commercial and rural land uses, a number of industrial, extractive industry and electricity generating land uses are located in the vicinity of the Project. Surrounding premises of this nature include the Wallerawang Power Station, Green Spot Manufacturers and Springvale Coal Mine. The Lidsdale Siding coal loading facility is located to the south of the Project Area.

The Project Area is located in proximity to major transport infrastructure and is approximately 3 km from the Great Western Highway and 1 km from Castlereagh Highway. Additionally, a series of large conveyer belts cross the landscape to transport coal between coal mines, the nearby Mt Piper Power Station and Lidsdale Siding. An active freight rail line is located within the Project Area and intersects the transmission line corridor to the south.

Consistent with the land uses described above, attended noise measurements demonstrated that the existing acoustic environment across the Project Area ranges from being dominated by road traffic and industrial noise, to being dominated by bird calls.

2.1.2 Heritage items

Wallerawang has a number of Heritage registered sites, listed as being of local heritage significance on the Lithgow City Council Local Environment Plan 2014, which are located within a 250 m radius of the Project Area. These include:

- Old Wallerawang School (the curtilage of this item is about 20 m from the transmission line however the built structures are about 130 m from the transmission line
- St John the Evangelist Church (about 30 m from the transmission line)
- Stone Viaduct Cox's River Wallerawang (about 70 m from the transmission line).

2.2 Noise catchment areas

To assist in determining noise management levels for the receivers surrounding the Project, three noise catchment areas (NCAs) were identified. For the purposes of undertaking a noise impact assessment the noise environment at each of the residential receivers within a NCA is considered to have a similar noise environment, considering the proximity to existing major noise sources. Each NCA is shown in **Figure 2-1**.

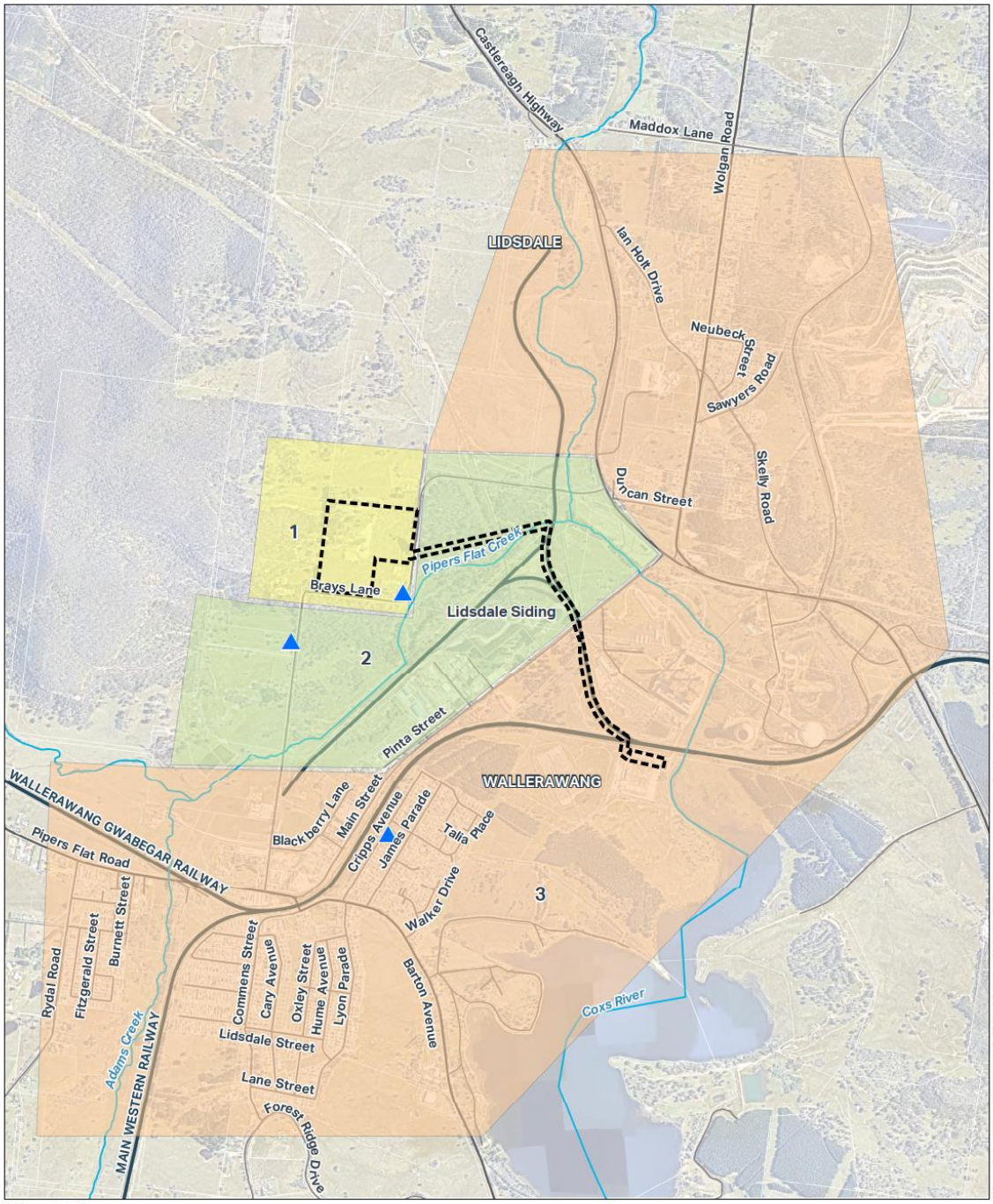


Figure 2-1
Noise Catchment Areas (NCAs) and Noise Monitoring Locations

Figure 2-1 The Site, noise monitoring locations, receivers and NCAs

2.3 Noise measurement methodology

Long term unattended and short term attended noise measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers around the Project. Measurements were made using noise loggers at three locations. The locations of the three noise loggers are shown in **Figure 2-1**.

The acoustic instrumentation employed during unattended and attended noise measurements comply with the requirements of *AS IEC 61672.1-2019 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).

2.3.1 Unattended noise measurements

The noise loggers were placed at representative locations around the Project Area as listed in **Table 2-1** and shown in **Figure 2-1**. The noise loggers were calibrated prior to and after the monitoring period with a drift in calibration not exceeding ±0.5 dB(A).

Table 2-1 Unattended noise monitoring details

NCA	Logger	Location	Period	Logger Model	Logger Serial number
1	1	173 Brays Lane, Wallerawang, NSW 2845	4 March 2021 – 17 March 2021	SVAN977	45417
2	2	113 Brays Lane, Wallerawang, NSW 2845	4 March 2021 – 11 March 2021	Rion NL21	00765701
3	3	29 Cripps Avenue, Wallerawang, NSW 2845	4 March 2021 – 11 March 2021	ARL 315	15299444

2.3.2 Attended noise measurements

Attended noise measurements were conducted at the three unattended noise monitoring locations on 4 March 2021. The measurements were conducted over 15 minute periods. Weather conditions were sunny on the days of monitoring, with no wind.

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(A).

2.4 Noise measurement results

2.4.1 Unattended noise measurements

The loggers were set for sample periods of 15 minutes. The microphones of all loggers were 1.5 m above ground level. The loggers measured the noise levels over the sample period and then determined L_{A10}, L_{A90}, L_{Amax}, and L_{Aeq} levels of the noise environment. The L_{A10} and L_{A90} levels are the levels exceeded for 10% and 90% of the sample period respectively. The L_{Amax} is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The L_{A90} is taken as the background noise level. 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 background noise level is defined by the EPA in the NSW Noise Policy for Industry as "*the underlying level of noise present in ambient noise when all unusual extraneous noise is removed*" (NSW EPA, 2017). It can include sounds that are normal features of a location and may include birds, traffic, insects etc. The background noise level is considered to be represented by the L_{A90} descriptor. The noise levels measured around the Project Area were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the EPA's NPfI, for each monitoring location. The ABL is established by determining the lowest ten percentile level of the L_{A90} noise data acquired over each period of interest. A summary of the measurement data is presented in **Table 2-2**. The noise logging results are presented in **Appendix B**.

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

NCA	Measurement Data	L_{Aeq} Ambient Noise Levels, dB(A)			L_{A90} Background Noise Levels, dB(A)		
		Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
1	Thu Mar 4 2021	54	33	-[3]	-[3]	-[3]	-[3]
	Fri Mar 5 2021	51	47	48	37	29	0
	Sat Mar 6 2021	50	47	46	36	35	23
	Sun Mar 7 2021	48	46	49	29	30	29
	Mon Mar 8 2021	49	46	47	36	36	26
	Tue Mar 9 2021	51	41	48	-[3]	-[3]	27
	Wed Mar 10 2021	48	44	49	31	32	37
	Thu Mar 11 2021	47	46	49	33	-[3]	30
	Fri Mar 12 2021	43	45	38	21	26	24
	Sat Mar 13 2021	50	54	53	28	47	28
	Sun Mar 14 2021	42	35	49	-[3]	20	32
	Mon Mar 15 2021	60	65	58	40	53	35
	Tue Mar 16 2021	52	43	64	-[3]	34	-[3]
	Wed Mar 17 2021	42	-[3]	66	-[3]	-[3]	-[3]
	Overall	**52**	**55**	**58**	**35 (33)[2]**	**33**	**30 (29)[2]**
2	Thu Feb 4 2021	46	38	35	-[3]	26	-[3]
	Fri Feb 5 2021	43	40	38	30	-[3]	24
	Sat Feb 6 2021	45	41	36	-[3]	-[3]	25
	Sun Feb 7 2021	42	37	32	-[3]	-[3]	-[3]
	Mon Feb 8 2021	43	38	36	31	-[3]	27
	Tue Feb 9 2021	46	38	36	32	26	26
	Wed Feb 10 2021	43	42	37	28	-[3]	29
	Thu Feb 11 2021	44	52	36	30	-[3]	-[3]
	Overall	**44**	**44**	**36**	**35 (30)[2]**	**30 (26)[2]**	**30 (26)[2]**
3	Thu Mar 4 2021	54	52	42	-[3]	36	-[3]
	Fri Mar 5 2021	51	53	46	33	35	-[3]
	Sat Mar 6 2021	58	41	48	-[3]	-[3]	28
	Sun Mar 7 2021	53	-[3]	50	-[3]	-[3]	-[3]
	Mon Mar 8 2021	52	-[3]	51	-[3]	-[3]	-[3]
	Tue Mar 9 2021	52	-[3]	51	-[3]	-[3]	-[3]
	Wed Mar 10 2021	56	-[3]	55	-[3]	-[3]	-[3]
	Thu Mar 11 2021	60	-[3]	61	-[3]	-[3]	-[3]
	Overall	**56**	**51**	**54**	**35 (33)[2]**	**36**	**30 (28)[2]**

Notes:

1. *Day: 7am to 6pm (Monday – Saturday) and 8am to 6pm (Sunday and Public holidays);*
   Evening: 6pm to 10pm; Night: 10pm to 7am (Monday – Saturday) and 10pm to 8am (Sunday and Public holidays)

2. *Where the rating background level is found to be less than 35 dB(A) during the daytime then it is set to 35 dB(A). Where is it found to be less than 30 dB(A) during evening or night-time then it is set to 30 dB(A) in accordance with NSW NPfI*

3. *Data that is affected by adverse weather conditions such as rain and / or extraneous noise has been excluded.*

2.4.2 Attended noise measurements

The results of the 15-minute attended noise monitoring are presented in **Table 2-3**.

Table 2-3 Attended noise measurements

Location	Date	Time	L_{Aeq} dB(A)	L_{A90} dB(A)	Comments
1	04/03/2021	11:31	52	37	Background noise dominated by industrial noise from nearby site 43 dB(A). Conveyor belt and truck movement audible. Bird calls occasionally. Sunny weather. Truck pass by on Brays Lane 71 dB(A). Rooster crowing 59 dB(A).
2	04/03/2021	10:58	50	31	Background noise dominated by bird calls 52 dB(A). Very low traffic on Brays Lane Lawn mowing measurement 55 dB(A).
3	04/03/2021	13:52	57	43	Background dominated by Road traffic noise. Helicopter pass by 63 dB(A). Bird calls 61 dB(A). Sunny weather.

3.0 Construction noise and vibration criteria

Construction of the Project has the potential to temporarily contribute to the existing external noise environment. This section will establish construction noise management levels and vibration criteria to address these potential impacts. The works are to typically be undertaken during standard hours only unless approved by NSW Department of Planning and Environment (DPE) (formerly referred to as NSW Department of Planning and Environment (DPIE)) in advance.

3.1 Construction noise

3.1.1 Construction noise management levels

The *Interim Construction Noise Guideline* (ICNG) is the principal guideline for the assessment and management of construction noise in NSW. As the proposed works are expected to continue for a period of more than three weeks and are within relatively close proximity to noise sensitive receivers, a quantitative assessment, based on representative construction scenarios, has been carried out for the Project.

Noise levels resulting from construction activities are predicted at nearby noise sensitive receivers using environmental noise modelling software and compared to the noise management levels (NML), derived in accordance with the ICNG.

Where an exceedance of the noise management levels is predicted, the ICNG 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 impacted residents of the nature of the works to be carried out, the expected noise level and duration, as well as provide contact details to facilitate feedback from affected residents during construction.

Where 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.

3.1.1.1 Residential receivers

Guidance for setting construction noise management levels for residential receivers are summarised in **Table 3-1**.

Table 3-1 Construction noise management levels – Residential receivers

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 RBL + 10 dB	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 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: 1. 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 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 RBL + 5 dB	• 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. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes:

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

The ICNG defines what is considered to be feasible and reasonable as follows:

- Feasible - a work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered 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.

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

Table 3-2 Construction noise management levels – Residential receivers

Noise catchment area	Period	RBL, L_{A90} dB(A)	Standard hours noise management levels, $L_{Aeq,15min}$, dB(A)	Out-of-hours noise management levels, $L_{Aeq,15min}$, dB(A)
1	Day	35	45 (75 – highly noise affected level)	40
	Evening	33	-	38
	Night	30	-	35
2	Day	35	45 (75 – highly noise affected level)	40
	Evening	30	-	35
	Night	30	-	35
3	Day	35	45 (75 – highly noise affected level)	40
	Evening	36	-	41
	Night	30	-	35

3.1.1.2 Non-residential receivers noise management levels

Table 3-3 presents the NMLs applicable to non-residential receivers.

Table 3-3 Construction noise management levels – Non-residential receivers

Land use	External noise levels, $L_{Aeq\ (15\ min)}$ (applies when properties are in use)
Place of worship	40 dB(A)
Classrooms at schools and other educational Institutions - Internal	45 dB(A)
[1] Classrooms at schools and other educational Institutions - External	55 dB(A)
Active recreation areas	65 dB(A)
Passive recreation areas	60 dB(A)
Industrial premises	75 dB(A)
Commercial premises (including cafes, bars, restaurants, retail stores and hotels)	70 dB(A)

Notes:

1. *This external noise management level is based upon a 45 dB(A) internal noise management level and a 10 dB(A) reduction from outside to inside through an open window*

3.1.2 Construction traffic noise

Construction traffic noise was assessed with reference to the *Road Noise Policy* (RNP), which provides the methodology for assessment and the threshold for noise mitigation.

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, in line with the RNP guidelines.

Where the predicted noise increase is 2 dB or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB, and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

3.2 Vibration criteria

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows:

- continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities
- impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers etc.

The relevant standards and guidelines for the assessment of construction vibration are summarised in **Table 3-4**.

Table 3-4 Standards / guidelines used for assessing construction vibration

Item	Standard / guideline
Structural damage	Heritage structures – German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150) Non-heritage structures – Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385:Part 2-1993) (BS 7385)
Human comfort (tactile vibration)	Assessing Vibration: A Technical Guideline (AVATG)[1]

Notes:

1. *The AVATG is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. However the Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.*

3.2.1 Structural damage

At present, no Australian Standards exist for the assessment of building damage caused by vibration. DIN 4150 and BS 7385-2 provide recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in **Table 3-5** and **Table 3-6** . DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not

necessarily result in damage. Structural damage criteria for heritage items have been taken from DIN 4150, whilst criteria for commercial / residential items have been taken from BS 7385.

Table 3-5 Structural damage safe criteria (DIN 4150) for building vibration (Peak particle velocity)

Group	Type of structure	At foundation – Less than 10 Hz	At foundation – 10 Hz to 50 Hz	At foundation – 50 Hz to 100 Hz[1]	Vibration at the horizontal plane of the highest floor for all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and / or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order / heritage listed)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Notes:

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values

Table 3-6 BS 7385-2: Transient vibration guide values for cosmetic damage

Group	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

3.2.2 Human comfort

The assessment of intermittent vibration outlined in the NSW EPA guideline A*ssessing Vibration: A Technical Guideline* (AVTG) is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in **Table 3-7**. The VDV criteria are based on the likelihood that a person would comment adversely on the level of vibration over the entire assessment period.

Table 3-7 Preferred and maximum vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime (7am – 10pm)		Night-time (10pm – 7am)	
	Preferred	Maximum	Preferred	Maximum
Critical areas[1]	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops[2]	0.8	1.6	0.8	1.6

Notes:

1. *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. Places where sensitive equipment is stored or delicate tasks are undertaken require more stringent criteria than the residential criteria specified above*

2. *Examples include automotive repair shops, manufacturing or recycling facilities. This includes places where manufacturing, recycling or repair activities are undertaken but do not require sensitive or delicate tasks.*

4.0 Operational noise and vibration criteria

The *Noise Policy for Industry* (NPfI) provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures. The NPfI applies to all noise emission from permanent operations fixed facilities for the Project. The assessment procedure in the *Noise Policy for Industry* has two components:

- 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 boundary of the noise sensitive receiver site. These criteria apply to environmental noise emissions from any plant installed as part of the Project, and for residential receivers represent the lower of the intrusive and amenity criteria.

4.1.1 Intrusive noise impacts

The *Noise Policy for Industry* states that the noise from any single noise source should not be greatly above the prevailing background noise level. Industrial noise sources are generally considered acceptable if the A-weighted equivalent continuous sound pressure level of noise from the source, measured over a 15 minute period ($L_{Aeq,15\ min}$) does not exceed the Rating Background Level (RBL) by more than 5 dB(A) for the period under consideration. This is termed the Intrusiveness Criterion.

The RBL is the background noise level to be used for assessment purposes and is determined by the methods given in the NPfI.

The RBL and the respective intrusive criteria for the day, evening and night periods are provided in **Table 4-1**.

Table 4-1 Intrusive criteria

Location	Period	RBL (L_{A90}), dB(A)	Intrusiveness criteria (RBL+5), dB(A)
NCA 1 Residential receivers	Day	35[1]	40
	Evening	33	38
	Night	30[1]	35
NCA 2 Residential receivers	Day	35	40
	Evening	30[1]	35
	Night	30[1]	35
NCA 3 Residential receivers	Day	35[1]	40
	Evening	35[2]	40
	Night	30[1]	35

Notes:

1. *Measured RBLs are below the minimum assumed RBLs in the NPfI, therefore the minimum assumed RBLs have been adopted in line with the NPfI.*
2. *The Noise Policy for Industry notes that the community generally expects a greater control of noise during the evening and night as compared to the day time. Therefore the evening RBL is set to no more than that for the daytime.*

4.1.2 Protecting amenity

To limit continuing increase in noise levels, the maximum ambient noise level within an area from all industrial noise sources should not normally exceed the recommended amenity noise levels specified in the *Noise Policy for Industry* and presented in column four of **Table 4-2**. That is the noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the "background creep" or "amenity criterion".

The project amenity level is equal to the recommended amenity noise level minus 5 dB(A). The project amenity level is then converted to a 15 minute period by adding 3 dB(A).

Table 4-2 Amenity criteria

Type of receiver	Indicative noise amenity area	Time of day	Recommended amenity noise level[1], dB(A)	Project amenity noise level, dB(A)	
			$L_{Aeq\ (period)}$	$L_{Aeq\ (period)}$	$L_{Aeq\ (15\ minute)}$
NCA 1 Residential receivers	Rural[2]	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
NCA 2 Residential receivers	Rural[2]	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
NCA 3 Residential receivers	Ruural[2]	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
Commercial premises	All	When in use	65	65	68
School classroom[4]	All	When in use	45	45	48
Place of worship[4]	All	When in use	50	50	53
Childcare[4]	All	When in use	45	45	48

Notes:

1. *Specified in Table 2.2 of the Noise Policy for Industry*
2. *The indicative noise amenity area was determined to be 'Rural' in accordance with Table 2.3 of the Noise Policy for Industry*
3. *External noise levels are based on internal criteria with a 10 dB(A) reduction from outside to inside through an open window.*

4.1.3 Environmental noise emission criteria summary

A summary of the project noise trigger level is presented in **Table 4-3** below in accordance with the *Noise Policy for Industry* (EPA, 2017). These criteria apply to environmental noise emissions from the Project and for residential receivers represent the lower of the intrusive and amenity criteria.

Table 4-3 Summary of environmental noise emission criteria

Location	Time of day	Project noise trigger level[1] L_{Aeq}, dB(A)
NCA 1	Day	40
	Evening	38
	Night	35
NCA 2	Day	40
	Evening	35
	Night	35
NCA 3	Day	40
	Evening	40
	Night	35
Commercial premises	When in use	68
Place of worship	When in use	53
School classroom	When in use	48

Notes:

1. These criteria represent the lower of the intrusive and amenity criteria presented in Table 4-1 and Table 4-2 respectively.

4.1.4 Tonality and NPfI modifying factors

The NPfI provides additional guidance and criteria for assessing noise emissions from sources with "annoying characteristics" such as tonality, intermittency, irregularity or dominant low-frequency content. Penalties of up to a maximum of 10 dB(A) may be applied where the subject noise has such characteristics at the receiver.

The modifying factor corrections should be applied having regard to:

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

4.1.5 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 for the nearest noise sensitive residential receivers are presented in **Table 4-4**.

Table 4-4 Night-time sleep disturbance screening levels

Location	Measured night-time RBL, $L_{A90, 15min}$ dB(A)	Sleep disturbance screening levels, dB(A)	
		$L_{Aeq,15min}$	$L_{AF,max}$
NCA 1 Residential receivers	30	40	52
NCA 2 Residential receivers	30	40	52
NCA 3 Residential receivers	30	40	52

4.2 Noise from operational road traffic generation – NSW Road Noise Policy

To assess noise impacts from traffic generated by the operation of the Project, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB, in line with the RNP. Where the predicted noise increase is 2 dB or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB, and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

4.3 Operational vibration

Operational vibration is not expected to be an issue as a result of the Project as the operational activities 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 impact assessment

A construction noise and vibration impact assessment has been completed for the Project.

5.1 Construction noise

This construction noise and vibration assessment is based on typical construction scenarios for this type of development.

5.1.1 Construction phases and sources

The construction phases that have been assessed are detailed below:

1. Enabling works
2. Civil, structural, mechanical, electrical works and transmission
3. Commissioning
4. Demobilisation

Sound power levels were obtained from published datasets in Australian Standard AS2436-2010, *Guide to noise control on construction, demolition and maintenance sites*, BS5228: Part 1 2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise* and AECOM's database. All equipment is assumed to be in good working order.

The equipment and associated sound power levels (SWL) for the four construction phases are shown in **Table 5-1**.

Table 5-1 Construction phases and equipment

Phase	Equipment / Activity	Percentage time on	'A' Weighted SWL dB(A)
Enabling works	Front end loaders	100	107
	Dump trucks	100	105
	Road trucks	100	108
	Water trucks	100	104
	Excavators	33	93
	Graders	100	106
	Light commercial vehicles	100	108
	Compactors and rollers	33	107
	Overall	**-**	**115**
Civil, structural, mechanical, electrical works and transmission connection	Front end loaders	100	104
	Road trucks	100	108
	Graders	100	108
	Concrete trucks and pumps	100	106
	Elevated work platforms	100	95
	Cranes / crane truck	20	104
	Concrete saws and grinders	33	110
	Dump trucks / tipper truck	100	105
	Excavators	33	93
	Scrapers	100	108
	Compactors and rollers	33	102
	Scrapers	100	108
	Backhoe	100	97
	Water trucks	100	113
	Light commercial vehicles	100	106
	Generators	100	94
	Directional drill rig	33	103
	Overall	**-**	**118**
Commissioning	Light commercial vehicles	100	106
	Elevated work platforms	100	98
	Cranes	100	104
	Generators	100	94
	Overall	**-**	**109**
Demobilisation	Road trucks	100	108
	Water trucks	100	104
	Light commercial vehicles	100	106
	Backhoe	100	97
	Compactors and rollers	100	107
	Overall	**-**	**119**

Construction is scheduled to be typically undertaken during recommended standard construction hours, with no night-time works scheduled. Noise generating equipment would not be utilised outside of standard construction hours unless permitted by DPE. As such, the impacts of construction activities on sleep disturbance have not been assessed.

5.1.2 Modelling and conditions

Modelling of the proposed construction scenarios was completed using SoundPLAN version 8.2 (industry standard) noise modelling software. Standard weather conditions were applied.

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

5.1.3 Results

The construction noise modelling results are presented as noise contour layers over aerial maps in **Appendix C**. **Table 5-2** presents the number of residential properties where the NMLs are likely to be exceeded during the day. **Table 5-3** presents the number of non-residential properties where the NMLs are likely to be exceeded.

Table 5-2 Number of residential buildings where noise levels may exceed NMLs – Standard hours

Phase	Exceedance of NML			Highly affected >75 dB(A)
	1-10 dB	11-20 dB	>20 dB	
Enabling works	1	3	1	0
Civil, structural, mechanical, electrical works and transmission connection	86	5	1	0
Commissioning	3	1	0	0
Demobilisation	2	3	0	0

Table 5-2 above shows that noise levels during all construction phases and activities are expected to mostly comply with the noise management levels at the residential receivers. During the Project's construction phases during the day, the Civil, structural, mechanical, electrical and commissioning works is predicted to cause a large number of exceedances.

During this work phase, there are expected to be 86 exceedances of the NML, however these are expected to be <10 dB. Noise levels at five residential receivers are expected to exceed the NML by 11 - 20 dB, and more than 20 dB at one receiver. None of the construction phases are expected to result in noise levels which exceed the 'highly noise affected' level of 75 dB(A) for residential receivers.

For most construction scenarios, it is expected that the construction noise levels would frequently be lower than predicted, as the noise levels presented in this report are based on the noisiest activities likely to occur. The predicted noise levels are conservative as it is assumed that all equipment would be running at all times, at the closest point within the construction site to each receiver. In reality not all construction equipment would be operating concurrently and construction works may be intermittent during the construction period.

As the transmission line construction works are progressive, construction noise levels would slowly increase as the works approach a receiver, would remain fairly constant while the works are directly in front of the receiver and would then slowly decrease again as the works move away (refer to the noise contour maps provided in **Appendix C**). In addition, the equipment required for the construction of the transmission would not comprise the full suite of machinery and equipment specified for construction scenario two and would be limited to that required to either under bore or trench the line.

Feasible and reasonable mitigation measures are detailed in the Construction Noise and Vibration Management Plan (refer to Section 5.5).

Table 5-3 Number of non-residential buildings where noise levels may exceed NMLs

Phase	Exceedance of NML		
	1-10 dB	11-20 dB	> 20 dB
Enabling works	0	0	0
Civil, structural, mechanical, electrical works and transmission connection	0	0	0
Commissioning	0	0	0
Demobilisation	0	0	0

The activities associated with the construction phases for the Project are expected to result in noise levels which comply with the noise management levels at non-residential receivers during the day.

5.2 Cumulative construction noise impacts

Simultaneous noise from construction works on other developments has the potential to increase noise levels at nearby sensitive receivers.

A search of publicly available information has been undertaken to identify existing and potential projects in the vicinity of the Project. This includes projects that are under construction, approved, or proposed. Resources used for this include:

- Department of Planning, Industry and Environment (DPE) Major Projects Website: (https://www.planningportal.nsw.gov.au/major-projects)
- Lithgow City Council's Development Application Determination Statements: (https://council.lithgow.com/development/da-determination-statements/)
- A review of the 'current projects' of other government agencies and utility providers who may be undertaking works in the vicinity of the Project Area (including Transgrid, Australian Rail Track Corporation (ARTC) and Transport for NSW).

The only other significant development (subject to planning approval) which may occur in the vicinity of the project is the construction, operation and maintenance of another Battery Energy Storage System (BESS), of approximately 500 Megawatts (MW) on the former Wallerawang Power Station. The EIS is currently being prepared for this development.

Due to the distance between the identified potential development and the Project Area construction noise associated with this development would not appreciably increase overall construction noise at receivers close to the Project.

5.3 Construction vibration

Vibrations may be generated by the equipment proposed to be utilised. The minimum working distances of these items of equipment from off-site receivers are shown in **Table 5-4**. This is based on recommendations of the TfNSW *Construction Noise and Vibration Strategy* (CNVS) and AECOM's previous project experience. If these minimum working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage. Equipment size would be selected by the construction contractor and would take into account the minimum working distances and the distance between the area of construction and the nearest receiver.

It is noted that the closest residential receiver is around 65 m from the Site therefore the Project can comply with minimum working distances at this location.

The rail corridor does pass immediately adjacent to the heritage listed St Johns the Evangelical Church, listed on the Lithgow LEP (2014). The heritage curtilage of the church contains the church along with the stone boundary walls and fences, and boundary plantings, including those that are located along the rail boundary. The distance from the proposed transmission line to St John the Evangelical Church

building is about 35 m. The proposed underground transmission line would be constructed nearby this heritage item (albeit within the existing rail corridor) using a trenching methodology. This methodology does not include vibration intensive works. To avoid damage occurring, vibration intensive works would not be undertaken within 50 m of St John the Evangelical Church. As such, impacts to the St Johns the Evangelical Church are not expected during the construction of the Project.

Table 5-4 Recommended minimum working distances for vibration intensive plant

Plant	Rating / Description	Minimum working distance		
		Cosmetic damage (BS7385) Light-framed structures	Cosmetic damage (DIN4150) heritage and other sensitive structures	Human response
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	14 m	15 m
	< 100 kN (Typically 2-4 tonnes)	6 m	16 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	33 m	40 m
	<300 kN (Typically 7-13 tonnes)	15 m	41 m	100 m
Piling Rig	≤800 mm	2 m nominal	4 m	4 m
Jackhammer	Handheld	1 m nominal	2 m	Avoid contact with structure

5.4 Construction traffic

The construction work would be undertaken in stages and would require several trucks to deliver materials, including concrete to the Project Area, as well as other light vehicles.

To assess the impact of construction traffic it has been assumed that 20 heavy vehicles and 50 light vehicles would visit the Site during a worst-case day.

The historical annual average daily traffic (AADT) at the TfNSW sample classifier Station Id 99084 and Station Id 99001 have been obtained. TfNSW sample classifier Station Id 99084 is located on the Castlereagh Highway, east of the Site and the Wallerawang town centre approximately 6 km from the Site. TfNSW sample classifier Station Id 6015 is located on the Great Western Highway, west of the Site and the Wallerawang town centre approximately 14 km from the Site.

In order to estimate the current background traffic flows of the road network near the Site the average annual background growth rates at each of these station locations was calculated using the traffic flows observed over the available years preceding. The results of these calculations and the estimated traffic volumes for 2021 are provided in **Table 5-5**. It is noted that this average excluded the non-typical traffic numbers from 2020 associated with travel restrictions put in place during the COVID19 pandemic and considers the 2021 estimate to representative of a ‘normal year’ not subject to COVID19 restrictions.

Table 5-5 Estimate of current (2021) traffic flows on the Castlereagh Highway and Great Western Highway

Location	Direction	AADT [1]	AM Peak[2] (8am-9am)	PM Peak[2] (3pm-4pm)
Castlereagh Highway at Station ID 99084	Southbound	3,077	85	342
	Northbound	3,262	352	216
	Combined	6,340	436	557
Great Western Highway Station Id 99001	Eastbound	4092	1035	1114
	Westbound	4095	921	1239
	Combined	8188	1956	2353

Based on the existing traffic volumes on the Castlereagh Highway and the Great Western Highway, the construction traffic to the Project Area is predicted to increase noise levels by less than 1 dB. Therefore, the potential impact would be very minor and would comply with Project acoustic requirements.

Given that the increase in noise levels would be less than 2 dB, in accordance with the RNP, noise mitigation at residential receivers would not be required to mitigate construction traffic noise impacts.

5.5 Construction noise and vibration mitigation

The Project is expected to comply with the relevant NMLs for most residential receivers during the construction stage. Exceedances have been found at properties in close proximity to the Project Area.

Although the NMLs are only likely to be marginally exceeded at residential receivers, reasonable and feasible noise mitigation measures and work practices would be implemented. Where receivers are predicted to be 'noise affected' the ICNG states that all feasible and reasonable works practices should be applied to meet the NMLs. It is recommended that a Construction Noise and Vibration Management Plan (CNVMP) as part of the Construction Environmental Management Plan be prepared prior to commencing construction activities at the Site.

Details of construction noise and vibration mitigation measures and management practices which would be considered in the CNVMP are detailed below.

The CNVMP should include the following:

- The objectives of the CNVMP
- Performance criteria and key performance indicators to measure the success of plan
- Legislative requirements including reference to relevant conditions of consent and management and mitigation measures
- Identification of nearby residences and other sensitive land uses
- Description of approved construction hours
- Description and identification of all construction activities, including work areas, equipment and duration
- A summary of the activities that are likely to cause impacts related to noise and vibration and the potential impacts identified in the SSD application documentation (including the EIS)
- This would include a list of the measures (generic and specific) that would be implemented to minimise noise and vibration impacts. Performance criteria alongside information on who is responsible for each measure, and the frequency and / or timing that applies to each measure would also be detailed
- A complaint handling process
- An outline of the noise and vibration monitoring requirements that would be implemented to meet any legislative requirements and the performance criteria alongside information on who is responsible for monitoring and the frequency and / or timing that applies

- Overview of community consultation required for identified high impact works.

Noise and vibration mitigation measures which would be considered in the CNVMP are detailed below in **Table 5-6**.

Table 5-6 Recommended noise mitigation measures

Action considered	Suggested safeguard details	Timing
Implement community consultation measures	Periodic notification (letterbox drop or equivalent), website, contact number for enquiries, Project Infoline, Community Complaints and Enquiries Hotline, email distribution list and community and stakeholder meetings, as required.	Construction
Site inductions	All employees, contractors and subcontractors would receive an environmental induction.	Construction
Behavioural practices	No swearing or unnecessary shouting or loud stereos / radios onsite. No dropping of materials from height, throwing of metal items and slamming of doors.	Construction
Attended vibration measurements	Vibration intensive work should not proceed within the minimum working distances unless a permanent vibration monitoring system is installed approximately a metre from the building footprint, to warn operators (via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective.	Construction
Construction hours and scheduling	Construction should be carried out during the standard daytime working hours. Unless otherwise agreed to by DPE under an approved out-of-hours work protocol, only low noise generating works that are demonstrated to meet NMLs would be undertaken outside of standard construction hours and these works would be scheduled during less noise sensitive periods.	Construction
Equipment selection and maintenance	Use quieter and less vibration emitting construction methods where feasible and reasonable. Equipment would be regularly inspected and maintained to ensure it is in good working order.	Construction
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 where feasible and reasonable.	Construction
Rental plant and equipment	Noise emissions should be considered as part of the selection process.	Construction

Action considered	Suggested safeguard details	Timing
Use and siting of plant	Where feasible and reasonable: • Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver. • The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. • Plant used intermittently to be throttled down or shut down. • Plant and vehicles to be turned off when not in use. • Noise-emitting plant to be directed away from sensitive receivers.	Construction
Non-tonal reversing alarms	Where practicable, non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used within the Project Area and for any out of hours work.	Construction
Minimise disturbance arising from delivery of goods to construction sites	• Loading and unloading of materials / deliveries to occur as far as possible from sensitive receivers where possible. • Select Site access points and roads as far as possible away from sensitive receivers, where possible. • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.	Construction
Construction related traffic	• Limit the speed of vehicles and avoid the use of engine compression brakes. • Maximise onsite storage capacity to reduce the need for truck movements during sensitive times where possible.	Construction
Alternative methods	All equipment should be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse vibration impacts.	Construction
Site specific minimum working distances	To avoid structural damage occurring, vibration intensive works would not be used within 50 m of St John the Evangelical Church. Vibration intensive work should not proceed within the minimum working distances unless a permanent vibration monitoring system is installed around one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective.	Construction
Noise monitoring	A noise monitoring program would be implemented for the duration of the works in accordance with the CNVMP and would focus on the use of high noise generating plant (e.g. jack hammering, rock breaking).	Construction

6.0 Operational noise assessment

The operational noise sources from the Project that have the potential to affect nearby receivers include the batteries, inverters and transformers.

6.1 Modelled operational scenario

In order to assess a reasonable worst-case operational scenario, it is assumed that the proposed equipment within the Site would operate in two modes:

1. at full capacity, during the daytime and evening periods, seven days per week, and
2. at reduced capacity, during the night-time period (to account for reduced need for the cooling / fan equipment to be running at night), seven days per week.

Given that the evening and night-time residential project noise trigger levels are the most stringent, the worst-case operational scenarios have been assessed during these periods. Compliance with the evening project noise trigger levels would demonstrate compliance during the evening and daytime periods for all residential receivers.

Operational noise impacts at non-residential receivers were based on the full capacity operational scenario and compared with the relevant noise trigger levels for non-residential receivers.

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

6.1.1 Assessment noise source levels

The sound power levels for the electrical equipment were provided by the manufacturer and have been used to model the noise emissions from the Site.

The sound power level inputs presented in **Table 6-1** were used in the noise modelling, and were assumed to be operating continuously.

Table 6-1 Plant items sound power levels

Plant item	Number	Sound power level, L_{Aeq}, dB(A)	Source height, m
Battery packs	376	84 dB(A) daytime and evening operation 79 dB(A) night-time operation	2.5 m (top of unit)
Medium-voltage transformer 22 kV	94	77	1.4 m (centre of unit)
High-voltage transformer 33/330 kV	3	88	2.6 m (centre of unit)

The noise generating equipment and the equipment sound power levels would be confirmed at the detailed design stage of the Project.

6.1.2 Maximum noise levels

In AECOM's experience, L_{Amax} sound power levels of electrical equipment are typically not greater than 5 dB above LAeq sound power levels, this has been assumed to provide a conservative assessment.

6.2 Modelling methodology

6.2.1 General modelling assumptions

Noise levels due to the operational activities at the Site were predicted to nearby noise sensitive receivers using SoundPLAN version 8.2 (industry standard) noise modelling software. The operational noise levels were predicted using an implementation of CONCAWE[1] algorithms in the SoundPLAN noise propagation software.

The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

The noise modelling process was iterative to determine feasible and reasonable noise mitigation measures which would minimise noise levels at nearby residential receivers.

6.2.2 Meteorological conditions

Both standard and noise enhancing meteorological conditions were considered, with the following parameters:

- Standard meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 0.5 m/s at 10 m.
- Noise enhancing meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 3 m/s at 10 m, and / or stability category F with winds up to 2 m/s at 10 m.

The noise modelling includes:

- Ground topography
- Buildings and structures
- All sources 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. The noise model was based on ground topography, and indicative plant equipment sound power levels. All predicted noise levels are free field and 1.5 m above ground level at the most-affected point within a residential property boundary within 30 m of the nearest facade.

6.2.3 Noise mitigation measures

A number of noise mitigation measures were considered to reduce noise impacts to the closest residential receivers. **Table 6-2** below presents the noise mitigation measures considered and whether they were found to be feasible and reasonable or not.

1 CONCAWE – The oil companies' international study group for conservation of clean air and water – Europe (established in 1963) Report 4/81 "The propagation of noise from petroleum and petrochemical complexes to neighbouring communities".

Table 6-2 '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: Consider equipment with 'low' sound power levels. This applies to battery packs and transformers.	Feasible	Reasonable due to: • reduction in source noise levels • total cost of noise mitigation	Adopted
Option 2: Layout of site optimised to reduce noise emissions	Feasible to an extent considering operational constraints	Reasonable due to: • reduction in source noise levels • total cost of noise mitigation	Adopted
Option 3: Reducing site operations during the evening	Not feasible during the evening due to high demand from electricity consumers.	Not reasonable during the evening period.	Rejected due to not being feasible or reasonable
Mitigation in the transmission path to the receiver			
Option 1: Noise barrier located around perimeter of site	Feasible	Not reasonable due to: • lack of acoustic performance	Rejected due to not being reasonable
Option 2: Noise barriers located close to equipment	Feasible	Reasonable due to • reduction in noise levels at receivers • total cost of mitigation	Adopted
Option 3: Enclosure or partial enclosure	Feasible	Not reasonable to: • operational requirements/constraints • total cost of mitigation	Rejected due to not being reasonable
Mitigation at the receiver			
Option 1: Engage in further consultation with receivers to discuss mitigation measures	Feasible	Reasonable	Adopted
Option 2: Consider the provision of mechanical ventilation to allow windows to remain closed where residual exceedances are marginal	Feasible	Reasonable due to: • reduction in internal noise levels at receivers • Total cost of noise mitigation given number of affected properties	Adopted

6.2.3.1 Noise barriers

Noise barriers were modelled surrounding each battery enclosure and each HV transformer. Noise barriers were assumed to be 10 m high and located at 8 m from the batteries and 20 m from the HV transformers. The barriers were assumed to be acoustically absorptive with a sound absorption coefficient of 0.8 on the sides facing the equipment, as per the guide for absorption coefficients provided in the Transport for NSW Noise wall design guideline (TfNSW, 2021).

6.3 Operational noise assessment results

6.3.1 Tonality

The noise spectrum at the closest receiver, 233 Brays Lane, was analysed to determine if any tonality penalties were applicable, in line with the NPfI. There were no “annoying characteristics” such as tonality, intermittency, irregularity or dominant low-frequency content. As a result, no penalties were applied.

6.3.2 L_{Aeq} results

The predicted noise levels at the closest residential receiver locations during the day, evening and night-time periods are presented in **Table 6-3**, **Table 6-4**, and **Table 6-5** respectively. Operational noise contours are also presented in **Appendix D**.

Table 6-3 Operational noise levels at closest residential receiver locations – Daytime period

Residential receiver address	NCA	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted Operational noise level, $L_{Aeq,15min}$, dB(A) (with level of exceedances)	
			Standard met conditions	Noise enhancing met conditions
233 Brays Lane, Wallerawang	1	40	40	42 (+2)
173 Brays Lane, Wallerawang	1	40	39	40
137 Brays Lane, Wallerawang	1	40	39	41 (+1)
113 Brays Lane, Wallerawang	2	40	33	35
91 Brays Lane, Wallerawang	2	40	30	33

Table 6-4 Operational noise levels at closest residential receiver locations – Evening period

Residential receiver address	NCA	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted Operational noise level, $L_{Aeq,15min}$, dB(A) (with level of exceedances)	
			Standard met conditions	Noise enhancing met conditions
233 Brays Lane, Wallerawang	1	38	40 (+2)	42 (+4)
173 Brays Lane, Wallerawang	1	38	39 (+1)	40 (+2)
137 Brays Lane, Wallerawang	1	38	39 (+1)	41 (+3)
113 Brays Lane, Wallerawang	2	35	33	35
91 Brays Lane, Wallerawang	2	35	30	33

Table 6-5 Operational noise levels at closest residential receiver locations – Night-time period

Residential receiver address	NCA	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted Operational noise level, $L_{Aeq,15min}$, dB(A) (with level of exceedances)	
			Standard met conditions	Noise enhancing met conditions
233 Brays Lane, Wallerawang	1	35	37 (+2)	39 (+4)
173 Brays Lane, Wallerawang	1	35	37 (+2)	38 (+3)
137 Brays Lane, Wallerawang	1	35	37 (+2)	39 (+4)
113 Brays Lane, Wallerawang	2	35	31	33
91 Brays Lane, Wallerawang	2	35	29	31

Table 6-3 indicates that during the daytime period, under standard meteorological conditions, noise levels from the operation of the Project comply at all residential receivers. Under noise enhancing meteorological conditions the criteria are exceeded by up to 2 dB at one receiver and by 1 dB at another receiver.

Table 6-4 indicates that during the evening period, under standard meteorological conditions, noise levels from the operation of the Project comply at most receivers with exceedances of up to 2 dB at three receivers. Under noise enhancing meteorological conditions the criteria are exceeded by up to 4 dB at the three same receivers.

Table 6-5 indicates that during the night-time period, under standard meteorological conditions, noise levels from the operation of the Project comply at most receivers with exceedances of up to 2 dB at three receivers. Under noise enhancing meteorological conditions the criteria are exceeded by up to 4 dB at the three same receivers.

Treatment of the three residential receivers worst affected properties is therefore recommended in line with the *Noise Policy for Industry* to address residual impacts, and would be considered. The three properties on Brays Lane are predicted to experience a marginal impact (≥ 3 but ≤ 5 dB above the project trigger levels) during the noise-enhancing meteorological conditions during both evening and night-time periods and would therefore qualify for consideration of at-property treatment. These properties are:

- 233 Brays Lane, Wallerawang
- 173 Brays Lane, Wallerawang
- 137 Brays Lane, Wallerawang.

Treatment would comprise the provision of mechanical ventilation and / or comfort conditioning systems. This would allow windows to be closed without compromising internal air quality / amenity. As the exceedance of the trigger levels is both during the evening and night-time periods, the treatment would apply to bedrooms and living rooms. If treatment is to be installed, it would be installed before the Project becomes operational.

6.4 Sleep disturbance assessment

The predicted L_{Aeq} and L_{Amax} levels are presented in **Table 6-6** and it can be seen that there are no exceedances of the sleep disturbance criteria under noise enhancing weather conditions. There would, therefore, be no exceedances under neutral weather conditions either.

Table 6-6 Sleep disturbance assessment – noise enhancing weather conditions

Residential receiver address	NCA	Sleep disturbance screening levels		Predicted operational noise level, $L_{Aeq,15min}$, dB(A)	
		$L_{Aeq,15min}$, dB(A)	L_{Amax}, dB(A)	$L_{Aeq,15min}$, dB(A)	L_{Amax}, dB(A)
233 Brays Lane, Wallerawang	1	40	52	39	<44
173 Brays Lane, Wallerawang	1	40	52	38	<43
137 Brays Lane, Wallerawang	1	40	52	39	<44
113 Brays Lane, Wallerawang	2	40	52	33	<38
91 Brays Lane, Wallerawang	2	40	52	31	<36

6.5 Operational road traffic noise assessment

The Site would be mostly unmanned once operational and as such no traffic movements would normally be produced. Intermittently, when maintenance is required, up to six light vehicles would visit the Site during a typical-case day. It is understood that heavy vehicles are not anticipated to regularly access the Site during operation.

Due the very small number of vehicles that would be required to access the Site during operation, the potential impact would be very minor and would comply with Project acoustic requirements.

7.0 Conclusion

Construction noise impacts were modelled to determine the potential noise impacts at nearby noise sensitive receivers and compared against the NSW EPA's *Interim Construction Noise Guideline* (ICNG) (DECC 2009), Noise Management Levels for construction scenarios. The modelling showed that noise levels at some residential noise sensitive receivers are predicted to exceed the construction noise management levels during the day. In general, the construction of the Project is expected to comply with the noise management levels during the Project's construction during standard construction hours. None of the construction is expected to result in noise levels which exceed the 'highly noise affected' level of 75 dB(A) for noise sensitive receivers.

The noise from traffic generated by the construction activities to and from the Project Area are considered acceptable according to the NSW EPA's *Road Noise Policy*.

Operational noise from the Site was also modelled and compared against established project noise trigger levels. A 10 m noise barrier with sound absorptive lining was assumed around the battery packs and the HV transformers. Results of the noise modelling showed that the operation of the BESS complies with the established project noise trigger levels at most residential receivers, however marginal exceedances of the trigger levels have been predicted for three residential receives under both standard and noise-enhancing meteorological conditions. Recommendations for at-property noise mitigation measures for these three receivers have been made.

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

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology that may have been used in this report.

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 1kHz 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 increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer / Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(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.
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.
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	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h 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.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's *Noise Policy for Industry* and the EPA's NSW *Road Noise Policy*.

Appendix B

Logger Reports

Noise Logger Report

173 Brays Lane, Wallerawang

Item	Information
Logger Type	SVAN977
Serial number	45417
Address	173 Brays Lane, Wallerawang
Location	173 Brays Lane, Wallerawang
Facade / Free Field	Free field
Environment	Background noise dominated by industrial noise from nearby site 43 dB(A). Conveyor belt and truck movement audible. Bird calls occasionally. Sunny weather. Truck pass by on Brays Lane 70.8 dB(A). Rooster crowing 58.8 dB(A).

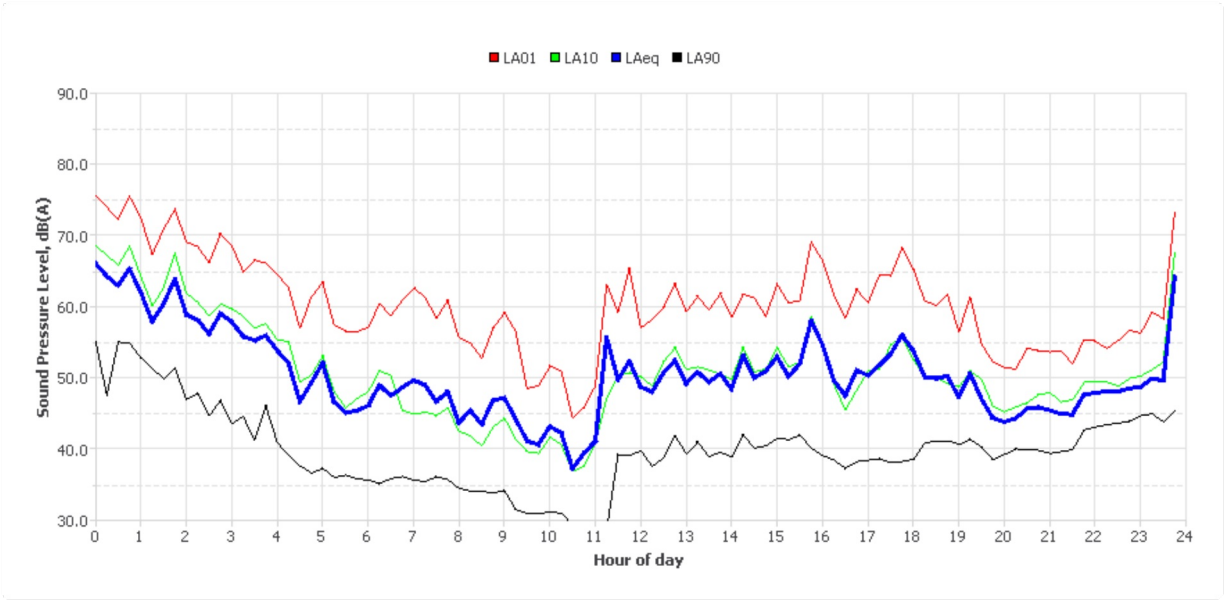
Measured noise levels

Logging Date	L_{Aeq} Day	Eve	Night	ABL Day	Eve	Night	$L_{Aeq,15hr}$	$L_{Aeq,9hr}$
Thu Mar 4 2021	54	33	-	-	-	-	52	-
Fri Mar 5 2021	51	47	48	37	29	-	50	48
Sat Mar 6 2021	49	47	46	36	35	23	49	46
Sun Mar 7 2021	48	46	49	29	30	29	48	49
Mon Mar 8 2021	49	46	47	36	36	26	48	47
Tue Mar 9 2021	51	41	48	-	-	27	47	48
Wed Mar 10 2021	48	44	49	31	32	37	48	49
Thu Mar 11 2021	47	46	48	33	-	30	47	48
Fri Mar 12 2021	43	45	38	21	26	24	44	38
Sat Mar 13 2021	50	54	53	28	47	28	51	53
Sun Mar 14 2021	42	35	49	-	20	32	40	49
Mon Mar 15 2021	60	65	58	40	53	35	62	58
Tue Mar 16 2021	52	43	64	-	34	-	50	64
Wed Mar 17 2021	42	-	66	-	-	-	42	66
Summary	**52**	**55**	**58**	**33**	**33**	**29**	**53**	**58**

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
	

Typical Day



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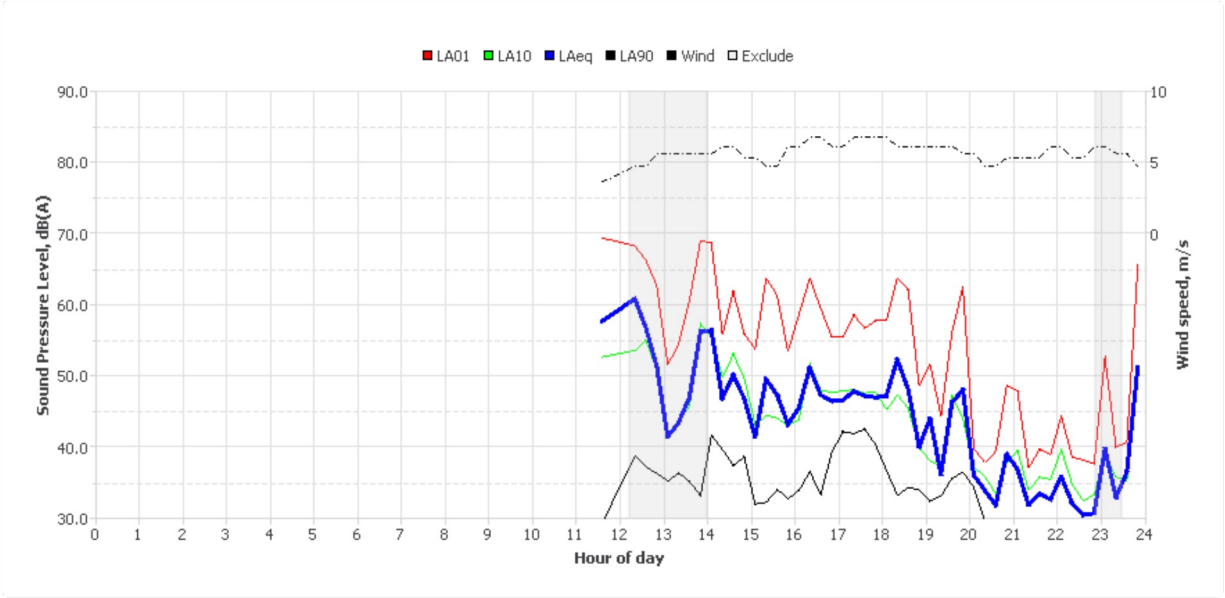

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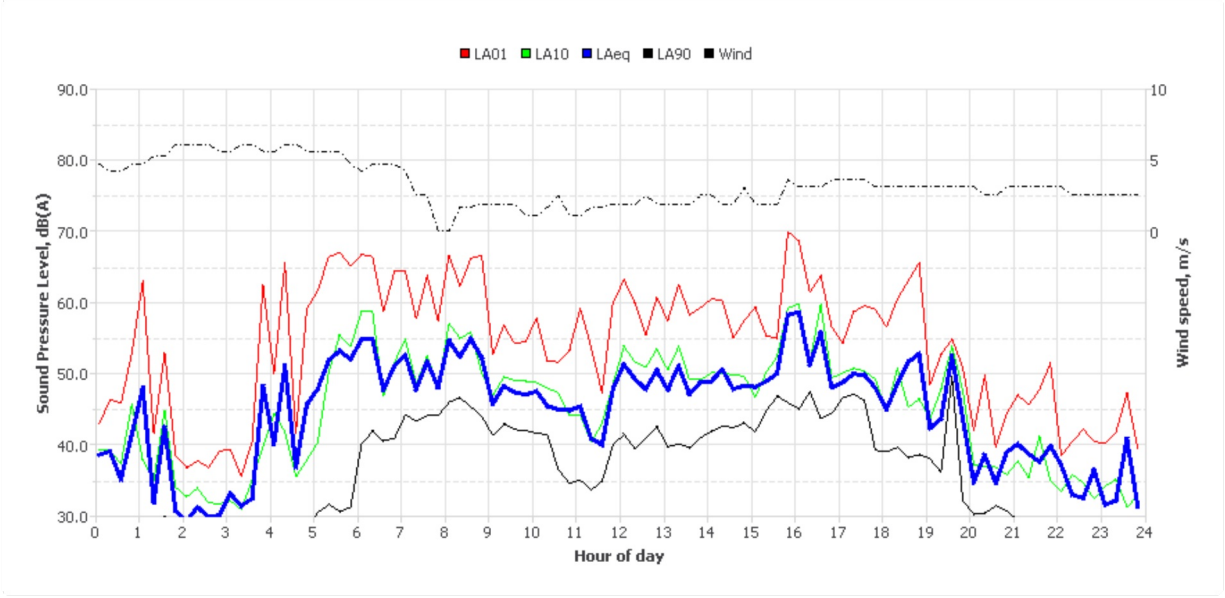

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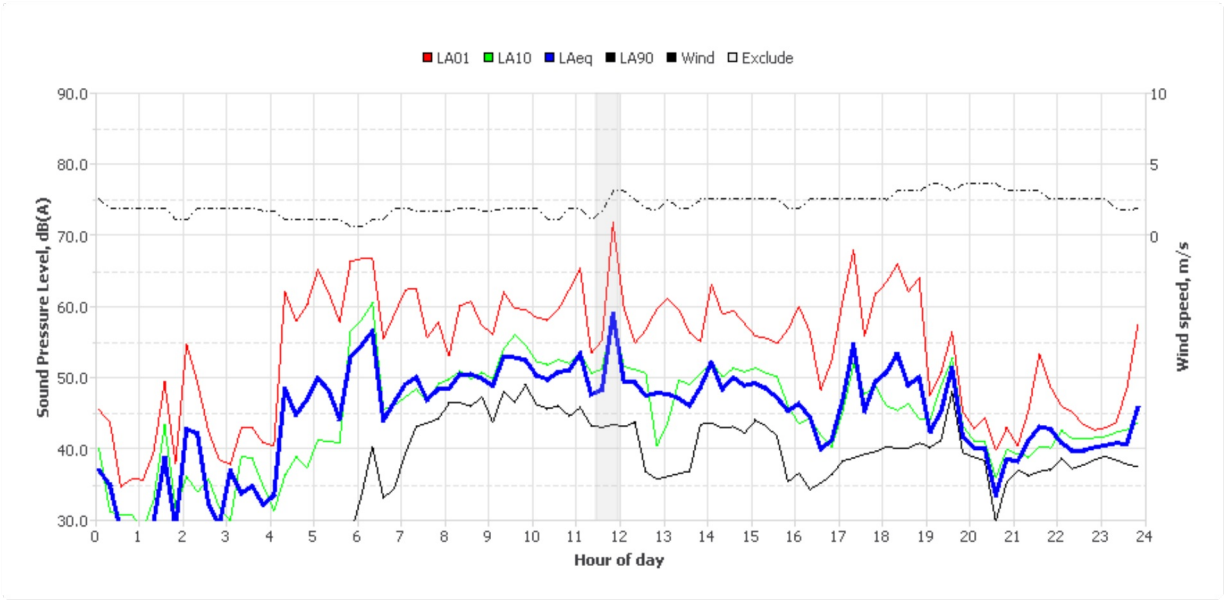

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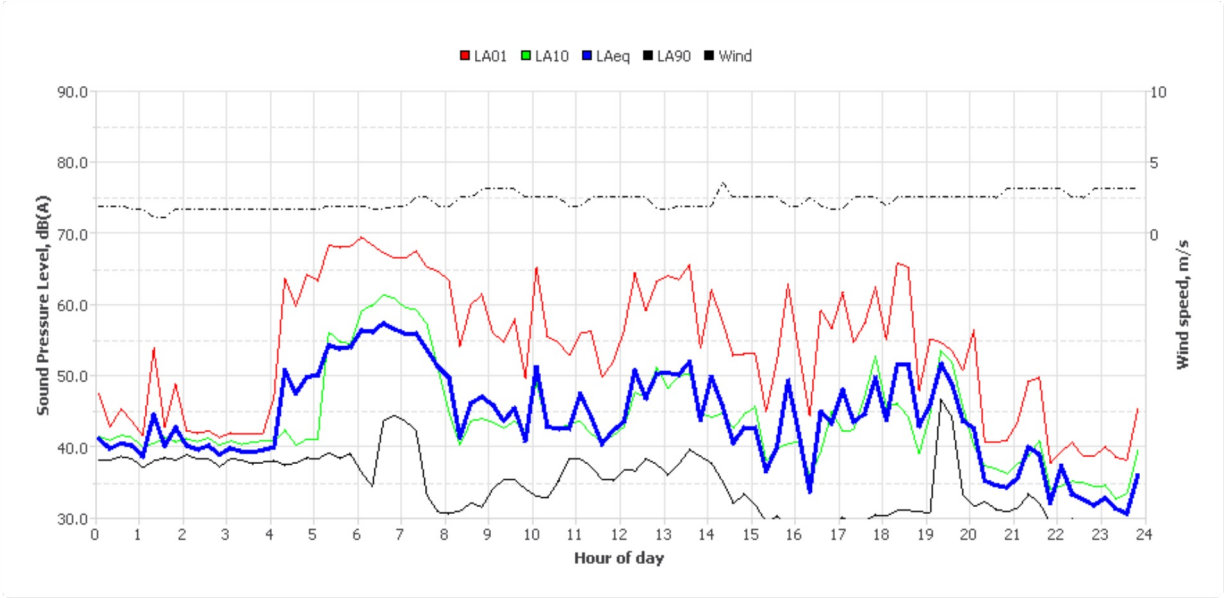

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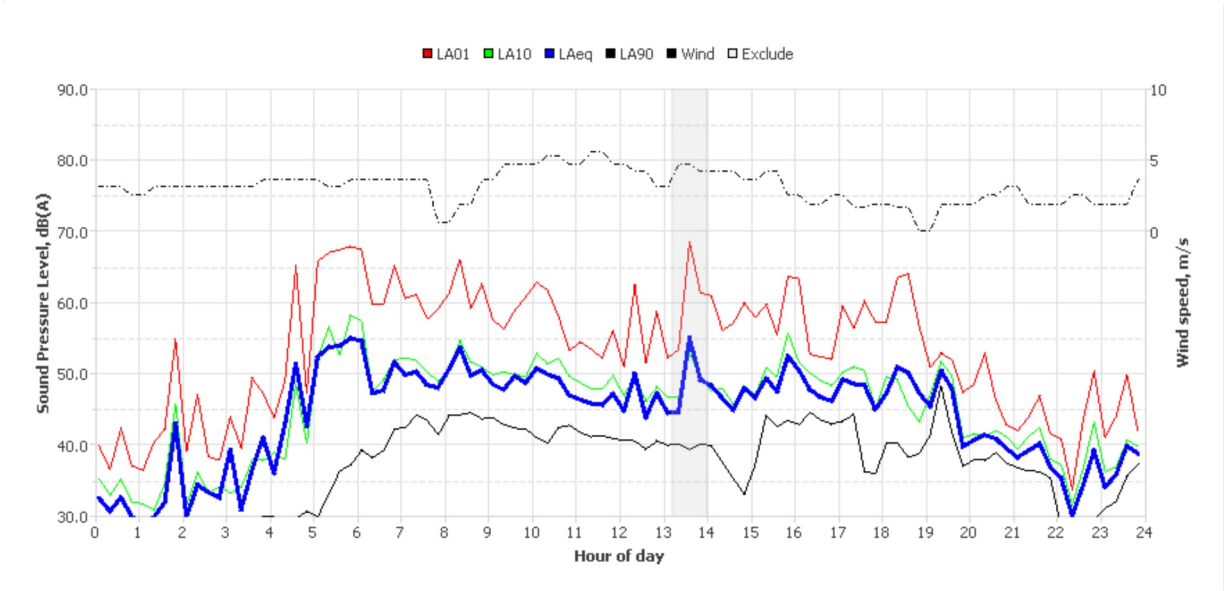

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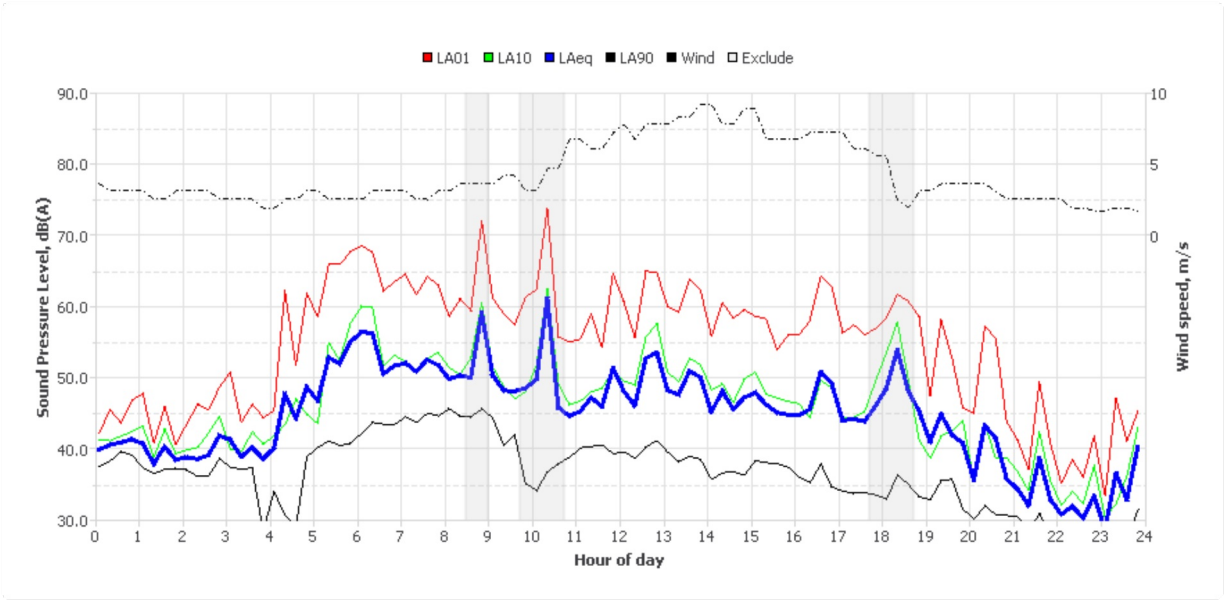

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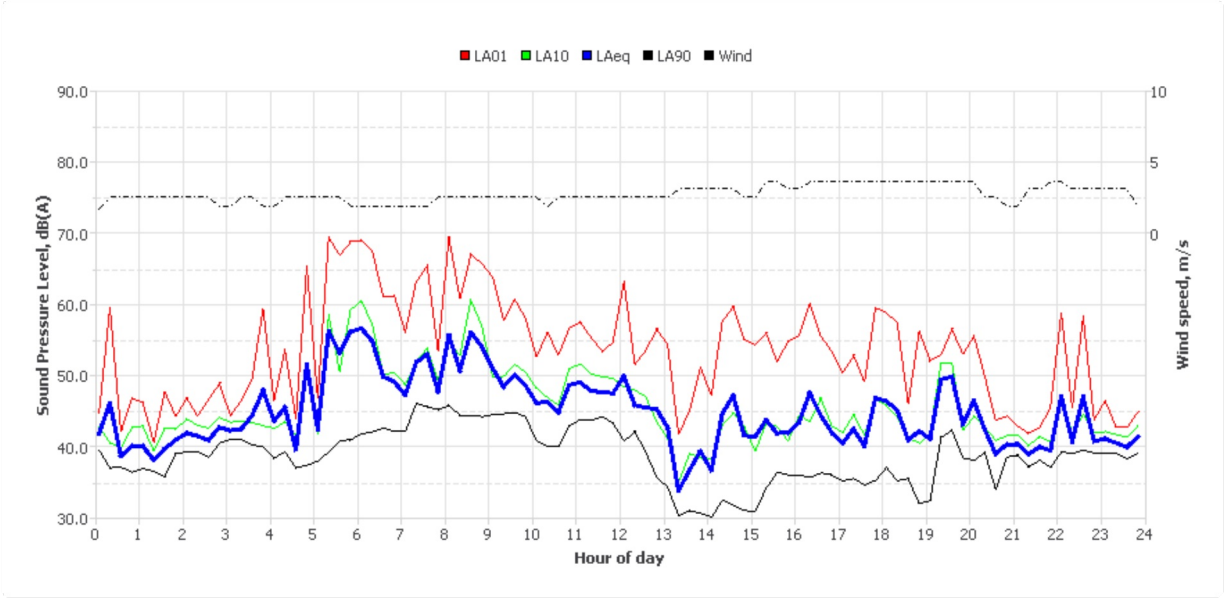

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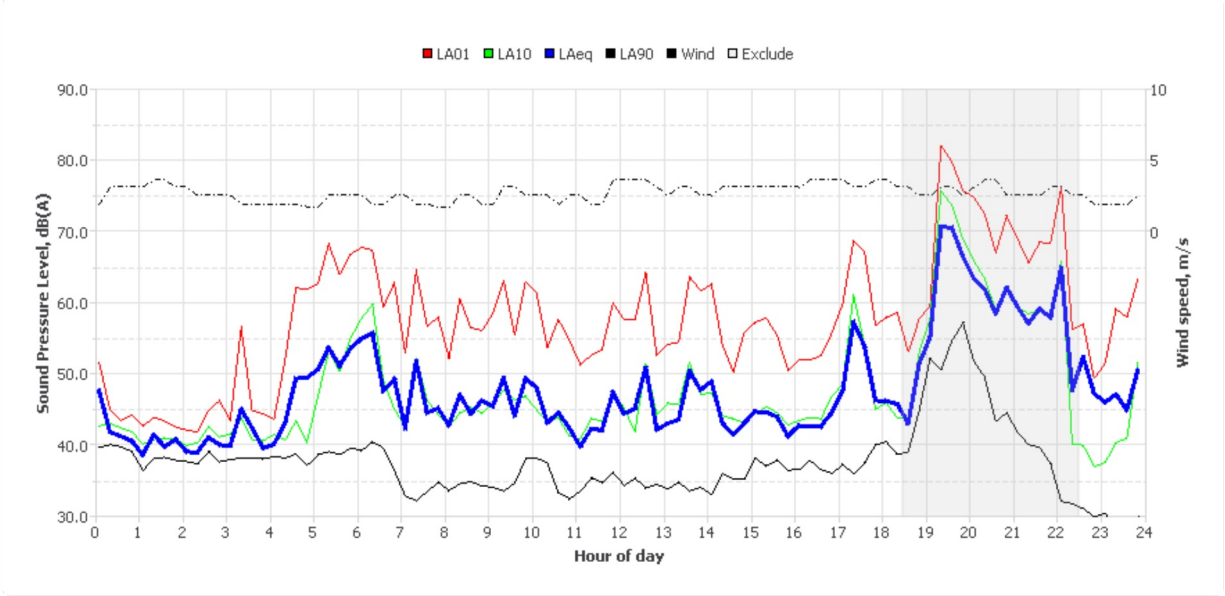

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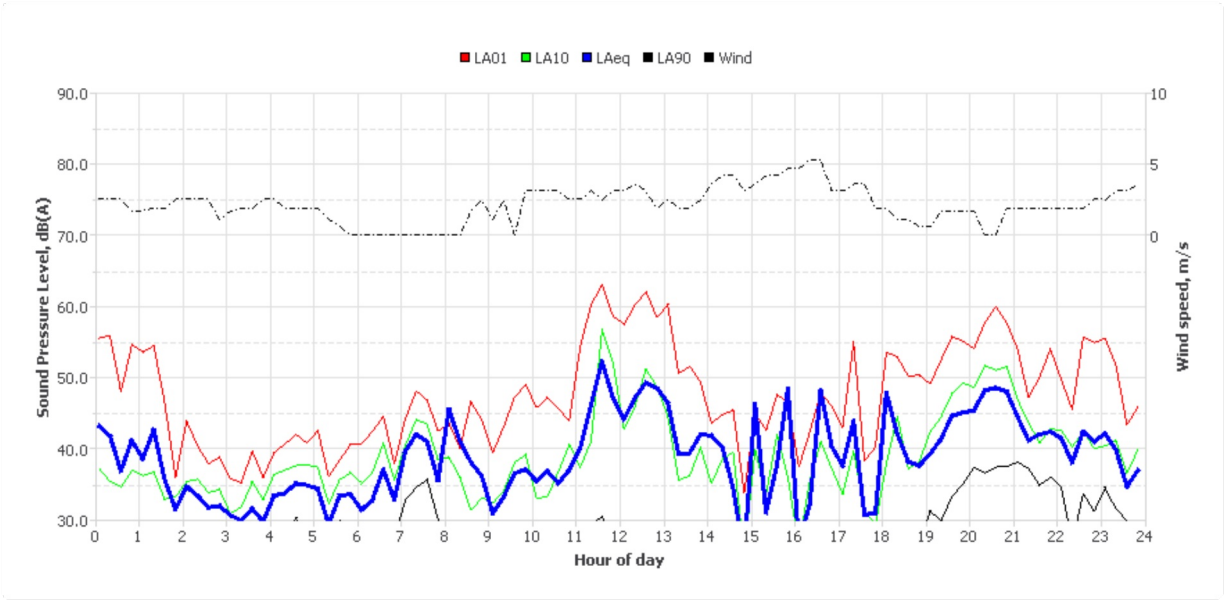

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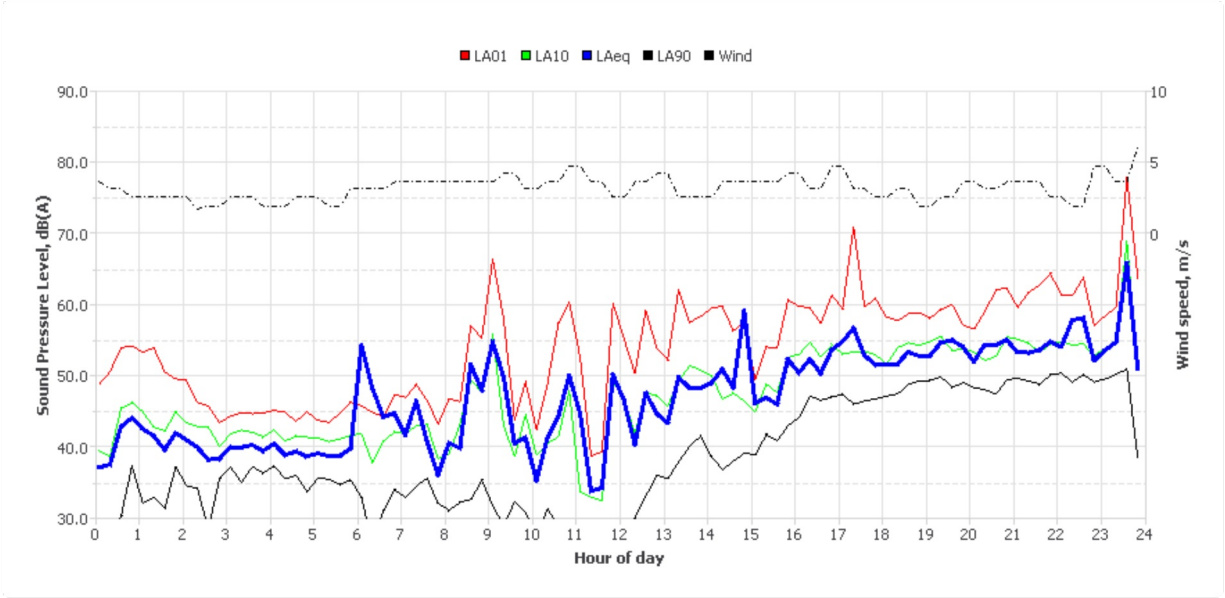

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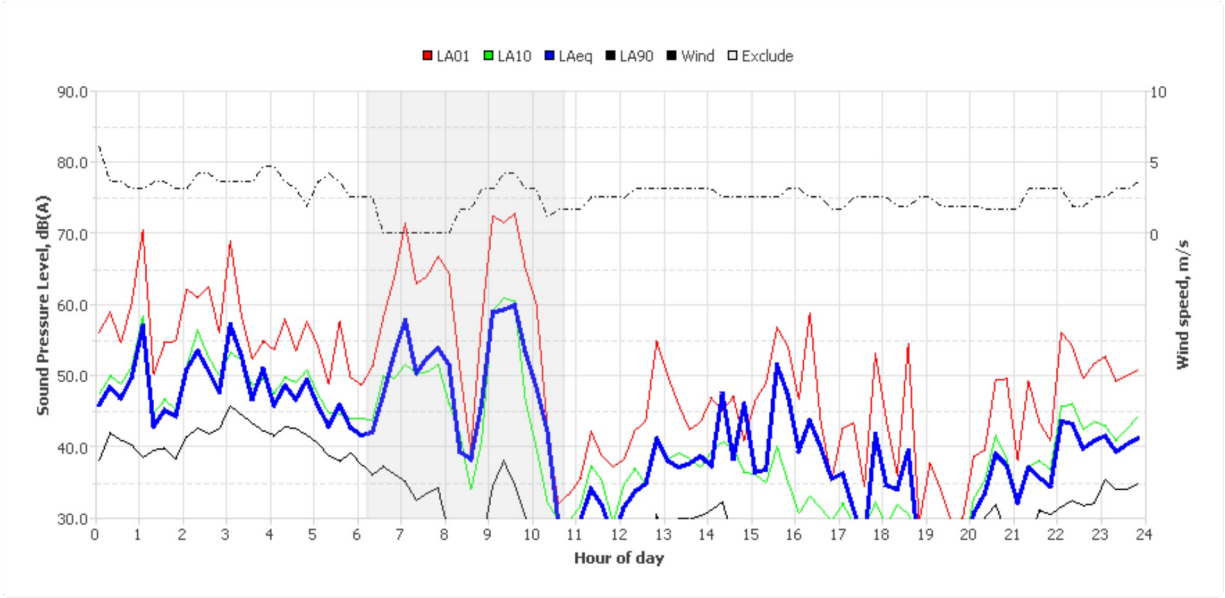

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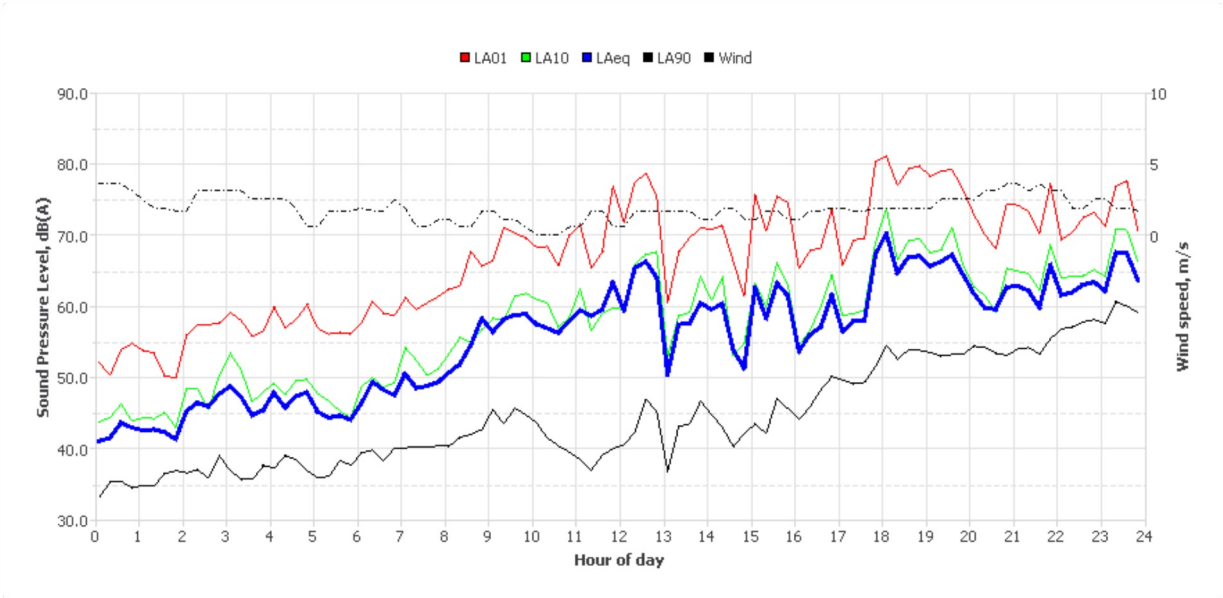

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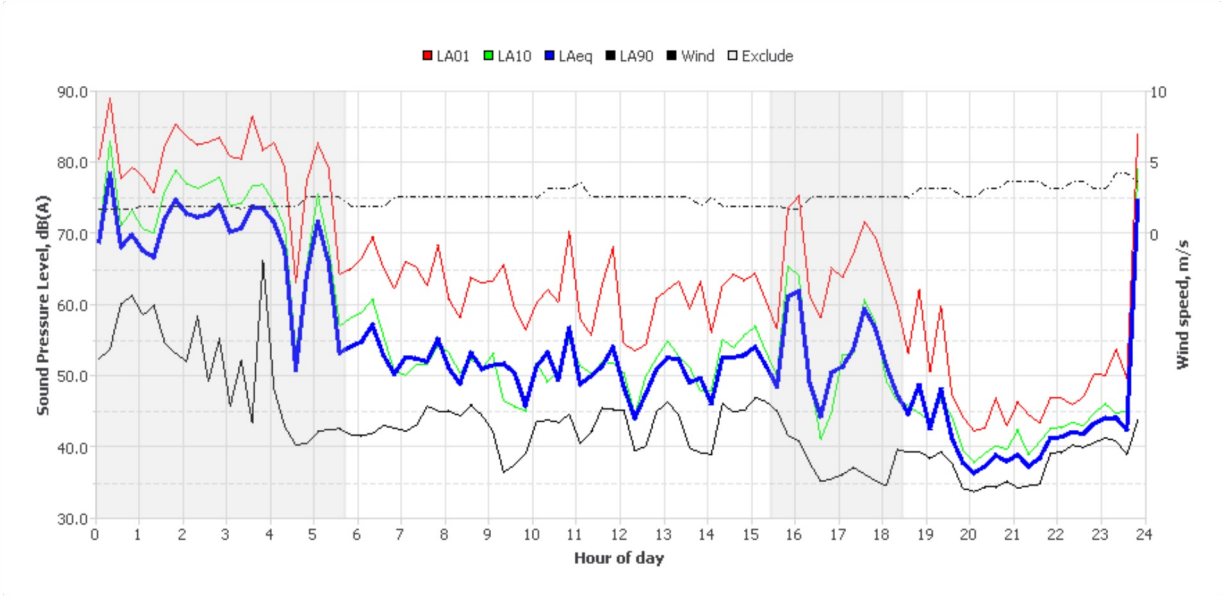

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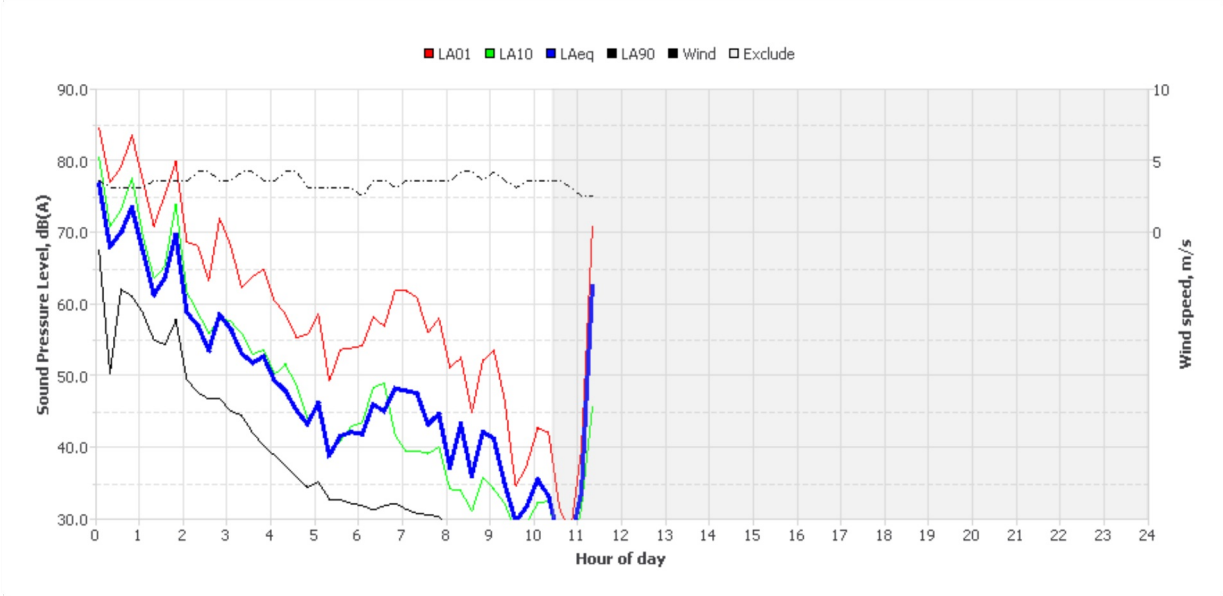


Noise Logger Report

113 Brays Lane, Wallerawang

Item	Information
Logger Type	NL21
Serial number	765701
Address	113 Brays Lane, Wallerawang
Location	113 Brays Lane, Wallerawang
Facade / Free Field	Free field
Environment	Background noise dominated by bird calls 52.1 dB(A). Very low traffic on Brays Lane Lawn mowing measurement 55.1 dB(A).

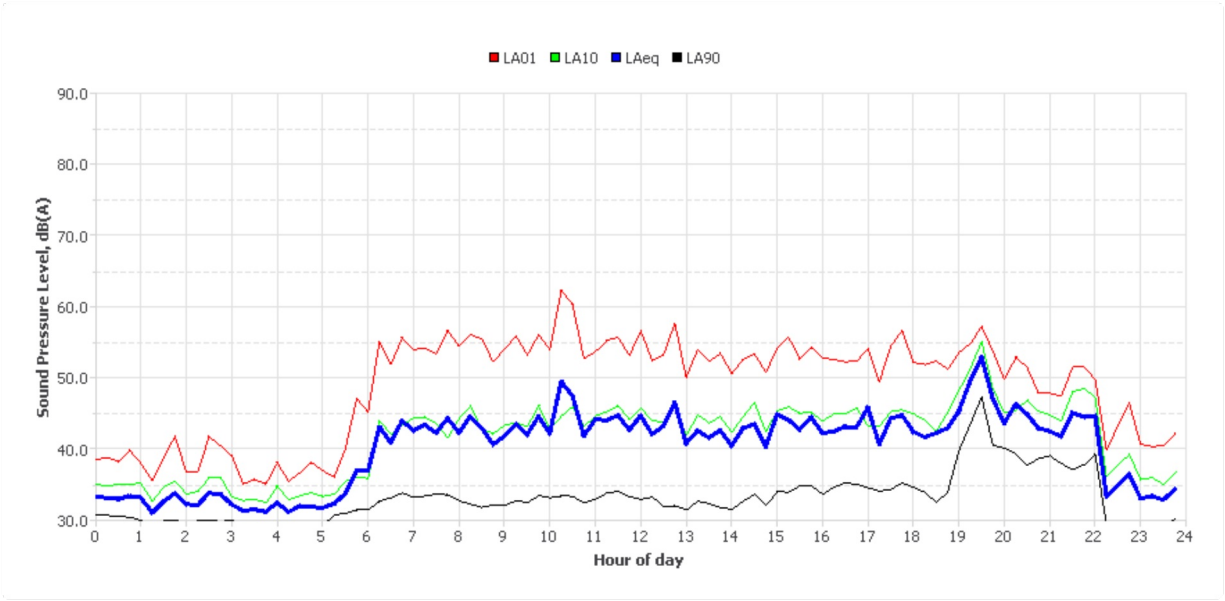
Measured noise levels

Logging Date	L_{Aeq} Day	Eve	Night	ABL Day	Eve	Night	$L_{Aeq,15hr}$	$L_{Aeq,9hr}$
Thu Feb 4 2021	46	38	35	-	26	-	44	35
Fri Feb 5 2021	43	40	38	30	-	24	43	38
Sat Feb 6 2021	45	41	36	-	-	25	44	36
Sun Feb 7 2021	42	37	32	-	-	-	41	32
Mon Feb 8 2021	43	38	36	31	-	27	42	36
Tue Feb 9 2021	46	38	36	32	26	26	44	36
Wed Feb 10 2021	43	42	37	28	-	29	43	37
Thu Feb 11 2021	44	52	36	30	-	-	47	36
Summary	**44**	**44**	**36**	**30**	**26**	**26**	**44**	**36**

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
	

Typical Day



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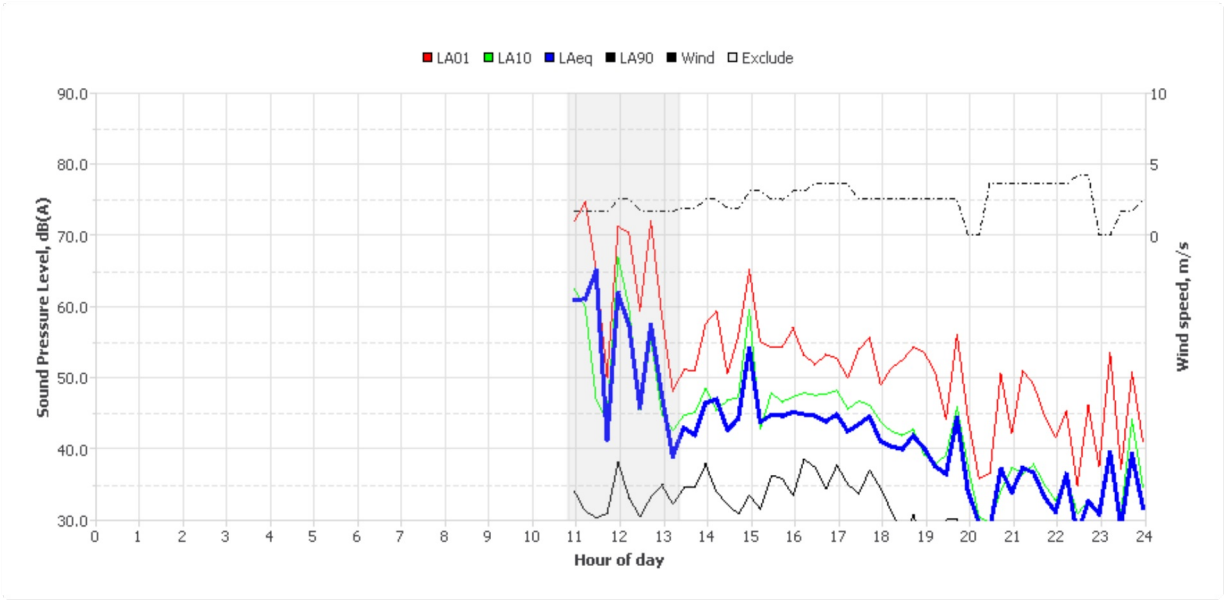

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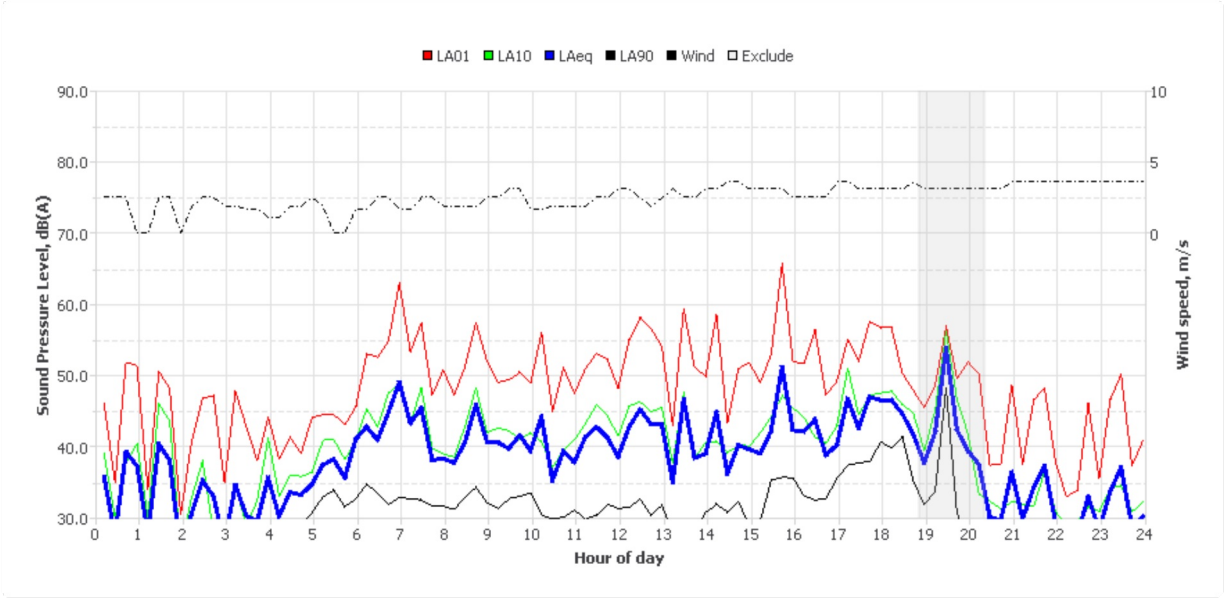

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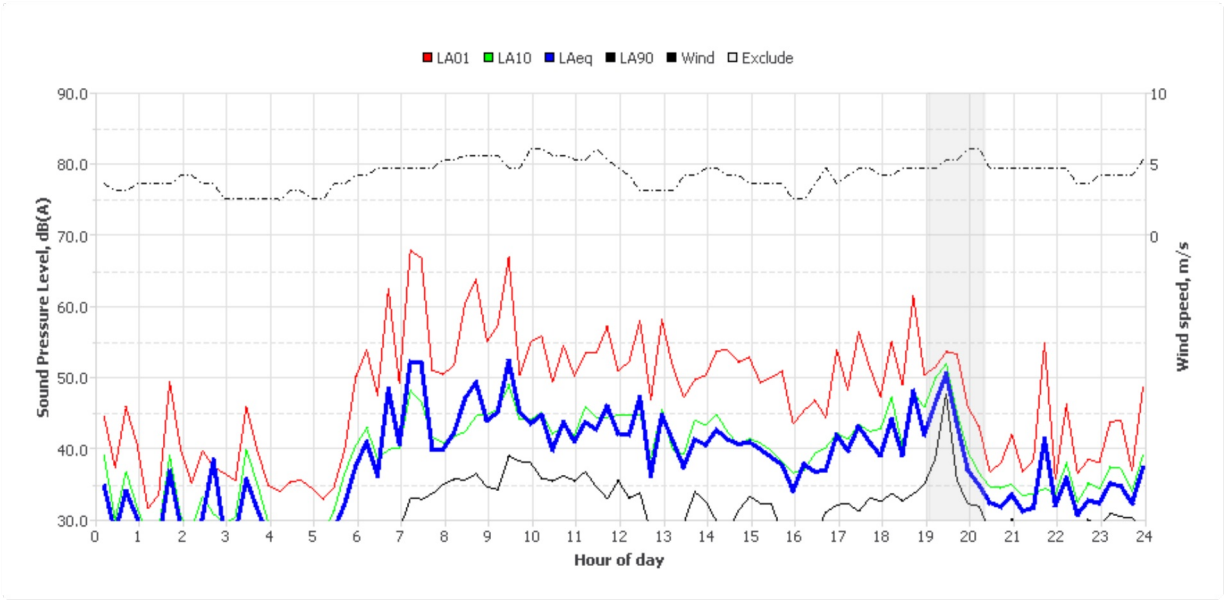

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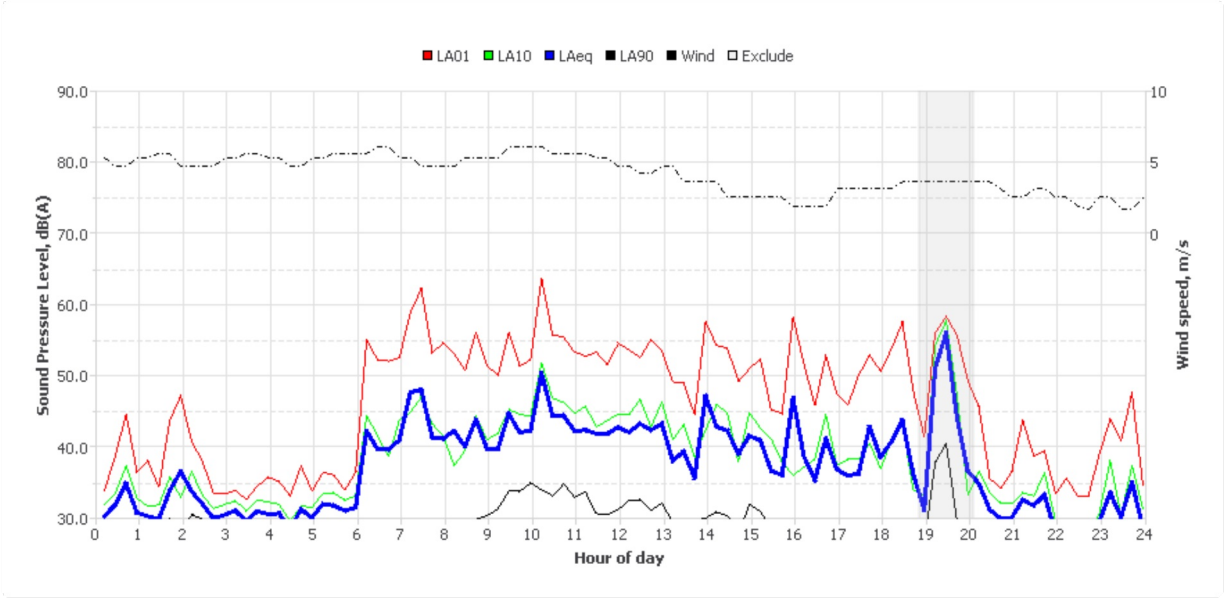

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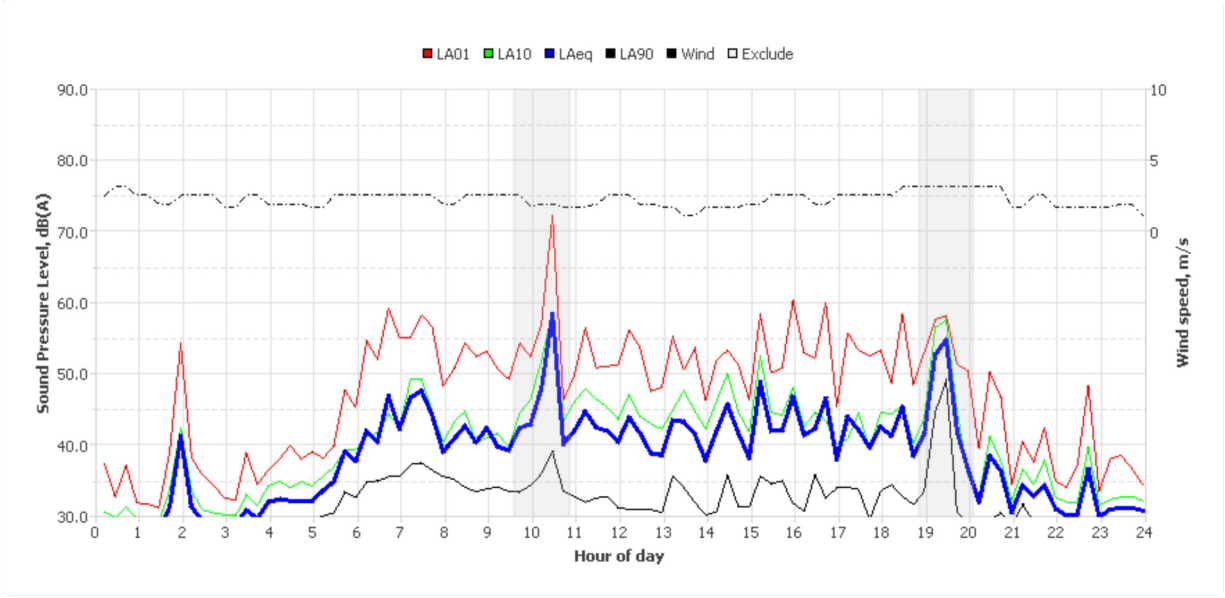

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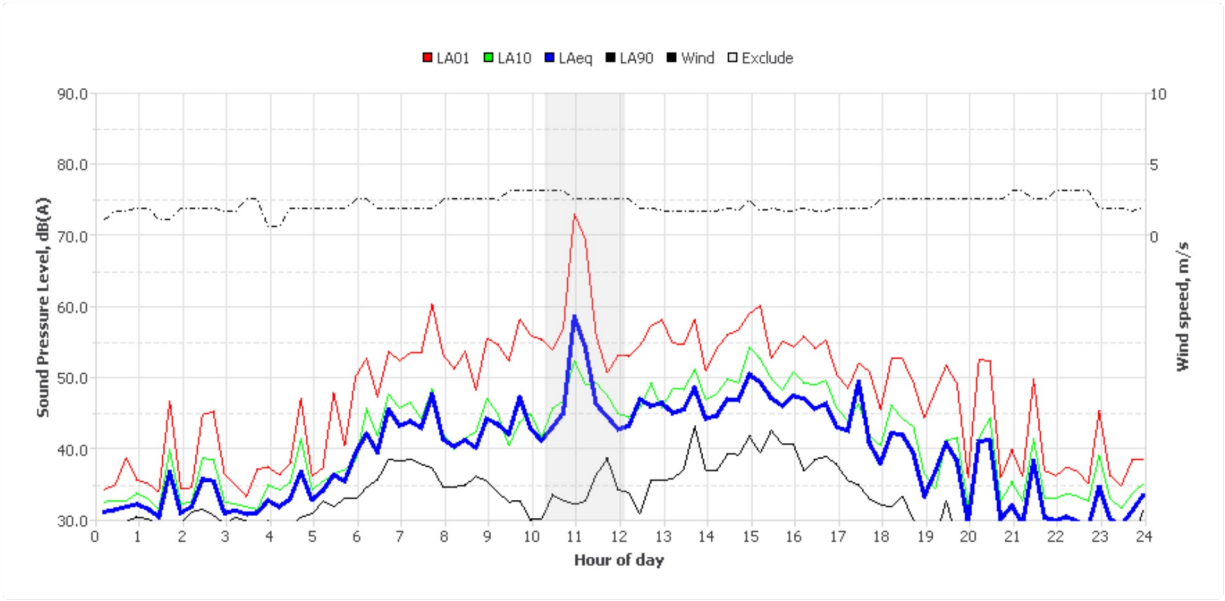

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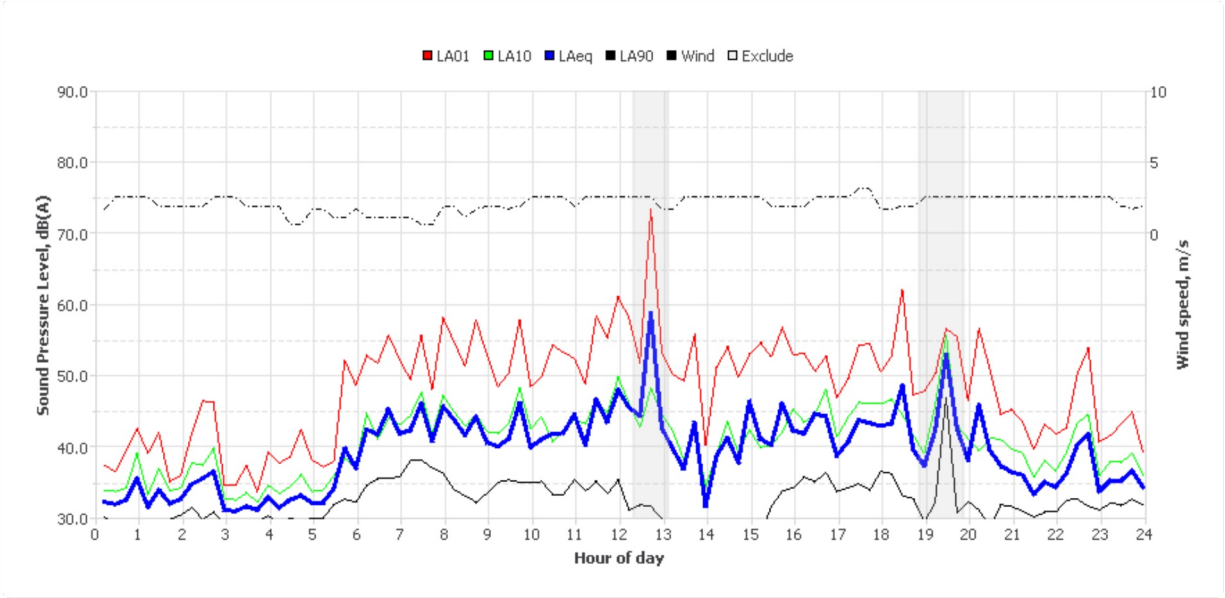
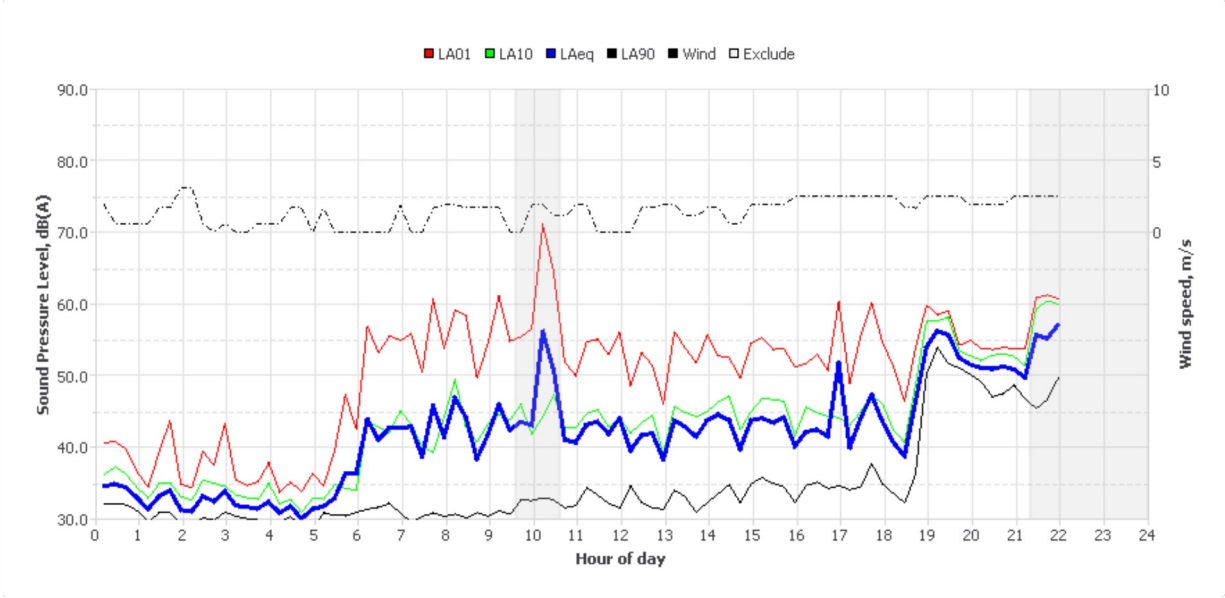


Thursday, 11 Feb 2021



Noise Logger Report

29 Cripps Avenue, Wallerawang

Item	Information
Logger Type	ARL 315
Serial number	15-299-444
Address	29 Cripps Avenue, Wallerawang
Location	29 Cripps Avenue, Wallerawang
Facade / Free Field	Free field
Environment	Background dominated by Road traffic noise Helicopter pass by 63 dB(A). Bird calls 61.2 dB(A). Sunny weather.

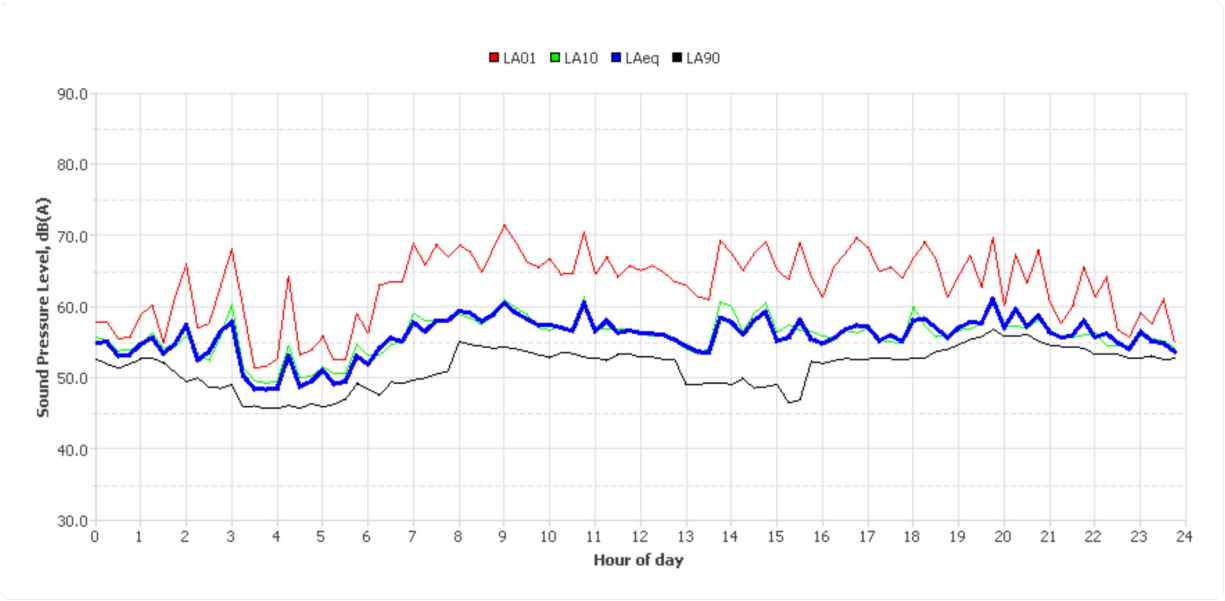
Measured noise levels

Logging Date	L_{Aeq} Day	Eve	Night	ABL Day	Eve	Night	$L_{Aeq,15hr}$	$L_{Aeq,9hr}$
Thu Mar 4 2021	52	46	-	-	-	-	50	-
Fri Mar 5 2021	51	49	47	34	-	-	51	47
Sat Mar 6 2021	54	59	39	-	-	-	56	39
Sun Mar 7 2021	54	58	49	-	52	-	56	49
Mon Mar 8 2021	56	59	46	39	52	-	57	46
Tue Mar 9 2021	53	59	55	-	53	-	57	55
Wed Mar 10 2021	59	58	54	-	-	-	59	54
Thu Mar 11 2021	60	-	61	-	-	-	60	61
Summary	**56**	**57**	**55**	**37**	**52**	**-**	**57**	**55**

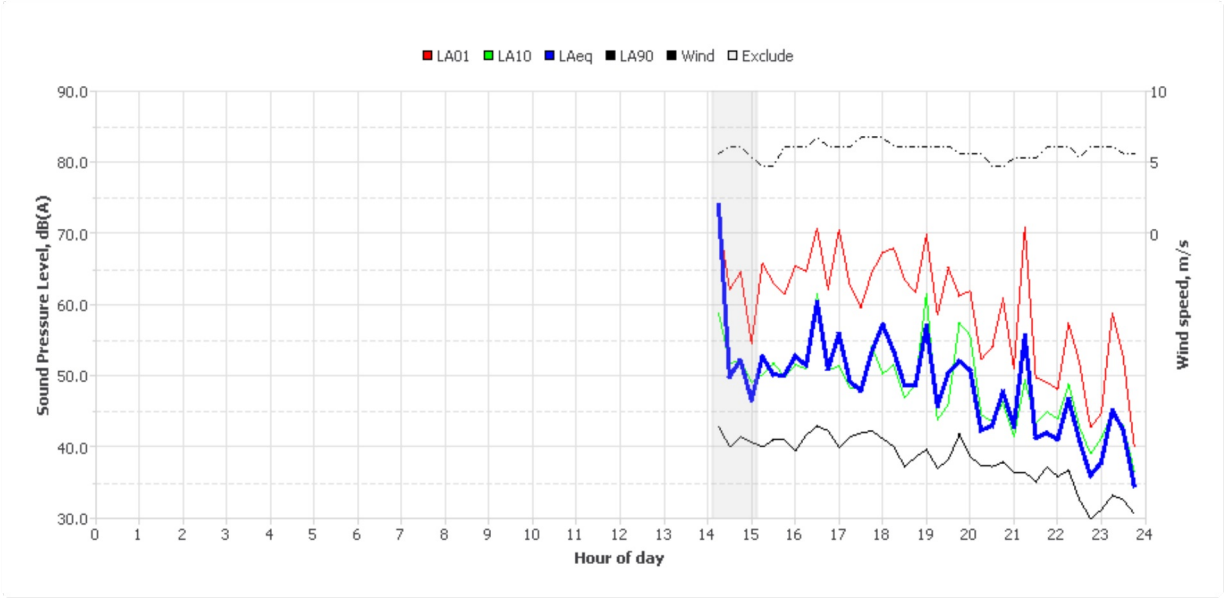
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

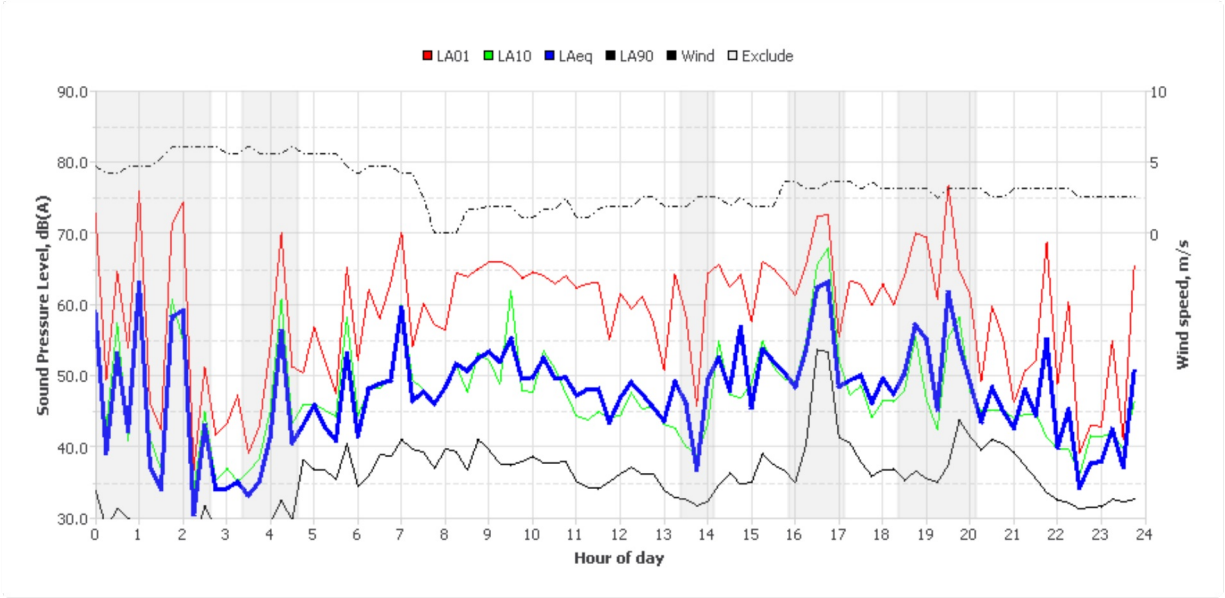
Typical Day



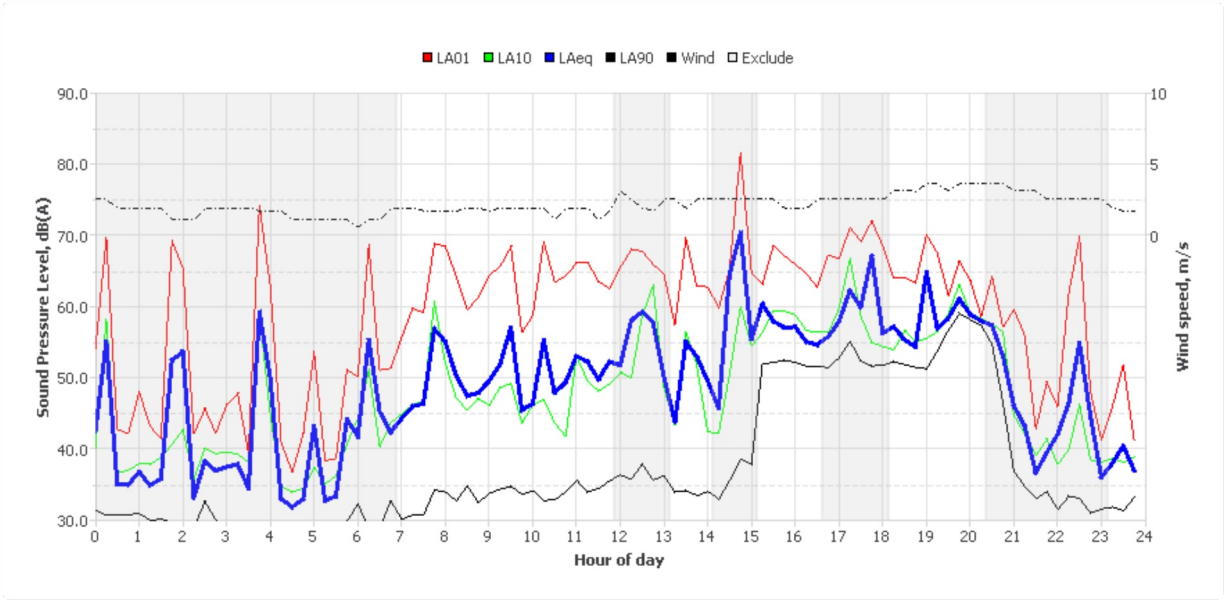
Thursday, 04 Mar 2021



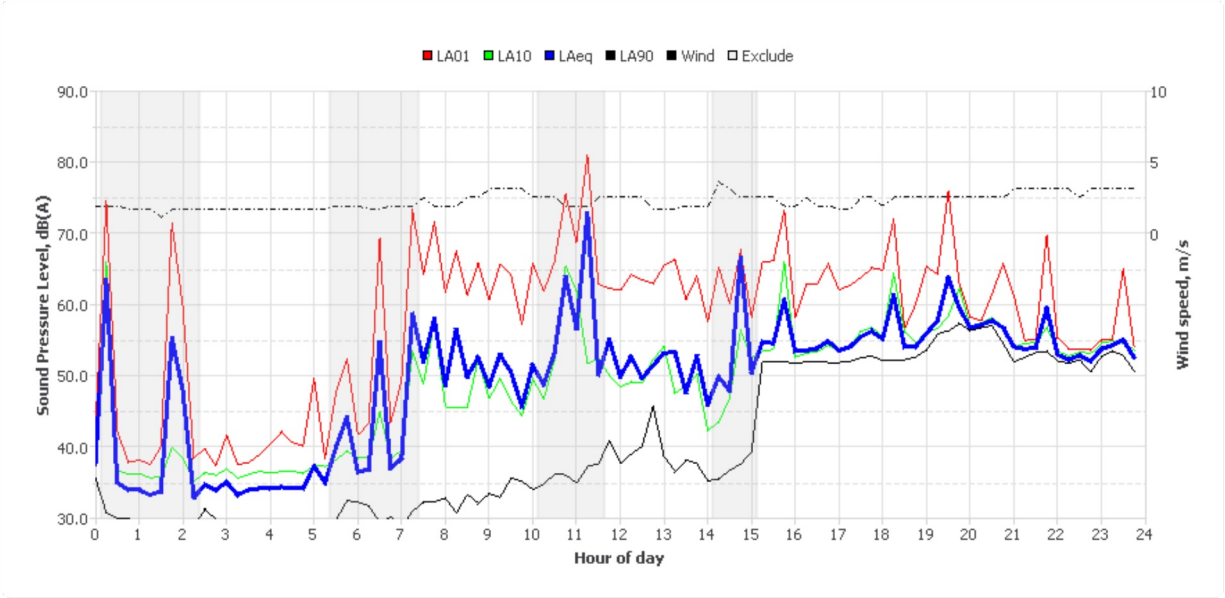
Friday, 05 Mar 2021



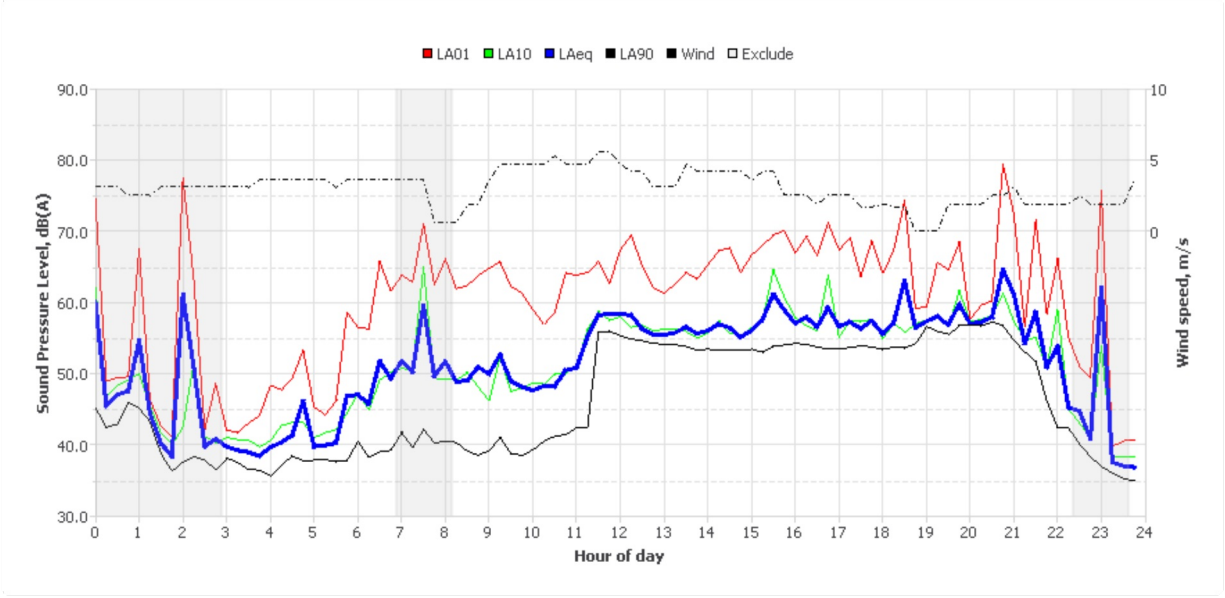
Saturday, 06 Mar 2021



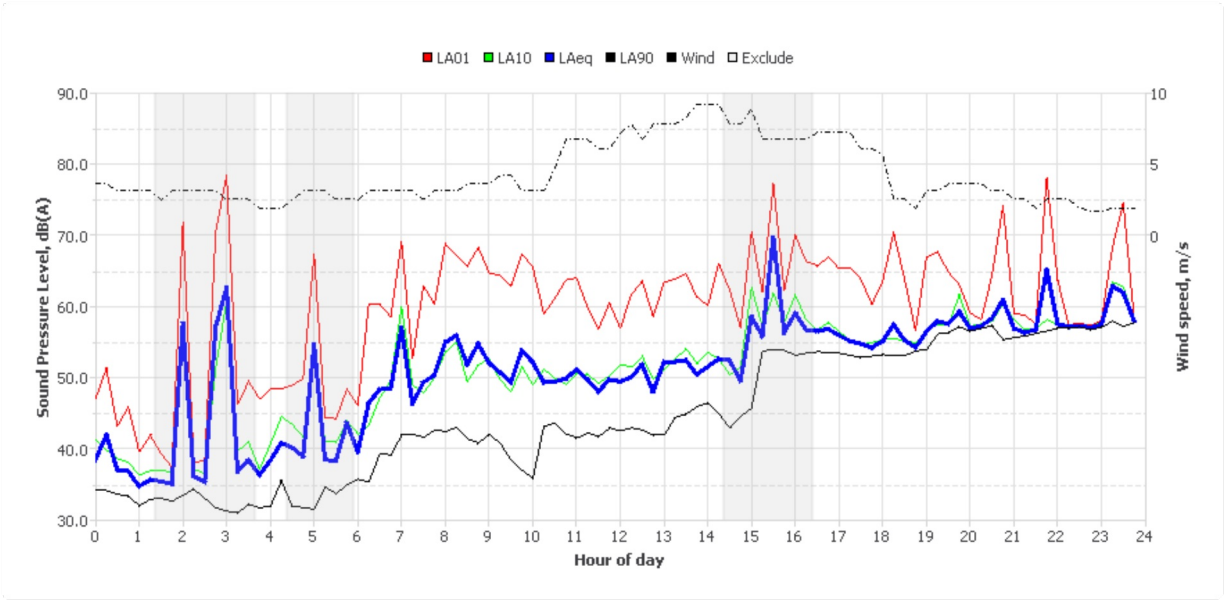
Sunday, 07 Mar 2021



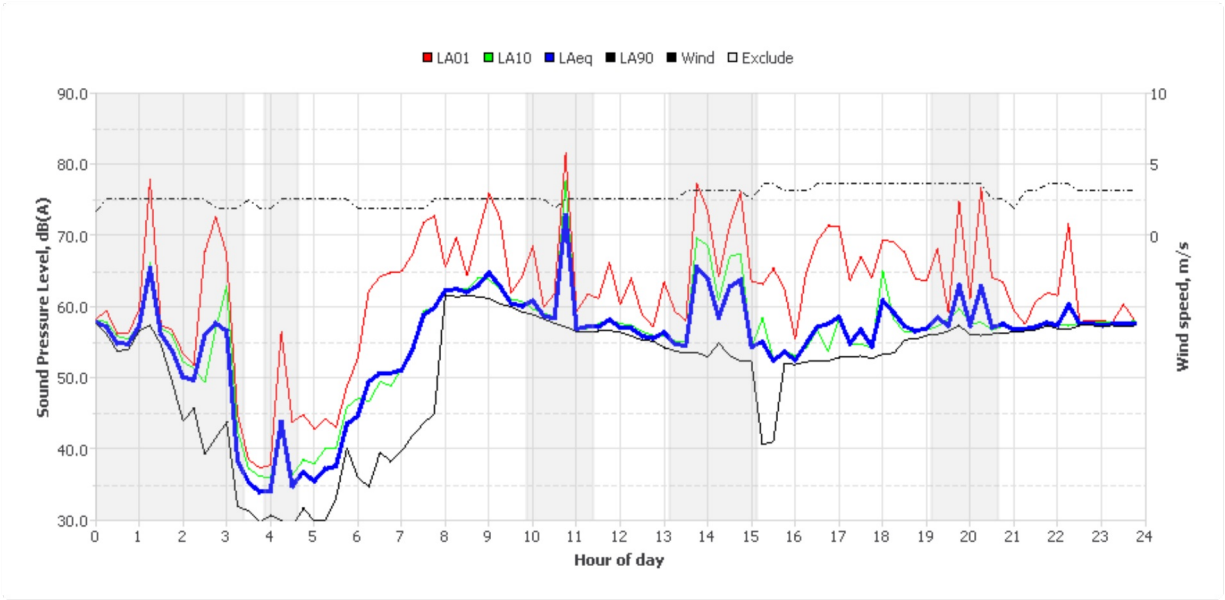
Monday, 08 Mar 2021



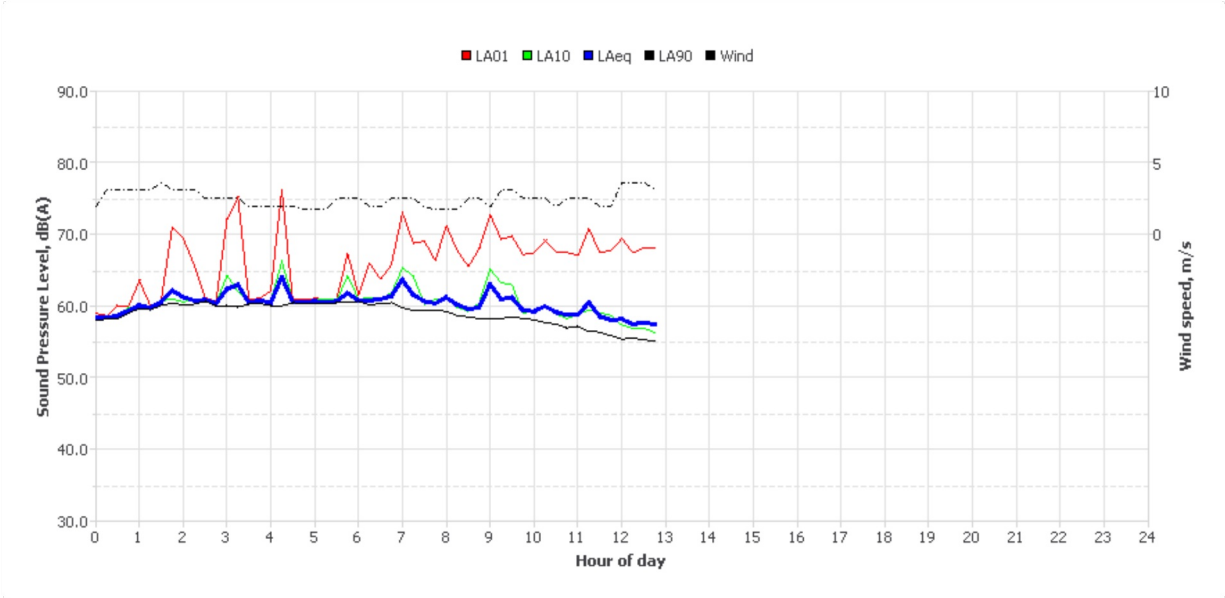
Tuesday, 09 Mar 2021



Wednesday, 10 Mar 2021



Thursday, 11 Mar 2021



Appendix C

Construction Contours

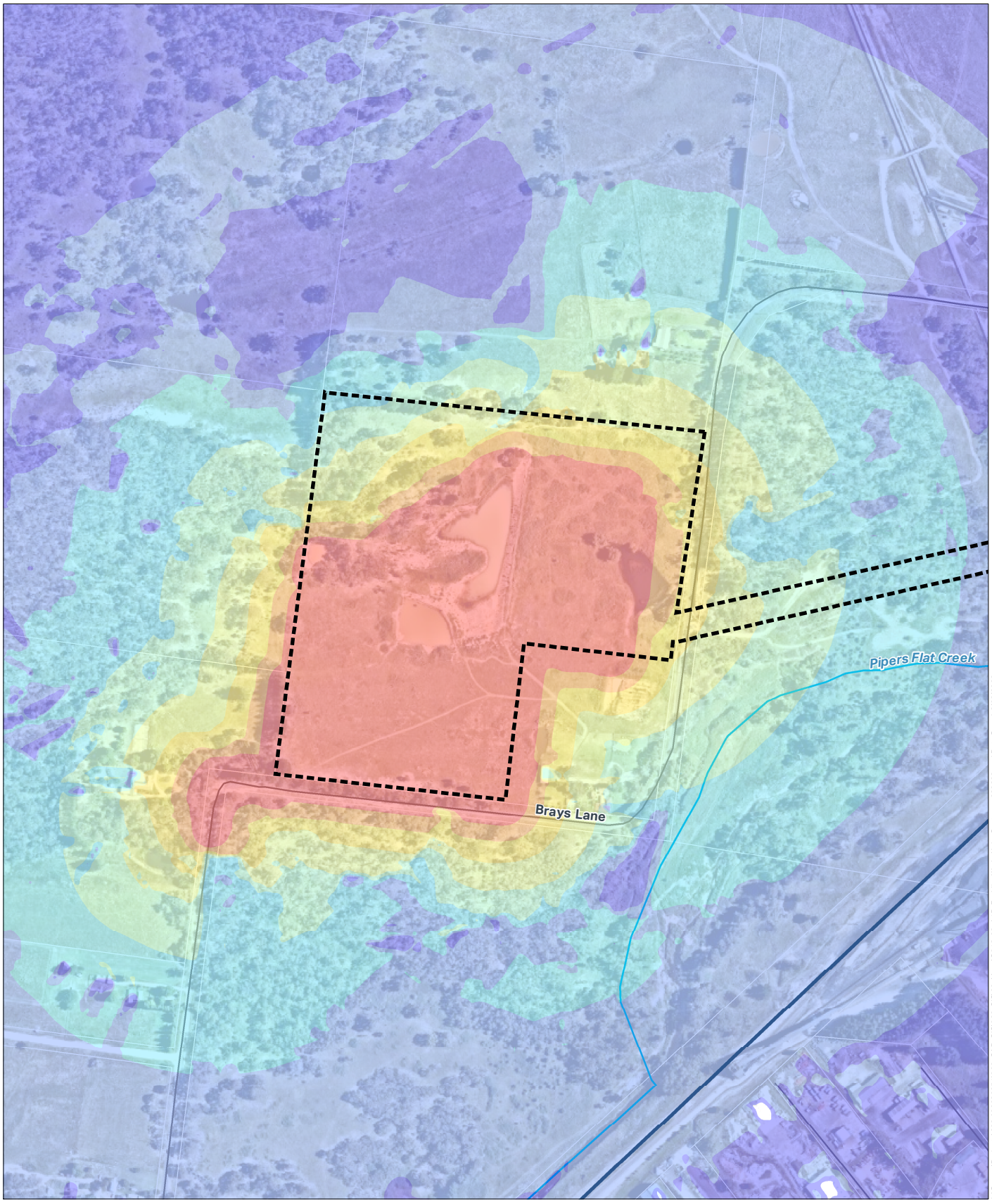


Figure C-1
Construction Scenario: 1. Enabling Works Noise Conditions

Legend

- Project Area
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- >75

N

0 110 220 m

AECOM

Source: Imagery © Nearmap, 2020.

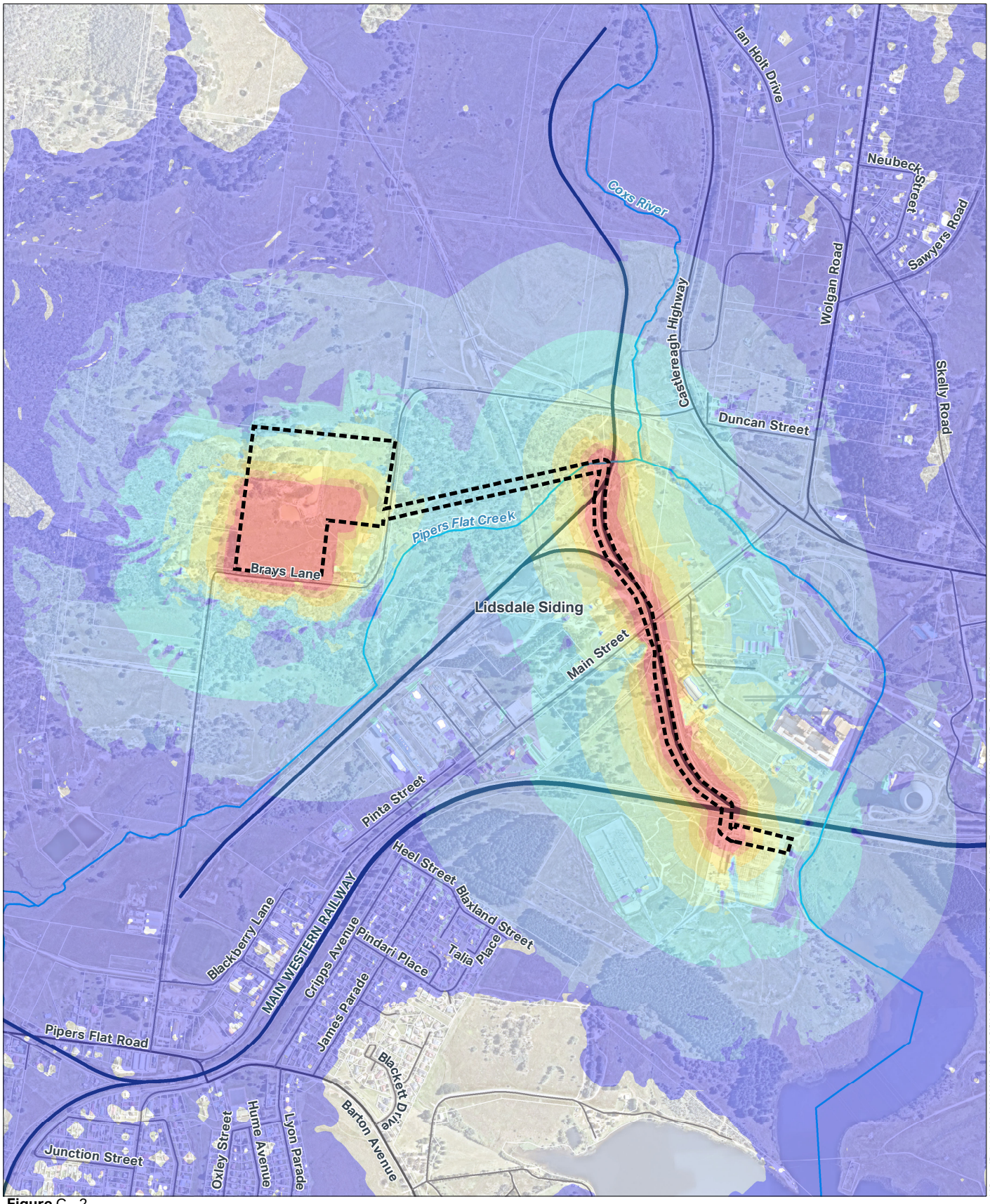


Figure C - 2
Construction Scenario: 2. Civil, Structural, Mechanical, Electrical Works and Transmission Connection Works

Legend

- Project Area
- Watercourse
- Primary Road
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- >75

N

0 300 600 m

AECOM

Source: Imagery © Nearmap, 2020.

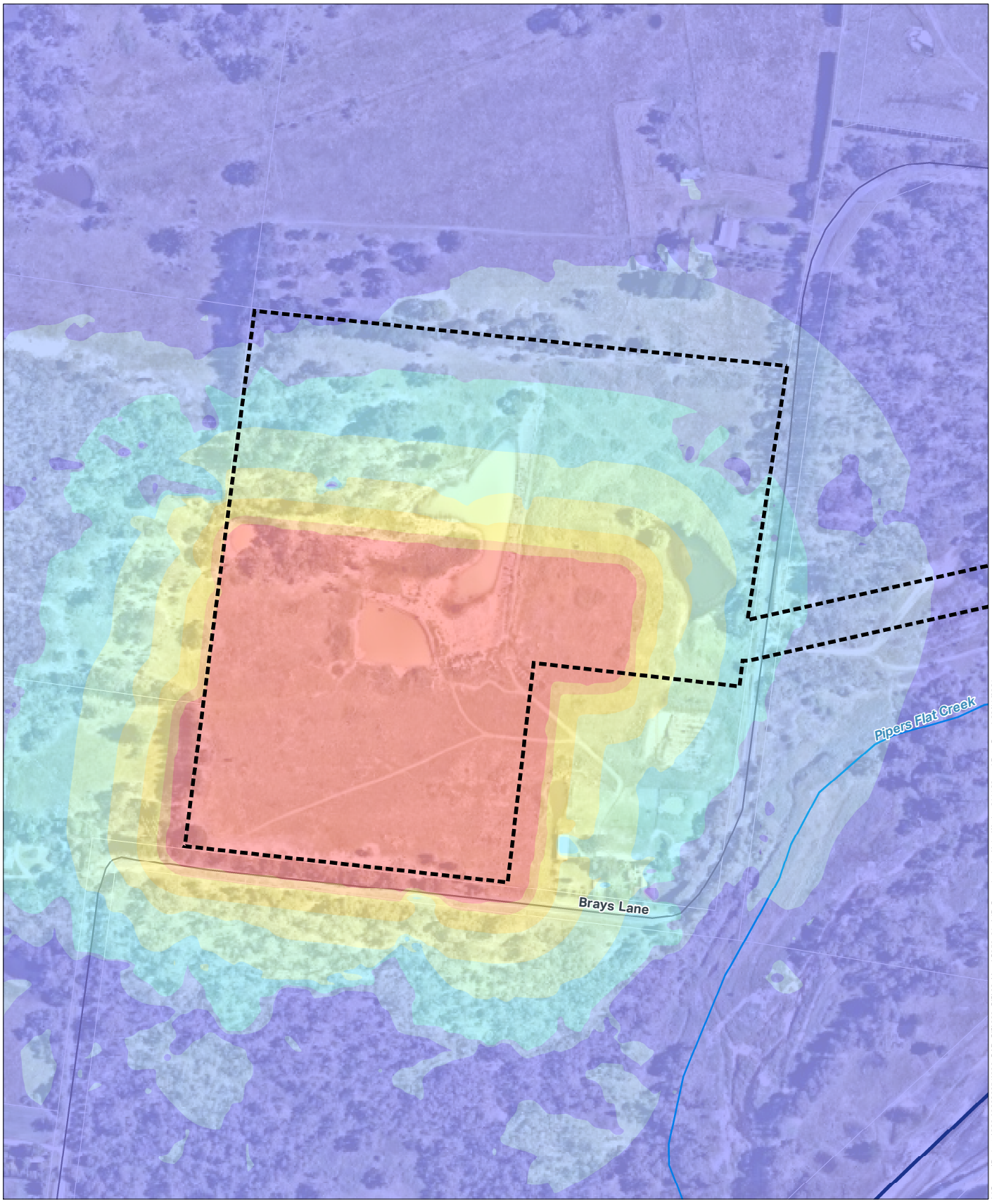


Figure C-3
Construction Scenario: 3. Commissioning Works Noise Contours

Legend

- Project Area
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- >75

N

0 75 150 m

AECOM

Source: Imagery © Nearmap, 2020.

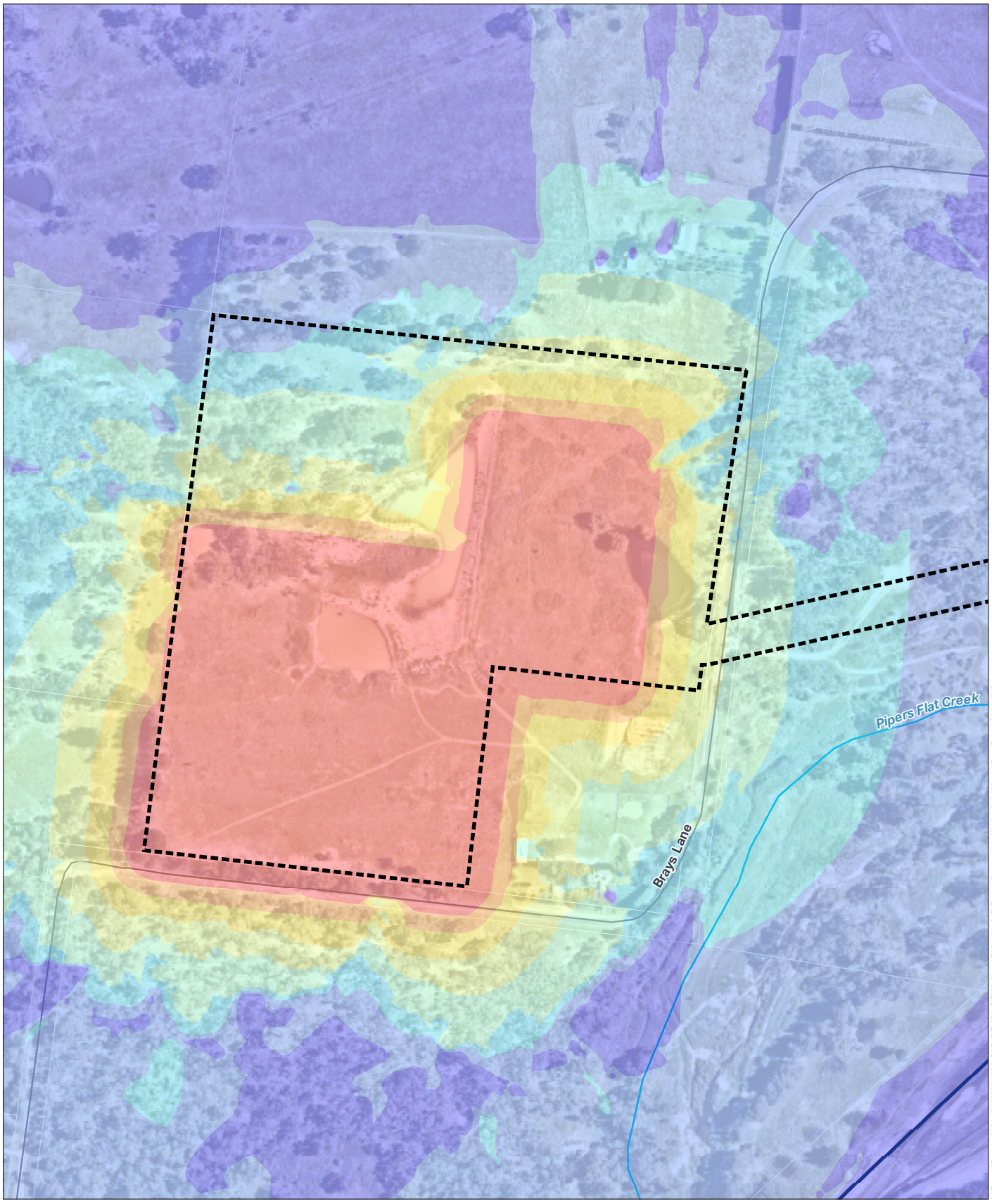


Figure C-4
Construction Scenario: 4. Demobilisation Works Noise Contours

Legend

- Project
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- >75

N 0 75 150 m

AECOM

Source: Imagery © Nearmap, 2020.

Appendix D

Operation Contours

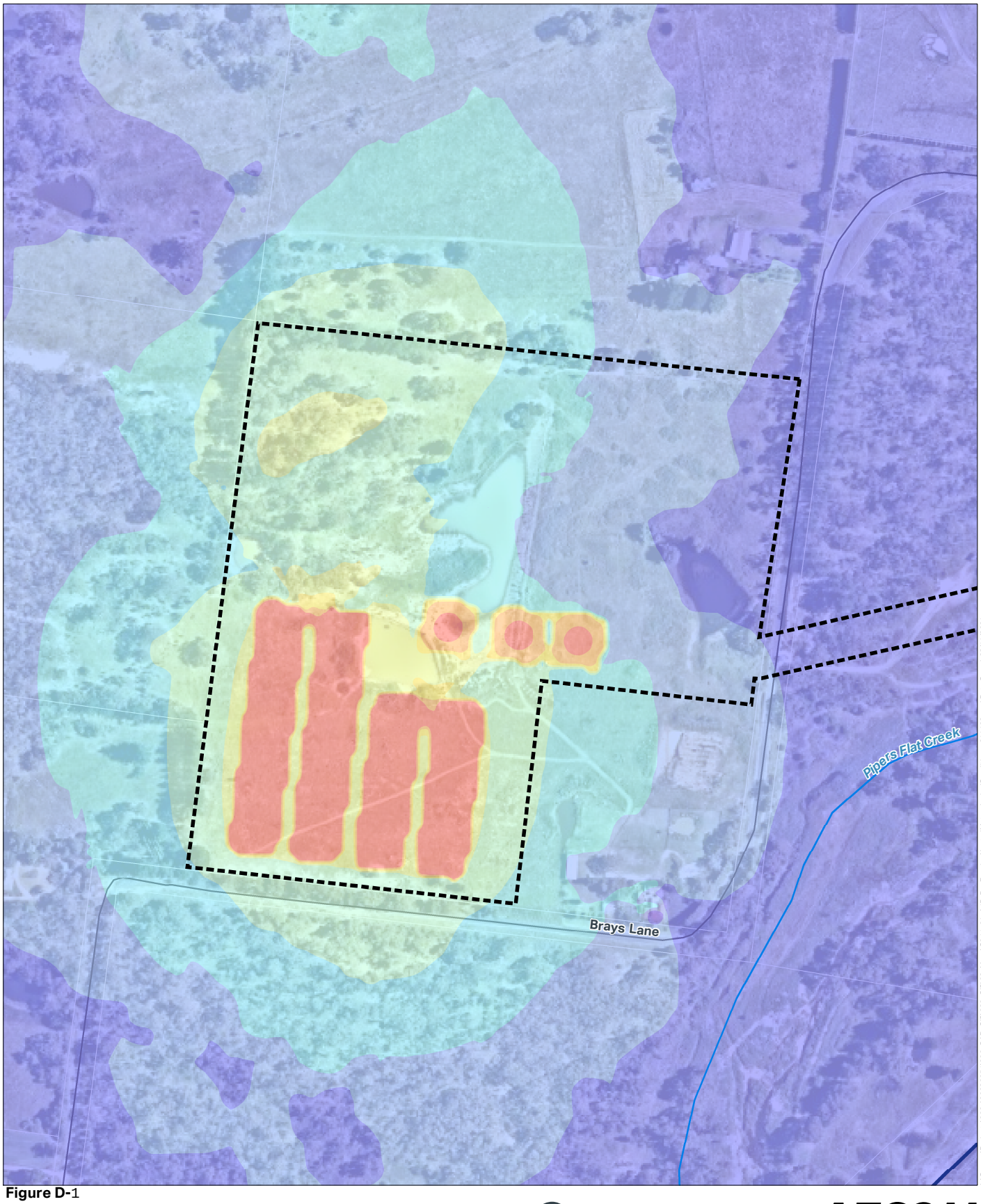


Figure D-1

Operational Scenario: Day/Evening - Neutral Meteorological Conditions

N 0 75 150 m

AECOM

Legend

- Project Area
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- >65

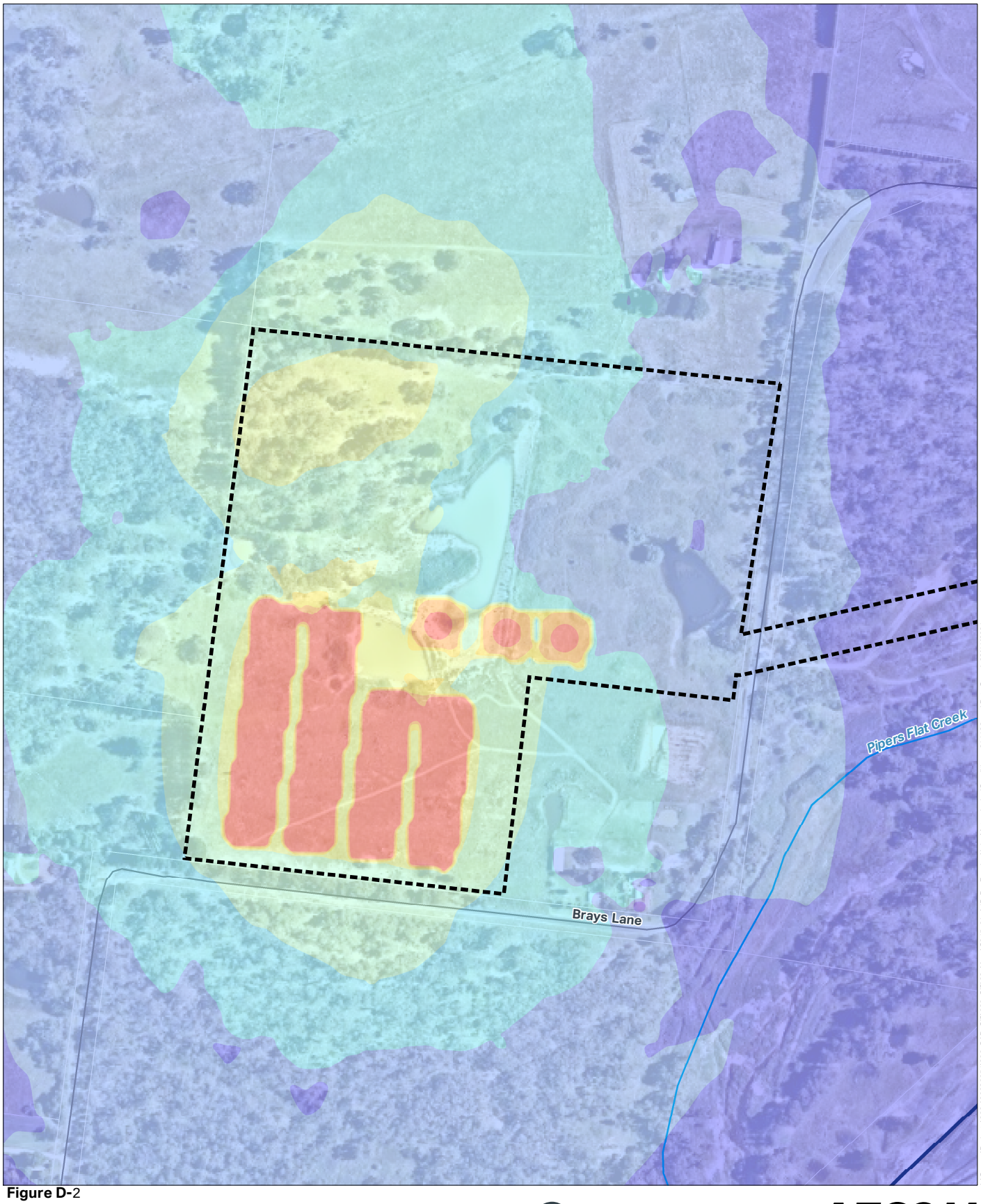


Figure D-2

Operational Scenario: Day/Evening - Noise Enhancing Meteorological Conditions

Legend

- Project Area
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- >65

N

0 75 150 m

AECOM

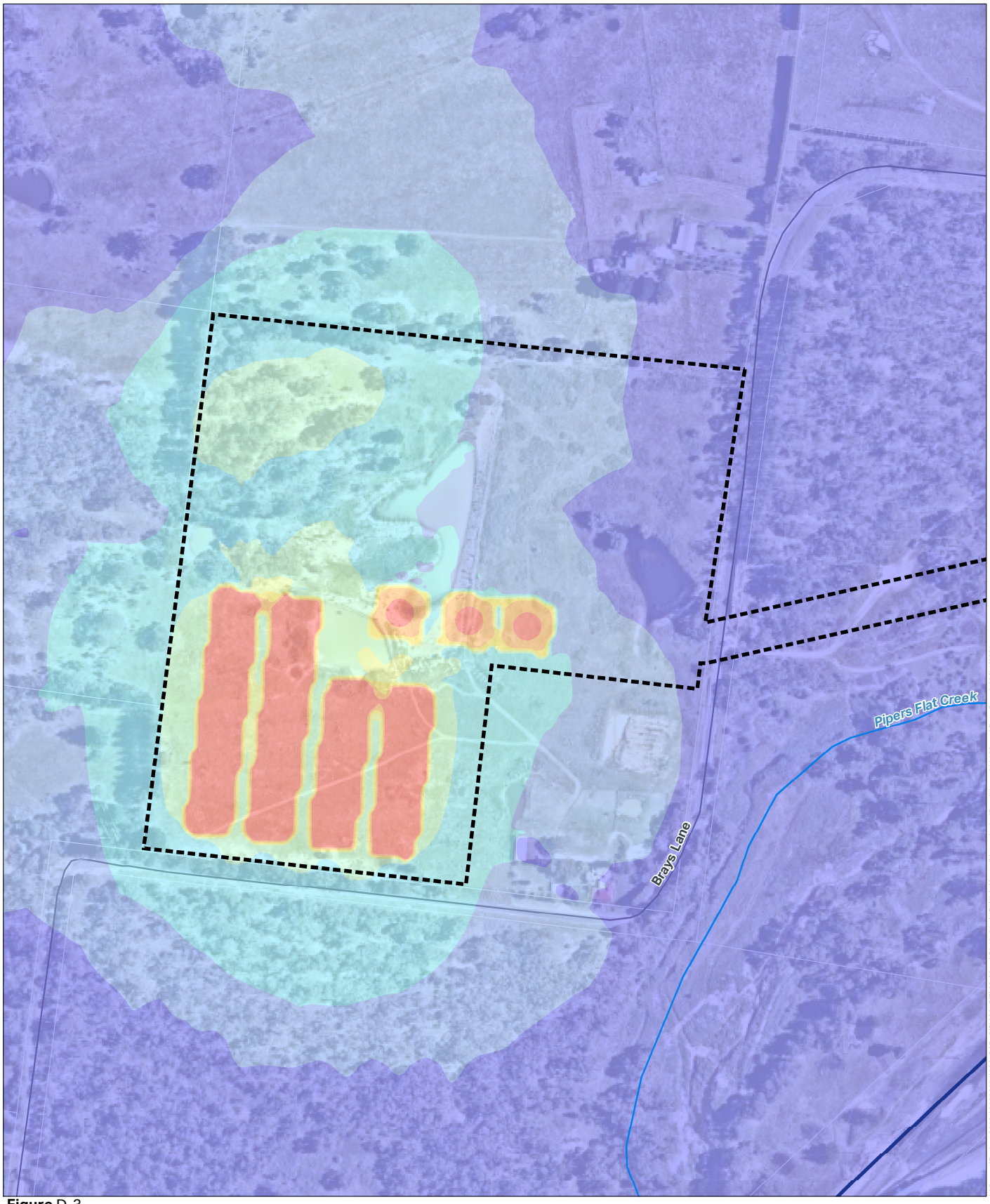


Figure D-3

Operational Scenario: Night - Neutral Meteorological Conditions

Legend

- Project
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- >65

N 0 75 150 m

AECOM

Source: Imagery © Nearmap, 2020.

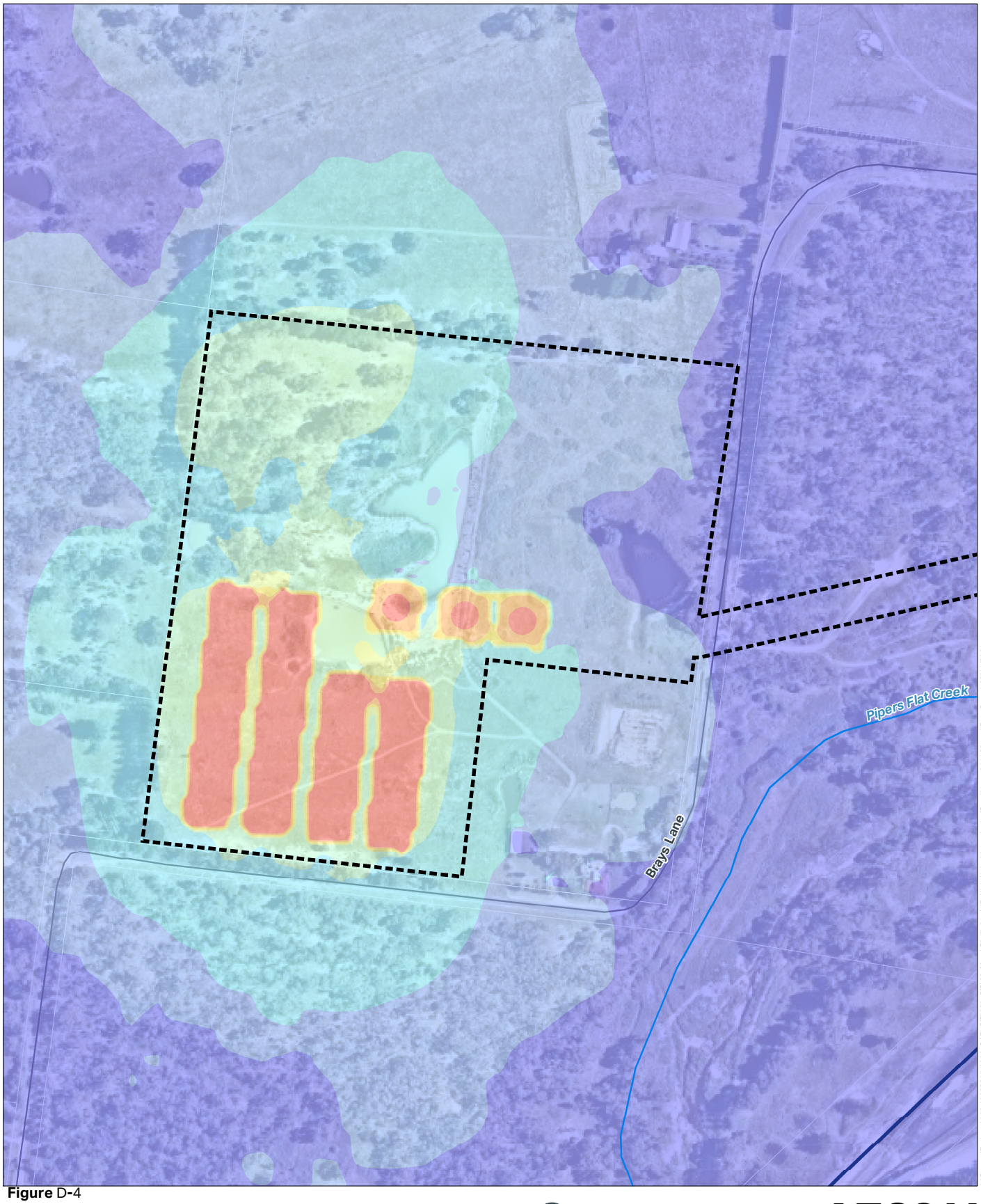


Figure D-4

Operational Scenario: Night - Noise Enhancing Meteorological Conditions

N 0 75 150 m

AECOM

Legend

- Project Area
- Watercourse
- Local Road
- Railway

Predicted $L_{eq\ 15\ min}$ dB(A) Noise Levels

- <35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- >65

Source: Imagery © Nearmap, 2020.