

PROJECT ATLAS DATA CENTRE

Noise and Vibration Impact Assessment

30 March 2026

Goodman Property Services (Aust) Pty Ltd

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Address:	The Hayesbery, 1 11 Hayes Road, Rosebery NSW 2018 Australia
Attention:	Athena Vercoe

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1 Introduction

1.1 Overview and purpose of report

This noise and vibration impact assessment (NVIA) has been prepared by Renzo Tonin & Associates (RTA), for Goodman Property Services (Aust) Pty Ltd (Goodman), to accompany a State Significant Development Application (SSD) 101067971 for the construction and ongoing operation of a data centre facility and associated Offsite Enabling Infrastructure (OEI) at 10 Roberts Road, Eastern Creek within in the Blacktown Local Government Area ("LGA"). The site is legally described as Lot 553 in Deposited Plan 1110447.

This report assesses noise and vibration impacts during the construction and operational phases of the Proposal. It proposes mitigation and management measures to reduce impacts during the construction and operational phases of the Proposal. The report has been prepared to address the requirements of the Secretary of the Department of Planning, Housing and Infrastructure (DPHI) ('the Secretary's environmental assessment requirements') (SEARs).

The noise and vibration assessment has been carried out in accordance with the policies, guidelines and standards presented in Section 1.4 of this report addressing construction noise and vibration and operational noise, respectively.

This report has been prepared by suitably qualified and experienced acoustic engineers. Engineers involved in the preparation and review of the report are of member grade of the Australian Acoustical Society (AAS), are appropriately experienced acoustic engineers employed by a firm being a member of the Association of Australasian Acoustic Consultants (AAAC) and have extensive experience in environmental acoustics.

1.2 Secretary's environmental assessment requirements

The Department of Planning, Housing and Infrastructure (DPHI) issued Secretary's environmental assessment requirements for the Proposal dated 16 January 2026. These requirements are addressed in this report, as outlined in Table 1-1.

Table 1-1: Secretary's environmental assessment requirements – Noise and vibration

Secretary's environmental assessment requirements	Where addressed
Noise and vibration	
a quantitative noise and vibration impact assessment (construction and operation) undertaken by a suitably qualified acoustic consultant in accordance with the relevant Environment Protection Authority guidelines and Australian Standards which includes:	This noise and vibration impact assessment report
details of noise monitoring surveys and background noise levels at the most-affected residential and aged care receivers	Section 2 - Receivers - Nearby noise and vibration sensitive receivers Section 3 – Noise monitoring and existing noise environment and noise levels
establishment of suitable project noise trigger levels at all nearby sensitive receivers	Section 2 - Receivers - Nearby noise and vibration sensitive receivers Section 5.1.3 – Project noise trigger levels
identification of realistic assessment scenarios for both construction and operation of the development (including potential impacts associated with traffic generation)	Operations Section 8.1 – Noise generating operations Section 8.2 - Noise source inventory and operational noise source details Section 8.4.4 - 'Worst case' noise emission scenarios (including testing of any back-up power system) Section 8.4.4 - Operational noise emission modelled assessment scenarios (including testing of any back-up power system) Section 8.7 – Operational road traffic noise assessment Construction stages Section 7 – Construction noise and vibration assessments Section 7.2 - Construction sources, activities and assessment scenarios
details of manufacturer specifications for plant and equipment and an associated noise source inventory for each scenario (demonstrating worst-case modelling of plant and equipment)	Section 8.2 - Noise source inventory and operational noise source details APPENDIX C - Manufacturer data for noise inventory plant and equipment
evidence, including data-derived justification from direct measurements of comparable operational data centres or analysis of equipment noise-cycling, demonstrating that the +3dB correction factor used to convert $L_{Aeq,period}$ to $L_{Aeq,15min}$ is applicable and appropriately accounts for continuous noise from the development	Section 5.1.2.2 – Project amenity noise levels and review of the appropriateness and applicability the +3dB correction factor used to convert $L_{Aeq,period}$ to $L_{Aeq,15min}$
an assessment of all 'worst case' noise emission scenarios (including testing of any back-up power system and a critical power failure scenario), supported by:	Section 8.2 - Noise source inventory and operational noise source details Section 8.4.4 - 'Worst case' noise emission scenarios (including testing of any back-up power system)

Secretary's environmental assessment requirements	Where addressed
noise contour maps and a detailed sleep disturbance assessment.	APPENDIX E – Noise contours Section 8.5.4 - Sleep disturbance assessment
a cumulative impact assessment inclusive of impacts from other proposed and approved developments in adjoining areas (including, but not limited to, other data centre developments in the vicinity of the site)	Section 5.1.4 – Cumulative criteria Section 7.3.3 - Cumulative construction noise Section 8.5 – Assessment of operational predictions, against cumulative criteria
if operation of the development is staged, an assessment of each stage in isolation to accurately represent the predicted noise impacts of each stage.	Section 7.3.1 – Construction noise predictions, including predictions from all construction stages Section 8.5 – Operational predictions, including predictions from all progressive stages
consideration of annoying characteristics of noise (including, but not limited to, low frequency noise) and prevailing meteorological conditions in the study area	Section 8.4.3 - Meteorological factors Section 8.5.2 - Annoying characteristics
details and analysis of the effectiveness of proposed 'feasible and reasonable' management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration impacts following application of these mitigation measures and details of any proposed compliance monitoring programs.	Section 8.3 - Initial assessment outcomes and Proposal acoustic mitigation and management measures review Section 8.5 – Operational noise predictions, inclusive of 'feasible and reasonable' management and mitigation measures Section 8.6 - Operational noise management
if required, a road noise assessment in accordance with the NSW Road Noise Policy	Section 8.7 – Operational road traffic noise assessment
NSW EPA's Recommended Secretary's Environmental Assessment Requirements	
Operational and construction activities on the premises that maybe considered vibration intensive should be assessed using the guidelines contained in the Assessing Vibration: a technical guideline (DEC, 2006)	Section 7 – Construction noise and vibration assessments
Operational noise from noise intensive activities to be undertaken on the premises should be assessed using the guidelines contained in the NSW Noise Policy for Industry (EPA, 2017)	Section 5.1 – NPfl operational noise objectives Section 5.1.3 – Project noise trigger levels Section 8.1 – Noise generating operations Section 8.2 - Noise source inventory and operational noise source details Section 8.4.4 - 'Worst case' noise emission scenarios (including testing of any back-up power system) Section 8.4.4 - Operational noise emission modelled assessment scenarios (including testing of any back-up power system)
If applicable, noise on public roads from increased road traffic generated by land use developments other than road projects should be assessed using the guidelines contained in the NSW Road Noise Policy (EPA, 2011) and associated application notes	Section 8.7 – Operational road traffic noise assessment
Airport Safeguarding	
including a risk assessment of the proposed development on the Western Sydney Airport operations and addressing related matters in the State Environmental Planning Policy (Western Parkland City) 2021 and the National Airports Safeguarding Framework and associated guidelines, including consideration of wildlife hazards.	Section 6 - Aircraft noise

1.3 Proposal overview

1.3.1 Proposal description

The Proposal is proposed for development under a State Significant Development Application (SSDA) as a data centre facility with associated offsite enabling infrastructure. The Proposal will include:

- Site preparation works including demolition, bulk excavation and removal of existing structures on the site, tree and vegetation clearing and bulk earthworks.
- Construction, fit-out and 24/7 operation of a Data Centre
- Offsite enabling infrastructure
- 2 Data Centre Buildings
 - Building 1 – 2 Level and rooftop plant
 - Building 2 – 3 Level and rooftop plant and associated plantrooms
- Ancillary office, EOT and amenity
- Provision of required utilities including:
 - diesel storage tanks
 - water tanks
 - substation on site
- Vehicle access for 20m articulated vehicles (semi-trailers)
- Associated landscaping and site servicing
- Installation of site services and drainage infrastructure

The overall Proposal plan is presented in Figure 1-1 and Figure 1-2

Figure 1-1: Proposal site context (Grimshaw, Project 25124, Rev A, 26/02/2026)

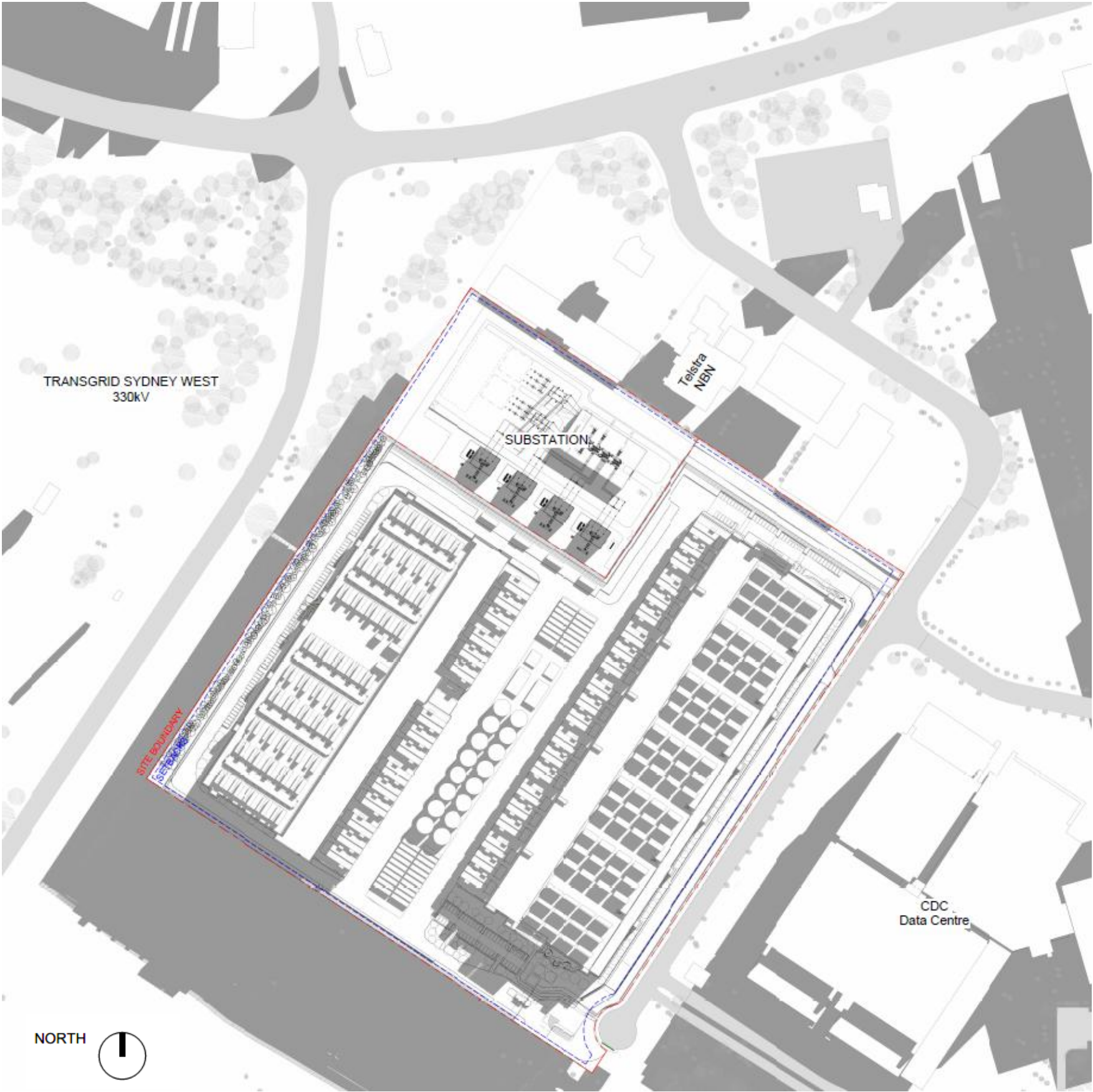


Figure 1-2: Proposal overall site plan (Grimshaw, Project 25124, Rev A, 26/02/2026)

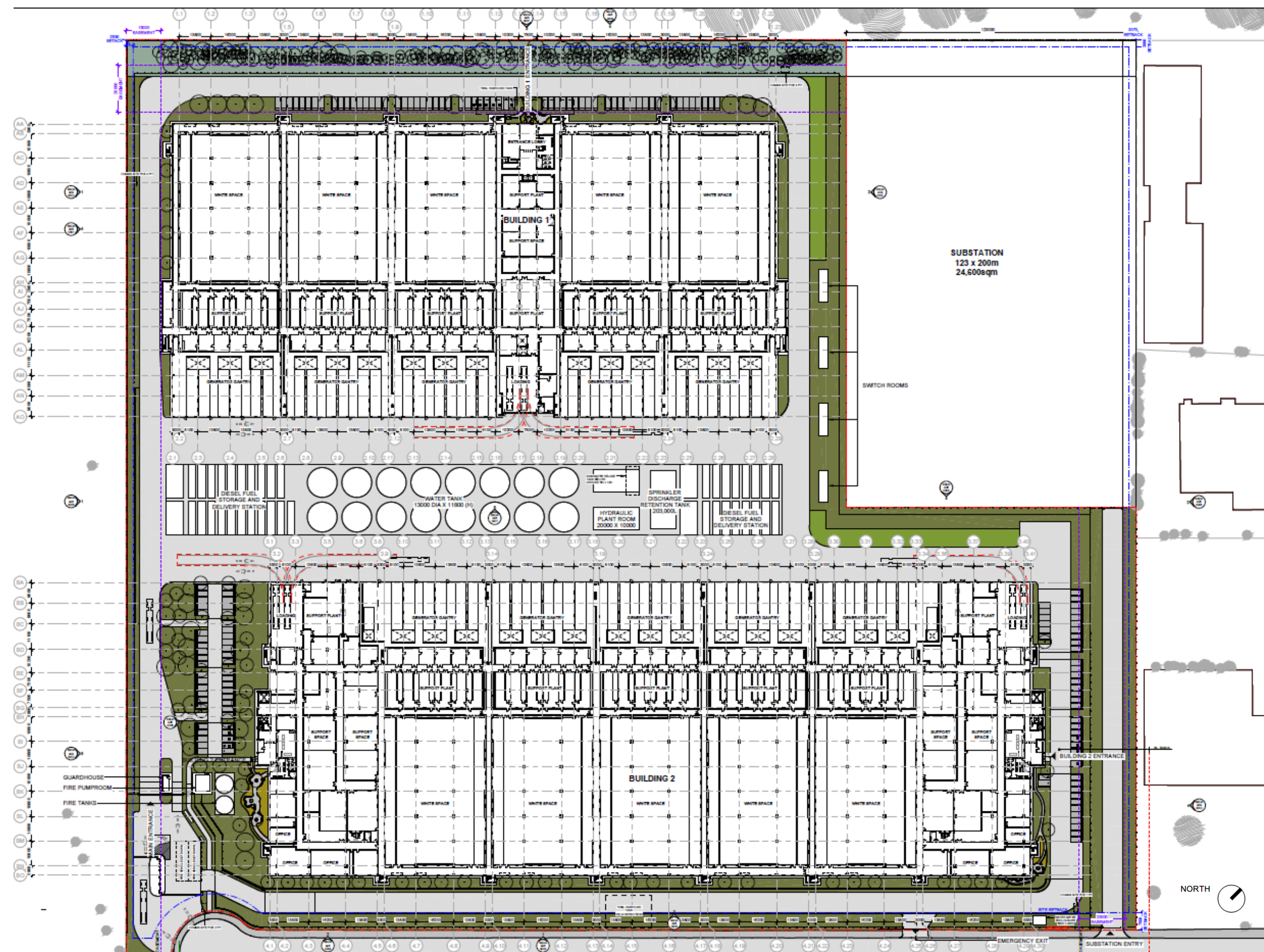
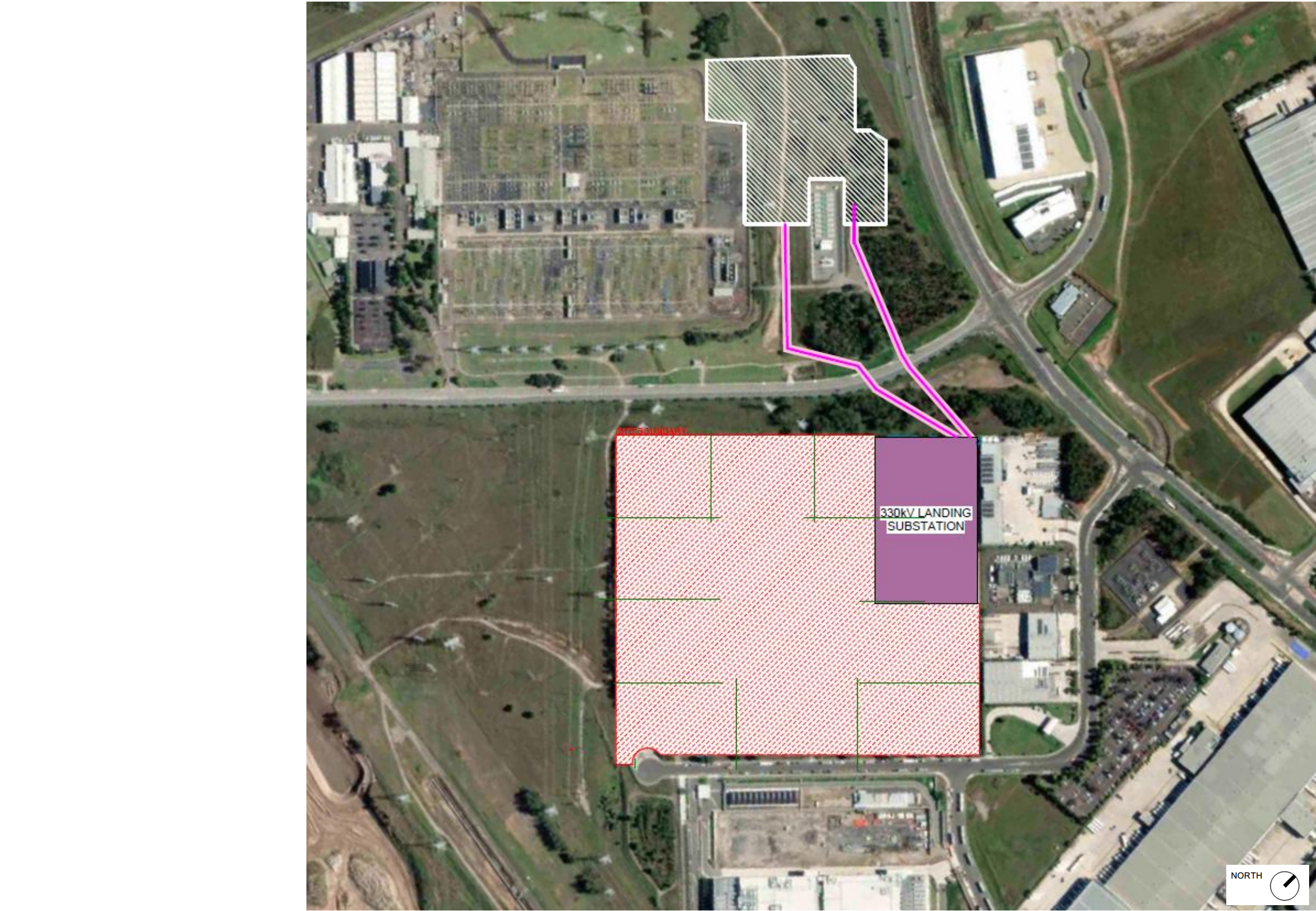


Figure 1-3: Proposal offsite infrastructure plan (Grimshaw, Project 25124, Rev A, 26/02/2026). Note: The final alignment for offsite enabling infrastructure works is subject to change, following coordination with Lumea (TransGrid).



1.3.2 Proposal hours

The Proposal hours of operation are to be 24 hours, 7 days per week.

1.3.3 Proposal location and context

The proposed Data Centre is located at 10 Roberts Road, Eastern Creek, legally referred to as Lot 553 DP1110447 with Offsite Enabling Infrastructure (OEI) proposed across Lot 21 DP1246626, Lot 20 DP1157491, and Lot 22 DP1246626 to connect to TransGrid's Sydney West Substation & Switchyard (refer to Figure 1 below). The site is located on Country of the Dharug people within the local government area of Blacktown.

The Data Centre site has a land area of approximately 168,574m².

The site is identified as part of the Eastern Creek Precinct Stage 3 within the Western Sydney Employment Area. It is located approximately 35km of the Sydney Central Business District (CBD) and 5.1 km from Rooty Hill Train Station.

The site has a site area of approximately 17 hectares and is bounded by industrial development and has a primary frontage of 400m to Roberts Road. The existing site contains an industrial warehouse and surrounding hard-stand areas. The site is shown in identified in Figure 1-4.

Figure 1-4: Proposal location



1.4 Assessment objectives

The assessment objectives are to determine the potential levels of noise and vibration at sensitive receivers located near the Proposal and determine the levels of mitigation that would be required to enable compliance with the current NSW requirements.

As part of preparing this assessment, the following policies, guidelines, and standards have been considered:

- *NSW Noise Policy for Industry (NPfI)* (EPA 2017)
- *NSW Road Noise Policy (RNP)* (DECCW 2011)
- *NSW Interim Construction Noise Guideline (ICNG)* (DECC 2009)
- *NSW Assessing Vibration – A Technical Guideline (AVTG)* (DEC 2006)
- *NSW Environmental Criteria for Road Traffic Noise (ECRTN)* (EPA 1999)
- *NSW Approved methods for measurement and analysis of environmental noise in NSW (NSW Approved Methods)* (EPA, 2022)
- *Australian Standard AS 1055:2018 Acoustics—Description and measurement of environmental noise*

1.5 Acoustic terms & quality

This report is technical in nature and uses acoustic terminology throughout. A summary and explanation of the common acoustic terms that have been used in this report is presented in APPENDIX A Section A.1. Some of the key acoustic concepts used in this report are outlined in APPENDIX A Section A.3.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 Nearby noise and vibration sensitive receivers

2.1 Site and surrounding land use

The Proposal site is identified as part of the Eastern Creek Precinct Stage 3 within the Western Sydney Employment Area. It is located approximately 35km of the Sydney Central Business District (CBD).

The Proposal site is bounded by industrial development and has a primary frontage of 400m to Roberts Road. The existing site contains an industrial warehouse and surrounding hard-stand areas.

Surrounding land uses in the vicinity include:

- North and Northeast: A range of mixed-use industry & commercial buildings including the current Coles NDC and an NBN data centre. Within this area is the Little Graces Childcare Centre. Beyond these, and north of the Western Motorway is the residential area of Minchinbury, approximately 2.5 kilometres from the Proposal.
- Southeast: The CDC Data Centre complex with an associated substation
- West: The Sydney west substation and switchyard currently owned and operated by Transgrid, and the Sydney Metro Precast facility. Beyond these, to the west is the residential area of Erskine Park, approximately 2 kilometres from the Proposal.
- South: Commercial and industrial developments in varying stages of delivery, ranging from fully operational to near completion and under development. Beyond these, to the south is the residential area of Horsley Park, approximately 1 kilometre from the Proposal.

The site is zoned IN1 General Industrial within Chapter 2 Western Sydney Employment Area of State environmental Planning Policy (Industry and Employment) 2021 (IESEPP). The proposal is permissible with development consent in the IN1 zone as per the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP).

Figure 2-1 shows the location of the Proposal, the nearby noise sensitive receivers and the land uses near the Proposal.

Given the large number of nearby receivers, the residential receivers have been grouped into noise catchment areas, and a set of representative receiver locations have been selected and are presented in Figure 2-1 to assess the potential worst case receiver locations.

2.2 Noise catchment areas

As the existing acoustic environment varies at the nearby residential receivers, these residential receivers have been grouped into Noise Catchment Areas (NCAs) based upon areas with similar acoustic environments, and similar grouping of receivers considering when impacts may occur.

The nearby residences have been divided into three NCAs, generally described as the following:

- NCA1 – Residences south and southeast of the proposal in Horsley Park, west of the M7
- NCA2 – Residences west of the Proposal in Erskine Park, north of Lenore Drive
- NCA3 – Residences north of the Proposal in Minchinbury, north of Western Motorway

This has been done to logically group the receivers to assist with the assessment and allocate the appropriate project noise trigger levels or management levels to each receiver. The locations of these noise catchment area boundaries are also shown in Figure 2-1.

2.3 Representative receivers

To assess to the potentially most affected locations surrounding the Proposal, noise levels have been modelled to a large range of nearby and potentially impacted noise sensitive receivers as shown in Figure 2-1. However, to simplify the reporting of results, only the results from critical locations are included based upon the noise levels at receivers with the highest predicted noise levels. For many receiver locations (eg. childcare, industrial etc) there are multiple buildings or assessment points considered, and the assessment is based upon the highest predicted noise levels.

As per Section 2.2, groups of residential receivers have been grouped into NCAs based on their acoustic environment. NCAs are presented in Table 2-1 and Figure 2-1.

Representative receivers from the following groups have been identified for assessment purposes:

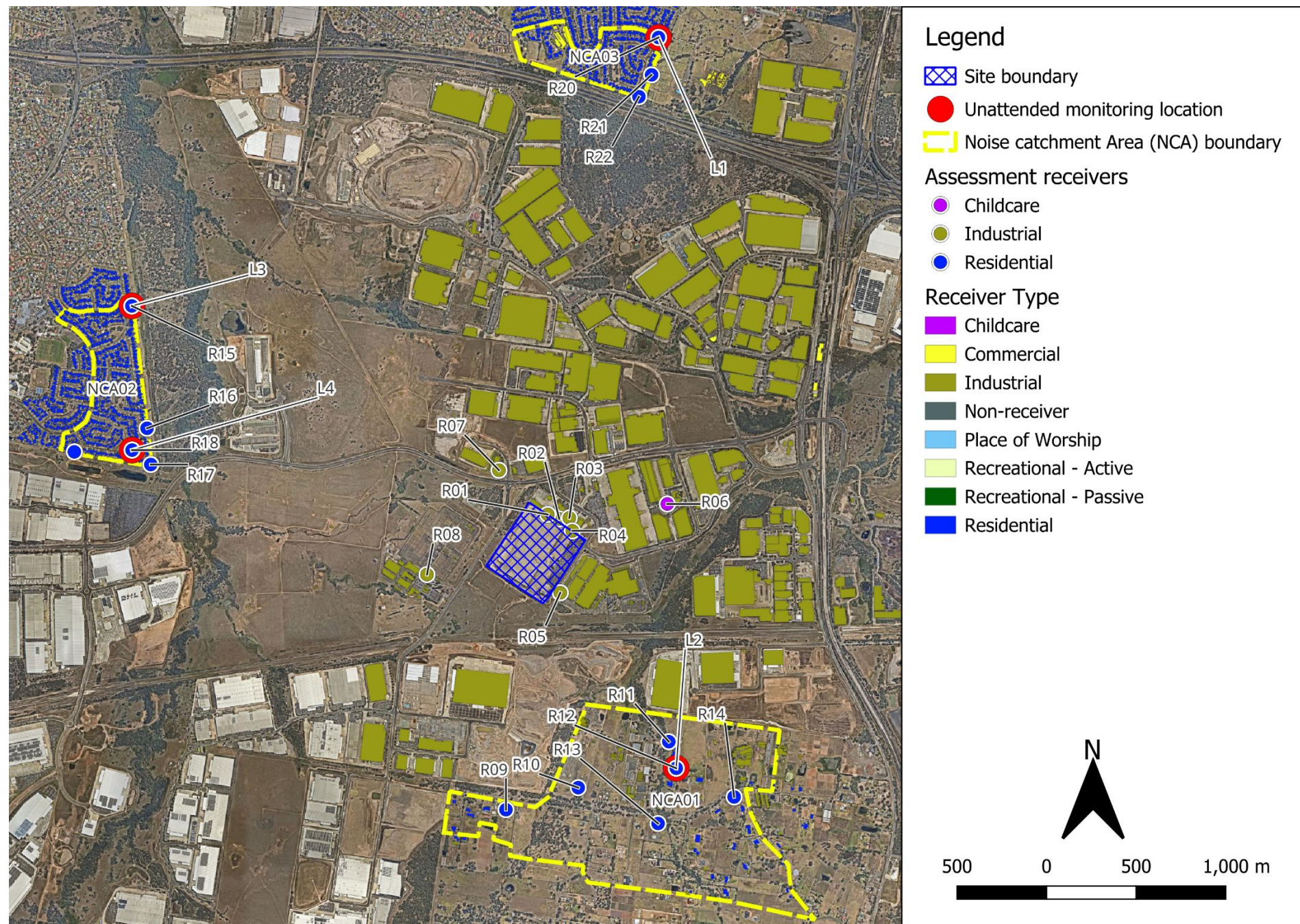
- **Residences** – Three residential NCA have been established, as per Section 2.2, with the receivers with the highest predicted noise levels along with a sample of representative locations included in the assessment reporting.
- **Childcare** – There is one childcare centre located nearby within the Eastern Creek Precinct Stage 3, The location is shielded by the industrial development on 3 Roberts Road from the Proposal. This childcare includes an outdoor play area on the northern sides of the facility.
- **Commercial and industrial receivers** – As the site is located within the Eastern Creek Precinct Stage 3, several commercial and industrial premises are located around the site on Roberts Road and Old Wallgrove Road.

The locations of the representative receiver are detailed in Table 2-1 and Figure 2-1.

Table 2-1: Representative receiver locations

Residential noise catchment area (NCA)	Receiver reference	Address	Receiver type	Approximate distance to the Proposal, metres ¹
-	R01	2/4 Roberts Rd, Eastern Creek ²	Industrial	Adjacent
-	R02	6 Roberts Rd, Eastern Creek ²	Industrial	Adjacent
-	R03	8 Roberts Rd, Eastern Creek ²	Industrial	Adjacent
-	R04	10A Roberts Rd, Eastern Creek ²	Industrial	Adjacent
-	R05	CDC Data Centre Campus, Eastern ² Creek	Industrial	Adjacent
-	R06	Little Graces Childcare Centre	Childcare centre	500
-	R07	1 Telopea Pl, Eastern Creek ²	Industrial	250
-	R08	200 Old Wallgrove Rd, Eastern Creek ²	Industrial	330
NCA1	R09	257 Burley Road, Horsley Park	Residential	1,170
NCA1	R10	188-196 Burley Road, Horsley Park	Residential	1,050
NCA1	R11	144 Burley Road, Horsley Park	Residential	1,050
NCA1	R12	142 Burley Rd, Horsley Park	Residential	1,140
NCA1	R13	131-141 Burley Road, Horsley Park	Residential	1,390
NCA1	R14	223-231 Walworth Road, Horsley Park	Residential	1,520
NCA2	R15	11 Sennar Rd, Erskine Park	Residential	2,460
NCA2	R16	68B Weaver St, Erskine Park	Residential	2,080
NCA2	R17	5 Cetus Pl, Erskine Park	Residential	1,950
NCA2	R18	69 Weaver St Erskine Park	Residential	2,080
NCA2	R19	118 Weaver St, Erskine Park	Residential	2,380
NCA3	R20	2 Farrington St, Minchinbury	Residential	2,840
NCA3	R21	17A Farrington St, Minchinbury	Residential	2,630
NCA3	R22	31 Farrington St, Minchinbury	Residential	2,500

- Notes:
1. Approximate distance from Proposal Boundary to closest receiver assessment location/building, as per Figure 2-1. It should be noted that a calibrated 3D noise model has been prepared for the Proposal to determine predicted noise levels. The distances in the table are provided for summary information only and have not been relied upon for the noise assessment.
 2. Receivers have been considered to be located at the worst-case location within the site boundary. The NPfI assessment point is reasonable most affected location, and would consider aspects such as if receivers are expected to be impacted at the assessment location. If further review of detailed impacts is required further review of the appropriate reasonable most affected location with consideration of the actual use of the facility.

Figure 2-1: Site location, assessment noise sensitive receivers, land uses and NCAs (Imagery: *Nearmap, December 2025*)

3 Existing noise environment and noise monitoring

Criteria for the assessment of operational and construction noise are usually derived from the existing noise environment of an area, excluding noise from the subject development.

As the noise environment of an area almost always varies over time, background and ambient noise levels need to be determined for the operational times of the proposed development. Background noise varies over the course of any 24-hour period, typically from a minimum at 3:00am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPfI) (EPA 2017) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. Fact Sheet B of the NPfI outlines the methods for determining the background noise level of an area.

The typical time periods in accordance with the NPfI are as follows:

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

3.1 Environmental noise monitoring

3.1.1 Existing noise environment - unattended noise monitoring

Fact Sheet B of the NSW EPA NPfI outlines two methods for determining the background noise level of an area, being '*B1 – Determining background noise using long-term noise measurements*' and '*B2 – Determining background noise using short-term noise measurements*'. This assessment has used long-term noise monitoring to determine background noise levels, supported by short-term noise measurements. The noise monitoring location is presented in Figure 2-1.

Noise measurements are ideally carried out at the nearest or most potentially affected locations surrounding a development in absence of noise from the subject site. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out. As such, noise catchment areas have been established to group assessment receivers based on areas with similar acoustic characteristics.

Unattended long-term noise monitoring was carried to measure ambient and background noise levels. The noise monitoring was conducted during May and June 2025.

Long-term noise monitoring was conducted in general accordance with Fact Sheet B of the NSW EPA NPfI. The noise level-vs-time graphs of the data are included in APPENDIX B.

Long-term noise monitoring was conducted using the instrumentation presented in Table 3-1. The equipment used for noise measurements were NTi Audio Type XL2 precision sound level analysers which are a Class 1 instruments having accuracy suitable for field and laboratory use. All instrumentation complies with IEC 61672 (parts 1-3) '*Electroacoustics – Sound Level Meters*' and IEC 60942 '*Electroacoustics – Sound calibrators*' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

The equipment calibration was field checked prior and after the measurement period using a Bruel & Kjaer Type 4231 calibrator, with no significant calibration drift observed. All noise monitoring locations were undertaken in the free field, and representative of the ambient noise environment for the associated residential receivers.

Table 3-1: Unattended noise monitoring equipment

Reference location	Address	Location	Serial number (Internal logger reference)	Monitoring period	Last calibrated
L1	2 Farrington Street, Minchinbury	Backyard	RTA07-043	29/05/2025 – 17/06/2025	28/02/2024
L2	142 Burley Road, Horsley Park	Front yard	RTA07-050	27/05/2025 – 13/06/2025	5/05/2025
L3	11 Sennar Road, Erskine Park	Backyard	RTA07-ATP01	29/05/2025 – 17/06/2025	30/04/2024
L4	69 Weaver Street, Erskine Park	Backyard	RTA07-ATP02	03/06/2025 – 17/06/2025	27/08/2024

The locations of the unattended long-term noise monitoring are presented in Figure 2-1. Descriptions of the unattended noise monitoring locations and observed noise environment at the noise monitoring locations is summarised in the Table 3-2 below.

Table 3-2: Unattended noise monitoring locations

Reference location	Address and location description	Observed noise environment	Justification for monitoring at this location
L1	2 Farrington Street, Minchinbury	Background controlled by the Western Motorway to the south (approximately 50-51 dB(A)). Ambient noise environment controlled by Western Motorway Road traffic noise, natural noises (birds etc.) and traffic passes on Farrington Street.	As the background noise levels at Minchinbury residences is dominated by the road traffic noise from the Western Motorway and Great Western Highway, and traffic noise levels can vary across the suburb, the monitoring location was selected at a location likely to have minimum traffic levels while also being unobstructed in the direction of the Proposal site, in order for the monitoring location to be representative of the potentially worst affected Minchinbury residential locations.
L2	142 Burley Road, Horsley Park	Background by the M7 to the east (approximately 43 dB(A) L_{AF}). Ambient noise environment had contributions from intermittent construction noise to the west and industrial noise from the north, and general natural noise sources (ie. bird calls)	This location was selected as it was within the closest residential properties to the Proposal site, while also at a location expected to be least impacted by existing industrial noise while also being exposed to similar levels of road traffic noise to the rest of the noise catchment, and so representative of the potentially worst affected Horsley Park residences.

Reference location	Address and location description	Observed noise environment	Justification for monitoring at this location
L3	11 Sennar Road, Erskine Park	Background noise controlled by traffic on Lenore Drive (approximately 40-41 dB(A) L_{AF}). Ambient noise had contributions from neighbourhood noises (ie. dogs barking and bird calls) in the vicinity of the monitoring location.	Two locations within Erskine Park were monitored, because of the proximity of Lenore Drive to the south-east corner of Erskine Park, which would result in varying levels of road traffic noise at residences along the eastern side of Erskine Park, meanwhile these residences are all at similar distances from the Proposal. As such, the lowest monitored levels of the two locations were then adopted for the assessment as a conservative approach to represent the potentially worst affected Erskine Park residences.
L4	69 Weaver Street, Erskine Park	Background noise controlled by traffic on Lenore Drive (approximately 48-50 dB(A) L_{AF}). Ambient noise had contributions from neighbourhood noises (ie. dogs barking and bird calls) in the vicinity of the monitoring location.	

A summary of the unattended noise monitoring results along with a graphical recorded output from the long-term noise monitoring is included in APPENDIX B. The graphs in APPENDIX B were analysed to determine an assessment background level (ABL) for each day, evening and night period in each 24-hour period of noise monitoring. Based on the median of individual ABLs an overall single Rating Background Level (RBL) for the day, evening and night period is determined over the entire monitoring period in accordance with the NPfI.

Noise measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the measurement data in accordance with the NPfI, based on data provided by the nearest Bureau of Meteorology (BOM) station, which was the Horsley Park weather station (Station 67119) approximately 4.1 km from the Proposal site. This station is considered representative of the noise monitoring locations in accordance with the NPfI. The long-term noise monitoring data was reviewed and all extraneous noise events (e.g. nearby local noise events and extraneous meteorological conditions) that were identified as not a usual feature of the area, were excluded as shown by the 'greyed' out areas of the graphs presented in APPENDIX B of this report.

3.1.2 Monitoring outcomes

The monitored existing ambient and background noise levels measured are presented Table 3-3 below. This table shows results measured at Locations 1 to 4, relevant to the potentially impacted receiver locations.

Table 3-3: Measured existing background and ambient noise levels, dB(A)

Ref	Applicable NCA	Monitoring address	Rating background noise levels (RBL), L_{A90} , 15 minute			Ambient noise levels ⁴ L_{Aeq} , 15 minute		
			Day ¹	Eve ²	Night ³	Day ¹	Eve ²	Night ³
L1	NCA03	2 Farrington Street, Minchinbury	45	47	42	58	57	53
L2	NCA01	142 Burley Road, Horsley Park	39	37	35	51	44	43
L3	NCA02	11 Sennar Road, Erskine Park	38	38	38	52	44	45
L4		69 Weaver Street, Erskine Park	40	43	42	53	52	51

Ref	Applicable NCA	Monitoring address	Rating background noise levels (RBL), L _{A90} , 15 minute			Ambient noise levels ⁴ L _{Aeq} , 15 minute		
			Day ¹	Eve ²	Night ³	Day ¹	Eve ²	Night ³

Notes:

1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Saturday and 10.00pm to 8.00am Sundays & Public Holidays
4. As required by the NPfI, the external ambient noise levels presented are free-field noise levels. [ie. no facade reflection]

4 Construction noise and vibration objectives

4.1 Construction noise objectives

4.1.1 Construction hours

4.1.1.1 Standard construction hours

The NSW *Interim Construction Noise Guideline* (DECCW, 2009) (ICNG) establishes standard construction hours, which are:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm on Saturday
- No work performed on Sunday and Public Holidays.

Whilst the standard construction hours are not mandatory, limiting construction works to within standard construction hours as much as practicable assists in managing noise or vibration impact by limiting potentially noisy and vibration causing activities to the daytime, when background noise levels are higher, and by providing respite from construction noise and vibration during the evening, overnight, and on weekends.

4.1.1.2 Works outside of standard construction hours

Where construction works cannot be undertaken during the ICNG standard construction hours, they would be subject to a separate approval process or approval pathway. The ICNG identifies that there are five categories of work that typically may be required to be carried out outside of the standard construction hours:

1. The **delivery of oversized plant or structures** that police or other authorities determine require special arrangements to transport along public roads
2. **Emergency work** to avoid imminent injury or the loss of life or damage to property, or to prevent environmental harm
3. **Maintenance and repair of public infrastructure** where disruption to essential services and/or considerations of worker safety do not allow work within standard construction hours
4. **Public infrastructure works** that shorten the length of the project and are supported by the affected community
5. Works where a proponent demonstrates and justifies a **need to operate outside the recommended standard construction hours**.

In the last two categories, the proponent should provide the relevant authority with clear justification for reasons other than convenience, such as to sustain operational integrity of road, rail and utility networks.

This report proposes some construction activities outside of standard construction hours (OOH) where they have been identified as required at this early planning stage. As such, this report addresses in Section 7.2.2 the reasons as to why these works are required to take place outside of standard construction hours for the Proposal. As required by the ICNG, along with the reasons as to why these works are required OOH, feasible and reasonable mitigation and management measures have been identified for consideration during future planning stages to be implemented during construction where feasible and reasonable.

However, during further construction planning, where other out of hours construction works (OOHW) are identified as being required, the proposed construction works may require an assessment of potential noise and/or vibration impacts, and the identification of feasible and reasonable mitigation and management measures that would be implemented as part of the construction works to manage potential noise and vibration impacts on nearby sensitive receivers.

If this is the case, the ICNG noise management levels that should be adopted for that assessment for the Proposal are presented in Section 4.1.5.

4.1.2 Noise management levels (NMLs)

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.
- Application of reasonable and feasible noise mitigation measures.
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.
- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods described for the assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration and involves the measurement and prediction of noise levels and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification. Given the scale and duration of the construction works proposed, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 4-1 reproduced from the ICNG, sets out the airborne noise management levels and how they are to be applied for residential receivers.

Table 4-1: Noise management levels at residential receivers

Time of day	Management level $L_{Aeq} (15 \text{ min})^*$	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm 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 $L_{Aeq} (15 \text{ min})$ 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: - times identified by the community when they are less sensitive to noise (such as before/ after school for works near schools, or mid-morning or mid-afternoon for works near residences) - 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 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see ICNG section 7.2.2.

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

4.1.3 Sleep disturbance

The ICNG recommends that where construction works are planned to extend over more than two consecutive nights, maximum noise levels and the extent and frequency of maximum noise level events exceeding the RBL should be considered.

In line with the ICNG, further guidance is taken from the NSW *Road Noise Policy (Department of Climate Change and Water, 2011) (RNP)*, as this document has superseded the NSW *Environmental Criteria for Road Traffic Noise (ECRTN)* (Environment Protection Authority 1999), in a similar manner to the EPA NPfI Section 2.5. The potential for both sleep disturbance and awakenings should be considered in the assessment.

To assess the likelihood of sleep disturbance, an initial screening level of $L_{Amax} < L_{A90(15min)} + 15 \text{ dB(A)}$ is used. This is an external noise level, while receivers will be located inside when there is potential for sleep disturbance impacts.

When considering awakening reactions, the RNP includes a review of internal sleep arousal research and concluded that:

- L_{Amax} (the maximum A-weighted noise level) internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep (corresponding to approximately 60–65 dB(A) external noise level with an open window)
- One or two noise events per night, with maximum internal noise levels of 65–70 dB(A) (corresponding to approximately 75–80 dB(A) external noise level assuming an open window), are not likely to affect health and wellbeing substantially.

Typically, when considering internal noise impacts using a conservative 10 dB(A) reduction from external noise levels to internal noise levels is assumed considering an open window in line with the ICNG, which is not always the case and could be greater especially in the case that the receivers have a closed windows/facade. Sealed facades or facades with windows closed can provide external to internal noise reductions much greater than 10 dB(A). Noise reductions greater than 20–25 dB(A) is achievable where facades consist of standard to thick glazing and heavy facade construction (eg. brick construction).

Where noise events are found to exceed the initial screening level, further analysis is then made to identify:

- The likely number, nature, distribution and frequency of events above the screening level that might occur during the night assessment period.
- Whether events exceed an 'awakening reaction' level of 55 dB(A) L_{Amax} (internal) (that equates to an external NML of L_{Amax} 75 dB(A), assuming closed windows).

4.1.4 Non-residential receiver construction noise management levels

Table 4-2 sets out the ICNG noise management levels for other noise sensitive receiver locations.

Table 4-2: Noise management levels at other noise sensitive land uses

Land use	Time of day	Where objective applies	Management level L_{Aeq} (15 min)
Classrooms at schools and other educational institutions	When in use	Indoor noise level	45 dB(A)
		Outdoor noise level ₁	55 dB(A)
Hospital wards and operating theatres	When in use	Indoor noise level	45 dB(A)
		Outdoor noise level ₁	55 dB(A)
Places of worship	When in use	Indoor noise level	45 dB(A)
		Outdoor noise level ₁	55 dB(A)
Active recreation areas	When in use	Outdoor noise level	65 dB(A)
Passive recreation areas	When in use	Outdoor noise level	60 dB(A)
Commercial premises	When in use	Outdoor noise level	70 dB(A)
Industrial	When in use	Outdoor noise level	75 dB(A)

Notes: 1. Outdoor noise level based on internal noise level in ICNG and assumes 10 dB loss through an open window

4.1.5 Summary of construction noise management levels

Table 4-3 presents the construction noise management levels established for the nearest noise sensitive residential receivers based upon the noise monitoring outlined in Section 3. The assessment locations and nearby sensitive receivers for the construction assessment are identified in Figure 2-1.

Table 4-3: Construction noise management levels

NCA	Receiver type	Noise management level $L_{Aeq(15min)}^1$				Sleep disturbance screening level (Night), $L_{Amax}^{4,7}$
		Standard construction hours	Outside standard construction hours			
			Day (OOHW)	Evening	Night	
NCA01	Residential	49	44	42	40	52 ⁵
NCA02	Residential	48	43	43	43	53
NCA03	Residential	55	50	50 ⁸	47	57
All	Childcare	55 ^{2,6}				n/a
All	Commercial	70 ²				n/a
All	Industrial	75 ²				n/a

- Notes:
- Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.
 - Noise management levels apply when receiver is in use.
 - External noise management level. A conversion from internal to external assumes 10dB(A) loss from outside to inside through open window.
 - Noise management level applies at the facade of the dwelling
 - Sleep disturbance screening level is RBL plus 15 dB or L_{AFmax} 52 dB(A), whichever is the greater consistent with the NPfI Section 2.5 guidance for maximum noise levels assessments.
 - External noise management level. An external screening level of 55 dB(A) is adopted for assessing childcare centres, based upon the recommended external and internal noise levels in the Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustics Assessment (2020), and assuming an equivalent external noise goals based upon a 20 dB loss from outside to inside with doors and/or windows closed. This considers the centre has sleeping areas.
 - Awakening reaction noise levels as per the NSW RNP of 65 dB(A) L_{Amax} is then assessed if noise events are above the screening level as per Section 4.1.3.
 - The measured (actual) Evening RBL value was 47 dB(A), which is greater than the measured Day RBL. As per the NPfI Section 2.3, if Evening RBL > Day RBL, then Day RBL has been used for assessment purposes

4.2 Construction vibration objectives

Construction vibration is associated with three main types of impact:

- disturbance to building occupants
- potential damage to buildings, and
- potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The International System of Units (SI unit) for distance is the metre (m), although common industrial standards include mm.
- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is metres per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x , y , and z) then the resultant PPV is the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.
- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is metres per second squared (m/s²). Construction vibration goals are summarised below.

The vibration objectives identified in this report are identified to appropriately minimise potential construction vibration impacts to nearby receivers and receiver structures. The vibration objectives are not set to prevent or mitigate impacts from other ground and/or structural aspects which are outside the discipline and responsibility of the acoustic consultant (ie. ground movement, settling, subsidence, etc).

Construction vibration goals are summarised below.

4.2.1 Disturbance to buildings occupants

The acceptable vibration values to assess the potential for human annoyance from vibration are set out in the NSW '*Environmental Noise Management Assessing Vibration: A Technical Guideline*' (AVTG).

To assess the potential for vibration impact on human comfort, an initial screening test will be done based on peak velocity units, as this metric is also used for the cosmetic damage vibration assessment. The screening test is based on the continuous vibration velocity (i.e. vibration that continues uninterrupted for a defined period). If the predicted vibration exceeds the initial screening test, the total estimated Vibration Dose Value (i.e. eVDV) will be determined based on the level and duration of the vibration event causing exceedance. The initial screening test values and VDV's recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected, are presented in Table 4-4. The 'Low probability of adverse comment eVDV' represent the preferred and maximum value presented in the AVTG.

Table 4-4: Vibration management levels for disturbance to building occupants

Place and Time	Initial screening test Velocity, PEAK, mm/s (>8Hz)	Low probability of adverse comment eVDV m/s ^{1.75}	Adverse comment possible eVDV m/s ^{1.75}	Adverse comment probable eVDV m/s ^{1.75}
Critical areas (day or night) ¹	0.28	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Residential buildings 16 hr day ²	0.56	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night ²	0.40	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Offices, schools, educational institutions and places of worship (day or night)	1.10	0.4 to 0.8	0.8 to 1.6	1.6 to 2.4
Workshops (day or night)	2.20	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above

Daytime is 7am to 10pm and night-time is 10pm to 7am

4.2.2 Cosmetic damage to building structures

Potential structural damage of buildings as a result vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard BS 7385 Part 2 and German Standard DIN 4150 Part 3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

It is noted that vibration levels required to cause minor cosmetic damage are typically 10 times higher than levels that will cause disturbance to building occupants. Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures.

BS 7385-2 sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) from BS 7385-2 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 4-5.

Table 4-5: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50

Notes:

1. Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.
2. PPV values increase between specified frequencies as detailed in BS7385-2
3. Values referred to are at the base of the building, as per Section 6.3 of BS7385-2

BS 7385-2 states that the guide values in Table 4-5 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 4-5 may need to be reduced by up to 50%.

BS 7385-2 goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 4-5 and major damage to a building structure may occur at values greater than four (4) times the tabulated values.

4.2.2.1 Heritage structures and items

Heritage items are considered on a case by case basis, and care should be taken as these structures can be difficult to repair in the case of damage. It should be noted that British Standard BS 5228-2:2009 states that '*a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive*' (p.39) when compared to other structures.

Where a structure is found to have defects, or is structurally unsound following an inspection, maximum vibration criteria are to be established for that specific structure for works to not further damage the structure. As stated previously, German Standard DIN 4150 - Part 3 (2016) '*Vibration in buildings - Effects on Structures*' (DIN 4150-3:2016) provides guidance for structures that are sensitive to vibration (eg. structurally unsound).

A conservative vibration damage screening level of 2.5 mm/s has been adopted as a screening level for heritage structures. This does not necessarily reflect that there would be a vibration impact on the structure if this level is exceeded, instead it is a suitable vibration level that is used as part of the construction vibration management process to trigger further investigation.

Any heritage structure predicted to exceed the screening level would be further investigated during detailed design, and appropriate vibration criteria for the structure adopted.

The general approach to manage potential vibration impacts on heritage items would be to:

1. Identify heritage items where the 2.5 mm/s peak component particle velocity objective may be exceeded during specific construction activities
2. Carry out a structural engineering report on identified heritage items, to confirm structural integrity of the building and confirm if item is 'structurally sound'
3. **Where the item is confirmed as 'structurally sound'**, adopt the recommended screening vibration level from the structural engineer, which may be adopting the appropriate level from BS7385 Part 2 with additional consideration for frequency or other recommended vibration management limit, or
4. **Where the item is confirmed as 'structurally unsound'**, adopt the vibration limits presented in DIN 4150-3: (2016) Table 1 Line 3 with additional consideration for frequency.

4.2.2.2 Vibration damage to buildings screening criteria

In accordance with BS 7385-2 and DIN 4150-3, a conservative vibration damage screening level (peak component particle velocity) per receiver type is outlined below:

The limits presented in Table 4-5 above relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Conservatively it is assumed that dynamic magnification due to resonance could occur, and so the guide values in Table 4-5 have been reduced by up to 50 percent to establish the below vibration screening criteria.

On this basis, consistent a conservative vibration screening criteria per receiver type is given below:

- Reinforced or framed structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s
- Heritage structures (if structurally unsound): 2.5 mm/s.

These levels do not necessarily reflect that there would be a vibration impact on the structure if this level is exceeded but are established as suitable vibration levels to be used as part of the construction vibration management process to trigger further investigation.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable vibration limit to manage the vibration intensive works.

4.2.3 Damage to vibration sensitive equipment

Some high technology manufacturing facilities, hospitals and laboratories utilise equipment that is highly sensitive and susceptible to vibration, for example scanning electron microscopes and micro-

electronic manufacturing facilities. In addition, buildings housing sensitive computer or telecommunications equipment may require assessment against stricter criteria than those nominated for building damage.

This is also important to consider for this project, noting that that construction will take place adjacent to operational data centre buildings which will potentially include vibration sensitive equipment. As such, potential impacts should be considered.

There is no explicit guidance on acceptable vibration levels for such equipment, so recommended vibration levels should be obtained from instrument manufacturers. In the absence of equipment specific data provided by manufacturers, there are generic vibration criteria that can be used to assess the impact of vibration generating activities on buildings housing vibration sensitive equipment. For example, the Vibration Criteria (VC) curves are often referred to as they are generic and apply to all tools/ equipment types within each category. The VC curves are defined over the frequency range 8 to 100 Hz.

Table 4-6 below summarises a range of suitable and conservatively stringent vibration limits that are applicable to buildings housing vibration sensitive equipment which may potentially be affected by construction vibration. The suitability of specific limits should be assessed considering the vibration sensitive equipment potentially impacted on a site specific basis.

Table 4-6: Acceptable vibration limits for vibration measured on building structure housing sensitive equipment

Equipment Requirements	Vibration Limit ¹ mm/s,		Description of Use ³
	RMS ⁴	Peak ⁵	
Computer Areas ²	0.7	1.0	Barely perceptible vibration. Adequate for computer equipment accommodation environments.
Medical ^{2, 3}	0.1	0.14	Vibration not perceptible. Suitable in most instances for microscopes to 100X and for other equipment of low sensitivity.
VC-A ³	0.05	0.07	Vibration not perceptible. Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc

Notes: 1. As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz. Vibration measured on the building structure near vibrating equipment or in areas containing sensitive equipment.
 2. Based on AS 2834 Computer Accommodation
 3. Gordon CG Generic Vibration Criteria for Vibration Sensitive Equipment
 4. Root Mean Square value representing the average value of a signal
 5. In the absence of Peak limits, RMS limits are converted to Peak by conservatively assuming the vibration signal is sinusoidal and random with a nominal crest factor of 1.414

4.2.4 Damage to buried services

Section 5.3 of DIN 4150-3:2016 also sets out guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework. These values, which apply at the wall of the pipe, are reproduced and presented in Table 4-7 below.

Table 4-7: DIN 4150-3:2016 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Vitrified clay, concrete, reinforced concrete, prestressed concrete, metal (with or without flange)	80
3	Masonry, plastics	50

For long-term vibration the guideline levels presented in Table 4-7 should be halved.

Recommended vibration goals for electrical cables and telecommunication services such as fibre optic cables range from between 50 mm/s and 100 mm/s. It is noted however that although the cables may sustain these vibration levels, the services they are connected to, such as transformers and switch blocks, may not.

5 Operational noise objectives

5.1 NSW EPA Noise Policy for Industry

This assessment aims to quantify the potential operational noise emissions from the Proposal in accordance with the NPfI. The assessment procedure has two components:

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

In accordance with the NPfI, noise impact should be assessed against the project noise trigger level which is the lower value of the project intrusiveness noise levels and project amenity noise levels, as a $L_{Aeq,15min}$ noise level.

5.1.1 Intrusive noise levels

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). The project intrusiveness noise level, which is only applicable to residential receivers, is determined as follows:

$$L_{Aeq,15minute} \text{ Intrusiveness noise level} = \text{Rating Background Level ('RBL')} \text{ plus } 5 \text{ dB(A)}$$

For the purposes of assessing operational noise impacts, rating background noise levels representative of the nearby affected residential receivers were described and presented in Section 3.1.1. The intrusiveness noise levels for residential receivers are reproduced in Table 5-1.

Table 5-1: Intrusiveness noise levels

NCA	Adopted monitoring location	Intrusiveness noise level, $L_{Aeq,15min}$		
		Day ¹	Evening ²	Night ³
NCA01	142 Burley Road, Horsley Park	39 + 5 = 44	37 + 5 = 42	35 + 5 = 40
NCA02	11 Sennar Road, Erskine Park ⁵	38 + 5 = 43	38 + 5 = 43	38 + 5 = 43
NCA03	2 Farrington Street, Minchinbury	45 + 5 = 50	45 ⁶ + 5 = 50	42 + 5 = 47

- Notes:
1. Day: 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays
 2. Evening: 6:00pm to 10:00pm Monday to Sunday & Public Holidays
 3. Night: 10:00pm to 7:00am Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays
 4. Consistent with Section 2.3 of the NPfI, the project intrusiveness noise level for the shoulder is set no greater than for Daytime.
 5. For a conservative assessment, the lowest monitored levels from the two monitoring locations L3 and L4 were adopted for the assessment.
 6. The measured (actual) Evening RBL value was 47 dB(A), which is greater than the measured Day RBL. As per the NPfI Section 2.3, if Evening RBL > Day RBL, then Day RBL has been used for assessment purposes

5.1.2 Amenity noise levels

The project amenity noise levels for different time periods of day are determined in accordance with Section 2.4 of the NPfl. The NPfl recommends amenity noise levels ($L_{Aeq,period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These “recommended amenity noise levels” represent the objective for total industrial noise experienced at a receiver location. However, when assessing a single industrial development and its impact on an area then “project amenity noise levels” apply.

The recommended amenity noise levels applicable for the subject receiver areas are reproduced from the NPfl Table 2.2 in Table 5-2 below.

Table 5-2: Recommended amenity noise levels

Type of receiver	Noise amenity area	Time of day	Recommended amenity noise level, L_{Aeq} , dB(A)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom (internal)	All	Noisiest 1-hour period when in use	35 ⁵
Hospital ward	All		
- Internal		Noisiest 1-hour	35
- External		Noisiest 1-hour	50
Place of worship (internal)	All	When in use	40
Passive recreation (e.g. national park)	All	When in use	50
Active recreation (e.g. school playground,	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	When in use	Add 5 dB(A) to recommended noise amenity area

- Notes:
1. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
 2. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
 3. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
 4. The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated
 5. In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq}(1hr)$

5.1.2.1 Residential amenity categories

NPfI Table 2.2 (presented in Table 5-2) identifies the three primary categories of residential receivers which can be assigned, they are: urban, suburban and rural. Table 2.3 "*Determining which of the residential receiver categories applies*" of the NPfI provides guidance on assigning residential receiver noise categories. Guidance from NSW EPA in the journal *Acoustics Australia (Volume 50, No. 3, September 2022)* (EPA updated amenity guidance) provided clarification on how to use the table to determine the noise amenity category for residential receivers.

It presents the following methodology for determining which of the residential receiver noise categories apply:

1. Determine the planning land use zoning for residential receivers.
2. Adopt the residential receiver category that aligns with the typical planning zoning (column 2 of NPfI Table 2.3).
3. Adopt the ANL that corresponds to the residential receiver category.
4. Variations to the ANL should only be varied with strong justification and having regard to the 'Typical existing background noise levels' (column 3 of NPfI Table 2.3) and 'Description' of the acoustic environment of the receiver' (column 4 of NPfI Table 2.3).
5. Report the derived ANL from land use planning and if applicable the amenity level varied based on Columns 3 and 4 of NPfI Table 2.3.

Following the above approach, the planning land use zoning for nearby residential receivers, is shown in Figure 5-1. The residential receiver category that aligns with the typical planning zoning (column 2 of NPfI Table 2.3) is presented in Table 5-3, along with whether there are any required variations to that residential amenity category for the assessment.

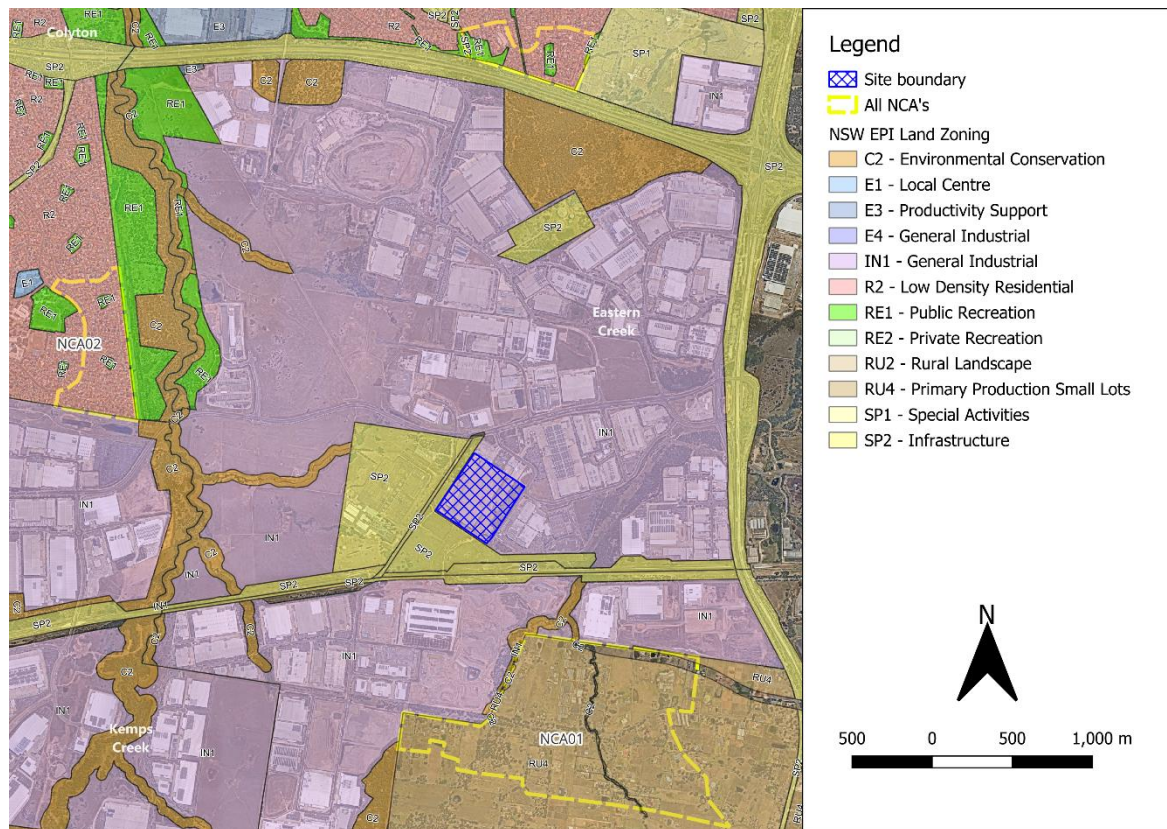
The receivers, zoned R2 (*low density residential*) & RU4 (*Primary production small lots*), are by default classified as 'suburban' and 'rural' respectively. A further detailed review changes to the residential amenity category was not undertaken, as any potential identified adjustments (ie. high traffic noise levels) would not apply to all receivers in the Minchinbury and Erskine Park defined NCAs.

Table 5-3: Review of residential receiver amenity category

NCA	Receiver zoning	Zoning residential receiver category ³	Amenity noise levels			Variation of category suitable and justified	Assessment residential receiver category	Amenity noise levels		
			Day	Eve	Night			Day	Eve	Night
NCA01	RU4 ¹	Rural	50	45	40	No	Rural	50	45	40
NCA02	R2 ²	Suburban	55	45	40	No	Suburban	55	45	40
NCA03	R2 ²	Suburban	55	45	40	No	Suburban	55	45	40

- Notes:
1. RU4 – Primary Production Small lots
 2. R2 – Low Density Residential
 3. Column 2 of NPfI Table 2.3

Figure 5-1 Zoning surrounding proposal site (Imagery: Nearmap, December 2025)



5.1.2.2 Project amenity noise levels

To ensure that the total industrial noise level (existing plus new) remains within the recommended overall amenity noise levels for an area, the project amenity noise level should apply for each new industrial noise development coming into the area.

The recommended amenity noise level from Table 2.2 of the NPfI represents the total industrial noise level from all sources that is sought to be achieved using feasible and reasonable controls. To ensure that the total industrial noise level (existing plus new) remains within the recommended overall amenity noise levels for an area, the approach included in the NPfI is that the project amenity noise level should apply for each new industrial noise source and is determined as follows:

$$L_{Aeq,period} \text{ Project amenity noise level (ANL)} = L_{Aeq,period} \text{ Recommended amenity noise level} - 5 \text{ dB(A)}$$

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level in order to standardise the time periods. This is so that both amenity and intrusiveness noise level descriptors are aligned as $L_{Aeq,15 \text{ minute}}$ levels.

$$L_{Aeq,15minute} = L_{Aeq,period} + 3\text{dB(A)}$$

The SEARs requests “evidence, including data-derived justification from direct measurements of comparable operational data centres or analysis of equipment noise-cycling, demonstrating that the +3dB correction factor used to convert $L_{Aeq,period}$ to $L_{Aeq,15min}$ is applicable and appropriately accounts for continuous noise from the development”.

This data is not readily available. All measurement data from previous other data centre monitoring undertaken by the consultant are in urban/suburban areas with nearby transport noise impacting the ambient environment, which means this data is not appropriate for reviewing data centre site noise variation at receiver locations.

To assist with addressing the SEARs requirement in providing further justification of the appropriateness and applicability of the +3 dB correction factor used to convert $L_{Aeq,period}$ to $L_{Aeq,15min}$ further confirmation was sought from EPA regarding the basis of this conversion. This confirmation was sought to ensure this conversion was applicable and appropriately accounts for continuous noise from the development and is consistent with NSW policy.

It was confirmed by EPA on 30 January 2026, that the PNTL's are target noise levels at a receiver location and so any conversion factor, whether assumed or derived, would take into account all factors including source noise variations and variations from noise propagation factors (e.g. variation in source levels / location, meteorological conditions, etc). As such, it is important to note that any conversion factor is not related to the source alone.

It was confirmed that the current position of the EPA is the application of the NPfI, which includes the 3 dB conversion factor, unless robust evidence for an alternative is provided at the project level. It was also confirmed this was consistent with advice provided by EPA for other similar data centre projects.

Considering the factors identified by EPA, AS1055:2018 'Acoustics – Description and measurement of environmental noise', which is referenced in the project SEARs Attachment 1 - Technical and Policy Guidelines to assist in the preparation of the environmental impact statement was also reviewed. This standard considers steady sound, as a source with variation less than or equal to ± 3 dB(A), and supports a +3 dB correction factor being appropriate when considering the potential variability of steady state source differences that may be experienced between the $L_{Aeq,period}$ to $L_{Aeq,15min}$, with consideration of the source alone.

While for consideration of noise propagation factors (e.g. variation in source levels / location, meteorological conditions, etc), monitoring and quantifying the noise emissions of a data centre over a full assessment period (ie. night period 10pm to 7am) is a very complex and challenging process, as noise emission levels from the facility are typically at or below the ambient noise levels at receiver locations because of approval noise limits. It is for this reason that a combination of methods is often used to satisfy compliance monitoring requirements of such facilities in accordance with NPfI Section 7. Direct measurement of facility noise levels is often not possible, because the at-receiver noise levels will include a range of other noise sources, both steady state (ie. distant road traffic, other industrial sources, etc.), and non-steady sources (ie. distant road traffic, other industrial sources, etc.). As such, suitable data

for reviewing premises specific correction factors is not readily available. It is for this reason that direct data to address the SEARs is not available.

Considering the above, and the confirmation of EPA of the appropriateness and applicability of the +3 dB conversion factor to data centre operational noise emission assessments is in accordance with the NPfI, and that there is not robust evidence for an alternative, a +3 dB correction factor used to convert $L_{Aeq,period}$ to $L_{Aeq,15min}$ is considered appropriate and applicable for this assessment.

Table 5-4: Project amenity noise levels

Type of receiver	Noise amenity area	Time of day ¹	Recommended noise level, dB(A)	
			$L_{Aeq, Period}$	$L_{Aeq, 15min}$
Residence	Suburban	Day	$55 - 5 = 50$	$55 + 3 = 53$
		Evening	$45 - 5 = 40$	$45 + 3 = 43$
		Night	$40 - 5 = 35$	$40 + 3 = 38$
	Rural	Day	$50 - 5 = 45$	$45 + 3 = 48$
		Evening	$45 - 5 = 40$	$45 + 3 = 43$
		Night	$40 - 5 = 35$	$40 + 3 = 38$
Childcare (external) ³	All	When in use	$50^3 - 5 = 45$	$45 + 3 = 48$
Industrial premises ²	All	When in use	$70 - 5 = 65$	$65 + 3 = 68$

Notes:

1. Daytime 7:00am to 6:00pm; Evening 6:00pm to 10:00pm; Night-time 10:00pm to 7:00am. On Sundays and Public Holidays, Daytime 8:00am - 6:00pm; Evening 6:00pm - 10:00 pm; Night-time 10:00pm - 7:00am.
2. Project noise trigger level is only applicable when the receiver type is in use.
3. An external noise goal of 50 dB(A) is adopted for assessing childcare centres, based upon the lower of the different recommended external and internal noise levels in the Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustics Assessment (2020), and assuming an equivalent external noise goal based upon a 10 dB loss from outside to inside with doors and/or windows open for indoor activity areas.

5.1.3 The Eastern Creek Precinct Plan - Stage 3

The Eastern Creek Precinct Plan – Stage 3 outlines the provisions relating to development of the Stage 3 Release Area within the *Eastern Creek Precinct of State Environmental Planning Policy No. 59 – Central Western Sydney Economic and Employment Area (SEPP 59)*. The draft Precinct Plan was adopted by Council on 7 December 2005 and came into force on 14 December 2005. *State Environmental Planning Policy No 59* was repealed as of 2016, with elements then incorporated into the now *State Environmental Planning Policy (Industry and Employment) 2021* (Industry and Employment SEPP). It is noted that as per Industry and Employment SEPP Part 2.3 Section 2.17, the Development Control Plan controls are not mandatory controls for SSD applications but should serve as guidelines to inform and guide development in line with DPHIs expectations. SEPP 59 Section 7.8, which relates to Noise and Vibration is detailed in Table 5-5.

As cumulative industrial noise management is a complex issue, and requires consideration of many site-specific factors, it is important to provide context about how cumulative industrial noise is addressed in accordance with NSW guidelines.

It provides guidance on Noise and Vibration within Section 7.8 of the Precinct Plan, detailed below:

Table 5-5: SEPP 59 Section 7.8 Noise and Vibration

7.8 Noise and Vibration						
<i>Given the nature of development within the Precinct, noise generation from the site is to be restricted to a reasonable level. Noise is to be contained where possible and not unreasonably impact on the operations or amenity of adjoining or surrounding sites.</i> Objectives <i>Ensure that development does not cause adverse environmental impacts from noise and vibration.</i> Controls <i>Development Applications should provide an assessment, and identify necessary mitigation measures, to minimise the potential environmental impacts from noise and vibration generated by the proposed development.</i> <i>Development Applications must comply with relevant Council, and government authority guidelines, to ensure no adverse environmental impacts occur both during and after development of the Precinct.</i> <i>Where appropriate, development may need to be treated to minimise the impact from noise generated both on and off site.</i> <i>Consideration shall be given to:</i> <i>the appropriate spatial arrangement of sensitive land uses.</i> <i>the sensitive location of buildings on lots; and</i> <i>the design of buildings to attenuate noise inside the building.</i> <i>The optimised noise level goals for the Precinct are outlined in Table 5-6. These goals will provide adequate protection to the noise amenity of residential areas surrounding the Precinct without unduly restricting the operation of development.</i>						
Table 5-6 Optimum Noise Level Goals						
Period	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Day	57 dBA	54 dBA	56 dBA	54 dBA	49 dBA	52 dBA
Evening	47 dBA	44 dBA	46 dBA	44 dBA	39 dBA	42 dBA
Night	42 dBA	40 dBA	40dBA	39 dBA	34 dBA	37 dBA

The proposal is located within Zone 6 of the Eastern Creek Precinct Stage 3.

For consideration of derivation of the PNTLs presented in Table 5-7 the following were considered:

- The day, evening and night PNTLs derived under the EPA NPfl are largely consistent with the precinct plan noise goals and are generally similar or lower (more stringent).
- The precinct plan was developed in 2005, more than 20 years ago and predates the NPfl (EPA 2017) which was released in 2017.
- The noise assessment parameters, implementation method and assessment period for which precinct plan noise goals apply is unclear and not stated in the plan.
- The EPA NPfl provides an assessment, compliance and mitigation framework for controlling noise from large industrial precincts with consideration of cumulative industrial noise (see Section 5.1.4).
- This approach is consistent with other SSDA and large industrial projects approved within the *Eastern Creek Precinct Plan – Stage 3* area since the NPfl was released, including other data centres.

5.1.4 Cumulative industrial noise considerations

The management of cumulative operational noise is required by the NPfI. By addressing cumulative noise impacts consistent with the NPfI, this will also sufficiently address cumulative impacts in accordance with the DPHI guideline *"Cumulative Impact Assessment Guidelines for State Significant Projects"* (DPE, 2022) as detailed in Section 3.5 of that document.

As stated in Section 2.1 of the NPfI *"The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses"*. The NPfI amenity noise criteria derived in Section 5.1.2 aims to control the total industrial noise level (existing plus new) with the aim for it to remain within the recommended amenity noise levels for the area. Accordingly, the potential cumulative noise impacts as a result of the development have been considered in the assessment through the derivation of criteria in accordance with the NPfI, and assessment against these levels.

5.1.5 Project noise trigger levels (PNTL)

A summary of all PNTLs for the Proposal are presented in Table 5-7 and these are applicable for cumulative noise emissions. In accordance with the approaches outlined in the previous sections the project noise trigger levels (PNTL) are presented in Table 5-7.

Table 5-7 Summary of project noise trigger levels (PNTL) for Proposal

Receiver location	L _{Aeq, 15min} Project noise trigger levels, dB(A) ⁶		
	Day ¹	Evening ¹	Night ¹
Residential receivers³			
NCA01	44	42	38
NCA02	43	43	38
NCA03	50	43	38
Other receivers²			
Childcare ⁴	48	48 ²	48 ²
Industrial ⁴	68	68 ²	68 ²

- Notes:
1. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
 2. Project noise trigger level is only applicable when the receiver type is in use.
 3. For a residence, the project noise trigger levels are to be assessed at the reasonably most-affected point on or within the residential property boundary, up to 30 metres from the residential dwelling
 4. For industrial premises, the noise level is to be assessed at the reasonably most-affected point on or within the property boundary.
 5. An external noise goal of 48 dB(A) L_{Aeq, 15min} is adopted for assessing childcare centres, based upon the lower of the different recommended external and internal noise levels in the Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustics Assessment (2020), and assuming an equivalent external noise goal based upon a 10 dB loss from outside to inside with doors and/or windows open for indoor activity areas.

5.2 Sleep disturbance noise levels

The potential for sleep disturbance due to maximum noise level events from the Proposal site during the night-time period needs to be considered. In accordance with NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed the following noise trigger levels:

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

Where there are noise events found to exceed the initial screening level, further analysis is undertaken.

The detailed assessment should consider all feasible and reasonable noise mitigation and management measures with a goal of achieving the sleep disturbance noise trigger levels. 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. Some guidance on possible impact is contained in the review of research results in the NSW *Road Noise Policy* (RNP).

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur,
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development
- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response.

In relation to maximum noise level events, the NSW RNP identifies in its summary on sleep disturbance research to date that:

1. *Maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
2. *One or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

The above references identify that internal noise levels of 50 to 55 dB(A), are unlikely to cause awakenings. On the assumption that there is a 10 dB(A) outside-to-inside noise loss through an open window (see Section 2.6 of the NPfI, p15), this indicates that external noise levels of L_{Amax} 60 to 65 dB(A)

are unlikely to cause awakening reactions. Given the equivalent external noise levels and considering the second point above, an L_{Amax} 65 dB(A) has then been used as the assessment noise level to determine the potential for awakening reactions.

In accordance with the NPfl and current scientific literature, the sleep disturbance project assessment noise levels, are presented in Table 5-8 below.

Table 5-8: Sleep disturbance project assessment noise levels

Noise catchment area	Sleep disturbance project assessment noise levels, dB(A) (Night - 10:00pm to 7:00am)		
	EPA NPfl sleep disturbance assessment levels, L_{Amax}	Awakening reaction ¹ , L_{Amax}	EPA NPfl sleep disturbance assessment levels, $L_{Aeq,15min}$
NCA01	52 ³	65	40 ²
NCA02	53	65	43
NCA03	57	65	47

Notes:

1. As per the NSW RNP
2. As per NPfl Section 2.5, minimum screening level is the greater of L_{Aeq} 40 dB(A) or $RBL + 5dB$.
3. As per NPfl Section 2.5, minimum screening level is the greater of L_{AFmax} 52 dB(A) or $RBL + 15dB$.

By achieving the PNTLs for the Proposal presented earlier in this report, the sleep disturbance $L_{Aeq,15min}$ assessment levels presented in the table above will automatically be met, as the PNTLs are equivalent or more stringent. Therefore, no further assessment of sleep disturbance $L_{Aeq,15min}$ levels is necessary.

5.3 Emergency operations

The Proposal will be served by a new 330 kilovolt (kV) substation, located in the northwest corner of the site (Incoming electrical switching station). This substation will be directly fed from the Sydney West Bulk Supply Point Substation (Sydney West BSP) via 2 redundant 330 kV feeders in an N-1 configuration, sized so that the full site load can be accommodated on 1 of the 2 feeders, stepping voltages down to 132 kV via three (3) 330/132 kV transformers. The outgoing transformer supplies are connected to 132 kV Gas-insulated switchgear (GIS) in a breaker-and-a-half configuration allowing for dedicated 132 kV supplies reticulating around site with N-1 redundancy across all development stages of the Proposal. This configuration ensures extremely high availability and reliability for distribution of mains power supply for the site, such that the loss of one redundant utility supply to the site does not trigger any requirement for generators to provide emergency power.

Sydney West BSP is operated by Transgrid and is located approximately 150 metres (m) southwest of the Proposal site. This infrastructure is subject to a Category 2 level of redundancy under NSW Transmission Reliability and Performance Standard (2017) and has a maximum allowable unserved energy (USE) of one (1) minute per year. To understand the likely frequency that the worst-case scenario where all 249 generators operating continuously at 100 % load could occur, the reliability of the power network has been considered against the latest information contained in the Endeavour Energy 2024 Distribution Annual Planning Report (DAPR) (Endeavour Energy, 2024).

Based on the DAPR and associated network reliability statistics, the average unplanned outage duration per year per customer over a 10-year period from financial-year 2013 (2013/14) to financial-year 2023 (2023/24) equated to approximately 82.0 minutes, although exact duration of power outages requiring standby generators cannot be determined. Correspondingly, the likelihood of power interruptions occurring is approximately 0.016 % of the time per year.

This Proposal differs from many other data centre developments, in that a significant level of redundancy is built into the design to ensure that the use of diesel generators is minimised. For example, other data centres may be connected to the electricity supply grid by one feeder only, such that any interruption to that supply would require full deployment of back-up power via diesel generators.

While Section 5.1.3 presents the PNTLs for typical operations, which includes scheduled maintenance testing of emergency plant and equipment, these PNTLs are not considered reasonable for emergency operating conditions outlined above, i.e. the event of a mains feeder failure or regional network failure, and would be considered unreasonable to implement noise treatment due to the extremely rare occurrence of this scenario. Similarly, noting the reliability of the feeders, it would be considered unreasonable to implement further noise treatments for the situation of an unexpected feeder failure due to this extremely rare occurrence of this scenario and minimal required duration that noise would be generated.

Based on the above, the requirement for a feasible and reasonable approach as required by the NPfI, existing regulations, and in absence of any relevant specific NSW guideline for emergency generators, noise limits for emergency operations are not required and have not been proposed.

Predicted noise levels for emergency operations will be presented for information purposes only.

5.4 Road traffic noise

Noise impacts from the potential increases in traffic on the surrounding road network due to construction and operational activities from the Proposal are assessed in accordance with the RNP. The RNP sets out criteria to be applied to types of road and land uses. These noise criteria are to be applied when assessing noise impacts and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

The Proposal will be using sub-arterial / arterial roads and not local roads. Therefore, for existing residences affected by additional traffic on existing sub-arterial / arterial roads generated by land use developments, the following RNP road traffic noise criteria would apply.

Table 5-9: RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L _{Aeq} (15 hour) 60 (external)	L _{Aeq} (9 hour) 55 (external)

Further to the above, the RNP states the following for land use developments generating additional traffic:

“For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use development**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding ‘no build option’.”

The RNP states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

6 Aircraft noise

This section addresses the noise component of the following Proposal SEARs requirement detailed in 1.2:

Airport Safeguarding – including a risk assessment of the proposed development on the Western Sydney Airport operations and addressing related matters in the State Environmental Planning Policy (Western Parkland City) 2021 and the National Airports Safeguarding Framework and associated guidelines, including consideration of wildlife hazards.

The following excerpt has been taken from Section 4.17 of the State Environmental Planning Policy (Western Parkland City) 2021 focusing on noise:

Table 6-1: State Environmental Planning Policy (Western Parkland City) 2021 Section 4.17 aircraft noise requirements

4.17 Aircraft noise
<i>The objectives of this section are—</i> 1) <i>to prevent certain noise sensitive development on land near the Airport, and</i> 2) <i>to minimise the impact of aircraft noise for other noise sensitive development, and</i> 3) <i>to ensure that land use and development near the Airport do not hinder or have other adverse impacts on the ongoing, safe and efficient 24 hours a day operation of the Airport.</i> <i>Development consent must not be granted to noise sensitive development if the development is to be located on land that is in an ANEF or ANEC contour of 20 or greater.</i> <i>Subsection (2) applies despite the following -</i> 1) <i>Part 2, Divisions 7 and 8 of State Environmental Planning Policy (Affordable Rental Housing) 2009,</i> 2) <i>Chapter 3 of State Environmental Planning Policy (Housing for Seniors or People with Disability) 2004,</i> 3) <i>State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017.</i> <i>Despite subsection (2), development consent may be granted to development for the purposes of dwelling houses on land that is in an ANEF or ANEC contour of 20 or greater if (a) immediately before the commencement of this Chapter—</i> 1) <i>there were no dwellings on the land, and</i> 2) <i>development for the purposes of dwelling houses was permitted on the land, and</i> 3) <i>the consent authority is satisfied that the development will meet the indoor design sound levels.</i> <i>Subsection (2) does not apply to development for the purposes of subdivision of land in an ANEF or ANEC con-tour of 20 or greater if the development application was made before 1 October 2020.</i>

As part of the final EIS the detailed modelling of the potential noise impacts for WSI's preliminary flight paths are provided in the Aircraft Overflight Noise Tool which is available at <https://wsiflightpaths.aerlabs.com/>. The tool indicated three Runway preference options, including no preference, a preference for Runway 05, and a preference for Runway 23.

Figure 6-1 shows the proposal does not lie within the ANEC 20 contour and thus would not be impacted by this policy.

**Figure 6-1: Western Sydney International (Nancy-Bird Walton) Airport Aircraft Overflight Noise Tool
(Year 2055) – Preferred 23 direction)**



7 Construction noise and vibration assessment

7.1 Background

Construction activities associated with the proposed development will result in increased noise levels during construction hours. The works undertaken in the various stages consist of a mixture of both high and low noise activities. This assessment identifies potentially noisy activities, their impacts on surrounding receivers and outlines management strategies to control the impacts of noise and vibration during the construction stages of the Proposal.

7.2 Construction noise and vibration activities and assumptions

7.2.1 Construction works and activities

An assessment of the potential level of construction noise and vibration impact has been carried out to determine whether mitigation would be required, and to determine appropriate management controls.

Specific construction equipment requirements are not yet known. The type and number of plant and equipment associated with the proposed works was assumed based upon experience with similar noise assessments. Prior to the commencement of construction, the final construction details should be reviewed against the assumptions in this report to ensure that the mitigation and management measures that will be implemented remain consistent with these assumptions, and appropriate for the Proposal.

Construction for the Proposal is proposed to take place over an approximate 3 year period. The approximate phases and duration of works are presented in Table 7-1. In most cases, multiple construction phases will be occurring concurrently. Additionally, there will be some variations on the phase durations for each of Building 1 and Building 2, with Building 1 to finish construction, fit-out and commissioning earlier than Building 2.

Table 7-1 includes the key construction work areas for each phase of the project proposal construction works. The key areas of construction are shown in Figure 7-1.

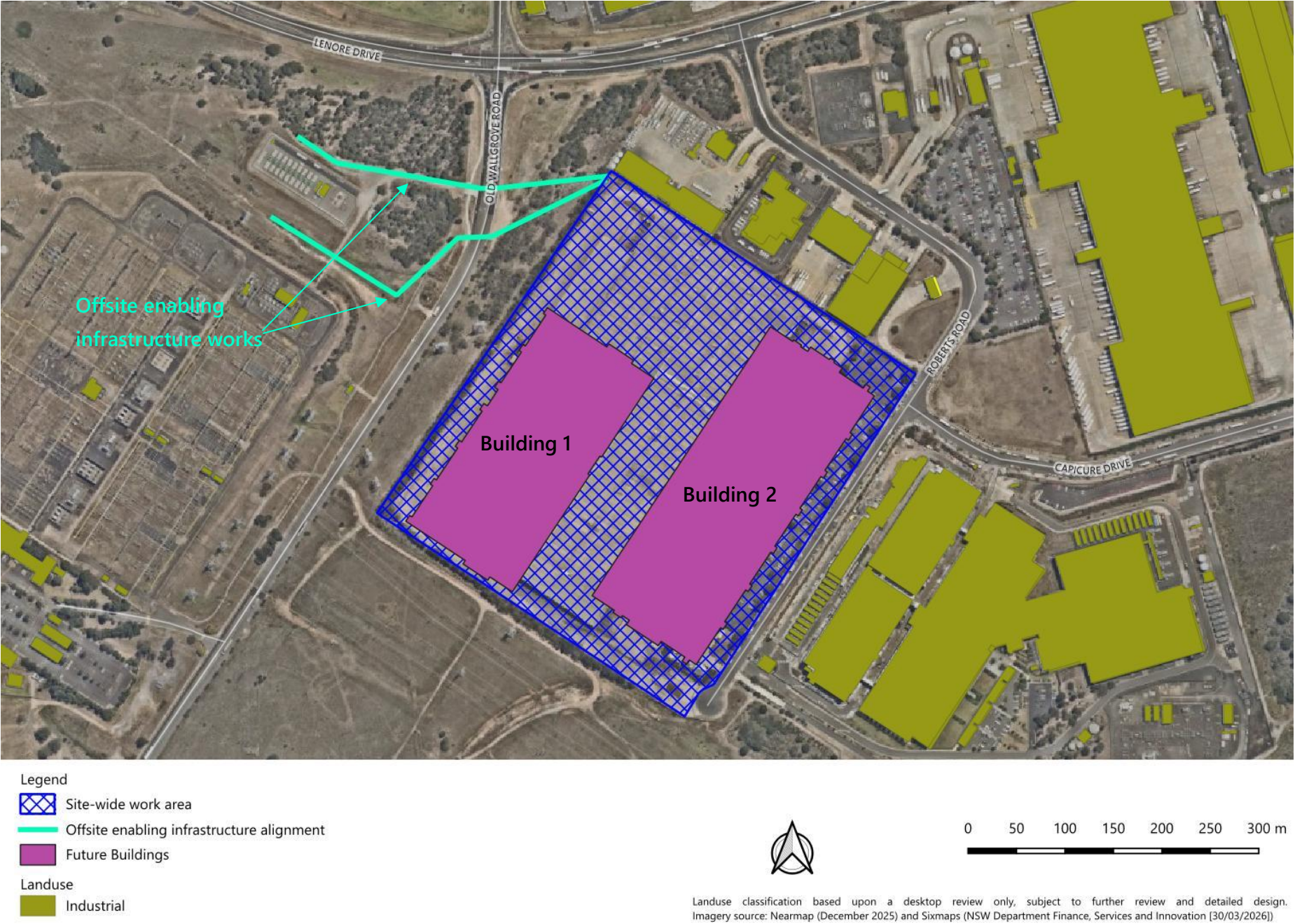
Table 7-1: Approximate construction phases and duration of works

Phase	Construction phase	Work area	Construction activities	Approximate duration ^{1,2,3}
Phase 1	Site establishment and preparation works	Site-wide	- Vegetation removal - Installation of environment controls - Establishment of construction facilities	6 months
Phase 2	Demolition works	Existing building in the site area	Demolition of existing buildings/structures	3 months

Phase	Construction phase	Work area	Construction activities	Approximate duration ^{1,2,3}
Phase 3	Earthworks	Site-wide	- Earthworks - Retaining walls - Ground compaction works	3 months
Phase 4	Civil, utilities and in-ground works	Site wide	- In-ground works - Infrastructure and services works - Surface preparation works - Footings and piling works (bored)	6 months
Phase 5	Building construction works	Future buildings	- Structural works - Construction of the main building structure - Facade construction / installation - In-ground services	12 months
Phase 6	Building fit out	Future buildings	- Installation of services - Fit out	6 months
Phase 7	Offsite enabling infrastructure works	Offsite enabling infrastructure alignment	- Trenching / civil works (approx. 8 months) - Cable installation and termination (approx. 4 months)	12 months
Phase 8	Commissioning, testing and completion works	Site wide	- Facilities and equipment commissioning - Landscaping - External works	2 months

- Notes:
1. In some cases, multiple works will occur during the one possession period. As such there are overlaps between the various works and the approximate duration of possession periods.
 2. Timeframes are indicative and may change.
 3. Timeframes will slightly vary for each of Building 1 and Building 2, with Building 1 to finish construction, fit-out and commissioning earlier than Building 2.

Figure 7-1: Key construction work areas



Note: The final alignment for offsite enabling infrastructure works is subject to change, following coordination with Lumea (TransGrid).

7.2.2 OOH construction works

7.2.2.1 Proposed OOH construction works

As part of the early planning stages, some works have been identified as being required to occur OOH or require contingency time outside of the standard construction hours as part of the expected construction program, although a contractor has not been appointed for the Proposal.

There may be other construction works that are identified as part of further construction planning (eg. requirements for extended concrete pours to extend into the evening or night periods) that would be required to take place during OOHW periods, and so the Proposal also seeks approval for, or an approval pathway or process for these construction works. It is recommended this would be in the form of the project CNVMP including an OOH management procedure or an OOHW protocol so that the required OOH works can be assessed separately when specific construction methods, locations, equipment which are known, so they can be approved separately to the satisfactory to the Planning Secretary.

Presented in Table 7-2 are works have been identified as part of the early planning stages as required to occur OOH (partially or completely) or require contingency time outside of the standard construction hours as part of the expected construction works. Indicative works durations are included, however, at this early planning stage, the required OOH durations are not known.

Table 7-2: Proposed OOH construction works

Proposed OOH construction works	Proposed OOHW periods	Potential OOH duration required
Offsite enabling infrastructure works	OOHW evening period OOHW night period	Works details not known at this stage. To be confirmed, based upon final alignment, final methodology, interaction or interface requirements with road network and utilities, and consultation with TransGrid/Lumea and their requirements.

This assessment is for the approval stage only and the final construction methodology is not known. As a contractor has not been appointed for the Proposal, the final requirements, justifications, works methodology, feasible and reasonable controls and are not confirmed. This will be subject to further construction planning as part of future project stages.

As such, although the identified construction works are expected to be required OOH, there is potential that the nature and duration of these works may change once a contractor is appointed. For this assessment, the proposed OOHW have been identified in a conservative manner with the aim of capturing the likely worst case required OOHW.

As part of further design development, when the specific construction methodology and likely construction equipment are known, the potential construction impacts for the required OOHW are to be assessed in detail through a works specific assessment to determine that they can be feasibly and reasonably managed within the construction noise management levels detailed in Section 4.1.2. This

assessment would identify the specific feasible and reasonable mitigation and management measures that would be implemented are part of the OOHW.

7.2.2.2 Justification for extended and OOHW construction hours

As per the requirements of the ICNG, strong justification is required when proposing to undertake construction works outside of the standard construction hours during the proposed time periods. The reasons that OOHW is required and so is being proposed are as follows:

Table 7-3: Justification for proposing to undertake construction works outside of the standard construction hours

Proposed OOH construction works	Justifications for proposing to undertake construction works outside of the standard construction hours
Offsite enabling infrastructure works	Due to the nature of the construction works, and proximity to the surrounding road networks, including Lenore Drive which is a state road, some works may need to occur after hours. Generally, roadworks will need to occur after hours if: • Carrying the proposed roadworks during standard construction hours would result in a high risk to construction personnel or public safety • The relevant Road Network Operator has advised the licensee in writing that carrying out the works and activities during standard construction hours would result in a high risk to road network operational performance • A relevant utility service operator has advised the licensee in writing that carrying out the works and activities during standard construction hours would result in a high risk to the operation and integrity of the utility network • Road authority refused to issue a road occupancy licence during standard construction hours Additional, due to the interaction with major electrical infrastructure (ie. Sydney West Substation) there may be time restrictions required by the utility providers.

7.2.3 Construction traffic

The worksite will generate additional traffic movements in the form of:

- Light vehicle movements generated by construction personnel travelling to and from work
- Heavy vehicle movements generated by:
 - Delivery vehicles bringing raw materials, plant, and equipment to the site
 - Trucks removing excavated spoil material and construction waste from the site

Construction traffic on the site is included as part of the construction noise assessment of the work activities identified in Section 7.2.1. When construction-related traffic moves on the public road network, a different noise assessment methodology is appropriate as vehicle movements would be regarded as additional road traffic on public roads rather than as part of the construction site's activities.

Based upon input from the project team, it is expected that the traffic activity generated during the construction period could typically be up to 472 movements per day considering both light and heavy vehicles. The majority of these vehicles are expected to be light vehicles.

The majority of the proposed construction traffic would access the site from Old Wallgrove Road/ Lenore Drive. Considering the existing high traffic volumes on the primary potential routes (ie. Lenore Drive) to/from the site presented in Section 8.7, and the expected volumes construction vehicles associated with the project, construction related road traffic noise level is not predicted to increase traffic noise levels by more than 2 dB on the surrounding roads.

Construction related road traffic noise is therefore expected to comply with the requirements of the RNP and is not expected to cause any adverse impacts and is not further addressed in this report.

For the OOHW construction works identified in Section 7.2.2, considering the existing number of heavy vehicles on Lenore Drive presented in Section 8.7, and that the proposed construction works for the Offsite enabling infrastructure works is not expected to require a substantial number of heavy vehicles, the change in traffic noise levels from additional construction vehicles is expected to be less than 2 dB(A) for these construction works and therefore expected to comply with the requirements of the RNP and is not expected to cause any adverse impacts.

7.2.4 Construction noise sources

The schedule of items of plant and equipment likely to be used during the construction phases of the Proposal is presented in Table 7-4 below. This is not a comprehensive list of all potential plant and equipment but covers the key likely plant and equipment items for the approval assessment purposes.

The sound power levels for the majority of construction plant and equipment presented in the above table are based on maximum noise levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', the ICNG, information from past projects and/or information held in the RTA library files.

The noise and vibration impacts from the final plant and equipment adopted by a contractor would be reviewed as part of the CNVMP developed for the Proposal during the construction planning stage.

Table 7-4: Typical construction equipment & sound power levels (L_{Aeq,15min})

Plant item	Estimated number of items	Individual source/activity sound power level ⁴ (L _w re. 1pW), L _{Aeq,15min} , dB(A)
Phase 1 - Site establishment and preparation works		
Tracked excavator with bucket (30t)	1	105
Hand tools	1	107
Elevated work platform (EWP)	1	95
Small truck	4 per hour	104
Franna crane	1	99
Truck with Hiab	1	96
Chainsaw	1	118 ²
Mulcher	1	119 ²
Up to 3 (noisiest) plant operating concurrently	-	122

Plant item	Estimated number of items	Individual source/activity sound power level ⁴ (L _w re. 1pW), L _{Aeq,15min} , dB(A)
Phase 2 - Demolition		
Tracked excavator with bucket (19 tonne)	2	100
Excavator with medium rock hammer (15t)	2	118 ²
Powered hand tool	Multiple	107
Tipper truck	2	104
Hand tools (non-powered)	Multiple	98
Water truck	1	100
Jack hammer	1	113 ²
Truck and dog	2	108
Up to 3 (noisiest) plant operating concurrently	-	121
Phase 3 - Earthworks, cut/fill and excavation works		
Excavator w bucket (25t)	1	105
Hand tools	Multiple	107
Tipper truck	2	104
Hand tools (non-powered)	Various	98
Water cart	1	107
Bulldozer (D8R)	1	116
Compactor	1	108
Grader	1	113
Truck and dog	2	106
Up to 3 (noisiest) plant operating concurrently	-	118
Phase 4 - Civil, utilities and in-ground works		
Excavator with bucket (40t)	1	107
Excavator with bucket (25t)	1	105
Hand tools	Various	107
Tipper truck	2	104
Hand tools (non-powered)	Various	98
Water cart	1	107
Truck and Dog	2	106
Smooth drum roller (13t) - high vibration mode	1	114 ²
Drill rig	1	111
Concrete agitator	1	108
Concrete pump	1	103
Piling rig - bored	1	112
Fibre cable winch	1	86
Generator	1	94
Trowelling machine	1	94
Up to 3 (noisiest) plant operating concurrently	-	117

Plant item	Estimated number of items	Individual source/activity sound power level ⁴ (L _w re. 1pW), L _{Aeq,15min} , dB(A)
Phase 5 - Building construction works		
Tower crane – diesel ²	2	110
Concrete pump	1	103
Concrete agitator	1	108
Mobile crane (300t)	1	105
Truck and dog	2	106
Hand tools	Various	107
Concrete vibrator	4	97
Franna crane	1	99
Elevated work platform	1	95
Telehandler	1	98
Non-powered hand tools	Various	90
Trowelling machine	1	94
Shotcrete pump/compressor	1	104
Compressor	1	100
Hand tool - grout / hand mixer	Various	107
Pump	1	104
Small truck	1	104
Up to 3 (noisiest) plant operating concurrently	-	114
Phase 6 - Building fit out		
Powered hand tools	Various	107
Mobile Crane (300T)	1	105
Delivery truck	Multiple	106
Bobcat	Multiple	107
Elevated work platform	Various	102
Up to 3 (noisiest) plant operating concurrently	-	111
Phase 7 – Offsite enabling infrastructure works³		
Trencher	1	109
Bobcat	1	107
Concrete/Road saw	1	119 ²
Daymaker	1	93
Tracked excavator with bucket (19 tonne)	1	100
Excavator with small rock hammer (5t)	1	117 ²
Generator	1	94
HDD drill rig	1	111 ²
Hand tools (non-powered)	1	98
Dump truck	1	108
Water truck	1	100
Capstan winch (full throttle)	2	99

Plant item	Estimated number of items	Individual source/activity sound power level ⁴ (L_w re. 1pW), $L_{Aeq,15min}$, dB(A)
Plate compactor	3	105
Up to 3 (noisiest) plant operating concurrently (low-impact)	-	114
Up to 3 (noisiest) plant operating concurrently (high impact)	-	122
Phase 8 - Commissioning		
Hand tools	Various	107
Mobile crane (300t)	1	105
Elevated work platform	1	95
Bobcat	2	107
Delivery truck	2 per hour	106
Hand tools (non-powered)	Various	98
Generator	Multiple	104
Up to 3 (noisiest) plant operating concurrently		111

- Notes:
1. In accordance with the ICNG, a 5 dBA 'penalty' is applied for activities identified as particularly annoying, such as rock hammers.
 2. Cranes modelled at 15m above the top of each building in the centre, as final location is not known at this planning stage.
 3. Activities modelled for OOHW
 4. Noise level includes any required annoyance penalty, along with the expected adjustments for typical usage.

As shown in Table 7-4, the offsite enabling infrastructure construction activities are likely to occur during the OOHW night-time period. To assess any exceedances with the L_{AFmax} sleep disturbance criterion, given below in Table 7-5 are the individual source/activity sound power levels for high instantaneous noise events (L_{Amax}) for offsite enabling infrastructure works.

Table 7-5 Typical construction equipment & sound power levels (OOHW) (L_{AFmax})

Plant item	Individual source/activity sound power level (L_w re. 1pW), L_{Amax} , dB(A)
Phase 7 – Offsite enabling infrastructure works	
Trencher	112
Bobcat	110
Concrete/Road saw	122
Daymaker	93
Tracked excavator with bucket (19 tonne)	108
Excavator with small rock hammer (5t)	126
Generator	95
HDD drill rig	116
Hand tools (non-powered)	111
Dump truck	120 ¹
Water truck	120 ¹
Capstan winch (full throttle)	103
Plate compactor	108

- Notes:
1. The sound power level for the trucks is based on the worst case from the air brake release noise. General operations maximum noise levels will be lower.

The sound power levels for construction plant and equipment presented in Table 7-4 and Table 7-5 above are based on maximum noise levels given in Table A1 of Australian Standard 2436 - 2010 '*Guide to Noise Control on Construction, Demolition and Maintenance Sites*', the Interim Construction Noise Guideline (ICNG), information from past projects and/or information held in our library files.

7.3 Construction noise and vibration assessment

7.3.1 Predicted construction noise levels

During the construction phase, noise levels at any receiver location resulting from construction works would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Potential construction noise levels at receivers have been determined by modelling the noise sources representing the proposed typical and noise intensive construction activities and operating times based on the information presented in Section 7.2 to the nearby representative receiver locations. A 5 dB(A) penalty has been factored into the noise modelling levels where applicable to allow for particularly annoying activities, such as excavator with medium rock hammer, as per the ICNG.

Table 7-6 to Table 7-8 present noise levels likely to be experienced at the nearby receiver locations based on the construction activities and plant and equipment associated with the Proposal construction.

Noise levels were calculated taking into consideration attenuation due to distance between the construction works and the receiver locations and any intervening structures. The worst affected receivers are typically the receivers with direct line-of-sight to the construction work area. Receivers located without direct line-of-sight to the construction area would typically be exposed to construction noise levels 5 to 10 dB(A) lower than the levels predicted for the worst affected receivers.

The noise level ranges presented represent the plant item operating at a location furthest (or most acoustically shielded) from the receiver and at the location closest (or highest potential noise level) to the receiver. While in practice, noise generating construction works would occur at different locations throughout the work area, resulting in differing noise levels at each receiver. This means that predicted noise levels are only likely to occur when works are at the closest point to each receiver. The noise impacts may be lower than predicted as the construction activities move around or progress around the construction site, as shown by the lower end of the range. This concept is demonstrated in Figure 7-2 and should be considered when reviewing the predicted noise levels in this assessment.

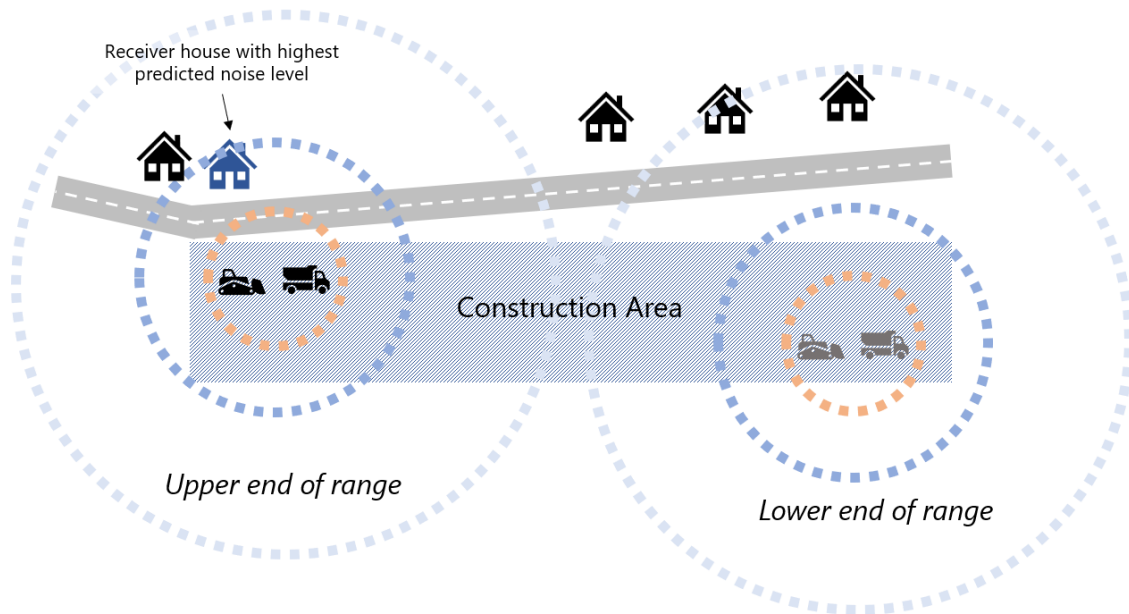
Figure 7-2: Predicted range of construction noise levels

Table 7-6: Day (standard construction hours) – Predicted construction noise levels, dB(A) $L_{Aeq,15min}$ for construction activities

Receiver ID	Predicted L _{Aeq} (15min) construction noise levels, dB(A)																					
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type ^{2,4}	Industrial	Industrial	Industrial	Industrial	Industrial	Childcare centre	Industrial	Industrial	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	-	-	-	-	-	-	-	-	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
NML, dB(A) ¹	75	75	75	75	75	55	75	75	49	49	49	49	49	49	48	48	48	48	48	55	55	55
PHASE 1 – SITE ESTABLISHMENT AND PREPARATION																						
Tracked excavator with bucket (19t)	22 - 71	22 - 66	22 - 60	<20 - 69	<20 - 57	<20	<20 - 39	24 - 35	<20	<20 - 21	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Powered hand tools	29 - 78	29 - 73	29 - 67	27 - 76	23 - 64	<20 - 22	<20 - 46	31 - 43	<20 - 27	<20 - 28	<20 - 30	<20 - 26	<20 - 23	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20
Elevated work platform	24 - 73	24 - 68	24 - 62	22 - 71	<20 - 59	<20	<20 - 41	26 - 38	<20 - 22	<20 - 23	<20 - 25	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Small truck	26 - 75	26 - 70	26 - 64	24 - 73	<20 - 61	<20	<20 - 43	28 - 40	<20 - 24	<20 - 25	<20 - 27	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Franna crane	21 - 70	21 - 65	21 - 59	<20 - 68	<20 - 56	<20	<20 - 38	23 - 35	<20	<20	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Truck with Hiab	<20 - 67	<20 - 62	<20 - 56	<20 - 65	<20 - 53	<20	<20 - 35	20 - 32	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Chainsaw	40 - 89	40 - 84	40 - 78	38 - 87	34 - 75	20 - 33	27 - 57	42 - 53	<20 - 38	23 - 39	<20 - 41	20 - 37	<20 - 34	<20 - 33	<20 - 24	22 - 27	23 - 28	22 - 27	<20 - 24	<20 - 24	<20 - 26	<20 - 30
Mulcher	41 - 91	41 - 85	41 - 79	39 - 88	35 - 76	22 - 34	29 - 58	43 - 55	21 - 39	24 - 40	20 - 42	22 - 38	<20 - 35	20 - 34	21 - 26	23 - 28	24 - 29	23 - 28	21 - 26	<20 - 25	<20 - 27	<20 - 32
Up to 3 (noisiest) plant operating concurrently	44 - 93	44 - 88	44 - 82	41 - 91	37 - 79	24 - 37	31 - 61	46 - 57	23 - 42	27 - 43	23 - 44	24 - 41	22 - 38	23 - 37	23 - 28	26 - 31	27 - 32	26 - 31	24 - 28	<20 - 28	<20 - 30	<20 - 34
PHASE 2 – DEMOLITION																						
Tracked excavator with bucket (19 tonne)	39 - 66	38 - 61	39 - 57	38 - 57	39 - 49	<20 - 24	24 - 38	28 - 35	<20 - 22	<20 - 23	20 - 25	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Excavator with medium rockhammer (15t)	59 - 86	58 - 81	59 - 77	58 - 77	59 - 69	34 - 44	44 - 58	48 - 55	38 - 42	40 - 43	40 - 45	39 - 42	37 - 40	36 - 39	31 - 32	32 - 35	33 - 36	32 - 35	30 - 33	<20 - 31	23 - 34	28 - 39
Powered hand tools	46 - 74	46 - 68	47 - 64	45 - 64	46 - 57	21 - 31	31 - 45	35 - 42	25 - 29	27 - 30	27 - 32	26 - 29	24 - 27	23 - 26	<20	<20 - 22	20 - 23	<20 - 22	<20	<20	<20 - 21	<20 - 26
Tipper truck	43 - 71	43 - 65	44 - 61	42 - 61	43 - 54	<20 - 28	28 - 42	32 - 39	22 - 26	24 - 27	24 - 29	23 - 26	21 - 24	20 - 23	<20	<20	<20	<20	<20	<20	<20	<20 - 23
Hand tools (non-powered)	37 - 65	37 - 59	38 - 55	36 - 55	37 - 48	<20 - 22	22 - 36	26 - 33	<20 - 20	<20 - 21	<20 - 23	<20 - 20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Water truck	39 - 66	38 - 61	39 - 57	38 - 57	39 - 49	<20 - 24	24 - 38	28 - 35	<20 - 22	<20 - 23	20 - 25	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Jackhammer	52 - 80	52 - 74	53 - 70	51 - 70	52 - 63	28 - 37	37 - 51	42 - 48	31 - 36	33 - 36	34 - 38	32 - 35	30 - 33	30 - 33	24 - 25	26 - 28	26 - 29	26 - 28	24 - 26	<20 - 24	<20 - 27	21 - 32
Truck and dog	47 - 75	47 - 69	48 - 65	46 - 65	47 - 58	22 - 32	32 - 46	36 - 43	26 - 30	28 - 31	28 - 33	27 - 30	25 - 28	24 - 27	<20	20 - 23	21 - 24	20 - 23	<20 - 21	<20	<20 - 22	<20 - 27
Up to 3 (noisiest) plant operating concurrently	60 - 88	60 - 82	61 - 78	59 - 78	60 - 71	35 - 45	45 - 59	49 - 56	39 - 43	41 - 44	41 - 46	40 - 43	38 - 41	37 - 40	32 - 33	33 - 36	34 - 37	33 - 36	31 - 34	<20 - 32	24 - 35	29 - 40

Receiver ID	Predicted L _{Aeq} (15min) construction noise levels, dB(A)																					
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type ^{2,4}	Industrial	Industrial	Industrial	Industrial	Industrial	Childcare centre	Industrial	Industrial	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	-	-	-	-	-	-	-	-	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
NML, dB(A) ¹	75	75	75	75	75	55	75	75	49	49	49	49	49	49	48	48	48	48	48	55	55	55
PHASE 3 – EARTHWORKS																						
Excavator w bucket (25T)	40 - 75	37 - 67	31 - 62	34 - 75	30 - 61	<20 - 29	<20 - 41	30 - 38	<20 - 26	21 - 26	<20 - 29	<20 - 26	<20 - 24	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 23
Hand tools	45 - 80	42 - 72	36 - 67	39 - 80	35 - 66	22 - 34	23 - 46	35 - 43	<20 - 31	26 - 32	22 - 34	23 - 31	22 - 29	23 - 29	<20 - 21	<20 - 24	20 - 24	<20 - 24	<20 - 22	<20	<20 - 23	<20 - 28
Tipper truck	42 - 77	39 - 69	33 - 64	36 - 77	32 - 63	<20 - 31	<20 - 43	32 - 40	<20 - 28	23 - 29	<20 - 31	<20 - 28	<20 - 26	20 - 26	<20	<20 - 21	<20 - 21	<20 - 21	<20	<20	<20	<20 - 25
Non-powered hand tools	28 - 63	25 - 55	<20 - 50	22 - 63	<20 - 49	<20	<20 - 29	<20 - 26	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Water cart	45 - 80	42 - 72	36 - 67	39 - 80	35 - 66	22 - 34	23 - 46	35 - 43	<20 - 31	26 - 32	22 - 34	23 - 31	22 - 29	23 - 29	<20 - 21	<20 - 24	20 - 24	<20 - 24	<20 - 22	<20	<20 - 23	<20 - 28
Bulldozer (D8R)	54 - 89	51 - 81	45 - 76	48 - 89	44 - 75	31 - 43	32 - 55	44 - 52	28 - 40	35 - 41	31 - 43	32 - 40	31 - 38	32 - 38	26 - 30	28 - 33	29 - 33	28 - 33	27 - 31	<20 - 28	<20 - 32	<20 - 37
Compactor	46 - 81	43 - 73	37 - 68	40 - 81	36 - 67	23 - 35	24 - 47	36 - 44	<20 - 32	27 - 33	23 - 35	24 - 32	23 - 30	24 - 30	<20 - 22	20 - 25	21 - 25	20 - 25	<20 - 23	<20 - 20	<20 - 24	<20 - 29
Grader	51 - 86	48 - 78	42 - 73	45 - 86	41 - 72	28 - 40	29 - 52	41 - 49	25 - 37	32 - 38	28 - 40	29 - 37	28 - 35	29 - 35	23 - 27	25 - 30	26 - 30	25 - 30	24 - 28	<20 - 25	<20 - 29	<20 - 34
Truck and Dog	46 - 81	43 - 73	37 - 68	40 - 81	36 - 67	23 - 35	24 - 47	36 - 44	<20 - 32	27 - 33	23 - 35	24 - 32	23 - 30	24 - 30	<20 - 22	20 - 25	21 - 25	20 - 25	<20 - 23	<20 - 20	<20 - 24	<20 - 29
Up to 3 (noisiest) plant operating concurrently	56 - 91	53 - 83	47 - 79	50 - 92	46 - 77	33 - 46	34 - 58	46 - 54	30 - 42	37 - 43	33 - 45	34 - 42	33 - 40	34 - 40	29 - 32	30 - 35	31 - 36	31 - 35	29 - 33	<20 - 30	<20 - 34	<20 - 39
PHASE 4 – CIVIL, UTILITIES AND IN-GROUND WORKS																						
Excavator w bucket (40T)	32 - 78	31 - 67	28 - 63	28 - 78	25 - 62	<20 - 25	22 - 41	28 - 37	<20 - 24	<20 - 24	<20 - 26	<20 - 24	<20 - 21	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20
Excavator w bucket (25T)	30 - 76	29 - 65	26 - 61	26 - 76	23 - 60	<20 - 23	<20 - 39	26 - 35	<20 - 22	<20 - 22	<20 - 24	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Hand tools	35 - 81	34 - 71	31 - 66	32 - 81	28 - 65	<20 - 28	25 - 44	31 - 40	<20 - 27	<20 - 27	<20 - 29	<20 - 27	<20 - 24	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 23
Tipper truck	32 - 78	31 - 68	28 - 63	29 - 78	25 - 62	<20 - 25	22 - 41	28 - 37	<20 - 24	<20 - 24	<20 - 26	<20 - 24	<20 - 21	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20
Hand tools (non-powered)	<20 - 64	<20 - 54	<20 - 49	<20 - 64	<20 - 48	<20	<20 - 27	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Water cart	35 - 81	34 - 71	31 - 66	32 - 81	28 - 65	<20 - 28	25 - 44	31 - 40	<20 - 27	<20 - 27	<20 - 29	<20 - 27	<20 - 24	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 23
Truck and Dog	36 - 82	35 - 72	32 - 67	33 - 82	29 - 66	<20 - 29	26 - 45	32 - 41	<20 - 28	21 - 28	<20 - 30	<20 - 28	<20 - 25	<20 - 25	<20	<20 - 21	<20 - 21	<20 - 21	<20	<20	<20	<20 - 24
Smooth drum roller (13t) - high vibration mode	42 - 88	41 - 78	38 - 73	39 - 88	35 - 72	24 - 35	32 - 51	38 - 47	24 - 34	27 - 34	24 - 36	24 - 34	24 - 31	25 - 31	22 - 24	23 - 27	24 - 27	23 - 27	22 - 25	<20	<20 - 25	<20 - 30
Drill rig	34 - 80	33 - 70	30 - 65	31 - 80	27 - 64	<20 - 27	24 - 43	30 - 39	<20 - 26	<20 - 26	<20 - 28	<20 - 26	<20 - 23	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20 - 22
Concrete agitator	36 - 82	35 - 72	32 - 67	33 - 82	29 - 66	<20 - 29	26 - 45	32 - 41	<20 - 28	21 - 28	<20 - 30	<20 - 28	<20 - 25	<20 - 25	<20	<20 - 21	<20 - 21	<20 - 21	<20	<20	<20	<20 - 24

Receiver ID	Predicted L _{Aeq} (15min) construction noise levels, dB(A)																					
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type ^{2,4}	Industrial	Industrial	Industrial	Industrial	Industrial	Childcare centre	Industrial	Industrial	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	-	-	-	-	-	-	-	-	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
NML, dB(A) ¹	75	75	75	75	75	55	75	75	49	49	49	49	49	49	48	48	48	48	48	55	55	55
Concrete pump	31 - 77	30 - 67	27 - 62	28 - 77	24 - 61	<20 - 24	21 - 40	27 - 36	<20 - 23	<20 - 23	<20 - 25	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Piling rig - bored	40 - 86	39 - 76	36 - 71	37 - 86	33 - 70	22 - 33	30 - 49	36 - 45	22 - 32	25 - 32	22 - 34	22 - 32	22 - 29	23 - 29	<20 - 22	21 - 25	22 - 25	21 - 25	20 - 23	<20	<20 - 23	<20 - 28
Fibre cable winch	<20 - 60	<20 - 50	<20 - 45	<20 - 60	<20 - 44	<20	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Generator	22 - 68	21 - 58	<20 - 53	<20 - 68	<20 - 52	<20	<20 - 31	<20 - 27	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Trowelling machine	22 - 68	21 - 58	<20 - 53	<20 - 68	<20 - 52	<20	<20 - 31	<20 - 27	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently	45 - 90	44 - 80	41 - 76	41 - 90	38 - 75	27 - 38	34 - 53	41 - 50	26 - 37	30 - 37	27 - 39	27 - 36	27 - 34	28 - 34	24 - 27	26 - 30	27 - 30	26 - 30	25 - 28	<20 - 23	<20 - 28	<20 - 33
PHASE 5 – BUILDING CONSTRUCTION WORKS																						
Tower crane - diesel	50 - 54	49 - 54	50 - 56	48 - 56	49 - 57	42 - 44	39 - 44	38 - 43	30 - 32	31 - 33	31 - 34	30 - 32	28 - 30	28 - 29	23 - 24	24 - 25	25 - 26	24 - 25	23 - 24	21 - 22	23 - 23	28 - 29
Concrete pump	<20 - 54	<20 - 58	<20 - 58	<20 - 64	<20 - 60	<20 - 36	<20 - 41	<20 - 40	<20 - 25	<20 - 26	<20 - 27	<20 - 24	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20	<20
Concrete agitator	<20 - 59	<20 - 63	<20 - 63	<20 - 69	<20 - 65	<20 - 41	<20 - 46	<20 - 45	<20 - 30	<20 - 31	<20 - 32	<20 - 29	<20 - 26	<20 - 25	<20	<20 - 20	<20 - 20	<20	<20	<20	<20	<20 - 21
Mobile crane (300t)	<20 - 56	<20 - 60	<20 - 60	<20 - 66	<20 - 62	<20 - 38	<20 - 43	<20 - 42	<20 - 27	<20 - 28	<20 - 29	<20 - 26	<20 - 23	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20
Truck and Dog	<20 - 59	<20 - 63	<20 - 63	<20 - 69	<20 - 65	<20 - 41	<20 - 46	<20 - 45	<20 - 30	<20 - 31	<20 - 32	<20 - 29	<20 - 26	<20 - 25	<20	<20 - 20	<20 - 20	<20	<20	<20	<20	<20 - 21
Hand tools	<20 - 58	<20 - 62	<20 - 62	<20 - 68	<20 - 64	<20 - 40	<20 - 45	<20 - 44	<20 - 29	<20 - 30	<20 - 31	<20 - 28	<20 - 25	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 20
Concrete vibrator	<20 - 50	<20 - 54	<20 - 54	<20 - 60	<20 - 56	<20 - 32	<20 - 37	<20 - 36	<20 - 21	<20 - 22	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Franna crane	<20 - 50	<20 - 54	<20 - 54	<20 - 60	<20 - 56	<20 - 32	<20 - 37	<20 - 36	<20 - 21	<20 - 22	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
EWP	<20 - 46	<20 - 50	<20 - 50	<20 - 56	<20 - 52	<20 - 28	<20 - 33	<20 - 32	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Telehandler	<20 - 45	<20 - 50	<20 - 50	<20 - 56	<20 - 52	<20 - 28	<20 - 33	<20 - 32	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Hand tools (non-powered)	<20 - 49	<20 - 53	<20 - 53	<20 - 59	<20 - 55	<20 - 31	<20 - 36	<20 - 35	<20 - 20	<20 - 21	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Trowelling machine	<20 - 45	<20 - 49	<20 - 49	<20 - 55	<20 - 51	<20 - 27	<20 - 32	<20 - 31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Shotcrete pump/compressor	<20 - 55	<20 - 59	<20 - 59	<20 - 65	<20 - 61	<20 - 37	<20 - 42	<20 - 41	<20 - 26	<20 - 27	<20 - 28	<20 - 25	<20 - 22	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20
Compressor	<20 - 51	<20 - 55	<20 - 55	<20 - 61	<20 - 57	<20 - 33	<20 - 38	<20 - 37	<20 - 22	<20 - 23	<20 - 24	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Handtool - grout / hand mixer	<20 - 58	<20 - 62	<20 - 62	<20 - 68	<20 - 64	<20 - 40	<20 - 45	<20 - 44	<20 - 29	<20 - 30	<20 - 31	<20 - 28	<20 - 25	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 20

Receiver ID	Predicted L _{Aeq} (15min) construction noise levels, dB(A)																					
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type ^{2,4}	Industrial	Industrial	Industrial	Industrial	Industrial	Childcare centre	Industrial	Industrial	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	-	-	-	-	-	-	-	-	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
NML, dB(A) ¹	75	75	75	75	75	55	75	75	49	49	49	49	49	49	48	48	48	48	48	55	55	55
Pump	<20 - 55	<20 - 59	<20 - 59	<20 - 65	<20 - 61	<20 - 37	<20 - 42	<20 - 41	<20 - 26	<20 - 27	<20 - 28	<20 - 25	<20 - 22	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20
Small truck	<20 - 55	<20 - 59	<20 - 59	<20 - 65	<20 - 61	<20 - 37	<20 - 42	<20 - 41	<20 - 26	<20 - 27	<20 - 28	<20 - 25	<20 - 22	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently	25 - 64	25 - 69	25 - 69	21 - 75	22 - 71	<20 - 46	<20 - 51	<20 - 50	<20 - 36	<20 - 36	<20 - 38	<20 - 34	<20 - 31	<20 - 30	<20	<20 - 26	<20 - 26	<20 - 25	<20 - 22	<20	<20 - 22	<20 - 27
PHASE 6 – BUILDING FIT OUT																						
Powered hand tools	<20 - 58	<20 - 62	<20 - 62	<20 - 68	<20 - 64	<20 - 40	<20 - 45	<20 - 44	<20 - 29	<20 - 30	<20 - 31	<20 - 28	<20 - 25	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 20
Mobile Crane (300T)	<20 - 56	<20 - 60	<20 - 60	<20 - 66	<20 - 62	<20 - 38	<20 - 43	<20 - 42	<20 - 27	<20 - 28	<20 - 29	<20 - 26	<20 - 23	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20
Delivery truck	<20 - 57	<20 - 61	<20 - 61	<20 - 67	<20 - 63	<20 - 39	<20 - 44	<20 - 43	<20 - 28	<20 - 29	<20 - 30	<20 - 27	<20 - 24	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20
Bobcat	<20 - 58	<20 - 62	<20 - 62	<20 - 68	<20 - 64	<20 - 40	<20 - 45	<20 - 44	<20 - 29	<20 - 30	<20 - 31	<20 - 28	<20 - 25	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20 - 20
Elevated work platform	<20 - 53	<20 - 57	<20 - 57	<20 - 63	<20 - 59	<20 - 35	<20 - 40	<20 - 39	<20 - 24	<20 - 25	<20 - 26	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently	<20 - 49	<20 - 53	<20 - 53	<20 - 59	<20 - 55	<20 - 31	<20 - 36	<20 - 35	<20 - 20	<20 - 21	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
PHASE 7 – OFFSITE ENABLING INFRASTRUCTURE WORKS																						
Trencher	41 - 58	34 - 50	30 - 49	39 - 52	<20 - 21	23 - 32	42 - 54	34 - 40	<20 - 26	<20 - 26	<20	<20	<20	<20	<20 - 24	21 - 26	22 - 26	21 - 25	<20 - 23	<20	<20 - 22	26 - 28
Bobcat	39 - 56	32 - 48	28 - 47	37 - 50	<20	21 - 30	40 - 52	32 - 38	<20 - 24	<20 - 24	<20	<20	<20	<20	<20 - 22	<20 - 24	<20 - 24	<20 - 23	<20 - 21	<20	<20	24 - 26
Concrete/Road saw	51 - 68	44 - 60	41 - 60	49 - 62	23 - 31	33 - 42	53 - 64	44 - 50	<20 - 36	<20 - 36	<20 - 23	<20 - 24	<20 - 26	<20 - 26	30 - 34	31 - 36	32 - 36	31 - 36	29 - 34	<20 - 22	30 - 32	36 - 39
Daymaker	25 - 42	<20 - 34	<20 - 33	23 - 36	<20	<20	26 - 38	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Tracked excavator with bucket (19 tonne)	32 - 48	25 - 41	21 - 40	30 - 43	<20	<20 - 23	33 - 45	25 - 31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Excavator with small rockhammer (5t)	49 - 65	42 - 58	38 - 57	47 - 60	21 - 29	30 - 40	50 - 62	42 - 48	<20 - 34	<20 - 34	<20 - 21	<20 - 21	<20 - 24	<20 - 24	27 - 32	29 - 34	29 - 34	29 - 33	27 - 31	<20	28 - 30	34 - 36
Generator	26 - 43	<20 - 35	<20 - 34	24 - 37	<20	<20	27 - 39	<20 - 25	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
HDD drill rig	43 - 60	36 - 52	32 - 51	41 - 54	<20 - 23	25 - 34	44 - 56	36 - 42	<20 - 28	<20 - 28	<20	<20	<20	<20	22 - 26	23 - 28	24 - 28	23 - 27	21 - 25	<20	22 - 24	28 - 30
Hand tools (non-powered)	30 - 47	23 - 39	<20 - 38	28 - 41	<20	<20 - 21	31 - 43	23 - 29	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Dump truck	40 - 57	33 - 49	29 - 48	38 - 51	<20	22 - 31	41 - 53	33 - 39	<20 - 25	<20 - 25	<20	<20	<20	<20	<20 - 23	20 - 25	21 - 25	<20 - 24	<20 - 22	<20	<20 - 21	25 - 27
Water truck	32 - 48	25 - 41	21 - 40	30 - 43	<20	<20 - 23	33 - 45	25 - 31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Receiver ID	Predicted L _{Aeq(15min)} construction noise levels, dB(A)																					
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type ^{2,4}	Industrial	Industrial	Industrial	Industrial	Industrial	Childcare centre	Industrial	Industrial	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	-	-	-	-	-	-	-	-	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
NML, dB(A) ¹	75	75	75	75	75	55	75	75	49	49	49	49	49	49	48	48	48	48	48	55	55	55
Capstan winch (full throttle)	31 - 48	24 - 40	20 - 39	29 - 42	<20	<20 - 22	32 - 44	24 - 30	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Plate compactor	37 - 53	30 - 46	26 - 45	35 - 48	<20	<20 - 28	38 - 50	30 - 36	<20 - 22	<20 - 22	<20	<20	<20	<20	<20	<20 - 22	<20 - 22	<20 - 21	<20	<20	<20	22 - 24
Up to 3 (noisiest) plant operating concurrently (low-impact)	46 - 63	39 - 55	36 - 55	44 - 57	<20 - 26	28 - 37	48 - 59	39 - 45	<20 - 31	<20 - 31	<20	<20	<20 - 21	<20 - 21	25 - 29	26 - 31	27 - 31	26 - 31	24 - 29	<20	25 - 27	31 - 34
Up to 3 (noisiest) plant operating concurrently (high impact)	54 - 70	47 - 62	43 - 62	52 - 65	25 - 34	35 - 45	55 - 66	47 - 52	<20 - 39	<20 - 38	<20 - 26	<20 - 26	<20 - 28	21 - 29	32 - 36	34 - 38	34 - 39	33 - 38	32 - 36	<20 - 24	32 - 35	38 - 41
PHASE 8 – COMISSIONING																						
Hand tools	29 - 78	29 - 73	29 - 67	27 - 76	23 - 64	<20 - 22	<20 - 46	31 - 43	<20 - 27	<20 - 28	<20 - 30	<20 - 26	<20 - 23	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20
Mobile crane (300t)	27 - 76	27 - 71	27 - 65	25 - 74	21 - 62	<20	<20 - 44	29 - 41	<20 - 25	<20 - 26	<20 - 28	<20 - 24	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20	<20
EWP	<20 - 66	<20 - 61	<20 - 55	<20 - 64	<20 - 52	<20	<20 - 34	<20 - 31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Bobcat	29 - 78	29 - 73	29 - 67	27 - 76	23 - 64	<20 - 22	<20 - 46	31 - 43	<20 - 27	<20 - 28	<20 - 30	<20 - 26	<20 - 23	<20 - 22	<20	<20	<20	<20	<20	<20	<20	<20
Delivery truck	28 - 77	28 - 72	28 - 66	26 - 75	22 - 63	<20 - 21	<20 - 45	30 - 42	<20 - 26	<20 - 27	<20 - 29	<20 - 25	<20 - 22	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20
Hand tools (non-powered)	20 - 69	20 - 64	<20 - 58	<20 - 67	<20 - 55	<20	<20 - 37	22 - 34	<20	<20	<20 - 21	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Generator	26 - 75	26 - 70	26 - 64	24 - 73	<20 - 61	<20	<20 - 43	28 - 40	<20 - 24	<20 - 25	<20 - 27	<20 - 23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently	34 - 83	34 - 78	33 - 71	31 - 80	27 - 69	<20 - 27	21 - 50	36 - 47	<20 - 31	<20 - 32	<20 - 34	<20 - 31	<20 - 28	<20 - 27	<20	<20 - 21	<20 - 22	<20	<20	<20	<20	<20 - 24

Notes:

1. Standard construction hours – Mon-Fri – 7:00am to 6:00pm, Sat – 8:00am to 1:00pm.

2. Only applies when in use

3. Grey filled cell is where the highest (i.e.. closest) predicted noise level could reach above the Day (standard) NML.

4. For commercial and industrial receivers, the NMLs apply at the reasonably most affected point on or within the property boundary. The assessment has been done in a conservative manner and the applicable location is to be reviewed during construction planning to assist with the management of the noise levels (for example, where the identifiedworst-case assessment location is not typically used by the commercial/industrial tenant).

Table 7-7: OOHW predicted LAeq(15min) construction noise levels for construction plant and activities for offsite enabling infrastructure works

Receiver ID	Predicted LAeq(15min) construction noise levels, dB(A)																					
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type²	Industrial	Industrial	Industrial	Industrial	Industrial	Childcare centre	Industrial	Industrial	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	-	-	-	-	-	-	-	-	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
OOHW Day NML, dB(A)¹	75	75	75	75	75	-	75	75	44	44	44	44	44	44	43	43	43	43	43	50	50	50
OOHW Evening NML, dB(A)¹	75	75	75	75	75	-	75	75	42	42	42	42	42	42	43	43	43	43	43	50	50	50
OOHW Night NML, dB(A)¹	75	75	75	75	75	-	75	75	40	40	40	40	40	40	43	43	43	43	43	47	47	47
PHASE 7 – OFFSITE ENABLING INFRASTRUCTURE WORKS																						
Trencher	41 - 58	34 - 50	30 - 49	39 - 52	<20 - 21	23 - 32	42 - 54	34 - 40	<20 - 26	<20 - 26	<20	<20	<20	<20	<20 - 24	21 - 26	22 - 26	21 - 25	<20 - 23	<20	<20 - 22	26 - 28
Bobcat	39 - 56	32 - 48	28 - 47	37 - 50	<20	21 - 30	40 - 52	32 - 38	<20 - 24	<20 - 24	<20	<20	<20	<20	<20 - 22	<20 - 24	<20 - 24	<20 - 23	<20 - 21	<20	<20	24 - 26
Concrete / Road saw	51 - 68	44 - 60	41 - 60	49 - 62	23 - 31	33 - 42	53 - 64	44 - 50	<20 - 36	<20 - 36	<20 - 23	<20 - 24	<20 - 26	<20 - 26	30 - 34	31 - 36	32 - 36	31 - 36	29 - 34	<20 - 22	30 - 32	36 - 39
Daymaker	25 - 42	<20 - 34	<20 - 33	23 - 36	<20	<20	26 - 38	<20 - 24	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Tracked excavator with bucket (19 tonne)	32 - 48	25 - 41	21 - 40	30 - 43	<20	<20 - 23	33 - 45	25 - 31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Excavator with small rockhammer (5t)	49 - 65	42 - 58	38 - 57	47 - 60	21 - 29	30 - 40	50 - 62	42 - 48	<20 - 34	<20 - 34	<20 - 21	<20 - 21	<20 - 24	<20 - 24	27 - 32	29 - 34	29 - 34	29 - 33	27 - 31	<20	28 - 30	34 - 36
Generator	26 - 43	<20 - 35	<20 - 34	24 - 37	<20	<20	27 - 39	<20 - 25	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
HDD drill rig	43 - 60	36 - 52	32 - 51	41 - 54	<20 - 23	25 - 34	44 - 56	36 - 42	<20 - 28	<20 - 28	<20	<20	<20	<20	22 - 26	23 - 28	24 - 28	23 - 27	21 - 25	<20	22 - 24	28 - 30
Hand tools (non-powered)	30 - 47	23 - 39	<20 - 38	28 - 41	<20	<20 - 21	31 - 43	23 - 29	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Dump truck	40 - 57	33 - 49	29 - 48	38 - 51	<20	22 - 31	41 - 53	33 - 39	<20 - 25	<20 - 25	<20	<20	<20	<20	<20 - 23	20 - 25	21 - 25	<20 - 24	<20 - 22	<20	<20 - 21	25 - 27
Water truck	32 - 48	25 - 41	21 - 40	30 - 43	<20	<20 - 23	33 - 45	25 - 31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Capstan winch (full throttle)	31 - 48	24 - 40	20 - 39	29 - 42	<20	<20 - 22	32 - 44	24 - 30	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Plate compactor	37 - 53	30 - 46	26 - 45	35 - 48	<20	<20 - 28	38 - 50	30 - 36	<20 - 22	<20 - 22	<20	<20	<20	<20	<20	<20 - 22	<20 - 22	<20 - 21	<20	<20	<20	22 - 24
Up to 3 (noisiest) plant operating concurrently (low-impact)	46 - 63	39 - 55	36 - 55	44 - 57	<20 - 26	28 - 37	48 - 59	39 - 45	<20 - 31	<20 - 31	<20	<20	<20 - 21	<20 - 21	25 - 29	26 - 31	27 - 31	26 - 31	24 - 29	<20	25 - 27	31 - 34
Up to 3 (noisiest) plant operating concurrently (high impact)	54 - 70	47 - 62	43 - 62	52 - 65	25 - 34	35 - 45	55 - 66	47 - 52	<20 - 39	<20 - 38	<20 - 26	<20 - 26	<20 - 28	21 - 29	32 - 36	34 - 38	34 - 39	33 - 38	32 - 36	<20 - 24	32 - 35	38 - 41

Notes:

1. Work outside of standard construction hours is defined as Out-of-Hours Work (OOHW) and can be divided into two periods of sensitivity.

- OOHW Period 1 is defined as Monday to Saturday 6:00pm to 10:00pm (evenings), Saturday 7:00am to 8:00am and 1:00pm to 10:00pm (day & evening) and Sunday and public holidays 8:00am to 6:00pm (days).

- OOHW Period 2 is defined as Monday to Saturday 10:00pm to 7:00am (nights) and Sundays and public holidays 6:00pm to 8:00am (nights)

2. Only applies when in use.

3. Grey filled cell is where the highest (i.e.. closest) predicted noise level could reach above the OOHW NML.

Table 7-8 OOHW predicted L_{AFmax} construction noise levels for construction plant and activities for offsite enabling infrastructure works (residences)

Receiver ID	Predicted L _{AFmax} construction noise levels, dB(A)													
	R09	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
Receiver Type ²	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
NCA	NCA1	NCA1	NCA1	NCA1	NCA1	NCA1	NCA2	NCA2	NCA2	NCA2	NCA2	NCA3	NCA3	NCA3
Sleep disturbance screening level (night), L _{Amax}	52	52	52	52	52	52	53	53	53	53	53	57	57	57
PHASE 7 - OFFSITE ENABLING INFRASTRUCTURE WORKS														
Trencher	<20 - 29	<20 - 29	<20	<20	<20	<20	23 - 27	24 - 29	25 - 29	24 - 28	22 - 26	<20	23 - 25	29 - 31
Bobcat	<20 - 27	<20 - 27	<20	<20	<20	<20	21 - 25	22 - 27	23 - 27	22 - 26	20 - 24	<20	21 - 23	27 - 29
Concrete / Road saw	<20 - 39	<20 - 39	20 - 26	<20 - 27	<20 - 29	21 - 29	33 - 37	34 - 39	35 - 39	34 - 38	32 - 36	<20 - 25	33 - 35	39 - 41
Daymaker	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Tracked excavator with bucket (19 tonne)	<20 - 25	<20 - 25	<20	<20	<20	<20	<20 - 23	20 - 25	21 - 25	<20 - 24	<20 - 22	<20	<20 - 21	25 - 27
Excavator with small rockhammer (5t)	22 - 43	22 - 43	24 - 30	23 - 31	22 - 33	25 - 33	37 - 41	38 - 43	39 - 43	38 - 42	36 - 40	23 - 29	37 - 39	43 - 45
Generator	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
HDD drill rig	<20 - 33	<20 - 33	<20	<20 - 21	<20 - 23	<20 - 23	27 - 31	28 - 33	29 - 33	28 - 32	26 - 30	<20	27 - 29	33 - 35
Hand tools (non-powered)	<20 - 28	<20 - 28	<20	<20	<20	<20	22 - 26	23 - 28	24 - 28	23 - 27	21 - 25	<20	22 - 24	28 - 30
Dump truck	<20 - 37	<20 - 37	<20 - 24	<20 - 25	<20 - 27	<20 - 27	31 - 35	32 - 37	33 - 37	32 - 36	30 - 34	<20 - 23	31 - 33	37 - 39
Water truck	<20 - 37	<20 - 37	<20 - 24	<20 - 25	<20 - 27	<20 - 27	31 - 35	32 - 37	33 - 37	32 - 36	30 - 34	<20 - 23	31 - 33	37 - 39
Capstan winch (full throttle)	<20 - 20	<20	<20	<20	<20	<20	<20	<20	<20 - 20	<20	<20	<20	<20	<20 - 22
Plate compactor	<20 - 25	<20 - 25	<20	<20	<20	<20	<20 - 23	20 - 25	21 - 25	<20 - 24	<20 - 22	<20	<20 - 21	25 - 27

Notes:

1. Sleep disturbance applies during the night-period which) is defined as Monday to Saturday 10:00pm to 7:00am (nights) and Sundays and public holidays 6:00pm to 8:00am (nights)

2. Grey filled cell is where the highest (i.e., closest) predicted noise level could reach above the LAFmax sleep disturbance screening level.

7.3.2 Discussion of construction noise results

7.3.2.1 Standard daytime construction hours

The predicted noise levels presented above indicate that surrounding receivers are not expected to experience noise levels above the noise management levels, except for nearby industrial receivers located adjacent to the site.

The predictions show the following:

- When the industrial premises in proximity to the site (R01 to R05) are in use, construction noise levels may be above the noise management levels during periods over the construction program, when high noise activities are being undertaken, such as chainsaws, excavator with rockhammers or smooth drum roller are occurring nearby on the closest boundary of the Proposal site to the receiver. However, when construction activities are taking place at more distant or shielded locations within the site or with different equipment that are not the worst case, the construction noise levels are predicted to achieve the NML.
- Earthworks, cut/fill and excavation works (Phase 3) has the greatest potential construction noise impacts.
- During all construction phases, the construction noise levels are predicted to achieve the NMLs at all other nearby non-residential receivers (ie. childcare) and residential areas.

No residential receivers are predicted to be highly noise affected [i.e. exposed to noise levels greater than 75 dB(A)].

The noise predictions presented in this NVIA represent a realistic worst-case scenario when construction occurs at work locations close to sensitive receivers. At each receiver, noise levels will vary during the construction period based on the position of equipment within the worksite, the distance to the receiver, the construction activities being undertaken and the noise levels of particular plant items and equipment. This variation is shown by the predicted range presented in Table 7-6, results, with Figure 7-2 showing what this range means. This means the actual construction noise levels will often be less than the predicted levels presented in this NVIA following construction planning, which would incorporate the mitigation and management measures where feasible and reasonable detailed in Section 7.3.4.

In light of the predicted noise levels above for residences and non-residences, it is recommended that a feasible and reasonable approach towards noise mitigation measures be applied to reduce noise levels as much as possible to mitigate the impact from construction noise. Further details on construction noise mitigation and management measures are provided in Section 7.3.4 below.

7.3.2.2 Outside of standard construction hours

Offsite enabling infrastructure works were assessed during the OOHW periods, as detailed in Section 7.2.2.

The predicted construction noise levels indicate that surrounding receivers are not expected to experience noise levels above the OOH noise management levels during the offsite enabling infrastructure works phase construction activities, except for nearby industrial receivers located adjacent to the site, if they are in use during the OOHW periods.

Maximum noise levels have been assessed and are predicted to comply with the night-time sleep disturbance screening levels at all residential receivers as presented in Table 7-8.

Noting the levels of exceedance, and that this is restricted to nearby industrial receivers, through construction planning and management, construction equipment selection, it would be feasible to appropriately manage construction noise emissions during the OOHW periods for these construction works, if OOHW is determined as being required.

7.3.3 Cumulative construction noise impacts

The Proposal is located in an area where there a number where similar industrial facility construction projects that are expected will be taking place over the next couple of years, shown by the various proposed/approved projects presented in Table 7-9. The following construction projects have been identified as potentially undertaking noise generating works in proximity to the same noise sensitive receivers during the construction of the Proposal.

Table 7-9: Construction projects with potential for cumulative noise impact

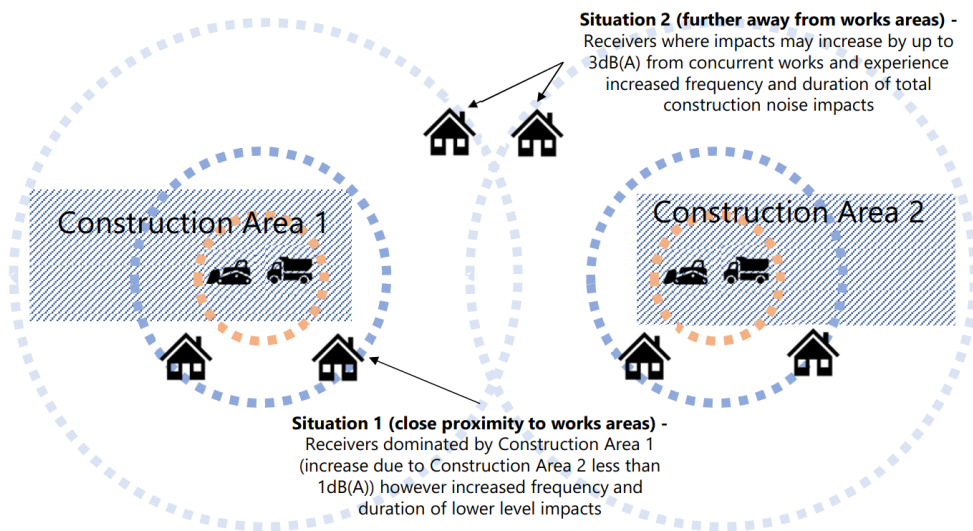
Address	DA Reference	Description	Status
10 Eastern Creek Drive, Eastern Creek	SSD-47320208	Project Echidna Data Centre Eastern Creek The Construction and Operation of a Data Centre with an operational capacity of 35MW including data hall fit out, associated emergency back-up generators and cooling plant, office space, equipment rooms and car parking.	Determined Under Construction
17 Roberts Road, Eastern Creek	SSD-10330-Mod 1	Roberts Road Data Centre Additional storey to buildings 5 and 6, including internal layout reconfiguration	Determined
	SSD-10330-Mod 2	Modification application for Additional back-up generators and diesel storage.	Under Assessment
2-10 Old Wallgrove Road, Horsley Park	SSD-37486043	Oakdale East Industrial Estate 5 stage, 77ha Industrial estate	Determined Under Construction Precinct 2 SSDA – Under Assessment

Address	DA Reference	Description	Status
16 Johnston Crescent, Horsley Park	SSD-63741210	NEXTDC S4 Data Centre Horsley Park Construction and operation of a data centre comprising of six data centre buildings with a maximum height of 38m and an operational capacity of 25MW, including substation, earthworks, car parking, landscaping and ancillary works.	Under Assessment
813 Wallgrove Road, Horsley Park	SSD-5248	Gazcorp Industrial Estate 16 Warehouse Industrial Estate	Determined Modification 7 –Under Assessment
3 Johnston Crescent, Horsley Park	SSD-71144719	Horsley Logistics Park Stage 2 Construction of two warehouse buildings and ancillary office space with a total gross floor area of 55,944sqm, access driveways, hardstand areas and loading docks, car parking, landscaping, earthworks.	Exhibition
1-3 Millner Avenue, Horsley Park	SSD-8209	Costco Warehouse Facility 35,756m ² warehouse and distribution centre	Determined
17 Roberts Road, Eastern Creek	SSD-10330	Roberts Road Data Centre An expansion to an existing data centre, including associated office space, supporting infrastructure and services, car parking and landscaping.	Determined
9 Rousell Road, Eastern Creek	SSD-41807966	Roussell Road Warehouse and Distribution Centre The construction and operation of a 25,113m ² warehouse with 1,352m ² of office space, with associated hardstand and landscaping.	Determined
20 Eastern Creek Drive, Eastern Creek	SSD-30923027	Compass 2 Warehouse & Distribution Centre Construction and operation of a Warehouse and Distribution Centre including minor earthworks, civil works and utilities servicing, and car parking.	Determined
10 Old Wallgrove Road, Horsely Park	SSD-37486043	Oakdale East Industrial Estate Concept masterplan for an industrial estate and Stage 1 works including intersection upgrades, bulk earthworks, internal roads, services, expansion of an existing warehouse in Precinct 1 and construction and operation of a warehouse in Precinct 3.	Determined Under Construction

Additional construction projects or construction works (i.e. utility providers) may also be required to take place in the vicinity of sensitive receivers nearby to the Proposal, during the construction of the Proposal, which should also be considered as part of construction planning where known.

There will be multiple projects undergoing noise generating construction works concurrently or with overlapping timeframes with the Proposal. As such, there is potential for cumulative or consecutive noise impacts as a result of the Proposal combined with other project with concurrent or similar timeframes. Typically, while impacts from one project or one construction site may be relatively short-term or noise intensive periods intermittent, when multiple construction projects are occurring at the same time near to a particular receiver cumulative construction noise impacts can occur. This can mean that construction noise impacting a sensitive receiver may be louder than from an individual set up works [by up to 3 dB(A)], the overall duration of construction impacts may be overall longer or impacts more frequent. Typically, concurrent projects can impact nearby receiver locations in one of two ways, as also shown in Figure 7-3.

Figure 7-3: Cumulative construction noise impacts (two concurrent projects)



Where construction works, in particular OOH works occur concurrently or during a similar timeframe (i.e. within the same week), there is potential for cumulative noise impacts from the Proposal combined with other concurrent construction projects in the short term.

Concurrent construction projects or projects that overlap or follow on one after, can lead to common sensitive receivers being impacted by construction noise and/or vibration over an extended duration, with insufficient respite. This may lead to both cumulative impacts and/or construction fatigue. To help to address the potential for construction impacts from cumulative or concurrent construction noise, recommended mitigation and management measures detailed in Section 7.3.4 (Table 7-12) are to be implemented during the construction works. As detailed in Section 7.3.4.2, the identified mitigation and management measures are to be considered and implemented where feasible and reasonable where there is potential for the noise management levels presented in Section 4.1.2 to be exceeded by the construction works either individually or cumulatively.

Specific mitigation and management measures are also included in Table 7-12 to minimise the risk of cumulative construction noise impacts, and cover:

- Coordinating work between construction sites to manage cumulative noise impacts (including respite)
- Community consultation to gauge key noise impacts
- Consideration of cumulative construction noise impacts during the development of noise mitigation and management measures
- Management of cumulative impacts from concurrent construction phases of the Proposal.

These measures are to be used to mitigate and manage cumulative noise impacts and reduce the likelihood of construction fatigue:

These mitigation measures would be included in the CNVMP or CEMP and would include how the above measures would be incorporated during the works.

7.3.4 Construction noise mitigation measures

7.3.4.1 General engineering noise controls

Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', are expected to reduce predicted construction noise levels.

Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 7-10 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 7-10: Relative effectiveness of various forms of noise control

Noise control method	Practical examples	Typical noise reduction possible in practice, dB(A)		Maximum noise reduction possible in practice, dB(A)	
		AS 2436	RTA	AS 2436	RTA
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustic barriers such as temporary or permanent noise barriers where barrier breaks line-of-sight between the source and receiver	5 to 10	5 to 10	15	15
Acoustic enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 25	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

The RTA' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436.

Table 7-11 below identifies possible noise control measures, which are applicable on the construction plant likely to be used on site.

Table 7-11: Possible noise control measures for likely construction plant

Plant description	Screening	Acoustic enclosures	Silencing	Alternative process
Tower crane - diesel	✗	✓	✓	✗
Excavator with rockhammer attachment	✓	✗	✗	✓
Jackhammers	✓	✗	✗	✓
Concrete truck/agitator	✓	✗	✓	✗
Delivery trucks	✓	✗	✓	✗
Electric / mobile crane	✓	✗	✗	✗
Concrete/Road saw	✓	✗	✗	✓
Drill rig	✓	✗	✓	✗
Hand tools	✓	✗	✓	✗

7.3.4.2 Noise management measures

The following recommendations provide feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers.

These should be considered and implemented where feasible and reasonable where there is potential for the noise management levels presented in Section 4.1.2 to be exceeded by the construction works either individually or cumulatively.

In accordance with the ICNG, feasible noise mitigation measures are those work practices or measures to reduce noise that are capable of being put into practice or of being engineered and are practical to build given project constraints such as safety and maintenance requirements. Reasonable noise mitigation measures are those feasible noise mitigation measures that are considered reasonable in the circumstances, based on a judgement that the overall noise benefits outweigh the overall adverse social economic and environmental effects, including the cost of implementing the measure. To make such a judgement, consideration is to be given to noise level impacts, duration of impacts, noise mitigation benefits, cost effectiveness of noise mitigation and community views.

Considering the predicted noise levels set out in Section 7.3.1 the following noise management are recommended for consideration by a contractor and implemented where feasible and reasonable. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

Table 7-12 summarises actions that can be applied to manage the potential for noise to impact on sensitive receivers near the Project construction works, which are to be applied where reasonable and feasible. Some measures will assist with minimising vibration impacts too, and are indicated where this is applicable, refer to Section 7.3.4.4 for vibration management measures.

Table 7-12: Noise mitigation and management measures

Action required	Applies to	Details	Estimated noise benefit
At-source mitigation measures			
Equipment selection	Airborne noise Vibration	Use quieter and less noise/vibration emitting construction methods where feasible and reasonable. Where loud plant and/or equipment are being used in construction works, where feasible and reasonable the selection of alternative quieter plant and/or equipment should be considered for tasks.	Variable. Minimise noise impact and reduce risk of annoyance.
Equipment noise and vibration levels	Airborne noise Vibration	Plant and equipment must be properly maintained. Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.	Variable. Minimise noise impact and reduce risk of annoyance.
Alternative construction methods to reduce vibration	Vibration	Alternative, less vibration generating construction methods will be reviewed where vibration significant works found to be within the site-specific minimum working distance of a structure, as determined by site vibration monitoring. For example, the use of rocksaw cutting instead of rockbreaking to excavate.	Variable. Minimise vibration impacts and reduce risk of structural damage and/or annoyance.
Rental plant and equipment	Airborne noise	The noise levels of plant and equipment items are to be considered in rental decisions, with quieter and less noise/vibration emitting construction methods where feasible and reasonable.	Variable. Minimise noise impact and reduce risk of annoyance.
Worksite planning and layout	Airborne noise Vibration	Locate noise-generating activities away from sensitive receivers, where practicable. Plan traffic flow, parking, loading/unloading, and other vehicle movements to keep vehicles away from sensitive receivers where possible and to minimise reversing movements.	Variable. Minimise noise impact and reduce risk of annoyance.
Use and siting of plant	Airborne noise Vibration	- Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. - The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. - Plant used intermittently to be throttled down or shut down. - Noise-emitting plant to be directed away from sensitive receivers. - Any equipment not in use for extended periods during construction work must be switched off.	Up to 20 dB reduction + reduce vibration
Non-tonal and ambient sensitive reversing alarms	Airborne noise	Alternative reverse or other audible alarms, such as 'quackers' instead of the tonal 'beeping' type will be installed on all vehicles, mobile plant and fixed plant regularly used on site and on all vehicles & plant required for OOHV. For example, avoid tonal alarms on plant items such as gantry cranes, EWPs etc. Consider limiting the volume of other audible alarms on plant/ equipment, while maintaining safe working. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	5-10 dB reduction

Action required	Applies to	Details	Estimated noise benefit
Minimise disturbance arising from delivery of goods	Airborne noise	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers if possible. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Minimise unnecessary acceleration on site and avoid vigorous slamming of truck doors, or noise events from tailgates.	Variable. Reduce noise/ vibration impact + risk of annoyance.
Silencers on mobile plant	Airborne noise	Where possible reduce noise from mobile plant through additional fittings, or the selection of items with preinstalled noise mitigation measures, including: - Residential grade mufflers - Air Parking brake engagement is silenced. Ensure plant including the silencer is well maintained.	0-20 dB reduction Reduce annoyance + sleep disturbance.
Prefabrication of materials off-site	Airborne noise	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.	5-20 dB reduction Reduce noise/ vibration impact + risk of annoyance
Engine compression brakes	Airborne noise	Limit the use of engine compression brakes in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.	5-20 dB reduction
Path mitigation measures			
Construction hoarding as noise barrier	Airborne noise	Any construction hoarding shall be installed on each worksite shall be constructed as a noise barrier, where practicable to provide shielding to the nearest affected receivers.	Receiver with line of site of the works area: 5-10 dB reduction Receiver without line of site of the works area: 0-5 dB reduction
Site sheds	Airborne noise	Site sheds to be strategically located to provide shielding to nearby residences.	Receiver with line of site of the works area: 5-10 dB reduction
Laydown and stockpiling	Airborne noise	Locate laydown and staging areas within the construction area as far from residences as practicably possible. Alternatively, where this is not possible or they would be effective as noise mounds, they should be considered for use as noise mounds. If constructed as noise mounds, they should be constructed such that noise sources are not between the mound and the nearest receivers.	Variable. Minimise noise impact and reduce risk of annoyance.
Shield stationary noise sources such as pumps, compressors etc	Airborne noise	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.	5-10 dB reduction

Action required	Applies to	Details	Estimated noise benefit
Use temporary noise barriers around work area	Airborne noise	Where works are to be completed as OOHW outside the construction hoarding area, relocatable noise barriers e.g. acoustic blankets hung from temporary construction fencing would be used, where practicable and effective. This can include use of temporary barriers around noise generating works at elevated construction locations.	Receiver with line of site of the works area: 5-10 dB reduction Receiver without line of site of the works area: 0-5 dB reduction
Mobile noise screens	Airborne noise	Where practicable, a mobile noise screen/tent would be used to reduce noise from moving plant items e.g. concrete saw. Mobile noise screens utilise aluminium mobile scaffold (or similar), with acoustic blanket/ quilt (e.g. Echo-barrier, FlexShield or similar) attached on up to 4 sides (including the top, where no solid platform). Mobile noise screens can provide 5 to 10 dB noise reduction, <u>where they can break line of sight between the source and the receiver.</u>	Receiver with line of site of the works area: 5-10 dB reduction Receiver without line of site of the works area: 0-5 dB reduction
Management measures			
Construction Noise and Vibration Management Plan update (or Construction Environmental Management Plan)	Airborne noise Vibration	A Construction Noise and Vibration Management Plan (CNVMP) is to be prepared for the Proposal (or the CEMP is to include at minimum relevant section for construction noise and vibration management). This must be prepared prior to the commencement of construction and regularly updated to account for changes in noise management issues and strategies.	-
Implement stakeholder consultation measures	Airborne noise	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. This should include details considering cumulative impacts across other stages of where applicable. In addition to Periodic Notification, the following strategies may be adopted to notify the community of upcoming works: • Project Specific Website • Project Infoline • Email Distribution List • Web-based Surveys • Social Media • Community and Stakeholder Meetings.	Keeps stakeholders informed of the likely impact. Community may identify solution to assist in managing impacts. Management of cumulative impacts
Register of noise and vibration sensitive receivers	Airborne noise Vibration	A register of most affected noise and vibration sensitive receivers (NVSRs) would be kept on site. The register would include the following details for each NVSR: • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. The register may be included as part of the Project's Community Liaison Plan or similar document.	Assists with keeping stakeholders informed of the likely impact. Assists with planning and reducing potential noise/ vibration impact + risk of annoyance

Action required	Applies to	Details	Estimated noise benefit
Site inductions	Airborne noise Vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.	Keeps construction workforce informed of actions required to minimise noise and vibration impact.
Construction hours and scheduling	Airborne noise Vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise levels and vibration intensive plant identified within minimum working distances for human response should be scheduled during less sensitive time periods, such as after 8 am and before 6 pm. If the work cannot be undertaken during the day, they would take place through a separate approval. As part of construction planning, these works should aim to be completed before 11 pm where feasible and reasonable. For works extending beyond 11 pm, noise intensive works should be scheduled to occur as early as possible.	Minimise noise and vibration impact and reduce risk of annoyance.
Respite coordination	Airborne noise	Consult with proponents of other construction works in the vicinity of the worksite and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers (e.g. aligning respite periods).	Minimises noise impacts Management of cumulative impacts
High noise generating works impacting non-residential receivers (including schools)	Airborne noise	Where high noise generating works are expected to impact non-residential receivers and it is determined through consultation that noise impacts could affect the receiver operations, feasible and reasonable management measure could be considered to manage impacts. Scheduling and timing of noisy works should done considering consultation and feedback from the nearby school receivers. Management could include minimising noise levels during exam periods, and considering school holidays when scheduling loud works periods. See Section 7.3.4.3 for further details.	Minimises noise impacts
Behavioural practices	Airborne noise	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.	0-20 dB reduction Reduce annoyance
Heavy vehicle routes	Airborne noise	Construction heavy vehicles and delivery vehicles should be scheduled during standard construction hours where feasible and reasonable.	Minimises noise impacts

Action required	Applies to	Details	Estimated noise benefit
Heavy vehicle code of conduct	Airborne noise	A Heavy Vehicle Code of Conduct (HVCC) is to be developed for all drivers to adhere to. The HVCC would require appropriate training of project contractors. It would include noise management methods such as limiting idling and compression braking, and traffic management practises to minimise noise emissions from vehicles entering and leaving the site.	Minimises noise impacts
Verification monitoring	Airborne noise	In response to noise complaints, a noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan (CNVMP) or CEMP and any approval conditions.	Minimises noise impacts
Vibration measurements	Vibration	Attended vibration measurements and permanent unattended vibration monitoring should be undertaken at the commencement of vibration generating activities to confirm that vibration levels as per Section 7.4.3.	Minimises and manages vibration impacts
Plant noise audit	Airborne noise	All plant and equipment likely to significantly noise affect sensitive receivers for an extended duration must be tested to check if noise emissions are compliant with noise limits reasonable for that item.	Minimises noise impacts
Complaints management	Airborne noise Vibration	See Section 7.5 for further details. In addition to the noise mitigation measures outlined above, a management procedure will need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint will need to be investigated, and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.	Minimise noise impact and reduce risk of annoyance.
Cumulative impact management - Coordination	Airborne noise	Consult with proponents of other construction works in the vicinity of the worksite and take reasonable steps to coordinate works to manage cumulative noise impacts, where feasible and reasonable. An example would be to ensure that where multiple sites are undertaking noise intensive works, such as demolition works, and these construction works could occur concurrently on multiple construction sites in proximity to the same noise sensitive receivers, these impacts are managed with consideration of both projects (eg. ensure that works from one project do not occur during designated respite periods of the other, or noise intensive works could occur concurrently to minimise overall duration).	Minimise risk of cumulative noise impacts Management of cumulative impacts
Cumulative impact management - Noise mitigation and management measure development	Airborne noise	Consideration of cumulative construction noise impacts during the development of noise mitigation and management measures for the worksites, where reasonable and feasible (eg. consideration of respite periods provided by other projects for approved OOH, so that timetables between projects don't result in other projects or the Proposal impacting the same noise sensitive receivers during designated periods of respite on consecutive OOH periods, or site layout designs to minimise cumulative impacts from adjacent sites).	Minimise risk of cumulative noise impacts Management of cumulative impacts

Additionally, implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', are expected to reduce predicted construction noise levels. Australian Standard 2436-2010, Appendix C, Table C1

suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

7.3.4.3 Noise impacts to nearby non-residential receivers

The surrounding industrial receivers nearest to the Proposal are predicted to experience construction noise that are above the NMLs.

As such, for construction activities with high noise generating plant and equipment such as excavators with rockhammers and road saws, consultation with affected receivers should be conducted to determine all feasible and reasonable mitigation measures. The following types of management measure could be considered to manage impacts:

- Implement respite periods throughout the day from high noise impact activities. Typically respite periods should be at least 1 hour long. During these periods no high noise impact activities should be carried out.
- Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided or minimised.
- The offset distance between noisy plant and adjacent sensitive receivers is to be maximised.
- Plant used intermittently to be throttled down or shut down.
- Noise-emitting plant to be directed away from known more sensitive locations within the adjacent industrial receivers.
- Any equipment not in use for extended periods during construction work must be switched off.

7.3.4.4 Noise monitoring

The following approach could be adopted regarding noise monitoring procedures during the construction works. In the event of a sustained complaint, noise monitoring may be carried out to examine noise impacts as follows:

- Reasonable and feasible noise reduction measures must be investigated, where necessary.
- Typically, short term (attended) noise monitoring would be undertaken to investigate a complaint as opposed to ongoing noise logging as this will enable a faster response time.
- In the event that short term (attended) noise measurements cannot produce a suitable outcome, long term noise monitoring will be considered. Typically, long term monitoring is useful primarily as a means to check if start/finish times or respite periods have been adhered to. Given this limitation, they are not typically proposed in the first instance.

As part of further design development, when a contractor is appointed and the specific construction methodology is known and the likely construction equipment are also known, the potential construction impacts are to be reviewed to determine that they are consistent with those presented in this SSDA NVIA and that the associated mitigation and management measures are appropriate.

7.4 Construction vibration assessment

7.4.1 Construction vibration sources

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is very site specific as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver. Potential vibration generated to receivers is dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration, and the receiver structure.

The recommended minimum working distances for vibration intensive plant are presented in Table 7-13 and Table 7-14. These distances are conservatively based on excavation of hard rock. Site specific minimum working distances for vibration intensive plant items must be measured on site where plant and equipment are likely to operate close to or within the minimum working distances for cosmetic damage, as detailed in Table 7-13

Unlike noise, vibration cannot be readily predicted. There are many variables from site to site, such as soil type and conditions, sub surface rock, building types and foundations, and actual plant on site.

The data relied upon in this assessment (tabulated below) is taken from a database of vibration levels measured at various sites or obtained from other sources (such as BS5228-2:2009). They are not specific to this proposal as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

As such, potential vibration impacts are to be further reviewed during the construction design, planning stages to determine if the final selected plant and equipment could be located within the minimum working distances and/or result in vibration levels about the applicable vibration limits. Where then identified, and feasible and reasonable mitigation and management would be implemented to achieve the applicable vibration limits.

Table 7-13: Minimum working distances (m) for cosmetic damage (continuous vibration)

Plant item	Minimum working distance (m) ⁵		
	Reinforced or framed structures (e.g. commercial buildings) ^{1,3}	Unreinforced or light framed structures (e.g. residential buildings) ^{1,3}	Sensitive structures (e.g. unsound heritage structures) ^{2,4}
Drill rig / bored piling	5	5	10
Smooth drum roller (13t) - High vibration	5	15	20
Smooth drum roller (13t) - Low vibration	5	5	10
Excavator with hammer attachment	5	10	15
Jackhammer	5	5	5

- Notes
1. Criteria referenced from British Standard 7385: Part 2 'Evaluation and measurement of vibration in buildings'.
 2. Criteria referenced from DIN 4150 Part 3, Structural Damage - Safe Limits for Short-term Building Vibration.
 3. Initial screening test criteria reduced by 50% due to potential dynamic magnification in accordance with BS7385.
 4. A site inspection should determine whether a heritage structure is structurally unsound.
 5. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method.

Table 7-14: Minimum working distances (m) for human annoyance (continuous vibration)

Plant item	Minimum working distances (m)				
	Critical areas ^{2,3} 0.28 mm/s	Residences ⁴		Offices / schools ^{2,4} 1.1 mm/s	Workshops ² 2.2 mm/s
		Day ¹ 0.56mm/s	Night ¹ 0.40 mm/s		
Drill rig / bored piling	30	20	20	10	10
Smooth drum roller (13t) - High vibration	120	70	90	40	25
Smooth drum roller (13t) - Low vibration	75	40	55	20	10
Excavator with hammer attachment	65	45	55	30	20
Jackhammer	25	15	20	10	5

- Notes:
1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
 2. Applicable when in use
 3. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992
 4. Offices, schools, educational institutions and places of worship (day or night)

7.4.2 Construction vibration assessment

As a screening assessment, items potentially impacted by vibration were identified if they were located within worst case minimum working distances from the various proposed vibration intensive activities, for the worst case structure/receiver type.

The minimum working distance from the extent of the construction areas, based upon the most vibration intensive plant, are presented in Figure 7-4 and Figure 7-5

Figure 7-4 – Main works area - Minimum working distances (MWD) for cosmetic damage from the construction area extents (most vibration intensive plant)

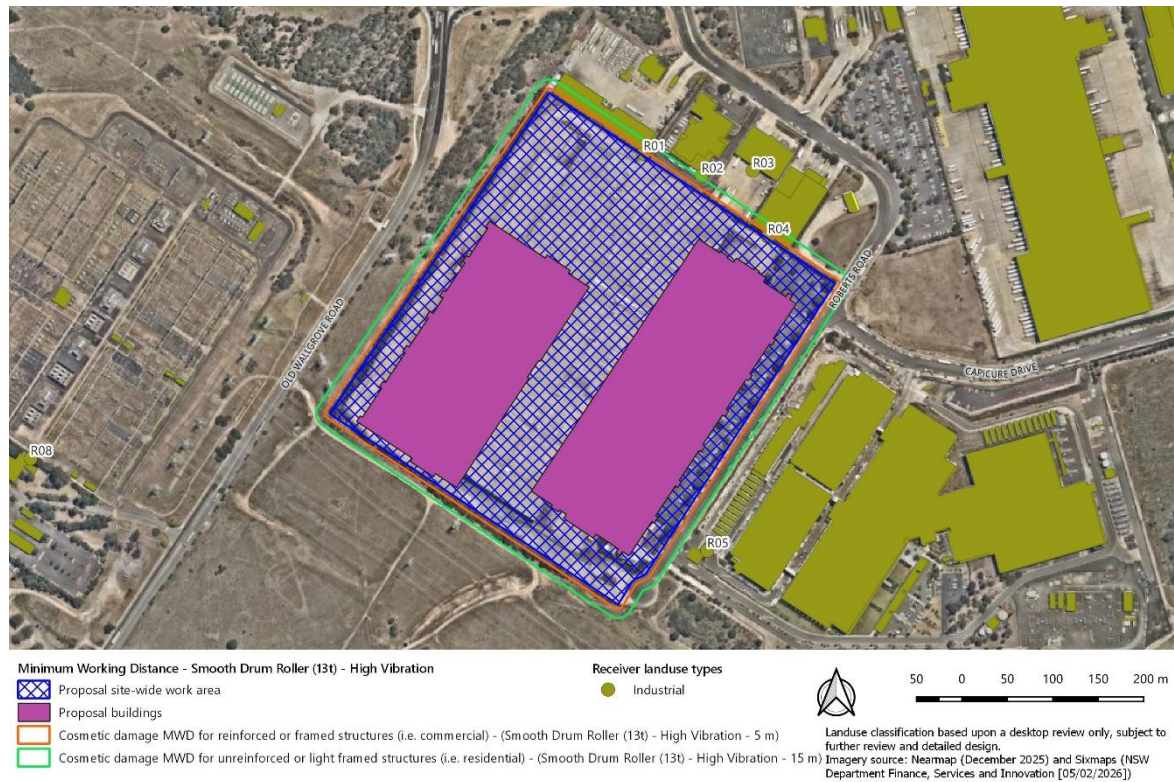
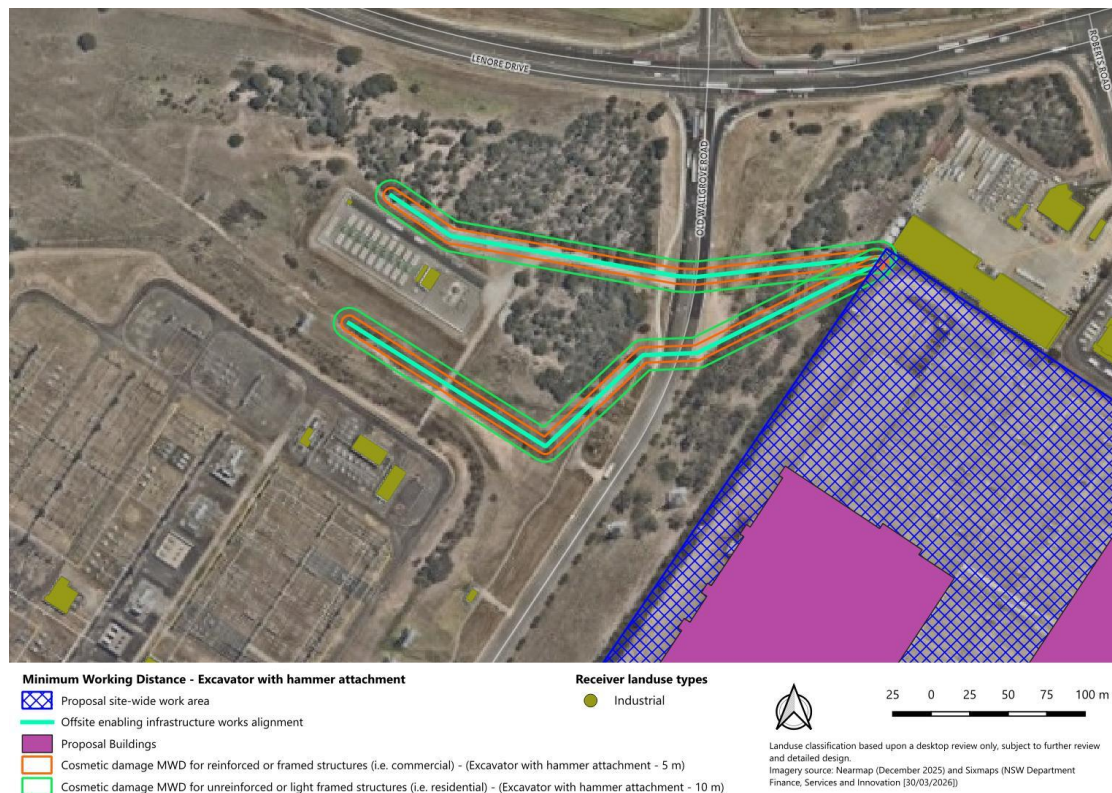


Figure 7-5 – Offsite enabling infrastructure works - Minimum working distances (MWD) for cosmetic damage from the construction area extents (most vibration intensive plant)



7.4.2.1 Cosmetic damage

Figure 7-4 indicates that the distance between the proposed construction works and the nearest sensitive residential receivers and childcare centre are likely to be outside of the cosmetic damage minimum working distance.

The exception is for the existing industrial receivers north of the construction site. These may be located within the cosmetic damage minimum working distance when vibration intensive activities (ie. vibratory rollers) are in use nearby during proposed construction works in close proximity to these receivers.

Vibration monitoring shall be undertaken to determine site specific minimum working distances of vibration intensive equipment to be used as part of the construction process, such as vibratory rollers. Following this, the construction vibration management recommendations in Section 7.4.3 should be followed.

7.4.2.2 Heritage listed items

Based on a review of available data, there are no identified heritage listed items or vibration sensitive unsound structures within the vicinity of the Proposal.

7.4.2.3 Data centres

As the project is being constructed in stages, such that there will be construction works taking place adjacent to adjacent to operational data centre buildings which will include vibration sensitive equipment, there is potential for vibration impacts on adjacent data centre shells when vibration intensive works occur in close proximity.

Although some guidance is provided in Section 4.2.3 for typical acceptable vibration limits for building structures that house sensitive equipment, which could be used as a guide to determine if there could be potential vibration impacts from vibration intensive construction works, it is not known if this is appropriate for the data centre equipment.

It is recommended that the equipment specific recommended vibration levels should be obtained from instrument manufacturers to aid with construction vibration management. These limits should then be implemented into the construction design, planning and management in a feasible and reasonable manner.

If there is any risk of exceeding the established limits after all of the above options have been considered, the vibration management processes detailed in Section 7.4.3 should be followed.

7.4.2.4 Human annoyance

The nearest sensitive residential receivers and childcare centre are generally located outside of the human comfort minimum working distance for vibration intensive equipment when vibratory rollers are in use nearby during proposed works.

As such, there is no potential for human annoyance, noting the variability of construction vibration. The potential for human annoyance impacts should be further reviewed during construction planning and managed appropriately when vibration intensive works are proposed to take place within established site specific acceptable minimum working distances with the known construction methodologies. These approaches are further detailed in Section 7.4.3.

7.4.3 Construction vibration management measures

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest receivers:

7.4.3.1 Cosmetic damage

1. Where construction activities occur in close proximity to:
 - a. sensitive receivers/structures or on material that will likely cause vibration to any identified receiver/structures, or;
 - b. within the identified minimum work distances.

Vibration testing of actual equipment on site should be carried out prior to their commencement of site operation to determine site specific acceptable minimum working distance to the nearby sensitive receiver/structures location/s.

The minimum working distances and vibration limits for the Proposal will be based upon the vibration limits identified in Section 4.2.

Undertake attended vibration measurements at the commencement of vibration-generating activities to establish site-specific minimum working distances and re-assess potential impacts (if required). This may include further detailed analysis based on the frequency content of the vibration levels.

2. If vibration intensive work is proposed to occur within the site specific acceptable minimum working distance, then the following would be carried out:
 - a. Evaluate whether alternative construction methods, plant or equipment can be utilised for the works and re-assess potential impacts (if required).
 - b. If there is any risk of exceeding the vibration objectives identified in Section 4.2 and after all of the above options have been considered, a permanent vibration monitoring system should be installed, to warn plant operators (via flashing light, audible alarm, SMS, etc) when vibration levels are approaching the structural/cosmetic damage limits. It is recommended that for the operator alerts, that multiple alert levels are set. Typically, this would be an alert trigger level at 75% of the vibration criteria (ie. amber alert), and an alert trigger level at 100% of the vibration criteria (ie. red alert).
 - c. A management procedure would be developed prior to the works taking place to determine the response to each trigger level. It is recommended that this includes a pause and management measures for an alert trigger level at 75% of the vibration

criteria, and stop work at an alert trigger level at 100% of the vibration criteria. Where stop work is triggered, it is recommended that the following are undertaken:

STOP WORKS ACTIONS

- i. Investigate cause of exceedance
 - ii. Visual inspection of the vibration sensitive building/structure/item including photos
 - iii. If no cosmetic damage is found, works and vibration monitoring can be resumed
 - iv. If cosmetic damage has been identified, repair damage or undertake any specific required action (ie. data centre notification) and a different construction method with lower source vibration levels is to be used.
- d. If works are proposed within the cosmetic damage minimum working distance, prior to starting work a building/structure condition survey would be carried out on vibration sensitive items/structures within the minimum working distances and vibration limits determined to manage cosmetic damage.
3. Dilapidation surveys must be conducted for all receivers and structures within close proximity of the construction site, including those identified as within the vibration minimum working distances for cosmetic damage for the construction site, prior to commencement of activities with the potential to cause property damage.

7.4.3.2 Human annoyance

Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures. At properties near the construction works, nearby receivers may be able to feel vibration when vibration-generating equipment is being utilised. For this reason, it is appropriate identify properties where there is a probability of adverse comment so that impacts can be managed.

1. A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.
2. Where vibration is found to be excessive, management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones as mentioned above, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.
3. Attended vibration measurements for human annoyance should be carried out as required to appropriately manage the works. The proximity of neighbouring residences will be communicated to subcontractors highlighting the relevant vibration restrictions and criteria

for the area. This information will also be communicated during pre-tender meetings, start-up meetings and site inductions of personnel.

4. Notification by letterbox drop would be carried out for all buildings in the vicinity of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property. Notification is to be provided to all occupants prior to any works that may cause vibration.
5. Following the implementation of feasible and reasonable mitigation and management measures, where construction vibration levels remain above the human annoyance limits when a premises is occupied, vibration intensive works, including the use of vibratory compactors, may continue where there is an agreement in place with the potentially impacted receiver.

7.5 Complaints management

Noise and vibration levels generated by construction activities associated with the construction of the development must aim to comply with the noise and vibration goals set by the relevant regulations and guidelines. The contractor is responsible for ensuring that all reasonable and feasible mitigation and management measures are implemented such as the provision of a Noise and Vibration Complaints Program, to minimise the generation of excessive noise and/or vibration levels from the site to nearby sensitive areas.

Owners and occupants of nearby affected properties are to be informed by direct mail/email or a direct telephone line and contact person to either make a noise and/or vibration complaint or request information.

Nearby development should be notified of the proposed works.

The notification should outline:

- Details of a site point of contact.
- The anticipated duration of the project construction works.
- Identify the duration of the construction stages.
- Identify what stages will have greatest potential impact on each resident. This will provide much clearer information for each party about how the site work will impact them specifically (the duration over which the greatest noise impact will occur).

All noise and/or vibration complaints associated with the construction works shall be investigated in accordance with the Noise / Vibration Complaint Management Procedure identified in APPENDIX F.

8 Operational noise assessment

8.1 Noise generating operations

8.1.1 Operational scenarios

The following operational scenarios have been considered in order to assess the noise from the site operation. These include:

- **Typical operations**, which are consider the following:
 - **Day:** all equipment operating and other concurrent site operations, in addition to maintenance testing of back-up generators or fire-pumps with associated load banks (see Section 8.1.2)
 - **Evening and night:** all equipment operating and other concurrent site operations.
- **Emergency critical power failure** (see Section 5.3 and 8.1.3)

8.1.2 Maintenance and testing operations

8.1.2.1 Backup generator maintenance testing

Maintenance testing of emergency plant and equipment (ie. backup generator systems) is proposed to occur during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays). This would occur as part of typical operations and has been incorporated into the noise modelling for the day period. The testing regime for the generators is summarised in Table 8-1 below.

Table 8-1: Proposed standby generator maintenance testing schedule

Test type	Duration of test	Quantity of site generators	Generators tested simultaneously	Testing hours
Annual	60 minutes + 5 minutes cooldown	249	Up to 5	Daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays)
6-monthly	30 minutes + 5 minutes cooldown	249	Up to 5	
Quarterly ¹	30 minutes + 5 minutes cooldown	249	Up to 5	

Notes: 1. The quarterly test is done twice per year and combined with the six-monthly and annual tests for the other two instances.

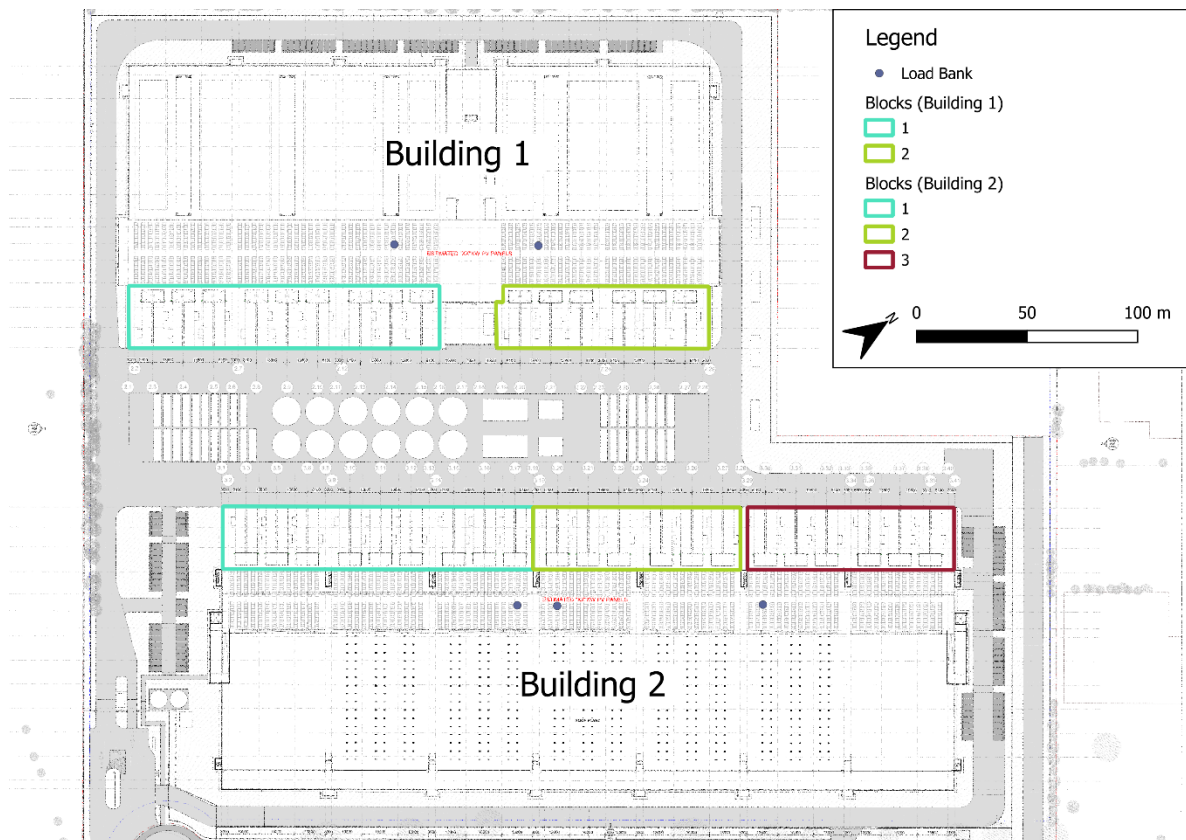
For the purpose of generator testing, Building 1 and Building 2 have been divided into blocks with a single load bank to test all generators within that block. These blocks are shown in Figure 8-1.

The load bank will be located on the roof level and within each block, with two for Building 1 and three for Building 2. The current Proposal design is based on a single generator tested at any one time per block. As there is only one load bank for each block, this means that only one generator within each

block can be tested at a time. The location of these blocks, and the worst-case modelled generator locations are included in Section 8.4.2.

As testing takes place one at a time in each block, this means that the combination of generators which result in the worst case noise levels would vary for each receiver. As such, the assessment methodology has been done to take this into account as detailed in Section 8.4.2.

Figure 8-1: Generator testing blocks and load bank locations



8.1.2.2 Other maintenance testing

8.1.2.2.1 Fire pumps rooms

The fire pump room is located on the southeastern side of Building 2, adjacent to the main entrance. This contains the hydrant pumps with associated mechanical ventilation for the room as per the SSDA NVIA. Maintenance testing of hydrant pumps is proposed to take place during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays).

8.1.2.2.2 Other maintenance requirements

The site is powered by via dual redundant feeders. In the case of other required maintenance operations, where a incoming electrical switching station transformer is required to be taken offline for

maintenance or other purposes, then the incoming feeder would be changed such that the transformer could be taken offline without the requirement for generators to operate.

8.1.3 Emergency operations

During emergency critical power failure, where all electrical feeders to the site are compromised, it is expected that all generators would operate. For the fully developed facility, this would be for all generators identified in Table 8-1.

As detailed in Section 5.3, this is expected to be an extremely rare occurrence of this scenario. As such, the predicted noise levels for emergency operations presented in Section 8.5.3 are for information purposes only.

8.2 Operational noise sources

8.2.1 Overview

To undertake a noise and vibration assessment for the facility, the NPfI requires a comprehensive assessment of the potential operational noise emissions from the Proposal. The basis of these noise emissions is what would be the “reasonable worst case 15-minute period” noise emissions for each of the Day (7:00am to 6:00pm), Evening (6:00pm to 10:00pm) and Night (10:00pm to 7:00am) periods.

The noise sources associated with the operation of the Proposal can be separated into the following categories:

- fixed mechanical and electrical plant/equipment, including emergency equipment (i.e. backup generators)
- staff vehicle movements and car parking
- loading dock activities

Although the internal noise level of some technical spaces can be high (eg. 80-85 dB(A)), as the internal spaces are conditioned, these spaces are sealed and are not expected to contribute to noise emissions. It has been assumed that noise breakout from internal noise levels via building services elements or through openings/penetrations identified during further design development will be acoustically designed to ensure that noise emission outcomes remain consistent with this assessment.

Where mechanical ventilation from internal spaces has been identified at this stage, it has been included in the noise modelling. The exceptions include the following (which are shown in Figure 8-2):

- Corridor louvres
- Data hall intake and exhaust ventilation ducting

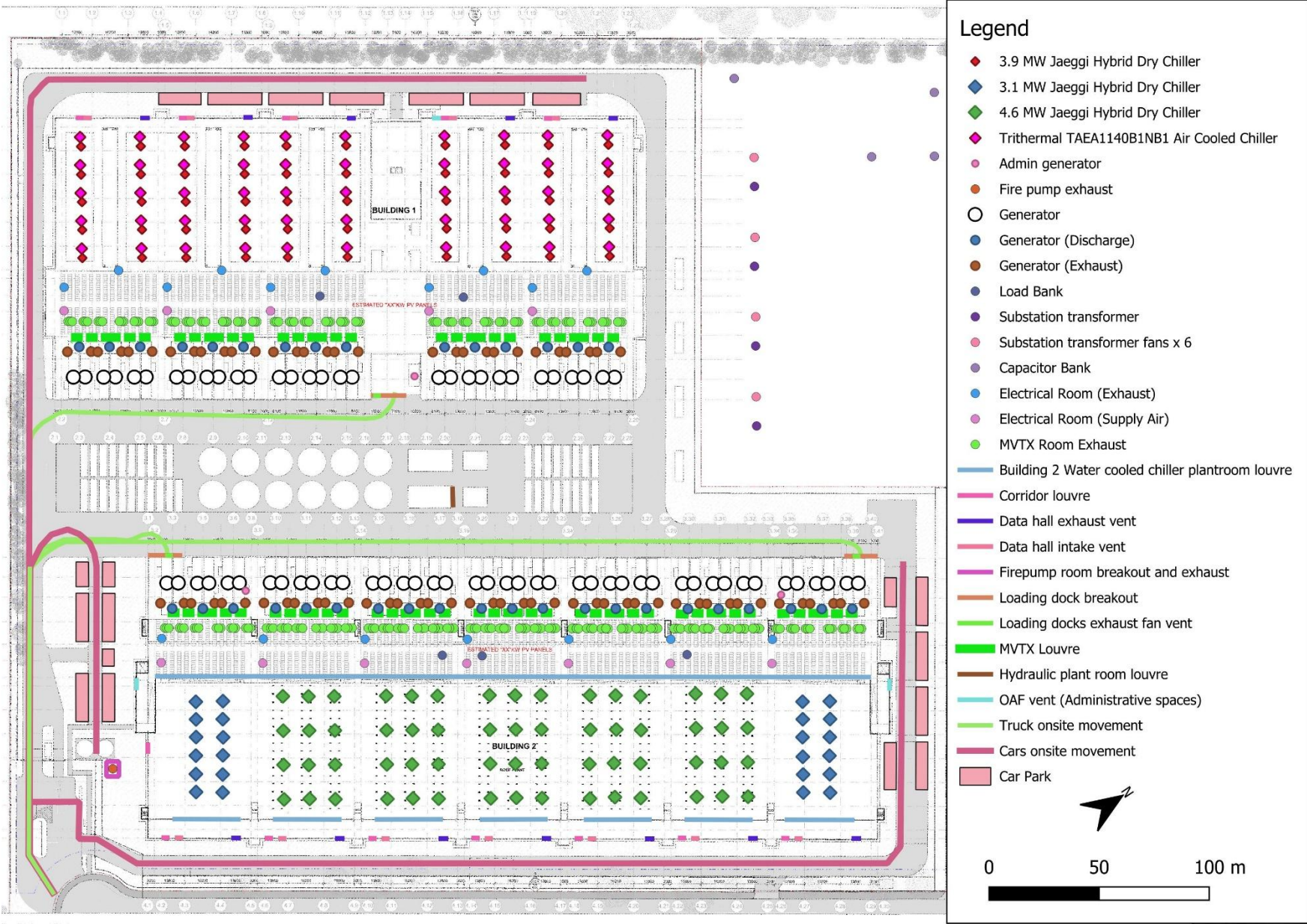
The following sections detail the key noise generating plant and equipment that will operate as part of typical operations of the facility. This section details the noise sources and associated operational assumptions.

The type and quantity for each of the various noise sources assessed across the operational scenarios are detailed in the relevant section of Section 8.1. For reference, the overall Proposal plan is presented in Figure 1-1.

8.2.2 Description of operational key noise sources

Figure 8-2 presents the Project plans showing the assumed locations of noise generating plant, equipment and activities that has been included in the noise modelling. This is based upon the project design combined with operational information provided by the client and project team in preparation of this NVIA.

Figure 8-2: Modelled noise generating components diagram (fully developed facility, with all blocks)



8.2.3 Key mechanical plant and equipment

Mechanical plant and equipment, along with other building services are the key sources of noise as part of a data centre's operations. The key building services and mechanical plant items likely to operate within the facility and which have been considered for the noise assessment are:

- Cooling systems
- Electrical distribution (low and high voltage) and storage
- Testing, auxiliary equipment, power generating equipment
- Additional building services and mechanical systems

At this early development approval stage of the Proposal, the mechanical plant/equipment design and selection have not been finalised. For assessment purposes, the key likely plant and equipment have been identified and locations shown in Figure 8-2 and further details of the various items included in this section. These have then been used to determine likely noise emissions, and likely mitigation and management measures required to achieve the noise goals detailed in Section 5 and demonstrate the Proposal is able to achieve the PNTL with likely equipment.

The following section also detailed the assumed mitigation measure assumptions that have been developed with the project team and incorporated into the design in order to determine a design that would achieve the required NPfI project trigger levels detailed in Section 5.1.3.

It is assumed that all the identified mechanical plant noise sources could typically operate during all assessment periods and have been included in the noise modelling during all assessment periods as such.

The location of the main items of plant is shown in Figure 8-2. The sound level data for the equipment and operational quantities were provided by the project team with supplementary data from the RTA database used where appropriate.

8.2.3.1 Cooling systems

The main cooling system mechanical element will be the use of air-cooled chillers and hybrid dry coolers in combination with water cooled chillers. A range of cooling systems including both hybrid-dry coolers/ cooling towers, water cooled chillers, and air-cooled chillers were considered as part of design development.

A design solution includes a combination of hybrid dry chillers, water cooled chillers and air-cooled chillers, following a detailed review of selections which adopt the quietest combination for the Proposal to achieve the requirements. This process focused on ensuring the noise levels were minimised at source, to reduce the requirement for further mitigation in the transmission path.

The modelled upper limiting sound power levels for the day, evening and night periods for the cooling units are detailed in Table 8-2. Details of the units are included in APPENDIX C.

Table 8-2: Assessment equipment noise levels – Cooling system plant selection

Plant/equipment	Full facility quantity operating	Period ¹	Individual source/activity sound power level (L _w re. 1pW), L _{Aeq,15min}								
			Overall dB(A) ^{2,3}	Octave Band Centre Frequency - Hz dB ^{2,3}							
				63	125	250	500	1k	2k	4k	8k
Water cooled chiller (Carrier 19MV-75Z75L459E39) ^{7,8}	Building 2 = 84 Within plant rooms (36 on block 1, 24 in block 2 and 24 on block 3)	Day, Evening & Night	103	89	95	91	94	100	94	95	84
Hybrid dry chiller Jaeggi 4.6 MW ^{1,5,9,10}	Building 2 = 60 (24 on block 1, 24 on block 2 and 12 on block 3)	Day & Evening	87	91	89	87	85	82	77	70	61
		Night	79	84	80	78	76	74	69	63	54
Hybrid dry chiller Jaeggi 3.1 MW ^{1,6,9,10}	Building 2 = 24 (12 on block 1 and 12 on block 3)	Day & Evening	84	87	87	84	82	79	74	67	58
		Night	79	82	82	78	77	74	69	62	53
Hybrid dry chiller Jaeggi 3.9 MW ^{1,6,9,10}	Building 1 = 50 (30 on block 1, 20 in block 2)	Day & Evening	85	88	88	85	83	80	75	68	59
		Night	80	83	83	79	78	75	70	63	54
Air cooled chiller Trithermal TAEA1140B1NB1 ^{1,4}	Building 1 = 50 (30 on block 1, 20 in block 2)	Day	89	86	89	89	85	84	79	77	81
		Evening	82	82	80	80	77	76	71	71	77
		Night	82	82	80	80	77	76	71	71	76

- Notes:
1. Ambient design temperatures and fan speeds used to determine the upper limiting sound power levels adopted are shown in APPENDIX C.
 2. Assumed sound data modelled with a +/- 3 dB(A) tolerance.
 3. Based upon source level information provided by the supplier.
 4. Unit height is 2.7m
 5. Unit height is 5.8m.
 6. Unit height is 4.9m.
 7. Water cooled chillers located inside a plant room on Level 3 of Building 2. Internal noise levels within the plant room, and then noise emissions have been modelled breaking out of the full height louvres on its northwest and southeast sides
 8. Based upon noise levels measured at 1m as per AHRI Standard 575, 80dB(A) at 1m.
 9. Overall sound power levels based upon the whole numbers presented in APPENDIX C.
 10. Unit operating up to 83% utilisation. See APPENDIX C.

The assessment of tonality and low-frequency noise is typically limited by the available data for the applicable noise sources, with supplier sound power level data typically being supplied as either a single overall level, or limited octave band levels (typically 63 Hz to 8 kHz), rather than 1/3 octave levels required for NPfl assessment of tonality and low-frequency noise. Supplier data for the selected units was provided in octave band spectrums shown in in APPENDIX C, down to 63 Hz. The cooling units are a dominant item of equipment for normal operations noise emissions. For assessment purposes, the 1/3

octave spectrum for these sources has been conservatively estimated based on measurements of similar equipment, adjusted for the supplier data. All mechanical plant is indicative and will be reviewed during detailed design.

The final cooling system operations and duty points will be further designed and refined as part of Proposal design development, but would maintain the outcomes presented in this NVIA.

8.2.3.2 Low-voltage electrical distribution and storage

Located on the roof level and generator gantries on other levels are the following equipment items.

- MVTX transformers (3000 kVA) (located within the MVTX room, which is mechanically ventilated, see Table 8-7 for noise emissions, which have been modelled consider the transformer noise level in Table 8-3).
- Uninterrupted power supply (UPS) (located inside the electrical room, which is mechanically ventilated, see Table 8-7 for noise emissions)

The modelled noise source levels for the transformers are presented in Table 8-3 below.

Table 8-3: Noise source levels – Low-voltage electrical distribution and storage

Plant/equipment	Full facility quantity	Individual source/activity sound power level (L_w re. 1pW), $L_{Aeq,15min}$								
		Overall dB(A)	Octave Band Centre Frequency - Hz dB							
			63	125	250	500	1k	2k	4k	8k
Transformer kiosk (3000 kVA) ^{1,2,3}	246	88 ²	77	88	94	87	73	63	51	37

- Notes:
1. Based upon a dry type of distribution transformer
 2. Sound power level based upon supplier data of 70dB(A) at 1m.
 3. Spectrum based upon RTA measured transformer

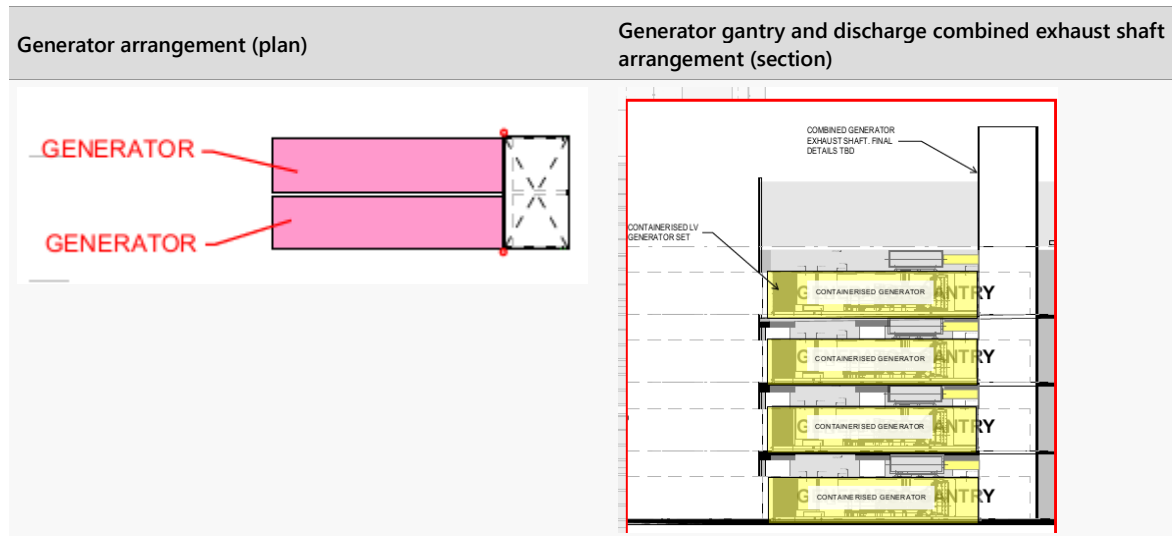
8.2.3.3 Testing, auxiliary equipment, power generating equipment

Generators within acoustic enclosures are located on the southeast side of Building 1 and northeast side of Building 2, within a dedicated generator gantry space. They are spread across all levels of Building 1 & 2. 3 administration generators are also located across Building 1 and Building 2. Their locations are shown in Figure 8-2.

- All generators will be a containerised solution, with specifically designed acoustic enclosures.
- Generator enclosures are arranged in pairs, connected to a common exhaust shaft, that is common for generators across gantry floors, as shown in Table 8-4.
- During a maintenance testing, up to five generators would operate during daytime testing, as detailed in Section 8.1.2.

- Testing will typically take place using the dedicated load bank for each block as per detailed in Section 8.1.2.

Table 8-4: Generator arrangement details



Fire pumps are located within a fire pumproom at the southern end of the site, adjacent to the site guardhouse.

The modelled noise source levels for the testing, auxiliary equipment, power generating equipment are presented in Table 8-5.

Table 8-5: Noise source levels – Testing, auxiliary equipment, power generating equipment

Plant/equipment	Location	Full facility quantity	Individual source/activity sound power level (L_w re. 1pW), $L_{Aeq,15min}$								
			Overall dB(A)	Octave Band Centre Frequency - Hz dB							
				63	125	250	500	1k	2k	4k	8k
Containerised generator unit (backup power only) (2,800kWe) ^{2,4} Acoustic enclosure body breakout (roof + one side) ¹¹	Generator gantries (all levels)	246	100 ²	115	112	100	92	83	85	82	94
Containerised generator unit (backup power only) (2,800kWe) ^{2,4} Intake			91 ²	96	98	83	71	72	74	67	92
Containerised generator unit (backup power only) (2,800kWe) ^{2,4} Discharge	Combined plenum covering all floors discharging at roof level		91 ²	96	98	83	71	72	74	67	92
Generator exhaust flue outlet ^{5,10}	Flue discharge at data centre roof level		86 ¹⁰	94	94	87	75	79	80	69	52

Plant/equipment	Location	Full facility quantity	Individual source/activity sound power level (L_w re. 1pW), $L_{Aeq,15min}$								
			Overall dB(A)	Octave Band Centre Frequency - Hz dB							
				63	125	250	500	1k	2k	4k	8k
Containerised generator unit (inclusive of exhaust flue) (Administrative Offices) ^{1,4,5}	Ground	3	101 ²	80	83	91	92	94	94	95	90
Load bank ⁶	Roof level, generator side of each block	5	97 ⁶	101	98	96	92	92	91	89	82
Diesel fire hydrant pumps set - Internal sound pressure level (engine noise)	Fire pump room, southern end of Building 2, near the main entrance	1 ⁷	112 ⁸	110	111	108	108	106	107	103	103
Diesel fire hydrant pumps set – Exhaust flue	(Exhaust flue discharge at roof level)	1 ⁷	107 ⁸	105	106	96	96	98	102	101	93

- Notes:
- Overall unit sound power provided, this includes all containerised noise cumulatively, including, air intake, discharge, container breakout, exhaust flue.
 - Based upon a supplier data for containerised generator engine within custom acoustic enclosure. Based upon acoustic enclosure achieving 75 dB(A) at 1m, with full enclosure sound power L_w 101dB(A), with indicative generator enclosure dimensions 18m x 4m x 5m enclosure. The emergency standby generator models to be installed at the Proposal site is not currently finalised, different generators than assumed may be selected for installation as part of the Proposal, they are to be confirmed to achieve the same acoustic outcomes as presented in this NVIA.
 - Spectrum based upon RTA measured transformer
 - Assumed enclosure sound data modelled with a +/- 2 dB(A) overall tolerance based upon supplier data.
 - Assumed exhaust flue sound data modelled with a +/- 3 dB(A) overall tolerance based upon supplier data.
 - Unmitigated load bank was, 91 dB(A) at 1m, sound power L_w 112 dB(A). Load bank enclosed in dedicated plant rooms at roof level, attenuator to be installed on intake and exhaust to achieve sound power L_w 97 dB(A). Spectrum is based upon supplier data.
 - Assumed internal noise levels during testing (ie. with one engine operating).
 - An indicative fire pump has been adopted as no selection is currently available. This is based upon the following base assumed unmitigated noise levels, Engine = 126 L_w dB(A), Exhaust = 139 L_w dB(A). The noise levels presented above include typical level of mitigation for the exhaust and assumed internal noise level within the fire pump room space. Critical grade exhaust muffler is assumed to installed and provide a minimum 32 dB(A) noise reduction.
 - Assumed plant room is constructed with minimum 150mm concrete walls, with roof construction of 1 x 0.48 mm Klip-lok roof cladding, 100mm cavity filled with 75mm Bradford Fibertex 350 Mineral Wool insulation (or equivalent), 1 x 9 mm Compressed Fibre Cement internal roof lining (minimum R_w 53 system performance) or acoustically equivalent. Single sets of double solid core doors (west facade), minimum R_w 25. Acoustically equivalent alternatives are acceptable.
 - Based upon exhaust flue with muffler to achieve 75 dB(A) at 1m.
 - Sound power from enclosure roof and one side, as generators with two generators abutting each other.

8.2.3.4 High voltage (HV) electrical distribution

A 330kV substation is to be constructed on the northern side of the facility. This is to be the connection point for the facility power supply.

The noise sources associated with the high voltage (HV) 330kV substation within the Proposal boundary, with consideration of planning consultation with Transgrid / Lumea, are detailed in Table 8-6. The location of these sources is shown in Figure 8-2.

Development of the substation design is still in progress with Transgrid / Lumea. Where additional noise generating elements are required, they are to be reviewed to determine the noise emissions from the Proposal remain consistent with the outcomes of this NVIA.

Table 8-6: Noise source levels – High-voltage electrical distribution

Plant/equipment	Location	Full facility quantity	Individual source/activity sound power level (L_w re. 1pW), $L_{Aeq,15min}$								
			Overall dB(A)	Octave Band Centre Frequency - Hz dB							
				63	125	250	500	1k	2k	4k	8k
Substation transformer (175 MVA) ²	Incoming substation	4	89 ^{1,3}	74	74	74	71	71	74	88	72
Transformer fan	All transformers	6 per transformer	78 dB(A) per fan, 86 dB(A) for all fans	85	83	79	76	67	69	68	58
Substation capacitor banks	Incoming substation	4	88 ⁴	73	73	73	70	70	73	87	71

- Notes:
1. Transformer sound power level based on AS/NZS 60076.10 (2023) - Outdoor Installation as a reduced maximum sound level and adjustment to achieve broadband levels provided by prospective manufacturer.
 2. Spectrum based upon RTA measurements of similar large substation transformer, adjusted to achieve the identified AS/NZS 60076.10 (2023) overall broadband sound power level.
 3. This is a reduced noise (mitigated) noise level, as per Section 8.3.2.
 4. Sound power level provided by Transgrid/Lumea, Spectrum assumed similar to that of a transformer, as per Note 2

8.2.3.5 Additional building services and mechanical systems noise sources

Additional building services and mechanical systems plant and equipment presented in Table 8-7 have been identified by the project team as part of concept design planning, and have been included in the noise modelling. The location of these sources is shown in Figure 8-2.

As part of further design development, the mechanical plant and equipment noise sources would be further assessed, and mitigated through typical building services acoustic treatment methods, such as attenuators, internally insulated ductwork, acoustic louvres and enclosures.

Table 8-7: Noise source levels – Additional building services and mechanical systems

Location	Noise source	Number of sources	Individual source power level (L_w re. 1pW), $L_{Aeq,15min}$	Noise source emission location	Indicative mitigation assumptions
MVTX	Exhaust fan	1 in each MVTX room Building 1 = 90 Building 2 = 156 246 for full facility	Building 1 G: 65, L1: 69, L2: 75 Building 2 G: 63, L1: 65, L2: 69, L3: 75	Roof	Indicative equipment. To be selected / designed to achieve identified sound power level. Assumed minimum 50mm thick internally insulated ductwork between fan and external roof opening. Unmitigated fan sound power level, L_w 90 dB(A).
MVTX	Breakout via louvre	1 in each MVTX room (1.4 sqm) Building 1 = 90 Building 2 = 156 246 for full facility	72	Building 1 = Southeast façade Building 2 = Northwest façade	Assumed minimum 3m 50mm thick internally insulated intake ductwork between fan and façade louvre. Unmitigated fan sound power level, L_w 90 dB(A).
Electrical room	Supply fan	Building 1 = 5 Building 2 = 7 12 for full facility	80	Roof	Indicative equipment, fan roof mounted. To be selected to achieve nominated sound power level.
Electrical room	Exhaust fan	Building 1 = 10 Building 2 = 7 17 for full facility	80	Roof	Indicative equipment, fan roof mounted. To be selected to achieve nominated sound power level.
Administrative offices	Outside air fan	Building 1 = 5 Building 2 = 4 9 for full facility	80	Building 1 = 1. Northwestern façade louvre 2. Southeast façade louvre Building 2 = 1. North façade louvre 2. South façade louvre	Indicative ventilation plant items. To be selected to achieve nominated sound power level.
Loading dock	Exhaust fans	1 for each loading dock area Building 1 = 1 Building 2 = 2 3 for full facility	80	Southeastern façade for Building 1 and Northwestern façade for Building 2	Indicative equipment. To be selected to achieve nominated sound power level.
Guardhouse	Condenser unit	1	78	Northeastern façade of the guardhouse	Indicative air-conditioning plant items. To be selected to nominated achieve sound power level.
Hydraulic plant room	Internal pumps	Multiple	80 (Internal sound pressure level)	Breakout via northeastern façade of the plantroom (louvre)	Indicative pump .To be selected to achieve nominated sound power level
FWU corridor	FCUs and fan ducted to external facade	1 per data hall Building 1 = 10 Building 2 = 19 29 for full facility	69	Northwestern façade (Building 1) and Southeastern façade (Building 2)	Indicative air-conditioning plant items. To be selected to achieve nominated sound power level.

Location	Noise source	Number of sources	Individual source power level (L_w re. 1pW), $L_{Aeq,15min}$	Noise source emission location	Indicative mitigation assumptions
Data hall	Internal data hall breakout via exhaust duct	1 per data hall Building 1 = 10 Building 2 = 19 29 for full facility	73	Northwestern façade (Building 1) and Southeastern façade (Building 2)	Assumed minimum 50mm thick internally insulated ductwork and two internally insulated bends between fan and external louvre. Assumed data hall internal sound pressure level 90 dB(A).
Corridor façade	Corridor facade louvres	Building 1 = 10 Building 2 = 21 Each 1.5 sqm 31 for full facility	65 dB(A) (Internal sound pressure level)	Building 1 = Northwest façade Building 2 = 1. Southeast façade 2. Southwest façade	Architectural weatherproof louvre only

Notes: 1. The sound power level includes assumed mitigation provided by the identified indicative treatment.

8.2.4 Offices and staff vehicle movements and car parking

The Proposal includes 150 at-grade car parking spaces, covering both the data centre buildings. This includes 60 spaces across the Building 1, and 90 spaces surrounding the Building 2.

Access to the Proposal, either to the northwest (Building 1) or southeast (Building 2) will be via Roberts Road on the southeastern side of the Proposal, as shown in Section 8.7. Once within the facility, car movements would then move along the internal facility roads to the respective parking areas located either to the northwestern side of Building 1 or southwestern or northeastern side of Building 2.

Once cars reach the respective parking areas, noise generated by car park activities includes vehicle doors closing, vehicle engines starting, vehicles accelerating and vehicles moving. To assess this noise, the $L_{Aeq\ 15\text{-minute}}$ noise level at the nearest affected receivers was determined for each relevant period based on the number of vehicle movements expected to occur during that period.

The assumed number of vehicles have been provided by the project traffic engineers (Ason). Further information on the traffic assumptions is detailed in Section 8.7 (public road assessment).

The project traffic engineers determine these movements based upon a first principles assessment, as detailed in the Transport Assessment (TA), considering staff and customers.

Worst case 15-minute movements and carparking activities have been based upon the maximum provided movement data for a conservative assessment for each of the day, evening and night periods. These assumed movements for the fully developed facility are presented in Table 8-8.

Table 8-8: Light vehicle movement assumptions

Applicable development stage	Worst case 15-minute assumed movements		
	Day	Evening	Night
Fully developed facility	28	6	2

The sound power levels generated by carpark activities on site are presented in Table 8-9 sourced from the RTA database. The carparking activities will generate noise emissions both moving to and from carparking spaces, and from associated activities (engine starts and door slams).

Noise generated by car park activities includes vehicle doors closing, vehicle engines starting, vehicles accelerating and vehicles moving. To assess this noise, the $L_{Aeq\ 15\text{-minute}}$ noise level at the nearest affected residential premises was determined for each relevant period based on the number of vehicle movements expected to occur during that period.

Table 8-9: Staff vehicle movements and car parking activity sound power levels

Equipment / Plant	Noise source / noise generating operation	Individual source/activity sound power level (L_w , re. 1pW), $L_{Aeq,t}$, dB(A)	
		$L_{Aeq,15min}$	L_{Amax}
Vehicle moving	$L_{Aeq,t}$ - Moving point source (10km/h)	79 ¹	90 ²
Carparking activities	Car engine starts	63	97
	Car door slams	56	96

Notes:

1. $L_{Aeq,t}$, sound power of moving point source. 15-minute level subject to movement duration.
2. During non-steady movement events

8.2.5 Loading dock activities

The facility includes three loading docks. Loading docks are located centrally in case of Building 1 and close to the northeastern and southwestern façade of Building 2. Access will be via the internal roads from the proposal's main entrance at the south end of Roberts Road.

A range of heavy vehicles could operate to and from the Proposal site. The facility has been designed for heavy vehicles up to 20m articulated vehicles (semi-trailers / low-loader), however, these vehicles will occur at very rare occasions and are not expected as part of typical operations. However, the modelling has conservatively assessed semi-trailer movements for a conservative assessment.

It is also expected that associated service/delivery truck movements would typically only occur during the daytime or evening period for typical operations, however, for a conservative assessment trucks have been modelled during all assessment periods.

Modelling of loading dock operations were based upon sound power levels presented in Table 8-10 which have been sourced from the RTA database of previous measured levels.

Table 8-10: Loading dock area activities sound power levels

Equipment / Plant	Noise source / noise generating operation	Individual source/activity sound power level (L_w , re. 1pW), $L_{Aeq,t}$, dB(A)	
		$L_{Aeq,15min}$	L_{Amax}
Heavy vehicle	Moving onsite ~ 10km/h	108 ^{1,2}	112
	Airbrake full release (when stopping at loading dock)	92	122
Loading dock activities	Loading dock internal activities	Internal pressure level 70 L_{Aeq}	

Notes:

1. Site has been developed to accommodate vehicles up to 20 articulated vehicles (semi-trailers / low-loaders), so this has been adopted for a conservative assessment.
2. $L_{Aeq,t}$, sound power of moving point source. 15-minute level subject to movement duration.

8.3 Initial assessment and acoustic mitigation and management review

8.3.1 Initial assessment outcome

During early design development modelling, it was determined that noise emissions from site operations may exceed the project noise trigger levels without further review of noise inputs assumptions and reasonable mitigation and management measures applied across the facility.

Key noise sources that were contributing to the overall cumulative noise emission level at nearby receivers were:

- Cooling units, including air-cooled chillers and hybrid-dry coolers
- Water cooled chiller plantrooms
- Other electrical distribution, mechanical and building services noise contributions.
- Generator testing during the daytime period

As such, a detailed review of input assumptions across all contributing noise sources was undertaken, noise modelling inputs were reviewed and refined, and feasible and reasonable mitigation and management measures that could be implemented have been identified and recommended with the aim to achieve the project noise trigger levels.

Noting the elevated nature of the noise sources and their large number, combined with the varied distances to receivers, and located in multiple directions, the mitigation approach focused firstly on reducing noise at the source. At source noise mitigation included quieter unit selections, on-unit mitigation at-intake or discharge points, relocating noise sources, and enclosing noise sources where possible, before reducing noise along transmission paths to receivers were investigated (ie. noise barriers).

Consistent with the NPfI Section 3.1 control strategies were considered and implemented in a hierarchical way so that all the measures that reduce noise for a large number of receivers (that is, source controls) were considered before more localised mitigation measures were considered.

Table 8-11 identifies the items were further identified and investigated for inclusion as part of the Proposal design:

Table 8-11: Key feasible and reasonable noise mitigation and management measure investigation

Item	Option	Outcome	Feasible / Reasonable
Chillers	Unit selection	Multiple cooling unit types and combinations of these types were investigated, including hybrid dry coolers and air-cooled chillers. Reduction at source was prioritised, prior to secondary and in path mitigation measures. The quietest combination of chillers, some with supplier acoustic mitigation measures implemented, including acoustic limiting modes and comprehensive noise insulation being applied to the units were adopted.	Implemented
	Noise barriers	Noise walls around the roof plant area were considered, but the focus remained on reduction at source. Sufficient noise reductions were determined through at-source strategies. This approach was due the high cost of any noise barriers, due to the size of the plant/equipment items, and the reduced effectiveness of noise barriers due the large source to receiver distances.	Not implemented Feasible but not reasonable
	Water cooled chiller plantroom	Review of water-cooled chiller selections. Investigation into acoustic mitigations to reduce internal noise buildup (acoustic absorption) and noise breakout via louvres (acoustic louvres and/or attenuators)	Implemented
Substation transformers and equipment	Reduced transformer noise levels	Reduced substation transformer sound power levels investigated and implemented, to achieve noise reduced noise levels as per AS/NZS 60076.10 (2023).	Implemented
Containerised generators	Generator acoustic enclosure acoustic performance	Generator acoustic enclosures with improved noise emission performance investigated and are to be implemented.	Implemented
Load bank mitigation	Load bank noise mitigation	Acoustic mitigation solutions for generator testing load banks investigated. The load banks to be selected to minimise noise levels and are to be located within dedicated locations that would be acoustically treated, including ventilation openings.	Implemented
Additional building services and mechanical systems	Acoustic mitigation of key ventilation systems	A range of ventilation systems to determine as part of future design development could result in cumulative noise emission increases. These were identified as readably treatable with typical acoustic mitigation strategies. Indicative measures to be included for further review a part of further design development.	Implemented

8.3.2 Summary of recommended design mitigation and management measures

Following the initial assessment of the site noise emissions, a range of feasible and reasonable mitigation and management measures were further investigated and identified in order to determine a design that would achieve the PNTLs and minimise noise emissions from the site.

Table 8-12 sets out recommended mitigation measures that have been included in this assessment. These are specific recommendations required for the Proposal, and further operational noise management measures that should be considered are detailed in Section 8.6.

The following acoustic mitigation measures have been developed with the project team to determine a design that would achieve the required PNTLs detailed in Section 5. For the site to achieve the PNTLs in Section 5 these mitigation or management measures are required to be implemented or are to be further investigated during design development to achieve the equivalent acoustic outcomes.

The mitigation and management measures in Table 8-12 are to be further reviewed as required during future design development stages so that they can be reasonably incorporated into the Proposal design as part of further design development where feasible, or alternative strategies developed to achieve the equivalent acoustic outcomes, as per Section 8.3.3.

The predicted noise levels presented in Section 8.5.1 incorporate the indicative noise mitigation and management measures presented in Table 8-12.

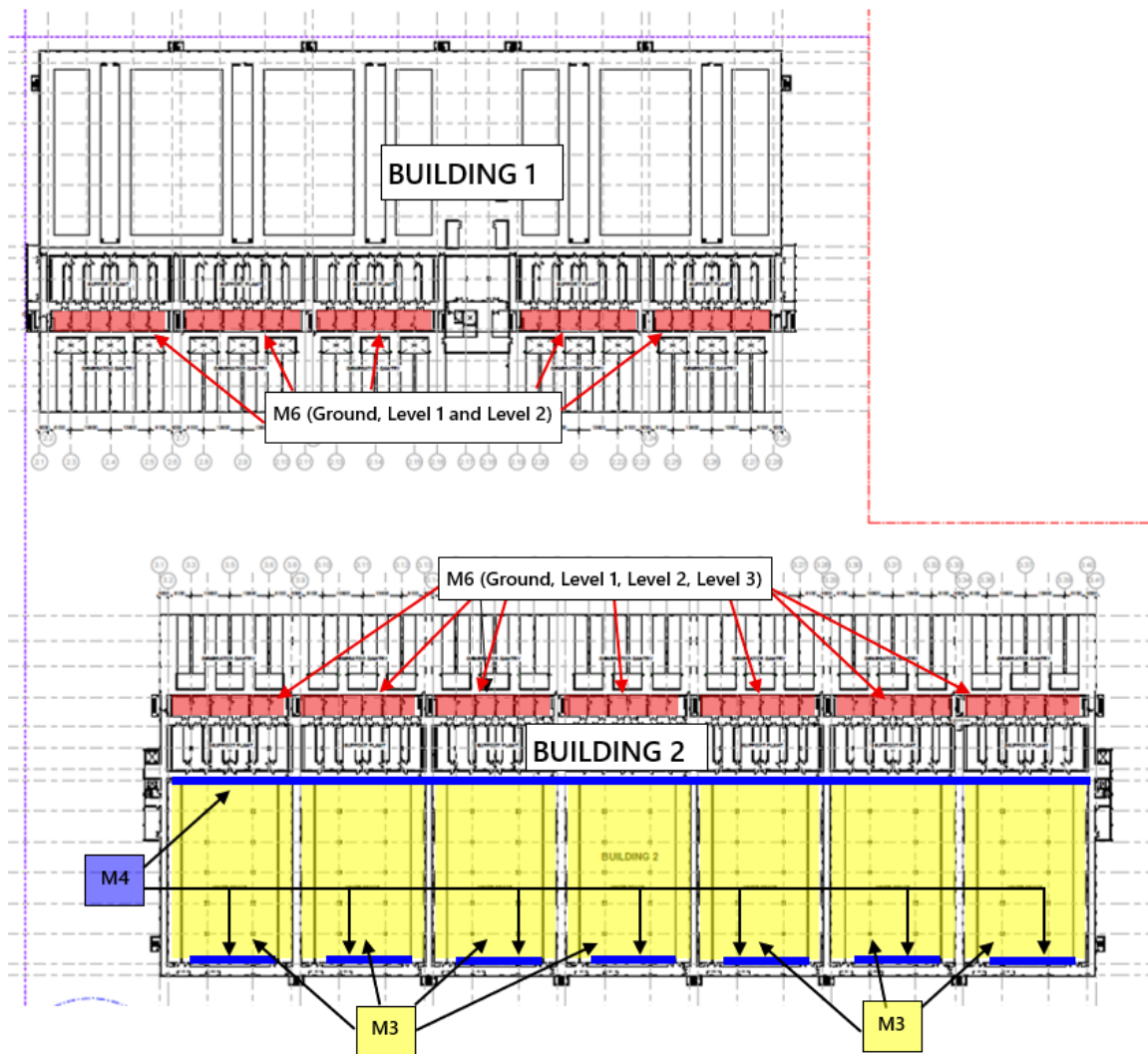
Table 8-12: Recommended and incorporated design mitigation measures

ID	Plant/ equipment	Details of assumed mitigation measures	Figure ref.
M1	All	Select equipment with sound power levels or assumed noise levels (both overall or spectrum) no more than those detailed in Section 8.2, considering the source locations shown in Figure 8-2, unless confirmed as achieving noise emission outcomes consistent with this NVIA.	Figure 8-2
M2	Chillers	Chillers are to be selected to not exceed the noise levels and quantities detailed in Section 8.2.3.1, for the locations shown in Figure 8-2, unless further acoustic analysis has been undertaken to confirm noise emission outcomes consistent with this NVIA.	Figure 8-2
M3	Water cooled chiller plantroom	Acoustic absorption (approx. NRC 0.85) installed to the underside of the plantroom roof and distributed across the roof area, minimum coverage of 50%, or acoustic design with equivalent acoustic outcome.	Figure 8-3
M4		Plantroom louvres are to be acoustic louvres. The noise modelling assumed the following acoustic louvres, with minimum 50% open area: - Northwest façade louvres – 300mm deep acoustic louvres (IAC LP 305 or acoustically equivalent) - Southeast façade louvres – 600mm deep acoustic louvres (IAC 2LP 610 or acoustically equivalent)	Figure 8-3
M5	Substation transformer	Transformers are to be designed with reduced noise levels, to not exceed the noise levels detailed in Section 8.2.3.4. This is to achieve the reduced noise levels for transformers as per AS-60076.10-2023 'Power transformers' for all transformers. This includes consideration of operating load.	Figure 8-2
M6	MVTX rooms (including transformers)	MVTX room louvres are to be designed to mitigate noise emissions, including breakout and ventilation noise as per Section 8.2.3.4 (Table 8-6). This will likely require acoustic mitigation to all ventilation openings. This will include consideration of the internal transformers, and if the transformer achieves the noise levels detailed in Section 8.2.3.2 (Table 8-3).	Figure 8-3

ID	Plant/ equipment	Details of assumed mitigation measures	Figure ref.
M7	Containerised generators	Generator acoustic enclosures to have upgraded acoustic performance and are to be designed to achieve the acoustic ratings as per Section 8.2.3.3 (Table 8-5). This includes consideration of all elements of the enclosure, including air intake, discharge, container breakout, and exhaust flue (except where specified separately for the exhaust) as this noise source is located away from the generator enclosure. Alternative generator enclosure acoustic performance can be adopted following detailed review, as per Section 8.3.3, where it is confirmed that the updated design and selection achieve noise emission outcomes consistent with this NVIA for cumulative Proposal noise emissions.	Figure 8-2
M8		Generator maintenance testing would take place during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays), as per Section 8.1.2. Where required testing would be managed as per Section 8.1.2.	
M9	Load bank	The load bank is to be installed within a dedicated enclosure, designed to achieve the external sound power requirement detailed in Section 8.2.3.3 (Table 8-5). This will need to include consideration and design of the noise breakout through any penetrations, openings, doors or similar required for the associated power cabling, to ensure the outcomes of this NVIA are maintained during maintenance testing.	Figure 8-2
M10	Fire pumps	Fire pump maintenance testing would take place during the daytime period (7am to 6pm Monday to Saturday; or 8am to 6pm on Sundays/Public Holidays), as per Section 8.1.2.	-
M11		Fire pump room to be designed to achieve the acoustic ratings as per Section 8.2.3.3 (Table 8-5).	-
M12	Additional building services and mechanical systems	The indicative mitigation measures assumed and recommended in Section 8.2.3.5 are to be further investigated as part of future design development to ensure they are designed and mitigated to achieve the noise outcomes consistent with this NVIA. This would include selection and design of items to avoid or sufficiently mitigate potential annoying characteristics (ie. tonality from water cooled chillers) at receivers.	-
M13	Proposal wide - To be undertaken as part of future design stages.	A detailed assessment of noise emissions is to be undertaken during detailed design stage considering the final mechanical plant and equipment items at the 'reasonable' worst case expected operational state, along with the building services, mechanical plant, plantroom spaces and any other typical operational noise sources. This should specifically consider the following items: • Cooling system operations • Substations and high-voltage distribution plant/equipment • Containerised generators, load banks and generator testing requirements and management • Building services and mechanical systems Cumulative noise emissions from the Proposal operations to be designed to achieve the project noise trigger levels presented in Section 5. This will likely include incorporation of mitigation and management measures detailed in this section (Section 8.3), where they remain appropriate. This could include selection of quiet plant/equipment, acoustic absorption, noise barriers, and the use of acoustic louvres and attenuators as part of the design, with consideration of Section 8.3.3.	-

ID	Plant/ equipment	Details of assumed mitigation measures	Figure ref.
M14	Proposal wide - To be undertaken as part of future design stages	Breakout façade penetrations and openings, in addition to breakout via materials of the facility facade and roof construction, including plantrooms, are to be considered as part of the above detailed assessment of noise emissions. These are to be designed to maintain the acoustic outcomes in Section 8.5.	-

Figure 8-3: Proposal indicative noise mitigation measure locations for plantrooms



8.3.3 In principle building services and mechanical plant and equipment measures

At this early development approval stage of the project, the appropriate detail for the mechanical plant to undertake a quantitative assessment and determine the 'best achievable noise levels' is not available. The required mechanical plant/equipment design and selection are at concept stage and have not been finalised. Preferred equipment suppliers have not been confirmed and therefore a preliminary schedule of equipment was developed with the project team along with identification of indicative likely other plant and equipment items for assessment purposes. In the absence of an appointed supplier, this noise

and vibration assessment is based on the Project concept design and a range of supplier data to demonstrate the projects feasibility.

Upon appointment of the successful supplier, confirmation should be provided that the selected equipment is able to perform within the predictions of this assessment. As part of further design development, the final operations and duty points of the mechanical and electrical systems will be further designed and refined.

However, the biggest noise emitting items have been reviewed and addressed above and indicative plant and equipment outlined in Section 8.2.3 have been assumed for the remaining mechanical systems plant items.

For assessment purposes, it is assumed that all the identified building services and mechanical plant noise sources could operate as typical during all assessment periods and have been included in the noise modelling during all assessment periods as such.

For enclosed spaces such as the data halls, pump rooms, enclosed substations, plantrooms, switch rooms, etc. similarly noise breakout through openings/penetrations from internal activity noise levels is not expected to contribute to noise emissions, except where specifically identified. As part of further design development, these spaces are to be acoustically designed to ensure that noise emissions outcomes remain consistent with this assessment.

Indicative mitigation measures (ie. acoustic louvres, attenuation to air openings, acoustic absorption lining, etc.) have also been identified and assumed as part of the modelling as detailed in Section 8.2.3.

As part of this further design development, these items would be readily treated with the below in-principle noise management measures, so that they would not increase to the overall site noise emissions in order to achieve the criteria presented in Section 5.1.3 during further design development stages. To ensure this, the following is required:

The following in-principle noise management measures should be considered during further design development stages:

- Acoustic assessment of mechanical services equipment should be undertaken during the detailed design phase of the development to ensure that the cumulative noise of all noise generating items and operations as part of typical operations (ie. building services and mechanical plant cumulatively with other noise sources such as trucks and loading activities) does not exceed the applicable noise criteria. This includes the detailed specification and location of mechanical plant on site.
- Noise control treatment can affect the operation of the mechanical services system. An acoustic engineer should be consulted during the initial design phase of mechanical services system to reduce potential redesign of the mechanical system.

- Mechanical plant noise emission can be controlled by appropriate mechanical system design and implementation of common engineering methods, which may include:
 - procurement of 'quiet' plant
 - strategic positioning of plant away from sensitive neighbouring premises to maximise intervening acoustic shielding between the plant and sensitive neighbouring premises
 - commercially available acoustic attenuators for air discharge and air intakes of plant
 - acoustically lined and lagged ductwork
 - acoustic barriers between plant and sensitive neighbouring premises
 - partial or complete acoustic enclosures over plant
- Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 '*Rotating and Reciprocating Machinery – Mechanical Vibration*'.

8.3.4 Considerations of the recommended mitigation and management measures

The above recommendations provide in-principle solutions to address project acoustic requirements. This information is presented for the purpose of the consent authority approvals process and for preliminary cost planning. It shall not be used for detailed design and construction purposes without approval in writing by the acoustic consultant.

The final acoustic performance, extents and quantities of noise mitigation measures and materials required, will largely depend on the final design, final selections and locations of noise generating plant and equipment across the facility and associated operations.

Assistance of the acoustic consultant must be sought during the detailed design phase of the project to confirm all details, design elements, material quantities and performance specifications are consistent with the outcomes of this assessment.

8.4 Noise prediction methodology

8.4.1 Modelling overview

Modelling and assessment of airborne noise impacts from the Proposal were determined by modelling the noise sources, receiver locations and topographical features, and possible noise mitigation measures using a 3D noise modelling package, CadnaA (Version 2025). Noise modelling algorithms were used to calculate the contribution of each noise source at each identified sensitive receiver location and to predict the total noise from the site for the various reasonable worst-case scenarios developed for the Proposal.

Critical internal spaces within the facility that could emit noise (ie. water cooled chiller plantrooms), were acoustically modelled using CadnaR (Version 2025) to determine the noise levels at the internal noise levels and noise levels at the openings to these spaces. These modelled noise levels were then incorporated into the overall CadnaA noise model.

The noise prediction modelling considers the following:

- Location of noise sources and sensitive receiver locations (including multi-storey buildings).
- Heights of sources and receivers referenced to digital ground contours (1 metre contour intervals) or relative to the Proposal building structure.
- Noise source levels of individual plant and equipment.
- Internal noise levels within key facility spaces (ie. Water cooled chiller plantroom), and the breakout of these noise levels through the facade building elements (ie. air-intake openings).
- Separation distances between sources and receivers.
- Ground type and reflections between sources and receivers
 - ground absorption value of 0 for the Proposal site, warehouse and industrial areas.
 - ground absorption value of 0.75 outside of this area (ie. from grassed areas / rural residential areas).
- Attenuation from barriers, buildings and structures (natural terrain and purpose built). This includes changes to the Proposal onsite buildings and structures.
- Atmospheric losses and meteorological conditions.
- Feasible and reasonable noise mitigation/treatments and management measures that have been determined for the Proposal.
- Noise prediction undertaken in 1/3 octave bands, using 1/3 octave band data for key noise sources, to enable assessment of low-frequency characteristics as per NPfl Fact Sheet C.

The noise enhancing conditions presented in Section 8.4.3 have been adopted for the assessment as per the NPfl. Both ISO 9613-2 (implemented in CadnaA in accordance with ISO 17534-3) and CONCAWE noise propagation algorithms have been implemented in the noise modelling, with the reported value based upon the highest of each algorithm, to assess potential noise impacts because:

- The surrounding potentially impacted receivers include receivers within a couple of hundred meters and up to 1-3 kilometres away, and as such distance considerations and limitations for both algorithms are addressed through the implementation of both.

- CONCAWE allows for the meteorological conditions presented in NPfl Fact Sheet D to be directly considered.
- The noise prediction modelling uses ISO 9613-2 algorithms which include noise-enhancing weather conditions including downwind propagation, or equivalently, propagation under a well-developed moderate ground-based temperature inversion.
- As such, this approach allows for prevailing noise enhancing weather conditions in accordance with the NPfl Fact Sheet D to be included and accounted for in the assessment and provides for a conservative assessment.

8.4.2 Maintenance testing noise modelling

Maintenance testing has been modelled with the worst combination of generators that could be tested concurrently for each of the three key residential areas of Horsley Park (NCA01), Erskine Park (NCA02) and Minchinbury (NCA03).

The location of the worst-case combination of generators was determined by predicted the noise levels from all generators locations. This data was analysed to determine the position of the worst-case generators in each the five blocks of generators for the worst case receiver within each NCA. The locations of these generators are shown in Figure 8-4, Figure 8-5, and Figure 8-6.

This worst-case combination of generators for each NCA was then added to the typical operations noise predictions to determine the worst-case daytime noise level.

This combination of generators will vary for every receiver location, and the predicted noise levels have been determined for each NCA's worst case generator testing combination, provided below. Where different generators are tested, the cumulative noise levels are expected to be less than those presented. This process aims to capture the worst-case noise levels as required by the SEARs.

The noise contour maps presented in APPENDIX D only show the worst case generator testing scenario for the NCA with the highest predicted daytime noise levels during maintenance testing, which is Horsley Park (NCA01).

Figure 8-4: Generator testing configuration for the worst-case receiver specific in Horsley Park

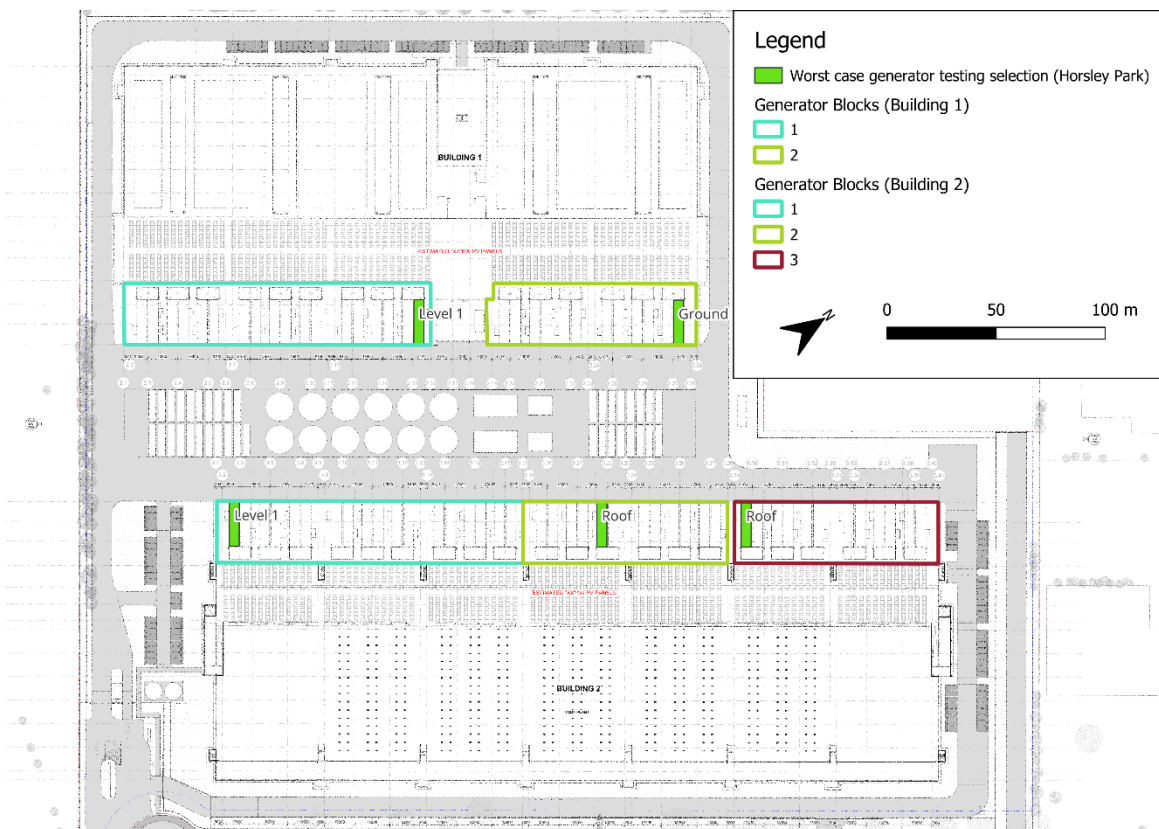
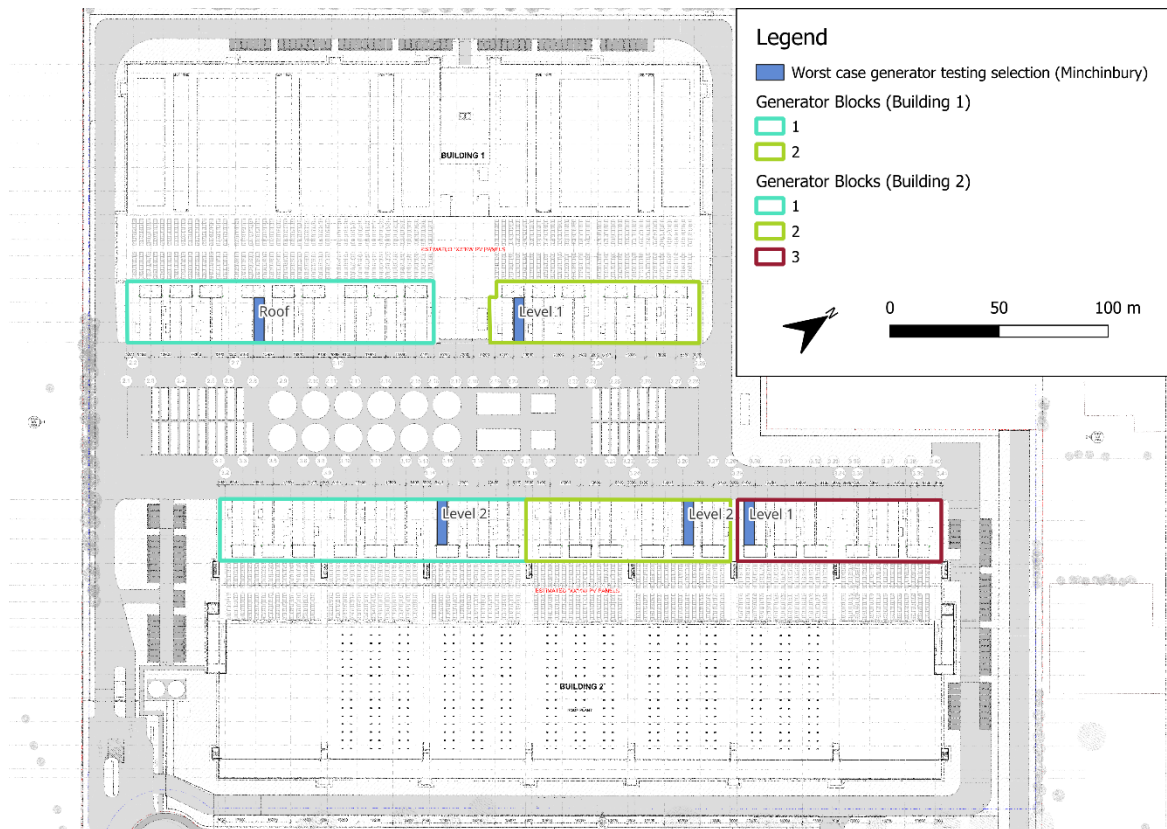


Figure 8-5: Generator testing configuration for the worst-case receiver specific in Erskine Park



Figure 8-6: Generator testing configuration for the worst-case receiver specific in Minchinbury

8.4.3 Meteorological conditions

In accordance with the NPfI, the noise assessment is required to consider the effects of adverse meteorological conditions such as wind and temperature inversions. The NPfI recommends that project noise criteria are to apply under weather conditions characteristic of an area. These may include standard meteorological conditions (ie. calm) and noise-enhancing meteorological conditions (ie. winds and temperature inversions). In this regard, the increase in noise that results from atmospheric temperature inversions and winds may need to be assessed. The noise levels predicted under characteristic meteorological conditions for each receiver are then compared with the criteria, to establish whether the meteorological effects will cause a significant impact.

The NPfI permits two approaches for assessing these effects, either use of default parameters or use of site-specific parameters. For this noise assessment, default parameters were used for a conservative assessment. By using default parameters, general meteorological values are used to predict noise levels, foregoing detailed analyses of site-specific meteorological data. This approach assumes that meteorological effects are conservative, in that it is likely to predict the upper range of increases in noise levels. Actual noise levels may be less than predicted.

Considering that receivers are both within a couple of hundred meters and up to 1-3 kilometres away, both ISO 9613-2 (implemented in CadnaA in accordance with ISO 17534-3) and CONCAWE noise propagation algorithms have been implemented in the noise modelling, to implement the NPfI noise-

enhancing meteorological conditions. In accordance with Table D1 of the NPfI, the following default parameters have been used for the CONCAWE algorithm when modelling to assess noise-enhancing meteorological conditions.

Table 8-13: NPfI Fact Sheet D (Option 1) noise-enhancing parameters for meteorological conditions

Meteorological conditions	Default parameters	Assessment periods
Noise-enhancing conditions	<u>Wind</u>	• Day (7am to 6pm) • Evening (6pm to 10pm) • Night (10pm to 7am)
	• Stability Category D • 3m/s wind speeds¹	
	<u>Temperature Inversions</u>	• Night (10pm to 7am)
	• Stability Category F • 2m/s wind speeds¹	

8.4.4 Assessment scenarios

To assess noise impacts from the Proposal, 'reasonable' worst-case scenarios (15-minute period) scenarios have been developed for predicting noise emissions from the facility for each assessment period (ie. day, evening and night). These scenarios have been developed based upon the operational assumptions, operational inputs from the project team. The operational scenarios considered are detailed in Section 8.1.

Additionally, as required by the SEARs, these scenarios have been established for each stage, so that the progressive noise emissions from the Proposal are predicted and understood, capturing both the change in the number of noise sources, and the relative differences in acoustic shielding of the Proposal through the phases.

The Proposal has two stages, which are as follows:

- **Stage 1:** Building 1 is constructed and fully operational while Building 2 is under construction/ finished construction but is not yet operational
- **Stage 2:** The full facility is operational, with both Building 1 and Building 2 fully constructed and operational

Table 8-14 details the 'reasonable' worst-case scenarios (15-minute period) for each assessed stage, covering the key noise generating activities detailed in Section 8.1 and noise intensive periods for the main areas of noise generation across the Proposal site, for each of the development phases. The locations of these key areas are shown in Figure 8-2 for reference.

Table 8-14: Assessment 15-minute noise generating assessment scenarios

Activity / noise sources group	Location	Activity / noise sources	Details	Quantity modelled for the reasonable' worst-case scenarios (15-minute period)		Modelling assumptions
				Stage 1 Building 1	Stage 2 Building 1 & 2	
Cooling system	Building 1 roof	Air cooled chiller	Trithermal TAEA1140B1NB1 units	50 units	50 units	Section 8.2.3.1
		1.9 MW Hybrid Dry Chiller	Jaeggi units	50 units	50 units	Section 8.2.3.1
	Building 2 roof	3.8 MW Hybrid Dry Chiller	Jaeggi units	0	60 units	Section 8.2.3.1
		2.6 MW Hybrid Dry Chiller	Jaeggi units	0	24 units	Section 8.2.3.1
	Building 2 water cooled chiller plantroom (Level 3)	Water cooled chiller	Carrier 19MV-75Z75L459E39 units	0	84 units	Section 8.2.3.1
Low-voltage electrical distribution and storage	MVTX Room	Transformer (MVTX)	246 across facility	90	246	Section 8.2.3.2
		Exhaust fan	246 across facility	90	246	Section 8.2.3.2
High voltage (HV) electrical distribution	Substation on the northwest corner of the proposal	Substation transformer (175 MVA)	4	4	4	Section 8.2.3.4
		Transformer fan	6 per transformer	24	24	Section 8.2.3.4
		Capacitor banks	4	4	4	Section 8.2.3.4
Additional building services and mechanical systems	MVTX	Exhaust fan	Indicative ventilation (exhaust)	90	246	Section 8.2.3.5
		Breakout via louvre	Indicative ventilation (supply)	90	246	Section 8.2.3.5
	Electrical room	Exhaust fan	Indicative ventilation (exhaust)	10	17	Section 8.2.3.5
		Supply fan	Indicative ventilation (supply)	5	12	Section 8.2.3.5
	Administrative Offices	Outside air fan	Indicative ventilation fan	5	9	Section 8.2.3.5
	Loading dock	Exhaust fans	Indicative ventilation fan	1	3	Section 8.2.3.5
	Guardhouse	Condenser unit	Indicative air-conditioning	1	1	Section 8.2.3.5
	Hydraulic plant room	Internal pumps	-	Operational	Operational	Section 8.2.3.5
	FWU corridor	FCUs and fan ducted to external facade	Indicative ventilation breakout	10	29	Section 8.2.3.5
	Data hall	Internal data hall breakout via exhaust duct	Indicative internal ventilation	10	29	Section 8.2.3.5

Activity / noise sources group	Location	Activity / noise sources	Details	Quantity modelled for the reasonable' worst-case scenarios (15-minute period)		Modelling assumptions
				Stage 1 Building 1	Stage 2 Building 1 & 2	
	Corridor façade	Corridor facade louvres	Indicative internal noise level breakout via louvre	10	31	Section 8.2.3.5
Carparking activities	Adjacent to each parcel	Carpark movements	Each movement is modelled on internal road and with associated carpark activity.	Facility wide = D/E/N = 28/6/2 each movement is modelled on internal road and with associated carpark activity. Distributed across carparks.		Section 8.2.4
Loading dock	At each building	Truck movements to loading dock	Each movement is modelled on internal road and with airbrake at loading dock, in addition to internal breakout with roller door closed.	Arrivals or departures Day = 2 Eve/Night = 1	Arrivals or departures Day = 4 Building 1=2, Building 2=2 Eve/Night = 3 (one each building)	Section 8.2.5
Maintenance testing						
Typical operations			All typical operations taking place	As above		
Maintenance testing activities	Worst combination of multiple generator locations for each receiver, one from each block. (Section 8.4.2) Associated load bank from each block.	Containerised generator unit	Daytime testing only Up to 5 generators operating concurrently across the facility	Up to 2	Up to 5	
		Generator exhaust flue outlet		Up to 2	Up to 5	
		Load bank		Up to 2	Up to 5	
		Fire pump		Up to 1	Up to 1	
Emergency critical power failure						
Typical operations			All typical operations taking place	As above		
Main power failure – emergency equipment			All 249 generators in operation Building 1 = 91 (inclusive of the 1 generator for the administrative spaces) Building 2 = 158 (inclusive of the 2 generators for the administrative spaces)	91	249	Section 8.2.3.3

Across these operational noise generating activities, the majority of the noise sources are steady-state, and as such do not result in instantaneous noise events with the potential to disturb sleep. Presented in Table 8-15 are the potential noise sources that could result in instantaneous noise events that could occur as part of operations that have been assumed in the sleep disturbance assessment at night.

Table 8-15: Instantaneous maximum noise events assessment scenarios (night period)

Location / activity	Instantaneous noise sources (L_{Amax} event)
Loading dock and delivery activities (not typically expected during the night period)	Truck airbrake at dock Truck working brake air-releases
Carpark	Car engine start Car vehicle door slam

8.5 Noise predictions

8.5.1 Predicted $L_{Aeq,15min}$ operational noise levels (Typical operations, including maintenance testing)

To assess operational noise emissions from the Proposal, the assessment scenarios identified in Section 8.4.4 (Table 8-14) were modelled.

As the Proposal includes two stages, noise predictions are provided for each stage (see Section 8.4.1). The assumed operating equipment for each stage is detailed in in Section 8.4.4 (Table 8-14).

Each of these assessment scenarios have assessed the reasonable worst-case operating scenarios that would take place, with all identified equipment operating

Predicted noise levels have been assessed to the nearby receivers, and a summary of these results are presented in the following tables for typical operations:

- Table 8-16 - Day (with worst case generator testing) (Building 1 only), Evening and Night
- Table 8-16 - Day (with worst case generator testing) (Building 1 & 2), Evening and Night

The predicted noise levels shown in Table 8-16 to Table 8-17 are based upon the highest noise level for each receiver including upper floors of buildings where relevant.

Noise contour maps at 1.5 metres above the local ground level for each of the scenarios assessed are presented in APPENDIX E.

The predicted noise levels presented in this section include all feasible and reasonable mitigation and management measures presented in Section 8.3, which have been recommended based upon an initial evaluation and the progressive assessment process to determine the Proposal mitigation and management measures to achieve the PNTLs identified in Section 5.

Noise levels have been reviewed for annoying characteristics as per NPfI Fact Sheet C, and adjustments applied where required (see Section 8.5.2 and APPENDIX D). During the daytime period, as different generators will impact different receiver locations during testing making a detailed annoying characteristics assessment prohibitively complex, conservatively, a 2 dB(A) adjustment has been applied to all predicted noise levels in accordance with NPfI Fact Sheet C to take into account the potential for low-frequency impacts during generator testing.

From Table 8-17 the predicted operational noise levels indicate that with the recommended mitigation and management measures presented in Section 8.3, the Proposal can achieve the project noise trigger levels at all nearby assessment receivers for all assessment periods.

As part of the noise assessment process, as per NPfI Figure 2, the noise assessment is to determine the 'best achievable noise levels', however, at this early development approval stage of the Proposal design, including the mechanical plant/equipment design and selection have not been finalised. As such, the 'best achievable noise levels' from the Proposal can only be determined as part of further design development during later design stages. These will depend upon final decisions to balance design requirements, project costs, and other factors. The predicted noise levels presented in this section, demonstrate it is possible for the Proposal to operate within the established PNTLs using conservative assumptions.

Table 8-16: Typical operations – Stage 1 (Building 1) - Predicted operational noise levels - L_{Aeq,15minute}, dB(A)

Assessment scenario				Day period (with worst case generator testing)						Evening period			Night period			
NCA	Receiver type	Receiver ID	Address	PNTL, $L_{Aeq\ 15min}$, dB(A)	Worst case generator testing for Horsley Park		Worst case generator testing for Erskine Park		Worst case generator testing for Minchinbury		PNTL, $L_{Aeq\ 15min}$, dB(A)	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)	Exceed	PNTL, $L_{Aeq\ 15min}$, dB(A)	Predicted noise level, $L_{Aeq\ 15min}$, dB(A)	Exceed
					Predicted noise level, $L_{Aeq\ 15min}$, dB(A) ³	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A) ³	Exceed	Predicted noise level, $L_{Aeq\ 15min}$, dB(A) ³	Exceed						
-	Industrial	R01	2/4 Roberts Rd, Eastern Creek	68	59	-	59	-	59	-	68	60 ²	-	68	60 ²	-
-	Industrial	R02	6 Roberts Rd, Eastern Creek	68	58	-	58	-	58	-	68	59 ²	-	68	59 ²	-
-	Industrial	R03	8 Roberts Rd, Eastern Creek	68	35	-	34	-	34	-	68	29	-	68	30	-
-	Industrial	R04	10A Roberts Rd, Eastern Creek	68	54	-	55	-	53	-	68	55 ²	-	68	55 ²	-
-	Industrial	R05	CDC Data Centre Campus, Eastern Creek	68	43	-	43	-	43	-	68	39 ²	-	68	41 ²	-
-	Childcare	R06	Little Graces Childcare Centre	48	41	-	42	-	41	-	48	41 ²	-	48	39 ²	-
-	Industrial	R07	1 Telopea Pl, Eastern Creek	68	51	-	51	-	51	-	68	51 ²	-	68	50 ²	-
-	Industrial	R08	200 Old Wallgrove Rd, Eastern Creek	68	49	-	49	-	49	-	68	47 ²	-	68	45 ²	-
NCA1	Residential	R09	257 Burley Road, Horsley Park	44	42	-	42	-	41	-	42	36 ¹	-	38	35 ¹	-
NCA1	Residential	R10	188-196 Burley Road, Horsley Park	44	40	-	40	-	40	-	42	33 ¹	-	38	33 ¹	-
NCA1	Residential	R11	144 Burley Road, Horsley Park	44	39	-	39	-	39	-	42	33 ¹	-	38	33 ¹	-
NCA1	Residential	R12	142 Burley Rd, Horsley Park	44	38	-	38	-	38	-	42	32 ¹	-	38	32 ¹	-
NCA1	Residential	R13	131-141 Burley Road, Horsley Park	44	37	-	37	-	37	-	42	31 ¹	-	38	31 ¹	-
NCA1	Residential	R14	223-231 Walworth Road, Horsley Park	44	36	-	36	-	36	-	42	30 ¹	-	38	30 ¹	-
NCA2	Residential	R15	11 Sennar Rd, Erskine Park	43	32	-	32	-	32	-	43	26	-	38	25	-
NCA2	Residential	R16	68B Weaver St, Erskine Park	43	36	-	36	-	36	-	43	30	-	38	29	-
NCA2	Residential	R17	5 Cetus Pl, Erskine Park	43	34	-	35	-	34	-	43	28	-	38	27	-
NCA2	Residential	R18	69 Weaver St Erskine Park	43	33	-	34	-	33	-	43	27	-	38	26	-
NCA2	Residential	R19	118 Weaver St, Erskine Park	43	32	-	33	-	32	-	43	26	-	38	25	-
NCA3	Residential	R20	2 Farrington St, Minchinbury	50	25	-	26	-	25	-	43	20	-	38	20	-
NCA3	Residential	R21	17A Farrington St, Minchinbury	50	30	-	31	-	31	-	43	25	-	38	24	-
NCA3	Residential	R22	31 Farrington St, Minchinbury	50	35	-	36	-	36	-	43	30	-	38	29	-

- Notes:
1.

2 dB(A) annoyance penalty applied for low-frequency noise in accordance with NPfl Fact Sheet C.
2.

5 dB(A) annoyance penalty applied for low-frequency noise in accordance with NPfl Fact Sheet C.
3.

As different generators will impact different receiver locations during testing, conservatively, a 2 dB(A) adjustment has been applied to all predicted noise levels in accordance with NPfl Fact Sheet C.

Table 8-17: Typical operations – Stage 2 (Buildings 1 & 2 fully operational) - Predicted operational noise levels - L_{Aeq,15minute}, dB(A)

Assessment scenario				Day period (with worst case generator testing)						Evening period			Night period			
NCA	Receiver type	Receiver ID	Address	PNTL, L _{Aeq 15min} , dB(A)	Worst case generator testing for Horsley Park		Worst case generator testing for Erskine Park		Worst case generator testing for Minchinbury		PNTL, L _{Aeq 15min} , dB(A)	Predicted noise level, L _{Aeq 15min} , dB(A)	Exceed	PNTL, L _{Aeq 15min} , dB(A)	Predicted noise level, L _{Aeq 15min} , dB(A)	Exceed
					Predicted noise level, L _{Aeq 15min} , dB(A) ³	Exceed	Predicted noise level, L _{Aeq 15min} , dB(A) ³	Exceed	Predicted noise level, L _{Aeq 15min} , dB(A) ³	Exceed						
-	Industrial	R01	2/4 Roberts Rd, Eastern Creek	68	62	-	62	-	62	-	68	62 ²	-	68	61 ²	-
-	Industrial	R02	6 Roberts Rd, Eastern Creek	68	61	-	61	-	62	-	68	61 ²	-	68	61 ²	-
-	Industrial	R03	8 Roberts Rd, Eastern Creek	68	39	-	39	-	38	-	68	34	-	68	33	-
-	Industrial	R04	10A Roberts Rd, Eastern Creek	68	58	-	58	-	58	-	68	60 ²	-	68	59 ²	-
-	Industrial	R05	CDC Data Centre Campus, Eastern Creek	68	60	-	60	-	60	-	68	63 ²	-	68	60 ²	-
-	Childcare	R06	Little Graces Childcare Centre	48	46	-	47	-	46	-	48	48 ²	-	48	45 ²	-
-	Industrial	R07	1 Telopea Pl, Eastern Creek	68	53	-	53	-	53	-	68	53 ²	-	68	51 ²	-
-	Industrial	R08	200 Old Wallgrove Rd, Eastern Creek	68	50	-	50	-	50	-	68	49 ²	-	68	47 ²	-
NCA1	Residential	R09	257 Burley Road, Horsley Park	44	44	-	44	-	43	-	42	40 ¹	-	38	38 ¹	-
NCA1	Residential	R10	188-196 Burley Road, Horsley Park	44	42	-	42	-	42	-	42	38 ¹	-	38	37 ¹	-
NCA1	Residential	R11	144 Burley Road, Horsley Park	44	42	-	42	-	42	-	42	39 ¹	-	38	37 ¹	-
NCA1	Residential	R12	142 Burley Rd, Horsley Park	44	41	-	41	-	41	-	42	38 ¹	-	38	36 ¹	-
NCA1	Residential	R13	131-141 Burley Road, Horsley Park	44	39	-	40	-	39	-	42	36 ¹	-	38	35 ¹	-
NCA1	Residential	R14	223-231 Walworth Road, Horsley Park	44	39	-	39	-	39	-	42	36 ¹	-	38	34 ¹	-
NCA2	Residential	R15	11 Sennar Rd, Erskine Park	43	35	-	35	-	35	-	43	29	-	38	28	-
NCA2	Residential	R16	68B Weaver St, Erskine Park	43	38	-	38	-	38	-	43	32	-	38	31	-
NCA2	Residential	R17	5 Cetus Pl, Erskine Park	43	37	-	37	-	37	-	43	31	-	38	29	-
NCA2	Residential	R18	69 Weaver St Erskine Park	43	36	-	36	-	36	-	43	30	-	38	29	-
NCA2	Residential	R19	118 Weaver St, Erskine Park	43	35	-	35	-	35	-	43	29	-	38	28	-
NCA3	Residential	R20	2 Farrington St, Minchinbury	50	29	-	29	-	30	-	43	25	-	38	23	-
NCA3	Residential	R21	17A Farrington St, Minchinbury	50	34	-	34	-	35	-	43	29	-	38	28	-
NCA3	Residential	R22	31 Farrington St, Minchinbury	50	39	-	39	-	40	-	43	34	-	38	32	-

- Notes:
1.

2 dB(A) annoyance penalty applied for low-frequency noise in accordance with NPfl Fact Sheet C
2.

5 dB(A) annoyance penalty applied for low-frequency noise in accordance with NPfl Fact Sheet C.
3.

As different generators will impact different receiver locations during testing, conservatively, a 2 dB(A) adjustment has been applied to all predicted noise levels in accordance with NPfl Fact Sheet C.

8.5.2 Annoying noise characteristics adjustments

Where the character of the industrial noise is assessed as particularly annoying at a receiver location (ie. if the resulting noise level at a receiver location is tonal, low frequency or is intermittent at night), then an adjustment is to be added to penalise the predicted noise for its potential increase in annoyance. The Fact Sheet C of the NPfI provides procedures for determining whether a modifying factor should be applied which is assessed as part of the Proposal. The corrections are to be added to the predicted noise levels at the receiver before comparison with the project noise trigger levels. The characteristics that require evaluation include:

- Tonality
- Low frequency
- Intermittent noise

The outcomes of the NPfI Fact Sheet C annoyance assessment for tonality and low-frequency for critical receivers is included APPENDIX D.

8.5.2.1 Tonality

The key noise sources associated with the Proposal which dominate the noise emissions are the cooling systems, which operate continuously and are steady-state or quasi-steady-state noise sources. Other operational noise sources that can typically exhibit tonal noise at source are:

- the reversing alarms on heavy vehicles
- substation transformers
- water cooled chillers (screw chillers)

These noise sources are generally either minor contributors to the overall noise emissions as they have already been mitigated (ie. substation transformers) or occur infrequently and for small periods of time (ie. heavy vehicle reversing operations), or there is opportunity to determine mitigation measures to address potential tonality issues at source, so they do not result at receivers (ie. water cooled chillers), so such these sources would not result in overall noise emissions from either facility or combined to result in tonal noise emissions.

As per NPfI Fact Sheet C1, the modifying factor corrections should be applied having regard to the contribution noise level from the premises when assessed/measured at a receiver location. As such, for predictions it is appropriate that the assessment also consider the existing background noise environment. Where the existing noise levels are sufficient to mask any tonal characteristics, then the tonal modifying factor correction is not applicable. However, for a conservative assessment the existing background noise environment has not been considered, and the assessment is of the predicted noise level contribution in isolation at the receivers with the highest noise predictions in each NCA.

As a result of this assessment, tonality was not identified at any receiver locations.

8.5.2.2 Intermittent noise

The key noise sources associated with both the existing data centre and the Proposal are the cooling systems, which operate continuously and are steady-state or quasi-steady-state noise sources. Therefore, there is unlikely to be significant variation in noise emissions resulting in intermittent noise level contributions at receivers. As such, as there are no known likely intermittent noise sources no intermittent penalty is applicable.

8.5.2.3 Low frequency assessment

The low frequency noise analysis was undertaken in accordance with Fact Sheet C of the NPfI. The NPfI requires this analysis to be undertaken for third octave bands ranging from 10 Hz to 160 Hz. Limitations in both the modelling software in addition to the supplier data only allow for noise predictions down to and including the 25 Hz third octave band. Hence, a best practice approach to apply the low frequency noise analysis was applied as detailed in the journal paper prepared by the NSW Environment Protection Authority published by Acoustics Australia (Downey, 2020).

As the modelled data does not extend below 25Hz, the data between 10Hz to 20 Hz has been extended by extrapolation based upon the 25Hz to 40Hz band data. The estimate of predicted levels from 10 Hz to 160 Hz allowed for an analysis of the low frequency noise impacts in accordance with Fact Sheet C of the NPfI, however, only so far as practicable through the data limitations. Noting the limitations of this approach, the potential for noise sources to result in low-frequency impacts are to be reviewed in detail by an acoustic consultant once actual plant/equipment are known to confirm the outcomes of this low-frequency screening assessment.

Daytime operations and generator maintenance testing

A review of critical receivers, including, with the combination of worst case generators and the outcomes are shown in APPENDIX D.

Several receiver locations were found to exceed the overall C- minus A-weighted noise levels derived from the estimated noise predictions. Typically, where overall C- minus A-weighted noise levels were above 15 dB, and there was the potential for low-frequency impacts during worst case combination of generators, then the assessment determined the noise levels were generally not more than 5 dB above the corresponding NPfI Table C2 noise thresholds, except for a small subset of receiver locations.

As a complex combination of generators have the potential to impact different receiver locations during testing, conservatively, a 2 dB(A) adjustment has been applied to all predicted noise levels during the daytime.

Evening and night operations

Although several receiver locations were found to exceed the overall C- minus A-weighted noise levels derived from the estimated noise predictions for the night period, including multiple industrial and childcare receivers (unlikely to be operating during the evening and night periods) that had predicted noise level above the low frequency thresholds defined in Table C2 of the NPfI. Thus, corrections have been applied to those receivers that exceeded the thresholds where required.

8.5.3 Emergency critical power failure operations

As detailed in Section 5.3, the emergency operating conditions, i.e. the event of a mains power failure, is expected to be a very rare occurrence and it would be considered unreasonable to implement noise treatment due to this. As such, consistent with the feasible and reasonable approach as required by the NPfI, existing regulations, and in absence of any relevant specific NSW guideline for emergency generators, noise limits for emergency operations are not required and have not been proposed.

Presented in Table 8-19 are the predicted noise levels for emergency operations for the fully developed facility to demonstrate the worst-case noise levels. As detailed in Section 5.3, these noise predictions are presented for information purposes only.

Table 8-11 identifies the items have been further investigated and identified for inclusion as part of the Proposal design.

Table 8-18: Key feasible and reasonable noise mitigation and management measure investigation

Key noise generating source	Noise mitigation and management measure element investigated	Estimated noise benefit	Comments on feasibility/ reasonableness	Design result
Containerised generator unit (emergency operations)	Further upgraded acoustic performance of generator acoustic enclosure	Variable for receiver and time of day	Not feasible or not reasonable. Emergency critical power failure will be an extremely rare occurrence as per Section 5.3. The acoustic enclosures of the generators, combined with the exhaust flues already incorporate upgraded acoustic enclosures to address potential impacts during maintenance testing. Further upgrades to the enclosure would have limited overall noise reductions at receivers as part of normal operations.	Further mitigation not adopted. Not feasible or reasonable.

Table 8-19: Predicted mains failure emergency operations noise levels - $L_{Aeq,15min}$, dB(A)

Receiver information				Predicted noise level, $L_{Aeq,15min}$, dB(A)
NCA	Receiver type	Receiver ID	Address	Building 1 & 2
-	Industrial	R01	2/4 Roberts Rd, Eastern Creek	72
-	Industrial	R02	6 Roberts Rd, Eastern Creek	73
-	Industrial	R03	8 Roberts Rd, Eastern Creek	49
-	Industrial	R04	10A Roberts Rd, Eastern Creek	67
-	Industrial	R05	CDC Data Centre Campus, Eastern Creek	59
-	Childcare	R06	Little Graces Childcare Centre	54
-	Industrial	R07	1 Telopea Pl, Eastern Creek	61
-	Industrial	R08	200 Old Wallgrove Rd, Eastern Creek	56
NCA1	Residential	R09	257 Burley Road, Horsley Park	52
NCA1	Residential	R10	188-196 Burley Road, Horsley Park	51
NCA1	Residential	R11	144 Burley Road, Horsley Park	50
NCA1	Residential	R12	142 Burley Rd, Horsley Park	49
NCA1	Residential	R13	131-141 Burley Road, Horsley Park	48
NCA1	Residential	R14	223-231 Walworth Road, Horsley Park	48
NCA2	Residential	R15	11 Sennar Rd, Erskine Park	46
NCA2	Residential	R16	68B Weaver St, Erskine Park	48
NCA2	Residential	R17	5 Cetus Pl, Erskine Park	47
NCA2	Residential	R18	69 Weaver St Erskine Park	47
NCA2	Residential	R19	118 Weaver St, Erskine Park	46
NCA3	Residential	R20	2 Farrington St, Minchinbury	39
NCA3	Residential	R21	17A Farrington St, Minchinbury	45
NCA3	Residential	R22	31 Farrington St, Minchinbury	51

8.5.4 Sleep disturbance assessment

This section assesses the potential for sleep disturbance impacts, specifically looking at the maximum noise levels (L_{Amax}).

The night-time noise sources associated with the Proposal are steady-state or quasi-steady-state. Therefore, there is unlikely to be significant variation between $L_{Aeq,15min}$ values and L_{Amax} values, and no significant peak noise events are expected.

The only potentially loud instantaneous noise events that could occur across the Proposal operations with the potential to disturb sleep could be loading dock or carpark related activities. Occasional night deliveries may occur. These activities are detailed in Table 8-15 and Section 8.4.4, and could include airbrake events and truck movement sources. Carparks are located adjacent to each building. Considering the loudest potential noise events Table 8-20 shows the highest predicted noise level for at representative residential receivers for the fully developed facility. Sleep disturbance impacts are not predicted.

**Table 8-20: Sleep disturbance assessment (Fully developed facility) (Night – 10:00pm to 7:00am);
L_{Amax}, dB(A)**

NCA	Representative receiver location with highest predicted noise level	Sleep disturbance assessment level, L _{Amax}	Awakening reaction, L _{Amax}	Highest predicted noise level, L _{Afmax} , dB(A)	Exceedance	
					Screening level	Awakening reaction
NCA1	257 Burley Road, Horsley Park	52	65	45	-	-
NCA1	188-196 Burley Road, Horsley Park	52	65	45	-	-
NCA1	144 Burley Road, Horsley Park	52	65	44	-	-
NCA1	142 Burley Rd, Horsley Park	52	65	45	-	-
NCA1	131-141 Burley Road, Horsley Park	52	65	41	-	-
NCA1	223-231 Walworth Road, Horsley Park	52	65	40	-	-
NCA2	11 Sennar Rd, Erskine Park	53	65	32	-	-
NCA2	68B Weaver St, Erskine Park	53	65	36	-	-
NCA2	5 Cetus Pl, Erskine Park	53	65	35	-	-
NCA2	69 Weaver St Erskine Park	53	65	34	-	-
NCA2	118 Weaver St, Erskine Park	53	65	32	-	-
NCA3	2 Farrington St, Minchinbury	57	65	30	-	-
NCA3	17A Farrington St, Minchinbury	57	65	33	-	-
NCA3	31 Farrington St, Minchinbury	57	65	38	-	-

8.6 Operational noise mitigation and management

8.6.1 Proposal operational noise mitigation management

The mitigation and management measures presented in Section 8.3.2 to 8.3.4 should be further reviewed as required so that they can be reasonably incorporated into the Proposal design where feasible. These are specific recommendations required for the Proposal.

For the site to achieve the requirements of the NPfI, these mitigation or management measures are required to be implemented or further investigated during design development, to achieve the outcomes consistent with this NVIA.

8.6.2 Noise compliance monitoring

It is recommended that noise compliance measurements are conducted once operations commence and are at a typical operating state, to determine that noise emissions are consistent with those documented in this assessment, and to determine that the mitigation measures are effective.

The method for measuring the performance and/or noise compliance of the Proposal should be undertaken in accordance with Section 7 'Monitoring performance' of the NPfI and consideration of *Approved Methods for measurement and Analysis of Environmental Noise in NSW* (EPA 2022).

8.6.3 Ongoing management

As part of the site's Operational Noise Management Plan (ONMP) or relevant section of the Operational Environmental Management Plan (OEMP), there should also be regular reviews of on-site noise mitigation and management practices to confirm that implemented controls are performing consistent with expectations, and incorporate and capture opportunities for reductions of site noise emissions where feasible and reasonable, with considerations of the following:

- Review of noise emission levels, and identification of reduction opportunities during changes or refinements of site noise generating activities in the case that noise emission levels are not consistent with those expected in this NVIA.
- Reviewing noise levels of plant, equipment and activities, during both ongoing compliance checks and in response to complaints.
- Improvements in Best Management Practice (BMP).
- Improvements in Best Available Technology Economically Achievable (BATEA).

8.7 Operational road traffic

8.7.1 Proposal vehicle movements and traffic generation

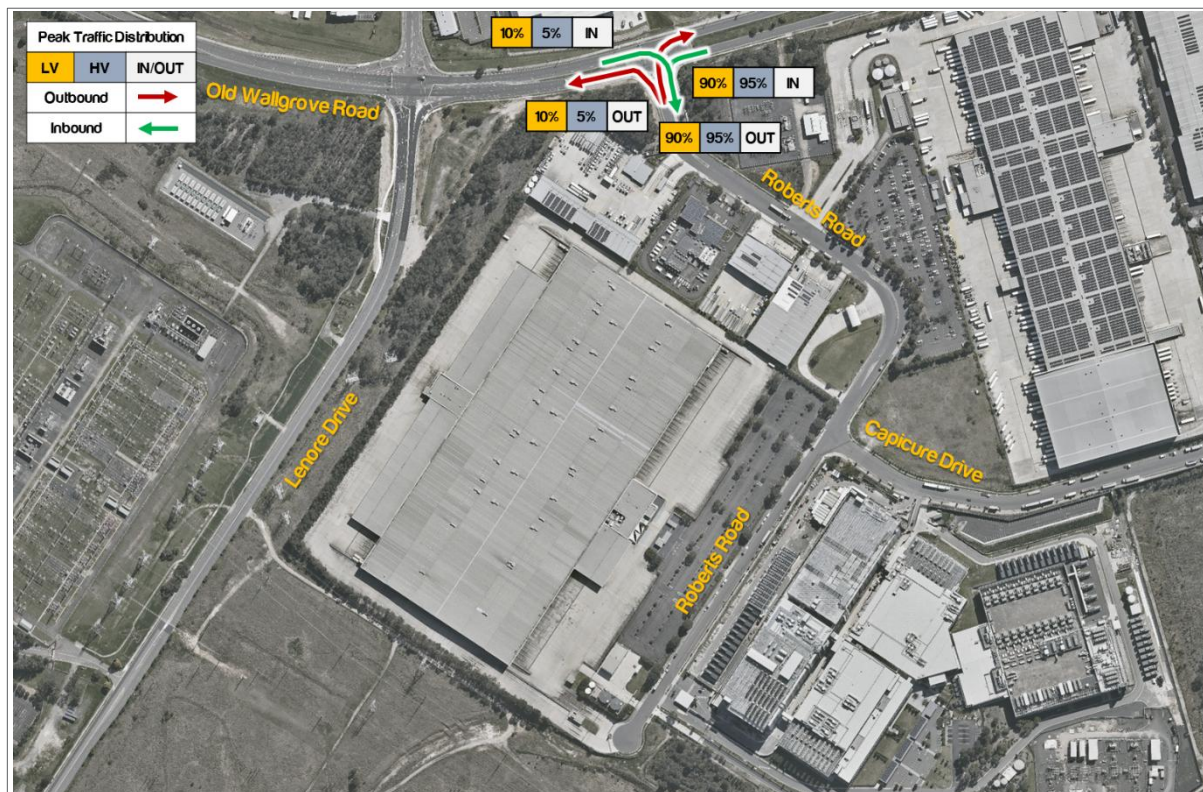
Vehicle movements for operational traffic to and from the Proposal site will be along Roberts Road to Old Wallgrove Road, then along to either the M7 motorway or Erskine Park Road via Lenore Drive and connecting to the nearby major arterial roads. These are shown in Figure 8-7 which shows likely access points and routes, which are as follows:

- Departing the site/travel to the Proposal via Old Wallgrove Road / Lenore Drive:
 - from Erskine Park Road
 - from M7 Motorway

The traffic volumes used for traffic noise predictions and assessment were based on traffic movement data provided by the project team.

Vehicle movements associated with the operations of the facility will access or depart via Old Wallgrove Road / Lenore Drive, and through Roberts Road as shown in Figure 8-7,

Figure 8-7: Detailed site access arrangements (Ason)



8.7.2 Existing traffic volumes

Traffic classification surveys were carried out on Lenore Drive by Geocounts Data Supply over a one-week period during November / December 2025. The results of the analysed daily existing traffic data on Lenore Road are presented in Table 8-21 below.

Table 8-21: Existing traffic volumes on access routes

Location	Direction	Day 7:00am – 10:00pm (15 hour)				Night 10:00pm – 7:00am (9 hour)			
		Total Vehicles	Light	Medium	Heavy	Total Vehicles	Light	Medium	Heavy
Lenore Drive	Combined both directions	12,591	7,997	2,171	2,423	4,475	3,267	449	759

Notes: 1. Traffic data based upon traffic survey on Lenore Drive, November 2025 – December 2025 by Geocounts Data supply.

8.7.3 Proposed traffic volumes

The expected 24 hour traffic generation from the Proposal site was provided by the Proposal traffic engineers (Ason). The summarised movement data is presented in Table 8-22 below.

For a conservative traffic noise assessment, it has been assumed that all traffic could travel along the same route, passing by residential receivers on Lenore Drive, even though in reality these vehicles would not all travel in the same direction along Lenore Drive to then connect to nearby arterial roads.

Table 8-22: Assumed Proposal typical generated daily traffic movements

Details	Total two-way movements	Day 7:00am to 10:00pm (15 hour)			Night 10:00pm to 7:00am (9 hour)		
		Light	Medium	Heavy ²	Light	Medium	Heavy ²
Building 1 and 2	460	371	29	1	56	2	1

- Notes:
1. Low-loader or semi-trailer movements will occur at very rare occasions and would not form part of normal operations. One movement has been included conservatively.
 2. Minimum one movement assumed for a conservative assessment

8.7.4 Predicted road traffic noise increase

The potential increase in road traffic noise levels has been calculated using the *Federal Highway Administration Model 2004 (TNM 2.5)* model to review the potential change in traffic noise levels at residential receivers adjacent to the sub-arterial/arterial roads that will be used by the Proposal. This model has been selected as it is identified in Appendix B4 of the RNP as a suitable road traffic noise model.

The potential increase in road traffic noise levels has been calculated based upon the Proposal in isolation considering existing traffic volumes on Lenore Drive, without consideration of future growth.

The assessment is based upon the existing traffic volumes presented in Table 8-21 and the Proposal traffic generating presented in Table 8-22. The results of the road traffic noise predictions are presented in Table 8-23.

Table 8-23: Predicted traffic noise increase on public roads

Road	Vehicle type	Noise increase, dB(A)	RNP increase criterion, dB(A)	Compliance
Lenore Drive	Day (15 hour - 7:00am to 10:00pm)	< 0.1	2.0	Yes
	Night (9 hour - 10:00pm to 7:00am)	0.1		Yes

As seen by the outcome in in Table 8-23, the portion of traffic generated by the Proposal makes up an insignificant amount of traffic compared to the potential future traffic volumes along the Lenore Drive, without consideration of the future expected growth.

From the above tables, road traffic noise level contributions from the vehicle movements associated with the Proposal are not expected to increase the existing traffic noise levels by more than 2 dB(A) as required by the RNP.

Therefore, following the above assessment, the traffic noise levels as a result of the operational traffic from the Proposal on public roads would meet the RNP requirements, and potential impacts from the road traffic generated by the Proposal on public roads does not require further consideration.

9 Conclusion

Renzo Tonin & Associates (RTA) has been engaged by Goodman Property Services Pty Ltd (Goodman) to undertake an operational and construction noise and vibration impact assessment (NVIA) to accompany the State Significant Development Application (SSD) 101067971 for the proposed Project Atlas Data Centre at 10 Roberts Road, Eastern Creek, NSW (the Proposal). The Proposal site is located within the Eastern Creek Precinct – Stage 3 (ECP). The ECP is located within the Central Western Sydney Economic and Employment Area.

This report assesses noise and vibration impacts during the construction and operational phases of the Proposal. It proposes mitigation and management measures to reduce impacts during the construction and operational phases of the Proposal. The report has been prepared to address the requirements of the Secretary of the Department of Planning, Housing and Infrastructure (DPHI) ('the Secretary's environmental assessment requirements') (SEARs).

9.1 Operational noise assessment

Operational noise impacts from the proposed data centre have been assessed, potential noise impacts identified, and a range of feasible and reasonable mitigation measures incorporated into the Proposal design to minimise noise impacts on sensitive receivers nearby and further removed from the site.

The assessment has reviewed the existing noise environment and established the noise emission objectives in accordance with the NSW Noise Policy for Industry (NPfI) (EPA 2017).

This assessment has reviewed the potential noise generating plant items and activities that are likely to take place as part of operations of the Proposal, including maintenance testing and emergency operations.

The assessment has predicted the potential noise impacts from the reasonable worst case site operations under the prevailing noise-enhancing meteorological conditions in accordance with the NPfI.

A detailed mitigation investigation was undertaken to determine the feasible and reasonable controls required to achieve the project noise trigger levels. Noting the elevated nature of the noise sources and their large number, combined with the varied distances to receivers, located in multiple directions, the mitigation approach focused firstly on reducing noise at the source. At-source noise mitigation included quieter unit selections, on-unit mitigation, relocating noise sources, and enclosing or attenuating noise sources where possible.

Following the implementation of a range of in-principle mitigation and management measures, the predicted noise levels have demonstrated that during typical operations of the data centre, which includes maintenance testing of generators, the predicted noise levels comply with the required PNTLs at receivers that surround the Proposal site. As part of further design development during later design stages detailed analysis will be undertaken to ensure that the design will achieve the project noise

trigger levels presented in Section 5.1.3 considering the final plant and equipment selections and operations.

The assessment has found that any potential sleep disturbance and operational road traffic noise increases attributed to the Project, would respectively meet the NPfl and RNP requirements.

9.2 Construction noise and vibration assessment

An assessment of construction noise impact from the Proposal construction works has been undertaken. Noise emissions from the proposed construction works have been predicted and assessed against the relevant noise management levels (NML) set by the NSW *Interim Construction Noise Guideline* (ICNG) (DECC 2009) during the recommended standard hours for construction.

During standard construction hours, noise levels are generally expected to be below the ICNG NMLs for nearby affected receivers, except when high noise generating plant and equipment are in use, such as excavators with rockhammers, which may be required during the bulk excavation and civil works / utilities stages of work, and these works are required in close proximity to the nearby receivers. The nearby schools and residences may experience construction noise levels above the NMLs if high noise activities are required during the bulk earthworks, but other typical and loud-earthmoving activities are expected to be under the NML. No residential receivers are predicted to be highly noise affected [experience construction noise levels above 75 dB(A)].

Additionally, the proposal has identified some construction works that may be required to take place outside of the standard ICNG construction hours. The Proposal is seeking approval for, or an approval pathway or process for these construction works to occur outside of the standard construction hours. Offsite enabling infrastructure works may be required to take place outside of the standard construction hours due to the nature of the construction works, and its proximity to the surrounding road networks and interfacing with major electrical infrastructure. Justifications for why it is required to undertake construction works outside of the standard construction hours (OOHW) have been provided, along with the noise predictions. The predicted construction noise levels indicate that surrounding receivers are not expected to experience noise levels above the OOH noise management levels during the works.

The final construction methodology at this stage of the proposal is not known as a contractor has not been appointed for the Proposal. For this assessment, the proposed OOHW have been identified in a conservative manner with the aim of capturing the likely worst case required OOHW, along with identifying a specific mitigation and management measure that are to be considered by the contractor as part of a works specific assessment during the construction stage. As part of further design development and when the specific construction methodology is known, a works specific assessment would be undertaken to determine the feasible and reasonable controls required to be implemented to manage the construction works within the construction noise management levels.

As the Proposal is located in an area where there a number where similar industrial facility construction projects that are expected will be taking place over the next couple of years there is potential for cumulative or consecutive noise impacts as a result of the Proposal combined with other project with

concurrent or similar timeframes, which may lead to both cumulative impacts and/or construction fatigue. As such, recommended mitigation and management measures have been included to be considered during further construction planning.

Construction related road traffic noise is expected to achieve the requirements of the NSW *Road Noise Policy* and is not expected to cause any adverse impacts at nearby receivers.

The expected construction noise levels have been predicted and presented in Section 7.3.1. Noise mitigation and management measures have been presented in Section 7.3.4 to aid in providing additional noise reduction benefits where exceedance of the objectives occurs.

A number of vibration intensive construction activities are likely to be required such as use of rock hammering and vibratory rolling. Due to the close proximity to nearby industrial receivers, a further review of potential vibration impacts and construction methodology, along with mitigation and management approaches to appropriately manage potential impacts would be required during further design development phases to ensure that potential vibration impacts are adequately mitigated and managed.

References

1. NSW Department of Climate Change and Water (2011), *Road Noise Policy* (RNP)
2. NSW Department of Environment and Climate Change (2009), *Interim Construction Noise Guideline* (ICNG)
3. NSW Environment Protection Authority (2017), *Noise Policy for Industry* (NPfI)
4. NSW Environment Protection Authority (2022), *Approved methods for measurement and analysis of environmental noise in NSW*
5. Standards Australia (2016), *Guide to Noise Control on Construction, Demolition and Maintenance Sites*, AS 2436:2010 (R2016)
6. Standards Australia (2018), *Acoustics—Description and measurement of environmental noise*, AS1055:2018
7. G. Downey, NSW Environment Protection Authority, "An example approach to consider low frequency noise in the context of the NSW noise policy for industry", 2020, Acoustics Australia 48:149-180, Parramatta, Australia

APPENDIX A Technical terms and concepts

A.1 Glossary of terminology - Noise

The following is a brief description of the technical terms used to describe noise and to assist in understanding the technical issues presented.

Absorption Coefficient α	The absorption coefficient of a material, usually measured for each octave or third-octave band and ranging between zero and one. For example, a value of 0.85 for an octave band means that 85% of the sound energy within that octave band is absorbed on coming into contact with the material. Conversely, a low value below about 0.1 means the material is acoustically reflective.
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard
Assessment period	The time period in which an assessment is made. e.g. Day 7am-10pm & Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible Range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receiver and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.
BS	British Standard
CoRTN	United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)"
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:

	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.		
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies. The dB(C) level is not widely used but has some applications.		
Deemed-to-Satisfy Provisions	The Deemed-to-Satisfy Provisions are an optional means of achieving compliance with the mandatory Performance Requirements of the National Construction Code. (also see Alternate Solution)		
Diffraction	The distortion of sound waves caused when passing tangentially around solid objects.		
DIN	German Standard		
Discontinuous Construction	A wall system having a minimum 20mm cavity between two separate leaves, where, for other than masonry there is no mechanical linkage between leaves except at the periphery.		
DnT,w	Weighted Standardised Field Level Difference A measure of sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in-situ. It is a field measurement that relates to the R_w laboratory measured value but is not equal to it because an in-situ space is not of the same quality as a laboratory space. The value is indicative of the level of speech privacy between spaces. The higher its value the better the insulation performance.		
ECRTN	Environmental Criteria for Road Traffic Noise, NSW, 1999		
ENMM	Environmental Noise Management Manual, Roads and Maritime Services (Transport for NSW)		
EPA	Environment Protection Authority		
Field Test	A test of the sound insulation performance in-situ. See also 'Laboratory Test' The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion. A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.		

FIIC	Field Impact Isolation Class. A measure of the noise impact performance of a floor. The value indicates the resistance of the floor to the transmission of impact sound and is measured using a standard tapping machine. It is measured in-situ and is therefore subject to the inherent accuracies involved in such a measurement. The term is defined in ASTM E492 and E1007. It is a field measure of the level of impact sound transmitted to a space via a floor. The equivalent measurement in a laboratory is termed the IIC. The higher the value the better the performance.
Flanking	Flanking is the transfer of sound through paths around a building element rather than through the building element material directly. For example, sound travelling through a gap underneath a door or a gap at the top of a wall.
Fluctuating Noise	Noise that varies continuously to an appreciable extent over the period of observation.
Free-field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
FSTC	Field Sound Transmission Class A measure of the sound insulation performance of a building element. It is characterised by the difference in noise level on each side of a wall or floor. It is measured in the field and is therefore subject to the inherent inaccuracies involved in such a measurement. The term was referred to in older superseded versions of the Building Code of Australia and has now been replaced with the term DnT,w.
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, NSW DEC 2007
IIC	Impact Isolation Class A measure of the noise impact performance of a floor. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from the operation a standard tapping machine placed on the floor. The term is defined in ASTM E492 and E1007. The higher the number the better the performance.
Impact Noise	The noise in a room, caused by impact or collision of an object onto the walls or the floor. Typical sources of impact noise are footsteps on the floor above a tenancy and the slamming of doors on cupboards mounted on the common wall between tenancies.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
INP	NSW Industrial Noise Policy, EPA 1999
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation.
Intertenancy wall	Walls that separate buildings or units within a building. They may provide sound resistance or serve as a fire wall. Synonymous with 'party wall'.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).

ISEPP	State Environmental Planning Policy (Infrastructure), NSW, 2007
ISEPP Guideline	Development Near Rail Corridors and Busy Roads - Interim Guideline, NSW Department of Planning, December 2008
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L10(1hr)	The L10 level measured over a 1 hour period.
L10(18hr)	The arithmetic average of the L10(1hr) levels for the 18 hour period between 6am and 12 midnight on a normal working day.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq or Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the LAeq.
LAeq(1hr)	The LAeq noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted Leq during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
LAeq(8hr)	The LAeq noise level for the period 10pm to 6am.
LAeq(9hr)	The LAeq noise level for the period 10pm to 7am.
LAeq(15hr)	The LAeq noise level for the period 7am to 10pm.
LAeq (24hr)	The LAeq noise level during a 24 hour period, usually from midnight to midnight.
Lmax	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the L _{Amax} .
Lmin	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the L _{Amin} .
Ln,w	Weighted Normalised Impact Sound Pressure Level A measure of the sound level transmitted from impacts on a floor to a tenancy below. It is measured in very controlled conditions in a laboratory and is characterised by how much sound reaches the receiving room from a standard tapping machine. A lower value indicates a better performing floor.
LnT,w	Weighted Standardised Field Impact Sound Pressure Level As for Ln,w but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The equivalent measurement in a laboratory is the Ln,w. A lower value indicates a better performing floor.
Laboratory Test	The performance of a building element when measured in a laboratory. The sound insulation performance of a building element installed in a building however can differ from its laboratory performance for many reasons including the quality of workmanship, the size and shape of the space in which the measurement is conducted, flanking paths and the specific characteristics of the material used which may vary from batch to batch.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.
Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
NCA	Noise Catchment Area. An area of study within which the noise environment is substantially similar.
NCG	Noise Criteria Guideline, Roads and Maritime Services (Transport for NSW)

NMG	Noise Mitigation Guideline, Roads and Maritime Services (Transport for NSW)
Noise	Unwanted sound
Normalised	A method of adjusting the measured noise indices in a laboratory so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the $L_{n,w}$ impact sound pressure level measured in a laboratory is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the sound absorption in the receiving room is set at 10m². This enables all laboratories to report the same value when measured under slightly different conditions. See also 'Standardised'.
NRC	Noise Reduction Coefficient. A measure of the ability of a material to absorb sound. The NRC is generally a number between 0 and 1 but in some circumstances can be slightly greater than 1 because of absorption at the edges of the material. A material with an NRC rating of 1 absorbs 100% of incoming sound, that is, no sound is reflected back from the material. The NRS is the average of the absorption coefficient measured in the octave bands 250Hz, 500Hz, 1kHz & 2kHz which correspond to the predominant frequencies associated with the human voice.
Partition wall	A wall dividing two rooms.
Party wall	A wall dividing two tenancies. Synonymous with 'Intertenancy Wall'.
Pre-construction	Work in respect of the proposed project that includes design, survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities such as site compounds, or other relevant activities determined to have minimal environmental impact (e.g. minor access roads).
RBL	Rating Background Level is the representative LA90 background noise level for a period, as defined in the NSW EPA's noise policies.
Reflection	Sound wave reflected from a solid object obscuring its path.
RING	Rail Infrastructure Noise Guideline, NSW, May 2013
RMS	Root Mean Square value representing the average value of a signal.
Rw	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australia. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the $D_{nT,w}$. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
RNP	Road Noise Policy, NSW, March 2011
Sabine	A measure of the total acoustic absorption provided by a material. It is the product of the Absorption Coefficient (alpha) and the surface area of the material (m²). For example, a material with alpha = 0.65 and a surface area of 8.2m² would have $0.65 \times 8.2 = 5.33$ Sabine. Sabine is usually calculated for each individual octave band (or third-octave).
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sole-occupancy Unit	An area within a building for the exclusive use of the owner or occupier.
Sound	A fluctuation of air pressure which is propagated as a wave through air.

Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the R_w and the sound insulation between two rooms can be described by the $D_{nT,w}$.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 micro Pascal.
Spoil	Soil or materials arising from excavation activities.
Standardised	A method of adjusting the measured noise indices in-situ so that they are independent of the measuring space. The noise level in a room is affected by reverberation in the room. For example, the $L'_{n,w}$ impact sound pressure level measured in a room is dependent upon the amount of absorptive material in the receiving room. The value is adjusted to what would be measured if the reverberation time in the receiving room is set at 0.5 seconds. This enables the same value to be reported independent of whether the room contains carpet and furnishings and the like. See also 'Normalised'.
STC	Sound Transmission Class A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by R_w .
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the R_w or R'_{w} or $D_{nT,w}$.

A.2 Glossary of terminology - Vibration

The following is a brief description of the technical terms used specifically to describe vibration and to assist in understanding the technical issues presented.

Acceleration	The rate of change of velocity, often measured in m/s^2 or g 's. $1 g = 9.81 m/s^2$. Commonly used to assess human response to vibration and for machine condition monitoring.
Accelerometer	A vibration transducer sensor that is used to measure acceleration.
ANC	The Association of Noise Consultants, UK.
Ambient vibration	The all-encompassing vibration occurring at a given location, at a given time, composed of all vibration sources near and far.

Amplification	Vibration amplification refers to an increase in vibration. Amplification may occur due to resonance, when an object or structure is excited at its natural frequency.
Attenuation	Attenuation refers to a reduction in vibration. This may occur due to damping of a vibration system, the inclusion of attenuating devices or, in the case of ground vibration, during propagation through the ground. Ground attenuation is determined by the dynamic properties of the site's soil and rock.
AVTG	Assessing Vibration: A Technical Guideline. NSW Department of Environment and Conservation's (DEC) 2006 guideline for assessing human responses to vibration. Based on BS 6472-1992.
Axis	A fixed reference line for the measurement for the measurement of vibration in a particular direction. Vibration is commonly measured in transverse (T), longitudinal (L) and vertical (V) axes (or X, Y and Z).
Background vibration	The underlying level of vibration present in the ambient environment, measured in the absence of the vibration sources of interest.
Blasting	Excavation or demolition using explosives.
Borehole transducer	A geophone transducer rigidly mounted at the bottom of a borehole (either permanently or temporarily) to measure underground vibration.
Broadband vibration	The overall vibration level which encompasses a wide range of frequencies. As opposed to vibration levels for specific frequency bands (see Octave) or narrowband vibration levels as produced by FFT.
BS	British Standard.
Continuous vibration	Vibration that continues uninterrupted over a defined period.
Cosmetic damage	Damage to a structure due to vibration that only affects the appearance of the structure and can be easily repaired, e.g. hairline cracks in mortar joints of brick or concrete constructions, or cracks in plasterwork.
Coupling loss	The change in vibration level when vibration is transmitted from the ground to a building's foundations.
Crest factor	The ratio of the peak value of a vibration event to the RMS value of a vibration event.
Damping	Reduction of vibrational energy due to friction or other forces.
DEC	NSW Department of Environment and Conservation, now the Department of Planning, Industry and Environment.
Decibel [dB]	The logarithmic unit used to represent sound and vibration levels. A vibration level in dB equals 20 times the logarithm to the base 10 of the ratio of the vibration level relative to the reference level. For vibration velocity, the reference level is commonly 1 nm/s. For vibration acceleration, the reference level is commonly 1 mm/s ² . Other reference values are commonly used. The reference value should always be stated.
DIN	German Standard.
Displacement	Change in position of a body from a reference point. Usually measured in m or mm.
EPA	Environment Protection Authority.
eVDV	Estimated Vibration Dose Value. See also VDV.
Filter	An electrical circuit that allows signals of certain frequency ranges to pass through, and blocks all other frequencies. Types of filters include low pass filters, high pass filters, and band pass filters.
FFT	Fast Fourier Transform. An algorithm that converts a signal from the time domain to the frequency domain.
Frequency	In the case of vibration, frequency is the number of oscillations that occurs per second. Frequency is measured in units of Hertz (Hz).
Geophone	A vibration transducer sensor that is used to measure velocity.

Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Ground spike	A metal stake with a flat top that is driven into the ground and used to mount a vibration transducer to measure vibration levels.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Intermittent vibration	Either interrupted periods of continuous vibration or repeated periods of impulsive vibration.
Impulsive vibration	Vibration that rapidly builds up to a peak followed by a damped decay. May consist of multiple impulsive events, typically less than 2 seconds in duration.
Isolation	The process of reducing the vibrational energy transmitted to an object, such as a piece of equipment or building, from the source of vibrations.
Minor damage	Damage to a structure due to vibration that affects the serviceability of residential style buildings or other sensitive structures but does not affect the structural elements. E.g. cracks in plastered or rendered surfaces, existing cracks enlarged or partitions detached.
Mode	A mode of vibration is a characteristic pattern or shape in which a mechanical system will vibrate. The actual vibration of a structure is a combination of all the vibration modes, but to varying degrees, depending on the vibration source.
Natural frequency	The frequency at which a system tends to oscillate in the absence of any driving or damping force.
Noise floor	The residual level of unwanted signal measured by an instrumentation system. The signal of interest must be above the noise floor to be measured accurately. See also Signal to noise ratio.
Octave	An octave represents a doubling or halving in frequency. Noise or vibration levels across a frequency spectrum are commonly given in octave or one-third octave frequency bands.
Peak-to-peak	The difference between the highest positive peak level and the lowest negative peak of a vibration event.
Peak vibration velocity	The absolute maximum value of the vibration velocity signal measured in the X, Y or Z axis during a given time interval. Also referred to as the peak component particle velocity.
PPV	Peak Particle Velocity. The absolute maximum value of the vibration velocity signal measured in any axis during a given time interval.
PVS	Peak Vector Sum. The vector sum of the peak vibration velocities measured in the three orthogonal axes.
Resonance	The phenomenon of increased amplitude that occurs when the frequency of an applied force is equal or close to the natural frequency of the system.
RMS	Root Mean Square value representing the average value of a signal.
Sampling rate	The number of samples per second taken from a continuous signal to make a discrete or digital signal. Measured in Hertz. To accurately record the signal and determine the spectrum, the sampling rate must be two or more times the maximum frequency of interest.
Settlement	The movement of soil due to vibration or other forces, often in relation to a building's foundations. The indirect effect of settlement and ground movement may cause building damage, separately from the direct effect of building vibration.
Signal to noise ratio	A ratio of the level of a desired signal to the level of the background, often expressed in decibels.
Source vibration	A source that generates vibration. Can be quantified by the amplitude, frequency content and duration of the vibration. Common sources of vibration include rail and road traffic, construction and demolition activities and blasting.
Spectrum	The result of transforming a signal from the time domain to the frequency domain.

Structural damage	Damage to a structure due to vibration that may affect its serviceability due to damage to structural elements. May result in the reduced stability of the building and/or reduction in load-bearing capacities.
Structural fatigue	The weakening of a material caused by cyclic loading that results in progressive and localised structural damage and the growth of cracks.
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft.
Tactile vibration	Vibration of a level that can be felt by humans, dependant on the amplitude and frequency of the source. Note that vibration may also be perceived through indirect effects such as ground-borne noise or the shaking of building elements.
Transducer	A device that converts energy from one form to another. Vibration transducers convert either acceleration, velocity or displacement to an electrical signal that is processed by the monitoring system.
Triaxial	Three axes. Measurement systems often consist of three vibration transducers arranged triaxially – oriented at 90° from each other.
VDV	Vibration Dose Value. A measure of tactile vibration levels used to assess intermittent vibration.
Velocity	The rate of change of vibration displacement, usually measured in mm/s.
Vibration	A mechanical phenomenon whereby oscillations occur about an equilibrium point; a periodic back-and-forth motion of an elastic body or medium, commonly resulting when almost any physical system is displaced from its equilibrium condition.
Vrms	Root mean square (RMS) vibration level for the train passby, typically expressed in mm/s
Waveform	A graphical representation of a vibration event in the time domain, showing the measured vibration levels for each sample.

A.3 Acoustic concepts

A.3.1 Sound and noise

The terms 'sound' and 'noise' are almost interchangeable, except that in common usage 'noise' is often used to refer to unwanted sound. Sound is a vibration that travels as an audible wave of pressure through the air from a source to a receiver location such as the human ear. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) is a unit of measurement used to express the ratio of a quantity to another on a logarithmic scale to make the wide range of sound pressure more manageable.

Sound power is the rate at which a source emits acoustic energy and is unaffected by the environment. It is a property of the source that is emitting acoustic energy.

In contrast, sound pressure is the effect, and it is affected by factors associated with the built and natural environment such as distance, direction, obstacles etc. The sound pressure is the acoustic energy or 'noise level' at a distance away from the noise source. The relationship between sound power and sound pressure can be explained by considering the analogy of an electric heater, which radiates heat into a room and temperature is the effect. Like sound pressure, temperature also reduces with distance from the source following the inverse square law.

In this technical working paper, sound power level is identified by the symbols SWL or L_w , while sound pressure level is represented by SPL or L_p , and both have the same scientific unit in dB.

A.3.2 Individual's perception of sound

The loudness of sound depends on its sound pressure level. The A-weighted decibel [dB(A)] is generally used for the purposes of environmental noise impact assessment as it has been adjusted to account for the varying sensitivity of the human ear to different frequencies of sound. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dB(A) is a good measure of the loudness of environmental noise to the human ear as it considers this frequency dependant sensitivity.

Different noise sources having the same dB(A) level generally sound equally loud. However, the frequency of a sound is what gives it a distinctive pitch or tone – for example, the rumble of distant thunder is an example of a low frequency sound and a whistle is an example of a high frequency sound. Most sounds we hear in our daily lives have sound pressure levels in the range of 30 to 90 dB(A). The following table provide some points of reference, measured in dB(A), of familiar sounds and those from construction activities.

Table A-1 Perception of sound - familiar sounds and construction noise

Common sounds	Construction noise	Sound pressure level
Leaf blower at operator's ear	Concrete saw or jack hammer 7 metres away	90 dB(A)

Common sounds	Construction noise	Sound pressure level
Airplane cabin during cruise (Airbus 321)	Excavator (with bucket) 7 metres away	80 dB(A)
General traffic noise kerbside next to Military Road	Towable compressor 7 metres away	75 dB(A)
Normal conversation at 1 metre		60 dB(A)
Outdoor air conditioning unit 1 metre away	Towable compressor 50 metres away	55 dB(A)
General office		50 dB(A)
Inside private office	Ground-borne noise from road header tunnel excavation between depths of 20 metres to 50 metres	40 dB(A)
Inside bedroom		30 dB(A)

In terms of sound perception, a change of 1 dB(A) or 2 dB(A) in the sound pressure level is difficult for most people to detect, whilst a 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness. An increase in sound level of 10 dB(A) is perceived as a doubling of loudness. However, individuals may perceive the same sound differently since many factors can influence an individual's response, including:

- The specific characteristics of the noise (eg. frequency, intensity, duration of the noise event)
- Time of day noise events occur
- Individual sensitivities and lifestyle
- Reaction to an unfamiliar sound
- Understanding of whether the noise is avoidable and the notions of fairness.

A.3.3 Environmental noise assessment indicators

Environmental noise is an accumulation of noise pollution that occurs outside and is most commonly attributed to various modes of transport as well as industrial and construction activities. Environmental noise has been shown to have an adverse effect on the quality of life, especially following long-term exposure. The focus of the present technical assessment is on annoyance and sleep disturbance as they constitute most of the burden related to the impact of environmental noise on health outcomes. Noise annoyance is defined by the World Health Organization as a feeling of displeasure, nuisance, disturbance or irritation caused by a specific sound. Sleep disturbance relates to difficulty with sleep initiation, consolidation as well as awakening and reduced quality of sleep.

In New South Wales, contemporary environmental noise assessment criteria for addressing noise annoyance and sleep disturbance are specified by the Environment Protection Authority (EPA). Potential road traffic noise impact is assessed in accordance with the NSW Road Noise Policy. For industrial facilities where the associated noise emissions are long-term in nature, noise criteria have been adopted in accordance with the Noise Policy for Industry. For enabling construction activities which are

temporary in nature and highly variable, EPA's Interim Construction Noise Guideline provides the underlying assessment principles for the determination of potential construction noise impact. Each policy/guideline is discussed in detail in the body of this report:

- Section 5.3 details the NSW Road Noise Policy
- Section 5.1 details the Noise Policy for Industry
- Section 4 details the EPA's Interim Construction Noise Guideline.

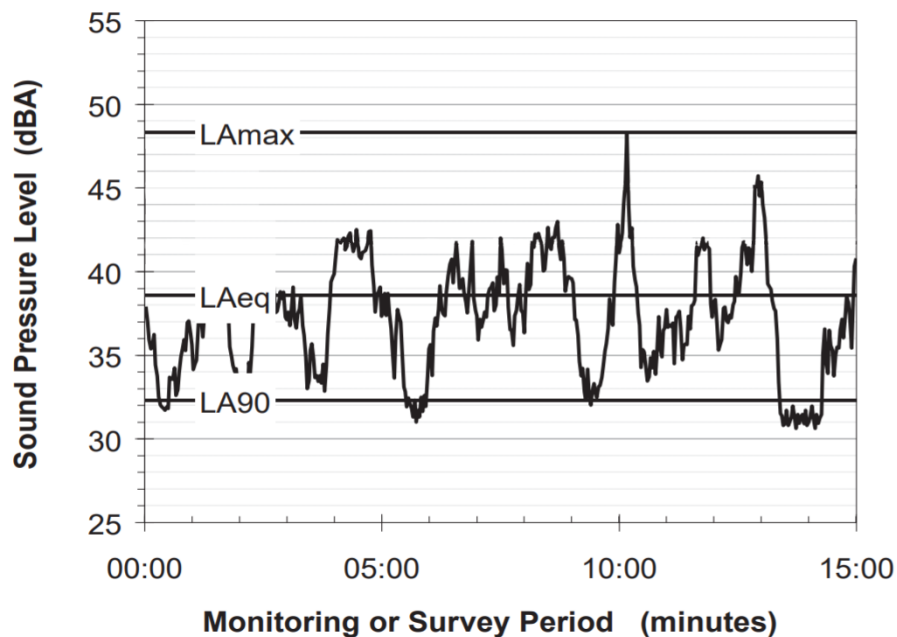
LAeq - To protect against long-term repeated noise exposure, the indicator for assessing the cumulative noise exposure level over a specific time interval is the equivalent sound pressure level, denoted as LAeq. The LAeq indicator accounts for the total energy content from all sources of sound under consideration. The fact that the LAeq is a cumulative measure means that louder activities have greater influence over the LAeq level than do quieter ones, and activities that last longer in time have greater LAeq than do shorter ones. An increase in the number of events also increases the LAeq. Further, people react to the duration of noise events, judging longer events to be more annoying than shorter ones, assuming equal maximum noise levels.

LAmx - It is important to note that LAeq levels are numerically lower than maximum noise levels (denoted as LAmx). None of the noise is ignored, just as all the rain that falls in the rain gauge in one hour counts toward the total. In the case of noisy but short-lived maximum noise events, which can sometime result in immediate short-term awakening reaction, potential impact is assessed using the LAmx indicator in which its emergence above the background noise environment is evaluated.

LA90 - The LA90 is the level of noise that is present almost constantly, or for 90 per cent of the time and is commonly referred to as the background noise. Typical examples of what types of noise may contribute to the background noise levels are continuously flowing traffic or air conditioner noise.

These three noise indicators of LAmx, LAeq and LA90 are presented in Figures A-1 for a sample noise monitoring survey period showing the sound pressure level of a varying noise environment such as environmental noise.

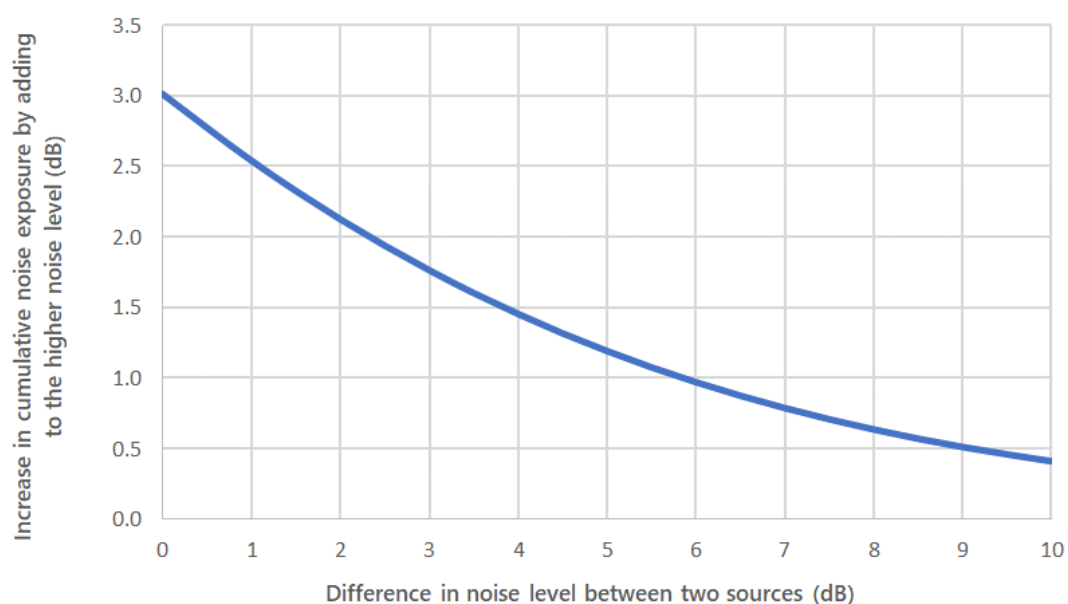
Figure A-1: Environmental noise assessment indicators



A.3.4 Cumulative sound exposure

As illustrated in Figure A-2, for two activities that result in the same amount of acoustical energy or noise level at a receiver location, the cumulative sound exposure level would be 3 dB higher than the level of just one single activity. This is because the decibel (dB) scale is logarithmic. Conversely, if the activity closer to your home results in noise exposure level that is 10 dB higher than the activity occurring further away, the quieter works would contribute very little to the cumulative noise exposure level.

Figure A-2: Difference in noise level between two sources



APPENDIX B Unattended monitoring results

Dates of Survey: 29/05/2025 - 17/06/2025
Monitoring ID: L1
Address: 2 Farrington Street, Minchinbury NSW 2770
Description: Adjacent to backyard fence

Background & Ambient Noise Monitoring Results

	L _{A90} Background Noise Levels			L _{Aeq} Ambient Noise Levels		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Representative Week⁴	45	47	42	58	57	53

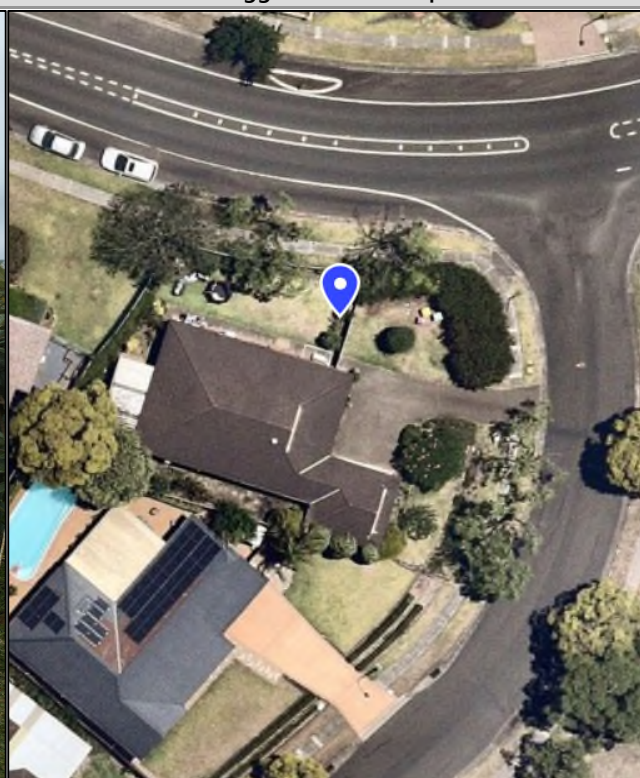
Notes:

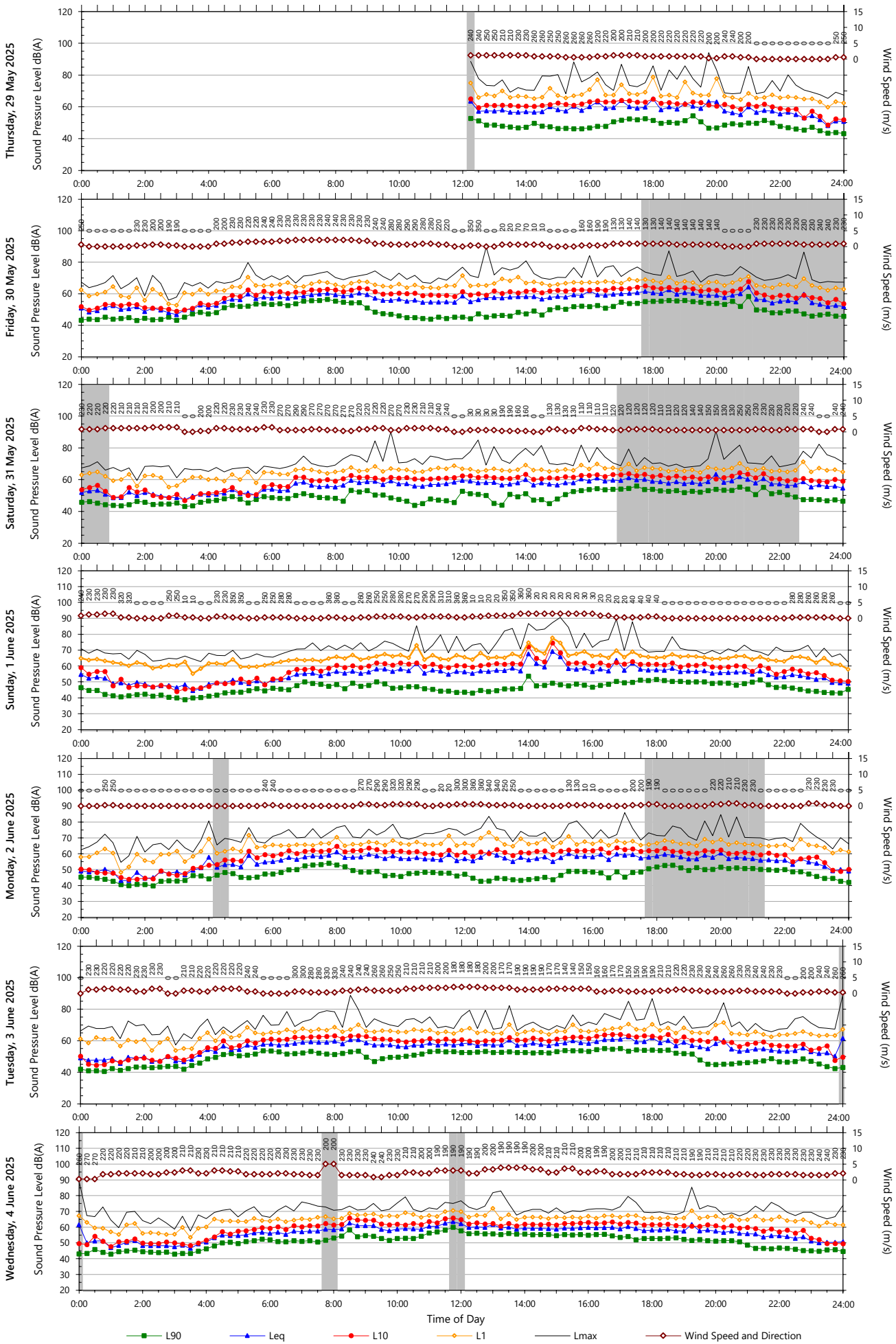
1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Sunday & Public Holidays
4. Rating Background Level (RBL) for LA90 and logarithmic average for LAeq

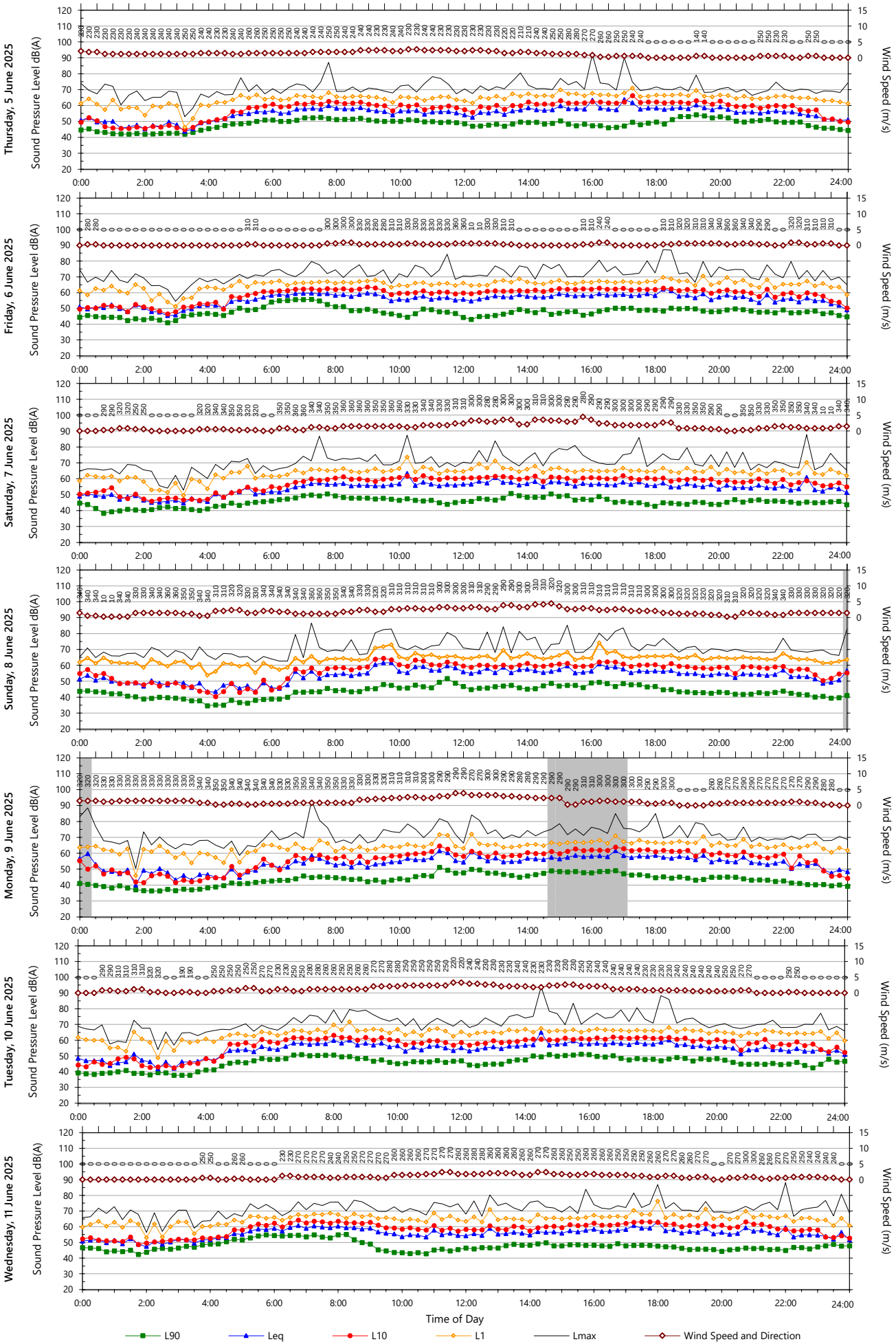
Logger location photograph

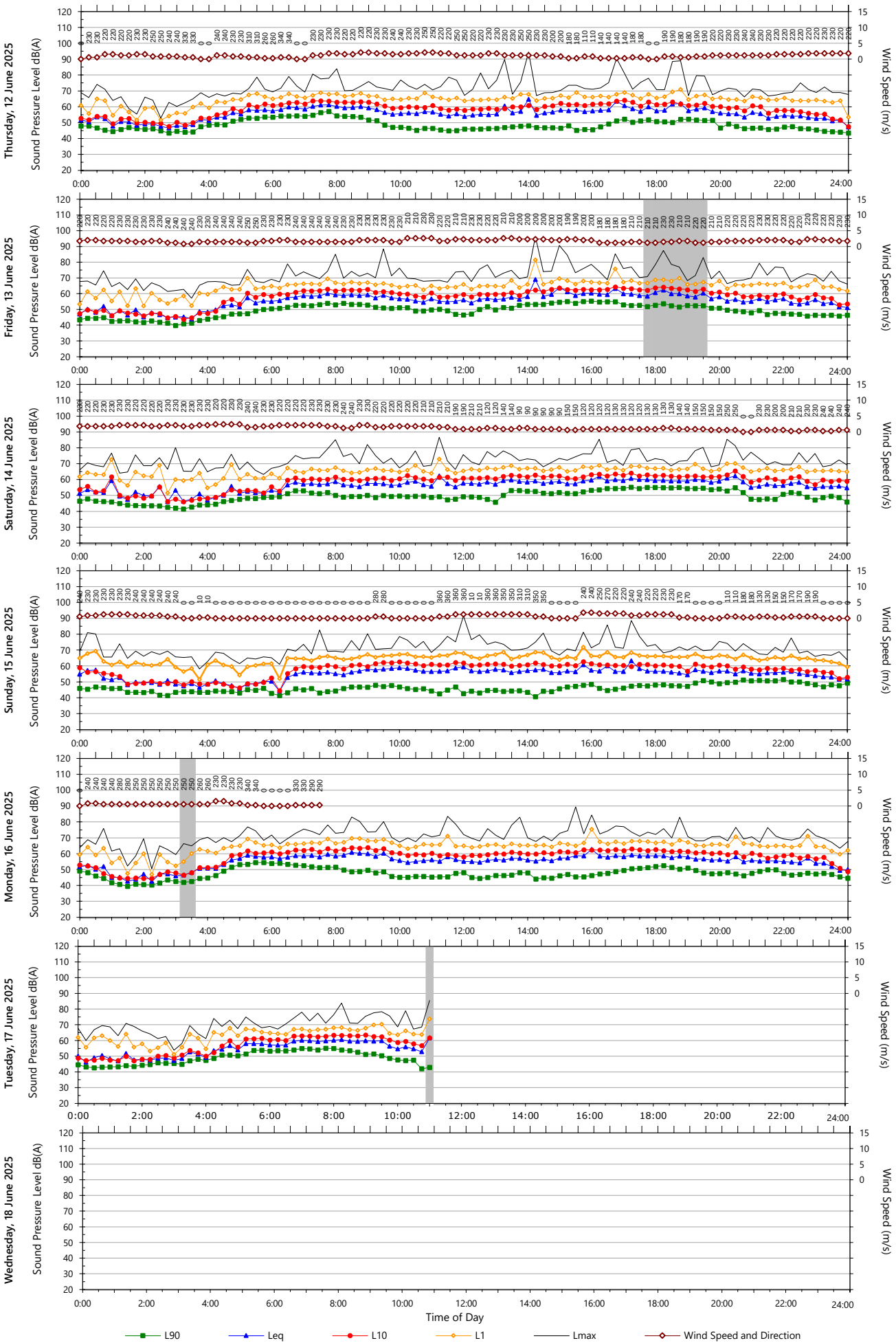


Logger location map









Dates of Survey: 27/05/2025 - 13/06/2025
Monitoring ID: L2
Address: 142 Burley Road, Horsley Park NSW 2175
Description: Behind the front fence

Background & Ambient Noise Monitoring Results

	L _{A90} Background Noise Levels			L _{Aeq} Ambient Noise Levels		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Representative Week⁴	39	37	35	51	44	43

Notes:

1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Sunday & Public Holidays
4. Rating Background Level (RBL) for LA90 and logarithmic average for LAeq

Logger location photograph

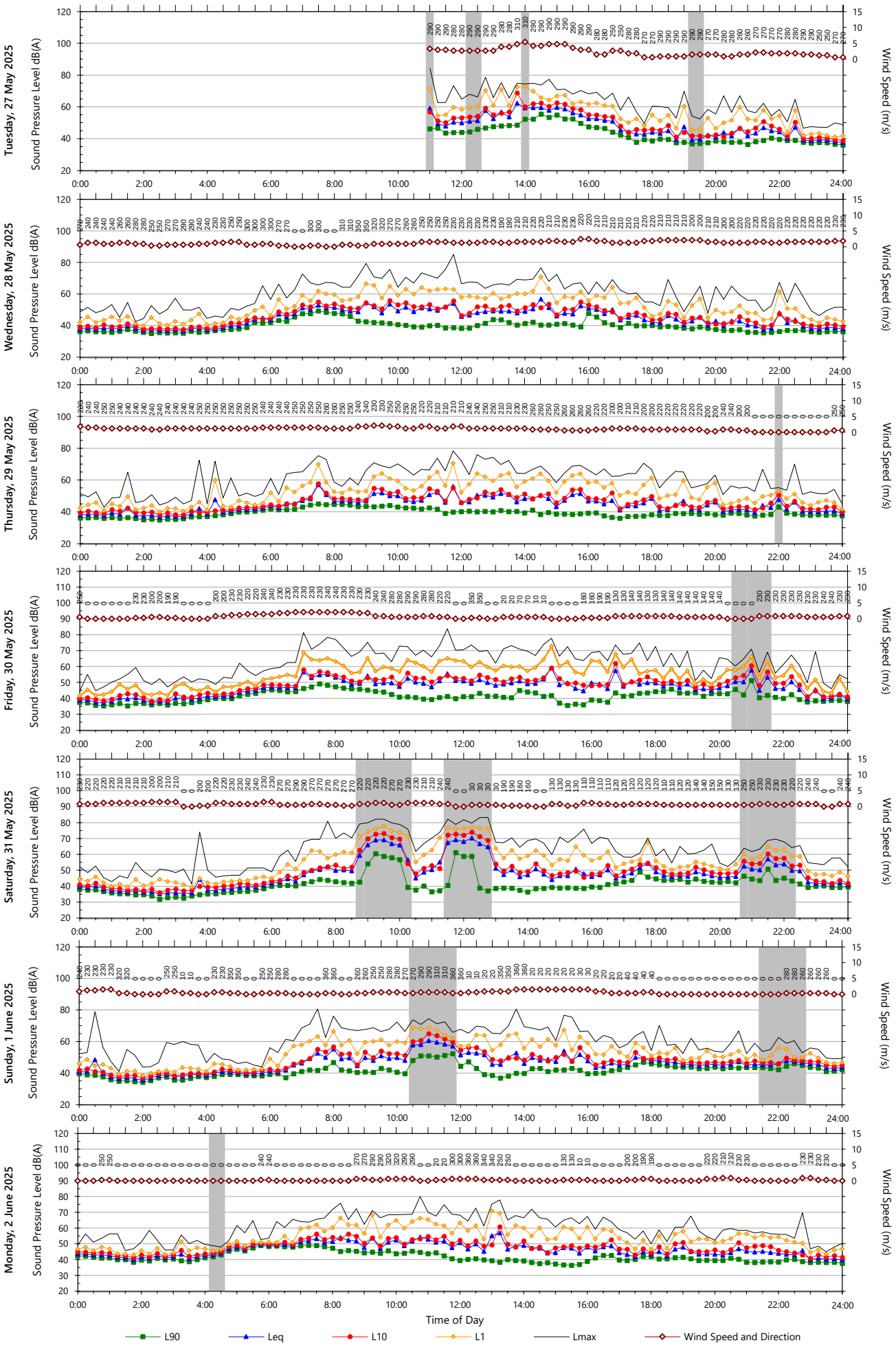


Logger location map



Unattended Monitoring Results

Location: 142 Burley Road, Horsley Park NSW 2175 - Behind the front fence

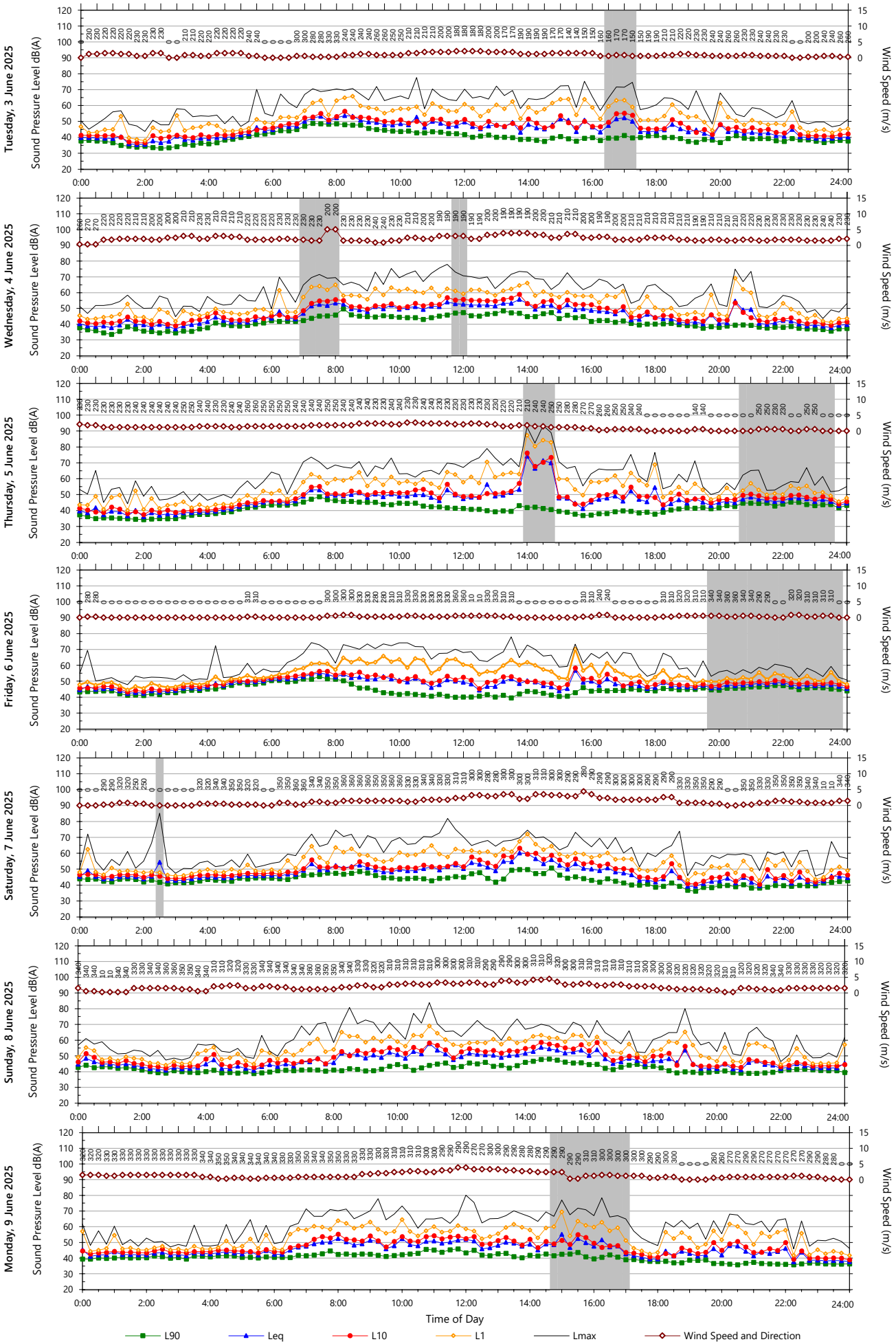


Data File: 2025-05-27_SLM_000_123_Rpt_Report.txt

Template: QTE-26 Logger Graphs Program (r47)

Unattended Monitoring Results

Location: 142 Burley Road, Horsley Park NSW 2175 - Behind the front fence

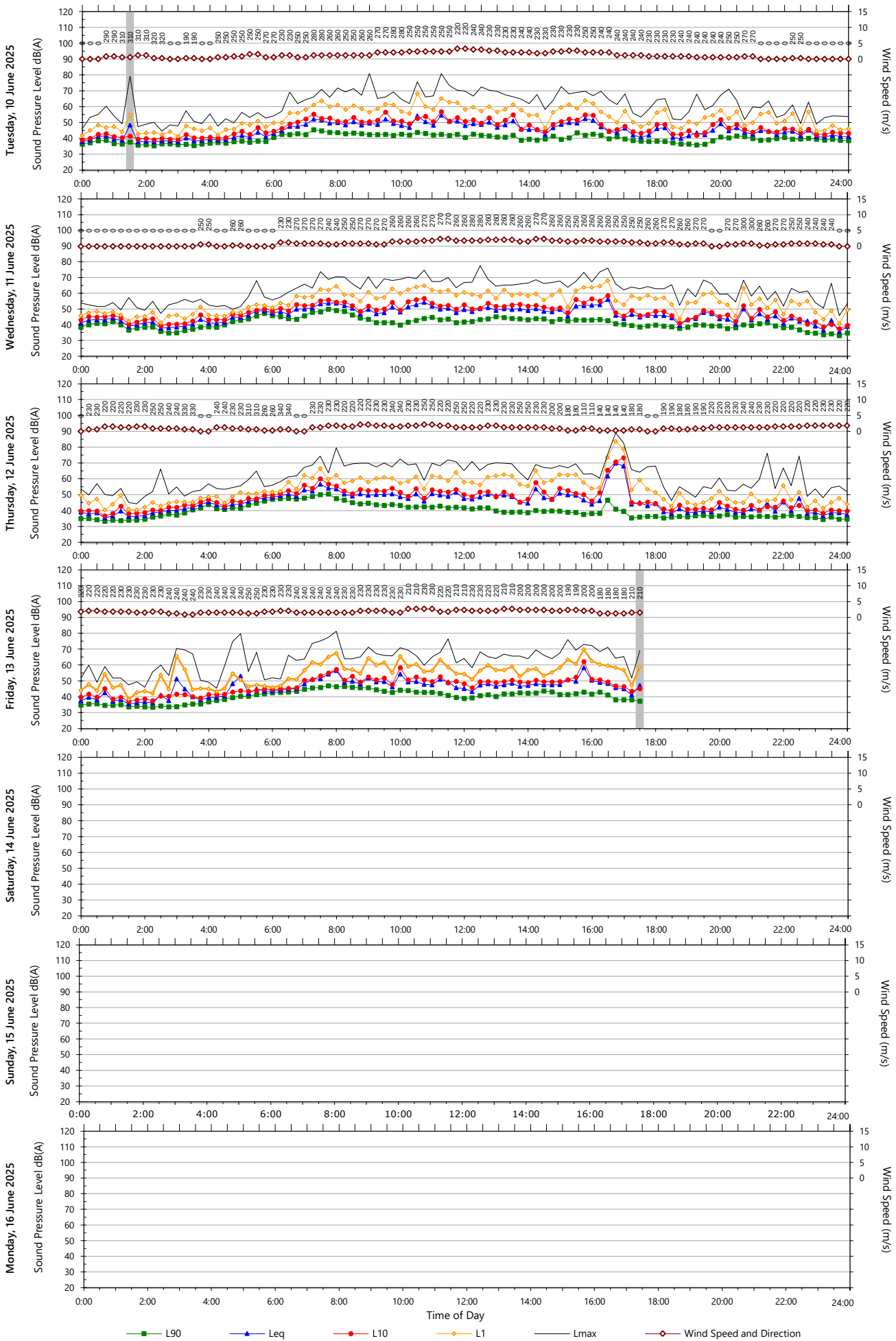


Data File: 2025-05-27_SLM_000_123_Rpt_Report.txt

Template: QTE-26 Logger Graphs Program (r47)

Unattended Monitoring Results

Location: 142 Burley Road, Horsley Park NSW 2175 - Behind the front fence



Data File: 2025-05-27_SLM_000_123_Rpt_Report.txt

Template: QTE-26 Logger Graphs Program (r47)

Dates of Survey: 29/05/2025 - 17/06/2025
Monitoring ID: L3
Address: 11 Sennar Road, Erskine Park NSW 2759
Description: Adjacent to the residential boundary fence on the east

Background & Ambient Noise Monitoring Results

	L _{A90} Background Noise Levels			L _{Aeq} Ambient Noise Levels		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Representative Week⁴	38	38	38	52	44	45

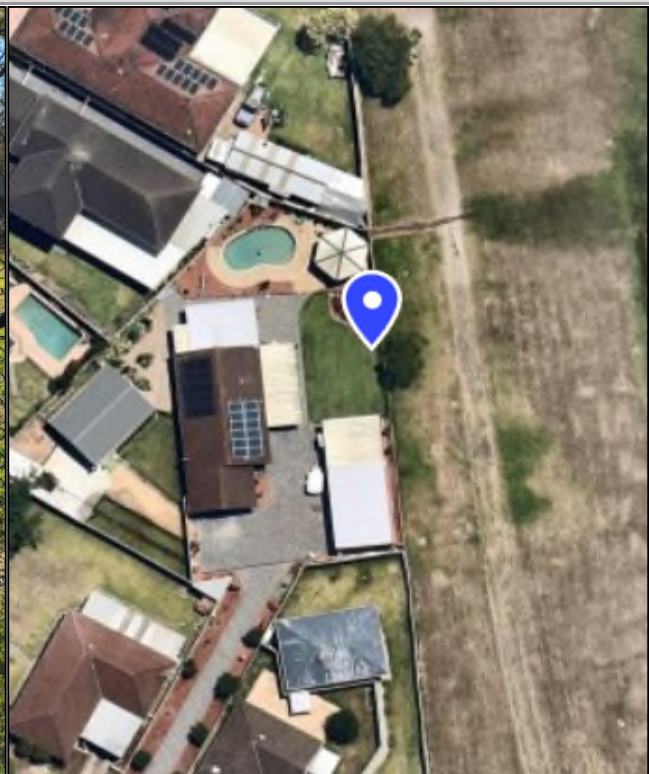
Notes:

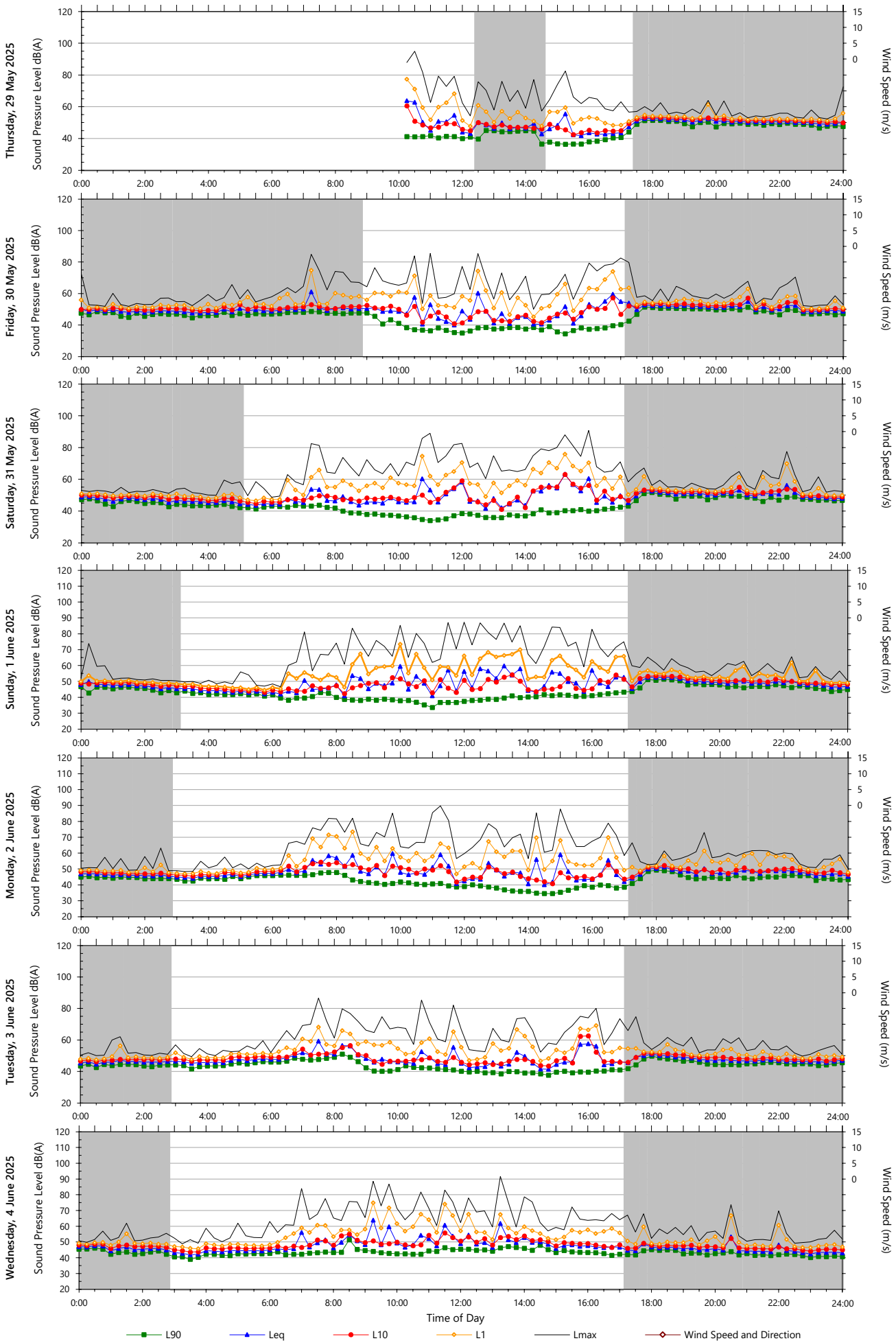
1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Sunday & Public Holidays
4. Rating Background Level (RBL) for LA90 and logarithmic average for LAeq

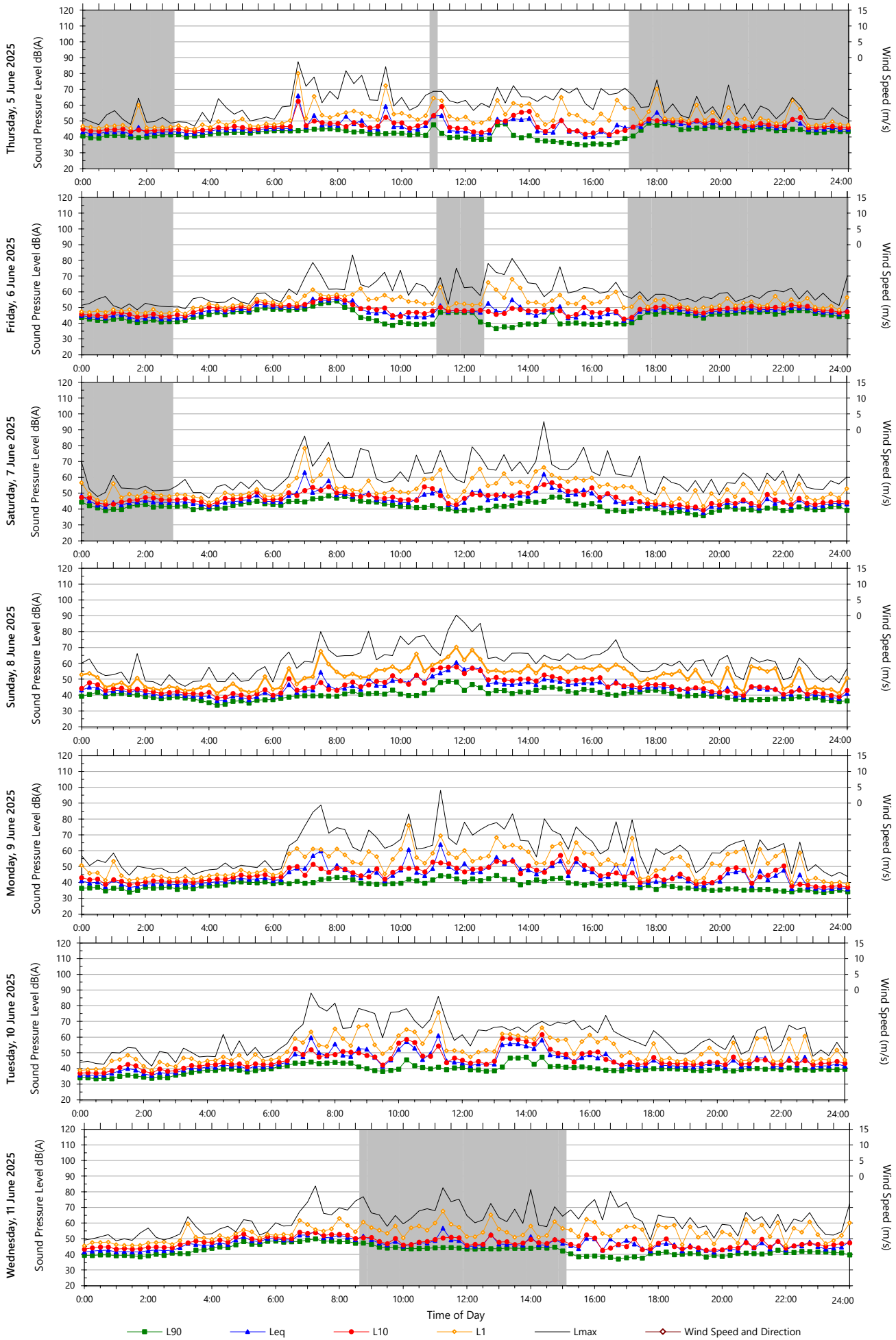
Logger location photograph

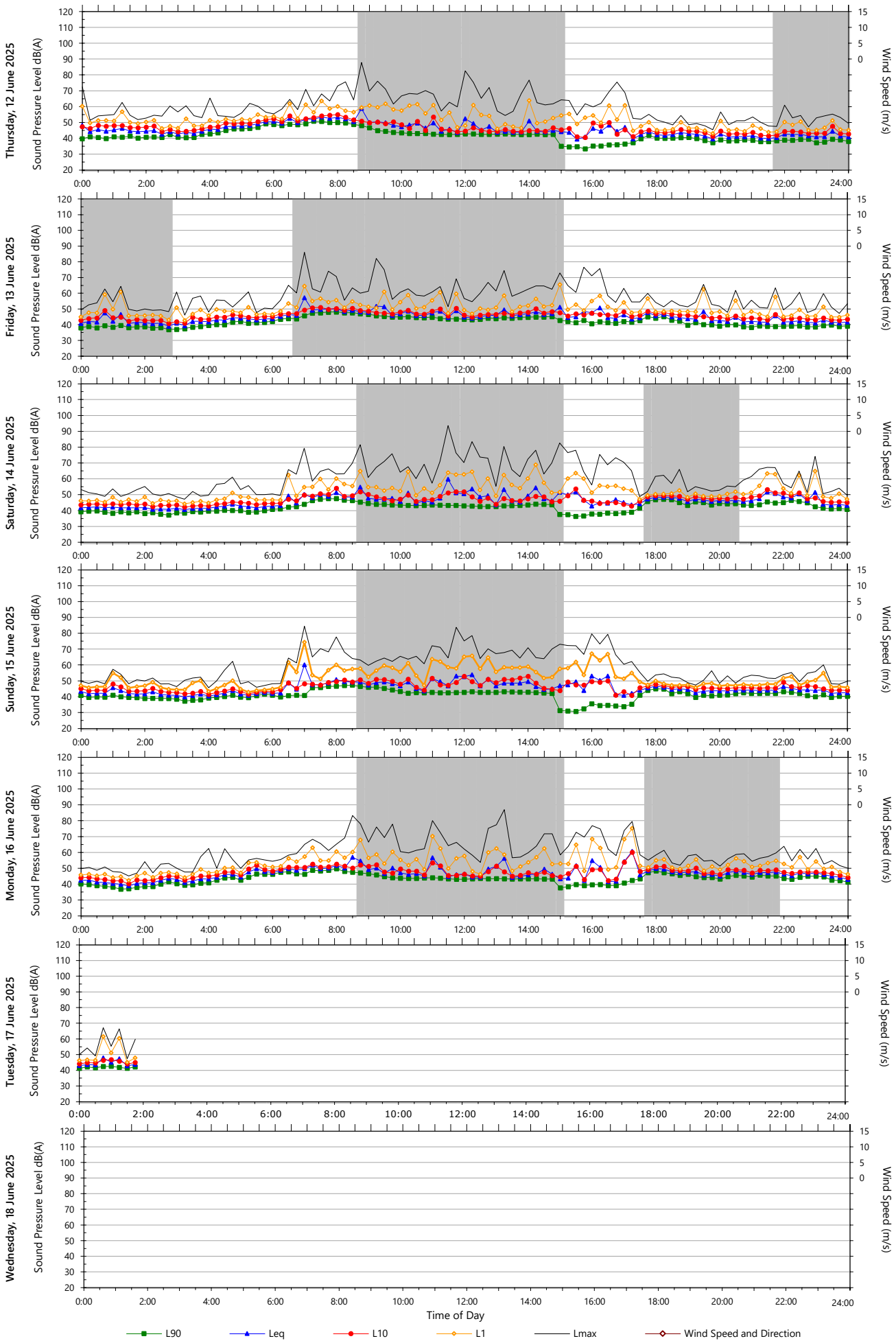


Logger location map









Dates of Survey: 03/06/2025 - 17/06/2025
Monitoring ID: L4
Address: 69 Weaver Street, Erskine Park NSW 2759
Description: Adjacent to residence southern fence

Background & Ambient Noise Monitoring Results

	L _{A90} Background Noise Levels			L _{Aeq} Ambient Noise Levels		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Representative Week⁴	40	43	42	53	52	51

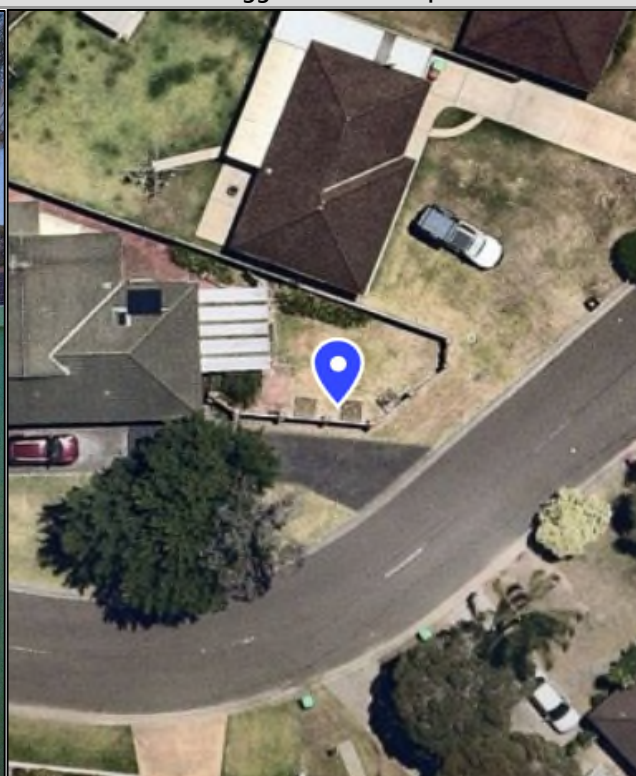
Notes:

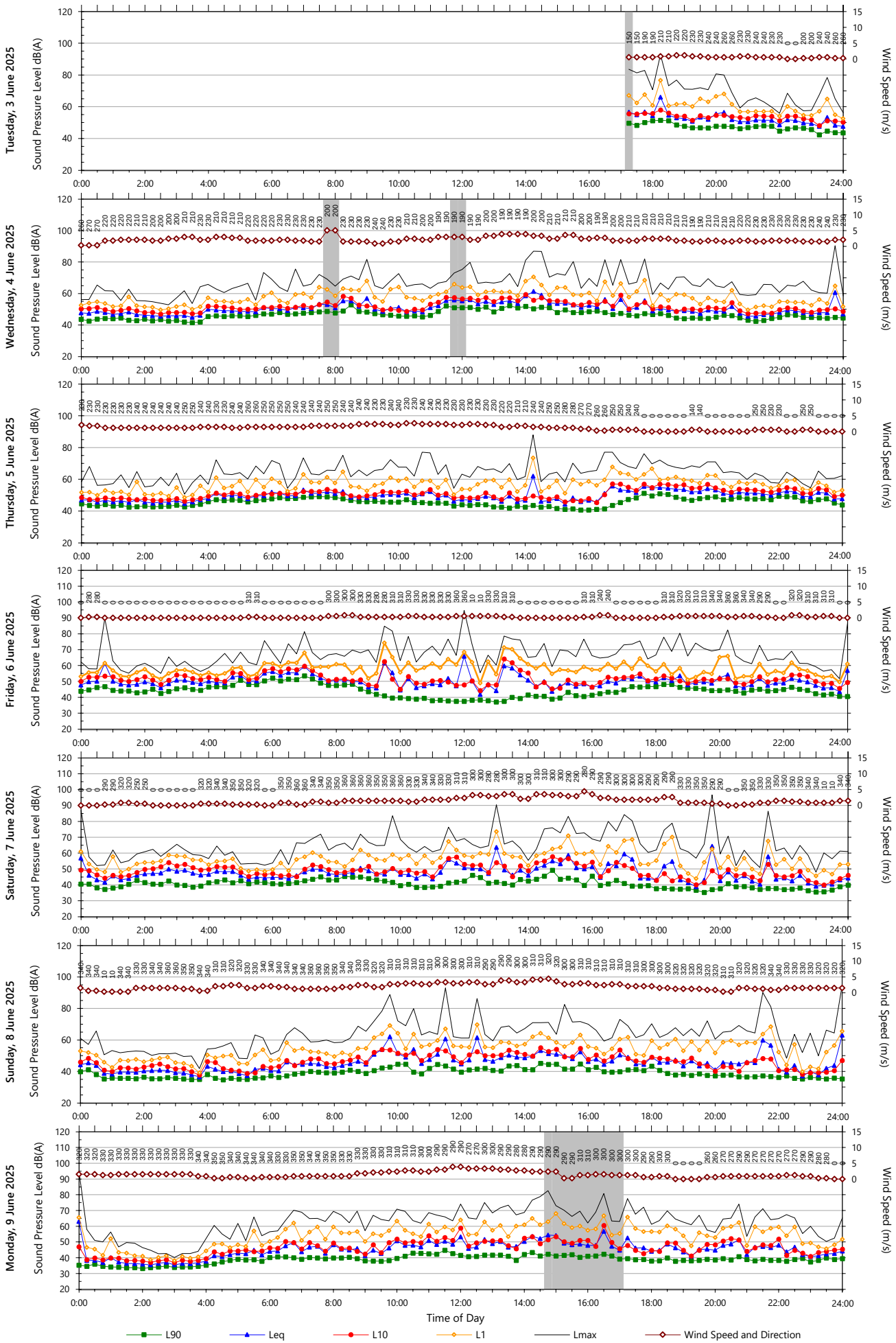
1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Sunday & Public Holidays
4. Rating Background Level (RBL) for LA90 and logarithmic average for LAeq

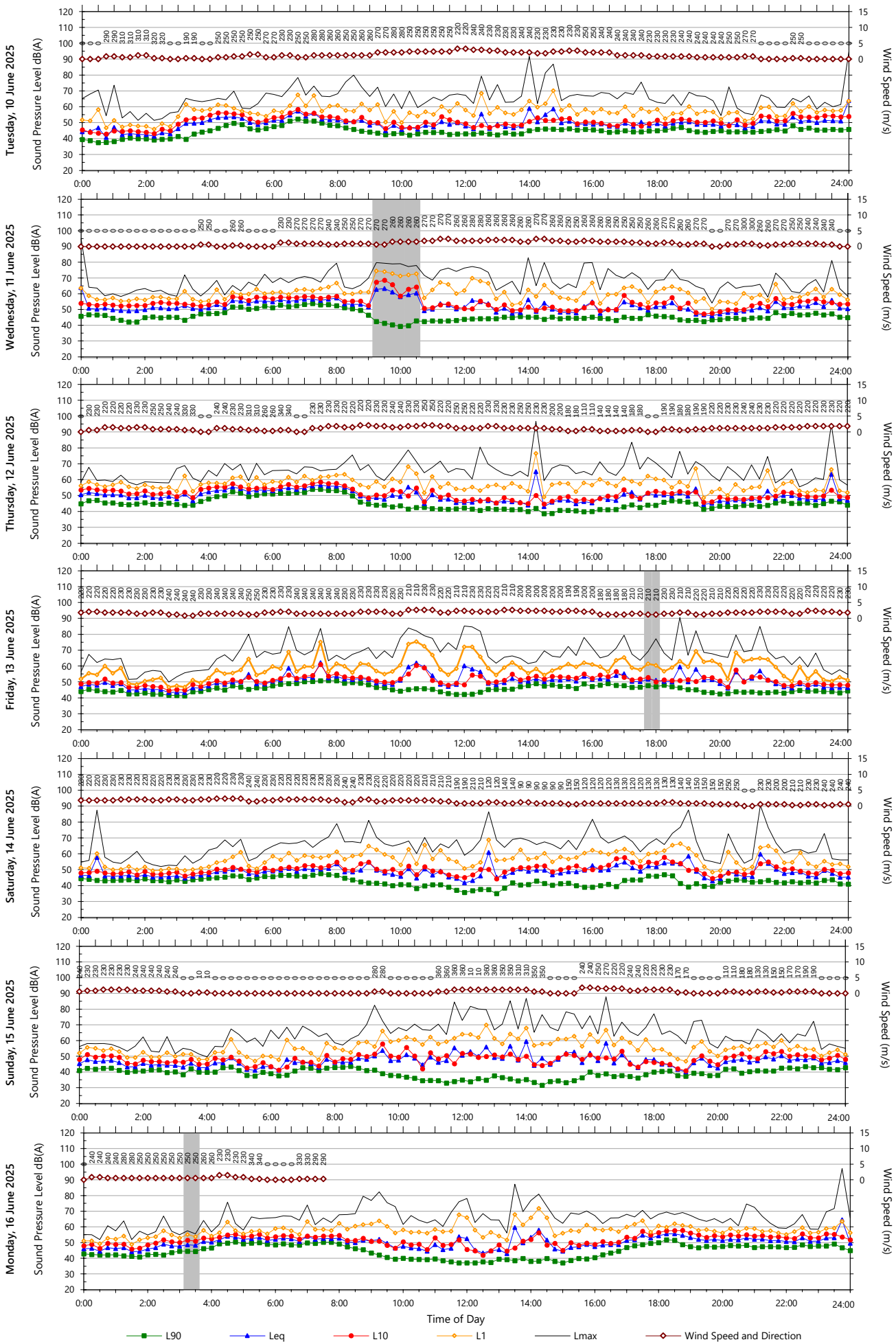
Logger location photograph



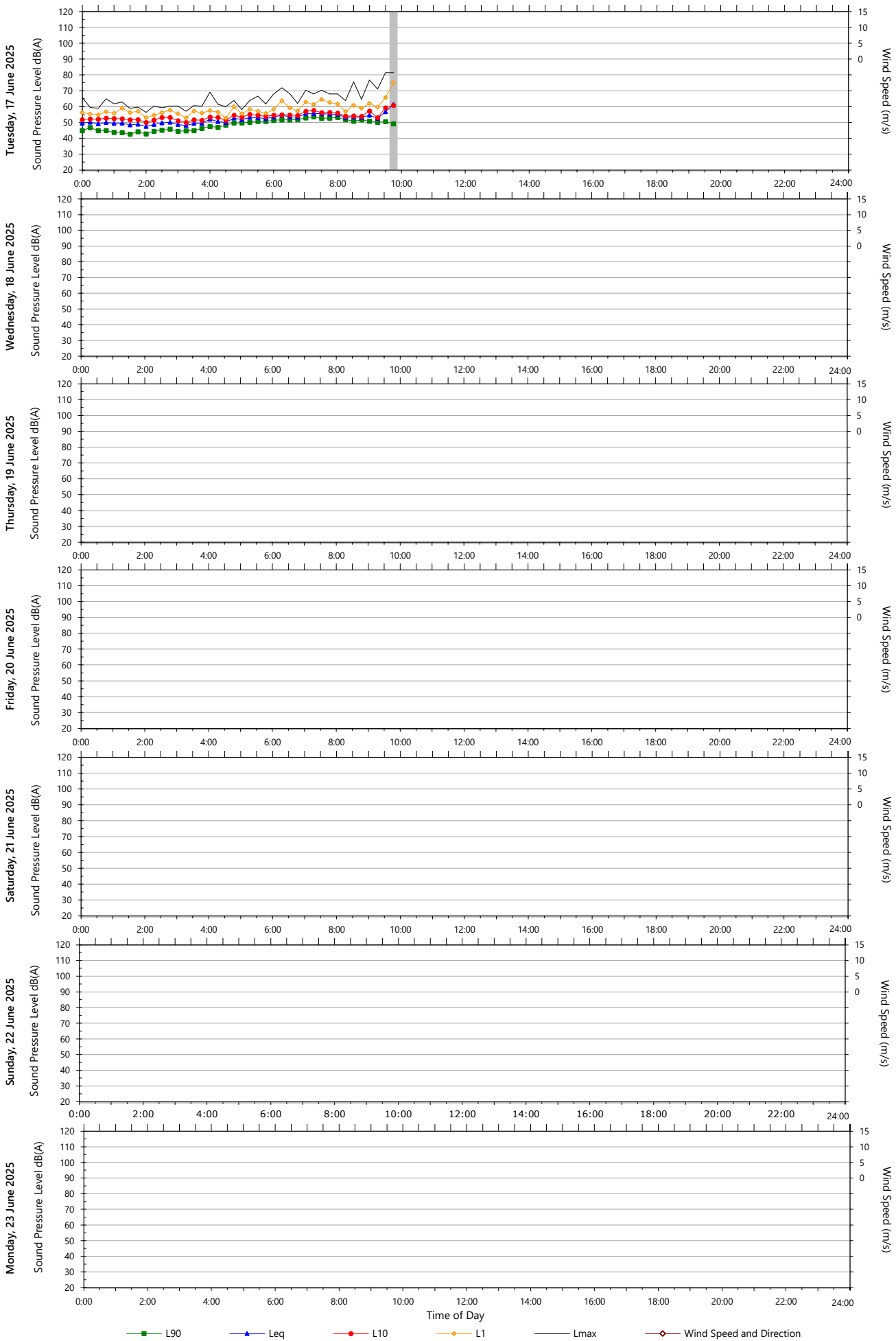
Logger location map







Unattended Monitoring Results Location: 69 Weaver Street, Erskine Park NSW 2759 - Adjacent to residence southern fence



APPENDIX C Plant and equipment manufacturer data for noise source inventory

(a) Air-cooled chiller units

Day selection



Project: NSW Data Centre - 1503 kW (Daytime operation)
 Mode of Operation: Normal Mode (Adiabatic Precooling + Fan Speed Limiting)
 Configuration: Standard fans with time of day speed limiting + **comprehensive sound insulation**

MAGNETIC CENTRIFUGAL COMPRESSOR AIR-COOLED PACKAGED CHILLER

Model #	TAEA1140B1NB	Rating version	FCBCv17d
Quantity	1	Refrigerant	R1234ze(E)
Selection Date	1 December 2025		

PHYSICAL SPECIFICATIONS

Compressor(s)	3xTGS380	Height (mm)	2,667
Length (mm)	12,259	Shipping weight (kg)	11,840
Width (mm)	2,286	Operating weight (kg)	12,384
		Approx. refrigerant charge (kg)	444

CHILLER PERFORMANCE

Percent of full load	100%	Unit power (kW) ³	332.4
Capacity (kW)	1503	Cooling Efficiency (COP, W/W)	4.521

EVAPORATOR

Model (Qty)	EF24140-208H (1)
Number of passes	1
Fluid	Water
Fluid flow rate (l/s)	76.80
Entering fluid temp. (°C)	30.70
Leaving fluid temp. (°C)	26.00
Fouling factor (m ² ·K/kW)	0.018
Pressure drop (kPa)	24.4
Fluid freezing point (°C)	0.00

CONDENSER

Fan Diameter (mm)	910
Fan Quantity (Type)	18 (EC)
Total Fan Power (kW)	12.12
Total Fan Running Current (A)	19.33
Total airflow (m ³ /hr)	254,200
Ambient dry-bulb temp. (°C)	39
Ambient wet-bulb temp. (°C)	27
External Static Pressure (Pa)	0
Adiabatic Water Consumption (L/s)	0.31

CHILLED WATER PUMP

Model (Qty)	TBA
Unit Static Pressure loss (kPa)	TBA
External Static (kPa)	TBA
Total Pump Static (kPa)	TBA
VFD Speed (%)	TBA
Power Consumption (kW)	TBA

ELECTRICAL CHARACTERISTICS

Unit power supply	400V/3/50
Motor starter mode	VFD
Unit Running Current (A)	539
Unit Max. Current (A)	702

SOUND DATA^{4,5}

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Overall dB(A)
Sound Power Level (dB)	86	89	89	85	84	79	77	81	89
Sound Pressure Level ⁶ at 10m (dB)	53	56	56	52	51	46	44	48	56

NOTES

- Unit delivered in 1 piece, fully charged & assembled.
- Shipping & operating weights may not include all selected options; to be confirmed at time of order.
- Chilled water pump power consumption is not included in total unit power (Supplied by separate power feed).
- Sound data may not include all selected options; to be confirmed at time of order.
- Octave band sound data is presented unweighted, overall sound level is presented A-weighted.
- Sound Pressure Level calculated according to ISO EN 3744 (hemispherical).

Evening selection



Project: NSW Data Centre - 805 kW (Evening Operation)
 Mode of Operation: Normal Mode (Adiabatic Precooling + Fan Speed Limiting)
 Configuration: Standard fans with time of day speed limiting + **comprehensive sound insulation**

MAGNETIC CENTRIFUGAL COMPRESSOR AIR-COOLED PACKAGED CHILLER

Model #	TAEA114081NB	Rating version	FCBCv17d
Quantity	1	Refrigerant	R1234ze(E)
Selection Date	5 December 2025		

PHYSICAL SPECIFICATIONS

Compressor(s)	3xTG5380	Height (mm)	2,667
Length (mm)	12,259	Shipping weight (kg)	11,840
Width (mm)	2,286	Operating weight (kg)	12,384
		Approx. refrigerant charge (kg)	444

CHILLER PERFORMANCE

Percent of full load	100%	Unit power (kW) ³	122.6
Capacity (kW)	805.0	Cooling Efficiency (COP, W/W)	6.567

EVAPORATOR

Model (Qty)	EF24140-208H (1)
Number of passes	1
Fluid	Water
Fluid flow rate (l/s)	76.82
Entering fluid temp. (°C)	28.52
Leaving fluid temp. (°C)	26.00
Fouling factor (m ² -K/kW)	0.018
Pressure drop (kPa)	25.6
Fluid freezing point (°C)	0.00

CONDENSER

Fan Diameter (mm)	910
Fan Quantity (Type)	18 (EC)
Total Fan Power (kW)	3.75
Total Fan Running Current (A)	6.21
Total airflow (m ³ /hr)	169,466
Ambient dry-bulb temp. (°C)	31.3
Ambient wet-bulb temp. (°C)	25.48
External Static Pressure (Pa)	0
Adiabatic Water Consumption (L/s)	0.11

CHILLED WATER PUMP

Model (Qty)	TBA
Unit Static Pressure loss (kPa)	TBA
External Static (kPa)	TBA
Total Pump Static (kPa)	TBA
VFD Speed (%)	TBA
Power Consumption (kW)	TBA

ELECTRICAL CHARACTERISTICS

Unit power supply	400V/3/50
Motor starter mode	VFD
Unit Running Current (A)	218
Unit Max. Current (A)	702

SOUND DATA^{4,5}

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Overall dB(A)
Sound Power Level (dB)	82	80	80	77	76	71	71	77	82
Sound Pressure Level ⁶ at 10m (dB)	49	47	47	44	43	38	38	44	49

NOTES

- Unit delivered in 1 piece, fully charged & assembled.
- Shipping & operating weights may not include all selected options; to be confirmed at time of order.
- Chilled water pump power consumption is not included in total unit power (Supplied by separate power feed).
- Sound data may not include all selected options; to be confirmed at time of order.
- Octave band sound data is presented unweighted, overall sound level is presented A-weighted.
- Sound Pressure Level calculated according to ISO EN 3744 (parallel piped).

Night selection



Project: NSW Data Centre - 736 kW (Nighttime operation)
 Mode of Operation: Normal Mode (Adiabatic Precooling + Fan Speed Limiting)
 Configuration: Standard fans with time of day speed limiting + **comprehensive sound insulation**

MAGNETIC CENTRIFUGAL COMPRESSOR AIR-COOLED PACKAGED CHILLER

Model #	TAEA1140B1NB	Rating version	FCBCv17d
Quantity	1	Refrigerant	R1234ze(E)
Selection Date	1 December 2025		

PHYSICAL SPECIFICATIONS

Compressor(s)	3xTG5380	Height (mm)	2,667
Length (mm)	12,259	Shipping weight (kg)	11,840
Width (mm)	2,286	Operating weight (kg)	12,384
		Approx. refrigerant charge (kg)	444

CHILLER PERFORMANCE

Percent of full load	100%	Unit power (kW) ³	94.14
Capacity (kW)	736.0	Cooling Efficiency (COP, W/W)	7.82

EVAPORATOR

Model (Qty)	EF24140-208H (1)
Number of passes	1
Fluid	Water
Fluid flow rate (l/s)	76.82
Entering fluid temp. (°C)	28.30
Leaving fluid temp. (°C)	26.00
Fouling factor (m ² -K/kW)	0.018
Pressure drop (kPa)	24.6
Fluid freezing point (°C)	0.00

CONDENSER

Fan Diameter (mm)	910
Fan Quantity (Type)	18 (EC)
Total Fan Power (kW)	3.75
Total Fan Running Current (A)	6.21
Total airflow (m ³ /hr)	169,466
Ambient dry-bulb temp. (°C)	32.8
Ambient wet-bulb temp. (°C)	23
External Static Pressure (Pa)	0
Adiabatic Water Consumption (L/s)	0.18

CHILLED WATER PUMP

Model (Qty)	TBA
Unit Static Pressure loss (kPa)	TBA
External Static (kPa)	TBA
Total Pump Static (kPa)	TBA
VFD Speed (%)	TBA
Power Consumption (kW)	TBA

ELECTRICAL CHARACTERISTICS

Unit power supply	400V/3/50
Motor starter mode	VFD
Unit Running Current (A)	175
Unit Max. Current (A)	702

SOUND DATA^{4,5}

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Overall dB(A)
Sound Power Level (dB)	82	80	80	77	76	71	71	76	82
Sound Pressure Level ⁶ at 10m (dB)	49	47	47	43	43	37	37	43	48

NOTES

- Unit delivered in 1 piece, fully charged & assembled.
- Shipping & operating weights may not include all selected options; to be confirmed at time of order.
- Chilled water pump power consumption is not included in total unit power (Supplied by separate power feed).
- Sound data may not include all selected options; to be confirmed at time of order.
- Octave band sound data is presented unweighted, overall sound level is presented A-weighted.
- Sound Pressure Level calculated according to ISO EN 3744 (hemispherical).

(b) Hybrid dry cooler units

Hybrid dry chiller - Jaeggli 3.9 MW**BLDG 1 - DAY**

JAEGGLI		no. of fans
dB(A)		4
Hz	per fan	total cooler
		10logNfans
63	55.8	61.9
125	66.0	72.1
250	70.0	76.1
500	74.1	80.2
1K	74.3	80.4
2K	70.3	76.4
4K	63.3	69.4
8K	51.6	57.7
Total	85	

	1,910	kW	36 / 30	°C					
	Dry Bulb / RH		Wet Bulb T						
Sound:									
Wet Mode @	39.9°C / 37.7%		27 °C						
n3~400V 50/60Hz	Fan @		331	RPM					
Oktav frequency	Hz	63	125	250	500	1k	2k	4k	8k
per fan	A-weighting	-26.2	16.1	8.6	3.2	0.0	1.2	1.0	1.1
Sound Power [Lwa]	dB(A)	56	66	70	74	74	70	63	52
Sound Power [Lw]	dB	82	82	79	77	74	69	62	53
Tolerance	dB	5	3	3	2	2	2	2	2
with no. of fans	4								
complete cooler	85	dB(A)							
whole unit	93	dB							

BLDG 1 - Night

JAEGGLI		no. of fans
dB(A)		4
Hz	per fan	total cooler
		10logNfans
63	50.6	56.6
125	60.8	66.8
250	64.8	70.8
500	68.9	74.9
1K	69.1	75.1
2K	65.1	71.1
4K	58.1	64.1
8K	46.4	52.4
Total	80	

2,462 kW		36 / 30 °C							
Dry Bulb / RH		Wet Bulb T							
Sound:									
Wet Mode @		32.8°C / 44.1%	23 °C						
Fan									
n3~400V 50/60Hz		@ 260 RPM							
Oktav frequency	Hz	63	125	250	500	1k	2k	4k	8k
per fan	A-weighting	-26.2	16.1	8.6	3.2	0.0	1.2	1.0	1.1
	dB(A)	51	61	65	69	69	65	58	46
Sound Power [Lwa]	dB	77	77	73	72	69	64	57	48
Sound Power [Lw]	dB	77	77	73	72	69	64	57	48
Tolerance	dB	5	3	3	2	2	2	2	2
with no. of fans	4								
complete cooler	80								
whole unit	88								

Hybrid dry chiller - Jaeggli 3.1 MW

2.57 MW Day

JAEGGLI		no. of fans
dB(A)		4
per fan	total cooler	
Hz		10logNfans
63	51.0	60.9
125	85.1	71.1
250	59.1	75.1
500	73.1	70.1
1K	73.4	73.4
2K	89.4	75.4
4K	82.3	68.3
8K	59.7	56.7
Total	84	dB(A)

2,570 kW		40.7 / 30.7 °C							
Dry Bulb / RH		Wet Bulb T							
Sound:		39.0°C / 37.0%							
Wet Node B		27 °C							
Fan		375 RPM							
n3~ 400V/50/60Hz									
Octave frequency	Hz	63	125	250	500	1k	2k	4k	8k
per fan	A-weighting	-26.2	18.1	8.8	3.2	0.0	1.2	1.0	1.1
Sound Power [Lwa]	dB(A)	55	65	69	73	73	69	62	51
Sound Power [Lw]	dB	81	61	76	76	73	64	61	52
Tolerance	dB	5	3	3	2	2	2	2	2
with no. of fans	d								
complete cooler	84	dB(N)							
whole unit	92	dB							

2.57 MW Night

JAEGGLI		no. of fans
dB(A)		4
per fan	total cooler	
Hz		10logNfans
63	49.8	55.6
125	59.8	65.8
250	50.3	60.8
500	67.3	73.8
1K	68.1	74.1
2K	84.1	70.1
4K	57.1	62.1
8K	45.4	51.4
Total	79	dB(A)

2,570 kW		40 / 30 °C							
Dry Bulb / RH		Wet Bulb T							
Sound:		34°C / 39.8%							
Wet Node B		23 °C							
n3~ 400V/50/60Hz		Fan @ 213 RPM							
Oktaf/frequency	Hz	63	125	250	500	1k	2k	4k	8k
per fan	A-weighting	-26.2	16.1	8.6	3.2	0.0	1.2	1.0	1.1
Sound Power [Lwa]	dB(A)	60	60	64	66	68	64	57	45
Sound Power [Lw]	dB	76	76	72	71	68	63	56	47
Tolerance	dB	5	3	3	2	2	2	2	2
with no. of fans		4							
complete cooler		79		dB(A)					
whole unit		67		dB					

Hybrid dry chiller - Jaeggi 4.6 MW

HDC Jaeggi

Building 2 (3- storey stack)

Total Cooling per block
4.6MW 100%
3.8MW at 83% utilisation

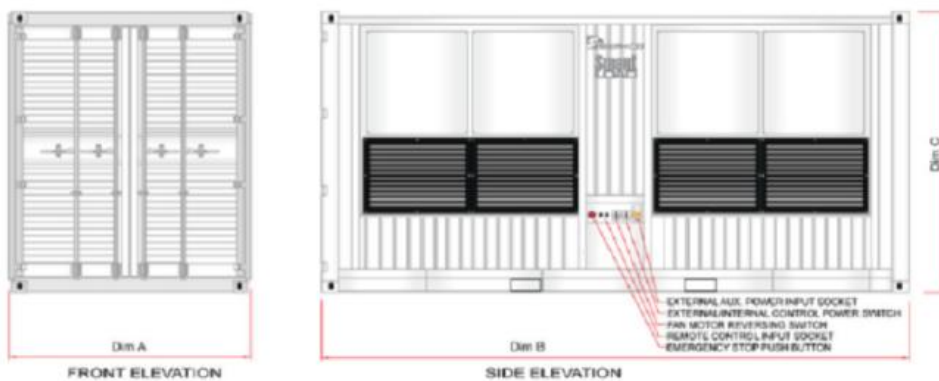
83% duty, day, wet												
JAEGGI		no. of fans										
dB(A)		3		n3- 400V 50/60Hz				262 min ⁻¹				
per total												
Hz	fan	cooler	10logN _{ref}									
63	59.6	64.4	4.8	Oktav frequency								
125	68.6	73.4	4.8	per fan								
250	73.2	78.0	4.8	A-weighting								
500	77.0	81.8	4.8	Sound Power [Lw]								
1K	77.3	82.1	4.8	dB(A)								
2K	73.6	78.4	4.8	Sound Power [Lw]								
4K	66.6	71.4	4.8	dB								
8K	55.3	60.1	4.8	Tolerances								
Total		86.9		dB(A)								
						with no. of fans						
						complete coolers						
						whole units						
						86.9 dB(A)						
						95.4 dB(A)						
Remarks												
The above values are derived from fan supplier's data for 1 single fan.												
No impact of fan motor, frequency inverter, transmission and cooler construction has been considered.												

83% duty, night, wet												
JAEGGI		no. of fans										
dB(A)		3		n3- 400V 50/60Hz				182 min ⁻¹				
per total												
Hz	fan	cooler	10logN _{ref}									
63	53.0	57.8	4.8	Oktav frequency								
125	59.1	63.9	4.8	per fan								
250	65.0	69.8	4.8	A-weighting								
500	68.5	73.3	4.8	Sound Power [Lw]								
1K	68.9	73.7	4.8	dB(A)								
2K	65.6	70.4	4.8	Sound Power [Lw]								
4K	58.9	63.7	4.8	dB								
8K	48.5	53.3	4.8	Tolerances								
Total		78.5		dB(A)								
						with no. of fans						
						complete coolers						
						whole units						
						78.5 dB(A)						
						87.4 dB(A)						
Remarks												
The above values are derived from fan supplier's data for 1 single fan.												
No impact of fan motor, frequency inverter, transmission and cooler construction has been considered.												

(c) Load bank (unmitigated)

SEPHCO WAR-CL SERIES LOAD BANK DIMENSIONS

WAR20CL, WAR40CL SERIES 2000kVa To 6500kVa



MODEL NO	RATING	LOAD STEPS	DIM.A	DIM.B	DIM.C	WEIGHT	NOISE LEVEL
WAR40CL650C	6500KVA	6.25KVA	2440	12100	2595	20000KG	92dBa @ 1M
WAR40CL450C	4500KVA	6.25KVA	2440	12100	2595	16400KG	92dBa @ 1M
WAR40CL400C	4000KVA	6.25KVA	2440	6058	2595	13500KG	91dBa @ 1M
WAR20CL330C	3300KVA	6.25KVA	2440	6058	2595	12800KG	91dBa @ 1M
WAR20CL300C	3000KW	6.25KVA	2440	6058	2595	12000KG	91dBa @ 1M
WAR20CL280C	2800KVA	6.25KVA	2440	6058	2595	11200KG	91dBa @ 1M
WAR20CL250C	2500KVA	6.25KVA	2440	6058	2595	10600KG	91dBa @ 1M
WAR20CL200C	2000KVA	6.25KVA	2440	6058	2595	10000KG	91dBa @ 1M

Load bank data

(d) Water cooled chiller



AquaEdge Chiller Estimated Acoustic Data
LCI Design DC Project - CH-1 - 4100 KW - Night Operation
Carrier Australia Sales Office

Date: 11/30/2025 6:20 PM

Prepared By: Najmul Islam



19MV-75Z75L459E39

Full Load - Chiller Sound Pressure Levels(Standard)

Percent Load	Octave Band Center Frequency, Hz									A-Weighted (dBA)
	31.5	63	125	250	500	1 k	2 k	4 k	8 k	
100.00	24	41	54	61	68	75	74	75	61	80

Max Capacity - Chiller Sound Pressure Levels(Standard)

Percent Load	Octave Band Center Frequency, Hz									A-Weighted (dBA)
	31.5	63	125	250	500	1 k	2 k	4 k	8 k	
109.29	26	41	56	62	69	76	74	74	61	80

Load Line - Chiller Sound Pressure Levels(Standard)

Percent Load	Octave Band Center Frequency, Hz									A-Weighted (dBA)
	31.5	63	125	250	500	1 k	2 k	4 k	8 k	
100.00	24	41	54	61	68	75	74	75	61	80
90.00	22	39	51	59	67	73	71	73	61	78
83.00	21	40	51	61	66	74	71	72	61	78

Notes:

Estimated Sound Pressure Levels - dB re: 20 micropascal.

Sound pressure levels used to develop this program were measured per AHRI Standard 575.

The sound pressure levels were measured in an acoustical free-field, i.e. a non-reflective environment. Field sound measurements can vary significantly as a function of the reflectivity and proximity of nearby surfaces and the presence of other sound sources.

Applied Chillers Asia Builder Version 2.27.0.0

Page 1 of 1

APPENDIX D **NPfl Fact Sheet C annoying characteristics analysis (Low frequency and tonality)**

Scenario: Day - Typical operations - with generator testing (Worst case generator testing configuration - Horsley Park)

Annoyance analysis (Low frequency and tonality)

Scenario: Evening - Typical operations

[illegible]

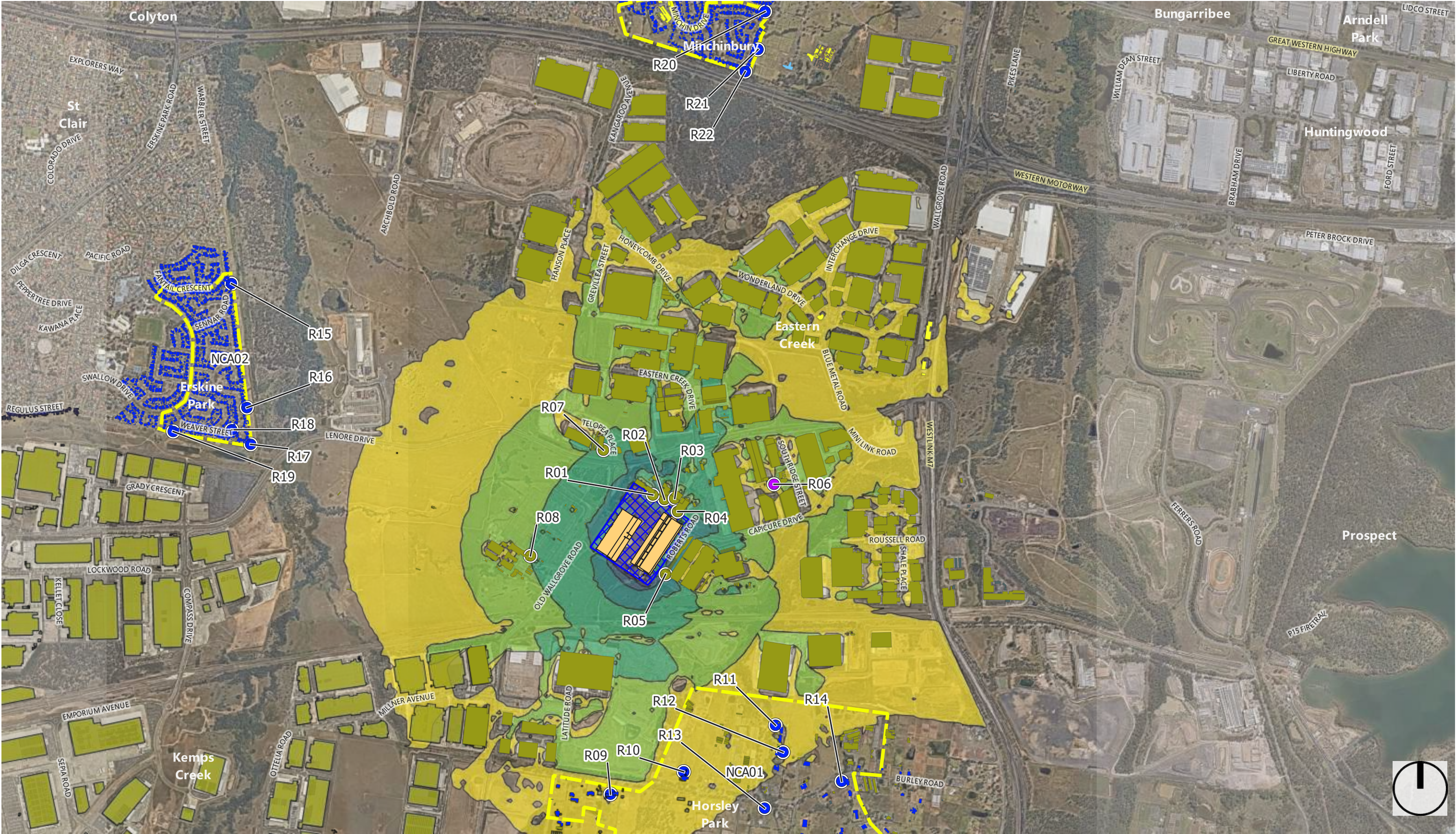
Scenario: Night - Typical operations - Without generator testing

[illegible]

Note 1: The overall noise levels are based upon the worst case spectral data for each receiver location.

APPENDIX E Predicted operational noise contours

E.1 Predicted operational noise levels, $L_{Aeq,15\text{minute}}$ – Daytime (with testing of 5 worst case combination of concurrent generators for Horsley Park)



Legend

- All NCA
- Proposal area
- Key Proposal buildings

Representative receivers

- Childcare
- Industrial
- Residential

Receiver buildings

- Residential
- Childcare
- Place of Worship
- Educational
- Commercial
- Industrial
- Recreational - Active
- Recreational - Passive

Predicted noise level, LAeq 15min, dB(A)

- 38 - 43
- 43 - 48
- 48 - 53
- 53 - 58
- 58 - 63
- > 63

Client:
Goodman Property Services
(Aust) Pty Ltd

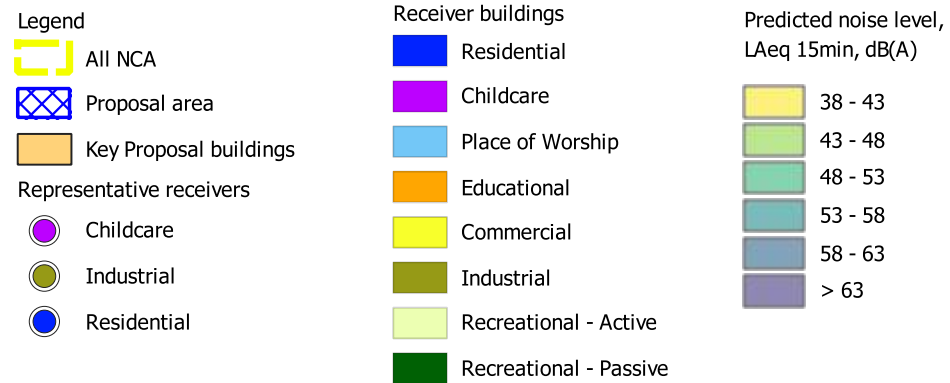
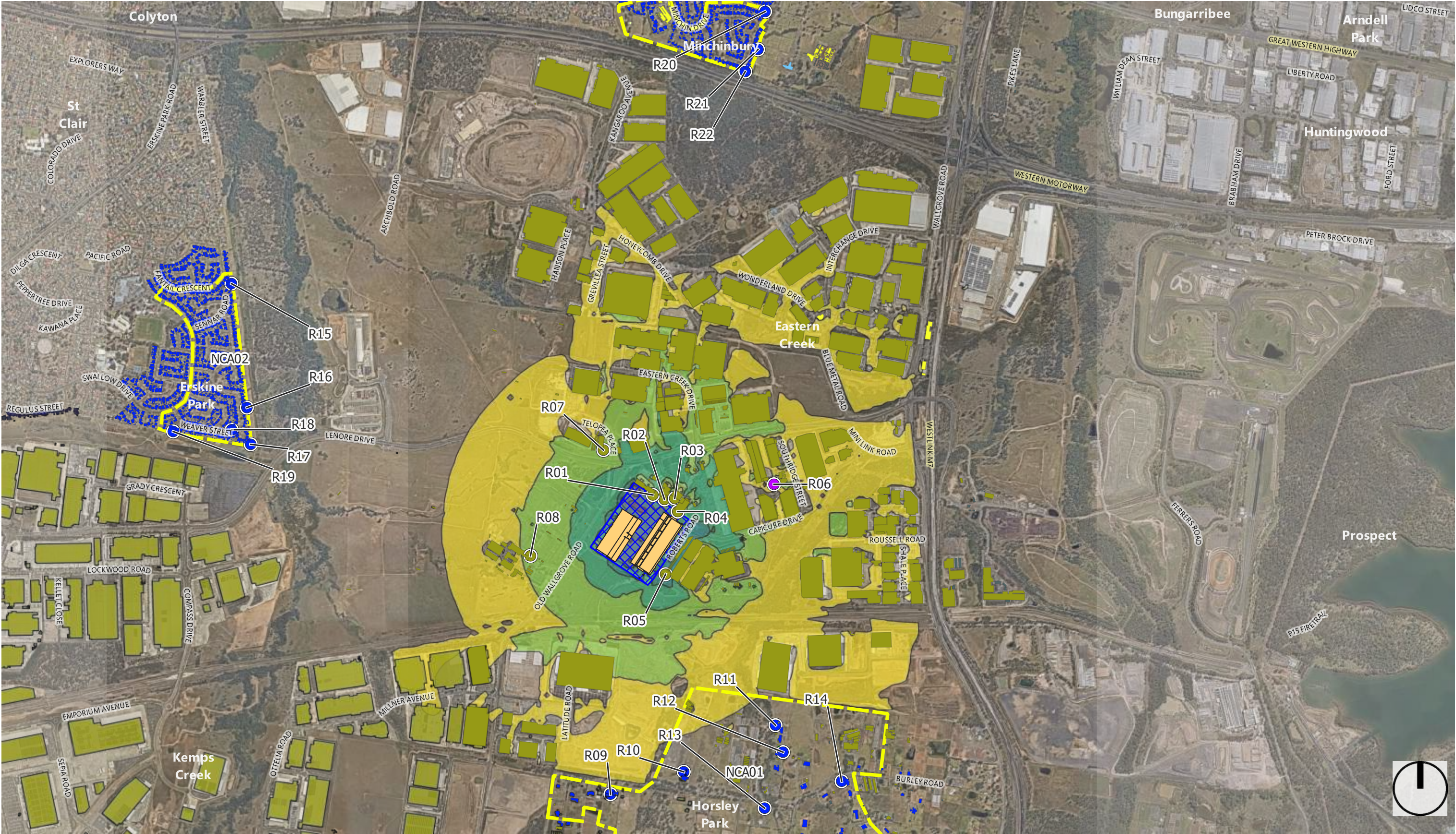
Project:
Project Atlas Data Centre
10 Roberts Road, Eastern Creek, NSW
State Significant Development (SSD) 101067971

Description:
Operational noise contour (1.5m NPfl assessment height)
Daytime (7:00am - 6:00pm) - LAeq 15minute
Typical operations with testing of 5 concurrent generators
(worst case generators for Horsley Park)

Notes

- Imagery source: Nearmap (Decemberr 2025) and Sixmaps (Department Finance, Services and Innovation (25/03/2026))
- Landuse classification based upon a desktop review only, subject to further review and detailed design.
- All noise contours are calculated based upon a grid, and interpolated between the grid resolution. All noise contours should be interpreted considering this calculation method and its limitations. Noise contours are presented to provide the required representation of predicted noise levels, at the NPfl assessment height. Noise levels are approximate due to interpolation of contours and should be used for reference only. Noise contours are not to be used for determining noise limits, or determining specific noise levels at locations.
- For information only and not for determining final operational noise levels or construction purposes.
- Do not scale from this figure.
- This information is protected by copyright.

E.2 Predicted operational noise levels, $L_{Aeq,15\text{minute}}$ – Typical operations – Evening



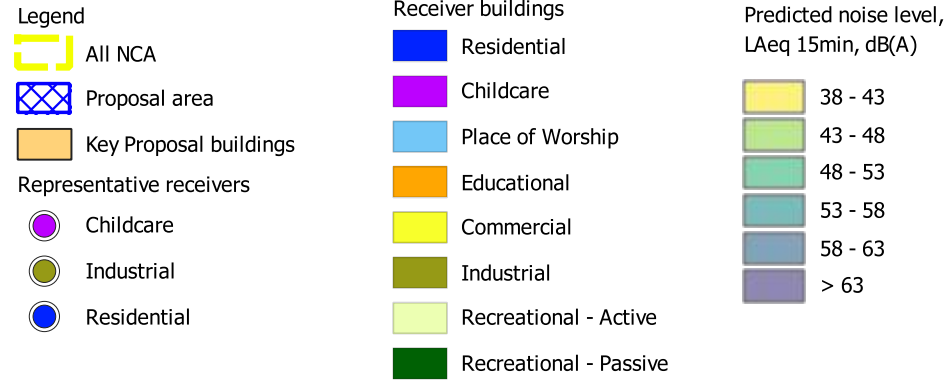
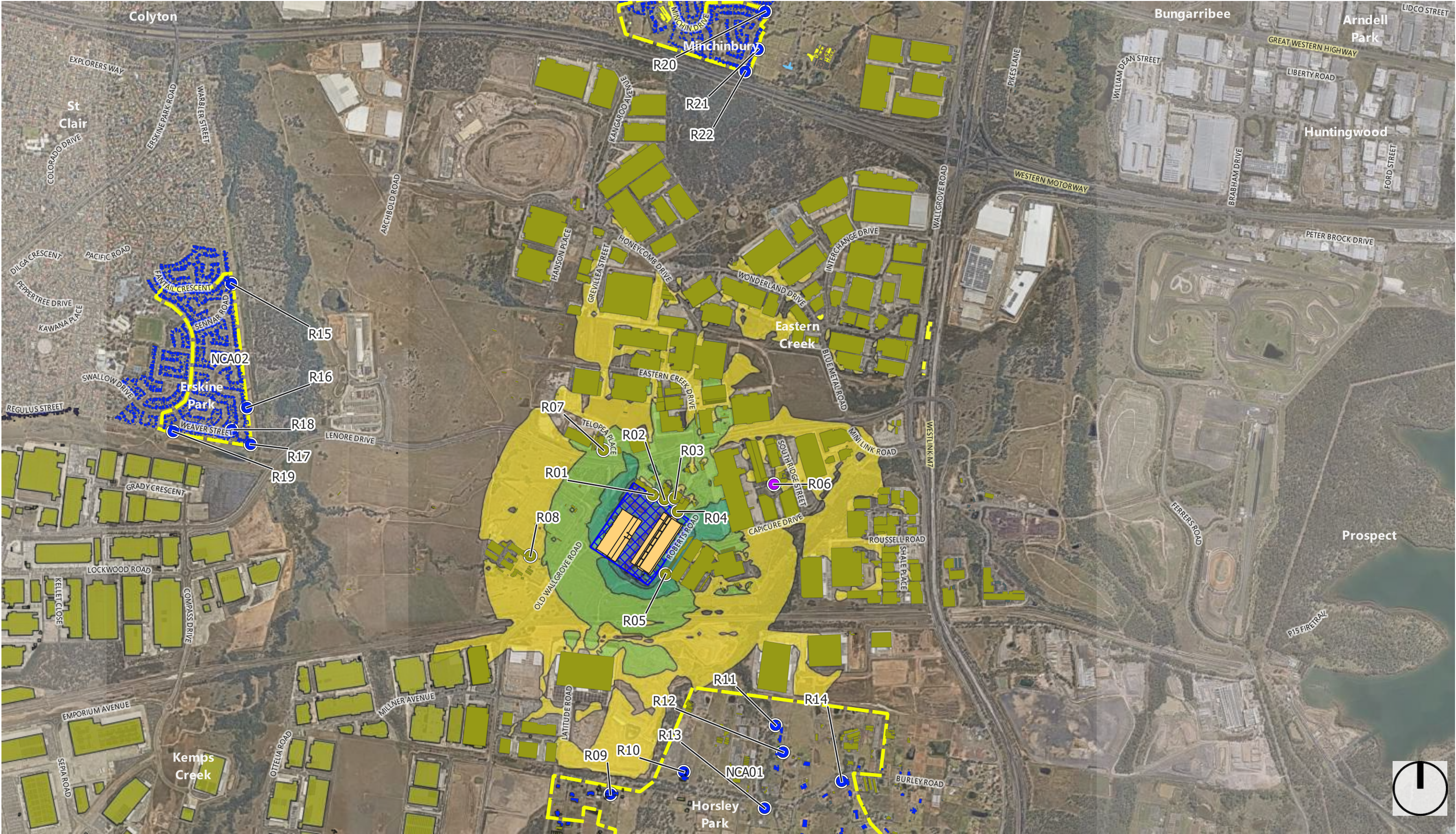
Client:
Goodman Property Services
(Aust) Pty Ltd

Project:
Project Atlas Data Centre
10 Roberts Road, Eastern Creek, NSW
State Significant Development (SSD) 101067971

Description:
Operational noise contour (1.5m NPfl assessment height)
Evening (6:00pm - 10:00pm) - LAeq 15minute
Typical operations

Notes
1. Imagery source: Nearmap (Decemberr 2025) and Sixmaps (Department Finance, Services and Innovation (25/03/2026))
2. Landuse classification based upon a desktop review only, subject to further review and detailed design.
3. All noise contours are calculated based upon a grid, and interpolated between the grid resolution. All noise contours should be interpreted considering this calculation method and its limitations. Noise contours are presented to provide the required representation of predicted noise levels, at the NPfl assessment height. Noise levels are approximate due to interpolation of contours and should be used for reference only. Noise contours are not to be used for determining noise limits, or determining specific noise levels at locations.
4. Do not scale from this figure.
5. This information is protected by copyright.

E.3 Predicted operational noise levels, $L_{Aeq,15\text{minute}}$ – Typical operations - Night



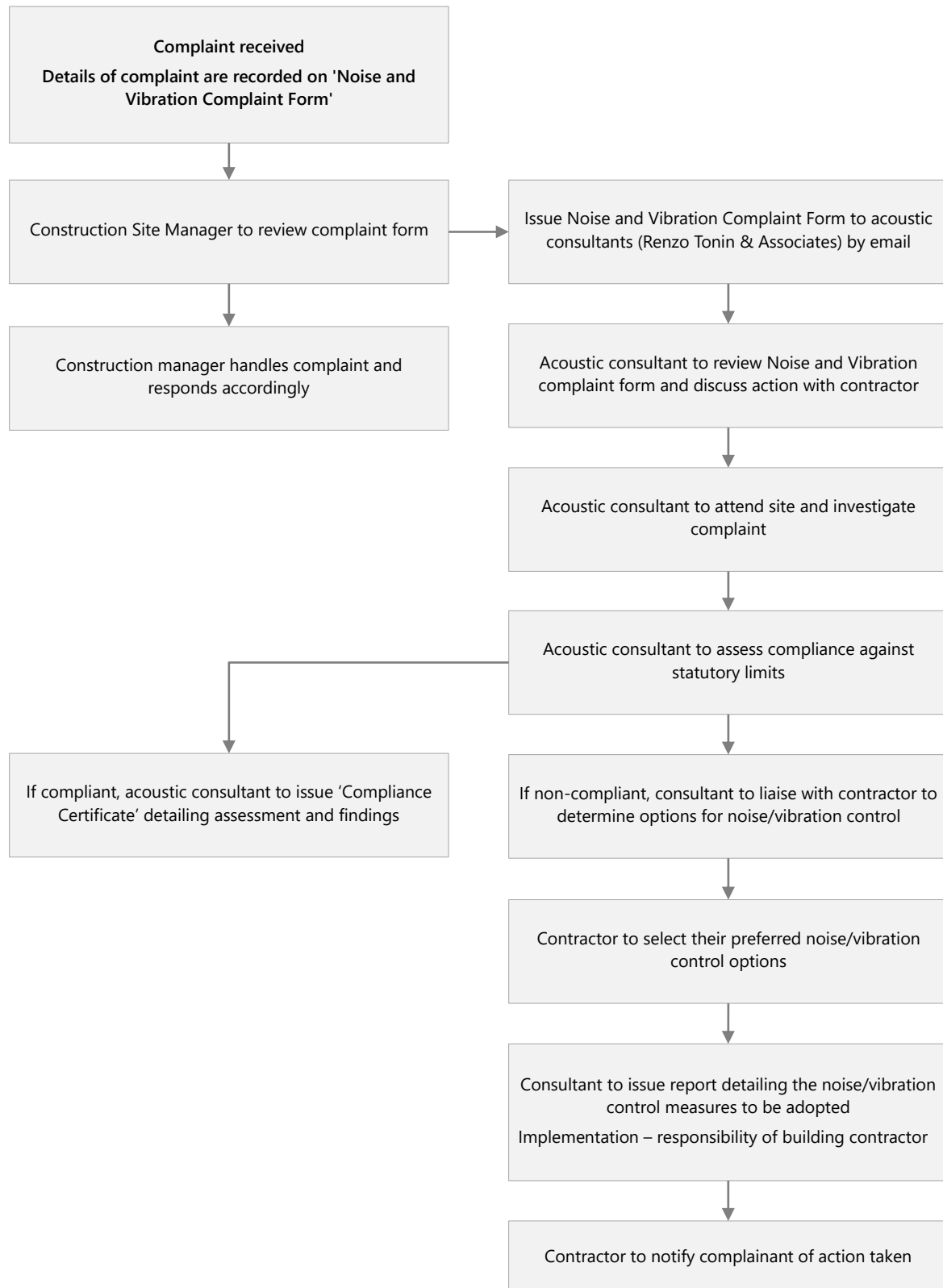
Client:
Goodman Property Services
(Aust) Pty Ltd

Project:
Project Atlas Data Centre
10 Roberts Road, Eastern Creek, NSW
State Significant Development (SSD) 101067971

Description:
Operational noise contour (1.5m NPfl assessment height)
Night (10:00pm - 7:00am) - LAeq 15minute
Typical operations

Notes
1. Imagery source: Nearmap (Decemberr 2025) and Sixmaps (Department Finance, Services and Innovation (25/03/2026))
2. Landuse classification based upon a desktop review only, subject to further review and detailed design.
3. All noise contours are calculated based upon a grid, and interpolated between the grid resolution. All noise contours should be interpreted considering this calculation method and its limitations. Noise contours are presented to provide the required representation of predicted noise levels, at the NPfl assessment height. Noise levels are approximate due to interpolation of contours and should be used for reference only. Noise contours are not to be used for determining noise limits, or determining specific noise levels at locations.
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APPENDIX F Noise / vibration complaint management procedure



NOISE/ VIBRATION COMPLAINT FORM

Project title:	_____	Date:	_____
Site contractor:	_____	Phone:	_____
Site contact:	_____	Email:	_____

Complaint details

Received by (circle): Phone / Email / In person / Other: _____

Name:	_____	H Ph:	_____
Address:	_____	W Ph	_____
Email:	_____	M Ph	_____

Describe when the problem occurred (date and time), what equipment caused the complaint (if known) and where person was standing when he/she experienced the noise/vibration:

Investigation

Question foreman responsible on site and obtain information on what equipment or processes would most likely have caused the complaint:

Following approval from the Project Manager, email this form to Renzo Tonin & Associates