

SYD01 Stage 2

Noise and Vibration Assessment

GreenSquareDC

Reference: P529297

Revision: 2

2026-05-22



Document control record

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Document control		aurecon				
Report title		Noise and Vibration Assessment				
Document code		SYD1-ST200-ACC-AUR-REP_X-00-0001	Project number		P529297	
File path		Https://aurecongroup.sharepoint.com/sites/529297/5_WorkingFiles/10 - Acoustics/01 SSDA/05 Report/08 Rev 2/GreenSquareDC SYD01 Stage 2 Noise and Vibration Assessment.docx				
Client		GreenSquareDC				
Client contact		Josh Martens	Client reference		Technical Director	
Rev	Date	Revision details/status	Author	Reviewer	Verifier (if required)	Approver
1	2025-12-17	Test of Adequacy Submission	AP/ MC	HM		KS
2	2026-05-22	SSDA Submission	AP	AL		KS
Current revision		2				

Approval			
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1 Preface

1.1 Executive Summary

This Noise and Vibration assessment has been prepared by Aurecon on behalf of GreenSquareDC to accompany a detailed State Significant Development Application (SSDA) for the proposed data centre development located at 3 Brookhollow Avenue, Norwest (Lot 2021 DP 831173), within the Hills Local Government Area (LGA).

The assessment within this report considers the construction and operational phases of the development including the noise from maintenance testing of back-up power systems.

The noise and vibration assessment undertaken for the project involved the following steps:

- Measurement of existing background and ambient noise levels at locations representative of the sensitive receivers in accordance with the NSW EPA Noise Policy for Industry (NPfI).
- Deriving project specific operational and construction noise criteria based on measured noise levels and applicable NSW policies.
- Developing a construction and operational equipment itinerary and predicting the construction and operational phase noise levels at the nearest sensitive receivers using computational noise modelling.
- Comparing the modelled noise impacts with the stipulated noise criteria specific at sensitive receivers.
- Determining the effect of potential vibration impacts on buildings and structures during construction.
- Developing feasible mitigation measures to achieve compliance.
- Addressing residual noise, if applicable.

1.1.1 Operational noise assessment:

With integrated mitigation measures (e.g., acoustic barriers, equipment siting, attenuators, custom generator enclosures), predicted noise levels are below the NPfI project noise trigger levels for all identified nearest sensitive receivers under standard operation and back-up power testing. Emergency critical power failure scenarios are rare and not subject to NPfI limits.

1.1.2 Operational vibration Assessment

Operational vibration impacts are expected to be negligible at all identified nearest sensitive dwellings.

1.1.3 Road traffic noise assessment

Construction traffic noise assessment

It is anticipated that only a few deliveries will occur over the course of the day and as such, the likelihood of a significant noise impact from construction is low. When construction traffic data is available, a screening test will be undertaken to determine whether a further assessment against the RNP road traffic noise criteria is required.

Operational traffic noise assessment

Additional traffic generated during operation will increase existing road noise levels by less than 0.4 dB, below the 2 dB threshold in the Road Noise Policy.

1.1.4 Construction noise assessment

Predicted worst-case construction noise levels exceed ICNG noise management levels at several sensitive receivers during the construction phases. A Construction Noise and Vibration Management Plan (CNVMP) and temporary noise barriers (≥ 3 m height) are recommended.

1.1.5 Construction vibration assessment

Construction vibration impacts are expected to be negligible at all identified nearest sensitive dwellings. Adherence to the safe working distances is advised for vibration-intensive activities.

1.1.6 Cumulative operational noise assessment

Combined mitigated noise impacts from Stage 1, Stage 2, and Stage 3 developments are predicted to remain within NPfI cumulative noise objectives.

1.1.7 Noise mitigation measures

Construction noise impacts

Standard noise mitigation measures in the form of site planning, works scheduling, plant selection and siting, have been recommended to minimise the construction noise impacts associated with the project.

Operational noise impacts

Operational noise mitigation measures in the form of acoustic barriers, equipment siting, attenuators, custom generator enclosures have been recommended and considered in the assessment.

1.1.8 Conclusion

In summary, the development is below the applicable noise trigger levels for operational noise, based on the assumptions and limitations documented in this report, achieved through the implementation of the recommended mitigation measures, listed below:

- Noise walls for rooftop Air Cooled chillers
- Solid acoustic baffles on top of chillers
- Containerised generators with specific acoustic treatments
- Quieter Load banks
- Acoustic louvres and attenuators for OAP rooms
- Heavy vehicles modified route

2 Introduction

2.1 Purpose of the report

This report has been prepared on behalf of Project Garden 1 Pty Ltd as trustee for the Norwest Property Trust (the applicant) in support of a State Significant Development Application (SSDA) submitted to the Department of Planning, Housing and Infrastructure (DPHI) under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The SSDA seeks development consent for the construction and operation of a data centre, with a total power consumption of approximately 96 MW (IT load). The proposal will form part of a broader state-of-the-art data centre campus equipped to cater for growing data storage needs within Australia and the emergence of artificial intelligence (AI).

In summary, approval for the following is sought:

- Minor excavation works beyond earthworks intended to be undertaken under the separate Substation Development Application under assessment by The Hills Shire Council;
- Civil earthworks and the installation of relevant servicing infrastructure and utilities;
- Construction of a four (4) storey data centre with roof top plant, equating to an RL 130 and Gross Floor Area (GFA) of 16,191 m²;
- Installation of 77 x diesel fuel generators and associated storage
- Provision of on-site car parking for approximately 25 spaces; and
- Landscaping, tree removal and offset tree planting.

This report provides an assessment of the operational and construction noise and vibration impacts from the site and respond to the Secretary's Environmental Assessment Requirements (SEARs) issued by DPHI on 8 April 2025 in relation to the project. The SEARs require the following in relation to the assessment of noise and vibrations as provided in Table 2-1.

Table 2-1 SEARs key issues – noise and vibration

SEARS key issue	Description of Requirement	Chapter Reference (this Report)
12 Noise and vibration assessment	Provide a noise and vibration assessment prepared in accordance with the relevant EPA guidelines and Australian / International Standards. The assessment must detail construction and operational noise and vibration impacts (including testing of any back-up power system) on nearby sensitive receivers and structures, and outline the proposed mitigation, management and monitoring measures that would be implemented.	■ Operational noise – Chapter 6 ■ Operational vibration – Chapter 6.5 ■ Road traffic noise – Chapter 7 ■ Construction noise – Chapter 8 ■ Construction vibration – Chapter 9 ■ Proposed mitigation, management and monitoring measures have been outlined for each assessment type.

2.2 Limitations and uncertainty

The following are the main limitations for the noise modelling:

- **Conservative equipment operation:** It has been assumed that all relevant equipment operates continuously and simultaneously during the assessment periods for the operation of the data centre. This provides conservative (worst-case) noise predictions. The sound power levels for each equipment have been based on realistic operating points for the day, evening and night periods.

- **Model input assumptions:** Computational modelling undertaken as part of this assessment is based on the assumptions stated in this report.
- It has been presumed that data such as building heights from Open Street Maps or the elevation contours from ELVIS (Elevation and Depth - Foundation Spatial Data) are accurate and current at the time of the assessment.
- At the time of the assessment, the preferred equipment supplier has not been confirmed and therefore a preliminary schedule of equipment has been developed in conjunction with project engineers. 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. Upon appointment of the successful supplier, confirmation should be provided that the selected equipment is able to perform within the predictions of this assessment. An acoustic review is required during the detailed design stage and also post construction and should consider the presence of any modifying factors for the noise in accordance with the NPfI. Where exceedances are observed, mitigation measures and management controls should be implemented to bring the noise and vibration to within acceptable limits.
- 1/3rd Octave band data was not available for all the equipment noise levels. Hence a tonality and low frequency assessment was not possible at the current stage of the project and will need to be revisited at a later stage of the project.
- Equipment for a fire emergency has not been modelled.

3 The Site

3.1 Site Context

The site is known as 3 Brookhollow Avenue, Norwest (Lot 2021 DP 831173) and is in the Norwest locality, which forms part of the Hills Local Government Area (LGA). Existing development surrounding the site comprises of a mix of commercial, retail and residential land uses as described below:

- To the north of the site is Norwest Boulevard, commercial office buildings, an early learning centre, 'Castle Pines' retirement community and Castle Hill Country Club Golf Course.
- To the east of the site is Windsor Road, commercial office buildings, small pockets of residential development and industrial development.
- To the south of the site is Brookhollow Avenue, commercial developments, a hotel and medium density residential development.
- To the west of the site is commercial development, including a shopping centre (Norwest Marketown), various retail offerings and the Norwest Metro Station located approximately 500m to the west, with the metro line running under the north / northwest boundary of the site.

The site is well serviced by public transport including bus and Metro. Norwest Metro Station provides connections to Tallawong in the northwest and Sydney CBD to the southeast. Bus stops along Norwest Boulevard provide connections through to Parramatta, Seven Hills and Rouse Hill [1]. These land uses are relevant for assessing potential noise impacts on sensitive receivers.

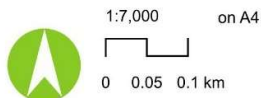
An aerial photograph of the site is provided in Figure 3-1.



Legend

- Site Boundary
- Buildings
- Education
- Roads
- Primary road
- Tertiary
- Secondary
- Road, residential, living street, etc.
- Cycleway, footpath etc.
- Lot

Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Site context



Figure 3-1 Site context map

3.2 Existing Site Description

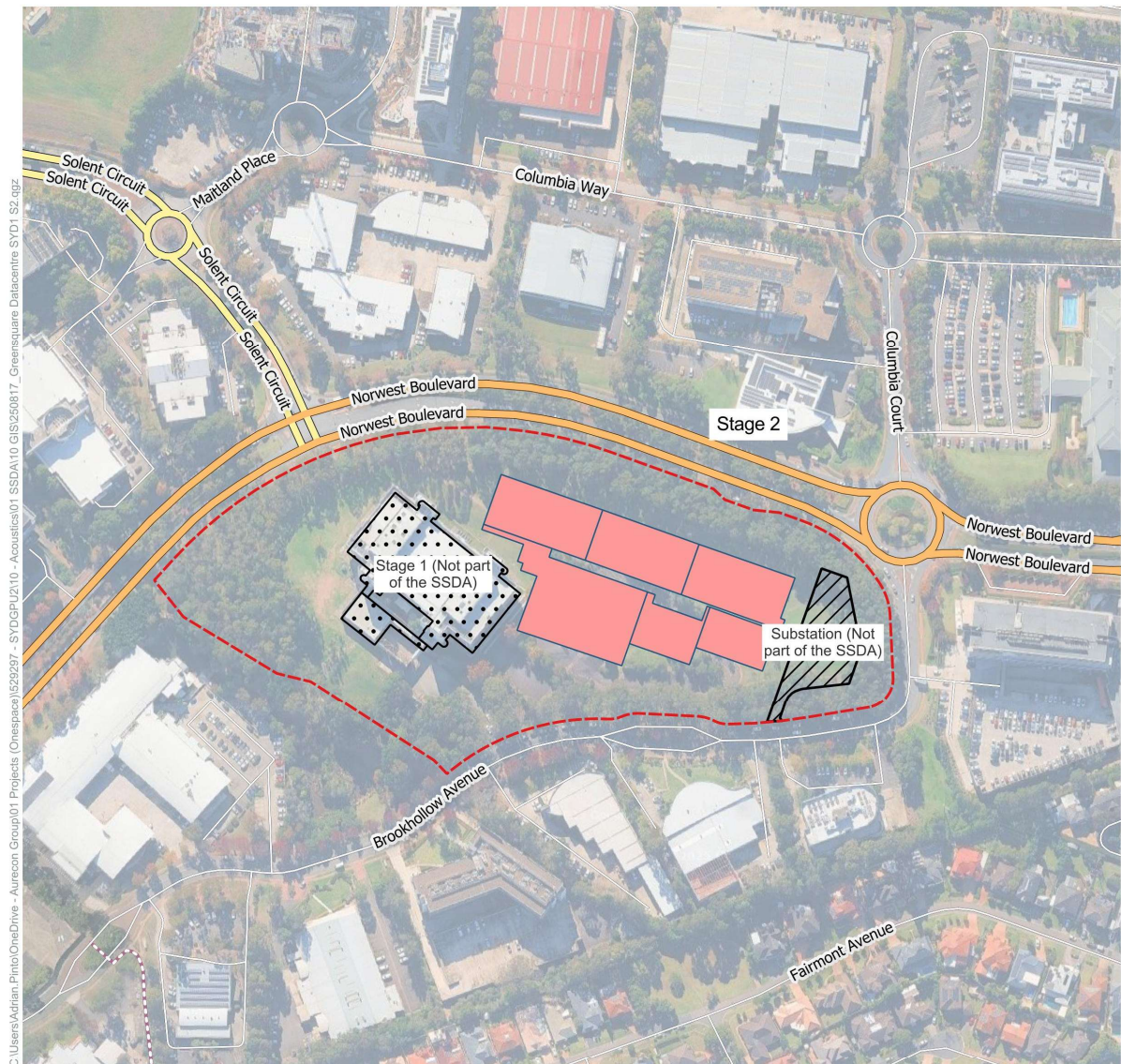
The subject site is legally described as Lot 2021 of Deposited Plan (DP) 831173. The site can be described as irregularly shaped and has a total land area of approximately 51,867 m². There is an existing 4MW data centre on a portion of the site that was approved under D93/318, dated 21 June 1993.

A Stage 1 approval was obtained from the Regional Planning Panel on 4 September 2025 under DA1382/2025/JP. Stage 1 involves significant upgrades and refurbishment of the existing data centre facility that occupies the site previously operated by IBM. The works are currently in progress and enable the repositioning of the existing dilapidated facility to be fit-for purpose and responsive to the evolving data storage demands of the market.

The site is bound by Brookhollow Avenue to the south and east, Brookhollow Reserve and the Hills Corporate Centre to the west and Norwest Boulevard to the North. The primary frontage of the site is to Brookhollow Avenue, where vehicular access is provided.

Based on a review of topographical mapping, the existing site appears to fall from east to west from a maximum height of RL104 m in the northeastern corner of the site to RL82 m along the western portion of the site. As part of the proposed Stage 2 project, the topography within the stage 2 footprint is expected to have suitable cut and fill.

An overall plan of the proposed site showing the project staging is provided in Figure 3 2 below.

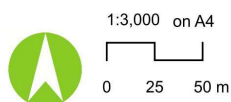


Legend

- | | |
|--|--------------------------------------|
| Site Boundary | Stage 1 |
| Roads | Stage 2 |
| Primary road | Substation DA construction footprint |
| Tertiary | |
| Road, residential, living street, etc. | |
| Cycleway, footpath etc. | |



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Site Aerial

Figure 3-2 Aerial of the site

3.3 Relevant approvals

The development approvals of relevance to this SSDA include:

- Complying Development Certificate (CDC): Certificate No. 25/250218-01 which provided consent for partial demolition of the existing data centre. The CDC was issued on 9 September 2025.
- Development Application for alterations and additions to existing data centre campus (1382/2025/JP) was approved by Council on 4 September 2025.
- Development Application for substation and bulk earthworks currently being prepared for submission to Council and expected for approval by June 2026.

3.3.1 CDC (Certificate No. 25/250218-01) – Demolition of Existing Internal Structures

On 9 September 2025, a CDC, Certificate No. 25/250218-01, Council Reference 239/2026/PC was issued by Certatude which provided consent for the partial demolition of the existing data centre. Specifically, the proposed works included the demolition of internal walls, access floors, slabs and roof, across Levels 1 to 4 of the existing data centre. The demolition works were required in order to facilitate the future Stage 1 development (1382/2025/JP).

The works have since been completed.

3.3.2 Stage 1 Development Application

Stage 1 approval was obtained from the Regional Planning Panel on 4 September 2025 under DA1382/2025/JP.

Stage 1 involves significant upgrades and refurbishment of an existing data centre facility that occupies the site previously operated by IBM. The works enable the repositioning of the existing dilapidated facility to be fit-for purpose and responsive to the evolving data storage demands of the market.

3.3.3 Stage 3 Substation and Early Works Development Application

A planning application is currently being prepared which will seek approval for on-site power infrastructure including a substation that will transform utility power supplied via a high voltage (132 kilovolts) line to medium voltage (33 kilovolts) designated as Stage 3. The substation will comprise of two main structures, a control building and two power transformers.

The substation is proposed to service Stage 1 (SYD01), with the intent to expand to Stage 2. Ahead of construction of the substation, the intent is to connect Stage 1 to the 11kv power supply, before creating a new point of connection from the proposed substation, which will be established once constructed.

Supply infrastructure will be provided from an Endeavour substation located nearby and will be delivered to the site under Part 5 powers held by Endeavour as an Electricity Supply Authority.

3.4 Overview of Proposed Stage 2 Development

The proposed development is depicted in the Figure 3-2, with full architectural details provided within the EIS, of which this report also forms an Appendix.

Key features of the proposed Stage 2 development are as follows:

- Minor excavation works beyond earthworks intended to be undertaken under the separate Substation Development Application under assessment by The Hills Shire Council;
- Civil earthworks and the installation of relevant servicing infrastructure and utilities;

- Construction of a four (4) storey data centre with roof top plant, equating to an RL 130 (39.39m) and Gross Floor Area (GFA) of 16,191 m²;
- Installation of 77 x diesel fuel generators and associated storage
- Provision of on-site car parking for approximately 25 spaces; and
- Landscaping, tree removal and offset tree planting.

As shown in Figure 3-3, the construction of the project is proposed to occur in 3 phases of construction:

- Phase 1 – Building B & associated gantry
- Phase 2 – Building C & associated gantry
- Phase 3 – Building D & associated gantry

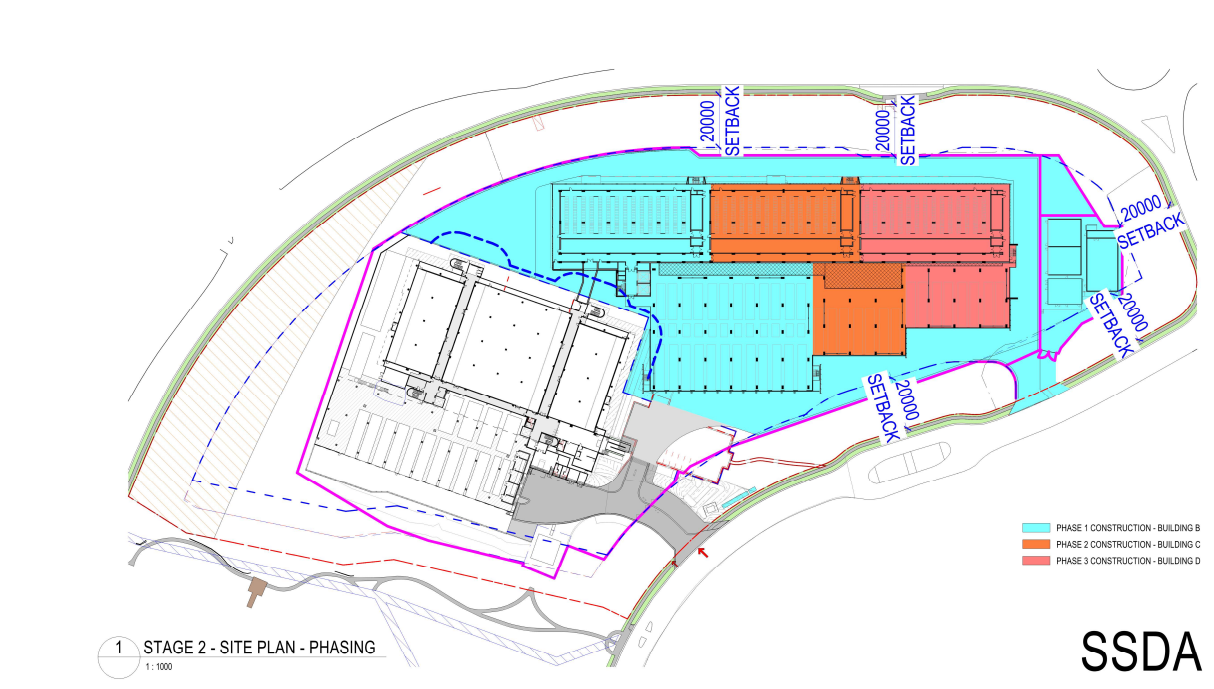


Figure 3-3 Site Plan - Phasing

4 Policy and Planning Context

4.1 Relevant Acts and Regulations

In NSW, the acceptability of noise and vibration impacts is regulated by the Protection of the Environment Operations (Noise Control) Regulation (POEO Noise Control Regulation) [2], which falls under the Protection of the Environment Operations Act No 156 (POEO Act) [3]. Refer to Table 4-1 for a summary.

Table 4-1 Relevant Acts and Regulation

Type	Title	Purpose
Act	NSW Protection of the Environment Operations Act [3]	The POEO Act establishes the framework for noise control in NSW. A key objective of the POEO Act is to protect, restore and enhance the quality of the NSW environment. The POEO Act contains broad provisions to address noise issues.
Regulation	POEO Noise Control Regulation [2]	The POEO Noise Control Regulation includes specific provisions to manage common neighbourhood noise issues.

4.2 Relevant Policies, standards and guidance documents

A summary of the relevant policies, standards and guidelines that apply to this Proposal is provided in Table 4-2. For full description of how these policies and assessment guidelines apply, please refer to the relevant documents.

Table 4-2 Relevant policies, standards and guidance documents

Acoustic aspect	Purpose	Relevant assessment document		
		Type	Title	Description
Air-borne noise	Assessment of operational noise for industrial developments and existing ambient / background noise	Policy	NSW Noise policy for Industry (NPfI) [4]	The purpose of the Noise Policy for Industry (NPfI) is to ensure noise impacts associated with industrial developments are evaluated and managed in a consistent and transparent manner. It provides a methodology for measuring the existing noise levels at a site. It provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures.

Acoustic aspect	Purpose	Relevant assessment document		
		Type	Title	Description
	Assessment of construction noise	Guideline	Interim Construction Noise Guideline (ICNG) [5]	The ICNG aims to mitigate disruptions due to noise during construction works. It sets permissible noise levels, timeframes, and acceptable work practices to minimize disturbance to residents and the environment.
	Sleep disturbance from construction noise	Guideline	Interim Construction Noise Guideline (ICNG) [5]	As described above. Further ICNG refers to the NSW Road Noise Policy [6] for further guidance on sleep disturbance.
	Assessment of operational and Construction traffic noise. Sleep disturbance from construction noise	Policy	Road Noise Policy (RNP) [6]	The RNP aims to identify the strategies that address the issue of road traffic noise from: ■ existing roads ■ new road projects ■ road redevelopment projects ■ new traffic-generating developments. ■ Construction traffic noise is assessed under the guidance of the RNP. The RNP also defines criteria to be used in assessing the impact of such noise and provides guidance on assessing sleep disturbance.
Vibration	Human comfort	Guideline	Assessing Vibration: A Technical Guideline (AVATG) [7]	The Assessing Vibration: A Technical Guideline (AVATG) provides guidance on vibration assessment for human comfort.
	Construction vibration effect on structures (cosmetic damage)	Standard	British Standard BS 7385 Part 2 – 1993 Evaluation and measurement for vibration in Buildings Part 2	These standards provide guidance on the assessment of building damage caused by vibrations

Acoustic aspect	Purpose	Relevant assessment document		
		Type	Title	Description
		Standard	German Standard DIN 4150: Part 3 – 2016 Effects of Vibration on Structures	

5 Existing environment

5.1 Study area

The study area was determined based on the proposed project construction and operational footprint, nearby sensitive receivers and the surrounding area. It includes locations that may be affected by noise and vibration from the proposed data centre activities. For this assessment, the area extends approximately 700 m¹ from the project footprint and is defined by the following roads:

- North of Barina Downs Road
- West of Windsor Road
- South of Spurway Drive
- East of Solent Circuit

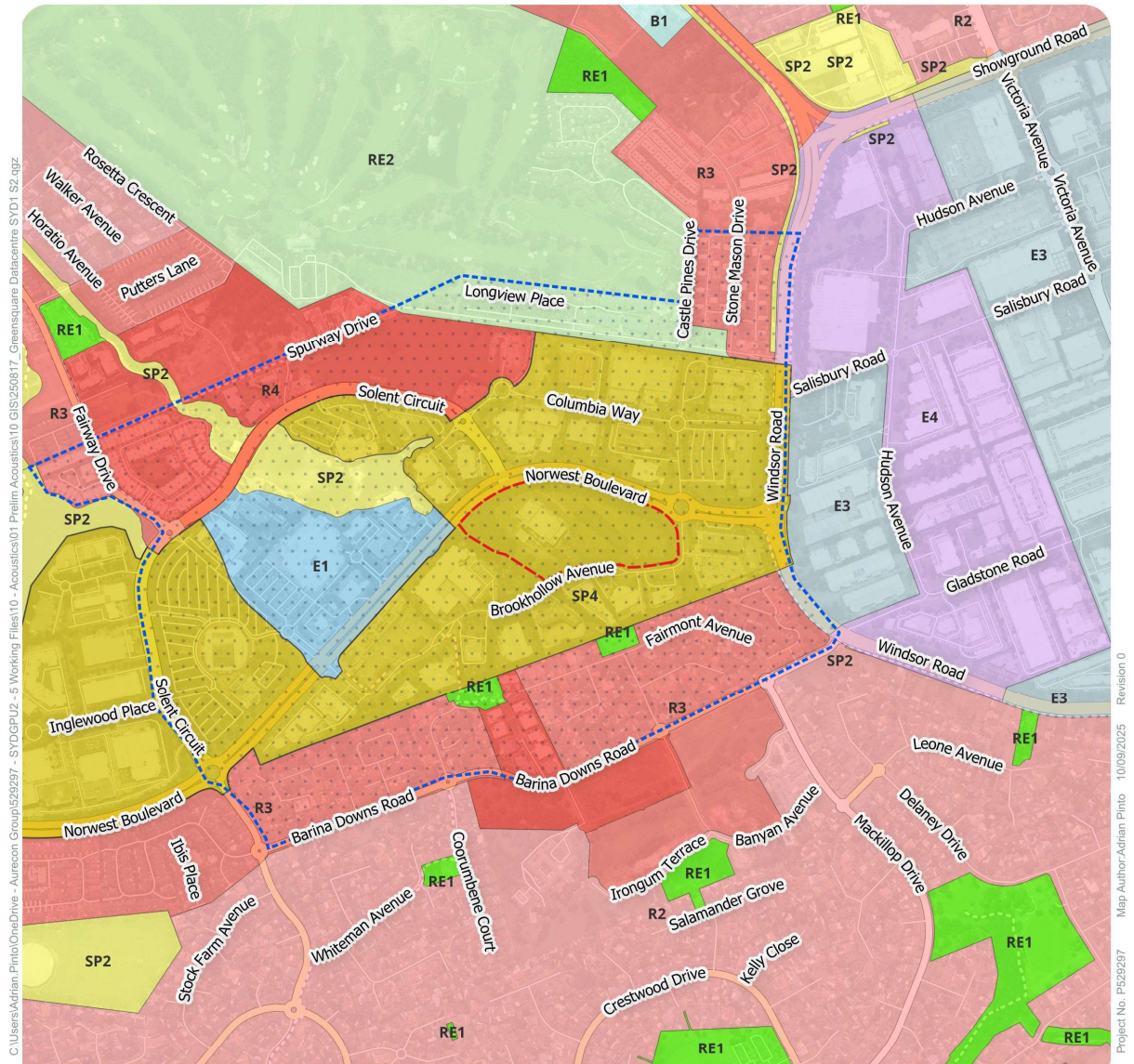
5.2 Surrounding land use

Figure 5-1 illustrates the project study area and the surrounding land-use zoning stipulated by The Hills Local Environment Plan 2019. These are listed in Table 5-1.

Table 5-1 Land use zoning around the proposed site

Code	Land zoning title	Key developments in zone
E1	Local Centre	Norwest Marketown shopping centre and high rise apartments
E3	Productivity Support	Businesses located to east of Windsor Road and either side of Victoria Avenue
E4	General Industrial	Industries located to east of Windsor Road and west of Victoria Avenue
R2	Low Density Residential	Residences located to south of Barina Downs Road
R3	Medium Density Residential	Residences to the south of the site and to the north of Barina Downs Road.
R4	High Density Residential	Apartments to the South of the site along Barina Park Place.
RE1	Public Recreation	Fairmont Avenue Reserve, Evesham Court Reserve
SP2	Infrastructure	Norwest Lake and surrounding roads
SP4	Special Activities	GreenSquareDC, Norwest Business park, Norwest Metro, Hillsong Convention Centre

¹ A 700-metre assessment distance has been approximately adopted for the noise impact assessment. This distance is commonly used for major NSW road, rail and linear infrastructure projects and captures the sensitive receivers most likely to experience measurable changes in noise due to the Project. The study area provides a pragmatic balance between modelling completeness and effort and is consistent with NSW guidance (ICNG; Noise Policy for Industry; Transport NSW Road/Rail noise guidance). Where initial modelling identifies potential impacts beyond 700 m, the assessment has been extended to include those receivers.



Legenda

Land zoning

- B1 - Neighbourhood Centre
- E1 - Local Centre
- E3 - Productivity Support
- E4 - General Industrial
- R2 - Low Density Residential
- R3 - Medium Density Residential
- R4 - High Density Residential
- RE1 - Public Recreation
- RE2 - Private Recreation

SP2 - Infrastructure

SP4 - Special Activities

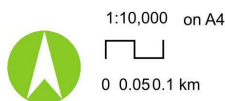
Site Boundary

Study Area

Roads

- Primary road
- Tertiary
- Secondary
- Road, residential, living street, etc.
- Cycleway, footpath etc.

Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Land use zones

Figure 5-1 Land use zones

5.3 Sensitive receivers

Based on a review of aerial photos and site inspections, the nearest most-affected residences, commercial buildings, childcare centres and place of worship were identified as noise sensitive receivers.

To simplify the assessment, these receivers were grouped into Noise Catchment Areas (NCAs). NCAs are geographic zones where receivers experience similar ambient noise levels and acoustic conditions. They help streamline noise impact assessments and guide mitigation strategies. Compliance with the established noise limits at receivers within each NCA indicates a compliance at receivers located further from the site.

Table 5-2 shows a list of identified NCAs and Figure 5-2 shows a mapping of the nearest receivers. Table 5-2 also shows the Land Zoning for these receivers based on the Hills LEP Land zoning and the receiver categories as identified in Table 2.3 of the Noise Policy for Industry. Where the NPfI had slightly different short code than the Hills LEP, the zoning was identified using the name of the zone rather than the short code e.g. B2 in the NPfI has been considered to be equivalent to E1 in the Hills LEP. This information is used to assign the relevant amenity noise targets.

Table 5-2 Sensitive receivers

NCA	Reasonably most-affected receiver ID	Address for Reasonably most-affected receiver	The Hills LEP Land zoning	NPfI Receiver category ¹	Nearest distance to NCA from the Stage 2 construction footprint (metres)
NCA C1	C1	26 Brookhollow Avenue	SP4 – Special Activities	Commercial	150
NCA C2	C2	18-20 Brookhollow Avenue	SP4 – Special Activities	Commercial	51
NCA C3	C3	10-12 Brookhollow Avenue	SP4 – Special Activities	Commercial	48
NCA C4	C4	2 Columbia Court	SP4 – Special Activities	Commercial	50
NCA C5	C5	14-16 Brookhollow Avenue	SP4 – Special Activities	Commercial	48
NCA MX1	MX1	11 Solent Circuit	E1 – Local centre	Mixed use – Urban residential	500
NCA MX2	MX2	8 Maitland Place	SP4 – Special Activities	Mixed use – Urban residential	250

¹ Receiver categories have been assigned as per the Table 2.3 of the Noise Policy for Industry to assist in the selection of the appropriate amenity noise levels.

NCA	Reasonably most-affected receiver ID	Address for Reasonably most-affected receiver	The Hills LEP Land zoning	NPfl Receiver category ¹	Nearest distance to NCA from the Stage 2 construction footprint (metres)
NCA R1	R1	34 Solent Circuit	R4 – High Density Residential	Urban residential	636
NCA R2	R2	16 Evesham Court	R3 – Medium density residential	Suburban residential	345
NCA R3i	R3i	40-52 Barina Downs Road	R4 – High Density Residential	Urban residential	264
NCA R3ii	R3ii	37 Fairmont Avenue	R3 – Medium density residential	Suburban residential	130
NCA R4	R4-1	3 Durack Crest	R3 – Medium density residential ²	Suburban residential	356
	R4-2	29 Castle Pines Dr, Norwest NSW 2153			318
NCA-CH1	CH1	14-16 Brookhollow Avenue	SP4 – Special Activities	Childcare centre	48
NCA CH2 / MX3	CH2 /MX3	2-8 Brookhollow Avenue	SP4 – Special Activities	Childcare centre within a mixed use development	83
NCA-H1	H1	22 Brookhollow Avenue	SP4 – Special Activities	Hotel	100
NCA-H2	H2	1 Columbia Court	SP4 – Special Activities	Hotel	97
NCA-PoW	PoW	2 Century Circuit	E1 – Local centre	Place of worship	562
HOS	HOS	17-19 Solent Circuit	SP4 – Special Activities	Hospital	350

² The Castle Pines Retirement village has been categorised as RE2 – Private recreation in the Hills LEP



Legend

Site Boundary	Buildings with land zoning	Residential
Roads	E1 - Local Centre	Commercial
Primary road	R3 - Medium Density Residential	Hotel
Tertiary	R4 - High Density Residential	Place of worship
Secondary	RE2 - Private Recreation	Childcare
Road, residential, living street, etc.	SP4 - Special Activities	
Cycleway, footpath etc.	Noise catchment areas	
	Mixed use	



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Sensitive receivers

Figure 5-2 Sensitive receivers

5.4 Noise survey

A site noise survey was undertaken at locations representative of the reasonably-most affected sensitive receivers to establish baseline noise levels and inform the development of Project Noise Trigger Levels (PNTLs), prior to the lodgement of the State Significant Development Application (SSDA). The survey was conducted in accordance with the NSW Noise Policy for Industry (NPfI), which outlines procedures for determining Rating Background Levels (RBLs) and calculating PNTLs.

Monitoring locations were selected to represent the reasonably most-affected residential receivers in each NCA, while avoiding vertical reflective surfaces and vegetation that could influence measurements. The location of all noise monitoring sites are shown in Figure 5 3.

Initial short-term monitoring was conducted in residential Noise Catchment Areas (NCAs) between 12 and 26 September 2025. The apartment buildings in NCA MX1 was identified as one of the reasonably most-affected residential receivers due to the line of sight to the proposed development. Due to limited access to apartment buildings within NCA MX1 during the initial survey, supplementary monitoring was carried out from 13 to 21 October 2025.

Traditionally noise measurements and predictions are conducted on a horizontal plane and ignore the vertical propagation especially to establish background levels. A study conducted in 2011 found that background noise levels in tall buildings tend to vary with elevation [8]. To account for this, the apartment buildings within NCA MX1 were categorised into three vertical zones assumed to have similar acoustic environments, since it was not practical conduct the noise survey on every floor:

- Zone 1: Floors 1–6
- Zone 2: Floors 7–12
- Zone 3: Floors 13–18

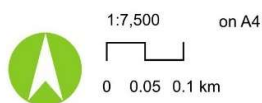


Legend

- | | |
|---------------------------------------|--|
| Unattended Noise Monitoring (Loggers) | Roads |
| Attended Noise Monitoring Locations | Primary road |
| Site Boundary | Tertiary |
| | Secondary |
| | Road, residential, living street, etc. |
| | Cycleway, footpath etc. |



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Noise monitoring locations

Figure 5-3 Noise monitoring locations

5.4.1 Short term noise monitoring

To inform the selection of long-term noise monitoring sites representative of the reasonably-most affected sensitive receivers, short-term attended noise measurements were undertaken. The process involved analysing the range of background noise levels within each identified catchment and to understand how data centre noise might propagate to those areas. Access to reasonably most-affected receivers was not available at multiple locations and so representative locations were chosen to place long term noise monitors.

During this survey a review of the configuration of the Nukids Early Learning Centre and Punthill Apartment Hotels was also made as these receivers may influence the siting of noise-generating equipment and the extent of noise control measures required. Site observations identified no open play areas in the areas facing the site for the Nukids Early Learning Centre, however, aerial images and the website for the childcare indicate a semi open play area at the rear of the site. For the purpose of the assessment, a conservative approach has been taken to assume the assessment location at the eastern side of the Nukids ELC.

Short-term monitoring was conducted for a minimum period of 15 minutes during the day period by Aurecon on the following dates:

- 12 September 2025
- 26 September 2025
- 13 October 2025

Measurements were conducted using a Class 1 sound level meter compliant with AS IEC 61672.1 using a tripod at a height of 1.5m above the ground and at least 3m from any reflective surfaces.

A summary of the short-term noise monitoring is presented in Table 5-3 and detailed short-term noise monitoring results are presented in Appendix E.

Table 5-3 Results of short-term operator-attended noise monitoring

Location	NCA	Time	Broadband Statistical Noise Levels dB	
			L _{Aeq} , 15 minute	L _{A90} , 15 minute
A1-2	NCA 1	12/09/2025 14:51	50	44
A1-1		12/09/2025 15:11	56	46
L1		12/09/2025 16:29	48	46
A2-1	NCA 2	12/09/2025 13:21	49	42
A2-2		12/09/2025 13:40	47	42
L2		12/09/2025 14:29	47	40
A3-1	NCA 3	12/09/2025 11:45	47	39
A3-2		12/09/2025 12:06	65	42
A3-3		12/09/2025 12:27	45	38
L3		12/09/2025 13:00	47	39
A4-1	NCA 4	12/09/2025 10:16	45	40
A4-2		12/09/2025 10:39	54	43

Location	NCA	Time	Broadband Statistical Noise Levels dB	
			L _{Aeq} , 15 minute	L _{A90} , 15 minute
L4		12/09/2025 11:14	55	43
AA-1	NCA CH1	26/09/2025 11:19	55	49
AA-2	NCA C4	26/09/2025 11:39	60	56
L5 / L5-1	NCA MX1	12/09/2025 17:14	58	55
A1803 ¹		13/10/2025 11:00	56	53
A703 ¹		13/10/2025 11:45	54	51
C210 ¹		13/10/2025 12:31	59	52

5.4.2 Long term noise monitoring

Based on the outcomes of the operator-attended short-term noise monitoring, a set of unattended long term noise monitoring was carried out by Aurecon at the locations representative of the reasonably most-affected receivers listed in **Table 5-4**.

Measurements were conducted using Class 1 and Class 2 sound level meters compliant with AS IEC 61672.1, with data logged over a minimum period of one week. Concurrent meteorological data was collected to exclude invalid measurements. In accordance with Fact Sheet A4 of the NSW Noise Policy for Industry (NPfI), data collected during rainfall or when wind speeds exceeded 5 m/s at microphone height was excluded from analysis.

The primary metric used to assess background noise was L_{A90,15min}, representing the noise level exceeded for 90% of a 15-minute period. The RBLs were determined using the 10th percentile method applied to valid data samples as detailed in Factsheet B of the NPfI. Where measured values were below the NPfI thresholds, minimum RBLs were adopted (35 dB(A) for daytime, 30 dB(A) evening/night).

Table 5-4 Locations for long term noise monitoring

Logger ID	NCA	Address	Logger Model & make	SI No.	Measurement period
L1	NCA R1	24 Central Park Ave, Norwest NSW 2153	Rion NL-21	709528	12/09/2025 to 26/09/2025
L2	NCA R2	48 Ridgehaven Pl, Baulkham Hills NSW 2153	Larson Davis LxT	1719	12/09/2025 to 26/09/2025
L3	■ NCA R3i ■ NCA R3ii	29 Fairmont Ave, Baulkham Hills NSW 2153	SVANTEK 979	35873	12/09/2025 to 26/09/2025

¹ A1803, A703 and C210 are apartment unit receivers and located at MX1 in the map of sensitive receivers shown in Figure 5-2.

Logger ID	NCA	Address	Logger Model & make	SI No.	Measurement period
L4	NCA R4	Castle Pines Ret Village, 92 Longview Pl, Baulkham Hills NSW 2153	SVANTEK 979	21094	12/09/2025 to 26/09/2025
L5 – C210	NCA MX1	210/11 Solent Cct, Norwest NSW 2153	Larson Davis LxT	1719	13/10/2025 to 21/10/2025
L5 – A703		703/11 Solent Cct, Norwest NSW 2153	Rion NL-21	709528	13/10/2025 to 21/10/2025
L5 - A1803		1803/11 Solent Cct, Norwest NSW 2153	Rion NL-21	709529	13/10/2025 to 21/10/2025

Long-term unattended noise monitoring was conducted using seven environmental noise loggers. Each logger was installed with a microphone positioned at a height of 1.5 metres and located at least 2.5 metres away from any reflective façade. The loggers operated continuously in A-weighted fast response mode.

All equipment was calibrated before and after the monitoring period, with no calibration drift exceeding ± 1 dB(A) observed.

Noise data was processed in accordance with the Noise Policy for Industry (NPfI). Invalid data—typically associated with rainfall or average wind speeds exceeding 5 m/s at microphone height—was excluded from the analysis.

Weather conditions were noted using data from the Bureau of Meteorology (BoM) Horsley Park weather station (Station ID: 067119), located approximately 16 km from the site. Wind speeds recorded at the station were adjusted to microphone height using the methodology outlined in *AS/NZS 1170.2:2021 Structural Design Actions – Part 2: Wind Actions*.

A summary of the monitoring results is provided in Table 5-5 with detailed data included in Appendix F.

Table 5-5 Ambient and background noise monitoring

Location ID	NCA	Rating background noise level (RBL) ^{1,2} LA90(period) dB			Ambient noise level LAeq(period) dB		
		Day	Evening	Night	Day	Evening	Night
L1	NCA R1	44	40	34	53	50	47
L2	NCA R2	38	38	33	50	47	42

1 RBL is the median of the measured LA90 noise level for each date during the day, evening, and night-time periods of the monitoring programme

2 For the rating background and ambient noise levels, the periods are defined as per the NPfI (EPA, 2017):

- Day: the period from 7.00 am to 6.00 pm Monday to Saturday or 8.00 am to 6.00 pm on Sundays and public holidays
- Evening: the period from 6.00 pm to 10.00 pm
- Night: the remaining periods.
- For the 15-hour and 9-hour ambient noise levels, as per the Development Near Rail Corridors and Busy Roads – Interim Guideline (NSW DoP, 2008), day refers to the 7am to 10pm while night refers to 10pm to 7am.

Location ID	NCA	Rating background noise level (RBL) ^{1,2} L _{A90(period)} dB			Ambient noise level L _{Aeq(period)} dB		
		Day	Evening	Night	Day	Evening	Night
L3	- NCA R3i - NCA R3ii	40	39	33	52	50	45
L4	NCA R4	43	42	39	56	50	50
L5 – C210 ³	NCA MX1	51	51 ⁴ (52)	44	55	61	53
L5 – A703 ³		51	50	45	55	58	52
L5 – A1803 ³		54	53	49	57	59	54

³ A1803, A703 and C210 are apartment unit receivers and located at MX1 in the map of sensitive receivers shown in Figure 5-2.
⁴ RBL for the evening time set to be equal to the day period RBL since it was higher. Values in brackets show the measured RBLs.

6 Operational noise assessment

6.1 Descriptors

To assess the operational noise, the $L_{Aeq, 15 \text{ minute}}$ metric has been used to assess the continuous noise while L_{Amax} metric has been used to assess maximum noise levels.

- The $L_{Aeq, 15 \text{ minute}}$ metric is appropriate to describe continuous noise level from operation of each piece of equipment separately, and levels can be aggregated to represent the cumulative noise level from all equipment operating during a given period.
- The L_{Amax} metric is appropriate to describe impact noise during night-time works. The $L_{A1, 15 \text{ minute}}$ metric can also be used as an alternative, however the NPfI explicitly recommends the use of the L_{Amax} metric.

6.2 Criteria for operational noise

6.2.1 Standard Operation

Project noise trigger levels

The project noise trigger level (PNTL) is defined by NPfI as ‘a level that, if exceeded, would indicate a potential noise impact on the community, and so ‘trigger’ a management response.’

Project noise trigger level (PNTL) is the lowest value of intrusiveness or project amenity noise level after conversion to the $L_{Aeq, 15 \text{ minute}}$ dBA equivalent level. Table 6-1 specifies the Project Noise Trigger Levels (PNTL) for the project based on the noise survey undertaken and considering the project amenity / intrusive noise levels. Detailed explanation of how the project noise trigger levels are established are presented in Appendix B. Intrusive noise levels are only applied to residential receivers (residences). For other receiver types, only the amenity levels apply.

Table 6-1 Project Noise Trigger Levels for the nearest sensitive receivers

NCA ID	Logger ID for RBLs	NPfI Receiver category ¹	Project intrusiveness noise level ²			Project amenity noise level			Project noise trigger levels		
			$L_{Aeq, 15 \text{ min}}$ dB			$L_{Aeq, 15 \text{ min}}$ dB			$L_{Aeq, 15 \text{ min}}$ dB		
			Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
NCA C1, C2, C3, C4, C5	-	Commercial	N/A	N/A	N/A	63	63	63	63	63	63
NCA MX1 – Zone 1	L5 – C210	Mixed use – Urban residential	56	56 (57)	49	58	48	43	56	48	43
NCA MX1 – Zone 2	L5 – A703	Mixed use – Urban residential	56	55	50	58	48	43	56	48	43

¹ Receiver categories have been assigned as per the table 2.3 of the Noise Policy for Industry to assist in the selection of the appropriate amenity noise levels.

² Intrusiveness noise level applies at residences only, does not apply to commercial undertakings including hotels

NCA ID	Logger ID for RBLs	NPfl Receiver category ¹	Project intrusiveness noise level ²			Project amenity noise level			Project noise trigger levels		
			L _{Aeq, 15min} dB			L _{Aeq, 15min} dB			L _{Aeq, 15min} dB		
			Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
NCA MX1 – Zone 3	L5 – A1803	Mixed use – Urban residential	59	58	54	58	48	43	58	48	43
NCA MX2	L5 - A703	Mixed use – Urban residential ³	56	55	50	58	48	43	56	48	43
NCA R1	L1	Urban residential	49	45	39	58	48	43	49	45	39
NCA R2	L2	Suburban residential	43	43	38	53	43	38	43	43	38
NCA R3i	L3	Urban residential	45	44	38	58	48	43	45	44	38
NCA R3ii	L3	Suburban residential	45	44	38	53	43	38	45	43	38
NCA R4	L4	Suburban residential	48	47	44	53	43	38	48	43	38
NCA-CH1	-	Childcare centre (external)	N/A	N/A	N/A	50	-	-	50	-	-
NCA-CH2	-	Childcare centre (external)	N/A	N/A	N/A	50	-	-	50	-	-
NCA-H1	-	Hotel	N/A	N/A	N/A	58	48	43	58	48	43
NCA-H2	-	Hotel	N/A	N/A	N/A	58	48	43	58	48	43
NCA-PoW	-	Place of worship (external)	N/A	N/A	N/A	48	48	-	48	48	-
NCA-Hos	-	Hospital	N/A	N/A	N/A	48	48	48	48	48	48

Sleep disturbance criteria

The NPfl contains guidance on sleep disturbance during the night-time and the following screening levels are used to identify where further investigation of sleep disturbance should be undertaken for residential properties. We highlight that the NPfl sleep disturbance criteria applies at residential locations only and therefore does not apply at childcare centres or hotels.

This assessment has considered both the night-time L_{Aeq,15min} noise levels and L_{AFmax} noise levels, where they are relevant. **Table 6-2** specifies the sleep disturbance screening levels for the nearest residential receivers to be assessed at the most reasonably affected point on or within a residential property. As

³ Assumed to be of similar background and ambient noise levels as Logger L5 A - A703 due to line of sight to the traffic noise from nearby highways.

described in Appendix B, based on the guidance provided by the ICNG, NPfI and RNP, a trigger level-based assessment on the emergence of noise for sleep disturbance will be used for this assessment.

Table 6-2 Sleep disturbance screening criteria

Receiver ID	RBLs (night) L _{Aeq} , 15min dB	NPfI Screening criteria		Awakening reaction criteria
		Night L _{Aeq} , 15min dB	Night L _{AFmax} dB	Night L _{Amax} dB
NCA R1	34	40	52	65
NCA R2	33	40	52	65
NCA R3i	33	40	52	65
NCA R3ii	33	40	52	65
NCA R4	39	44	54	65
NCA MX1 – Zone 1	44	49	59	65
NCA MX1 – Zone 2	45	50	60	65
NCA MX1 – Zone 3	49	54	64	65

6.2.2 Back-up power system testing

Maintenance testing of the back-up power system will occur on a regular basis which will include operation of generators and load banks. Testing is proposed to occur during day period only (7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays as per NPfI) to reduce the impact to neighbouring properties and reduce risks of sleep disturbance.

The Standard Operation criteria defined in the section 6.2.1 above for daytime hours will apply to the testing activities and periods.

6.2.3 Critical Power Failure

Standard Operation Criteria have been established to address both normal operation and maintenance testing for back up power systems.

The NPfI applies to industrial noise sources from activities listed in Schedule 1 of the Protection of the Environment Operations (POEO) Act 1997 and regulated by the EPA. The (POEO) Act Schedule 1 lists the activities that are Scheduled Activities for the purposes of the Act. Schedule 1 Part 1 Clause 17(1A) stipulates that the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year is not a scheduled activity.

Emergency operation of generators under a critical power failure event is rare and the impact would be short in duration (typically less than one day). On this basis, this is not a Scheduled Activity and the noise limits established by the NPfI would not apply. It is not feasible and reasonable as defined in NPfI to design the facility to specific target noise levels for this scenario.

6.3 Computational noise model

A computational noise model was developed for the site to predict environmental noise emissions from the Project during its operational phases. Noise emissions for the Project were calculated using the CONCAWE noise propagation model within SoundPLAN noise software (version 9.1). CONCAWE is a noise propagation

model that has been widely used for calculating the level of noise radiated into surrounding communities by most industrial sound sources.

The CONCAWE model incorporates the following with the calculations performed in 1/1 octave frequency bands between 63 Hz and 8000 Hz:

- Noise attenuation over distance
- Atmospheric absorption
- Ground effects
- Source-height effects
- Shielding or screening from buildings, terrain and noise walls
- Meteorological effects

6.3.1 Key parameters and assumptions

Table 6-3 indicates the key parameters and assumptions for the noise modelling.

Table 6-3 Parameters and assumptions for the computational noise modelling

Parameter	Comment
Calculation algorithms	Industrial noise – predictions for the noise from data centre's mechanical and electrical equipment have been completed using the CONCAWE noise propagation model.
Terrain	5 m contours were extracted from the Digital Elevation Model (DEM) available from Geoscience Australia via Elvis Elevation and Depth . Project civil ground contours were provided by the architect for the project.
Buildings	Building information such as addresses, outlines and the heights were obtained from Open Street Maps. Where this data was not available, building outlines were hand-drawn and approximate heights were used for the buildings based on the number of storeys.
Ground Absorption	Ground absorption factor was set to 50% for the entire study area.
Sound Power Levels	Sound power levels are as presented in Table 6-7 for operational noise sources. These noise levels have been provided by the manufacturers for a preliminary selection of equipment or derived based on expected equipment power ratings and past project experience for some equipment.
Source heights	Based on the specification provided for each equipment / plant. Heavy vehicles are assumed to be dominated by engine noise at 1.5m above ground level.
Receiver heights	1.5 m for single storey buildings and 4.5 m for 2 storey buildings and increments of 3m for high rise apartments.
Reflection for buildings ¹	1 dB reflection loss with 3 orders of reflection.
Receiver location	Receivers have been placed 30 m within the boundary of the dwelling and in free field.

¹ Reflection loss is the loss of energy occurring at each reflection of sound waves off an object. The magnitude of the loss depends on the material of the wall, the impact angle, the frequency, and the size of the wall. For sound-reflecting surfaces i.e., buildings, a reflection loss of 1.0 dB per reflection is generally assumed (corresponds to an absorption factor α of 0.21). This flat-rate factor includes scattering losses that occur in structured facades due to windows, balconies, etc.

Parameter	Comment
Period of operation	The Project would operate any time over a 24-hour period 365 days per year.
Period of assessment	The worst-case 15-minute period has been assessed for day, evening and night periods as defined in the NPfl.
Meteorological conditions	A conservative approach has been taken by adopting noise enhancing meteorological conditions for all assessment periods in accordance with fact sheet D of the NPfl. Source-to-receiver wind vectors have been considered for all receivers with the following stability category and wind speed: Noise enhancing meteorological conditions: ■ Day / evening – stability category D with light winds - up to 3m/s at 10m AGL ■ Night – Stability category F with winds - up to 2 m/s at 10m AGL Other conditions: ■ Relative Humidity: 70% (day, evening) / 90% (night) ■ Temperature 20°C (day, evening) / 10°C(night) ■ Air Pressure 101.3 kPa.

6.3.2 Back-up power testing regimes

Over a typical year, the nominal maintenance testing regime is summarised as follows:

- Generator maintenance testing schedule to be harmonised across SYD1 Stage 1 and the Proposal site, and arranged to ensure cumulative duration shall not exceed 200 hours per year.
- Quantity: Maximum number of simultaneous generators per tests: three (3) across the site suiting the load bank arrangement of one (1) at SYD1 Stage 1 and two (2) at SYD1 Stage 2.
- Testing frequency (nominal):
 - Start tests: monthly
 - Full load: annual
 - Other maintenance activities:
 - i) Transformer maintenance: Once-per-5 years requiring associated generator to run, nominally 20% per year
 - ii) HV ring maintenance: Arrangement does not require generators to run
- Testing duration:
 - Start tests: 10 minutes per test
 - Full load: 40 minutes per test
 - Transformer maintenance: 240 minutes to support maintenance
- Maximum tests per day:
 - No load tests: 24
 - Full load: 11
 - Transformer maintenance: 1
- Testing hours: Confined to 'Day' period as defined by the Noise Policy for Industry

- Monday to Saturday – 07:00 to 18:00
- Sundays and Public Holidays – 08:00 to 18:00

Testing is to be coordinated across both stages so that the total generator run hours are minimised and also remain below 200hrs per annum.

Stage 1 (Building A)												
ID	Test	Exercises per Year	Generators		Test			Nominal Load (% of design load)	Total Run Time (mins per year, worst case) per Exercise	Maximum Tests Per Day	Description of Test	Additional Notes
			Overall Quantity of Generators	Generators Undergoing Simultaneous Testing	No. of Tests per Exercise	Run Time (mins) per Test	Cooldown, excl. from Runtime (mins) per Test					
1	Full Load Run	1	10	1	10	40	15	100%	400	1	Full load run of generators using load bank	
2	Start Test	12	10	1	10	10	15	0%	1200	1		
3	Transformer Maintenance	0.2	10	1	10	240	15	80%	480	1	Maintenance on transformers will force the power string onto associated generator, for a couple of hours.	Each transformer is maintained on a five year rolling schedule, schedule to be developed in operation so that ~20% of transformers are maintained in any 12 month period.
Total test time per annum (mins) – Stage 1									2,080			
Total test time per annum (hours) – Stage 1									34.70			

Stage 2 (Building B+C+D)												
ID	Test	Exercises per Year	Generators		Test			Nominal Load (% of design load)	Total Run Time (mins per year, worst case) per Exercise	Maximum Tests Per Day	Description of Test	Additional Notes
			Overall Quantity of Generators	Generators Undergoing Simultaneous Testing	No. of Tests per Exercise	Run Time (mins) per Test	Cooldown, excl. from Runtime (mins) per Test					
1	Full Load Run	1	77	2	39	40	15	100%	1,560	11	Full load run of generators using load bank (2 off available, limiting simultaneous tests).	Exact numbers of tests per day dependent on cable system, maximum set based on allowing cooldown before commencing next start.
2	Start Test	11	77	2	39	10	15	0%	4,290	24	Start test only, undertaken without any load. Limit of 2 simultaneous.	Maximum set based on allowing cooldown before commencing next start.
3	Transformer Maintenance	0.2	77	1	77	240	15	80%	3,840	1	Maintenance on transformers will force the power string onto associated generator, for a couple of hours.	Each transformer is maintained on a five year rolling schedule, schedule to be developed in operation so that ~20% of transformers are maintained in any 12 month period.
Total test time per annum (mins) – Stage 2									9,690			
Total test time per annum (hours) – Stage 2									161.50			
Total for site (Stage 1+ Stage 2)									161.50			

6.3.3 Operating Scenarios

Three scenarios have been modelled to assess the noise from the site operation. These include:

- Standard operations
- Back-up power testing
- Emergency critical power failure

Noise sources in these scenarios are from equipment associated with data centre operation, back-up power generators and light / heavy vehicles. Although the mechanical plant is likely to operate at a reduced capacity during certain periods, a conservative approach has been taken by assuming 100% operation during all the assessment periods. Note, emergency / critical power failure scenario is where there is a complete power failure for the data centre and all back-up generators are operational.

The operation of the substation and the Stage 1 of the Data Centre has been considered as part of the cumulative impact assessment.

Consideration for construction phasing

To reflect construction phasing for Stage 2, operational noise was modelled for day, evening, and night periods under the Noise Policy for Industry (NPfI) for Standard operations, Backup power testing and Emergency critical power failure. The assessment has been conducted for 15 minutes under noise-enhancing weather conditions.

Phase 1: Operation of plant associated with Building B inclusive of associated gantry.

Phase 2: Operation of plant associated with Building B & C inclusive of associated gantries

Phase 3: Operation of plant associated with Building B, C & D inclusive of associated gantries .

Consideration for operating conditions

Air cooled chillers (ACC)

Aurecon has selected evaporative air-cooled chillers based on the most extreme ambient dry bulb conditions for a 20-year period at full data-hall load. The annual weather conditions at Norwest are generally lower than this extreme ambient weather condition throughout the year which means the ACC would likely operate at a lower fan duty and hence the noise emitted may be lower. In addition, the load in the data hall may fluctuate below the design load. Hence the worst-case scenario for the ACC is the condition where a total of 96 ACC run at 100% fan duty for the day, evening and night period (43 for Building B, 26 for Building C and 27 for Building D). For this purpose, appropriate sound power levels of the ACC have been used for the representative condition of operation.

Other mechanical equipment

All other mechanical equipment have been selected based on the most extreme ambient dry bulb conditions for a 20-year period as required from the end user.

Car parking and heavy vehicle movements

Up to 2 car movements have been assumed for a 15 minute period based on the traffic data provided by the traffic consultant.

A maximum of 1 heavy vehicle associated with loading bay, maintenance or garbage collection activities has been modelled as moving point source (Sound power level of 107 dB(A)) within the site boundary. The truck has been assumed to be travelling at a low speed of 10 km/h with the spectrum representative of an accelerated truck pass by. The assumed sound power level is based on Aurecon's internal noise database for similar projects and is also consistent with noise data from *Department for Environment Food and Rural Affairs (DEFRA), Update of Noise Database for Prediction of Noise on Construction and Open Sites*.

Table 6-4 Summary of scenarios

Standard operation	Back up power system testing	Emergency critical power failure
■ Mechanical equipment within the datacentre & on rooftop ■ Onsite traffic (light and heavy vehicles)	■ Mechanical equipment within the datacentre & on rooftop ■ Up to 2 backup generators being tested along with a load bank to simulate typical data centre loads (day period only) ■ Onsite traffic (light and heavy vehicles)	■ Mechanical equipment within the datacentre & on rooftop ■ All back-up generators operational ■ Onsite traffic (light and heavy vehicles)

Table 6-5 Modelled noise sources for each scenario

Equipment	Normal operation	Back-up power system testing	Emergency critical power failure
Air cooled chillers ¹	✓	✓	✓
Generators		✓ (2 generators)	✓ (77 generators)
Load Bank		✓ (2 load banks)	
Heavy/light vehicles	✓	✓	✓

6.3.4 Other assumptions

Table 6-6 provides other assumptions that have been considered for the noise modelling.

Table 6-6 Other assumptions

Item	Assumption
Noise barriers	The following design specifications are assumed for noise barriers: ■ An overall surface weight of greater than or equal to 10 kg/m² (It is assumed that a heavier construction may be required for structural or other design reasons) ■ Noise barriers are solid and continuous. ■ The location of the noise barriers are shown in Appendix G of this report.

¹ Sound power levels of ACC include chilled water pump noise

6.3.5 Operational equipment noise data

At this stage a preliminary schedule of equipment has been developed by the design engineer. This is based on indicative equipment selections, numbers, and associated equipment acoustic data from various mechanical and electrical plant suppliers. Table 6-7 summarises noise data assumed for the assessment, with further details provided in Appendix C. The noise data has been sourced based on industry experience and available supplier data for similar equipment used in other approved data centre projects. 1/1 Octave data has been sourced from the suppliers and publicly available data where available.

Table 6-7 Operational noise data of modelled noise sources

Equipment	Capacity	Operating conditions	No. of units	Noise source locations	Sound power level / unit, dB(A)
Air cooled chillers (ACC) ¹	1.2 MW	100% load at ambient dry-bulb temperature of 44.7 °C – day / evening period	Phase 1 – 43 Phase 2 – 26 Phase 3 – 27 Total - 96	Base of ACC 5.5m above roof level	86
		100% load at ambient dry-bulb temperature of 30.0 ° - night period			80
Containerised generators fitted with attenuators for intake, exhaust and hot air discharge.	2.5MW	Maximum Load	Phase 1 – 47 Phase 2 – 14 Phase 3 – 16 Total - 77	Exhaust gas discharge – on roof level at 130m RL Hot air discharge – southern façade / gantry Intake – on roof level	Exhaust gas discharge – 75 dBA SPL ² at 1m Hot air discharge – 75 dBA SPL at 1m Intake – 75 dBA SPL at 1m
Load Bank - untreated	Creschic 2.5MW	Maximum Load	Phase 1 & 2 – 1 Phase 3 – 1 additional load bank Total - 2	On ground level	108
Load Bank – mitigated	Creschic 2.5MW	Maximum Load	Phase 1 & 2 – 1 Phase 3 – 1 additional load bank Total - 2	On ground level	99

¹ Sound power level of air-cooled chillers includes the noise from the chilled water pumps housed within the unit.

² Sound Pressure level

Equipment	Capacity	Operating conditions	No. of units	Noise source locations	Sound power level / unit, dB(A)
Heavy vehicles	Typical heavy vehicle	Maximum Load	1 / peak hour	Along access road	107
Light vehicles	Typical light vehicle	Maximum Load	2 /peak hour	Along access road	98

6.3.6 Results

This section presents predicted noise levels from the continuous operation of the facility with mitigation measures which have been integrated into the current design. Noise generated by the facility would exceed limits without mitigation and hence mitigation must be applied.

Results have been presented for two configurations:

- **Base model** - The base noise model refers to the design provided in the architectural drawings and has been used to investigate the dominant noise sources. The data provided by the prospective suppliers for equipment have considered reduced sound power levels for key equipment such as air-cooled chillers. Refer to Figure 6-1, Figure 6-2 and Figure 6-3 for testing scenario, and Figure 6-4, Figure 6-6 and Figure 6-8 for critical power failure scenario. The key issues identified with the base model are as follows:
 - The phasing for the construction didn't consider rooftop noise propagation especially for the south eastern residential receivers
 - Exceedances were identified at the southern receivers due to the siting of the load bank at its initial proposed location.
 - The length of the truck route was identified to slightly affect the childcare centre receiver on the south of the datacentre.
- **Mitigated model** - noise control measures were added to the design where they were likely to be most effective in reducing noise emissions at the nearest receivers. Refer to Figure 6-1, Figure 6-2 and Figure 6-3 for testing scenario, and Figure 6-5, Figure 6-7 and Figure 6-9 for critical power failure scenario. The specific recommended mitigation measures are fully detailed in section 6.6; noise control measures include:
 - Noise barriers to block line of sight to the nearest receivers from the air cooled chillers and associated pumps. Temporary noise barriers would be required to address the exceedance in noise in intermediate phases of construction.
 - Custom acoustic generator enclosures with sound absorbing finish to interior walls and attenuators at each opening.
 - Attenuators for Outside Air pressurisation units located within the buildings.
 - Siting load bank to be away from the southern façade facing the childcare centre.

The predicted noise levels with and without all acoustic mitigation included in the model are shown in the result section below. It is noted that generator testing scenario has been assessed cumulatively along with the vehicle movements and mechanical equipment as the worst-case day time scenario. The results are presented for the expected worst case weather conditions only. Emergency scenario results are presented for the night period only.

Modifying factors

The predicted noise was analysed at each receiver and modifying factors were determined quantitatively in accordance with the NPfl Fact Sheet C.

- **Tonality** - 1/3rd Octave band data was not available for all the equipment noise levels. Hence narrow band analysis using the objective method for assessing the audibility of tones in noise (simplified method) in ISO 1996-2007, Annex C was not possible at the current stage of the project. Hence a tonality assessment will need to be revisited at a later stage of the project.
- **Low frequency** - 1/3rd Octave band data was not available for all the equipment noise levels. Hence a low frequency assessment was not possible at the current stage of the project and will need to be revisited at a later stage of the project.-
- **Intermittency** – There are no repeated sudden and periodic step changes in noise that might occur from loud equipment that regularly cycles on and off. Hence no intermittency correction is applicable.
- **Duration** - No duration factors were applied since there are no one-off and unusual events occurring on site.

Continuous noise emission

Phase 1

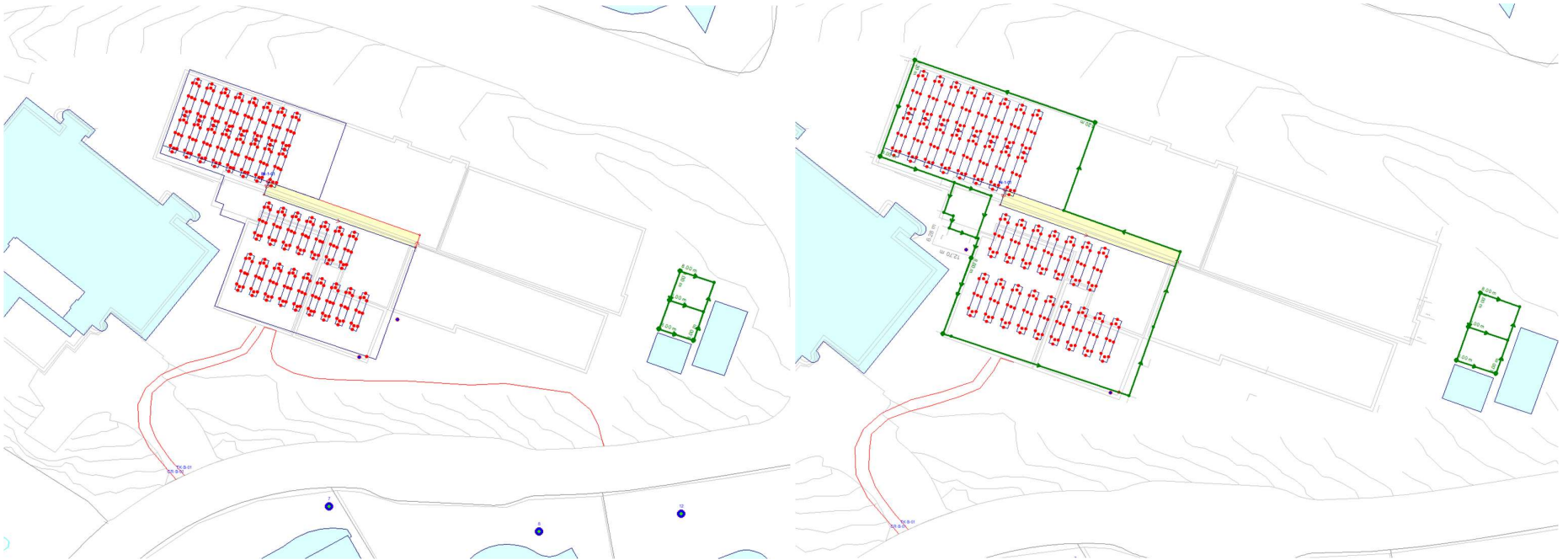


Figure 6-1 Base model (left) and Mitigated model (right) for Phase 1 (testing scenario shown)

Table 6-8 Predicted continuous noise emission for Phase 1

Receiver ID	Base case									Mitigated					
	Criteria LAeq 15min dB			Back-up power testing LAeq15min dB		Standard operations LAeq15min dB				Back-up power testing LAeq15min dB		Standard operations LAeq15min dB			
	Day	Evening	Night	Day	Compliant?	Evening	Compliant?	Night	Compliant?	Day	Compliant?	Evening	Compliant?	Night	Compliant?
				3m/s winds		3 m/s winds		2m/s winds		3m/s winds		3 m/s winds		2m/s winds	
				D Class Temperature inversions		D Class Temperature inversions		F Class Temperature inversions		D Class Temperature inversions		D Class Temperature inversions		F Class Temperature inversions	
C1	63	63	63	52	yes	43	yes	40	yes	46	yes	39	yes	37	yes
C2	63	63	63	62	yes	48	yes	46	yes	46	yes	44	yes	42	yes
C3	63	63	63	59	yes	46	yes	45	yes	41	yes	40	yes	37	yes
C4	63	63	63	51	yes	47	yes	42	yes	43	yes	42	yes	37	yes
C5	63	63	63	61	yes	47	yes	45	yes	43	yes	41	yes	39	yes
CH1	50	na	na	59	no (+9)	45	na	42	na	40	yes	39	na	34	na
CH2	50	na	na	43	yes	41	na	37	na	41	yes	41	na	36	na
H1	58	48	43	58	yes	47	yes	45	no (+2)	45	yes	44	yes	42	yes
H2	58	48	43	47	yes	44	yes	39	yes	38	yes	37	yes	32	yes
HOS	48	48	48	37	yes	37	yes	32	yes	32	yes	31	yes	26	yes
MX1	56	48	43	37	yes	37	yes	33	yes	36	yes	36	yes	32	yes
MX2	56	48	43	43	yes	42	yes	38	yes	41	yes	41	yes	36	yes
PoW	48	48	48	32	yes	32	yes	27	yes	27	yes	26	yes	20	yes
R1	49	45	39	34	yes	33	yes	29	yes	28	yes	27	yes	22	yes
R2	43	43	38	45	no (+2)	38	yes	34	yes	40	yes	32	yes	29	yes
R3i	45	44	38	41	yes	39	yes	34	yes	34	yes	32	yes	27	yes
R3ii	45	43	38	55	no (+10)	42	yes	38	yes	36	yes	35	yes	31	yes
R4-1	48	43	38	38	yes	37	yes	33	yes	30	yes	30	yes	25	yes
R4-2	48	43	38	39	yes	39	yes	34	yes	33	yes	32	yes	26	yes

Phase 2

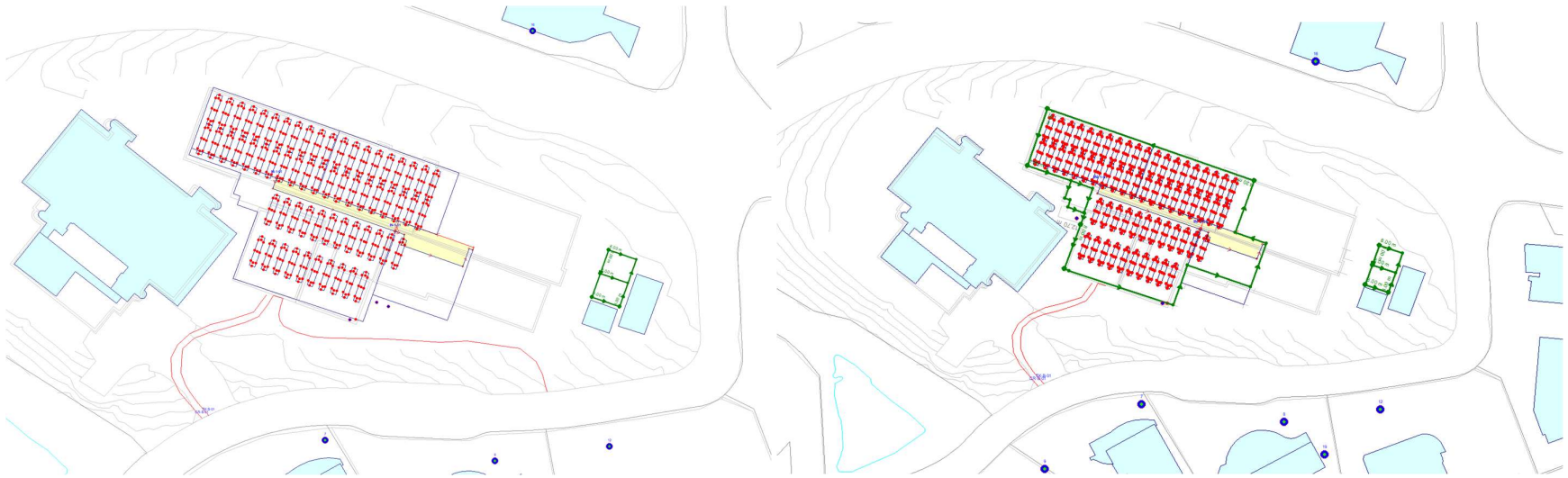


Figure 6-2 Base model (left) and Mitigated model (right) for Phase 2 (testing scenario shown)

Table 6-9 Predicted continuous noise emission for Phase 2

Receiver ID	Base case									Mitigated					
	Criteria L _{Aeq} 15min dB			Back-up power testing L _{Aeq} 15min dB		Standard operations L _{Aeq} 15min dB				Back-up power testing L _{Aeq} 15min dB		Standard operations L _{Aeq} 15min dB			
	Day	Evening	Night	Day	Compliant?	Evening	Compliant?	Night	Compliant?	Day	Compliant?	Evening	Compliant?	Night	Compliant?
				3m/s winds		3 m/s winds		2m/s winds		3m/s winds		3 m/s winds		2m/s winds	
				D Class Temperature inversions		D Class Temperature inversions		F Class Temperature inversions		D Class Temperature inversions		D Class Temperature inversions		F Class Temperature inversions	
C1	63	63	63	57	yes	44	yes	41	yes	46	yes	40	yes	37	yes
C2	63	63	63	68	no (+5)	49	yes	47	yes	47	yes	45	yes	43	yes
C3	63	63	63	62	yes	48	yes	45	yes	42	yes	42	yes	38	yes
C4	63	63	63	50	yes	50	yes	44	yes	45	yes	45	yes	40	yes
C5	63	63	63	67	no (+4)	48	yes	46	yes	44	yes	43	yes	39	yes
CH1	50	na	na	64	no (+14)	47	na	43	na	42	yes	41	na	36	na
CH2	50	na	na	46	yes	46	na	42	na	45	yes	45	na	40	na
H1	58	48	43	64	no (+6)	49	no (+1)	46	no (+3)	46	yes	45	yes	42	yes
H2	58	48	43	47	yes	47	yes	42	yes	41	yes	41	yes	35	yes
HOS	48	48	48	39	yes	38	yes	34	yes	34	yes	33	yes	28	yes
MX1	56	48	43	40	yes	40	yes	35	yes	39	yes	39	yes	35	yes
MX2	56	48	43	45	yes	45	yes	40	yes	44	yes	44	yes	39	yes
PoW	48	48	48	34	yes	34	yes	29	yes	29	yes	28	yes	23	yes
R1	49	45	39	35	yes	35	yes	31	yes	30	yes	30	yes	25	yes
R2	43	43	38	51	no (+8)	39	yes	36	yes	40	yes	34	yes	31	yes
R3i	45	44	38	44	yes	41	yes	37	yes	36	yes	35	yes	30	yes
R3ii	45	43	38	59	no (+14)	44	no (+1)	40	no (+2)	39	yes	38	yes	34	yes
R4-1	48	43	38	41	yes	40	yes	36	yes	33	yes	33	yes	28	yes
R4-2	48	43	38	41	yes	41	yes	36	yes	35	yes	35	yes	29	yes

Phase 3

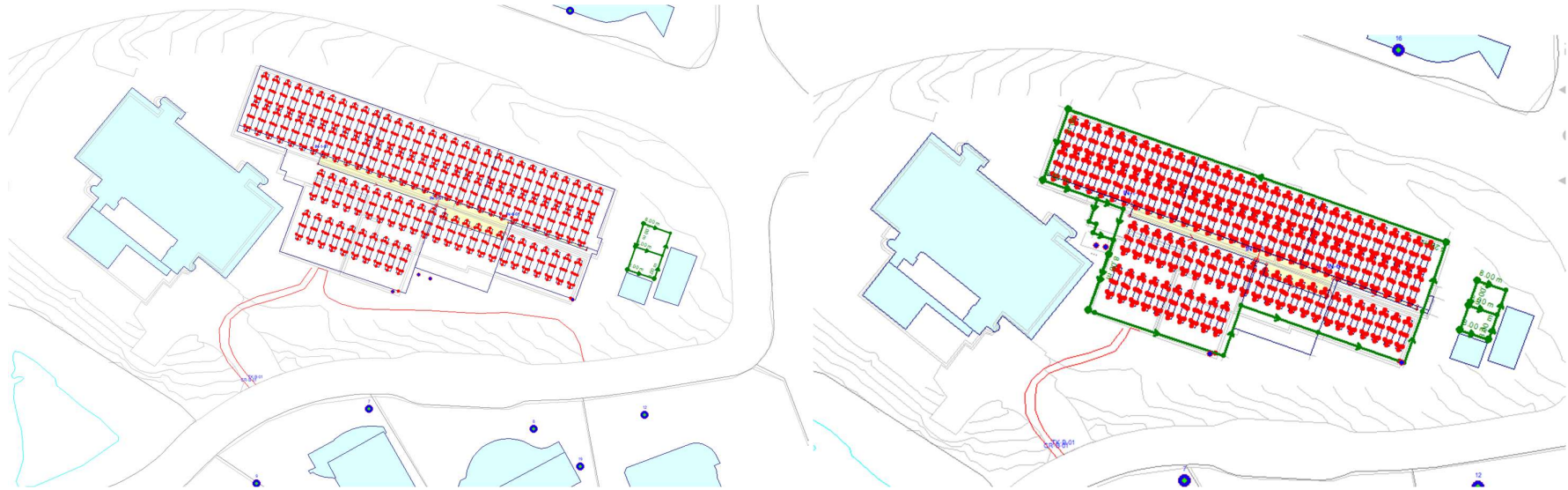


Figure 6-3 Base model (left) and Mitigated model (right) for Phase 3 (testing scenario shown)

Table 6-10 Predicted continuous noise emission for Phase 3

Receiver ID	Base case									Mitigated					
	Criteria LAeq 15min dB			Back-up power testing LAeq15min dB		Standard operations LAeq15min dB				Back-up power testing LAeq15min dB		Standard operations LAeq15min dB			
	Day	Evening	Night	Day	Compliant?	Evening	Compliant?	Night	Compliant?	Day	Compliant?	Evening	Compliant?	Night	Compliant?
				3m/s winds		3 m/s winds		2m/s winds		3m/s winds		3 m/s winds		2m/s winds	
				D Class Temperature inversions		D Class Temperature inversions		F Class Temperature inversions		D Class Temperature inversions		D Class Temperature inversions		F Class Temperature inversions	
C1	63	63	63	58	yes	46	yes	42	yes	47	yes	41	yes	38	yes
C2	63	63	63	68	no (+5)	50	yes	48	yes	49	yes	47	yes	43	yes
C3	63	63	63	63	yes	50	yes	47	yes	49	yes	46	yes	41	yes
C4	63	63	63	53	yes	52	yes	47	yes	48	yes	48	yes	43	yes
C5	63	63	63	67	no (+4)	51	yes	48	yes	50	yes	46	yes	42	yes
CH1	50	na	na	64	no (+14)	50	na	46	na	48	yes	45	na	40	na
CH2	50	na	na	49	yes	49	na	44	na	48	yes	48	na	43	na
H1	58	48	43	64	no (+6)	50	no (+2)	46	no (+3)	49	yes	46	yes	43	yes
H2	58	48	43	49	yes	49	no (+1)	44	no (+1)	43	yes	43	yes	37	yes
HOS	48	48	48	40	yes	39	yes	35	yes	35	yes	34	yes	29	yes
MX1	56	48	43	42	yes	41	yes	37	yes	41	yes	40	yes	36	yes
MX2	56	48	43	47	yes	47	yes	42	yes	46	yes	45	yes	41	yes
PoW	48	48	48	34	yes	34	yes	29	yes	30	yes	29	yes	24	yes
R1	49	45	39	36	yes	36	yes	31	yes	32	yes	31	yes	26	yes
R2	43	43	38	51	no (+8)	41	yes	37	yes	41	yes	36	yes	32	yes
R3i	45	44	38	45	yes	43	yes	38	yes	39	yes	37	yes	31	yes
R3ii	45	43	38	59	no (+14)	46	no (+3)	42	no (+4)	45	yes	41	yes	36	yes
R4-1	48	43	38	43	yes	43	yes	38	yes	36	yes	35	yes	30	yes
R4-2	48	43	38	42	yes	42	yes	37	yes	36	yes	35	yes	30	yes

Critical Power Failure Scenario

The predictions in Table 6-11, Table 6-12 and Table 6-13 below show the predicted noise levels in the event of a critical power failure where all backup generators are in operation in addition to the mitigated standard operation scenario equipment. As noted in section 6.2.3, no criteria are proposed for this scenario, so these are presented for information only.

Phase 1

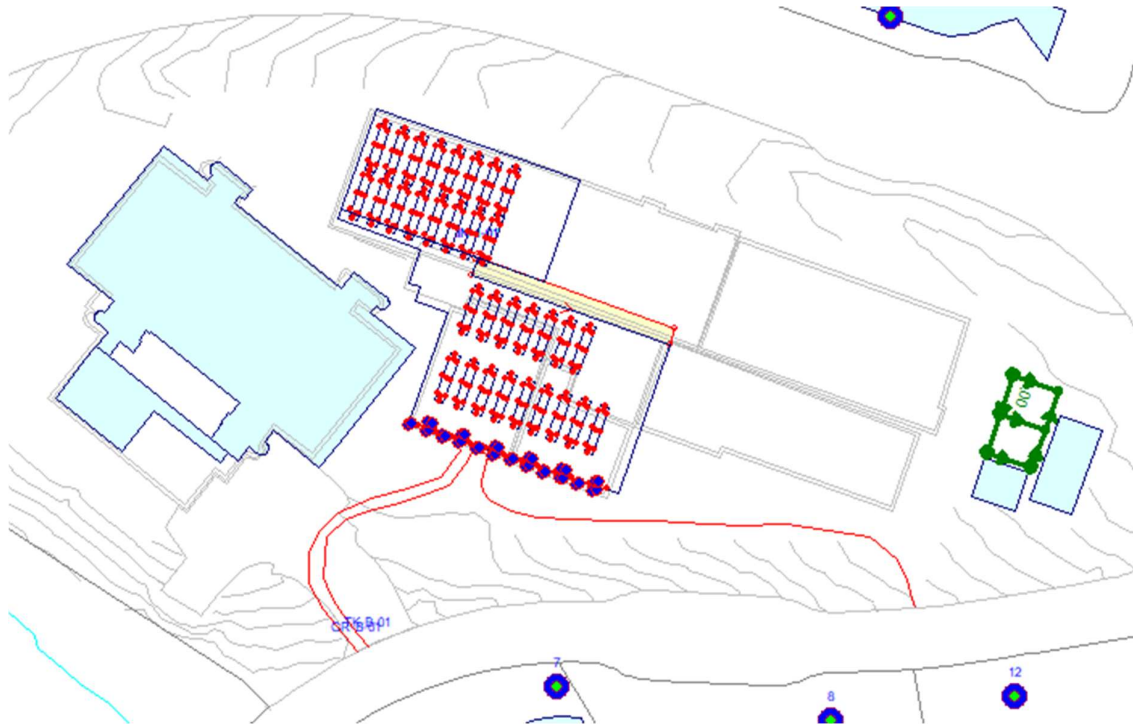


Figure 6-4 Base model for Phase 1 (critical power failure scenario)

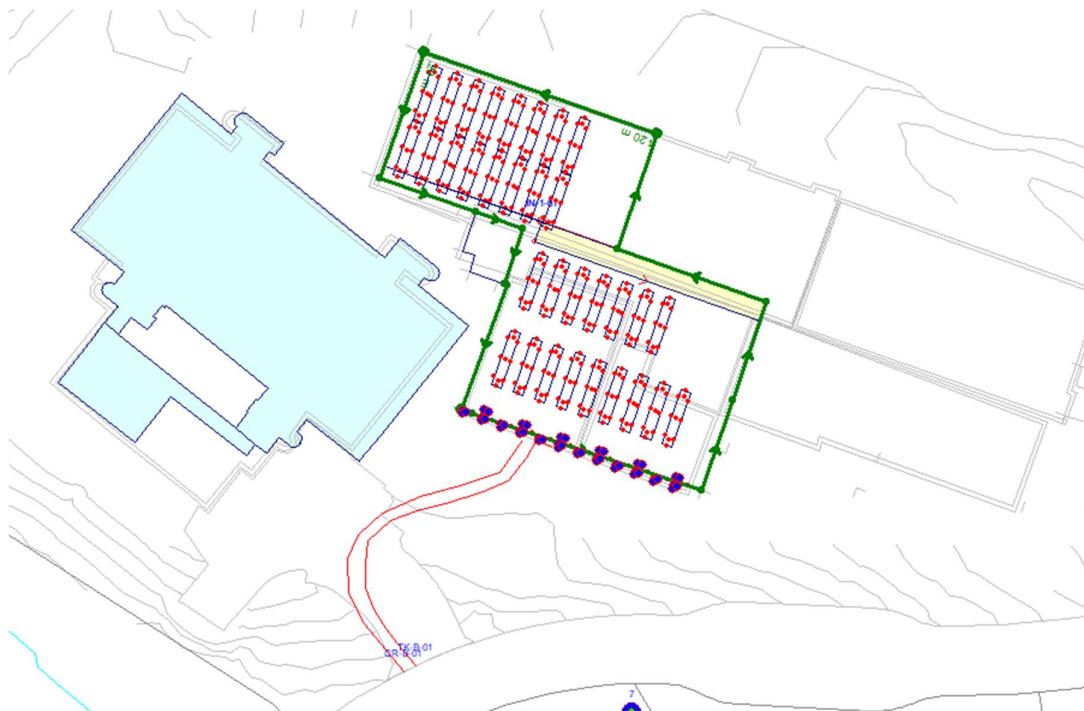


Figure 6-5 Mitigated model for Phase 1 (critical power failure scenario)

Table 6-11 Predicted noise levels for critical power failure - Phase 1

Receiver ID	Base case		Mitigated	
	Critical power failure L _{Aeq15min} dB		Critical power failure L _{Aeq15min} dB	
	Night	Night	Night	Night
	0.5m/s winds	2m/s winds	0.5m/s winds	2m/s winds
	D Class Temperature inversions	F Class Temperature inversions	D Class Temperature inversions	F Class Temperature inversions
C1	52	54	53	54
C2	61	62	62	62
C3	55	56	54	55
C4	51	52	46	47
C5	57	58	58	58
CH1	54	55	55	56
CH2	41	43	39	40
H1	58	59	58	59
H2	49	51	44	46
HOS	43	45	41	43
MX1	42	44	42	44
MX2	46	48	44	46
PoW	34	36	34	35
R1	38	40	38	40
R2	46	47	46	47
R3i	47	48	47	48
R3ii	47	49	46	48
R4-1	42	43	39	40
R4-2	42	43	37	39

Phase 2

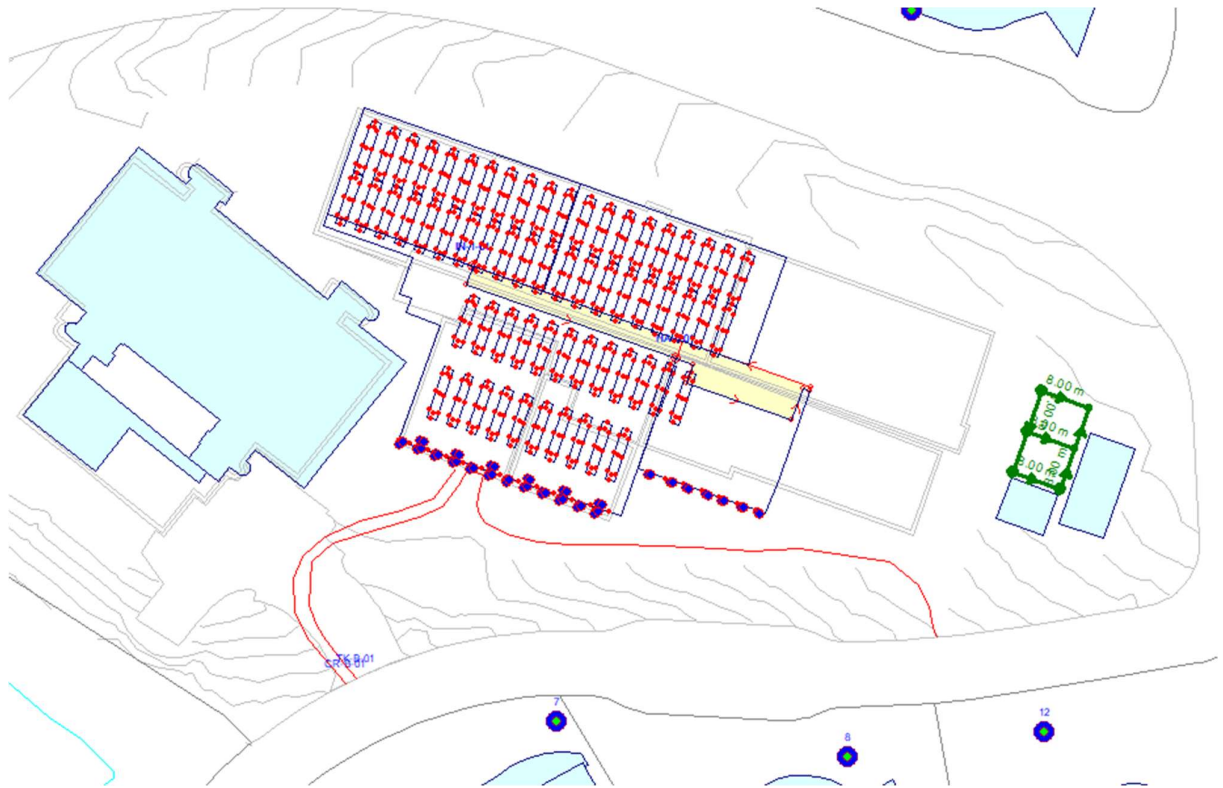


Figure 6-6 Base model for Phase 2 (critical power failure scenario)

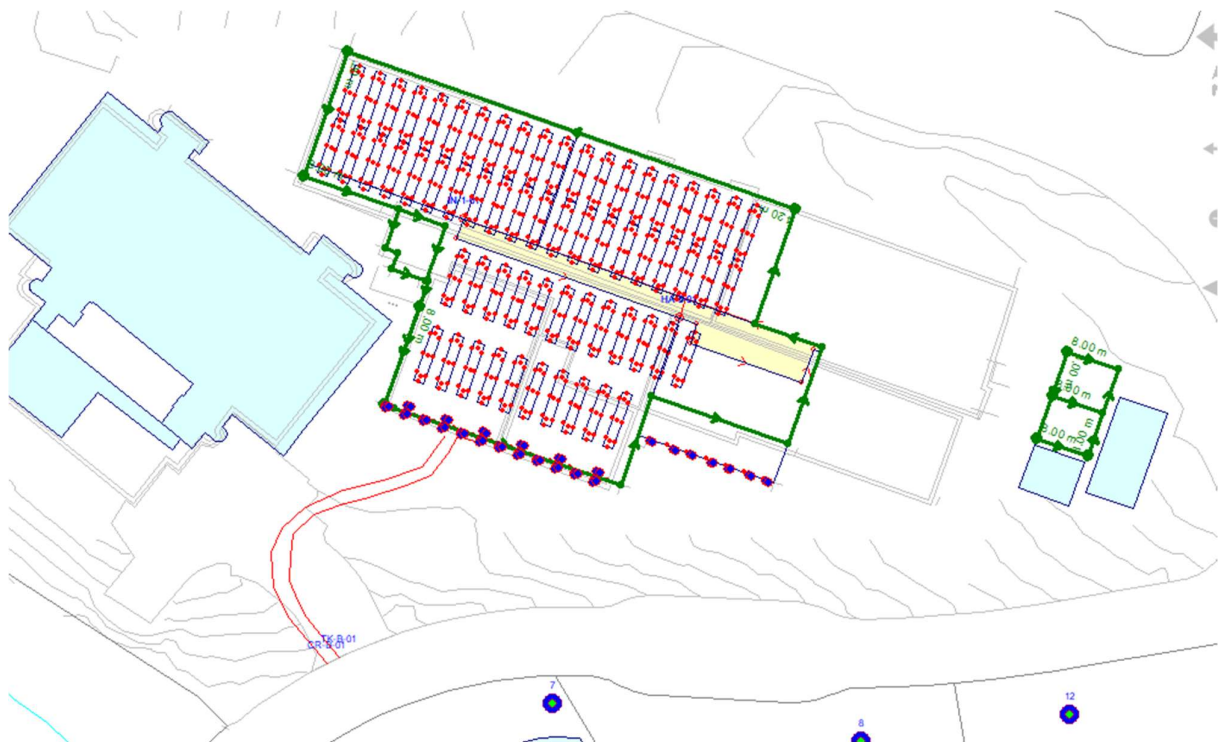


Figure 6-7 Mitigated model for Phase 2 (critical power failure scenario)

Table 6-12 Predicted noise levels for critical power failure - Phase 2

Receiver ID	Base case		Mitigated	
	Critical power failure $L_{Aeq15min}$ dB		Critical power failure $L_{Aeq15min}$ dB	
	Night	Night	Night	Night
	0.5m/s winds	2m/s winds	0.5m/s winds	2m/s winds
	D Class Temperature inversions	F Class Temperature inversions	D Class Temperature inversions	F Class Temperature inversions
C1	53	55	53	55
C2	62	63	63	63
C3	57	58	57	58
C4	51	52	46	47
C5	59	60	60	61
CH1	56	57	57	58
CH2	43	45	42	43
H1	59	60	59	60
H2	50	52	46	48
HOS	43	45	42	44
MX1	43	45	43	44
MX2	47	49	46	47
PoW	35	37	35	36
R1	39	41	38	41
R2	47	48	47	48
R3i	48	49	48	50
R3ii	51	53	51	53
R4-1	43	45	39	41
R4-2	42	44	38	40

Phase 3

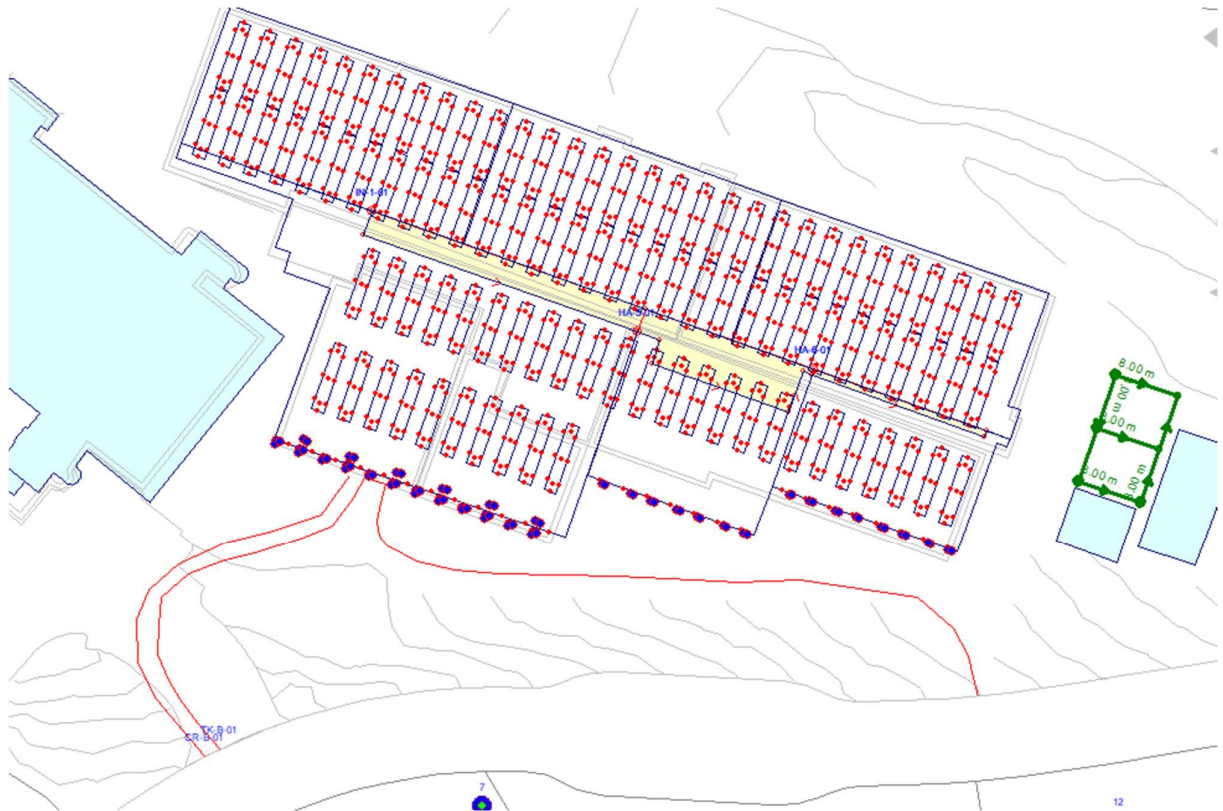


Figure 6-8 Base model for Phase 3 (critical power failure scenario)

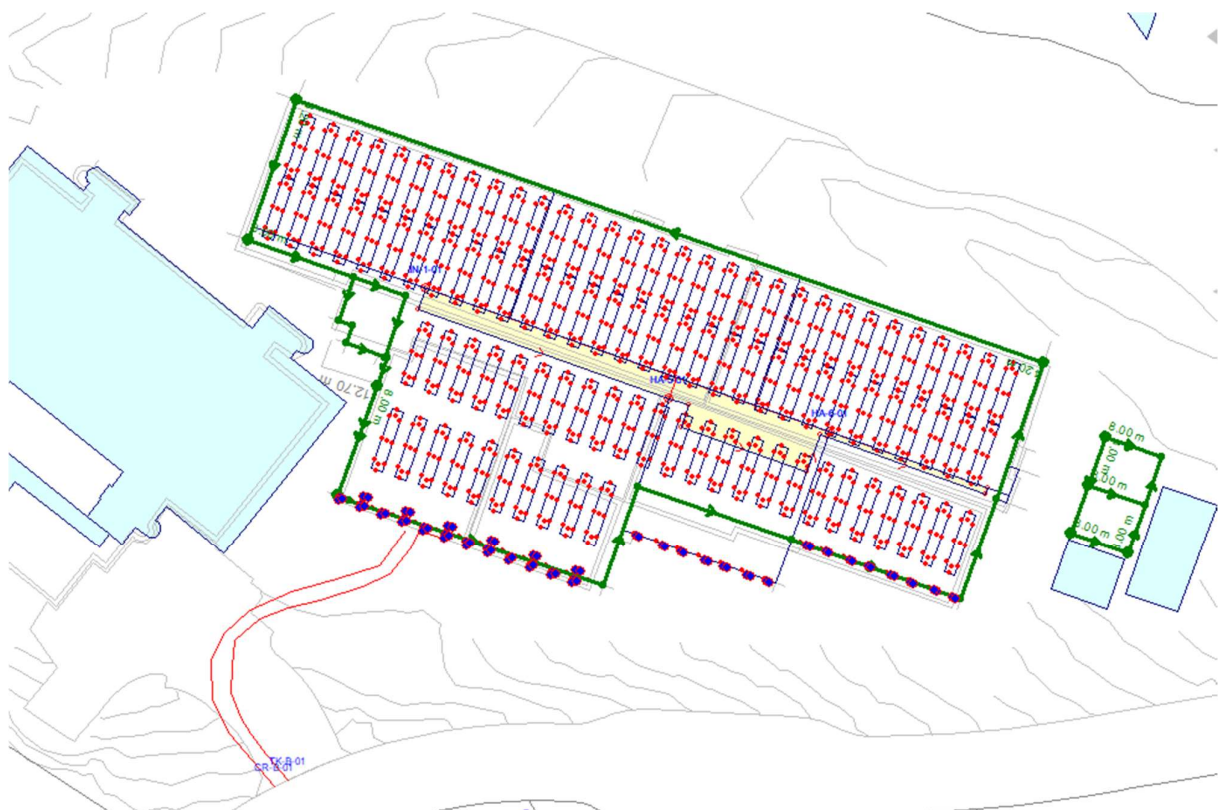


Figure 6-9 Mitigated model for Phase 3 (critical power failure scenario)

Table 6-13 Predicted noise levels for critical power failure - Phase 3

Receiver ID	Base case		Mitigated	
	Critical power failure $L_{Aeq15min}$ dB		Critical power failure $L_{Aeq15min}$ dB	
	Night	Night	Night	Night
	0.5m/s winds	2m/s winds	0.5m/s winds	2m/s winds
	D Class Temperature inversions	F Class Temperature inversions	D Class Temperature inversions	F Class Temperature inversions
C1	54	55	54	56
C2	63	63	63	64
C3	60	61	60	61
C4	51	52	46	47
C5	61	62	62	63
CH1	59	60	60	61
CH2	45	46	43	45
H1	59	60	60	60
H2	49	51	46	47
HOS	44	46	42	44
MX1	44	45	44	45
MX2	48	50	46	48
PoW	36	37	35	36
R1	39	42	39	41
R2	47	49	47	49
R3i	49	50	49	51
R3ii	54	55	55	57
R4-1	45	46	41	42
R4-2	43	44	39	40

Sleep disturbance

In addition to a comparison against the project noise trigger level, the predicted noise levels should also be compared to the sleep disturbance criteria which for this project are based directly on measured night-time period RBL.

Sleep disturbance criteria are provided for steady state sources (L_{Aeq}) and intermittent events (L_{Amax}). Based on the standard operation during the night-time period after mitigation is applied, the only sources contributing to L_{Amax} are infrequent events associated with trucks and car parking such as doors opening or closing, starting the car or acceleration. All other sources are steady state sources and would contribute to the $L_{Aeq,15minute}$ level.

The predicted noise levels are provided in Table 6-14, Table 6-15 and Table 6-16.

Phase 1

Table 6-14 Predicted operational noise levels comparison with sleep disturbance criteria - Phase 1

Receiver ID	Base case						Mitigated			
	Criteria dB		Standard operations LAeq15min dB		Standard operations LAmax dB		Standard operations LAeq15min dB		Standard operations LAmax dB	
	Night LAeq	Night LAmax	Night	Compliant?	Night	Compliant?	Night	Compliant?	Night	Compliant?
			2m/s winds		2m/s winds		2m/s winds		2m/s winds	
			F Class Temperature inversions		F Class Temperature inversions		F Class Temperature inversions		F Class Temperature inversions	
MX1	49	59	33	yes	33	yes	32	yes	32	yes
MX2	49	59	38	yes	38	yes	36	yes	36	yes
R1	40	52	29	yes	29	yes	22	yes	22	yes
R2	40	52	34	yes	34	yes	29	yes	29	yes
R3i	40	52	34	yes	34	yes	27	yes	27	yes
R3ii	40	52	38	yes	38	yes	31	yes	31	yes
R4-1	44	54	33	yes	33	yes	25	yes	25	yes
R4-2	44	54	34	yes	34	yes	26	yes	26	yes

Phase 2

Table 6-15 Predicted operational noise levels comparison with sleep disturbance criteria - Phase 2

Receiver ID	Base case						Mitigated			
	Criteria dB		Standard operations LAeq15min dB		Standard operations LAmax dB		Standard operations LAeq15min dB		Standard operations LAmax dB	
	Night LAeq	Night LAmax	Night	Compliant?	Night	Compliant?	Night	Compliant?	Night	Compliant?
			2m/s winds		2m/s winds		2m/s winds		2m/s winds	
			F Class Temperature inversions		F Class Temperature inversions		F Class Temperature inversions		F Class Temperature inversions	
MX1	49	59	35	yes	35	yes	35	yes	35	yes
MX2	49	59	40	yes	40	yes	39	yes	39	yes
R1	40	52	31	yes	31	yes	25	yes	25	yes
R2	40	52	36	yes	36	yes	31	yes	31	yes
R3i	40	52	37	yes	37	yes	30	yes	30	yes
R3ii	40	52	40	yes	40	yes	34	yes	34	yes
R4-1	44	54	36	yes	36	yes	28	yes	28	yes
R4-2	44	54	36	yes	36	yes	29	yes	29	yes

Phase 3

Table 6-16 Predicted operational noise levels comparison with sleep disturbance criteria – mitigated - Phase 3

Receiver ID	Base case						Mitigated			
	Criteria dB		Standard operations L _{Aeq15min} dB		Standard operations L _{Amax} dB		Standard operations L _{Aeq15min} dB		Standard operations L _{Amax} dB	
	Night L _{Aeq}	Night L _{Amax}	Night	Compliant?	Night	Compliant?	Night	Compliant?	Night	Compliant?
			2m/s winds		2m/s winds		2m/s winds		2m/s winds	
			F Class Temperature inversions		F Class Temperature inversions		F Class Temperature inversions		F Class Temperature inversions	
MX1	49	59	37	yes	37	yes	36	yes	36	yes
MX2	49	59	42	yes	42	yes	41	yes	41	yes
R1	40	52	31	yes	31	yes	26	yes	26	yes
R2	40	52	37	yes	37	yes	32	yes	32	yes
R3i	40	52	38	yes	38	yes	31	yes	31	yes
R3ii	40	52	42	no (+2)	42	yes	36	yes	36	yes
R4-1	44	54	38	yes	38	yes	30	yes	30	yes
R4-2	44	54	37	yes	37	yes	30	yes	30	yes

With mitigation measures in place, it is anticipated that noise levels will be below steady state sleep disturbance criteria for standard operation and potential infrequent events on site will be below the maximum night-time criterion.

6.4 Cumulative noise impacts

The NPfI defines cumulative industrial noise levels as the total level of noise from all industrial sources and states that the ambient noise level within an area from all industrial noise sources combined should remain below the Recommended Amenity Noise Levels (RANL) where feasible and reasonable. Operational noise levels from existing projects are captured in the ambient noise survey in Section 5.4. The effects of future major projects which may contribute to the cumulative noise are considered in this section.

The NPfI explains that the Recommended Amenity Noise Levels represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. This suggests that the **objective for the cumulative noise is the Recommended Amenity Noise Level**.

Future major projects planned and approved near the site, that have the potential to generate cumulative impacts were identified using the DPHI Major Projects Planning Portal at the time of our noise modelling and assessment. In accordance with the Cumulative Impact Assessment Guidelines for State Significant Projects [9], relevant future projects considered for the cumulative impact assessment include:

- Projects which may have intensity of operations change over time (e.g. the project is currently operating below its approved capacity, the project is currently under construction and will only start operating in two years)
- The project has been approved under the EP&A Act but has not started construction.
- The application for the project has been exhibited and is currently under assessment.

To assess the cumulative impacts from the future (noise generating) projects within and around the site, the relevant acoustic assessment reports have been reviewed to qualitatively assess the cumulative impacts (refer to Table 6-17 and the discussion that follows).

Table 6-17 Future noise generating projects identified

DA Reference, project name & address	Current status	Development description	Relationship to Project footprint	Comments
SYD 1 GreenSquareDC - Stage 1	Stage 1 approval was obtained from the Regional Planning Panel on 4 September 2025	Stage 1 Datacentre	This project is located to the west of the Stage 2 area.	The stage 1 of the project has been designed to be 4 dBA below the PANLs for overall campus.
SYD 1 GreenSquareDC - Stage 3	Stage 3 Substation and Early Works Development Application is currently in progress	Stage 3 Substation and Early Works Development Application	This project is located to the east of the Stage 2 area.	The stage 3 of the project has been designed to be 10 dBA below the PANLs for overall campus.

The NPfI states that *the approach of deriving the project amenity noise level resulting from a new development on the basis of the recommended amenity noise level minus 5 dB is based on a receiver not being impacted by more than three to four individual industrial noise sources.*

For the assessment of cumulative impacts from the Project and nearby proposed and future projects, the night-time criteria has been utilised as this would be the most stringent criteria. The proposed stage 2 of the SYD1 GreenSquareDC campus is predicted to result in noise levels of up to 38 dB(A) after considering all feasible and reasonable mitigation under noise enhancing meteorological conditions which achieves the cumulative noise level requirements as per NPfI.

Based on the data available at the time of the assessment as described in Table 6-18, the cumulative noise contribution from the Project is assessed assuming the predicted noise levels are equal to or below the requirements for the sensitive receivers. Based on this, the overall cumulative impact is predicted to be 40 dBA.

Table 6-18 Estimated cumulative noise levels

NCA1	Cumulative noise criteria L _{Aeq,15min} dB	Stage 1 ¹ L _{Aeq,15min} dB	Stage 2 L _{Aeq,15min} dB	Stage 3 ² L _{Aeq,15min} dB	Cumulative impact L _{Aeq,15min} dB
Nearest residential receivers	43	34	38	27	40 dBA

6.5 Operational vibration impacts

A detailed review of the operational vibration impacts of the data centre has not been performed. During the design it is anticipated that the design team will incorporate all necessary vibration isolation for reciprocating equipment and vibration will be controlled at source.

There are also no specific operational scenarios that are expected to generate enough vibration to create disturbance at the nearest receivers.

6.6 Recommended operational noise mitigation

Operational noise impacts are predicted to exceed project trigger levels with the base noise model. As part of the design process, appropriate treatments have been identified to further treat the base model. These treatments have been applied for the mitigated noise model.

Throughout the design of the data centre, acoustic performance of the selected equipment should be reviewed to confirm that they perform within the predictions of this assessment. The review should consider the presence of any modifying factors for the noise in accordance with the NPfI. Where exceedances are observed, mitigation measures shall be considered, and operational management controls should be implemented to bring the noise and vibration to within acceptable limits.

The following noise mitigation measures and management strategies are required for the Project.

¹ Stage 1 noise predictions are as presented in the acoustics report for Stage 1 presented in *SYD 1 – Norwest – Stage 1 – Noise Impact Assessment, Issue 3, 31 May 2025*

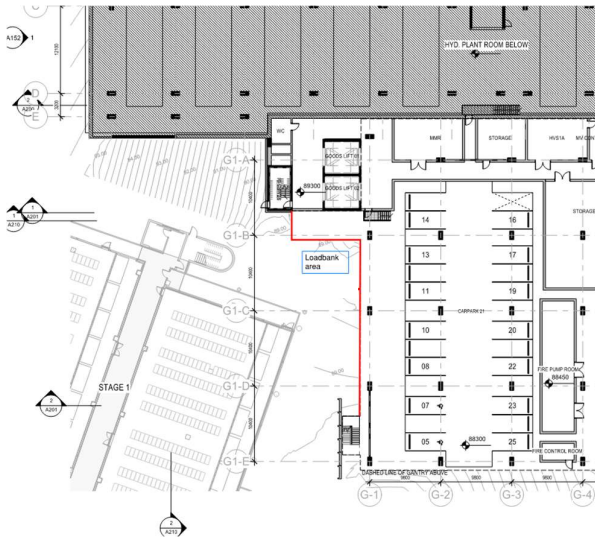
² Stage 3 noise predictions are as presented in the DA submission acoustic report. GreenSquare SYD1-Substation DA - Noise and Vibration, Rev B, 28 November 2025

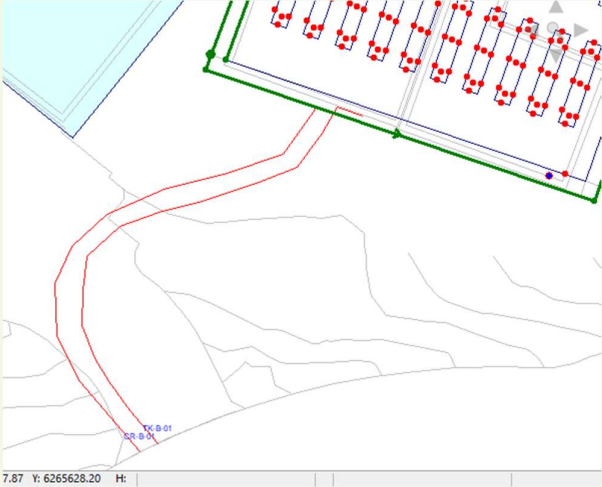
Table 6-19 Recommended Noise Mitigation Measures

Aspect	Mitigation measures: remedial actions, work practices and complaints handling	Timing
Operational Noise	Integrate all mitigation measures discussed in Table 6-20.	Design Phases Pre-construction
Low Frequency Penalty / Tonal noise penalty	Assess specified equipment to determine whether low frequency or tonal noise penalties apply. If relevant, further mitigation may be required to achieve project trigger levels.	Design Phases Pre-construction
Critical Power Failure Noise	As noted in the criteria section, it is not feasible or reasonable to achieve a noise criterion for the rare event of a critical power failure. However, this should be confirmed with the state authority.	Design Phases

Table 6-20 Mitigation measures included in noise impact assessment

Item	Mitigation	Comments/Assumptions
Air cooled chillers	1. Vertical perimeter noise wall above roof deck which support the chillers up to RL 130 m 2. A solid horizontal acoustic baffle between top of chillers. The air-cooled chiller design sound power level must be such that the overall site noise levels are below the PNTLs for the back-up power testing and standard operation scenarios under noise enhancing meteorological conditions.	Indicative sound power levels used in the model (Table 6-7) are as provided by the prospective manufacturer and consider the use of quieter fans.
Generators – All buildings	Enclosed in custom acoustic rooms/containers fitted with exhaust silencers, rectangular attenuators and sound absorbing lining for the exposed walls (approx. 50 to 70% area) of the generator room such that the overall noise levels from the site does not exceed the PNTLs for the back-up power testing scenario under noise enhancing meteorological conditions. Further the mitigation should sufficiently address factors such as low frequency and tonality if present.	Final attenuation requirements will be confirmed during the detailed design phase as the design develops further.

Item	Mitigation	Comments/Assumptions
Load bank	Quieter selection of load bank should be used as feasible and reasonable. To prevent exceedances of noise above the PNTLs, a solid wall (floor to floor) needs to be installed adjacent to the car park. See figure below with noise walls shown in red. 	In order to limit the noise contribution from these units, the sound power levels must be equal to or below the levels stated in Table 6-7.
OAP rooms	The location and noise levels within the OAP rooms are currently unknown. These rooms are expected to be louvred and suitable rectangular attenuators are indicatively required to attenuate noise breakout from ventilation openings at the FOH OAP's such that the overall noise levels from the site does not exceed the PNTLs for the standard operations or back-up power testing scenario under noise enhancing meteorological conditions.	Final attenuation requirements will be confirmed during the detailed design phase as the design develops further. In order to limit the noise contribution from these units, the sound power levels must be equal to or below the levels stated in Table 6-7.
Rooftop fans	The design has not currently progressed to a level of detail which identifies the location, number and specifications of the rooftop fans. These will need to be appropriately treated such that the PNTLs are not exceeded.	

Item	Mitigation	Comments/Assumptions
Heavy vehicle movements	To reduce the impacts to the Nukids childcare centre, the heavy vehicle route needs to be modified if feasible and reasonable. Where practicable, ensure trucks are turned off while being loaded / unloaded. 	-

7 Road traffic noise assessment

7.1 Traffic noise criteria

The Road Noise Policy, RNP [6] provides traffic noise criteria for residential and non-residential land uses affected by additional operational traffic on the public road network.

The RNP states that any increase in the total traffic noise levels should be limited to 2 dB above the existing road traffic noise levels, as an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. This applies for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments.

To assess noise impacts that may result in from off-site operational road traffic noise, an initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2 dB with the addition of the traffic generated by the project.

Where traffic increases the existing road traffic noise levels by more than 2 dBA, then further assessment against the RNP road traffic noise criteria for residential and non-residential as summarised in Table 7-1 and Table 7-2, respectively, is required.

Table 7-1 Road traffic noise assessment criteria for residential land uses

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

Table 7-2 Road traffic noise assessment criteria for non-residential land uses

Existing sensitive land use	Assessment criteria, dB(A)		Additional consideration
	Day (7am – 10pm)	Night (10pm – 7am)	
School classrooms	L _{Aeq} , (1 hour) 40 (internal) when in use	-	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2. Hospital 2107:2000 (Standards Australia 2000).
Hospital wards	L _{Aeq} , (1 hour) 35 (internal)		
Places of worship	L _{Aeq} , (1 hour) 40 (internal)		The criteria are internal, i.e. the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship.

Existing sensitive land use	Assessment criteria, dB(A)		Additional consideration
	Day (7am – 10pm)	Night (10pm – 7am)	
Open space (active use)	L _{Aeq} , (15 hour) 60 (external) when in use	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.
Open space (passive use)	L _{Aeq} , (15 hour) 55 (external) when in use	-	
Isolated residences in commercial or industrial zones	-	-	For isolated residences in industrial or commercial zones, the external ambient noise levels can be higher than those in residential areas.
Mixed use development	-	-	Each component of use in a mixed-use development should be considered separately.
Childcare facilities	Sleeping rooms L _{Aeq} , (1 hour) 35 (internal) Indoor play areas L _{Aeq} , (1 hour) 40 (internal) Outdoor play areas L _{Aeq} , (1 hour) 55 (external)	-	Multi-purpose spaces, e.g. shared indoor play/sleeping rooms should meet the lower of the respective criteria.
Aged care facilities	-	-	Residential land use noise assessment criteria should be applied to these facilities.

In addition to the assessment criteria outlined in Table 7-1 and Table 7-2, any increase in the total traffic noise level at a location due to a proposed project must be considered. Where existing traffic noise levels are above the noise assessment criteria, Section 3.4 of the RNP outlines that the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria.

7.2 Road traffic noise assessment

The primary frontage of the site is to Brookhollow Avenue, where vehicular access is provided. Existing roads associated with the proposed operational traffic route, as indicated in Figure 7-1, are as follows:

- Brookhollow Avenue – Local Road
- Norwest Boulevard – State Road
- Windsor Road – State Road
- Old Windsor Road – State Road

To understand the current traffic volumes on roads along the operational traffic route, baseline traffic data have been extracted from Traffic Impact Assessment (prepared by ptc., dated February 2025) for Norwest

Metro Station Site Development Stage 1 (DA no.: 908/2025/JP). It should be noted that no relevant baseline traffic data for Norwest Boulevard (between Old Windsor Road and Brookhollow Avenue) and Old Windsor Road (north and south of Norwest Boulevard) is available. For the purpose of initial screening test for operational road traffic noise assessment, only road segments with available traffic data are considered. Volumes of baseline traffic volumes on existing roads surrounding the site are provided in Appendix D.

7.2.1 Construction road traffic

It is anticipated that deliveries to site during construction will be via Windsor Road, Norwest Boulevard and Brookhollow Avenue.

Full details of the likely numbers of deliveries expected per day during construction is not available at this stage, and similarly a detailed construction traffic study for the site has not been received for review. Further review of the expected increase in road traffic will be required as part of the detailed construction noise assessment / Construction Noise and Vibration Management Plan (CNVMP). However, it is anticipated that only a few deliveries will occur over the course of the day and as such, the likelihood of a significant noise impact from construction is low.

When construction traffic data is available, a screening test will be undertaken to determine whether a further assessment against the RNP road traffic noise criteria is required.

7.2.2 Operational road traffic

The 2 dB screening test has been conducted using the available day and night traffic flow data for all road segments. The nearest sensitive receiver to each road segment has been chosen for assessment. Road traffic noise levels have been estimated based on the road noise emission and propagation algorithm Calculation of Road Traffic Noise (CoRTN).

The operational traffic routes and the identified nearest sensitive receivers are shown in Figure 7-1. Volumes of the estimated traffic generated by the Project on existing roads surrounding the site are provided in Appendix D. The predicted operational road traffic noise levels are summarised in Table 7-3. As seen, the predicted increases in road traffic noise levels are no more than 0.4 dB(A) and 0.3 dB(A) at all road segments during day and night periods, respectively. Therefore, it is anticipated that the additional traffic generated by the Project will have negligible effects on the existing road traffic noise levels on the surrounding road network, and no further assessment is required.



Legend

Site Boundary

Roads

Primary road

Tertiary

Secondary

Secondary link

Road, residential, living street, etc.

Cycleway, footpath etc.

Receivers - road noise

Residential

Commercial

Hotel

Childcare



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



1:9,994

on A4

Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Operational traffic routes

Figure 7-1 Operational traffic routes

Table 7-3 Operational road traffic noise impact assessment results

Road	Segment	Identified nearest sensitive receiver		Approximate Distance from Road, m	Predicted noise levels (without Project), dB(A) ^{1 2}		Predicted noise levels (with Project), dB(A) ¹		Difference in noise level, dB(A) ¹	
		Receiver ID	Receiver address		Day	Night	Day	Night	Day	Night
Brookhollow Avenue ³	West of access point	R01	1/23 Brookhollow Ave, Norwest NSW 2113	20	55.8 L _{Aeq,1h}	54.2 L _{Aeq,1h}	56.1 L _{Aeq,1h}	54.5 L _{Aeq,1h}	0.3	0.3
	East of access point	R02	14 Brookhollow Ave, Norwest NSW 2153	25	54.9 L _{Aeq,1h}	54.0 L _{Aeq,1h}	55.3 L _{Aeq,1h}	54.2 L _{Aeq,1h}	0.4	0.2
Norwest Boulevard ⁴	Between Brookhollow Avenue and Windsor Road	R03	1 Columbia Ct, Norwest NSW 2153	30m from eastbound 45m from westbound	63.8 L _{Aeq,15h}	55.2 L _{Aeq,9h}	63.8 L _{Aeq,15h}	55.2 L _{Aeq,9h}	0.0	0.0
Windsor Road ⁴	North of Norwest Boulevard	R04	3 Stone Mason Dr	30m from northbound 40m from southbound	64.0 L _{Aeq,15h}	55.7 L _{Aeq,9h}	64.0 L _{Aeq,15h}	55.7 L _{Aeq,9h}	0.0	0.0
	South of Norwest Boulevard	R05	92-100 Barina Downs Rd	30m from northbound 40m from southbound	63.1 L _{Aeq,15h}	54.9 L _{Aeq,9h}	63.1 L _{Aeq,15h}	54.9 L _{Aeq,9h}	0.0	0.0

Notes:

[1] All numbers have been rounded to one decimal place in accordance with the RNP.

[2] Road traffic noise levels were predicted based on traffic volume data shown in Appendix D.

[3] $L_{Aeq(1hour)}$ was considered as Brookhollow Avenue is a local road in accordance with the RNP. For this assessment, the available baseline traffic peak hour volumes for Brookhollow Avenue are used. As a conservative approach, the total Project AM and PM peak hourly flows are used to calculate traffic noise levels at both R01 and R02.

[4] $L_{Aeq(15hour)}$ and $L_{Aeq(15hour)}$ were considered as Norwest Boulevard and Windsor Road are aerial roads in accordance with the RNP. The available daytime 15-hour traffic flow and night 9-hour traffic flow were normalised to 18-hour traffic flow for noise predictions using the CoRTN methodology.

8 Airborne construction noise assessment

8.1 Approach

The approach provided in the ICNG has been utilised to assess the noise from the construction activities:

- Identifying sensitive land uses that may be affected. Section 5.3 provides details on the sensitive land uses / receivers.
- Identifying hours for the proposed construction works. Chapter 8.4 provides details on the hours of construction and the duration of construction.
- Assessing noise impacts at sensitive land uses. Section 8.90 provides details on the construction noise impacts compared against the relevant noise management levels in Section 8.7. In accordance with the ICNG, the quantitative method has been chosen since the duration of the Proposal occurs longer than 3 weeks.
- Selecting and applying suitable work practices to minimise noise impacts as described in section 8.10.

8.2 Descriptors

To assess the construction noise, the $L_{Aeq, 15\text{-minute}}$ metric has been used to assess the continuous noise.

The $L_{Aeq, 15\text{minute}}$ metric is appropriate because it can be used to describe:

- Continuous noise level from operation of each piece of equipment separately, and levels can be aggregated to represent the cumulative noise level from all equipment operating during a given period.
- Noise level during an entire phase.
- Average noise over all phases of the construction.

The L_{Amax} metric is appropriate to describe impact noise during night-time works. No night-time construction works are anticipated for this Project.

8.3 Calculation methodology and assumptions

Assessment of construction works has been approached using a desktop-based calculation method to provide an estimate of construction noise levels.

This approach considers the following for each phase of construction:

- Each phase has a schedule of specific equipment and activities depending on the work to be accomplished during that phase.
- As a result of the schedule of equipment, each phase has its own noise characteristics; some phases have higher continuous noise levels than others, and some have higher impact noise levels than others.
- For each phase, the sound power level of each item of equipment in the equipment schedule are added together logarithmically to provide a representative cumulative noise level and accounted for the following:
 - Sound power level of each equipment.
 - Usage factors to account for the fraction of time that the equipment is in use over the specified time period.
 - Distance from receiver to the piece of equipment.
- Each phase is modelled as an area source with the cumulative sound power level to predict the noise at the nearest sensitive receivers.

8.4 Proposed hours of work

The proposed construction working hours for this Project are:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm Saturday
- No work anticipated on Sundays and public holidays.

No works are expected to occur outside standard hours of work. If any activities, such as oversized over-mass (OSOM) deliveries, are required to take place outside of the standard hours of work, approval from the relevant authorities will be sought in advance.

8.5 Construction staging and scenarios

Detailed construction information is not available at this stage of the project. Construction activities are assumed based on data from comparable data centre projects, as recommended by the construction team and endorsed by the client. As such, the construction noise predictions are indicative and are anticipated to be updated during the detailed design phase of the Project.

The total construction period is anticipated to take up to 36 to 48 months, where five key construction activities are likely to take place:

- **Activity 1:** site establishment – activities include upgrading and/or construction of the access and internal access roads, laydown area(s), fencing and construction facilities including site office and amenities. This phase also includes site enabling works including relocation and removal of existing services.
- **Activity 2:** Civil and earthworks – site preparation including clearing of vegetation such as tree removal, ground clearing, shallow excavation and other ground disturbance activities including concrete slab construction and gravel laying
- **Activity 3:** Structure works – infrastructure construction including building structure, new drainage, drainage upgrades, laying of cabling and collector units, security fencing, lighting and other ancillary infrastructure
- **Activity 4:** Fit out works – internal area fit-out. This phase also includes fit-outs in external facing areas.
- **Activity 5:** Plant installation & commissioning – installation of equipment and their commissioning

The modelled construction noise scenarios corresponding to the activities are outlined in Table 8-1.

Table 8-1 Modelled construction noise scenarios

Scenario ID	Area of construction	Description
S1	Entire site area	Site establishment in area
S2	Entire site area	Civil and earthworks
S3a	Building B & gantry	Structure work
S3b		Fit-out work
S3c		Commissioning
S4a	Building C & gantry	Structure work
S4b		Fit-out work
S4c		Commissioning
S5a	Building D & gantry	Structure work

Scenario ID	Area of construction	Description
S5b		Fit-out work
S5c		Commissioning

8.6 Plant and Equipment Noise Sources

Table 8-2 provides the noise generating plant assumed for the construction scenarios and their sound power levels (L_w). The anticipated activities and plant have been provided by the project team based on experience of similar previous construction projects. Equipment sound power levels used in the construction noise assessment have been sourced from:

- Department for Infrastructure and Transport (2021). Guideline for the Management of Noise and Vibration: Construction and Maintenance Activities.
- Transport for NSW (2023), Construction Noise and Vibration Guideline.

The usage factor factors have been referenced based on guidance in the Federal Highway Administration (FHWA) Construction Noise Handbook and indicates the percentage of time that the construction equipment is operational for during the assessment period. A 5 dBA penalty has been applied to the sources which are expected to have annoying characteristics such as excavator with hydraulic hammer, vibratory roller, saw cutting and jackhammer.

Table 8-2 Sound power levels for plant items and construction equipment

Construction Scenario ID	Plant Item	Sound power level per item, dB(A)	Number of items operational in worst-case 15-minute period	Usage factor ¹ (%)	Total Activity L_{wT} dB(A)
S1	Franna crane (40 tonnes)	98	1	20%	111
	Forklift (diesel)	106	1	50%	
	Truck (>20 tonne)	108	2	40%	
	Truck (water cart)	107	2	40%	
	Vehicle (light commercial e.g. 4WD)	103	2	10%	
	Roller (Smooth-drum)	107	1	20%	
S2	Backhoe loader	111	1	40%	126
	Compactor	106	1	20%	
	Concrete mixer truck (Trowel)	109	2	100%	
	Franna crane	98	2	20%	
	Excavator (30t) + bucket attachment	110	2	40%	

¹ Based on Federal Highway Administration (FHWA) Construction Noise Handbook

Construction Scenario ID	Plant Item	Sound power level per item, dB(A)	Number of items operational in worst-case 15-minute period	Usage factor ¹ (%)	Total Activity L _w , dB(A)
	Excavator (30t) + hydraulic hammer	127	2	20%	
	Loader (Front-end) - 23t	112	1	40%	
	Grader	113	1	100%	
	Jack Hammer	113	1	20%	
	Roller (vibratory)	114	1	20%	
	Roller (Smooth-drum)	107	1	20%	
	Pavement laying machine	114	1	50%	
	CFA & Bored Piling Rig.	112	2	20%	
	Scraper	113	1	40%	
	Ground anchor rig	111	1	20%	
	Truck (>20 tonne) - medium rigid	103	2	40%	
	Truck (water cart)	113	1	40%	
	Vehicle (light commercial e.g. 4WD)	103	2	10%	
S3a, S3b, S3c	Concrete pump	109	2	100%	121
	Tower Crane (Crane fixed)	113	2	100%	
	Backhoe loader	111	1	40%	
	Loader (Front-end)	112	1	40%	
	Concrete mixer truck	109	2	100%	
	Franna crane	98	1	20%	
	Forklift (diesel)	106	1	50%	
	EWP	97	2	20%	
	Concrete saw	93	1	20%	
	Grinder	105	1	50%	
	Handheld power tools	110	1	50%	
	Concrete trowels	109	2	100%	

Construction Scenario ID	Plant Item	Sound power level per item, dB(A)	Number of items operational in worst-case 15-minute period	Usage factor ¹ (%)	Total Activity L _w , dB(A)
	Jack Hammer	113	1	20%	
	Vehicle (light commercial e.g. 4WD)	103	2	10%	
	Truck (water cart)	107	1	40%	
	Truck (>20 tonne)	103	1	40%	
S4a, S4b, S4c	Franna crane	98	1	20%	115
	Tower Crane (Crane fixed)	113	1	100%	
	Forklift (diesel)	106	1	50%	
	EWP	97	1	20%	
	Concrete saw	93	1	20%	
	Grinder	105	1	50%	
	Handheld power tools	110	1	50%	
	Vehicle (light commercial e.g. 4WD)	103	2	10%	
	Truck (>20 tonne)	108	1	20%	
S5a, S5b, S5c	Franna crane	98	1	20%	114
	Tower Crane (Crane fixed)	113	1	100%	
	EWP	97	1	20%	
	Handheld power tools	110	1	50%	
	Vehicle (light commercial e.g. 4WD)	103	1	10%	
	Truck (>20 tonne)	108	1	20%	

8.7 Computational noise model

A high level computational noise model was developed for the site to predict environmental noise emissions from the Project during its construction phases. Noise emissions for the Project were calculated using the CONCAWE noise propagation model within SoundPLAN noise software (version 9.1). The calculations incorporate the following:

- Noise attenuation over distance
- Atmospheric absorption
- Ground effects

- Source-height effects
- Shielding or screening from buildings, terrain and noise walls
- Meteorological effects

8.7.1 Key parameters and assumptions

Table 8-3 indicates the key parameters and assumptions for the noise modelling.

Table 8-3 Parameters and assumptions for the computational noise modelling

Parameter	Comment
Calculation algorithms	Industrial noise – predictions for the noise from construction plant and equipment have been computed using the CONCAWE noise propagation model.
Terrain	5 m contours were extracted from the Digital Elevation Model (DEM) available from Geoscience Australia via Elvis Elevation and Depth . Project civil ground contours were provided by the architect for the project.
Buildings	Building information such as addresses, outlines and the heights were obtained from Open Street Maps. Where this data was not available, building outlines were hand-drawn and approximate heights were used for the buildings based on the number of storeys.
Ground Absorption	Ground absorption factor was set to 50% for the entire study area.
Sound Power Levels	Sound power levels are as presented in Table 8-2.
Source heights	Assumed as 1.5m above ground level.
Receiver heights	1.5 m for single storey buildings and 4.5 m for 2 storey buildings and increments of 3m for high rise apartments.
Reflection for buildings ¹	1 dB reflection loss with 3 orders of reflection.
Receiver location	Receivers have been placed 30 m within the boundary of the dwelling and in free field.
Period of construction	Standard hours of construction
Period of assessment	The worst-case 15-minute period has been assessed for standard hours (day period).

¹ Reflection loss is the loss of energy occurring at each reflection of sound waves off an object. The magnitude of the loss depends on the material of the wall, the impact angle, the frequency, and the size of the wall.
For sound-reflecting surfaces i.e., buildings, a reflection loss of 1.0 dB per reflection is generally assumed (corresponds to an absorption factor α of 0.21). This flat-rate factor includes scattering losses that occur in structured facades due to windows, balconies, etc.

Parameter	Comment
Meteorological conditions	Standard meteorological conditions have been assumed for the assessment period. Source-to-receiver wind vectors have been considered for all receivers with the following stability category and wind speed: <i>Standard meteorological conditions:</i> - Day / evening / night – stability category D with wind speed up to 0.5 m/s at 10 m AGL. <i>Other conditions:</i> - Relative Humidity: 70% (day) - Temperature 20°C (day) - Air Pressure 101.3 kPa.

8.8 Criteria for construction noise

8.8.1 Proposal construction noise management levels

Recommended construction noise management levels (NMLs for residential receivers, based on the ICNG and the calculated RBLs (refer to 5.4.2) are summarised in Table 8-4. The NMLs represent a noise level that, if exceeded, would require management measures including the following:

- Reasonable and feasible work practices
- Contact with residences to inform them of the nature of works to be carried out, the expected noise levels and durations and contact details.

Table 8-4 provides the Proposal-specific construction NML's based on the guidance provided in the ICNG.

The noise affected level (NAL) represents the point above which there may be some community reaction to noise. The highly noise affected level (HNAL) represents the point above which there may be strong community reaction to noise.

For residential receivers, the noise management levels are calculated as follows:

Recommended standard hours:

- Noise affected - **RBL + 10 dB**
- Highly noise affected - **75 dB(A)**

Where noise from construction works is above the 'noise affected' levels presented below, the proponent should apply all feasible and reasonable work practices to minimise noise. Management measures aim to reduce noise impacts on the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level.

Table 8-4 Proposal-specific Construction Noise Management Levels (NMLs)

Receiver NCA	Applicable Logger Location	Recommended standard hours NML ^{1 2} (Noise affected level), LAeq(15min) dB	Highly affected NML, LAeq(15min) dB
NCA C1, C2, C3, C4	-	70	-
NCA MX1 – Zone 1	L5 – C210	61	75
NCA MX1 – Zone 2	L5 – A703	61	75
NCA MX1 – Zone 3	L5 – A1803	64	75

Receiver NCA	Applicable Logger Location	Recommended standard hours NML ^{1 2} (Noise affected level), L _{Aeq(15min)} dB	Highly affected NML, L _{Aeq(15min)} dB
NCA MX2	-	45 (internal) 55 (external)	75
NCA R1	L1	54	75
NCA R2	L2	48	-
NCA R3i	L3	50	75
NCA R3ii	L3	50	75
NCA R4	L4	53	-
NCA-CH1	-	45 (internal) 55 (external)	-
NCA-H1 ³	L3	50	75
NCA-H2 ³	L4	53	75
NCA-PoW	-	45 (internal) 55 (external)	75
NCA-Hos	-	45 (internal) 55 (external)	-

Notes:

[1] Recommended standard hours of construction as per ICNG.

[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.

[3] Assumed to be residential due to the end use.

8.8.2 Proposal sleep disturbance criteria during construction

All construction works associated with the Proposal are expected to be undertaken during the following standard hours of work:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm Saturday

No construction works are expected to take place during evening and night-time hours. If any activities, such as oversized over-mass (OSOM) deliveries, are required to take place during night-time hours, sleep disturbance noise impacts should be assessed against the relevant policies and guidelines including ICNG, RNP and NPfl.

8.9 Results

Construction noise was assessed for the 11 scenarios described in Table 8-1. The predicted construction noise levels are presented in Table 8-5. A map of the sensitive receivers are shown in Figure 5-2.

Residential receivers (MX1, R1 to R4, H1 to H2)

Predicted noise levels indicate that the NML for standard hours of work is likely to be exceeded at all nearest sensitive receivers during most construction phases. The highly affected NML is unlikely to be exceeded at the nearest sensitive receivers.

Commercial receivers (C1 to C4)

Predicted noise levels indicate that the NML for standard hours of work is likely to be exceeded at C2 to C4 for some of the construction phases particularly Phase 2.

Other non-residential receivers (MX2, CH1, POW, HOS)

Predicted noise levels indicate that the NML for standard hours of work is likely to be exceeded at MX2 and CH1 during all construction phases, and POW and HOS at all construction phases except Phase 1. Highest noise exceedances at CH1 are expected due to its close proximity to the Stage 2 construction footprint. Feasible noise mitigation measures should be implemented to minimise noise impacts on the receivers.

Table 8-5 Predicted worst-case construction noise levels

Receiver NCA	ICNG Noise Management Levels, $L_{Aeq,15min}$		Predicted noise levels, $L_{Aeq,15min}$ dB										
	Standard hours of work noise affected level	Highly affected level	Phase 1: Site Establishment	Phase 2: Civil & earthworks	Phase 3: Structure works			Phase 4: Fit-out works			Phase 5: Installation & Commissioning		
			S1	S2	S3a	S3b	S3c	S4a	S4b	S4c	S5a	S5b	S5c
C1	70	-	52	66	61	55	54	63	57	56	61	54	53
C2	70	-	61	75	70	64	63	71	65	64	69	63	62
C3	70	-	59	73	66	60	59	67	61	60	71	65	64
C4	70	-	59	73	67	61	60	69	63	62	69	64	63
MX1	61	75	38	52	44	38	37	47	41	40	50	44	44
MX2	55	-	57	71	63	57	56	64	58	57	69	63	62
R1	54	75	29	43	45	39	38	38	32	31	37	32	31
R2	48	75	45	59	54	48	47	56	50	49	55	48	47
R3i	50	75	38	52	45	39	38	45	39	39	49	44	43
R3ii	50	75	55	69	63	57	56	63	57	56	66	60	59
R4-1	53	75	30	44	39	33	32	39	33	32	41	36	34
R4-2	53	75	41	55	55	49	48	55	49	48	48	41	40

Receiver NCA	ICNG Noise Management Levels, $L_{Aeq,15min}$		Predicted noise levels, $L_{Aeq,15min}$ dB										
	Standard hours of work noise affected level	Highly affected level	Phase 1: Site Establishment	Phase 2: Civil & earthworks	Phase 3: Structure works			Phase 4: Fit-out works			Phase 5: Installation & Commissioning		
			S1	S2	S3a	S3b	S3c	S4a	S4b	S4c	S5a	S5b	S5c
CH1	55	-	60	74	67	61	60	69	63	62	71	65	64
H1	50	75	58	72	68	62	61	69	63	62	67	60	59
H2	53	75	53	67	61	55	54	61	54	54	64	58	57
POW	55	-	20	34	30	24	23	30	24	23	31	25	24
HOS	55	-	40	54	53	47	46	50	44	43	47	40	40

Note: Noise exceedances are highlighted as follows:

-  dotted cell indicates exceedance above the highly affected level.
-  shading indicates exceedance above the standard hours of work noise affected level.

8.10 Discussion and recommendations

It should be noted that these predicted levels are worst-case as they assume that all equipment for each construction scenario will be in use simultaneously. In addition, these predictions are made with the construction activity at the closest location to the receivers. Noise levels may therefore be reduced when activity is further away and less equipment is in use as per the construction schedule.

Based on the assessment, noise resulting from the construction of the project may exceed the ICNG construction noise affected levels during certain activities at the sensitive receivers. Therefore, a noise management plan will need to be developed and implemented for the site, which includes close communication with affected residents.

All relevant feasible and reasonable work practices, and appropriate noise control measures should be implemented to limit exposure for all receivers surrounding the site. Recommended standard construction mitigation measures are provided below.

Table 8-6 Recommended noise mitigation measures

Aspect	Mitigation measures: remedial actions, work practices and complaints handling	Timing
Construction Noise	The predicted level exceeds the noise management level and as per the ICNG a construction noise and vibration plan shall be developed to reduce the impacts of noise and vibration during construction at the nearby residential properties as much as is practical. All potentially impacted residents shall be informed of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. The highly noise affected level is exceeded during some construction stages which may create a strong community reaction to noise. As per the ICNG, the relevant authority (consent, determining or <i>regulatory</i>) <i>may require respite periods by restricting the hours that the very noisy activities can occur, considering:</i> times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. It is preferred to schedule OSOM movements during 7am to 10pm. If OSOM deliveries need to occur during the night hours (specifically, 10pm to 7am), an initial screening assessment should be carried out. If necessary, this should be followed by a detailed assessment of the maximum noise levels.	Pre-construction Construction

8.10.1 Standard construction noise and vibration mitigation measures

Table 8-7, Table 8-8, Table 8-9 and Table 8-10 below show standard noise mitigation measures that should be considered when planning any construction activity. The tables are separated into works planning and implementation stages. These noise controls are in addition to the measures and controls mentioned in the previous sections.

Not all the issues and associated mitigation measures will directly apply to every construction and maintenance activity. It is the responsibility of the contractor to identify which of the suggested mitigation measures apply to their particular construction or maintenance project.

Table 8-7 Noise controls at Project-specific works scheduling stage

Works feature	Action required
All works	Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver. Ensure noisy plant schedules are clear in Works Plan.
Any time: High noise and vibration generating activities (Includes, but not limited to, jack and rock hammering, sheet, rock breaking and vibratory rolling)	Only carry out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block ("Continuous" includes any period during which there is less than a 60 minutes respite between ceasing and recommencing any of the work)
All works	Schedule deliveries to nominated hours only. Schedule OSOM movements during 7am to 10pm only

Table 8-8 Noise controls at works planning stage: plant and methods

Works feature	Action required
Fabrication work involved	Carry out noisy fabrication work at another site (for example, within enclosed factory premises) and then transport to site.
Generators to be used on site	Use mains power supply rather than use generators. Switch off generators when not in use, particularly during out of hours work / peak customer use for station works. Locate generators away from residences and behind structure that could provide acoustic shielding. Use one larger generator to power multiple plant items (ensuring safe cabling). Use mobile noise curtains around generators. Mark location of Mains power and generators on Site Plan.
Reversing alarms ("beepers") on site(including entry/exit from site)	Install less annoying non-tonal broadband 'quacker' reversing
Small or hand held plant	Use mobile noise curtains to shield from sensitive receivers
Metal chutes to be used	Reduce noise from metal chutes and bins by placing damping material in the bin.
Delivery vehicles	Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.

Table 8-9 Noise controls at site planning stage: vehicle access, parking and site preparation.

Works feature	Action required
All works requiring road or rail vehicle material transportation	Minimise disturbance arising from delivery of goods to construction sites
All works requiring road vehicle material transportation	Reduce the number of vehicle trips to and from the site – organise amalgamated loads rather than using a number of vehicles with smaller loads. Show material transport plans in Works Schedule
	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Loading/unloading areas to be shielded if close to sensitive receivers

Works feature	Action required
	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site, such as by including drive-through for parking and deliveries. Show traffic flow, loading/unloading areas on site Plan
	Select site access points and roads as far as possible away from sensitive receivers.
All works requiring road truck access.	Nominate an off-site truck parking area, away from residences, for trucks arriving prior to gates opening.

Table 8-10 Noise Controls at Site Planning Stage: Plant Location and Landform

Works feature	Action required
All works	Place as much distance as possible between the plant or equipment and residences and other sensitive land uses.
All works	Restrict areas and times in which mobile plant can operate so that it is away from residences and other sensitive land uses.
All works	Direct noise-emitting plant away from sensitive receivers.
All works, particularly noisy out of hours	Where possible, place fixed equipment, behind earth bunds, site sheds, solid fencing, nearby buildings.
All works, particularly noisy out of hours	Keep noisy equipment away from large flat, hard surfaces (which may increase reflected noise levels)
Long duration >3 weeks, and / or "highly affected" out of hours	Use temporary site buildings and materials stockpiles as noise barriers.
Long duration >3 weeks, and / or "highly affected" out of hours	Where feasible and reasonable, use temporary barriers from hoarding (noise curtains, plywood boards or proprietary products eg Flexshield Sonic Acoustic Curtains, Echo Barrier, RVT Group Soundex Temporary Acoustic Barriers, Acoustica Acoustiflex SQ flexible barriers or similar) with no gaps between the panels at the site boundary or around the work area, specifically to shield the sensitive receivers located east and south of the site. The temporary noise barriers should be at least 3m in height and a weighted sound reduction index of at least Rw 27. Erect temporary noise barriers before work commences.
High noise stationary plant (over 80 dBA at 10 m)	Shield / enclose stationary noise sources such as pumps, compressors, fans etc, using noise curtains, solid plywood, or temporary acoustic tents. May need additional absorptive materials facing the noisy plant. Ensure that the occupational health and safety of workers is maintained.

9 Construction Vibration Assessment

9.1 Methodology

In case of outdoor works, vibration is generated when energy from equipment is transmitted into the ground and is generally attenuated with distance. The vibration level of a source is inversely proportional to the distance between the source and receiver. The magnitude and attenuation of ground vibration is dependent on the following:

- The ground type and topography.
- The stiffness of the medium transmitting the vibration impacts.
- The efficiency of the energy transfer mechanism of the equipment (i.e. impulsive, reciprocating, rolling or rotating equipment).
- The frequency content.
- The type of wave (surface or body).

Due to the above factors, there is inherent variability in ground vibration predictions without site-specific measurement data. Nonetheless, existing research data has been used to predict the vibration levels during certain vibration intensive tasks to obtain an estimate.

Typical rate of vibration attenuation can be calculated from the following regression analysis formula:

$$PPV_{equipment} = PPV_{ref} \left(\frac{D_{ref}}{D_{equipment}} \right)^n$$

Where,

PPV_{ref} = reference Peak particle velocity (PPV in m/s) at D_{ref} metres

$D_{equipment}$ = distance from the equipment to the receiver in m

n = site attenuation exponent = 1.1 for the construction works area assumed to be hard soils - dense compacted sand, dry consolidated clay, some exposed rock (need a pick to break up). Table 9-1 shows typical values of n for various types of soils and Figure 9-1 shows the variation of the PPV against the distance from the source for various values of n . It can be seen that, $n=1$ provides a conservative value for the PPV.

Table 9-1 Typical values of the site attenuation exponent n

Description of soil material	n , slope or attenuation rate or composite value for geometric and material damping
Weak or soft soils: loose soils, mud, loose beach sand, dune sand, recently ploughed ground, top soil (shovel penetrates easily)	1.4
Competent soils: most sands, sandy clays, gravel, silts, weathered rock (can dig with a shovel)	1.3
Hard soils: dense compacted sand, dry consolidated clay, some exposed rock (need a pick to break up)	1.1
Hard, competent rock: bedrock, freshly exposed hard rock (difficult to break with hammer)	1

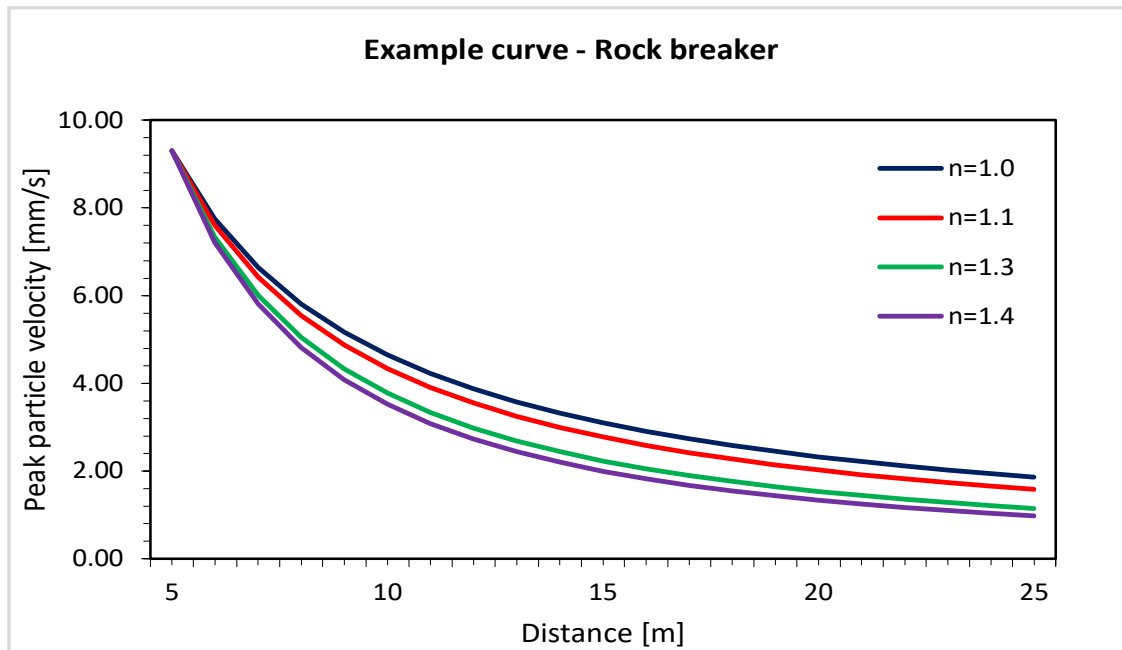


Figure 9-1 PPV for various values of the exponent

The following method as outlined in the RMS Environment Noise Management Manual (ENMM) has been used to assess the impacts due to vibration from the construction equipment:

- Identification of the type of plant and equipment to be used during the construction and their corresponding vibration levels.
- Broad description of the construction activities that are expected to occur (e.g. earthworks)
- Calculate the worst-case vibration impacts for each group of vibration-sensitive receivers taking account of distance corrections and the combined vibration levels of all equipment to be used simultaneously during each activity.
- Take account of the typical duration, timing and frequency of various construction activities, the use of various plant and equipment potentially affecting the vibration-sensitive receivers.
- Evaluate potential construction vibration impacts with reference to a comparison of estimated vibration levels with vibration goals.
- Identify all cost-effective construction noise and vibration control options that could be used to reduce vibration levels towards the goals.

9.2 Limitations and uncertainty

It is assumed that the soil between the construction area and the receivers are made up of hard soils such as dense compacted sand, dry consolidated clay, some exposed rock (need a pick to break up). Hence the assumption of $n = 1.1$ leads to a conservative prediction.

Due to the inherent variability in ground vibration predictions without site-specific measurement data, the vibration assessment is at the best an estimate based on available research at the time of the assessment.

9.3 Proposed vibration criteria

The effect of vibration impacts on buildings and structures can be divided into two categories:

- Human comfort impacts – where the occupants or users of the affected building are possibly disturbed by the construction vibration.
- Cosmetic damage impacts – effects on building contents and cosmetic damage to buildings.

9.3.1 Impacts to human comfort

Construction vibration can adversely affect the amenity of occupants inside buildings as it may affect their quality of life or working efficiency. Human comfort impacts are experienced at levels well below those that can damage or affect a structure and its contents. Though it may not always be possible to comply with the more stringent human comfort criterion during the construction of infrastructure projects near residential dwellings, human comfort should always be used as the objective to aim for and be the basis of assessment.

Guidance in relation to acceptable vibration levels for human comfort are provided in Assessing Vibration a Technical Guideline (AVATG) (Department of Environment and Conservation, 2006), which in turn is based on the guidelines contained in *British Standard BS 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 hertz (Hz) to 80 Hz)*. Although a new version of BS 6472 has been published in 2008, AVATG still references the 1992 version of this standard and the EPA still advises vibration to be assessed in accordance with this version of the standard.

AVATG classifies vibration as one of three types:

- Continuous – where vibration occurs uninterrupted and can include sources such as machinery, constant road traffic and continuous construction activity such as tunnel boring machine.
- Impulsive – where vibration occurs over a short duration (typically less than two seconds) and occurs up to three distinct events during an assessment period. This may include activities such as occasional dropping of heavy equipment, occasional loading / unloading activities.
- Intermittent – occurs where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, impact pile driving, pavement breakers, jack hammers, forging machines, trains, passing heavy vehicle.

In the case of this Proposal, the type of construction activities capable of generating vibrations would be classified as “Intermittent”. The vibration limits corresponding to intermittent vibration relevant to the surrounding sensitive receiver types are presented in Table 9-2.

The proposed construction works involve low vibration intensive equipment such as excavators without rock breaker attachment, trenching equipment, trucks and compactors. The closest building from the construction works is about ~50m. At this distance, the vibration impacts from the above-mentioned equipment would be negligible and hence a detailed vibration assessment is not deemed required.

Table 9-2 Human comfort intermittent vibration limits

Receiver type	Assessment Period ¹	Peak particle velocity (PPV) mm/s	
		Preferred	Maximum
Residences	Daytime	8.6	17
	Night-time	2.8	5.6

9.3.2 Cosmetic damage

Vibration transmission from construction activities through the ground can cause vibration in surrounding structures and structure coupled elements (walls, windows, roof etc.). The transmitted vibration energy has the potential to damage and compromise the integrity of a structure as well as increase the risk of damage to building contents.

At present, no Australian Standard exist for the assessment of cosmetic damage caused by vibration. Guidance on limiting vibration values with the potential to cause cosmetic damage is typically referenced from the following national standards:

- German Standard DIN 4150: Part 3 – 2016 Effects of Vibration on Structures (DIN standard).
- British Standard BS 7385: Evaluation and Measurement for Vibration in Buildings Part 2 (BS 7385)

The DIN standard represents more stringent criteria for building damage caused by vibration and has been accepted within NSW. Hence this would be the basis for the vibration assessment for the surrounding buildings in this study.

Buildings

The DIN standard recommends maximum permissible levels of vibration for each axis (x, y or z) that reduce the likelihood of superficial building damage caused by vibration and are presented in Table 9-3 and graphically presented in Figure 9-2.

Table 9-3 Guideline values for short-term vibration on structures

Line	Type of Structure	Peak Particle Velocity (PPV) v _{i, max} , mm/s			Topmost floor, horizontal direction, i = x,y All Frequencies	Floor slabs, vertical direction, i = z All frequencies
		Foundation, all directions, i = x, y, z at a frequency of				
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹		
L1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
L2	Residential dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15	20

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

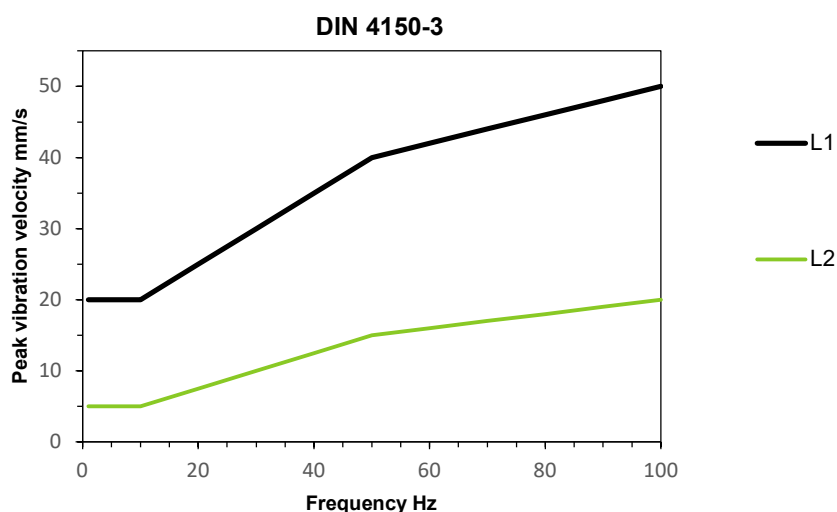


Figure 9-2 Graphical representation of guideline values specified in Table 9-3 for peak particle velocities measured at the foundation

9.4 Construction equipment reference vibration levels

Table 9-4 presents a list of typical PPV levels of vibration intensive construction equipment obtained from various resources.

Table 9-4 Typical vibration levels for vibration intensive construction equipment

Equipment	Reference PPV (mm/s)	Reference Distance (m)	Measured / others	Source	Description / Comments
Jackhammer	0.9	7.6	Measured	FTA	-
Concrete Saw	0.4	10	Measured	NEPA	sawing hard rock, attachment to excavator
Vibratory Roller	5.3	7.6	Measured	FTA	-
Vibratory Roller (CAT CP533E)	2.3	20	Measured	RRL	on high vibratory setting
Vibratory Roller (CAT CS44)	11	5	Measured	NEPA	on high vibratory setting
30t Excavator (rock breaker)	9.3	5	Measured	NEPA	scooping large rocks with spoil
Concrete Pump Truck	1.9	7.6	Others	-	standard concrete pump truck
Compactor	11	5	Measured	RRL	Soil Compactor CAT CS44
Articulated Wheel Loader (Backhoe)	2.9	6	Measured	NEPA	utilising rear digger
Large Excavator	3.6	7.6	Measured	MW	> 30t
Bored Piling Rig	0.9	7.6	Others	-	-
Hydraulic Excavator Volvo EC460BLC	1.8	5	Measured	RRL	excavating with bucket
Crane (Franna)	1.1	15	Measured	NEPA	-
PC 228US Excavator	1.1	5	Measured	NEPA	crawling

Notes:

FTA Federal Transit Administration - Transit noise and vibration impact assessment

NEPA North Eastern Program Alliance - NEPA 1 and 2

RRL Regional Rail Link - Sunshine, Footscray to Deer Park

9.5 Predicted vibration impacts

Based on the expected vibration intensive construction equipment, typical vibration levels (see Table 9-4) and the methodology detailed in Section 9.1, indicative vibration levels have been predicted at set distances and are detailed in Table 9-5. These predicted levels are based on typical ground conditions and provide an

indication of the expected vibration impacts. Predictions have been presented starting at 20 metres, as vibration predictions are not reliable at less than or equal to 5 metres.

Table 9-5 Estimated construction vibration levels

Equipment	Reference PPV, mm/s	Reference distance, m	Estimated PPV at distance to source, mm/s				
			5m	10m	20m	50m	100m
Jackhammer	0.9	7.6	1.4	0.7	0.3	0.1	0.1
Concrete Saw	0.4	10	0.9	0.4	0.2	0.1	0.0
Vibratory Roller	5.334	7.6	8.5	3.9	1.8	0.7	0.3
Vibratory Roller (CAT CP533E)	2.3	20	10.6	4.9	2.3	0.8	0.4
Vibratory Roller (CAT CS44)	11	5	11.0	5.1	2.4	0.9	0.4
30t Excavator (rock breaker)	9.3	5	9.3	4.3	2.0	0.7	0.3
Concrete Pump Truck	1.93	7.6	3.1	1.4	0.7	0.2	0.1
Compactor	11	5	11.0	5.1	2.4	0.9	0.4
Articulated Wheel Loader (Backhoe)	2.9	6	3.5	1.7	0.8	0.3	0.1
Large Excavator	3.6	7.6	5.7	2.7	1.2	0.5	0.2
Bored Piling Rig	0.9	7.6	1.4	0.7	0.3	0.1	0.1
Hydraulic Excavator Volvo EC460BLC	1.8	5	1.8	0.8	0.4	0.1	0.1
Crane (Franna)	1.1	15	3.7	1.7	0.8	0.3	0.1
PC 228US Excavator	1.1	5	1.1	0.5	0.2	0.1	0.0

9.6 Identified assets and receivers

The closest sensitive receivers, such as residences, commercial properties and childcare centres, are located over 45m away from the construction works area, vibration impacts from the construction equipment on existing dwellings would be negligible. Assets in close proximity to the Project's construction footprint, as summarised in Table 9-6, have been identified. It is noted that the Endeavour Energy's 31 kV cable within the site will be removed to accommodate the Project. Also, it is expected that the section of Uecomm's underground cable extending beyond the Stage 1 development will be removed. The minimum separation distance between the Stage 1 development and Stage 2 construction footprint is approximately 5m.

It is anticipated that construction vibrations on the nearby assets and receivers are unlikely, and hence a detailed vibration assessment is not deemed required.

Table 9-6 Summary of identified assets near Project's construction footprint

Assets	Approx. distance from Project construction footprint, m	Status	Potential for vibration impacts
Endeavour Energy's 31 kV cable	~3m	To be removed to accommodate the Project	Unlikely
Uecomm's fibre optic / telecommunication cable	Within the construction footprint of Gantry B	Expected to be removed to accommodate the Project	Unlikely
GreenSquareDC Stage 1	~5m	Existing building structure to be upgraded as Stage 1 of the Project	Potentially

9.7 Safe working distances

Safe working buffer distances are distances below which human comfort or cosmetic damage criteria may be exceeded and have been calculated based on the methodology described in Section 9.1. These distances are the horizontal distance along the ground surface and do not account for the load from the construction equipment. If receivers are located within the safe working buffer distances, they could exceed the vibration criteria. The safe working distances for each equipment are listed in Table 9-7.

The safe working buffer distances are dependent on the equipment that the construction contractor selects and local geotechnical conditions. They apply under the assumption that the soil is made up of hard soils (i.e., dense compacted sand, dry consolidated clay, some exposed rock (need a pick to break up)).

Table 9-7 Safe working buffer distances

Equipment / machinery	Human comfort AVATG / BS 6472 – 1992			Structural damage DIN 4150-3		
	8.6 mm/s	2.8 mm/s	18 mm/s	5 mm/s	20 mm/s	50 mm/s
	Residence - Day	Residence - Night	Commercial properties	Residence	Commercial properties	Pipeline
Jackhammer	1.0 m	2.7 m	0.5 m	1.6 m	0.5 m	0.2 m
Concrete Saw	0.6 m	1.7 m	0.3 m	1.0 m	0.3 m	0.1 m
Vibratory Roller	4.9 m	13.7 m	2.5 m	8.1 m	2.3 m	1.0 m
Vibratory Roller (CAT CP533E)	6.0 m	16.7 m	3.1 m	9.9 m	2.8 m	1.2 m
Vibratory Roller (CAT CS44)	6.3 m	17.3 m	3.2 m	10.2 m	2.9 m	1.3 m
30t Excavator (rock breaker)	5.4 m	14.9 m	2.7 m	8.8 m	2.5 m	1.1 m
Concrete Pump Truck	2.0 m	5.4 m	1.0 m	3.2 m	0.9 m	0.4 m
Compactor	6.3 m	17.3 m	3.2 m	10.2 m	2.9 m	1.3 m

Equipment / machinery	Human comfort AVATG / BS 6472 – 1992			Structural damage DIN 4150-3		
	8.6 mm/s	2.8 mm/s	18 mm/s	5 mm/s	20 mm/s	50 mm/s
	Residence - Day	Residence - Night	Commercial properties	Residence	Commercial properties	Pipeline
Articulated Wheel Loader (Backhoe)	2.2 m	6.2 m	1.1 m	3.7 m	1.0 m	0.5 m
Large Excavator	3.4 m	9.6 m	1.8 m	5.6 m	1.6 m	0.7 m
Bored Piling Rig	1.0 m	2.7 m	0.5 m	1.6 m	0.5 m	0.2 m
Hydraulic Excavator Volvo EC460BLC	1.2 m	3.3 m	0.6 m	2.0 m	0.6 m	0.2 m
Crane (Franna)	2.3 m	6.4 m	1.2 m	3.8 m	1.1 m	0.5 m
PC 228US Excavator	0.8 m	2.1 m	0.4 m	1.3 m	0.4 m	0.2 m

9.8 Mitigation for construction vibration impacts

Based on the assessment, construction footprint of the project is expected to be at least 5m from the nearest sensitive receiver i.e. Stage 1 of the project. Hence the impacts due to vibration is unlikely.

Table 9-8 Recommended noise mitigation measures

Aspect	Mitigation measures: remedial actions, work practices and complaints handling	Timing
Construction Vibration	A summary of safe working distances for construction activities to reduce the likelihood of disturbance and damage is provided in Table 9-7 . These should be used where practical. Where these cannot be achieved, vibration monitoring of activities will be required and alternative approaches which are less vibration intense must be employed to reduce the risk of structural damage at the nearest receivers.	Pre-construction Construction

10 Conclusion

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD -81928961). The assessment considers the construction and operational stages of the development including the noise from the use of back-up power.

Noise and vibration assessment has been undertaken for construction and operation of the proposed data centre with consideration given to the relevant policies, guidelines, standards, and any other relevant documents. Below summarises the key findings of this assessment report.

Key findings of noise and vibration assessment

Ambient noise levels

- Background noise levels at the site and vicinity were recorded through long-term and short-term monitoring.
- Typical ambient noise sources included road noise, residential activities and other noise such as construction and machinery noise.
- Measured background noise levels were representative of the urban and suburban setting of the project area.

Noise criteria

The nearest sensitive receivers to the site have been identified for both construction and operational noise assessment. Noise and vibration criteria at these receivers have been established based on their land uses and the ambient noise levels obtained from long-term and short-term noise monitoring.

Construction noise levels

Construction noise assessment has been undertaken with assumptions made based on comparable data centre projects, as detailed construction information is not available at this stage of the project. Predicted worst-case noise levels indicate that the ICNG noise management levels are exceeded at most nearest sensitive receivers.

Construction vibration assessment

Construction vibration impacts are expected to be negligible at all identified nearest sensitive dwellings. Adherence to the safe working distances is advised for vibration-intensive activities.

Operational noise levels

With integrated mitigation measures (e.g., acoustic barriers, equipment siting, attenuators, custom generator enclosures), predicted noise levels are below the NPfI project noise trigger levels for all identified nearest sensitive receivers under standard operation and back-up power testing. Emergency critical power failure scenarios are rare and not subject to NPfI limits

Operational vibration Assessment

Operational vibration impacts are expected to be negligible at all identified nearest sensitive dwellings.

Cumulative operational noise assessment

Combined noise impacts from Stage 1, mitigated Stage 2, and Stage 3 developments are predicted to remain within NPfI cumulative noise objectives.

Road traffic noise levels

Road traffic noise assessment has been conducted based on the available baseline and development traffic data. Predicted operational road traffic noise levels indicate that the additional traffic generated by the Project will have negligible effects on the existing road traffic noise levels on the surrounding road network, and therefore no further assessment is required. No quantitative construction road traffic noise assessment has been conducted, as construction traffic data is unavailable at the time of this report. Further review of the expected increase in road traffic during construction is required, however, it is anticipated that only a few

deliveries will occur over the course of the day and as such, the likelihood of a significant noise impact from construction is low.

Noise and vibration mitigation measures

Noise and vibration management and mitigation measures for the Project, have been recommended to minimise the noise impacts associated with the construction and operation of the proposed data centre. By adhering to these recommendations, adverse noise and vibration impacts from the Project are unlikely.

11 Bibliography

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Appendix A – Glossary

Table A 1 Abbreviations

Term	Definition
ABL	Assessment background level
AGL	Above ground level
AVATG	Assessing Vibration: A Technical Guideline
CONCAWE	A noise propagation model developed by the European Oil Company Organisation for Environment, Health and Safety (Belgium).
CoRTN	Calculation of Road Traffic Noise
dB	decibel
dB(A)	A-weighted decibel level
dB(C)	C-weighted decibel level
DDA	Disability Discrimination Act 1992
DECC	Department of Environment Climate Change & Water NSW. Currently named as Department of Planning Housing and Infrastructure
DPE	Department of Planning & Environment, NSW
DEFRA	Department for Environment Food and Rural Affairs, UK
DPHI	Department of Planning Housing and Infrastructure
EPA	Environment Protection Authority, NSW
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EV	Electric Vehicle
FID	Final investment decision
GFA	Gross Floor Area
ICNG	NSW Interim Construction Noise Guidelines (2009)
ISO 9613-2:1996	Acoustics: Attenuation of sound during propagation outdoors, Part 2: General method of calculation
MW	Megawatts
MWh	Megawatt hour
NPfl	New South Wales Noise Policy for Industry (2017)
NSW	New South Wales
OSOM	Oversize over mass equipment

Term	Definition
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
PPV	Peak Particle Velocity
RBL	Rating background level

Table A 2 Glossary of acoustic terms

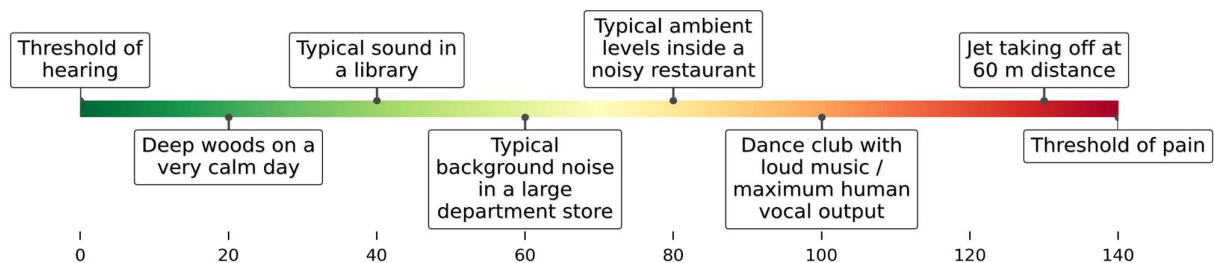
Term	Definition
Assessment Background Level (ABL)	The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time) for each day. It is determined in accordance with the methods described in Fact Sheet B of the Noise Policy for Industry (NSW) by calculating the 10th percentile (lowest 10th percent) background level (LA90) for each period.
Ambient Noise Level	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. Generally measured as a dB(A) noise level.
The Act	Protection of the Environment Operations Act 1997 (POEO)
Background Noise Level	The A-weighted sound pressure level that is exceeded for 90 percent of the measurement period, LA90.
Background relevant area	A noise sensitive area within a rural area where background levels may be higher than usual. This includes areas where freeway or highway traffic is a significant audible background noise source.
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative industrial noise level	The total level of noise from all industrial sources.
Decibel	The decibel is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage, intensity, or other parameters.
dB(A)	The A-weighted sound pressure level in decibels, denoted dB(A) is the unit generally used for the measurement of environmental, transportation or industrial noise. The A-weighting scale approximates the sensitivity of the human ear when exposed to normal levels and correlates well with subjective perception of typical sounds. An increase or decrease in sound level of approximately 10 dB(A) corresponds to a subjective doubling or halving in loudness. A change in sound level of 3 dB(A) is considered subjectively just noticeable and a change of 1 to 2 dB(A) is subjectively not noticeable.
dB (C)	C-weighting is an adjustment made to sound-level measurements that takes account of low-frequency components of noise within the audibility range of humans.
Frequency	The rate of repetition of a sound wave. The unit of frequency is Hertz (Hz), defined as one cycle per second. Human hearing ranges approximately from 20 Hz to 20,000 Hz. Octave bands are the most used frequency bands. For more detailed analysis each octave band may be split into three one-third octave bands or narrow frequency bands.

Habitable Room	Any room of a dwelling or residential building other than a bathroom, laundry, toilet, pantry, walk-in wardrobe, corridor, stair, lobby, photographic darkroom, clothes drying room and other space of a specialised nature occupied neither frequently nor for extended periods.
$L_{Aeq, T}$	The equivalent continuous A-weighted sound pressure level is the value of the A-weighted sound pressure level of a continuous steady sound that has the same mean square sound pressure level as a sound under consideration with a level that varies with time when determined over the same measurement period.
$L_{Aeq, 15min}$ dB	A-weighted energy averaged noise level over a 15-minute period. Used in the EPA Interim Construction Noise Guideline (ICNG).
L_{AFmax}	The maximum sound pressure level of an event measured with a sound level meter satisfying AS IEC 61672.1-2004 set to 'A' frequency weighting and fast time weighting
$L_{A10, 15min}$ dB	The A-weighted sound pressure level that is exceeded for 10% of the 15-minute measurement period.
$L_{A90, 15min}$ dB	The A-weighted sound pressure level measured using fast time weighting that is exceeded for 90% of the time over a 15-minute assessment period. This is a measure of background noise.
$L_{AF90, (day, evening, night)}$ dB	The A-weighted sound pressure level measured using fast time weighting that is exceeded for 90% of the time over a day, evening or night-time assessment period. This is a measure of background noise.
Low frequency	Noise containing major components in the low-frequency range (10 hertz [Hz] to 160 Hz) of the frequency spectrum.
Median	The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value. If there is an even number of values, the median is the arithmetic average of the two middle values.
Meteorological conditions	Wind and temperature-inversion conditions.
Noise	Noise is unwanted, harmful, or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid, or solid.
Noise impact assessment (NIA)	The component of an Environmental Impact Statement, Environmental Assessment, Statement of Environmental Effects, or licence application that considers the impacts of noise resulting from a development or activity.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels which the proponent has predicted can be met during the environmental assessment.
Noise-sensitive land uses	Land uses that are sensitive to noise, such as residential areas, churches, schools, and recreation areas.

Noise catchment area (NCA)	NCAs are areas where receivers have a similar land use and ambient noise environment and are applicable to residential receivers only.
Noise Management Level (NML)	These are the guidance noise levels for airborne noise at sensitive land uses during any construction work as prescribed in the Interim Construction Noise Guideline
Non-compliance	Any exceedance of a consent/licence limit is considered a non-compliance. However, the type of regulatory action taken by a regulatory authority will depend on a number of factors, in accordance with the authority's prosecution policies and guidelines.
1/1 Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit. For example, the 1000 Hz (1 kHz) octave band contains noise energy at all frequencies from 707 to 1414 Hz.
1/3 Octave Band	The one-third octave bands are subintervals of one octave. An octave is spanned by three 1/3-octave bands.
Project noise trigger levels	Target noise levels for a particular noise-generating facility during its operational phase. They are based on the most stringent of the project intrusiveness noise level or the project amenity noise level.
Rating Background Level (RBL)	The Rating Background Level for each period is the median value of the ABL values for the period over all the days measured. There is therefore an RBL value for each period – daytime, evening and night-time.
Residence	A lawful and permanent structure erected in a land-use zone that permits residential use (or for which existing use rights under the EP&A Act apply) where a person/s permanently reside and is not, nor associated with, a commercial undertaking such as caretakers' quarters, hotel, motel, transient holiday accommodation or caravan park.
Reasonably most affected location	Locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver. This should not be construed to mean that limits only apply at the worst, most-affected location
Receiver	The noise-sensitive land use at which noise from a development can be heard.
Sound Power	The total airborne sound energy emitted by a sound source per unit time. The unit of sound power is Watts (W). The sound power level allows us to objectively compare the sound output of different devices, without any knowledge of the environment in which they were tested or the distance at which measurements were taken.
Sound pressure or acoustic pressure	Sound pressure at a point is the local pressure deviation from the ambient (average or equilibrium) atmospheric pressure, caused by a sound wave. In air, sound pressure can be measured using a microphone, and in water with a hydrophone. The SI unit of sound pressure is the pascal (Pa).

Sound Pressure Level (SPL or Lp)	Sound pressure level is equal to 10 times the logarithm (to base 10) of the ratio of the rms sound pressure squared to a reference sound pressure squared. The reference value for sound pressure levels is 20 µPa. $L_p = 10 \log_{10} \frac{p^2}{p_0^2}$
Sound Power Level (SWL or Lw)	Sound power level is equal to 10 times the logarithm (to base 10) of the ratio of the rms sound power to a reference sound power. the reference value for sound power levels is 1 pW. $L_w = 10 \log_{10} \frac{W}{W_0}$
Tenth (10th) percentile method	Method to establish the rating background levels as described in the Fact Sheet B of the NSW Noise Policy for Industry
Tonality	Sound containing a prominent discrete frequency or frequencies and characterised by a definite pitch.
Temperature inversion	A factor that can impact sound propagation over long distances is temperature gradients in the atmosphere. On a typical sunny afternoon, air is warmest near the ground and temperature decreases at higher altitudes. This temperature gradient causes sound waves to refract upward, away from the ground and results in lower noise levels being heard at the listener's position. In the evening, this temperature gradient will reverse, resulting in cooler temperatures near the ground. This condition, often referred to is a temperature inversion will cause sound to bend downward toward the ground and results in louder noise levels at the listener position.
Wind gradient	Wind alters sound propagation by the mechanism of refraction; that is, wind bends sound waves. Wind nearer to the ground moves more slowly than wind at higher altitudes, due to surface characteristics such as hills, trees, and man-made structures that interfere with the wind. This wind gradient, with faster wind at higher elevation and slower wind at lower elevation causes sound waves to bend downward when they are traveling to a location downwind of the source and to bend upward when traveling toward a location upwind of the source. Waves bending downward means that a listener standing downwind of the source will hear louder noise levels than the listener standing upwind of the source. This phenomenon can significantly impact sound propagation over long distances and when wind speeds are high.

Indicative noise levels of typical sources



Qualitative Interpretation of Construction Noise Impacts

This qualitative description of construction noise impacts has been provided to assist interpretation of the results presented in this report, and to facilitate understanding of the level of impact for affected receivers. The qualitative descriptions are:

Table A 3 Qualitative interpretation of construction noise impacts

LAeq(15minute)	Perception by a human being
5 to 10 dB(A) above the background	Noticeable.
10 to 20 dB(A) above the background	Clearly noticeable
20 to 30 dB(A) above the background	Moderately intrusive
More than 30 dB(A) above the background	Highly intrusive

Table A 4 Glossary of vibration terms

Term	Definition
Amplitude	The measurement of energy or movement in a vibrating object. Amplitude is measured and expressed in three ways: Displacement (typically in mm Pk-Pk); Velocity (typically in mm/s Pk); and Acceleration (typically in m/s² RMS). Amplitude is also the y-axis of the vibration time waveform and spectrum; it helps define the severity of the vibration.
Frequency	The repetition rate of a periodic vibration, per unit of time, determined by taking the reciprocal of the period (T). Frequency is expressed in: Hz (how many cycles per second); Frequency is also the x-axis of the vibration spectrum.
Hertz (Hz)	Vibration can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. The frequency of vibration and sound is measured in hertz (Hz). Once hertz is one cycle per second. Structural Vibration is generally measured over the frequency range from 1Hz to 500Hz (0.5kHz).
Peak to Peak (Pk-Pk)	This is the measure of the vibration amplitude, maximum to minimum, equal to twice of the RMS value of a sine wave.
Peak particle velocity (PPV or Vi max)	The maximum resultant particle velocity Vi max characterizes the vibration severity
Peak vector sum	The resultant particle velocity magnitude or vector sum of the transverse, vertical and longitudinal particle velocity components.
RMS velocity	For most applications where there is continuous vibration, vibration is measured in terms of root mean square RMS velocity (mm/s).

Appendix B - Establishing criteria according to NPfl

Project intrusiveness noise level

The intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment. A noise source would generally be considered non-intrusive if the monitored average noise level (L_{Aeq}) for a period does not exceed the RBL by more than 5 dB(A). Intrusive noise levels are only applied to residential receivers (residences).

$$L_{Aeq,15min} = \text{rating background noise level} + 5 \text{ dB}$$

Project amenity noise level

To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in **Table B 1** where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.

Since the night-time amenity noise criterion is the most stringent, it is the controlling time-period. To account for converting $L_{Aeq, \text{period}}$ to $L_{Aeq,15min}$, the NPfl accepts a default conversion factor of $L_{Aeq,15min} = L_{Aeq, \text{period}} + 3 \text{ dB}$. This correction factor of +3dB is described in section 2.2 of NPfl as an acceptable assumption for the relationship between $L_{Aeq, \text{period}}$ and $L_{Aeq,15min}$. It is also referenced in the worked examples in the NPfl document.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

$$\text{Project Amenity noise level } L_{Aeq,15min} = \text{recommended amenity noise level} - 5 \text{ dB} + 3 \text{ dB}$$

The amenity noise levels have been presented in **Table B 1**. This classification is based on factors such as land-use zoning, measured existing ambient noise levels and the description of noise environments specified in the NPfl.

Table B 1 Operational noise project amenity levels

Receiver	Noise amenity area	Time of the day	Recommended Amenity noise level, $L_{Aeq, \text{period}}$ dB	Recommended Amenity noise level, $L_{Aeq, 15minute}$ dB	Project amenity noise level ²¹ $L_{Aeq,15min}$ dB
Residential	Suburban	Day	55	53	53
		Evening	45	43	43
		Night	40	38	38
Residential	Urban	Day	60	58	58
		Evening	50	48	48
		Night	45	43	43
Hotel	Suburban	Day	60	58	58

²¹ Adjusted level calculated by applying 5 dB reduction to account for cumulative existing and future industrial noise sources and 3 dB addition to adjust the amenity noise level from $L_{Aeq, \text{period}}$ to $L_{Aeq,15min}$

Receiver	Noise amenity area	Time of the day	Recommended Amenity noise level, $L_{Aeq, period}$ dB	Recommended Amenity noise level, $L_{Aeq, 15minute}$ dB	Project amenity noise level ²¹ $L_{Aeq, 15min}$ dB
		Evening	50	48	48
		Night	45	43	43
Commercial premises	All	When in use	65	63	63
Place of worship	All	When in use	40 (internal) 50 (external)	38 (internal) 48 (external)	38 (internal) 48 (external)
School classroom	All	Noisiest 1 hour when in use	35 (internal) 45 (external)	33 (internal) 43 (external)	33 (internal) 43 (external)
Hospital ward	All	Noisiest 1-hour	35 (internal) 50 (external)	33 (internal) 48 (external)	33 (internal) 48 (external)

Project noise trigger levels

The project noise trigger level (PNTL) is defined by NPfI as ‘a level that, if exceeded, would indicate a potential noise impact on the community, and so ‘trigger’ a management response.’

Project noise trigger level (PNTL) is the lowest value of intrusiveness or project amenity noise level after conversion to the $L_{Aeq, 15 minute}$ dBA equivalent level. Table 6-1 specifies the Project Noise Trigger Levels (PNTL) for the project based on the noise survey undertaken and considering the project amenity / intrusive noise levels.

Sleep disturbance criteria

Guidance from RNP

NSW Road Noise Policy (RNP) in 2011 provides a review of a wide range of literature using the $L_{A_{night}}$, outside as a primary measure of night-time noise which is roughly equivalent to the $L_{Aeq, 9hour}$ night-time descriptor used in the RNP:

- Maximum internal noise levels below 50 to 55 dB(A) would be unlikely to result in people's sleep being disturbed.
- If the maximum internal noise exceeds 65 to 70 dB(A) once or twice each night, the disturbance would be unlikely to have any notable health or wellbeing effects.

This indicates that internal noise levels of 50 to 55 dB(A) are unlikely to cause sleep awakenings. At levels above 55 dB(A), sleep disturbance would be considered a risk. Assuming that residential receivers have windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicated in the ICNG, resulting in external limit to cause an awakening reaction of 65 dB(A).

Guidance from NPfI

In addition, the NPfI provides the latest Environmental Protection Authority (EPA) guidance for the assessment of sleep disturbance. It recommends an assessment of maximum noise levels which have the

potential to cause sleep disturbance impacts. Sleep disturbance is both awakenings and disturbance to sleep stages.

The NPfI recommends an initial screening test for maximum noise level events at the assessment locations, with the following screening levels:

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

Appendix C – Equipment noise levels

Table C 2 Equipment schedule and Noise data for the Stage 2

Item	Rated capacity	No. of units in design	No. of units in Acoustic model	Noise Data Type	Octave Band Centre Frequency (Hz)								Overall sound level dB(A)
					Linear weighted dB(Z)								
					63	125	250	500	1k	2k	4k	8k	
Air cooled chillers – Day	1.2 MW	96	96	L _w / unit	82	86	85	81	81	77	75	80	86
Air cooled chillers – Night	1.2 MW	96	96	L _w / unit	84	76	75	76	76	73	69	69	80
Generator – Exhaust gas discharge	2.5 MW	77	77	L _p / unit at 1m	75	76	71	61	67	70	68	57	75
Generator – Hot Air Discharge	2.5 MW	77	77	L _p / unit at 1m	85	88	76	49	38	40	60	72	75
Generator – Intake	2.5 MW	77	77	L _p / unit at 1m	85	88	76	49	38	40	60	72	75
Load bank - unmitigated	2.5 MW	2	2	L _w / unit	110	113	112	107	99	96	93	90	108
Load bank - mitigated	2.5 MW	2	2	L _w / unit	100	98	102	97	94	91	87	83	97

Appendix D – Traffic volume data

Table D 1 Baseline traffic volumes on roads surrounding the site

Road	Segment	Bound	Traffic flow, number of vehicle movements ^{1, 2}							
			AM peak hour (8am to 9am)		PM peak hour (4:30pm to 5:30pm)		Day period (7am to 10pm) ²		Night period (10pm to 7am) ²	
			LV	HV	LV	HV	LV	HV	LV	HV
Brookhollow Avenue	West of access point	Eastbound	395	5	169	0	3555	43	395	7
		Westbound	169	1	289	1	2601	9	289	1
	East of access point	Eastbound	143	2	395	4	3555	34	395	6
		Westbound	486	1	263	2	4374	17	486	3
Norwest Boulevard	Between Brookhollow Avenue and Windsor Road	Eastbound	1258	42	2196	6	19764	360	2196	60
		Westbound	2178	53	1395	17	19602	454	2178	76
Windsor Road	North of Norwest Boulevard	Northbound	982	33	2006	56	18054	480	2006	80
		Southbound	2175	56	1670	64	19575	549	2175	91
	South of Norwest Boulevard	Northbound	1467	40	1465	51	13203	437	1467	73
		Southbound	1736	52	1907	34	17163	446	1907	74
Norwest Boulevard	Between Old Windsor Road and Brookhollow Avenue	Eastbound & Westbound	No available data							

Road	Segment	Bound	Traffic flow, number of vehicle movements ^{1, 2}							
			AM peak hour (8am to 9am)		PM peak hour (4:30pm to 5:30pm)		Day period (7am to 10pm) ²		Night period (10pm to 7am) ²	
			LV	HV	LV	HV	LV	HV	LV	HV
Old Windsor Road (A2)	North and South of Norwest Boulevard	Northbound & Southbound	No available data							

Table D 2 Operational daily traffic volumes on roads surrounding the site generated by the Project

Road	Segment	Bound	Traffic flow, number of vehicle movements			
			Day period (7am to 10pm)		Night period (10pm to 7am)	
			Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Brookhollow Avenue	West of access point	Eastbound	4	1	10	0
		Westbound	14	1	0	0
	East of access point	Eastbound	14	2	0	0
		Westbound	4	2	10	0
Norwest Boulevard	Between Brookhollow Avenue and Windsor Road	Eastbound	14	2	0	0
		Westbound	4	2	10	0
Windsor Road	North of Norwest Boulevard	Northbound	7	1	0	0
		Southbound	2	1	5	0
	South of Norwest Boulevard	Northbound	2	1	5	0
		Southbound	7	1	0	0

Road	Segment	Bound	Traffic flow, number of vehicle movements			
			Day period (7am to 10pm)		Night period (10pm to 7am)	
			Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Norwest Boulevard	Between Old Windsor Road and Brookhollow Avenue	Eastbound	4	1	10	0
		Westbound	14	1	0	0
Old Windsor Road (A2)	North of Norwest Boulevard	Northbound	7	1	0	0
		Southbound	2	1	5	0
	South of Norwest Boulevard	Northbound	2	0	5	0
		Southbound	7	0	0	0

Table D 3 Operational peak hourly traffic volumes on roads surrounding the site generated by the Project

Road	Bound	Traffic flow, number of vehicle movements			
		AM peak (6:30am to 7:30am)		PM peak (6:30pm to 7:30pm)	
		Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Windsor Road	Both direction	12	0	12	0
Norwest Boulevard	Both direction	24	0	24	0
Brookhollow Avenue	Both direction	22	0	22	0
Solent Circuit	Both direction	2	0	2	0

Appendix E – Short term noise monitoring

Table E 4 Results of short-term operator-attended noise monitoring

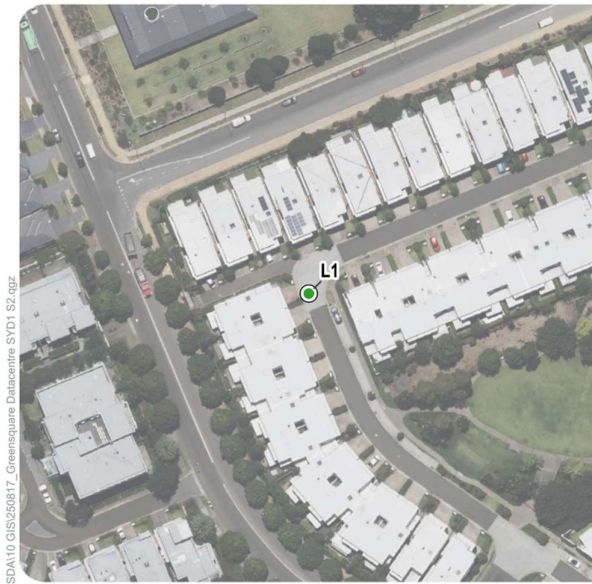
ID	Location	Address description	Start Time	Duration	Broadband Statistical Noise Levels					Comments
					L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	L _{Amin}	
001	A4-1	Castle Pines Retirement Village, 92 Longview Pl, Baulkham Hills NSW 2153	12/09/2025 10:16	15 min	45	64	47	40	38	Ongoing construction on main road & apartments across the road (elevates background levels). Occasional residential mechanical noise, birds, footsteps. Not ideal for logger placement despite proximity to site.
002	A4-2	36 Stone Mason Dr, Baulkham Hills NSW 2153 - Front Yard	12/09/2025 10:39	15 min	54	73	57	43	39	Quiet suburban street except for construction at intersection. Occasional saw/impact noise. Less construction noise than A4-1. Much higher ambient noise levels due to being more open and at a higher level.
003	L4i	L4 - Castle Pines Retirement Village, 92 Longview Pl, Baulkham Hills NSW 2153	12/09/2025 11:14	15 min	55	81	52	43	41	Logger placed at 92 Longview (side yard). Very quiet private street, negligible vehicle flow. Lower ambient levels than A4-2.

ID	Location	Address description	Start Time	Duration	Broadband Statistical Noise Levels					Comments
					L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	L _{Amin}	
004	A3-1	Cul-de-sac - 28 Fairmont Ave, Baulkham Hills NSW 2153	12/09/2025 11:45	15 min	47	75	46	39	37	Quiet residential street. Main road noise from Windsor Rd & Barina Dr is dominant background contributor.
005	A3-2	Roundabout - 1 Hillsborough Way, Baulkham Hills NSW 2153	12/09/2025 12:06	15 min	65	95	64	42	39	Busy Barina Downs Rd, continuous light vehicle traffic. Likely future construction nearby. Not ideal for logger placement.
006	A3-3	39 Fairmont Ave, Baulkham Hills NSW 2153 - Front Yard	12/09/2025 12:27	15 min	45	69	45	38	36	Quiet street. Distant idling diesel vehicle. Windsor Rd noise audible but not dominant. Ideal logger location for this NCA given low L90.
007	L3	29 Fairmont Ave, Baulkham Hills NSW 2153 - Front Yard	12/09/2025 13:00	15 min	47	72	45	39	37	Logger placed at 29 Fairmont Ave. Similar to A3-3, slightly further down the street.
008	A2-1	25 Camarena Ave, Baulkham Hills NSW 2153 - Along Cct	12/09/2025 13:21	15 min	49	70	50	42	40	At 33 Jacqui Cct. Consistent industrial hum from north. Busy Barina Downs Rd clearly audible.
009	A2-2	Cul-de-sac - 14 Ridgehaven Pl, Baulkham Hills NSW 2153	12/09/2025 13:40	15 min	47	72	48	42	39	Quiet suburban street. Norwest Blvd clearly audible and main contributor.

ID	Location	Address description	Start Time	Duration	Broadband Statistical Noise Levels					Comments
					L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	L _{Amin}	
010	L2	46 Ridgehaven Pl, Baulkham Hills NSW 2153 - Front Yard	12/09/2025 14:29	15 min	47	69	47	40	37	Logger placed at 48 Ridgehaven Pl. Similar to A2-2 but further inwards, no direct line of sight to Norwest Blvd. Includes brief resident interaction.
011	A1-2	2 Lakeside Cres, Baulkham Hills NSW 2153 - Front Yard	12/09/2025 14:51	15 min	50	70	51	44	41	At 35 Central Park Ave. Lots of residential activity and road noise from Solent Cct & Fairway Dr (main contributors). Time aligned with school pickup.
012	A1-1	36 Solent Cct, Norwest NSW 2153	12/09/2025 15:11	15 min	56	79	55	46	43	At 2 Lakeside Cres. Solent Cct very busy (semi-peak traffic). Significant mechanical noise from west. Blower stopped mid-measurement.
013	L1	2 Lakeside Cres, Baulkham Hills NSW 2153 - Front Yard	12/09/2025 16:29	15 min	48	66	49	46	44	Logger placed at 24 Central Park Ave. Similar to A1-1 but slightly busier due to near-peak traffic. Solent Cct & Norwest Blvd main contributors.
014	L5 / L5-1	Level 12 Balcony facing NE (Unit 1203) /11 Solent Cct, Norwest NSW 2153	12/09/2025 17:14	15 min	58	88	58	55	52	Logger placed at Level 12 apartment (facing NE). High ambient noise – fountains, traffic all around, kids playing. Windsor Rd and Solent Cct dominant.

ID	Location	Address description	Start Time	Duration	Broadband Statistical Noise Levels					Comments
					L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	L _{Amin}	
015	AA-1	@ Castle Pines Ret Vlge, 92 Longview Pl, Baulkham Hills NSW 2153	26/09/2025 11:19	15 min	55	71	59	49	47	Quietish road, measurement conducted during offpeak time. Slight industrial hum from the north. Dominant noise source is the main road on the east.
016	AA-2	@36 Stone Mason Dr, Baulkham Hills NSW 2153 - Front Yard	26/09/2025 11:39	15 min	60	77	63	56	52	At the roundabout, extremely busy. College right on main road which is the dominant contributor to background noise.
017	A1803	1803/11 Solent Cct, Norwest NSW 2153 - Balcony facing NE	13/10/2025 11:00	15 min	56	71	57	53	52	High ambient noise with traffic, fountains, etc. Dominant sources include Windsor Road and Solent Circuit with direct line of sight.
018	A703	703/11 Solent Cct, Norwest NSW 2154 - Balcony facing NE	13/10/2025 11:45	15 min	54	70	55	51	49	Moderate noise levels, shielded from direct traffic. Fountain noise dominant and considered part of the existing environment; road noise less pronounced than Level 18.
019	C210	210/11 Solent Cct, Norwest NSW 2155 - Balcony facing NE	13/10/2025 12:31	15 min	59	85	57	52	50	Noise mainly from pedestrians and local traffic near pathways and retail outlets. Frequent short-term fluctuations observed.

Appendix F – Long term noise monitoring



C:\Users\mildred.majumdar\OneDrive - Aurecon Group\529297 - SYDGPU2 - 10 - Appendices\01 SSDA10 GIS\250817_Greensquare Datacentre SYD1 S2.gpr

ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L1	Rion NL-21	709528	24 Central Park Ave, Norwest NSW 2153	2025-09-12	2025-09-26	2024-05-28	F	A	Front Yard

Ambient noise monitoring results - NPfl & ICNG time periods			
	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{A90} , period dB	44	40	34

Ambient noise monitoring results - RNP time periods		
	Day 15 hr	Night 9 hr
L_{Aeq} period dB	53	47
L_{Aeq} , 1hr dB	54	48

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

Night 10 pm to 7 am

Notes:

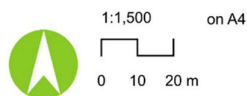
Solent Cct very busy due to peak hour traffic (Main contributor to background noise). Significant mechanical noise from west. Norwest Blvd second most dominant noise source noticed on site. Internal roads used only by residents - very quiet.

Legend

- Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

Projection: GDA2020 / MGA zone 56 (EPSG:7856)

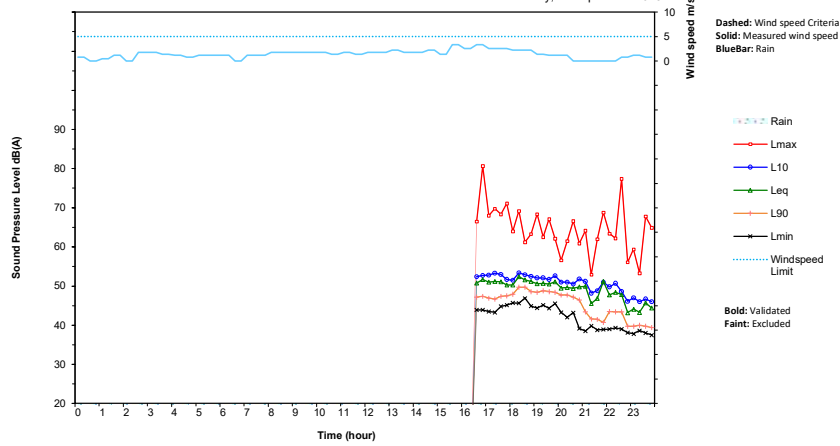
Noise monitoring location - Logger L1

Revision 0
Map Author: Mildred Majumdar 28/10/2025
Project No. P529297

Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

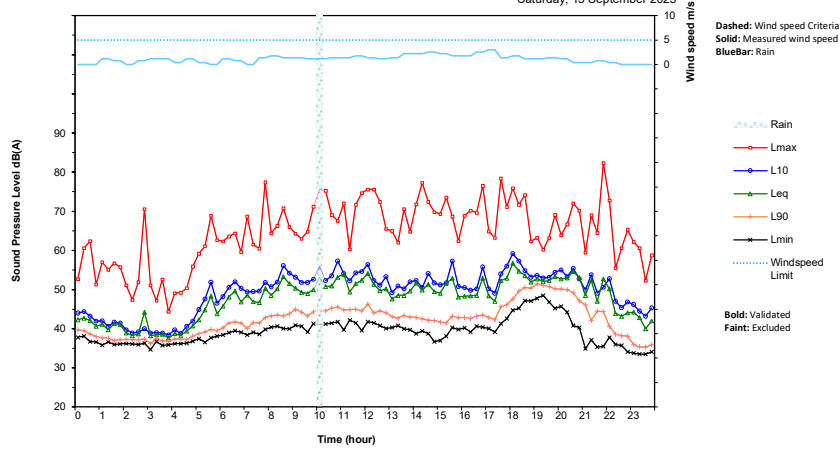
Friday, 12 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

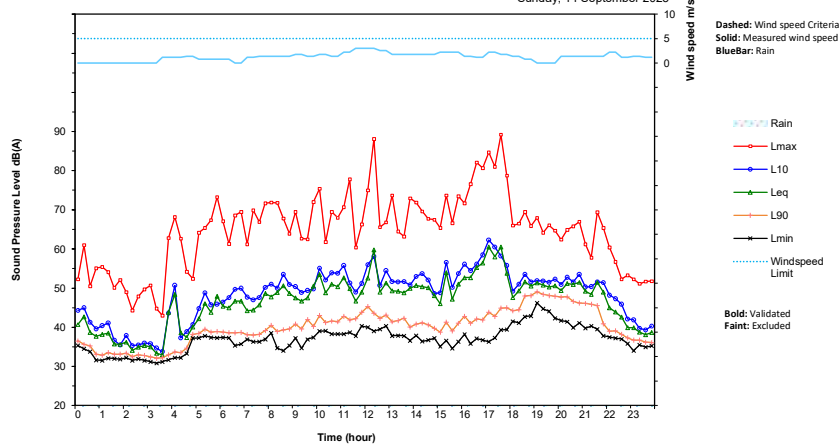
Saturday, 13 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

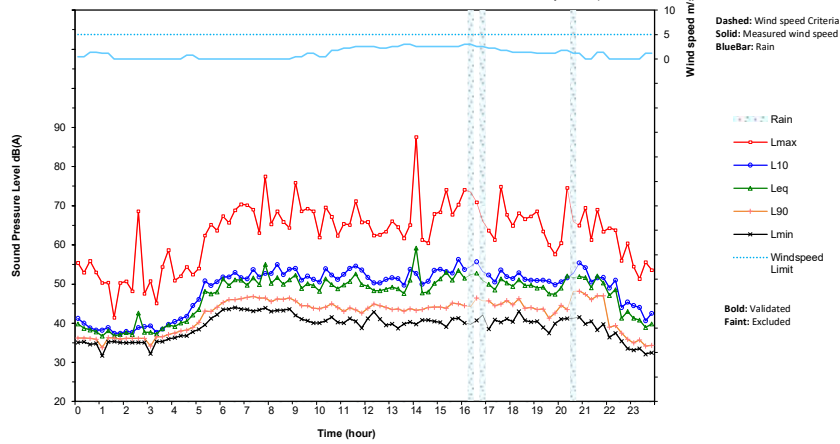
Sunday, 14 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

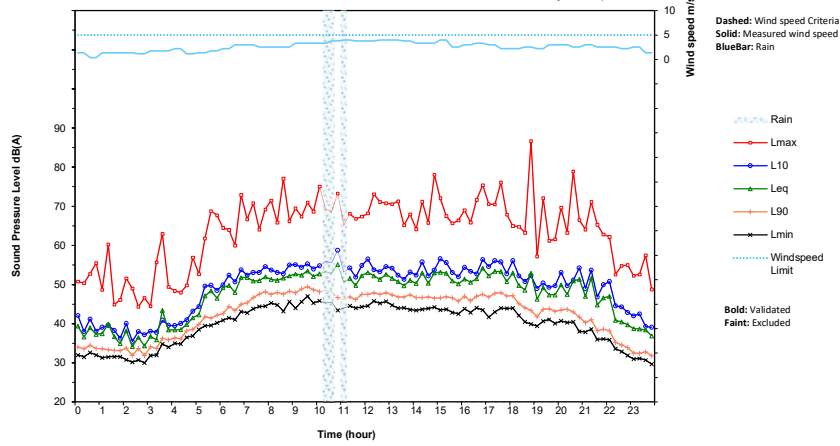
Monday, 15 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

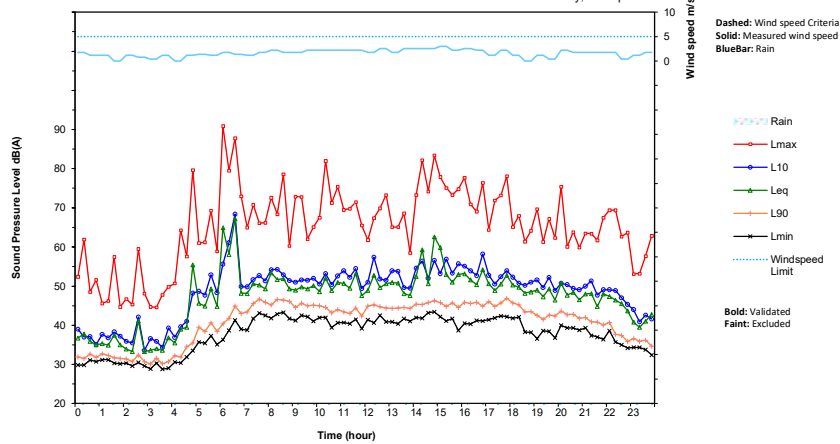
Tuesday, 16 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

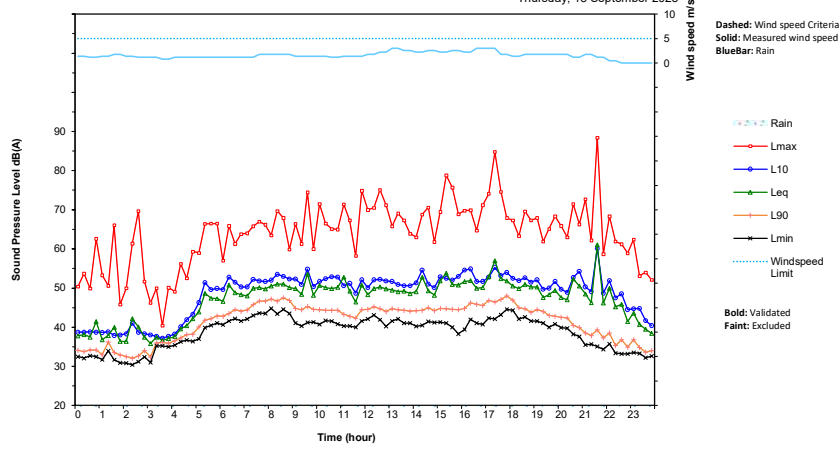
Wednesday, 17 September



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

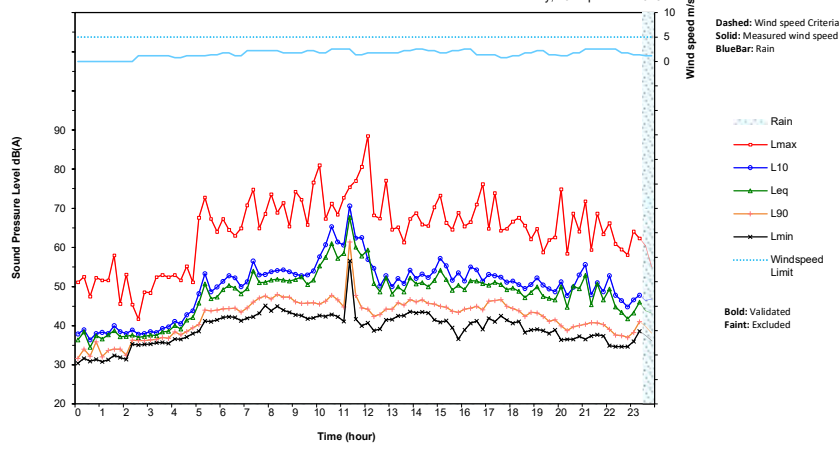
Thursday, 18 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

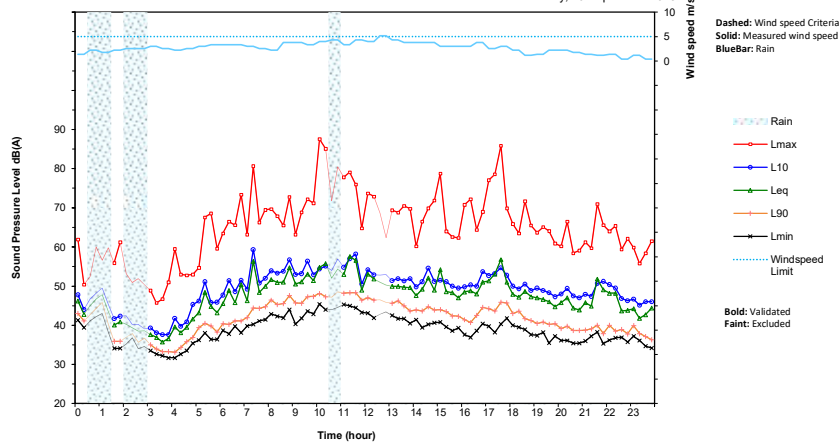
Friday, 19 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

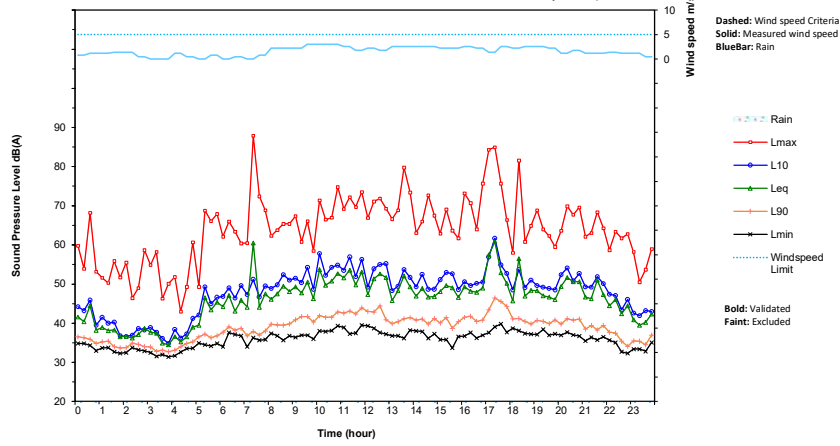
Saturday, 20 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

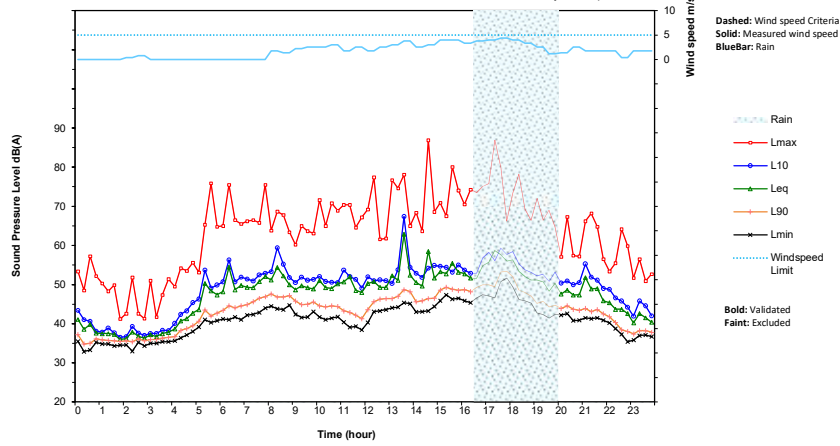
Sunday, 21 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

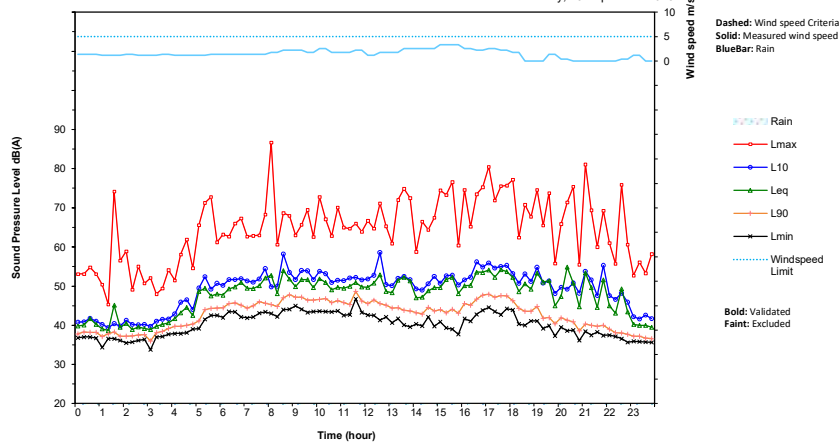
Monday, 22 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

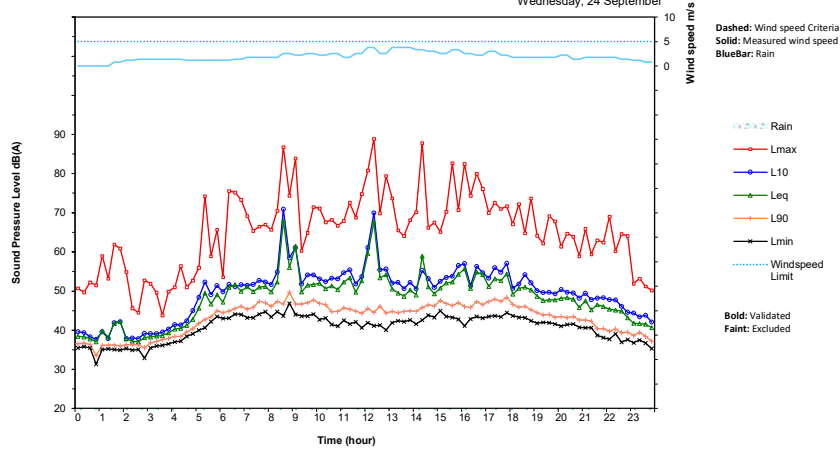
Tuesday, 23 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

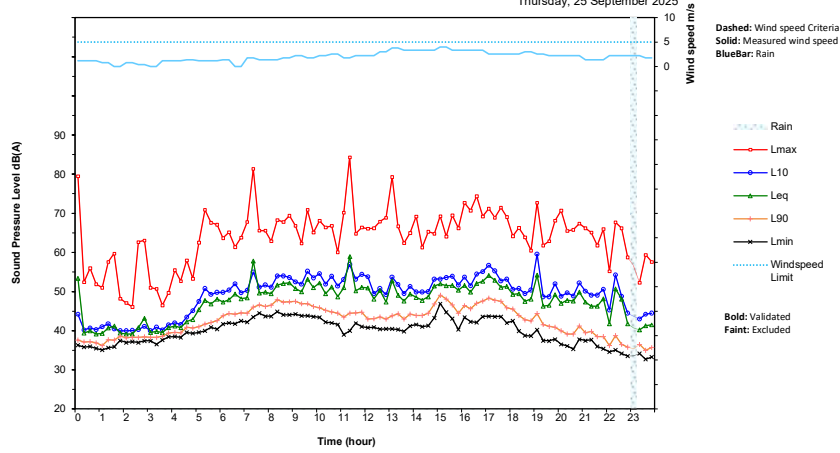
Wednesday, 24 September



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

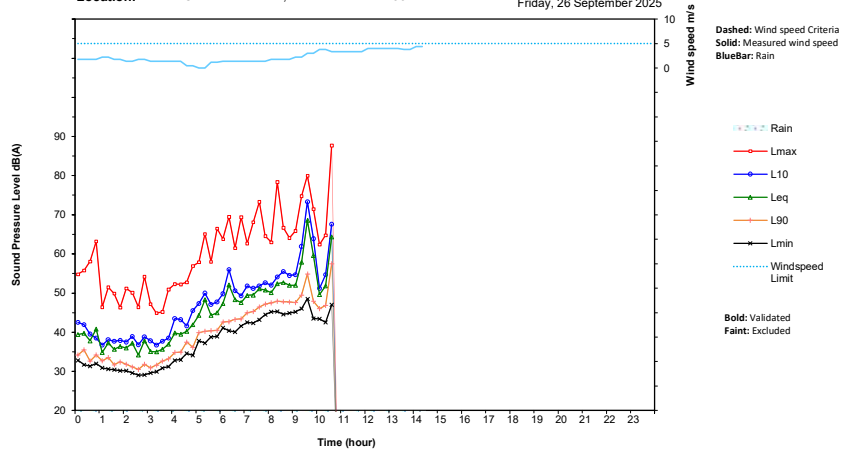
Thursday, 25 September 2025



Logger ID: L1

Location: 24 Central Park Ave, Norwest NSW 2153

Friday, 26 September 2025





ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L2	Larson & Davus LxT	1719	48 Ridgehaven Pl, Baulkham Hills NSW 2153	2025-09-12	2025-09-26	2024-05-22	F	A	Front Yard

Ambient noise monitoring results - NPfl & ICNG time periods

	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{Aeq} , period dB	38	38	33

Ambient noise monitoring results - RNP time periods

	Day 15 hr	Night 9 hr
L_{Aeq} period dB	49	42
L_{Aeq} , 1hr dB	51	47

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

Night 10 pm to 7 am

Notes:

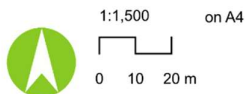
Quiet suburban street. Norwest Blvd clearly audible and main contributor. No direct line of sight to Norwest Blvd.

Legend

● Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

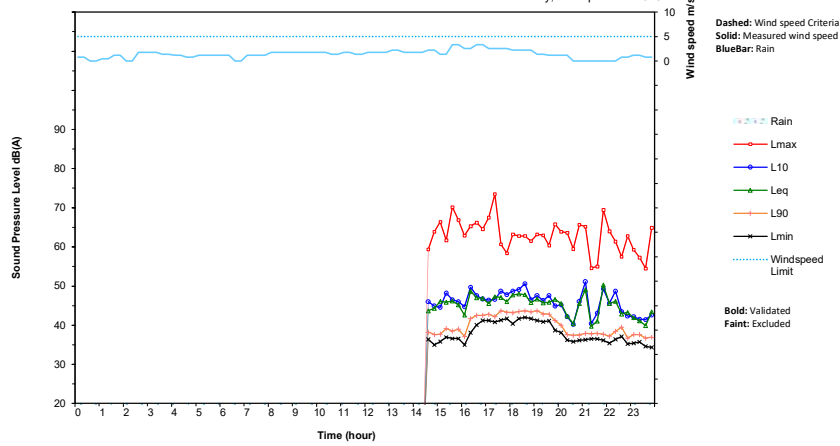
Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Noise monitoring location - Logger L2

Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

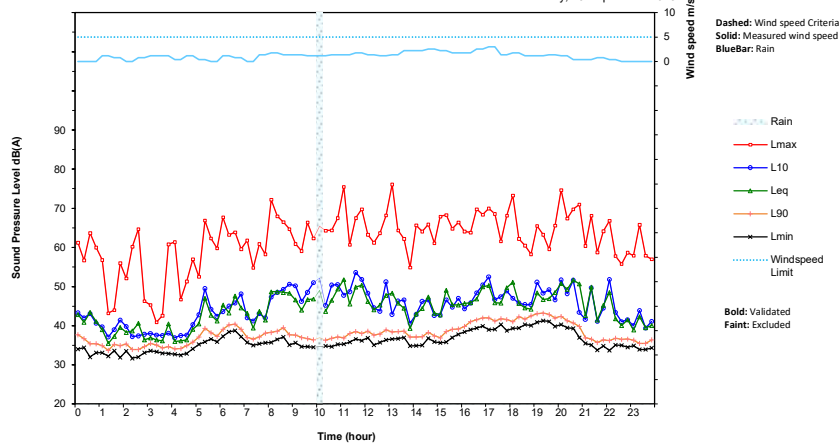
Friday, 12 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

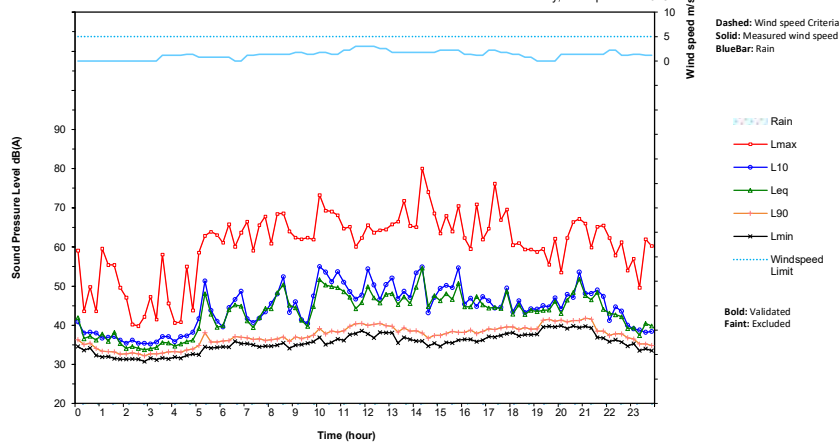
Saturday, 13 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

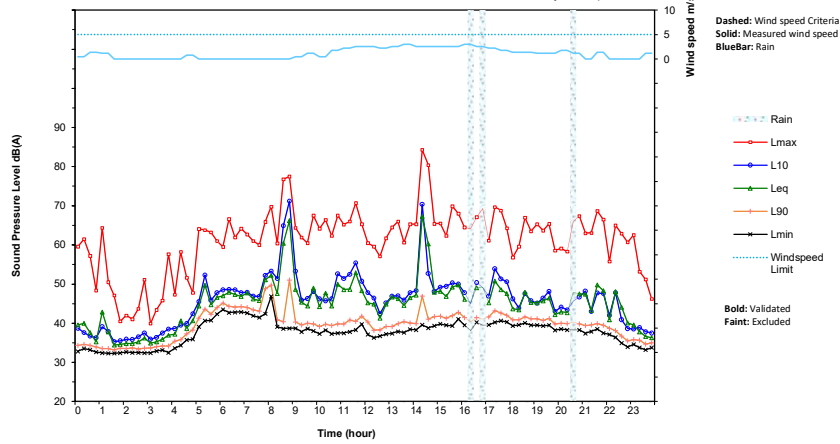
Sunday, 14 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

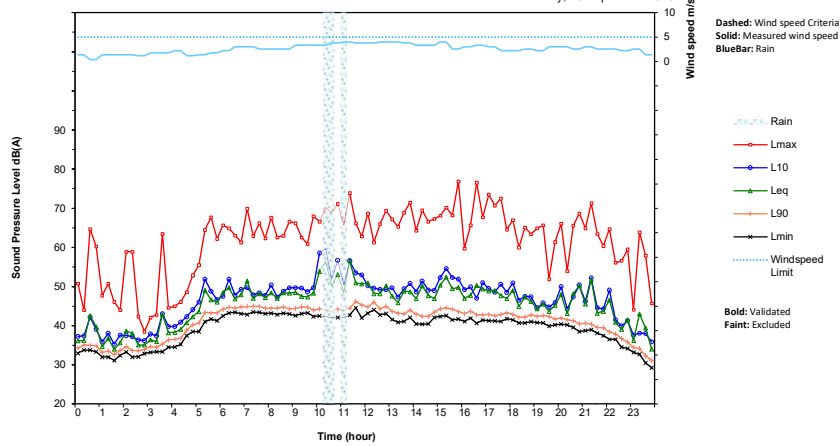
Monday, 15 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

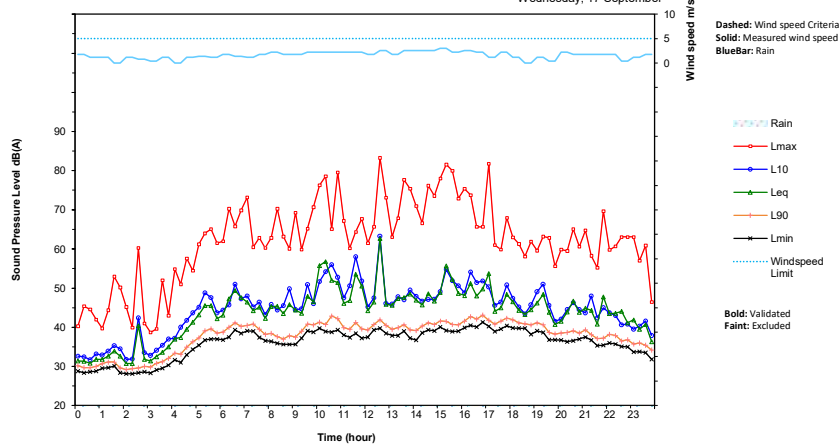
Tuesday, 16 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

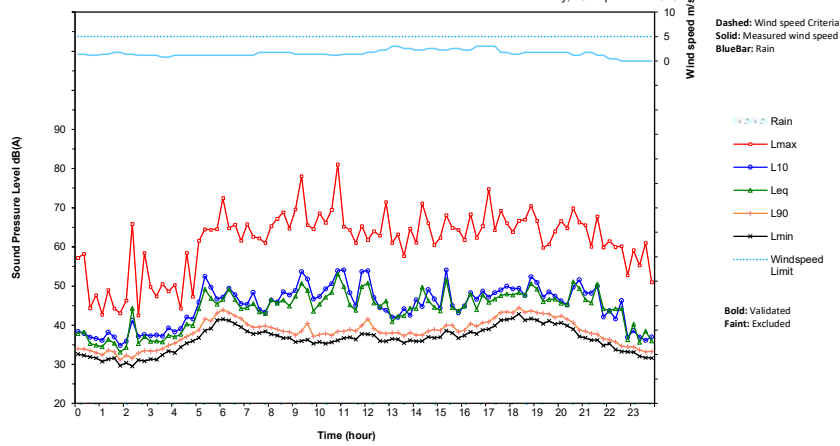
Wednesday, 17 September



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

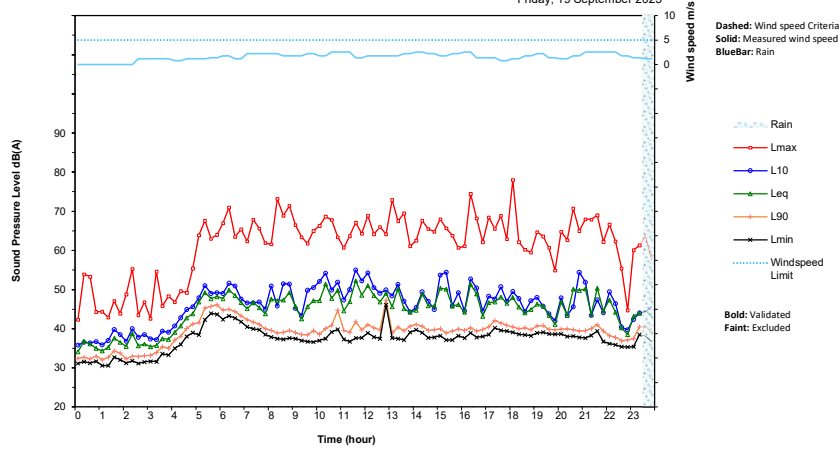
Thursday, 18 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

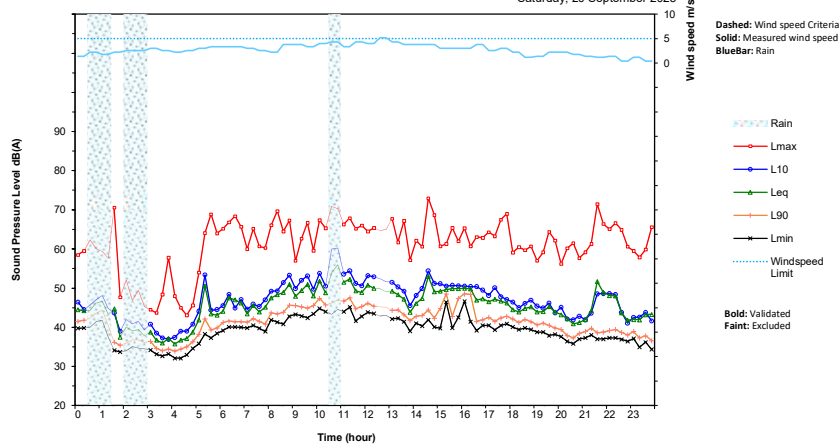
Friday, 19 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

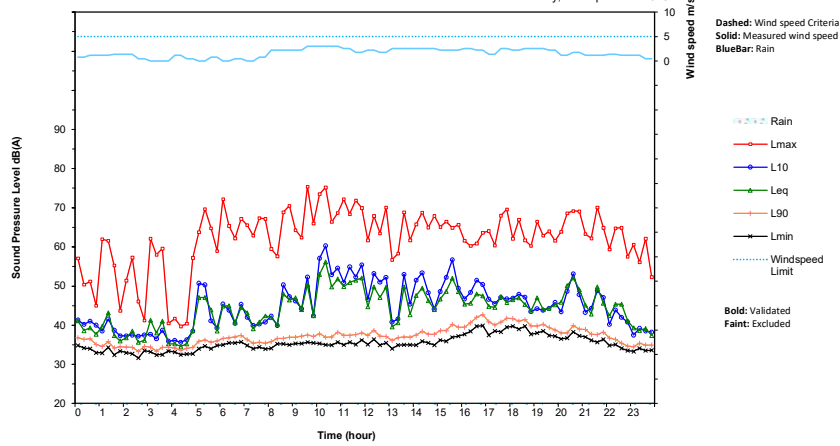
Saturday, 20 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

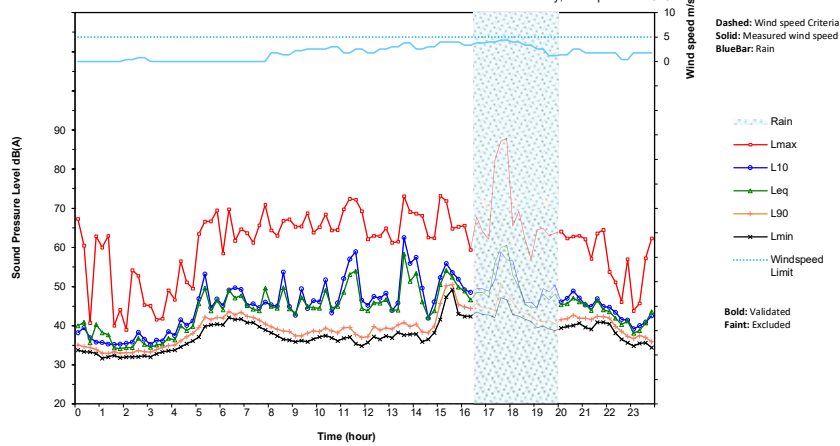
Sunday, 21 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

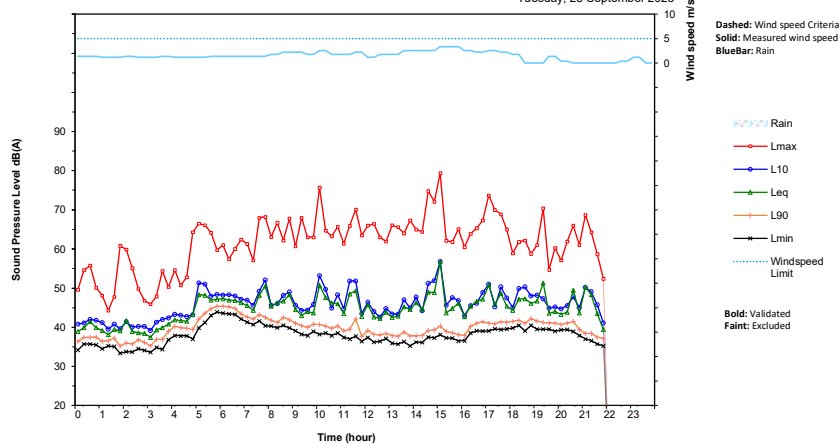
Monday, 22 September 2025



Logger ID: L2

Location: 48 Ridgehaven Pl, Baulkham Hills NSW 2153

Tuesday, 23 September 2025





ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L3	SVANTEK 979	35873	29 Fairmont Ave, Baulkham Hills NSW 2153	2025-09-12	2025-09-26	2024-07-29	F	A	Front Yard

Ambient noise monitoring results - NPfl & ICNG time periods			
	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{Aeq} , period dB	40	39	33

Ambient noise monitoring results - RNP time periods		
	Day 15 hr	Night 9 hr
L_{Aeq} period dB	52	46
L_{Aeq} , 1hr dB	53	50

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

Night 10 pm to 7 am

Notes:

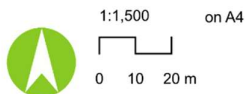
Quiet street. Distant idling diesel vehicle. Windsor Rd noise audible but not very active given non-peak hour time of logger deployment.

Legend

● Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

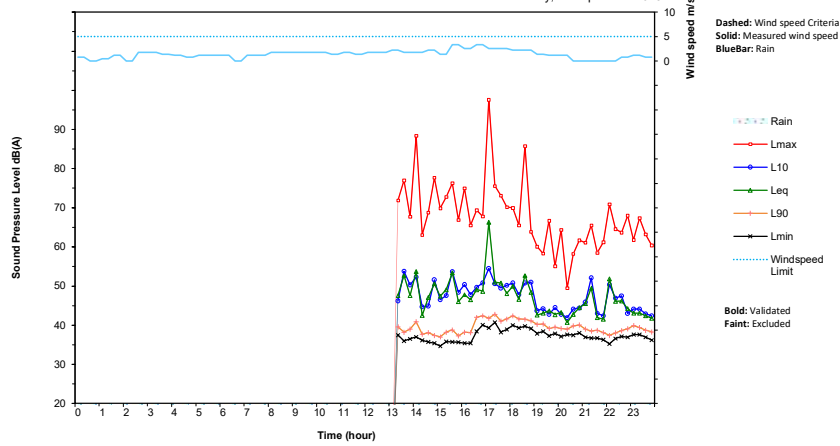
Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Noise monitoring location - Logger L3

Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

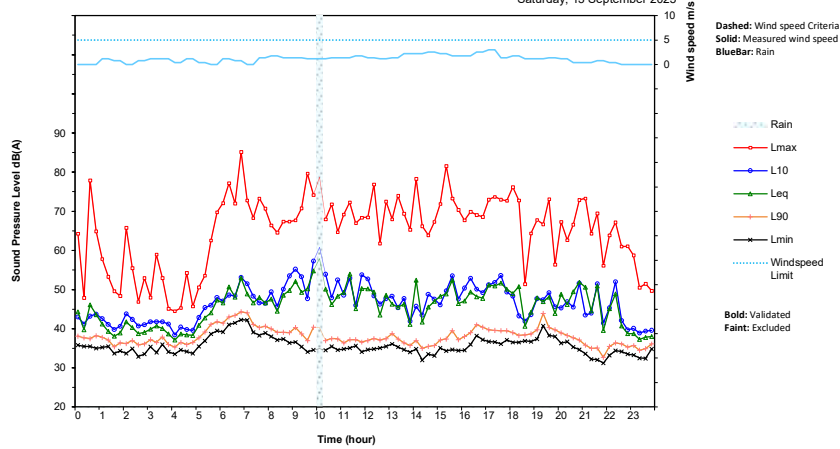
Friday, 12 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

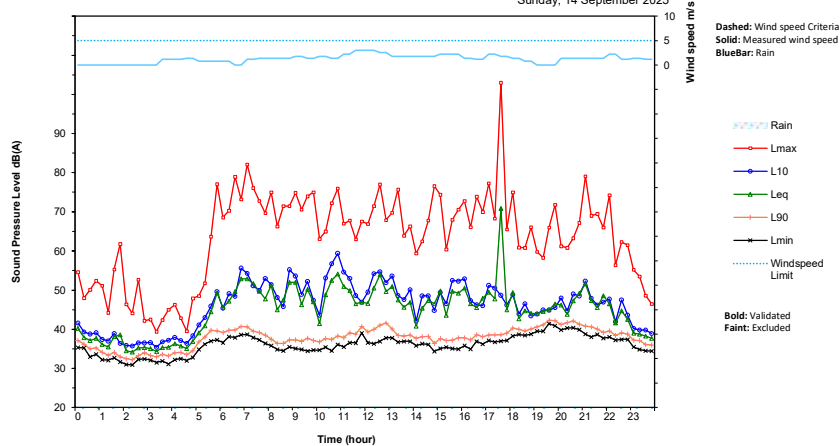
Saturday, 13 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

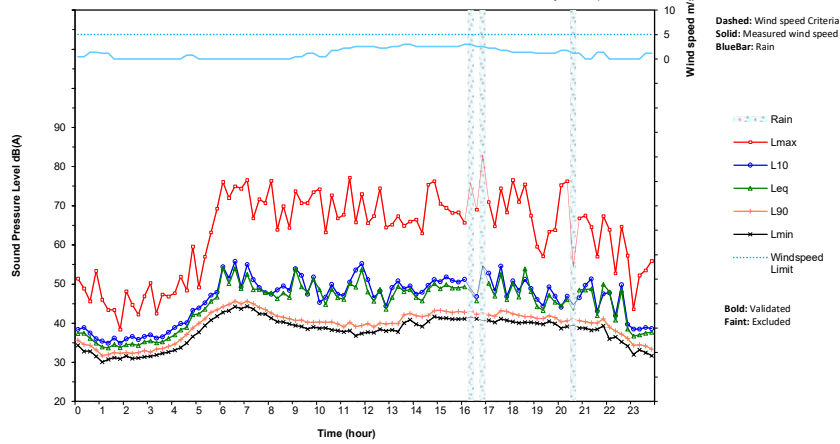
Sunday, 14 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

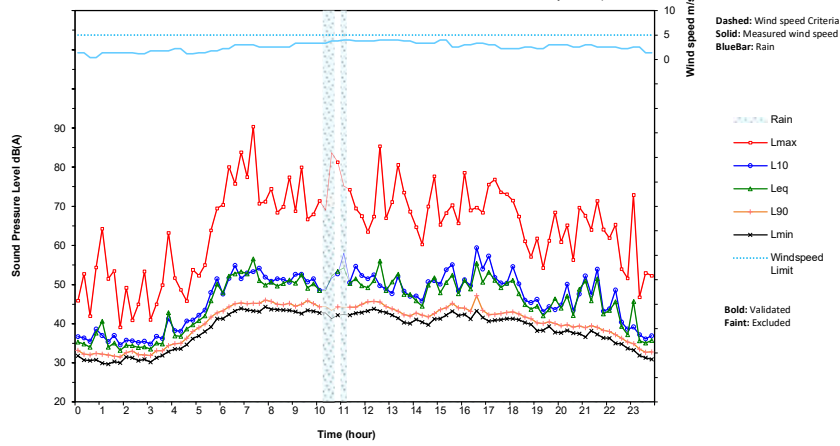
Monday, 15 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

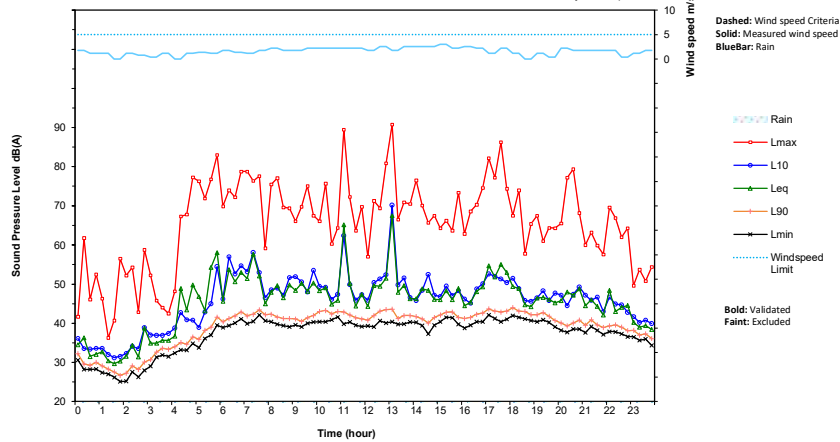
Tuesday, 16 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

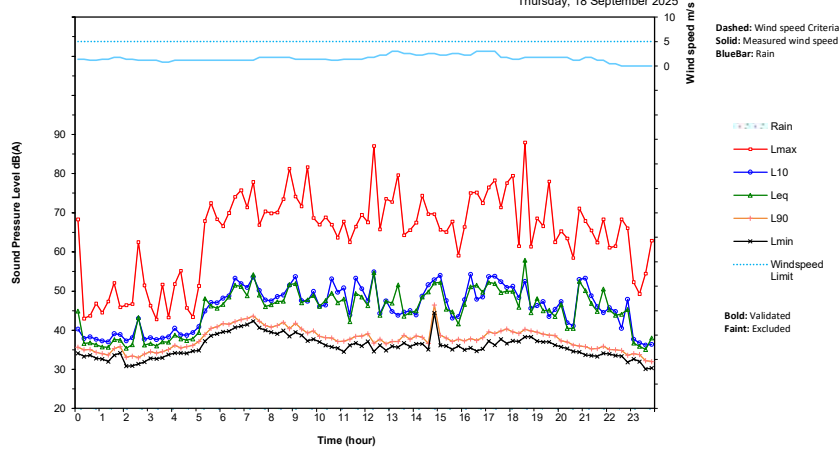
Wednesday, 17 September



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

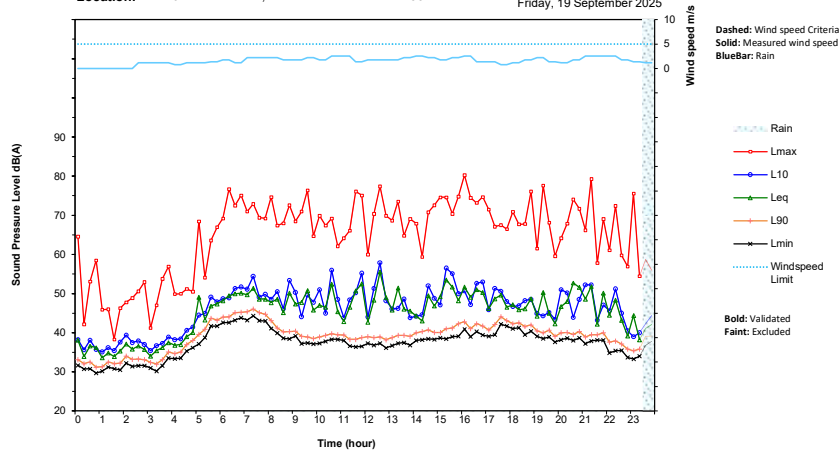
Thursday, 18 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

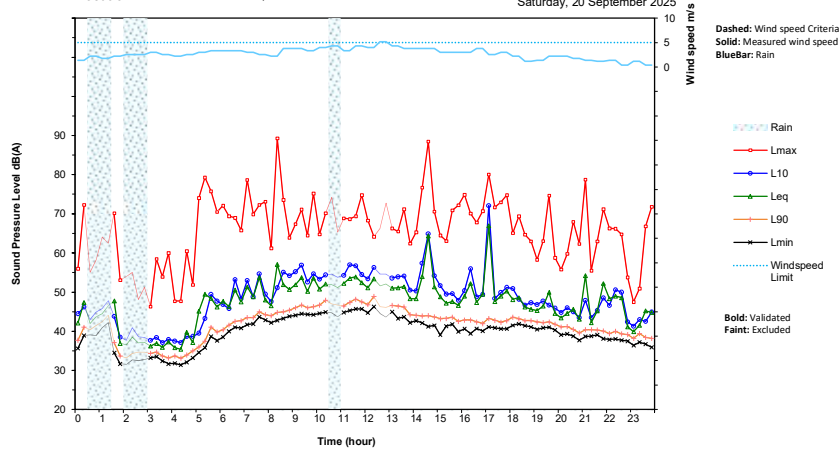
Friday, 19 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

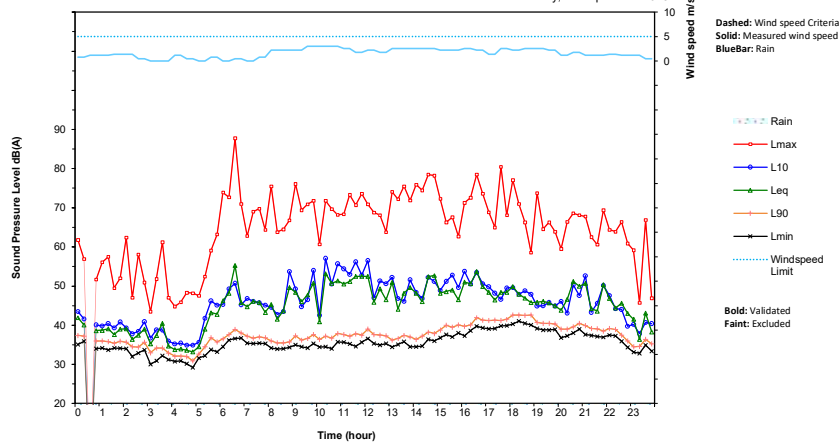
Saturday, 20 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

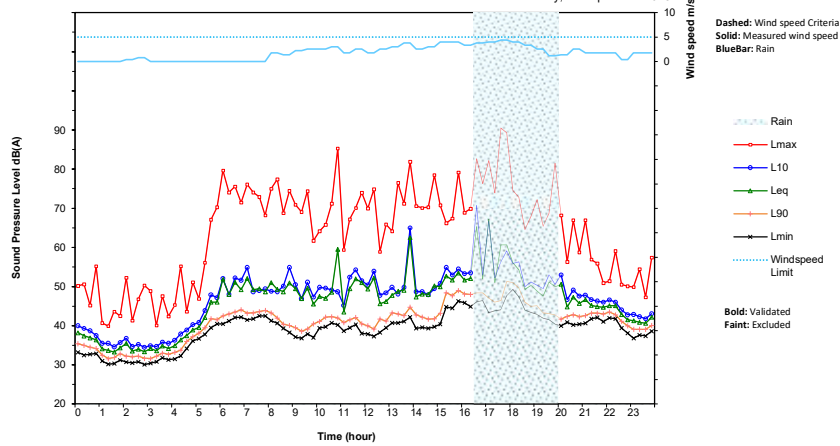
Sunday, 21 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

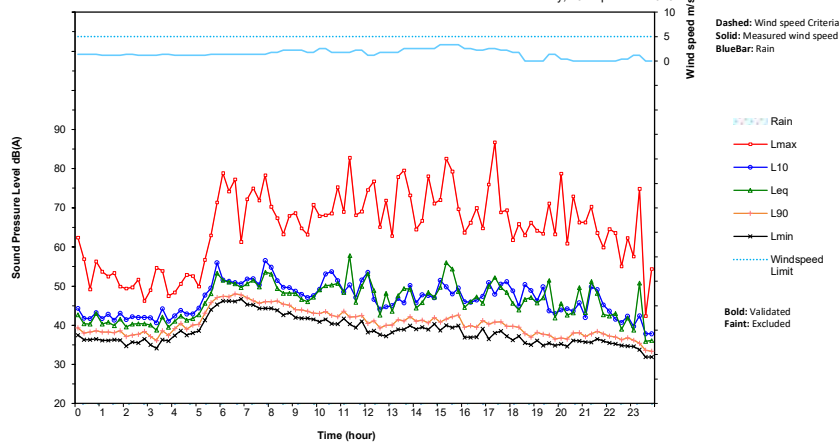
Monday, 22 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

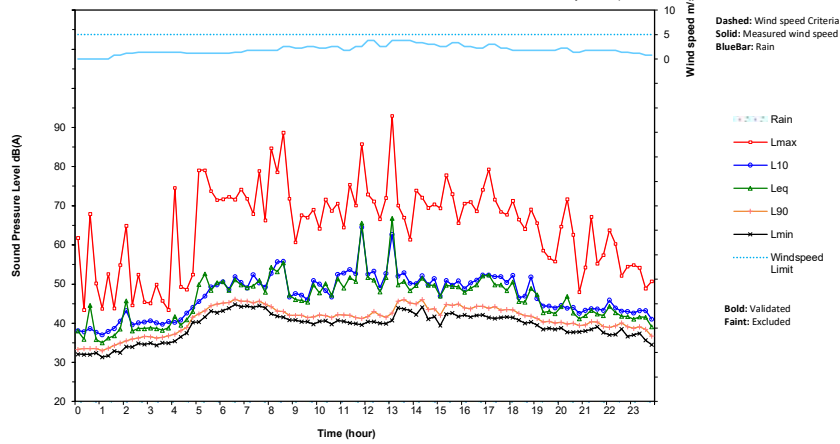
Tuesday, 23 September 2025



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

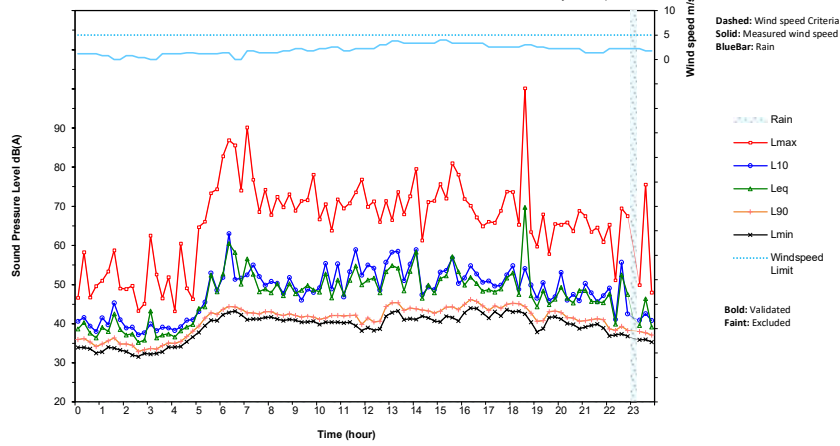
Wednesday, 24 September



Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

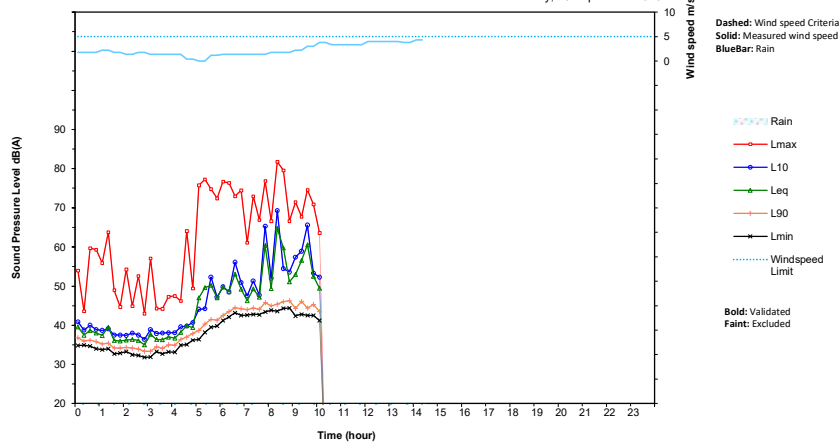
Thursday, 25 September 2025

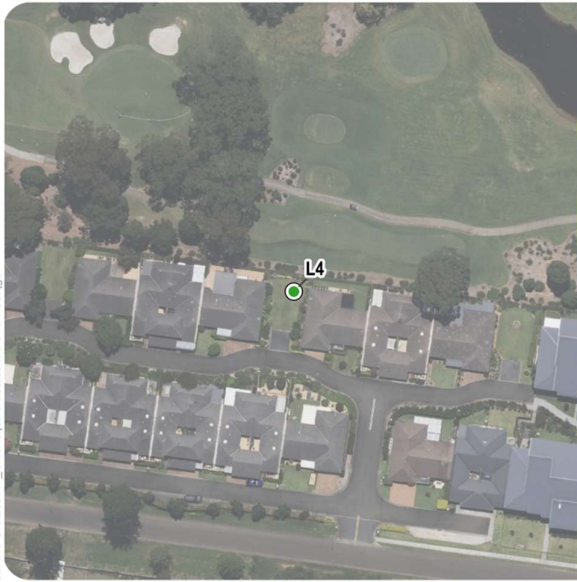


Logger ID: L3

Location: 29 Fairmont Ave, Baulkham Hills NSW 2153

Friday, 26 September 2025





ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L4	SVANTEK 979	21094	Castle Pines Ret Vige, 92 Longview Pl, Baulkham Hills NSW 2153	2025-09-12	2025-09-26	2024-07-29	F	A	Side Yard

Ambient noise monitoring results - NPfl & ICNG time periods			
	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{Aeq} , period dB	43	42	39

Ambient noise monitoring results - RNP time periods		
	Day 15 hr	Night 9 hr
L_{Aeq} period dB	55	50
L_{Aeq} , 1hr dB	56	54

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

Night 10 pm to 7 am

Notes:

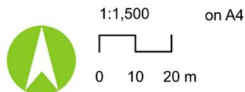
Very quiet private street (retirement village), negligible vehicle flow.
Ongoing construction on main road & apartments across the road.
Occasional residential mechanical noise, birds omnipresent.

Legend

● Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

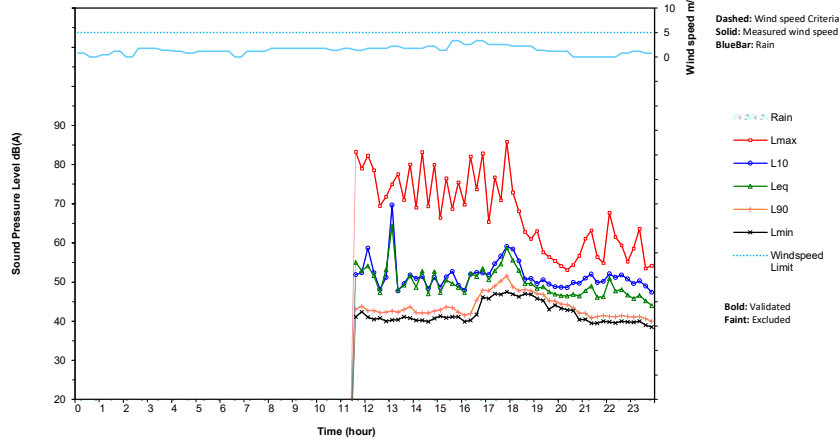
Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Noise monitoring location - Logger L4

Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

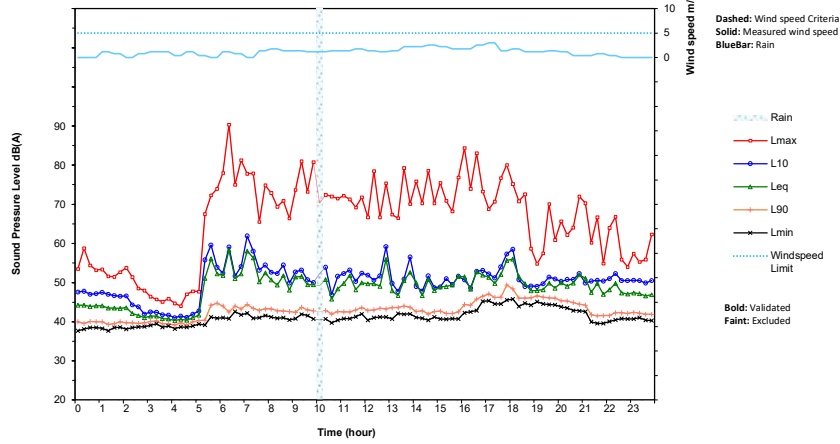
Friday, 12 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

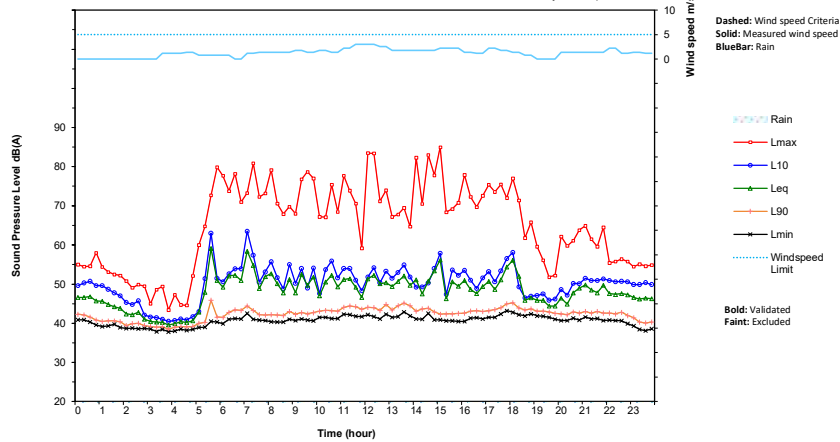
Saturday, 13 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

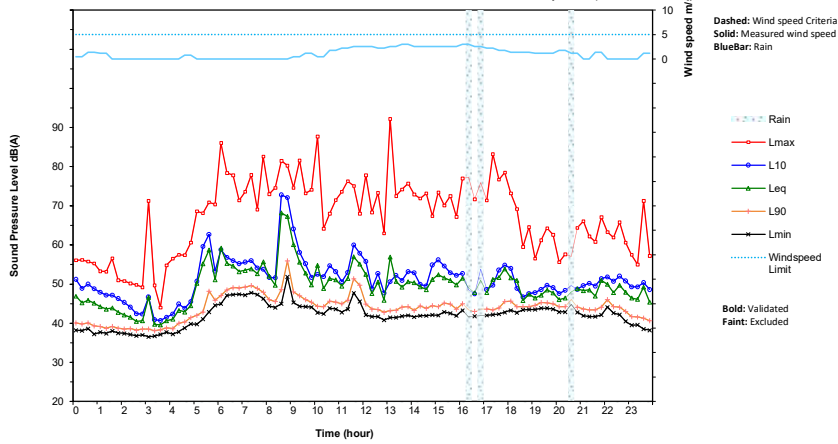
Sunday, 14 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

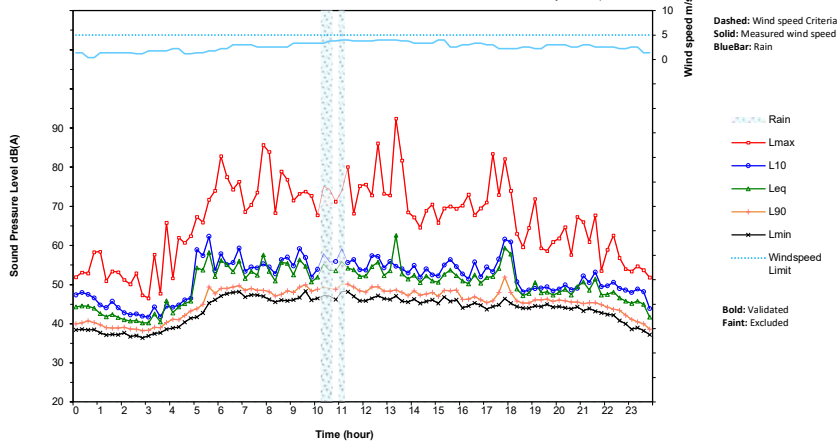
Monday, 15 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

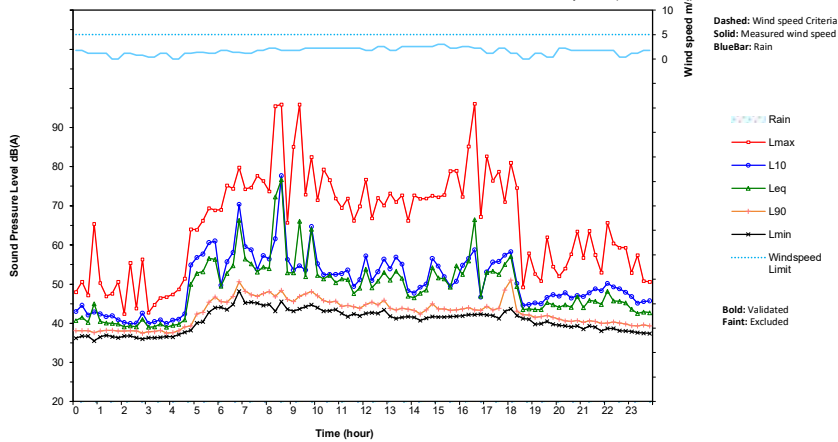
Tuesday, 16 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

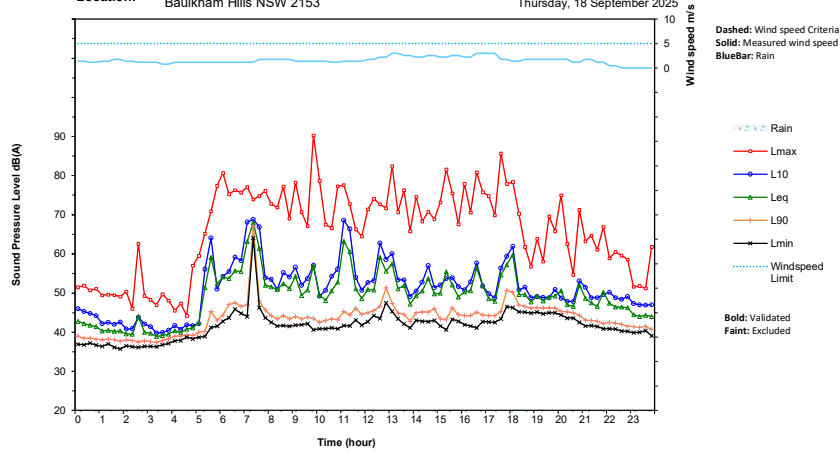
Wednesday, 17 September



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

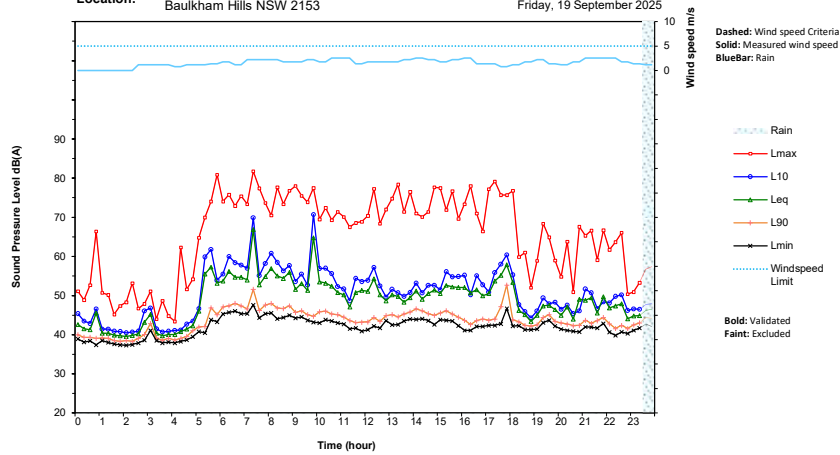
Thursday, 18 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

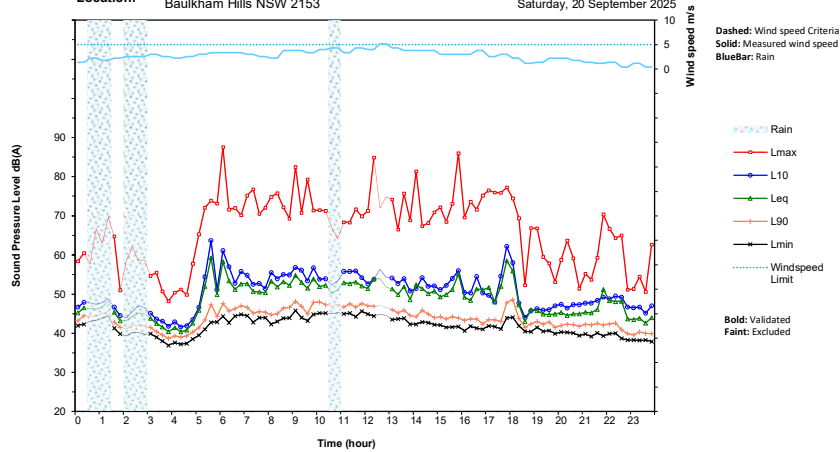
Friday, 19 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

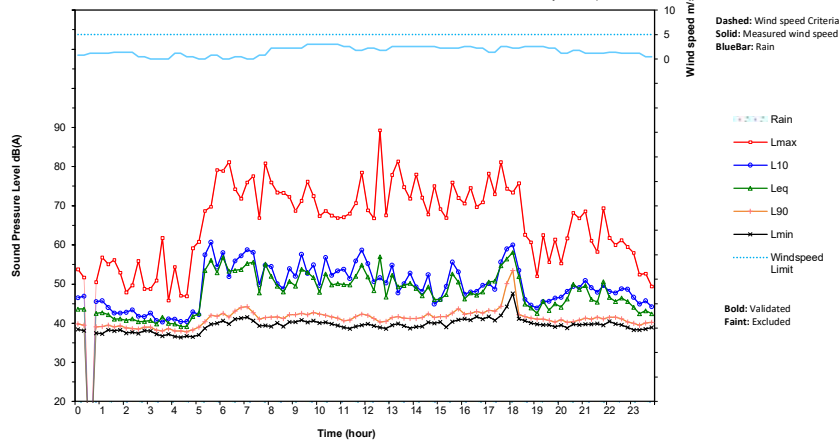
Saturday, 20 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

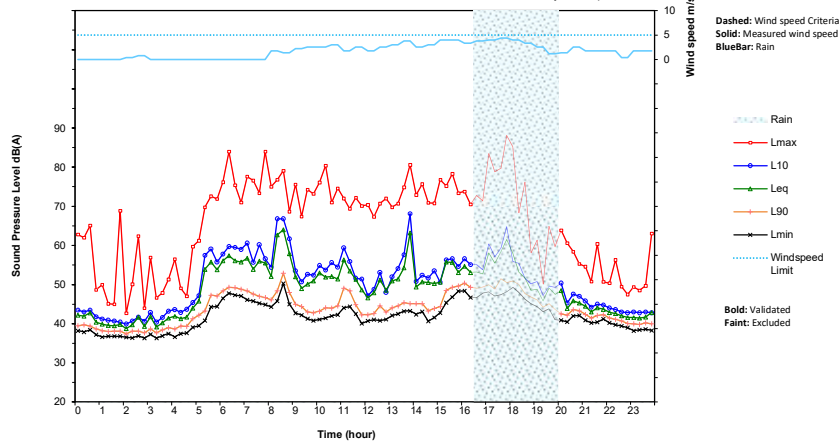
Sunday, 21 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

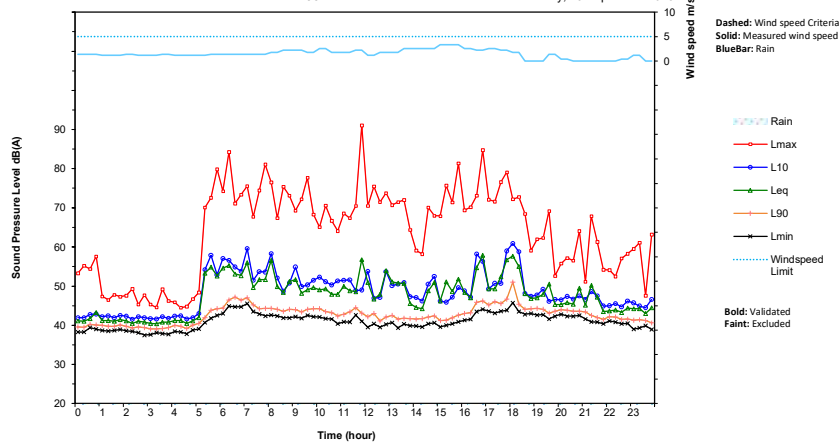
Monday, 22 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

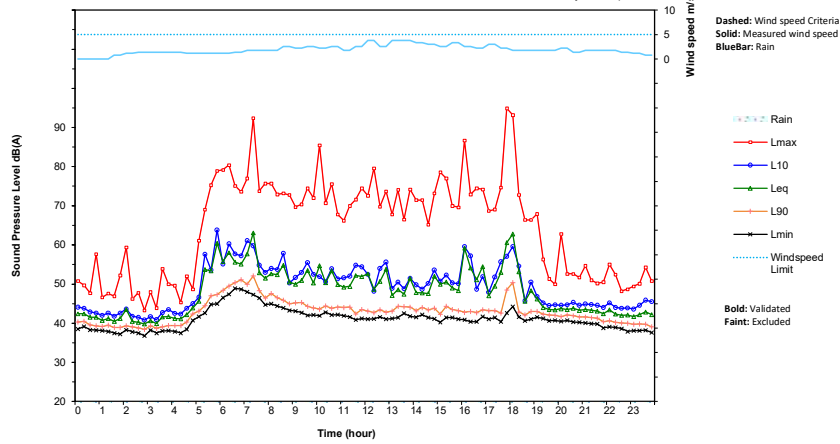
Tuesday, 23 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

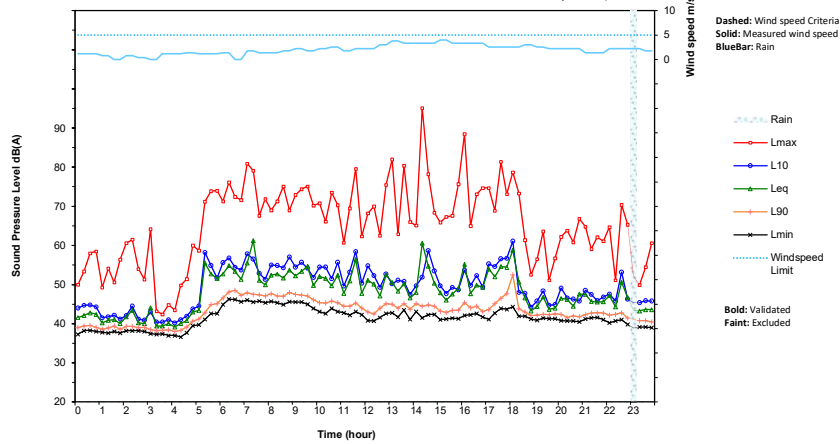
Wednesday, 24 September



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

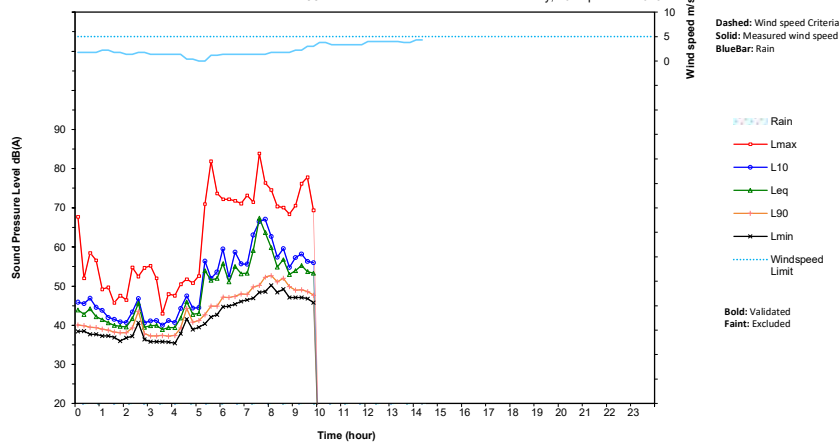
Thursday, 25 September 2025



Logger ID: L4

Location: Castle Pines Ret Vlg, 92 Longview Pl,
Baulkham Hills NSW 2153

Friday, 26 September 2025





ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L5 - C210	Larson & Davus LxT	1719	210/11 Solent Cct, Norwest NSW 2153	2025-10-13	2025-10-21	2024-05-22	F	A	Level 2 Balcony Facing NE

Ambient noise monitoring results - NPfl & ICNG time periods			
	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{Aeq} , period dB	51	52	44

Ambient noise monitoring results - RNP time periods		
	Day 15 hr	Night 9 hr
L_{Aeq} period dB	58	53
L_{Aeq} , 1hr dB	60	58

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

Night 10 pm to 7 am

Notes:

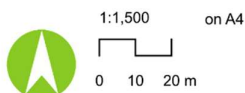
This logger recorded noise primarily associated with pedestrian and local traffic activity. The proximity to pathways and adjacent retail/commercial outlets contributed to frequent short-term fluctuations in sound levels.

Legend

- Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

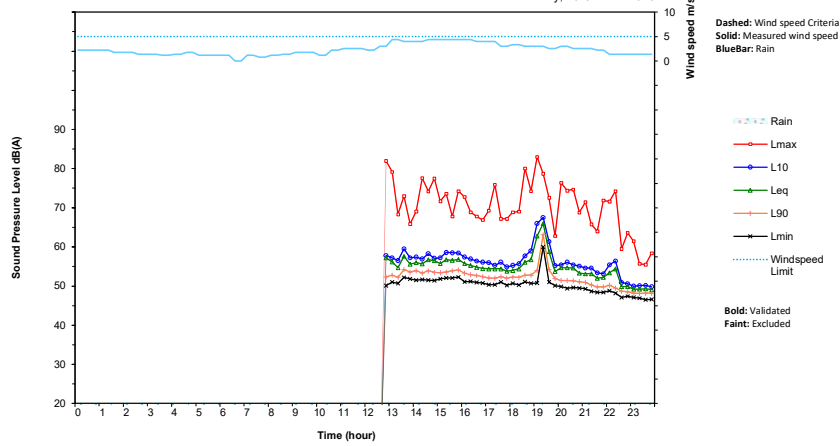
Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Noise monitoring location - Logger L5 - C210

Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

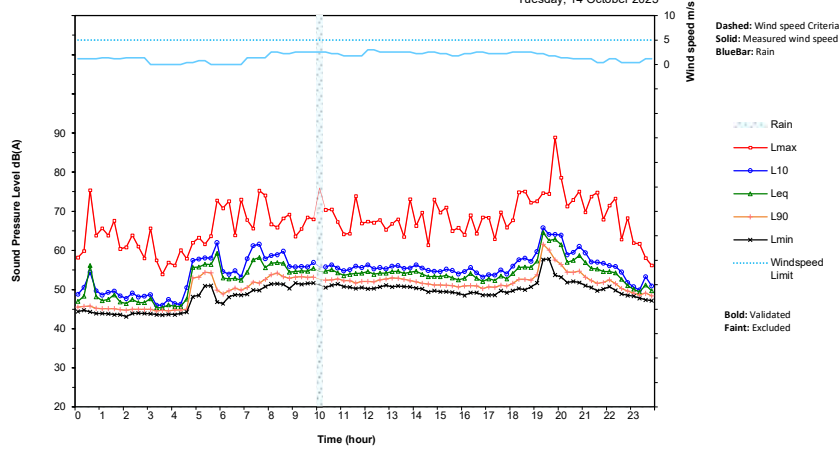
Monday, 13 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

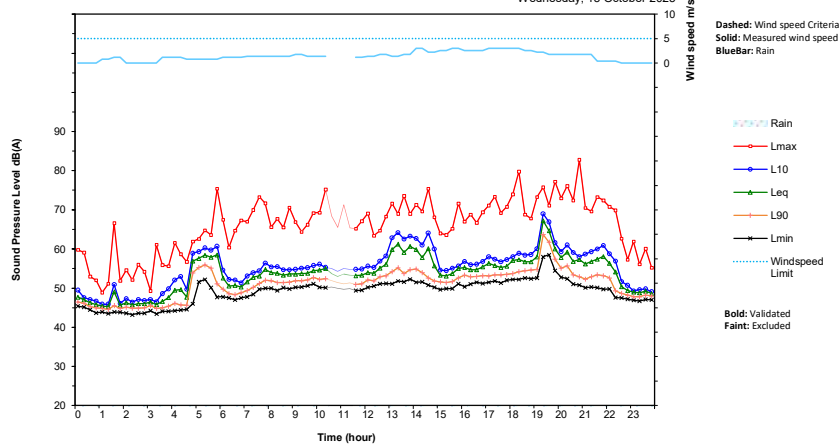
Tuesday, 14 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

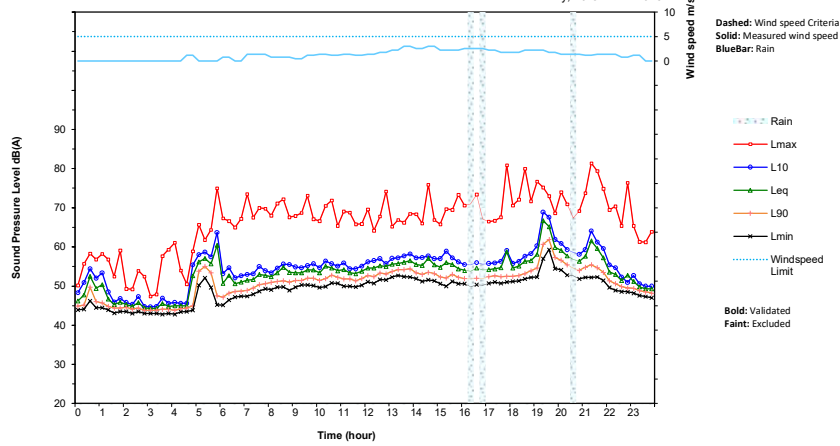
Wednesday, 15 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

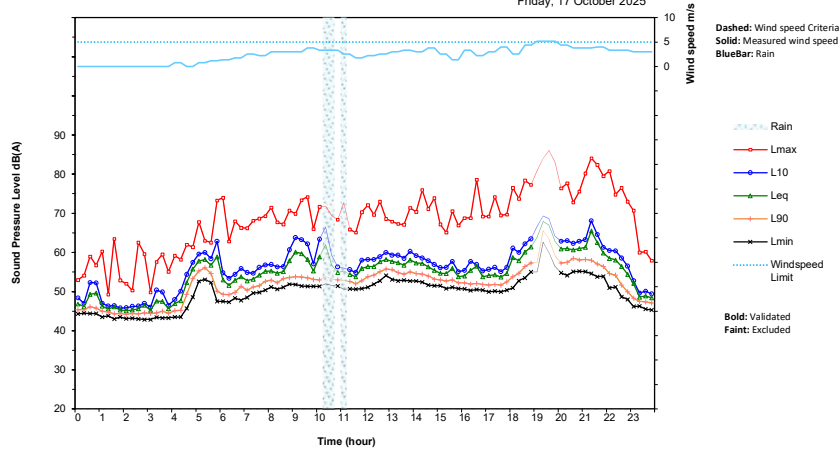
Thursday, 16 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

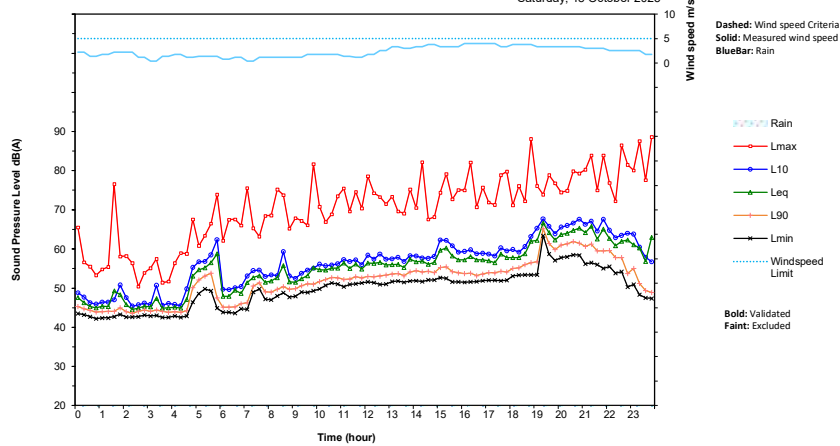
Friday, 17 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

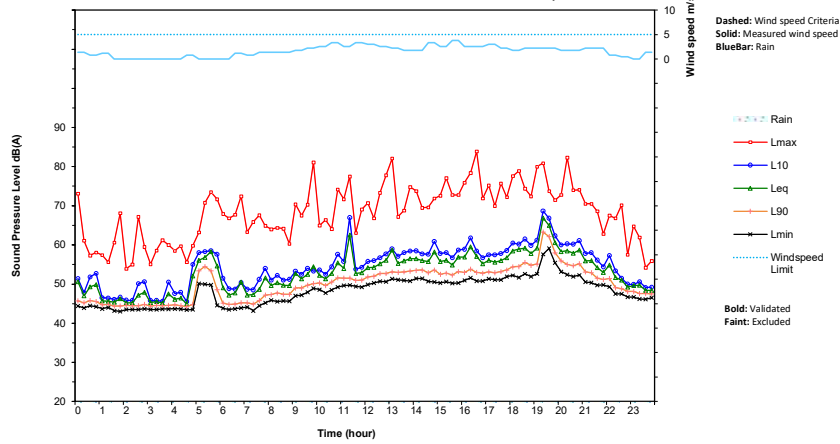
Saturday, 18 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

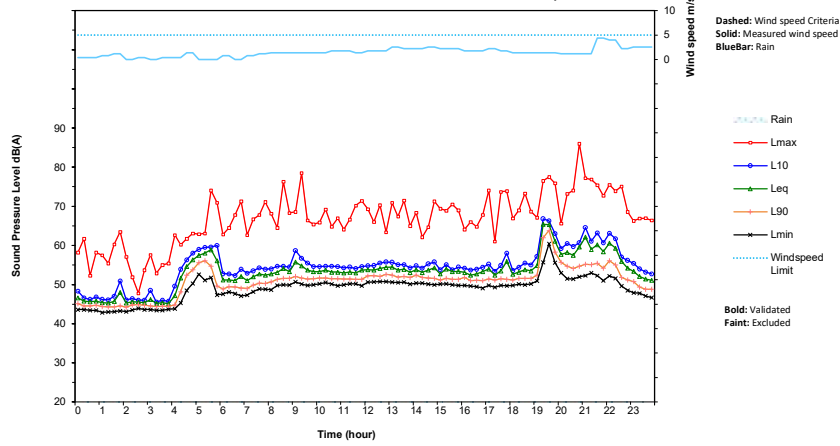
Sunday, 19 October 2025



Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

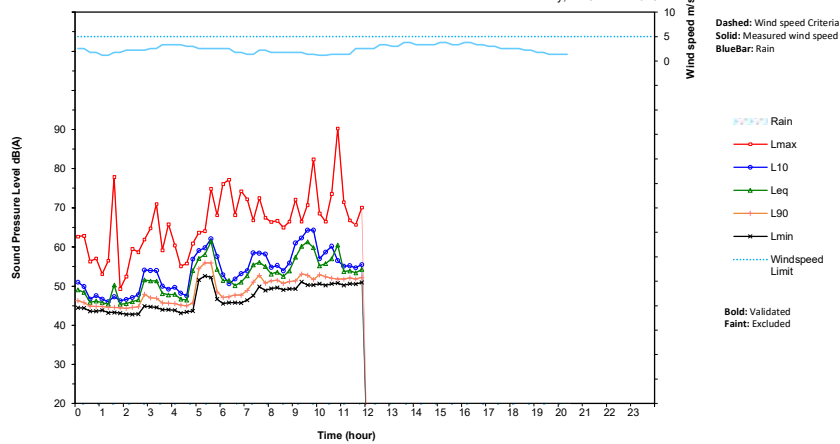
Monday, 20 October 2025

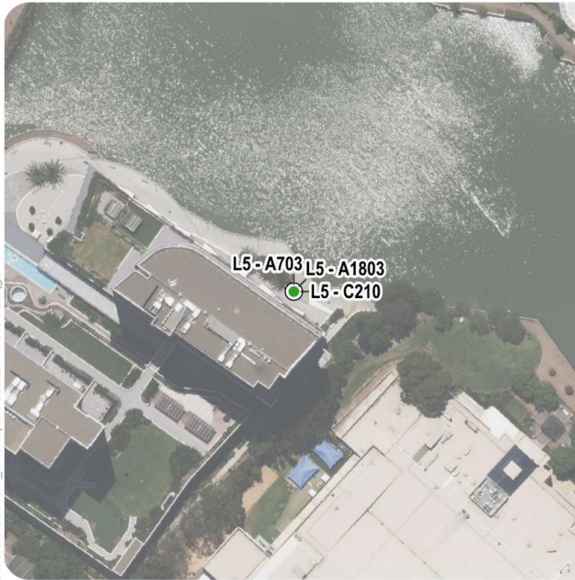


Logger ID: L210

Location: 210/11 Solent Cct, Norwest NSW 2153

Tuesday, 21 October 2025





ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L5 - A703	Rion NL-21	709528	703/11 Solent Cct, Norwest NSW 2153	2025-10-13	2025-10-21	2024-05-22	F	A	Level 7 Balcony Facing NE

Ambient noise monitoring results - NPfl & ICNG time periods

	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{Aeq} , period dB	51	50	45

Ambient noise monitoring results - RNP time periods

	Day 15 hr	Night 9 hr
L_{Aeq} period dB	56	52
L_{Aeq} , 1hr dB	58	57

Notes:

Compared to Level 18, the ambient noise was relatively lower due to improved shielding from surrounding building structures. While traffic noise from Windsor Road was still perceptible, it was less dominant.

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

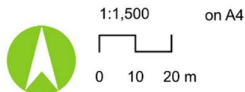
Night 10 pm to 7 am

Legend

- Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

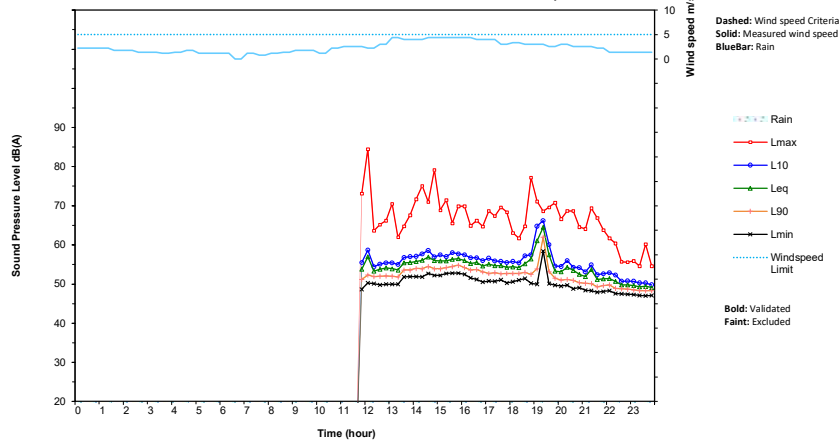
Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Noise monitoring location - Logger L5 - A703

Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

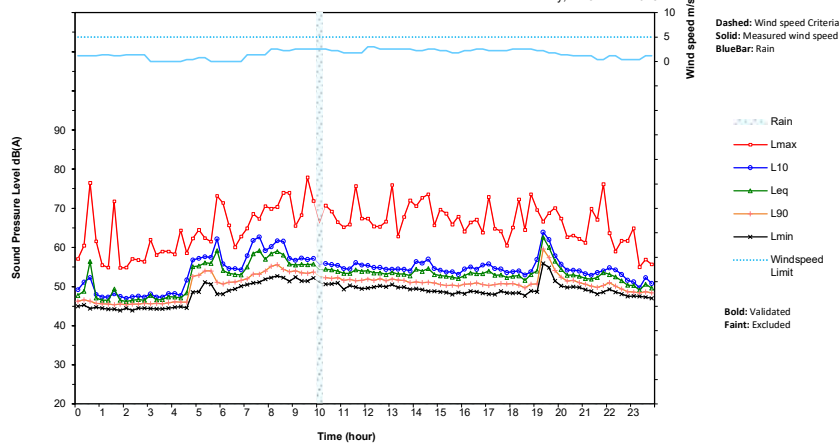
Monday, 13 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

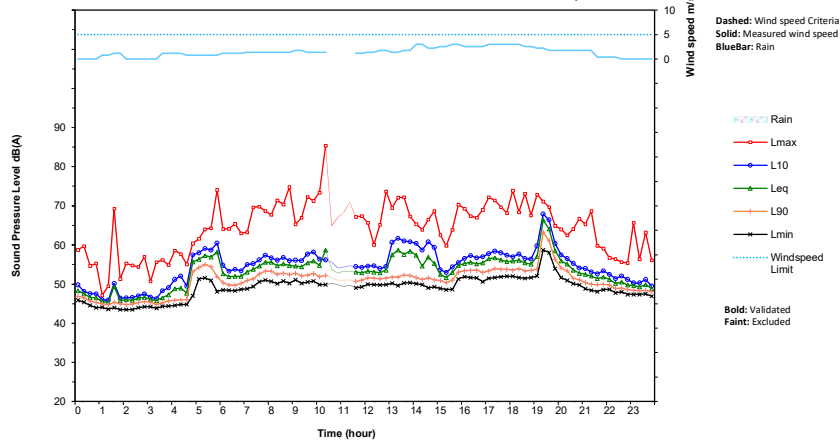
Tuesday, 14 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

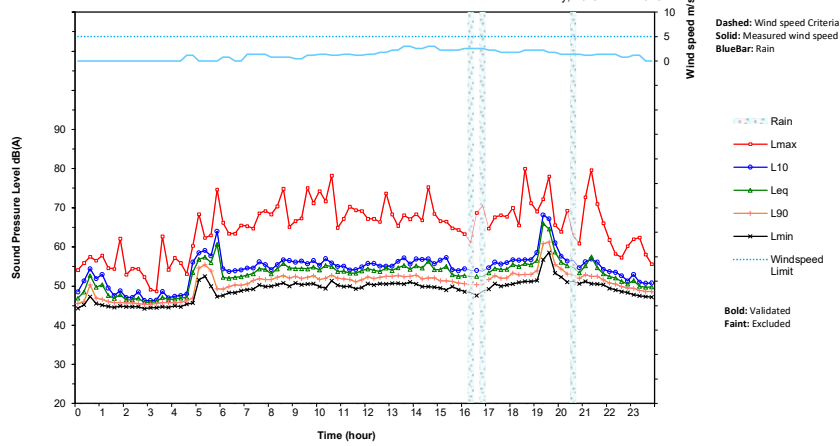
Wednesday, 15 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

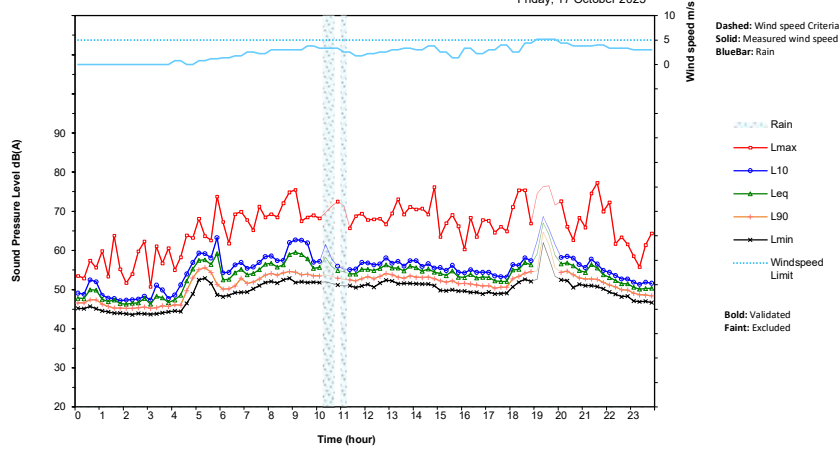
Thursday, 16 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

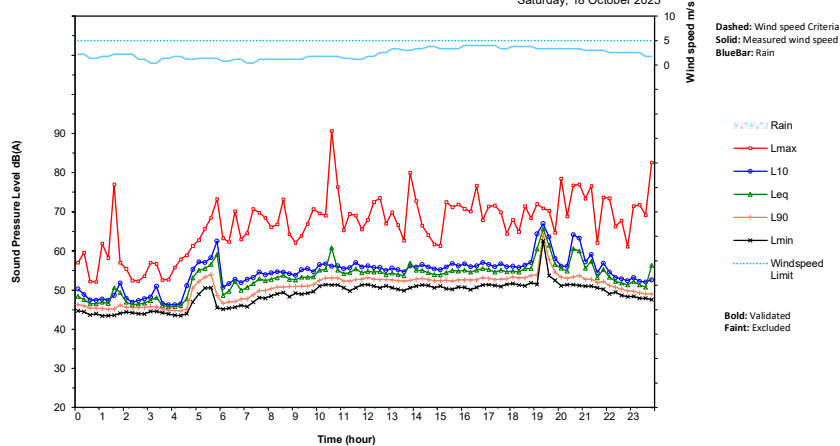
Friday, 17 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

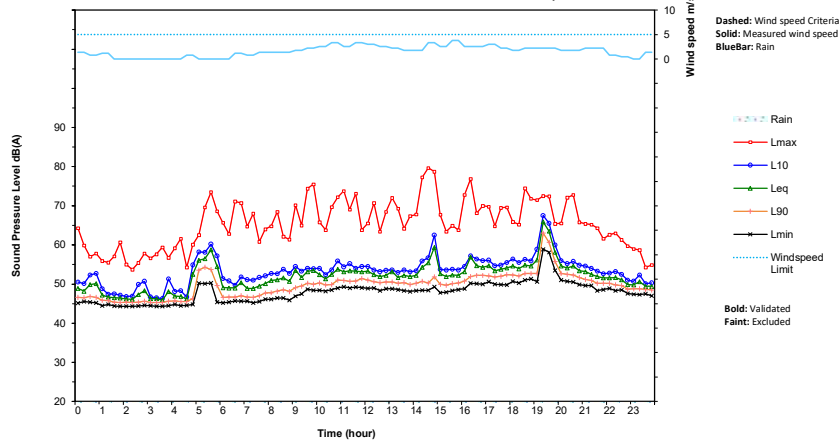
Saturday, 18 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

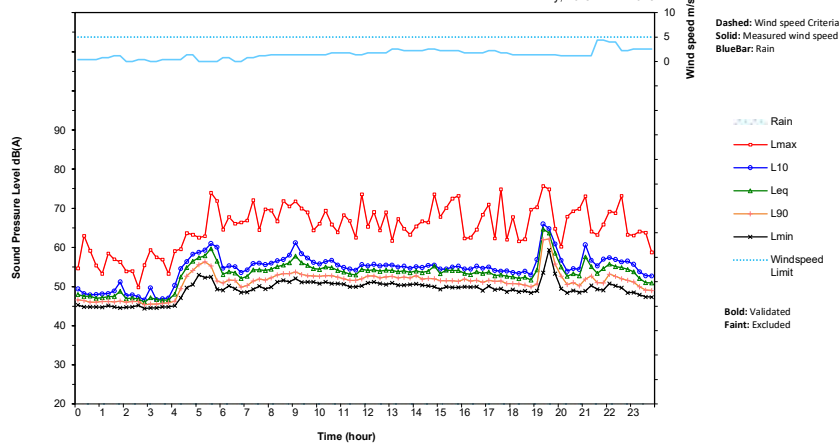
Sunday, 19 October 2025



Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

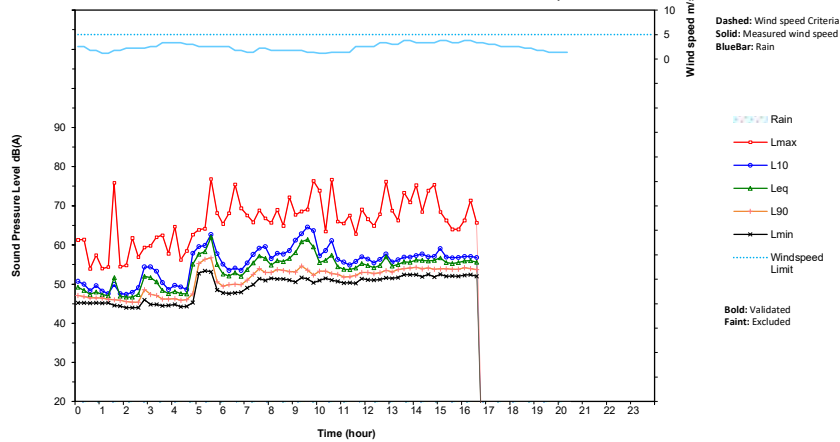
Monday, 20 October 2025

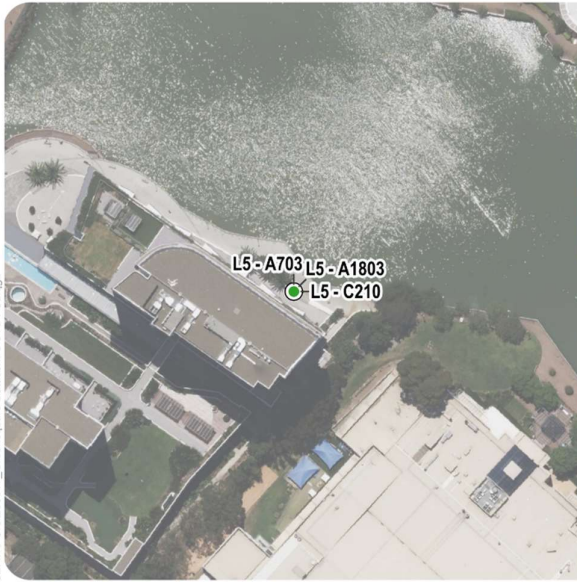


Logger ID: L703

Location: 703/11 Solent Cct, Norwest NSW 2153

Tuesday, 21 October 2025





ID	Model	SI No	Address	Start Date	Finish Date	Cal Date	Time Weight	Freq Weight	Location
L5 - A1803	Rion NL-21	709529	1803/11 Solent Cct, Norwest NSW 2153	2025-10-13	2025-10-21	2024-09-10	F	A	Level 18 Balcony Facing NE

Ambient noise monitoring results - NPfl & ICNG time periods			
	Day 11 hr	Evening 4 hr	Night 9 hr
RBLs L_{Aeq} , period dB	54	53	49

Ambient noise monitoring results - RNP time periods		
	Day 15 hr	Night 9 hr
L_{Aeq} period dB	58	53
L_{Aeq} , 1hr dB	59	57

Time periods for NPfl & ICNG

Day 7 am to 6 pm Monday to Saturday
8 am to 6 pm Sundays and Public Holidays

Evening 6 pm to 10 pm

Night Remaining periods

Time periods for RNP

Day 7 am to 10 pm

Night 10 pm to 7 am

Notes:

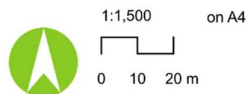
. Dominant contributors to the overall sound levels were road traffic from Windsor Road and Solent Circuit.

Legend

● Unattended Noise Monitoring (Loggers)



Source: Aurecon, NSW Spatial Services, ESRI, Open street maps



Greensquare Datacentre SYD1 GPU2 Noise Impact Assessment

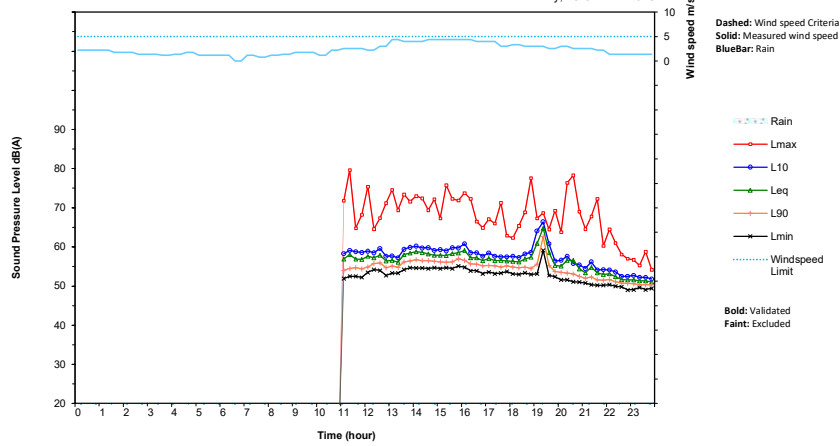
Projection: GDA2020 / MGA zone 56 (EPSG:7856)

Noise monitoring location - Logger L5 - A1803

Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

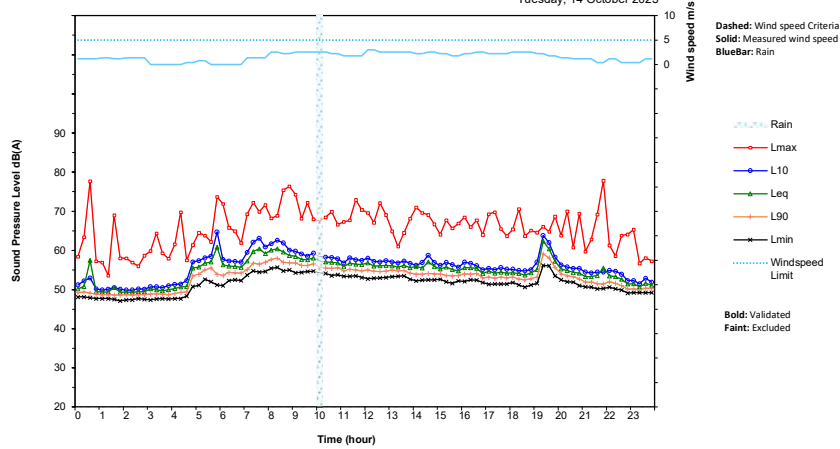
Monday, 13 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

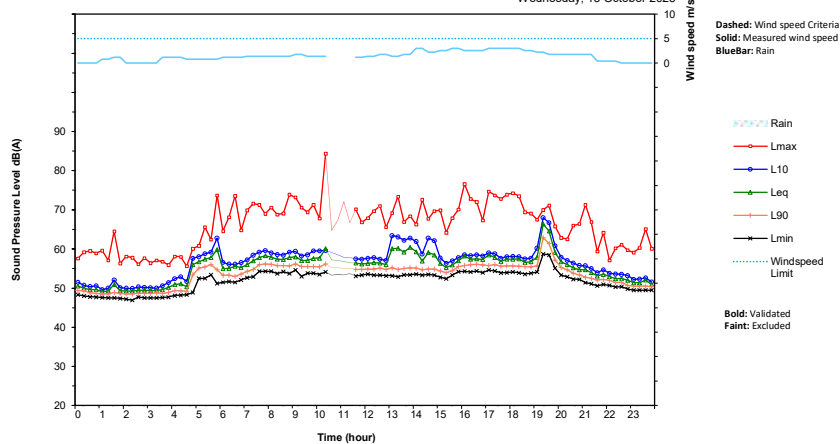
Tuesday, 14 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

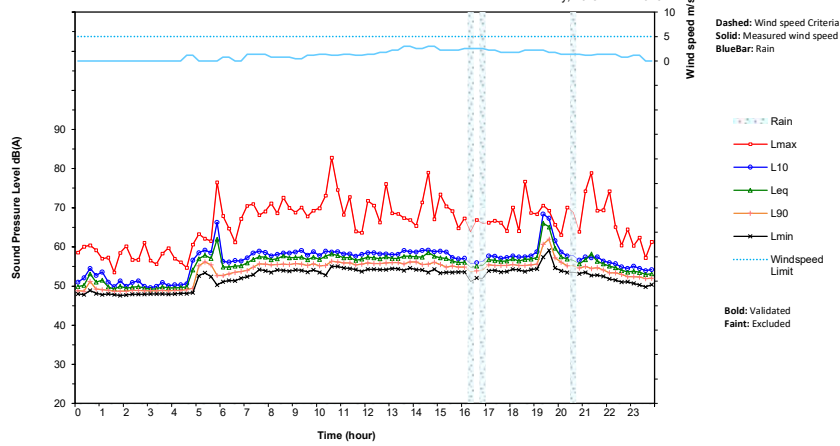
Wednesday, 15 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

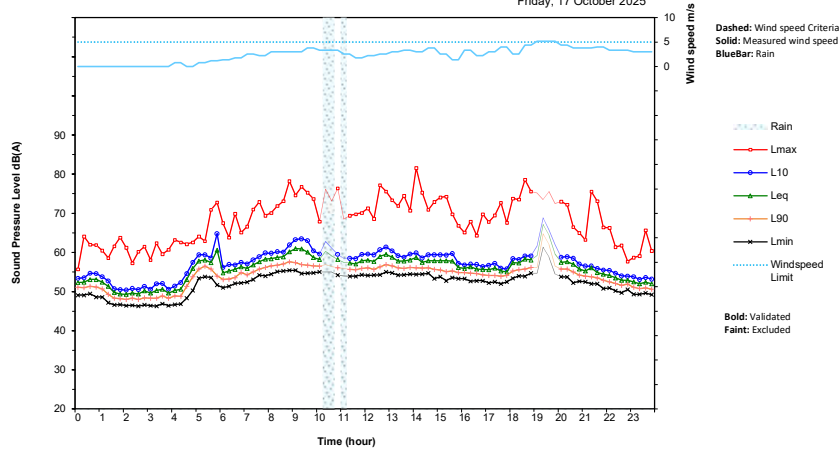
Thursday, 16 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

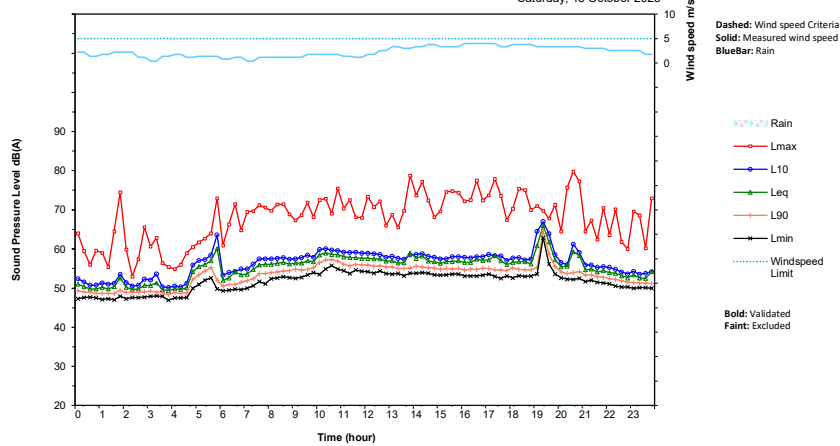
Friday, 17 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

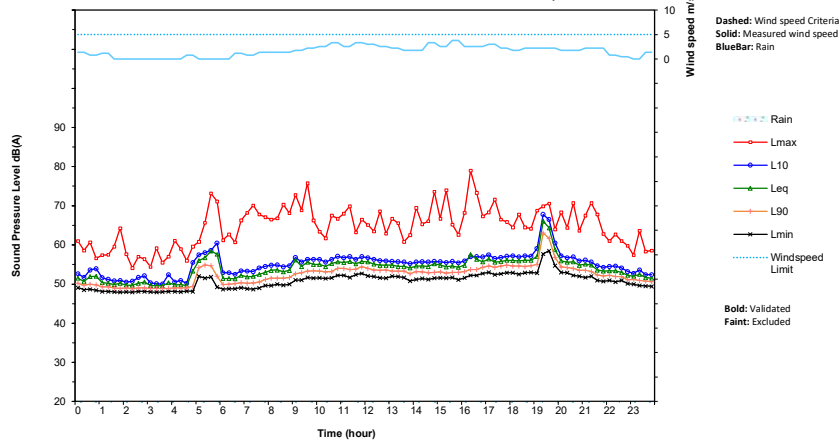
Saturday, 18 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

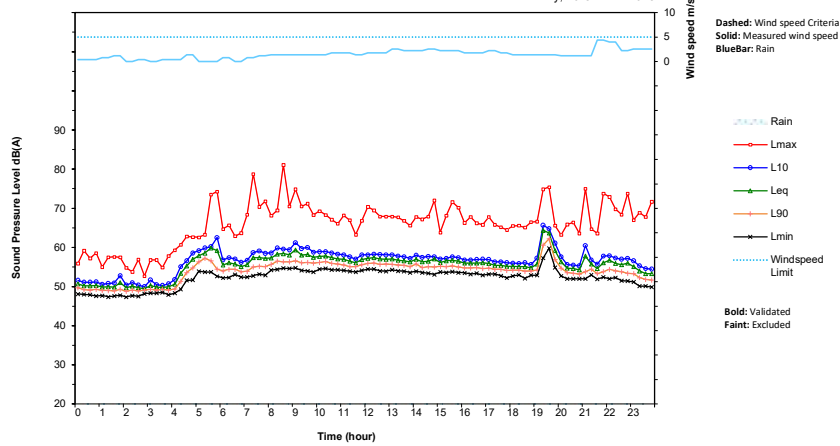
Sunday, 19 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

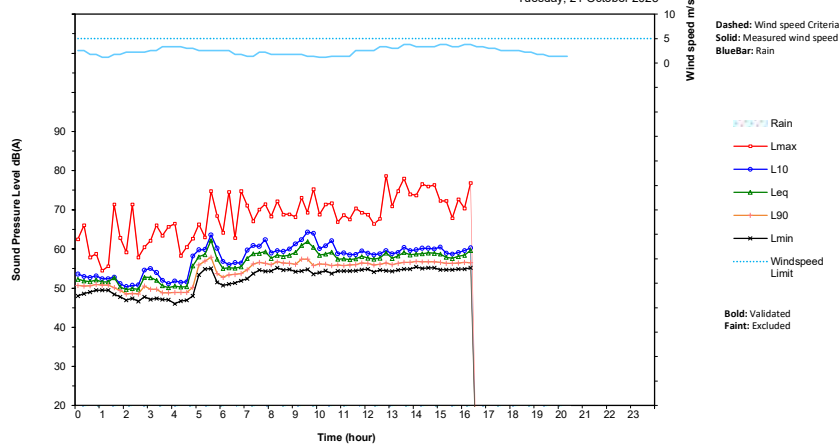
Monday, 20 October 2025



Logger ID: L1803

Location: 1803/11 Solent Cct, Norwest NSW 2153

Tuesday, 21 October 2025



Appendix G – Noise wall layouts

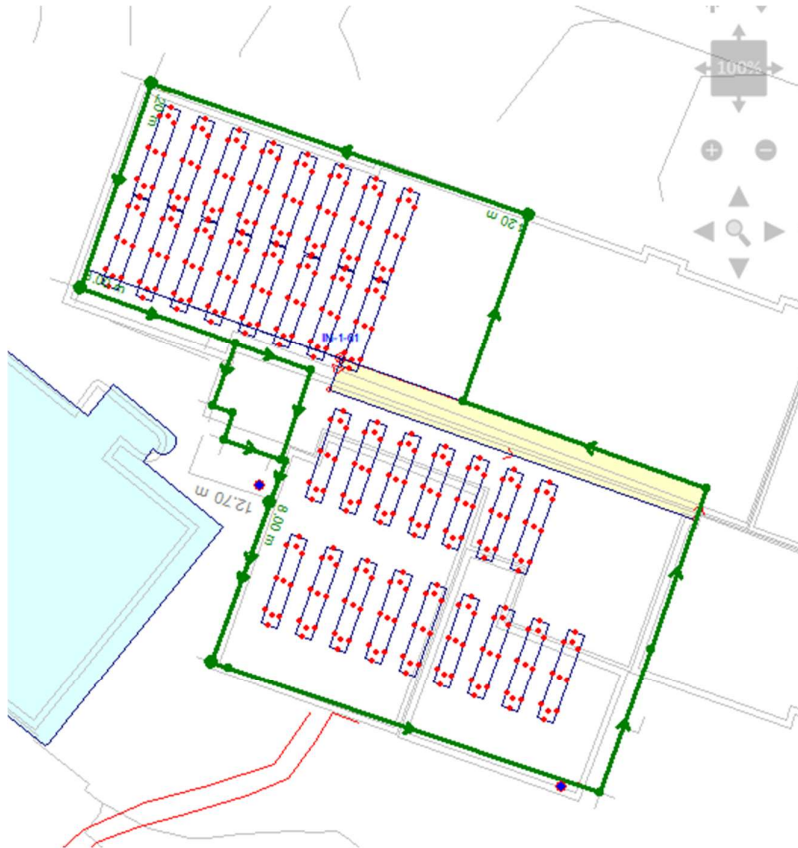
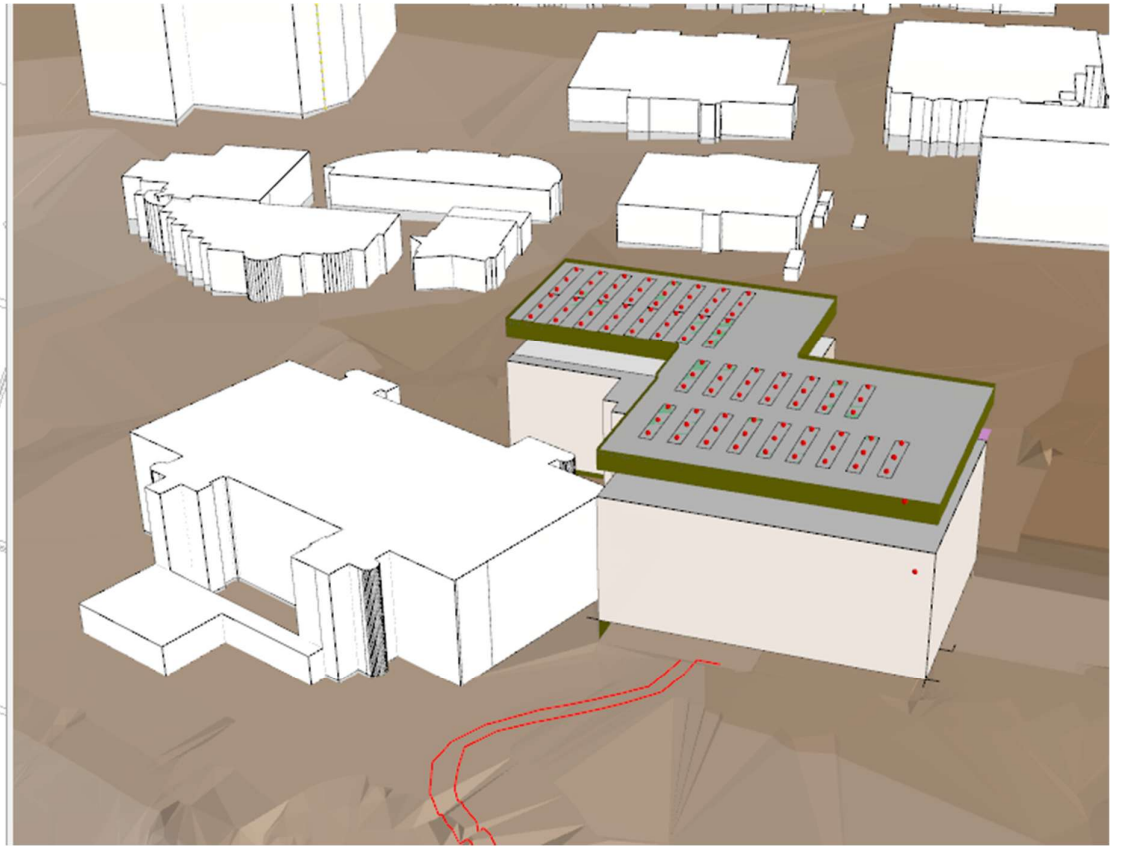


Figure 11-1 Phase 1



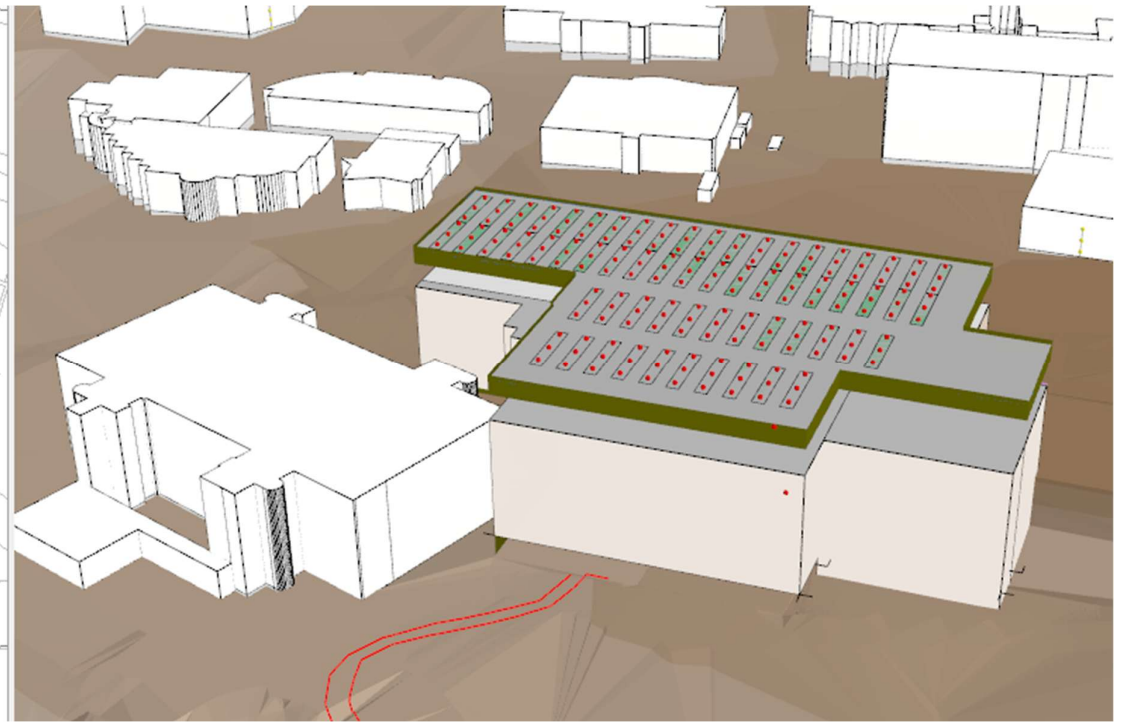
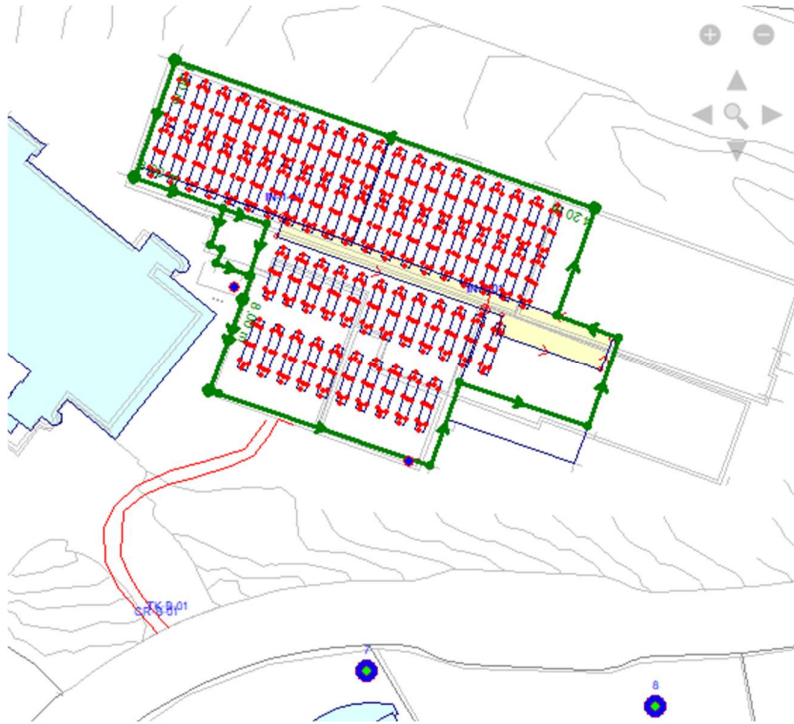
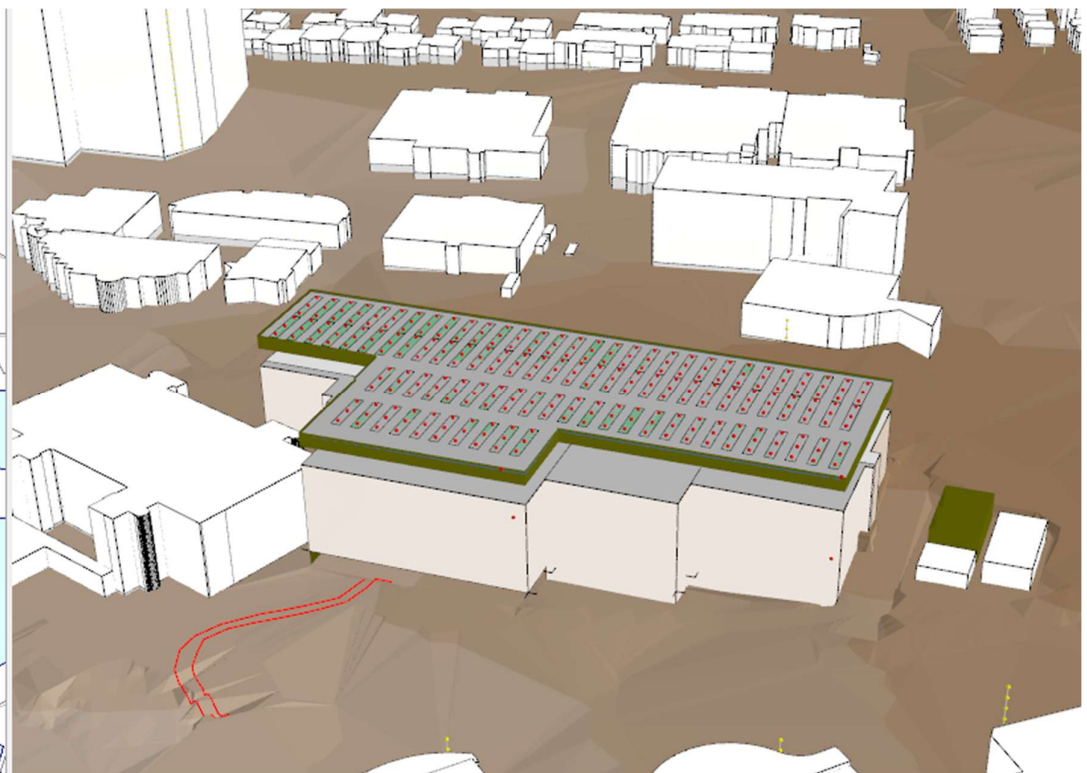
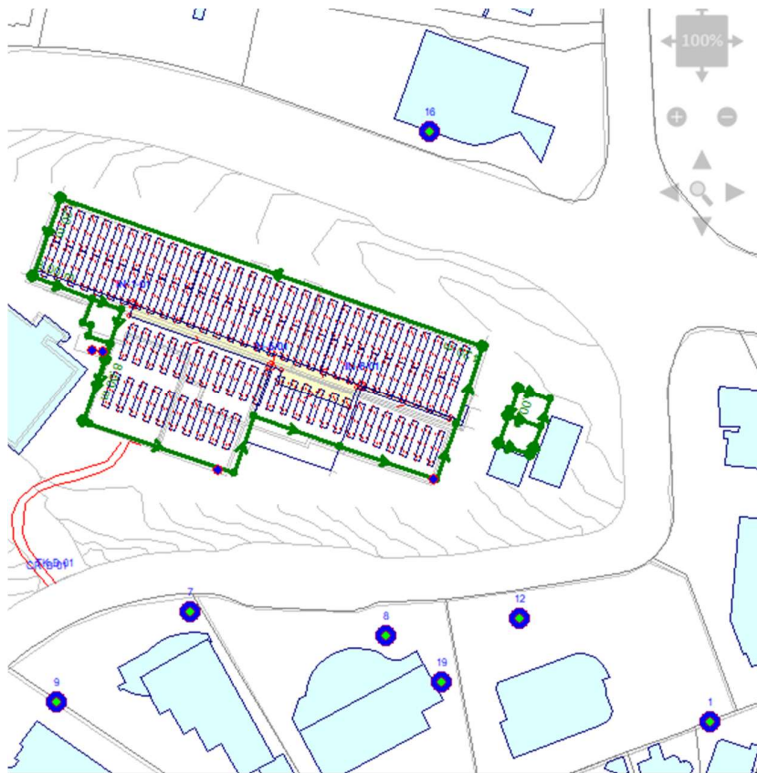


Figure 11-2 Phase 2



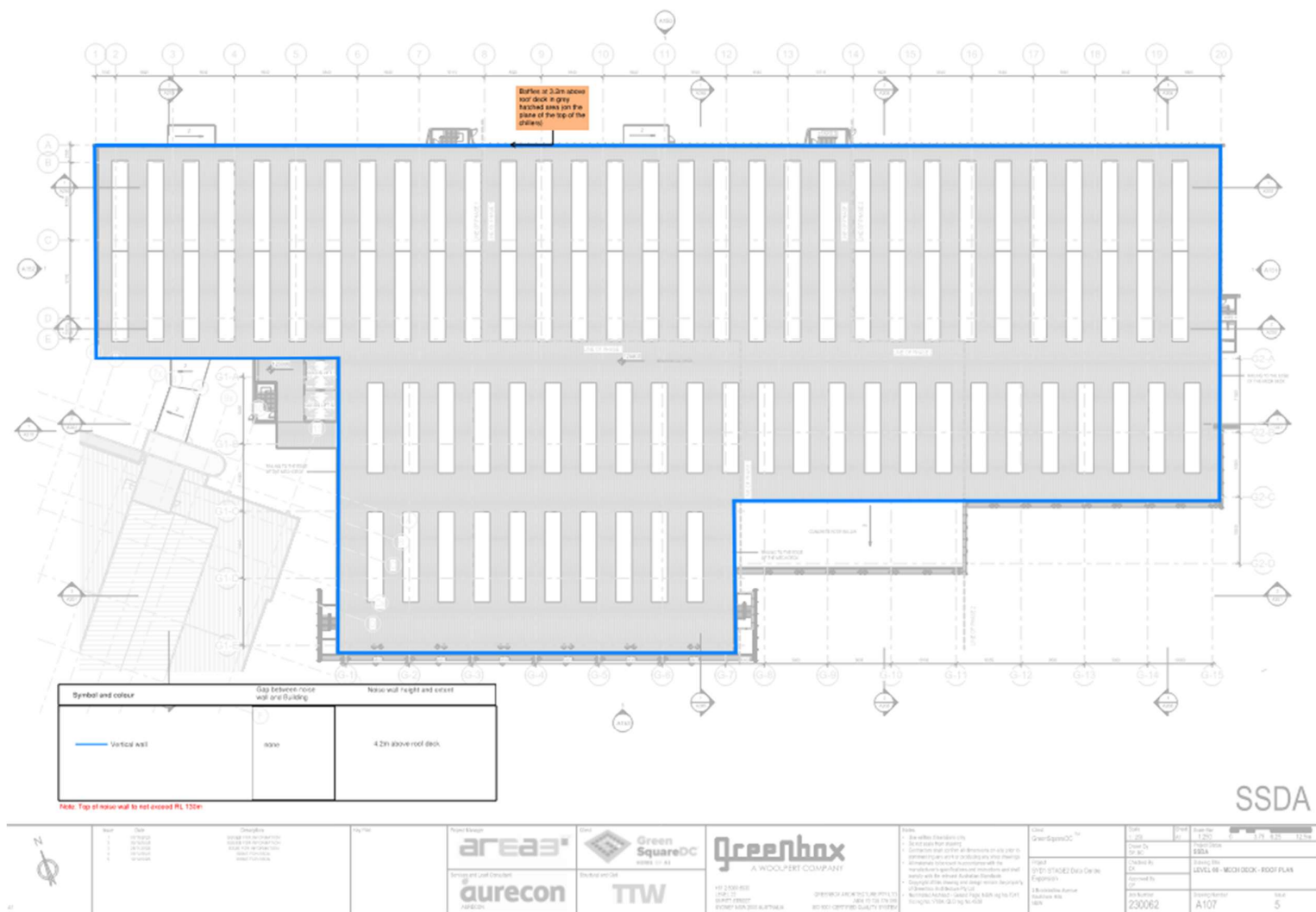
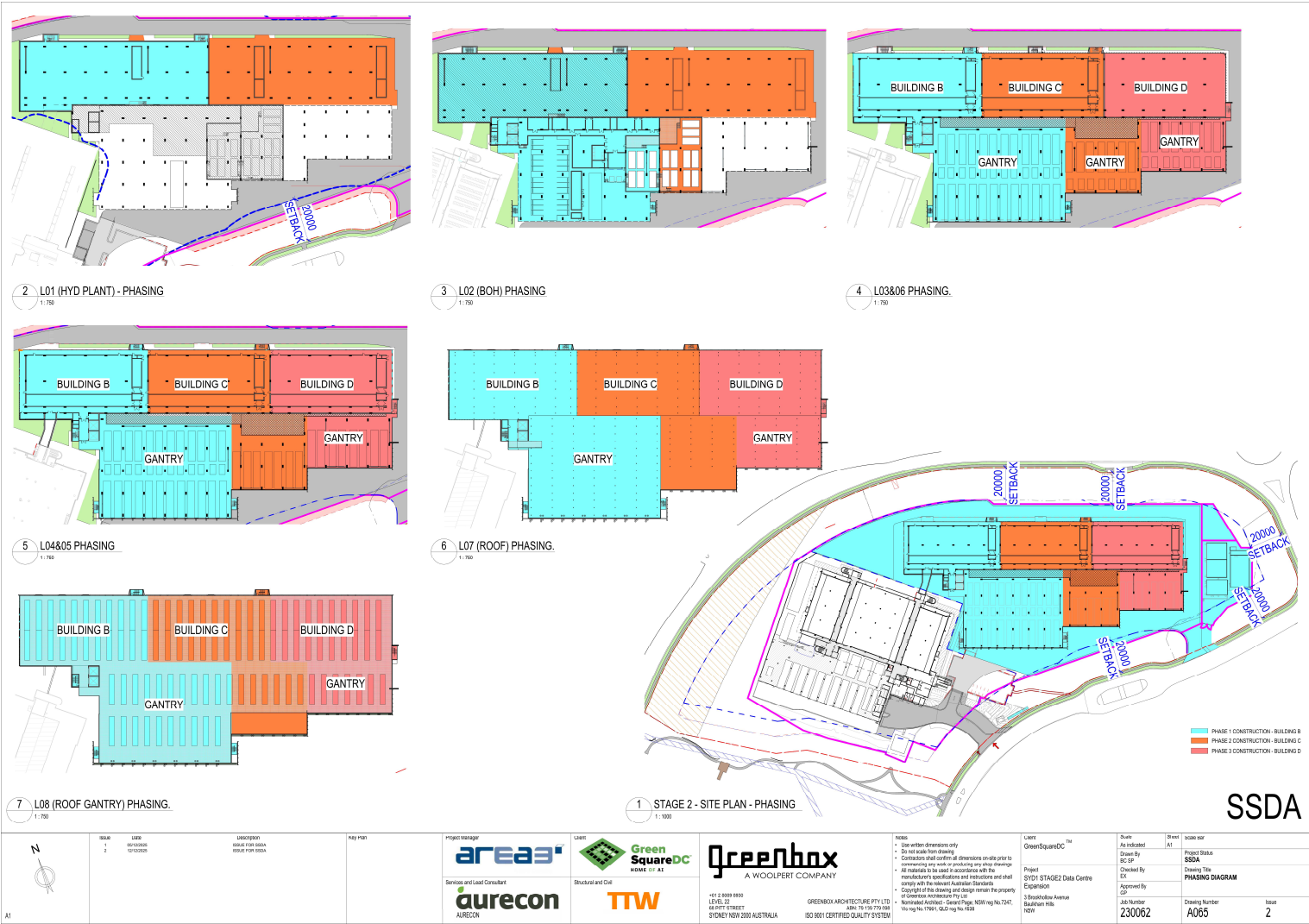


Figure 11-3 Phase 3

Appendix H – Construction phasing diagram



Document prepared by

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