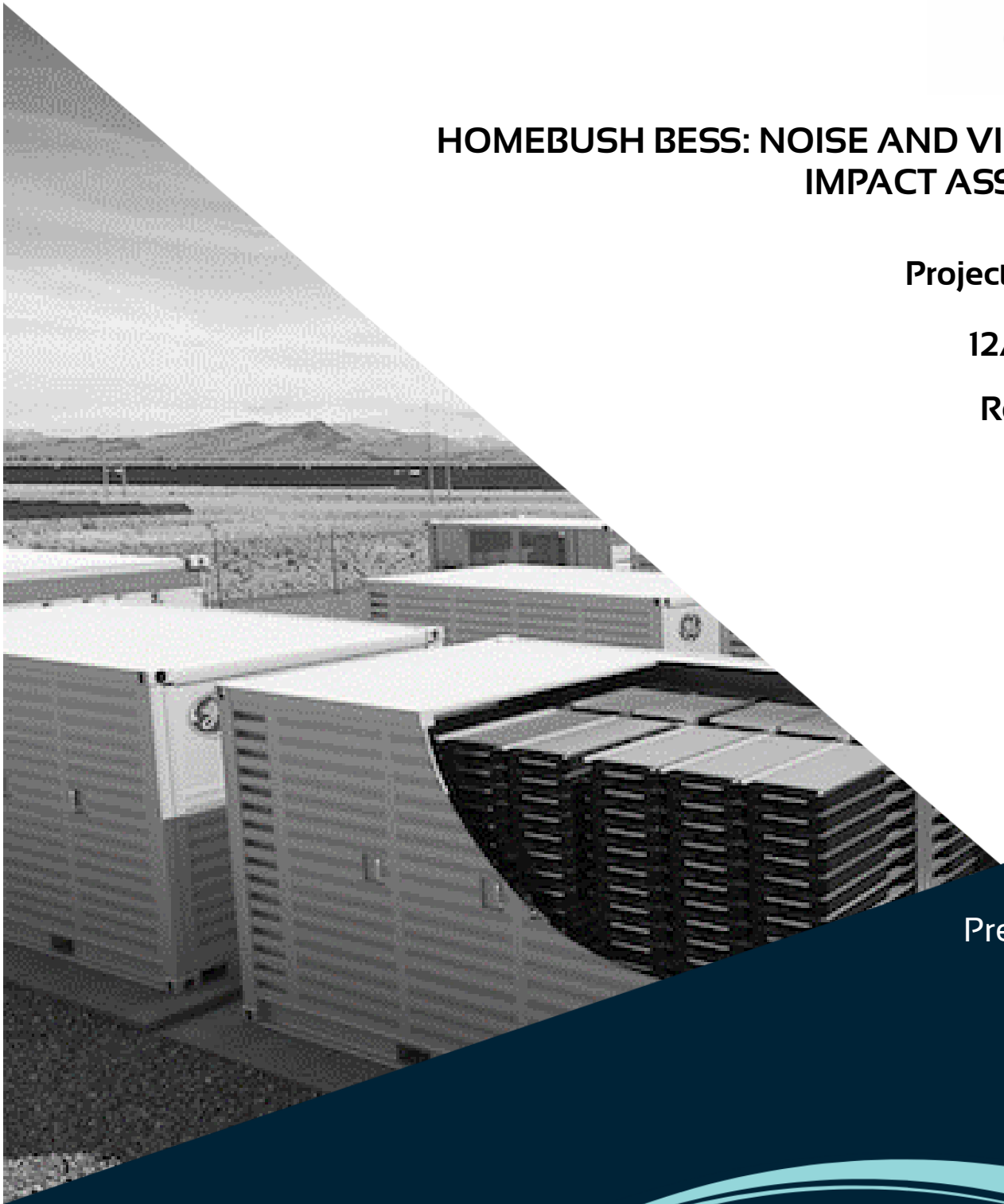

HOMEBUSH BESS: NOISE AND VIBRATION IMPACT ASSESMENT

Project ID: 15670

12/05/2025

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Table 1: History of Revisions

Revision	Date	Issued to	Changes
R0	25/11/2024	R. Rockwood	Initial Release
R1	9/01/2025	R. Rockwood	Minor Changes
R2	71/01/2025	R. Rockwood	Update to Modelling Scenario
R3	21/02/2025	R. Rockwood	Update to Formatting and Text
R4	19/03/2025	R. Rockwood	Update to Construction Assessment
R5	7/05/2025	R . Rockwood	Minor Changes
R6	12/05/2025	R. Rockwood	Minor Changes

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GLOSSARY

A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
Acoustic Background Level (ABL)	The single-figure background level representing each assessment period– day, evening and night (i.e. three ABLs are determined for each 24-hour period of the monitoring period). ABL is a measure of background noise level in the absence of noise from the source. Determination of the ABL is by the tenth percentile method, i.e. sort the recorded hourly LA90's into ascending order and select the lowest ten percentile level.
dB(A) or dBA	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Free field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally, as measured outside and away from buildings.
L_{Aeq}	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. Noise levels often fluctuate over a wide range with time. Therefore, when a noise varies over time, the L_{Aeq} is the equivalent continuous sound which would contain the same sound energy as the time varying sound. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.
LA_{10}, LA_{90}, LA_n	Noise level exceeded for n% of the measurement period with A-weighted, calculated by statistical analysis - where n is between 0.01% and 99.99%. For example, LA10 is the noise level just exceeded for 10% of the measurement period, calculated by statistical analysis and used to determine traffic noise and LA90 is the noise level exceeded for 90% of the measurement period, A-weighted and calculated by statistical analysis and used to determine background noise levels.
LAF_{max}	A-weighted, fast response, maximum, sound level.
LAF_{min}	A-weighted, fast response, minimum, sound level.
RBL	Rating background noise level – the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
SWL	Sound Power Level in decibels is ten times the logarithm of the ratio of the sound power to the sound power reference level of 1 Pico Watt.

ABBREVIATIONS

ANL	Amenity Noise Level
BESS	Battery Energy Storage System
BOM	Bureau of Meteorology
CRTN	Calculation of Road Traffic Noise
DCNG	Draft Construction Noise Guideline
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW)
EPA	Environmental Protection Authority (NSW)
ICNG	Interim Construction Noise Guidelines
LGA	Local Government Area
LIDAR	Light Direction and Ranging
ML	Monitoring Location
MVPS	Medium Voltage Power Station
NEM	National Electricity Market
NPfI	Noise Policy for Industry
PPV	Peak Particle Velocity
RMS	Root Mean Square
RNP	Road Noise Policy (NSW)
RMU	Ring Main Unit
SSD	State Significant Development
STSS	Sub-Transmission Switching Station
VDV	Vibration Dose Value

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1 INTRODUCTION

1.1 Background

Ausgrid is seeking development consent to construct, operate and maintain a Battery Energy Storage System (BESS) with a capacity of 200 MW at Homebush (the Project). This NIA focuses on the noise producing equipment associated with the Project. The BESS would provide storage capacity to the National Electricity Market (NEM), which would increase the stability of the electricity network by providing both energy storage and ancillary services. The Project is classified as State Significant Development (SSD - 774432).

1.2 Scope of Assessment

Assured Environmental (AE) was appointed by Ausgrid to undertake a Noise and Vibration Impact Assessment for the Project. The Project will be located at 10 Homebush Bay Drive, Homebush, NSW.

This noise and vibration assessment considers the potential impacts of the construction and operation of the BESS infrastructure (namely the Tesla Megapack 2XL batteries and step up transformers utilised in BESS operations) on nearby sensitive receptors in accordance with the following NSW policies and guidelines:

- NSW Noise Policy for Industry (NPfI) (EPA, 2017);
- NSW Assessing Vibration: a technical guideline (DEC 2006);
- NSW Road Noise Policy (DECCW, 2011);
- Interim Construction Noise Guideline (ICNG) (DECC, 2009); and
- Draft Construction Noise Guideline (EPA, 2017).

2 PROJECT DESCRIPTION

2.1 Project Overview

The Project is located approximately 14 km north-west of the Sydney CBD. The Project Area is zoned SP2 Infrastructure (specifically Electricity Supply) and falls within the Strathfield Local Government Area. The Project is located in the central portion of Lot 1 Deposited Plan 1218218, to the southeast of the existing Sub-transmission Switching Station (STSS).

The Project lot is approximately 6.19 hectares (ha) in total and the area that is likely to be physically disturbed by the Project is approximately 2.65 ha. The Project will be undertaken on property that is currently owned by Ausgrid. The Project is enclosed by the Western Motorway (M4) to the south and west, Homebush Bay Drive to the north and the Direct Factory Outlet (DFO) to the east.

The nearby land is zoned and in use for a variety of purposes including:

- General Industrial.
- Infrastructure.
- Mixed Use.
- Public Recreation; and
- Medium Density Residential.

2.2 Key Details

Ausgrid proposes to construct, operate and maintain a 200MW (2-hour duration, i.e. 400 MWh) BESS adjacent to the Homebush substation, in the Homebush SP2 Infrastructure precinct. The Project would comprise a BESS to store energy from the grid, releasing it during high demand periods. The BESS would also perform other ancillary services for the grid

Key features of the Project would include but not be limited to:

- Construction and operation of a BESS with a 200 MW maximum power output capacity with 2-hour duration (i.e. 400 MWh)
- Containerised battery units (112 Tesla Megapack 2XL) and associated infrastructure, including inverters and 56 medium voltage transformers
- Connection of the BESS to the Mason Park sub-transmission switching station (STSS) infrastructure via a 33 kV underground cabling.
- Combined switch room and control room building
- Eight Ring Main Units (RMU)

On-site workshop facility

- Two auxiliary transformers
- Backup diesel generator

Two spaces for on-site car parking

- Other ancillary infrastructure including fire suppression, stormwater management, 2.4m high boundary security chain wire fencing, Acoustic barriers, lighting and CCTV.

2.2.1 Operational Noise Emissions

Noise emissions generated from BESS developments are primarily generated from the internal cooling mechanisms – namely fans – which are required to prevent overheating and internal failure. Battery cells generate significant heat when charging or discharging making fans vital systems in regulating internal temperatures.

The other main source of noise emissions generated from BESS developments are from the transformers required to adjust voltage levels between the energy storage system and the power grid.

Section 9.2 details the operational noise sources considered in this assessment.

2.2.2 Road Traffic Emissions

This NIA also considers the noise emissions generated from road traffic associated with The Project. The Project can be separated into three distinct stages: construction, operation and decommissioning.

The peak traffic generation potential is during construction which generates trips associated with the workface accessing the Project and the delivery of raw materials and plant. Decommissioning is anticipated to generate a similar level of traffic to the construction stage.

Traffic generated during the operational phase of the Project will be limited to weekly maintenance carried out by 1-2 full time maintenance personnel, as such the emissions generated during the operation phase are negligible and further assessment of operational vehicle emissions is not warranted.

Overall, the Project is expected to generate up to 71 vehicles per hour in the morning and evening peak hours during the peak construction period, which would reduce to 38 vehicle per hour during the average construction periods. Predicted traffic volumes are provided in Table 2.

Table 2: Traffic Generation during Construction Period

Vehicle Type		Average Construction Period		Peak Construction Period	
		Vehicle Trips Per Day (vpd)	Peak Hour Trips (vph)	Vehicle Trips Per Day (vpd)	Peak Hour Trips (vph)
Light Vehicles		67	34	134	67
Heavy Vehicles (HV)	Rigid Trucks	2	1	6	1
	Truck and Dog	2	1	0	0
	Semi-Trailers	0	0	0	0
	B-Doubles	1	1	2	1
	Special Purpose Vehicles (SPV)	2	1	2	1
	Non-High Risk OSOM	4	1	10	1
	HV Subtotal	10	4	20	4
Total		78	38	154	72

3 ASSESMENT METHODOLOGY

3.1 Unattended Background Monitoring

3.1.1 Methodology

Noise measurements were undertaken in accordance with the requirements of Australian Standard AS 1055-2018 *'Acoustics – Description and measurement of environmental noise'* and the NPfI (EPA, 2017). A Norsonic139 Class 1 Sound Level Meter was situated in a free-field position and a sampling time of 15-minutes was adopted for the monitoring. The microphone was positioned at a height of 1.5 metres above ground level and fitted with a windshield throughout the measurements.

3.1.2 Monitoring Locations

Baseline noise monitoring was conducted in August of 2024 at one location, The boundary of the Homebush Business Village; 20/11-21 Underwood Road, Homebush NSW (Figure 4). No attended measurements were required for this assessment.

3.1.3 Attended Monitoring

No attended measurements were conducted, the unattended background survey was conducted over a seven-day period and was used in determination of rated background levels as per the methodology outlined in the NPfI Fact Sheet A. The Project site is currently undeveloped, attended measurements would not provide additional detail used in modelling or background level determination.

3.1.4 Weather Affected Bias

Baseline monitoring was conducted between the 23rd of August to the 30th of August 2024. Wind and rainfall data from the nearest Bureau of Meteorology (BOM) station at Sydney Olympic Park (95765) indicates approximately 15 hours of noise data were potentially affected by rainfall or winds above 5 m/s. To avoid weather-related bias, noise measurements associated with wind or rain-affected periods have not been considered.

3.1.5 Equipment

The serial numbers and calibration information for the sound monitoring instrument used are presented in Appendix C.

3.2 Construction Noise Assessment Methodology

For the purposes of predicting impacts associated with noise emissions from the Project on nearby sensitive receptors, calculations of the noise impacts from construction activities have been undertaken using first principal calculations based on the distance separation of the receptor and the facility infrastructure.

Construction activities across the site will vary in location and duration; mobile plant will move around the Project throughout the construction phase. Table 11 presents noise levels predicted for the most affected receptor, taking into consideration the following assumptions:

- All equipment and plant are in the same area –This is considered to be a hypothetical worst-case scenario and unlikely to occur

- Initial phase of construction (Removal of vegetation/ site clearing and establishment of temporary site office) is considered from the boundary of the site where relevant site clearing activities will be undertaken

- For all other construction phases considered, all equipment and plant are modelled at the edge of the BESS hardstand area where works will take place. Construction activities (not inclusive of initial vegetation clearing phase) will take place on the area denoted "BESS Infrastructure" in Figure 5. These construction phases will consider the distance between the edge of the BESS infrastructure hardstand (indicated in Figure 5 by the blue polygon) and the receptor in calculation of predicted construction noise levels to determine worst-case noise emissions.

- The equipment quantities are currently estimates.

- Propagation is assumed to occur over hard ground and no screening objects between the source and the receiver; and

- Predicted noise level calculations are based on a minimum separation distance between construction activities and the receptors and the conservative assumption all equipment is running concurrently. In practice construction activities will be closest to the receptor for a short period of time with all construction equipment unlikely to be running concurrently. Given this, the potential for adverse impacts at any one receptor is expected to only occur for a short period of time.

3.3 Road Traffic Noise Modelling Methodology

For the purposes of predicting impacts associated with road traffic noise emissions was completed using the proprietary software CadnaA (2024 MR2 build 203.5403)) developed by DataKustik. The model incorporates the influence of terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. All predictions have been undertaken in accordance with Calculation of Road Traffic Noise (CRTN) methodology developed by the UK Department of Transport. In accordance with the requirements of the RNP, the predictive noise modelling incorporated the following assumptions:

- L_{Aeq} values were calculated from the L_{A10} values predicted by the CRTN methodology using the approximation $L_{Aeq,1\ hour} = L_{A10,1\ hour} - 3$.

- Noise source heights were set at 0.5 m above road level for cars, 1.5 m for heavy vehicle engines and 3.6 m for heavy vehicle exhausts.

- Noise from heavy vehicle exhausts is 8 dB lower than the steady continuous engine noise; and

- Corrections established for Australian conditions applied through a negative correction to the CRTN predations of -1.7 dB for façade-corrected levels (Samuels and Saunders, 1982).

The traffic assessment was modelling computationally to determine the maximum noise road traffic noise generated by vehicles during peak construction phase.

3.4 Operational Noise Assessment Methodology

3.4.1 Software

For the purposes of predicting impacts associated with noise emissions from the Project on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software CadnaA (2024 MR2 build 203.5403) developed by DataKustik. CadnaA incorporates the influence of meteorology, terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations.

The model is utilised to assess the potential noise emissions from the Project under a range of operating scenarios and meteorological conditions. The noise modelling also allows investigation of possible noise management solutions, in the event that non-compliance with the assessment criterion is predicted.

3.4.2 Meteorology

The NPfI presents guidelines for the consideration of meteorological effects on noise propagation, specifically, temperature inversions and/or gradient winds. NPfI provides two options for assessing meteorological effects as detailed in Table 3.

Table 3: Standard and Noise Enhancing Meteorological Conditions

Meteorological Conditions	Meteorological Parameters
Standard conditions	Day/Evening/Night: stability categories A-D with wind speed up to 0.5 m/s at 10 m AGL[b].
Noise enhancing conditions	Day/Evening: stability categories A-D with light winds (up to 3 m/s at 10 m AGL).
	Night: stability categories A-D with light winds (up to 3 m/s at 10 m AGL). And/or stability category F with light winds (up to 2 m/s at 10 m AGL).

a) Pasquill-Gifford Atmospheric Stability Class
b) AGL: Above ground level

3.4.3 Model Configuration

Table 4 summarises the model configuration used for the modelling.

Table 4: Model Configuration

Parameter	Approach
Standards	CONCAWE
Time Periods	Day (07:00 – 18:00 hours Evening (18:00 – 22:00 hours) Night (22:00 – 07:00 hours)
Digital Terrain	LIDAR data at 1 m intervals.
Ground Absorption	Ground absorption set for hard ground (0.1)
Meteorology	Day and Evening: Stability class D at 3 m/s Night: Stability class F at 2 m/s Worst case source to receptor

4 DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Receptors

There are existing dwellings, general industrial and commercial business and infrastructure receptors located in the vicinity of the Project. Table 5 and Figure 1 provide a summary of selected relevant sensitive receptors and their approximate distance to the Project boundary. All receptors were assessed individually and therefore no noise catchment area was applied.

Table 5: Nearby Sensitive Receptors

Receptor	Description	Coordinates (EPSG 7856)		Distance to Project Boundary (m)	Height (m) [(a)]
		Easting	Northing		
R01 Ground Floor	Residential	322203	6251942	121	1.5
R01 First Floor	Residential	322218	6251930	121	4.5
R02 Ground Floor	Residential	322228	6251948	134	1.5
R02 First Floor	Residential	322229	6251945	134	4.5
R03 Ground Floor	Residential	322239	6251952	148	1.5
R03 First Floor	Residential	322242	6251948	148	4.5
R04 Ground Floor	Residential	322254	6251957	160	1.5
R04 First Floor	Residential	322256	6251952	160	4.5
R05 Ground Floor	Residential	322265	6251960	174	1.5
R05 First Floor	Residential	322266	6251954	174	4.5
R06 Ground Floor	Residential	322278	6251964	183	1.5
R06 First Floor	Residential	322279	6251960	183	4.5
R07 Ground Floor	Residential	322288	6251967	190	1.5
R07 First Floor	Residential	322290	6251964	190	4.5
R08 Ground Floor	Residential	322296	6251970	203	1.5
R08 First Floor	Residential	322298	6251966	203	4.5
R09	Commercial	322179	6252002	95	1.5
R10	Commercial	322118	6251870	56	1.5
R11	Commercial	322224	6252018	132	1.5
R12	Commercial	322266	6252126	240	1.5
R13	Commercial	322280	6252105	229	1.5

Receptor	Description	Coordinates (EPSG 7856)		Distance to Project Boundary (m)	Height (m) [a]
		Easting	Northing		
R14	Commercial	322303	6252066	222	1.5
R15	Active Recreation	322384	6252113	311	1.5
R16	Active Recreation	322325	6252212	332	1.5
R17	Commercial	322112	6252092	132	1.5
R18	Commercial	321991	6252200	50	1.5
R19	Active Recreation	321817	6252266	69	1.5
R20	Active Recreation	321762	6252258	86	1.5
R21	Active Recreation	321629	6252187	108	1.5
R22	Residential	321725	6251845	196	1.5
R23	Commercial	321761	6251828	188	1.5
R24	Commercial	321825	6251782	192	1.5
R25	Commercial	321932	6251755	173	1.5
R26	Residential	322229	6251822	176	1.5
R27	Residential	322221	6251789	184	1.5
R28 Ground Floor	Residential	322228	6251904	146	1.5
R28 First Floor	Residential	322234	6251896	155	4.5
R29	Residential	322261	6251851	196	1.5
R30	Residential	322349	6251968	258	1.5
R31	Residential	322359	6251975	270	1.5
R32	Residential	322373	6251979	280	1.5
R33	Commercial	322420	6251999	330	1.5
R34	Active Recreation	322240	6252341	316	1.5
R35	Active Recreation	322296	6252295	352	1.5
R36	Passive Recreation	322515	6252143	470	1.5
R37 Ground Floor	Residential	322239	6251910	162	1.5
R37 First Floor	Residential	322244	6251905	162	4.5
R38	Residential	322250	6251917	172	1.5
R39	Residential	322270	6251911	187	1.5
R40	Residential	322275	6251929	188	1.5
R41	Commercial	322122	6252148	133	1.5
R42 Ground Floor	Residential	322102	6251847	72	1.5
R42 First Floor	Residential	322108	6251834	72	4.5

Receptor	Description	Coordinates (EPSG 7856)		Distance to Project Boundary (m)	Height (m) [a]
		Easting	Northing		
R42 Second Floor[a]	Residential	322108	6251834	72	7
R43 Ground Floor	Residential	322092	6251824	98	1.5
R43 First Floor	Residential	322100	6251815	98	4.5
R43 Second Floor[a]	Residential	322100	6251815	98	7
R44 Ground Floor	Residential	322127	6251829	99	1.5
R44 First Floor	Residential	322126	6251829	99	4.5
R44 Second Floor[a]	Residential	322126	6251829	99	7
R45 Ground Floor	Residential	322115	6251803	114	1.5
R45 First Floor	Residential	322115	6251803	114	4.5
R45 Second Floor[a]	Residential	322115	6251803	114	7
R46 Ground Floor	Residential	322154	6251815	131	1.5
R46 First Floor	Residential	322153	6251814	131	4.5
R46 Second Floor[a]	Residential	322153	6251815	131	7
R47 Ground Floor	Residential	322143	6251789	140	1.5
R47 First Floor	Residential	322144	6251789	140	4.5
R47 Second Floor[a]	Residential	322143	6251789	140	7
R48 Ground Floor	Residential	322187	6251802	159	1.5
R48 First Floor	Residential	322187	6251802	159	1.5
R48 Second Floor[a]	Residential	322187	6251802	159	1.5

a) Height measured in AHD (m)

4.2 Topography

Figure 3 Illustrates the local topography, as obtained from NSW Six Maps. It can be seen that the topography of the general area is flat.

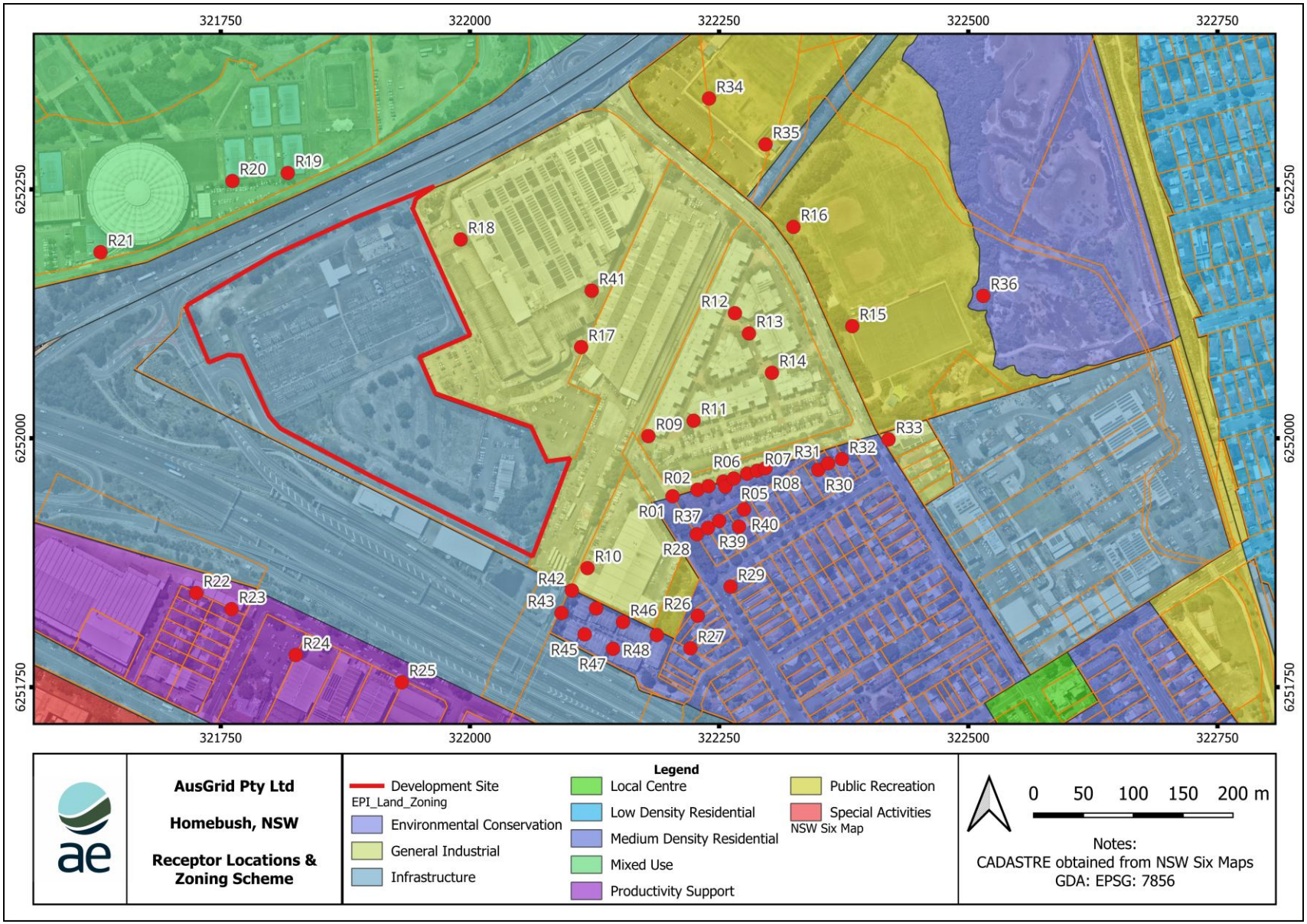

Figure 1: Surrounding Land Use and Receptors

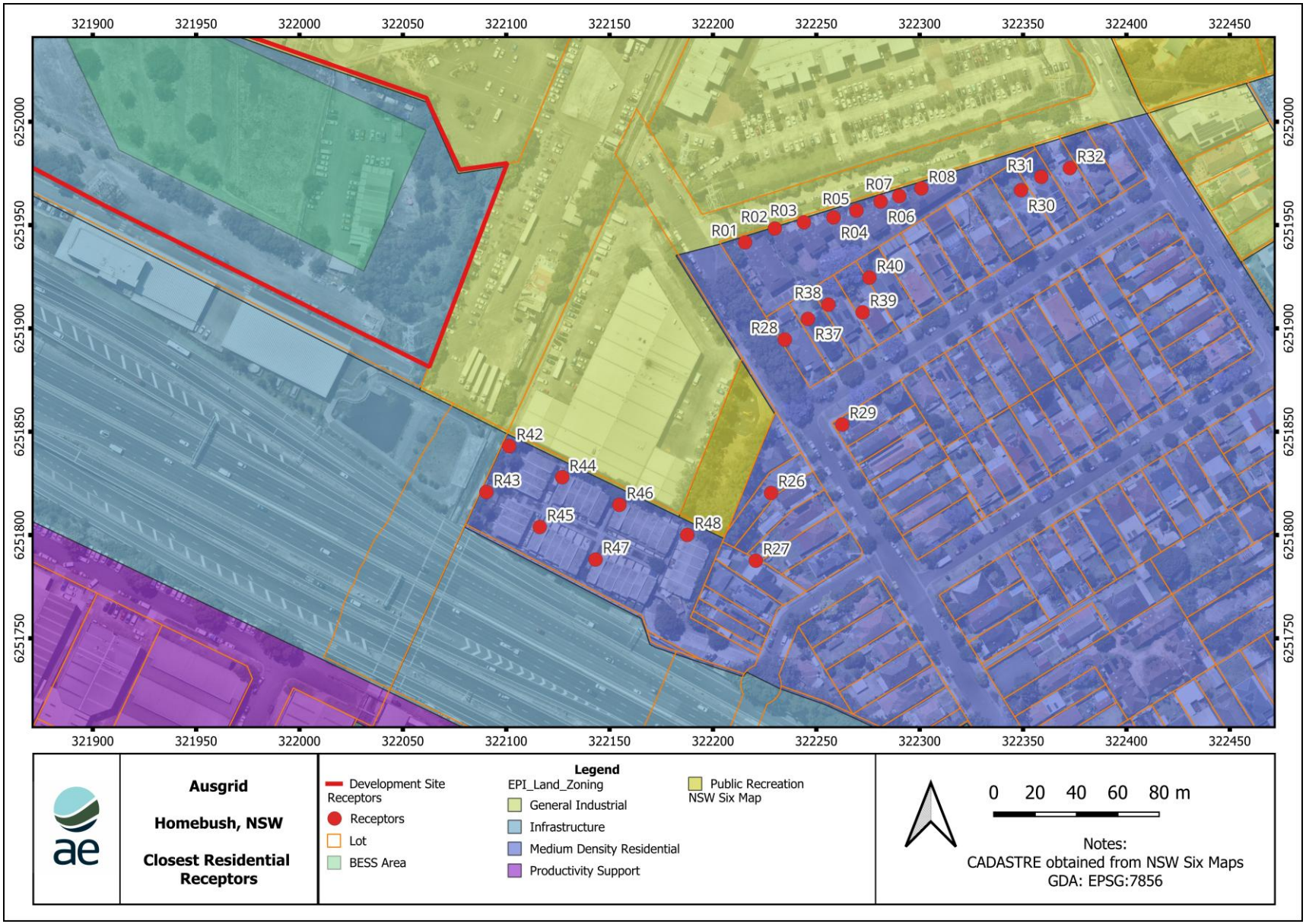

Figure 2: Closest Residential Receptors

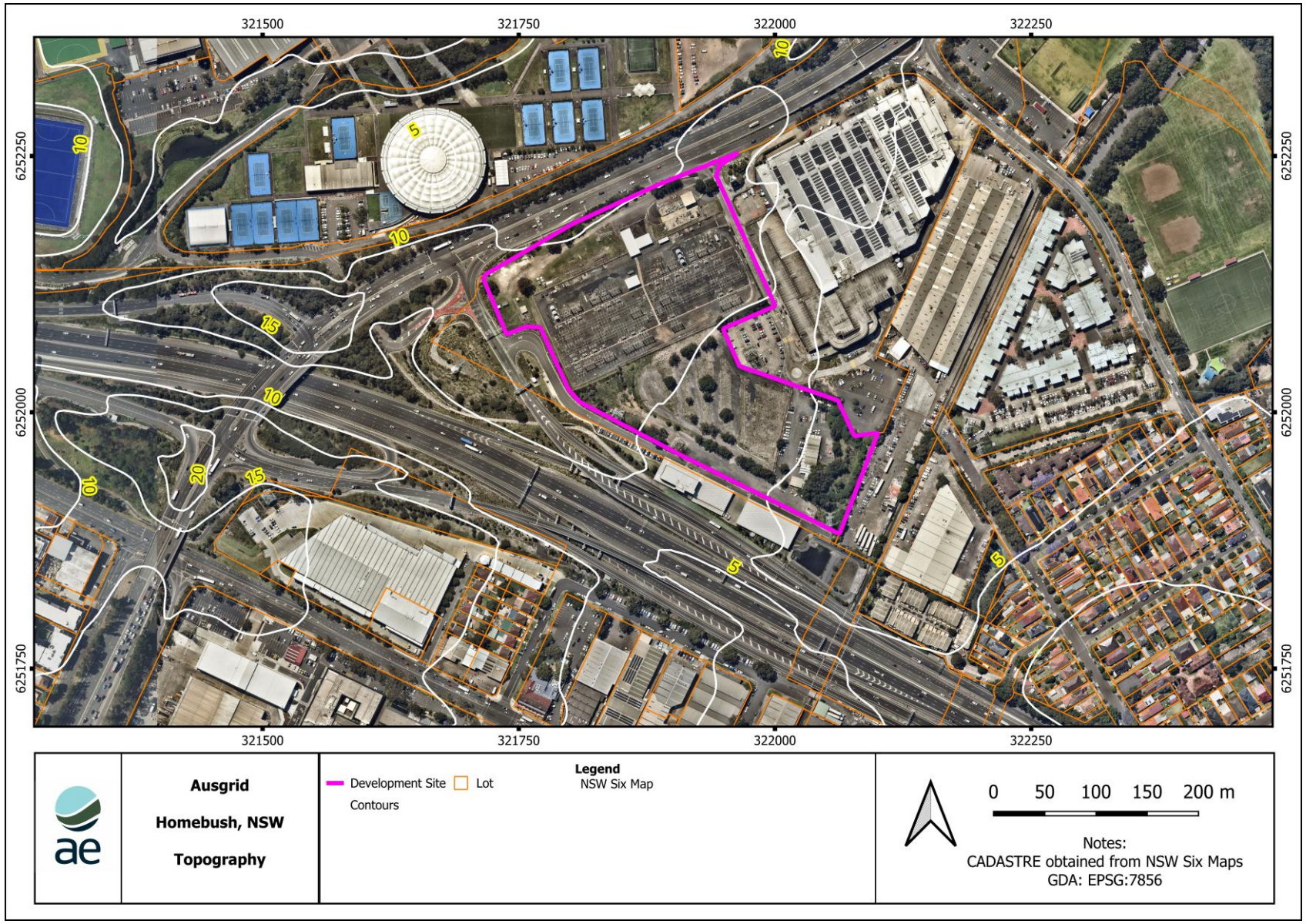

Figure 3: Topography

4.3 Summary of Noise Measurement Data

The unattended background noise monitoring was carried out per the methodology discussed in Section 3.1.

A summary of the noise monitoring data by period are presented in Table 6. The time history of noise measurements is presented in Appendix B. A review of the 1/3 octave spectrum for each period identified an increase between 3.15 kHz and 8 kHz, which is mostly associated with insect noise. This interpretation of the data was confirmed by onsite observations, which identified that insect noise was prevalent nearby. The noise monitoring data has been adjusted to remove this influence.

Table 6: Overall Noise Measurement Data

Period	L_{max}	L_1	L_{10}	L_{90}	L_{eq}	RBL
Day	104	62	54	48	56	45
Evening	82	62	55	49	54	49
Night	94	57	52	47	52	45

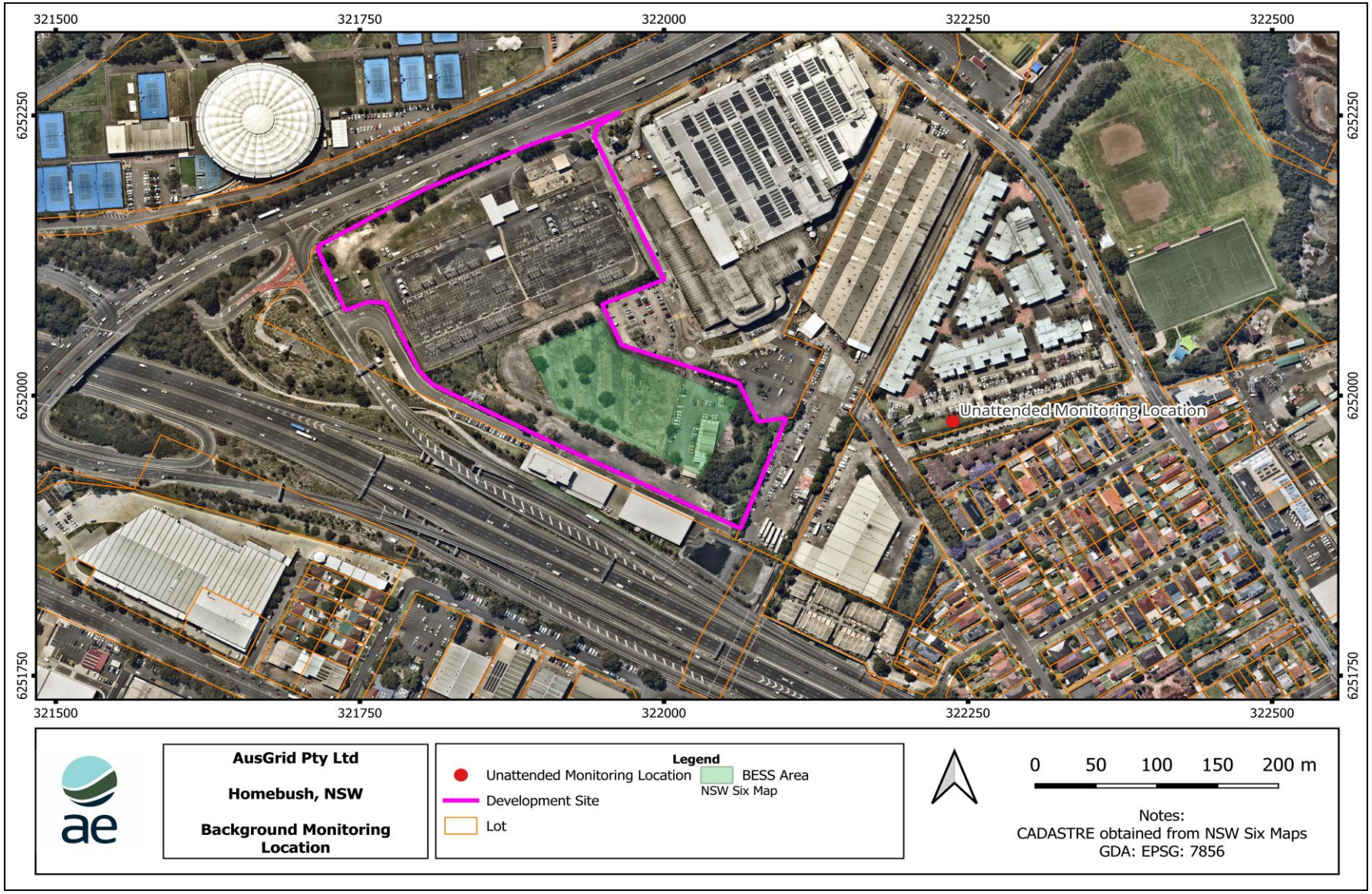

Figure 4: Noise Measurement Location

5 CONSTRUCTION NOISE ASSESSMENT

5.1 Duration of Construction Works

The construction of the Project is expected to take from late 2025 through to middle of 2027. It is expected over this approximately 22-month period a number of different activities will be undertaken. At this stage of development specific timeframes for each construction activity are not established, however it is noted that there are no overlapping construction phases and therefore each construction phase can be assessed independently.

The key construction phases identified in site development are as follows:

- Vegetation Removal/ site clearance.
- Site Establishment.
- Civil, structural mechanical and electrical works.
    - Civil works for BESS equipment.
    - Installation of BESS equipment.
    - Installation of Ancillary Operation Equipment.
    - Landscaping and establishment of noise walls.
- Testing and commissioning; and
- Demobilisation.

Construction would be restricted to what the EPA term 'recommended construction hours' (as described in Table 7). Standard Construction hours are defined between 7 am and 6 pm Monday to Friday and 8 am to 1 pm Saturday, with no works on Sundays or Public Holidays. This assessment has therefore considered the potential for adverse amenity impacts associated with construction during recommended standard hours only.

Table 7: Standard Construction Hours

Work type	Weekday	Saturday	Sunday or Public Holiday
Normal Construction	0700 to 1800	0800 to 1300	No work

Minor construction activities such as electrical commissioning and fit out may occur outside of standard hours if required. These works are expected to produce a negligible amount of noise and have not been considered in this assessment.

5.2 Construction Noise Criteria

5.2.1 Interim Construction Noise Guideline

Guidance on the assessment and management of construction noise in NSW is provided in the Interim Construction Noise Guideline (ICNG) published by the NSW DECC (2009).

The main objectives of the ICNG are to:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts;

- encourage construction to be undertaken only during the recommended standard hours (Table 1), unless approval is given for works that cannot be undertaken during these hours;
- streamline the assessment and approval stages and reduce time spent dealing with; and
- provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

In achieving these objectives, the guideline provides a framework for the qualitative and quantitative assessment of potential construction noise impacts noting that, for major projects, a quantitative assessment is the preferred approach.

Table 8 presents construction noise criteria outlined in the guideline. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Table 8: NSW EPA Construction Noise Criteria – Residential Receivers

Time of Day	Management Level (Free field)	How to Apply
Recommended standard hours: Monday to Friday, 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected. RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected. 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 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.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise

Time of Day	Management Level (Free field)	How to Apply
		affected level, the proponent should negotiate with the community.

Where nearby sensitive uses are predicted to be noise affected, the proponent of the Project is required to apply reasonable and feasible noise mitigation measures. Noise mitigation measures are considered feasible if it is capable of being put into practice and is practical to build given the Project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic, and environmental effects.

For construction noise management levels, the assessment criteria have been determined based on the day-time RBL measured during unattended background monitoring, RBL's were measured in accordance with guidance provided in the NPfI. Table 6 presents the summary of noise measurement data and the derived RBLs used in this assessment.

The unattended background logging measured a RBL of 45 dB(A) (refer to Table 6) for daytime periods (standard operating hours) thereby resulting in a noise affected management level of 55 dB(A) and a highly noise affected management level of 75 dB(A).

Should work be required to be performed outside of standard hours, a separate noise affected management level of 50 dB(A) (calculated as the night RBL + 5 dB) would apply. The Project construction noise management levels are demonstrated in Table 9.

Table 9: Project Construction Noise Management Levels

Project RBL	Noise Affected Criteria	Highly Noise affected Criteria	Outside Recommended Standard Hours - Noise Affected Criteria
45 dB(A)	55 dB(A)	75 dB(A)	50 dB(A)

5.3 Construction Noise Impact Assessment

Table 10 presents a summary of the plant and equipment likely to be required to complete the on-site construction works. The sound power levels presented have been sourced from published noise emission datasets and the library of source noise levels maintained by Assured Environmental. This assessment has considered the impacts from all construction phases at individual receptors assessed separately. This assessment was conducted using first principal calculations. Predicted receptor levels during construction considered minimum separation distances between where construction activities will take place and the receptor as detailed in Section 4.1.

Table 10: Construction Noise Sources

Construction Phase [a)]	Timeframe	Plant Item	Number Required	Sound Power Level, dB(A)	Acoustical Usage Factor, % [b)]	Total SWL by Scenario
Vegetation Removal / Site clearing[(c)]	Phase 0	Bulldozer D9	1	116	40	121
		Excavator (tracked) 35t	1	110	40	
		Chainsaw 4-5 hp	2	114	50	
		Tub grinder/Mulcher 40-50 hp	1	116	100	
		Dump Truck	4	110	100	
Site Establishment[(d)]	Phase 1	Front end Loader	1	112	40	116
		Dump Truck	4	116	40	
		Excavator	1	110	40	
		Grader	1	113	40	
		Compactor	1	106	20	
		Diesel Generator	1	103	50	
		Water cart	1	107	40	
Civil Works for BESS[(d)]	Phase 2	Front end loader	1	112	40	116
		Bobcat	4	106	40	
		Concrete Truck	3	114	40	
		Concrete pump	1	109	20	
		Diesel Generator	1	103	50	
		Concrete Saw	1	118	20	
		Dump truck	2	113	40	
Installation of BESS Equipment[(d)]	Phase 3	Elevated work platforms	2	108	16	106
		Mobile Crane	1	107	16	
		Hand Tools	5	102	50	
		Diesel Generator	1	103	50	
Installation of Ancillary Operational Equipment[(d)]	Phase 4	Elevated work platform	1	102	40	106
		Hand Tools	5	102	50	
		Mobile Crane	1	110	16	
		Diesel Generator	1	103	50	

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Construction Phase [a)]	Timeframe	Plant Item	Number Required	Sound Power Level, dB(A)	Acoustical Usage Factor, % [b)]	Total SWL by Scenario
Landscaping and establishment of noise walls [(d)]	Phase 5	Water Truck	1	107	40	113
		Backhoe	1	110	40	
		Compactor	1	106	20	
		Fanna crane	1	98	16	
		Bobcat	2	103	40	
		Dump Truck	2	113	40	
		Front end Loader	1	112	40	
All	All	Light Vehicle	134 / day			
All	All	Heavy Vehicle	20 / day			

a) in construction are based on conservative estimates of equipment used in construction phases

b) The 'Acoustical Usage Factor' represents the percentage of time that a particular item of equipment is assumed to be running at full power while working on site.

c) Vegetation removal construction phase measured from boundary of Project to receptors, all other phases are considered from the BESS hardstand area where civil works will occur.

d) Construction phases measured from boundary of "BESS Infrastructure" area (refer to Figure 5) where construction activities will take place. The BESS Infrastructure area is defined by the area where internal access roads, containerized BESS equipment and noise walls are located. Areas defined as "Laydown area" are expected to be used for a construction site office and vehicle parking as such is not expected to produce noisy activities outside of the vegetation removal construction phase (phase 0).

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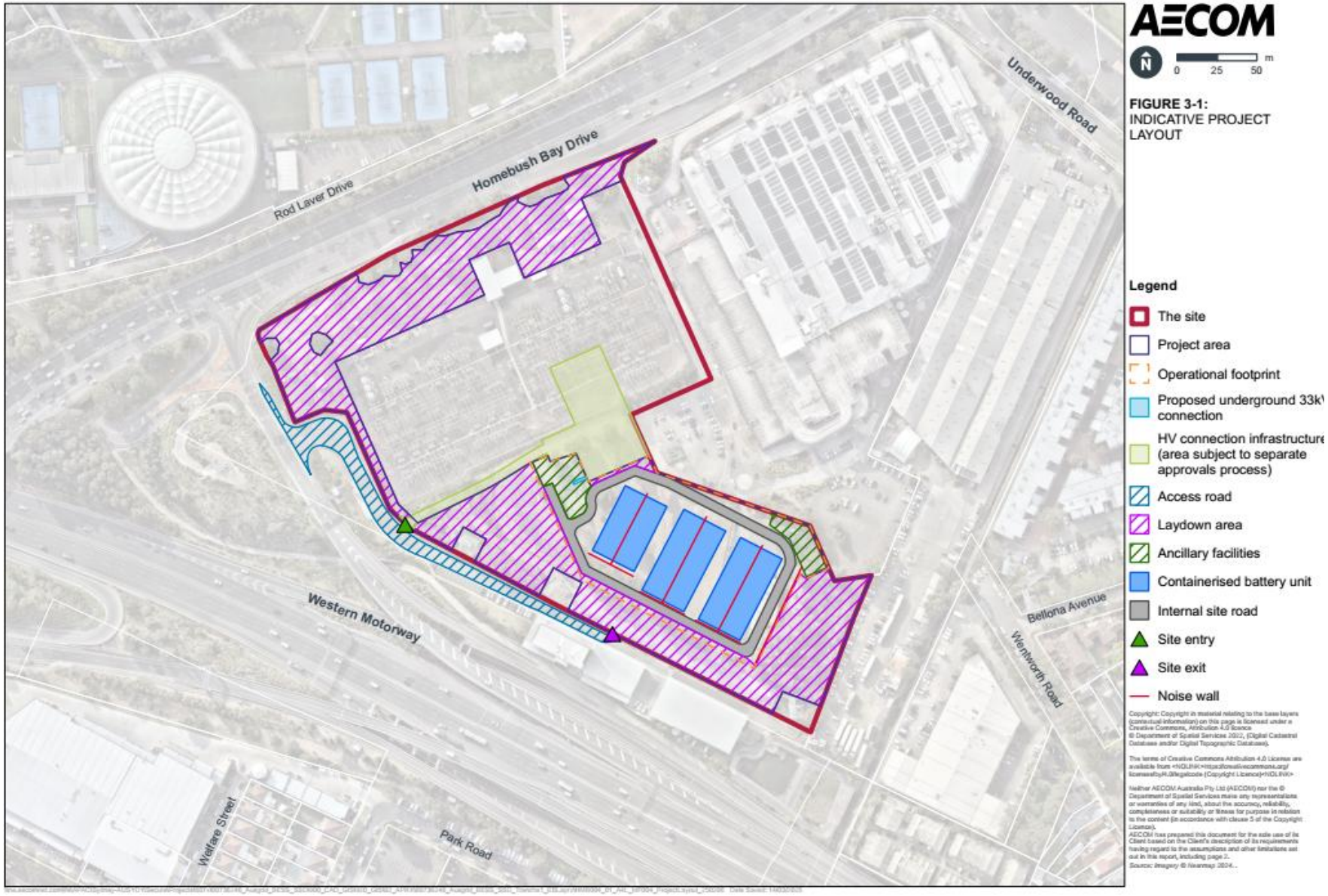


Figure 5: Indicative Project Layout

5.4 Assessment of Construction Noise Impacts

The construction noise assessment demonstrates that all residential receptors are exposed to levels of noise above the relevant noise management level (55 dB(A)) and therefore it is recommended that the reasonable and feasible mitigation measures such as those presented in Section 6 of this report are implemented.

The modelling results demonstrated that during the initial construction phase of vegetation removal / site clearance the predicted noise levels exceed the highly affected noise criterion of 75 dB(A). It is noted however, that vegetation/site clearing activities are expected to occur for no more than a week and as such further mitigation measures such as alternative accommodation are not warranted due to the timeframe the activities will occur in.

The results presented in Table 11 show the following:

- It is expected during initial vegetation clearance construction phase (phase 0) the most affected residential receptor R42 is predicted to experience a noise level of 84 dB(A), it is however noted that vegetation clearing activities are expected to occur for a limited period of time and vegetation clearing works undertaken at the eastern boundary of the Project closest to the receptor will occur for less than two days.

- Similarly, all commercial and active recreation receptors are expected to experience exceedances of the noise management level during the vegetation clearing construction phase (phase 0), though these exceedances are expected for a relatively short duration and as such further mitigation beyond the controls established to manage the noise emissions to residences during this phase of construction are not warranted.

- It is expected that for all other construction phases nearby sensitive residential receptors are predicted to experience noise levels above noise management level throughout the duration of construction but are below the highly affected noise criteria, and as such reasonable and feasible mitigation measures outlined in Section 6 are warranted.

- The closest residential receptors to the east of the Project are experience the greatest exceedances during the site establishment and civil works construction phases; the predicted noise level of 74 dB(A) is above the noise affected criterion but falls below the highly noise affected criterion of 75 dB(A).

- The ICNG specifies that commercial receptors have separate assessment criteria for construction noise. The predicted external noise levels should be assessed again a criterion of 70 dB(A) for land uses such as retail outlets and offices. Receptors R09-R14, R17-18, R23-R25, R33 and R41 fall under this criterion. Outside of vegetation clearing activities, which are expected to occur for a short period, the largest predicted exceedances are up to 6 dB above the specified management levels at R10. The exceedances predicted at commercial receptors are significantly lower than exceedances of the noise management level predicted at residential receptors, therefore the mitigation measures established to manage the noise emissions to residences (outlined in Section 6) will sufficiently control noise emissions to commercial receptors.

- The ICNG specifies that active recreation areas should be assessed against an external noise criterion of 65 dB(A). Receptors R15-16, R19-21 and R34-35 fall under this criterion of active recreation areas. It is noted that the predicted receptor levels of the active

recreation receptors exceed the noise management criteria established by the ICNG. It is predicted that during construction, noise exceedances of 2dB above the criteria are predicted during phase 1 and 2 at R16 and R19-21. . The exceedances predicted at active recreation receptors are significantly lower than exceedances of the noise management level predicted at residential receptors, therefore the mitigation measures established to manage the noise emissions to residences (outlined in Section 6) will sufficiently control noise emissions to active-recreation receptors.

- Receptor R36 (Mason Park Wetlands) falls within an environmental conservation zone. The ICNG does not establish criteria for environmental conservation zones, and as such the closest land use "passive recreation area" was used in establishing noise criteria. The wetlands are mostly inaccessible to the public and therefore noise produced from construction is unlikely to cause adverse amenity effects on people.

Table 11: Predicted Construction Noise Levels at Residential Receptors

Receptor	Standard Hours Criteria (dB(A))		Predicted Construction Noise Levels for Each Construction Phase ($L_{Aeq, 15min}$ dB(A))					
	Noise Affected	Highly Noise Affected	Vegetation Removal / Site Clearance	Site Establishment	Civil Works for BESS	Installation of BESS Equipment	Installation of Ancillary Operational Equipment	Landscaping and Establishment of Noise Walls
R01	55	75	79	71	72	62	62	69
R02	55	75	78	70	70	61	60	67
R03	55	75	78	69	70	60	60	67
R04	55	75	77	69	69	59	59	66
R05	55	75	76	68	69	59	59	66
R06	55	75	76	68	68	59	58	66
R07	55	75	75	68	68	58	58	65
R08	55	75	75	67	68	58	58	65
R22	55	75	75	68	68	59	58	66
R26	55	75	76	68	68	59	58	66
R27	55	75	76	68	68	58	58	65
R28	55	75	78	69	69	60	59	67
R29	55	75	75	67	68	58	58	65
R30	55	75	73	66	66	57	56	64
R31	55	75	72	66	66	56	56	63
R32	55	75	72	65	66	56	56	63
R37	55	75	77	69	69	59	59	66
R38	55	75	76	68	69	59	59	66
R39	55	75	76	68	68	58	58	65
R40	55	75	75	68	68	59	58	66
R42	55	75	84	73	74	64	64	71

Receptor	Standard Hours Criteria (dB(A))		Predicted Construction Noise Levels for Each Construction Phase ($L_{Aeq, 15min}$ dB(A))					
	Noise Affected	Highly Noise Affected	Vegetation Removal / Site Clearance	Site Establishment	Civil Works for BESS	Installation of BESS Equipment	Installation of Ancillary Operational Equipment	Landscaping and Establishment of Noise Walls
R43	55	75	81	73	73	63	63	70
R44	55	75	81	72	72	62	62	69
R45	55	75	80	71	71	62	61	69
R46	55	75	79	70	70	61	60	68
R47	55	75	78	70	70	60	60	67
R48	55	75	77	69	69	59	59	66

a) Cells highlighted in orange indicate they are above the "noise affected" management level and warrant further mitigation measures as outlined in section 6
b) Cells highlighted in red indicate they are above the "highly noise affected" management level and warrant further mitigation measures as outlined in section 6
c) Vegetation clearing activities are expected to occur for a relatively short time frame and as such further mitigation measures such as alternative accommodation are not considered warranted. It is also noted that vegetation activities are modelled with all equipment located at the boundary of the property and are therefore inherently conservative.

Table 12: Predicted Construction Noise Levels at Non-Residential Receptors

Receptor	Standard Hours Criteria (dB(A))	Predicted Construction Noise Levels for Each Construction Phase ($L_{Aeq, 15min}$ dB(A))					
	Noise Affected	Vegetation Removal / Site Clearance	Site Establishment	Civil Works for BESS	Installation of BESS Equipment	Installation of Ancillary Operational Equipment	Landscaping and Establishment of Noise Walls
R09	70	81	73	73	63	63	70
R10	70	86	75	76	66	66	73
R11	70	79	67	68	58	58	65
R12	70	73	67	67	58	57	65
R13	70	74	67	67	57	57	64
R14	70	74	65	65	55	55	62

Receptor	Standard Hours Criteria (dB(A))	Predicted Construction Noise Levels for Each Construction Phase ($L_{Aeq, 15min}$ dB(A))					
	Noise Affected	Vegetation Removal / Site Clearance	Site Establishment	Civil Works for BESS	Installation of BESS Equipment	Installation of Ancillary Operational Equipment	Landscaping and Establishment of Noise Walls
R15	65	71	65	65	55	55	62
R16	65	70	66	66	56	56	63
R17	70	81	74	74	64	64	71
R18	70	87	68	68	58	58	65
R19	65	84	67	67	58	57	65
R20	65	82	67	67	57	57	64
R21	65	80	65	66	56	56	63
R23	70	75	69	69	59	59	66
R24	70	75	70	70	60	60	67
R25	70	76	70	70	60	60	67
R33	70	71	64	64	55	54	62
R34	65	71	64	64	54	54	61
R35	65	70	64	64	55	54	62
R36[c]	60	68	62	62	52	52	59
R41	70	78	72	72	62	62	69

a) Cells highlighted in red indicate they are above the management level and warrant further mitigation measures as outlined in section 6

b) Vegetation clearing activities are expected to occur for a relatively short time frame and as such further mitigation measures such as alternative accommodation are not considered warranted. It is also noted that vegetation activities are modelled with all equipment located at the boundary of the property and are therefore inherently conservative.

c) The ICNG does not nominate criteria for environmental conservation zones, an External noise level of 60 dB(A) criteria is nominated from the "passive recreation criteria" which most closely represents the land uses of an environmental conservation zone. It is further noted that the wetlands this receptor considers are mostly inaccessible to the public and therefore noise produced from construction is unlikely to cause adverse amenity effects on people.

6 ROAD TRAFFIC NOISE ASSESSMENT

6.1 Introduction

Noise impacts associated with vehicle movements during the operational phase of the Project are expected to be negligible as vehicle movements would be limited to weekly operational maintenance conducted by a few staff members.

During construction of the facility however, traffic movements will be more significant as additional vehicle flow is generated through site workers and contractors' movements in addition to equipment and construction materials that are delivered to the Project.

6.2 Vehicle Access

The area around the Project is serviced by an extensive road network designed for heavy haulage vehicles catering to the surrounding industrial and commercial land uses. The primary access point to the Project would be off a slip road which can be accessed from the eastbound onramp onto the M4 via Homebush Bay Drive.

6.3 Traffic Volumes

During construction up to 20 heavy vehicles per day would be required for the delivery of construction equipment, removal of spoil and delivery of the Project components, A maximum of four heavy movements are expected during the peak hour of the construction period. This would fluctuate depending on the construction phase. Additionally, 134 light vehicles per day have been considered as a conservative estimate to account for staff travel during the peak construction phase. Traffic volumes modelled are presented in Table 13 and Table 14.

Given this, the assessment has considered the potential impacts associated with noise emissions from the main vehicle route (Homebush Bay Drive) and the site entry along the local access road (slip road).

Table 13: Traffic Generation during Peak Construction (Homebush Bay Drive Arterial Road)

Road Segment	Vehicle Type	Vehicle Speed	Number of Vehicles	
			Day (7 am to 10 pm)	Night (10 pm to 7 am) [a)]
Homebush Bay Drive	Light	60 km/hr	67	67
	Heavy	60 km/hr	10	10

a) Assumes worst case where all heavy vehicle deliveries and staff arrivals can be arriving on site between 6 am to 7am and therefore consideration against night-time criteria was completed.

Table 14: Traffic Generation during Peak Construction (Slip Road Site Access - Local Road).

Road Segment	Vehicle Type	Vehicle Speed[(b)]	Number of Movements	
			Day (Peak 1-hour)	Night (Peak 1- hour) [a)]
Slip Road Site Access	Light	-	67	67
	Heavy	-	4	4

a) Private road owned by Westconnex – speed limit is not defined but is expected that vehicle speeds would be lower than 40km/hr.

6.4 Assessment Criteria

The ICNG does not provide criteria for the assessment of construction road traffic during the establishment of the Project. Given this, reference is made to the noise criteria provided in the NSW Road Noise Policy (RNP). Based on the type of roadway, Table 15 presents the applicable road traffic noise criteria for existing residences that may be affected by the Project.

Table 15: Applicable Road Traffic Noise Criteria

Road Category	Type of Project & Land Use	Assessment Criteria
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	Day: $L_{Aeq,1\ hour}$ 55 dB(A) Night: $L_{Aeq,1\ hour}$ 50 dB(A) (external)
Freeway / arterial / sub-arterial road	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	Day: $L_{Aeq,15\text{-}hour}$ 60 dB(A) Night: $L_{Aeq,9\text{-}hour}$ 55 dB(A) (external)

6.5 Assessment of Road Traffic Noise Impacts

Traffic data provided by Transport NSW for Homebush Bay Drive (Station ID 29010) demonstrate daily vehicle volumes measured along Homebush Bay Drive. Predicted vehicle volumes for peak construction periods can be assessed against current measured vehicle volumes to determine relative increase in noise emissions. Table 16 demonstrates the measured vehicle volumes along Homebush Bay Drive in comparison to the additional vehicles generated during peak construction phase of the Project. Table 17 and Table 18 presents the predicted noise contribution caused from the Project in isolation during the peak construction phase along the affected travel route.

Table 16: Vehicle Volumes Measured on Homebush Bay Drive (January 2025 Daily Average)

Vehicle Volumes on Homebush Bay Drive	Total Northbound and Southbound Vehicles During the Daytime Assessment Period	Total Northbound and Southbound Vehicles During the Nighttime Assessment Period
2025 January Measured Vehicle Volumes	43235 light vehicles	8436 light vehicles
	9163 heavy vehicles	3626 heavy vehicles
2025 January Total Daily Measured Vehicles	52398 vehicles	12062 vehicles

Review of the traffic data recorded on the M4 adjacent to the Project only extends to 2016, The data indicated that the daily average vehicles travelling along The M4 adjacent to the Project in 2016 was approximately 90,000 vehicles a day. As such it can be expected that the noise generated on the adjacent M4 will mask the minor emissions expected during the peak construction phase of the Project.

Given the predicted vehicle volumes and measured traffic volumes, first principal calculations predict an increase in noise in the magnitude of <0.1 dB.

The RNP states that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible to the average person. Furthermore, the RNP makes the provision for existing residences or sensitive land uses affected by additional traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB(A) above the corresponding "no build option".

Table 17: Predicted $L_{Aeq,period}$ Noise Contribution Levels - Road Traffic Noise (Arterial Road)

Sensitive Receptor	Setback from Road[(a)]	Period	Parameter	Criteria	Predicted Noise Level	Comply (Y/N)
Nearest to Victoria Avenue	63 m	Day	$L_{Aeq,15\text{-hour}}$	60 dB(A)	51 dB(A)	Y
		Night	$L_{Aeq,15\text{-hour}}$	55 dB(A)	51 dB(A)	Y

a) Setback distance taken from centre of Homebush Bay Drive to closest residential receptor (71 Victoria Avenue, Homebush, NSW) This location was chosen as it represents the minimum separation distance from the vehicle route and a residential receptor.

b) Predicted noise levels are generated from traffic volumes and vehicle speeds provided in table 12 and with reference to the minimum setback distance of 63m

Table 18: Predicted $L_{Aeq,period}$ Noise Contribution Levels - Road Traffic Noise (Local Road)

Sensitive Receptor	Setback from Road[(a)]	Period	Parameter	Criteria	Predicted Noise Level	Comply (Y/N)
Nearest to Verley Drive	96 m	Day	$L_{Aeq,1\text{-hour}}$	55 dB(A)	44 dB(A)	Y
		Night	$L_{Aeq,1\ hour}$	50 dB(A)	44 dB(A)	Y

a) Setback distance taken from edge of parking lot for heavy and light vehicles to closest receptors on Verley Drive, as this represents the closest the vehicles will drive to a sensitive receptor

Given the low traffic generated during the construction phase the increase in traffic noise as a result of the Project would result in a negligible (<2 dB) increase in noise at surrounding residences. As such the Project will be compliant with the road traffic noise criteria during all phases of construction and operation.

7 OPERATIONAL NOISE ASSESSMENT

7.1.1 Operational Noise Criteria Overview

The acoustic assessment has been completed in accordance with the procedure identified in the NPfI. The NPfI recognises that scientific literature has identified that both the increase in noise level above background levels (that is, intrusiveness of a source), as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources.

In response to this, the NPfI establishes two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses. These two criteria are then used to determine project triggers levels against which the proposed development will be assessed. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response.

The derivation of the two sets of criteria is presented in Table 19. For residential dwellings, the noise criteria are assessed at the most-affected point (i.e., highest noise level) on or within the property boundary. Where the property boundary is more than 30 metres from the house, then the criteria apply at the reasonably most-affected point within 30 m of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2-1.5 metres above the ground level.

7.1.2 Intrusiveness Noise Criteria

The project intrusiveness noise level is intended to protect against significant changes in noise levels as a result of industrial development. To achieve this, the NPfI describes intrusive noise as noise that exceeds background noise levels (i.e. the RBL) by more than 5 dB(A).

Background monitoring was conducted at a representative location to determine RBL for the general area. Refer to Table 6 for unattended background monitoring data used to determine RBLs.

Table 19: Derived Intrusiveness Noise Criteria

Receptor	Intrusiveness $L_{Aeq,15\text{-minute}}$ Criteria (dB(A))		
	Day	Evening	Night
All nearby residential receptors [a)b]	45+5 = 50	49+5 = 54	45 + 5 = 50

c) For a residence, the project noise trigger level are to be assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most affected point within 30 metres of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2–1.5 metres above ground level.

a) Maximum noise levels used in assessment of sleep disturbance would be assessed at the facade

7.1.3 Amenity Criteria

The project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for land uses. Amenity noise levels are not used directly as regulatory limits. They are used in combination with the project intrusiveness noise level to assess the potential impact of noise, assess reasonable and feasible mitigation options, and subsequently determine achievable noise requirements.

A review of the surrounding area has identified that there are other industrial noise sources in the area, and that future industrial development in the area is likely. As such, 5 dB have been subtracted from the project amenity noise levels to indicate the project specific noise amenity area levels, the amenity criteria is presented Table 20.

It is noted that while the LGA zoning scheme classifies nearby residential receptors as "R3 medium density residential" which falls under the "Suburban Residential" receiver category, the NPfI describes typical existing background levels of each receiver category. It can be demonstrated through the results of the background monitoring that the RBL of the area in all periods are representative of an "urban residential" receiver category. This, in conjunction with the area having nearby commercial, industrial districts and characteristically heavy and continuous traffic flows on the adjacent M4 and arterial roads, demonstrates the area is most appropriately defined as "urban residential".

Table 20: NPfI Amenity Noise Levels

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level (dB(A))	
			Total Industrial Noise	Project Specific
Residence	Urban	Day	60	55
		Evening	50	45
		Night	45	40
Commercial Premises	All	When in use	65	60
Active Recreation	All	When in use	55	50
Passive Recreation	All	When in use	50	45

7.1.4 Project Trigger Levels

The project trigger level (i.e., the noise criteria considered by the assessment) is the lower value of the project intrusiveness noise level and the project amenity noise level (ANL), after the conversion to $L_{Aeq,\ 15\ min}$ dB(A) equivalent level. Table 21 presents the standardised intrusiveness noise level and the project amenity level as derived by adding 3 dB to each period of the day to convert the measurement from $LA_{eq,\ period}$ to $LA_{eq,15minutes}$.

Table 21: Determining Project Trigger Level

Type of Receiver	Time of Day	Standardised $L_{Aeq,\ 15\ min}$ Noise Level (dB)		
		Intrusiveness Criteria	Project Specific ANL	Project Trigger Level
Residence	Day	50	55 + 3 = 58	50
	Evening	54	45 + 3 = 48	48
	Night	50	40 + 3 = 43	43
Commercial Premises	When in use	-	60 + 3 = 63	63
Passive Recreation	When in use	-	45 + 3 = 48	48
Active Recreation	When in use	-	50 + 3 = 53	53

7.1.5 Sleep Disturbance

NSW EPA have identified a screening assessment for sleep disturbance based on the night-time noise levels at a residential location. Where noise levels at a residential location exceed:

- $L_{Aeq,\ 15\ min}$ 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 whichever is the greater, a detailed maximum noise level event assessment should be undertaken.

As discussed in Section 8.3 the predicted night-time noise levels at residential locations do not exceed 50 dB(A) $L_{Aeq,\ 15\ min}$ and therefore a detailed sleep disturbance assessment is not required.

Further, given the noise sources associated with the operation of the BESS are all continuous and the characteristics of noise produces are consistent in nature (i.e. it is not expected to have large spikes in acoustic energy during operation), consideration of compliance against the L_{AFmax} sleep disturbance criteria is unwarranted.

7.2 Operational Noise Sources

All noise sources associated with the Project are considered continuous in nature and are associated with fixed plant items operating in the charging and distribution process. Where annoying noise characteristics have been identified the adjustment has been included in the L_{Aeq} column of Table 22. The sound power levels have been taken from the following sources:

- Transformer SWL calculated from Australian Standard AS60076.10: 2009 'Power transformers Determination of sound levels.
- 1/3 Octave spectral data for transformers were taken from the Australian Acoustical Society[a]
- BESS noise data taken from 2024 Q3 Tesla Megapack manufacturer's noise testing datasheet[b]
- All sides are modelled as vertical area sources based on discussions with manufacturer
- A review of low frequency noise and tonality was assessed with respect to procedures detailed in the NPfI. Computational modelling did not predict tonal or annoying low frequency characteristics to be present at sensitive receptors; therefore, additional tonal corrections were not applied; and

[a] Paper Number 23, Proceedings of ACOUSTICS 2011: Low-frequency and Tonal Characteristics of Transformer Noise: Prepared by Michael Gange November 2011

[b] Megapack 2 XL Sound Data – Tesla Energy Q3'2024.

Table 22: Noise Sources

Noise Source	Qty	Height (m)	Acoustical Usage (%)[d]			Sound Power Level (dB(A))	Noise Characteristics (as per Appendix C of the NPfI)
			Day	Evening	Night	L_{Aeq}	
Tesla MEGAPACK 2XL (nine fan)[a][b]	112	2.90 m	100	100	100	78 - 91 depending on which side [c]	N/A
Step up transformers	56	2 m	100	100	100	77	N/A
Auxiliary Transformer	1	2m	100	100	100	77	N/A

a) The left and right façade of the Tesla Megapack produce >10 dB below the level produced by the loudest facades, and as such the noise landscape is dominated by the loudest facades.

b) The manufacturer's datasheet provides sound pressure levels at each façade at 10 m. These measurements can be used to calibrate the model such that the modelled equipment produces the same sound pressure levels at a distance of 10 m at each distinct façade. Modelling equipment with vertical and area sources allows for accurate directionality to be applied to noise sources.

c) The Tesla-Megapack 2XL was run at differing fan settings during each assessment period, as such the sound power levels were variable dependant on the relevant fan settings for each assessment periods, therefore the SWL has been provided in a range to capture this.

d) Acoustical Usage refers to the amount of time the equipment will be operational during an assessment period, (I.E all BESS equipment will run continuously throughout the day)

7.3 Predicted Operational Noise Levels

7.3.1 Predicted Receptor Noise Levels Without Acoustic Mitigation

Table 23 presents the noise levels predicted to be experienced by receptors during the operational phase of the Project based on the sound power levels listed in Table 22. This assessment assumes that the BESS fans operate in an unrestricted capacity and that acoustic barriers are not present. Appendix A presents the noise contours for this scenario.

Table 23: Predicted Receptor Noise Levels Without Any Acoustic Mitigation Implemented

Receptor	Predicted Noise Levels (dB(A))			Project Trigger Level (Day time / Evening / Night time)	Comply (Y/N)
	Day ($L_{Aeq, 15min}$)	Evening ($L_{Aeq, 15min}$)	Night ($L_{Aeq, 15min}$)		
R01 Ground Floor	59	59	59	50 / 48 / 43	N / N / N
R01 First Floor	59	59	59	50 / 48 / 43	N / N / N
R02 Ground Floor	57	57	57	50 / 48 / 43	N / N / N
R02 First Floor	58	58	58	50 / 48 / 43	N / N / N
R03 Ground Floor	57	57	57	50 / 48 / 43	N / N / N
R03 First Floor	58	58	58	50 / 48 / 43	N / N / N
R04 Ground Floor	56	56	56	50 / 48 / 43	N / N / N
R04 First Floor	52	52	52	50 / 48 / 43	N / N / N
R05 Ground Floor	55	55	55	50 / 48 / 43	N / N / N
R05 First Floor	45	45	45	50 / 48 / 43	Y / Y / N
R06 Ground Floor	55	55	55	50 / 48 / 43	N / N / N
R06 First Floor	44	44	44	50 / 48 / 43	Y / Y / N
R07 Ground Floor	54	54	54	50 / 48 / 43	N / N / N
R07 First Floor	50	50	50	50 / 48 / 43	Y / N / N
R08 Ground Floor	54	54	54	50 / 48 / 43	N / N / N
R08 First Floor	44	44	44	50 / 48 / 43	Y / Y / N
R09	59	59	59	63[a]	Y / Y / Y
R10	63	63	63	63[a]	Y / Y / Y
R11	51	51	51	63[a]	Y / Y / Y
R12	44	44	44	63[a]	Y / Y / Y
R13	43	43	43	63[a]	Y / Y / Y
R14	48	48	48	63[a]	Y / Y / Y
R15	47	47	47	53[a]	Y / Y / Y
R16	45	45	45	53[a]	Y / Y / Y
R17	60	60	60	63[a]	Y / Y / Y
R18	41	41	41	53[a]	Y / Y / Y
R19	53	53	53	53[a]	Y / Y / Y
R20	51	51	51	53[a]	Y / Y / Y
R21	48	48	48	53[a]	Y / Y / Y
R22	51	51	51	50 / 48 / 43	N / N / N

Receptor	Predicted Noise Levels (dB(A))			Project Trigger Level (Day time / Evening / Night time)	Comply (Y/N)
	Day ($L_{Aeq, 15min}$)	Evening ($L_{Aeq, 15min}$)	Night ($L_{Aeq, 15min}$)		
R23	51	51	51	63[(a)]	Y / Y / Y
R24	55	55	55	63[(a)]	Y / Y / Y
R25	55	55	55	63[(a)]	Y / Y / Y
R26	52	52	52	50 / 48 / 43	N / N / N
R27	50	50	50	50 / 48 / 43	Y / N / N
R28 Ground Floor	54	54	54	50 / 48 / 43	N / N / N
R28 First Floor	58	58	58	50 / 48 / 43	N / N / N
R29	53	53	53	50 / 48 / 43	N / N / N
R30	49	49	49	50 / 48 / 43	Y / N / N
R31	52	52	52	50 / 48 / 43	N / N / N
R32	52	52	52	50 / 48 / 43	N / N / N
R33	50	50	50	63[(a)]	Y / Y / Y
R34	40	40	40	53[(a)]	Y / Y / Y
R35	42	42	42	53[(a)]	Y / Y / Y
R36	45	45	45	53[(a)]	Y / Y / Y
R37 Ground Floor	56	56	56	50 / 48 / 43	N / N / N
R37 First Floor	58	58	58	50 / 48 / 43	N / N / N
R38	46	46	46	50 / 48 / 43	Y / Y / N
R39	47	47	47	50 / 48 / 43	Y / Y / N
R40	47	47	47	50 / 48 / 43	Y / Y / N
R41	39	39	39	53[(a)]	Y / Y / Y
R42 Ground Floor	61	61	61	50 / 48 / 43	N / N / N
R42 First Floor	63	63	63	50 / 48 / 43	N / N / N
R42 Second Floor	62	62	62	50 / 48 / 43	N / N / N
R43 First Floor	63	63	63	50 / 48 / 43	N / N / N
R43 Ground Floor	61	61	61	50 / 48 / 43	N / N / N
R43 Second Floor	62	62	62	50 / 48 / 43	N / N / N
R44 Ground Floor	42	42	42	50 / 48 / 43	Y / Y / Y
R44 First Floor	47	47	47	50 / 48 / 43	Y / Y / N
R44 Second Floor	53	53	53	50 / 48 / 43	N / N / N
R45 Ground Floor	41	41	41	50 / 48 / 43	Y / Y / Y
R45 First Floor	45	45	45	50 / 48 / 43	Y / Y / N
R45 Second Floor	51	51	51	50 / 48 / 43	N / N / N
R46 Ground Floor	46	46	46	50 / 48 / 43	Y / Y / N
R46 First Floor	47	47	47	50 / 48 / 43	Y / Y / N
R46 Second Floor	53	53	53	50 / 48 / 43	N / N / N
R47 Ground Floor	45	45	45	50 / 48 / 43	Y / Y / N
R47 First Floor	49	49	49	50 / 48 / 43	Y / N / N

Receptor	Predicted Noise Levels (dB(A))			Project Trigger Level (Day time / Evening / Night time)	Comply (Y/N)
	Day ($L_{Aeq, 15min}$)	Evening ($L_{Aeq, 15min}$)	Night ($L_{Aeq, 15min}$)		
R47 Second Floor	54	54	54	50 / 48 / 43	N / N / N
R48 Ground Floor	49	49	49	50 / 48 / 43	Y / N / N
R48 First Floor	55	55	55	50 / 48 / 43	N / N / N
R48 Second Floor	59	59	59	50 / 48 / 43	N / N / N

a) Notes: Cells coloured in orange indicate non-compliance with established criteria.

A review of the predicted noise levels outlined above indicates that without acoustic mitigation implemented, the noise emissions from the Project are generally non-compliant with the derived amenity criteria at numerous sensitive receptors during all three assessment periods.

7.3.2 Predicted Receptor Noise Levels with Acoustic Mitigation Implemented

Table 24 presents predicted receptor noise levels during the operational phase of the BESS based on the sound power levels listed in Table 22 and including the source and barrier locations identified in Figure 6

The Project was initially modelled with acoustic barriers and unrestricted fan operation settings, and it was found that exceedances were still predicted at nearby sensitive receptors, In response to this additional modelling simulations were run at lower battery fan duties for the Tesla Megapack2XL until compliance can be established for each assessment period.

The operational fan duty cycles for the batteries were restricted to ensure compliance with established noise criteria. The modelled fan duties for their respective time periods are as follows.

- During the daytime assessment period the fan duty of the batteries is restricted to 90%
- During the evening assessment period the fan duty of the batteries is restricted to 70%; and
- During the night-time assessment periods, the fan duty of the batteries is restricted to 50%.

A review of the predicted noise levels confirms that compliance with the assessment criteria can be achieved for all receptors during the daytime, evening, and night-time periods under noise-enhancing meteorological conditions.

Appendix B presents the predicted noise contours for the Project with acoustic mitigation implemented.

Table 24: Predicted Receptor Noise Levels with Acoustic Mitigation Implemented

Receptor	Predicted Noise Levels ($L_{Aeq, 15min}$ dB(A))			Criteria (Day-time / Evening/ Night-time)	Comply (Y/N)
	Day	Evening	Night		
R01 Ground Floor	46	44	39	50 / 48 / 43	Y / Y / Y
R01 First Floor	47	45	40	50 / 48 / 43	Y / Y / Y
R02 Ground Floor	45	43	39	50 / 48 / 43	Y / Y / Y
R02 First Floor	47	45	40	50 / 48 / 43	Y / Y / Y
R03 Ground Floor	45	43	38	50 / 48 / 43	Y / Y / Y
R03 First Floor	46	44	40	50 / 48 / 43	Y / Y / Y
R04 Ground Floor	45	43	38	50 / 48 / 43	Y / Y / Y
R04 First Floor	44	42	37	50 / 48 / 43	Y / Y / Y
R05 Ground Floor	45	43	38	50 / 48 / 43	Y / Y / Y
R05 First Floor	40	38	33	50 / 48 / 43	Y / Y / Y
R06 Ground Floor	45	43	38	50 / 48 / 43	Y / Y / Y
R06 First Floor	39	37	32	50 / 48 / 43	Y / Y / Y
R07 Ground Floor	44	42	38	50 / 48 / 43	Y / Y / Y
R07 First Floor	43	41	36	50 / 48 / 43	Y / Y / Y
R08 Ground Floor	44	42	38	50 / 48 / 43	Y / Y / Y
R08 First Floor	39	37	32	50 / 48 / 43	Y / Y / Y
R09	50	48	43	63[(a)]	Y / Y / Y
R10	47	45	41	63[(a)]	Y / Y / Y
R11	45	43	38	63[(a)]	Y / Y / Y
R12	40	38	34	63[(a)]	Y / Y / Y
R13	39	37	33	63[(a)]	Y / Y / Y
R14	43	41	36	63[(a)]	Y / Y / Y
R15	41	39	35	53[(a)]	Y / Y / Y
R16	41	39	34	53[(a)]	Y / Y / Y
R17	56	54	49	63[(a)]	Y / Y / Y
R18	38	36	32	53[(a)]	Y / Y / Y
R19	47	45	41	53[(a)]	Y / Y / Y
R20	45	43	38	53[(a)]	Y / Y / Y
R21	42	40	35	53[(a)]	Y / Y / Y
R22	46	44	40	50 / 48 / 43	Y / Y / Y
R23	46	44	40	63[(a)]	Y / Y / Y
R24	48	46	41	63[(a)]	Y / Y / Y
R25	48	46	41	63[(a)]	Y / Y / Y
R26	45	43	38	50 / 48 / 43	Y / Y / Y
R27	42	40	36	50 / 48 / 43	Y / Y / Y
R28 Ground Floor	44	42	38	50 / 48 / 43	Y / Y / Y
R28 First Floor	46	44	39	50 / 48 / 43	Y / Y / Y
R29	44	42	37	50 / 48 / 43	Y / Y / Y

Receptor	Predicted Noise Levels ($L_{Aeq, 15min}$ dB(A))			Criteria (Day-time / Evening/ Night-time)	Comply (Y/N)
	Day	Evening	Night		
R30	42	40	35	50 / 48 / 43	Y / Y / Y
R31	43	41	36	50 / 48 / 43	Y / Y / Y
R32	43	41	36	50 / 48 / 43	Y / Y / Y
R33	42	40	35	63[(a)]	Y / Y / Y
R34	37	35	31	53[(a)]	Y / Y / Y
R35	39	37	32	53[(a)]	Y / Y / Y
R36	39	37	32	53[(a)]	Y / Y / Y
R37 Ground Floor	44	42	38	50 / 48 / 43	Y / Y / Y
R37 First Floor	46	44	39	50 / 48 / 43	Y / Y / Y
R38	40	38	34	50 / 48 / 43	Y / Y / Y
R39	41	39	35	50 / 48 / 43	Y / Y / Y
R40	41	39	34	50 / 48 / 43	Y / Y / Y
R41	36	34	29	53[(a)]	Y / Y / Y
R42 Ground Floor	47	45	40	50 / 48 / 43	Y / Y / Y
R42 First Floor	49	47	42	50 / 48 / 43	Y / Y / Y
R42 Second Floor	50	48	43	50 / 48 / 43	Y / Y / Y
R43 First Floor	49	47	42	50 / 48 / 43	Y / Y / Y
R43 Ground Floor	49	47	43	50 / 48 / 43	Y / Y / Y
R43 Second Floor	50	48	43	50 / 48 / 43	Y / Y / Y
R44 Ground Floor	39	37	32	50 / 48 / 43	Y / Y / Y
R44 First Floor	43	41	37	50 / 48 / 43	Y / Y / Y
R44 Second Floor	48	46	42	50 / 48 / 43	Y / Y / Y
R45 Ground Floor	38	36	31	50 / 48 / 43	Y / Y / Y
R45 First Floor	41	39	35	50 / 48 / 43	Y / Y / Y
R45 Second Floor	46	44	40	50 / 48 / 43	Y / Y / Y
R46 Ground Floor	42	40	35	50 / 48 / 43	Y / Y / Y
R46 First Floor	43	41	37	50 / 48 / 43	Y / Y / Y
R46 Second Floor	46	44	39	50 / 48 / 43	Y / Y / Y
R47 Ground Floor	41	39	34	50 / 48 / 43	Y / Y / Y
R47 First Floor	44	42	37	50 / 48 / 43	Y / Y / Y
R47 Second Floor	47	45	40	50 / 48 / 43	Y / Y / Y
R48 Ground Floor	44	42	37	50 / 48 / 43	Y / Y / Y
R48 First Floor	47	45	41	50 / 48 / 43	Y / Y / Y
R48 Second Floor	49	47	42	50 / 48 / 43	Y / Y / Y

7.4 Operational Noise Mitigation Measures

7.4.1 Acoustic Barrier Design

Acoustic barriers have been considered in this assessment to allow for compliance with the applicable noise criteria. The design of the Project includes the installation of noise barriers surrounding each block of battery units. There are three distinct tiers of barriers surrounding each of the respective block.

All noise barriers considered for the Project are assumed to have a minimum surface density of 12 kg/m^2 to ensure effective barrier design.

It is noted that all barriers have a minimum separation distance of 2.50 m from the front façade of the Megapack. Additionally, there must be a minimum separation distance of 0.15 m from the side facades of the Megapacks and the acoustic barriers. These minimum equipment clearances between the noise barriers and the Megapacks are determined based on minimum equipment clearances outlined the in the Tesla Megapack 2XL operational manual.

The BESS equipment would be arranged in three distinct "blocks", and acoustic mitigation has been designed considering this equipment arrangement. The indicative noise barrier allocation is presented in Figure 6. The barrier heights considered in this acoustic assessment are as follows:

- (Block 1):
    - Internal barrier between column of BESS batteries:. 5.00 m in height and approximately 50 m in length.
    - External barrier at the southern end of Block 1: 5.00 m in height and approximately 32 m in length, spanning the width of Block 1.
- (Block 2):
    - Internal barrier between rows of batteries: 5.30 m in height and approximately 61 m in length.
    - External barrier at the southern end of Block 2: 5.30 m in height and approximately 32 m in length, spanning the width of Block 2.
- Block 3:
    - Internal barrier between rows of batteries: 6.00 m in height and approximately 61 m in length.
    - External barrier at the eastern and southern end of Block 3: 6.00 m in height and approximately 91 m in length, spanning the width and length of Block 3.

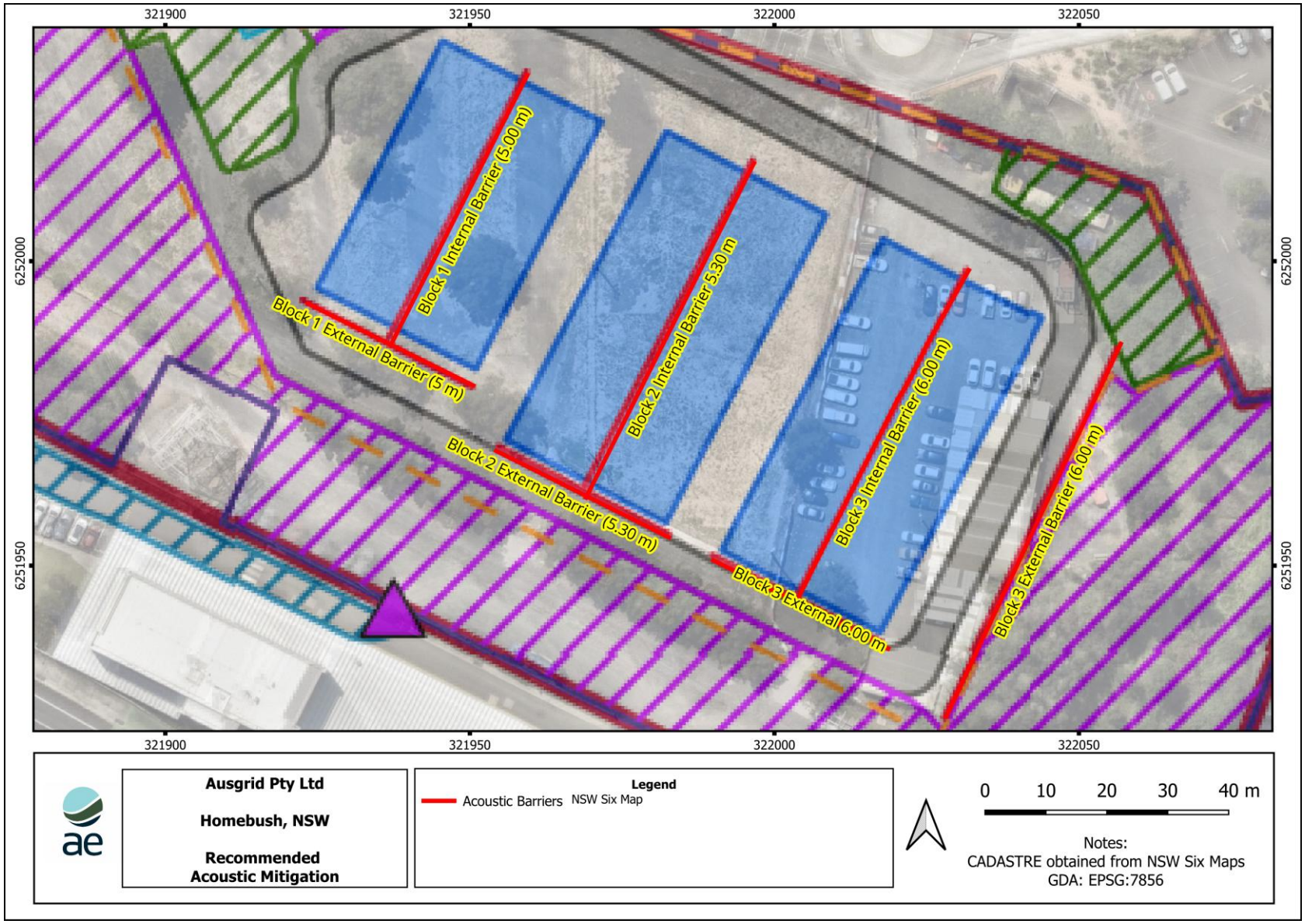


Figure 6: Noise Barrier Locations

8 RECOMMENDED ACOUSTIC MITIGATION MEASURES

8.1 Mitigation of Construction Noise

Given the variable and mobile nature of the construction works and that construction works that generate the largest noise emissions at the receiver will occur at the site boundary where construction of barriers are impractical, the use of permanent or temporary acoustic barriers at source is not considered feasible. Potential controls available to the construction contractor to minimise potential impacts for construction works could include:

- Implement community consultation or notification measures;
- Ensure workers and contractors are aware of noise management requirements in approvals consents or licenses, site inductions and "toolbox talks" providing a summary of relevant to the Project requirements for reference;
- Inform all vehicles and mobile plant equipment of designated vehicle routes, parking locations and acceptable delivery hours or other relevant practices, such as minimising use of engine brakes and avoiding engine idling;
- Using broad band reversing alarms on all mobile plant and equipment where possible;
- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine;
- Operating plant in a quiet and efficient manner;
- Reduce throttle setting and turn off equipment when not being used;
- Regularly inspect and maintain equipment to ensure it is in good working order including checking the condition of mufflers;
- Avoid unnecessary dropping of materials from a height and metal to metal contact on equipment; and
- It is recommended that during any work generating high noise levels that have impulsive, intermittent, low frequency or tonal characteristics, consultation with sensitive receptors occurs regularly.
- During works, following best practice mitigation detailed above and staff training regarding excessive noise from machinery use is recommended.
- A full, detailed and specific CNVMP must be prepared prior to commencing works on site, once a contractor is appointed and the detailed construction methodology is known.
- Should work be required to be performed outside of standard hours, the proponent should negotiate with the community to minimise intrusive noise.

It should be noted that the construction assessment is conservative in nature and that the likelihood of exceeding the predicted noise levels is low.

8.2 Construction Noise and Vibration Management Plan

As predicted construction noise levels are expected to be above the "Noise Affected" management goals, AE has provided a schedule of appropriate noise control recommendations and proposed inclusions for Construction Noise and Vibration Management Plan (CNVMP), to assist in mitigating noise impacts from construction stages.

All feasible noise controls and management practises detailed in this report should be adopted as initial controls as the noise emissions exceed the noise management levels in many cases. In addition to the best practice noise mitigation practices, the following additional management measures are recommended to assist in managing community disturbance during construction.

Table 25 provides a description of each of the additional measures. Additional Mitigation measures outlined in Table 25 may be applied where noise levels may still exceed noise management levels.

Table 25: Additional Mitigation (Road and Maritime Services, 2016)

Mitigation Measure	Description
Notification (N) (letterbox drop or equivalent)	Advanced warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activity, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.
Specific notifications (SN)	Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and informative to more highly affected receivers than covered in general letterbox drops.
Phone calls (PC)	Phone calls detailing relevant information made to identified/affected stakeholders within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs. Where the resident cannot be telephoned then an alternative form of engagement should be used.
Individual briefings (IB)	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Project representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. Where the resident cannot be met with individually then an alternative form of engagement should be used.
Respite Offers (RO)	Respite Offers should be considered made where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers.

Mitigation Measure	Description
	The purpose of such an offer is to provide residents with respite from an ongoing impact. This measure is evaluated on a project-by-project basis and may not be applicable to all projects.
Duration Respite (DR)	Respite offers and respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration Respite so that the project can be completed more quickly.
Verification (V)	Please see Appendix F of the Construction Noise and Vibration Guideline (2016) for more details about verification of Noise and Vibration levels as part of routine checks of noise levels or following reasonable complaints. This verification should include measurement of the background noise level and construction noise.

Table 26 provides a summary of the noise management measures recommended for each phase for each receptor. This assumes all works would be undertaken during standard construction hours.

Construction activities inherently generate noise, but it is accepted that some level of noise is necessary to facilitate development. It is noted that the ICNG states that selecting reasonable measures involves judging whether the overall noise benefits from a feasible option outweigh the overall adverse social, economic and environmental effects. Consideration needs to be made of the relatively short construction period, as well as the long term benefits that the BESS will bring the community.

Table 26: Recommended Management during Standard Construction Hours

Receptor	Management Measured by Activity					
	Vegetation clearing / Site Clearance	Site Establishment	Civil Works for BESS	Installation of BESS Equipment	Installation of Ancillary Operational Equipment	Landscaping and establishment of noise walls
R01	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	N , DR
R02	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R03	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R04	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R05	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R06	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R07	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R08	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R09	V, N, DR	V, N , DR	V, N , DR	N , DR	N , DR	N , DR
R10	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	N , DR
R11	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R12	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R13	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R14	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R15	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R16	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R17	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R18	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R19	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R20	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R21	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R22	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R23	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R24	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR

Receptor	Management Measured by Activity					
	Vegetation clearing / Site Clearance	Site Establishment	Civil Works for BESS	Installation of BESS Equipment	Installation of Ancillary Operational Equipment	Landscaping and establishment of noise walls
R25	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R26	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R27	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R28	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R29	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R30	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R31	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R32	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R33	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R34	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R35	V, N , DR	N , DR	N , DR	N , DR	N , DR	N , DR
R36	N, DR	N , DR	N , DR	N , DR	N , DR	N , DR
R37	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R38	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R39	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R40	N, V, PC, RO	N , DR	N , DR	N , DR	N , DR	N , DR
R41	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	N , DR
R42	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R43	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R44	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R45	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R46	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R47	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR
R48	N, V, PC, RO	V, N , DR	V, N , DR	N , DR	N , DR	V, N , DR

9 OPERATIONAL COMPLIANCE MONITORING PROGRAM

9.1 Schedule

AE recommends that noise testing be conducted:

- Following the commissioning of the Project to validate that its initial state achieves an acceptable acoustic outcome; and
- Recurring every twelve months to verify that the required acoustic performance is maintained.

9.2 Monitoring Locations

It is recommended that the monitoring be conducted at two locations:

- ML1: A location in proximity to the BESS equipment such that it provides a suitably representative sample of the source noise level and characteristics. This monitoring location should be kept constant across the annual tests such that it provides a direct comparison of source noise levels during each measurement, which would assist in recognising any variability due to inclement weather or aging equipment.
- ML2: A location in proximity to the residential receptors closest to the Project. The result at this location can be directly compared to the assessment criteria as detailed in the NIA. Should the noise from the Project not be dominant, which may be the case based on its predicted level in relation to extraneous noise from existing road traffic noise and surrounding industry, an intermediate location closer to the Project should be selected and the result back calculated to the residential receptors.

Specific locations are to be determined on-site based on the ambient conditions and sources of extraneous noise.

9.3 Assessment Criteria

The monitoring results at sensitive receptors should be compared to the assessment criteria derived in the NIA and reproduced in Table 27.

Table 27: Project Noise Criteria

Receptors	Parameter	Criteria. $L_{Aeq,15mins}$ (dB(A))			Criteria LAF_{max} (dB(A))
		Day	Evening	Night	L_{Amax}
All	($L_{Aeq,adj,T}$)	50	48	43	52

9.4 Survey Details

The noise survey must include a minimum 15-minute measurement at the two identified locations, excluding any pauses due to extraneous noise. The microphone should be placed 1.2 - 1.5 metres above the ground level in free-field conditions, in accordance with *Australian Standard AS1055:2018 Acoustics – Description and measurement of environmental noise*. The microphone should be placed on a tripod to minimise reflections off the operator.

Detailed notes should be kept alongside the measurement, noting the meteorological conditions (ideally using a handheld anemometer or portable weather station), location

including photographs, start and end time, and observations of noise from the Project and other extraneous sources, including the audibility of any annoying characteristics such as tonality or impulsive noise.

9.5 Instrumentation

The noise monitoring should be completed with a Class 1 sound level meter traceable to NATA calibration. Field calibration checks should be conducted with a NATA calibrated device before and after each measurement. The data should be discarded, and the measurement repeated if the check reveals significant system drift (≥ 1 dB).

10 VIBRATION ASSESSMENT

10.1 Introduction

A review of the proposal indicates there is potential for impacts as a result of vibration generated by plant and equipment during the construction phase. Given this, an assessment of the potential for vibration impacts has been undertaken. In particular, the assessment has considered the potential for impacts on both human comfort and structural damage for the nearest sensitive receptors to the construction works.

10.2 Assessment Criteria

The vibration criteria presented in the Environmental Noise Management – *Assessing Vibration: A Technical Guideline* (2006) published by the NSW Department of Environment and Conservation (DEC) have been adopted for the assessment. The technical guide provides vibration criteria associated with amenity impacts (human annoyance) for the three categories of vibration:

- Continuous vibration (e.g., road traffic, continuous construction activity).
- Impulsive vibration includes less than 3 distinct vibration events in an assessment period (e.g., occasional dropping of heavy equipment); and
- Intermittent vibration includes interrupted periods of continuous vibration (e.g., drilling), repeated periods of impulsive vibration (e.g., pile driving) or continuous vibration that varies significantly in amplitude.

Table 28 and Table 29 present the criteria for continuous and impulsive vibration and intermittent vibration, respectively.

Table 28: Continuous and Impulsive Vibration Criteria for Residences – Peak Velocity

Location	Vibration Type	Preferred Limit (mm/s)	Maximum Limit (mm/s)
Residences	Continuous	0.28	0.56
Residences	Impulsive	8.6	17
Offices	Continuous	0.56	1.1
Offices	Impulsive	18	36
Workshops	Continuous	1.1	2.2
Workshops	Impulsive	18	36

Table 29: Intermittent Vibration Criteria for Residences

Location	Assessment Period	Preferred Value (m/s1.75)	Maximum Value (m/s1.75)
Residences	Daytime	0.20	0.40

The above criteria are suitable for assessing human annoyance in response to vibration levels. In order to assess potential damage to buildings, reference has been made to British Standard *BS 7385-2: 1993 Evaluation and measurement of vibration in buildings – Part 2: Guide to damage levels from ground borne vibration*. Table 30 presents vibration criteria for assessing the potential for building damage.

Table 30: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Particle Velocity (mm/s)	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures – residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

10.3 Potential Vibration Sources

Table 31 identifies the vibration source levels for the equipment likely to be used for the construction of the Project.

Table 31: Vibration Source levels – Peak Particle Velocity

Equipment Item	PPV at 10 metres (mm/s)	Source
Roller	5 – 6	DEC
7 tonne compactors	5 – 7	DEC
Loaded trucks (rough surface)	5	USA DT [a)]
Loaded trucks (smooth surface)	1 – 2	USA DT [a)]
Excavator	2.5 – 4	DEC

a) Transit Noise and Vibration Impact Assessment, US Department of Transportation, May 2006.

10.4 Assessment of Potential Vibration Impacts

Based on the vibration source levels at 10 metres (presented in Table 31), peak particle velocities have been predicted at various separation distances. The NSW DEC indicates that in predicting vibration levels, it can be assumed that the vibration level is inversely proportional to distance (with the relationship varying between $d^{-0.8}$ to $d^{-1.6}$ based on field data).

The US Department of Transportation's Transit Noise and Vibration Impact Assessment (May 2006) presents the following construction vibration propagation formula assuming an inverse relationship:

$$PPV@d_2 = PPV@d_1 \times (d_1/d_2)^{1.5}$$

where: d_1 = distance 1 (reference distance for source data) (m)

d_2 = distance 2 (separation distance for predicted PPV) (m)

PPV = peak particle velocity (mm/s)

The above formula has been considered for predicted PPVs at various distances from construction equipment. Table 32 presents these predictions.

Table 32: Predicted Peak Particle Velocity at Sensitive Receptors (mm/s)

Distance from Source (m)	Predicted Peak Particle Velocity (mm/s)				
	Roller	7 tonne compactor	Excavator	Loaded trucks (rough surfaces)	Loaded trucks (smooth surfaces)
10	6.00	7.00	4.00	5.00	1.00 – 2.00
20	2.12	2.47	1.41	1.77	0.35 – 0.71
30	1.15	1.35	0.77	0.96	0.19 – 0.38
40	0.75	0.88	0.50	0.63	0.13 – 0.25
50	0.54	0.63	0.36	0.45	0.09 – 0.18
60	0.41	0.48	0.27	0.34	0.07 – 0.14
70	0.32	0.38	0.22	0.27	0.06 – 0.11
80	0.27	0.31	0.18	0.22	0.05 – 0.09
90	0.22	0.26	0.15	0.19	0.04 – 0.07
100	0.19	0.22	0.13	0.16	0.03 – 0.06
150	0.1	0.12	0.07	0.09	0.02 – 0.03
Type	Continuous			Intermittent	
Nuisance Criteria	Residential 0.28 (preferred) / 0.56 (max)			Residential 0.20 (preferred) / 0.40 (max)	
Building Criteria	Residential 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz. 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above				

The predicted vibration levels presented in Table 32 indicate compliance with the continuous maximum vibration nuisance criteria for locations at a separation distance of 50-60 metres. Compliance with the building damage criteria is predicted at 60 metres from construction for each source. Therefore, as the closest receptor is 72 m from the nearest vibration source, there will be no adverse impact.

It is noted that workshops and offices have less stringent criteria than residential receptors for vibration, therefore compliance with the nearest residential receptor at 50-60 metres will imply compliance with all other nearby sensitive receptors located 50-60 metres from the Project. At a distance between 30-40 metres from construction offices and workshops will be below the maximum continuous criteria and therefore all commercial receptors identified in this assessment are compliant with the continuous vibration criteria.

For intermittent vibration associated with haul vehicles the relevant criteria are expressed as Vibration Dose Value (VDV) in $m/s^{1.75}$. The calculation of VDV required both overall weighted RMS (root mean square) acceleration (m/s^2) which is typically obtained from on-site measurements and the estimated time period for vibration events.

In lieu of this site-specific information a conservative assumption where all haul vehicles are operating continuously was used to demonstrate worst case vibration impacts. At a distance of 100 metres the predicted peak particle velocity is below the established preferred nuisance criteria of 0.28 mm/s. Therefore, it is expected that the vibration generated from haul trucks will be within the acceptable vibration criteria at nearest sensitive receptors.

10.5 Operational Vibration

The vibration from the Project will be minimal due to the negligible vibration generated from the on-site equipment and the hardstand the equipment will be placed on.

11 CONCLUSION

Assured Environmental was appointed by Ausgrid to prepare a Noise and Vibration Impact Assessment for the Project. Computational noise models and first principal calculations were utilised to predict the noise from the Project during construction and operation at surrounding land uses and in accordance with the relevant guidelines.

The assessment of potential noise impacts assumes construction takes place during standard hours only. For construction during standard hours, it is predicted that the Project has the potential to exceed the noise management levels during all phases of construction and as such mitigation measures are warranted. This assessment provides reasonable and feasible controls as outlined by the ICNG (DECC, 2009) to minimise impacts on nearby residential receptors. The construction noise emissions are considered acceptable provided the mitigation measured detailed in this assessment are implemented.

This assessment considered the operational noise emissions of the Project with and without acoustic mitigation measures implemented. The predictive modelling demonstrated that without the use of the acoustic mitigation, exceedances are expected to occur during all assessment periods and at multiple receptors.

The predictive noise modelling results for the Project, with acoustic mitigation measures in place, indicate that compliance with the established noise criteria at all receptors can be achieved. Compliance is reliant on acoustic barriers being installed as outlined in Figure 6 and operational fan speeds being restricted as specified in Section 8.4.2. Therefore, with the acoustic mitigation measures in place, the Project is unlikely to result in adverse amenity impacts to nearby receptors.

The potential impacts from road traffic and the generation of vibration during construction and operation were assessed. During operation, vibration and road traffic emissions are considered negligible due to the nature of the BESS equipment and minimal staff vehicle volumes required.

The largest potential for road and vibration impacts occurs during the construction phase. Assessment of these impacts during the construction phase identified that road traffic and vibration emissions would comply with the applicable criteria.

Overall, based on the results of the assessment, the risk of residual adverse impacts as a result of the Project is considered to be low. The Project does exceed the construction noise management levels but this is considered an acceptable outcome with the implementation of mitigation measures detailed in this assessment.

APPENDIX A: NOISE CONTOURS WITHOUT ACOUSTIC MITIGATION

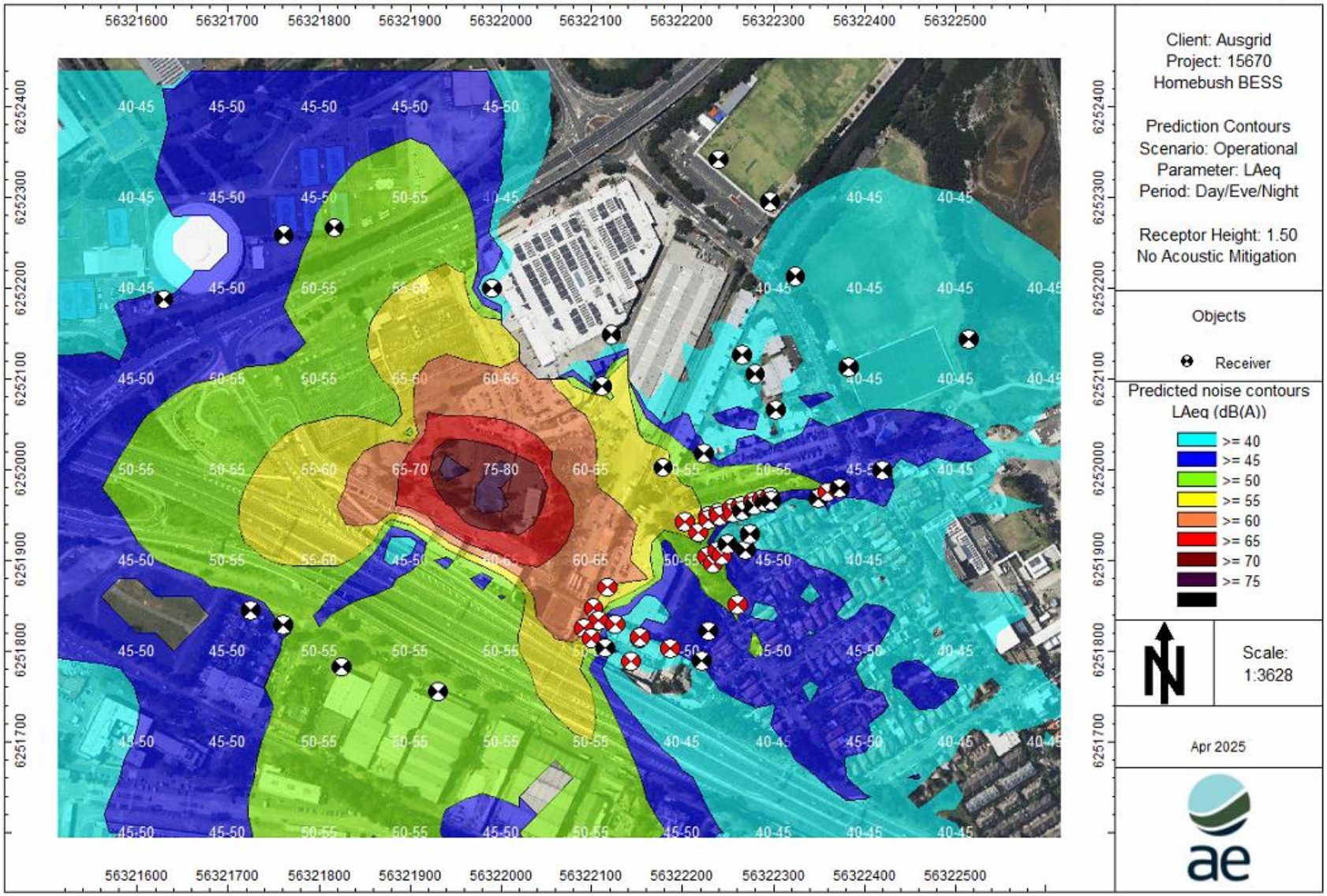


Figure 7: Prediction Contours - No Acoustic Mitigation at 1.50 m Receptor Height

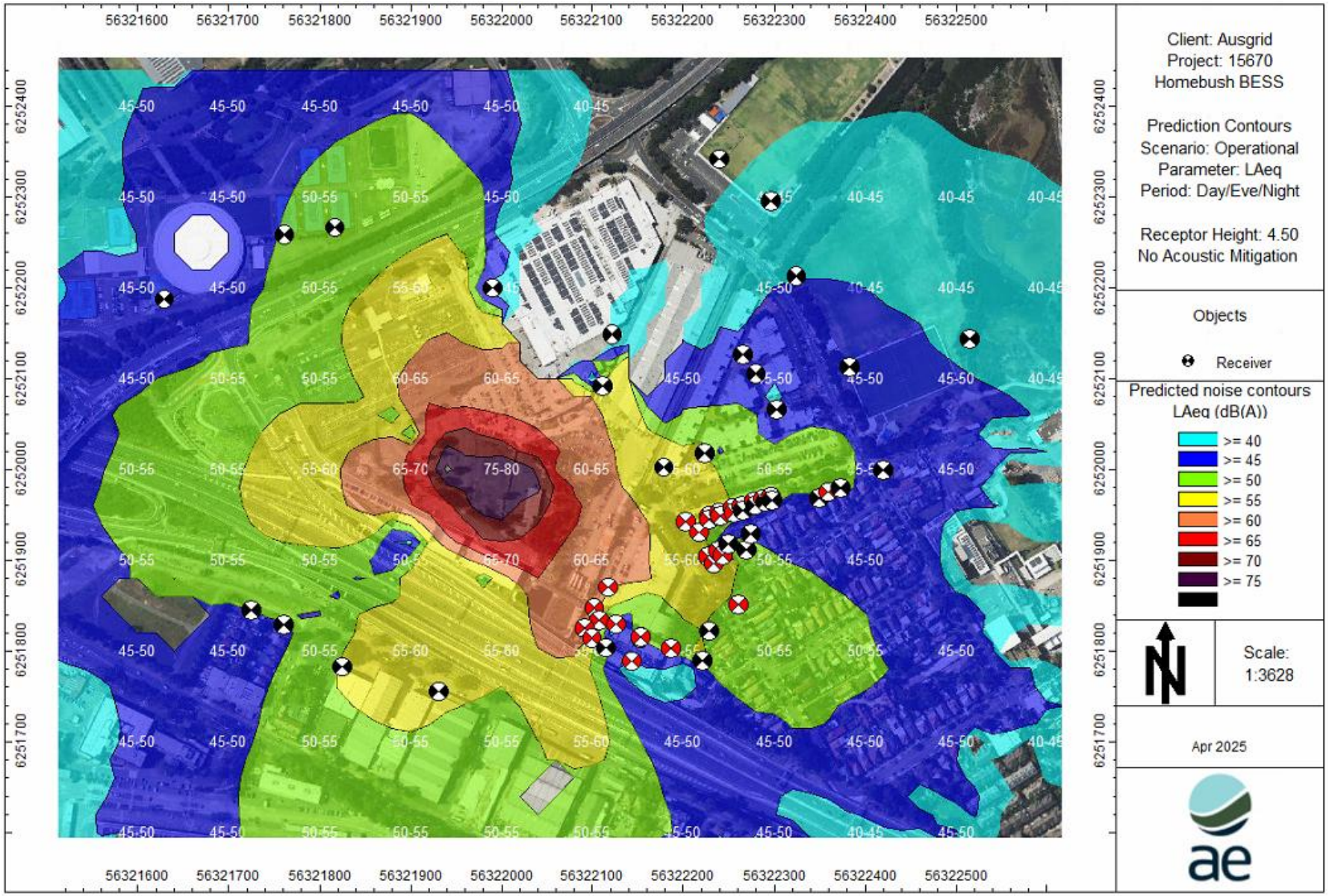


Figure 8: Prediction Contours - No Acoustic Mitigation at 4.50 m Receptor Height

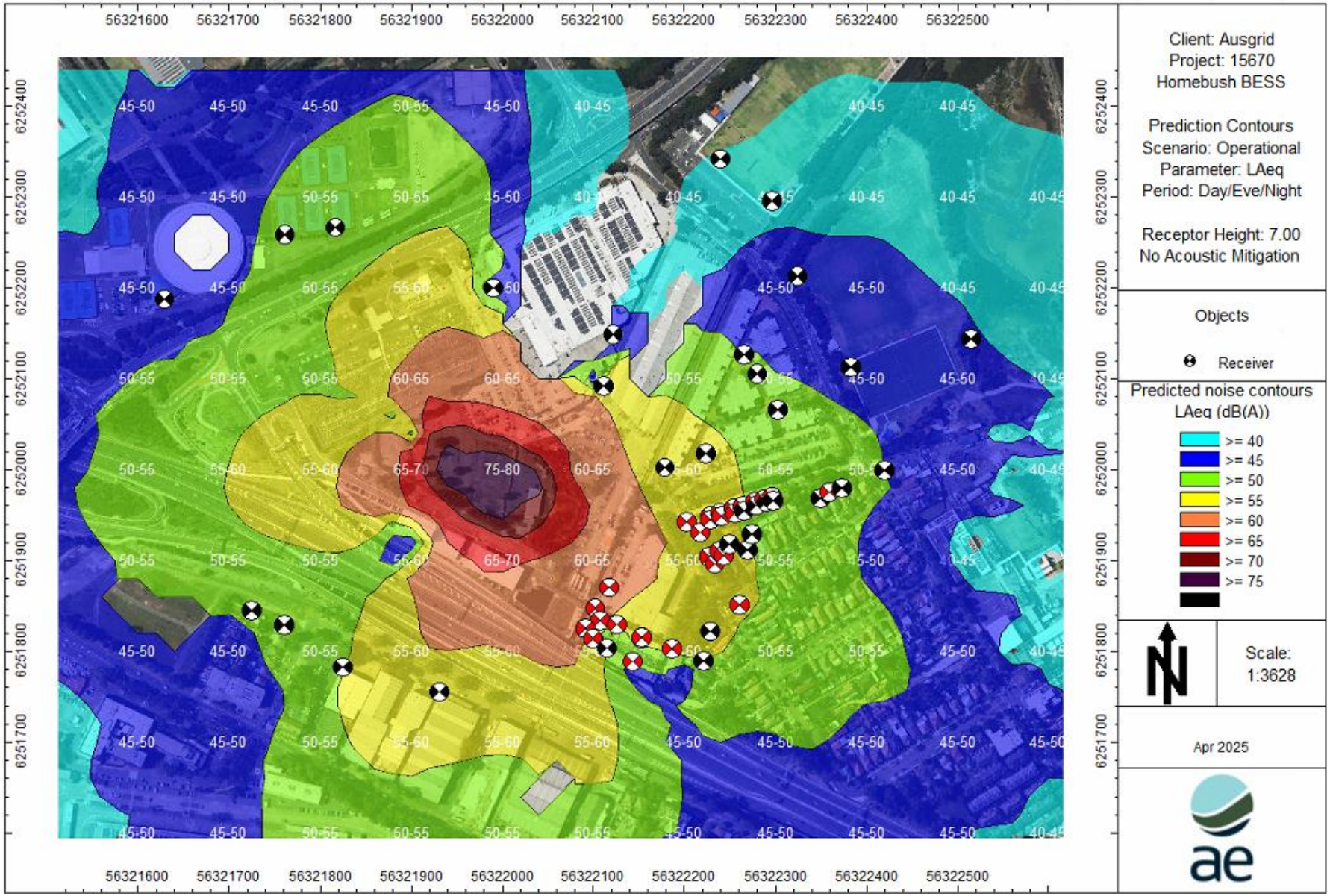


Figure 9: Prediction Contours - No Acoustic Mitigation at 7.00 m Receptor Height

APPENDIX B: NOISE CONTOURS WITH ACOUSTIC MITIGATION APPLIED

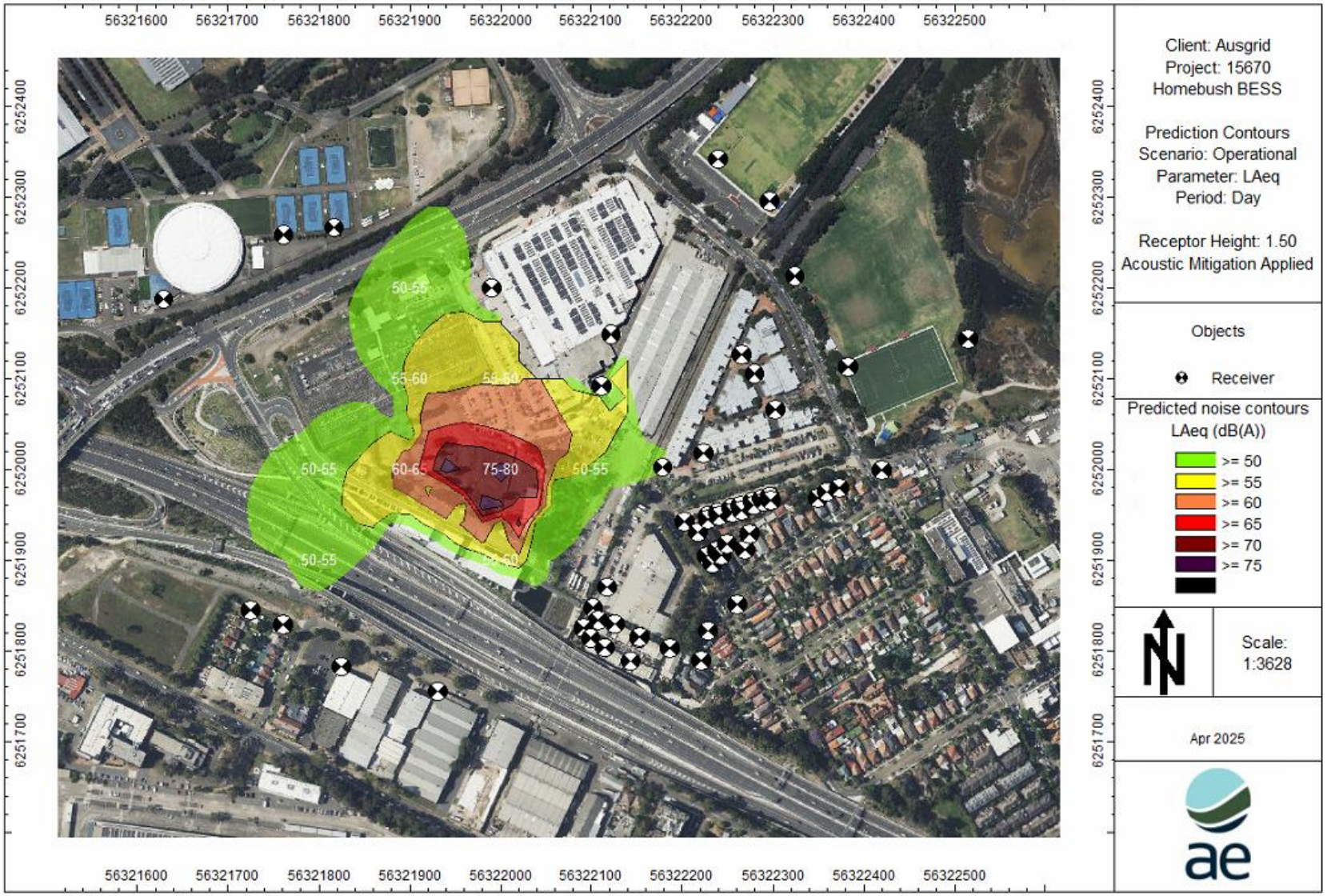


Figure 10: Prediction Contours -Acoustic Mitigation Applied at 1.50 m Receptor Height During the Day

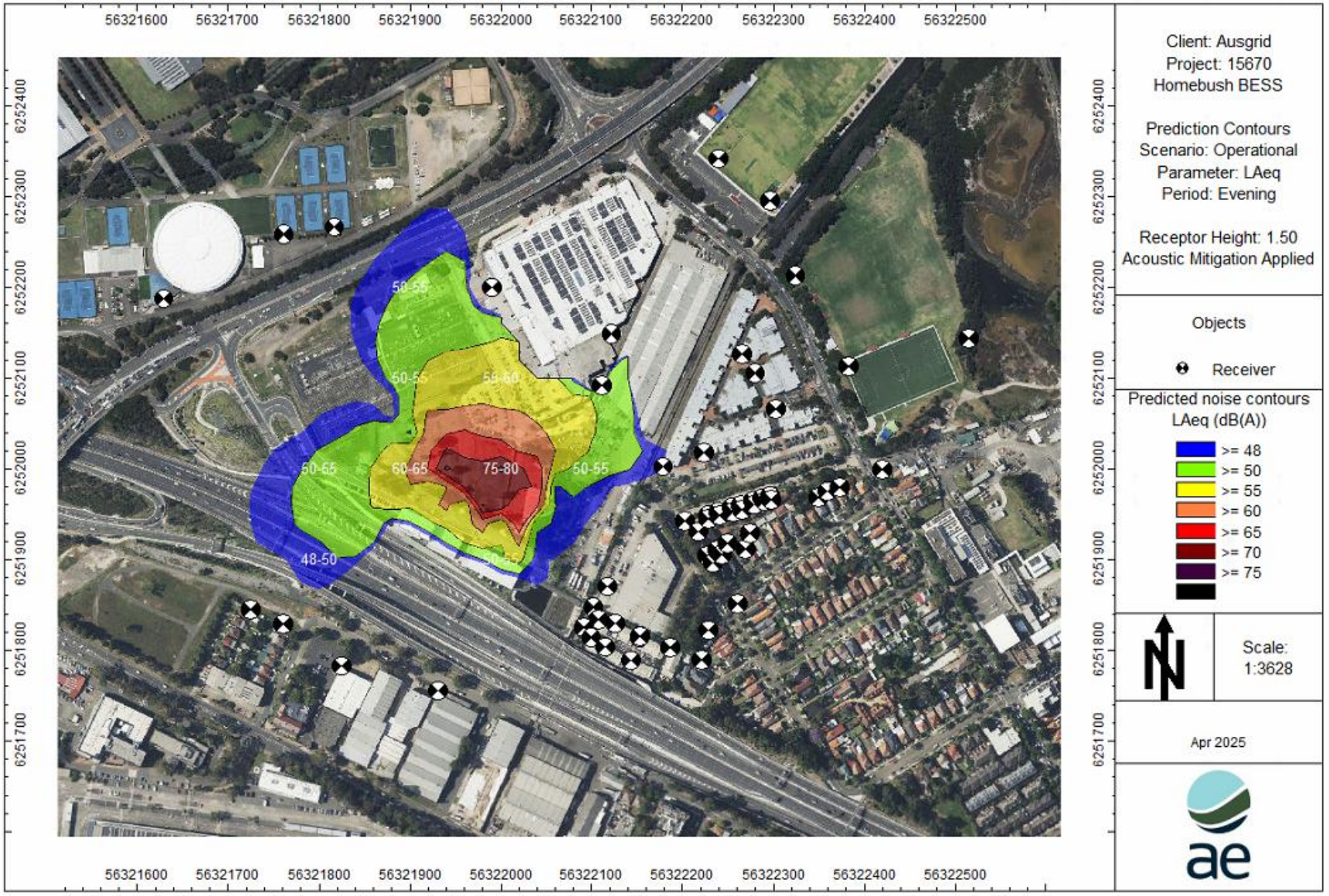


Figure 11: Prediction Contours -Acoustic Mitigation Applied at 1.50 m Receptor Height During the Evening

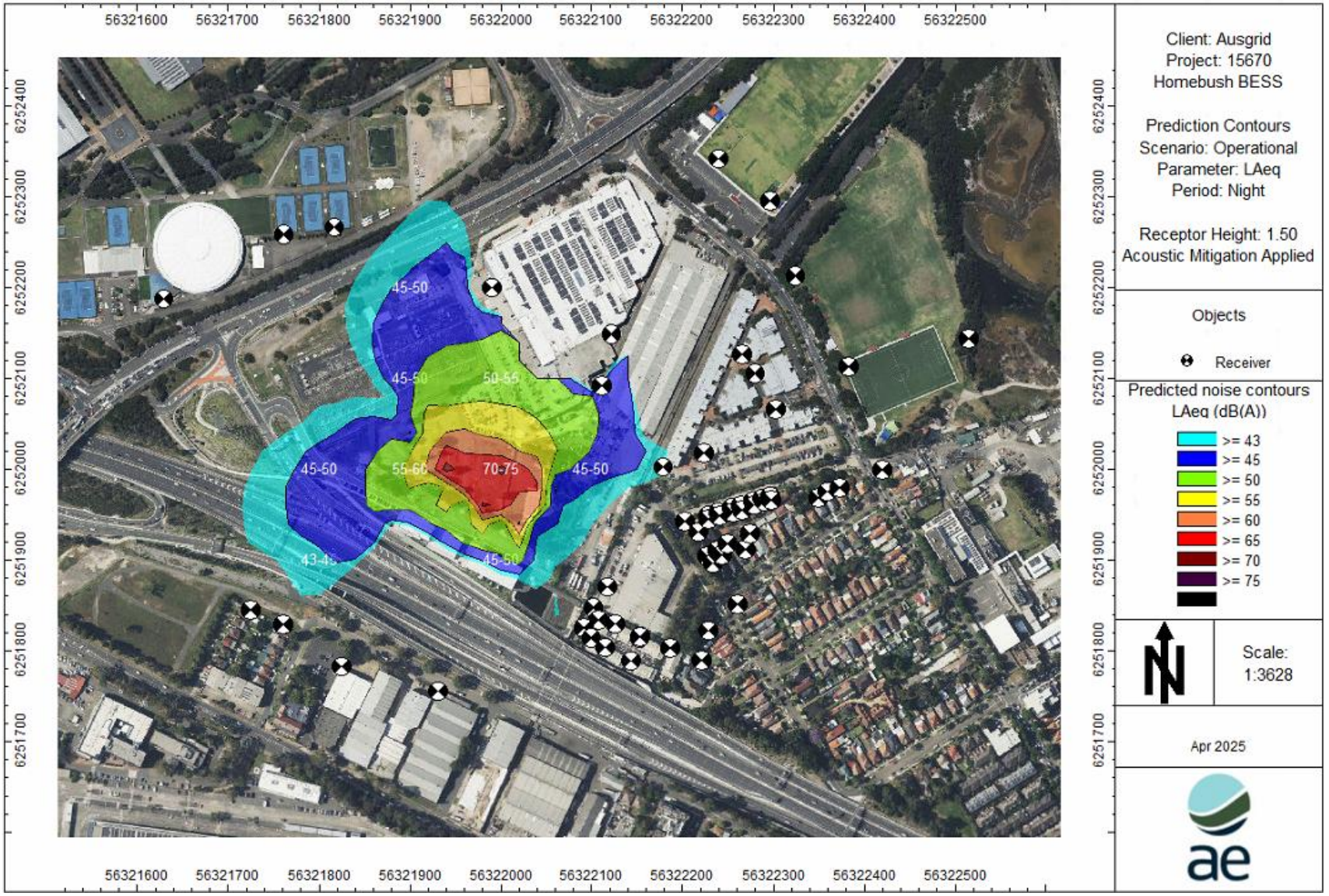


Figure 12: Prediction Contours -Acoustic Mitigation Applied at 1.50 m Receptor Height During the Night

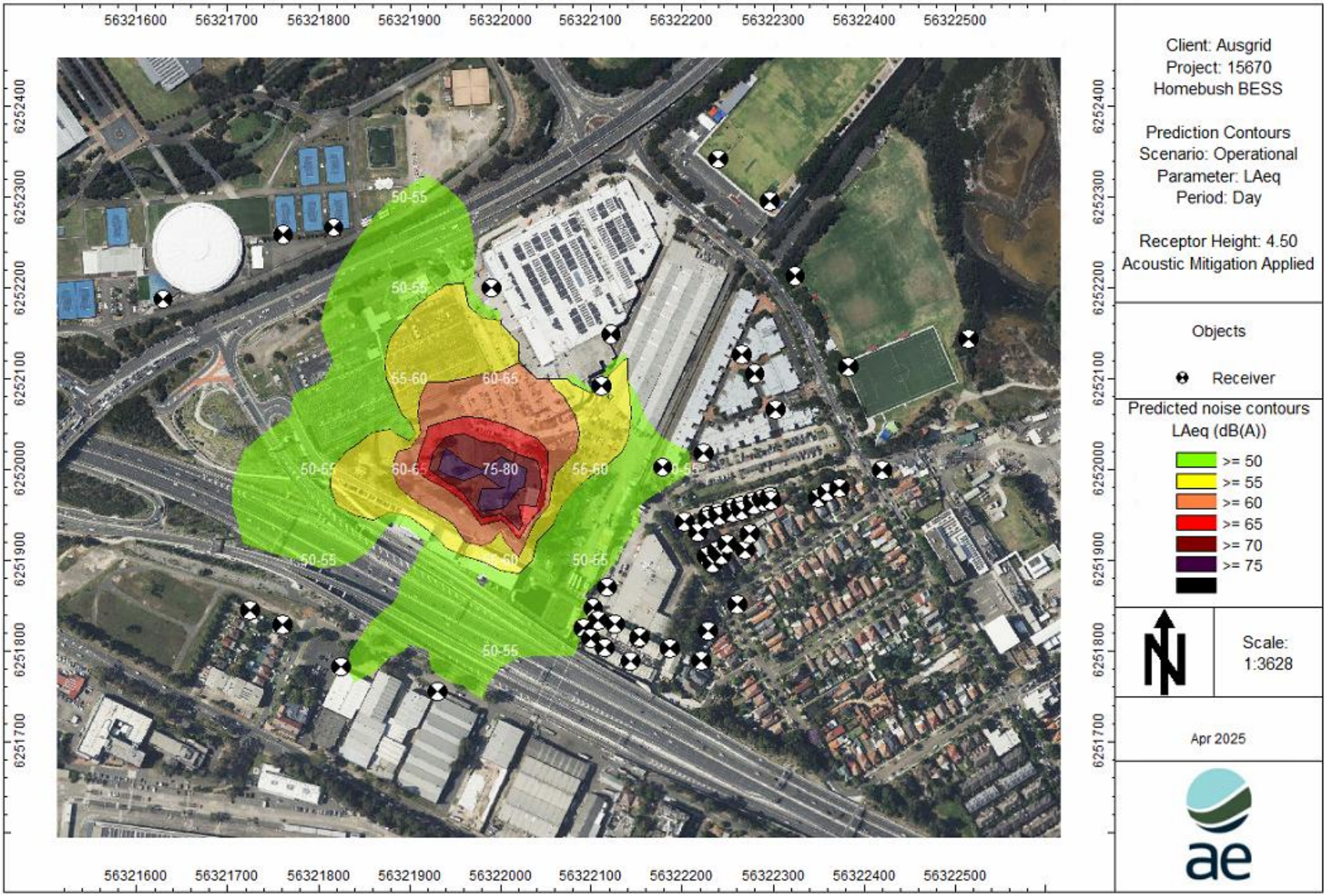


Figure 13: Prediction Contours -Acoustic Mitigation Applied at 4.50 m Receptor Height During the Day

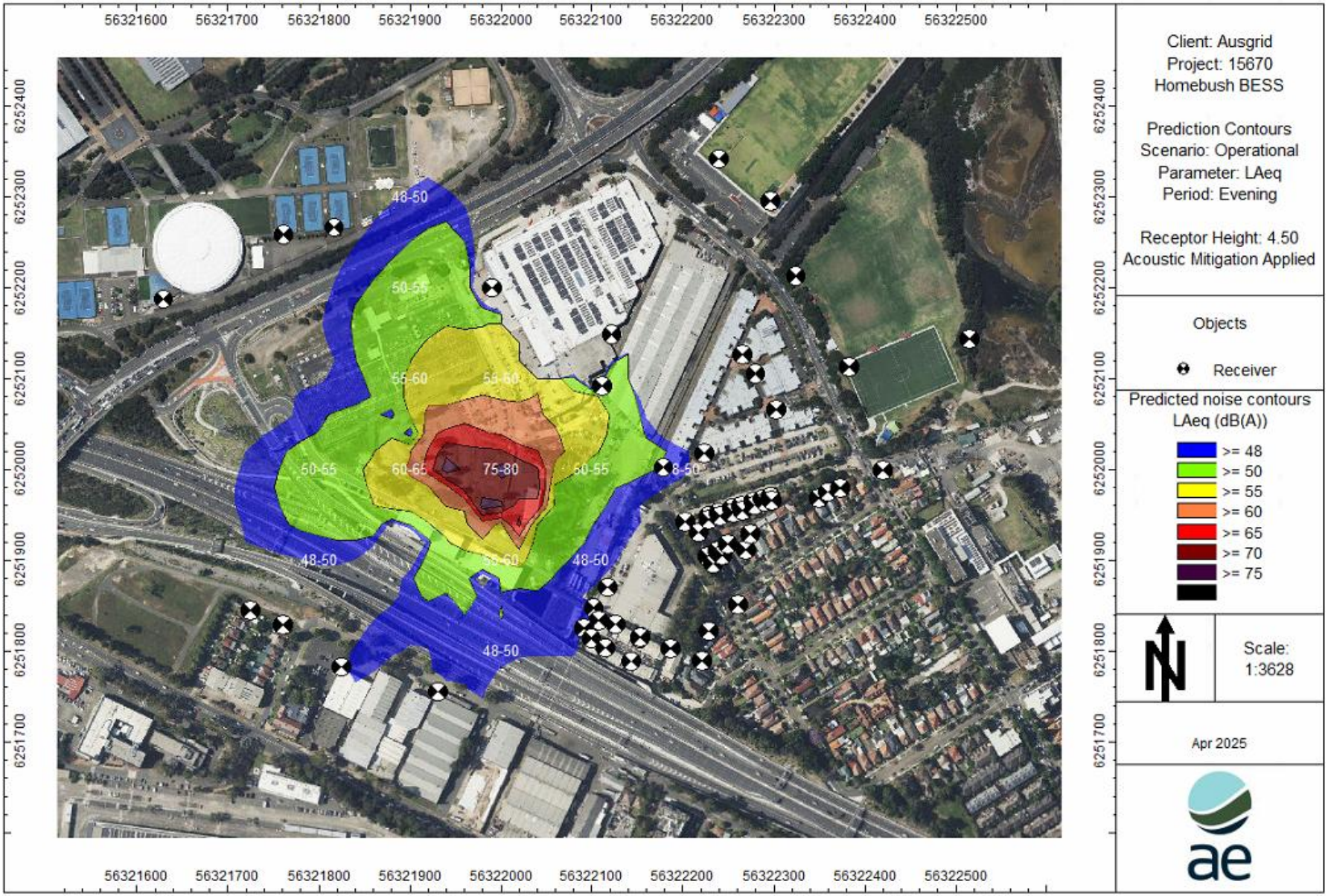


Figure 14: Prediction Contours -Acoustic Mitigation Applied at 4.50 m Receptor Height During the Evening

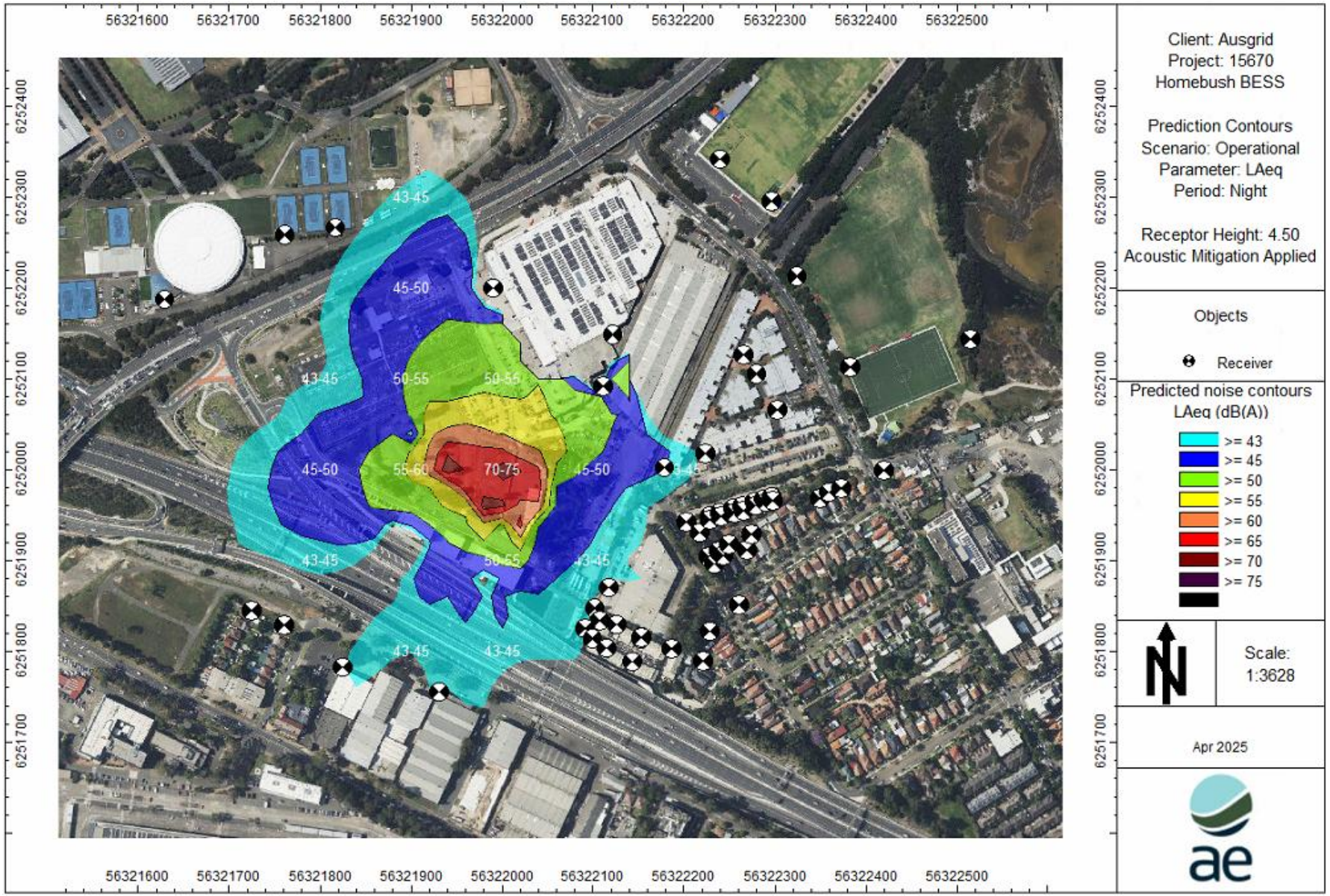


Figure 15: Prediction Contours -Acoustic Mitigation Applied at 4.50 m Receptor Height During the Night

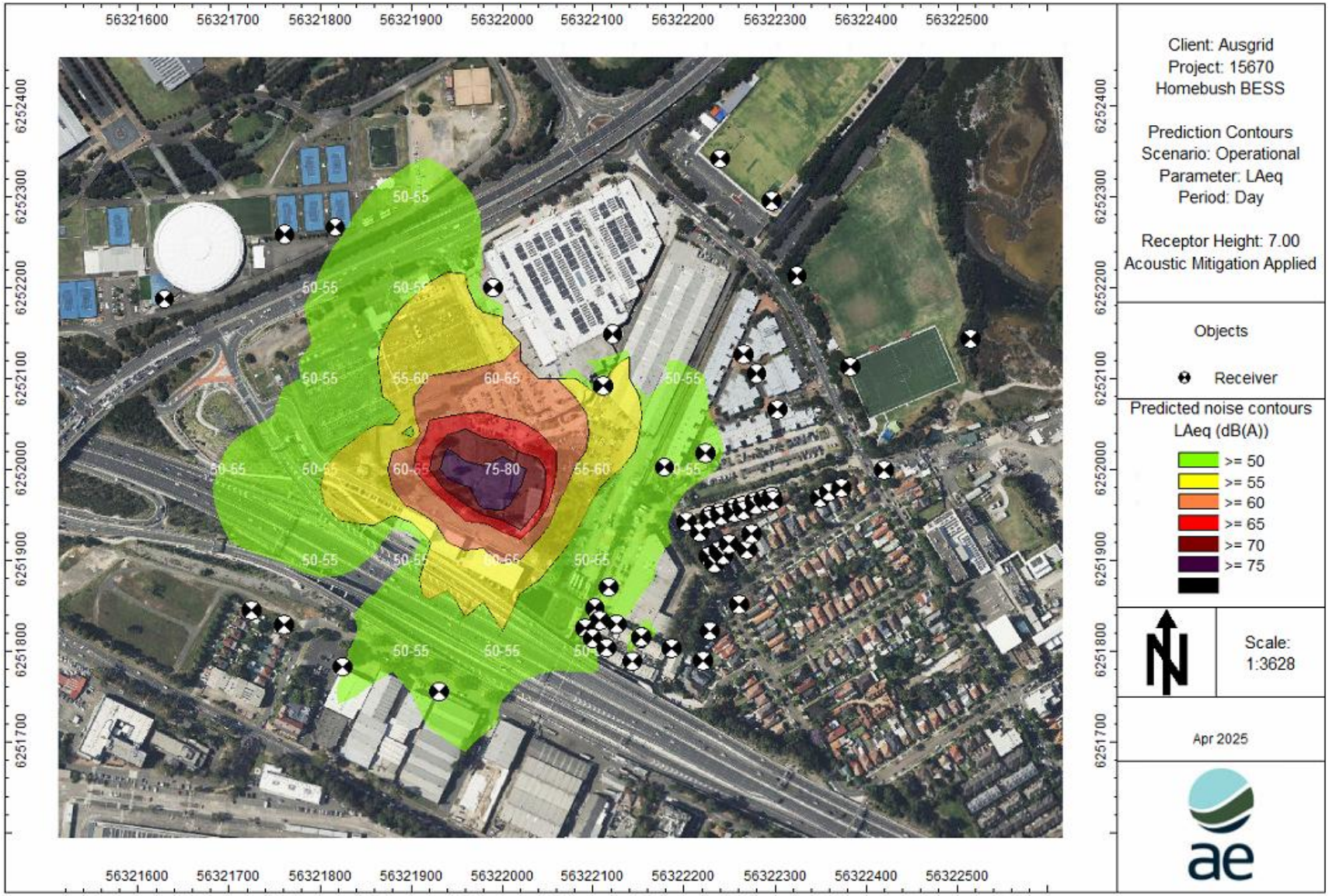


Figure 16: Prediction Contours -Acoustic Mitigation Applied at 7.00 m Receptor Height During the Night

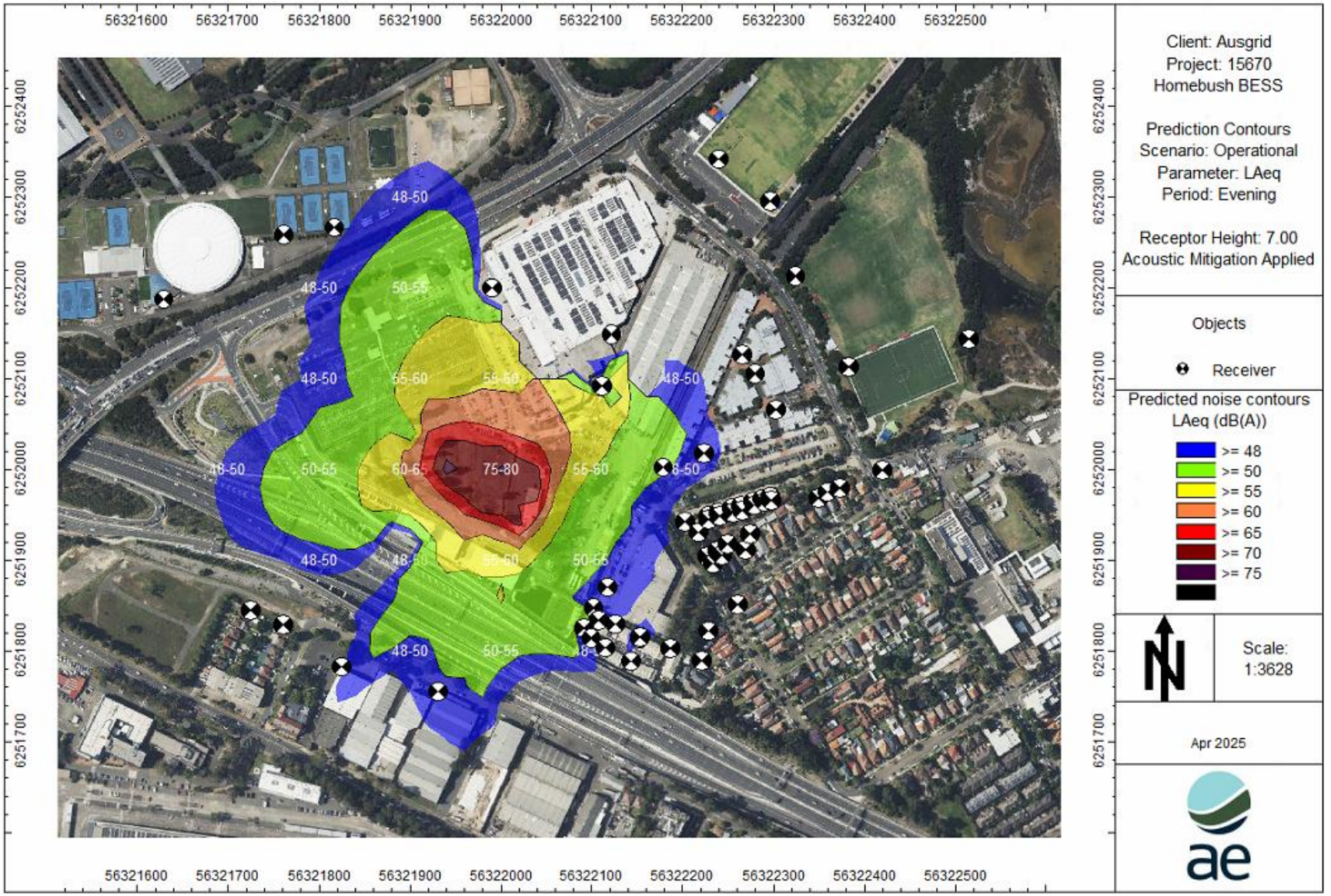


Figure 17: Prediction Contours -Acoustic Mitigation Applied at 7.00 m Receptor Height During the Evening

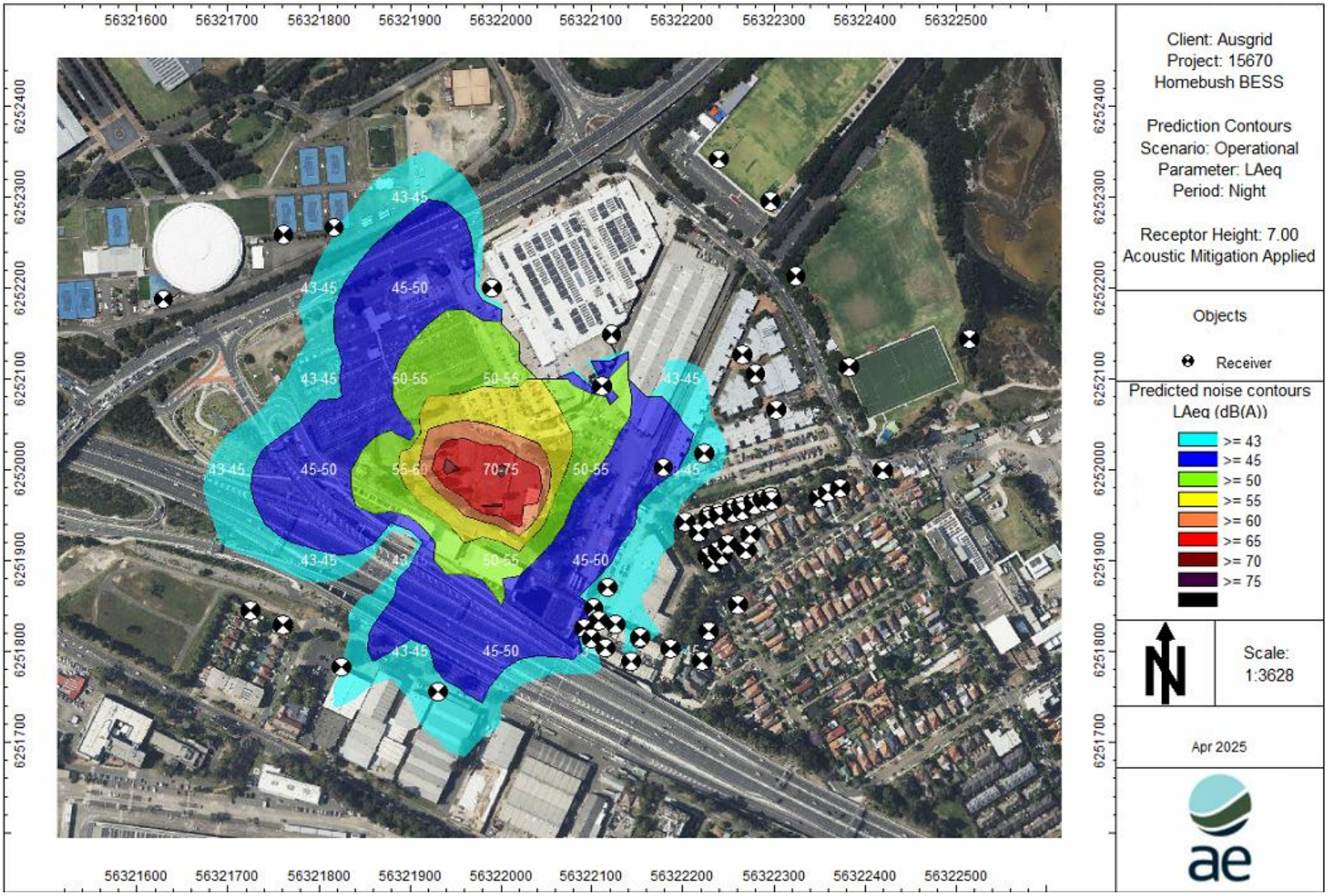
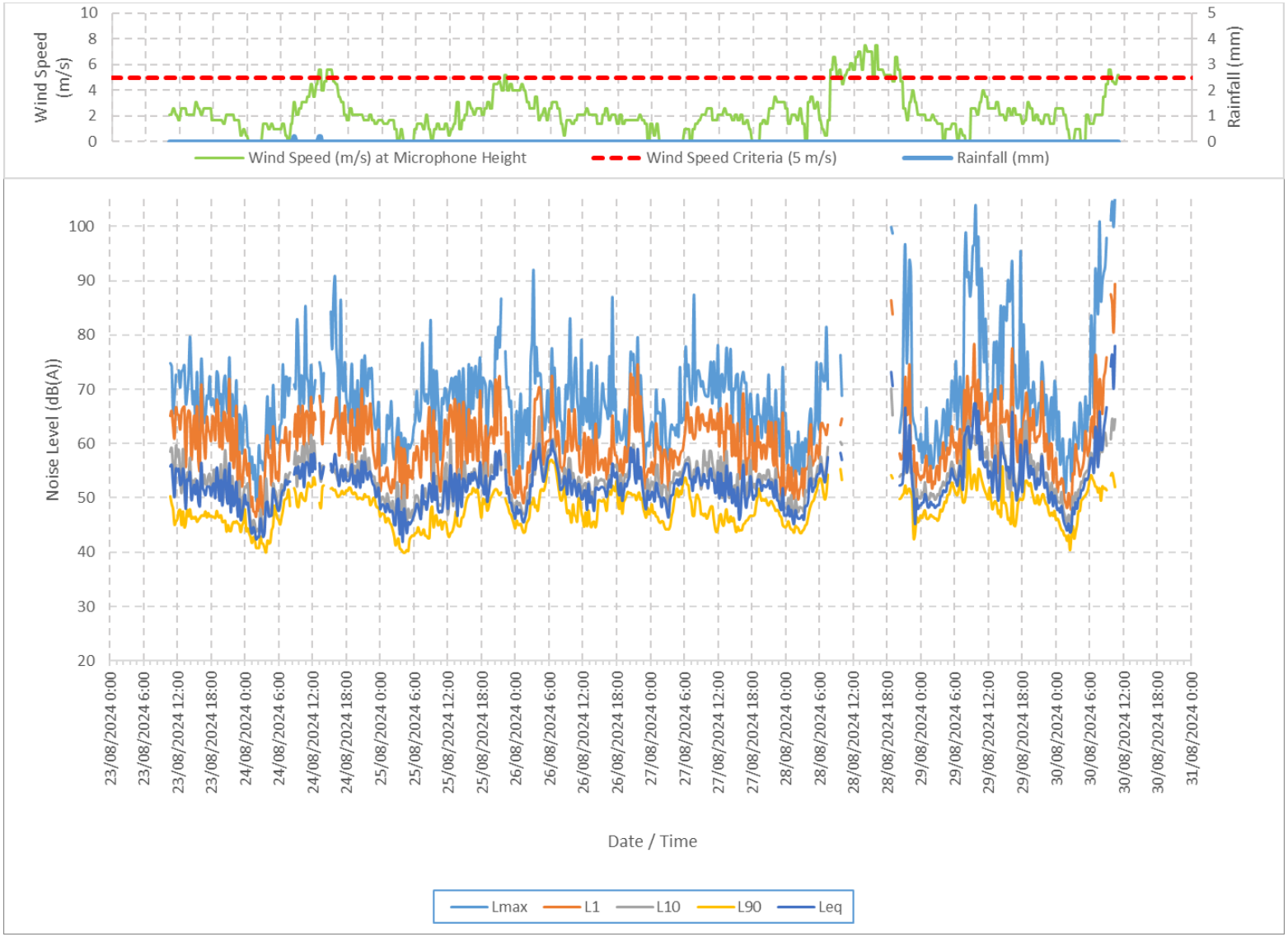


Figure 18: Prediction Contours -Acoustic Mitigation Applied at 7.00 m Receptor Height During the Night

APPENDIX C: SOUND MONITORING INSTRUMENTATION AND DATA

Table 33: Site Details

Site Details: NML 1	
Coordinates:	-33°51'27.3"S, 151°04'42.0"E
Start / End Date	23 August at 10:00 AM to 30 August at 10:30 AM 2024
Logger Details	Norsonic Nor139 (serial number – 12346632) Next Laboratory Calibration Due: 30th October 2025
Calibration Details	Larson Davis CAL200 Precision Acoustic Calibrator 8359 Start / End Calibration Level: 94.1 dB(A) / 94.0 dB(A) Next Laboratory Calibration Due: 22 November 2024
Measurement Details:	Fast/ A-weighting / 15-min duration / 1.2 m microphone height / Free field position
Weather Details	BOM weather station (Sydney Olympic Park) used for meteorological data
On-site Observations:	Located at the boundary of the Homebush Business village close to the residential receptors on Bellona Avenue
Site Photo	


Wind Speed (m/s)
Rainfall (mm)
Wind Speed (m/s) at Microphone Height
Wind Speed Criteria (5 m/s)
Rainfall (mm)
Noise Level (dB(A))
Date / Time
Lmax
L1
L10
L90
Leq