ARNOTT'S HUNTINGWOOD PROCESSING EXPANSION

Noise and Vibration Assessment

Prepared for:

Charter Hall Holdings Pty Ltd
333 George St,
Sydney NSW 2000

SLR Ref: 610.30322-R01
Version No: -v0.5
August 2021

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Charter Hall Holdings Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30322-R01-v0.5	24 August 2021	Robbie Cain	Mark Irish	
610.30322-R01-v0.4	21 July 2021	Robbie Cain	Mark Irish	
610.30322-R01-v0.3	16 June 2021	Robbie Cain	Mark Irish	
610.30322-R01-v0.2	10 June 2021	Robbie Cain	Mark Irish	

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by FDC Construction on behalf of Charter Hall Holdings Pty Ltd to undertake a noise and vibration impact assessment of the proposed development of the existing food processing facility (bakery) at 65 Huntingwood Drive, Huntingwood (the Site). The facility is occupied by Arnott's Biscuits. This assessment has been prepared to accompany the proposal.

This report summarises the potential construction and operational noise and vibration impacts associated with the proposal.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

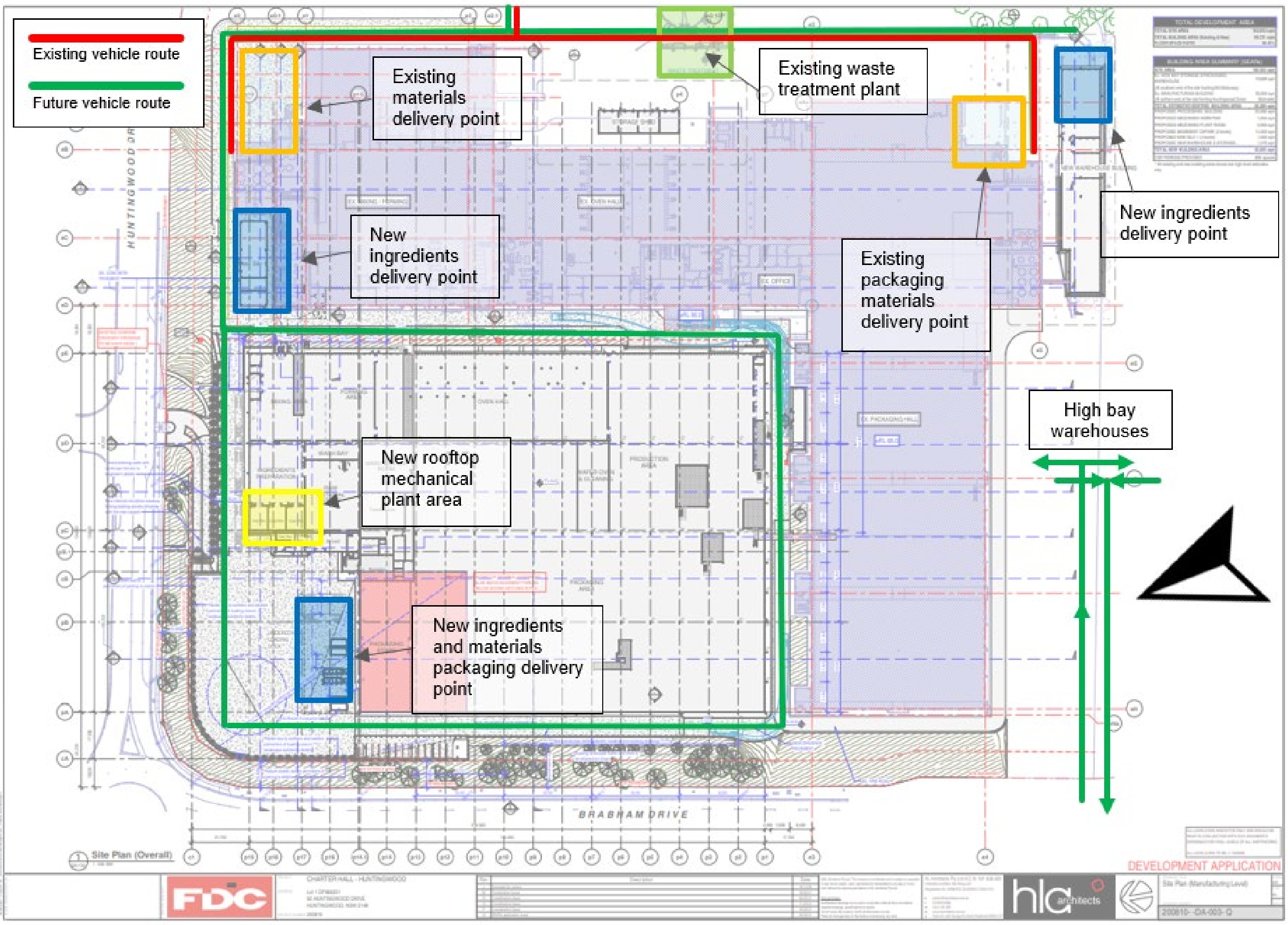
1.1 Proposal Description

The proposed development is located within the existing site at 65 Huntingwood Drive. The site is adjacent to Huntingwood Drive and Brabham Drive, which are located around 10 m to the north and west respectively.

The site location is shown in **Figure 1** and the proposed ground floor layout is shown in **Figure 2** (HLA Architects Drawing No: 200810-DA-003-Q). This figure has been annotated to show existing and proposed future vehicle routes and mechanical plant locations.

Figure 1 Site Location and Surrounding Receivers

Figure 2 Proposed Development



The expanded facility will continue to operate 24 hours per day, seven days per week. Deliveries to and from the development could occur at any time during the opening hours, on any day of the week.

The identified sources of noise from the proposed development include:

- Mechanical plant
- Internal warehouse operations
- Trucks unloading to silos
- Skip bin change outs
- Forklift movements
- Truck and light vehicle movements on internal access roads.

On-site vehicle routes being at the north extent of the site from Huntingwood Drive. Currently, vehicles move from this point to the north east and north west corner of the site. After the site expansion, vehicles will move further into the south eastern corner of the site within a new ingredients and packaging materials delivery point.

The expansion will involve a new processing facility in the north west corner of the site (as indicated in **Figure 2**), including two levels of car parking and loading area above.

1.2 Nearest Receivers

The nearest sensitive receivers are commercial and industrial properties surrounding the site, ranging from 30 metres to the north to 170 metres to the south. The nearest receivers are shown in **Figure 1** and detailed in **Table 1**.

Table 1 Surrounding Sensitive Receivers

ID	Address	Type	Distance (m)	Direction
R01	Brabham Drive, Eastern Creek	Industrial	160	North West
R02	64 Huntingwood Drive, Huntingwood	Commercial	30	North
R03	62 Huntingwood Drive, Huntingwood	Commercial	50	North
R04	58 Huntingwood Drive, Huntingwood	Commercial	30	North
R05	52 Huntingwood Drive, Huntingwood	Industrial	70	North east
R06	51 Huntingwood Drive, Huntingwood	Industrial	80	East
R07	22 Peter Brock Drive, Eastern Creek	Industrial	170	South
R08	10 Peter Brock Drive, Eastern Creek	Industrial	170	South
R09	2A Peter Brock Drive, Eastern Creek	Hotel	150	South
R10	71 Huntingwood Drive, Huntingwood	Industrial	50	West
R11	9 Flemming Grove, Doonside	Residential	1500	North
R12	19 Shelley Crescent, Blacktown	Residential	1500	North
R13	1 Mariko Place, Blacktown	Residential	1400	North-East
R14	41 Pikes Lane, Eastern Creek	Residential	1100	West

2 Existing Noise Environment

The existing noise environment at the site is understood to be generally dominated by road traffic from the surrounding road network with the nearest major roads being Huntingwood Drive, which is located 10 m to the north and Brabham Drive, which is located 10 m to the west. The Great Western Highway is located 400 m to the north and the M4 Western Motorway is located 70 m to the south. Other existing noise sources include industrial and commercial sites which are located approximately 30 m to the north, 70 m to the east and 70 m to the west.

2.1 Existing Noise Survey and Monitoring Locations

Attended noise monitoring was completed in the study area during June 2021. The measured noise levels have been used to determine the existing noise environment, set the criteria used to assess the potential impacts from the project and to quantify noise impacts from current noise operations.

A Brüel & Kjær 2270 (S/N 3029487) Sound Level Meter was utilised for all attended measurements. The microphone was fixed to a tripod and set to a height of 1.5m. Weather was observed during the monitoring period and was appropriate to take noise measurements in accordance with the NPfI.

The noise monitoring equipment measured existing noise levels in 15-minute periods during the daytime, evening and night-time. All equipment carried current National Association of Testing Authorities (NATA) or manufacturer calibration certificates and equipment calibration was confirmed before and after each measurement.

The noise monitoring locations are shown in **Figure 1** and the results are summarised in **Table 2**. Locations A1-A3 were selected as site boundary measurements to quantify the existing noise emissions from the site and to determine the character of the emissions. Location A4 was selected as a nearby sensitive residential receiver. Attended measurements were selected to be the most suitable noise monitoring method in order to determine current contributions from the site at the residential receiver. Long term unattended background noise monitoring was not deemed necessary as impacts from the development were expected to be "low-risk", which is considered sufficient justification in accordance with Fact Sheet B in the Noise Policy for Industry. As the nearest receivers to the site are commercial and industrial, only the amenity criteria is applicable. Other residential noise sensitive receivers are not considered to be in close proximity. Details of the attended monitoring observations have been provided in **Appendix B**.

Table 2 Summary of Attended Noise Monitoring Results

ID	Address	Measured Noise Levels (dBA)					
		Background Noise (RBL)			Average Noise (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
A4	9 Flemming Grove, Doonside	42	43	36	47	47	39

Note 1: The assessment periods are the daytime which is 7 am to 6 pm Monday to Saturday and 8 am to 6 pm on Sundays and public holidays, the evening which is 6 pm to 10 pm, and the night-time which is 10 pm to 7 am on Monday to Saturday and 10 pm to 8 am on Sunday and public holidays. See the NSW EPA *Noise Policy for Industry*.

2.2 Prevailing Weather Conditions

Certain meteorological/weather conditions can increase noise levels. This can occur during temperature inversions (where temperatures increase with height above ground level), or where there is a wind gradient (where wind speed increases with height).

SLR performed meteorological modelling in 2019 using a combination of TAPM and CALMET models for the purpose of air pollution dispersion modelling. A single-point, ground-level meteorological dataset was 'extracted' from the 3-dimensional dataset from a nearby location at Horsley Park (approximately 4km to the south west of the site). This data was analysed to determine the frequency of noise-enhancing wind and temperature inversion conditions which may affect noise levels at the site.

2.2.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of noise to the receiver. At higher wind speeds, the noise produced by the wind can obscure noise generated from industrial and transport sources.

Wind effects need to be considered where wind is a feature of the project area. The NPfI states that where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the daytime, evening or night-time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

The NPfI defines the analyse parameters of noise enhancing meteorological conditions in the following way:

- Daytime/evening: stability categories A–D with light winds (up to 3 m/s at 10 m AGL).
- Night-time: stability categories A–D with light winds (up to 3 m/s at 10 m AGL) and/or stability category F with winds up to 2 m/s at 10 m AGL.

The measured weather data was analysed to determine the frequency of occurrence of wind speeds up to 3 m/s in each period.. The results of the wind analysis for the daytime, evening and night-time periods are presented in **Table 3**, **Table 4** and **Table 5**, respectively. In each table, the wind direction and percentage occurrence are those dominant during each season.

Table 3 Seasonal Frequency of Occurrence of Wind Speed Intervals in 2019 – Daytime

Season	Dominant Wind Direction	Frequency of Occurrence		
		Up to 2 m/s	2 to 3 m/s	Up to 3 m/s
Summer	N	10%	7%	17%
Autumn	N, NE	11%	5%, 4%	16%
Winter	SW	12%	6%	19%
Spring	N	9%	3%	12%

Table 4 Seasonal Frequency of Occurrence of Wind Speed Intervals in 2019 – Evening

Season	Dominant Wind Direction	Frequency of Occurrence		
		Up to 2 m/s	2 to 3 m/s	Up to 3 m/s
Summer	SE	2%	6%	8%
Autumn	S	3%	2%	5%
Winter	SW	4%	1%	6%
Spring	SW	11%	4%	15%

Table 5 Seasonal Frequency of Occurrence of Wind Speed Intervals in 2019 – Night-time

Season	Dominant Wind Direction	Frequency of Occurrence		
		Up to 2 m/s	2 to 3 m/s	Up to 3 m/s
Summer	S	9%	4%	13%
Autumn	SW	8%	2%	10%
Winter	SW	9%	5%	14%
Spring	SW	5%	2%	7%

The above indicates that during the daytime, evening and night time periods, winds of up to 3 m/s did not exceed the 30% threshold during any season.

On this basis, assessment of noise-enhancing wind conditions during all periods is not required, although consideration of noise-enhancing conditions (temperature inversion) for night time operations is required.

2.2.2 Temperature Inversions

Temperature inversions have the ability to increase noise levels by focusing sound waves towards sensitive receivers. Temperature inversions occur predominantly at night-time when the atmosphere is stable and temperatures are cooler. For a noise-enhancing temperature inversion to be a significant characteristic of the area, the NPfI requires it to occur for at least 30% of the total night-time during any one season. This equates to approximately two nights per week.

There are seven atmospheric stability classes, ranging from extremely stable to extremely unstable, and these are shown in **Table 6**.

Table 6 Description of Atmospheric Stability Classes

Atmospheric Stability Class	Category Description
A	Extremely unstable
B	Moderately unstable
C	Slightly unstable
D	Neutral
E	Slightly stable
F	Moderately stable

Atmospheric Stability Class	Category Description
G	Extremely stable

The measured weather data has been analysed to determine the frequency of occurrence of each stability class and is presented in **Table 7**. Noise-enhancing temperature inversions are categorised as atmospheric stability Class F or Class G.

Table 7 Night-time Stability Class Distribution – 2019

Stability Class	Frequency of Occurrence			
	Summer	Autumn	Winter	Spring
F+G	**34%**	**33%**	**51%**	**48%**

The above indicates that temperature inversions of Class F or Class G occur more than 30% of the night-time period during all four seasons. Therefore, noise-enhancing temperature inversions are required to be included in the assessment of noise impacts during the night-time period.

3 Assessment Criteria

3.1 Planning Secretary's Environmental Assessment Requirements (SEARs)

SEARs have been issued on 12th May 2021. Items relevant to this assessment and where they have been addressed has been summarised in **Table 8**.

Table 8 NMLs for Project Specific Other Sensitive Receivers

Item In SEARS	Where Addressed
The identification of impacts associated with construction, site emission and traffic generation at noise affected sensitive receivers, including the provision of operational noise contours and a detailed sleep disturbance assessment.	Section 4 Section 5.1 Section 6.1 Section 6.2
Details of noise monitoring survey, background noise levels, noise source inventory and 'worst case' noise emission scenarios.	Section 2.1 Section 5.1
Consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area.	Section 2.2 Section 3.5.3
A cumulative impact assessment inclusive of impacts from other developments, including the existing development.	Section 6.3
Details and analysis of the effectiveness of proposed management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration following application of mitigation these measures and details of any proposed compliance monitoring programs.	Section 6.5

3.2 Sleep Disturbance

The NPfI defines the sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater. The 52 dBA L_{AFmax} screening level has been used for this for this assessment.

3.3 Interim Construction Noise Guideline

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise at residences and 'other sensitive' land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) based on the existing background noise in the area. Representative 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

3.3.1 Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 9**.

Table 9 Determination of NMLs for Residential Receivers

<table>
<tr><th>Time of Day</th><th>NML (dBA) LAeq(15minute)</th><th>How to Apply</th></tr>
<tr><td rowspan="2">Standard Construction Hours:
Monday to Friday
7 am to 6 pm
Saturday
8 am to 1 pm
No work on Sundays or public holidays</td><td>Noise affected
RBL[1] + 10 dB</td><td>The noise affected level represents the point above which there may be some community reaction to noise.
• Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises 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.</td></tr>
<tr><td>Highly Noise Affected
75 dBA</td><td>The Highly Noise Affected (HNA) 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 restructuring 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.</td></tr>
<tr><td>Outside Standard Construction Hours</td><td>Noise affected
RBL + 5 dB</td><td>• 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 practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.</td></tr>
</table>

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

3.3.2 Other Sensitive Land Uses

The ICNG provides criteria for a number of non-residential 'other sensitive' land uses, such as educational institutes, hospitals, medical facilities, commercial premises and outdoor recreational areas. The ICNG references AS 2107 for criteria for other sensitive receivers which are not listed in the guideline.

The ICNG NMLs for other sensitive receivers are shown in **Table 10**.

Table 10 NMLs for Project Specific Other Sensitive Receivers

Land Use	NML LAeq(15minute)
Commercial	External noise level 70 dBA
Industrial	External noise level 75 dBA
Hotel[1]	Internal noise level 45 dBA

Note 1: Derived from ICNG criteria for educational institutions, hospitals and places of worship

3.3.3 Summary of NMLs

The NMLs for the proposal are determined using the background noise monitoring and are shown in **Table 11**. The works are proposed to occur during Standard Construction Hours so only the daytime NMLs are shown.

Table 11 Construction Noise Management Levels

Receiver Type	Noise Management Level ($L_{Aeq(15minute)}$ – dBA)				Sleep Disturbance Screening Criteria
	Standard Construction Hours	Out of Hours			
	Daytime	Daytime[1]	Evening	Night-time	
Residential	52	n/a	n/a	n/a	n/a
Industrial	75	n/a	n/a	n/a	n/a
Commercial	70	n/a	n/a	n/a	n/a
Hotel[2]	65	n/a	n/a	n/a	n/a

Note 1: This refers to the period on Saturday between 7am – 8am and 1pm – 6pm, on Sunday and public holidays between 8am – 6pm.

Note 2: 45 dBA internal criteria – assuming 20 dB reduction with closed windows.

3.3.4 Construction Road Traffic Noise

The potential impacts from construction traffic on public roads are assessed under the NSW EPA *Road Noise Policy* (RNP)).

An initial screening test is first used to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB as a result of project related construction traffic. Where this is considered likely, further assessment is required using the RNP base criteria shown in **Table 12**.

Table 12 RNP Criteria for Assessing Construction Traffic on Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am - 10 pm)	Night-time (10 pm - 7 am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

3.4 Construction Vibration

Minimum working distances for typical vibration intensive construction equipment are provided in the Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG) and are shown in **Table 13**.

The minimum working distances are for both cosmetic damage (from *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2*, BSI, 1993) and human comfort (from the NSW DEC *Assessing Vibration: A Technical Guideline*, 2006). Works that occur further from receivers than the minimum distances are unlikely to result in vibration impacts.

Table 13 CNVG Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Distance	
		Cosmetic Damage (BS 7385)	Human Response (NSW EPA Guideline)
Vibratory Roller	1-2 tonne	5 m	15 m to 20 m
	2-4 tonne	6 m	20 m
	4-6 tonne	12 m	40 m
	7-13 tonne	15 m	100 m
	13-18 tonne	20 m	100 m
	>18 tonne	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	73 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Hand held	1 m (nominal)	2 m

Note 1: More stringent conditions may apply to heritage or other sensitive structures.

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to human response and/or cosmetic damage of typical buildings under typical geotechnical conditions.

3.5 Noise Policy for Industry

The NSW *Noise Policy for Industry* (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW.

3.5.1 Industrial Noise Trigger Levels

The NPfI defines how to determine 'trigger levels' for noise emissions from industrial developments. Where a development is likely to exceed the trigger levels at existing noise sensitive receivers, feasible and reasonable noise management measures are required to be considered to reduce the impacts.

There are two types of trigger levels – one to account for 'intrusive' noise impacts and one to protect the 'amenity' of particular land uses:

- The **intrusiveness** of an industrial noise source is generally considered acceptable if the L_{Aeq} noise level of the source, measured over a period of 15-minutes, does not exceed the representative background noise level by more than 5 dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.

- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended **amenity** levels specified in the NPfI for that particular land use.

For this assessment, the area surrounding the proposal is considered to be 'urban' as per the NPfI definitions. The nearest residential receivers have also been defined as 'urban' due to their proximity to main roads and industry.

3.5.2 Project Noise Trigger Levels

The trigger levels for industrial noise from the proposal are summarised in **Table 14**.

Table 14 Project Noise Trigger Levels

Applicable Receptors	Receiver Type	Period	Amenity Noise Level L_{Aeq} (dBA)	Project Noise Trigger Levels $L_{Aeq(15minute)}$ (dBA)	
				Intrusiveness	Amenity[1,2]
R02-R04	Commercial	When in use	65	-	**63**
R01, R05-R08, R10	Industrial	When in use	70	-	**68**
R09	Hotel	Day	65	-	**63**
		Evening	55	-	**53**
		Night	50	-	**48**
R11-R14	Residential	Day	60	**47**	58
		Evening	50	**47**	48
		Night	45	**41**	43

Note 1: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.

Note 2: The recommended amenity noise levels have been reduced by 5 dB, where appropriate, to give the project amenity noise levels due to other sources of industrial noise being present in the area.

3.5.3 Annoying Characteristics

Sources of industrial noise can cause greater annoyance where they contain certain characteristics, such as tonality, intermittency or dominant low-frequency content. The NPfI specifies the following modifying factors, shown in **Table 15**, which are to be applied where annoying characteristics are present.

Table 15 NPfI Modifying Factors

Factor	Assessment/Measurement	When to Apply	Correction[1]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by the levels defined in the NPfI.	5 dB[2]

Factor	Assessment/Measurement	When to Apply	Correction[1]
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements	Measure/assess source contribution C and A weighted $L_{eq,t}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and the level to which the thresholds defined in the NPfI are exceeded.	2 or 5 dB[2]
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level	The source noise heard at the receiver varies by more than 5 dB and the intermittent nature of the noise is clearly audible.	5 dB[3]
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated.	Maximum correction of 10 dB[2] (excluding duration correction)

Note 1: Corrections to be added to the measured or predicted levels.

Note 2: Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

Note 3: Adjustment to be applied to night-time only.

3.6 Operational Traffic on Surrounding Roads

The potential impacts from project related traffic on the surrounding public roads are assessed using the NSW EPA *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB. Where this is considered likely, further assessment is required using the RNP criteria shown in **Table 16**.

Table 16 RNP/NCG Criteria for Assessing Traffic on Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am – 10 pm)	Night-time (10 pm – 7 am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

4 Construction Noise and Vibration Assessment

4.1 Construction Activities

The activities likely required to build the proposal involve conventional construction equipment such as ground excavation equipment, mobile cranes, delivery trucks and trade equipment.

The representative construction scenarios developed to assess potential impacts during construction are detailed in **Table 17.**

Table 17 Construction Activities

Works ID	Scenario	Working Hours			
		Standard Daytime	Day OOH[1]	Evening	Night-time
W.001	Site establishment	✓	-	-	-
W.002	Demolition of existing structures and pavement	✓	-	-	-
W.003	Earth works	✓	-	-	-
W.004	Concrete works	✓	-	-	-
W.005	Structure works	✓	-	-	-
W.006	Finishing works	✓	-	-	-

Note 1: OOH = Out of hours. During the daytime this refers to the period on Saturday between 7am – 8am and 1pm – 6pm, on Sunday and public holidays between 8am – 6pm.

4.1.1 Working Hours

The works would be undertaken during Standard Construction Hours, which are:

- 7.00 am to 6.00 pm Monday to Friday
- 8.00 am to 1.00 pm on Saturdays
- No work on Public Holidays or Sundays.

It is not expected that there would be any requirement for works during evening or night-time periods.

4.1.2 Construction Activity Source Noise Levels

The assessment uses ‘realistic worst-case’ scenarios to determine the impacts from the noisiest 15-minute period that is likely to occur for each work scenario, as required by the ICNG. Sound power levels for the construction equipment used in the modelling are listed in **Table 18**.

Table 18 Construction Works and Sound Power Levels for Construction Equipment

Works ID	Scenario	Sound Power Level (LAeq dBA)													
		Concrete Mixer Truck	Concrete Pump	Concrete Vibrator	Elevated Working Platform	Excavator – Breaker	Excavator 22 T	Front End Loader	Generator	Hammer Drill	Hand Tools	Mobile Crane Franna	Mobile Crane 100 T	Roller – Vibratory	Truck
		103	106	102	97	121	99	104	102	108	94	98	100	109	107
W.01	Site establishment								X		X				X
W.02	Demolition					X	X	X	X						X
W.03	Earth works						X		X					X	X
W.04	Concrete works	X	X	X					X						X
W.05	Structure works				X				X	X			X		X
W.06	Finishing works				X				X		X	X			X

Note 1: The ICNG requires that activities identified as particularly annoying (such as jackhammering, rock breaking and power saw operation) have a 5 dB 'penalty' added to predicted noise levels when using the quantitative method.

Note 2: Sound Power Levels have been taken from DEFRA, RMS *Construction Noise and Vibration Guideline* and TfNSW *Construction Noise and Vibration Strategy*.

4.2 Construction Noise Assessment

The following overview is based on the predicted impacts at the most affected receivers and is representative of the realistic worst-case noise levels (without additional mitigation) that are likely to occur during construction. Receivers which are further away from the works and/or shielded from view would have substantially lower impacts. The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios.

The noise levels are also shown as a range (eg 55 to 68 dBA), which represents the likely noise levels when works are 'near' to 'far' from a particular receiver.

Noise predictions from the construction works have been predicted to the nearest receivers during the daytime and are summarised in **Table 19**.

Table 19 Predicted Daytime Construction Noise Levels

Receiver	Day NML	Predicted Worst-case LAeq(15minute) Noise Level (dBA)											
		W.01		W.02		W.03		W.04		W.05		W.06	
		Far	Near	Far	Near	Far	Near	Far	Near	Far	Near	Far	Near
R01 (Industrial)	75	34	44	43	56	36	51	36	49	36	49	31	46
R02 (Industrial)	75	35	63	43	65	38	66	37	65	38	60	33	60
R03 (Commercial)	70	32	54	45	62	36	58	36	55	36	57	31	53

Receiver	Day NML	Predicted Worst-case LAeq(15minute) Noise Level (dBA)											
		W.01		W.02		W.03		W.04		W.05		W.06	
		Far	Near	Far	Near	Far	Near	Far	Near	Far	Near	Far	Near
R04 (Commercial)	70	35	46	51	56	40	51	41	49	41	51	37	47
R05 (Industrial)	75	28	37	46	47	34	43	37	42	37	41	33	37
R06 (Industrial)	75	39	47	53	59	44	52	44	51	45	52	41	48
R07 (Industrial)	75	26	40	43	51	30	44	34	43	36	44	32	40
R08 (Industrial)	75	27	39	43	49	32	43	35	42	36	44	33	40
R09 (Hotel)	65	35	39	46	48	42	44	38	41	38	42	35	38
R10 (Industrial)	75	31	57	41	67	35	63	34	59	35	59	30	55
R11 (Residential)	52	22	23	32	35	26	30	25	28	25	28	20	25
R12 (Residential)	52	17	20	30	35	21	27	20	27	20	28	16	24
R13 (Residential)	52	20	24	33	38	24	31	25	29	26	31	21	27
R14 (Residential)	52	26	29	37	41	31	35	29	33	30	34	26	30

The above shows that compliance is predicted at all surrounding receptors for works during standard hours. The highest construction noise impacts are predicted during demolition works, when construction equipment is located the western portion of the site (near R10) and earth works when construction equipment is located in the northern portion of the site (near R02).

Best practice construction noise mitigation and management measures are discussed in **Section 4.5**.

4.2.1.1 Works Outside Standard Construction Hours

No works outside of standard construction hours are currently planned for the development.

Should the need for out of hours works arise, the works will be conducted in accordance with an approved Out of Hours protocol to be prepared, submitted and approved as part of the Construction Environmental Management Plan (CEMP) prior to commencement of the works.

4.3 Construction Vibration Assessment

The major potential sources of vibration from the proposed construction activities would likely be during demolition and earthworks when rock breakers and vibratory rollers are being used.

Vibration offset distances have been determined from the CNVG minimum working distances for cosmetic damage and human response in **Table 13**. Buildings within the minimum working distances are summarized below.

Consideration of vibration offset distances should also be given to existing buildings on site that will be occupied during construction works.

Cosmetic Damage Assessment

All receivers are outside of the safe work distances for cosmetic damage.

Human Comfort Vibration Assessment

Buildings directly to the west and north of the site are approximately 70 and 30 metres respectively from the site boundary. Earth works may involve the use of a vibratory roller.

- Receiver R10 to the west is within the safe work distance for human comfort for large vibratory rollers (above 7 tonnes).
- Receiver R2 to the north is within the safe work distances for 2-4 tonne vibratory rollers.

Occupants of these buildings may be able to perceive vibration impacts at times when vibration intensive equipment is in use. Where impacts are perceptible, they would likely only be apparent for relatively short durations when vibration intensive equipment is in use.

Construction vibration mitigation and management measures are discussed in **Section 4.5**.

4.4 Construction Traffic

Construction traffic would generally access the site from Huntingwood Drive to the north and Brabham Drive to the west via the M4 motorway or Great Western Highway. The construction traffic route would travel through an industrial/commercial area with no adjacent residential sensitive receivers.

The requirements for construction traffic movements would be minimal and would not be expected to result in any additional noise impacts at the nearest receivers due to the existing volumes of traffic on the access roads, noting that a vehicle increase of roughly 60% would be required to increase the noise levels by 2 dB.

4.5 Construction Noise and Vibration Mitigation

Although no exceedances of the NMLs are expected, noise or vibration impacts may be apparent at the nearest receivers at certain times during construction of the proposal. The project should apply all feasible and reasonable mitigation measures to minimise the impacts, particularly during noise intensive works, such as demolition.

The following best-practice measures shown in **Table 20** should be implemented to minimise the potential impacts from the works.

Table 20 Standard Construction Recommended Mitigation and Management Measures

Project stage	Measure
Scheduling	Highly noisy intensive works should only be undertaken during the following Standard Construction Hours, unless otherwise assessed and justified: - 7 am to 6 pm Mondays to Fridays, inclusive; and - 8 am to 1 pm Saturdays; and - at no time on Sundays or public holidays.
	Provide appropriate respite periods as per the CNVG when noise intensive works are undertaken or during periods of high noise impacts.
	Carry out community consultation to determine the need and frequency of respite periods, if necessary.
	Avoid loading and unloading of materials / deliveries outside of daytime hours.
Site Layout	Site entry and exit points should be located as far as possible from sensitive receivers.
	Compounds and work areas should be one-way to minimise the need for vehicles to reverse.
	Work compounds, parking areas, equipment and stockpiles should be positioned away from noise-sensitive locations and/or in shielded locations.
	Trucks should not idle near to residential receivers.
	Stationary sources of noise, such as generators, should be located away from sensitive receivers.
Contractor management	Training should be provided to project personnel, including relevant sub-contractors, on noise and vibration requirements and the location of sensitive receivers during inductions and toolbox talks.
	Delivery vehicles should be fitted with straps rather than chains for unloading, wherever possible.
	Truck drivers should avoid compression braking as far as practicable.
	Where night-time works are required, trucks should use broadband reversing alarms.
Noise source mitigation	Use the minimum sized equipment necessary to complete the work and where possible, use alternative, low-impact construction techniques.
	Power tools should use mains power where possible rather than generators.
	Shut down machinery, including generators, when not in operation.
	Avoid dropping materials from a height and dampen or line metal trays, as necessary.
	Ensure equipment is operated in the correct manner.
	All equipment should be appropriately maintained and fitted with noise control devices, where practicable, including acoustic lining of engine bays and air intake / discharge silencers, etc.
Community consultation	Provide appropriate notice to the affected sensitive receivers prior to starting works and before any noisy periods of works.
	Provide signage with a 24 hour contact number.
	Where there are complaints regarding noise, review and implement additional control measures, where feasible and reasonable.
Monitoring	Conduct noise and/or vibration monitoring in response to any valid complaints received.
	Conduct vibration monitoring whenever vibration intensive works are undertaken within the minimum working distances of sensitive receivers or structures.

5 Operational Noise Assessment Methodology

The potential operational noise levels from the proposal have been predicted to the surrounding receivers using CONCAWE industrial noise algorithm in SoundPLAN V8. The model includes ground topography, buildings and representative noise sources from the proposal.

The potential impacts have been determined by comparing the predicted noise levels to the NPfI Project Noise Trigger Levels in a 15-minute assessment period. Both current operations and expanded operations have been considered as part of this assessment.

5.1 Operational Noise Sources

A summary of the noise sources associated with the operation of the development is provided below.

5.1.1 On-Site Traffic

Current and future on-site traffic volume estimations have been provided by Arnott's. These volumes have been presented in **Table 21**.

Table 21 Vehicle Traffic Data – Daily Vehicle Volumes

Location	Vehicle Type	Approximate Timing	Current Huntingwood Daily Numbers	Expected Additional Daily Numbers Post Project Completion	Total
Raw Materials	Semi-trailer tankers	24 hrs/day	12	3	15
	Semi-trailer	7am – 7pm	8	4	12
	Rigid	7am – 7pm	6	1	7
Waste	Rigid/skip change out	5am – 11pm	6	2	8
	Semi-trailer	7am – 3pm	2	1	3
Packaging Materials	B-Double	7am – 6pm	once/twice per week – no change		
	Semi-trailer	7am – 6pm	7	2	9
	Rigid	7am – 6pm	5	2	7
High Bay Warehouse	B-Double	6am – 10 pm	9	2	11
	Semi-trailer	6am – 10 pm	15	2	17
	Rigid	6am – 10 pm	1	0	1
	Container delivery/collection	6am – 10 pm	4	2	6
Service and Support Vehicles	Courier vans	7am – 5pm	3	1	4
	Engineering and service vans	7am – 5pm	1	0	1
	Deliveries	7am – 5pm	2	1	3
Total Movements			**81**	**23 (30% increase)**	**104**

Based on the information provided by Arnotts, predictions have been made based on a worst-case 15 minute scenario. On-site vehicles have been modelled using the data shown in **Table 22** (current operations) and **Table 23** (expanded operations). The volumes are conservative and representative of a potential worst-case 15-minute period for the daytime, evening and night-time.

Table 22 Vehicle Traffic Data – Worst-Case 15-Minute Period (Current Operations)

Location	Vehicle Type	Sound Power Level (dBA)[1]	Vehicle Speed (km/h)[3]	Number of Vehicles in Worst-case 15-minute Period		
				Daytime	**Evening**	**Night-time**
Raw materials	Large Trucks	108[1]	20/5	4	3	1
Waste	Large Trucks	108[1]	20/5	2	-	-
Packaging Materials	Large Trucks	108[1]	20/5	4	-	-
Service and Support	Delivery Vans	96[2]	20/5	3	-	-
High Bay Warehouse	Large Trucks	108[1]	20/5	5	4	4
	Delivery Vans	96[2]	20/5	1	1	1

Note 1: Based on trucks accelerating for around 80% of the time with a SWL of 111 dBA, with the remaining 20% at 105 dBA.

Note 2: Taken from *Road Traffic Noise Prediction Model "ASJ RTN-Model 2013" Proposed by the Acoustical Society of Japan – Part 2: Study on Sound Emission of Road Vehicles*, OKADA et al, Internoise 2014, and accounts for vehicles accelerating.

Note 3: 5 km/h used for corners and entry roads, 20 km/h used for all other roads

Table 23 Vehicle Traffic Data – Worst-case 15-Minute Period (Expanded Operations)

Location	Vehicle Type	Sound Power Level (dBA)[1]	Vehicle Speed (km/h)[3]	Number of Vehicles in Worst-case 15-minute Period		
				Daytime	**Evening**	**Night-time**
Raw materials	Large Trucks	108[1]	20/5	7	4	1
Waste	Large Trucks	108[1]	20/5	3	-	-
Packaging Materials	Large Trucks	108[1]	20/5	5	-	-
Service and Support	Delivery Vans	96[2]	20/5	4	-	-
High Bay Warehouse	Large Trucks	108[1]	20/5	6	5	4
	Delivery Vans	96[2]	20/5	2	1	1

Note 1: Based on trucks accelerating for around 80% of the time with a SWL of 111 dBA, with the remaining 20% at 105 dBA.

Note 2: Taken from *Road Traffic Noise Prediction Model "ASJ RTN-Model 2013" Proposed by the Acoustical Society of Japan – Part 2: Study on Sound Emission of Road Vehicles*, OKADA et al, Internoise 2014, and accounts for vehicles accelerating.

Note 3: 5 km/h used for corners and entry roads, 20 km/h used for all other roads

5.1.2 Mechanical Plant

The location of current and future locations for cooling towers, cooling water pumps and centrifuge fans have been provided by FDC. The assumed details for these mechanical plant items are shown in **Table 24**.

Table 24 Typical Mechanical Plant Details

Noise Source	Sound Power Level (dBA)	Number		Typical Duration of Operation	Source Height (m)
		Current Operations	Expanded Operations		
Cooling towers	95	3	6	24 hours	1[1]
Cooling water pumps	80	-	4	24 hours	1[1]
Centrifuge fan	88	1	1	24 hours	2

Note 1: Height above roof.

The impacts from mechanical plant should be reviewed during detailed design stage once further information is available. It is unlikely that mechanical plant will influence noise levels at receivers above on site vehicle movements and other on-site activities. In the event of predicted impacts, it is generally straightforward to control mechanical plant noise emissions using standard mitigation measures (ie quieter equipment specification, localised shielding, etc).

5.1.3 On-Site Activities/Loading Docks

In addition to vehicle movements on site, locations have been assumed for noisy on site activities. The locations for these sources are the designated loading docks/delivery points. The details of these activities have been provided in .

Table 25 Typical Loading Dock Noise Sources

Noise Source	Sound Power Level (dBA)	Typical Duration of Use in Worst-case 15-minute Period	Source Height (m)
Truck reversing alarm[1]	102[1]	60 seconds	1
Forklift reversing alarm[1]	97[1]	90 seconds	0.5
Truck Idling (while unloading to silo)	105	300 seconds	1
Skin Bin Change Out	110	30	1.5
Air brakes	118	1 second	1
Gas Forklift	93	900 seconds	1

Note 1: SWL includes a -3 dB reduction for LAeq to account for alarm on-time.

Building breakout noise generated from activities from within the packaging facility are expected to be negligible in comparison to external vehicle movements and other on-site activities and have therefore not been included in the assessment.

5.2 Weather Conditions

Certain weather conditions can increase noise levels by focusing noise towards receivers. Noise-enhancing weather conditions can occur where wind blows from the source to the receiver, or where temperature inversions occur.

The NPfI defines 'standard' and 'noise-enhancing' weather conditions as shown in **Table 26**. Noise-enhancing weather should be included in the assessment where they occur for more than 30% of the daytime, evening or night-time period in any season.

Table 26 Standard and Noise-Enhancing Weather Conditions

Weather Conditions	Meteorological Parameters
Standard	Daytime/evening/night-time: stability categories A–D with wind speed up to 0.5 m/s
Noise-enhancing	Daytime/evening: stability categories A–D with light winds up to 3 m/s Night-time: stability categories A–D with light winds up to 3 m/s and/or stability category F with winds up to 2 m/s

An analysis of prevailing weather conditions has been conducted as per **Section 2.2**. The noise predictions have considered the weather conditions presented in **Table 27** for each time period.

Table 27 Modelled Weather Conditions

Period	Weather Condition	Meteorological Parameters used in Assessment
Daytime	Standard	Stability categories A–D with wind speed up to 0.5 m/s
Evening	Standard	Stability categories A–D with wind speed up to 0.5 m/s
Night-time	Noise-enhancing	Stability categories A–D with light winds up to 3 m/s and/or stability category F with winds up to 2 m/s (source to receiver).

6 Operational Noise Assessment

6.1 Predicted Noise Levels

A summary of the noise assessment at the receivers surrounding the proposal is shown in **Table 28** (current operations) and **Table 29** (expanded operations). The predicted levels are compared to the PNTLs to determine the potential impact from the proposal under neutral (daytime/evening) and noise-enhancing (night-time) weather conditions.

Table 28 Industrial Noise Assessment (Current Operations)

Receiver Location	Period	Noise Level LAeq(15minute) (dBA)			Compliance
		Project Noise Trigger Level	Predicted	Exceedance	
R1	Daytime	70	43	-	Yes
	Evening	70	42	-	Yes
	Night-time	70	46	-	Yes
R2	Daytime	65	38	-	Yes
	Evening	65	36	-	Yes
	Night-time	65	39	-	Yes
R3	Daytime	65	39	-	Yes
	Evening	65	34	-	Yes
	Night-time	65	38	-	Yes
R4	Daytime	65	55	-	Yes
	Evening	65	51	-	Yes
	Night-time	65	52	-	Yes
R5	Daytime	70	46	-	Yes
	Evening	70	44	-	Yes
	Night-time	70	45	-	Yes
R6	Daytime	70	62	-	Yes
	Evening	70	60	-	Yes
	Night-time	70	60	-	Yes
R7	Daytime	70	56	-	Yes
	Evening	70	54	-	Yes
	Night-time	70	55	-	Yes
R8	Daytime	70	43	-	Yes
	Evening	70	41	-	Yes
	Night-time	70	43	-	Yes
R9	Daytime	63	38	-	Yes
	Evening	53	37	-	Yes

Receiver Location	Period	Noise Level LAeq(15minute) (dBA)			Compliance
		Project Noise Trigger Level	Predicted	Exceedance	
	Night-time	48	40	-	Yes
R10	Daytime	70	37	-	Yes
	Evening	70	36	-	Yes
	Night-time	70	39	-	Yes
R11	Daytime	47	25	-	Yes
	Evening	47	24	-	Yes
	Night-time	41	30	-	Yes
R12	Daytime	47	20	-	Yes
	Evening	47	18	-	Yes
	Night-time	41	25	-	Yes
R13	Daytime	47	26	-	Yes
	Evening	47	23	-	Yes
	Night-time	41	29	-	Yes
R14	Daytime	47	27	-	Yes
	Evening	47	25	-	Yes
	Night-time	41	32	-	Yes

Table 29 Industrial Noise Assessment (Expanded Operations)

Receiver Location	Period	Noise Level LAeq(15minute) (dBA)			Compliance
		Project Noise Trigger Level	Predicted	Exceedance	
R1	Daytime	70	45	-	Yes
	Evening	70	43	-	Yes
	Night-time	70	47	-	Yes
R2	Daytime	65	40	-	Yes
	Evening	65	37	-	Yes
	Night-time	65	40	-	Yes
R3	Daytime	65	41	-	Yes
	Evening	65	37	-	Yes
	Night-time	65	40	-	Yes
R4	Daytime	65	56	-	Yes
	Evening	65	51	-	Yes
	Night-time	65	52	-	Yes
	Daytime	70	48	-	Yes

R5	Evening	70	40	-	Yes
	Night-time	70	41	-	Yes
R6	Daytime	70	62	-	Yes
	Evening	70	54	-	Yes
	Night-time	70	54	-	Yes
R7	Daytime	70	62	-	Yes
	Evening	70	56	-	Yes
	Night-time	70	57	-	Yes
R8	Daytime	70	61	-	Yes
	Evening	70	54	-	Yes
	Night-time	70	55	-	Yes
R9	Daytime	63	57	-	Yes
	Evening	53	36	-	Yes
	Night-time	48	39	-	Yes
R10	Daytime	70	50	-	Yes
	Evening	70	46	-	Yes
	Night-time	70	48	-	Yes
R11	Daytime	47	30	-	Yes
	Evening	47	24	-	Yes
	Night-time	41	31	-	Yes
R12	Daytime	47	29	-	Yes
	Evening	47	24	-	Yes
	Night-time	41	31	-	Yes
R13	Daytime	47	30	-	Yes
	Evening	47	24	-	Yes
	Night-time	41	31	-	Yes
R14	Daytime	47	35	-	Yes
	Evening	47	30	-	Yes
	Night-time	41	36	-	Yes

The above assessment indicates that noise from the proposal is predicted to comply with the Project Noise Trigger Levels at all surrounding receivers. Predicted noise levels for current operations range from 18 dBA (R12) to 62 dBA (R6). Predicted noise levels for expanded operations range from 24 dBA (R11-R13) to 62 dBA (R6/R7). The range of noise levels are similar for both current and expanded operations, however the receivers most impacted by the site are different due to changes in on-site vehicle routes and location of related on-site activities.

Noise emissions from the site are dominated by heavy vehicle movements and activities at loading zones, silos and skip bin areas. Variations in noise levels between time periods are predominately due to differences in vehicle routes during the day, evening and night-time. Operational noise contours for the predictions have been presented in **Figure 3** - **Figure 8** below:

Figure 3 Current Operations – Daytime (Operational Noise Contour)

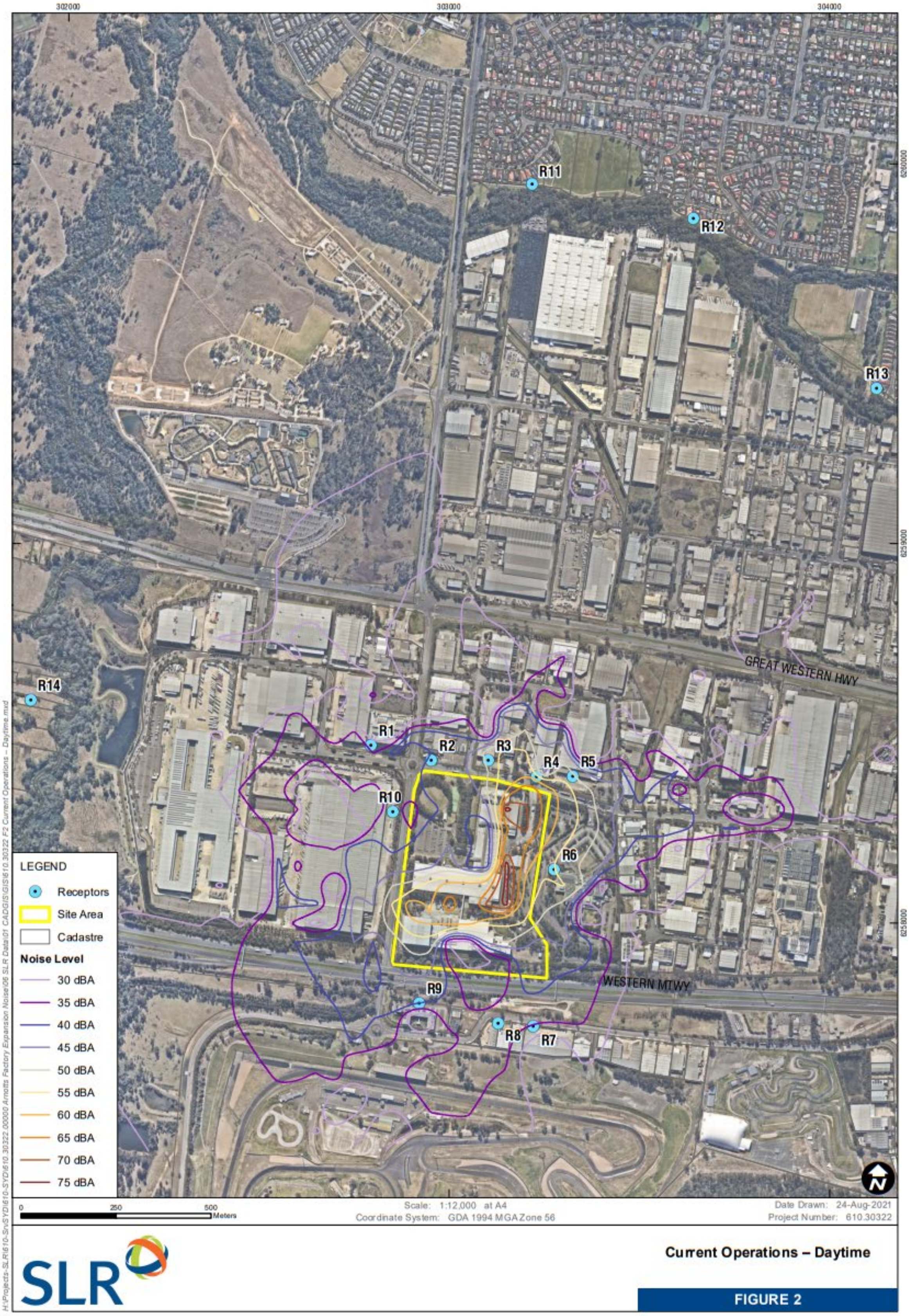


Figure 4 Current Operations – Evening (Operational Noise Contour)

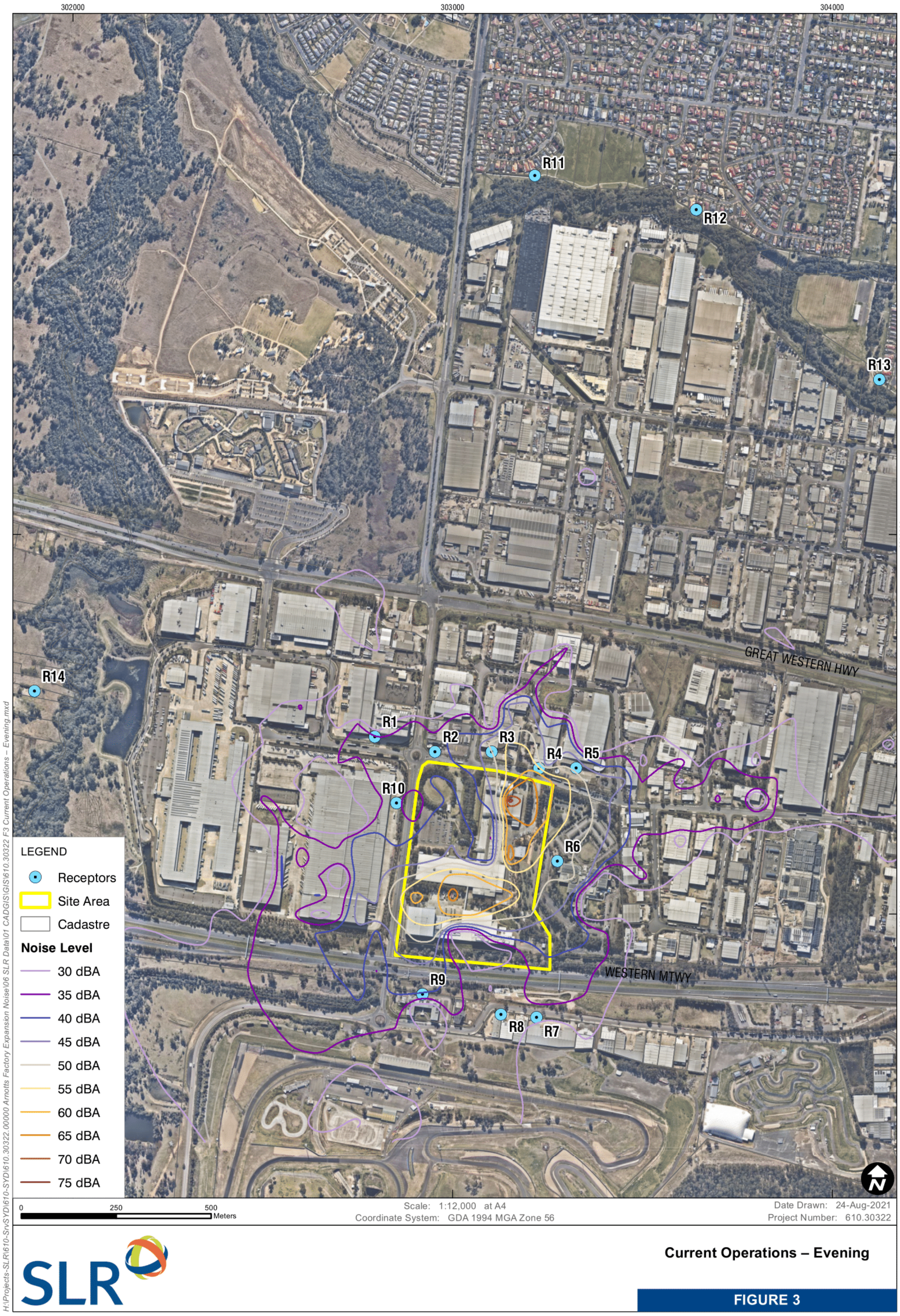


Figure 5 Current Operations – Night time – Temperature Inversion (Operational Noise Contour)

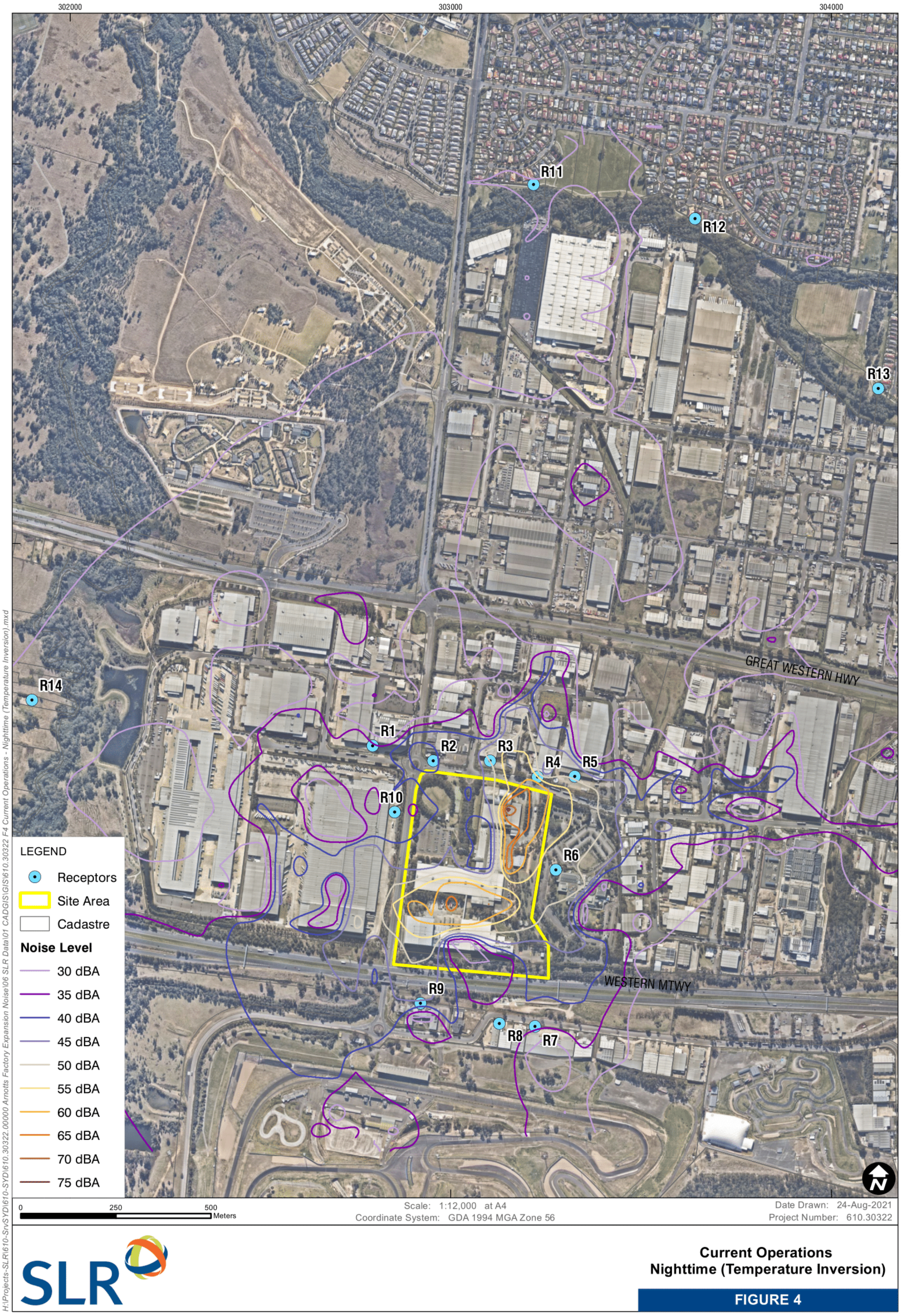


Figure 6 Expanded Operations – Daytime (Operational Noise Contour)

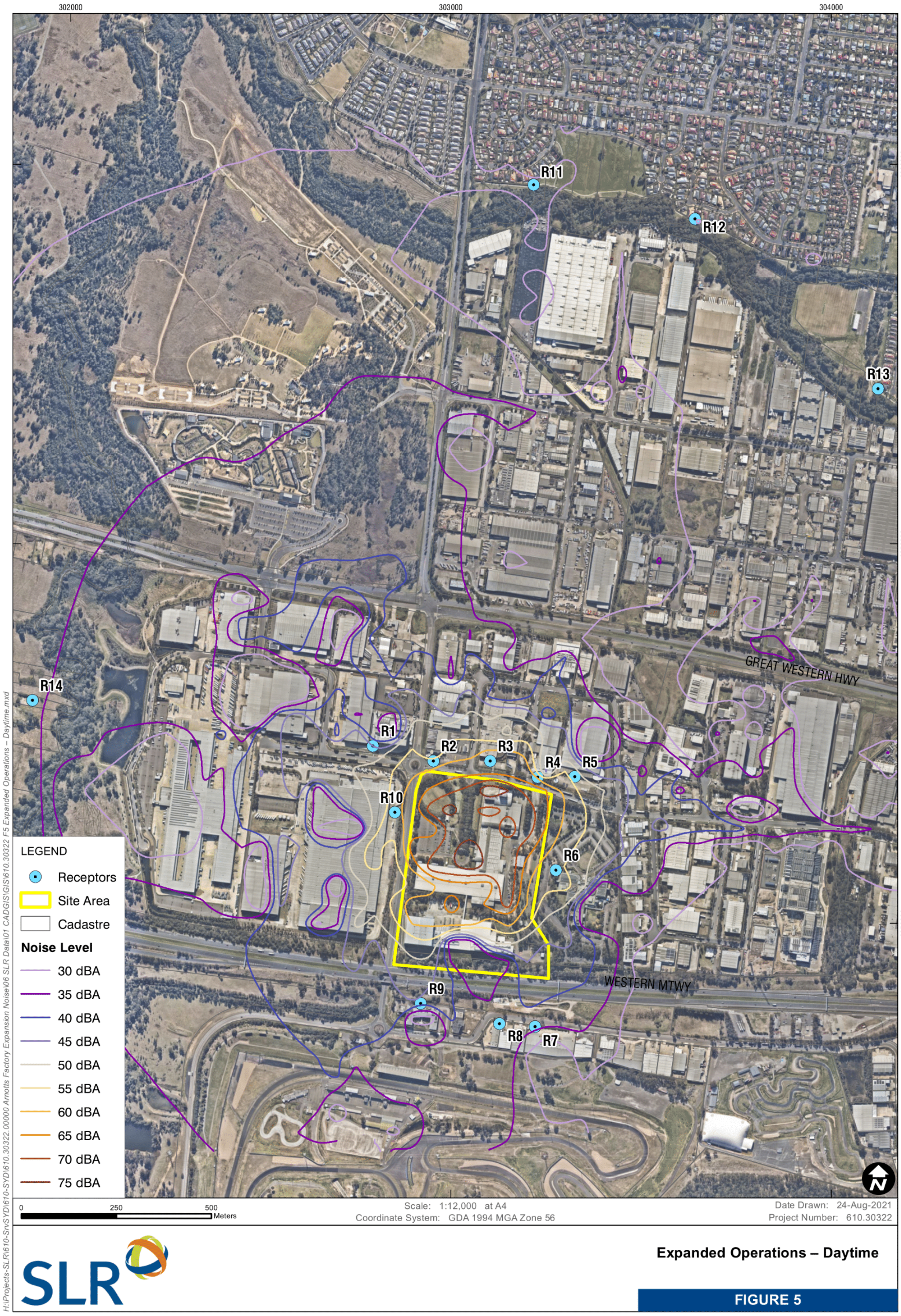


Figure 7 Expanded Operations – Evening (Operational Noise Contour)

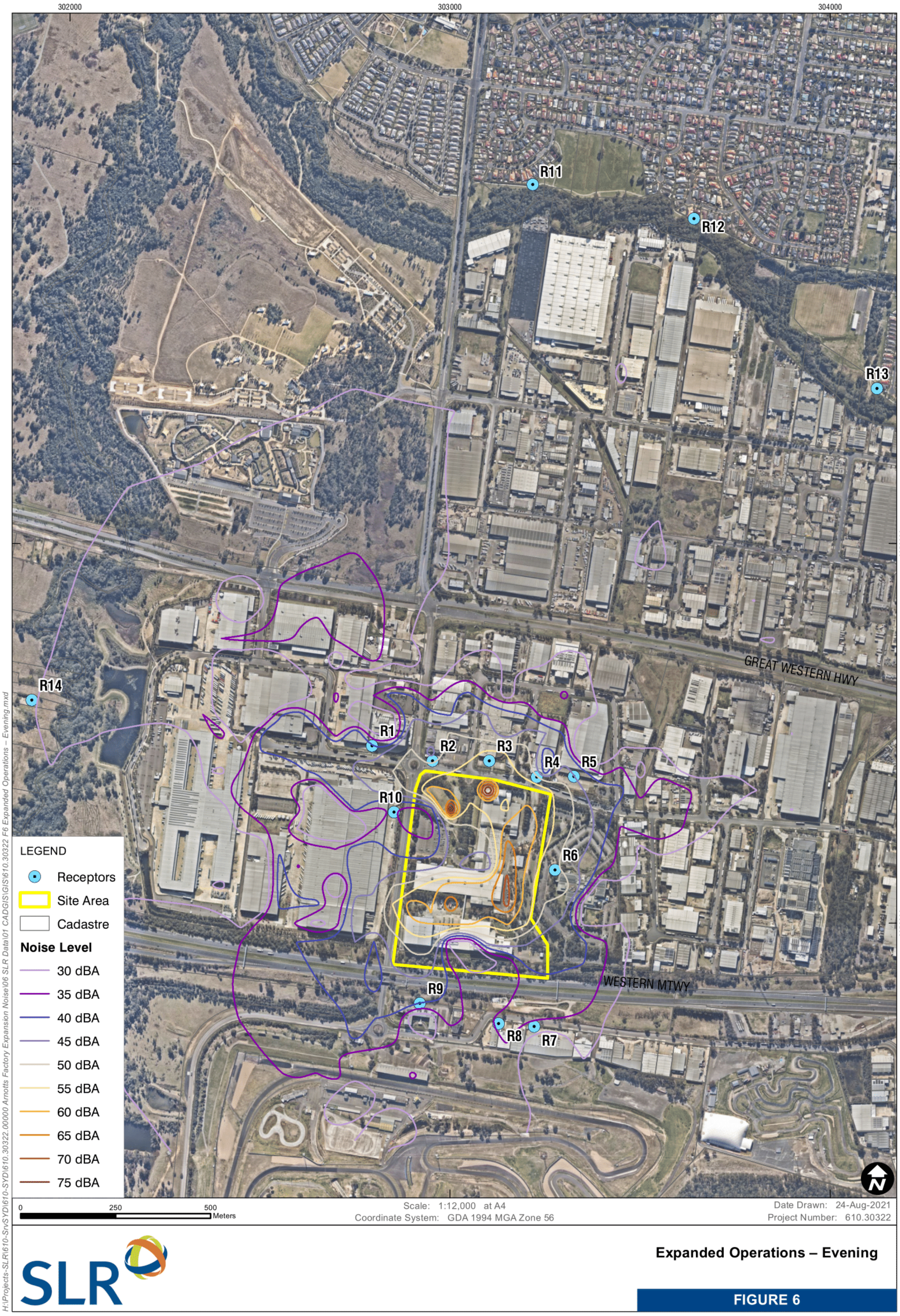
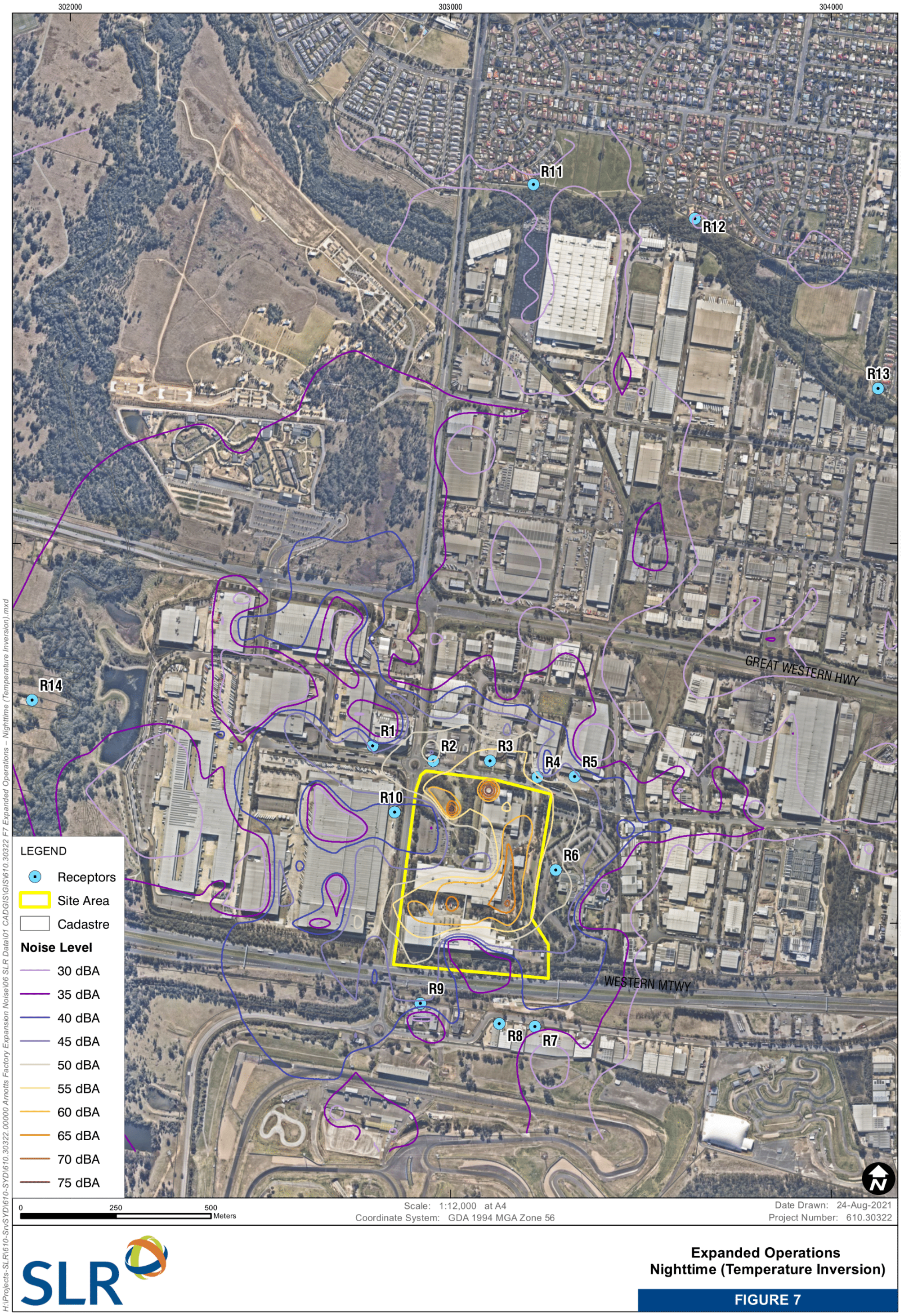


Figure 8 Expanded Operations – Night time – Temperature Inversion (Operational Noise Contour)



6.2 Sleep Disturbance

The predicted night-time L_{Amax} noise levels at the nearest residential receivers are shown in **Table 30**.

Table 30 Sleep Disturbance Assessment

Receiver Location	Source	Noise Level L_{Amax} (dBA)			Below Screening Level
		Sleep Dist. Screening Level	Predicted	Exceedance	
R11	Air Brakes	52	46	-	Yes
	Truck Movements		34	-	Yes
	Rev. Alarm Fork Lift		<30	-	Yes
	Rev. Alarm Trucks		39	-	Yes
	Skip Bing Change Out		<30	-	Yes
	Truck Unloading to Silo		<30	-	Yes
R12	Air Brakes	52	46	-	Yes
	Truck Movements		35	-	Yes
	Rev. Alarm Fork Lift		<30	-	Yes
	Rev. Alarm Trucks		39	-	Yes
	Skip Bing Change Out		<30	-	Yes
	Truck Unloading to Silo		<30	-	Yes
R13	Air Brakes	52	46	-	Yes
	Truck Movements		40	-	Yes
	Rev. Alarm Fork Lift		<30	-	Yes
	Rev. Alarm Trucks		<30	-	Yes
	Skip Bing Change Out		35	-	Yes
	Truck Unloading to Silo		<30	-	Yes
R14	Air Brakes	52	48	-	Yes
	Truck Movements		39	-	Yes
	Rev. Alarm Fork Lift		34	-	Yes
	Rev. Alarm Trucks		43	-	Yes
	Skip Bing Change Out		<30	-	Yes
	Truck Unloading to Silo		35	-	Yes

The above assessment indicates that maximum noise events from the proposal are predicted to be below the sleep disturbance screening level at all surrounding residential receivers.

6.3 Cumulative Noise Impacts

Observations during attended monitoring at residential location A4 did not find that the existing project facility operations contributed to the existing noise level at any time of day, as it was not audible. The noise environment at this location was dominated by road traffic, noise from other existing industry north of the project and local flora and fauna.

Given this and the low predicted noise levels at residential receiver R11-R14 for future scenarios, cumulative impacts are not predicted to be a concern. A comparison between the predicted levels for the future expanded scenario and measured noise levels has been presented in **Table 31** to demonstrate the negligible level of impact that the project is predicted to have on the existing noise environment at the residential receivers to the north.

Table 31 Predicted and Measured Levels – R11

Receiver	Predicted Noise Level LAeq(15minute) (dBA) – Expanded Scenario			Measured Noise Levels (dBA)					
				LA90			LAeq		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
R11	30	24	24[1]	42	43	36	47	47	39

Note 1: Neutral weather prediction

6.4 Traffic Increases on Surrounding Roads

Light and heavy vehicles would access the development directly from Huntingwood Drive. The potential noise impacts from additional traffic are unlikely to result in a noticeable increase in noise given the small number of vehicles accessing the development relative to the high existing volumes on this route.

As the predicted noise increase from additional traffic is below the screening assessment of 2dB, no further assessment is required.

6.5 Noise Mitigation

Operational noise emissions from the proposal are predicted to comply with the PNTLs at the surrounding receivers and no specific mitigation measures are required.

7 Conclusion

SLR has been engaged to assess the potential construction and operational noise and vibration emissions from the proposed development at the existing food processing facility at 65 Huntingwood Drive, Huntingwood. The proposal includes the expansion of the existing facility, which would continue to be operational 24 hours a day, seven days a week.

Noise levels during the construction of the site expansion are not anticipated to exceed the Noise Management Levels at any time during works. A number of best-practice mitigation and management measures have been recommended to be applied, where feasible and reasonable, to minimise the impacts during construction as far as practicable.

Operational noise emissions from the proposal have been predicted to the surrounding receivers and the levels are expected to comply with the trigger levels. No specific mitigation measures are required to be considered.

No exceedances of the sleep disturbance screening criteria were found.

Based on the predicted levels, the proposal is considered appropriate from an acoustic standpoint.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms ‘sound’ and ‘noise’ are almost interchangeable, except that ‘noise’ often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. ‘A’ Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an ‘A-weighting’ filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as ‘linear’, and the units are expressed as dB(lin) or dB.

3. Sound Power Level

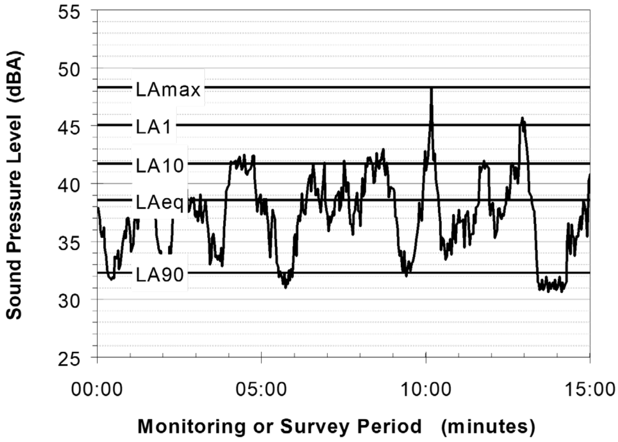
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

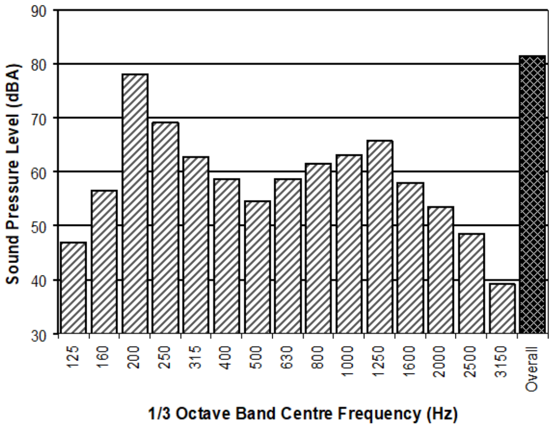
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

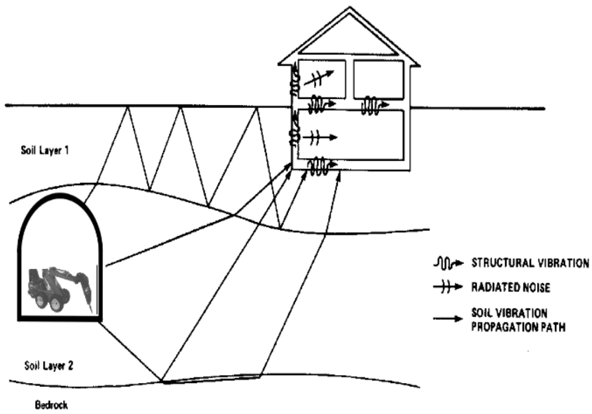
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

APPENDIX B

Attended Measurement Details

Location	Date	Time	Duration	LAmax	LAeq	LA1	LA10	LA90	Observations (dBA)
A1	07-06-21	16:35	15:00	85	68	77	71	60	Mechanical plant from site – 54-57 Cars – 70-85 Trucks – 75-85
A1	07-06-21	17:51	15:00	87	67	76	71	58	Mechanical plant from site – 55-68 Cars – 70-80 Trucks – 70-85
A2	07-06-21	17:08	15:00	86	71	80	74	62	Site inaudible Cars – 70-80 Trucks – 75-85
A3	07-06-21	17:27	15:00	86	72	80	75	65	Site inaudible Cars – 70-75 Trucks – 70-85
A4	08-06-21	12:23	15:00	68	48	60	47	43	Site inaudible Distant traffic – 40-50 Plane – 48-50 Birds/dogs – 45-60 Industrial mechanical noise (not project related) – 40-45
A4	08-06-21	12:38	15:00	68	46	55	48	42	Site inaudible Distant traffic – 40-50 Industrial mechanical noise (not project related) – 40-45
A1	07-06-21	20:22	15:00	79	62	75	65	55	Mechanical plant from site – 55-56 Trucks – 70-80 Cars – 70-75
A1	07-06-21	20:38	15:00	79	61	73	64	55	Mechanical plant from site – 55-56 Trucks – 70-79 Cars – 60-70
A2	07-06-21	21:01	15:00	82	64	75	69	51	Site inaudible Other industry (not project related) – 45-60 Trucks – 75-82 Cars – 70-75
A3	07-06-21	21:22	15:00	87	66	75	69	54	Site inaudible Distant traffic – 60-70 Local traffic – 70-85
A4	07-06-21	18:36	15:00	66	47	56	48	43	Site inaudible Distant traffic – 40-60
A4	07-06-21	18:51	15:00	63	47	56	47	43	Site inaudible Traffic – 40-50 Plane – 50-60
A1	07-06-21	23:12	15:00	79	63	76	63	56	Mechanical plant from site – 55 Cars – 60-70 Trucks – 70-79
A2	07-06-21	23:33	15:00	77	62	72	66	49	Site inaudible Trucks – 70-78 Cars – 55-75 Other industry (not project related) – 50-60
A3	07-06-21	23:54	15:00	77	62	73	66	50	Site inaudible Distant traffic – 50-60 Local traffic – 70-75
A4	08-06-21	01:16	15:00	52	39	47	42	36	Site inaudible Distant traffic – 40-45 Industrial mechanical noise (not project related) – 40-45

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