

APPENDIX H

Environmental Noise Assessment prepared by SLR

brazier mott





North Shore Central, Townsville

Environmental Noise Assessment

Oreana Project Management Pty Ltd

Level 17, 627 Chapel Street
South Yarra Victoria 3182

Prepared by:

SLR Consulting Australia Pty Ltd

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Making Sustainability Happen

Revision Record

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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 Oreana Project Management 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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1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Oreana Project Management Pty Ltd (Oreana) to conduct an operational noise impact assessment for Stage 1 of the North Shore Central commercial development, referred hereto as 'the Project'.

This report presents the results of the noise impact assessment conducted to address the applicable zone-specific requirements from the Townsville City Plan 2024, as well as the requirements from the Townsville Development Manual Planning Scheme Policy (PSP) – *SC6.4.19 Noise and Vibration*.

Long term- unattended noise monitoring was conducted on the subject site to capture existing noise levels at locations considered representative of existing and future Noise Sensitive Receptors (NSR) external to Stage 1 of the Project. The noise data recorded was used to derive applicable noise limits in accordance with the abovementioned Policy.

Following this, detailed computational noise modelling of typical operational scenarios to predict noise levels at NSR, which was informed by the inputs provided by the various Project design team disciplines.

The noise predictions were assessed against the noise limits and in-principle recommendations were provided to mitigate the noise impacts at the NSR, aiming at complying with the operational noise limits.

Details of all the above aspects are presented in the following sections of this report.

A glossary of terms used in this report are detailed in **Appendix A**.



2.0 Project Description

2.1 Project Overview

Stage 1 of the Project will encompass a core retail centre including a supermarket, discount department store, a mix of specialty and food/beverage offerings as well as associated carparking/internal road network.

Stage 1 will be located at 13 Mareket Street, Burdell QLD, on Lot 869 on SP361255 in Tonwsville. The location of the subject site is shown in **Figure 1**.

Figure 1 Subject site and closest existing noise sensitive receptor



Image source: Buchan

A site plan is presented in **Figure 2**, which shows the layout of the various commercial uses, as well as future development areas, which will be part of a separate application.

It is proposed that Stage 1 will comprise a sub-regional shopping centre anchored by a supermarket, discount department store, three (3) mini majors and 45 specialty retail tenancies.

The proposed hours of operations are 24 hours for Coles, open for trading between 8am-9pm Mon-Fri, 8.00am-6.00pm Saturday and 9.00am-6.00pm Sundays & Public Holidays. Proposed delivery hours will be 5.00am to 11.00pm 7 days a week, and 24 hours for night fill (shelf stocking) operations.

Potential afterhours activity may include open Food and Beverage (F&B) restaurants.



At this stage, the future development to the Northwest and Southeast is provisioned for medium density housing, whilst the future development area to the Southwest is provisioned for show room type commercial use.

The future development area will be delivered approximately 15 years after completion of Stage 1, as follows:

- Western Future Development Area: Future Medium Density housing (up to 2-3 storey housing).
- Southern Future Development Area: Large Format Retail precinct.
- Eastern Future Development Area: Future pad sites for Convenience and/or Childcare.

2.2 Noise Sensitive Receptors

With reference to **Figure 2**, the closest Noise Sensitive Receptors (NSR) to the proposed development are as follows:

- NSR1 - Existing single and two-storey residential receptors at 1-27 Earlando Lane.
- NSR 2-6 - Western Future Development Area. These locations have been chosen for modelling purposes as representative of the potentially most exposed future 2-3 storey residential dwelling locations.
- NSR 7 - Eastern Future Development Area for potential childcare. The specific location within this area is undefined at this stage.

Compliance with noise emission limits at these receptors would result in compliance at receptors located at a further distance away from the proposed development.



AREA SCHEDULE - GLA	
AREA TYPE	GLA
DISCOUNT DEPARTMENT	6724 m ²
FRESH FOOD	385 m ²
KIOSK	151 m ²
LIQUOR	153 m ²
MINI MAJOR	2866 m ²
SPECIALTY	2338 m ²
SPECIALTY - FAB	1280 m ²
SUPERMARKET	4207 m ²
TOTAL	17954 m ²

PARKING NUMBER	
Description	Count
ACCESSIBLE PARKING	16
ELECTRIC	10
MOTORCYCLE PARKING	10
PARKING WITH PRAMS	12
SENIOR PARKING	10
SHORT TERM PARKING	12
STAFF PARKING	11
STANDARD PARKING	657
TOTAL	738

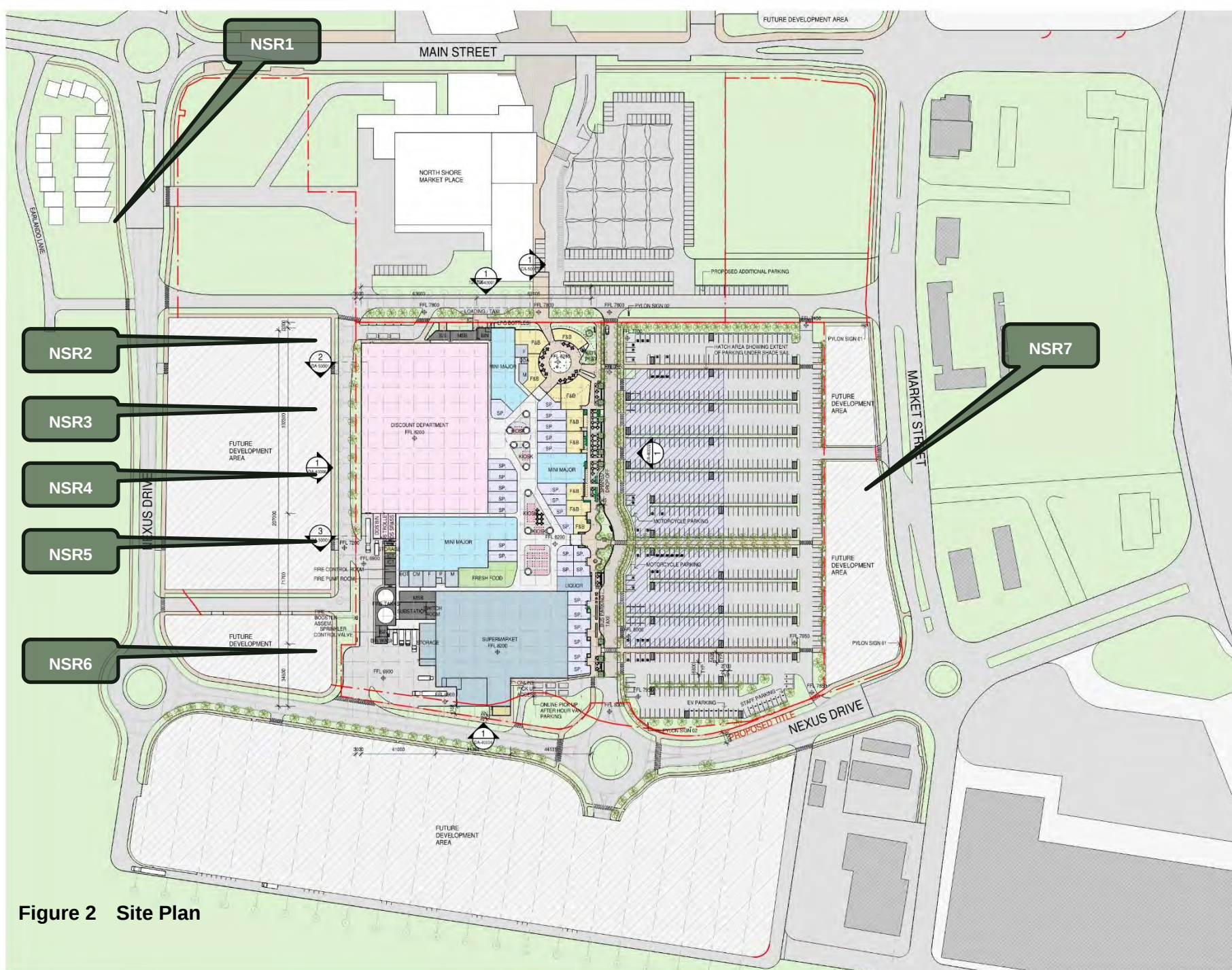
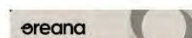


Figure 2 Site Plan

Rev	Date	Description	Rev	Date
1	08/05/2026	TOWN PLANNING APPLICATION	1	08/05/2026

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Project
NORTH SHORE CENTRAL

Project Number
250030

Status	19/02/26 12:43:27 PM
Date Printed	1:1000 @A1
Scale	

Drawing Title
SITE PLAN

Drawing Number
NTS-BUC-DR-A-DA-20001

Revision
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3.0 Noise Monitoring

Noise monitoring was conducted with the purpose of quantifying the existing environments on site and to derive the assessment noise limits.

Monitoring was conducted between Friday 21st November and Monday 1st December 2025. The approximate location of the Noise Monitors (NM) is shown in **Figure 3**.

Figure 3 Noise Monitoring Locations



Image source: Nearmap January 2026



All items of acoustic instrumentation employed during the noise monitoring survey (detailed in **Table 1**) were designed to comply with the requirements of AS IEC 61672.1 - 2004 “Electroacoustics - Sound Level Meters - Specifications” and carried appropriate and current NATA¹ calibration certificates issued by an accredited laboratory at the time of testing.

Table 1 Noise Monitoring Equipment

Equipment	Manufacturer & Type	Serial Number	Latitude	Longitude
Noise Logger NM1	SVAN 977	98069	-19.253053°	146.698355°
Noise Logger NM2	ARL Ngara	8781C7	-19.254783°	146.697561°
Acoustic calibrator	Svan SV30A	24513	-	-

Noise measurements were conducted in accordance with the QLD Noise Measurement Manual (NMM) and 1055:2018 – *Acoustics - Description and measurement of environmental noise* (AS1055) with the instruments setup as follows:

- A-weighting frequency response.
- “Fast” time response.
- 1-minute and 15 minutes.
- Microphone height 1.8m above the ground, aimed vertically upwards in the free-field with wind shield applied.

The instruments were set up to measure the A-weighted L_{Amin} , L_{A90} , L_{Aeq} , L_{A10} , L_{A1} and L_{AMax} noise descriptors.

The loggers were checked for calibration before and after the monitoring, with no drift in calibration exceeding 1.0 dBA. This is within the 1 dB tolerance allowed for in AS1055; therefore, the measurements are considered valid.

Noise monitoring results of noise descriptors relevant to this assessment are summarised in **Table 2**. Full monitoring results and plots for NM1 and NM2 are provided **Appendix B**.

It is noteworthy that relevant rainfall was observed by the Bureau of Meteorology (BoM) on the 26th November, 30th November and 1st December 2025. As such, the data for these days was excluded from the analysis and averages. Spectrum noise data was also analysed and processed for filtering of insect noise prior to the calculation of the Rating Background Level (RBL) and ultimately the noise limits detailed in **Section 4.0**.

Table 2 Unattended Noise Logging Results (rounded)

Location	Rating Background Level, RBL			Min $L_{Aeq,15min}$			$L_{Aeq,T}$ (See note 1)		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
NM1	41	41	33	48	48	45	56	52	52
NM2	39	39	33	43	44	38	47	46	44

Note 1: T means 11hr (7am-6pm) – 4hr (6pm-10pm) – 9hr (10pm-7am)

¹ National Association of Testing Authorities.



4.0 Noise Assessment Criteria

4.1 Noise Emission Criteria

According to the Townsville MAPS tool, the subject site is located within an Emerging Community (EC) zone, with external NSR also located within an EC zone. As such, the acoustic requirements of the Emerging Community Zone Code apply.

In relation to noise emissions, the Emerging Community Zone Code does not specify objective (quantitative) noise criteria for commercial development other than a home based business², which are not considered reasonable for a large commercial development within a mixed use context.

As such, the requirements within the Townsville City Plan 2014 - *Development Manual Planning Scheme Policy (PSP) – SC6.4.19 Noise and Vibration* have been applied.

Additionally, the Environmental Protection Act 1994 is also referred to address any potential complaints in relation to mechanical plant noise.

4.1.1 Townsville City Plan 2014 - Development Manual Planning Scheme Policy (PSP) – SC6.4.19 Noise and Vibration

It is acknowledged that, whilst not referred to specifically in the Emerging Community Zone Code, the PSP provides guidance on preparing a noise impact assessment report with the intent of ensuring developments are managed in a way which prevents nuisance from the effects of noise on health, community well-being and quality of life.

Following guidance from the PSP, the overall noise assessment limits are derived as follows³:

1. The Intrusive Noise Levels in the PSP per day, evening and night period are defined as the RBL + 5 dB. The $L_{Aeq,Adj,15min}$ Intrusive Noise Levels is derived from the RBL noise measurements (**Table 2**).
1. The calculated $L_{Aeq,Adj,15min}$ corrected Amenity Noise Level for residences calculated as the PSP Recommended Amenity Noise Level (Urban) – 5 dB + 3dB.
2. The $L_{Aeq,Adj,15min}$ Project Trigger Noise Level below is the lower of the Intrusive Noise Level and the corrected Amenity Noise Level.

The derived noise limits are presented in **Table 3**. Noise limits based on NM1 are applicable at the closest existing NSR 1 group of receptors. Noise limits based on NM2 are applicable at the future NSR 2 receptors, noting that these receptors can be designed and built to meet internal noise criteria.

Table 3 PSP Project Trigger Noise Levels, dBA

ID	RBL			Intrusive Noise Level $L_{Aeq,Adj,15min}$ dBA			Amenity Noise Level (Urban) $L_{Aeq,Adj,15min}$ dBA			Project Trigger Noise Level $L_{Aeq,Adj,15min}$ dBA		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
NM1	41	41	33	46	46	38	58	48	38	46	46	38
NM2	39	39	33	44	44	38	58	48	38	44	44	38

² For home-based business, noise levels emitted are not to exceed acoustic quality objectives under the Environmental Protection (Noise) Policy 2019.

³ In deriving noise limits, further guidance was sought from the NSW EPA Noise Policy for Industry, from which the TCC PSP is based.



Additionally, according to the PSP,

“ L_{Amax} assessment only applies to ‘specified noise sources’ which are defined as impact noises; hammering; loading/unloading; dropping items; beepers, alarms, bells, phones, sirens; power tools; valve releases; air brakes; door slamming. Note - People noise and vehicle pass-by noise (engine, exhaust, induction, tyres) are specifically excluded. Where the subject development can satisfy the following three maximum noise level event trigger levels no additional assessment or evaluation of sleep disturbance is required:

- o *$L_{Aeq,15min}$ 40 dBA 1 metre from the façade or the existing rating background level plus 5 dB, whichever is the greater.*
- o *The arithmetic average of the maximum levels from up to 15 single events over a given night-time period L_{AFmax} 52 dBA 1 metre from the façade or the existing rating background level plus 15 dB, whichever is the greater.*
- o *The absolute highest L_{AFmax} 60 dBA 1 metre from the façade or the existing rating background level plus 15 dB, whichever is the greater.”*

With reference to the NM1 and NM2 noise measurements (**Table 2**) the sleep disturbance criterion limits are as follows:

- **NM1**
 - o Greater of 40 dBA and 33 + 5 at night = $L_{Aeq,15min}$ 40 dBA at any time between 10pm-7am.
 - o Greater of L_{AFmax} 52 dBA and 33 + 15 at night = 52 dBA (average of 15 loudest events, between 10pm-7am.
 - o L_{AFmax} 60 dBA for the loudest event within 10pm-7am.
- **NM2**
 - o Greater of 40 dBA and 33 + 5 at night = $L_{Aeq,15min}$ 40 dBA at any time between 10pm-7am.
 - o Greater of L_{AFmax} 52 dBA and 33 + 15 at night = 52 dBA (average of 15 loudest events, between 10pm-7am.
 - o L_{AFmax} 60 dBA for the loudest event within 10pm-7am.

The following is noted:

- For residences, the amenity noise levels apply at the reasonably most-affected point on or within the residential property boundary or, if this is more than 30 metres from the residence, at the reasonably most-affected point within 30 metres of the residence. However, this requirement should not be read to infer that the noise limit only applies at the ‘reasonably worst affected location’.
- The PSP acknowledges that assessment of low frequency noise may not be required when the noise being considered does not involve a significant contribution from low frequencies. Some specific source examples where low frequency noise is mentioned in the PSP include gas turbines, boilers, forced draft and induced draft fans, shakers on hoppers, vibratory screens, wind farms, solar farm inverters, power stations or generators, night clubs or uses that provide amplified music.

Noise sources of significant low frequency content such as those mentioned above will not be introduced by Stage 1. Therefore, assessment of moving vehicles and mechanical using the PSP Project Trigger Level and the EPA Act 1994 is considered sufficient.



4.1.2 Queensland Environmental Protection Act 1994

The *EP Act 1994* enables the framework for environmental assessments to be developed in Queensland. The *EP Act 1994* is applicable to all members and bodies in the community, including industry and government. It provides a method for government departments to incorporate environmental factors into their decision-making process.

The objective of the *EP Act 1994* is as follows:

The object of the Environmental Protection Act 1994 is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

There is a general environmental duty to prevent and minimise environmental harm under section 319 of the *EP Act 1994*. The *EP Act* specifically states:

A person must not carry out an activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm (the general environment duty).

To decide the measures required to meet the general environmental duty in accordance with the *EP Act 1994*, regard must be had to:

- The nature of the harm or potential harm.
- The sensitivity of the receiving environment.
- The current state of technical knowledge for the activity.
- The current state of successful application of the different measures that might be taken.
- The financial implications of the different measures as they would relate to the type of activity.

The *EP Act 1994* prescribes default noise standards for activities and noise sources. The default standards in the *EP Act* aim to recognise the needs of businesses and individuals in undertaking activities that generate noise while achieving an appropriate acoustic environment for the amenity of residential areas. For activities or equipment relevant to this noise impact assessment (NIA), the *EP Act* default noise standard applicable to the development is summarised in **Table 4**.

Table 4 EP Act Operational Noise Criteria Relevant to the Project

Equipment or Activity	Times of Use that the Noise Standard Applies to	Noise Standard – Prohibited Noise Level at Affected Premises $L_{A90,T}$ dBA
Air conditioning units and refrigeration equipment	7 am – 10 pm	More than 5 dBA above background level
	10 pm – 7 am	More than 3 dBA above background level

With the RBL values in **Table 2** applied conservatively to define pre-development representative background noise recorded, the applicable noise limits for mechanical plant noise emissions measured at the external receptors are presented in **Table 5**.



Table 5 EP Act Noise Limits Derived from Background Noise Measurements for Air Conditioning Units and Refrigeration Equipment

ID	Times of Use that the Noise Standard Applies to	Noise Standard – Prohibited Noise Level at Affected Premises L_{A90} dBA
NM1	7am - 6pm	46
	6pm - 10pm	46
	10pm - 7am	38
NM2	7am - 6pm	44
	6pm - 10pm	44
	10pm - 7am	36

4.1.3 Noise Emission Limits for the Proposed Development

Taken as the lowest noise emission limits between the Townsville PSP and the EPA Act 1994, the derived noise emission limits for mechanical plant are presented in **Table 6**.

Table 6 Noise Assessment Limits

ID	Time period	Noise Limit, dBA		
		PSP Project Trigger Noise Levels	EP Act Section 440U-440V air conditioning and refrigeration equipment	PSP Sleep Disturbance
NM1	Day (7am - 6pm)	$L_{Aeq,Adj,15min}$ 46 dBA	$L_{A90,15min}$ 46 dBA	-
	Evening (6pm - 10pm)	$L_{Aeq,Adj,15min}$ 46 dBA	$L_{A90,15min}$ 46 dBA	-
	Night (10pm - 7am)	$L_{Aeq,Adj,15min}$ 38 dBA	$L_{A90,15min}$ 38 dBA	$L_{Aeq,Adj,15min}$ 40 dBA L_{AFmax} 52 dBA (average 15 loudest events) L_{AFmax} 60 dBA (loudest event)
NM2	Day (7am - 6pm)	$L_{Aeq,Adj,15min}$ 44 dBA	$L_{A90,15min}$ 44 dBA	-
	Evening (6pm - 10pm)	$L_{Aeq,Adj,15min}$ 44 dBA	$L_{A90,15min}$ 44 dBA	-
	Night (10pm - 7am)	$L_{Aeq,Adj,15min}$ 38 dBA	$L_{A90,15min}$ 36 dBA	$L_{Aeq,Adj,15min}$ 40 dBA L_{AFmax} 52 dBA (average 15 loudest events) L_{AFmax} 60 dBA (loudest event)



5.0 Noise Modelling Details

To assess the noise impacts from the development, a computational noise model was developed using SoundPLAN (Version 8.2) acoustic software. SoundPLAN is a software package that enables the development of a sophisticated 3D digital terrain and building elevation model, the locations and noise emission levels of identified noise sources, and the locations of communities and other sensitive receptors with potential to be impacted.

The software applies acoustic and environmental standards and guidelines to calculate the emission of noise from multiple sources and the propagation of noise within the environment. The modelling accounts for the complex interaction of the noise emissions with the local environment, including screening and reflection of noise from local buildings, the effects of local weather conditions, the acoustic properties of the local ground coverage and the frequency content of the noise emission sources.

A Digital Elevation Model (DEM) was developed from the following inputs:

- LiDAR digital elevation and building roof eaves elevation data downloaded from a QLD Government website. A 3D model was developed from the digital survey to derive terrain contours at 1.0m intervals as the best available resolution.
- Project drawings presented in **Appendix C**.
- Preliminary road and car park levels markup by Premise. A 3D model of the development site is not available at this stage.

Noise predictions were made using the SoundPLAN implementation of International Standard ISO 9613-2:1996 – *Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors*.

5.1 Noise Source Emissions Overview

The following sections detail the noise sources applied to the noise model. A worst-case scenario was modelled of the noise sources relevant to a worst-case 15-minute assessment period, during the day, evening and night periods to predict cumulative noise levels.

An overview of the noise model is presented in **Figure 4** and **Figure 5**.



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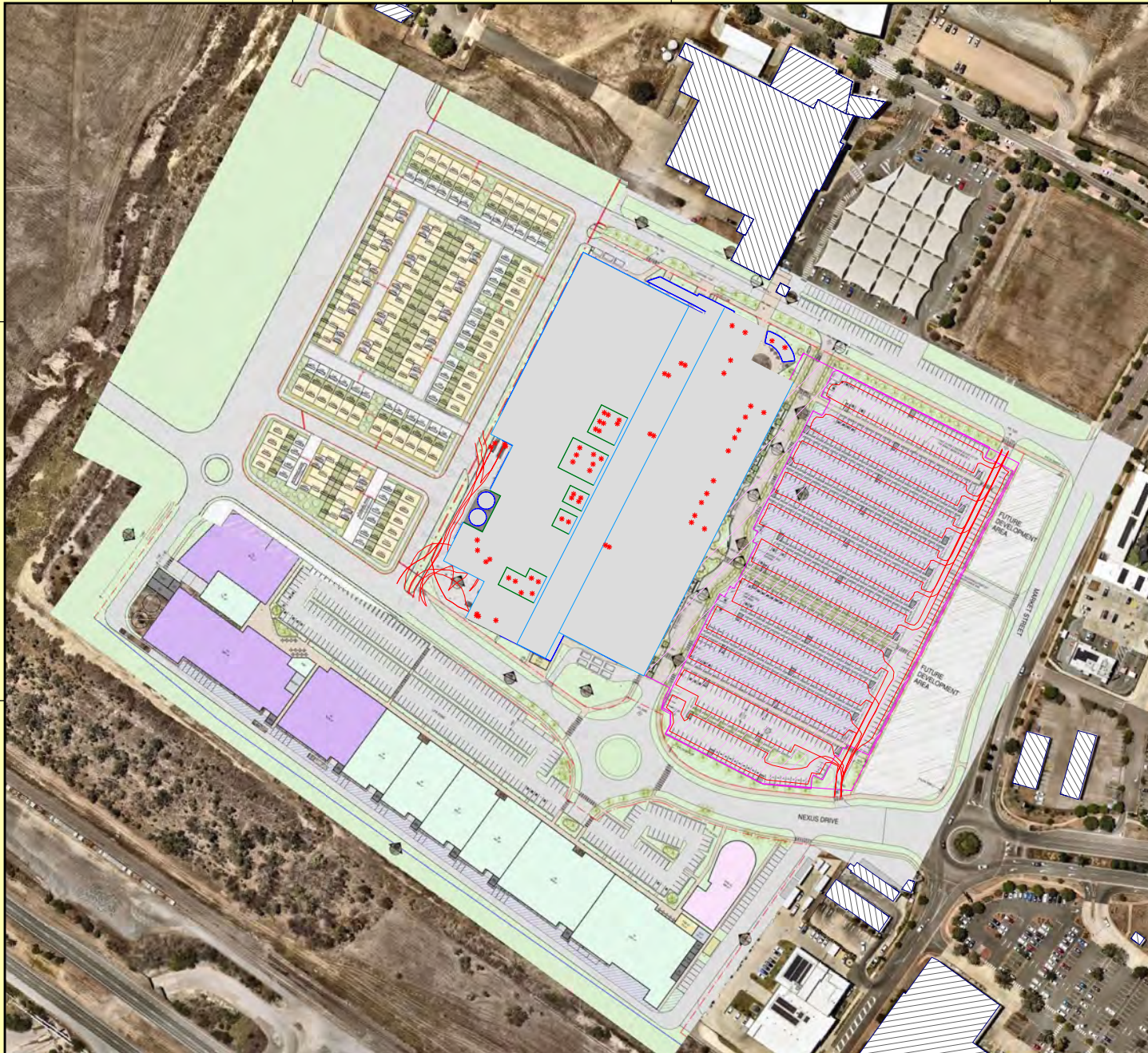
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7871000

7870800

7871000

7870800



468200

468400

468600

North Shore Central, Townsville
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Figure 4 Noise Model Site Plan

Created: 21/02/2026
Processed with SoundPLAN 8.2, Update 18/10/2024

Signs and symbols

-  North Shore Central
-  Rooftop Plant
-  Car / truck line source
-  Patron Area source
-  External Buildings
-  Mechanical Plant Noise Fence
-  Mechanical Plant Deck

Scale 1:3000

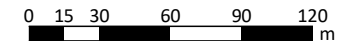
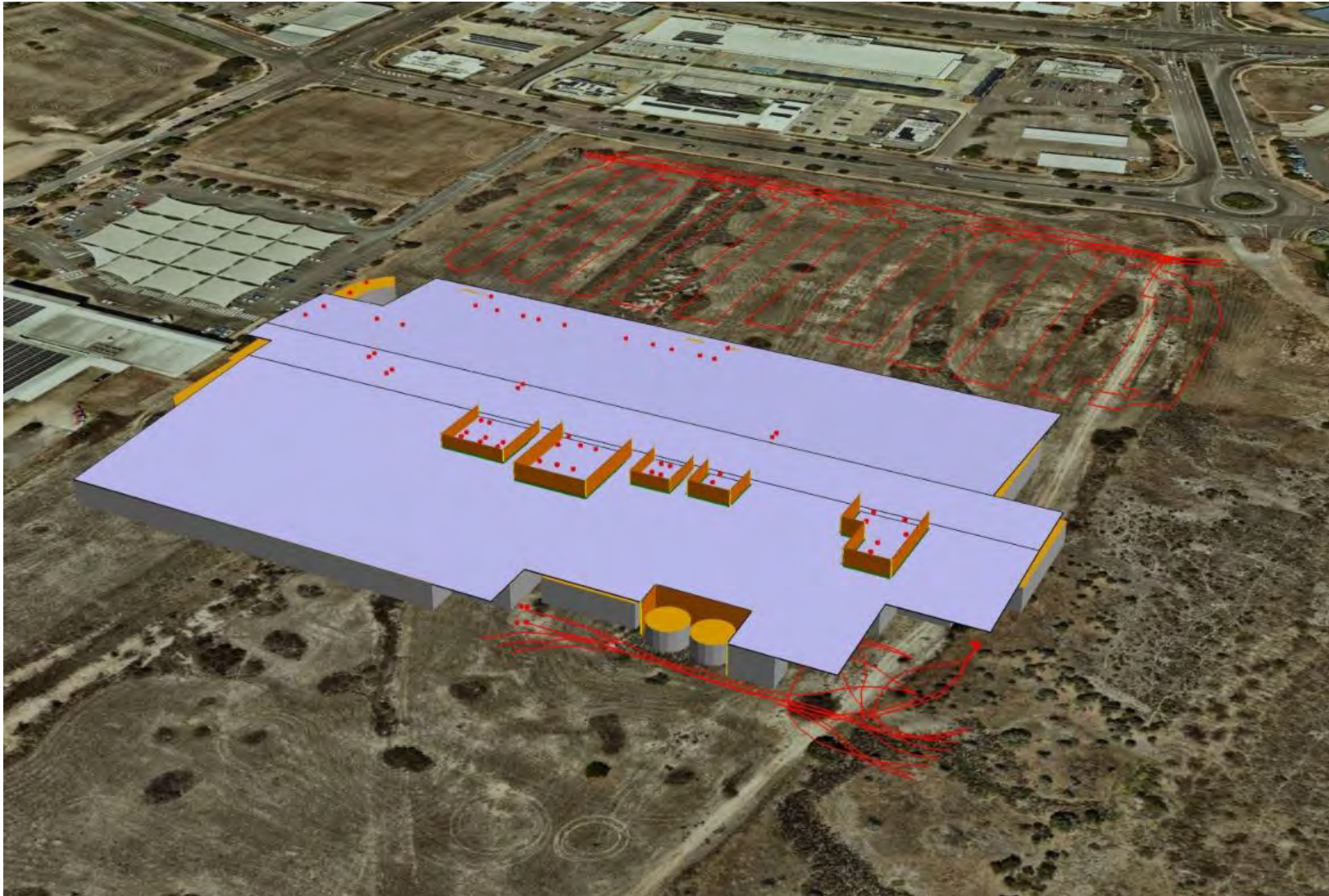


Figure 5 Modelled Development, 3D View



5.2 Noise Source Emission Inputs

5.2.1 Vehicle Movements

To determine the number of car park and loading bay movements, reference is made to the markup shown in **Figure 6** prepared by the SLR Transport Group.

Time histograms were applied in the computer model to predict the 15 minute noise emission using time histograms to distribute the traffic volumes in the shown proportions, for each Day, Evening and Night period, as shown in **Figure 6**.

The noise emission of vehicles has been modelled for the operation of these whilst within the Project precinct. Road traffic noise produced on public roads has not been considered, noting that the development public roads will also be used by other traffic not generated by the development.

Car Parks

Car park use will be concentrated within the Day and Evening periods, with limited use by night shift staff, expected to cause negligible noise impact within the night-time period compared to other site traffic.

Light vehicle activity noise emissions (sound power levels) from SLR's acoustic library were used to assess potential noise emissions from the car park movements. These are presented in **Table 7**.

Table 7 Car park sound power levels

Source	Sound power level – octave values in dB linear								
	Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Car movement	79	83	75	74	74	70	69	68	77
Door closure	87	60	73	80	74	83	75	71	84

Car movements were modelled as a moving point source travelling 10 km/hr at 0.5m above the ground. Lines were digitised in the noise model to represent an approximately even spread use of the car park.

Door closures were modelled assuming one noise event per car trip of 1 second duration. An average one (1) door closure per car movement was assumed.

An area source was applied at 1m above the ground to represent the distribution of the events within the car park.

Loading Bays

Loading bay use will be concentrated during the Day period, with minimal use (i.e. of up to two (2) trucks) within each Evening and Night period. Worst-case vehicle movements were modelled as follows:

- Supermarket:
 - o Day: Ten (10) Articulated Vehicle (AV) or Heavy Rigid Vehicle (HRV) movements per hour, including refrigerated vehicles, plus one (1) Refuse collection Vehicle (RCV).
 - o Evening: Two (2) AV/HRV movements per hour, including refrigerated vehicles, plus one (1) Refuse collection Vehicle (RCV).



- o Night: Two (2) AV/HRV movements per hour, including refrigerated vehicles, plus one (1) Refuse collection Vehicle (RCV).
- Northern Specialty Retail:
 - o Day: Two (2) Medium Rigid Vehicle (MRV) or Small Rigid Vehicle (SRV) movements per hour.
 - o Evening: No use.
 - o Night: No use.
- Discount department / Mini Major:
 - o Day: Ten (10) AV/HRV movements per hour, without refrigeration, plus one (1) Refuse collection Vehicle (RCV).
 - o Evening: Two (2) AV/HRV movements per hour, without refrigeration, plus one (1) Refuse collection Vehicle (RCV).
 - o Night: Two (2) AV/HRV movements per hour, without refrigeration, plus one (1) Refuse collection Vehicle (RCV).
- Southern Specialty:
 - o Day: Ten (10) AV/HRV movements per hour, without refrigeration, plus one (1) Refuse collection Vehicle (RCV).
 - o Evening: Two (2) AV/HRV movements per hour, without refrigeration, plus one (1) Refuse collection Vehicle (RCV).
 - o Night: Two (2) AV/HRV movements per hour, without refrigeration, plus one (1) Refuse collection Vehicle (RCV).

The following assumptions were made:

- AV, MRV and SRV accessing the site will maintain their engines OFF during unloading. Adequate signage will be applied at loading areas.
- Full electric pallet jacks will be used for unloading of vehicles (with negligible noise emission). No forklifts will be used on site.
- It has been assumed that RCV movement and bin unloading may occur once per day within each Day, Evening or Night periods.
- The supermarket compactors will share the same area of the trucks. At a lower noise emission than the latter, noise control for trucks will also manage the noise emission of the compactors; therefore, this noise source is not considered further.

Sound power levels from SLR's acoustic library were used for the service vehicles as presented in **Table 8**.

Table 8 Service vehicle sound power levels

Vehicle type	Details	Sound power level – octave values in dB linear									
		Overall, dBA	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
HRV AV	Moving point source at 10km/h. 1.5m above the ground	103	100	103	101	99	98	99	96	90	79
HRV AV	Refrigeration Unit at 2.5m above the ground	100	100	115	104	99	97	93	94	86	76



Vehicle type	Details	Sound power level – octave values in dB linear									
		Overall, dBA	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
	OFF after unloading										
HRV AV	Air breaks Point source at 1.5m above the ground, 2 second duration per event	107	106	100	94	93	93	98	102	102	84
MRV SRV RCV	Moving point source at 10km/h and 1.0m above the ground.	98	95	98	96	94	93	94	91	85	74
RCV bin unload	Unloading of large bins. Point source at 1.5m above ground. Modelled as a 3 second event duration.	108	-	95	97	96	94	101	103	101	95
The sound directivity of the refrigeration unit has been reproduced from Jessie Roy and Peter VanDelelden – <i>Sound Power Level and Directivity Patterns of Refrigerated Transport Trailers</i> .											



Northshore Traffic Volumes - peak hour:
 Car park:
 • 7AM-6PM: as shown below
 • 6PM-10PM: Maximum of ~70% shown below
 • 10PM-7AM: Negligible (likely only staff movements)
 Loading bay:
 • 7AM-6PM: as shown below
 • 6PM-10PM: Negligible (maybe 1-2 trucks)
 • 10PM-7AM: Negligible (maybe 1-2 trucks)

GFA: 22196m²
 SITE COVERAGE: 56498m²

AREA SCHEDULE - GLA	
AREA TYPE	GLA
DISCOUNT DEPARTMENT	6724 m ²
FRESH FOOD	385 m ²
KIOSK	191 m ²
LIQUOR	153 m ²
MINI MAJOR	2666 m ²
SPECIALTY	2338 m ²
SPECIALTY - F&B	1290 m ²
SUPERMARKET	4207 m ²
TOTAL	17954 m ²

PARKING NUMBER	
Description	Count
ACCESSIBLE PARKING	16
ELECTRIC	10
MOTORCYCLE PARKING	10
PARKING WITH FRAMS	12
SENIOR PARKING	10
SHORT TERM PARKING	12
STAFF PARKING	11
STANDARD PARKING	657
TOTAL	738

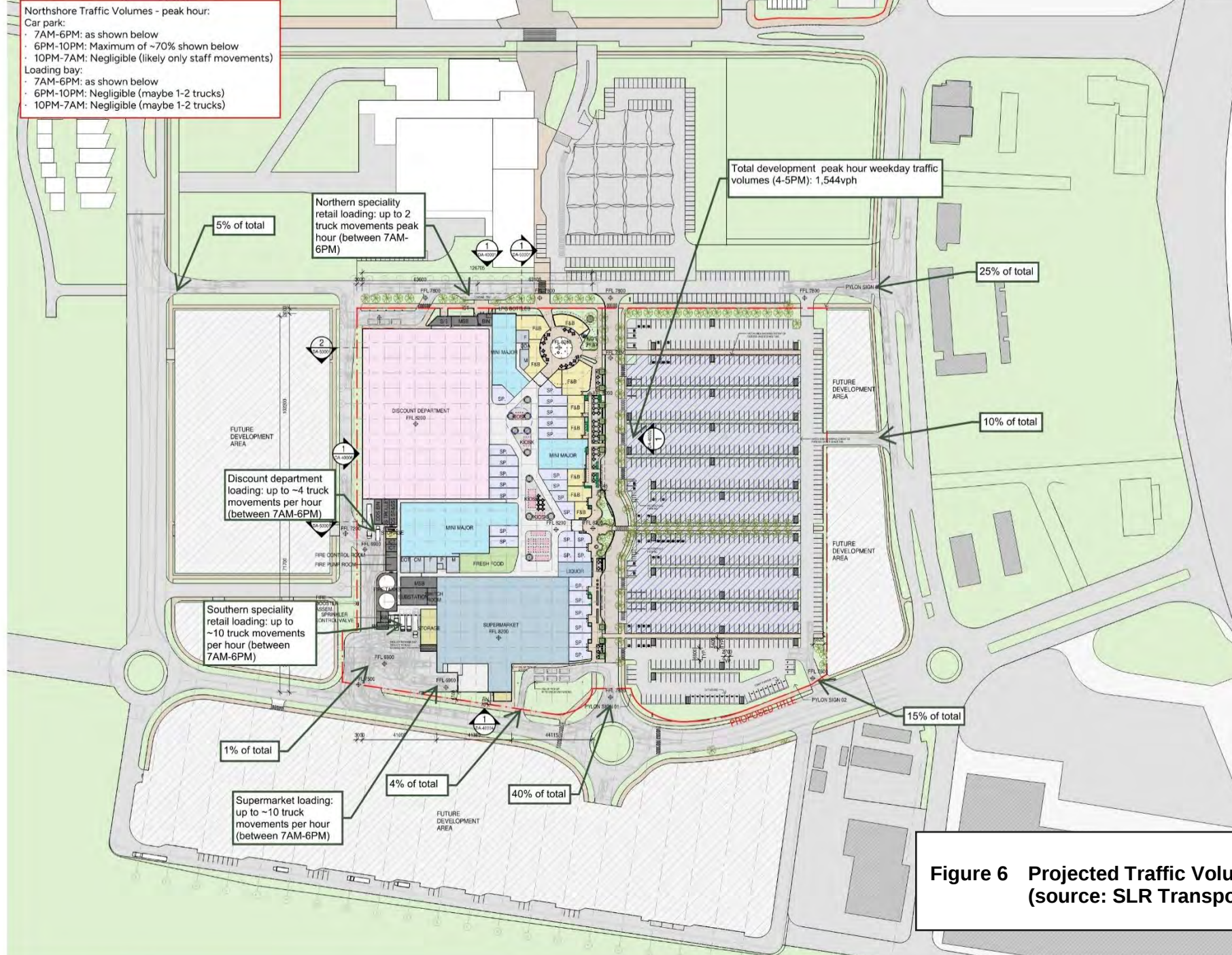
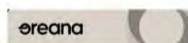


Figure 6 Projected Traffic Volumes
 (source: SLR Transport Group)

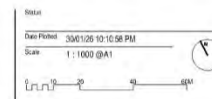
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NORTH SHORE CENTRAL

Project Number
 250030



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 Drawing Number
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5.2.2 Mechanical Plant

A preliminary mechanical design package developed by the mechanical Consultant (ADP Consulting) has been assessed. This includes:

- Roof mounted Air Handling Unit (AHU) equipment and air-cooled chiller plant.
The plant decks for the above noise sources are shown with tall enclosures in the architectural drawings. A preliminary calculation showed predicted exceedances by various large plant items without these. To reduce the noise levels at the receptors, the following noise barrier heights have been modelled surrounding the rooftop plant decks:
 - o Discount store AHU deck: 3.0m
 - o Central chiller deck: 4.0m
 - o Mini Major AHU deck: 3.0m
 - o Fresh Food chiller deck: 3.5m
 - o Supermarket chiller deck: 4.0m
 It is noteworthy that the noise barrier heights are indicative as they are based on noise predictions made for preliminary plant designs and plant selections and are to be revised during the Detailed Design phase. Thus, noise barrier designs are to be reviewed during the subsequent Project design stages.
- Kitchen Exhaust Fans (KEF) and Kitchen Supply Fans (KSF) will also be introduced. The noise contribution of these will be minor and will be in operation during operational hours only. These noise sources have been incorporated in the noise model without further noise attenuation.

The preliminary design package also shows Smoke Exhaust Fans (SEF). However, since they will only operate during emergencies, they have not been considered in this assessment.

The mechanical system assessed is shown in the **Figure 7** markup.

The modelled noise emissions for the preliminary plant selections are presented in **Table 9**, which are based on the specifications and advice provided by the mechanical plant consultant.

Table 9 Mechanical Plant Sound Power Levels

	Number of units and time of use ¹	Details ²	Sound power level, per unit – octave values in dB linear								
			Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
AHU Inlet	Common areas 1 x trading hours, 8am-9pm	Inlet noise - Point source modelled at 1.5m above rooftop	76	70	75	78	75	69	68	63	61
AHU	1 x 24 hours Discount store	Breakout noise -	72	90	84	76	62	53	42	34	28



	Number of units and time of use ¹	Details ²	Sound power level, per unit – octave values in dB linear								
			Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
	3 x trading hours, 8am-9pm 1 x 24 hours Mini Major 4 x trading hours, 8am-9pm	Point source modelled at 1.5m above rooftop									
Chiller Central 1-3	3 x trading hours, 8am-9pm	2.5m above rooftop	99	91	91	96	95	93	94	84	83
Chiller Central 4-5	1 x trading hours, 8am-9pm 1 x 24 hours ³	2.5m above rooftop	97	90	90	90	94	92	93	83	81
Heat pump 1 Central	1 x trading hours, 8am-9pm	Point source 2.5m above rooftop	91	81	87	92	88	86	82	74	75
Heat pump 2 Central	1 x trading hours, 8am-9pm	Point source 2.5m above rooftop	92	82	88	93	89	87	83	75	76
Chiller Supermarket	1 x trading hours, 8am-9pm 1 x 24 hours	Point source 2.5m above rooftop	95	87	89	89	91	91	88	79	79
Chiller Fresh Food	1 x trading hours, 8am-9pm 1 x 24 hours	Point source 2.5m above rooftop	95	87	89	89	91	91	88	79	79
Refrigerant condenser Supermarket	2 x trading hours, 8am-9pm 1 x 24 hours	Point source 2.5m above rooftop	85	77	79	79	81	81	78	69	69
Heat pump Supermarket	1 x 24 hours	Point source 2.5m above rooftop	91	81	87	92	88	86	82	74	75
KEF	10 x Trading hours, 8am-9pm	Point source 0.5m above rooftop	85	81	91	85	83	79	74	70	67
KSF	10 x Trading hours, 8am-9pm	Point source 0.5m above rooftop	82	79	79	81	78	78	75	70	67

¹ Trading hour operation has been nominally modelled between 7am-10pm. Compliance within 8am-9pm, also results in compliance between 7am-10pm.

² Noise source elevations above rooftop are approximate.

³ Chiller Central 5 will operate at low load at night. Noise emission modelled as 20dB lower than the stated values within this period.



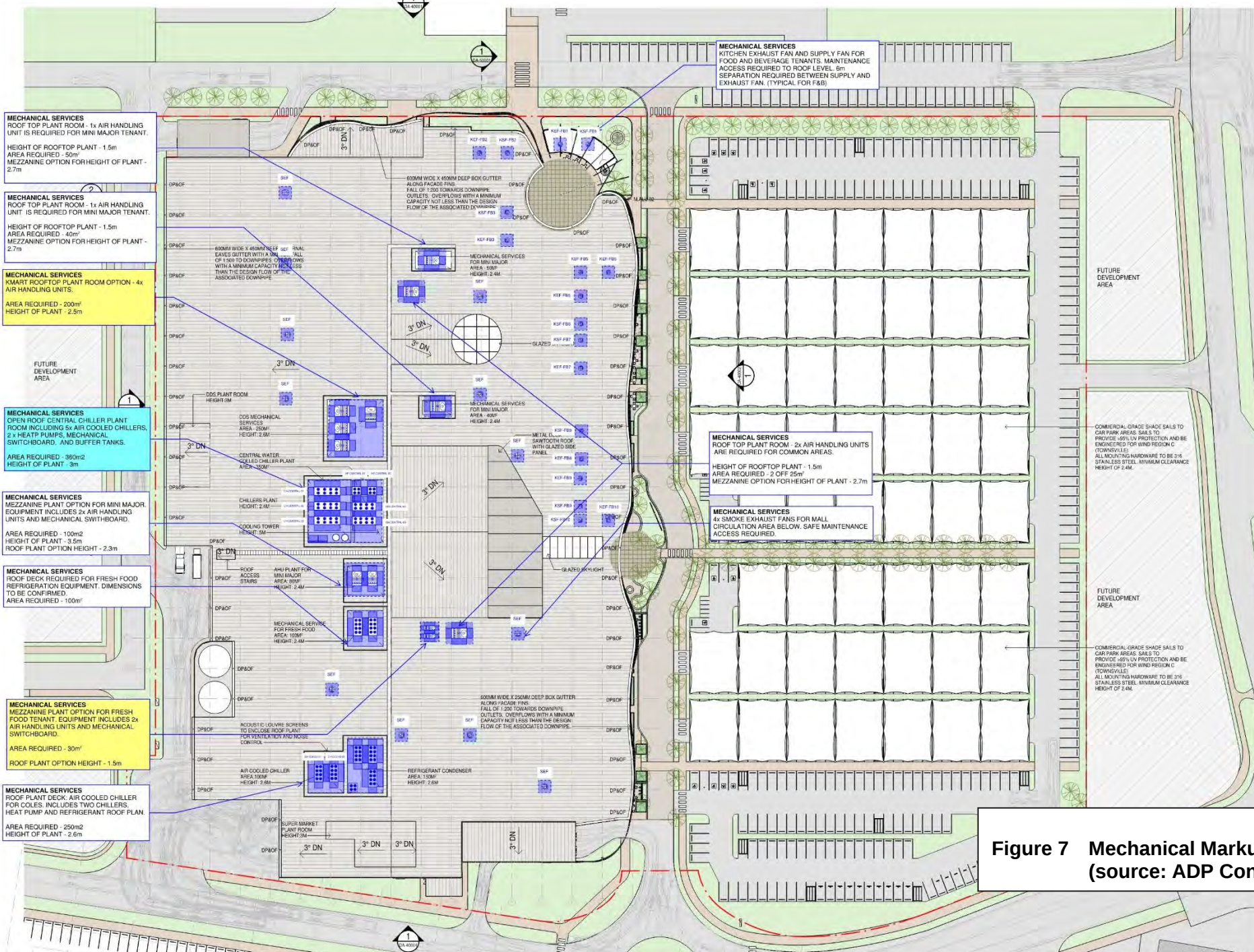


Figure 7 Mechanical Markup
(source: ADP Consulting)

5.2.3 Food & Beverage and Shopping

The proposed development will incorporate ten (10) Food and Beverage (FB) and 27 Shopping outlets.

In the absence of patronage estimates, the noise emissions have been modelled assuming patron numbers (persons speaking simultaneously) of one fourth of the total car parking movements. This equates to the following number of persons speaking simultaneously, whilst outdoors:

- Day: 386 people
- Evening: 270 people
- Night: 20 people.

Refer to **Table 10** for the noise emission applied as an area source distributed over the car park and outdoor areas, modelled as an area source 1.5m above the ground. The noise source emission has been reproduced from ANSI 3.5-1997. American National Standard – *Methods for Calculation of the Speech Intelligibility Index* (1997), as reproduced in Odeon Acoustic Software *Application Note – Restaurants*.

It is acknowledged that the noise emission pertains unamplified speech, but a raised voice sound level is considered representative of the normal use of the intercom, which has been assumed to be used during 30% of a measurement period.

Table 10 Food and drink outlet intercom and outdoor dining noise emission

Source	Sound power level – octave values in dB linear								
	Overall, dBA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Outdoor person with normal voice, per person.	71	45	55	65	69	63	56	50	68



6.0 Noise Assessment and Recommendations

The following sections present the results of noise predictions at the worst-case (closest) receptors to the Project. Noise contour maps of worst-case cumulative noise levels are provided in **Appendix D**.

6.1 Noise Predictions at Existing Noise Sensitive Receptors

Results of the noise predictions conducted for the general operation of the Project at NSR1 are presented in **Table 11**. Results are presented for the individual noise source group contributions, as well as the cumulative noise.

The following assessment is made:

- Noise levels are predicted below the $L_{Aeq,Adj,15min}$ noise limits for the Day and Evening periods.
- The night noise emissions are predicted to exceed the $L_{Aeq,Adj,15min}$ noise limit by 4 dBA, but are predicted below the L_{Amax} 52 dBA and 60 dBA noise limits.
- The noise exceedance is controlled by the Supermarket loading bay, specifically by the noise emitted by truck movements and refrigeration units during truck unloading.

The following is noted:

- The predicted cumulative $L_{Aeq,Adj,15min}$ noise level of 42 dBA at night is 3 dBA lower than the minimum measured $L_{Aeq,1hr}$ at NSR1 (refer to **Table 2**) within the same period. In other words, the Project noise contribution is lower than the existing noise environment at the receptors.
- The cumulative noise level assumes that all the modelled noise sources are active simultaneously within a 15-minute measurement period. This is an unlikely scenario for the loading bays. Therefore, the cumulative noise levels can be expected to be lower than the predicted levels at most times.
- Further, the noise levels from loading bays will reduce as the future areas South of NSR1 commenced to be developed, as the building structures will provide acoustic screening (i.e. noise barrier effects).

From the above assessment, noise impacts at NSR1 from the operation of the loading bays is not expected. Notwithstanding this, the Project can be designed and operated in a manner that the noise sources meet noise limits independently as well as cumulatively at NSR1 to allow night use of the Supermarket loading bay, by implementing reasonable and feasible mitigation measures.

Recommendation:

- 1 Implement an operational plan for the supermarket to limit the arrival of deliveries with refrigerated trucks to one (1) truck per any 15-minute interval, between 10pm and 7am.
- 2 Operate trucks with non-tonal, broadband type reversing alarms.
- 3 Manage the loading bay noise emission by conducting the unloading of goods with the truck engine and refrigeration unit OFF. Apply adequate signage in visible areas to remind supermarket operators and truck drivers.
- 4 Design the mechanical plant with the required noise controls to meet the noise limits in **Table 6** for the residual noise after the management of the loading bay noise emission.



Table 11 Noise level predictions at NSR 1

Receptor	Noise source group	L _{Aeq,Adj,15min} dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
NSR 1 Ground Floor	Cumulative	45	44	42	-
	Car Park	13	12	1	26
	Central - Mechanical Plant	39	39	14	34
	Common Areas - Mechanical Plant	18	18	9	9
	Discount Store - Loading Bay	36	13	13	50
	Discount Store - Mechanical Plant	16	16	12	11
	Food & Beverage – Patrons	28	26	15	18
	Fresh Food - Mechanical Plant	33	33	31	31
	Kitchen - Mechanical Plant	33	33	-	-
	Mini Major - Bin Collection	5	5	5	42
	Mini Major - Loading Bay	34	33	33	48
	Mini Major - Mechanical Plant	20	20	-	-
	Supermarket - Bin Collection	3	3	3	40
	Supermarket - Loading Bay	40	40	40	48
	Supermarket - Mechanical Plant	34	34	31	30
NSR 1 First Floor	Cumulative	45	45	41	-
	Car Park	14	12	1	26
	Central - Mechanical Plant	40	40	15	35
	Common Areas - Mechanical Plant	19	19	10	10
	Discount Store - Loading Bay	36	12	12	49
	Discount Store - Mechanical Plant	17	17	12	12
	Food Beb - Patrons	28	27	16	19
	Fresh Food - Mechanical Plant	33	33	32	32
	Kitchen - Mechanical Plant	33	33	-	-
	Mini Major - Bin Collection	4	4	4	41
	Mini Major - Loading Bay	33	32	32	48
	Mini Major - Mechanical Plant	22	22	-	-
	Supermarket - Bin Collection	3	3	3	39
	Supermarket - Loading Bay	40	40	40	48
	Supermarket - Mechanical Plant	34	34	31	31



6.2 Noise Predictions at Future Development Area Receptors

Results of the noise predictions conducted for the general operation of the Project at NSR 2 to NSR 6 pertaining the future development area are presented in **Table 12**. The table shows the noise contribution from the individual noise source groups, as well as the total (cumulative) noise level.

The following assessment is made at NSR2 to NSR6:

- Noise levels are predicted to exceed the $L_{Aeq,Adj,15min}$ noise limits for the Day, Evening and Night periods.
 - o Exceedances up to 19 dBA (Day), 18 dBA (Evening) and 24 dBA (Night) are predicted cumulatively.
- Noise levels are predicted to exceed the L_{Amax} noise limits for the Night period by up to 24 dBA.
- The noise exceedances are controlled by the noise emitted by the loading bays and bin collection, followed by mechanical plant.

Loading bays and bin collection

- o The loudest noise emission is produced by the Supermarket refrigerated truck.
- o The 52 dBA L_{Amax} noise limit for the loudest 15 events is anticipated to comply based on the arithmetic average of the 15 loudest events at night.
- o Night L_{Amax} noise exceedances to the 60 dBA limit for the loudest event are predicted to be caused by Bin collection at the Department Store / Mini Major and the Supermarket. Collection during Day and Evening hours is predicted to result in compliance for this noise source individually.

Mechanical plant

- o Mechanical plant noise exceeds the $L_{Aeq,Adj,15min}$ noise limits by up to 4 dBA (Day), 4 dBA (Evening) and 2 dBA (Night), where the noise level increases with the increased floor levels, as the noise screening of the noise fences reduces with the increased line of sight between the receptors and the noise sources.

The residual noise exceedance after the modelled noise fences can be managed during Detailed Design with a low noise plant selection and additional noise controls such as inlet attenuators, if required.

At the Future Development Area represented by NSR7, noise predictions show noise levels between 53-56 dBA $L_{Aeq,Adj,15min}$. At these levels, the noise intrusion at sensitive receptors to be located in this area are considered manageable via suitable location of childcare playgrounds and other sensitive internal spaces facing away from the noise sources and/or screened by other intervening buildings, and by the implementation of acoustic treatments to the building facades.

Recommendation:

Whilst the noise intrusion (and noise emission) to and from the Future Development Areas are to be dealt with in a separate application, the following is preliminarily advised:

- 1 Mechanical plant pertaining North Shore Central should be designed to meet the noise limits in **Table 6**. This is considered achievable at the Future Area receptors NSR 2-6 with the implementation of reasonable and feasible noise control measures which can be confirmed during Detailed Design stage.



- 2 Due to the close distance between the loading bays and the Future Development Area receptors located to the west of it, compliance with noise limits may not be achievable on an individual and/or cumulative basis, based on the results of the noise predictions. The noise impacts will affect mostly the first-row dwellings facing North Shore Central and will reduce at the second-row dwellings and beyond due to the noise screening provided by the first-row dwellings and can be managed by a combination of the following measures:
- Implement an operational plan for the supermarket to limit the arrival of deliveries with refrigerated trucks to one (1) truck per any 15-minute interval, between 10pm and 7am.
 - Operate trucks with non-tonal, broadband type reversing alarms.
 - Manage the loading bay noise emission by conducting the unloading of goods with the truck engine and refrigeration unit OFF. Apply adequate signage in visible areas to remind supermarket operators and truck drivers.
 - Design and build the Future Development Area dwellings with architectural treatments to the facades.

With the above measures in place, compliance with suitable internal criteria is expected to be achievable.

Table 12 Noise level predictions at NSR 2-6

Receptor	Noise source group	LAeq,Adj,15min dBA			LAmix dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
NSR 2 Ground Floor	Cumulative	46	45	41	-
	Car Park	11	9	-	27
	Central - Mechanical Plant	41	41	13	33
	Common Areas - Mechanical Plant	19	19	8	8
	Discount Store - Loading Bay	38	11	11	48
	Discount Store - Mechanical Plant	19	19	13	12
	Food & Beverage – Patrons	24	22	11	16
	Fresh Food - Mechanical Plant	32	32	30	30
	Kitchen - Mechanical Plant	35	35	-	-
	Mini Major - Bin Collection	7	7	7	43
	Mini Major - Loading Bay	35	34	34	50
	Mini Major - Mechanical Plant	22	22	-	-
	Supermarket - Bin Collection	2	2	2	38
	Supermarket - Loading Bay	39	39	39	50
	Supermarket - Mechanical Plant	33	33	29	29
NSR 2 First Floor	Cumulative	49	48	42	-
	Car Park	13	11	-	29



Receptor	Noise source group	LAeq,Adj,15min dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
	Central - Mechanical Plant	45	45	18	38
	Common Areas - Mechanical Plant	24	24	14	14
	Discount Store - Loading Bay	39	11	11	48
	Discount Store - Mechanical Plant	23	23	15	15
	Food Beb - Patrons	26	24	13	16
	Fresh Food - Mechanical Plant	37	37	34	34
	Kitchen - Mechanical Plant	37	37	-	-
	Mini Major - Bin Collection	5	5	5	42
	Mini Major - Loading Bay	36	35	35	49
	Mini Major - Mechanical Plant	25	25	-	-
	Supermarket - Bin Collection	1	1	1	37
	Supermarket - Loading Bay	39	39	39	49
	Supermarket - Mechanical Plant	38	38	35	34
	Cumulative	49	49	43	-
NSR 2 Second Floor	Car Park	14	12	1	29
	Central - Mechanical Plant	46	46	20	40
	Common Areas - Mechanical Plant	27	27	15	15
	Discount Store - Loading Bay	39	11	11	48
	Discount Store - Mechanical Plant	24	24	19	19
	Food Beb - Patrons	28	27	15	18
	Fresh Food - Mechanical Plant	38	38	35	35
	Kitchen - Mechanical Plant	38	38	-	-
	Mini Major - Bin Collection	7	7	7	43
	Mini Major - Loading Bay	36	35	35	49
	Mini Major - Mechanical Plant	29	29	-	-
	Supermarket - Bin Collection	<1	<1	<1	37
	Supermarket - Loading Bay	40	40	40	49
	Supermarket - Mechanical Plant	39	39	35	35
NSR 3 Ground Floor	Cumulative	48	46	44	-
	Car Park	5	3	-	13
	Central - Mechanical Plant	41	41	13	33
	Common Areas - Mechanical Plant	20	20	8	8
	Discount Store - Loading Bay	42	16	16	53
	Discount Store - Mechanical Plant	19	19	13	13
	Food & Beverage – Patrons	20	19	7	3
	Fresh Food - Mechanical Plant	33	33	31	31



Receptor	Noise source group	LAeq,Adj,15min dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
	Kitchen - Mechanical Plant	29	29	-	-
	Mini Major - Bin Collection	10	10	10	47
	Mini Major - Loading Bay	39	38	38	52
	Mini Major - Mechanical Plant	22	22	-	-
	Supermarket - Bin Collection	4	4	4	40
	Supermarket - Loading Bay	42	42	42	52
	Supermarket - Mechanical Plant	35	35	31	31
NSR3 First Floor	Cumulative	50	49	44	-
	Car Park	7	6	-	14
	Central - Mechanical Plant	46	46	19	39
	Common Areas - Mechanical Plant	24	24	11	10
	Discount Store - Loading Bay	43	16	16	53
	Discount Store - Mechanical Plant	24	24	19	19
	Food Beb - Patrons	23	21	10	6
	Fresh Food - Mechanical Plant	38	38	36	36
	Kitchen - Mechanical Plant	33	33	-	-
	Mini Major - Bin Collection	9	9	9	46
	Mini Major - Loading Bay	38	37	37	52
	Mini Major - Mechanical Plant	27	27	-	-
	Supermarket - Bin Collection	3	3	3	39
	Supermarket - Loading Bay	41	41	41	51
	Supermarket - Mechanical Plant	40	40	36	36
NSR 3 Second Floor	Cumulative	51	50	45	-
	Car Park	11	9	-	21
	Central - Mechanical Plant	47	47	20	40
	Common Areas - Mechanical Plant	28	28	13	13
	Discount Store - Loading Bay	43	16	16	53
	Discount Store - Mechanical Plant	25	25	20	20
	Food Beb - Patrons	26	24	13	9
	Fresh Food - Mechanical Plant	39	39	38	38
	Kitchen - Mechanical Plant	37	37	-	-
	Mini Major - Bin Collection	9	9	9	46
	Mini Major - Loading Bay	38	37	37	52
	Mini Major - Mechanical Plant	30	30	-	-
	Supermarket - Bin Collection	3	3	3	39
	Supermarket - Loading Bay	42	42	42	51



Receptor	Noise source group	LAeq,Adj,15min dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
NSR 4 Ground Floor	Supermarket - Mechanical Plant	41	41	37	37
	Cumulative	51	49	47	-
	Car Park	4	3	-	11
	Central - Mechanical Plant	41	41	12	32
	Common Areas - Mechanical Plant	20	20	11	10
	Discount Store - Loading Bay	48	26	26	62
	Discount Store - Mechanical Plant	20	20	14	13
	Food & Beverage – Patrons	20	18	7	2
	Fresh Food - Mechanical Plant	34	34	32	32
	Kitchen - Mechanical Plant	28	28	-	-
	Mini Major - Bin Collection	12	12	12	49
	Mini Major - Loading Bay	42	41	41	57
	Mini Major - Mechanical Plant	21	21	-	-
	Supermarket - Bin Collection	6	6	6	43
	Supermarket - Loading Bay	46	46	46	55
	Supermarket - Mechanical Plant	40	40	36	36
NSR 4 First Floor	Cumulative	53	51	48	-
	Car Park	8	6	-	15
	Central - Mechanical Plant	46	46	18	38
	Common Areas - Mechanical Plant	24	24	17	17
	Discount Store - Loading Bay	48	26	26	62
	Discount Store - Mechanical Plant	25	25	19	19
	Food Beb - Patrons	23	21	10	6
	Fresh Food - Mechanical Plant	40	40	38	38
	Kitchen - Mechanical Plant	33	33	-	-
	Mini Major - Bin Collection	13	13	13	49
	Mini Major - Loading Bay	42	41	41	58
	Mini Major - Mechanical Plant	26	26	-	-
	Supermarket - Bin Collection	5	5	5	42
	Supermarket - Loading Bay	46	46	46	55
	Supermarket - Mechanical Plant	41	41	37	37
NSR 4 Second Floor	Cumulative	53	51	48	62
	Car Park	10	8	-	17
	Central - Mechanical Plant	47	47	20	40
	Common Areas - Mechanical Plant	28	28	20	20
	Discount Store - Loading Bay	48	26	26	62



Receptor	Noise source group	L _{Aeq,Adj,15min} dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
	Discount Store - Mechanical Plant	26	26	21	20
	Food Beb - Patrons	25	24	12	9
	Fresh Food - Mechanical Plant	41	41	39	39
	Kitchen - Mechanical Plant	37	37	-	-
	Mini Major - Bin Collection	13	13	13	50
	Mini Major - Loading Bay	42	41	41	58
	Mini Major - Mechanical Plant	29	29	-	-
	Supermarket - Bin Collection	7	7	7	44
	Supermarket - Loading Bay	46	46	46	55
	Supermarket - Mechanical Plant	41	41	38	37
NSR 5 Ground Floor	Cumulative	57	53	52	-
	Car Park	7	6	-	15
	Central - Mechanical Plant	45	45	16	36
	Common Areas - Mechanical Plant	20	20	15	15
	Discount Store - Loading Bay	54	39	39	76
	Discount Store - Mechanical Plant	19	19	14	13
	Food & Beverage – Patrons	23	21	10	7
	Fresh Food - Mechanical Plant	39	39	36	36
	Kitchen - Mechanical Plant	29	29	-	-
	Mini Major - Bin Collection	17	17	17	54
	Mini Major - Loading Bay	48	47	47	66
	Mini Major - Mechanical Plant	23	23	0	0
	Supermarket - Bin Collection	12	12	12	49
	Supermarket - Loading Bay	50	50	50	61
	Supermarket - Mechanical Plant	41	41	37	36
NSR 5 First Floor	Cumulative	57	54	52	-
	Car Park	9	8	-	18
	Central - Mechanical Plant	46	46	18	38
	Common Areas - Mechanical Plant	23	23	16	16
	Discount Store - Loading Bay	54	39	39	76
	Discount Store - Mechanical Plant	24	24	19	19
	Food Beb - Patrons	24	23	11	10
	Fresh Food - Mechanical Plant	40	40	37	37
	Kitchen - Mechanical Plant	33	33	-	-
	Mini Major - Bin Collection	18	18	18	55
	Mini Major - Loading Bay	48	47	47	66



Receptor	Noise source group	LAeq,Adj,15min dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
	Mini Major - Mechanical Plant	25	25	-	-
	Supermarket - Bin Collection	12	12	12	49
	Supermarket - Loading Bay	50	50	50	61
	Supermarket - Mechanical Plant	42	42	38	37
NSR 5 Second Floor	Cumulative	57	54	53	-
	Car Park	11	10	-	22
	Central - Mechanical Plant	48	48	19	39
	Common Areas - Mechanical Plant	26	26	18	18
	Discount Store - Loading Bay	54	39	39	76
	Discount Store - Mechanical Plant	25	25	21	20
	Food Beb - Patrons	26	25	14	13
	Fresh Food - Mechanical Plant	40	40	38	38
	Kitchen - Mechanical Plant	35	35	-	-
	Mini Major - Bin Collection	18	18	18	55
	Mini Major - Loading Bay	48	47	47	65
	Mini Major - Mechanical Plant	27	27	-	-
	Supermarket - Bin Collection	14	14	14	51
	Supermarket - Loading Bay	51	51	51	61
	Supermarket - Mechanical Plant	43	43	38	38
NSR 6 Ground Floor	Cumulative	63	62	62	-
	Car Park	8	6	-	18
	Central - Mechanical Plant	46	46	17	37
	Common Areas - Mechanical Plant	18	18	17	16
	Discount Store - Loading Bay	53	36	36	73
	Discount Store - Mechanical Plant	21	21	16	16
	Food & Beverage – Patrons	23	21	10	10
	Fresh Food - Mechanical Plant	37	37	36	36
	Kitchen - Mechanical Plant	28	28	-	-
	Mini Major - Bin Collection	30	30	30	67
	Mini Major - Loading Bay	55	54	54	71
	Mini Major - Mechanical Plant	22	22	-	-
	Supermarket - Bin Collection	32	32	32	68
	Supermarket - Loading Bay	61	61	61	69
	Supermarket - Mechanical Plant	39	39	36	35
NSR 6 First Floor	Cumulative	63	62	62	-
	Car Park	10	8	-	20



Receptor	Noise source group	LAeq,Adj,15min dBA			L _{Amax} dBA
		Day Limit: 46 dBA	Evening Limit: 46 dBA	Night Limit: 38 dBA	Night Limit: 52 dBA Average 15 loudest events 60 dBA Maximum
	Central - Mechanical Plant	47	47	18	38
	Common Areas - Mechanical Plant	24	24	23	23
	Discount Store - Loading Bay	53	36	36	73
	Discount Store - Mechanical Plant	22	22	17	17
	Food Beb - Patrons	25	23	12	12
	Fresh Food - Mechanical Plant	41	41	39	39
	Kitchen - Mechanical Plant	31	31	-	-
	Mini Major - Bin Collection	33	33	33	70
	Mini Major - Loading Bay	55	54	54	71
	Mini Major - Mechanical Plant	24	24	-	-
	Supermarket - Bin Collection	32	32	32	68
	Supermarket - Loading Bay	62	62	62	69
	Supermarket - Mechanical Plant	40	40	37	36
	Cumulative	63	62	62	-
NSR 6 Second Floor	Car Park	11	10	-	22
	Central - Mechanical Plant	48	48	19	39
	Common Areas - Mechanical Plant	25	25	23	23
	Discount Store - Loading Bay	53	36	36	73
	Discount Store - Mechanical Plant	23	23	18	18
	Food Beb - Patrons	26	25	14	14
	Fresh Food - Mechanical Plant	42	42	40	40
	Kitchen - Mechanical Plant	32	32	-	-
	Mini Major - Bin Collection	33	33	33	70
	Mini Major - Loading Bay	55	54	54	70
	Mini Major - Mechanical Plant	24	24	-	-
	Supermarket - Bin Collection	32	32	32	68
	Supermarket - Loading Bay	61	61	61	69
	Supermarket - Mechanical Plant	41	41	38	37



7.0 Conclusion

An operational noise impact assessment has been conducted for the proposed commercial development known as North Shore Central, to be located at 13 Market Street, Burdell QLD, on Lot 869 on SP361255. The assessment was conducted to address the requirements of the Townsville City Plan 2014 - *Development Manual Planning Scheme Policy (PSP)* – SC6.4.19 *Noise and Vibration*.

Long-term unattended noise monitoring was conducted on site to quantify representative pre-development noise levels, which were used to determine the Project assessment noise limits. Following this, a noise model was developed to predict the potential operational noise impacts from the Project, which were assessed against the noise limits.

To meet the noise emissions to compliant noise levels at the existing Noise Sensitive Receptors located Northwest of the Project, the following is recommended to be implemented, as a minimum:

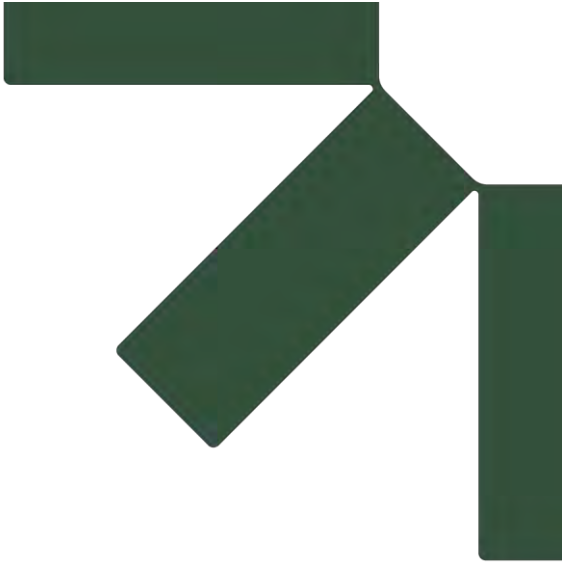
- 1 Implement an operational plan for the supermarket to limit the arrival of deliveries with refrigerated trucks to one (1) truck per any 15-minute interval, between 10pm and 7am.
- 2 Operate trucks with non-tonal, broadband type reversing alarms.
- 3 Manage the loading bay noise emission by conducting the unloading of goods with the truck engine and refrigeration unit OFF. Apply adequate signage in visible areas to remind supermarket operators and truck drivers.
- 4 Design the mechanical plant with the required noise controls to meet the noise limits in **Table 6** for the residual noise after the management of the loading bay noise emission.

The above noise mitigation measures will also reduce the noise impacts at the Future Development Area, where this is developed for residential use west of the loading bays. Whilst not part of the North Shore Central application, the Future Development Area may be designed and built to achieve suitable internal noise limits (not considered in this assessment) with the introduction of architectural treatments to the building facades, in addition to the above minimum noise mitigation measures.

Similarly, noise impacts onto sensitive areas located at the Future Development Area East of North Shore Central may be managed via suitable location of childcare playgrounds and other sensitive internal spaces facing away from the noise sources and/or screened by other intervening buildings, and by the implementation of acoustic treatments to the building facades.

In summary, it is expected that the noise impacts from North Shore Central can be controlled to manage levels at external Noise Sensitive Receptors via the implementation of reasonable and feasible noise mitigation measures, such as those presented in this assessment.





Appendix A Glossary of Terms

North Shore Central, Townsville

Environmental Noise Assessment

Oreana Project Management Pty Ltd

SLR Project No.: 620.042760.00001

4 March 2026



Sound Level (or Noise Level)

The terms sound and noise are almost interchangeable, except that in common usage noise is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear (and those of other species) responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (dB or dBL) scale reduces this ratio to a more manageable size by the use of logarithms.

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 human hearing.

Change in Sound Pressure Levels

For human perception, a change of 1 dBA or 2 dBA in the level of a sound is considered to be indiscernible, while a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. As noted in Section 2.4 of the TMR CoP Vol 1, while the above noted changes in sound pressure level are not precisely verifiable for road traffic noise, it is useful in understanding the significance of change in environmental noise exposure.

Additional facts about road traffic noise as stated in Section 2.4 of the TMR CoP Vol 1:

- A 3 dBA change in noise level is equivalent to halving or doubling the traffic volumes.
- A 10 dBA change in noise level is equivalent to halving or doubling the subjective or perceived loudness or a tenfold increase or decrease in traffic volume.
- A 10 km/h increase in speed will increase the noise level by approximately 1 dBA.
- A 3.5% compound annual growth rate in traffic will increase the noise level by approximately 1.5 dBA over a 10-year horizon.
- An 8% compound annual growth rate in traffic will increase the noise level by approximately 3.0 dBA over a 10-year horizon.

Typical Sound Pressure Levels

The table below lists examples of typical sound pressure levels.

Table A-1 Examples of Perceived Sound Pressure Levels

Sound pressure level (dBA)	Typical Example
130	Threshold of pain
120	Metal hammering
110	Grinding on steel
100	Loud car horn at 3 metres (m)
90	Dog bark at 1 m
80	Cicadas at 1 m
70	Noise level directly adjacent to a busy main road
60	Ambient noise level in urban area close to main roads



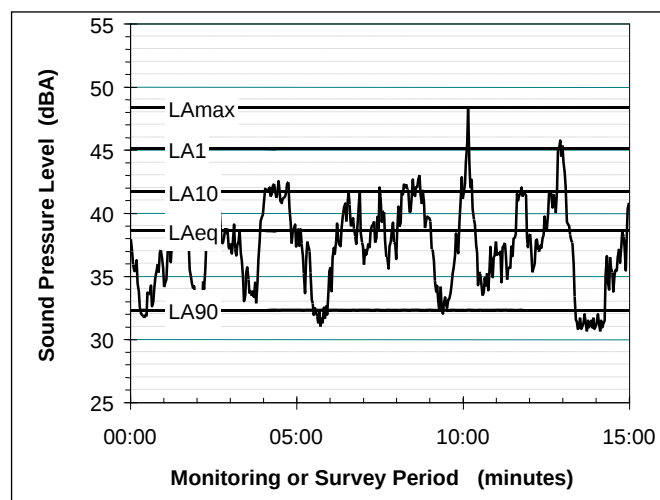
Sound pressure level (dBA)	Typical Example
50	Day time in a quiet suburban environment with background or distant road traffic noise
40	Night-time in a quiet suburban environment with background or distant road traffic noise Ambient noise level in rural to semi-rural environments with light breezes and some noise from insects, birds and distant traffic
30	Ambient noise level in a typical rural noise environment in the absence of insect noise and wind. Inside bedroom
20	Ambient noise level in remote rural environment away from main roads with no wind and no insect noise

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 and LA10 the noise exceeded for 10% of the time.

Figure A-1 below presents a hypothetical 15-minute noise measurement, illustrating various common statistical indices of interest.

Figure A-1 Hypothetical 15-minute Noise Measurement



Of particular relevance to this study, are:

- LA10: The A-weighted noise level exceeded for 10% during any given measurement period. This is commonly referred to as the average maximum noise level.

Additionally;

- LA10(18hour) Road Traffic Noise Level: the level exceeded for 10% of any measurement period; the usual period of measurement is 1 hour. The hourly LA10 level, therefore, is the traffic noise level exceeded for 6 minutes in the hour. The 18-hour LA10 level



(LA₁₀(18hour)) is the arithmetic average of 18, hourly LA₁₀ traffic noise levels measured in consecutive hours between 6:00 am and 12:00 midnight.

- LA₁₀(12hour) Road Traffic Noise Level – is the arithmetic average of 12 hourly LA₁₀ traffic noise levels measured in consecutive hours between 6:00 am and 6:00 pm.
- LA₁(1hour) Road Traffic Noise Level – the level exceeded for n% of a 1-hour period.

Noise Propagation

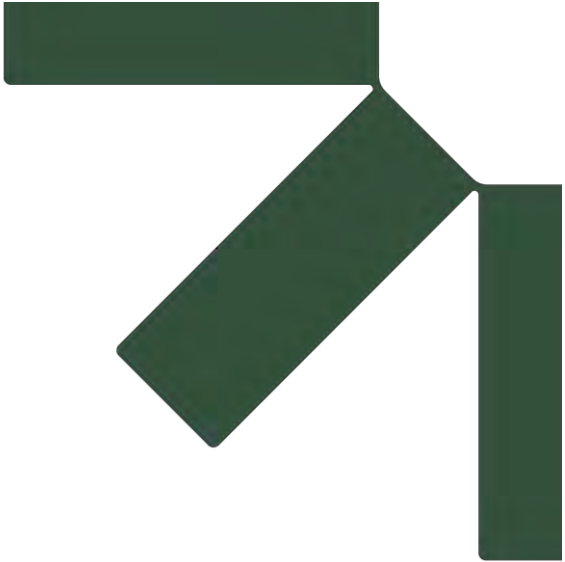
Provided the receptor is in the far-field of the noise source, noise levels will reduce as a receptor moves further away from the source. This is due to spreading of the noise source energy over distance. For a simple point source (for example, a motor) the theoretical reduction in noise levels is 6 dBA per doubling of distance. For a line source (for example, a busy road) the theoretical reduction is 3 dBA per doubling of distance. In reality however other factors affect noise propagation. These include ground absorption, air absorption, acoustic screening, and meteorological effects.

Facade Corrected versus Free field

A 'facade corrected' measurement/monitoring location is a location which is influenced by facade reflections. Measurements at facades are typically taken at a distance of 1 m away and the measured noise level generally regarded as being +2.5 dB higher than in the 'free field'.

A 'free field' measurement/monitoring location is a location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise. This is typically regarded as a position 3.5 m or greater from a reflective surface.





Appendix B Noise Monitoring Results

North Shore Central, Townsville

Environmental Noise Assessment

Oreana Project Management Pty Ltd

SLR Project No.: 620.042760.00001

4 March 2026



Table B-1: Summary of Measured Noise Levels at NM1

Descriptor, dBA	One week average	Fri 21 Nov 2025	Sat 22 Nov 2025	Sun 23 Nov 2025	Mon 24 Nov 2025	Tue 25 Nov 2025	Wed 26 Nov 2025	Thu 27 Nov 2025	Fri 28 Nov 2025	Sat 29 Nov 2025	Sun 30 Nov 2025	Mon 1 Dec 2025
max LAeq,1hr (7am-6pm)	61	-	59	59	60	59	-	67	60	59	-	-
max LAeq,1hr (6pm-10pm)	54	54	54	54	53	53	-	57	55	56	-	-
max LAeq,1hr (10pm-7am)	58	56	58	58	57	-	-	58	60	-	-	-
LAeq,7am-6pm	56	-	55	54	55	56	-	61	55	55	-	-
LAeq,6pm-10pm	52	51	51	51	50	50	-	55	54	55	-	-
LAeq,10pm-7am	52	51	51	53	51	-	-	53	52	-	-	-
min LAeq,1hr (7am-6pm)	48	-	49	43	48	51	-	48	48	50	-	-
min LAeq,1hr (6pm-10pm)	48	47	48	44	44	46	-	53	52	53	-	-
min LAeq,1hr (10pm-7am)	45	46	45	44	41	-	-	48	45	-	-	-
LA90,7am-6pm	44	-	46	42	43	45	-	44	43	43	-	-
LA90,6pm-10pm	44	45	44	42	42	42	-	46	44	47	-	-
LA90,10pm-7am	39	41	38	36	37	-	-	42	38	-	-	-
RBL,7am-6pm	41	-	41	39	41	43	-	43	40	38	-	-
RBL,6pm-10pm	41	43	43	37	39	38	-	44	41	46	-	-
RBL,10pm-7am	33	38	33	29	32	-	-	38	32	-	-	-

One week averages were obtained from the available data, up to seven days including weekends.



Figure B-1 Time Trace of Relevant Noise Descriptors at NM1

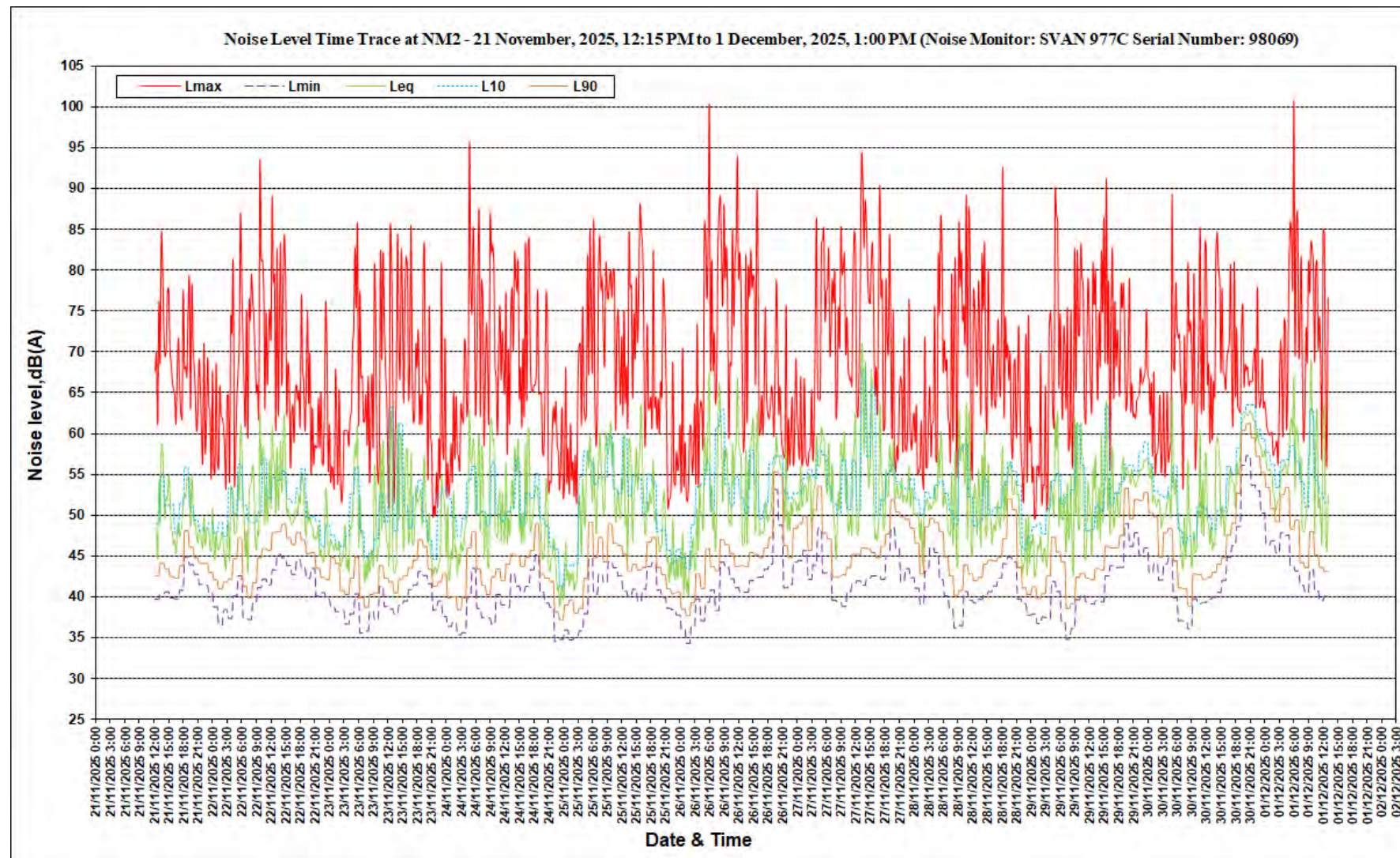


Table B-2: Summary of Measured Noise Levels at NM2

Descriptor, dBA	One week average	Fri 21 Nov 2025	Sat 22 Nov 2025	Sun 23 Nov 2025	Mon 24 Nov 2025	Tue 25 Nov 2025	Wed 26 Nov 2025	Thu 27 Nov 2025	Fri 28 Nov 2025	Sat 29 Nov 2025	Sun 30 Nov 2025	Mon 1 Dec 2025
max L _{Aeq,1hr} (7am-6pm)	52	-	50	46	47	56	-	57	53	56	-	-
max L _{Aeq,1hr} (6pm-10pm)	49	47	55	44	46	48	-	49	51	52	-	-
max L _{Aeq,1hr} (10pm-7am)	49	50	49	48	52	-	-	50	45		-	-
L _{Aeq,7am-6pm}	47	-	41	38	39	40	-	42	37	38	-	-
L _{Aeq,6pm-10pm}	46	41	42	39	37	38	-	41	37	44	-	-
L _{Aeq,10pm-7am}	44	36	31	31	32	-	-	37	34		-	-
min L _{Aeq,1hr} (7am-6pm)	43	-	44	41	42	44	-	46	42	42	-	-
min L _{Aeq,1hr} (6pm-10pm)	44	45	47	42	40	41	-	47	43	47	-	-
min L _{Aeq,1hr} (10pm-7am)	38	42	36	36	36	-	-	42	38		-	-
L _{A90,7am-6pm}	41	-	43	39	41	43	-	43	40	41	-	-
L _{A90,6pm-10pm}	41	43	43	40	40	41	-	44	40	47	-	-
L _{A90,10pm-7am}	38	40	37	37	36	-	-	39	37		-	-
RBL _{7am-6pm}	39	-	41	38	39	40	-	42	37	38	-	-
RBL _{6pm-10pm}	39	41	42	39	37	38	-	41	37	44	-	-
RBL _{10pm-7am}	33	36	31	31	32	-	-	37	34		-	-

One week averages were obtained from the available data, up to seven days including weekends.



Figure B-2 Time Trace of Relevant Noise Descriptors at NM2

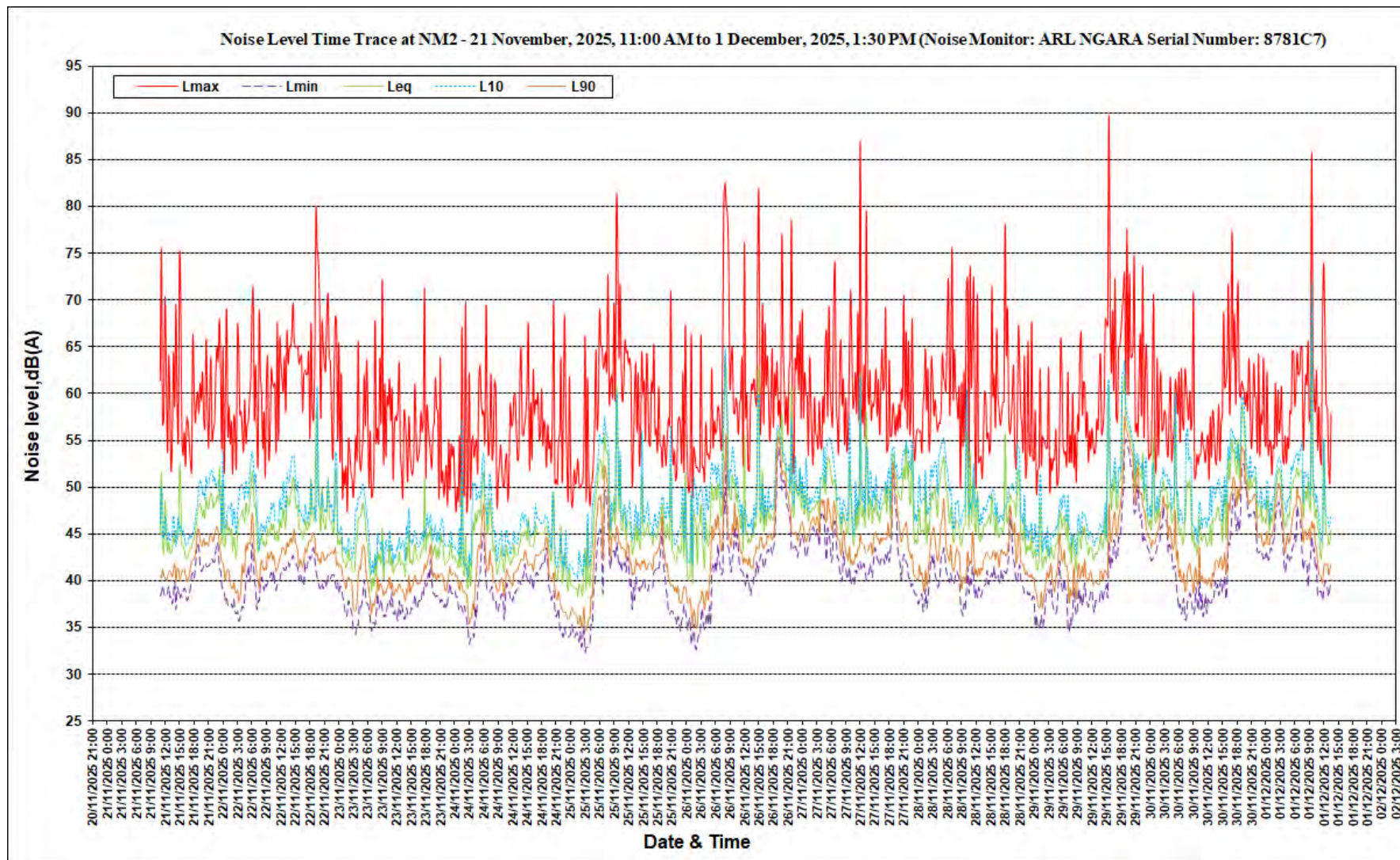


Table B-3: BoM weather observations during monitoring (monitored days circled)

Townsville, Queensland
November 2025 Daily Weather Observations



Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm						
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP	
		°C	°C					km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa	
1	Sa	26.6	33.2	0			ENE	44	12:51	30.4	67		NE	17	1016.3	31.0	63		NE	30	1013.9	
2	Su	25.5	33.7	0			NNE	35	11:11	30.5	57	2	N	17	1014.1	31.9	52	6	NNE	24	1010.2	
3	Mo	26.9	33.5	0			W	43	18:49	30.0	65	8	NNE	28	1011.9	31.9	56		NE	24	1008.4	
4	Tu	24.4	34.6	0			ENE	37	14:40	30.6	43	7	SSE	19	1013.1	32.2	47		ENE	28	1008.9	
5	We	24.4	33.4	0			NE	33	10:36	30.5	59	3	NE	13	1012.8	31.5	58	2	NNE	19	1009.1	
6	Th	24.6	33.5	0			NE	37	10:20	31.3	62	1	ENE	24	1012.7	31.3	60		NE	28	1010.1	
7	Fr	26.4	32.4	0			ENE	41	09:25	30.9	56	8	NNE	20	1013.9	30.1	54	8	NE	24	1011.2	
8	Sa	24.9	32.3	0			NE	44	12:16	30.1	52		NNE	17	1013.8	30.3	57		ENE	28	1010.3	
9	Su	24.3	32.4	0			NE	35	12:41	28.9	62	8	ENE	11	1012.2	29.0	62	6	NNW	17	1008.6	
10	Mo	22.0	32.1	24.2			NE	31	12:32	27.9	74			Calm	1012.0	31.1	61		NNE	15	1007.8	
11	Tu	23.1	32.7	0			ENE	35	13:44	30.2	59	3	NE	13	1012.1	30.2	60		ENE	26	1008.9	
12	We	24.5	32.0	7.0			ENE	43	23:30	30.1	69	1	ENE	17	1013.3	29.3	67	1	ENE	28	1010.7	
13	Th	26.0	33.1	0			ENE	44	01:30	30.0	55	8	NE	28	1014.3	29.8	57	2	ENE	26	1011.2	
14	Fr	25.9	30.8	0			NNE	37	12:07	28.6	62	8	N	20	1013.5	28.8	58	8	NNE	20	1010.4	
15	Sa	24.6	32.4	0			N	41	14:45	29.4	62	1	NNE	17	1013.7	30.5	52	2	N	20	1010.3	
16	Su	25.9	33.2	0			ENE	33	12:51	29.3	68	8	NNE	17	1012.4	30.1	60		NNE	20	1007.6	
17	Mo	24.4	34.3	2.2			SW	37	12:16	27.6	70	7	WSW	11	1010.2	33.9	37	8	S	17	1005.4	
18	Tu	19.8	36.1	0			NNE	35	10:14	30.7	59		WSW	9	1008.0	34.9	21		NE	19	1003.8	
19	We	23.0	33.1	0			ENE	35	13:19	30.0	64		NE	19	1009.6	32.2	57		ENE	28	1007.1	
20	Th	24.9	32.9	0			ENE	35	12:05	30.3	58		ENE	24	1011.8	30.7	54		NE	22	1009.1	
21	Fr	24.0	32.9	0			ENE	37	13:51	29.7	56		NE	13	1011.2	31.0	50		ENE	26	1008.7	
22	Sa	23.0	33.2	0			ENE	44	13:32	30.0	58	4	E	17	1011.3	30.8	57		NE	30	1008.6	
23	Su	26.3	34.0	0			ENE	35	13:53	30.2	66		NE	17	1011.5	31.5	61		ENE	30	1007.4	
24	Mo	25.9	34.0	0			N	37	17:58	30.0	65	1	N	9	1008.7	31.8	58		N	26	1004.4	
25	Tu	27.0	33.7	0			ENE	35	11:45	30.7	69	8	ENE	19	1009.2	32.5	55		NNW	19	1004.1	
26	We	23.8	32.5	22.8			SE	39	07:27	24.6	94	7	NE	19	1010.1	31.2	65	3	NNE	28	1005.8	
27	Th	24.6	33.1	0.8			NNE	39	11:45	30.5	73	8	NW	15	1010.1	30.9	71	8	N	20	1006.1	
28	Fr	23.5	33.9	1.0			SSE	54	01:02	30.7	64		N	13	1009.1	32.7	58		N	20	1005.8	
29	Sa	27.9	34.3	0			NNE	31	10:50	31.5	67	8	N	15	1009.6	31.3	73	8	E	22	1006.4	
30	Su	26.0	33.5	2.4			N	33	13:36	30.3	72	8	SW	6	1009.1	30.8	71	3	N	20	1005.5	
Statistics for November 2025																						
Mean		24.8	33.2							29.9	63	5		16	1011.7	31.2	57	5		23	1008.2	
Lowest		19.8	30.8							24.6	43	1		Calm	1008.0	28.8	21	1	NNE	15	1003.8	
Highest		27.9	36.1	24.2			SSE	54		31.5	94	8	#	28	1016.3	34.9	73	8	#	30	1013.9	
Total				60.4																		

Observations were drawn from Townsville Aero (station 032040)

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Users of this product are deemed to have read the information and
accepted the conditions described in the notes at
<http://www.bom.gov.au/climate/dwo/IDCJDW0000.pdf>

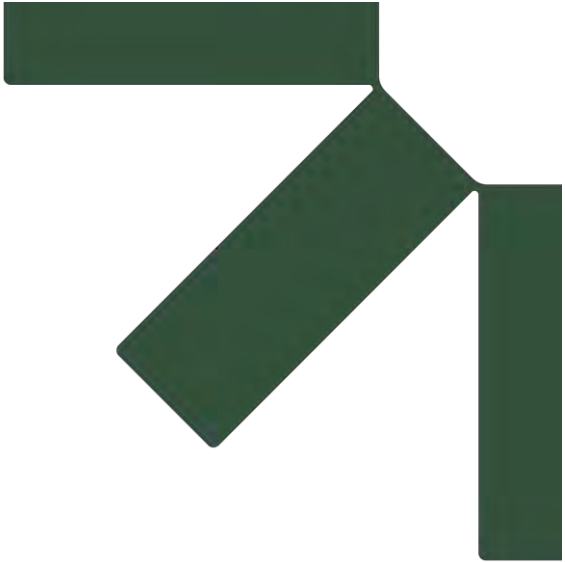


**Townsville, Queensland
December 2025 Daily Weather Observations**Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C					km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	24.6	33.0	33.6			NNE	33	11:43	29.9	69	7	WNW	11	1009.3	31.4	67	1	N	20	1005.0
2	Tu	23.7	36.3	0.2			ENE	48	15:31	32.6	34		S	15	1009.8	32.8	47		ENE	33	1007.0
3	We	25.8	32.1	0			E	54	10:40	30.1	56		E	28	1014.2	30.9	53		E	33	1012.2
4	Th	25.1	31.3	0			ENE	50	16:00	27.9	59	8	ESE	20	1016.9	28.8	57	3	ENE	33	1013.5
5	Fr	22.3	31.5	0			NE	46	14:52	28.4	58	1	SE	17	1016.1	29.6	60		ENE	33	1012.2
6	Sa	21.6	31.9	0			ENE	37	13:06	29.0	53		ESE	20	1013.3	30.2	53		ENE	31	1009.7
7	Su	21.8	31.8	0			NE	37	12:26	28.9	61		ENE	17	1011.3	29.8	58		ENE	28	1007.7
8	Mo	24.8	32.7	0			ENE	43	15:49	29.6	60		ENE	17	1010.5	30.8	58		ENE	28	1008.5
9	Tu	24.1	32.1	0			ENE	41	13:52	29.7	60	3	ESE	17	1013.1	30.9	58		NE	28	1009.8
10	We	23.3	33.0	0			ENE	46	13:59	29.9	56	1	SE	19	1014.2	30.8	51		ENE	33	1011.0
11	Th	24.0	32.4	0			NE	46	14:08	29.6	51		ESE	24	1013.3	30.7	55		ENE	31	1009.1
12	Fr	24.6	32.1	0			ENE	41	10:09	29.7	59	1	E	24	1011.3	30.3	57		NE	28	1007.8
13	Sa	24.8	32.7	0			NNE	39	12:47	29.9	56	2	ENE	15	1011.1	30.6	50		ENE	28	1007.3
14	Su	24.3	33.0	0			NE	31	11:35	30.1	58		ENE	15	1010.6	31.9	51		ENE	17	1006.3
15	Mo	25.8	33.1	0			ENE	39	13:07	31.0	55	1	SE	9	1010.1	31.0	59		NE	30	1007.6
16	Tu	25.7	33.3	0			ENE	50	20:56	29.5	67	8	E	17	1010.7	31.7	59	7	ENE	30	1009.0
17	We	23.5	32.1	6.0			ESE	48	13:10	28.2	70	7	ESE	24	1013.2	30.1	61	8	E	30	1011.5
18	Th	25.7	32.9	0.2			ESE	44	09:44	30.4	61	4	ESE	30	1013.9	32.0	53	5	ENE	31	1010.6
19	Fr	24.3	33.1	0.8			E	43	10:56	29.8	62	1	ESE	28	1011.8	31.4	57		ENE	30	1009.3
20	Sa	25.1	32.5	0			ENE	37	13:22	29.4	63	2	ESE	17	1009.9	31.1	62		ENE	28	1007.7
21	Su	25.1	32.7	0			NE	37	12:38	30.4	62	1	E	17	1009.6	31.0	64		ENE	28	1007.4
22	Mo	25.2	33.6	0			ENE	39	16:52	31.1	64		ENE	15	1009.3	32.7	54		ENE	30	1006.9
23	Tu	26.0	33.9	0			ENE	37	21:52	31.2	67		NE	19	1009.7	32.3	63		NE	28	1006.7
24	We	25.4	33.0	12.4			ENE	44	09:25	30.2	79	4	E	17	1008.9	31.5	68	4	ENE	26	1006.4
25	Th	24.3	31.7	21.8			NE	37	04:21	29.0	77	5	ENE	6	1008.5	30.8	74	4	ENE	17	1004.1
26	Fr	24.8	33.6	31.0			NNW	39	16:08	26.8	91	8	WNW	9	1006.5	32.6	61	7	N	17	1001.9
27	Sa	24.5	31.8	15.2			SSE	52	00:37	28.8	78	7	SSW	6	1007.4	27.2	90	8	SSE	13	1005.5
28	Su	22.7	28.9	54.8			ESE	39	11:44	25.0	88	8	SSE	13	1011.3	27.1	78	8	ESE	22	1009.2
29	Mo	22.9	27.7	7.2			ENE	50	10:20	25.4	83	8	E	26	1011.1	25.7	79	8	ENE	19	1009.0
30	Tu	22.2	28.6	142.2			ESE	54	13:28	26.2	83	8	SE	20	1009.6	25.5	80	8	ESE	28	1007.5
31	We	24.1	25.8	10.0			ENE	43	13:07	24.4	87	8	E	19	1008.6	24.7	94	8	ESE	17	1005.6
Statistics for December 2025																					
Mean		24.3	32.1							29.1	65	4		17	1011.1	30.3	62	6		26	1008.2
Lowest		21.6	25.8							24.4	34	1	#	6	1006.5	24.7	47	1	SSE	13	1001.9
Highest		26.0	36.3	142.2			#	54		32.6	91	8	ESE	30	1016.9	32.8	94	8	#	33	1013.5
Total				335.4																	

Observations were drawn from Townsville Aero (station 032040)

IDCJDW4128.202512 Prepared at 16:02 UTC on 2 Feb 2026
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accepted the conditions described in the notes at
<http://www.bom.gov.au/climate/dwo/IDCJDW0000.pdf>



Appendix C Site Plans

North Shore Central, Townsville

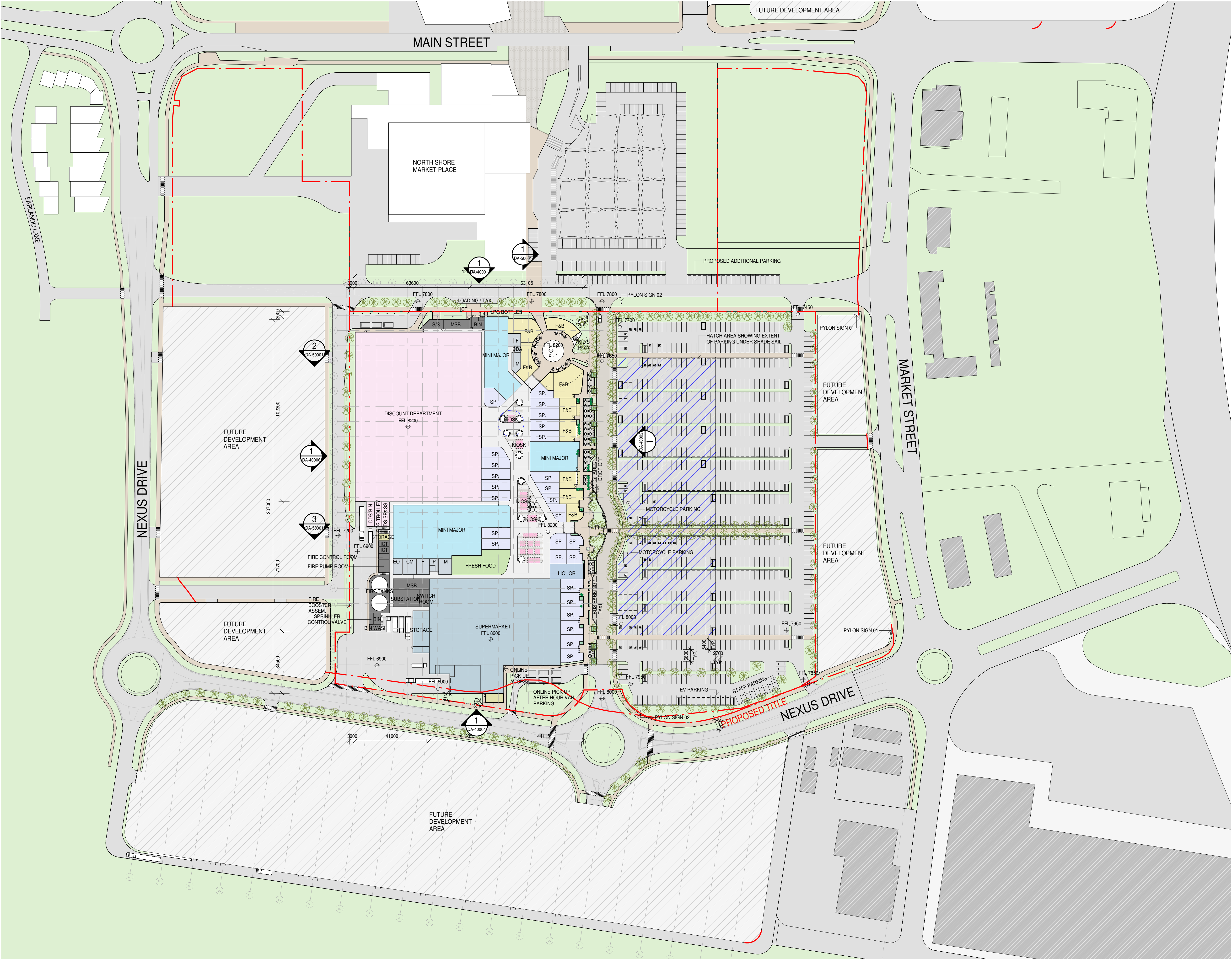
Environmental Noise Assessment

Oreana Project Management Pty Ltd

SLR Project No.: 620.042760.00001

4 March 2026





GFA: 22196m²
SITE COVERAGE: 56498m²

AREA SCHEDULE - GLA	
AREA TYPE	GLA
DISCOUNT DEPARTMENT	6724 m ²
FRESH FOOD	365 m ²
KIOSK	191 m ²
LIQUOR	153 m ²
MINI MAJOR	2666 m ²
SPECIALTY	2338 m ²
SPECIALTY - F&B	1290 m ²
SUPERMARKET	4207 m ²
TOTAL	17954 m ²

PARKING NUMBER	
Description	Count
ACCESSIBLE PARKING	16
ELECTRIC	10
MOTORCYCLE PARKING	10
PARKING WITH PRAMS	12
SENIOR PARKING	10
SHORT TERM PARKING	12
STAFF PARKING	11
STANDARD PARKING	657
TOTAL	738

Rev.	Date	Description	Iss.	Appr.
A	08/02/2026	TOWN PLANNING APPLICATION	LY	

File
Document Set ID: 250030-005 / 250030-R25-North-Shore-Townsville/NTS-BUC-AZ-M6-A-R25-MALL.mt
Version: 1, Version Date: 08/05/2026

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Project
NORTH SHORE CENTRAL

Project Number
250030

Status

Date Plotted
18/02/26 12:43:27 PM

Scale
1 : 1000 @A1

Drawing Title
SITE PLAN

Drawing Number
NTS-BUC-DR-A-DA-20001

Revision
A

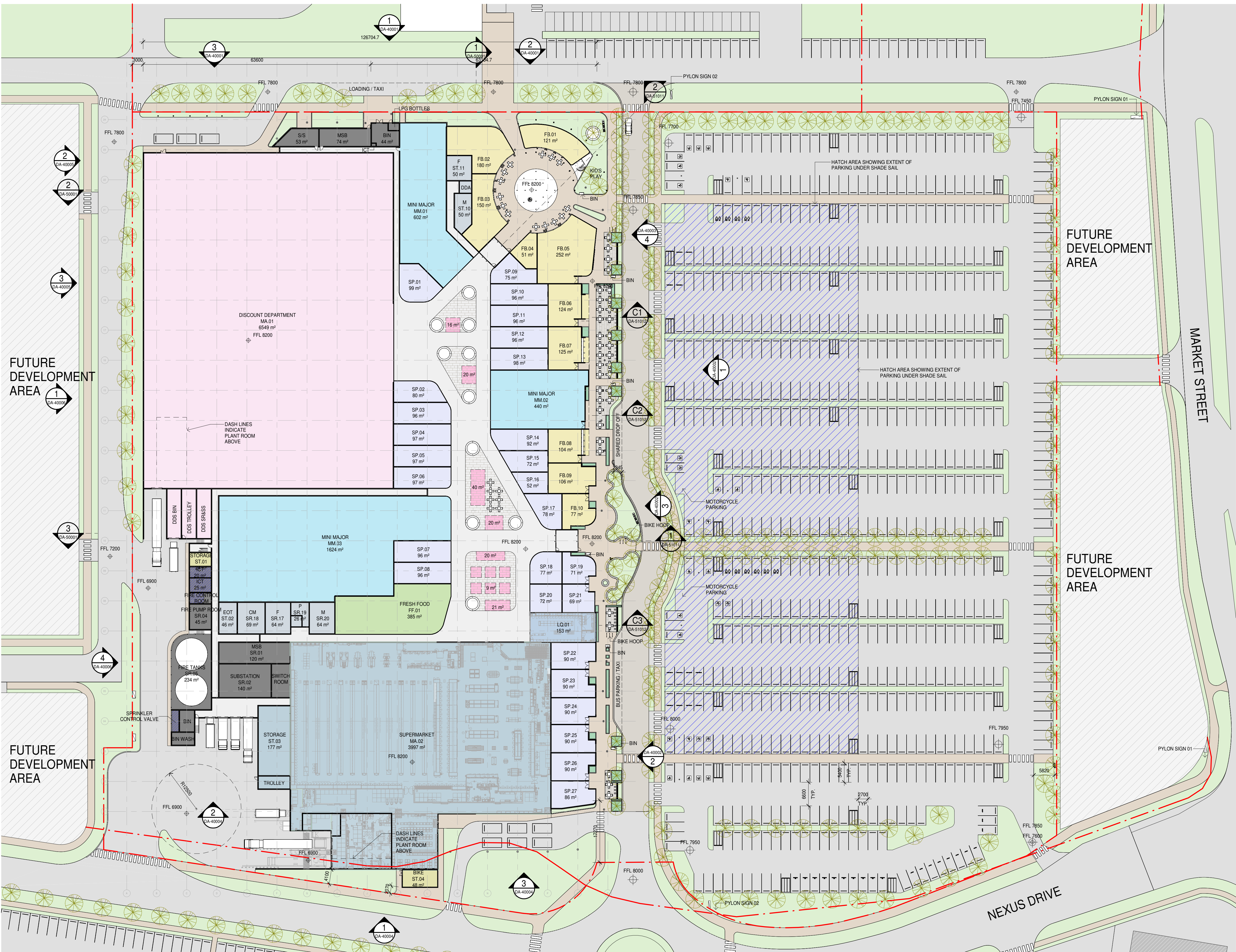
BUCHAN

Melbourne Studio
+ 61 3 9329 1077 / buchan.au

GFA: 22196m²
SITE COVERAGE: 56498m²

AREA SCHEDULE - GLA	
AREA TYPE	GLA
DISCOUNT DEPARTMENT	6724 m ²
FRESH FOOD	385 m ²
KIOSK	191 m ²
LIQUOR	153 m ²
MINI MAJOR	2666 m ²
SPECIALTY	2338 m ²
SPECIALTY - F&B	1290 m ²
SUPERMARKET	4207 m ²
TOTAL	17954 m ²

PARKING NUMBER	
Description	Count
ACCESSIBLE PARKING	16
ELECTRIC	10
MOTORCYCLE PARKING	10
PARKING WITH PRAMS	12
SENIOR PARKING	10
SHORT TERM PARKING	12
STAFF PARKING	11
STANDARD PARKING	657
TOTAL	738



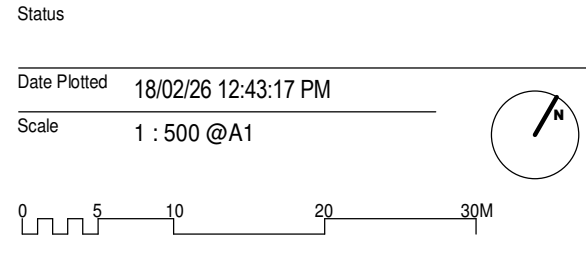
Rev.	Date	Description	Iss.	Appr.
A	08/02/2025	TOWN PLANNING APPLICATION	LY	

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NORTH SHORE CENTRAL

Project Number
250030



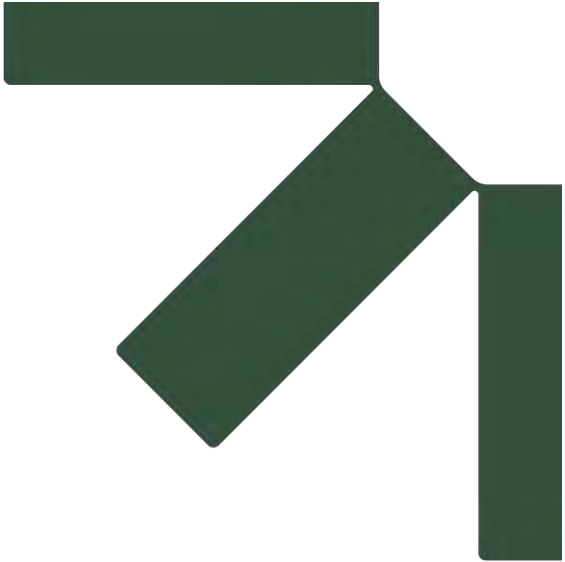
GROUND FLOOR PLAN

Drawing Number
NTS-BUC-DR-A-DA-20002

Revision
A

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Appendix D Noise Contour Maps

North Shore Central, Townsville

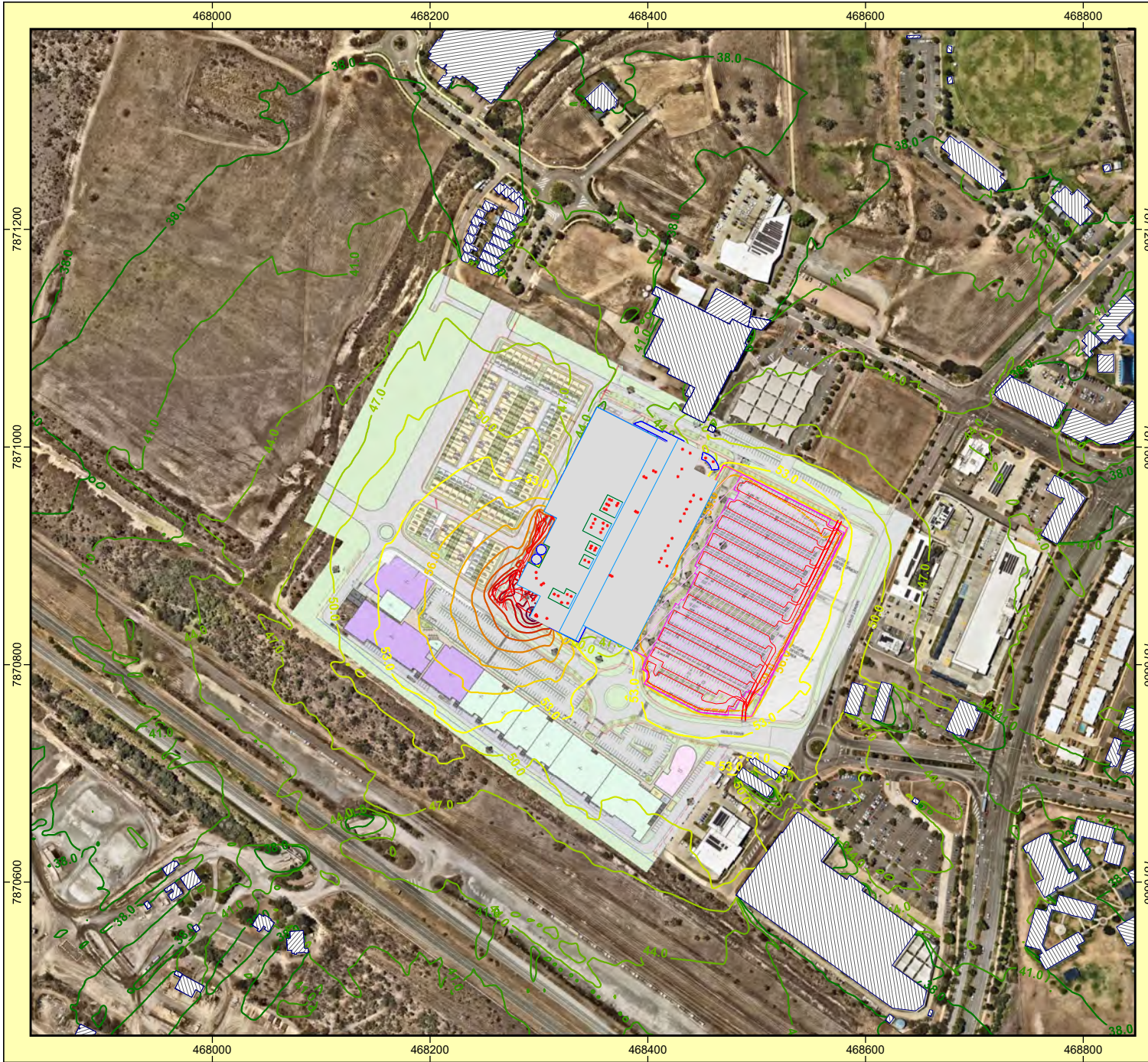
Environmental Noise Assessment

Oreana Project Management Pty Ltd

SLR Project No.: 620.042760.00001

4 March 2026





North Shore Central, Townsville
SLR Ref. No.: 620.042760.00001



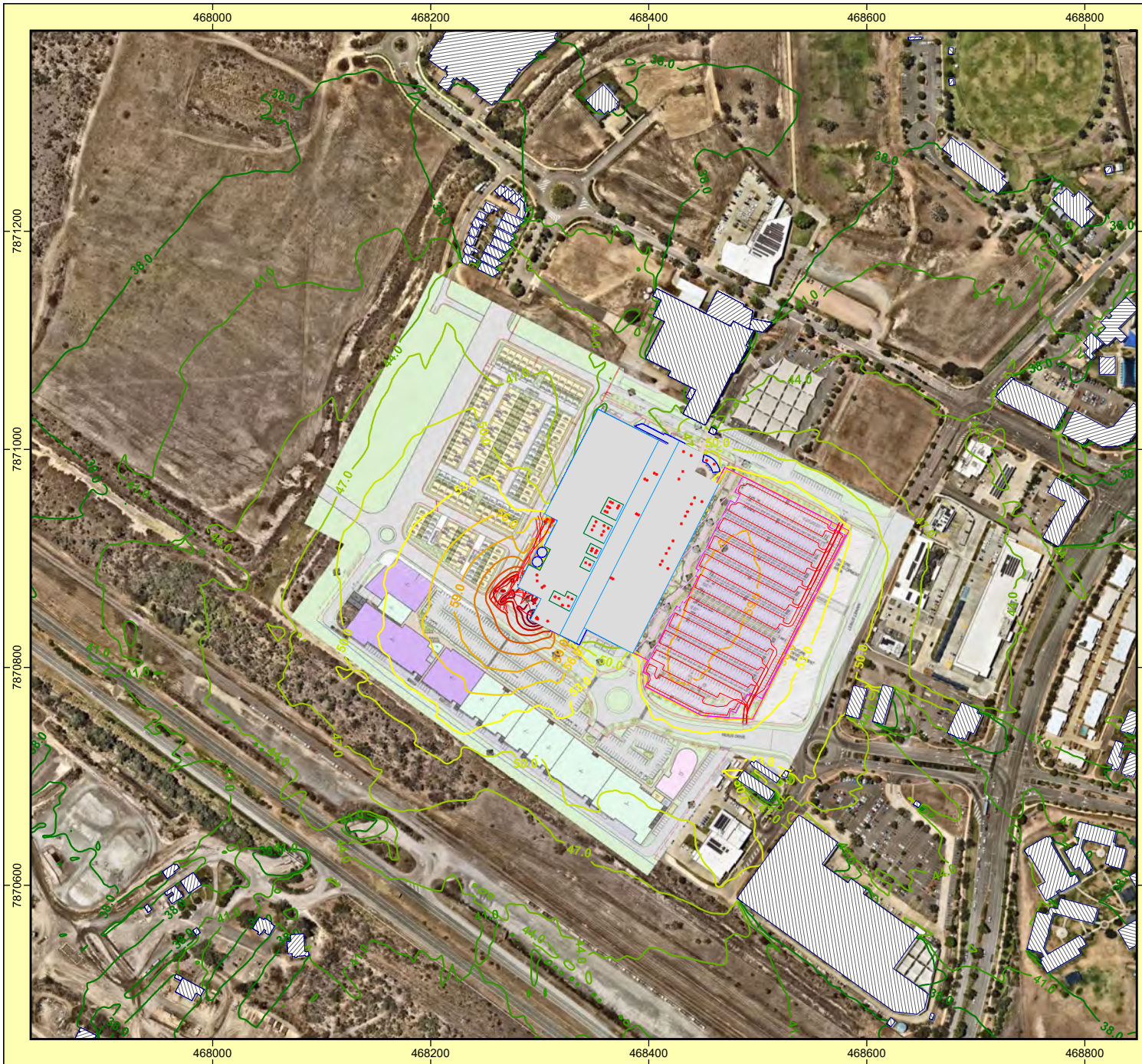
Figure D-1
Cumulative Noise Levels, Daytime (7am-6pm)
LAeq,Adj,15min Ground Floor Noise Levels at 1.8m Above the Ground

Created: 21/02/2026
 Processed with SoundPLAN 8.2, Update 18/10/2024

LAeq,Adj,15min	Signs and symbols
38 < 38	North Shore Central
41 < 41	Rooftop Plant
44 < 44	Car / truck line source
47 < 47	Patron Area source
50 < 50	External Buildings
53 < 53	Mechanical Plant Noise Fence
56 < 56	Mechanical Plant Deck
59 < 59	
62 < 62	
65 < 65	
68 < 68	
71 < 71	
74 < 74	
77 < 77	
80 < 80	

Scale 1:5000
 0 25 50 100 150 200 m



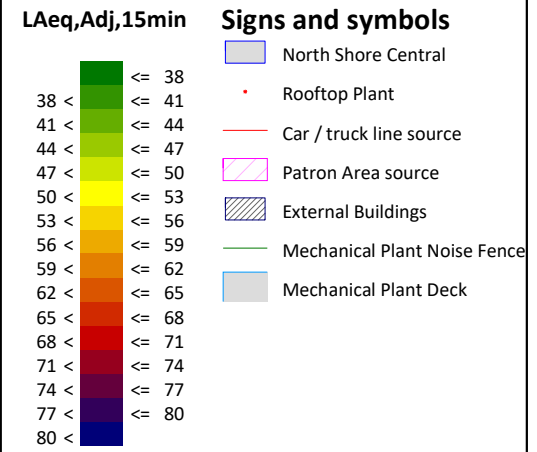


North Shore Central, Townsville
SLR Ref. No.: 620.042760.00001

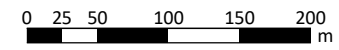


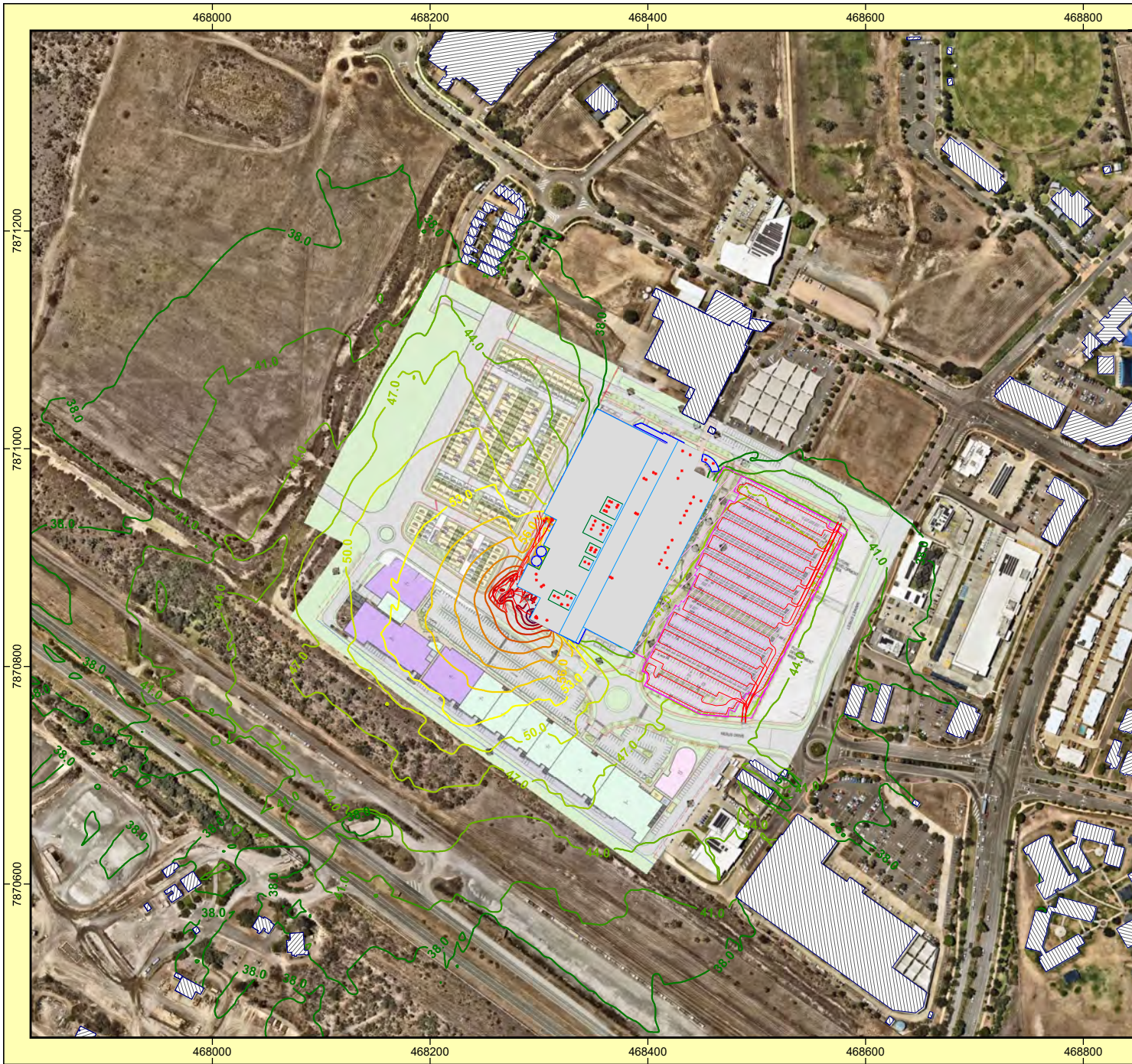
Figure D-2
Cumulative Noise Levels, Evening (6pm-10pm)
LAeq,Adj,15min Ground Floor Noise Levels at 1.8m Above the Ground

Created: 21/02/2026
Processed with SoundPLAN 8.2, Update 18/10/2024



Scale 1:5000



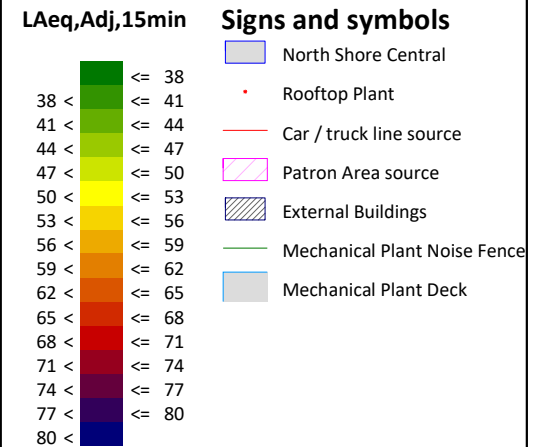


North Shore Central, Townsville
SLR Ref. No.: 620.042760.00001

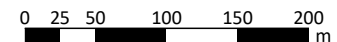


Figure D-3
Cumulative Noise Levels, Night (10pm-7am)
LAeq,Adj,15min Ground Floor Noise Levels at 1.8m Above the Ground

Created: 21/02/2026
Processed with SoundPLAN 8.2, Update 18/10/2024



Scale 1:5000





North Shore Central, Townsville
SLR Ref. No.: 620.042760.00001



Figure D-4
Maximum Noise Levels, Night (10pm-7am)
Lmax Ground Floor Noise Levels at
1.8m Above the Ground

Created: 21/02/2026
 Processed with SoundPLAN 8.2, Update 18/10/2024

Lmax

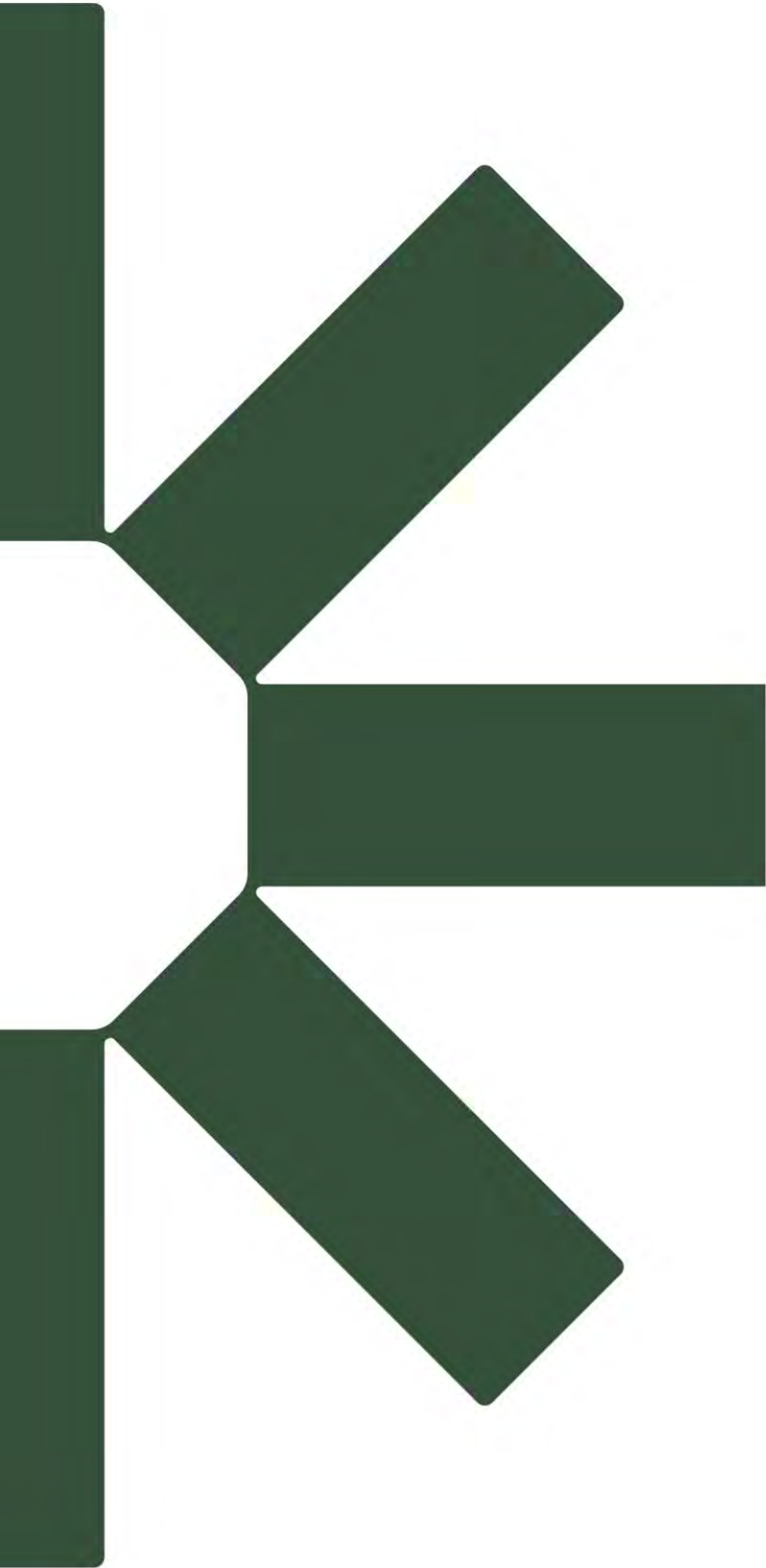
38 <	≤ 38
41 <	≤ 41
44 <	≤ 44
47 <	≤ 47
50 <	≤ 50
53 <	≤ 53
56 <	≤ 56
59 <	≤ 59
62 <	≤ 62
65 <	≤ 65
68 <	≤ 68
71 <	≤ 71
74 <	≤ 74
77 <	≤ 77
80 <	≤ 80

Signs and symbols

- North Shore Central
- Rooftop Plant
- Car / truck line source
- Patron Area source
- External Buildings
- Mechanical Plant Noise Fence
- Mechanical Plant Deck

Scale 1:5000
 0 25 50 100 150 200 m





Making Sustainability Happen