HORSLEY LOGISTICS PARK

SSD 10436
Section 4.55 Modification MOD4
Operational Noise Impact Assessment

Prepared for:

ESR
Level 29
20 Bond Street
Sydney

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BASIS OF REPORT

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19360-R10-v1.0	23 November 2021	Mark Irish	Antony Williams	Mark Irish
610.19360-R10-v0.1	18 November 2021	Mark Irish	Antony Williams	

EXECUTIVE SUMMARY

An operational noise impact assessment has been conducted for the Lot 204 Warehouse A & B design of the Horsley Logistics Park (HLP). The proposed modification entails alterations to the layout of Lot 204 to reflect the needs of future operators of the site, including changes to the size, built form, access and car parking.

Operational Noise Impacts

An analysis of the prevailing weather conditions for the HLP indicated that adverse weather is a feature of the area only during the night-time period.

The operational noise modelling of the Modification 4 Application Masterplan found no exceedances of the Operational Noise Limits at any sensitive receivers under both neutral (day, evening periods) and adverse (night period) weather conditions. Compliance with the sleep disturbance screening criterion in each catchment is also predicted.

Noise Mitigation Measures

The assessment concluded that no additional noise mitigation measures to the approved SSD-10436-Mod-1 Modification 1 Application Masterplan are required.

Comparison with Approved Development

The operational noise impacts at the identified residential receivers are generally predicted to be consistent with the Modification 1 Application Masterplan.

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by ESR to prepare a noise impact assessment for a modification (MOD4) to the Horsley Logistics Park (HLP) Masterplan. This assessment is required to accompany a S4.55 modification (MOD4) of the Development Consent SSD 10436.

The proposed modification includes alterations to the layout of Lot 204 to reflect the needs of future operators of the site, including changes to the size, built form, access and car parking.

The SSDA approved development was assessed in SLR report 610.19360-R02-v2.1 dated 2 November 2020.

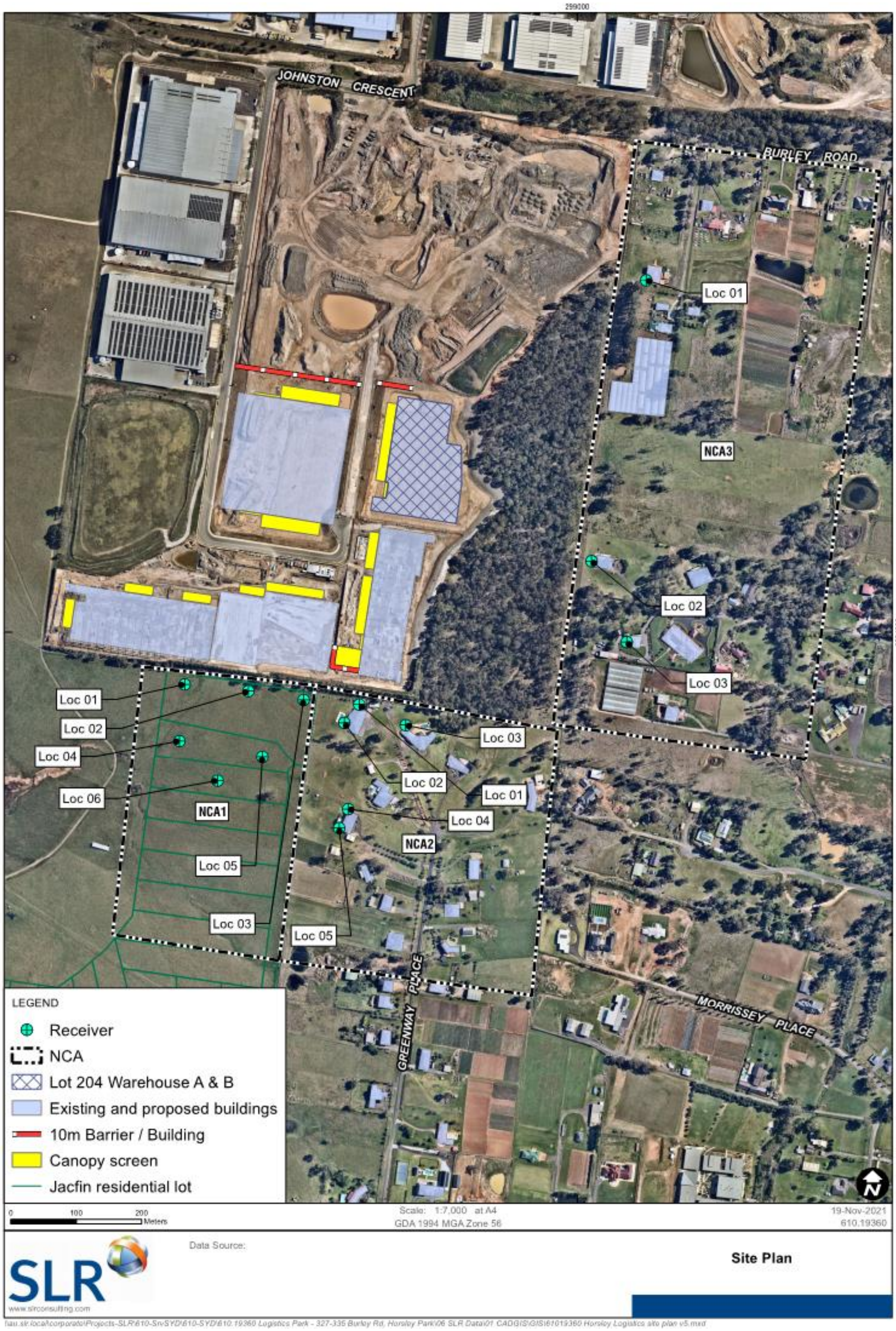
The consent was subsequently modified in Modification 1 Application (MOD1), which was assessed in SLR report 610.19360-R06-v0.1 dated 12 April 2021 and approved under SSD-10436-Mod-1 on 4 August 2021. MOD1 addresses the Lot 201 building form, office fit-out, car parking layout and hardstand arrangements.

This assessment uses specific acoustic terminology. An explanation of common terms is included as **Appendix A**.

1.1 MOD4 Development

The location of the approved development and surrounding receivers are shown in **Figure 1**.

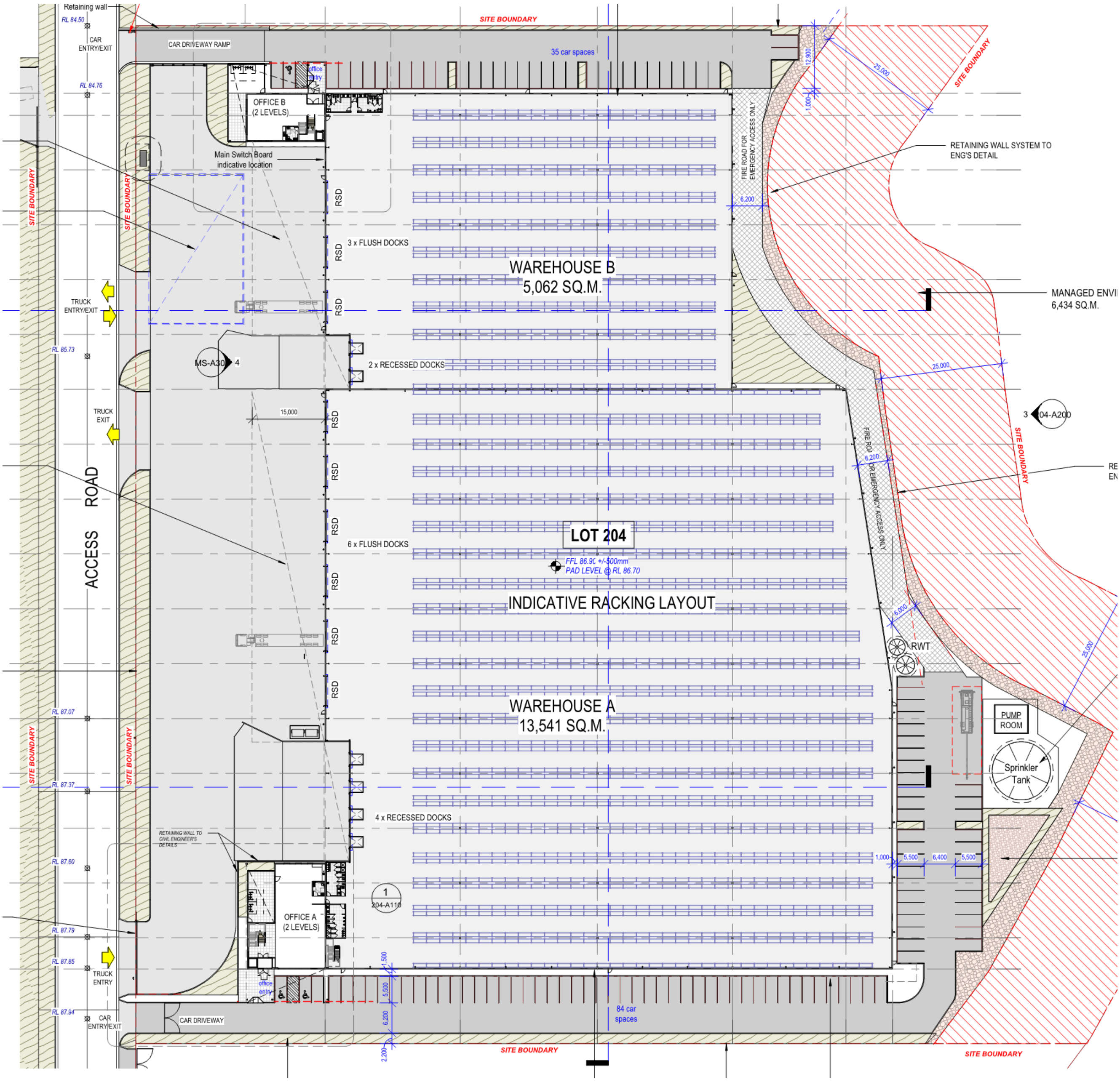
Figure 1 MOD4 Masterplan



1.2 Section 4.55 Modification (MOD4)

The proposed S4.55 modification (MOD4) covers the alterations to the layout of Lot 204 to reflect the needs of future operators of the site, including changes to the size, built form, access and car parking, shown in the Site and Facility plan DA-204-A100 Rev P7 dated 2.11.21, as shown in **Figure 2**.

Figure 2 Lot 204 Warehouse A & B Site and Facility Plan MOD4



2 Operational Noise Limits

The operational noise limits for the HLP are defined in Condition B11 of Development Consent SSD 10436. The operational noise limits for each receiver Noise Catchment Area (NCA) are shown in **Table 1**.

Table 1 Operational Noise Limits

Location	Daytime $L_{Aeq(15minute)}$ (dBA)	Evening $L_{Aeq(15minute)}$ (dBA)	Night-time $L_{Aeq(15minute)}$ (dBA)	Night-time L_{AFmax} (dBA)
NCA1	44	43	38	52
NCA2	40	40	38	52
NCA3	44	43	38	52

3 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).

The *Noise Policy for Industry* (NPfI) contains guidance for determining prevailing weather conditions. The weather conditions at the development site were determined using 12 months of weather data (January 2016 to December 2016) obtained from the Bureau of Meteorology automatic weather station at Horsley Park, which is approximately 6 km to the east of the development. This data was analysed to determine the frequency of noise-enhancing wind and temperature inversion conditions which may affect noise levels at the site.

The analysis indicated that during the daytime and evening periods, winds of up to 3 m/s did not exceed the 30% threshold specified in the NPfI during any season. However, the 30% threshold was exceeded during the night-time period in autumn, in both the south-west and west-south-west directions.

The analysis also indicated that temperature inversions of Class F or Class G are likely to occur for 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.

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

4 Operational Noise Impact Assessment

4.1 Operational Noise Modelling

Noise modelling of the development site was undertaken using the CONCAWE noise prediction algorithms in SoundPLAN modelling software.

A 3D digital noise model was constructed from a combination of aerial photography, existing ground topography, design ground topography, receiver buildings / structures and design plans for the development. Warehouse buildings and office buildings within the HLP have been modelled based on the design plans.

The modelled MOD4 layout is shown in **Figure 2**.

The modelling inputs and source sound power levels (SWL) for each type of noise source associated with Lot 204 Warehouse A & B are summarised in the following sections.

4.1.1 Lot 204 Warehouse A & B Vehicle Numbers

The approved MOD1 heavy vehicle (HV) and light vehicle (LV) volumes for Lot 204 Warehouse A & B are provided in **Table 2** and **Table 3**. All other Lots have been modelled with identical vehicle movements to both the approved SSDA and MOD1.

The modelled line sources were subdivided into the following sections:

- Access road movements at 25 km/h, 20% accelerating driving condition
- Loading and hardstand areas at 5 km/h.

Table 2 Lot 204 Daytime Vehicle Movements

Source	Source SWL, dBA	Number of Vehicles (two way)
204 (A) HV Day Loading	105	4
204 (A) HV Day Road	105 (80%) 111 (20%)	4
204 (B) HV Day Loading	105	3
204 (B) HV Day Road	105 (80%) 111 (20%)	3
204 (A) LV Day Carpark	96	6
204 (A) LV Day Road	96	6
204 (B) LV Day Carpark	96	2
204 (B) LV Day Road	96	2

Table 3 Lot 204 Night-time Vehicle Movements

Source	Source SWL, dBA	Number of Vehicles (two way)
204 (A) HV Day Loading	105	3
204 (A) HV Day Road	105 (80%) 111 (20%)	3
204 (B) HV Day Loading	105	2

Source	Source SWL, dBA	Number of Vehicles (two way)
204 (B) HV Day Road	105 (80%) 111 (20%)	2
204 (A) LV Day Carpark	96	4
204 (A) LV Day Road	96	4
204 (B) LV Day Carpark	96	2
204 (B) LV Day Road	96	2

4.1.2 Area Sources

The area sources associated with each hardstand or loading area are included in **Table 4**.

Table 4 L_{Aeq} Sound Power Levels – Area Sources

Noise Source	Source SWL, dBA	Duration of Use in Peak 15-minute Period, s	Comment
Truck Reversing Alarm	107[1]	60	Applicable to 50% of two way truck movements
Forklift Reversing Alarm	102[1]	90	-
Gas Forklift	93	900	-

Note 1. LAeq sound power level 3 dBA lower than the maximum sound power level

4.1.3 External Point Sources

Each nominal rooftop plant point source is modelled using SWL 90 dB, with a total SWL 95 dB per Lot.

Maximum noise level events are modelled to occur anywhere within the area sources at each hardstand with the SWLs shown in **Table 5**.

Table 5 L_{Amax} Sound Power Levels – Hardstand, Loading Areas and Car Parks

Noise Source	Source SWL, dBA
Air brake	118
Truck Reversing Alarm	110
Forklift Reversing Alarm	105
Car Peak Events	100

It is anticipated that the L_{Aeq} noise contribution from occasional impact sounds due to loading activities would not be significant compared to the dominant sources included in **Table 5**.

The maximum SWL of occasional impact sounds is also considered unlikely to exceed the air brake SWL of 118 dBA in **Table 5** for the sleep disturbance screening assessment.

4.1.4 Nearest Sensitive Receivers

The area surrounding the development has been divided into three Noise Catchment Areas (NCAs). The NCAs and sensitive receivers near to the development are shown in **Figure 1**. NCA1 includes nominal locations of future receivers to the south of the development. NCA2 and NCA3 include existing receivers to the south and east of the development, respectively.

Noise levels have been assessed at the most-affected point at each residential property, see **Figure 1**, and at a height of between 1.2–1.5 m above ground level, in accordance with guidance in the NPfI.

Demonstrating compliance at the nearest receivers as indicated in **Figure 1** will also result in compliance at more distant residential and educational receivers.

4.2 Predicted Operational Noise Impacts

The predicted MOD4 operational noise levels at the most affected receiver in each catchment are summarised in **Table 6**. These predictions also include all external sources of noise from the MOD1 assessment. The indicative 10 m barriers/buildings representing future Stage 3 development are also included in the noise model as shown in **Figure 1**.

Table 6 Predicted Operational Noise Levels – MOD4 Masterplan

NCA	Period (weather)	$L_{Aeq(15minute)}$ Noise Level (dBA)			L_{Amax} Noise Level (dBA)		
		Operational Noise Limit	Predicted	Compliance	Sleep Disturbance Screening Noise Level	Predicted	Compliance
NCA01	Daytime (neutral)	44	36	Yes	n/a[2]	n/a	n/a
	Evening (neutral)	43	36	Yes	n/a[2]	n/a	n/a
	Night-time (noise-enhancing)	38	37	Yes	52	48	Yes
NCA02	Daytime (neutral)	40	38	Yes	n/a[2]	n/a	n/a
	Evening (neutral)	40	38	Yes	n/a[2]	n/a	n/a
	Night-time (noise-enhancing)	38	38	Yes	52	50	Yes
NCA03	Daytime (neutral)	44	35	Yes	n/a[2]	n/a	n/a
	Evening (neutral)	43	35	Yes	n/a[2]	n/a	n/a
	Night-time (noise-enhancing)	38	37	Yes	52	51	Yes

Note 1: **Bold** text indicates an exceedance of the Operational Noise Limits.

The above results indicate that compliance with the Operational Noise Limits is predicted at the most affected receivers in all noise catchments during all periods.

Compliance with the sleep disturbance screening criterion is also predicted, therefore, a detailed maximum noise level assessment is not required.

Noise contours are provided for daytime/evening (neutral weather) in **Figure 3** and night-time (noise-enhancing weather) in **Figure 4.**

Figure 3 Predicted Daytime/Evening Noise Levels – MOD4 Masterplan

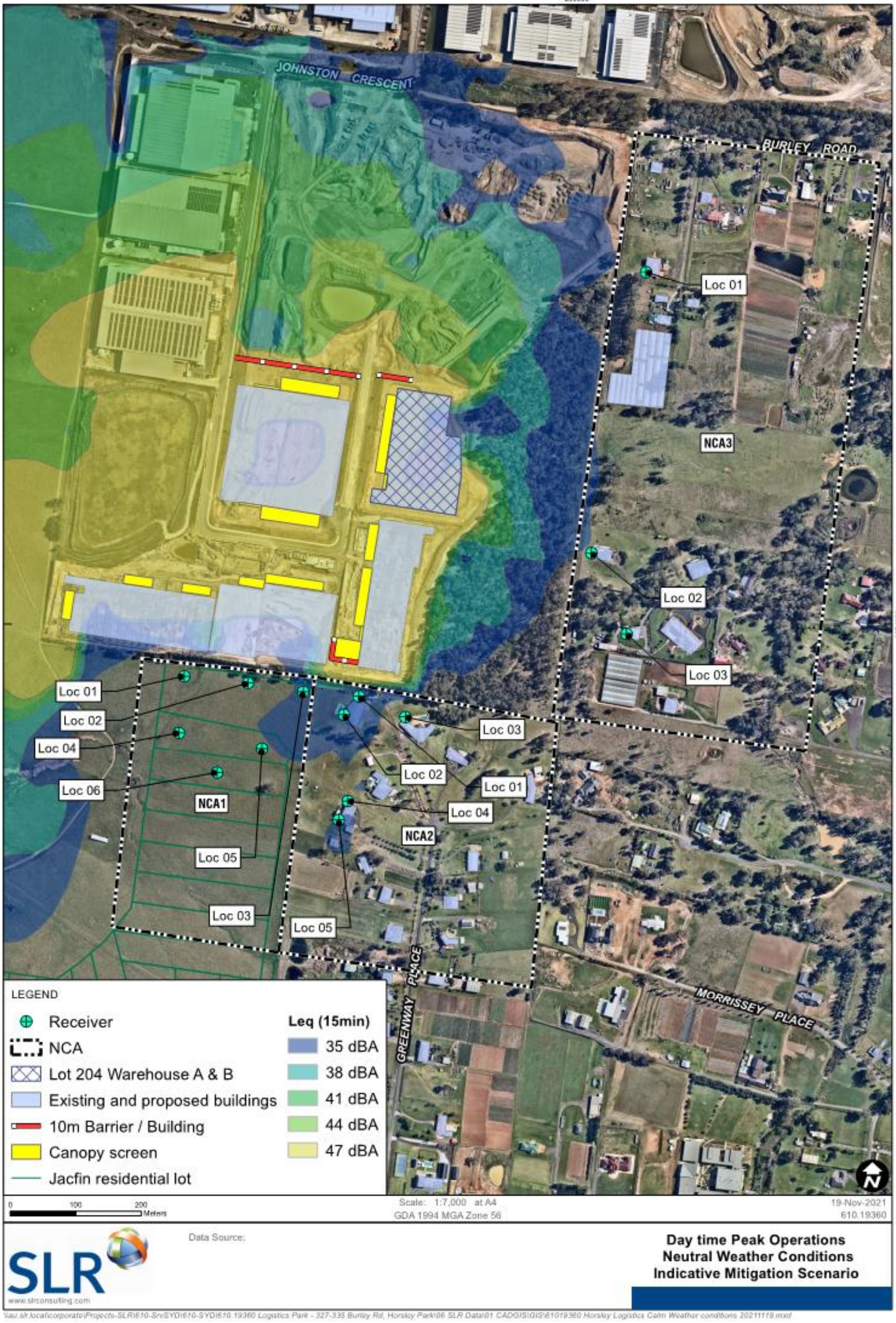
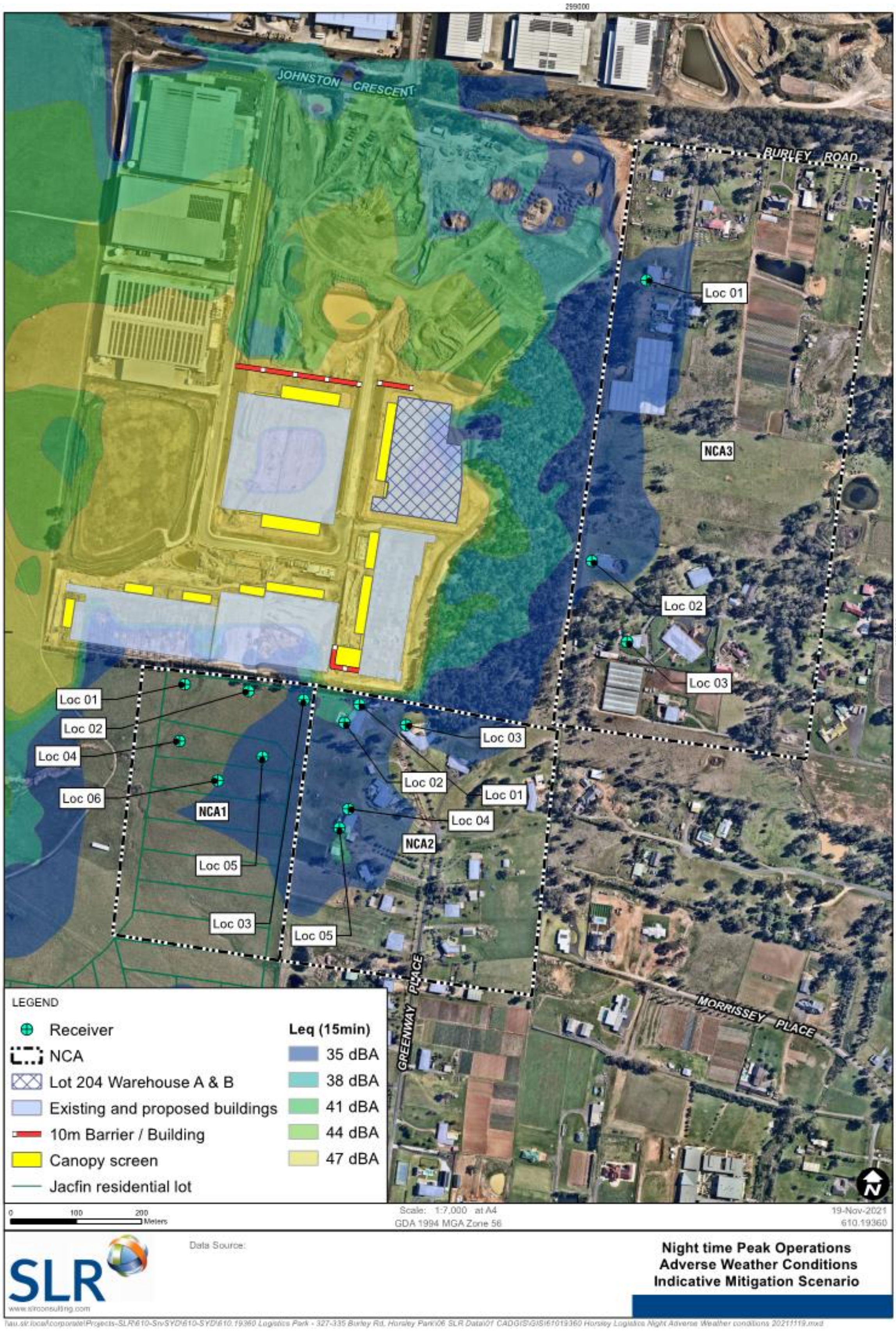


Figure 4 Predicted Night-time Noise Levels – MOD4 Masterplan



4.3 Noise Mitigation Measures

No additional noise mitigation measures to the approved SSD-10436-Mod-1 Modification 1 Application Masterplan are required for the predicted noise impacts to achieve the operational noise levels in **Table 6**.

The approved MOD1 noise mitigation measures included in the model are summarised below:

- Indicative 10m barrier/building included to the northern boundary of Lot 204 and Lot 206 to represent future Stage 3 buildings or other temporary screening measures (shown in **Figure 1)**
- Infill noise wall to southern and western eave height of Lot 202 (formerly Lot 204) super canopy (shown in **Figure 1**)
- Rooftop plant screening to southern and eastern elevations of other Lots.

Lot 202 infill noise wall is included in the noise model primarily to provide screening of noise sources associated with Lot 202 itself, along with a residual screening benefit to external sources associated with other Lots.

4.4 Discussion of Noise Impacts

The results in **Table 6** indicate that operational noise levels of Lot 204 Warehouse A & B and the MOD4 Masterplan design are predicted to comply with the residential noise limits at all identified residential receivers under both neutral and adverse weather conditions during the applicable periods.

Compliance with the sleep disturbance screening criterion in each NCA is also predicted, therefore, a detailed maximum noise level assessment is not required.

As such, operational noise emissions from the MOD4 Masterplan are considered to be compliant, assuming the mitigation measures detailed in **Section 4.3** are used.

An Operation Noise Management Plan for Lot 204 should be provided prior to occupancy to ensure the operational noise impacts are appropriately managed and monitored to maintain compliance with the Operational Noise Limits.

4.5 Comparison with Approved MOD1 Development Impacts

The operational noise impacts at the identified residential receivers are predicted to be compliant with the Operational Noise Limits with the alterations to the Lot 204 size, built form, access and car parking.

Overall, the predicted operational noise impacts of the Lot 204 Warehouse A & B external operations are considered to be consistent with those of the approved MOD1 development.

5 Conclusion

An operational noise impact assessment has been conducted for the operations of Modification 4 at Lot 204 Warehouse A & B of the Horsley Logistics Park.

Approval for development of the Horsley Logistics Park was granted under State Significant Development Application Development Consent SSD 10436. The consent was subsequently modified in Modification 1 Application and approved under SSD-10436-Mod-1 on 4 August 2021.

The operational noise modelling of the Modification 4 Application Masterplan and external operations of Lot 204 Warehouse A & B found no exceedances of the Operational Noise Limits at any sensitive receivers under both neutral (day, evening and night periods) and adverse (night period) weather conditions. Compliance with the sleep disturbance screening criterion in each catchment is also predicted.

Overall, the predicted operational noise impacts of the operations of Lot 204 Warehouse A & B are considered to be consistent with those of the approved Modification 1 Application development.

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

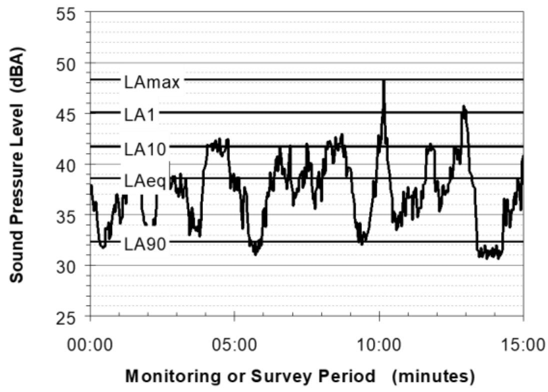
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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

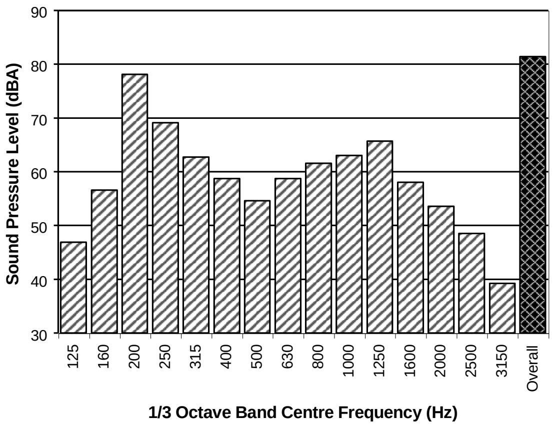
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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

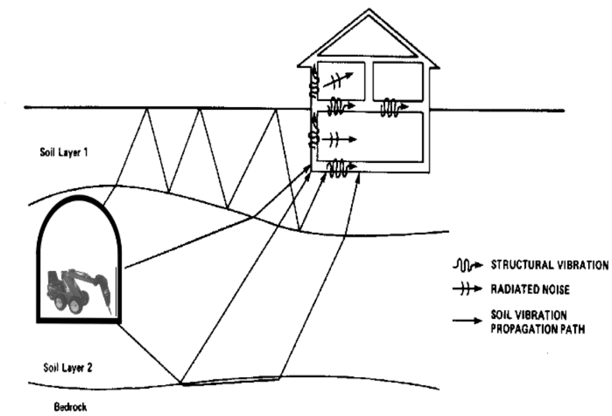
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience 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.

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