Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770
www.lgacoustics.com.au

Environmental Noise Assessment

Workshop and Moulding Facility
Operational Updates
17 Cardup Siding Road, Cardup

Reference: 16053600-05C

Prepared for:
Wormall Group Pty Ltd

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Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

www.lgacoustics.com.au

Contacts	General	Daniel Lloyd	Terry George	Matt Moyle
E:	info@lgacoustics.com.au	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au
P:	9401 7770	0439 032 844	0400 414 197	0412 611 330
Contacts	**Rob Connolly**	**Daryl Thompson**	**Hao Tran**	**Matt Nolan**
E:	rob@lgacoustics.com.au	daryl@lgacoustics.com.au	hao@lgacoustics.com.au	matt.nolan@lgacoustics.com.au
P:	0410 107 440	0420 364 650	0438 481 207	0448 912 604

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13-Mar-23	B	Included Alternate Truck Parking Option	Matt Moyle	Terry George
18-Apr-23	C	Updated workshop noise descriptions	Matt Moyle	Terry George

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1 INTRODUCTION

A workshop depot operated by Wormall Civil and plastic moulding facility operated by Smartstream Technology Pty Ltd are located within Cardup Business Park, at Lot 41 (17) Cardup Siding Road, Cardup – refer *Figure 1-1*. Due to an increase in demand for products and services, both facilities are proposing to extend their approved hours of operations, which would be within the night-time period of the *Environmental Protection (Noise) Regulations 1997*. The specific time period variations proposed are as follows:

- Smartstream Technology: 24-hours Monday to Friday, and 7.00am to 1.00pm Saturdays, internal activities only, all roller doors closed.
- Wormall Civil Workshop and Depot: 6.00am to 8.00pm, with operations prior to 7.00am limited to movement of light vehicles and trucks, and workshop doors in closed configuration.

The purpose of this report is to provide a study and assessment of relevant noise emissions expected to occur at both facilities during this night time period. As the two sites have previously been assessed and approved to operate during the day, this study will only address those noise events expected to occur within the proposed extended hours.

Figure 1-1 Project Locality

The identified noise sources/events occurring during the extended hours as relevant to the assessment, are as follows:

- Smartstream Technology – Moulding equipment running within enclosed shed throughout the night-time, all roller doors are closed. No deliveries or other external works (e.g. forklifts, movement of stock) occurring outside of currently approved day time period.
- Wormall Civil – Eight (8) pre-loaded (from previous day) trucks starting and idling, then moving off site between the hours of 6.00am to 7.00am via the main entry onto Cardup Siding Road. Light workshop activities within the two large sheds, with all doors closed. No additional external works or loading will be conducted outside currently approved day time period.
- Wormall Civil – A single truck may return on rare occasion to site and park (no unloading to occur) during the evening (between 7pm and 10pm). This has been assessed as an isolated event which happens on an infrequent basis.
- Car park noise from employee light vehicles prior to 7.00am.

Appendix A contains a description of some of the terminology used throughout this report.

2 CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

Regulation 7 defines the prescribed standard for noise emissions as follows:

"7. (1) Noise emitted from any premises or public place when received at other premises –

(a) Must not cause or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) Must be free of –

i. tonality;

ii. impulsiveness; and

iii. modulation,

when assessed under regulation 9"

A "…noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level…"

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

(a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) The noise emission complies with the standard prescribed under regulation 7 after the adjustments of *Table 2-1* are made to the noise emission as measured at the point of reception.

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.

Table 2-2 Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial	All hours	65	80	90

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

With reference to *Figure 2-1*, the nearest residences are grouped in four areas, being:

A. Multiple Residences along Soldiers Road, Cardup;

B. Single Residence at 15 Pinebrook Road, Byford and boundary position;

C. Multiple Residences at Coulterhand Circle, Byford; and

D. Single Residence at 1047 South Western Hwy, Byford and boundary position.

The influencing factor applicable at the residential groups varies at each location depending on their proximity to industrial land (including the subject site) and to secondary roads. Furthermore, as the

influencing factor can vary within the group, a typical influencing factor has been used. For instance, those on Coulterhand Circle are assumed to be greater than 100m from South Western Highway (a secondary road) in order to assess at a more critical location (i.e. a lower influencing factor for a similar noise level). *Table 2-3* to *Table 2-6* provide the methodology in determining the influencing factor.

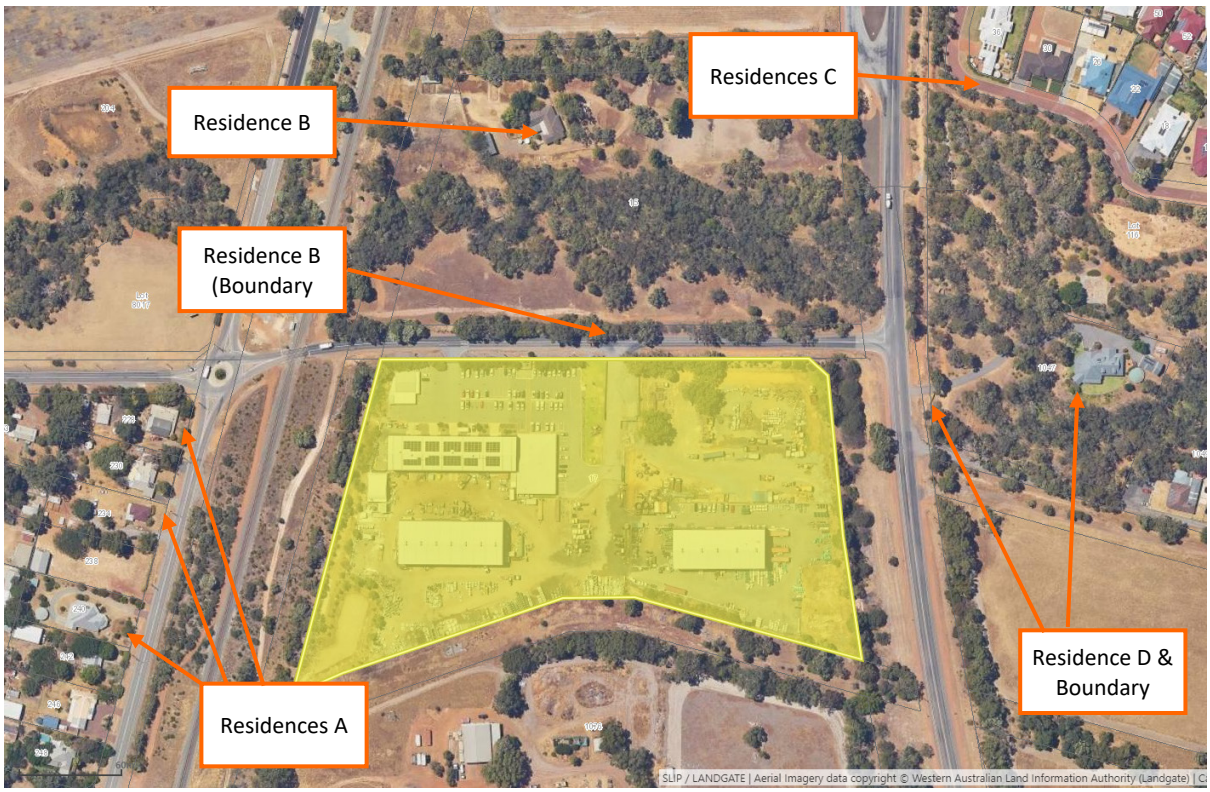


Figure 2-1 Noise Sensitive Premises (DPLH WA Image)

Table 2-3 Influencing Factor Calculation – Residences A

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 dB 0 %	2.6 dB 26 %	3 dB
Transport Factor			**0 dB**
Total			**3 dB**

Table 2-4 Influencing Factor Calculation – Residence B

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 dB 0 %	1.7 dB 17 %	2 dB
Transport Factor			**0 dB**
Total			**2 dB**

Table 2-5 Influencing Factor Calculation – Residences C

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 dB 0 %	1.0 dB 10 %	1 dB
Transport Factor			**0 dB**
Total			**1 dB**

Table 2-6 Influencing Factor Calculation – Residence D

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 dB 0 %	2.3 dB 23 %	2 dB
Secondary Road	SW Highway	-	2 dB
Transport Factor			**2 dB**
Total			**4 dB**

Table 2-7 shows the assigned noise levels (ANL) including the influencing factor and transport factor at the receiving locations.

Table 2-7 Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Residences A	0700 to 1900 hours Monday to Saturday (Day)	48	58	68
	0900 to 1900 hours Sunday and public holidays (Sunday)	43	53	68
	1900 to 2200 hours all days (Evening)	43	53	58
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	38	48	58
Residence B	0700 to 1900 hours Monday to Saturday (Day)	47	57	67
	0900 to 1900 hours Sunday and public holidays (Sunday)	42	52	67
	1900 to 2200 hours all days (Evening)	42	52	57
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	37	47	57
Residences C	0700 to 1900 hours Monday to Saturday (Day)	46	56	66
	0900 to 1900 hours Sunday and public holidays (Sunday)	41	51	66
	1900 to 2200 hours all days (Evening)	41	51	56
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	36	46	56
Residence D	0700 to 1900 hours Monday to Saturday (Day)	49	59	69
	0900 to 1900 hours Sunday and public holidays (Sunday)	44	54	69
	1900 to 2200 hours all days (Evening)	44	54	59
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	39	49	59
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

It must be noted the assigned noise levels apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

In the case of Residence Group A, it is noted that the Influencing factor varies by +/-0.3 dB depending on which residence is assessed and the amount of Type A and B land use percentage lies in the outer 450m circle. In this assessment, the predicted levels are presented for only the worst case receivers of the group. No.228 and No.230 Soldiers Road are identified as having IF 2 dB, while all others within 450m of the site have IF 3 dB.

It is further noted the assigned noise levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *a period of time of not less than 15 minutes, and not exceeding 4 hours*, which is determined by an *inspector* or *authorised person* to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission. An *inspector* or *authorised person* is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Environment Regulation. Acoustic consultants or other environmental consultants are not appointed as an *inspector* or *authorised person*. Therefore, whilst this assessment is based on a 1 hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

Under regulation 3, nothing in the Regulations applies to the following noise emissions –

(a) noise emissions from the propulsion and braking systems of motor vehicles operating on a road;

(b) noise emissions from a safety warning device, other than a reversing alarm, fitted to a motor vehicle operating on a road;

(c) noise emissions from –

(i) a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment; or

(ii) a startup or movement alarm fitted to plant,

if

(iii) it is a requirement under another written law that such an alarm be fitted; and

(iv) it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these Regulations;

Where the Wormall Civil site is proposed to have 8 trucks leave the site prior to 7am, the noise levels are assessable under the Regulations while they are moving on the site's private road and internal hard stand areas, as this does not constitute a road as defined under the Act. Car and truck door closing noise is also assessable since these do not form part of vehicle propulsion or braking systems.

3 METHODOLOGY

Computer modelling has been used to predict noise levels at each nearby receiver. The advantage of modelling is that it is not affected by background noise sources and can provide the noise level for various weather conditions and operating scenarios if necessary.

The software used was *SoundPLAN 7.4* with the ISO 9613 (ISO 17534-3 improved method) algorithms selected. These algorithms have been selected as they include the influence of wind and atmospheric stability. Input data required in the model are:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1 Meteorological Information

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1 Modelling Meteorological Conditions

Parameter	Night (1900-0700)
Temperature (°C)	15
Humidity (%)	50
Wind Speed (m/s)	Up to 5
Wind Direction*	All

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

3.2 Topographical Data

Topographical data was based on that publicly available from *Google* in the form of spot heights, noting the topography is relatively flat. Residential buildings have also been included at 3.5m high. To represent the equivalent attenuation (insertion loss) of the vinyl wall enclosing the western wash bay (noted to be some 4 metres high), a solid barrier of 1.8m height is included in the model.

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, a value of 0.1

has been used in the hard stand, road and carpark areas of the industrial sites, with 0.5 use for areas of light vegetation, and 1.0 used for dense vegetation.

3.4 Source Sound Levels

Table 3-2 shows the sound power levels used in the modelling. The general list of noise emissions considered in the assessment is:

- Wormall Civil - General internal workshop noise with closed roller doors;
- Smartstream Technology – Roto-moulding plant noise (as previously measured on site) with closed roller doors;
- Trucks being started (including door closure), and idling while preparing to leaving the site (pre-start); and
- Trucks moving near the exit/entry to site. These are based on file data of measured trucks of similar power rating.

The Wormall Civil site activities proposed will be minimal prior to 7am, however for conservative purposes, light workshop noise (with roller doors closed) and the idling and moving off of a number of loaded trucks has been considered. These trucks, ranging in size and horsepower, will be preloaded the day before so minimal additional loading noises will occur. Source levels are based on file data from similar projects.

Table 3-2 Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)							Overall dB(A)
	63	125	250	500	1k	2k	4k	
Wormall Civil - Closed Roller Door 5m x 5m, General Assembly /m^2 – L_{A10}	81	77	79	73	68	57	52	75
Smartstream Closed Roller Door 5m x 5m, Roto-Moulding Noise /m^2 – L_{A10}	86	86	87	79	76	66	59	82
Volvo PM 600hp Truck (3 off) Moving at 20km/h – L_{Aeq}	117	114	105	96	90	91	90	102
Volvo PM 600hp Truck Reversing & Parking – L_{Aeq}	118	116	107	98	92	93	92	104
Volvo PM 600hp Truck (3 off) Idling – L_{Aeq}	113	111	102	93	87	88	87	98
Isuzu N-Series Truck 260Hp (5 off) Moving at 20 km/h – L_{Aeq}	107	97	91	91	93	91	88	97
Isuzu N-Series Truck 260Hp (5 off) Idling – L_{Aeq}	102	92	86	86	88	86	83	92
Truck Engine Start-up – L_{Amax}	107	101	98	96	95	92	88	100
Truck Driving Brake Air-Release – L_{AMax}	96	89	82	84	90	94	99	104
Vehicle Door Closing – L_{Amax}	71	74	77	81	80	78	72	84

With regard to *Table 3-2*, the following notes are provided:

- Vehicle starts, doors and noises are modelled as point sources at 1.0m above ground level. Large (Volvo PM 600hp) truck engine sources are modelled 1.5m above ground level.
- A travelling speed of 20km/h is assumed, therefore a time-history method is used to statistically calculate the noise from a moving truck as it travels each second ($L_{eq,slow}$) through the yard. To this effect, a point source is modelled at 5.5m spaces on the path leading to Cardup Siding Road. It takes approximately 39 seconds for a truck to leave the site at this speed.
- As a maximum, three (3) Prime Mover Trucks and five (5) smaller 260hp trucks are assumed to leave the site prior to 7am. It is understood that on average the number of trucks is no more than 5 during this time, however for conservative purposes the maximum number is assessed.
- The truck braking (air-release) noise is assumed to occur for the larger prime mover trucks only. The point source is positioned in the model at the exit/entry point (last position on internal road) and at 1.0m above ground level.
- The "Wormall Civil – closed roller door" source is based on general assembly noise within the Wormall workshop and includes morning prestarts and servicing jobs with hand tools only (not rattle guns, welders, grinders or compressors). Activities include operation of the wash pod and light vehicle hoists.

A 2D preview of the relevant sources is shown in *Figure 3-1*. The relevant noise modelling scenarios are:

1. Workshop Noise – Includes Wormall workshop and Smartstream technology roto-moulding noise, both workshops with closed roller doors.
2. Truck Noise – includes noise from 8x engine starts, truck doors and a 5-minute period of trucks idling (pre-start) then moving off one at a time to exit the site at 20 km/h. It is conservatively assumed that one large truck will idle simultaneously with an idling smaller truck (once per day). This is to account for the infrequent scenario where some trucks my idle simultaneously.
3. Car park noise – maximum noise event from each car park space.
4. Truck noise – A single truck returning to site after 7pm (evening time period). This includes a period of idling and reversing beeper noise, and noise from the park brake air release.

Figure 3-1 Noise Model Sources Overview

4 RESULTS

4.1 Scenario 1 – Workshop Noise

The results of the noise modelling for this scenario are presented in *Table 4-1*. *Figure 4-1* shows the predicted noise levels as a contour map. The noise level expected from the Wormall workshop is quite low in reality, it is understood that only light service repair work occurs within the shed prior to 7am, with no power tool use (welding, grinding, rattle guns) or workshop radio operating. However, for conservative purposes some light assembly with power tools noise is assumed (with doors close) and this is therefore considered in isolation from truck movement noise.

Table 4-1 Predicted Noise Levels – Workshop Noise, dB L_{A10}

Receiver	Smartstream Technology Workshop	Wormall Civil Workshop	Total
Residences A	20	29	**30**
Residence B	23	27	**29**
Residence B (Boundary)	30	32	**34**
Residences C	24	17	**25**
Residence D	29	18	**29**
Residence D (Boundary)	19	35	**35**

4.2 Scenario 2 – Truck Departures

The results of the noise modelling for this scenario are presented in *Table 4-2*. *Figure 4-2* shows the predicted time history noise level of trucks leaving the site as received at Residences A. The study is statistical and assumes the trucks are stationary for 5 minutes of idling each, then leave the site in succession prior to 7.00am. The larger Prime Mover trucks are each assumed to release a light air-brake noise when stopping at the site exit.

Table 4-2 Predicted Noise Levels – Truck Departures, dB

Receiver	L_{A10}	L_{A1}	L_{AMax}
Residences A	37	40	43
Residence B	33	40	45
Residence B (Boundary)	42	52	62
Residences C	30	35	37
Residence D	34	37	39
Residence D (Boundary)	33	41	42

Figure 4-1

Lot 41 Cardup Siding Road, Cardup - Workshop Noise

L_{A10} Noise Level Contours - Scenario 1 - Night Ground Floor Predicted Noise Levels

Lloyd George Acoustics
by Matt Moyle
matt@lgacoustics.com.au
(61) 412 611 330

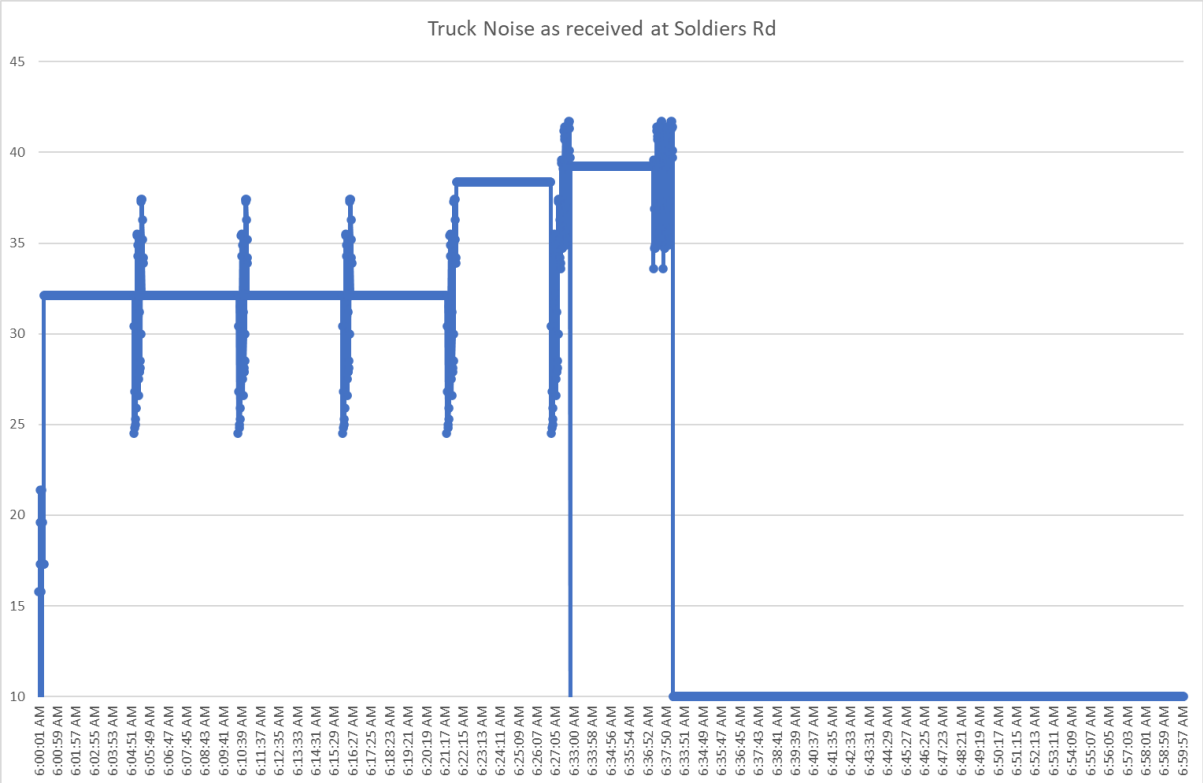


Figure 4-2 Time History – Truck Starts, Idles and Departures at Residences A

The noise levels are higher for the three 600hp prime movers as they exit the site, as is to be expected given their higher source level. The five Isuzu trucks are lower in noise level, driving and at idle. While it is acknowledged that in reality the trucks may leave in a more staggered fashion over the hour between 6am and 7am, the outcome statistically would not differ from that presented in *Figure 4-2*.

4.3 Scenario 3 – Car Park Noise

The results of the noise modelling for this scenario are presented in *Table 4-3*. The results present the maximum car door closing noise event as predicted at a given receiver.

Table 4-3 Predicted Noise Levels – Car Door Noise, dB

Receiver	L_{AMax}
Residences A	32
Residence B	32
Residence B (Boundary)	41
Residences C	23
Residence D	25
Residence D (Boundary)	32

4.4 Scenario 4 – Prime Mover Truck Returns to Base (Between 7pm and 8pm)

The results of the noise modelling for this scenario are presented in *Table 4-4*. This scenario includes a minute of engine idling (slow reversing) to park the truck. A 15-minute RAP may be considered appropriate for this scenario, and the statistical results are therefore calculated accordingly. This scenario includes noise from the parking brake release, relevant to the L_{Amax} time period.

Table 4-4 Predicted Noise Levels – Single Truck Arrival, dB

Receiver	L_{A10}	L_{A1}	L_{AMAx}
Residences A	30	41	42
Residence B	28	41	45
Residence B (Boundary)	34	51	61
Residences C	26	35	37
Residence D	27	38	39
Residence D (Boundary)	30	41	42

5 ASSESSMENT

5.1 Scenario 1 – Workshop Noise

The noise levels predicted in *Section 4.1* are assessed against the most critical night period, as relevant to the proposed amendment of operating conditions. Based on measured data of the noise emitted via closed roller doors, no intrusive characteristics are identified as applicable to the assessment.

Table 5-1 Assessment of Workshop Noise Levels, dB L_{A10}

Receiver	Total Workshop Noise, L_{A10}	Night Assigned Noise Level	Exceedence
Residences A*	**30**	37*	*Complies*
Residence B	**29**	37	*Complies*
Residence B (Boundary)	**34**	60	*Complies*
Residences C	**25**	36	*Complies*
Residence D	**29**	39	*Complies*
Residence D (Boundary)	**35**	60	*Complies*

*Highest predicted level is at #230 Soldiers Road, with an IF of +2 dB.

Noise from internal workshop activities at both the Wormall and Smartstream Technology sites is demonstrated to comply at the critical night-time period. Noise levels comply by at least 8 dB.

5.2 Scenario 2 – Truck Departures

This scenario involves the assessment of three (3) Prime Mover trucks and five (5) flat bed 260hp (or similar) trucks leaving the site. It is understood that this is the maximum number of expected truck movements prior to 7am, with the average being closer to 5 movements per day (before 7am). The L_{A10} noise level is more critical for assessment since this parameter's noise level is the highest level relative to assigned level. Therefore, only the L_{A10} level from *Table 4-2* needs to be assessed for compliance in *Table 5-2* below.

Table 5-2 Assessment of Truck Departure Noise Levels, dB L_{A10}

Receiver	Trucks Moving Noise, L_{A10}	Night Assigned Noise Level	Exceedence
Residences A*	37	38*	*Complies*
Residence B	33	37	*Complies*
Residence B (Boundary)	42	60	*Complies*
Residences C	30	36	*Complies*
Residence D	34	39	*Complies*
Residence D (Boundary)	33	60	*Complies*

*Highest predicted level is at #234 Soldiers Road, with an IF of +3 dB.

The variable engine speeds and gear changes generally means the noise is unlikely to be measured as tonal as the frequency of the noise constantly shifts. Based on the assessment of calculated truck departure levels, compliance is demonstrated at night for all locations and no further mitigation is required. The assessment conservatively assumes 30 minutes of idling time, and in reality this may be shorter. Furthermore, the assessment scenario considers the maximum of 8 truck movements in the hour before 7am, which is for conservative purposes. Where the average number of 5 trucks per morning is considered, the noise level will be lower and result in lower amenity impact for a given week.

At the time of this assessment, the subject sites owned and operated by Wormall Group are the lone industrial land users in the Cardup Business Park. With regard to Regulation 7(2), a noise emission maybe considered significantly contribute to existing noise levels where it exceeds a value which is 5 dB below the assigned level. Achieving this criterion now would provide for adequate accommodation should the Cardup Business Park continue to grow with other industry operators.

Therefore, an additional 4 dB reduction to truck departure noise levels should be considered. Noise mitigation options might involve relocating the truck park up site to an area farther east or more shielded by buildings or by utilising local screens for the site or truck parking areas.

5.3 Scenario 3 – Car Park Noise

The L_{Amax} noise level is most critical for assessment of the worst-case noise level for a given car door closing. The results of this scenario are assessed in *Table 5-3*.

Table 5-3 Assessment of Car Door Noise Levels, dB L_{Amax}

Receiver	Adjusted Car Door Noise[1], L_{Amax}	Night Assigned Noise Level	Exceedence
Residences A[2]	**42**	57[2]	*Complies*
Residence B	**42**	57	*Complies*
Residence B (Boundary)	**51**	80	*Complies*
Residences C	**33**	56	*Complies*
Residence D	**35**	59	*Complies*
Residence D (Boundary)	**42**	80	*Complies*

1. Levels are adjusted by +10 dB for impulsiveness.
2. Highest predicted level is at #228 Soldiers Road, with an IF of +2 dB.

The noise from car doors on employee vehicles arriving before 7am is demonstrated to comply with the night time assigned noise levels (ANL) by at least 15 dB.

5.4 Scenario 4 – Truck Arrival between 7pm and 8pm

Due to the shorter RAP of 15-minutes being applicable, the L_{A1} noise level is most critical for assessment since this parameter's noise level is the highest level relative to assigned level. Therefore, only the L_{A1} level from *Table 4-4* needs to be assessed for compliance against the Evening time period in *Table 5-4* below.

Table 5-4 Assessment of Truck Arrival Noise Levels, dB L_{A1}

Receiver	Truck Moving Noise, L_{A1}	Evening Assigned Noise Level	Exceedence
Residences A*	41	48*	*Complies*
Residence B	41	47	*Complies*
Residence B (Boundary)	51	75	*Complies*
Residences C	35	46	*Complies*
Residence D	38	49	*Complies*
Residence D (Boundary)	41	60	*Complies*

*Highest predicted level is at #234 Soldiers Road, with an IF of +3 dB.

Compliance with evening assigned noise levels is demonstrated by at least 7 dB at all nearest noise sensitive premises. It is noted that the L_{A10} and L_{Amax} assessment scenarios also comply with ANLs.

6 RECOMMENDATIONS & CONCLUSION

The potential noise impacts from the proposed extended hours of operation at Wormall Civil and the of Smartstream Technology Pty Ltd, have been assessed in accordance with the *Environmental Protection (Noise) Regulations 1997*.

Night-time compliance with the assigned levels is calculated where roller doors to all sheds are in the fully closed position. It is understood that during this time, activity in the Wormall workshop will be limited to light servicing repairs with hand tools, pre-starts and light vehicle hoist use. The use of noisier plant and tools is not required until after 7am, such as air compressors, grinders, rattle guns and welding.

Noise from eight (8) pre-loaded trucks departing prior to 7.00am from the Wormall site is demonstrated to comply with the night-time assigned noise level for all nearest noise sensitive premises. However, acknowledging Regulation 7(2), non-compliance is predicted when aiming to achieve a level that is 5 dB under the assigned levels. As such mitigation strategies should be investigated and applied where effective. *Section 6.1* demonstrates one such effective strategy for achieving this reduction, by way of modifying the truck parking location.

Truck drivers should be instructed to not idle their vehicles for longer than necessary and to maintain a direct route to the site exit, as well as driving in a responsible manner on public roads.

Night-time noise levels from carpark use, resulting from light vehicle door closures is demonstrated to comply with the night-time assigned level at all nearest noise sensitive receivers.

6.1 Alternate Truck Parking Location

To achieve a 4 dB noise reduction with regard to expected noise emissions from truck departures, an alternate location should be prepared for the pre-7am outgoing trucks. Additional analysis has been completed to demonstrate the effectiveness of the alternate location. The principles resulting in reduced noise levels are to provide increased distance separation from sensitive receptors to the West, reduced time to exit the compound and local barriers (in the form of storage containers) to attenuate noise to receptors North and Northeast.

Figure 6-1 provides a marked up site plan showing the alternate location, the trucks are drawn to scale, with the 3 larger vehicles parked in the far east positions. This future hardstand area should be prepared accordingly with appropriate signage/lane-marking and drivers understanding that parking position is critical to the mitigation being effective. Three standard “40ft shipping” storage containers were required in addition, these are to be positioned as indicated in the figure and assumed to be 2.6m high.

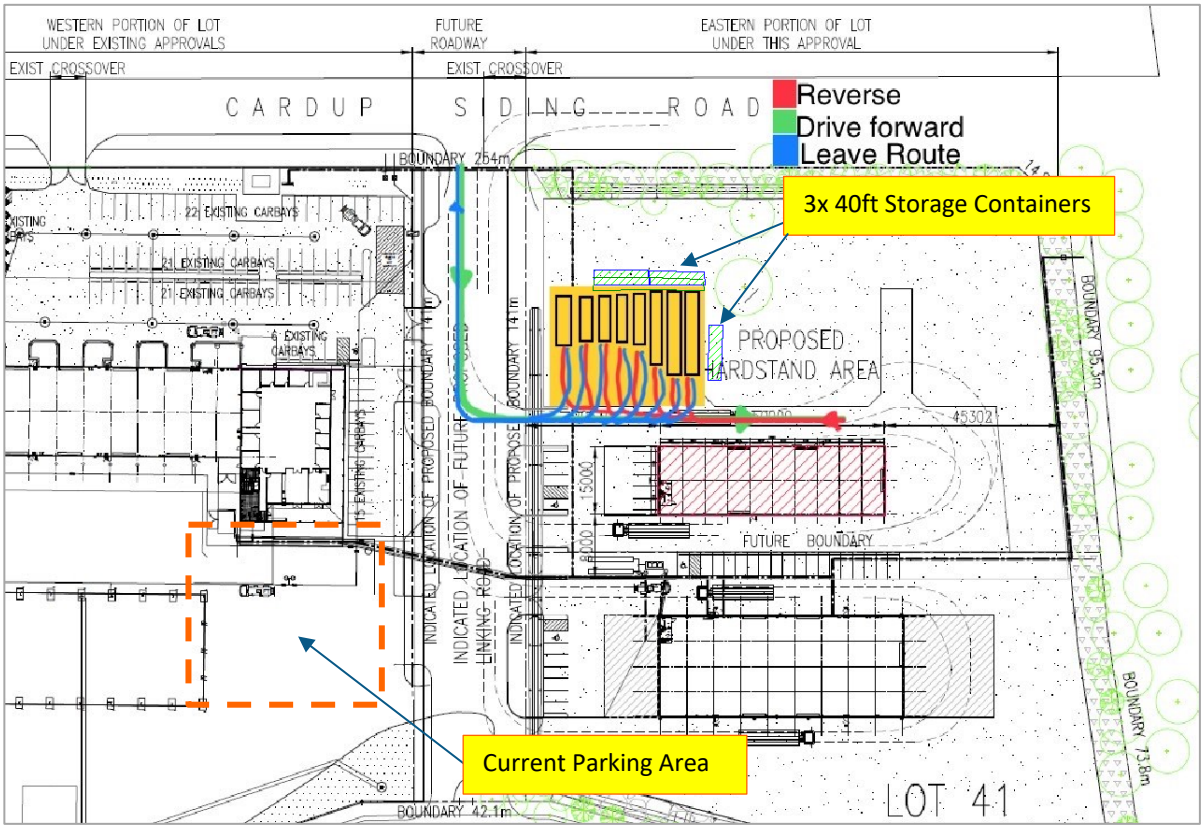


Figure 6-1 Proposed Alternate Truck Parking Area

The noise levels for the alternate parking location, including storage containers were predicted, in similar fashion to Scenario 2 of *Section 4.2*. The results are summarised and assessed in *Table 6-1* noting that this also considers the 5 dB buffer for significant contribution (in brackets).

Table 6-1 Predicted Noise Levels – Truck Departures (Alternate), dB

Receiver	L_{A10}	L_{A1}	L_{AMax}	Assigned Noise Level, L_{A10}	Exceedence
Residences A*	30	37	43	**37 (32)**	*Complies*
Residence B	32	44	48	**37 (32)**	*Complies*
Residence B (Boundary)	43	52	62	**60 (55)**	*Complies*
Residences C	31	32	37	**36 (31)**	*Complies*
Residence D	33	39	41	**39 (34)**	*Complies*
Residence D (Boundary)	39	43	47	**60 (55)**	*Complies*

* Highest predicted level is at #228 Soldiers Road, with an IF of +2 dB.

It is therefore demonstrated that compliance is achieved based on the alternate parking location and storage container placement. The margin of compliance is at least 5 dB below the ANL therefore is not considered to contribute to other industry noise emitters.

Appendix A

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Power Level (L_w)
Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (L_p)
The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}
This is the noise level in decibels, obtained using the A frequency weighting and the S (Slow) time weighting as specified in IEC 61672-1:2002. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}
This is the noise level in decibels, obtained using the A frequency weighting and the F (Fast) time weighting as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}
This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

L_{Amax}
An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}
An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{Aeq}
The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}
An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

One-Third-Octave Band
Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

L_{Amax} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise
A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise
A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;

(b) is present for at least 10% of the representative.

Impulsive Noise
An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is:

a variation in the emission of a noise where the difference between $L_{A\ peak}$ and $L_{A\ Max\ slow}$ is more than 15 dB when determined for a single representative event;

Major Road
Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road
Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing Factor (IF)

$$= \frac{1}{10}(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}) + \frac{1}{20}(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450})$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

Representative Assessment Period
Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

Background Noise
Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise
Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise
Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

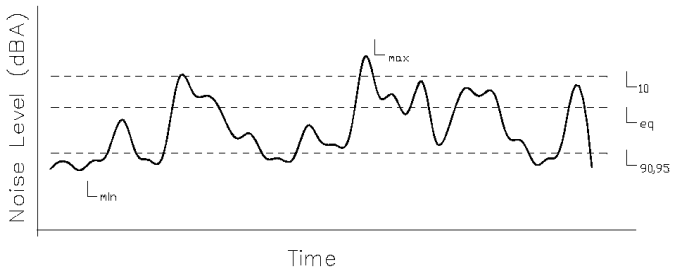
Peak Component Particle Velocity (PCPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

Peak Particle Velocity (PPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

RMS Component Particle Velocity (PCPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Peak Particle Velocity (PPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Chart of Noise Level Descriptors



Typical Noise Levels