HARWOOD ACOUSTICS
ACOUSTICAL CONSULTING

50 Junction Street, Nowra, NSW 2541

P: 4421 4583
E: 0414 315 775

matthew@harwoodacoustics.com.au
www.harwoodacoustics.com.au

ABN: 71634 997 937

Industrial Noise Intrusion Assessment Proposed Planning Proposal – Land Rezoning For Residential Subdivision

Lot 10 DP 1018281, Lansdowne Street and Robinson Street
Goulburn, NSW 2580

Prepared For:-

Simgrow Pty Ltd
PO Box 539
Goulburn NSW 2580

Attention: Mr Robert Mowle

Reference: 1810009T-R1

Prepared by:-

Matthew Harwood MAAS
5th March 2019

Document Control Page

Revision	Author	Released By	Date
Draft	MH	MH	29/01/2019
Draft 2	MH	MH	05/03/2019
Draft 3	MH	MH	22/05/2019
Final	MH	MH	17/06/2019

Harwood Acoustics was requested by Simgrow Pty Ltd, to carry out an Industrial Noise Intrusion Assessment for a proposed residential development to be developed at Lansdowne Street and Robinson Streets Goulburn, NSW 2580

Harwood Acoustics has prepared this report for the exclusive use of the Client identified on the title page. The report was prepared in accordance with the brief and scope of works agreed between the Client and Harwood Acoustics and may not be suitable for use beyond that scope.

Harwood Acoustics undertakes no duty nor accepts any responsibility to any third party who may rely upon this report.

Advice and recommendations provided in this report are in relation to acoustical issues only. No claims of expertise are made, and no liability is accepted, in relation to issues falling outside the field of acoustical consulting. These may include, but are not limited to, structural and waterproofing considerations, fire rating or thermal rating. Relevant authorities and / or experts should be consulted regarding areas other than acoustics.

TABLE OF CONTENTS

1. INTRODUCTION AND SUMMARY

Harwood Acoustics was engaged by Simgrow Pty Ltd to carry out an Industrial Noise Intrusion Assessment in relation to a planning proposal that will seek to rezone land located at Lot 10 in DP 1018281, (hereafter the Site) Goulburn, in order to facilitate a residential subdivision.

The Site is located on the southern side of Lansdowne Street and the western side of Robinson Street approximately 2.4 kilometres south west of the CBD of Goulburn.

The Site in question is located on land that adjoins and partially surrounds a recent residential subdivision which is serviced by Theatre Drive. The overall Site is in a predominantly industrial area and there are industrial premises located opposite Lansdowne Street to the north and opposite Robinson Street to the west and south east as shown in Figure 1.

Industrial premises in the estate include, but are not limited to, Boral Concrete, Allmac Welding, Goulburn Farm Machinery, Storage King and Millennium Windows. The closest proposed lots fronting Lansdowne Street are at a distance of approximately 30 metres from the nearest industrial premises to the north. Those lots fronting Robinson Street are at a distance of approximately 25 metres from the nearest industrial premises to the south east.

The rezoning proposal seeks to have the remaining land on the site, being Lot 10, rezoned so as to allow for residential development similar to the adjoining lots serviced by Theatre Drive. This Industrial Noise Intrusion assessment will be submitted with the rezoning request. The assessment is to determine the potential for noise emanating from the existing industrial premises to impact on any future residences.

Noise arising from industrial premises is typically assessed against the NSW EPA's *Noise Policy for Industry* 2017. This is particularly relevant for new industrial sites potentially affecting existing residential areas. The policy provides a method for establishing project specific noise goals in order to assess the potential impact of noise from industry. The policy includes a framework for considering feasible and reasonable noise mitigation measures. However, the policy is designed for large industrial and agricultural sources and specifies substantial monitoring and assessment procedures that may not always be applicable to the types of sources that Councils need to address. Neither is it intended for use as a mandatory requirement, but rather as a guide in determining the potential for noise impact and to identify reasonable and feasible noise mitigation measures.

Given the close proximity of the existing and proposed residential allotments to the existing industrial premises in this instance, it may not be practicable to expect that the level of noise emission arising from the operation of the existing industrial premises would not exceed the project trigger levels that would be established under the Policy, at least for some premises, on some occasions.

That being said, the existing approved residential lots within the existing subdivision each have restrictions placed on them via 88b instruments. The 88b instruments on the subject land require that any future dwellings are to be constructed such that external noise intrusion will achieve the recommended internal noise levels derived from Australian Standard AS2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'* (AS2107).

AS2107 provides a list of recommended design sound levels for different areas of occupancy in various buildings. The appropriate indoor noise design goals in this instance are considered

to be 35 dBA ($L_{eq,\ 1\ hour}$) inside bedrooms between 10 pm and 7 am and 40 dBA ($L_{eq,\ 1\ hour}$) inside all habitable spaces at any time. External noise levels are the energy average sound pressure levels of noise emission arising from the nearby industrial premises when measured or established over a typical worst-case one-hour period ($L_{eq,\ 1\ hour}$).

It is assumed that each of the residential lots within the proposed subdivision of Lot 10, if approved by Council, will have similar restrictions placed on each lot via a similar 88b instrument.

This assessment therefore establishes typical existing industrial noise levels across the development site and provides an assessment of the potential for compliance with the internal design goals set by AS2107 for typical future dwellings.

The author visited the site on several occasions throughout November and December 2018 and again in January 2019 to measure the level of noise emission from the various industrial premises in proximal of the future proposed lots.

Industrial noise levels range from 51 to 62 dBA $L_{eq,\ 1\ hour}$ during the day at the furthest and closest future dwellings to the noise producing industrial premises. Consideration is also given to noise associated with heavy vehicle movements prior to 7 am based on attended noise measurements and acoustical modelling. The predicted noise level from passing trucks at the closest future residential lots to Lansdowne Street is 56 dBA ($L_{eq,\ 1\ hour}$) at night and for those lots closest to Robinson Street the predicted level is 54 dBA ($L_{eq,\ 1\ hour}$).

The as-measured and predicted external industrial and heavy vehicle noise levels have been used to determine the potential for compliance with the internal noise limits within typical future dwellings. An assessment of the potential noise intrusion from industrial activity into a selection of potential future dwellings on the Site has been undertaken based on typical living room and bedroom sizes.

Individual assessments for dwellings will be required once the subdivision is created prior to the issue of Construction Certificates for each dwelling. This may be done through the inclusion of 88b instruments on those lots and examples of such instruments are provided in Section 3.1.

Acoustical treatment of these dwellings will be dependent upon, for example, room sizes; ratio of glazing to the overall façade; orientation of windows and rooms to the respective roads; floor coverings and shielding from other dwellings, boundary fences, etc.

It is proposed to erect a minimum 2.1-metre-high timber lapped and capped fence, (noise barrier with a minimum surface density of 15 kg/m^2) along the entire Lansdowne Street frontage. The sound barrier fence will therefore achieve an effective height of **2.1 metres** above the finished ground level of the proposed lots adjacent to Lansdowne Street. This will provide varying level of noise attenuation from noise emission from industrial premises and heavy vehicles. A similarly constructed noise barrier is proposed for the Robinson Street frontage and will be erected to a minimum height of 1.8 metres.

In any event, for even the most exposed future dwellings to industrial noise, acoustical treatment where required, will not be significantly onerous and examples are given in Section 5 of this Report.

2. SITE AND PLANNING PROPOSAL DESCRIPTION

The Site is located on the southern side of Lansdowne Street and the western side of Robinson Street approximately 2.4 kilometres south west of the CBD of Goulburn.

The Site in question is located on land that adjoins a recent residential subdivision serviced by Theatre Drive. The overall Site is in a predominantly industrial area and there are industrial premises located opposite Lansdowne Street to the north and opposite Robinson Street to the west and south east as shown in Figure 1.

Industrial premises in the estate include, but are not limited to, Boral Concrete, Allmac Welding, Goulburn Farm Machinery, Storage King and Millennium Windows. The closest proposed lots fronting Lansdowne Street are at a distance of approximately 30 metres from the nearest industrial premises to the north and those fronting Robinson Street are at a distance of approximately 25 metres from the nearest industrial premises to the south east.

The rezoning proposal seeks to have the remaining land on the site, being Lot 10, rezoned so as to allow for residential development of approximately 20 lots as shown in Figure 2.

Figure 1. Location Plan – Lot 10 in DP 1018281, Goulburn, NSW

Figure 2. Planning Proposal – Proposed Subdivision

(source: CPC Land Development Consultants Pty Ltd, plan no. 21355-D-20190527/CH, May 2019)

3. NOISE CRITERIA

Noise arising from industrial premises is typically assessed against the NSW EPA's *'Noise Policy for Industry'* 2017. This is particularly for new industrial sites potentially affecting existing residential areas. The policy provides a method for establishing project specific noise goals in order to assess the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures. However, the policy is designed for large industrial and agricultural sources and specifies substantial monitoring and assessment procedures that may not always be applicable to the types of sources Councils need to address. It is not intended for use as a mandatory requirement but rather as a guide to regulatory authorities. Given the close proximity of the existing and proposed residential allotments to the existing industrial premises in this instance, it may not be practicable to expect that the level of noise emission arising from the operation of the existing industrial premises would always meet the project trigger levels that would be established under the policy, at least for some premises, on some occasions.

As such, the existing approved residential lots within the existing subdivision each have restrictions placed on them via 88b instruments. The 88b instruments on the subject land requires that any future dwellings are to be constructed such that external noise intrusion will achieve the recommended internal noise levels derived from Australian Standard AS2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'* (AS2107).

3.1 88B Instrument DP 1247119

An example of the 88b instrument applied to burdened lots on Theatre Drive is as follows:-

> *"all future dwellings on burdened lots are to be designed and constructed such that external noise intrusion will achieve the recommended internal noise levels in accordance with AS2107."*

3.2 AS 2107:2016

Australian Standard AS 2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'* provides a list of recommended design sound levels for different areas of occupancy in buildings. The recommended internal noise levels and reverberation times for various relevant rooms are shown in Table 1 below.

Table 1 Recommended L_{eq} Design Sound Level (AS2107-2016)

Type of Occupancy/Activity	Recommended Design Sound Level, L_{eq} dB(A)		Recommended Reverberation Time (T).s
	Satisfactory	Maximum	
RESIDENTIAL BUILDINGS			
Houses and apartments in suburban areas or near **major** roads –			
Living areas	35	45	-
Sleeping (night time)	35	40	-
Houses and apartments in suburban areas or near **minor** roads –			
Living areas	30	40	-
Sleeping (night time)	30	35	-

Given the location of the development site with respect to the industrial area and Hume Street to the south, it is considered that **35 dBA** is a realistic noise design goal for bedrooms (at night) and **40 dBA** is a realistic noise design goal for all habitable rooms during day time hours. These levels are also in line with those set by Clauses 87 and 102 of SEPP Infrastructure 2007 relating to rail and road noise intrusion respectively.

a) *Day is defined as the period from 7 am to 10 pm; and*

b) *Night is defined as the period from 10pm to 7am.*

4. INDUSTRIAL NOISE LEVELS

4.1 Measured Noise from Industrial Premises

The author visited the Site on several occasions throughout November and December 2018 and January 2019 to carry out attended noise surveys of noise emission from industrial activity at various locations across the development Site, as shown in Figure 1.

The acoustical environment during all noise surveys was dominated by activity at Boral Concrete which included the loading of cement trucks from the hoppers, washing cement trucks (or adding water to the mix).

Other industrial activity included noise emanating from Goulburn Farm Machinery, Allmac Welding and heavy vehicle movements along Lansdowne Street. The level of noise emission from premises along Robinson Street was significantly lower than those along Lansdowne Street, particularly near to Boral Concrete. The level of noise emission from the eastern end of Lansdowne Street was considerably less than the Boral site.

The highest measured noise level at the closest proposed lots to Lansdowne Street was 62 dBA whilst typical Boral activities occurred simultaneously for a minimum 15 minutes.

As a conservative worst-case scenario this assessment assumes this level is representative of any given one-hour period. In practice this is unlikely to occur regularly as once the cement mixer trucks leave the site the level of noise producing activity is considerably lower.

It is reported that Boral Concrete and other surrounding industries do not commence operating until 7 am. Noisy activities prior to 7 am are dominated by heavy vehicle movements, predominantly in Lansdowne Street. Heavy vehicle noise emission is detailed in Section 4.2 below.

The noise levels measured from nearby industry during the noise surveys have therefore been used to establish the octave band and overall 'A' frequency weighted sound pressure levels, in decibels re: 1 pW, shown in Table 1 below.

Table 1 $L_{eq,\ 1\ hour}$ **Industrial Noise Levels – Various locations across the Site**

Industrial Noise Levels		Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)							
	dBA	63	125	250	500	1k	2k	4k	8k
Most exposed future dwellings to Industrial Noise									
Day Time $L_{eq,\ 1\ hr}$	**62**	65	63	58	54	57	56	53	43
Least exposed future dwellings to Industrial Noise									
Day Time $L_{eq,\ 1\ hr}$	**51**	54	52	47	43	46	45	42	32

4.2 Heavy Vehicle Noise Levels

During the noise surveys the author measured the level of noise emission from a number of heavy vehicle movements along Lansdowne Street. Trucks included semi-trailers and smaller rigid trucks approximately 13 metres in length. There is potential for a variety of heavy vehicle types and movements to occur in both Lansdowne Street and Robinson Street, prior to 7 am.

A calculation based on the sound exposure level for various vehicles has therefore been carried out. The sound exposure level (L_{Ae}) is a summation of the sound energy produced during a single event (i.e. a motor vehicle pass-by, train pass-by, etc).

In addition to the measurements taken on site, the author has measured the level of noise emission from numerous heavy vehicles including, for example, truck and trailer, semi-trailer, b-double, refrigerated rigid trucks.

The average maximum measured sound exposure levels of a range vehicles, normalised to a distance of 15 metres is as follows:-

- Truck – 85 dBA;

Once established, a sound exposure level (L_{Ae}) can be used to calculate an energy average, sound pressure level ($L_{eq,\ time}$) using the following formula:-

$$L_{eq,\ 1\ hour} = L_{ae} - 10\ log_{10}\ (T) + 10\ log_{10}\ (N)$$

Where T is time in seconds (1 hour in this instance in line with the requirements of AS2107) and N is the number of vehicle trips. For the purpose of establishing a typical worst-case scenario, it is assumed that there may be five (5) heavy vehicle movements along Lansdowne Street and three (3) along Robinson Street in any given one-hour period prior to 7 am (e.g. between 6 am and 7 am – which is within the night time shoulder period).

The predicted octave band and overall 'A' frequency weighted sound pressure levels, in decibels re: 1 pW from heavy vehicle movements are shown in Table 2 below.

Table 2 $L_{eq,\ 1\ hour}$ Heavy Vehicle Noise Levels – Various locations across the Site

Heavy Vehicle Noise Levels	dBA	Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
Closest future dwellings to Heavy Vehicle movements – Lansdowne Street									
Night Time $L_{eq,\ 1\ hr}$	**56**	66	56	51	50	53	48	45	38
Closest future dwellings to Heavy Vehicle movements – Robinson Street									
Night Time $L_{eq,\ 1\ hr}$	**54**	64	54	49	48	51	46	43	36

Instrumentation used during the noise survey is shown in the attached Appendix A.

4.3 Required Noise Reduction

The required noise reduction is as follows:

For the future dwellings most exposed to noise from industrial activity and heavy vehicles

- (62 – 40 =) 22 dB for all Living areas; and (industry during the day)
- (56 – 35 =) 21 dB for all sleeping areas (heavy vehicles prior to 7 am – i.e. at night)

For the future dwellings least exposed to noise from industrial activity and heavy vehicles

- (51 – 40 =) 11 dB for all Living areas; and (industry during the day)
- (54 – 35 =) 19 dB for all sleeping areas (heavy vehicles prior to 7 am – i.e at night)

The higher noise levels at night arise from heavy vehicle movements as it is reported that the industrial premises, particularly Boral Concrete do not operate prior to 7 am, other than truck movements to the Site. Traffic count information provided also indicated that there are minimal truck movements between 6 pm and 6 am.

5. NOISE MODELLING AND RECOMMENDED ACOUSTICAL TREATMENT

5.1 Noise Modelling Methodology

Design and layout of any potential future dwellings are unknown at this stage. For the purpose of modelling and assessment, typical living areas and bedroom sizes have been assumed as follows:-

- Open-plan Living / Dining / Kitchen, timber or tile flooring – 8 metres x 7 metres x 2.7 metres with:-
    - sliding glass door (2000 mm x 2700 mm);
    - one main window (2200 mm x 2100 mm); and
    - one highlight window (600 mm x 2400 mm).
- Bedroom, carpeted – 3.5 metres x 4.5 metres x 2.7 metres with:-
    - one window (2400 mm x 1800 mm); and
    - one sliding door (2000 mm x 2700 mm).

The internal noise levels can be calculated using the formula: -

$$L_{p2} = L_{p1} - R_w + 10 \text{ Log}_{10} (S/A) - K + 6 \text{ dB}$$

Where:

L_{p1} is the external freeway noise level;
R_w is the weighted sound reduction index of the partition;
S is the area of the partition (e.g. wall, roof, window or glazed door);
A is the acoustic absorption of the room;
K is an angle of view correction.

5.2 Building Construction Recommendations

The level of noise intrusion has been calculated through the roof, floor, walls, glazed doors and windows.

The recommended internal noise levels from AS2107:2016 can be met using the following construction methods and materials.

5.2.1 Walls

- External walls may be of brick veneer or other masonry construction; or
- Cement composite external cladding, for example Hardies 'Scyon', 'Linea', 'Stria', or CSR Cemintel or equivalent with similar minimum mass; and
- Internal plasterboard wall lining may be of standard 13 mm thick plasterboard construction with standard thermal insulation in the external wall cavity.

5.2.2 Ceiling and Roof System

- Concrete tile or metal deck roof with 13 mm thick standard or 10 mm thick sound rated plasterboard ceiling below and minimum 50 mm thick glasswool insulation (minimum 11 kg/m^3) in the ceiling cavity will be acceptable;

5.2.3 Windows and Glazed Doors

Glazing

- Windows and glazed doors may be fixed, sliding, awning, casement or double hung style in aluminium or timber frames;
- Based on the above example room dimensions and window sizes, windows for dwellings at various locations should achieve the following weighted sound reduction index ratings (R_w):-
    - Most exposed – living room R_w 32 (e.g. 6.38 mm thick laminated glass);
    - Most exposed – Bedroom R_w 30 (e.g. 6.38 mm thick laminated glass);
    - Least exposed – living room R_w 25 (e.g. 4 mm thick float glass);
    - Least exposed – Bedroom R_w 26 (e.g. 5 mm thick float glass).

Discussion

The required acoustical performance of future building elements is dependent upon, for example, the rooms sizes; the proportion of glazing to the remaining walls; the orientation of the rooms and windows to the external noise source; the floor coverings within the rooms; any shielding from other buildings, boundary fences, etc.

Individual assessments for future dwellings will be required once the subdivision is created, prior to the issue of Construction Certificates for each dwelling.

This may be done through the establishment of 88b instruments on those lots, along the lines of the example provided in Section 3.1 of this Report.

5.3 External Noise Reduction

As stated previously it is unlikely that external intrusiveness project noise levels that would be established under the EPA's Noise Policy for Industry 2017 would be met at the closest future dwellings to some industrial premises, at least on some occasions for 15 minute periods during the day.

Practical steps to minimise external noise impacts include:-

Boundary Screening

- Erecting boundary fences along shared boundaries with Lansdowne Street and Robinson Street;
    - Fences may be constructed from any impervious materials including lapped and capped timber, corrugated sheet steel, masonry, or proprietary modular wall systems;
- At this stage it is proposed to erect a minimum 2.1-metre-high barrier along the entire Lansdowne Street frontage. This will provide attenuation of between 5 and 6 dB from noise emission arising from industrial sites and trucks passing on Lansdowne Street.

The proposed boundary fence will provide a reduction in external noise levels which will improve external noise amenity in gardens and courtyards and also potentially reduce the level of construction required to meet the recommended internal noise design goals.

Outdoor Areas & Building Design

- Locate outdoor areas such as courtyards, patios, barbeque areas as far from the respective roads as practicable;
- Avoid elevated decking;
- Shield outdoor areas and noise sensitive rooms from the road or industrial premises by service rooms (see Figure 3 below as an example)

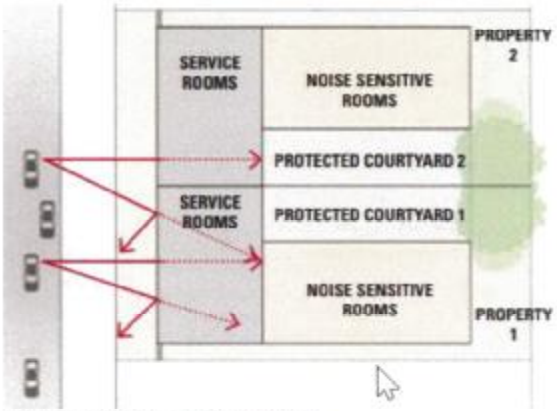

Figure 3.17: Noise shielded courtyards

Figure 3. Building Layout and Design to Reduce Noise Impact

(source: NSW Department of Planning's Development Near Rail Corridors and Busy Roads – Interim Guideline 2008, Figure 3.17)

Important note:-

These recommendations are given to minimise external noise impacts through the construction of boundary fences and building design so far as may be reasonably practicable for the builder or home owner. This assessment does not provide advice and recommendations to ensure compliance with any external noise limits at future dwellings from existing industrial operations.

Previously approved residential allotments on Theatre Drive, adjoining the subject Site, are restricted via 88b instruments requiring internal noise design goals to be met. This assessment adopts the same approach to the proposed subdivision of Lot 10.

6. CONCLUSION

An industrial noise intrusion assessment has been undertaken in relation to a planning proposal seeking to rezone land at Lot 10 in DP 1018281 Lansdowne and Robinson Streets, Goulburn, NSW to facilitate residential subdivision.

Industrial noise levels and heavy vehicle movement noise levels have been established across the Site based on attended noise surveys undertaken in November and December 2018 and January 2019. Industrial noise levels range from 51 to 62 dBA during the day and noise emitted from heavy vehicles are from 54 to 56 dBA at night at the least exposed and most exposed potential future dwellings respectively.

These measured and established noise levels have been used to determine the potential for compliance with the internal noise design goals derived from Australian Standard AS2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'* (AS2107).

These design goals can be achieved for any future residences based on typical example constructions outlined in **Section 5** of this report. Individual assessments of future dwellings may be undertaken prior to issue of construction certificates.

This may be facilitated by the inclusion of 88b instruments on burdened lots.

Any acoustical treatment, where required will not be onerous and result typically in an upgrade to standard glazing thicknesses and or standard plasterboard thickness in some ceilings.

The approach of including 88b instruments that require internal noise design goals to be met in accordance with AS2107:2016 is in keeping with the approved residential subdivision on the adjoining parcel of land at Theatre Drive.

This assessment does not address potential for compliance with external noise goals derived from the EPA's *Noise Policy for Industry* (2017) for noise emission arising from industrial premises impacting on future residents. However, advice is provided in **Section 5.3** to reduce external noise impacts in the design stage of future dwellings so far as is reasonably practicable.

Matthew Harwood, MAAS

Principal Acoustical Consultant

Attachments:-

Appendix A – Noise Survey Instrumentation

Noise Survey Instrumentation	Appendix A

The instrumentation used during the noise survey consisted of the following:-

Description	Model No.	Serial No.
SvanTek Sound Level Meter	SVAN 957	15395
Bruel & Kjaer Sound Level Meter	2260	244 3406

The sound level meters conform to Australian Standard AS IEC 61672.1-2004 : 'Electroacoustics - Sound level meters – Specifications' as a Class 1 precision sound level meter.

The calibration of the meter was checked before and after the measurement period. No significant system drift occurred over the measurement period. The sound level meter and calibrator have been checked, adjusted and aligned to conform to the factory specifications and issued with conformance certificates as required by the regulations.