WOOLWORTHS AUBURN

Proposed Warehouse and Distribution Centre
Construction Noise Management Plan

Prepared for:

Vaughan Constructions Pty Ltd
9a Commercial Road
Kingsgrove NSW 2208

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BASIS OF REPORT

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

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

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

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30224-R01-v1.1	27 August 2021	Shannon Harvey	Aaron Miller	Aaron Miller
630.30224-R01-v1.0	19 August 2021	Shannon Harvey	Aaron Miller	Aaron Miller

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Vaughan Constructions Pty Ltd (Vaughan) to prepare a Construction Noise Management Plan (CNMP) for construction works to be conducted for the proposed warehouse and distribution centre located at 11-13 Percy Street, Auburn.

The CNMP is designed to address the potential construction noise impacts on the surrounding residential receivers and to detail procedures for minimising, managing and monitoring these impacts. The CNMP addresses Condition B4 of the Development Consent Conditions, which is reproduced below. The locations where the other associated Development Consent Conditions are addressed within the report are provided in **Table 1**.

The Applicant must prepare a Construction Noise Management Plan for the development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with Condition C2 and must:

(a) be prepared by a suitably qualified and experienced noise expert;

(b) be approved by the Planning Secretary prior to the commencement of construction (or each stage of construction, where relevant) of the development;

(c) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time);

(d) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;

(e) include strategies that have been developed with the community for managing high noise generating works;

(f) describe the community consultation undertaken to develop the strategies in Condition B4(e); and

(g) include a complaints management system that would be implemented for the duration of the development.

Table 1 Where Development Consent Conditions are addressed within this Report

Condition	Description	Where Addressed
B1	Hours of Work	**Section 2.3**
B2	Exceptions to Hours of Works	**Section 2.3**
B3	Construction Noise Limits	**Section 4**
B4 a)	Qualifications and Experience	**Section 10**
B4 b)	Approval from Planning Secretary	Pending
B4 c)	Procedures for achieving the noise management levels in the ICNG	**Section 5.1**
B4 d)	Mitigation measures to manage high noise generating works	**Section 5.1** and **Section 5.2**
B4 e)	Noise mitigation strategies developed with the community	**Section 5.3**
B4 f)	Community consultation undertaken to develop strategies	**Section 5.3**

Condition	Description	Where Addressed
B4 g)	Complaints management system	**Section 6**

Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in **Appendix A**.

2 Project Description

2.1 Site Description

The proposed development at 11-13 Percy Street, Auburn will consist of a two-storey warehouse building which will include ancillary offices and customer pickup operations, customer pick up for 56 vehicles, parking for up to 150 vehicles, 103 vans and loading bays for 35 vehicles as well as landscaping and signage.

The immediate area surrounding the subject site comprises a range of industrial and commercial land uses. Beyond this, to the north-west includes residential receivers, located approximately 150 m from the subject site. An aerial photograph showing the site and nearby sensitive receivers is provided as **Figure 1**.

An Environmental Impact Statement (EIS) was conducted by Willow Tree Planning as part of the SSD for the project (Refer to *Environmental Impact Statement SSD-10470, Proposed Warehouse and Distribution Centre, 11 & 13 Percy Street, Auburn Lot 1 & 2 DP1183821, October 2020*).

2.2 Noise Sensitive Receivers

The nearest potential noise sensitive receivers to the site are the multi-storey residential dwellings at 30-80 St Hilliers Street to the north-west, commercial receivers to the north, south and south-west at 15 Percy Street, 7-9 Percy Street, 42-58 Percy Street and 57-73 St Hilliers Road as well as industrial receivers to the west and east at 75-81 St Hilliers Road and 42 Boorea Street. Details of receivers are summarised in **Table 2**.

Table 2 Nearest Sensitive Receivers

Sensitive Receiver	Occupancy Type	Approx. Distance	Direction
30 St Hilliers Road	Residential	150 m	North-west
32-34 St Hilliers Road	Residential	150 m	North-west
38 St Hilliers Road	Residential	150 m	North-west
40-46 St Hilliers Road	Residential	150 m	North-west
52 St Hilliers Road	Residential	150 m	North-west
54 St Hilliers Road	Residential	150 m	North-west
56-60 St Hilliers Road	Residential	150 m	North-west
62 St Hilliers Road	Residential	150 m	North-west
64-66 St Hilliers Road	Residential	150 m	North-west
68-70 St Hilliers Road	Residential	150 m	North-west
72 St Hilliers Road	Residential	150 m	North-west
74-78 St Hilliers Road	Residential	150 m	North-west

Sensitive Receiver	Occupancy Type	Approx. Distance	Direction
80 St Hilliers Road	Residential	150 m	North-west
15 Percy Steet	Commercial (C1)	2 m	North
7-9 Percy Street	Commercial (C2)	2 m	South
42-58 Percy Street	Commercial (C3)	25 m	South-west
75-81 St Hilliers Road	Industrial (I1)	25 m	West
42 Boorea Street	Industrial (I2)	12 m	East

A site plan of the development is shown in **Figure 1**.

Figure 1 Site Description, Noise Monitoring Locations and Sensitive Receivers

2.3 Project Schedule

The hours of work that must be complied in accordance with Condition B1 of the Development Consent Conditions are reproduced in **Table 3**. These hours correspond with the 'Standard Construction Hours' detailed in the EPA's *Interim Construction Noise Guideline* (ICNG), this is discussed further in **Section 4.2.1**.

Table 3 Condition B1 – Hours of Work

Activity	Day	Time
Demolition, Earthworks and Construction	Monday to Friday	7:00 am to 6:00 pm
	Saturday	8:00 am to 1:00 pm

Condition B2 of the Development Consent Conditions states that:

> *Works outside of the hours identified in Condition B1 may be undertaken in the following circumstances:*
>
> *(a) Works that are inaudible at the nearest sensitive receivers;*
>
> *(b) Works agreed to in writing by the Planning Secretary;*
>
> *(c) For the delivery of materials required outside of these hours by the NSW Police Force or other authorities for safety reasons; or*
>
> *(d) Where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm.*

The project will occur in four stages. Indicative timelines for each stage are provided in **Table 4**.

Table 4 Project Stages

Stage	Duration
Demolition	5 weeks
Bulk Earthworks	10 weeks
Concreting	TBD
Construction	68 weeks

2.4 Plant and Equipment Noise Levels

A list of acoustically significant plant and equipment likely to be used during the stages of work detailed in **Table 4** has been provided by Vaughan Constructions. Sound power levels for the construction equipment applied in the modelling are listed in **Table 5**. Sound power levels for equipment used in the assessment have been obtained from the *Transport for NSW Construction Noise and Vibration Strategy April 2020* and an SLR database of similar equipment. It is assumed that all items would operate continuously for at least 15 minutes.

Table 5 Construction Works and Sound Power Levels for Construction Equipment

Construction Scenario	Equipment	Sound Power Level (dBA)	Quantity
Demolition	Excavator (tracked) 35t	110	4
	Hydraulic hammer	122	1
	Front end loader 23t	112	1
	Dump truck 30t	110	2
	Water cart 15t	110	1
	Truck and trailer	108	4
Bulk Earthworks	Bulldozer CAT D9 48t	116	1
	Scraper	113	1
	Excavator (tracked) 35t	110	1
	Hydraulic hammer	122	1
	Grader	113	1
	Dump truck	110	1
	Roller (smooth drum) 12t	107	1
	Water cart 15t	110	1
Concreting	Franna crane 20t	98	1
	Piling rig (bored)	108	1
	Power generator	101	1
	Concrete pump	106	1
	Concrete truck	106	1
	Compressor	95	1
	Pneumatic hammer	108	1
	Welding equipment	110	1
Construction	Franna crane 20t	98	1
	Elevated work platform	97	1
	Semi-trailer 20t	106	4
	Hand tools (electric)	96	1

3 Existing Acoustic Environment

SLR was unable to perform noise monitoring at the site due to Covid-19 restrictions imposed by the NSW Government. In addition, noise monitoring undertaken during restricted periods where traffic flows are limited may not be representative of the noise environment during normal (i.e no Covid-19 restrictions imposed by the NSW Government) periods; which are expected to cover the majority of the works considering the project duration (1.5 years). Therefore to determine the existing noise environment and quantify background noise levels, noise logging data measured previously for the project as part of the Environmental Impact Statement (EIS) has been used as a basis for assessing the potential noise impacts during construction.

Unattended noise monitoring was conducted at the existing residential site at 56-60 St Hilliers Road, Auburn, from Friday 26 June 2020 to Friday 10 July 2020. The measured Rating Background Levels (RBLs) that correspond to the time periods described in the NSW Environment Protection Authority's (EPA's) *Noise Policy for Industry* (NPfI) are presented in **Table 6**. SLR notes that there were still some Covid-19 restrictions imposed by the NSW Government during this time, however SLR was advised by TfNSW that traffic flows returned to pre-restriction levels on 20 July 2020.

Table 6 Measured Background Noise Levels Corresponding to EPA NPfI Assessment Periods

Daytime[1] RBL[2]	Evening[1] RBL[2]	Night-time[1] RBL[2]
60	56	46

Note 1: For Monday to Saturday: Daytime is 7:00 am to 6:00 pm, Evening is 6:00 pm to 10:00 pm, Night-time is 10:00 pm to 7:00 am. On Sundays and public holidays: Daytime is 8:00 am to 6:00 pm, Night-time is 10:00 pm to 8:00 am.

Note 2: The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Noise Policy for Industry.

4 Project Criteria and Trigger Levels

4.1 Development Consent Condition B3

Condition B3 of the Development Consent Conditions for the project states:

> *"The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures in the Appendix 2."*

4.2 NSW Interim Construction Noise Guideline

The EPA's Interim Construction Noise Guideline (ICNG) required by Development Consent Condition B3 sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts.

The ICNG requires project specific Noise Management Levels (NMLs) to be established for noise affected receivers. The NMLs are not mandatory limits, however in the event construction noise levels are predicted to be above the NMLs, feasible and reasonable work practices are to be investigated to minimise noise emissions.

4.2.1 Hours of Construction

The EPA's ICNG stipulates permissible work times as outlined in **Table 7**.

Table 7 Preferred Construction Hours

Day	Preferred Construction Hours
Monday to Friday	7 am to 6 pm
Saturdays	8 am to 1 pm
Sundays or Public Holidays	No construction

4.2.2 Residential Receivers

The ICNG provides an approach for determining NMLs at sensitive receivers based on RBL for the area during the Standard Construction Hours, as described in **Table 8**.

Table 8 Determination of NMLs for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Recommended standard hours: Monday to Friday 7:00am to 6:00pm Saturday 8:00am to 1:00pm No work on Sundays or public holidays	RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences. • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

4.2.3 Commercial and Industrial Premises

The ICNG notes that due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is outlined as follows:

- Offices, retail outlets: external 70 dBA $L_{Aeq(15minute)}$
- Industrial premises: external $L_{Aeq(15\ min)}$ 75 dBA

4.2.4 Sleep Disturbance

Sleep disturbance has not been considered as the proposed construction hours are during the daytime only.

4.3 NML Summary

Based upon the proposed construction hours and the unattended noise monitoring results contained in **Table 6** the project specific construction noise management levels are provided in **Table 9**.

Table 9 NMLs Criterion for Construction Noise

Location	Receiver Type	RBL	Management Level $L_{Aeq(15minute)}$ (dBA)	Highly Noise Affected (dBA)[1]
30-80 St Hilliers Road	Residential (R1)	60	70	75
15 Percy Street	Commercial (C1)	-	70	N/A
7-9 Percy Street	Commercial (C2)	-	70	N/A
57-73 St Hilliers Road 42-58 Percy Street	Commercial (C3)	-	70	N/A
75-81 St Hilliers Road	Industrial (I1)	-	75	N/A
42 Boorea Street	Industrial (I2)	-	75	N/A

Note 1: The 'Highly Noise Affected' threshold only applies to residential receivers.

5 Construction Noise Assessment

Noise predictions from the construction works have been predicted to the nearest receivers during the daytime and are summarised for residential receivers in **Table 10** and for commercial and industrial receivers in **11**.

Table 10 Predicted Daytime Construction Noise Levels – Residential Receivers

Construction Stage	Receiver	Noise Level $L_{Aeq(15\ minute)}$ (dBA)		
		Predicted Construction Noise Level $L_{Aeq(15minute)}$	Noise Criteria (NML)	NML Exceedance
Stage 1 (Demolition)	30 St Hilliers Road	65-66	70	-
	32-34 St Hilliers Road	64-67	70	-
	38 St Hilliers Road	64-69	70	-
	40-46 St Hilliers Road	63-67	70	-
	52 St Hilliers Road	70-73	70	**3**
	54 St Hilliers Road	70-71	70	**1**
	56-60 St Hilliers Road	61-68	70	-
	62 St Hilliers Road	67	70	-
	64-66 St Hilliers Road	62-68	70	-
	68-70 St Hilliers Road	61-65	70	-
	72 St Hilliers Road	61-65	70	-
	74-78 St Hilliers Road	61-65	70	-
	80 St Hilliers Road	61	70	-
Stage 2 (Bulk Earthworks)	30 St Hilliers Road	65-67	70	-
	32-34 St Hilliers Road	63-67	70	-
	38 St Hilliers Road	64-70	70	-
	40-46 St Hilliers Road	64-69	70	-
	52 St Hilliers Road	70-74	70	**4**

Construction Stage	Receiver	Noise Level $L_{Aeq(15\ minute)}$ (dBA)		
		Predicted Construction Noise Level $L_{Aeq(15minute)}$	Noise Criteria (NML)	NML Exceedance
	54 St Hilliers Road	71	70	**1**
	56-60 St Hilliers Road	62-70	70	-
	62 St Hilliers Road	68	70	-
	64-66 St Hilliers Road	63-69	70	-
	68-70 St Hilliers Road	61-65	70	-
	72 St Hilliers Road	61-65	70	-
	74-78 St Hilliers Road	62-66	70	-
	80 St Hilliers Road	62	70	-
Stage 3 (Concreting)	30 St Hilliers Road	55-57	70	-
	32-34 St Hilliers Road	54-57	70	-
	38 St Hilliers Road	54-60	70	-
	40-46 St Hilliers Road	54-58	70	-
	52 St Hilliers Road	62-64	70	-
	54 St Hilliers Road	62	70	-
	56-60 St Hilliers Road	53-60	70	-
	62 St Hilliers Road	59-60	70	
	64-66 St Hilliers Road	54-60	70	-
	68-70 St Hilliers Road	52-56	70	-
	72 St Hilliers Road	52-56	70	-
	74-78 St Hilliers Road	51-56	70	-
	80 St Hilliers Road	52	70	-
Stage 4 (Construction)	30 St Hilliers Road	52-54	70	-
	32-34 St Hilliers Road	51-54	70	-
	38 St Hilliers Road	52-60	70	-
	40-46 St Hilliers Road	52-56	70	-
	52 St Hilliers Road	56-60	70	-
	54 St Hilliers Road	56-57	70	-
	56-60 St Hilliers Road	50-56	70	-
	62 St Hilliers Road	56-57	70	-
	64-66 St Hilliers Road	51-57	70	-
	68-70 St Hilliers Road	49-53	70	-
	72 St Hilliers Road	49-53	70	-
	74-78 St Hilliers Road	49-53	70	-
	80 St Hilliers Road	49	70	-

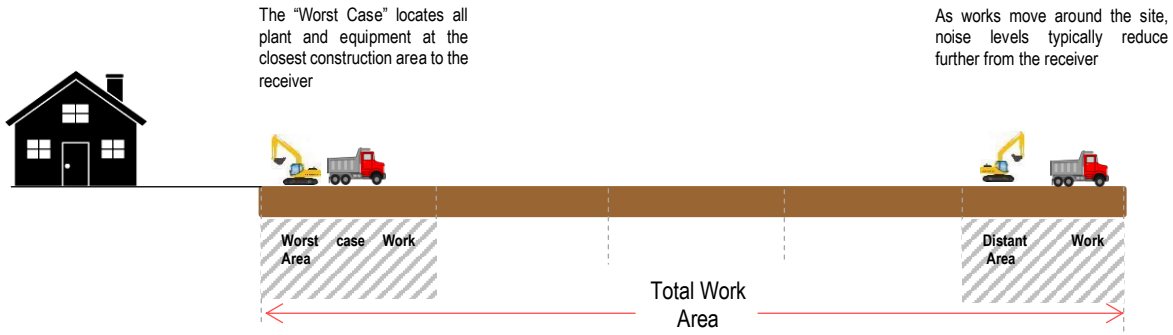
Table 11 Predicted Daytime Construction Noise Levels – Commercial/Industrial Receivers

Construction Stage	Receiver	Noise Level $L_{Aeq(15\ minute)}$ (dBA)		
		Predicted Construction Noise Level $L_{Aeq(15minute)}$	Noise Criteria (NML)	NML Exceedance
Stage 1 (Demolition)	Commercial (C1) 15 Percy Street	84	70	**14**
	Commercial (C2) 7-9 Percy Street	85	70	**15**
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	81	70	**11**
	Industrial (I1) 75-81 St Hilliers Road	81	75	**6**
	Industrial (I2) 42 Boorea Street	84	75	**9**
Stage 2 (Bulk Earthworks)	Commercial (C1) 15 Percy Street	85	70	**15**
	Commercial (C2) 7-9 Percy Street	86	70	**16**
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	82	70	**12**
	Industrial (I1) 75-81 St Hilliers Road	82	75	**7**
	Industrial (I2) 42 Boorea Street	85	75	**10**
Stage 3 (Concreting)	Commercial (C1) 15 Percy Street	76	70	**6**
	Commercial (C2) 7-9 Percy Street	77	70	**7**
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	73	70	**3**
	Industrial (I1) 75-81 St Hilliers Road	73	75	-
	Industrial (I2) 42 Boorea Street	76	75	**1**
Stage 4 (Construction)	Commercial (C1) 15 Percy Street	72	70	**2**

Construction Stage	Receiver	Noise Level $L_{Aeq(15\ minute)}$ (dBA)		
		Predicted Construction Noise Level $L_{Aeq(15minute)}$	Noise Criteria (NML)	NML Exceedance
	Commercial (C2) 7-9 Percy Street	69-72	70	**2**
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	64-66	70	-
	Industrial (I1) 75-81 St Hilliers Road	64-66	75	-
	Industrial (I2) 42 Boorea Street	68	75	-

The results represent the worst-case noise levels where all equipment in each scenario is working concurrently. For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted, particularly where the works are more distant from particular receivers; this concept is demonstrated in **Figure 2**.

Figure 2 Illustration of Works Areas



The above figure illustrates that when works move away from a receiver the noise levels from the operation of the construction equipment would reduce accordingly.

The above information shows the following:

- Minor to moderate noise impacts are predicted during the worst-case scenarios due to the proximity of the adjacent receivers. The impacts from the works are however expected to be limited as the works would be completed during standard construction hours.
- Daytime exceedances of up to around 16 dB above NML are predicted at the nearest receivers. These impacts would however only be apparent during the worst-case situation when noise generating items of equipment are in use. The noise levels at receivers which are further away would be substantially less than the worst-case predictions and noise levels would also frequently be lower than worst-case when noise intensive activities are not being completed.

As the NML's are not expected to be achieved at some receiver locations, particularly when construction activities occur close to these receivers, the construction contractor should apply all feasible and reasonable noise mitigation and management measures to minimise the impacts.

5.1 Standard Mitigation Measures

Due to the nature of construction activities and the proximity of the works to the sensitive receivers, it is inevitable that noise impacts will be apparent at certain times during the works.

Consequently, the project should apply all feasible and reasonable work practices to meet the NMLs, where possible, and inform all potentially impacted sensitive receivers of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and contact details during construction.

The recommended construction migitaion measures are shown in **Table 12**.

Table 12 Recommended Mitigation Measures

Project stage	Measure
Project planning	Where possible, consider the application of alternative, low-impact construction techniques to rock breaking and concrete sawing.
	Power tools using mains power rather than by using generators.
	Use the minimum sized equipment necessary to complete the work, this is particularly relevant to compacting and hydraulic hammering / rock breaking.
Scheduling	Carry out community consultation and provide advanced warning of potential disruptions to sensitive receivers (refer to **Section 5.2**).
	Deliveries are to occur during Standard Construction Hours only.
Site Layout	Site entry and exit points will be located as far as possible from sensitive receivers, taking into account the importance of safe access.
	Compounds, refuelling areas and work areas will be designed to promote one-way traffic so that vehicle reversing movements are minimised.
	Work compounds, parking areas, equipment and material stockpile sites will be positioned away from noise-sensitive locations
	Trucks will be carefully scheduled and not queue up outside residential properties.
Training	Training will be provided to all project personnel, including relevant sub-contractors on noise requirements through inductions, toolboxes and targeted awareness training.
	All relevant staff and sub contractors will be informed of areas and work practises where potential noise impacts have been identified.
	Horn signals between drivers are not permitted.
Contractor management	Delivery vehicles should be fitted with straps rather than chains for unloading, wherever possible.
	Truck drivers should avoid compression braking as far as practicable and should use main roads where feasible.
Noise source mitigation and controlling the transmission of noise	Switch off generators/items of plant when not in use.
	Avoid dropping materials from a height.
	Shut down or throttle down machinery when not in operation.
	Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver

Project stage	Measure
	Ensure equipment is operated in the correct manner including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components, repair of leakages in compressed air lines and shutting down equipment not in use.
	Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise
	Plant will be fitted with noise control devices, where practicable, including acoustic lining of engine bays and air intake / discharge silencers
	Ensure that all doors/hatches are shut during operation of plant and equipment.
	Check hatches/enclosures regularly to ensure that seals are in good working order and doors close properly against seals.
	Use residential-grade mufflers on plant.
	Use dampened bits on impulsive tools such as jackhammers to avoid 'ringing' noise.
	An acoustic shroud (skirt) can be installed on hydraulic rockbreakers and concrete saws.
	Ensure truck movements are kept to a minimum, ie that trucks are fully loaded on each trip.
	Mobile plant and trucks operating on site for a significant portion of the project will have reversing alarm noise emissions minimised, where possible, recognising the need to maintain occupational safety standards. This may potentially be achieved through restrictions on reversing activities or installation of non-tonal reversing alarms on mobile plant and equipment.
	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.
Community consultation	Provide at least five and not more than 14 days' notice to affected receivers prior to starting works (refer to **Section 5.2**).
	Provide signage detailing who is undertaking the works and a contact number.
	Where there are complaints about noise from an identified work activity, review and implement, where feasible and reasonable, additional control measures.
Monitoring	Conduct noise monitoring in response to any complaints received to verify that levels do not substantially exceed predicted levels.
	Initial noise monitoring of plant and equipment will be undertaken to ensure the noise levels are being met (refer to **Section 5.2**).

5.2 Additional Mitigation Measures

The Transport for New South Wales (TfNSW) *Construction Noise and Vibration Strategy* (CNVS) provides additional mitigation measures for receivers who trigger the project NMLs or are highly noise affected and are used as guidance on this project. **Table 13** shows additional measures to be implemented for each receiver depending on how far predicted airborne noise levels are above the background noise level (RBL) or airborne noise management level (ANML). The applicable CNVS additional management measures for the Standard Construction Hours are outlined in **Table 14** on the following page.

Table 13 Additional Airborne Noise Management Measures

Construction Hours	Receiver Perception	dB(A) above RBL	dB(A) above ANML	Additional Management Measures[1]
Standard Hours Monday to Friday (7am to 6pm) Saturday (8am to 1pm)	Noticeable	5 to 10	0	-
	Clearly Audible	> 10 to 20	< 10	-
	Moderately Intrusive	> 20 to 30	> 10 to 20	PN, V
	Highly Intrusive	> 30	> 20	PN, V
	75dBA or greater[2]	N/A	N/A	PN, V, SN

Note 1: PN = Project notification, V = Verification monitoring, SN = Specific notification.

Note 2: Applicable to residential receivers only.

There are no additional airborne noise mitigation measures required at the residential receivers. In addition to the additional mitigation measures described above, the ICNG notes regarding commercial and industrial premises that:

> *The proponent should assess construction noise levels for the project, and consult with occupants of commercial and industrial premises prior to lodging an application where required.*
>
> *During construction, the proponent should regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work.*

Additionally, the CNVS notes regarding commercial and industrial premises that:

> *Community consultation will be required during the assessment and planning phase of a project (prior to construction) to confirm the location of other sensitive receivers including collecting information on specialised requirements for each receiver (for example education or community facilities that provide Autism-specific services or identifying to location of vibration sensitive equipment in medical facilities). This may be achieved by completing a door-knock exercise or completing specific notifications prior to construction.*

Table 14 Additional Management Measures (reproduced from the CNVS)

Measure	Description	Abbreviation
Periodic Notification	For each project, a notification entitled 'Project Update' or 'Construction Update' is produced and distributed to stakeholders via letterbox drop and distributed to the project postal and/or email mailing lists. Periodic notifications provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. noisy works) can assist in reducing the impact on stakeholders. The approval conditions for projects specify requirements for notification to sensitive receivers where works may impact on them. Most projects distribute notifications on a monthly basis. Each notification is graphically designed within a branded template. In certain circumstances media advertising may also be used to supplement Periodic Notifications, where considered effective.	PN

Measure	Description	Abbreviation
Verification Monitoring	Verification monitoring of noise during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended or operator attended surveys (i.e. for specific periods of construction noise). The purpose of monitoring is to confirm that: • construction noise from the project is consistent with the predictions in the noise assessment • mitigation and management of construction noise is appropriate for receivers affected by the works Where noise monitoring finds that the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required.	V
Specific Notification	Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. Alternatively (or in addition to), communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing. • Letters may be letterbox dropped or hand distributed • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project Specific notifications are used to support periodic notifications, or to advertise unscheduled works.	SN

On the basis of the above, the additional mitigation measures recommended for the nearby commercial/industrial receivers at each stage are provided in **Table 15**.

Table 15 Additional Mitigation Measures – Commercial and Industrial Receivers

Construction Stage	Receiver	dB(A) above ANML	Additional Management Measures[1]
Demolition	Commercial (C1) 15 Percy Street	14	PN, V, SN
	Commercial (C2) 7-9 Percy Street	15	PN, V, SN
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	11	PN, V, SN
	Industrial (I1) 75-81 St Hilliers Road	6	PN, SN

Construction Stage	Receiver	dB(A) above ANML	Additional Management Measures[1]
	Industrial (I2) 42 Boorea Street	9	PN, SN
Earthworks	Commercial (C1) 15 Percy Street	15	PN, V
	Commercial (C2) 7-9 Percy Street	16	PN, V
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	12	PN, V
	Industrial (I1) 75-81 St Hilliers Road	7	PN
	Industrial (I2) 42 Boorea Street	10	PN, V
Concreting	Commercial (C1) 15 Percy Street	6	PN
	Commercial (C2) 7-9 Percy Street	7	PN
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	3	PN
	Industrial (I1) 75-81 St Hilliers Road	-	PN
	Industrial (I2) 42 Boorea Street	1	PN
Construction	Commercial (C1) 15 Percy Street	2	PN
	Commercial (C2) 7-9 Percy Street	2	PN
	Commercial (C3) 57-73 St Hilliers Road 42-58 Percy Street	-	PN
	Industrial (I1) 75-81 St Hilliers Road	-	PN
	Industrial (I2) 42 Boorea Street	-	PN

The requirements in **Table 15** can be summarised as follows:

- Door-knock or specifically notify each of the sensitive commercial and industrial receivers identified at least 7 days prior to the commencement of the Demolition works.

- Conduct attended noise monitoring at the commencement of both the Demolition and the Earthworks scenarios to verify the noise level predictions. This is detailed further in **Section 7**.
- Perform a letter box drop to each of the identified sensitive commercial and industrial receivers detailing the works progress and expected noise levels from upcoming construction activities on a monthly basis.

5.3 Community Consultation

Vaughan has advised SLR that they have undertaken the Specific Notification mitigation measure in accordance with the requirements detailed in **Section 5.2** at the following identified sensitive receivers:

- 7-9 Percy Street
- 15 Percy Street
- 42-58 Percy Street
- 75-81 St Hilliers Road
- 42 Boorea Street

Vaughan has advised that these receivers did not consider themselves to be sensitive and did not provide any suggestions regarding mitigation measures or strategies in addition to those listed in **Table 12**.

Vaughan has also advised that they have commenced the Periodic Notifications at these same receivers.

6 Complaint Handling

The construction contractor will adopt the following protocol for handling complaints. This protocol is intended to ensure that the issues are addressed and that appropriate corrective action is identified and implemented as necessary:

- The construction contractor will record all verbal and telephone complaints in writing and will forward all complaints to the Project Manager, together with details of the circumstance leading to the complaint and all subsequent actions.
- Complaints received by the Project Manager will, as an initial step, be referred to the construction contractor. The construction contractor will respond as described above.
- The Project Manager will investigate the complaint in order to determine whether a criterion exceedance has occurred or whether noise has occurred unnecessarily.
- If excessive or unnecessary noise have been caused, corrective action will be planned and implemented by the construction contractor.
- Complainants will be informed by the Project Manager that their complaints are being addressed, and (if appropriate) that corrective action is being taken.
- Follow up monitoring or other investigations will be carried out by the Project Manager and the construction contractor to confirm the effectiveness of the corrective action.
- Complainants will be informed of the implementation of the corrective action that has been taken to mitigate the adverse effects.

7 Noise Monitoring

Noise monitoring will be conducted by suitably trained personnel as required in accordance with the requirements of **Table 15** or in response to any complaints.

Attended noise monitoring for the construction works will be undertaken at the closest, potentially most affected residences, in order to differentiate between construction noise sources and other sources (such as road traffic and aircraft noise) and also in order to observe and identify any abnormally noisy construction equipment or operations.

During attended monitoring, typical maximum noise levels associated with particular operations and/or plant items will be noted. Extraneous noise events such as road and air traffic noise will be excluded from the results or highlighted in accompanying notes. Equipment and methods will need to comply with AS 1055:2018. The statistical parameters to be measured will be the L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq} evaluated over consecutive 15 minute periods.

Where noise monitoring has occurred within the preceding week, reports will be submitted to the Project Manager at weekly intervals. These reports will cover the preceding weeks' activities and will include the following:

- Attended monitoring locations.
- Tabulation of attended noise measurement results together with notes identifying the principal noise sources.
- Summary of measurements exceeding the criteria levels and descriptions of the plant or operations causing these exceedances (if available).
- Details of corrective action applicable to criteria exceedances and confirmation of its successful implementation. Where corrective action has not yet been implemented, it may be shown as pending and the status of its implementation shall be carried forward to following reports.

8 Identifying and Managing Future Noise Issues

If additional activities or plant are found to be necessary these will be assessed on a case-by-case basis and appropriate mitigation measures will be implemented.

Progressive impact assessments will be conducted as the works proceed in the event that works significantly deviate from those originally planned.

9 Non-Compliance and Corrective Action

Where the noise monitoring identifies non-compliance with the relevant criteria, corrective actions will be conducted in accordance with the Construction Environmental Management Plan.

The corrective action may involve supplementary monitoring in order to identify the source of the non-conformance and may involve modification of the construction techniques or programme to avoid any recurrence or minimise its adverse effects.

10 Final Remarks

This report has been prepared by SLR Consulting Australia Pty Ltd, a member firm of the Association of Australasian Acoustical Consultants (AAAC).

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 (e.g. 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

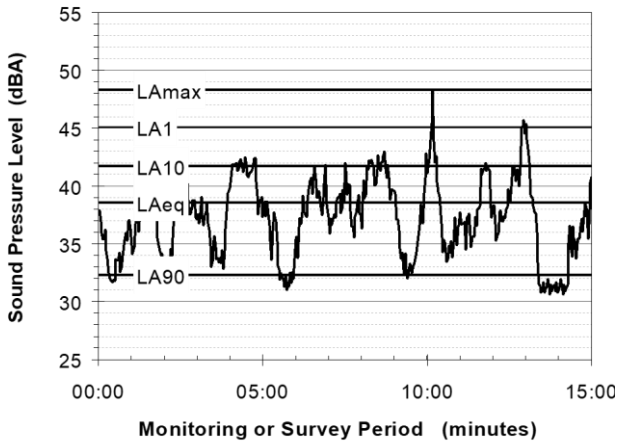
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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

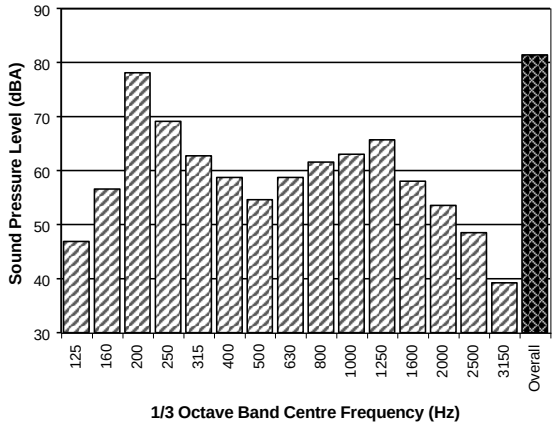
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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 (i.e. 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 (i.e. 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

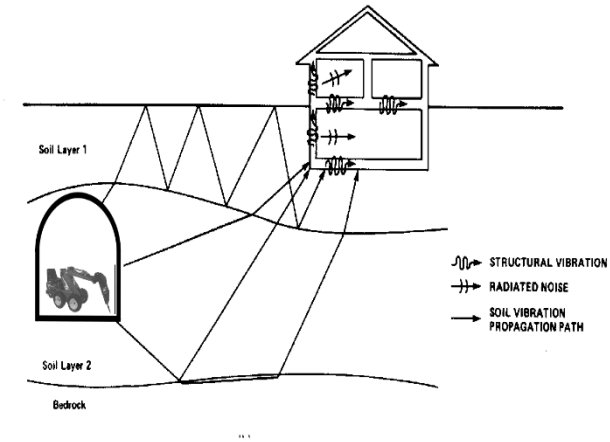
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience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