

MANAGING DIRECTORS

MATTHEW PALAVIDIS
VICTOR FATTORETTO

DIRECTORS

MATTHEW SHIELDS
BEN WHITE



Sydney International Convention Centre

Demolition, Excavation and Construction Noise Management Plan

SYDNEY

A: 9 Sarah St Mascot NSW 2020
T: (02) 8339 8000
F: (02) 8338 8399

SYDNEY MELBOURNE BRISBANE CANBERRA
LONDON DUBAI SINGAPORE GREECE

www.acousticlogic.com.au

ABN: 11 068 954 343

The information in this document is the property of Acoustic Logic Consultancy Pty Ltd ABN 11 068 954 343 and shall be returned on demand. It is issued on the condition that, except with our written permission, it must not be reproduced, copied or communicated to any other party nor be used for any purpose other than that stated in particular enquiry, order or contract with which it is issued.

DOCUMENT CONTROL REGISTER

Project Number	20130328.1
Project Name	Sydney International Convention Centre
Document Title	Demolition, Excavation and Construction Noise Management Plan
Document Reference	20130328.1/0606A/R2/TA
Issue Type	Email
Attention To	Lend Lease Project Management & Construction (Aust) P/L Mr Michael McNelis

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	6/06/2013	20130328.1/0606A/R0/TA	TA		TA
1	06/06/2013	20130328.1/0606A/R1/TA	VF		VF
2	6/06/2013	20130328.1/0606A/R2/TA	TA		TA

TABLE OF CONTENTS

1	EXECUTIVE SUMMARY.....	5
2	INTRODUCTION	6
3	PROJECT DESCRIPTION	6
3.1	GENERAL	6
3.2	THE SITE AND POTENTIALLY MOST IMPACTED RECEIVERS	6
3.3	ACTIVITIES AND METHODOLOGY	7
3.3.1	Bayside Convention Centre	7
3.3.2	Parkside Convention Centre	7
3.3.3	Exhibition Centre	7
3.3.4	Multifunction Entertainment Centre	7
3.3.5	Public Domain	8
3.4	NOISE SOURCE LEVELS	9
3.5	EXCAVATION TRAFFIC	9
3.6	HOURS OF WORK	10
4	CONSTRUCTION NOISE AND VIBRATION GOALS	11
4.1	NOISE	11
4.2	VIBRATION	12
4.2.1	Assessing Amenity - EPA NSW "Assessing Vibration: A Technical Guideline"	13
5	ASSESSMENT OF POTENTIAL NOISE EMISSIONS	14
5.1	INTRODUCTION AND INTENT	14
5.2	POTENTIALLY AFFECTED RECEIVERS	14
5.3	EXTERNAL NOISE GOALS	14
5.4	INTERNAL NOISE GOALS	16
5.5	PREDICTED NOISE LEVELS	17
5.5.1	Convention Centre	18
5.5.1.1	Goldsbrough Apartments (243 Pyrmont Street)	18
5.5.1.2	Bullecourt Apartments (287 Pyrmont Street)	19
5.5.1.3	Harbourside Shopping Centre	20
5.5.1.4	Novatel Sydney	21
5.5.1.5	Novatel Rockford Darling Harbour	22
5.5.1.6	UTS Haymarket Campus	23
5.5.1.7	IMAX	24
5.5.1.8	Commonwealth Bank Place	25
5.5.1.9	Southern Cross Suites	26
5.5.1.10	Chinese Gardens	27
5.5.2	Exhibition Halls	28
5.5.2.1	Goldsbrough Apartments (243 Pyrmont Street)	28
5.5.2.2	Bullecourt Apartments (287 Pyrmont Street)	29
5.5.2.3	Harbourside Shopping Centre	30
5.5.2.4	Novatel Sydney	31
5.5.2.5	Novatel Rockford Darling Harbour	32
5.5.2.6	UTS Haymarket Campus	33
5.5.2.7	IMAX	34
5.5.2.8	Commonwealth Bank Place	35
5.5.2.9	Southern Cross Suites	36
5.5.2.10	Chinese Gardens	37
5.5.3	The Theatre	38

5.5.3.1	Goldsbrough Apartments (243 Pyrmont Street)	38
5.5.3.2	Bullecourt Apartments (287 Pyrmont Street)	39
5.5.3.3	Harbourside Shopping Centre	40
5.5.3.4	Novatel Sydney	41
5.5.3.5	Novatel Rockford Darling Harbour	42
5.5.3.6	UTS Haymarket Campus	43
5.5.3.7	IMAX	44
5.5.3.8	Commonwealth Bank Place	45
5.5.3.9	Southern Cross Suites	46
5.5.3.10	Chinese Gardens	47
5.6	DISCUSSION	48
5.7	RECOMMENDATIONS	50
5.7.1.1	Saturday Works	50
6	ASSESSMENT OF VIBRATION	51
7	GENERAL MITIGATION METHODS THAT WOULD BE APPLIED TO MANAGE NOISE/VIBRATION EMISSIONS	52
7.1	NOISE CONTROL METHODS	52
7.1.1	Selection of Alternate Appliance or Process	52
7.1.2	Acoustic Barriers	52
7.1.3	Silencing Devices	53
7.1.4	Material Handling	53
7.1.5	Treatment of Specific Equipment	53
7.1.6	Establishment of Site Practices	53
7.1.7	Introduction of Construction Joints	53
7.1.8	Strategic Positioning of Processes On-Site	53
7.1.9	Combination of Methods	53
7.1.10	Establishment of Direct Communication with Affected Parties	54
7.1.11	Management Training	54
8	MONITORING	56
8.1	RESPONSE TO VIBRATION ALARMS	56
9	COMMUNITY INTERACTION AND COMPLAINTS HANDLING	57
9.1	ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES	57
9.2	DEALING WITH COMPLAINTS	57
10	CONTINGENCY PLANS.....	59
11	CONCLUSION.....	60

1 EXECUTIVE SUMMARY

The Management Plan outlines the development of controls and safeguards that would be applied to all activity on the SICEEP site during the demolition, excavation and construction phases. The objective of these controls is to ensure that all work is carried out in a highly controlled and predictable manner that will minimise emissions and protect the amenity of the sensitive receivers surrounding the site including UTS Haymarket Campus, Novatel Sydney, The Oaks Goldsbrough Apartments, 287 Pyrmont Street, the Commonwealth Bank, The IMAX cinema, Harbourside Shopping Complex, the Chinese Gardens, Southern Cross Suites and the Novatel Rockford, Darling Harbour.

Further reviews would be undertaken through the demolition, excavation and construction period, as required, in response to revised methods and equipment, as well as in response to the monitoring and evaluation of actual impacts. This management plan outlines the procedures that would be adopted by the contractor during the detailed demolition, excavation and construction planning and execution phases.

2 INTRODUCTION

This document presents the demolition and construction noise and vibration plan that will be used to manage noise and vibration from the demolition of the existing structures, excavation of footings and construction of new structures.

3 PROJECT DESCRIPTION

3.1 GENERAL

The entertainment precinct of the SICEEP comprises of the Theatre, Exhibition Halls and the Convention Centre. It is proposed that the buildings undergo major additions and refurbishment which also involves the demolition of some of the existing structures and excavation of footings.

3.2 THE SITE AND POTENTIALLY MOST IMPACTED RECEIVERS

The site is bounded to the north by the Harbourside Shopping Centre and the Novatel Hotel. To the west of the site is the Oaks Goldsbrough Apartments and the Bullecourt Apartments 243 and 287 Pyrmont Street respectively. To the south of the site, across Pier Street is the Entertainment Centre car park. Further to the south is the UTS Haymarket Campus. The Novatel Rockford Hotel is located to the southeast of the proposed development site. The Chinese Gardens, IMAX theatre, Commonwealth Bank development and Darling Harbour Southern Cross Suites are located to the east of the site.

These receivers represent the nearest potentially affected locations for demolition, excavation and construction noise emissions from the SICEEP site.

It is noted that the works associated with The Haymarket Hotel Complex are the subject of a separate Project Application.

The boundary of the proposed works is presented in Figure 1.

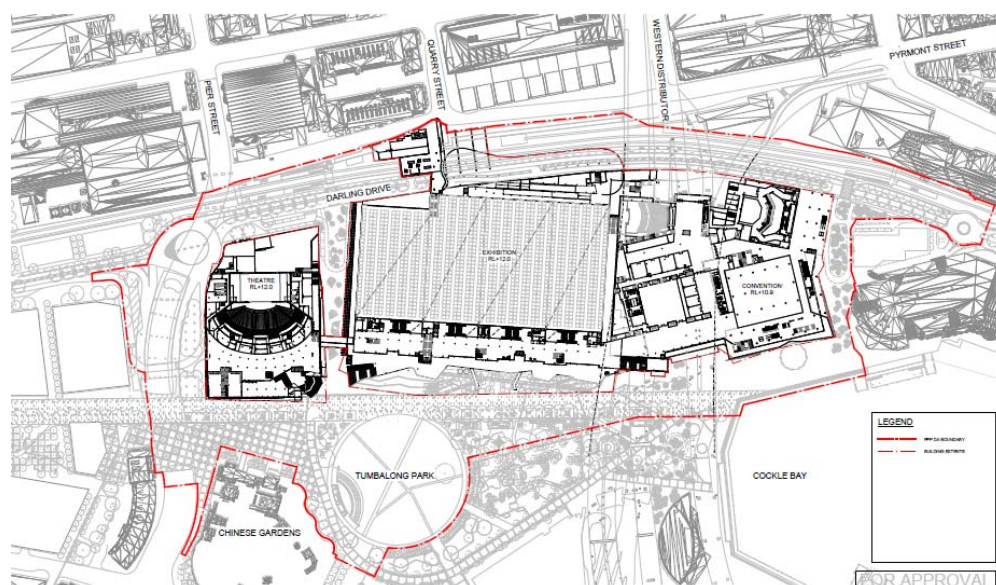


Figure 1 – Site Boundary

3.3 ACTIVITIES AND METHODOLOGY

Following is a description of the activities and methodology proposed to be employed to complete the various project phases.

Demolition principally involves partial demolition of structures and finishes of the existing convention centre and exhibition halls, as described below.

3.3.1 Bayside Convention Centre

It is proposed to completely demolish the existing Bayside Convention Centre, remove foundations and commence piling and structure from existing ground level. The eastern element of the new convention building is conventional concrete structure for six levels and a structural steel roof. The western element is a plenary building of intermittent floors, largely constructed of structural steel. A tower crane has been incorporated into the building for the eastern element and crawler crane for the western element. Materials handling is from the west and along northern side of new building from Darling Drive.

3.3.2 Parkside Convention Centre

This building will undergo a “soft” demolition. That is, the finishes and services will be stripped back to the structural elements, which will be retained. This building is to be progressively decommissioned to allow demolition on the lower two floors to allow new fitout to commence. The top level will be used initially for a construction office and amenities until relocation into south halls to allow completion of this level. Materials handling shall be from west, using the existing Darling Drive loading dock

3.3.3 Exhibition Centre

The existing Exhibition Halls structure will be demolished down to existing floor level, maintaining the existing car park underneath this level. New foundations will be located at carpark level, allowing the erection of new structural steel double stack and single stack halls over the current floor level. A steel structure is proposed with intermittent floors on both east and west sides of the new halls. A full span steel truss roof will span both new halls. A new delivery truck ramps and loading dock is to be erected over Darling Drive to service the new halls. Materials handling will be from three sides, east, south and west, with tower cranes to each hall and crawler cranes from the external sides.

3.3.4 Multifunction Entertainment Centre

To accommodate the location of the new Entertainment Centre, the existing Exhibition Halls structure shall be demolished down to existing floor level and the existing carpark underneath will be maintained. New foundations shall be located at carpark level, allowing the erection of a new structural steel centre over the current floor level. The structure is steel with intermittent floors on both east and sides of the new centre. A full span steel truss roof shall span the new centre. A new delivery dock and carpark are to be erected on the western side of the new centre. Materials handling will be from all sides, north, east, south and west, with crawler cranes from the external sides and within for steel erection.

3.3.5 Public Domain

Taking into account requirements from the bid documents, the public domain works have been programmed and planned around special yearly events within the precinct to maintain it active. Staging of the works will involve completion of the main boulevard to allow a through access from Pier Street to Darling Harbour. The other stages address location and access for both construction and the general public to completion. New in-ground services are the main element to be incorporated within the planning.

3.4 NOISE SOURCE LEVELS

The A-weighted sound power levels for typical equipment/processes anticipated to be used during these works are outlined in Table 1 below.

Table 1 - Sound Power Levels

EQUIPMENT /PROCESS	SOUND POWER LEVEL dB(A)**
Excavator/ Bulldozer	114
Concrete crusher	114
Bobcat	105
Hydraulic Hammer on 20-60t Excavator	130*
Hydraulic Hammer on 5t Excavator	123*
Rock/Masonry Saw on Excavator	110
Piling Rig	115
Rock Anchor Drill Rig	110
Pneumatic Hammer	115*
Electric Hammer	105*
Concrete Pump	110
Concrete Truck	110
Truck	108
Forklifts	100
Angle grinders	118*
Electric Saw	116*
Drilling	94
Hammering	125*
Site Crane	105
Impact drill	105
Remediation Plant	115
Air compressor	86
Concrete Float/Vibrators	105

* - includes 5 dB(A) addition for characteristics of noise source.

** - The noise levels presented in the above table are derived from on-site measurements, Table A1 of Australian Standard 2436-2010 and data held by this office from other similar studies.

3.5 EXCAVATION TRAFFIC

Arrival and departure routes have been outlined in a Construction Traffic Management Plan (CTMP) prepared by Hyder and dated 19 March 2013.

Heavy vehicle traffic will include large rigid and articulated trucks. It is anticipated that the largest vehicle to be used will be a large semi-trailer as described in the RMS Guidelines (16.9m by 2.5m).

Heavy vehicle trips expected each day will vary and these will be distributed during the day without any perceived peak hour period. Hyder CTMP have estimated that 3 – 4 trucks per hour will access the site for the duration of the construction.

Given the existing number of vehicle and heavy vehicle movements on the existing local road network, and because off-site disposal of excavated material is to be minimised by reusing on the site, no adverse impacts are expected from the expected number of vehicle movements on local streets.

3.6 HOURS OF WORK

The proposed hours of work are:

- Monday to Friday 7am to 7pm
- Saturdays 7am to 5pm.
- No work on Sundays or public holidays.

It is proposed that the standard hours of construction for weekdays be 7am to 7pm and that Saturday construction hours be 7am to 5pm. The proposed construction hours are based on precedence set on other projects in the vicinity of the site including Darling Quarter, Cockle Bay; Global Switch, Ultimo; The Brewery and UTS FEIT, Broadway; UTS Chau CHak, Ultimo and 420 George Street, Sydney CBD.

The reasons for the proposed construction hours are:

- The EPA guidelines are general guidelines that would be applicable in more sensitive situations - in quiet residential suburbs, for example. In this particular case, the affected properties are adjacent to a major entertainment precinct that is largely comprised of commercial premises with some residential receivers.
- City of Sydney guidelines are less stringent than standard EPA time restrictions and permit longer construction hours on Saturdays.
- Adopting the proposed hours will allow for efficient construction on Saturdays and the entire construction timetable will be expedited which will benefit the surrounding community.
- Noise restrictions are proposed to limit noise impacts outside the standard hours.

It is proposed that the following noise limits will be applied outside the standard hours:

- Between the hours of 7am and 8am on Saturday, only activities that comply with “background + 5dB(A)” criteria at residential receivers be permitted in accordance with EPA guideline.
- Between the hours of 6pm and 7pm weekdays and 1pm and 5pm on Saturday, only operations complying with “background +10dB(A)” limit at residential receivers will be permitted. It is noted that the “background + 10dB(A)” will be a noise emission limit rather than a management level.

4 CONSTRUCTION NOISE AND VIBRATION GOALS

4.1 NOISE

The applicable guidelines and standards are:

- EPA Interim Construction Noise Guideline. This guideline nominates a methodology for assessing and managing construction noise (and vibration) impacts.

A quantitative assessment is undertaken involving the prediction of likely noise levels from activities at sensitive receivers, and these noise levels are compared to noise “goals”. This process identifies the processes causing emissions that may exceed the goals, so that feasible and reasonable management of those processes can be assessed and implemented to these processes.

- Australian Standard 2436-2010 “Guide to Noise Control on Construction Maintenance and Demolition Sites”.

AS 2436 states that care shall be taken in applying criteria that normally would be used to regulate noise emitted from industrial, commercial and residential premises to construction, particularly for those activities which are transitory and of short duration. The principles of AS2436 are as follows:

- A reasonable suitable noise criterion is established;
- All practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

AS 2436 and the EPA largely adopt the same broad objectives, except that the EPA Guideline is more detailed in its recommendations. Based on these the following procedure will be used to assess noise emissions:

- Develop noise management levels for sensitive receivers around the site to broadly achieve EPA guidelines and objectives.
- Assess noise levels produced by construction activities at the sensitive receivers.
- If noise levels exceed EPA “Noise Affected” Management Level (NAML) (rating background noise level + 10 dB(A) for residential receivers) investigate and implement all reasonable and feasible techniques to limit noise emissions.
- If noise levels exceed EPA “Highly Noise Affected” Management Level (HNAML) (75dB(A) for residential receivers) after applying all practical engineering controls to limit noise emissions investigate time management and other techniques to further mitigate noise emissions.

As per the EPA Interim Construction Noise Guideline, the external noise management level for commercial / retail outlets should be 70 dB(A) L_{eq} externally. The noise management level for the Chinese Gardens should be 60dB(A) L_{eq} as it would be deemed a “passive recreational area”.

There is no internal noise level requirement stipulated for offices within the EPA guideline. Based on the EPA a compliant external noise level of 70dB(A) L_{eq} and the typical façade transmission loss of a closed window being 20dB(A), an internal noise level of 50dB(A) L_{eq} would be expected would be expected in this scenario.

It can be extrapolated that an internal noise level of 50dB(A) L_{eq} should be the noise management level for offices. This is also consistent with the criteria developed for other sensitive internal receivers in accordance with the IENG.

4.2 VIBRATION

It is proposed to adopt the following vibration guidelines, namely:

- German Standard DIN 4150-3 (1999-02): *“Structural Vibration – Effects of Vibration on Structures”* – which will be used to assess and limit building damage risk.
- EPA Interim Construction Noise Guideline – which contains guidelines to assess and limit impacts on building occupant’s amenity based on the *“Assessing Vibration: A Technical Guide”*.

The criteria and the application of this standard are discussed in separate sections below.

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 2.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 2 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms ⁻¹)			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

4.2.1 Assessing Amenity - EPA NSW “Assessing Vibration: A Technical Guideline”

EPA NSW “Assessing Vibration: A Technical Guideline” (Feb 2006) is based on the guidelines contained in BS 6472:1992. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and manage vibration from the site. Where vibration exceeds, or is likely to exceed, the recommended levels then an assessment of reasonable and feasible methods for the management of vibration should be undertaken.

Table 3 – EPA Recommended Vibration Criteria

		RMS acceleration (m/s ²)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices		0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices		0.64	1.28	13.0	26.0	18.0	36.0
Workshops		0.64	1.28	13.0	26.0	18.0	36.0

5 ASSESSMENT OF POTENTIAL NOISE EMISSIONS

5.1 INTRODUCTION AND INTENT

The purpose of the assessment of noise emissions is to highlight those activities that have the potential to exceed the NAML, so that management of those activities can be assessed in accordance with the ICNG. **The noise levels presented in the assessment are worst case noise levels without any management that may be possible (eg physical controls, time scheduling, selection of alternative process, etc that are proposed as part of this management plan).**

There will be some addition of noise levels as a result of concurrently operating equipment, however because the predicted noise levels are “worst case”, the cumulative effect will not be represented by the addition of the presented noise levels.

It is noted that this is a preliminary construction noise and vibration management plan and a full analysis will be conducted once construction processes become more defined.

5.2 POTENTIALLY AFFECTED RECEIVERS

A survey of potentially affected sensitive commercial and residential receivers has been conducted and the following locations have been identified:

- The UTS Haymarket Campus,
- The Novatel Sydney,
- The Oaks Goldsbrough Apartments,
- Bullecourt Apartments,
- Harbourside Shopping Centre,
- Novatel Rockford, Darling Harbour,
- IMAX
- Chinese Gardens
- Commonwealth Bank Place, and
- Southern Cross Suites Darling Harbour.

5.3 EXTERNAL NOISE GOALS

Noise generated by plant and equipment throughout the duration of the project will be managed in accordance with the management levels, and for the morning and afternoon periods on Saturdays in accordance with the noise criteria at residences.

In order to establish noise goals specific to receivers, background noise levels were measured at all locations representing the most sensitive receiver groups.

Daytime background noise levels have been determined using a combination of attended and long term, unattended measurements.

Attended and unattended measurements of background noise was conducted between 27 June and 7 July 2012. Supplementary attended measurements were conducted on 22 April and 5 June 2013.

The daytime background noise level at these locations obtained from the measurements are summarised in the following table. A number of 15 minute noise recordings were made at each

location between 7am to 5pm. Where there was a significant variation in measured background noise levels, the typical lowest levels are presented in the table and used to establish the noise goals.

Table 2 - Measured Daytime Background Noise Levels and Corresponding Noise Goals/Management Levels

Location	Background Noise Level dB(A) L ₉₀			“Noise Affected” Management Level dB(A) L _{eq}		
	Weekday 7am – 6pm	Sat 7am - 8am	Sat 1pm – 5pm	Weekday 7am – 6pm	Sat 7am - 8am	Sat 1pm – 5pm
Goldsbrough Apartments (243 Pyrmont Street)	58	56	58	68	61	68*
Bullecourt Apartments (287 Pyrmont Street)	56	55	58	66	60	68*
Southern Cross Suites on Darling Harbour	58	57	58	68	63	68*
Harbourside Shopping Centre Retail/Commercial Receivers	N/A (commercial / retail receiver)			70		
Chinese Gardens	N/A (passive recreational area)			60		

*noise limit rather than NAML.

5.4 INTERNAL NOISE GOALS

The two Novatel buildings and the UTS Haymarket Campus have fixed glazing (or glazing that is normally closed) and air conditioned. The Imax building has been designed to exclude noise from the adjacent roadways. For these buildings the application of external noise goals would be unnecessarily stringent.

For the Novatel buildings and the Imax noise goals would be based on the internal noise level, rather than the external noise level. For the UTS Haymarket Campus, internal noise levels should not exceed 45dB(A) L_{eq} as per the EPA Interim Construction Noise Guideline.

Internal noise levels for the Novatel buildings have been based on Australian Standard 2107:2000 *“Acoustics—Recommended design sound levels and reverberation times for building interiors”*. As per AS2107:2000 noise levels within the hotel rooms would be 35dB(A) as a result of constant noise sources (traffic, air-conditioning). The management level for these spaces has been set 5dB(A) higher than the normal level from traffic, etc in accordance with Section 4.1.2 of the ICNG.

Table 3 – Internal Noise Goals/Management Levels

Location	“Noise Affected” Management Level dB(A) L_{eq}
Novatel Sydney Hotel	40
Novatel Rockford, Darling Harbour	40
UTS Haymarket Campus	45
Commonwealth Bank Place	50
Imax Theatre	35*

* - due to the nature of the activities carried out the NML a 5 dB(A) allowance has not been added to the AS2107 noise level for this receiver.

5.5 PREDICTED NOISE LEVELS

Noise levels have been predicted at various locations representing the range of potentially affected receivers around the site. The worst case noise level has been predicted based on the minimum working distances between the source and receiver that is likely to occur.

The predicted noise levels assume that the activity will be occurring continuously and that there is no screening between the source and the receiver. As plant items will generally be spread around the site, and the plant will not operate continuously for the entire day, the upper limit noise levels indicated in the tables would generally only be reached for limited periods and represent the absolute worst case.

Predictions of internal noise levels have been made assuming a 35dB(A) reduction from modern glazed façade constructions, and 50 dB(A) for the Imax theatre.

Noise emissions have been predicted from each of the SICEEP precincts (International Convention Centre, Exhibition Halls and the Theatre) to each of the sensitive receivers surrounding the site.

The predictions take into account the nominated sound power levels, corrected for distance losses, screening losses (if applicable), air absorption, façade loss (where internal levels are calculated, and time of continuous use.

5.5.1 Convention Centre

5.5.1.1 Goldsbrough Apartments (243 Pyrmont Street)

The following tables present a summary of noise levels which will occur at the residential receivers located at 243 Pyrmont Street as a result of Convention Centre construction.

Table 4 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE MANAGEMENT LEVEL dB(A) L _{eq}
Excavator/ Bulldozer	66	NAML 68 Sat 7am to 8am Noise Limit -61 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -68 HNAML 75
Concrete crusher	66	
Bobcat	57	
Hydraulic Hammer on 20-60t Excavator	82	
Hydraulic Hammer on 5t Excavator	75	
Rock/Masonry Saw on Excavator	62	
Piling Rig	67	
Rock Anchor Drill Rig	62	
Pneumatic Hammer	67	
Electric Hammer	57	
Concrete Pump	62	
Concrete Truck	62	
Truck	60	
Forklifts	52	
Angle grinders	70	
Electric Saw	68	
Drilling	46	
Hammering	77	
Site Crane	57	
Impact drill	57	
Remediation Plant	67	
Air compressor	38	
Concrete Float/Vibrators	57	

The predictions indicate that in worst case situations, excavator-mounted hydraulic hammers would exceed the noise goals at the nearest receivers during normal weekdays operating hours and the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in NVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. See Section 5.7 for recommendations. Other items of plant are generally in compliance with the NAML at all times

5.5.1.2 Bullecourt Apartments (287 Pyrmont Street)

The following tables present a summary of noise levels which will occur at the residential receivers located at 287 Pyrmont Street as a result of construction activity within the Convention Centre precinct site.

Table 5 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE MANAGEMENT LEVEL dB(A) L _{eq}
Excavator/ Bulldozer	56	NAML 66 Sat 7am to 8am Noise Limit -60 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -66 HNAML 75
Concrete crusher	56	
Bobcat	47	
Hydraulic Hammer on 20-60t Excavator	72	
Hydraulic Hammer on 5t Excavator	65	
Rock/Masonry Saw on Excavator	52	
Piling Rig	57	
Rock Anchor Drill Rig	52	
Pneumatic Hammer	57	
Electric Hammer	47	
Concrete Pump	52	
Concrete Truck	52	
Truck	50	
Forklifts	42	
Angle grinders	60	
Electric Saw	58	
Drilling	36	
Hammering	67	
Site Crane	47	
Impact drill	47	
Remediation Plant	57	
Air compressor	28	
Concrete Float/Vibrators	47	

The predictions indicate that in worst case situations, excavator-mounted hydraulic hammers would exceed the noise goals at the nearest receivers during normal weekdays operating hours and the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. See Section 5.7 for recommendations. Other items of plant are generally in compliance with the NAML at all times

5.5.1.3 Harbourside Shopping Centre

The following tables present a summary of noise levels which will occur at the commercial and retail receivers located within the Harbourside Shopping Centre as a result of construction activity within the Convention Centre precinct site.

Table 6 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE MANAGEMENT LEVEL dB(A) L _{eq}
Excavator/ Bulldozer	76	NAML 70 HNAML 75
Concrete crusher	76	
Bobcat	67	
Hydraulic Hammer on 20-60t Excavator	92	
Hydraulic Hammer on 5t Excavator	85	
Rock/Masonry Saw on Excavator	72	
Piling Rig	77	
Rock Anchor Drill Rig	72	
Pneumatic Hammer	77	
Electric Hammer	67	
Concrete Pump	72	
Concrete Truck	72	
Truck	70	
Forklifts	62	
Angle grinders	80	
Electric Saw	78	
Drilling	56	
Hammering	87	
Site Crane	67	
Impact drill	67	
Remediation Plant	77	
Air compressor	48	
Concrete Float/Vibrators	67	

Predictions indicate that there will be exceedances of the noise management level. Noise emissions from this activity should be minimised by adopting the process indicated in NVMP to ensure that noise emissions are managed. See Section 5.7 for recommendations.

5.5.1.4 Novatel Sydney

The following tables present a summary of noise levels which will occur at the residential receivers located within the Novatel Sydney as a result of construction activity within the Convention Centre site.

Table 7 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER INTERNAL NOISE MANAGEMENT LEVEL dB(A) L_{eq}
Excavator/ Bulldozer	34	NAML 40
Concrete crusher	34	
Bobcat	25	
Hydraulic Hammer on 20-60t Excavator	50	
Hydraulic Hammer on 5t Excavator	43	
Rock/Masonry Saw on Excavator	30	
Piling Rig	35	
Rock Anchor Drill Rig	30	
Pneumatic Hammer	35	
Electric Hammer	25	
Concrete Pump	30	
Concrete Truck	30	
Truck	28	
Forklifts	20	
Angle grinders	38	
Electric Saw	36	
Drilling	14	
Hammering	45	
Site Crane	25	
Impact drill	25	
Remediation Plant	35	
Air compressor	6	
Concrete Float/Vibrators	25	

Predictions indicate that in worst case scenarios, there will be marginal exceedances of the NAML as a results of hammering works. These exceedances should be managed in accordance with the recommendations of the CNVMP. See Section 5.7. Other items of plant are generally in compliance with the NAML at all times

5.5.1.5 Novatel Rockford Darling Harbour

The following tables present a summary of noise levels which will occur at the residential receivers located at the Novatel Rockford Darling Harbour as a result of construction activity within the Convention Centre precinct site.

Table 8 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER INTERNAL NOISE MANAGEMENT LEVEL dB(A) L_{eq}
Excavator/ Bulldozer	19	NAML 40
Concrete crusher	19	
Bobcat	10	
Hydraulic Hammer on 20-60t Excavator	35	
Hydraulic Hammer on 5t Excavator	28	
Rock/Masonry Saw on Excavator	15	
Piling Rig	20	
Rock Anchor Drill Rig	15	
Pneumatic Hammer	20	
Electric Hammer	10	
Concrete Pump	15	
Concrete Truck	15	
Truck	13	
Forklifts	<10	
Angle grinders	23	
Electric Saw	21	
Drilling	<10	
Hammering	30	
Site Crane	10	
Impact drill	10	
Remediation Plant	20	
Air compressor	<10	
Concrete Float/Vibrators	10	

Predictions indicate that noise emissions from the site will be in compliance with noise goals at all times.

5.5.1.6 UTS Haymarket Campus

The following tables present a summary of noise levels which will occur within the UTS Haymarket Campus as a result of construction activity within the Convention Centre precinct site.

Table 9 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER INTERNAL NOISE MANAGEMENT LEVEL dB(A) L _{eq}
Excavator/ Bulldozer	30	NAML 45
Concrete crusher	30	
Bobcat	21	
Hydraulic Hammer on 20-60t Excavator	46	
Hydraulic Hammer on 5t Excavator	39	
Rock/Masonry Saw on Excavator	26	
Piling Rig	31	
Rock Anchor Drill Rig	26	
Pneumatic Hammer	31	
Electric Hammer	21	
Concrete Pump	26	
Concrete Truck	26	
Truck	24	
Forklifts	16	
Angle grinders	34	
Electric Saw	32	
Drilling	10	
Hammering	41	
Site Crane	21	
Impact drill	21	
Remediation Plant	31	
Air compressor	2	
Concrete Float/Vibrators	21	

Predictions indicate that there will be a 1dB(A) exceedance of the 45dB(A) NAML when the large hydraulic hammer is operating on the southernmost boundary of the site. All other items of plant are in compliance with the NAML. See Section 5.7 for recommendations.

5.5.1.7 IMAX

The following tables present a summary of noise levels which will occur at IMAX as a result of construction activity within the Convention Centre precinct site.

Table 10 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER INTERNAL NOISE MANAGEMENT LEVEL dB(A) L _{eq}
Excavator/ Bulldozer	12	NAML 35
Concrete crusher	12	
Bobcat	<10	
Hydraulic Hammer on 20-60t Excavator	28	
Hydraulic Hammer on 5t Excavator	21	
Rock/Masonry Saw on Excavator	<10	
Piling Rig	13	
Rock Anchor Drill Rig	<10	
Pneumatic Hammer	13	
Electric Hammer	<10	
Concrete Pump	<10	
Concrete Truck	<10	
Truck	<10	
Forklifts	<10	
Angle grinders	16	
Electric Saw	14	
Drilling	<10	
Hammering	23	
Site Crane	<10	
Impact drill	<10	
Remediation Plant	13	
Air compressor	<10	
Concrete Float/Vibrators	<10	

Predictions indicate that noise emissions will be in compliance with the NAML at all times.

5.5.1.8 Commonwealth Bank Place

The following tables present a summary of noise levels which will occur within Commonwealth Bank Place offices as a result of construction activity within the Convention Centre precinct site.

Table 11 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER INTERNAL NOISE MANAGEMENT LEVEL dB(A) L _{eq}
Excavator/ Bulldozer	27	NAML 50
Concrete crusher	27	
Bobcat	18	
Hydraulic Hammer on 20-60t Excavator	43	
Hydraulic Hammer on 5t Excavator	36	
Rock/Masonry Saw on Excavator	23	
Piling Rig	28	
Rock Anchor Drill Rig	23	
Pneumatic Hammer	28	
Electric Hammer	18	
Concrete Pump	23	
Concrete Truck	23	
Truck	21	
Forklifts	13	
Angle grinders	31	
Electric Saw	29	
Drilling	<10	
Hammering	38	
Site Crane	18	
Impact drill	18	
Remediation Plant	28	
Air compressor	<10	
Concrete Float/Vibrators	18	

Predictions indicate that noise emissions will be in compliance with noise management levels at all times.

5.5.1.9 Southern Cross Suites

The following tables present a summary of noise levels which will occur at Southern Cross Suites as a result of construction activity within the Convention Centre precinct site.

Table 12 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	54	NAML 68 Sat 7am to 8am Noise Limit -63 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -68 HNAML 75
Concrete crusher	54	
Bobcat	45	
Hydraulic Hammer on 20-60t Excavator	70	
Hydraulic Hammer on 5t Excavator	63	
Rock/Masonry Saw on Excavator	50	
Piling Rig	55	
Rock Anchor Drill Rig	50	
Pneumatic Hammer	55	
Electric Hammer	45	
Concrete Pump	50	
Concrete Truck	50	
Truck	48	
Forklifts	40	
Angle grinders	58	
Electric Saw	56	
Drilling	34	
Hammering	65	
Site Crane	45	
Impact drill	45	
Remediation Plant	55	
Air compressor	26	
Concrete Float/Vibrators	45	

Predictions indicate that in worst case situations hammering with the hydraulic hammer on a 20-60t excavator works will exceed the NAML. The predictions also indicate that rock-breaking and hammering will exceed the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. Noise emissions from other plant items (excluding hammering) are generally within the NAML at all times.

See Section 5.7 for recommendations.

5.5.1.10 Chinese Gardens

The following tables present a summary of noise levels which will occur at the Chinese Garden as a result of construction activity within the Convention Centre precinct site.

Table 13 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	56	NAML 60 HNAML 75
Concrete crusher	56	
Bobcat	47	
Hydraulic Hammer on 20-60t Excavator	72	
Hydraulic Hammer on 5t Excavator	65	
Rock/Masonry Saw on Excavator	52	
Piling Rig	57	
Rock Anchor Drill Rig	52	
Pneumatic Hammer	57	
Electric Hammer	47	
Concrete Pump	52	
Concrete Truck	52	
Truck	50	
Forklifts	42	
Angle grinders	60	
Electric Saw	58	
Drilling	36	
Hammering	67	
Site Crane	47	
Impact drill	47	
Remediation Plant	57	
Air compressor	28	
Concrete Float/Vibrators	47	

Predictions indicate that in worst case situations, construction noise associated with hammering and rock-breaking works will exceed the NAML. Noise emissions from other plant items (excluding hammering) are generally within the NAML at all times. See Section 5.7 for recommendations.

5.5.2 Exhibition Halls

5.5.2.1 Goldsbrough Apartments (243 Pyrmont Street)

The following tables present a summary of noise levels which will occur at the residential receivers located at 243 Pyrmont Street as a result of construction activity within the Exhibition Hall site.

Table 14 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	62	NAML 68 Sat 7am to 8am Noise Limit -61 Sat 1pm to 5pm Noise Limit - 68 HNAML 75
Concrete crusher	62	
Bobcat	53	
Hydraulic Hammer on 20-60t Excavator	78	
Hydraulic Hammer on 5t Excavator	71	
Rock/Masonry Saw on Excavator	58	
Piling Rig	63	
Rock Anchor Drill Rig	58	
Pneumatic Hammer	63	
Electric Hammer	53	
Concrete Pump	58	
Concrete Truck	58	
Truck	56	
Forklifts	48	
Angle grinders	66	
Electric Saw	64	
Drilling	42	
Hammering	73	
Site Crane	53	
Impact drill	53	
Remediation Plant	63	
Air compressor	34	
Concrete Float/Vibrators	53	

The predictions indicate that in worst case situations, excavator-mounted hydraulic hammers would exceed the noise goals at the nearest receivers during normal weekdays operating hours and the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. Noise emissions from other plant items (excluding hammering) are generally within the NAML at all times See Section 5.7 for recommendations.

5.5.2.2 Bullecourt Apartments (287 Pyrmont Street)

The following tables present a summary of noise levels which will occur at the residential receivers located at 287 Pyrmont Street as a result of construction activity within the Exhibition Hall precinct site.

Table 15 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	66	NAML 66 Sat 7am to 8am Noise Limit -60 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -66 HNAML 75
Concrete crusher	66	
Bobcat	57	
Hydraulic Hammer on 20-60t Excavator	82	
Hydraulic Hammer on 5t Excavator	75	
Rock/Masonry Saw on Excavator	62	
Piling Rig	67	
Rock Anchor Drill Rig	62	
Pneumatic Hammer	67	
Electric Hammer	57	
Concrete Pump	62	
Concrete Truck	62	
Truck	60	
Forklifts	52	
Angle grinders	70	
Electric Saw	68	
Drilling	46	
Hammering	77	
Site Crane	57	
Impact drill	57	
Remediation Plant	67	
Air compressor	38	
Concrete Float/Vibrators	57	

Predictions indicate that there will be exceedances of the typical weekday NAML and the Saturday morning NAML. Noise emissions from this activity during these times should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. The excavator-mounted hydraulic hammering is predicted to exceed the Saturday afternoon 1pm to 5pm noise limit and therefore should not operate during this time. Marginal exceedances are expected from angel grinders, pneumatic hammering and angle grinders during this time period also, however recommended treatments will be nominated to ensure that the noise limit is not exceeded.

5.5.2.3 Harbourside Shopping Centre

The following tables present a summary of noise levels which will occur at the commercial and retail receivers located within the Harbourside Shopping Centre as a result of construction activity within the Exhibition Hall precinct site.

Table 16 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	60	NAML 70 HNAML 75
Concrete crusher	60	
Bobcat	51	
Hydraulic Hammer on 20-60t Excavator	76	
Hydraulic Hammer on 5t Excavator	69	
Rock/Masonry Saw on Excavator	56	
Piling Rig	61	
Rock Anchor Drill Rig	56	
Pneumatic Hammer	61	
Electric Hammer	51	
Concrete Pump	56	
Concrete Truck	56	
Truck	54	
Forklifts	46	
Angle grinders	64	
Electric Saw	62	
Drilling	40	
Hammering	71	
Site Crane	51	
Impact drill	51	
Remediation Plant	61	
Air compressor	32	
Concrete Float/Vibrators	51	

The predictions indicate that in worst case situations, excavator mounted hydraulic hammers would exceed the noise management level. Noise emissions from this activity should be minimised by adopting the process indicated in NVMP to ensure that noise emissions are managed. See Section 5.7 for recommendations.

5.5.2.4 Novatel Sydney

The following tables present a summary of noise levels which will occur at the residential receivers located within the Novatel Sydney as a result of construction activity within the Exhibition Hall site.

Table 17 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	23	NAML 40
Concrete crusher	23	
Bobcat	14	
Hydraulic Hammer on 20-60t Excavator	39	
Hydraulic Hammer on 5t Excavator	32	
Rock/Masonry Saw on Excavator	19	
Piling Rig	24	
Rock Anchor Drill Rig	19	
Pneumatic Hammer	24	
Electric Hammer	14	
Concrete Pump	19	
Concrete Truck	19	
Truck	17	
Forklifts	<10	
Angle grinders	27	
Electric Saw	25	
Drilling	<10	
Hammering	34	
Site Crane	14	
Impact drill	14	
Remediation Plant	24	
Air compressor	<10	
Concrete Float/Vibrators	14	

Predictions indicate that construction noise emissions will be in compliance with noise goals at all times. Noise emissions from the excavator-mounted hydraulic hammering are approaching the NAML. See Section 5.7 for recommendations

5.5.2.5 Novatel Rockford Darling Harbour

The following tables present a summary of noise levels which will occur at the residential receivers located at the Novatel Rockford Darling Harbour as a result of construction activity within the Exhibition Hall precinct site.

Table 18 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	24	NAML 40
Concrete crusher	24	
Bobcat	15	
Hydraulic Hammer on 20-60t Excavator	40	
Hydraulic Hammer on 5t Excavator	33	
Rock/Masonry Saw on Excavator	20	
Piling Rig	25	
Rock Anchor Drill Rig	20	
Pneumatic Hammer	25	
Electric Hammer	15	
Concrete Pump	20	
Concrete Truck	20	
Truck	18	
Forklifts	10	
Angle grinders	28	
Electric Saw	26	
Drilling	<10	
Hammering	35	
Site Crane	15	
Impact drill	15	
Remediation Plant	25	
Air compressor	<10	
Concrete Float/Vibrators	15	

Predictions indicate that construction noise emissions will be in compliance with noise management goals at all times. Excavator-mounted hydraulic hammering is approaching the NAML. See Section 5.7 for recommendations

5.5.2.6 UTS Haymarket Campus

The following tables present a summary of noise levels which will occur within the UTS Haymarket Campus as a result of construction activity within the Exhibition Hall precinct site.

Table 19 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	34	NAML 45
Concrete crusher	34	
Bobcat	25	
Hydraulic Hammer on 20-60t Excavator	50	
Hydraulic Hammer on 5t Excavator	43	
Rock/Masonry Saw on Excavator	30	
Piling Rig	35	
Rock Anchor Drill Rig	30	
Pneumatic Hammer	35	
Electric Hammer	25	
Concrete Pump	30	
Concrete Truck	30	
Truck	28	
Forklifts	20	
Angle grinders	38	
Electric Saw	36	
Drilling	14	
Hammering	45	
Site Crane	25	
Impact drill	25	
Remediation Plant	35	
Air compressor	6	
Concrete Float/Vibrators	25	

Predictions indicate that there will be a marginal exceedance of the 45dB(A) noise goal when the large hydraulic hammer is operating on the southernmost boundary of the site. See Section 5.7 for recommendations.

5.5.2.7 IMAX

The following tables present a summary of noise levels which will occur at IMAX as a result of construction activity within the Exhibition Halls precinct site.

Table 20 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	12	NAML 35
Concrete crusher	12	
Bobcat	<10	
Hydraulic Hammer on 20-60t Excavator	28	
Hydraulic Hammer on 5t Excavator	21	
Rock/Masonry Saw on Excavator	<10	
Piling Rig	13	
Rock Anchor Drill Rig	<10	
Pneumatic Hammer	13	
Electric Hammer	<10	
Concrete Pump	<10	
Concrete Truck	<10	
Truck	<10	
Forklifts	<10	
Angle grinders	16	
Electric Saw	14	
Drilling	<10	
Hammering	23	
Site Crane	<10	
Impact drill	<10	
Remediation Plant	13	
Air compressor	<10	
Concrete Float/Vibrators	<10	

Predictions indicate that noise emissions will not exceed the NAML at all times.

5.5.2.8 Commonwealth Bank Place

The following tables present a summary of noise levels which will occur within Commonwealth bank place as a result of construction activity within the Exhibition Halls precinct site.

Table 21 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	27	NAML 50
Concrete crusher	27	
Bobcat	18	
Hydraulic Hammer on 20-60t Excavator	43	
Hydraulic Hammer on 5t Excavator	36	
Rock/Masonry Saw on Excavator	23	
Piling Rig	28	
Rock Anchor Drill Rig	23	
Pneumatic Hammer	28	
Electric Hammer	18	
Concrete Pump	23	
Concrete Truck	23	
Truck	21	
Forklifts	13	
Angle grinders	31	
Electric Saw	29	
Drilling	<10	
Hammering	38	
Site Crane	18	
Impact drill	18	
Remediation Plant	28	
Air compressor	<10	
Concrete Float/Vibrators	18	

Predictions indicate that noise emissions will be in compliance with noise management levels at all times.

5.5.2.9 Southern Cross Suites

The following tables present a summary of noise levels which will occur at Southern Cross Suites as a result of construction activity within the Exhibition Halls precinct site.

Table 22 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	56	NAML 68 Sat 7am to 8am Noise Limit -63 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -68 HNAML 75
Concrete crusher	56	
Bobcat	47	
Hydraulic Hammer on 20-60t Excavator	72	
Hydraulic Hammer on 5t Excavator	65	
Rock/Masonry Saw on Excavator	52	
Piling Rig	57	
Rock Anchor Drill Rig	52	
Pneumatic Hammer	57	
Electric Hammer	47	
Concrete Pump	52	
Concrete Truck	52	
Truck	50	
Forklifts	42	
Angle grinders	60	
Electric Saw	58	
Drilling	36	
Hammering	67	
Site Crane	47	
Impact drill	47	
Remediation Plant	57	
Air compressor	28	
Concrete Float/Vibrators	47	

Predictions indicate that in worst case situations hammering with the hydraulic hammer on a 20-60t excavator works will exceed the NAML. The predictions also indicate that rock-breaking and hammering will exceed the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. Noise emissions from other plant items (excluding hammering) are generally within the NAML at all times. See Section 5.7 for recommendations.

5.5.2.10 Chinese Gardens

The following tables present a summary of noise levels which will occur at the Chinese Garden as a result of construction activity within the Exhibition Halls precinct site.

Table 23 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	64	NAML 60 HNAML 75
Concrete crusher	64	
Bobcat	55	
Hydraulic Hammer on 20-60t Excavator	80	
Hydraulic Hammer on 5t Excavator	73	
Rock/Masonry Saw on Excavator	60	
Piling Rig	65	
Rock Anchor Drill Rig	60	
Pneumatic Hammer	65	
Electric Hammer	55	
Concrete Pump	60	
Concrete Truck	60	
Truck	58	
Forklifts	50	
Angle grinders	68	
Electric Saw	66	
Drilling	44	
Hammering	75	
Site Crane	55	
Impact drill	55	
Remediation Plant	65	
Air compressor	36	
Concrete Float/Vibrators	55	

Predictions indicate that construction noise associated will exceed noise management levels at the Chinese Gardens. See Section 5.7 for recommendations.

5.5.3 The Theatre

5.5.3.1 Goldsbrough Apartments (243 Pyrmont Street)

The following tables present a summary of noise levels which will occur at the residential receivers located at 243 Pyrmont Street as a result of Theatre construction.

Table 24 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	56	NAML 68 Sat 7am to 8am Noise Limit -61 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -68 HNAML 75
Concrete crusher	56	
Bobcat	47	
Hydraulic Hammer on 20-60t Excavator	72	
Hydraulic Hammer on 5t Excavator	65	
Rock/Masonry Saw on Excavator	52	
Piling Rig	57	
Rock Anchor Drill Rig	52	
Pneumatic Hammer	57	
Electric Hammer	47	
Concrete Pump	52	
Concrete Truck	52	
Truck	50	
Forklifts	42	
Angle grinders	60	
Electric Saw	58	
Drilling	36	
Hammering	67	
Site Crane	47	
Impact drill	47	
Remediation Plant	57	
Air compressor	28	
Concrete Float/Vibrators	47	

Predictions indicate that in worst case situations hammering with the hydraulic hammer on a 20-60t excavator works will exceed the NAML. The predictions also indicate that rock-breaking and hammering will exceed the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. Noise emissions from other plant items (excluding hammering) are generally within the NAML at all times. See Section 5.7 for recommendations.

5.5.3.2 Bullecourt Apartments (287 Pyrmont Street)

The following tables present a summary of noise levels which will occur at the residential receivers located at 287 Pyrmont Street as a result of construction activity within the Theatre precinct site.

Table 25 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	66	NAML 66 Sat 7am to 8am Noise Limit -60 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -66 HNAML 75
Concrete crusher	66	
Bobcat	57	
Hydraulic Hammer on 20-60t Excavator	82	
Hydraulic Hammer on 5t Excavator	75	
Rock/Masonry Saw on Excavator	62	
Piling Rig	67	
Rock Anchor Drill Rig	62	
Pneumatic Hammer	67	
Electric Hammer	57	
Concrete Pump	62	
Concrete Truck	62	
Truck	60	
Forklifts	52	
Angle grinders	70	
Electric Saw	68	
Drilling	46	
Hammering	77	
Site Crane	57	
Impact drill	57	
Remediation Plant	67	
Air compressor	38	
Concrete Float/Vibrators	57	

Predictions indicate that there will be exceedances of the typical weekday NAML and the Saturday morning NAML. Noise emissions from this activity during these times should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. The excavator-mounted hydraulic hammering is predicted to exceed the Saturday afternoon 1pm to 5pm noise limit and therefore should not operate during this time. Marginal exceedances are expected from electric saws, pneumatic hammering and angle grinders during this time period also, however recommended treatments will be nominated to ensure that the noise limit is not exceeded.

5.5.3.3 Harbourside Shopping Centre

The following tables present a summary of noise levels which will occur at the commercial and retail receivers located within the Harbourside Shopping Centre as a result of construction activity within the Theatre precinct site.

Table 26 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	54	NAML 70 HNAML 75
Concrete crusher	54	
Bobcat	45	
Hydraulic Hammer on 20-60t Excavator	70	
Hydraulic Hammer on 5t Excavator	63	
Rock/Masonry Saw on Excavator	50	
Piling Rig	55	
Rock Anchor Drill Rig	50	
Pneumatic Hammer	55	
Electric Hammer	45	
Concrete Pump	50	
Concrete Truck	50	
Truck	48	
Forklifts	40	
Angle grinders	58	
Electric Saw	56	
Drilling	34	
Hammering	65	
Site Crane	45	
Impact drill	45	
Remediation Plant	55	
Air compressor	26	
Concrete Float/Vibrators	45	

The predictions indicate that noise emissions from the Theatre site will comply at the Harbourside Shopping Centre at all times. Noise emissions from the excavator-mounted hydraulic hammering are approaching the NAML. See Section 5.7 for recommendations

5.5.3.4 Novatel Sydney

The following tables present a summary of noise levels which will occur at the residential receivers located within the Novatel Sydney as a result of construction activity within the Theatre site.

Table 27 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	15	NAML 40
Concrete crusher	15	
Bobcat	<10	
Hydraulic Hammer on 20-60t Excavator	31	
Hydraulic Hammer on 5t Excavator	24	
Rock/Masonry Saw on Excavator	11	
Piling Rig	16	
Rock Anchor Drill Rig	11	
Pneumatic Hammer	16	
Electric Hammer	<10	
Concrete Pump	11	
Concrete Truck	11	
Truck	<10	
Forklifts	<10	
Angle grinders	19	
Electric Saw	17	
Drilling	<10	
Hammering	26	
Site Crane	<10	
Impact drill	<10	
Remediation Plant	16	
Air compressor	<10	
Concrete Float/Vibrators	<10	

Predictions indicate that noise emissions will be in compliance with noise management levels at all times.

5.5.3.5 Novatel Rockford Darling Harbour

The following tables present a summary of noise levels which will occur at the residential receivers located at the Novatel Rockford Darling Harbour as a result of construction activity within the Theatre precinct site.

Table 28 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	31	NAML 40
Concrete crusher	31	
Bobcat	22	
Hydraulic Hammer on 20-60t Excavator	47	
Hydraulic Hammer on 5t Excavator	40	
Rock/Masonry Saw on Excavator	27	
Piling Rig	32	
Rock Anchor Drill Rig	27	
Pneumatic Hammer	32	
Electric Hammer	22	
Concrete Pump	27	
Concrete Truck	27	
Truck	25	
Forklifts	17	
Angle grinders	35	
Electric Saw	33	
Drilling	11	
Hammering	42	
Site Crane	22	
Impact drill	22	
Remediation Plant	32	
Air compressor	<10	
Concrete Float/Vibrators	22	

Predictions indicate that there will be a marginal exceedance of the 40dB(A) NAML when the large hydraulic hammer is operating on the southernmost boundary of the site. See Section 5.7 for recommendations.

5.5.3.6 UTS Haymarket Campus

The following tables present a summary of noise levels which will occur within the UTS Haymarket Campus as a result of construction activity within the Theatre precinct site.

Table 29 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	36	NAML 45
Concrete crusher	36	
Bobcat	27	
Hydraulic Hammer on 20-60t Excavator	52	
Hydraulic Hammer on 5t Excavator	45	
Rock/Masonry Saw on Excavator	32	
Piling Rig	37	
Rock Anchor Drill Rig	32	
Pneumatic Hammer	37	
Electric Hammer	27	
Concrete Pump	32	
Concrete Truck	32	
Truck	30	
Forklifts	22	
Angle grinders	40	
Electric Saw	38	
Drilling	16	
Hammering	47	
Site Crane	27	
Impact drill	27	
Remediation Plant	37	
Air compressor	<10	
Concrete Float/Vibrators	27	

Predictions indicate that there will be a marginal exceedances of the 45dB(A) NAML when the large hydraulic hammer is operating on the southernmost boundary of the site. See Section 5.7 for recommendations.

5.5.3.7 IMAX

The following tables present a summary of noise levels which will occur at IMAX as a result of construction activity within the Theatre precinct site.

Table 30 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	<10	NAML 35
Concrete crusher	<10	
Bobcat	<10	
Hydraulic Hammer on 20-60t Excavator	23	
Hydraulic Hammer on 5t Excavator	16	
Rock/Masonry Saw on Excavator	<10	
Piling Rig	<10	
Rock Anchor Drill Rig	<10	
Pneumatic Hammer	<10	
Electric Hammer	<10	
Concrete Pump	<10	
Concrete Truck	<10	
Truck	<10	
Forklifts	<10	
Angle grinders	11	
Electric Saw	<10	
Drilling	<10	
Hammering	18	
Site Crane	<10	
Impact drill	<10	
Remediation Plant	<10	
Air compressor	<10	
Concrete Float/Vibrators	<10	

Predictions indicate that noise emissions will be in compliance with the NAML at all times.

5.5.3.8 Commonwealth Bank Place

The following tables present a summary of noise levels which will occur within Commonwealth bank place as a result of construction activity within the Theatre precinct site.

Table 31 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	27	NAML 50
Concrete crusher	27	
Bobcat	18	
Hydraulic Hammer on 20-60t Excavator	43	
Hydraulic Hammer on 5t Excavator	36	
Rock/Masonry Saw on Excavator	23	
Piling Rig	28	
Rock Anchor Drill Rig	23	
Pneumatic Hammer	28	
Electric Hammer	18	
Concrete Pump	23	
Concrete Truck	23	
Truck	21	
Forklifts	13	
Angle grinders	31	
Electric Saw	29	
Drilling	<10	
Hammering	38	
Site Crane	18	
Impact drill	18	
Remediation Plant	28	
Air compressor	<10	
Concrete Float/Vibrators	18	

Predictions indicate that noise emissions will be in compliance with the NAML at all times.

5.5.3.9 Southern Cross Suites

The following tables present a summary of noise levels which will occur at Southern Cross Suites as a result of construction activity within the Theatre precinct site.

Table 32 – Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L_{eq}	RECEIVER NOISE GOAL dB(A) L_{eq}
Excavator/ Bulldozer	59	NAML 68 Sat 7am to 8am Noise Limit -63 Sat 1pm to 5pm Noise Limit - 68 Weekday 6pm to 7pm Noise Limit -66 HNAML 75
Concrete crusher	59	
Bobcat	50	
Hydraulic Hammer on 20-60t Excavator	75	
Hydraulic Hammer on 5t Excavator	68	
Rock/Masonry Saw on Excavator	55	
Piling Rig	60	
Rock Anchor Drill Rig	55	
Pneumatic Hammer	60	
Electric Hammer	50	
Concrete Pump	55	
Concrete Truck	55	
Truck	53	
Forklifts	45	
Angle grinders	63	
Electric Saw	61	
Drilling	39	
Hammering	70	
Site Crane	50	
Impact drill	50	
Remediation Plant	60	
Air compressor	31	
Concrete Float/Vibrators	50	

Predictions indicate that in worst case situations hammering with the hydraulic hammer on a 20-60t excavator works will exceed the NAML. The predictions also indicate that rock-breaking and hammering will exceed the Saturday morning 7am to 8am period. Noise emissions from these activities should be minimised by adopting the process indicated in CNVMP to ensure that noise emissions are managed. Noise emissions from excavator-mounted hammering will exceed the Saturday 1pm to 5pm noise limit, and therefore these operations should not occur during this period. Noise emissions from other plant items (excluding hammering) are generally within the NAML at all times. See Section 5.7 for recommendations.

5.5.3.10 Chinese Gardens

The following tables present a summary of noise levels which will occur at the Chinese Garden as a result of construction activity within the Theatre precinct site.

Table 33 - Predicted Noise Levels

EQUIPMENT /PROCESS	PREDICTED NOISE LEVEL dB(A) L _{eq}	RECEIVER NOISE GOAL dB(A) L _{eq}
Excavator/ Bulldozer	72	NAML 60 HNAML 75
Concrete crusher	72	
Bobcat	63	
Hydraulic Hammer on 20-60t Excavator	88	
Hydraulic Hammer on 5t Excavator	81	
Rock/Masonry Saw on Excavator	68	
Piling Rig	73	
Rock Anchor Drill Rig	68	
Pneumatic Hammer	73	
Electric Hammer	63	
Concrete Pump	68	
Concrete Truck	68	
Truck	66	
Forklifts	58	
Angle grinders	76	
Electric Saw	74	
Drilling	52	
Hammering	83	
Site Crane	63	
Impact drill	63	
Remediation Plant	73	
Air compressor	44	
Concrete Float/Vibrators	63	

Predictions indicate that construction noise associated will exceed noise management levels at the Chinese Gardens. See Section 5.7 for recommendations.

5.6 DISCUSSION

Predicted worst case noise levels at various potentially affected receivers are presented above.

Residential premises surrounding the site will receive noise levels exceeding the noise management level. These are primarily as a result of excavator mounted hydraulic hammers. Other operations would generally comply with the noise affected management levels at all times at the residential receivers surrounding the site.

Specific treatments to items of plant will be developed in conjunction with Lend Lease in an ongoing acoustic review of construction methodology. These reviews will be undertaken regularly and when more detailed planning regarding including possible actual plant locations, actual plant being used, etc are known.

The following potential site specific treatments are being proposed at this stage, however these will be updated as details about construction planning are available:

- During the undertaking of remediation soil treatment works on site, the treatment processes will typically be undertaken within enclosures (where practicable) which will aid in noise reduction.
- The utilisation of 2.4m high solid Class-A perimeter hoardings intermittently around the site will act as appropriate noise screens and barriers for lower level receivers and the Chinese Garden.
- As the excavation reaches depths, the surrounding retention systems will act as barriers to noise generation equipment within the excavation
- Where practicable, positioning major mobile temporary plant such as concrete crushers, concrete pumps, concrete trucks and the like as far as possible from sensitive receptors. The strategic positioning of these items can result in construction noise levels not exceeding the NAML around the site.
- Where possible the maintaining of buffer/separation zones at various stages of the works between the key noise generating activities and receptors such as the Harbourside Shopping Centre and the Chinese Gardens should be adopted.
- Where feasible, begin morning site works at the boundary of the site furthest from the residential receivers and progressively advance towards the residential receivers throughout the day. In this way, noise emissions from the site will be least whilst residents are at home.
- Onsite crushing and screening of concrete for reuse on site thereby potentially reducing material transported offsite to landfill and reducing traffic on public roads and associated noise.

The noise and vibration assessment indicates that exceedances of the noise and vibration management goals would primarily be caused by excavator-mounted hydraulic hammer operations. Hence these activities should be managed as follows:

- Hammering should only be undertaken where non-percussive extraction method is not feasible or reasonable.
- Where hammering is undertaken it should be performed according to the following:
 - Using the smallest equipment as is practical provides benefits in terms of the noise/time to complete balance. (In other words a smaller hammer may be quieter but may result in significantly extended period of operation, leading to no overall benefit.)
 - Using hammers with low-noise heads or wrapping the head to minimise radiated noise.
 - Where practical and effective erect, temporary barriers consisting of heavy carpet lined 1.8m mesh barricades placed close to the work face to screen most affected receivers.

In this regard, site hoardings and sheds where possible should form imperforate barriers and be placed to screen the most affected receivers being the Chinese Gardens, and along the northern site boundary. It is noted that these barriers would be effective only for low level receivers.

- Where noise emissions exceed the “highly noise affected management level” the location of this equipment around the site should be varied throughout the day such that noise is shared between the receivers.

For example, the equipment operating near the northern boundary of the Convention Centre Precinct is likely to impact the cafes/restaurants mostly around lunch time, so during this period hammering operations should be directed away from this location and closer to the south-western boundary of the site. The aim is to reduce the average daily dose to the 75 dB(A) L_{eq} “highly noise affected management level”.

- The local community should be informed via a liaison committee (or other method as appropriate) as to the nature, period and times of hammering. Community response may be used to formulate impact minimisation strategies. For example, hammering close to the cafes/restaurants at the Harbourside Shopping Centre may be avoided during the busy lunch period, or other sensitive periods.

5.7 RECOMMENDATIONS

Demolition and excavation activities are typically the loudest construction activities on site. Given the close proximity to existing residential development and the Chinese Gardens, strict compliance with noise emission goals (as set out in section 4) will not be possible.

We note the following:

- While the demolition and excavation period will potentially generate higher noise levels than those recommended in Section 4, the period of the proposed works are relatively modest.
- The equipment to be used (excavator and bored piles) means the noise generated will be quieter than that often generated in excavation/typical piling.
- Given the nearest residential development is multistorey (and therefore will overlook the site) acoustic treatments such as noise screens will not be feasible.
- Substantial restrictions on times of use are likely to be of little benefit:
 - o It would prolong the overall excavation/demolition period.
 - o Respite periods are likely to be of relatively minimum benefit as this will provide little benefit to residential receivers during the day.

5.7.1.1 Saturday Works

The following items of equipment should not be used on site between 7am to 8am and 1pm to 5pm on Saturdays in addition to 6pm to 7pm weekdays:

- Hydraulic hammering; and
- Rock-breaking equipment;

It is noted that noise emissions from the piling rigs, pneumatic hammers, angle grinders and electric saws marginally exceed the Saturday 1pm to 5pm noise limit and the weekday 6pm to 7pm noise limit. However, these processes will be managed so that operations only occur on the eastern most boundary of SICEEP site so that continued, compliant operation could occur during these periods.

6 ASSESSMENT OF VIBRATION

As the proposed piling method is bored piling, the only activity that has the potential to produce significant ground vibration would be the excavation of rock using hydraulic hammers. Due to the significant distance separation between the activities and most sensitive structures or occupancies and the nature of the works being undertaken, predictions indicate that the recommended vibration levels will not be exceeded and additional mitigation methods will not be required.

7 GENERAL MITIGATION METHODS THAT WOULD BE APPLIED TO MANAGE NOISE/VIBRATION EMISSIONS

The procedures that will be applied to regulate noise and vibration impacts are summarised in the following flow chart.

7.1 NOISE CONTROL METHODS

The determination of appropriate noise/vibration control measures will be dependent on the particular activities and demolition appliances. This section provides an outline of available methods.

7.1.1 Selection of Alternate Appliance or Process

Where a particular activity or demolition appliance is found to generate noise levels that exceed the criteria, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying out this activity by use of pneumatic hammers or pulverising techniques lower levels of noise will result.

It is proposed to use “low noise” hydraulic hammers either proprietary hammers, retro-fitted encased hammers or pulverising techniques.

7.1.2 Acoustic Barriers

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant (tower cranes). Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

Barriers can also be placed between the source and the receiver. The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 12mm plywood would be acceptable for the barriers.

It is proposed to utilise portable carpet faced plywood barriers to screen the affected receivers from hammering point wherever practicable.

7.1.3 Silencing Devices

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

7.1.4 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

7.1.5 Treatment of Specific Equipment

In certain cases it may be possible to specially treat a piece of equipment to reduce the sound levels emitted. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

7.1.6 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers.

Construction vehicles accessing the site should not queue in residential streets and should only use the designated construction vehicle routes. Loading of these vehicles should occur as far as possible from any sensitive receiver.

7.1.7 Introduction of Construction Joints

Construction joints will prevent the direct transmission of vibration from work spaces to sensitive spaces. It is noted that transmission of vibration may still occur via other connections and less direct structural paths.

7.1.8 Strategic Positioning of Processes On-Site

Where practicable, particular processes or activities can be located in particular positions on site to minimise noise to surrounding sensitive receivers.

For example, stationary plant may be positioned where direct line of sight shielding can be achieved using natural barriers, or may maximise the distance to the nearest sensitive receiver. This may also be applicable to the demolition of building structures where the façade closest to residential receivers is left until last to provide barrier screening for the demolition of the other parts of the building.

7.1.9 Combination of Methods

In some cases it may be necessary that two or more control measures be implemented to minimise noise emissions.

7.1.10 Establishment of Direct Communication with Affected Parties

In order for any construction noise management programme to work effectively, continual communication is required between all parties that may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process that allows for the adjustment of control methods and criteria for the benefit of all parties.

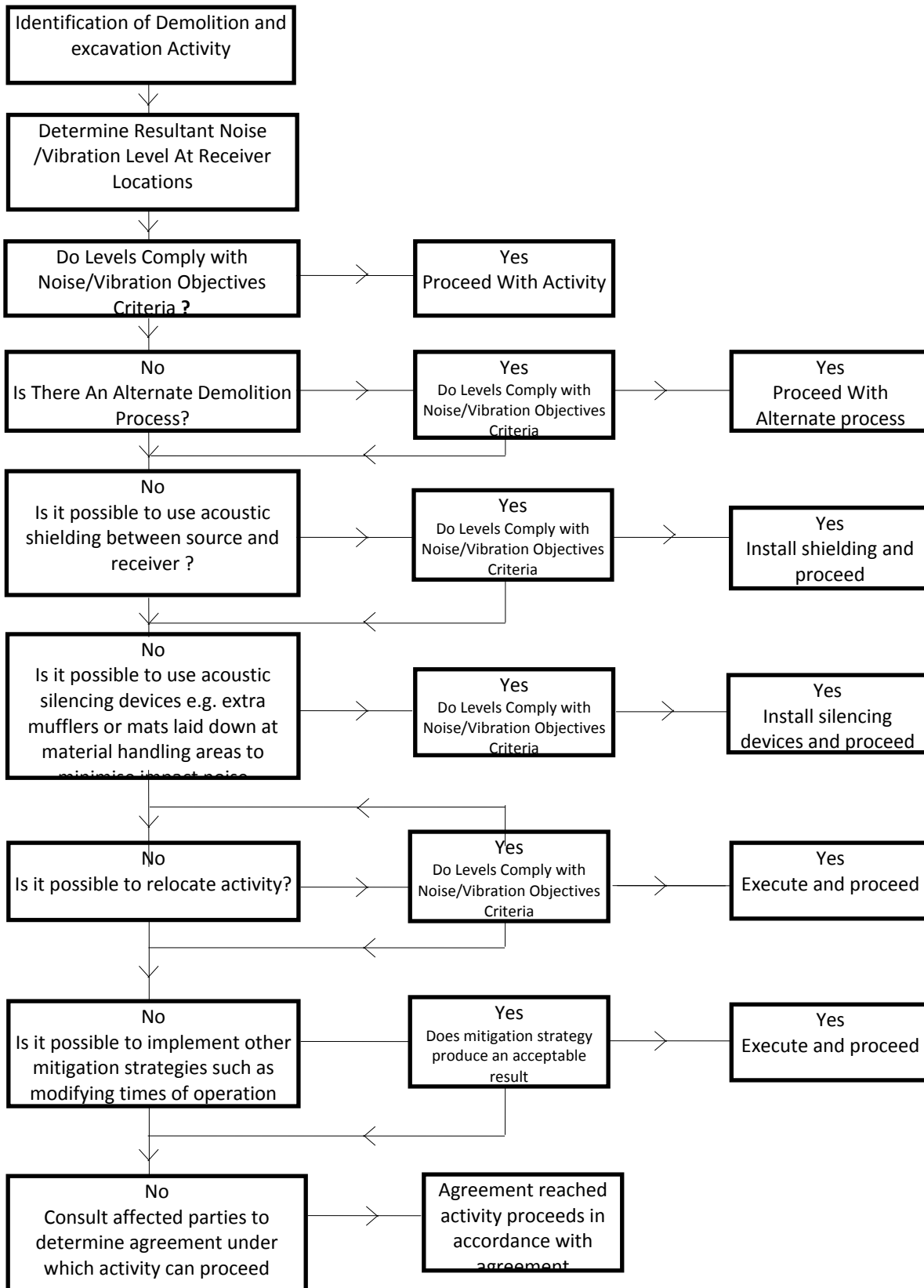
The objectives of the consultation process are to:

- Inform and educate the groups about the project and the noise controls being implemented.
- Increase understanding of all acoustic issues related to the project and the options available.
- Identify group concerns generated by the project, so that they can be addressed.

7.1.11 Management Training

All site managers should be made aware of noise and vibration limits, applicable control measures and methods. They should ensure that all agreed noise and vibration measures are carried out by employees and sub-contractors.

CONTROL OF NOISE FLOW CHART



8 MONITORING

It is proposed to undertake a programme of noise and vibration monitoring to comply to monitor noise and vibration levels within at critical locations around the site.

The monitoring would consist of attended monitoring (to confirm noise/vibration predictions, to identify safe working distances or methods and in response to complaints) and unattended monitoring in order to provide a historical record of emissions, to provide vibration alarms and to identify exceedences where complaints are made.

Vibration loggers, positioned in locations representative of sensitive receivers, would be used to provide a record of vibration levels and to provide alarms if vibration limits are exceeded. Installation of noise loggers would be undertaken for recording purposes in case of complaints and to monitor progress of the works.

8.1 RESPONSE TO VIBRATION ALARMS

The following general procedure should be adopted in zones where only unattended logging is required in response to alarm events. During the course of demolition and construction where a monitor alarm is activated the following action shall be undertaken:

- Monitoring alarms shall be managed using in built paging systems as part of the unattended vibration monitoring equipment. An SMS notification shall be sent upon an exceedence of the vibration trigger level to relevant site personnel.
- Where the exceedence of the amenity vibration targets is minor and does not occur for a greater than 5 minute interval per hour then the activities should continue but care should be taken to minimise vibration.
- If minor exceedences occur for greater than 5 minutes, if single events occur that exceed 10mm/s then the following should occur.
- Investigate if there may be sources of extraneous vibration.
- If not, all vibration producing works in the vicinity of the alarm shall immediately be stopped.
- The cause of the exceedence shall be investigated and if the cause is seen as a single event that is unlikely to be repeated continue with works.
- If the cause of the event is likely to occur again, or if another alarm is triggered, then the acoustic specialist should be advised and further action taken before works recommence.

One of two courses of action can then follow. 1. If attended monitoring is established the activity can continue with the attended monitoring confirming that even if the alarm level is exceeded the works can proceed provided the vibration limit is not exceeded. 2. Work practices are modified and attended monitoring used to confirm.

9 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

9.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continuous communication is required between all parties which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation processes is to:

- Inform and educate the groups about the project and the noise controls being implemented;
- Increase understanding of all acoustic issues related to the project and options available;
- Identify group concerns generated by the project, so that they can be addressed; and
- Ensure that concerned individuals or groups are aware of and have access to the Complaints Register which will be used to address any construction noise related problems should they arise.

An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generate higher noise/vibration levels.

9.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration criteria occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. In the case of exceedances of the vibration limits all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of a complaint shall involve where applicable;

- noise measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

10 CONTINGENCY PLANS

Where non-compliances or noise complaints are raised the following methodology will be implemented.

1. Determine the offending plant/equipment/process
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc. where practical.
4. Selecting alternative equipment/processes where practical
5. If necessary, setup noise/vibration and dust monitoring devices at locations representing the nearest noise/vibration and dust affected receivers and provide data for each complain time period. Analysis is required to determine suitable mitigation measures.

Complaints associated with noise /vibration and dust generated by site activities shall be recorded on a Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

11 CONCLUSION

A demolition, excavation and construction noise and vibration management plan has been developed that will be used by the contractor to manage impacts from the SICEEP construction activities.

The assessment of noise and vibration emissions indicates that:

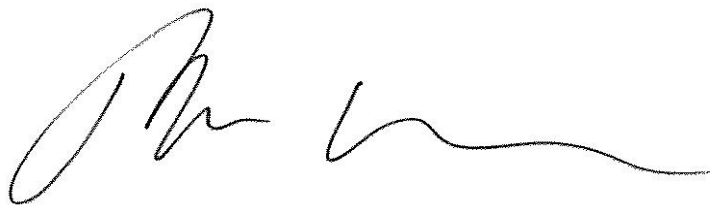
- For at least part of the site demolition and excavation period, some processes are likely to generate noise levels that will require additional management according to the procedures outlined in the Management Plan. Adoption of the elements of the Noise and Vibration Management Plan will ensure that noise and vibration impacts will be minimised.
- Recommendations are made to safeguard existing structures immediately adjacent to the site.

The management plan outlines the development of controls and safeguards that would be applied to all activity on the site. The objective of these controls is to ensure that all work is carried out in a highly controlled and predictable manner that will minimise emissions and protect the amenity of the sensitive receivers surrounding the site.

The controls and safeguards implemented as a result of the analysis recommended in the Plan would be reviewed at a number of stages as required to respond to local conditions, revised methods and equipment, as well as in response to the monitoring and evaluation of actual impacts. This management plan outlines the procedures that would be adopted during the planning and execution phases by the contractor.

Further reviews would be undertaken through the demolition and construction period, as required, in response to revised methods and equipment, as well as in response to the monitoring and evaluation of actual impacts.

Prepared by

A handwritten signature in black ink, appearing to read 'Tom Aubusson', with a stylized, flowing script.

ACOUSTIC LOGIC CONSULTANCY PTY LIMITED
Tom Aubusson