Aged Care Centre at 22 Hospital Road, Bulli

Construction Noise & Vibration Management Plan

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1 INTRODUCTION

Acoustic Logic Consultancy has been engaged to prepare a Noise and Vibration Management Plan for the Aged Care Centre at 22 Hospital Road, Bulli to satisfy Conditions of consent B24.

The issues which will be addressed in this report are:

- Identification of the noise and vibration standards which will be applicable to this project.
- Identification of potentially impacted nearby development.
- Identify likely sources of noise and vibration generation and predicted noise levels at nearby development.
- Formulation of a strategy to comply with the standards identified and mitigation treatments in the event that compliance is not achievable.

2 SITE DESCRIPTION

The subject site is located at 22 Hospital Road, Bulli. It is bounded by Hospital Road to the south, existing residential houses to the west and north, and a commercial development to the east.

Hospital Road is a two-way road, with space dedicated to on-street parking on either side of the road.

It is proposed to demolish all existing structures on site and construct a new three-storey Age Care Centre.

We have been advised that all works on site are proposed to extend over an approximate 16-month period, divided into three stages:

- Demolition & Remediation;
- Ground Works & Pilling, and;
- Construction & Fit-out.

Primary noise producing activities associated with the works will be:

- Pilling (screw/augured).
- Bulk and detailed excavation in soil (using excavator with bucket attachment).
- Use of mobile cranes.
- Erection of building structure (powered hand tools for formwork, concrete pump, vibrators).
- Façade Installation (powered hand tools)
- Landscaping (front end loaders etc).

Figure 1 below illustrates location of the subject site and surrounding properties. Sensitive receivers include:

Receiver 1: Residential Development located across Hospital Road, 15-33 Hospital Road, Bulli

Receiver 2: Residential Houses located along the western boundary of the site, 24-32 Hospital Road, Bulli

Receiver 3: Residential Houses located along the northern boundary of the site, 25-47 Organs Road, Bulli

Receiver 4: Residential Development and houses located along the eastern boundary of the site, 13A Organs Road and 14-20 Hospital Road, Bulli.

All construction traffic will access the site via the three access gates located along the southern boundary of the site, as illustrated in Figure 2 below. Mobile crane locations and concrete pump locations are shown in figures 2 and 3.

Figure 1 - Aerial Site Map (Sourced from SixMaps 2017)

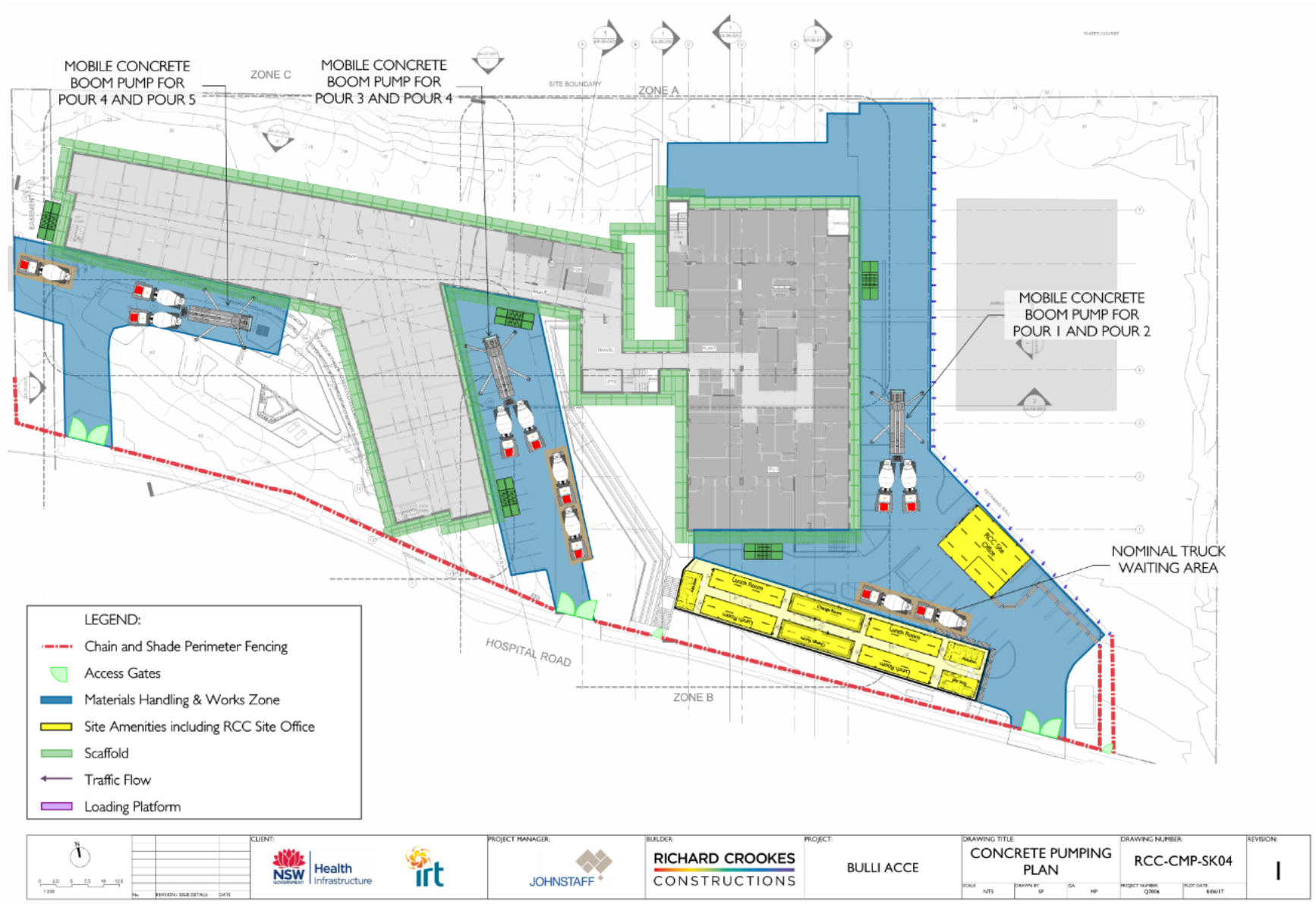


Figure 2 - Site Plan (Concrete Pump Locations)

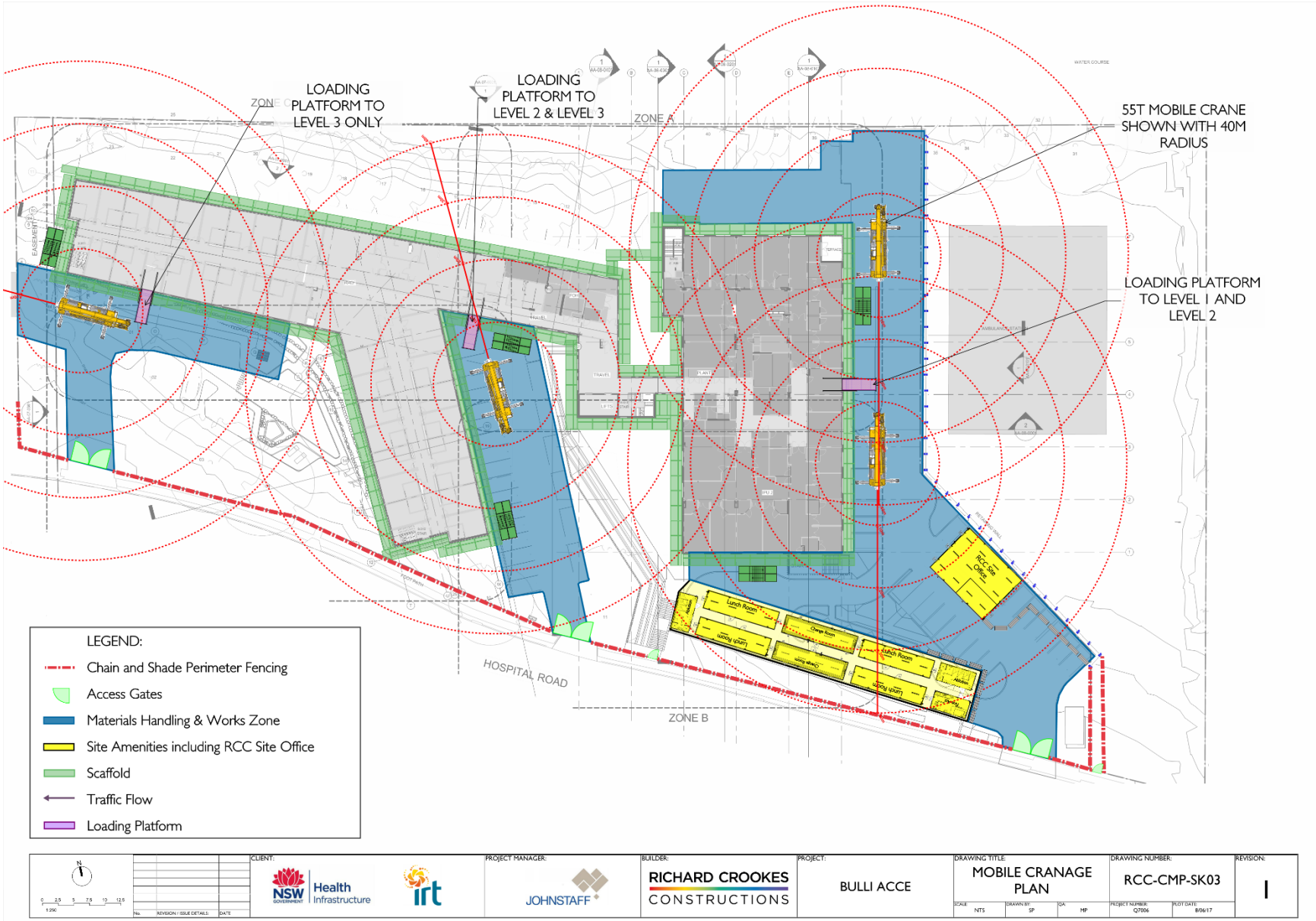


Figure 3 - Site Plan (Crane Locations)

3 HOURS OF WORK

Condition C1 of the development consent SSD 7751, outlines the following with regards to any works proposed on site;

PART C DURING CONSTRUCTION
Hours of Work
C1.

a) The hours of construction, including the delivery of materials to and from the Subject Site, must be restricted as follows:

i) between 7 am and 6 pm, Mondays to Fridays inclusive;

ii) between 7 am and 5 pm, Saturdays; and

iii) no work on Sundays and public holidays.

b) Works may be undertaken outside these hours where:

iv) the delivery of materials is required outside these hours by the Police or other authorities; or

v) it is required in an emergency to avoid the loss of life, damage to property and/or to prevent environmental harm; or

vi) *variation is approved in advance in writing by the Secretary or nominee.*

This is summarised as follow;

Table 1 – Approved Hours of Work

Day	Time
Monday to Friday	7:00am – 6:00pm
Saturday	7:00am – 5:00pm
Sundays and Public Holidays	No works permitted at any time

4 BACKGROUND NOISE MEASUREMENT

Long term unattended and attended background noise measurements were undertaken by Acoustic Logic at project approval stage (See DA Acoustic Assessment Doc Ref: 20161364.1/3009A/R2/TL for more information). The background noise levels determined by this logging are presented below.

Table 2 – Measured Background Noise Levels, dB(A) L_{90}

LOCATION	PERIOD/TIME	BACKGROUND NOISE LEVEL dB(A) L_{90}
North-west Corner of the proposed site (See Figure 1)	Day (7am to 6pm)	40
	Evening (6pm to 10pm)	33
	Night (10pm to 7am)	30

*This monitoring location is nearest to the residential receivers 2, located 24 Hospital Road, Bulli.

5 CONSTRUCTION NOISE AND VIBRATION OBJECTIVES

5.1 NOISE OBJECTIVES

Noise associated with demolition, excavation and construction activities on the site will be assessed in conjunction with the following guidelines,

- Development Consent SSD 7751;
- NSW EPA Interim Construction Noise Guideline; and
- Australian Standard 2436-2010 "*Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*".

5.1.1 Development Consent SSD 7751

Construction Noise and Vibration Management Plan
B24.

a) Prior to the commencement of works on the Subject Site, a Construction Noise and Vibration Management Plan (CNVMP) must be submitted to the satisfaction of the Certifying Authority. The plan must address, but not be limited to, the following matters where relevant:

i) be prepared by a suitably qualified expert;

ii) be prepared in consultation with all noise sensitive receivers where noise levels exceed the highly affected noise management level, in accordance with EPA guidelines;

iii) identify works that will exceed the highly affected noise management level, which must be restricted to the standard construction hours in the EPA guidelines;

iv) describe the measures that would be implemented to ensure:

v) best management practice is being employed;

vi) compliance with the relevant conditions of this consent;

vii) describe the proposed noise and vibration management measures in detail;

viii) include strategies that have been developed to address impacts to noise sensitive receivers where noise levels exceed the construction noise management level, for managing high noise generating works;

ix) describe the consultation undertaken to develop the strategies in viii) above;

x) evaluates and reports on the effectiveness of the noise and vibration management measures; and

xi) include a complaints management system that would be implemented for the duration of the project.

b) The Applicant must submit a copy of the CNVMP to the Department and Council prior to the commencement of work.

5.1.2 EPA Interim construction noise guideline

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise generation goals (based on ambient noise monitoring).
- Review of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.
- "*Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

In addition to the above goals for residential receivers, the ICNG nominates a Management Level of 45dB(A) $L_{eq(15min)}$ internally for School Classrooms and 70dB(A) $L_{eq(15min)}$ at commercial receptor facades (typical office, retail).

A summary is presented below.

Table 3 – Noise Management Levels - Residential

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Development	50	75

If noise levels exceed the criteria identified in the tables above, reasonable and feasible noise management techniques will be reviewed.

5.2 VIBRATION

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*
- For human exposure to vibration, the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

5.2.1 Structure Borne Vibrations (Building Damage Criteria)

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 4.

It is noted that the peak velocity is the 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 4 – 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

The surrounding commercial and educational buildings would be considered a Type 1 structure, whilst the Convict Wall would be considered a Type 3 structure.

5.2.2 Assessing Amenity

The NSW EPA document "*Assessing Vibration: A Technical Guideline*" provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings, and is used in the assessment of vibration impact on amenity.

Relevant criteria are presented below.

Table 5 – 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

6 PROPOSED CONSTRUCTION ACTIVITIES

We have been advised of the typical equipment/processes anticipated to be used for the construction of the subject development. Noise impacts from these activities on the amenity of the surrounding identified sensitive receivers, will be predicted in this section.

The A-weighted sound power levels for the anticipated equipment/processes are outlined in the tables below.

Table 6 – Proposed Construction Activities and Associated Sound Power Levels

Construction Activity	Equipment /Process	Sound Power Level dB(A)
Demolition & Remediation	Excavators with Bucket	105
	General Trucks	100-105
	Bobcat	105
Ground Works & Pilling	Screw & Bored Pilling	105
	Excavators with Bucket	105
	General Trucks	100-105
	Bobcat	105
	Rolling Compactor	105
Construction & Fit-out	General Trucks	100-105
	Cement Mixing Truck	105
	Concrete Pump	107
	Powered Hand Tools	95*

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

The noise levels presented in the above table are derived from the following sources:

- On-site measurements;
- Table D2 of Australian Standard 2436-1981 & Table A1 of Australian Standard 2436-2010; and
- Data held by this office from other similar studies.

Noise levels take into account correction factors (for tonality, intermittency where necessary).

7 ASSESSMENT OF NOISE EMISSIONS

7.1.1 Methodology

Noise from the loudest typical construction activities for each stage of works have been predicted to the nearest most affected sensitive receivers. The predicted noise levels are presented in this section and are based on the areas on the site in which the plant is likely to be used.

It is noted that:

- Many of the noise sources are present over a small period of the day or may be present for a few days with a significant intervening period before the activity occurs again.
- The distance between the noise source and the receiver (which varies depending on the position of the activity on the site).
- The screening effect provided by any remaining building structure or building shell.

7.1.2 Predicted Noise Levels

Please see tables below for predicted noise levels for each receiver.

Table 7 - Predicted Noise Generation to Residential Receiver 1 (Residences south of the site)

Activity	Predicted Level dB(A)$L_{eq(15min)}$ (External Areas)	Comment
Excavator with Bucket Attachment	55-70	All noise levels predicted to receiver 1 exceed the 50dB(A) Noise Management Level, but still complies with the Highly Noise affected level of 75dB(A).
Trucks (typical)	60-65	
Bobcat	55-70	
Screw & Bored Pilling	55-65	
Compactor - Rolling	55-70	
Concrete Pump	55-70	
Mobile Crane	60-70	
Powered Hand Tools – External Areas	45-60	Intermittent exceedance of 50dB(A) Noise Management Level when working on the southern boundary. Complies with Highly Noise Effected Level of 75dB(A).
Powered Hand Tools – Internal Areas	≤ 50	Complies with Noise Management Level and Highly Noise Affected Level of 75dB(A).

Table 8 - Predicted Noise Generation to Residential Receiver 2 (Residences west of the site)

Activity	Predicted Level dB(A)$L_{eq(15min)}$ (External Areas)	Comment
Excavator with Bucket Attachment	55-75	Noise levels approaching Highly Noise Affected Level for major external works on the Western property boundary. Intermittent exceedance of the Noise Management levels when working away from the property boundary.
General Delivery Trucks	55-75	
Bobcat	55-75	
Screw & Bored Pilling	55-75	
Compactor - Rolling	55-75	
Concrete Pump	55-70	
Mobile Crane	55-75	
Powered Hand Tools – External Areas	45-65	Intermittent exceedance of 50dB(A) Noise Management Level when working on the western boundary. Complies with Highly Noise Effected Level of 75dB(A).
Powered Hand Tools – Internal Areas	≤ 50	Complies with Noise Management Level and Highly Noise Affected Level of 75dB(A).

For noise impacts on the residences to the north, noise emissions are predicted both at the property boundary and at the façade of the residences (as there is typically a significant distance between the property bound and the dwelling itself).

Table 9 - Predicted Noise Generation to Residential Receiver 3

Activity	Predicted Level dB(A)$L_{eq(15min)}$ (At Boundary)	Predicted Level dB(A)$L_{eq(15min)}$ (At Façade)	Comment
Excavator with Bucket Attachment	55-75	50-65	Noise levels approaching Highly Noise Affected Level for major external works on the Northern property boundary. Intermittent exceedance of the Noise Management levels when working away from the property boundary. No exceedance of Highly Noise Affected Level when considering the noise impact at the façade of the dwelling itself (as opposed to at the property boundary).
General Delivery Trucks Amend for SWL102.5	55-60	50-60	
Bobcat	55-75	50-65	
Screw & Bored Pilling	55-75	50-65	
Compactor - Rolling	55-75	50-65	
Cement Mixing Truck	55-65	55-60	
Concrete Pump	60-65	55-60	
Mobile Crane	55-65	55-60	
Powered Hand Tools – External Areas	45-65	45-60	Intermittent exceedance of 50dB(A) Noise Management Level when working on the northern boundary. Complies with Highly Noise Effected Level of 75dB(A).
Powered Hand Tools – Internal Areas	≤ 50	< 50	Complies with Noise Management Level and Highly Noise Affected Level of 75dB(A).

Table 10 - Predicted Noise Generation to Residential Receiver 4

Activity	Predicted Level dB(A)$L_{eq(15min)}$ (External Areas)	Comment
Excavator with Bucket Attachment	55-70	Noise levels predicted to receiver 4 exceed the 50dB(A) criteria, but still comply with the highly noise affect level of 75dB(A).
General Delivery Trucks	55-60	
Bobcat	55-70	
Screw & Bored Pilling	55-70	
Compactor - Rolling	55-70	
Cement Mixing Truck	55-60	
Concrete Pump	55-60	
Mobile Crane	55-60	
Powered Hand Tools – External Areas	45-65	Noise Levels exceed the 50dB(A) when work is conducted within 55 meters of the nearest receiver.
Powered Hand Tools – Internal Areas	≤ 50	Compliant with noise criteria.

8 ASSESSMENT OF VIBRATION EMISSIONS

It is impossible to predict the vibrations induced by the demolition, piling and excavation operations on site at potentially affected receivers. This is because vibration level is principally proportional to the energy impact which is unknown nature of terrain in the area (type if soil), drop weight, height etc.

Acoustic Consultant can undertake monitoring of initial demolition/excavation process when conducted near potentially affected receivers to ensure that vibration criteria set out in section 5.2 are not exceeded.

9 DISCUSSION & RECOMMENDATIONS

9.1 NOISE

9.1.1 Excavator, Bobcat and Piling Noise

We note that excavators (bucket attachment) and augured piling are typically proposed for remediation, bulk excavation and soil retention. There are typically less noise intensive equipment items.

Excavators, bobcats and piling operations are also proposed to be used for the majority of the time during the remediation/excavation period. Where prolonged use of bobcats or excavators is necessary on the western boundary, this equipment/machinery could be intermittently moved to another part of the site to offer the receiver closest to the plant some respite.

Management processes include;

- We recommend commencing all excavation works within 20m of the western boundary of the site only after 7.30am (although set up during this time would be reasonable).
- Receivers 2 and 3 should be notified of the duration and extent of the works proposed during the excavation stage via letterbox drops.

9.1.2 Tower Crane, Vehicle Noise and Concrete Pumps

All construction traffic, including loading and unloading operations are proposed to occur within the three designated zones shown in figure 2. Additionally, we recommend the following controls;

- Trucks must turn off their engines when on site to reduce impacts on adjacent land use (unless truck ignition needs to remain on during concrete pumping).
- To minimise noise at the western residential receiver, all trucks located on the western side of the site should park as far as possible from the western property boundary.
- Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.
- Avoid careless dropping of construction materials into empty trucks.

- The most significant noise impact will be a result of use of pumps and cane near the western property boundary:

    - On days of concrete pours by this pump, notification to the residence to the west should be provided. We note that there are only (approximately) 10 days during the construction period that are anticipated to have concrete pours by the western most pump.

    - Avoid use of the western mobile crane prior to 7.30am.

9.2 VIBRATION

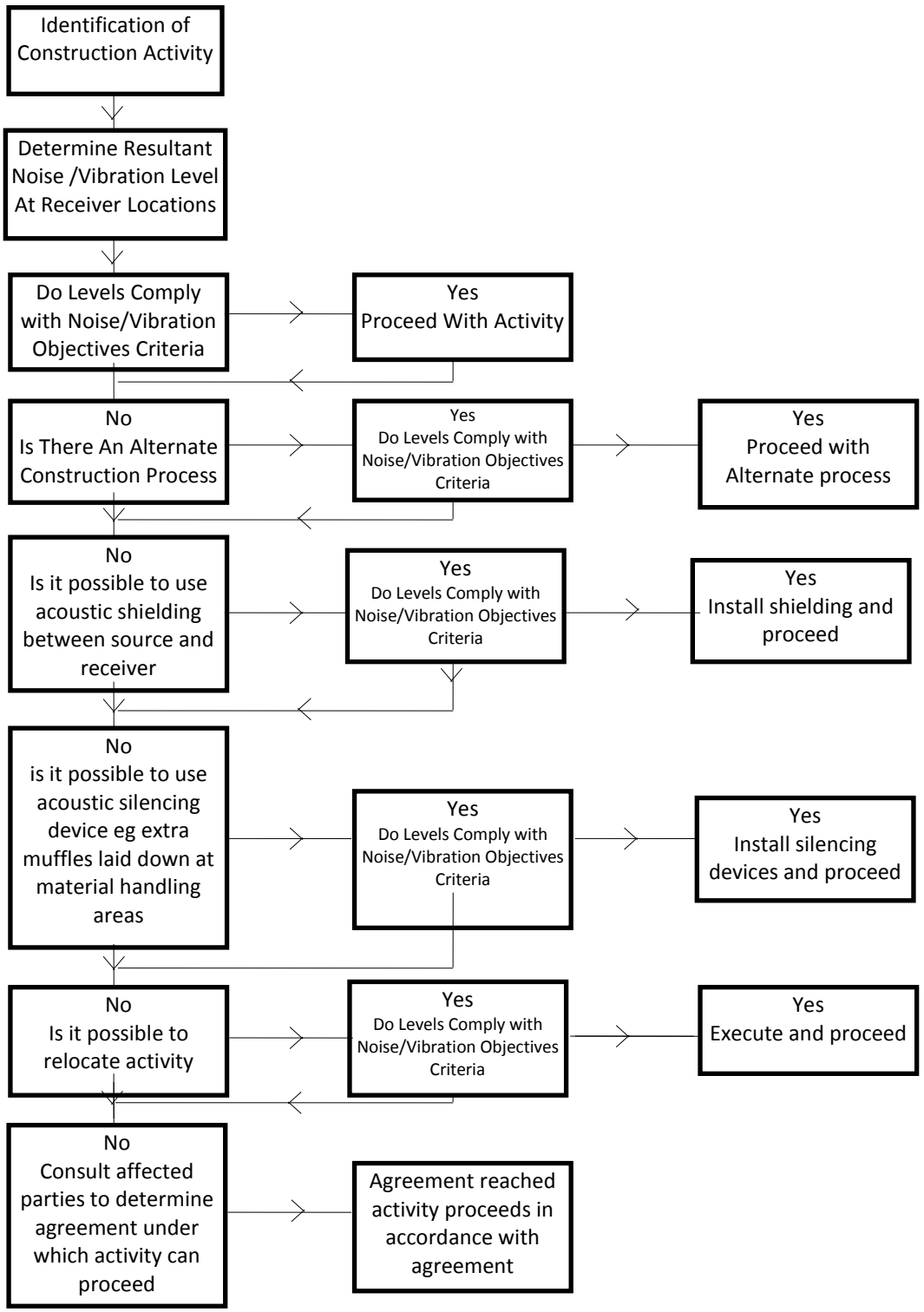
Typically, piling (augured), excavation in soil and compaction using a non-vibratory roller will not produce significant levels of vibration.

Use of vibratory rollers and percussive excavation equipment is not recommended whenever possible.

In the event bulk excavation in rock or use of vibratory rollers/compactors is required, use of a vibration monitoring is recommended. Any vibration monitor should have an SMS warning system to enable the contractor to be notified immediately in the event that vibration exceeding the criteria in table is generated. Indicatively, SMS warning trigger should be set at 3mm/s initially.

10 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that will be followed in the event of complaint:



11 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered.

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

11.1 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

Where a particular activity or construction appliance is found to generate excessive noise levels, 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. Undertaking this activity using bulldozers, ripping and/or milling machines will result in lower noise levels.

11.2 ACOUSTIC BARRIER

Given the position of adjacent development, it is unlikely that noise screens will provide significant acoustic benefit for commercial or residential receivers, but will provide noticeable improvement for those on ground level.

The placement of barriers at the source is generally only effective for static plant. Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

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 no line of sight is obstructed by the barrier, 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 that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

11.3 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).

11.4 TREATMENT OF SPECIFIC EQUIPMENT

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

11.5 ESTABLISHMENT OF SITE PRACTICES

This involves the formulation of work practices to reduce noise generation. A more detailed management plan will be developed for this project in accordance to the construction methodology outlining work procedures and methods for minimising noise.

11.6 COMBINATION OF METHODS

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

12 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.

If a noise complaint is received the complaint should be recorded. Any 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.

13 CONCLUSION

A noise and vibration assessment has been undertaken of the proposed construction works to be undertaken at 22 Hospital Road, Bulli.

Potential noise and vibration impacts on nearby development have been assessed.

Provide that the recommendations, management controls and procedures outlined in this report are implemented, noise and vibration impacts from the proposed works will be minimised.

This report has been prepared in order to address conditions of consent B24.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Jenna MacDonald