100 Mount Street, North Sydney

Assessment of Proposed Additional Construction Hours

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1 INTRODUCTION

Acoustic Logic Consultancy has been engaged to conduct a review of noise generated by a proposed extension to currently permitted hours at 100 Mount Street, North Sydney.

We note that condition of consent B52 required a construction noise and vibration management plan for the site. Condition B52 sets out reporting requirements such as identification of noise receivers, acoustic criteria, work activities and noise mitigation techniques. Condition B52 relates to standard hours of construction (as per condition D1) and was addressed in our Construction Noise and Vibration Management Plan (ref 20160130.1/0225A/R1/TT dated 3 Mach 2016.

This report will also address the reporting requirements of condition B52 (identification of work activities, prediction of noise levels etc) however will be done with reference to the appropriate EPA noise emission criteria for work conducted outside of standard construction hours.

2 PERMISSIBLE AND PROPOSED NEW HOURS OF WORK

Condition D1 currently limits work hours as follows:

Permissible construction hours are dictated by condition of consent E16, which permits the following:

- Demolition/excavation:
    - Monday to Friday: 8am-5pm.
    - Saturday: Not permitted.
    - Sunday: Not permitted.
- Other work:
    - Monday to Friday: 7am-5pm.
    - Saturday: 8am-1pm.
    - Sunday: Not permitted.

Proposed changes to construction hours are:

- Demolition/excavation:
    - Monday to Friday: 7am-6pm.
    - Saturday: 7am-5pm.
    - Sunday: Not permitted.

- Other work (external):
    - Monday to Friday: 7am-8pm.
    - Saturday: 7am-5pm.
    - Sunday: Not permitted.
- Other work (internal):
    - Monday to Friday: 7am-10pm.
    - Saturday: 7am-5pm.
    - Sunday: Not permitted.

3 SITE DESCRIPTION

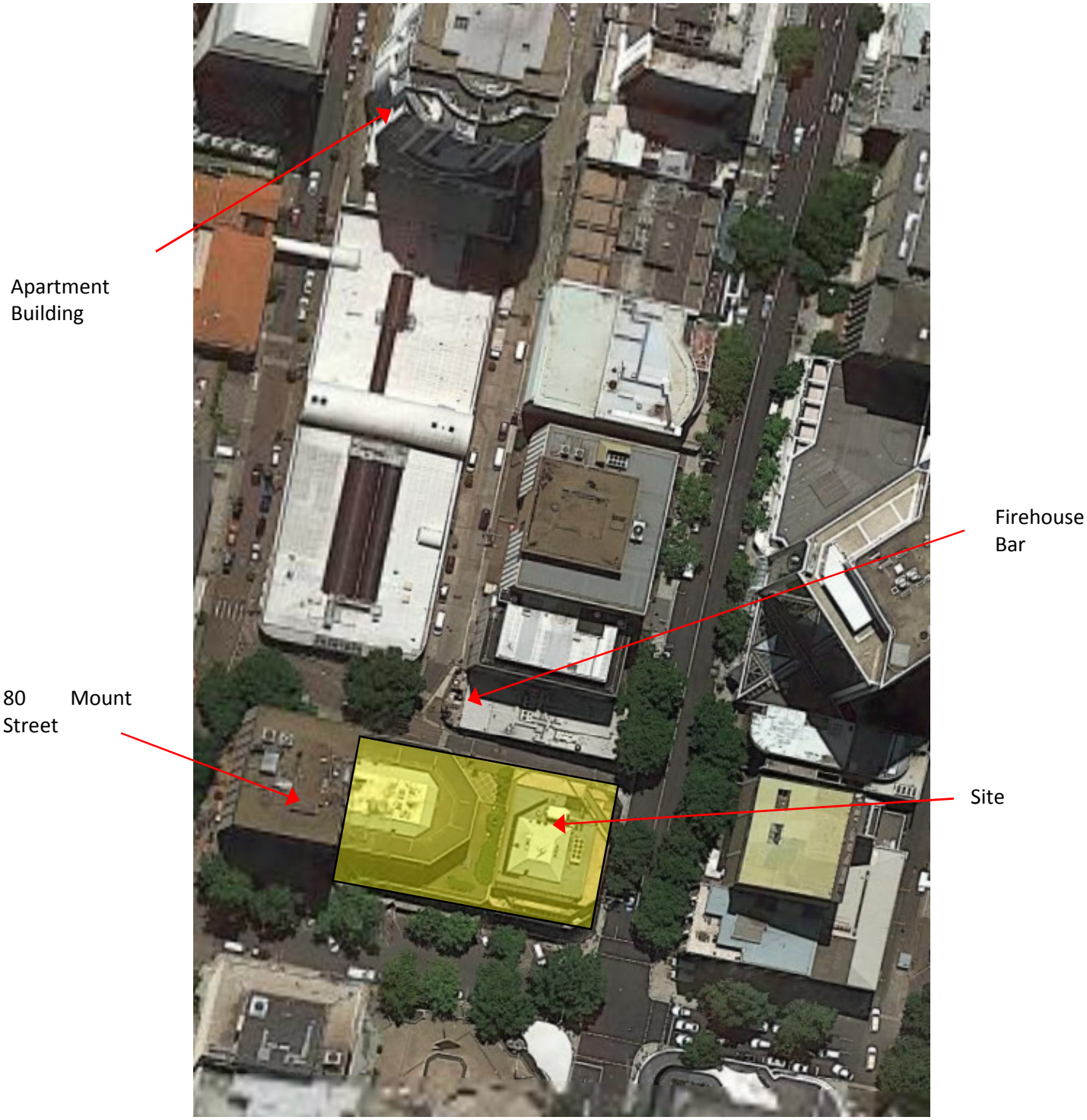
The site is located on the corner of Mount and Walker Streets, North Sydney (90 and 100 Mount Street).

The proposed development involves demolition of the existing building, additional basement excavation and the construction of a new 35 storey commercial tower.

The nearest noise sensitive development to the site is as follows:

- 80 Mount Street (a commercial development). Although this building abuts the site, the buildings are physically separate (ie – there is no common wall to 90 Mount Street), however there are localised point of connection at flashings/cladding etc. The risk of noise generation as a result of structure borne vibration transmitted via the points of contact will be discussed later in this report.
- Other commercial development is further away from the site (on the other side of Mount/Walker/Spring Street).
- The Firehouse Bar, to the north of the site (in particular the outdoor dining area).
- Residential tower on Berry Street, approximately 140m to the north of the site.

See aerial photo below.


Apartment Building
Firehouse Bar
80 Mount Street
Site

With respect to the proposed work to be conducted in the additional hours:

- Internal works in the 6pm-10pm period would only be conducted on levels where the external façade is complete, and the works are proposed to are to consist of:
    - Internal fitout - ceiling installation, painting, joinery installation, floor sanding, laying of carpet.
    - Crane, hoist, external elevator.
    - Installation of internal services.
- Proposed external works between 7am to 8am weekdays and 1pm and 5pm on Saturdays is to be limited to:
    - Services installation, plant room/lift works construction.
    - Jumpform works/formwork, reinforcement, concrete finishing.
    - Survey.
    - Façade construction.
    - Crane, hoist, external elevator.
    - Finishing trades.

4 BACKGROUND NOISE MEASUREMENT

Background noise levels were measured at project approval stage and set out in the Acoustic Report by PKA Acoustic Consulting dated May 2009.

In the PKA report, background noise levels were determined by long term noise logging conducted at three locations (2 to the north of the site, one to the south).

Using the logging data I nteh PKA report, the background noise levels during the proposed additional hours of work are presented below.

Table 1 - Measured Background Noise Levels (7am-6pm)

Location	Background Noise Level (dB(A)L_{90})		
	7am-8am Weekday	6pm-10pm Weekday	1pm-5pm Saturday
Spring Street*	60	59	60
Mount Street	61	60	58

*These levels will be indicative of background noise levels at the nearest residents, who are north of the site.

5 NOISE AND VIBRATION CRITERIA

5.1 CONDITION OF CONSENT B52 – NOISE AND VIBRATION MANAGEMENT PLAN

Condition B52 sets out the requirements for a construction noise and vibration management plan for site. Similar requirements would also apply for noise generated during proposed additional construction hours. The requirements of condition B52 are presented below.

B52 Noise and Vibration Management Plan

Prior to the issue of a Construction Certificate, a Noise and Vibration Management Plan prepared by a suitably qualified person shall be submitted to and approved by the Certifying Authority. The Plan shall address, but not be limited to, the following matters:

1. *Identification of the specific activities that will be carried out and associated noise sources,*
2. *Identification of all potentially affected sensitive receivers including residences, schools, and properties containing noise sensitive equipment,*
3. *The construction noise objective specified in the conditions of this approval*
4. *The construction vibration criteria specified in the conditions of this approval,*
5. *Determination of appropriate noise and vibration objectives for each identified sensitive receiver,*
6. *Noise and vibration monitoring, reporting and response procedures,*
7. *Assessment of potential noise and vibration from the proposed construction activities including noise from construction vehicles and any traffic diversions,*
8. *Description of specific mitigation treatments, management methods and procedures that will be implemented to control noise and vibration during construction*
9. *Justification of any proposed activities outside the construction hours specified in the conditions of this approval.*
10. *Construction timetabling to minimise noise impacts including time and duration restrictions, respite periods, and frequency,*
11. *Procedures for notifying residents of construction activities that are likely to affect their amenity through noise and vibration,*
12. *Contingency plans to be implemented in the event of non-compliances and/or noise complaints,*

5.2 NOISE EMISSION GOALS (OUTSIDE OF STANDARD CONSTRUCTION HOURS)

Condition of consent B52 does not set out any specific noise emission criteria to be adopted. In the absence of this, the construction noise criteria for the EPA Interim Construction Noise Guidelines will be adopted.

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)$L_{eq(15min)}$for work during standard construction hours (7am-6pm Monday to Friday and 8am to 1pm on Saturdays) and

- 5dB(A)$L_{eq(15min)}$for work outside of standard construction hours.

- "*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.

The noise emission goals for the proposed period of additional work hours are presented below.

Table 3 – Noise Emission Goals (Outside of Standard Construction Hours)

Location	Background Noise Level (dB(A)L_{90})		
	7am-8am Weekday	6pm-10pm Weekday	1pm-5pm Saturday
Residential Development*	65	64	65
Commercial Development	70	70	70

*Based on measured background noise levels presented in table 2.

Where nearby commercial development has fixed windows, internal noise level goals are commonly developed with reference to Australian Standard 2107 *Recommended Design Sound Levels and Reverberation Times for Building Interiors.*

For the purpose of assessing noise impacts to internal areas, an internal noise goal of 50dB(A)$L_{eq(15min)}$ will be adopted as:

- This is consistent with the noise emission goals adopted in the development approval stage acoustic report and

- Is equal to the AS2107 recommended internal noise level for office areas + 5dB(A), which is reasonable for a temporary noise impact.

5.3 VIBRATION CRITERIA

Vibration guidelines, both with respect to potential building damage and amenity impacts are presented below.

5.3.1 Structure Borne Vibration (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 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 3 - 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

Project specific vibration limits have been developed based on:

- The recommendations in Table 3.
- The vibration sources producing the highest vibration levels would not generate significant vibration at frequencies of less than 10Hz.

The recommended conservative vibration limit for the surrounding buildings is below:

- 5mm/s PPV for residential buildings.
- 20mm/s PPV for commercial properties including rail tunnel.

5.3.2 Amenity Impacts

The NSW EPA document "*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 regulate vibration within the excavation/construction site.

Table 4 – Vibration Goals

		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 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

The potential noise impact from primary processes and equipment will be assessed. The sound power levels of these activities is presented below.

Typically, the loudest (and most vibration intensive) works are bulk excavation in rock and piling (particularly driven or sheet piling). We note that neither of these activities are proposed as part of these works.

A summary of the primary noise generating works and typical sound power levels for the equipment items is presented below.

Table 5 - Sound Power Levels of the Proposed Equipment

EQUIPMENT /PROCESS	SOUND POWER LEVEL dB(A)
Demolition (Building and Basement)	
Concrete Muncher	115
Pneumatic Hammer	120
Jackhammer	110-115
Bobcat	100-105
Excavation	
Ripper	110-115
Excavator with Pneumatic Hammer	120
Rock Saw	120
Erection of Structure	
Crane (Diesel)	110
Crane (Electric)	100-105
Powered Hand Tools	100
Bobcat	100-105
Concrete Pumps/Slab Finishing (Helicopter Float)	105-110
Truck	100-105
Internal Works	
Powered Hand Tools	100

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

- Table A1 of Australian Standard 2436-2010.

- Data held by this office from other similar studies.

7 NOISE AND VIBRATION ASSESSMENT

Noise levels from extended hours of construction work have been predicted at the nearby development, and assessed against the acoustic criteria in section 5.2.

The following sections address:

- The potential noise impact on nearby residential development (the Berry Street apartments to the north of the site) and

- The potential noise impact on nearby commercial development.

In each case, predictions are made taking into account the noise management recommendations set out in section 8.

7.1 NOISE IMPACT ON RESIDENTIAL DEVELOPMENT

As assessment of the proposed additional work on the residential development to the north of the site is presented below.

All periods of additional work (7am-8am weekdays, 6pm-10pm weekdays and 1pm-5pm Saturdays) are assessed using their respective criteria (as identified in section 5.2, and the equipment proposed in that particular period (as identified in section 3).

Noise emissions are assessed below.

Table 6 – Predicted Noise Generation to Berry Street Apartments

Activity	Predicted Level (dB(A)$L_{eq(15min)}$)	Comment/Assessment
Demolition/Excavation (7am-8am weekdays, 1pm-5pm Saturday)		
Concrete Muncher	61	Complies with 65dB(A) noise goal. (7am-8am weekday, 1pm-5pm Saturday)
Pneumatic Hammer	66	Complies with 65dB(A) noise goal. (7am-8am weekday, 1pm-5pm Saturday)
Bobcat	54	Complies with 65dB(A) noise goal. (7am-8am weekday, 1pm-5pm Saturday)
Use of excavators (pneumatic hammer)	61	Prediction takes into account screening provided by hoarding (refer to section 8). Complies with 65dB(A) noise goal. (7am-8am weekday, 1pm-5pm Saturday)
Rippers	51	Prediction takes into account screening provided by hoarding (refer to section 8). Complies with 65dB(A) noise goal. (7am-8am weekday, 1pm-5pm Saturday)
Rock saw	61	Prediction takes into account screening provided by hoarding (refer to section 8). Complies with 65dB(A) noise goal. (7am-8am weekday, 1pm-5pm Saturday)
6pm-10pm works (Internal works and use of crane/hoist, truck delivery/unloading)		
Crane (Diesel)	56	Complies with 64dB(A) noise goal. (6pm-10pm weekdays)
Crane (Electric)	46	Complies with 64dB(A) noise goal. (6pm-10pm weekdays)
Powered hand Tool * (internal works)	<50	Complies with 64dB(A) noise goal. (6pm-10pm weekdays)
Truck Delivery	<55	Complies with 64dB(A) noise goal. (6pm-10pm weekdays)

*Assuming up to 20 power hand tools used in internal areas at any one time, with the facade

Provided that construction activities are restricted as per section 8, noise emissions form the proposed additional work hours will be compliant with EPA noise goals at the nearby residences.

7.2 NOISE IMPACT ON COMMERCIAL DEVELOPMENT

We note:

- Being a commercial development, EPA guidelines do not distinguish between standard or outside of standard hours when setting noise emission goals. A target noise level of 70dB(A) at the building façade applies in either case.

- Given this, there is no chance to the noise emission predictions and assessment presented in our original *Construction Noise and Vibration Management Plan*. A copy of the predicted noise emissions is presented in Appendix 1.

As identified in our original *Construction Noise and Vibration Management Plan*, there are some activities with the potential to generate noise levels exceeding EPA guidelines (in particular during demolition and excavation). In regard to the proposed extension of construction hours:

- For external works (demolition, excavation, structure):

    - Noise management for these activities was identified in the original Construction Noise Management Plan. These recommendations remain applicable for any period of extended works (extension limited to 7am-8am and 1pm-5pm for demolition excavation and other external work). These noise and vibration control recommendations are reiterated in section 8 of this report.

    - Although there are exceedances of noise emission goals predicted at nearby commercial development, there will potentially be benefit in proposed additional hours:

        - External works are proposed to be extended to include the 7am-8am weekday period and the 1pm-5pm Saturday.

        - It would be expected that for the vast majority of nearby commercial development, the buildings will not be occupied (or at least reduced occupation) during the period of extended works. Obviously if the building is not occupied, there can be no adverse impact, even if the construction noise exceeds EPA recommended levels.

        - However, it is estimated that the additional construction hours will reduce the overall demolition, excavation, and erection of structure period by 10% (an estimated reduction of 2 weeks).

        - In effect, by working at times when the majority of nearby commercial development will not be noise sensitive (7am-8am and Saturday afternoons), all nearby commercial development will be benefitted by the overall reduction in construction program.

- For internal works/use of crane/hoist (6pm-10pm):

    - Noise emissions are predicted to be compliant in any event and

- As is the case for external works, any noise impact associated with internal works will occur at times when the majority of commercial tenancies will not be in use.

8 RECOMMENDATIONS

For the proposed additional periods of construction:

- In the 6pm-10pm period:
  - All works are to be internal works.
  - Internal works are only to be conducted on levels where the external façade has been completed (so as to minimise noise breakout from the site).
  - The only external works are to consist of the use of the crane/hoist and for deliveries (which are predicted to comply with EPA after hours construction noise guidelines.
- For any external works, the noise control recommendations from our original *Construction Noise and Vibration Management Plan* are to apply.

Recommendations to be carried through from the Construction Noise and Vibration Management plan are as follows:

- Hoardings:
  - Recommend the construction of a 3m plywood hoarding around the perimeter of the site.
  - This will provide some noise screening from the work site (particularly basement excavation) to the Firehouse Bar and to lower levels of nearby commercial development.
- Demolition:
  - Removal of façade cladding should be conducted prior commencement of structural demolition is recommended. This should enable visual inspection of the degree of connection (or otherwise) between 90 Mount Street (the demolition site) and 80 Mount Street (the adjacent commercial building).
  - As much as practicable, any points of contact between the two buildings should be removed prior to commencement of structural demolition.
  - Whenever practicable, use of concrete munchers (as opposed to pneumatic hammers) should be used in order to minimise both noise and vibration impacts.
  - As much as practicable, the external building shell should be retained as the remainder to that level of the building is demolished (to enable the building shell to provide noise screening to nearby development).

- Drop zones should be located as far as practicable from the common wall with 80 Mount Street. Ensure drop zones have rubble or similar at the base to minimise vibration generation.

- Demolition hours to be limited as per condition of consent D1.

- Excavation:

  - Excavation hours to be limited as per condition of consent D1.

  - Use of rippers (as opposed to pneumatic hammers) is recommended whenever possible to minimise noise and vibration generation.

  - When pneumatic hammers must be used, in order to minimise vibration impact on 80 Mount Street, use a concrete saw to cut away rock on the common boundary prior to the use of pneumatic hammers are used.

- Cranes:

  - These are to be located on the southern side of the site (as far from residences and the Firehouse Bar outdoor area as possible). One crane is proposed in the south-eastern corner of the site, and one in the south-western corner.

  - If practicable, locate diesel crane in the south-eastern corner of the site (maximising distance to 80 Mount Street).

- Vehicle access/work zones:

  - These are to be located on the southern and eastern sides of the site, maximising distance to the nearest commercial development.

  - 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 during excavation.

- Community consultation:

  - Informing local residents/businesses is typically a critical aspect in reducing complaint regarding construction noise. The objective in undertaking a consultation processes is to:

    - Inform the groups about the project, the duration of noisy works and the noise controls being implemented;
    - Identify group concerns generated by the project, so that they can be addressed;
    - Ensure that concerned individuals or groups are aware of and have access to the Site Complaints Register which will be used to address any construction noise related problems should they arise. This should include:

      - 24 hour site contact details.

- Detail regarding complaints register.
- Estimates regarding duration of noisy construction activities (in particular demolition and excavation).

  - We note that consultation with management of the Firehouse Bar has already been undertaken by Laing O'Rourke, and is proposed to continue through the demolition/construction process.
  - Complaints handling - In the event of complaint, the procedures outlined, sections 9, 10, 11 and 12 should be adopted.

- Vibration and Structure Borne Noise Impacts.
  - Vibration monitoring on the building shell of 80 Mount Street is recommended during demolition and excavation.
  - Any vibration monitor should have SMS notification capability to advise Laing O'Rourke or the demolition/excavation contractor immediately in the event of exceedance of EPA vibration criteria. Monitor location to be determined based on access to 80 Mount Street.
  - In the event of complaint by the occupants on 80 Mount Street, attended measurements of vibration/structure borne noise may be considered by Lain O'Rourke.
  - In the event that access to the 80 Mount Street is permitted, we recommend that during initial demolition works that attended measurements of structure borne noise within 80 Mount Street are undertaken to determine if further noise mitigation is necessary.

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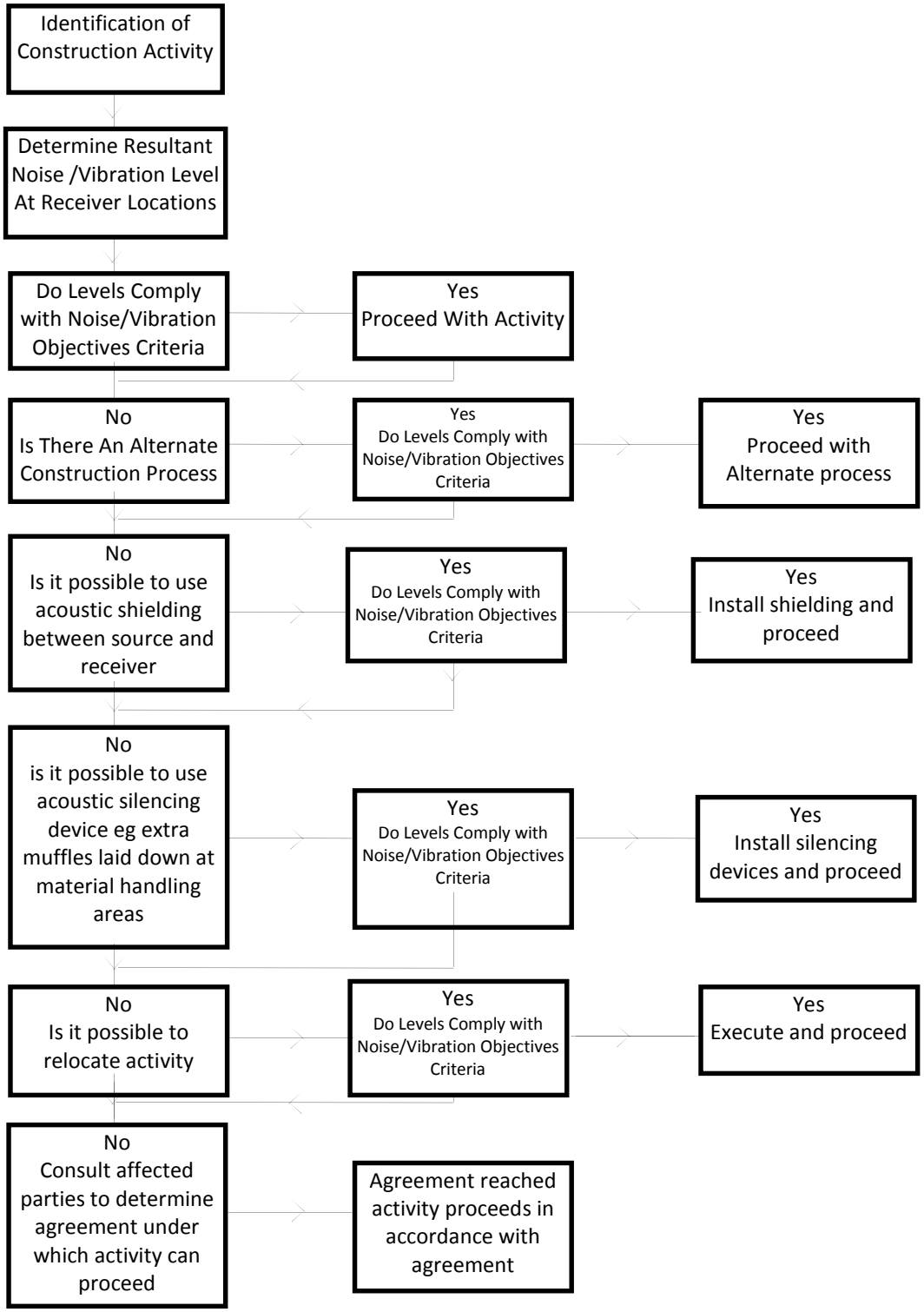
9 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that will be followed in assessing construction activities.



10 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaint, 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.

10.1 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. By carrying this activity by use of pneumatic hammers, bulldozers ripping and/or milling machines lower levels of noise will result.

10.2 ACOUSTIC BARRIER

Acoustic screens/barriers can be effective provided that they break the line of sight between the noise source and the noise effected property.

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

The degree of noise reduction provided by barriers is dependant 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. In determining whether use of a screen will provide any benefit, examination of the line of sight between the noise source and the residences is necessary.

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.

10.3 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.

11 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 by the contractor. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact phone number.

12 CONTINGENCY PLANS

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

- Conduct measurements of noise/vibration at effected sites to identify primary noise sources and potential treatment options.
- Determine the offending plant/equipment/process.
- Locate the plant/equipment/process further away from the affected receiver(s) if possible.
- Implement additional acoustic treatment in the form of localised barriers, silencers etc where practical.
- Selecting alternative equipment/processes where practical

13 CONCLUSION

A noise and vibration assessment has been undertaken of the proposed extension in the currently approved construction hours at site 100 Mount Street, North Sydney.

The assessment of construction noise and vibration indicates that provided that the recommendations in section 8 of this report are adopted:

- Noise impacts will be compliant with EPA guidelines for after-hours construction at nearby residential development.

- Although there is an exceedance of EPA guidelines for some activities at the nearby commercial development (which are much closer to the site than the residences):

    - The noise impacts will occur at a time when the vast majority of the commercial tenancies would not be in use and therefore not noise sensitive and

    - The proposed additional work hours will reduce the overall construction time, meaning that the total time during which the nearby commercial developments will be impacted will be reduced (by an estimated 10%).

In light of the above, in our opinion the proposed changes in construction time are reasonable.

Yours faithfully,

Thomas Taylor
Acoustic Logic Consultancy Pty Ltd

Appendix 1

Noise Emission Assessment of Commercial Development

Predicted Noise Generation to Firehouse Bar (Outdoor Dining)

Activity	Predicted Level (dB(A)$L_{eq(15min)}$)	Comment
Demolition		
Concrete Muncher	70-84	Exceedance of noise goals (70dB(A)), particularly when working towards northern façade of site. See recommendations in section 8.
Pneumatic Hammer	75-89	Exceedance of noise goals (70dB(A)) when working towards northern façade of site. Avoid use when muncher can be used instead (see section 8)
Bobcat	63-77	Intermittent exceedance of noise goals (70dB(A)) when working on lower levels towards northern façade of site.
Excavation		
Use of excavators (pneumatic hammer)	65-79	Intermittent exceedance of noise goals (70dB(A)) when working towards northern façade of site. Prediction takes into account screening provided by hoarding (refer to section 8). Avoid use when ripper can be used instead. See recommendations in section 8.
Rippers	55-69	Intermittent exceedance of noise goals (70dB(A)) when working towards northern façade of site. Prediction takes into account screening provided by hoarding (refer to section 8). Marginal exceedance when working towards northern boundary of site.
Rock saw	65-79	Intermittent exceedance of noise goals (70dB(A)) when working towards northern façade of site. Prediction takes into account screening provided by hoarding (refer to section 8). See recommendations in section 8
Construction		
Crane (Diesel)	65	Complies with 70dB(A) noise goal.
Crane (Electric)	55	Complies with 70dB(A) noise goal.
Concrete Pump	48	Complies with 70dB(A) noise goal.
Powered hand Tool (external works)	62-76	Intermittent exceedance of noise goals (70dB(A)) when working towards northern façade of site.
Powered hand Tool (internal works)	37-51	Complies with 70dB(A) noise goal.

Predicted Noise Generation to Commercial Development
(80 Mount Street, Commercial Development opposite the site)

Activity	Predicted Level (dB(A)$L_{eq(15min)}$)*	Comment
Demolition		
Concrete Muncher	72-81 (external) 47-56 (internal)	Intermittent exceedance of external goal (73dB(A)). Intermittent exceedance of internal goal (50dB(A)).
Pneumatic Hammer	77-86 (external) 52-61 (internal)	Exceedance of external goal (73dB(A)). Exceedance of internal goal (50dB(A)). Avoid use when muncher can be used instead (see section 8)
Bobcat	65-74 (external) 40-49 (internal)	Minor intermittent exceedance of external goal (73dB(A)). Complies with internal goal (50dB(A)).
Excavation		
Use of excavators (pneumatic hammer)	72-81 (external) 47-56 (internal)	Intermittent exceedance of external goal (73dB(A)). Intermittent exceedance of internal goal (50dB(A)). Avoid use when muncher can be used instead (see section 8)
Rippers	62-71 (external) 37-46 (internal)	Complies with external goal (73dB(A)). Complies with internal goal (50dB(A)). Prediction takes into account screening provided by hoarding (refer to section 8).
Rock saw	72-81 (external) 47-56 (internal)	Intermittent exceedance of external goal (73dB(A)). Intermittent exceedance of internal goal (50dB(A)). Avoid use when muncher can be used instead (see section 8)
Construction		
Crane (Diesel)	Up to 73 (external) Up to 48 (internal)	Complies with external goal (73dB(A)). Complies with internal goal (50dB(A)). See section 8 regarding crane location.
Crane (Electric)	Up to 63 (external) Up to 38 (internal)	Complies with external goal (73dB(A)). Complies with internal goal (50dB(A)).
Concrete Pump	Up to 66 (external) Up to 41 (internal)	Complies with external goal (73dB(A)). Complies with internal goal (50dB(A)). See section 8 pump location.
Powered hand Tool (external works)	Up to 66 (external) Up to 41 (internal)	Complies with external goal (73dB(A)). Complies with internal goal (50dB(A)).
Powered hand Tool (internal works)	Less than (external) Less than 40 (internal)	Complies with 73dB(A) noise goal.

*Noise level is predicted both at the commercial building façade (external), and inside the building (internal).