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Noise, Vibration and Dust Management Plan

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1 EXECUTIVE SUMMARY

This report addresses the construction noise, dust and vibration management for the demolition, piling, excavation and construction works proposed to be carried out at 122 Marine Parade, Miami (Nalu). Out of hours works have currently not been proposed and in case these should be required, additional acoustic assessment would be required.

In recognition of the requirement to manage noise, dust and vibration intrusion from the construction site to surrounding premises, 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust have commissioned this study. The study has been undertaken to determine the potential impacts and risks, which will result at the various premises which border to the site for the specific activities. These forecasts will be used to formulate and streamline effective regulation and mitigation measures.

A critical component of this report is the formulation of control strategies for all the different processes. These strategies include the formulation of site management procedures, whether they can be operational or time based. The formulation of mitigative treatments and the selection of processes have been reviewed. The objective in all cases is to manage noise, vibration and dust emissions from the construction process while also allowing the works at this significant development to progress.

In conclusion, provided all measures outlined in this report are fully implemented, construction noise, dust and vibration will be controlled and impacts managed.

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2 INTRODUCTION

This report presents a discussion on the process which will be followed in order to manage noise, dust and vibration from the works carried out at Nalu.

The proposal is to carry out Regulated activities (i.e. an activity specified in Schedule 1 of Local Law No.8) in accordance with the proposed conditions of a Permit. Out of hours works have currently not been proposed and in case these should be required, additional acoustic assessment would be required.

Provided all measures outlined in this report are fully implemented, construction noise, dust and vibration will be controlled and impacts managed.

Out of hours works have currently not been proposed and in case these should be required, additional assessment would be required.

3 NOISE CONSIDERATIONS

3.1 GOLD COAST CITY COUNCIL REQUIREMENTS

3.1.1 Gold Coast City Council Local Law No.8

Under Division 1 Building work of Part 5 (Prescribed noise standard), the Local Law states that:

"if a permit for building work noise given under this local law states a noise standard for the building work – a person must not carry put building work in a way that makes an audible noise outside the time stated in the permit for the duration and location stated in the permit and subject to any other conditions stated in the permit".

Under Part 6 Regulated activities:

A person must not-

(a) Operate a regulated activity on premises within the local government area unless authorised by a permit granted under Section 18(1) of the Local Law; or
(b) Change the manner of operation of a regulated activity on premises within the local government area unless authorised by a permit granted under Section 18(1) of the local law.

In accordance to Schedule 1, the regulated activities are:

- Building work noise;
- Building site delivery noise.

Based on the Local Law No.8, it is realised that:

- Emissions would not be limited on a business day or Saturday, from 6:30am til 6:30pm and can be extended, however, we note that extended working hours beyond standard EPA1994 working hours have not been proposed.
- No specific noise limit is set for the standard work hours from 630am til 6:30pm.

3.1.2 Subordinate Local Law No.8.1 2008

In accordance to Section 10 Prescribed criteria for a noise permit:

For the purposes of Schedule 2 and Section 18(1)(g) of Local Law No.8 2008 the carrying out of the regulated activity must comply with the following prescribed criteria –

(a) The applicant must establish and maintain a procedure for taking and managing complaints about noise from the regulated activity carried out outside the prescribed times, which must-
    a. Provide a 24hour telephone number for persons to call to make a compliant about the noise caused by the building work or delivery; and
    b. Set out a procedure that must be followed by the applicant after the receipt of a compliant to ensure the complaint is adequately addressed; and
    c. Require that the local government is notified of any compliant within 24hours after the complaint is receiver; and
    d. Otherwise be to the satisfaction of the local government.
(b) The applicant must provide written notification (in the prescribed form) of the commencement of any building work or delivery carried out outside the prescribed times to the following persons, not less than 48 hours prior to the commencement of the building work or delivery:
    a. The residents or operators of any noise sensitive place exposed to audible noise caused by the building work or delivery; and

b. The local government.

(c) Signage must be erected at the premises where the building work or delivery is being carried out which clearly identifies –
   a. The permit number issued by the local government; and
   b. The dates and times at which the permit authorises the building work or delivery to be carried out outside the prescribed times; and
   c. The 24 hour telephone number for persons to call to make a complaint about the noise caused by the building work or delivery.

(d) Unless a condition of a permit specifies different signage requirements the signage referred to in subsection (c) must-
   a. Be no larger than 0.6m2; and
   b. Have letters 50mm in height; and
   c. Not be illuminated; and
   d. Be securely fixed to fencing or a building and visible from a road; and
   e. Not project outwards more than 30mm from the fence or building.

Based on the Subordinate Local Law No.8.1, it is realised that:

- Emissions would not be limited on a business day or Saturday, from 6:30am til 6:30pm, and extended working hours can be granted, however, we note that extended working hours beyond standard EPA1994 working hours have not been proposed.
- No specific noise limit is set for the standard work hours from 630am til 6:30pm.

3.1.3 Condition 42 of GCCC Conditions

In accordance to Condition 42, a Noise Management Plan is required, as follows:

Noise management plan

a. Prepare and submit for approval a Noise management plan addressing construction activities prior to any works commencing (excluding demolition)

b. The Noise management plan must be prepared by a suitably qualified professional and include in particular:
   i. Provide details of expected noise sources.
   ii. Identify the measures and work practices to be implemented to ensure noise from construction activities does not cause an 'environmental nuisance' (within the meaning of the term set out in the Environmental Protection Act 1994) at any sensitive receptor stated in schedule 1 of the Environmental Protection (Noise) Policy 2008.
   iii. Identify the measures and work procedures to monitor noise emissions.
   iv. Provide details of complaint response procedures.
   v. Identify procedures to monitor and review the noise management plan.

c. Implement the Noise management plan prior to any works commencing at no cost to Council.

In terms of noise targets, Condition 42 requests and we note the following:

- Avoid (based on definition in EPA1994) Environmental Nuisance. The latter is defined as 'unreasonable interference or likely interference with an environmental value caused by noise. The environmental value is identified by relevant policy to be enhanced or protected. The Policy identifies values, however, it notes that Acoustic Quality objectives are intended to be progressively achieved over the long term, thus clearly indicating that the intent of the quality objectives is not for a short duration of works, such as piling/excavation/demolition/construction works. On that basis, the proposal is to fully implement the provisions of Environmental Protection

Act 1990 440R Building work. As per the policy, the sensitive receptors are residential receivers, as well as commercial and in accordance with the approved Noise Impact Assessment, the allowable variable noise (note: long term as per intent of the Policy and not short term associated with the works by 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust) already exceed the targets in the Policy (NIA provides a limit of 52dB(A) L_{eqT} for the operation of the site post construction), and the noise levels in the vicinity also exceed those listed in the Policy (i.e. 53dB(A)Leq,T measured during daytime average). On that basis, the trigger after which noise impacts are recommended to require further investigation are based on the following sections and the ultimate is based on EPA1994 440R. The investigation of activities is proposed to be based on current noise environment + 5dB(A).

3.2 EPA1994 AND NOISE POLICY

GCCC conditions do not explicitly state noise limits for the proposed hours of demolition, excavation and construction but are in line with 440R of the Environmental Protection Act 1994. No works outside of the normal EPA1994 have been proposed and therefore, no noise generation occurs outside the hours.

Regarding any stationary equipment being used during excavation (e.g. pumps) which may need to operate after normal EPA1994 hours, given the audibility limits of the above, it is likely that any such equipment must be acoustically enclosed or not operated outside of the prescribed hours of EPA1994.

In accordance with Section 3.1.3, Environmental Protection (Noise) Policy 2008 has only been applied to determine which receivers are sensitive as per Condition 42 requirements, however, the noise values in the Policy are already exceeded in the area and the Policy would only be applicable for operational noise and not for building and/or construction activities. On that basis, the trigger values have been determined based on project specific recommendations as per the following sections.

3.3 NOISE ENVIRONMENT AND CLOSEST SENSITIVE RECEIVERS

In accordance to the acoustic report (operational noise emission assessment only) submitted with the development application MCU/2025/155 (ref: Acoustic Report, dated 24 April 2025), the following closest noise sensitive residential receivers have been identified:

- Residential uses to the North and South.
    - North (1): approximately 12metres from the site boundary (e.g. 134 Marine Pde and 2 Fraser Ave(
    - South (2): approximately 5 metres from the demolition but within 2metres of construction works (e.g. 120 Marine Pde and 38 Nagel Ave)

All other surrounding sites are further afield and on that basis, have not been considered in the assessment.



The existing noise environment varies throughout the day, ranging from 45-61dB(A)Leq,T with an average noted to be around 52-53dB(A)Leq,T.

3.4 AUSTRALIAN STANDARD AS2436

The Australian Standard AS2436 "Guide to noise control on construction, maintenance and demolition sites" states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites AS2436 nominates the following:

a. That reasonable suitable noise criterion is established,

b. That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and

c. The undertaking of noise monitoring to assist in the management and control strategies of noise emission from the construction site.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic comprises between construction sites and potential noise affected receivers.

Based on these the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Adopt additional management conditions as per AS 2436 in the event of exceedances of proposed noise targets.

3.5 OTHER REFERENCES

If the construction noise would be associated with infrastructure works by Main Roads, then the component noise from general construction activities can be determined based on the following.

Work Period		External Noise level $L_{Aeq,adj,15\ minute}$[4], dB(A)	
		Lower Limit	Upper Limit
Standard hours		RBL + 10 [1][2][3]	75 Where: RBL > 55
			70 Where: 40 < RBL ≤ 55
			65 Where: RBL ≤ 40
Non-Standard hours	Evening	RBL + 5 [3]	Not applicable
	Night-time		
Note: [1] RBL + 5 dB(A) should be considered where a facility, equipment and long-term earthworks are required in an area for greater than 6 months. [2] Where the lower limit value exceeds the upper limit value, the lower limit is taken to equal the upper limit value. [3] Minimum lower limit are 50 dB(A) for Standard hours and 45 dB(A) for Non-Standard hours. A maximum lower limit of 75 dB(A) applies to Non-Standard hours [4] Noise contribution from construction activity.			

Based on the lowest measured daytime average value of 44dB(A), the external noise limit would be as follows:

- Lower limit $L_{Aeq,adj,15min}$ = 54dB(A) considering long term works
- Upper limit: $L_{Aeq,1hr}$ = 70dB(A) with allowances to exceed short, events

3.6 SUMMARY OF NOISE TRIGGER TARGETS

Under this proposed management plan, the construction works would currently be undertaken during standard EPA construction hours (6:30am-6:30pm Monday to Saturday). EPA1994 does not provide specific noise limits during these standard hours.

Given that:

- the EPA1994 does not provide a noise limit for the duration of construction, excavation, piling and demolishing works during normal EPA construction hours.
- Environmental Protection (Noise) Policy 2008 noise levels are applicable for operational noise and not short term demolition/construction/excavation works and the approved acoustic report shows values higher than the Policy, however, the locations of sensitive receptors are considered in the review as per Policy
- AS2436 requests to set a 'reasonable' target to establish noise management strategies.
- Sensitive receptors would not be more sensitive to road construction than they would be to demolition works, and on that basis, these values have been referenced.

the management strategies to address noise emissions are based on other numerous projects on the Gold Coast, i.e. In accordance with the noise levels in Section 3.3 and the application of Condition 42 (refer to Section 3.1.3) as well as considering other references (Section 3.5), the following trigger levels will be used during the proposed hours of work (daytime only, no night works/after-hours works are proposed): $L_{eq,1hr}$ = 58dB(A). As with any other construction noise, when all reasonable and feasible controls are investigated for the specific activity, the noise levels can be higher. If the construction was associated with infrastructure works by Main Roads, the target would be 54-70dB(A)$L_{eq,adj,15min}$. Sensitivity from short term construction works is anticipated to be same as sensitivity to roadworks and on that basis, we suggest short term noise trigger levels of 70dB(A)$L_{eq,adj,T}$ and in any case, compliance with EPA 1994 440R shall be applicable as the ultimate limit for the construction works.

For the control and regulation of noise the following would be required:

a. That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and

b. The undertaking of further noise monitoring where noise target exceedances occurs to assist in the management and control of noise emission from the construction site.

c. Where noise levels are still beyond the nominated criterion values, 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust would need to apply community engagement strategies.

4 NOISE REVIEW

This Section presents evaluation of potential noise emissions from the demolition, excavation, piling and construction works to be carried out at Nalu.

The aim of this study is to undertake an analysis of noise impact arising from site activities.

The activities will be carefully managed and appropriate noise mitigate measures will be strictly implemented where required. The formulation of noise management plans for the various activities will arise from the assessment carried out in this report and the strict enforcement of all determined control measures.

The level of noise generated by a construction site is largely dependent on the activities, which are in progress. It can not be categorically stated that all construction sites emit the same level of noise no matter what stage or part of the construction programme they are at.

4.1 NOISE SENSITIVE RECEIVERS

The following closest noise sensitive residential receivers have been identified:

- Residential uses to the North and South.
    - North (1): approximately 12metres from the site boundary (e.g. 134 Marine Pde and 2 Fraser Ave(
    - South (2): approximately 5 metres from the demolition but within 2metres of construction works (e.g. 120 Marine Pde and 38 Nagel Ave)

All other surrounding sites are further afield and on that basis, have not been considered in the assessment.



4.2 DETERMINATION OF EXPECTED CONSTRUCTION ACTIVITY NOISE IMPACT

4.2.1 General Considerations for Calculations

All construction noise sources are assumed to be located at a typical expected point on the construction site. In this way the expected typical noise level situations are determined.

The calculations determine the A-Weighted noise levels, from typical loudest activity. Depending on work practises, equipment etc, the noise levels estimated to likely occur at the affected premises could differ. Refer to this report regarding management and activities should an exceedance at the affected premises occur.

4.2.2 Sound Power Levels

Noise impact will be determined from all major processes and major noise emitting equipment, which are involved in the activities outlined below by defining the levels of sound, which they generate. It is noted that other processes/equipment which are associated with the given construction activity are generally emitting lower noise levels and therefore, if the provided processes in table do not cause adverse impact on amenity, the other processes are not expected to do so either.

The A-weighted sound power levels for all the component parts of the above-described activities are outlined in the tables below.

Table 1: Typical Sound Power Levels of Major Tasks Associated with Each Construction Activity

Stage	Equipment/Process	Sound Power Level dB(A)
Demolition	Excavator w/ Bucket Attachment	110
	Excavator w/ Hydraulic Hammer Attachment	118
Excavation/Piling	Semi-Trailer Truck	105
	Excavator w/ Bucket Attachment	110
	Impact Piling	138dB(A)L_{max}/132 dB(A) $L_{eq,1min}$
	Bored Piling/CFA	111
	Mobile Crane	104
	Loading of Truck	113-117
Construction	Angle Grinder	105
	Concrete Pump	105
	Pumping Line	88 (L_{eq}) / 102 (L_{Max})
	Helicopter Floats	100
	Concrete Saw	114
	Concrete Truck	105
	Hammering	105
	Materials Hoist	105
	Semi-Trailer Truck (Material Delivery)	105
	Tower Crane	96
	Hammering	110
	Impact drill	105
	Electric Saw	111

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

- Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

4.3 PREDICTED BASELINE NOISE

Noise from the construction activity have been predicted to the nearest most affected sensitive receivers based on the sound power levels expected from typical activities as indicated in Table 1 and assuming that each worst event occurs closest to the worst affected (at the site boundary of the development).

It is noted that the impacts vary during each period due to sequencing of works as well as different processes used. As such, these impacts in reality would not be continuous for the whole duration, however, the assessment below only present the worst expected based on distance attenuation and no specific respite periods, with the exception of the following:

- Trucks are not continuously operational and move around/adjacent to site typically 20minutes in each hour (no idling) and given the site constraints, public roadworks will be used rather than movements around the site. It is considered that the trucks will use Marine Parade and be stopping for loading/unloading during demolition/excavation/construction as indicate below. The truck entry and movements are no closer than 30metres from sensitive sites.



- Excavator movements have respite periods between loading and due to general movements, thus generally operating continuously for 15-20minutes in each hour and nominally not closer than 5 metres from receiver.
- Based on experience with other projects, hammering would not exceed on average 20seconds continuous operation in each minute and, sawing, impact drill and excavation phase activities are not continuous in each hour and typically would not exceed 15-20 second continuous activity in each minute.
- Piling works include respite periods and typically, each piling rig will continuously operate for 30 minutes in the worst hour and considered to be around 3 metres from closest receiver.
- Tower crane is considered to be located no less than 20 metres from the closest sensitive site and is generally in constant movement for 50% of the time in each hour.
- Concrete pumping stations are considered to be located along Marine Parade at the location of the truck loading stations as shown in image above (i.e. pumps are no closed than 30metres to sensitive receivers)
- Demolition works are considered to be closest 3metres to the sensitive receivers and having the hammering occurring continuously 20minutes in each hour.

Table 2: Calculated Potential Worst Noise Impacts

Construction Activity	SPL ($L_{eq,T}$ dBA)[1] Worst Affected (Outdoor) Without Any Controls	Management Conditions and Engineering Noise Controls
Material Deliveries, Crane and Worker Transportation on Site	≤63[2]	General: refer to Section 5 and Section 8 Community Engagement: refer to Section 10 Site Specific: refer to Section 11
Concrete Pouring Works	≤82[4]	
Formwork Operations	≤84[5]	
Tower Façade Installation	≤81[6]	
Tower Services Installation and Internal Works	≤70[7]	
Excavation	≤87[3]	
Piling	≤90 (bored/CFA/CSM or equivalent) ≤112 (impact piling, impact sheet piling and the like)[8]	
Demolition	95	

- *Note 1: closest and worst location to any building (In this case the closest building located 3 meters to the South), noting that trucks are nominally 30metres from the nearest sensitive building*
- *Note 2: Mainly driven by trucks loading approximately 30metres from sensitive buildings, impacts are predicted to remain below short-term targets. Cranes are elevated over buildings by a nominal 10metres off the ground and located nominally 20metres from sensitive receivers, and given the sporadic operation of cranes, the impacts of cranes are predicted to remain well below the truck noise levels.*
- *Note 3: Mainly driven by excavator within the perimeter of the site. Respite periods recommended as well as solid hoarding to the South and North.*
- *Note 4: Substantially lower noise levels expected after construction of podium levels are completed. With the distance from the pump and concrete trucks (no less than 30metres), the main contributor is the concrete helicopter float which would be very short time and unavoidable activity with no feasible controls applicable. The impacts represent the worst case impacts, noting that pump and truck noise are predicted to be compliant with the short term targets.*
- *Note 5: Noise levels presented for the lower-level works at 5 metres from sensitive receiver, however, once the lower tower floors are completed, noise at the sensitive receivers will be reduced due to additional distance. The closest formwork setup works are unavoidable activities, however, these are short term in nature and therefore, no specific engineering controls are provided, other than maximizing respite periods.*
- *Note 6: Tower façade installation is predicted at the low level at worst impacted location (nominally 6metres from receiver). The impacts are short term and would not allow any specific further engineering controls, other than maximizing respite periods.*
- *Note 7: Will be carried out when facades closed, thus allowing in excess of 15db(A) noise reduction. Given compliance with short term targets are achieved, no further controls are provided.*
- *Note 8: based on the predictions at the worst location, bored/CFA/CSM methods are preferred over the impact piling methods.*

Based on the assessment, controls are recommended for the works, especially these occurring within podium levels. However, compliance with EPA 1994 440R shall be applicable as the ultimate limit for the construction works.

Noise levels at other receivers further afield will experience same or lower noise impacts due to loss of line-of-sight to the site and shielding by other buildings.

Based on the above preliminary assessment, it is noted that numerous reviewed major noise emitting activities, except internal services installation and material loading at the considered dedicated zone 30metres from the receivers have the potential to exceed trigger levels. However, at a typical construction site, the following is applicable:

1. Respite period combined with site movements:
    a. Avoiding demolition works concentrated to one location and allowing respite periods during demolition can decrease the predicted noise impacts. We note that there are limited opportunities to further reduce demolition noise impacts substantially by additional controls. AS2436 provides additional comments in that regard. The impacts for short periods can exceed the trigger limits.
2. Piling: pile rig noise barriers can be considered for any impact driven piles which nominally reduce the impacts by up to 10dB. Such pile drive noise barriers are attached to the piling rig and such attachments are highly recommended when impact piles are used. It is, however, recommended to use bored piles on this project, considering the high vibration risks with any other methods.
   Further controls will be applied as required.

4.4 NOISE MONITORING

Noise monitoring can be an effective method in determining unusual noise emissions from the site and provide additional noise control methods if and when required. Condition 42 excludes noise management during demolition and on that basis, the excavation and piling phases of work would benefit from the below monitoring stations.



5 GENERAL NOISE CONTROLS

5.1 NOISE MONITORING

Noise monitoring: Refer to Section 4.4.

5.2 CONDITIONS OF PERMIT

The regulated activities are to be carried out in accordance to the Development Conditions.

5.3 ACOUSTIC BARRIER

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/activities or in case of impact piling rigs when attached to the rig. 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 around the site perimeter as indicated in blue (i.e. solid plywood hoarding)

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.



5.4 REVIEW OF APPLIANCES OR PROCESSES

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 and limit the use of specific appliance (e.g. hours/ of usage).

5.5 MAINTENANCE OF PLANT, EQUIPMENT AND MACHINERY

All plant, equipment and machinery are to be regularly serviced and maintained at optimum operating conditions, to ensure excessive noise emissions are not generated from faulty, overused or unmaintained machinery.

5.6 SITE PRACTISES

This involves the formulation of work practices to reduce noise generation. It is recommended that all available and reasonable treatments and mitigation strategies presented in this report be adopted to minimise noise emissions from the construction activities on site.

5.7 MATERIAL HANDLING (DROPPING)

Minimal material handling is proposed. Given that this construction site would have material handling generally occurring within podium level, the treatment would not be specifically required but can be considered when complaints are lodged in regards to the material handling after typical construction hours.

5.8 STAFF TRAINING AND REPORTING MECHANISM

This involves the education of site personnel regarding work practices and general behaviours in and around site to reduce noise generation.

All construction staff on site, as part of the site induction process, will be informed of the surrounding sensitive receivers on site and the site specific recommendations to reduce noise impacts to these receivers (late starts, respite period, vehicle noise control etc. – refer to sections in this report).

Any complaints received by construction staff must be immediately reported to the site foreman or the relevant person assigned to deal with complaints, followed by completion of incident report form and steps detailed in this report.

5.9 ENTERTAINMENT DEVICES

Where works are carried out, no amplified entertainment devices (e.g. radios) are to be used externally to the construction site. The devices could be used at moderate sound levels internally during fitout works at any time when all facades of the building are fully enclosed, and the devices do not otherwise have adverse impact on the adjacent sensitive receptors. It is recommended that this requirement is conveyed to the staff/contractors as part of the Staff training/site induction.

5.10 VEHICLE NOISE AND CONCRETE PUMPS

Best practice techniques which will minimise noise include the following:

- Trucks, trailers and concrete trucks must not idle and turn off their engines when on site to reduce impacts on adjacent land use (unless truck ignition needs to remain on during concrete pumping).
- Locating concrete pumps within the basement/podium in enclosed area once the podium level is completed. Apply other acoustic treatment to the pumping area as required.

5.11 ANGLE GRINDERS

Angle grinders would only be typically used sporadically. Notwithstanding, where practical, the use of angle grinders should be limited to areas which are screened from surrounding receiver locations or otherwise their use limited during non-typical construction hours.

5.12 VEHICLE NOISE AND CONCRETE PUMPS

Best practice techniques which will minimise noise include the following:

- Trucks, trailers and concrete trucks must not idle and turn off their engines when on site to reduce impacts on adjacent land use (unless truck ignition needs to remain on during concrete pumping).

- During basement and ground level pours, locate the pump closest to the street as possible.
- Locating concrete pumps within the podium in enclosed area once the podium level is completed. Apply other acoustic treatment to the pumping area as required.

5.13 OTHER ACTIVITIES

- In the event of complaint, noise management techniques identified in this report should be employed to minimise the level of noise impact.
- Notwithstanding above, general management techniques and acoustic treatments are included in this report which may be implemented on a case-by-case basis to reduce noise emissions to surrounding receivers.

5.14 TIME RESTRICTIONS

Environmental Protection Act 1990 440R Building work.

5.15 COMBINATION OF METHODS

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

6 CONTROL OF CONSTRUCTION NOISE

Refer to Section 5 and Section 8.

7 VIBRATION REVIEW

7.1 CONDITION 39 VIBRATION MANAGEMENT PLAN

In accordance to Condition 39, a Vibration Management Plan is required, as follows:

Vibration management plan

a. Prepare and submit for approval a Vibration management plan addressing basement construction activities in accordance with the City's Basement Construction Vibration Guideline prior to any basement construction commencing.

b. The Vibration management plan must be prepared by a suitably qualified professional

c. Comply with the approved Vibration Management plan and Section 4.2 and 4.5 of the Basement Construction Vibration Guideline

d. Vibration levels must not exceed the levels in the approved Vibration management plan

Note: vibration monitoring may be required to be carried out at no cost to Council to determine compliance with the approved vibration management plan or the Guideline.

7.2 CONSTRUCTION VIBRATION GUIDELINE

Condition 39 references Sections 4.2 and 4.5 of the Guideline,

- Section 4.2: this section provides limits based on amenity and not based on limits on structures. PPV 1.1-5mm/s is the limit at the residential buildings. It is noted that 1mm/s can be exceeded only with written agreement from the affected neighbouring building owner of body corporate with an RPEQ structural engineer report addressing structural aspects. In any case, the upper limit of 5mm/s PPV in case of residential and 20mm/s PPV in case of commercial must not be exceeded.

    - Section 4.5 seeks vibration monitoring unless the buffer distances of the Guideline are exceeded and details of the vibration monitoring to be available to the City's Development Compliance officers on request.

7.3 EFFECTS ON STRUCTURE

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*

- Transient Vibration for cosmetic damage BS7385-2:1993

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

Short term vibration

5.3 Effects on buried pipework

Table 2 gives guideline values for evaluating the effects of vibration on buried pipework. It is assumed that the pipes have been manufactured and laid using current technology; if this is not the case, special considerations will have to be made. Additional considerations need also be made where mechanical processes in the ground could have deleterious effects on pipes, or where there are different stress conditions at junctions (e.g. junctions with the structure).

The values given in table 1 for foundations also apply to the first two metres (nearest the building) of gas and water service pipes. For information regarding gas supply pipelines, see DIN EN 1594.

Drain pipes shall be evaluated using the values given in line 3 of table 2.

Table 2: Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe material	Guideline values for velocity measured on the pipe, v_i, in mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Long term vibration

6.3 Effects on buried pipework

The guideline values given in table 2 may be reduced by 50 % without further analysis when evaluating the effects of long-term vibration on buried pipework.

The restrictions given in subclause 5.3 apply here by analogy.

Effect on Structure

Line	Type of structure	Guideline values for velocity, v_i, in mm/s			
		Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*)	at all frequencies
1	Buildings used for 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 occupancy	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

*) At frequencies above 100 Hz, the values given in this column may be used as minimum values.

7.4 VIBRATION RISK ASSESSMENT

7.4.1 Closest Receivers

The following closest noise sensitive residential receivers have been identified:

- Residential uses to the North and South.
    - North (1): approximately 12metres from the site boundary (e.g. 134 Marine Pde and 2 Fraser Ave(
    - South (2): approximately 5 metres from the demolition but within 2metres of construction works (e.g. 120 Marine Pde and 38 Nagel Ave)

All other surrounding sites are further afield and on that basis, have not been considered in the assessment.



7.4.2 Vibration Risk Assessment

Condition 39 seeks to address basement construction activities and on that basis, the following have been considered to produce significant ground vibration include:

- Excavation Works
- Piling

Once the basement works have been completed, the construction of the tower would pose limited risk on vibration generation.

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

In accordance to GCCC Basement Construction Guideline, the following impacts at worst location would therefore be expected based on separation distance from closest residential building.

1. Concrete saw and jackhammers: none proposed within 5metres, thus impacts predicted to be ≤1mm/s
2. Hydraulic hammers: advised as not required for the basement construction as the ground would soft/sand/mix which requires excavation only.
3. Excavator: ≤4.6mm/s based on the worst-case distance of 5metres from sensitive receivers. To be managed as per the GCCC Construction Guideline. Vibration monitoring recommended for the duration of excavator use within 15metres of closest receiver
4. CFA, D-Wall/Bored Piling: <2.0mm/s based on nominally 5metre separation distance. To be managed as per the GCCC Construction Guideline. Vibration monitoring recommended for the

duration of piling. Note: structural damage risks very low even at 3 metres from closest sensitive receiver.

5. Impact sheet piling, impact piling or Vibratory sheet piling: not recommended for this project, given that pipes are required around 5metres from closest sensitive receivers which would lead to structural risks (e.g. 74mm/s PPV for vibratory, 44mm/s PPV for impact)
6. Temporary sheet piles: these may be required for temporary retaining for pedestrian pathways and would only be pushed in due to soft ground (typically not more than 3metres deep). With no impacts/vibratory activities and the piles pushed in along North and East (i.e. in excess of 12metres from sensitive receivers), excavator/bored piling level of vibration has been previously determined. The impacts are short period and significantly below any structural risks (<1.8mm/s PPV).

Based on our review of the proposed major vibration intense activities associated with the basement works, we note the following:

1. Surrounding sites closest sensitive receivers are generally meeting the vibration limits for structural damage on the proviso that the impact sheet piling, impact piling or vibratory sheet piling are not used, however, subject to location of the activity may for a short period exceed GC buffer requirements for the currently proposed vibration intense activities and would therefore require short term monitoring during piling and excavation works.
2. 3 vibration monitoring stations are recommended during the piling and excavation works, until the concrete has been poured on basement levels.

7.4.3 Vibration Monitoring

3 vibration monitoring stations are recommended during the piling and excavation works, until the concrete has been poured on basement levels.



Vibration monitors will have SMS notification capability to enable 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust to be immediately informed when vibration limits are reached.

Downloading of the vibration monitor data will be conducted on a regular basis. In the event of exceedance of the vibration criteria, downloading of the vibration monitor data will be conducted more frequently. Results obtained from the vibration monitor will be presented in a graph format and will be forwarded to 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust for review. It is proposed that reports are provided monthly with any exceedances in the vibration criteria reported as detailed in this report, however, the SMS notifications must be activated and site

personnel assessment and stop work requirements are still applicable continuously irrespective of a monthly summary reporting.

A monthly summary report will be submitted to MPX via email summarising the vibration events. The vibration exceedance of criteria is recorded, and the report shall be submitted within 24 hours. Complete results of the continuous vibration logging will be presented in monthly reports including graphs of the collected data.

Signage shall be installed next to the vibration monitor and battery boxes:

MONITORING EQUIPMENT ONLY

ENQUIRIES – XXX (Vibration Monitoring Contractor)

TEL NO. XXXXXXXX

7.4.3.1 Trigger Values

During vibration monitoring, the following will be applied:

Observation limit: 4mm/s or as determined by Acoustic Logic prior and during monitoring.

Stop Work limit: as per structural limits (Section 7.3)

7.4.3.2 Persons to Receive Alarms

The following personnel will receive SMS alarms in case of Observation limit is exceeded:

- MPX Project Manager, unless otherwise assigned
- MPS HSEQ Manager, unless otherwise assigned
- MPX Senior Site Manager, unless otherwise assigned

The following personnel will receive SMS alarms in case of Stop Work limit is exceeded:

- MPX Project Manager
- MPS HSEQ Manager
- MPX Senior Site Manager
- Vibration consultant/Structural engineer.

7.4.3.3 Vibration Alert and Response Plan

The following provides minimum recommended action plans:

Observe And Assess Limit Exceedance

- Works do not need to be stopped across the site but it is required to immediately advise the Site Manager and Project Manager (or as assigned by MPX) on site to immediately inspect the work site closest to the trigger location and to identify the cause of the vibration exceedance, advise the equipment operator and assess risks associated to proceeding

- The exceedance is to be registered by MPX in an on-site log detailing:
    1) Date, time of the alarm.
    2) Plant and processes that triggered the alarm.

3) Distance of activity to monitor and monitor identity.
4) What ameliorative measures have been implemented

- Proceed with works if safe to do so and no further risks are identified.

Stop Work Limit Exceeded

From the time an alarm event occurs the following procedure will be followed:

- The builders will immediately stop all excavation, piling and construction activities at the location causing the exceedance.
- It is required to immediately advise the Site Manager and Project Manager on site to immediately inspect the work site closest to the trigger location and to identify the cause of the vibration exceedance, advise the equipment operator and assess risks associated to proceeding
- Vibration monitoring engineer will be notified and recent event data from the remote vibration monitor will be downloaded and reviewed.
- Project manager will make a phone call to the vibration engineer/advisor/AL, with details of site activities near to the monitor advised. Following this discussion, vibration mitigation methods and/or change in work methodology will be advised and increasing the vibration monitoring frequency will be determined;
- The exceedance is to be registered by Construction Project Manager in an on-site log detailing:
    1) Date, time of the alarm.
    2) Plant and processes that triggered the alarm.
    3) Distance of activity to monitor and monitor identity.
    4) What ameliorative measures have been implemented to ensure the alarm level is not triggered from further site activity.
- Structural engineers inspection may be required in case it is determined that the exceedance has been caused by site work and the specific limits have been exceeded by actual site works.
- Works and methods will be reviewed and vibration monitoring survey frequency increased;
- Works will only be allowed to proceed in the area where the exceedance occurred once the work methods and restrictions to work zones of equipment or any other recommendations have been implemented to the satisfaction of Structural Engineer and Project Manager. Resumption of work to be given by the structural engineer and not by vibration monitoring engineer or others.

8 CONTROL OF CONSTRUCTION NOISE AND VIBRATION

8.1 PROCESS MANAGEMENT

The execution of this work will facilitate the formulation of noise control strategies for this project.

The flow chart presented in Figure 2 illustrates the process that will be followed in assessing construction activities.

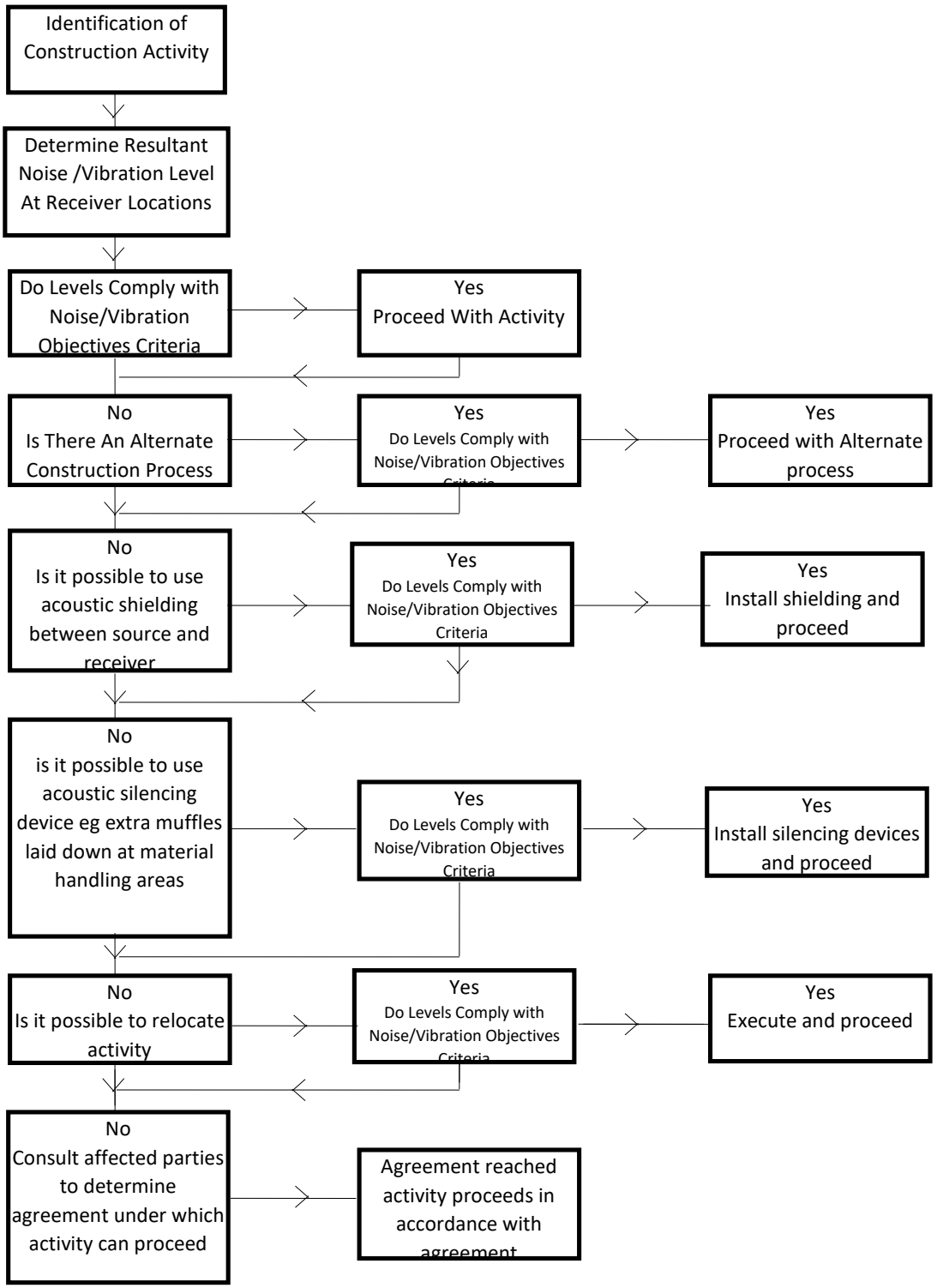


Figure 1: Process Flowchart

8.2 VIBRATION CONTROLS

Refer to Section 7 which provides risk assessment and recommendation to not use impact or vibratory piling methods. Vibration monitoring is required to ensure the assigned vibration limits are complied with.

8.3 NOISE CONTROLS

Refer to Section 5 which provides common controls applicable to noise emissions. The ultimate limit applicable is based on the EPA1994 Section 440R.

9 DUST EMISSIONS

9.1 CONDITIONS 43 DUST MANAGEMENT PLAN

In accordance to Condition 43, a Dust Management Plan is required, as follows:

Vibration management plan

a. Prepare and submit for approval a Dust management plan generally in accordance with the City Plan prior to any works commencing (excluding excavation).

b. The Dust management plan must be prepared by a suitably qualified professional and include in particular

    a. Provide details of sources of dust and particulate emissions

    b. Identify the measures and work practices to be implemented ensuring the release of dust and particulate matter from construction activities does not cause an 'environmental nuisance' (within the meaning of that term set out in the Environmental Protection Act 1994) at any sensitive receptor stated in schedule 1 of the Environmental Protection (Noise) Policy 2008.

    c. Identify procedures to be adopted for monitoring and reporting air emissions

    d. Provide details of complaint response procedures that will be adopted

    e. Identify the procedures to be adopted for revision and review of the dust management plan.

c. Implement the Dust management plan during all construction works at no cost to Council.

9.2 TARGETS

Under the Environmental Protection Act 1994, dust is considered an environmental nuisance when the release of dust interferes with an environmental value. The dust limits, for PM2.5 and PM10, and total suspended particles (TSP), are based on Environmental Protection (Air) Policy 2019, given the purpose of the policy is to achieve the object of the Act in relation to the air environment.

For respirable dust the PM2.5 and PM10 particulate matter sizes which are linked to adverse health effects are typically monitored in real-time and electronic warnings issued when hourly levels are excessive. Nuisance dust is measured by dust deposition gauges (bottles), or alternatives.

In accordance to the Environmental Protection (Air) Policy 2019, the following have been applied.

Table 3 - Dust Impact Criterion

Pollutant	Averaging Period	Concentration
$PM_{2.5}$	24 hours	25 µg/m^3
PM_{10}		50 µg/m^3

We also acknowledge the Environmental Protection (Air) Policy 2019 1 year criterion for reference, however we note the application of immediate controls to achieve such levels may be difficult to demonstrate given that they are determined over a 1 year time period, however, given the length of the project, the first annual outcomes will be used to determine stricter control applied for the consecutive years.

- $PM_{2.5}$ 1 year average: 8 µg/m^3
- PM_{10} 1 year average: 25 µg/m^3

- Additional strategies will also be reviewed monthly as when the yearly average shows to be exceeded monthly preventative strategies can be applied to manage the risks of exceeding the 1-year average levels above.

Total suspended particles (TSP) limit is 90 μg/m^3 for 1 year.

Proposed dust deposition sampling limit (to be assessed if required based on complaint/s issued and management strategies) is 4g/m^2/month dust deposition.

Considering the proposed methods of dust control (i.e. monitoring), alert values can be applied which are in line with the Air Quality categories of 'live' monitoring values applied by the QLD Department of Environment and Science (DES) on live air data monitoring systems.

The air quality categories are based on particle concentration averaged over one hour as shown in the following table. The dust monitor can be programmed to send an alert via SMS or email when the average hourly concentration reached the 'Poor' category in either particle size concentration. This short-term level warning can be used to control respirable dust from the site. However, the assessment level is the 24-hour average level as outlined in previous table (Dust Impact Criterion).

Table 4– Alert Limits Based on Hourly Air Quality Categories

Pollutant	Averaging Time	Concentration	Air Quality Category
$PM_{2.5}$	1 hour	< 25 μg/m^3	Good
		25-50 μg/m^3	Fair
		50.1-100 μg/m^3	Poor
		100.1-300 μg/m^3	Very Poor
		> 300 μg/m^3	Extremely Poor
PM_{10}	1 hour	< 50 μg/m^3	Good
		50-100 μg/m^3	Fair
		100.1-200 μg/m^3	Poor
		200.1-600 μg/m^3	Very Poor
		> 600 μg/m^3	Extremely Poor

9.3 ACTIVITIES TO BE CONDUCTED AND POTENTIAL AIRBORNE DUST GENERATION

The potential for dust generation from the expected site activities are presented below. It would be expected that the greatest potential for airborne dust will be during the demolition and excavation stages. Some potential dust generation may occur during the concrete floor preparation stages before the façade is installed.

Table 5 – Dust Risk Assessment

Stage	Equipment/Process	Airborne Dust Potential
Demolition	Excavator w/ muncher	low*
	Excavator w/ Bucket loading dump trucks/trailer	high
	Excavator w/ Bucket stockpiling	medium
	Excavator w/ Hydraulic Hammer	high
	Uncovered dry stockpile	high
	Dump trucks leaving site	medium
Excavation/Piling	Excavator w/ Bucket loading dump trucks/trailer	high
	Excavator w/ Bucket stockpiling	medium
	Excavator w/ Hydraulic Hammer	high
	Excavator w/ Rock Saw	high
	Uncovered dry stockpile	high
	CFA Bore Piling	minimal
	Dump trucks leaving site	medium
Construction	Formwork removal, jump form movement	low
	Drilling concrete slabs	medium
	jackhammering of concrete slabs***	high
	Grinding of concrete surfaces***	high
	Wet concrete cutting and coring	low**

Table Notes:

*Potential for dust generated by falling elements

** Slurry must be cleaned or washed away so it doesn't form dry dust

***Not expected to occur during construction, or occur internally without impacting receivers.

9.4 CONTROL OF DUST

9.4.1 Monitoring

Given the review of dust generation (Section 9.3), we recommend 2 monitoring stations during demolition and excavation/piling phases. After basement concrete pour, the risk of adverse dust generation is generally low and would not require monitoring, however, subject to the plans of construction, these will be determined post-basement slab pour.



Where complaints are received associated with dust the complaints procedure listed in the 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust Community Engagement Management Plan will be followed and where required, further dust monitoring will be implemented if required. Two types of dust monitors will then be required (pending review of requirements based on complaint/s issued and management strategies) on site to assist in the control strategies and management of airborne dust emissions, namely:

- Realtime PM2.5 and PM10 dust monitors which can provide email or sms alerts when dust levels are excessive.
- Dust deposition gauges to measure surface dust (to be assessed if required based on complaint/s issued and management strategies and to be carried out in accordance with AS3580.10.1:2003. Given that the management plan is required for works excluding demolition, gauges are not currently proposed.

9.4.2 Dust Suppression and Prevention

To regulate dust emanating from the construction, demolition and excavation process presented in Section 9.3, the construction, demolition and excavation contractors will use appropriate dust suppression strategies, examples of such include:

- **Water sprays and dust suppression surfactants:**
    - Directly hosing the hydraulic hammer or rock saws.
    - Site perimeter water mist spray system where applicable.
    - Truck wash bay.
    - Stockpiles and haul roads to be kept damp (e.g. sprinklers).
- **Barriers:**
    - Solid perimeter hoarding, solid site entry doors.
    - Wind breaks (temporary cyclone fence with fine shade cloth).
    - Tarps over spoil mounds.
    - Traps over dump truck trays and trailers.
-

- **Other measures:**
    - Carry out concrete crushing/recycling off site wherever possible.
    - Carry out sorting, sifting of spoil off site.
    - Use of gravel, asphalt paving or road base to seal dusty and trafficable areas
    - Daily review of wind forecast and proposed works at morning tool box meetings to program works or implement measures if unfavourable wind conditions are forecast to reduce impact on buildings, staff and patrons.
- **Fine Particle Emissions:**
    - Machinery should be checked on arrival to site that its in good working order.
    - Proper maintenance and tuning of engines.
    - Catalytic converters and exhaust filters (if available).
    - Correct fuel specification.
    - Limiting idling time.
    - Avoiding overloading.
    - Appropriate height of exhaust discharge above ground level.
- **Warning System:**
    - An audible, visual or electronic messaging alert system is required with a dust monitoring system. AL suggests a warning level set at 85% of the lower bound of the POOR air quality category, i.e:
        - PM2.5 1 hour and 10min warning level: 42.5µg/m^3
        - PM10 1 hour and 10min warning level: 85µg/m^3
    - Should the trigger levels be exceeded, the nominal management strategies outlined above are to be reviewed and adopted as applicable, with additional control strategies investigated as required targeting sources of elevated dust generation based on activities being carried out at the time of the exceedance.
    - If water mist suppression techniques are implemented on site, dust monitors may require a heated inlet otherwise spurious results may arise, which is to be assessed if required should issues arise during monitoring.

Additional dust treatment strategies can be investigated targeting high dust generating sources based on monitoring.

10 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

In order for any construction noise and vibration management programme to work effectively, 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.

Any community interaction and complaints handling will be in accordance with the 122 Marine Parade P/L ATF 122 Marine Parade Unit Trust Community and Stakeholder Engagement Plan, however, the minimum includes the following.

10.1.1 Signage

In accordance to the Subordinate Local Law No 8.1, signage must be erected at the premises, which:

- Identifies the Permit number issued by the GCCC;
- Shows the dates and times at which the Permit authorises the building work or delivery to be carried out outside the EPA1994 hours.
- Identifies contact details of person(s) to make a complaint about the noise by the building work or delivery (24hour telephone number).

10.1.2 Establishment of Communication with Affected Parties

In order for any construction noise, dust and vibration management programme to work effectively, 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.

In accordance to the Subordinate Local Law No 8.1, the following minimum procedures are required:

- Erect a signage in accordance to Permit;
- Provide written notification of the commencement of any building work or delivery carried out outside the typical EPA1994 hours, not less than 48 hours prior to the commencement of the building work or delivery to the following persons:
    - The residents or operators of any sensitive place;
    - The local government.
- Deal with complaints as per the Subordinate Law

In addition to that, where relevant, the builder may carry out a community consultation 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; and advise on the long-term benefits of the extended work hours.
- 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 a Constructions Complaints Register which will be used to address any construction noise related problems should they arise.

10.1.3 Dealing with Complaints

Should ongoing complaints occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices.

In accordance to Subordinate Local Law No 8.1, the applicant must manage the complaints lodged for regulated activity carried out outside the typical EPA1994 hours. The applicant must:

- Provide a 24hour telephone number to make a compliant;
- Set out the procedure that must be followed by the applicant after the receipt of a compliant to ensure the compliant is adequately addressed; and

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

- 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 and to the GCCC.

The investigation of a complaint may involve where applicable;

- Noise and vibration measurements at the site or at affected receiver, if required;
- 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 Permit or outside the Permit.
- Whether any feasible controls are possible or the works were short term during the entire construction process and therefore, impacts will be short term.

Where complaint is in relation to work practices, these shall be investigated and modified if required to ensure compliance with the Permit.

Measurement or other methods can be used to validate the results of any corrective actions arising from a complaint where applicable.

10.1.4 Reporting Requirements

The following shall be kept on site:.

1. A register of complaints received/communication with the local community shall be maintained and kept on site.

2. Where noise complaints require noise monitoring, results from monitoring shall be retained on site at all times.

3. Any noise exceedances occurring including, the actions taken and results of follow up monitoring.

4. A report detailing complaints received and actions taken shall be presented to the GCCC upon request.

5. Any other relevant information deemed necessary.

10.1.5 Contingency Plans

Where non-compliances with conditions of the Permit have been established 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.

11 SUMMARY OF SITE-SPECIFIC NOISE, VIBRATION AND DUST AMELIORATIVE MEASURES

The following sections summarise specific feasible and reasonable ameliorative measures applied for the construction site for the purposes of reducing impacts during normal EPA1994 construction hours.

11.1 VIBRATION AND STRUCTURE BORNE NOISE IMPACTS

Vibration comments are provided in Section 7.

Heightened structural damage risks have been predicted for the impact sheet piling, impact piling or vibratory sheet piling due to the proximity to the receivers, and in any case, these would exceed GCCC buffer distances. On that basis, bored piling/CFA/D-Wall or equivalent methods are recommended.

Other activities are predicted to be within structural limits, however, subject to distances may exceed the buffer distances and, on that basis, vibration monitoring is recommended as per Section 7.4.3 during piling and excavation works until the concrete has been poured on the basement level.

11.2 GENERAL VEHICLE NOISE

The following will be utilized:

- Trucks and trailers 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).
- Material handling must be carried out with care with no unnecessary impacts generated.

11.3 ENTERTAINMENT DEVICES

No amplified entertainment devices (e.g. radios) are to be used externally to the construction site. The devices could be used at moderate sound levels internally during fitout works at any time when all facades of the building are fully enclosed, and the devices do not otherwise have adverse impact on the adjacent sensitive receptors. It is recommended that this requirement is conveyed to the staff/contractors as part of the Staff training/site induction.

11.4 TIME RESTRICTIONS

Under this proposed management plan, the construction works would be undertaken during standard EPA construction hours (6:30am-6:30pm Monday to Saturday). EPA1994 does not provide specific noise limits during these standard hours.

11.5 PILING METHODS

Due to noise and vibration emissions, we recommend CFA/bored/CSM or equivalent piling generally and the use of augers. The temporary retaining sheet piling may be required along the boundary to North and East which is proposed over a very short period and is shallow (with piles pushed in and not impacted/vibrated), thus the impacts are managed. The feasible control applicable is to maximise to push of the pile in the ground and minimize vibratory piling activity to the greater depths. Vibration monitoring during piling activities is required as per Section 7.4.3.

11.6 SOLID BOUNDARY FENCING

Due to the high noise impacts predicted to the surrounding residential/accommodation site toward North and South, we recommend a solid fencing erected along these boundaries, as per Section 5.3.



11.7 OTHER NOISE CONTROLS AND MONITORING

Section 5 and Section 11 provide general feasible noise controls and Section 4.4 provides recommended noise monitoring locations.

11.8 DUST CONTROLS AND MONITORING

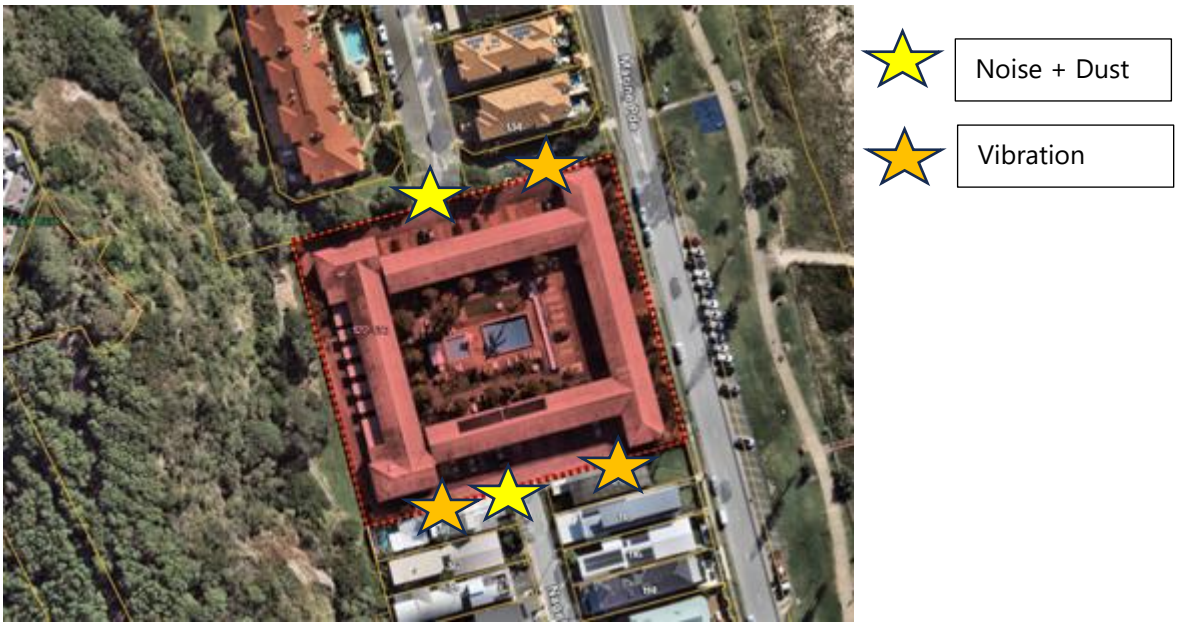
Dust suppression and prevention methods are detailed in Section 9.4.2 and based on the review, real-time dust monitoring is recommended (PM2.5 and PM10) as per Section 9.4.1

11.9 COMMUNITY INTERACTION AND COMPLIANT HANDLING

Details have been provided in Section 10.

11.10SUMMARY OF MONITORING STATIONS

Based on the review, the following monitoring stations are recommended for the piling and excavation works until the concrete has been poured on the basement level. Noise, vibration and dust generation risks are low once the basement construction has been completed and the requirements to continue monitoring will be reviewed once the works progress closer to the completion of the basement works. The following image provides recommended monitoring stations for the period. Conditions 39, 42, 43 address basement and construction works excluding demolition and on that basis, at this stage, no monitoring has been proposed for the period addressing the above conditions.


Noise + Dust
Vibration

12 PROPOSED CONDITIONS AND MANAGEMENT SUMMARY

Based on the analysis presented in the report, the following Permit conditions are recommended.

1. Time Restrictions: refer to Section 5.14

2. Complaint Management: refer to Section 10

3. Noise Management: refer to Section 5 and Section 11, noting that noise monitoring is recommended as per Section 4.4.

4. Dust Management: refer to Section 9.4, noting that dust monitoring is recommended as per Section 9.4.1.

4. Vibration Management: refer to Section 7.4 and Section 11.1. Note: vibration monitoring is required in addition to dilapidation report at surrounding receivers as required.

In terms of vibration impacts to surrounding residential/accommodation, the following is noted:

1. Based on the currently proposed equipment, distances and processes analysed in Section 7.4, we note that risks of exceeding limits for structural effects of existing residential buildings has been predicted be reduced substantially when impact and vibratory piling methods are avoided, however, dilap reporting by structural engineer is required in any case. Vibration monitoring is recommended to ensure compliance with the set limits and enough reaction time for site personnel before structural limits are achieved.

The vibration monitoring report must contain the following information:

- Monitoring methodology and instrumentation
- Vibration levels measured (PPV) at the sensitive place;
- Analysis of the data and discussion of the results relative to the relevant vibration criteria
- Recommendations for modified operations in case of exceedance, to reduce ground vibration.

The vibration monitor must be capable of measuring peak particle velocity (PPV in mm/s) and frequency (in Hz) in three orthogonal directions.

The vibration monitor must be capable of sensing SMS alerts and must be set up with SMS alarm trigger level of 4mm/s PPV, or the appropriate vibration limit specified by the asset owner. Stop work are recommended in Section 7.4.3.1 which are in line with the other monitoring programs currently undertaken by Acoustic Logic.

Recipients of the SMS alert should be the Onsite Supervisor/Site Foreman, Project Engineer and Vibration Monitoring Technician. The SMS message must contain the following information: Time of event, PPV in mm/s and Frequency in Hz.

In case of vibration limit (Stop Works) exceedances are confirmed (no extraneous event at monitoring station), structural engineer must inspect the affected building or asset and determine if works can proceed.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Pty Ltd
Tarmo Saar