

Appendix B Noise Assessment

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Definition of terms

Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
dB(A)	Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
Extraneous noise	Noise resulting from activities that are not typical of the area such as construction, and traffic generated by holiday periods or special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: <ul style="list-style-type: none"> ■ noise mitigation benefits (noise reduction provided, people protected) ■ cost of mitigation (cost of mitigation versus benefit provided) ■ community views (aesthetic impacts and community wishes) ■ noise levels for affected land uses (existing and future levels)
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).
L_{A90}	The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise.
L_{Aeq}	The equivalent continuous A-weighted noise level—the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
Maximum noise level, max L_{pA}	The highest noise level during a specified time period or during a specified number of events expressed as the absolute maximum level of the root-mean-square (r.m.s.) sound pressure level using time weighting 'F'.
Sleep disturbance	Defined objectively in a number of ways ranging from the smallest detectable physiological response to some external stimulus whilst asleep to actual awakening. Sleep disturbance can also be described subjectively using an appropriate scale. Effects on mood, attitudes or performance of some task the next day could be measured objectively and subjectively.
Sound power	Noise generation of a given item of plant and is independent of the distance from the plant item (analogous to the wattage of a light-bulb) allowing direct comparison of the relative acoustic 'size' of different plant items. From this data, the sound pressure level (or noise level) at a distance can be calculated (analogous to the light intensity from a light-bulb – intensity reduces with distance.)

1. Introduction

In addition to the noise impact assessment undertaken for the project The Alliance will require a development approval for ERA 28 level 1 (b) Motor vehicle workshop. The workshop would carryout maintenance activities during the whole of the Hinze Dam Stage 3 construction period. This report has been prepared to assess the potential for the operation of the workshop during the evening (6:30 – 12:00am) to impact on the acoustic amenity of the nearest residents. Where impacts are found to be acceptable at the closest residential dwellings, other locations would also be expected to comply.

This report includes:

- Identification of noise sensitive receivers nearest to the proposed workshop site;
- A description of the existing noise environment and ambient noise levels at receivers nearest the workshop;
- A review of noise legislation relevant to the construction works;
- An assessment of the potential construction noise impacts on the identified sensitive receivers; and
- Recommendations, as necessary, for noise controls measures which would assist in maintaining construction noise levels at a practical minimum in order to comply with the assessment goals.

The project noise level goals developed for the night-time works would be used as goals to assist with maintaining a reasonable level of noise within the adjacent community. In determining the requirement for noise controls and the optimal noise mitigation solutions during the construction works, should these be required, a step wise monitoring and evaluation approach would be adopted. The outcomes of monitoring and investigations would be used to modify the EMP and noise management commitments, as required, as the project proceeds.

2. Details of Proposed Workshop

The workshop will be situated within the project boundary in the north west of the site, and the nearest residences are located approximately 300m east of the workshop area. Where night time operation of the workshop is required, noise from the workshop would present a significant impact to the existing night time noise environment, without some form of mitigation. The activities to be undertaken at the workshop are similar to standard vehicle workshop activities, and will include:

- Conduct servicing, maintenance and repairs to heavy plant, light vehicles, and other field equipment used in the construction of the dam;
- Storage of plant, equipment, spares, and small quantities of chemicals and oils associated with these activities;
- Conduct vehicle and equipment washing for cleaning and seed/weed control purposes;
- Conduct tyre-changes for all equipment;
- Storage of waste oils, glycols and other related chemicals prior to disposal or recycling off-site;
- Office and administrative functions associated with workshop activities;
- Maintenance of pollution-control equipment; and
- Parking of plant and equipment.

The scope of activities does not include spray-painting, sand-blasting or other abrasive cleaning.

Hours of Operation

The workshop will be required to operated during the following periods:

- Monday to Friday 6:30 am – 6:30 pm
- Saturdays (each 4th week) 8:00 am – 6.00 pm
- A maintenance shift between 3.00pm and 12.00pm.

Workshop Facilities and Layout

The workshop facilities will comprise:

- 12m x 12m enclosed workshop building on concrete slab;
- Vehicle washdown and refuelling area, each on concrete hardstanding;
- Oil and waste oil storage tanks (on concrete hardstanding);
- Equipment stores (four 7x3m sized shipping containers); and
- First flush water diversion system and oil/water separator.

The mitigation measures proposed for the workshops include provision of an acoustic shed which can be closed when necessary. The shed will be a portal framed structure clad in an appropriate

covering to provide attenuation of noise to the outside. Hinged or sliding doors on the front of the shed would be required to prevent theft and to provide a comfortable environment for workers during the colder months. These doors should also include sound attenuation measures in the design. An aerial view of the workshop site with respect to nearby residences is shown in Figure 1.

- **Figure 1 Maintenance Workshop Location**

3. Existing Noise Environment

3.1 Local Setting and Sensitive Receivers

Land use surrounding the Dam is predominantly rural residential set in the Gold Coast hinterland characterised by hills and valleys. The existing noise environment in the vicinity of the Dam is subjectively described as quiet during both the daytime and night time as there are no observed noise impacts from industrial or road traffic noise sources in the area.

During the daytime, typical noise in the area north of the dam wall was observed as sounds from birds and occasional domestic activities such as lawn mowing. At night time, noise measurements indicate that the background noise level in the vicinity of the dam is very low and can be at the lower range of human audibility.

3.2 Existing Noise Environment

The noise environment at residential locations near the Hinze Dam wall and construction areas was measured using both attended and unattended monitoring methods. The measurements were undertaken in general accordance with the EPA Noise Monitoring Manual. A list of common descriptors used in this noise assessment as well as their meaning is provided here for reference.

- L_{A10} – the noise level exceeded for ten percent of the fifteen minute interval, this is commonly referred to as the average-maximum level;
- L_{A90} – the noise level exceeded for 90 percent of the fifteen minute interval. This is commonly referred to as the background noise level and represents the quietest 90 seconds in a fifteen minute period;
- L_{Aeq} – the noise level having the same energy as the time varying noise level over the fifteen minute interval.
- L_{Amax} maximum noise level measured at a given location over the fifteen minute interval.

The locations for the noise monitoring survey were selected to represent the noise environment of the closest residences to the dam construction area, and provide a 24 hour noise profile in these locations over the period of one week. The locations for noise monitoring around the dam are presented in **Table 3-1**.

■ Table 3-1 Noise Monitoring Locations

ID	Address	Description
H1	Mottee Court	Residential dwelling approx. 560 m north of the dam wall
H2	Toula Court	Residential dwelling approx. 840 m north of the dam wall
H3	Duncan Road	Residential dwelling approx. 450 m north east of new saddle dam

Unattended noise monitoring was undertaken at locations identified in **Table 3-1** for a nominal period of seven days between 20 and 27 February 2007 at Mottee Court and 13 and 21 March 2007 at Toula Court and Duncan Road. The unattended monitoring was undertaken with B&K type 2238 automatic noise loggers. This data collected was used to determine the median values for the L_{Aeq} , L_{A90} , L_{A10} and L_{A1} descriptors for the day, evening and night time period

The Rating Background Level (RBL) in **Table 3-2** is the overall, single-figure, background level representing each of the day, evening or night assessment periods over the whole monitoring period. This is the level used for assessment purposes when referring to background noise.

■ **Table 3-2 Results of Unattended Noise Monitoring**

Location	Monitoring Dates	Rating Background Level (RBL)			L_{Aeq} over the assessment period			
		Day	Evening	Night	Day	Evening	Night	L_{Aeq} 24 Hr
H1	20/02/07 to 27/02/07	34 dB(A)	36 dB(A)	32 dB(A)	45 dB(A)	43 dB(A)	39 dB(A)	43 dB(A)
H2	13/03/07 to 21/03/07	33 dB(A)	29 dB(A)	24 dB(A)	47 dB(A)	40 dB(A)	41 dB(A)	44 dB(A)
H3	13/03/07 to 21/03/07	31 dB(A)	28dB(A)	25 dB(A)	43 dB(A)	39 dB(A)	44 dB(A)	44 dB(A)

4. Construction Noise Goals

Unlike the earthworks, the maintenance workshop operation has a requirement for night time operations (between 6:30pm – 12:00am), which would last for the duration of the project. These activities have the potential to cause noise impacts during the quiet part of the evening and night time and have therefore been addressed against sleep disturbance criteria to ensure that noise emissions would be minimised to a level that is not likely to interfere with the amenity of the local residents.

4.1 Workshop Noise Assessment Criteria

Much of the operation of the workshop would be during project construction hours between 6:30am and 6:30pm. The noise impacts for the general construction works have been assessed separately in the Hinze Dam Noise Impact Assessment report. At the time of writing the initial noise report, night time works were only to be undertaken in special circumstances where the works were required outside of the project hours. This was to ensure that the acoustic amenity of the residents is protected during the quiet periods of the evening and night.

However, in order to meet the regulated construction timeframe, the workshop is required to be operational until 12:00am each day to ensure that repairs to vital construction equipment can be completed during the construction down time. The potential for noise impacts on the acoustic amenity of the residents during the night will be compared to the sleep disturbance criteria to determine an acceptable operational noise level for the works.

Sleep Disturbance Criteria

The Queensland EPA's Guideline, Planning for Noise Control, recommends that maximum instantaneous internal noise levels in sleeping areas should not exceed approximately 45 dB(A) more than 10 – 15 times per night. Corresponding external maximum noise levels (L_{Amax}), that would represent a probability of less than 1% awakenings, are presented in **Table 4-1**. These levels are estimated by the applying the attenuation offered by different window types to the maximum internal noise level.

■ **Table 4-1 External Maximum Instantaneous Noise Level (L_{Amax}) (EPA 2004).**

Window type and setting	Typical Noise Reduction	External L_{Amax} (dB(A))
Wide open	5	37
Partially closed	10	42
Single glazed, closed	20	52
Thermal double glazed, closed	25	57

Given the very low noise level at residential locations during the night time, an L_{Amax} night time noise goal of 42 dB(A) is recommended for the nearest dwelling, which represents the maximum external level for partially closed windows.

Sleep disturbance goals are used to minimise the impact from short duration high intensity events, such as metal dropping onto other hard surfaces. It is the number and level of these high intensity noise events and their emergence above the existing ambient noise environment that is critical in the assessment of sleep disturbance.

An approach adopted by the NSW DEC is to use the L_{A1} statistical index and limit L_{A1} noise from a particular activity to ≤ 15 above the L_{A90} . The L_{A1} noise level is the level which is exceeded for 1% of the time during the monitoring period and is therefore representative of the average of maximum noise levels generated from a number of high noise level events. This approach recognises that a number of high energy acoustic impacts may occur as the result of operations, as opposed to the L_{Amax} goal which only assesses the maximum level. The potential for sleep disturbance impacts from the workshop will be assessed against both the L_{Amax} and the L_{A1} noise goals to ensure that night time acoustic amenity is maintained.

Sleep Disturbance Noise Goals

During the night time, the L_{A1} and L_{Amax} noise level goals inside sleeping areas within a residence should be achieved to reduce the likelihood of sleep disturbance and complaints. Existing measured L_{A90} noise levels at Toula Court can be as low as 24dB(A). For the residential receivers near to the workshop, the sleep disturbance noise level limit is derived using the calculation:

$$L_{A90} + 15 \text{ dB(A)} = L_{A1SD}$$

$$24 \text{ dB(A)} + 15 \text{ dB(A)} = 39 \text{ dB(A)}$$

This limit effectively means that for a 15 minute monitoring period, the noise level would not be permitted to exceed 39 dB(A) for more than 9 seconds during the monitoring period. From **Table 4-1** the maximum noise emission from workshop should not exceed a level of L_{Amax} 42 dB(A).

5. Workshop Noise Assessment

The assessment of noise impacts associated with the operations of the workshop has been undertaken using noise modelling to predict the noise level at residential locations based on the typical noise emissions from this type of activity.

5.1 Modelling Methodology

The SoundPLAN V6.4 noise modelling package was used to predict noise levels from the workshop. This model is accepted and endorsed by numerous agencies nationally and internationally, including the Queensland EPA. The CONCAWE prediction algorithm is considered to provide the most appropriate form of assessment for this type of application and was used during modelling. This method takes into account attenuation due to distance, atmospheric absorption, structural and topographical barriers, the effect of intervening ground types and weather conditions.

Description of Activities

The workshop will undertake repair work on a vast array of equipment types and would use a number of different techniques to make the repairs. In addition to the repair of site based equipment fabrication of new components may also be required. The equipment used in the workshop would include major items of noise generating tools and processes such as:

- Angle grinders;
- Air arc;
- Hammers;
- Drills; and
- Air compressors.

Testing of repaired equipment and vehicle start ups may also occur within the shed during the night. While the workshop may generate noise impacts during the night time, it is expected that the processes employed would not be continuous in nature but will have periods of quiet followed by periods of noisy activity. An estimated L_{A1} sound power of 108 dB(A), (equivalent to a truck start up) has been used to predict noise levels at the nearest residences. An L_{Amax} noise level may be several dB(A) higher than this depending on the activity being undertaken however given that the activities generating the L_{A1} noise levels are expected to be noisy in nature a difference of +5 dB(A) between L_{Amax} and L_{A1} noise levels has been assumed.

5.2 Predicted Noise Levels

The predicted levels are based on the attenuation achieved by providing an acoustic workshop shed having a minimum sound attenuation of 26 dB(A) through 3 sides and the roof. The doors at the entrance of the shed would also have an attenuation of 26 dB(A) however, when no noisy activities

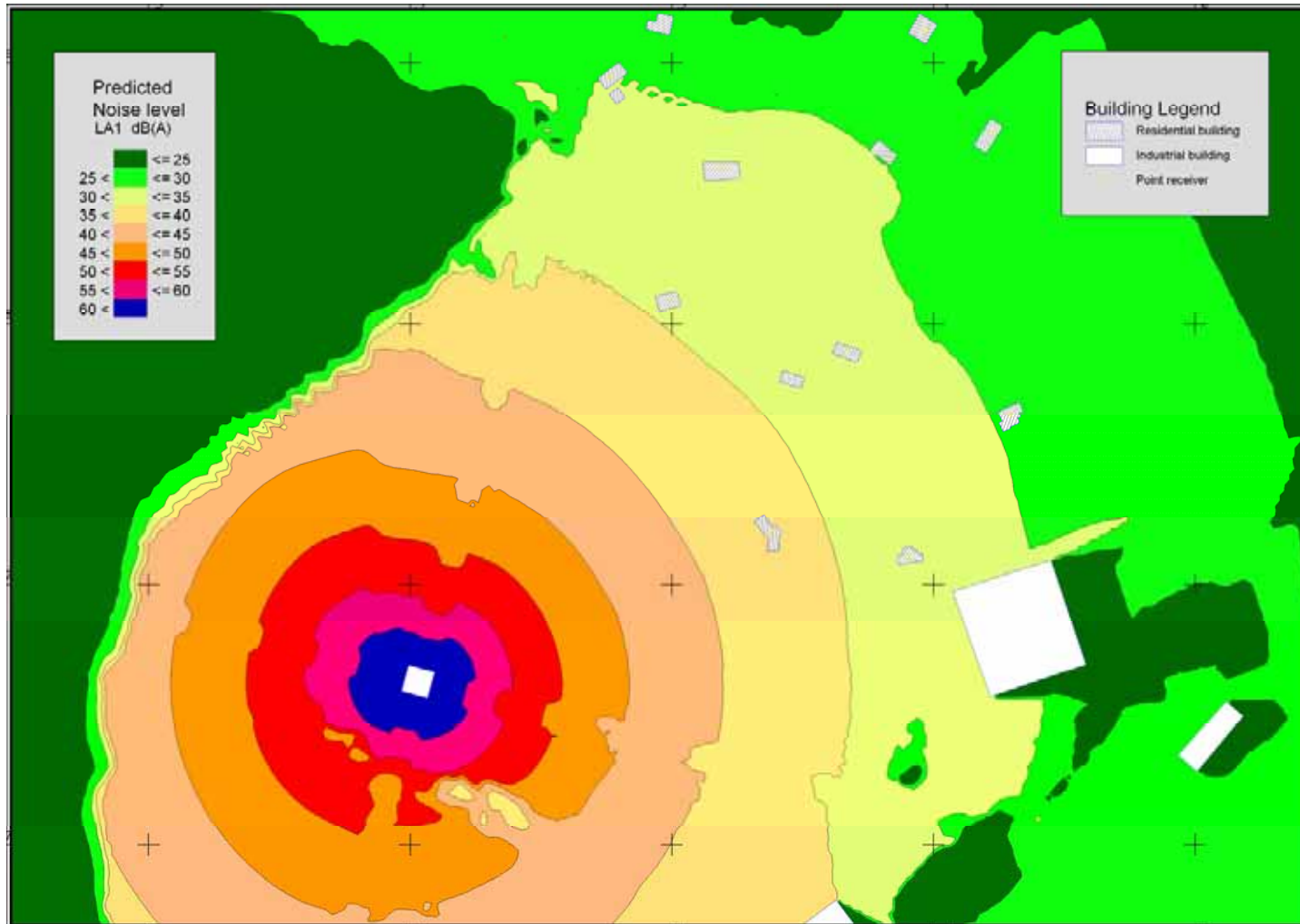
are being undertaken, the doors could remain open to assist with ventilation. The internal lining of the shed should be covered in a foil faced insulation to reduce reverberant noise within the space. The L_{A1} noise level predictions from the workshop activities at the nearest representative sensitive receivers are shown graphically in **Figure 2**.

■ **Figure 2 Predicted Noise Levels - Workshop Activities**



Predicted noise levels at the nearest receiver indicate that the L_{A1} noise level at the nearest receiver will be approximately 38 dB(A) and the corresponding L_{Amax} noise level would be 43 dB(A). When compared to the noise criteria outlined in Section 4, the predicted L_{A1} noise level from the maintenance workshop would comply with the night time noise goals for sleep disturbance. The L_{Amax} noise level is likely to be in the range of compliance but the predicted levels indicate that this may be marginal. **Figure 3** presents the predicted noise contours for the workshop.

■ Figure 3 Predicted Noise Contours - Workshop Activities



6. Noise Management

The assessment presented in this report has investigated the potential for noise issues associated with the operations of the maintenance workshop during the night-time hours. By employing an acoustic shed for the workshop and engaging in a proactive approach to noise management, the night time workshop activities are not likely to result in significant noise impacts to adjacent receivers. **Table 6-1** summarises the noise management principles that are to be specifically adopted for the maintenance workshop. In addition, monitoring of these activities should be undertaken during the early stages of the project to ensure an appropriate noise levels can be achieved at nearby residential locations.

■ Table 6-1 Noise Management Measures for Workshop Activities

Strategy	Options for work practices
Time restrictions	Workshop activities will be restricted to the hours of: <ul style="list-style-type: none"> ■ Monday to Friday 6:30 am – 6:30 pm ■ Saturdays (each 4th week) 8:00 am – 6.00 pm ■ A maintenance shift between 3.00pm and 12.00pm.
General work practices	Scheduling of activities Maintenance activities must continue to be developed to schedule noisier work during daytime hours. A site activity log would be kept to assist with the retrospective investigation of community complaints. The log would record the type of activities occurring during day and night-time hours. <ul style="list-style-type: none"> ■ Incorporate silencing enclosures for noisy plant and continuous operations (generators, compressors etc) ■ Regularly train workers and contractors (such as during tool box meetings) to minimise noise. ■ Site managers would regularly check the site in the vicinity of receivers for noise problems so that solutions can be quickly applied. ■ Reduce throttle setting and turn off equipment if not being used.
Night time works	All Works <ul style="list-style-type: none"> ■ Workshop doors must remain closed during the evening and night time periods. ■ Minimise the amount of plant and equipment used ■ Avoid the use of loud radios/stereos outdoors where neighbours can be affected. ■ Avoid shouting, swearing and talking loudly where neighbours can be affected. ■ Avoid impulsive noise emissions from equipment ■ Avoid dropping materials from a height ■ Ensure unavoidable maximum noise level events are not repetitious ■ Ensure appropriate behaviour when exiting site at the completion of night shift

7. Conclusion

An assessment of noise for the night time operations of the Hinze Dam Stage 3 maintenance workshop has been undertaken to assist in the assessment and approval of ERA 28. The assessment has considered potential noise from the workshop at nearby residential locations and compared the results of predicted levels to the sleep disturbance assessment criteria.

The Results of the noise predictions indicate that levels likely to represent the L_{A1} noise environment within the Shed would be sufficiently attenuated at residential dwellings where an acoustic shed is used to house the maintenance activities.

Additional management measures should be employed to ensure the risk of unnecessary noise impacts is minimised. Noise monitoring during the early part of the project would be necessary to ensure that noise levels are at an acceptable level to maintain the acoustic amenity of the local community.

Appendix A Example Site Activity Log Format

Site Activity Log – Pipeline Tunnelling

Name

Date

mark the duration of equipment operations and include relevant comments on noise generating activities at or adjacent to the site

Equipment	Duration of Activity (start time)																								Comments	
	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	01	02	03	04	05	06	07		
Air Compressors																										
Crawler Crane																										
Tug																										
Hammer																										
Drill Rig																										
Welding Rig																										
Hand tools																										
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Appendix B Sample Noise Diary Format

Noise Diary

Name

Address

Date of the noise event	
Record the time of the noise event	
The Approximate duration of the noise event:	
What were you doing when the noise disturbed you	
What effect did the noise event have on you	
Describe the noise Did it: 1. Continue without changing? 2. Stop and start? 3. Change pitch (like a siren)? 4. Go from quiet to loud back to quiet etc.	
Describe where the noise came from in relation to your house (ie back, front, side etc)	

What type of activity do you think caused the noise	
Could you hear the noise inside? If so, which room? (bedroom, living/dining room, study etc)	
Were windows/doors open or closed	