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Re: East Guyong Quarry Noise Monitoring Report

Dear Martin,

1 Introduction

EMGA Mitchell McLennan Pty Limited (EMM) has been commissioned by Hanson Construction Materials Pty Ltd (NSW) to complete an acoustic assessment of noise emissions from East Guyong Quarry (the Quarry) at two locations within the Quarry's boundary. The Quarry is located approximately 22 km southeast of Orange, NSW.

At the time of the attended noise monitoring on 30 August 2013, the Quarry's activities comprised of the following:

- Establishment of an extraction area to extract basalt using standard drill, blast, load and haul techniques;
- Construction of a site access road and intersection with the Mitchell Highway; and
- Construction of a range of bunds and mounds and establishment of native vegetation to provide visual screening for the quarry operations.

The Quarry's approved hours of operation are as followed:

- Monday to Friday (non-daylight savings) from 6 am to 6 pm;
- Monday to Friday (daylight savings) from 6 am to 8 pm; and
- Saturdays from 7 am to 1 pm.

The following material was referenced as part of this assessment:

- Environmental Protection Authority (EPA), 2000 - Industrial Noise Policy (INP); and
- R. W. Corkery & Co Pty Limited, 2013 - Noise management plan for the East Guyong Quarry.

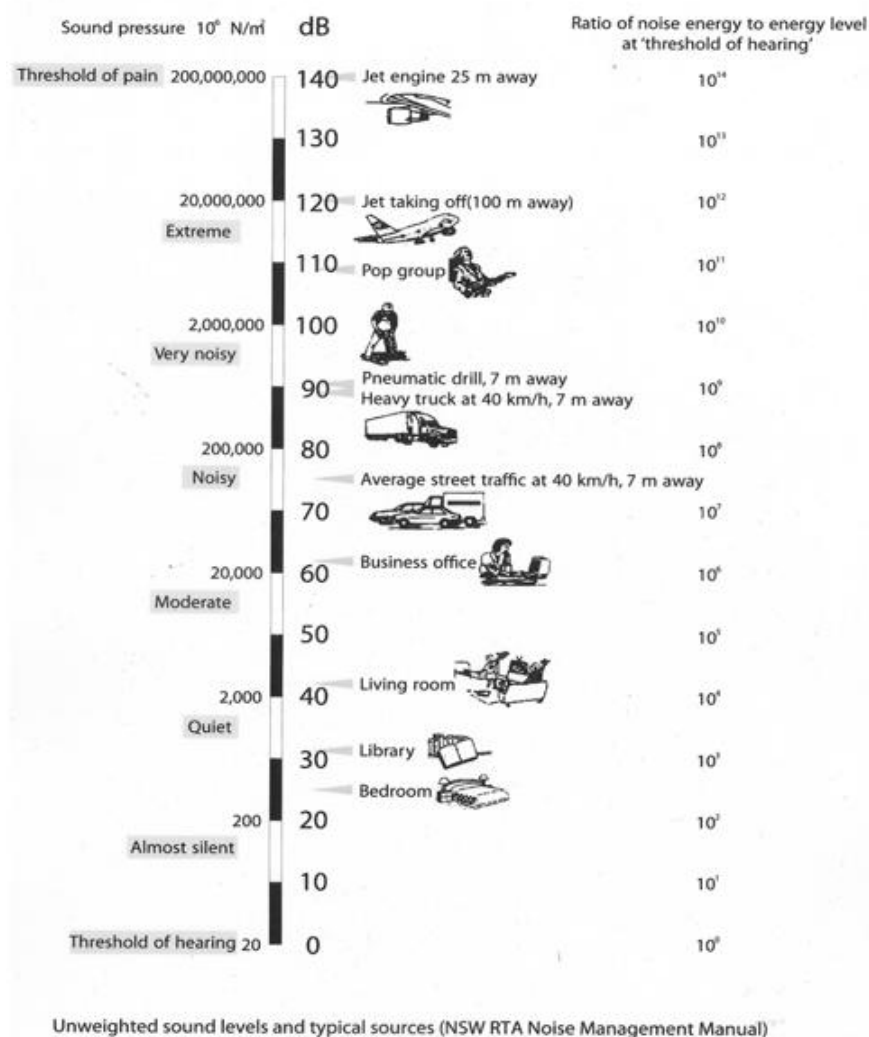
Several technical terms are discussed in this report. These are explained in Appendix A.

It is useful to have an appreciation of decibels, the unit of noise measurement. Table 1 gives an indication as to what an average person perceives about changes in noise levels:

Table 1 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times as loud (or quarter) as loud

Examples of common noise levels are provided in Figure 1.



Source: RTA Environmental Noise Management Manual (RTA, 2001)

Figure 1 Common noise levels

2 Methodology

2.1 Attended noise monitoring methodology

The noise monitoring assessment was divided into three scenarios:

1. Background noise (ambient noise environment - no Quarry noise);
2. Mobile crushing circuit and loader, and construction fleet; and
3. Mobile crushing circuit and loader (no construction fleet).

A Brüel & Kjær 2250 sound level metre was used to conduct 15 min measurements to record octave frequencies and statistical noise indices. The sound level metre was calibrated before and after the completion of the survey using a Brüel & Kjær Type 4230 calibrator. The instruments were within their NATA laboratory calibration period at the time of the noise monitoring and certificates can be made available on request. Where possible throughout each survey the operator quantifies the contribution of each significant noise source.

2.2 Noise assessment locations

The noise monitoring included two 15 min background noise measurements between 6 am and 7 am. Additionally, to quantify emissions from the Quarry, four 15 min attended noise monitoring measurements were completed during the daytime period (after 7 am) on 30 August 2013 at locations N1 and N2 (refer to Figure 2). Operational noise monitoring was not possible before 7am as the Quarry was not in operation until after 7am.

Locations N1 and N2 are located near the eastern and north-eastern boundaries of the Quarry respectively. Location N1 is approximately 500 m west-northwest of "Wheatfields", the closest residence situated south-east of the Quarry. Location N2 is approximately 150 m south-west of "Hartley Cottage" situated north-east of the Quarry. These are intermediate monitoring locations selected for the purpose of not inconveniencing the residents, and are consistent with the Noise Management Plan for the East Guyong Quarry prepared by R.W. Corkery & CO. Pty Limited (2013). Monitoring at these locations as opposed to the residences also provides a better opportunity to capture site related noise, being closer to the operations.

2.3 Noise assessment criteria

The noise assessment criteria for all sensitive receivers are identified in Condition 3(5) of PA 06_0193, and these are $L_{eq,15min}$ 35 dB(A) at any residence for all assessment periods with the exception of the "Fairview" residence which has a daytime criterion of 36 dB(A). However as indicated in Section 2.2, noise monitoring was undertaken at intermediate locations N1 and N2 situated within the Quarry's boundary in accordance with the Noise Management Plan.

To ensure compliance at the sensitive (residential) receivers identified in Condition 3(5) of PA_0193, the noise monitoring results will be assessed against the following (intermediate) noise criteria. These intermediate location criteria are reference values predetermined using modelling in the noise impact assessment prepared by SLR, as cited in Section 11.2 of the Quarry's noise management plan:

- N1 - 43 dB(A), $L_{eq(15-min)}$,dB(A); and
- N2 - 50 dB(A), $L_{eq(15-min)}$,dB(A).

It is understood that by satisfying these intermediate location criteria, quarry noise at residences would also satisfy residential criteria.



Figure 2 - Site boundary and monitoring locations

3 Results

Noise monitoring results for the two intermediate locations N1 and N2 are presented in Table 2 for the three scenarios described in Section 2.1.

All L_{eq} contributions from the Quarry recorded at the two locations satisfied the relevant criteria. Therefore, noise levels from the Quarry are expected to satisfy the relevant criteria at all sensitive receivers identified in Condition 3(5) of PA_0193. However, it should be noted that the wind speeds recorded by the site's weather station (10 m high) were above 3 m/s during the noise monitoring period for scenario 2 and scenario 3 (see Table 2). According to the project approval conditions, the criteria do not apply under these wind conditions.

Notwithstanding, the winds during these measurements were coming from the direction of the Quarry, therefore it is anticipated that noise levels from the Quarry would be of a lower magnitude during calmer conditions at the two locations. Further, it was noted that wind speeds at ground level were occasionally recorded in the order of 5 to 6 m/s during some of the measurements, enhancing quarry noise levels received at the monitors and potentially contaminating readings due to wind effects on the microphone. Hence, readings are considered to provide a conservative contribution of site noise.

Table 2 **Attended noise monitoring summary**

Location	Scenario	Time (hrs)	Attended noise monitoring results, dB(A)				Criteria dB(A)	Met conditions ¹		Comments
			Total measured			Site contribution L _{eq}		Wind speed (m/s)	Wind direction (degrees)	
			L _{eq}	L _{max}	L ₉₀					
N1	1	6:51	45	74	37	N/A	43	2.1	356	Traffic noise from Mitchell Hwy dominant, birds also constantly audible and livestock occasionally audible.
	2	9:27	46	57	44	42	43	6.6	307	Mobile crushing circuit and loader, and construction fleet audible including mobile plant, reversing alarms and excavator bang. Birds constantly audible. Wind gusts affecting levels at microphone occasionally.
	3	9:46	46	63	43	43	43	7.0	302	Mobile crushing circuit and loader audible. Birds constantly audible. Wind gusts affecting levels at microphone occasionally.
N2	1	6:29	43	55	38	N/A	50	3.0	312	Traffic noise from Mitchell Hwy dominant, birds also constantly audible. Plane flying above briefly.
	2	8:18	46	64	44	43	50	3.1	347	Construction fleet audible including mobile plant. Mobile crushing circuit and loader just audible. Traffic noise from Mitchell Hwy, birds and livestock audible.
	3	10:07	48	61	45	45	50	8.8	306	Mobile crushing circuit and loader audible. Birds and insects constantly audible. Livestock occasionally audible and plane flying above briefly. Wind gusts affecting levels at microphone occasionally.

Notes: 1. Meteorological data was recorded by the East Guyong Quarry site's weather station located near location N1.

4 Sound power testing summary

Sound power testing of the mobile crushing circuit in operation on-site was completed on 30 August 2013. It should be noted that the mobile crushing circuit consists of an excavator, jaw crusher and cone crusher, and the sound power level for all three plant items was determined as one single source. The sound power results and octave analysis for the mobile crushing circuit are presented in Table 3.

Table 3 $L_{eq}dB(A)^1$ sound power level $(L_w)^2$ spectrum

Mobile crushing plant L_w - 'A' Weighted frequency (Hz)									Total
31.5	63	125	250	500	1000	2000	4000	8000	dB(A)
67	94	108	104	102	108	107	101	90	114

Notes: 1. L_{eq} : Energy average noise from a source. This is the equivalent continuous sound pressure level over a given period.
2. L_w : Measure of the total power radiated by a source, and is independent of the surrounding environment.

The results identified a sound power level of 114 dB(A) for the mobile crushing circuit. It is noted that the mobile crushing circuit on-site at the time of monitoring is different to the fixed crushing circuit that will be used when the Quarry becomes fully operational. It is understood that the proposed fixed crushing plant will have a lower sound power level of 112 dB(A).

5 Conclusion

EMM has completed a noise assessment for the current operations at East Guyong at two intermediate monitoring locations within the Quarry's boundary. The noise monitoring results demonstrates that the noise levels received at both monitoring locations satisfied the relevant noise criteria in accordance with the Noise Management Plan for the East Guyong Quarry. Therefore it is also expected that noise levels from the Quarry will satisfy the relevant criteria at all sensitive receivers identified in Condition 3(5) of PA_0193. However, it should be noted that wind speeds during most of the monitoring were above the project approval threshold of 3 m/s when noise limits do not apply and therefore presented quarry noise is conservative. The winds were coming from the direction of the Quarry, having an enhancing effect on the noise levels received from the Quarry. It was also noted that the mobile crushing circuit is different to the one to be used when the Quarry becomes fully operational, and has a higher sound power level. This also means that measured levels during our site visit are likely to be higher than the ultimate installation.

Yours sincerely



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Appendix A

Glossary of Acoustic Terms

Term	Description
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L ₉₀	Commonly referred to as the background noise level. The noise level exceeded 90% of the time.
L _{eq}	The energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The L _{eq(15min)} descriptor refers to an L _{eq} noise level measured over a 15 minute period.
L _{max}	The maximum root mean squared sound pressure level received during a measuring interval.
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels
PSNL	The project specific noise levels (PSNC) are target noise levels for a particular industrial noise source or industry. They are based on the more stringent of the intrusive criteria or amenity criteria. Which of the two criteria is more stringent is determined by measuring the level and nature of existing noise in the area surrounding the actual noise generating industrial noise source or industry.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am - 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm - 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm - 8 am.
Sound Power Level (L _w)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.