Noise Monitoring Assessment

Wallerawang Quarry
March 2021

Prepared for: Walker Quarries Pty Ltd
April 2021
MAC160392RP9V1

Muller Acoustic Consulting

Document Information

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Walker Quarries Pty Ltd to complete a bi-annual Noise Monitoring Assessment (NMA) for Wallerawang Quarry ('the quarry'). This assessment has been undertaken as the first bi-annual assessment for 2021.

The NMA involved quantifying the noise contribution of the quarry by direct attended measurements to compare quarry emissions against relevant criteria. Monitoring has been conducted at three representative receiver locations in accordance with the Walker Quarry Noise Management Plan (NMP) and the quarry's Environmental Protection License (ref: 13172). An additional measurement at a nearfield reference location was also conducted to verify the operation of quarry plant and to quantify the noise contribution from site.

The assessment has been conducted in accordance or with reference to the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Environment Protection Licence EPL 13172 (EPL);
- Development Consent 344-1-2001 (Mod 3), February 2020;
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures;
- Muller Acoustic Consulting Pty Ltd, Noise and Vibration Impact Assessment, 2019; and
- Umwelt, Wallerawang Quarry Noise Management Plan (NMP), 2019.

A glossary of terms, definitions and abbreviations used in this report is provided in Appendix A.

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2 Noise Criteria

2.1 Environmental Protection License Noise Limits

Table 1 reproduces the noise criteria for the quarry as per Condition L4.1 of EPL 13172.

Table 1 EPL Noise Limits, dBA

Location	Day	Evening	Night
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$
All privately owned residences	43	43	39

Note: Day Period is 7am to 6pm, Evening Period is 6pm to 10pm, Night Period is 10pm to 7am.

It is noted that Condition L4.3 of EPL 13172 identifies conditions under which the noise criteria do not apply and include:

a) Wind speeds greater than 3m/s at 10m above ground level;

b) Temperature inversion conditions greater than 3 degrees Celsius / 100m; or

c) Under "non-significant weather conditions".

2.2 Development Consent Noise Limits

Schedule 3 of the site's Development Consent (DA344-11-2001) outlines applicable noise criteria for the operation of the quarry. **Table 2** reproduces the criteria as outlined in the development consent.

Table 2 Development Consent Noise Limits, dBA

Location	Day	Evening	Night
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$
All privately owned residences	43	43	35

Additionally, Condition 3B of Schedule 3 of the Development Consent states, '*The noise criteria in Table 2 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.*'

2.3 Variance in noise limits

It is noted that the night-time criteria presented in the Development Consent differs from that outlined in the EPL. This is due to the consent being updated to reflect the recent modification for site. Hence, the more conservative criteria outlined in the consent have been adopted for this assessment. Notwithstanding, as the quarry is not operational during the night period, the variance in the applicable noise criteria is inconsequential.

2.4 Quarry Plant Sound Power Noise Limits

Table 15 of the Noise and Vibration Impact Assessment (NVIA) (Muller Acoustic Consulting, April 2019) prepared for the Environmental Impact Statement (EIS) (Umwelt (Australia)) sets out the noise targets for mobile plant operating at the quarry. The logarithmic site total sound powers are reproduced in **Table 3.**

Table 3 Quarry Plant Sound Power Levels, dBA (re 10^{-12} Watts)

Noise Source/Item	Total dBA
Sandvik Crusher	111
Pugmill	108
Service Vehicle	82
Wirtgen Kleeman Secondary/Tertiary Crusher	111
Wirtgen MR130Z Track Mounted Impact Crusher	113
Wirtgen Kleeman Cone/Sand Plant	110
Wirtgen Kleeman Screen	111
Drill	115
Cat D8 Dozer	111
Komatsu PC450 Excavator	109
Komatsu Loader	99
Komatsu WA500 Loader	105
Komatsu WA480 Wheel Loader	100
Komatsu HM400 Articulated Dump Truck (x3)	106
Volvo 6 Wheeled Water Cart	101
Manitou	96
Standard Road Truck (x3)	102
Total Site Sound Power	**121**

3 Methodology

3.1 Locality

Wallerawang is located approximately 10km to the north west of Lithgow, NSW. Receivers in the locality surrounding the quarry are primarily rural/residential and for consistency the naming conventions for each receiver has been retained from the NMP. The monitoring locations with respect to the quarry are presented in **Table 4** and graphically in the locality plan shown in **Figure 1.**

Table 4 Receiver Locations

ID	Address	Distance to Quarry Boundary
RL1	Reference Location (adjacent to site office)	N/A
N1	139 Gemalong, Marrangaroo, NSW	1200m
N2	987 Great Western Highway, Marrangaroo, NSW	400m
N3	2 Cypress Close, Wallerawang, NSW	550m

3.2 Environmental Noise Assessment Methodology

The attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise", the EPL and NMP. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 31 March 2021. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Two daytime measurements of 15-minutes in duration were completed at each monitoring location during standard onsite operations. Where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis to calculate the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant EPL limits.

FIGURE 1

LOCALITY PLAN

REF: MAC160392

0 200m

KEY	
N1	RECEIVER/MONITORING LOCATION
RL1	REFERENCE LOCATION
	SITE LOCATION

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*Imagery Source : nearmaps

4 Results

4.1 Assessment Results – Onsite Reference Location (RL1)

Operational attended noise monitoring was completed at RL1 on Wednesday 31 March 2021. **Table 5** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 5 Operator-Attended Noise Survey Results – Reference Location 1 (RL1)

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit[1]	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
31/03/2021	13:12	70	60	59	43	WS: 0.1m/s WD: SW Rain: Nil	Quarry Generator 58-62 Quarry Traffic 62-70 Quarry Pump 58-62
Quarry Site $L_{Aeq(15min)}$ Contribution							62
31/03/2021	14:42	70	64	63	43	WS: 0.3m/s WD: W Rain: Nil	Quarry Generator 62-64 Quarry Traffic 62-70 Quarry Pump 62-64
Quarry Site $L_{Aeq(15min)}$ Contribution							62

Note 1: EPL not applicable for this onsite reference location.

4.2 Assessment Results – Location N1

Operational attended noise monitoring was completed at N1 on Wednesday 31 March 2021. **Table 6** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 6 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
31/03/2021	11:24	63	50	43	43	WS: 0.1m/s WD: SW Rain: Nil	Traffic 40-63 Birds 40-48 Quarry Inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution							<43
31/03/2021	14:00	62	47	41	43	WS: 0.2m/s WD: NW Rain: Nil	Traffic 42-62 Aircraft 47-56 Birds 42-46 Quarry Inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution							<43

Note 1: Quarry Site $L_{Aeq(15min)}$ calculated based on nearfield measurements.

4.3 Assessment Results – Location N2

Operational attended noise monitoring was completed at N2 on Wednesday 31 March 2021. **Table 7** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 7 Operator-Attended Noise Survey Results – Location N2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
31/03/2021	13:34	63	53	48	43	WS: 0.5m/s WD: W Rain: Nil	Quarry screening plant 48-63 Wind in trees <51
Quarry Site $L_{Aeq(15min)}$ Contribution							53
31/03/2021	15:04	62	45	42	43	WS: 0.4m/s WD: W Rain: Nil	Birds 40-52 Traffic 40-62 Screen Plant 46-51
Quarry Site $L_{Aeq(15min)}$ Contribution							48

Note 1: Quarry Site LAeq(15min) calculated based on nearfield measurements.

4.4 Assessment Results – Location N3

Operational attended noise monitoring was completed at N3 on Wednesday 31 March 2021. **Table 8** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 8 Operator-Attended Noise Survey Results – Location N3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
31/03/2021	11:44	62	49	42	43	WS: 0.1m/s WD: SW Rain: Nil	Traffic 38-62 Birds 38-42 Local residential noise 38-44 Quarry Inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution							<25
31/03/2021	14:20	64	50	46	43	WS: 0.3m/s WD: WNW Rain: Nil	Traffic 44-64 Birds 44-48 Local residential noise 44-58 Quarry Inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution							<25

Note 1: Quarry Site LAeq(15min) calculated based on nearfield measurements.

4.5 Sound Power Audit Results

Sound power calculations for measured on-site plant are presented in **Table 9**. Results of the analysis identify that the overall sound power of items of plant used at the project site are below target sound power levels outlined in the EIS and NVIA.

Table 9 Sound Power Levels, dBA

Plant	Octave Band Centre Frequency, Lw Spectrum									Sound Power Lw	Criteria
	32	63	125	250	500	1k	2k	4k	8k		
Komatsu WA480 FEL	70	80	84	87	89	92	91	84	71	97	100
Komatsu MH400 #1	70	78	81	84	89	92	88	83	72	96	106
Komatsu MH400 #2	69	79	82	87	91	94	91	85	74	98	106
Screen and Crusher	88	96	102	103	112	114	114	110	100	119	111
Komatsu PC450 LC Ex 201	83	89	93	94	98	100	98	93	83	105	109
Komatsu PC450 LC Ex 202	70	78	101	95	95	97	96	92	82	105	109
Atlas Copo ECM 660	67	84	102	98	104	105	105	104	101	112	115
Volvo 6 Wheeled Water Cart	62	71	79	84	88	91	89	84	74	95	101
Total Site Sound Power										**120**	**121**

It is noted that the sound power level of the screen and crusher are above the EIS levels for each item of plant. Notwithstanding, the total emissions from all onsite plant are lower than the total logarithmic sum of the overall site criteria as shown in **Table 9**. Hence, the total target sound power levels are satisfied for site.

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5 Discussion

5.1 Discussion of Results – Reference Location (RL1)

Noise measurements conducted on Wednesday 31 March 2021 were conducted when Wallerawang Quarry was operating at normal production levels, which included use of crusher train, mobile screen, excavator, road trucks and water cart.

The noise contribution from the quarry at the reference location was 62dB $LA_{eq(15min)}$ for both measurements. The noise environment at the reference location was primarily dominated by a nearby generator, water pump and onsite traffic.

To verify the offsite noise levels, calculations were undertaken to estimate the attenuation from the site to each monitoring location. The attenuation calculations incorporated loss due to distance, and conservative topography (ie barrier attenuation) and air absorption losses. The results of the attenuation calculations identified received noise level and the results of the attended surveys are discussed for each monitoring location in Section 5.2 to Section 5.4.

5.2 Discussion of Results – Location N1

Measurements conducted on Wednesday 31 March 2021 identified that Wallerawang Quarry noise was inaudible during both measurements conducted, and therefore satisfied the relevant noise limits of 43dB $LA_{eq(15min)}$. Extraneous non-quarry related sources included highway traffic, birds, and aircraft, that were significant contributors to the ambient noise environment.

The calculated attenuation between the quarry site and N1, considering distance loss, the surrounding topography and air absorption, was 76dB. Based on the site Lw established from the near field measurements, the resulting received quarry contribution at N1 is <43dBA. This level is significantly lower than the ambient dominant sources which generally masks site noise and confirms the quarry was audible as a background noise source at this location for both measurements conducted.

5.3 Discussion of Results – Location N2

Measurement results for N2 were dominated by onsite crushing and screen that were continually audible during both measurements conducted on Wednesday 31 March 2021. Quarry emissions were above the applicable noise criteria for privately owned residences during both measurements conducted at this location. Notwithstanding, it is noted that in accordance with Condition 3B of Schedule 3 of the site's development consent (reproduced in Section 2.2 of this report), monitoring location N2 has entered into a private agreement with the quarry and accordingly noise criteria are not applicable at this location. It is recommended that in accordance with Section 6.1.2 of the Noise Management Plan and as a best practice measure, a highwall is maintained on the northern boundary of site and that stockpiles and equipment is to be optimised so that there is no clear line of site between the screening/crushing plant and location N2.

The attenuation between the quarry site and N2 taking into account distance between the locations, the loss due to surrounding topography (ie ground attenuation) and air absorption is 66dB. Based on the current site sound power level established from the near field measurements of the screening/crushing plant, the resulting received quarry contribution at N2 is 53dBA. This estimated noise level is generally consistent with the measured noise contribution from the attended monitoring.

5.4 Discussion of Results – Location N3

Measurements conducted on Wednesday 31 March 2021 for N3 were dominated by local and highway traffic which masked quarry noise. Quarry operations were inaudible during all measurements at this location, notwithstanding quarry contributions remained below the relevant criteria of 43dB $LA_{eq(15min)}$ for both measurements conducted at the location.

The total attenuation due to distance, air absorption and surrounding topography for N3 was estimated to be 73dB. This resulted in an estimated site noise contribution of <25dBA which is consistent with the measured noise contribution from the attended monitoring.

5.5 Discussion of Results – Sound Power Audit

The results of the sound power audit demonstrate that current plant used onsite comply with the relevant mobile and static sound power criteria as outlined in the NVIA, with the exception of the screening plant and the crusher train. This is as the screening plant and the crusher train consists of five items of plant with the criteria outlined in the NVIA for a single item of plant. Notwithstanding, the overall emissions from combined plant on site remain below the combined site sound power criteria.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment on behalf of Walker Quarries Pty Ltd. The assessment was completed to assess Wallerawang Quarry noise emissions against relevant criteria presented in EPL 13172 and DA 344-11-2001.

Attended measurements conducted on Wednesday 31 March 2021 identified that noise emissions generated by Wallerawang Quarry were above the applicable noise criteria for privately owned residences at location N2. However, this location has entered into a private agreement with the quarry and accordingly noise criteria are not applicable at this location. Recommendations to reduce the noise at N2 in accordance with the sites NMP are outlined in Section 5.3 of this report.

Quarry noise remained inaudible at both locations N1 and N3 for attended measurements conducted on Wednesday 31 March 2021, which satisfies the specified noise limits in the Noise Management Plan and Environmental Protection Licence. These monitoring locations were dominated by extraneous sources that predominantly masked quarry operations.

The results of the sound power audit demonstrate that current plant used onsite comply with the relevant mobile and static sound power criteria as outlined in the NVIA, with the exception of the screen plant and the crusher train. Notwithstanding, the overall emissions from combined plant on site remain below the combined site sound power criteria.

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Appendix A – Glossary of Terms

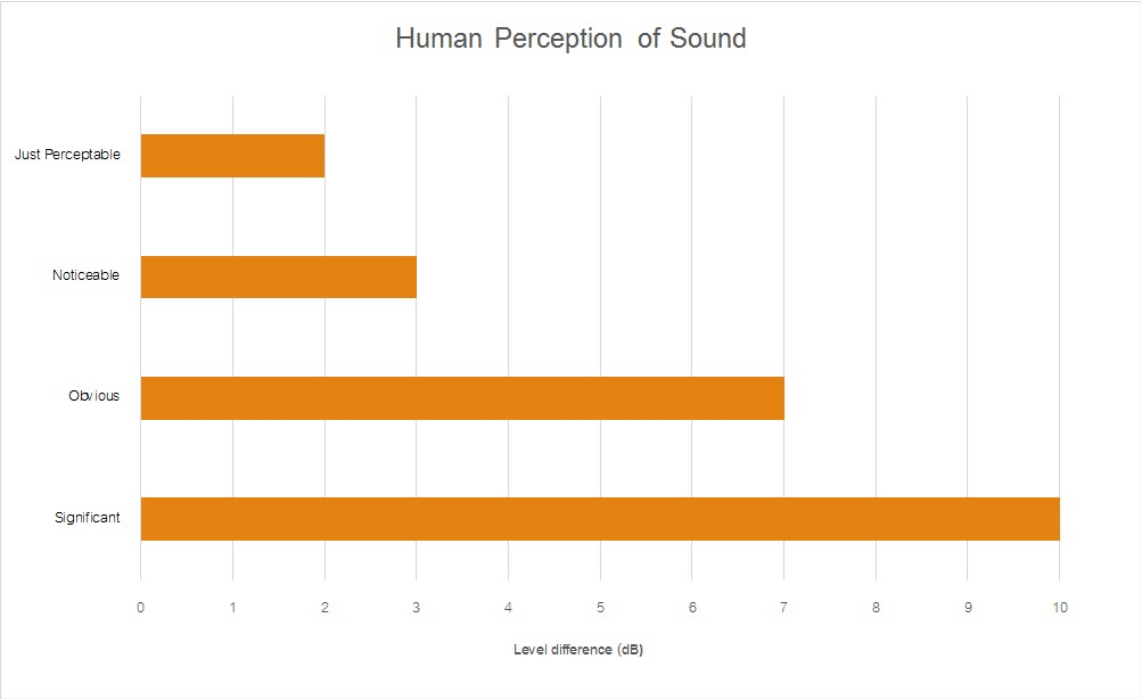
Several technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI 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.
Ambient Noise	The noise associated with a given environment. Typically, a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	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.
dB(Z)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure 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 ABL's.
Sound power level (SWL)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix B – Correspondence Register

Table B1 Correspondence Register			
Date	Contact Between	Phone/Email	Comment
Monday 29 March 2021	J Van Der Merwe, R Heaton, A Irwin & N Shipman	Email	Initial contact to schedule environmental compliance survey and sound power audit in March 2021.
Monday 29 March 2021	J Van Der Merwe, R Heaton, A Irwin & N Shipman	Email	Email to confirm go ahead for survey.
Tuesday 30 March 2021	J Van Der Merwe and R Heaton	Call	Call to schedule survey on Wednesday 31 March 2021.
Wednesday 31 March 2021	Nicholas Shipman	Onsite meeting	Meeting prior to survey to confirm operations for the day, survey completed.

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