Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW
Quarter 1 Ending January 2022.

Prepared for: Holcim (Australia) Pty Ltd
January 2022
MAC180611-02RP15

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 1 Ending March 2022

Prepared for: Holcim (Australia) Pty Ltd

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (the 'quarry'), Marulan, NSW.

The monitoring has been conducted in accordance with the Lynwood Noise Management Plan (NMP) and in general accordance with the Noise Policy for Industry (NPI), at four representative monitoring locations. This assessment has been undertaken for the quarterly period ending March 2022, and forms part of the annual noise monitoring program to address conditions outlined in the Development Consent.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Lynwood Quarry Noise Management Plan (NMP), 2016;
- Lynwood Quarry Environmental Protection Licence (EPL), 2013 (12939);
- Lynwood Quarry, Development Consent, 2005 (DA128-5-2005); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

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2 Noise Criteria

The Lynwood Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers L1 – L16 surrounding the quarry, and are presented in **Table 1**.

Table 1 Noise Criteria[1]

Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LA1(1min)
L1	35	35	35	45
L2	35	35	35	45
L3	35	35	35	45
L4	35	37	35	46
L5	35	35	35	46
L6	35	37	36	46
L7	38	38	35	55
L8	39	38	36	55
L9	39	39	37	56
L10	42	42	40	53
L11	35	35	35[1]	47
L12	37	37	36	47
L13	40	38	37	47
L14	35	35	35	47
L15	35	35	35	47
L16	35	35	35	45

Note 1: Noise criteria adopted from the EPL.

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3 Methodology

3.1 Locality

The quarry is located near Marulan, NSW approximately 4km west of the town centre. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Hume Highway situated to the east and south of the site. Highway traffic is a dominant noise source in the area along with rural noise. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1** and presented in **Table 2.**

Table 2 Monitoring Location Addresses

NMP ID	EPL ID	Address	Criteria dB			
			Day	Evening	Night	Night
			$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
N1	L1	1114 Carrick Road, Marulan	35	35	35	45
N2	L6	End of Maclura Drive, Marulan	35	37	36	46
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan[1]	35	35	35[2]	47
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Intermediate noise monitoring point.

Note 2: Noise criteria adopted from the EPL.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Lynwood Quarry EPL. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 19 January 2022 and Thursday 20 January 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Wednesday 19 January 2022 and Thursday 20 January 2022 to satisfy the requirements of the NMP.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. In the event of quarry attributed noise being above criteria, prevailing meteorological conditions for the monitoring period are sourced from the onsite meteorological station and analysed in accordance with Fact Sheet D of the NPI to determine the stability category present at the time of each attended measurement.

Where the quarry is inaudible, the contribution is estimated to be at least 10dBA below the ambient noise level.

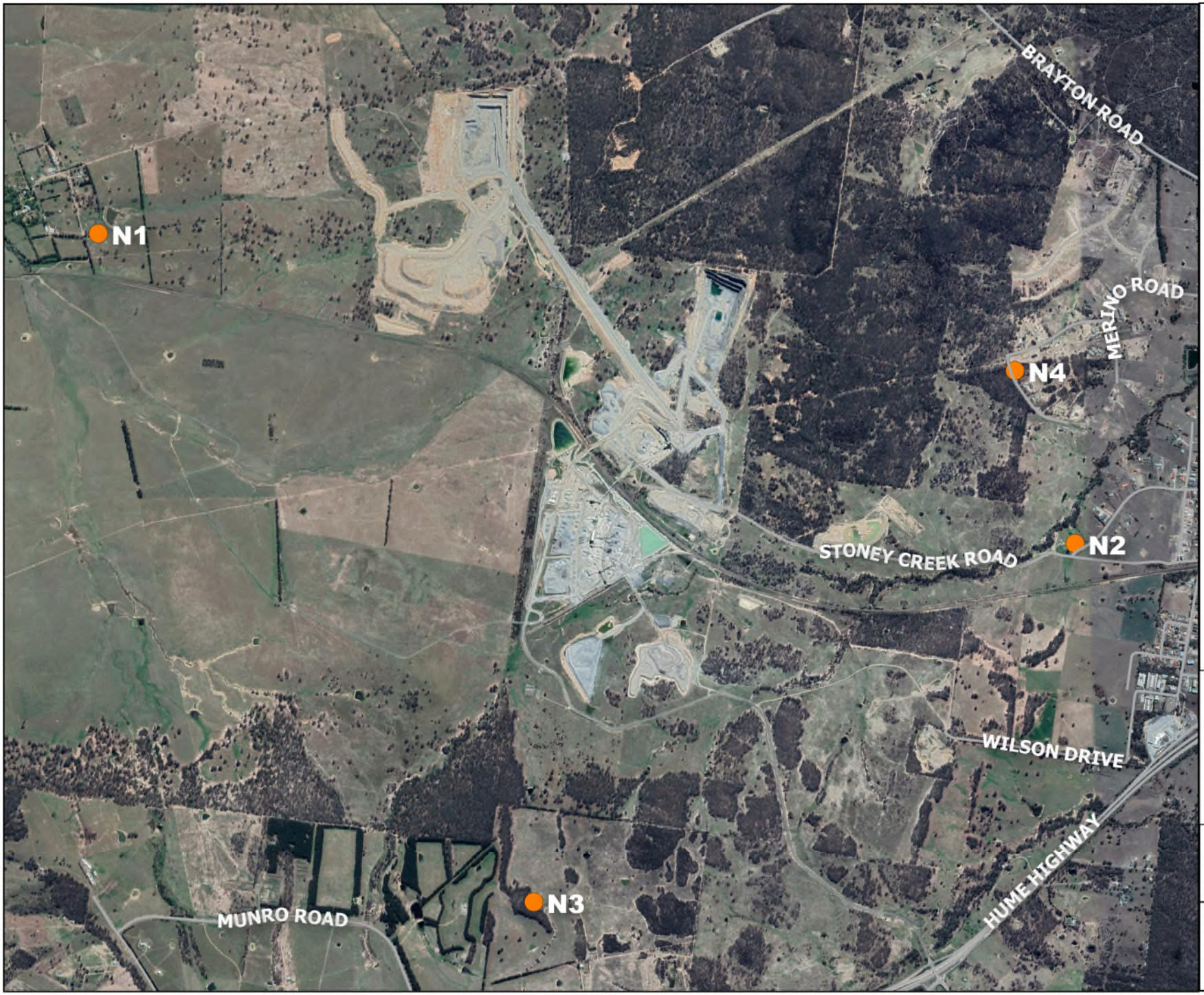

FIGURE 1

Site Locality

MAC180611-02

Holcim Lynwood Quarry

KEY

Noise Monitoring Locations

0 200 400 600 800 1000 m

N

MAC
Muller Acoustic Consulting

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4 Results

4.1 Assessment Results - Location N1

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N1 for the NMA are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/01/2022	14:43 (Day)	52	41	38	WD: SE WS: 1.5m/s Rain: Nil	Wind 36-52 Distant traffic <36 Birds 33-38 Quarry – Impacts <35 (multiple 1-2 second durations) Quarry – Haul Trucks <30 (barely audible 50% measurement)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
20/01/2022	21:44 (Evening)	70	51	37	WD: E WS: 1.0m/s Rain: Nil	Insects 34-38 Wind 31-47 Train 35-70 Quarry Haul Trucks 30-35 (just audible 50% measurement) Quarry – Hum <30 (barely audible throughout)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
20/01/2022	22:10 (Night)	44	36	34	WD: E WS: 0.5m/s Rain: Nil	Insects 32-38 Wind 30-44 Quarry Haul Trucks 30-33 (just audible <25% measurement) Quarry – Hum <30 (barely audible throughout)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<45

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Assessment Results - Location N2

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N2 for the NMA are presented in **Table 4**.

Table 4 Operator-Attended Noise Survey Results – Location N2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/01/2022	13:43 (Day)	64	48	45	WD: SE WS: 2.0m/s Rain: Nil	Traffic 43-49 Wind 40-54 Birds 40-45 Train 40-64 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
20/01/2022	20:40 (Evening)	61	51	47	WD: E WS: 1.0m/s Rain: Nil	Insects 44-57 Traffic 41-51 Train 45-61 Wind <40 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<37
20/01/2022	23:14 (Night)	71	51	42	WD: E WS: 1.0m/s Rain: Nil	Traffic 39-51 Wind 36-45 Insects 36-43 Train 45-71 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<36
Lynwood Quarry $L_{A1(1min)}$ Contribution						<46

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3 Assessment Results - Location N3

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N3 for the NMA are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location N3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/01/2022	12:59 (Day)	53	45	42	WD: SE WS: 1.0m/s Rain: Nil	Traffic 40-46 Wind 37-44 Birds 37-50 Aircraft 40-53 Quarry – Vehicles enter/exit 35-44 (2 movements, 10-20 seconds)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
20/01/2022	20:00 (Evening)	53	43	40	WD: SE WS: 1.0m/s Rain: Nil	Traffic 37-46 Wind 34-49 Birds 34-53 Insects <35 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
20/01/2022	23:53 (Night)	49	41	38	WD: E WS: 1.5m/s Rain: Nil	Traffic 34-45 Wind 34-49 Insects 37-43 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Assessment Results - Location N4

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N4 for the NMA are presented in **Table 6**.

Table 6 Operator-Attended Noise Survey Results – Location N4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/01/2022	14:06 (Day)	57	45	41	WD: SE WS: 1.5m/s Rain: Nil	Wind 36-53 Traffic 39-57 Birds 36-40 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<37
20/01/2022	21:02 (Evening)	57	42	40	WD: SE WS: 1.0m/s Rain: Nil	Wind 35-40 Traffic 37-57 Insects <35 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<37
20/01/2022	22:51 (Night)	52	41	38	WD: SE WS: 1.0m/s Rain: Nil	Wind 34-40 Traffic 37-52 Insects 34-40 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<36
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5 Discussion

5.1 Discussion of Results - Location N1

Monitoring on Wednesday 19 January 2022 and Thursday 20 January 2022 identified quarry noise was just audible during daytime, evening and night measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included haul truck movements, rock impacts and general site hum. Extraneous noise sources measured included distant traffic, birds, passing trains, insects and wind.

5.2 Discussion of Results - Location N2

Monitoring Tuesday Wednesday 19 January 2022 and Thursday 20 January 2022 identified quarry noise was inaudible during daytime, evening and night-time measurement with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included birds, passing trains, traffic, birds, insects and wind.

5.3 Discussion of Results - Location N3

Monitoring on Wednesday 19 January 2022 and Thursday 20 January 2022 identified that quarry noise was audible during daytime and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources audible during the survey were trucks entering and exiting site. Extraneous noise sources included aircraft, birds, traffic, insects and wind.

5.4 Discussion of Results - Location N4

Monitoring on Wednesday 19 January 2022 and Thursday 20 January 2022 identified quarry noise was inaudible during daytime, evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included birds, traffic, insects and wind.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) for Holcim (Australia) Pty Ltd at the Lynwood Quarry, Marulan, NSW. The assessment was completed to assess the quarry's compliance with the relevant noise criteria during Quarter 1, ending March 2022.

Attended noise monitoring was undertaken on Wednesday 19 January 2022 and Thursday 20 January 2022 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were audible at two locations, however quarry noise emissions were below the relevant noise criteria, satisfying the applicable noise criteria throughout the survey period.

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Appendix A - Glossary of Terms

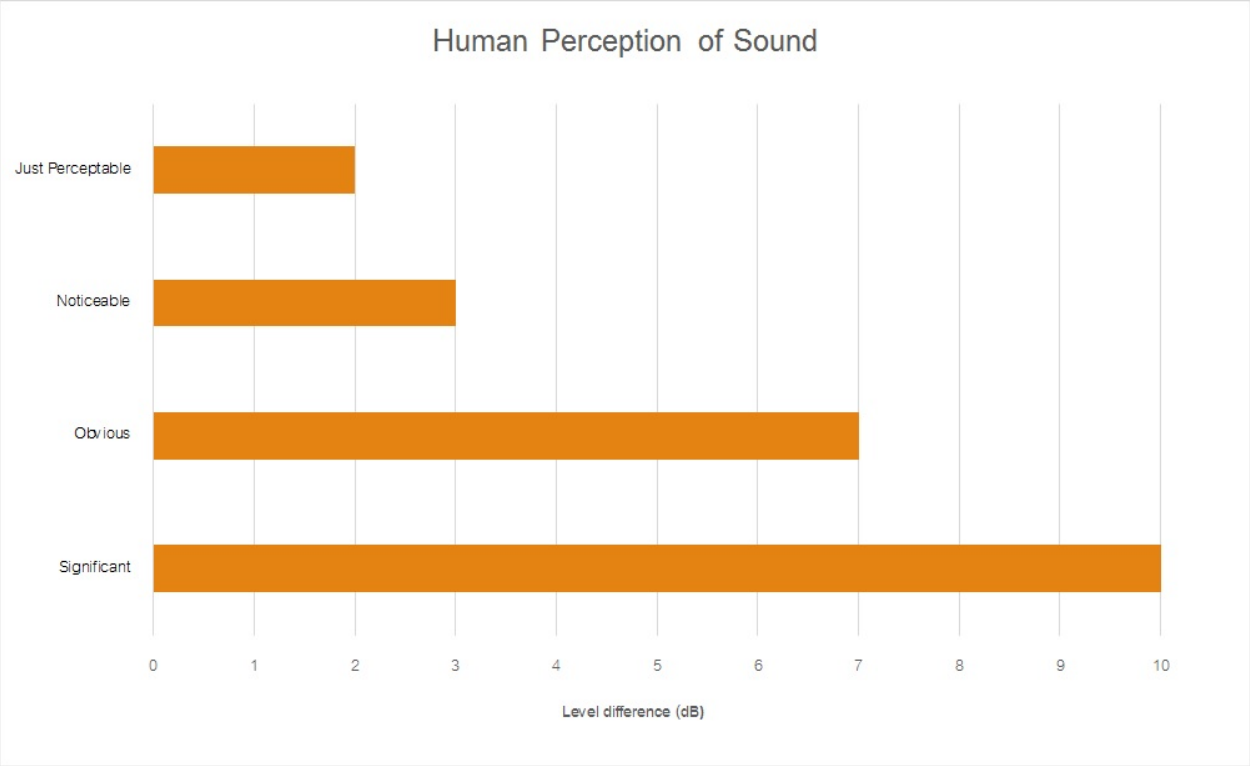
Table A1 provides a number of technical terms have been used in this report.

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 LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
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), dB(L)	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 (LW)	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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Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW
Quarter 2 Ending June 2022.

Prepared for: Holcim (Australia) Pty Ltd
May 2022
MAC180611-02RP16

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 2 Ending June 2022

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CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (the 'quarry'), Marulan, NSW.

The monitoring has been conducted in accordance with the Lynwood Noise Management Plan (NMP) and in general accordance with the Noise Policy for Industry (NPI), at four representative monitoring locations. This assessment has been undertaken for the quarterly period ending June 2022, and forms part of the annual noise monitoring program to address conditions outlined in the Development Consent.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Lynwood Quarry Noise Management Plan (NMP), 2016;
- Lynwood Quarry Environmental Protection Licence (EPL), 2013 (12939);
- Lynwood Quarry, Development Consent, 2005 (DA128-5-2005); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

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2 Noise Criteria

The Lynwood Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers L1 – L16 surrounding the quarry, and are presented in **Table 1**.

Table 1 Noise Criteria[1]

Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LA1(1min)
L1	35	35	35	45
L2	35	35	35	45
L3	35	35	35	45
L4	35	37	35	46
L5	35	35	35	46
L6	35	37	36	46
L7	38	38	35	55
L8	39	38	36	55
L9	39	39	37	56
L10	42	42	40	53
L11	35	35	35[1]	47
L12	37	37	36	47
L13	40	38	37	47
L14	35	35	35	47
L15	35	35	35	47
L16	35	35	35	45

Note 1: Noise criteria adopted from the EPL.

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3 Methodology

3.1 Locality

The quarry is located near Marulan, NSW approximately 4km west of the town centre. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Hume Highway situated to the east and south of the site. Highway traffic is a dominant noise source in the area along with rural noise. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1** and presented in **Table 2.**

Table 2 Monitoring Location Addresses

NMP ID	EPL ID	Address	Criteria dB			
			Day	Evening	Night	Night
			$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
N1	L1	1114 Carrick Road, Marulan	35	35	35	45
N2	L6	End of Maclura Drive, Marulan	35	37	36	46
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan[1]	35	35	35[2]	47
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Intermediate noise monitoring point.

Note 2: Noise criteria adopted from the EPL.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Lynwood Quarry EPL. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 19 April 2022 and Thursday 21 April 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Tuesday 19 April 2022 and Thursday 21 April 2022 to satisfy the requirements of the NMP.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. In the event of quarry attributed noise being above criteria, prevailing meteorological conditions for the monitoring period are sourced from the onsite meteorological station and analysed in accordance with Fact Sheet D of the NPI to determine the stability category present at the time of each attended measurement.

Where the quarry is inaudible, the contribution is estimated to be at least 10dBA below the ambient noise level.

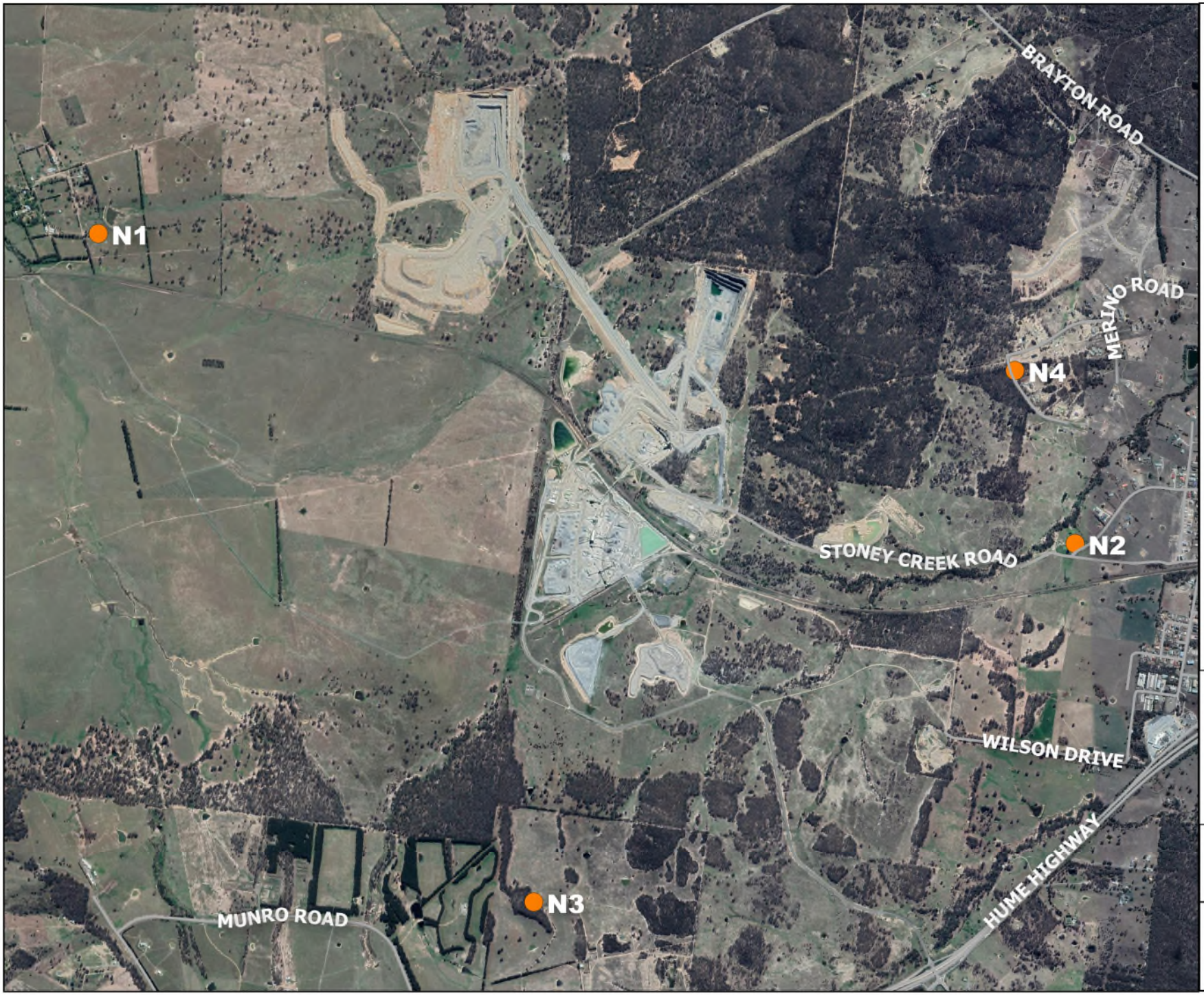

FIGURE 1

Site Locality

MAC180611-02

Holcim Lynwood Quarry

KEY

Noise Monitoring Locations

0 200 400 600 800 1000 m

N

MAC
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4 Results

4.1 Assessment Results - Location N1

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N1 for the NMA are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/04/2022	15:32 (Day)	60	45	35	WD: SW WS: 1.0m/s Rain: Nil	Insects 32-39 Birds 20-57 Train 30-60 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
21/04/2022	21:40 (Evening)	76	59	34	WD: SE WS: 1.0m/s Rain: Nil	Insects 32-41 Distant traffic 30-41 Train 35-76 Quarry – reverse alarms <30 (Infrequent 3-5 second durations) Quarry – haul trucks <29-38 (Just audible <50% measurement)
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
21/04/2022	22:05 (Night)	56	39	33	WD: SE WS: 1.5m/s Rain: Nil	Insects 31-38 Wind 28-46 Distant traffic 25-38 MAC operator 56 Quarry – reverse alarms <30 (Infrequent 3-5 second durations) Quarry – haul trucks <29-35 (Just audible <25% measurement)
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
Lynwood Quarry $L_{A1(1min)}$ Contribution						<45

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Assessment Results - Location N2

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N2 for the NMA are presented in **Table 4**.

Table 4 Operator-Attended Noise Survey Results – Location N2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/04/2022	14:26 (Day)	62	47	37	WD: SW WS: 1.0m/s Rain: Nil	Insects 35-39 Traffic 32-41 Birds 32-51 Train 32-62 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
21/04/2022	20:35 (Evening)	64	48	44	WD: SE WS: 0.5m/s Rain: Nil	Traffic 41-54 Train 38-64 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<37
21/04/2022	23:09 (Night)	78	57	43	WD: SE WS: 1.0m/s Rain: Nil	Traffic 40-56 Insects <37 Train 40-78 Quarry inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<36
Lynwood Quarry $L_{A1(1min)}$ Contribution						<46

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3 Assessment Results - Location N3

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N3 for the NMA are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location N3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/04/2022	13:50 (Day)	48	40	37	WD: SE WS: 1.0m/s Rain: Nil	Insects 35-41 Traffic 32-41 Birds 32-48 Wind 32-46 Quarry - vehicles enter/exit <35 (2 movements, 10-20 seconds each)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
21/04/2022	19:57 (Evening)	51	42	40	WD: S WS: 0.5m/s Rain: Nil	Traffic 37-47 MAC operator 51 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
21/04/2022	23:49 (Night)	51	42	39	WD: SW WS: 1.5m/s Rain: Nil	Traffic 33-43 Wind 36-51 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Assessment Results - Location N4

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N4 for the NMA are presented in **Table 6**.

Table 6 Operator-Attended Noise Survey Results – Location N4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/04/2022	14:49 (Day)	59	40	32	WD: SW WS: 1.0m/s Rain: Nil	Insects 27-38 Traffic 30-59 Birds 27-44 Aircraft 30-41 Quarry – machinery <27-38 (Just audible 50% measurement)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
21/04/2022	20:59 (Evening)	52	42	38	WD: S WS: 1.0m/s Rain: Nil	Traffic 36-46 Wind 33-38 Aircraft 35-52 Train 35-50 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<37
21/04/2022	22:45 (Night)	56	42	39	WD: SW WS: 1.5m/s Rain: Nil	Traffic 34-56 Wind 37-46 Quarry inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<36
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5 Discussion

5.1 Discussion of Results - Location N1

Monitoring on Tuesday 19 April 2022 and Thursday 21 April 2022 identified quarry noise was inaudible during daytime measurements and just audible during evening and night measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included haul truck movements and reverse alarms. Extraneous noise sources measured included wind, distant traffic, birds, insects, passing trains and MAC operator noise.

5.2 Discussion of Results - Location N2

Monitoring Tuesday 19 April 2022 and Thursday 21 April 2022 identified quarry noise was inaudible during daytime, evening and night-time measurement with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included birds, traffic, insects and passing trains.

5.3 Discussion of Results - Location N3

Monitoring on Tuesday 19 April 2022 and Thursday 21 April 2022 identified that quarry noise was audible during daytime and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources audible during the survey were trucks entering and exiting site. Extraneous noise sources included wind, birds, traffic, insects and MAC operator noise.

5.4 Discussion of Results - Location N4

Monitoring on Tuesday 19 April 2022 and Thursday 21 April 2022 identified quarry noise was just audible during daytime measurements and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included general machinery noise, Extraneous noise sources included birds, traffic, insects, wind, aircraft and passing trains.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) for Holcim (Australia) Pty Ltd at the Lynwood Quarry, Marulan, NSW. The assessment was completed to assess the quarry's compliance with the relevant noise criteria during Quarter 2, ending June 2022.

Attended noise monitoring was undertaken on Tuesday 19 April 2022 and Thursday 21 April 2022 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were generally just audible at three locations, however quarry noise emissions were below the relevant noise criteria, satisfying the applicable noise criteria throughout the survey period.

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Appendix A - Glossary of Terms

Table A1 provides a number of technical terms have been used in this report.

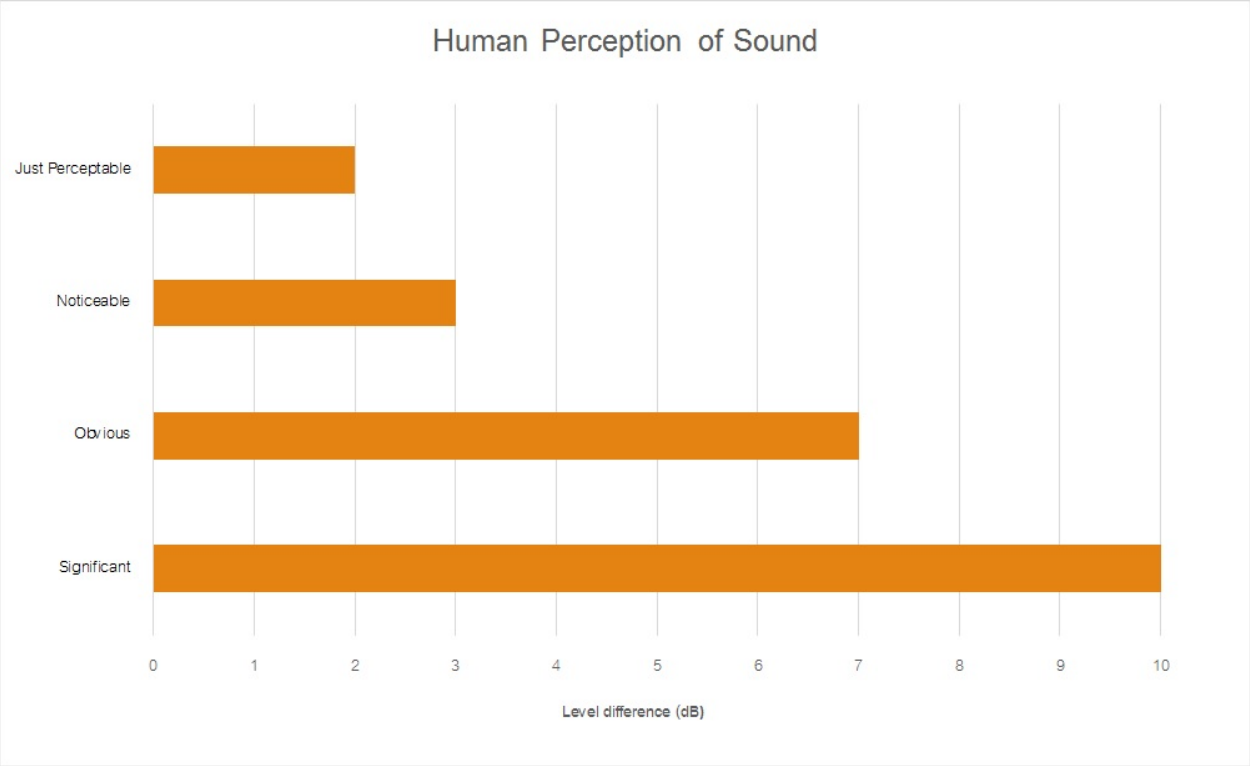
Table A1 Glossary of Terms

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 LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
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), dB(L)	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 (LW)	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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Muller Acoustic Consulting

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW
Quarter 3 Ending September 2022.

Prepared for: Holcim (Australia) Pty Ltd
October 2022
MAC180611-02RP17

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 3 Ending September 2022

Prepared for: Holcim (Australia) Pty Ltd

Prepared by: Muller Acoustic Consulting Pty Ltd
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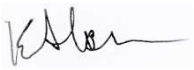
Document ID	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-02RP17	21 October 2022	Kristian Allen		Rod Linnett	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (the 'quarry'), Marulan, NSW.

The monitoring has been conducted in accordance with the Lynwood Noise Management Plan (NMP) and in general accordance with the Noise Policy for Industry (NPI), at four representative monitoring locations. This assessment has been undertaken for the quarterly period ending September 2022, and forms part of the annual noise monitoring program to address conditions outlined in the Development Consent.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Lynwood Quarry Noise Management Plan (NMP), 2016;
- Lynwood Quarry Environmental Protection Licence (EPL), 2013 (12939);
- Lynwood Quarry, Development Consent, 2005 (DA128-5-2005); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

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2 Noise Criteria

The Lynwood Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers L1 – L16 surrounding the quarry, and are presented in **Table 1**.

Table 1 Noise Criteria[1]

Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LA1(1min)
L1	35	35	35	45
L2	35	35	35	45
L3	35	35	35	45
L4	35	37	35	46
L5	35	35	35	46
L6	35	37	36	46
L7	38	38	35	55
L8	39	38	36	55
L9	39	39	37	56
L10	42	42	40	53
L11	35	35	35[1]	47
L12	37	37	36	47
L13	40	38	37	47
L14	35	35	35	47
L15	35	35	35	47
L16	35	35	35	45

Note 1: Noise criteria adopted from the EPL.

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3 Methodology

3.1 Locality

The quarry is located near Marulan, NSW approximately 4km west of the town centre. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Hume Highway situated to the east and south of the site. Highway traffic is a dominant noise source in the area along with rural noise. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1** and presented in **Table 2.**

Table 2 Monitoring Location Addresses

NMP ID	EPL ID	Address	Criteria dB			
			Day	Evening	Night	Night
			$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
N1	L1	1114 Carrick Road, Marulan	35	35	35	45
N2	L6	End of Maclura Drive, Marulan	35	37	36	46
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan[1]	35	35	35[2]	47
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Intermediate noise monitoring point.

Note 2: Noise criteria adopted from the EPL.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Lynwood Quarry EPL. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 27 September 2022 and Thursday 29 September 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Tuesday 27 September 2022 and Thursday 29 September 2022 to satisfy the requirements of the NMP.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. In the event of quarry attributed noise being above criteria, prevailing meteorological conditions for the monitoring period are sourced from the onsite meteorological station and analysed in accordance with Fact Sheet D of the NPI to determine the stability category present at the time of each attended measurement.

Where the quarry is inaudible, the contribution is estimated to be at least 10dBA below the ambient noise level.

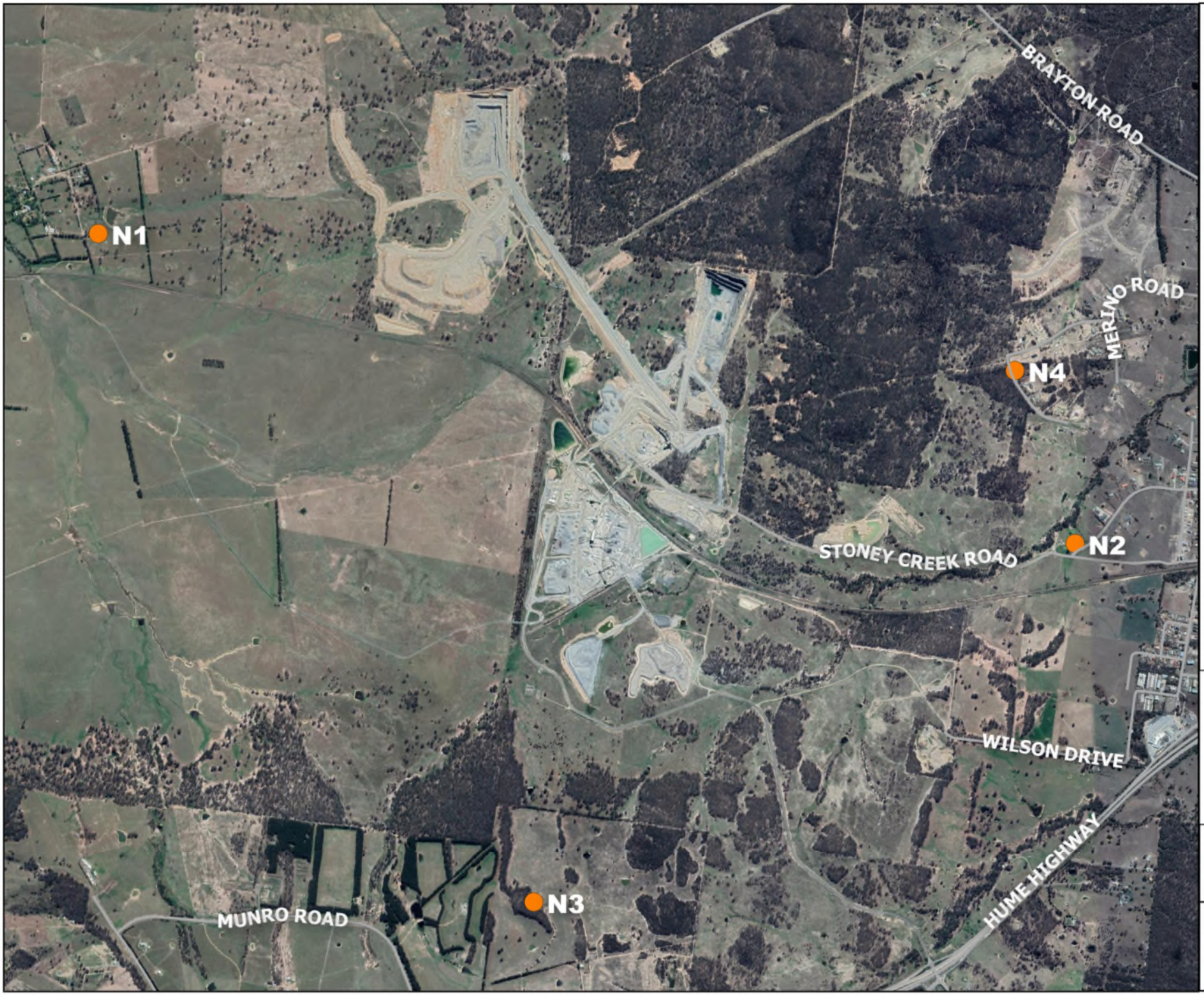

FIGURE 1

Site Locality

MAC180611-02

Holcim Lynwood Quarry

KEY

Noise Monitoring Locations

0 200 400 600 800 1000 m

N

MAC
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4 Results

4.1 Assessment Results - Location N1

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N1 for the NMA are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
27/09/2022	15:08 (Day)	61	39	29	WD: NW WS: 1.5m/s Rain: Nil	Wind 25-48 Birds 25-55 Insects 25-30 Aircraft 30-43 Distant Thunder 40-61 Quarry Inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
29/09/2022	21:37 (Evening)	55	39	36	WD: NW WS: 1.5m/s Rain: Nil	Insects 30-35 Wind 30-48 Distant Traffic 30-35 Train Passby 35-55 Quarry Inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
29/09/2022	22:00 (Night)	53	38	36	WD: E WS: 1.5m/s Rain: Nil	Wind 30-46 Insects 30-35 Distant Traffic 30-35 Aircraft 35-53 Quarry Inaudible
Lynwood Quarry $L_{Aeq(15min)}$ Contribution						<35
Lynwood Quarry $L_{A1(1min)}$ Contribution						<45

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Assessment Results - Location N2

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N2 for the NMA are presented in **Table 4**.

Table 4 Operator-Attended Noise Survey Results – Location N2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
27/09/2022	14:11 (Day)	61	46	34	WD: W WS: 0.5m/s Rain: Nil	Birds 32-55 Construction 35-46 Train Passby 35-61 Insects 32-36 Traffic 30-35 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
29/09/2022	20:33 (Evening)	74	57	45	WD: W WS: 2.0m/s Rain: Nil	Insects <40-43 Traffic 40-48 Residential Noise 40-65 Train Passby 45-74 Wind 40-53 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<37
29/09/2022	22:58 (Night)	58	47	44	WD: SE WS: 1.5m/s Rain: Nil	Insects <40-45 Traffic 40-53 Residential Noise 40-58 Wind 40-48 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<36
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<46

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3 Assessment Results - Location N3

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N3 for the NMA are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location N3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
27/09/2022	13:33 (Day)	64	41	37	WD: W WS: 1.5m/s Rain: Nil	Insects 35-40 Birds 32-54 Distant Traffic <35 Wind 35-48 Quarry – Vehicles Enter/Exit 32-48 (3 movements, 10 -20 second each) Quarry – Blast 62-64 (1 instance, 2 second duration)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
29/09/2022	19:55 (Evening)	56	47	45	WD: E WS: 1.5m/s Rain: Nil	Insects <40 Distant Traffic 40-48 Wind 43-56 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
29/09/2022	23:46 (Night)	53	46	44	WD: SE WS: 1.0m/s Rain: Nil	Insects 40-45 Distant Traffic 40-53 Wind <40 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Assessment Results - Location N4

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N4 for the NMA are presented in **Table 6**.

Table 6 Operator-Attended Noise Survey Results – Location N4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
27/09/2022	14:34 (Day)	57	40	34	WD: W WS: 1.0m/s Rain: Nil	Birds 30-48 Traffic 30-57 Wind 31-52 Distant Thunder 38-51 Quarry – Haul Trucks 30-38 (barely to audible 50% measurement)
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<35
29/09/2022	20:55 (Evening)	62	47	44	WD: E WS: 2.0m/s Rain: Nil	Wind 40-62 Insects 40-43 Traffic 40-57 Train 45-53 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<37
29/09/2022	22:35 (Night)	55	45	44	WD: SE WS: 1.5m/s Rain: Nil	Insects 40-43 Traffic 40-48 Wind 40-55 Quarry Inaudible
	Lynwood Quarry $L_{Aeq(15min)}$ Contribution					<36
	Lynwood Quarry $L_{A1(1min)}$ Contribution					<47

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5 Discussion

5.1 Discussion of Results - Location N1

Monitoring on Tuesday 27 September 2022 and Thursday 29 September 2022 identified quarry noise was inaudible during daytime, evening and night measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources measured included wind, distant traffic, birds, insects, passing trains, aircraft, and distant thunder.

5.2 Discussion of Results - Location N2

Monitoring Tuesday 27 September 2022 and Thursday 29 September 2022 identified quarry noise was inaudible during daytime, evening and night-time measurement with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included wind, birds, traffic, insects, passing trains, residential and construction noise.

5.3 Discussion of Results - Location N3

Monitoring on Tuesday 27 September 2022 and Thursday 29 September 2022 identified that quarry noise was audible during daytime and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources audible during the survey were trucks entering and exiting site and blasting noise. Extraneous noise sources included wind, birds, distant traffic, and insects.

5.4 Discussion of Results - Location N4

Monitoring on Tuesday 27 September 2022 and Thursday 29 September 2022 identified quarry noise was audible during daytime measurements and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included haul truck movements, Extraneous noise sources included birds, traffic, insects, wind, distant thunder and passing trains.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) for Holcim (Australia) Pty Ltd at the Lynwood Quarry, Marulan, NSW. The assessment was completed to assess the quarry's compliance with the relevant noise criteria during Quarter 3, ending September 2022.

Attended noise monitoring was undertaken on Tuesday 27 September 2022 and Thursday 29 September 2022 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were generally audible at two locations during the day period, however quarry noise emissions were below the relevant noise criteria, satisfying the applicable noise criteria throughout the survey period.

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Appendix A - Glossary of Terms

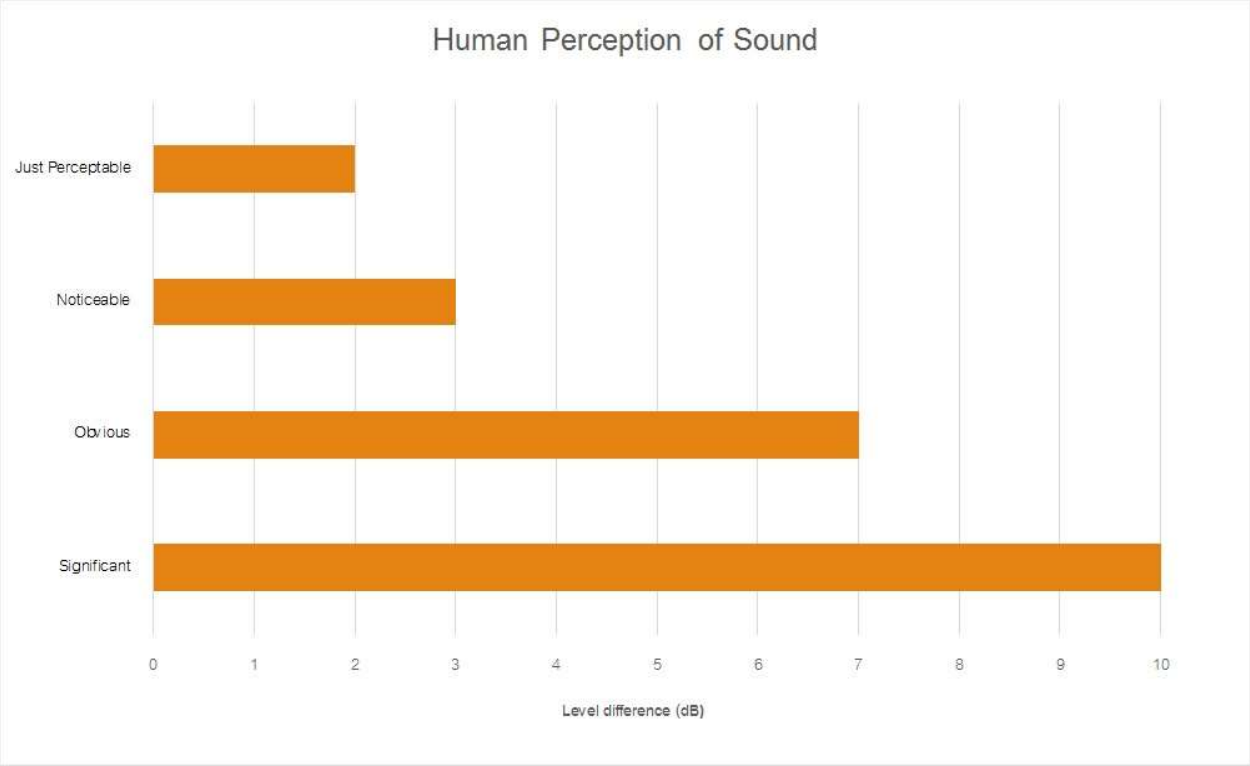
Table A1 provides a number of technical terms have been used in this report.

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 LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
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), dB(L)	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 (LW)	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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Intended for
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Document type
Report

Date
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Project number
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QUARTERLY NOISE MONITORING ASSESSMENT – QUARTER 4 2022 LYNWOOD QUARRY, MARULAN, NSW

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Project name	**Quarterly Noise Monitoring Assessment for Lynwood Quarry – Quarter 4 2022**
Project no.	**318000911**
Recipient	**Wayne Beattie**
Document type	**Report**
Version	**1**
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Prepared by	**Jake Bourke, Nathalie Tomson**
Checked by	**Patrick Murray**
Approved by	**Greer Laing**
Description	**Data collected on 6 and 7 December 2022 for the quarterly period ending December 2022 at Marulan, NSW, as part of the noise monitoring program**

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

CONTENTS

ABBREVIATIONS AND DEFINITIONS

Ambient Noise	The all-encompassing noise within a given environment. It is the composite of sounds from many sources, both near and far.
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 LA90 descriptor (see below).
dB	Abbreviation for decibel, a measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm of a given sound power to a reference power.
dB(A)	A measure of A-weighted sound levels. A Weighting is an adjustment made to the sound level measurement to approximate the response of the human ear.
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods. Normal daily traffic is not extraneous noise.
LA1	The noise level, measured in dB(A), which is exceeded for 1 per cent of the measurement period.
LA1(1min)	The noise level, measured in dB(A), which is exceeded for 1 per cent of the time over a 1-minute measurement period, i.e., is exceeded for 0.6 seconds. This measure can approximate to the maximum noise level but may be less if there is more than 1 noise event during this 0.6 second period.
LA10	The noise level, measured in dB(A), which is exceeded for 10 per cent of the time.
LA90	The noise level, measured in dB(A), which is exceeded for 90 per cent of the time, referred to as the background noise level. This is considered to represent the background noise (see above).
LAeq	The level of noise equivalent to the energy average of noise levels occurring over a defined measurement period.
LAeq (period)	The average equivalent noise level, measured in dB(A), during a measurement period (e.g., 15-minute, day, evening, or night).
LAmax	The A-weighted sound pressure level that represents the maximum noise level measured over the time that a given sound is measured.
NMA	Noise Monitoring Assessment
NMP	Noise Management Plan

Source: Noise Guide for Local Government (NSW EPA, 2013)

1. OVERVIEW

1.1 Project Driver

Ramboll Australia Pty Ltd (Ramboll) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry ("the quarry") at Marulan, NSW.

This NMA was done in accordance with the following documents:

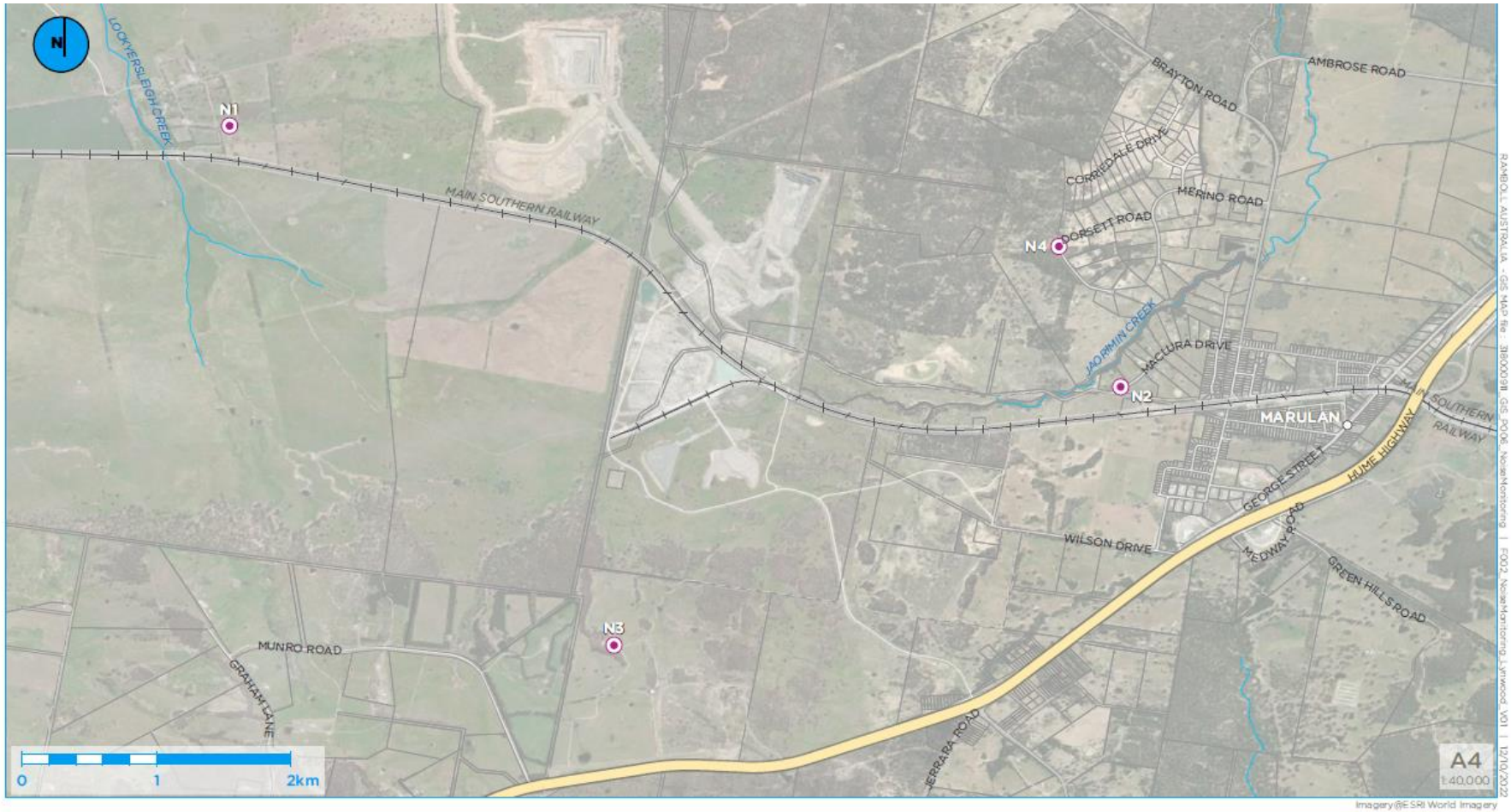
- Noise Policy for Industry (NPI) (NSW EPA, 2017).
- Lynwood Quarry Noise Management Plan (NMP) (Holcim Australia, 2019).
- Environment Protection Licence (EPL) number 12939 (NSW EPA, 2021).
- Development Consent DA 128-5-2005 (Minister for Planning, 2017).
- Australian Standard AS 1055:2018 Acoustics — Description and measurement of environmental noise (Standards Australia, 2018).
- IEC 60942 Ed. 3.0 b:2003 Electroacoustics - Sound calibrators (Standards Australia, 2003).

This NMA has been undertaken for the quarterly period October to December 2022, and forms part of the monitoring program to determine compliance with conditions of the Development Consent.

1.2 Site Location and Sensitive Receptors

The quarry is located at 278 Stoney Creek Road, approximately 4 km to the west of the Marulan railway station and town centre. Sensitive receptors surrounding the quarry are primarily rural and residential (to the west of the site). The Hume Highway is located to the east and south of the quarry. Highway traffic (Hume Highway) is a dominant noise source.

The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1**.



Legend

- Noise monitoring location

Figure 1 : Noise monitoring locations at Lynwood Quarry

2. NOISE CRITERIA

Table 2-1 includes the applicable noise criteria outlined in the Development Consent and the EPL for the 16 residential receivers surrounding the quarry (L1–L16), and the four monitoring locations adopted from the NMP that are deemed representative and applicable for this NMA (N1–N4). It should be noted that N3 was only accessible during the day and evening; night monitoring was completed at nearby location NM3 but on reflection the location within the quarry boundary to deemed unsuitable.

Table 2-1: Monitoring locations and noise criteria

EPL ID	Receiver Description	Monitoring Locations		Day[1]	Evening[2]	Night[3]	Night[3]
		NMP ID	Address	LAeq (15min)	LAeq (15min)	LAeq (15min)	LA1 (1min)
				dBA			
L1	West of the Granite Pit.	N1	1114 Carrick Road, Marulan	35	35	35	45
L2	Northeast of the site	-	-	35	35	35	45
L3	Northeast of the site	-	-	35	35	35	45
L4	East of the site in Marulan	-	-	35	37	35	46
L5	East of the site in Marulan	-	-	35	35	35	46
L6	East of the site in Marulan	N2	End of Maclura Drive, Marulan	35	37	36	46
L7	East of the site in Marulan	-	-	38	38	35	55
L8	East of the site in Marulan	-	-	39	38	36	55
L9	East of the site in Marulan	-	-	39	39	37	56
L10	Southeast of the site in Old Marulan	-	-	42	42	40	53
L11	South of the site	N3	Northern Boundary, 16038 Hume Highway, Marulan	35	35	36	47
L12	East of the site in Marulan	N4	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47
L13	East of the site in Marulan	-	-	40	38	37	47
L14	South of the site	-	-	35	35	35	47
L15	South of the site	-	-	35	35	35	47
L16	Northeast of the site	-	-	35	35	35	45

[1] 7 am–6 pm Monday to Saturday and 8 am–6 pm Sunday and public holidays

[2] 6 pm–10 pm Monday to Sunday

[3] 10 pm–7 am Monday to Saturday and 10 pm–8 am Sunday and public holidays

3. METHODOLOGY

The monitoring program was designed in accordance with the procedures described in Australian Standard AS 1055:2018 and the Approval Documents referenced in Section 1. The measurements were carried out using a RION Sound Level Meter NL-52 on Tuesday 6 December and Wednesday 7 December 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672-1:2013/2002 class 1. Calibration of all instrumentation was checked prior to and following measurements using a Pulsar Acoustic Calibrator 105 which carried a current NATA calibration and complies with IEC 60942:2003. Drift in calibration did not exceed ±0.3 dBA.

Attended noise monitoring was conducted for 15-minutes in duration during the day, evening and night periods over two days. Where possible, throughout each measurement the operator quantified the contribution of each significant noise source.

Where the quarry was not distinctly audible during the attended monitoring, the quarry contribution is estimated to be at least 10 dBA below the ambient noise level, as determined by the LA90, or estimated to be less than criteria value.

4. RESULTS AND DISCUSSION

4.1 Location N1

Noise monitoring at location N1 conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise during the day, evening, and night. The results and observations taken during the monitoring events at Location N1 are presented in **Table 4-1**.

The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. Extraneous noise sources measured included birds, barking dogs, children yelling, wind, rustling leaves, vehicles and a passing freight train.

Table 4-1: Noise survey results and observations for Location N1

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmax	LAeq	LA90						
06-12-22	7:31 (Day)	77	52	27	WD: n/a WS: 0 Rain: Nil	Birds Ute Dogs barking Children yelling Quarry inaudible	<35	35	n/a	n/a
06-12-22	19:52 (Evening)	73	54	40	WD: 270° WS: 3.6 m/s Rain: Nil	Dogs barking 49-70 Wind/rustling leaves 48-54 Quarry inaudible	<35	35	n/a	n/a
07-12-22	6:24 (Night)	77	61	32	WD: n/a WS: 0 Rain: Nil	Background 34 Birds 68 Freight train passing 65-76 Quarry inaudible	<35	35	<45	45

4.2 Location N2

Noise monitoring at location N2 conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise at night, with audible noise measured during the day and evening. The results and observations taken during the monitoring events at Location N2 are presented in Table 4-1.

The quarry was faintly audible during all periods. It was difficult to discern construction activities at this location from quarry activities during the day period. The quarry contribution was noted as below criteria when it was audible when construction activities ceased. The dominant noise source was motorway traffic. Extraneous noise sources measured included birds, earth moving construction, excavators, starting machinery, truck movement and motorway traffic.

Table 4-2 Noise survey results and observations for Location N2

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmax	LAeq	LA90						
06-12-22	10:06 (Day)	72	49	40	WD: 90° WS: 1.2 m/s Rain: Nil	Birds 51 Construction earth moving 46 Truck 72 Excavator 49 Machine starting 45 Motorway 44 Quarry faintly audible	<41[1]	35	n/a	n/a
06-12-22	18:33 (Evening)	55	44	41	WD: 90° WS: 1.9 m/s Rain: Nil	Birds 44-45 Motorway traffic 43-48 Wind/rustling leaves 42-47 Car turning around 48 Quarry faintly audible	<37	37	n/a	n/a
07-12-22	5:29 (Night)	71	55	41	WD: n/a WS: 0 Rain: Nil	2 x Freight train passing 50-69 Birds 48-50 Road Quarry inaudible	<36	36	<46	46

[1] Noted that construction works adjacent to monitoring location confounded ability to isolate quarry noise from construction noise

4.3 Location N3

Noise monitoring at location N3 conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise during the day and evening. The location was unable to be accessed during the night period due to a locked gate, so measurements were completed at an intermediate monitoring location approximately 550m closer to the quarry within the site boundary. The results and observations taken during the monitoring events at Location N3 are presented in **Table 4-13**.

The quarry was audible during the night period, above the noise criteria, but the monitoring location used within the quarry boundary was deemed unsuitable given distance from nearest sensitive receiver (approximately 500 m) when compared to the nominated location. For future monitoring, access will be sought through the locked gate or an alternative publicly accessible location on Munro Road will be used. Extraneous noise sources measured included birds, motorway traffic, wind, and rustling leaves.

Table 4-3: Noise survey results and observations for Location N3

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmax	LAeq	LA90						
06-12-22	17:18 (Day)	63	45	42	WD: 180º WS: 1.1 m/s Rain: Nil	Birds 48-51 Motorway traffic 50-63 Quarry inaudible	<35	<35	n/a	n/a
06-12-22	18:00 (Evening)	56	47	44	WD: 180º WS: 1.1 m/s Rain: Nil	Motorway traffic/road 46-51 Wind/rustling leaves 47-50 Quarry inaudible	<35	<35	n/a	n/a

Location unable to be accessed for night monitoring (i.e. unexpected locked gate)

4.4 Location N4

Noise monitoring at location N4 was conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise during the evening and night, with audible noise measured during the day. The results and observations taken during the monitoring events at location N2 are presented in **Table 4-1**.

These results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance, where quarry contribution was noted. Extraneous noise sources measured included birds, aircraft, passing cars, motorway traffic, wind, rustling leaves and a passing train.

Table 4-4: Noise survey results and observations for Location N4

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmax	LAeq	LA90						
06-12-22	9:34 (Day)	63	42	33	WD: 180° WS: 1.1 m/s Rain: Nil	Birds 55 Motorway traffic 35 Car passing 57 Quarry plant audible	<37	37	n/a	n/a
06-12-22	19:15 (Evening)	67	45	39	WD: 270° WS: 1.8 m/s Rain: Nil	Motorway traffic 43-45 Aircraft 54 Car on gravel road 44 Cars passing 56-58 Wind/rustling leaves 46 Birds 43-45 Quarry inaudible	<37	37	n/a	n/a
07-12-22	5:50 (Night)	63	44	37	WD: n/a WS: 0 Rain: Nil	Birds 53 Motorway traffic 42-47 Train 50 Quarry inaudible	<36	36	<47	47

5. CONCLUSION

Monitoring was carried out on Tuesday 6 December 2022 and Wednesday 7 December 2022 at four locations selected as representative to the sensitive receptors at the surroundings to Lynwood Quarry. No audible noise above the noise criteria from quarry operations was recorded at any of the four locations during the day, evening, and night periods. It was difficult to discern quarry noise from sub-division construction noise in location N2 during the day period.

This noise monitoring assessment completed by Ramboll at the Holcim Lynwood Quarry, Marulan, NSW as a quarterly requirement of the NMP showed compliance to the relevant noise criteria.

6. REFERENCES

Holcim Australia (2019) *Lynwood Quarry, Noise Management Plan*.

Minister for Planning and Infrastructure (2005) 'Development Consent DA 128-5-2005, Lynwood Hard Rock Quarry, and associated infrastructure'.

NSW EPA (2021) Environment Protection Licence number 12939

NSW EPA (2013) *Noise Guide for Local Government*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/20130127nglg.pdf (Accessed: 25 October 2022).

NSW EPA (2017) *Noise Policy for Industry (NPfI)*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/17p0524-noise-policy-for-industry.pdf (Accessed: 25 October 2022).

Standards Australia (2018) *AS 1055:2018 Acoustics—Description and measurement of environmental noise*. Australian Standard. Available at: https://infostore.saiglobal.com/preview/825367946534.pdf?sku=1131503_SAIG_AS_AS_2626154 (Accessed: 19 January 2023).

Standards Australia (2003) *AS 60942:2003 Electroacoustics - Sound calibrators.* Australian Standard.