

# Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW  
Quarter 1 Ending March 2020.



# Document Information

## Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 1 Ending March 2020

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 2020, 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**.

<b>Table 1 Noise Criteria<sup>1</sup></b>				
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 <sup>1</sup>	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, dB LAeq(15min)**

Location	NMP ID	Address	Criteria		
			Day	Evening	Night
N1	L1	1114 Carrick Road, Marulan	35	35	35
N2	L6	End of Maclura Drive, Marulan	35	37	36
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan <sup>1</sup>	35	35	35 <sup>2</sup>
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36

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.

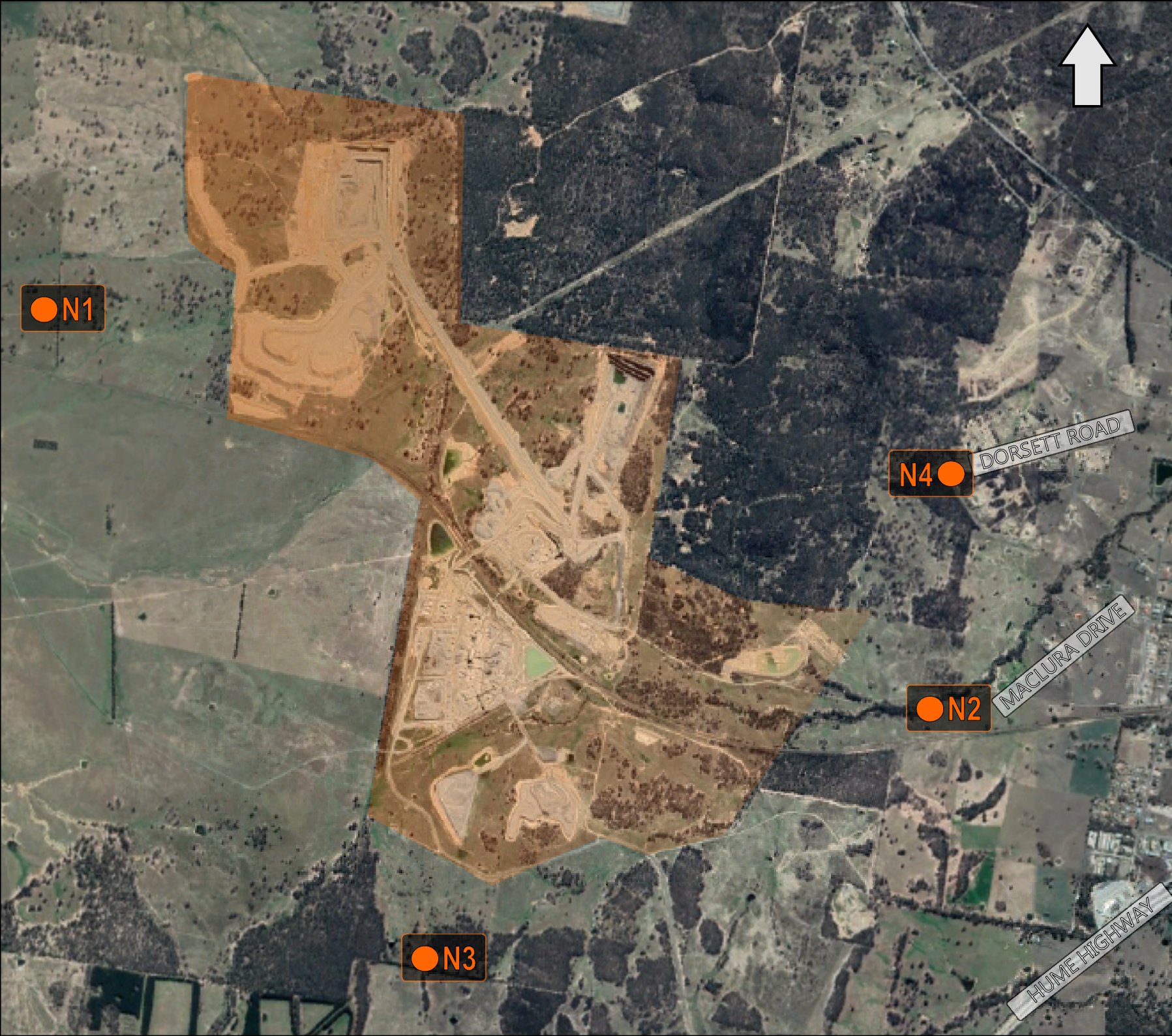
#### 3.2 Assessment Methodology

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 4 February 2020 and Thursday 6 February 2020. 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  $\pm 0.5$  dBA.

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 4 February 2020 and Thursday 6 February 2020 to satisfy the requirements of the NMP.



Extraneous noise sources were excluded from the analysis to determine the  $L_{Aeq}(15min)$  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 A4 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**  
**LOCALITY PLAN**  
REF: MAC180611-02



KEY	
	RECEIVER LOCATION
	SITE LOCATION



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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
		LAmax	LAeq	LA90		
04/02/2020	19:27 (Evening)	53	41	37	WD: NE	Wind 35-48
					WS: 1.5m/s	Distant Traffic <25
					Rain: Nil	Birds 35-53
						Holcim Vehicles/Alarms <30
Lynwood Quarry LAeq(15min) Contribution						<30
06/02/2020	10:27 (Day)	71	47	37	WD: E	Wind 40-55
					WS: 1.5m/s	Birds 37-45
					Rain: Nil	Farm Vehicle 40-71
						Holcim Vehicles <32
Lynwood Quarry LAeq(15min) Contribution						<32

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
04/02/2020	20:28 (Evening)	61	43	39	WD: E	Wind 33-48
					WS: 1.5m/s	Distant Traffic 33-41
					Rain: Nil	Train 38-61
						Holcim Site Inaudible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
06/02/2020	09:05 (Day)	73	48	40	WD: SE	Distant Traffic 34-42
					WS: 1.0m/s	Birds 40-62
						Wind 35-38
						Train 44-73
						Aircraft 42-51
						Holcim Site Inaudible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
04/02/2020	21:07 (Evening)	54	42	37		Wind 32-47
					WD: E	Distant Traffic 32-44
					WS: 1.5m/s	Train 38-54
					Rain: Nil	Holcim Vehicles/Alarms <30-32
						Holcim Hum <30
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<32
06/02/2020	11:15 (Day)	57	41	38		Birds 34-57
					WD: SE	Distant Traffic 34-41
					WS: 1.0m/s	Trucks on Access Road 36-49
					Rain: Nil	Holcim Loader <32-34
						Holcim Vehicles/Alarms <34-39
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
04/02/2020	20:04 (Evening)	70	43	37		Wind 34-48
					WD: E	Birds 34-61
					WS: 1.5m/s	Local Traffic 40-60
					Rain: Nil	Operator 70
						Holcim Site Inaudible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
06/02/2020	09:26 (Day)	55	39	35		Birds 33-55
					WD: SE	Aircraft 40-47
					WS: 1.5m/s	Wind 30-36
					Rain: Nil	Holcim Site Inaudible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30

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 4 February 2020 identified that quarry noise was just audible during the evening period with quarry noise contributions estimated to be below 30dBA. Monitoring on Thursday 6 February 2020 identified that quarry noise was just audible during the day period with quarry noise contributions estimated to be below 32dBA. Therefore, quarry noise emissions satisfy the relevant noise criteria for both periods. Quarry noise sources audible during the survey included Holcim site vehicles and vehicle reversing alarms. Extraneous noise sources included wind in trees, birds, distant traffic and farm vehicles.

### 5.2 Discussion of Results - Location N2

Monitoring on Tuesday 4 February 2020 and Thursday 6 February 2020 identified that quarry noise was inaudible during both evening and daytime surveys with contributions estimated to be below 30dBA therefore satisfying the relevant noise criteria for both measurements. Extraneous noise sources measured included wind in trees, trains, distant traffic, birds, and aircraft.

### 5.3 Discussion of Results - Location N3

Monitoring on Tuesday 4 February 2020 identified that quarry noise was audible during the evening period with quarry noise contributions estimated to be below 32dBA. Monitoring on Thursday 6 February 2020 identified that quarry noise was audible during the day period with quarry noise contributions estimated to be below 35dBA. Therefore, quarry noise emissions satisfy the relevant noise criteria for both periods. Quarry noise sources audible during the survey included Holcim site vehicles, vehicle reverse alarms and quarry hum. Extraneous noise sources included wind in trees, trains, birds and distant traffic.

### 5.4 Discussion of Results - Location N4

Quarry noise was inaudible during the measurements conducted on Tuesday 4 February 2020 and Thursday 6 February 2020. Quarry noise emissions were estimated to be below 30dBA for both evening and daytime surveys, therefore satisfying relevant noise criteria for both measurements. Extraneous noise sources included wind in trees, aircraft, operator noise, birds and local traffic.

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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 2020.

Attended noise monitoring was undertaken on Tuesday 4 February 2020 and Thursday 6 February 2020 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were occasionally audible, 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

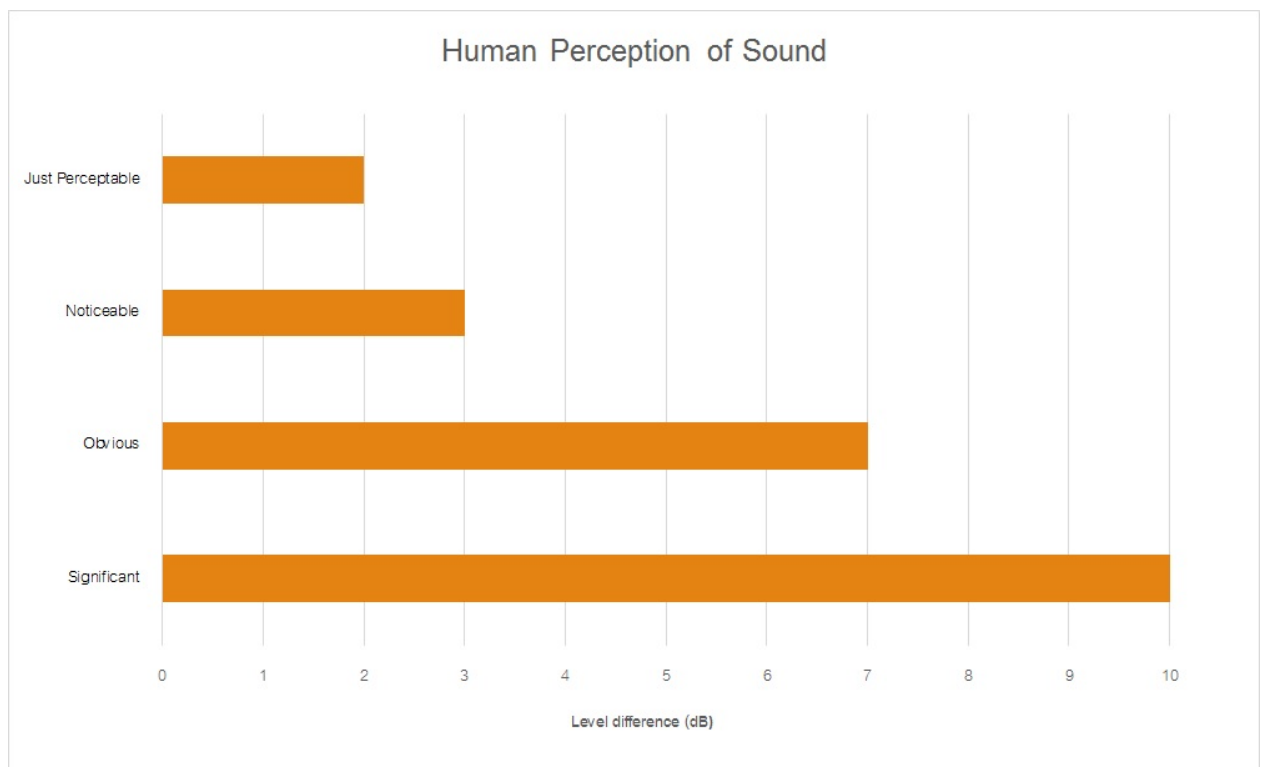
Table A1 provides a number of technical terms have been used in this report.

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.
LAm <sub>ax</sub>	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W<sub>0</sub> is the sound reference power at 10-12 watts.</p>

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 2020.

# *Document Information*

## Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 2 Ending June 2020

Prepared for: Holcim (Australia) Pty Ltd

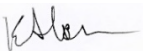

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MAC180611-02RP8	Final	29 April 2020	Kristian Allen		Rod Linnett	

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# 1 Introduction

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

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- 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**.

<b>Table 1 Noise Criteria<sup>1</sup></b>				
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 <sup>1</sup>	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**

Location	NMP ID	Address	Criteria dB LAeq(15min)		
			Day	Evening	Night
N1	L1	1114 Carrick Road, Marulan	35	35	35
N2	L6	End of Maclura Drive, Marulan	35	37	36
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan <sup>1</sup>	35	35	35 <sup>2</sup>
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36

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

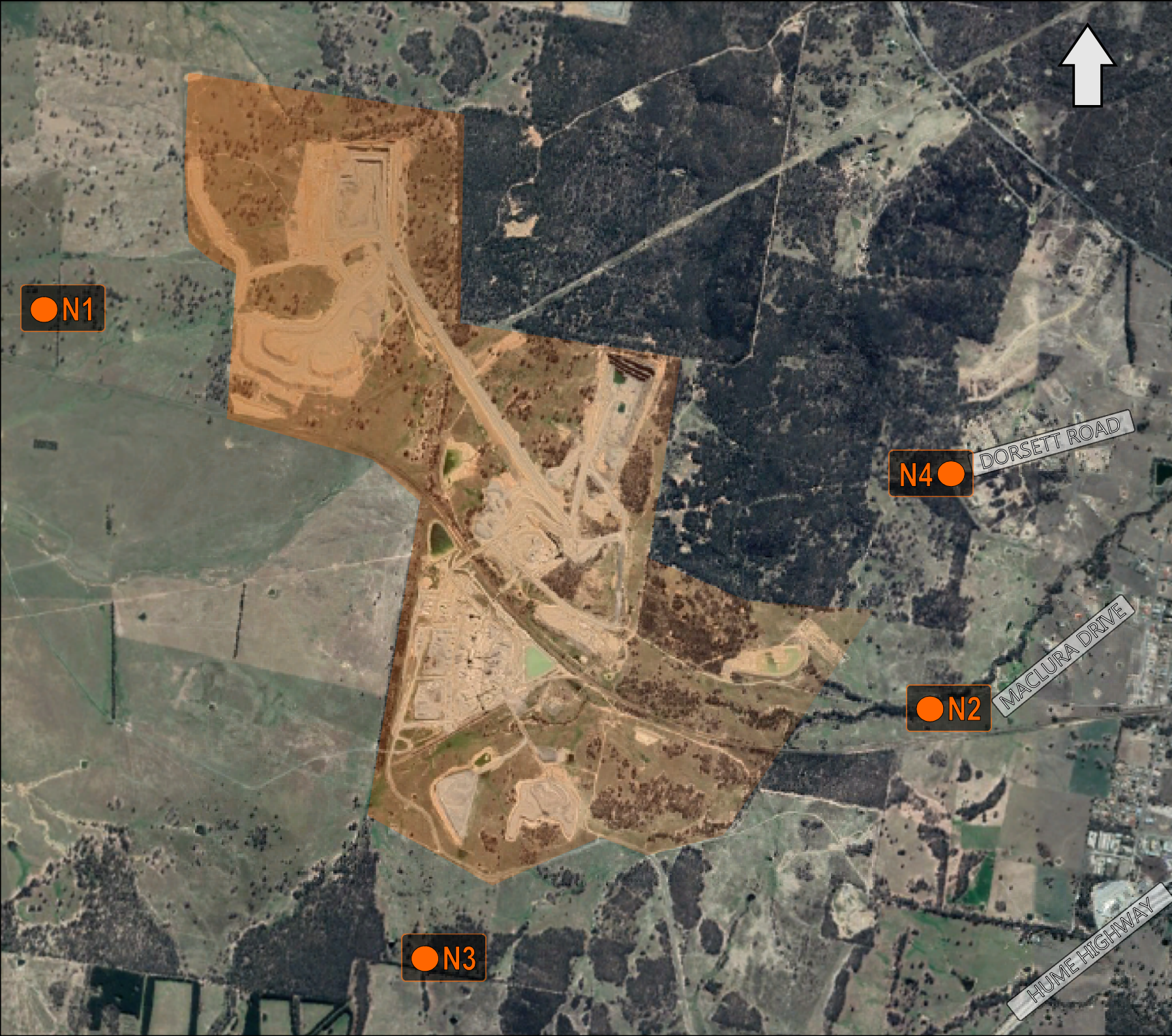
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Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Tuesday 21 April 2020 and Wednesday 22 April 2020 to satisfy the requirements of the NMP.

Extraneous noise sources were excluded from the analysis to determine the  $L_{Aeq}(15min)$  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 A4 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**

**LOCALITY PLAN**

REF: MAC180611-02



**KEY**



RECEIVER LOCATION



SITE LOCATION



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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
		LAmax	LAeq	LA90		
21/04/2020	15:06	74	41	32	WD: W	Birds 32-56
	(Day)				WS: 1.5m/s	Wind to 51
					Rain: Nil	Operator/Car 74
Lynwood Quarry LAeq(15min) Contribution						<30
22/04/2020	12:39	74	56	37	WD: W	Wind 33-56
	(Day)				WS: 2.5m/s	Birds 40-45
					Rain: Nil	Train 37-74
Lynwood Quarry LAeq(15min) Contribution						<30

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
21/04/2020	13:59 (Day)	56	39	36	WD: SW	Wind 35-56
					WS: 1.5m/s	Birds 30-38
					Rain: Nil	Holcim Vehicles <30
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
22/04/2020	11:37 (Day)	69	47	41	WD: SW	Wind 38-69
					WS: 2.5m/s	Birds 35-40
					Rain: Nil	Holcim Vehicles <30
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
21/04/2020	13:20 (Day)	54	41	36		Wind 33-54
					WD: SW	Birds 30-35
					WS: 1.5m/s	Distant Traffic 30-35
					Rain: Nil	Holcim Vehicles 30-38
						Holcim Site Hum <30
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35
22/04/2020	10:45 (Day)	68	45	37		Wind 32-68
					WD: SW	Distant Traffic 32-36
					WS: 2.5m/s	Birds 32-41
					Rain: Nil	Holcim Vehicles <34-38
						Holcim Site Hum 30-33
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
21/04/2020	14:23 (Day)	68	46	36	WD: SW WS: 2.0m/s Rain: Nil	Wind 33-55
						Local Traffic 36-68
						Birds 30-42
						Construction Noise <30-32
						Holcim Vehicles <30
						Holcim Reverse Alarms <30
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
22/04/2020	12:00 (Day)	72	53	43	WD: SW WS: 3.0m/s Rain: Nil	Wind 40-72
						Local Traffic 41-64
						Birds 37-68
						Construction Noise <35
						Holcim Site Inaudible
						Lynwood Quarry L <sub>A</sub> eq(15min) Contribution

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.

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## 5 Discussion

### 5.1 Discussion of Results - Location N1

Monitoring on Tuesday 21 April 2020 and Wednesday 22 April 2020 identified that quarry noise was inaudible during both daytime measurements with contributions estimated to be below 30dBA therefore satisfying the relevant noise criteria for both measurements. Extraneous noise sources included wind in trees, birds, trains and operator noise.

### 5.2 Discussion of Results - Location N2

Monitoring on Tuesday 21 April 2020 and Wednesday 22 April 2020 identified quarry noise was just audible during both daytime measurements with contributions estimated to be below 30dBA, therefore satisfying the relevant noise criteria for both measurements. Quarry noise sources included vehicle movements. Extraneous noise sources measured included wind in trees and birds.

### 5.3 Discussion of Results - Location N3

Monitoring on Tuesday 21 April 2020 and Wednesday 22 April 2020 identified that quarry noise was audible during both daytime measurements with quarry noise contributions estimated to be below 35dBA. Therefore, quarry noise emissions satisfy the relevant noise criteria for both measurements. Quarry noise sources audible during the survey included vehicle movements and quarry hum. Extraneous noise sources included wind in trees, birds and distant traffic.

### 5.4 Discussion of Results - Location N4

Monitoring on Tuesday 21 April 2020 identified that quarry noise was just audible during the daytime measurements with quarry noise contributions estimated to be below 30dBA. Monitoring on Wednesday 22 April 2020 identified that quarry noise was inaudible during the day period with quarry noise contributions estimated to be below 35dBA, therefore, satisfying relevant noise criteria for both measurements. Quarry noise sources audible during the survey included vehicles movements and vehicle reverse alarms. Extraneous noise sources included wind in trees, birds, construction noise and local traffic.

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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 2020.

Attended noise monitoring was undertaken on Tuesday 21 April 2020 and Wednesday 22 April 2020 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were occasionally audible, 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

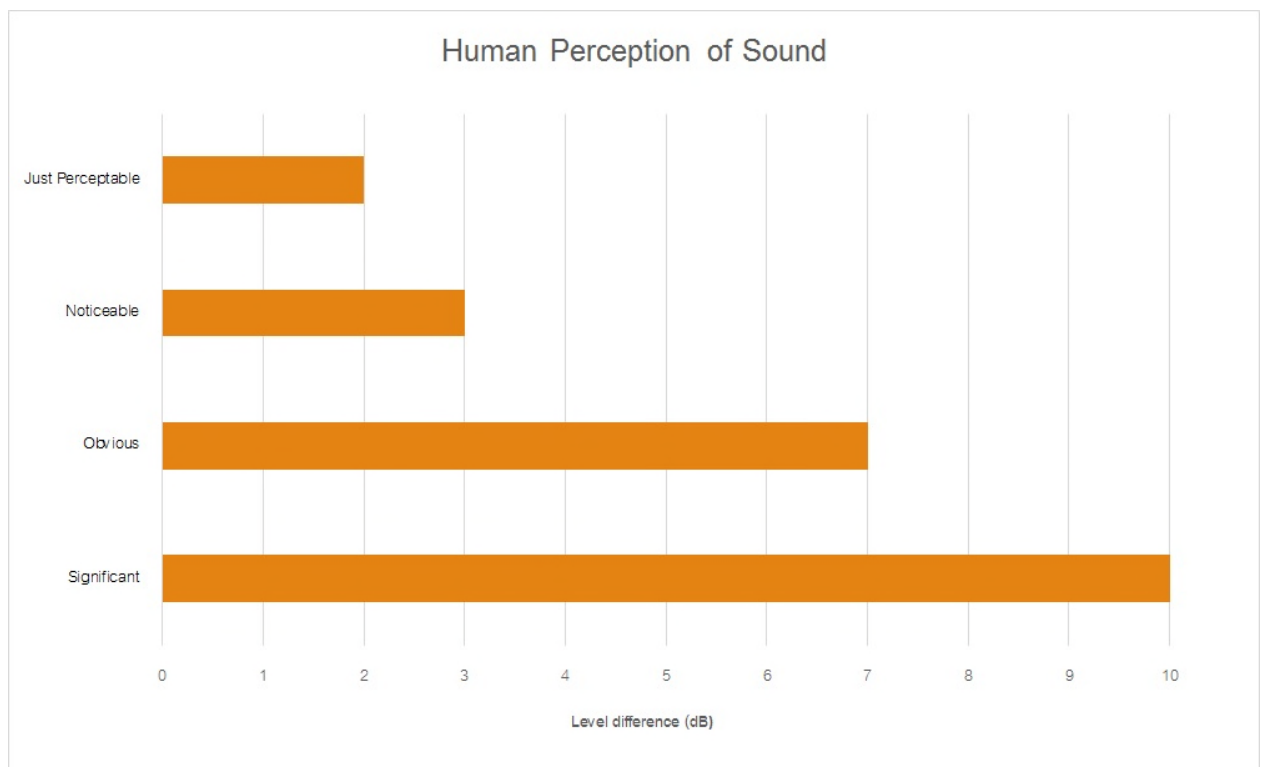
Table A1 provides a number of technical terms have been used in this report.

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.
LAm <sub>ax</sub>	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W<sub>0</sub> is the sound reference power at 10-12 watts.</p>

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 3 Ending September 2020.

# Document Information

## Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 3 Ending September 2020

Prepared for: Holcim (Australia) Pty Ltd

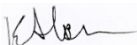

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# 1 Introduction

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 September 2020, 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**.

<b>Table 1 Noise Criteria<sup>1</sup></b>				
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 <sup>1</sup>	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 LAeq(15min)		
			Day	Evening	Night
N1	L1	1114 Carrick Road, Marulan	35	35	35
N2	L6	End of Maclura Drive, Marulan	35	37	36
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan <sup>1</sup>	35	35	35 <sup>2</sup>
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36

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 16 September 2020 and Thursday 17 September 2020. 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  $\pm 0.5$  dBA.

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 16 September 2020 and Thursday 17 September 2020 to satisfy the requirements of the NMP.

Extraneous noise sources were excluded from the analysis to determine the  $L_{Aeq}(15min)$  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 A4 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.



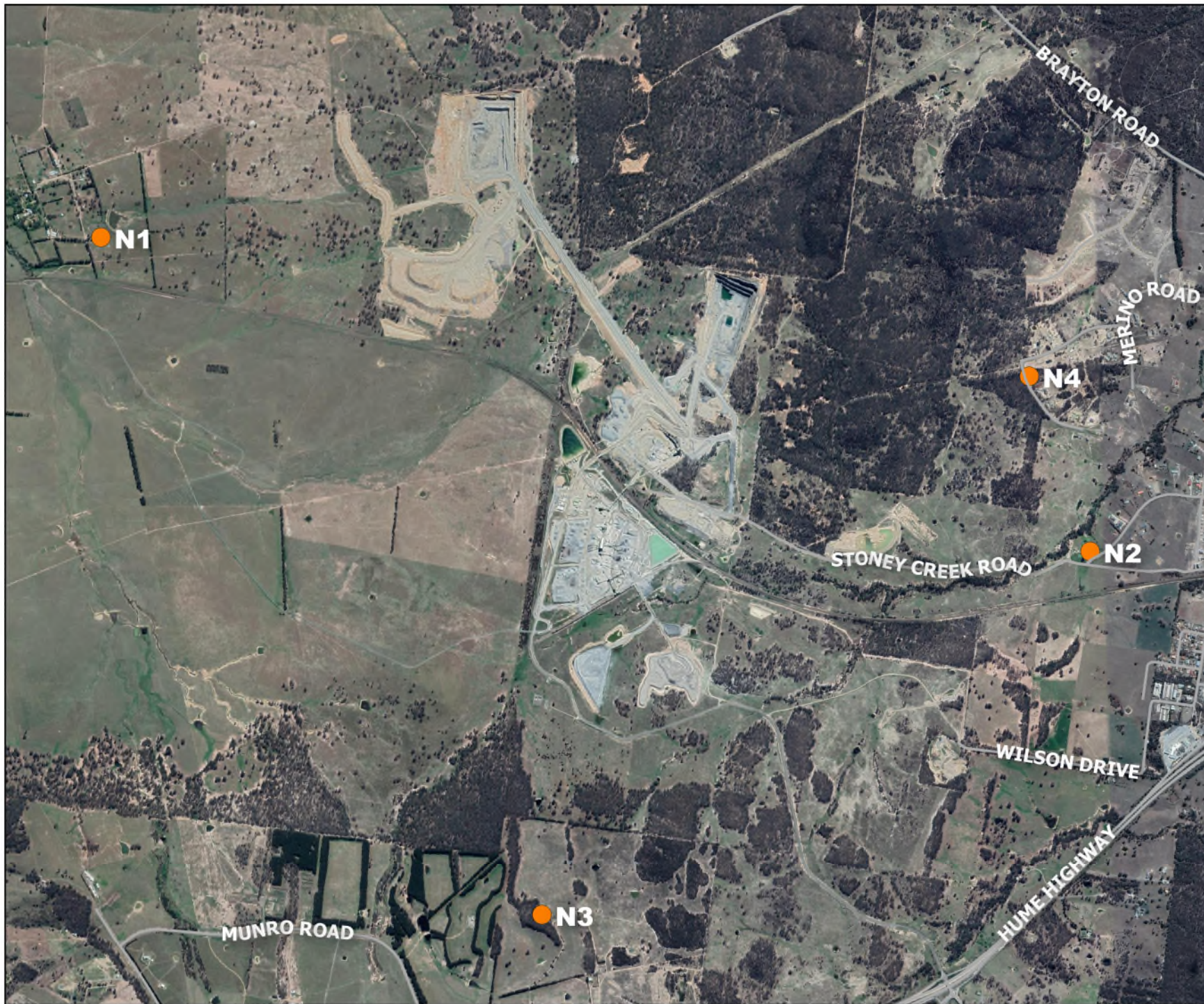


FIGURE 1

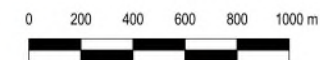
Site Locality

MAC180611-02

Holcim Lynwood Quarry

**KEY**

● Noise Monitoring Locations



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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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
16/09/2020	14:31 (Day)	68	50	37	WD: NW WS: 1.5m/s Rain: Nil	Wind 37-49
						Livestock 34-38
						Dogs 34-41
						Birds 34-56
						Train 42-68
						Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
18/09/2020	00:03 (Night)	55	46	40	WD: SE WS: 1.0m/s Rain: Nil	Insects 37-55
						Distant Traffic <34-37
						Livestock <34-37
						Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
16/09/2020	13:24 (Day)	59	39	36		Birds 37-59
					WD: NW	Wind <30-46
					WS: 1.5m/s	Distant Traffic <34-38
					Rain: Nil	Quarry Noise <30
						(Infrequent 1-2 second durations)
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
17/09/2020	22:57 (Night)	74	55	42		Distant Traffic 38-49
					WD: SE	Train 40-74
					WS: 1.0m/s	Insects <40
					Rain: Nil	Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
16/09/2020	12:33 (Day)	60	46	42	WD: NW WS: 2.5m/s Rain: Nil	Wind 38-51
						Operator 60
						Birds 35-49
						Distant Traffic <38
						Quarry Haul Trucks <35
						(<5 minute total duration)
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35
17/09/2020	22:13 (Night)	48	42	40	WD: SE WS: 1.0m/s Rain: Nil	Insects 35-41
						Distant Traffic <35-45
						Wind <35-43
						Operator 48
						Quarry Vehicles <35
						(<5 minute total duration)
Quarry Reverse Alarms <35 (Infrequent <5 second durations)						<35
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
16/09/2020	13:49 (Day)	57	45	36	WD: NW	Wind 32-57
					WS: 2.0m/s	Construction Works <30
					Rain: Nil	Birds <33-38
						Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
17/09/2020	23:20 (Night)	48	38	34	WD: SE	Distant Traffic 36-45
					WS: 1.0m/s	Operator 48
					Rain: Nil	Insects <27
						Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30

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 16 September 2020 and Thursday 17 September 2020 identified that quarry noise was inaudible during both daytime and night time measurements, therefore quarry noise contributions were estimated to satisfy the relevant daytime and night time noise limits. Extraneous noise sources included wind in trees, birds, trains, insects, dogs barking, distant traffic and livestock.

### 5.2 Discussion of Results - Location N2

Monitoring on Wednesday 16 September 2020 identified quarry noise was just audible during daytime measurements and monitoring on and Thursday 17 September 2020 identified quarry noise was inaudible during night time measurements with quarry noise contributions estimated to satisfy the relevant daytime and night time noise limits. Quarry noise sources included machine noise. Extraneous noise sources measured included wind in trees, distant traffic, trains, insects and birds.

### 5.3 Discussion of Results - Location N3

Monitoring on Wednesday 16 September 2020 and Thursday 17 September 2020 identified that quarry noise was just audible during both daytime and night time measurements with quarry noise contributions estimated to satisfy the relevant daytime and night time noise limits. Quarry noise sources audible during the survey included haul trucks, vehicle and loader movements and reverse alarms. Extraneous noise sources included wind in trees, operator noise, birds, insects and distant traffic.

### 5.4 Discussion of Results - Location N4

Monitoring on Wednesday 16 September 2020 and Thursday 17 September 2020 identified that quarry noise was inaudible during both daytime and night time measurements, therefore quarry noise contributions were estimated to satisfy the relevant daytime and night time noise limits. Extraneous noise sources included wind in trees, birds, construction noise, insects, distant traffic and operator noise.

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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 2020.

Attended noise monitoring was undertaken on Wednesday 16 September 2020 and Thursday 17 September 2020 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were occasionally audible, 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

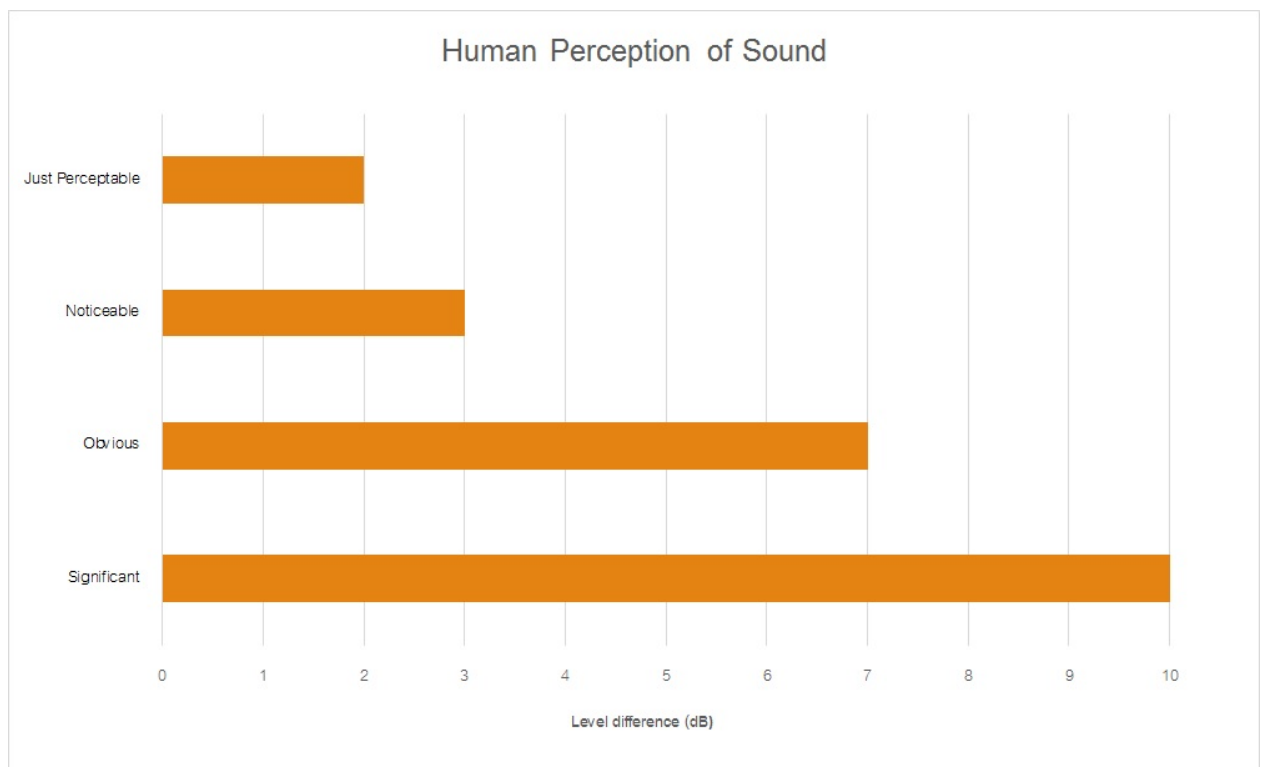
Table A1 provides a number of technical terms have been used in this report.

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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.
LAmx	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W<sub>0</sub> is the sound reference power at 10-12 watts.</p>

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 4 Ending December 2020.

# Document Information

## Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 4 Ending December 2020

Prepared for: Holcim (Australia) Pty Ltd



Prepared by: Muller Acoustic Consulting Pty Ltd

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MAC180611-02RP10	Final	17 November 2020	Nicholas Shipman		Rod Linnett	

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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 December 2020, 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**.

<b>Table 1 Noise Criteria<sup>1</sup></b>				
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 <sup>1</sup>	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 LAeq(15min)		
			Day	Evening	Night
N1	L1	1114 Carrick Road, Marulan	35	35	35
N2	L6	End of Maclura Drive, Marulan	35	37	36
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan <sup>1</sup>	35	35	35 <sup>2</sup>
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36

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 Monday 9 November 2020 and Wednesday 11 November 2020. 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  $\pm 0.5$  dBA.

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 Monday 9 November 2020 and Wednesday 11 November 2020 to satisfy the requirements of the NMP.

Extraneous noise sources were excluded from the analysis to determine the  $L_{Aeq}(15min)$  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.



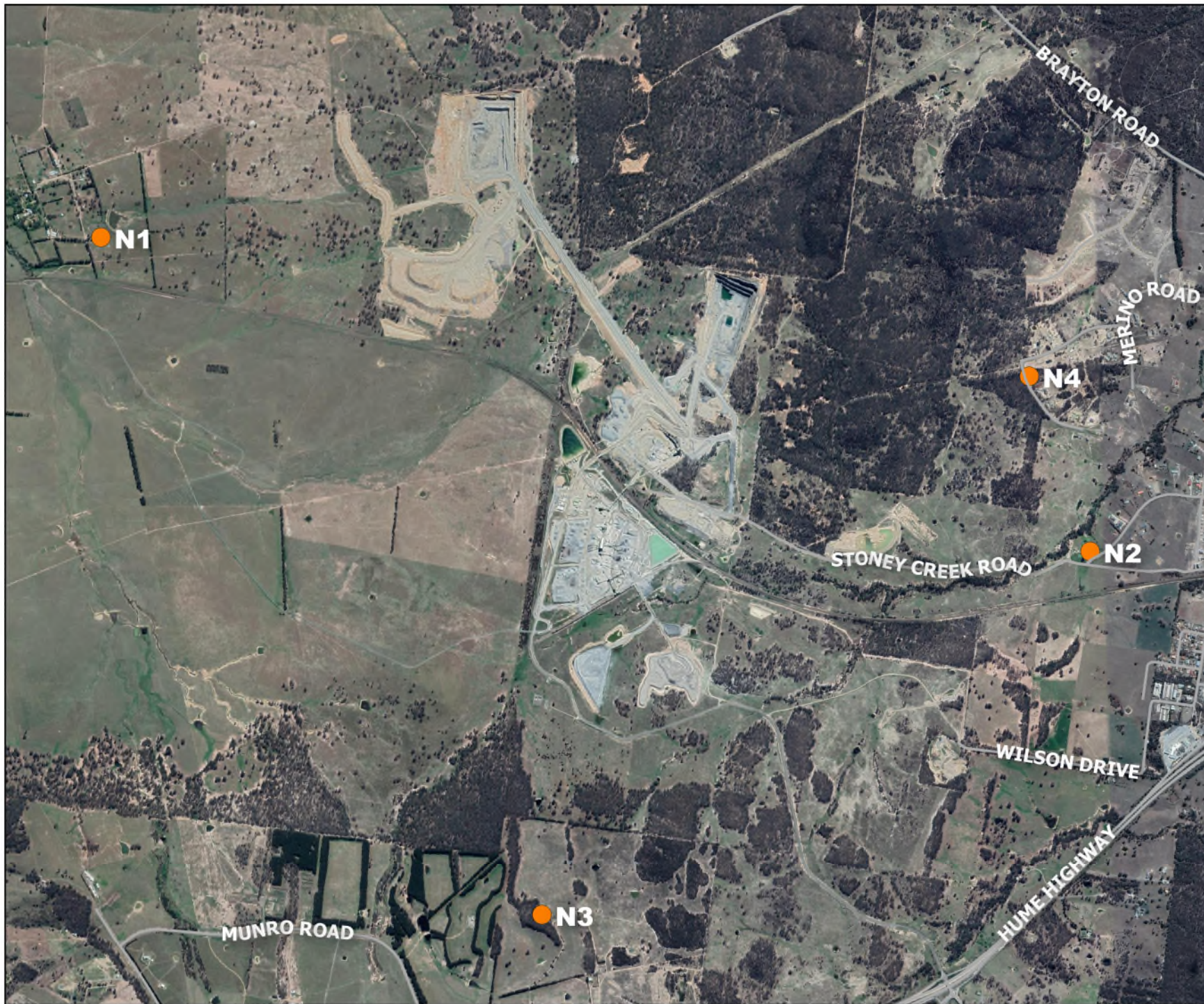


FIGURE 1

Site Locality

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Holcim Lynwood Quarry

**KEY**

● Noise Monitoring Locations



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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
		LAmax	LAeq	LA90		
09/11/2020	13:56 (Day)	64	46	34	WD: NE	Birds 31-44
					WS: 0.5m/s	Train 31-64
					Rain: Nil	Quarry Processing Plant <33
					Lynwood Quarry LAeq(15min) Contribution	
11/11/2020	08:21 (Day)	64	42	32	WD: NE	Livestock 29-54
					WS: 0.1m/s	Birds 29-56
					Rain: Nil	Aircraft 29-64
					Lynwood Quarry LAeq(15min) Contribution	

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
09/11/2020	12:59 (Day)	73	46	36	WD: E WS: 0.4m/s Rain: Nil	Birds 34-42
						Traffic 34-41
						Train 34-73
						Insects <34
						Dog bark <34
						Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<30
11/11/2020	09:16 (Day)	65	47	38	WD: NE WS: 0.1m/s Rain: Nil	Birds 37-50
						Insects 37-41
						Train 38-65
						Quarry Reverse Alarms <35
						Quarry Processing plant <35
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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
		LAmax	LAeq	LA90		
09/11/2020	12:24 (Day)	57	40	35	WD: SE	Birds 34-57
					WS: 0.5m/s	Traffic 34-52
					Rain: Nil	Insects <33
						Quarry Processing Plant <33
Lynwood Quarry LAeq(15min) Contribution						<33
11/11/2020	09:53 (Day)	60	42	38	WD: N	Birds 34-60
					WS: 0.1m/s	Insects 34-38
					Rain: Nil	Traffic 34-54
						Quarry Processing Plant <34
Lynwood Quarry LAeq(15min) Contribution						<34

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 <sub>A</sub> max	L <sub>A</sub> eq	L <sub>A</sub> 90		
09/11/2020	13:21 (Day)	62	42	38	WD: E  WS: 0.7m/s  Rain: Nil	Insects <35
						Birds 35-62
						Traffic 36-44
						Train 36-44
						Quarry Not Audible
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35
11/11/2020	08:56 (Day)	54	46	43	WD: NE  WS: 0.1m/s  Rain: Nil	Insects 42-49
						Birds 44-46
						Traffic 43-54
						Quarry Reverse Alarms <35
						Quarry Processing Plant <35
Lynwood Quarry L <sub>A</sub> eq(15min) Contribution						<35

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 Monday 9 November 2020 identified quarry noise was audible during the daytime measurement with quarry noise contributions estimated to satisfy the relevant daytime noise limits. Monitoring on Wednesday 11 November 2020 identified quarry noise was inaudible during daytime measurements. Audible quarry noise sources included the screening plant. Extraneous noise sources measured included birds, traffic, train, insects, and dog bark.

### 5.2 Discussion of Results - Location N2

Monitoring on Monday 9 November 2020 identified quarry noise was inaudible during the daytime measurement. Monitoring on Wednesday 11 November 2020 identified quarry noise was audible during daytime measurements with quarry noise contributions estimated to satisfy the relevant daytime noise limits. Quarry noise sources included reverse alarms and processing plant. Extraneous noise sources measured included birds, traffic, train, insects, and dog bark.

### 5.3 Discussion of Results - Location N3

Monitoring on Monday 9 November 2020 and Wednesday 11 November 2020 identified that quarry noise was audible during both daytime measurements with quarry noise contributions estimated to satisfy the relevant daytime noise limits. Quarry noise sources audible during the survey included the processing plant. Extraneous noise sources included birds, traffic, and insects.

### 5.4 Discussion of Results - Location N4

Monitoring on Monday 9 November 2020 identified quarry noise was inaudible during the daytime measurement. Monitoring on Wednesday 11 November 2020 identified quarry noise was audible during daytime measurements with quarry noise contributions estimated to satisfy the relevant daytime noise limits. Quarry noise sources included reverse alarms and screening plant. Extraneous noise sources measured included insects, birds, traffic, and 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 4, ending December 2020.

Attended noise monitoring was undertaken on Monday 9 November 2020 and Wednesday 11 November 2020 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were occasionally audible, 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

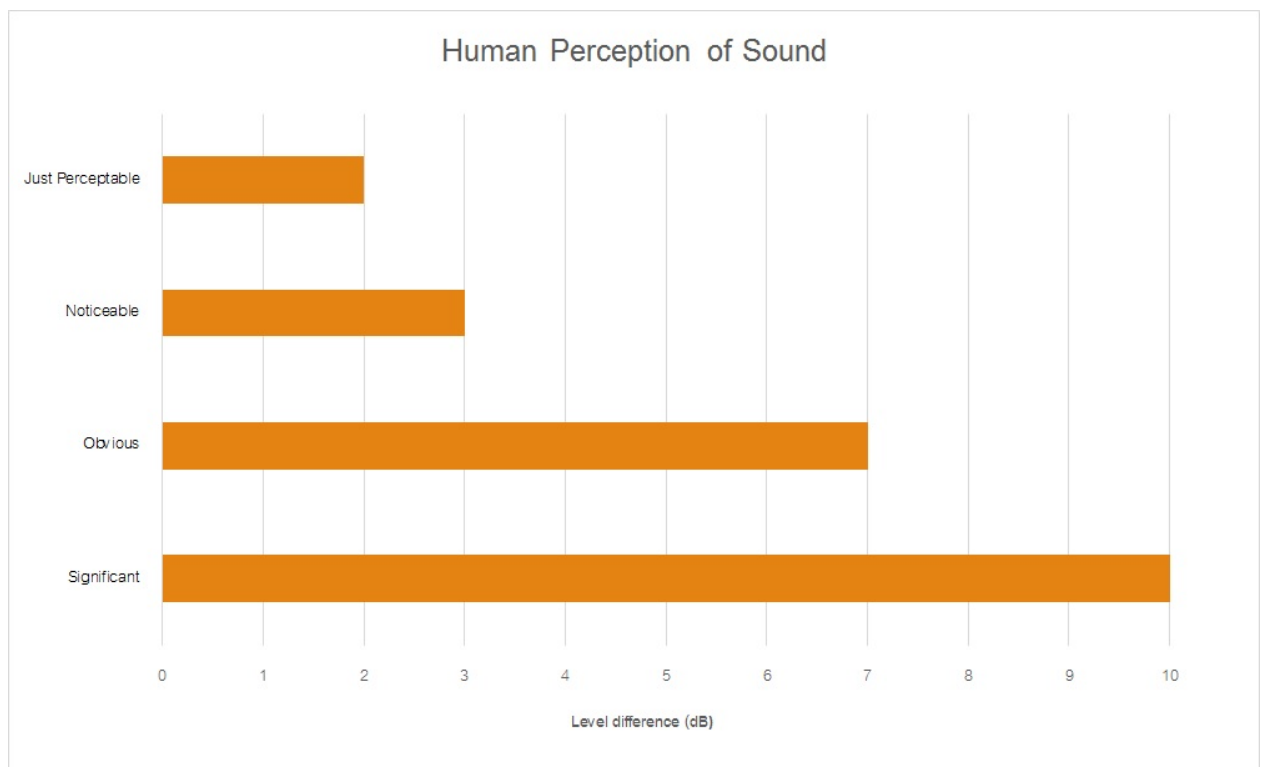
Table A1 provides a number of technical terms have been used in this report.

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.
LAm <sub>ax</sub>	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W<sub>0</sub> is the sound reference power at 10-12 watts.</p>

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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