Monthly Noise Monitoring Assessment

Tomingley Gold Mine, March 2017

Prepared for : Tomingley Gold Operations Pty Limited

April 2017

MAC
Muller Acoustic Consulting

Document Information

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Document ID	Status	Date	Prepared	Signed
MAC160270RP9	Final	20 April 2017	Oliver Muller (MAAS)	

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Tomingley Gold Operations Pty Ltd (TGO) to complete a Noise Monitoring Assessment (NMA) for Tomingley Gold Mine ('the mine').

The NMA involved quantifying the noise contribution of the mine by direct attended measurements to determine mining noise emissions so that effective management and controls can be implemented to minimise noise levels within the surrounding community. The monitoring has been conducted in accordance with the TGO Noise Management Plan and in general accordance with Conditions L4.2 to L4.7 of the EPL at six representative receiver locations. It is noted that this assessment has not been completed as part of the annual noise monitoring program to address conditions of the Environmental Protection License (EPL).

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

- NSW Environment Protection Authority (EPA), Industrial Noise Policy (INP), 2000;
- Environment Protection Licence EPL 20169 (EPL); and
- Standards Australia AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures.

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

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2 Environmental Protection License Noise Limits

Historic assessments for the mine categorise receivers into Noise Assessment Groups (NAGs). The NAGs were derived based on ambient noise data that controlled receiver RBLs.

Table 1 reproduces the operational and sleep disturbance noise limits for assessed receivers referenced from the EPL that have been adopted for this NMA and are consistent with historic EPL monitoring locations.

Table 1 Noise Limits, dBA

Noise Assessment Group	Receivers	Day	Evening	Night	
		LAeq(15-min)	LAeq(15-min)	LAeq(15-min)	LA1(1-min)
NAG A	R1, R6	36	36	36	45
	R5	37	37	37	45
	R4	36	36	36	45
NAG B	R2	36	36	36	45
NAG C	R3	49	40	40	45
	R29	48	40	40	45
NAG D	R23	43	39	39	46

Note: Refer to figure in Appendix 4 of Project Approval 09-0155 for noise locations. However, these criteria do not apply if the Proponent has an agreement with the relevant owner(s) of these residences / land to generate higher noise levels, and the Proponent has advised the Department of Planning and Infrastructure and EPA in writing of the terms of this agreement.

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3 Methodology

3.1 Locality

TGO is located to the south of the village of Tomingley, NSW. Receivers in the locality surrounding the mine are primarily rural/residential and for consistency the naming conventions for each receiver has been retained from historic noise assessments. The monitoring locations with respect to the mine is presented in the locality plan shown in **Figure 1.** It is noted that due to heavy rain, access was not possible to Location 4 and Location 6 for the March 2017. Therefore, the noise monitoring locations for these receivers were conducted parallel to the highway at the same or similar offset as the receivers.

3.2 Assessment Methodology

The attended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, "Acoustics - Description and Measurement of Environmental Noise" and the EPL. The measurements were carried out using Svantek Type 1, 971 noise analyser from Tuesday 21 March 2017 to Friday 24 March 2017. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2004-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Both evening and night measurements were of 15 minutes in duration (pending presence of suitable weather conditions ie. no rain) at each location over four consecutive dates, but may alter due to unsuitable meteorological conditions. Where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis as to calculate the $L_{Aeq(15\text{-}min)}$ mine noise contribution for comparison against the relevant EPL limit.

Prevailing meteorological conditions for the monitoring period were sourced from TGO's meteorological station and analysed in accordance with Appendix E4 of the INP to determine the stability category present at the time of each measured sample. This was undertaken to determine applicability of results in accordance with Condition L4.3 of the EPL. Results obtained during non-prevailing meteorological conditions (ie F Class Stability in conjunction with a 2m/s drainage wind or a G Class Stability) are considered not applicable against the EPL criteria. It is noted that some measurements were rain effected and therefore where excluded from this assessment. It is noted that measurements that where cut short due to high winds and rain have been presented in a bold font in the relevant tables.

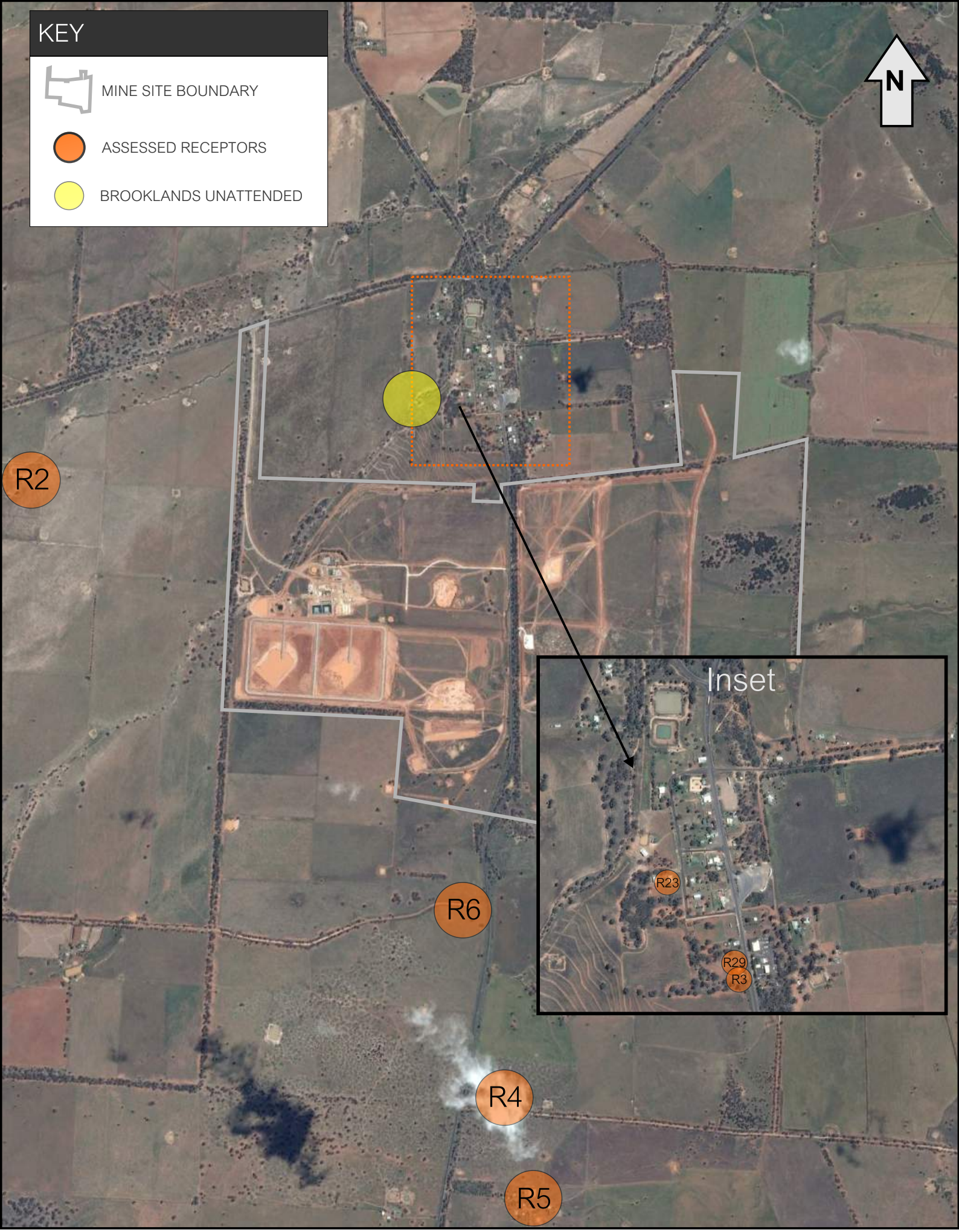

FIGURE 1 - LOCALITY PLAN AND ASSESSMENT LOCATIONS

TOMINGLEY GOLD MINE

REF: MAC160270

0 1000m

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4 Results

The monitoring and assessment results are presented in individual tables for each assessment location.

4.1 Assessment Results - Location R2

The results of the attended noise measurements at location R2 for Tuesday 21 March 2017 to Thursday 23 March 2017 are summarised in **Table 2** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 2 Operator-Attended Noise Survey Results – Location R2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LA_{eq}	LA_{90}			
21/03/17	21:29	53	41	40	36	Dir: N 1 m/s Stab Class: F	Mine hum 30 - 34 Insects < 30 Highway traffic 36 - 42
			TGO Site LAeq(15-min) Contribution				32
21/03/17	22:00	47	40	40	36	Dir: N 2 m/s Stab Class: E	Highway traffic 34 - 38 Insects < 36 Thunder 40 - 47
			TGO Site LAeq(15-min) Contribution				TGO Inaudible
22/03/17	**21:31**	**77**	**53**	**47**	**36**	**Dir: N 5 m/s Stab Class: E**	**Mine hum 28 -32 Insects < 30 Thunder 70 - 77**
			TGO Site LAeq(15-min) Contribution				**30**
22/03/17	22:01	55	40	39	36	Dir: N 5 m/s Stab Class: E	Mine hum 29 - 33 Insects < 28 Thunder 50 - 55 Highway traffic 36 - 38
			TGO Site LAeq(15-min) Contribution				31
23/03/17	**21:53**	**64**	**48**	**47**	**36**	**Dir: N 6 m/s Stab Class: D**	**Mine hum 29 - 30 Wind in trees 40 - 46 Thunder 60 - 64**
			TGO Site LAeq(15-min) Contribution				**30**
23/03/17	**22:00**	**59**	**45**	**45**	**36**	**Dir: N 3 m/s Stab Class: D**	**Wind in trees 40 - 46 Insects < 40**
			TGO Site LAeq(15-min) Contribution				**TGO Inaudible**

Note 1: Meteorological data obtained from TGO's on-site weather station.

Note 2: Measurements that were rain effected have been presented in bold.

4.2 Assessment Results - Location R3/R29

The results of the attended noise measurements at location R3/R29 for Tuesday 21 March 2017 to Thursday 23 March 2017 are summarised in **Table 3** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution. It is noted that both locations R3 and R29 are within 10m of each other and therefore have been assessed simultaneously.

Table 3 Operator-Attended Noise Survey Results – Location R3/R29

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
21/03/17	20:49	84	63	61	40	Dir: N 1 m/s Stab Class: F	Highway traffic to 84 Local residential noise 40 - 43 Insects < 40
TGO Site LAeq(15-min) Contribution							TGO Inaudible
21/03/17	22:39	84	62	61	40	Dir: N 2 m/s Stab Class: D	Insects < 40 Livestock < 63 Highway traffic to 84
TGO Site LAeq(15-min) Contribution							TGO Inaudible
Evening measurements on 22/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.							
22/03/17	22:53	85	66	65	40	Dir: N 5 m/s Stab Class: D	Highway traffic to 85 Insects < 63 Wind in trees < 60 Thunder 80 - 85
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/03/17	20:17	86	65	63	40	Dir: N 10 m/s Stab Class: D	Highway traffic to 82 Thunder 80 -86 Wind in trees 45 - 60
TGO Site LAeq(15-min) Contribution							TGO Inaudible
Night measurements on 23/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.							

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.3 Assessment Results - Location R4

The results of the attended noise measurements at location R4 for Tuesday 21 March 2017 to Thursday 23 March 2017 are summarised in **Table 4** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 4 Operator-Attended Noise Survey Results – Location R4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
Evening measurements on 21/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.							
21/03/17	23:21	82	61	59	36	Dir: N 3 m/s Stab Class: E	Highway traffic to 82 Insects < 54
TGO Site LAeq(15-min) Contribution							TGO Inaudible
22/03/17	20:00	82	64	61	36	Dir: N 1 m/s Stab Class: E	Livestock < 55 Wind in trees < 60 Thunder 66 - 70 Highway traffic 78 - 81
TGO Site LAeq(15-min) Contribution							TGO Inaudible
22/03/17	**23:37**	**81**	**56**	**54**	**36**	**Dir: N 6 m/s Stab Class: D**	**Insects < 55 Highway traffic 79 - 81 Thunder 60 - 70**
TGO Site LAeq(15-min) Contribution							**TGO Inaudible**
23/03/17	19:38	82	60	57	36	Dir: N 8 m/s Stab Class: D	Highway traffic to 82 Wind in trees < 57 Insects < 47 Thunder 62 - 73
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/03/17	23:46	80	58	55	36	Dir: N 5 m/s Stab Class: D	Insects < 54 Highway traffic to 80 Wind in trees < 55
TGO Site LAeq(15-min) Contribution							TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

Note 2: Measurements that were rain effected have been presented in bold.

4.4 Assessment Results - Location R5

The results of the attended noise measurements at location R5 for Tuesday 21 March 2017 to Friday 24 March 2017 are summarised in **Table 5** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 5 Operator-Attended Noise Survey Results – Location R5

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
21/03/17	**19:32**	**80**	**62**	**60**	**37**	**Dir: NE** **1 m/s** **Stab Class: F**	**Insects < 60** **Birds < 60** **Thunder 70 - 74** **Highway traffic to 80**
TGO Site LAeq(15-min) Contribution							**TGO Inaudible**
21/03/17	23:39	84	62	60	37	Dir: N 3 m/s Stab Class: E	Mine hum < 28 Insects < 60 Highway traffic to 84
TGO Site LAeq(15-min) Contribution							< 28
22/03/17	19:41	84	64	62	37	Dir: NE 2 m/s Stab Class: E	Highway traffic to 84 Insects and birds < 62 Wind in trees < 62
TGO Site LAeq(15-min) Contribution							TGO Inaudible
Night measurements on 22/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.							
23/03/17	19:20	82	63	62	37	Dir: NE 7 m/s Stab Class: D	Wind in trees 55 - 60 Birds and insects < 55 Highway traffic to 82
TGO Site LAeq(15-min) Contribution							TGO Inaudible
24/03/17	00:03	86	66	64	37	Dir: N 6 m/s Stab Class: D	Insects < 60 Wind in trees 60 - 64 Highway traffic to 86
TGO Site LAeq(15-min) Contribution							TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

Note 2: Measurements that were rain effected have been presented in bold.

4.5 Assessment Results - Location R6

The results of the attended noise measurements at location R6 for Tuesday 21 March 2017 to Thursday 23 March 2017 are summarised in **Table 6** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 6 Operator-Attended Noise Survey Results – Location R6

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
21/03/17	20:28	74	53	52	36	Dir: N 2 m/s Stab Class: E	Mine hum 34 - 35 Highway traffic to 74 Insects <52
TGO Site LAeq(15-min) Contribution							35
21/03/17	23:00	76	55	52	36	Dir: N 3 m/s Stab Class: E	Mine hum 30 - 34 Highway traffic to 76 Insects < 52
TGO Site LAeq(15-min) Contribution							32
Evening measurements on 22/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.							
22/03/17	23:14	76	59	56	36	Dir: N 5 m/s Stab Class: D	Highway traffic 6 Insects < 56
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/03/17	19:57	76	58	56	36	Dir: NE 5 m/s Stab Class: D	Highway traffic to 76 Insects < 56 Wind in trees 45 - 62
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/03/17	23:28	75	54	52	36	Dir: N 5 m/s Stab Class: D	Highway traffic 75 Insects < 53 Livestock < 52
TGO Site LAeq(15-min) Contribution							TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.6 Assessment Results - Location R23

The results of the attended noise measurements at location R23 for Tuesday 21 March 2017 to Thursday 23 March 2017 are summarised in **Table 7** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 7 Operator-Attended Noise Survey Results – Location R23

Date	Time (hrs)	Descriptor (dBA re 20 µPa) LAmax	LAeq	LA90	EPL Limit	Meteorology[1]	Description and SPL, dBA
21/03/17	21:07	55	42	41	39	Dir: N 2 m/s Stab Class: D	Mine hum 30 - 33 Insects < 41 Highway traffic 45 - 55
TGO Site LAeq(15-min) Contribution							33
21/03/17	22:22	56	40	38	39	Dir: N 3 m/s Stab Class: E	Highway traffic 48 - 56 Insects < 38
TGO Site LAeq(15-min) Contribution							TGO Inaudible
Evening measurements on 22/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.							
22/03/17	22:22	63	44	42	39	Dir: N 4 m/s Stab Class: D	Thunder 55 - 63 Wind in trees 40 - 53 Highway traffic < 42 Insects 55 - 60
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/03/17	**20:47**	**79**	**61**	**57**	**39**	**Dir: N 7 m/s Stab Class: D**	**Thunder 60 - 79 Wind in trees 55 - 62 Highway traffic 60 - 63**
TGO Site LAeq(15-min) Contribution							**TGO Inaudible**
23/03/17	22:21	57	45	44	39	Dir: NE 5 m/s Stab Class: D	Wind in trees 40 - 48 Highway traffic 43 - 57 Thunder 50 - 54
TGO Site LAeq(15-min) Contribution							TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

Note 2: Measurements that were rain effected have been presented in bold.

5 Discussion

5.1 Discussion of Results - Location R2

Monitoring between Tuesday 21 March 2017 to Thursday 23 March 2017 identified that TGO noise was audible on four of six occasions. Noise contribution from TGO when audible was measured at between 30dBA and 32dBA, and therefore satisfied the relevant noise limits of 36dBA.

5.2 Discussion of Results - Location R3/R29

Monitoring results for R3/R29 were dominated by highway traffic that were constant during all measurements. TGO emissions were inaudible on all occasions, as noise was masked by dominant highway traffic noise and wind in trees. Measurements were unable to be obtained during the evening period on the 22/03/17 and night period on 23/03/17 as meteorological conditions including rain and high winds occurred. All remaining measurements were below relevant EPL criteria. Extraneous sources other than highway traffic were also audible during the three dates with livestock, local residential noise, wind, thunder and insects all audible.

5.3 Discussion of Results - Location R4

Mine noise was inaudible during all the March 2017 measurements at R4 and remained below criteria. Evening measurements on the 21/03/17 were unable to be obtained due to unsuitable meteorological conditions. All measurements satisfied the EPL criteria during the attended measurements throughout the March 2017 survey period at R4. Non-mining noise sources included wind in trees, thunder, highway traffic and insects.

5.4 Discussion of Results - Location R5

Mining noise emissions were inaudible during all attended noise monitoring surveys at this location for the March 2017 monitoring period. Measurements were unable to be obtained during the night period on the 22/03/17 as meteorological conditions such as high winds and rain occurred. Highway traffic was the dominant source at this receiver during the March 2017 assessment period. Other non-mining sources include birds, thunder, insects and highway traffic.

5.5 Discussion of Results - Location R6

TGO mine hum was audible on two of the five occasions throughout the March 2017 monitoring period at R6. The $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 32dBA and 35dBA on the evening and night periods on the 21/03/17 and satisfied the relevant EPL noise limit of 36dBA $LA_{eq(15\text{-}min)}$. TGO noise emissions where inaudible during the remainder of the March 2017 survey. Measurements were unable to be obtained on the evening period on the 22/03/17 as meteorological conditions such as high wind and rain occurred. Non-mining sources included Insects, livestock, highway traffic and wind in trees.

5.6 Discussion of Results - Location R23

Mining noise was audible on one of six occasions at this location. TGO was audible during measurements on the evening period of 21 March 2017 with the contribution being 33dBA, therefore remained below the relevant EPL criteria. Evening measurements were unable to be obtained due to meteorological conditions on the 22/03/17 as high winds and rain occurred. Non-mining sources included highway traffic, insects, thunder and wind in trees.

6 Comparison of Attended and Unattended Monitoring Results

To address Condition 6 of Schedule 3 of the Project Approval, a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results has been completed.

The validation compares monthly attended monitoring results against the closest assessed unattended monitoring location. Currently, TGO has one unattended real time monitoring terminal installed at the Brooklands property (nearest to R23). The **Figure 1** locality plan identifies the location of the monitor with respect to the attended monitoring locations. It is noted that the Brooklands unattended monitor is situated 600m west of the attended noise monitoring location R23, therefore, background (LA90) noise levels are significantly lower due to offset distance to highway traffic.

A comparison of mine noise contributions between attended and unattended noise monitoring demonstrates a general consistency between attended and unattended results. It was noted that wind and insect noise influenced measured noise levels for this assessment period with mine noise remaining below criteria and was generally inaudible throughout the March 2017 assessment period. Furthermore, for March 2017, results remained below the relevant criteria for both attended and unattended locations.

It is also noted that due to meteorological conditions, measurements were unable to be obtained on the evening period on 22 March as weather conditions were unsuitable.

Table 8 provides a summary comparison of results between the attended and unattended noise surveys for R23.

Table 8 Comparison of Attended and Unattended Results – R23								
Assessment Type	Time (hrs)	Descriptor (dBA re 20 µPa)			Criteria	Mine Noise Contribution	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90				
21 March 2017								
Attended	21:07	55	42	41	39	33	Dir: N 2 m/s Stab Class: D	Mine hum Insects Highway traffic
Unattended	21:00	50	35	30	39	29		Mine hum Insects Highway traffic
Attended	22:22	56	40	38	39	TGO Inaudible	Dir: N 3 m/s Stab Class: E	Highway traffic Insects
Unattended	22:15	58	45	33	39	35		Mine hum Insects Highway traffic
22 March 2017								
Evening measurements on 22/03/17 were unable to be obtained due to unsuitable meteorological conditions as per AS1055.								
Attended	22:22	63	44	42	39	TGO Inaudible	Dir: N 4 m/s Stab Class: D	Thunder Wind in trees Highway traffic Insects
Unattended	22:15	62	43	34	39	35		Mine hum Insects Highway traffic
23 March 2017								
Attended	20:47	79	61	57	39	TGO Inaudible	Dir: N 7 m/s Stab Class: D	Thunder Wind in trees Highway traffic
Unattended	20:45	86	61	45	39	TGO Inaudible		Wind Insects Highway traffic
Attended	22:21	57	45	44	39	TGO Inaudible	Dir: NE 5 m/s Stab Class: D	Wind in trees Highway traffic Thunder
Unattended	22:15	59	44	35	39	36		Mine hum Wind Insects Highway traffic

7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a noise monitoring assessment on behalf of Tomingley Gold Operations (TGO). The assessment was completed to provide monthly monitoring data so that TGO can actively quantify and manage site noise emissions.

Due to severe weather conditions, attended noise logging did not occur on some occasions. Therefore, some measurements were not included.

Notwithstanding attended monitoring for four consecutive dates, from 21 March 2017 to 24 March 2017, has identified that noise emissions generated by TGO did not exceed limits on any occasion during the March 2017 assessment period.

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Appendix A - Glossary of Terms

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

Table A1 Glossary of Terms

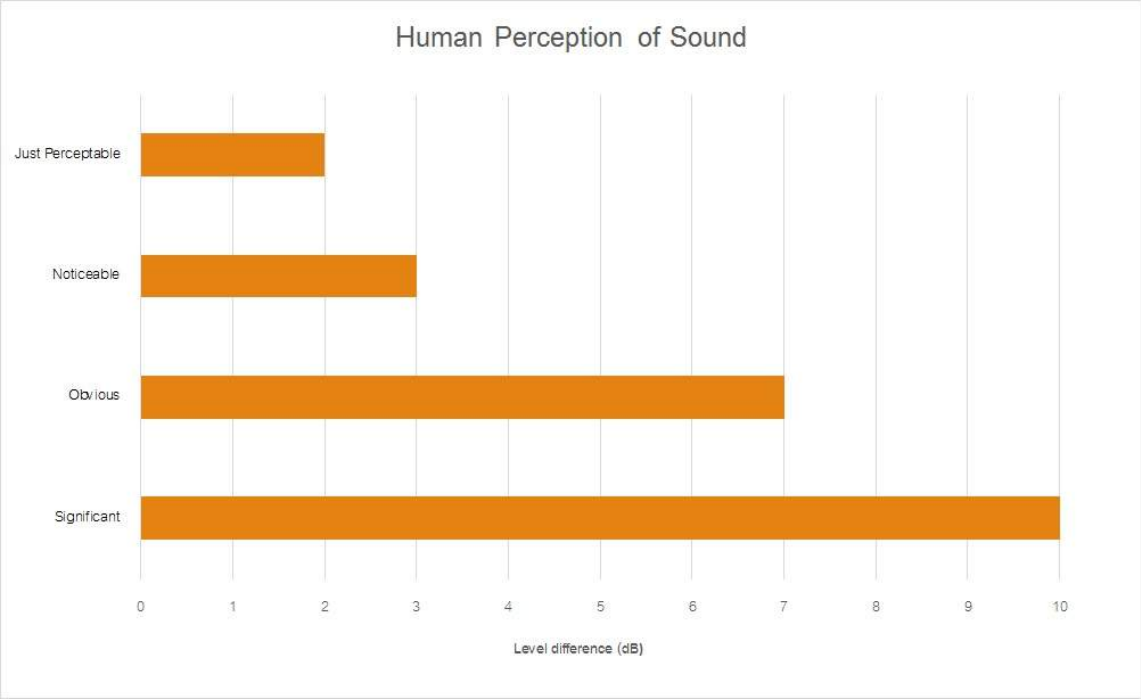
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (SWL)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

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

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

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

Figure A1 – Human Perception of Sound



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