Monthly Noise Monitoring Assessment

Tomingley Gold Mine, March 2020

Prepared for: Tomingley Gold Operations Pty Limited
April 2020
MAC160270RP41

Muller Acoustic Consulting

Document Information

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Prepared for: Tomingley Gold Operations Pty Limited

Prepared by: Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

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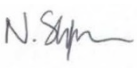
MAC160270RP41	Final	6 April 2020	Nicholas Shipman		Oliver Muller	

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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'), Tomingley, NSW.

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 where required. 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 been completed as part of an internal noise management initiative and does not form 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), Noise Policy for Industry (NPI) 2017;
- Environment Protection Licence EPL 20169 (EPL); and
- Australian Standard AS 1055:2018 - 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	
		$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
NAG A	R4, R5, R6	35	35	35	45
NAG B	R2	36	35	35	45
NAG C	R3, R29	45	35	35	45
NAG D	R23	43	38	36	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 have been retained from historic noise assessments. The monitoring locations with respect to the mine are presented in the locality plan shown in **Figure 1**.

3.2 Assessment Methodology

The attended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the EPL. Measurements were carried out using Svantek Type 1, 971 noise analyser between Tuesday 17 March 2020 and Thursday 19 March 2020. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS 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.

Both evening and night measurements were of 15 minutes duration. Where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis to calculate the $LA_{eq(15min)}$ 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 NPI 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 or G Class Stability) are considered not applicable against the EPL criteria.

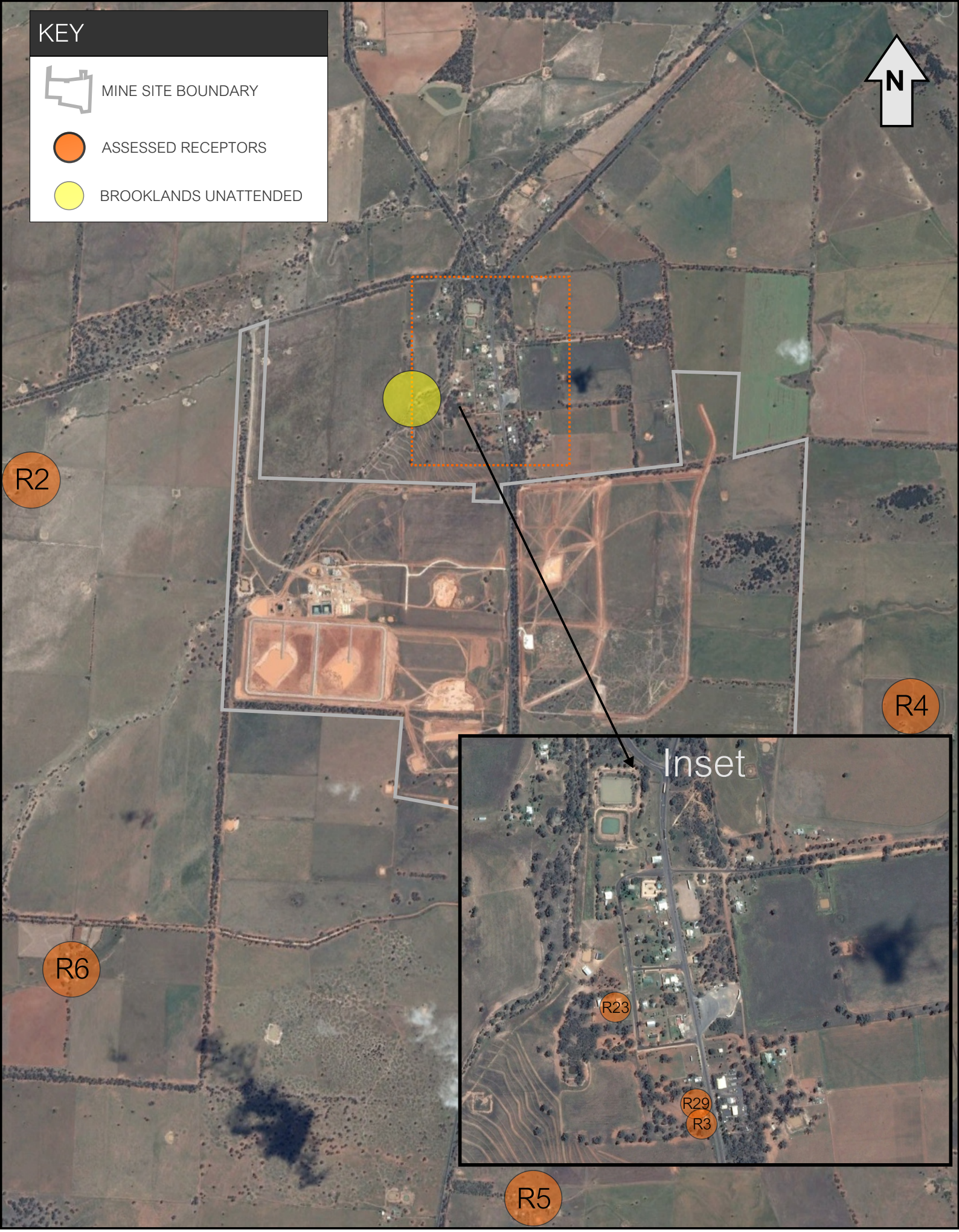

FIGURE 1 - LOCALITY PLAN AND ASSESSMENT LOCATIONS

TOMINGLEY GOLD MINE EPL NOISE MONITORING

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 the March 2020 survey are summarised in **Table 2** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

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
		L_{Amax}	L_{Aeq}	L_{A90}			
17/03/2020 (Evening)	21:45	67	41	26	35	WD: E WS: 0.5m/s Stab Class: F	Local traffic 34-67 Distant traffic 28-34 Wind 29:34 TGO haul truck 28-32 TGO reverse alarms <27
TGO Site LAeq(15min) Contribution							30
17/03/2020 (Night)	22:00	46	29	26	35	WD: E WS: 1m/s Stab Class: E	Wind 28-46 Distant traffic 28-34 TGO haul truck 28-34 TGO reverse alarms <28
TGO Site LAeq(15min) Contribution							32
18/03/2020 (Evening)	21:45	59	27	14	35	WD: E WS: 0.1m/s Stab Class: F	Distant traffic 24-32 Livestock 34-59 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
18/03/2020 (Night)	22:05	50	20	14	35	WD: E WS: 0.1m/s Stab Class: E	Distant traffic 20-32 Birds 14-28 Livestock 34-50 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
19/03/2020 (Evening)	21:35	74	52	17	35	WD: W WS: 0.1m/s Stab Class: E	Local traffic 32-74 Insects <32 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
19/03/2020 (Night)	22:00	45	20	18	35	WD: W WS: 0.1m/s Stab Class: E	Distant traffic 22-45 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

4.2 Assessment Results - Location R3/R29

The results of the attended noise measurements at location R3/R29 for the March 2020 survey are summarised in **Table 3** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

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
		L_{Amax}	L_{Aeq}	L_{A90}			
17/03/2020 (Evening)	21:09	86	66	39	35	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 36-86 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
17/03/2020 (Night)	22:46	88	64	39	35	WD: E WS: 1m/s Stab Class: D	Highway traffic 42-88 Wind <36 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Evening)	21:07	81	61	27	35	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 34-81 Insects <34 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Night)	22:46	86	67	44	35	WD: E WS: 0.1m/s Stab Class: F	Highway traffic 36-86 Local residential noise <38 Insects <36 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Evening)	20:55	85	66	44	35	WD: W WS: 0.1m/s Stab Class: D	Highway traffic 32-85 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Night)	22:42	85	66	42	35	WD: W WS: 0.1m/s Stab Class: E	Highway traffic 34-85 Birds 48-59 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

4.3 Assessment Results - Location R4

The results of the attended noise measurements at location R4 for the March 2020 survey are summarised in **Table 4** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

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
		L_{Amax}	L_{Aeq}	L_{A90}			
17/03/2020 (Evening)	20:19	44	22	16	35	WD: E WS: 0.1m/s Stab Class: D	Insects <18 Distant traffic 18-44 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
17/03/2020 (Night)	23:33	63	47	43	35	WD: E WS: 2m/s Stab Class: D	Wind 36-63 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Evening)	20:14	55	26	19	35	WD: E WS: 0.1m/s Stab Class: E	Distant traffic 22-55 Insects <22 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Night)	23:32	55	32	25	35	WD: E WS: 0.1m/s Stab Class: E	Insects 14-22 Distant traffic 18-55 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Evening)	20:07	53	29	20	35	WD: W WS: 0.1m/s Stab Class: E	Distant traffic 25-53 Insects <25 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Night)	23:30	57	32	25	35	WD: W WS: 0.1m/s Stab Class: E	Insects 26-31 Distant traffic 31-57 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

4.4 Assessment Results - Location R5

The results of the attended noise measurements at location R5 for the March 2020 survey are summarised in **Table 5** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

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
		L_{Amax}	L_{Aeq}	L_{A90}			
17/03/2020 (Evening)	19:57	81	62	41	35	WD: E WS: 0.5m/s Stab Class: E	Highway traffic 36-81 Offsite drilling 38-59 Insects <36 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
17/03/2020 (Night)	23:53	81	65	57	35	WD: E WS: 2.5m/s Stab Class:	Offsite drilling 56-62 Wind <60 Highway traffic 59-81 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Evening)	19:53	79	63	39	35	WD: E WS: 0.1m/s Stab Class: D	Highway traffic 36-79 Insects <36 Offsite drilling 36-40 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Night)	23:54	80	61	41	35	WD: E WS: 0.1m/s Stab Class: E	Offsite drilling 38-52 Highway traffic 46-80 Insects <38 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Evening)	19:45	82	62	40	35	WD: E WS: 0.1m/s Stab Class: E	Offsite drilling 34-48 Highway traffic 34-82 Birds<44 Dogs 34-38 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Night)	23:52	77	54	45	35	WD: E WS: 0.1m/s Stab Class: F	Offsite drilling 42-55 Highway traffic 46-77 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

4.5 Assessment Results - Location R6

The results of the attended noise measurements at location R6 for the March 2020 survey are summarised in **Table 6** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

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
		L_{Amax}	L_{Aeq}	L_{A90}			
17/03/2020 (Evening)	10:48	52	34	30	35	WD: E WS: 0.1m/s Stab Class: E	Traffic 28-36 Insects <28 TGO screening plant 29-36 TGO reverse alarms <34 Livestock 32-52
TGO Site $L_{Aeq(15min)}$ Contribution							34
17/03/2020 (Night)	23:08	58	47	44	35	WD: E WS: 2m/s Stab Class: D	Wind 34-58 Traffic <34 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Evening)	20:39	58	29	18	35	WD: E WS: 0.1m/s Stab Class: F	Insects 22-34 Traffic 22-58 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
18/03/2020 (Night)	23:08	53	29	22	35	WD: E WS: 0.1m/s Stab Class: F	Traffic 30-53 Insects 24-30 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Evening)	20:31	49	29	24	35	WD: W WS: 0.1m/s Stab Class: E	Insects 26-34 Traffic 30-49 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35
19/03/2020 (Night)	23:06	53	31	20	35	WD: W WS: 0.1m/s Stab Class: E	Insects 22-26 Traffic 22-53 Livestock <29 TGO Inaudible
TGO Site $L_{Aeq(15min)}$ Contribution							<35

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

4.6 Assessment Results - Location R23

The results of the attended noise measurements at location R23 for the March 2020 survey are summarised in **Table 7** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 7 Operator-Attended Noise Survey Results – Location R23

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
17/03/2020 (Evening)	21:25	68	44	28	38	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 36-48 Insects <36 Dogs 42-68 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
17/03/2020 (Night)	22:28	66	46	37	36	WD: E WS: 2m/s Stab Class: E	Dogs 38-44 Wind 38-46 Highway traffic 36-66 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
18/03/2020 (Evening)	21:29	55	44	35	38	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 29-55 Insects <29 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
18/03/2020 (Night)	22:27	58	42	33	36	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 34-58 TGO reverse alarms <36 Insects <34
TGO Site LAeq(15min) Contribution							<36
19/03/2020 (Evening)	21:14	63	43	36	38	WD: W WS: 0.1m/s Stab Class: D	Dogs 36-63 Highway traffic 36-54 Insects <36 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35
19/03/2020 (Night)	22:22	61	42	35	36	WD: W WS: 0.1m/s Stab Class: E	Highway traffic 34-61 Insects <34 TGO Inaudible
TGO Site LAeq(15min) Contribution							<35

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

5 Discussion

5.1 Discussion of Results - Location R2

Monitoring between Tuesday 17 March 2020 to Thursday 19 March 2020 identified that TGO mobile plant and reverse alarms were audible during two measurements at location R2. Notwithstanding, the mining contribution remained below 35dBA. Therefore, the relevant noise limit of 35dB $LA_{eq(15min)}$ was satisfied. Extraneous sources such as wind in trees, livestock, birds, insects, local and distant traffic were audible during the survey periods.

5.2 Discussion of Results - Location R3/R29

Monitoring from Tuesday 17 March 2020 to Thursday 19 March 2020 identified that TGO was inaudible during measurements at location R3, and the estimated mining contribution remained below 35dBA. Therefore, the relevant noise limit of 35dB $LA_{eq(15min)}$ was satisfied. Extraneous sources such as highway traffic, wind in trees, insects, birds and local residential noise were audible during the measurements.

5.3 Discussion of Results - Location R4

Monitoring from Tuesday 17 March 2020 to Thursday 19 March 2020 identified that TGO was inaudible during measurements at location R4, and the estimated mining contribution remained below 35dBA. Therefore, the relevant noise limit of 35dB $LA_{eq(15min)}$ was satisfied. Extraneous sources such as insects, traffic and wind in trees were audible during the measurements.

5.4 Discussion of Results - Location R5

Monitoring from Tuesday 17 March 2020 to Thursday 19 March 2020 identified that TGO was inaudible during measurements at location R5. The estimated mining contribution remained below 35dBA, and the relevant noise limit of 35dB $LA_{eq(15min)}$ was satisfied. Extraneous sources such as traffic, offsite drilling, insects, wind in trees, birds and dogs barking were audible during the measurements.

5.5 Discussion of Results - Location R6

Monitoring from Tuesday 17 March 2020 to Thursday 19 March 2020 identified that TGO was audible on one occasion at location R6. Notwithstanding, the estimated mining contribution remained below 35dBA, and the relevant noise limit of 35dB $LA_{eq(15min)}$ was satisfied. Extraneous sources such as traffic, insects, livestock and wind in trees were audible during the measurements.

5.6 Discussion of Results - Location R23

Monitoring between Tuesday 17 March 2020 to Thursday 19 March 2020 identified that TGO was audible during one measurement at location R23. The estimated mining contribution did not exceed 35dBA, and the relevant noise limit of 36dB $LA_{eq(15min)}$ was satisfied. Extraneous sources such as traffic, insects, dogs barking and wind in trees were audible during the survey periods.

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 an unattended real-time monitoring terminal installed at the Brooklands property (nearest to R23). Figure 1 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 (L_{A90}) 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 birds and highway traffic noise influenced measured noise levels for this assessment. Furthermore, for March 2020, results remained below the relevant criteria for both attended and unattended locations.

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
		L_{Amax}	L_{Aeq}	L_{A90}				
Tuesday 17 March 2020								
Attended	21:25	68	44	28	38	<35	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 36-48 Insects <36 Dogs 42-68 TGO Inaudible
Unattended	21:30	73	49	42	38	<35		Wind Traffic TGO inaudible
Attended	22:28	66	46	37	36	<35	WD: E WS: 2m/s Stab Class: E	Dogs 38-44 Wind 38-46 Highway traffic 36-66 TGO Inaudible
Unattended	22:30	65	48	40	36	<35		Wind TGO Inaudible
Wednesday 18 March 2020								
Attended	21:29	55	44	35	38	<35	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 29-55 Insects <29 TGO Inaudible
Unattended	21:30	58	46	39	38	<35		Birds TGO Inaudible
Attended	22:27	58	42	33	36	<36	WD: E WS: 0.1m/s Stab Class: E	Highway traffic 34-58 TGO reverse alarms <36 Insects <34
Unattended	22:30	53	37	30	36	<35		Birds TGO Inaudible
Thursday 19 March 2020								
Attended	21:14	63	43	36	38	<35	WD: W WS: 0.1m/s Stab Class: D	Dogs 36-63 Highway traffic 36-54 Insects <36 TGO Inaudible
Unattended	21:15	53	42	35	38	<35		Birds TGO Inaudible
Attended	22:22	61	42	35	36	<35	WD: W WS: 0.1m/s Stab Class: E	Highway traffic 34-61 Insects <34 TGO Inaudible
Unattended	22:30	57	41	31	36	<35		Local residential noise TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station or by direct measurement by the operator.

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.

Attended monitoring conducted from Tuesday 17 March 2020 to Thursday 19 March 2020, identified that TGO mine noise was occasionally audible at three of the monitoring locations R2, R6 and R23, the other three locations remained inaudible during the measurement period. A review of monitoring data and operator attended observations determined that TGO contributions did not exceed relevant limits during applicable meteorological conditions.

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Appendix A - Glossary of Terms

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

Table A1 Glossary of Terms

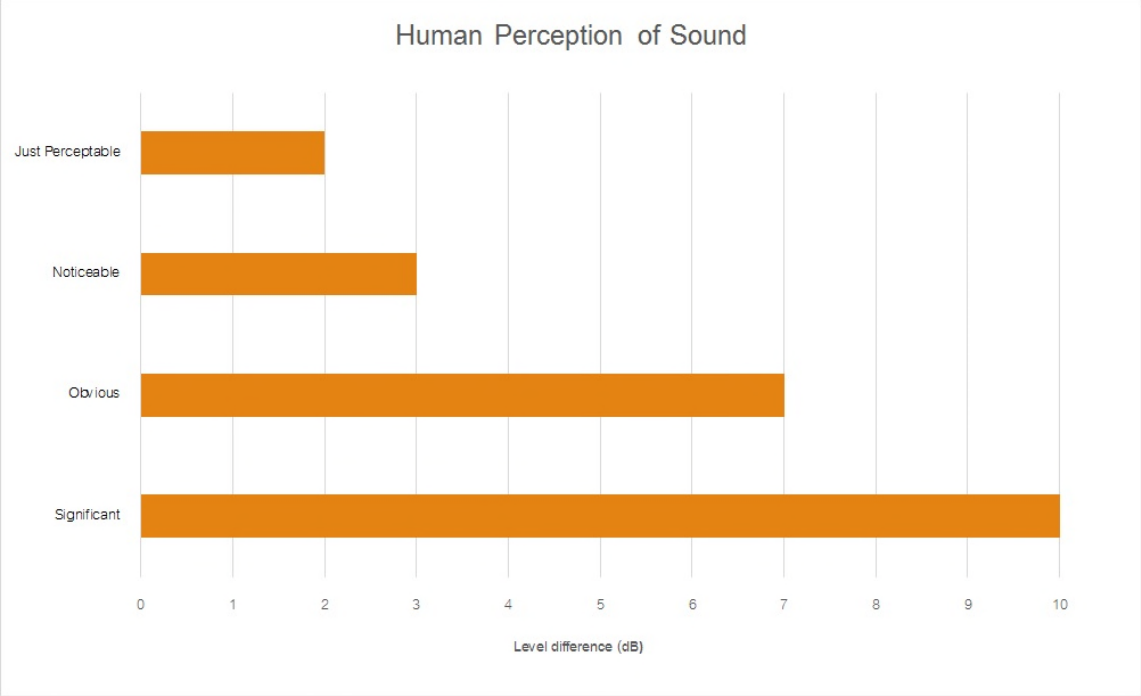
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for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

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

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

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

Figure A1 – Human Perception of Sound



Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting