

Noise Monitoring Assessment

Tomingley Gold Mine, Tomingley, NSW.



Document Information

Noise Monitoring Assessment

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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 has been completed to address Condition M4.1 their Environment Protection License 20169 ('the EPL') from NSW Environment Protection Authority (EPA) and Condition 6 of Schedule 3 of the Project Approval (PA) number 09_0155 issued by the Department of Planning and Environment (DPE).

The monitoring assessment involves quantifying the noise contribution of the mine by direct attended measurements as per the EPL at the nearest affected receivers.

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);
- Project Approval 09_0155 (PA); 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 and Project Approval Noise Limits

2.1 Environmental Protection License (EPL)

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 noise limits for assessed receivers referenced from the EPL, 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.

Conditions L4.3 to L4.8 of the EPL set out the conditions under which the noise limits apply and are reproduced below.

L4.3 For the purpose of condition L3.1:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.
- Evening is defined as the period 6pm to 10pm.
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and Public Holidays.

L4.4 The noise limits set out in condition L3.1 apply under all meteorological conditions except for the following:

- Wind speeds greater than 3 m/second at 10 metres above ground level;
- Stability category F temperature inversion conditions and wind speeds greater than 2 m/second at 10 metres above ground level; or

- Stability category G temperature inversion conditions.

L4.5 For the purposes of condition L3.3:

- Data recorded by a meteorological station installed on site must be used to determine meteorological conditions; and
- Temperature inversion conditions (stability category) are to be determined by the sigma-theta method referred to in Part E4 of Appendix E of the NSW Industrial Noise Policy.

L4.6 To determine compliance:

a) with the $LA_{eq}(15min)$ noise limits in condition L3.1, the noise measurement equipment must be located:

- approximately on the property boundary, where any dwelling is situated 30 metres or less from the property boundary closest to the premises; or
- within 30 metres of a dwelling façade, but not closer than 3 metres, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable within approximately 50 metres of the boundary of a National Park or a Nature Reserve.

b) with the $LA1(1\text{ minute})$ noise limits in condition L3.1:

- the noise measurement equipment must be located within 1 metre of a dwelling façade.

c) with the noise limits in condition L3.1 the noise measurement equipment must be located:

- at the most affected point at a location where there is no dwelling at the location; or
- at the most affected point within an area at a location prescribed by conditions L3.5(a) or L3.5(b).

L4.7 A non-compliance of condition L3.1 will still occur where noise generated from the premises in excess of the appropriate limit is measured:

- at a location other than an area prescribed by conditions L3.5(a) and L3.5(b); and/or
- at a point other than the most affected point at a location.

L4.8 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

Condition M4.1 of the EPL identifies that to assess compliance with Condition L3.1, attended noise monitoring must be undertaken in accordance with Conditions L3.5 and:

- a) At each one of the locations listed in Condition L3.1;
- b) Occur annually in a reporting period;
- c) Occur during each day, evening and night period as defined in the NSW Industrial Noise Policy for a minimum of:
 - 1.5 hours during the day;
 - 30 minutes during the evening; and
 - 1 hour during the night.
- d) Occur for three consecutive days.

2.2 Project Approval 09_0155

Condition 6 of Schedule 3 of the Project Approval states:

- (c) include a monitoring program that:
 - i. uses a combination of real-time and supplementary attended monitoring measures to evaluate the performance of the project;
 - ii. adequately supports the proactive and reactive noise management system on site;
 - iii. defines what constitutes a noise incident, and includes a protocol for identifying noise incidents and notifying the Department and relevant stakeholders of any such incident;
 - iv. evaluates and reports on the effectiveness of the noise management system on site;
 - v. includes a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results over time (so the real time monitoring program can be used as a better indicator of compliance with the noise criteria in this approval and a trigger for further attended monitoring); and

(d) include a noise reduction strategy for progressively reducing mine noise during open cut mining operations, consistent with the noise scenarios described in the document 'Tomingley Gold Mine Environmental Assessment – Project Approval No. 09_0155 Modification 3' dated November 2015.

A comparison on attended versus unattended data has been completed as part of this assessment with results presented in Section 6.

3 Methodology

3.1 Locality

The mine 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 convention for each receiver has 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 surveys were 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 simultaneously by two MAC staff members at separate locations using Svantek Type 1, 971 and 977 noise analysers from Tuesday 8 November 2016 to Friday 11 November 2016. 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 ± 0.5 dBA.

Evening measurements consisted of two 15 minutes (ie 30 minutes) in duration and night measurements were of four 15 minutes (ie 1 hour) in duration at each location over three consecutive dates. Where possible, throughout each survey the operator quantified the contribution of each significant noise source and included a review of octave data to quantify low frequency or tonal contributions. Where possible, 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 L4.4 of the EPL. Results obtained during non-prevailing meteorological conditions (ie F Class in conjunction with a 2m/s drainage wind or a G class inversion) are considered not applicable against the EPL criteria.

Furthermore, a 2dB field tolerance as per Section 11.1.3 of the INP is also applicable to reported levels and has been applied in this NMA report.

KEY



MINE SITE BOUNDARY



ASSESSED RECEPTORS



BROOKLANDS UNATTENDED



ELLERSLIE UNATTENDED

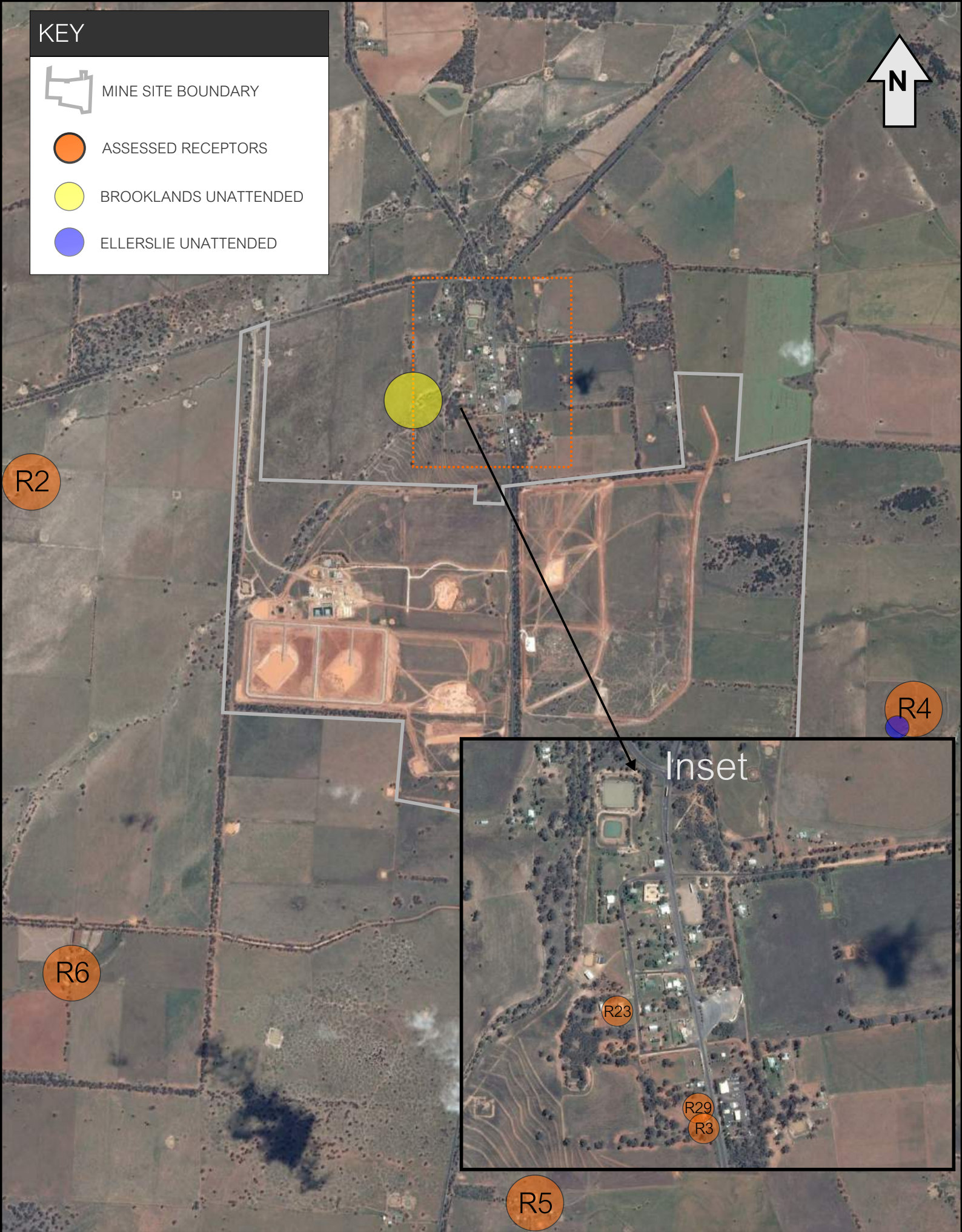


FIGURE 1 - LOCALITY PLAN AND ASSESSMENT LOCATIONS

TOMINGLEY GOLD MINE EPL NOISE MONITORING

REF: MAC160243

4 Results

4.1 Location R2 – Assessment Results

The monitoring and assessment results are presented in individual tables for each day of consecutive monitoring. The results of the attended noise measurements at location R2 for 8 November to 11 November 2016 are summarised in **Table 2** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution. It is noted that the first attended measurement (21:52) on the 8/11/2016 was influenced by rain, however one 15-minute sample was able to be completed without any influence from adverse weather conditions.

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}			
8/11/2016	21:52	58	33	30	36	4 m/s	Highway traffic 28 Livestock 29-36
						SW	
Average TGO Site L _{Aeq} (15-min) Contribution							30
8/11/2016	22:11	62	36	32	36	4 m/s	Birds & Insects 28-42 Livestock 29-36 Tipping 28-33 Highway traffic 28-42
						SW	
Average TGO Site L _{Aeq} (15-min) Contribution							33
9/11/2016	20:22	95	54	30	36	2 m/s	Livestock 28-39 Insects 28-31 Highway traffic 29-30
						N	
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
9/11/2016	22:00	49	27	25	36	3 m/s	Birds & Insects 23-41 Highway traffic 24-28 Livestock & Dog 24-40
						N	
Average TGO Site L _{Aeq} (15-min) Contribution							23
10/11/2016	18:52	79	52	44	36	1 m/s	Birds & Insects 34-46 Livestock & Dog 42-68 Highway traffic 38-43
						S	
Average TGO Site L _{Aeq} (15-min) Contribution							30
10/11/2016	22:14	58	43	35	36	1 m/s	Livestock 39-54 Birds & Insects 30-50
						S	
Average TGO Site L _{Aeq} (15-min) Contribution							27

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

4.2 Location R3 and 29 – Assessment Results

The results of the attended noise measurements at location R3/R29 for 8 November to 11 November 2016 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 μ Pa)			EPL Limit	Meteorology ¹	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}			
8/11/2016	20:07	87	67	45	40	2 m/s	Highway Traffic 38-87
						SW	Insects 40-43
						Stab Class: D	Wind 44-52
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
9/11/2016	00:34	84	59	34	40	0 m/s	Rock crusher 34-41
						-	Insects 32-33
						Stab Class: E	Highway traffic 35-84
Average TGO Site L _{Aeq} (15-min) Contribution							37
9/11/2016	19:04	85	65	63	40	3 m/s	Dog 39-40
						N	Highway traffic 38-85
						Stab Class: D	Insects & Birds 37-49
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
10/11/2016	00:22	85	63	61	40	3 m/s	Highway traffic 33-85
						N	Birds & Insects 31-36
						Stab Class: E	
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
10/11/2016	20:15	86	71	69	40	2 m/s	Highway traffic 48-86
						S	Insects 46-49
						Stab Class: D	Rock Crushing 56-58
Average TGO Site L _{Aeq} (15-min) Contribution							37
11/11/2016	00:34	81	60	58	40	0 m/s	Highway traffic 45-81
						-	Mine hum 35-45
						Stab Class: F	Reversing noise 40-44
Average TGO Site L _{Aeq} (15-min) Contribution							40

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

4.3 Location R4 – Assessment Results

The results of the attended noise measurements at location R4 for 8 November to 10 November 2016 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
		L _{Amax}	L _{Aeq}	L _{A90}			
8/11/2016	20:56	60	39	37	36	7 m/s	Wind 37-41
						SW	Tipping 34
						Stab Class: D	Insect 33-40
Average TGO Site L _{Aeq} (15-min) Contribution							34
9/11/2016	0:49	47	32	30	36	1 m/s	Highway traffic 21-34
						SW	Dog 26-37
						Stab Class: F	Insects 21-26
Average TGO Site L _{Aeq} (15-min) Contribution							28
9/11/2016	19:39	47	33	32	36	2 m/s	Highway traffic 31-39
						N	Birds & Insects 28-31
						Stab Class: E	Livestock 31-38
Average TGO Site L _{Aeq} (15-min) Contribution							35
9/11/2016	23:29	52	37	36	36	2 m/s	Mine hum 29-36
						N	Tipping 34-38
						Stab Class: E	Wind 34-39
Average TGO Site L _{Aeq} (15-min) Contribution							35
10/11/2016	19:29	70	42	37	36	2 m/s	Tipping 33-36
							Livestock 24-33
						S	Birds & Insects 27-34
						Stab Class: D	Highway traffic 33-70
							Local residential noise 55-75
Average TGO Site L _{Aeq} (15-min) Contribution							28
10/11/2016	23:27	62	34	28	36	2 m/s	Insects 20-26
							Livestock 19-34
						S	Rock crushing 28-29
						Stab Class: E	Highway traffic 20-26
							Mine hum 19-28
Average TGO Site L _{Aeq} (15-min) Contribution							25

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

4.4 Location R5 – Assessment Results

The results of the attended noise measurements at location R5 for 8 November to 11 November 2016 are summarised in **Table 5** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution. It is noted that the first attended measurement (21:52) on the 8/11/2016 was influenced by rain, however one 15-minute sample was able to be completed without any influence from adverse weather conditions.

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}			
8/11/2016	21:36	83	58	56	37	3 m/s SW Stab Class: D	Highway traffic 34-75 Insects 28-34
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
8/11/2016	22:14	76	58	56	37	4 m/s SW Stab Class: D	Birds 38-52 Highway traffic 28-76 Insects 24-36
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
9/11/2016	18:56	79	62	60	37	3 m/s N Stab Class: D	Highway traffic 59-79 Birds & Insects 40-52 Aircraft 46
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
10/11/2016	0:42	78	57	55	37	3 m/s N Stab Class: E	Birds & Insects 31-46 Livestock 26-36 Highway traffic 35-78 Mine hum 27-28
Average TGO Site L _{Aeq} (15-min) Contribution							28
10/11/2016	18:48	80	60	58	37	2 m/s S Stab Class: D	Highway traffic 33-80 Birds & Insects 30-35 Livestock & Dog 28-40
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
11/11/2016	00:40	83	60	58	37	1 m/s S Stab Class: F	Highway traffic 25-83 Livestock 20-26 Birds & Insects 18-46 Mine hum 22-24
Average TGO Site L _{Aeq} (15-min) Contribution							23

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

4.5 Location R6 – Assessment Results

The results of the attended noise measurements at location R6 for 8 November to 11 November 2016 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 μ Pa)			EPL Limit	Meteorology ¹	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}			
8/11/2016	19:55	53	39	36	36	2 m/s SW Stab Class: E	Livestock 36-44
							Wind 37-43
							Insects 31-36
							Birds 43
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
8/11/2016	23:28	75	46	31	36	3 m/s SW Stab Class: D	Insects 24-34
							Highway traffic 27-34
							Livestock 32-43
							Mine hum 31-32
Average TGO Site L _{Aeq} (15-min) Contribution							32
9/11/2016	20:26	43	33	32	36	2 m/s N Stab Class: E	Mine hum 32-37
							Livestock 31-36
							Insects 32-33
							Average TGO Site L _{Aeq} (15-min) Contribution
9/11/2016	22:02	50	34	33	36	3 m/s N Stab Class: E	Reversing noise 30
							Rock crusher 30-33
							Insects 26-30
							Highway traffic 30-33
Average TGO Site L _{Aeq} (15-min) Contribution							31
10/11/2016	20:13	61	33	31	36	2 m/s S Stab Class: D	Rock crushing 29-31
							Highway traffic 28-32
							Insects 28-30
							Livestock 32-35
Average TGO Site L _{Aeq} (15-min) Contribution							30
10/11/2016	22:10	63	34	31	36	1 m/s S Stab Class: F	Rock crushing 28-36
							Birds & Insects 28-35
							Livestock 22-37
							Aircraft 36
Average TGO Site L _{Aeq} (15-min) Contribution							34

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

4.6 Location R23 – Assessment Results

The results of the attended noise measurements at location R23 for 8 November to 11 November 2016 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)			EPL Limit	Meteorology ¹	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}			
8/11/2016	21:04	75	45	39	39	7 m/s	Highway traffic 38-45
						SW	Tipping >39
							Wind 36-52
							Insects 39-41
Average TGO Site L _{Aeq} (15-min) Contribution							34
8/11/2016	23:27	59	43	39	39	3 m/s	Insects 40
						SW	Rock crusher 36-42
							Dog 42-44
							Highway traffic 48-50
							Tipping 42-43
							Reversing noise 40
Average TGO Site L _{Aeq} (15-min) Contribution							39
9/11/2016	19:38	74	49	44	39	2 m/s	Local residential noise 38-40
						N	Birds 34-59
							Highway traffic 35-65
Average TGO Site L _{Aeq} (15-min) Contribution							TGO Inaudible
10/11/2016	00:14	58	40	38	39	1 m/s	Highway traffic 36-56
						N	Birds & Insects 28-35
							Dog 38-48
Average TGO Site L _{Aeq} (15-min) Contribution							36
10/11/2016	19:36	74	51	45	39	2 m/s	Crusher 35-49
						S	Birds 44-56
							Highway traffic 42-55
							Dog 46-48
Average TGO Site L _{Aeq} (15-min) Contribution							39
10/11/2016	23:26	59	46	45	39	2 m/s	Insects 36
						S	Track slaps 42
							Dog 41-51
							Reversing noise 40-49
Average TGO Site L _{Aeq} (15-min) Contribution							39

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

5 Discussion

5.1 Discussion of Results – Location R2

Measurements conducted on Tuesday 8 November were influenced by wind and rain. Therefore only one applicable 15-minute measurement was able to be obtained during the evening on 8 November 2016. Attended measurement results for monitoring conducted at R2 identified that mine noise was audible on all but one monitoring event, although was masked by insect, livestock and highway traffic noise which were dominant sources. Notwithstanding, the noise contribution from TGO was measured at between 23dBA to 33dBA and satisfied the relevant evening and night noise limits of 36dBA $L_{Aeq(15\text{-min})}$ for all measurements.

5.2 Discussion of Results – Location R3/R29

Monitoring results for the November 2016 monitoring survey were dominated by highway traffic and heavy vehicles. Notwithstanding, mine noise was audible during breaks in traffic and contributed to levels between 37dBA to 40dBA over the three-day monitoring period. Dominant mine noise sources consisted of rock crushing, tipping and reversing although remained below the criteria of 40dBA $L_{Aeq(15\text{min})}$ for all measurements.

5.3 Discussion of Results – Location R4

Mine noise was audible during each attended survey at R4, and the $L_{Aeq(15\text{-min})}$ mine noise contribution ranged between 28dBA to 34dBA. Notable non-mining noise sources at this location include birds, insects, livestock and highway traffic (trucks). All mining contributions remained below the criteria of 36dBA $L_{Aeq(15\text{-min})}$ for all measurements. When mining was audible, tipping and rock crushing were the most identifiable activities.

5.4 Discussion of Results – Location R5

Adverse meteorology conditions including wind and rain influenced the evening measurement on Tuesday 8 November 2016, resulting in only one applicable 15-minute measurement for that period. Highway traffic noise was the dominant source at this receiver for the entire three consecutive day assessment period with only two of the six measurements containing audible mine noise. In general, traffic noise masked mining emissions. Notwithstanding, during breaks in highway traffic, mining noise was barely audible with the $L_{Aeq(15\text{-min})}$ mine noise contribution ranging between 23dBA to 28dBA. Hence, the EPL noise limit of 37dBA, $L_{Aeq(15\text{-min})}$ was satisfied for all measurements during November 2016.

5.5 Discussion of Results – Location R6

TGO was audible on five of six attended monitoring surveys at R6. When audible, $LA_{eq(15-min)}$ mine noise contribution ranged between 30dBA to 34dBA and hence satisfied the relevant EPL noise limit of 36dBA $LA_{eq(15-min)}$ for all measurements. Noise contributions from TGO included mine hum, rock crushing and reversing noise. Dominant non-mining sources included livestock, insects, wind and birds.

5.6 Discussion of Results – Location R23

Highway traffic was the dominant source at this location over the November 2016 noise survey. Notwithstanding, mine noise was audible during all six measurements with the $LA_{eq(15-min)}$ mine noise contribution ranging between 34dBA to 39dBA.

It was noted that the mining contribution included rock crushing and tipping which were the two most acoustically significant sources. The SPLs from these sources ranged from 36dBA to 44dBA. Extraneous non-mining sources include wind, insects, birds and dog barking.

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 methodology adopted to achieve this has compared monthly attended monitoring results for the closest assessed unattended monitoring location. Currently, TGO have two unattended real time monitoring terminals installed within the community surrounding the project site and includes unattended monitors at Ellerslie (R4) and the Brooklands property (nearest to R23). The **Figure 1** locality plan identifies the location of each monitor with respect to the attended monitoring locations. It is noted that the Brooklands unattended monitoring is situated 600m east of the attended noise monitoring location R23, therefore, background (LA90) noise levels are significantly lower due to offset distance to highway traffic. Notwithstanding, the TGO mine noise contribution has been the key indicator in validating noise levels for this assessment.

A comparison of mine noise contributions between attended and unattended noise monitoring demonstrates a general consistency between attended and unattended results. The average difference between attended and unattended mining noise contribution results is 1.8dB, which is reasonable considering the distance between the attended and unattended monitoring positions and the varying timing metrics of each 15-minute interval. Therefore, the unattended monitoring systems are considered an appropriate tool for managing noise emissions from TGO.

Furthermore, results identify that for the November 2016, results remained below the relevant criteria for both locations. **Table 8** and **Table 9** provide a summary of comparisons or results between the attended and unattended noise surveys for R4 and R23 respectively.

Table 8 Comparison of Attended and Unattended Results – R4

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}				
8 November 2016								
Attended	20:56	60	39	37	36	34	7 m/s SW Stab Class: D	Wind 37-41 Tipping 34 Insect 33-40
Unattended	20:46	66	48	37	36	TGO Inaudible		Wind Insects
9 November 2016								
Attended	0:49	47	32	30	36	28	1 m/s SW Stab Class: F	Highway traffic 21-34 Dog 26-37 Insects 21-26
Unattended	00:46	65	38	24	36	24		Wind Highway Insects Mine hum
Attended	19:39	47	33	32	36	35	2 m/s N Stab Class: E	Highway traffic 31-39 Birds / Insects 28-31 Livestock 31-38
Unattended	19:31	58	37	31	36	31		Birds / Wind Highway traffic Mine hum
Attended	23:29	52	37	36	36	35	2 m/s N Stab Class: E	Mine hum 29-36 Tipping 34-38 Wind 34-39
Unattended	23:16	49	36	32	36	32	2 m/s N Stab Class: E	Wind Highway traffic

Table 8 Comparison of Attended and Unattended Results – R4

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}				
10 November 2016								
Attended	19:29	70	42	37	36	28	Mine hum Tipping 33-36 Livestock 24-33 Birds / Insects 27-34 Highway traffic 33-70 Local residential noise 55-75	
Unattended	19:16	74	46	29	36	29	Livestock Mine hum Birds Highway traffic	
Attended	23:27	62	34	28	36	25	Insects 20-26 Livestock 19-34 Rock crushing 28-29 Highway traffic 20-26 Mine hum 19-28	
Unattended	23:16	48	32	27	36	27	Insects Wind Mine hum	

Table 9 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}				
8 November 2016								
Attended	21:04	75	45	39	39	34	7 m/s SW Stab Class: D	Highway traffic 38-45 Tipping >39 Wind / Insects 36-52
Unattended	21:00	64	45	40	39	TGO Inaudible	Stab Class: D	Wind Insects Insects 40
Attended	23:27	59	43	39	39	39	3 m/s SW Stab Class: D	Rock crusher 36-42 Dog 42-44 Highway traffic 48-50 Tipping and reversing 40-43
Unattended	23:30	56	45	40	39	39	Stab Class: D	Mine hum Insects Tipping Highway traffic
9 November 2016								
Attended	19:38	74	49	44	39	TGO Inaudible	2 m/s N Stab Class: E	Local residential noise 38-40 Birds 34-59 Highway traffic 35-65
Unattended	19:30	73	45	34	39	TGO Inaudible	Stab Class: E	Birds and Insects Highway traffic
10 November 2016								
Attended	00:14	58	40	38	39	36	1 m/s N	Highway traffic 36-56 Birds & Insects 28-35

Table 9 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}				
Unattended	00:15	56	41	31	39	33	Stab Class: D	
							Dog 38-48	
Attended	19:36	74	51	45	39	39	Highway traffic	
							Local residential noise	
Unattended	19:30	55	42	36	39	36	Mine hum	
							Crusher 35-49	
Attended	23:26	59	46	45	39	39	Birds 44-56	
							Highway traffic 42-55	
Unattended	23:15	84	68	37	39	TGO Inaudible	Dog 46-48	
							Birds	
Attended	23:26	59	46	45	39	39	2 m/s	
							Track slaps 42	
Unattended	23:15	84	68	37	39	TGO Inaudible	S	
							Dog 41-51	
Attended	23:26	59	46	45	39	39	Stab Class: D	
							Reversing noise 40-49	
Unattended	23:15	84	68	37	39	TGO Inaudible	Stab Class: E	
							Wind	
Attended	23:26	59	46	45	39	39	Dog	
							Insects	

7 Conclusion

MAC has completed a Noise Monitoring Assessment on behalf of Tomingley Gold Operations. The assessment was completed to quantify site noise emissions in accordance with relevant Environment Protection License EPL20169 (EPL) conditions pertaining to mine noise emissions.

Validation between the attended surveys and TGO unattended real time noise monitoring results identify that the average difference between TGO mine contribution is 1.8dBA. Therefore, the current unattended monitoring systems are considered an appropriate tool for managing noise emissions from TGO.

Attended monitoring for three consecutive days between 8 November 2016 to 11 November 2016, has identified that noise emissions generated by TGO comply with relevant statutory noise limits specified in EPL conditions at all assessed locations.

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Appendix A - Glossary of Terms

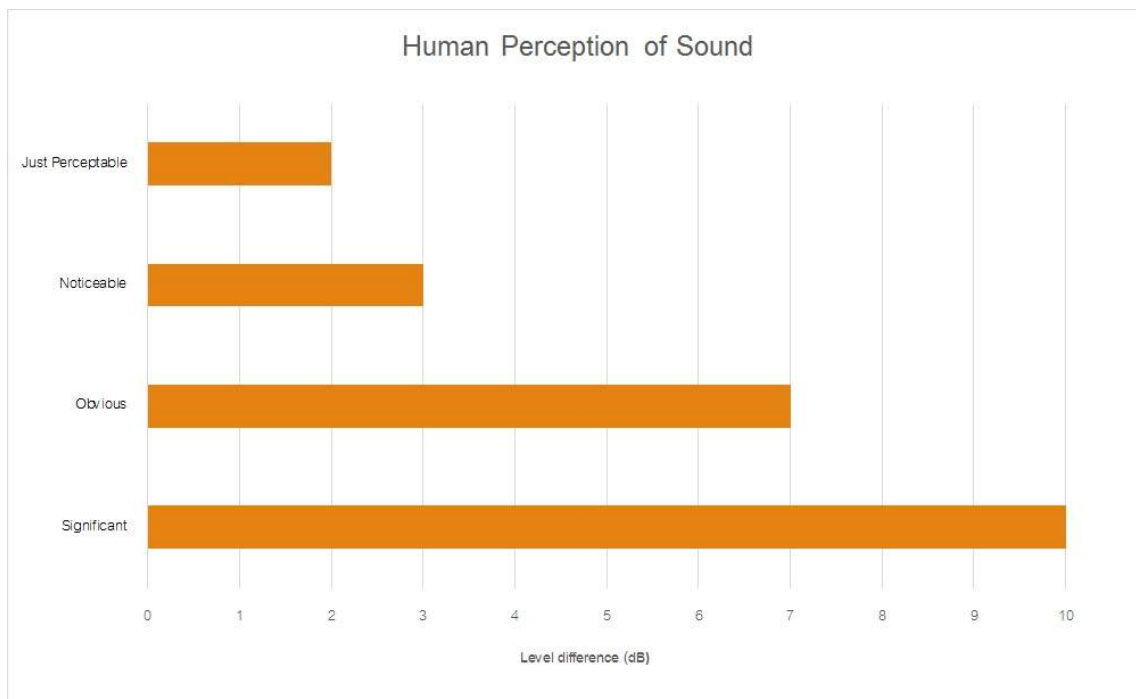
Several technical terms have been used in this report and are explained in **Table A1**.

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.
LAm _{ax}	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 : $= 10 \cdot \log_{10} (W/W_0)$ Where : W is the sound power in watts and W ₀ 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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