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Matai Project

Environmental Noise Impact Assessment

Bojanala Platinum District Municipality

North West Province

Project No : 082/2019
Compiled by : B v/d Merwe
Date : 15 March 2019

DECLARATION OF INDEPENDENCE

I, **Barend J B van der Merwe,** as duly authorised representative of **dBAcoustics**, hereby confirm my independence and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which **Kimopax (Pty)Ltd** was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act) for the compilation of an EIA and EMP for the establishment of the different mine expansion activities at the Matai Mine. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it. I have disclosed, to the environmental assessment practitioner, in writing, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act. I have further provided the environmental assessment practitioner with written access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 and any other specific and relevant legislation (national and provincial), policies, guidelines and best practice.

Signature	:	
Full Name	:	Barend Jacobus Barnardt van der Merwe
Date	:	15 March 2019
Title / Position	:	Environmental noise specialist
Qualification(s)	:	MSc Environmental Management
Experience (years)	:	16 years
Registration(s)	:	SAAI, NACA, IAIA and SAAG

Details of specialist and expertise

I, Barend JB van der Merwe of 43 6th Street, Linden Johannesburg have been an environmental noise and ground vibration specialist for the last 15 years. I have been instrumental in the pre-feasibility studies of proposed projects which may have an impact on the environment and noise sensitive areas. I am also involved with the noise and ground vibration impact assessments and the environmental management plans compilation of large projects such as wind farms, mining, roads, trains (primarily the Gautrain) and various point noise sources. As a post-graduate student in Environmental Management at the University of Johannesburg, I obtained an MSc degree with the research project concentrating on the impact of noise and ground vibration on a village close to a new underground mine. I have played a major role in the identification, evaluation and control of physical factors such as noise and ground vibration in the following projects – wind farms, various platinum and coal mines and the quarterly noise evaluation of the Gautrain, the decommissioning of the N11 near Mokopane, construction of the P166 near Mbombela, design of the Musina by-pass, noise mitigatory measures at the N17 road near Trichardt, establishment of the weigh bridge along the N3 near Pietermaritzburg, George Western by-pass. The following large environmental companies are amongst my clients: Gibb, Royal Haskoning DHV, Coffey Environmental, Golder Associates Africa (Pty) Ltd, GCS Environmental (Pty) Ltd, Knight Piesold Environmental (Pty) Ltd and SRK Engineering (Pty) Ltd

Qualifications

1. MSc – Environmental Management – University of Johannesburg;
2. BSc Honours in Geography and Environmental Management – University of Johannesburg;
3. National Higher Diploma in Environmental Health - Witwatersrand Technikon;
4. National Diploma in Public Health - Cape Town Technikon;
5. National Certificate in Noise Pollution - Technikon SA;
6. National Certificate in Air Pollution - Technikon SA;
7. National Certificate in Water Pollution - Technikon SA;
8. Management Development Diploma - Damelin Management School; and
9. Advanced Business Management Diploma - Rand Afrikaans University.

Membership

- South African Institute of Acoustics (SAAI);
- International Association of Impact Assessment (IAIA);
- National Association of Clean Air (NACA);
- South African Association of Geographers (SAAG).

Experience

- Noise impact assessment of different mine establishments;
- Noise Control Officer i.t.o. Noise Control Regulations;
- Compilation of noise management plans;
- Annual and quarterly baseline noise surveys;
- Moderator Wits Technikon – Environmental Pollution III.
- Various road projects for SANRAL.
- Compilation of the Integrated Pollution strategy for Ekurhuleni Town Council.
- Represent clients at Town Planning Tribunals.
- Represent clients at Housing Board tribunals.
- Determine residual noise levels in certain areas as required by clients.
- Noise attenuation at places of entertainment.
- Design and implementation of sound attenuators.
- Noise projections and contouring.
- Advisory capacity regarding noise related cases to local authorities: - Sandton, Roodepoort, Randburg, Krugersdorp, Alberton, Centurion, Vereeniging. Due to my previous experience in Local Government I provide a service to these Local government departments on the implementation of the Noise Control Regulations and SANS 10103 of

2008 – The measurement and rating of environmental noise with respect to land use, health annoyance and to speech communication.

- Identification, Evaluation and Control of noise sources in industry.

I was involved in the following noise impact assessments during the Environmental Impact Assessment process (Noise and/or Vibration):

- Airlink BID for landing in Kruger National Park;
- Coal gasification plant in Theunissen;
- Langhoogte and Wolseley wind farms;
- Widening of N3 at Howick, KZN;
- Tulu Kapi Mine, Ethiopia;
- Boabab Iron Ore Mine, Mozambique;
- N11 Decommissioning Mokopane;
- Baseline noise survey for NuCoal Mines, Woestalleen, Vuna and Mooiplaats Collieries;
- Baseline noise monitoring Mooinooi mine;
- Leeuwpan coal mine;
- N17 Road at Trichardt for KV3 Engineers;
- N17 Road in Soweto;
- Proposed new by-pass road at Musina;
- George Western By-pass road between George Airport and Outeniqua Pass;
- Gautrain baseline monitoring;
- Upgrade of Delmas Road extensions in Moreletta Park, Pretoria;
- Proposed weigh bridge, N3, Pietermaritzburg:
- Tonkolili Manganese mine, Sierra Leone;
- Proposed wind turbines in the Western Cape – Caledon;
- Extension of works at the PPC factory in Piketberg;
- Exxaro Arnot Colliery – Mooifontein;
- Hydro power plant – 2 Sites in Durban;
- Coal export terminal in Beira, Mozambique;
- Site selection for new Power Station – Kangra Mine, Piet Retief;
- Gas exploration at Ellisras;
- Noise survey and assessment of future mine shafts at various mines;
- Mining exploration at Potgietersrus – Lonmin Akani;
- New coal mines in Witbank – Dorstfontein Expansion Project;
- New coal mines in Middelburg and Ermelo;
- New Vanadium Manganese mine in Potgietersrus;

- Xolobeni mining project in Transkei;
- Glynn mines in Sabie;
- Rezoning of properties for housing at Burgersfort, Shosanguve, Hammanskraal;
- Various noise impact assessment for clients in and around Centurion;
- Relocation of night races from Newmarket racecourse to Turfontein racecourse;
- Rezoning applications for private clients.

Indemnity and Conditions Relating to this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on scientific and recommended survey and assessment techniques. This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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Executive summary

Introduction

dBAcoustics was appointed to determine the prevailing ambient noise levels in the vicinity of the proposed Matai mine project and at the residential areas in the vicinity of the of the study area.

The Matai mining project will be situated north of the Pilansberg National Park and located in the Bojanala Platinum District. The Matai prospecting right area is situated 65km north of Rustenburg and access to the proposed mine will be along the R510 and smaller feeder roads which runs through the villages. The proposed mining activities will take place in the northern side of the prospecting right area. Ga Ramosidi, Sefikile, Mononono, Manamakhotheng, Moruleng, Ramoga, Lesetlheng and Legkraal are situated some distance from the prospecting right boundaries and the following villages are situated some distance from the prospecting right boundaries.

The mining method will be a conventional open pit mining method where blasting will be used to fragment the over burden and rock. The material will be transported over land to the processing plant (jaw crusher, double deck sizing screen, primary cone crusher, secondary cone crusher, double deck sizing screen and product stockpile) where the product will be loaded onto hauling vehicles to the end user. Waste rock will be hauled to the waste rock dump which is planned north of the open cast mining area.

Environmental Noise Impact Assessment

In terms of the Noise Regulations a noise disturbance is created when the prevailing ambient noise level is exceeded by 7.0dBA or more. Noise however becomes audible when the prevailing ambient noise level is exceeded by 5.0dBA. It will therefore be more environmentally sustainable for a new development that the latter benchmark be used as a completely mechanised development will be introduced into the study area. Noise and/or sound is part of our daily exposure to different sources which is part of daily living and some of these physical attributes which may at times be intrusive forms part of the ambient levels that people get used to without noticing the higher levels.

Two aspects are important when considering potential impacts of a project:

- The increase in the noise levels, and;
- The overall noise levels produced.

The proposed changes during the pre-construction, construction, operational, decommissioning and post closure phases will require approved management measures and ongoing environmental noise surveys to ensure compliance to the relevant environmental noise regulations and/or standards.

Conclusion and Recommendations

The noise impact during the pre-construction, construction and decommissioning phases, of which most will be during daytime periods only, will be insignificant and moderate during the operational phase. There will be a slight noise increase during the operational phase of the project but not exceeding the 5.0dBA threshold value. Noise mitigatory measures must at all times be in place in order for the proposed mining activities to comply with the relevant noise standards.

The proposed Matai mine project will be in line with the noise standards and guidelines provided that the noise mitigatory measures are in place and that the Environmental management Plan (EMP) for the proposed mine establishment is adhered to and implemented at all times.

Barend van der Merwe – MSc UJ
Environmental noise and vibration specialist

List of Figures

List of Tables

This report was prepared in terms of the Environmental Management Act, 1998 (Act No. 107 of 1998), the Environmental Impact Assessment Regulations, 2014 – Regulation 982 and the following aspects are dealt with in the report:

No.	Requirement	Section in report
1a)	Details of -	
(i)	The specialist who prepared the report	3
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	3
b)	A declaration that the specialist is independent	2
c)	An indication of the scope of, and the purpose for which, the report was prepared	15
d)	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	13
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process	21
f)	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	28
g)	An identification of any areas to be avoided, including buffers	n/a
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	15 and 24
i)	A description of any assumption made and any uncertainties or gaps in knowledge	15
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment	37
k)	Any mitigation measures for inclusion in the EMPr	50
l)	Any conditions for inclusion in the environmental authorisation	52
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	50 & 51
n)	A reasoned opinion -	
(i)	As to whether the proposed activity or portions thereof should be authorised	
(ii)	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	53
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	n/a
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
q)	Any other information requested by the competent authority	n/a

1. Introduction

The Matai mining project will be situated north of the Pilansberg National Park and located in the Bojanala Platinum District. The Matai prospecting right area is situated 65km north of Rustenburg and access to the proposed mine will be along the R510 and smaller feeder roads which runs through the villages. The proposed mining activities will take place in the northern side of the prospecting right area. Ga Ramosidi and Sefikile are situated towards the northern side, Mononono towards the eastern side, Manamakhotheng, Moruleng, Ramoga and Lesetlheng towards the southern side and Legkraal towards the western side. It is only Manamakhotheng and Mononono which abuts the boundary of the prospecting right area as all the other villages are situated some distance from the prospecting right boundaries.

Swartklip mine and another opencast mine is situated to the north and west respectively of the Matai mine study area. No mining activities from the other mines in the area were audible during the time of the Matai mine noise survey which was carried out on 28 February 2019.

The mine infra-structure (offices and workshop facilities) will be situated on 2 hectares which will be north of the opencast mining operations.

The location of the Matai mine prospecting boundaries is illustrated in Figure 1.1.

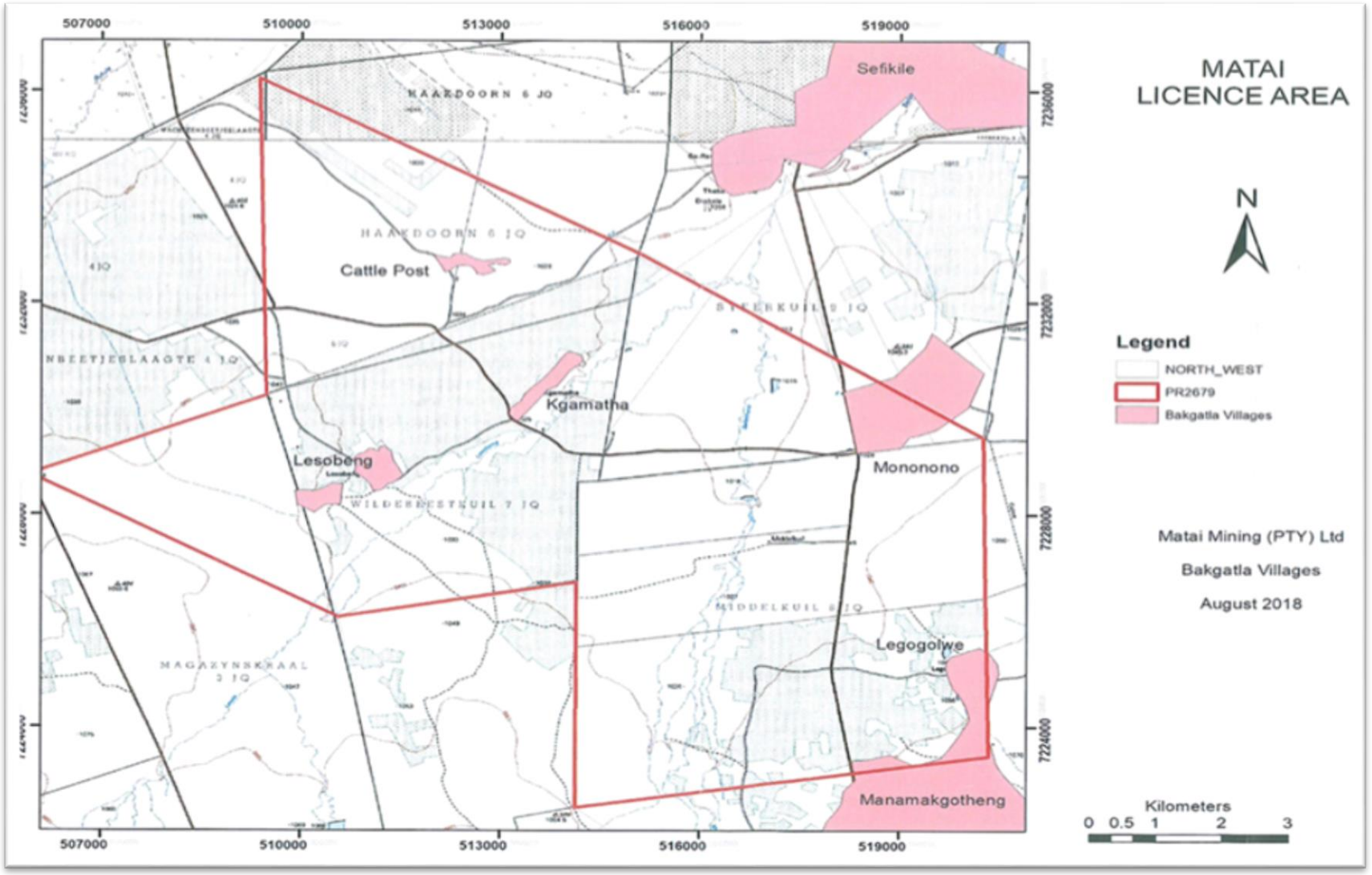


Figure 1.1: Matai mine prospecting right boundaries

The purpose of the environmental noise study was to determine the environmental baseline noise levels at the mine establishment area and abutting noise receptors. The noise baseline information will be used to calculate the potential noise intrusion levels from the mine activities at the noise receptors to the north, east, west and south of the Matai prospecting area.

The distances between the noise sources and the receptors, topography, vegetation, noise level at the noise source and the wind direction are all variables that may have an impact on how the sound will be propagated to and perceived by the noise receptor/s. The distances between the different linear and/or point sources and topography will be dealt with later on in the report.

The general objectives of the specialist study were to gain a detailed understanding of the baseline noise environment where the mine establishment will take place as well as at the abutting noise receptors.

1.1 Project Description

The mining method will be a conventional open pit mining method where blasting will be used to fragment the over burden and rock. The material will be transported over land to the processing plant (jaw crusher, double deck sizing screen 1, primary cone crusher, secondary cone crusher, double deck sizing screen 2 and product stockpile) where the product will be loaded onto hauling vehicles to the end user. Waste rock will be hauled to the waste rock dump which is planned north of the open cast mining area. The proposed lay-out of the mining area is illustrated in Figure 1.2.

Figure 1.2: Proposed lay-out of the mining area

1.2 The purpose of the environmental noise study

The field survey was done to determine the environmental baseline environmental noise levels at the proposed Matai mine project area.

The noise baseline environmental noise information will be used to calculate the possible noise intrusion levels from the proposed mine activities and infra-structure at the noise receptors. The distances between the noise sources and the receptors, topography, vegetation, noise level at the noise source and the wind direction are all variables that may have an impact on how the sound will be propagated to the noise receptor/s.

1.3 Assumptions and Limitations

The following limitations forms part of the environmental noise measurements:

- The prevailing ambient noise levels for the study area was created by far and near noise sources associated with traffic, domestic activities and seasonal agricultural activities with the result that the prevailing ambient noise level may change at times;
- Noise measurements in the presence of winds in excess of 3.0m/s may impact the outcome of the environmental noise results;
- The identification of noise measuring points may create a problem in terms of the prevailing noise levels should it not be done with outmost care and in a scientific manner;
- The influx of traffic into an area will have an influence on the prevailing ambient noise levels and should be considered during the noise impact assessment process

There will be a difference between the summer and winter periods as the insect activities such as crickets and cicadas raise the prevailing ambient noise levels during the summer period whereas the prevailing ambient noise levels will not be influenced by insects during the winter period.

2. Background to environmental noise

2.1 Environmental noise

Sound is a wave motion, which occurs when a sound source sets the nearest particles of air in motion. The movement gradually spreads to air particles further away from the source. Sound propagates in air with a speed of approximately 340 m/s.

The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – inverse square law. Expressed logarithmically as decibels, this means the sound level decreases 6.0dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3.0dB per doubling of distance. The decibel scale is logarithmic, therefore decibel levels cannot be added in the normal arithmetic way, for example, two sound sources of 50.0dB each do not produce 100.0dB but 53.0dB, nor does 50.0dB and 30.0dB equal 80.0dB, but remains 50.0dB. Air absorption is important over large distances at high frequencies and it depends on the humidity but is typically about 40.0dB/km @ 4000 Hz. Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

When measuring the intensity of a sound, an instrument, which duplicates the ear variable sensitivity to sound of different frequency, is usually used. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter because it conforms to the internationally standardized A-weighting curves. Measurements of sound level made with this filter are called A-weighted sound level measurements, and the unit is dB.

Sound propagation is affected by wind gradient rather than the wind itself. The profile of the ground causes such a gradient. The sound may be propagated during upwind conditions upwards to create a sound shadow. A downwind refracts the sound towards the ground producing a slight increase in sound level over calm isothermal conditions. The velocity of sound is inversely proportional to the temperature therefore a temperature gradient produces a velocity gradient and a refraction of the sound. Temperature decreases with height and the sound is refracted upwards.

For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening can be effective when there is a barrier between the receiver and the source i.e. walls, earth mounds, cuttings and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m^2.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general the ear is less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3.0-5.0dBA.

There are certain effects produced by sound which, if it is not controlled by approved acoustic mitigatory measures, seem to be construed as undesirable by most people and they are:

- Long exposure to high levels of sound, which may damage the hearing or create a temporary threshold shift – in industry or at areas where music is played louder than 95.0dBA. This will seldom happen in far-field conditions;
- Interference with speech where important information by the receiver cannot be analysed due to loud noises;
- Excessive loudness; and
- Annoyance.

A number of factors, for example clarity of speech, age of listener and the presence of noise induced threshold displacement, will influence the comprehensibility of speech communication.

The effect of noise (with the exception of long duration, high level noise) on humans is limited to disturbance and/or annoyance and the accompanying emotional reaction. This reaction is very difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noise maker, the time of day or night and the day of the week.

Types of noise exposure:

- Continuous exposure to noise – The level is constant and does not vary with time e.g. traffic on freeway and an extractor fan;
- Intermittent exposure to noise – The noise level is not constant and occurs at times e.g. car alarms and sirens;
- Exposure to impact noise – A sharp burst of sound at intermittent intervals e.g. explosions and low frequency sound.

Noise affects humans differently and the new noise which will be coming from the mine expansionist and the associated activities will depend upon the intensity of the sound, the length of time of exposure and how often over time the ear is exposed to it. Urban dwellers are besieged by noise, not only in the city streets but also in the busy workplaces and household noises.

The time-varying characteristics of environmental noise are described using statistical noise descriptors:

- Leq: The Leq is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same period of time.
- L_{Max}: The instantaneous maximum noise level for a specified period of time.
- L_{Min}: The instantaneous minimum noise level for a specified period of time.

The following relationships occur for increases in A-weighted noise levels:

- The trained healthy human ear is able to discern changes in sound levels of 1.0dBA under controlled conditions in an acoustic laboratory;
- It is widely accepted that the average healthy ear can barely perceive noise level changes of 3.0dBA;
- A change in sound level of 5.0dBA is a readily perceptible increase in noise level; and
- A 10.0dBA change in the sound level is perceived as twice as loud as the original source.

The World Bank in the Environmental Health and Safety Guidelines has laid down the following noise level guidelines:

- Residential area – 55.0dBA for the daytime and 45.0dBA for the night-time period; and
- Industrial area – 70.0dBA for the day- and night-time periods.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be. In order to evaluate such, there must be uniform guidelines to evaluate each scenario. SANS 10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise levels per district as given in Table 2.1.

Table 2-1: Recommended noise levels for different districts

Type of	**Equivalent continuous rating level ($L_{Req.T}$) for ambient noise -** dBA

district	Outdoors			Indoors, with open windows		
	Day-night L_{Rdn}	Daytime L_{Reqd}	Night-time L_{Reqn}	Day-night $L_{R.dn}$	Daytime $L_{Req.d}$	Night-time $L_{Req.n}$
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
e) Central business district	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

For industrial districts, the $L_{R.dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24h day/night cycle, $L_{Req.d} = L_{Req.n} = 70$dBA can be considered as typical and normal.

The response to noise can be classified as follows:

- An increase of 1.0dBA to 3.0dBA above the ambient noise level will cause no response from the affected community. For a person with normal hearing an increase of 0.0dBA to 3.0dBA will not be noticeable.
- An increase between 1.0dBA to 10.0dBA will elicit little to sporadic response. When the difference is more than 5.0dBA above the ambient noise level a person with normal hearing will start to hear a difference.
- An increase between 5.0dBA to 15.0dBA will elicit medium response from the affected community.
- An increase between 10.0dBA to 20.0dBA will elicit strong community reaction.

Because there is no clear-cut transition from one community response to another as well as several variables, categories of responses can overlap. This should be taken into consideration during the evaluation of a potential noise problem. There is therefore a mixture of activities and higher noise levels as per the above recommended continuous rating levels within i.e. residential, industrial and feeder roads in close proximity of each other. The ambient noise level will therefore differ throughout the study area, depending on the region and the measuring position in relation to areas with existing mining activities. People exposed to an increase in the prevailing ambient noise level will react differently to the noise levels and the response is given in Table 2.2.

Table 2-2: Estimated community/group response when the ambient noise level is exceeded

Excess	Estimated community/group response	
dB	Category	Description
0	None	No observed reaction
0-10	Little	Sporadic complaints
5-15	Medium	Widespread complaints
10-20	Strong	Threats of community/group action

>15	Very strong	Vigorous community/group action

3. Study methodology

3.1 Instrumentation

The noise survey was conducted in terms of the provisions of the Noise Control Regulations, 1994 and the SANS 10103 of 2008 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) using a digital Larson Davis 831 – Class 1 meter with Logging, Environmental 1/1, 1/3 Octave Band and percentiles Sound Level Meter (Class 1). On taking measurements the device-meter scale was set to the "A" weighed measurement scale which enables the device to respond in the same manner as the human ear. The device was held approximately 1.5 m above the surface and at least 3.0m away from hard reflecting surfaces. A suitable wind shield was used on the microphone for all measurements in order to minimize wind interference. The Instrument was checked and calibrated prior to use and maintained in accordance with equipment and coincided below 1.0dBA.The following instruments were used in the noise survey:

- Larsen Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0001072;
- Larsen Davis Pre-amplifier – Serial no.PRM831 0206;
- Larsen Davis ½" free field microphone – Serial no. 377 B02 SN 102184;
- Larsen Davis Calibrator 200 – Serial no.9855;
- Certificate Number: 2018-AS-0912;
- Date of Calibration: 15 August 2018; and,
- Date of next calibration August 2019.

The instrument was calibrated before and after the measurements was done and coincided within 1.0dBA. Batteries were fully charged and the windshield was in place at all times.

The noise survey was carried out in terms of the Noise Control Regulations being:

"16 (1) Any person taking readings shall ensure that -

(a) sound measuring instruments comply with the requirements for type I instrument in accordance with SABS-IEC 60651, SABS-IEC 60804 and SABS-I EC 60942 as the case may be;(b) the acoustic sensitivity of sound level meters is checked before and after every series of measurements by using a sound calibrator, and shall reject the results if the before and after calibration

values differ by more than 1 dBA;(c) the microphones of sound measuring instruments are at all times provided with a windshield;(d) the sound measuring instruments are operated strictly in accordance with the manufacturer's instructions; and,

(e) sound measuring instruments are verified annually by a calibration laboratory for compliance with the specifications for accuracy of national codes of practice for acoustics, to comply with the Measuring Units and National Measuring Standards Act 1973 (Act No. 76 of 1973).

(2) The measuring of dBA values in respect of controlled areas, ambient sound levels

or noise levels in terms of these regulations shall be done as follows:

(a) outdoor measurements on a piece of land: By placing the microphone of an integrating impulse sound level meter at least 1,2 metres, but not more than 1,4 metres, above the ground and at least 3,5 metres away from walls, buildings or other sound reflecting surfaces".

The calibration certificates are attached as Appendix A. The measured ambient noise level during the daytime and night time periods will be the baseline ambient noise criteria for the study area and will be evaluated in terms of SANS 10103 of 2008.

3.2 Measuring points

The measuring points for the study area were selected to be representative of the prevailing ambient noise levels for the study area and include all the noise sources such as distant traffic noise, agricultural activities but exclude traffic noise which was intermittent in the vicinity of the measuring points. The measuring points are illustrated in Figure 3.1

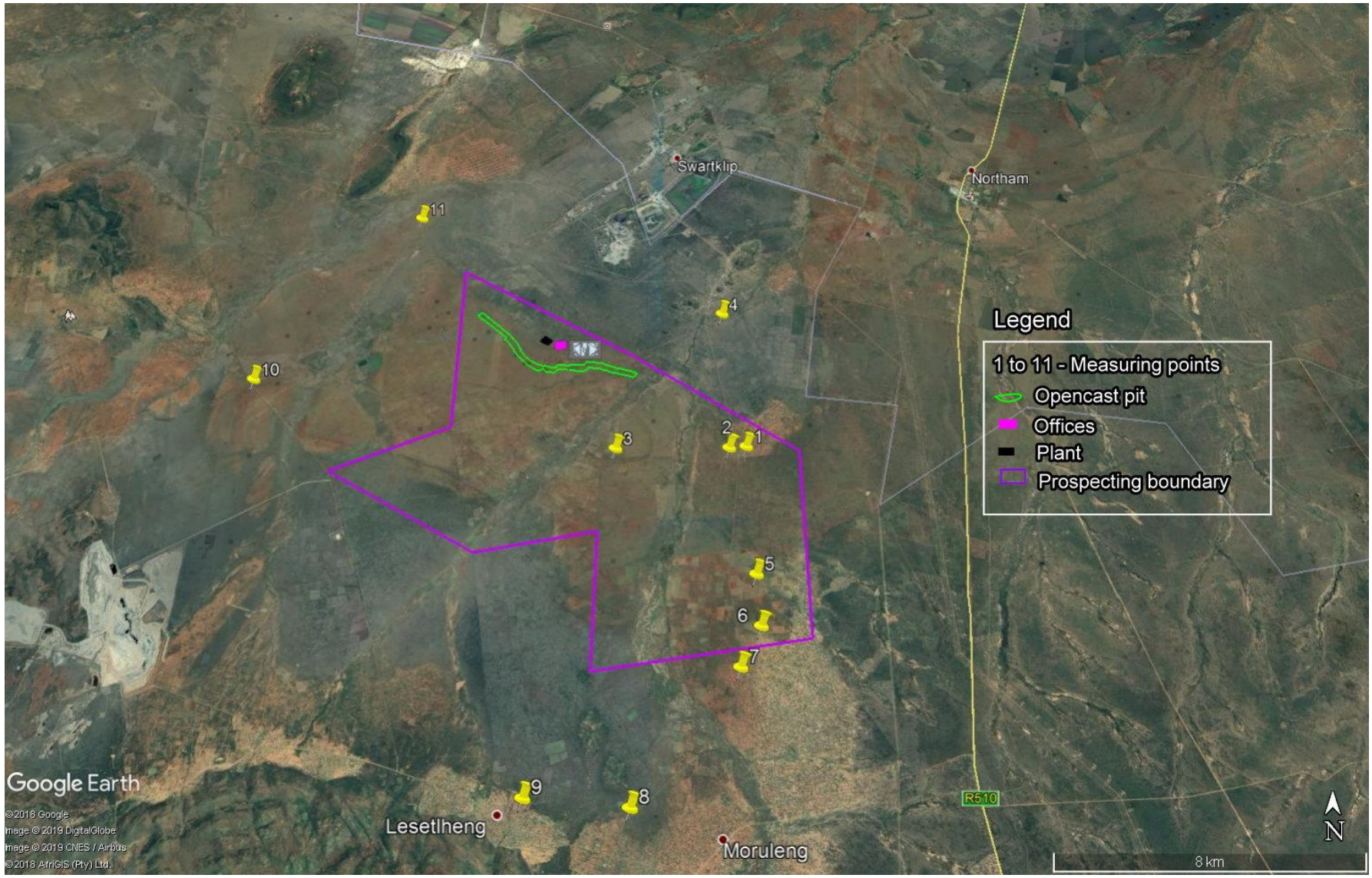


Figure 3-1: Measuring points for the study area

The measuring points along the boundaries of the study area and the physical attributes of each measuring point are illustrated in Table 3.1.

Table 3-1: Measuring points and co-ordinates for the study area

Position	Latitude	Longitude	Remarks
1	25^0 3.192' S	027^0 11.000' E	Mononono Village. Distant traffic, birds, insects
2	25^0 3.215' S	027^0 10.692' E	Mononono Village. Distant traffic, birds and domestic.
3	25^0 3.227' S	027^0 8.630' E	Kgamatha. Birds and insects.
4	25^0 0.510' S	027^0 10.605' E	Ga Romosidi. Distant traffic, birds and insects.
5	25^0 5.463' S	027^0 11.115' E	Manamakhotheng. Distant traffic and insects.
6	25^0 6.313' S	027^0 11.168' E	Manamakhotheng. Distant traffic and insects.
7	25^0 6.959' S	027^0 10.809' E	Manamakhotheng. Distant traffic and insects.
8	25^0 9.007' S	027^0 9.048' E	Moruleng. Distant traffic and birds.
9	25^0 8.878' S	027^0 7.378' E	Lesetlheng. Distant traffic and birds.
10	25^0 1.879' S	027^0 1.800' E	Gravel road to Magalane. Birds and insects.
11	24^0 58.344' S	027^0 4.527' E	Gravel road to Mopyane. Birds and insects.

The following is of relevance to the ambient noise measurements:

- The L_{Aeq} was measured over a representative sampling period exceeding 10 minutes at each measuring point; and
- The noise survey was carried out during the day and night-time period being 06h00 to 22h00 for the day time and 22h00 to 06h00 for the night time period

3.3 Site Characteristics

The following observations were made in and around the study area:

- The proposed Matai mine will take place in an area where there subsistence farming , gravel roads and distant mining activities;
- There was a an intermittent flow of traffic along the tarred feeder and gravel roads;
- There was an intermittent flow of traffic in the villages;
- Traffic noise contributes to the higher prevailing ambient noise level for the residential areas in close proximity of the feeder roads;;
- The wind and weather conditions play an important role in noise propagation; and
- Distant traffic noise contributes to a large portion of the prevailing ambient noise levels.

3.4 Current noise sources

The following are noise sources in the vicinity of and the boundaries of the study area:

- Seasonal agricultural activities;
- Traffic noise along the feeder roads;
- Distant traffic noise from the abutting feeder roads;
- Insects;
- Birds; and
- Wind noise.

3.5 Atmospheric conditions during the noise survey

The noise readings were carried out at the different measuring points and the prevailing atmospheric conditions i.e. wind speed, wind direction and temperature were taken into consideration. The readings were done away from any large vertical structures, which may influence the outcome of the readings.
The following meteorological conditions were recorded:

28 February 2019
Daytime

- Wind speed – less than 2.0m/s;
- Temperature – 34.5^{o}C – No strong temperature gradient occurred near the ground;
- Cloud cover – High cloud cover;
- Wind direction – The wind was blowing from a north-westerly direction; and
- Humidity – 30 % humidity.

Night time

- Wind speed – less than 0.8m/s;
- Temperature – 19.5^{o}C ;
- Cloud cover – No cloud cover;
- Wind direction – The wind was blowing from a south-westerly direction; and
- Humidity – 20 % humidity.

4. Regulatory and Legislative Requirements

There are specific regulatory and legislative requirements which regulate the proposed development in terms of environmental noise. The legislative documents are as follows:

4.1 Department of Environment Affairs: Noise Control Regulations promulgated under the Environment Conservation Act, (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994.

These noise control regulations are applicable in the study area and the main aspect of these noise control regulations is that you may exceed the prevailing ambient noise levels by 7.0dBA before a noise disturbance is created.

4.2 South African National Standards – SANS 10103 of 2008

The South African National Standards provide the guidelines for the different recommended prevailing ambient noise levels and how to evaluate when a specific operation or activity is creating a noise disturbance and what reaction can be expected if a noise disturbance is created.

4.3 South African National Standards – SANS 10210 of 2004

This national standard is used when calculating or predicting increased road traffic noise during new developments.

4.4 General Environmental, Health and Safety Guidelines of the IFC of the World Bank

The recommended noise level for a noise sensitive area is 55.0dBA during the day and 45.0dBA during the night.

The Constitution of the Republic of South Africa Act, (Act No 108 of 1996) makes provision for the health and well-being of the citizens and to prevent pollution and to promote conservation.

According to Article 24 of the Act, everyone has the right to:

(a) an environment that is not harmful to their health and well-being; and

(b) have the environment protected for the present and future generations through reasonable legislative and other measures:

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecological sustainable development and use of natural resources, while promoting justifiable economic and social development.

It is widely recognized that many aspects of mining operations may lead to an increase in the environmental ambient noise levels. The impact of such an increase in the prevailing noise levels can be both physical and physiological. Many aspects of mining operations lead to an increase in noise levels over the prevailing ambient levels (Garvin *et al*., 2009).

5. Description of the receiving environment

Traffic, seasonal agricultural activities, domestic activities birds (during the day) insects (during the night) and domestic type noises contribute to the prevailing ambient noise level of the study area. The residential properties in the vicinity of the proposed mine project area and other mining activities are illustrated in Figure 5.1.

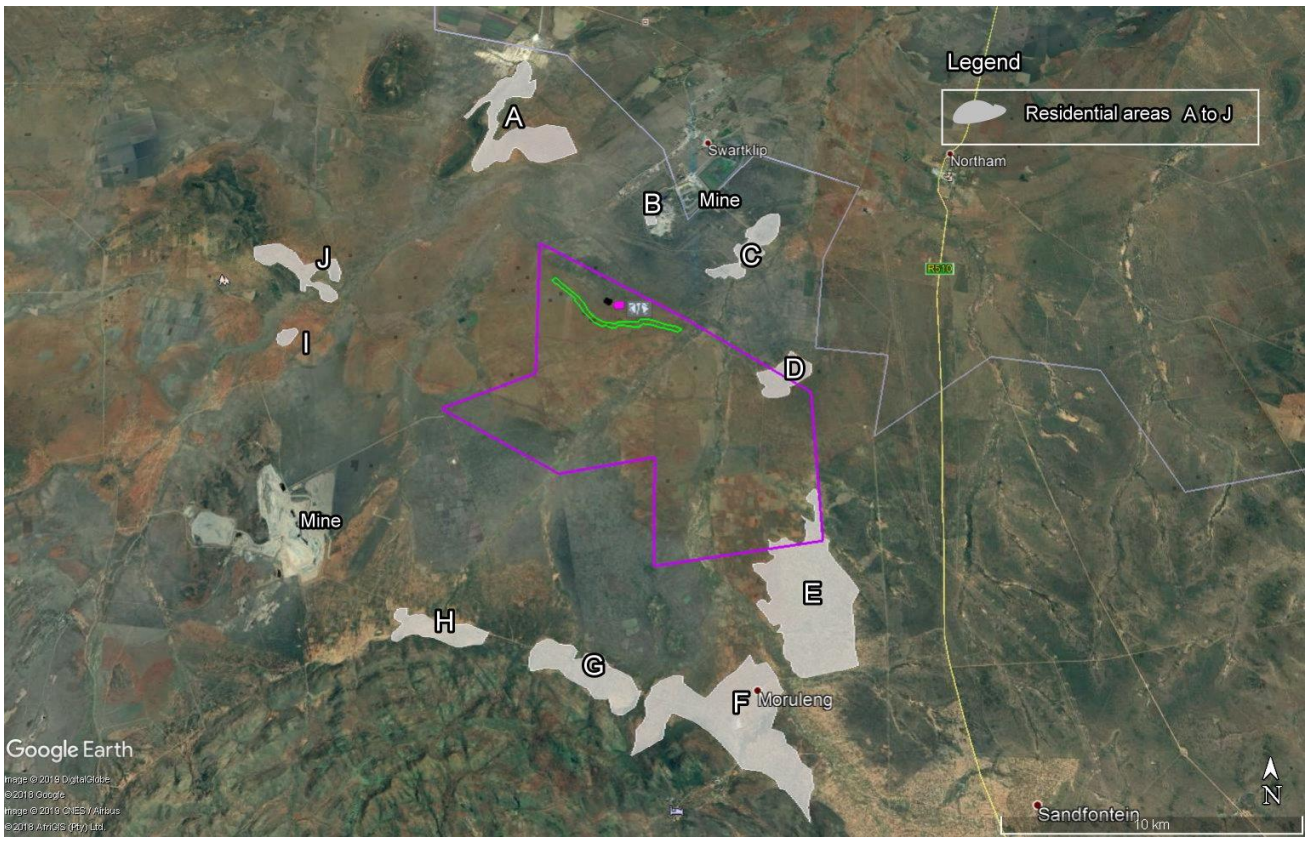


Figure 5-1: Residential properties

The distances between the different mine project areas and the residential properties are given in Table 5.1. This is for direct line of sight and vertical structures such as trees, topography between the source and receptors were not taken into consideration.

Table 5-1 Distances (in meter) between the different mining activities and the residential areas.

Position	Plant	Waste rock	Crusher at plant	ROM at plant	Overland conveyor	Admin offices	Open cast pit west	Opencast pit middle	Opencast pit east	Haul road	Access Road
A	7512	8302	7512	7954	7935	8306	6572	8861	9632	8056	8235
B	4174	4165	4174	4612	4891	4071	4872	5291	5003	4680	3241
C	4234	3621	4234	4488	4721	3818	6198	5060	3030	4868	1125
D	7141	5863	7141	6836	6995	6269	9011	6497	4287	6981	4917
E	11505	10302	11505	11184	11181	10820	13213	10605	8938	11260	10251
F	15652	15131	15652	15135	14909	15422	16451	14644	13882	15062	15654
G	14489	14192	14489	13732	13572	14027	14726	13401	13439	13837	15863
H	14425	14379	14425	13575	13788	14325	14410	13289	14432	13615	16834
I	12476	13634	12476	12479	12157	13256	10733	12551	15114	12593	16046
J	11060	12072	11060	11335	11025	11824	9182	10916	13300	10880	14527

6. Results of the noise survey

6.1 Noise survey

In Table 6.1 are the different prevailing ambient noise levels for the specific areas, which include all the noise sources currently in the area such as domestic, traffic noise, distant mine noise and natural noise sources. Leq is the average noise level for the specific measuring point over a period of time, the Lmax is the maximum noise level and the Lmin is the minimum noise level registered during the noise survey for the specific area in dBA.

Table 6-1: Noise levels for the day and night in the study area.

Position	Day time				Night time			
	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks
1	**44.9**	63.0	28.6	Distant traffic, domestic & birds.	**48.9**	61.6	38.7	Without traffic 40.9dBA, insects & domestic.
2	**34.2**	62.7	22.9	Distant traffic, domestic & birds.	**35.3**	51.7	21.4	Insects.
3	**37.3**	63.4	27.2	Distant birds.	**35.4**	53.9	20.6	Insects.
4	**36.2**	63.0	24.9	Distant traffic, domestic & birds.	**44.4**	54.7	41.2	Insects and distant traffic.
5	**36.2**	63.6	23.1	Distant traffic, domestic & birds.	**44.7**	55.5	40.0	Insects and distant traffic.
6	**43.0**	58.4	30.3	Distant traffic, domestic & birds.	**44.4**	54.7	41.2	Domestic and insects.
7	**45.6**	66.1	26.8	Distant traffic, domestic & birds.	**45.4**	63.2	38.2	Domestic, insects and distant traffic.
8	**36.3**	62.5	25.7	Distant traffic, domestic & birds.	**37.6**	56.3	27.8	Insects and distant traffic.
9	**36.2**	64.3	22.4	Distant traffic, domestic & birds.	**38.0**	51.3	28.7	Insects and distant traffic.
10	**34.9**	65.1	22.0	Birds.	**33.8**	60.5	21.9	Distant insects.
11	**33.4**	63.8	20.5	Birds.	**30.3**	54.5	18.4	Distant insects.

The arithmetic averages throughout the study area are as follows:

- Villages – 35.6dBA during the day and 34.7dBA during the night; and
- Vicinity of feeder roads – 45.6dBA during the day and 45.4dBA during the night.

Table 6-2: Sound pressure levels of construction machinery

Equipment	**Reduction in the noise level some distance from the source - dBA**								
Cumulative distance from source in meters	2m from the machinery and/or equipment	15m	30m	60m	120m	240m	480m	960m	1920m
Dump truck	91.0	62.5	56.5	50.4	44.4	38.4	32.4	26.4	20.3
Backhoe	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Drilling Equipment	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Flatbed truck	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pickup truck	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Tractor trailer	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Crane	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pumps	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Welding Machine	72.0	43.5	37.5	31.4	25.4	19.4	13.4	7.4	1.3
Generator	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Compressor	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pile driver	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Jackhammer	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Rock drills	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Pneumatic tools	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Cumulative noise levels from the construction activities when all of such work within a radius of 30m	105.5	76.9	70.9	64.9	58.9	52.9	46.8	40.8	34.8

The noise reduction calculated in Table 5.2 is for direct line of sight and medium ground conditions. Engineering control measures and topography can have an influence on how the noise level is perceived by the occupants of nearby noise sensitive areas. The cumulative noise level of the machinery and equipment will be 64.9dBA at 60m and 40.8dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time. This will seldom happen and the cumulative noise level will therefore be lower.

6.2 Noise impact at the different noise receptors

The following equation was used to calculate the noise level at the noise sensitive areas during the construction phase:

$$Lp = Lw - 20\log R - 5dB$$

Where, Lp is the sound level at a distance from the source in dBA;

Lw is the sound level at the source in dBA; and

R is the distance from the source.

The following sound levels were used in determining the noise intrusion level during the construction phase during mining establishment:

- Clearing and grubbing of the plant footprint – 85.0dBA;
- Construction activities at plant – 90.0dBA;
- Construction of the infra-structure – 85.0dBA;
- Civil construction activities – 85.0dBA;
- Construction of the overland conveyor – 80.0dBA; and
- Construction of hauling roads – 85.0dBA.

The following sound levels were used in determining the noise intrusion level during the operational phase of the mining activities:

- Processing plant activities – 85.0dBA;
- Crushing activities – 95.0dBA;
- Pit activities – 90.0dBA;
- ROM – 87.5.0dBA;
- Hauling of material to the plant – 85.0dBA;
- Hauling of waste rock to the waste rock dump – 87.0dBA;
- Traffic – 80.0dBA; and
- Emergency generator – 95.0dBA.

The following sound levels were used in determining the noise intrusion level during the Closure/rehabilitation phase of the mining activities:

- Removal of all Infra-structure – 80.0dBA; and
- Landfill and planting of grass – 80.0dBA.

This noise impact formula and the Interactive noise calculator (ISO 9613) will be used to determine the noise levels during the construction phase of the project. The noise levels at the noise sensitive areas will be added in a logarithmic manner to determine the overall sound exposure at the receptor. The categorization of the intrusion levels during the construction and operational phases will be as follows. The increase in the prevailing ambient noise level is calculated in the following manner:

$\Delta L\text{Req,T} = L\text{Req,T (post)} - L\text{Req,T (pre)}$

where,

LReq,T (post) – noise level after completion of the project – projected or calculated noise levels;

LReq,T (pre) – noise level before the proposed project – ambient noise level.

The criteria for assessing the magnitude of a noise impact are illustrated in Table 6.3.

Table 6-3: Noise intrusion level criteria

Increase Δ-dBA	**Assessment of impact magnitude**	**Color code**
$0 < \Delta \leq 1$	Not audible	
$1 < \Delta \leq 3$	Very Low	
$3 < \Delta \leq 5$	Low	
$5 < \Delta \leq 10$	Medium	
$10 < \Delta \leq 15$	High	
$15 < \Delta$	Very High	

The noise levels from the different mining activities will be added in a logarithmic manner as perceived at the noise sensitive areas. The noise intrusion level will be calculated by subtracting the prevailing ambient noise level from the cumulative noise level.

6.2.1 Construction phase

The noise intrusion levels during the construction phase at processing plant, overland conveyor and infra-structure are illustrated in Table 6.4. The noise intrusion during the construction phase will be insignificant.

Table 6-4: Noise intrusion levels (in dBA) during construction phase

Position	Clearing and grubbing of the plant footprint	Construction activities at plant	Construction of the infra-structure	Civil construction activities	Construction of the overland conveyor	Construction of hauling roads	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time

A	3.0	3.0	3.0	5.0	4.5	4.4	11.7	33.4	30.4	0.0	0.1
B	8.1	8.1	8.1	10.1	8.7	9.1	15.0	33.5	30.4	0.1	0.1
C	8.0	8.0	8.0	10.0	9.0	8.8	15.0	36.2	37.3	0.0	0.0
D	3.4	3.4	3.4	5.4	5.6	5.6	12.2	34.2	35.3	0.0	0.0
E	-0.7	-0.7	-0.7	1.3	1.5	1.5	10.1	36.2	35.3	0.0	0.0
F	-3.4	-3.4	-3.4	-1.4	-1.0	-1.1	9.2	36.3	37.6	0.0	0.0
G	-2.7	-2.7	-2.7	-0.7	-0.2	-0.3	9.4	36.2	38.0	0.0	0.0
H	-2.7	-2.7	-2.7	-0.7	-0.3	-0.2	9.4	36.2	38.0	0.0	0.0
I	-1.4	-1.4	-1.4	0.6	0.8	0.5	9.8	34.9	33.8	0.0	0.0
J	-0.4	-0.4	-0.4	1.6	1.7	1.8	10.2	34.9	33.8	0.0	0.0

6.2.2 Operational phase

The calculated noise levels and subsequent noise intrusion levels at the abutting noise receptors during mining activities at the mine footprint (plant and open cast) will be illustrated in Table 6.5 (open pit activities to the east and the plant operations), Table 6.6 (open pit activities at the middle and the plant operations) and Table 6.7 (open pit activities to the west and the plant operations) respectively. Noise modelling will be done later on in the report which is based on the ISO 9613 method (distance from the source, noise barriers, and ground effect and air absorption).

The mine activities will not be audible during the day and night after the implementation of the noise mitigatory measures. The threshold value of 7.0dBA will not be exceeded at any of the noise receptors.

Table 6-5: Noise intrusion levels (dBA) at the residential areas during pit activities (eastern) and the plant

Position	Processing plant activities	Crushing activities	Pit activities	ROM	Hauling of material to the plant	Hauling of waste rock to the waste rock dump	Traffic	Emergency generator	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time
A	8.0	13.0	12.5	12.5	7.4	7.4	-2.8	12.5	17.1	33.5	30.5	0.1	0.2
B	13.1	18.1	17.2	17.2	12.1	12.1	5.3	16.7	21.4	33.7	30.8	0.3	0.5
C	13.0	18.0	17.5	17.5	11.8	11.8	14.5	17.0	22.3	36.4	37.4	0.2	0.1
D	8.4	13.4	13.8	13.8	8.6	8.6	1.7	13.6	18.3	34.3	35.4	0.1	0.1
E	4.3	9.3	9.5	9.5	4.5	4.5	-4.7	9.5	14.5	36.2	35.3	0.0	0.0
F	1.6	6.6	6.9	6.9	1.9	1.9	-8.4	7.0	12.4	36.3	37.6	0.0	0.0
G	2.3	7.3	7.7	7.7	2.7	2.7	-8.5	7.8	13.0	36.2	38.0	0.0	0.0
H	2.3	7.3	7.8	7.8	2.8	2.8	-9.0	7.7	13.0	36.2	38.0	0.0	0.0
I	3.6	8.6	8.6	8.6	3.5	3.5	-8.6	8.8	13.7	34.9	33.8	0.0	0.0
J	4.6	9.6	9.4	9.4	4.8	4.8	-7.7	9.7	14.5	34.9	33.9	0.0	0.1

Table 6-6: Noise intrusion levels (dBA) at the residential areas during pit activities (middle) and the plant

Position	Processing plant activities	Crushing activities	Pit activities	ROM	Hauling of material to the plant	Hauling of waste rock to the waste rock dump	Traffic	Emergency generator	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time

A	8.0	13.0	11.6	12.5	7.4	7.4	-2.8	12.5	17.1	33.5	30.5	0.1	0.2
B	13.1	18.1	16.0	17.2	12.1	12.1	5.3	16.7	21.4	33.7	30.8	0.3	0.5
C	13.0	18.0	16.4	17.5	11.8	11.8	14.5	17.0	22.3	36.4	37.4	0.2	0.1
D	8.4	13.4	14.2	13.8	8.6	8.6	1.7	13.6	18.3	34.3	35.4	0.1	0.1
E	4.3	9.3	10.0	9.5	4.5	4.5	-4.7	9.5	14.5	36.2	35.3	0.0	0.0
F	1.6	6.6	7.2	6.9	1.9	1.9	-8.4	7.0	12.4	36.3	37.6	0.0	0.0
G	2.3	7.3	8.0	7.7	2.7	2.7	-8.5	7.8	13.0	36.2	38.0	0.0	0.0
H	2.3	7.3	8.0	7.8	2.8	2.8	-9.0	7.7	13.0	36.2	38.0	0.0	0.0
I	3.6	8.6	8.5	8.6	3.5	3.5	-8.6	8.8	13.7	34.9	33.8	0.0	0.0
J	4.6	9.6	9.7	9.4	4.8	4.8	-7.7	9.7	14.5	34.9	33.9	0.0	0.1

Table 6-7: Noise intrusion levels (dBA) at the residential areas during pit activities (western) and the plant

Position	Processing plant activities	Crushing activities	Pit activities	ROM	Hauling of material to the plant	Hauling of waste rock to the waste rock dump	Traffic	Emergency generator	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time
A	8.0	13.0	14.1	12.5	7.4	7.4	-2.8	12.5	17.1	33.5	30.5	0.1	0.2
B	13.1	18.1	16.7	17.2	12.1	12.1	5.3	16.7	21.4	33.7	30.8	0.3	0.5
C	13.0	18.0	14.7	17.5	11.8	11.8	14.5	17.0	22.3	36.4	37.4	0.2	0.1
D	8.4	13.4	11.4	13.8	8.6	8.6	1.7	13.6	18.3	34.3	35.4	0.1	0.1
E	4.3	9.3	8.1	9.5	4.5	4.5	-4.7	9.5	14.5	36.2	35.3	0.0	0.0
F	1.6	6.6	6.2	6.9	1.9	1.9	-8.4	7.0	12.4	36.3	37.6	0.0	0.0
G	2.3	7.3	7.1	7.7	2.7	2.7	-8.5	7.8	13.0	36.2	38.0	0.0	0.0
H	2.3	7.3	7.3	7.8	2.8	2.8	-9.0	7.7	13.0	36.2	38.0	0.0	0.0
I	3.6	8.6	9.9	8.6	3.5	3.5	-8.6	8.8	13.7	34.9	33.8	0.0	0.0
J	4.6	9.6	11.2	9.4	4.8	4.8	-7.7	9.7	14.5	34.9	33.9	0.0	0.1

6.2.3 Calculation of road traffic noise

The main access road to and from the Matai mine is illustrated in Figure 6.1.

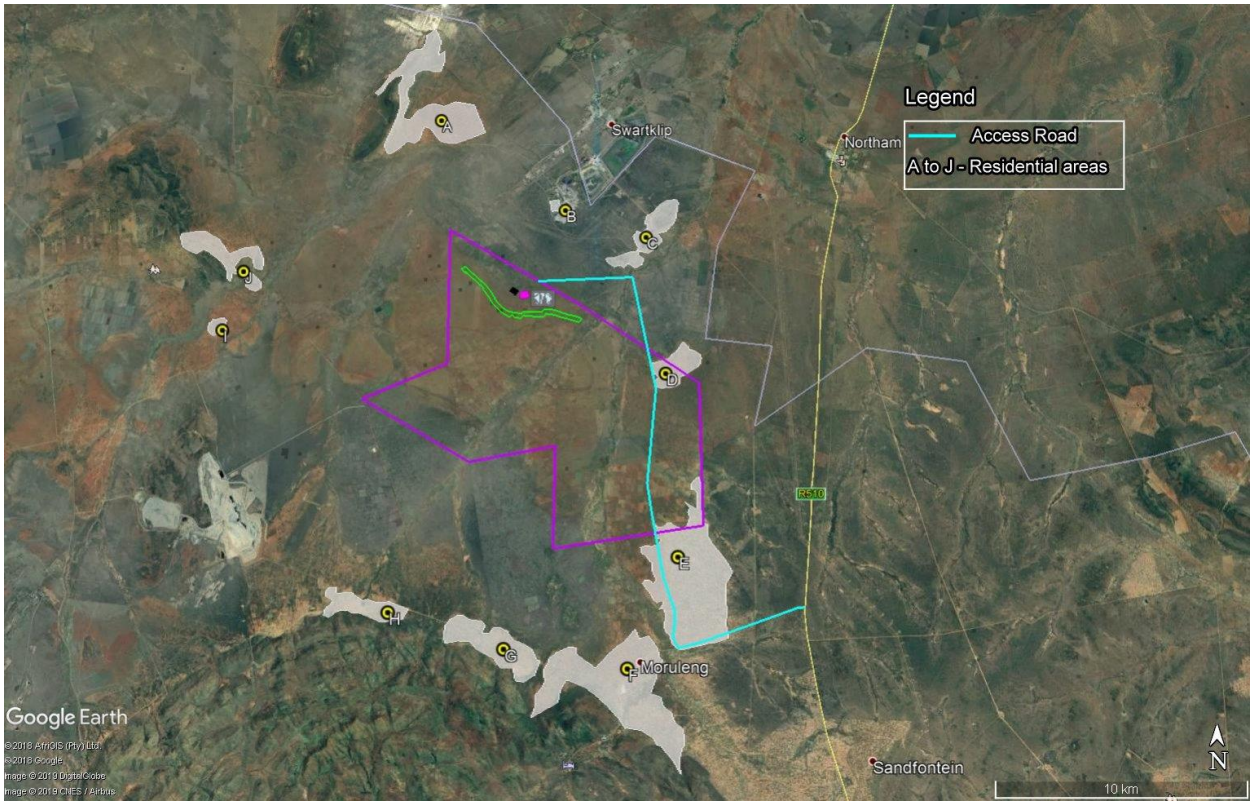


Figure 6-1: Feeder road to the Matai mine

The calculations to determine the noise level from the additional traffic during peak times in the morning and the evening are based on the following equation:

SANS 10210 of 2004, the national standard for the calculating and predicting of road traffic noise was used to calculate the noise level to be generated by the traffic along a road. The graph in Figure 6-2 is a typical example of an intermittent type traffic flow with increased levels during peak periods when busses, taxis and motor-vehicles travelled along a road. The measuring point was 30m from the edge of the road and the peak values were created by busses (7), taxis (6), and cars (5) over a period of 20-minutes.

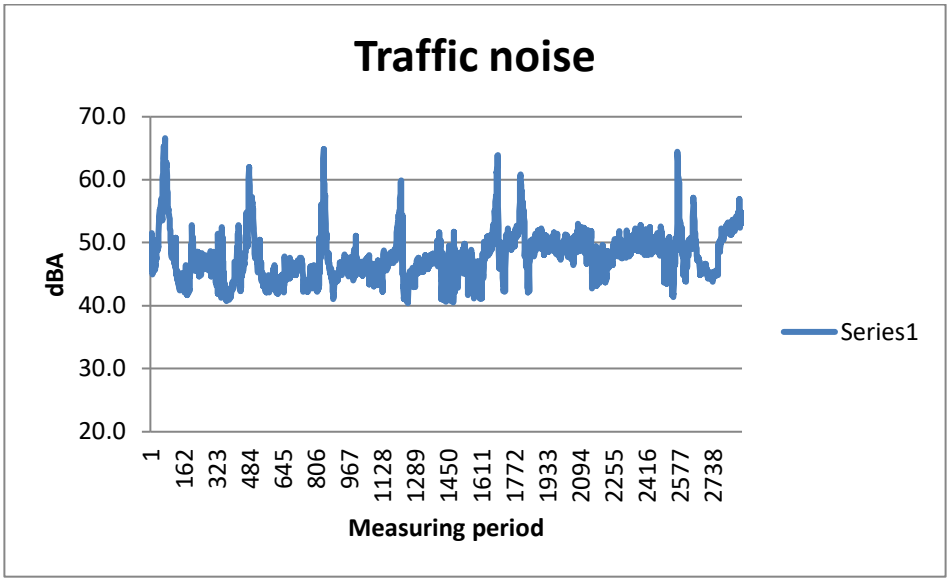


Figure 6-2: Traffic noise levels along a mine feeder road

The calculation of the noise levels during the construction phase are based on a total of 52 vehicles per hour of which 45 will be heavy-duty vehicles and 7 will be motor-vehicles. The traffic volume per hour during the operational phase will be 95 vehicles of which 60 will be busses and 35 motor-vehicles per hour.

Basic Model

$$L_{Basic} = 38.3 + 10 \text{ Log } (Q_r) \text{ dBA},$$

where; L_{Basic} = basic noise level in dBA and Q_r is the mean traffic flow per hour.

The calculated traffic noise level during the construction phase will be 57.5dBA at 25m from the road and 44.7dBA at 200m from the road. The traffic noise level during the operational phase will be 58.1dBA at 25m from the road and 45.6dBA at 200m from the road.

6.2.4 Wind direction

The wind rose for the Pilansberg region is illustrated in Figure 6.3. Airflow at the weather station at the Pilansberg National Park shows a diurnal influence with winds originating from the north, south and south-west during the day-time. An increase in wind speeds is recorded at this station during the afternoon and early evening (12:00 – 18:00). A shift in the wind-field is observed after 18:00 with winds originating from the northerly and westerly sectors during the night-time.

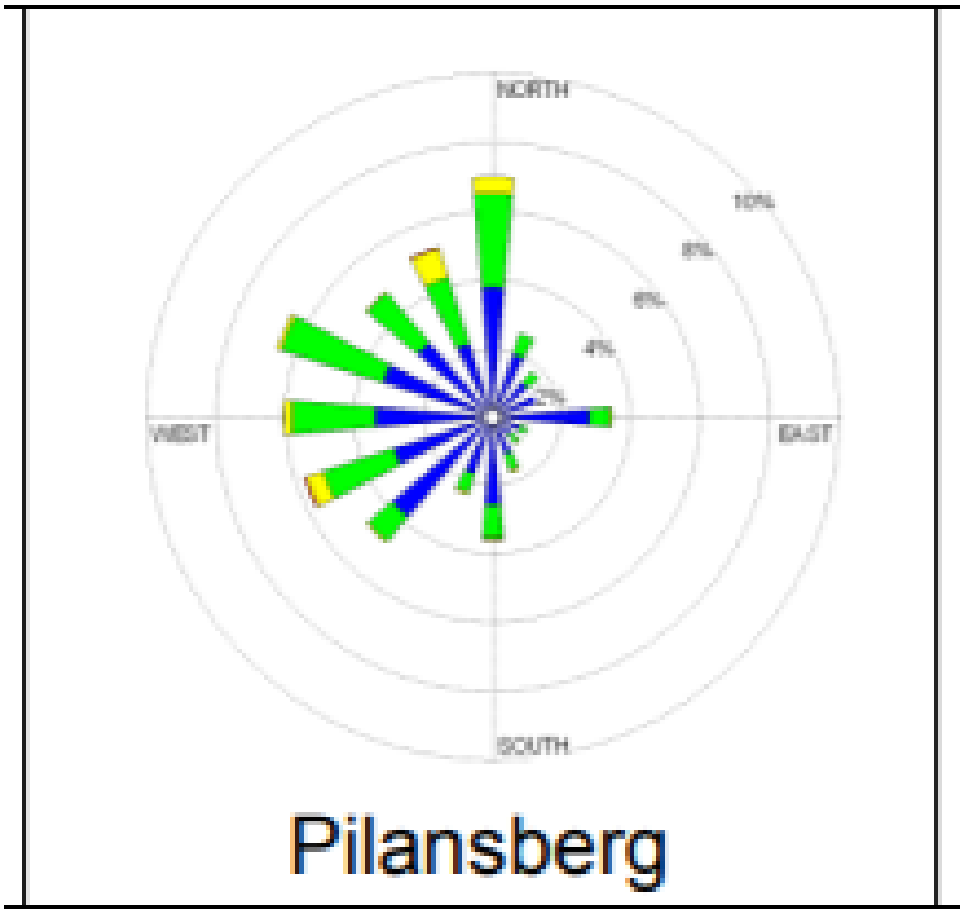


Figure 6-3: Windrose for the Pilansberg region

Thermo-topographical induced flow is anticipated to represent an important component in the airflow over the study area with significant differences evident between day-time and night-time wind field characteristics.

7. Noise impact assessment

In terms of the Noise Regulations a noise disturbance is created when the prevailing ambient noise level is exceeded by 7.0dBA or more. Noise however becomes audible when the prevailing ambient noise level is exceeded by 5.0dBA. It will therefore be more environmentally sustainable for a new development that the latter benchmark be used as a completely mechanised development will be introduced into an area where there is currently no noise except for natural type noises such as insect, bird or wind noise and seasonal agricultural activities. The residents in the vicinity of the Matai mine were exposed to industrial type noise levels due to existing distant mining operations. The topography, wind direction, distances between the mine activities (point and/or linear noise sources) and the residential areas play an important role in how the sound will be propagated. Noise modelling was done for the operational phase. The noise contours are attached as Appendix B. The noise projections were done with stable conditions with no winds.

The topography between the proposed mine activities in the valley and some of the residential areas to the north-south and the east-west are illustrated in the following figures and this will illustrate how sound will be propagated when there is a flat plain and undulated areas.

The topography between north-south is a flat plain and west-east undulated and is illustrated in Figure 7.1 and Figure 7.2 respectively.

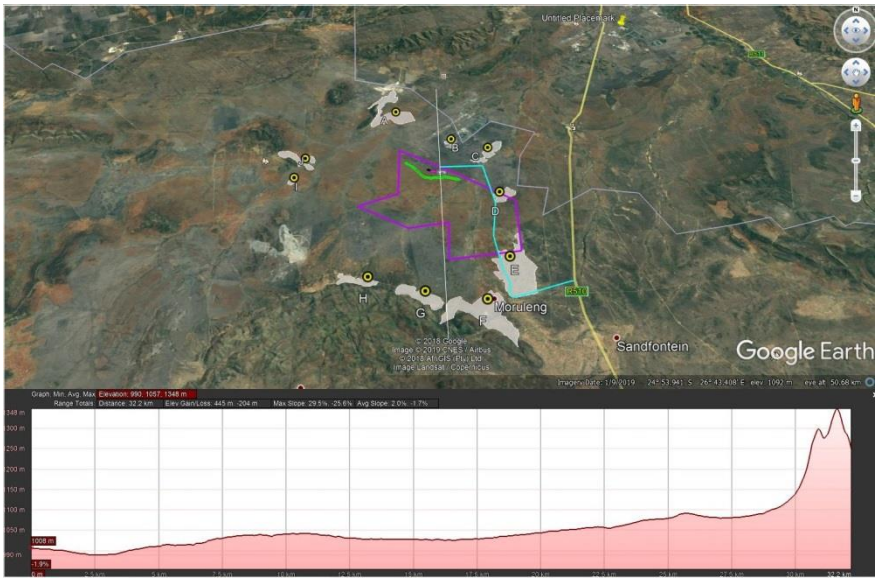


Figure 7-1: Topography between north and south

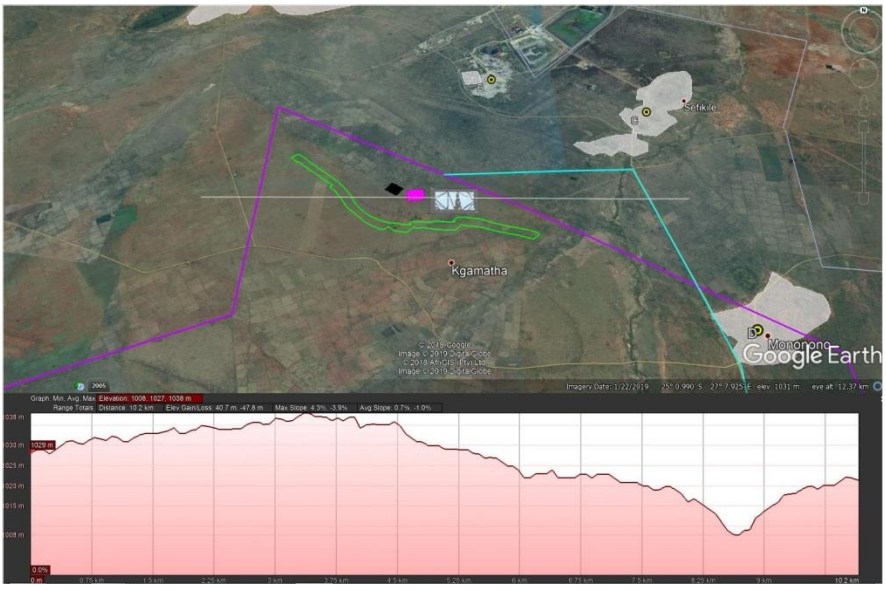


Figure 7-2: Topography between the west and east

8. Vibration Impact Assessment

The vibration and over-air pressure levels during blasting will result in an increase in the prevailing noise level when blasting take place. The same physical attributes such as distance, topography and wind direction will play a role on how the receptors will perceive the over-air pressure and ground vibration levels which last for up to 3-seconds per blast.

9. Impact Identification and Assessment

Noise or sound is part of our daily exposure to different sources which is part of daily living and some of the sounds which are intrusive such as traffic noise forms part of the ambient noise that people get accustomed to without noticing the higher sound levels. Any person in the workplace and at home is exposed to the following noise levels as given in Table 9.1. These are the average noise levels in the workplace and at home that will mask noise from a source introduced into an area:

Table 9-1: Different noise levels in and around the house and workplace

	Activity	**dBA**
Communication	Whisper	30.0
Communication	Normal Conversation	55.0-65.0
Communication	Shouted Conversation	90.0
Communication	Baby Crying	80.0
Communication	Computer	37.0-45.0
Home/Office	Refrigerator	40.0-43.0
Home/Office	Radio Playing in Background	45.0-50.0
Home/Office	Background Music	50.0
Home/Office	Washing Machine	50.0-75.0
Home/Office	Microwave	55.0-59.0
Home/Office	Clothes Dryer	56.0-58.0
Home/Office	Alarm Clock	60.0-80.0
Home/Office	Vacuum Cleaner	70.0
Home/Office	TV Audio	70.0
Home/Office	Flush Toilet	75.0-85.0
Industry	Industrial activities	85.0-95.0
Home/Office	Ringing Telephone	80.0
Home/Office	Hairdryer	80.0-95.0
Home/Office	Maximum Output of Stereo	100.0-110.0

Two aspects are important when considering potential noise impacts of a project and it is:

- The increase in the noise level, and;
- The overall noise level produced.

9.1 Risk Assessment

A risk assessment methodology has been formalised to comply with Regulation 31(2)(l) of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA). The identified noise sources for each stage of the proposed development will be assessed and mitigatory measures will be recommended to ensure compliance to the Noise Control Regulations and Blasting Standards.

The following activities may generate noise during the pre-construction phase of the project:

- Exploration activities;
- Building of temporary roads; and
- Field studies by different specialists.

The following activities may generate noise during the construction phase of the project:

- Clearing and grubbing of the plant footprint;
- Construction activities at plant;
- Construction of the infra-structure;
- Civil construction activities;
- Construction of the overland conveyor; and
- Construction of hauling roads.

The noise sources within the project area that may create increased noise levels on a temporary and/or permanent basis during the operational phase of the project:

- Processing plant activities;
- Crushing activities;
- Pit activities;
- ROM;
- Hauling of material to the plant;
- Hauling of waste rock to the waste rock dump;
- Additional traffic; and
- Emergency generator.

The following activities may generate noise during the decommissioning phase of the project:

- Backfill of mined areas;
- Planting of grass and vegetation at the rehabilitated area;
- Removal of infra-structure.

9.2 Environmental impact assessment

The impact assessment methodology has been formalised to comply with Regulation 31(2)(l) of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), which states the following:

An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision …, and must include –

an assessment of each identified potentially significant impact, including –

(i) **cumulative** impacts;
(ii) the **nature** of the impact;
(iii) the **extent** and **duration** of the impact;
(iv) the **probability** of the impact occurring;
(v) the **degree** to which the **impact can be reversed**;
(vi) the **degree** to which the impact may **cause irreplaceable loss of resources**; and
(vii) the **degree** to which the **impact can be mitigated**.

Based on the above, the EIA Methodology will require that each potential impact identified is clearly described (providing the nature of the impact) and be assessed in terms of the following factors:

- **extend** (spatial scale) - will the impact affect the national, regional or local environment, or only that of the site?
- **duration** (temporal scale) - how long will the impact last?;
- **magnitude** (severity) - will the impact be of high, moderate or low severity?; and
- **probability** (likelihood of occurring) - how likely is it that the impact may occur?.

To enable a scientific approach for the determination of the environmental significance (importance) of each identified potential impact, a numerical value has been linked to each factor.

The following ranking scales are applicable:

	Duration:	**Probability:**
Occurrence	5 – Permanent	5 – Definite/don't know
	4 - Long-term (ceases with the operational life)	4 – Highly probable
	3 - Medium-term (5-15 years)	3 – Medium probability

	2 - Short-term (0-5 years)	2 – Low probability
	1 – Immediate	1 – Improbable
		0 – None
Severity	**Extent/scale:**	**Magnitude:**
	5 – International	10 - Very high/uncertain
	4 – National	8 – High
	3 – Regional	6 – Moderate
	2 – Local	4 – Low
	1 – Site only	2 – Minor
	0 – None	

Once the above factors had been ranked for each identified potential impact, the environmental significance of each impact can be calculated using the following formula:

Significance = (duration + extend + magnitude) x probability

The maximum value that can be calculated for the environmental significance of any impact is 100. The environmental significance of any identified potential impact is then rated as either: high, moderate or low on the following basis:

- More than 60 significance value indicates a high (H) environmental significance impact;
- Between 30 and 60 significance value indicates a moderate (M) environmental significance impact; and
- Less than 30 significance value indicates a low (L) environmental significance impact.

In order to assess the ***degree to which the potential impact can be reversed and be mitigated***, each identified potential impact will need to be assessed twice.

- Firstly the potential impact will be assessed and rated prior to implementing any mitigation and management measures; and
- Secondly, the potential impact will be assessed and rated after the proposed mitigation and management measures have been implemented.

The purpose of this dual rating of the impact before and after mitigation is to indicate that the significance rating of the initial impact is and should be higher in relation to the significance of the impact after mitigation measures have been implemented.

In order to assess the ***degree to which the potential impact can cause irreplaceable loss of resources***, the following classes (%) will be used and will need to select based on your informed decision and discression:

5) 100% - Permanent loss

4) 75% - 99% - significant loss

3) 50% - 74% - moderate loss

2) 25% - 49% - minor loss

1) 0% - 24% - limited loss

9.2.1 Impact assessment during the pre-construction phase

- Exploration activities;
- Building of temporary roads; and
- Field studies by different specialists.

Table 9-2: Exploration activities

Activity	**Exploration activities**					
Project phase	*Pre-construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential properties*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	4	27	Low
Mitigation measures	*Exploration with machinery to be done during daytime working hours.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	18	Low

Table 9-3: Building of temporary roads

Activity	**Building of temporary roads**					
Project phase	*Pre-construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	4	27	Low
Mitigation measures	*Building activities to be done during daytime working hours.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	18	Low

Table 9-4: Field studies by different specialists

Activity	**Field studies by different specialists**					
Project phase	*Pre-construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	4	27	Low
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance***	***Significance***

Management Impact rating					***score***	
	2	3	2	4	18	Low

9.2.2 Impact assessment during the construction phase

Table 9-5: Clearing and stripping of topsoil and vegetation

Activity	**Clearing and stripping of topsoil and vegetation**					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	6	33	Moderate
Mitigation measures	*Earthwork activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	27	Low

Table 9-6: Construction activities at plant

Activity	**Construction activities at plant**					
Project phase	*Construction phase*					
Impact Summary	*Earthwork activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	6	33	Moderate
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	27	Low

Table 9-7: Construction of the infra-structure at the different areas

Activity	**Construction of the infra-structure at the different areas**					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	6	33	Moderate
Mitigation measures	• *Building activities to be done during daytime working hours only.* • *All equipment which will be used will have to comply with the manufacturers specifications.* • *Noise survey to be done to ensure that the 85.0dBA threshold value will not be exceeded.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	27	Low

Table 9-8: Civil construction activities

Activity	**Civil construction activities**					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	6	33	Moderate
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance***	***Significance***

Management Impact rating					***score***	
	2	3	2	4	27	Low

Table 9-9: Construction of the overland conveyor

Activity	**Construction of the overland conveyor**					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	6	33	Moderate
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	27	Low

Table 9-10: Construction of hauling roads

Activity	**Construction of hauling roads**					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	6	33	Moderate
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	27	Low

9.2.3 Impact assessment during the operational phase

Table 9-11: Processing plant activities

Activity	**Processing plant activities**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	6	39	Moderate
Mitigation measures	• *All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off.* • *Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the boundaries of the Mototolo concentrator plant have not changed.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	4	33	Moderate

Table 9-12: Crushing activities

Activity	**Crushing activities at the northern decline shaft**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	6	39	Moderate
Mitigation measures	• *All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off.* • *Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the footprint boundaries are in line with the 70.0dBA threshold value.*					

After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	4	33	Moderate

Table 9-13: Pit activities

Activity	**Pit activities**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	6	39	Moderate
Mitigation measures	• *All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off.* • *Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the footprint boundaries are in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	4	33	Moderate

Table 9-14: ROM

Activity	**ROM**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	6	39	Moderate
Mitigation measures	*Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the footprint boundaries are in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	4	33	Moderate

Table 9-15: Hauling of material to the plant

Activity	**Hauling of material to the plant**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	6	39	Moderate
Mitigation measures	*Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the footprint boundaries are in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	4	33	Moderate

Table 9-16: Hauling of waste rock to the waste rock dump

Activity	**Hauling of waste rock to the waste rock dump**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	6	39	Moderate
Mitigation measures	*Noise survey to be done on a quarterly basis and after one year to change to an annual basis if the prevailing ambient noise levels at the footprint boundaries are in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	5	2	4	33	Moderate

Table 9-17: Additional traffic

Activity	**Additional traffic**					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	2	5	2	6	26	Low
Mitigation measures	*Speed limit of mining areas to be adhered to at all times.*					
After Management Impact rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	2	5	2	4	22	Low

Table 9-18: Emergency generator

Activity	**Emergency generator**					
Project phase	*Operational phase*					
Impact Summary	*Noise readings to be done in the vicinity of and along the emergency boundaries to ensure that the prevailing ambient noise level is not exceeded.*					
Potential Impact Rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	3	5	2	6	39	Moderate
Mitigation measures	*Noise survey to be done at the footprint boundaries of the emergency generator and the threshold value of 70.0dBA may not be exceeded at any one time.*					
After Management Impact rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	3	5	2	4	33	Moderate

9.2.4 Impact assessment during the decommissioning phase

Table 9-19: Removal of infra-structure

Activity	**Removal of infra-structure**					
Project phase	*Decommissioning phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	3	3	2	4	27	Low
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After Management Impact rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	2	3	2	4	18	Low

Table 9-20: Backfill of disturbed areas

Activity	**Backfill of disturbed areas**					
Project phase	*Decommissioning phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*
	3	3	2	4	27	Low
Mitigation measures	*Building activities to be done during daytime working hours unless there is no heavy duty machinery which may create a noise problem.*					
After	*Probability*	*Duration*	*Extent*	*Magnitude*	*Significance score*	*Significance*

Management Impact rating	2	3	2	4	18	Low

Table 9-21: Planting of grass and vegetation at rehabilitated

Activity	**Planting of grass and vegetation at rehabilitated area**					
Project phase	*Decommissioning phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	4	27	Low
Mitigation measures	*Planting of grass and vegetation to be done during daytime working.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	18	Low

9.2.5 Impact assessment during the post closure phase

Table 9-22: Maintenance of disturbed areas

Activity	**Maintenance of disturbed areas**					
Project phase	*Post closure phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	3	2	4	27	Low
Mitigation measures	*Maintenance activities to be done during daytime working hours.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	3	2	4	18	Low

9.3 Summary of the potential impacts

The proposed Matai mine establishment project will take place in an area where there are other distant mining activities and feeder roads with a continuous flow of traffic during the day and intermittent traffic flow during the night. The prevailing ambient noise level in the vicinity of the proposed mining area was made up out of traffic noise, domestic noise and, bird/insect noises.

The potential environmental noise impact will be low during the post construction, construction, decommissioning and post closure phases and moderate during the operational phase. The implementation of noise mitigatory measures will ensure that the impact will change from moderate to low. The following mining related activities will create a noise increase in the immediate vicinity of the mining activities on a permanent basis:

- Processing plant activities;
- Crushing activities;
- Emergency generators;
- Traffic to the mining areas;
- Emergency sirens; and

- Reverse signals on mining vehicles.

Noise monitoring, according to the noise monitoring management plan, to be carried out to identify the noise sources on a pro-active manner.

10. Recommendations

The following three primary variables should be considered when designing acoustic screening measures for the control of sound and/or noise:

- The source – Reduction of noise at the source;
- The transmission path – Reduction of noise between the source and the receiver;
- The receiver – Reduction of the noise at the receiver.

The last option is not applicable and the noise levels at the noise source will be controlled on a pro-active manner when and if such increase the prevailing noise levels.

10.1 Acoustic screening recommendations

The acoustic screening measures for the project are given in Table 10.1. These are based on the best practicable methods, acoustic screening techniques and the IFC's Health and Safety Guidelines.

Table 10-1: Recommended acoustic screening measures

Activity	**Recommendations**
Construction phase	• Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels and any noise sources above 85.0dBA to be acoustically screened off. • Construction activities to take place during daytime period only. • Blasting to be done during daytime and to use the safe blasting techniques. • Environmental noise monitoring on a quarterly basis.
Operational phase	• Equipment and/or machinery which radiate noise levels between 85.0dBA and 90.0dBA to be acoustically screened off. • Emergency generators to be placed in such a manner that it is away from any residential area. • Noise monitoring to be carried out along the footprint boundaries at the processing

	plant, overland conveyor, along haul roads, pit activities and at the rim of the open cast pit; • Noise monitoring at the residential areas and the mine boundaries to be done on a quarterly basis for a year after which the frequency can change to an annual basis; • Actively manage the process and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. The levels to be evaluated in terms of the baseline noise levels.
Decommissioning phase	• Machinery with low noise levels which complies with the manufacturer's specifications to be used; and • Activities to take place during daytime period only.

The following are the Environmental, Health and Safety Guidelines of the IFC of the World Bank, which should be taken into consideration during the construction, operational and decommissioning phases of the project:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment causing radiating noise;
- Installing vibration isolation for mechanical equipment;
- Re-locate noise sources to areas which are less noise sensitive, to take advantage of distance and natural shielding;
- Taking advantage during the design stage of natural topography as a noise buffer;
- Develop a mechanism to record and respond to complaints.

The following noise impact management plan as given in Table 10.2 will be applicable during the pre-construction, construction, operational, decommissioning and post closure phases:

The Noise Impact Management Plan (NIMP) for the proposed mine establishment will consist of the following as illustrated in Table 10-2. Regular environmental monitoring will provide the data for reviewing, checking and revising the NIMP.

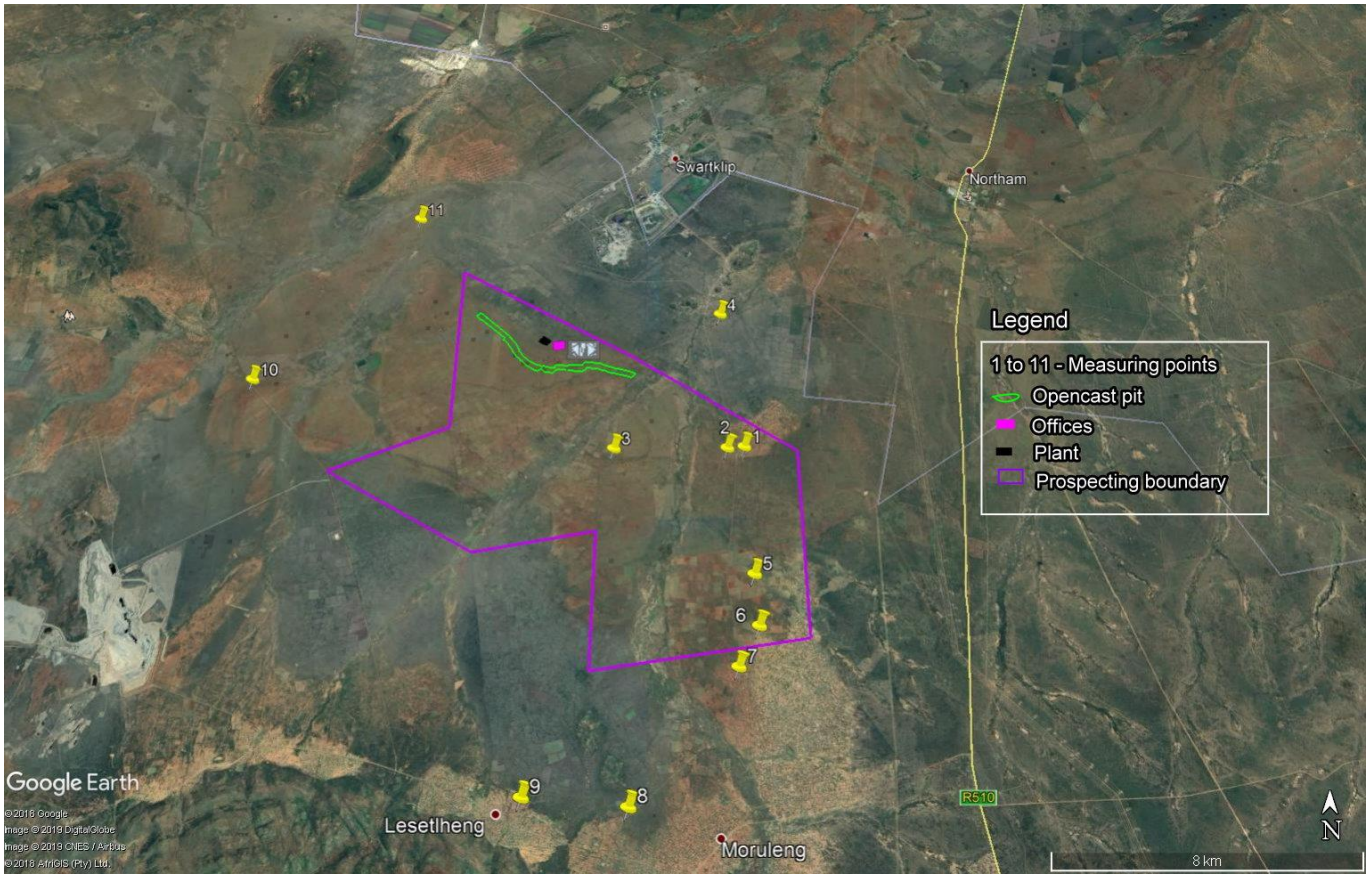
Table 10-2: Environmental noise management plan

Action	Description	Frequency	Responsible person
Management objective	To ensure that the legislated environmental noise levels will be adhered to at all times.	Quarterly for a period of a year after which the frequency can change to an annual basis.	The engineer during the construction phase and the responsible person (Matai Environmental Department) during the operational phase of the project
Monitoring objective – Construction phase	Measure the environmental noise levels during the construction phase of the project to ensure compliance to the recommended environmental noise levels.	Quarterly for a period of a year after which the frequency can change to an annual basis.	Matai Environmental Department

Monitoring objective – Operational phase	Measure the environmental noise levels during the operational phase of the project to ensure compliance to the recommended environmental noise levels.	Quarterly for a period of a year after which the frequency can change to an annual basis.	Matai Environmental Department
Monitoring technology	The environmental noise monitoring must take place with a calibrated Class 1 noise monitoring equipment.	Quarterly for a period of a year after which the frequency can change to an annual basis.	Matai Environmental Department
Specify how the collected information will be used	The data must be collated and discussed on a monthly basis during the construction phase and on a quarterly basis during the operational phase for a year thereafter on an annual basis with the Matai Mine Environmental Department	Quarterly for a period of a year after which the frequency can change to an annual basis.	Matai Environmental Department
Spatial boundaries	At the boundaries of the identified residential areas A to J as well as at the boundaries of the different mining areas.	Quarterly for a period of a year after which the frequency can change to an annual basis.	Matai Environmental Department
Define how the data will be analysed and interpreted and how it should be presented in monitoring reports	Reports must be compiled for each monitoring cycle and the results must be compared to the previous set of results to determine if there was a shift in the prevailing ambient environmental noise levels.	Quarterly for a period of a year after which the frequency can change to an annual basis.	Matai Environmental Department
Accuracy and precision of the data	The environmental noise surveys will have to be conducted in terms of the recommendations of the Noise Control Regulations and SANS 10103 of 2008.	Calibrated equipment must be used at all times and at the measuring points given in Figure 10.1.	Environmental noise specialist

The proposed noise monitoring points for the study area is illustrated in Figure 10.1.

Figure 10-1: Proposed measuring points for the Matai mine project.



10.2 Recommended conditions for authorisation

The following conditions will be applicable from an environmental noise point of view:

- Baseline environmental noise levels to be recorded on a quarterly basis for the first year after which the frequency can change to a quarterly basis ;
- All acoustic screening measures must be in place before commissioning the mining activities;
- Environmental noise monitoring to be carried out during the different phases of the project;
- All noise sources at the different mining areas to be identified and registered;
- The Noise Control Regulations, 1994 and/or guidelines to be adhered to at all times.

11. Conclusion

The environmental noise impact during the pre-construction, construction, decommissioning and post-closure phases will be insignificant during summer and winter periods. The noise impact will change during the operational phase where the noise intrusion will be moderate. This is based on a noise intrusion level of 5.0dBA and not the benchmark noise intrusion of 7.0dBA before a noise disturbance is created.

The potential environmental noise intrusion levels can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Noise Regulations, 1994. The proposed environmental noise management plan must be in place during all the phases of the mine establishment so as to identify any noise increase on a pro-active basis and to address the problem accordingly.

The proposed Matai mine establishment will be in line with the environmental noise standards and guidelines provided that all the noise mitigatory measures are in place and that the Noise Impact Management Plan (NIMP) and Noise Monitoring Plan (NMP) for the Matai mine is adhered to.

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12. List of Definitions and Abbreviations

12.1 Definitions

Ambient noise
The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources, both near and far

A-weighted sound pressure level (sound level) (L_{pA}), in decibels
The A-weighted sound pressure level is given by the equation:

$L_{pA} = 10 \log (p_A/p_o)^2$

Where

p_A is the root-mean-square sound pressure, using the frequency weighting network A in pascals; and

p_o is the reference sound pressure (p_o = 20 μPa).

NOTE The internationally accepted symbol for sound level is dBA.

Distant source
A sound source that is situated more than 500 m from the point of observation

Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$), in decibels
The value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval T, has the same mean-square sound pressure as a sound under consideration whose level varies with time. It is given by the equation

$$L_{Aeq,T} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2(t)}{p_o^2} dt \right]$$

Where
$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T that starts at t_1 and ends at t_2;

p_o is the reference sound pressure (p_o = 20 μPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal, in pascals.

Impulsive sound
Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise

Initial noise
The component of the ambient noise present in an initial situation before any change to the existing situation occurs

Intelligible speech

Speech that can be understood without undue effort

Low frequency noise
Sound, which predominantly contains frequencies below 100 Hz

Nearby source
A sound source that is situated at a distance of 500 m or less from the point of observation

Residual noise
The ambient noise that remains at a given position in a given situation when one or more specific noises are suppressed

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source
NOTE Complaints about noise usually arise as a result of one or more specific noises.

Ambient sound level
Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Disturbing noise
Means a noise that causes the ambient noise level to rise above the designated zone level by 7.0dBA or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SANS 10103.

Noise nuisance
Means any sound which disturbs or impairs the convenience or peace of any person

12.2 Abbreviations

dBA – A-weighted sound pressure level;

IBR – Angular trapezoidal fluted profile sheet;

IFC – International Finance Corporation;

Km/h - Kilometres per hour;

Kg/m^3 – Kilogram per cubic meter;

m/s – meters per second;

NIMP – Noise impact management plan;

NMP – Noise monitoring plan;

NSA – Noise sensitive areas;

L_{Basic} – Basic noise level in dBA;

SANS – South African National Standards;

TLB – Tractor-loader-backhoe

13. References

Constitution of the Republic of South Africa, 1996: (Act 108 of 1996). http://www.environment.co.za/environmental-laws-and-legislation-in-South-Africa. Accessed 12 March 2010.

DEAT (2004a) - Overview of Integrated Environmental Management Information Series. Department of Environment Affairs and Tourism (DEAT), Pretoria;

Environmental, Health and Safety Guidelines for Community Noise, World Health Organisation, Geneva, 1999;

Environmental Protection Agency (EPA). Office of Environmental Enforcement (OEE)

Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4). April, 2012. http://*www.epa.ie* › About Us › Organisational Structure. *Accessed 12 July 2012.*

Google Earth, 2019, http//www.google.com/earth/download-earth.html. Accessed 12 January 2019**;**

Imperial Chemical Industries – ICI(1971). Handbook of Blasting Tables;

International Organization for Standardization – ISO (1993). ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 1. Calculation of the absorption of sound by the atmosphere;

International Organization for Standardization – ISO (1993). ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 2. General method of calculation;

Kim, D. & Lee, S., 2000, Propagation and attenuation characteristics of various ground vibrations. *Soil Dynamics and Earthquake Engineering*. 19:115 – 126;

Kubo, M., Terauchi, F., Aoki, H. & Matsuoka Y., 2001, An investigation into a synthetic vibration model for humans: An investigation into a mechanical vibration human model constructed according to the relations between the physical, psychological and physiological reactions of humans exposed to vibration. *International Journal of Industrial Ergonomics*. 27: 219-232;

Massarch, K.R., 1993, Manmade vibrations and solutions. *Proceedings of the Third International Conference on case histories in Geo technical engineering*, 1393 – 405;
Noise reducing thin layers for Highways, Internoise 2006, Honolulu - Final Report S12.405210 Tyre Road noise Volume 2;

Noise Control Regulations - Noise Regulations of 1994. GN154 as promulgated in Government Gazette No. 13717 dated 10 January 1994;

SANS 10357 of 2004 – The calculation of sound propagation by the concave method (SANS, 2004);

SANS 10210 of 2004 – Calculating and predicting road traffic noise (SANS, 2004);

SANS 10328 of 2008 – Methods for environmental noise impact assessments (SANS, 2008);

SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication (SANS, 2008);

Standards Australia (2006). AS 2187.2:2006. Explosives – Storage and Use – use of Explosives;

United States of Bureau - Mine Standards, BMRI 8507. http://www.arblast.osmre.gov/.../RI%208057%20Blasting%20Vibration%20198.pdf. *Accessed 20 July 2012.*

World Bank, 1995, Guidelines for community noise. *International Finance Corporation General Concerns*. http://www.who.euromat.org. Accessed 20 July 2012;

Woods, R. D. & Jedele, L.P., 1985, Energy attenuation relationships from construction vibrations. *Vibration problems in Geotechnical engineering*. ASCE convention in Detroit, Michigan;

Wylie D.C. & C.W. Mah. 2004: Rock Slope Engineering, ISBN 041528001 X.

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