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Dwarsrivier Chrome Mine

Mpumalanga Province

Project No : 058/2023
Compiled by : B v/d Merwe
Date : 20 March 2023

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 **Envirogistics (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 for the proposed ventilation project at the western side of the Dwarsrivier mining area. 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	:	16 March 2023
Title / Position	:	Environmental noise specialist
Qualification(s)	:	MSc Environmental Management
Experience (years)	:	22 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 supplied by. The accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. dBAcoustics does not accept responsibility for any errors or omissions in the supplied data and information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions and the findings apply to the site conditions as they existed at the time of the field survey. These opinions do not necessarily apply to conditions that may arise after the date of the field survey and subsequent noise impact assessment report. 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 refer 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 by Envirogistics (Pty)Ltd to determine the potential noise increase of the proposed ventilation project. The environmental noise impact assessment will be done for the ventilation shaft footprint..

The Dwarsrivier ventilation project entails the following:

- Establishment of an Upcast and Down cast ventilation shaft and associated infra-structure; and
- Access to and from the ventilation shaft footprint is from an existing feeder road.

The following infrastructure will be assessed in terms of potential noise sources:

- Upcast Ventilation shaft;
- Downcast Ventilation shaft;
- Emergency generator; and
- Sub-station and transformer.

The environmental baseline noise information will be used to calculate the potential noise intrusion levels from the proposed ventilation shafts. The environmental noise survey was conducted on 13 March 2023.

The proposed Dwarsrivier ventilation project will take place in an area where there are roads, mining activities from mines in the vicinity of the project area. The prevailing ambient noise level in the vicinity of the project area is made up out of mining activity noises, traffic, domestic, insects and birds.

Conclusion

The environmental noise impact during the construction, operational and decommissioning phases will be low. The potential noise intrusion from the proposed project 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 and the International Finance Corporation's Environmental Health and Safety Guidelines.

The proposed Dwarsrivier ventilation project will be in line with the environmental noise standards and guidelines provided that all the noise mitigatory measures are in place.

The authorisation of this ventilation shaft project can be approved from an Environmental noise point of view.

Barend van der Merwe – MSc UJ
Environmental noise specialist

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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	Page 2
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Page 3
b)	A declaration that the specialist is independent	Page 2
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
d)	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 3
f)	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 3
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	Figures 1-1, Figure 5-1.
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1
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	Section 7 & 8
k)	Any mitigation measures for inclusion in the EMPr	Section 8
l)	Any conditions for inclusion in the environmental authorisation	Section 8
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 9
n)	A reasoned opinion -	Section 9
(i)	As to whether the proposed activity or portions thereof should be authorised	Section 9
(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	Section 9
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

dBAcoustics was appointed by EnviroGistics (Pty)Ltd to determine the potential noise increase of the proposed ventilation shaft, sub-station, and powerlines for the north shaft into the abutting environment. The environmental noise impact assessment will be done for the ventilation upcast shaft and associated infrastructure on the western side of the mining right area (MRA). The environmental noise survey was conducted on 13 March 2023 which was during the end of the summer period.

Dwarsrivier Chrome Mine (the mine) is wholly owned subsidiary of Assore Limited. holds the surface and mineral rights for portions of the farm Dwarsrivier 372 KT on which the mine is located. Dwarsrivier mine is located approximately 30km southwest of Steelpoort and approximately 57km west of Lydenburg, in the Limpopo Province. The mine consists of two underground shafts and a chrome beneficiation plant. Associated infrastructure include mine residue facilities, workshops, and offices. The surface area extends approximately 600ha and the proposed expansion project will take place west of an existing waste rock dump and east of an access road to existing mining operations. The location of the mine and the proposed ventilation shaft and infra-structure is illustrated in Figure 1-1.

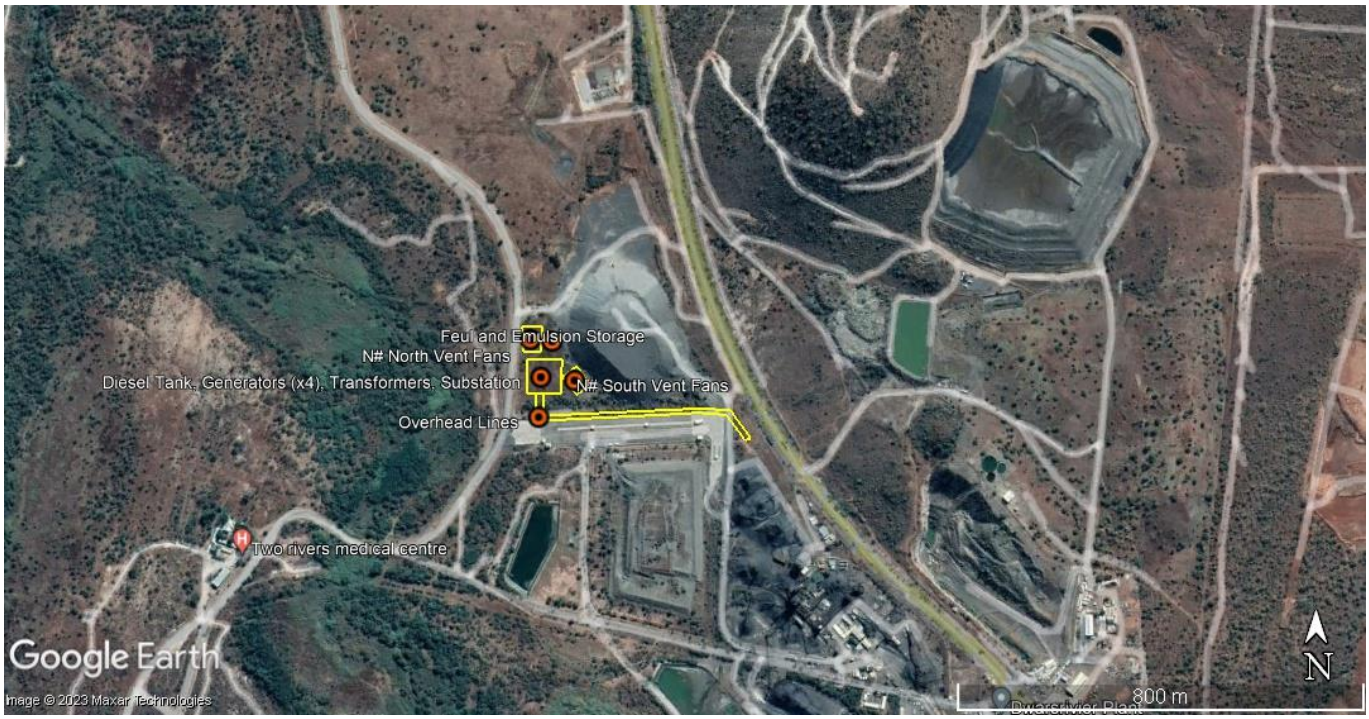

Figure 1-1: Locality plan

The general objectives of the environmental noise study were to gain a detailed understanding of the baseline noise environment along the boundaries of the ventilation shaft project boundaries.

1.1 The purpose of the environmental noise study

The field survey was done to determine the environmental baseline noise levels in the vicinity of the proposed ventilation shaft site.

The environmental baseline noise information will be used to calculate the potential noise intrusion levels from the proposed ventilation shaft into the abutting areas of which the Two rivers medical centre will be the nearest to the site.

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 towards a specific area.

1.2 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, mining activities with the result that the prevailing ambient noise level may change at times;
- The prevailing wind direction is a north westerly wind;
- 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;
- Insect noise may inflate the prevailing ambient noise level during summertime whereas the prevailing ambient noise during wintertime may be lower; and
- The noise survey calculations were done on the assumption that it is twin upcast ventilation shaft and there will be one emergency generator for back-up power.

The distances, wind direction and topography between the proposed mining ventilation shaft and infra-structure and noise receptors will play a role in the noise propagation and how the sound from the proposed mining establishment will be perceived.

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 the 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.

Several 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 (except for 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 exposures:

- 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. 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 district	**Equivalent continuous rating level ($L_{Req.T}$) for ambient noise -** dBA					
	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 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 (GN154 as promulgated in Government Gazette No. 13717 dated 10 January 1994) and 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 to minimise 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:

1. Larson Davis Sound Expert LXT

    - Larson Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0006037;
    - Larson Davis Pre-amplifier – Serial no. PRM LXT1 069946;
    - Larson Davis ½” free field microphone – Serial no. 316345;
    - Certificate Number: 2022-AS-0035;
    - Date of Calibration: 17 January 2022.

2. Larson Davis 831

    - Larson Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0001072;
    - Larson Davis Pre-amplifier – Serial no. PRM831 377B02;
    - Larson Davis ½” free field microphone – Serial no. 0206 and 316581;
    - Certificate Number: 2022-AS-1688;
    - Date of Calibration: 22 November 2022.

3. Larson Davis Handheld Calibrator 200

    - Serial no.9855;
    - Certificate number: 2022-AS-1679;
    - Date of Calibration: 21 November 2022.

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, mining activity noise from abutting mining companies and Dwarsrivier mining activities. The measuring points are illustrated in Figure 3-1.

Figure 3-1: Location of the measuring points

The measuring points along the boundaries of the study area and inside the boundaries of the mining 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	24° 55.740'S	30° 6.375'E	Two rivers medical centre.
2	24° 55.592'S	30° 6.727'E	South of the proposed ventilation shaft.
3	24° 55.463'S	30° 6.719'E	North of the proposed ventilation shaft.
4	24° 55.585'S	30° 7.020'E	East of the proposed ventilation shaft and along the feeder road.

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 daytime and 22h00 to 6h00 for the night-time.

3.3 Site Characteristics

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

- There are and existing mining activity noises from the abutting mining houses.
- There was a continuous flow of traffic along the Steelpoort to Lydenburg road and an intermittent flow of traffic from 24h00 to 4h00.
- Traffic noise and distant mining activity noise contributes to the higher prevailing ambient noise level at some of the measuring points;

- The wind and weather conditions play an important role in noise propagation;
- The prevailing noise levels along the boundaries of the proposed Ventilation shaft area are typical of the noise levels expected within the vicinity of mining activities; and
- There was no blasting during the time of the noise survey.

3.4 Current noise sources

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

- Distant mining activities noise;
- Traffic noise along the 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:

13 March 2023

Daytime

- Wind speed – less than 1.2m/s;
- Temperature – 28.2^{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 – 10 % humidity.

Night-time

- Wind speed – less than 1.0m/s;
- Temperature – 16.4^{o}C – No strong temperature gradient occurred near the ground;
- Cloud cover – High cloud cover;
- Wind direction – The wind was blowing from a south-westerly direction; and
- Humidity – 10 % humidity

4. Regulatory and Legislative Requirements

There are specific regulatory and legislative requirements which regulate the proposed development in terms of environmental noise and vibration. 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 and/or ground vibration levels over the prevailing ambient levels (Garvin *et al*., 2009).

5. Results of the noise survey

5.1 Noise survey

In Table 5.1 are the prevailing ambient noise levels for the specific areas, which include all the noise sources currently in the area such as domestic, traffic noise, distant mining 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 5-1: Noise levels for the day and night in the study area

Position	Daytime				Night – time 1				Night-time 2			
	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks
1	**50.2**	67.2	45.2	Traffic and mining activities noise	**49.3**	56.7	47.1	Traffic and mining activities noise	**47.7**	54.9	45.2	Traffic and mining activities noise
2	**55.7**	72.8	42.9	Traffic and mining activities noise	**55.0**	65.6	48.8	Traffic and mining activities noise	**54.6**	64.5	51.2	Traffic and mining activities noise
3	**55.4**	75.0	39.8	Traffic and mining activities noise	**51.9**	68.9	44.6	Traffic and mining activities noise	**50.4**	74.6	46.7	Traffic and mining activities noise
4	**69.9**	87.4	40.3	Traffic and mining activities noise	**58.8**	87.6	45.2	Traffic and mining activities noise	**53.8**	65.2	46.1	Traffic and mining activities noise

The noise level of construction type vehicles at different distances from the activity are illustrated in Table 5-2.

Table 5-2: 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

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
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.

5.2 Noise impact at the Two Rivers Medical Centre

The following equation was used to calculate the noise level at the Two Rivers Medical Centre during the construction phase:

$$Lp = Lw - 20\log R - 2dB$$

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 at the Two Rivers Medical Centre which is 729m southwest of the project area:

- Clearing and stripping of topsoil and vegetation at the different sections of the mining establishment – 85.0dBA;
- Construction activities at the ventilation upcast ventilation shaft – 86.0dBA;
- Construction activities at the ventilation upcast ventilation shaft – 86.0dBA;

- Construction activities at the transformer and sub-station – 85.6dBA; and
- Construction activities at emergency generator – 85.6dBA.

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

- Ventilation shaft – 102.0dBA;
- Operational activities at the ventilation shaft footprint – 87.0dBA;
- Operational activities of the emergency generator – 95.0.0dBA;
- Maintenance activities – 80.0dBA;

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

- Removal of all Infrastructure – 85.0dBA;
- Earthworks and planting of vegetation – 85.0dBA; and
- Rehabilitation of the pit – 87.5dBA.

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 following formula will be used to categorize the intrusion levels during the construction and operational phases. 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 criterion for assessing the magnitude of a noise impact is illustrated in Table 5.3.

Table 5-3: Noise intrusion level criteria

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

5.2.1 Construction phase

The noise intrusion levels during the construction phase are given in Table 5-4 and the threshold value of 7.0dBA will not be exceeded.

Table 5-4: Noise intrusion levels during the construction phase of ventilation shaft footprint

Position	**Clearing and stripping of topsoil and vegetation at the Ventilation footprint**	**Construction activities at the ventilation upcast ventilation shaft**	**Construction activities at the ventilation downcast ventilation**	**Construction activities at the transformer and sub-station**	**Construction activities at emergency generator**	**Cumulative Levels**	**Cumulative noise level - Daytime**	**Cumulative noise level – night-time**	**Intrusion noise level - daytime**	**Intrusion noise level – night- time**
T medical centre	16.3	18.3	18.5	22.8	20.2	28.6	38.7	36.6	0.5	0.7

5.2.2 Operational phase

The noise contours during the operational phase of the project at the different areas within the mining boundaries are illustrated in Figure 5-1. The projected noise level at the clinic will be 40.0dBA. The waste rock east of the ventilation footprint will create a noise barrier to the east of the ventilation footprint. The noise level along the road to the west of the footprint will be 46.0dBA to 50.0dBA.

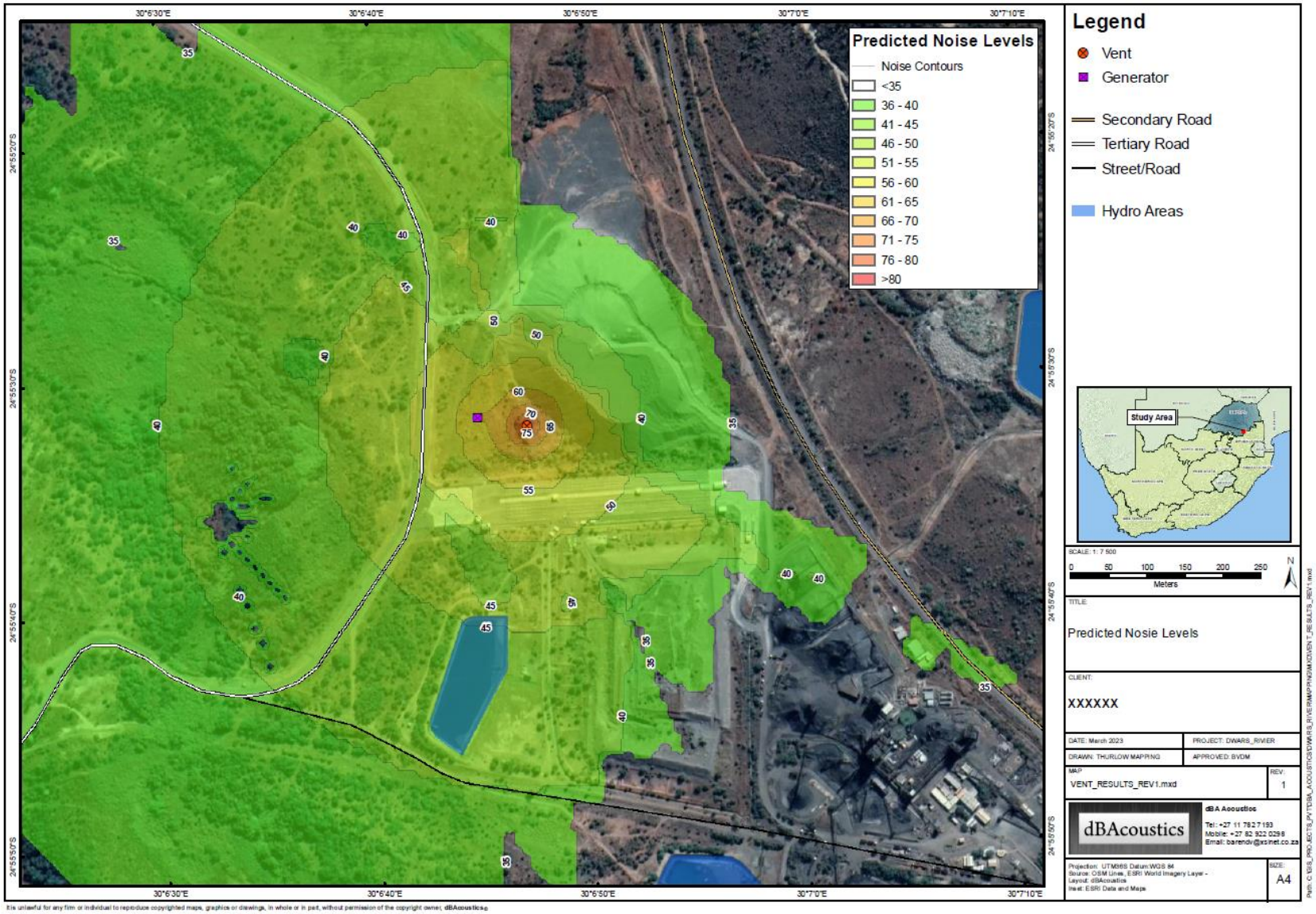

Figure 5-1: Noise contours for the vent shaft footprint

5.2.3 Decommissioning phase

The calculated noise levels and subsequent noise intrusion levels at the abutting noise receptors during the rehabilitation phase of the project at the different areas within the mining ventilation footprint are illustrated in Tables 5-5. The threshold value of 7.0dBA will not be exceeded.

Table 5-5: Noise intrusion levels during the decommissioning phase – Ventilation footprint

Position	Removal of infrastructure	Earthworks and planting of grass	Rehabilitation of the ventilation footprint	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – night-time	Intrusion noise level - daytime	Intrusion noise level – night-time
Twee Rivieren medical centre	25.2	20.2	23.2	28.2	50.2	48.5	0.0	0.0

6. 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. The occupants of the twee Rivieren medical centre are already exposed to industrial type noise levels due to existing mining operations. The topography, wind direction, distances between the mine activities (point and/or linear noise sources) and the location of the receptors in terms of the mining activities play an important role in how the sound will be propagated.

7. 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 7.1. These are the average noise levels in the workplace and at home that will mask noise from a source introduced into an area:

Table 7-1: 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

	Activity	dBA
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.

7.1 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.

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

- Clearing and stripping of topsoil and vegetation at the different sections of the ventilation footprint;
- Construction activities at the ventilation upcast ventilation shaft;
- Construction activities at the ventilation down cast shaft;
- Construction activities at the transformer and sub-station; and
- Construction activities at the emergency generator.

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:

- Operational activities at the ventilation upcast ventilation shaft;
- Operational activities at the ventilation down cast shaft;
- Operational activities at the transformer and sub-station; and
- Operational activities at the emergency generator;

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

- Removal of all Infrastructure;
- Earthworks and planting of vegetation; and
- Rehabilitation of the pit.

7.2 Environmental impact assessment

The significance of the identified impacts will be determined using an accepted methodology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998. As with all impact methodologies, the impact is defined in a semi-quantitative way and will be assessed according to methodology prescribed in the following section.

The standard impact assessment methodology is illustrated in Appendix B.

7.2.1 Impact assessment during the construction phase

The risk assessment for the construction phase is illustrated in Table 7.2 to 7.6.

Table 7-2: Clearing and stripping of topsoil and vegetation at the ventilation footprint

Activity	***Clearing and stripping of topsoil and vegetation at the ventilation footprint***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting communities.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Construction activities at the different construction sites may be carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of the mine is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	6	20	Low

Table 7-3: Construction activities at the ventilation upcast shaft

Activity	***Construction activities at the ventilation upcast shaft***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting communities*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Construction activities at the different construction sites may be carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of the mine is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime.* *Ventilation outlet to face to the north-western side.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	6	20	Low

Table 7-4: Construction activities at the downcast ventilation shaft

Activity	***Construction activities at the downcast ventilation shaft***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting communities*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Construction activities at the different sites within the footprint may be carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of the mine is not exceeded. When the prevailing ambient noise is exceeded such activities may only take place during daytime.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 7-5: Construction activities at the transformer and sub-station site

Activity	***Construction activities at the transformer and sub-station site***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting communities*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Construction activities at the non-carb softs site within the footprint may be carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of the mine is not exceeded. When the prevailing ambient noise is exceeded such activities may only take place during daytime.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 7-6: Construction activities at the emergency generator site

Activity	***Construction activities at the emergency generator site***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting communities*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Construction activities at the non-carb hards site within the footprint may be carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of the mine is not exceeded. When the prevailing ambient noise is exceeded such activities may only take place during daytime.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

7.2.2 Impact assessment during the operational phase

The risk assessment during the operation phase is illustrated in Tables 7.7 to 7.8.

Table 7.7: Noise from the upcast ventilation shaft

Activity	***Noise from the upcast ventilation shaft***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting medical centre.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	4	4	2	6	48	Moderate
Mitigation measures	*Noise monitoring to be done on a quarterly basis but more frequently when there are complaints.* *Noise readings must be conducted at the ventilation footprint boundary and along the MRA boundaries and the threshold noise level of 70.0dBA may not be exceeded.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	6	36	Moderate

Table 7-8: Emergency generator

Activity	***Emergency generator***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting medical centre*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	4	4	2	4	40	Moderate
Mitigation measures	*Noise monitoring to be done on a quarterly basis along the infrastructure footprint , at the Emergency generator footprint and along the MRA boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *Emergency generator to be encapsulated and acoustically screened off.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	4	2	4	20	Low

7.2.3 Impact assessment during the decommissioning phase

The risk assessment during the rehabilitation phase is illustrated in Tables 7-9 to 7-11 respectively.

Table 7-9: Removal of infra-structure

Activity	***Removal of infra-structure***					
Project phase	*Closure/Rehabilitation phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential area*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Demolition activities to be done during daytime periods.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 7-10: **Planting of grass and planting of grass and vegetation**

Activity	***Planting of grass and vegetation***					
Project phase	*Closure/Rehabilitation phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential area*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Demolition activities to be done during daytime periods.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 7-11: **Back fill of disturbed areas**

Activity	***Back fill of disturbed areas***					
Project phase	*Closure/Rehabilitation phase*					
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential area*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Low
Mitigation measures	*Activities to be done during daytime activities.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

8.3 Summary of the potential impacts

The proposed ventilation shafts and infra-structure will take place in an area where there are other mining activities and a feeder road 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 ventilation shaft footprint is made up out of traffic, distant mining activities, birds, and insect noises.

The potential noise impact will be low during the construction, and decommissioning phases and low to medium during the operational phase. The implementation of noise mitigatory measures will ensure that the noise impact will be low during the operational phase of the project.

8. 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 noise intrusions may occur.

8.1 Acoustic screening recommendations

The acoustic screening measures for the Dwarsrivier ventilation project are given in Table 9.1. These are based on the best practicable methods, acoustic screening techniques and the IFC's Health and Safety Guidelines.

Table 8-1: 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 day/night-time provided that the prevailing ambient noise level along the mine boundaries will not be exceeded. • Environmental noise monitoring on a quarterly basis.
Operational phase	• Equipment and/or machinery which radiate noise levels above 85.0dBA to be acoustically screened off. • Noise monitoring at the Two Rivers medical clinic and the mine boundaries to be done on a quarterly basis for a year after which the frequency can change to an annual basis if there is no shift in the noise regime; • 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 implemented 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.

8.2 Recommended conditions for authorisation

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

- Baseline environmental noise levels to be collated and recorded;
- All noise sources at the different mining areas to be identified and registered;
- An environmental noise complaint system must be in place for residents to register noise complaints;
- The noise (Noise Control Regulations, 1994) and/or guidelines to be adhered to at all times.

9. Conclusion

The environmental noise impact during the construction, operational and decommissioning phases will be low after some noise mitigatory measures were put in place.

The potential noise intrusion during the operational phase can 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 and the International Finance Corporation's Environmental Health and Safety Guidelines.

The proposed ventilation project 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 Dwarsrivier mine is adhered to.

The authorisation can be approved from an Environmental noise point of view.

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10 List of Definitions and Abbreviations

10.1 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.

10.2 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

11. 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**;**

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);

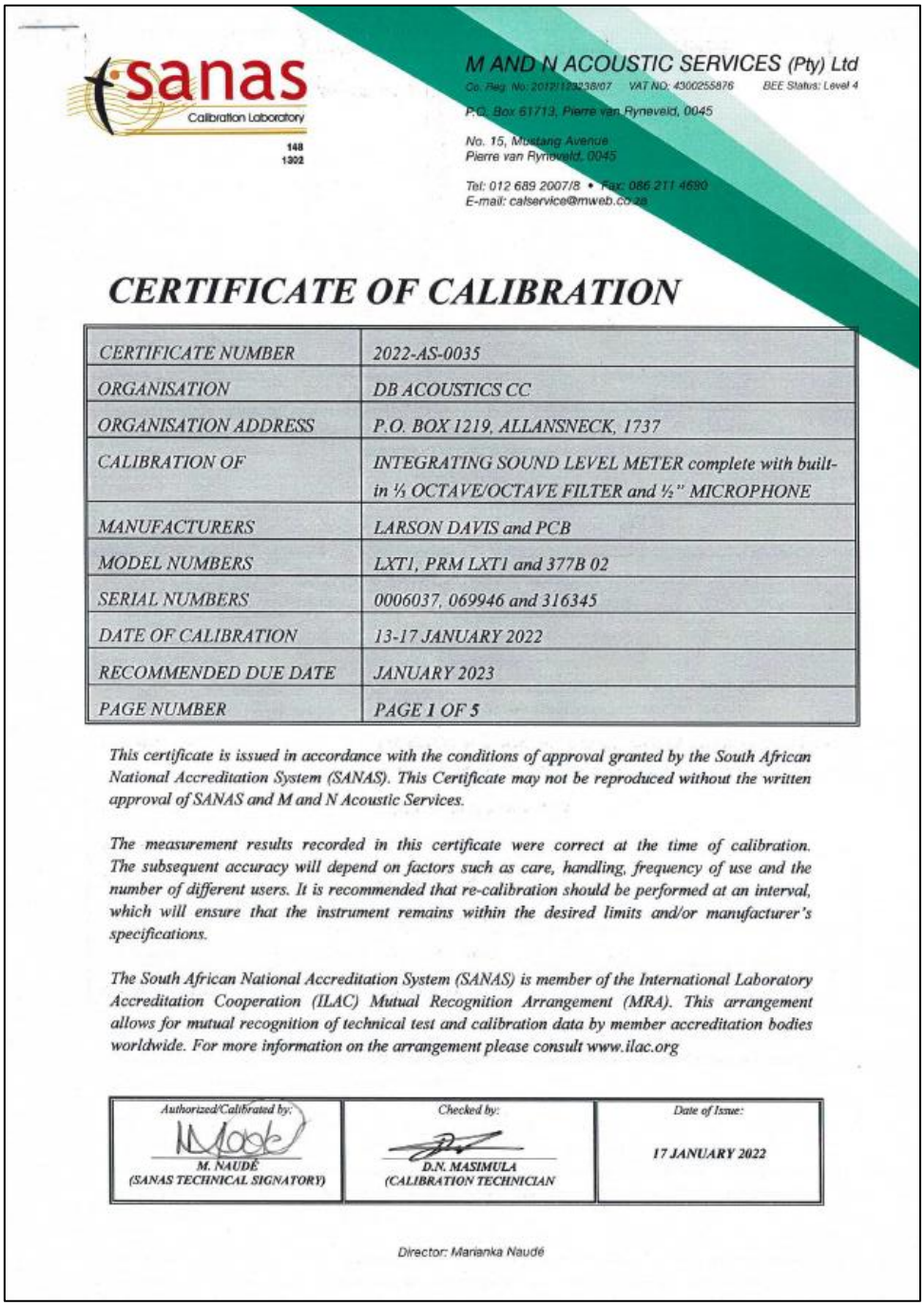
SANS 10210 of 2004 – Calculating and predicting road traffic noise (SANS, 2004);

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);

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

Appendix A – Calibration certificate



sanas
Calibration Laboratory
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1302

M AND N ACOUSTIC SERVICES (Pty) Ltd
Co. Reg. No: 2012/139238/07 VAT NO: 4300255876 BEE Status: Level 4
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E-mail: calservice@mweb.co.za

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2022-AS-0035
ORGANISATION	DB ACOUSTICS CC
ORGANISATION ADDRESS	P.O. BOX 1219, ALLANSNECK, 1737
CALIBRATION OF	INTEGRATING SOUND LEVEL METER complete with built-in ⅓ OCTAVE/OCTAVE FILTER and ½" MICROPHONE
MANUFACTURERS	LARSON DAVIS and PCB
MODEL NUMBERS	LXT1, PRM LXT1 and 377B 02
SERIAL NUMBERS	0006037, 069946 and 316345
DATE OF CALIBRATION	13-17 JANUARY 2022
RECOMMENDED DUE DATE	JANUARY 2023
PAGE NUMBER	PAGE 1 OF 5

This certificate is issued in accordance with the conditions of approval granted by the South African National Accreditation System (SANAS). This Certificate may not be reproduced without the written approval of SANAS and M and N Acoustic Services.

The measurement results recorded in this certificate were correct at the time of calibration. The subsequent accuracy will depend on factors such as care, handling, frequency of use and the number of different users. It is recommended that re-calibration should be performed at an interval, which will ensure that the instrument remains within the desired limits and/or manufacturer's specifications.

The South African National Accreditation System (SANAS) is member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA). This arrangement allows for mutual recognition of technical test and calibration data by member accreditation bodies worldwide. For more information on the arrangement please consult www.ilac.org

Authorized/Calibrated by:	Checked by:	Date of Issue:
M. NAUDÉ (SANAS TECHNICAL SIGNATORY)	D.N. MASIMULA (CALIBRATION TECHNICIAN	17 JANUARY 2022

Director: Marianka Naudé

Annexure B – Risk Assessment Methodology

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 –

(l) 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:

Occurrence	**Duration:**	**Probability:**
	5 – Permanent	5 – Definite/do not 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.

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.

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