



Environmental Noise Impact Assessment for the Bundu Rietvlei Mine

Project done on behalf of **Gomes Sand (Pty) Ltd**

Project Compiled by:

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Revision Record

Revision Number	Date	Reason for Revision
Rev 0	October 2024	For internal review
Rev 1	October 2024	For client review

LIST OF ACRONYMS AND SYMBOLS

Airshed	Airshed Planning Professionals (Pty) Ltd
BSI	British Standard
dB	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure.
dBA	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure that has been A-weighted to simulate human hearing.
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
GG	Government gazette
GN	Government notice
Hz	Frequency in Hertz
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
ISO	International Standards Organisation
kHz	Kilohertz
km	Kilometre
kW	Kilowatt
$L_{Aeq}(T)$	The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)
$L_{Aeq}(T)$	The impulse corrected A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)
L_{A90}	The A-weighted 90% statistical noise level, i.e., the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the L_{Aeq} could have been in the absence of noisy single events and is considered representative of background noise levels (L_{A90}) (in dBA)
L_{AFmax}	The A-weighted maximum sound pressure level recorded during the measurement period
L_{AFmin}	The A-weighted minimum sound pressure level recorded during the measurement period
L_p	Sound pressure level (in dB)
L_w	Sound Power Level (in dB)
m	Metres
m/s	Speed in metres per second

NACA	National Association for Clean Air
NEMA	National Environmental Management Act
NEMAQA	National Environmental Management: Air Quality Act
NIA	Noise Impact Assessment
NSRs	Noise sensitive receptors
Pa	Pressure in Pascal
μPa	Pressure in Micro-Pascal
p _{ref}	Reference pressure, 20 μPa
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professions
SANS	South African National Standards
SLM	Sound level meter
WHO	World Health Organisation
WRF	Weather Research and Forecasting Model
%	Percent
°C	Degrees Celsius

EXECUTIVE SUMMARY

Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned by Gomes Sand (Pty) Ltd to undertake an Environmental Noise Impact Assessment (NIA) for the proposed Bundu Rietvalei Mine (hereafter referred to as the project).

The main objective of the noise specialist study was to determine the potential impact on the acoustic environment and noise sensitive receptors (NSRs) as a result of the proposed operations and to recommend suitable management and mitigation measures.

To meet the above objective, the following tasks were included in the Scope of Work:

- A review of available technical project information.
- A review of the legal requirements and applicable environmental noise guidelines.
- A study of the receiving (baseline) acoustic environment, including:
 - The identification of NSRs from available maps and field observations;
 - A study of environmental noise attenuation potential by referring to available weather records and land use; and
 - Determining representative baseline noise levels through the analysis of sampled environmental noise levels obtained from the 2024 noise survey conducted for the site.
- An impact assessment, including:
 - The establishment of a source inventory for proposed activities.
 - Noise propagation simulations to determine environmental noise levels as a result of the project.
 - The screening of simulated noise levels against environmental noise criteria.
- The identification and recommendation of suitable mitigation measures and monitoring requirements.
- The preparation of a comprehensive specialist noise impact assessment report.

In the assessment of simulated noise levels, reference was made to the draft Environmental Noise Standards. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline at NSRs were calculated and compared to guidelines published in the SANS 10103 and the 1992 Noise Control Regulations. The Gauteng Noise Control Regulations were also considered for the assessment.

The baseline acoustic environment was described in terms of the location of NSRs, the ability of the environment to attenuate noise over long distances, as well as existing baseline noise levels. The following was found:

- The closest potential sensitive receptors to the proposed project consist of individual dwellings.
- The baseline noise levels (L_{Aeq}) in the vicinity of the project site during day-time conditions were between 36.8 dBA and 43.4 dBA and for night-time conditions between 32.2 dBA and 46.1 dBA.
- The study area in close proximity to the project is classified as agricultural with equivalent draft Environmental Noise Standards of 45 dBA for day-time conditions and 35 dBA for night-time conditions.

The source inventory, local meteorological conditions and information on local land use were used to populate the noise attenuation model (CadnaA, ISO 9613). The propagation of noise was calculated over an area of 6.6 km east-west by 5.6 km north-south. The area was divided into a grid matrix with a 20 m resolution.

The main findings of the impact assessment were as follows:

- The environmental noise impact assessment considered the operations due to the proposed project only.
- Day-time noise levels due to project operations exceed the draft Environmental Noise Standards for agricultural districts at the closest off-site NSRs to the project.
- For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); the predicted increase in noise levels from the current baseline due to proposed project operations is not expected to result in community reaction at the closest NSRs to the project.

The project will need to operate within the draft Environmental Noise Standards for agricultural districts. The noise impacts due to the project marginally exceeds the draft Environmental Noise Standards at the closest NSRs to the project site. Mitigation measures, as recommended in Section 6, may be implemented to reduce noise levels further. A complaints register must be kept throughout the life of the operations. Provided that the project meets the draft Environmental Noise Standards for agricultural districts at the closest off-site NSRs, it is the specialist's opinion that the project may be authorised.

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Environmental Noise Impact Assessment for the Bundu Rietvlei Mine

1 INTRODUCTION

Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned by Gomes Sand (Pty) Ltd to undertake an Environmental Noise Impact Assessment (NIA) for the proposed Bundu Rietvlei Mine (Figure 1-1) (hereafter referred to as the project).

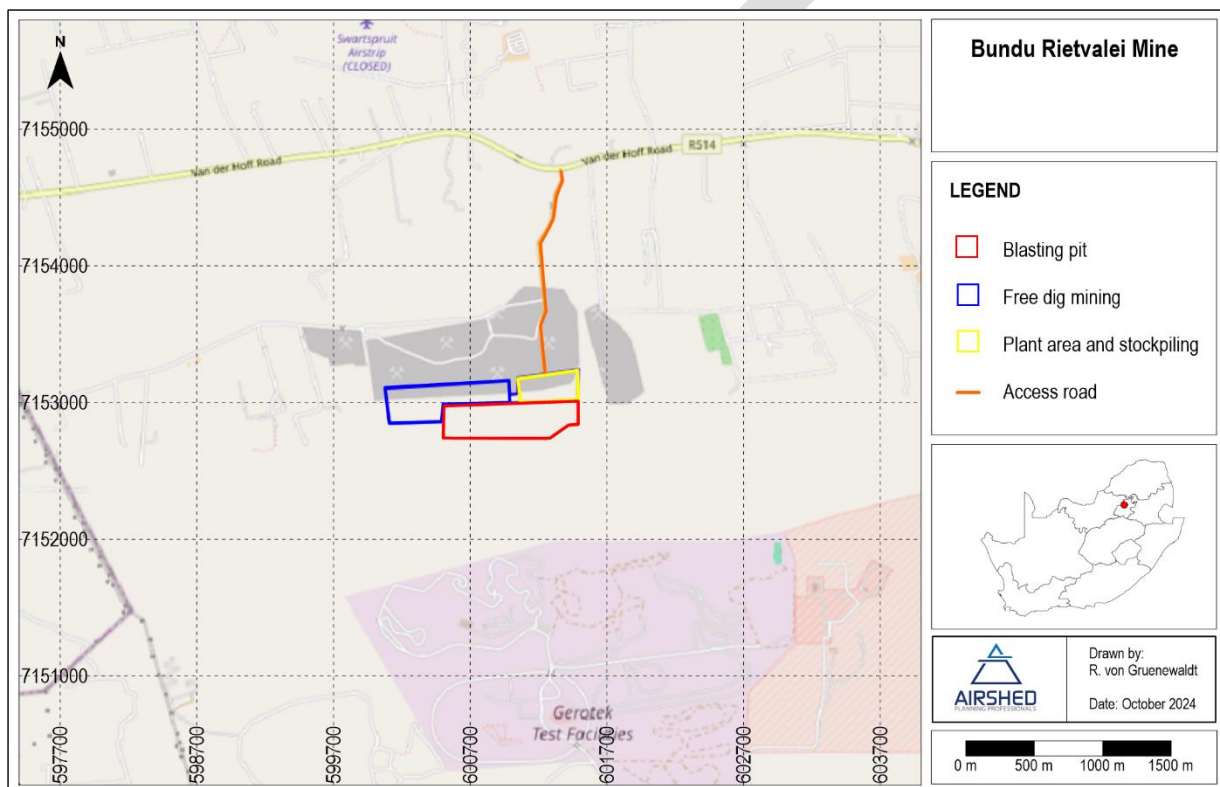


Figure 1-1: Project location

1.1 Study Objective

The main objective of the noise specialist study was to determine the potential impact on the acoustic environment and noise sensitive receptors (NSRs) as a result of the operations at the project site and to recommend suitable management and mitigation measures.

1.2 Scope of Work

To meet the above objective, the following tasks were included in the Scope of Work:

- A review of available technical project information.

- A review of the legal requirements and applicable environmental noise guidelines.
- A study of the receiving (baseline) acoustic environment, including:
 - The identification of potential NSRs from available maps and field observations.
 - A study of environmental noise attenuation potential by referring to available weather records and land use.
 - Determining representative baseline noise levels through the analysis of sampled environmental noise levels obtained from a survey conducted for the site.
- An impact assessment, including:
 - The establishment of a source inventory for proposed activities.
 - Noise propagation simulations to determine environmental noise levels as a result of the project activities.
 - The screening of simulated noise levels against environmental noise criteria.
- The identification and recommendation of suitable mitigation measures and monitoring requirements.
- The preparation of a comprehensive specialist noise impact assessment report.

1.3 Specialist Details

1.3.1 Specialist Details

Airshed is an independent consulting firm with no interest in the project other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.

1.3.2 Competency Profile of Specialist

Reneé von Gruenewaldt is a Registered Professional Natural Scientist (Registration Number 400304/07) with the South African Council for Natural Scientific Professions (SACNASP) and a member of the National Association for Clean Air (NACA).

Following the completion of her bachelor's degree in atmospheric sciences in 2000 and honours degree (with distinction) with specialisation in Environmental Analysis and Management in 2001 at the University of Pretoria, her experience in air pollution started when she joined Environmental Management Services (now Airshed Planning Professionals) in 2002. Reneé von Gruenewaldt later completed her master's degree (with distinction) in Meteorology at the University of Pretoria in 2009.

Reneé von Gruenewaldt became a partner of Airshed Planning Professionals in September 2006. Airshed Planning Professionals is a technical and scientific consultancy providing scientific, engineering, strategic impact assessments, management services and policy support to assist clients in addressing a wide variety of air pollution and environmental noise related projects.

She has experience on the various components of environmental noise assessments from 2015 to present. Her project experience range over various countries in Africa, providing her with an inclusive knowledge base of international legislation and requirements pertaining to noise impacts.

A comprehensive curriculum vitae of Reneé von Gruenewaldt is provided in Appendix A.

Declaration of independence is provided in Appendix B

1.4 Description of Activities from a Noise Perspective

Material mined will be in the range of 25 000 tpm. Processing will be in the range of 20 000 tpm. Once blasted, material will be mined from the pit and transported directly to the plant by means of a dump truck. The run of mine (ROM) will be tipped straight into the plant so there will be no stockpiling of ROM by the plant. Drilling and blasting will be done every 6-8 weeks. ROM is loaded by a 40t excavator and transported to the plant with a 30t articulate dump truck (ADT). The plant will consist of a primary jaw crusher, 2 cone crushers, a vertical impact crusher, 4 screens, 1 water pump and multiple conveyors. Product from the plant will be stockpiled and loaded into trucks by means of a front-end loader.

Whereas ore processing activities generate noise fairly constantly; drilling, blasting, ore and waste handling, transport activities and operating diesel mobile equipment generate noise that is intermittent and highly variable spatially.

The biggest determinant of noise impacts from operations will be the spatial distribution of noise sources and to a lesser extent mining rates and fleet size due to the non-linear cumulative nature of sound pressure levels (see Section 1.5.3).

Although not assessed as part of this study, the character of noise generated by blasting is mentioned. Blasting can cause noise and vibration, which can have an impact upon neighbouring noise receptors. Blasting usually results in both ground and airborne vibration. The latter includes both audible noise and vibration known as airblast, which can cause objects to rattle and make noise. Annoyance and discomfort from blasting can occur when noise startles individuals or when airblast or ground vibration causes vibration of building elements such as windows. The degree of annoyance is influenced by the level of airblast and vibration as well as factors such as the time of day, the frequency of occurrence and the sensitivity of individuals. The generation and transmission of airblast and ground vibration is affected by a number of factors including blast design, meteorology (particularly wind speed and direction and temperature inversions), topography, geology and soil water content (Aloui, Bleuzen, Essefi, & Abbes, 2016). Whereas the audible part of the airblast (acoustic) is characterized by frequencies ranging from 20 to 20 000 Hz the non-audible part, consist of sound energy below 20 Hz and is referred to as an 'over pressure' when the air blast pressure exceeds atmospheric pressure. Airblast over pressure exerts a force on structures and may in turn cause secondary and audible rattles within structures such as windows (Aloui, Bleuzen, Essefi, & Abbes, 2016).

1.5 Background to Environmental Noise and the Assessment Thereof

Before more details regarding the approach and methodology adopted in the assessment is given, the reader is provided with some background, definitions and conventions used in the measurement, calculation and assessment of environmental noise.

Noise is generally defined as unwanted sound transmitted through a compressible medium such as air. Sound in turn, is defined as any pressure variation that the ear can detect. Human response to noise is complex and highly variable as it is subjective rather than objective.

A direct application of linear scales (in pascal (Pa)) to the measurement and calculation of sound pressure leads to large and unwieldy numbers. As the ear responds logarithmically rather than linearly to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The advantage of using dB can be clearly seen in Figure 1-2. Here, the linear scale with its large numbers is converted into a manageable scale from 0 dB at the threshold of hearing (20 micro-pascals (μPa)) to 130 dB at the threshold of pain (~100 Pa) (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

As explained, noise is reported in dB. “dB” is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure. The relationship between sound pressure and sound pressure level is illustrated in this equation.

$$L_p = 20 \cdot \log_{10} \left(\frac{p}{p_{ref}} \right)$$

Where:

L_p is the sound pressure level in dB;

p is the actual sound pressure in Pa; and

p_{ref} is the reference sound pressure (*p_{ref}* in air is 20 µPa).

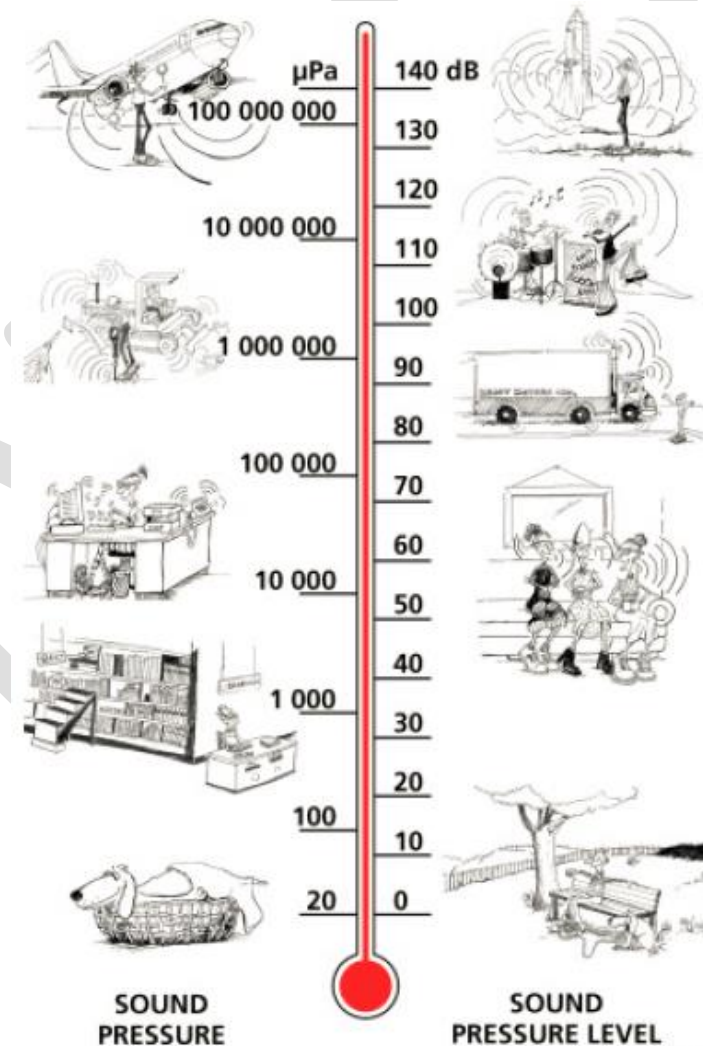


Figure 1-2: The decibel scale and typical noise levels (Brüel & Kjær Sound & Vibration Measurement A/S, 2000)

1.5.1 Perception of Sound

Sound has already been defined as any pressure variation that can be detected by the human ear. The number of pressure variations per second is referred to as the frequency of sound and is measured in hertz (Hz). The hearing frequency of a young, healthy person ranges between 20 Hz and 20 000 Hz.

Even though an increase in sound pressure level of 6 dB represents a doubling in sound pressure, an increase of 8 to 10 dB is required before the sound subjectively appears to be significantly louder. Similarly, the smallest perceptible change is about 1 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.5.2 Frequency Weighting

Since human hearing is not equally sensitive to all frequencies, a 'filter' has been developed to simulate human hearing. The 'A-weighting' filter simulates the human hearing characteristic, which is less sensitive to sounds at low frequencies than at high frequencies (Figure 1-3). "dBA" is the descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units (in this case sound pressure) and have been A-weighted.

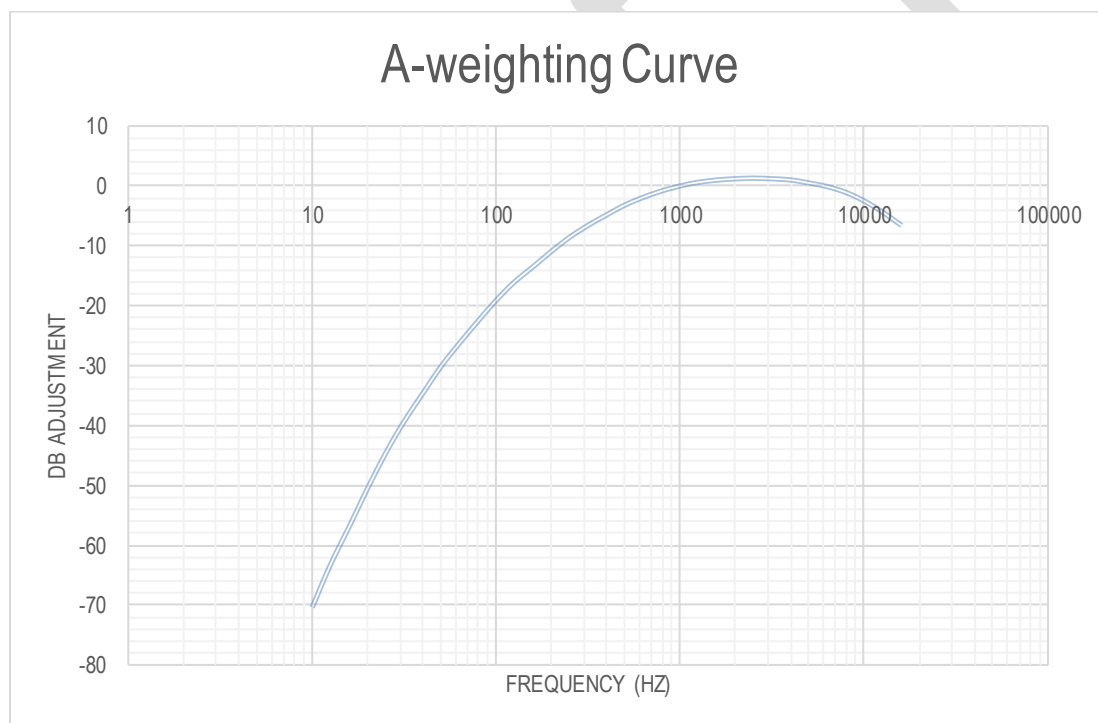


Figure 1-3: A-weighting curve

1.5.3 Adding Sound Pressure Levels

Since sound pressure levels are logarithmic values, the sound pressure levels as a result of two or more sources cannot simply be added together. To obtain the combined sound pressure level of a combination of sources such as those at a mine or industrial plant, individual sound pressure levels must be converted to their linear values and added using:

$$L_{p_combined} = 10 \cdot \log \left(10^{\frac{L_{p1}}{10}} + 10^{\frac{L_{p2}}{10}} + 10^{\frac{L_{p3}}{10}} + \dots 10^{\frac{L_{pi}}{10}} \right)$$

This implies that if the difference between the sound pressure levels of two sources is nil the combined sound pressure level is 3 dB more than the sound pressure level of one source alone. Similarly, if the difference between the sound pressure levels of two sources is more than 10 dB, the contribution of the quietest source can be disregarded (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.5.4 Environmental Noise Propagation

Many factors affect the propagation of noise from source to receiver. The most important of these are:

- The type of source and its sound power (L_w);
- The distance between the source and the receiver;
- Atmospheric conditions (wind speed and direction, temperature and temperature gradient, humidity etc.);
- Obstacles such as barriers or buildings between the source and receiver;
- Ground absorption; and
- Reflections.

To arrive at a representative result from either measurement or calculation, all these factors must be taken into account (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

1.6 Study Approach and Methodology

The assessment included a study of the legal requirements pertaining to environmental noise impacts, a study of the physical environment of the area surrounding the project and the analyses of existing noise levels in the area. The impact assessment focused on the estimation of sound power levels (L_w 's) (noise 'emissions') and sound pressure levels (L_p 's) (noise impacts) associated with the operational phase. The findings of the assessment components informed recommendations of management measures, including mitigation and monitoring. Individual aspects of the noise impact assessment methodology are discussed in more detail below.

1.6.1 Information Review

An information requirements list was sent to Gomes Sand (Pty) Ltd at the onset of the project. In response to the request, the following information was supplied:

- Site location map;
- Description of project activities; and
- List of project equipment.

1.6.2 Review of Assessment Criteria

In South Africa, provision is made for the regulation of noise under the National Environmental Management Air Quality Act (NEMAQA) (Act. 39 of 2004). Draft Environmental Noise Standards, referencing the SANS 10103 of 2008 'The

measurement and rating of environmental noise with respect to annoyance and to speech communication', was made available in June 2024. These standards are currently out for comment.

Use was made of the draft Environmental Noise Standards, National Noise Control Regulations and Gauteng Noise Control Regulations. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline at NSRs were calculated and compared to guidelines published in the SANS 10103.

1.6.3 Study of the Receiving Environment

NSRs generally include private residences, community buildings such as schools, hospitals and any publicly accessible areas outside an industrial facility's property. Potential NSRs were identified from satellite imagery (Google Earth – accessed September 2024) and the site visit conducted on 11 to 13 September 2024.

The ability of the environment to attenuate noise as it travels through the air was studied by considering local meteorology, land use and terrain. Atmospheric attenuation potential was described based on modelled meteorological data at the project site, for the period 2021 to 2023. Land-use was determined from satellite imagery (Google Earth) and site observations.

1.6.4 Baseline Environmental Noise Survey

Reference is made to the noise survey conducted for the area on 11 to 13 September 2024.

The survey methodology, which closely follows guidance provided by the International Finance Corporation (IFC) General Environmental Health and Safety (EHS) Guidelines (IFC, 2007) and SANS 10103 (2008), is summarised below:

- The survey was designed by a trained specialist.
- Sampling was carried out using a Type 1 sound level meter (SLM) that meets all appropriate International Electrotechnical Commission (IEC) standards and is subject to annual calibration by an accredited laboratory. Equipment details are included in Table 1-1. Calibration certificates are included in Appendix C.
- The acoustic sensitivity of the SLM was tested with a portable acoustic calibrator before and after each measurement session.
- Samples representative and sufficient for statistical analysis, were taken with the use of the portable SLM capable of logging data continuously over the time. Measurements representative of the day- and night-time conditions were taken.
- As generally recommended, the following acoustic indices were recorded: $L_{Aeq}(T)$, $L_{Aeq}(T)$; L_{AFmax} ; L_{AFmin} ; statistics and 3rd octave frequency spectra.
- The SLM was located approximately 1.5 m above the ground and 3.5 m from reflecting surfaces.
- SANS 10103 states that one must ensure (as far as possible) that the measurements are not affected by the residual noise and extraneous influences, e.g., wind, electrical interference and any other non-acoustic interference. All measurements were taken during periods where wind speeds were less than 5 m/s.

Table 1-1: Noise survey equipment used for the assessment

Equipment	Serial Number	Purpose	Last Calibration Date
Svantek 977 sound level meter	S/N 36183	Noise sampling	14 March 2023
Svantek 7052E ½" microphone	S/N 78692		
Svantek SV 12L ½" pre-amplifier	S/N 40659		
SVANTEK SV33 Class 1 Acoustic Calibrator	S/N 43170	Testing of the acoustic sensitivity before and after each daily sampling session.	14 March 2023
Kestrel 4000 Pocket Weather Tracker	S/N 559432	Determining wind speed, temperature and humidity during sampling.	Not Applicable

1.6.5 Source Inventory

To determine the change in noise impacts associated with the project, a source inventory had to be developed. A list of equipment was provided and used to compile the source inventory. L_w 's for these were calculated using predictive equations for industrial machinery as per the Handbook of Acoustics, Chapter 69, by Bruce and Moritz (1998).

Numerous plant noise source L_w 's for project operations was obtained from a database for similar operations. Values from the database are based on source measurements carried out in accordance with the procedures specified in SANS 10103.

Estimates of road traffic were made given production rates and assumed vehicle speeds and road conditions.

1.6.6 Noise Propagation Simulations

The propagation of noise from proposed activities was simulated with the DataKustic CadnaA software. Use was made of the International Organisation for Standardization's (ISO) 9613 module for outdoor noise propagation from industrial noise sources.

1.6.6.1 ISO 9613

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission. These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The method also predicts an average A-weighted sound pressure level. The average A-weighted sound pressure level encompasses levels for a wide variety of meteorological conditions. The method specified in ISO 9613 consists specifically of octave-band algorithms (with nominal mid-band frequencies from 63 Hz to 8 kHz) for calculating the attenuation of sound which originates from a point sound source, or an assembly of point sources. The source (or sources) may be moving or stationary. Specific terms are provided in the algorithms for the following physical effects: geometrical divergence, atmospheric absorption, ground surface effects, reflection and obstacles. A basic representation of the model is given in the equation below:

$$L_P = L_W - \sum [K_1, K_2, K_3, K_4, K_5, K_6]$$

Where;

L_P is the sound pressure level at the receiver;

L_W is the sound power level of the source;

K_1 is the correction for geometrical divergence;

K_2 is the correction for atmospheric absorption;

K_3 is the correction for the effect of ground surface;

K_4 is the correction for reflection from surfaces; and

K_5 is the correction for screening by obstacles.

This method is applicable in practice to a great variety of noise sources and environments. It is applicable, directly or indirectly, to most situations concerning road or rail traffic, industrial noise sources, construction activities, and many other ground-based noise sources.

To apply the method of ISO 9613, several parameters need to be known with respect to the geometry of the source and of the environment, the ground surface characteristics, and the source strength in terms of octave-band sound power levels for directions relevant to the propagation.

1.6.6.2 Simulation Domain

If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source. All sources were quantified as point sources or areas/lines represented by point sources. The sound energy from a point source spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source and decreases by 6 dB per doubling of distance. This holds true until ground and air attenuation noticeably affect the level. The impact of an intruding industrial noise on the environment will therefore rarely extend over more than 5 km from the source and is therefore always considered "local" in extent.

The propagation of noise was calculated over an area of 6.6 km east-west by 5.6 km north-south and encompasses the project area. The southwest corner of the calculated area is 597400 m Easting and 7150200 m Northing (WGS84). The area was divided into a grid matrix with a 20 m resolution. The model was set to calculate L_P 's at each grid intercept point at a height of 1.5 m above ground level.

1.6.7 Presentation of Results

Results are presented in tabular and isopleth form. An isopleth is a line on a map connecting points at which a given variable (in this case sound pressure, L_P) has a specified constant value. This is analogous to contour lines on a map showing terrain elevation. In the assessment of environmental noise, isopleths present lines of constant noise level as a function of distance.

Simulated noise levels were assessed according to guidelines published in the draft Environmental Noise Standards, National Noise Control Regulations and Gauteng Noise Control Regulations. To assess annoyance at nearby places of residence, the increase in noise levels above the baseline at NSRs were calculated and compared to guidelines published in the SANS 10103.

1.6.8 Recommendations of Management and Mitigation

The findings of the noise specialist study informed the recommendation of suitable noise management and mitigation measures.

1.7 Management of Uncertainties

The following limitations and assumptions should be noted:

- Only normal project operations were assessed. The impacts due to emergency activities were not modelled.
- Estimates of road traffic on the access road were made with the provided product material throughputs. The truck capacity of 40 t and speed of 40 km/hr was assumed.
- The mitigating effect of pit walls, buildings, and infrastructure acting as acoustic barriers were not taken into account providing a conservative assessment of the noise impacts off-site.
- The quantification of sources of noise was limited to the operational phase of the project. Construction and closure phase activities are expected to be similar or less significant. Noise impacts will cease post-closure.
- Operating time was given to be from Monday to Friday from 07:00 to 17:00. Only day-time noise impacts were thus provided in the assessment.
- Although other existing sources of noise within the area were identified, such sources were not quantified but were taken into account during the survey.
- Blast vibration and noise did not form part of the scope of work of this assessment.
- The environmental noise assessment focussed on the evaluation of impacts for humans. It is important to note that the applicability of environmental noise assessments to wildlife is limited as it is not possible simply to infer the impacts of anthropogenic noise on wildlife from the human literature. This is because the hearing ranges and sensitivities of non-human animals can be very different from those of humans. Noise studies on humans understandably use methodologies that tailors the quantification of anthropogenic noise to our hearing capabilities: for example, the use of microphones limited to the human hearing range (20 Hz – 20 kHz) and the implementation of frequency filters effectively mimicking human auditory sensitivity (A-weighting). As such, noise measurements may only cover part of the relevant acoustic range for other species. Moreover, species differences in behaviour, physiology, and ecology, in addition to hearing capabilities and perception, mean that extrapolations from human studies can provide only a limited understanding of the potential impact of anthropogenic noise on wildlife.

2 REGULATORY REQUIREMENTS AND ASSESSMENT CRITERIA

2.1 National Noise Control Regulations

The 1992 Noise Control Regulations (The Republic of South Africa, 1992) published in terms of Section 25 of the Environment Conservation Act (Act no. 73 of 1989) defines a “disturbing noise” as a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

The Noise Control Regulations were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

In 1994, with the shift of regulatory power from governmental to provincial level, the authority to promulgate noise regulations was ceded to provinces. Each province could therefore decide whether to develop their own regulations, or to adopt and adapt existing regulations. To date, three provinces (Gauteng, Free State and Western Cape) have promulgated such regulations.

2.2 Gauteng Noise Control Regulations

In Gauteng, the 1992 Noise Control Regulations were replaced by the Gauteng Noise Control Regulations in 1999 (The Gauteng Provincial Government, 1999). Of importance to the current study are the Gauteng Noise Control Regulations definitions for the following:

- (a) A “controlled area” is a piece of land designated by a local authority where, in case of industrial noise near an industry:
 - i. the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter was in operation, exceeds 60 dBA; or
 - ii. the calculated outdoor equivalent continuous “A”-weighted” sound pressure level at a height of at least 1.2 metres, but not more than 1.4 metres, above the ground for a period of 24 hours, exceeds 60 dBA.
- (b) A “disturbing noise” means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, as per SANS 10103 (2008) (Table 2-1).

2.3 South African National Standards

In South Africa, provision is made for the regulation of noise under the National Environmental Management Air Quality Act (NEMAQA) (Act. 39 of 2004). Draft Environmental Noise Standards were published in June 2024 which are, at the time of this assessment, out for public comment. These recommended Environmental Noise Standards reference the South African Bureau of Standards (SABS) standard SANS 10103 (2008) ‘The measurement and rating of environmental noise with respect to annoyance and to speech communication’ (Table 2-1). This standard has been widely applied in South Africa and is frequently used by local authorities when investigating noise complaints. The standard is also fully aligned with the World Health Organisation (WHO) guidelines for Community Noise (WHO, 1999).

Table 2-1: Draft South African National Standards for Environmental Noise

Type of district	Land use purpose	10-Minute L_{Aeq} dB(A) - Outdoor Noise	
		Day-time (06:00 – 22:00)	Night-time (22:00 – 06:00)
Agricultural districts	Agricultural purposes	45	35
Suburban districts	Residential purposes	50	40
Urban districts	Business purposes	55	45
Urban districts with one or more of the following: business premises; and main roads.	Business purposes	60	50
Central business districts	Business purposes	65	55
Industrial districts	Business purposes	70	60

SANS 10103 also provides a useful guideline for estimating community response to an increase in the general ambient noise level caused by intruding noise. If Δ is the increase in noise level, the following criteria are of relevance:

- $\Delta \leq 0$ dB: There will be no community reaction;
- $0 \text{ dB} < \Delta \leq 10$ dB: There will be 'little' reaction with 'sporadic complaints';
- $5 \text{ dB} < \Delta \leq 15$ dB: There will be a 'medium' reaction with 'widespread complaints'. $\Delta = 10$ dB is subjectively perceived as a doubling in the loudness of the noise;
- $10 \text{ dB} < \Delta \leq 20$ dB: There will be a 'strong' reaction with 'threats of community action'; and
- $\Delta > 15$ dB: There will be a 'very strong' reaction with 'vigorous community action'.

The categories of community response overlap because the response of a community does not occur as a stepwise function, but rather as a gradual change.

2.4 Regulations Regarding Report Writing

This report complies with the requirements of the National Environmental Management Act, 1998 (NEMA, No. 107 of 1998) and the Environmental Impact Assessment (EIA) regulations (Government Notice [GN] R982 as amended by GN 326 of 7 April 2017; GN 706 of 13 July 2018 and GN 320 of 20 March 2020). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 2-2: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (Government Notice [GN] R982 as amended by GN 326 of 7 April 2017; GN 706 of 13 July 2018 and GN 320 of 20 March 2020)

A specialist report prepared in terms of the Environmental Impact Regulations must contain:	Relevant section in report
Details of the specialist who prepared the report	Section 1.3
The expertise of that person to compile a specialist report including a curriculum vitae	Section 1.3.2 Appendix A
A declaration that the person is independent in a form as may be specified by the competent authority	Section 1.3.1 Appendix B
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
An indication of the quality and age of base data used for the specialist report;	Section 3
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4

A specialist report prepared in terms of the Environmental Impact Regulations must contain:	Relevant section in report
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3 Section 4
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.6
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Section 3.1
An identification of any areas to be avoided, including buffers	Section 3.1 Section 4
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 4
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.7
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Section 4
Any mitigation measures for inclusion in the EMPr	Section 6
Any conditions for inclusion in the environmental authorisation	Section 6
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 7
Regarding the acceptability of the proposed activity or activities; and	Section 4
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 4 Section 6 Section 7
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable
A summary and copies if any comments that were received during any consultation process	None received
Any other information requested by the competent authority.	None received

2.5 Procedures for the Assessment

This report complies with protocols for the assessment and minimum report content in terms of sections 24(5)(a), (h) and 44 of the National Environmental Management Act, 1998 (NEMA, No. 107 of 1998) (Government Gazette No. 43110) published on 20 March 2020. The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 2-3: Specialist assessment requirements in terms of Government Gazette No. 43110 (2020)

Assessment and Reporting on Noise Impacts	Section in Report
The assessment must be undertaken by a noise specialist	Section 1.3 and Appendix A
The assessment must be undertaken based on a site inspection as well as applying the noise standards and methodologies stipulated in SANS 10103:2008 and SANS 10328:2008 (or latest versions) for residential and non-residential areas as defined in these standards.	Section 2, Section 3.3 and Section 4
A baseline description must be provided of the potential receptors and existing ambient noise levels. The receptors could include places of residence or tranquillity that have amenity value associated with low noise levels. As a minimum, this description must include the following:	

Assessment and Reporting on Noise Impacts	Section in Report
current ambient sound levels recorded at relevant locations (e.g. receptors and proposed new noise sources) over a minimum of two nights and that provide a representative measurement of the ambient noise climate, with each sample being a minimum of ten minutes and taken at two different times of the night (such as early evening and late at night) on each night, in order to record typical ambient sound levels at these different times of night;	Section 3.3
records of the approximate wind speed at the time of the measurement;	Section 3.3
mapped distance of the receiver from the proposed development that is the noise source; and	Section 3.1
discussion on temporal aspects of baseline ambient conditions.	Section 3.3
Assessment of impacts done in accordance with SANS 10103:2008 and SANS 10328:2008 (or latest versions) must include the following aspects which must be considered as a minimum in the predicted impact of the proposed development: characterisation and determination of noise emissions from the noise source, where characterization could include types of noise, frequency, content, vibration and temporal aspects;	Section 4
projected total noise levels and changes in noise levels as a result of the construction, commissioning and operation of the proposed development for the nearest receptors using industry accepted models and forecasts; and,	Section 4
desired noise levels for the area.	Section 2, Section 4 and Section 5
The findings of the Noise Specialist Assessment must be written up in a Noise Specialist Report that must contain as a minimum the following information: details and relevant qualifications and experience of the noise specialist preparing the assessment including a curriculum vitae;	Section 1.3 and Appendix A
a signed statement of independence by the specialist;	Appendix B
the duration and date of the site inspection and the relevance of the season and weather conditions to the outcome of the assessment;	Section 3
a description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant, together with results of the noise assessment;	Section 1.6.4, Section 1.6.6 and Section 4
a map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope;	Figure 1-1
confirmation from the specialist that all reasonable measures have been considered, or not, in the micro-siting of the proposed development to minimise disturbance of receptors;	Section 4 and Section 6
a substantiated statement from the specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development;	Section 7
any conditions to which this statement is subjected;	Section 6 and Section 7
the assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered;	Section 4. No alternative development footprints were provided for the assessment.
a motivation must be provided if there were development footprints identified as per paragraph 2.5.9. above that were identified as having a "low" noise sensitivity and that were not considered appropriate;	Not applicable
where identified, proposed impact management outcomes, mitigation measures for noise emissions during the construction and commissioning phases that may be of relative short duration, or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and,	Section 6
a description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 1.7

3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Potential Sensitive Receptors

Potential sensitive receptors surrounding the project site (indicated in Figure 3-1), include individual dwellings.

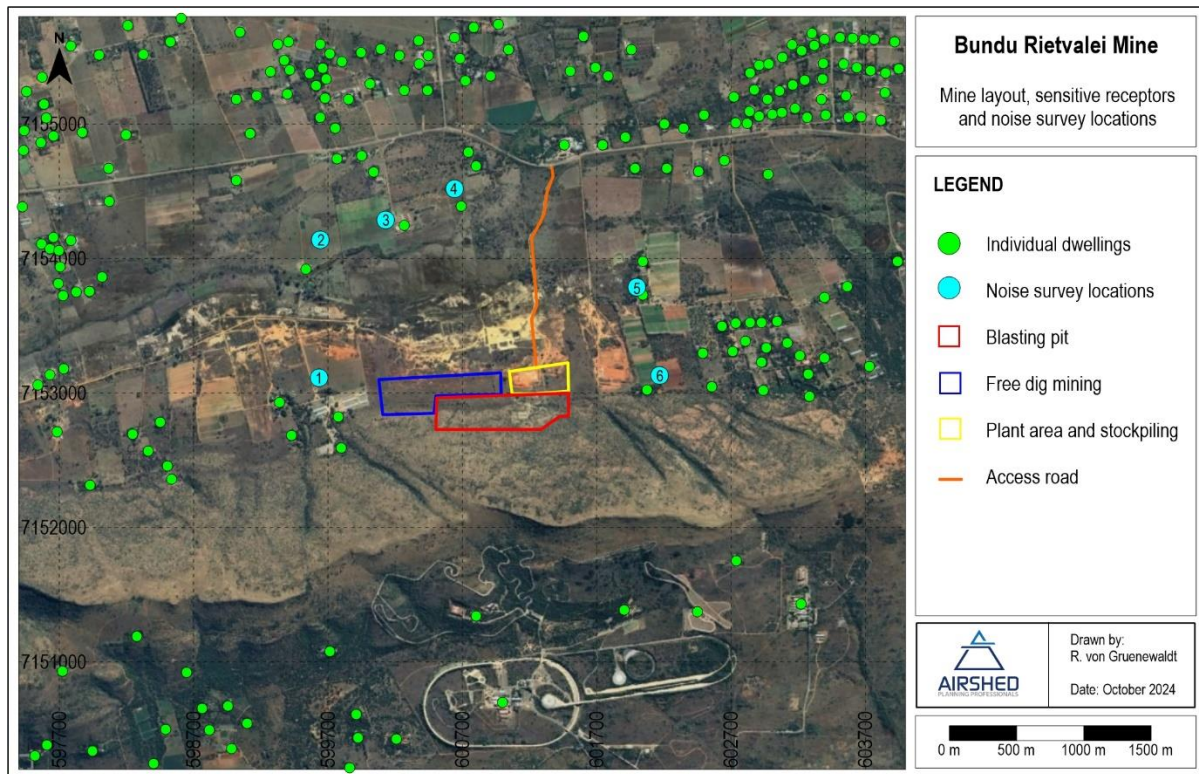


Figure 3-1: Noise survey sites and potential sensitive receptors surrounding the study area

3.2 Environmental Noise Propagation and Attenuation Potential

3.2.1 Atmospheric Absorption and Meteorology

The main meteorological parameters affecting the propagation of noise include wind speed, wind direction and temperature. These along with other parameters such as relative humidity, air pressure, solar radiation and cloud cover affect the stability of the atmosphere and the ability of the atmosphere to absorb sound energy.

Wind speed increases with altitude. This results in the 'bending' of the path of sound to 'focus' it on the downwind side and creating a 'shadow' on the upwind side of the source. Depending on the wind speed, the downwind level may increase by a few dB but the upwind level can drop by more than 20 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). It should be noted that at wind speeds of more than 5 m/s, ambient noise levels are mostly dominated by wind generated noise.

Meteorological data from the Weather Research and Forecasting (WRF) Model for the period 2021 - 2023 was selected for the assessment. The modelled data set indicates wind flow primarily from the northeastern sector (Figure 3-2 (a)). During

the day the predominant wind direction is from the northeast with the predominant wind direction during the night from the northeast and east-northeast. On average, noise impacts are expected to be more notable to the southwest during the day.

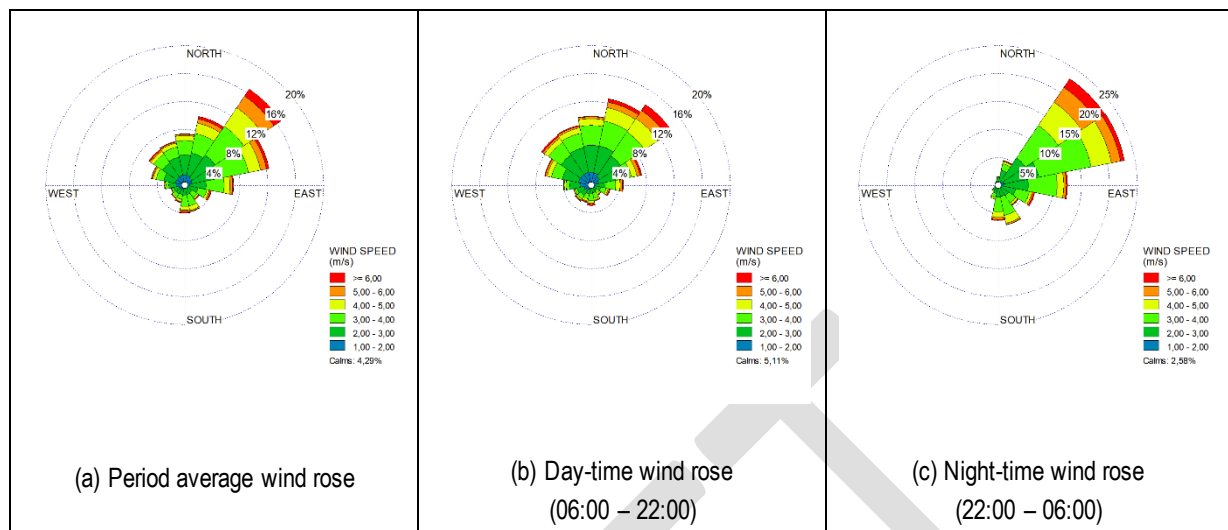


Figure 3-2: Wind rose for WRF data for the period 2021 - 2023

Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night (Figure 3-3). The average temperature and relative humidity for the site (as obtained from the WRF data set for the period 2021 to 2023) was 19°C and 47% respectively.

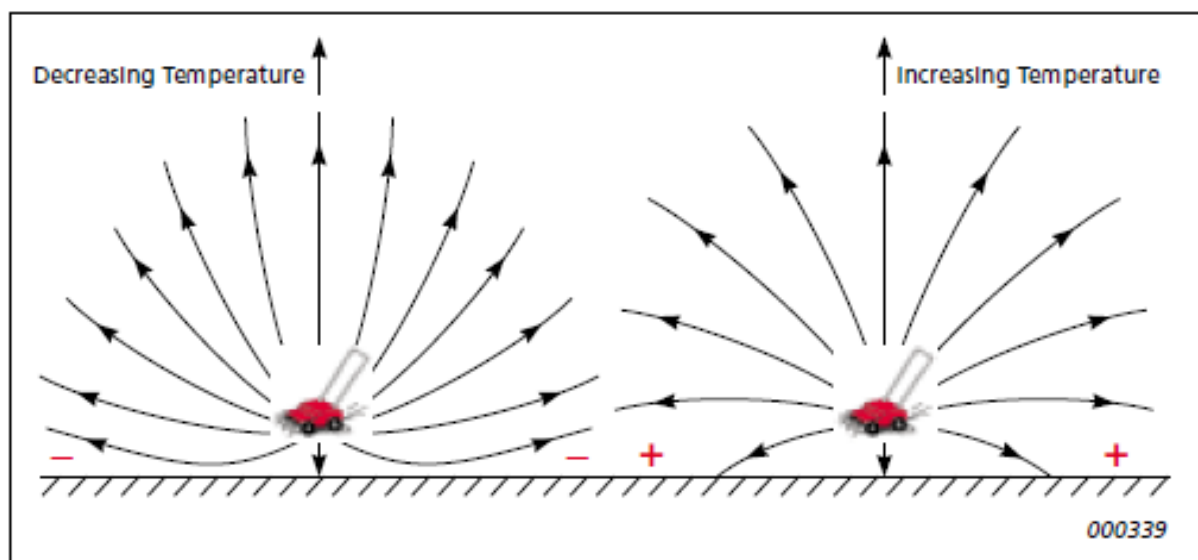


Figure 3-3: Bending the path of sound during typical day time conditions (image provided on the left) and night-time conditions (image provided on the right)

3.2.2 Terrain, Ground Absorption and Reflection

Noise reduction caused by a barrier (i.e., natural terrain, installed acoustic barrier, building) feature depends on two factors namely the path difference of a sound wave as it travels over the barrier compared with direct transmission to the receiver and the frequency content of the noise (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). The topography for the study area is provided in Figure 3-4.

Sound reflected by the ground interferes with the directly propagated sound. The effect of the ground is different for acoustically hard (e.g., concrete or water), soft (e.g., grass, trees or vegetation) and mixed surfaces. Ground attenuation is often calculated in frequency bands to take into account the frequency content of the noise source and the type of ground between the source and the receiver (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Based on observations made during the visit to site, ground cover was found to be acoustically mixed.

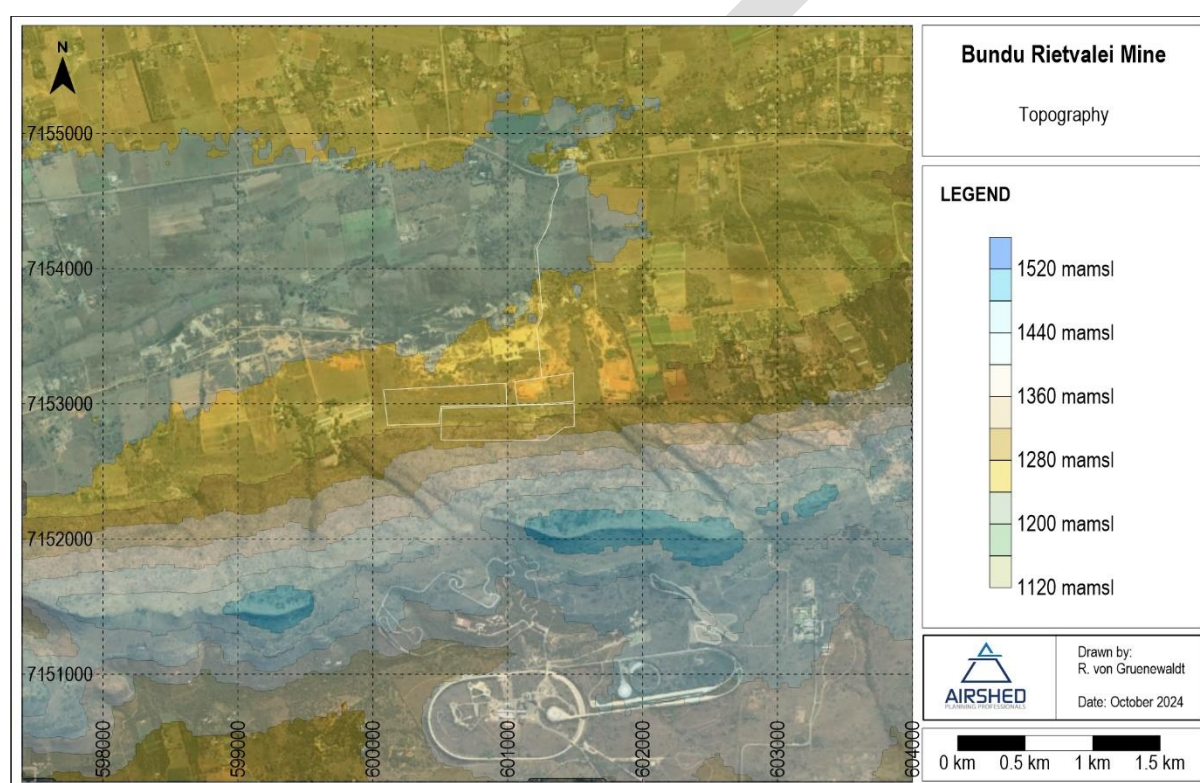


Figure 3-4: Topography for the study area

3.3 Baseline Noise Survey

3.3.1 Site Selection

Survey sites were selected after careful consideration of future activities, accessibility, potential noise sensitive receptors, and safety restrictions. A total of 6 survey sites was selected for the survey conducted in September 2024. The locations of the survey sites, with coordinates, are provided in Table 3-1 and shown in Figure 3-1.

Table 3-1: Location of the noise survey sites

Site	Latitude	Longitude
1	25.737081°S	27.993668°E
2	25.727296°S	27.993648°E
3	25.725939°S	27.998697°E
4	25.724142°S	28.003442°E
5	25.730523°S	28.016893°E
6	25.736499°S	28.018572°E

3.3.2 Measured Noise Levels

The noise survey campaign was undertaken on the 11th to the 13th of September 2024. The survey results are summarised in Table 3-2 with the district categorisation and recommended Environmental Noise Standards provided in Table 3-3. For comparison purposes, the measured noise levels (L_{Aeq}) are presented in Figure 3-5 (day-time results) and Figure 3-6 (night-time results). Draft Environmental Noise Standards are not exceeded at the survey sites during the day-time sampling campaign. During the night-time, the draft Environmental Noise Standards is exceeded for Site 1, Site 2 Site 3 and Site 4. The acoustic climate in the area is mainly influenced by birds, insects, dogs and vehicles.

For detailed time-series, frequency spectra and statistical results, the reader is referred to Appendix D.

In order to illustrate the increase in ambient noise levels as a result of the project, the day-time representative background noise level of 40.7 dBA was used (the average day-time noise levels measured at all the sites).

Table 3-2: Project baseline environmental noise survey results summary

Sampling point	Visual and acoustic observations	General weather conditions	Time of day	Start date and time	Duration	L _A F _{max} (dBA)	L _A F _{min} (dBA)	L _A eq (dBA)	L _A leq (dBA)	L _A 90 (dBA)	L _A eq,d and L _A eq,n ^(a)	Draft Environmental Noise Standards (dBA)
Site 1	Near Jura poultry farm (~200 m north) and farmhouse (~250 m east). Noise sources include birds, insects (during the night) and security vehicle patrolling.	Winds of 2.2 m/s (N); 25°C; 43% humidity; 10% cloud cover	Day	2024/09/11 18:00	00:20:26	63.8	37.3	42.8	63.9	39.9	42.7	45
		Winds of 1.9 m/s (NW); 26°C; 40% humidity; 20% cloud cover	Day	2024/09/12 18:07	00:20:09	56.5	30.7	42.6	53.2	35.9		
		No wind; 20°C; 60% humidity; 10% cloud cover	Night	2024/09/12 01:29	00:20:02	55.4	29.7	36.4	58.4	31.4	46.1	35
		Winds of 0.9m/s (NW); 20°C; 60% humidity; 20% cloud cover	Night	2024/09/13 01:40	00:20:01	66.6	33.3	48.9	49.8	36.6		
Site 2	Site is ~200 m northeast of a farmhouse and ~600 m from R514. Noise sources include birds, dogs and insects (during the night).	Winds of 1.9 m/s (N); 24°C; 43% humidity; 10% cloud cover	Day	2024/09/11 18:48	00:20:12	59.9	33.5	41.8	52.1	35.4	41.1	45
		Winds of 1.8 m/s (NW); 25°C; 43% humidity; 20% cloud cover	Day	2024/09/12 18:58	00:20:03	63.9	31.9	40.3	77.8	34.2		
		No wind; 20°C; 60% humidity; 10% cloud cover	Night	2024/09/12 00:42	00:20:01	64.8	23.6	35.9	52.0	26.7	39.9	35
		Winds of 0.9 m/s (NW); 21°C; 60% humidity; 20% cloud cover	Night	2024/09/13 00:35	00:20:02	60.0	30.5	42.0	56.1	35.0		
Site 3	The site is located ~100 m from buildings and ~600 m south of	Winds of 1.9 m/s (N); 24°C; 44% humidity; 10% cloud cover	Day	2024/09/11 19:25	00:20:01	65.0	30.6	41.8	50.8	35.4	43.4	45

Sampling point	Visual and acoustic observations	General weather conditions	Time of day	Start date and time	Duration	LAF _{max} (dBA)	LAF _{min} (dBA)	L _{Aeq} (dBA)	L _{Aleq} (dBA)	L _{A90} (dBA)	L _{Aeq,d} and L _{Aeq,n} ^(a)	Draft Environmental Noise Standards (dBA)
	the R514. Noise sources include birds, dogs, vehicles and insects (during the night).	Winds of 1.5 m/s (NW); 25°C; 44% humidity; 20% cloud cover	Day	2024/09/12 19:36	00:20:01	61.9	33.0	44.5	59.0	35.5	39.2	35
		No wind; 20°C; 58% humidity; 10% cloud cover	Night	2024/09/12 00:14	00:20:01	60.4	30.4	36.1	51.6	31.5		
		No wind; 21°C; 58% humidity; 20% cloud cover	Night	2024/09/12 23:59	00:20:32	68.1	26.9	41.0	59.6	29.5		
Site 4	Site is located close to a farmhouse and ~450 m from the R514. Noise sources include birds, dogs, and insects (during the night).	Winds of 0.9 m/s (N); 22°C; 46% humidity; 10% cloud cover	Day	2024/09/11 20:00	00:20:01	60.9	32.1	38.3	51.4	34.0	37.6	45
		Winds of 0.9 m/s (NW); 25°C; 45% humidity; 20% cloud cover	Day	2024/09/12 20:17	00:20:01	56.9	31.2	36.7	54.1	33.2		
		No wind; 20°C; 58% humidity; 10% cloud cover	Night	2024/09/11 23:33	00:20:44	55.1	23.4	34.1	57.6	27.1	37.8	35
		No wind; 21°C; 58% humidity; 20% cloud cover	Night	2024/09/12 23:26	00:20:03	64.2	25.0	39.8	68.6	31.2		
Site 5	Site is located close to a farmstead. Noise sources include birds, dogs, occasional vehicles passing and insects (during the night).	Winds of 0.8 m/s (N); 20°C; 50% humidity; 10% cloud cover	Day	2024/09/11 20:41	00:20:44	60.1	35.0	39.5	51.0	36.6	38.2	45
		Winds of 0.8m/s (N); 24°C; 48% humidity; 20% cloud cover	Day	2024/09/12 20:58	00:20:02	55.4	29.7	36.4	58.4	31.4		
		No wind; 20°C; 58% humidity; 10% cloud cover	Night	2024/09/11 22:41	00:20:03	51.9	22.1	30.6	52.6	24.3	32.2	35
		No wind; 22°C; 58% humidity; 20% cloud cover	Night	2024/09/12 22:38	00:20:07	50.0	28.1	33.4	53.7	30.0		

Sampling point	Visual and acoustic observations	General weather conditions	Time of day	Start date and time	Duration	LAF _{max} (dBA)	LAF _{min} (dBA)	L _{Aeq} (dBA)	L _{Aleq} (dBA)	L _{A90} (dBA)	L _{Aeq,d} and L _{Aeq,n} ^(a)	Draft Environmental Noise Standards (dBA)
Site 6	Site is located close to a farmstead. Noise sources include birds, dogs, and insects (during the night).	No wind; 20°C; 52% humidity; 10% cloud cover	Day	2024/09/11 21:21	00:20:07	55.1	23.4	34.1	57.6	27.1	36.8	45
		Winds of 0.6m/s (NW); 22°C; 52% humidity; 20% cloud cover	Day	2024/09/12 21:36	00:20:38	55.1	25.9	38.4	51.4	29.6		
		No wind; 20°C; 56% humidity; 10% cloud cover	Night	2024/09/11 22:01	00:20:04	59.8	20.9	29.4	51.0	22.5	33.4	35
		No wind; 22°C; 56% humidity; 20% cloud cover	Night	2024/09/12 22:01	00:20:38	57.9	28.9	35.5	52.0	31.1		

(a) Measured noise levels (L_{Aeq}) that exceed the recommended Environmental Noise Standards are provided in bold.

Table 3-3: District categorisation and recommended Environmental Noise Standards

Sampling point	District Classification	Draft Environmental Noise Standards	
		Day	Night
Site 1	Agricultural	45	35
Site 2	Agricultural	45	35
Site 3	Agricultural	45	35
Site 4	Agricultural	45	35
Site 5	Agricultural	45	35
Site 6	Agricultural	45	35

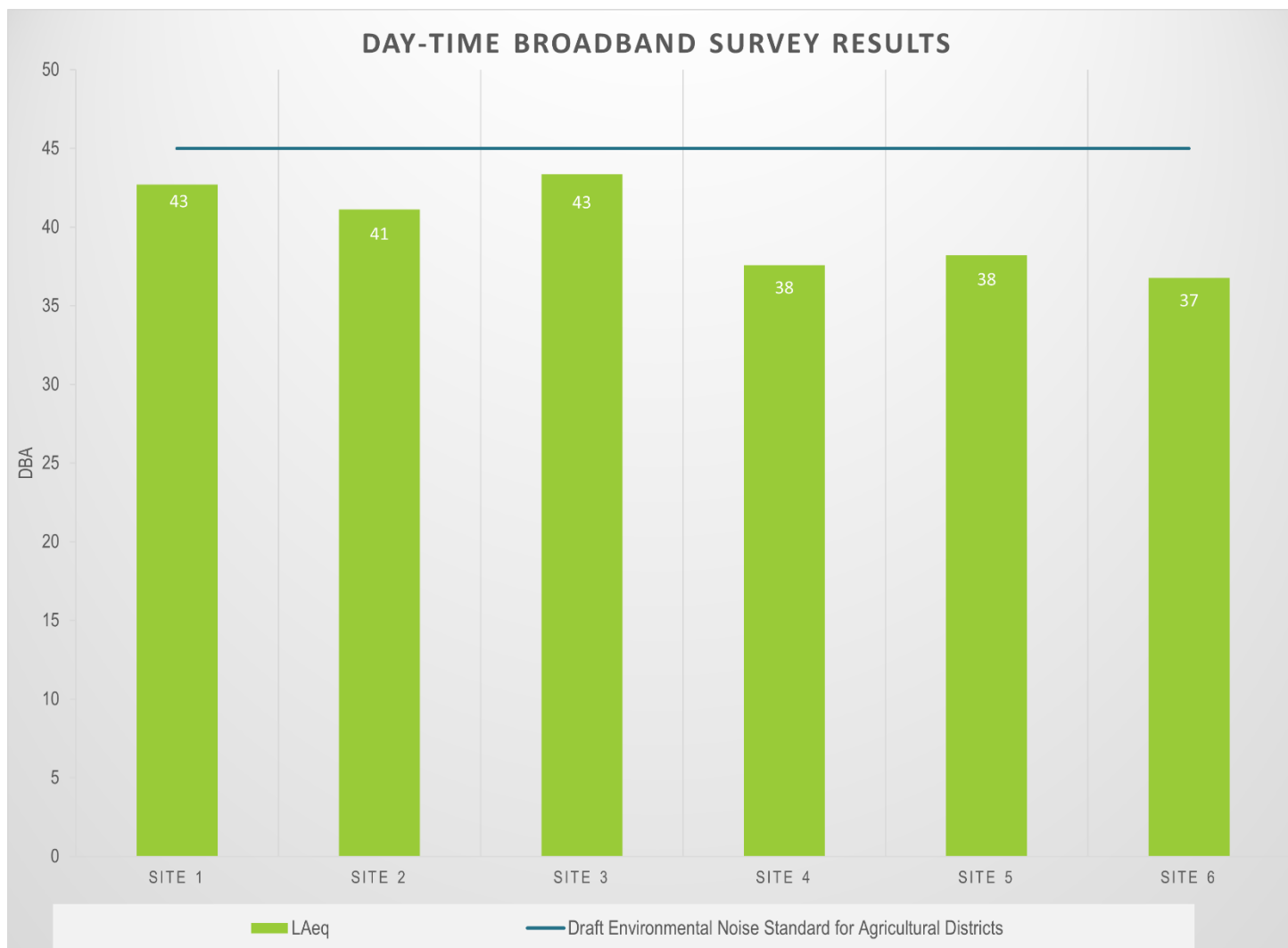


Figure 3-5: Day-time broadband survey results

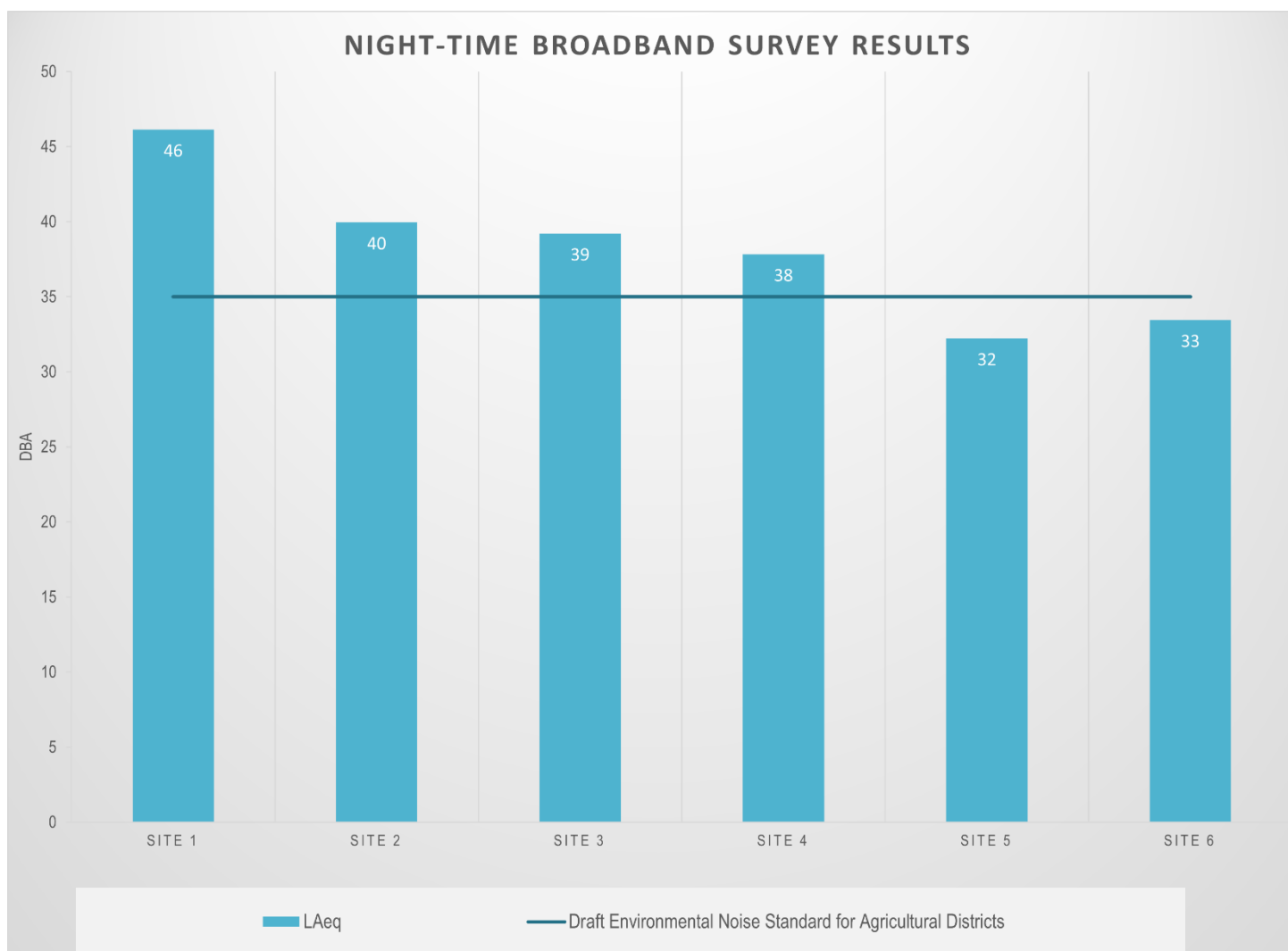


Figure 3-6: Night-time broadband survey results

4 IMPACT ASSESSMENT

The noise source inventory, noise propagation modelling and results are discussed in Section 4.1 and Section 4.2 respectively.

4.1 Noise Sources and Sound Power Levels

The reader is reminded of the non-linearity in the addition of L_w 's. If the difference between the sound power levels of two sources is nil the combined sound power level is 3 dB more than the sound pressure level of one source alone. Similarly, if the difference between the sound power levels of two sources is more than 10 dB, the contribution of the quietest source can be disregarded (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

The complete source inventory for the project activities is included in Table 4-1. Octave band frequency spectra L_w 's are included in Table 4-2.

Table 4-1: List of equipment for the project operations

No.	Type	Description	kW Rating	Working hours per day
1	Excavator	Volvo EC380	226	10
1	ADT	Volvo A30F	266	10
1	Front-end-loader	Volvo L150H	224	10
1-2	Drill rigs	Sandvik DX800 drilling rigs	162	10
1	Generator	630kVA Volvo Generator		10
1	Primary jaw crusher		75	10
1	Cone crusher 1		90	10
1	Cone crusher 2		110	10
1	Screen 1		18	10
1	Screen 2		18	10
2	Screen 3		5.5	10
1	Vertical impact crusher		180	10
2	Dewatering screen		4.5	10
15	Conveyors			10
15	Conveyor motors		15	10
1	CDE machine	Motor on pump	55	10

Table 4-2: Octave band frequency spectra Lw's for project operations

Equipment	Type	Lw octave band frequency spectra (dB)								Lw (dB)	LWA (dBA)	Source
		63	125	250	500	1000	2000	4000	8000			
Excavator	Lw	111.5	116.5	119.5	114.5	112.5	109.5	103.5	97.5	123.2	117.8	Lw Predictions (Bruce & Moritz, 1998)
ADT	Lw	112.2	117.2	120.2	115.2	113.2	110.2	104.2	98.2	123.9	118.5	Lw Predictions (Bruce & Moritz, 1998)
Font-End-Loader	Lw	111.5	116.5	119.5	114.5	112.5	109.5	103.5	97.5	123.1	117.8	Lw Predictions (Bruce & Moritz, 1998)
Drilling Rigs	Lw	110.1	115.1	118.1	113.1	111.1	108.1	102.1	96.1	121.7	116.4	Lw Predictions (Bruce & Moritz, 1998)
Generator	Lw	119.2	109.1	108.9	109.2	106.0	100.8	94.0		120.5	110.5	Lw database
Jaw crusher motor	Lw	79.8	82.8	84.8	87.8	87.8	86.8	81.8	73.8	93.9	92.5	Lw Predictions (Bruce & Moritz, 1998)
Cone crusher motor	Lw	80.6	83.6	85.6	88.6	88.6	87.6	82.6	74.6	94.7	93.3	Lw Predictions (Bruce & Moritz, 1998)
Screen 1 motor	Lw	71.4	74.4	76.4	79.4	79.4	78.4	73.4	65.4	85.5	84.1	Lw Predictions (Bruce & Moritz, 1998)
Screen 2 motor	Lw	71.4	74.4	76.4	79.4	79.4	78.4	73.4	65.4	85.5	84.1	Lw Predictions (Bruce & Moritz, 1998)
Cone 2 motor	Lw	81.5	84.5	86.5	89.5	89.5	88.5	83.5	75.5	95.6	94.2	Lw Predictions (Bruce & Moritz, 1998)
Vertical impact crusher motor	Lw	83.6	86.6	88.6	91.6	91.6	90.6	85.6	77.6	97.7	96.3	Lw Predictions (Bruce & Moritz, 1998)
Screen 3 motor (x2)	Lw	62.7	65.7	67.7	70.7	70.7	69.7	64.7	56.7	76.7	75.4	Lw Predictions (Bruce & Moritz, 1998)
Dewatering screen motor (x2)	Lw	61.2	64.2	66.2	69.2	69.2	68.2	63.2	55.2	75.3	73.9	Lw Predictions (Bruce & Moritz, 1998)
CDE machine motor on pump	Lw	78.5	81.5	83.5	86.5	86.5	85.5	80.5	72.5	92.6	91.2	Lw Predictions (Bruce & Moritz, 1998)
2 x 4kW motors on screens	Lw	60.3	63.3	65.3	68.3	68.3	67.3	62.3	54.3	74.4	73.0	Lw Predictions (Bruce & Moritz, 1998)
15 conveyors	Lw "	67.0	61.0	65.0	66.0	64.0	52.0	40.0		72.1	67.1	Lw database
15 conveyor motors	Lw	70.1	73.1	75.1	78.1	78.1	77.1	72.1	64.1	84.1	82.8	Lw Predictions (Bruce & Moritz, 1998)
Jaw crusher	Lw	120.6	117.9	118.1	117.1	113.4	109.6	104.8		125.1	118.6	Lw database
Cone crusher (2)	Lw	123.0	123.0	121.0	111.0	106.0	105.0	100.0		127.4	115.8	Lw database
Screens (4)	Lw	106.0	108.9	107.7	109.0	109.2	109.0	109.0		117.0	115.2	Lw database
Vertical impact crusher	Lw	106.3	110.5	113.0	112.8	114.7	114.5	110.2		120.9	119.6	Lw database
Water Bowser	Lw	110.0	115.0	118.0	113.0	111.0	108.0	102.0	96.0	121.7	116.3	Lw Predictions (Bruce & Moritz, 1998)
Product truck (40t)	Lw	112.7	117.7	120.7	115.7	113.7	110.7	104.7	98.7	124.4	119.0	Lw Predictions (Bruce & Moritz, 1998)

4.2 Noise Propagation and Simulated Noise Levels

The propagation of noise generated during the operational phase was calculated with CadnaA in accordance with ISO 9613. Meteorological and site-specific acoustic parameters as discussed in Section 3.2 along with source data discussed in Section 4.1, were applied in the model.

Project operations will be from 07:00 to 17:00, for 5 days per week (Monday to Friday). The assessment of noise for operational activities is therefore limited to day-time only.

Simulated noise levels due to project operations are presented in the form of isopleth plots (Figure 4-1 and Figure 4-2).

Noise levels due to project operations are predicted to be within the Gauteng Noise Control Regulations of 60 dBA at all residential NSRs within the study area (Figure 4-1). The draft Environmental Noise Standard for agricultural districts is 45 dBA for day-time conditions and is exceeded up to ~650 m from the project activities. This draft Environmental Noise Standard (which is the Gauteng Noise Control Regulations for “disturbing” noise) is exceeded at the closest NSRs of R1 (48 dBA) and R2 (49 dBA) (Figure 4-1).

For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); the predicted increase in noise levels from the current baseline due to proposed project activities is not expected to result in community reaction at off-site NSRs (Figure 4-2).

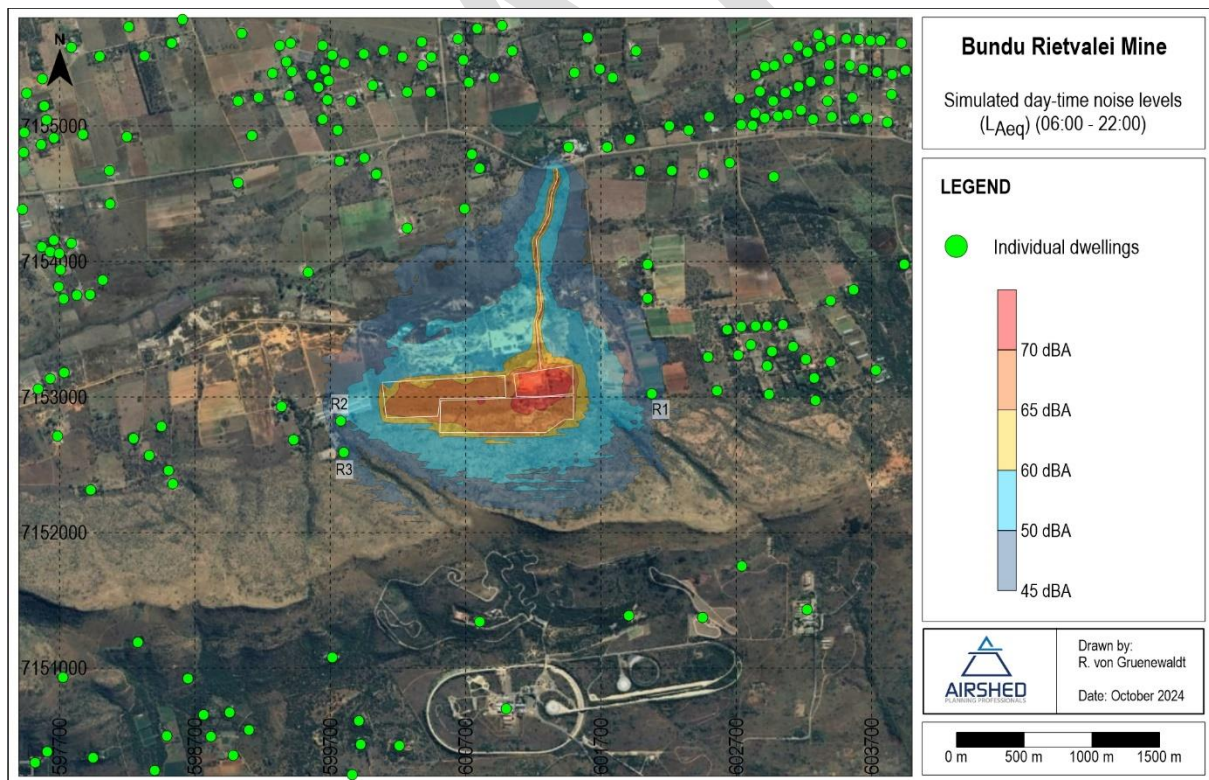


Figure 4-1: Simulated day-time noise levels due to proposed project operations only

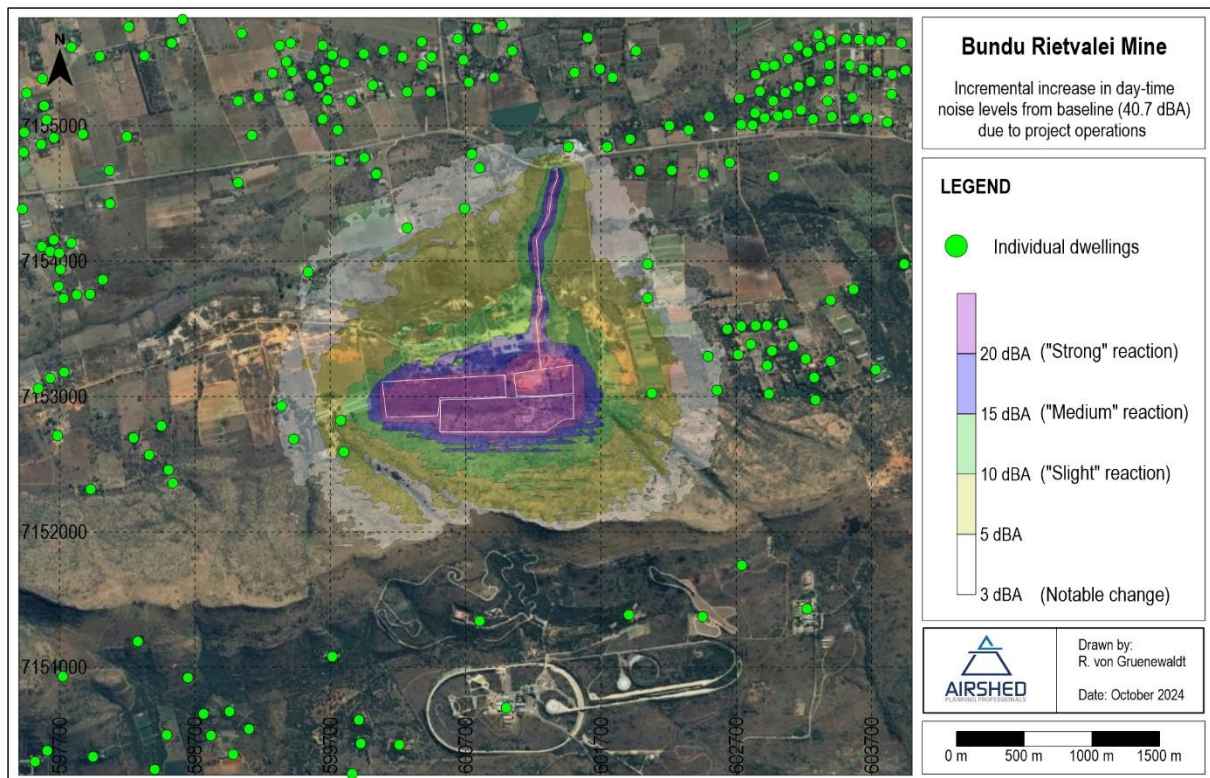


Figure 4-2: Simulated increase in equivalent continuous day-time rating level above the baseline due to project operations

5 IMPACT SIGNIFICANCE RATING

The impact significance of the project is provided below and follows the method provided by AquaStrat Solutions (Pty) Ltd (Appendix F). The project is expected to have the following significance rating:

- Construction Phase:
 - Without mitigation: medium negative significance rating.
 - With Mitigation: low negative significance rating.
- Operation Phase (day-time only):
 - Without mitigation: medium negative significance rating.
 - With Mitigation: low negative significance rating.
- Decommissioning Phase:
 - Without mitigation: medium negative significance rating.
 - With Mitigation: low negative significance rating.

The noise impact assessment also considers the incremental increase in noise from baseline and thus considers cumulative impacts. There is therefore no distinction made between project only and cumulative operations for the significance rating.

Table 5-1: Significance rating for potential environmental noise impacts due to the project activities

NEG/POS	Potential impacts	Spatial scale	Duration	Severity	Probability	Degree of certainty	Significance before mitigation	Proposed mitigation measures	Deduction for mitigation	Significance after mitigation
Construction Phase										
Neg	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the construction of the project.	3	1	3	3	4	5.6 (Medium)	- o 'Low noise' equipment, or methods of work is to be selected; - o Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events; - o Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant; - o Regular inspection and maintenance of all equipment is to be established; - o Avoid unnecessary equipment idling; - o Limit activities to day-time working hours (6am – 6pm); - o Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.	3.0	2.6 (Low)
Operational Phase										
Neg	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the operation of the project.	3	2	3	3	4	6 (Medium)	- o Train operational staff on noise control plan during health & safety briefings; - o Regular inspection and maintenance of all equipment. - o Noise berms. - o Avoid clustering of noisy equipment near sensitive receptors. - o Restrict activities on project site to day-time hours only. - o A noise complaints register must be kept. - o If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.	3.0	3.0 (Low)

NEG/POS	Potential impacts	Spatial scale	Duration	Severity	Probability	Degree of certainty	Significance before mitigation	Proposed mitigation measures	Deduction for mitigation	Significance after mitigation
Closure Phase										
Neg	Nuisance and health risks caused by an increase in the ambient noise level as a result of noise impacts associated with the closure of the project.	3	1	3	3	4	5.6 (Medium)	- o Regular inspection and maintenance of all equipment. - o Avoid clustering of noisy equipment near sensitive receptors. - o Restrict activities on project site to day-time hours only. - o A noise complaints register must be kept. - o If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.	3.0	2.6 (Low)

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6 MANAGEMENT MEASURES

In the quantification of noise emissions and simulation of noise levels as a result of the project, it was found that environmental noise evaluation criteria are exceeded at the closest at off-site NSRs (i.e. R1 and R2).

The measures discussed in this section are measures typically applicable to industrial sites and are considered good practice by the IFC (2007) and British Standard BSI (2014).

It should be noted that not all mitigation measures are to be implemented, but should the need arise the mitigation measures as discussed in this section can be considered.

6.1 Controlling Noise at the Source

6.1.1 General Good Practice Measures

Good engineering and operational practices will reduce levels of annoyance. For general activities, the following good engineering practice should be applied to all project phases:

- Unless it is an emergency situation, non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.
- Complaints register, including the procedure which governs how complaints are received, managed and responses given (refer to Section 6.2), must be implemented, and maintained.

6.1.2 Specifications and Equipment Design

Equipment to be employed should be reviewed to ensure the quietest available technology is used. Equipment with lower sound power levels must be selected in such instances and vendors/contractors should be required to guarantee optimised equipment design noise levels.

6.1.3 Enclosures

As far as is practically possible, sources of significant noise should be enclosed. The extent of enclosure will depend on the nature of the machine and their ventilation requirements. Generators and pumps are examples of such equipment.

It should be noted that the effectiveness of partial enclosures and screens can be reduced if used incorrectly, e.g. noise should be directed into a partial enclosure and not out of it, there should not be any reflecting surfaces such as parked vehicles opposite the open end of a noise enclosure.

6.1.4 Use and Siting of Equipment and Noise Sources

The following good practice should be implemented:

- (a) Machines and mobile equipment used intermittently should be shut down between work periods or throttled down to a minimum and not left running unnecessarily. This will reduce noise and conserve energy.
- (b) Acoustic covers of engines should be kept closed when in use or idling.

- (c) Doors to generators should be kept closed when in use.

6.1.5 Maintenance

Regular and effective maintenance of equipment are essential to noise control. Increases in equipment noise are often indicative of eminent mechanical failure. Also, sound reducing equipment/materials can lose effectiveness before failure and can be identified by visual inspection.

6.2 Controlling the Spread of Noise

The layout and placement of the facility itself is crucial in minimising the noise impact resulting from the project. Appropriate techniques include:

- Placing as much distance as possible between the noise source and the noise-sensitive area (spatial separation).
- Placing noise-compatible activities such as parking areas, open spaces and non-noisy facilities between the noise source and the noise-sensitive areas.
- Using buildings and, to a lesser extent, plantings as barriers to screen sensitive areas.

If noise control at the source and the use of distance between source and receiver is not possible, screening methods may be considered. The effectiveness of a noise barrier is dependent on its length, effective height, and position relative to the source and receiver as well as material of construction. To optimize the effect of screening, screens should be located close to either the source of the noise, or the receiver.

The careful placement of barriers such as screens or berms can significantly reduce noise impacts but may result in additional visual impacts. Although vegetation such as shrubs or trees may improve the visual impact of sites, it will not significantly reduce noise impacts and should not be considered as a control measure.

Earth berms can be built to provide screening for large scale earth moving operations and can be landscaped to become permanent features once construction is completed. Care should be taken when constructing earth berms since it may become a significant source of dust.

6.3 Monitoring

In the event that noise related complaints are received short term ambient noise measurements, at the complainant, should be conducted as part of investigating the complaints. The results of the measurements should be used to inform any follow up interventions. The investigation of complaints should include an investigation into equipment or machinery that likely result or resulted in noise levels annoying to the community. This could be achieved with source noise measurements.

The following procedure should be adopted for all noise surveys (for complaints):

- Any surveys should be designed and conducted by a trained specialist.
- Sampling should be carried out using a Type 1 SLM that meets all appropriate IEC standards and is subject to annual calibration by an accredited laboratory.
- The acoustic sensitivity of the SLM should be tested with a portable acoustic calibrator before and after each sampling session.

- Samples sufficient for statistical analysis should be taken with the use of portable SLM's capable of logging data continuously over the time period. Samples, representative of the day- and night-time acoustic environment should be taken.
- The following acoustic indices should be recorded and reported: $L_{Aeq}(T)$, statistical noise level L_{A90} , L_{AFmin} and L_{AFmax} , octave band or 3rd octave band frequency spectra.
- The SLM should be located approximately 1.5 m above the ground and no closer than 3.5 m to any reflecting surface.
- Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g. wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.
- A detailed log and record should be kept. Records should include site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.

7 CONCLUSIONS

The project will need to operate within the draft Environmental Noise Standards for agricultural districts (refer to Section 2.3 and Table 3-3 for reference). The noise impacts due to the project marginally exceeds the draft Environmental Noise Standards at the closest NSRs to the project site. Mitigation measures, as recommended in Section 6, may be implemented to reduce noise levels further. A complaints register must be kept throughout the life of the operations. Provided that the project meets the draft Environmental Noise Standards for agricultural districts at the closest off-site NSRs, it is the specialist's opinion that the project may be authorised.

DRAFT

8 REFERENCES

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APPENDIX A – CURRICULUM VITAE

CURRICULUM VITAE

RENÉE VON GRUENEWALDT

FULL CURRICULUM VITAE

Name of Firm	Airshed Planning Professionals (Pty) Ltd
Name of Staff	Reneé von Gruenewaldt (<i>nee</i> Thomas)
Profession	Air Quality and Environmental Noise Scientist
Position	Principal consultant
Date of Birth	13 May 1978
Years with Firm	Since January 2002
Nationalities	South African

MEMBERSHIP OF PROFESSIONAL SOCIETIES

- Registered Professional Natural Scientist (Registration Number 400304/07) with the South African Council for Natural Scientific Professions (SACNASP)
- Member of the National Association for Clean Air (NACA)

KEY QUALIFICATIONS

Reneé von Gruenewaldt (Air Quality Scientist): Reneé joined Airshed Planning Professionals (Pty) Ltd (previously known as Environmental Management Services cc) in 2002. She has, as a Specialist, attained over twenty (20) years of experience in the Earth and Natural Sciences sector in the field of Air Quality and nine (9) years of experience in the field of environmental noise assessments. As an environmental practitioner, she has provided solutions to both large-scale and smaller projects within the mining, minerals, and process industries.

She has developed technical and specialist skills in various air quality modelling packages including the AMS/EPA Regulatory Models (AERMOD and AERMET), UK Gaussian plume model (ADMS), EPA Regulatory puff-based model (CALPUFF and CALMET), puff-based HAWK model and line-based models, Lagrangian GRAL model. Her experience with air emission models includes Tanks 4.0 (for the quantification of tank emissions), WATER9 (for the quantification of wastewater treatment works) and GasSim (for the quantification of landfill emissions). Noise propagation modelling proficiency includes CONCAWE, South African National Standards (SANS 10210) for calculating and predicting road traffic noise and CadnaA for propagation of industrial, road and rail noise sources.

Having worked on projects throughout Africa (i.e., South Africa, Mozambique, Malawi, Kenya, Angola, Democratic Republic of Congo, Namibia, Madagascar and Egypt for Air Quality Impact Assessments and Mozambique, Namibia, Botswana, Kenya, Ghana, Suriname and Afghanistan for Environmental Noise Impact Assessments) Reneé has developed a broad experience base. She has a good understanding of the laws and regulations associated with ambient air quality and emission limits in South Africa and various other African countries, as well as the World Bank Guidelines, European Community Limits and World Health Organisation.

RELEVANT EXPERIENCE (AIR QUALITY)

Mining and Ore Handling

Reneé has undertaken numerous air quality impact assessments and management plans for coal, platinum, uranium, copper, cobalt, chromium, fluorspar, bauxite, manganese and mineral sands mines. These include: compilation of emissions databases for Landau and New Vaal coal collieries (SA), impact assessments and management plans for numerous mines over Mpumalanga (viz. Schoonoord, Belfast, Goedgevoonden, Mbila, Evander South, Driefontein, Hartogshoop, Belfast, New Largo, Geluk, etc.), Mmamabula Coal Colliery (Botswana), Moatize Coal Colliery (Mozambique), Revuboe Coal Colliery (Mozambique), Toliera Sands Heavy Minerals Mine and Processing (Madagascar), Corridor Sands Heavy Minerals Mine monitoring assessment, El Burullus Heavy Minerals Mine and processing (Egypt), Namakwa Sands Heavy Minerals Mine (SA), Tenke Copper Mine and Processing Plant (DRC), Rössing Uranium (Namibia), Lonmin platinum mines including operations at Marikana, Baobab, Dwaalkop and Doornvlei (SA), Impala Platinum (SA), Pilannesburg Platinum (SA), Aquarius Platinum, Hoogland Platinum Mine (SA), Tamboti PGM Mine (SA), Sari Gunay Gold Mine (Iran), chrome mines in the Steelpoort Valley (SA), Mecklenburg Chrome Mine (SA), Naboom Chrome Mine (SA), Kinsenda Copper Mine (DRC), Kassinga Mine (Angola) and Nokeng Fluorspar Mine (SA), etc.

Mining monitoring reviews have also been undertaken for Optimum Colliery's operations near Hendrina Power Station and Impunzi Coal Colliery with a detailed management plan undertaken for Morupule (Botswana) and Glencor (previously known as Xstrata Coal South Africa).

Air quality assessments have also been undertaken for mechanical appliances including the Durban Coal Terminal and Nacala Port (Mozambique) as well as rail transport assessments including BHP-Billiton Bauxite transport (Suriname), Nacala Rail Corridor (Mozambique and Malawi), Kusile Rail (SA) and WCL Rail (Liberia).

Metal Recovery

Air quality impact assessments have been carried out for Highveld Steel, Scaw Metals, Lonmin's Marikana Smelter operations, Saldanha Steel, Tata Steel, Afro Asia Steel and Exxaro's Manganese Pilot Plant Smelter (Pretoria).

Chemical Industry

Comprehensive air quality impact assessments have been completed for NCP (including Chloorkop Expansion Project, Contaminated soils recovery, C3 Project and the 200T Receiver Project), Revertex Chemicals (Durban), Stoppani Chromium Chemicals, Foskor (Richards Bay), Straits Chemicals (Coega), Tenke Acid Plant (DRC), and Omnia (Sasolburg).

Petrochemical Industry

Numerous air quality impact assessments have been completed for Sasol (including the postponement/exemption application for Synfuels, Infrachem, Natref, MIBK2 Project, Wax Project, GTL Project, re-commissioning of boilers at Sasol Sasolburg and Ekandustria), Engen Emission Inventory Functional Specification (Durban), Sapref refinery (Durban), Sasol (at Elrode) and Island View (in Durban) tanks quantification, Petro SA and Chevron (including the postponement/exemption application).

Pulp and Paper Industry

Air quality studies have been undertaken on the expansion of Mondi Richards Bay, Multi-Boiler Project for Mondi Merebank (Durban), impact assessments for Sappi Stanger, Sappi Enstra (Springs), Sappi Ngodwana (Nelspruit) and Pulp United (Richards Bay).

Power Generation

Air quality impact assessments have been completed for numerous Eskom coal fired power station studies including the ash expansion projects at Kusile, Kendal, Hendrina, Kriel and Arnot; Fabric Filter Plants at Komati, Grootvlei, Tutuka, Lethabo and Kriel Power Stations; the proposed Kusile, Medupi (including the impact assessment for the Flue Gas Desulphurization) and Vaal South Power Stations. Reneé was also involved in the cumulative assessment of the existing and return to service Eskom power stations assessment and the optimization of Eskom's ambient air quality monitoring network over the Highveld.

In addition to Eskom's coal fired power stations, various Eskom nuclear power supply projects have been completed including the air quality assessment of Pebble Bed Modular Reactor and nuclear plants at Duvnefontein, Bantamsklip and Thyspunt.

Apart from Eskom projects, power station assessments have also been completed in Kenya (Rabai Power Station) and Namibia (Paratus Power Plant).

Waste Disposal

Air quality impact assessments, including odour and carcinogenic and non-carcinogenic pollutants were undertaken for the Waste Water Treatment Works in Magaliesburg, proposed Waterval Landfill (near Rustenburg), Tutuka Landfill, Mogale General Waste Landfill (adjacent to the Leipardsvlei Landfill), Cape Winelands District Municipality Landfill, the Tsoeneng Landfill (Lesotho) and the FG Landfill (near the Midstream Estate). Air quality impact assessments have also been completed for the BCL incinerator (Cape Town), the Ergo Rubber Incinerator and the Ecorevert Pyrolysis Plant.

Cement Manufacturing

Impact assessments for ambient air quality have been completed for the Holcim Alternative Fuels Project (which included the assessment of the cement manufacturing plants at Ulco and Dudfield as well as a proposed blending platform in Roodepoort).

Management Plans

Reneé undertook the quantification of the baseline air quality for the first declared Vaal Triangle Airshed Priority Area. This included the establishment of a comprehensive air pollution emissions inventory, atmospheric dispersion modelling, focusing on impact area "hotspots" and quantifying emission reduction strategies. The management plan was published in 2009 (Government Gazette 32263).

Reneé has also been involved in the Provincial Air Quality Management Plan for the Limpopo Province.

RELEVANT EXPERIENCE (GREENHOUSE GAS EMISSION FOOT-PRINTING AND CLIMATE CHANGE IMPACT STATEMENTS)

Mining and Tailings Storage Facilities

Reneé has quantified the direct and indirect (Scope 2 and Scope 3) emissions for numerous mines over the highveld of South Africa and the Democratic Republic of Congo. She has also assessed the climate risks and vulnerabilities of the project and surrounding communities due to increasing ambient temperatures, water scarcity, risk of intense storms.

Gas to Power Plants

Reneé has quantified the direct and indirect (Scope 2 and Scope 3) emissions for gas to power plants proposed for South Africa. She has also assessed the climate risks and vulnerabilities of the project and surrounding communities due to increasing ambient temperatures, water scarcity, risk of intense storms.

RELEVANT EXPERIENCE (NOISE)

Mining

Reneé has undertaken numerous environmental noise assessments for mining operations. These include environmental noise impact assessments including baseline noise surveys for numerous coal, platinum, manganese, tin and zinc mines. Projects include, but are not limited to, Balama (Mozambique), Masama Coal (Botswana), Lodestone (Namibia), Osino (Namibia), Kurmuk (Ethiopia), Gamsberg (SA), Prieska (SA), Kolomela (SA), Heuningkranz (SA), Syferfontein (SA), South 32 (SA), Mamatwan (SA), Alexander (SA) and Marula Platinum Mine (SA), etc.

Power Generation

Environmental noise assessments have been completed for numerous Eskom coal fired power station studies in SA including the Kriel Fabric Filter Plant, Kendal ash facility, Medupi ash facility. Apart from Eskom projects, power plant assessments have also been completed in Botswana (Morupule), Kenya (Or Power geothermal power plants), Suriname (EBS power plant) and SA (Richards Bay combined cycle power plant).

Process Operations

Environmental noise assessments have been undertaken for various process operations including waste disposal facilities (Bon Accord in Gauteng), bottling and drink facilities (Imali and Isanti Project in Gauteng) and Smelter (Gamsberg in Northern Cape).

Transport

An environmental noise assessment was completed for the Obetsebi road expansion and flyover project in Ghana, the Scorpion Zinc Mine transport route in Namibia and the Sisian-Kajaran (North-South Corridor) Road Project in Armenia.

Gas Pipelines

An environmental noise assessment was completed for the Sheberghan gas pipeline in Afghanistan.

Baseline Noise Surveys

Baseline noise surveys have been undertaken for numerous mining and process operation activities (including Raumix quarries, Kolomela and Sibanye Stillwater Platinum Mines (SA)) in support of onsite Environmental Management Programmes.

OTHER EXPERIENCE (2001)

Research for B.Sc Honours degree was part of the "Highveld Boundary Layer Wind" research group and was based on the identification of faulty data from the Majuba Sodar. The project was THRIP funded and was a joint venture with the University of Pretoria, Eskom and Sasol (2001).

EDUCATION

M.Sc Earth Sciences	University of Pretoria, RSA, Cum Laude (2009) Title: <i>An Air Quality Baseline Assessment for the Vaal Airshed in South Africa</i>
B.Sc Hons. Earth Sciences	University of Pretoria, RSA, Cum Laude (2001) Environmental Management and Impact Assessments
B.Sc Earth Sciences	University of Pretoria, RSA, (2000) Atmospheric Sciences: Meteorology

ADDITIONAL COURSES

CALMET/CALPUFF	Presented by the University of Johannesburg, RSA (March 2008)
Air Quality Management	Presented by the University of Johannesburg, RSA (March 2006)

COUNTRIES OF WORK EXPERIENCE

South Africa, Mozambique, Botswana, Ghana, Suriname, Afghanistan, Malawi, Liberia, Kenya, Angola, Democratic Republic of Congo, Ethiopia, Afghanistan, Lesotho, Namibia, Madagascar, Egypt, Suriname and Iran.

EMPLOYMENT RECORD

January 2002 - Present

Airshed Planning Professionals (Pty) Ltd, (previously known as Environmental Management Services cc until March 2003), Principal Air Quality and Environmental Noise Scientist, Midrand, South Africa.

2001

University of Pretoria, Demi for the Geography and Geoinformatics department and a research assistant for the Atmospheric Science department, Pretoria, South Africa.

Department of Environmental Affairs and Tourism, assisted in the editing of the Agenda 21 document for the world summit (July 2001), Pretoria, South Africa.

1999 - 2000

The South African Weather Services, vacation work in the research department, Pretoria, South Africa.

CONFERENCE AND WORKSHOP PRESENTATIONS AND PAPERS

- Understanding the Synoptic Systems that lead to Strong Easterly Wind Conditions and High Particulate Matter Concentrations on The West Coast of Namibia, H Liebenberg-Enslin, R von Gruenewaldt, H Rauntenbach and L Burger. National Association for Clean Air (NACA) conference, October 2017.
- Topographical Effects on Predicted Ground Level Concentrations using AERMOD, R.G. von Gruenewaldt. National Association for Clean Air (NACA) conference, October 2011.
- Emission Factor Performance Assessment for Blasting Operations, R.G. von Gruenewaldt. National Association for Clean Air (NACA) conference, October 2009.
- Vaal Triangle Priority Area Air Quality Management Plan – Baseline Characterisation, R.G. Thomas, H Liebenberg-Enslin, N Walton and M van Nierop. National Association for Clean Air (NACA) conference, October 2007.
- A High-Resolution Diagnostic Wind Field Model for Mesoscale Air Pollution Forecasting, R.G. Thomas, L.W. Burger, and H Rautenbach. National Association for Clean Air (NACA) conference, September 2005.
- Emissions Based Management Tool for Mining Operations, R.G. Thomas and L.W. Burger. National Association for Clean Air (NACA) conference, October 2004.
- An Investigation into the Accuracy of the Majuba Sodar Mixing Layer Heights, R.G. Thomas. Highveld Boundary Layer Wind Conference, November 2002.

LANGUAGES

	Speak	Read	Write
English	Excellent	Excellent	Excellent
Afrikaans	Fair	Fair	Fair

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and my experience.



Signature of staff member

29/07/2024

Date (Day / Month / Year)

Full name of staff member:

Renee Georgeinna von Gruenewaldt

APPENDIX B – DECLARATION OF INDEPENDENCE

DECLARATION OF INDEPENDENCE - PRACTITIONER

Name of Practitioner: Reneé von Gruenewaldt

Name of Registration Body: South African Council for Natural Scientific Professions

Professional Registration No.: 400304/07

Declaration of independence and accuracy of information provided:

Environmental Noise Impact Assessment for the Bundu Rietvalei Mine

I, René von Gruenewaldt, declare that I am independent of the applicant. I have the necessary expertise to conduct the assessments required for the report and will perform the work relating the application in an objective manner, even if this results in views and findings that are not favourable to the applicant. I will disclose to the applicant and the air quality officer all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the air quality officer. The additional information provided in this atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51(1)(g) of this Act.

Signed at Pretoria on this 8th of October 2024

SIGNATURE

Principal Noise Scientist

CAPACITY OF SIGNATORY

APPENDIX C – CALIBRATION CERTIFICATES



M AND N ACOUSTIC SERVICES (Pty) Ltd

Co. Reg. No. 2012/123238/07 VAT NO: 4300255876 BEE Status: Level 4

P.O. Box 61713, Pierre van Ryneveld, 0045

No. 15, Mustang Avenue
Pierre van Ryneveld, 0045

Tel: 012 689-2007 (076 920 3070) • Fax: 086 211 4690

E-mail: admin@mnacoustics.co.za

Website: www.mnacoustics.co.za

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2023-AS-0353
ORGANISATION	AIRSHED PLANNING PROFESSIONALS (PTY) LTD
ORGANISATION ADDRESS	P.O. BOX 5260, HALFWAY HOUSE, 1685
CALIBRATION OF	SOUND & VIBRATION ANALYZER complete with built-in 1/3-OCTAVE/OCTAVE FILTER, 1/2" PRE-AMPLIFIER and 1/2" MICROPHONE
MANUFACTURERS	SVANTEK and ACO
MODEL NUMBERS	SVAN 977, SV 12L and 7052E
SERIAL NUMBERS	36183, 40659 and 78692
DATE OF CALIBRATION	14 - 15 MARCH 2023
RECOMMENDED DUE DATE	MARCH 2024
PAGE NUMBER	PAGE 1 OF 6

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

Calibrated by Calibration Technician:	 N.J. BLIGNAUT	Clause 3.1, 3.2 & 3.3
Calibrated/Supervised by Calibration Technician:	 W.S. SIBANYONI	Clause 3.1 - 3.4
Authorized/Checked by SANAS Technical Signatory:	 M. NAUDÉ	Date of Issue: 15 MARCH 2023

Director: Marianka Naudé

1. PROCEDURE

The Integrating Sound Level Meter was calibrated according to procedure 1002/P/013 and to the IEC 61672-3:2006 specifications as well as the manufacturer's specifications.

The ½" Microphone was calibrated according to procedure 1002/P/002 and 1002/P/011 as well as the manufacturer's specifications.

The ½-Octave/Octave Filter was calibrated according to procedure 1002/P/008 and to the IEC 61260 specification as well as the manufacturer's specifications.

2. MEASURING EQUIPMENT

JFW	50BR-022	50 Ohm Step Attenuator	7051581438
Keysight	33522A	Function Generator	MY 50000462
Major Tech	MT 669	Environmental Logger	150828456
Keysight	34461A	Digital Multimeter	MY 53223917
Agilent	34461A	Digital Multimeter	MY 53205694
G.R.A.S	42 AP	Piston Phone	256092
B&K	2829	4-Ch Microphone Power Supply	2329283
G.R.A.S	26 AJ	½" Pre-Amplifier	188476
G.R.A.S	40 AQ	½" Microphone	160816
B&K	4226	Multi-Functional Calibrator	2912645
Greysinger	80 CL	Data Logger	02304030/1/2
G.R.A.S	42 AG	Multi-Frequency Calibrator	279025
Gems	PD6000-6RO	Pressure Sensor	1606-0204475

Calibrations performed by this laboratory are in terms of standards, the accuracies of which are traceable to national measuring standards as maintained by NMISA.

Calibrated by Calibration Technician:	 N.J. BLIGNAUT	Clause 3.1, 3.2 & 3.3
Calibrated/Supervised by Calibration Technician:	 W.S. SIBANYONI	Clause 3.1 - 3.4
Authorized/Checked by SANAS Technical Signatory:	 M. NAUDÉ	Date of Issue: 15 MARCH 2023

Director: Marianka Naudé - marianka@mnacoustics.co.za

3. RESULTS - ACCORDING TO THE IEC 61672-3: 2006:

3.1 The following parameters of the Integrating Sound Level Meter were calibrated:

Parameter	Specification	Uncertainty of Measurement in dB
Calibration Check Frequency at 114,0 dB at 1 000 Hz at Nominal Range: High	IEC 61672-3: Clause 9	$\pm 0,3$
Self-Generated Noise:	IEC 61672-3: Clause 10	-----
A-Weighted with Microphone 23,7 dB		
A-Weighted Electrical 18,7 dB		
C-Weighted Electrical 19,2 dB		
Z-Weighted Electrical 23,7 dB		
B-Weighted Electrical 21,4 dB		
Level Linearity at 8 000 Hz Nominal Range: High Reference Level at 114,0 dB: (69,4 dB to 149,0 dB)	IEC 61672-3: Clause: 14	$\pm 0,3$
Level Range Control at 1 000 Hz Reference Level at 114,0 dB Nominal Range: High Low Range	IEC 61672-3: Clause: 15	$\pm 0,3$
Frequency and Time Weightings at 1 000 Hz at 114,0 dB	IEC 61672-3: Clause 13	$\pm 0,3$
Tone Burst Response (Max. Fast, Max. Slow, LA _{eq} and SEL)	IEC 61672-3: Clause 16	$\pm 0,3$

Calibrated by Calibration Technician:	 N.J. BLIGNAUT	Clause 3.1, 3.2 & 3.3
Calibrated/Supervised by Calibration Technician:	 W.S. SIBANYONI	Clause 3.1 - 3.4
Authorized/Checked by SANAS Technical Signatory:	 M. NAUDÉ	Date of Issue: 15 MARCH 2023

Director: Marianka Naudé - marianka@mnacoustics.co.za

Parameter	Specification	Uncertainty of Measurement in dB
A-Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	$\pm 0,3$
C-Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	$\pm 0,3$
Z- Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	$\pm 0,3$
B- Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	$\pm 0,3$
Peak, C Low Peak Range	IEC 61672-3: Clause 17	$\pm 0,3$

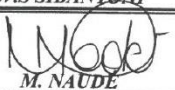
Conclusion: The Integrating Sound Level Meter complied with the above-specified clauses of the IEC 61672-3:2006 specifications, recommended tests and requirements according to ARP 0109:2014, **Class 1**.

3.2 The following parameters of the built-in 1/3-Octave/Octave Filter were calibrated:

Octave Frequency Response (31,5 to 16 000) Hz	IEC 61260: Sections 4.7 & 5.6
1/3-Octave Frequency response (25 to 20 000) Hz	IEC 61260: Sections 4.7 & 5.6

The uncertainty of measurement was estimated as follows: $\pm 0,3$ dB

Conclusion: The built-in Octave Filter complied with the above-specified clauses of the IEC 61260 specification, **Class 1**.

Calibrated by Calibration Technician:	 N.J. BLIGNAUT	Clause 3.1, 3.2 & 3.3
Calibrated/Supervised by Calibration Technician:	 W.S. SIBANYONI	Clause 3.1 - 3.4
Authorized/Checked by SANAS Technical Signatory:	 M. NAUDE	Date of Issue: 15 MARCH 2023

Director: Marianka Naudé - marianka@mnacoustics.co.za

- 3.3 The following parameters of the ½" Microphone were calibrated and the results were corrected to the ambient condition of 1 013,25 mBar:

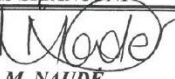
Output Sensitivity at 250 Hz at 94,0 dB was found to be: -28,33 dB/Pa or 37,36 mV/Pa
Frequency Response (31,5 to 16 000) Hz

The uncertainty of measurements was estimated as follows:

Conclusion: The parameters measured for the ½" Microphone, complied with the manufacturer's specification.

- 3.4 The ½" Microphone was calibrated Electroacoustic according to Clause 12 of IEC 61672-3: 2006 complete with Integrating Sound Level Meter and Svantek SV 12L ½" Pre-amplifier Serial No: 40659, free-field corrections were taken into consideration and the results were corrected to the ambient condition of 1 013,25 mBar:

FREQUENCY (Hz)	CALCULATED EXPECTED VALUE (dB)	MEASURED VALUE (dB)	DEVIATION (dB)	UoM (dB)
1 000 (Ref)	114,0	114,0	0,0	± 0,3
31,5	111,2	111,3	+ 0,1	± 0,3
63	113,4	113,4	0,0	± 0,3
125	113,9	114,0	+ 0,1	± 0,3
250	114,0	114,1	+ 0,1	± 0,3
500	114,0	114,1	+ 0,1	± 0,3
1 000	114,0	114,0	0,0	± 0,3
2 000	113,6	113,7	+ 0,1	± 0,3
4 000	113,2	112,9	- 0,3	± 0,3
8 000	106,7	107,4	+ 0,7	± 0,3
12 500	100,9	101,7	+ 0,8	± 0,3
16 000	96,4	97,4	+ 1,0	± 0,3

Calibrated by Calibration Technician:	 N.J. BLIGNAUT	Clause 3.1, 3.2 & 3.3
Calibrated/Supervised by Calibration Technician:	 W.S. SIBANYONI	Clause 3.1 - 3.4
Authorized/Checked by SANAS Technical Signatory:	 M. NAUDÉ	Date of Issue: 15 MARCH 2023

Director: Marianka Naudé - marianka@mnacoustics.co.za

4. REMARKS

- 4.1 The reported expanded uncertainties of measurements are based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of approximately 95,45%, the uncertainties of measurements have been estimated in accordance with the principles defined in the GUM (Guide to Uncertainty of Measurement) ISO, Geneva, 1993
- 4.2 The environmental conditions during calibration of items in section 3 were:
Temperature: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \% \text{RH}$
- 4.3 Calibration labels bearing cal date, due date (if requested), certificate number and serial number have been affixed to the instrument.
- 4.4 The above statement of conformance is based on the measurement values obtained, extended by the estimated uncertainty of measurement, being within the appropriate specification limits.
- 4.5 The above specified Sound & Vibration Analyser and $\frac{1}{2}$ " Microphone must be used as a unit. The $\frac{1}{2}$ " Microphone's frequency range determines the useful frequency range of the instrument vice versa.
- 4.6 The result on this Certificate relates only to the items and parameters calibrated.
- 4.7 Abbreviation:
UoM = Uncertainty of Measurement

-----SECTION 4.7 THE END OF CERTIFICATE-----

Calibrated by Calibration Technician:	 N.J. BLIGNAUT	Clause 3.1, 3.2 & 3.3
Calibrated/Supervised by Calibration Technician:	 W.S. SIBANYONI	Clause 3.1 - 3.4
Authorized/Checked by SANAS Technical Signatory:	 M. NAUDÉ	Date of Issue: 15 MARCH 2023

Director: Marianka Naudé - marianka@mnacoustics.co.za

CERTIFICATE OF CONFORMANCE

CERTIFICATE NUMBER	2023-AS-0347
ORGANISATION	AIRSHED PLANNING PROFESSIONALS (PTY) LTD
ORGANISATION ADDRESS	P.O. BOX 5260, HALFWAY HOUSE, 1685
CALIBRATION OF	ACOUSTIC CALIBRATOR
MANUFACTURER	SVANTEK
MODEL NUMBER	SV 33
SERIAL NUMBER	43170
DATE OF CALIBRATION	14 MARCH 2023
RECOMMENDED DUE DATE	MARCH 2024
PAGE NUMBER	PAGE 1 OF 3

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.

Calibrations performed by this laboratory are in terms of standards, the accuracies of which are traceable to national measuring standards as maintained by NMISA.

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

Calibrated by:  W.S. SIBANYONI (CALIBRATION TECHNICIAN)	Authorized/Checked by:  M. NAUDÉ (SANAS TECHNICAL SIGNATORY)	Date of Issue: 15 MARCH 2023
--	---	--

Director: Marianka Naudé

1. PROCEDURE

The UUT was calibrated according to the procedures 1002/P/001 and also to the IEC 60942:1997 specifications for Sound Level Calibrators as well as the manufacturer's specifications.

2. MEASURING EQUIPMENT

Keysight	34461A	Digital Multimeter	MY 53224004
Greysinger	80 CL	Environmental Logger	02304030/1/2
G.R.A.S	42 AP	Piston Phone	256092
G.R.A.S	26 AJ	½" Pre-Amplifier	188476
B&K	2829	4-Ch Microphone Power Supply	2329283
G.R.A.S	40 AQ	½" Microphone	160816
Leader	LDM-170	Distortion Meter	0100240
Svantek	SV 35	Acoustic Calibrator	58106
LG	FC-7015	Universal Counter	00022701
Agilent	34461A	Digital Multimeter	MY 53205694
G.R.A.S	42 AG	Multi-Frequency Calibrator	279025

3. RESULTS

3.1 The following parameters of the Calibrator were calibrated:

Output Level	IEC 60942: Section 5.2.3
Output Frequency	IEC 60942: Section 5.3.3
Selective Distortion	IEC 60942: Section A.4.9

The Calibrator output level was found to be 114,1 dB at 1 000,03 Hz.
No adjustment was made.

These results were corrected to the ambient condition of 1 013,25 Pa.

Conclusion: The Calibrator complied with the above-specified clauses of the IEC 60942:1997 specifications, recommended tests, and requirements according to ARP 0109:2014, **Class 1**.

Calibrated by:  W.S. SIBANYONI (CALIBRATION TECHNICIAN)	Authorized/Checked by:  M. NAUDÉ (SANAS TECHNICAL SIGNATORY)
--	--

Director: Marianka Naudé - marianka@mnacoustics.co.za

4.1 The reported expanded uncertainties of measurements are based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of approximately 95,45%, the uncertainties of measurements have been estimated in accordance with the principles defined in the GUM (Guide to Uncertainty of Measurement) ISO, Geneva, 1993.

4.3 Calibration labels bearing calibration date, due date (if requested), certificate number and serial number have been affixed to the instrument.

4.5 The uncertainty of measurements was estimated as follows:

4.6 The result on this Certificate relates only to the items and parameters calibrated.

-----SECTION 4.6 THE END OF CERTIFICATE-----

Director: Marianka Naudé - marianka@mnacoustics.co.za

APPENDIX D – TIME-SERIES, STATISTICAL, AND FREQUENCY SPECTRUM RESULTS

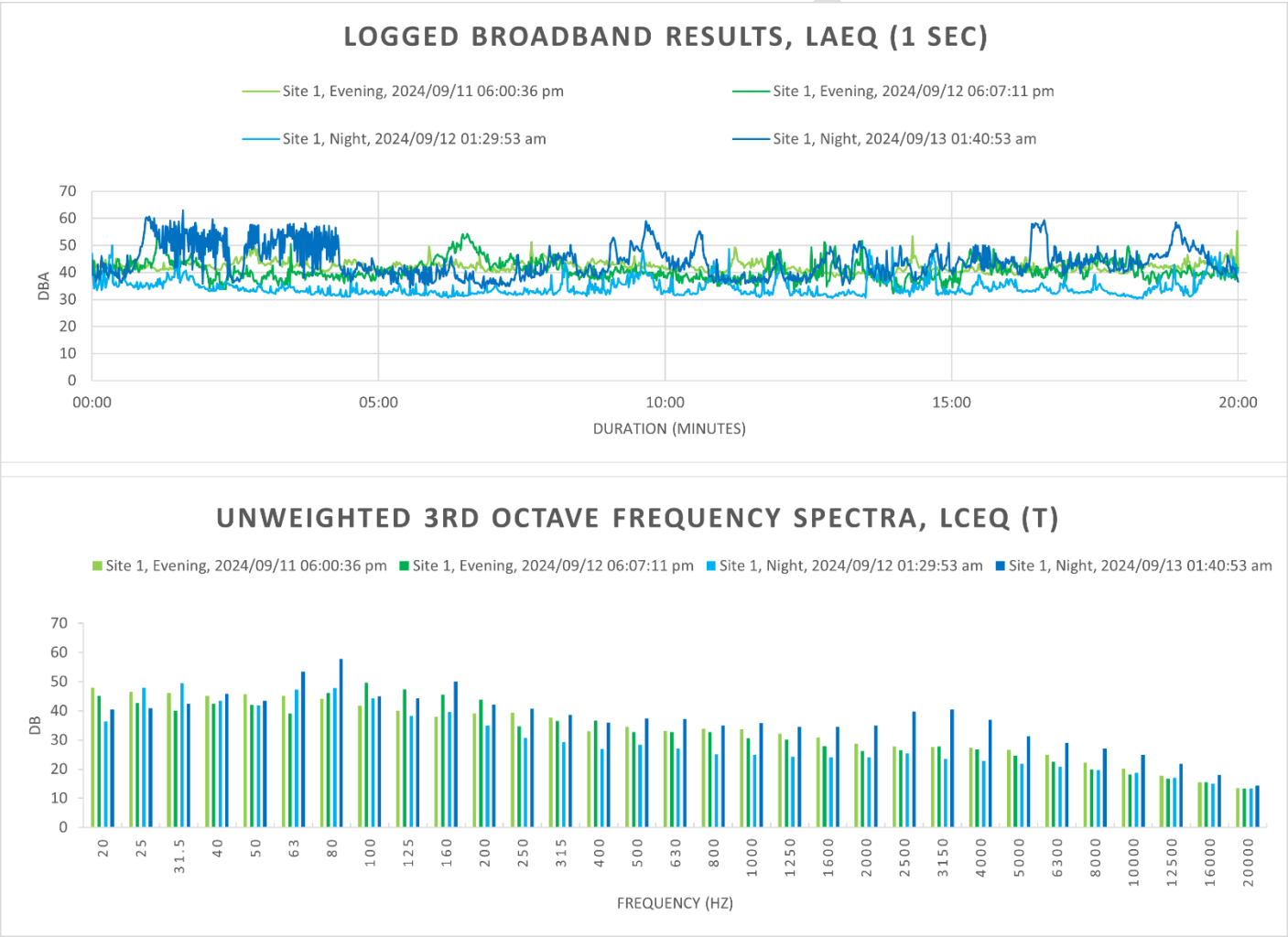


Figure D-1: Detailed day-time survey results for Site 1

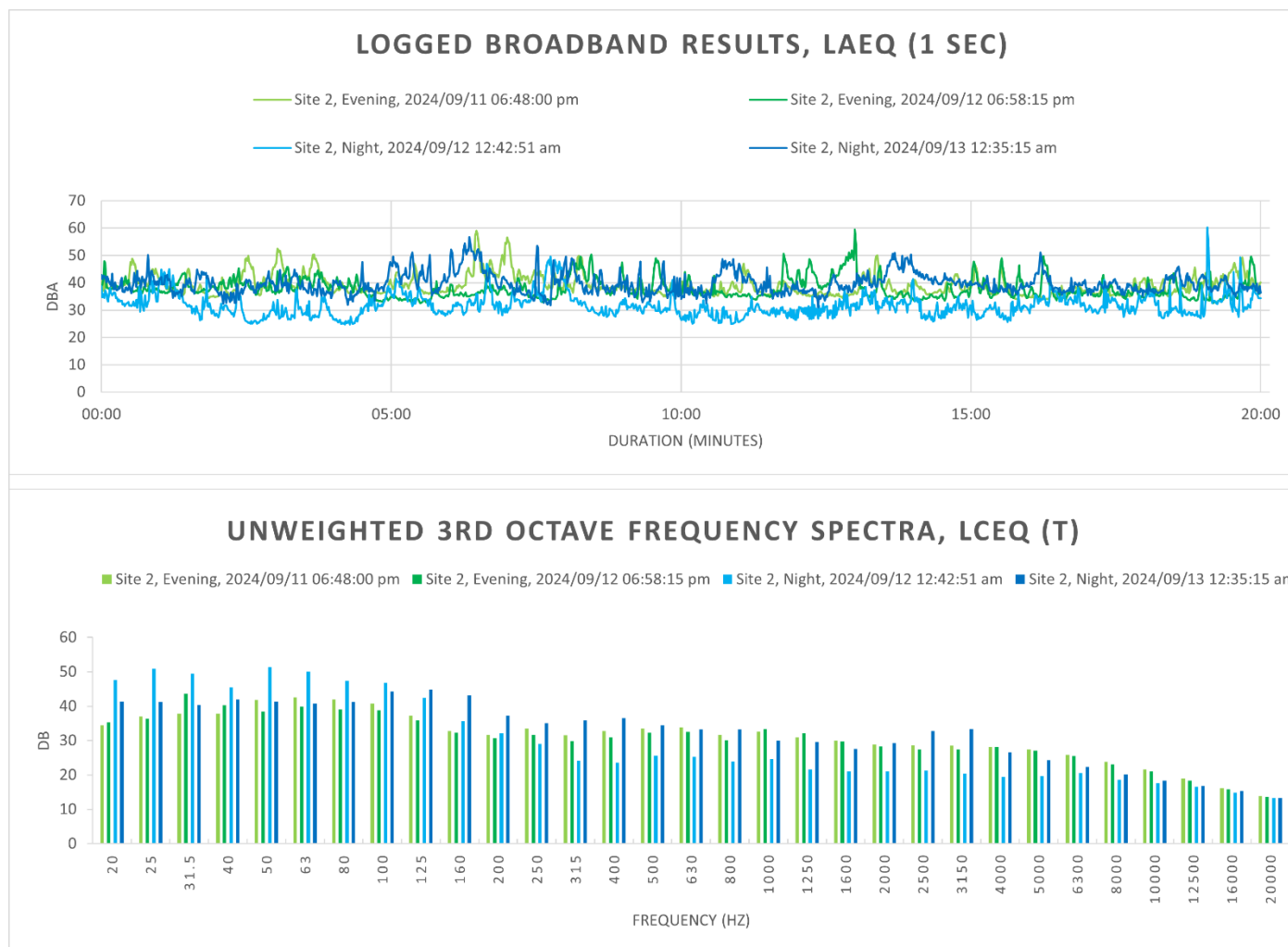


Figure D-2: Detailed day-time survey results for Site 2

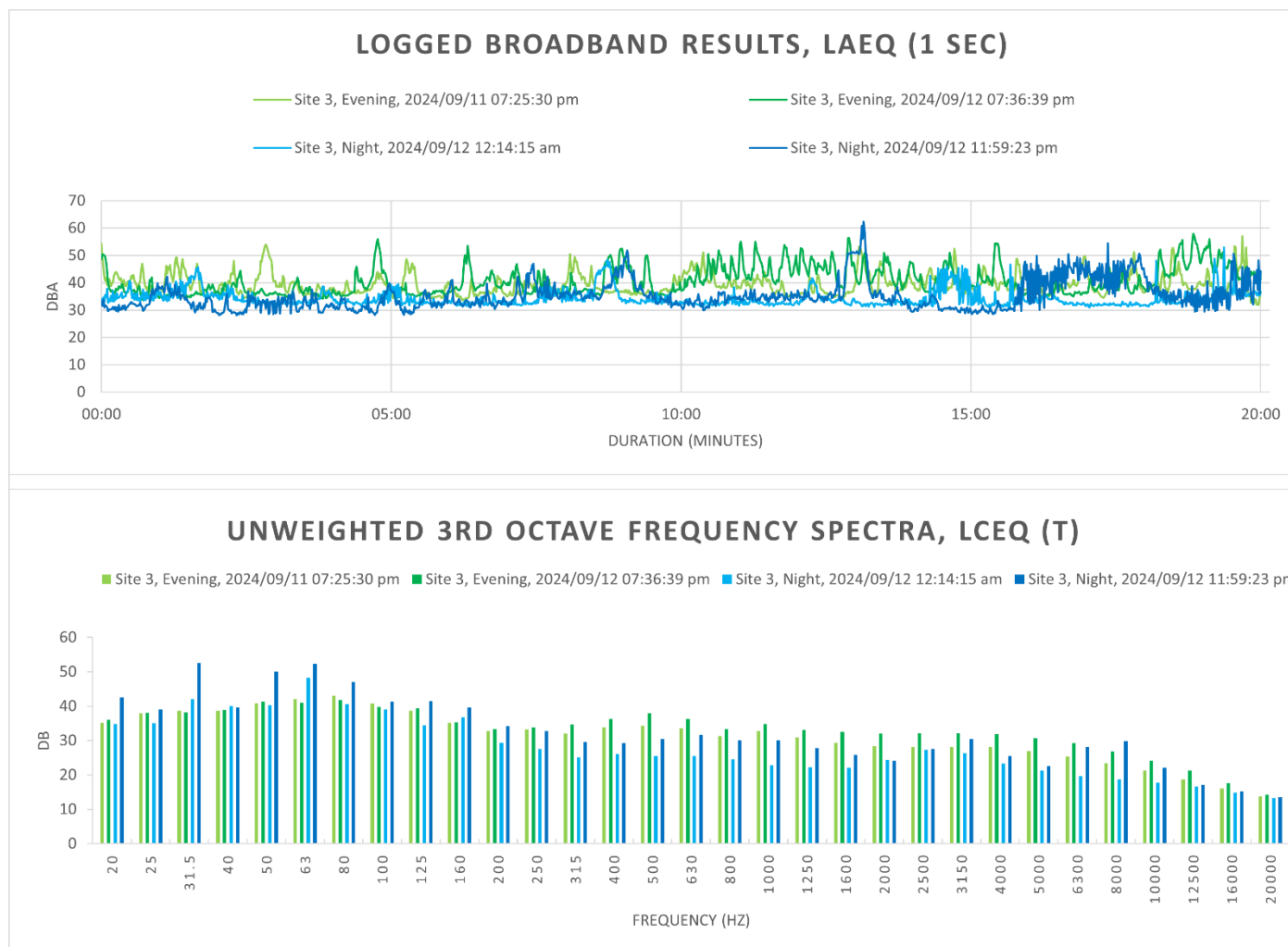


Figure D-3: Detailed day-time survey results for Site 3

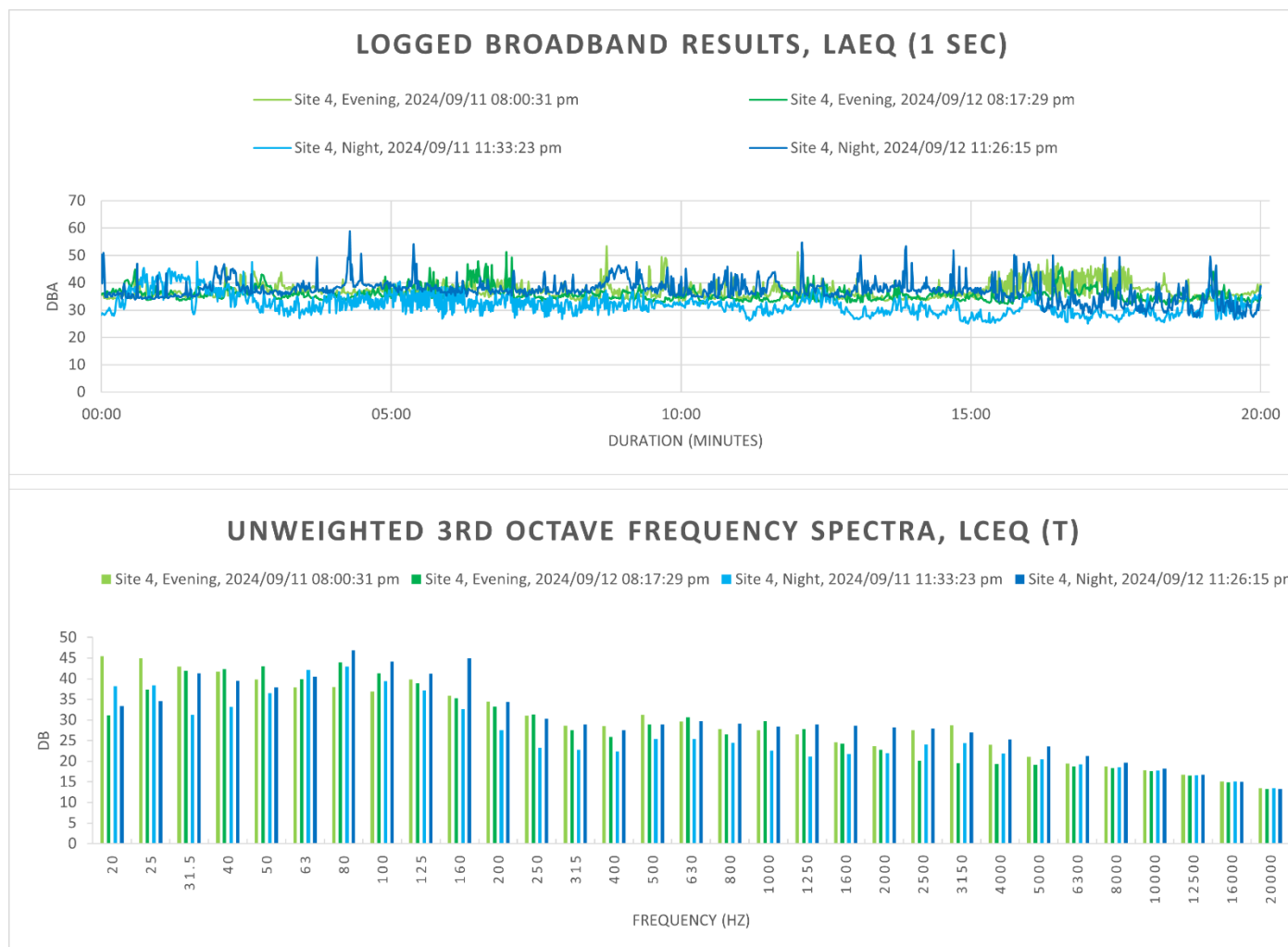


Figure D-4: Detailed day-time survey results for Site 4

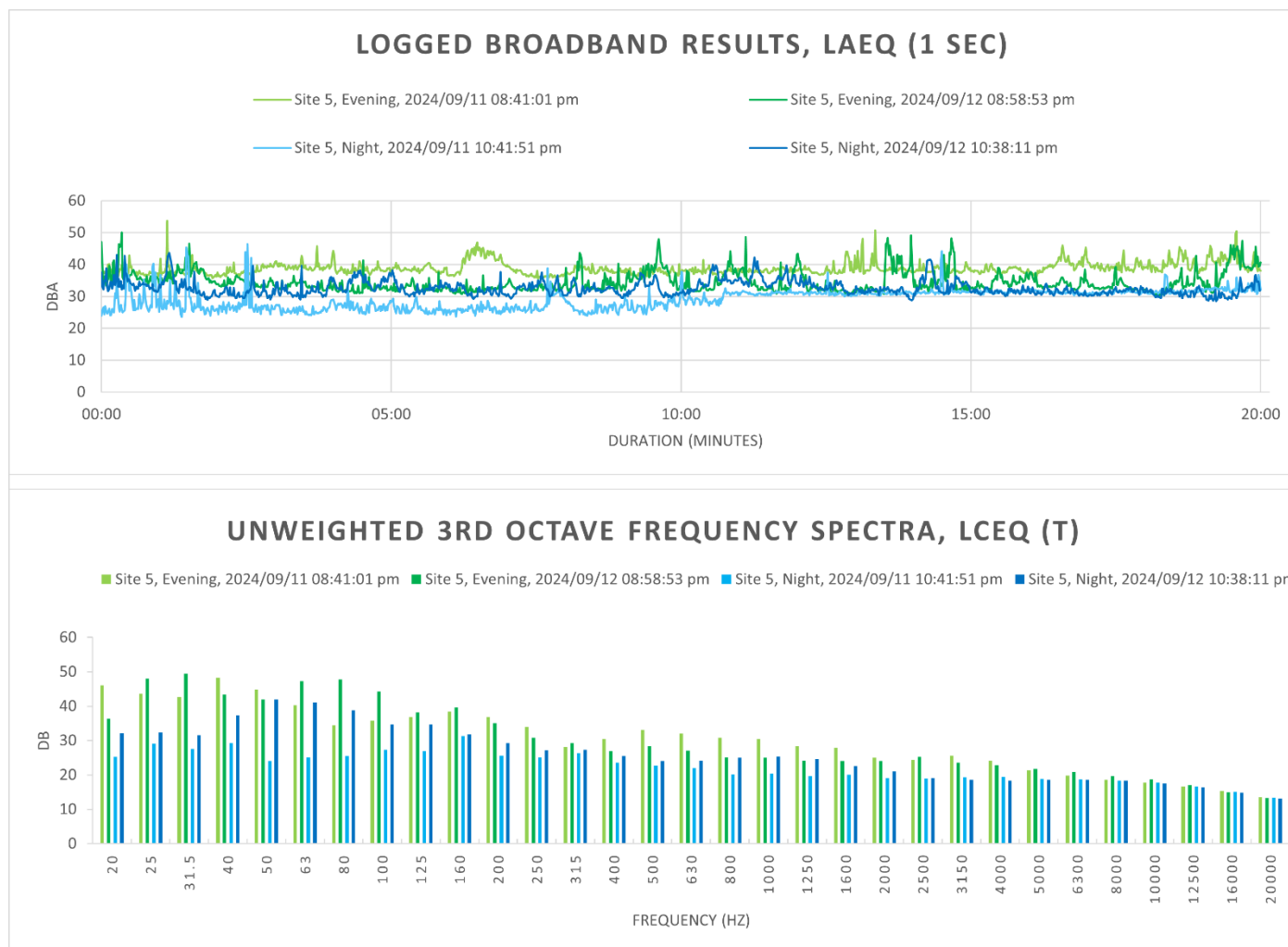


Figure D-5: Detailed day-time survey results for Site 5

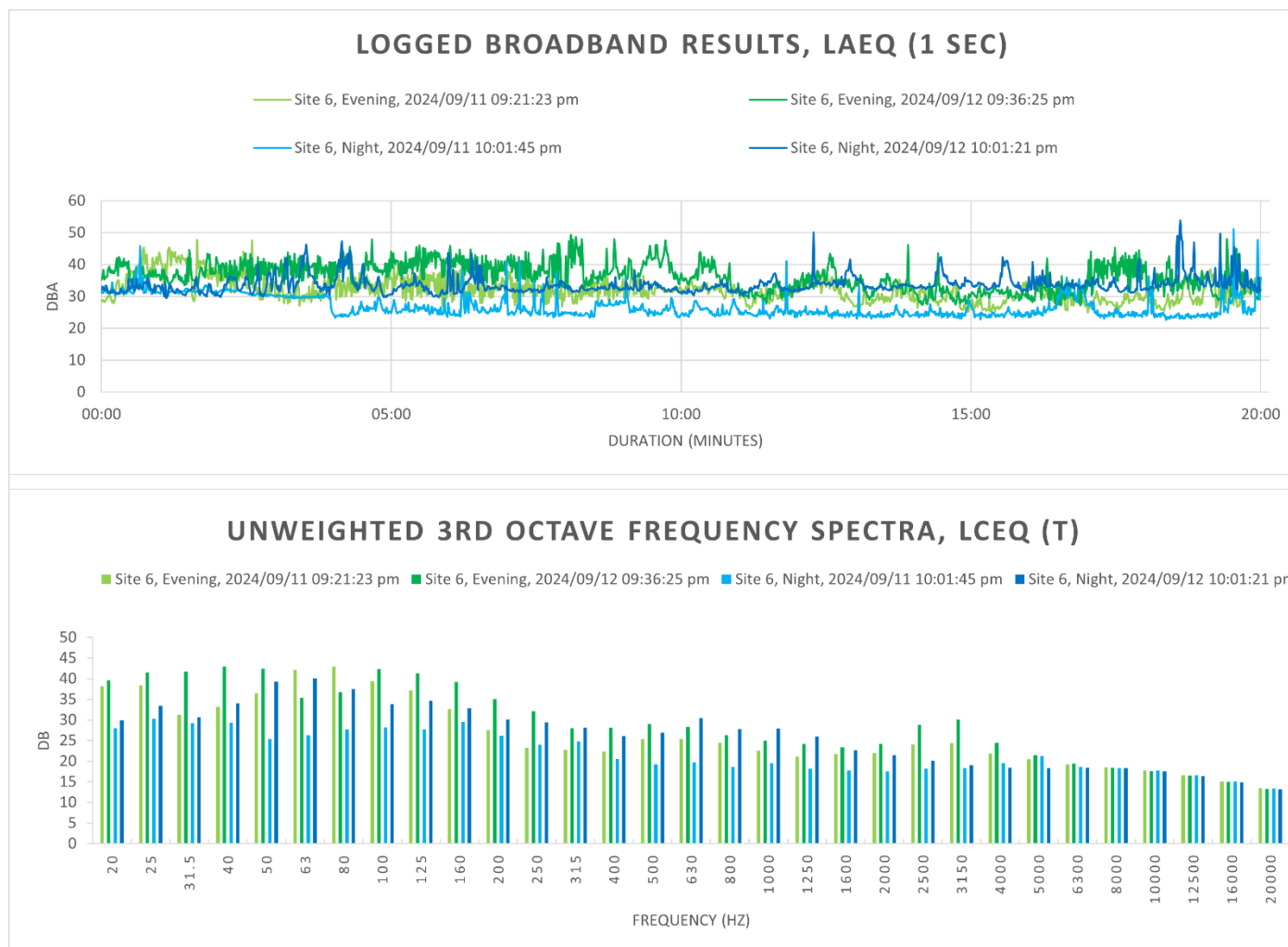


Figure D-6: Detailed day-time survey results for Site 6

APPENDIX E – PHOTOGRAPHS OF ENVIRONMENTAL NOISE SURVEY SITES



Figure E-1: Photographs of environmental noise survey Site 1



Figure E-2: Photographs of environmental noise survey Site 2



Figure E-3: Photographs of environmental noise survey Site 3



Figure E-4: Photographs of environmental noise survey Site 4



Figure E-5: Photographs of environmental noise survey Site 5



Figure E-6: Photographs of environmental noise survey Site 6

APPENDIX F – IMPACT SIGNIFICANCE RATING METHODOLOGY

IMPACT ASSESSMENT TABLES – BUNDU MINING RIETVALEI

1. IMPACTS THAT MAY RESULT FROM THE CONSTRUCTION AND OPERATIONAL PHASE

Impact Assessment Methodology Impact assessment processes were developed in order to: - identify potential impacts of a proposed development/activity on the environment - predict the likely nature of these impacts and - evaluate the significance of the potential impacts. Negative impacts are identified, described, rated in terms of the spatial scale, duration, severity and probability to determine the magnitude of the significance of the specific individual impacts. In many proposed projects, there may be positive impacts, which are actions and activities with a positive contribution to overall ecological and/or habitat functioning and health, above and beyond the mitigation measures for the negative impacts of the project. These positive impacts are only considered to be relevant if the criteria below can be met: - Positive impact must align with conservation goals for the vegetation type and local, provincial and national development frameworks and plans. - Positive impact is considered a long-term impact and not simply related to the construction phase mitigation measures. - Management actions to achieve positive impact are prescribed and regulated by means of an EMP and Environmental Authorisation to ensure ongoing implementation, monitoring, auditing and adaptive management Rating of positive impacts are done by means of the same rating system used for negative impacts as described below and an Adjusted Significance rating is calculated for the relevant impacts. Significance is a fundamental concept in the impact assessment steps above and ultimately, in decision-making within the specific socio-economic and environmental contexts. Significance consists broadly of three forms, namely Institutional recognition (including legislation, policies, guidelines), Public recognition (ex. voluntary conservation action) and Technical recognition (scientific and technical assessments of critical resource characteristics). Significance can be determined in terms of a three-stage process involving scaling, weighting and aggregation (DEAT, 2002). <i>Scaling</i> is the standardization of empirical data onto a common scale to allow comparisons between different types of impacts. <i>Weighting</i> is the imposition of professional and/or societal values on a range of potential environmental impacts. <i>Aggregation</i> is the combination of different types of impact values to produce composite scores, which facilitates a comparison of project alternatives. Predictions on the nature of the impacts are based on simplified conceptual models of how natural processes function. Criteria that can be used to describe the nature of an impact include (DEAT, 2002; GN 326 of 2017; Chetty, 2015): • spatial extent; • resource sensitivity • duration and timing of the impact; • intensity or severity of the impact; • status of the impact (i.e. either positive (a benefit) or negative (a cost) or neutral); • reversibility (i.e. reversible or permanent); • probability of occurrence • degree of certainty; and • mitigatory potential. Rating Although there are numerous approaches internationally to impact determination, the current general practice of determining significance is to derive it from a combination of scientific methods and values ascribed by the EIA team. The criteria from the list in 12.1 were incorporated in the four main aspects of significance determination, including spatial scale, duration, severity and probability. Rating of each criterion is based on a sliding scale with high impacts rated as 5, medium-high as 4, medium as 3, low-medium as 2 and low as 1. Each significance score is therefore assessed in relation to the highest potential score of 10 as indicated in Table 6 below.
--

Degree of certainty is indicated for each impact assessed, however is not included in the significance rating calculation, and is rather meant as a reference to the data source used to identify the impact. Degree of certainty is based on the following criteria:

Table 1: Criteria for rating the degree of certainty of the impact rating

Degree of certainty	
Scientific data: specialist assessment specified impact rating	High
Inferred from specialist assessment	Medium
Generally associated impact	Low

The criteria for rating the nature of impacts (DEAT, 2002) are illustrated below:

Table 2: Criteria for rating the extent or spatial scale of impacts

Spatial scale Rating		Numerical rating
High	Widespread; Far beyond site boundary Regional/national/international scale	5
Medium-High	Within local catchment	4
Medium	Beyond site boundary Local area	3
Low-Medium	Within site boundary	2
Low	Within site footprint	1

Table 3: Criteria for rating the duration of impacts

Duration Rating		Numerical rating
High (Long term)	Permanent. Beyond decommissioning. Long term (More than 15 years).	5
Medium-High	Not easily reversible over time. Lifespan of the project and several years beyond. Medium term (5 – 15 years).	4
Medium (Medium term)	Reversible over time. Lifespan of the project and a short time beyond. Medium term (3 – 5 years).	3
Low-Medium	Relatively quickly reversible. Lifespan of the project. Medium short term (1 – 2 years).	2
Low (Short term)	Quickly reversible. Less than the project lifespan. Short term (0 – 1 years).	1

Table 4: Criteria for rating intensity or severity of impacts

Severity Rating		Numerical rating
High	Disturbance of pristine areas that have important conservation value; or Destruction of rare or endangered species.	5
Medium-High	Disturbance of areas that have confirmed conservation value or are of use as resource; or Complete change in large-scale species occurrence or variety.	4
Medium	Disturbance of areas that have potential conservation value or are of use as resource; or Complete change in species occurrence or variety on site.	3
Low-Medium	Disturbance of partially degraded areas, which have little conservation value; or Small change in species occurrence or variety.	2
Low	Disturbance of highly degraded areas, which have little conservation value; or Negligible change in species occurrence or variety.	1

Table 5: Criteria for rating probability of impacts occurring

Probability Rating		Numerical rating
High	Very likely to occur	5
Medium-High	Likely to occur regularly	4
Medium	Likely to occur occasionally	3
Low-Medium	Small likelihood	2
Low	Not likely	1

Table 6: Summary of impact magnitude and significance

Impact Magnitude and Significance Rating		Rating range	
		NEG	POS
High	Impact is unavoidable and relatively substantial. Mitigation requires higher level of input than EMP, i.e., specialist input such as an Ecological Management Plan. Social, cultural and economic activities of communities are disrupted or continue in the changed form. In the case of beneficial impacts, the impact contributes significantly to conservation goals and will bring about long-term positive change.	7 - 10	7 - 10
Medium	- Impact is real, but not substantial. - Mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). - In the case of beneficial impacts, the impact may contribute to conservation goals and will bring about some positive change.	4 - 6	4 - 6
Low	- Impact is of a low order and likely to have a small effect. - Mitigation is relatively easily achieved by implementing EMP measures. - Small changes to social, cultural and economic activities of communities. - In the case of beneficial impacts, the impact will bring about a small positive change in the short term.	1 - 3	1 - 3
No impact	Zero impact.	0	

Mitigation

Mitigation is defined in the EIA Regulations (GN 326 of 2017) as "to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible". Mitigation measures are included in each specialist assessment and these are included in the impact assessment to show an impact score before and after mitigation. The Environmental Management Plan includes all expected impacts from the proposed activities above, as well as mitigation, monitoring and auditing requirements.