Environmental Noise Impact Assessment: Motuoane Exploration Right Application (ER386), Free State Province

Project done for Environmental Impact Management Services (Pty) Ltd

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Version	Date	Comments
Rev 0.0	April 2026	For Internal review
Rev 0.1	April 2026	For Client review
Rev 1	April 2026	Final Report

Executive Summary

Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned by Environmental Impact Management Services (Pty) Ltd (EIMS) to undertake an Environmental Noise Impact Assessment (NIA) for the proposed Motuoane Exploration Right (ER) Application (ER386) (hereafter referred to as "the Project"). Noise generating sources that form part of the exploration activities include vehicles, drilling operations, and seismic surveys. This report details the findings of the NIA undertaken for the Project.

Motuoane proposes to explore all saleable gases including but not limited to methane, carbon dioxide, helium, and nitrogen in the licensed area. The main activities are core / percussion exploration drilling and seismic survey activities. The proposed approach is to first determine and map the geographic extent of all boreholes currently emitting gas on and near the ER area. Then measure rates and monitor pressures where possible and perform gas composition analysis. The geophysical wireline logging of existing boreholes (where possible) will include monitoring of water levels. If no existing gas emitting boreholes are identified near a target area, new drilling activities are proposed within that area using percussion or rotary drilling method. Five target areas and nine seismic transects are included in the application.

The seismic survey activities are proposed throughout the exploration right as and when necessary. Motuoane will search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. If no data are available, Motuoane will either acquire its own seismic or telluric data on the property, following proper environmental protocols and with the written permission of the landowner. The preliminary proposed transects for seismic / telluric survey are over 70 km long around known structures and possible drill locations. Seismic and/or telluric locations and lengths are subject to be changed as knowledge increases. Although the Vibroseis technique is the likely method to be undertaken for the seismic activities, there is also a potential alternative to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) which Motuoane may consider over the Vibroseis.

Findings from the Environmental Noise Baseline Assessment

Potential noise sensitive receptors (NSRs) within the study area include primarily homesteads and farmhouses surrounding the Target Areas and Seismic Transects.

Due to the prevailing winds, noise impacts are expected to be slightly more notable to southwest of the project activities. There are no distinguishable topographical features between the Target Areas / Seismic Transects and nearby noise sensitive receptor locations.

Day- and night-time noise measurements were conducted from 2 to 4 June 2025 at five locations in the exploration rights area. At the survey sites closest to the proposed Target Areas and Seismic Transects, both daytime and night-time sound pressure levels were well below the typical rating levels for rural areas and mainly influenced by natural and agricultural noise sources. At survey sites located to the east of the town of Welkom and closer to the

mining operations within the study area, higher day- and night-time sound pressure levels were recorded, mainly influenced by mining, processing operations and vehicle traffic.

Findings from the Environmental Noise Impact Assessment

In terms of noise generating sources that form part of the exploration activities, the main sources will include drill rigs, seismic vibrators, trucks for equipment transport, vibroseis trucks, recording trucks and light vehicles.

The propagation of noise generated during the operational phase was calculated with CadnaA in accordance with ISO 9613). The South African Draft Environmental Noise Standards were adopted as assessment criteria for the NIA.

Because of very low baseline noise levels in the study area, exploration activities, particularly drilling activities, could be audible up to 5 km away from operational areas, while vehicle movements and seismic surveys could be audible up to 2.5 km away from the seismic transects. Based on noise attenuation modelling results, noise levels could be disturbing (>7 dBA increase from baseline) to residents up to 2 km from drilling activities and 1 km from seismic surveys. There are several identified residential receptors within these areas.

Drilling and other exploration activities could be disturbing (albeit for relatively short periods) to the residents of the homesteads in or near the target areas, especially at:

- The homesteads just to the northeast of the Target Area 11- GP A 500 m buffer (-27.820°S 26.973°E);
- The homestead to the northeast of Target Area 10- GP B (-27.823°S 26.987°E);
- The homestead to the west (~300 m) of Seismic Transect HF2 (-27.991°S 27.061°E);
- The homestead to the east of Target Area 1 – RSB D and southeast of Target Area 2 – RSB E (-25.172°S 26.994°E); and,
- The homestead inside Target Area 2 – RSB E (-28.161°S 26.979°E).

Conclusions and Recommendations

It is the specialist's opinion that the project can be authorised without significant impact on the current acoustic climate if:

- All exploration activities are limited to day-time hours (i.e., 06:00 to 18:00).
- All residents within 2 km of drilling activities and 1 km of seismic surveys are consulted and informed regarding the exploration activities.
- Scheduling of activities are communicated and co-ordinated with nearby residents.
- A noise complaints register is kept. If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated. Channels for logging of complaints should be communicated to all residents within 5 km of the Target Areas and 2.5 km of the Seismic Transects.

Glossary and Abbreviations

Airshed	Airshed Planning Professionals (Pty) Ltd
AWD	Accelerated Weight Drop Survey
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.
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
ER	Exploration Right
GG	Government gazette
GN	Government notice
ha	Hectare
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
km	Kilometre
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_{AIeq} (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)
$L_{Req,d}$	The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period, i.e., from 06:00 to 22:00.
$L_{Req,n}$	The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period, i.e., from 22:00 to 06:00.
$L_{R,dn}$	The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night, i.e. 24 hours, and wherein the $L_{Req,n}$ has been weighted with 10dB in order to account for the additional disturbance caused by noise during the night.
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
LNG	Liquid Natural Gas
m	Metre
mm	Millimetre
NEMAQA	National Environmental Management: Air Quality Act
NIA	Noise Impact Assessment
NSL	Noise Survey Location
NSRs	Noise Sensitive Receptors
PEGs	Propelled Energy Generators

PR	Production Right
SABS	South African Bureau of Standards
SAIChE	South African Institution of Chemical Engineers
SANS	South African National Standards
SLM	Sound level meter
SRTM	Shuttle Radar Topography Mission
USGS	United States Geological Survey
WHO	World Health Organisation

Table of Contents

List of Tables

List of Figures

1 Introduction

Motuoane proposes to explore all saleable gases including but not limited to methane, carbon dioxide, helium, and nitrogen in the licensed area. Due to the large area and complex exploration methodology, the Exploration Right (ER) will be required for an initial period of three years with the option to renew three additional periods of two years resulting in a total of nine years. The accepted application for an exploration right (ER386) is located over an area of approximately 58 000 hectares (ha), covering various farm portions near the towns of Virginia, Welkom, Hennenman and Odendaalsrus in the Free State Province.

The main activities are core / percussion exploration drilling and seismic survey activities. The proposed approach is to first determine and map the geographic extent of all boreholes currently emitting gas on and near the ER area. Then measure rates and monitor pressures where possible and perform gas composition analysis. The geophysical wireline logging of existing boreholes (where possible) will include monitoring of water levels. If no existing gas emitting boreholes are identified near a target area, new drilling activities are proposed within that area using percussion or rotary drilling method. Five target areas and nine seismic transects, shown in Figure 1, are included in the application. Each exploration well will have an overall depth of approximately 650 m and a maximum width of 350 mm, commencing with a 6 m x 323 mm spud hole section, followed by 80 m x 254 mm conductor hole section, then an intermediate hole section of 450 m x 203 mm and finally an open hole section of 650 m x 144 mm. The actual casing sizes and configurations will vary depending on the specific geological characteristics and functional requirements. Each borehole will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of exploration to prevent groundwater seepage.

The seismic survey activities are proposed throughout the exploration right as and when necessary. Motuoane will search records at the Council for Geoscience and the Petroleum Agency for seismic data that was acquired on the Exploration Right in the past. If no data are available, Motuoane will either acquire its own seismic or telluric data on the property, following proper environmental protocols and with the written permission of the landowner. The preliminary proposed transects for seismic / telluric survey are over 70 km long around known structures and possible drill locations. Seismic and/or telluric locations and lengths are subject to be changed as knowledge increases.

Although the Vibroseis technique is the likely method to be undertaken for the seismic activities, there is also a potential alternative to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) which Motuoane may consider over the Vibroseis.

Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned by Environmental Impact Management Services (Pty) Ltd (EIMS) to undertake an Environmental Noise Impact Assessment (NIA) for the proposed Motuoane Exploration Right Application (ER386) (hereafter referred to as “the Project”). Noise generating sources that form part of the exploration activities include vehicles, drilling operations, and seismic surveys. This report details the findings of the NIA undertaken for the project.

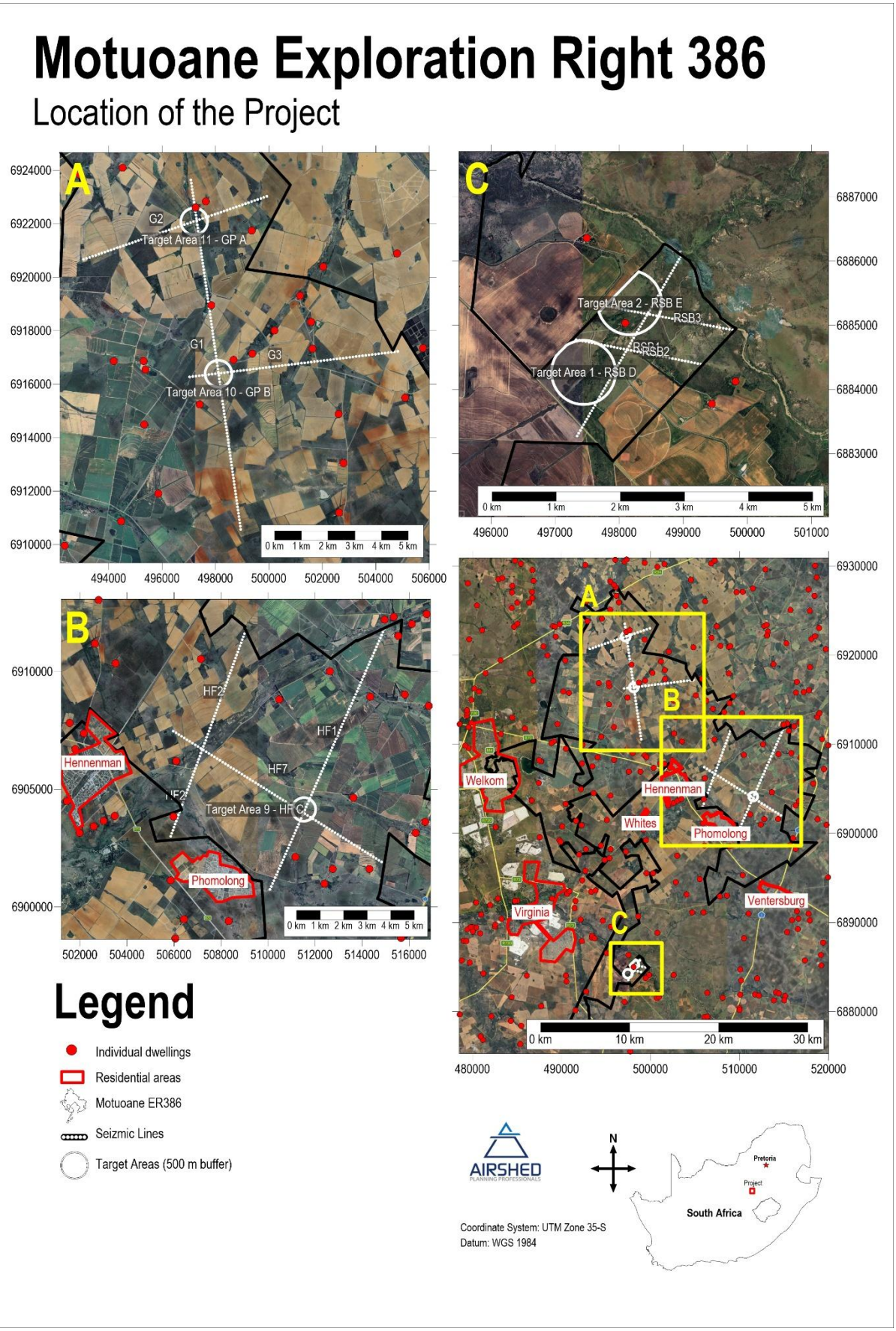

Figure 1: Project location

1.1 Study Objective

The main objective of the noise specialist study was to determine the potential impact on the acoustic environment and NSRs as a result of the proposed Motuoane exploration activities, 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 (SoW):

- A study of the receiving environment, including nearby noise sensitive receptor (NSR) locations, meteorology, topography and land use.
- A three-day site visit to collect baseline noise data.
- Baseline noise measurements conducted according to the South African National Standards (SANS 10103:2008) 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. Measurements will be conducted during the day and night at locations representative of the noise climate and at sensitive receptors. Measurement time intervals will be so chosen that the results are representative of the noise climate, taking into account variations in weather conditions and variations existing noise levels
- Estimation of noise emissions from the project's operational phase. The propagation of noise was simulated using CadnaA software for industrial applications. Data, representative of conditions in the study area, were applied in the calculations.
- Noise impacts were calculated both in terms of incremental ambient noise levels as a result of the project's activities, as well as the effective change in ambient noise levels. Impacts were calculated and assessed in accordance with SANS 10103:2008 and the relevant guidelines provided by the International Finance Corporation (IFC).
- The findings of the above components informed recommendations of noise management measures, including mitigation and monitoring (where necessary).
- The compilation of a comprehensive specialist Noise Impact Assessment Report.

1.3 Specialist Details

1.3.1 Specialist Details

Airshed Planning Professionals (Pty) Ltd 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

Report Author: Nick Grobler – BEng (Chem), BEng (Hons) (Env) (University of Pretoria)
Nick Grobler joined Airshed Planning Professionals after finishing his BEng degree in Chemical Engineering and BEng (Hons) in Environmental Engineering, both from the University of Pretoria. Airshed Planning Professionals is a technical and scientific consultancy providing scientific, engineering and strategic air pollution impact assessment and management services and policy support to assist clients in addressing a wide variety of air pollution related risks and air quality management challenges. Nick has been actively involved in all facets off air quality management, including ambient air quality monitoring, dispersion modelling, air quality impact assessments, and the compilation of air quality management plans since 2011. Nick also expanded into conducting environmental noise baseline and impact assessments in 2017.

Nick is an associate member of the South African Institution of Chemical Engineers (SAIChE) and a member of Golden Key international. Nick has been actively involved with projects for the opencast and underground mining of: copper, platinum, chrome, gold, iron, coal, limestone, potash, graphite, lead, mineral sands, aggregate stone, clay and zinc. Furthermore, he's also conducted air quality or noise studies for the production of: copper, platinum, PGM metals, gold, base metals, iron, steel, coal, coke, heavy mineral sands, vanadium, solder, lime, urea, chrome, gypsum, asphalt, acetylene, LNG liquefaction, vegetable oil, fertilizer, explosives, wood pulp, cement, grease, oil recycling, tyre and general waste pyrolysis, power generation, fuel storage as well as crematoriums, general waste landfills, meat processing and rendering at abattoirs and animal waste incineration. Nick has experience in working with projects in South Africa, Zimbabwe, Namibia, Mozambique, Republic of Congo, Democratic Republic of Congo, Ghana, Liberia, Guinea, Mali, Suriname and Saudi Arabia.

1.4 Description of Activities from a Noise Perspective

Noise generating sources at the Motuoane exploration activities include light and heavy vehicle movements that form part of the drilling operations and seismic surveys, as well as drill rigs employed for well drilling. Existing noise sources in the study area were not included in the noise source inventory or noise attenuation modelling but is accounted for in the noise survey.

The above listed sources represent the main noise generating sources at the Motuoane exploration activities. 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). Therefore, although some sources of noise at the perhaps were perhaps not quantified (light vehicle movements, power tool usage etc) the incremental contributions of such sources are expected to be minimal given that the majority of significant sources are considered in the source inventory.

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 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).*

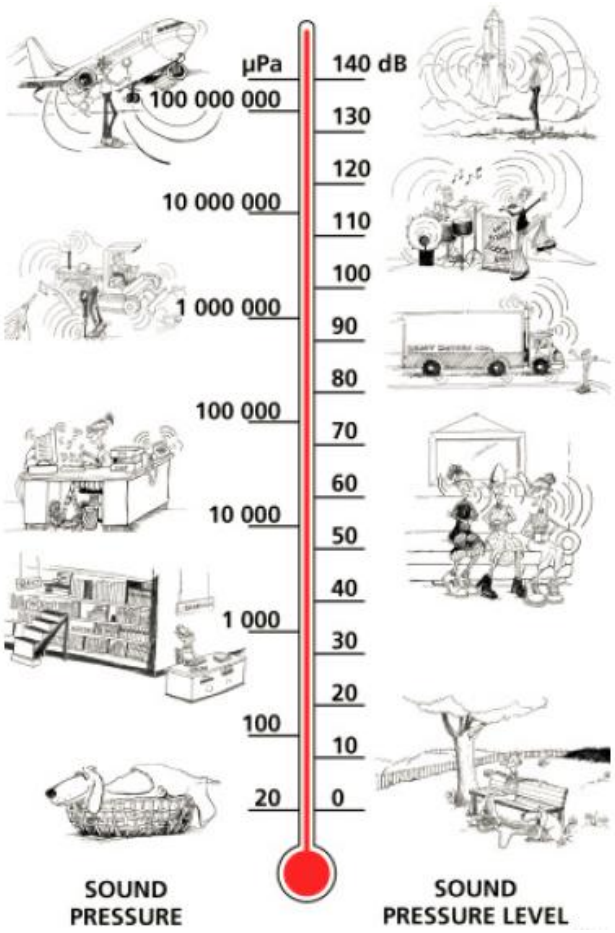

Figure 2: The decibel scale and typical noise levels (Brüel & Kjær Sound & Vibration Measurement A/S, 2000)

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.

In terms of L_P, audible sound ranges from the threshold of hearing at 0 dB to the pain threshold of 130 dB and above. 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 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.

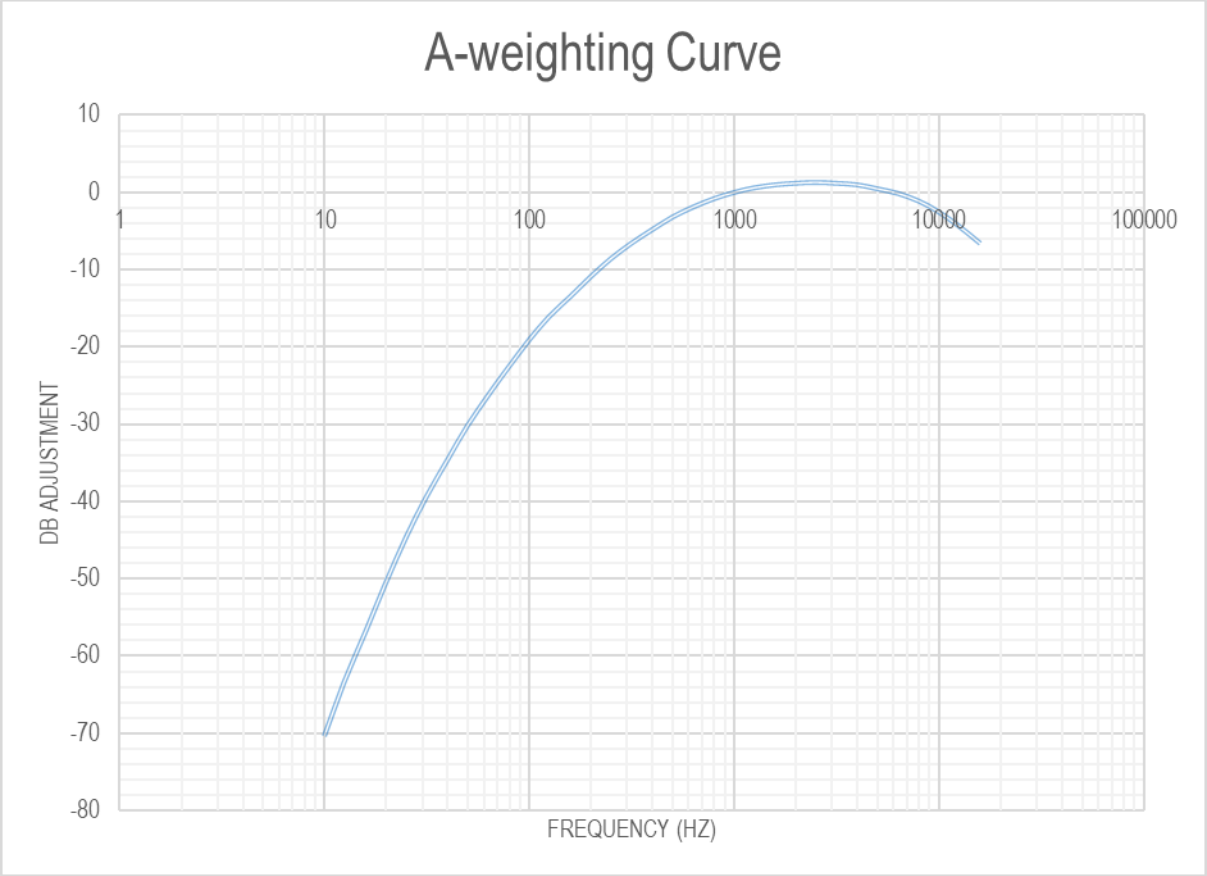

Figure 3: A-weighting curve

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 industrial operations, individual sound pressure levels must be converted to their linear values and added using:

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

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).

1.5.5 Environmental Noise Indices

In assessing environmental noise either by measurement or calculation, reference is made to the following indices:

- **L_{Aeq} (T)** – The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured).
- **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_{AFmax}** – The maximum A-weighted noise level measured with the fast time weighting. It's the highest level of noise that occurred during a sampling period.
- **L_{AFmin}** – The minimum A-weighted noise level measured with the fast time weighting. It's the lowest level of noise that occurred during a sampling period.

1.6 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 measurement and analyses of existing noise levels in the study 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 drilling and seismic survey activities. 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 request was sent to EIMS at the onset of the project. In response to the request, the following information was supplied:

- The project details, including the Final Scoping Report, which contains the process description and all other relevant information;
- Layout maps for the Exploration Rights 386 area, Target Areas and proposed seismic transects;
- A description and approximate number and specifications of the proposed equipment (vehicles, drill rigs);

- Operational times of all equipment;
- The reports and feedback from the public consultation process.

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 and National Noise Control Regulations. These draft standards, which are in line with those published by the IFC in their *General EHS Guidelines* (IFC 2007) and World Health Organisation (WHO) *Guidelines for Community Noise* (WHO 1999), were considered in the assessment.

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 operation's property. Residential receptors in the vicinity of the Target Areas and Seismic Transects were identified from satellite imagery.

The ability of the environment to attenuate noise as it travels through the air was studied by considering local meteorology, land use and terrain.

Readily available terrain data was obtained from the United States Geological Survey (USGS) web site (https://earthexplorer.usgs.gov/) accessed in January 2026. A study was made of Shuttle Radar Topography Mission (STRM) 1 arc-sec data.

1.6.4 Noise Survey

The extent of noise impacts as a result of an intruding noise depends largely on existing noise levels in an area. Higher ambient noise levels will result in less noticeable noise impacts and a smaller impact area. The opposite also holds true. Increases in noise will be more noticeable in areas with low ambient noise levels. The data from a baseline noise survey conducted by Airshed from 2 to 4 June 2025 was studied to determine current noise levels within the area.

The survey methodology, which closely followed guidance provided by the IFC (2007) and SANS 10103 (2008), is summarised below:

- The survey was designed and conducted by a trained specialist.
- Sampling was carried out using a Type 1 sound level meter (SLM) that meet all appropriate International Electrotechnical Commission (IEC) standards and is subject to calibration by an accredited laboratory (Appendix C). Equipment details are included in Table 1.

- The acoustic sensitivity of the SLM was tested with a portable acoustic calibrator before and after each sampling session.
- Samples, 10 to 15 minutes in duration, representative and sufficient for statistical analysis were taken with the use of the portable SLM capable of logging data continuously over the sampling time period. Samples representative of the day- and night-time acoustic environment were taken. SANS 10103 defines day-time as between 06:00 and 22:00 and night-time between 22:00 and 06:00 (SANS 10103, 2008).
- L_{Aleq} (T), L_{Aeq} (T); L_{AFmax}; L_{AFmin}; L_{Zeq} (T), L_{90} and 3rd octave frequency spectra were recorded.
- The SLM was located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface.
- 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, and that the instrument is operated under the conditions specified by the manufacturer.
- A detailed log and record were kept. Records included site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.

Table 1: Sound level meter details

Equipment	Serial Number	Purpose	Last Calibration Date
Svantek 977 sound level meter	S/N 36183	Noise sampling.	March 2025
Svantek 7052E ½" microphone	S/N 71175		
SVANTEK SV33 Class 1 Acoustic Calibrator	S/N 43170	Testing of the acoustic sensitivity before and after each daily sampling session.	March 2025
Kestrel 3500 Pocket Weather Tracker	S/N 2263089	Determining wind speed, temperature and humidity during sampling.	Not Applicable

SANS 10103 (2008) prescribes the method for the calculation of the equivalent continuous rating level ($L_{Req,T}$) from measurement data. $L_{Req,T}$ is the equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$) during a specified time interval, plus specified adjustments for tonal character, impulsiveness of the sound and the time of day; and derived from the applicable equation:

$$L_{Req,T} = L_{Aeq,T} + C_i + C_t + K_n$$

Where

- $L_{Req,T}$ is the equivalent continuous rating level;
- $L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels;
- C_i is the impulse correction;
- C_t is the correction for tonal character; and
- K_n is the adjustment for the time of day (or night), 0 dB for daytime and +10 dB for night-time.

1.6.5 Source Inventory

Sound power levels for vehicles associated with the exploration activities were calculated using the Sound Power Level Predictions for Industrial Machinery as given in the Handbook of Acoustics (Crocker et al, 1998). Use was made of sound power levels for drill rigs from a database of historic sound power measurements for similar equipment maintained by Airshed.

1.6.6 Noise Propagation Simulations

1.6.6.1 Propagation Model

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.

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 three areas (Figure 1) encompassing the Target Areas, Seismic Transects and nearby NSRs. Each area was divided into a grid matrix with a 20 m resolution. The model was set to calculate L_P's at each grid and discrete receptor point at a height of 1.5 m above ground level. The coordinates of the southwestern and northeastern corners of each of the three simulation domains are given in Table 2

Table 2: Simulation Domains

Simulation Domain	Coordinates of SW Corner (UTM 35S)		Coordinates of NE Corner (UTM 35S)	
	Easting	Northing	Easting	Northing
Domain A	492 168	6 909 312	502 004	6 924 666
Domain B	501 196	6 898 623	516 913	6 913 077
Domain C	495 500	6 882 012	501 265	6 887 709

1.6.7 Presentation of Results

Results are presented in isopleth form, showing the incremental daytime impact of exploration activities throughout each modelling domain (activities will be limited to daytime hours, with no drilling or seismic surveys conducted during the night).

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 SANS 10103 and by the IFC.

Simulated incremental and cumulative noise levels at the survey locations and closest identified residential locations, as well as the simulated increase from current noise levels, are presented in tabular form.

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.

1.6.9 Impact Significance Assessment

The significance of environmental noise impacts was assessed according to the methodology provided by EIMS. Refer to Appendix G of this report for the methodology.

1.7 Management of Uncertainties

The following limitations and assumptions should be noted:

- The quantification of sources of noise was limited to the exploration activities.
- The source power levels for noise sources were based on the equipment list provided by EIMS.
- Exploration activities were assumed to be limited to the daytime.
- Although other existing sources of noise within the area were identified during the survey, such sources were not quantified but were taken into account during the baseline sampling.
- Noise surveys were not conducted at each identified NSR, therefore baseline sound pressure levels were assumed to be similar to the closest noise survey location to each receptor location.
- The environmental noise assessment focuses on the evaluation of impacts for humans.
- Ground vibration did not form part of the scope of work of this assessment.
- Although some sources of noise at the proposed exploration activities were perhaps not quantified, the incremental contributions of such sources are expected to be minimal given that the majority of significant sources are considered in the source inventory.

2 Legal Requirements and Noise Level Guidelines

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 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'. 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 3: 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 dB < $\Delta \leq 10$ dB: There will be 'little' reaction with 'sporadic complaints';
- 5 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 dB < $\Delta \leq 20$ dB: There will be a 'strong' reaction with 'threats of community action'; and
- 15 dB < Δ: 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.

2.3 Free State Provincial By-law

In the Free State Province, provision is made under the Air Quality Management By-Law, published in December 2011 under the Local Government: Municipal Systems Act (No 171 of 2011) for noise pollution management. Under the by-law, no person, animal, machine, device, vehicle, recreational vehicle, apparatus or any combination thereof is allowed to cause a disturbing noise, which impairs or may impair the convenience or peace of any reasonable person.

2.4 International Finance Corporation Guidelines on Environmental Noise

The IFC General Environmental Health and Safety Guidelines on noise address impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines.

The IFC states that noise impacts **should not exceed the levels presented in Table 4**, or result in a maximum **increase above background levels of 3 dBA** at the nearest receptor location off-site (IFC, 2007). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. $\Delta = 3$ dBA is, therefore, a useful significance indicator for a noise impact.

It is further important to note that the IFC noise level guidelines for residential, institutional and educational receptors correspond with the SANS 10103 guidelines for urban districts.

Table 4: IFC noise level guidelines

Area	One Hour L_{Aeq} (dBA) 07:00 to 22:00	One Hour L_{Aeq} (dBA) 22:00 to 07:00
Industrial receptors	70	70
Residential, institutional and educational receptors	55	45

2.5 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 (EIA Regulations, 2014 (GN R 982, as amended in 2016, 2017, 2018 and 2020)). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 5: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014), as amended in 2017

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 (as amended in 2017) 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
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 3.2 Section 3.3
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 3 Section 4 and Section 2.2
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.3 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 Section 1
An identification of any areas to be avoided, including buffers	Section 3.1 Section 4 Section 6
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 Section 5
Any mitigation measures for inclusion in the EMPr	Section 6
Any conditions for inclusion in the environmental authorisation	Section 7
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

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 (as amended in 2017) must contain:	Relevant section in report
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 relating to noise
Any other information requested by the competent authority.	None received

2.6 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 6: 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:	
• 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 to 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:	

Assessment and Reporting on Noise Impacts	Section in Report
• characterisation and determination of noise emissions from the noise source, where characterization could include types of noise, frequency, content, vibration and temporal aspects;	Section 4.1
• 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 4.2
• desired noise levels for the area.	Section 3.3, Section 4 and Section 2.2
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 3.2 and Section 3.3
• 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 50m buffered development envelope;	Figure 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;	Micro-siting not available yet, only Target Areas have been defined.
• 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

This chapter provides details of the receiving acoustic environment which is described in terms of:

- Local NSRs;
- The local environmental noise propagation and attenuation potential; and,
- Current noise levels and the existing acoustic climate.

3.1 Noise Sensitive Receptors

NSRs generally include places of residence and areas where members of the public may be affected by noise generated by industrial activities.

As mentioned in Section 1.5.4, the impact of an intruding industrial noise on the environment rarely extends over more than 5 km from the source. Potential noise sensitive receptors within the study area include primarily homesteads and farmhouses surrounding the Target Areas and Seismic Transects, as shown in Figure 4. The closest NSRs to the operational areas were modelled as discreet receptors (labelled A to S on Figure 4, with more details provided in Table 11)

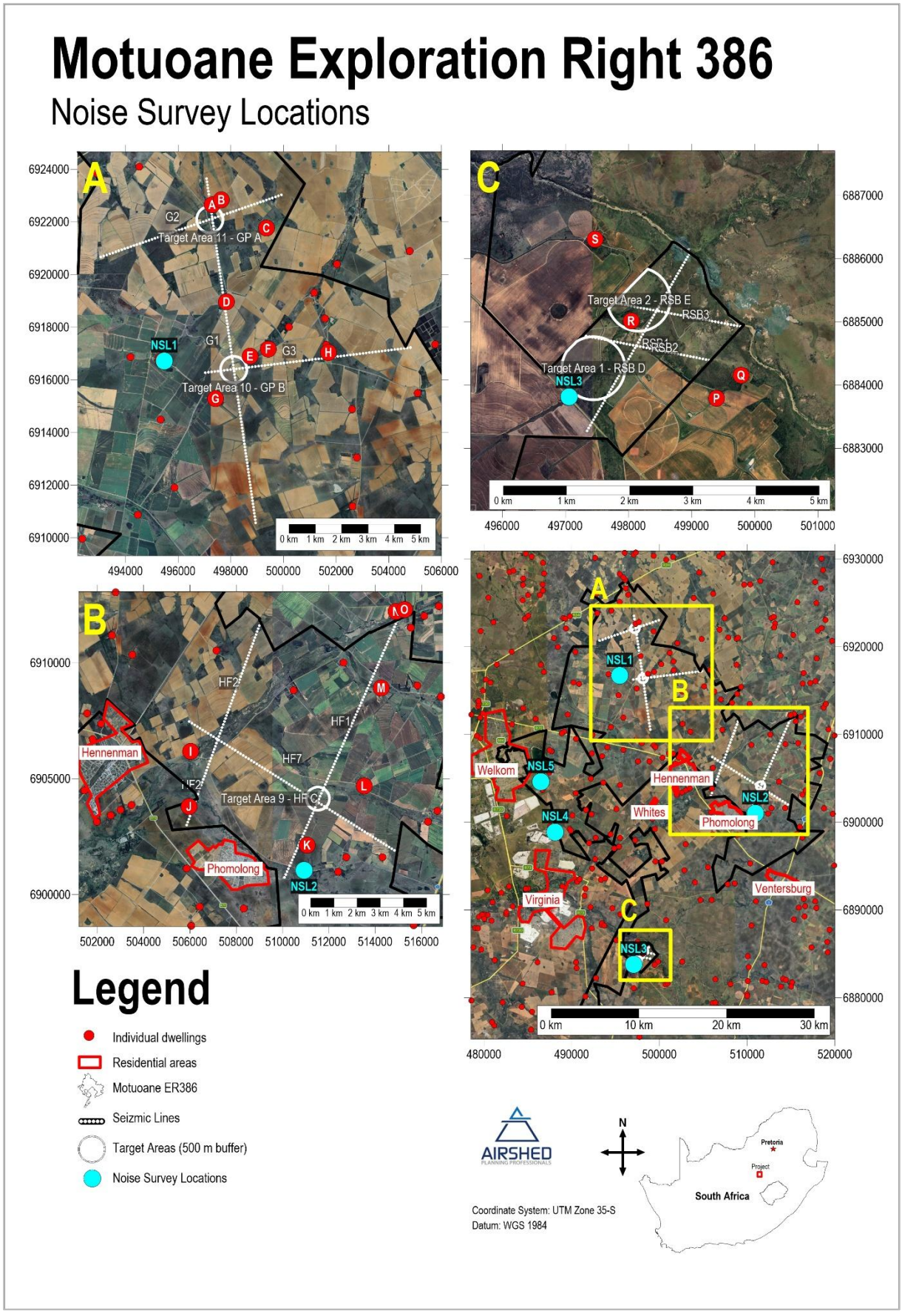

Figure 4: Sensitive receptors and noise survey sites

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.

The wind field of an area can be presented using wind roses. Wind roses represent wind frequencies for the 16 cardinal wind directions. Frequencies are indicated by the length of the shaft when compared to the circles drawn to represent a frequency of occurrence. Wind speed classes are assigned to illustrate the frequencies with high and low winds occurring for each wind vector. The frequencies of calms, defined as periods for which wind speeds are below 1 m/s, are also indicated.

Reference was made to meteorological data from the South African Weather Services (SAWS) operated station located in Welkom, for the period January 2015 to January 2022. The measured data set indicates wind flow primarily from the northeastern sector (Figure 5**)** during the day with winds also frequent from the northwestern and southwestern sectors. At night, the wind field is mostly from a northeastern sector (Figure 5). Calm conditions occur 2.96% of time during the day and 3.11% during the night. On average, noise impacts are expected to be slightly more notable to the southeast and southwest of the project activities during the day and to the southwest of the project activities during the night.

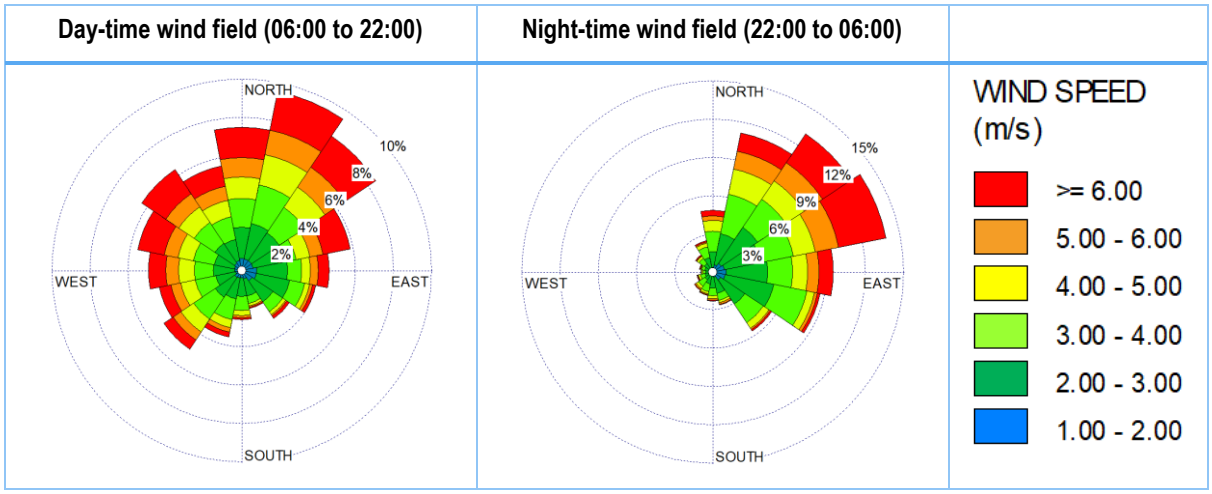

Figure 5: Wind rose for SAWS Welkom station, January 2015 to January 2022

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 6).

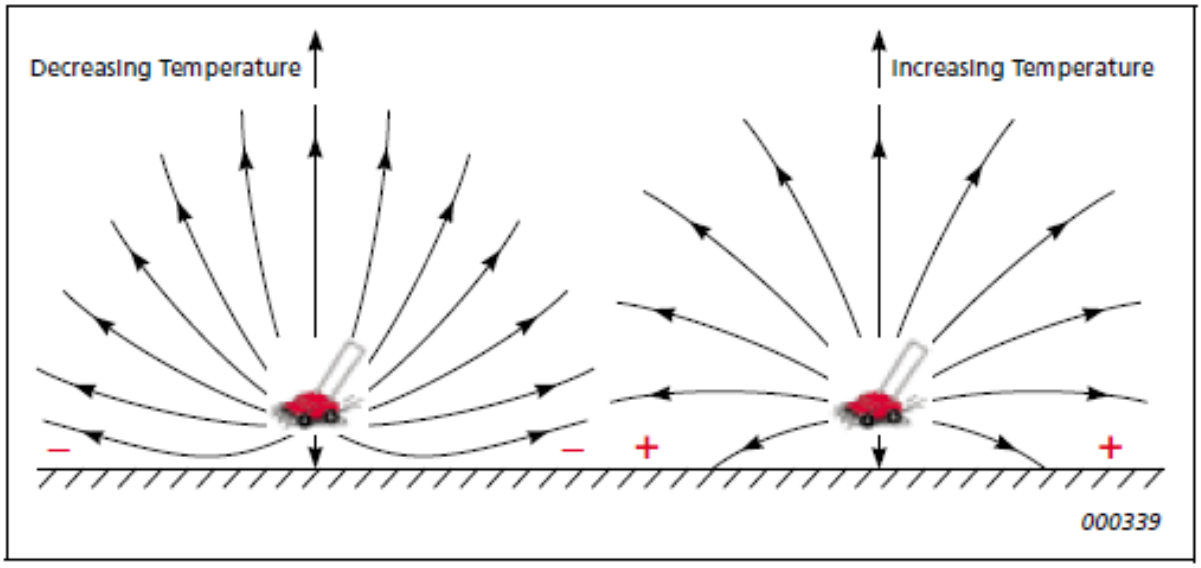

Figure 6: Bending the path of sound during typical day time conditions (image provided on the left) and night-time conditions (image provided on the right)

The average temperature for the site (as obtained from the SAWS data set for 2015 to 2022) was 15°C, while the average humidity was assumed as 50%.

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).

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). The ground conditions were modelled as acoustically mixed.

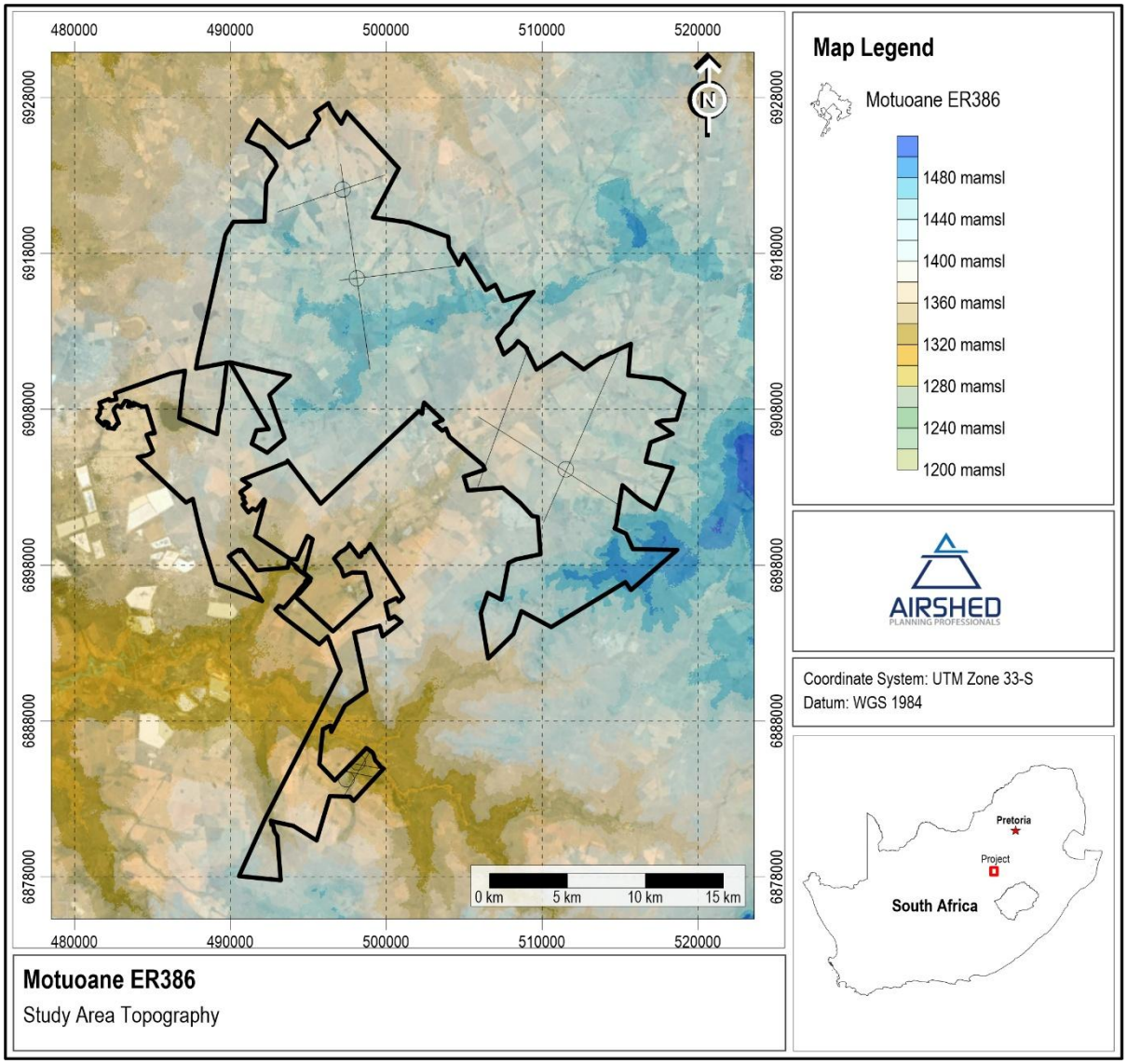

Figure 7: Topography for the study area

3.3 Baseline Noise Survey and Results

Day- and night-time noise measurements were conducted from 2 to 4 June 2025 at five noise survey locations NSLs) representative of the acoustic climate in the exploration rights area (Figure 4). Noise monitoring was conducted by Airshed personnel and logged Sound Level Meter (SLM) output data, together with sampling log sheets, were recorded. Survey sites were selected taking into consideration the location of the proposed activities, nearby NSRs, accessibility and safety.

The locations of the sampling sites are shown in Figure 4, with coordinates provided in Table 6. Photographs of the sites are included in Appendix D and log sheets in Appendix F. Recorded time-series broadband sound pressure levels are shown in Appendix E.

Table 7: Location of the noise survey sites.

Site ID	Latitude	Longitude
NSL 1	-27.874321°S	26.953961°E
NSL 2	-28.015746°S	27.11111°E
NSL 3	-28.171378°S	26.970042°E
NSL 4	-28.035107°S	26.879039°E
NSL 5	-27.983465°S	26.862453°E

The daytime noise survey results are shown in Figure 8, while the night-time survey results are shown Figure 9 .

The recorded average (L_{Aeq}), maximum (L_{AFMax}) and background (L_{A90}) broadband sound pressure levels, together with the sampling dates, times, durations, noted noise sources, and general weather conditions are given in Table 8 for the daytime and in Table 9 for the night-time survey.

At the survey sites closest to the proposed Target Areas and Seismic Transects (survey sites 1, 2 and 3), both daytime and night-time sound pressure levels were well below the typical rating levels for rural areas. At survey sites 4 and 5, which are located to the east of the town of Welkom and closer to nearby mining operations, significantly higher (but still fairly low) day- and night-time sound pressure levels were recorded.

Because of low baseline sound pressure levels any intrusive noise sources, such as drilling, would be audible over large distances and could lead to significant disturbance at nearby NSRs, especially during the night-time.

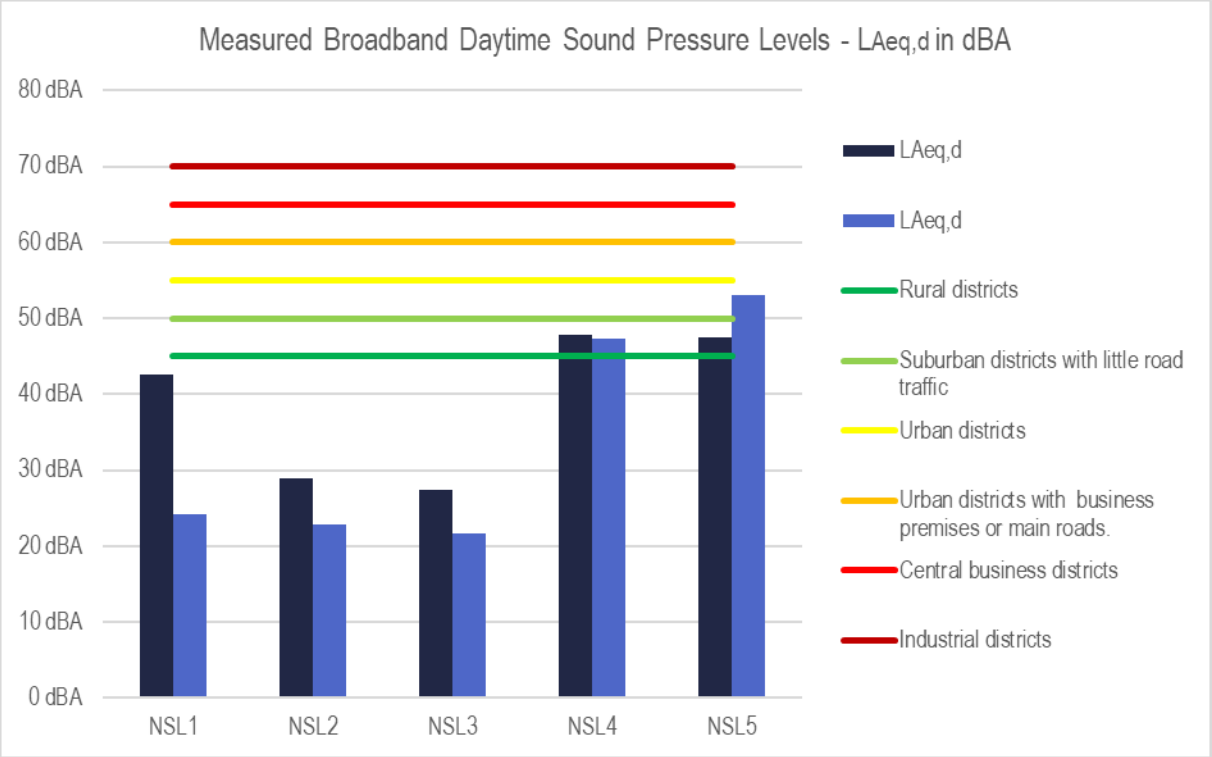

Figure 8: Broadband daytime survey results – June 2025 survey

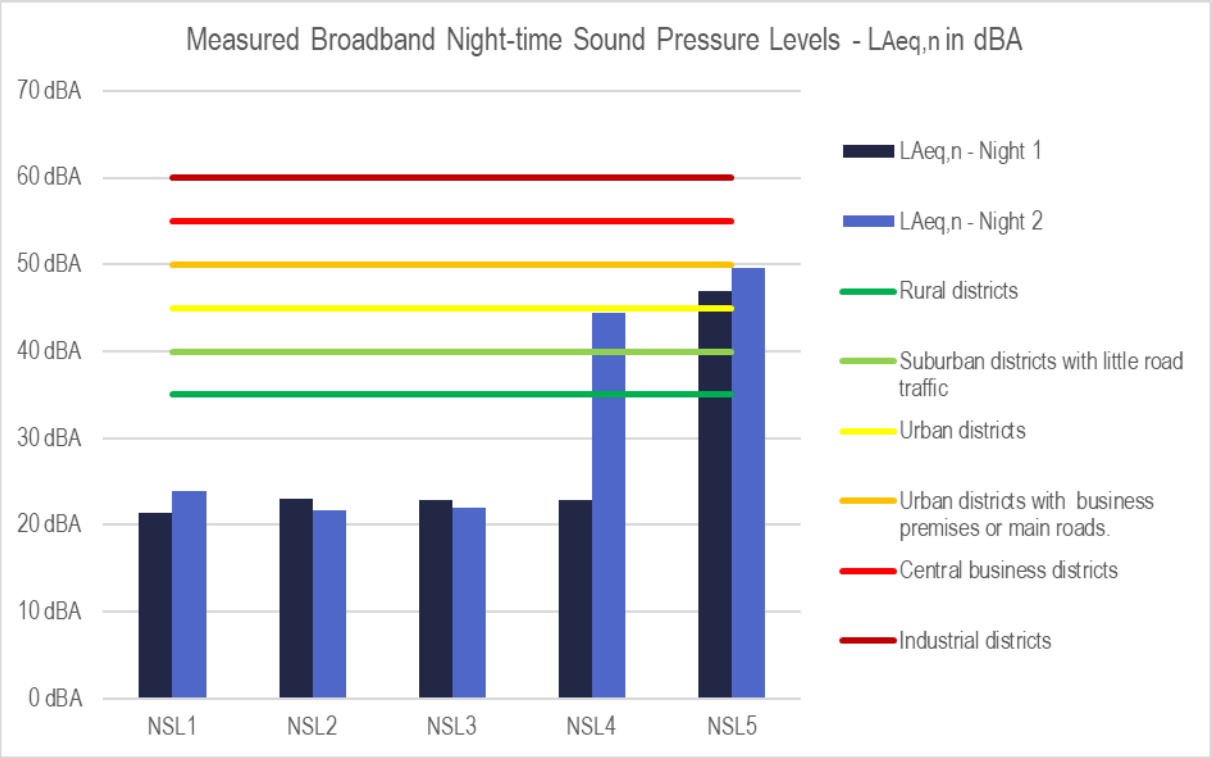

Figure 9: Broadband night-time survey results – June 2025 survey

Table 8: Logged broadband results and observations at all sampling locations - daytime

Site	Date	Time	Duration	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A90}	L_{A90}	L_{Aeq}	Acoustic Climate	General Weather Conditions
1	2025/06/02	18:19	00:20	42.6	60.4	19.8	24.1	21.5	**33.4**	Near Ons Anker School. Noise sources include Cattle, dogs, people talking, occasional vehicles, birds, insects, faint music	Winds of 0.8 m/s from the S. Temp of 8.2°C, 60 % RH, 0% clouds
	2025/06/03	18:57	00:15	24.2	79.6	23.2	21.3			Near Ons Anker School. Noise sources include Insects, dogs, faint community, vehicles, music	Winds of 0.6 m/s from the S. Temp of 7.6°C, 56 % RH, 0% clouds
2	2025/06/02	19:23	00:15	28.9	58.0	20.7	23.2	21.7	**25.9**	Close to a farm road to the east of Phomolong. Noise sources include: Hum from Phomolong, birds, insects, faint community, music and vehicles	Winds of 0.8 m/s from the N. Temp of 11°C, 34 % RH, 0% clouds
	2025/06/03	19:56	00:15	22.8	79.4	22.6	21.5			Close to a farm road to the east of Phomolong. Noise sources include: Hum from Phomolong	Winds of 1.5 m/s from the N. Temp of 7.4°C, 51 % RH, 0% clouds
3	2025/06/02	20:35	00:15	27.4	56.9	17.4	20.4	19.3	**24.6**	Close to the road between Virginia and Aldam. Noise sources include: Birds, insects, rusting of grass	Winds of 0.5 m/s from the N. Temp of 6.4°C, 38 % RH, 0% clouds
	2025/06/03	21:04	00:15	21.7	82.5	21.1	19.8			Close to the road between Virginia and Aldam. Noise sources include: Birds, faint vehicles	Winds of 0.1 m/s from the N. Temp of 2.9°C, 65 % RH, 0% clouds
4	2025/06/02	21:25	00:15	47.8	71.1	27.1	29.2	25.6	**47.6**	East of Harmony Gold Saaiplaas. Noise sources include: Hum from Saaiplaas plant, cars, trucks, busses, insects	Winds of 0.7 m/s from the N. Temp of 9.4°C, 40 % RH, 0% clouds
	2025/06/04	18:00	00:20	47.3	84.0	24.0	23.7			East of Harmony Gold Saaiplaas. Noise sources include: Hum from Saaiplaas plant, cars, busses, birds, insects, air traffic	Winds of 0.4 m/s from the W. Temp of 14.2°C, 37 % RH, 0% clouds
5	2025/06/02	21:56	00:15	47.6	90.1	32.1	32.1	31.3	**50.3**	Between Goldfields Masimong 4 and 5. Noise sources include: Hum from Masimong 4 & 5, reverse alarms, cars, busses, dogs	Winds of 0.5 m/s from the N. Temp of 11°C, 40 % RH, 0% clouds
	2025/06/04	18:41	00:20	53.0	88.7	30.4	35.6			Between Goldfields Masimong 4 and 5. Noise sources include: Lots of vehicle traffic, cars and busses	Winds of 0.1 m/s from the NE. Temp of 11.2°C, 38 % RH, 0% clouds

Table 9: Logged broadband results and observations at all sampling locations – night-time

Site	Date	Time	Duration	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A90}	L_{A90}	L_{Aeq}	Acoustic Climate	General Weather Conditions
1	2025/06/03	00:23	00:10	21.4	81.4	20.0	18.0	20.5	**22.7**	Near Ons Anker School. Noise sources include Noise sources include Cattle, faint road and air traffic	Winds of 0.6 m/s from the S. Temp of 7.6°C, 56 % RH, 0% clouds
	2025/06/03	22:11	00:10	23.9	73.8	20.9	19.5			Near Ons Anker School. Noise sources include Birds, insects, dogs, community	Winds of 0.1 m/s from the S. Temp of 7.3°C, 33 % RH, 0% clouds
2	2025/06/03	01:18	00:10	23.0	82.4	20.9	19.6	21.0	**22.4**	Close to a farm road to the east of Phomolong. Insects, dogs	Winds of 1.5 m/s from the N. Temp of 7.4°C, 51 % RH, 0% clouds
	2025/06/03	23:00	00:10	21.7	80.3	21.1	19.1			Close to a farm road to the east of Phomolong. Birds, dogs, community	Winds of 0.5 m/s from the N. Temp of 8.4°C, 56 % RH, 0% clouds
3	2025/06/03	02:17	00:11	22.8	84.0	20.9	18.9	21.1	**22.4**	Close to the road between Virginia and Aldam. Noise sources include: Birds	Winds of 0.1 m/s from the N. Temp of 2.9°C, 65 % RH, 0% clouds
	2025/06/03	23:56	00:10	22.0	83.9	21.2	19.3			Close to the road between Virginia and Aldam. No notable noise sources were observed	Winds of 0.1 m/s from the N. Temp of 6.3°C, 68 % RH, 0% clouds
4	2025/06/03	02:17	00:11	22.8	84.0	20.9	18.9	26.9	**33.6**	East of Harmony Gold Saaiplaas. Noise sources include: Hum from plant, occasional vehicles	Winds of 0.5 m/s from the N. Temp of 3°C, 76 % RH, 0% clouds
	2025/06/04	22:05	00:15	44.5	86.3	32.9	33.0			East of Harmony Gold Saaiplaas. Noise sources include: Insects, cars	Winds of 3 m/s from the N. Temp of 10°C, 70 % RH, 0% clouds
5	2025/06/03	03:27	00:10	46.9	85.0	39.5	39.6	43.5	**48.3**	Between Goldfields Masimong 4 and 5. Hum from Masimong 4 and 5, vehicles	Winds of 0.1 m/s from the N. Temp of 5°C, 68 % RH, 0% clouds
	2025/06/04	22:34	00:15	49.6	87.5	47.5	47.9			Between Goldfields Masimong 4 and 5. Hum from Masimong 5 plant, vehicles, dogs	Winds of 3 m/s from the N. Temp of 10°C, 70 % RH, 0% clouds

4 Impact Assessment

The noise source inventory and noise propagation modelling and results are discussed in the following sections.

4.1 Noise Sources and Sound Power Levels

In terms of noise generating sources that form part of the exploration activities, the main sources will include drill rigs, seismic vibrators, trucks for equipment transport, vibroseis trucks, recording trucks and light vehicles.

Sound power levels for all equipment were calculated using the Sound Power Level Predictions for Industrial Machinery as given in the Handbook of Acoustics (Crocker et al, 1998). The following equations were used in the calculation of sound power levels of equipment:

For Diesel-Powered, Mobile Equipment:

$$L_W = 99 + 10 \log kW - 4dB$$

Where kW is the power rating of the turbocharged or naturally aspirated engine, with conventional exhaust mufflers. A corrective factor of 4 dB is applied since the engine is frequently not operated in the maximum-power condition.

Sound power levels for the drill rigs were estimated based on historic sound power measurements for similar equipment.

The octave band sound power levels were calculated by subtracting the values published in the Handbook of Acoustics (Crocker et al, 1998) for each equipment type from the calculated sound power levels.

The reader is reminded of the non-linearity in the addition of L_W's. The above listed sources represent the main noise generating sources at the exploration activities. 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). Therefore, although some sources of noise at the exploration activities were perhaps not quantified (light vehicle movements, tool usage etc) the incremental contributions of such sources are expected to be minimal given that the majority of significant sources are considered in the source inventory.

Table 10: Calculated sound power levels

Number	Equipment	Power	L_W octave band (Hz) frequency spectra (dB)									L_W (dB)	L_{WA} (dBA)
			31.5	63	125	250	500	1000	2000	4000	8000		
Target Areas and Drilling Operations													
3	Trucks	250	112.0	112.0	117.0	120.0	115.0	113.0	110.0	104.0	98.0	123.9	118.2
1	Drill Rig - Engine	250	112.0	112.0	117.0	120.0	115.0	113.0	110.0	104.0	98.0	123.9	118.2
2	Light Vehicles	100	108.0	108.0	113.0	116.0	111.0	109.0	106.0	100.0	94.0	119.9	114.3
	Drilling		119.6	119.6	125.3	120.8	122.1	116.6	116.0	127.3	127.3	132.9	131.1
Total			122.2	122.2	127.6	127.8	125.0	121.5	119.4	127.4	127.3	135.0	132.1
Seismic Transects													
1	Seismic Vibrator - Engine	250	112.0	112.0	117.0	120.0	115.0	113.0	110.0	104.0	98.0	123.9	118.2
1	Seismic Vibrator	250	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.0	94.0
2	Light Vehicles	100	108.0	108.0	113.0	116.0	111.0	109.0	106.0	100.0	94.0	119.9	114.3
Total			121.1	123.5	118.4	121.4	116.4	114.4	111.4	105.4	99.4	128.1	119.7

4.2 Noise Propagation and Simulated Noise Levels

The propagation of noise generated from exploration activities was calculated with CadnaA in accordance with ISO 9613. Site specific acoustic parameters as discussed in Section 3.2 along with source data discussed in Section 4.1.1, were applied in the model.

Results are presented in isopleth form for the cumulative impact of exploration activities during the day-in Figure 10, no night-time activities will be conducted, therefore night-time impacts are not assessed.

Cumulative impacts of exploration activities, together with background noise sources, are assessed at the closest noise sensitive receptor locations, as well as at the noise survey locations, in Table 11.

Because of very low baseline noise levels in the study area, exploration activities, particularly drilling activities, could be audible up to 5 km away from operational areas, while vehicle movements and seismic surveys could be audible up to 2.5 km away from the seismic transects (Figure 10). Based on noise attenuation modelling results, noise levels could be disturbing (>7 dBA increase from baseline) to residents up to 2 km from drilling activities and 1 km from seismic surveys.

Drilling and other exploration activities could be disturbing (albeit for relatively short periods) to the residents of the homesteads in or near the target areas, especially at:

- The homesteads just to the northeast of the Target Area 11- GP A 500 m buffer (NSRs A & B in Table 11 and Figure 10);
- The homesteads to the northeast of Target Area 10- GP B (NSR E in Table 11 and Figure 10);
- The homesteads to the west (~300 m) of Seismic Transect HF2 (in the south, NSR J in Table 11 and Figure 10);
- The homestead to the east of Target Area 1 – RSB D and southeast of Target Area 2 – RSB E (NSR P in Table 11 and Figure 10); and,
- The homestead inside Target Area 2 – RSB E (NSR R in Table 11 and Figure 10).

The exploration activities could be audible and might be disturbing at several of the other identified noise receptors, including at NSRs B, G, H, I, K, L, M and Q.

It is therefore recommended that all exploration activities be limited to the daytime, and that all residents within 2 km of drilling activities and 1 km of seismic surveys be consulted and informed regarding the exploration activities, and that scheduling of activities be communicated and co-ordinated with nearby residents.

Table 11: Summary of simulated noise levels (provided as dBA) for proposed exploration activities at noise survey locations and identified nearby noise sensitive receptors

NSR ID (Figure 15)	Closest Operational Area	Direction from Activities	Coordinates (WGS84 UTM 35S)		Measured Baseline Day-time Sound Pressure Level (L_{Aeq} in dBA)	Simulated Cumulative Daytime Sound Pressure Level (L_{Aeq} in dBA)	Simulated Increase from Baseline Sound Pressure Levels (ΔL_{Aeq} in dBA)[e]
NSL1	TA10 - GP B	WNW	495414	6916734	33.4	33.5	0.1
NSL2	TA9 - HF C	S	510926	6901074	25.9	26.3	0.4
NSL3	TA1 - RSB D	SW	497050	6883805	24.7	**55.8**[d]	31.1
A	TA11 - GP A	N	497291	6922653	33.4[a]	**56.9**[d]	23.5
B	TA11 - GP A	NE	497640	6922838	33.4[a]	42.6	9.2
C	Transect - G2	S	499356	6921765	33.4[a]	35.4	2.0
D	Transect - G1	E	497836	6918961	33.4[a]	36.7	3.3
E	TA10 - GP B	NE	498729	6916900	33.4[a]	**45.1**[d]	11.7
F	TA10 - GP B	ENE	499419	6917171	33.4[a]	38.1	4.7
G	TA10 - GP B	SW	497420	6915287	33.4[a]	38.9	5.5
H	Transect - G3	N	501709	6917043	33.4[a]	41.8	8.4
I	Transect - HF7	S	506034	6906183	25.9[b]	30.9	5.0
J	Transect - HF2	W	505960	6903805	25.9[b]	43.1	17.2
K	Transect - HF1	E	511056	6902136	25.9[b]	32.6	6.7
L	TA9 - HF C	NE	513516	6904689	25.9[b]	31.9	6.0
M	Transect - HF1	E	514255	6908923	25.9[b]	32.5	6.6
N	Transect - HF1	N	514901	6912220	25.9[b]	28.8	2.9
O	Transect - HF1	N	515263	6912308	25.9[b]	27.4	1.5
P	Transect - RSB2	E	499392	6883791	24.7[c]	35.2	10.5
Q	Transect - RSB2	SE	499781	6884155	24.7[c]	33.9	9.2
R	TA2 - RSB E		498041	6885015	24.7[c]	**73.8**[d]	49.1
S	TA2 - RSB E	NW	497472	6886310	24.7[c]	37.3	12.6

Notes:

(a) Based on baseline sound pressure levels at NSL1

(b) Based on baseline sound pressure levels at NSL2

(c) Based on baseline sound pressure levels at NSL3

(d) Exceedance of daytime Draft Environmental Noise Standards for rural is provided in bold.

(e) Likely community response in accordance with the SANS 10103:

<3 dBA	*< 5 dBA*	*< 10 dBA*	*< 15 dBA*	*< 20 dBA*
Change imperceptible	*No reaction*	*'Little' reaction with sporadic complaints*	*'Medium' reaction with widespread complaints*	*'Strong' to 'very strong' reaction with threats of community action or vigorous community action.*

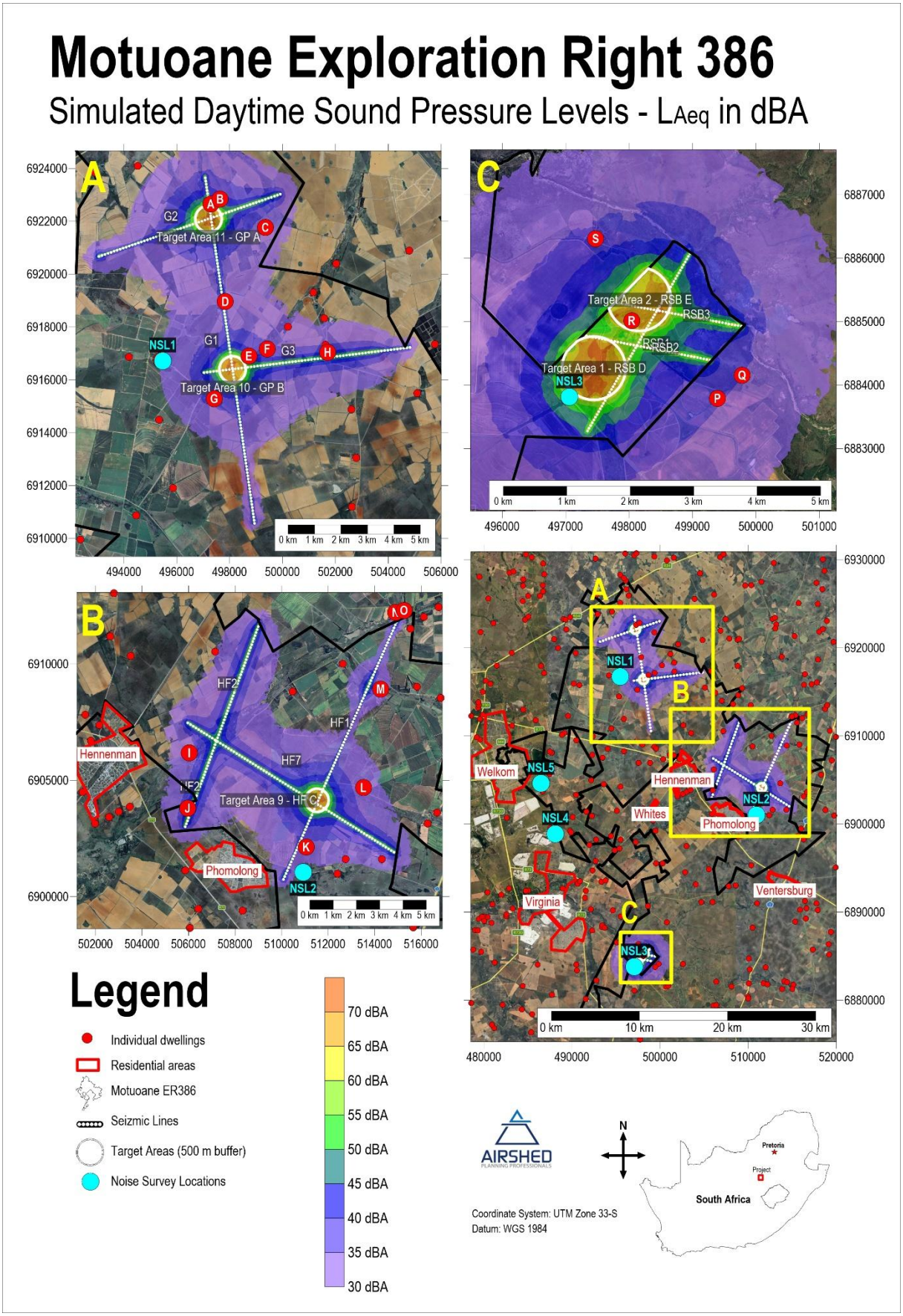

Figure 10: Simulated incremental day-time rating levels ($L_{Aeq,d}$)

5 Impact Significance Rating

The significance of environmental noise impacts was assessed according to the methodology adopted by EIMS. Refer to Appendix G of this report for the methodology. Since no exploration activities will be conducted during the night, only daytime impacts are assessed (Table 12).

Table 12: Significance rating for potential environmental noise impacts due to the project activities

Impact Description		Pre-Mitigation						Pre-mitigation environmental risk	Post Mitigation						Post-mitigation environmental risk	Confidence	Priority Factor Criteria			Priority Factor	Final score
Impact	**Phase**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Reversibility**	**Probability**		**Nature**	**Extent**	**Duration**	**Magnitude**	**Reversibility**	**Probability**			**Public Response**	**Cumulative Impact**	**Irreplaceable loss**		
Increase in noise levels (day-time)	Target Areas (Exploration and Drilling)	-1	3	1	4	1	4	-9 (medium)	-1	3	1	3	1	4	-8 (low)	Medium	2	1	1	2.00	-8 (low)
Increase in noise levels (day-time)	Seismic Transects (Seismic Surveys)	-1	3	1	3	1	3	-6 (low)	-1	3	1	2	1	3	-5.25 (low)	Medium	2	1	1	2.00	-5.25 (low)

6 Management Measures

Noise attenuation modelling indicated that, because of very low baseline noise levels in the study area, exploration activities, particularly drilling activities, could be audible up to 5 km away from operational areas, while vehicle movements and seismic surveys could be audible up to 2.5 km away from the seismic transects. Noise levels due to exploration activities could also exceed the Draft Environmental Noise Standards for rural areas at the closest residences for short periods.

Good practise noise mitigation and management measures are recommended in this section to ensure generated noise, and its subsequent impact on the receiving environment, is kept to a minimum.

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 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:

- All exploration activities should be limited to day-time hours (i.e., 06:00 to 18:00).
- All residents within 2 km of drilling activities and 1 km of seismic surveys should be informed regarding the exploration activities. Scheduling of activities should be communicated and coordinated with nearby residents.
- A noise complaints register must be kept. If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated. Channels for logging of complaints should be communicated to all residents within 2 km of the Target Areas and 1 km of the Seismic Transects and signage indicating the channels for logging grievances should be posted at the closest public road boundary and at the site entrance.
- All equipment should be maintained according to the manufacturer's specifications. This should particularly include the regular inspection and, if necessary, replacement of rotary equipment. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.
- Investigate use of alternatives to audible reversing alarms where possible (such as broadband noise emitting models).

6.1 Monitoring

In the event that noise related complaints are received, short term ambient noise measurements 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 future noise surveys:

- Any surveys should be designed and conducted by a trained specialist.
- Sampling should be carried out using a Type 1 Sound Level Meter (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 recoded 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 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 Conclusion

Based on the findings of the assessment and the noise attenuation modelling results, it is the specialist's opinion that the project can be authorised without significant impact on the current acoustic climate if:

- All exploration activities are limited to day-time hours (i.e., 06:00 to 18:00).
- All residents within 2 km of drilling activities and 1 km of seismic surveys are consulted and informed regarding the exploration activities.
- Scheduling of activities are communicated and coordinated with nearby residents.
- A noise complaints register is kept. If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated. Channels for logging of complaints should be communicated to all residents within 5 km of the Target Areas and 2.5 km of the Seismic Transects.

8 References

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9 Appendix A – Specialist Curriculum Vitae

Name	Nick Brian Grobler
Date of Birth	14 August 1986
Nationality	South African
Employer	Airshed Planning Professionals (Pty) Ltd
Position	Senior Air Quality and Noise Specialist
Profession	Chemical Engineer employed as an Air Quality and Noise Specialist
Years with Firm	Since May 2011

Education

- BEng (Chemical Engineering) University of Pretoria – Completed in 2009
- BEng (Hons) (Environmental Engineering) University of Pretoria – Completed in 2010

Membership of Professional Societies

- Institution of Chemical Engineers (IChemE) – Associate Member – 2014 to present.
- Golden Key International Honour Society - 2011 to present.

Experience

- Project management, proposal preparation and project invoicing.
- Emissions inventory compilation. Proficient in quantifying emissions using:
  - Engineering calculations, isokinetic and continuous stack sampling results, US EPA AP42 emission factors, Australian NPI emission factors, IPCC emission factors, ADDAS model (wind erosion), US EPA TANKS, Water9, GasSim.
- Meteorological, topographical and land use data processing and preparation.
- Dispersion modelling: experienced in SCREEN, AERMOD, ADMS, CALPUFF, SLAB and HAWK dispersion models.
- Proficient with the following specialist air quality / noise software: R, OpenAir, WRPlot, Surfer, ADDAS, TANKS, GasSim, CadnaA.
- Impact and compliance assessment.
- Air quality and dust management plan preparation.
- Air quality monitoring program design and implementation.
- Air quality monitoring set-up, training, processing and interpretation of:
  - SO_2, NO_2, CO, CH_4, O_3, HCl, VOCs, BTEX, H_2S, NH_3, PAHs, PM_{10}, $PM_{2.5}$, dust fallout, salt deposition, chloride deposition and meteorological parameters.
- Environmental noise monitoring campaign design.
- Environmental noise monitoring and data processing.
- Noise source monitoring and sound power level estimation.
- Ground vibration and overblast monitoring and reporting.
- Compilation of noise source inventories.
- Noise impact and compliance assessments.
- Atmospheric Emission License application.
- Greenhouse gas emissions inventories and pollution prevention plan preparation.
- Experienced in the compilation of:
  - Monthly, quarterly and annual air quality monitoring reports,
  - Noise survey reports,
  - Baseline, scoping and air quality impact assessment reports,
  - Air quality management plans,
  - Emission reduction plans, pollution prevention plans, greenhouse gas and climate change impact assessments

    - Health impact assessments, odour assessments and radiation studies.
- Online NAEIS (National Atmospheric Emissions Inventory System) and SAGERS (South African Greenhouse Gas Emissions Reporting System) completion and submission.
- Industry sectors in which experience have been gained with specific reference to air quality include:
    - Opencast and underground mining of: copper, platinum, chrome, gold, iron, coal, limestone, potash, graphite, lead, mineral sands, aggregate stone, clay and zinc.
    - Production of: copper, platinum, PGM metals, gold, base metals, iron, steel, coal, coke, heavy mineral sands, vanadium, solder, lime, urea, chrome, gypsum, asphalt, acetylene, LNG liquefaction, vegetable oil, fertilizer, explosives, wood pulp, cement, grease, oil recycling, tyre and general waste pyrolysis, power generation, fuel storage as well as crematoriums, general waste landfills, meat processing and rendering at abattoirs and animal waste incineration.

Courses Completed

- Spreadsheets as an Engineering Tool, Presented by the University of Pretoria, RSA (September 2012)

Courses Presented

- NWU Centre for Environmental Management Essential Air Quality Management Course
- NWU Centre for Environmental Management Integrated Waste Law Course – Air Quality Aspects

Countries of Work Experience

South Africa, Zimbabwe, Namibia, Mozambique, Zambia, Democratic Republic of Congo, Republic of Congo, Ghana, Liberia, Morocco, Mali, Guinea, Suriname, Saudi Arabia

Languages

Language	Proficiency
English	Full proficiency
Afrikaans	Full proficiency

10 Appendix B – Declaration of Independence

The specialist appointed in terms of the Regulations

I, **Nick Brian Grobler** , declare that --

General declaration:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority 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 competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Airshed Planning Professionals (Pty) Ltd

Name of company (if applicable):

8 April 2026

Date:

11 Appendix C – Sound Level Meter Calibration Certificates

sanas
Calibration Laboratory
CAL-048-13-00
CAL-048-01-00

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
15 Mustang Avenue, Pierre van Ryneveld, 0045
Tel: 012 689-2008 (076 920 3070) • Fax: 086 211 4690
E-mail: admin@mnacoustics.co.za / marianka@mnacoustics.co.za
Website: www.mnacoustics.co.za

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2025-AS-0771
ORGANISATION	AIRSHED PLANNING PROFFESSIONALS (PTY) LTD
ORGANISATION ADRESS	POSTNET SUITE #18, PRIVATE BAG X59, HALFWAY GARDENS, MIDRAND, 1685
CALIBRATION OF	SOUND & VIBRATION ANALYZER complete with built-in ⅓-OCTAVE/OCTAVE FILTER, ½" PRE-AMPLIFIER and ½" MICROPHONE
MANUFACTURERS	SVANTEK and ACO
MODEL NUMBERS	SV 977, SV 12L and 7052E
SERIAL NUMBERS	36183, 40659 and 78692
RECEIVE DATE	03 MARCH 2025
DATE OF CALIBRATION	06 – 11 MARCH 2025
RECOMMENDED DUE DATE	MARCH 2026
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:	K.L. MONTSHO	Clause 3.1 & 3.2
Calibrated/Supervised by Calibration Technician:	W.S SHANYONI	Clause 3
Authorized/Checked by SANAS Technical Signatory:	M. NAUDÉ	Date of Issue: 18 MARCH 2025

Director: Marianka Naudé (082 727 3312)

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 ⅓-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	4610290706
Agilent	33522A	Function Generator	MY 6200417
Agilent	34461A	Digital Multimeter	MY 53223905
Major Tech	MT 669	Data Logger	150828456
B&K	4226	Multi-Frequency Calibrator	3081643
Gems	PD6000-6RO	Pressure Gauge Digital	1606-0204475
Svantek	SV 35	Acoustic Calibrator	58106
Major Tech	MT 669	Data Logger	150828469
Keysight	34461A	Digital Multimeter	MY 53224004
G.R.A.S	42 AP	Piston Phone	256092
G.R.A.S	26 AG	½" Pre-Amplifier	189056
Greysinger	80 CL	Data Logger	02304030/1/2
B&K	2829	4-Ch Microphone Power Supply	2329283
G.R.A.S	40 AQ	½" Microphone	160815

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:	***K.L. MONTSHO***	***Clause 3.1 & 3.2***
Calibrated/Supervised by Calibration Technician:	***W.S SIBANYONI***	***Clause 3***
Authorized/Checked by SANAS Technical Signatory:	***M. NAUDÉ***	***Date of Issue: 18 MARCH 2025***

Director: Marianka Naudé | 082 727 3312

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	± 0,3
Self-Generated Noise: A-Weighted with Microphone 26,3 dB A-Weighted Electrical 28,6 dB C-Weighted Electrical 28,8 dB Z-Weighted Electrical 28,7 dB B-Weighted Electrical 19,5 dB	IEC 61672-3: Clause 10	-------
Level Linearity at 8 000 Hz Nominal Range: High Reference Level at 114,0 dB: (49,3 dB to 129,0 dB)	IEC 61672-3: Clause: 14	± 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	± 0,3
Frequency and Time Weightings at 1 000 Hz at 114,0 dB	IEC 61672-3: Clause 13	± 0,3
Tone Burst Response (Max. Fast, Max. Slow, LA_{eq} and SEL)	IEC 61672-3: Clause 16	± 0,3

Calibrated by Calibration Technician:	*K.L. MONTSHO*	*Clause 3.1 & 3.2*
Calibrated/Supervised by Calibration Technician:	*W.S SIBANYONI*	*Clause 3*
Authorized/Checked by SANAS Technical Signatory:	*M. NAUDÉ*	*Date of Issue: 18 MARCH 2025*

Director: Marianka Naudé | 082 727 3312

Parameter	Specification	Uncertainty of Measurement in dB
A-Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	± 0,3
C-Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	± 0,3
Z- Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	± 0,3
B- Weighting Network (31,5 to 20 000) Hz	IEC 61672-3: Clause 12	± 0,3
Peak, C Low Peak Range	IEC 61672-3: Clause 17	± 0,3
Overload Indication	IEC 61672-3: Clause 18	± 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 ⅓-Octave/Octave Filter were calibrated:

Octave Frequency Response (31,5 to 16 000) Hz	IEC 61260: Sections 4.7 & 5.6
⅓-Octave Frequency response (25 to 20 000) Hz	IEC 61260: Sections 4.7 & 5.6

The uncertainty of measurement was estimated as follows: ± 0,3 dB

Conclusion: The built-in Octave Filter complied with the above-specified clauses of the IEC 61260 specifications, recommended tests and requirements according to ARP 0109:2014, **Class 1.**

Calibrated by Calibration Technician:	*K.L. MONTSHO*	*Clause 3.1 & 3.2*
Calibrated/Supervised by Calibration Technician:	*W.S SIBANYONI*	*Clause 3*
Authorized/Checked by SANAS Technical Signatory:	*M. NAUDÉ*	*Date of Issue: 18 MARCH 2025*

Director: Marianka Naudé | 082 727 3312

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: - 28,57 dB re 1 V/Pa
Frequency Response (31,5 to 16 000) Hz

Manufacturer's Specification:
Open Circuit Sensitivity (250 Hz): –29,0 ±2 dB re.1 V/Pa, 50 mV/Pa

The uncertainty of measurements was estimated as follows: ± 0,3 dB

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)	114,2	114,2	0,0	± 0,3
31,5	111,3	111,3	0,0	± 0,3
63	113,5	113,4	- 0,1	± 0,3
125	114,1	114,0	- 0,1	± 0,3
250	114,2	114,1	- 0,1	± 0,3
500	114,2	114,1	- 0,1	± 0,3
1 000	114,1	114,2	+ 0,1	± 0,3
2 000	113,8	113,7	- 0,1	± 0,3
4 000	112,9	112,8	- 0,1	± 0,3
8 000	106,8	107,4	+ 0,6	± 0,3
12 500	101,4	101,5	+ 0,1	± 0,3
16 000	96,5	97,5	+ 1,0	± 0,3

Calibrated by Calibration Technician:	*K.L. MONTSHO*	*Clause 3.1 & 3.2*
Calibrated/Supervised by Calibration Technician:	*W.S SIBANYONI*	*Clause 3*
Authorized/Checked by SANAS Technical Signatory:	*M. NAUDÉ*	*Date of Issue: 18 MARCH 2025*

Director: Marianka Naudé | 082 727 3312

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 for items in Section 3 were:
Temperature: (23 ± 3) °C
Relative Humidity: (50 ± 15) %RH

The Environmental Conditions specified in the relevant IEC and ISO standards took precedence.

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 ½" Microphone must be used as a unit. The ½" 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:	*K.L. MONTSHO*	*Clause 3.1 & 3.2*
Calibrated/Supervised by Calibration Technician:	*W.S SIBANYONI*	*Clause 3*
Authorized/Checked by SANAS Technical Signatory:	*M. NAUDE*	*Date of Issue: 18 MARCH 2025*

Director: Marianka Naudé | 082 727 3312

sanas
Calibration Laboratory
CAL-048-13-00
CAL-048-01-00

M AND N ACOUSTIC SERVICES (Pty) Ltd
Co. Reg. No: 2012/123238/07 VAT NO: 4300255876 BEE Status: Level 4
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E-mail: admin@mnacoustics.co.za / marianka@mnacoustics.co.za
Website: www.mnacoustics.co.za

CERTIFICATE OF CONFORMANCE

CERTIFICATE NUMBER	2025-AS-0770
ORGANISATION	AIRSHED PLANNING PROFFESSIONALS (PTY) LTD
ORGANISATION ADDRESS	POSTNET SUITE #18, PRIVATE BAG X59, HALFWAY GARDENS, MIDRAND, 1685
CALIBRATION OF	ACOUSTIC CALIBRATOR
MANUFACTURER	SVANTEK
MODEL NUMBER	SV 33
SERIAL NUMBER	43170
RECEIVE DATE	03 MARCH 2025
DATE OF CALIBRATION	06 MARCH 2025
RECOMMENDED DUE DATE	MARCH 2026
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:	Authorized/Checked by:	Date of Issue:
W.S. SIBANYONI (CALIBRATION TECHNICIAN)	M. NAUDÉ (SANAS TECHNICAL SIGNATORY)	18 MARCH 2025

Director: Marianka Naudé (082 727 3312)

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 AG	½" Pre-Amplifier	189056
G.R.A.S	40 AQ	½" Microphone	160815
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
B&K	2829	4-Ch Microphone Power Supply	2329283

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 1 000,04 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:	*Authorized/Checked by:*
W.S. SIBANYONI *(CALIBRATION TECHNICIAN)*	*M. NAUDÉ* *(SANAS TECHNICAL SIGNATORY)*

Director: Marianka Naudé | 082 727 3312

12 Appendix D – Survey Site Photos

Facing north

Facing east

Facing south

Facing west

Figure 11: Photographs of environmental noise survey site 1

Facing north

Facing east

Facing south

Facing west

Figure 12: Photographs of environmental noise survey site 2

Facing north

Facing east

Facing south

Facing west

Figure 13: Photographs of environmental noise survey site 3

Facing north

Facing east

Facing south

Facing west

Figure 14: Photographs of environmental noise survey site 4

Facing north

Facing east

Facing south

Facing west

Figure 15: Photographs of environmental noise survey site 5

13 Appendix E – Recorded Time-series Broadband Sound Pressure Levels

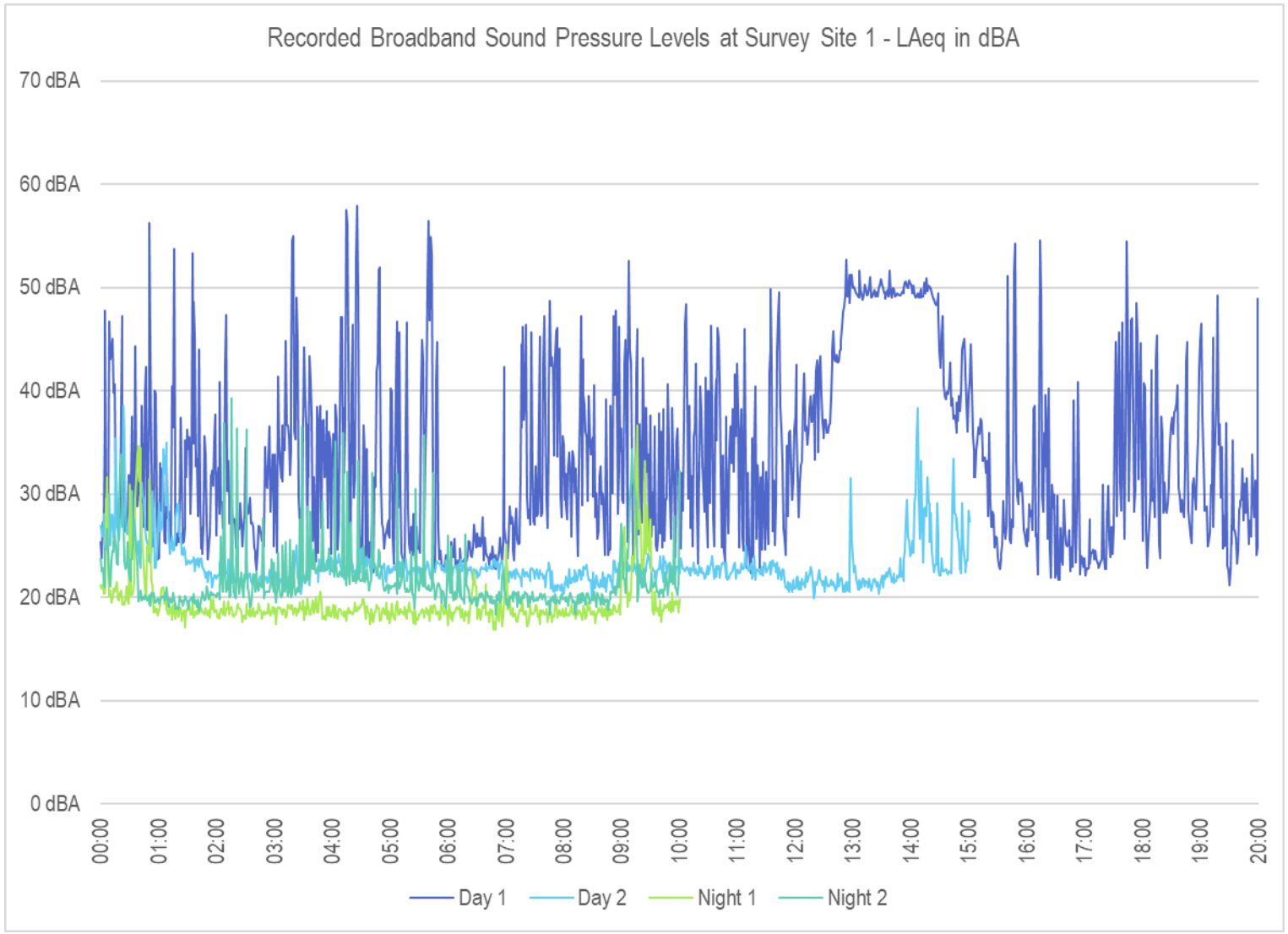

Figure 16: Recorded Time-Series Broadband Sound Pressure Levels at Survey Site 1

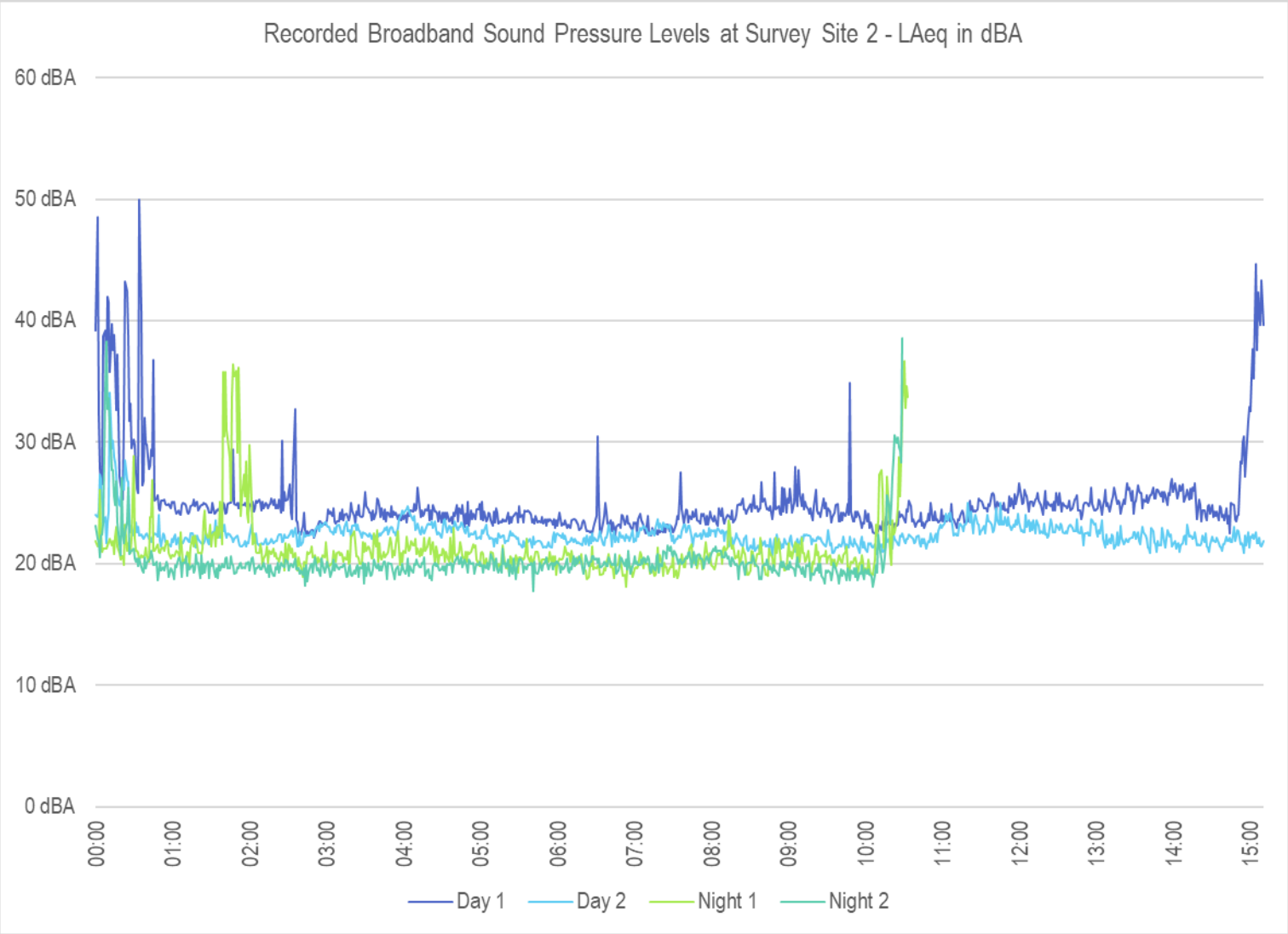

Figure 17: Recorded Time-Series Broadband Sound Pressure Levels at Survey Site 2

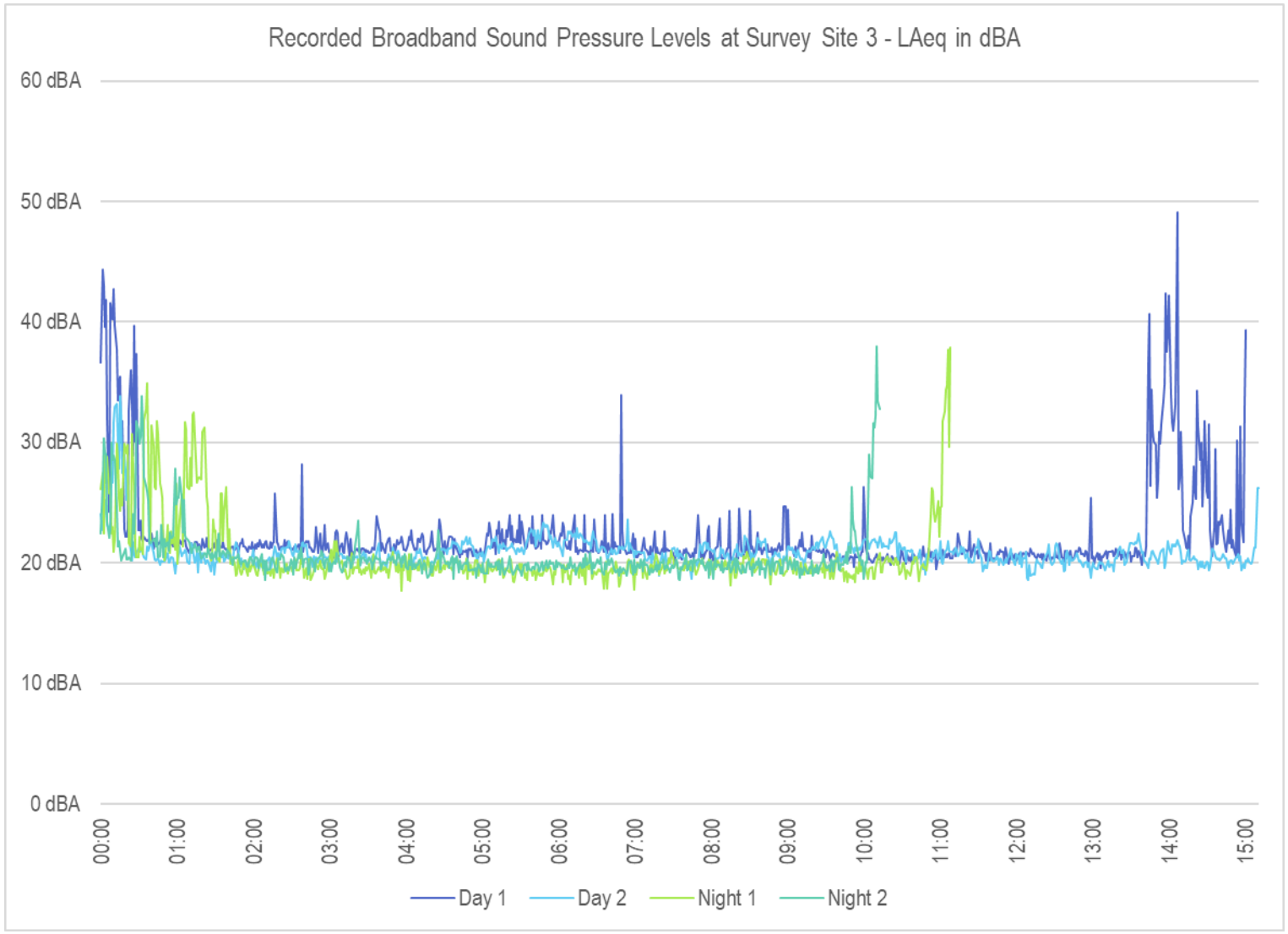

Figure 18: Recorded Time-Series Broadband Sound Pressure Levels at Survey Site 3

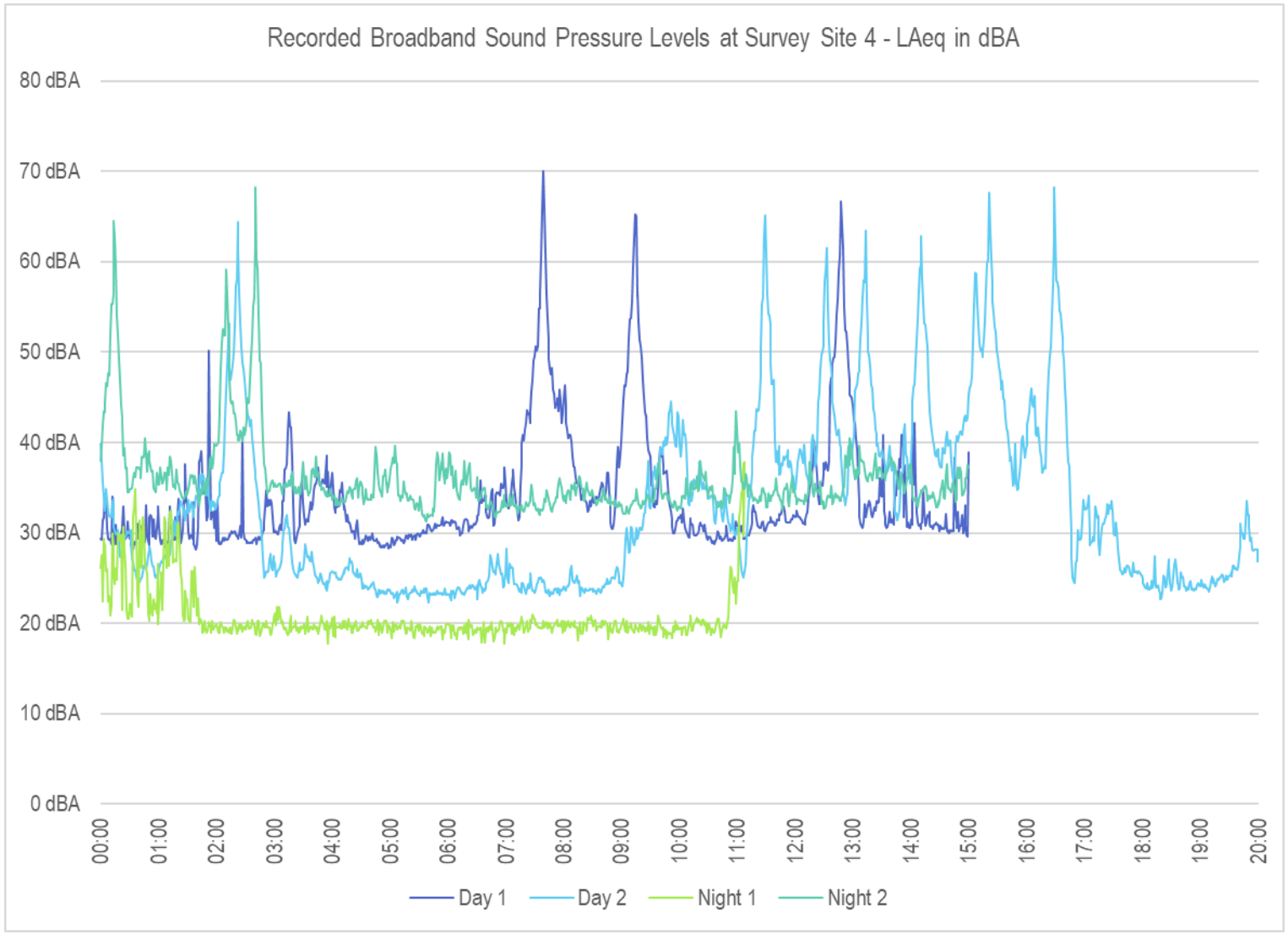

Figure 19: Recorded Time-Series Broadband Sound Pressure Levels at Survey Site 4

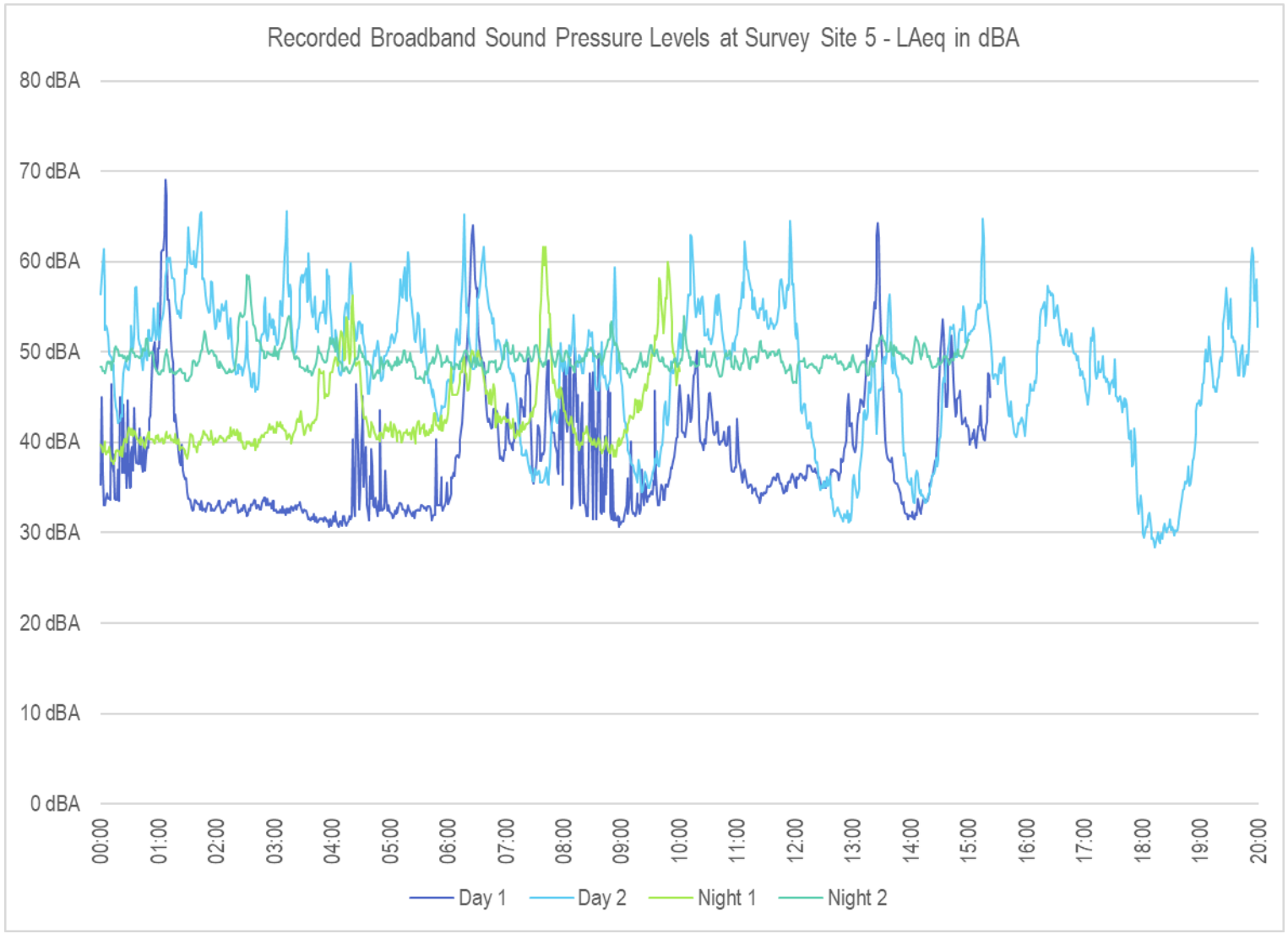

Figure 20: Recorded Time-Series Broadband Sound Pressure Levels at Survey Site 5

14 Appendix F – Noise Survey Logsheets

NOISE SAMPLING LOG SHEET

SITE NUMBER: 1		SLM DATA RECORD: Mar 1	
Longitude/Easting: 26.953960	Latitude/Northing: -27.874320		Elevation:
Short location Description & Notes: Ons Anker skool			

SETUP:	Start Date & Time: 2/6/25 18:19	End Date & Time: NB min 20	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.8	S	8.2	60	0	

NOISE CLIMATE	☑ Birds	☑ Insects	☑ Dogs	☐ Music	☑ Community	☐ Air Traffic	☑ Road Traffic	☐ Constr.	☐ other

Description:

- long grass, trees, & wire fence, cattle, houses occupied, dirt road
  ↳ continuous

Time	Description	Time	Description	Time	Description
18:19	Cattle } To many				
	Dog }				
18:20	Cattle ; almost continuous (stops				
18:21	Dog;				
18:22	Dog				
18:27	Shout + conversation				
18:31	car + conversation				
	(stops. 18:34)				
18:35	shout + conversation				
18:37	Car + Car door.				

CF = ~~-0.1~~ -0.19dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 1	SLM DATA RECORD: MORIZ	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes: Ons Anker School		

SETUP:	Start Date & Time: 3/8/2025 15:44	End Date & Time: 18:57	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0	N	29.6	57	0	

NOISE CLIMATE	☐ Birds	☑ Insects	☑ Dogs	☑ Music	☐ Community	☐ Air Traffic	☑ Road Traffic	☐ Constr.	☐ other

Description:

- No cattle tonight.

Time	Description	Time	Description	Time	Description

CF = -0.4 dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 1 Night	SLM DATA RECORD: MOR7	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes: Ons Anker School		

SETUP:	Start Date & Time: 3/6/25 10 Min	End Date & Time:	Sensitivity Before:	Sensitivity After:
	0:23			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.6	S	7.6	56	0	

NOISE CLIMATE	□ Birds	□ Insects	□ Dogs	□ Music	☑ Community	☑ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:
- Cattle

Time	Description	Time	Description	Time	Description
00:23	Cattle				
09:30	Cattle				

CF = -0.2 dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 1 Night	SLM DATA RECORD: MOR 15	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes: Ons Anker School		

SETUP:	Start Date & Time: 3/6/25 10 Min 22:11	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0	S	7.3	33	0	

NOISE CLIMATE	☑ Birds	☑ Insects	☑ Dogs	☐ Music	☑ Community	☐ Air Traffic	☐ Road Traffic	☐ Constr.	☐ other

Description:

- No cattle tonight

Time	Description	Time	Description	Time	Description

NOISE SAMPLING LOG SHEET

SITE NUMBER: 2	SLM DATA RECORD: MAR 2	
Longitude/Easting: 27.1111	Latitude/Northing: -28.015746	Elevation:
Short location Description & Notes: Farm road 1		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	2/6/25 15min 19:23			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.3 - 0.8	N	11	34	0	

NOISE CLIMATE	☑ Birds	☑ Insects	☐ Dogs	☐ Music	☐ Community	☐ Air Traffic	☑ Road Traffic	☐ Constr.	☐ other

Description:
- Hum from Phomolong, tall grass, dirt road, trees across the road + music

Time	Description	Time	Description	Time	Description
19:24	Car door				

Ct = -0.32dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 2	SLM DATA RECORD: MOR13	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Farm road 1		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	3/6/25 15Min 19:56			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.5 - 0.7	N	10.6	53	0	

NOISE CLIMATE	□ Birds	□ Insects	☑ Dogs	□ Music	☑ Community	□ Air Traffic	□ Road Traffic	□ Constr.	□ other

Description:

- Hum from Phomolong

Time	Description	Time	Description	Time	Description

NOISE SAMPLING LOG SHEET

SITE NUMBER: 2 Night	SLM DATA RECORD: MOR 8	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes: Farm Road 1		

SETUP:	Start Date & Time: 3/6/26 10Min	End Date & Time:	Sensitivity Before:	Sensitivity After:
	1:18			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.7 – 1.5	N	7.4	51	0	

NOISE CLIMATE	□ Birds	☑ Insects	☑ Dogs	□ Music	□ Community	□ Air Traffic	□ Road Traffic	□ Constr.	□ other
Description:									
•									

Time	Description	Time	Description	Time	Description

CF = 0.2dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 2 Night	SLM DATA RECORD: MAR 16	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Farm Road 1		

SETUP:	Start Date & Time: 31/2-5 10 min 23:00	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	2.5	N	8.4	56	0	

NOISE CLIMATE	☑ Birds	□ Insects	☑ Dogs	□ Music	☑ Community	□ Air Traffic	□ Road Traffic	□ Constr.	□ other

Description:

-

Time	Description	Time	Description	Time	Description

NOISE SAMPLING LOG SHEET

SITE NUMBER: 3	SLM DATA RECORD: MOR 3	
Longitude/Easting: 26.9700442	Latitude/Northing: -23.17378	Elevation:
Short location Description & Notes: Farm road 2		

SETUP:	Start Date & Time: 2/6/25 15 min 20:35	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.5	N	6.4	38	0	

NOISE CLIMATE	☑ Birds	☑ Insects	☐ Dogs	☐ Music	☐ Community	☑ Air Traffic	☑ Road Traffic	☐ Constr.	☐ other

Description:

- Wire fence - medium to tall grass, powerline.

Time	Description	Time	Description	Time	Description

Cf −0.27 dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 3	SLM DATA RECORD: MOR14	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Farm Road 2		

SETUP:	Start Date & Time: 3/6/2025 15Min 21:04	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.5	S	6.4	60	0	

NOISE CLIMATE	☑ Birds	□ Insects	□ Dogs	□ Music	□ Community	□ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:

-

Time	Description	Time	Description	Time	Description

NOISE SAMPLING LOG SHEET

SITE NUMBER: 3 Night	SLM DATA RECORD: MORG	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Farm Road 2		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	3/6/25 10min 22:17			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0	N	2.9	65	0	

NOISE CLIMATE	☑ Birds	□ Insects	□ Dogs	□ Music	□ Community	□ Air Traffic	□ Road Traffic	□ Constr.	□ other

Description:
- Frost on grass

Time	Description	Time	Description	Time	Description

Ct = 0.2910

NOISE SAMPLING LOG SHEET

SITE NUMBER: 3 Night	SLM DATA RECORD: MOR17	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Farm Road 2		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	3/6/25 10min 23:56			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0	N	6.3	68	0	

NOISE CLIMATE	□ Birds	□ Insects	□ Dogs	□ Music	□ Community	□ Air Traffic	□ Road Traffic	□ Constr.	□ other
Description: •									

Time	Description	Time	Description	Time	Description

CF = 0.450

NOISE SAMPLING LOG SHEET

SITE NUMBER: 4	SLM DATA RECORD: MCRL	
Longitude/Easting: 26.879039	Latitude/Northing: -28.035107	Elevation:
Short location Description & Notes: Harmony Gold Saaiplaas		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	2/6/25 15min 25:25			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	07	N	9.4	40	0	

NOISE CLIMATE	□ Birds	☑ Insects	□ Dogs	□ Music	□ Community	☑ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:
- Hum from plant. Power lines ± 15-20m S-SE. Tall grass. Tree ± 20m N

Time	Description	Time	Description	Time	Description
21:31	~~Truck~~ stops 21:33				
~~21~~:	Bus				
21:34	Car				
21:38	Car				

NOISE SAMPLING LOG SHEET

SITE NUMBER: 4	SLM DATA RECORD: MOR 18	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Harmony Gold Saaiplaas		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	4/6/25 18:00 ~~18min~~ 29 min			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.4	W	14.2	37	0	

NOISE CLIMATE	☐ Birds	☑ Insects	☐ Dogs	☐ Music	☐ Community	☑ Air Traffic	☑ Road Traffic	☐ Constr.	☐ other

Description:
- Hum from Saaiplaas plant

Time	Description	Time	Description	Time	Description
18:02	car				
18:09	car				
18:11	car				
18:12	car				
18:13	car				
18:14	car				
18:15	car				
	Bus				
18:16	car				
18:21	car				

Lt = 42.8dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 4 Night	SLM DATA RECORD: MOR 18	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Har many Gold Sacaplaas		

SETUP:	Start Date & Time: 31/6/25 10min 3:00	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0.5	N	3	76	0	

NOISE CLIMATE	□ Birds	□ Insects	□ Dogs	□ Music	□ Community	□ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:
- Hum from plant. Frost on grass

Time	Description	Time	Description	Time	Description
3:05	Car				

NOISE SAMPLING LOG SHEET

SITE NUMBER: 4 Night	SLM DATA RECORD: MCR20	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Harmony Gold Saaiplaas		

SETUP:	Start Date & Time: 4/6/25 15 min 22:05	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	2 - 3 Burst up to 4 m/s	N	10	70	0	

NOISE CLIMATE	□ Birds	☑ Insects	□ Dogs	□ Music	□ Community	□ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:

-

Time	Description	Time	Description	Time	Description
22:05	car				
22:07	car				
22:08	car				

NOISE SAMPLING LOG SHEET

SITE NUMBER: 5	SLM DATA RECORD: NOR #6	
Longitude/Easting: 26.867453	Latitude/Northing: -27.983465	Elevation:
Short location Description & Notes: Goldfields & Masimong 4		

SETUP:	Start Date & Time: 2/6/25 15 21:56	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0-0.5	N	11	40	0	

NOISE CLIMATE	□ Birds	□ Insects	☑ Dogs	□ Music	□ Community	□ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:
- Trees, medium grass. Hum from mine (NE) Masimong 5? + and 4. (Reverze horns)

Time	Description	Time	Description	Time	Description
21:56	Dog steps 21:58				
21:57	Car				
22:00	Dog				
22:02	Bus				
22:03	Car				
22:04	Dog				
22:06	Car				
22:09	Bus				
22:10	Car				

L1 = 0.2 dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 5	SLM DATA RECORD: Mar 19	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes: Goldfields Masi Morgh		

SETUP:	Start Date & Time: 4/6/25 18:41	18 min 20	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0	NE	11.2	38	0	

NOISE CLIMATE	☑ Birds	☐ Insects	☐ Dogs	☐ Music	☐ Community	☑ Air Traffic	☑ Road Traffic	☐ Constr.	☐ other

Description:
- Lots of traffic this time of the night.

Time	Description	Time	Description	Time	Description
18:41	car x2	18:46	carx2 + carx2+car		
18:42	car	18:47	car + car + carx3		
	car	18:49	carx2 + carx2		
	carx2	18:51	car + Bus + carx2		
	Bus	18:52	car + carx3 + carx3 + car		
	car	18:54	car		
18:43	carx4	18:56	carx2 + car + car + car		
	car	18:57	car + car + carx2		
Lots 18:44	car	18:58	car + car		
	carx3	19:00	car + car		
	car	19:01	car		
18:45	car				
	car				
	car				

Ct = 0.4 dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 5 Night	SLM DATA RECORD: MOR 11	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Goldfields Masimong 4		

SETUP:	Start Date & Time:	End Date & Time:	Sensitivity Before:	Sensitivity After:
	3/6/25 10Min 3:24			

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	0	N	5	68	0	

NOISE CLIMATE	□ Birds	□ Insects	□ Dogs	□ Music	□ Community	□ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:
- Hum from Masimong 4 Cluster E + Masimong 5 quite prominent.

Time	Description	Time	Description	Time	Description
3:31	Car				
3:33	Car				
3:35	Car				
3:38	Car				

Ct = -0.22dB

NOISE SAMPLING LOG SHEET

SITE NUMBER: 5 Night	SLM DATA RECORD: MOR24	
Longitude/Easting:	Latitude/Northing:	Elevation:
Short location Description & Notes : Goldfields Masimong 4		

SETUP:	Start Date & Time: 4/6/25 15Min 22:34	End Date & Time:	Sensitivity Before:	Sensitivity After:

METEROLOGY	Wind Speed(m/s)	Wind Direction	Temperature(°C)	Humidity (%)	Clouds (%)	Remarks
Start	1 - 3 Burst upto 4 M/s	N			0	

NOISE CLIMATE	□ Birds	□ Insects	☑ Dogs	□ Music	□ Community	□ Air Traffic	☑ Road Traffic	□ Constr.	□ other

Description:

- Hum from plant Masimong 5 (North)
  Trees ± NE ± 50 m (Wind)

Time	Description	Time	Description	Time	Description
22:34	Dog				
22:36	Cars				

15 Appendix G – Significance Rating Methodology

The impact significance rating methodology, as presented herein and utilised for all EIMS Impact Assessment Projects, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. The ER is determined for the pre- and post-mitigation scenario. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives.

Determination of Environmental Risk:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E + D + M + R) * N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table A-1 below.

Table A-1: Criteria for determining impact consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or

Aspect	Score	Definition
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table A-2.

Table A-2: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table A-3: Determination of environmental risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		Probability				

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table A-4.

Table A-4: Significance classes

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

Impact Prioritisation:

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table A-5: Criteria for determining prioritisation

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table A-5. The impact priority is therefore determined as follows:

$$Priority = Cl + LR$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (refer to Table A-6).

Table A-6: Determination of prioritisation factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e., if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table A-7: Final environmental significance rating

Significance Rating	Description
≥-17	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
≥-17, ≤-9	Medium negative (i.e. where the impact could influence the decision to develop in the area).
>-9, <0	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
>0, <9	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥9, ≤17	Medium positive (i.e. where the impact could influence the decision to develop in the area).
>17	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.