Environmental Noise Impact Assessment for the Combined-Cycle Gas Turbine Power Plant at Kelvin Power Station

Project done on behalf of **Environmental Impact Management Services (Pty) Ltd**

Project Compiled by:

R von Gruenewaldt

Report No: 23EIM03 | **Date:** July 2024

Address: 62 Constantia Ave, Pretoria
Postal: PostNet Suite #18 Private Bag x59, Halfway House, 1685
Tel: +27 (0)11 805 1940

www.airshed.co.za

Report Details

Status	Rev 1
Report Title	Environmental Noise Impact Assessment for the Combined-Cycle Gas Turbine Power Plant at Kelvin Power Station
Report Number	23EIM03
Date	July 2024
Client	Environmental Impact Management Services (Pty) Ltd
Prepared by	Renee von Gruenewaldt, (Pr. Sci. Nat.), MSc (University of Pretoria)
Field Work by	Nick Grobler, BEng (Chem), BEng (Hons) (Env) (University of Pretoria)
Reviewed by	Nick Grobler, BEng (Chem), BEng (Hons) (Env) (University of Pretoria)
Notice	Airshed Planning Professionals (Pty) Ltd is a consulting company located in Midrand, South Africa, specialising in in air quality, climate change and noise impact assessments. The company originated in 1990 as Environmental Management Services, which amalgamated with its sister company, Matrix Environmental Consultants, in 2003.
Declaration	Airshed is an independent consulting firm with no interest in the project other than to fulfil the contract between the client and the consultant for delivery of specialised services as stipulated in the terms of reference.
Copyright Warning	

Revision Record

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

LIST OF ACRONYMS AND SYMBOLS

Airshed	Airshed Planning Professionals (Pty) Ltd
Anergi	Anergi group
BSI	British Standard
CCGT	Combined-cycle gas turbine
dB	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure.
dBA	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure that has been A-weighted to simulate human hearing.
EHS	Environmental Health and Safety
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
GG	Government gazette
GN	Government notice
HRSG	Heat Recovery Steam Generator
Hz	Frequency in Hertz
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IPB	Isolated Phase Bus Duct
ISO	International Standards Organisation
Kelvin	Kelvin Power (Pty) Ltd
kHz	Kilohertz
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_{Aleq} (T)	The impulse corrected A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)
L_{A90}	The A-weighted 90% statistical noise level, i.e., the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the L_{Aeq} could have been in the absence of noisy single events and is considered representative of background noise levels (L_{A90}) (in dBA)
L_{AFmax}	The A-weighted maximum sound pressure level recorded during the measurement period

L_{AFmin}	The A-weighted minimum sound pressure level recorded during the measurement period
L_P	Sound pressure level (in dB)
L_W	Sound Power Level (in dB)
m^3	Cubic metres
m/s	Speed in metres per second
MW	Megawatt
NACA	National Association for Clean Air
NEMA	National Environmental Management Act
NEMAQA	National Environmental Management: Air Quality Act
NIA	Noise Impact Assessment
NSRs	Noise sensitive receptors
Pa	Pressure in Pascal
μPa	Pressure in Micro-Pascal
p_{ref}	Reference pressure, 20 μPa
PIC	Public Investment Corporation
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professions
SANS	South African National Standards
SAWS	South African Weather Service
SLM	Sound level meter
SRTM	Shuttle Radar Topography Mission
USGS	United States Geological Survey
WHO	World Health Organisation

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 Combined-Cycle Gas Turbine (CCGT) Power Plant at the Kelvin Power Station (hereafter referred to as the project).

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

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

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

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

- The closest potential sensitive receptors to the proposed project consist of residential settlements and industrial areas.
- The baseline noise levels (L_{Aeq}) for the area during day-time conditions were between 42.3 dBA and 60.6 dBA and for night-time conditions between 48.0 dBA and 59.4 dBA.

The source inventory, local meteorological conditions and information on local land use were used to populate the noise attenuation model (CadnaA, ISO 9613). The propagation of noise was calculated over an area of 5 km east-west by 5 km north-south. The area was divided into a grid matrix with a 20 m resolution.

The main findings of the impact assessment were as follows:

- The environmental noise impact assessment considered the construction and operations due to the proposed project only.

- Noise levels due to project construction activities are predicted to be within the Gauteng Noise Control Regulations of 60 dBA and recommended day-time Environmental Noise Standards at all residential NSRs within the study area.
- Noise levels due to operational phase project activities are predicted to be within Gauteng Noise Control Regulations and the recommended day-time Environmental Noise Standards at all residential NSRs within the study area.
- For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); the predicted increase in noise levels from the current baseline due to proposed project construction only is expected to result in no community reaction.
- The predicted increase in noise levels from the current baseline due to proposed project operations only is expected to result in "little" reaction with sporadic complaints at the industrial area directly north and west of the project site.
- The 1992 Noise Control Regulations 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 increase in noise levels from baseline due to project operations does not exceed 7 dBA at surrounding NSRs.

The noise impacts due to the project operations are within the Environmental Noise Standards at the closest NSRs if the plant operates with the sound pressure of 85 dBA at a distance of 1 m from all equipment. This may be achieved by including noise attenuators or enclosures where feasible.

Based on the findings of the assessment and provided attenuation measures are in place, it is the specialist opinion that the project may be authorised.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Environmental Noise Impact Assessment for the Combined-Cycle Gas Turbine Power Plant at Kelvin Power Station

1 INTRODUCTION

Kelvin Power Pty Ltd ("Kelvin") is a coal fired power plant situated in Kempton Park, Ekurhuleni, South Africa, owned by the Anergi group ("Anergi") and Public Investment Corporation ("PIC"). The existing power plant comprises of: (i) the still operational B Station which was built in the 1960s and includes seven 60 MW steam turbines and eight pulverised coal boilers, and (ii) the now decommissioned A Station which was built in the 1950s. The A station ceased operations in 2012 and a Basic Assessment has been approved for its demolition.

A pre-feasibility study was concluded in 2023 to assess the various technology options available to generate 450 MW to 650 MW on the current A Station site. The pre-feasibility study's objective was to identify proven technology available for generation on the available site considering the infrastructure available. The study concluded that a combined-cycle gas turbine (CCGT) Power Plant with a net output of approximately 600 MW comprising one H class gas turbine, a heat recovery boiler and a steam turbine, would be the optimum technology for this site. The plant is expected to operate as a mid-merit plant with an annual average capacity factor of 50%.

The main structures at the plant would consist of:

- Gas turbine building;
- Steam turbine building;
- Heat Recovery Steam Generator (HRSG);
- Mechanical draft cooling tower;
- Extra High Voltage (EHV) substation;
- Auxiliary buildings;
- Administration buildings; and,
- Exhaust stack.

The site allocated to the new plant is in the area of the redundant A Station auxiliary plant formerly occupied by the A Station dry coal store, coal tipplers, coal stockpile and cooling towers. In addition to the construction area of the permanent plant, other construction facilities such as laydown areas, fabrication shops, warehousing, construction offices, and welfare facilities would be required. The A Station auxiliary plant area is sufficient to accommodate both the permanent plant and the construction facilities outlined above.

Cooling water would be sourced from the existing Kelvin water supply pipelines. Treated sewage wastewater (grey water) would be supplied to the power plant from Diepsloot ~37 km away for use as cooling water. Approximately 52 033 m³ per day of such water has previously been supplied to the Kelvin power plant and as such, quantity would be available for the new plant. The new plant is expected to consume approximately 11 000 m³ of water per day when operating as a mid-merit plant with a capacity factor of 50%. The Diepsloot pump house and water pipeline to the plant is the responsibility of, and is maintained by, Kelvin Power. The grey water is dosed with biocides, algaecides, and a corrosion inhibitor.

In addition to the new plant that would be constructed on the Kelvin site, an electrical connection to an Eskom / City Power substation and a gas pipeline to the Sasol gas pipeline system would be required. Should the new plant be connected to the City Power Sebenza substation, a transmission line of approximately 1 km would be required. Alternatively, if the connection was to the Eskom North Rand substation, a transmission line of approximately 5 km would be required. Construction of this transmission line would be the responsibility of Kelvin. A new 25 km gas supply pipeline connecting the new plant to the Sasol high pressure gas transmission system would be required. Construction of this gas supply pipeline would be the responsibility of Sasol.

Figure 1-1: CCGT layout

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 CCGT Power Plant (hereafter referred to as the project).

1.1 Study Objective

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

1.2 Scope of Work

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

- A review of available technical project information.
- A review of the legal requirements and applicable environmental noise guidelines.

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

1.3 Specialist Details

1.3.1 Specialist Details

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

1.3.2 Competency Profile of Specialist

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

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

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

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

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

Declaration of independence is provided in Appendix B

1.4 Description of Activities from a Noise Perspective

Sources of noise at the project site will include the following:

- Gas turbines;
- Steam turbines;
- Heat Recovery Steam Generator (HRSG);
- Pumps;
- Fans;
- Compressors;
- Motors; and,
- Exhaust stacks.

1.5 Background to Environmental Noise and the Assessment Thereof

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

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

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

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

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

Where:

Lp *is the sound pressure level in dB;*

p *is the actual sound pressure in Pa; and*

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

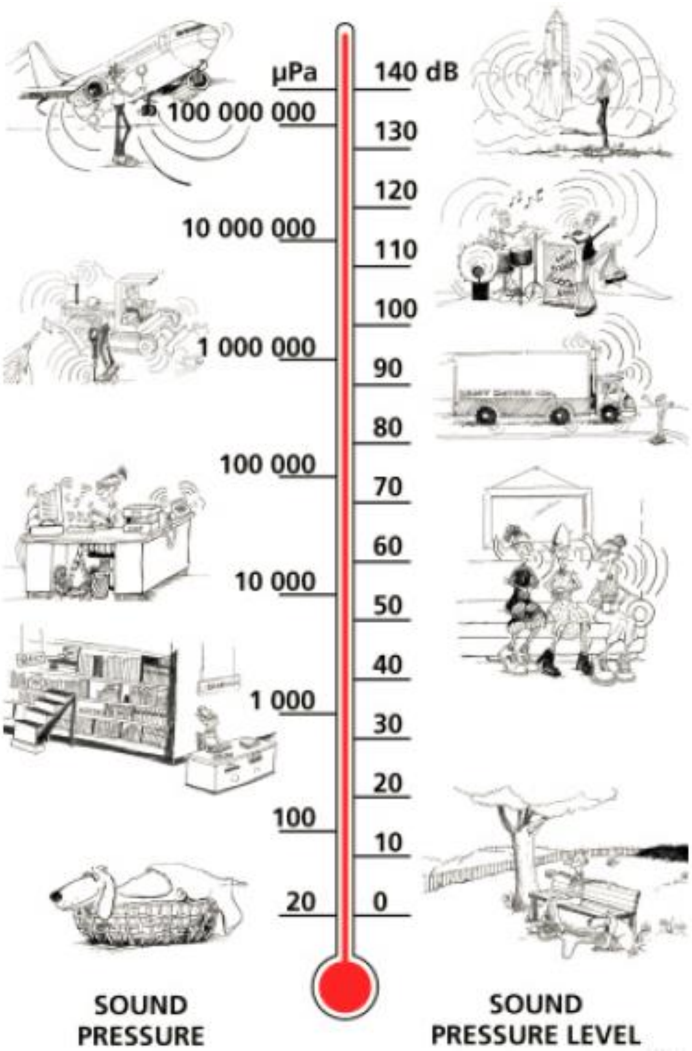


Figure 1-2: The decibel scale and typical noise levels (Brüel & Kjær Sound & Vibration Measurement A/S, 2000)

1.5.1 Perception of Sound

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

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

1.5.2 Frequency Weighting

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

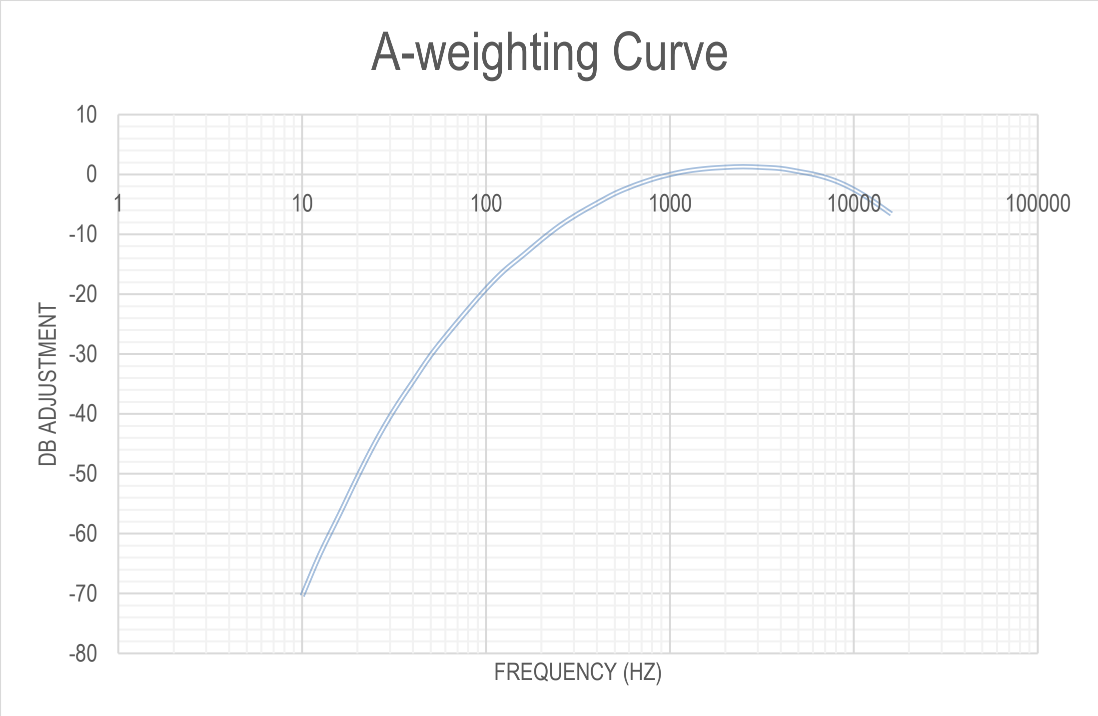


Figure 1-3: A-weighting curve

1.5.3 Adding Sound Pressure Levels

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

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

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).

1.6 Study Approach and Methodology

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

1.6.1 Information Review

An information requirements list was sent to EIMS at the onset of the project. In response to the request, the following information was supplied:

- Layout maps;
- Description of project activities; and
- List of project equipment.

1.6.2 Review of Assessment Criteria

In South Africa, provision is made for the regulation of noise under the National Environmental Management Air Quality Act (NEMAQA) (Act. 39 of 2004). Draft Environmental Noise Standards, referencing the SANS 10103 of 2008 'The measurement and rating of environmental noise with respect to annoyance and to speech communication', was made available in June 2024. These standards are currently out for comment. These draft standards, together with the Gauteng Noise Control Regulations, were also considered for 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 facility's property. Potential NSRs were identified from satellite imagery (Google Earth – accessed June 2024) and the site visit conducted on 5 to 6 February 2024.

The ability of the environment to attenuate noise as it travels through the air was studied by considering local meteorology, land use and terrain. Atmospheric attenuation potential was described based on measured meteorological data measured at OR Tambo for the period for the period 2020 to 2022. Land-use was determined from satellite imagery (Google Earth) and site observations.

1.6.4 Baseline Environmental Noise Survey

Reference is made to the noise survey conducted for the area on 5 to 6 February 2024.

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

- The survey was designed by a trained specialist.
- Sampling was carried out using a Type 1 sound level meter (SLM) that meets all appropriate International Electrotechnical Commission (IEC) standards and is subject to annual calibration by an accredited laboratory. Equipment details are included in Table 1-1. Calibration certificates are included in Appendix C.
- The acoustic sensitivity of the SLM was tested with a portable acoustic calibrator before and after each measurement session.
- Samples representative and sufficient for statistical analysis, were taken with the use of the portable SLM capable of logging data continuously over the time. Measurements representative of the day- and night-time conditions were taken.
- As generally recommended, the following acoustic indices were recoded: LAeq (T), LAIeq (T); LAFmax; LAFmin; statistics and 3rd octave frequency spectra.
- The SLM was located approximately 1.5 m above the ground and 10 m from reflecting surfaces.
- SANS 10103 states that one must ensure (as far as possible) that the measurements are not affected by the residual noise and extraneous influences, e.g., wind, electrical interference and any other non-acoustic interference. All measurements were taken during periods where wind speeds were less than 5 m/s.

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

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

1.6.5 Source Inventory

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

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

1.6.6 Noise Propagation Simulations

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

1.6.6.1 ISO 9613

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

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

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

Where;

L_P is the sound pressure level at the receiver;
L_W is the sound power level of the source;
K_1 is the correction for geometrical divergence;
K_2 is the correction for atmospheric absorption;
K_3 is the correction for the effect of ground surface;
K_4 is the correction for reflection from surfaces; and
K_5 is the correction for screening by obstacles.

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

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

1.6.6.2 Simulation Domain

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

The propagation of noise was calculated over an area of 5 km east-west by 5 km north-south and encompasses the project area. The southwest corner of the calculated area is 619 780 m Easting and 7 108 575 m Northing (WGS84). The area was divided into a grid matrix with a 20 m resolution. The model was set to calculate L_P’s at each grid intercept point at a height of 1.5 m above ground level.

1.6.7 Presentation of Results

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

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

1.6.8 Recommendations of Management and Mitigation

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

1.7 Management of Uncertainties

The following limitations and assumptions should be noted:

- The quantification of sources of noise was limited to the construction and operational phase of the project. Closure and decommissioning phase activities are expected to be similar to construction phase and its impacts only assessed qualitatively. Noise impacts will cease post-closure.
- Although other existing sources of noise within the area were identified, such sources were not quantified but were taken into account during the survey.
- Construction activities for the project will be from 7am to 5pm, 5 days per week (Monday to Friday).
- The estimated construction will take approximately 36-42 months, with mobile equipment and activities generating the maximum noise only 50% of the time.
- Ony normal project operations were assessed. The impacts due to emergency activities were not modelled.
- It was provided that all equipment for operations will be selected to limit the sound pressure to below 85 dBA in any passage or work area. This will be achieved by ensuring that the noise of all equipment at 1 m will be less than 85 dBA. This may be achieved by including noise attenuators or enclosures where feasible. The attenuation modelling of the noise impacts under operating conditions takes this into account.
- The project will operate a 65% capacity (8760 hours per year). The general daily operations were provided as follows:
    - Morning peak between 6am to 9am;
    - Evening peak between 5pm and 7pm.

- Hot starts would be 30-40 minutes in duration.
- Black starts would be for 4 hours per day and there would be 5 black starts per year.
- The environmental noise assessment focussed on the evaluation of impacts for humans. It is important to note that the applicability of environmental noise assessments to wildlife is limited as it is not possible simply to infer the impacts of anthropogenic noise on wildlife from the human literature. This is because the hearing ranges and sensitivities of non-human animals can be very different from those of humans. Noise studies on humans understandably use methodologies that tailors the quantification of anthropogenic noise to our hearing capabilities: for example, the use of microphones limited to the human hearing range (20 Hz – 20 kHz) and the implementation of frequency filters effectively mimicking human auditory sensitivity (A-weighting). As such, noise measurements may only cover part of the relevant acoustic range for other species. Moreover, species differences in behaviour, physiology, and ecology, in addition to hearing capabilities and perception, mean that extrapolations from human studies can provide only a limited understanding of the potential impact of anthropogenic noise on wildlife.

2 REGULATORY REQUIREMENTS AND ASSESSMENT CRITERIA

2.1 National Noise Control Regulations

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

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

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

2.2 Gauteng Noise Control Regulations

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

(a) A "controlled area" is a piece of land designated by a local authority where, in case of industrial noise near an industry:
   i. the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter was in operation, exceeds 60 dBA; or
   ii. the calculated outdoor equivalent continuous "A"-weighted" sound pressure level at a height of at least 1.2 metres, but not more than 1.4 metres, above the ground for a period of 24 hours, exceeds 60 dBA.

(b) A "disturbing noise" means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, as per SANS 10103 (2008) (Table 2-1).

2.3 South African National Standards

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

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

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

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

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

2.4 Regulations Regarding Report Writing

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

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

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

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

2.5 Procedures for the Assessment

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

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

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

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

Assessment and Reporting on Noise Impacts	Section in Report
• a description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 1.7

3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Potential Sensitive Receptors

Potential sensitive receptors within the project area (indicated in Figure 3-1), include residential areas, i.e. Esther Park, Edleen, Cresslawn, Croydon, Illiondale, and Edenvale.

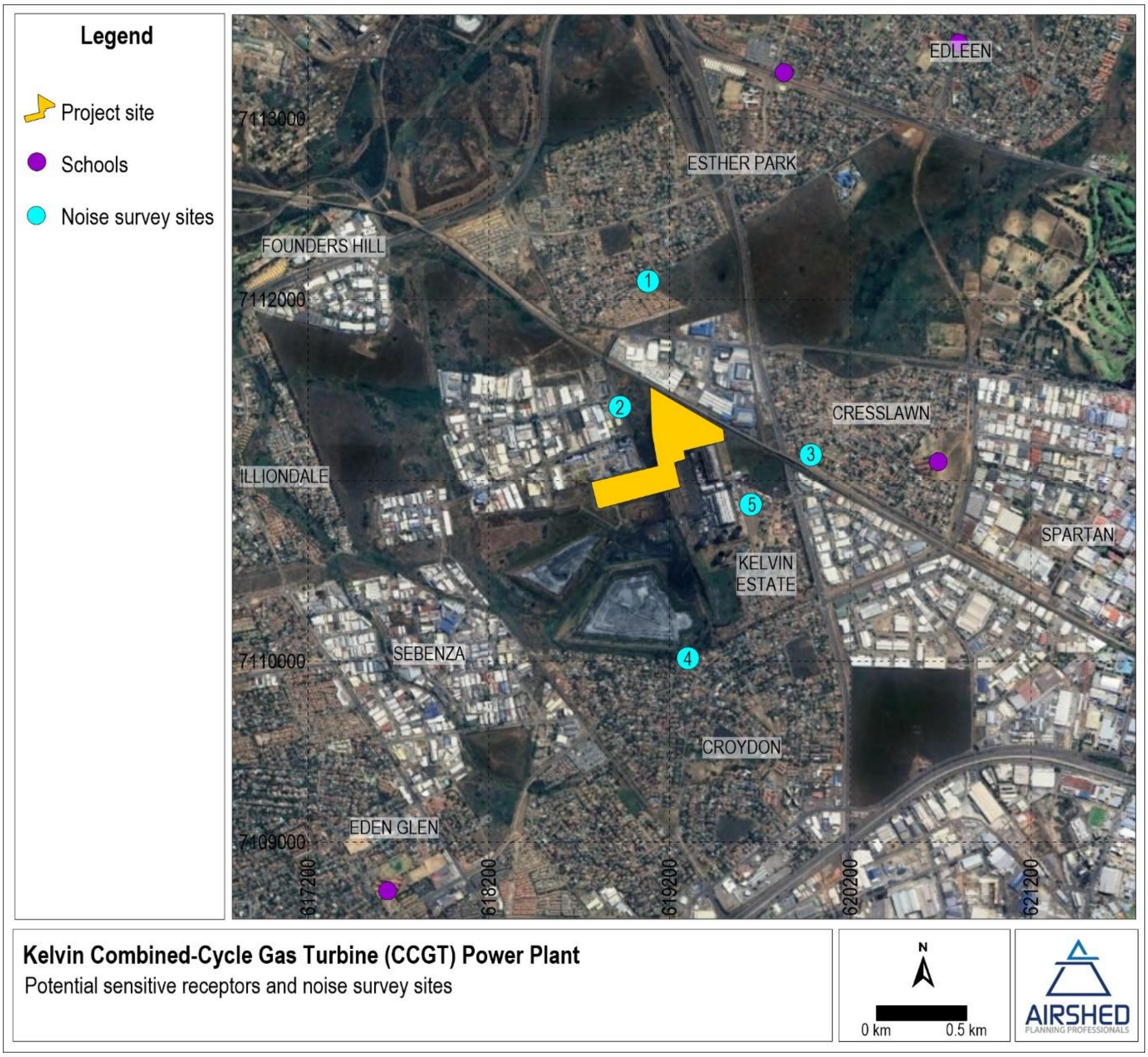


Figure 3-1: Potential sensitive receptors and noise survey sites within the study area

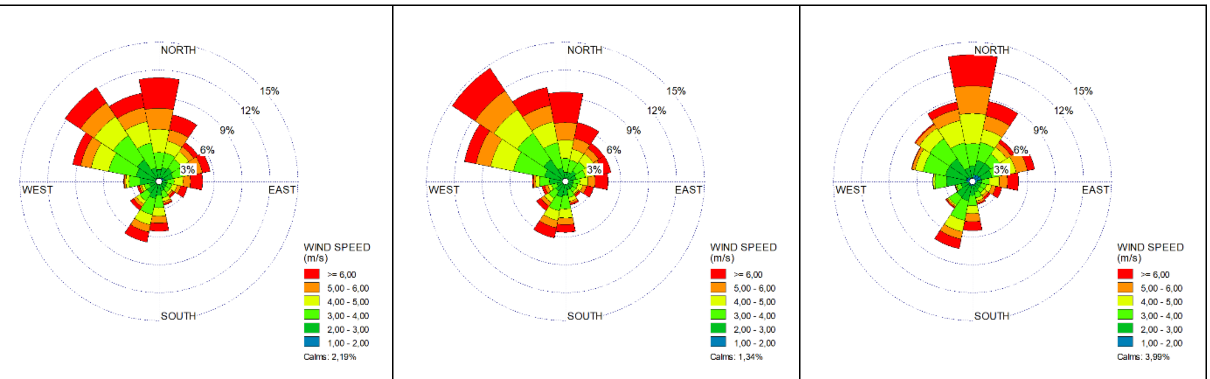
3.2 Environmental Noise Propagation and Attenuation Potential

3.2.1 Atmospheric Absorption and Meteorology

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

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

Meteorological data from the OR Tambo South African Weather Service (SAWS) meteorological station, for the period 2020 to 2022, was used for the baseline assessment. The measured data set indicates wind flow primarily from the northwestern sector (Figure 3-2 (a)). During the day the predominant wind direction is from the west-northwest with the predominant wind direction during the night from the north. On average, noise impacts are expected to be more notable to the southeast during the day and to the south during the night.



(a) Period average wind rose | (b) Day-time wind rose (07:00 – 22:00) | (c) Night-time wind rose (22:00 – 07:00)

Figure 3-2: Wind rose for OR Tambo SAWS station for the period 2020 to 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 3-3).

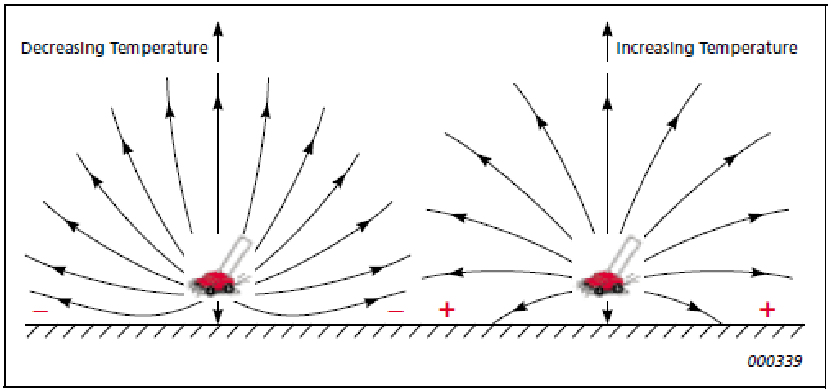


Figure 3-3: Bending the path of sound during typical day time conditions (image provided on the left) and night-time conditions (image provided on the right)

3.2.2 Terrain, Ground Absorption and Reflection

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

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

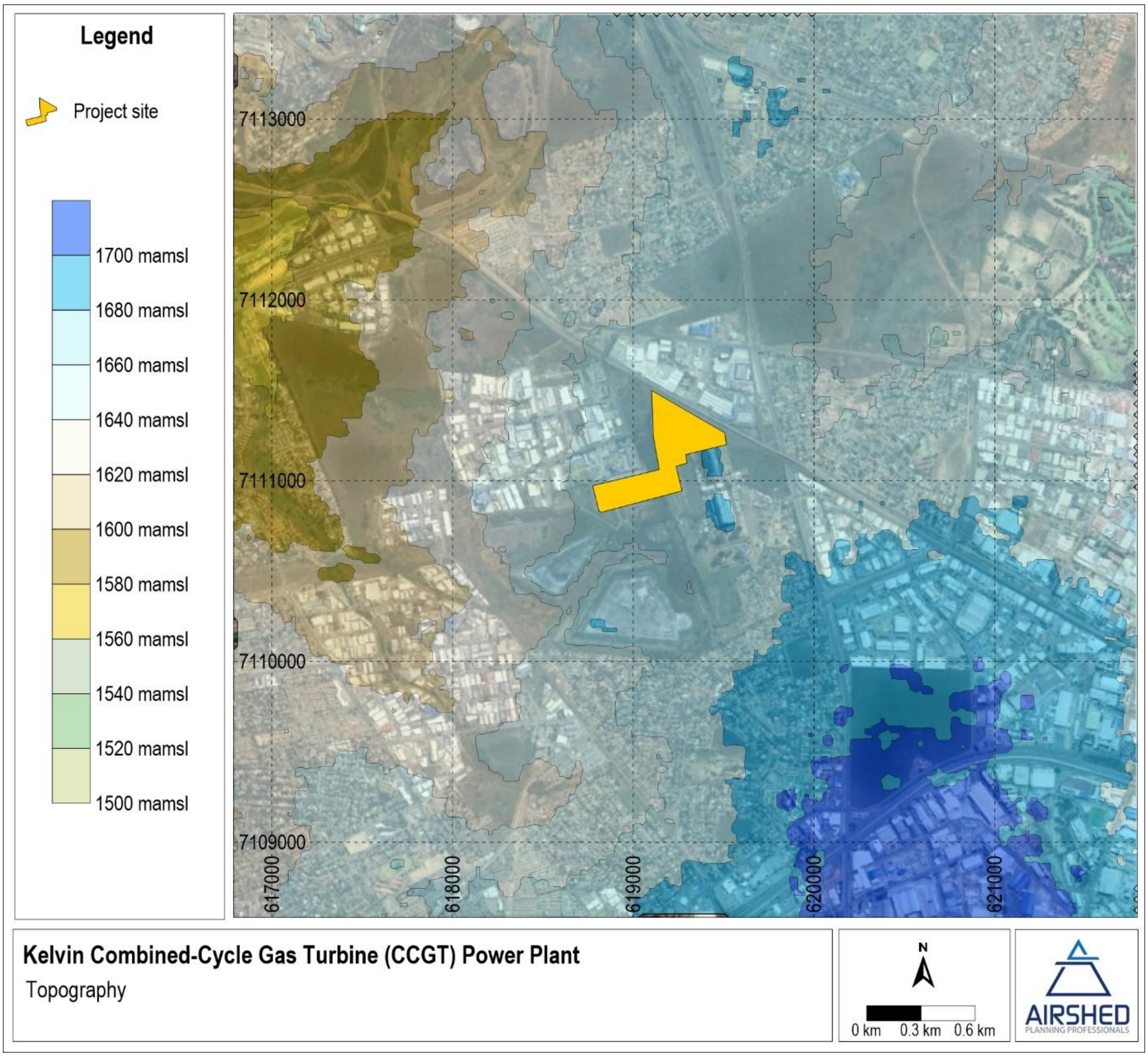


Figure 3-4: Topography for the study area

3.3 Baseline Noise Survey

3.3.1 Site Selection

Survey sites were selected after careful consideration of future activities, accessibility, potential noise sensitive receptors, and safety restrictions. A total of 5 survey sites was selected for the survey conducted in February 2024. The locations of the survey sites, with coordinates, are provided in Table 3-1 and shown in Figure 3-1.

Table 3-1: Location of the noise survey sites

Site	Latitude	Longitude
1	26.105364°S	28.190997°E
2	26.111805°S	28.189483°E
3	26.114337°S	28.199879°E
4	26.124442°S	28.193131°E
5	26.116567°S	28.196581°E

3.3.2 Measured Noise Levels

The first noise survey campaign was undertaken on the 5th and 6th of February 2024. The survey results are summarised in Table 3-2 with the district categorisation and recommended Environmental Noise Standards provided in Table 3-3. For comparison purposes, the measured noise levels (L_{Aeq}) are presented in Figure 3-5 (day-time results) and Figure 3-6 (night-time results). Draft Environmental Noise Standards for night-time conditions are exceeded at Site 1, Site 4 and Site 5.

The acoustic climate in the area is mainly influenced by birds, insects, traffic, community and industrial activity.

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

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

Sampling point	Visual and acoustic observations	General weather conditions	Time of day	Start date and time	Duration	L_{AFmax} (dBA)	L_{AFmin} (dBA)	L_{Aeq} (dBA)	L_{AIeq} (dBA)	L_{A90} (dBA)	L_{Aeq} (dBA)[(a)]	Recommended Environmental Noise Standards
Site 1	Survey site located at the residential area of Esther Park. Noise sources include birds, dogs, community activity and vehicles.	Winds of 4 m/s (S); 29°C; 34% humidity; 75% cloud cover	Day	2024/02/05 18:08	00:20:13	79.4	36.9	56.1	51.7	39.6	55	55
		Winds of 1 m/s (S); 25°C; 34% humidity; 10% cloud cover	Day	2024/02/06 20:22	00:20:13	75.2	41.8	54.3	51.5	49.9		
		Winds of 3 m/s (SSE); 18°C; 77% humidity; 10% cloud cover	Night	2024/02/05 23:53	00:20:04	62.5	38.2	51.4	59.0	47.7	**51.0**	45
		No wind; 23°C; 40% humidity; 0% cloud cover	Night	2024/02/06 22:03	00:20:07	69.2	34.9	50.5	51.8	38.6		
Site 2 (industrial site)	Survey site located at the Sebenza industrial area west of the Kelvin Power Station, ~6m from the Lovato Road. Noise sources include birds, insects, dogs, community activity, vehicles and Gautrain.	Winds of 4 m/s (S); 27°C; 39% humidity; 75% cloud cover	Day	2024/02/05 18:35	00:20:10	81.9	43.6	59.7	70.3	46.8	60.6	70
		Winds of 1 m/s (W); 29°C; 28% humidity; 10% cloud cover	Day	2024/02/06 18:09	00:20:01	79.7	40.6	61.4	50.0	44.0		
		Winds of 2 m/s (S); 19°C; 65% humidity; 30% cloud cover	Night	2024/02/05 23:25	00:20:08	67.0	46.4	50.9	64.9	48.1	51.0	60
		Winds of 0.4 m/s (S); 22°C; 42% humidity; 0% cloud cover	Night	2024/02/06 22:35	00:20:02	81.8	41.1	51.0	51.5	43.0		
Site 3	Survey site located at the residential area	Winds of 4 m/s (SE); 26°C; 39% humidity; 75% cloud cover	Day	2024/02/05 19:02	00:20:04	75.4	43.4	53.6	51.4	46.0	52.4	60

Sampling point	Visual and acoustic observations	General weather conditions	Time of day	Start date and time	Duration	L_{AFmax} (dBA)	L_{AFmin} (dBA)	L_{Aeq} (dBA)	L_{AIeq} (dBA)	L_{A90} (dBA)	L_{Aeq} (dBA)[(a)]	Recommended Environmental Noise Standards
	of Cresslawn. Noise sources include insects, dogs, music, community activity, air traffic and vehicles. Vehicles from the M39 and the Kelvin Power Station were audible throughout the survey.	Winds of 1 m/s (S); 27°C; 31% humidity; 0% cloud cover	Day	2024/02/06 19:24	00:20:01	74.6	42.9	50.7	58.6	45.4		
		No wind; 22°C; 52% humidity; 20% cloud cover	Night	2024/02/05 22:00	00:20:03	69.9	43.2	49.7	56.7	45.1	48.7	50
		No wind; 22°C; 42% humidity; 0% cloud cover	Night	2024/02/06 23:03	00:20:02	57.9	41.4	47.5	50.5	43.9		
Site 4	Survey site located at the residential area of Croydon, ~2m from Toermalyn Road. Noise sources include insects, dogs and vehicles.	Winds of 3 m/s (SE); 25°C; 44% humidity; 75% cloud cover	Day	2024/02/05 19:30	00:18:10	73.5	42.3	52.1	53.6	44.6	52.3	55
		Winds of 1 m/s (W); 28°C; 29% humidity; 0% cloud cover	Day	2024/02/06 18:56	00:20:01	73.9	38.9	52.4	51.5	41.8		
		No wind; 21°C; 60% humidity; 10% cloud cover	Night	2024/02/05 22:28	00:20:05	73.9	35.3	46.9	53.1	37.3	**48.0**	45
		No wind; 19°C; 59% humidity; 0% cloud cover	Night	2024/02/06 23:30	00:20:04	68.4	36.2	48.8	55.4	39.1		
Site 5	Survey site located to the east of the Kelvin Power Station. Noise sources include insects, Kelvin Power	Winds of 4 m/s (N); 22°C; 50% humidity; 75% cloud cover	Day	2024/02/05 21:32	00:20:04	66.7	58.3	60.1	60.2	59.1	60	60
		Winds of 1 m/s (SW); 26°C; 33% humidity; 0% cloud cover	Day	2024/02/06 19:53	00:20:00	66.0	57.9	60.3	63.6	59.1		

Sampling point	Visual and acoustic observations	General weather conditions	Time of day	Start date and time	Duration	L_{AFmax} (dBA)	L_{AFmin} (dBA)	L_{Aeq} (dBA)	L_{AIeq} (dBA)	L_{A90} (dBA)	L_{Aeq} (dBA)(a)	Recommended Environmental Noise Standards
	Station cooling towers and boiler house.	Winds of 2 m/s (S); 21°C; 56% humidity; 10% cloud cover	Night	2024/02/05 22:58	00:20:07	66.3	56.5	58.8	61.3	57.6	**59.4**	50
		Winds of 0.4 m/s (SW); 22°C; 42% humidity; 0% cloud cover	Night	2024/02/06 23:57	00:20:35	67.6	58.0	59.9	62.3	58.9		

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

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

Sampling point	District Classification	Recommended Environmental Noise Standards	
		Day	Night
Site 1	Urban	55	45
Site 2	Industrial districts	70	60
Site 3	Urban with main road	60	50
Site 4	Urban	55	45
Site 5	Urban with business district(a)	60	50

(a) The area has been classified as urban with business district as it is a residential area, however it is within the Kelvin Estate.

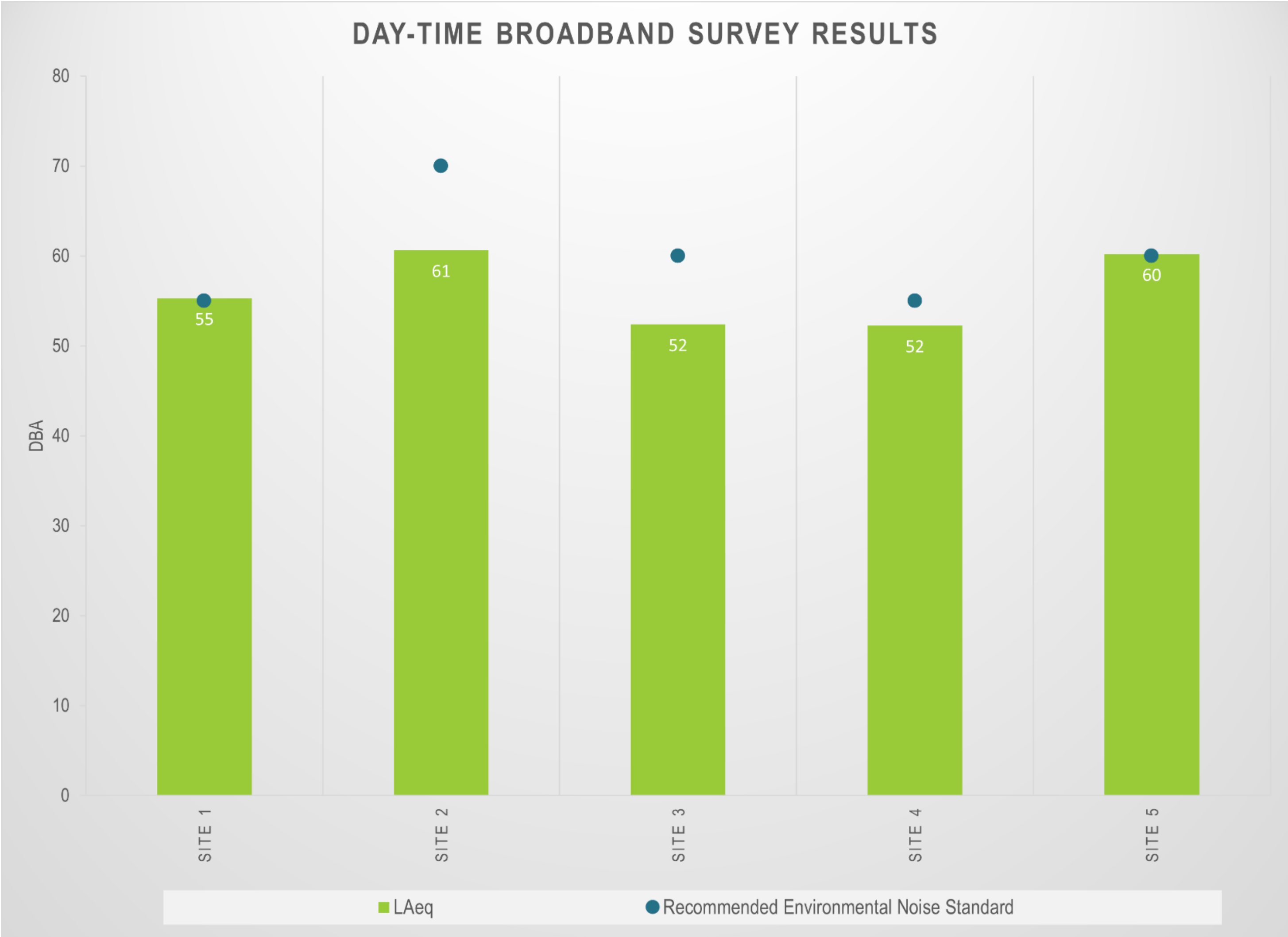


Figure 3-5: Day-time broadband survey results

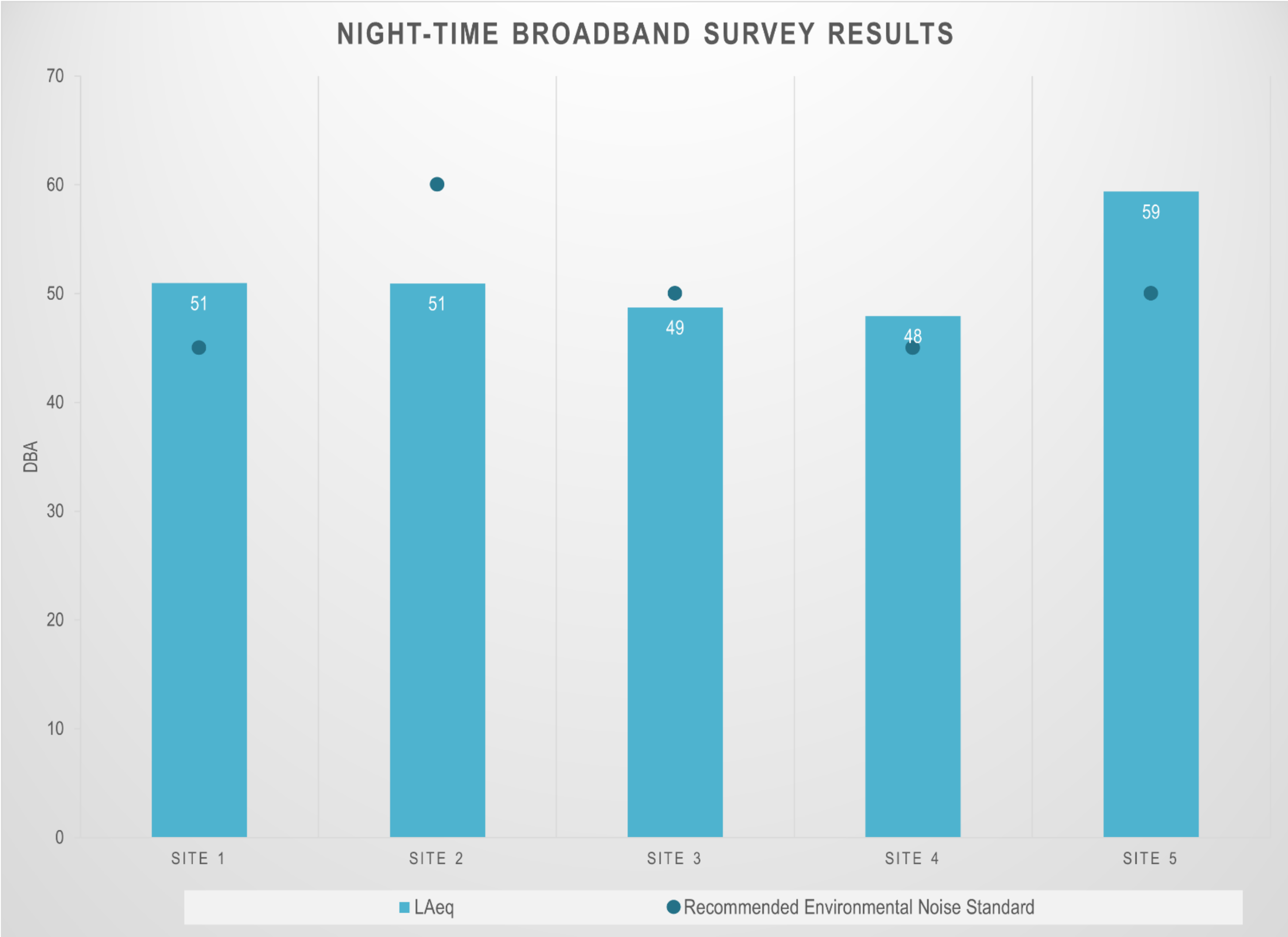


Figure 3-6: Night-time broadband survey results

4 IMPACT ASSESSMENT

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

4.1 Noise Sources and Sound Power Levels

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

4.1.1 Construction

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

Table 4-1: List of equipment for the project construction activities

No.	Type	Gross weight (ton)	KW Rating	Working hours per day
5	30-ton Dump Truck	53	270	10
2	Front End Loader	15	195	10
4	12-ton Excavator	20	117	10
2	12-ton Compactor	13	106	10
2	Tractor Loader Backhoes (TLB's)	7.2	64	10
2	Plate Compactor	0.075	3	10
2	50-ton Mobile Cranes	36	142	10
1	220-ton Mobile Crane	60	390	10
3	Telehandler	5	55	10
3	Water Bowsers	30	280	10
2	Concrete Mixer Truck	18	250	10
1	Tower Crane	20	80	10
2	Skid Steer	3.5	50	10
1	Trencher	5	138	10
1	Batching Plant	~25	150	10
20	Bakkies	2.3	165	10
2	Grader	16	128	10
2	Dozer	8.5	70	10
2	Compressor	0.115	2.2	10
4	250 kW Generator	3.5	250	10

Table 4-2: Octave band frequency spectra L_W's

Equipment	Type	L_W octave band frequency spectra (dB)								L_W (dB)	L_{WA} (dBA)	Source
		63	125	250	500	1000	2000	4000	8000			
30-ton Dump Truck	L_W	112.3	117.3	120.3	115.3	113.3	110.3	104.3	98.3	123.9	118.6	L_W Predictions (Bruce & Moritz, 1998)
Front End Loader	L_W	110.9	115.9	118.9	113.9	111.9	108.9	102.9	96.9	122.5	117.2	L_W Predictions (Bruce & Moritz, 1998)
12-ton Excavator	L_W	108.7	113.7	116.7	111.7	109.7	106.7	100.7	94.7	120.3	114.9	L_W Predictions (Bruce & Moritz, 1998)
12-ton Compactor	L_W	108.3	113.3	116.3	111.3	109.3	106.3	100.3	94.3	119.9	114.5	L_W Predictions (Bruce & Moritz, 1998)
Tractor Loader Backhoes (TLB's)	L_W	106.1	111.1	114.1	109.1	107.1	104.1	98.1	92.1	117.7	112.3	L_W Predictions (Bruce & Moritz, 1998)
Plate Compactor	L_W	92.8	97.8	100.8	95.8	93.8	90.8	84.8	78.8	104.4	99.0	L_W Predictions (Bruce & Moritz, 1998)
50-ton Mobile Cranes	L_W	109.5	114.5	117.5	112.5	110.5	107.5	101.5	95.5	121.2	115.8	L_W Predictions (Bruce & Moritz, 1998)
220-ton Mobile Crane	L_W	113.9	118.9	121.9	116.9	114.9	111.9	105.9	99.9	125.5	120.2	L_W Predictions (Bruce & Moritz, 1998)
Telehandler	L_W	105.4	110.4	113.4	108.4	106.4	103.4	97.4	91.4	117.0	111.7	L_W Predictions (Bruce & Moritz, 1998)
Water Bowsers	L_W	112.5	117.5	120.5	115.5	113.5	110.5	104.5	98.5	124.1	118.7	L_W Predictions (Bruce & Moritz, 1998)
Concrete Mixer Truck	L_W	112.0	117.0	120.0	115.0	113.0	110.0	104.0	98.0	123.6	118.2	L_W Predictions (Bruce & Moritz, 1998)
Tower Crane	L_W	107.0	112.0	115.0	110.0	108.0	105.0	99.0	93.0	118.7	113.3	L_W Predictions (Bruce & Moritz, 1998)
Skid Steer	L_W	105.0	110.0	113.0	108.0	106.0	103.0	97.0	91.0	116.6	111.3	L_W Predictions (Bruce & Moritz, 1998)
Trencher	L_W	109.4	114.4	117.4	112.4	110.4	107.4	101.4	95.4	121.0	115.7	L_W Predictions (Bruce & Moritz, 1998)
Batching Plant	L_W	109.8	114.8	117.8	112.8	110.8	107.8	101.8	95.8	121.4	116.0	L_W Predictions (Bruce & Moritz, 1998)
Bakkies	L_W	110.2	115.2	118.2	113.2	111.2	108.2	102.2	96.2	121.8	116.4	L_W Predictions (Bruce & Moritz, 1998)
Grader	L_W	109.1	114.1	117.1	112.1	110.1	107.1	101.1	95.1	120.7	115.3	L_W Predictions (Bruce & Moritz, 1998)
Dozer	L_W	106.5	111.5	114.5	109.5	107.5	104.5	98.5	92.5	118.1	112.7	L_W Predictions (Bruce & Moritz, 1998)
Compressor	L_W	91.4	96.4	99.4	94.4	92.4	89.4	83.4	77.4	103.1	97.7	L_W Predictions (Bruce & Moritz, 1998)
250 kW Generator	L_W	112.0	117.0	120.0	115.0	113.0	110.0	104.0	98.0	123.6	118.2	L_W Predictions (Bruce & Moritz, 1998)

4.1.2 Operation

The complete source inventory and estimated electric load for the project operations is included in Table 4-3 and Table 4-4 respectively. Octave band frequency spectra L_W's are included in Table 4-5 with the total plant octave frequency spectra provided in Table 4-6.

It was provided that all equipment will be selected to limit the sound pressure to below 85 dBA in any passage or work area. This will be achieved by ensuring that the noise of all equipment at 1 m will be less than 85 dBA. This may be achieved by including noise attenuators or enclosures where feasible. From Table 4-6, it is evident that the facility will exceed 85 dBA at the equipment and that noise attenuation will be necessary. The assessment has been undertaken with the assumption that the noise levels will be 85 dBA at 1 m from the equipment and elevated exhaust emissions have also been modelled with the parameters as provided in Table 4-7.

Table 4-3: List of equipment for the project operations

Item	Quantity for Complete Plant
F-class Gas Turbine incl. auxiliaries and enclosure	1 set
Industrial Gas Turbine incl. auxiliaries and enclosure	2 sets
Air intake system, exhaust system	3
Generators incl. auxiliaries	5 sets
Steam turbine incl. auxiliaries	2 sets
Hot Box	3
HRSG, triple pressure, reheat, drum type	3 sets
Water/ Steam Cycle	
Steam systems	2
Feedwater system pumps	18
Condensate system pumps	4
Condenser vacuum pumps	4
IP/LP Bypass System	2 sets
HP Bypass System	3 sets
Chemical dosing and sampling	2 sets
Demin Plants	2
Fuel System	
Fuel gas skid for GT's	1
Fuel gas metering for each GT and final filter	1
Fuel gas preheating system	1
Cooling Systems: Wet mechanical draft cooling towers	2
Closed cooling water system pumps	4
Structures and Cranes	
Turbine building and Foundations and structures	2
Outdoor facilities incl. Admin. & Workshop	1
GT Building Overhead Travelling Cranes	1
GT Building Overhead Travelling Cranes for Generators	3
ST Building Overhead Travelling Cranes	2
Auxiliary and Ancillary Systems	
Compressed air system	2 sets

Item	Quantity for Complete Plant
Heating ventilation air conditioning (HVAC)	1 set
Firefighting/ protection	1 set
Power Plant Control System	1 set
Electrical Equipment List	
Isolated Phase Bus Duct (IPB), consisting of: Main IPB from GT and ST generators to their step-up transformers Branch IPB to unit auxiliary transformers for 2 GTs	5
Generator Circuit Breaker Installed in course of the GT IPBs	3
Earthing and Lightning Protection System	1 set (CP)
Medium Voltage Switchgear	1 set
Low Voltage Switchgear AC 400/230V and 690V (GT/ST/Cooling tower/BOP)	1 set
Low Voltage Switchgear DC 220V (GT/ST)	1 set
Battery backup system	2
Battery Charger	10
Generator Transformer	5
Unit Auxiliary Transformer	3
Black start Diesel Generators Preinstalled in containerised housings	1
Metering and Measuring System	5
Automatic Synchronizing System	5
HV Interface Panel	5
MV Busbar Transfer System	2
Automatic Voltage Regulator for Transformer	5
Unit Protection System (generator & transformer protection)	5
MV-Cables	1 set (CP)
LV-Cables (including LV control cables)	1 set (CP)
Cable Trays and Racks	1 set (CP)
Power Control Centres (PCCs) with lighting and HVAC	1 set
Lighting and Small Power System	1 set (CP)
Communication and Security System	By CP

Table 4-4: Estimated electric load for the project operations

Equipment	No in plant	Nominal kW (Operating)
Pump Motors		
HP Feedwater Pump	9	950.8
IP Feedwater Pump	9	395.26
Condensate Forwarding Pump	4	339.34
Condenser C.W. Pump	4	387.78
Condenser Vacuum Pump	4	22.37
Treated Water Pump 1	2	2.98
Denim Water Pump	4	4.66
Raw Water Pump 1	2	2.61
Raw Water Pump 2	2	2.61
Aux Cooling Water Pump (closed loop)	4	42.51
Jockey Fire Pump	2	2.24
Aux Cooling Water Pump (open loop)	4	42.51
Cooling Tower Fan Motors		
Main Cooling Tower Fan	8	145.41
Fuel Gas Compressor Motors		
Fuel Compressor	4	2129
Air Compressor Motors		
Station Air Compressor	4	82.03
Bridge Crane Motors		
GT bridge crane hoist motor	2	96.94
GT bridge crane bridge motor	4	7.08
GT bridge crane trolley motor	4	6.34
ST bridge crane hoist motor	2	55.93
ST bridge crane bridge motor	4	4.1
ST bridge crane trolley motor	4	3.73
GT Auxiliary Loads		
GT Frame Blower Motor	6	141.69
GT Lube Oil Pumps	6	268.44
GT HVAC	18	18.642
Misc. GT Aux Loads	50	44.374
ST Auxiliary Loads		
ST Lube Oil Pumps	4	253.51
Misc. SC Aux Loads	11	14.17
Miscellaneous Plant Loads		
HVAC Loads	2	82.03
Lighting Loads	2	164.05
Misc. Plant Aux Loads	25	26.85

Table 4-5: Octave band frequency spectra Lw's

Equipment	Type	Lw octave band frequency spectra (dB) 63	125	250	500	1000	2000	4000	8000	Lw (dB)	LWA (dBA)	Source
Pump Motors												
HP Feedwater Pump	Lw	93.7	94.7	95.7	97.7	97.7	100.7	97.7	93.7	106.1	105.3	Lw Predictions (Bruce & Moritz, 1998)
IP Feedwater Pump	Lw	92.6	93.6	94.6	96.6	96.6	99.6	96.6	92.6	105.0	104.2	Lw Predictions (Bruce & Moritz, 1998)
Condensate Forwarding Pump	Lw	92.4	93.4	94.4	96.4	96.4	99.4	96.4	92.4	104.8	104.0	Lw Predictions (Bruce & Moritz, 1998)
Condenser C.W. Pump	Lw	92.5	93.5	94.5	96.5	96.5	99.5	96.5	92.5	104.9	104.2	Lw Predictions (Bruce & Moritz, 1998)
Condenser Vacuum Pump	Lw	85.3	86.3	87.3	89.3	89.3	92.3	89.3	85.3	97.7	96.9	Lw Predictions (Bruce & Moritz, 1998)
Treated Water Pump 1	Lw	76.5	77.5	78.5	80.5	80.5	83.5	80.5	76.5	88.9	88.1	Lw Predictions (Bruce & Moritz, 1998)
Denim Water Pump	Lw	78.5	79.5	80.5	82.5	82.5	85.5	82.5	78.5	90.9	90.1	Lw Predictions (Bruce & Moritz, 1998)
Raw Water Pump 1	Lw	75.9	76.9	77.9	79.9	79.9	82.9	79.9	75.9	88.3	87.6	Lw Predictions (Bruce & Moritz, 1998)
Raw Water Pump 2	Lw	75.9	76.9	77.9	79.9	79.9	82.9	79.9	75.9	88.3	87.6	Lw Predictions (Bruce & Moritz, 1998)
Aux Cooling Water Pump (closed loop)	Lw	88.1	89.1	90.1	92.1	92.1	95.1	92.1	88.1	100.5	99.7	Lw Predictions (Bruce & Moritz, 1998)
Jockey Fire Pump	Lw	75.3	76.3	77.3	79.3	79.3	82.3	79.3	75.3	87.7	86.9	Lw Predictions (Bruce & Moritz, 1998)
Aux Cooling Water Pump (open loop)	Lw	88.1	89.1	90.1	92.1	92.1	95.1	92.1	88.1	100.5	99.7	Lw Predictions (Bruce & Moritz, 1998)
Cooling Tower Fan Motors												
Main Cooling Tower Fan	Lw	139.4	139.4	136.4	133.4	129.4	126.4	123.4	115.4	144.1	135.6	Lw Predictions (Bruce & Moritz, 1998)
Fuel Gas Compressor Motors												
Fuel Compressor	Lw	112.3	108.3	113.3	112.3	110.3	113.3	118.3	115.3	122.9	122.1	Lw Predictions (Bruce & Moritz, 1998)
Air Compressor Motors												
Station Air Compressor	Lw	98.1	94.1	99.1	98.1	96.1	99.1	104.1	101.1	108.8	107.9	Lw Predictions (Bruce & Moritz, 1998)
Bridge Crane Motors												
GT bridge crane hoist motor	Lw	84.4	84.4	87.4	89.4	92.4	92.4	91.4	86.4	98.6	98.2	Lw Predictions (Bruce & Moritz, 1998)
GT bridge crane bridge motor	Lw	68.0	68.0	71.0	73.0	76.0	76.0	75.0	70.0	82.2	81.8	Lw Predictions (Bruce & Moritz, 1998)
GT bridge crane trolley motor	Lw	67.2	67.2	70.2	72.2	75.2	75.2	74.2	69.2	81.4	81.0	Lw Predictions (Bruce & Moritz, 1998)
ST bridge crane hoist motor	Lw	82.0	82.0	85.0	87.0	90.0	90.0	89.0	84.0	96.2	95.8	Lw Predictions (Bruce & Moritz, 1998)
ST bridge crane bridge motor	Lw	64.0	64.0	67.0	69.0	72.0	72.0	71.0	66.0	78.2	77.8	Lw Predictions (Bruce & Moritz, 1998)
ST bridge crane trolley motor	Lw	63.3	63.3	66.3	68.3	71.3	71.3	70.3	65.3	77.5	77.1	Lw Predictions (Bruce & Moritz, 1998)
GT Auxiliary Loads												
GT Frame Blower Motor	Lw	86.0	86.0	89.0	91.0	94.0	94.0	93.0	88.0	100.3	99.8	Lw Predictions (Bruce & Moritz, 1998)
GT Lube Oil Pumps	Lw	96.1	97.1	98.1	100.1	100.1	103.1	100.1	96.1	108.5	107.7	Lw Predictions (Bruce & Moritz, 1998)

Equipment	Type	Lw octave band frequency spectra (dB)								Lw (dB)	LWA (dBA)	Source
		63	125	250	500	1000	2000	4000	8000			
GT HVAC	Lw	74.8	80.8	84.8	96.8	93.8	89.8	84.8	79.8	99.5	98.1	Lw Predictions (Bruce & Moritz, 1998)
ST Auxiliary Loads												
ST Lube Oil Pumps	Lw	95.8	96.8	97.8	99.8	99.8	102.8	99.8	95.8	108.2	107.4	Lw Predictions (Bruce & Moritz, 1998)
Miscellaneous Plant Loads												
HVAC Loads	Lw	74.8	80.8	84.8	96.8	93.8	89.8	84.8	79.8	99.5	98.1	Lw Predictions (Bruce & Moritz, 1998)
Turbines												
Gas Turbine (intake)	Lw	147.2	148.2	149.2	149.2	152.2	158.2	163.2	163.2	167.2	167.3	Lw Predictions (Bruce & Moritz, 1998)
Gas Turbine (casing)	Lw	123.1	126.1	128.1	129.1	129.1	129.1	129.1	129.1	137.2	136.0	Lw Predictions (Bruce & Moritz, 1998)
Gas Turbine (exhaust)	Lw	142.4	146.4	148.4	148.4	147.4	145.4	143.4	139.4	155.0	152.5	Lw Predictions (Bruce & Moritz, 1998)
Steam Turbine-Generator Units	Lw	112.2	115.2	117.2	118.2	118.2	118.2	118.2	118.2	126.4	125.2	Lw Predictions (Bruce & Moritz, 1998)

Table 4-6: Calculated octave band frequency spectra Lw's for the facility

Equipment	Type	Lw octave band frequency spectra (dB)								Lw (dB)	LWA (dBA)
		63	125	250	500	1000	2000	4000	8000		
Plant (total)	Lw	150.9	151.3	150.7	150.1	152.4	158.2	163.2	163.2	167.4	167.3

Table 4-7: Stack parameters

Stacks	X	Y	Stack height (m)	Exit temperature of stack (°C)	Stack diameter (m)	Exit velocity of stack (m/s)
Stack 1 (4000F)	619234.72	7111295.22	60	87	8	18.5
Stack 2 (SGT800)	619180.64	7111214.48	60	72	4	11.9
Stack 3 (SGT800)	619158.13	7111212.84	60	72	4	11.9
Bypass Stack 1 (4000F)	619258.56	7111229.77	60	623	8	47.2
Bypass Stack 2 (SGT800)	619172.36	7111160.1	60	595	4	30
Bypass Stack 3 (SGT800)	619199.99	7111174	60	595	4	30

4.2 Noise Propagation and Simulated Noise Levels

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

4.2.1 Construction Phase

Construction will be from 7am to 5pm, for 5 days per week (Monday to Friday). The assessment of noise for construction activities is therefore limited to day-time only.

Table 4-8 provides a summary of simulated noise levels for the project construction activities at NSRs within the study area. Simulated noise levels due to project construction activities are also presented in the form of isopleth plots (Figure 4-1).

Noise levels due to project construction activities are predicted to be within the Gauteng Noise Control Regulations of 60 dBA and the proposed Environmental Noise Standards at all residential NSRs within the study area (Table 4-3). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); the predicted increase in noise levels from the current baseline due to proposed project construction activities only is expected to result in "no" reaction (Table 4-8).

Table 4-8: Summary of simulated noise levels (provided as dBA) due to proposed project construction activities at potential NSRs within the study area

Noise Sensitive Receptor	Classification in accordance with the SANS 10103 classification (and proposed Environmental Noise Standard)	Proposed Environmental Noise Standards	Project activities [a]	Baseline [b]	Increase above baseline [c]
		Day	Day	Day	Day
Industrial area directly north of project site	Industrial	70	63.4	60.63	4.6
Industrial area directly west of project site	Industrial	70	62.7	60.63	4.2
Esther Park	Urban	55	49.1	55.29	0.9
Cresslawn	Urban with main road	60	50.4	52.39	2.1
Kelvin Estate	Urban with business district	60	49.5	60.2	0.4
Croydon	Urban	55	41.8	52.25	0.4
Sebenza	Industrial	70	38.6	60.63	0.0

Notes:

(a) Exceedance of the proposed Environmental Noise Standards is provided in bold
(b) Baseline measurements based on closest or representative sampling sites and reflective of current noise levels.
(c) 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.*

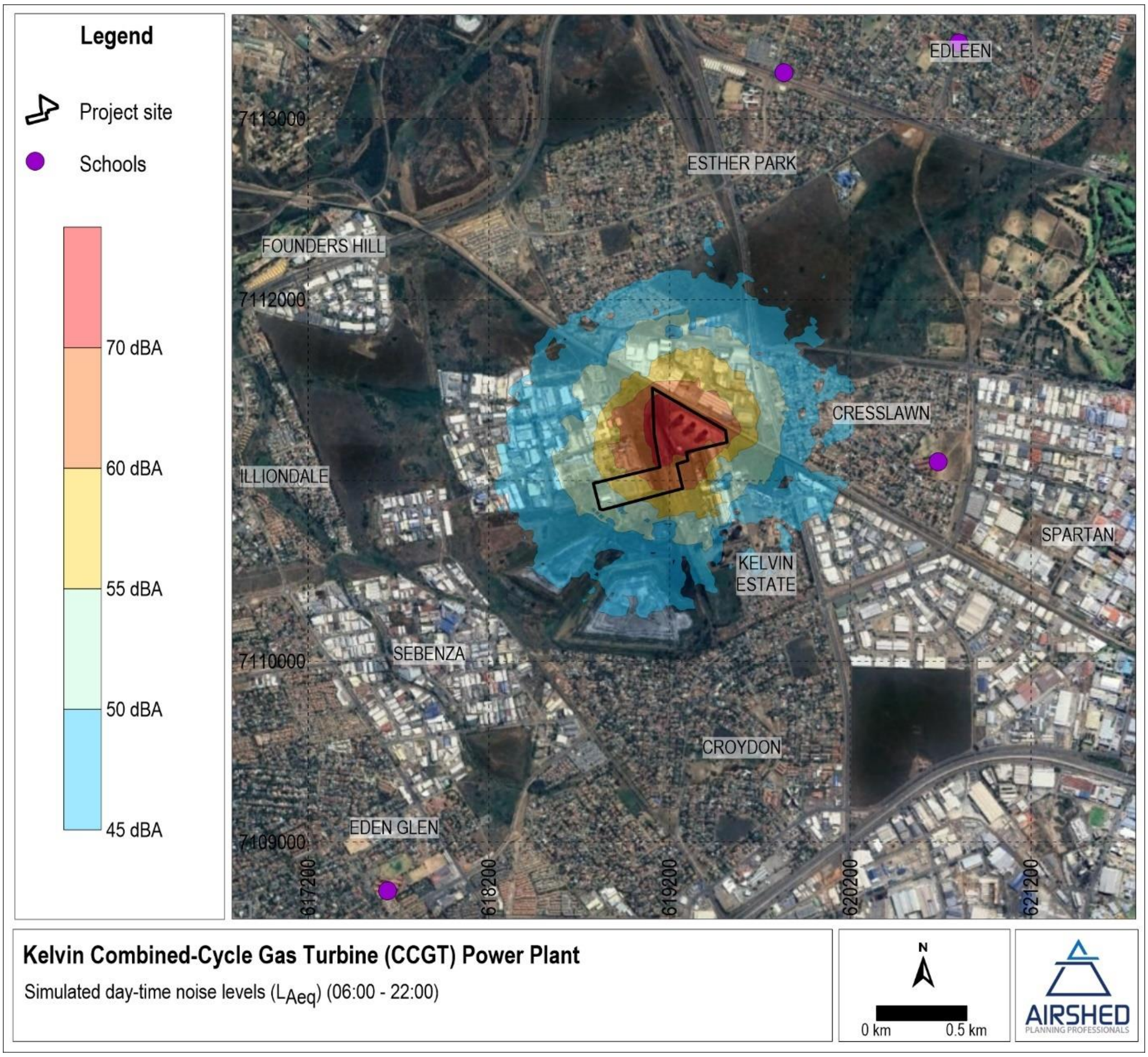


Figure 4-1: Simulated day-time noise levels due to proposed project construction activities only

4.2.2 Operation Phase

The project is required for Eskom daily peaks:

- Morning peak between 6am and 9am; and,
- Evening peak between 5pm and 7pm.

The assessment of noise for operational activities is therefore limited to day-time only.

The plant is designed for hot starts and black starts. Hot starts and black starts may be required under emergency conditions and do not form part of normal operations for the project. The plant is, however, required to run the diesel generators once a month for an hour for testing. Two scenarios were therefore assessed:

- Scenario 1: Normal operating conditions; and,
- Scenario 2: Normal operating conditions as well as the diesel generators running for an hour.

Table 4-9 and Table 4-10 provides a summary of simulated noise levels for normal project operation activities at NSRs within the study area. Simulated noise levels due to project operations are also presented in the form of isopleth plots (Figure 4-2 and Figure 4-3).

Noise levels due to project operations (under normal operating conditions) are predicted to be within the Gauteng Noise Control Regulations of 60 dBA and proposed day-time Environmental Noise Standards for all residential NSRs within the study area.

According to SANS 10103 (2008); the predicted increase in noise levels from the current baseline due to proposed project operations only is expected to result in "little" reaction with sporadic complaints at the following NSRs (Table 4-9 and Table 4-10):

- Industrial area to directly north of the project site (day-time); and,
- Industrial area to directly west of the project site (day-time).

The 1992 Noise Control Regulations 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 increase in noise levels from baseline due to project operations does not exceed 7 dBA at any NSR surrounding the project.

Table 4-9: Summary of simulated noise levels (provided as dBA) due to proposed project activities (Scenario 1) at potential NSRs within the study area

Noise Sensitive Receptor	Classification in accordance with the SANS 10103 classification (and proposed Environmental Noise Standard)	Proposed Environmental Noise Standards	Project activities [a]	Baseline [b]	Increase above baseline [c]
		Day	Day	Day	Day
Industrial area directly north of project site	Industrial	70	65.2	60.63	5.9
Industrial area directly west of project site	Industrial	70	64.2	60.63	5.2
Esther Park	Urban	55	50.2	55.29	1.2
Cresslawn	Urban with main road	60	50.9	52.39	2.3
Kelvin Estate	Urban with business district	60	50	60.2	0.4
Croydon	Urban	55	47.7	52.25	1.3
Sebenza	Industrial	70	40.5	60.63	0.0

Notes:

(a) Exceedance of the proposed Environmental Noise Standards is provided in bold
(b) Baseline measurements based on closest or representative sampling sites and reflective of current noise levels.
(c) 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.*

Table 4-10: Summary of simulated noise levels (provided as dBA) due to proposed project activities (Scenario 2) at potential NSRs within the study area

Noise Sensitive Receptor	Classification in accordance with the SANS 10103 classification (and proposed Environmental Noise Standard)	Proposed Environmental Noise Standards	Project activities (a)	Baseline (b)	Increase above baseline (c)
		Day	Day	Day	Day
Industrial area directly north of project site	Industrial	70	65.7	60.63	6.2
Industrial area directly west of project site	Industrial	70	64.8	60.63	5.6
Esther Park	Urban	55	50.3	55.29	1.2
Cresslawn	Urban with main road	60	51.6	52.39	2.6
Kelvin Estate	Urban with business district	60	50.5	60.2	0.4
Croydon	Urban	55	48.5	52.25	1.5
Sebenza	Industrial	70	41.3	60.63	0.1

Notes:

(a) Exceedance of the proposed Environmental Noise Standards is provided in bold

(b) Baseline measurements based on closest or representative sampling sites and reflective of current noise levels.

(c) 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.*

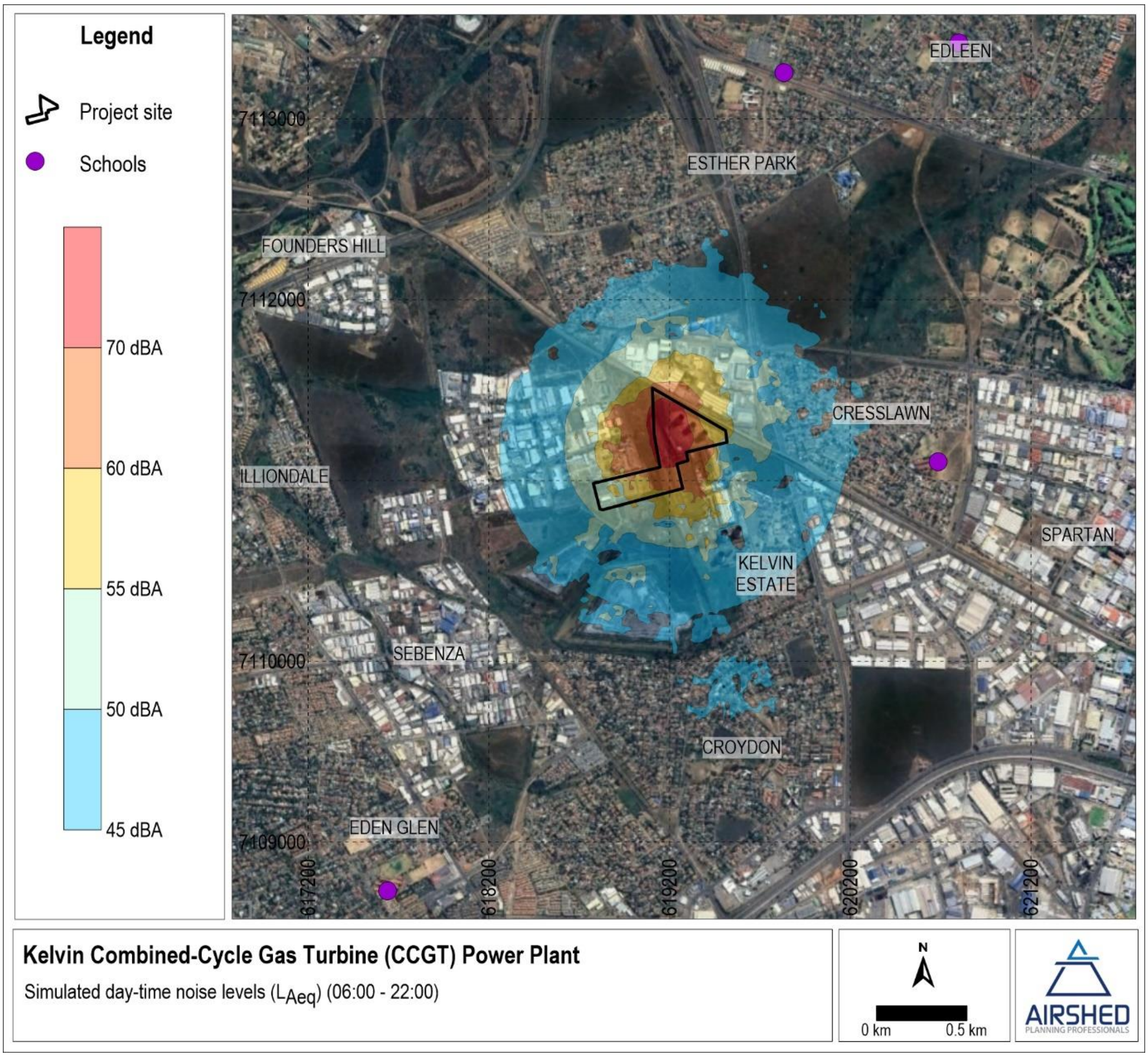


Figure 4-2: Simulated day-time noise levels due to proposed project operations only (Scenario 1)

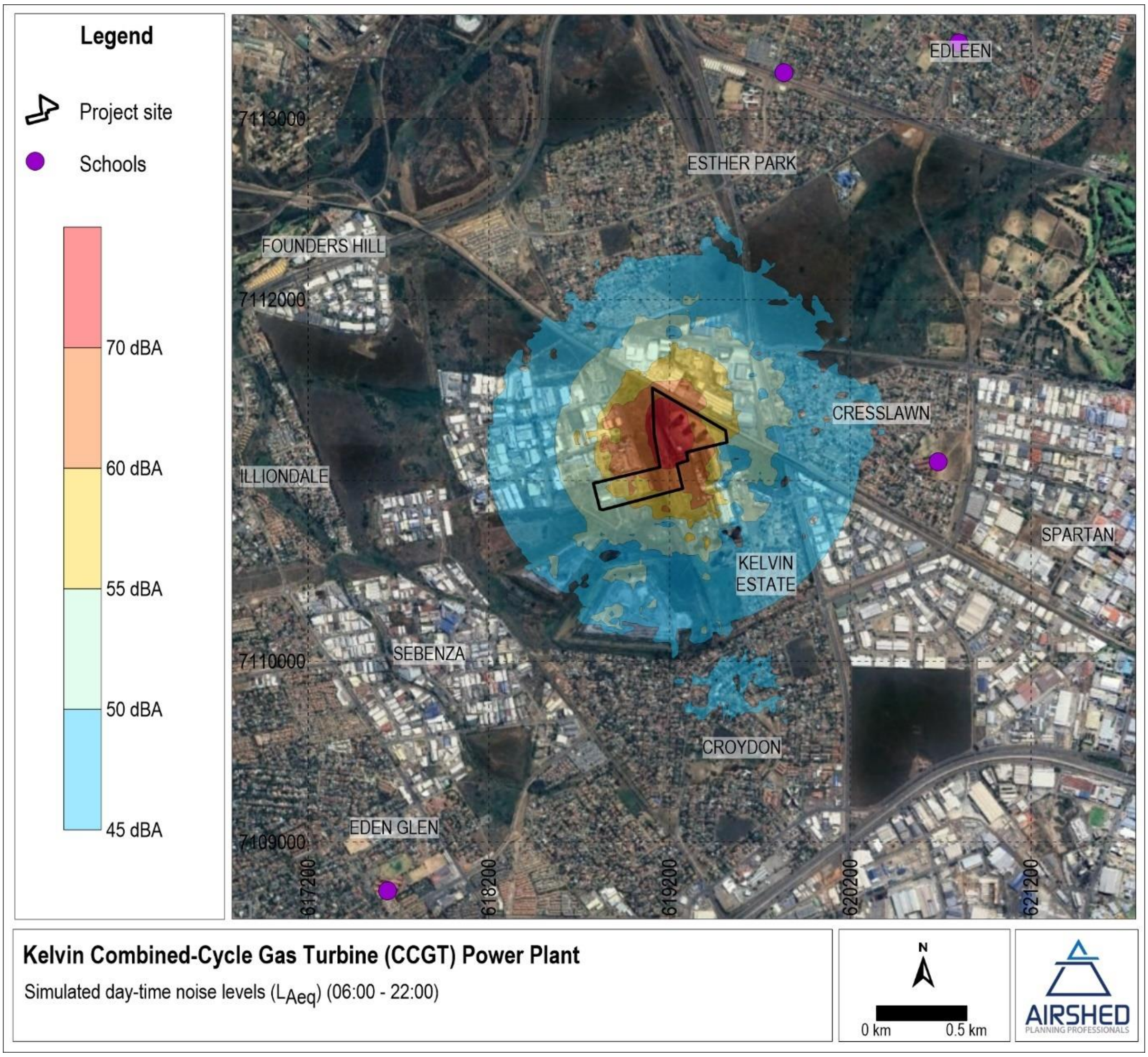


Figure 4-3: Simulated day-time noise levels due to proposed project operations only (Scenario 2)

5 IMPACT SIGNIFICANCE RATING

The impact significance of the project is provided below and follows the method provided by EIMS (Appendix E). The project is expected to have the following significance rating:

- Construction Phase:
  - Without mitigation: low negative significance rating.
  - With Mitigation: low negative significance rating.
- Operation Phase:
  - Without mitigation: medium negative significance rating.
  - With Mitigation: medium negative significance rating.
- Decommissioning Phase:
  - Without mitigation: low negative significance rating.
  - With Mitigation: low negative significance rating.

It should be noted that the impact assessment considers the mitigated operations for the project, i.e. 85 dBA at a distance of 1 m from the equipment which will be achieved by including noise attenuators or enclosures where feasible.

Table 5-1: 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			Cumulative Impact	Irreplaceable loss		
Increase in noise levels	Construction	-1	3	2	3	2	3	-7.5 (low)	-1	3	2	2	2	3	-6.75 (low)	Medium	1	1	1.00	-6.75
Increase in noise levels	Operation	-1	3	4	4	3	4	-14 (medium)	-1	3	4	2	3	3	-9 (medium)	Medium	1	1	1.00	-9
Increase in noise levels	Decommis-sioning	-1	3	2	3	2	3	-7.5 (low)	-1	3	2	2	2	3	-6.75 (low)	Medium	1	1	1.00	-6.75

6 MANAGEMENT MEASURES

In the quantification of noise emissions and simulation of noise levels as a result of the project, it was found that environmental noise evaluation criteria will be met at all off-site NSRs.

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

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

6.1 Controlling Noise at the Source

6.1.1 General Good Practice Measures

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

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

6.1.2 Specifications and Equipment Design

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

6.1.3 Enclosures

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

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

The enclosures should provide noise attenuation to ensure that the noise levels are 85 dBA at a distance of 1 m from the equipment.

6.1.4 Use and Siting of Equipment and Noise Sources

The following good practice should be implemented:

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

6.1.5 Maintenance

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

6.2 Monitoring

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

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

- Any surveys should be designed and conducted by a trained specialist.
- Sampling should be carried out using a Type 1 SLM that meets all appropriate IEC standards and is subject to annual calibration by an accredited laboratory.
- The acoustic sensitivity of the SLM should be tested with a portable acoustic calibrator before and after each sampling session.
- Samples sufficient for statistical analysis should be taken with the use of portable SLM's capable of logging data continuously over the time period. Samples, representative of the day- and night-time acoustic environment should be taken.
- The following acoustic indices should be recoded and reported: LAeq (T), statistical noise level LA90, LAFmin and LAFmax, 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 CONCLUSIONS

The noise impacts due to the project operations are within the Environmental Noise Standards at the closest NSRs if the plant operates with the sound pressure of 85 dBA at a distance of 1 m from all equipment. This may be achieved by including noise attenuators or enclosures where feasible.

Based on the findings of the assessment and provided attenuation measures are in place, it is the specialist opinion that the project may be authorised.

8 REFERENCES

Brüel & Kjær Sound & Vibration Measurement A/S. (2000). *www.bksv.com.* Retrieved October 14, 2011, from Brüel & Kjær: http://www.bksv.com

BSI. (2014). Code of practice for noise and vibration control on construction and open sites - Part 1: Noise. *BS 5228-1:2009*.

DFFE. (2017). *Amendment of the Environmental Impact Assessment Regulations (Listing Notice 1 of 2014).* Department of Forestry, Fisheries and the Environment, Government Gazette No. 40772 (No. 327), 7 April 2017.

DFFE. (2017). *Amendment of the Environmental Impact Assessment Regulations (Listing Notice 2 of 2014).* Department of Forestry, Fisheries and the Environment, Government Gazette No. 40772 (No. 325), 7 April 2017.

DFFE. (2017). *Amendment of the Environmental Impact Assessment Regulations (Listing Notice 3 of 2014).* Department of Forestry, Fisheries and the Environment, Government Gazette No. 40772 (No. 324), 7 April 2017.

DFFE. (2017). *Amendment of the Environmental Impact Assessment Regulations, 2014.* Department of Forestry, Fisheries and the Environment, Government Gazette No. 40772 (No. 326), 7 April 2017.

IFC. (2007). *Environmental, Health, and Safety Guidelines for Noise Management.* International Finance Corporation. World Bank Group.

SANS 10103. (2008). *The measurement and rating of environmental noise with respect to annoyance and to speech communication.* Pretoria: Standards South Africa.

WHO. (1999). *Guidelines to Community Noise.* (B. Berglund, T. Lindvall, & D. Schwela, Eds.) Geneva: WHO.

APPENDIX A – CURRICULUM VITAE

FULL CURRICULUM VITAE

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

MEMBERSHIP OF PROFESSIONAL SOCIETIES

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

KEY QUALIFICATIONS

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

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

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

RELEVANT EXPERIENCE (AIR QUALITY)

Mining and Ore Handling

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

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

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

Metal Recovery

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

Chemical Industry

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

Petrochemical Industry

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

Pulp and Paper Industry

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

Power Generation

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

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

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

Waste Disposal

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

Cement Manufacturing

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

Management Plans

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

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

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

Mining and Tailings Storage Facilities

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

Gas to Power Plants

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

RELEVANT EXPERIENCE (NOISE)

Mining

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

Power Generation

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

Process Operations

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

Transport

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

Gas Pipelines

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

Baseline Noise Surveys

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

OTHER EXPERIENCE (2001)

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

EDUCATION

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

ADDITIONAL COURSES

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

COUNTRIES OF WORK EXPERIENCE

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

EMPLOYMENT RECORD

January 2002 - Present

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

2001

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

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

1999 - 2000

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

CONFERENCE AND WORKSHOP PRESENTATIONS AND PAPERS

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

LANGUAGES

	Speak	Read	Write
English	Excellent	Excellent	Excellent
Afrikaans	Fair	Fair	Fair

CERTIFICATION

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

29/07/2024

Signature of staff member

Date (Day / Month / Year)

Full name of staff member: Reneé Georgeinna von Gruenewaldt

APPENDIX B – DECLARATION OF INDEPENDENCE

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
Environmental Noise Impact Assessment for the Combined-Cycle Gas Turbine Power Plant at Kelvin Power Station

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Environmental Noise Impact Assessment
Specialist Company Name	Airshed Planning Professionals (Pty) Ltd
Specialist Name	Reneé von Gruenewaldt
Specialist Identity Number	7805130128080
Specialist Qualifications:	MSc.(Earth Sciences)
Professional affiliation/registration:	South African Council for Natural Scientific Professionals: 400304/07
Physical address:	62 Constantia Ave, Pretoria
Postal address:	PostNet Suite #18, Private Bag x59
Postal address	Halfway House, 1685
Telephone	011 805 1940
Cell phone	083 222 6916
E-mail	renee@airshed.co.za

SPECIALIST DECLARATION FORM – AUGUST 2023

2. DECLARATION BY THE SPECIALIST

I, Reneé von Gruenewaldt declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Airshed Planning Professionals (Pty) Ltd

Name of Company:

28 July 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Reneé von Gruenewaldt swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Airshed Planning Professionals (Pty) Ltd

Name of Company

28/07/2024

Date

7112929

Signature of the Commissioner of Oaths

2024. 07. 28

Date

AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2024 -07- 28
GEMEENSKAPSDIENSSENTRUM
BROOKLYN
SUID-AFRIKAANSE POLISIEDIENS

CERTIFY ... ALTERATIONS, AN AMENDMENT OR A CHANGE ... I FURTHER

HANDTEKENING / SIGNATURE

MAGSNOMMER / FORCE NUMBER 7112929 RANG / RANK

NAAM IN DRUKSKRIF / NAME IN PRINT

Batho pele- putting people first

Page 3 of 3

APPENDIX C – CALIBRATION CERTIFICATES

sanas
Calibration Laboratory
148
1302

M AND N ACOUSTIC SERVICES (Pty) Ltd

Co. Reg. No. 2012/123238/07 VAT NO: 4300255876 BEE Status: Level 4
P.O. Box 61713, Pierre van Ryneveld, 0045
No. 15, Mustang Avenue
Pierre van Ryneveld, 0045
Tel: 012 689-2007 (076 920 3070) • Fax: 086 211 4690
E-mail: admin@mnacoustics.co.za
Website: www.mnacoustics.co.za

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2023-AS-0353
ORGANISATION	AIRSHED PLANNING PROFFESSIONALS (PTY) LTD
ORGANISATION ADRESS	P.O. BOX 5260, HALFWAY HOUSE, 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	SVAN 977, SV 12L and 7052E
SERIAL NUMBERS	36183, 40659 and 78692
DATE OF CALIBRATION	14 - 15 MARCH 2023
RECOMMENDED DUE DATE	MARCH 2024
PAGE NUMBER	PAGE 1 OF 6

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

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

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

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

Director: Marianka Naudé

1. PROCEDURE

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

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

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

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

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

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

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

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

Parameter	Specification	Uncertainty of Measurement in dB
Calibration Check Frequency at 114,0 dB at 1 000 Hz at Nominal Range: High	IEC 61672-3: Clause 9	± 0,3
Self-Generated Noise: A-Weighted with Microphone 23,7 dB A-Weighted Electrical 18,7 dB C-Weighted Electrical 19,2 dB Z-Weighted Electrical 23,7 dB B-Weighted Electrical 21,4 dB	IEC 61672-3: Clause 10	-------
Level Linearity at 8 000 Hz Nominal Range: High Reference Level at 114,0 dB: (69,4 dB to 149,0 dB)	IEC 61672-3: Clause: 14	± 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:	N.J. BLIGNAUT	*Clause 3.1, 3.2 & 3.3*
Calibrated/Supervised by Calibration Technician:	W.S SIBANYONI	*Clause 3.1 - 3.4*
Authorized/Checked by SANAS Technical Signatory:	M. NAUDÉ	*Date of Issue:* *15 MARCH 2023*

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

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 specification, **Class 1.**

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

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

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

Output Sensitivity at 250 Hz at 94,0 dB was found to be: -28,55 dB/Pa or 37,36 mV/Pa
Frequency Response (31,5 to 16 000) Hz

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)	114,0	114,0	0,0	± 0,3
31,5	111,2	111,3	+ 0,1	± 0,3
63	113,4	113,4	0,0	± 0,3
125	113,9	114,0	+ 0,1	± 0,3
250	114,0	114,1	+ 0,1	± 0,3
500	114,0	114,1	+ 0,1	± 0,3
1 000	114,0	114,0	0,0	± 0,3
2 000	113,6	113,7	+ 0,1	± 0,3
4 000	113,2	112,9	- 0,3	± 0,3
8 000	106,7	107,4	+ 0,7	± 0,3
12 500	100,9	101,7	+ 0,8	± 0,3
16 000	96,4	97,4	+ 1,0	± 0,3

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

4. REMARKS

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

4.2 The environmental conditions during calibration of items in section 3 were:
Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %RH

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

4.4 The above statement of conformance is based on the measurement values obtained, extended by the estimated uncertainty of measurement, being within the appropriate specification limits.

4.5 The above specified Sound & Vibration Analyser and 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:	***N.J. BLIGNAUT***	***Clause 3.1, 3.2 & 3.3***
Calibrated/Supervised by Calibration Technician:	***W.S SIBANYONI***	***Clause 3.1 - 3.4***
Authorized/Checked by SANAS Technical Signatory:	***M. NAUDÉ***	***Date of Issue:*** ***15 MARCH 2023***

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

148
1302

M AND N ACOUSTIC SERVICES (Pty) Ltd
Co. Reg. No: 2012/123238/07 VAT NO: 4300255876 BEE Status: Level 4
P.O. Box 61713, Pierre van Ryneveld, 0045

No. 15, Mustang Avenue
Pierre van Ryneveld, 0045

Tel: 012 689-2007 (076 920 3070) • Fax: 086 211 4690
E-mail: admin@mnacoustics.co.za
Website: www.mnacoustics.co.za

CERTIFICATE OF CONFORMANCE

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

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

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

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

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

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

Director: Marianka Naudé

1. PROCEDURE

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

2. MEASURING EQUIPMENT

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

3. RESULTS

3.1 The following parameters of the Calibrator were calibrated:

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

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

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

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

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

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

4. REMARKS

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

4.2 The environmental conditions were:

Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 15) %RH

4.3 Calibration labels bearing calibration 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 uncertainty of measurements was estimated as follows:

Sound Pressure Level:	± 0,13 dB
Frequency:	± 0,1 Hz
Distortion:	± 0,2 %

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

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

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

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

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

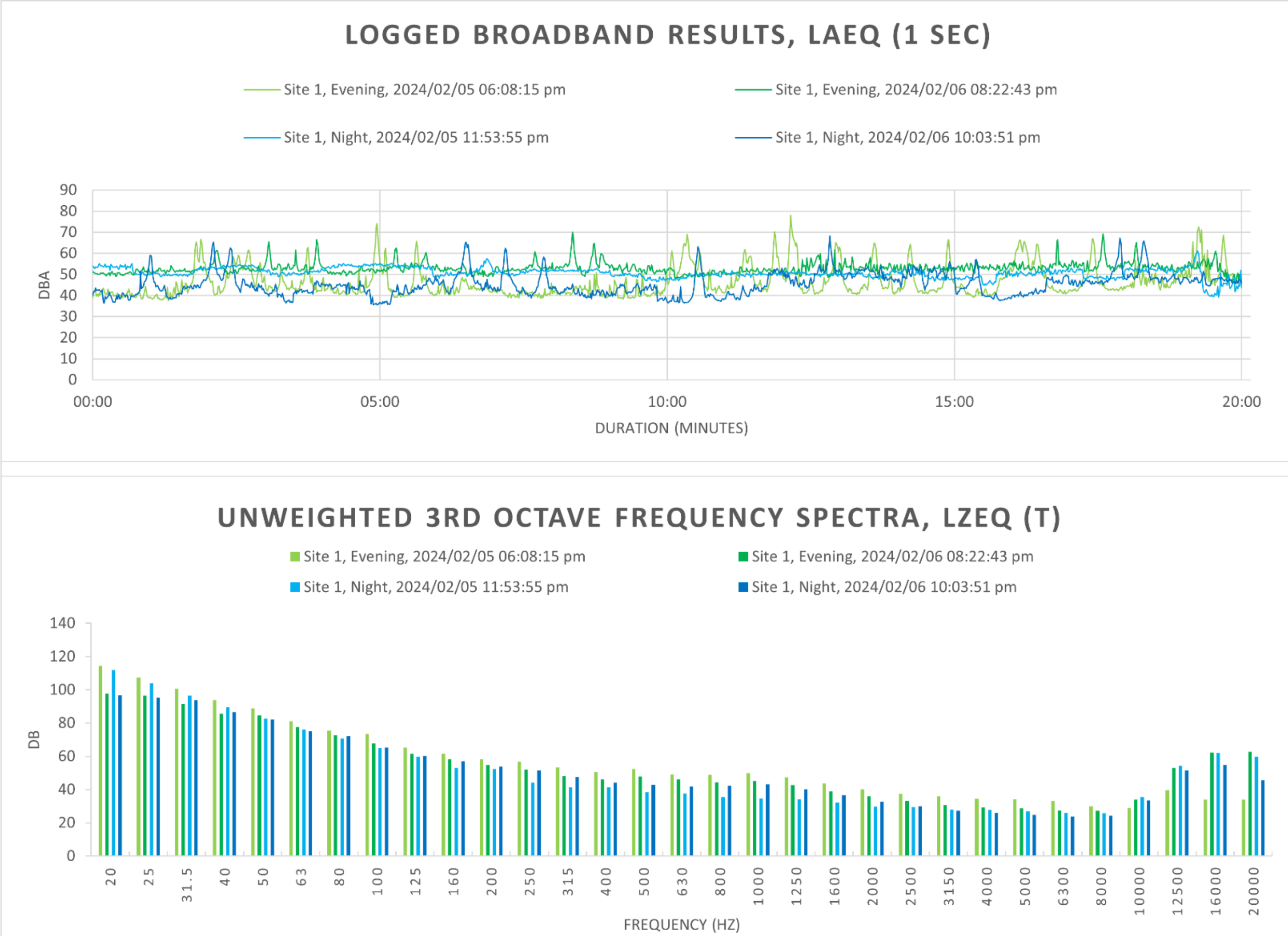


Figure B-0-1: Detailed day-time survey results for Site 1

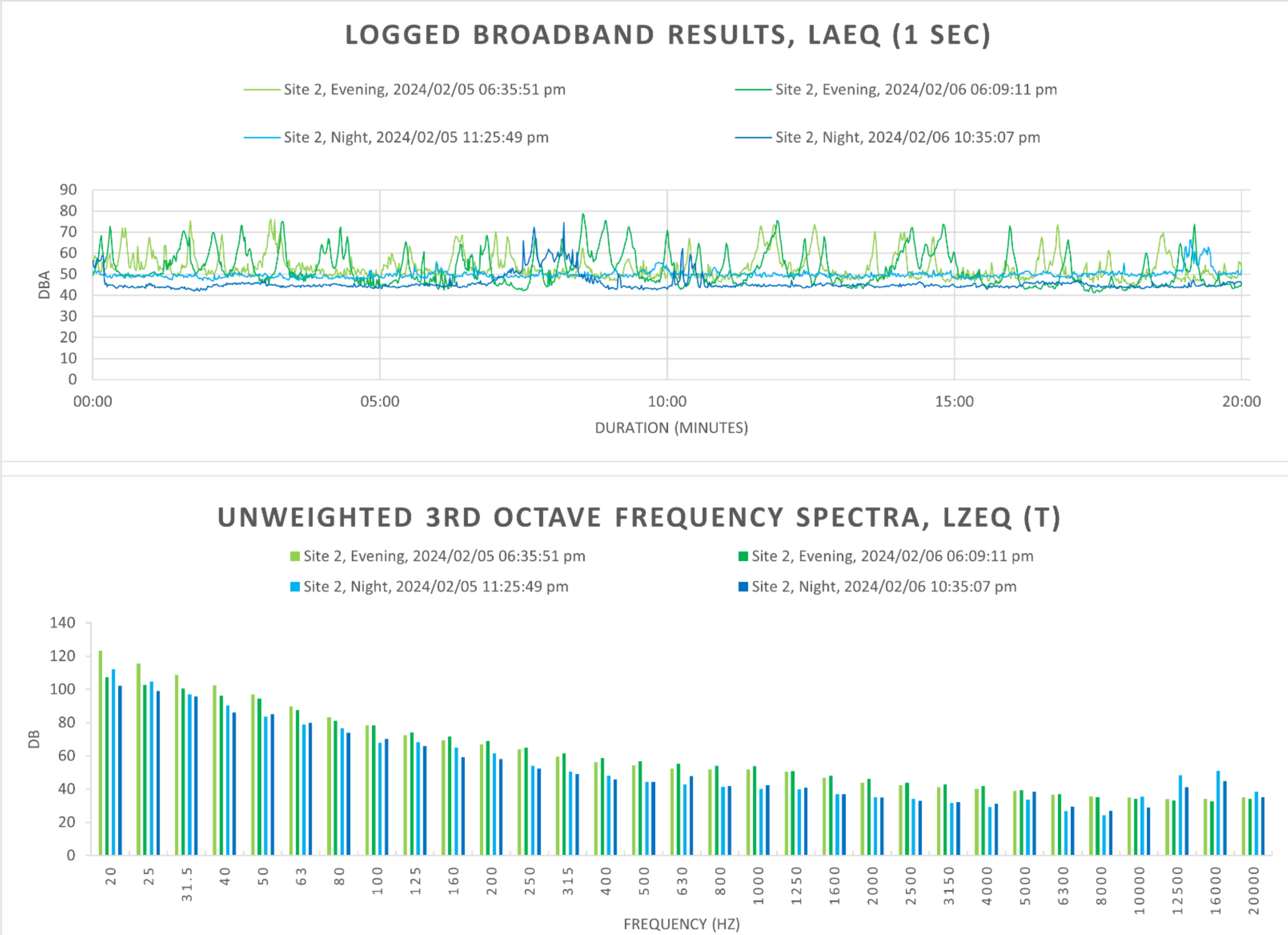
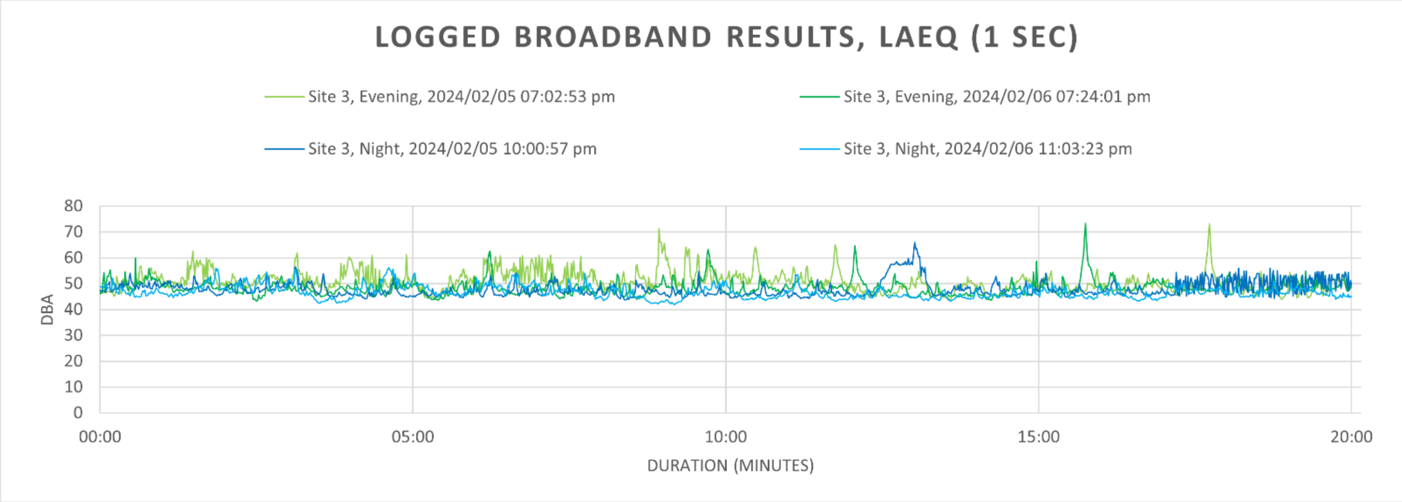


Figure B-0-2: Detailed day-time survey results for Site 2



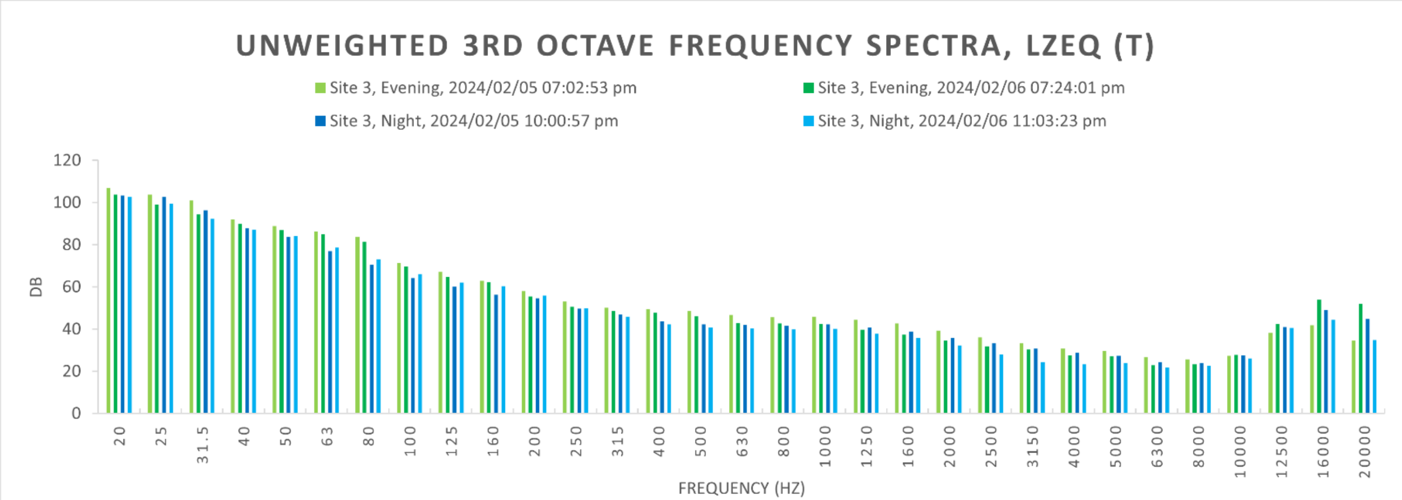


Figure B-0-3: Detailed day-time survey results for Site 3

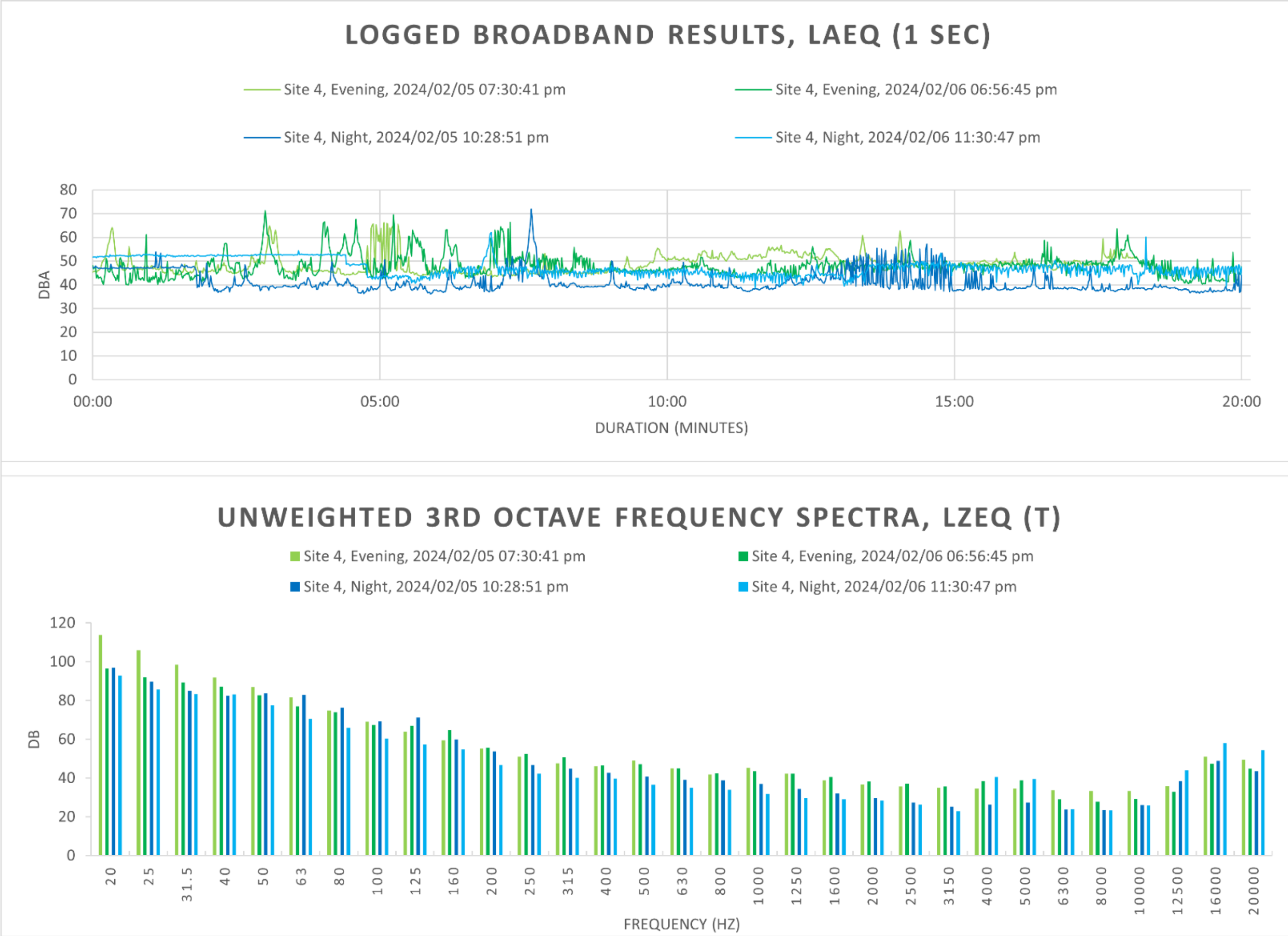
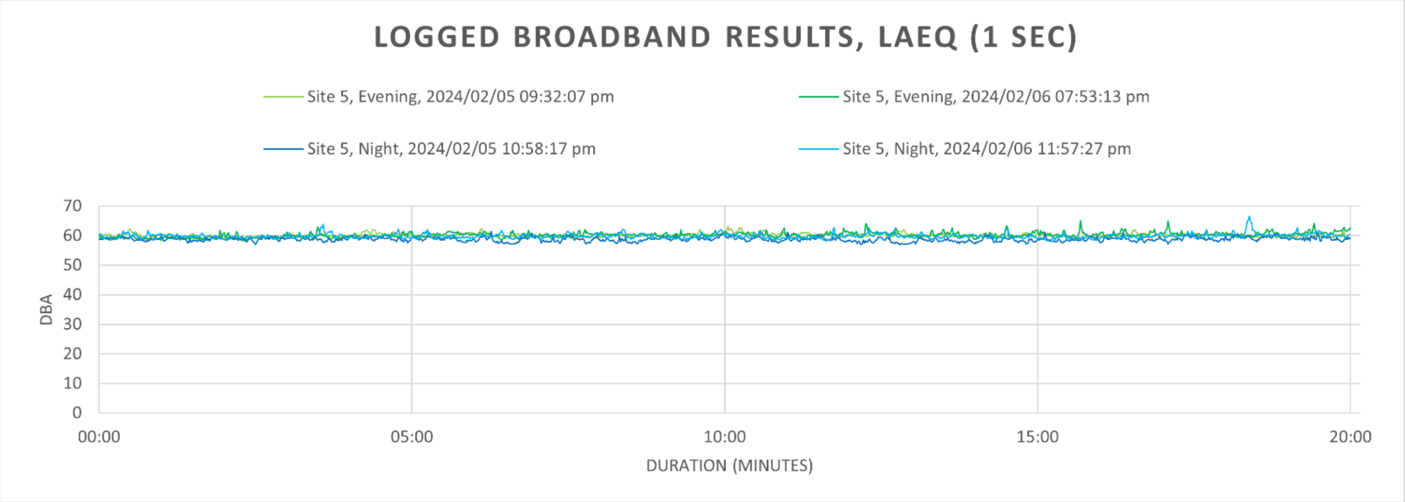


Figure B-0-4: Detailed day-time survey results for Site 4



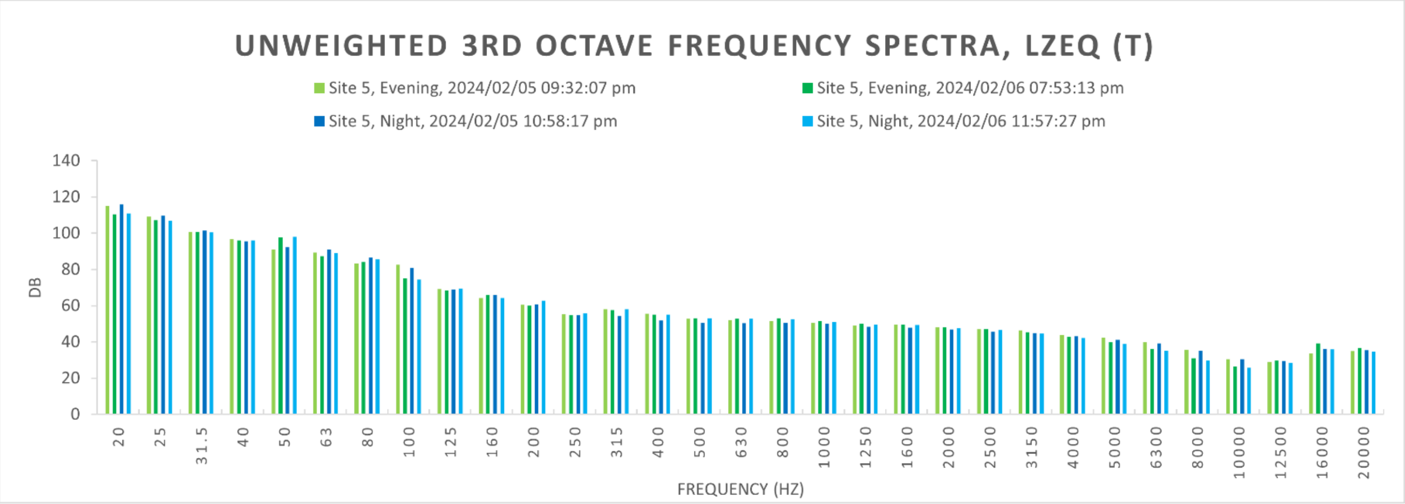


Figure B-0-5: Detailed day-time survey results for Site 5

APPENDIX E – IMPACT 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 C-1 below.

Table C-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)

Aspect	Score	Definition
	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
	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 C-2.

Table C-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 C-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 C-4.

Table C-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 C-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 C-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 C-6).

Table C-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 C-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.