ENVIRONMENTAL & ENGINEERING

REPORT

CANYON RESOURCES (PTY) LTD

NOISE IMPACT ASSESSMENT (NIA)

REPORT REF: 19-907

PORTION 4 OF THE FARM KOPPIE 228 IS, PORTIONS 2, 3, 6, 9, 10, 11, 21, 27, 30, 31, AND 32 OF THE FARM UITGEDACHT 229 IS - MPUMALANGA PROVINCE.)

2021-09-15

VERSION 03

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CC– draft				Quality review
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Nature of Signoff:	Responsible Person:	Role / Responsibility	Qualification
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DISCLAIMER:

EXPERTISE OF THE REVIEWER

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Education	- Senior Certificate Matric (Cum Laude). - B.Sc. Geography (Cum Laude) (University of Pretoria). - BSc Honours Environmental Management and Analysis (Cum Laude) (University of Pretoria). - MSc Project Management (Thesis Cum Laude) (University of Pretoria).
Professional skills	Mr. Henno Engelbrecht has 10 years working experience as an Environmental Consultant and specialized in Environmental Management and Analysis. Henno worked for Environmental Assurance Pty (Ltd) as an environmental consultant since completing his studies until mid-2013 and served an array of clients in various fields of environmental practice. He has vast environmental monitoring & measurement, environmental authorisations, mine closure, and environmental impact assessment experience and worked within various project teams, up to the level of Programme Manager being responsible for all projects which fell within the Environmental Assurance (Pty) Ltd programme. His expertise led to his specialist inputs and studies to be used in several Environmental Impact Assessments, Water Use License Applications, Waste License Applications, Air Emission License Applications and Mine Closure/Rehabilitation Planning Activities. Henno holds the MSc Project Management degree at the Engineering Faculty with the University of Pretoria. He worked in mining, industrial, natural and construction environments but his expertise lies mainly within the mining sector and currently holds the position of Director at Eco Elementum (Pty) Ltd.
Skills	- Mine Closure financial quantum determination, mine closure planning and reporting. - Rehabilitation planning, reporting, management and coordination of opencast and underground mining. - Ambient air quality monitoring, measurement and implementation (passive and active) in accordance to the National Environmental Management: Air Quality Act 39 of 2004, Government Notice 248 NEM: AQA (39/2004) which contains the Listed Activities, and the National Ambient Air Quality Standards (SANS 1929: 2005). - Noise monitoring and measurement according to SANS 10103:2008, the measurement and rating of environmental noise with respect to annoyance and to speech communication & SANS 10328:2008, Methods for environmental noise impact assessment. - Water quality monitoring, measurement, reporting and data analyses including surface water, ground water, process water, sewage water and biological indicators. - Groundwater hydrocensus studies – borehole surface water depth monitoring, measurement, transections and analysis. - ISO 14001 Environmental Management Systems auditing, system implementation, training and environmental analysis (creation of aspect/impact registers, contractor training, general environmental awareness training, legal compliance audits, GAP analysis, documentation reviews, roles and authority allocations etc.) - Legal compliance auditing and reporting in accordance with the National Environmental Management Acts and other associated environmental related (NEMA listed activities, Air Quality Act listed activities, Water Use Licensing, Waste Licensing, Air Emissions Licensing etc.) - Environmental training (contractor training, monitoring and measurement training, awareness training). - Environmental impact assessments and Integrated Water Use License Applications. - Environmental Management Plan development, monitoring, compliance auditing etc. - Environmental Control Officer Site inspections- non-conformance reporting (NCR), corrective action request (CAR) and preventative action request (PAR).

SPECIALIST DECLARATION OF INDEPENDENCE

In support of an application in terms of the National Environmental Management Act 107 of 1998 (GNR983, GNR984 and GNR985, GG38282 of 4 December 2014 ("Listed Activities") that will require an environmental authorisation if triggered. As amended by GNR 327, GNR 325 and GNR 324.

I, **Neel Breitenbach** as specialist, has been appointed in terms of regulation 12(1) or 12(2), and can confirm that I shall —

a. Be independent;
b. have expertise in undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity;
c. ensure compliance with these Regulations;
d. 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 application'
e. take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application;
f. disclose to the proponent or applicant, registered interested and affected parties to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing –
g. any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or
h. the objectivity of any report, plan or document to be prepared by the EAP or specialist, in terms of these Regulations for submission to the competent authority; and
i. Unless access to that information is protected by law, in which case it must be indicated that such protected information exists and is only provided to the competent authority.

Neel Breitenbach	[signature]
Name and Surname	Signature
2021-01-21	**George**
Date	Signed at

EXECUTIVE SUMMARY

Canyon Resources (Pty) Ltd appointed Eco Elementum (Pty) Ltd to undertake environmental authorisations associated with the proposed Koppie MR project. The applicant propose to conduct underground mining on an area of 1 955.45 ha comprising of Portion 4 of the Farm Koppie 228 IS, Portions 2, 3, 6, 9, 10, 11, 21, 27, 30, 31, and 32 of the Farm Uitgedacht 229 IS in the Mpumalanga Province of South Africa.

Eco Elementum (Pty) Ltd has also been appointed to undertake the Noise Impact Assessment for the Koppie MR project.

Canyon Resources (Pty) Ltd (Canyon) proposes to open a new greenfields underground coal mining operation.

The major coal seams present in the area are named from the base upwards the No. 1, No. 2 Lower, No. 2 Upper, No. 4 Lower, No. 4 Upper and No. 5 Seam respectively. The following seams are earmarked for extraction as part of the Koppie project:

- 4 Lower Seam – 58.96 m to 118.8 m below surface; and
- 2 Lower Seam – 89.35 m to 132.72 m below surface.

The project has an inferred resource of 68,199 Mt of coal that will be marketed to Export/local markets. It is anticipated that mining will involve removing ~ 150 000 tonnes of coal per month with life of mine 21 years

The ROM coal is going to be processed at an on-site beneficiation plant.

The scope of work for this Noise Impact Assessment will include:

1. Investigate the applicable noise legislation relating to the proposed project site.
2. Measurements of the existing noise levels at various locations.
3. Estimate the noise emissions from the proposed project site during construction and operational phases.
4. Mitigation and recommendations where noise impact is expected.

SUMMARY OF FINDINGS

The findings reported here are a mixture of historical, observed and measured data and provided the background reference values for the proposed Koppie MR project;

- Noise samples taken during the assessment also indicated a typical rural and farming noise character and is higher in close proximity to the farms where a contribution of the farming vehicle noise was experienced during the sampling initiative.
- Noise measurement ranged from as low as 33.0 dBa to 46.5 dBa at the highest value close to the farming activities.

The ambient noise survey serves as part of the management tool during continuous monitoring during the life of the operation to determine whether significant increases has occurred that require management and mitigation measures that might be more stringent than what have been listed in this particular report.

It should however be noted that the measurements taken is only applicable to the time and date which sampling was undertaken and that results would differ as more measurements are taken. Therefore, the importance of ensuring a monitoring programme to be implemented during the operation of the proposed project.

Various noise influencing factors and sources exists in the region, including;

- The supporting regional roads
- General vehicle noise on auxiliary roads in close proximity to the site
- Noise generated as a result of agricultural activities (mainly farming vehicles)

MODELLING RESULTS

Looking at Table 1 below, the Preferred scenario is predicted to exceed the SANS 10103:2008 limit at 0 sensitive receptors during the day-time and 3 sensitive receptors during the night-time. The average predicted dB at the sensitive receptors, predicted to be impacted by the proposed operation, is calculated as 12.29dB.

While the Alternate scenario is predicted to also exceed the SANS 10103:2008 limit at 0 sensitive receptor during the day-time and 3 sensitive receptors during the night-time. The average predicted dB at the sensitive receptors, predicted to be impacted by the proposed operation, is calculated as 17.51dB

Based on the modelled results, the preferred scenario is predicted to have the least noise impact on the receiving sensitive receptors.

Table 1: Comparison between the Preferred and Alternative scenarios

Scenario	Day-time Exceedances	Night-time Exceedances	Average dB
Preferred	0	3	12.29 dB
Alternative	0	3	17.51 dB

Through the implementation of the management and mitigation measures and continuous compliance monitoring, the potential impact of the Koppie MR development on the receiving environment can be lowered and mitigated to an extent where the significance will be moderate and acceptable within the tolerable level, and therefore be supported by this study. It can therefore be concluded that the proposed project can go forward without a detrimental impact on the environment given the sound implementation of the management, mitigation and monitoring measures as presented throughout this report.

Table 2: Summarizing the significance of noise impacts on the sensitive receptors for the Operational phase.

Nature of impact: Potential noise impact on the sensitive receptors for the construction phase.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**3**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5 km to 50 km) (4); National (5)]	**3**	**2**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**4**	**4**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**5**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**5**	**3**
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	**5**	**5**
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	**1**	**1**

Nature of impact: Potential noise impact on the sensitive receptors for the construction phase.				
Consequence	Severity + Spatial Scale + Duration		**10**	**8**
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection		**16**	**14**
Risk	Consequence * Likelihood		**MODERATE (160)**	**MODERATE (112)**
Mitigation:		- Noise barrier in the form of a berm, tree break or similar noise fence between the sensitive receptors and noise sources. - The barrier will help with the attenuation of noise produced by the proposed activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance. - Construction and mining-related machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers. - Switching off equipment when not in use. - Fixed noise producing sources such as generators, pump stations and crushers to be either housed in enclosures or barriers put up around the noise source. - Equipment with lower sound power levels would be used in preference to noisier equipment. - The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.		
Cumulative Impact:		The construction of the proposed Koppie MR project with its associated infrastructure will increase the cumulative noise impact within the region.		

The impact on the surrounding land users will be more significant but can still be seen as MODERATE. Although the activities will be highly audible, with the correct mitigation measures, the impact on the users will still be MODERATE, although lower.

Mitigation Measures

Mitigation measures may be considered in two categories:

- Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered.
- Secondary measures designed to specifically address the remaining negative effects of the final development proposals.

Primary measures that will be implemented will mainly be measures that will minimise the noise impact of the receiving environment by reducing the noise of the operational equipment. Such measures may include:

- Berms or noise breaks between the operational area and the sensitive receptors.
- Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers be put up around these sources.
- Use equipment with lower sound levels used in preference over higher sound emitting equipment.
- Maintaining the onsite road network to reduce the noise emitting from trucks traveling on the roads.

Secondary measures may include the following:

- Operational machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers.
- Switching off equipment when not in use.

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Definition of Terms

Assessment	A systematic, independent and documented review of operations and practises to ensure that relevant requirements are met.
Construction	The time period that corresponds to any event, process, or activity that occurs during the Construction phase (e.g., building of site, buildings, and processing units) of the proposed project. This phase terminates when the project goes into full operation or use.
Critical viewpoints	Important points from where viewers will be able to view the proposed or actual development and from where the development may be significant.
Cumulative Impacts	The summation of the effects that result from changes caused by a development in conjunction with the other past, present or reasonably foreseen actions (The landscape Institute, Institute of Environmental Management & Assessment. 2002)
Decommissioning	to remove or retire (a mine, etc.) from active service.
Environmental Component	An attribute or constituent of the environment (i.e., air quality; marine water; waste management; geology, seismicity, soil, and groundwater; marine ecology; terrestrial ecology, noise, traffic, socio-economic) that may be impacted by the proposed project.
Environmental Impact	A positive or negative condition that occurs to an environmental component as a result of the activity of a project or facility. This impact can be directly or indirectly caused by the project's different phases (i.e., Construction, Operation, and Decommissioning).
Field of view:	The field of view is the angular extent of the observable world that is seen at any given moment. Humans have an almost 180º forward-facing field of view. Note that human stereoscopic (binocular) vision only covers 140º of the field of view in humans; the remaining peripheral 40º have no binocular vision due to the lack of overlap of the images of the eyes. The lower the focal length of a lens (see below), the wider the field of view.
Landscape Integrity	Landscape integrity is visual qualities represented by the following qualities, which enhance the visual and aesthetic experience of the area
Mitigation (in the context of Visual Impact Assessment):	Any action taken or not taken in order to avoid, minimise, rectify, reduce, eliminate, or compensate for actual or potential adverse visual impacts.
Operation	The time period that corresponds to any event, process, or activity that occurs during the Operation (i.e., fully functioning) phase of the proposed project or development. (The Operation phase follows the Construction phase, and then terminates when the project or development goes into the Decommissioning phase.)
Record of Decision	Is an environmental authorisation issued by a state department.
Scenic value	Degree of visual quality resulting from the level of variety, harmony and contrast among the basic visual elements.
Sense of place	the character of a place, whether natural, rural or urban, it is allocated to a place or area through cognitive experience by the user.
Visual absorption capacity (VAC):	The ability of elements of the landscape to "absorb" or mitigate the visibility of an element in the landscape. Visual absorption capacity is based on factors such as vegetation height (the greater the height of vegetation, the higher the absorption capacity), structures (the larger and higher the intervening structures, the higher the absorption capacity) and topographical variation (rolling topography presents opportunities to hide an element in the landscape and therefore increases the absorption capacity).
Visual character	the overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape's components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual Exposure	Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed mine activities and associated infrastructure were not visible, no visual impact would occur. Visual exposure is determined by the Viewshed or the view catchment being the area within which the proposed development will be visible.
Visual Integrity	Visual sensitivity can be determined by a number of factors in combination, such as prominent topographic or other scenic features, including high points, steep slopes and axial vistas
Visually sensitive	Areas in the landscape from where the visual impact is readily or excessively encountered.

Abbreviations

CA:	Competent Authority
DEA:	Department of Environmental Affairs (The former Department of Environmental Affairs and Tourism)
DMR:	The Department of Mineral Resources (The former Department of Minerals and Energy)
DWA:	Department of Water Affairs (Is now referred to the Department of Water and Sanitation – DWS)
EIA:	Environmental Impact Assessment
EMP:	Environmental Management Plan
EMPr:	Environmental Management Programme
I&AP's:	Interested and Affected Parties
IWUL:	Integrated Water Use License
IWWMP:	Integrated Water and Water Management Plan
MPRDA:	Mineral and Petroleum Resources Development Act, 28 of 2002
NAAQS:	National Ambient Air Quality Standards
NEMA:	National Environmental Management Act, 107 of 1998
NEMAQA:	National Environmental Management: Air Quality Act, 39 of 2004
NEMBA:	National Environmental Management: Biodiversity Act, 10 of 2004
NEMWA:	National Environmental Management: Waste Act, 59 of 2008
NHRA:	National Heritage Resources Act, 25 of 1999
NWA:	National Water Act, 36 of 1998
ROD:	Record of Decision
VAC:	Visual Absorption Capability
VIA:	Visual Impact Assessment
WSA:	Water Services Act, 108 of 1997
WUL:	Water Use Licence

PROJECT INFORMATION

Table 3: Applicant Details

Name of Applicant:	Canyon Resources (Pty) Ltd
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File Reference Number DMR:	MP 30/5/1/2/2/10273 MR

Table 4: EAP Details

EAP Company:	Eco Elementum (Pty) Ltd
Company Reg. No.:	2012/021578/07
Physical Address:	361 Oberon Ave, Glenfield Office Park, Nika Building, 1st Floor, Faerie Glen, Pretoria, 0081
Postal Address:	Postnet Suite #252, Private Bag X025. Lynnwood Ridge, Pretoria, 0040
Contact Person:	Riana Panaino
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Table 5: Specialist Details

Specialist Company:	Eco Elementum (Pty) Ltd
Company Reg. No.:	2012/021578/07
Physical Address:	361 Oberon Ave, Glenfield Office Park, Nika Building, 1st Floor, Faerie Glen, Pretoria, 0081
Postal Address:	Postnet Suite #252, Private Bag X025. Lynnwood Ridge, Pretoria, 0040
Contact Person:	Henno Engelbrecht
Contact Number:	012 807 0383
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Website:	www.ecoe.co.za

1. INTRODUCTION

Canyon Resources (Pty) Ltd appointed Eco Elementum (Pty) Ltd to undertake environmental authorisations associated with the proposed Koppie MR project. The applicant propose to conduct Underground mining on an area of 1 955.45 ha comprising of Portion 4 of the Farm Koppie 228 IS, Portions 2, 3, 6, 9, 10, 11, 21, 27, 30, 31, and 32 of the Farm Uitgedacht 229 IS in the Mpumalanga Province of South Africa.

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- 2 Lower Seam – 89.35 m to 132.72 m below surface.

The project has an inferred resource of 68,199 Mt of coal that will be marketed to Export/local markets. It is anticipated that mining will involve removing ~ 150 000 tonnes of coal per month with life of mine 21 years.

Two site layout options are evaluated.

Project Description

1.1.1 Underground Bord and Pillar Mining

A boxcut or incline will be opened where the strip ratio is the lowest with an adit. The underground mining operations will be conducted by the owner or contractor. The underground mining method to be undertaken is bord and pillar mining with continuous miners (CM) and shuttle cars, supported by roof bolters for roof support.

The mined coal from the underground workings will be transported via conveyer belts and the haul roads and stored on the Run of Mine (RoM) stockpile area. The coal will be fed into a crushing and washing plant with a conveyor after which the coal product will be temporarily stored at the product stockpile area before being transported to the newly proposed or existing siding for distribution or directly via truck to the relevant markets. A temporary discard dump containing one year's capacity will be constructed to store discard before being rewashed.

To conduct the above-mentioned process, the planned mining equipment to be utilized above ground is as follows:

- 1 x Dozer;
- 1 x Excavator;
- 3 x BELL Articulated Dump trucks;
- 1 x Conveyor Belt;
- 2 x 10 000 litre CAT Water Bowser;
- 1 x CAT Grader
- 1 x 4 000 litre Diesel Bowser;
- Support equipment (transport / material handling – Diesel);

The processing plant planned equipment is as follow:

- Primary Crusher
- Secondary Crusher
- Screening
- Drum Plant
- Spiral Plant
- Cyclone Plant
- Front end Loader
- Conveyor;

1.1.2 High level description of the processing plant

1.1.2.1 Screening and Crushing

The RoM will be fed into the plant by means of a feeder bin at the RoM pad. The feeding capacity of the plant will be 400 tons/hour. Coal will either be manually fed into the bin by means of a Front-End Loader or via conveyor belts. The first stage of the process plant is to screen the coal into various particle sizes.

This is done by the use of a 1.5 x 2.5 m primary vibrating grizzly screen fitted with 80 mm bar spacing. The coal fraction of 250 x 80 mm fraction will be discharged into a primary double roll crusher, which will reduce the oversize fraction to 90 mm in size. The primary crusher product will re-join the grizzly undersize fraction which feeds into a secondary 1.8 x 6.0 m double deck screen fitted with 60 and 50 mm bar spacing. The oversize (+75 mm) fraction will be fed to a secondary double roll crusher, the crushed product will be returned to the primary screen feed conveyor belt, in a closed crushing circuit.

1.1.2.2 Coal Washing and Processing

The eventual crushed and screened undersize fraction (-75mm) will be fed to the cyclone, drum and spiralsections of the wash plant which will then be deposited onto a product stockpile. The washing section will operate during mining hours.

The slurry from the thickener underflow will report to the filter press and make up 12 % to 15 % of the plant feed. The Dense Media Separation (DMS) plant will be capable of a 95 % organic efficiency with a product yield of 75 %.

The plant will produce a product suitable for local and export markets.

1.1.2.3 Product Storage

The coal product will be stored on a product stockpile. The product stockpile conveyor belt will be fitted with a level probe to avoid over filling the stockpile and a mass meter for process accounting purposes.

1.1.3 Construction Phase

The construction phase will commence immediately upon granting of a mining right and will be completed in approximately 1 year. This includes site establishment and construction of all infrastructures and approximately 6 months is required the shaft development.

Table 6: Project Locality

Farm Name:	**Portion 4 of the Farm Koppie 228 IS, Portions 2, 3, 6, 9, 10, 11, 21, 27, 30, 31, and 32 of the Farm Uitgedacht 229 IS – Mpumalanga Province - South Africa**
Application Area:	1 955.45 ha
Magisterial District:	Gert Sibande District Municipality, Mpumalanga Province South Africa
Distance and direction from nearest town:	The Project Area is ~ 13km north of . See Figure 1.

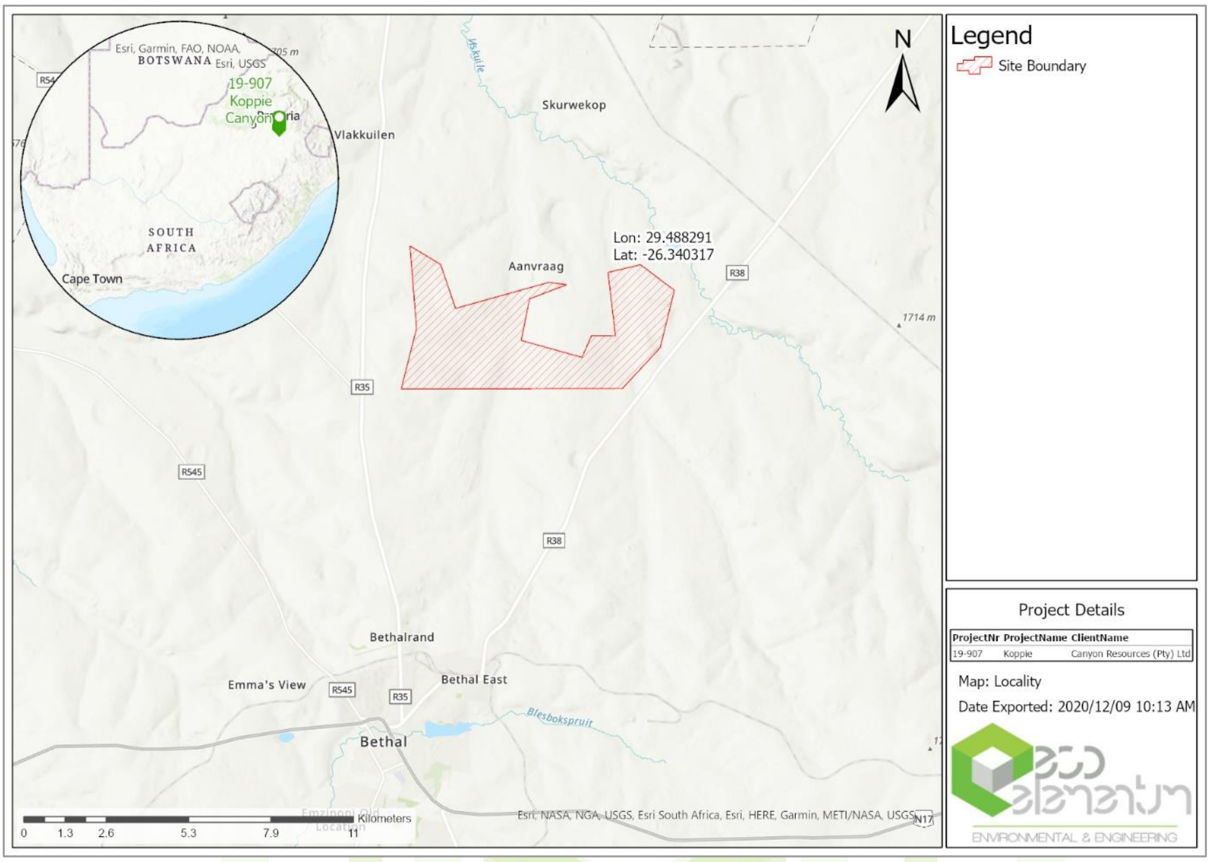


Figure 1: Locality map of the proposed Koppie MR project.

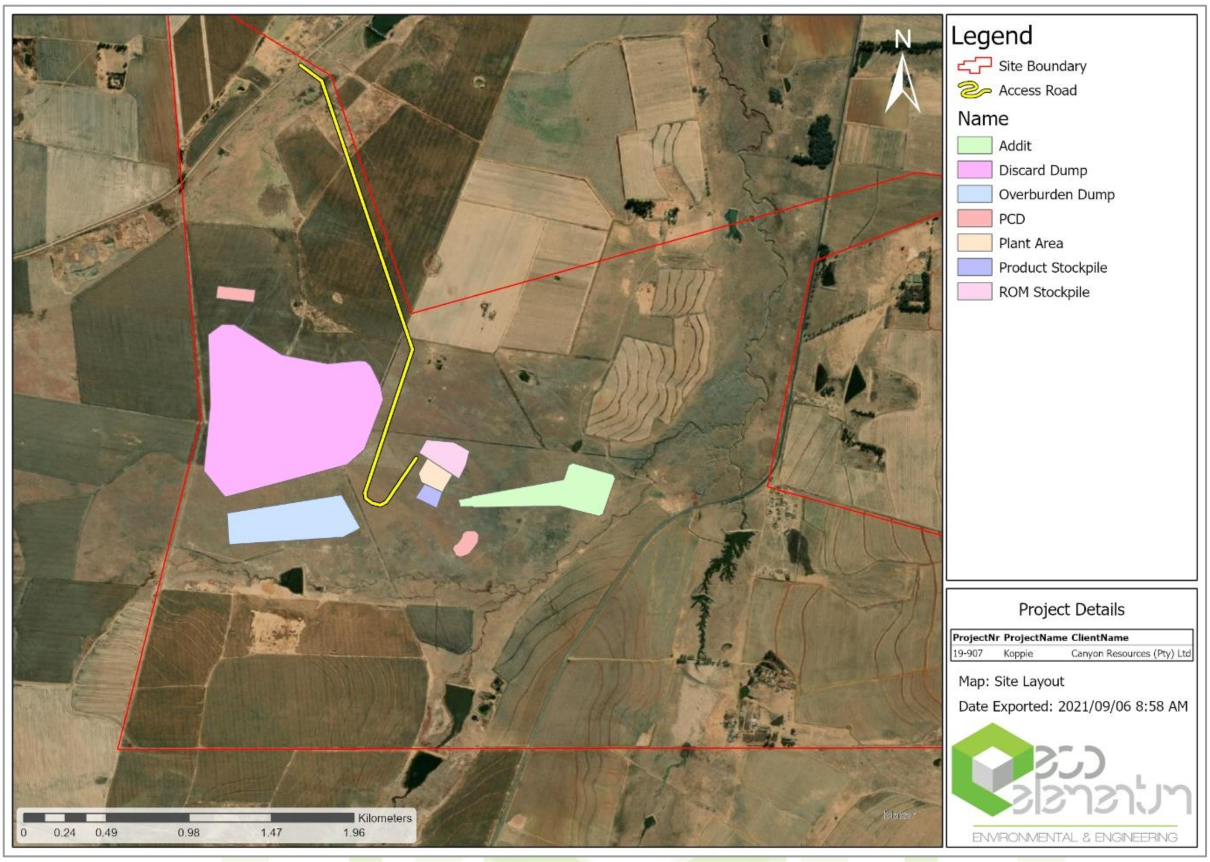


Figure 2: Preferred Site Layout of the proposed Koppie MR project.

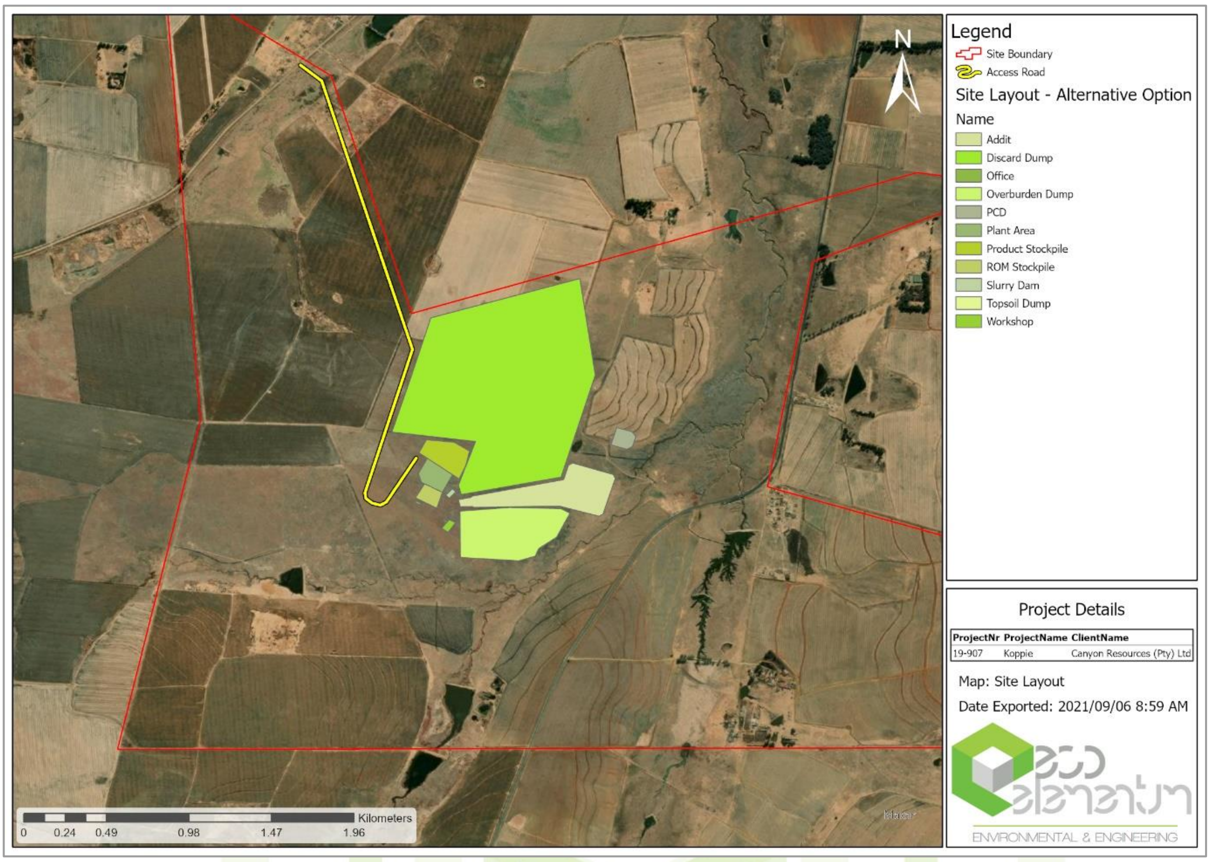


Figure 3: Alternative Site Layout of the proposed Koppie MR project.

2. SCOPE OF WORK

The scope of work for this Noise Impact Assessment will include:

1. Investigate the applicable noise legislation relating to the proposed project site.
2. Measurements of the existing noise levels at various locations.
3. Estimate the noise emissions from the proposed project site during construction and operational phases.
4. Mitigation and recommendations where noise impact is expected.

3. DESCRIPTION OF AFFECTED AREA AND ENVIRONMENT

This section of the report provides a description of the current status of the environment. This provides a baseline context for assessment of the proposed structures.

Location

3.1.1 Population

Figure 4: Population areas within close proximity of the proposed Koppie MR project.

From a desktop study of satellite imagery various sensitive receptors in the form of human habitation areas, consisting of the various farm steads were identified in the vicinity of the proposed Koppie MR project area can be seen in Figure 4. It should be noted that the sensitive receptors in the area may differ from those identified as not all areas may have been identified from the imagery.

3.1.2 Regional Air

South Africa is located in the sub-tropics where high pressures and subsidence dominate. However, the southern part of the continent can serve as a source of hot air that intrudes sub-tropics, and that sometimes lead to convective movement of air masses. On average, a low pressure will develop over the southern part of the continent, while the normal high pressures will remain over the surrounding oceans. These high pressures are known as Indian High Pressure Cells and Atlantic High pressure Cells. The intrusion of continents will allow for the development of circulation patterns that draw moisture (rain) from either tropics (hot air masses over equator) or from the mid-latitude and temperate latitudes.

Southern Africa is influenced by two major high pressure cells, in addition to various circulation systems prevailing in the adjacent tropical and temperate latitudes. The mean circulation of the atmosphere over Southern Africa is anticyclonic throughout the year (except near the surface) due to the dominance of the three high pressure cells, namely South Atlantic High Pressure, off the west coast, the South Indian High Pressure off the east coast and the Continental High Pressure over the interior.

3.1.3 Meso-Scale Meteorology

The nature of the local climate will determine what will happen to the pollution when it is released into the atmosphere (Tyson and Preston-Whyte, 2000). Pollution levels fluctuate daily and hourly, in response to changes in atmospheric stability and variations in mixing depth. Similarly, atmospheric circulation patterns will have an effect on the rate of transport and dispersion of pollution.

The release of atmospheric pollutants into a large volume of air results in the dilution of those pollutants. This is best achieved during conditions of free convection and when the mixing layer is deep (unstable atmospheric conditions). These conditions occur most frequently in summer during the daytime. This dilution effect can however be inhibited under stable atmospheric conditions in the boundary layer (shallow mixing layer). Most surface pollution is thus trapped under a surface inversion (Tyson and Preston-Whyte, 2000).

Inversion occurs under conditions of stability when a layer of warm air is situated directly above a layer of cool air. This layer prevents a pollutant from diffusing freely upward, resulting in an increased pollutant concentration at or close to the earth's surface. Surface inversions develop under conditions of clear, calm and dry conditions and often occur at night and during winter (Tyson and Preston-Whyte, 2000). Radiative loss during the night results in the development of a cold layer of air close to the earth's surface. These surface inversions are however, usually destroyed as soon as the sun rises and warm the earth's surface. With the absence of surface inversions, the pollutants are able to diffuse freely upward; this upward motion may however be prevented by the presence of an elevated inversion (Tyson and Preston-Whyte, 2000).

Elevated inversions occur commonly in high pressure areas. Sinking air warms adiabatically to temperatures in excess of those in the mixed boundary layer. The interface between the upper, gently subsiding air is marked by an absolutely stable layer or an elevated subsidence inversion. This type of elevated inversions is most common over Southern Africa (Tyson and Preston-Whyte, 2000).

The climate and atmospheric dispersion potential of the interior of South Africa is determined by atmospheric conditions associated with the continental high pressure cell located over the interior. The continental high pressure present over the region in the winter months results in fine conditions with little rainfall and light winds with a northerly flow. Elevated inversions are common in such high pressure areas due to the subsidence of air. This reduces the mixing depth and suppresses the vertical dispersion of pollutants, causing increased pollutant concentrations (Tyson and Preston- Whyte, 2000).

Seasonal variations in the positions of the high pressure cells have an effect on atmospheric conditions over the region. For most of the year the tropical easterlies cause an air flow with a north-easterly to north-westerly component. In the winter months the high pressure cells move northward, displacing the tropical easterlies northward resulting in disruptions to the westerly circulation. The disruptions result in a succession of cold fronts over the area in winter with pronounced variations in wind direction, wind speeds, temperature, humidity, and surface pressure.

Airflow ahead of a cold front passing over the area has a strong north-north-westerly to north-easterly component, with stable and generally cloud-free conditions. Once the front has passed, the airflow is reflected as having a dominant southerly component (Tyson and Preston-Whyte, 2000).

Easterly and westerly wave disturbances cause a southerly wind flow and tend to hinder the persistence of inversions by destroying them or increasing their altitude, thereby facilitating the dilution and dispersion of pollutants. Pre-frontal conditions tend to reduce the mixing depth. The potential for the accumulation of pollutants during pre-frontal conditions is therefore enhanced over the plateau (Tyson and Preston-Whyte, 2000).

3.1.4 Site-Specific Conditions

A period wind rose for the site is presented in Figure 6 below. Wind roses comprise of 16 spokes which represents the direction from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories.

Based on an evaluation of the meteorological data simulations run from a global NEMS weather model at ~30 km resolution from 1985 to current of the project area. The following deductions regarding the prevailing wind direction and wind frequency can be assessed. Looking at Figure 6 below, the predominant wind direction is predicted to occur mainly from the ENE 1143 hours per year respectively. A secondary direction is predicted from WNW and E 762 and 839 hours per year, respectively, with wind speeds higher than 5 km/h.

From Figure 5, at the site, calm conditions with wind speeds of 12 km/h or less, are predicted 2-7 days per month throughout the year. 12-19 km/h winds are predicted 10-16 days per month through the year. Wind speeds of more than 19 km/h are predicted to occur 8-13 days per year on average.

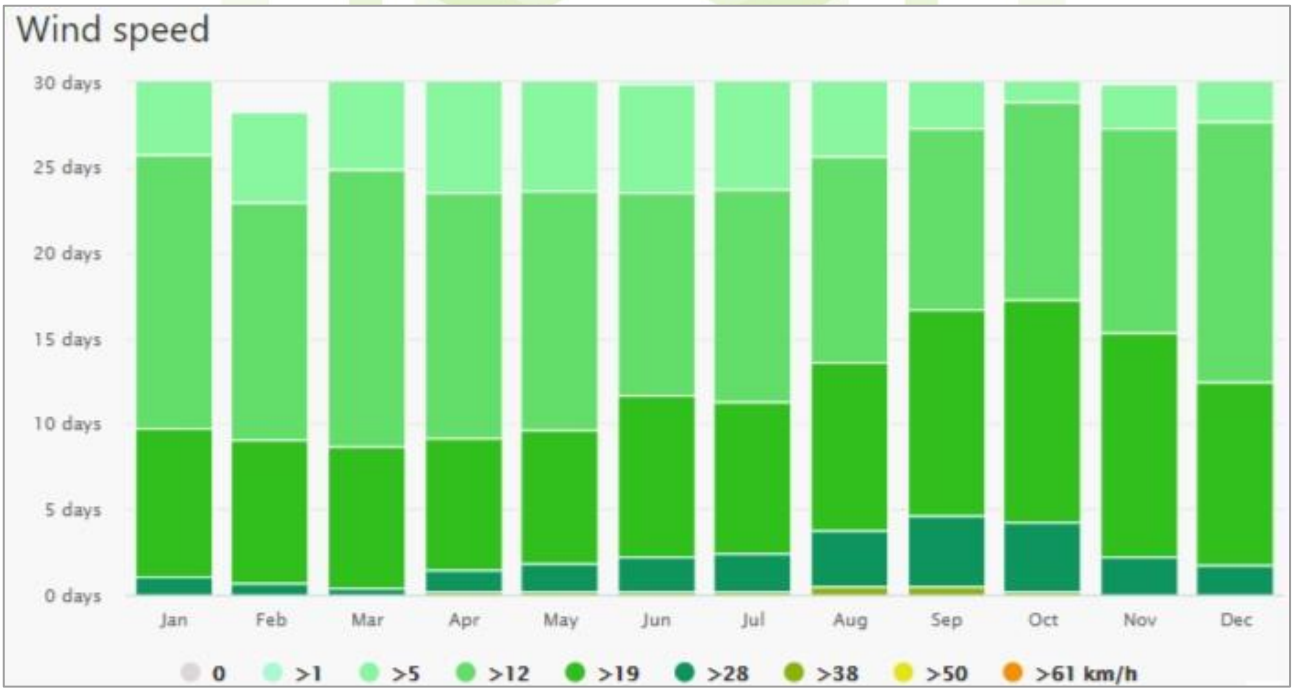


Figure 5: Wind Class Frequency Distribution per month.

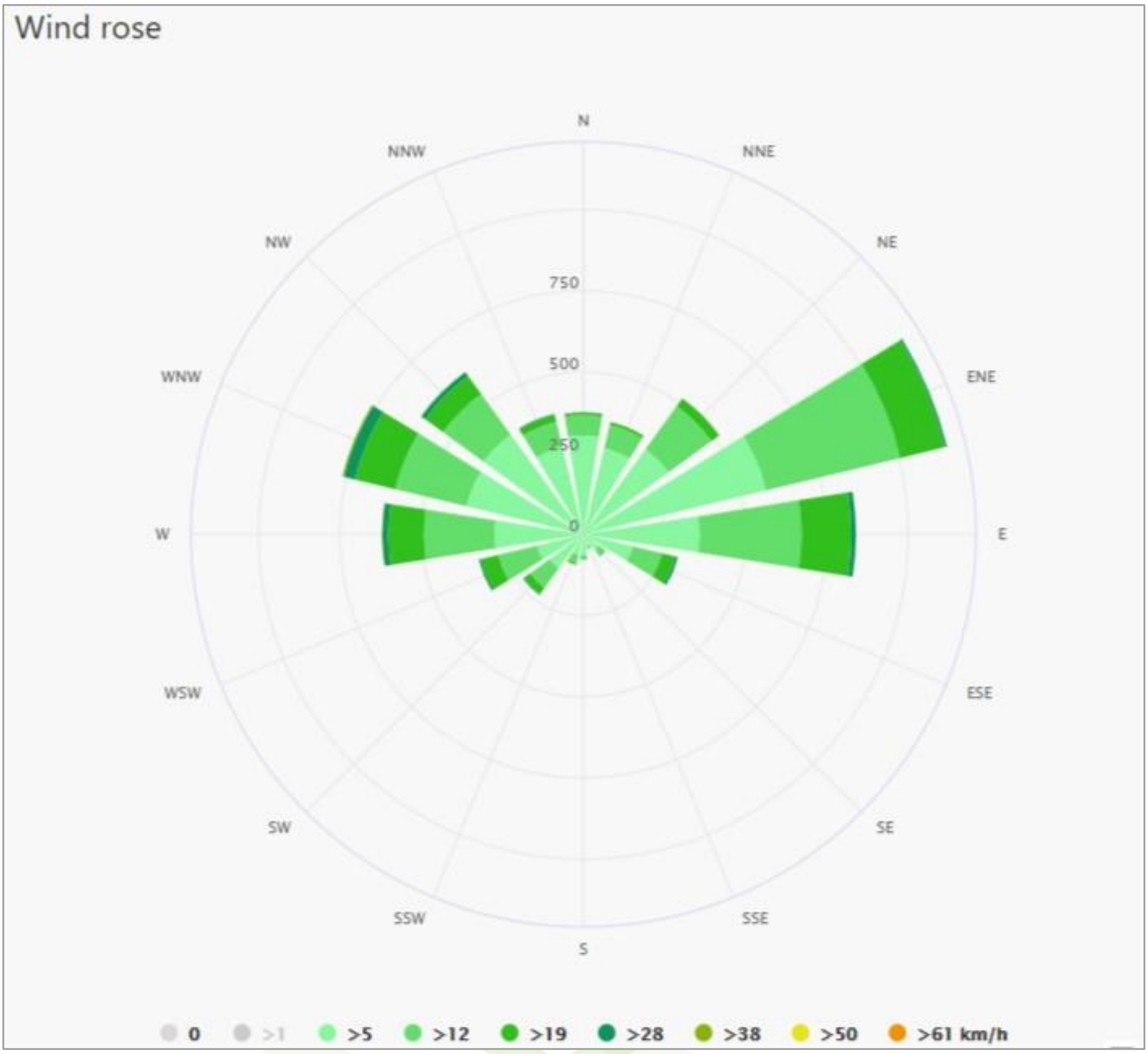


Figure 6: NEMS 30 km simulation model wind rose for the proposed Koppie MR project area for the period 1985 to current.

3.1.5 Temperature

Temperature affects the formation, action, and interactions of pollutants in various ways (Kupchella and Hyland, 1993). Chemical reaction rates tend to increase with temperature and the warmer the air, the more water it can hold and hence the higher the humidity. When relative humidity exceeds 70%, light scattering by suspended particles begins to increase, as a function of increased water uptake by the particles (CEPA / FPAC Working Group, 1999). This results in decreased visibility due to the resultant haze. Many pollutants may dissolve in water to form acids. Temperature also provides an indication of the rate of development and dissipation of the mixing layer.

Based on an evaluation of the meteorological data simulations run from the global NEMS weather model at ~30 km resolution from 1985 to current of the project area. The following deductions can be made from Figure 7; in the summer months' maximum average daily temperatures are predicted to be 23°C - 26°C on average with a maximum of 32°C possible during hot days, dropping to a predicted 8°C - 13°C on average at night and 2°C minimum on cold nights. During winter months the average day time temperature are predicted in the 18°C - 21°C range while cold winter night time temperatures predicted to drop to -3°C.

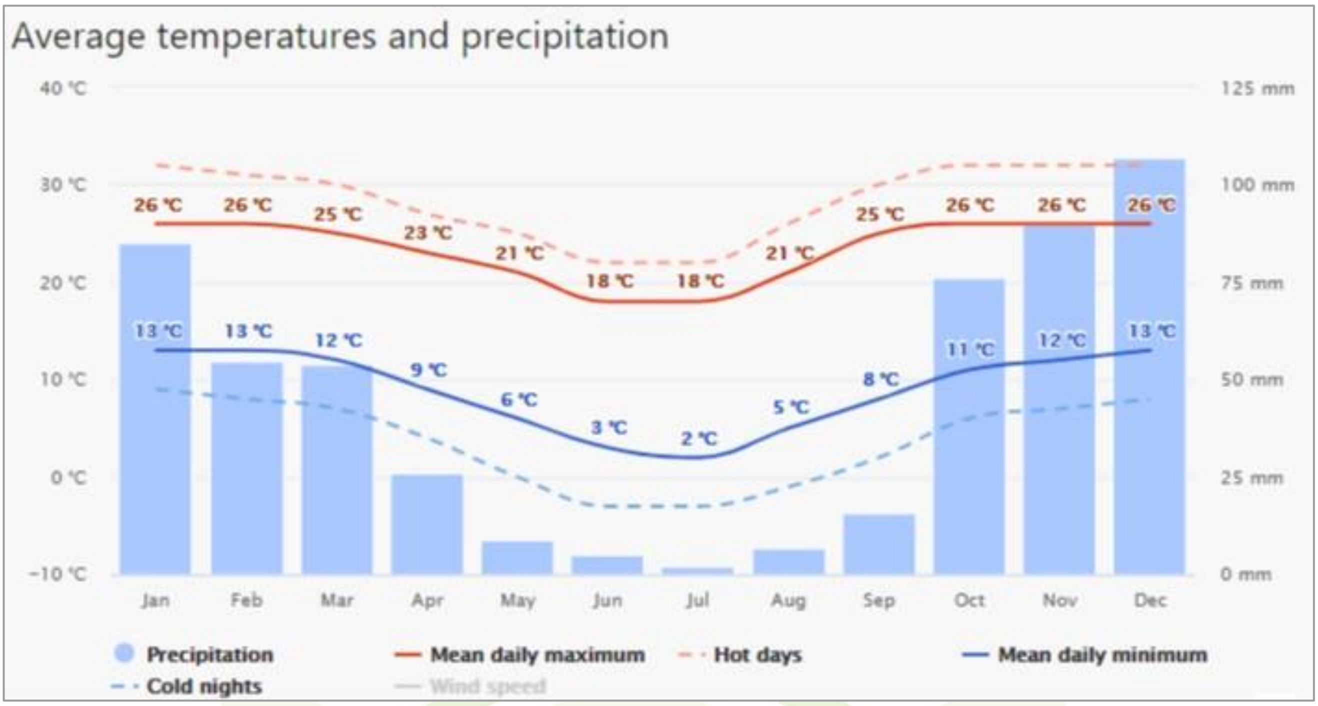


Figure 7: Temp and precipitation simulation results from the NEMS model for the Koppie MR project area (1985 - current).

3.1.6 Winds Speed, Temperature and Precipitation Validation

To validate the NEMS model simulation results, only weather stations with more than 10 years' consistent data are considered for validation. The validation is thus not necessarily the closest station with actual measured data but rather the closest reliable station. The measurements from the chosen station is then aggregated on a weekly or monthly data. Figure 8 show the closest station to the proposed Koppie MR project area that fall within the validation criteria as stated above, in this case Ermelo, 51km away with the project site at an altitude difference of -162. The recorded data show good correlation in respect to temperature and wind speed. No precipitation comparison was made.

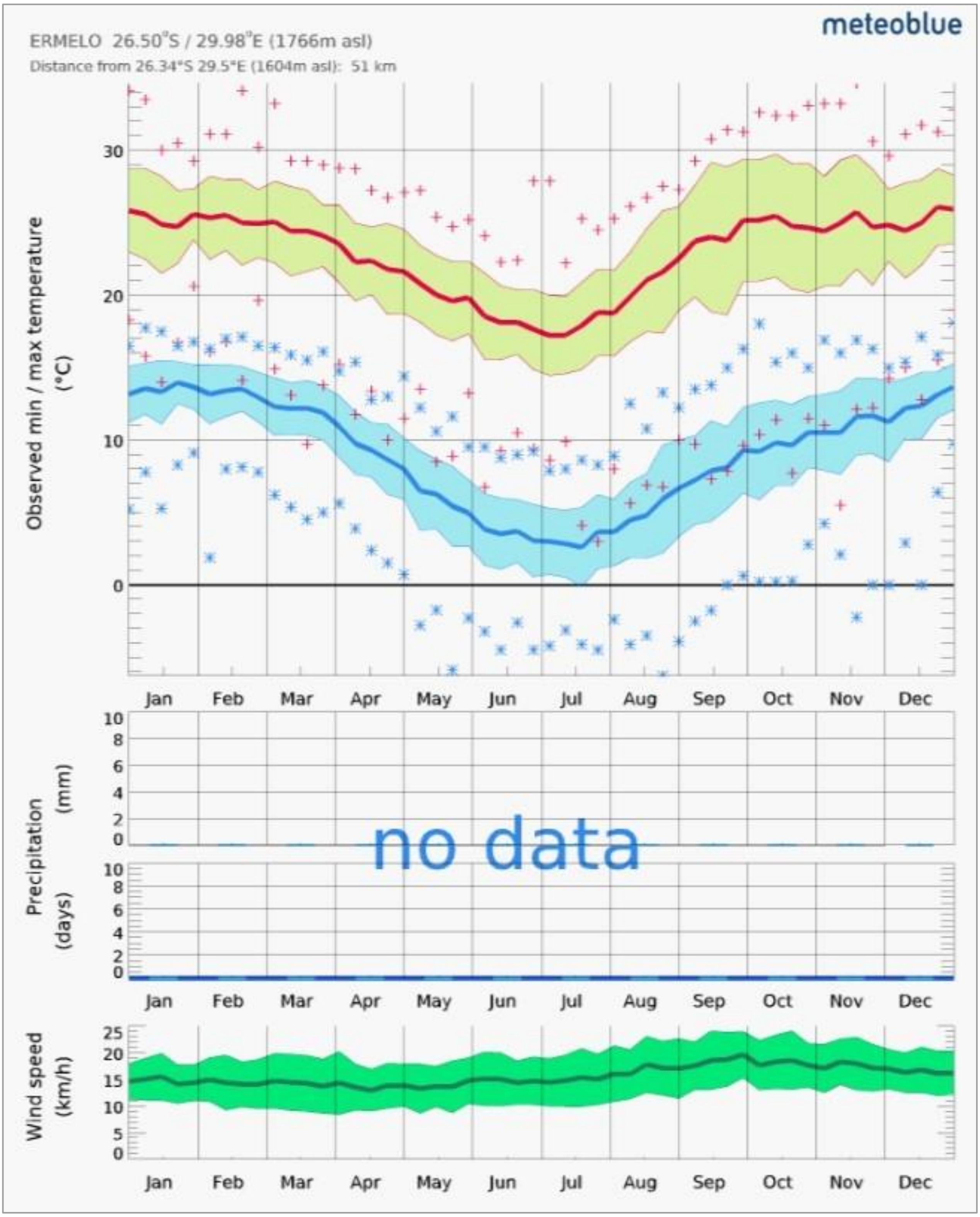


Figure 8: Measurement data for the closest measurement location with enough data to verify the NEMS model result.

4. RELEVANT LEGISLATION, GUIDELINES & STANDARDS

International Noise Guidelines & Standards

In general, the standards applied by the international community are similar for different countries. Internationally, the current trends are to apply more stringent criteria due to the deteriorating noise climate. The noise impacts due to a proposed project are generally based on the difference between the expected noise level increase and the existing noise levels in the area, as well as on comparisons against area-specific noise guidelines.

The available international guidelines are presented in the sections below and have taken into consideration the following adverse effects of noise:

- Annoyance.
- Speech intelligibility and communication interference.
- Disturbance of information extraction.
- Sleep disturbance
- Hearing impairment.

The World Health Organisation (WHO) together with the Organisation for Economic Co-ordination and Development (OECD) have developed their own guidelines based on the effects of the exposure to environmental noise. These provide recommended noise levels for different area types and time periods.

The WHO has recommended that a standard guideline value for average outdoor noise levels of 55 dB(A) be applied during normal daytime, in order to prevent significant interference with the normal activities of local communities. The relevant night-time noise level is 45 dB(A). The WHO further recommends that, during the night, the maximum level of any single event should not exceed 60 dB(A). This limit is to protect against sleep disruption. In addition, ambient noise levels have been specified for various environments. These levels are presented in Table 7 below.

Table 7: Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	Leq [dB(A)]	Time base [hours]	Lmax, fast [dB(A)]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech comprehension and moderate annoyance, daytime and evening	35	16	45
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoors	Sleep disturbance	30	sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		

Specific environment	Critical health effect(s)	Leq [dB(A)]	Time base [hours]	Lmax, fast [dB(A)]
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 #2
	Hearing impairment (children)	-	-	120 #2
Outdoors in parkland and conservation areas	Disruption of tranquillity	#3		

#1: as low as possible

#2: peak sound pressure (not Lmax, fast), measured 100 mm from the ear

#3: existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low

#4: under headphones, adapted to free-field values

The WHO specifies that an environmental noise impact analysis is required before implementing any project that would significantly increase the level of environmental noise in a community (WHO, 1999). Significant increase is considered a noise level increase of greater than 5 dB.

The World Bank Group (WBG, 1998) has developed a program in pollution management so as to ensure that the projects they finance in developing countries are environmentally sound. Noise is one of the pollutants covered by their policy. It specifies that noise levels measured at noise receptors, located outside the project's property boundary, should not be 3 dB(A) greater than the background noise levels, or exceed the noise levels depicted in Table 8 below.

The International Finance Corporation (IFC) has recently revised and published Performance Standards on Social & Environmental Sustainability (April 2006). Performance Standard 3 regarding "Pollution Prevention and Abatement" deals with forms of pollution such as noise, and adopts the WBG guidelines presented in the table above. The Standard also refers to the WHO Guidelines for Community Noise (WHO, 1999) for the provision of guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Table 8: IFC/WBG Recommended noise limits

Receptor	Maximum Allowable Ambient Noise Levels 1-hour LAeq (dB(A)) Daytime **07:00 – 22:00**	Night-time **22:00 – 07:00**
Residential, institutional, educational	55	45
Industrial, commercial	70	70
Note: No LAeq values are stipulated for rural areas.		

4.1.1 South African Noise Legislation and Standards

The original noise regulations pertaining to noise were published in 1990 under the Environment Conservation Act, 1989. At first they were not compulsory and local authorities were required to apply for permission to make them legally applicable in its area of jurisdiction. Since this lead to an unsatisfactory number of applications, the noise regulations were made compulsory in 1992. However, the arrival of the new Constitution in 1994 voided the legal driving force behind these regulations, since the issue of environmental noise was handed down from national to provincial level. The Minister of the Environment did circulate sample noise regulations to the provinces in 1997, which they could adopt unchanged or adapt to their own requirements. To date this has happened in only three provinces, i.e. the Free State, Gauteng and Western Cape.

The original sample noise regulations contain a number of serious flaws and a thorough revision has been undertaken. These revised national noise regulations have been circulated for comments. They will be published under the Air Quality Act, 2005. However, it is not clear when this will actually happen and until then the regulatory situation in most of the provinces will remain uncertain.

In terms of the setting of standards the new regulations will make direct and extensive reference to South African National Standard (SANS) 10103. This is a very successful document addressing the technical requirements for environmental noise measurements and the assessment of the results in the South African context. It is in line with the guidelines provided by the World Health Organisation (WHO) as mentioned in the previous section and conforms to the requirements of standards ISO 1996 Parts 1 and 2 issued by the International Standards Organisation (ISO).

In Table 9 below of SANS 10103 typical ambient noise levels in different types of districts are listed.

Table 9: Typical ambient noise levels (as per SANS 10103 Table 2)

Type of district	Noise level, dB(A)		
	LR,dn	LReq,d	LReq,n
a) Rural districts	45	45	35
b) Suburban districts with little road traffic	50	50	40
c) Urban districts	55	55	45
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50
e) Central business districts	65	65	55
f) Industrial districts	70	70	60

4.1.2 Comparison of Different Ambient Noise Levels

The different noise levels presented in the previous paragraphs, including South African and International, has been presented in a comparative manner in

Table 10 below.

Table 10: Comparison of specified ambient noise levels

Document	Type	Description of the environment	LAeq dB(A)	
			Day	Night
SANS 10103	A	Rural districts	45	35
	B	Suburban districts with little road traffic	50	40
	C	Urban districts	55	45
	D	Urban districts with one or more of the following: workshops; business premises; and main roads	60	50
	E	Central business districts	65	55
	F	Industrial districts	70	60
WHO, WB, IFC	1	Residential; institutional; educational	55	45
	2	Industrial; commercial	70	70

It is clear that SANS 10103 provides a considerably more differentiated set of districts and associated ambient noise levels than each of the WHO, WB or IFC guidelines. Although there is agreement between the ambient noise levels of types (c) '*Urban districts'* and (1) '*Residential; institutional; educational'* those associated with type (a) *'Rural districts'* are more than likely applicable to the environment of the Project

5. METHODOLOGY

AMBIENT NOISE ASSESSMENT METHODOLOGY

The approach that will be used when investigating noise impacts is based on guidelines provided by SANS 10103:2008. According to the SANS 10103:2008 the sound pressure level is used as the measurement unit for noise guidelines. The acceptable rating levels according to SANS 10103:2008 for ambient noise in different districts (residential and non-residential) are presented in the Table 11 below.

Table 11: SANS 10103:2008 for ambient noise in different districts (residential and non-residential)

Type of District	Equivalent continuous rating level ($L_{Req,T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]
RESIDENTAIL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON-RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

The probable community/group response to levels in excess of the acceptable rating levels are presented in

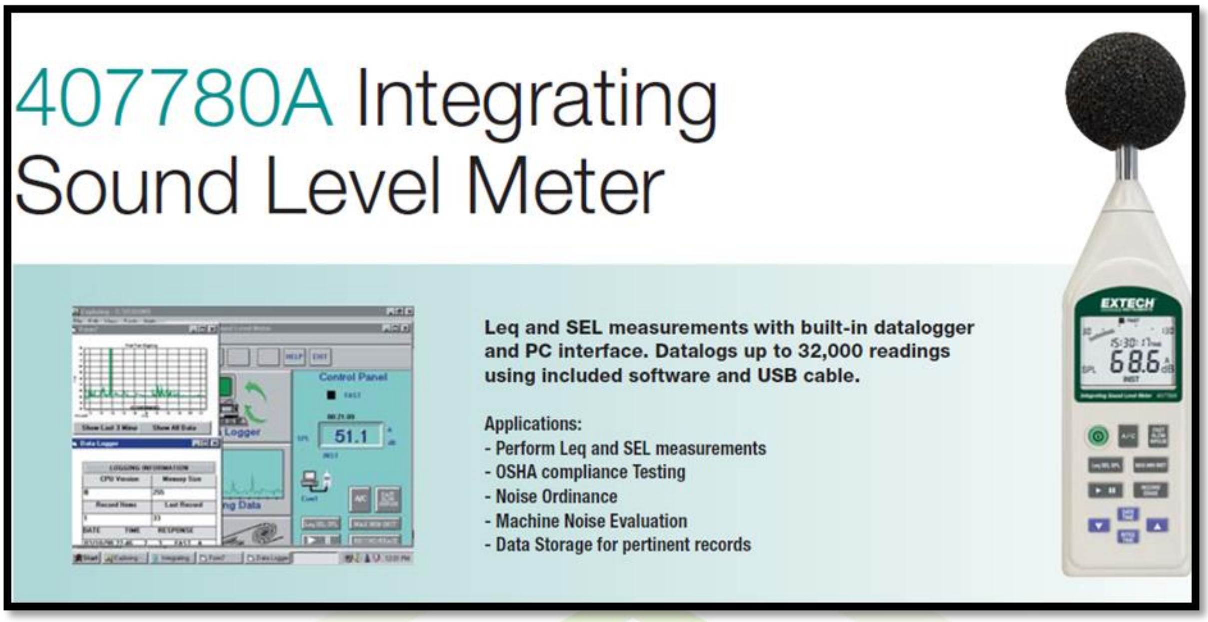
Table 12 below, where LReq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less than 30 minutes. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Table 12: Estimated Community/Group response

Excess ($\Delta L_{Req,T}$)^{a}dBA	Estimated community/group response	
	Category	Description
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 - 20	Strong	Threats of action
>15	Very strong	Vigorous action
NOTE Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.		
a $\Delta L_{Req,T}$ should be calculated from the appropriate of the following:		
1) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS LReq,T of the residual noise (determined in the absence of the specific noise under investigation);		
2) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;		
3) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or		
4) $\Delta L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.		

For this study baseline noise measurements were taken at various points, refer to Figure 10 for the map indicating the measurement positions, surrounding the proposed project area. The baseline noise measurements have been carried out to assess the current ambient noise levels in the area. According to the SANS 10103:2008 guidelines 'daytime' is defined as anytime between 06:00 to 22:00, and 'night time' between 22:00 to 06:00. No indication of the operational hours are available at this time, thus only the day time period has been considered for the noise measurements. Predictive modelling can be performed through the use of the modelling software Sound Plan that use ISO 9613-2: 1996 standards to predict the noise impacts at the various sensitive receptors.

Indicative noise sampling has been conducted with a handheld noise meter as shown below in Figure 9;



Specifications	
Applicable Standards	IEC 61672-1, 60651 and 60804 Type 2, ANSI S1.4 Type 2
Accuracy	±1.5dB (ref 94dB@1KHz)
Resolution	0.1dB
Digital Display	4 digital LCD
Measurement Parameters	SPL, SPL MIN/MAX, SEL, and Leq
Measurement Range	30dB to 130dB
Linearity Range	100dB
Measurement Frequency Range	31.5Hz to 8KHz
Frequency Weighting	A and C
Response	Impulse, Fast and Slow
Microphone	1/2 " Electret condenser microphone
Sampling time	updated every 0.5s
Bargraph	4dB steps, 100dB range, 125ms update
Display Warning Function	
Overrange Indicator	Displayed at the upper limit
Underrange Indicator	Displayed at the lower limit
Analog AC/DC Output	2Vrms (at full scale), 10mVDC/dB
Power Supply	Four 1.5V AA batteries, Optional AC adapter
Battery Life	Approximately 24 hours
Dimensions	10.4x2.8x0.8" (265x72x21mm)
Weight	10.9oz (310g)

Figure 9: 407780A Integrating Sound Level Meter specifications

6. BASELINE NOISE SAMPLING RESULTS

Noise Sampling Location

Baseline noise sampling were done during the daytime period on 2020-10-22 at the locations as shown in Figure 10.

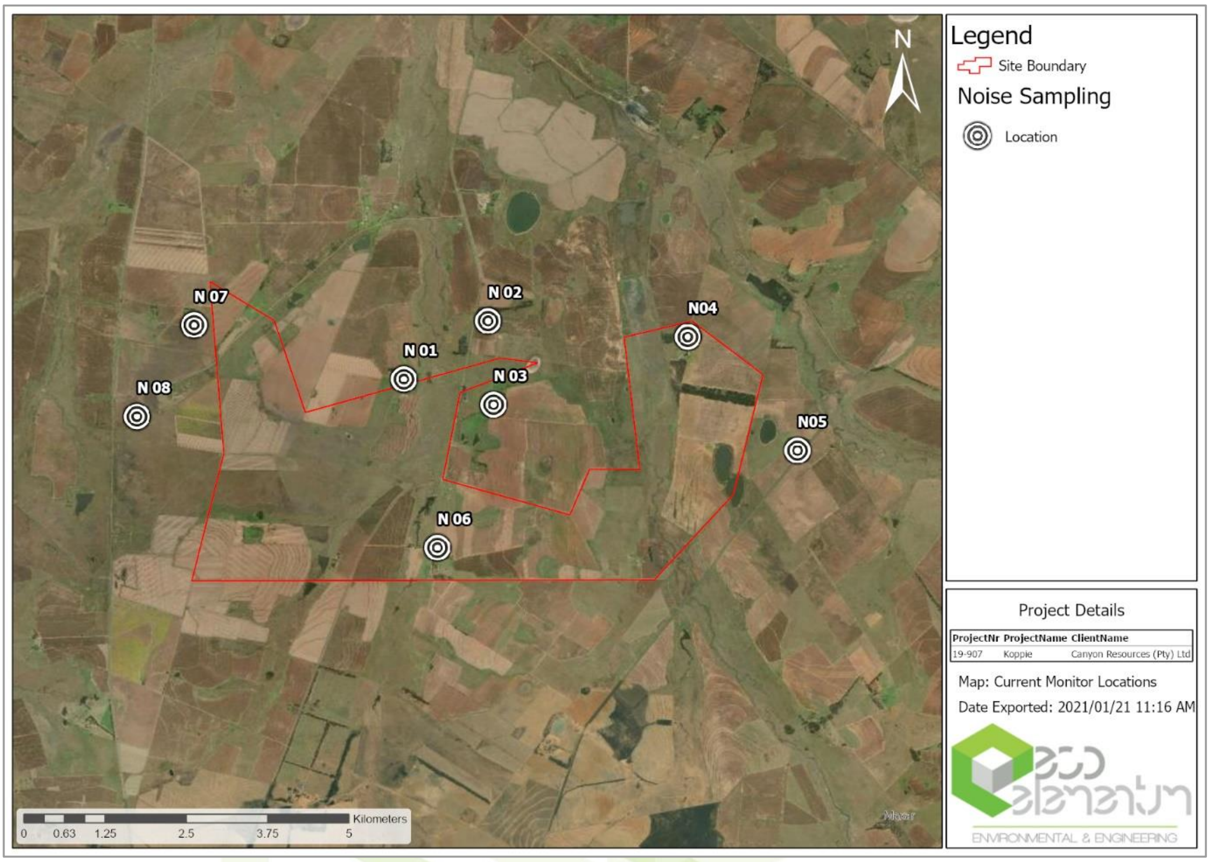


Figure 10: Noise measurement locations for the proposed Koppie MR project

Noise Sampling Results

The results are summarised in Table 13 below.

Table 13: Koppie MR Baseline Noise Measurement Results

Sampling site	Baseline noise measurement weighted average sound pressure level results (leq)	Observations
VO-N-01	46.5 dB	Between farm lands. Birds nesting 60m away.
VO-N-02	38.4 dB	Light winds
VO-N-03	38.4 dB	Light winds
VO-N-04	33.0 dB	Light winds
VO-N-05	39.0 dB	Light winds
VO-N-06	44.9 dB	Light winds
VO-N-07	41.1 dB	Moderate to strong wind East to West. Between farmlands.
VO-N-08	41.7 dB	Moderate to strong wind East to West. Farm activities 300m away.

Noise Sampling Discussion

6.1.1 Baseline Noise Impact Contributing Sources

Various noise influencing factors and sources exists in the region including;

- The main road network and supporting regional roads
- General vehicle noise on auxiliary roads in close proximity to the site
- Agricultural activities resulting in noise (mostly related to farming vehicles and machinery noise)

6.1.2 Discussion

Current results measured and obtained during the sampling initiative during the daytime period on 2020-10-22 by aid of handheld indicative active sampling equipment indicated generally low ambient noise levels. Noise levels measured were within the 33-46 dBa range which is below the daytime 50dBa equivalent continuous rating level prescribed for *Suburban districts with little road traffic*. It should however be noted that indicative samples were taken for a period of 10min at each sampling point. Due to continues measurement not possible due to the risk of theft of the equipment, cost, and the project being a greenfields proposed project area. 10 min intervals were chosen and scheduled at such a time that it is representative of the ambient noise of the proposed project area.

Sound is generated when there are rapid fluctuations in air pressure as a result of any form of disturbance to air movement. Thus, sound is actually the sensation that is perceived by human ear as a result of these fluctuations. Sound travels/propagates in the form of waves from the source and the further these waves propagate the more the sound level decreases. One other factor that leads to sound reduction out-doors, is atmospheric absorption/molecular absorption.

Noise on the other hand, is an undesired/ unpleasant or unwanted sound, which may have a damaging effect on human hearing mechanisms if noise exposure is excessive. Noise or unwanted sound is one of the most widely and frequently experienced problems of an environment surrounded by industrial activities. It can be annoying, interfere with communication, cause fatigue, and reduce work efficiency. Annoyance is in general a negative reaction of the community or person to a condition, which threatens the general wellbeing, either by creating displeasure and/ or interference with specific activities.

The risk of negative reaction escalates with increasing noise levels and duration of noise exposure. It also depends on the characteristic of the offending sound (therefore referred to as noise), such as its frequency and whether it is impulsive or continuous. Over and above these mentioned above, it should be noted that some individuals are more susceptible to noise than other.

The ambient noise levels emitted were primarily due to the **main and auxiliary roads in close proximity to the study area.**

All of the noise measurements sampling points was within the allowable limit as per SANS 10103:2008 of 50dB for *Suburban districts with little road traffic* during daytime.

7. SOUNDPLAN MODEL

MODEL

7.1.1 Model Description

SoundPlan software is used to assess the potential noise impacts of the relevant sources on the receiving environment. Soundplan utilise the ISO 9613-2: 1996 method that calculate the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.

As with all prediction software, the input data can radically alter the predicted results. However, where possible, worst case situations were modelled.

7.1.2 Assumptions

The following worst case conditions were used as input data:

Sources were lifted of the ground surface;

Ground effect were taken into account with a sound absorption coefficient of 0.6 across mid-high frequencies. The Concawe method suggest a fully absorptive characteristic for ground that consists of dense vegetation, moist conditions. Where hard surfaces with minimal vegetation exists, a reflective characteristic is suggested. The modelled coefficient will thus cater for the variations in the ground surface.

Low atmospherics sound absorption conditions were simulated:

- Air Temperature @ 10°C;
- Atmospheric Pressure @ 1013.25 mbar;
- Humidity @ 70%
- Meteorological conditions have not been considered in the simulations.
- The ground was modelled with elevation contours of 5m intervals.

7.1.3 Model Input Data

7.1.3.1 Preferred Scenario

Table 14: Preferred scenario noise sources

				Frequency spectrum [dB(A)]																				
Source name	Reference	Level dB(A)		63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.3 kHz	1.6 kHz	2 kHz	2.5 kHz	3.2 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz
Access Road	Lw/m	Day	44.2	27.1	30.8	31.1	34.2	36.9	29.4	31.6	33.7	37.5	39	40.4	37.4	38.3	38.9	37.2	37.5	37.5	31.5	31.2	30.8	26.1	25.2
Access Road		Night	44.2	27.1	30.8	31.1	34.2	36.9	29.4	31.6	33.7	37.5	39	40.4	37.4	38.3	38.9	37.2	37.5	37.5	31.5	31.2	30.8	26.1	25.2
Conveyor	Lw/unit	Day	52.5	31.8	35.5	32.9	35.9	38.6	41.1	43.4	45.4	38.2	39.8	41.1	42.2	43	43.6	43	43.2	43.3	48.2	48	47.5	46.9	45.9
Conveyor		Night	52.5	31.8	35.5	32.9	35.9	38.6	41.1	43.4	45.4	38.2	39.8	41.1	42.2	43	43.6	43	43.2	43.3	48.2	48	47.5	46.9	45.9
Primary Crusher	Lw/unit	Day	118	-	-	-	-	-	-	-	-	-	118	-	-	-	-	-	-	-	-	-	-	-	-
Primary Crusher		Night	118	-	-	-	-	-	-	-	-	-	118	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Crusher	Lw/unit	Day	122	-	-	-	-	-	-	-	-	-	122	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Crusher		Night	122	-	-	-	-	-	-	-	-	-	122	-	-	-	-	-	-	-	-	-	-	-	-
Loading ROM	Lw/unit	Day	81.9	60.8	64.5	67.9	70.9	73.6	74.1	76.4	78.4	70.2	71.8	73.1	75.2	76	76.6	75	75.2	75.3	70.2	70	69.6	61.9	60.9
Loading ROM		Night	81.9	60.8	64.5	67.9	70.9	73.6	74.1	76.4	78.4	70.2	71.8	73.1	75.2	76	76.6	75	75.2	75.3	70.2	70	69.6	61.9	60.9
Loading ROM to Crusher	Lw/unit	Day	74.7	56.8	60.5	57.9	60.9	63.6	59.1	61.4	63.4	65.2	66.8	68.1	69.2	70	70.6	69	69.2	69.3	65.2	65	64.6	57.9	56.9
Loading ROM to Crusher		Night	74.7	56.8	60.5	57.9	60.9	63.6	59.1	61.4	63.4	65.2	66.8	68.1	69.2	70	70.6	69	69.2	69.3	65.2	65	64.6	57.9	56.9
Dozer on Discard	Lw/unit	Day	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9
Dozer on Discard		Night	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9
Dozer on OVB	Lw/unit	Day	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9
Dozer on OVB		Night	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9

7.1.3.2 Alternative Scenario

Table 15: Alternative scenario noise sources

				Frequency spectrum [dB(A)]																				
		Level		63	80	100	125	160	200	250	315	400	500	630	800	1	1.3	1.6	2	2.5	3.2	4	5	6.3	8
Source name	**Reference**	**dB(A)**		**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**Hz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**	**kHz**
Access Road	Lw/m	Day	44.2	27.1	30.8	31.1	34.2	36.9	29.4	31.6	33.7	37.5	39	40.4	37.4	38.3	38.9	37.2	37.5	37.5	31.5	31.2	30.8	26.1	25.2
Access Road		Night	44.2	27.1	30.8	31.1	34.2	36.9	29.4	31.6	33.7	37.5	39	40.4	37.4	38.3	38.9	37.2	37.5	37.5	31.5	31.2	30.8	26.1	25.2
Conveyor	Lw/unit	Day	52.5	31.8	35.5	32.9	35.9	38.6	41.1	43.4	45.4	38.2	39.8	41.1	42.2	43	43.6	43	43.2	43.3	48.2	48	47.5	46.9	45.9
Conveyor		Night	52.5	31.8	35.5	32.9	35.9	38.6	41.1	43.4	45.4	38.2	39.8	41.1	42.2	43	43.6	43	43.2	43.3	48.2	48	47.5	46.9	45.9
Primary Crusher	Lw/unit	Day	118	-	-	-	-	-	-	-	-	-	118	-	-	-	-	-	-	-	-	-	-	-	-
Primary Crusher		Night	118	-	-	-	-	-	-	-	-	-	118	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Crusher	Lw/unit	Day	122	-	-	-	-	-	-	-	-	-	122	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Crusher		Night	122	-	-	-	-	-	-	-	-	-	122	-	-	-	-	-	-	-	-	-	-	-	-
Loading ROM	Lw/unit	Day	81.9	60.8	64.5	67.9	70.9	73.6	74.1	76.4	78.4	70.2	71.8	73.1	75.2	76	76.6	75	75.2	75.3	70.2	70	69.6	61.9	60.9
Loading ROM		Night	81.9	60.8	64.5	67.9	70.9	73.6	74.1	76.4	78.4	70.2	71.8	73.1	75.2	76	76.6	75	75.2	75.3	70.2	70	69.6	61.9	60.9
Loading ROM to Crusher	Lw/unit	Day	74.7	56.8	60.5	57.9	60.9	63.6	59.1	61.4	63.4	65.2	66.8	68.1	69.2	70	70.6	69	69.2	69.3	65.2	65	64.6	57.9	56.9
Loading ROM to Crusher		Night	74.7	56.8	60.5	57.9	60.9	63.6	59.1	61.4	63.4	65.2	66.8	68.1	69.2	70	70.6	69	69.2	69.3	65.2	65	64.6	57.9	56.9
Dozer on Discard	Lw/unit	Day	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9
Dozer on Discard		Night	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9
Dozer on OVB	Lw/unit	Day	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9
Dozer on OVB		Night	85.7	52.8	56.5	67.9	70.9	73.6	68.1	70.4	72.4	73.2	74.8	76.1	81.2	82	82.6	81	81.2	81.3	74.2	74	73.6	65.9	64.9

7.1.4 Preferred Scenario

Table 16 below show the predicted noise levels at the various identified sensitive receptors for the preferred scenario.

3 of the identified sensitive receptors are predicted to be above the Night-time limit of the SANS 10103:2008 night-time limit for rural districts of 35 dB. It should however be noted that due to site specific environmental and meteorological conditions these may still fall within the allowed standards.

Day-time predicted noises level fall within the allowed 45 dB SANS 10103:2008 day-time limit for identified sensitive receptors.

Figure 11 show the predicted noise contours for the Preferred scenario.

Table 16: Predicted noise levels at the sensitive receptors due to the Preferred scenario operations

No.	Receiver name	Coordinates		Limit		Level	
		X	Y	Day	Night	Day	Night
		UTM35S		dB(A)		dB(A)	
1	1	749336.9	7086029	45	35	39.4	**39.4**
2	2	750601.9	7086798	45	35	30.8	30.8
3	3	750490.1	7088642	45	35	24.1	24.1
4	4	750644.4	7085572	45	35	34.3	34.3
5	5	753226.5	7086516	45	35	-50.8	-50.8
6	6	753587.8	7089931	45	35	0	0
7	7	755069.5	7087588	45	35	0	0
8	8	754727.8	7084845	45	35	0	0
9	9	758197.7	7086374	45	35	0	0
10	10	755768.3	7080973	45	35	0	0
11	11	751229.4	7080268	45	35	-47.6	-47.6
12	12	749853	7083257	45	35	37.9	**37.9**
13	13	747729.4	7079646	45	35	23.6	23.6
14	14	745001.9	7078806	45	35	0	0
15	15	744915.9	7080777	45	35	23.6	23.6
16	16	745662.2	7085516	45	35	35.5	**35.5**
17	17	746428.1	7086881	45	35	33.9	33.9
18	18	749297.7	7089449	45	35	-10.1	-10.1

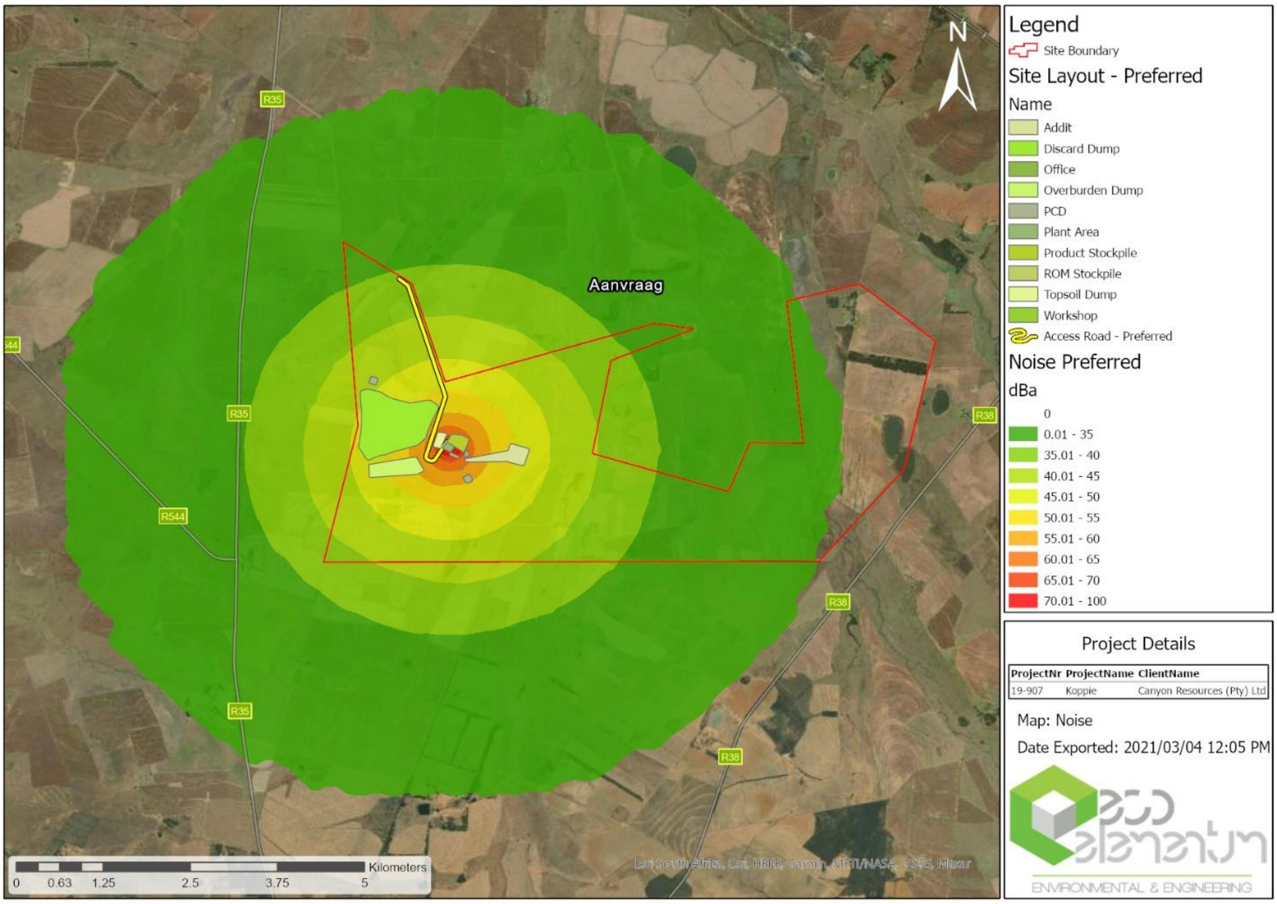


Figure 11: Predicted noise contours for the Preferred scenario

7.1.5 Alternate Scenario

Table 17 below show the predicted noise levels at the various identified sensitive receptors for the alternate scenario.

3 of the identified sensitive receptors are predicted to be above the Night-time limit of the SANS 10103:2008 night-time limit for rural districts of 35 dB. It should however be noted that due to site specific environmental and meteorological conditions these may still fall within the allowed standards.

Day-time predicted noises levels are predicted to be above the 45 dB SANS 10103:2008 day-time limit for none of the identified sensitive receptors.

Figure 12 show the predicted noise contours for the Alternate scenario.

Table 17: Predicted noise levels at the sensitive receptors due to the Preferred scenario operations

No.	Receiver name	Coordinates		Limit		Level	
		X	Y	Day	Night	Day	Night
		UTM35S		dB(A)		dB(A)	
1	1	749336.9	7086029	45	35	39.3	**39.3**
2	2	750601.9	7086798	45	35	30.8	30.8
3	3	750490.1	7088642	45	35	24.1	24.1
4	4	750644.4	7085572	45	35	34.3	34.3
5	5	753226.5	7086516	45	35	-15.7	-15.7
6	6	753587.8	7089931	45	35	0	0
7	7	755069.5	7087588	45	35	0	0
8	8	754727.8	7084845	45	35	0	0
9	9	758197.7	7086374	45	35	0	0
10	10	755768.3	7080973	45	35	0	0
11	11	751229.4	7080268	45	35	-47.6	-47.6
12	12	749853	7083257	45	35	37.9	**37.9**
13	13	747729.4	7079646	45	35	23.6	23.6
14	14	745001.9	7078806	45	35	0	0
15	15	744915.9	7080777	45	35	23.6	23.6
16	16	745662.2	7085516	45	35	35.5	**35.5**
17	17	746428.1	7086881	45	35	33.9	33.9
18	18	749297.7	7089449	45	35	-9.6	-9.6

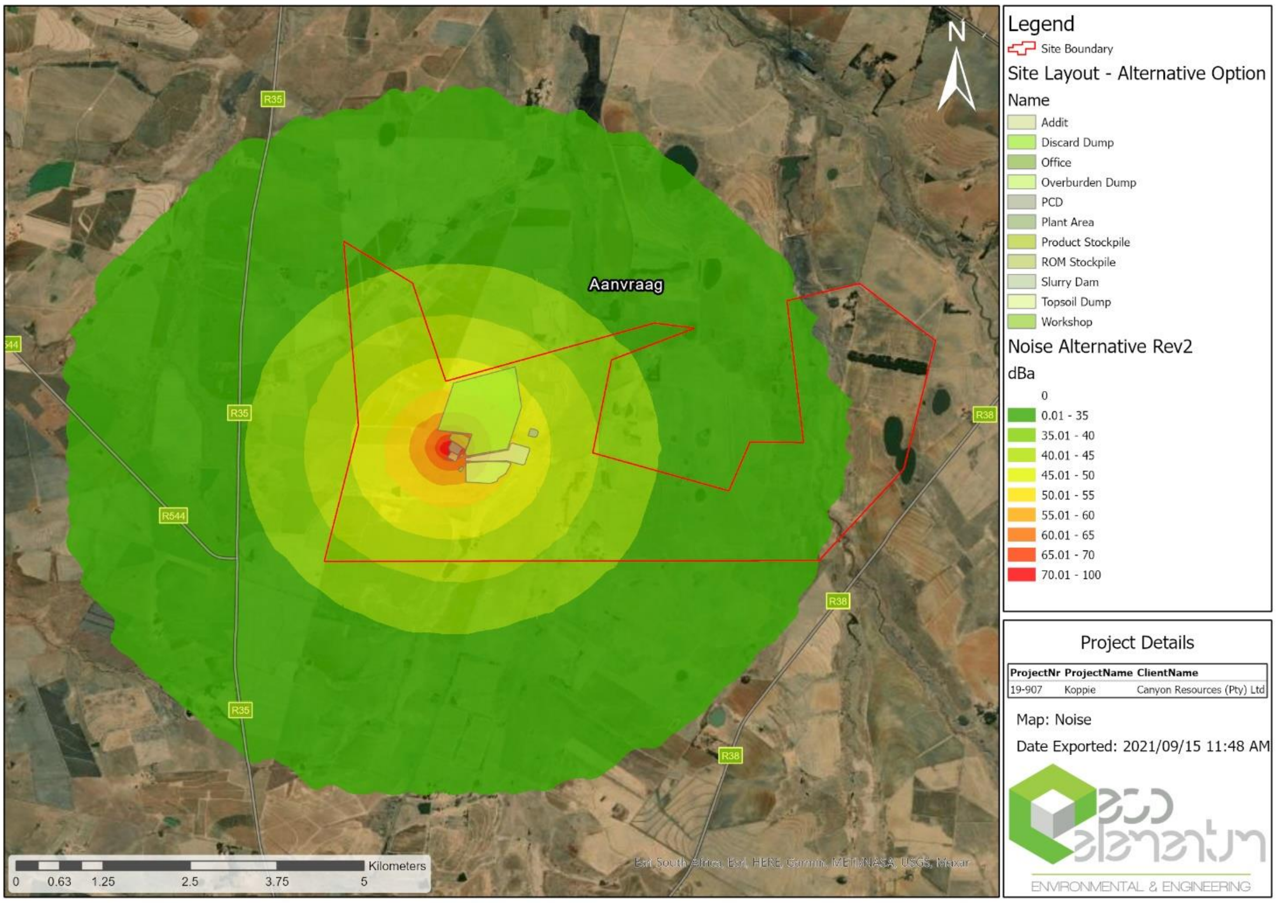


Figure 12: Predicted noise contours for the Alternate scenario

7.1.6 Comparison

Looking at Table 18 below, the Preferred scenario is predicted to exceed the SANS 10103:2008 limit at 0 sensitive receptors during the day-time and 3 sensitive receptors during the night-time. The average predicted dB at the sensitive receptors, predicted to be impacted by the proposed operation, is calculated as 14.55dB.

While the Alternate scenario is predicted to also exceed the SANS 10103:2008 limit at 0 sensitive receptor during the day-time and 3 sensitive receptors during the night-time. The average predicted dB at the sensitive receptors, predicted to be impacted by the proposed operation, is calculated as 31.47dB

Based on the modelled results, the preferred scenario is predicted to have the least noise impact on the receiving sensitive receptors.

Table 18: Comparison between the Preferred and Alternative scenarios

Scenario	Day-time Exceedances	Night-time Exceedances	Average dB
Preferred	0	3	12.29 dB
Alternative	0	3	17.51 dB

8. IMPACT ASSESSMENT

The level of detail as depicted in the EIA regulations were fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project.

The impact assessment criteria used to determine the impact of the proposed development are as follows:

1. ***Severity*** of the impact;
2. **Spatial Scale** - The physical and spatial scale of the impact;
3. ***Duration*** - The lifetime of the impact, measured in relation to the lifetime of the proposed development;
4. ***Frequency of the Activity*** – How often do the activity take place;
5. ***Frequency of the incident/impact*** – How often does the activity impact on the environment;
6. ***Legal Issues*** – How is the activity governed by legislation; and
7. ***Detection*** – How quickly/easily the impacts/risks of the activity be detected on the environment, people and property.

To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts is comparable. For this reason a clearly defined rating scale is provided for the specialist to assess impacts associated with the investigation.

Table 19: Assessment criteria

SEVERITY	
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful / within a regulated sensitive area	5
SPATIAL SCALE	
Area specific (at impact site)	1
Whole site (entire surface right)	2
Local (within 5 km)	3
Regional / neighboring areas (5 km to 50 km)	4
National	5
DURATION	
One day to one month (immediate)	1
One month to one year (Short term)	2
One year to 10 years (medium term)	3
Life of the activity (long term)	4
Beyond life of the activity (permanent)	5
FREQUENCY OF THE ACTIVITY	
Annually or less	1

6 monthly	2
Monthly	3
Weekly	4
Daily	5
FREQUENCY OF THE INCIDENT/IMPACT	
Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5
LEGAL ISSUES	
No legislation	1
Fully covered by legislation	5
DETECTION	
Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5
Immediately	1

The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

8.1.1 Consequence

Consequence is determined by the following equation after the assessment of each impact.

Consequence = Severity + Spatial Scale + Duration

8.1.2 Likelihood

The Likelihood of the activity is then calculated based on frequency of the activity and impact, how easily it can be detected and whether the activity is governed by legislation. Thus:

Likelihood = Frequency of activity + frequency of impact + legal issues + detection

8.1.3 Risk

The risk is then based on the consequence and likelihood.

Risk = Consequence x likelihood

8.1.4 Impact Ratings

The impact is then rated according to the following table:

Table 20: Impact Rating Table

Rating	Class
1-55	(L) Low Risk
56-169	(M) Moderate Risk
170-600	(H) High Risk

PREDICTED IMPACTS

8.1.5 Summarised Impacts According To Development Phases

Table 21 Summarises the activities from each phase of the project.

Table 21: Impacts according to Development Phases

PHASE	ACTIVITIES
Construction Phase	**Typical Activities** - Site clearing, removal of topsoil and vegetation, Construction of Infrastructure, General Transportation and hauling of material.
Operational Phase	As per Modelling
Closure and Decommissioning	**Typical Activities** - Demolition & Removal of all infrastructure (incl. transportation off site) and Rehabilitation (Spreading of soil, revegetation, profiling / contouring)

8.1.6 Construction Phase

- **Typical Activities** - Site clearing, removal of topsoil and vegetation, construction of Infrastructure, general transportation and hauling of material. (Table 22)

Table 22: Summarizing the significance of noise impacts on the sensitive receptors for the Construction phase.

Nature of impact: Potential noise impact on the sensitive receptors for the construction phase.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**3**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5 km to 50 km) (4); National (5)]	**1**	**1**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**2**	**2**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**4**

Nature of impact: Potential noise impact on the sensitive receptors for the construction phase.			
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**4**	**3**
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	**5**	**5**
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	**1**	**1**
Consequence	Severity + Spatial Scale + Duration	**7**	**5**
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection	**14**	**13**
Risk	Consequence * Likelihood	**MODERATE (98)**	**MODERATE (65)**
Mitigation:	• Noise barrier in the form of a berm, tree break or similar noise fence between the sensitive receptors and noise sources. • The barrier will help with the attenuation of noise produced by the proposed activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance. • Construction and mining-related machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers. • Switching off equipment when not in use. • Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source. • Equipment with lower sound power levels would be used in preference to noisier equipment. • The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.		
Cumulative Impact:	The construction of the proposed Koppie MR project with its associated infrastructure will increase the cumulative noise impact of within the region.		

The impact on the surrounding farmers and land users will be more significant but can still be seen as MODERATE because of the short time the proposed activity will be undertaken. Although the construction activities will be highly visible, the time of exposure is short and thus the impact on the users will be low after mitigation measures have been implemented.

8.1.7 Operational Phase

Table 23: Summarizing the significance of noise impacts on the sensitive receptors for the Operational phase.

Nature of impact: Potential noise impact on the sensitive receptors for the operational phase.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**3**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5 km to 50 km) (4); National (5)]	**3**	**2**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**4**	**4**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**5**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**5**	**3**
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	**5**	**5**
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	**1**	**1**
Consequence	Severity + Spatial Scale + Duration	**10**	**8**
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection	**16**	**14**
Risk	Consequence * Likelihood	**MODERATE (160)**	**MODERATE (112)**

Mitigation:

- Noise barrier in the form of a berm, tree break or similar noise fence between the sensitive receptors and noise sources.
- The barrier will help with the attenuation of noise produced by the proposed activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance.
- Construction and mining-related machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers.
- Switching off equipment when not in use.
- Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source.
- Equipment with lower sound power levels would be used in preference to noisier equipment.
- The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.

Nature of impact: Potential noise impact on the sensitive receptors for the operational phase.	
Cumulative Impact:	The proposed Koppie MR project with its associated infrastructure will increase the cumulative noise impact within the region.

The impact on the surrounding land users will be more significant but can still be seen as MODERATE. Although the activities will be highly audible, with the correct mitigation measures, the impact on the users will still be MODERATE, although lower.

8.1.8 Closure and Decommissioning Phase

- **Typical Activities** - Demolition & Removal of all infrastructure (incl. transportation off site) and Rehabilitation (Spreading of soil, revegetation, profiling / contouring). (Table 24)

Table 24: Summarizing the significance of noise impacts on the sensitive receptors for the Closure and Decommissioning phase.

Nature of impact: Potential noise impact on the sensitive receptors for the Closure and Decommissioning phase.			
		Unmitigated	**Mitigated**
Assessment Criteria	**Severity** [Insignificant / non-harmful (1); Small / potentially harmful (2); Significant / slightly harmful (3); Great / harmful (4); Disastrous / extremely harmful / within a regulated sensitive area (5)]	**3**	**2**
	Spatial Scale [Area specific (at impact site) (1); Whole site (entire surface right) (2); Local (within 5km) (3); Regional / neighbouring areas (5 km to 50 km) (4); National (5)]	**2**	**2**
	Duration [One day to one month (immediate) (1); One month to one year (Short term) (2); One year to 10 years (medium term) (3); Life of the activity (long term) (4); Beyond life of the activity (permanent) (5)]	**2**	**2**
	Frequency of Activity [Annually or less (1); 6 monthly (2); Monthly (3); Weekly (4); Daily (5)]	**5**	**4**
	Frequency of Incident/Impact [Almost never / almost impossible / >20% (1); Very seldom / highly unlikely / >40% (2); Infrequent / unlikely / seldom / >60% (3); Often / regularly / likely / possible / >80% (4); Daily / highly likely / definitely / >100% (5)	**5**	**3**
	Legal Issues [No legislation(1); Fully covered by legislation (5)]	**5**	**5**
	Detection [Immediately(1); Without much effort (2); Need some effort (3); Remote and difficult to observe (4); Covered (5)]	**1**	**1**
Consequence	Severity + Spatial Scale + Duration	**7**	**6**
Likelihood	Frequency of Activity + Frequency of impact + Legal issues + Detection	**16**	**13**
Risk	Consequence * Likelihood	**MODERATE (112)**	**MODERATE (78)**
Mitigation:	• Construction and mining-related machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers. • Switching off equipment when not in use. • Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source.		

Nature of impact: Potential noise impact on the sensitive receptors for the Closure and Decommissioning phase.	
	• Equipment with lower sound power levels would be used in preference to noisier equipment. • The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads
Cumulative Impact:	The decommissioning of the proposed Koppie MR project with its associated infrastructure will increase the cumulative noise impact on the receiving environment.

The impact on the surrounding land users will be more significant but can still be seen as MODERATE because of the short time the proposed activity will be undertaken. Although the activities will be highly audible, the time of exposure is short and thus the impact on the users will still be MODERATE, although lower, after mitigation measures have been implemented.

Mitigation Measures

Mitigation measures may be considered in two categories:

- Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered.
- Secondary measures designed to specifically address the remaining negative effects of the final development proposals.

Primary measures that will be implemented will mainly be measures that will minimise the noise impact of the receiving environment by reducing the noise of the operational equipment. Such measures may include:

- Berms or noise breaks between the operational area and the sensitive receptors.
- Fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers be put up around these sources.
- Use equipment with lower sound levels used in preference over higher sound emitting equipment.
- Maintaining the onsite road network to reduce the noise emitting from trucks traveling on the roads.

Secondary measures may include the following:

- Operational machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers.
- Switching off equipment when not in use.

9. CONCLUSION

The findings reported here are a mixture of historical, observed and measured data and provided the background reference values for the proposed Koppie MR development;

- Noise samples taken during the assessment also indicated a typical rural and farming noise character and is higher in close proximity to the farms where a contribution of the farming vehicle noise was experienced during the sampling initiative.
- Noise measurement ranged from as low as 33.0 dBa to 46.5 dBa at the highest value close to the farming activities.

The ambient noise survey serves as part of the management tool during continuous monitoring during the life of the operation to determine whether significant increases has occurred that require management and mitigation measures that might be more stringent than what have been listed in this particular report. Due to time constraints, no modelling were done at the time of this report. Should the need arise would noise modelling be conducted in order to determine the exact location and design of specialised noise barriers in between the proposed activity and the sensitive receptors, although currently the management and mitigation measures as discussed should suffice.

It should however be noted that the measurements taken is only applicable to the time and date which sampling was undertaken and that results would differ as more measurements are taken. Therefore, the importance of ensuring a monitoring programme to be implemented during the operation of the proposed project.

Various noise influencing factors and sources exists in the region including;

- The supporting regional roads
- General vehicle noise on auxiliary roads in close proximity to the site
- Noise generated as a result of agricultural activities (mainly farming vehicles)

MODELLING RESULTS

Looking at Table 25 below, the Preferred scenario is predicted to exceed the SANS 10103:2008 limit at 0 sensitive receptors during the day-time and 3 sensitive receptors during the night-time. The average predicted dB at the sensitive receptors, predicted to be impacted by the proposed operation, is calculated as 12.29dB.

While the Alternate scenario is also predicted to exceed the SANS 10103:2008 limit at 0 sensitive receptor during the day-time and 3 sensitive receptors during the night-time. The average predicted dB at the sensitive receptors, predicted to be impacted by the proposed operation, is calculated as 17.51dB

Based on the modelled results, the preferred scenario is predicted to have the least noise impact on the receiving sensitive receptors.

It should however be noted due the timeframe and last minute site layout changes, the update Alternative 2 layout could not be modelled.

Table 25: Comparison between the Preferred and Alternative scenarios

Scenario	Day-time Exceedances	Night-time Exceedances	Average dB
Preferred	0	3	12.29 dB
Alternative	0	3	17.51 dB

Through the implementation of the management and mitigation measures and continuous compliance monitoring should the potential impact of the Koppie MR development on the receiving environment be lowered and can it be mitigated to an extent where the significance will be moderate and acceptable within the tolerable level. It can therefore be concluded that the proposed project can go forward without a detrimental impact on the environment given the sound implementation of the management, mitigation and monitoring measures as presented throughout this report.

10. REFERENCE

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