dBAcoustics

BASIC ENVIRONMENTAL NOISE IMPACT STATEMENT REPORT FOR THE PROPOSED ENERGY CONVERSION FACILITY PROJECT AT GLENCORE OPERATIONS SA (PTY)LTD – LION SMELTER, STEELPOORT

ENVIRONMENTAL NOISE IMPACT STATEMENT REPORT

BJB van der Merwe.

Telephone numbers:
+ 027 82 922 0298
+027 11 782 7193

Date: 14 February 2022

DECLARATION OF INDEPENDENCE

I, **Barend J B van der Merwe** as duly authorised representative of **dBAcoustics**, hereby confirm my independence and declare that I have no interest, be it business, financial, personal, or other, in any proposed activity, application or appeal in respect of which **nettZero** was appointed as the Environmental Assessment Practitioner (EAP) in terms of the NEMA, the Environmental Impact Assessment Regulations, No 43110 of 20 March 2020. dBAcoustics was appointed by nettZero to compile a Basic Noise Assessment Report in terms of Regulation 16 (1) (v) of the Environmental Impact Assessment (EIA) Regulations (GNR 982 GG 38282 of 4 December 2014), as amended. I further declare that I am confident in the results of the environmental noise survey study undertaken and conclusions drawn because of it. I have disclosed, to EAP, in writing, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2020. I have further provided the EAP with written access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2020 and any other specific and relevant legislation (national and provincial), policies, guidelines, and best practice.

Signature: 

Full Name: Barend Jacobus Barnardt van der Merwe.

Date: 14 February 2022

Title / Position: Environmental Noise Specialist

Qualification(s): MSc Environmental Management

Experience (years): 20 years

Registration(s): SAAI, NACA, SAAG and IAIAsa

Details of specialist and expertise

I, Barend JB van der Merwe of 43 6th Street, Linden Johannesburg have been an environmental noise and ground vibration specialist for the last 18 years. I have been instrumental in the pre-feasibility studies of proposed projects which may have an impact on the environment and noise receptors. I am also involved with the noise and ground vibration impact assessments and the environmental management plans compilation of large projects such as wind farms, mining, roads, trains (primarily the Gautrain) and various point noise sources. As a post-graduate student in Environmental Management at the University of Johannesburg, I obtained an MSc degree with the research project concentrating on the impact of noise and ground vibration on a village close to a new underground mine. I have played a major role in the identification, evaluation, and control of physical factors such as noise and ground vibration in the following projects – wind farms, various platinum and coal mines and the quarterly noise evaluation of the Gautrain, construction of the N2 near Butterworth, design of the Musina by-pass, noise mitigatory measures at the N17 road near Trichardt, establishment of the weigh bridge along the N3 near Pietermaritzburg, George Western by-pass. The following large environmental companies are amongst my clients: Chameleon Environmental, Gibb, Royal Haskoning DHV, Coffey Environmental, Golder Associates Africa (Pty) Ltd, GCS Environmental (Pty) Ltd, Hatch, Knight Piesold Environmental (Pty) Ltd and SRK Engineering (Pty) Ltd, WOOD Environmental.

Qualifications

1. MSc – Environmental Management – University of Johannesburg;
2. BSc Honors in Geography and Environmental Management – University of Johannesburg;
3. National Higher Diploma in Environmental Health - Witwatersrand Technikon;
4. National Diploma in Public Health - Cape Town Technikon;
5. National Certificate in Noise Pollution - Technikon SA;
6. National Certificate in Air Pollution - Technikon SA;
7. National Certificate in Water Pollution - Technikon SA;
8. Management Development Diploma - Damelin Management School; and
9. Advanced Business Management Diploma - Rand Afrikaans University.

Membership

- South African Institute of Acoustics (SAAI);
- International Association of Impact Assessment (IAIA);
- National Association of Clean Air (NACA);
- South African Association of Geographers (SAAG).

Experience

- Noise impact assessment of different mining establishments;
- Noise Control Officer i.t.o. Noise Control Regulations;

- Compilation of noise management plans;
- Annual and quarterly baseline noise surveys;
- Moderator Wits Technikon – Environmental Pollution III.
- Various road projects for SANRAL.
- Compilation of the Integrated Pollution strategy for Ekurhuleni Town Council.
- Represent clients at Town Planning Tribunals.
- Represent clients at Housing Board tribunals.
- Determine residual noise levels in certain areas as required by clients.
- Noise attenuation at places of entertainment.
- Design and implementation of sound attenuators.
- Noise projections and contouring.
- Advisory capacity regarding noise related cases to local authorities: - Sandton, Roodepoort, Randburg, Krugersdorp, Alberton, Centurion, Vereeniging. Due to my previous experience in Local Government I provide a service to these Local government departments on the implementation of the Noise Control Regulations and SANS 10103

  of 2008 – The measurement and rating of environmental noise with respect to land use, health annoyance and to speech communication.

• Identification, Evaluation and Control of noise sources in industry.

I was involved in the following noise impact assessments during the Environmental Impact Assessment process (Noise and/or Vibration):

- Airlink BID for landing in Kruger National Park;
- Coal gasification plant in Theunissen;
- Langhoogte and Wolseley wind farms;
- Widening of N3 at Howick, KZN;
- Tulu Kapi Mine, Ethiopia;
- Boabab Iron Ore Mine, Mozambique;
- N11 Rehabilitation Mokopane;
- Baseline noise survey for NuCoal Mines, Woestalleen, Vuna and Mooiplaats Collieries;
- Baseline noise monitoring Mooinooi mine;
- Leeuwpan coal mine;
- N17 Road at Trichardt for KV3 Engineers;
- N17 Road in Soweto;
- Proposed new by-pass road at Musina;
- George Western By-pass road between George Airport and Outeniqua Pass;
- Gautrain baseline monitoring;
- Upgrade of Delmas Road extensions in Moreletta Park, Pretoria;
- Proposed weigh bridge, N3, Pietermaritzburg:
- Tonkolili Manganese mine, Sierra Leone;

- Proposed backup thermal generators in the Western Cape – Caledon, Wolseley, Swellendam;
- Extension of works at the PPC factory in Piketberg;
- Exxaro Arnot Colliery – Mooifontein;
- Hydro power plant – 2 Sites in Durban;
- Coal export terminal in Beira, Mozambique;
- Site selection for new Power Station – Kangra Mine, Piet Retief;
- Gas exploration at Ellisras;
- Noise survey and assessment of future mine shafts at various mines;
- Mining exploration at Potgietersrus – Lonmin Akani;
- New coal mines in Witbank – Dorstfontein Expansion Project;
- New coal mines in Middelburg and Ermelo;
- New Vanadium Manganese mine in Potgietersrus;
- Xolobeni mining project in Transkei;
- Glynn mines in Sabie;
- Rezoning of properties for housing at Burgersfort, Shosanguve, Hammanskraal;
- Various noise impact assessment for clients in and around Centurion;
- Relocation of night races from Newmarket racecourse to Turfontein racecourse;
- Rezoning applications for private clients

Indemnity and Conditions Relating to this Report.

The findings, results, observations, conclusions, and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information supplied by nettZero. The accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. dBAcoustics does not accept responsibility for any errors or omissions in the supplied data and information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions and the findings apply to the site conditions as they existed at the time of the field survey. These opinions do not necessarily apply to conditions that may arise after the date of the field survey and subsequent noise impact assessment report. The report is based on scientific and recommended survey and assessment techniques. This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

Copyright

EXECUTIVE SUMMARY

dBAcoustics was appointed to assess the potential environmental noise impact of the proposed energy conversion which is planned at the Glencore Operations South Africa (Pty)Ltd Lion Smelter in Steelpoort. The project description for the proposed energy conversion facility is as follow:

- To convert excess thermal energy in the excess furnace gas from the Lion Smelter into electrical energy in Swedish Stirling's propriety power generation technology (PWR BLOK 400-F units). The projected total output electrical capacity will be 10MW which will be generated by various reciprocating engines at the proposed stand-alone energy conversion facility (ECF) plant; and
- The generated electrical energy will be fed back into the internal electrical network of the Lion Smelter Complex

The noise intrusion levels from the proposed ECP activities will be insignificant during the Construction and Rehabilitation Phases and the increase along the north-western boundary for the operational phase will be 1.6dBA during the day and 3.3dBA during the night. This is below the threshold level of 7.0dBA before the noise increase can be classified as a noise disturbance i.t.o the Noise Control Regulations, 1994.

There will be a shift in the prevailing ambient noise level in the immediate vicinity of the ECFactivities but at a distance, the intrusion level will be minimal and in line with the Noise Control Regulations. 1994. People who may work or visit the proposed ECF project area will experience an increase in the prevailing ambient noise level in the vicinity of the site. The noise increase at the residential properties will be insignificant.

The application for the proposed ECF project can be approved provided that the recommended mitigatory measures will be in place.

Barend van der Merwe – MSc UJ
Environmental Noise and Vibration Specialist

BASIC ENVIRONMENTAL NOISE STATEMENT REPORT FOR THE PROPOSED ENERGY CONVERSION PROJECT AT GLENCORE OPERATIONS SA (PTY)LTD – LION SMELTER, STEELPOORT BASIC ENVIRONMENTAL NOISE STATEMENT REPORT

CONTENTS

Tables

Figures

This report was prepared in terms of the Environmental Management Act, 1998 (Act No. 107 of 1998), the Environmental Impact Assessment Regulations, 2014 as amended and associated “procedures for the assessment and minimum criteria for reporting on identified environmental themes” GN no. 43110 of 20 March 2020 – no. 43110 of 20 March 2020 – Regulation 982 and the following aspects are dealt with in the report:

Noise protocol number	Requirement	Section in report
	Details of -	
3.3.1	Contact details of the noise specialist, their qualifications, and expertise in preparing the statement and a curriculum vitae	Page 1-3 to Page 1-5
3.3.2	A signed statement of independence by the noise specialist	Page 1-2
3.3.3	A map showing the proposed development footprint	Page 8
3.3.4	Confirmation that all reasonable measures have been taken through micro- siting to minimize disturbance to receptors	Page 27 to Page 29
3.3.5	A substantiated statement from the noise specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development	Page 1-7
3.3.6	Any conditions to which this statement is subjected	Page 38
3.3.7	Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr	Page 39
3.3.8	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations	Page 29
3.4	A signed copy of the compliance statement must be appended to the Basic Assessment Report	Page 44

ABBREVIATIONS

dBA – A-weighted sound pressure level;

dB – Decibel;

IFC – International Finance Corporation;

Km/h – kilometre per hour;

m – Meters;

m/s – meters per second;

N, E, S, W – North, East, West, South

L_{Basic} – Basic noise level in dBA;

NSA – Noise sensitive areas;

MP – Measuring points;

SANS – South African National Standards;

TLB – Tractor loader backhoe

GLOSSARY

Ambient sound level
Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

A-weighted sound pressure level (sound level) (L_{pA}), in decibels
The A-weighted sound pressure level is given by the equation:

$L_{pA} = 10 \log (p_A/p_o)^2$

Where

p_A is the root-mean-square sound pressure, using the frequency weighting network A in pascals; and

p_o is the reference sound pressure (p_o = 20 μPa).

NOTE The internationally accepted symbol for sound level is dBA.

Distant source
A sound source that is situated more than 500 m from the point of observation.

Disturbing noise
A disturbing noise means the following:

- A noise level which will exceed the ambient rating level by 7.0dBA or more;

Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$), in decibels
The value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval T, has the same mean-square sound pressure as a sound under consideration whose level varies with time. It is given by the equation.

$$L_{Aeq,T} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2(t)}{p_o^2} dt \right]$$

Where
$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T that starts at t_1 and ends at t_2;

p_o is the reference sound pressure (p_o = 20 μPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal, in pascals.

Impulsive sound
Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise.

Initial noise
The component of the ambient noise present in an initial situation before any change to the existing situation occurs.

Intelligible speech
Speech that can be understood without undue effort.

Low frequency noise
Sound, which predominantly contains frequencies below 100 Hz.

Nearby source
A sound source that is situated at 500 m or less from the point of observation.

Noise nuisance
Means any sound which disturbs or impairs the convenience or peace of any person.

Rating level
Means the applicable outdoor equivalent continuous rating level indicated in Table 2 of SANS 10103 2008.

Residual noise
Means means the all-encompassing sound in each situation at a given time, measured as the reading on an integrated impulse sound level meter for a total period of at least 10 minutes, excluding noise alleged to be causing a noise nuisance or disturbing noise.

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means, and which may be associated with a specific source.

NOTE Complaints about noise usually arise because of one or more specific noises.

1 INTRODUCTION

dBAcoustics was appointed by Nettzero (Pty) Ltd, to determine the potential noise increase from the stand-alone ECF plant at the Glencore Operations South Africa (PTY) Ltd Lion Smelter in Steelpoort.

Excess thermal energy in the furnace gas from the Lion Smelter will be converted into electrical energy (10MW) in Swedish Stirling's propriety stand-alone power generation technology (PWR BLOK 400-F units). The Swedish Stirling's reciprocating engines recover energy from industrial residual gasses and convert such to a 100% carbon-neutral electricity. These engines will be housed in a stand-alone container structures and adequate ventilation will be provided to supply fresh air to the engines. The generated electrical energy will be fed back into the internal electrical network of the Lion Smelter Complex. A PWR BLOK 400-F units is illustrated in Figure 1.

Figure 1: Swedish Stirling's propriety stand-alone power generation technology (PWR BLOK 400-F

The Stirling engines converts the heat generated by burning the off-furnace gas into a mechanical motion which is subsequently converted into electricity via an alternator. This process may generate some noise and the purpose of the noise impact assessment is to determine the potential noise intrusion levels into the abutting living environment. The reciprocating engines, exhaust outlets, generators (14 per block) and the flare will be sources of noise. In total there will be 25 of these container units on the site as illustrated in Figure 1.

The Lion Smelter site falls within the Fetakgomo – Greater Tubatse Local Municipality (FGTM) which is located within the Greater Sekhukhune District Municipality of the Limpopo Province of the Republic of South Africa. The Lion ECF will be located within the Lion Smelter premises, farm Xstrata 630 KT. The regional location of the proposed EFC plant within the boundaries of the Lion Smelter is presented in Figure 2.

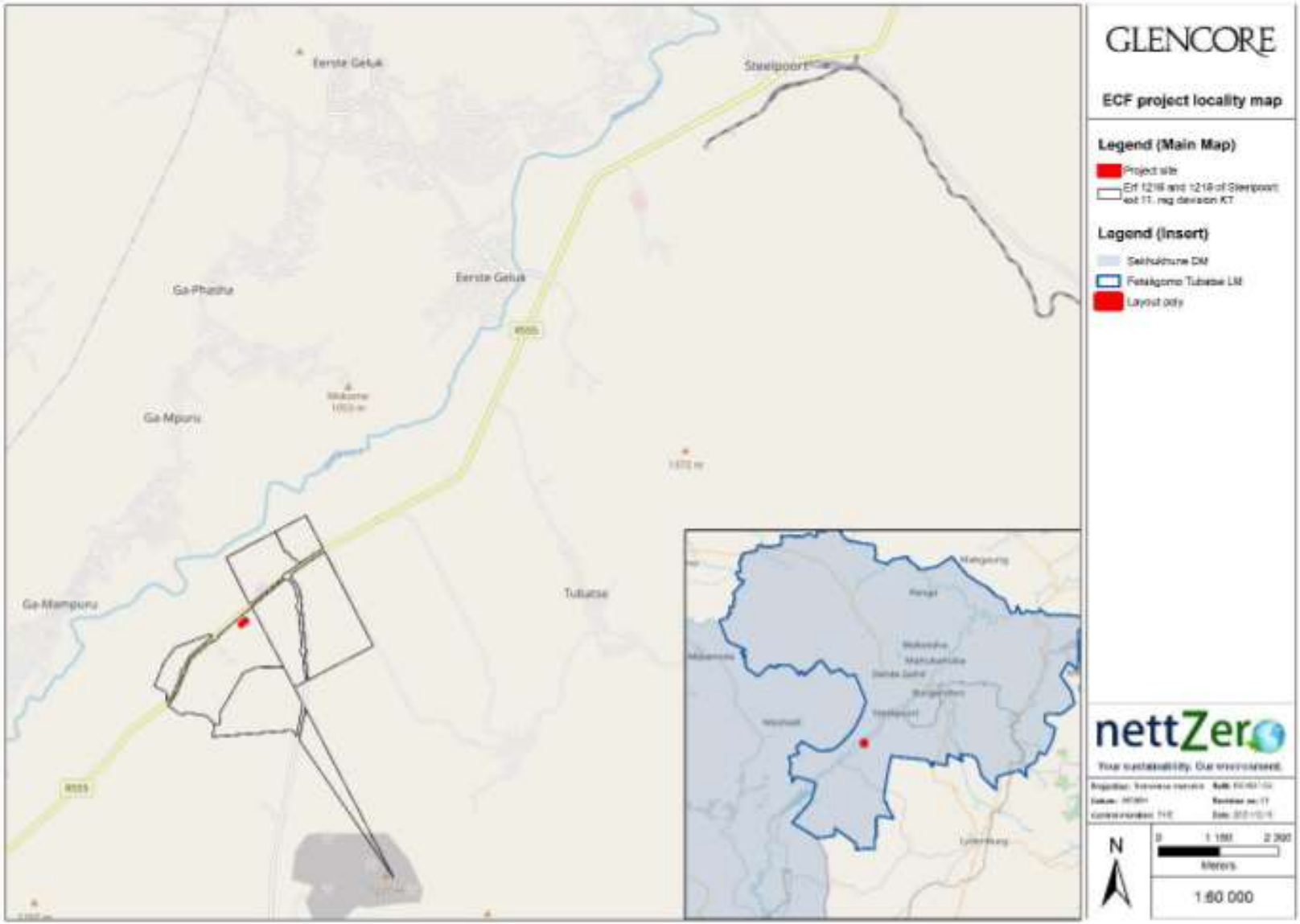


Figure 2: Regional location of the proposed ECF plant

The land-use in the study area is characterised by various mining related activities from Tubatse Ferrochrome, Winterveld Chrome, and Modikwa Platinum mine respectively. The study area can therefore be zoned in terms of SANS 10103 of 2008 as industrial with the recommended noise level along the boundaries of Lion Smelter of 70.0dBA during the day and night-time period as the Lion Smelter operates on a 24-hour basis. A Special Economic Zone (SEZ) is further proposed on the farm Spitskop 333 KT to the northeast of the proposed site along the R555. The residential areas, to the south-west is 1 725 from the proposed EFC footprint and there is a training academy (Mediro training academy) some 1 250m to the south-east. The proposed lay out of the ECF is given in Table 3.

2 BACKGROUND TO ENVIRONMENTAL NOISE

2.1.1 Environmental noise

Sound is a wave motion, which occurs when a sound source sets the nearest particles of air in motion. The movement gradually spreads to air particles further away from the source. Sound propagates in air with a speed of approximately 340 m/s.

The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – Inverse Square Law. Expressed logarithmically as decibels, this means the sound level decrease 6 dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3 dB per doubling of distance.

The decibel scale is logarithmic therefore decibel levels cannot be added together in the normal arithmetic way, for example, two sound sources of 50 dB each do not produce 100 dB but 53 dB, nor does 50 dB and 30 dB equal 80 dB but remains 50 dB.

Air absorption is important over large distances at high frequencies, and it depends on the humidity but is typically about 40 dB/km @ 4000 Hz. Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

When measuring the intensity of a sound, an instrument, which duplicates the ear variable sensitivity to sound of different frequency, is usually used. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter because it conforms to the internationally standardized A-weighting curves. Measurements of sound level made with this filter are called A-weighted sound level measurements, and the unit is dB.

Sound propagation is affected by wind gradient rather than the wind itself. The profile of the ground causes such a gradient. The sound may be propagated during upwind conditions upwards to create a sound shadow. A downwind refracts the sound towards the ground producing a slight increase in sound level over calm isothermal conditions.

The velocity of sound is inversely proportional to the temperature therefore a temperature gradient produces a velocity gradient and a refraction of the sound. Temperature decreases with height and the sound is refracted upwards.

For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening can be effective when there is a barrier between the receiver and the source i.e., walls, earth mounds, cuttings, and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m^2.
There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general, the ear is less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3-5 dBA.

There are certain effects produced by sound which, if it is not controlled by approved acoustic mitigatory measures, seem to be construed as undesirable by most people and they are:

- Long exposure to high levels of sound, which may damage the hearing or create a temporary threshold shift – in industry or at areas where music is played louder than 95 dBA. This will seldom happen in far-field conditions;
- Interference with speech where important information by the receiver cannot be analysed due to loud noises;
- Excessive loudness;
- Annoyance.

Several factors, for example clarity of speech, age of listener and the presence of noise induced threshold displacement, will influence the comprehensibility of speech communication. The effect of noise (except for long duration, high level noise) on humans is limited to disturbance and/or annoyance and the accompanying emotional reaction. This reaction is very difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noisemaker, the time of day or night and the day of the week.

Types of noise exposure:

- Continuous exposure to noise – The level is constant and does not vary with time e.g., traffic on freeway and an extractor fan;
- Intermittent exposure to noise – The noise level is not constant and occurs at times e.g., car alarms and sirens;
- Exposure to impact noise – A sharp burst of sound at intermittent intervals e.g., explosions and low frequency sound.

These time-varying characteristics of environmental noise are described using statistical noise descriptors:

Leq: The Leq is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same period.

L_{Max}: The instantaneous maximum noise level for a specified period.

L_{Min}: The instantaneous minimum noise level for a specified period.

The following relationships occur for increases in A-weighted noise levels:

- The trained healthy human ear can discern changes in sound levels of 1 dBA under controlled conditions in an acoustic laboratory;
- It is widely accepted that the average healthy ear can barely perceive noise level changes of 3 dBA;
- A change in sound level of 5 dBA is a readily perceptible increase in noise level;
- A 10-dBA change in the sound level is perceived as twice as loud as the original source.

The World Bank in the Environmental Health and Safety Regulations has laid down the following noise level guidelines:

- Residential area – 55 dBA for the daytime and 45 dBA for the night-time period;
- Industrial area – 70 dBA for the day- and night-time periods.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be. To evaluate such, there must be uniform guidelines to evaluate each scenario. SANS 10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise levels per district as given in Table 1.

Table 1: Recommended noise levels for several types of districts

Type of district	Equivalent continuous rating level $L_{Req.T}$ for ambient noise					
	Outdoors			Indoors, with open windows		
	Day-night	Daytime	Night-time	*Day-night*	Daytime	Night-time
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
e) Central business district	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

*Should the operating hours be on a 24-hour basis the recommended noise level for a type (f) district will be 70.0dBA for the day and the night-time

The reference time intervals can be specified to cover typical human activities and variations in the operation of noise sources and are for daytime between 6h00 to 22h00 and for night-time between 22h00 and 6h00.

The study area falls within an (a) to (d) type districts because of the type of activities such as main roads, gravel roads, little traffic and major traffic which all have an influence on the prevailing ambient noise level for a specific area.

There is therefore a mixture of activities and higher noise levels as per the above recommended continuous rating levels within i.e., residential, agricultural activities (seasonal) and feeder roads in proximity of each other or to a farmhouse. A residential property next to the R69 road will experience higher noise levels than residential properties some distance from roads. The ambient noise level will therefore differ throughout the study area, depending on the location and the measuring position in relation to areas with existing noise sources such as roads.

People exposed to an increase in the prevailing ambient noise level will react differently to the noise levels and the response is given in Table 2.

Table 2: Estimated community/group response when the ambient noise level is exceeded (Source: SANS 10103 of 2008).

1	2	3
Excess)$L_{Req,T}$[1)]	**Estimated community/group response**	
dB	**Category**	**Description**
0	None	No observed reaction
0-10	Little	Sporadic complaints
5-15	Medium	Widespread complaints
10-20	Strong	Threats of community/group action
>15	Very strong	Vigorous community/group action

1) Calculate)$L_{Req,T}$ from the appropriate of the following:
a))$L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determine the specific noise under investigation).
b))$L_{Req,T}$ = $L_{req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambie table 1.
c))$L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicab determined from table 2.

The difference between the actual noise and the ambient noise level will determine how people will respond to sound.

3 LEGISLATIVE AND POLICY CONTEXT

There are specific regulatory and legislative requirements which regulate the proposed development in terms of environmental noise and vibration. The legislative documents are as follows:

Department of Environment Affairs: Noise Control Regulations promulgated under the Environment Conservation Act, (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994. This report was prepared in terms of the Environmental Management Act, 1998 (Act No. 107 of 1998), the Environmental Impact Assessment Regulations, 2014 as amended and associated “procedures for the assessment and minimum criteria for reporting on identified environmental themes – Noise protocol ” GN no. 43110 of 20 March 2020 – no. 43110 of 20 March 2020 – Regulation 982

These noise control regulations are applicable in the study area and the main aspect of these noise control regulations is that you may exceed the prevailing ambient noise levels by 7.0dBA before a noise disturbance is created.

4.2 South African National Standards – SANS 10103 of 2008

The South African National Standards provide the guidelines for the different recommended prevailing ambient noise levels and how to evaluate when a specific operation or activity is creating a noise disturbance and what reaction can be expected if a noise disturbance is created.

4.3 South African National Standards – SANS 10210 of 2004

This national standard is used when calculating or predicting increased road traffic noise during new developments.

4.4 General Environmental, Health and Safety Guidelines of the IFC of the World Bank

The recommended noise level for a noise sensitive area is 55.0dBA during the day and 45.0dBA during the night.

The Constitution of the Republic of South Africa Act, (Act No 108 of 1996) makes provision for the health and well-being of the citizens and to prevent pollution and to promote conservation.

According to Article 24 of the Act, everyone has the right to:

(a) an environment that is not harmful to their health and well-being; and

(b) have the environment protected for the present and future generations through reasonable legislative and other measures:

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecological sustainable development and use of natural resources, while promoting justifiable economic and social development.

It is widely recognized that many aspects of industrial operations may lead to an increase in the environmental ambient noise levels. The impact of such an increase in the prevailing noise levels can be both physical and physiological. Many aspects of mining operations lead to an increase in noise levels and/or ground vibration levels over the prevailing ambient levels (Garvin *et al*., 2009).

4 STUDY METHODOLOGY

The noise survey was conducted in terms of the provisions of the Noise Control Regulations, 1994 and the SANS 10103 of 2008 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) using a digital Larson Davis 831 – Class 1 meter with Logging, Environmental 1/1, 1/3 Octave Band and percentiles Sound Level Meter (Class 1). On taking measurements the device-meter scale was set to the "A" weighed measurement scale which enables the device to respond in the same manner as the human ear. The device was held approximately 1.5 m above the surface and at least 3.0m away from hard reflecting surfaces. A suitable wind shield was used on the microphone for all measurements to minimise wind interference. The Instrument was checked and calibrated prior to use and maintained in accordance with equipment and coincided below 1.0dBA. The noise survey was conducted in terms of the provisions of the Noise Control Regulations, 1999 and the South African National Standards, SANS 10103 of 2008. The following integrated noise level meters were used in the noise survey:

Larson Davis 831

- Larsen Davis Integrated Sound Level Meter Type 1 – Serial no. S/N 0001072;
- Larsen Davis Pre-amplifier – Serial no.PRM831 0206;
- Larsen Davis ½" free field microphone – Serial no. 377B02-316581;
- Larsen Davis Calibrator 200 – Serial no.9855;
- Certificate Number: 2019-AS-0892A;
- Date of Calibration: 17 February 2021.

Larson Davis LXT Sound Expert

- Larsen Davis Integrated Sound Level Meter Type 1 – Serial no. S/N 0006037;
- Larsen Davis Pre-amplifier – Serial no. PRM LXT1 and 377B 02;
- Larsen Davis Calibrator 200 – Serial no.9855;
- Certificate Number: 2019-AS-0892A;
- Date of Calibration: 28 July 2020.

Batteries were fully charged, and a windshield was always in use. The calibration certificates are attached as Appendix A.

The noise survey was carried out in terms of the Noise Control Regulations Section 16 being**:**
"16 (1) Any person taking readings shall ensure that -

(a) sound measuring instruments comply with the requirements for type I instrument in accordance with SABS-IEC 60651, SABS-IEC 60804, and SABS-I EC 60942 as the case may be;

(b) the acoustic sensitivity of sound level meters is checked before and after every series of measurements by using a sound calibrator, and shall reject the results if the before and after calibration values differ by more than 1 dBA;

(c) the microphones of sound measuring instruments are at all times provided with a windshield;

(d) the sound measuring instruments are operated strictly in accordance with the manufacturer's instructions; and

(e) sound measuring instruments are verified annually by a calibration laboratory for compliance with the specifications for accuracy of national codes of practice for acoustics, to comply with the Measuring Units and National Measuring Standards Act 1973 (Act No. 76 of 1973).

(2) The measuring of dBA values in respect of controlled areas, ambient sound levels or noise levels in terms of these regulations shall be done as follows:

(a) outdoor measurements on a piece of land: By placing the microphone of an integrating impulse sound level meter at least 1,2 metres, but not more than 1,4 metres, above the ground and at least 3,5 metres away from walls, buildings or other sound reflecting surfaces".

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The communities to the north of the ECF and the distance between the ECF and the communities are presented in Table 5 and illustrated in Figure 4.

Table 5: Location of the noise receptors

Receptor	Distance from the proposed ECF footprint in meters	Land use type
A	1 509	Community – residential, main road and business.
B	2 348	Community – residential, main road and business.
C	3 200	Community – residential, main road and business.
D	5 016	Community – residential, main road and business.
Mediro training facility	1 166	Training facility.
Tshufi camp	3 172	Guest farm.
North-western boundary	70	North-western boundary onto the R555 feeder road.

The location of the noise receptors (A to D, Mediro training facility and Tshufi camp in the vicinity of the proposed ECF footprint is illustrated in Figure 4.

Figure 4: Noise receptors in the vicinity of the proposed ECF footprint

6 MEASURING POINTS

The measuring points for the study area were selected to be representative of the prevailing ambient noise levels for the study area and include all the noise sources such as distant traffic noise and industrial activity noise. The measuring points are illustrated in Figure 5. The measuring points along the boundaries of the study area and inside the boundaries of the mining area and the physical attributes of each measuring point are illustrated in Table 6.

Table 6: Measuring points and co-ordinates for the study area

Position	Latitude	Longitude	Remarks
1	24° 48.736'S	30° 7.288'E	Northern corner of Smelter property
2	24° 49.093'S	30° 7.390'E	Eastern Smelter property boundary
3	24° 49.570'S	30° 7.436'E	South-eastern Smelter property boundary
4	24° 49.199'S	30° 6.541'E	North-west of Smelter, across R555
5	24° 49.080'S	30° 6.692'E	North-west of Smelter, across R556
6	24° 48.911'S	30° 7.002'E	North-western Smelter property boundary
7	24° 48.694'S	30° 6.634'E	690m north-west of Smelter property boundary
8	24° 49.449'S	30° 6.681'E	At the parking area for the Administration offices

The following is of relevance to the ambient noise measurements:

- The L_{Aeq} was measured over a representative sampling period exceeding 10 minutes at each measuring point; and
- The noise survey was carried out during the day and night-time period being 06h00 to 22h00 for the daytime and 22h00 to 6h00 for the night-time.

Figure 5: Measuring points for the study area

6.1 Site Characteristics

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

- The proposed ECF is situated within the boundaries of the Lion Smelter and will be situated along the south-western boundary some 100m from the R555;
- The traffic along the R555 contribute to the higher prevailing ambient noise levels of study area;
- There was a continuous flow of traffic along the daytime and an intermittent flow of traffic along the night-time along the R555;
- Intermittent traffic noise along the gravel road contributes to the higher prevailing ambient noise level at some of the measuring points; and
- The wind and weather conditions play an important role in noise propagation.

6.2 Current noise sources

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

- Industrial activity noises;
- Distant intermittent traffic noise from the gravel roads and/or R555;
- Insects;
- Birds; and
- Wind noise.

6.3 Atmospheric conditions during the noise survey

The noise readings were carried out at the different measuring points and the prevailing atmospheric conditions i.e., wind speed, wind direction and temperature were taken into consideration. The readings were done away from any large vertical structures, which may influence the outcome of the readings. The following meteorological conditions were recorded:

1 December 2021

Daytime

- Wind speed – less than 3.3m/s;
- Temperature – 32.1^{o}C – No strong temperature gradient occurred near the ground;
- Cloud cover – High cloud cover;
- Wind direction – The wind was blowing from a north-easterly direction; and
- Humidity – 18 % humidity.

Night-time

- Wind speed – less than 2.2m/s to no wind;
- Temperature – 19.2^{o}C – No strong temperature gradient occurred near the ground;

- Cloud cover – High cloud cover;
- Wind direction – The wind was blowing from a north-westerly direction; and
- Humidity – 20 % humidity.

7 RESULTS OF THE NOISE SURVEY

In Table 7 are the prevailing ambient noise levels for the specific areas, which include all the noise sources currently in the area such as industrial activities, traffic noise, and natural noise sources. Leq is the average noise level for the specific measuring point over a period, the Lmax is the maximum noise level and the Lmin is the minimum noise level registered during the noise survey for the specific area in dBA.

Table 7: Noise levels for the day and night in the study area.

Position	Daytime noise level			Remarks	Night-time 1 noise level			Remarks	Night-time 2 noise level			Remarks
	LAeq	Lmax	Lmin		LAeq	Lmax	Lmin		LAeq	Lmax	Lmin	
1	**64.2**	78.0	48.1	Traffic noise & insects. Measurement with no traffic was 54.5dBA	**61.3**	75.9	39.2	Intermittent traffic noise, insects & distant plant. Measurement with no traffic was 46.7dBA	**54.7**	73.7	42.8	Distant plant noise, Insects & intermittent traffic noise. Measurement with no traffic was 48.5dBA
2	**66.1**	79.9	54.2	Traffic noise & plant noise. Measurement with no traffic was 58.3dBA	**63.7**	77.9	55.2	Traffic noise, plant noise & insects. Measurement with no traffic was 57.8dBA	**61.4**	75.9	57.1	Plant noise & intermittent traffic noise. Measurement with no traffic was 59.3dBA
3	**60.7**	72.1	48.0	Traffic noise & distant plant noise. Measurement with no traffic was 53.6dBA	**58.6**	70.3	50.7	Intermittent traffic noise, distant plant noise, distant sirens & distant reverse signals. Measurement with no traffic was 53.2dBA	**55.3**	66.3	51.1	Distant plant noise & intermittent traffic. Measurement with no traffic was 53.4dBA
4	**61.3**	72.5	46.3	Distant plant noise, traffic noise & bird noise. Measurement with no traffic was 51.5dBA	**56.2**	70.4	46.1	Distant plant noise, intermittent traffic & insects. Measurement with no traffic was 48.1dBA	**50.9**	63.1	44.5	Distant plant noise, intermittent traffic & insects. Measurement with no traffic was 48.2

Position	Daytime noise level			Remarks	Night-time 1 noise level			Remarks	Night-time 2 noise level			Remarks
	LAeq	Lmax	Lmin		LAeq	Lmax	Lmin		LAeq	Lmax	Lmin	
5	**59.5**	67.8	51.5	Distant plant noise, traffic noise, sirens & reverse signals. Measurement with no traffic was 56.1dBA	**57.2**	66.4	52.7	Distant plant noise, intermittent traffic & insects. Measurement with no traffic was 55.2dBA	**54.8**	63.2	50.7	Distant plant noise, intermittent traffic & insects. Measurement with no traffic was 52.1dBA
6	**67.3**	78.4	52.9	Plant noise, intermittent traffic noise & plant activity. Measurement with no traffic was 58.0dBA	**66.0**	80.1	54.1	Plant and plant activity & intermittent traffic. Measurement with no traffic was 57.3dBA	**60.1**	71.0	54.8	Plant noise & intermittent traffic. Measurement with no traffic was 58.0dBA
7	**46.2**	51.3	41.1	Distant plant and plant activities noise & birds	**48.1**	52.2	45.0	Distant plant and plant activities noise & insects	**43.8**	51.5	40.5	Distant plant and plant activities noise & insects
8	**54.8**	64.1	48.4	Plant noise, wind noise, birds, distant traffic & worker noise	**52.1**	58.6	46.1	Plant noise, insects & distant, intermittent traffic	**52.6**	60.8	48.9	Plant noise & insects

The noise levels during the day, night 1 and night 2 is illustrated in Appendix B.

The noise level of construction type vehicles at different distances from the activity are illustrated in Table 8.

Table 8: Sound pressure levels of construction machinery

Equipment	Reduction in the noise level some distance from the source - dBA								
Cumulative distance from source in meters	**2m from the machinery**	**15m**	**30m**	**60m**	**120m**	**240m**	**480m**	**960m**	**1920m**
Dump truck	91.0	62.5	56.5	50.4	44.4	38.4	32.4	26.4	20.3
Backhoe	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Drilling Equipment	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Flatbed truck	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Front end loader	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Excavator	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pickup truck	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Tractor trailer	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Crane	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pumps	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Welding Machine	72.0	43.5	37.5	31.4	25.4	19.4	13.4	7.4	1.3

Generator	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Compressor	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pile driver	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Jackhammer	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Rock drills	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Pneumatic tools	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Cumulative noise levels from the construction activities when all such work within a radius of 30m	**105.6**	**77.1**	**71.0**	**65.1**	**59.1**	**53.0**	**46.9**	**41.1**	**35.9**

The noise reduction calculated in Table 8 is for direct line of sight and medium ground conditions. Engineering control measures and topography can have an influence on how the noise level is perceived by the occupants of nearby noise sensitive areas. The cumulative noise level of the machinery and equipment will be 64.9dBA at 60m and 41.1dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time. This will seldom happen, and the cumulative noise level will therefore be lower.

7.1 Noise impact at the different noise receptors

The following equation was used to calculate the noise level at the noise sensitive areas during the construction phase:

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

Where, Lp is the sound level at a distance from the source in dBA;
Lw is the sound level at the source in dBA; and
R is the distance from the source.

The following sound levels were used in determining the noise intrusion level during the construction phase during the construction of the ECF Structures and infra-structure:

- Clearing and stripping of topsoil and vegetation at the ECF Pad – 85.0dBA;
- Construction of the ECF Pad – 85.5dBA;
- Construction activities at the ECF pad – 81.0dBA;
- Installation of the containers and the pipes and flare – 84.0dBA; and
- Construction activities of the offices/operator's area – 82.0dBA.

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

- Noise from the ECF Pad (cumulative noise level for 25 power bloks – 110.0dBA;
- Generation of electricity by the generators – 90.0dBA;
- Emergency release valve – 100.0dBA;
- Reciprocation engines – 100.0dBA;
- Pumping of cooling water – 95.0dBA; and
- Office/Operator room – 75.0dBA.

The following sound levels were used in determining the noise intrusion level during the

Rehabilitation phase of the mining activities:

- Removal of all Infra-structure – 95.0dBA; and
- Earthworks and planting of vegetation – 85.0dBA.

The noise levels at the noise sensitive areas will be added in a logarithmic manner to determine the overall sound exposure at the receptor. The following formula will be used to categorize the intrusion levels during the construction phase. Noise modelling will be done for the operational phase. The increase in the prevailing ambient noise level during the different phases is calculated in the following manner:

$\Delta L\text{Req,T} = L\text{Req,T (post)} - L\text{Req,T (pre)}$
where,
LReq,T (post) – noise level after completion of the project – projected or calculated noise levels;
LReq,T (pre) – noise level before the proposed project – ambient noise level.

The criterion for assessing the magnitude of a noise impact is illustrated in Table 9.

Table 9: Noise intrusion level criteria

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

7.2 Noise projections

The following equation was used to calculate the noise level at the noise sensitive areas during the construction/operational phases:

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

Where, Lp is the sound level at a distance from the source in dBA;
Lw is the sound level at the source in dBA; and
R is the distance from the source.

7.2.1 Construction phase

The noise intrusion levels during the construction phase are given in Table 10 and the threshold value of 7.0dBA will not be exceeded and the noise intrusion level will be insignificant.

Table 10: Noise intrusion levels (in dBA) during construction phase

Residential property	Clearing and grubbing of topsoil and vegetation at the ECF-Pad	Construction activities of the ECF Pad	Construction activities at the ECF Pad	Installation of the containers, pipes, and flare	Construction activities of the offices/operator's area	Cumulative Levels	Cumulative noise level - Daytime	Intrusion noise level - daytime
A	19.9	19.9	19.4	18.9	16.9	26.2	55.0	0.0
B	16.1	16.1	15.6	15.1	13.1	22.4	55.0	0.0
C	13.4	13.4	12.9	12.4	10.4	19.7	55.0	0.0
D	9.5	9.5	9.0	8.5	6.5	15.9	55.0	0.0
Mediro training facility	22.2	22.2	21.7	21.2	19.2	28.4	60.7	0.0
Tshufi camp	13.5	13.5	13.0	12.5	10.5	19.8	46.2	0.0
North-western boundary	46.6	46.6	46.1	45.6	43.6	52.8	67.5	0.2

7.2.2 Operational phase

The noise contours and the subsequent noise intrusion levels at the abutting noise receptors during the operational phase of the project at the different areas and at the abutting noise sensitive areas are illustrated in Figure 6. The threshold value of 7.0dBA will not be exceeded and due to the traffic noise and seasonal agricultural activities the noise intrusion will be below 0.5dBA during the day and night which is insignificant. The noise intrusion along the north-western boundary will be low and within the 7.0dBA threshold value. The calculated cumulative noise levels during the operational phase at the noise receptors are given in Table 11.

Table 11: Cumulative noise levels (dBA) during the operational phase

Residential property	Noise from the ECF Pad	Generation of electricity	Emergency release valve	Reciprocation engines	Pumping of cooling water	Office /operator's room	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – Night-time	Intrusion noise level - daytime	Intrusion noise level – night-time
A	31.9	21.4	31.4	31.9	26.4	6.4	37.1	55.1	45.6	0.1	0.6

B	28.1	17.6	27.6	28.1	22.6	2.6	33.2	55.0	45.3	0.0	0.3
C	25.4	14.9	24.9	25.4	19.9	-0.1	30.6	55.0	45.2	0.0	0.2
D	21.5	11.0	21.0	21.5	16.0	-4.0	26.7	55.0	45.1	0.0	0.1
Mediro training facility	34.2	23.7	33.7	34.2	28.7	8.7	39.3	60.7	56.8	0.0	0.1
Tshufi camp	25.5	15.0	25.0	25.5	20.0	0.0	30.6	46.3	44.0	0.1	0.2
North-western boundary	58.6	48.1	58.1	58.6	53.1	33.1	63.7	68.9	66.4	1.6	3.3

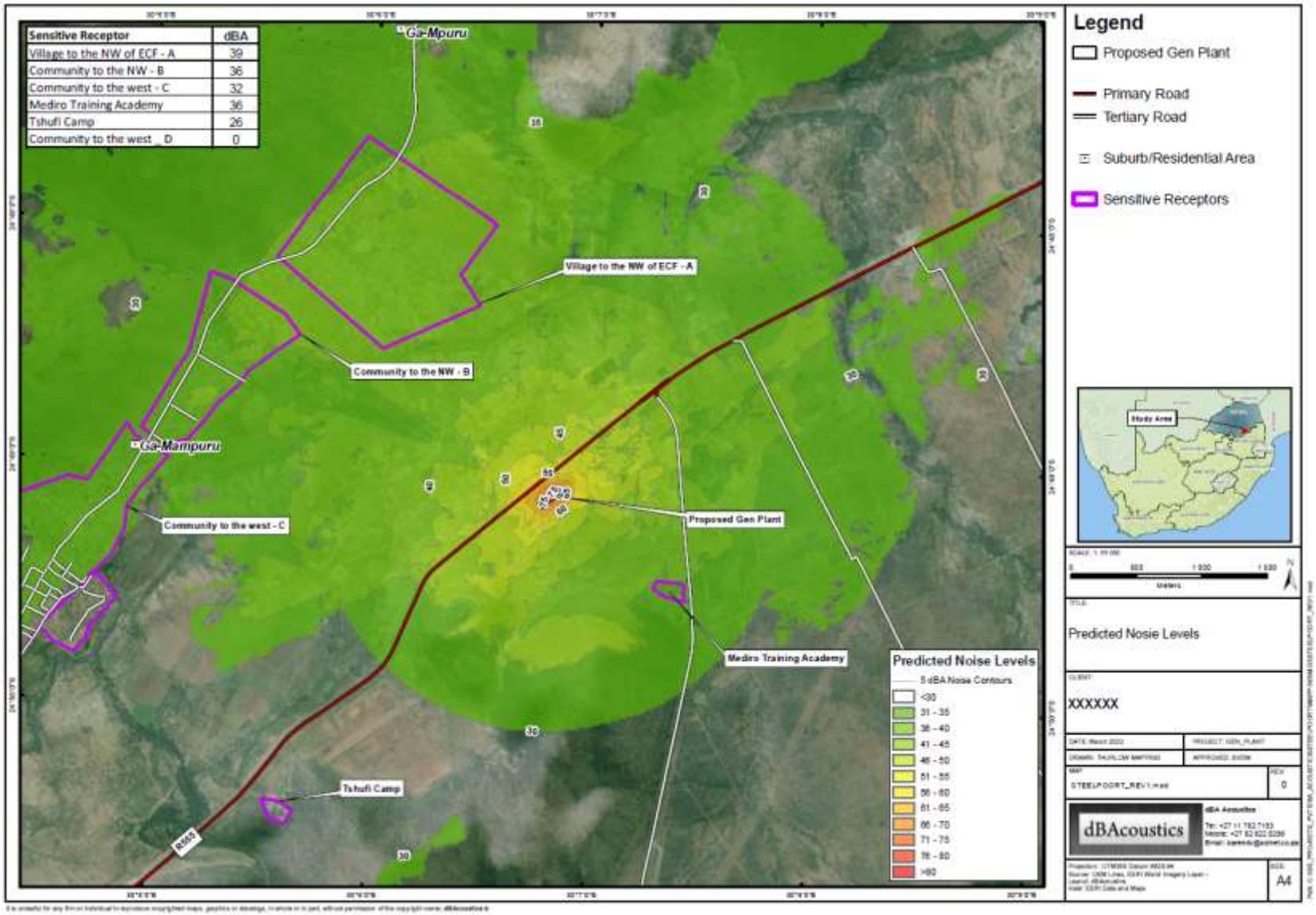


Figure 6: Noise contours during the operational phase

7.2.3 Rehabilitation phase

The noise intrusion levels during the rehabilitation phase are given in Table 12 and the threshold value of 7.0dBA will not be exceeded and the noise intrusion level will be insignificant.

Table 12: Noise intrusion levels (in dBA) during rehabilitation phase

Position	Removal of Infra-structure	Planting of grass	Cumulative Levels	Cumulative noise level - Daytime	Intrusion noise level - daytime
A	29.9	16.4	30.2	55.0	0.0
B	26.1	12.6	26.4	55.0	0.0
C	23.4	9.9	23.8	55.0	0.0
D	19.5	6.0	20.1	55.0	0.0
Mediro training facility	32.2	18.7	32.4	60.7	0.0
Tshufi camp	23.5	10.0	23.8	46.2	0.0
North-western boundary	56.6	43.1	56.8	67.7	0.4

Two aspects are important when considering potential noise impacts of a project namely:

- The increase in the noise level during the construction, operational and rehabilitation phase, and;
- The overall noise level produced by the proposed mining activities.

The prevailing ambient noise level may change according to the season of the year when insects becomes the pre-dominant contributor to the higher ambient noise levels.

7.2.4 Assumptions and Limitations

The following assumptions were used in the noise impact assessment:

- The noise calculations were based on the location of the ECF Pad at it's position as illustrated in Figure 5;
- Noise calculations were based as if the construction and rehabilitation phases will take place during the day and the operational phase during the day and night;
- The report is based on project information provided by the client;
- The noise calculations were based on the following noise levels per activity:
  - Clearing and stripping of topsoil and vegetation at the ECF Pad – 85.0dBA;
  - Construction of the ECF Pad – 85.5dBA;
  - Construction activities at the ECF pad – 81.0dBA;
  - Installation of the containers and the pipes and flare – 84.0dBA;
  - Construction activities of the offices/operator's area – 82.0dBA;
  - Noise from the ECF Pad – 100.5dBA;
  - Generation of electricity by the generators – 90.0dBA;
  - Emergency release valve – 100.0dBA;
  - Reciprocation engines – 100.0dBA;
  - Pumping of cooling water – 95.0dBA; and
  - Office/Operator room – 75.0dBA.

8 IMPACTS IDENTIFICATION AND ASSESSMENT

8.1 Identification of Impacts

8.1.1 Construction Phase

- Clearing and stripping of topsoil and vegetation at the ECF Pad;
- Construction of the ECF Pad;
- Construction activities at the ECF pad;
- Installation of the containers and the pipes and flare; and
- Construction activities of the offices/operator's area.

8.1.2 Operational Phase

- Noise from the ECF Pad;
- Generation of electricity by the generators;
- Emergency release valve;
- Reciprocation engines;
- Pumping of cooling water;
- Office/Operator room; and
- Emergency generator.

8.1.3 Rehabilitation Phase

- Removal of all Infra-structure; and
- Earthworks and planting of vegetation

8.2 Impact Assessment Methodology

The impact assessment methodology has been formalised to comply with Regulation 31(2) (l) of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), which states the following:

An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision and must include –

(l) an assessment of each identified potentially significant impact, including –

(i) **cumulative** impacts;

(ii) the **nature** of the impact;

(iii) the **extent** and **duration** of the impact;

(iv) the **probability** of the impact occurring;

(v) the **degree** to which the **impact can be reversed**;

(vi) the **degree** to which the impact may **cause irreplaceable loss of resources**; and

(vii) the **degree** to which the **impact can be mitigated**.

Based on the above, the EIA Methodology will require that each potential impact identified is clearly described (providing the nature of the impact) and be assessed in terms of the following factors:

- **extend** (spatial scale) - will the impact affect the national, regional, or local environment, or only that of the site?
- **duration** (temporal scale) - how long will the impact last?
- **magnitude** (severity) - will the impact be of high, moderate, or low severity? and
- **probability** (likelihood of occurring) - how likely is it that the impact may occur?

To enable a scientific approach for the determination of the environmental significance (importance) of each identified potential impact, a numerical value has been linked to each factor.

The following ranking scales are applicable:

Occurrence	**Duration:**	**Probability:**
	5 – Permanent	5 – Definite/do not know
	4 - Long-term (ceases with the operational life)	4 – Highly probable
	3 - Medium-term (5-15 years)	3 – Medium probability
	2 - Short-term (0-5 years)	2 – Low probability
	1 – Immediate	1 – Improbable
		0 – None
Severity	**Extent/scale:**	**Magnitude:**
	5 – International	10 - Very high/uncertain
	4 – National	8 – High
	3 – Regional	6 – Moderate
	2 – Local	4 – Low
	1 – Site only	2 – Minor
	0 – None	

Once the above factors had been ranked for each identified potential impact, the environmental significance of each impact can be calculated using the following formula:

Significance = (duration + extend + magnitude) x probability

The maximum value that can be calculated for the environmental significance of any impact is 100.

The environmental significance of any identified potential impact is then rated as either: high, moderate, or low on the following basis:

- More than 60 significance value indicates a high (H) environmental significance impact;
- Between 30 and 60 significance value indicates a moderate (M) environmental significance impact; and
- Less than 30 significance value indicates a low (L) environmental significance impact.

To assess the ***degree to which the potential impact can be reversed and be mitigated***, each identified potential impact will need to be assessed twice.

- Firstly, the potential impact will be assessed and rated prior to implementing any mitigation and management measures; and
- Secondly, the potential impact will be assessed and rated after the proposed mitigation and management measures have been implemented.

The purpose of this dual rating of the impact before and after mitigation is to indicate that the significance rating of the initial impact is and should be higher in relation to the significance of the impact after mitigation measures have been implemented.

To assess the ***degree to which the potential impact can cause irreplaceable loss of resources***, the following classes (%) will be used and will need to select based on your informed decision and discression:

5) 100% - Permanent loss
4) 75% - 99% - Significant loss
3) 50% - 74% - Moderate loss
2) 25% - 49% - Minor loss
1) 0% - 24% - Limited loss

8.2.1 Construction Phase

The noise risk assessment is illustrated in Tables 13 to 17.

Table 13: Clearing and stripping of topsoil and vegetation at the ECF Footprint

Activity	***Clearing and stripping of topsoil and vegetation at the ECF Footprint***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Moderate
Mitigation measures	*Construction activities at the different ECP Pas carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of Lion Smelter is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 14: Construction of the ECF Footprint

Activity	***Construction of the ECF Footprint – different PBU units, flare, offices***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Moderate
Mitigation measures	*Construction activities at the ECF Footprint carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of Lion Smelter is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 15: Construction activities in the vicinity of the ECF Footprint

Activity	***Construction activities in the vicinity of the ECF Footprint***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Moderate
Mitigation measures	*Construction activities at the different ECP Pas carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of Lion Smelter is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 16: Installation of the containers, the pipes and flare

Activity	***Installation of the containers, the pipes and flare***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter..*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Moderate
Mitigation measures	*Construction activities at the different ECP Pas carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of Lion Smelter is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

Table 17: Construction activities of the offices/operator's area

Activity	***Construction activities of the offices/operator's area***					
Project phase	*Construction phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	2	2	4	24	Moderate
Mitigation measures	*Construction activities at the different ECP Pas carried out during the day and night-time provided that the prevailing ambient noise levels at the boundary of Lion Smelter is not exceeded. When the prevailing ambient noise is exceeded during night-time such activities may only take place during daytime*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	2	2	4	16	Low

8.2.2 Operational Phase

The noise risk assessment for the operational phase is given in Table 18 to Table 23.

Table 18: *Noise from the ECF Pad*

Activity	***Noise from the ECF Pad***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	6	36	Moderate
Mitigation measures	*All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. Noise survey to be done on a monthly basis and after one year to change to a quarterly basis if the prevailing ambient noise level at Lion Smelter is in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	4	30	Moderate

Table 19: Generation of electricity by the generators

Activity	***Generation of electricity by the generators***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	6	36	Moderate
Mitigation measures	*All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. Noise survey to be done on a monthly basis and after one year to change to a quarterly basis if the prevailing ambient noise level at Lion Smelter is in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	4	30	Moderate

Table 20: Emergency release valve

Activity	***Emergency release valve***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	6	36	Moderate
Mitigation measures	*All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. Noise survey to be done on a monthly basis and after one year to change to a quarterly basis if the prevailing ambient noise level at Lion Smelter is in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	4	30	Moderate

Table 21: **Reciprocation engines**

Activity	***Reciprocation engines***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	6	36	Moderate
Mitigation measures	*All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. Noise survey to be done on a monthly basis and after one year to change to a quarterly basis if the prevailing ambient noise level at Lion Smelter is in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	4	30	Moderate

Table 22: **Pumping of cooling water**

Activity	***Pumping of cooling water***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	6	36	Moderate
Mitigation measures	*All noise sources exceeding 85.0dBA to be identified and if practical to be acoustically screened off. Noise survey to be done on a monthly basis and after one year to change to a quarterly basis if the prevailing ambient noise level at Lion Smelter is in line with the 70.0dBA threshold value.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	3	4	2	4	30	Moderate

Table 23: **Office/operator room**

Activity	***Office/operator room***					
Project phase	*Operational phase*					
Impact Summary	*Noise increase at the boundary of the Lion Smelter.*					
Potential Impact Rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	5	2	6	26	Low
Mitigation measures	*No mitigation measures required.*					
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Significance score***	***Significance***
	2	5	2	4	22	Low

8.2.3 Rehabilitation Phase

The noise risk assessment for the rehabilitation phase is given in Table 24 to Table 26.

Table 24: **Removal of infra-structure**

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

After Management Impact rating	2	2	2	4	16	Low

Table 25: **Back fill of disturbed areas**

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

Table 26: **Planting of grass and vegetation**

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

8.3 Potential Mitigation Measures

The mitigation measures which will be part of the mine establishment is given in Table 27.

Table 27: Mitigation Measures.

Activity	Recommendations	Legislation
Construction phase	• Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels and any noise sources above 85.0dBA to be acoustically screened off. • Construction activities may only take place during daytime periods and provided that the prevailing ambient noise level along the mine boundaries will not be exceeded. • Environmental noise monitoring on a monthly basis.	Environmental Department: Noise Control Regulations promulgated under the Environment Conservation Act, (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994
Operational phase	• Equipment and/or machinery which radiate noise levels above 85.0dBA to be acoustically screened off. • Noise monitoring at the residential areas and the mine boundaries to be done monthly for a year after which the frequency can change to a quarterly basis; • Actively manage the process and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. The levels to be evaluated in terms of the threshold noise levels of 70.0dBA along the boundaries of the property; • .	Environmental Department: Noise Control Regulations promulgated under the Environment Conservation Act, (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994. SANS 10103 of 2008.

Rehabilitation phase	• Machinery with low noise levels which complies with the manufacturer's specifications to be used; and • Activities to take place during daytime period only.	Environmental Department: Noise Control Regulations promulgated under the Environment Conservation Act, (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994

8.4 Impact Assessment - Alternatives

8.4.1 No Go Option

The ECP position will be the best position next to the R555 for this type of project.

9 NOISE MONITORING PROGRAMME

The noise monitoring programme will need to be a pro-active programme to manage the noise levels within the boundaries of the property boundaries. The noise monitoring programme must consist out of the following phases:

- Noise surveys must be done monthly.

The following noise results must be kept on record:

- Leq – values of each measuring point in dBA;
- Spectrum analysis of the results;
- Any physical characteristics in and next to the measuring points which may change the noise regime of the area;
- Any other details such as the instrument, competent person etc. will be compiled and made available.

The geographical position of the proposed measuring points is given in Table 21.

Table 21: Geographical position of the measuring points

Position	Latitude	Longitude	Remarks
1	24° 48.736'S	30° 7.288'E	Northern corner of Smelter property
2	24° 49.093'S	30° 7.390'E	Eastern Smelter property boundary
3	24° 49.570'S	30° 7.436'E	South-eastern Smelter property boundary
4	24° 49.199'S	30° 6.541'E	North-west of Smelter, across R555
5	24° 49.080'S	30° 6.692'E	North-west of Smelter, across R556
6	24° 48.911'S	30° 7.002'E	North-western Smelter property boundary
7	24° 48.694'S	30° 6.634'E	690m north-west of Smelter property boundary
8	24° 49.449'S	30° 6.681'E	At the parking area for the Administration offices

The noise survey to be conducted at the following noise monitoring points:

Figure 7: Proposed monitoring points

10 CONCLUSION

The noise intrusion levels from the proposed ECP Project will have to be monitored during the construction, operational and rehabilitation phases to ensure that the recommended noise levels (of 70.0dBA) along the boundaries of the Lion Smelter will not be exceeded. The Risk assessment done on the ECP project revealed that the threshold value of 7.0dBA will not be exceeded during the day and/or night- time periods.

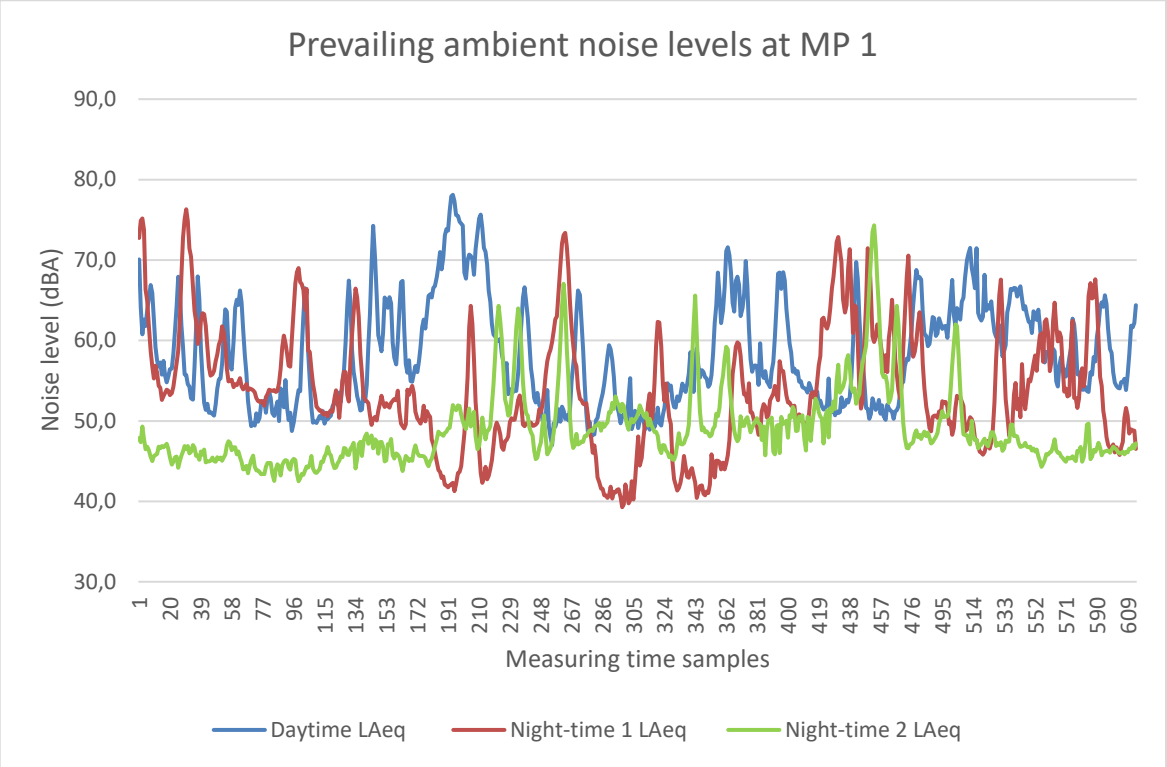
There will be a shift in the prevailing ambient noise level in the immediate vicinity of the proposed ECP project but the new noise level along the north-western boundary will not exceed the recommended noise level of 70.0dBA for an industrial area and in line with the Noise Control Regulations. People who may work or visit the mining activities will experience an increase in the prevailing ambient noise level in the vicinity of the Lion Smelter. The noise increase at the residential properties will be insignificant.

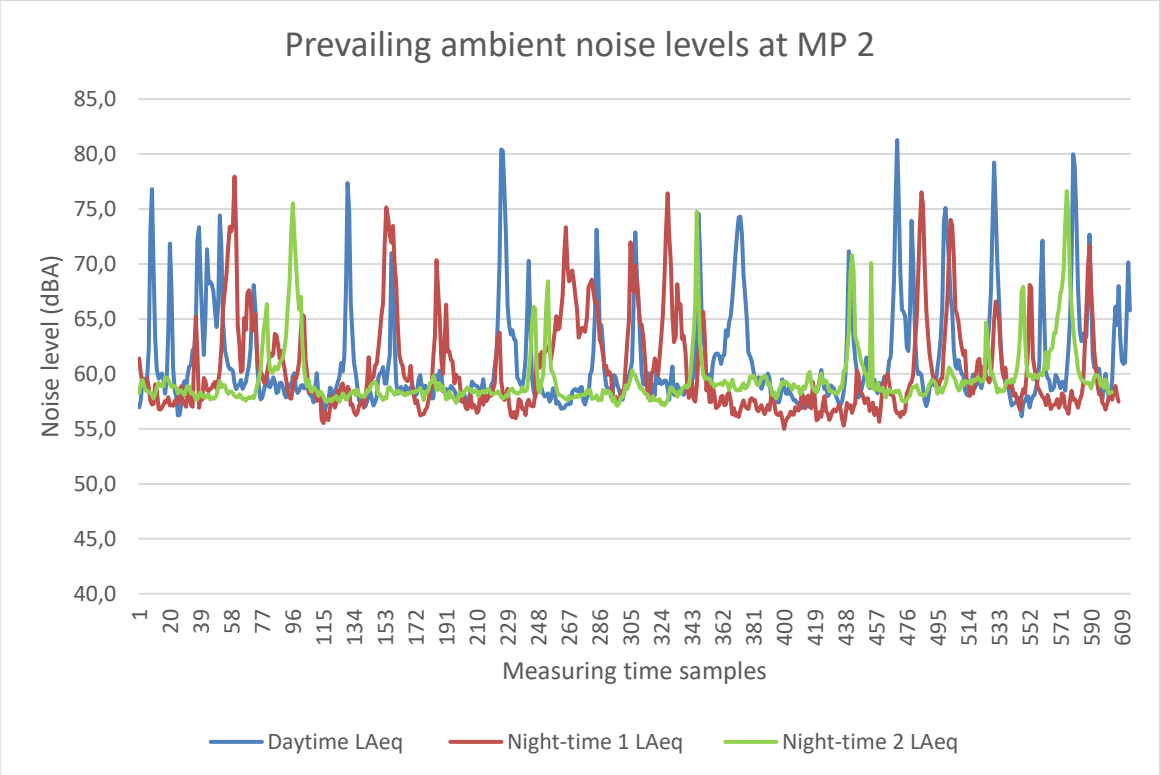
The large variations in the meteorological conditions and the geographical relations between the proposed ECP activities and the noise sensitive receptors allow for the decrease in the noise as it propagates from the Lion Smelter.

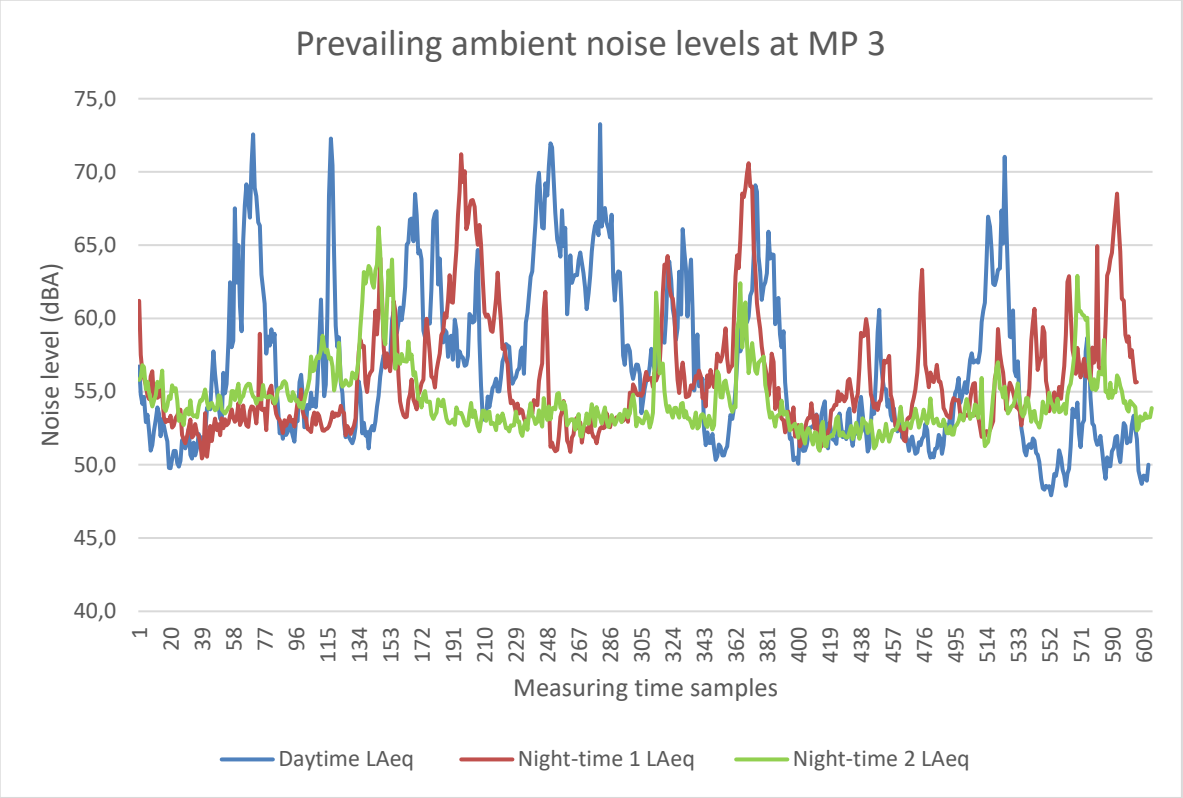
The potential noise impact from the proposed ECP Project will be low with all the mitigatory measures in place and authorisation for the ECP Project may be granted from an environmental noise point of view.

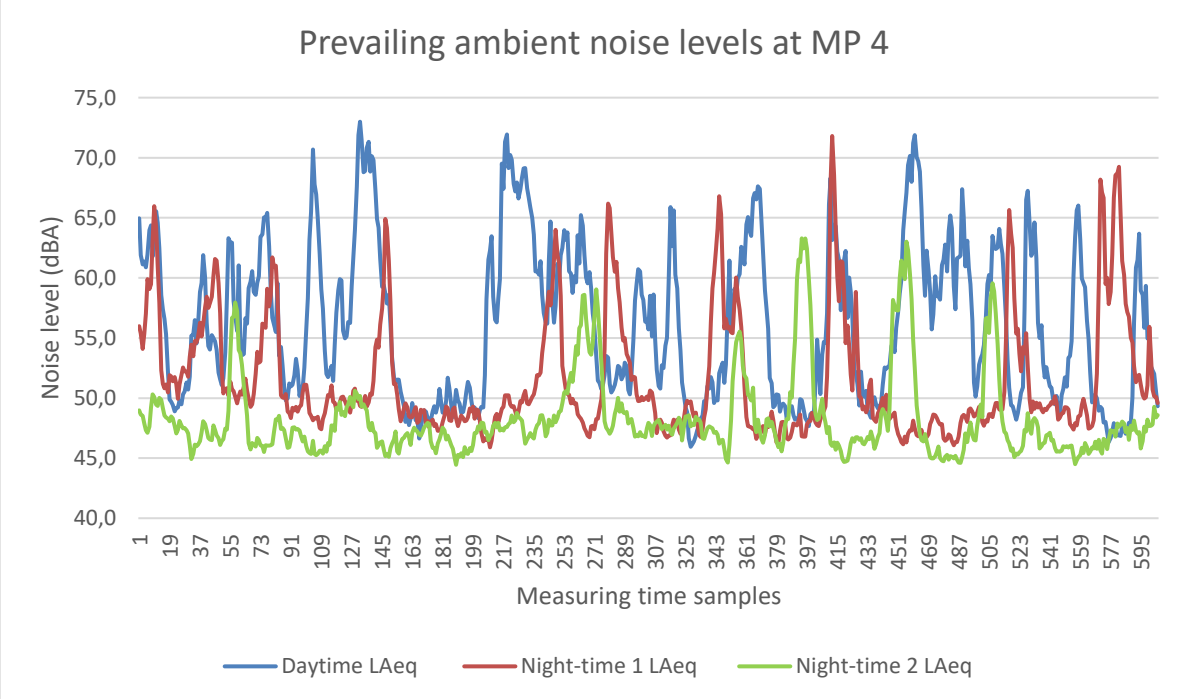
Barend van der Merwe – MSc Environmental Management UJ.
Environmental noise and vibration specialist

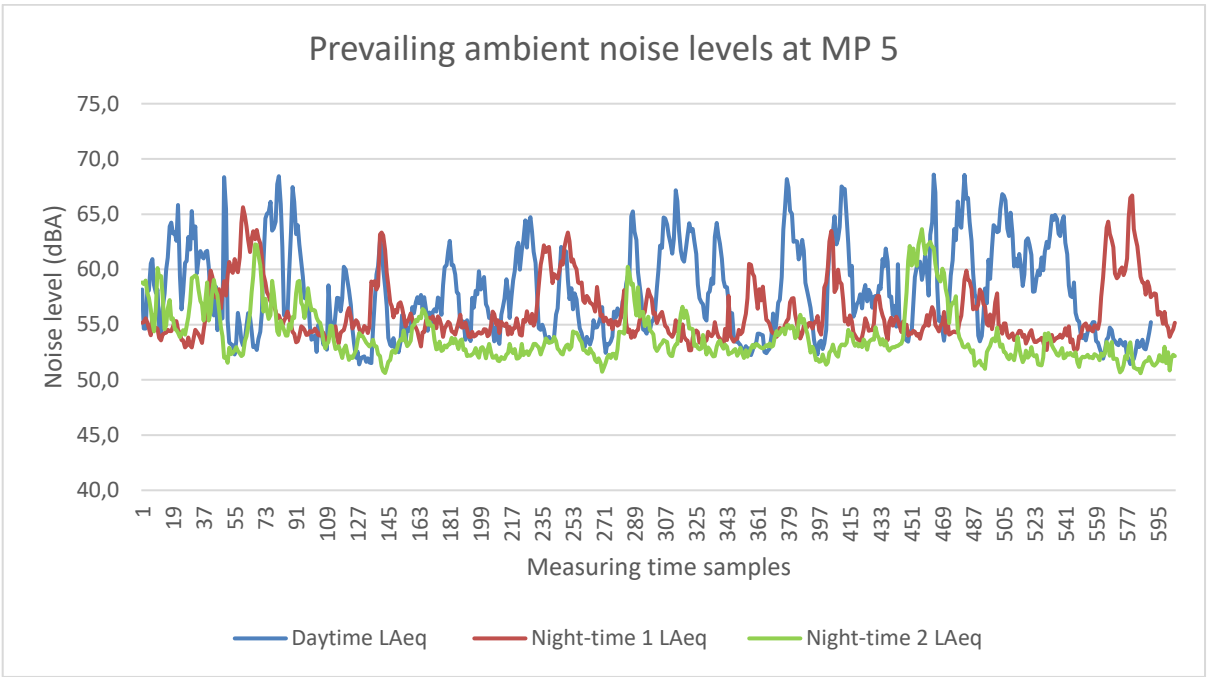
Appendix A

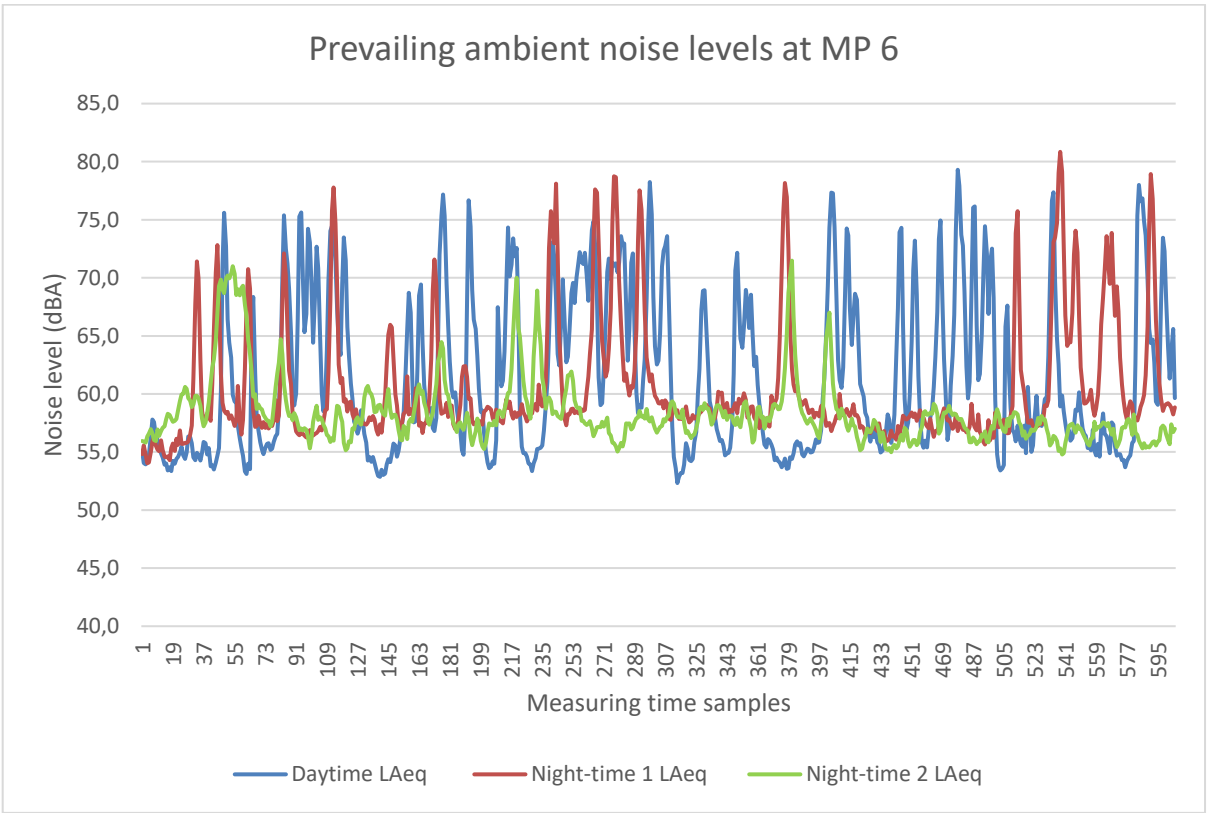

Prevailing ambient noise levels at MP 1
90,0
80,0
70,0
60,0
50,0
40,0
30,0
Noise level (dBA)
1 20 39 58 77 96 115 134 153 172 191 210 229 248 267 286 305 324 343 362 381 400 419 438 457 476 495 514 533 552 571 590 609
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq

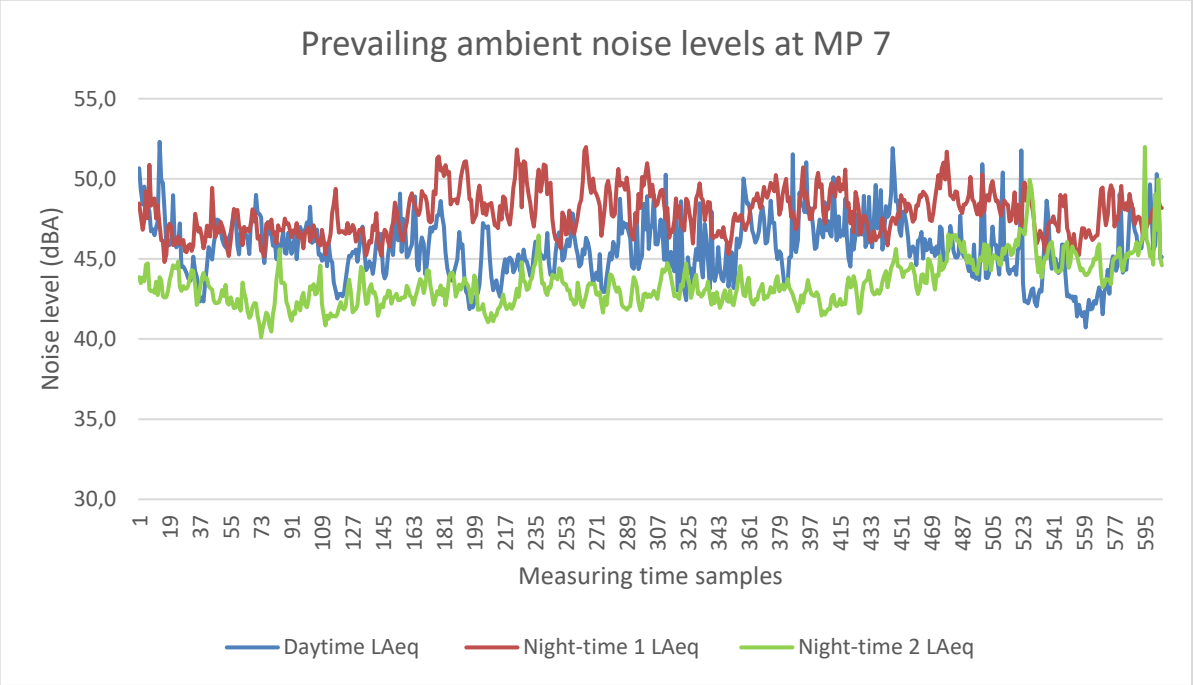

Prevailing ambient noise levels at MP 2
85,0
80,0
75,0
70,0
65,0
60,0
55,0
50,0
45,0
40,0
Noise level (dBA)
1 20 39 58 77 96 115 134 153 172 191 210 229 248 267 286 305 324 343 362 381 400 419 438 457 476 495 514 533 552 571 590 609
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq

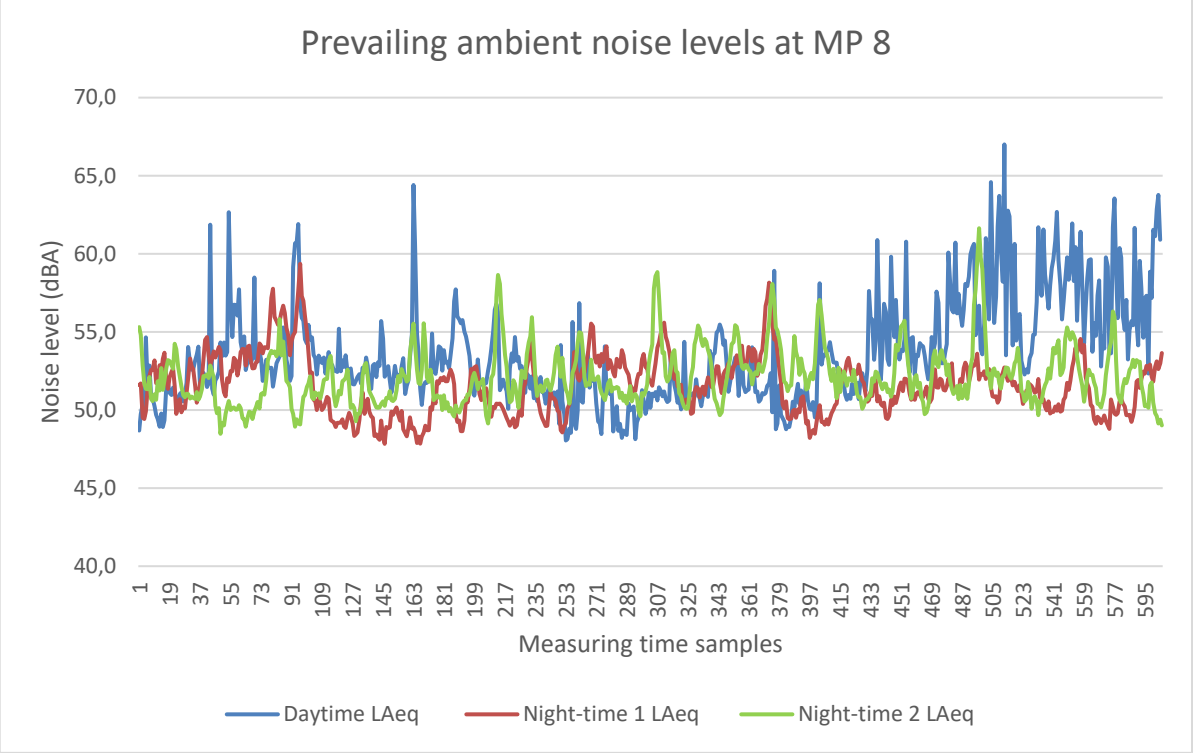

Prevailing ambient noise levels at MP 3
Noise level (dBA)
75,0
70,0
65,0
60,0
55,0
50,0
45,0
40,0
1 20 39 58 77 96 115 134 153 172 191 210 229 248 267 286 305 324 343 362 381 400 419 438 457 476 495 514 533 552 571 590 609
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq


Prevailing ambient noise levels at MP 4
Noise level (dBA)
75,0
70,0
65,0
60,0
55,0
50,0
45,0
40,0
1 19 37 55 73 91 109 127 145 163 181 199 217 235 253 271 289 307 325 343 361 379 397 415 433 451 469 487 505 523 541 559 577 595
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq


Prevailing ambient noise levels at MP 5
Noise level (dBA)
75,0
70,0
65,0
60,0
55,0
50,0
45,0
40,0
1 19 37 55 73 91 109 127 145 163 181 199 217 235 253 271 289 307 325 343 361 379 397 415 433 451 469 487 505 523 541 559 577 595
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq


Prevailing ambient noise levels at MP 6
Noise level (dBA)
85,0
80,0
75,0
70,0
65,0
60,0
55,0
50,0
45,0
40,0
1 19 37 55 73 91 109 127 145 163 181 199 217 235 253 271 289 307 325 343 361 379 397 415 433 451 469 487 505 523 541 559 577 595
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq


Prevailing ambient noise levels at MP 7
Noise level (dBA)
55,0
50,0
45,0
40,0
35,0
30,0
1 19 37 55 73 91 109 127 145 163 181 199 217 235 253 271 289 307 325 343 361 379 397 415 433 451 469 487 505 523 541 559 577 595
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq


Prevailing ambient noise levels at MP 8
Noise level (dBA)
70,0
65,0
60,0
55,0
50,0
45,0
40,0
1 19 37 55 73 91 109 127 145 163 181 199 217 235 253 271 289 307 325 343 361 379 397 415 433 451 469 487 505 523 541 559 577 595
Measuring time samples
Daytime LAeq
Night-time 1 LAeq
Night-time 2 LAeq

Appendix B

dBAcoustics – BJB van der Merwe as the noise specialist was appointed to assess the potential environmental noise impact of the proposed energy conversion facility which is planned at the Glencore Operations South Africa (Pty)Ltd Lion Smelter in Steelpoort. The project description for the proposed energy conversion facility is as follow:

- To convert excess thermal energy in the excess furnace gas from the Lion Smelter into electrical energy in Swedish Stirling's propriety power generation technology (PWR BLOK 400-F units). The projected total output electrical capacity will be 10MW which will be generated by various reciprocating engines at the proposed stand-alone energy conversion facility (ECF) plant; and
- The generated electrical energy will be fed back into the internal electrical network of the Lion Smelter Complex .

The Electric Conversion Facility (ECF) will take place on the ECF Pad well within the boundaries of the Lion Smelter. This is illustrated in the following aerial imagery of the project area.

Figure 1: ECF Facility and residential areas

The noise intrusion levels from the proposed ECF activities will be insignificant during the construction and rehabilitation Phases and the increase along the north-western boundary for the operational phase will be 1.6dBA during the day and 3.3dBA during the night. This is below the threshold level of 7.0dBA before the noise increase can be classified as a noise disturbance i.t.o the Noise Control Regulations, 1994.

There will be a shift in the prevailing ambient noise level in the immediate vicinity of the ECF activities but at a distance, the intrusion level will be minimal and in line with the Noise Control Regulations. 1994. The noise increase at the residential properties will be insignificant.

The application for the proposed ECF project can be approved provided that the recommended mitigatory measures will be in place.

Barend van der Merwe – MSc UJ
Environmental Noise and Vibration Specialist

11 REFERENCES

Constitution of the Republic of South Africa, 1996: (Act 108 of 1996). http://www.environment.co.za/environmental-laws-and-legislation-in-South-Africa. Accessed 12 March 2010.

DEAT (2004a) - Overview of Integrated Environmental Management Information Series. Department of Environment Affairs and Tourism (DEAT), Pretoria;

Environmental, Health and Safety Guidelines for Community Noise, World Health Organisation, Geneva, 1999;

Environmental Protection Agency (EPA). Office of Environmental Enforcement (OEE)

Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4). April 2012. http://*www.epa.ie* › About Us › Organisational Structure*. Accessed 12 July 2012.*

Google Earth, 2021, http//www.google.com/earth/download-earth.html. Accessed 13 May 2021**;**

International Organization for Standardization – ISO (1993). ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 1. Calculation of the absorption of sound by the atmosphere;

International Organization for Standardization – ISO (1993). ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 2. General method of calculation;

Noise Control Regulations - Noise Regulations of 1994. GN154 as promulgated in Government Gazette No. 13717 dated 10 January 1994;

SANS 10357 of 2004 – The calculation of sound propagation by the concave method (SANS, 2004);

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

SANS 10328 of 2008 – Methods for environmental noise impact assessments (SANS, 2008);

SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication (SANS, 2008);

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