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Exxaro Belfast Coal Mine Expansion Project

Emakhazeni Local Municipality

Wards 1 and 8

Mpumalanga Province

Environmental Noise Impact Assessment

Project No : 024/2021
Compiled by : B v/d Merwe
Date : 12 August 2021

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 **Nsovo Environmental Consulting** was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act) for the compilation of an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the establishment of the different mine expansion activities at the **Belfast Mine, Exxaro Resources Limited**. I further declare that I am confident in the results of the studies undertaken and conclusions drawn because of it. I have disclosed, to the environmental assessment practitioner, 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, 2014 and any specific environmental management Act. I have further provided the environmental assessment practitioner with written access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 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	:	12 August 2021
Title / Position	:	Environmental noise specialist
Qualification(s)	:	MSc Environmental Management
Experience (years)	:	19 years
Registration(s)	:	SAAI, NACA, IAIA and SAAG

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 15 years. I have been instrumental in the pre-feasibility studies of proposed projects which may have an impact on the environment and noise sensitive areas. 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, the decommissioning of the N11 near Mokopane, construction of the P166 near Mbombela, 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: Gibb, Royal Haskoning DHV, Coffey Environmental, Golder Associates Africa (Pty) Ltd, GCS Environmental (Pty) Ltd, Knight Piesold Environmental (Pty) Ltd and SRK Engineering (Pty) Ltd.

Qualifications

1. MSc – Environmental Management – University of Johannesburg;
2. BSc Honours 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 mine 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 Decommissioning 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 wind turbines in the Western Cape – Caledon;
- 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 Nsovo Environmental Consulting and by Exxaro Resources Limited – Belfast Mine. 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.

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Executive summary

Introduction

dBAcoustics was appointed to determine the prevailing ambient noise levels in the vicinity of the proposed BEP Mine expansion project and at the residential houses along the boundaries of the mining right area. Belfast Coal Mine (BCM) is a wholly owned subsidiary of Exxaro Resources Limited and is situated in the Emakhazeni Local Municipality (Wards 1 and 8) and is some 7km south-west of the Town Belfast. The N4 runs through a section of the northern portion of the mining right area. The N4 is major feeder road between Johannesburg and Maputo.

It is the intension of Exxaro Resources Limited to expand its current operations Belfast Implementation Project (BIP) to the north of the mining right area (MRA). This area will be the Belfast Expansion Project (BEP) and will consist out of open cast mining area, underground mining, process plant and subsequent infra-structure. The following proposed expansion of the infrastructure and secondary infrastructure requires a noise impact assessment to be done in terms of The National Environmental Management Act (Act No. 107 of 1998 (NEMA).

Key infrastructure:

- Open cast pits for the years 2031 to 2039 and haul roads;
- Underground mining;
- Mining infra-structure to the mining operations;
- Overland conveyor from underground mining to plant;
- Pollution Control Dams X3;
- Haul roads;
- Mine Residue Facility (MRF) – MRF north and MRF south;
- North and South dump;
- Decline shaft;
- Buildings – Administration, Ablution and Workshops
- Topsoil Stockpile.

The baseline environmental noise survey was carried out during the summertime (14 October 2020 and 10 February 2021). The environmental baseline noise information will be used to calculate the potential noise intrusion levels from the proposed expansion activities and infra-structure at the farmhouses marked A to K along the boundaries of the study area.

The proposed BEP mine expansion project will take place in an area where there are other mining activities and feeder roads with a continuous flow of traffic during the day and intermittent traffic flow

during the night. The prevailing ambient noise level in the vicinity of the different expansion footprint areas was made up out of mining activity noises, agricultural noises, and traffic noise.

The potential noise impact will be low during the construction and decommissioning phases. The implementation of noise mitigatory measures will ensure that the impact will remain low. The noise impact during the operational phase of the project will be moderate during some of the activities and will remain moderate after the implementation of mitigatory measures.

Conclusion

The potential noise intrusion from the mining activities can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Noise Regulations, 1994 and the International Finance Corporation's Environmental Health and Safety Guidelines. The proposed noise management plan must be in place during the construction and operational phases to identify any noise increase on a pro-active basis and to address the problem accordingly.

The proposed BEP Mine expansion project will be in line with the environmental noise standards and guidelines provided that all the noise mitigatory measures are in place.

Barend van der Merwe – MSc UJ
Environmental noise specialist

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No.	Requirement	Section in report
1a)	Details of -	
(i)	The specialist who prepared the report	P3 to P6
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	P3 to P6
b)	A declaration that the specialist is independent	P2
c)	An indication of the scope of, and the purpose for which, the report was prepared	P 15
cA)	An indication of the quality and age of the base data used for the specialist report	P 13
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	P 41
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	P 13
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process	P 21
f)	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	P 30
g)	An identification of any areas to be avoided, including buffers	N/A
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	P 13 and P 14
i)	A description of any assumption made and any uncertainties or gaps in knowledge	P 27
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment	P 41
k)	Any mitigation measures for inclusion in the EMPr	P 52
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n)	A reasoned opinion -	
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iA)	Regarding the acceptability of the proposed activity or activities: and	P 55
(ii)	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	P 56
o)	A description of any consultation process that was undertaken during preparing the specialist report	3 Farmers on 10 February 2021

1. Introduction

Belfast Coal Mine (BCM) is a wholly owned subsidiary of Exxaro Resources Limited and is situated in the Emakhazeni Local Municipality (Wards 1 and 8) and is some 7km south-west of the Town Belfast. The N4 runs through a section of the northern portion of the mining right area. The N4 is major feeder road between Johannesburg and Maputo. Access to the mine is off the R33 and the N4. The mine expansion project will consist out of open cast mining (Pits 8 to 12), surface infra-structure and underground mining. The location of the mining right boundary (yellow polygon) and mining areas (open cast and underground mining areas) are given in Figure 1.1.

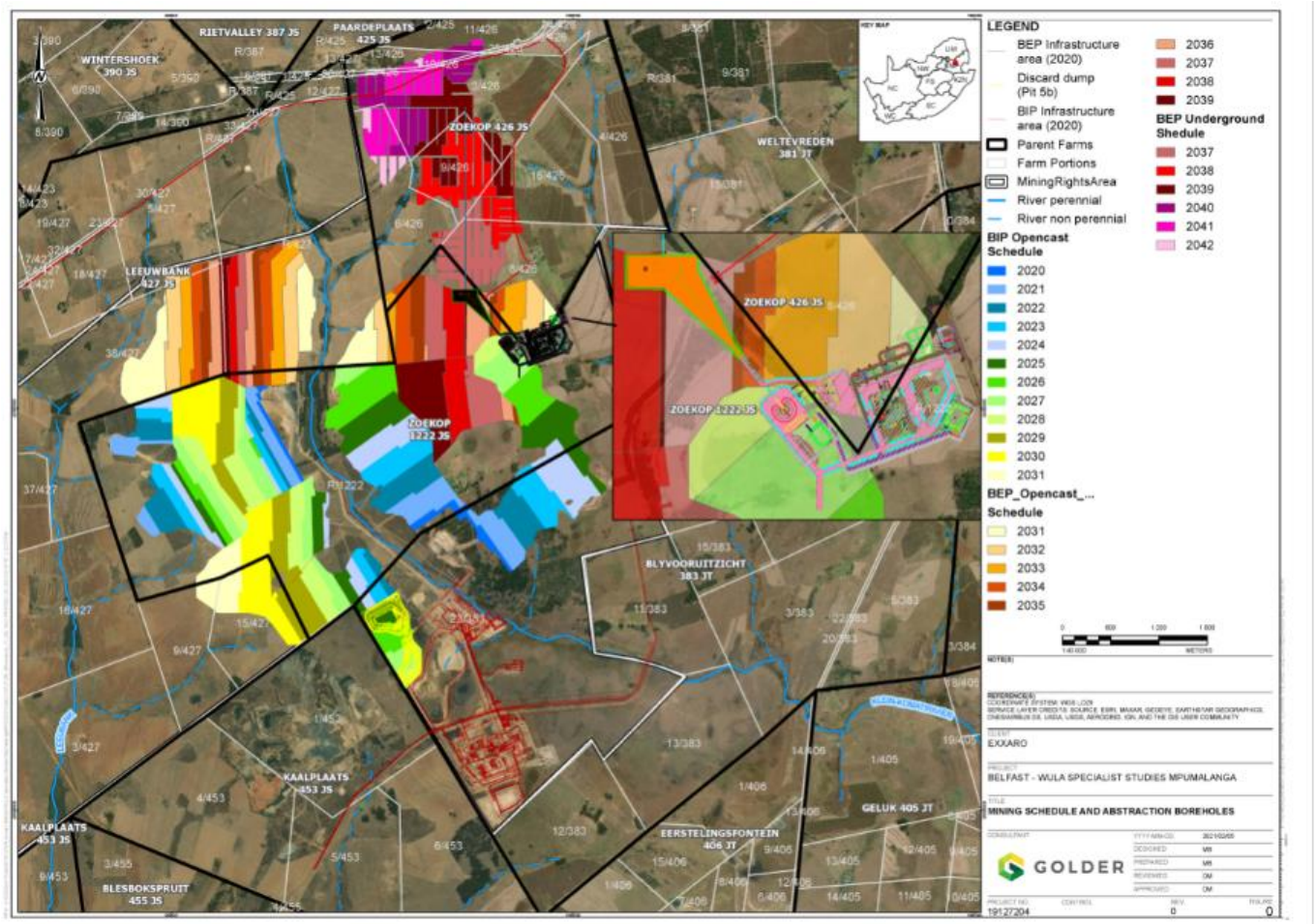

Figure 1-1: Belfast Coal mining right area

It is the intension of Belfast Coal to expand its existing operations and to add additional infrastructure to its existing operations. The proposed expansion will be located within the Belfast Coal mining right and surface lease areas on remaining extent of farm portions which is illustrated in Figure 2.

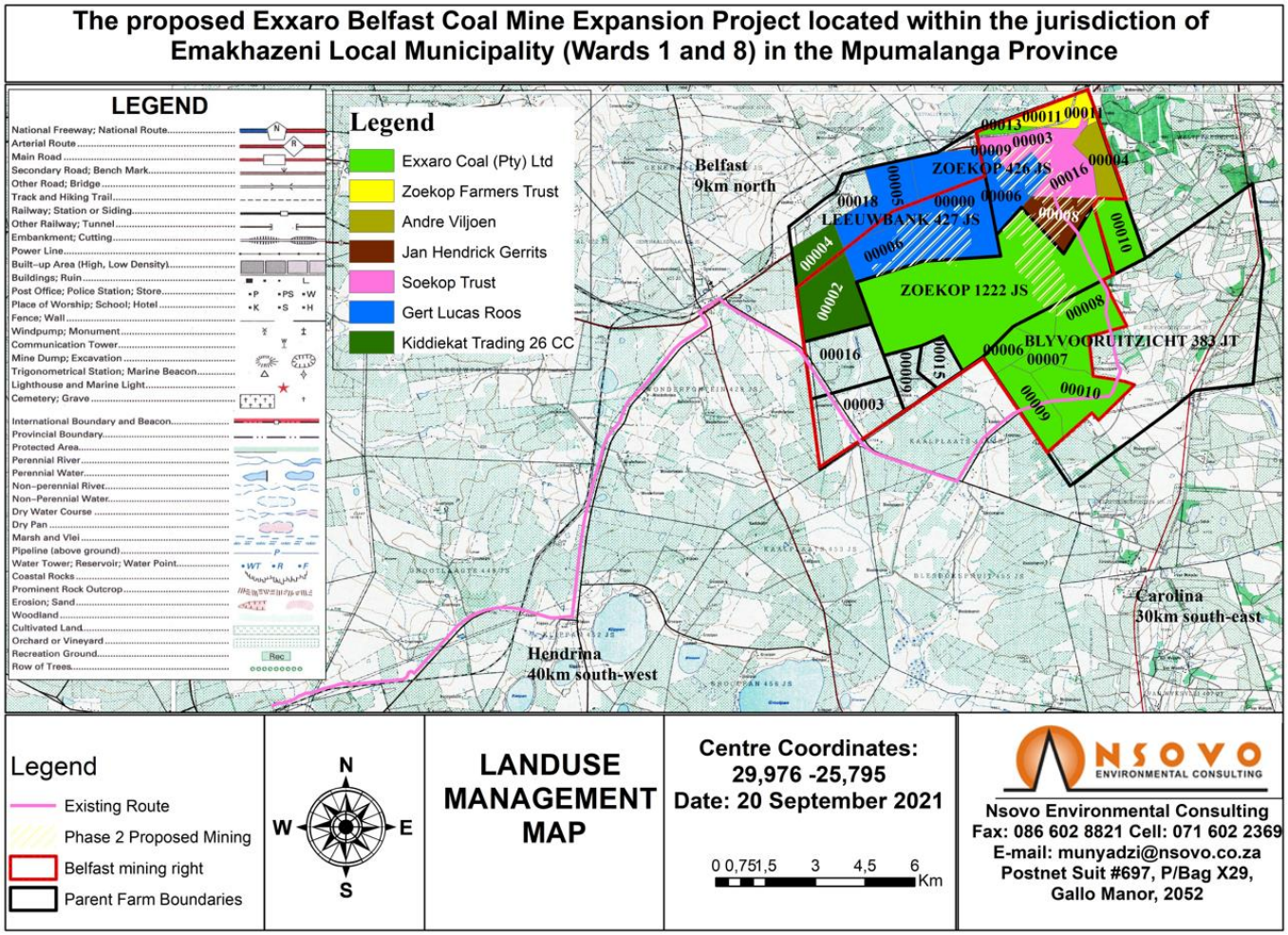

Figure 1-2: Land use Management Map

The potential mining areas and infra-structure for the BEP is illustrated in Figure 1-3

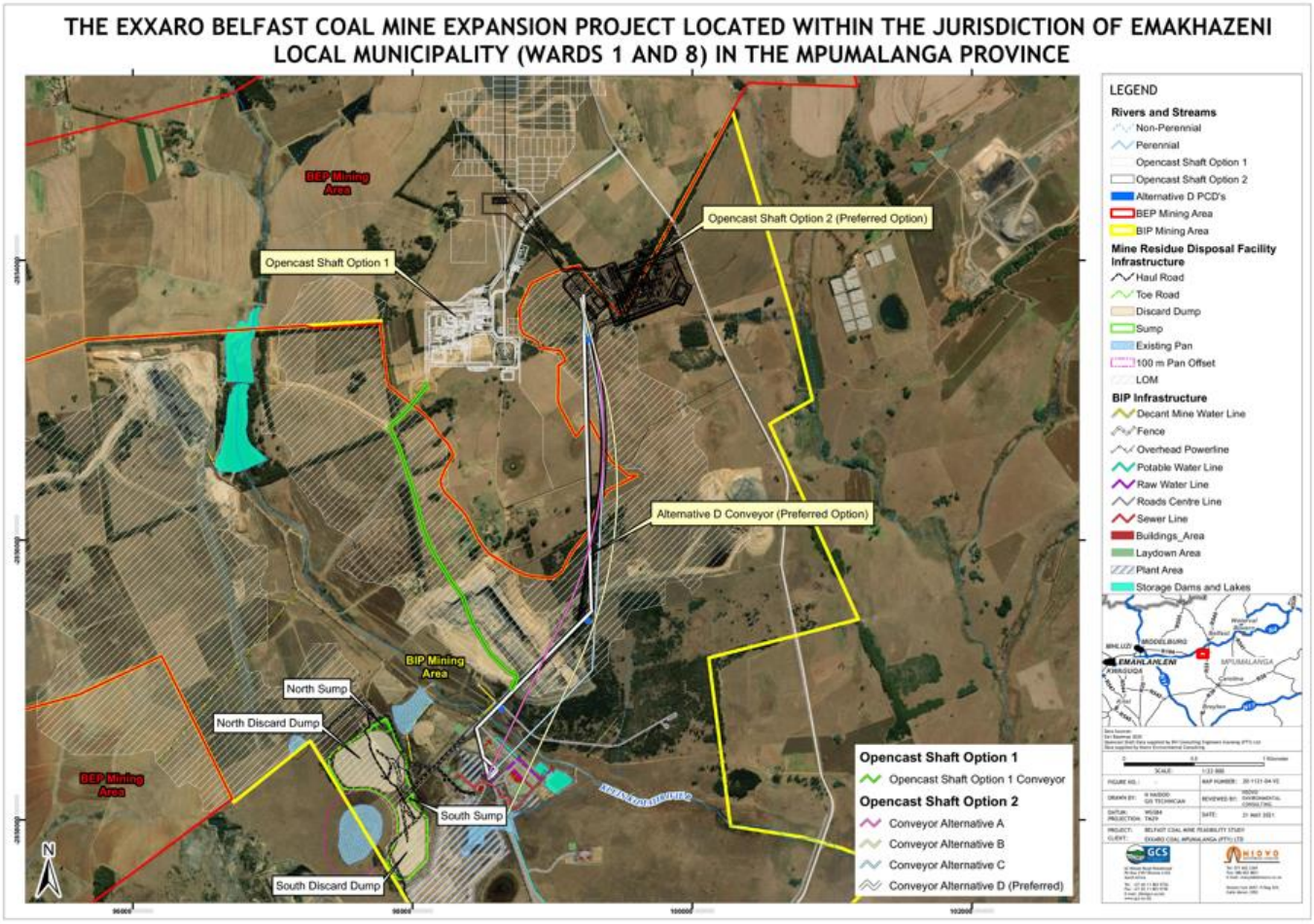

Figure 1-3: BEP Potential mining areas and infra-structure

The following proposed expansion of the infrastructure and secondary infra structure requires a noise impact assessment to be done in terms of The National Environmental Management Act (Act No. 107 of 1998 (NEMA).

Key infrastructure:

- Open cast pits for the years 2031 to 2039 and haul roads;
- Underground mining;
- Mining infra-structure to the mining operations;
- Overland conveyor from underground mining to plant;
- Pollution Control Dams X3;
- Haul roads;
- Mine Residue Facility – Discard dump north and Discard dump south;
- North and South dump;
- Decline shaft;
- Buildings – Administration, Ablution and Workshops; and
- Topsoil Stockpile.

The above key infrastructure will have secondary infrastructure and possible noise increase in the prevailing ambient noise levels. The lay-out of the proposed infra structure is illustrated in Figure 1-4 (Alternative 1) and Figure 1-5 (Alternative 2).

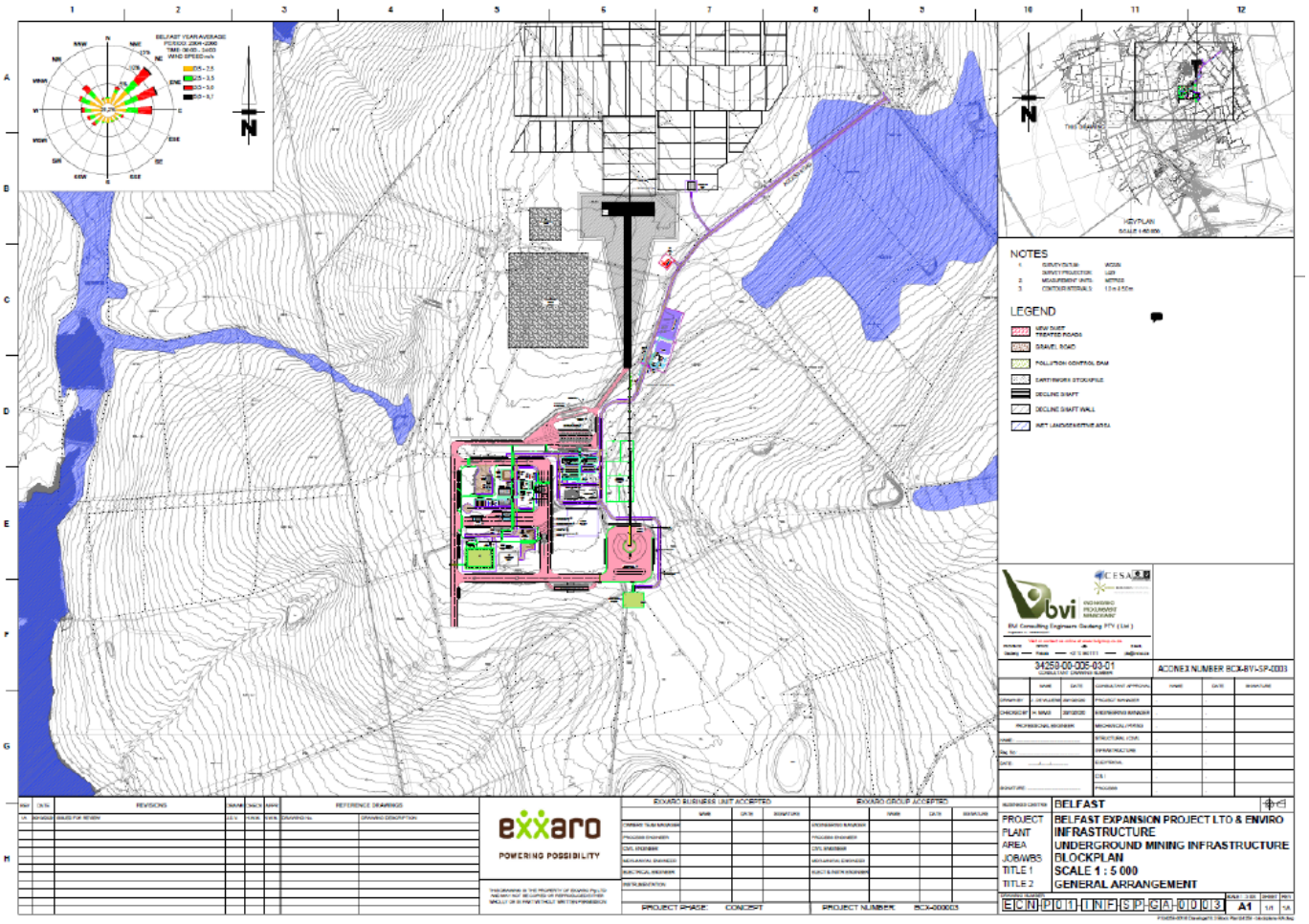

Figure 1-4: Potential mining infra-structure (Alternative 1)

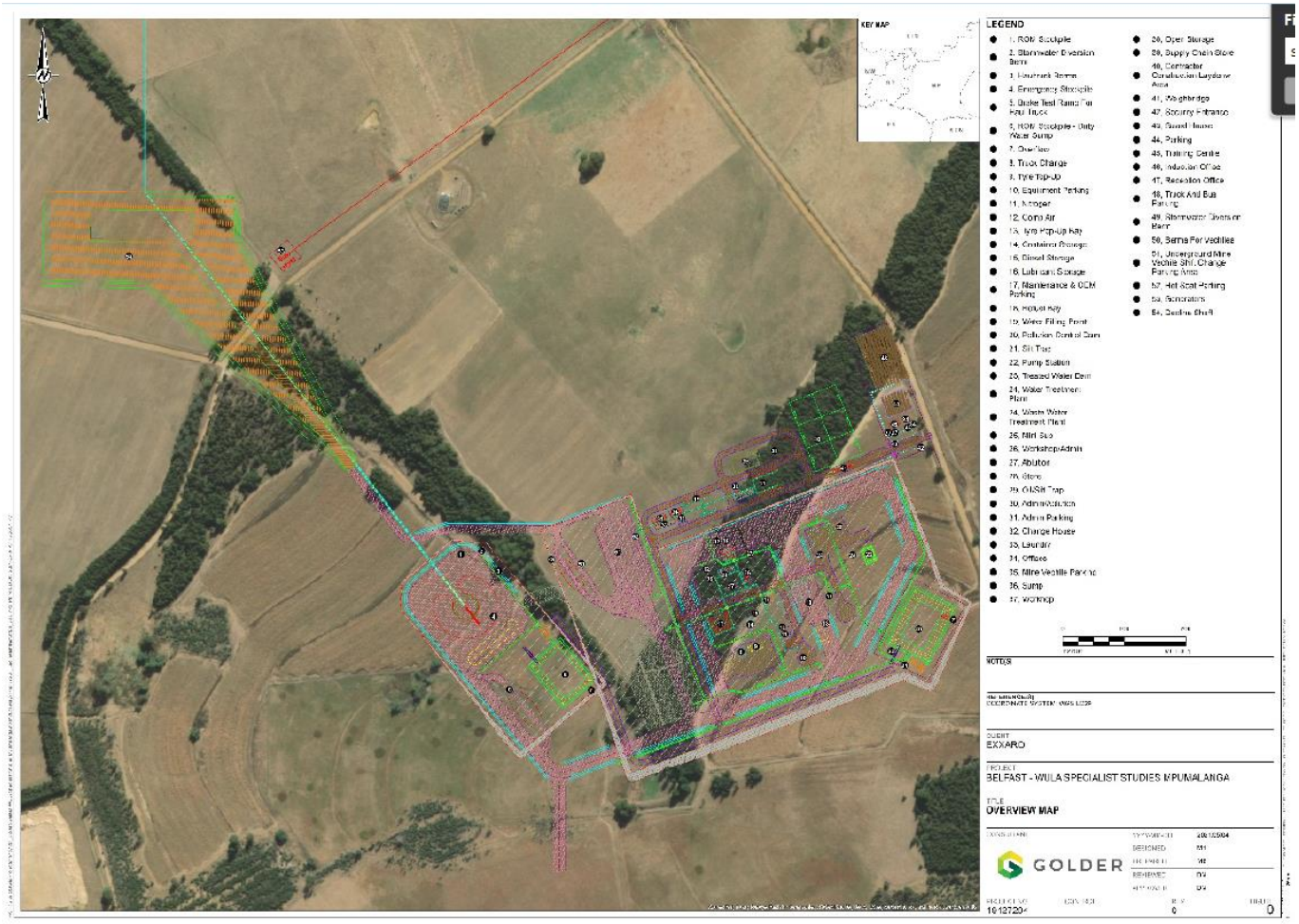

Figure 1-5: Potential mining infra-structure (Alternative 2)

The Mine Residue Facility (MRF) will be divided into a Northern Stockpile and a Southern Stockpile and the access to the MRF will be via ramps that link to the existing internal Haul road infra-structure along the eastern boundary of pit 5.The MRF proposed locality is illustrated in Figure 1-6.

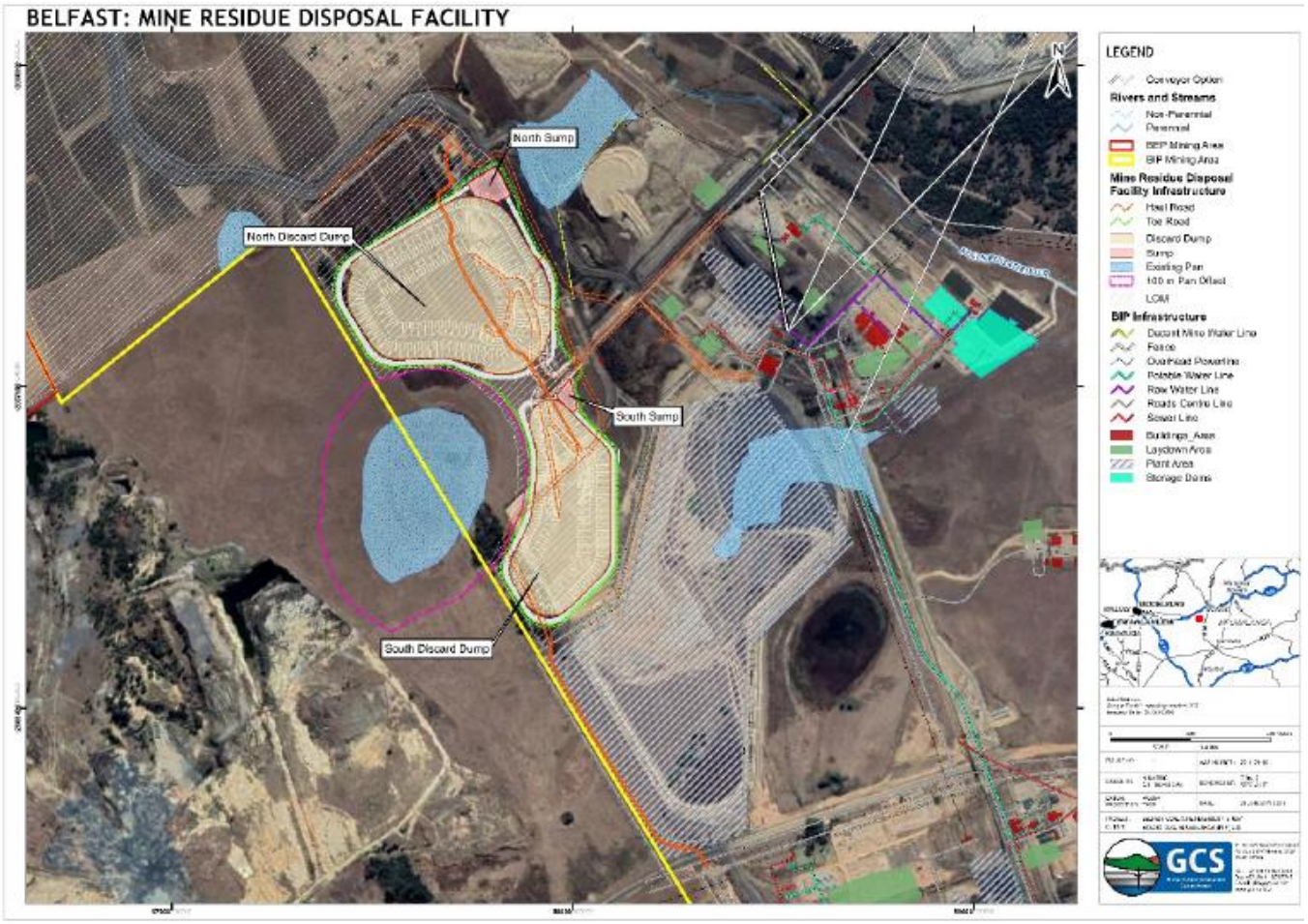

Figure 1-6: Proposed Mine Residue Facility

The landscape of the mine expansion area can be described as flat with a gentle slope to the north-east. The proposed mining area consist of agricultural land an at the time of the noise survey on 14 October 2020 and 10 February 2021 respectively it was maize fields.

1.2 Purpose of the environmental noise survey

The purpose of the environmental noise study was to determine the environmental baseline noise levels at the mine expansion areas. The noise baseline information will be used to calculate the possible noise intrusion levels from the mine expansion activities at the abutting noise receptors. The distances between the noise sources and the receptors, topography, vegetation, noise level at the noise source and the wind direction are all variables that may have an impact on how the sound will be propagated to and perceived by the noise receptor/s. The distances between the different linear and/or point sources and topography will be dealt with later in the report. The general objectives of the environmental noise study were to gain a detailed understanding of the baseline noise environment along the boundaries of the mining area and at the abutting NSA's.

1.3 Assumptions and Limitations

The following limitations forms part of the environmental noise measurements:

- The prevailing ambient noise levels for the study area was created by far and near noise sources associated with traffic, existing mining activities and seasonal agricultural activities with the result that the prevailing ambient noise level may change at times;
- Noise measurements in the presence of winds more than 3.0m/s may impact the outcome of the environmental noise results;
- The identification of noise measuring points may create a problem in terms of the prevailing noise levels should it not be done with outmost care and in a scientific manner;
- The influx of traffic into an area will have an influence on the prevailing ambient noise levels and should be considered during the noise impact assessment process;
- The noise from the mining activities in the open cast pits will vary depending on the depth of mining and the point of mining at a specific time.

There will be a difference in the prevailing ambient noise levels between the summer and winter periods as the insect activities such as crickets raise the prevailing ambient noise levels during the summer period whereas the prevailing ambient noise levels will not be influenced by insects during the winter period. The distances and topography between the proposed mining establishment activities and the residential areas will play a role in the noise propagation and how the sound from the proposed mining establishment will be perceived.

2. Background to environmental noise

2.1 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 decreases 6.0dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3.0dB per doubling of distance. The decibel scale is logarithmic, therefore decibel levels cannot be added in the normal arithmetic way, for example, two sound sources of 50.0dB each do not produce 100.0dB but 53.0dB, nor does 50.0dB and 30.0dB equal 80.0dB but remains 50.0dB. Air absorption is important over large distances at high frequencies, and it depends on the humidity but is typically about 40.0dB/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 3.0 - 5.0dBA.

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 95.0dBA. 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; and
- 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 difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noise maker, 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.

Noise affects humans differently and the new noise which will be coming from the mine expansionist and the associated activities will depend upon the intensity of the sound, the length of time of exposure and how often over time the ear is exposed to it. Urban dwellers are besieged by noise, not only in the city streets but also in the busy workplaces and household noises.

The 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 1.0dBA under controlled conditions in an acoustic laboratory;
- It is widely accepted that the average healthy ear can barely perceive noise level changes of 3.0dBA;
- A change in sound level of 5.0dBA is a readily perceptible increase in noise level; and
- A 10.0dBA change in the sound level is perceived as twice as loud as the original source.

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

- Residential area – 55.0dBA for the daytime and 45.0dBA for the night-time period; and
- Industrial area – 70.0dBA 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 2.1.

Table 2-1: Recommended noise levels for different districts

Type of district	Equivalent continuous rating level ($L_{Req.T}$) for ambient noise - dBA					
	Outdoors			Indoors, with open windows		
	Day-night L_{Rdn}	Daytime L_{Reqd}	Night-time L_{Reqn}	Day-night $L_{R.dn}$	Daytime $L_{Req.d}$	Night-time $L_{Req.n}$
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

For industrial districts, the $L_{R.dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24h day/night cycle, $L_{Req.d} = L_{Req.n} = 70$dBA can be considered as typical and normal.

The response to noise can be classified as follows:

- An increase of 1.0dBA to 3.0dBA above the ambient noise level will cause no response from the affected community. For a person with normal hearing an increase of 0.0dBA to 3.0dBA will not be noticeable.
- An increase between 1.0dBA to 10.0dBA will elicit little to sporadic response. When the difference is more than 5.0dBA above the ambient noise level a person with normal hearing will start to hear a difference.
- An increase between 5.0dBA to 15.0dBA will elicit medium response from the affected community.
- An increase between 10.0dBA to 20.0dBA will elicit strong community reaction.

Because there is no clear-cut transition from one community response to another as well as several variables, categories of responses can overlap. This should be taken into consideration during the evaluation of a potential noise problem. There is therefore a mixture of activities and higher noise levels as per the above recommended continuous rating levels within i.e. residential, industrial and feeder roads in proximity of each other. The ambient noise level will therefore differ throughout the study area, depending on the region and the measuring position in relation to areas with existing mining activities. 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 2.2.

Table 2-2: Estimated community/group response when the ambient noise level is exceeded

Excess	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

3. Study methodology

3.1 Instrumentation

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 following instruments 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 377B02;
- Larsen Davis ½" free field microphone – Serial no. 0206 and 316581;
- Certificate Number: 2021-AS-0108;
- Date of Calibration: 3 February 2021.

The instrument was calibrated before and after the measurements was done and coincided within 1.0dBA. Batteries were fully charged, and the windshield was always in place.

The noise survey was carried out in terms of the Noise Control Regulations, 1999 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".

The calibration certificates are attached as Appendix A. The measured ambient noise level during the daytime and night-time periods will be the baseline ambient noise criteria for the study area and will be evaluated in terms of SANS 10103 of 2008.

3.2 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, agricultural activities but exclude traffic noise which was intermittent in the vicinity of the measuring points. The measuring points are illustrated in Figure 3.1.

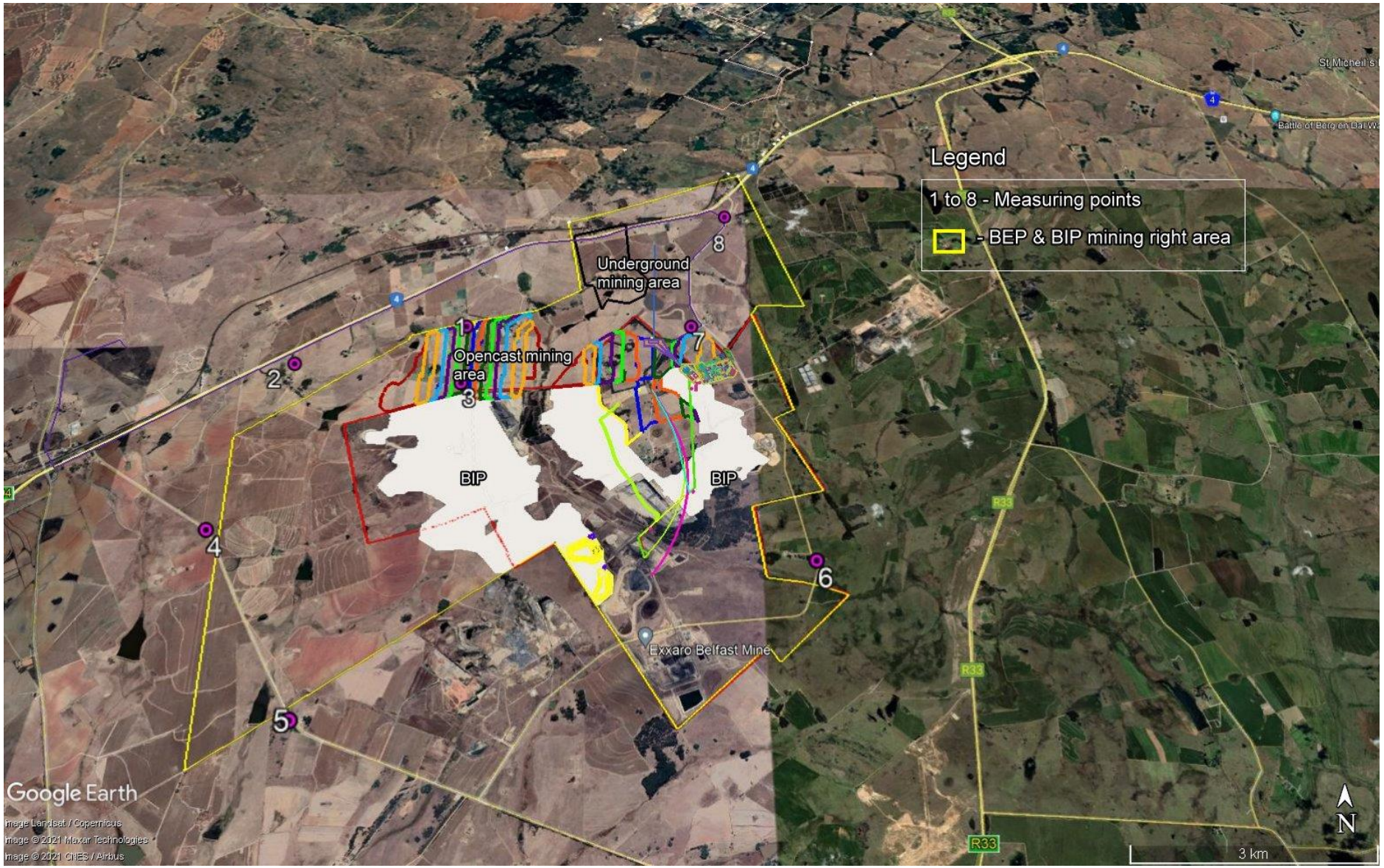

Figure 3-2: Measuring points for the study area

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 3.1.

Table 3-1: Measuring points and co-ordinates for the study area

Position	Latitude	Longitude	Remarks
1	25^0 47.100' S	028^0 57.185' E	South of Mr Roos's property. Distant traffic and agricultural activities.
2	25^0 47.529' S	028^0 55.592' E	Farmhouse south-east of the N4 Freeway. Distant traffic noise.
3	25^0 47.753' S	028^0 57.223' E	Northern side of the BIP boundary. Distant mining activities.
4	25^0 49.240' S	028^0 55.209' E	Western boundary of the BEP area. Distant traffic noise and agricultural activities.
5	25^0 50.827' S	028^0 56.279' E	Southern boundary of the BEP area. Distant traffic noise and agricultural activities.
6	25^0 49.553' S	030^0 00.432' E	Eastern boundary of the BIP area. Distant mining activities.
7	25^0 47.120' S	028^0 59.392' E	Eastern side of the BIP area in line with Mr Gerrit's farmhouse.
8	25^0 45.664' S	029^0 59.758' E	Along gravel road at Mr Viljoen's farmhouse. Distant traffic noise.

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 on 14 October 2020 during the day only (farmers requirements); and
- The noise survey was carried out during the day and night-time period being 06h00 to 22h00 for the daytime and 22h00 to 06h00 for the night-time period on 10 February 2021.

3.3 Site Characteristics

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

- The proposed Belfast coal mine expansion will take place in an area where there are other mining activities;
- There was a constant to intermittent flow of traffic along the N4 Freeway and the gravel feeder road to the mine complex (MP's 2 and 8);
- Mining activity noise was audible at MPs 3, 5, 6 and 7;
- Traffic noise contributes to the higher prevailing ambient noise level at MPs 2 and 8;
- The wind and weather conditions play an important role in noise propagation; and
- Distant traffic noise and mining activity noise contributes to a large portion of the prevailing ambient noise levels.

3.4 Current noise sources

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

- BIP mining activities noise;
- Traffic noise along the feeder roads;
- Distant traffic noise from the abutting feeder roads;

- Agricultural activity noise;
- Insects;
- Birds; and
- Wind noise.

3.5 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:

14 October 2020

Daytime

- Wind speed – less than 1.2m/s;
- Temperature – 23.7^{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 – 10 % humidity.

10 February 2021

Daytime

- Wind speed – less than 2.7m/s;
- Temperature – 23.1^{o}C – No strong temperature gradient occurred near the ground;
- Cloud cover – Little to high cloud cover;
- Wind direction – The wind was blowing from a north-westerly direction; and
- Humidity – 35% humidity recorded.

Night-time

- Wind speed – less than 2.2m/s;
- Temperature – 14.4^{o}C ;
- Cloud cover – No cloud cover;
- Wind direction – The wind was blowing from a north-westerly direction; and
- Humidity – 34 % humidity.

4. Regulatory and Legislative Requirements

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

4.1 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.

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 mining 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).

5. Description of the receiving environment

Existing mining activities, traffic, seasonal agricultural activities, domestic activities contribute to the prevailing ambient noise levels depending on the distance the houses/residential area is from the existing mining activities. The prevailing ambient noise levels were created by seasonal farming activity noise, intermittent traffic noise along the feeder roads, traffic noise along the N4. The residential properties in the vicinity of the proposed mine project area and other mining activities are illustrated in Figure 5.1. The distances between the different mine project areas and the residential properties are given in Appendix B. This is for direct line of sight and vertical structures such as trees, topography between the source and receptors were not taken into consideration.

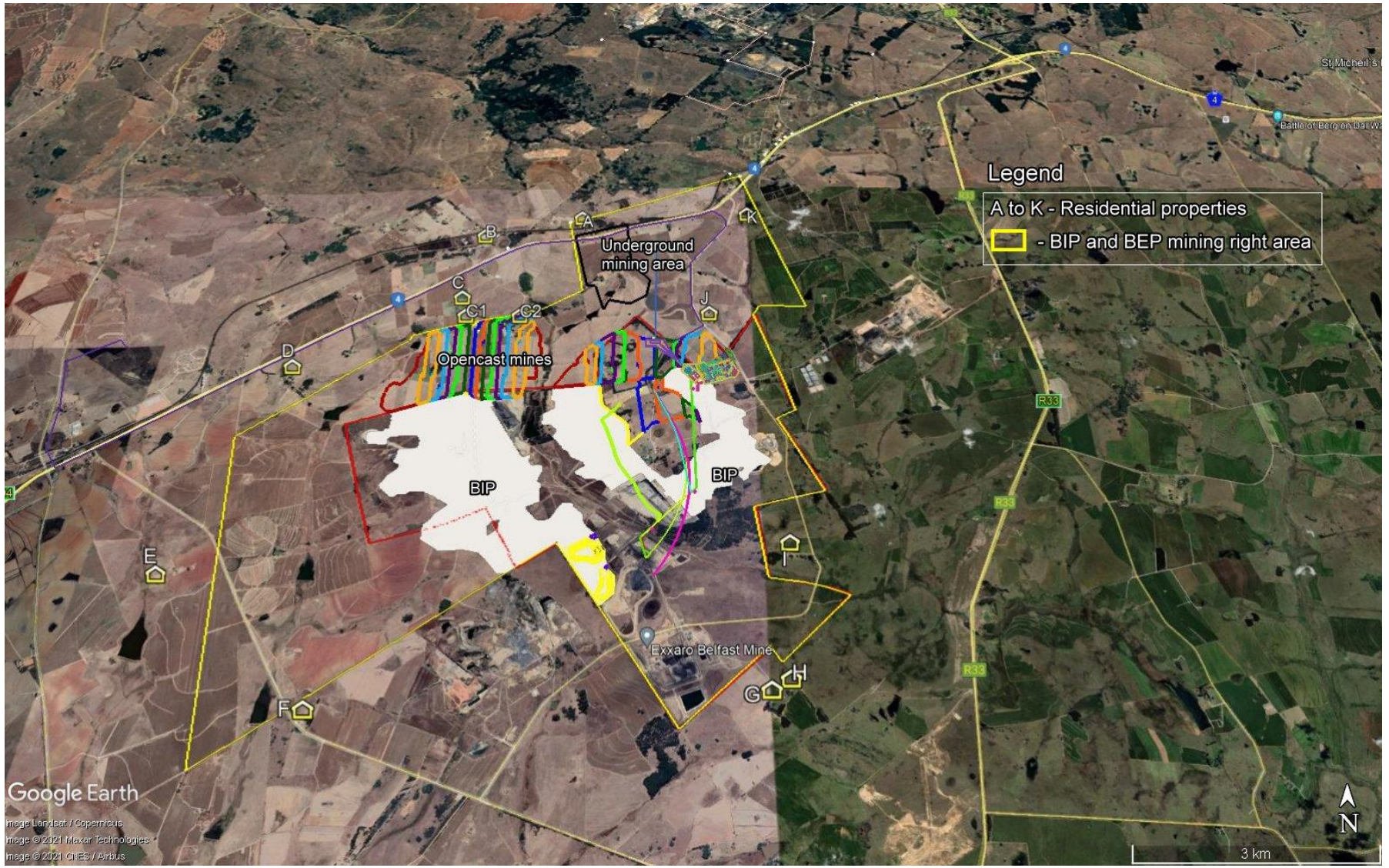

Figure 5-1: Residential areas in the vicinity of the Belfast Coal Expansion project

6. Results of the noise survey

6.1 Noise survey

In Table 6.1 are the prevailing ambient noise levels for the specific areas, which include all the noise sources currently in the area such as domestic, traffic noise, distant mine 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.

On 14 October 2020 it was only possible to do noise readings at MP's 3, 4, 5 and 6 due to a requirement of the farmers in the vicinity of the proposed BEP mining area. These noise levels are given in Table 6.2. A follow-up noise survey was carried out on 10 February 2021 during the day and night-time periods. These measuring points were at NSA C, C1, C2, J and K which is the nearest BEP mining area. These noise levels are given in Table 6.1.

The noise level along the N4 (at 40m from the edge of the N4) during daytime was 67.7dBA and during the night-time 59.2dBA. The noise level at NSA C (northern side of the homestead) at 600m from the N4 was during night-time 47.9dBA. Traffic noise was the predominant noise level at this measuring point. The noise levels during the evening and night-time were higher as for the noise levels during the daytime and this was caused by insect activities (crickets) which increase the noise level accordingly and is a phenomenon during the summertime.

Table 6-1: Noise levels (dBA)for the day and night in the study area.

Position	Morning			Afternoon			Evening			Night			Remarks
	Leq	Lmax	Lmin	Leq	Lmax	Lmin	Leq	Lmax	Lmin	Leq	Lmax	Lmin	
1	**40.2**	52.4	30.9	**41.1**	57.2	30.5	**35.0**	47.5	28.4	**44.9**	54.9	39.3	The measured noise level during the day was impacted by the wind noise from the maize. During the evening there was a period when there was no wind with the result that the noise level dropped to 35.0dBA. Insect activities, distant mine activities and reverse signals at the mine activities to the south increased the noise level.
2	**41.0**	50.3	33.7	**44.8**	54.2	38.8	**52.9**	58.6	39.7	**48.3**	53.9	43.9	Distant traffic noise during the morning, afternoon and evening periods contributed to the higher noise levels. Traffic noise contributed to the night-time noise level.
3	**39.4**	52.7	31.4	**32.6**	52.9	25.7	**33.5**	44.4	25.0	**51.1**	54.4	34.1	Reverse signals from the mining vehicles, and distant mining activities during the morning, afternoon and evening periods were audible at this measuring point which was at the BIP mining southern boundary. Distant mining activities and insects contributed to the noise level of 51.1dBA.
7	**42.9**	60.4	28.8	**35.8**	49.3	26.4	**58.5**	63.3	51.9	**51.3**	63.9	51.2	Distant traffic, wind noise and mining during the day and traffic noise & insect noise during the night contributed to the measured noise levels.
8	**42.1**	59.2	31.2	**45.1**	56.2	34.2	**47.5**	52.2	44.6	**47.4**	56.8	40.5	Distant traffic, farming activity noises during the daytime and distant traffic, insect, and mines to the north during night-time contributed to the prevailing ambient noise level.

Table 6.2: Daytime noise levels on 14 October 2020

Position	Day time			
	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks
3	42.7	67.1	33.9	Distant traffic and mining activities.
4	40.1	66.6	28.3	Distant traffic and wind noise.
5	45.8	66.4	39.5	Distant mining activity noise.
6	45.3	67.0	36.0	Distant mining activity noise.

The noise levels of construction type machinery during the construction phase of the project is illustrated in Table 6.3. It is seldom that all the machinery will operate at once. The noise reduction calculated in Table 6.3 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 40.8dBA 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.

Table 6-3: 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 and/or equipment	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
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	105.5	76.9	70.9	64.9	58.9	52.9	46.8	40.8	34.8

6.2 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 and operational phases of the proposed project:

$$Lp = Lw - 20\log R - 5dB$$

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 mining establishment:

- Clearing and stripping of topsoil and vegetation at the different mine expansion footprints – 85.0dBA;
- Construction activities at the topsoil stockpile – 86.0dBA;
- Construction activities at the Shaft position footprint – 85.0dBA;
- Construction activities at the waste rock dump – 84.5dBA;
- Earthworks – 85.0dBA;
- Construction activities at the haul roads – 84.5dBA;
- Construction activities at the offices, workshop, and ablution – 85.5dBA.

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

- Earth drilling – 100.0dBA;
- Hauling vehicles – 84.0dBA;
- Generator – 85.0dBA;
- Shaft position – 90.5dBA;
- Conveyor – 74.5dBA;
- MRF – 85.5dBA;
- Middle of the pit – 90.5dBA.

The following sound levels were used in determining the noise intrusion level during the Closure/rehabilitation phase of the mining activities:

- Removal of all Infra-structure – 80.0dBA; and

- Landfill and planting of grass – 80.0dBA.

This noise impact formula and the Interactive noise calculator (ISO 9613) will be used to determine the noise levels during the construction phase of the project. 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 categorization of the intrusion levels during the construction and operational phases will be as follows. The increase in the prevailing ambient noise level is calculated in the following manner:

$$\Delta L\text{Req,T} = L\text{Req,T (post)} - L\text{Req,T (pre)}$$

where,

*L*Req,T (post) – noise level after completion of the project – projected or calculated noise levels;

*L*Req,T (pre) – noise level before the proposed project – ambient noise level.

The criteria for assessing the magnitude of a noise impact are illustrated in Table 6.4.

Table 6-4: 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	

The noise levels from the different mining activities will be added in a logarithmic manner as perceived at the noise sensitive areas. The noise intrusion level will be calculated by subtracting the prevailing ambient noise level from the cumulative noise level. A central point was used for the alternative shafts, conveyors and the MRF ito distances between the mining activity and the abutting noise receptors and such will be reflected in the in the noise intrusion tables for the construction and operational phases of the project.

6.2.1 Construction phase

The noise intrusion levels during the construction phase for year 2031 to 2033 are given in Table 6.5, for year 2034 to 2036 in Table 6.6 and year 2037 to 2039 in Table 6.7.

Table 6-5: Noise intrusion levels (in dBA) during construction phase for year 2031 to 2033

	2031 West 1		2031 West 2		2031 East 3		2031 East 4		2032 West 1		2032 West 2		2032 East 3		2032 East 4		2033 West 1		2033 West 2		2033 East 3		2033 East 4	
Residential property	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	0.3	0.4	0.2	0.2	0.1	0.1	0.0	0.0	0.5	0.6	0.2	0.3	0.2	0.3	0.0	0.0	0.9	1.1	0.3	0.4	0.3	0.4	0.0	0.0
C1	0.6	0.7	0.2	0.3	0.1	0.1	0.0	0.0	1.3	1.5	0.1	0.2	0.1	0.2	0.0	0.0	1.7	2.0	0.4	0.4	0.6	0.7	0.0	0.0
C2	0.2	0.2	1.4	1.6	0.2	0.2	0.0	0.0	0.2	0.2	0.3	0.4	0.3	0.4	0.1	0.1	0.2	0.3	7.1	7.7	0.2	0.2	0.1	0.1
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
G	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J	0.1	0.2	0.1	0.3	0.1	0.3	0.8	1.7	0.1	0.2	0.1	0.3	0.1	0.3	1.4	2.9	0.1	0.2	0.1	0.3	0.1	0.2	1.3	2.6
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6-6: Noise intrusion levels (in dBA) during construction phase for year 2034 to 2036

	2034 West 1		2034 West 2		2034 East 3		2034 East 4		2035 West 1		2035 West 2		2035 East 3		2035 East 4		2036 West 1		2036 West 2		2036 East 3		2036 East 4	
Residential property	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
A	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.1
B	0.3	0.1	0.3	0.1	0.1	0.1	0.1	0.0	0.3	0.1	0.4	0.2	0.1	0.0	0.1	0.1	0.3	0.1	0.4	0.2	0.1	0.0	0.1	0.0
C	4.2	4.7	2.7	3.1	0.4	0.5	0.2	0.3	4.4	4.9	3.3	3.8	0.2	0.3	0.4	0.5	5.8	6.4	4.0	4.5	0.3	0.4	0.2	0.3
C1	14.3	15.0	4.3	4.8	0.5	0.6	0.2	0.3	10.3	11.1	6.6	7.3	0.2	0.3	0.4	0.5	15.1	15.9	7.8	8.4	0.4	0.4	0.2	0.3
C2	2.2	2.5	18.3	19.1	1.2	1.4	0.4	0.4	3.0	3.4	14.2	14.9	0.4	0.4	1.0	1.2	3.1	3.5	7.0	7.7	0.7	0.8	0.5	0.6
D	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0
E	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
F	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
G	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
H	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
I	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2
J	0.3	0.6	0.4	0.9	1.4	2.7	5.3	8.3	0.3	0.7	0.4	0.9	4.3	7.1	1.6	3.1	0.3	0.7	0.4	0.8	1.2	2.4	3.4	5.9
K	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1

Table 6-7: Noise intrusion levels (in dBA) during construction phase for year 2037 to 2039

	2037 West 1		2037 East 2		2037 East 3		2038 West 1		2038 East 2		2039 West 1		2039 East 2		2039 East 3	
Residential property	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
C	0.8	0.9	0.1	0.1	0.0	0.0	0.3	0.4	0.3	0.4	1.1	1.3	0.0	0.0	0.3	0.3
C1	2.7	3.1	0.1	0.1	0.0	0.0	0.6	0.7	0.6	0.7	4.6	5.1	0.1	0.1	0.3	0.4
C2	1.4	1.6	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.8	1.0	0.1	0.1	0.5	0.6
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
G	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
H	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
I	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
J	0.1	0.2	0.3	0.7	0.2	0.6	0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.4	3.2	5.6
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1

6.2.2 Operational phase

The noise intrusion levels during the operational phase are illustrated in Table 6.7 (year 2031 to 2033), Table 6.8 (year 2034 to 2036) and Table 6.9 (year 2037 to 2039) respectively.

Table 6-8: Noise intrusion levels (in dBA) during the operational phase for year 2031 to 2033

	2031 West 1		2031 West 2		2031 East 3		2031 East 4		2032 West 1		2032 West 2		2032 East 3		2032 East 4		2033 West 1		2033 West 2		2033 East 3		2033 East 4	
Residential property	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
A	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1
B	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.0	0.3	0.1	0.3	0.1	0.2	0.1	0.1	0.0	0.3	0.1	0.3	0.1	0.2	0.1	0.1	0.0
C	1.9	2.2	1.0	1.2	0.4	0.5	0.2	0.2	2.6	3.0	1.6	1.9	0.5	0.6	0.2	0.2	4.2	4.7	1.7	2.0	1.9	2.2	0.2	0.2
C1	3.2	3.6	1.5	1.8	0.5	0.6	0.2	0.2	5.3	5.9	1.0	1.2	0.7	0.8	0.2	0.2	6.4	7.1	2.0	2.3	3.1	3.5	0.2	0.3
C2	1.0	1.2	10.6	11.4	1.2	1.4	0.3	0.3	1.2	1.4	10.6	11.4	1.6	1.8	0.3	0.4	1.5	1.8	14.6	15.4	1.0	1.2	0.4	0.5
D	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.2	0.1	0.0	0.0
E	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
F	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
G	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
H	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
I	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.2
J	0.3	0.8	0.6	1.3	0.7	1.5	4.1	6.7	0.4	0.8	0.5	1.1	1.1	2.2	5.8	8.9	0.4	0.9	0.6	1.3	0.4	1.0	5.3	8.3
K	0.1	0.0	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.3	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.3	0.1

Table 6-9: Noise intrusion levels (in dBA) during the operational phase for year 2034 to 2036

	2034 West 1		2034 West 2		2034 East 3		2034 East 4		2035 West 1		2035 West 2		2035 East 3		2035 East 4		2036 West 1		2036 West 2		2036 East 3		2036 East 4	
Residential property	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
A	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.1
B	0.3	0.1	0.3	0.1	0.1	0.1	0.1	0.0	0.3	0.1	0.4	0.2	0.1	0.1	0.1	0.0	0.3	0.1	0.3	0.1	0.1	0.0	0.1	0.0
C	3.8	4.3	2.4	2.8	0.4	0.5	0.2	0.3	4.0	4.5	3.0	3.5	0.4	0.4	0.2	0.3	5.4	5.9	3.7	4.1	0.3	0.3	0.2	0.2
C1	13.6	14.4	3.9	4.4	0.5	0.6	0.2	0.3	9.7	10.5	6.2	6.8	0.4	0.5	0.2	0.3	14.4	15.2	7.3	7.9	0.3	0.4	0.2	0.3
C2	2.0	2.3	17.6	18.4	1.1	1.3	0.4	0.4	2.7	3.1	13.5	14.3	1.0	1.1	0.4	0.4	2.9	3.3	6.6	7.2	0.6	0.7	0.4	0.5
D	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
E	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
F	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
G	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
H	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
I	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.2
J	0.4	0.9	0.5	1.2	1.4	2.7	5.1	8.0	0.4	0.9	0.5	1.1	1.5	3.0	4.1	6.8	0.4	0.9	0.5	1.1	1.1	2.4	3.2	5.6
K	0.1	0.0	0.1	0.0	0.2	0.1	0.3	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.3	0.1	0.1	0.0	0.1	0.0	0.2	0.1	0.2	0.1

Table 6-10: Noise intrusion levels (in dBA) during the operational phase for year 2037 to 2039

	2037 West 1		2037 East 2		2037 East 3		2038 West 1		2038 East 2		2039 West 1		2039 East 2		2039 East 3	
Residential property	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
A	0.2	0.1	0.2	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1
B	0.3	0.1	0.1	0.1	0.1	0.0	0.4	0.2	0.1	0.0	0.3	0.1	0.1	0.0	0.1	0.0
C	3.9	4.3	0.3	0.4	0.2	0.2	6.1	6.7	0.3	0.3	4.8	5.4	0.3	0.3	0.2	0.3
C1	8.5	9.2	0.4	0.5	0.2	0.3	11.9	12.6	0.3	0.4	11.6	12.3	0.3	0.4	0.3	0.3
C2	5.6	6.2	0.8	0.9	0.4	0.5	4.0	4.5	0.6	0.7	3.9	4.4	0.7	0.8	0.5	0.6
D	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
E	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
F	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
G	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
H	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
I	0.0	0.1	0.1	0.2	0.1	0.3	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.3	0.1	0.2
J	0.4	1.0	1.7	3.3	1.4	2.7	0.4	1.0	2.6	4.7	0.4	0.9	0.8	1.8	3.0	5.3
K	0.1	0.0	0.2	0.1	0.2	0.1	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.1	0.2	0.1

6.2.3 Calculation of road traffic noise

The main access road from the main gate from the N4 is illustrated in Figure 6.1. The prevailing ambient noise level along the access road from the N4 road to the Shaft position entrance was 42.1dBA during the day and 47.4dBA during the night. The noise level along the N4 was 67.7dBA during the day and 59.2dBA during the night.

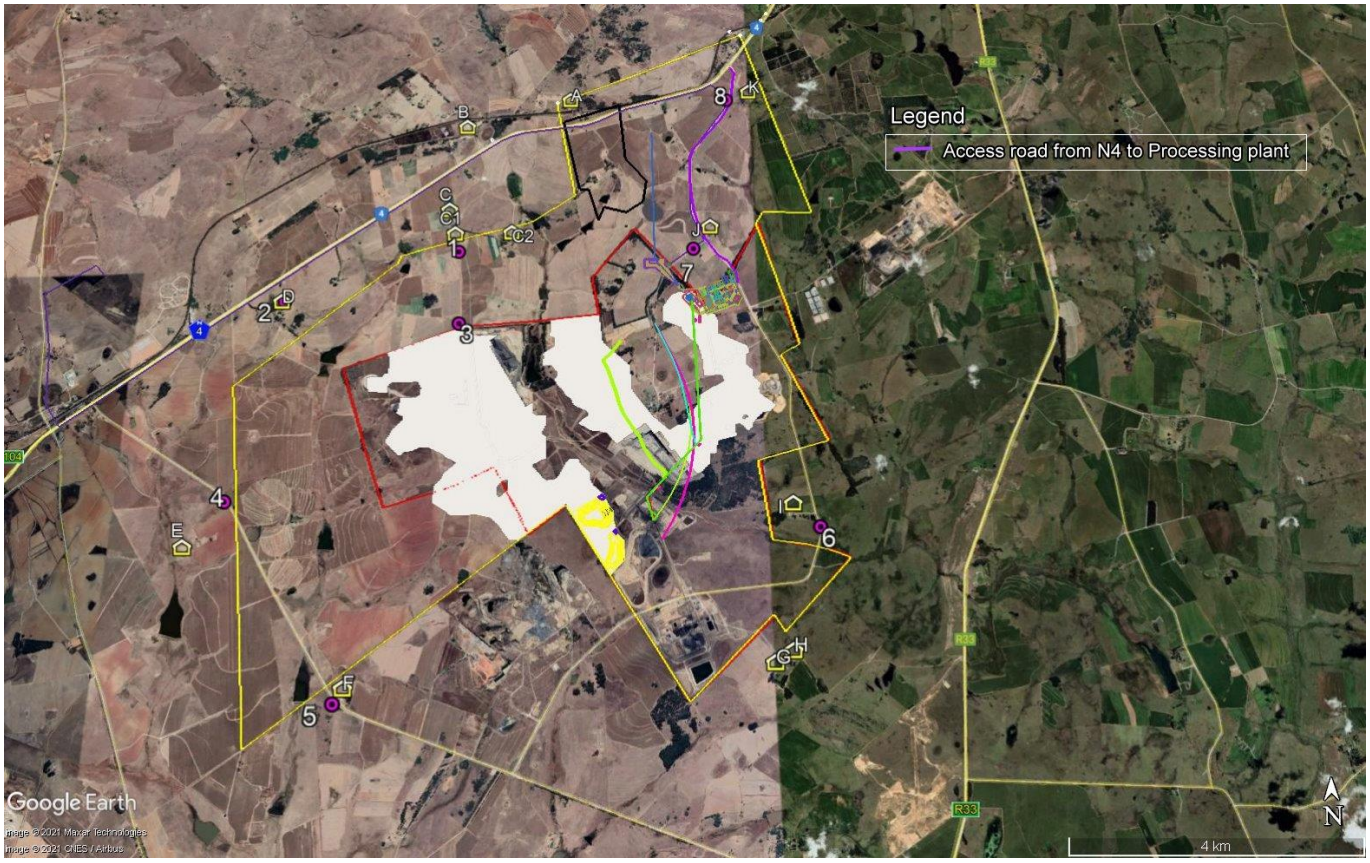

Figure 6-1: Access road from N4 to Shaft position

SANS 10210 of 2004, the national standard for the calculating and predicting of road traffic noise was used to calculate the noise level to be generated by the traffic along the access and N11 roads. The status of traffic noise along the feeder road to the access road to the main entrance to the mine and along the N11 is illustrated in the following figure. This is a typical example of an intermittent type of traffic flow with increased levels during peak periods. The measuring point was 20m from the edge of the road.

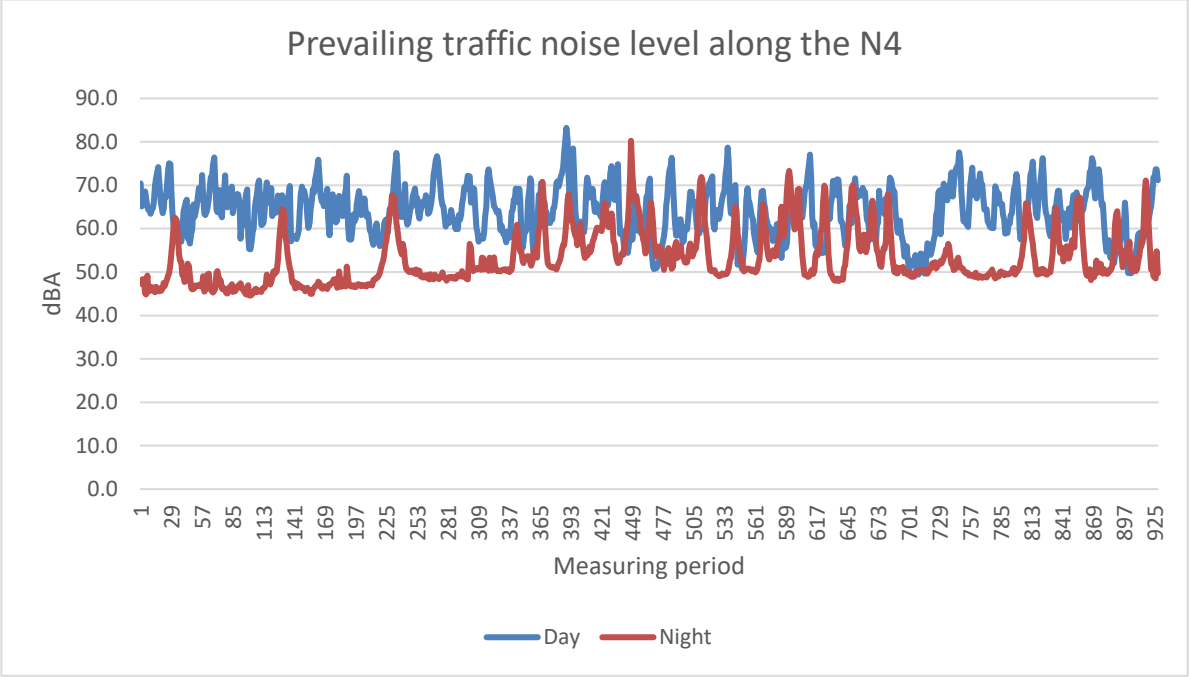

Figure 6-2: Traffic noise level along the N4

SANS 10210 of 2004, the National standard for the calculating and predicting of road traffic noise was used to calculate the noise level to be generated by the traffic along the access and N11 roads. increased levels during peak periods.

The calculation of the noise levels during the construction phase are based on a total of 15. vehicles per hour of which 10 will be heavy-duty vehicles and 5 will be motor-vehicles. The traffic volume per hour during the operational phase will be 60 vehicles of which 50 will be hauling trucks and 10 motor-vehicles per hour.

Basic Model

$$L_{Basic} = 38.3 + 10 \text{ Log } (Q_r) \text{ dBA},$$

where; L_{Basic} = basic noise level in dBA and Q_r is the mean traffic flow per hour.

The calculated traffic noise level during the construction phase will be 49.6dBA at 25m from the road and 36.8dBA at 200m from the road. The traffic noise level during the operational phase will be 56.9dBA at 25m from the road and 43.7dBA at 200m from the road.

6.2.4 Wind direction

The wind is most often from the west for 4.5 months, from April 17 to September 1, with a peak percentage of 43% on June 11. The wind is most often from the north for 2.9 months, from September 1 to November 29, with a peak percentage of 38% on September 24. The wind is most often from the east for 4.6 months, from November 29 to April 17, with a peak percentage of 43% on January 1.

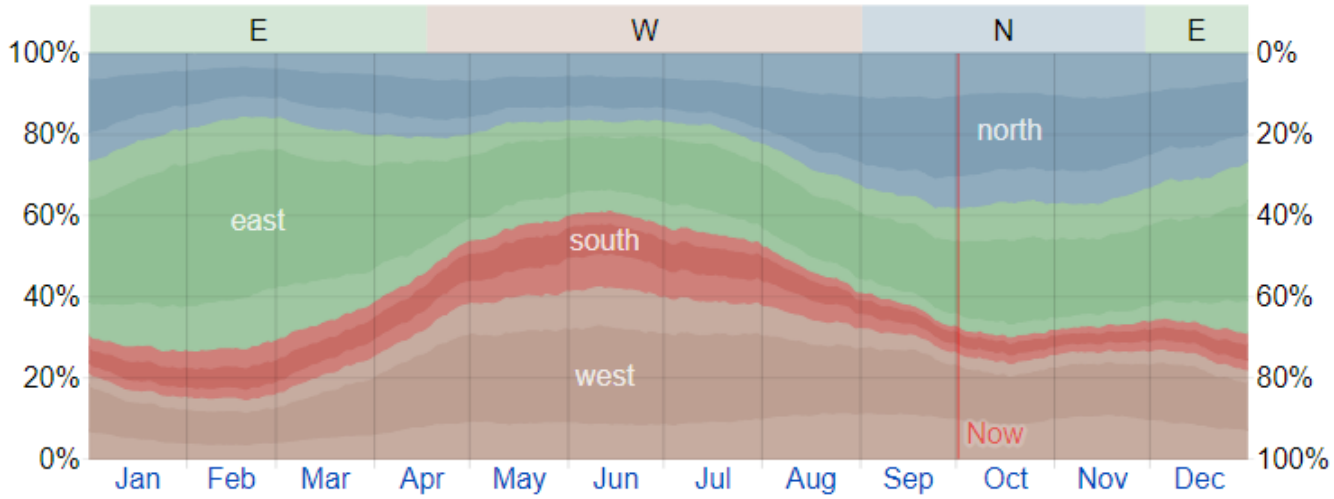

Figure 6-3: Wind direction in the vicinity of the study area

7. Noise impact assessment

In terms of the Noise Regulations a noise disturbance is created when the prevailing ambient noise level is exceeded by 7.0dBA or more. Noise however becomes audible when the prevailing ambient noise level is exceeded by 5.0dBA. The residents in the vicinity of the BEP mine are already exposed to industrial type noise levels due to the existing BIP mining operations. The topography, wind direction, distances between the mine activities (point and/or linear noise sources) and the location of the residential in terms of the mining activities play an important role in how the sound will be propagated. The noise projections were done with stable conditions with no winds. The topography between the proposed mining activities and some of the farm-houses are undulated and covered with trees.

8. Impact Identification and Assessment

Noise or sound is part of our daily exposure to different sources which is part of daily living and some of the sounds which are intrusive such as traffic noise forms part of the ambient noise that people get accustomed to without noticing the higher sound levels. Any person in the workplace and at home is exposed to the following noise levels as given in Table 8.1. These are the average noise levels in the workplace and at home that will mask noise from a source introduced into an area:

Table 8-1: Different noise levels in and around the house and workplace

	Activity	dBA
Communication	Whisper	30.0
Communication	Normal Conversation	55.0-65.0
Communication	Shouted Conversation	90.0
Communication	Baby Crying	80.0
Communication	Computer	37.0-45.0
Home/Office	Refrigerator	40.0-43.0
Home/Office	Radio Playing in Background	45.0-50.0
Home/Office	Background Music	50.0
Home/Office	Washing Machine	50.0-75.0
Home/Office	Microwave	55.0-59.0
Home/Office	Clothes Dryer	56.0-58.0
Home/Office	Alarm Clock	60.0-80.0
Home/Office	Vacuum Cleaner	70.0
Home/Office	TV Audio	70.0
Home/Office	Flush Toilet	75.0-85.0
Industry	Industrial activities	85.0-95.0
Home/Office	Ringing Telephone	80.0
Home/Office	Hairdryer	80.0-95.0
Home/Office	Maximum Output of Stereo	100.0-110.0

Two aspects are important when considering potential noise impacts of a project and it is:

- The increase in the noise level, and;
- The overall noise level produced.

8.1 Impact Assessment

An 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). The identified noise sources for each stage of the proposed development will be assessed and mitigatory measures will be recommended to ensure compliance to the Noise Control Regulations. The following activities may create a noise increase during the different phases of the project:

Construction phase

- Clearing and stripping of topsoil and vegetation at the different mine expansion footprints;
- Construction activities at the topsoil stockpile;
- Construction activities at the Shaft position footprint;
- Construction activities at the waste rock dump;
- Earthworks;
- Construction activities at the haul roads; and

- Construction activities at the offices, workshop, and ablution

Operational phase

- Earth drilling;
- Hauling vehicles;
- Generator;
- Shaft position;
- Conveyor;
- MRF; and
- Middle of the pit.

Closure/rehabilitation phase

- Removal of all Infra-structure; and
- Landfill and planting of grass.

8.2 Environmental impact assessment

The significance of the identified impacts will be determined using an accepted methodology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998. As with all impact methodologies, the impact is defined in a semi-quantitative way and will be assessed according to methodology prescribed in the following section.

Scale utilised for the evaluation of the Environmental Risk Ratings

Status of Impact

The impacts are assessed as either having a:

- negative effect (i.e., at a `cost' to the environment),
- positive effect (i.e., a `benefit' to the environment), or
- Neutral effect on the environment.

Extent of the Impact

(**1**) Site (site only),

(**2**) Local (site boundary and immediate surrounds),

(**3**) Regional (within the City of Johannesburg),

(**4**) National, or

(**5**) International.

Duration of the Impact

The length that the impact will last for is described as either:

(**1**) immediate (<1 year)

(**2**) short term (1-5 years),

(**3**) medium term (5-15 years),

(**4**) long term (ceases after the operational life span of the project),

(**5**) Permanent.

Magnitude of the Impact

The intensity or severity of the impacts is indicated as either:

(**0**) none,

(**2**) Minor,

(**4**) Low,

(**6**) Moderate (environmental functions altered but continue),

(**8**) High (environmental functions temporarily cease), or

(**10**) Very high / Unsure (environmental functions permanently cease).

Probability of Occurrence

The likelihood of the impact occurring is indicated as either:

(**0**) None (the impact will not occur),

(**1**) improbable (probability very low due to design or experience)

(**2**) low probability (unlikely to occur),

(**3**) medium probability (distinct probability that the impact will occur),

(**4**) high probability (most likely to occur), or

(5) Definite.

Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance rating (**S**). This rating is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.

$$S=(E+D+M)P$$

The significance ratings are given below

- (**<30**) low (i.e., where this impact would not have a direct influence on the decision to develop in the area),
- (**30-60**) medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),

(**>60**) high (i.e., where the impact must have an influence on the decision process to develop in the area).

8.2.1 Impact assessment during the construction phase

- Clearing and stripping of topsoil and vegetation at the different mine expansion footprints;
- Construction activities at the topsoil stockpile;
- Construction activities at the Shaft position footprint;
- Construction activities at the waste rock dump;
- Earthworks;
- Construction activities at the haul roads; and
- Construction activities at the offices, workshop, and ablution

Table 8-2: Clearing and stripping of topsoil and vegetation at the different mine expansion footprints

Issue	***Clearing and stripping of topsoil and vegetation at the different mine expansion footprints***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-3: Construction activities at the topsoil stockpile

Issue	***Construction activities at the topsoil stockpile***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-4: Construction activities at the Shaft position footprint

Issue	***Construction activities at the Shaft position footprint***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-5: Construction activities at the waste rock dump.

Issue	***Construction activities at the waste rock dump***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-6: Earthworks

Issue	***Earthworks***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-7: Construction activities at the haul roads

Issue	***Construction activities at the haul roads***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-9: Construction activities at the offices, workshop, and ablution

Issue	***Construction activities at the offices, workshop, and ablution***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

8.2.2 Impact assessment during the operational phase

- Decline access shaft footprint;
- Silo Activities;
- Earthworks;
- Ventilation shaft at the decline access shaft;
- Hauling vehicles;
- Generator;
- Shaft position;
- Conveyor;
- Underground mining activities;
- MRF; and
- Middle of the pit.

Table 8-10: Decline access shaft footprint

Issue	***Decline access shaft footprint***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-11: Silo activities

Issue	***Silo activities***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-12: Earth drilling

Issue	***Earth drilling***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-13: Ventilation shaft at the decline access shaft

Issue	***Ventilation shaft at the decline access shaft***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the MRA and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-14: MRF activities

Issue	***MRF activities***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-15: Hauling vehicles

Issue	***Hauling vehicles***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-16: Alternative Shaft

Issue	***Alternative Shaft***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-17: Access road to the coal loading pad

Issue	***Access road to the coal loading pad***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-18: Underground mining activities

Issue	***Underground mining activities***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 8-19: Emergency generator

Issue	***Emergency generator***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

Table 31: Middle of the pit

Issue	***Middle of the pit***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**4**	**6**	**3**	**36**	**Medium**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**4**	**4**	**3**	**30**	**Low**

8.2.3 Impact assessment during the decommissioning phase

- Removal of infra-structure;
- Earthworks and planting of vegetation.

Table 31: Removal of infra-structure

Issue	***Removal of infra-structure***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 32: Earthworks and planting of vegetation

Issue	***Earthworks and planting of vegetation***							
Impact Summary	*Noise increase more than the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	*Noise monitoring to be done monthly along the shaft complex footprint boundaries and the threshold noise level of 70.0dBA may not be exceeded.* *All noise sources within the footprint boundaries more than 85.0dBA must be acoustically screened off.*							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

8.3 Summary of the potential impacts

The proposed mining activities will have an impact during the construction and the operational phase onto the living environment (residents) C, C1, C2 and J depending which block will be mined. The closer the block will be from these residential areas the more noise intrusion will there be. The noise projections revealed that the noise intrusion levels during the construction phase will be as follow:

- Noise receptor C – 2.2dBA to 4.7dBA;
- Noise receptor C1 – 2.0dBA to 7.6dBA;
- Noise receptor C2 – 2.4dBA to 15.4dBA;
- Noise receptor J – 2.2dBA to 6.7dBA.

The noise intrusion levels during the operational phase will be:

2031 to 2033

- Noise receptor C – 2.6dBA to 6.4dBA;
- Noise receptor C1 – 2.0dBA to 7.1dBA;
- Noise receptor C2 – 2.2dBA to 15.4dBA;
- Noise receptor J – 2.8dBA to 8.9dBA.

2034 to 2036

- Noise receptor C – 2.4dBA to 5.9dBA;
- Noise receptor C1 – 3.9dBA to 14.4dBA;
- Noise receptor C2 – 2.3dBA to 14.5dBA;
- Noise receptor J – 2.4dBA to 4.1dBA.

2037 to 2039

- Noise receptor C – 3.9dBA to 6.7dBA;
- Noise receptor C1 – 8.5dBA to 12.6dBA;
- Noise receptor C2 – 4.0dBA to 5.5dBA;
- Noise receptor J – 2.7dBA to 5.3dBA.

9. Recommendations

The following three primary variables should be considered when designing acoustic screening measures for the control of sound and/or noise:

- The source – Reduction of noise at the source;
- The transmission path – Reduction of noise between the source and the receiver;
- The receiver – Reduction of the noise at the receiver.

The last option is not applicable and the noise levels at the noise source will be controlled on a pro-active manner when and if such increase occur and there may be an increase in the prevailing noise levels.

9.1 Acoustic screening recommendations

The acoustic screening measures for the BEP expansion project are given in Table 10.1. These are based on the best practicable methods, acoustic screening techniques and the IFC's Health and Safety Guidelines.

Table 9-1: Recommended acoustic screening measures

Activity	Recommendations
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. • An earthberm to be constructed on the southern boundary of the residential areas C, C1 and C2 of a height of at least 10m. • Construction activities to take place during day/night-time provided that the prevailing ambient noise level along the mine boundaries will not be exceeded. • Environmental noise monitoring monthly for the first year after which it can change to a quarterly basis.
Operational phase	• Equipment and/or machinery which radiate noise levels between 85.0dBA and 90.0dBA to be acoustically screened off. • Noise monitoring to be carried out along the mining boundaries in the vicinity of the mining expansion footprint areas to identify noise sources on a pro-active basis. • Noise monitoring at the residential areas and the mine boundaries to be done monthly for 2years after which the frequency can change to a quarterly basis; • Noise monitoring at the Shaft position footprint, the decline footprint in conjunction with the noise monitoring at the residential areas monthly for 2years after which the frequency can change to a quarterly basis; • Final lay-out of the entire mining area to illustrate the haul routes, lay-out of the Shaft position, decline infra-structure and the conveyor route to be provided; • 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 baseline noise levels.
Decommissioning 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.

The following are the Environmental, Health and Safety Guidelines of the IFC of the World Bank, which should be implemented during the construction, operational and decommissioning phases of the project:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment causing radiating noise;
- Installing vibration isolation for mechanical equipment;
- Re-locate noise sources to areas which are less noise sensitive, to take advantage of distance and natural shielding;
- Taking advantage during the design stage of natural topography as a noise buffer;
- Develop a mechanism to record and respond to complaints.

The following noise impact management plan Table 9.2 will be applicable during the construction, operational, decommissioning phases:

The Noise Impact Management Plan (NIMP) for the proposed mine expansion project will consist of the following as illustrated in Table 10-2. Regular environmental monitoring will provide the data for reviewing, checking, and revising the NIMP.

Table 9-2: Noise impact management plan

Action	Description	Frequency	Responsible person
Management objective	To ensure that the legislated noise levels will be always adhered to.	Monthly for a period of a year after which the frequency can change to a quarterly basis.	The engineer during the construction phase and the responsible person (BEP Environmental Department) during the operational phase of the project
Monitoring objective – Construction phase	Measure the environmental noise levels during the construction phase of the project to ensure compliance to the recommended noise levels.	Monthly for a period of a year after which the frequency can change to a quarterly basis.	BEP Environmental Department
Monitoring objective – Operational phase	Measure the environmental noise levels during the operational phase of the project to ensure compliance to the recommended noise levels.	Monthly for a period of a year after which the frequency can change to a quarterly basis.	BEP Environmental Department
Monitoring technology	The environmental noise monitoring must take place with	Monthly for a period of a year after which the	BEP Environmental Department

	a calibrated Class 1 noise monitoring equipment.	frequency can change to a quarterly basis.	
Specify how the collected information will be used	The data must be collated and discussed monthly during the construction phase and monthly during the operational phase for the first two years thereafter on a quarterly basis.	Quarterly for a period of a year after which the frequency can change to an annual basis.	BEP Environmental Department
Spatial boundaries	At the boundaries of the identified abutting residential areas as well as at the boundaries of the different mining areas.	Quarterly for a period of a year after which the frequency can change to an annual basis.	BEP Environmental Department
Define how the data will be analysed and interpreted and how it should be presented in monitoring reports	Reports must be compiled for each monitoring cycle and the results must be compared to the previous set of results to determine if there was a shift in the prevailing ambient noise.	Quarterly for a period of a year after which the frequency can change to an annual basis.	BEP Environmental Department
Accuracy and precision of the data	The noise surveys will have to be conducted in terms of the recommendations of the Noise Control Regulations and SANS 10103 of 2008.	Calibrated equipment must be always used and at the measuring points given in Figure 10.1.	Environmental noise and vibration specialist

The proposed noise monitoring points for the study area is illustrated in Figure 9.1.

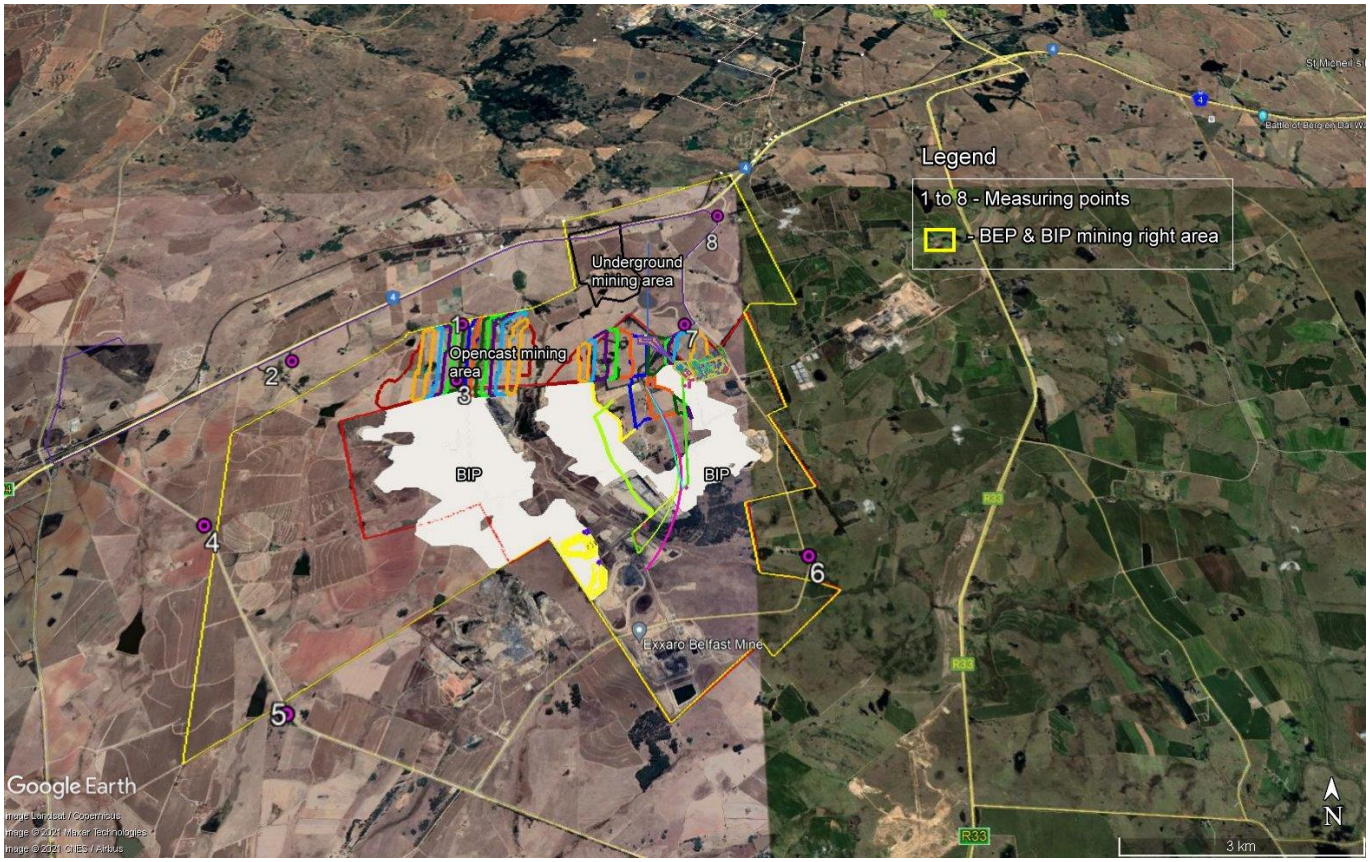

Figure 9-1: Proposed environmental noise measuring points

9.2 Recommended conditions for authorisation

The following conditions will be applicable from an environmental noise point of view:

- Baseline environmental noise levels to be collated and recorded;
- All acoustic screening measures must be in place before commissioning the expansion mining project;
- All noise mitigatory measures as per Table 9.1 to be complied with.
- Environmental noise monitoring to be carried out during the different phases of the project;
- All noise sources at the different mining areas to be identified and registered;
- The noise (Noise Control Regulations, 1994) and/or guidelines to be always adhered to.

10. Conclusion

The environmental noise impact during the construction phase will be low and during the operational phase will be moderate to low when the mitigatory measures are in place. The alternative shaft position 2 will be the preferred option and alternative conveyor D will be the preferred overland conveyor for this project. The location of the MRF and the subsequent activities will ensure that the noise will be insignificant at the abutting noise receptors.

The potential noise intrusion from the mining activities can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Noise Regulations, 1994 and the International Finance Corporation's Environmental Health and Safety Guidelines. The proposed noise management plan must be in place during the construction and operational phases to identify any noise increase on a pro-active basis and to address the problem accordingly.

The proposed BEP Mine expansion project will be in line with the environmental noise standards and guidelines provided that all the noise mitigatory measures are in place and that the Noise Impact Management Plan (NIMP) and Noise Monitoring Plan (NMP) for BEP mine is adhered to.

Barend van der Merwe – MSc UJ
Environmental noise specialist

11. List of Definitions and Abbreviations

11.1 Definitions

Ambient noise
The totally encompassing sound in each situation at a given time and usually composed of sound from many sources, both near and far

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

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

Residual noise
The ambient noise that remains at a given position in each situation when one or more specific noises are suppressed

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.

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.

Disturbing noise
Means a noise that causes the ambient noise level to rise above the designated zone level by 7.0dBA or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SANS 10103.

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

11.2 Abbreviations

dBA – A-weighted sound pressure level;

IBR – Angular trapezoidal fluted profile sheet;

IFC – International Finance Corporation;

Km/h - Kilometres per hour;

Kg/m^3 – Kilogram per cubic meter;

m/s – meters per second;

NIMP – Noise impact management plan;

NMP – Noise monitoring plan;

NSA – Noise sensitive areas;

L_{Basic} – Basic noise level in dBA;

SANS – South African National Standards;

TLB – Tractor-loader-backhoe

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CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2021-AS-0108
ORGANISATION	dB ACOUSTICS
ORGANISATION ADRESS	P.O. BOX 1219, ALLENS NEK, 1737
CALIBRATION OF	INTEGRATING SOUND LEVEL METER complete with built-in ⅓ OCTAVE/OCTAVE FILTER and ½" MICROPHONE
MANUFACTURERS	LARSON DAVIS and PCB
MODEL NUMBERS	831, PRM 831 and 377B02
SERIAL NUMBERS	0001072, 0206 and 316581
DATE OF CALIBRATION	02-03 FEBRUARY 2021
RECOMMENDED DUE DATE	FEBRUARY 2022
PAGE NUMBER	PAGE 1 OF 6

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

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Calibrated by:	Authorized/Checked by:	Date of Issue:
W.S. SIBANYONI (CALIBRATION TECHNICIAN)	M. NAUDÉ (SANAS TECHNICAL SIGNATORY)	03 FEBRUARY 2021

Director: Marianka Naudé

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M AND N ACOUSTIC SERVICES (Pty) Ltd
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CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2019-AS-0585
ORGANISATION	DB ACOUSTICS CC
ORGANISATION ADDRESS	P.O. BOX 1219, ALLANSNECK, 1737
CALIBRATION OF	INTEGRATING SOUND LEVEL METER complete with built-in ⅓ OCTAVE/OCTAVE FILTER and ½" MICROPHONE
MANUFACTURERS	LARSON DAVIS and PCB
MODEL NUMBERS	LXT1, PRM LXT1 and 377B 02
SERIAL NUMBERS	0006037, 069946 and 316345
DATE OF CALIBRATION	27-28 JULY 2020
RECOMMENDED DUE DATE	JULY 2021
PAGE NUMBER	PAGE 1 OF 5

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Calibrated by:	Authorized/Checked by:	Date of Issue:
W.S. SIBANYONI (CALIBRATION TECHNICIAN)	M. NAUDÉ (SANAS TECHNICAL SIGNATORY)	28 JULY 2020

Annexure B – Distances between residential area and mine activities

Distance between residential area and opencast pit 2031 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3871	3871	3871	3871	4437	5300	6854	4450
B	2503	2503	2503	2503	5183	5412	6757	3229
C	1024	1024	1024	1024	4555	4541	5599	2803
C1	738	738	738	738	4328	4158	5072	1503
C2	1559	1559	1559	1559	3427	6318	4762	2066
D	2255	2255	2255	2255	6814	7617	6207	1936
E	5545	5545	5545	5545	8608	6416	6121	4628
F	6343	6343	6343	6343	7841	4427	4325	5628
G	8257	8257	8257	8257	5369	4213	2976	5997
H	8207	8207	8207	8207	5132	2479	3221	7668
I	7212	7212	7212	7212	3169	2291	2469	8379
J	4686	4686	4686	4686	1383	2518	4757	6763
K	6159	6159	6159	6159	3817	5199	7471	6400

Distance between residential area and opencast pit 2031 west 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2927	2927	2927	2927	4437	5300	6854	3371
B	2638	2638	2638	2638	5183	5412	6757	2874
C	1520	1520	1520	1520	4555	4541	5599	1623
C1	1220	1220	1220	1220	4328	4158	5072	1247
C2	470	470	470	470	3427	6318	4762	3577
D	3969	3969	3969	3969	6814	7617	6207	6208
E	6617	6617	6617	6617	8608	6416	6121	6478
F	7043	7043	7043	7043	7841	4427	4325	7001
G	7338	7338	7338	7338	5369	4213	2976	7133
H	7325	7325	7325	7325	5132	2479	3221	7494
I	5781	5781	5781	5781	3169	2291	2469	4571
J	2859	2859	2859	2859	1383	2518	4757	3190
K	4587	4587	4587	4587	3817	5199	7471	5061

Distance between residential area and opencast pit 2031 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3822	3822	3822	3822	4437	5300	6854	3475
B	3756	3756	3756	3756	5183	5412	6757	3668
C	2661	2661	2661	2661	4555	4541	5599	2803
C1	2340	2340	2340	2340	4328	4158	5072	2332
C2	1427	1427	1427	1427	3427	6318	4762	1786
D	4201	4201	4201	4201	6814	7617	6207	4465
E	6610	6610	6610	6610	8608	6416	6121	6703
F	6286	6286	6286	6286	7841	4427	4325	6323
G	6253	6253	6253	6253	5369	4213	2976	5997
H	6176	6176	6176	6176	5132	2479	3221	6079
I	4432	4432	4432	4432	3169	2291	2469	4546
J	2531	2531	2531	2531	1383	2518	4757	2569
K	4679	4679	4679	4679	3817	5199	7471	4831

Distance between residential area and opencast pit 2031 east 4 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3991	3991	3991	3991	4437	5300	6854	3805
B	4812	4812	4812	4812	5183	5412	6757	4608
C	4409	4409	4409	4409	4555	4541	5599	4364
C1	4169	4169	4169	4169	4328	4158	5072	4146
C2	3334	3334	3334	3334	3427	6318	4762	3296
D	6768	6768	6768	6768	6814	7617	6207	6670
E	8938	8938	8938	8938	8608	6416	6121	8896
F	8351	8351	8351	8351	7841	4427	4325	8141
G	6087	6087	6087	6087	5369	4213	2976	5762
H	5941	5941	5941	5941	5132	2479	3221	5801
I	3880	3880	3880	3880	3169	2291	2469	3769
J	767	767	767	767	1383	2518	4757	886
K	3275	3275	3275	3275	3817	5199	7471	3265

Distance between residential area and opencast pit 2032 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3494	3494	3494	3494	4437	5300	6854	4032
B	2235	2235	2235	2235	5183	5412	6757	3036
C	852	852	852	852	4555	4541	5599	1585
C1	490	490	490	490	4328	4158	5072	2332
C2	1382	1382	1382	1382	3427	6318	4762	1786
D	2160	2160	2160	2160	6814	7617	6207	2153
E	5576	5576	5576	5576	8608	6416	6121	4972
F	6679	6679	6679	6679	7841	4427	4325	5677
G	8217	8217	8217	8217	5369	4213	2976	7651
H	8296	8296	8296	8296	5132	2479	3221	7571
I	6925	6925	6925	6925	3169	2291	2469	6338
J	4470	4470	4470	4470	1383	2518	4757	4579
K	5973	5973	5973	5973	3817	5199	7471	6318

Distance between residential area and opencast pit 2032 west 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2620	2620	2620	2620	4437	5300	6854	3199
B	2108	2108	2108	2108	5183	5412	6757	2856
C	1199	1199	1199	1199	4555	4541	5599	1774
C1	1619	1619	1619	1619	4328	4158	5072	1396
C2	233	233	233	233	3427	6318	4762	862
D	3631	3631	3631	3631	6814	7617	6207	3557
E	6605	6605	6605	6605	8608	6416	6121	6140
F	7041	7041	7041	7041	7841	4427	4325	6322
G	7423	7423	7423	7423	5369	4213	2976	6710
H	7385	7385	7385	7385	5132	2479	3221	6739
I	5779	5779	5779	5779	3169	2291	2469	5288
J	2872	2872	2872	2872	1383	2518	4757	2999
K	4452	4452	4452	4452	3817	5199	7471	5073

Distance between residential area and opencast pit 2032 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2945	2945	2945	2945	4437	5300	6854	3303
B	3058	3058	3058	3058	5183	5412	6757	3508
C	2326	2326	2326	2326	4555	4541	5599	2803
C1	2035	2035	2035	2035	4328	4158	5072	2332
C2	1237	1237	1237	1237	3427	6318	4762	1564
D	4649	4649	4649	4649	6814	7617	6207	4640
E	7105	7105	7105	7105	8608	6416	6121	7026
F	7099	7099	7099	7099	7841	4427	4325	6705
G	6500	6500	6500	6500	5369	4213	2976	6105
H	6409	6409	6409	6409	5132	2479	3221	6093
I	4554	4554	4554	4554	3169	2291	2469	4470
J	1843	1843	1843	1843	1383	2518	4757	2037
K	3896	3896	3896	3896	3817	5199	7471	4416

Distance between residential area and opencast pit 2032 east 4 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3589	3589	3589	3589	4437	5300	6854	3874
B	4490	4490	4490	4490	5183	5412	6757	4659
C	4047	4047	4047	4047	4555	4541	5599	4206
C1	3832	3832	3832	3832	4328	4158	5072	4602
C2	2855	2855	2855	2855	3427	6318	4762	3162
D	6515	6515	6515	6515	6814	7617	6207	6508
E	8694	8694	8694	8694	8608	6416	6121	8757
F	8219	8219	8219	8219	7841	4427	4325	7988
G	6175	6175	6175	6175	5369	4213	2976	5924
H	6023	6023	6023	6023	5132	2479	3221	5862
I	3971	3971	3971	3971	3169	2291	2469	3987
J	543	543	543	543	1383	2518	4757	701
K	2989	2989	2989	2989	3817	5199	7471	3213

Distance between residential area and opencast pit 2033 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3422	3422	3422	3422	4437	5300	6854	3859
B	2132	2132	2132	2132	5183	5412	6757	2905
C	595	595	595	595	4555	4541	5599	1445
C1	412	412	412	412	4328	4158	5072	1059
C2	1218	1218	1218	1218	3427	6318	4762	1492
D	2500	2500	2500	2500	6814	7617	6207	3594
E	5761	5761	5761	5761	8608	6416	6121	6722
F	6749	6749	6749	6749	7841	4427	4325	7226
G	8239	8239	8239	8239	5369	4213	2976	7725
H	8259	8259	8259	8259	5132	2479	3221	7712
I	6815	6815	6815	6815	3169	2291	2469	6131
J	4306	4306	4306	4306	1383	2518	4757	3095
K	5716	5716	5716	5716	3817	5199	7471	4669

Distance between residential area and opencast pit 2033 west 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2529	2529	2529	2529	4437	5300	6854	3697
B	2043	2043	2043	2043	5183	5412	6757	3668
C	1090	1090	1090	1090	4555	4541	5599	2803
C1	997	997	997	997	4328	4158	5072	2332
C2	142	142	142	142	3427	6318	4762	1786
D	3773	3773	3773	3773	6814	7617	6207	4465
E	6858	6858	6858	6858	8608	6416	6121	6703
F	7399	7399	7399	7399	7841	4427	4325	6323
G	7786	7786	7786	7786	5369	4213	2976	5997
H	7738	7738	7738	7738	5132	2479	3221	6079
I	6030	6030	6030	6030	3169	2291	2469	4546
J	2914	2914	2914	2914	1383	2518	4757	2569
K	4397	4397	4397	4397	3817	5199	7471	4831

Distance between residential area and opencast pit 2033 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3871	3871	3871	3030	4437	5300	6854	3400
B	2503	2503	2503	3301	5183	5412	6757	3539
C	1024	1024	1024	2586	4555	4541	5599	2701
C1	738	738	738	2224	4328	4158	5072	2414
C2	1559	1559	1559	1531	3427	6318	4762	1571
D	2255	2255	2255	4829	6814	7617	6207	4728
E	5545	5545	5545	7323	8608	6416	6121	7090
F	6343	6343	6343	6413	7841	4427	4325	6835
G	8257	8257	8257	6482	5369	4213	2976	6136
H	8207	8207	8207	4734	5132	2479	3221	6129
I	7212	7212	7212	1825	3169	2291	2469	4554
J	4686	4686	4686	1867	1383	2518	4757	1987
K	6159	6159	6159	3934	3817	5199	7471	4120

Distance between residential area and opencast pit 2033 east 4 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3441	3441	3441	3441	4437	5300	6854	3515
B	4201	4201	4201	4201	5183	5412	6757	4301
C	3797	3797	3797	3797	4555	4541	5599	3851
C1	3648	3648	3648	3648	4328	4158	5072	3728
C2	2685	2685	2685	2685	3427	6318	4762	2922
D	6400	6400	6400	6400	6814	7617	6207	6349
E	8577	8577	8577	8577	8608	6416	6121	8536
F	8143	8143	8143	8143	7841	4427	4325	7889
G	6419	6419	6419	6419	5369	4213	2976	5972
H	6194	6194	6194	6194	5132	2479	3221	5714
I	4136	4136	4136	4136	3169	2291	2469	3975
J	584	584	584	584	1383	2518	4757	770
K	3148	3148	3148	3148	3817	5199	7471	3209

Distance between residential area and opencast pit 2034 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3236	3236	3236	3236	4437	5300	6854	3859
B	2104	2104	2104	2104	5183	5412	6757	2905
C	643	643	643	643	4555	4541	5599	1445
C1	161	161	161	161	4328	4158	5072	1059
C2	1012	1012	1012	1012	3427	6318	4762	1492
D	2631	2631	2631	2631	6814	7617	6207	3594
E	5909	5909	5909	5909	8608	6416	6121	6722
F	6843	6843	6843	6843	7841	4427	4325	7226
G	8148	8148	8148	8148	5369	4213	2976	7725
H	8147	8147	8147	8147	5132	2479	3221	7712
I	6759	6759	6759	6759	3169	2291	2469	6131
J	4086	4086	4086	4086	1383	2518	4757	3095
K	5635	5635	5635	5635	3817	5199	7471	4669

Distance between residential area and opencast pit 2034 west 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2609	2609	2609	2609	4437	5300	6854	3697
B	2033	2033	2033	2033	5183	5412	6757	3668
C	876	876	876	876	4555	4541	5599	2803
C1	626	626	626	626	4328	4158	5072	2332
C2	100	100	100	100	3427	6318	4762	1786
D	3516	3516	3516	3516	6814	7617	6207	4465
E	6522	6522	6522	6522	8608	6416	6121	6703
F	7237	7237	7237	7237	7841	4427	4325	6323
G	7739	7739	7739	7739	5369	4213	2976	5997
H	7689	7689	7689	7689	5132	2479	3221	6079
I	6165	6165	6165	6165	3169	2291	2469	4546
J	3213	3213	3213	3213	1383	2518	4757	2569
K	4850	4850	4850	4850	3817	5199	7471	4831

Distance between residential area and opencast pit 2034 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2903	2903	2903	2903	4437	5300	6854	3400
B	3180	3180	3180	3180	5183	5412	6757	3539
C	2638	2638	2638	2638	4555	4541	5599	2701
C1	2303	2303	2303	2303	4328	4158	5072	2414
C2	1458	1458	1458	1458	3427	6318	4762	1571
D	5187	5187	5187	5187	6814	7617	6207	4728
E	7681	7681	7681	7681	8608	6416	6121	7090
F	7621	7621	7621	7621	7841	4427	4325	6835
G	6708	6708	6708	6708	5369	4213	2976	6136
H	6638	6638	6638	6638	5132	2479	3221	6129
I	4741	4741	4741	4741	3169	2291	2469	4554
J	1592	1592	1592	1592	1383	2518	4757	1987
K	3765	3765	3765	3765	3817	5199	7471	4120

Distance between residential area and opencast pit 2034 east 4 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3502	3502	3502	3502	4437	5300	6854	3515
B	4045	4045	4045	4045	5183	5412	6757	4301
C	3670	3670	3670	3670	4555	4541	5599	3851
C1	3579	3579	3579	3579	4328	4158	5072	3728
C2	2757	2757	2757	2757	3427	6318	4762	2922
D	6208	6208	6208	6208	6814	7617	6207	6349
E	8643	8643	8643	8643	8608	6416	6121	8536
F	8157	8157	8157	8157	7841	4427	4325	7889
G	8333	8333	8333	8333	5369	4213	2976	5972
H	6211	6211	6211	6211	5132	2479	3221	5714
I	4076	4076	4076	4076	3169	2291	2469	3975
J	612	612	612	612	1383	2518	4757	770
K	3133	3133	3133	3133	3817	5199	7471	3209

Distance between residential area and opencast pit 2035 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3267	3267	3267	3267	4437	5300	6854	3581
B	2112	2112	2112	2112	5183	5412	6757	2694
C	616	616	616	616	4555	4541	5599	1357
C1	261	261	261	261	4328	4158	5072	785
C2	828	828	828	828	3427	6318	4762	1281
D	2554	2554	2554	2554	6814	7617	6207	4465
E	5853	5853	5853	5853	8608	6416	6121	6703
F	6795	6795	6795	6795	7841	4427	4325	6323
G	8011	8011	8011	8011	5369	4213	2976	5997
H	8020	8020	8020	8020	5132	2479	3221	6079
I	6506	6506	6506	6506	3169	2291	2469	4546
J	3958	3958	3958	3958	1383	2518	4757	4010
K	5490	5490	5490	5490	3817	5199	7471	5767

Distance between residential area and opencast pit 2035 west 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2628	2628	2628	2628	4437	5300	6854	3288
B	1850	1850	1850	1850	5183	5412	6757	2681
C	762	762	762	762	4555	4541	5599	1329
C1	430	430	430	430	4328	4158	5072	829
C2	163	163	163	163	3427	6318	4762	736
D	3536	3536	3536	3536	6814	7617	6207	3100
E	6567	6567	6567	6567	8608	6416	6121	6703
F	7276	7276	7276	7276	7841	4427	4325	6323
G	7692	7692	7692	7692	5369	4213	2976	5997
H	7800	7800	7800	7800	5132	2479	3221	6079
I	6127	6127	6127	6127	3169	2291	2469	4546
J	3243	3243	3243	3243	1383	2518	4757	3408
K	4696	4696	4696	4696	3817	5199	7471	5185

Distance between residential area and opencast pit 2035 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2779	2779	2779	2779	4437	5300	6854	3697
B	3207	3207	3207	3207	5183	5412	6757	3668
C	2688	2688	2688	2688	4555	4541	5599	2885
C1	2491	2491	2491	2491	4328	4158	5072	2527
C2	1594	1594	1594	1594	3427	6318	4762	1682
D	5195	5195	5195	5195	6814	7617	6207	4975
E	7907	7907	7907	7907	8608	6416	6121	6703
F	7618	7618	7618	7618	7841	4427	4325	6323
G	6758	6758	6758	6758	5369	4213	2976	5997
H	6662	6662	6662	6662	5132	2479	3221	6079
I	4687	4687	4687	4687	3169	2291	2469	4546
J	1454	1454	1454	1454	1383	2518	4757	2569
K	3442	3442	3442	3442	3817	5199	7471	4831

Distance between residential area and opencast pit 2035 east 4 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3340	3340	3340	3340	4437	5300	6854	3472
B	4325	4325	4325	4325	5183	5412	6757	3750
C	3647	3647	3647	3647	4555	4541	5599	3832
C1	3475	3475	3475	3475	4328	4158	5072	3539
C2	2763	2763	2763	2763	3427	6318	4762	2648
D	6176	6176	6176	6176	6814	7617	6207	4465
E	8489	8489	8489	8489	8608	6416	6121	6703
F	7988	7988	7988	7988	7841	4427	4325	6323
G	6195	6195	6195	6195	5369	4213	2976	5997
H	6146	6146	6146	6146	5132	2479	3221	6079
I	4109	4109	4109	4109	3169	2291	2469	4546
J	727	727	727	727	1383	2518	4757	913
K	3221	3221	3221	3221	3817	5199	7471	3433

Distance between residential area and opencast pit 2036 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2997	2997	2997	2997	4437	5300	6854	3562
B	2034	2034	2034	2034	5183	5412	6757	3668
C	487	487	487	487	4555	4541	5599	1194
C1	146	146	146	146	4328	4158	5072	788
C2	803	803	803	803	3427	6318	4762	1094
D	2695	2695	2695	2695	6814	7617	6207	2726
E	5895	5895	5895	5895	8608	6416	6121	6703
F	6931	6931	6931	6931	7841	4427	4325	6323
G	8106	8106	8106	8106	5369	4213	2976	5997
H	8028	8028	8028	8028	5132	2479	3221	6079
I	6580	6580	6580	6580	3169	2291	2469	4546
J	3915	3915	3915	3915	1383	2518	4757	4039
K	5364	5364	5364	5364	3817	5199	7471	5632

Distance between residential area and opencast pit 2036 west 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2744	2744	2744	2744	4437	5300	6854	3453
B	1946	1946	1946	1946	5183	5412	6757	2681
C	665	665	665	665	4555	4541	5599	1337
C1	366	366	366	366	4328	4158	5072	876
C2	405	405	405	405	3427	6318	4762	916
D	3164	3164	3164	3164	6814	7617	6207	3185
E	6486	6486	6486	6486	8608	6416	6121	6703
F	6974	6974	6974	6974	7841	4427	4325	6323
G	7938	7938	7938	7938	5369	4213	2976	5997
H	7914	7914	7914	7914	5132	2479	3221	6079
I	6298	6298	6298	6298	3169	2291	2469	4546
J	3513	3513	3513	3513	1383	2518	4757	2569
K	4914	4914	4914	4914	3817	5199	7471	5260

Distance between residential area and opencast pit 2036 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3564	3564	3564	3564	4437	5300	6854	3146
B	3566	3566	3566	3566	5183	5412	6757	4260
C	3044	3044	3044	3044	4555	4541	5599	3175
C1	2806	2806	2806	2806	4328	4158	5072	2802
C2	2024	2024	2024	2024	3427	6318	4762	2080
D	5026	5026	5026	5026	6814	7617	6207	4465
E	7300	7300	7300	7300	8608	6416	6121	6703
F	7026	7026	7026	7026	7841	4427	4325	6323
G	5867	5867	5867	5867	5369	4213	2976	5997
H	5811	5811	5811	5811	5132	2479	3221	6079
I	4080	4080	4080	4080	3169	2291	2469	4546
J	1754	1754	1754	1754	1383	2518	4757	1948
K	4121	4121	4121	4121	3817	5199	7471	4285

Distance between residential area and opencast pit 2036 east 4 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3271	3271	3271	3271	4437	5300	6854	3403
B	3980	3980	3980	3980	5183	5412	6757	3619
C	3595	3595	3595	3595	4555	4541	5599	3688
C1	3439	3439	3439	3439	4328	4158	5072	3407
C2	2442	2442	2442	2442	3427	6318	4762	2492
D	5971	5971	5971	5971	6814	7617	6207	4465
E	8338	8338	8338	8338	8608	6416	6121	6703
F	7915	7915	7915	7915	7841	4427	4325	6323
G	6321	6321	6321	6321	5369	4213	2976	5997
H	6233	6233	6233	6233	5132	2479	3221	6079
I	4255	4255	4255	4255	3169	2291	2469	4546
J	868	868	868	868	1383	2518	4757	2569
K	3251	3251	3251	3251	3817	5199	7471	3530

Distance between residential area and opencast pit 2037 west 1 in meters								
Residential area	Clearing and grubbing of the footprint	Earth drilling	Hauling vehicles	Generator	Shaft position	Conveyor	MRF	Middle of opencast pit
A	2913	2913	2913	2913	4437	5300	6854	3403
B	2058	2058	2058	2058	5183	5412	6757	2676
C	641	641	641	641	4555	4541	5599	1332
C1	312	312	312	312	4328	4158	5072	904
C2	471	471	471	471	3427	6318	4762	948
D	3077	3077	3077	3077	6814	7617	6207	3052
E	6364	6364	6364	6364	8608	6416	6121	6703
F	7066	7066	7066	7066	7841	4427	4325	6323
G	7962	7962	7962	7962	5369	4213	2976	5997
H	7980	7980	7980	7980	5132	2479	3221	6079
I	6416	6416	6416	6416	3169	2291	2469	4546
J	3580	3580	3580	3580	1383	2518	4757	3666
K	5078	5078	5078	5078	3817	5199	7471	5442

Distance between residential area and opencast pit 2037 east 2 in meters								
Residential area	Clearing and grubbing of the footprint	Earth drilling	Hauling vehicles	Generator	Shaft position	Conveyor	MRF	Middle of opencast pit
A	2800	2800	2800	2800	4437	5300	6854	3372
B	3297	3297	3297	3297	5183	5412	6757	3732
C	2830	2830	2830	2830	4555	4541	5599	3083
C1	2593	2593	2593	2593	4328	4158	5072	2805
C2	1788	1788	1788	1788	3427	6318	4762	1968
D	5354	5354	5354	5354	6814	7617	6207	5337
E	7822	7822	7822	7822	8608	6416	6121	6703
F	7692	7692	7692	7692	7841	4427	4325	6323
G	6606	6606	6606	6606	5369	4213	2976	5997
H	6639	6639	6639	6639	5132	2479	3221	6079
I	4772	4772	4772	4772	3169	2291	2469	4546
J	1351	1351	1351	1351	1383	2518	4757	1527
K	3540	3540	3540	3540	3817	5199	7471	3902

Distance between residential area and opencast pit 2037 east 3 in meters								
Residential area	Clearing and grubbing of the footprint	Earth drilling	Hauling vehicles	Generator	Shaft position	Conveyor	MRF	Middle of opencast pit
A	3982	3982	3982	3982	4437	5300	6854	4462
B	4401	4401	4401	4401	5183	5412	6757	4864
C	3688	3688	3688	3688	4555	4541	5599	4010
C1	3345	3345	3345	3345	4328	4158	5072	3729
C2	2625	2625	2625	2625	3427	6318	4762	3054
D	5791	5791	5791	5791	6814	7617	6207	4465
E	7783	7783	7783	7783	8608	6416	6121	6703
F	7217	7217	7217	7217	7841	4427	4325	6323
G	5557	5557	5557	5557	5369	4213	2976	5997
H	5430	5430	5430	5430	5132	2479	3221	6079
I	3533	3533	3533	3533	3169	2291	2469	4546
J	1567	1567	1567	1567	1383	2518	4757	1895
K	4139	4139	4139	4139	3817	5199	7471	4498

Distance between residential area and opencast pit 2038 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2787	2787	2787	2787	4437	5300	6854	3558
B	1888	1888	1888	1888	5183	5412	6757	2713
C	436	436	436	436	4555	4541	5599	1224
C1	202	202	202	202	4328	4158	5072	803
C2	623	623	623	623	3427	6318	4762	1021
D	3092	3092	3092	3092	6814	7617	6207	2820
E	6230	6230	6230	6230	8608	6416	6121	6703
F	7069	7069	7069	7069	7841	4427	4325	6323
G	8100	8100	8100	8100	5369	4213	2976	5997
H	7961	7961	7961	7961	5132	2479	3221	6079
I	6424	6424	6424	6424	3169	2291	2469	4546
J	3636	3636	3636	3636	1383	2518	4757	3801
K	5029	5029	5029	5029	3817	5199	7471	5554

Distance between residential area and opencast pit 2038 east 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3289	3289	3289	3289	4437	5300	6854	3337
B	3817	3817	3817	3817	5183	5412	6757	3509
C	3244	3244	3244	3244	4555	4541	5599	3365
C1	2969	2969	2969	2969	4328	4158	5072	3065
C2	2070	2070	2070	2070	3427	6318	4762	3285
D	5704	5704	5704	5704	6814	7617	6207	5502
E	7947	7947	7947	7947	8608	6416	6121	6703
F	7640	7640	7640	7640	7841	4427	4325	6323
G	6280	6280	6280	6280	5369	4213	2976	5997
H	6229	6229	6229	6229	5132	2479	3221	6079
I	4242	4242	4242	4242	3169	2291	2469	4546
J	1006	1006	1006	1006	1383	2518	4757	1297
K	3520	3520	3520	3520	3817	5199	7471	3624

Distance between residential area and opencast pit 2039 west 1 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	2946	2946	2946	2946	4437	5300	6854	3552
B	2035	2035	2035	2035	5183	5412	6757	2702
C	538	538	538	538	4555	4541	5599	1231
C1	210	210	210	210	4328	4158	5072	707
C2	640	640	640	640	3427	6318	4762	1006
D	2698	2698	2698	2698	6814	7617	6207	2763
E	6051	6051	6051	6051	8608	6416	6121	6703
F	6745	6745	6745	6745	7841	4427	4325	6323
G	7997	7997	7997	7997	5369	4213	2976	5997
H	7866	7866	7866	7866	5132	2479	3221	6079
I	6502	6502	6502	6502	3169	2291	2469	4546
J	3865	3865	3865	3865	1383	2518	4757	3817
K	5292	5292	5292	5292	3817	5199	7471	5701

Distance between residential area and opencast pit 2039 east 2 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	4160	4160	4160	4160	4437	5300	6854	4280
B	4009	4009	4009	4009	5183	5412	6757	4540
C	3162	3162	3162	3162	4555	4541	5599	3450
C1	2758	2758	2758	2758	4328	4158	5072	3190
C2	1896	1896	1896	1896	3427	6318	4762	2493
D	5152	5152	5152	5152	6814	7617	6207	5396
E	7045	7045	7045	7045	8608	6416	6121	6703
F	6616	6616	6616	6616	7841	4427	4325	6323
G	5822	5822	5822	5822	5369	4213	2976	5997
H	5539	5539	5539	5539	5132	2479	3221	6079
I	3637	3637	3637	3637	3169	2291	2469	4546
J	2148	2148	2148	2148	1383	2518	4757	2173
K	4440	4440	4440	4440	3817	5199	7471	4739

Distance between residential area and opencast pit 2039 east 3 in meters								
Residential area	**Clearing and grubbing of the footprint**	**Earth drilling**	**Hauling vehicles**	**Generator**	**Shaft position**	**Conveyor**	**MRF**	**Middle of opencast pit**
A	3328	3328	3328	3328	4437	5300	6854	3414
B	3843	3843	3843	3843	5183	5412	6757	3967
C	3321	3321	3321	3321	4555	4541	5599	3381
C1	3082	3082	3082	3082	4328	4158	5072	3159
C2	2283	2283	2283	2283	3427	6318	4762	2375
D	5689	5689	5689	5689	6814	7617	6207	5754
E	8027	8027	8027	8027	8608	6416	6121	6703
F	7763	7763	7763	7763	7841	4427	4325	6323
G	6424	6424	6424	6424	5369	4213	2976	5997
H	6145	6145	6145	6145	5132	2479	3221	6079
I	4097	4097	4097	4097	3169	2291	2469	4546
J	914	914	914	914	1383	2518	4757	1140
K	3462	3462	3462	3462	3817	5199	7471	3631