ENVIRONMENTAL NOISE IMPACT ASSESSMENT

FOR THE PROPOSED MINING ACTIVITIES ON THE FARM WELTEVREDEN 381 JT

NORTHERN COAL (PTY) LTD.

MAY 2009

Environmental Solutions Provider

Prepared By:
Digby Wells & Associates
Environmental Solutions Provider
Private Bag X10046,
Randburg, 2125,
South Africa
Tel: +27 (11) 789-9495
Fax: +27 (11) 789-9498
E-Mail: info@digbywells.co.za

This document has been prepared by **Digby Wells & Associates (Pty) Ltd** © 2009

Name	Responsibility	Signature	Date
Lukas Sadler *EAP*	Report Writer		
Andrew Husted *EAP*	Review		

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk. While DWA takes reasonable care to ensure the accuracy of the information in this report, neither DWA nor any of its directors, officers or employees shall be held responsible for any losses or liabilities arising from the use of this information.

This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without DWA's prior written consent.

EXECUTIVE SUMMARY

Digby Wells and Associates (DWA) was commissioned by Northern Coal (Pty) Ltd to carry out an environmental noise impact assessment for the proposed Northern Coal mining operations for the Weltevreden project.

Baseline noise measurements were conducted at relevant receptors within a 2km radius around the area where the mining activities are proposed to take place. In total there were seven sampling points, they are WN1, WN2, WN3, and WN4, WN5, WN6 and WN7. The measurements were taken once during the day and once during the night time for a period no less then 30 minutes.

The results were compared to the rating levels established by the South African Bureau of Standards (SABS). The South African National Standard for "the measurement of environmental noise with respect to land use, health, annoyance and speech communication" (SANS 10103:2008) underwritten by SABS, gives guidelines for acceptable rating levels for ambient noise in various districts for land use purposes.

Most of the daytime results taken during a weekday and/or weekend period indicate that the levels at the various receptors were below the maximum acceptable rating level for rural districts, the few that were slightly higher were due to noise associated with domestic and farm animals such as dogs and cows, as well as noise associated with traffic on the R33. The night time measurements that were slightly higher, may have been attributed to the *Kassina senegalensis* (Bubbling Kassina), *Semnodactylus wealii* (Rattling frog), and the *Orthoptera spp.* (Crickets) in the area. The vehicular activity on the R33 during the night time periods also contributed to the relatively high noise levels at receptor points WN3 and WN4.

The highest noise level was measured at sample point WN3. The high noise level was caused by the vehicular activity on the R33, which is running adjacent to the farmstead.

During the construction and operational phase, the continuous mining activities will impact significantly on receptor location WN7, which is why strict attention should be given to the mitigation measures put forward in this report. The continuous mining activities throughout the construction, operational and decommissioning phases have a low significance of impact on the rest of the receptors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 TERMS OF REFERENCE

Digby Wells and Associated (DWA) was commissioned by Northern Coal (Pty) Ltd to carry out an environmental noise impact assessment for the proposed mining activities on portion 15 & 16 of the farm Weltevreden 381 JT. The purpose of the study was to assess the impact of the proposed mining activities on the ambient noise climate of the area, which is primarily rural. The approach used in investigating noise impacts is based on guidelines provided by the South African National Standards (SANS). The following legislation was considered for this survey:

- The National Environmental Management Act (Act no 107 of 1998), NEMA;
- The National Environmental Management Air Quality Act (Act no 39 of 2004), NEMAQA; and
- The Environment Conservation Act, 1989 (Act 73 of 1989).

The Environmental Noise Impact Assessment report will present baseline noise measurements taken at identified receptors, predicted noise impacts on the identified receptors during the various mining phases as well as recommendations and mitigation measures thereof.

2 INTRODUCTION

Mining is a major contributor to environmental noise pollution, with noise sources such as blasting as well as machinery used during construction, operation and decommissioning. These noise sources impact on the local ambient noise levels. There are three major categories of noise sources associated with mining. They are:

- Fixed equipment or process operations (generators, pumps, electrical equipment, crushers, drilling);
- Mobile equipment or process operations (haulage, service operations); and
- Blasting operations.

Baseline noise measurements in support of an environmental noise impact assessment were performed for the proposed Weltevreden project. The baseline noise measurements were done to determine the present ambient noise levels at the chosen receptors.

The approach used in investigating noise impacts is based on guidelines provided by the South African National Standards (SANS). Currently there are no statutory regulations governing environmental noise emissions and SANS have no documented standards describing acceptable noise levels for mining. The SANS10103:2008 “The measurement and rating of environmental noise with respect to health, land use, annoyance and to speech communication” (SANS10103:2008), has thus been used to assess the noise impacts of the mining operation. The SANS10103:2008 covers methods and provides guidelines to assess working and living environments with respect to acoustic comfort, excellence, preservation of health, land use and with

respect to possible annoyance by noise. In addition the SANS 10103:2008 guidelines give the acceptable levels of noise in both residential and non residential areas.

The results of the measurements have been included in this report. Mitigation measures for the construction, operational and decommissioning phases and suitable recommendations are included in the report as well as monitoring plan to be followed throughout the life of mine.

3 METHODOLOGY

The approach used in investigating noise impacts is based on guidelines provided by SANS 10103:2008. According to the SANS 10103:2008 guidelines, the sound pressure level is often used as the measurement unit for noise guidelines. The acceptable rating levels according to SANS 10103:2008 for ambient noise in different districts (residential and non residential) are presented in Table 1.

Table 1: Acceptable rating levels for noise in districts (SANS 10103, 2008)

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level ($L_{Req,T}$) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day/night $L_{R,dn}$ [a]	Daytime $L_{Req,d}$ [b]	Night-time $L_{Req,n}$ [b]	Day/night $L_{R,dn}$ [a]	Daytime $L_{Req,d}$ [b]	Night-time $L_{Req,n}$ [b]
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 one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.

NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken, and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7. (See also annex B.)

NOTE 3 In districts where outdoor $L_{R,dn}$ exceeds 55 dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor $L_{Req,T}$ values in line with those given in table 1.

NOTE 4 For industrial districts, the $L_{R,dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24 h day/night cycle, $L_{Req,d} = L_{Req,n} = 70$ dBA can be considered as typical and normal.

NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.

NOTE 6 The noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum A-weighted sound pressure level of 50 dBA at a distance of 15 m from each individual source.

a The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day.

b The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.

The probable community/group response to levels in excess of the acceptable rating levels are presented in Table 2, where LReq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less then 30 minutes. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Table 2: Categories of community/group response (SANS 10103, 2008)

1	2	3
Excess ($\Delta L_{Req,T}$)[a] dBA	**Estimated community or group response**	
	Category	**Description**
0 to 10	Little	Sporadic complaints
5 to 15	Medium	Widespread complaints
10 to 20	Strong	Threats of community or group action
>15	Very strong	Vigorous community or group action

NOTE Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.

[a] $\Delta L_{Req,T}$ should be calculated from the appropriate of the following:

1) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation);

2) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;

3) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or

4) $\Delta L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.

Baseline noise measurements were taken at all relevant sensitive noise receptors, within a radius of two kilometres from the mining activities, such as various farmsteads and informal settlements. The reason for the two kilometre buffer zone is because according to the Concawe method (SANS 10357) of calculating noise propagation, the specific noise levels produced by the heavy earth moving equipment and haul trucks that operate continuously will not impact beyond two kilometres The sampling points are presented in **Appendix A**

According to the SANS 10103:2008 guidelines, ‘daytime’ constitutes anytime between 06:00 to 22:00, and ‘night time’ constitutes anytime between 22:00 to 06:00. As a result of these guidelines, measurements were taken once during the daytime and once during night time at each identified noise receptor. Monitoring was taken at a measurement of 1.5 meters above ground level, and for a minimum period of 30 minutes (SANS 10103:2008).

With the close proximity of receptor WN7 to the proposed mining activities it is predicted that the specific receptor will be impacted on considerably, therefore full day and night time measurements were taken at receptor WN7 during a weekend (includes Saturday and Sunday) and weekday. Daytime measurements were taken for 16 hours between 06:00 – 22:00 and night time measurements were taken for 8 hours between 22:00 – 06:00.

The noise monitor used was a Quest Model 1200 Precision Integrated Sound Level Meter and was calibrated (calibration certificates are available on request).

A list of identified receptors within the 2km range where noise measurements were taken is presented in Table 3. Photographs of the identified receptors are presented in Figure 1 to Figure 13.

Table 3: Identified receptors

Code	Farm	Portion	Owner	Figure
WN1	Weltevreden 381 JT	15	Mrs Lotter	1 & 2
WN2	Weltevreden 381 JT	2	Mrs Lotter	3 & 4
WN3	Vogelstruispoort 384 JT	1	Mr Potgieter	5 & 6
WN4	Blyvooruitzicht 383 JT	4	Mr Kotze	7 & 8
WN5	Zoekop 426 JS	4	Mr Viljoen	9 & 10
WN6	Zoekop 426 JS	8	Mr Gerrits	11 & 12
WN7	Zoekop 426 JS	10	Mr Pretorius	13

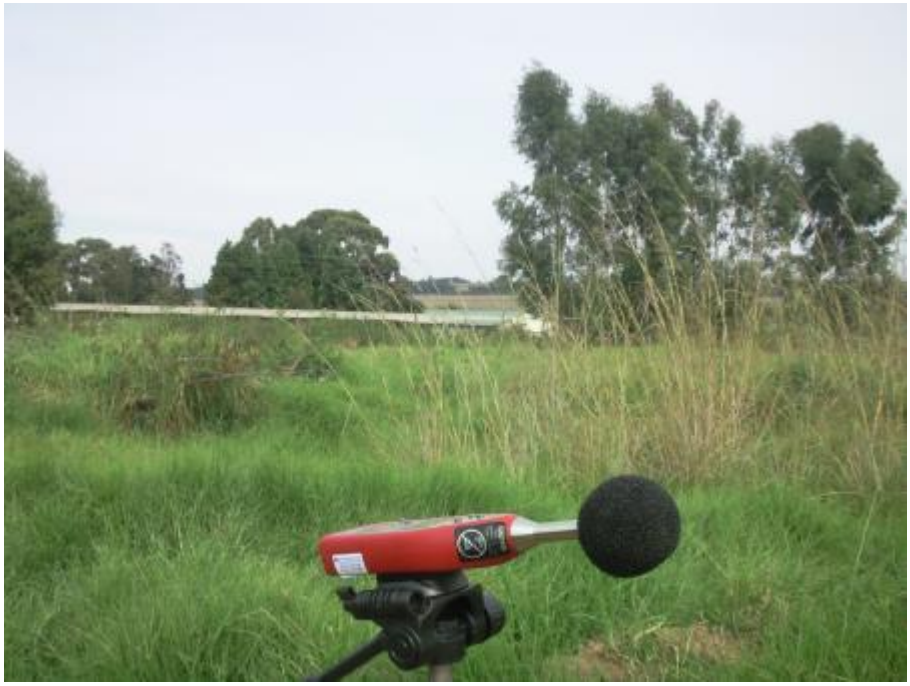

Figure 1: Noise sample point (WN1) taken on the south western border of the proposed site near farmhouse of Mr Pretorius residing on portion 10 of the farm Zoekop; view towards farmhouse.

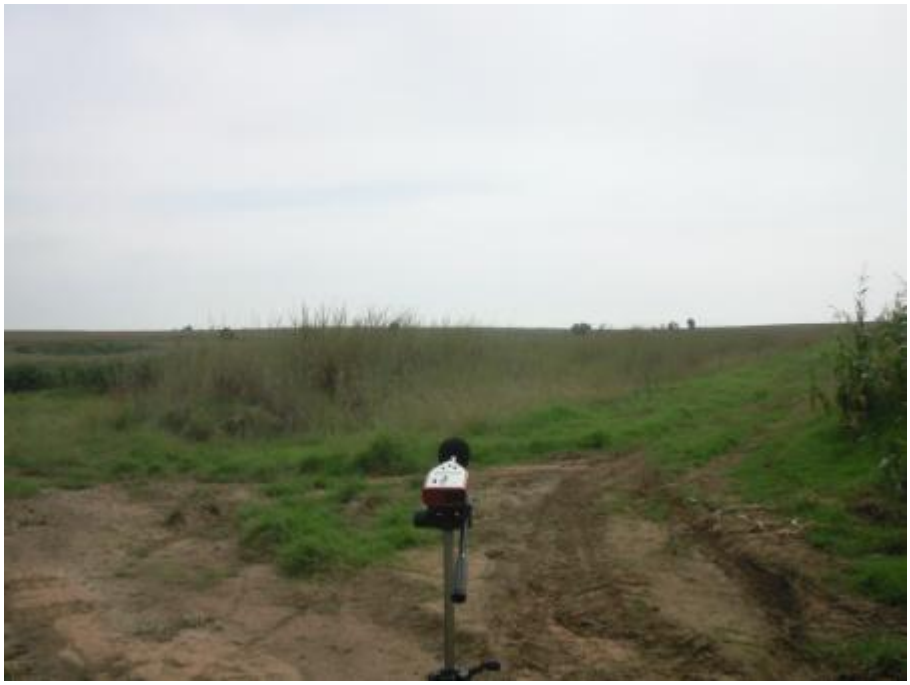

Figure 2: Noise sample point WN1; view towards the proposed mining activities

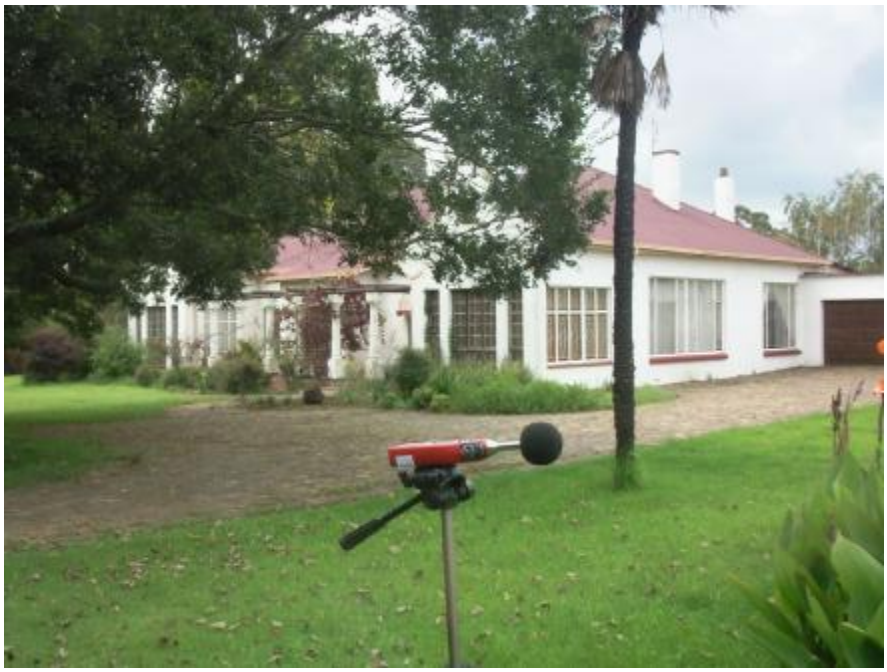

Figure 3: Noise sample point WN2; view towards the farmhouse

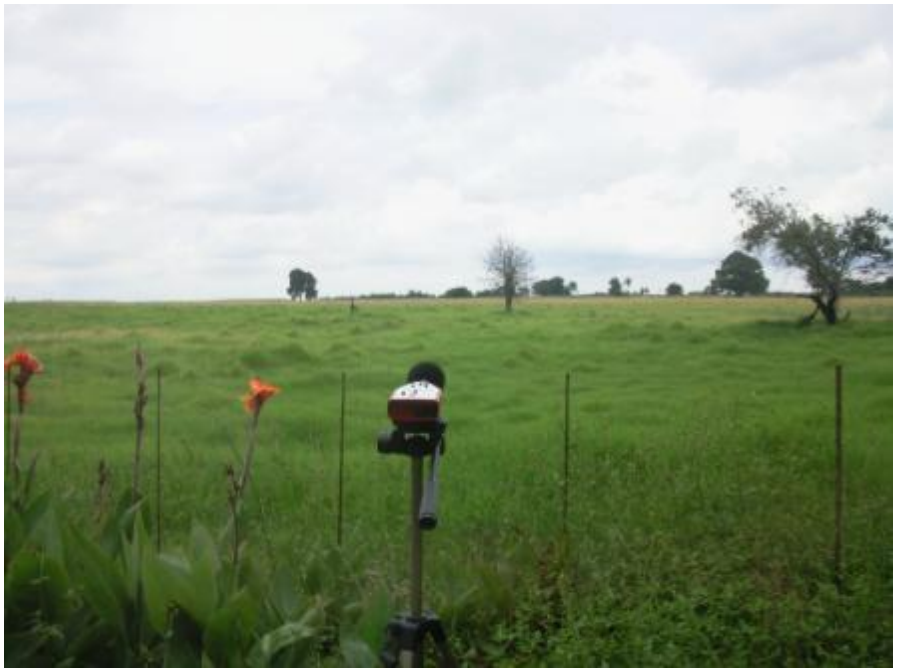

Figure 4: Noise sample point WN2; view towards the proposed mining activities

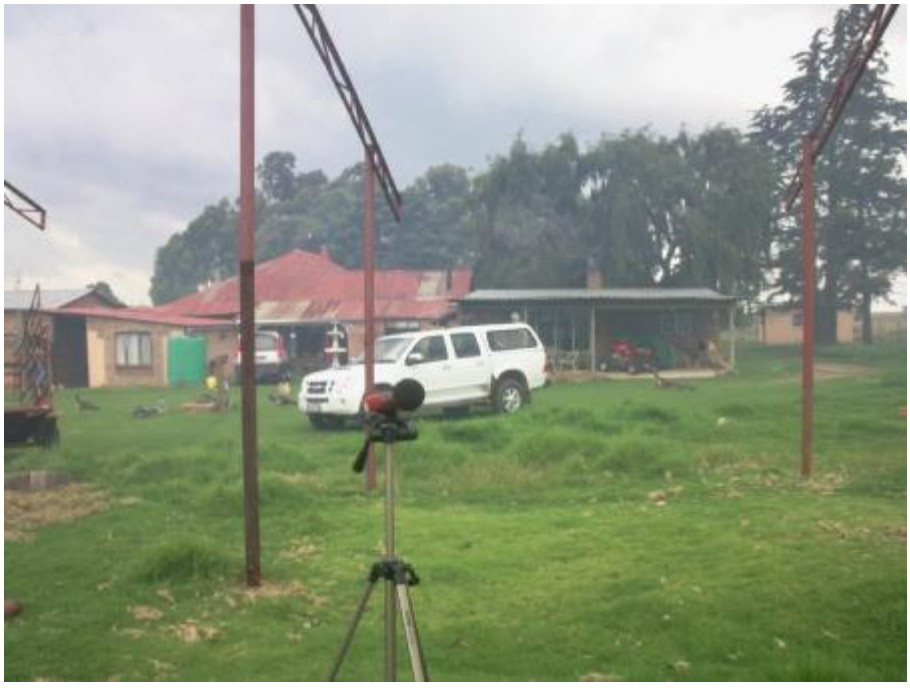

Figure 5: Noise sample point WN3; view towards farmhouse

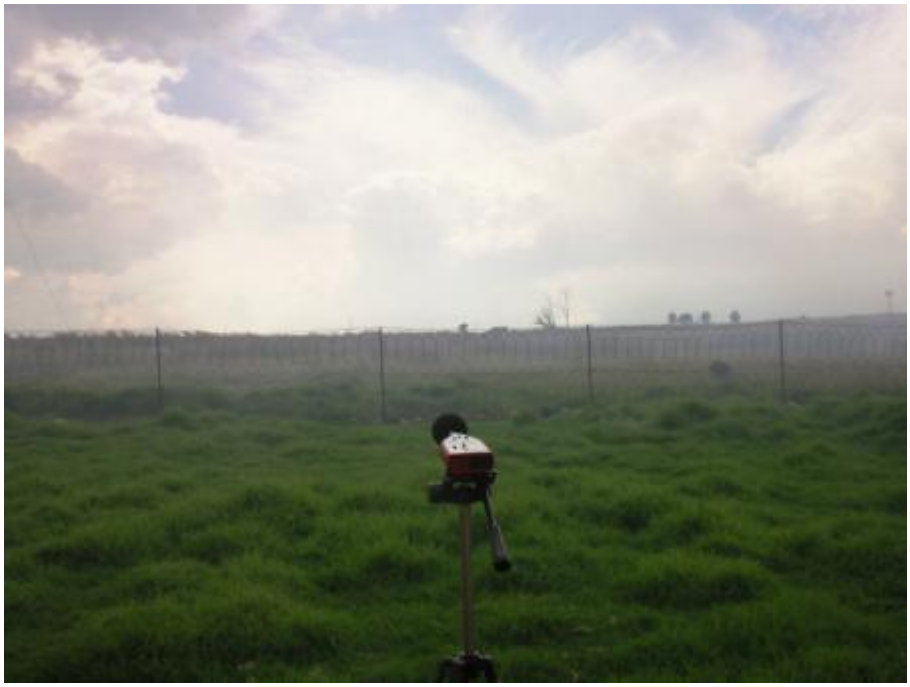

Figure 6: Noise sample point WN3; view towards the proposed mining activities

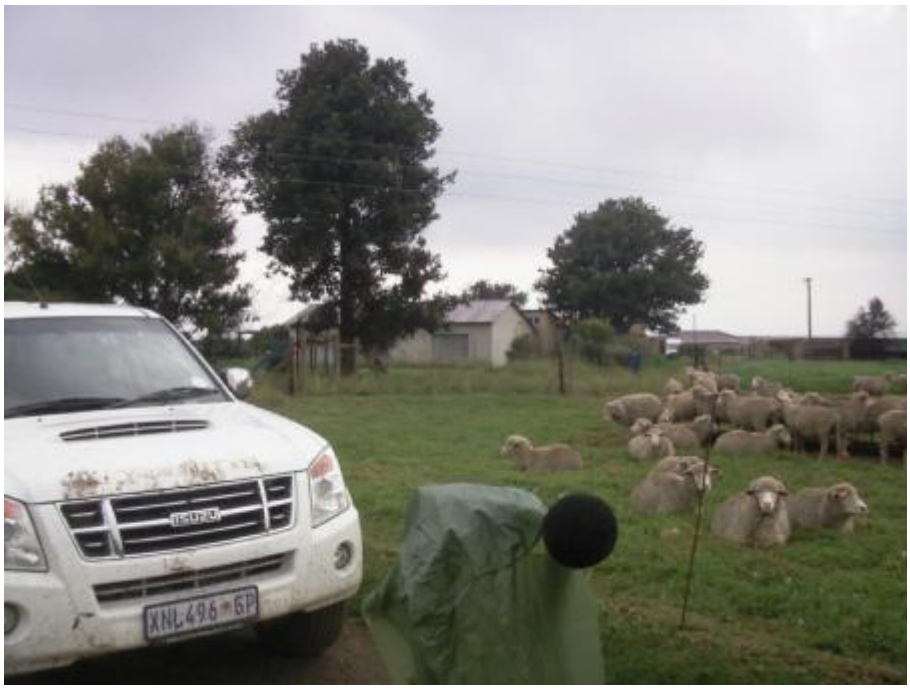

Figure 7: Noise sample point WN4; view towards the farmhouse

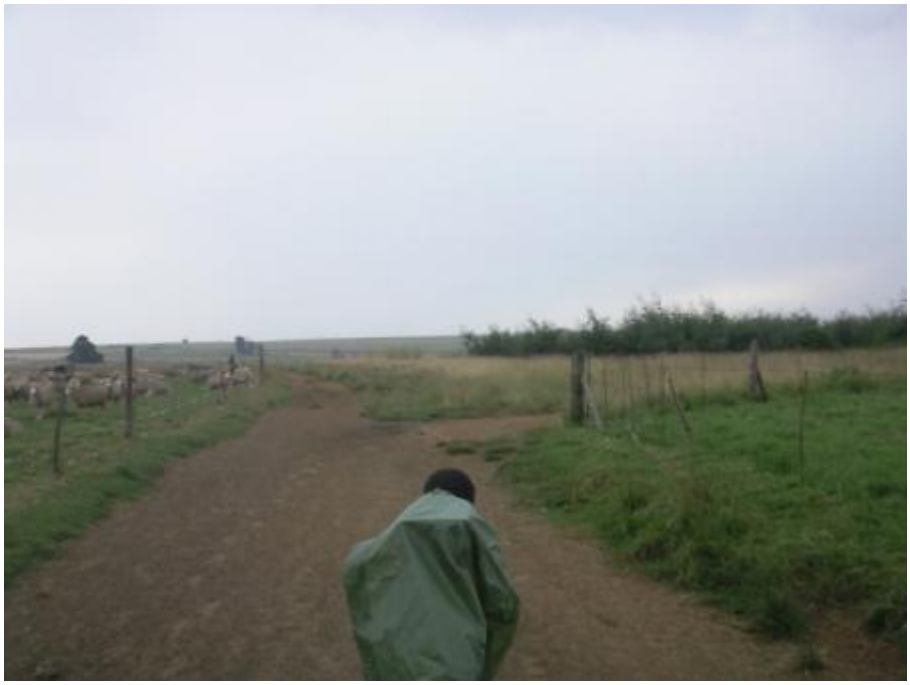

Figure 8: Noise sample point WN4; view towards the proposed mining activities

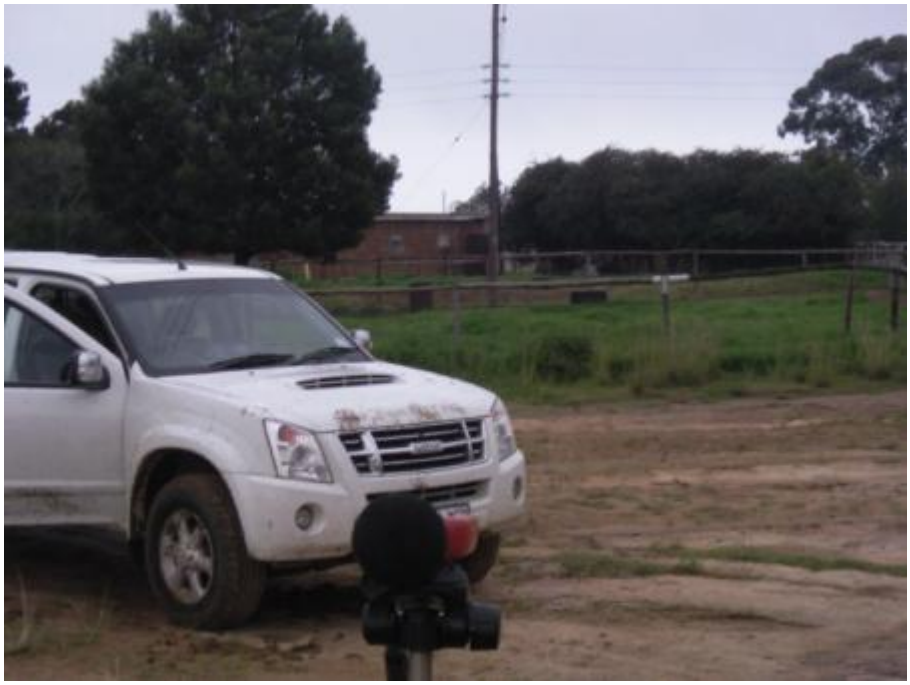

Figure 9: Noise sample point WN5; view towards the farmhouse

Figure 10: Noise sample point WN5; view towards the proposed mining activities

Figure 11: Noise sample point WN6; view towards the farmhouse

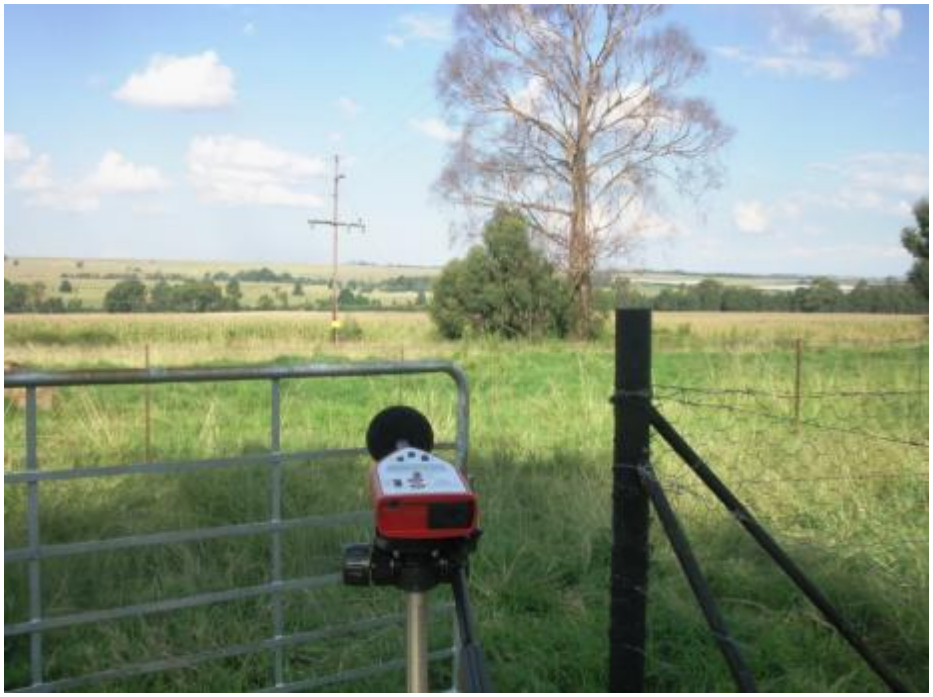

Figure 12: Noise sample point WN6; view towards the proposed mining activities

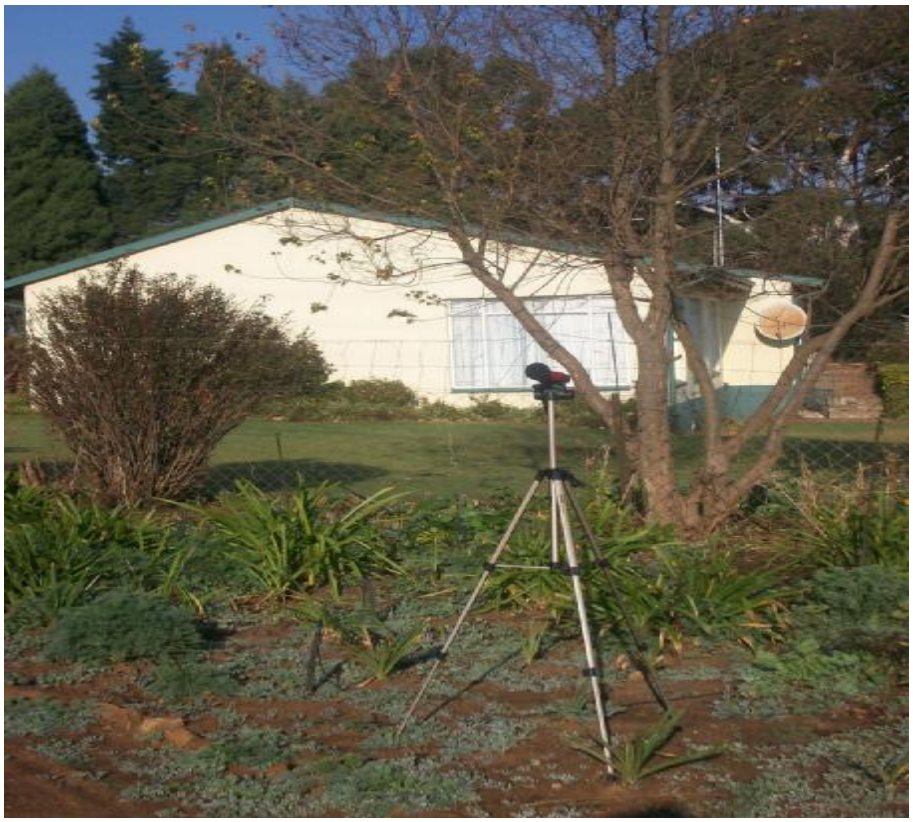

Figure 13: Noise sample point WN6; view towards the farmhouse

4 RESULTS

The results of the baseline environmental noise measurements taken during the day and night time on a weekday are presented in Table 4 below and measurements taken during the day and night time on a weekend are presented in Table 5.

Table 4: Results of baseline environmental noise measurements taken during a weekday

ID	Rural districts (dB)	LAeq,t (dB)	Maximum (dB)	Minimum (dB)	Date & Time	Period
WN1	45	37.1	49.6	30.9	09/03/09 09:30 -10:30	Day
WN2	45	39.4	51.2	31.5	09/03/09 11:30 -12:30	Day
WN3	45	49.8	67.6	33.2	09/03/09 13:00 -13:47	Day
WN4	45	41.1	59.6	30.8	09/03/09 17:00 -17:48	Day
WN5	45	36.3	57.2	30.4	09/03/09 18:00 -18:45	Day
WN6	45	40.3	59	32.1	10/03/09 08:00 -09:00	Day
WN7	45	55.1	87.6	29	22/06/09 06:00 -22:00	Day
WN1	35	36.7	44.5	31.2	26/03/09 00:50 -01:20	Night
WN2	35	45.4	53.4	40.6	26/03/09 01:25 -01:55	Night
WN3	35	46.9	51.9	37.4	25/03/09 22:00 -22:30	Night
WN4	35	43.7	52.6	37.1	25/03/09 22:35 -23:05	Night
WN5	35	44.7	53	35.2	26/03/09 00:07 -00:37	Night
WN6	35	35.3	48.3	32.1	25/03/09 23:30 -00:00	Night
WN7	35	36.6	65.4	30	22/06/09 22:00 -06:00	Night
	Indicates LAeq,t levels above either the Daytime noise limit or the Night time noise limit					

Note: LAeq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less then 30 minutes. 'A weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Table 5: Results of baseline environmental noise measurements, taken during a weekend

Sample	SANS Rating Limit	Measurements Period				
ID	Rural districts (dB)	LAeq,t (dB)	Maximum (dB)	Minimum (dB)	Date & Time	Period
WN1	45	48.7	54.7	41.6	22/03/09 11:45 -12:45	Day
WN2	45	44.3	57.6	31.8	22/03/09 18:15 -18:45	Day
WN3	45	50.1	66	29.9	22/03/09 13:00 -14:00	Day
WN4	45	39	55.6	30.6	22/03/09 14:30 -15:30	Day
WN5	45	40.3	53.2	32.3	22/03/09 17:00 -18:00	Day
WN6	45	41.7	62.7	30.6	20/06/09 06:00 -22:00 & 21/06/09 06:00 -22:00	Day
WN7	45	45.9	75.9	28.3	22/03/09 15:45 -16:46	Day
WN1	35	42.3	45.2	32.8	23/03/09 01:00 -01:30	Night
WN2	35	34.6	39.4	33	23/03/09 01:35 -02:05	Night
WN3	35	30.2	50	28.4	22/03/09 22:00 -22:35	Night
WN4	35	31.5	39.4	30.3	22/03/09 23:00 -23:30	Night
WN5	35	43.1	51.9	36.7	22/03/09 23:45 -00:15	Night
WN6	35	40.4	47.4	35.6	23/03/09 00:20 -00:50	Night
WN7	35	43.6	68.5	37.6	20/06/09 06:00 -22:00 & 21/06/09 06:00 -22:00	Night
	Indicates LAeq,t levels above either the Daytime noise limit or the Night time noise limit					

Note: LAeq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less then 30 minutes. 'A weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Sample point WN1:

The sample was taken on the south western border of the proposed site, which is on portion 16 of the farm Weltevreden 381 JT, near the farmhouse of Mr Pretorius residing on portion 10 of the farm Zoekop 426 JS. The daytime Leq level measured 43.7 dB during the weekday and 48.7 dB during the weekend. The weekday measurement is below the limit of 45 dB for rural districts and weekend measurement is slightly above. There was no apparent noise source that caused the weekend measurement to be slightly above the limit for rural districts.

The night time Leq level measured 36.7 dB during the weekday and 42.3 dB during the weekend. Both measurements are above the night time limit for rural districts. The cause of the slightly high level may be attributed to the noise generated by the *Kassina senegalensis* (Bubbling Kassina) and *Semnodactylus wealii* (Rattling frog), as well as the high pitch sound made by the *Orthoptera spp*. (Crickets) in the area.

Sample point WN2:

The sample was taken at the farmhouse on portion 2 of the farm Weltevreden 381 JT. The daytime Leq level measured 39.4 dB during the weekday and 44.3 dB during the weekend, both measurements are below the daytime limit for rural districts.

The night time Leq level measured 45.4 dB during the weekday and 34.6 dB during the weekend. The weekday measurement is above the night time limit for rural districts. There was no apparent noise source that caused the weekend measurement to be slightly above the limit for rural districts.

Sample point WN3:

The sample was taken at the farmstead of Mr Potgieter, who resides on portion 1 of the farm Vogelstruispoort 384 JT. The daytime Leq level measured 49.8 dB during the weekday and 50.1 dB during the weekend. Both measurements are above the limit of 45 dB for rural districts. The cause of the high level may be attributed to the noise generated by the vehicular activity on the R33, which runs adjacent to the property.

The night time Leq level measured 46.9 dB during the weekday and 30.2 dB during the weekend. The cause of the high level of the weekday measurement may be attributed to the noise generated by the vehicular activity on the R33. The potential reason for the difference between the weekday and weekend measurement taking during the night time may be attributed to the reduction in vehicular activity on the R33 over weekend periods.

Sample point WN4:

The sample was taken at the residence of Mr Kotze, residing on portion 4 of the farm Blyvooruitzicht 383 JT. The daytime Leq level measured 41.1 dB during the weekday and 39 dB during the weekend, both measurements are below the daytime limit for rural districts.

The night time Leq level measured 43.7 dB during the weekday and 31.5 dB during the weekend. The weekday measurement is above the night time limit for rural districts. The cause of the level during the weekday may be attributed to the noise generated by the vehicular activity on the R33, which is located 670 meters to the east of the farmstead.

Sample point WN5:

The sample was taken at the residence of Mr Viljoen, who resides on portion 4 of the farm Zoekop 426 JS. The daytime Leq level measured 36.3 dB during the weekday and 40.3 dB during the weekend, both measurements are below the daytime limit for rural districts.

The night time Leq level measured 44.7 dB during the weekday and 43.1 dB during the weekend, both measurements are above the night time limit for rural districts. The cause of the high level may be attributed the high pitch sound made by the ***Orthoptera spp***. (Crickets) in the area as well the noise generated by the ***Kassina senegalensis*** (Bubbling Kassina) and ***Semnodactylus wealii*** (Rattling frog).

Sample point WN6:

The sample was taken at the residence of Mr Gerritz, who resides on portion 8 of the farm Zoekop 426 JS. The daytime Leq level measured 40.3 dB during the weekday and 41.7 dB during the weekend, both measurements are below the daytime limit for rural districts.

The night time Leq level measurement was 35.3 dB during the weekday and 40.4 dB during the weekend. The weekend measurement is slightly higher then the night time limit for rural districts. The cause of the slightly higher level may be attributed to the constant barking of the small dog on the property.

Sample point WN7:

The sample was taken at the residence of Mr Pretorius who resides on portion 10 of the farm Zoekop 426 JS. The daytime Leq level measured 55.1 dB during the weekday and 45.9 dB during the weekend, the weekday measurement is above the both the daytime limit for rural districts and the weekend measurement was equal to the daytime limit. The cause of the high level during the weekday may be attributed to the birdsong on the farmstead.

The night time Leq level measured 36.6 dB during the weekday and 43.6 dB during the weekend. Both the measurements are slightly higher then the night time limit for rural districts. There was no apparent noise source that caused the levels to be above the night time limit.

5 DISCUSSION OF RESULTS:

Based on the results from the baseline environmental noise measurements it is noted that the day time ambient noise levels in and around site are between 36dB and 55dB during the weekday measurements, and between 39dB and 51dB during the weekend measurements, ranging from within the acceptable outdoor rating levels for ambient noise in a rural district to slightly above. The reason of the Lreq,t levels being above the acceptable range limit may be attributed to noises associated with the vehicular activity on the, especially influencing the levels at receptor points WN3 and WN4.

The night time ambient noise levels in and around site are between 35dB and 47dB during the weekday measurements and between 30dB and 44dB during the weekend measurements, ranging from within the acceptable outdoor rating levels for ambient noise in a rural district to slightly above. The reason of the Lreq,t levels being above the acceptable range limit may be attributed to the noise generated by a dog barking at receptor point WN6, noise generated by ***Kassina senegalensis*** (Bubbling Kassina) and ***Semnodactylus wealii*** (Rattling frog), as well as the high pitch sound made by the ***Orthoptera spp.*** (Crickets), which are common in the area.

6 ENVIRONMENTAL IMPACT ASSESSMENT

6.1 Predicted impacts:

Mining activities do generate noise from the various sources. The predicted noise levels of the primary noise sources are presented in Table 6.

Table 6: Noise levels at source

Activity	Noise level at source measured in dBA
Blasting	± 120
Compressors	± 91
Dozer	± 110
Excavator	± 106
Front end Loader	± 105
Haul trucks	± 110
Light delivery vehicles	± 80

The earth moving equipment and haul trucks on site are the primary source for continuous noise generated by the mining activities. Blasting activities cause the highest noise levels but are of an impulsive nature.

The most important factors affecting noise propagation and that were used to calculate the specific noise levels of the mining activities at the receptors are (Brüel & Kjær, Sound & Vibration Measurement A/S. 2001):

- Type of source (point or line)
- Distance from source
- Atmospheric absorption
- Wind
- Temperature and temperature gradient
- Obstacles such as barriers and buildings
- Ground absorption
- Humidity

6.2 Impact Assessment for the various phases of the project

The SANS 10357:2004 “The calculation of sound propagation by the Concawe method” addresses a method for calculation of sound propagation taking into account the factors mentioned above.

The tables below present the calculated daytime noise levels of the various mining activities at the receptor points during the wet season as well as during the dry windy season. Table 7 presents the calculated daytime noise levels for the construction phase during the wet season, Table 8 presents the calculated daytime noise levels for the construction phase during the dry windy season,

6.2.1. Construction phase

Table 7: Calculated increase in the ambient noise level for the construction phase during the wet season

Sampling point	Weekday baseline noise measurement dB (Daytime)	Weekend baseline noise measurements dB (Daytime)	Average between the Weekday and Weekend measurements dB	Distance from proposed mining activities as per current mine plan (m)	Activity	Calculated noise level from activity at specific receptor point (dB);	Difference between calculated and average baseline ambient noise dB
WN1	37.1	48.7	42.9	600 m	Construction machinery that will be active during construction phase	55.1	12.2
					Blasting	65.7	22.8
WN2	39.4	44.3	41.85	1000 m	Construction machinery that will be active during construction phase	40.7	0
					Blasting	51.6	9.75
WN3	49.8	50.1	49.95	1650 m	Construction machinery that will be active during construction phase	38.7	0
					Blasting	49.7	0
WN4	41.1	39	40.05	1050 m	Construction machinery that will be active during construction phase	40.1	0.05
					Blasting	51	10.95
WN5	36.3	40.3	38.3	1900 m	Construction machinery that will be active during construction phase	28.1	0
					Blasting	44.9	6.6
WN6	40.3	41.7	41	2500 m	Construction machinery that will be active during construction phase	24.1	0
					Blasting	48.4	7.4
WN7	55.1	45.9	50.5	800 m	Construction machinery that will be active during construction phase	51.8	1.3
					Blasting	62.5	12

Note : The following meteorological conditions were used to calculate the noise levels at the receptors; temperature 25° C; relative humidity 60%; dominant wind direction north east; wind speed 3 m/s.

Table 8: Calculated increase in the ambient noise level for the construction phase during the dry windy season

Sampling point	Weekday baseline noise measurement dB (Daytime)	Weekend baseline noise measurements dB (Daytime)	Average between the Weekday and Weekend measurements dB	Distance from proposed mining activities as per current mine plan (m)	Activity	Calculated noise level from activity at specific receptor point (dB);	Difference between calculated and average baseline ambient noise dB
WN1	37.1	48.7	42.9	600 m	Construction machinery that will be active during construction phase	58.2	15.3
					Blasting	68.5	25.6
WN2	39.4	44.3	41.85	1000 m	Construction machinery that will be active during construction phase	42.8	0.95
					Blasting	53.3	11.45
WN3	49.8	50.1	49.95	1650 m	Construction machinery that will be active during construction phase	42	0
					Blasting	52.7	2.75
WN4	41.1	39	40.05	1050 m	Construction machinery that will be active during construction phase	42.2	2.15
					Blasting	52.8	12.75
WN5	36.3	40.3	38.3	1900 m	Construction machinery that will be active during construction phase	28.1	0
					Blasting	47.8	9.5
WN6	40.3	41.7	41	2500 m	Construction machinery that will be active during construction phase	24.1	0
					Blasting	48.3	7.3
WN7	55.1	45.9	50.5	800 m	Construction machinery that will be active during construction phase	55.2	4.7
					Blasting	65.6	15.1

Note : The following meteorological conditions were used to calculate the noise levels at the receptors; temperature 15° C; relative humidity 40%; dominant wind direction north; wind speed 6 m/s.

Impact: Construction machinery which is responsible for the initial removal of topsoil and overburden, as well as for the construction of hydrocarbons storage facilities, temporary office and ablutions, water management facilities, pollution control dams and the upgrade and widening of haul road will generate noise. The key noise producing operations during this phase will be the blasting operations required to allow for the establishment of the initial box cut.

According to the calculated noise levels of the mining activities at the receptor locations, the noise from the construction machinery will measure above the SANS 10103:2008 daytime noise limit guidelines for rural districts at receptor points WN7, during the wet season as well as during the dry windy season. The difference between the calculated noise level and the average baseline noise level at the mentioned receptor points, during the wet season and dry windy season is between 12 and 15 decibels (dB). An increase of about 8−10 dB is required before the sound subjectively appears to be significantly louder (Brüel & Kjær, Sound & Vibration Measurement A/S. 2001). The noise from the construction machinery will therefore impact significantly on receptor location WN7.

According to Table 7 and Table 8, the noise from the blasting activities will measure above the SANS 10103:2008 daytime noise limit guidelines for rural districts at all receptor locations, but will only impact significantly on receptor locations WN2, WN4 and WN7 because the difference between the calculated noise levels and the average noise levels are greater then 8 dB. The noise from the blasting activities will only impact significantly on receptor location WN5 during the dry windy season as seen on Table 8.

Significance: During the construction phase at the proposed Weltevreden project site, the significance of the impact of the noise from the construction machinery will be medium-high and have a rating of 50/100. The overall significance of the impact of the blasting operations on the surrounding receptors will be medium-high for a short duration and mitigation is required.

Mitigation: to ensure that the noise generated by the Mining-related machinery and vehicles stay below the SANS 10103:2008 noise limit guidelines, the following is recommended: Mining-related machinery and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers, as well as installing broad band reverse alarms. Standard reversing alarms are typically a source of annoyance for nearby residents. Broadband alarms emit a directional, lower, less intrusive sound and are important in minimising the impact of night works on nearby residents. Broadband sound is also localised so that when the vehicle has passed by, the sound of the alarm is diminished, and reducing the noise disturbance from construction activities, which should be limited to daylight hours.

As for the blasting operations it is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. The following with regards to blasting operations should be applied:

- The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended (Sengupta, M.1993);

- Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed (Sengupta, M.1993);
- Areas to be clearly demarcated and signs to be erected indicating blasting zones etc;
- Workers to be required to be trained in safety and to wear personal protective equipment e.g. ear plugs; and
- An environmental noise-monitoring programme should be implemented when construction of the proposed Weltevreden project commence. Noise measurements should be conducted on an ongoing basis at noise sensitive areas and mine management should be advised of any significant increase in the ambient sound level as construction continues.

The following tables present the calculated daytime and night time noise levels of the various mining activities at the receptor points during the wet season as well as during the dry windy season. Table 9 presents the calculated day and night time noise levels for the operational phase during the wet season, Table 10 presents the calculated day and night time noise levels for the operational phase during the dry windy season,

6.2.2. Operational phase

Table 9: Calculated increase in the ambient noise level for the operational phase during the wet season

Sampling point	Weekday baseline noise measurement dB (Daytime/Night time)	Weekend baseline noise measurement dB (Daytime/Night time)	Average between Weekday and Weekend baseline noise measurements (Daytime/Night time)	Distance from proposed mining activities as per current mine plan (m)	Activity	Calculated noise level from activity at specific receptor point (dB);(Daytime/Night time)	Difference between calculated and average baseline ambient noise dB
WN1	37.1 / 36.7	48.7 / 42.3	42.9 / 39.5	600 m	Truck and shovel activities that will be active during operational phase	48 / 49	5.1 / 9.5
					Crusher	55 / 55	12.1 / 15.5
					Haul trucks	54 / 54	11.1 / 14.5
					Blasting	66 / 66	23.1 / 26.5
WN2	39.4 / 45.4	44.3 / 34.6	41.9 / 40	1000 m	Truck and shovel activities that will be active during operational phase	35 / 36	0 / 0
					Crusher	42 / 43	0.1 / 3
					Haul trucks	40 / 40	0 / 0
					Blasting	52 / 52	10.1 / 12
WN3	49.8 / 46.9	50.1 / 30.2	49.9 / 38.6	1650 m	Truck and shovel activities that will be active during operational phase	33 / 34	0 / 0
					Crusher	41 / 41	0 / 2.4
					Haul trucks	38 / 39	0 / 0.4
					Blasting	50 / 51	0.1 / 12.4
WN4	41.1 / 43.7	39 / 31.5	40.1 / 37.6	1050 m	Truck and shovel activities that will be active during operational phase	38 / 39	0 / 1.4
					Crusher	46 / 46	5.9 / 8.4
					Haul trucks	43 / 44	2.9 / 6.4
					Blasting	55 / 56	14.9 / 18.4
WN5	36.3 / 44.7	40.3 / 43.1	38.3 / 43.9	1900	Truck and shovel activities that will be active during operational phase	32 / 32	0 / 0
					Crusher	39 / 40	0.7 / 0
					Haul trucks	36 / 37	0 / 0
					Blasting	48 / 49	9.7 / 5.1
WN6	40.3 / 35.3	41.7 / 40.4	41/ / 37.9	2500	Truck and shovel activities that will be active during operational phase	32 / 33	0 / 0
					Crusher	40 / 40	0 / 2.1
					Haul trucks	37 / 38	0 / 0.1
					Blasting	48 / 50	7 / 12.1
WN7	55.1 / 36.6	45.9 / 43.6	50.5 / 40.1	800	Truck and shovel activities that will be active during operational phase	45 / 46	0 / 5.9
					Crusher	52 / 52	1.5 / 11.9
					Haul trucks	50 / 51	0 / 10.9
					Blasting	63 / 63	12.5 / 22.9

Note: The following meteorological conditions for the daytime were used to calculate the noise levels at the receptors; temperature 25° C; relative humidity 60%; dominant wind direction north east; wind speed 3 m/s and for the night time; temperature 15° C; relative humidity 70%; dominant wind direction north east; wind speed 3 m/s

Table 10: Calculated increase in the ambient noise level for the operational phase during the dry windy season

Sampling point	Weekday baseline noise measurement dB (Daytime/Night time)	Weekend baseline noise measurement dB (Daytime/Night time)	Average between Weekday and Weekend baseline noise measurements (Daytime/Night time)	Distance from proposed mining activities as per current mine plan (m)	Activity	Calculated noise level from activity at specific receptor point (dB);(Daytime/Night time)	Difference between calculated and average baseline ambient noise dB, (Daytime/Night time)
WN1	37.1 / 36.7	48.7 / 42.3	42.9 / 39.5	600 m	Truck and shovel activities that will be active during operational phase	51 / 50	8.1 / 10.5
					Crusher	57 / 56	14.1 / 16.5
					Haul trucks	56 / 56	13.1 / 16.5
					Blasting	69 / 68	26.1 / 28.5
WN2	39.4 / 45.4	44.3 / 34.6	41.9 / 40	1000 m	Truck and shovel activities that will be active during operational phase	34 / 34	0 / 0
					Crusher	42 / 41	0.1 / 1
					Haul trucks	39 / 38	0 / 0
					Blasting	50 / 49	8.1 / 9
WN3	49.8 / 46.9	50.1 / 30.2	49.9 / 38.6	1650 m	Truck and shovel activities that will be active during operational phase	36 / 35	0 / 0
					Crusher	42 / 41	0 / 2.4
					Haul trucks	41 / 40	0 / 1.4
					Blasting	53 / 52	3.1 / 13.4
WN4	41.1 / 43.7	39 / 31.5	40.1 / 37.6	1050 m	Truck and shovel activities that will be active during operational phase	40 / 39	0 / 1.4
					Crusher	47 / 46	6.9 / 8.4
					Haul trucks	45 / 44	4.9 / 6.4
					Blasting	58 / 57	17.9 / 19.4
WN5	36.3 / 44.7	40.3 / 43.1	38.3 / 43.9	1900	Truck and shovel activities that will be active during operational phase	34 / 33	0 / 0
					Crusher	41 / 40	2.7 / 0
					Haul trucks	39 / 38	0.7 / 0
					Blasting	51 / 50	12.7 / 6.1
WN6	40.3 / 35.3	41.7 / 40.4	41/ / 37.9	2500	Truck and shovel activities that will be active during operational phase	36 / 35	0 / 0
					Crusher	43 / 42	2 / 4.1
					Haul trucks	42 / 41	1 / 3.1
					Blasting	54 / 52	13 / 14.1
WN7	55.1 / 36.6	45.9 / 43.6	50.5 / 40.1	800	Truck and shovel activities that will be active during operational phase	48 / 47	0 / 6.9
					Crusher	54 / 53	3.5 / 12.9
					Haul trucks	53 / 53	2.5 / 12.9
					Blasting	66 / 65	15.5 / 24.9

Note : The following meteorological conditions for the daytime were used to calculate the noise levels at the receptors; temperature 15° C; relative humidity 40%; dominant wind direction north east; wind speed 6 m/s and for the night time; temperature 5° C; relative humidity 60%; dominant wind direction north north east; wind speed 6 m/s.

Impact: The blasting activities, crushing activities, the movement of the haul trucks on the haul roads and the truck and shovel activities on site will be the main noise producing sources during the operational phase.

According to Table 9 and Table 10, noise from the shovels, crushing activities and haul trucks will measure above the SANS 10103:2008 daytime noise limit guidelines for rural districts at receptor location WN7, but will not impact on the specific receptor because there is not much difference between the calculated noise levels and the average baseline noise levels. Noise from the crushing activities and haul trucks will impact significantly on receptor location WN7 during the night time. Noise from the shovels, crushing activities and haul trucks will not impact on the rest of the receptor locations, although the night time calculations are slightly above the SANS 10103:2008 night time noise limit guidelines for rural districts, there is not much difference between the calculated noise levels and the average baseline noise levels at the specific receptor locations.

The noise levels from the blasting activities will be above the baseline noise levels as well as above the SANS 10103:2008 daytime and night time noise limit guidelines for rural districts at most of the receptor locations .

Significance: During the operational phase at the proposed Weltevreden project site, the significance of the impact of the noise from the truck and shovel, and crushing activities will be medium-high, with a significance rating of 50/100 through out the operational phase and mitigation is required. The overall significance of the impact of the blasting operations on the surrounding receptors will be medium-high through out the operational phase and mitigation is required.

Mitigation: The following mitigation measures are recommended to ensure the noise generated by the mining-related machinery and vehicles stay below the SANS 10103:2008 noise limit guidelines:

- An environmental noise-monitoring programme should be implemented when the operation phase of the proposed Weltevreden project commences. Noise measurements should be conducted on an ongoing basis at noise sensitive areas and mine management should be advised of any significant increase in the ambient sound level as operations continue;
- Noise barriers should be constructed between main noise sources and sensitive noise receptors;
- The Crusher should be housed in an enclosure that is constructed with brick or dense concrete in order to reduce the transmission of noise into the surrounding environment;
- Sources of noise should be pointed away from residential or affected receptors;
- Optimum location of pumps etc;
- Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers; and
- Switching off equipment when not in use.

As for the blasting operations it is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. The following with regards to blasting operations is recommended:

- The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended (Sengupta, M.1993);
- Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed (Sengupta, M.1993);
- Areas to be clearly demarcated and signs to be erected indicating blasting zones etc; and
- Workers to be required to be trained in safety and to wear personal protective equipment e.g. ear plugs.

The following tables represent the calculated daytime noise levels of the various mining activities at the receptor points during the wet season as well as during the dry windy season. Table 11 presents the calculated daytime noise levels for the decommissioning phase during the wet season and Table 12 presents the calculated daytime noise levels for the decommissioning phase during the dry windy season.

6.2.3. Decommissioning phase

Table 11: Calculated increase in the ambient noise level for the decommission phase during the wet season

Sampling point	Weekday baseline noise measurement dB (Daytime)	Weekend baseline noise measurement dB (Daytime)	Average between the Weekday and Weekend measurements dB	Distance from proposed mining activities as per current mine plan (m)	Activity	Calculated noise level from activity at specific receptor point (dB)	Difference between calculated and average baseline ambient noise dB
WN1	37.1	48.7	42.9	600 m	Construction machinery that will be active during Decommissioning phase	54	11.1
WN2	39.4	44.3	41.85	1000 m	Construction machinery that will be active during Decommissioning phase	40	0
WN3	49.8	50.1	49.95	1650 m	Construction machinery that will be active during Decommissioning phase	38	0
WN4	41.1	39	40.05	1050 m	Construction machinery that will be active during Decommissioning phase	43	2.95
WN5	36.3	40.3	38.3	1900 m	Construction machinery that will be active during Decommissioning phase	36	0
WN6	40.3	41.7	41	2500 m	Construction machinery that will be active during Decommissioning phase	37	0
WN7	55.1	45.9	50.5	800 m	Construction machinery that will be active during Decommissioning phase	50	0

Note : The following meteorological conditions were used to calculate the noise levels at the receptors; temperature 25° C; relative humidity 60%; dominant wind direction north east; wind speed 3 m/s.

Table 12: Calculated increase in the ambient noise level for the decommission phase during the dry windy season

Sampling point	Weekday baseline noise measurement dB (Daytime)	Weekend baseline noise measurement dB (Daytime)	Average between the Weekday and Weekend measurements dB	Distance from proposed mining activities as per current mine plan (m)	Activity	Calculated noise level from activity at specific receptor point (dB)	Difference between calculated and average baseline ambient noise dB
WN1	37.1	48.7	42.9	600 m	Construction machinery that will be active during Decommissioning phase	56	13.1
WN2	39.4	44.3	41.85	1000 m	Construction machinery that will be active during Decommissioning phase	39	0
WN3	49.8	50.1	49.95	1650 m	Construction machinery that will be active during Decommissioning phase	41	0
WN4	41.1	39	40.05	1050 m	Construction machinery that will be active during Decommissioning phase	45	4.95
WN5	36.3	40.3	38.3	1900 m	Construction machinery that will be active during Decommissioning phase	39	0.7
WN6	40.3	41.7	41	2500 m	Construction machinery that will be active during Decommissioning phase	42	1
WN7	55.1	45.9	50.5	800 m	Construction machinery that will be active during Decommissioning phase	53	2.5

Note : The following meteorological conditions were used to calculate the noise levels at the receptors; temperature 15° C; relative humidity 40%; dominant wind direction north east; wind speed 6 m/s.

Impact: The activities of the decommissioning phase involve the following:

- dismantling and removing of infrastructure;
- filling of final void;
- spreading of subsoil and topsoil; and
- Profiling and contouring of the area to preserve natural drainage lines.

The machinery operating during the decommissioning phase will be the main noise producing sources. According to Table 11 and Table 12 the noise from the decommissioning activities will only be above the SANS 10103:2008 daytime noise limit guidelines for rural districts at receptor locations WN7, but will not impact on the specific receptor because there is not much difference between the calculated noise levels and the average baseline noise levels.

Significance: The overall significance of the impact of the mining activities on the ambient noise levels during the decommissioning phase will be low.

Mitigation: The following mitigation measures are recommended to ensure that the noise levels remain below the SANS 10103:2008 noise limits:

- Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers;
- Switching off equipment when not in use; and
- Decommissioning activities should be limited to daylight hours.

7 CUMULATIVE IMPACTS

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The proposed Weltevreden project is considered a causative source of noise pollution that will contribute to the increase of the ambient noise levels in the area, particularly due to the blasting activities, which can be heard for kilometres.

Presently noise generated in the area is predominantly caused by agricultural activities such as tractors used for ploughing and combine harvesters used for the harvesting of maize. The cumulative impact of the agricultural activities has a significance rating of 20/100 (which is of a low significance), because it only occurs at specific times of the year and occurs during the day. If the proposed mining activities on the farm of Weltevreden portions 15 and 16 take place the overall significance of the cumulative impacts of the project will have a significance rating of 50/100 (which is of a medium-high significance) due to most of the mining activities being continuous of nature and operating during day and night times. Even though the blasting will cause high noise levels at times of event, it will be of an impulsive nature and will not influence ambient noise levels on a continuous basis. In future the increase of mining activities due to more mines starting up in the area will contribute to the cumulative impacts on ambient noise levels. The cumulative impacts caused by the increased

mining activities in the area will have a significance rating of 75/100 (which is of a high significance) due to increased blasting activities that only takes place during daylight hours as well as an increase of mining vehicles operating continuously during day and night time .

Ambient noise levels from the proposed Weltevreden project area should be monitored on a regular basis to determine potential sources of noise, increases and decreases in noise levels, and determine the level of mitigation required. Once the material from the proposed Weltevreden project area have been mined, processed and decommissioned, overall ambient levels will decrease and the cumulative impact in the area could improve.

8 KNOWLEDGE GAPS

Due to the nature of the environmental noise impact assessment as well as that all baseline noise measurements were carried out to satisfactory requirements, No knowledge gaps were identified.

9 ENVIRONMENTAL MONITORING PROGRAMMES

It is recommended that a monitoring plan be implemented to monitor the noise levels generated by the mining activities, to ensure the levels remain below the SANS 10103:2008 noise limits at the relevant receptors. Components to be included in the proposed monitoring plan are discussed below:

- Baseline noise monitoring is to be conducted on a quarterly basis for a period of twelve months. A report must be compiled quarterly and submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. The measurement points must take into account noise sensitive receptors, such as farmsteads, schools, hospitals, churches etc. only sensitive areas within a radius of two kilometres from the mining activities will be taken into account. The reason for the two kilometre buffer zone is because according to the Concawe method (SANS 10357) of calculating noise propagation, the specific noise levels produced by the heavy earth moving equipment and haul trucks that operate continuously will not impact beyond two kilometres. At each measurement point the ambient noise level will be sampled in terms of the following parameters:
- The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.
- Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00).

Requirements:

The blasting schedule for the proposed project is required to ensure that the quarterly measurements can incorporate the noise levels generated by the blasting activities.

10 CONCLUSION

With regards to the baseline assessment, the daytime results taken during the weekday and weekend indicate that most of the levels at the various receptors were below the acceptable rating level for rural districts, the few noise levels that were slightly above was due to noise associated with domestic and farm animals such as dogs, sheep, birds and cows as well as vehicular activity on the R33. The night time measurements that were slightly higher, may have been attributed to the *Kassina senegalensis* (Bubbling Kassina), *Semnodactylus wealii* (Rattling frog), and *Orthoptera spp.* (Crickets) in the area. The R33 also contributed to the noise levels being above the night time limit at receptor points WN3 and WN4.

Noise levels generated by most of the mining activities at a distance of one kilometre and further will not exceed the SANS 10103:2008 noise limit guidelines for rural districts(Table 1), except for blasting which will be above the SANS 10103:2008 noise limit guidelines, but is classified as an impulsive noise source (Brüel & Kjær, 2001).

During the construction and operational phase, the mining activities will impact significantly on receptor location WN7. The continuous mining activities throughout the construction, operational and decommissioning phases have a low significance of impact on the rest of the receptors.

11 REFERENCES

South African National Standard - Code of practice, SANS 10103:2008, Edition Six, *The measurement and rating of environmental noise with respect to annoyance and to speech communication*. Available [online] http://www.sabs.co.za

South African National Standard - Code of practice, SABS 0357:2004, *The Calculation of Sound Propagation by the Concawe Method*.

National Environmental Management Act, Act no 107 of 1998

National Environmental Management Air Quality Act, Act no 39 of 2004

National Conservation Act, Act 73 of 1989

Sengupta, M. Environmental Impacts of Mining: Monitoring, Restoration, and Control.CRC Press, 1993.

Brüel & Kjær, Sound & Vibration Measurement A/S. *Environmental Noise*, 2001

Appendix A: Location Of Noise Sampling Points

Plan 14

Northern Coal Weltevreden

Noise Sampling Points

Legend

- Noise Sampling Points
- Perennial Stream
- Non-Perennial Stream
- Contours 20m
- National Route
- Main Road
- Minor Road
- Weltevreden Site
- Farms Boundary
- Farm Portion Boundary
- Dam
- Perennial Pan
- Non-Perennial Pan

© Digby Wells & Associates June 2009

Projection: Transverse Mercator
Central Meridian: Lo31
Datum: WGS84

1:25,000

0 0.25 0.5 1 1.5 2
Kilometres

Ref:/bjt.NOR335.200811.004