Proposed Rietkol Mining Operation

Air Quality Impact Assessment

PREPARED FOR:

Jacana Environmentals CC

DATE: 31 May 2021

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Proposed Rietkol Mining Operation: Air Quality Impact Report

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Table of Contents

Table of Figures

Table of Tables

Declaration of Interest

I, Stuart Thompson declare that: -

General Declaration:

- I act as the independent specialist in this application;
- I will perform work relating to the application in a manner, even if it results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have experience in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the National Environmental Management Act.

Signature of Specialist

EBS Advisory Services (Pty) Ltd.

Name of company (if applicable)

31 May 2021

Date

Summary of Requirements

In terms of the NEMA 2014 EIA Regulations contained in GN R982 of 04 December 2014 (as amended in 2017) all specialist studies must comply with Appendix 6 of the NEMA 2014 EIA Regulations (GN R982 of 04 December 2014). Table 1 shows the requirements as indicated above.

Table 1: Legal Requirements for All Specialist Studies Conducted

Legal Requirement		Relevant Section in Specialist study
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of-	
	(i) the specialist who prepared the report; and	**Appendix C.**
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	**Appendix C.**
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Page 7.**
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	**Section 1.**
(cA)	an indication of the quality and age of base data used for the specialist report;	**Section 3.**
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Section 4.C**
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	**Section 3.E**
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Section 4.**
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	**Section 4.C**
(g)	an identification of any areas to be avoided, including buffers;	**Section 4.C**
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Section 4.C** **Appendix A**
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	**Section 2.H**
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	**Section 4.D**
(k)	any mitigation measures for inclusion in the EMPr;	**Section 4.E**
(l)	any conditions for inclusion in the environmental authorisation;	**Section 4.E**
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**Section 6.**
(n)	a reasoned opinion	**Section 4.D**
	whether the proposed activity, activities or portions thereof should be authorised;	**Section 4.D**

Legal Requirement		Relevant Section in Specialist study
	regarding the acceptability of the proposed activity or activities; and	**Section 4.D**
	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	**Section 4.D**
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	**Refer to EIAR**
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	**Refer to Appendix B**
(q)	any other information requested by the competent authority.	**Not Applicable**

1. Introduction

Nhlabathi Minerals (Pty) Ltd are applying for the mining rights for Silica and associated minerals as part of the Rietkol Project, with EBS Advisory Services have been appointed to undertake the Air Quality Specialist Study. The study will focus on determining the extent of the mine's impact on the air in the region, this will be done through ambient baseline monitoring prior to mining operations, the development of an emissions inventory, and dispersion modelling of pollutants using typical meteorological conditions in the region.

As part of the impact assessment for the proposed project, a baseline assessment was undertaken which includes a review of available meteorological data to evaluate the prevailing meteorological conditions in the area. The baseline air quality situation was assessed through a review of available monitored data which was obtained from the South African Weather services, and ambient onsite monitoring through two monitoring campaigns. During the impact assessment phase, the potential impact of emissions from the proposed project on the surrounding environment was evaluated through the compilation of an emissions inventory and subsequent dispersion modelling simulations using the AERMOD dispersion model.

a. Enterprise Details

Enterprise Name	Nhlabathi Minerals (Pty) Ltd
Trading As	N/A
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc	Private Company
Company/Close Corporation/Trust Registration Number (Registration Numbers if Joint Venture)	2012/071272/07
Registered Address	Consol House, Osborn Road, Wadeville
Postal Address	PO Box 157, Delmas, 2210
Telephone Number (General)	013 665 7900
Fax Number (General)	013 665 7910
Industry Type/Nature of Trade	Silica Mining Operations
Land Use Zoning as per Town Planning Scheme	Agricultural
Land Use Rights if outside Town Planning Scheme	Agricultural
Responsible Person Name or Emission Control Officer (where appointed)	Prince Fikile Holomisa
Telephone Number	013 665 7900
Cell Phone Number	083 298 9656
Fax Number	013 665 7910
E-mail Address	fikile@silq.co.za
After Hours Contact Details	083 298 9656

b. Location and Extent of the Plant

The Rietkol Project is located in Wards 8 and 9 of the Victor Khanye Local Municipality within the Nkangala District Municipality of Mpumalanga Province. Delmas / Botleng are approximately 6 km east and Eloff 4 km south of the Mining Right Application (MRA) area. The Rietkol Project is located strategically close to major roads in the area, including the N12 (to the north-west), R50 (to the north-east) and R555 (to the south). The Springs/Durban Transnet Freight Rail (TFR) railway line is situated to the south, alongside the R555.

The Rietkol MRA covers an area of 221 ha consisting of:

- 16 Modder East Agricultural Holdings on the farm Olifantsfontein 196 IR, each approximately 4.1 ha in extent;
- Portion 71 of the farm Rietkol 237 IR; and
- A portion of Remaining Extent (RE) of portion 31 of the farm Rietkol 237 IR.

The MRA area is situated in a mixed land use area approximately 6 km west of the town of Delmas and 4 km north of the Eloff hamlet as indicated in Figure 1 below.

Table 2: Location and extent of the plant.

Physical Address of the Plant	**AH 209**	**T11927/2019**	**TOIR04410000020900000**	**Consol Glass (Pty) Ltd**
	AH 210	T8896/2019	TOIR04410000021000000	Consol Glass (Pty) Ltd
	AH 211	T38311/1969	TOIR04410000021100000	Christo Smit
	AH 212	T1558/2020	TOIR04410000021200000	Consol Glass (Pty) Ltd
	AH 213	T171746/2005	TOIR04410000021300000	Johanna Elizabeth van der Walt
	AH 214	T5414/2018	TOIR04410000021400000	Consol Glass (Pty) Ltd
	AH 215	T2743/20003	TOIR04410000021500000	Veizaj Sokol
	AH 216	T116099/2006	TOIR04410000021600000	Bheki Mthethwa Lorraine Mthethwa
	AH 217	T2918/2019	TOIR04410000021700000	Consol Glass (Pty) Ltd
	AH 218	T7171/2019	TOIR04410000021800000	Consol Glass (Pty) Ltd
	AH 219	T7171/2019	TOIR04410000021900000	Consol Glass (Pty) Ltd
	AH 220	T2918/2019	TOIR04410000022000000	Consol Glass (Pty) Ltd
	AH 221	T2918/2019	TOIR04410000022100000	Consol Glass (Pty) Ltd
	AH 222	T78652/2004	TOIR04410000022200000	Johanna Catharina Kotze Piet Kotze
	AH 223	T2918/2019	TOIR04410000022300000	Consol Glass (Pty) Ltd
	AH 224	T34277/1990	TOIR04410000022400000	Petrus Johannes Naude
	RE of Ptn 31 of Rietkol 237 IR	T16617/1993	T0IR00000000023700031	Christiaan Le Cordeur Rossouw
	Ptn 71 of Rietkol 237 IR	T1885/2018	T0IR00000000023700071	Rossouw Pluimvee-Eiers (Pty) Ltd
Description of Site (Where No Street Address)	The mine is situated 3km south of the R50 main road, approximately 6km west of Delmas			

Coordinates of Approximate Centre of Operations	UTM reference – Grid Zone: 35J North-south: 7109362.28 m S East-west: 660710.93 m E
Extent (km²)	2.21
Elevation Above Mean Sea Level (m)	1450 - 1670
Province	Mpumalanga
Metropolitan/District Municipality	Nkangala District Municipality
Local Municipality	Victor Khanye Local Municipality
Designated Priority Area	Highveld Priority Area
Emission Control Officer	
Telephone Number	
Cell Phone Number	
Fax Number	
E-mail Address	
Full Qualifications	

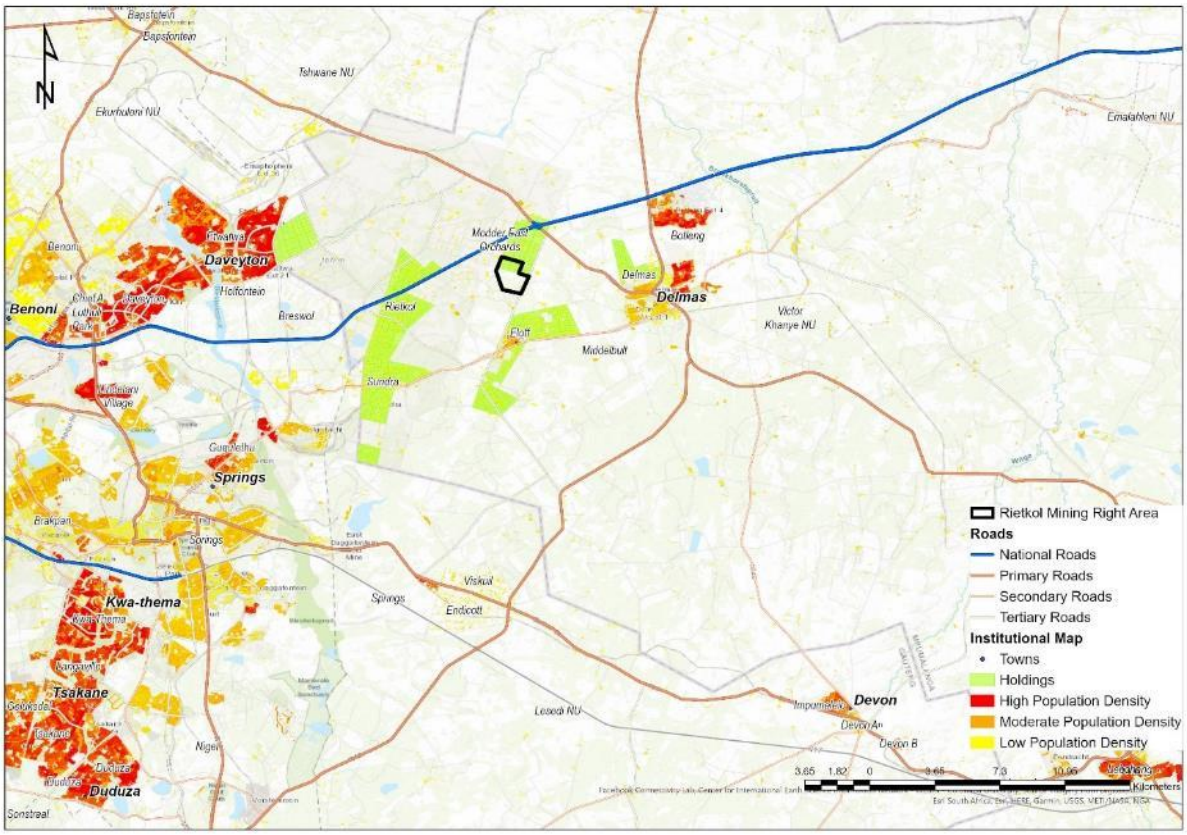

Figure 1: Rietkol Project Locality Map

c. Site Sensitivity Verification Statement

Nhlabathi applied for a Mining Right to mine silica in February 2018 and commenced with the Environmental Impact Assessment (EIA) process as contemplated in the National Environmental Management Act 107 of 1998 (NEMA) and Government Notice (GN) No. R. 982-986 of 4 December 2014: NEMA: Environmental Impact Assessment Regulations, as amended (2014 EIA Regulations), for the Rietkol Project.

Several specialist studies were conducted within the Mining Right Application (MRA) area in support of the EIA process, and a comprehensive Public Participation process was initiated. The Final Scoping Report was submitted on 3 April 2018 and accepted by the Department of Mineral Resources and Energy (DMRE) on 26 April 2018. However, the MRA was rejected by the DMRE Mpumalanga Mine Economics Directorate on the basis that the MRA formed part of another right granted in terms of the MPRDA. This decision resulted in a delay in the EIA process, ultimately causing the application for Environmental Authorisation to lapse.

Nhlabathi has recently re-initiated the MRA process and applied for a Mining Right over the same farm portions in early 2020. The MRA was accepted by the DMRE on 21 January 2021 and Nhlabathi has since re-initiated the EIA process with Jacana Environmentals cc (Jacana) appointed as the independent Environmental Assessment Practitioner (EAP).

Several additional requirements when applying for Environmental Authorisation (EA) have emerged since the 2018 EIA process, including but not limited to:

1. Notice was given in Government Notice No. 960 (GN 960) dated 5 July 2019 of the requirement to submit a report generated by the National Web Based Environmental Screening Tool in terms of section 24(5)(h) of the NEMA and regulation 16(1)(b)(v) of the 2014 EIA Regulations. Such a Screening Report became compulsory when applying for an EA 90 days from publication of GN 960 (5 October 2019). The purpose of the Screening Report is to identify the list of specialist assessments that needs to be conducted in support of the EA application, based on the selected classification, and the environmental sensitivities of the proposed development footprint.
2. Government Notice No. 320 (GN 320) dated 20 March 2020 prescribes general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report content requirements of environmental impacts for environmental themes for activities requiring EA in terms of sections 24(5)(a), (h) and 44 of NEMA. These procedures and requirements came into effect 50 days after publication of GN 320 (15 May 2020). The purpose of the site sensitivity verification is to verify (confirm or dispute) the current use of the land and the environmental sensitivity of the site under consideration as identified in the Screening Report. This will determine the level of assessment required for each environmental theme, i.e. Specialist Assessment or Compliance Statement.

As indicated above, several specialist studies were commissioned for the Rietkol Project during 2016-2018 in support of the previous application, including:

- Soils, land use and capability, Hydropedology,
- Terrestrial / Aquatic Biodiversity,
- Groundwater,
- Air Quality,
- Ambient Noise,
- Blasting & Vibration,
- Traffic,
- Heritage and Cultural Resources,
- Palaeontology,
- Visual and Aesthetics,
- Social,
- Hazard Identification and Risk Assessment (HIRA), and
- Land Trade-off & Macro-Economic Analysis.

Comprehensive specialist assessments were conducted for all the environmental and social themes listed above, irrespective of the sensitivity identified by the specialist assessment (2018) or the Screening Report. Therefore, no site sensitivity verification has been done for this EA application as all themes have been considered to have a **high to very high sensitivity**, requiring a full Specialist Assessment.

The list of specialist assessments listed in the Screening Report and the extent to which it has been addressed in the re-application for EA for the Rietkol Project is indicated below. With applicable, motivation provided for the exclusion of certain specialist assessments.

GN 960 requirement	Extent to which it is included in the Plan of Study
Agricultural Impact Assessment	Soil and Land Capability Assessment by Scientific Aquatic Services.
Landscape/Visual Impact Assessment	Visual Impact Assessment by Scientific Aquatic Services.
Archaeological and Cultural Heritage Impact Assessment	Phase 1 Heritage Impact Assessment by R&R Cultural Resource Consultants.
Palaeontology Impact Assessment	Palaeontology Impact Assessment by ASG Geo Consultants (Pty) Ltd {Dr Gideon Groenewald}.
Terrestrial Biodiversity Impact Assessment	Faunal, Floral and Freshwater Assessment by Scientific Terrestrial Services.
Aquatic Biodiversity Impact Assessment	Faunal, Floral and Freshwater Assessment by Scientific Terrestrial Services.
Hydrology Assessment	Baseline Water Quality Assessment by Scientific Aquatic Services. Water Management Plan – Preliminary Design Report by Onno Fortuin Consulting.
Noise Impact Assessment	Environmental Noise Impact Assessment by Enviro Acoustic Research.
Radioactivity Impact Assessment	Waste Classification by Groundwater Complete. Analysis will include Uranium and Thorium to determine potential for radioactivity within the resource.
Traffic Impact Assessment	Traffic Impact Assessment by Avzcons Civil Engineering Consultant.
Geotechnical Assessment	A geotechnical assessment will be undertaken as part of the engineering package for the project, if required. This is not included in the application for EA.
Climate Impact Assessment	A greenhouse gas emissions statement is included in the Air Quality Impact Assessment by EBS Advisory.
Health Impact Assessment	Hazard Identification and Risk Assessment by AirCheck Occupational Health, Environmental & Training Services.
Socio-Economic Assessment	Socio-Economic Impact Assessment by Diphororo Development.
Ambient Air Quality Impact Assessment	Air Quality Impact Assessment by EBS Advisory.
Seismicity Assessment	A Blasting Impact Assessment is included and has been conducted by Blast Management Consulting. It deals extensively with the potential impact in respect of air blast and vibration from blasting operations.
Plant Species Assessment	Part of Terrestrial Biodiversity Impact Assessment.
Animal Species Assessment	Part of Terrestrial Biodiversity Impact Assessment.

Further studies that are not included in the GN 960 requirements, but were commissioned for the Rietkol Project, are:

- Hydropedological Assessment by Scientific Aquatic Services.
- Geohydrological Investigation by Groundwater Complete.
- Blasting Impact Assessment by Blast Management Consulting.
- Land Trade-off Study and Macro-Economic Impact Analysis by Mosaka Economic Consultants.
- Rehabilitation, Decommissioning and Closure Plan by Jacana Environmentals.

Where a specific environmental theme protocol has been prescribed by GN 320, the specialist assessment will adhere to such protocol. Where no protocol has been prescribed, the report will comply with Appendix 6 of the EIA Regulations.

d. Nature of the Process

The general mineral category to be mined on Mineral Area 2 on the farm Olifantsfontein 196IR and Rietkol 237IR is Silica. Table 3 details the key economic minerals within this category which are expected to be found in the MR area.

Table 3: Mineral to be Mined

Type of Mineral expected to be found in Area	
Glass Sand (Silica) QG Type Q Silica sand (general) Q Type Q Sand (general) QY Type I Silica Sand QD Type Q Clay (CA) Type Cy Ball Clay (CL) Type Cy Concrete Sand (QO) Type Q Building Sand (QB) Type Q Clay (general) (Cy) Type Cy Crusher Sand (Silica) (QC) Type Q	Foundry Sand (Silica) (QF) Type Q Filling Sand (Silica) (QL) Type Q Fuller's Earth (Clay) (CE) Type Cy Group (Clay) (Cl) Type Cy Metallurgical Silica (QM) Type Q Shale/Brick Clay (CS) Type Cy Silcrete (Silica) (QS) Type Q

e. Authorisation Details

No Atmospheric Emission Licence has as yet been applied for.

The construction and operation of a dryer will be undertaken. Prior to this a licence for the drier will be required.

Listed Activity in GN 893

The following listed activity will require an AEL application in terms of Section 22A of the NEM: AQA, as amended:

Category 5: Mineral Processing, Storage and Handling

Subcategory 5.2: Drying

Description: The drying of mineral solids including ore, using dedicated combustion installations.

Application: Facilities with a capacity of more than 100 tons/month product.

2. Process Details and Mass Balance

a. Summary

Table 4: summary of the process details

Process	Process Function	Input	Output	Emissions
Mining	Supply of raw material		Coarse rock	Dust
Crushing and Screening	Crush raw material into manageable material for processing	Coarse Rock	Fine and Course material	Dust
Dryer	Drying and handling of material	Fine and Course material Diesel	Final product for market	SO_2, PM_{10}, NO_x

b. Process Description

Silica is planned to be mined by means of conventional opencast methods to a depth of between 30 and 50 meters below surface (mbs). The estimated life of mine (LOM) for the proposed Rietkol Project is 20 years. Further exploration drilling will be conducted during the operational phase, which may increase the LOM and mining depth if the resource proofs viable.

The proposed project includes the following mining and related infrastructure:

- Opencast pits;
- Run of mine (RoM) stockpiles;
- Processing plant (crushing, screening, washing and drying operations);
- Product stockpiles;
- Administration office facilities (i.e. security building, administration and staff offices, reception area, ablution facilities, etc.);
- Production facilities (i.e. locker rooms, laboratory, workshops, stores, explosives magazine, ablution facilities, etc.);
- Bagging facility and warehouse;
- Weighbridge;
- Access roads; and
- Clean and dirty water management infrastructure.

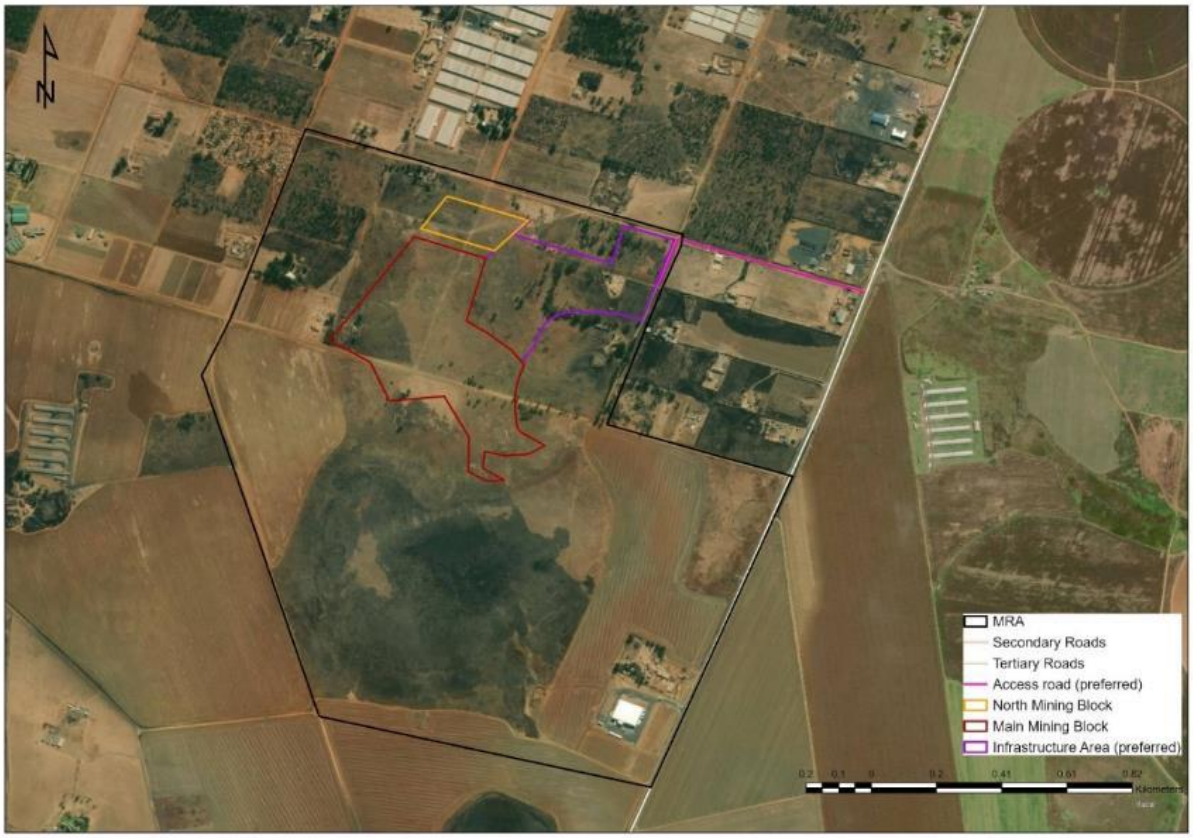

Figure 2: Rietkol Project Layout

c. Resource Particulars

Type of Mineral

The borehole analytical results and the associated geological report correlates with the historic geological model. Inclusive of the additional borehole results, the total in-situ resource is estimated to be 29.75 million tonnes (Mt).

The predominant minerals to be mined are:

- Glass Sand (Silica) QG Type Q,
- Silica sand (general) Q Type Q,
- Sand (general) QY Type I,
- Silica Sand QD Type Q.

The mining may encounter the following minerals, which will be mined as part of the planned mining operations:

- Clay (CA) Type Cy,
- Ball Clay (CL) Type Cy,
- Concrete Sand (QO) Type Q,
- Building Sand (QB) Type Q,
- Clay (general) (Cy) Type Cy,
- Crusher Sand (Silica) (QC) Type Q,
- Foundry Sand (Silica) (QF) Type Q,

- Filling Sand (Silica) (QL) Type Q,
- Fuller's Earth (Clay) (CE) Type Cy,
- Group (Clay) (Cl) Type Cy,
- Metallurgical Silica (QM) Type Q,
- Shale/Brick Clay (CS) Type Cy,
- Silcrete (Silica) (QS) Type Q.

Products and Markets

The main reason for this MRA is for the supply of silica sand to various markets including the glass, foundry and filtration industries in the Gauteng and Mpumalanga regions. In addition to this, many other local industries rely on various grades of silica sand to manufacture their products. The main products that are envisaged to be sold are River Sand, Amber Sand, Flint Sand, Chemical Sand and Filter Sand.

Roughly 95% of the products will be distributed within the region while the remaining 5% is destined for the remainder of South Africa and surrounding African countries. The main industries that make use of the products are as follow:

Product	Industry
River Sand	Construction and road works
Amber Sand	Container glass industry
Flint Glass	Flat glass industry
Chemical Sand	Sodium Silicate
Filter Sand	Water Purification

Based on the current market structure approximately 70% of the mined material would be supplied to the glass industry, and the remaining to other silica sand users, including:

- Silica Distributors,
- Adhesive Manufacturers,
- Metal Foundries,
- Golf Course Maintenance,
- Building Maintenance, and
- Coatings and Adhesives Producers.

d. Open Pit Mining

Silica will be mined through an opencast bench mining method. The benches will be mined at a width of 30 metres and a height of 10 metres. Final mining depth will be between 30 and 50 mbs. Mining will commence in the northern portion of the MRA area and will progress in a south-easterly direction.

Drilling and blasting of the rock face will be conducted on a predetermined schedule in accordance with projected volumes of production and will be undertaken by blast professionals and with the required safety procedures applied.

The mining method will include:

- Vegetation and topsoil stripping ahead of mining. At least one cut (30m) should already be stripped and available for drilling between the active topsoil stripping operation and the open void prior to mining commencing;

- The topsoil will be loaded onto dump trucks by excavators and hauled to areas that require rehabilitation;
- Drilling operations will commence in the front of the advancing pit after the topsoil has been removed;
- The blasted Run of Mine (RoM) will be stockpiled with excavators; and
- Thereafter RoM will be transported to the crushing plant by means of haul trucks with a loading capacity of approximately 40 tons.

Mining Model and Schedule (Figure 3)

Access ramps will be located along the Eastern pit limit and are laid out within the orebody to minimise the mining of waste.

The North Block will be mined for the first 3 years of LOM in a northernly direction, commencing from Block S04. Block S04 is the deepest and the ore body floor slopes up to the outcrop in Block S01. The ore from Block S04 will be used as a strategic stockpile in readiness for plant start-up.

Once Block S04 has been mined out a void exists to dump the tailings from the washing plant from about YR2 onwards. Since it is the deepest portion of the block, the water will not negatively impact on the mining operation of S03, S02 and S01. The void created by mining the North Block is 309 197 bank cubic meters (BCM) and tailings can be dumped in the North Block for the first 16 years of mining life.

Once the North block has been mined out, mining in the Main Mining Block will commence in YR4, in a southernly direction up to Block 14 in YR20. The barrier between North Block and the Main Mining Block is 30m. This constitutes a loss and can be optimized by means of further detailed geotechnical analysis. Various machinery and vehicles will be used in the pit and to transport the RoM to the crushing plant. The equipment includes excavators, front-end loaders and ADT's.

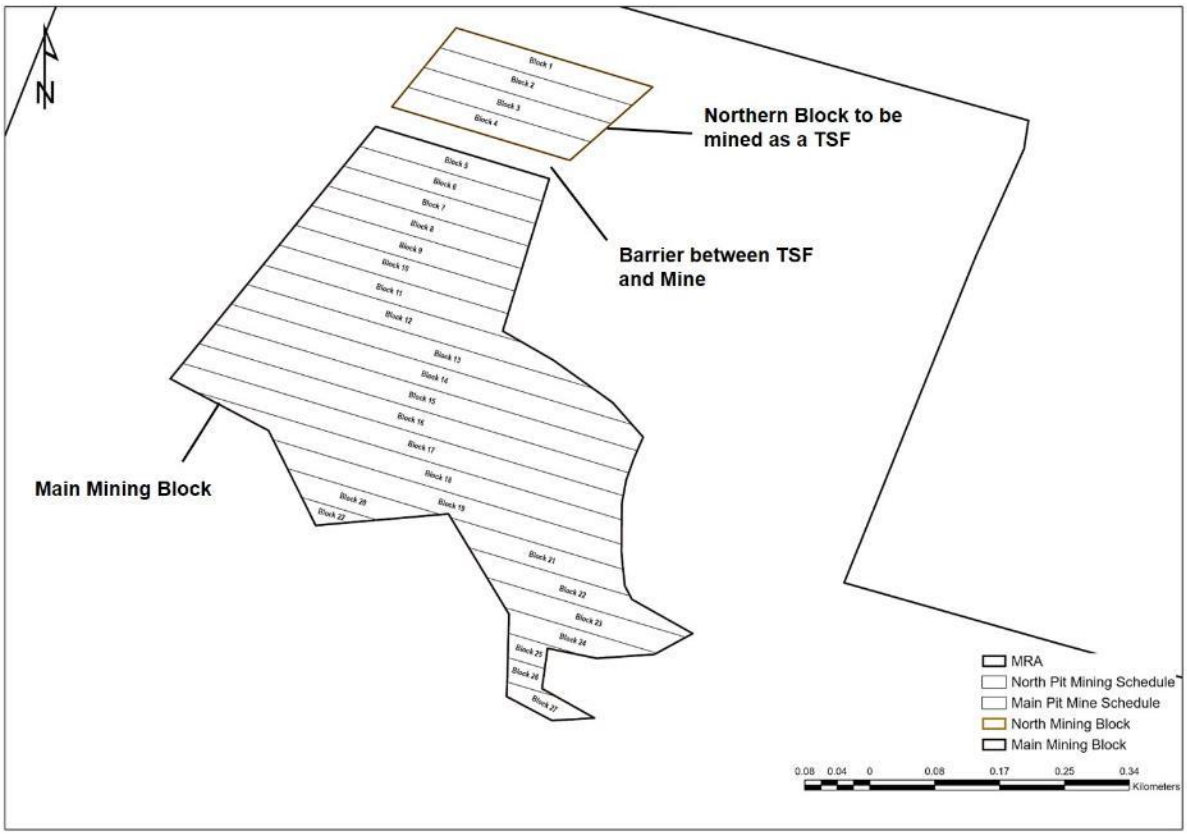

Figure 3: Plan view of the mining blocks

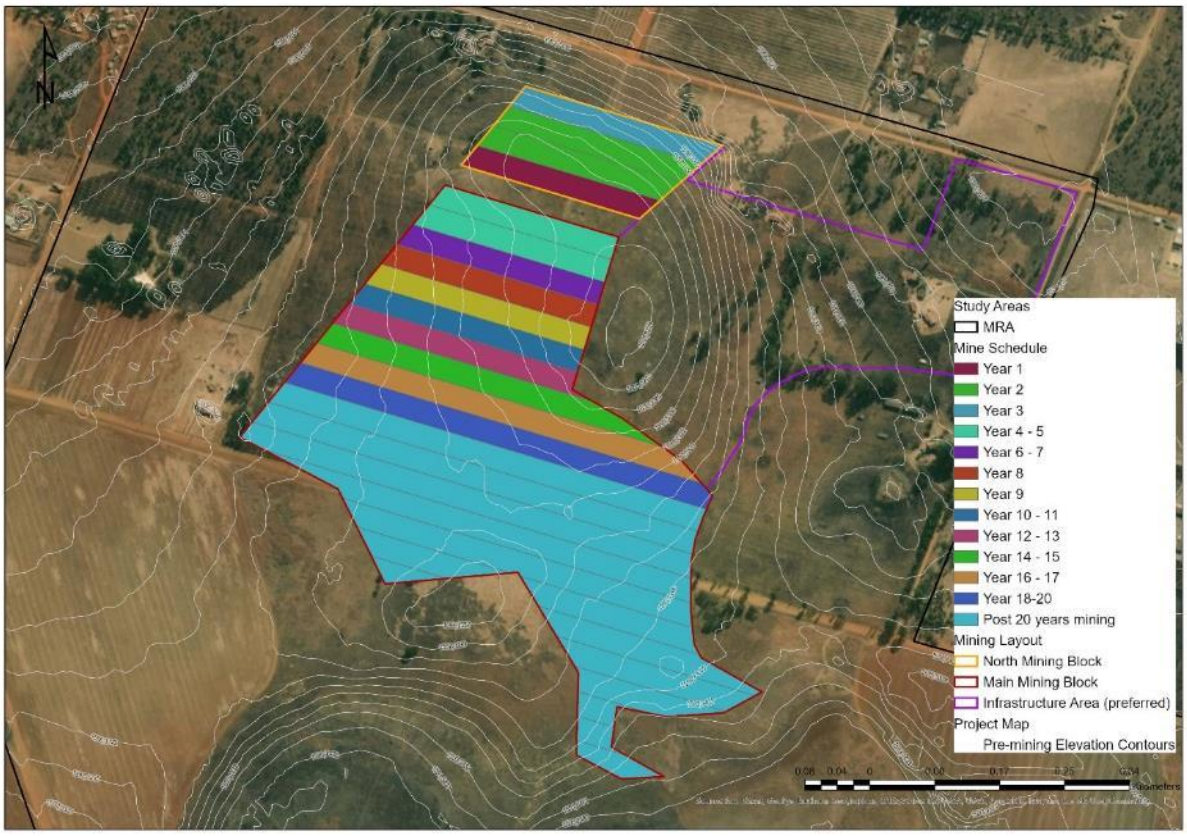

Figure 4: Mine Schedule for first 20 years of mining

Rehabilitation and Closure Planning

Slimes will be pumped into the North Block and will form part of the rehabilitation process. As most of the material mined is processed and removed from site as product, backfilling of the Main Block to a free-draining state will not be possible. Therefore, the final rehabilitation plan allows for the backfilling of all the remaining material and building rubble into the pit area, sloping of the high-wall areas and establishment of a recreational area within the Main Block final void area, as per the agreement with the stakeholders and authorities.

At the end of LOM, all infrastructure that has a beneficial post-mining use will be retained. The remaining infrastructure and buildings will be demolished and building rubble will be placed in the pit. The cleared areas will be ripped and levelled before topsoil is replaced and the area is re-vegetated. Inert reject material will be placed in the open pit area and the sides of the pit will be sloped and re-vegetated.

d. A Rehabilitation, Decommissioning and Closure Plan

Financial provision will be developed for the Rietkol Project during the EIA Phase, in line with the requirements of Government Notice No. R.1147 (GNR 1147): "*Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations*" promulgated in November 2015. Financial provision will be updated on an annual basis in line with the requirements of GNR 1147. Description of the Processing Plant

e. Processing plant

The processing plant comprises of crushing, screening, washing and drying operations. Amber and flint sand will not go through the dryer.

Crushing

RoM is fed to the crushing plant by tipping it into a feed chute feeding a grizzly screen which screens the RoM before the oversize material is crushed. The crushed RoM is fed via conveyor to a screen with the upper and lower decks consisting of larger and smaller screening panels respectively. The oversize material from the upper deck is fed with a conveyor to a jaw crusher which crushes the material to the desired size. River sand product is stockpiled (undersize) while the oversize together with a recycle stream and the crushed product is discharged into a chute.

The final crushing plant screen consists of varying screening panels to yield different grades of material which are used as feed stocks for the various wash plant products. The -20mm particles are screened out in the front of the screen while the undersize is collected at the rear of the screen. The oversize material is fed to a Gyro crusher with conveyor and the crushed product (100% passing 40mm) is recycled for washing. The material is drawn from underneath the -5mm stockpile by a tunnel conveyor that feeds the wash plant.

Wash Plant

Various products are produced in the wash plant using crusher feed stock. Depending on the category and quality requirement, additional crushing, screening and hydro-sizing equipment is employed.

Screening Process

A vibratory feeder feeds the feedstock onto conveyor which discharges the material onto a grizzly screen which cuts at the desired size. The material from the grizzly screen is wet screened on the main screen. The oversize from the first screen is discharged onto the dewatering screen containing a mixture of screening panels (arranged in increasing aperture size in the direction of flow). The oversize material from the second screen is fed to a vertical shaft impactor from where the material is crushed to -5mm which is recycled and recombined with the raw feed.

The slurries collected underneath the first screen and the front section of the dewatering screen gravitates into a pot in which slimes overflow to the thickener pot and the underflow is pumped, dewatered and stacked with a separator on the product stockpile. The overflow from the separator returns to the pot below the screens.

The material collected in the collection pan at the rear section of the dewatering screen gravitates into another pot in which slimes are removed in the overflow to the thickener pot and the underflow is pumped to a separator, dewatered and stacked onto the Filter Product stockpile. Finally, the overflow from this separator returns to a pot.

All the overflows from the various pots in the screening and hydro-sizing plants combine into a pot from where it is pumped to the thickener.

Screening with hydro-sizing process

Feedstock is fed onto a conveyor with a vibratory feeder that combines with the recycled oversize material from screen. The dewatering float glass screen disposes material onto a single conveyor. This feeds the vertical side impactor (VSI) that crushes the -40mm feed to 100% passing 5mm. The crushed material from the VSI is fed onto the main screen consisting of only 1mm screening panels and the oversize from the screen is discharged onto the dewatering screen which consists of 1mm panels in the front and 4 rows of panels with 5mm apertures at the rear section of the screen.

The material screened out in the main and dewatering screens is collected and together both are discharged into a pot. From this pot material is pumped to a dewatering cyclone where the solids are dewatered in preparation of further washing. The cyclone overflow is returned to the pot under the main screen and the overflow from this pot is gravity fed to the pot that goes to the thickener.

The cyclone underflow comprises the feed to the primary classifier where the D50 cut size of 665µm is achieved by an upward flow of water. The underflow of the cyclone gravity feeds to a pot from where the underflow is dewatered with a separator and stacked as filter product. The overflow of the separator is returned to another pot and the overflow from this pot gravitates to the thickener pot.

The overflow from the first classifier gravitates into a secondary classifier of which the D50 cut size is 75µm. The underflow of this classifier is fed into a pot from where the underflow is pumped to and dewatered with a separator and stacked as the final product. The overflow of the separator is returned to a pot and the overflow from the pot gravitates to the thickener return pot. Finally, the overflow from the secondary classifier flows into a pot, the underflow of which is pumped to a dedicated separator, dewatered and stacked onto the chemical sand product stockpile. The separators overflow is returned to the pot and the overflow from this pot feeds into the tailings facility (open pit).

Drier Plant

After being dried in the respective stockpiles to a moisture content of 5% amber and float glass filter products are fed with a tunnel conveyor into a silo from which it is fed to driers with vibratory feeders.

The energy required to dry the material to a desired moisture content of less than 1% is obtained by combusting a heavy hydrocarbon fuel blend. The combusted fuel (flue gas) heats the filter sand thereby evaporating the moisture associated with the sand. Flue gas exits the drier and entrained dust is removed in a dust suppression system before the gas is discharged into the atmosphere. The dried filter product is discharged from the drier onto conveyors and is stockpiled in the dry sand shed before being sized in the screening plant according to product specifications.

Material that is not fed through the driers is placed on drying beds adjacent to the plant. Water run-off from the drying beds is collected in a sump and channelled to the process water dam located to the south-west of the plant for re-using in the plant.

The dried filter sand is fed by means of conveyor to the dry screening plant where it is sized into fractions by means of vibratory screens in accordance with product specifications.

f. Terms of Reference

The terms of reference for the Air Quality Impact Assessment for the proposed project can briefly be summarised as follows:

Baseline Assessment

- Provide an overview of the prevailing meteorological conditions in the area;
- Review applicable legislation and policies related to air quality management which are applicable to the proposed operations;
- Review potential health effects associated with emissions released from the proposed operations;
- Identification of existing sources of emission and surrounding sensitive receptors, such as local communities, surrounding the mine; and
- Assess the baseline air quality using available ambient air quality monitored data.

Impact Assessment

- Compilation of an emissions inventory for the proposed air quality related sources identified on site;
- Dispersion modelling simulations undertaken using AERMOD to determine the potential air quality impacts of the proposed activities on the surrounding area;
- Comparison of the modelled results to the National ambient air quality standards to determine compliance; and
- Compilation of an Air Quality Impact Assessment Report.

g. Methodology

An overview of the methodological approach to be followed during this Air Quality Baseline and Impact Assessment is outlined in the section which follows.

Baseline Assessment

During the baseline assessment, a qualitative approach was used to assess the baseline conditions in the project area. Meteorological Data was obtained from the South African Weather Services' Springs Station (0476762A35). The data is from 2013 to 2017 to determine the atmospheric dispersion potential of the area. On-site Particulate Matter monitoring was conducted in Oct & Nov 2016, April 2018 and again in March 2021.

Impact Assessment

During this phase, an emissions inventory was compiled to estimate emissions from the identified emission sources associated with the proposed activities. Where information is not available, use will be made of available United States Environmental Protection Agency (USEPA) emission factors or emission models to estimate emission releases. Dispersion modelling simulations were undertaken using the AERMOD dispersion model and presented graphically as isopleths plots. Comparison with the National ambient air quality standards were made to determine compliance. Based on the predicted results, recommendations for appropriate mitigation measures and/or ambient air quality monitoring programme was provided.

h. Study Limitations

Prior to the outline of the proposed impacts in the area, the following issues need to be highlighted, which are considered limitations to undertaking the terms of reference detailed above.

- As no long term on-site meteorological data was available during the current investigation, it was decided to make use of measured data from the South African Weather Services Springs Meteorological Station to describe the micro meteorological aspects of the area.
- Ambient air quality monitoring has been undertaken by Eskom at the Chicken Farm Site, which due to its distance from urban areas, is the closest representative site to Delmas, approximately 30km northeast, with the South African Air Quality Information System (SAAQIA) providing the following information from 1 January 2017 to 31 December 2017.
- All information provided in regard to mining rates, infrastructure layouts and mining methodology is assumed to be correct.

i. Report Structure

Section 1 of the report provides background of the project. **Section 2** focuses on the process summaries and various operations involved in the project. Section 3 includes a meteorological overview of the region as well as a review of the applicable air quality legislation, pollutants and their potential health effects. The emissions inventory and impact assessment are presented in **Section 4**. **Section 5** gives a summary of the general conclusions and recommendations presented in the report. The references and glossary are provided in **section 6** and **section 7** respectively.

3. Baseline Description of the Area

a. Meso-Scale Meteorology

The data was gathered from the South African Weather Services' Springs Station. The period data that is under investigation range from 1 January 2013 to 31 December 2017.

The macro-ventilation characteristics of a region are determined by the nature of the synoptic systems that dominate the circulations of the region, and the nature and frequency of occurrence of alternative systems and weather perturbations over the region. Meso-scale processes affecting the dispersion potential include thermo-topographically induced circulations, the development and dissipation of surface inversions, and the modification of the low-level wind field and stability regime by urban areas.

Atmospheric processes at meso-scale were taken into account in the characterisation of the atmospheric dispersion potential of the study area. Reference was made to hourly average meteorological data recorded at Springs, modelled to the precise mine location. Parameters that need to be taken into account in the characterisation of meso-scale ventilation potentials include wind speed, wind direction, extent of atmospheric turbulence, ambient air temperature and mixing depth.

The nature of the local climate will determine what will happen to pollutants when it is released into the atmosphere (Tyson & Preston-Whyte, 2000). Pollution levels fluctuate from day to day and from hour to hour, in response to changes in atmospheric stability and variations in mixing depth. Wind systems will have an effect on the transportation and dispersion of pollution.

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

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

Elevated inversions occur commonly in high pressure areas. Sinking air warms adiabatically to temperatures in excess of those in the mixed boundary layer. The interface between the upper, gently

subsiding air is marked by an absolutely stable layer or an elevated subsidence inversion (Tyson & Preston-Whyte, 2000).

i. Wind

Dispersion comprises vertical and horizontal components of motion. The wind field largely determines the horizontal dispersion of pollution in the atmospheric boundary layer. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume stretching. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction and the variability in wind direction, determine the general path pollutants will follow, and the extend of cross-wind spreading.

Period wind roses (blowing from) for the target area is presented in Figure 5. Wind roses comprise 16 spokes, which represents the directions from which winds blew during the period. The colours used in the wind roses reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories.

The frequency with which calms occurred, i.e. periods during which the wind speed was below 1m/s is also noted in the key of the diagram.

From the wind rose it is noted that winds are mainly light to moderate and blow from the north-easterly and easterly sectors except for short periods during thunderstorms or weather changes when they have a north westerly component (Figure 5).

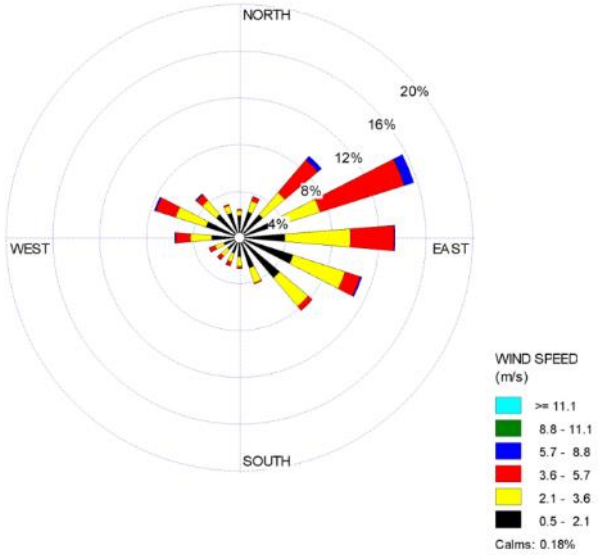

Figure 5: Annual Wind rose (Blowing from)

An assessment of the win frequency distribution as depicted in Figure 6 indicates that the majority of the winds are weak i.e. less than 4 m/s for the region potentially hampering the dispersion potential of any pollutants liberated to atmosphere.

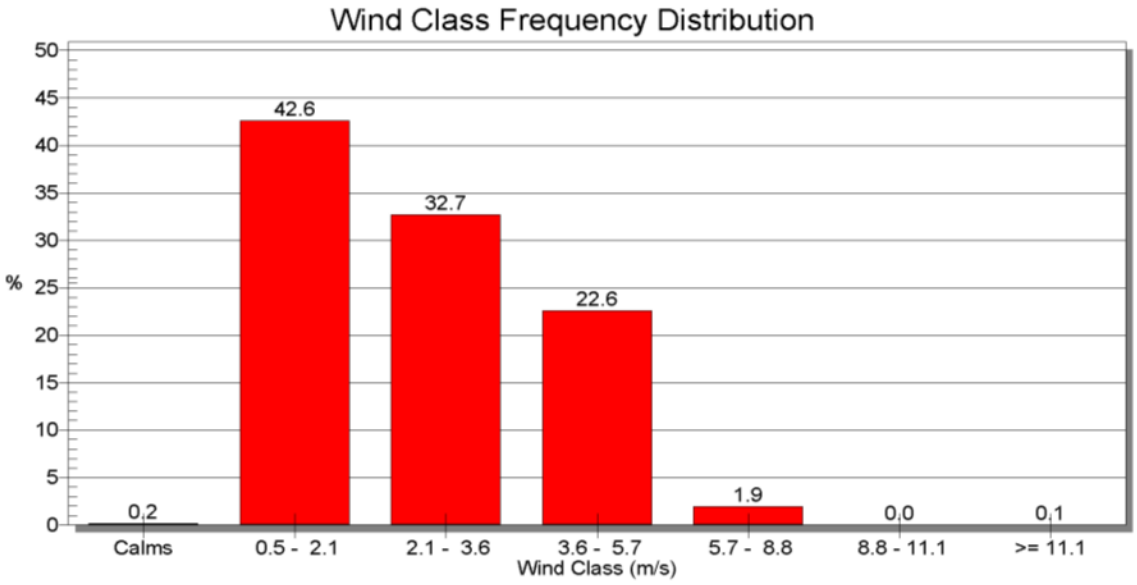

Figure 6: Wind Frequency Distribution

ii. Atmospheric Stability

The vertical component of dispersion is a function of the extent of thermal turbulence and the depth of the surface mixing layer. Unfortunately, the mixing layer is not easily measured and must often be estimated using prognostic models that derive the thickness from some of the other parameters that are often measured, e.g. solar radiation and temperature. During the day-time, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the extension of the mixing layer to the lowest elevated inversion. Radiative flux divergence during the night usually results in the establishment of ground-based inversions and the erosion of the mixing layer. Day-time mixing heights were calculated with the prognostic equations of Batchvarova and Gryning, while night-time boundary layer heights were calculated from various diagnostic approaches for stable and neutral conditions. The mixing layer in the study area ranges from 0 metres (only a stable or neutral layer exists) during night-times to the base of the lowest-level elevated inversion during unstable, day-time conditions.

Atmospheric stability is frequently categorised into one of six stability classes. These are briefly presented for the site under investigation in Figure 7. The hourly standard deviation of wind direction, wind speed and solar radiation is used to determine hourly-average stability classes (STAR method).

The atmospheric boundary layer is normally unstable during the day as a result of the turbulence due to the sun's heating effect on the earth's surface. The thickness of this mixing layer depends mainly on the extent of solar radiation, growing gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. The situation is more pronounced during the winter months due to strong night-

time inversions and a slower developing mixing layer. During the night a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral.

For elevated releases, the highest ground level concentrations would occur during unstable, day-time conditions. The wind speed resulting in the highest ground level concentration depends on the buoyancy. If the plume is considerably buoyant (high exit gas velocity and temperature) together with a low wind, the plume will reach the ground relatively far downwind. With stronger wind speed, on the other hand, the plume may reach the ground closer, but due to the increased ventilation, it will be more diluted. A wind speed between these extremes would therefore be responsible for the highest ground level concentrations. The highest concentrations for low level releases would occur during weak wind speeds and stable atmospheric conditions. Air pollution episodes frequently occur just prior to the passage of a frontal system that is characterised by calm wind and stable conditions.

Figure 7 indicates that the site has a high frequency of moderately to extremely stable conditions (Class F) at 36% of the time. Slightly stable (Class E), neutral (Class D), slightly unstable (Class C), moderately unstable (Class B) occur in a similar level of frequency, with the lowest frequency of occurrence being extremely unstable conditions (Class A) at only 5% of the time.

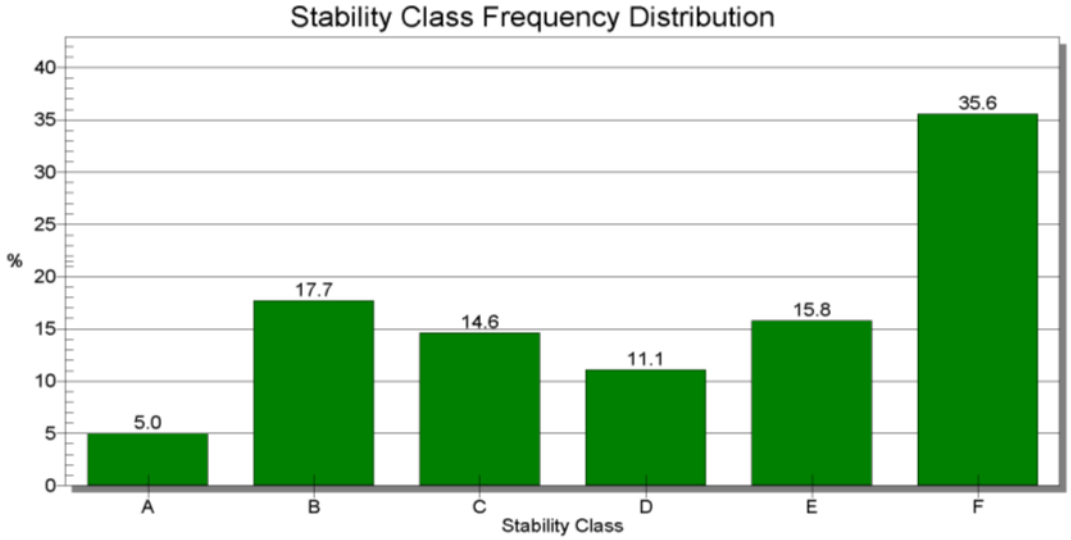

Figure 7: Stability Class Distribution

iii. Temperature and Humidity

The monthly distribution of average daily maximum temperatures (centre light blueline in Figure 8) shows that the average midday temperatures for Delmas ranges from 17°C in June to 26°C in January. The region is the coldest during July when it drops to 0.8°C on average during the night. The average humidity of the region is in the region of 74.6% (ranging between 54.4% and 89.2%).

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of mixing and inversion layers.

Figure 8: Temperature Profile for the Delmas Area (orange line indicates maximum range for the period, dark blue line the minimum range and light blue line the average recorded during the period January 2013 – December 2017)

iv. Precipitation

The average annual rainfall, mainly occurring as a result of thunderstorms, with an average of 575mm per year (Figure 9).

The rainy season lasts from about October to March, the peak of the rainy season falling in January. It receives the lowest rainfall (0mm) in July and the highest (104mm) in January. About 50 to 80 rain days per year may be expected. The rainfall is somewhat unreliable and in about 12% of all years rather severe drought conditions occurred.

Precipitation represents an effective removal mechanism of atmospheric pollutants.

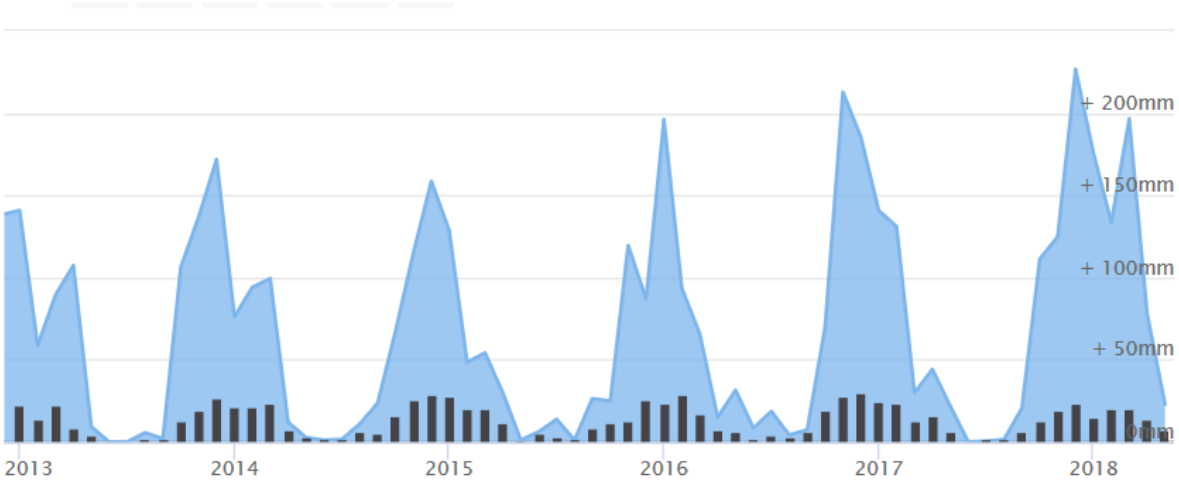

Figure 9: Rainfall Summary at Springs

b. Applicable Air Quality Legislation

Since 1965, the approach to air pollution control in South Africa was informed and driven by the Atmospheric Pollution Prevention Act (APPA) (Act No. 45 of 1965) (hereinafter the APPA). The Act did not set targets or standards that would permit the achievement of an environment that is not harmful to health or well-being. This requirement is now contained in the Bill of Rights in the Constitution of

the Republic of South Africa (Act No. 108 of 1996). The Constitution is thus the pivotal piece of legislation that informs all environmental legislation.

Given this environmental right, it was clear that air quality legislation that included an underlying drive towards cleaner air was needed. Following on from this, the publication in May 2000 of a critical policy document, the White Paper on Integrated Pollution and Waste Management for South Africa, A Policy on Pollution Prevention, Waste Minimisation, Impact Management and Remediation (IP&WM, 2000) marked a turning point for pollution and waste governance in South Africa. From an air quality management perspective, the new policy represented a paradigm shift in approach and necessitated the introduction of a new approach to air quality management.

The new National Environmental Management Air Quality Act introduces a system based on ambient air quality standards and corresponding emission limits to achieve them. Four significant regulations stemming from NEM:AQA have been promulgated in this regard:

- **GNR 1210** on 24 December 2009 (Government Gazette 32816) National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) National Ambient Air Quality Standards.
- **GNR 248** on 31 March 2010 (Government Gazette 33064) National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) List of Activities which result in Atmospheric Emissions which have or may have a significant detrimental effect on the environment, including Health Social Conditions, Economic Conditions, Ecological Conditions or Cultural Heritage.
- **GNR 486** on the 29 June 2012 (Government Gazette 35463) National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) National Ambient Air Quality Standards for Particulate Matter with Aerodynamic Diameter less than 2.5-micron meters (PM2.5) were published, adding to the stricter standards of PM_{10}.
- **GNR 1007** on the 7 December 2012 (Government Gazette 35931) National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) National Dust Control Regulations were published. The regulations stated the dust fallout level bands that are acceptable in residential and non-residential areas.

The new national ambient standards for air quality were based primarily on guidance offered by four standards set by the South African National Standards (SANS), namely:

- **SANS 69:2004**: Framework for Implementing National Ambient Air Quality Standards
- **SANS 1929:2011**: Ambient Air Quality – Limits for Common Pollutants
- **SANS 69:2004** makes provision for the establishment of air quality objectives for the protection of human health and the environment as a whole. Such air quality objectives include limit values, alert thresholds and target values.

- **SANS1929:2011** uses the provisions in SANS 69 to establish air quality objectives for the protection of human health and the environment and stipulates that limit values are initially set to protect human health. The setting of such limit values represents the first step in a process to manage air quality and initiate a process to ultimately achieve acceptable air quality nationally. The limit values presented in this standard are intended as information to be used in air quality management but have only become enforceable as revised under GNR 1210 since 24 December 2009 (applicable to SANS 1929:2009). National ambient air quality standards for criteria pollutants generally have specific averaging periods; compliance dates (timeframes), permissible frequencies of exceedence and reference methods. The newer SANS 1929:2011 document doesn't contain time frames of when newer guidelines will be implemented, the guideline distinguishes between interim and target values for pollutants.

- **National Environmental Management Air Quality Act (No.39 of 2004)**

NEMAQA represents a distinct shift from exclusively source-based air pollution control to holistic and integrated effects-based air quality management. It focuses on the adverse impacts of air pollution on the ambient environment and sets standards to control ambient air quality levels, while at the same time it sets emission standards to minimise the amount of pollution that enters the environment.

The objects of the legislation are as follows:

- to protect the environment by providing reasonable measures for –
    - the protection and enhancement of the quality of air in the Republic;
    - the prevention of air pollution and ecological degradation; and
    - securing ecologically sustainable development while promoting justifiable economic and social development; and
- generally, to give effect to Section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

The Department of Environmental Affairs and Tourism issued ambient air quality guidelines for several criteria pollutants, including particulates (PM_{10}), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), ozone (O_3), carbon monoxide (CO) and benzene (C_6H_6). The NEM: Air Quality Act of 2004 adopted these guidelines as National ambient air quality standards. On 2 June 2006, the then Minister of Environmental Affairs and Tourism announced his intention of setting new ambient air quality standards in terms of Section 9(1)(a) and (b) of the Air Quality Act. The proposed new standards were published for public comment in the Government Gazette of 9 June 2006 with revised National standards, including allowable frequencies of exceedance and compliance timeframes, published for comment on 13 March 2009. On 25 December 2009, the then Minister of Water and Environmental Affairs established National ambient air quality standards (Table 4). The human health effects associated with the above-mentioned criteria pollutants are described in the sub-sections below.

Table 4: National Ambient air quality standards for criteria pollutants. The Values given in the brackets are expressed as ppb

Pollutant	Averaging Period	Concentration (µg/m^3)	Frequency of Exceedance
Sulphur dioxide (SO_2)	10-min average	500 (192)	526
	1-hr average	350 (134)	88
	24-hr average	125(48)	4
	Annual average	50 (19)	0
Nitrogen dioxide (NO_2)	1-hr average	200 (106)	88
	Annual average	40 (21)	0
Carbon monoxide (CO)	1-hr average	30 000	88
	8-hr running average	10 000	11
Ozone (O_3)	8-hr running average	120 (61)	11
Particulate Matter (PM10)	24-hr average	75	4
	Annual average	40	0
Particulate Matter (PM2.5)	24-hr average	40	4
	Annual average	20	0
Lead (Pb)	Annual average	0.5	0
Benzene (C_6H_6)	Annual average	10 (3.2) 5 (1.6)	0

The pollutants of concern for the mine are the following. These pollutants will be investigated in this study.

- Particulate Matter (PM_{10} and $PM_{2.5}$)
- Sulphur dioxide (SO_2)
- Oxides of Nitrogen (NO_x) to be assessed as Nitrogen dioxide (NO_2)

i. Particulate Matter with an aerodynamic diameter of less than 10microns (PM_{10}) and less than 2.5microns ($PM_{2.5}$)

With regards to the setting of limit values for particulate matter, SANS 1929:2011 recognises the following:

- different types of particles can have different harmful effects on human health;
- there is evidence that risks to human health associated with exposure to man-made PM_{10} are higher than risks associated with exposure to naturally occurring particles in ambient air; and
- as far as they relate to PM_{10}, action plans and other reduction strategies should aim to reduce concentrations of fine particles as part of the total reduction in concentrations of particulate matter.

Stringent Limit and Target Values for particulate matter (expressed in µg/m³) have been suggested as guidelines in SANS 1929:2009, and revised in 2011. These were developed by a panel of experts on the basis of best international practice. However, the latest regulations emanating from NEM:AQA (GNR 1210) were promulgated in late 2009 for PM_{10} and in mid-2012 for $PM_{2.5}$ and stipulate a phased approach towards the implementation of national ambient air quality standards as tabulated below (Table 5 and Table 6). The newer SANS 1929:2011 document differentiated between the phased in approach and now specifies two pollutant levels, Interim and Target levels.

Table 5: National Ambient Air Quality Standards for Particulate Matter (PM_{10})

Averaging Period	Concentration	Frequency of Exceedance (per calendar year)	Compliance Date
24-hour	75 µg/m³	4	1 January 2015
Annual	40 µg/m³	0	1 January 2015

Table 6. National ambient air quality standards for Particulate Matter ($PM_{2.5}$)

Averaging Period	Concentration	Frequency of Exceedance (per calendar year)	Compliance Date
24-hr average	65	**4**	29 June 2012 – 31 December 2015
24-hr average	40	**4**	1 January 2016 – 31 December 2029
24-hr average	25	**4**	1 January 2030
Annual average	25	**0**	29 June 2012 – 31 December 2015
Annual average	20	**0**	1 January 2016 – 31 December 2029
Annual average	15	**0**	1 January 2030

ii. Particulate Matter with regard to Crystalline Silica

The association of silica dust exposure and its potential for lung cancer, has been controversial for many decades, with extensive studies being undertaken to determine the risk and limits of exposure.

Dust exposure has been linked to risk of illness in many previous environmental and occupational health studies. The World Health Organization has estimated that 1.4% of all deaths result from exposure to various dust particles. To this end US Occupational Safety and Health Administration, has implemented as specific exposure limit of 0.1 mg/m³ for respirable silica.

iii. Dust Fallout (DFO)

On the 7th of December 2012 the Minister of Water and Environmental affairs published the National Dust Control Regulations. This document now enforces the monitoring of dust fallout from activities that is suspected of contributing significantly to dust fallout in its region. The regulation provides a set standard for dust fallout to comply to, enforces that a baseline should be established to projects that

would give rise to increased dust fallout, specifications for dust fallout monitoring and the format of reports if the activity should exceed the thresholds.

Table 7: Acceptable Dust Fallout Rates measured at and beyond the boundary of the premises where dust originates.

Restriction Areas	Dust Fallout rate (mg/m^2/30-days average)	Permitted frequency of exceeding dust fall rate
Residential area	D < 600	Two within a year, not sequential months.
Non-residential area	600 < D > 1200	Two within a year, not sequential months.

*Note – the measurement of dust fallout is in accordance with the methodology prescribed in **ASTM 1739:2017**

If an activity exceeds the standard the entity must submit a dust monitoring report to the air quality officer (local authority), before December 2013 (Section 4, GN1007 of 2012). The entity must develop a dust management plan, within three months after the submission of a dust monitoring report (Section 5, GN1007 of 2012). If the dust fallout limit is continued to be exceeded, the authority may request that continuous PM10 monitoring be conducted at the site.

iv. Sulphur dioxide

SO_2 is an irritant that is absorbed in the nose and aqueous surfaces of the upper respiratory tract and is associated with reduced lung function and increased risk of mortality and morbidity. Adverse health effects of SO_2 include coughing, phlegm, chest discomfort and bronchitis.

Short-period exposures (less than 24 hours)

Most information on the acute effects of SO_2 comes from controlled chamber experiments on volunteers exposed to SO_2 for periods ranging from a few minutes up to one hour (WHO, 2000). Acute responses occur within the first few minutes after commencement of inhalation. Further exposure does not increase effects. Effects include reductions in the mean forced expiratory volume over one second (FEV_1), increases in specific airway resistance, and symptoms such as wheezing or shortness of breath. These effects are enhanced by exercise that increases the volume of air inspired, as it allows SO_2 to penetrate further into the respiratory tract. A wide range of sensitivity has been demonstrated, both among normal subjects and among those with asthma. People with asthma are the most sensitive group in the community. Continuous exposure-response relationships, without any clearly defined threshold, are evident.

Sub-chronic exposure over a 24-hour period

Information on the effects of exposure averaged over a 24-hour period is derived mainly from epidemiological studies in which the effects of SO_2, suspended particulate matter and other associated

pollutants are considered. Exacerbation of symptoms among panels of selected sensitive patients seems to arise in a consistent manner when the concentration of SO_2 exceeds 250 µg/m^3 in the presence of suspended particulate matter. Several more recent studies in Europe have involved mixed industrial and vehicular emissions now common in ambient air. At low levels of exposure (mean annual levels below 50 µg/m^3; daily levels usually not exceeding 125 µg/m^3) effects on mortality (total, cardiovascular and respiratory) and on hospital emergency admissions for total respiratory causes and chronic obstructive pulmonary disease (COPD), have been consistently demonstrated. These results have been shown, in some instances, to persist when black smoke and suspended particulate matter levels were controlled for, while in others no attempts have been made to separate the pollutant effects. In these studies no obvious threshold levels for SO_2 has been identified.

Long-term exposure

Earlier assessments, using data from the coal-burning era in Europe judged the lowest-observed-adverse-effect level of SO_2 to be at an annual average of 100 µg/m^3, when present with suspended particulate matter. More recent studies related to industrial sources of SO_2, or to the changed urban mixture of air pollutants, have shown adverse effects below this level. There is, however, some difficulty in finding this value.

Based upon controlled studies with asthmatics exposed to SO_2 for short periods, the WHO (WHO, 2000) recommends that a value of 500 µg/m^3 (0.175 ppm) should not be exceeded over averaging periods of 10 minutes. Because exposure to sharp peaks depends on the nature of local sources, no single factor can be applied to estimate corresponding guideline values over longer periods, such as an hour. Day-to-day changes in mortality, morbidity, or lung function related to 24-hour average concentrations of SO_2 are necessarily based on epidemiological studies, in which people are in general exposed to a mixture of pollutants; and guideline values for SO_2 have previously been linked with corresponding values for suspended particulate matter. This approach led to a previous guideline 24-hour average value of 125 µg/m^3 (0.04 ppm) for SO_2, after applying an uncertainty factor of two to the lowest-observed-adverse-effect level. In more recent studies, adverse effects with significant public health importance have been observed at much lower levels of exposure. However, there is still a large uncertainty with this and hence no concrete basis for numerical changes of the 1987-guideline values for SO_2.

The European Commission's air quality criteria represent standards to be achieved by the year 2005 and would supersede the European Union standards. The ambient air quality standards of the US-EPA are based on clinical and epidemiological evidence. These standards were established by determining concentrations with the lowest-observed-adverse effect, adjusted by an arbitrary margin of safety factor to allow for uncertainties in extrapolating from animals to humans and from small groups of humans to larger populations. The standards of the US-EPA also reflect the technological feasibility of attainment.

Ambient air quality guidelines and standards issued for SO_2 are given in Table 8.

Table 8: Ambient air quality guidelines and standards for sulphur dioxide

Origin	Annual Average Maximum ($\mu g/m^3$)	24-Hour Maximum ($\mu g/m^3$)	1-Hour Maximum ($\mu g/m^3$)	<1-Hour Maximum ($\mu g/m^3$)
RSA	50	125	350	500 (10 min average)

v. Oxides of Nitrogen

The Department of Environmental Affairs and Tourism currently supports guidelines for nitrogen oxides (NO_x) in addition to nitric oxide (NO) and nitrogen dioxide (NO_2) (Table 9). Air quality guidelines and standards issued by most other countries and organisations tend to be given exclusively for NO_2 concentrations. The reason being that NO_2 is the most important species from a human health point of view. It is currently being recommended that South Africa follow suit and replace its NOx, NO and NO_2 guidelines with a set of standards for NO_2.

Table 9: South African air quality guidelines for oxides of nitrogen

Averaging Period	NO DEAT Guideline		NO_2 DEAT Guideline		NO_x DEAT Guideline	
	$\mu g/m^3$	ppb	$\mu g/m^3$	ppb	$\mu g/m^3$	ppb
Annual Average	188	150	96	50	283	200
Max. 1-month Ave	250	200	153	80	403	300
Max. 24-hour Ave	375	300	191	100	566	400
Max. 1-hour Ave	750	600	382	200	1132	800
Instantaneous Peak	1125	900	955	500	2080	1400

Note:

(1) Although the standards are given by the DEAT in ppb, the equivalent values in $\mu g/m^3$ were calculated for NO_2 and NO based on the molecular weights of these constituents and the assumption of ambient conditions comprising an ambient temperature of 20°C and a pressure of 1 atmosphere. NO_x concentration limits in $\mu g/m^3$ were calculated by summing the NO and NO_2 limits.

NO is one of the primary pollutants emitted by aircraft and motor vehicle exhausts. As discussed previously, NO_2 is formed through oxidation of these oxides once released in the air. NO_2 is an irritating gas that is absorbed into the mucous membrane of the respiratory tract. The most adverse health effect occurs at the junction of the conducting airway and the gas exchange region of the lungs. The upper airways are less affected because NO_2 is not very soluble in aqueous surfaces. Exposure to NO_2 is linked with increased susceptibility to respiratory infection, increased airway resistance in asthmatics and decreased pulmonary function.

Available data from animal toxicology experiments indicate that acute exposure to NO_2 concentrations of less than 1 880 $\mu g/m^3$ (1 ppm) rarely produces observable effects (WHO 2000). Normal healthy

humans, exposed at rest or with light exercise for less than two hours to concentrations above 4 700 µg/m^3 (2.5 ppm), experience pronounced decreases in pulmonary function; generally, normal subjects are not affected by concentrations less than 1 880 µg/m^3 (1.0 ppm). One study showed that the lung function of subjects with chronic obstructive pulmonary disease is slightly affected by a 3.75-hour exposure to 560 µg/m^3 (0.3 ppm) (WHO 2000).

Asthmatics are likely to be the most sensitive subjects, although uncertainties exist in the health database. The lowest concentration causing effects on pulmonary function was reported from two laboratories that exposed mild asthmatics for 30 to 110 minutes to 565 µg/m^3 (0.3 ppm) NO_2 during intermittent exercise. However, neither of these laboratories was able to replicate these responses with a larger group of asthmatic subjects. NO_2 increases bronchial reactivity, as measured by the response of normal and asthmatic subjects following exposure to pharmacological bronchoconstrictor agents, even at levels that do not affect pulmonary function directly in the absence of a bronchoconstrictor. Some, but not all, studies show increased responsiveness to bronchoconstrictors at NO_2 levels as low as 376-565 µg/m^3 (0.2 to 0.3 ppm); in other studies, higher levels had no such effect. Because the actual mechanisms of effect are not fully defined and NO_2 studies with allergen challenges showed no effects at the lowest concentration tested (188 µg/m^3; 0.1 ppm), full evaluation of the health consequences of the increased responsiveness to bronchoconstrictors is not yet possible.

Studies with animals have clearly shown that several weeks to months of exposure to NO_2 concentrations of less than 1 880 µg/ m^3 (1ppm) causes a range of effects, primarily in the lung, but also in other organs such as the spleen and liver, and in blood. Both reversible and irreversible lung effects have been observed. Structural changes range from a change in cell type in the tracheobronchial and pulmonary regions (at a lowest reported level of 640 µg/m^3), to emphysema-like effects. Biochemical changes often reflect cellular alterations, with the lowest effective NO_2 concentrations in several studies ranging from 380-750µg/m^3. NO_2 levels of about 940 µg/m^3 (0.5ppm) also increase susceptibility to bacterial and viral infection of the lung. Children of between 5-12 years old are estimated to have a 20% increased risk for respiratory symptoms and disease for each increase of 28 µg/m^3 NO_2 (2-week average), where the weekly average concentrations are in the range of 15-128 µg/m^3 or possibly higher. However, the observed effects cannot clearly be attributed to either the repeated short-term high-level peak, or to long-term exposures in the range of the stated weekly averages (or possibly both). The results of outdoor studies consistently indicate that children with long-term ambient NO_2 exposures exhibit increased respiratory symptoms that are of longer duration, and show a decrease in lung function.

vi. Licensing requirements

The National Environmental Management: Air Quality Act (39 of 2004) includes the following regarding Atmospheric Emission Licenses.

22. No person may without a provisional atmospheric emission license or an atmospheric license conduct an activity:

(a) Listed in the National List anywhere in the Republic; or

(b) Listed on the list applicable in a province anywhere in that province;

AQA Implementation

Listed Activities and Minimum Emission Standards

Listed Activities and associated minimum emission standards identified in terms of section 21 of the National Environmental Management: Air Quality Act, 39 of 2004 (31 March 2010 GG Vol. 537 No. 33064)

Table 10: Provides the Maximum allowable emissions for a dryer

Pollutant	Symbol	Type of Facility	mg/Nm^3
Particulate Matter	NA	New	50
		Existing	100

The compliance time frame for these standards is as follows:

- New plants must comply with the new plant minimum emission standards from the date of publication of the Notice (1 April 2010).
- Existing plants must comply with the minimum emission standards for existing plants within 5 years of the date of publication of the Notice (1 April 2015)
- Existing plants must comply with the minimum emission standards for new plants within 10 years of the date of publication of the Notice (1 April 2020)

vii. International guidelines and standards

United Nations Framework Convention on Climate Change (UNFCCC1)

The Convention entered into force on 21 March 1994. The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 192 countries having ratified including South Africa.

[1]www.UNFCCC.org

Under the Convention, governments gather and share information on greenhouse gas emissions, national policies and best practices launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries and cooperate in preparing for adaptation to the impacts of climate change.

Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. This amounts to an average of five per cent against 1990 levels over the five-year period 2008-2012.

The Kyoto Protocol is generally seen as an important first step towards a truly global emission reduction regime that will stabilize GHG emissions and provides the essential architecture for any future international agreement on climate change. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. 180 nations including South Africa have ratified the treaty to date. Under the Treaty, countries must meet their targets primarily through national measures. However, the Kyoto Protocol offers them an additional means of meeting their targets by way of three market-based mechanisms.

The Kyoto mechanisms are:

- Emissions trading – known as “the carbon market",
- the clean development mechanism (CDM),
- joint implementation (JI).

These mechanisms help stimulate green investment and help Parties meet their emission targets in a cost-effective way.

The Vienna Convention for the Protection of the Ozone Layer

The ultimate objective of the Convention is to protect human health and the environment against adverse effects resulting from human activities which modify or are likely to modify the ozone layer and urges the Parties to take appropriate measures in accordance with the provisions in the Convention and its Protocols which are in force for that party. To achieve the aforementioned objectives, the Parties, within their capabilities, are expected to: cooperate to better understand and assess the effects of human activities on the ozone layer and the effects of the modification of the ozone layer; adopt appropriate measures and cooperate in harmonizing appropriate policies to control the activities that are causing the modification of the ozone layer; cooperate in the formulation of agreed measures for the implementation of this Convention; and cooperate with competent international bodies to implement effectively this Convention and protocols to which they are party.

The Montreal Protocol on Substances that deplete the Ozone Layer

These protocol controls production of ozone depleting substances: The Montreal Protocol on Substances that Deplete Ozone Layer is a protocol under the Vienna Convention. The Protocol controls the production and consumption of the most commercially and environmentally significant ozone-depleting substances - those listed in the Annexes to the Protocol. One feature of the Montreal Protocol which makes it unique, is Article 6 that requires the control measures to be revised at least every four years (starting 1990), based on the review and assessment of latest available information on scientific, environmental, technical and economic aspects of the depletion of the ozone layer. Based on reports of assessment panels appointed by the Parties and taking into consideration the needs and situation of the developing countries, the Protocol has already been adjusted and amended twice.

At present, 191 nations have become party to the Montreal Protocol. The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16, 1987 and entered into force on January 1, 1989 followed by a first meeting in Helsinki, May 1989. Since then, it has undergone seven revisions, in 1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), and 1999 (Beijing).

The Stockholm Convention on Persistent Organic Pollutants (POPs)

The Stockholm Convention is an international legally binding agreement on persistent organic pollutants (POPs). In 1995, the Governing Council of the United Nations Environment Programme (UNEP) called for global action to be taken on POPs, which it defined as “chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment”.

Following this, the Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme for Chemical Safety (IPCS) prepared an assessment of the 12 worst offenders. Known as the Dirty Dozen, this list includes eight organo-chlorine pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene; two industrial chemicals: hexachlorobenzene (HCB) and the polychlorinated biphenyl (PCB) group; and two groups of industrial by-products: dioxins and furans.

The negotiations for the Stockholm Convention on Persistent Organic Pollutants were completed on May 23rd 2001 in Stockholm, Sweden. The convention entered into force on May 17th, 2004 with ratification by an initial 128 parties and 151 signatories. Co-signatories agreed to outlaw nine of the "dirty dozen" chemicals, limit the use of DDT to malaria control, and curtail inadvertent production of dioxins and furans. Parties to the convention have agreed to a process by which persistent toxic compounds can be reviewed and added to the convention, if they meet certain criteria for persistence and trans boundary threat. Several other substances are being considered for inclusion in the Convention. These are: hexabromobiphenyl, octaBDE, pentaBDE, pentachlorobenzene, short-chained

chlorinated paraffin's, lindane, α- and β-hexachlorocyclohexane, dicofol, endosulfan, chlordecone and PFOS.

The Convention sets out several objectives including:

- The elimination from commerce of identified POPs and others that may be identified in the future;
- encouraging the transition in commerce to safer alternatives;
- identifying additional POPs;
- the clean-up of old stockpiles and equipment containing POPs; and
- encouraging all stakeholders to work towards a POP-free environment.

International Concerns Around mercury

There are international initiatives to address mercury but to date no international policy has been developed. A recent programme backed by the United Nations (UN) that aims to reduce the health and environmental impacts of mercury includes a two-year period of voluntary action to reduce emissions and an evaluation to determine whether an international treaty is necessary. It aims to develop partnerships between government, industry and other key groups to reduce emissions.

Equator Principles

The Environmental Assessment report required needs to addresses baseline environmental and social conditions, requirements under host country laws and regulations, applicable international treaties and agreements, sustainable development and use of renewable natural resources, protection of human health, cultural properties, and biodiversity, including endangered species and sensitive ecosystems, use of dangerous substances, major hazards, occupational health and safety, fire prevention and life safety, socio-economic impacts, land acquisition and land use, involuntary resettlement, impacts on indigenous peoples and communities, cumulative impacts of existing projects, the proposed project, and anticipated future projects, participation of affected parties in the design, review and implementation of the project, consideration of feasible environmentally and socially preferable alternatives, efficient production, delivery and use of energy, pollution prevention and waste minimization, pollution controls (liquid effluents and air emissions) and solid and chemical waste management.

International Finance Corporation

The International Finance Corporation (IFC) recommends the following in regard to air pollution. "Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislation standards, or in their absence, the current World Health Organization (WHO) Air Quality Guidelines (AQGs0 or other internationally recognized sources. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed." However also includes that

the “25 percent increment rule itself is too strict to be applied universally on all guidelines, to be noted that the emission figures vary greatly between different guidelines and therefore a universal increment rule will lead in most cases to big unnecessary problems without enhancing the environment.”

c. Existing Sources of Air Pollution

A description of the emissions estimated from the mining activities will be discussed below. During various site visits local airborne pollutant sources were identified, however the air quality in the region can be viewed as natural (rural). These are important to consider in terms of assessing the cumulative impact potential on air quality in the region:

- Agricultural activities,
- Vehicle Emissions,
- Veld and Agricultural Fires,
- Industrial Emissions (brick kiln emissions),
- Power Generation,
- Mining Activities (Coal),
- Home Fires.

A qualitative discussion on each of these source types is provided in the subsections which follow.

i. Agriculture

Large scale agriculture to the south and east, along with small-scale type of agriculture (small holdings) which supply a family and relatives of food within the community are common in the area, with the exception of one, high intensity flowers grown in greenhouses. The airborne pollutant associated with the farming is Particulate Matter (TSP, PM10, PM2.5, etc.) generated by animal husbandry, wind erosion of open tilled fields and planting.

Agricultural activity can be considered a significant contributor to particulate emissions, although tilling, harvesting and other activities associated with field preparation are seasonally based.

The main focus internationally with respect to emissions generated due to agricultural activity is related to animal husbandry, with special reference to malodours generated as a result of the feeding and cleaning of animal. The types of livestock assessed included pigs, sheep, goats and chickens (within close proximity to the project). Emissions assessed include ammonia and hydrogen sulphide (USEPA, 1996).

Little information is available with respect to the emissions generated due to the growing of crops. The activities responsible for the release of particulates and gasses to atmosphere would however include:

- Particulate emissions generated due to wind erosion from exposed areas;
- Particulate emissions generated due to the mechanical action of equipment used for tilling and harvesting operations;
- Vehicle entrained dust on paved and unpaved road surfaces;
- Gaseous and particulate emissions due to fertilizer treatment; and
- Gaseous emissions due to the application of herbicides and pesticides.

ii. Vehicles

The force of the wheels of vehicles travelling on unpaved roadways causes the pulverisation of surface material. Particles are lifted and dropped from the rotating wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic (USEPA, 1996). Due to the nature of both mining and agricultural activity, road networks can often be of a temporary nature, and are thus unpaved. An unpaved road network exists in the area. Due to the volume of heavy vehicles using the roads near the site, the expected volumes of entrained dust are likely to be considerable and will need to be addressed.

Due to the proximity of the site to the N12 Highway, exhaust tailpipe emissions from vehicles including rail are a significant source of particulate emissions. Exhaust fumes contain nitrogen, oxygen, carbon monoxide, water vapour, sulphur dioxide, nitrogen oxide, volatile hydrocarbons and polyaromatic hydrocarbons (PAHs) and their derivatives, acetylaldehyde, benzene and formaldehyde, carbon particles, sulphates, aldehydes, alkanes, and alkenes.

iii. Veld and Agricultural Burning

A veld fire or controlled agricultural burn is a large-scale natural combustion process that consumes various ages, sizes, and types of flora growing outdoors in a geographical area. Consequently, fires are potential sources of large amounts of air pollutants that should be considered when attempting to relate emissions to air quality. The size and intensity, even the occurrence, of fires depend directly on such variables as meteorological conditions, the species of vegetation involved and their moisture content, and the weight of consumable fuel per hectare (available fuel loading).

Once a fire begins, the dry combustible material is consumed first. If the energy released is large and of sufficient duration, the drying of green, live material occurs, with subsequent burning of this material as well. Under suitable environmental and fuel conditions, this process may initiate a chain reaction that results in a widespread conflagration. It has been hypothesized, but not proven, that the nature and amounts of air pollutant emissions are directly related to the intensity and direction (relative to the wind) of the fire and are indirectly related to the rate at which the fire spreads. The factors that affect the rate of spread are (1) weather (wind velocity, ambient temperature, relative humidity); (2) fuels (fuel type, fuel bed array, moisture content, fuel size); and (3) topography (slope and profile). However, logistical problems (such as size of the burning area) and difficulties in safely

situating personnel and equipment close to the fire have prevented the collection of any reliable emissions data on actual fires, so that it is not possible to verify or disprove the hypothesis.

The major pollutants from burning are particulate matter, carbon monoxide, and volatile organics. Nitrogen oxides are emitted at rates of from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible (USEPA, 1996). A study of biomass burning in the African savannah estimated that the annual flux of particulate carbon into the atmosphere is estimated to be of the order of 8 Tg C, which rivals particulate carbon emissions from anthropogenic activities in temperate regions (Cachier et al, 1995).

iv. Brick kiln emissions

Clay brick manufacturing face poor uptake of tunnel kiln technology, and lack of abatement on clamp kilns, particularly of PM and CO emissions. Tunnel kiln technology is promoted in new, regulated operations.

v. Power Generation

The burning of coal for power generation can result in emissions being generated. At the power stations surrounding the ash facility, various mitigation measures have been put in place at the stations to reduce the emissions before entering the atmosphere. These include bag filters or electrostatic precipitators (ESPs) for the removal of particulate matter and ash, scrubbers for sulphur dioxide and over air burners for oxides of nitrogen. These mitigation measures are highly efficient with up to 99% of all emissions being captured or removed.

vi. Opencast coal dust

Opencast coal mining should control of particulate matter (PM) on mine haul roads. Water spraying is a cheap and effective means of control and should be consistently applied across mines in the Highveld Priority Area (HPA). Other studies have indicated that some haul road temporary chemicals re-surfacing techniques are effective. Potential sources of fugitive dust emissions (PM_{10} and DUST) are released from these sources; material handling operations, vehicle entrainment by haul vehicles, windblown dust from tailings dams and oxides of nitrogen (NO_X) and carbon monoxide (CO) which are produced during mining operations. Fugitive dust emissions released during mining operations are generally only of concern within 3 - 5 km of the mine boundary.

vii. Home Fires

Domestic fuel burning continues partly due to poor uptake of technology, and high pace of settlement growth. Awareness and technology promotion activities are increasing, although local and provincial authorities have lacked capacity and means to ensure awareness and conversion. In the region of the mine, the housing associated with low-income housing with minimal electricity usage for heating during the colder winter months and for cooking. The open fires are made from any combustible material (usually wood, or coal) and is often used to cook and to heat up the house. The associated emissions from these cooking fires differentiate from the type of material used for energy and the

most common airborne pollutants are. Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO), Carbon dioxide (CO_2) and Particulate matter (TSP, PM_{10}, $PM_{2.5}$, etc.). During the winters cold day's inversions form over the surface of the land and cause the airborne pollutants from domestic fuel burning to be entrapped. The air movement cannot disperse the air pollutant from the region and causes the concentrations to build up. The inversion layer and domestic fuel burning takes place at the same time, which increases the severity of the situation at some locations. As the day heats up (midday) the inversion layer breaks up and the pollutants can disperse.

d. Emissions Inventory for Highveld Priority Area

A detailed emissions inventory for the Highveld Priority Area was carried out as part of the Air Quality Management Plan with the pollutants and sources identified, and still being updated.

The Highveld area, in parts of Gauteng and parts of Mpumalanga provinces in South Africa, is associated with gold and platinum group minerals mines, coal mines, coal based electrical power generation, and many informal settlers using wood fuel.

Parts of the region suffer from poor air quality and elevated concentrations of 'criteria pollutants' due to concentration of industrial and domestic sources in some areas.

The former SA Minister of Environmental Affairs declared the Highveld Priority Area (HPA) in late 2007. The Department of Environmental Affairs (DEA) now manages the priority area and is developing an air quality management plan.

Air emissions of fine particulate matter (PM_{10}) in the Highveld Priority Area over a year, is estimated at 279 630 tons, including:

- 89% PM_{10} from general industrial sources,
- 50% PM_{10} from opencast mine haul roads dust,
- 17% PM_{10} from primary metallurgical industries, and
- 12 % PM_10 from coal power generation.

NO_x air emission total 978 781 tons per year in the Highveld Priority Area, including:

- 90% NO_x from industrial sources, and
- 73% NO_x from coal power generation.

SO_2 air emissions in the Highveld total 1 622 233 tons per year, including:

- 99% SO_2 from industrial sources, and
- 82% SO_2 from coal power generation.

Big eight air emissions sources

Major industrial air emissions sources are grouped into these categories:

1. Power Generation,

2. Coal Mining,
3. Primary Metallurgical Operations,
4. Secondary Metallurgical Operations,
5. Brick Manufacturers,
6. Petrochemicals Industry,
7. Other Ekurhuleni (East Rand) Industrial Sources, and
8. Other Mpumalanga Highveld Industrial Sources.

Smaller air emissions sources categories include:

- Motor Vehicles,
- Household Fuel Burning, and
- Biomass Burning (wood fires).

Parts of the HPA have relatively good air quality, but generally ambient air quality in the HPA is poor. Eight extensive areas occur where ambient SO_2, PM_{10} and ozone (O_3) concentrations exceed air quality standards.

Air emissions hot spots regularly exceed 24-hour SO_2 and PM_{10} standards, as confirmed by ambient monitoring. Air quality hotspots result mostly from a combination of emissions from local industrial sectors and residential fuel burning.

Motor vehicles, mining and cross-boundary transport of pollutants into the HPA, add to the base loading.

A separate study had earlier found that in winter, grassland 'veld' fires and woodland fires in southern African and central Africa contribute to streams of smoke over southern Africa. Project Safari involved satellite, airborne and ground observation by a combined team of USA NASA, SA CSIR, and environmental agencies.

Highveld air pollution hot spots

Areas of concern include Kendal, Witbank, Middelburg, Secunda, Ermelo, Standerton, Balfour, and Komati.

Air emissions assessment and monitoring sites, for which results are published in the state assessment report, included these residential and industrial areas; Emalahleni municipality, Kendal, Witbank, Steve Tshwete municipality, Columbus Ssteel, Komati, Hendrina, Middelburg, Govan Mbeki municipality, Langverwacht, Bosjesspruit coal mine, Elandsfontein, Leandra, Sasol Secunda, Msukaligwa municipality, Camden, Ermelo, Pixley Ka Seme municipality, Amersfoort, Majuba, Verkykkop, Lekwa Standerton, Dipaleseng Balfour.

Effects of poor air dispersion conditions in winter are evident for all pollutants. PM10 displays a striking seasonal trend. Ozone (O_3) peaks in spring, partly due to polar air streams, lightning and rain clouds.

CO and benzene are within acceptable limits at new sites, using newer petrochemicals technology. Trends in pollutant concentrations could not be identified in the data.

Air pollution versus health

Outdoor air pollution in urban areas cause (Norman et al, 2007a):

- 3.7% of mortality, from cardiopulmonary disease in adults 30 years and older,
- 5.1% of mortality, from cancers of trachea, bronchus, and lung in adults,
- 1.1% of mortality, from acute respiratory infections in children under 5 years.

Exposure to indoor air pollution is associated with diseases like COPD, lung cancer, nasopharyngeal cancer, tuberculosis, cataracts, asthma, birth defects, and acute lower respiratory infections (ALRI) among children younger than 5 years (Norman et al, 2007b).

ALRIs were the leading cause of death of children under 5 years worldwide, and fourth highest in South African children. ALRI burden on children under 5 years was 24% in 2000, attributable to indoor air pollution from household fuel use (Norman et al, 2007b).

For COPD, females experienced more than double the male attributable burden. Lung cancer burden was relatively minor from indoor air pollution as a result of household fuel use. Indoor air pollution from household fuel use was responsible for 2489 deaths, or 0.5% of the total health burden on individuals, and resulted in the loss of 60 934 disability adjusted life years, or 0.4% of the total burden (Norman et al, 2007b).

Air emissions exposure problem areas

Air quality hotspots on the HPA include Emalahleni, Kriel, Steve Tshwete municipality, Ermelo, Secunda, Ekurhuleni (East Rand), Lekwa, Balfour, and Delmas.

Residential areas where wood and coal are used, suffer high concentrations of particulates and CO, particularly those that are densely populated, leading to high exposure.

Air emissions abatement technology issues

Several technology challenges are listed in the official Highveld air quality assessment, as facing major air emissions industries on the Highveld, including management of fugitive and non-point sources, SO_2 and NO_2 emission management and control, and petrochemicals technology. Legislation and carbon trade regimes are expected to force continuous improvement.

Air quality management and measurement problems

Air quality management capacity challenges in the Highveld Priority Area include:

- Low level of capacity, human resources and skills at authorities,
- Two municipalities were not confident to implement the Air Quality Act,
- Five municipalities have not made air quality officer (AQO) appointments,

- 12 municipalities and both provincial departments have identified capacity building needs, including technical, legal, and general AQM training and assistance.

Six municipalities had indicated that they do not do ambient air quality monitoring. Monitoring initiatives were not integrated, there was no standardised monitoring, reporting, or quality control approach.

Air emission data growing

All of 12 municipalities and one provincial department on the Highveld, had undertaken an emission inventory. The HPA project has initiated a comprehensive emission inventory to be completed and maintained.

Two district municipalities and one provincial department have not initiated steps to prepare for the delegation of the AEL function with the repeal of the APP Act.

Air emissions and air quality management issues have been forwarded into strategy analysis and management planning stages of the air quality management programme (AQMP).

e. Background Concentration

Ambient air quality monitoring has been undertaken by Eskom at the Chicken Farm Site, which due to its distance from urban areas, is the closed representative site to Delmas, approximately 30km north-east, with the South African Air Quality Information System (SAAQIA) providing the following information from 1 January 2017 to 31 December 2017.

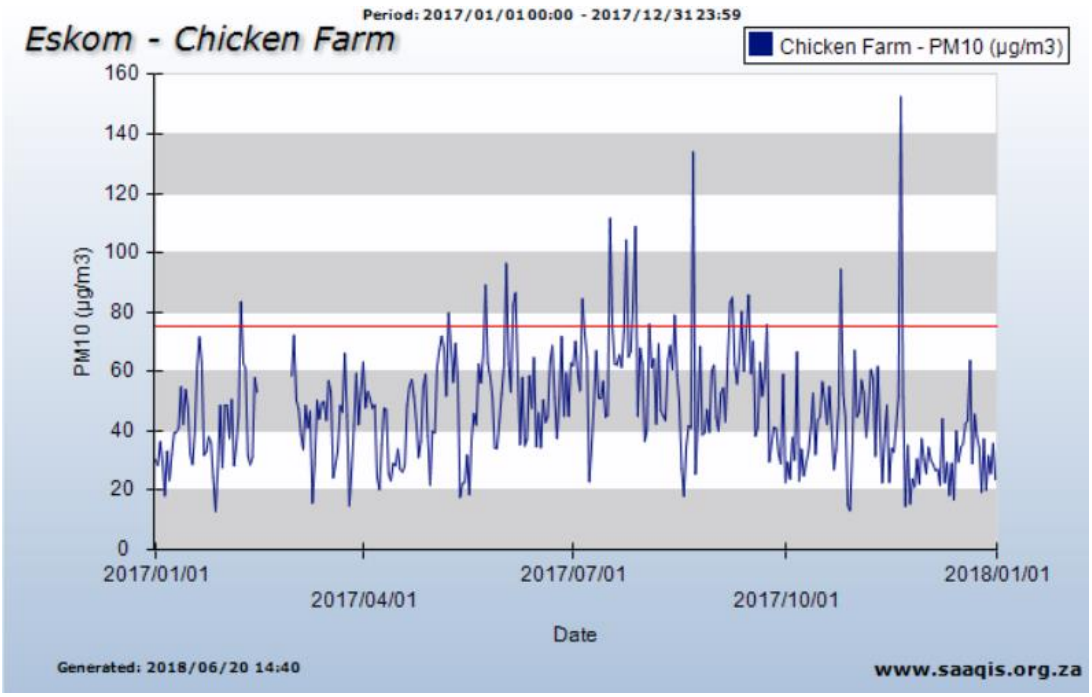

Figure 10: PM_{10} Monitoring results at the Eskom Chicken Farm site (Daily standard: 75µg/m³)

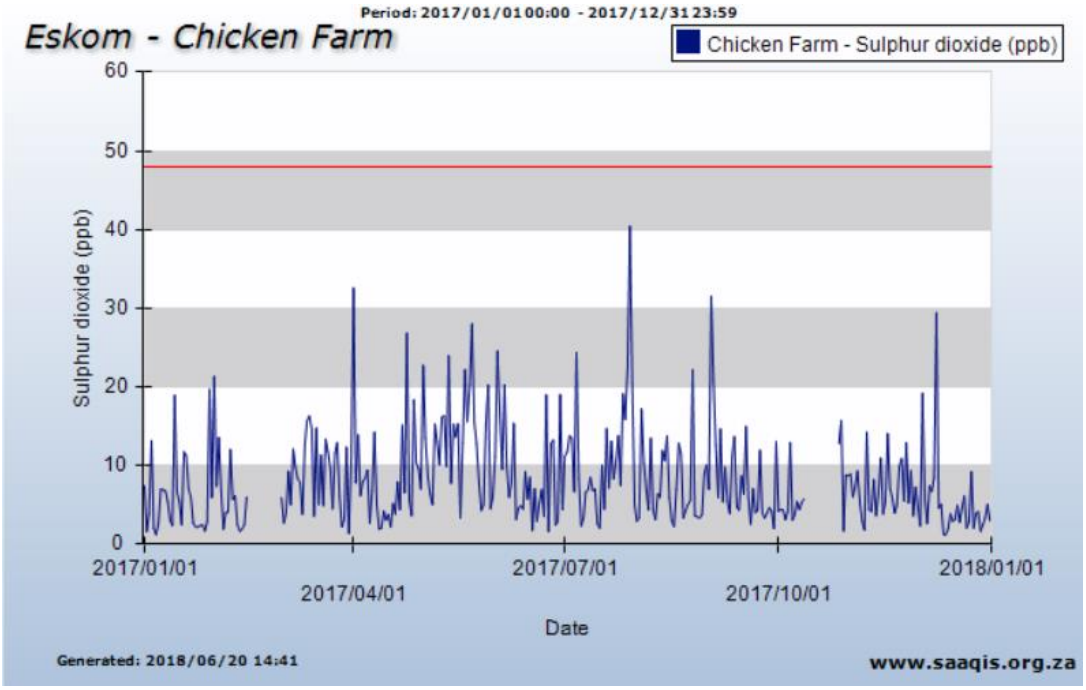

Figure 11: Sulphur Dioxide Monitoring results at Eskom Chicken Farm site (Daily Standard: 48ppb)

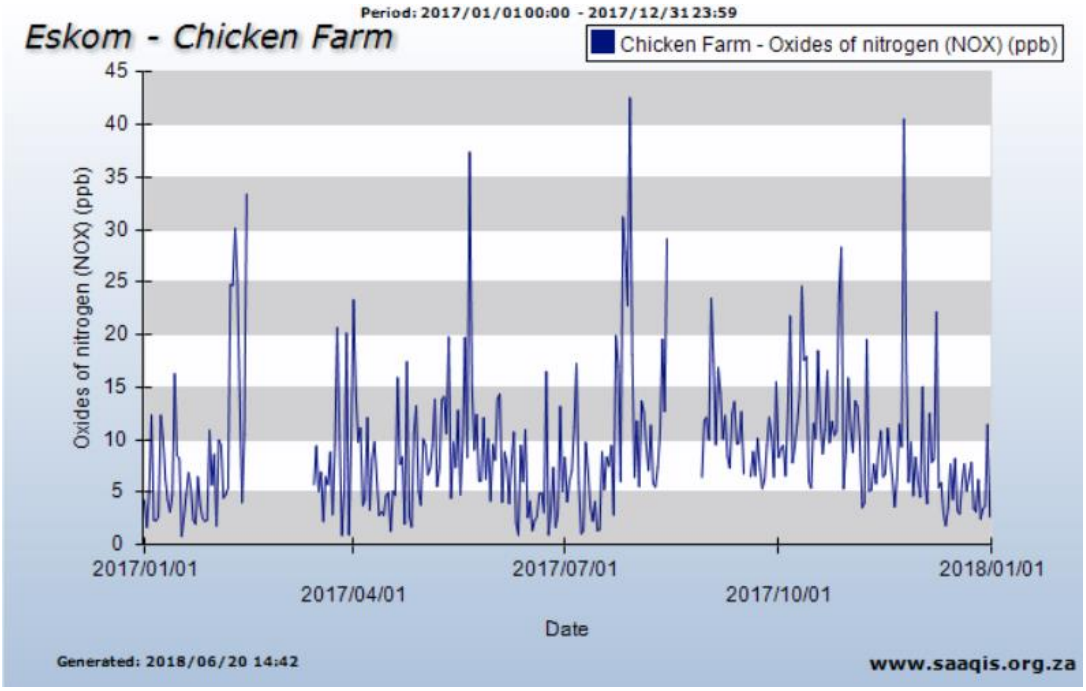

Figure 12: Oxides of Nitrogen Monitoring results at Eskom Chicken Farm site (No Daily Standard prescribed)

Ambient monitoring was undertaken as part of the baseline assessment of this study at the following locations:

Figure 13: Ambient Particulate Monitoring

Table 11: Ambient Particulate Matter monitoring undertaken surrounding the site

µg/m³	Oct 16	Nov 16	Apr 18	March 21
Wocke	10.6	11.6	15.6	26.2
Burger	18.2	19.0	23.8	40.0
van der Walt	22.7	21.9	24.1	40.5
Die Plaas	10.3	11.0	14.9	25.0
Blomme			16.3	27.4
N12			32.8	55.1
Rossgro			12.5	21.0
Geluk			17.1	28.7

Due to the property area being increased between the first and second rounds of monitoring, additional monitoring points were added in the April 2018 monitoring campaigns. A further round of monitoring was conducted in March 2021.

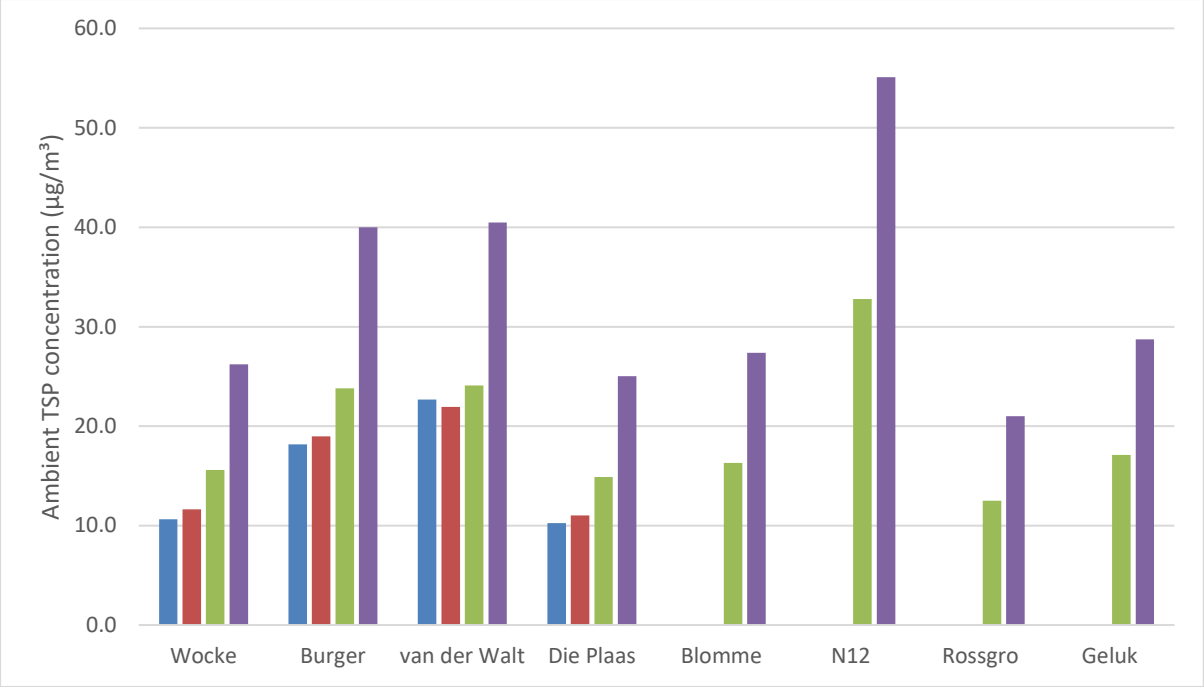

Figure 14: Graphical representation of ambient concentrations (Daily standard: 75µg/m³)

The results indicate an ambient particulate load on the lower side of the ambient conditions for the highveld, and well below the National Standard.

f. Sensitive Receptors

The proposed mining development is located to the west of Delmas in a sparsely populated area (with the exception of informal settlements to the north and west) with rural dwellings and agriculture making up the sensitive receptors near the proposed mine (see Figure 15**)**. Other sensitive receptors within the area would be the local fauna and flora. It has been identified that dust settling on the leaves of plants can result in damage to plants and inhalation of dust may result in sickness and associated lung diseases for wildlife and humans which will be present near the proposed mining locations.

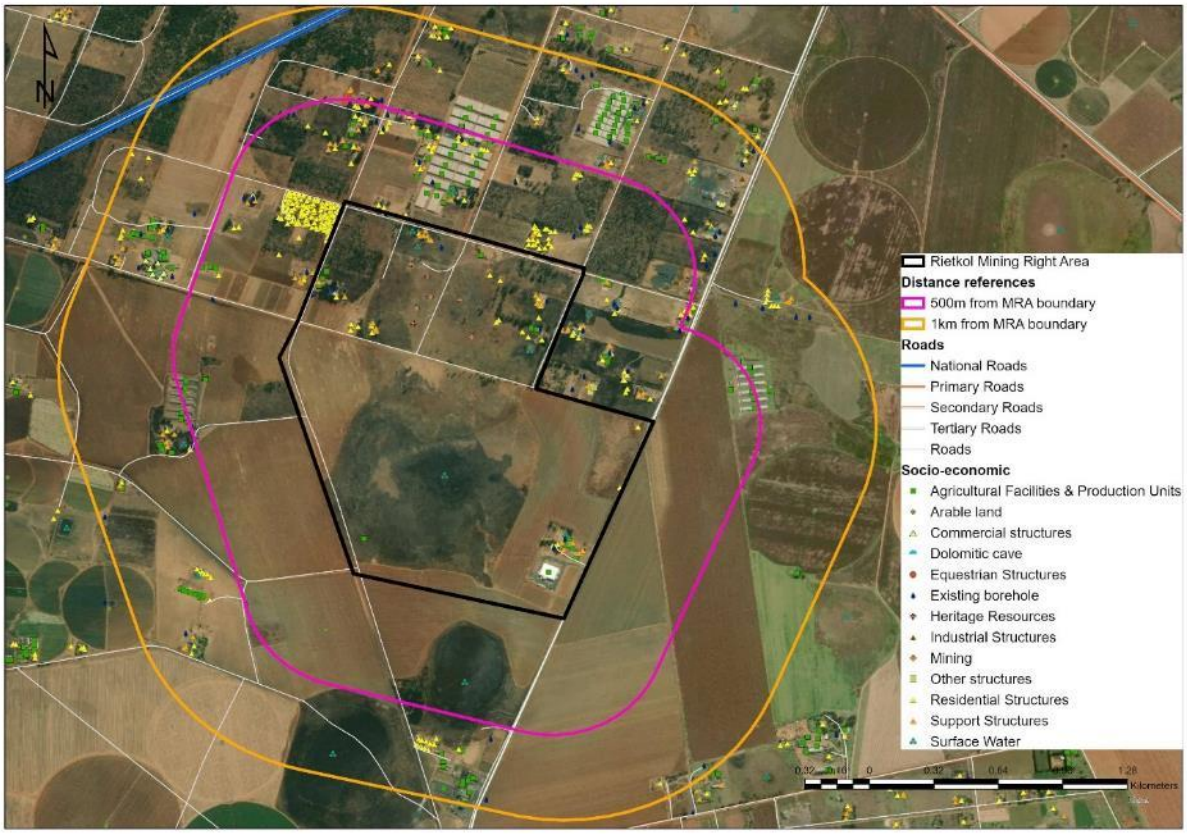

Figure 15: Sensitive Receptor Map

4. Impact Assessment

This section of the report will outline the potential ambient air quality impacts associated with the proposed activities at the mine. During the Impact Assessment phase, a detailed emissions inventory was compiled to determine the emissions released from the proposed activities. Dispersion modelling simulations was undertaken using the AERMOD dispersion model and the impacts will be presented graphically as isopleths plots.

a. Emission Inventory

The emission inventory was compiled based on US EPA AP42 Emission factors for the mining aspects as well as crushing and screening of material.

Emissions of total suspended particulates (TSP) and particulate matter with an aerodynamic diameter of less than 10-micron (PM10) and less than 2.5 micron (PM 2.5), Sulphur dioxide and Oxides of Nitrogen are classified as criteria pollutants from this listed activity and therefore were the focus.

The mining operations are comprised of different processes the emissions calculated will be estimated for each specific stages within the mining process.

i. Mining phase

During the mining phase, the pit is active. The emission factor is based on the amount of TSP (with the assumption that all TSP released is classed as PM_{10}) is released during this phase and the gathering of mineral ore. Based on the US-EPA AP-42 Appendix B.2 publication of Generalised particle size distribution, 15% of the total dust produced is estimated to be PM 2.5 (for Unprocessed Ores).

- Drilling & Blasting
    - To determine the total amount of TSP emitted into the atmosphere per blast. The result was then multiplied to the number of blasts per year to get the annual emission rate.
- ROM handling & Hauling
    - To determine the total amount of TSP emitted by the handling and transport of material from pit to stockpiles.
- ROM Stockpiling
    - The emissions from wind erosion and the vehicle traffic at stockpiles (maintenance).

Model Input Code	Description	Area (m²)	PM10 (g/s)	PM 2,5 (g/s)	NO_x (g/s)	SO_2 (g/s)
AREA1	Primary Crusher	240,00	8,36673E-09	1,25501E-09	0	0
AREA2	Transfer Station	31,90	1,12332E-09	1,68498E-10	0	0
AREA3	Screening and Washing	1275,40	4,01678E-10	6,02517E-11	0	0
AREA4	Dryer	1052,70	3,81676E-10	5,72514E-11	0	0
AREA5	Baghouse	444,60	2,15732E-10	3,23598E-11	0	0
AREA6	Loading Zone	2589,20	3,23191E-10	4,84787E-11	0	0
AREA7	Strategic ROM	4096,40	1,71378E-11	2,57067E-12	0	0
AREA8	Pebble Stockpile	295,00	1,34533E-11	2,01800E-12	0	0
AREA9	Sand Stockpile	347,70	3,05679E-07	4,58519E-08	0	0
AREA10	Waste Rock	333,90	1,41923E-07	2,12885E-08	0	0
OPIT1	Open Pit (total footprint)	226540,10	2,68911E-07	4,03367E-08	0	0

ii. Crushing & Screening phase

During the crushing & screening process (beneficiation) phase, the ROM is processed to different grades of product. The emission elements are the handling, crushing and screening and stockpiling and transport of product.

- Crushing & screening
    - The amount of TSP emitted by the crushing and screening process.
- Stockpiling and transferring of product
    - The emissions from wind erosion and the vehicle traffic at stockpiles (maintenance).

AP42 - Table 11.19.2-1	E-factor	Crushing & Screening	CE	Emissions	No of days	Emissions	Emissions	Emissions	Emissions
TSP	**(kg/ton)**	**(ton/day)**		**(kg/day)**		**(kg/hour)**	**(g/s)**	**Area**	**(g/s/m²)**
Screening	0,0018	1280		2,304	365	0,096000	0,026667	1275,4	2,09085E-05
Primary Crushing	0,0011	1280		1,408	365	0,058667	0,016296	240	6,79012E-05
PM10	**(kg/ton)**	**(ton/day)**		**(kg/day)**		**(kg/hour)**	**(g/s)**	**Area**	**(g/s/m²)**
Screening	0,0011	1280		1,408	365	0,058667	0,016296	1275,4	1,27774E-05
Primary Crushing	0,00037	1280		0,474	365	0,019733	0,005481	240	2,28395E-05
PM2.5	**(kg/ton)**	**(ton/day)**		**(kg/day)**		**(kg/hour)**	**(g/s)**	**Area**	**(g/s/m²)**
Screening	0,0011	1280		1,408	365	0,058667	0,016296	1275,4	1,27774E-05
Primary Crushing	0,000025	1280		0,032	365	0,001333	0,000370	240	1,54321E-06

iii. Transportation

Access roads are constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Often however, these unused haul roads are left as is in the event that sections of them could be reused at a later stage.

A large amount of dust emissions is generated by vehicle traffic over these temporary unpaved roads (USEPA, 1996). Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads (USEPA, 1996). Passing traffic can thus re-suspend the deposited material. To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts.

A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated.

Emission Factor Calculation					
Pollutant	**lb/VMT**	**g/VKT**	**g/day**	**g/s**	**g/s/m²**
TSP	12,50	3523,94	239691,20	2,774203	1,70663E-05
PM10	3,19	898,12	61088,47	0,707042	4,34956E-06
PM2,5	0,32	89,81	6108,85	0,070704	4,34956E-07

iv. Dryer

After the crushing & screening process (beneficiation) phase, the ROM is processed to reduce the moisture content within the material. The dryer is usually a fuel based rotary dryer, and so emissions from the dryer are based on the fuel burnt, in the form of Sulphur dioxide and Oxides of nitrogen. As part of the emission mitigation, the dryer will have its own bag filter to collect product for use.

The dryer emission factors are based on a throughput of 77 000 tons/annum and a dryer operated using diesel, this information will be updated in the air quality study required for the Atmospheric Emissions Licence which will applied for closer to the time.

Fuel Oil Combustion Dryer

- NO_x – 4.0g/s
- SO_x – 5.13g/s

b. AERMOD Dispersion Model Setup

i. Air Dispersion Modelling Software

During the assessment the ISC/AERMOD view dispersion model was used to evaluate air quality impacts.

Dispersion modelling was undertaken using the US-EPA approved Aermod View Dispersion Model, a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

There are two input data processors that are regulatory components of the AERMOD modelling system: AERMET, a meteorological data pre-processor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data pre-processor that incorporates complex terrain using USGS Digital Elevation Data. Other non-regulatory components of this system include: AERSCREEN, a screening version of AERMOD; AERSURFACE, a surface characteristics pre-processor, and BPIPPRIME, a multi-building dimensions program incorporating the GEP technical procedures for PRIME applications.

The Aermod View model is used extensively to assess pollution concentrations and deposition rates from a wide variety of sources. Aermod View is a true, native Microsoft Windows application and runs in Windows 2000/XP and NT4 (Service Pack 6).

Some of the modelling capabilities are summarised as follows:

- Aermod View may be used to model primary pollutants and continuous releases of toxic hazardous waste pollutants;
- Aermod View model can handle multiple sources, including point, volume, area and open pit source types. Line sources may also be modelled as a string of volume sources or as elongated area sources;
- Source emission rates can be treated as constant or may be varied by month, season, hour of day, or other periods of variation, for a single source or for a group of sources;
- The model can account for the effects of aerodynamic downwash due to nearby buildings on point source emissions;
- The model contains algorithms for modelling the effects of settling and removal (through dry deposition) of large particulates and for modelling the effects of precipitation scavenging from gases or particulates;
- Receptor locations can be specified as gridded and/or discrete receptors in a Cartesian or polar coordinate system;
- Aermod View incorporates the COMPLEX1 screen model dispersion algorithms for receptors in complex terrain;
- Aermod View model uses real-time meteorological data to account for the atmospheric conditions that affect the distribution of air pollution impact on the modelling area; and

- Output results are provided for concentration, total deposition, dry deposition, and/or wet deposition flux.

Input data to the Aermod View model includes source and receptor data, meteorological parameters, and terrain data. The meteorological data includes wind velocity and direction, ambient temperature, mixing height and stability class, from surface and upper air stations.

The uncertainty of the Aermod View model predictions is considered to be equal to 2, thus it is possible for the results to be over predicting by double or under predicting by half, it is therefore recommended that monitoring be carried out at the proposed more during operation to confirm the modelled results, to ensure legal standards are maintained.

ii. GIS Input Data

The Mine is located in an area that is surrounded by gentle undulating terrain systems, therefore requiring the inclusion of a complex terrain file. The modelling domain selected for this campaign is 20km x 20km, covering an approximate area of 400km^2, with the mine at the centre of the domain (Table 12). The dispersion model was setup to model 882 points evenly distributed across the domain.

Table 12: GIS Domain input points – UTM zone 35J WGS84 projection

Domain Points	X Coordinate (m)	Y Coordinate (m)
NE Study Domain point	682744.13	7132304.29
SE Study Domain point	682289.69	7087921.20
SW Study Domain point	638133.82	7087466.77
NW Study Domain point	638436.78	7132077.07

iii. Topography

The general elevation in the region is shown in Figure 16.

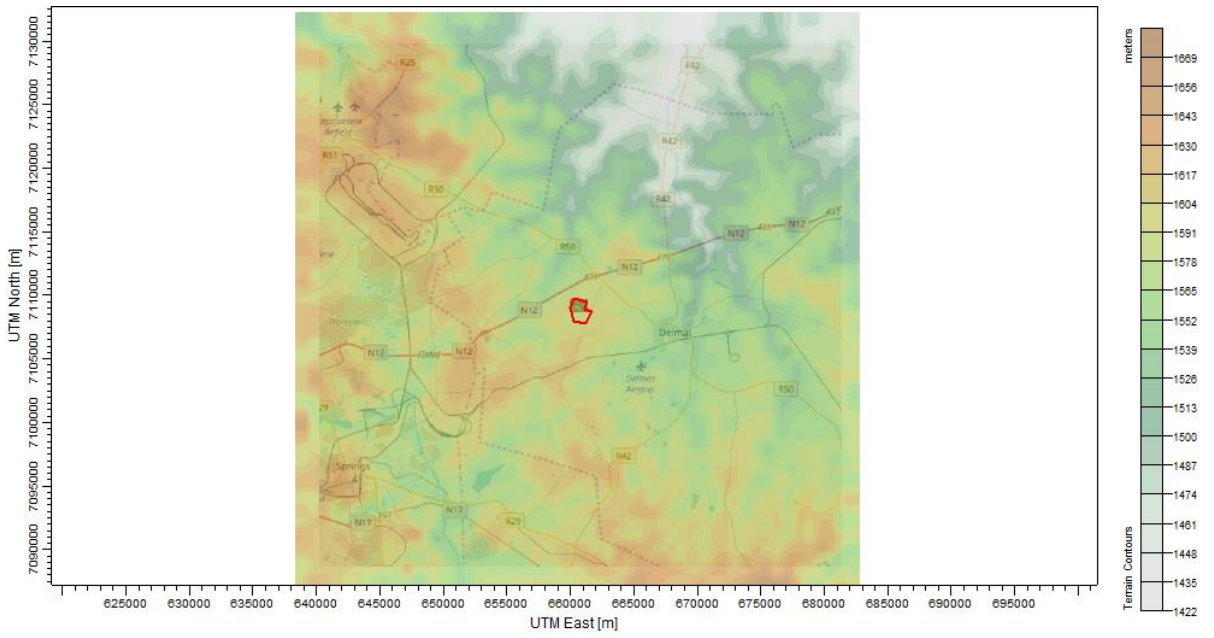

Figure 16: Topography of the region

iv. Meteorological Input Data

Meteorological data was obtained from the South African Weather Service meteorological station located at Springs for the period 2013 – 2017 for inclusion into the dispersion model. Table 13 presents the data recovery statistics obtained by the model, which is affected by the requirements of the meteorological pre-processor within the model.

Table 13: Meteorological data statistics

Period	Total Hours	Data used	Missing data	Calm conditions
2013 - 2017	43 800	43 800	0	788

c. Dispersion Modelling Results

The dispersion of pollutants through the air was modelled with the AERMOD software. The physical environmental parameters, such as wind, temperature, humidity and rain, influence the concentrations over distance. The modelling software took all of these parameters into account in the primary calculations, a concentration value per pollutant was calculated at each of the grid points to be able to form iso-pleth images for graphical presentation of the typical plume dispersion in the region.

The modelled results are presented in the table below and compared with the national standards. The concentrations depicted are all the second highest concentration calculated, as per statistical law. The different modelled components are:

1. Mining phase – This focused on the pollutants generated during mining (pit operations).
2. Crushing & Screening – This calculated the emission emitted from the crushing and screening, loading and unloading of stockpiles and the transport of product around the site.
3. Dryer – This addressed the pollutants from the dryer plant.

Results are a cumulative impact showing total impacts from the site. (Refer to Appendix A for graphical outputs)

It should be duly noted that all the model runs were done as worst-case scenarios, thus no mitigation measures control efficiencies are included in the emission rate calculation. The mitigation measure control efficiencies are presented in the following section. The values noted in the table below is the maximum concentration calculated throughout the model, the majority of the maximum concentrations are most likely to be located either on-top of an area source or close to an area source. The concentration of the pollutant will decrease as it moves away towards the fence line (MRA boundary). The maximum concentration that enters the receiving environment, beyond the fence line is highlighted as the MRA Boundary concentration below.

Table 14: Dispersion Results from AERMOD – Worst Case Scenario (all results represented as µg/m³)

SO_2			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	70.14	29.70	350
Daily	6.47	6.45	125
Annual	2.47	2.27	50
PM10			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	578.62	296.57	-
Daily	229.05	67.39	75
Annual	101.93	13.69	40
PM2.5			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	60	35	-
Daily	24	10	40
Annual	10	3	20
NOx			
Averaging Period	Peak	MRA Boundary	Standard
Hourly	67.34	28.51	200
Daily	6.22	2.26	-
Annual	2.37	0.24	40

Due to the potential risks associated with Silica exposure, the United States Occupational Health Association has determined an acceptable exposure limit of 100µg/m³. Provided in below using the PM10 isopleths, indicates the MRA boundary, with the US exposure limit highlighted in red. The limit is not exceeded outside the site boundary.

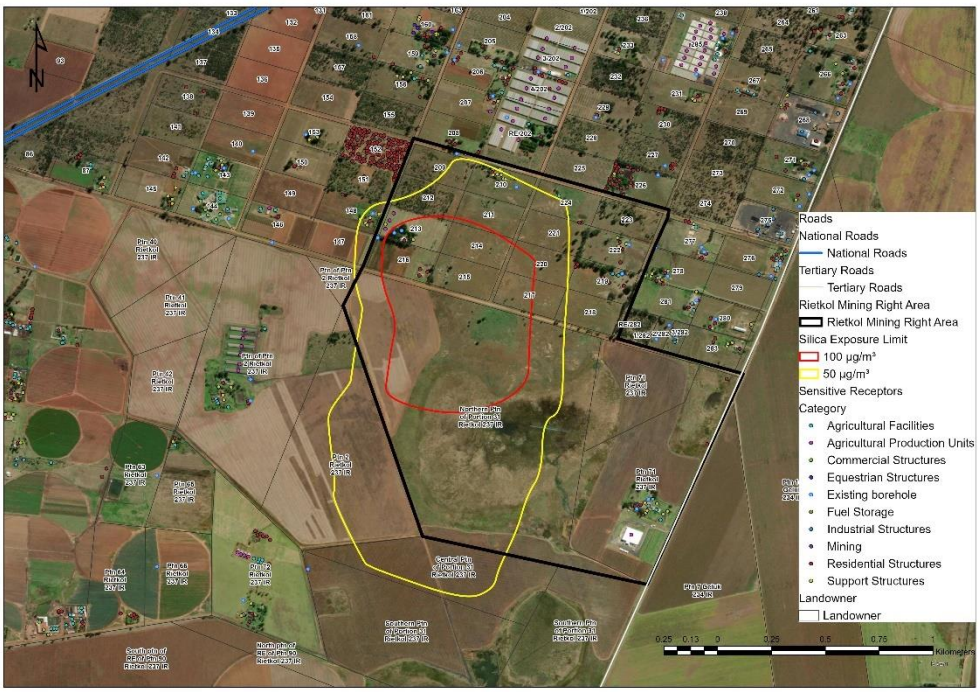

Figure 17: Silica exposure limit of 100µg/m³ (red line)

Dust fallout modelling indicates the areas where fallout is expected to exceed the permissible limits for residential and industrial areas (Figure 18). Exceedances of both limits fall within the site boundary. It is recommended that dust fallout monitoring be undertaken to determine the effectiveness of the mitigation measures implemented.

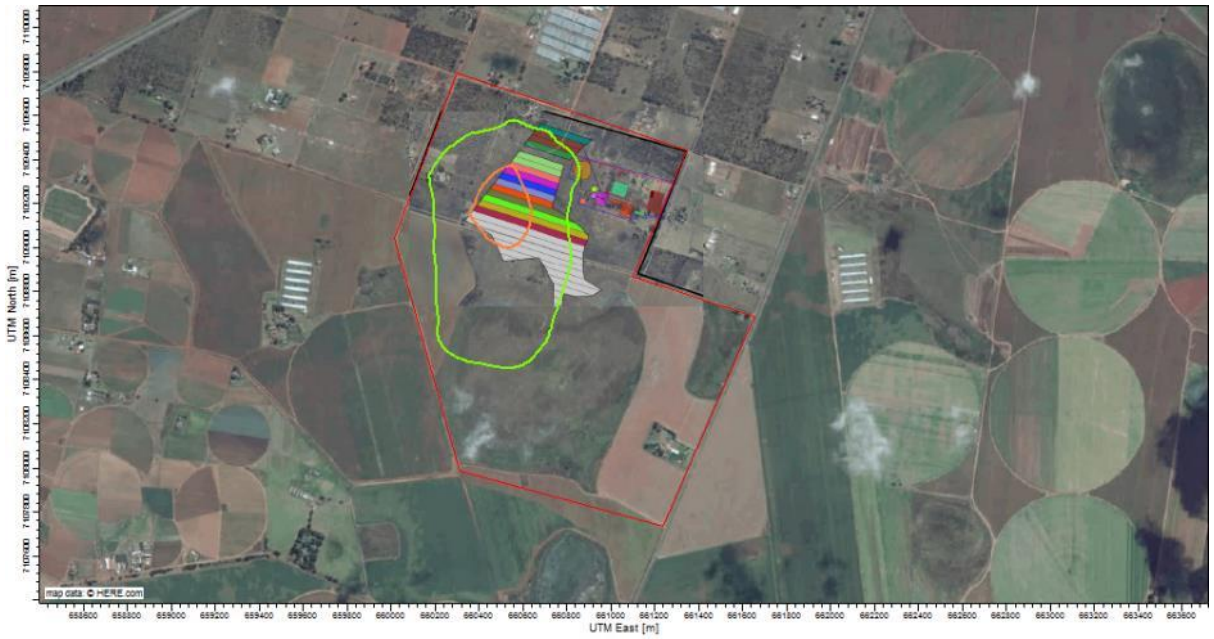

Figure 18: Predicted dust fallout impacts with the residential impact (600mg/m²/day) in green and the industrial (1200mg/m²/day) in orange

d. Conclusion and Recommendations

The modelled results presented in the tables above indicated the possible worst-case future concentrations of pollutants that can be found in the region as a result of the proposed mining activities. The worst case is derived from the emission sources not being mitigated and the concentration level is the second highest concentration calculated from the model.

For the entire Receptor Grid modelled, beyond the MRA boundary, the impacts from the mine are below the ambient air quality standards. When combined with the current background concentrations monitored at the Eskom Chicken Farm, the results are still below the health criteria standards for ambient air quality.

In regard to the potential risk of silica exposure, the Occupational Health of employees / contractors working on site needs to be carefully considered, however the risk identified for ambient environmental exposure, is below the US exposure limits.

Based on the information provided, the baseline assessment and the impact assessment and modelling results, no impacts have been identified which would result in this project having a significant impact on the environment. To this end, the mitigation measures identified below need to be implemented to limit and further reduce impacts on the surrounding environment.

e. Mitigation measures

There are a wide range of mitigation measures that can be implemented at the Rietkol Project operations, to further reduce the impacts. The table below list the activity and the plausible mitigation measure(s) that can be introduced to effectively control pollutants.

Source	Description
Vehicle wind and wheel dust	Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. The higher the speed the more dust will be generated. It is recommended the speed limit be set to 40km/h on unpaved roads. Include speedbumps to control the speed limits. Include a program of wet suppression of the unpaved roads with major vehicle activity. The wet suppression can be of typical grey water from the mine or the water can contain a chemical that will increase the dust trapping capability once sprayed over a surface. Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust that need be. Product transport trucks must be covered with tarpaulins, the covers must be secured.
Mining	Limit the area of operation to what is absolutely necessary. During the pre-mining preparation of the area, ensure that only the minimum area is disturbed and not all the vegetation is removed from the site un-necessarily. It is recommended that the flora of the areas be kept as natural as possible.
Stockpiles	Limit the height and slope of stockpiles to reduce wind entrainment. The ideal stockpile height is less than 3m with a slope no more than 30°. Ideally stockpiles should be fully enclosed or be kept in a store warehouse, this is very unlikely to occur at the mine and the maintenance of the stockpile. The general vehicle traffic around the stockpile areas should be limited. Windshield (barriers) can be implemented on the slopes and surface of the stockpile; these barriers are typically large trees with a good foliage coverage (the area of the mine and the soil characteristics cause the possibility of this option to be low). The substitute of the wind barriers is a wind shield made from a prose material (shade cover). It should be noted that the height of the wind shield will reduce the wind effect by 10x in distance.
Crushing and Screening	During the processing of material, the material should be kept wet to ensure the dust does not escape during the processing. Dust suppression should be installed along all conveyors, at conveyor transfer stations and at the drier plant.
Air Quality Management Program	The air quality management program will provide the health, safety, and environment person to report to the managers about the air quality impact on the surrounding environment. This AQMP will include monitoring schedules and can be used to effectively determine if some mitigation measures are capable of reducing the emission effectively and to determine areas of concern. To limit potential risks, it is recommended that dust fallout monitoring be undertaken both on and off-site to determine potential exposure, to improve air quality management. Samples should be analysed regularly to determine silica exposure.

5. Environmental Ratings

The primary pollutant of concern is particulate matter and dust that will be generated and emitted from the activities of the mine. The environmental ratings will thus only focus on assessing the impacts from the dust (this includes TSP, PM10 and PM2.5).

The following table provide the results of the impact ratings.

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Duration value	Extent	Extent Value	Probability	Probability Value	Intensity	Intensity Value	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Efficiency value	Impact Significance	Significant Points
	CONSTRUCTION PHASE																				
	Air quality	Transport of material	Access roads are constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Often however, these unused haul roads are left as is in the event that sections of them could be reused at a later stage.	Negative	Temporary	1	Local	2	Probable	3	Low	2	LowtoMedium	2	Low	16	Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. The higher the speed the more dust will be generated. It is recommended the speed limit be set to 40km/h on unpaved roads. Include speed-bumps to control the speed limits. Include a program of wet-suppression of the unpaved roads with major vehicle activity. The wet-suppression can be of typical grey water from the mine or the water can contain a chemical that will increase the dust trapping capability once sprayed over a surface. Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust that need be.	Medium to High	0.4	Low	6.4
	Air quality	Pre-mining preparation	During the pre-mining phase it is expected that, the main sources of impact will result due to the construction of access roads, the clearing of land and initial clearing for of mine area. resulting in open unprotected soils which are prone to wind erosion.	Negative	Short Term	2	District	3	Probable	3	Mediu m	3	Medium	3	Low to Medium	33	Limit the area of operation to what is absolutely necessary. During the pre-mining preparation of the area, ensure that only the minimum area is disturbed and not all the vegetation is removed from the site un-necessarily. It is recommended that the fauna of the areas be kept as natural as possible.	Medium	0.6	Low	19.8
	Air quality	Construction of plant	During the construction assessment phase it is expected that, the main sources of impact will result due to the construction of infrastructure such as conveyor lines, etc. resulting in open unprotected soils which are prone to wind erosion.	Negative	Short Term	2	District	3	Probable	3	Mediu m	3	Medium	3	Low to Medium	33	Limit the area of operation to what is absolutely necessary. During the pre-mining preparation of the area, ensure that only the minimum area is disturbed and not all the vegetation is removed from the site un-necessarily. It is recommended that the fauna of the areas be kept as natural as possible.	Medium	0.6	Low	19.8

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Duration value	Extent	Extent Value	Probability	Probability Value	Intensity	Intensity Value	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Efficiency value	Impact Significance	Significant Points
	OPERATIONAL PHASE																				
	Air quality	In-pit activities	Activities include drilling and blasting, as well as the handling of materials from rock face to haul truck.	Negative	Long Term	4	Site specific	1	Highly Probable	4	Medium	3	Medium	3	Low to Medium	36	Water sprays should be applied during the removal of the waste rock to reduce fugitive emissions. Drilling and blasting activities should not be undertaken during high wind periods to avoid excess dust being transported across to neighbouring communities. Monitoring of key meteorological parameters such as wind speed, wind direction, temperature, precipitation, atmospheric pressure a	Low to Medium	0.8	Low to Medium	28.8
	Air quality	Transport	A large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads. Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads. Passing traffic can thus re-suspend the deposited material. To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts. A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated.	Negative	Long Term	4	Local	2	Highly Probable	4	Medium	3	Medium	3	Low to Medium	39	Set the speed limit for hauling vehicles and vehicles in general to as low a speed possible and enforce the speed limits specified. The higher the speed the more dust will be generated. It is recommended the speed limit be set to 40km/h on unpaved roads. Include speed-bumps to control the speed limits. Include a program of wet-suppression of the unpaved roads with major vehicle activity. The wet-suppression can be of typical grey water from the mine or the water can contain a chemical that will increase the dust trapping capability once sprayed over a surface. Limit the load size of the vehicles to ensure the wind in transit does not pick up more dust that need be. Product transport trucks must be covered with tarpaulins, the covers must be secured.	Medium	0.6	Low to Medium	23.4
	Air quality	Stockpiling	Particulate matter and nuisance dust is expected from the working stockpiles, transfer and tipping points during normal operations.	Negative	Long Term	4	Local	2	Highly Probable	4	High	4	MediumtoHigh	4	Medium	56	Limit the height and slope of stockpiles to reduce wind entrainment. The ideal stockpile height is less than 3m with a slope no more than 30˚. Ideally stockpiles should be fully enclosed or be kept in a store warehouse, this is very unlikely to occur at the mine and the maintenance of the stockpile. the general vehicle traffic around the stockpile areas should be limited. Windshield (barriers) can be implemented on the slopes and surface of the stockpile, these barriers are typically large trees with a good foliage coverage (the area of the mine and the soil characteristics cause the possibility of this option to be low). The substitute of the wind barriers is a wind shield made from a prose material (shade cover). It should be noted that the height of the wind shield will reduce the wind effect by 10x in distance.	Medium to High	0.4	Low to Medium	22.4
	Air quality	Dryer Plant	The dryer is usually a fuel based rotary dryer, and so emissions from the dryer are based on the fuel burnt, in the form of Sulphur dioxide and Oxides of	Negative	Long Term	4	Site specific	1	Improbable	2	Low	2	Medium	3	Low to Medium	27	As part of the emission mitigation, the dryer will have its own bag filter to collect product for use	Medium	0.6	Low	16.2
	Air quality	Crushing & Screening	During the crushing & screening process (beneficiation) phase, the ROM is processed to different grades of product. The emission elements are the handling, crushing and screening and stockpiling and transport of product.	Negative	Long Term	4	Local	2	Probable	3	High	4	Medium	3	Low to Medium	39	During the processing of material, the material should be kept wet to ensure the dust does not escape during the processing. Dust suppression should be installed along all conveyors, at conveyor transfer stations and at the drier plant.	Medium	0.6	Low to Medium	23.4

ID	Activity	Risk (impact) trigger	Potential Impact	Nature of Impact	Duration	Duration value	Extent	Extent Value	Probability	Probability Value	Intensity	Intensity Value	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Efficiency value	Impact Significance	Significant Points
	DECOMMISSIONING																				
1	Air quality		The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The total rehabilitation will ensure that the total area will be a free draining covered with topsoil and grassed. The following activities are associated with the decommissioning phase . Exposed soil is often prone to erosion by water. The erodability of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover	Negative	Long Term	4	Site specific	1	Definite	5	Medium	3	Medium	3	Low to Medium	39	Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.	Medium	0.6	Low to Medium	23.4

6. Air Quality Monitoring Program

The ambient air quality monitoring program is in essence not a mitigation measure, however valuable data can be gathered from the monthly and annual monitoring of the air quality and mitigation programs can be assessed and their effectiveness can be measured.

The impact assessments indicated that there is a suite of airborne pollutants that will be emitted from the opencast mining operations and mineral processing. Some of these airborne pollutants are listed as criteria airborne pollutants in the South African National Ambient Air Quality Standards. These identified airborne pollutants are Particulate Matter (PM10 and PM2.5), and dust fallout.

It is recommended that monthly dust fallout monitoring be conducted along the mining operations and in the surrounding community (Figure 19) and that PM10 monitoring be undertaken at southwestern boundary of the site close to monitoring point DF03. It is proposed that a minimum of 12 monitoring points be set up, including the locations where ambient monitoring has been undertaken as part of the baseline assessment. The monitoring can be supported by additional Particulate Matter monitoring be undertaken annually to determine Silica exposure. It is also strongly advice that the meteorological conditions (Temperature, Humidity, Rainfall, Atmospheric Pressure, Solar Radiation, Wind Speed and Wind Direction) also be measured by an onsite metrological station. The measured airborne concentrations can be compared with the onsite measured meteorological conditions to assess the effectiveness of mitigation measures and systems implemented at the mine.

Figure 19: Proposed DFO monitoring points

There are currently many products on the market that can either measure one or a combination of airborne pollutant(s). Any approved and published monitoring method can be used to assess the ambient air quality concentrations at the mine.

7. References

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8. Appendices

a. Air Dispersion Model Outputs

The following dispersion results are a representation of the worst-case scenarios for each of the pollutants and their time frames.

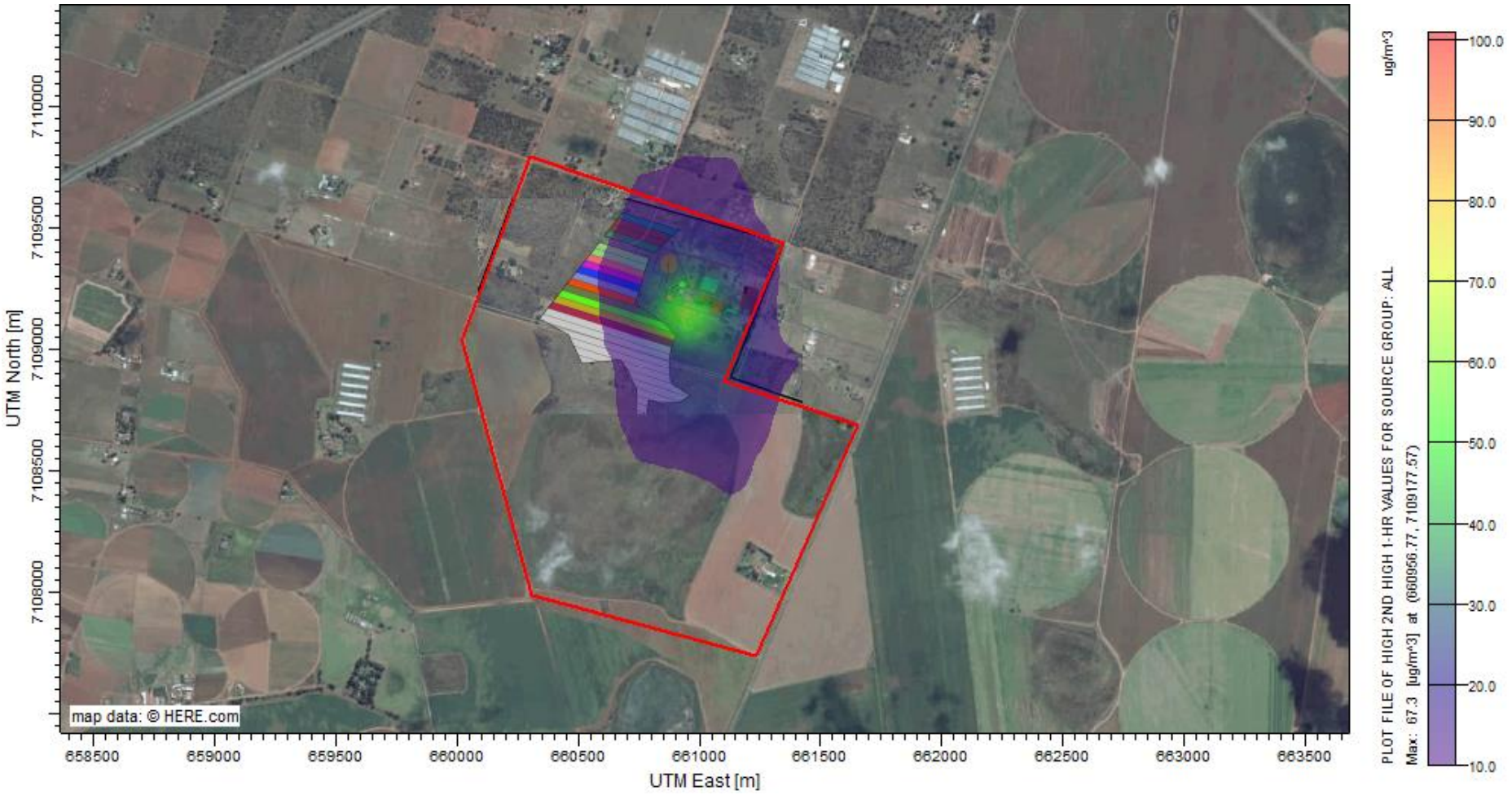

Figure 20: Hourly average predicted ambient ground level concentrations (µg/m³) of Oxides of Nitrogen (Standard: 200µg/m³)

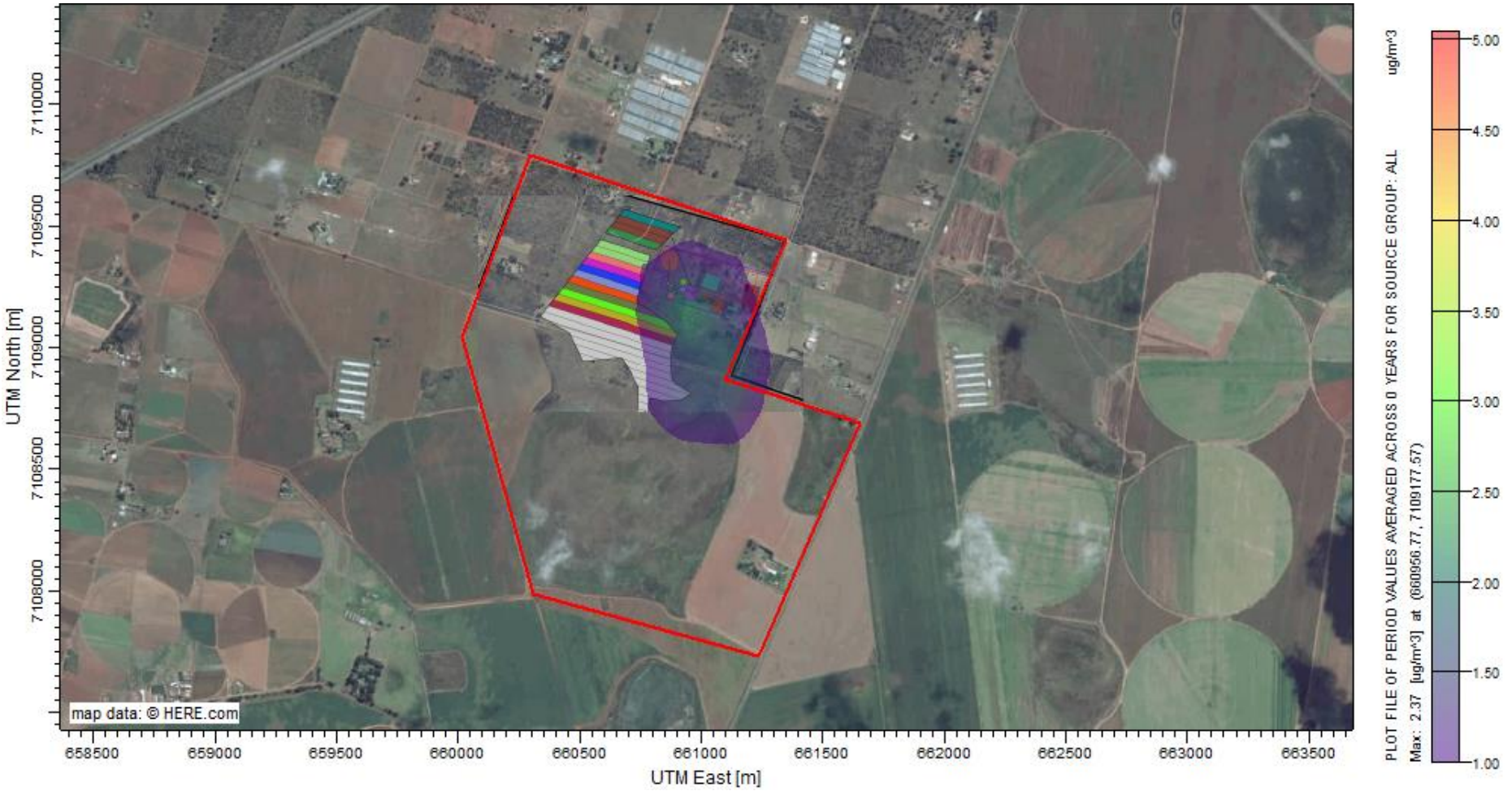

Figure 21: Annual average predicted ambient ground level concentrations (µg/m³) of Oxides of Nitrogen (Standard: 40µg/m³)

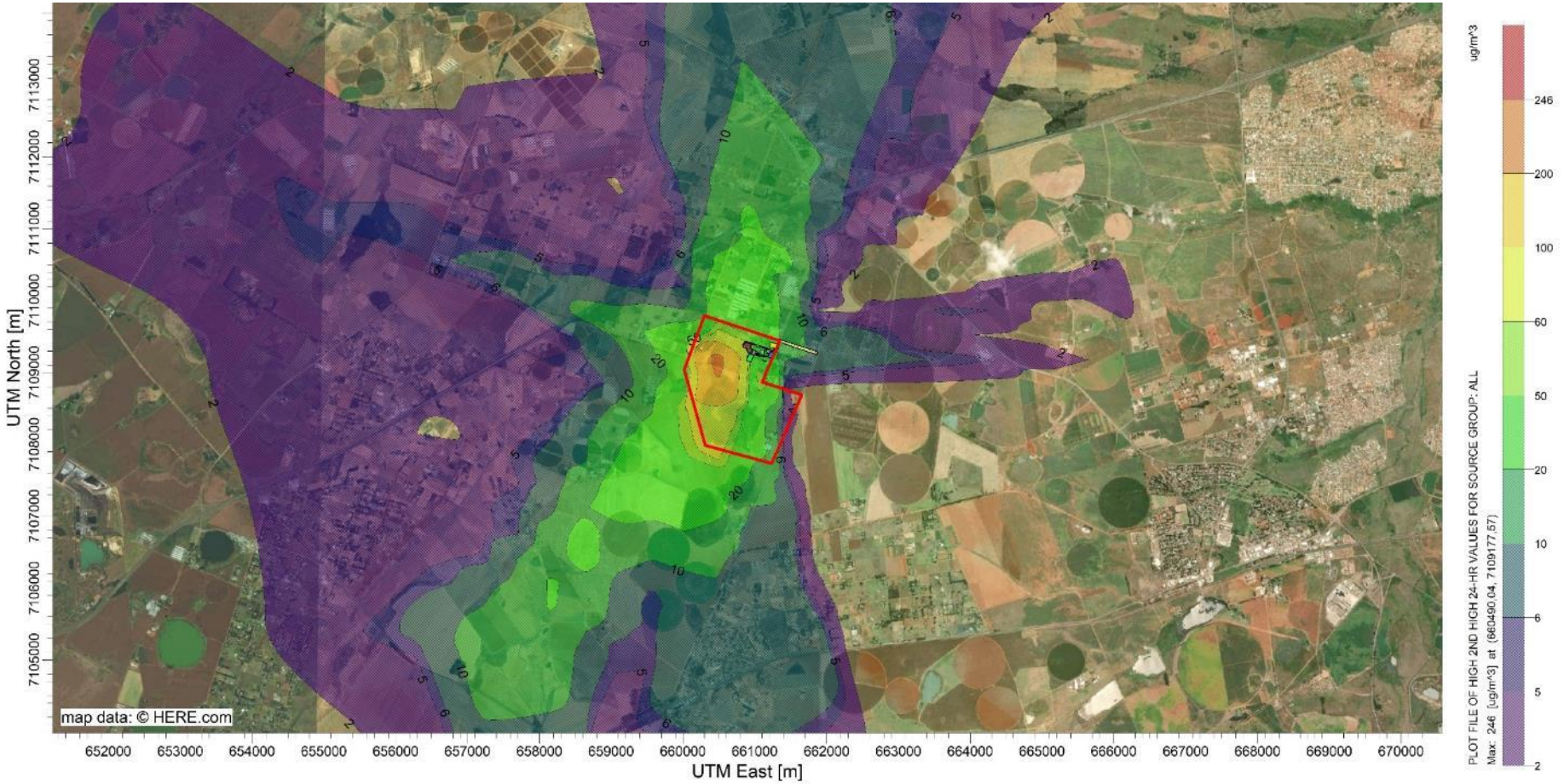

Figure 22: Daily average predicted ambient ground level concentrations (µg/m³) of Particulate Matter PM_{10} (Standard: 75µg/m³)

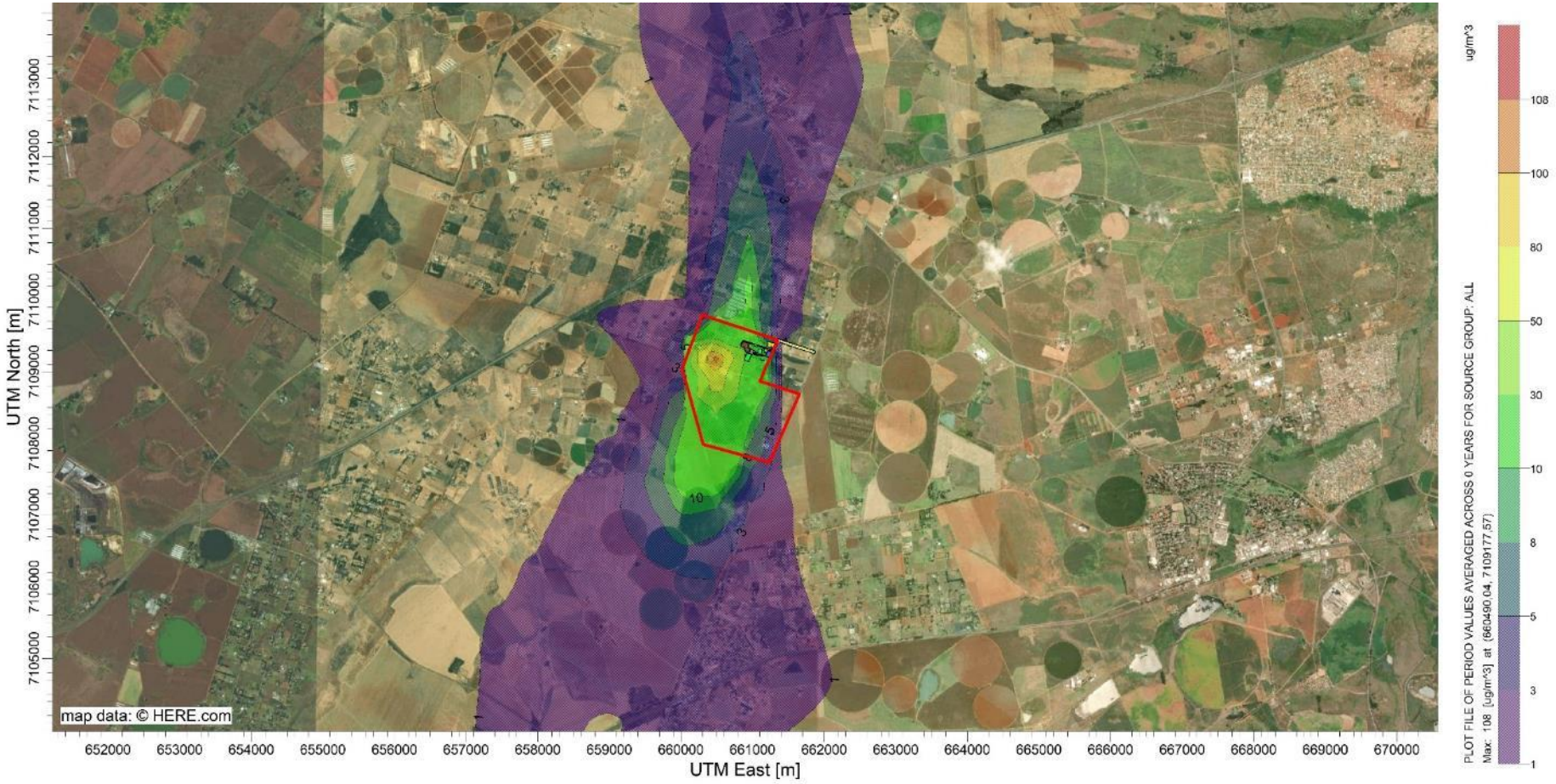

Figure 23: Annual average predicted ambient ground level concentrations (µg/m³) of Particulate Matter PM10 (Standard: 40µg/m³)

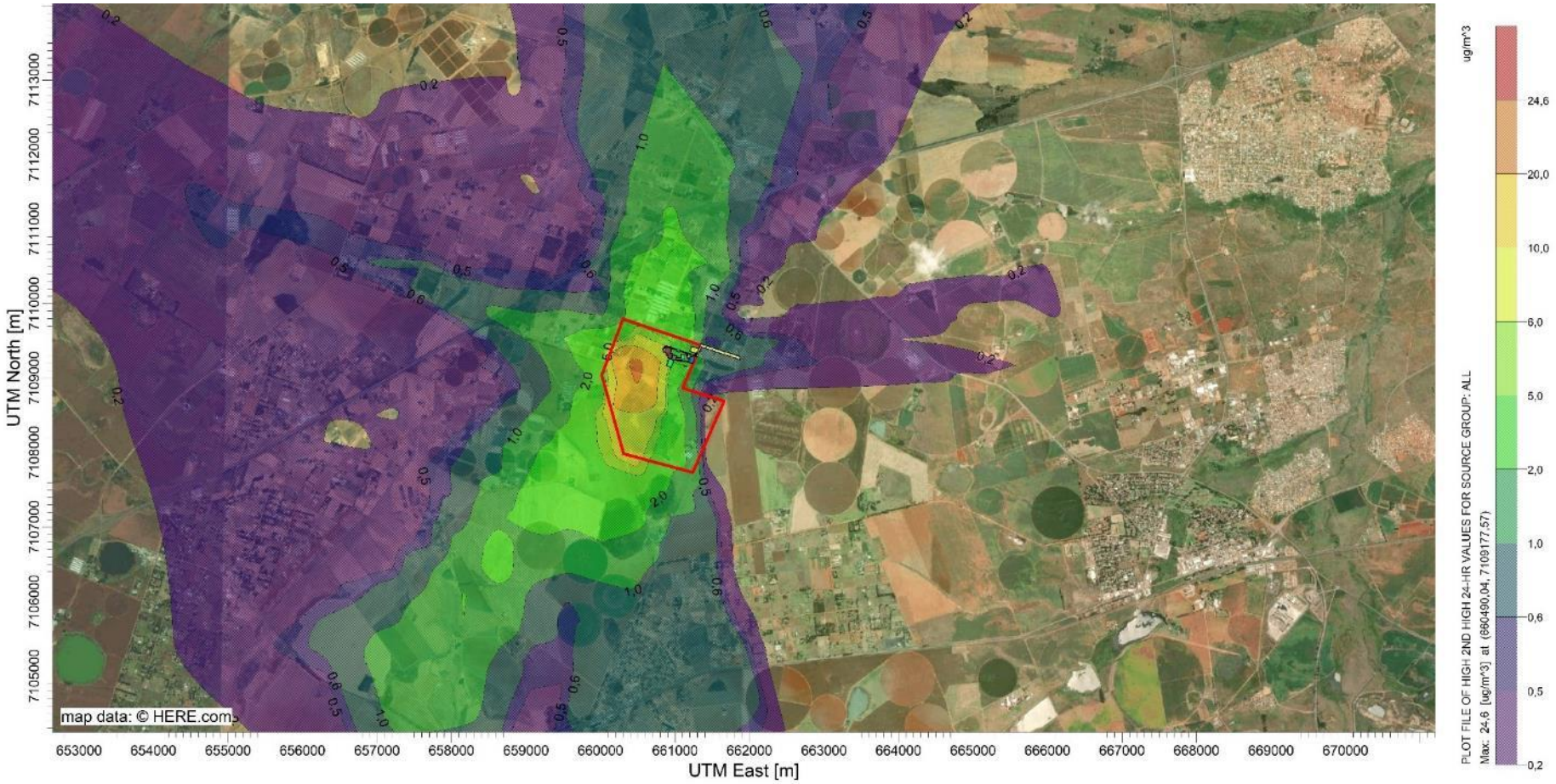

Figure 24: Daily average predicted ambient ground level concentrations (µg/m³) of Particulate Matter $PM_{2.5}$ (Standard: 40µg/m³)

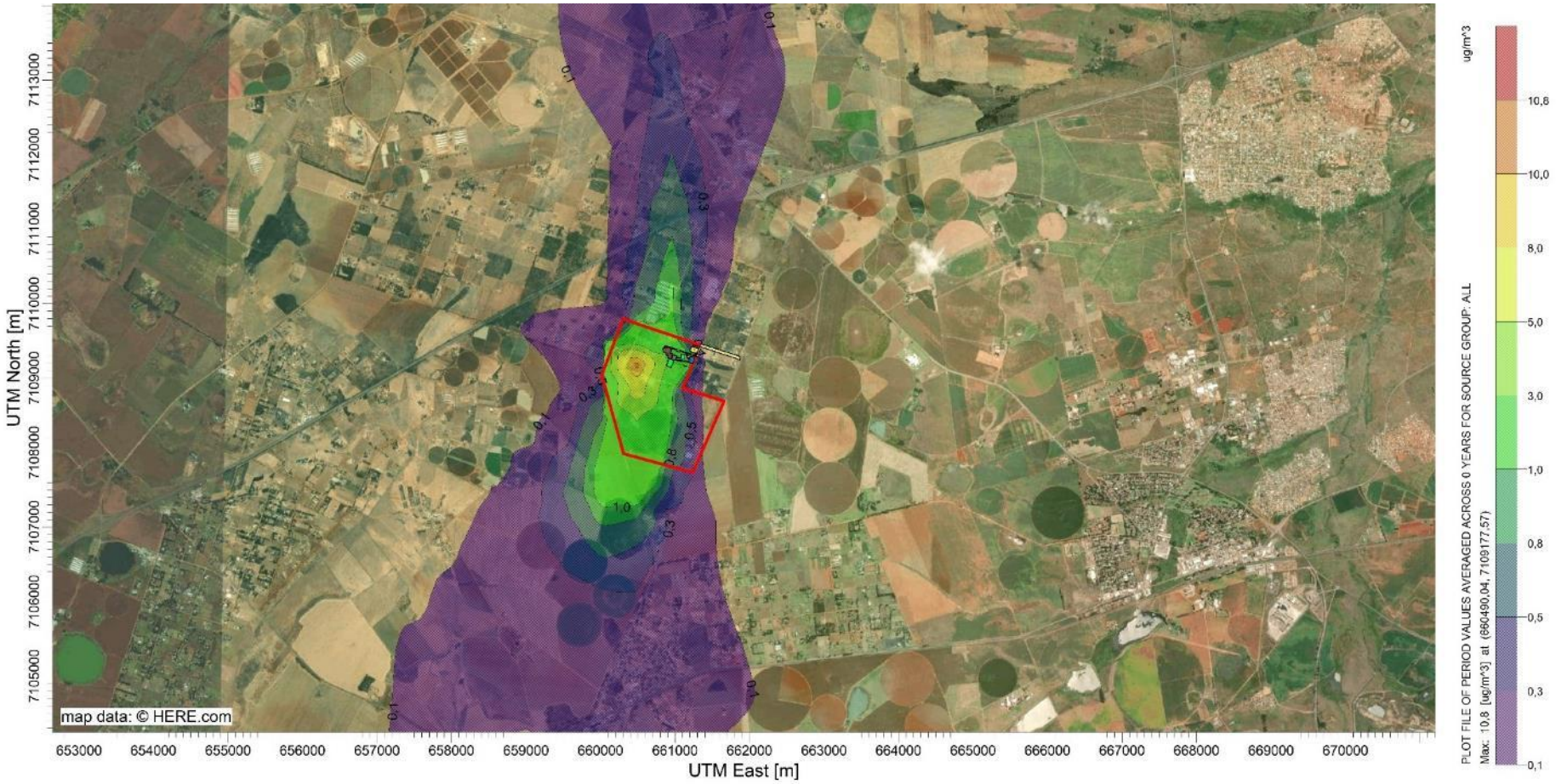

Figure 25: Annual average predicted ambient ground level concentrations (µg/m³) of Particulate Matter PM2.5 (Standard: 20µg/m³)

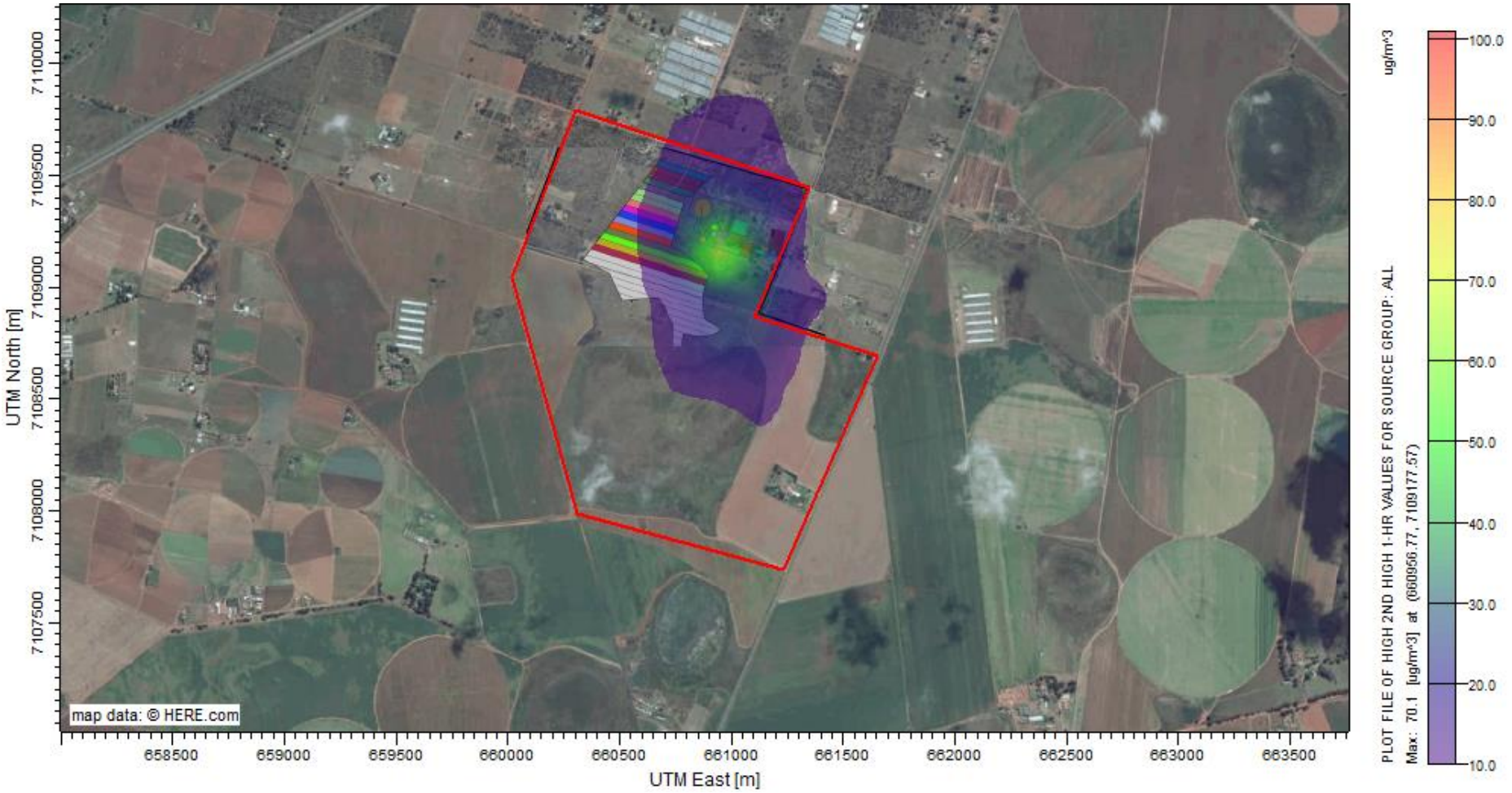

Figure 26: Hourly average predicted ambient ground level concentrations (µg/m³) of Sulphur dioxide (Standard: 350µg/m³)

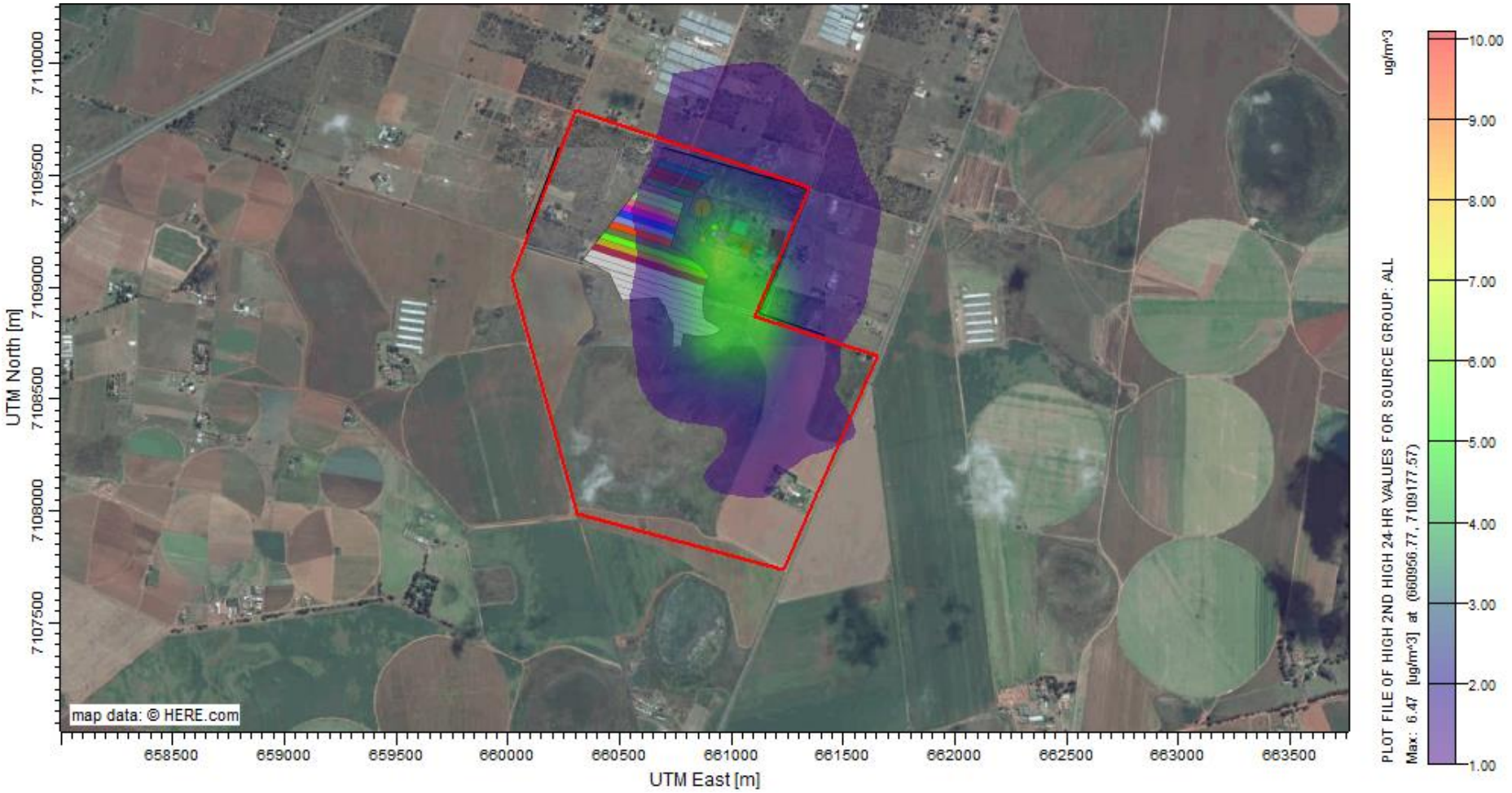

Figure 27: Daily average predicted ambient ground level concentrations (µg/m³) of Sulphur dioxide (Standard: 125µg/m³)

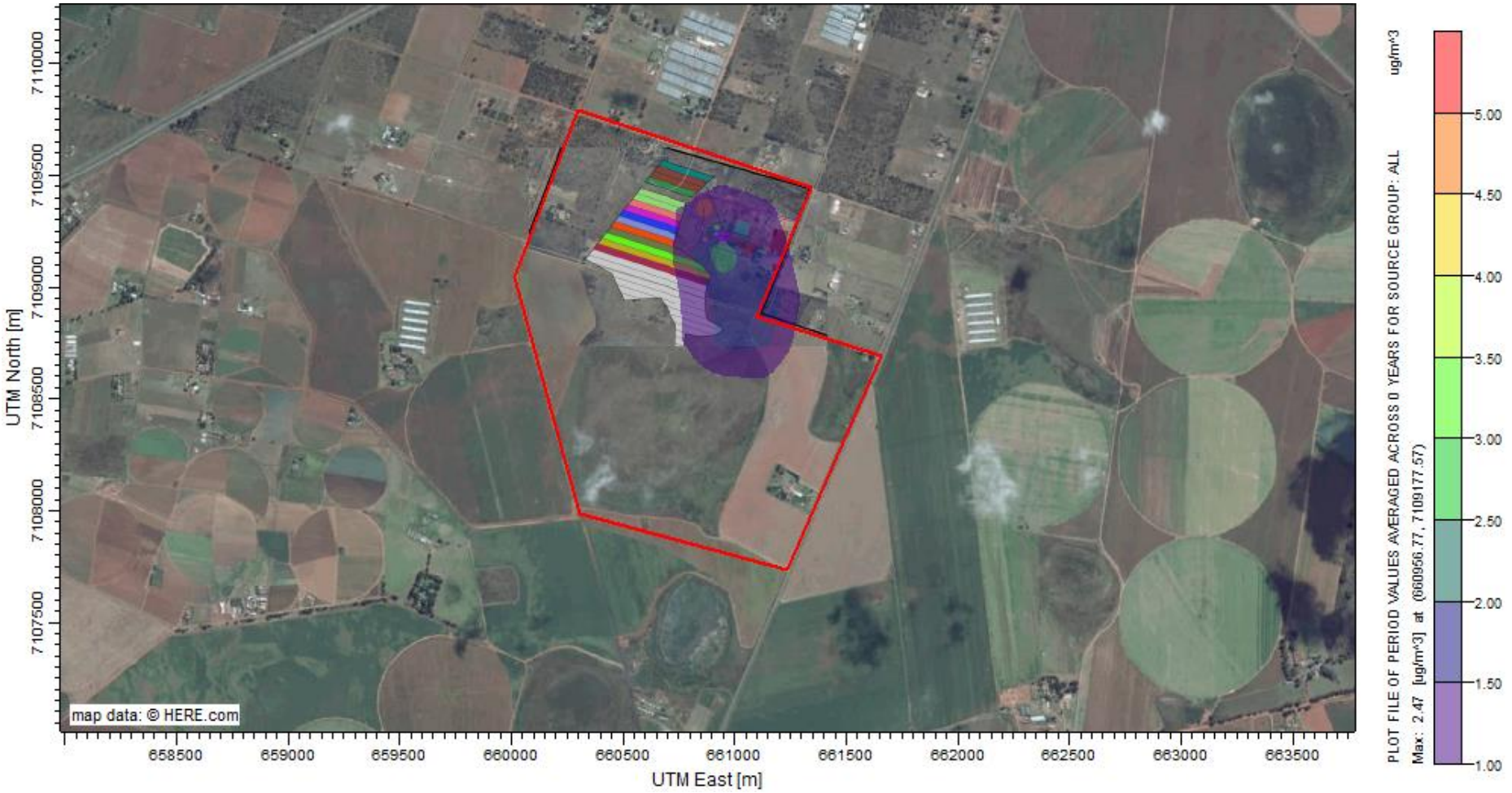

Figure 28: Annual average predicted ambient ground level concentrations (µg/m³) of Sulphur dioxide (Standard: 50µg/m³)

b. Responses to stakeholder comments

Comments from MRA Landowners

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	Translated: I would like to request that you make available the full details of the impact assessment when it is complete. I would also like to engage with the air quality specialists regarding the type of tests they will be conducting. A survey of silica (fallout) before and after/during mining is of utmost importance and it has to include the difference in crystal form. (I unfortunately do not know what the name for the test is, which is why I want to talk to them). Substantial water issues are also of importance to us personally. Good luck with the general public in the area. The mine will not be received with open arms at all. As I have learned, legal advice is already being obtained regarding the misleading "Rietkol" instead of Modder-East orchards	Van der Walt, Piet Plot 213 MRA Landowner Email 27 Jul 2016	*Translated:* As described in the Background Information Document, the process will be conducted through two phases (the Scoping and EIA Phases) where opportunity will be provided to the public for participation, input and provision of information regarding the various specialist studies. The first report that will be made available is the Scoping Report, which will basically describe the Environment Baseline (which is the current status) and provide details of further in-depth specialist studies. Only after this report and further interactions with the public will the full environmental impact study be compiled and made available. Thank you for the information you provided, we have directed it to our groundwater and air quality specialists for further investigation.
4	I am at the van der Walt property, and no Air Quality baseline study was done at my place. There was a Noise Assessment done but not air quality. There was a machine that measured noise, but there was nothing that measured dust fallout. I would propose to everyone to have their lung function tested before the mine starts.	Van der Walt, Piet Plot 213 MRA Landowner Meeting 9 Mar 2018	The noise and air quality baseline monitoring were done at the same time. The teams moved together. It is not measured with dust buckets. It is measured with a specific machine that measures particulate matter.
6	Factors that will influence our business are as follow: WATER: live birds require big amounts of water to grow. The chicken houses need water for	Rossouw, Adriaan Rossgro Pluimvee	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	cleaning. AIR QUALITY: Dust will cause lung cancer etc. NOISE: Will prevent birds from eating, therefor they won't grow. They will also suffer heart attacks. SECURITY: Theft will be a huge problem due to extra feet in the nearby area.	Rietkol 327 IR Ptn 31, 71 MRA Landowner Email 4 Mar 2016	Phase. The concerns raised by Mr Rossouw will be forwarded to the specialists for consideration during their assessments. Note: A Health Impact Risk Assessment (HIRA) will be conducted to determine the potential health risks to the community, with a focus on the impacts concerning silicosis.
9	I will now deal with the contents of the DRS and supporting baseline studies applicable to the DSR relevant to the my client's, extensive Egg Producing, Chicken Broiler and Chicken Feed Stock business ("the business") on the above properties which are within and adjacent to the proposed mining area of the proposed Rietkol Silica Mine. It must not be construed or implied that my client necessarily agree with the contents of the DSR which we do not specifically address in this letter, and my client's rights are reserved to comment in future on any of those issues if it deems it necessary, and once it is in receipt of the draft Environmental Impact Assessment Report and the necessary Environmental Specialist Reports which will follow the DSR. 5. You are advised, at this early stage of the proposed project that my client will suffer irreparable loss and damages should the proposed mine be established on properties adjacent or nearby to the affected properties. 6. Environmental degradation associated with mining such as air pollution, dust pollution, noise, water depletion and polluted water are not conducive to the business of my client as explained above. 7. The below mentioned studies should also focus particular on the chicken business of my client also with regard to the health and well-being of the chickens, and anti-pollution measures with regard to the contamination of feed stock with dust and silica dust should be investigated.	Johann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103 and Geluk 234 IR Ptn 2 & 24 and others. MRA landowner Email 18 Mar 2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. The potential impact on the economic activities of Rossgro will be assessed as part of the macro-economic impact assessment. The possible main macro-economic impact could be the possible impact on the available water and quality of the water. This will be determined applying the groundwater specialist report.
10	Air Pollution: The Environmental Specialist should investigate and evaluate the effect that dust, especially silica dust and dust emanating from the proposed mine, may have on the business of my client. It is noted in this section of the DSR that *"There are numerous planned and existing mines located near the proposed Rietkol Project. There exists a*	Johann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103 and Geluk 234 IR Ptn 2 & 24 and others.	Noted. The concerns raised will be forwarded to the air quality specialist for consideration during their assessments. Baseline particulate matter (PM) monitoring was conducted and the results presented in the

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	potential that air quality impacts from other mines could influence the cumulative air quality impacts at and near the site." Dust monitoring points must be installed at the business site and must be regularly monitored. The Environmental Specialist must investigate such cumulative effect.	MRA landowner Email 18 Mar 2018	Scoping Report (Par 8.8.3). Further monitoring will be conducted during the EIA Phase to confirm the baseline air quality in the area. Dust monitoring will be implemented on granting of the mining right, prior to any construction activities. Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects.
30	It is common cause that my client will suffer loss and damage to its entire business should mining in future take place on the affected property. Noise, air and water pollution will have a serious effect on egg and chicken production.	Johann Minnaar on behalf of Rossgro Group of Companies: 1. Portion 71 of the Farm Rietkol 237 IR owned by Rossouw Pluimvee- Eiers (Edms) Beperk - Highveld Packing Station; 2. Portions 2, 40, 41, and 42 of the Farm Rietkol 237 IR owned by Rustig Landgoed (Edms) Beperk - chicken broilers 24 Feb 2021	Your concerns around noise, air and water pollution and the potential impact on your client's businesses are noted and will be considered during the EIA process. Specifically, potential impact on the economic activities of Rossgro will be assessed as part of the macro-economic impact assessment, including impacts on GDP and employment.
31	You are alluded to the fact that my client sells eggs to retailers which have very strict requirements with regard to hygiene and quality control. There are also statutory requirements that my client has to comply with regarding food production for human consumption. The contamination of eggs by silica, and the dust generated by silica mining, will have a serious impact on the egg packing stores, and will render eggs unfit for human consumption, with the consequence that retailers will stop buying eggs from my client. My client will as a result of the aforesaid suffer irreparable loss and damage.	Johann Minnaar on behalf of Rossgro Group of Companies: 1. Portion 71 of the Farm Rietkol 237 IR owned by Rossouw Pluimvee- Eiers (Edms) Beperk - Highveld Packing Station;	Your concerns around air pollution and the potential impact on your client's businesses are noted and will be considered during the EIA process. Specifically, potential impact on the economic activities of Rossgro will be assessed as part of the macro-economic impact assessment, including impacts on GDP and employment.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
39	Special attention should be paid to the fact that the facilities primarily functions are the production of food, for humans and animals, and if these produced food (especially eggs) are contaminated with silica dust in particular, and dust in general, my client will not be able to sell these food products to retailers and consumers, as very specific and stringent rules and regulations, as well as retailer's specific requirements concerning health cannot be met by my client in the above circumstances. Packing of eggs and packing material will be contaminated by dust.	Johann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103 and Geluk 234 IR Ptn 2 & 24 and others. MRA landowner 22 Apr 2021	The potential impact of dust will be addressed in the Air Quality Impact Assessment during the EIA Phase. Also refer to responses below on the specialist studies. It is noted that studies about the side effects of using silicon dioxide in food have found it to be of little risk to human health (Medical News Today). The concern around silica is therefore inhalation, not intake.
40	The effect on the egg laying hens and broiler chickens will be dealt with below. Environmental degradation associated with mining such as noise, ground vibration, air pollution, dust pollution, water depletion and polluted water are not conducive to the business of my client. The below mentioned studies should also focus particular on the business of my client, also with regard to anti-pollution measures with regard to the accumulation of silica dust in the atmosphere, and consequently, silica dust, and dust in general, which will gather on the various facilities associated with the business of my client.	Johann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103 and Geluk 234 IR Ptn 2 & 24 and others. MRA landowner 22 Apr 2021	Your concerns around environmental degradation are noted and will be considered during the EIA process and within the relevant specialist impact studies. Mitigation measures will be determined to deal with any of the concerns raised and impacts identified by the specialists for inclusion in the EMPr. Also refer to responses below on the specialist studies.
42	EFFECT OF SILICOSIS ON HUMAN BEINGS Environmental, Medical and Scientific Studies should be undertaken to evaluate and to investigate the effect that silica dust emanating from the proposed mine may have on the inhabitants of the area. The following statements made on page 13, paragraph 7.1.1 in the Hazard Identification and Risk Assessment Report, namely, "During a survey conducted by AirCHECK at an existing mine in the Delmas area, it was establish that the crystalline silica contents of the dust was 26%." , and "it has been estimated that there are at least 480 000 cases of silicosis and 226 000 cases of tuberculosis in former mineworkers attributable to work in South African mines", are of great concern and ,to say the least, shocking. The environmental impact and degradation concerning the health risks and health threats associated with silicosis, and medical conditions associated with silicosis should be	Johann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103 and Geluk 234 IR Ptn 2 & 24 and others. MRA landowner 22 Apr 2021	The health risks and medical conditions associated with silicosis have been well researched for many years, and specifically by the World Health Organisation (WHO) and US Occupational Safety and Health Administration who have set standards based on their research, 40 and 100 µg/m3 respectively. It is noted that silica sand covers many beaches, and it makes up most of the rocks on earth. In fact, silica-containing minerals or silica itself make up more than 95% of the earth's crust (Medical News Today). One of the products Nhlabathi manufactures, is utilised for water filtration. Therefore, there is no risk associated with the product. The main risk is

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	extensively research with regard to this new proposed silica mine, especially in the light of the Covid-19 Virus Pandemic, as persons with underlying medical conditions (such as lung deceases and respiratory illnesses) will be more at risk to contract the Covid-19 Virus. The studies should include, not only mineworkers and contractors who will work on the proposed mine, but also the general public residing adjacent and in close proximity of the mine. The Plan of Study should include a comprehensive medical research and study report as referred to above, especially in the light of the crushing methods that will be used to crush and screen the silica sand to a very small size of -5mm. The Applicant is alluded to the following provisions of Section 24(a) of the Constitution of the Republic of South Africa, No.108 of 1996 which clearly provides that *"Everyone has the right to an environment that is not harmful to their health or well-being".*		during crushing, which will be managed and controlled as part of the occupational hygiene programme for the mine. Dust from chrushing operations can be effectively controlled and managed. Nhlabathi is required to scan their staff regularly and report to DMR. The silicosis risk to adjoining properties and residents will be lower than the risk to workers at the mine. The potential for silica dust-fallout will be addressed in the Air Quality Impact Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. In addition, Nhlabathi has committed to undertake a medical research study as proposed.
43	THE EFFECT OF SILICOSIS ON CHICKENS The effect of silicosis on chickens should be research by veterinarians, as this possible health risk could have a detrimental effect on the business of my client due to	Johann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103	The Air Quality Specialist report will address fall out dust. Hygiene dust will be monitored in line with the Mine Health and Safety Act requirements. Annual dust fallout monitoring (including silica) will be conducted at the egg plant once a mining licence is granted.
44	AIR POLLUTION The Environmental Specialist should investigate and evaluate the effect that dust may have on the business of my client, especially silica dust and dust emanating from the proposed mine. The statement on page 161, paragraph 8.2.7.1.6 of the DSR, namely, "Opencast mining should control the generation of particulate matter on mine haul roads. Water spraying is a cheap and effective means of control and should be consistently applied across mines in the Highveld Priority Area " is a general statement and does not address mitigation methods for air pollution from the emission of dust generated by the crusher and screening plants, especially in the light of the fact that those dust particles contain silica particles which is detrimental to the health of the affected	ohann Minnaar on behalf of Rossgro Group of Companies Rietkol 237 IR Ptn 2, RE/31, 71, RE/90, 103 and Geluk 234 IR Ptn 2 & 24 and others. MRA landowner 22 Apr 2021	As mentioned previously, the potential for dust-fallout will be addressed in the Air Quality Impact Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. Site specific mitigation measures will be determined to address the potential impact identified by the impact modelling. This will include the identification of dust monitoring points, which will be implemented on granting of the mining right. The 2017 Eskom data refers to the regional air quality which will be taken into account to

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	and interested party and the community living in close proximity to the proposed mine. Of paramount importance is that the environmental specialised study on Air Pollution should be extended, particular with regard to the effect that silica dust in particular, and dust in general, will have on the chickens and egg laying hens. The statement "*Fugitive dust emissions released during mining operations are generally only of concern within 3 - 5 km of the mine boundary"* on the same page of the DSR is a clear indication that dust will have an effect on my client's business operations, as its property falls within this range, as a matter of fact it is by far nearer than the indicated range. The statement on page 195, paragraph 9.7.1 of the DSR, namely "Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health." is a clear indication that the Air Pollution Impact Assessment Studies should be amplified to show clearly the mitigation measures which will be implemented by the mine, and that such studies should specifically include mitigating measures concerning fugitive dust emissions which will certainly affect my client's business. The reference to studies that were conducted in 2017 by Eskom on a Chicken Farm Site situated approximately 30km north-east of the Rietkol mining area in the DSR is, with respect irrelevant, and has no bearing on the air environment in the Rietkol study area. It is not clear if that dust emissions were generated by a coal mine or by a silica mine. If the intention of the Applicant was that the Eskom study should be used to apply to the business of my client, then such assumptions, due to irrelevance, are incorrect and are rejected as such. Dust monitoring points must be installed at the business		identify any cumulative effects. Adequate baseline air quality data have been obtained for the Rietkol site, which was also presented in the Scoping Report.

Comments from Municipalities

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
76	When was the air quality monitoring done?	Jakob Nkabinde Air Quality & Environment officer Victor Khanye Local Municipality Meeting 9 Mar 2018	It was done in 2016 when we commenced with the baseline studies.
77	Once the results and modelling is available we will provide comments on the air quality.	Jakob Nkabinde Air Quality & Environment officer Victor Khanye Local Municipality Meeting 9 Mar 2018	Noted

Comments from Neighbouring Landowners

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
91	3. I will now deal with the contents of the DRS and supporting baseline studies applicable to the DSR relevant to the business of my client on the above properties, which are adjacent to the proposed mining area of the proposed Rietkol Silica Mine. It must not be construed or implied that my client necessarily agree with the contents of the DSR which we do not specifically address in this letter, and my client's rights are reserved to comments in future on any of those issues if it deems it necessary, and once it is in receipt of the draft Environmental Impact Assessment Report and the necessary Environmental Specialist Reports which will follow the DSR. 4. You are advised, at this earlier stage of the proposed project that my client will suffer irreparable loss and damages should the proposed mine	Johann Minnaar on behalf of Unex Roses Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 18 Mar 2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. The potential impact on the economic activities of Unex Roses will be assessed as part of the macro-economic impact assessment. The financial and economic and level of employment importance of Unex Roses in terms of the local economy will necessitate that it be analysed separately and reported on.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	be established on properties adjacent or nearby to the affected properties. 5. Environmental degradation associated with mining such as air pollution, dust pollution, water depletion and polluted water are not conducive		
92	6. The below mentioned studies should also focus particular on the business of my client also with regard to anti pollution measures with regard to the accumulation of silica dust on the hothouses, the arable grazing, roses and prickly pears, and the increased financial cost of the removal of excessive dust from the hothouses. It this regard it should be noted that the removal of dust on the hothouses will necessitate an increase in water consumption and the employment of more labour intensive methods.	Johann Minnaar on behalf of Unex Roses Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 18 Mar 2018	As indicated above, the potential impact on the economic activities of Unex Roses will be assessed as part of the macro-economic impact assessment. Dust monitoring will be implemented on granting of the mining right, prior to any construction activities. If the data indicate excessive (above prescribed standards) dust fallout in the vicinity of Unex Roses, the necessary discussions will be held with the company at the time.
93	7. Air Pollution: The Environmental Specialist should investigate and evaluate the effect that dust, especially silica dust and dust emanating from the proposed mine, may have on the business of my client. It is noted in this section of the DSR that *"There are numerous planned and existing mines located near the proposed Rietkol Project. There exists a potential that air quality impacts from other mines could influence the cumulative air quality impacts at and near the site."* Dust monitoring points must be installed at the business site and must be regularly monitored. The Environmental Specialist must investigate such cumulative effect.	Johann Minnaar on behalf of Unex Roses Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 18 Mar 2018	Noted. The concerns raised will be forwarded to the air quality specialist for consideration during their assessments. Baseline particulate matter (PM) monitoring was conducted and the results presented in the Scoping Report (Par 8.8.3). Further monitoring will be conducted during the EIA Phase to confirm the baseline air quality in the area. Dust monitoring will be implemented on granting of the mining right, prior to any construction activities. Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects.
101	Based on the Environmental Impact Evaluation and Mitigation measures and specifically the Impact Risk Matrix (Table 63: Initial High- Level Risk Impact Matrix Summary) our clients immovable properties, as above, will be impacted negatively as is clearly set out in the report. The properties are adjacent to the proposed	Arthur Channon on behalf of Roy Robertson Family Trust Plot 278,279,281 Neighbouring landowner to the MRA area Email 19 Mar 2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. The potential impact on the economic activities

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	location of the mine. Our client therefore objects to the proposed location of the mine based on the direct negative impact it will have on the properties as per Table 63 and Table 4. These are, inter alia, as follows: 1. Infrastructure area: Loss of soil, impact of fauna and flora, killing of animals, loss of biodiversity and pollution. 2. Hazardous chemicals and waste: Pollution due to accidental spillage. 3. Mining: Lowering of groundwater levels. 4. Communities: Increased dust, noise impact, traffic etc. 5. Residual impact: Post closure land use, impact on ecosystem. 6. Negative visual impact. 7. Lighting: Constant lighting due to night-time lighting. 8. The purpose for which our client's properties are used will be affected negatively by the proposed mine and will therefore greatly reduce in value as our client will no longer be in a position to use the properties for the purposes it is currently used for. All our clients rights remain strictly reserved but our client will consider as acceptable, reasonable and fair offer for the three properties, in its totality.		situated on these properties will be assessed as part of the macro-economic impact assessment.
107	What about when you blast, what about the dust caused then?	Martin van Zyl Unex Roses Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Meeting 9 Mar 2018	This will be included in the Air Quality, Blasting and Health Impact Assessment.
108	How many operations do you have? What are your current issues there in terms of dust, water, etc.	Martin van Zyl Unex Roses Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Meeting 9 Mar 2018	We have the two operation, one in the Cape and one here in Delmas. We have good relationships with our neighbours, we have farmers next door with chickens. We work closely with them to manage the dust. Most of our dust complaints were due to the gravel road and not the mine itself. We spend a lot of money grading and watering that road. Water wise we work well with our neighbours; we have about 8 boreholes of our own on the property that have not been affected

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
			by blasting. It is however a different geological formation. I understand that you are upset, there will be an impact, but the reality is we have nowhere else to go, this particular silica quarts deposit is the only one we know of. We employ 3000 people, the rest of the floating industry employs another 3000 people and there is probably 50 000 in the trade and glass industries downstream. If there was silica in a place far from people, we would prioritise that resource, but we have been working on this resource for 10 years. This is the only one we know of. All I can say is that we are not an unreliable operation. We are hopefully going to be around for the next 70 years, and available in the public space. We do not want to be bad neighbours, but we have to find a way to make this work, otherwise we put the glass, floating and metal industries at risk. We will listen to the law and take the recommendations of the specialists.
128	Special attention should be paid to the fact that the commercial farming business is, *inter alia*, the production of food, for humans and animals, and if these produced food (especially prickly pears) are contaminated with silica dust in particular, and dust in general, my client will not be able to sell the food product to retailers and consumers, as very specific and stringent rules and regulations, as well as retailer's specific requirements concerning health cannot be met by my client in the above circumstances. Packing material will be contaminated by dust. The same applies to the selling and marketing of roses (and maize if applicable to my client's business) *mutatis mutandis.*	Johann Minnaar on behalf of Unex Rose Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 23 Apr 2021	The potential impact of dust will be addressed in the Air Quality Impact Assessment during the EIA Phase. Also refer to responses below on the specialist studies. It is noted that studies about the side effects of using silicon dioxide in food have found it to be of little risk to human health (Medical News Today). The concern around silica is therefore inhalation, not intake.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
129	You are advised, in the light of the aforesaid, at this earlier stage of the proposed project that my client will suffer irreparable loss and damages should the proposed mine be established on properties adjacent or nearby to the affected properties. Environmental degradation associated with mining such as air pollution, dust pollution, water depletion and polluted water are not conducive to the business of my client as explained above.	Johann Minnaar on behalf of Unex Rose Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 23 Apr 2021	Your concerns around environmental degradation are noted and will be considered during the EIA process and within the relevant specialist impact studies. Mitigation measures will be determined to deal with any of the concerns raised and impacts identified by the specialists for inclusion in the EMPr. Also refer to responses below on the specialist studies.
131	EFFECT OF SILICOSIS ON HUMAN BEINGS Environmental and Scientific Studies should be undertaken to evaluate and to investigate the effect that silica dust emanating from the proposed mine may have on the inhabitants of the area. The following statements made on page 13, paragraph 7.1.1 in the Hazard Identification and Risk Assessment Report, namely, *"During a survey conducted by AirCHECK at an existing mine in the Delmas area, it was was 26%."* , and *"it has been estimated that there are at least 480 000 cases of silicosis and 226 000 cases of tuberculosis in former mineworkers attributable to work in South African mines*", are of great concern and ,to say the least, shocking. The environmental impact and degradation concerning the health risks and health threats associated with silicosis, and medical conditions associated with silicosis should be extensively research with regard to this new proposed silica mine, especially in the light of the Covid-19 Virus Pandemic, as persons with underlying medical conditions (such as lung deceases and respiratory illnesses) will be more a risk to contract the Covid-19 Virus. The studies should include, not only mineworkers and contractors who will work on the proposed mine, but also the general public residing adjacent and in close proximity of the mine. The Plan of Study should include a comprehensive medical research and study report as referred to above, especially in the light of the crushing methods that will be used to crush and screen the silica sand to a very small size of -5mm. The Applicant is alluded to the following provisions of Section 24(a) of the Constitution of the Republic of South Africa, No.108 of 1996 which clearly	Johann Minnaar on behalf of Unex Rose Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 23 Apr 2021	The health risks and medical conditions associated with silicosis have been well researched for many years, and specifically by the World Health Organisation (WHO) and US Occupational Safety and Health Administration who have set standards based on their research, 40 and 100 µg/m3 respectively. It is noted that silica sand covers many beaches, and it makes up most of the rocks on earth. In fact, silica-containing minerals or silica itself make up more than 95% of the earth's crust (Medical News Today). One of the products Nhlabathi manufactures, is utilised for water filtration. Therefore, there is no risk associated with the product. The main risk is during crushing, which will be managed and controlled as part of the occupational hygiene programme for the mine. Dust from chrushing operations can be effectively controlled and managed. Nhlabathi is required to scan their staff regularly and report to DMR. The silicosis risk to adjoining properties and residents will be lower than the risk to workers at the mine. The potential for silica dust-fallout will be addressed in the Air Quality Impact

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	provides that *"Everyone has the right to an environment that is not harmful to their health or well-being".*		Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. In addition, Nhlabathi has committed to undertake a medical research study as proposed.
132	AIR POLLUTION The Environmental Specialist should investigate and evaluate the effect that dust may have on the business of my client, especially silica dust and dust emanating from the proposed mine. The statement on page 161, paragraph 8.2.7.1.6 of the DSR, namely, *"Opencast mining should control the generation of particulate matter on mine haul roads. Water spraying is a cheap and effective means of control and should be consistently applied across mines in the Highveld Priority Area "* is a general statement and does not address mitigation methods for air pollution from the emission of dust generated by the crusher and screening plants, especially in the light of the fact that those dust particles contain silica particles which is detrimental to the health of the affected and interested party and the community living in close proximity to the proposed mine. The statement "*Fugitive dust emissions released during mining operations are generally only of concern within 3 - 5 km of the mine boundary"* on the same page of the DSR is a clear indication that dust will have an effect on my client's business operations, as its property falls within this range. The statement on page 195, paragraph 9.7.1 of the DSR, namely *"Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health.*" Is a clear indication that the Air Pollution Impact Assessment Studies should be amplified to show clearly the mitigation measures which will be implemented by the mine, and that such studies should specifically include mitigating measures concerning fugitive dust emissions which will certainly affect my client's business. The reference to studies that were conducted in 2017 by Eskom on a Chicken Farm Site situated approximately 30km north-east of the Rietkol	Johann Minnaar on behalf of Unex Rose Plot 198, 201, 202, 204 Neighbouring landowner to the MRA area Email 23 Apr 2021	As mentioned previously, the potential for dust-fallout will be addressed in the Air Quality Impact Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. Site specific mitigation measures will be determined to address the potential impact identified by the impact modelling. This will include the identification of dust monitoring points, which will be implemented on granting of the mining right. The 2017 Eskom data refers to the regional air quality which will be taken into account to identify any cumulative effects. Adequate baseline air quality data have been obtained for the Rietkol site, which was also presented in the Scoping Report.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	mining area in the DSR is, with respect irrelevant, and has no bearing on the air environment in the Rietkol study area. It is not clear if that dust emissions were generated by a coal mine or by a silica mine Dust monitoring points must be installed at the business site of my client and must be regularly monitor.		

Comments from Landowners within 1km radius

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
294	4. I will now deal with the contents of the DRS and supporting baseline studies applicable to the DSR relevant to the my client's, extensive business of planting flowers of various cultivars in hothouses (tunnels) and the marketing thereof ("the business") on the above properties which are adjacent to the proposed mining area of the proposed Rietkol Silica Mine. It must not be construed or implied that my client necessarily agree with the contents of the DSR which we do not specifically address in this letter, and my client's rights are reserved to comment in future on any of those issues if it deems it necessary, and once it is in receipt of the draft Environmental Impact Assessment Report and the necessary Environmental Specialist Reports which will follow the DSR. 5. You are advised, at this earlier stage of the proposed project that my client will suffer irreparable loss and damages should the proposed mine be established on properties adjacent or nearby to the affected properties. 6. Environmental degradation associated with mining such as air pollution, dust pollution, water depletion and polluted water are not conducive to the business of my client as explained above.	Johann Minnaar on behalf of PJ Pretorius Blomme CC Plot 285 Landowner within 1km MRA buffer Email 18 Mar 2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. The potential impact on the economic activities of Pretorius Blomme will be assessed as part of the macro-economic impact assessment. The possible main macro-economic impact could be the possible impact on the available water and quality of the water. This will be determined applying the groundwater specialist report.
296	8. Air Pollution: The Environmental Specialist should investigate and evaluate the effect that dust, especially silica dust and dust emanating from the proposed mine, may have on the business of my client. It is	Johann Minnaar on behalf of PJ Pretorius Blomme CC Plot 285	Noted. The concerns raised will be forwarded to the air quality specialist for consideration during their assessments.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	noted in this section of the DSR that *"There are numerous planned and existing mines located near the proposed Rietkol Project. There exists a potential that air quality impacts from other mines could influence the cumulative air quality impacts at and near the site."* Dust monitoring points must be installed at the business site and must be regularly monitored. The Environmental Specialist must investigate such cumulative effect.	Landowner within 1km MRA buffer Email 18 Mar 2018	Baseline particulate matter (PM) monitoring was conducted and the results presented in the Scoping Report (Par 8.8.3). Further monitoring will be conducted during the EIA Phase to confirm the baseline air quality in the area. Dust monitoring will be implemented on granting of the mining right, prior to any construction activities. Cumulative effects will be investigated as far as it is practical and relevant. The regional air quality will be taken into account to identify any cumulative effects.
306	On the air quality what is the current baseline on one of their other Silica mines. It is important that we compare that with what is actually happening at an existing Silica mine. It would be good to see what the air quality looks like within a 1 and 2 km radius around an existing mine, so that we can see what effect it will have on us. The wind does not care where it goes; it picks up particulate matter and takes it where it is blowing. I cannot shut my mouth every time the wind changes direction or stop operation / production in my greenhouses. I want this to be verified, not an estimate, so that we can make informed decision. We want it done by real experts that have no contractual relationship with Consol. Monitoring data should be kept on record on a monthly basis at every mine. We would like to see the monitoring data of the last 5 years of all the mines that Consol has a stake in. Showing the comparative figures in terms of air quality and the surrounding area, with GPS coordinates of the monitoring points. Also indicate the prevailing winds.	Pretorius, Leon Landowner Plot 285 Landowner within 1km MRA buffer Meeting 9 Mar 2018 & Martin van Zyl, Odette Wiese	We will engage the management of the mines to see what data is available and provide feedback.
310	What kind of studies have been done in the past on the dust, and the effect it has on greenhouses. We know for a fact that if there is a lot of dust on the greenhouses, the plants don't grow. Is there any information that will help us understand what the impact will be on our plants, as well as for all the crops grown in the area and the poultry sheds and so on.	Pretorius, Leon Landowner Plot 285 Landowner within 1km MRA buffer Meeting 9 Mar 2018	The intention of the air quality study is not to look at the impacts on a particular greenhouse. The study will be about fugitive dust particles, which may leave the site and be transferred elsewhere. The baseline study indicate the current

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	We sit with living organisms that provide an income, pay our labourers, to what extent will the mine have an impact on our profitability and market share. At the moment we have the best quality on the market and it comes at a premium price, and if I lose my premium price due to an external factor that came into my area, how is that going to work, how is that going to impact on my business and all the other businesses. How is that going to be compensated and how are you going to assess the damage being done, production wise, contract wise, etc. Let us be honest, all the models that have been done before such a development cannot be compared to the real life situation. Practically, real life is happening. During wintertime when we do not have a lot of rain, we have a lot more dust in the air; we have to wash off the dust from the greenhouses once or twice a month to allow sufficient sunlight to get through. This depends on weather conditions, the wind direction, mines, whether the farmers are harvesting, there is all these factors. We lose about 15% for every week that we postpone to wash the greenhouses.	& Martin van Zyl	conditions. The impact model will indicate where and if any particles may leave the site. The impact study will then propose mitigation measures to minimize any identified impact. It will not look at the greenhouses parse, but will recommend measures to make sure that the dust does not leave the site in an excessive volume. You may well be right, you have your own version, and there might be studies that were correct in their assessment. That is your baseline reality right now, which you can control to a degree. What need to be addressed is the risk of dust pollution emanating onto your property. The purpose of the baseline study is to say that is where we are today, and then for the mine to ensure that between all it does, blasting, processing, vehicle, etc., it does not increase that to a format that is unacceptable. The impact assessment looks at the potential impacts and evaluates which impacts are likely to occur and are there mechanisms that can minimize that impact. The studies will say, this is where we are today, this is what the impacts will likely be, and this is what can be done to minimize the impact.
318	We reside with our children on plot 200. 1. We have a nursery and plant vegetables, which is our main income. 2. We are concerned that our groundwater levels and quality will be affected. 3. Michael Swart purchased this property for a purpose, as it is perfect for vegetable crops and seedlings. 4. The landowners work in Sandton and commute the distance every day. 5. The possibility of a mine within 1km of the property has already affected the property value.	Dorette van Schalkwyk Landowner / tenant within 1km MRA buffer Plot 200 Email 16-3-2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. A Health Impact Risk Assessment (HIRA) will be conducted to determine the potential health risks to the community. The concerns raised will be forwarded to the specialists for consideration during their assessments.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	6. The parents are expecting their babies in July 2018, and are very concerned about air quality, dust and deposits the mine may cause and the related health risks. 7. We prefer that you purchase the property, if you decide to go ahead with the mine. 8. Your promises are now great, but when we have problems there will be no one to deal with the problems.		
319	We do not agree with the establishment of a mine here. We are landowners with children that will be affected. Silicosis are serious. We are concerned about the groundwater.	Mariska du Plessis Plot 229 Landowner with 1km MRA buffer Email 18 Mar 2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality and air quality. A Health Impact Risk Assessment (HIRA) will be conducted to determine the potential health risks to the community, with a focus on the impacts concerning silicosis. The concerns raised will be forwarded to the specialists for consideration during their assessments.
325	11. Air pollution (as per 8.8) a. Consideration must be given to the effect of silica dust for humans and animals. Especially high performance competitive horses. b. Dust (fine dust like from blasting) causes damage to horse's lungs. Horse lung capacity +- 55 lt vs human +- 6	Sarel Kritzinger Goudhoek SA Boerperd Stoet / Ovomart (Pty) Ltd / SJN Kritzinger cc Plot: 158, 160, 161, 162. Landowners within the 1km MRA buffer Email 19 Mar 2018	A Health Impact Risk Assessment (HIRA) will be conducted to determine the potential health risks to the community, with a focus on the impacts concerning silicosis. There is sufficient scientific literature that indicates that animals can also contract silicosis. Silicosis is a progressive illness that develops over many years, even decades. With a life expectancy of 25 years for horses, the effect will thus be low compared to humans with a life expectancy of 60 years. If the dust fallout is managed to an acceptable standard for humans, no impact is expected on the horses. Lung capacity does not influence the progression of the illness.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
346	Water: This commodity cannot be replaced by humans. As you know the whole area, is depending on groundwater. Not only for farming but also more so for human consumption. Any disturbance of the ground formation will cause that the dolomite will cave in and boreholes included. That already happened at Bapsfontein, and to the east of Delmas. If the water is contaminated, it will affect quite a number of people and agriculture. Value of property: Our properties will have no value without clean water. Water is the main issue required if you want to sell your property. All banks have this requirement if one would apply for financing. Modder East Orchards is known for the underground lake and if for mining to start, they will have to pump a lot of water to somewhere. Where will that be? The mine will flood constantly, as the water will seep through all the time. Mining interference: Dust, trucks, road deteriorate. Explosions and vibrations will cause cracks in our homes with a tremendous amount of dust. Presently we enjoy wonderful clean air with no pollution. We have invested our life savings to enjoy this wonderful gift of nature. What impact will that have on our health, property value and general living standards? Especially in winter time. Conclusion: Does this mineral deposit justify the consequence it will create? We are all positive for job creation, but what will be done to compensate for our life investment? Will the mine even consider to buy our properties at Municipal valuation?	Dennis Webster Plot 266, 268, 263 Landowner within 1km MRA buffer Email 21-03-2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. Other studies include a Health Impact Risk Assessment (HIRA), traffic impact assessment and a social impact assessment. Impact of air blast and vibration on all structures within the blast impact zone will be addressed as part of the blasting impact assessment. The potential impact on the existing economic activities and the benefits of the proposed mining activity will be assessed as part of the macro-economic impact assessment, including impacts/benefits on GDP and employment. A cumulative impact zone will be determined around the proposed mining activities once all the specialist studies have been completed, and only then will a decision be taken on the proposed buy-out of properties.
347	We are concerned about the following: ▪ We have 3 houses and 2 businesses on our property. ▪ Air pollution with the Open Cast ▪ Water pollution with the drilling and blasting. ▪ Damage to property with blasting and heavy motor vehicles on the access road.	Pieter Fourie Plot 276 Email 22 Feb 2021	Noted, your comments will be considered during the EIA Phase. Specialist studies that will be conducted include: • Air Quality • Surface and Groundwater including water quality assessments • Blasting and Vibration study • Noise Impact Assessment • Social and Economic Impact Assessment
360	You are advised, at this earlier stage of the proposed project that my client will suffer irreparable loss and damages should the proposed mine be established on properties adjacent or nearby to the affected	Johann Minnaar on behalf of PJ Pretorius Blomme CC Plot 285	Your concerns around environmental degradation are noted and will be considered during the EIA process and within the relevant specialist impact

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	properties. Environmental degradation associated with mining such as air pollution, dust pollution, water depletion and polluted water are not conducive to the business of my client as explained above.	Landowner within 1km MRA buffer Email 20 Apr 2021	studies. Mitigation measures will be determined to deal with any of the concerns raised and impacts identified by the specialists for inclusion in the EMPr. Also refer to responses below on the specialist studies.
363	AIR POLLUTION The Environmental Specialist should investigate and evaluate the effect that dust may have on the business of my client, especially silica dust and dust emanating from the proposed mine The statement on page 161, paragraph 8.2.7.1.6 of the DSR, namely, *"Opencast mining* should control the generation of particulate matter on mine haul roads. Water spraying is a cheap and effective means of control and should be consistently applied across mines in the *Highveld Priority Area "* is a general statement and does not address mitigation methods for air pollution from the emission of dust generated by the crusher and screening plants, especially in the light of the fact that those dust particles contain silica particles which is detrimental to the health of the affected and interested party and the community living in close proximity to the proposed mine. The statement "Fugitive dust emissions released during mining operations are generally only of concern within 3 - 5 km of the mine boundary" on the same page of the DSR is a clear indication that dust will have a effect on my client's business operations, as its property falls within this range. The statement on page 195, paragraph 9.7.1 of the DSR, namely *"Fine particles can be* dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely *affect human health.*" Is a clear indication that the Air Pollution Impact Assessment Studies should be amplified to show clearly the mitigation measures which will be implemented by the mine, and that such studies should specifically include mitigating measures concerning fugitive dust emissions which will certainly affect my client's business.	Johann Minnaar on behalf of PJ Pretorius Blomme CC Plot 285 Landowner within 1km MRA buffer Email 20 Apr 2021	As mentioned previously, the potential for dust-fallout will be addressed in the Air Quality Impact Assessment, which will provide an indication of the risk to not only employees, but also the general public adjacent to the proposed mine. Site specific mitigation measures will be determined to address the potential impact identified by the impact modelling. This will include the identification of dust monitoring points, which will be implemented on granting of the mining right. The 2017 Eskom data refers to the regional air quality which will be taken into account to identify any cumulative effects. Adequate baseline air quality data have been obtained for the Rietkol site, which was also presented in the Scoping Report.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
	The reference to studies that were conducted in 2017 by Eskom on a Chicken Farm Site situated approximately 30km north-east of the Rietkol mining area in the DSR is, with respect irrelevant, and has no bearing on the air environment in the Rietkol study area. It is not clear if that dust emissions were generated by a coal mine or by a silica mine.		

Comments from Landowners outside 1km radius

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
285	*Translated:* I reside on plot 231, between Mabona and Pretorius Flowers. I heard from the neighbours about the planned development and understand that it includes plot 209 to 224. How will we be affected in terms of Silica dust, our borehole water and would we be required to move?	Wentzel, Annamarie Landowner Plot 231 Landowner within 1km MRA buffer Email 12 Feb 2016	*Translated:* As explained in the document, the process is at the beginning, and a number of specialist studies will be conducted as part of the process. It is therefore too early in the process to be able to provide answers to your questions regarding impacts, as we first need to complete the specialist studies. We have registered you on the project and will keep you updated on the progress. I trust that this answers your question. If you need any further information please contact our Public Participation Office
385	1. Property value will decrease after the mining start, due to the blasting noise, dust, and water usage. 2. Borehole water, the lack of water or decrease in water levels. The quality of our water. 3. More land invasions-to live closer to the mine and or waiting to be employed. 4. Animals (Horses) that can be injured – due to the blasting. 5. Damage to our buildings due to blasting.	Karin Badenhorst-Brooks Landowner outside 1km MRA buffer Email 16-03-2018	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. Impact of blasting on infrastructure and horses will be addressed as part of the blasting impact assessment. Influx of employment seekers will be addressed in the social impact assessment. The concerns raised will be forwarded to the specialists for consideration during their assessments.

No	Comments/Suggestions/Question/Concern	Stakeholder, Date & Method	Response
387	What will the impact be on our: Water supply Health Roads Land & property value Safety Damage to property Wildlife and endangered animals and plants like the Bull frogs, vet plants	Rentia Rohlandt AJM Boerdery Plot 241 Landowner outside the 1km MRA buffer Online 15 Feb 2016	Noted. Impacts associated with the proposed Rietkol Project will be identified during the EIA Phase, including impacts on groundwater levels and quality, air quality and property value. A Health Impact Risk Assessment (HIRA) will be conducted to determine the potential health risks to the community, with a focus on the impacts concerning silicosis. Other studies include a traffic impact assessment and a social impact assessment, to address issues such as safety and security.

EBS ADVISORY

ESG | RISK | STRATEGY | COMMUNICATIONS | IMPACT

Stuart Thompson

Senior ESG Consultant

Work Experience in Africa

South Africa, Namibia, Botswana, Zimbabwe, Mozambique, Lesotho, Swaziland, Angola, Malawi, Madagascar, Zambia, Tanzania, Mauritius, Kenya, Ethiopia, DRC, Cameroon, Nigeria, Cote D'Ivoire, Sierra Leone, Senegal, Libya, Eritrea, Mali, Peru, Georgia, Estonia, Canada, Argentina, Netherlands, France, Germany, Italy, Austria, Czech Republic, Switzerland, Greece, Belgium, Cyprus, Australia, Indonesia, India, Malta, United Arab Emirates, Mexico, Columbia

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Profession: Senior ESG Consultant

Nationality: South African

Languages: English, Afrikaans

Date of Birth: 1981-11-07

Education:

Qualification	Specialisation	Date Obtained	Institution
Certificate	Climate Change Science	2016	University of British Columbia
Certificate	Climate Change Adaptation and Policy Development	2012	University of Cape Town
BSc (Hons)	Applied Environmental Science	2004	University of KwaZulu-Natal
BSc	Environmental Science and Hydrology	2003	University of Natal

Profile

Stuart has worked in an engineering firm with a focus on the estimation of impacts scenarios associated with design options proposed in manufacturing, heavy process and mining operations. Primary inputs have been on estimating health and carcinogenic impacts to humans associated with emissions released to atmosphere. This has included provision of inputs used by occupational hygienists and environmental toxicologist in assessing worker health and safety or long-term impact to surrounding land owners. Stuart has focused on scenario planning with respect to the implementation of Best Engineering Practice Principles. This aims at reducing impacts by avoiding for example stack downwash potential.

He has also undertaken additional assessments focused on determining inherent environmental risks and liabilities at a sight, this involves a site audit and can include the assessment of process optimisation initiatives including the implementation of energy savings measures, identification of occupational health and safety risks and contaminated land assessments. Stuart and his team have the capacity to take physical samples to verify levels of impact, this is done using active air, noise & water monitors and soil probes. Once the extent of these impacts is ascertained the liabilities associated with historic and current operations on site can be estimated. Stuart and his team provide this service to financial institutions prior to investment, as well as to operational entities looking to acquire environmental insurance products.

Market Segments with Experience

- AGRICULTURE
- ENERGY
- TRANSPORTATION
- WASTE
- MINING AND OIL AND GAS
- FINANCE
- RETAIL, COMMERCIAL & RESIDENTIAL INFRASTRUCTURE
- CONSTRUCTION
- HEALTHCARE
- MANUFACTURING AND INDUSTRIAL PROCESSES

Employment History

Designation	Duration	Company Name
Project Planner	May 2006 – Feb 2007	SiVest SA
Associate: Air Quality	Feb 2007- Dec 2012	SSI Engineers and Environmental Consultant
Portfolio Manager: Specialist Environmental Services	Jan 2013 - April 2017	Royal HaskoningDHV
Senior ESG Consultant	May 2017 - Present	EBS Advisory

Expertise

Key studies undertaken focused on the assessment of impacts related to:

- All phases of a project life cycle;
- Impacts associated with:
  - mining operations (coal, gold, platinum, uranium, diamonds, chromium, zinc, copper, mineral sands);
  - smelters (platinum, iron ore, chromium, vanadium);
  - refineries (oil and gas);
  - chemical industry (manufacturing etc.);
  - energy sector (Thermal and Renewable);
  - landfill sites, sewage works and incinerators; and
  - expansion of road and rail networks.

Key strengths employed in executing these projects include, strong project management, driven by innovative solutions, analytical and detailed oriented, working well in a team. Experience working with various financial institutions, including private equity, asset managers, unit trusts, DFIs and commerical banks, along with Industrial Development Banks. Specific focus areas with respect to supporting these sectors include:

- Capacity building and training,
- ESG Due Diligence Assessments,
- Compilation of ESMS,
- Compilation of ESAPs,
- Contaminated land assessments,
- Air Quality Modelling,
- Carbon Footprinting,
- Climate change adaptation studies,
- Tracking of process implementation,
- Data analytics,
- Reporting,
- Tool development,
- Strategic workshops,
- Process optimisation,
- Disaster Managemet, and
- Strategic Advisory Services