AIR QUALITY IMPACT AND CLIMATE REPORT

Exxaro Belfast Expansion Project

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1. INTRODUCTION

The Department of Minerals and Energy (DMRE) issued Exxaro Coal Mpumalanga (Pty) Ltd. (Exxaro) a Mining Right (MR) (DMRE Ref No. MP 30/5/1/2/2/431 MR) for development of the Belfast open cast mine in Belfast on 9th October 2013 within the jurisdiction of Emakhazeni Local Municipality in the Mpumalanga Province. The mining project is collectively known as the Belfast Implementation Project (BIP). Upon issuing the MR, construction activities for the BIP commenced, and the first coal was produced in September 2019. Once mined, the coal is transported by trucks from the Belfast mine to Rietkuil Siding (approximately 30km from the mine) and transported by rail to Richards Bay Coal Terminal for export.

In 2019, the exploitation analysis of the Belfast Resource, outside the current BIP layout area, revealed during the Concept Phase that there is potential for a 5,200 kcal/kg (five thousand two hundred kilocalories/kilogram) opencast and underground mining scenario as well as a 5,800 kacl/kg (five thousand eight hundred kilocalorie/kilogram) underground scenario. A potential of 39.7 Mt (thirty-nine point seven million tonnes) of Run of Mine (RoM) can be additionally mined at a yield of 69% (sixty-nine percent), resulting in 27.4 Mt (twenty-seven point four million tonnes) of product. Exxaro has commissioned an Environmental Impact Assessment (EIA) for this site and the project is collectively known as the Belfast Expansion Project (BEP). The coal that will be mined from the BEP will be transported the same way as that from the BIP.

Kijani Green Energy was appointed by Nsovo Environmental Consulting (Nsovo) to provide specialist air quality and climate change input into the EIA application for the proposed expansion of coal mining activities at Exarro's Belfast Coal project.

Kijani is a specialist air quality consultancy with extensive experience in the provision of specialist input into EIAs in South Africa. All relevant staff are fully trained in all aspects of air quality analysis and modelling and are competent to undertake such work in a professional and timely manner.

Furthermore, Kijani hereby declares their independence on this matter, in keeping with the requirements of specialist professionals as outlined by the National Environmental Management Act, 107 of 1998 (NEMA). Kijani works under the auspices of Nsovo on this project.

This report is compiled for an EIA for the proposed expansion of the activities at Belfast Coal mine which will include the following:

- Open cast mining activities;
- Underground mining activities;
- Construction of a Conveyor belt;

- Development of haul roads within the MRA;
- Development of a Mine Residue Facility/Discard dump;
- Pollution control dams;
- Sewage treatment plant; and
- Associated infrastructure.

2. ENTERPRISE DETAILS

Table 1: Enterprise details

Enterprise Name	Exxaro Resources Limited
Trading As	Exxaro Resources Limited
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc	Company
Registered Address	The conneXXion 263B, West Avenue Die Hoewes Centurion 0163
Telephone Number (General)	+27 12 307 5000
Industry Type/Nature of Trade	Mining
Land Use Zoning as per Town Planning Scheme	Open land

2.1 Location and extent of plant

Table 2: Location and extent of plant

Coordinates	25°47’14.51 S 29°58’15.44 E
Extent (km^2)	58.6 km2
Elevation Above Mean Sea Level (m)	1800 m
Province	Mpumalanga Province
Metropolitan/District Municipality	Nkangala District Municipality
Local Municipality	eMakhazeni Local Municipality

The site is situated approximately 12km southwest of Belfast, in the Mpumalanga Province, at 25°47’14.51 S and 29°58’15.44 E; and at an altitude of 1800m above sea level. Refer to Figures 1 and 2 below for the location of the proposed site.

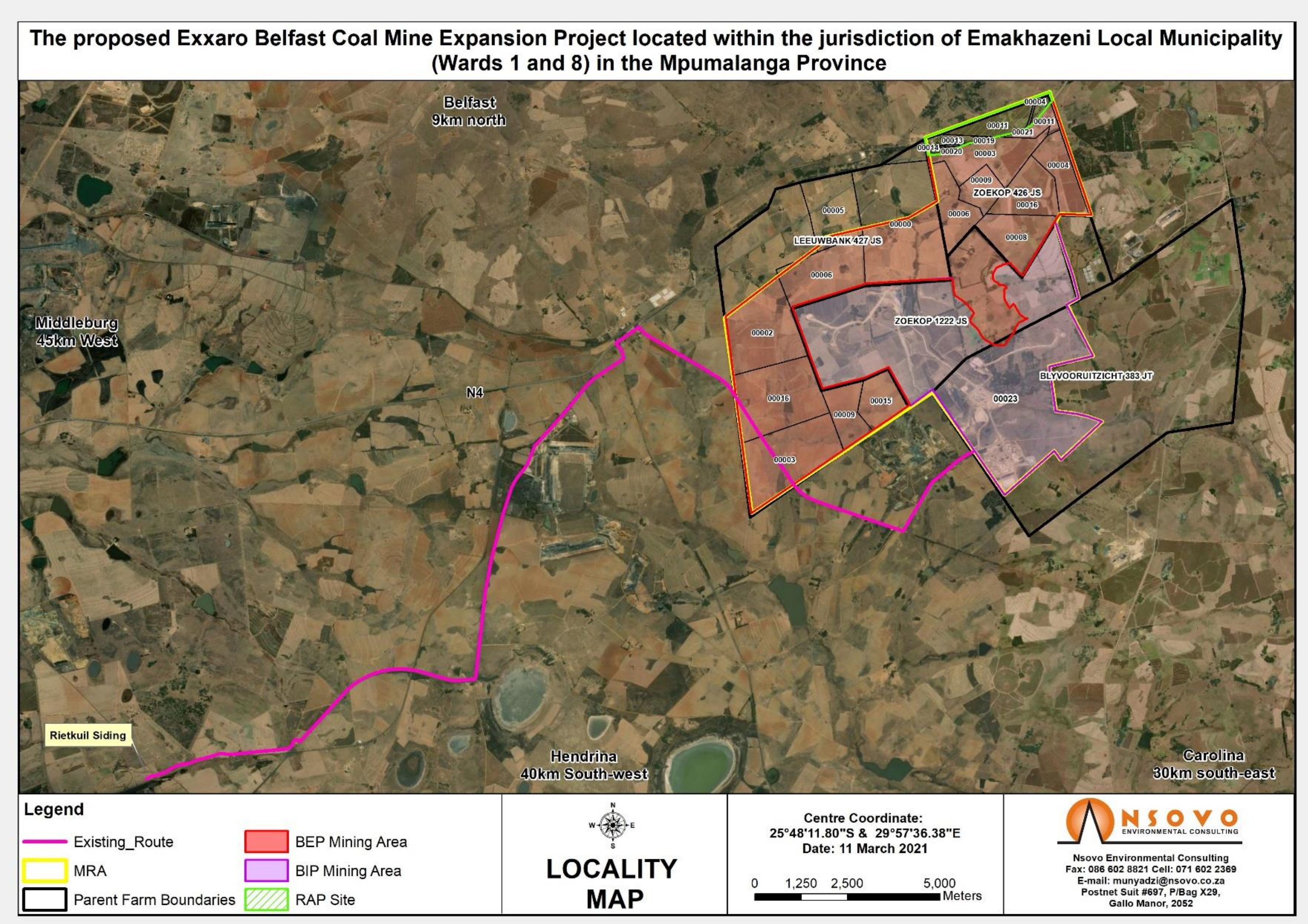


Figure 1: Locality Map indicating the Belfast Implementation project, proposed BEP and existing road (Nsovo,2021)

2.2 Atmospheric Emissions Legislation

The project is situated in the Mpumalanga Province, in the Nkangala District Municipality. This area has not been formally declared as an Air Quality Priority Area in terms of Section 18(1) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (AQA).

2.2.1 National Ambient Air Quality Standards

The following National Ambient Air Quality Standards have relevance[1]:

Table 3: National Ambient Air Quality Standards for particulate matter (PM_{10})

Averaging period	Concentration	Frequency of exceedance	Compliance date
24 hours	75 µg/m^3	4	1 January 2015
1 year	40 µg/m^3	0	1 January 2015
The reference method for the determination of the particulate matter fraction of suspended particulate matter shall be EN 12341			

The National Dust Control Regulations were signed into law on the 1st of November, 2013. An acceptable dustfall rate for a non-residential area is considered to be more than 600 mg/m^2/day but less than 1200 mg/m^2/day (30-day average), with a maximum allowable of two exceedances per year, provided these exceedances do not take place in consecutive months.

A dustfall monitoring programme as prescribed in terms of the Regulations must include:

(a) The establishment of a network of dust monitoring points using method ASTM D1739: 1970 (or equivalent), sufficient in number to establish the contribution of the person to dustfall in residential and non-residential areas in the vicinity of the premises, to monitor identified or likely sensitive receptor locations, and to establish the baseline dustfall for the district; and

(b) A schedule for submitting to the air quality officer dustfall monitoring reports annually or at more frequent intervals if so, requested by the air quality officer.[2]

[1] After the National Environmental Management Act: Air Quality Act Handbook (2015) and as per the National Environmental Management Act Air Quality Act, 2004 (Act no. 39 of 2004), National Ambient Air Quality Standards

[2] National Dust Control Regulations, National Environmental Management: Air Quality Act, 2004 (Act No. 39 Of 2004), No. R. 827, 1 November, 2013

3. NATURE OF THE PROCESS

3.1 Air quality listed activities

There are no air quality listed activities requiring an Atmospheric Emissions Licence associated with the proposed project.

3.2 Process description

The project involves the expansion of existing mining activities at Belfast Coal Mine and will entail the following activities:

- Open cast mining activities;
- Underground mining activities;
- Construction of a conveyor belt;
- Development of haul roads
- Development of a Mine Residue Facility/Discard dump;
- Pollution control dams;
- Sewage treatment plant; and
- Associated infrastructure.

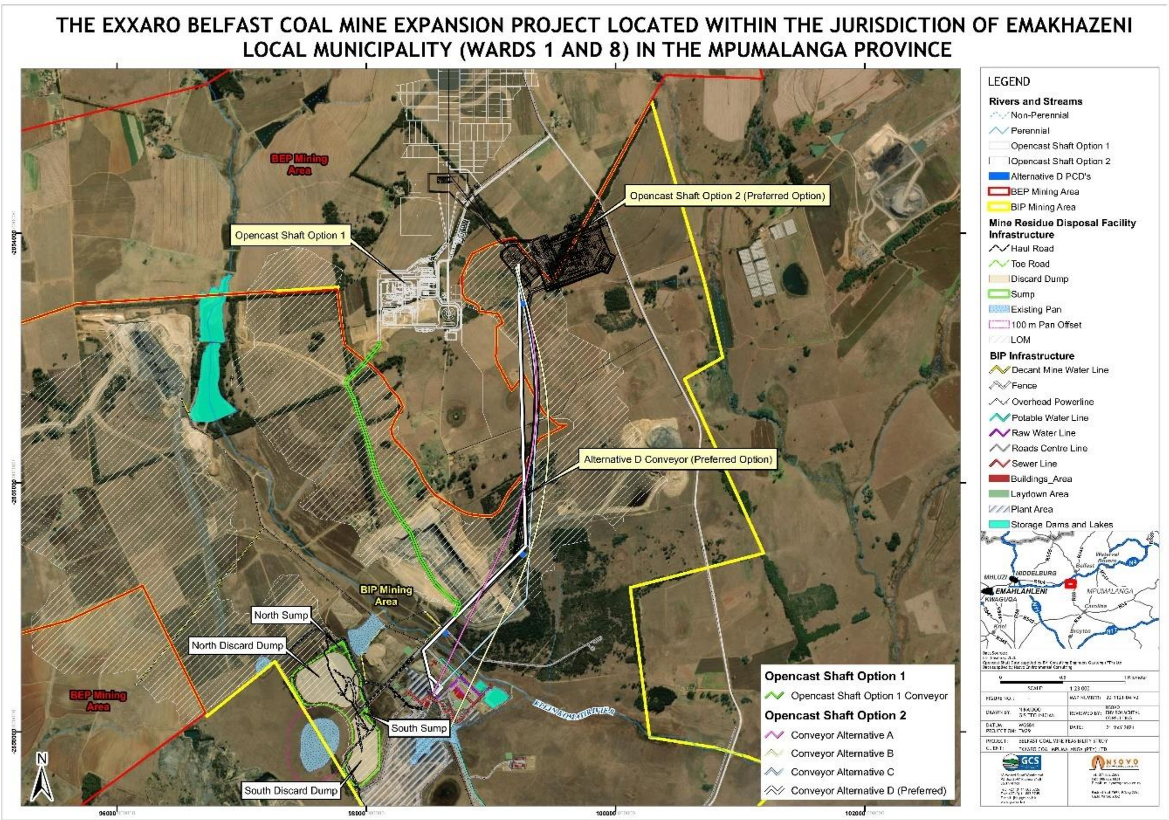


Figure 2: Surface and underground infrastructure for the proposed Belfast Coal Mine expansion

4. CLIMATE DESCRIPTION

No long-term weather dataset was available for the site in question, so the South African Weather Service (SAWS) data for Belfast, Mpumalanga Province, was selected as an acceptable proxy for the climate analysis. This station is a first-order weather station and is a good indicator of expected conditions for the site.

For the wind roses and modelling, data from an on-site weather station was used, for the year 2020.

Dust emissions are a function of the makeup of the exposed material (particularly silt and small particle content), wind and moisture. Conditions of fine, dry, exposed material in windy weather will result in the most significant emissions. Thus, in analysing potential dust from potential sources such as these factors on which the focus lies.

4.1 Wind

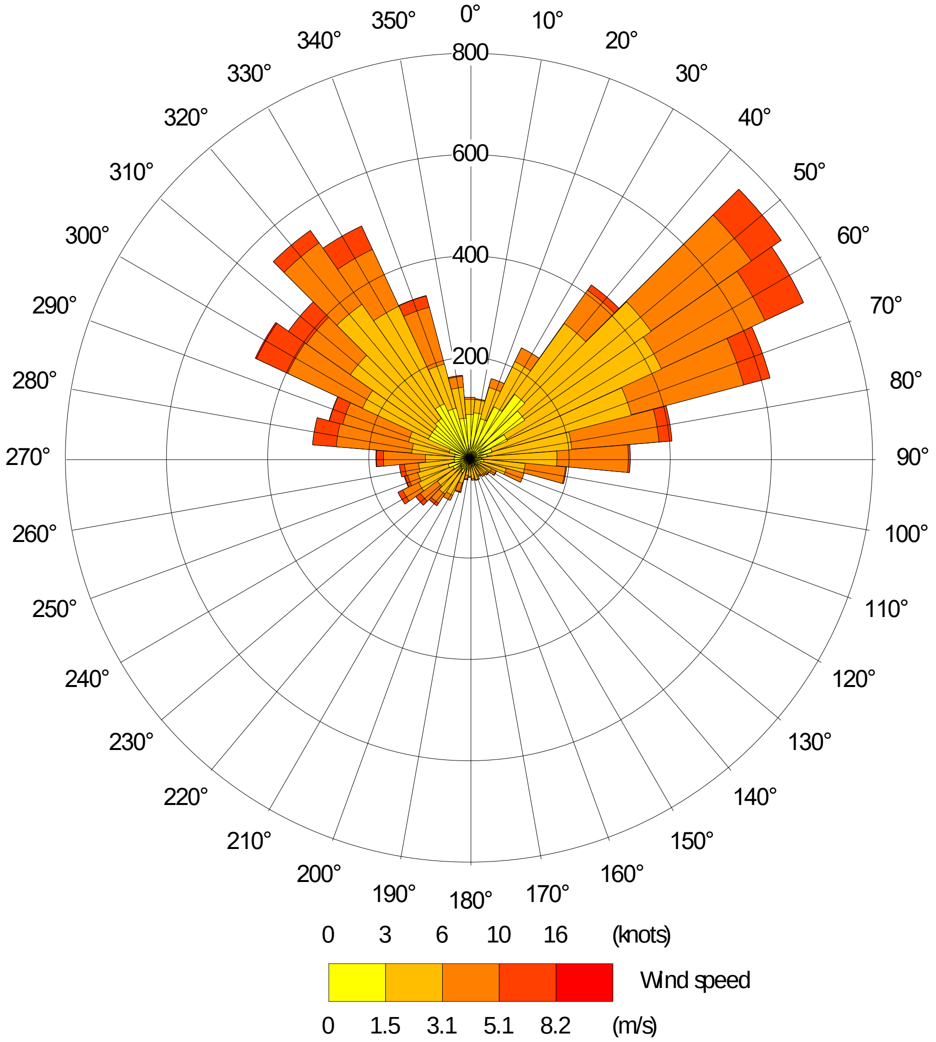
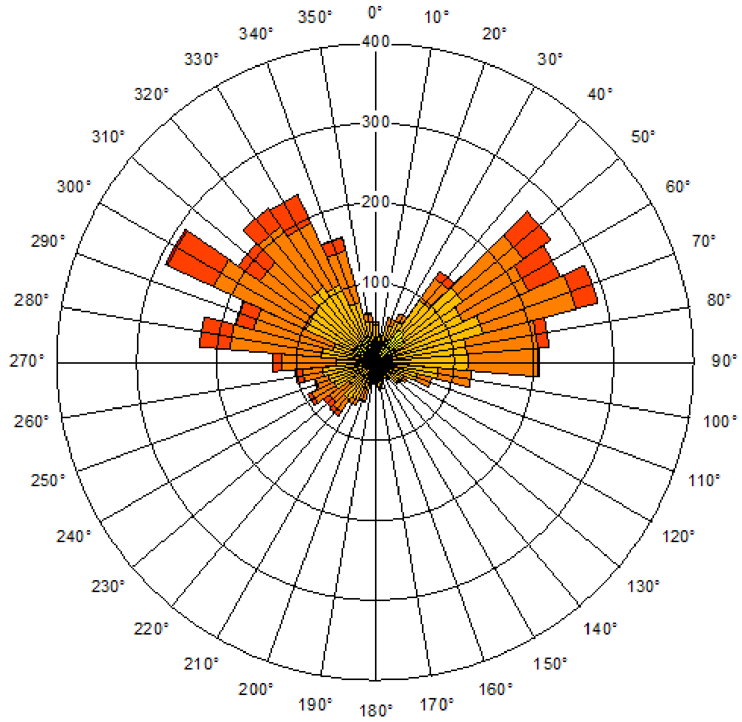
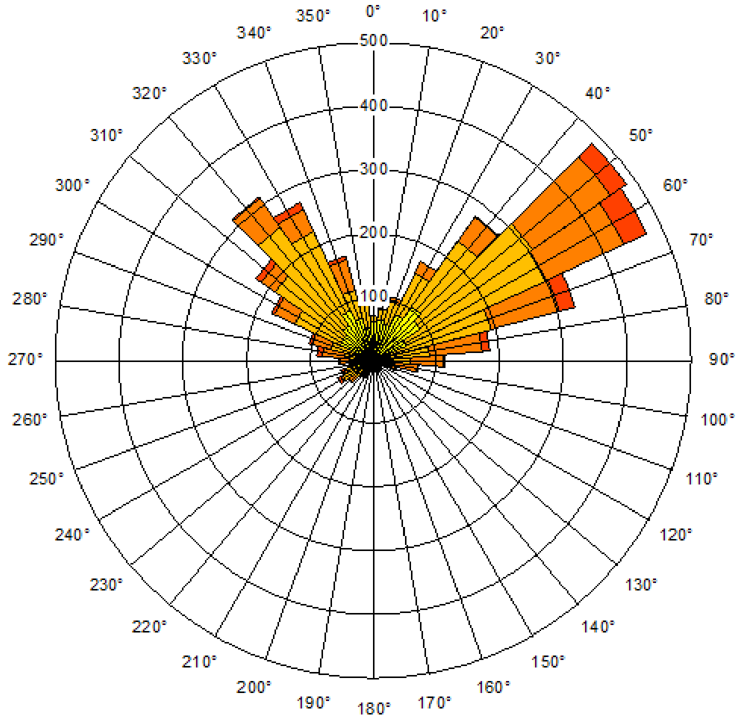


Figure 3. 2020 Annual wind rose for Exxaro Belfast, Mpumalanga Province, South Africa (Exxaro, 2021).



Day



Night

Figure 4. Wind direction and strength for Day (6am to 6pm) and night (6pm to 6am) for the 2020 calendar year, Exxaro Belfast, Mpumalanga Province, South Africa (Exxaro, 2021)

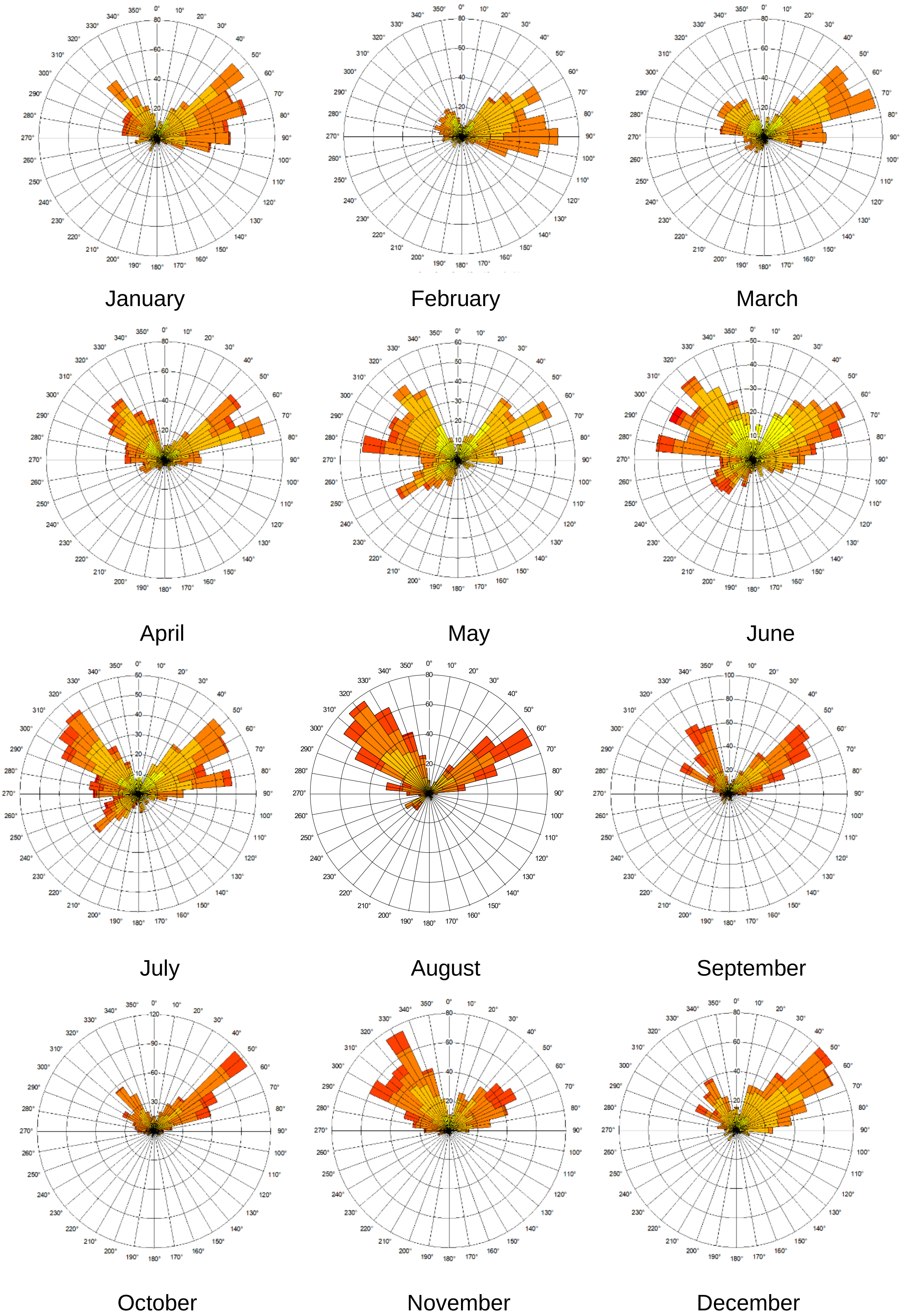


Figure 5. Monthly wind direction and strength for the 2020 calendar year, Exxaro Belfast, Mpumalanga Province, South Africa (Exxaro, 2021)

The prevailing winds are from the northwest and northeast, with dispersion from the site likely to be predominantly to the southwest, southeast and west.

4.2 Precipitation

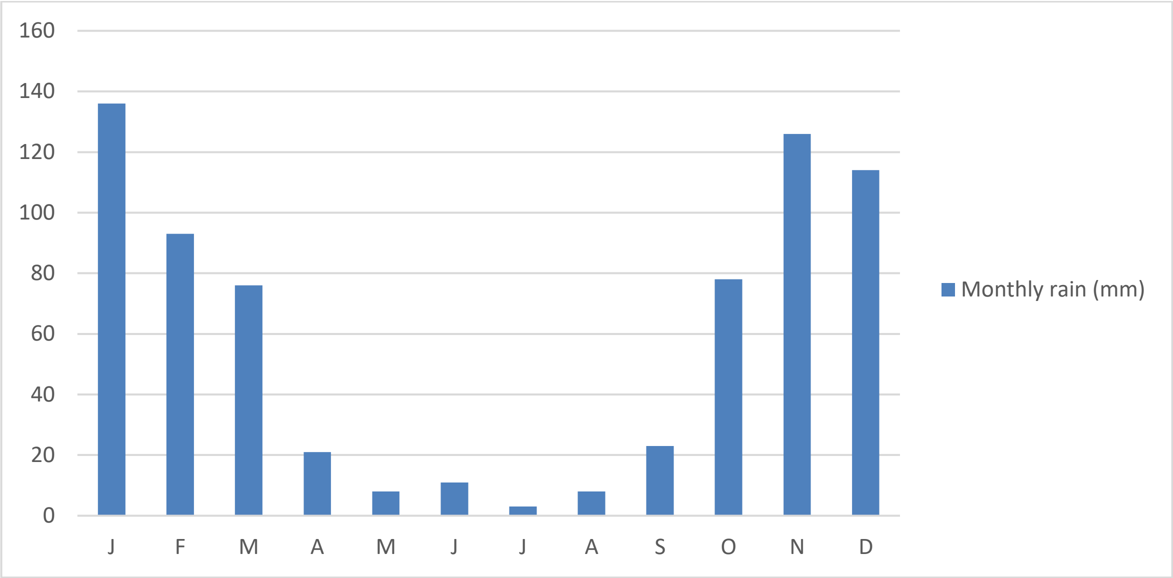


Figure 6: Average monthly rainfall figures for Belfast, Mpumalanga Province, South Africa (SAWS, 1961-1990) (mm per month)

The site is on the eastern Highveld, at an altitude of approximately 1800m above sea level. It is in South Africa's summer rainfall region with an annual average rainfall of 685mm per year. Rain peaks mid- season, in January, while the winter months are characterised by a long and very dry period.

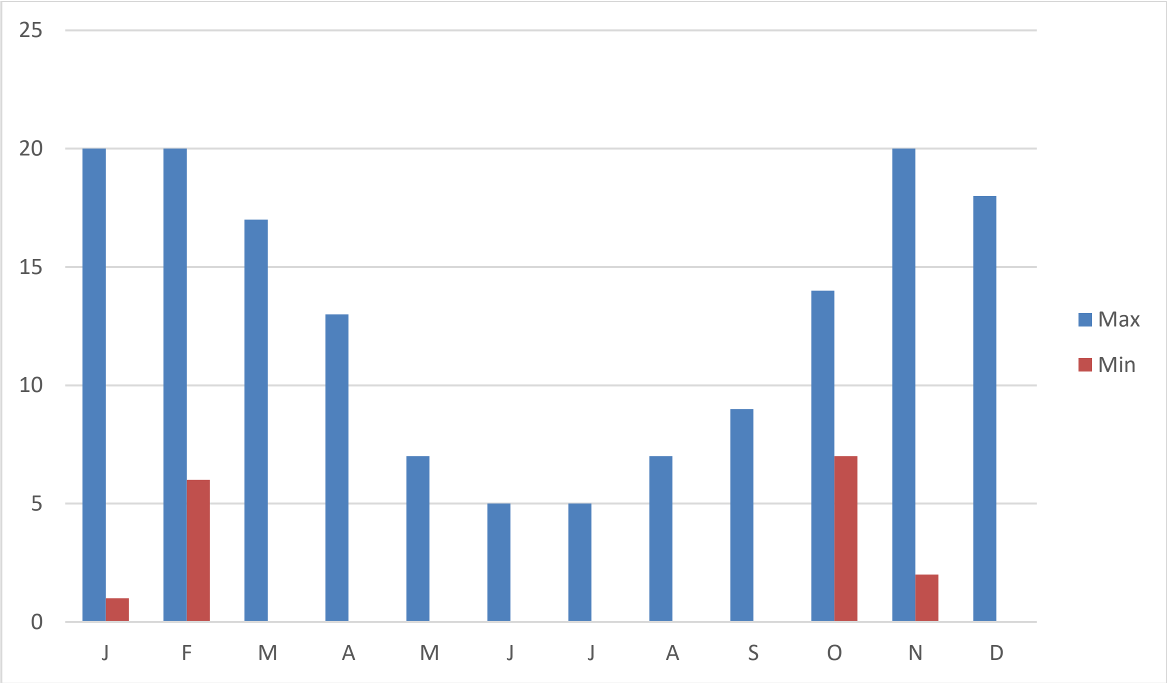


Figure 7: Maximum and minimum monthly rain days (days where precipitation exceeds 0.1mm) for Belfast, Mpumalanga Province, South Africa (SAWS, 1961-1990) (number of days per month)

Even the addition of a small amount of moisture can have a dramatic effect on the reduction of potential dust emissions. Similarly, a long spell without rain will necessitate intervention in the form of dust control measures in order to manage impacts on the surrounding environment. These will be particularly necessary during the months from April to September.

4.3 Temperature

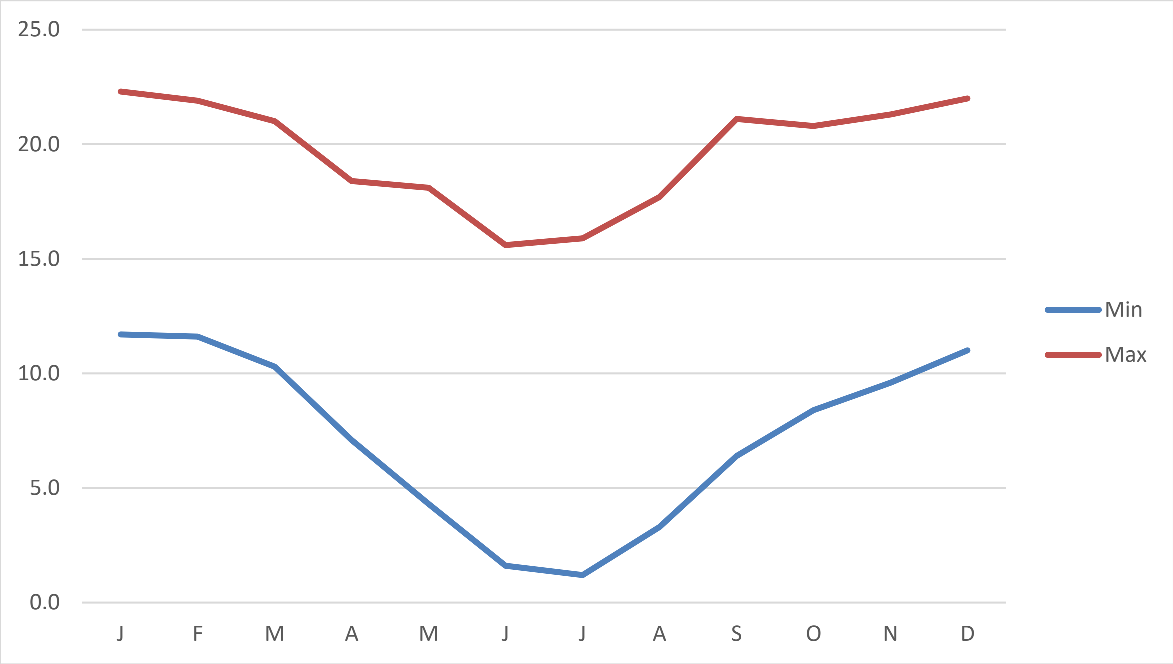


Figure 8: Average minimum and maximum daily temperature (Celsius) for Belfast, Mpumalanga Province, South Africa (SAWS, 1961-1990)

The warmest period is December / January when maximum temperatures average around 23 degrees centigrade while June/July is the coldest period with daytime temperatures averaging 16 degrees and overnight temperatures frequently dropping below freezing. The winter period is also very dry with little or no rainfall and relative humidity dropping below the 40% mark.

4.4 Summary

The site is situated in a high-altitude region characterized by summer rains but where the winters are cool, dry, and windy, resulting in conditions ideal for the desiccation of the environment and the wind entrainment of any loose material.

4.5 Climate change assessment

The eastern summer rainfall region of South Africa is expected to experience warming over the coming years as a result of global climate change. With this, seasonal variability in rainfall, in particular, is expected to increase, with wetter wet periods and more extreme droughts forecast[3]. With this in mind, it is worth noting that historical flood lines may need to be reassessed and decisions on the placement of infrastructure be made extremely conservatively.

[3] WIREs Clim Change 2014, 5:605–620. doi: 10.1002/wcc.295

5. ATMOSPHERIC EMISSIONS

5.1 Area source parameters

Figure 9: Area sources for the proposed Belfast Coal Mine expansion

Key:

Proposed open cast areas

Proposed surface infrastructure

Mining Rights Area

Proposed waste dumps

Emissions to air during the construction and operation of a mine of this nature are generally limited to dust, smoke emissions from heavy machinery and vehicles, and a wide range of trace gases given off during the drying of solvents and similar processes resulting from activities associated with routine construction and maintenance.

Of these, dust is by far the most significant potential polluter.

The degree to which dust becomes a polluter is in direct relation to four factors:

- The nature of the area to be exposed by surface clearing (including total area, shape relative to prevailing winds and height of dumps etc.).
- The moisture content of the soil and by association, the average rainfall for the area;
- The silt content and grading of the material exposed to the surface; and
- Activities taking place on that surface (transport, loading, blasting and entrainment by the passage of vehicles).

Mining operations result in a significant total area of previously protected material becoming exposed to the elements. Depending on the silt content and grading of the various layers of material and the efficacy of mitigation measures in place, significant dust emissions could result.

Dust is considered in two broad categories, namely total suspended particulates (TSP) and particulate matter with a diameter less than 10µm (PM_{10}).

TSP is also referred to as 'nuisance dust' and accounts for the visible dust that may settle and cause the clogging of machinery as well as have an adverse effect on local flora through the clogging of stomata.

The second category of dust is made up of those particles smaller than 10µm (PM_{10}). PM_{10} particles are small enough to be inhaled and are thus a significant contributing factor to respirable illness associated with air pollution.

5.2 Dispersion Modelling

Potential emission modelling is undertaken using the US EPA's AERMOD model. Input data combines field data and estimates generated using the Australian National Pollution Inventory (NPI) *Emission Estimation Technique Manual for Mining, Version 3.1*(2012). Meteorological data is sourced from the South African Weather Services (SAWS).

5.2.1 Emission factors

Fugitive dust emissions from a mine of this nature are generally a function of the rate of activity on the mine and the silt and moisture content of the material being handled. These are then exacerbated by wind and dry weather conditions.

When modelling emissions from a site where real data is not available, it is possible to estimate the emissions generated by using a series of equations to determine the likely emission of each process. These are called emission factors. An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.

The emission factors used for this study were taken from the Australian National Pollution Inventory (NPI)'s *Emission Estimation Technique Manual for Mining, Version 3.1*(2012). The emission factors contained therein are mostly based on those developed by the United States Environmental Protection Agency (USEPA, 1985 and 1998) and are in turn published in *Emission Factor Documentation for AP-42* itself considered an industry standard. South Africa has yet to develop its own set of emission factors.

A broad overview of potential dust emissions likely to be emitted *during operation* can be obtained through the use of the NPI's general equation:

$$E_{kpy,i} = [A * OpHrs] * EF_i * [1 - (CE_i/100)]$$

where:

$E_{kpy,i}$ = emission rate of pollutant i, kg/yr

A = activity rate, t/h

OpHrs = operating hours, h/yr

EF_i = uncontrolled emission factor of pollutant i, kg/t

CE_i = overall control efficiency for pollutant i, %

The bulk of the activity on the proposed site is likely to take place underground, so dust impacts directly related to mineral extraction should be minimised. The most significant dust impact is likely to result from the driving of heavy vehicles over unpaved roads. Thus, the following emissions of TSP, PM10 and PM2.5 can be anticipated:

Table 4: Estimated emissions per activity, as per *Emission Estimation Technique Manual for Mining, Version 2.3* (2001) and US EPA's *Emission factors for unmitigated fugitive dust sources*.

Operation / Activity	TSP (g/s)		PM10 (g/s)		PM2.5 (g/s)	
	Estimate	Default	Estimate	Default	Estimate	Default
Excavators/shovels/front end loaders (on coal)	0.104	0.113	0.006	0.133	0.0006	0.013
Bulldozers on coal	3.01	2.833	1.2	0.903	0.12	0.09
Trucks (dumping coal)	-	0.039	-	0.016	-	0.002
Drilling	-	0.001	-	0.000	-	0.000
Blasting	0.014	-	0.007	-	0.001	-
Wheel generated dust from unpaved roads	1.332	0.898	0.387	0.222	0.04	0.02
Scrapers	0.028	0.001	0.01	0.012	0.001	0.001
Graders	0.141	0.031	-	-	-	-
Loading stockpiles	-	0.016	-	0.007	-	0.0007
Uploading from stockpiles	-	0.117	-	0.051	-	0.005
Wind erosion	-	0.056	-	0.028	-	0.003

In order to highlight areas of potential dust impact, inputs were assumed extremely conservatively so as to maximise indicated emissions. This is done to ensure that any areas that may be impacted are thrown into stark relief and appropriate plans can be drawn up to monitor and, if necessary, mitigate potential emissions. To this end, the model was run on unmitigated scenarios. Since, with unlimited budget and application of resources, dust emissions could theoretically be consistently mitigated to zero, no mitigated scenarios were modelled. Instead, it is recommended that dust fall be monitored based on the flow patterns modelled, and the processes on site be managed accordingly.

In addition, the receiving environment is not dust free. For this reason, mine management need to be conservative in reading these impacts, in order to avoid a cumulative impact that exceeds national standards.

6. MODELLING

6.1 Modelling Methodology and assumptions

Emissions to air during the operation of a facility of this nature are generally limited to fugitive dust emissions.

6.1.1 Meteorological data

Following discussions with the South African Weather Service (SAWS), the nearest available long-term dataset was identified is Belfast, Mpumalanga Province, South Africa. For modelling purposes, the on-site hourly dataset for 2020 was used (Exxaro (2021).

6.1.2 Emission factors

Potential emission modelling is undertaken using the AERMOD model. Input data combines field data and estimates generated using the Australian National Pollution Inventory (NPI) *Emission Estimation Technique Manual for Mining, Version 3.1*(2012). Meteorological data is sourced from the South African Weather Services (SAWS) and from Exxaro's on-site weather station.

Dust emissions were estimated as unmitigated.

6.2 Results

When assessing the modelling results, it is important to bear the following in mind: The absolute values of modelled dust emissions may not be a reliable indicator of the values expected in the real world. However, the exercise is valuable in terms of assessing relative values. For example, if an area to one side of a source appears more heavily impacted by dust dispersion, it is reasonable to assume that that will be the case in the real world.

The model was run using estimated emissions from the relevant activities. The model was run once on a 5 000m by 5 000m grid, with centre point at 25°48'17.93 S 29°58'08.00 E.

6.2.1 PM10

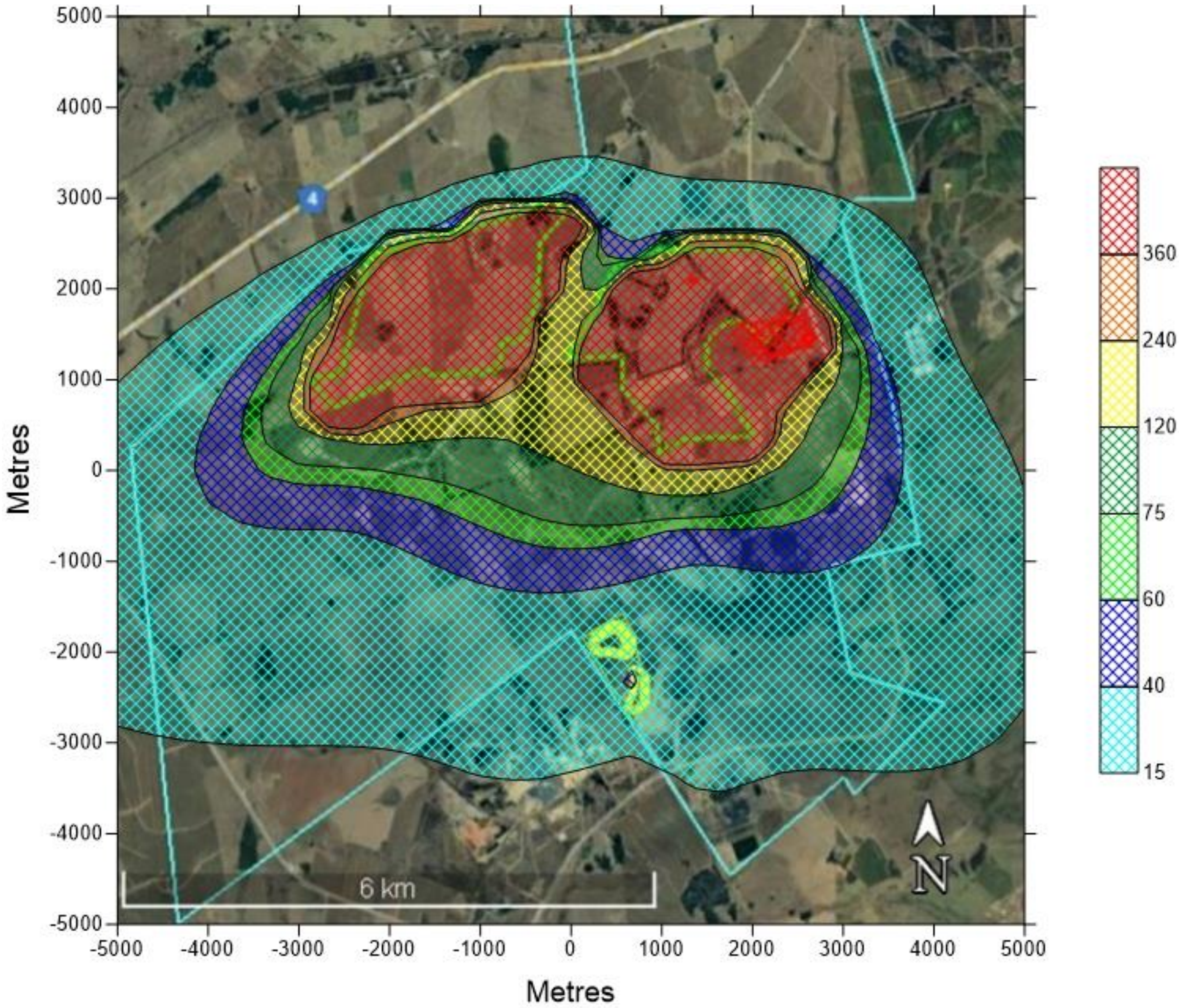


Figure 10: Modelled representation of estimated, unmitigated PM_{10} dispersion from fugitive dust emissions from the proposed BEP. Long-term averages, 24 hour averaging period, levels indicated in µg/m^3

Dispersion is predominantly to the south with material dust fallout levels not expected to be elevated beyond the MRA boundaries.

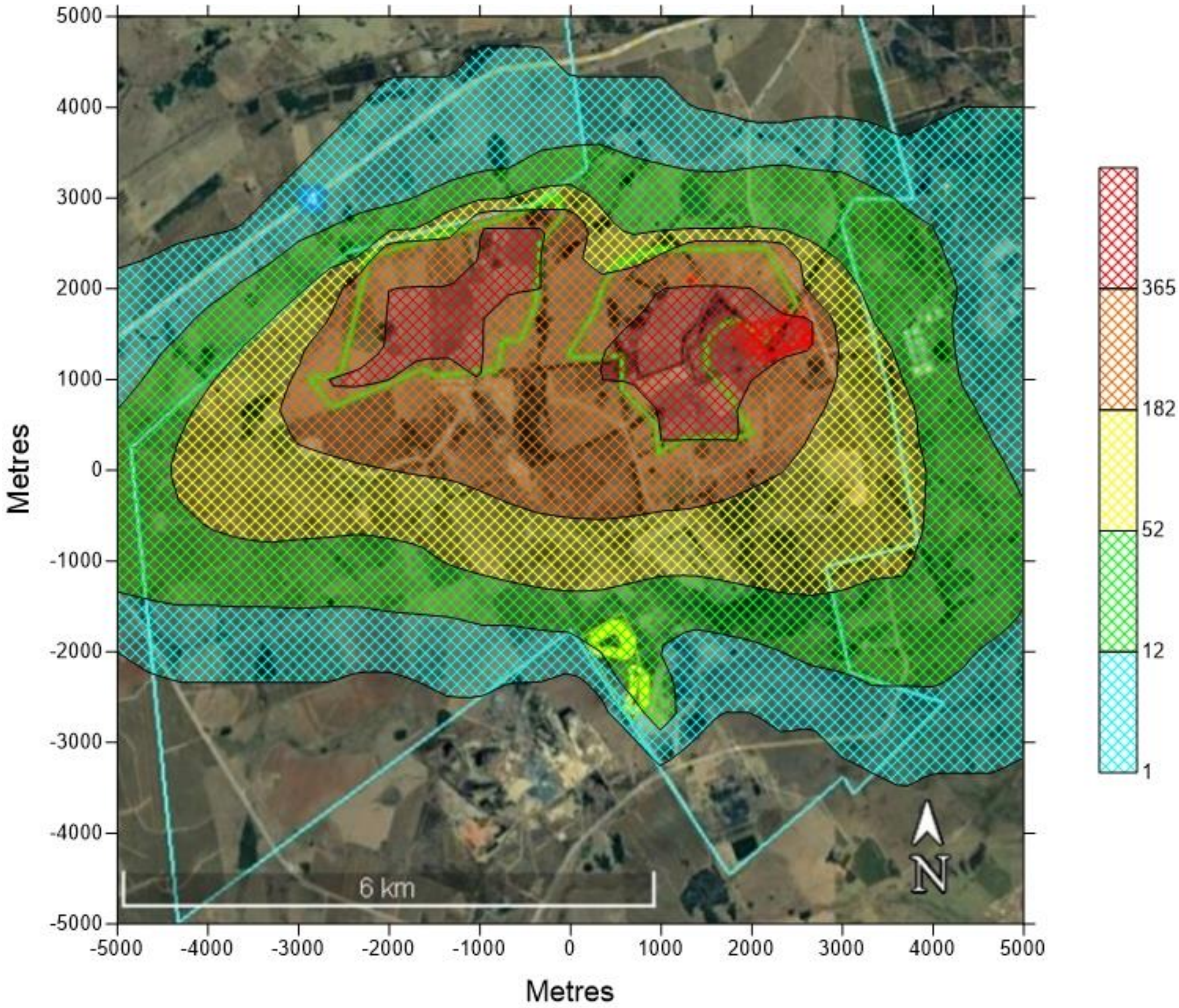


Figure 11: Modelled representation of incidences of ambient, unmitigated PM_{10} levels from the proposed BEP exceeding the 75 µg/m^3 level. Long-term averages, 24 hour averaging period, levels indicate number of hourly exceedances per year.

The figure above shows the likely number of exceedances in any one year of the 75 µg/m^3 level. Regular exceedances can be expected in the immediate vicinity of the open cast areas and to the south of the site.

6.2.2 PM 2.5

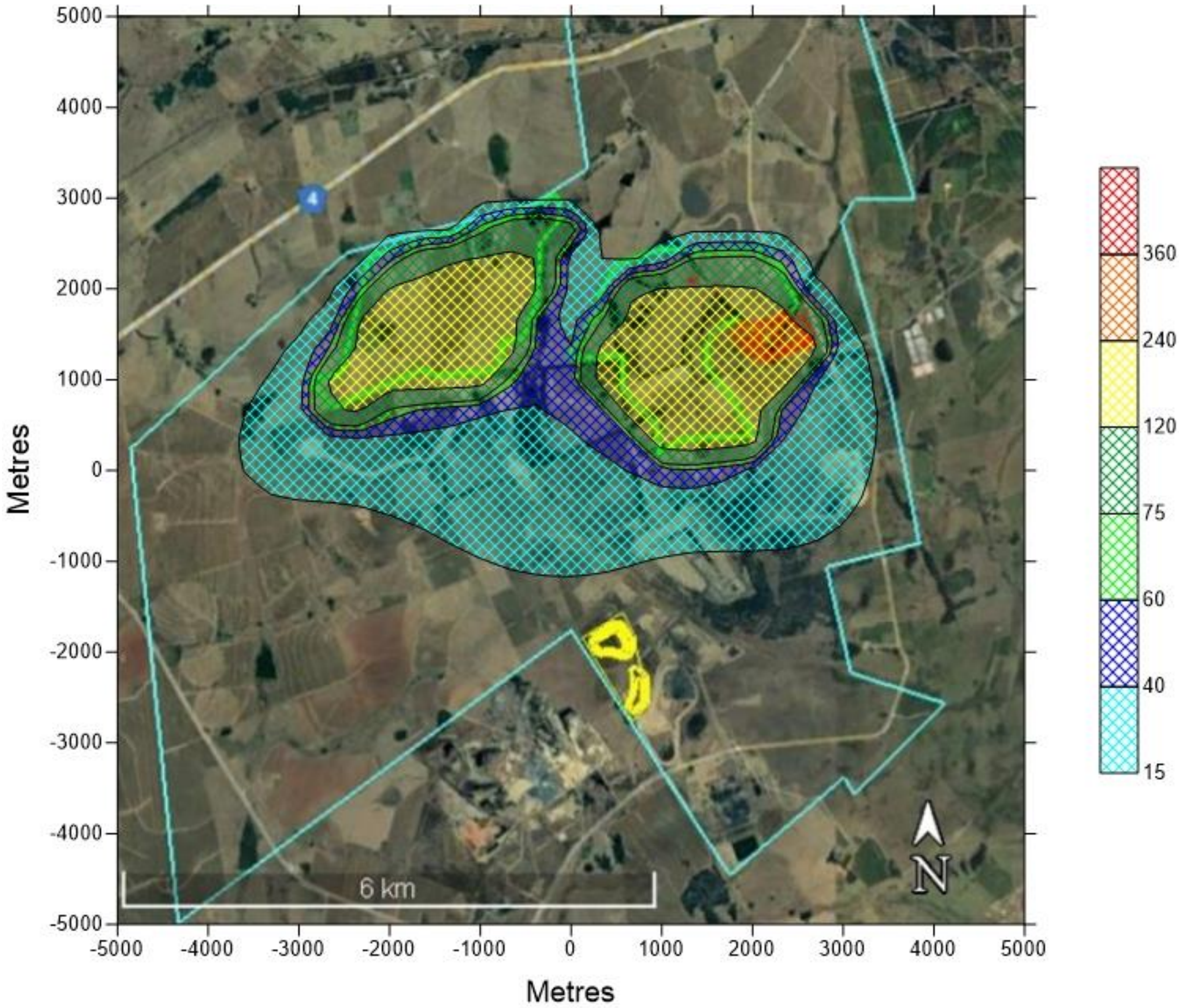


Figure 12: Modelled representation of estimated, unmitigated $PM_{2.5}$ dispersion from fugitive dust emissions from the proposed BEP. Long-term averages, 24 hour averaging period, levels indicated in µg/m^3

Dispersion is predominantly to the south with no impact expected significantly beyond the boundaries of the opencast areas.

6.2.3 Total suspended particulates (TSP)

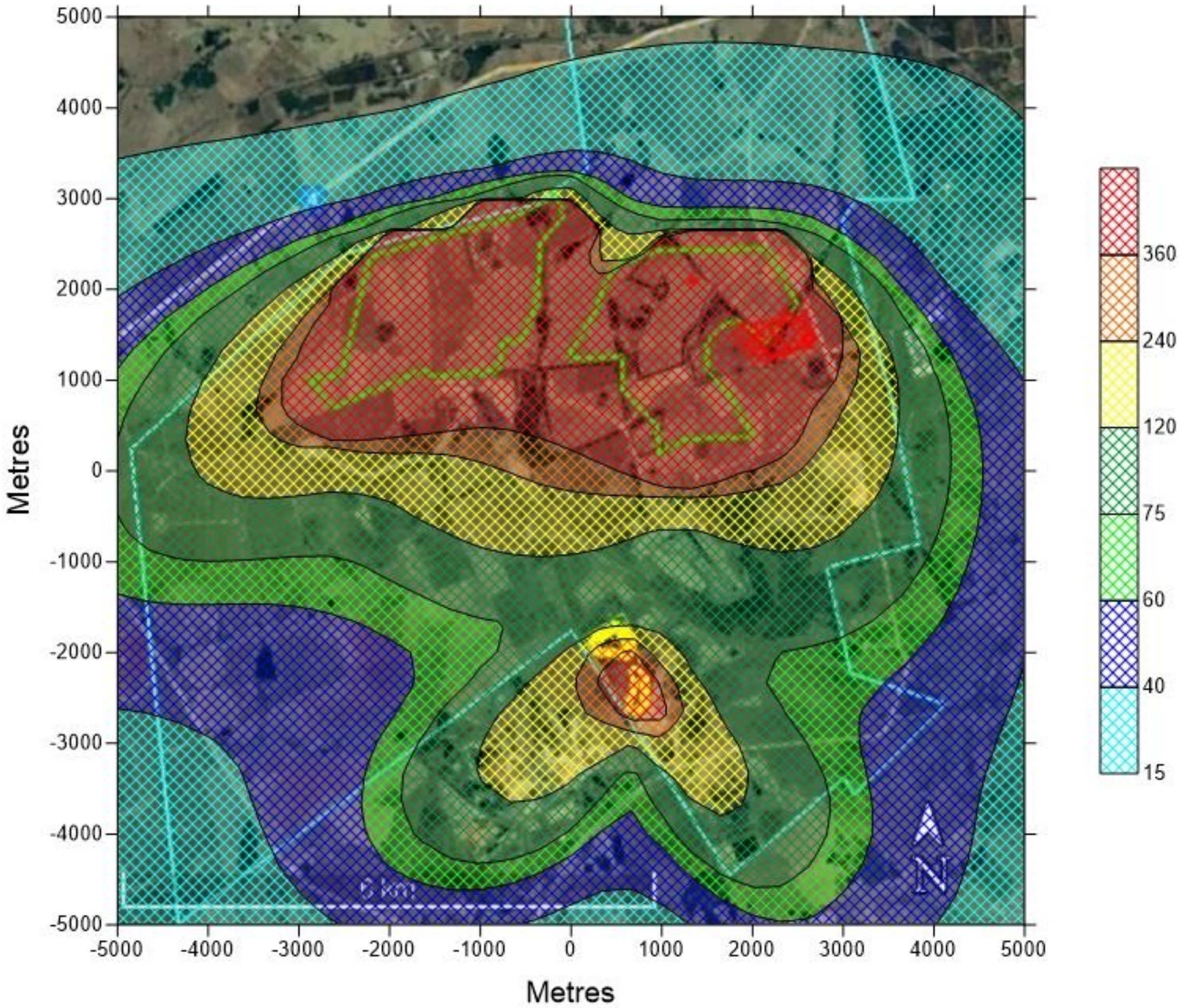


Figure 13: Modelled representation of estimated, unmitigated TSP dispersion from fugitive dust emissions from the proposed BEP. Long-term averages, 24 hour averaging period, levels indicated in µg/m^3

Dispersion is predominantly to the south with some impact expected beyond the boundaries of the opencast areas but within the MRA.

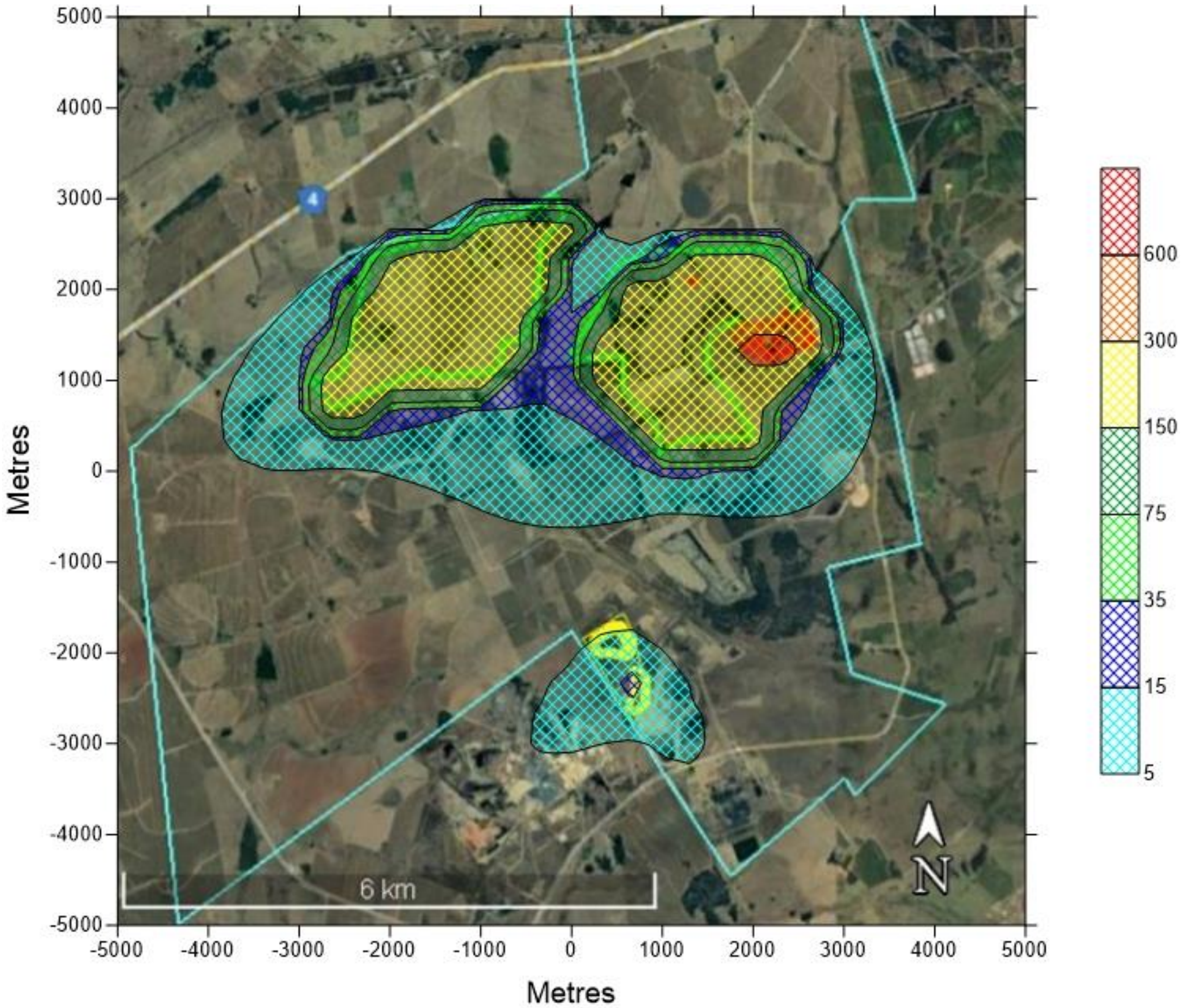


Figure 14: Modelled representation of estimated, unmitigated dust deposition from fugitive dust emissions from the proposed BEP. Long-term averages, 24 hour averaging period, levels indicated in mg/m^2/day

Deposition is expected to be concentrated within the boundaries of the active mining areas, with some impact to the immediate south of these sites. Impact is not expected to extend beyond the boundary of the MRA.

7. CLIMATE CHANGE IMPACTS

7.1 Greenhouse gases

A greenhouse gas (GHG) is defined as any gas that enhances the greenhouse effect prevalent in our planet. The greenhouse effect is the natural phenomenon whereby energy emitted from a sun-warmed earth is trapped within the atmosphere by certain gases, thus stabilising the earth's energy balance and allowing our planet to be habitable. Naturally, this role is played by a range of gases, of which by far the most common are water vapour (H_2O) and carbon dioxide (CO_2). Of concern is the enhanced greenhouse effect, whereby the earth warms unnaturally because of the addition into our atmosphere of a range of gases that are usually the by-product of industrial processes, most notably, the burning of fossil fuels.

In addition to the gases mentioned above, many other gases also play a role in the greenhouse effect. The most common and readily reported[4] ones are listed in Table 1.

Table 5: Common Reportable Greenhouse Gases

Gas name	Symbol	Global warming potential (GWP)	Unnatural sources
Carbon dioxide	CO_2	1	Fossil fuel combustion, forest clearing
Methane	CH_4	21	Landfills, petroleum industry, livestock, rice cultivation, fossil fuel combustion
Nitrous oxide	N_2O	320	Fossil fuel combustion, fertilizers, nylon production, manure
Hydro fluorocarbons	HFCs	140 - 11700	Refrigeration gases, aluminium smelting, semiconductor manufacturing
Per fluorocarbons	PFCs	6500 - 9200	Aluminium production, semiconductor industry
Sulphur hexafluoride	SF_6	23 900	Electrical transmissions and distribution systems, circuit breakers, magnesium production

Of those gases listed above, only those associated with the burning of fossil fuels are relevant to this project, in this case, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Refrigeration systems within the Exxaro Belfast Expansion Project may emit trace amounts of hydro fluorocarbons which are not included. These are easily mitigated through the proper maintenance of any refrigeration or air conditioning equipment on site. It is not expected that these emissions would make a material difference to the overall carbon equivalent profile of the BEP.

[4] After Inter-governmental Panel on Climate change, IPCC, 2005

Similarly, some sulphur hexafluoride emissions may result from electricity distribution infrastructure on the proposed project. These facilities belong to Eskom and are included in Eskom's carbon equivalent emission factor.

7.2 Global warming potential

A gas's global warming potential (GWP) or its carbon equivalence (CO_2eq) is a measure of its efficacy at trapping outgoing longwave radiation and contributing to the atmospheric greenhouse effect. This potential is expressed as a ratio to the global warming potential of carbon dioxide. Thus, one unit of methane, with a GWP of 21, is 21 times as effective at contributing to global warming as carbon dioxide.

When making carbon footprint calculations, all greenhouse gases are aggregated together, and the total is expressed as units of carbon equivalents (CO_2eq).

7.3 Reporting requirements

It is important to differentiate between GHGs emitted as a part of the mine's operations and those that will result from the combustion of the coal that the mine will produce. While the former (those emissions resulting from the combustion of fuel and the use of electricity) should make up the annual reporting done by the mine, an assessment of the actual global impact of the mine must consider the contribution of the coal that will be mined over the mine's lifespan, even though, when this coal is burnt, those emissions will be accounted for by the end-user of the coal, not the mine itself.

7.3.1 Combustion sourced GHGs (Scope 1 emissions)

Scope 1 emissions are those GHG emissions that are a direct result of the activity of an emitter. They primarily include fuel burnt in the conduct of the activity by engines owned by the emitter.

The following sources of GHG emissions were identified:

Table 6: GHG Emissions from BMC for Diesel consumption (2020)

		Total CO_2 emissions	NOx emissions	SOx emissions	VOC emissions	Carbon monoxide emissions	Particulate emissions	Carbon equivalents[5]
	Factor[6]	164	4.41	0.29	0.36	0.95	0.31	2.68
Units	Litres	Tons	Tons	Tons	Tons	Tons	Tons	Tons
BMC	626379	1600	43	3	4	9	3	1679

Diesel fuel use refers to fuel that is imported onto the site for use by onsite vehicles or stationary industrial equipment. Emission factors were sourced from the *US EPA AP-42, Chapter 3.3: Stationary Diesel Sources*.

7.3.2 Electricity-sourced GHG emissions (Scope 2)

Scope 2 emissions refer to those second-party emissions that result from the use of grid electricity supplied by a third party, in this case, Eskom.

Eskom heavily dominates the South African electricity supply. Recent years have seen the rise of private or municipal power producers, but their contribution to the national grid so small, thus negligible. Of Eskom's power, approximately 90% is still derived from coal fired power stations, resulting in significant indirect emissions for South African customers. In addition to this, recent shortages in power supply have forced the utility to increase the power produced using diesel generation. The emission factors related to the use of Eskom power change subtly year on year. The figures in this report reflect those published by Eskom for the year ending March 2019[7], the last time that these were updated by Eskom.

[5] US EPA 2011 Climate Registry Default Emission Factors and IPCC, 2006

[6] Factor in lb per mmBTu. Converted to tons of emission using a Btu value for diesel of 130000

[7] https://www.eskom.co.za/OurCompany/Investors/IntegratedReports/Pages/Annual_Statements.aspx

Table 7: GHG Emissions from BMC for Electricity consumption (2020)

	Electricity Consumption	Coal Use	Water Use	Particulate Emissions	CO_2 Emissions	CO_2 Emissions	SOx emissions	NOx Emissions
	Factor	0.55	1.4	0.48	1.04	1.06	8.9	4.27
Units	MWh	t	kl	t	t	t	t	t
BMC	2905	1598	4067	1	3021	3079	26	12

7.3.3 Scope 3 emissions (coal produced)

Scope 3 emissions are typically emissions that result from the activities of third-party suppliers to a project, or emissions related to the sale, use and disposal of the product of an activity. In the case of a coal mine, where the product has no value unless used for fuel, this results in a significant emission.

Table 8. Scope 3 emissions resulting from product of Exxaro Belfast Expansion Project

	Coal produced	CO_2 Emissions
	Factor	2.28096[8]
Units	Tons per year	Tons per year
BMC	1611765	3676371

The project is expected to generate a total of 27.4Mt of coal over a 17-year life of mine. Assuming that all of this is purchased and burnt locally, this would increase South Africa's carbon emissions by 3.7 $MtCO_2eq$ per year, or by approximately 0.9%. However, a significant proportion of this coal is likely to be marked for export. While this would still have a global impact, this exported product would not count against South Africa's carbon budget. This impact does, however, contribute to the cumulative impact of the mine.

[8] South African Technical Guidelines (2017), assuming a calorific value of 23.76 GJ/ton

7.4 Climate change summary

As is evident in the table below, by far the greatest climate change impact that the BEP will have is through the sale (and subsequent Scope 3 emissions that result from) the combustion of coal which is the product of the project. This means that no energy efficiency programmes within the mine's operation will be sufficient to offset the substantial Scope 3 emissions impact that will result from the project. However, energy efficiency programs typically aim to balance the impact of Scope 1 and Scope 2 emissions, both of which are modest enough to be viably offset by the company.

Modest Scope 3 emission offsets could be achieved through partnerships and collaboration with the customer and the general value chain.

Table 9. Scope emissions from the Exxaro Belfast Expansion Project

	Tons (annual)	% of project total emissions
Scope 1	1679	0.05%
Scope 2	3079	0.08%
Scope 3	3676371	99.87%

8. IMPACTS

8.1 Dust impacts

While there will likely be an impact on the air quality of the surrounding area, particularly to the southwest of the site, the modelling evidence suggests that particulate matter and fallout dust levels may exceed national standards and must be actively mitigated.

8.1.1 Alternatives

Various alternatives are offered regarding the location of shafts and conveyors.

It is found that the exact location of this infrastructure is not particularly important to the overall dust profile of the site.

Regarding the shafts, no dust impacts are expected in operation. Some dust might be generated in construction and through the operating of vehicles nearby, which are dealt with elsewhere in the report.

Regarding the conveyors, no preference regarding route or location is expressed from a dust perspective, so long as the conveyors are equipped with the standard coverings typical in the design of medium to long-distance mine conveyors.

8.2 Climate change impacts

The immediate climate change impacts of the project itself are negligible. However, if the climate change impacts of the *product* of the project are considered, a moderate impact is anticipated. The mining and combustion of coal will unavoidably add to South Africa's (or South Africa's trading partners') global climate impact. Climate change is a global issue and cannot be materially mitigated at the project scale. An aggressive offset program can reduce the net, direct (Scope 1 and 2) carbon emissions of the project to zero.

8.2.1 Alternatives

The various alternatives will make no difference to the climate change impact of the project.

8.3 Cumulative impacts

8.3.1 Dust

Cumulative dust impacts are anticipated from the addition of this project to additional activities in the area, but will not exceed the sum of their separate parts. In addition, all dust impacts directly related to the mine are expected to cease with the cessation of activities and eventual rehabilitation of the site.

There is an existing dust load in the environment, and for this reason, mine management should be aggressive in their mitigation of dust emissions in order to prevent impacts on the environment that, when combined with the base-level dust in the area, or from adjacent sources, result in dust fall that exceeds national standards.

8.3.2 Climate change

A moderate cumulative impact is anticipated from the indirect climate change impact of the project, as it is anticipated that the addition of carbon to the atmosphere resulting from the sale and subsequent combustion of the product of the mine will contribute to the total carbon emissions of the planet, regardless of where this combustion ultimately takes place.

8.4 Impact ratings

Table 10. Direct impact rating table[9]

Project activity or issue	Potential impact	Nature of impact	Significance before mitigation						Significance after mitigation as per EMPr					
		+ / -	E	D	M	P	S	SR	E	D	M	P	S	SR
Air quality														
Opencast mining	Emissions to air	-	2	4	4	4	40	M	2	4	2	4	36	M
Underground mining	Emissions to air	-	2	4	2	2	16	L	2	4	1	2	14	L
Climate change														
Opencast mining	Climate change	-	5	4	2	3	33	M	5	4	2	3	33	M
Underground mining	Climate change	-	5	4	2	3	33	M	5	4	1	3	30	M

9 As per Nsovo recommendation and standard DEA requirements, 15/12/2020

Table 11. Cumulative impact rating table[10]

Project activity or issue	Potential impact	Nature of impact	Significance before mitigation						Significance after mitigation as per EMPr					
		+ / -	E	D	M	P	S	SR	E	D	M	P	S	SR
Air quality														
Opencast mining	Emissions to air	-	2	4	4	4	40	M	2	4	2	4	36	M
Underground mining	Emissions to air	-	2	4	2	2	16	L	2	4	1	2	14	L
Climate change														
Opencast mining	Climate change	-	5	4	3	3	36	M	5	4	3	3	36	M
Underground mining	Climate change	-	5	4	3	3	36	M	5	4	3	3	36	M

[10] As per Nsovo recommendation and standard DEA requirements, 15/12/2020

9. MITIGATION

9.1 Dust

A significant factor in fugitive dust emissions from mines is as a result of vehicular activity on disturbed ground.

9.1.1 Transport

On its own, the passage of a single vehicle causes a spike in pollution, dependent on speed, which returns to ambient air conditions fairly rapidly. However, under high-risk conditions with multiple vehicle passes in a short space of time, entrainment into the air stream will occur, contributing to the regional dust risk. It is important to note that the increase in road dust emission is exponential for speeds between zero and 40km/hour. It is impossible to monitor dust quantitatively in real time, so the following subjective classification of road dust defect becomes useful in alerting operators to real time conditions. The project is committed to retaining the existing access road between the site and the Rietkuil siding decreasing unnecessary additional emissions.

Table 12: Classification of Road Dust Defect.

Dust defect degree descriptions for PM_{10} dust emissions per haul truck pass at 40km/hour ($mg.m^{-3}$)				
Degree 1 <3.50	Degree 2 3.51 to 23.50	Degree 3 23.51 to 45.00	Degree 4 45.01 to 57.50	Degree 5 >57.51
Minimal dust	Dust just visible behind vehicle	Dust visible, no oncoming vehicle driver discomfort, good visibility	Notable amount of dust, windows closed in oncoming vehicle, visibility just acceptable, overtaking difficult	Significant amount of dust, windows closed in oncoming vehicle, visibility poor and hazardous, overtaking not possible.

The following is recommended:

- Speed control on all transport routes be strictly enforced;
- The roads be surfaced with a dust retardant material to limit wheel-entrained dust; and
- Dust fallout monitoring must be implemented, specifically on the southwest side to which most entrained dust will disperse.

9.1.2 Mining operations

The heavy machinery necessary on coal stockpiles and dumps is an unavoidable source of soil disturbance and subsequent dust. Mitigation is difficult, but a few management measures are possible to limit the impact of the dust on surrounding areas. Primary among these is an efficient mining process that limits the number of times that material needs to be transferred as loading and off-loading are a significant dust source.

The following is recommended:

- Monitoring of fence-line fallout dust;
- Spraying of haul roads with dust retardant;
- Strictly enforced speed limits on haul roads and waste dumps; and
- Limiting of transfer of material.

9.2 Climate change

Due to the global nature of climate change impacts, it is possible to mitigate and offset project-scale emissions at the scope 1 and Scope 2 level.

The following is recommended:

- Implementation of energy efficiency programmes, wherever possible;
- Use of renewable energy, wherever possible; and
- Purchasing of carbon offset products (or the implementation of auditable carbon offset programs) to offset the remainder of the net carbon emissions of the immediate project.

There are no viable offset programs that would be able to offset the Scope 3 emissions of the project, especially as regards the eventual combustion of the product.

10. DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

PROJECT TITLE

Exxaro Belfast Coal expansion project – Air Quality and climate report

Specialist:	Kijiji Kijani Environmental Consultants		
Contact person:	Simon Gear		
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Project consultant:	Nsovo Environmental Consulting		
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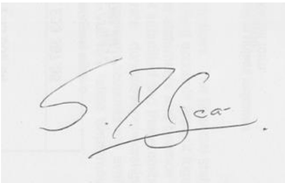
Telephone:	087 803 9294	Fax:	
E-mail:	masala.mugwagwa@nsovo.co.za		

The specialist appointed in terms of the Regulations

I, Simon Gear, declare that

- I act as an independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any 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 Act.



Signature of the specialist:

Kijiji Kijani Environmental Consulting

Name of company (if applicable):

29 November 2021

Date:

11. CONCLUSION

Dust impacts from the proposed expansion are likely to be concentrated within the opencast pits and the immediate southwest of these facilities. Active mitigation and monitoring may be necessary to ensure no exceedance of South African Ambient Air Quality Standards.

Climate change impacts directly related to the project (Scope 1 and 2) are expected to be negligible while the Scope 3 impacts could have the potential to marginally, negatively impact South Africa's overall attempts to decrease its carbon footprint over the coming two decades.