PROPOSED EXPANSION OF THE SUPREME POULTRY CHICKEN PROCESSING PLANT FROM 120 000 UNITS TO 140 000 UNITS PER DAY, BOTSHABELO, FREE STATE PROVINCE

Air Quality Impact Assessment

March 2022

Prepared for:

Prepared by:

Mr Christoff du Plessis

christoff@enviroworks.co.za

QUALITY AND REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
Author	Visual Specialist	Christoff du Plessis		12/04/2022
Reviewer	Quality Check Officer	Elana Mostert		19/04/2022
SACNASP Registered Reviewer	Air Quality Officer	Liketso Tsotetsi		28/04/2022

This report has been prepared in accordance with Enviroworks Quality Management System.

REVISION RECORD

Revision Number	Objective	Change	Date
Version 1	Determine the Air Quality Impact of the Proposed Botshabelo Rendering Plant, Free State Province.	-	12/04/2022

DISCLAIMER

Even though every care is taken to ensure the accuracy of this report, Air Quality Impact Assessment studies are limited in scope, time and budget. Discussions are to some extent made on reasonable and informed assumptions built on bona fide information sources, as well as deductive reasoning. Since air quality impact studies deal with dynamic natural systems additional information may come to light at a later stage during the impact assessment phase. The author does not accept responsibility for conclusions made in good faith based on own databases or on the information provided. Although the Author exercised due care and diligence in rendering services and preparing documents, he accepts no liability, and the client, by receiving this document, indemnifies the Author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the authors and by the use of this document. This report should therefore be viewed and acted upon with these limitations in mind.

EXECUTIVE SUMMARY

Enviroworks was appointed by Supreme Poultry (PTY) Ltd to undertake the Atmospheric Impact Assessment (AIA) and Air Emissions License (AEL) Application process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the National Environmental Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) listed activities for their existing Rendering Plant situated on Portion 0 of Erf 166, Botshabelo, Free State Province. The proposed project will trigger the following listed activities in terms of the NEM:AQA:

- Government Notice 893 of 2013 as amended by Government Notice 551 of 12 June 2015: Category 1 (Combustion Installations, Subcategory 1.6: Waste Co-feeding Combustion Installations); and,
- Government Notice 893 of 2013 as amended by Government Notice 551 of 12 June 2015: Category 8 (Thermal Treatment of Hazardous and General Waste, Subcategory 8.1: Thermal Treatment of General and Hazardous Waste).

PROJECT DESCRIPTION

The site where the proposed expansion is set to occur is situated on Portion 0 of Erf No. 166 in the Industrial Area of Botshabelo, Free State Province.

The Processing Plant is an established facility, with the current slaughtering volumes not exceeding one hundred and twenty thousand (120 000) units per day. The Applicant proposes an expansion of the output to one hundred and forty thousand (140 000) units per day. The Processing Plant was designed to process more units than what it currently achieved; therefore no physical construction will occur in order to facilitate this increase of the slaughtering volumes. The Processing plant and associated infrastructure has a development footprint of ten thousand square metres (10 000 m^2), with approximately twelve thousand, three hundred kilogrammes (12 300 kg) of general waste recycled per month.

The standard activities taking place in the abattoir consist of four (4) phases. The initial phase includes the delivery of the chickens, ante-mortem (before slaughtering) inspection and the lairage (where the birds are kept prior to slaughtering). The second phase includes the slaughtering activities, which consist of the stunning and bleeding out of the chickens, debunking, removal of feathers and internal organs. After the organs are removed, they are washed, packaged, weighed, and stored. Hereafter the organs are sold to the intended prospective clients. The blood, fat and feathers are removed and transported via conveyer belts and pipes to the Sterilizing Plant. The third phase includes the packaging and cooling of the processed units. A post-mortem inspection is performed on the meat whereafter carcass registration takes place. The cutting or quartering of the carcasses into portions then takes place, after which the portions are washed at the cut-up wash station. Hereafter the portions are packaged and chilled in large industrial freezers and in “fresh areas”. Finally, the last phase constitutes of the delivery phase, whereby the processed portions are transported to the loading bay area and then transferred to the intended prospective clients. Should the post-mortem inspection identify undesirable or unusable biological material, this material will be transported to the Sterilizing Plant.

An average of thirty-one (31) tonnes of Grade A coal is delivered to the Supreme Poultry Botshabelo Processing Plant on a monthly basis. The coal is stored in a bund storage area, before being loaded into the two Boilers, or steam generators, present on site. Coal is burnt in the two Boilers, hereby generating steam which is subsequently transferred to various areas of Production and the Sterilizing Plant. The coal ash produced by the Boilers are then stored in a designated storage area, whereafter it is removed by a brick maker. Approximately two thousand three hundred and forty kilogrammes (2 340 kg) of ash is produced daily. As mentioned above, the blood, feathers, fats and Dead-on Arrival birds are received from the processing plant with dedicated pipe lines and conveyer belts at the Sterilizing Plant. Steam obtained from the Boilers, or steam generators, is utilised in order to cook the biological material. After the cooking process has been finalised, the material is then dried out, and grounded. The final product is the feather meal, which is packaged and stacked, whereafter it will be sold to prospective clients. For more clarity, please refer to Figure 1 down below regarding the operation of the Boilers and Sterilizing Plant.

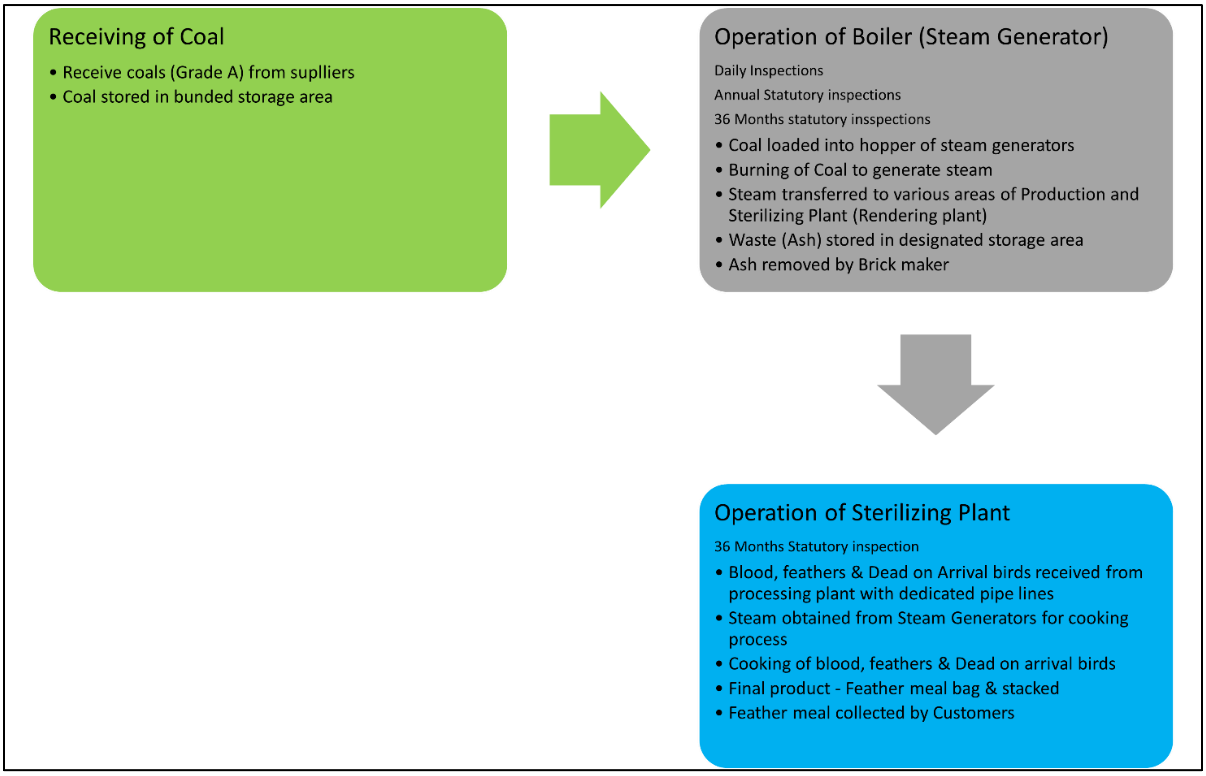

Figure 1: Flow diagram indicating the operation of the Boiler and Sterilizing Plant

As of January 2021, the facility produces two hundred and eleven thousand, five hundred and eleven kilogrammes (211 511 kg) of blood, feathers and fat per month, with Dead on Arrival birds included within this figure. The upper and lower limits for the quantity of Dead-on Arrival birds per month are nineteen point five four (19.54) tonnes and five point nine seven (5.97) tonnes respectively. The feathers, blood, fat and Dead-on Arrival birds are re-worked into feather meal via the Sterilizing Plant. This process involves the cooking, drying out and grounding of the material whereby the biological material is transformed into feather meal. Sieves at the back of the facility collect any solid materials (when the blood, feathers and fat material is removed), preventing these materials from entering the effluent drains. The liquid effluent is discarded within the municipality drains and is tested monthly. The excess fat and blood are collected from the sieves, and processed at the Sterilizing Plant, whereafter it would be sold as feather meal. Overall, more than ten thousand kilogrammes (10 000 kg) of general waste (blood, feathers, fat, Dead on Arrival birds) are processed by the Sterilizing Plant daily.

Sanitary and Medical Waste are collected by a registered waste removal contractor (Compass Waste Services) and are incinerated off site. Sewerage from the ablution processing, admin, stores and workshop areas, as well as grey water from the showers and washing facilities are disposed of at an approved treatment facility. Additionally, industrial effluent from processing activities is disposed of via the municipal effluent system. Paper, cardboard, plastic, scrap metal and wood pallets are recycled and reused wherever possible. Food waste produced within the Canteen is collected by a local pig farmer and/or disposed of at the local, registered landfill site by a registered general waste removal contractor.

CONCLUSION AND RECOMMENDATIONS

Simulated ambient criteria pollutant (SO_2, NO_x, CO and PM) concentrations were well below the South African National Ambient Air Quality Standards (SA NAAQS) at all identified sensitive receptor locations as summarised in the Table below. **The level of impact is considered to be of low significance to human health.**

EMISSION	NAAQS THRESHOLD	MODELED CONCENTRATION VALUE			SPARE CAPACITY
		HOURLY	24 HOUR	ANNUAL	
SO_2	50 µg/m³ (annual)	139.52176 µg/m³	25 µg/m³	6.6 µg/m³	87 % (annual)
NO_2	40 µg/m³ (annual)	61 µg/m³	10.9 µg/m³	3 µg/m³	93 % (annual)
PM_{10}	40 µg/m³ (annual)	102 µg/m³	17.6 µg/m³	5.2 µg/m³	77 % (annual)
CO	30 000 µg/m³ (hourly)	377 µg/m³	64 µg/m³	16.2 µg/m³	98 % (hourly)

The contribution from the proposed facility to cumulative ambient air quality is regarded insignificant based on the low simulated ground level concentrations and monitoring results from the nearby monitoring station (Pelonomi NAQI Monitoring Station). It is recommended that mitigation measures as stated within the Air Quality Management Plan be adhered to in order to keep the concentrations below the thresholds during the operational phase of the Facility.

DECLATATION OF THE SPECIALIST

I, **Christoff du Plessis**, **ID 911126 5012 084**, declare that I:

- am an Environmental Specialist at Enviroworks;
- act as an independent Specialist Consultant in the field of Air Quality Impact Assessments;
- am assigned as Specialist Consultant by Supreme Poultry for this proposed project;
- I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference;
- remuneration for services by the proponent in relation to this proposal is not linked to approval by decision-making Authorities responsible for permitting this proposal;
- the consultancy has no interest in secondary or downstream developments as a result of the Authorisation of this project.
- have no and will not engage in conflicting interests in the undertaking of the Activity;
- undertake to disclose to the Client and the Competent Authority any material, information that have or may have the potential to influence the decision of the Competent Authority required in terms of the Environmental Impact Assessment Regulations 2017, as amended; and,
- will provide the Client and Competent Authority with access to all information at my disposal, regarding this project, whether favourable or not.

Christoff du Plessis
christoff@enviroworks.co.za

SPECIALIST CV AND DETAILS

Company Name:	Enviroworks
Specialist Name:	Christoff du Plessis
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Postal Code:	9324
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Christoff du Plessis

Relevant Qualifications

Baccalaureus Scientiae (B.Sc) in Environmental Geography: University of the Free State (2014)

Work Experience

January 2015 – Present: Environmental Specialist at Enviroworks

Key Specialist Experience

Visual Impact Assessment (VIA):

- Phalaborwa Wildlife Activity Hub, Kruger National Park, Limpopo Province (SANParks).
- 4.9ha Sand Mine on Portion 5 of the Farm Doornekraal No. 830, Western Cape Province (Greenmined).
- Proposed development of the Harvard Powerline, Bloemfontein, Free State Province (Centlec).
- Proposed development of the 35 m Buffeljagsrivier Monopole Mast, Buffeljagsrivier, Western Cape Province (Coast to Coast Towers).
- Proposed development of the 25 m Robertson Monopole Mast, Robertson, Western Cape Province (Coast to Coast Towers).
- Proposed development of the Klein Mooimaak Rest Camp Facility, West Coast National Park (SANParks).
- Proposed development of a Sand Mine near Malmesbury, Western Cape Province (Greenmined).
- Proposed upgrade of the R27 Gate and Geelbek Restaurant, West Coast National Park, Western Cape Province (SANParks).
- Proposed development of the 25 m Roodekrans Monopole Mast, Krugersdorp, Gauteng Province (Coast to Coast Towers).
- Proposed development of a 25 m Monopole Mast on Portion 25 of the Farm Klein Bottelary No. 17, Brackenfell, Western Cape Province (Coast to Coast Towers).
- Proposed development of a Landfill Site on Portion 3 of the Farm Katbosch No. 93, Sasolburg, Free State Province (Metsimaholo Landfill).
- Proposed development of numerous visitor information centres at Schroda and Mapungubwe Hill, Mapungubwe National Park, Limpopo Province (SANParks).

- Proposed development of a 35 m Monopole Mast on Portion 13 of the Farm Van Aries Kraal No. 455, Grabouw, Western Cape Province (Coast to Coast Towers).
- Proposed development of a 25 m Monopole Mast on Erf 532, Gansbaai, Western Cape Province (Coast to Coast Towers).
- Proposed development of a 35 m Lattice Mast on Portion 7 of the Farm Jagersvlakte No. 292, Grabouw, Western Cape Province (Warren Petterson Planning).
- Proposed development of a 35 m Lattice Mast on Erf 532, Stanford, Western Cape Province (Warren Petterson Planning).
- Proposed development of a 15 m Lattice Mast on Portion 4 of the Farm No. 53, Genadendal, Western Cape Province (Warren Petterson Planning).
- Proposed development of a 25 m Monopole Mast on Portion 8 of the Farm Delta No. 1003, Groot Drakenstein, Western Cape Province (Coast to Coast Towers).
- Proposed development of a 30 m Tree Mast on Portion 87 of the Farm Langverwacht No. 241, Kuils River, Western Cape Province (Warren Petterson Planning).
- Proposed development of a 20 m Tree Mast on Erf 679, Gouda, Western Cape Province (Atlas Towers).
- Proposed development of an IPP 400kV Power Line from Grommis to Aggeneys, Northern Cape Province (Eskom).
- Proposed development of a 30 m Lattice Mast on Erf 2819, Caledon, Western Cape Province (Atlas Towers).
- Proposed development of a 54 m Lattice Mast on Portion 7 of the Farm Haane Kuil No. 335, Beaufort West, Western Cape Province (Star Towers).
- Proposed development of a 25 m Monopole Mast on Erf 1035, Caledon, Western Cape Province (Atlas Towers).
- Proposed development of a 25 m Tree Mast on Erf 47, Birkenhead, Western Cape Province (Atlas Towers).
- Proposed development of a 25 m Monopole Mast on Erf 1201, Van Dyks Bay, Western Cape Province (Atlas Towers).
- Proposed development of a 20 m Tree Mast on Erf 1671, Melkbosstrand, Western Cape Province (Atlas Towers).
- Proposed development of a 15 m Tree Mast on Erf 740, Klein Brak River, Western Cape Province (Atlas Towers).
- Proposed Upgrades to the Alpha 1 Recreational Lounge, Robben Island, Western Cape Province (Robben Island Museum).
- Proposed development of a 25 m Tree Mast on Erf 969, Picaltsdorp, Western Cape Province (Atlas Towers).
- Proposed development of a 25 m Tree Mast on Erf 20601, George, Western Cape Province (Atlas Towers).
- Proposed development of a 25 m Monopole Mast on Erf 571, Dellville Park, Western Cape Province (Atlas Towers).
- Proposed development of a 15 m Tree Mast on Portion 113 of the Farm Ruygte Vally No. 205, Sedgefield, Western Cape Province (Atlas Towers).
- Proposed development of a 15 m Dome Mast on Erf 8281, Mossel Bay, Western Cape Province (Atlas Towers).

- Proposed development of a 35 m Tree Mast on Portion 42 of the Farm Harkerville No. 428, Plettenberg Bay, Western Cape Province (Atlas Towers).
- Proposed development of a 25 m Monopole Mast on the Remaining Extent of the Farm No. 790, Philippi, Western Cape Province (Atlas Towers).
- Proposed development of a 15 m Tree Mast on Portion 3 of the Farm No. 452, Grabouw, Western Cape Province (Atlas Towers).
- Proposed development of a 15 m Tree Mast on the Remainder of Erf 3331, Vredenburg, Western Cape Province (Atlas Towers).
- Proposed development of a 40 m Lattice Mast on Portion 24 of the Farm Olyven Boomen No. 83, Malan Valley, Western Cape Province (Atlas Towers).
- Proposed development of the Lendlovu Lodge, Addo Elephant Park, Eastern Cape Province (SANParks).
- Proposed development of a 25 m Tree Mast on Erf 2, Villiersdorp, Western Cape Province (Atlas Towers).
- Proposed development of a 25 m Tree Mast on Erf 270, Franschhoek, Western Cape Province (Galaxy Palms).
- Proposed development of a 25 m Lattice Mast on Erf 9, Nuwerus, Western Cape Province (Atlas Towers).
- Proposed development of the Karoo Power Reserve, Prieska, Northern Cape Province (Greenbox Consulting).
- Proposed development of the Khauta Solar PV Cluster (Three 100 MW PV Plants) near Welkom, Free State Province (WKN Windcurrent).
- Proposed development of the 25 m Monopole Mast on Erf 3266, Onrusrivier, Western Cape Province (Gyro)

Wetland Delineation Studies:

- Wetlands Delineation study for the development of 13 borrow pits along National Road 8, Ladybrand, Free State Province (SANRAL).
- Wetland Delineation study for the development of a 12.5ha cemetery on Erf 4233, Western Cape Province (Theewaterskloof Local Municipality).
- Wetland Delineation study for the proposed development of an Agri-Hub near Cederville, Eastern Cape Province (Femplan).
- Wetland Delineation study for the proposed development of an Agri-Hub near Lambasi, Eastern Cape Province (Femplan).
- Wetland Delineation study for the proposed development of the Blue Hills Curro Castle, Midrand, Gauteng Province (Curro Holdings).

Stormwater Management Plans:

- Stormwater Management Plan for the Agri-World Recycling Plant, Swellendam, Western Cape Province (Agri-World Recycling Plant).
- Stormwater Management Plan for the Klaasvoogds Granite Mine, Springbok, Northern Cape Province (Greenmined Environmental).
- Stormwater Management Plan for the Moreson Poultry Project, Brandfort, Free State Province (Moreson Poultry).

- Stormwater Management Plan for the Sintier Poultry Project, Bronkhorstspruit, Gauteng Province (Sintier Poultry).
- Stormwater Management Plan for the maintenance and extending of a canal near Karatera, Western Cape Province (Eden Municipality).
- Stormwater Management Plan for Layer Hen Houses on the Remaining Extent of Portion 1 of the Farm Elandsfontein No. 21, Moloti City, North West Province (Bramakama Poultry).
- Stormwater Management Plan for the Proposed Installation Battery Energy Storage Facility on Erf 2202, Ashton, Western Cape Province (Eskom)

REVIEW SPECIALIST CV AND DETAILS

Company Name:	Enviroworks
Specialist Name:	Liketso Anna Tsotetsi
Physical Address:	5 Walter Sisulu Drive, Park West, Bloemfontein, 9301
Postal Address:	Suite 116, Private Bag X01, Brandhof
Postal Code:	9324
Telephone:	051 436 0793
Email:	Liketso@enviroworks.co.za
Fax:	086 601 7507

Liketso Anna Tsotetsi

Relevant Qualifications

Master of Science (M.Sc) in Environmental Management (Air Pollution and Renewable Energy: University of Ibadan, Nigeria (2016)

Work Experience

January 2017 – Present: Environmental Specialist at Enviroworks (Air Quality)

Key Specialist Experience

Air Quality Impact Assessment (AQIA):

- Carbon foot-printing assessment for Thebe Health Risk Management on behalf of GEMS medical scheme.
- Atmospheric Impact Statement for the Proposed Sand Mine in Malmesbury, Western Cape Province (Greenmined Environmental).
- Atmospheric Impact Assessment for the proposed Brick Making Plant in Thaba-Nchu, Free State Province (Environmental Management Group).
- Atmospheric Impact Statement for Qamata Feed Mill within Eastern Cape (Department of Land Reform).
- Atmospheric Impact Assessment for the proposed Oil Recycling Plant in Bloemfontein, Free State Province (Patrick Mofokeng Trading).

- Atmospheric Impact Statement for Supreme Chicken in Mafikeng, Bloemfontein and Thaba Nchu, Free State (Supreme Poultry).
- Atmospheric Impact Assessment for the proposed Iron Smelt Plant in Botshabelo, Free State Province.
- Review of Air Quality Management Plan for the West Coast, Western Cape Province (West Coast District Municipality).

REQUIREMENTS OF A SPECIALIST REPORT

Appendix 6 of Government Notice Regulation 326 of 7 April 2017 outlines the basic requirements of a Specialist Report. Please refer to the Table below for a summary of all requirements.

REQUIREMENTS	YES/NO
A Specialist report prepared in terms of these Regulations must contain – a. Details of – i. The Specialist who prepared the report; and, ii. The expertise of that Specialist to compile a specialist report including a curriculum vitae;	Yes
b. A declaration that the Specialist is independent in a form as may be specified by the Competent Authority;	Yes
c. An indication of the scope of, and the purpose for which, the report was prepared; i. An indication of the quality and age of base data used for the Specialist Report; ii. A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	Yes
d. The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Yes
e. A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Yes
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;	Yes
g. An identification of any areas to be avoided, including buffers;	Yes
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;	Yes
i. A description of any assumptions made and any uncertainties or gaps in knowledge;	Yes
j. A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Yes
k. Any mitigation measures for inclusion in the EMP'r	Yes
l. Any conditions for inclusion in the Environmental Authorisation;	Yes
m. Any monitoring requirements for inclusion in the EMP'r or Environmental Authorisation;	Yes
n. A reasoned opinion – i. Whether the proposed activity, activities or portions thereof should be authorised;	Yes

REQUIREMENTS		YES/NO
	ii. 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 EMP'r, and where applicable, the closure plan;	
o.	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p.	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and,	N/A
q.	Any other information requested by the Competent Authority.	Yes

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ABBREVIATIONS

AEL	-	Air Emissions License
AIR	-	Atmospheric Impact Report
CO	-	Carbon Monoxide
M^3	-	Cubic Metre
NAAQS	-	National Ambient Air Quality Standards
NEMA	-	National Environmental Management Act
NEM:AQA	-	National Environmental Management: Air Quality Act
NO_2	-	Nitrogen Oxides / Nitrogen Dioxide
PM_{10}	-	Particulate Matter
PPB	-	Parts Per Billion
SA NAAQS	-	South African National Ambient Air Quality Standards
SAWS	-	South African Weather Service
SO_2	-	Sulphur Dioxide
$\mu g/m^3$	-	Micro-grams per Cubic Metre
US EPA	-	United States Environmental Protection Agency
WHO	-	World Health Organisation

1 INTRODUCTION

Enviroworks was appointed by Supreme Poultry (PTY) Ltd to undertake the Atmospheric Impact Assessment (AIA) and Air Emissions License (AEL) Application process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the National Environmental Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) listed activities for their existing Rendering Plant situated on Portion 0 of Erf 166, Botshabelo, Free State Province. The proposed project will trigger the following listed activities in terms of the NEM:AQA:

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- Government Notice 893 of 2013 as amended by Government Notice 551 of 12 June 2015: Category 8 (Thermal Treatment of Hazardous and General Waste, Subcategory 8.1: Thermal Treatment of General and Hazardous Waste).

1.1 PURPOSE AND SCOPE OF WORK

- Review of the ambient air quality monitoring information (if available);
- Review of guidelines and standards against which air emissions, ambient air quality and inhalation health impacts are assessed and/or screened;
- Study of physical environmental parameters that influence the dispersion of pollutants in the atmosphere, including terrain, land use and meteorology;
- Assessment of compliance of estimated emissions standards and Atmospheric Emission License (AEL) requirements;
- Atmospheric dispersion modelling to determine ground level pollutant concentrations; and,
- A health risk and environmental screening study based on predicted ground level pollutant concentrations in comparison with selected air quality criteria.

1.2 LIMITATIONS OF THE STUDY

- Baseline ambient air quality is not computed due to unavailability of data from the Mangaung Metropolitan Municipality Air Quality Monitoring Network Stations;
- As this facility is yet to be constructed, no stack monitoring has been done, thus some parameters used for the modelling purpose of this study may change during the operational stage of the facility; and,
- Dust modelling was not undertaken for the purpose of this study.

1.3 ENTERPRISE DETAILS

Table 1: Enterprise Details

Enterprise Name	Country Bird Holdings
Trading As	Supreme Poultry (PTY) Ltd
Type of Enterprise	Company
Registered Address	Ground Floor, 8 Melville Road, Illovo, Johannesburg, 2196
Postal Address	P.O Box 412523, Craighall, 2024
Telephone Number (General)	051 410 2600
Fax Number (General)	051 447 0640

Industry Type/Nature of Trade	Abattoir / Food Processing
Land Use Zoning as per Town Planning Scheme	Industrial Zoning
Land Use Rights if outside Town Planning Scheme	N/A

1.4 DETAILS OF THE CONTACT PERSON

Table 2: Details of the Contact Person

Responsible Person Name or Emission Control Officer (where appointed)	Shirlene Arends
Telephone Number	051 534 1115
Fax Number	051 447 0929
Email Address	shirlenearends@supremepoultry.co.za

1.5 LOCATION AND EXTENT OF THE FACILITY

The facility in question is situated on Portion 0 of Erf 166 within the Botshabelo Industrial Areas which fall under the jurisdiction of the Mangaung Metropolitan Municipality, Free State Province.

Table 3: Property Description

Physical address of the plant	2 Yellow Street, Botshabelo-IA, Botshabelo, Free State Province
Description of the Site	Industrial Facility (Rendering Plant)
Co-ordinates of approximate centre of operations	Lat: -29.201050° Long: 26.705949°
Extent (m^2)	39 937.77 m^2
Elevation Above Mean Sea Level (m)	1 432 m
Province	Free State Province
Metropolitan/District Municipality	Mangaung Metropolitan Municipality
Local Municipality	Mangaung Local Municipality
Designated Priority Area	N/A

1.6 DESCRIPTION OF SURROUNDING LAND USE (WITHIN 5 KM RADIUS)

The site in question is situated on Portion 0 of Erf No. 166, Botshabelo, Free State Province. The site is situated within the centre of the Botshabelo Industrial Zone and is surrounded by Industrial Warehouses (Free State Development Corporation). As distance increases from the Supreme Poultry Botshabelo Plant the land-use transforms from industrial warehousing to residential areas with scattered commercial properties. The outskirts of Botshabelo predominantly consist of Agricultural Farmland and/or natural areas. Table 4 below provide the name, land-use, co-ordinates, distance from the activity and compass direction of the fifty-seven (57) receptors identified for this study.

Table 4: Details of Surrounding Land-uses.

ID	NAME	LANDUSE	LATTITUDE	LONGATUDE	DISTANCE (M)	DIRECTION
1	Industrial Warehouse	Industrial	-29.200689°	26.707226°	127.50	E
2	Industrial Warehouse	Industrial	-29.201248°	26.707142°	145.03	ESE
3	Industrial Warehouse	Industrial	-29.201943°	26.707037°	194.61	SE
4	Ye-Dah Knitting	Industrial	-29.202601°	26.706943°	255.07	SSE
5	Industrial Warehouse	Industrial	-29.203016°	26.706818°	295.35	SSE
6	Industrial Warehouse	Industrial	-29.202374°	26.706285°	214.29	SSE
7	Industrial Warehouse	Industrial	-29.202490°	26.705564°	225.70	S
8	Industrial Warehouse	Industrial	-29.202128°	26.705123°	199.01	SSW
9	Industrial Warehouse	Industrial	-29.202498°	26.705040°	242.14	SSW
10	Industrial Warehouse	Industrial	-29.202019°	26.704568°	217.11	SW
11	Industrial Warehouse	Industrial	-29.201387°	26.704765°	152.80	WSW
12	Industrial Warehouse	Industrial	-29.200918°	26.704880°	115.07	WSW
13	Industrial Warehouse	Industrial	-29.200016°	26.705139°	93.71	W
14	JT Workshop	Industrial	-29.199602°	26.705789°	98.87	NNW
15	Industrial Warehouse	Industrial	-29.199920°	26.706724°	97.41	NE
16	Industrial Warehouse	Industrial	-29.199587°	26.706910°	136.86	NE
17	Industrial Warehouse	Industrial	-29.199352°	26.706962°	159.72	NE
18	Industrial Warehouse	Industrial	-29.199805°	26.707640°	181.17	ENE
19	Industrial Warehouse	Industrial	-29.200139°	26.707515°	156.61	ENE
20	Botshabelo Mall	Mall	-29.202318°	26.709556°	403.29	E

ID	NAME	LANDUSE	LATTITUDE	LONGATUDE	DISTANCE (M)	DIRECTION
21	Botshabelo H1 Neighbourhood	Residential	-29.204085°	26.716845°	1 128.96	E
22	Setjhaba Se Maketse Combined School	School	-29.205359°	26.713529°	913.47	ESE
23	Botshabelo H1 Neighbourhood	Residential	-29.205172°	26.723292°	1 763.73	E
24	Seithati Primary School	School	-29.208849°	26.724897°	2 058.90	ESE
25	Botshabelo H1 Neighbourhood	Residential	-29.210385°	26.730212°	2 597.42	ESE
26	Botshabelo Cemetery	Cemetery	-29.211982°	26.738953°	3 448.28	E
27	Botshabelo H1 Neighbourhood	Residential	-29.212949°	26.709682°	1 428.63	SSE
28	Lenyora La Thuto Secondary School	School	-29.211937°	26.708243°	1 292.23	SSE
29	Botshabelo H1 Neighbourhood	Residential	-29.213265°	26.713147°	1 579.85	SE
30	Hohle Primary School	School	-29.221793°	26.716652°	2 591.27	SSE
31	Botshabelo G Neighbourhood	Residential	-29.226651°	26.722216°	3 292.89	SE
32	Grassland	Grassland	-29.234878°	26.733348°	4 657.83	SE
33	Botshabelo District Hospital	Hospital	-29.232486°	26.715460°	3 669.06	SSE
34	Botshabelo Traffic Department	Traffic Department	-29.232148°	26.705377°	3 507.99	S
35	Industrial Warehouse	Industrial	-29.208562°	26.704642°	900.82	SSW
36	Botshabelo J Neighbourhood	Residential	-29.219860°	26.703519°	2 167.92	S
37	Bolokehang Intermediate School	School	-29.224255°	26.699462°	2 714.36	SSW
38	Kaizer Sebothelo Stadium	Stadium	-29.230766°	26.701028°	3 376.41	SSW

ID	NAME	LANDUSE	LATTITUDE	LONGATUDE	DISTANCE (M)	DIRECTION
39	Botshabelo C Neighbourhood	Residential	-29.242009°	26.703486°	4 603.78	S
40	Industrial Warehouse	Industrial	-29.205556°	26.700206°	788.02	SW
41	Botshabelo K Neighbourhood	Residential	26.700206°	26.696168°	1 493.78	SSW
42	Reentseng Primary School	School	-29.211343°	26.692782°	1 748.98	SW
43	Retsamaile Primary School	School	-29.216817°	26.687200°	2 557.92	SSW
44	Botshabelo F Neighbourhood	Residential	-29.220252°	26.681500°	3 227.35	SSW
45	Botshabelo F Neighbourhood	Residential	-29.224711°	26.674376°	4 085.75	SSW
46	Grassland	Grassland	-29.227984°	26.669252°	4 691.62	SSW
47	Botshabelo IA Neighbourhood	Industrial	-29.202073°	26.696811°	910.28	W
48	Grassland	Grassland	-29.204832°	26.691660°	1 477.92	WSW
49	Seemahale Secondary School	School	-29.208730°	26.675702°	3 069.97	WSW
50	Botshabelo Residential Area	Residential	-29.204531°	26.663916°	4 116.98	W
51	Industrial Warehouse	Industrial	-29.197696°	26.700723°	592.10	NNW
52	Grassland	Grassland	-29.189108°	26.694875°	1 661.24	NW
53	Agricultural Farmland	Agricultural	-29.173165°	26.681676°	3 849.20	NW
54	Grassland	Grassland	-29.191693°	26.708681°	1 001.84	N
55	Grassland	Grassland	-29.165055°	26.715440°	4 046.71	N
56	Grassland	Grassland	-29.196639°	26.716762°	1 139.33	NE
57	Agricultural Farmland	Agricultural	-29.190191°	26.737300°	3 263.09	NE

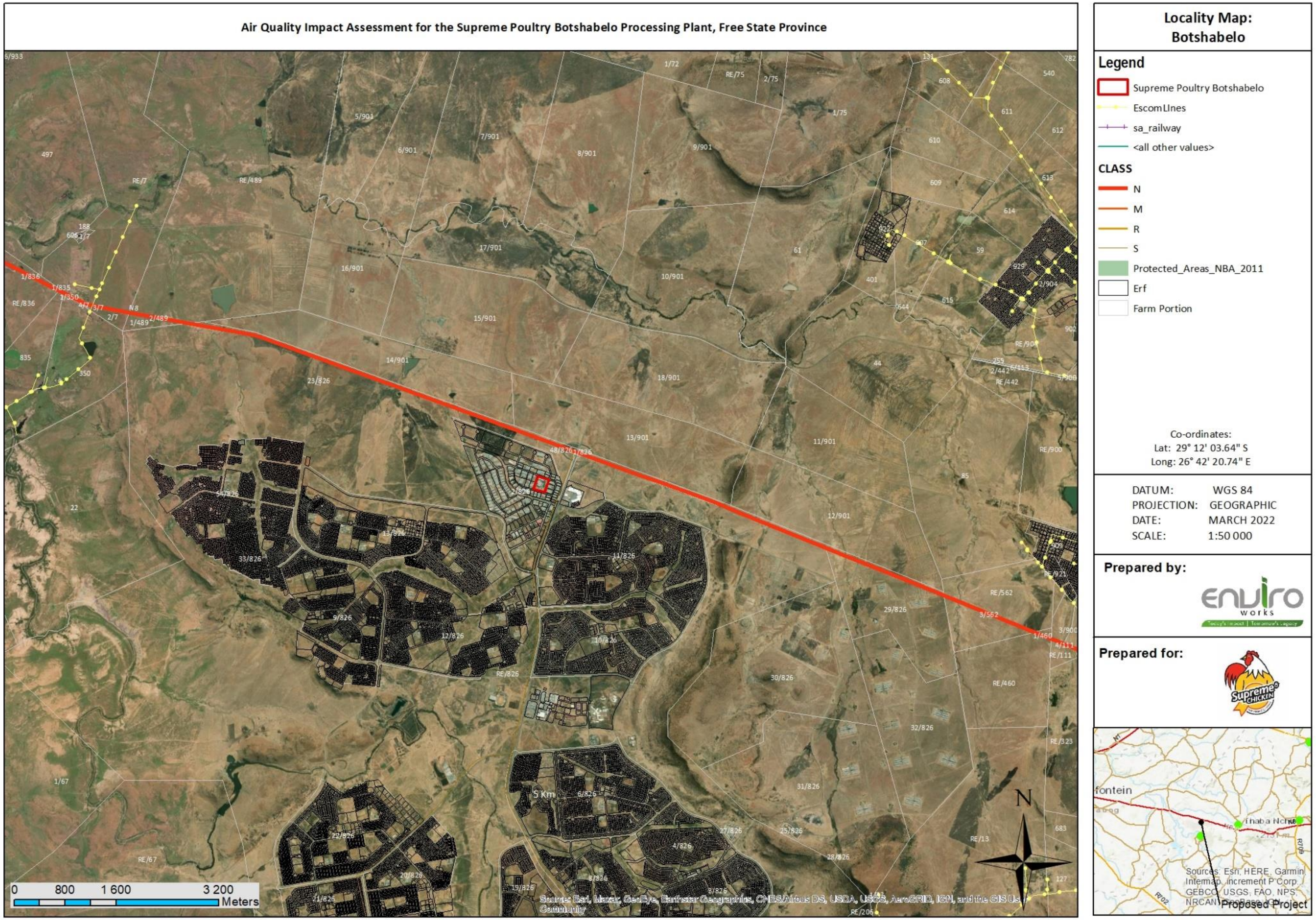

Figure 2: Locality Map of the Supreme Poultry Botshabelo Rendering Plant, Free State Province.

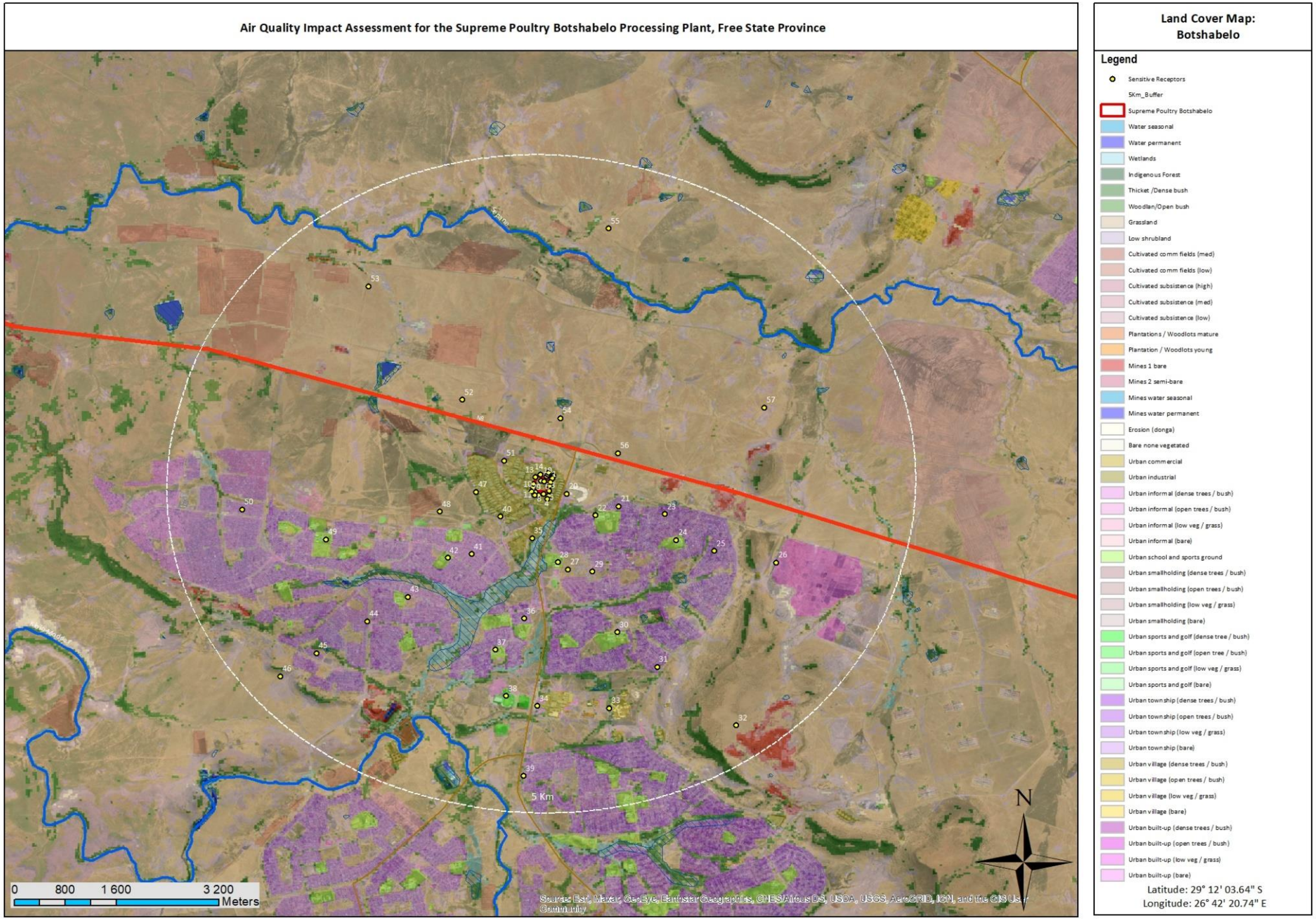

Figure 3: Sensitive Receptors and their respective Land-uses.

2 PROJECT DESCRIPTION

The site where the proposed expansion is set to occur is situated on Portion 0 of Erf No. 166 in the Industrial Area of Botshabelo, Free State Province.

The Processing Plant is an established facility, with the current slaughtering volumes not exceeding one hundred and twenty thousand (120 000) units per day. The Applicant proposes an expansion of the output to one hundred and forty thousand (140 000) units per day. The Processing Plant was designed to process more units than what it currently achieved; therefore no physical construction will occur in order to facilitate this increase of the slaughtering volumes. The Processing plant and associated infrastructure has a development footprint of ten thousand square metres (10 000 m^2), with approximately twelve thousand, three hundred kilogrammes (12 300 kg) of general waste recycled per month.

The standard activities taking place in the abattoir consist of four (4) phases. The initial phase includes the delivery of the chickens, ante-mortem (before slaughtering) inspection and the lairage (where the birds are kept prior to slaughtering). The second phase includes the slaughtering activities, which consist of the stunning and bleeding out of the chickens, debunking, removal of feathers and internal organs. After the organs are removed, they are washed, packaged, weighed, and stored. Hereafter the organs are sold to the intended prospective clients. The blood, fat and feathers are removed and transported via conveyer belts and pipes to the Sterilizing Plant. The third phase includes the packaging and cooling of the processed units. A post-mortem inspection is performed on the meat whereafter carcass registration takes place. The cutting or quartering of the carcasses into portions then takes place, after which the portions are washed at the cut-up wash station. Hereafter the portions are packaged and chilled in large industrial freezers and in “fresh areas”. Finally, the last phase constitutes of the delivery phase, whereby the processed portions are transported to the loading bay area and then transferred to the intended prospective clients. Should the post-mortem inspection identify undesirable or unusable biological material, this material will be transported to the Sterilizing Plant.

An average of thirty-one (31) tonnes of Grade A coal is delivered to the Supreme Poultry Botshabelo Processing Plant on a monthly basis. The coal is stored in a bund storage area, before being loaded into the two Boilers, or steam generators, present on site. Coal is burnt in the two Boilers, hereby generating steam which is subsequently transferred to various areas of Production and the Sterilizing Plant. The coal ash produced by the Boilers are then stored in a designated storage area, whereafter it is removed by a brick maker. Approximately two thousand three hundred and forty kilogrammes (2 340 kg) of ash is produced daily. As mentioned above, the blood, feathers, fats and Dead-on Arrival birds are received from the processing plant with dedicated pipe lines and conveyer belts at the Sterilizing Plant. Steam obtained from the Boilers, or steam generators, is utilised in order to cook the biological material. After the cooking process has been finalised, the material is then dried out, and grounded. The final product is the feather meal, which is packaged and stacked, whereafter it will be sold to prospective clients. For more clarity, please refer to Figure 4 down below regarding the operation of the Boilers and Sterilizing Plant.

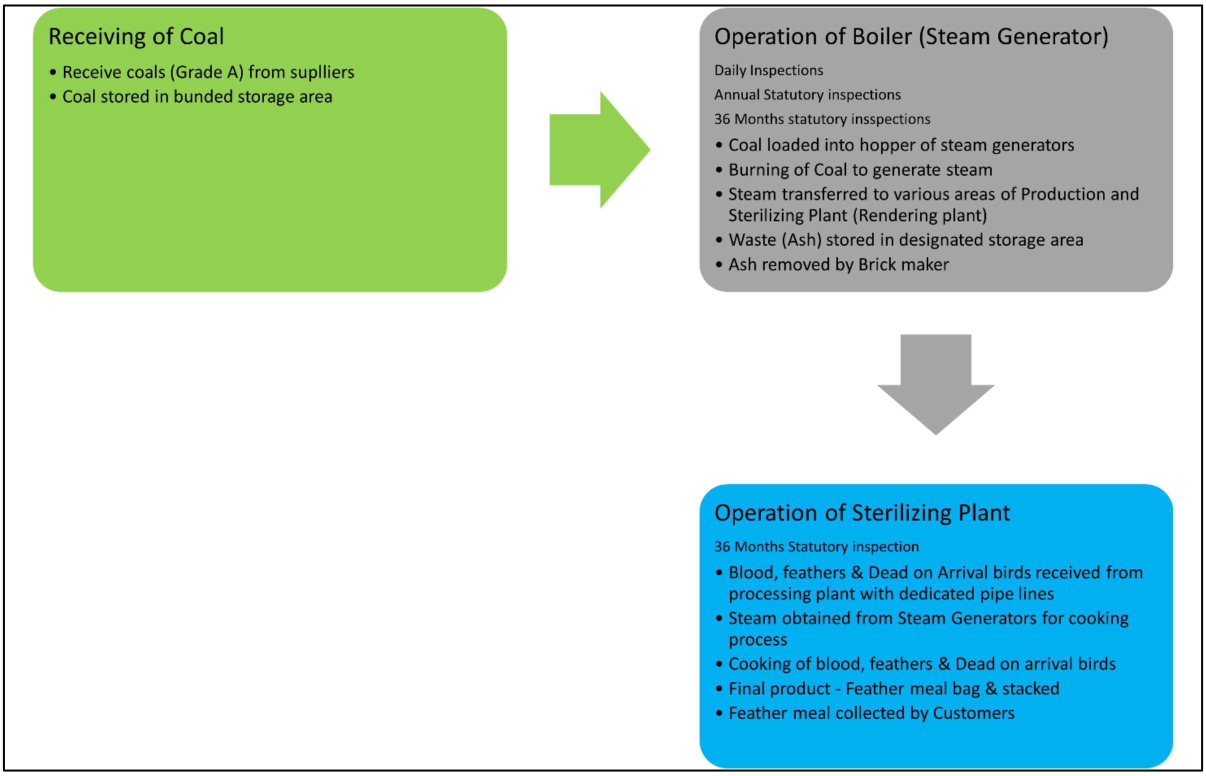

Figure 4: Flow diagram indicating the operation of the Boiler and Sterilizing Plant

As of January 2021, the facility produces two hundred and eleven thousand, five hundred and eleven kilogrammes (211 511 kg) of blood, feathers and fat per month, with Dead on Arrival birds included within this figure. The upper and lower limits for the quantity of Dead-on Arrival birds per month are nineteen point five four (19.54) tonnes and five point nine seven (5.97) tonnes respectively. The feathers, blood, fat and Dead-on Arrival birds are re-worked into feather meal via the Sterilizing Plant. This process involves the cooking, drying out and grounding of the material whereby the biological material is transformed into feather meal. Sieves at the back of the facility collect any solid materials (when the blood, feathers and fat material is removed), preventing these materials from entering the effluent drains. The liquid effluent is discarded within the municipality drains and is tested monthly. The excess fat and blood are collected from the sieves, and processed at the Sterilizing Plant, whereafter it would be sold as feather meal. Overall, more than ten thousand kilogrammes (10 000 kg) of general waste (blood, feathers, fat, Dead on Arrival birds) are processed by the Sterilizing Plant daily.

Sanitary and Medical Waste are collected by a registered waste removal contractor (Compass Waste Services) and are incinerated off site. Sewerage from the ablution processing, admin, stores and workshop areas, as well as grey water from the showers and washing facilities are disposed of at an approved treatment facility. Additionally, industrial effluent from processing activities is disposed of via the municipal effluent system. Paper, cardboard, plastic, scrap metal and wood pallets are recycled and reused wherever possible. Food waste produced within the Canteen is collected by a local pig farmer and/or disposed of at the local, registered landfill site by a registered general waste removal contractor.

3 LEGISLATIVE CONTEXT

The following Acts will be applicable:

Table 5: Applicable Legislation applicable to the Project.

TITLE OF LEGISLATION, POLICY OR GUIDELINE	APPLICABILITY TO THE PROJECT	ADMINISTERING AUTHORITY	DATE
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The proposed project will be subjected to a Basic Assessment Process for Environmental Authorisation.	Department of Economic, Small Business Development, Tourism and Environmental Affairs	1998
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)	The proposed project will require an Air Emissions License.	Mangaung Metropolitan Municipality	2004
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	Given the treatment and recycling of waste on site a Waste Management License will be required.	National Department of Fisheries, Forestry and Environment	2008

Table 6: Listed Activities Triggered.

CATEGORY OF LISTED ACTIVITY	SUB-CATEGORY OF THE LISTED ACTIVITY	NAME OF THE LISTED ACTIVITY	DESCRIPTION OF THE LISTED ACTVITY
Category 1 (Combustion Installations)	Subcategory 1.6	Waste Co-feeding Combustion Installations	Combustion installations co-feeding waste with conventional fuels in processes used primarily for steam raising or electricity generation.
Category 8 (Thermal Treatment of Hazardous and General Waste)	Subcategory 8.1	Thermal Treatment of General and Hazardous Waste	Facilities where general and hazardous waste are treated by the application of heat. All installations treating 10 kg per day of waste.

4 TECHNICAL INFORMATION

4.1 RAW MATERIAL USED

Table 7: Raw material used within the process.

RAW MATERIAL TYPE	DESIGN CONSUMPTION RATE (QUANTITY)	UNITS (QUANTITY/PERIOD)
Coal	1 ton	1 ton per day

5 ATMOSPHERIC EMISSIONS

5.1 POINT SOURCE PARAMETERS

Table 8: Point Source Parameter.

STACK ID	SOURCE NAME	LATTITUDE	LONGATUDE	HEIGHT RELEASE ABOVE GROUND	HEIGHT ABOVE NEARBY BUILDING	DIAMETER AT STACK TIP	ACTUAL GAS EXIT TEMPERATURE (°C)	ACTUAL GAS VOLUMETRIC FLOW (m^3/hr)	ACTUAL GAS EXIT VELOCITY (m/s)
STCK1	No. 1 Boiler Stack	-29.20048	26.70594	21	10	0.555	120	6340	7.28
STCK2	No. 2 Boiler Stack	-29.20055	26.70632	21	10	0.850	137	7272	3.56

5.2 POINT SOURCE MAXIMUM EMISSION RATES (NORMAL OPERATING CONDITIONS)

Table 9: Point Source Maximum Emissions Rates.

ID	POLLUTANT NAME	MAXIMUM RELEASE RATE			EMISSIONS HOURS
		Mg/M^3_n	g/s	Averaging Period	
STCK1	SO_2	224.81	0.257007	Daily	Continuous
	CO	233.69	0.267159	Daily	Continuous
	NO_x	151.89	0.173644	Daily	Continuous
	PM	341.46	0.390362	Daily	Continuous
	PB As + Sb + Cr + Co + Cu + Mn + Ni V	-	0.000000006	Daily	Continuous
	HG	-	0.0000000000039	Daily	Continuous
STCK2	SO_2	439.96	0.507672	Daily	Continuous
	CO	1455.90	1.679971	Daily	Continuous
	NO_x	143.68	0.165792	Daily	Continuous
	PM	147.90	0.170667	Daily	Continuous
	PB As + Sb + Cr + Co + Cu + Mn + Ni V	-	0.000000006	Daily	Continuous
	HG	-	0.0000000000039	Daily	Continuous

5.3 POINT SOURCE EMISSION ESTIMATION INFORMATION

Table 10: Point Source Emission Rate Estimates.

ID	BASIS FOR EMISSIONS RATES
STCK 1	Emission rates were determined by Mr K.C Wyngaardt during the annual emission survey conducted on 25 August 2021.
STCK 2	Emission rates were determined by Mr K.C Wyngaardt during the annual emission survey conducted on 25 August 2021.

6 EMERGENCY INCIDENTS

No emergency incidents have been recorded to date on site.

7 IMPACT OF ENTERPRISE ON THE RECEIVING ENVIRONMENT

7.1 STUDY METHODOLOGY

The study methodology can conveniently be divided into a “planning phase” and “execution phase”. The planning phase included the following basic steps prior to performing the actual dispersion modelling and analyses:

1. Understand Scope of Work;
2. Assign Appropriate Specialists;
3. Review of legal requirements (e.g. dispersion modelling guidelines); and,
4. Decide on a Dispersion Model.

The Regulations regarding Air Dispersion Modelling (Gazette No. 37804 published 11 July 2014) was referenced for the dispersion model selection. Three (3) levels of assessment are defined within the Regulations regarding Air Dispersion Modelling:

- **Level 1:** Where worst-case air quality impacts are assessed using simpler screening models;
- **Level 2:** For assessment of air quality impacts as part of license application or amendment processes, where impacts are the greatest within a few kilometres downwind (less than 50 km); and,
- **Level 3:** Requires more sophisticated dispersion models (and corresponding input data, resources and model operator expertise) in situations:
    - Where a detailed understanding of air quality impacts, in time and space, is required;
    - Where it is important to account for causality effects, calms, non-linear plume trajectories, spatial variations in turbulent mixing, multiple source types, and chemical transformations;
    - When conducting permitting and/or environmental assessment processes for large industrial developments that have considerable social, economic and environmental consequences, when evaluating air quality management approaches involving multi-source, multi-sector contributions from permitted and non-permitted sources in an air-shed; or,
    - When assessing contaminants resulting from non-linear processes (e.g. deposition, ground-level ozone (O3), particulate formation and visibility).

This study was considered to meet the requirements of a Level 2 assessment, and AERMOD was selected on the basis that this Gaussian plume model is well suited to simulate dispersion where transport distances are likely to be less than fifty kilometres (50 km).

The execution phase (i.e. dispersion modelling and analyses) firstly involves gathering specific information in relation to the emission source(s) and site(s) to be assessed. The includes:

1. **Source Information:** Emission rate, exit temperature, volume flow, exit velocity, etc;
2. **Site Information:** Site building layout, terrain information, land-use date, etc;
3. **Meteorological Data:** Wind speed, wind direction, temperature, cloud cover, mixing height, etc; and,

4. **Receptor Information:** Locations using discrete receptors and/or gridded receptors.

The model uses this specific input data to run various algorithms to estimate the dispersion of pollutants between the source and receptor. The model output is in the form of a predicted time-averaged concentration at the receptor. These predicted concentrations are added to suitable background concentrations and compared with the relevant ambient air quality standard or guideline. In some cases post-processing can be carried out to produce percentile concentrations or contour plots that can be prepared for reporting purposes.

7.1.1 DISPERSION MODEL SELECTION

Gaussian plume models are best used for near-field applications where the steady-state meteorology assumption is most likely to apply. One of the most widely used Gaussian plume model is the US EPA AERMOD model that was used in this study. AERMOD is a model developed with the support of the AMS/EPA Regulatory Model Improvement Committee (AERMIC), whose objective has been to include state-of-the-art science in regulatory models (Hanna *et al*, 1999). AERMOD is a dispersion modelling system with three (3) components, namely: AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD terrain pre-processor) and AERMET (AERMOD meteorological pre-processor).

AERMOD is an advanced new-generation model. It is designed to predict pollution concentration from continuous point, flare, area, line, and volume sources. AERMOD offers new and potentially improved algorithms for plume rise and buoyancy, and the computation of vertical profiles of wind, turbulence and temperature; however, it retains the single straight line trajectory limitation. AERMET is a meteorological pre-processor for AERMOD. Input data can come from hourly cloud cover observations, surface meteorological observations and parameters and vertical profiles of several atmospheric parameters. AERMAP is a terrain pre-processor designed to simplify and standardise the input of terrain data for AERMOD. Input data includes receptor terrain elevation data. The terrain data may be in the form of digital terrain data. The output includes, for each receptor, location and height scale, which are elevations used for the computation of air flow around hills. Receptors were identified using satellite imagery (Google Earth) and the 2013 Landcover Map for South Africa was used for verification purposes. Each receptor was plotted on Google Earth and imported into AERMOD for modelling purposes.

A disadvantage of the model is that spatial varying wind fields, due to topography or other factors cannot be included. Input data types required for the AERMOD model include: source data, meteorological data (pre-processed by the AERMET model), terrain data and information on the nature of the receptor grid. Version 10 of the AERMOD and its pre-processors were used in the study.

7.1.2 LEGAL REQUIREMENTS

7.1.2.1 ATMOSPHERIC IMPACT REPORT

According to the NEM:AQA, an Air Quality Officer (AQO) may require the submission of an Atmospheric Impact Report (AIR) in terms of Section 30, if:

1. The AQO reasonably suspects that a person has contravened or failed to comply with the NEM:AQA or any conditions of an AEL and that detrimental effects on the environment occurred or there was a contribution to the degradation in ambient air quality; or,
2. A review of a provisional AEL or an AEL is undertaken in terms of Section 45 of the NEM:AQA.

The format of the AIR is stipulated in the Regulations prescribing the format of the AIR, Government Gazette No. 36904, and Notice No. 747 of 2013 of 11 October 2013.

7.1.2.2 NATIONAL AMBIENT AIR QUALITY STANDARDS

Measured and modelled concentrations were assessed against National Ambient Air Quality Standards (NAAQS).

Table 11: National Ambient Air Quality Standards (NAAQS) 2015.

POLLUTANT	AVERAGING PERIOD	CONCENTRATION (µg/m^3)	FREQUENCY OF EXCEEDANCE	COMPLIANCE DATE
SO_2	1 Hour	350	88	Immediate
	24 Hours	125	4	Immediate
	1 Year	50	0	Immediate
NO_2	1 Hour	200	88	Immediate
	1 Year	40	0	Immediate
PM_{10}	24 Hours	75	4	Immediate
	1 Hour	40	0	Immediate
CO	1 Hour	30 000	88	Immediate
	8 Hour	10 000	11	Immediate

7.1.2.3 LISTED ACTIVITIES AND MINIMUM EMISSIONS STANDARDS

The proposed activity is a Listed Activity under Section 21 of the NEM:AQA and requires an AEL to operate. The minimum emission limits as per the Listed Activity Sub-Category 1.6 and 8.1 are provided in Table 12 and Table 13 below.

Table 12: Subcategory 1.6: Waste co-feeding Combustion Installations.

DESCRIPTION	Combustion installations co-feeding waste with conventional fuels in processes used primarily for steam raising or electricity generation.		
APPLICATION	All installations.		
SUBSTANCE OR MIXTURE OF SUBSTANCES		PLANT STATUS	Mg/Nm^3 UNDER NORMAL CONDITIONS OF 273 Kelvin and 101.3 kPa.
COMMON NAME	CHEMICAL SYMBOL		
Carbon monoxide	CO	New	50
		Existing	75
	HCL	New	10
		Existing	10
Hydrogen Fluoride	HF	New	1
		Existing	1
Sum of Lead, arsenic, antimony, chromium, cobalt, copper,	Pb + As + Sb + Cr + Co + Cu + Mn + NI + V	New	0.5
		Existing	0.5

DESCRIPTION	Combustion installations co-feeding waste with conventional fuels in processes used primarily for steam raising or electricity generation.		
APPLICATION	All installations.		
SUBSTANCE OR MIXTURE OF SUBSTANCES		**PLANT STATUS**	**Mg/Nm³ UNDER NORMAL CONDITIONS OF 273 Kelvin and 101.3 kPa.**
COMMON NAME	**CHEMICAL SYMBOL**		
manganese, nickel, vanadium			
Mercury	Hg	New	0.05
		Existing	0.05
Cadmium Thallium	Cd + TI	New	0.05
		Existing	0.05
Total organic compounds	TOC	New	10
		Existing	10
Ammonia	NH_3	New	10
		Existing	10
Dioxins and furans	PCDD/PCDF	New	0.1
		Existing	0.1

Table 13: Sub-Category 8.1: Thermal Treatment of General and Hazardous Waste.

DESCRIPTION	Facilities where general and hazardous waste are treated by the application of heat.		
APPLICATION	All installations treating 10 kg per day of waste.		
SUBSTANCE OR MIXTURE OF SUBSTANCES		**PLANT STATUS**	**Mg/Nm³ UNDER NORMAL CONDITIONS OF 273 Kelvin and 101.3 kPa.**
COMMON NAME	**CHEMICAL SYMBOL**		
Particulate Matter	N/A	New	10
		Existing	25
Carbon monoxide	CO	New	50
		Existing	75
Sulphur dioxide	SO_2	New	50
		Existing	50
Oxides of nitrogen	NO_x expressed as NO_2	New	200
		Existing	200
Hydrogen Chloride	HCL	New	10
		Existing	10
Hydrogen Fluoride	HF	New	1
		Existing	1

DESCRIPTION	Facilities where general and hazardous waste are treated by the application of heat.		
APPLICATION	All installations treating 10 kg per day of waste.		
SUBSTANCE OR MIXTURE OF SUBSTANCES		**PLANT STATUS**	**Mg/Nm^3 UNDER NORMAL CONDITIONS OF 273 Kelvin and 101.3 kPa.**
COMMON NAME	**CHEMICAL SYMBOL**		
Sum of Lead, arsenic, antimony, chromium, cobalt, copper, manganese, nickel, vanadium	Pb + As + Sb + Cr + Co + Cu + Mn + NI + V	New	0.5
		Existing	0.5
Mercury	Hg	New	0.05
		Existing	0.05
Cadmium Thallium	Cd + TI	New	0.05
		Existing	0.05
Total organic compounds	TOC	New	10
		Existing	10
Ammonia	NH_3	New	10
		Existing	10
Dioxins and furans	PCDD/PCDF	New	0.1
		Existing	0.1

7.1.3 ATMOSPHERIC DISPERSION POTENTIAL

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The analysis of hourly average meteorological data is necessary to facilitate a comprehensive understanding of the dispersion potential of the site. The horizontal dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. For this assessment the AERMET processed meteorological data for the period January 2019 to December 2021 provided the parameters useful for describing the dispersion and dilution potential of the site i.e., wind speed, wind direction, temperature and rainfall, as discussed below.

7.1.3.1 LOCAL WIND FIELD

The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

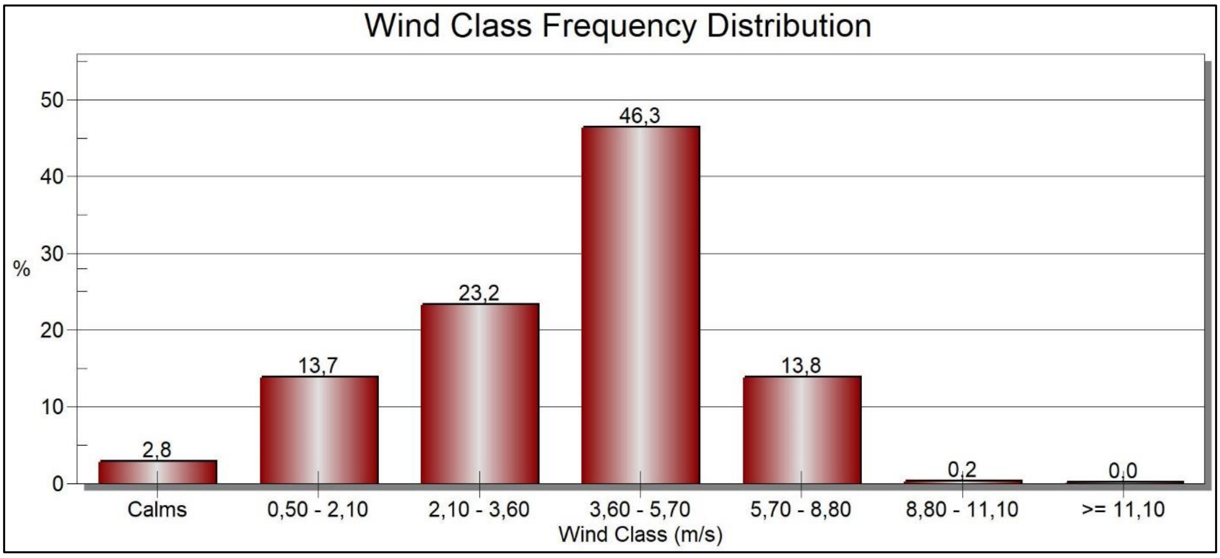

Figure 5: Wind Frequency Distribution at Botshabelo, Free State Province.

Wind roses for Botshabelo are given in Figures 6 to 12 for the period January 2021 to December 2021. These wind roses comprise of thirty-six (36) spokes, which represents the directions from which winds blew during the period. The colours reflect the different categories of wind speeds with the dotted circles indicating the frequency of occurrence, and each circle represents a one percent (1 %) frequency of occurrence.

The period wind field at Botshabelo (Figure 12) shows the dominant wind direction being from the northeast six-point-nine percent (6.9 %) of the time and from northwest two to four percent (2 % – 4 %) of the time. The prevailing wind speed were between three point six (3.6) and five point seven metres per second (5.7 m/s) which occurred throughout the year. The average wind speed recorded was three point six metres per second (3.6 m/s) between 2019 and 2021. Differences in the daytime and night-time wind fields occur. During night-time (18:00 – 06:00) higher wind speeds were recorded, and the dominant winds are from the northeast (Figure 11). During daytime conditions (06:00 – 18:00) the dominant winds came from the northeast and west northwest, and slightly lower speeds as compared to that of night-time (Figure 10).

The seasonal wind field for Botshabelo is presented in Figures 6, 7, 8 and 9. The highest wind speeds were recorded from the northeast with the highest wind speeds occurring in spring and summer. Generally lower wind speeds were recorded during winter and autumn, with an increased contribution of wind from the west. Spring has the lowest frequency of calms with an average of one and a half percent (1.5 %). Increased frequencies are observed during winter with calms with an average of three percent (3 %).

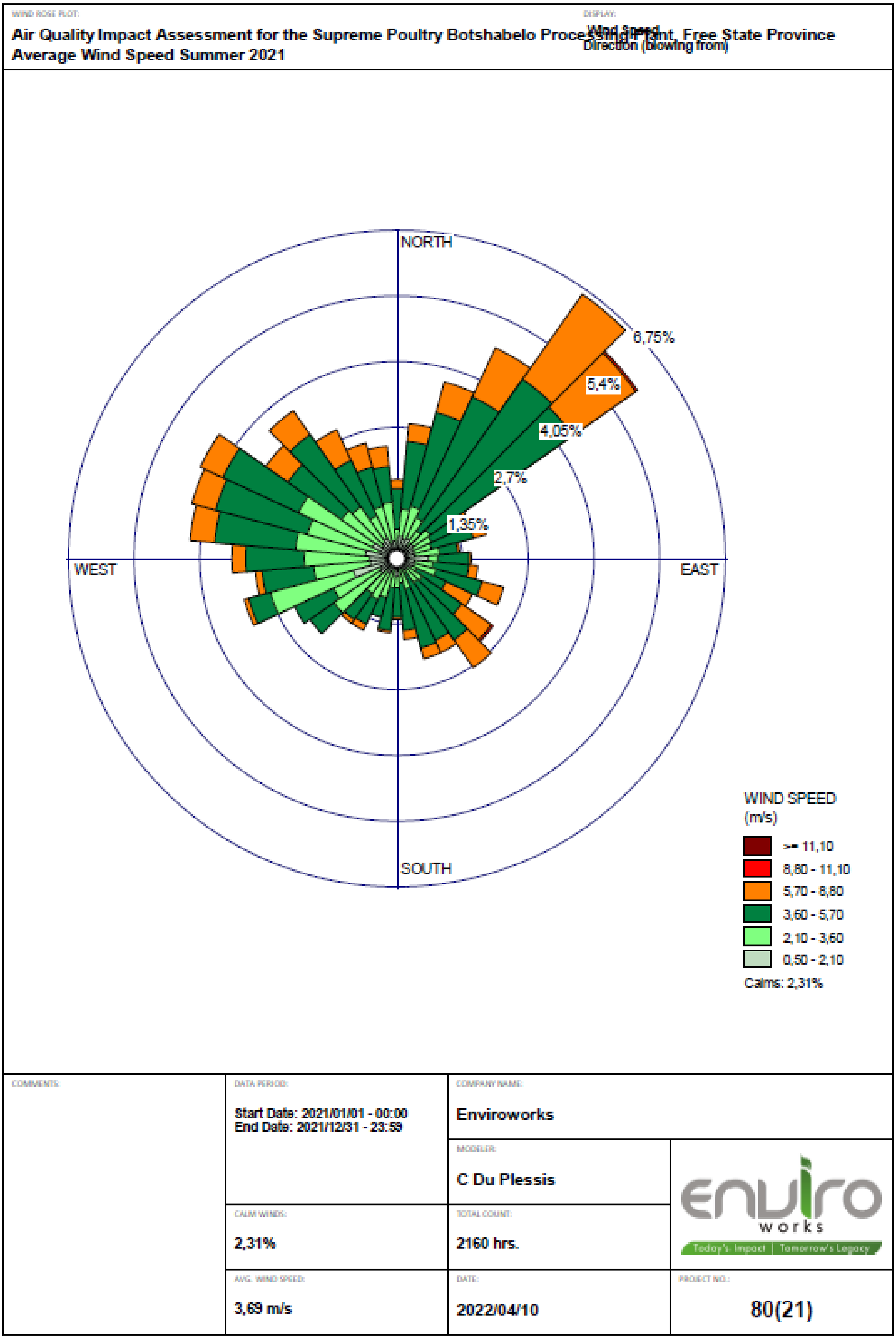

Figure 6: Wind Frequency Distribution Summer 2021.

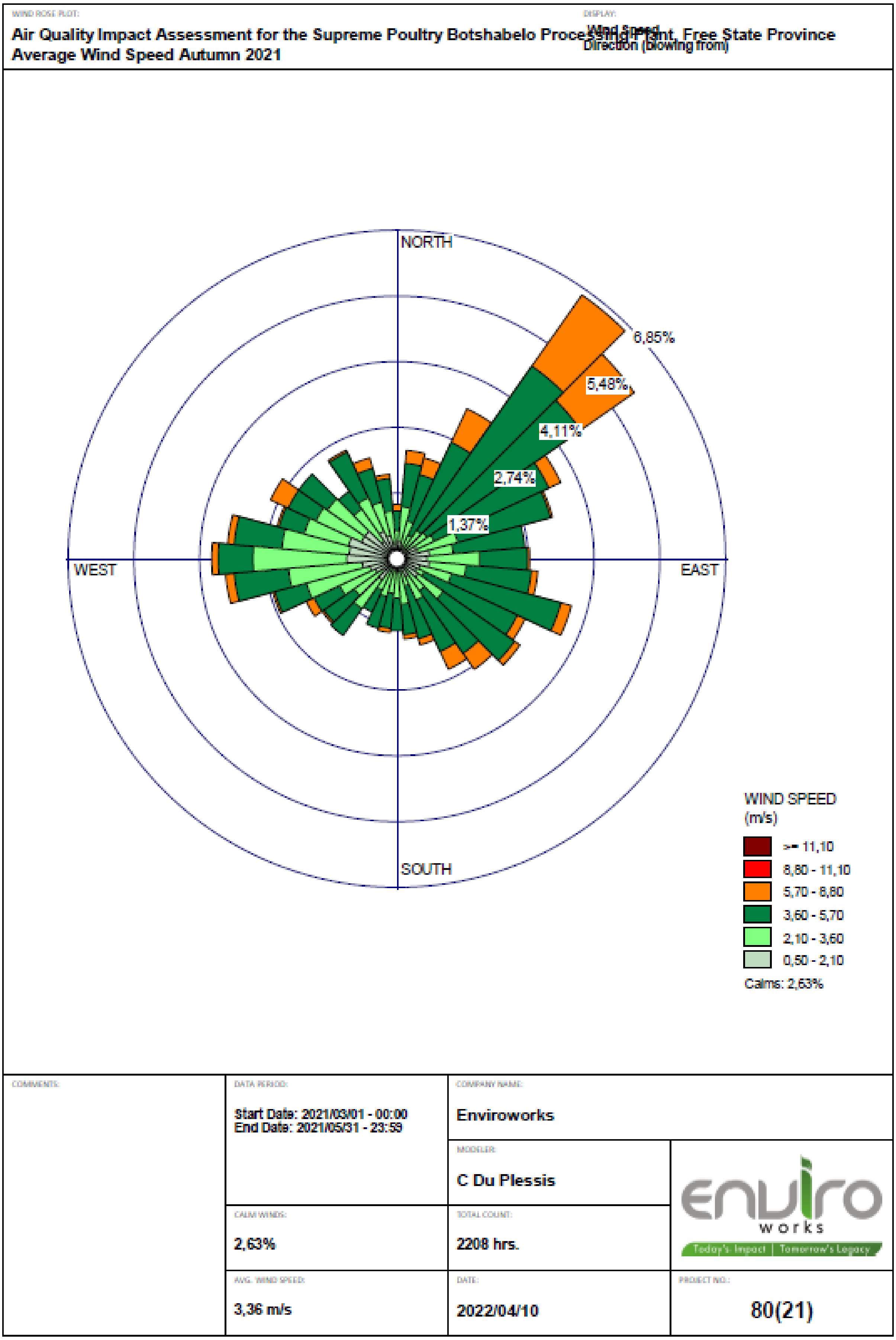

Figure 7: Wind Frequency Distribution Autumn 2021.

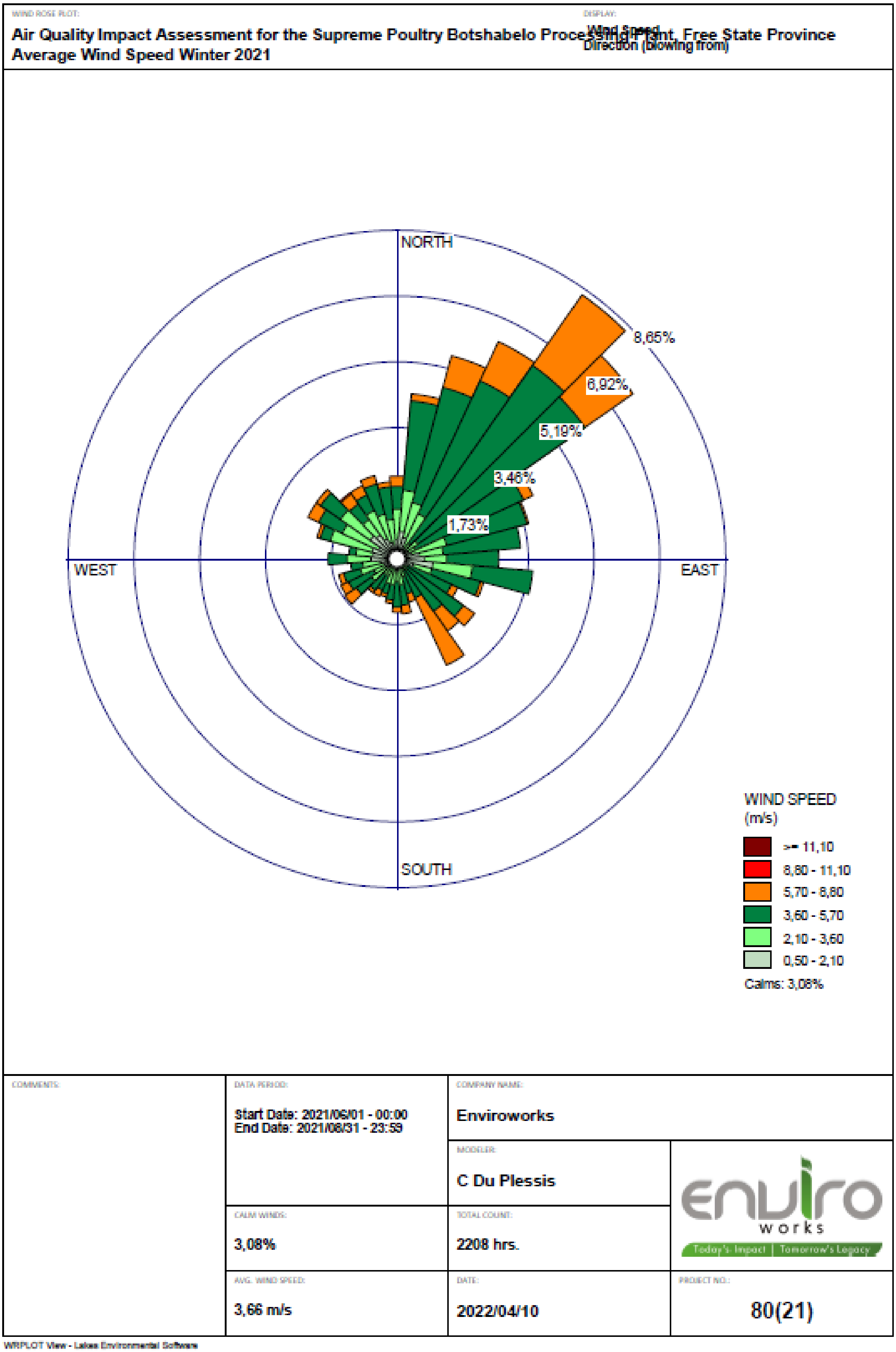

Figure 8: Wind Frequency Distribution Winter 2021.

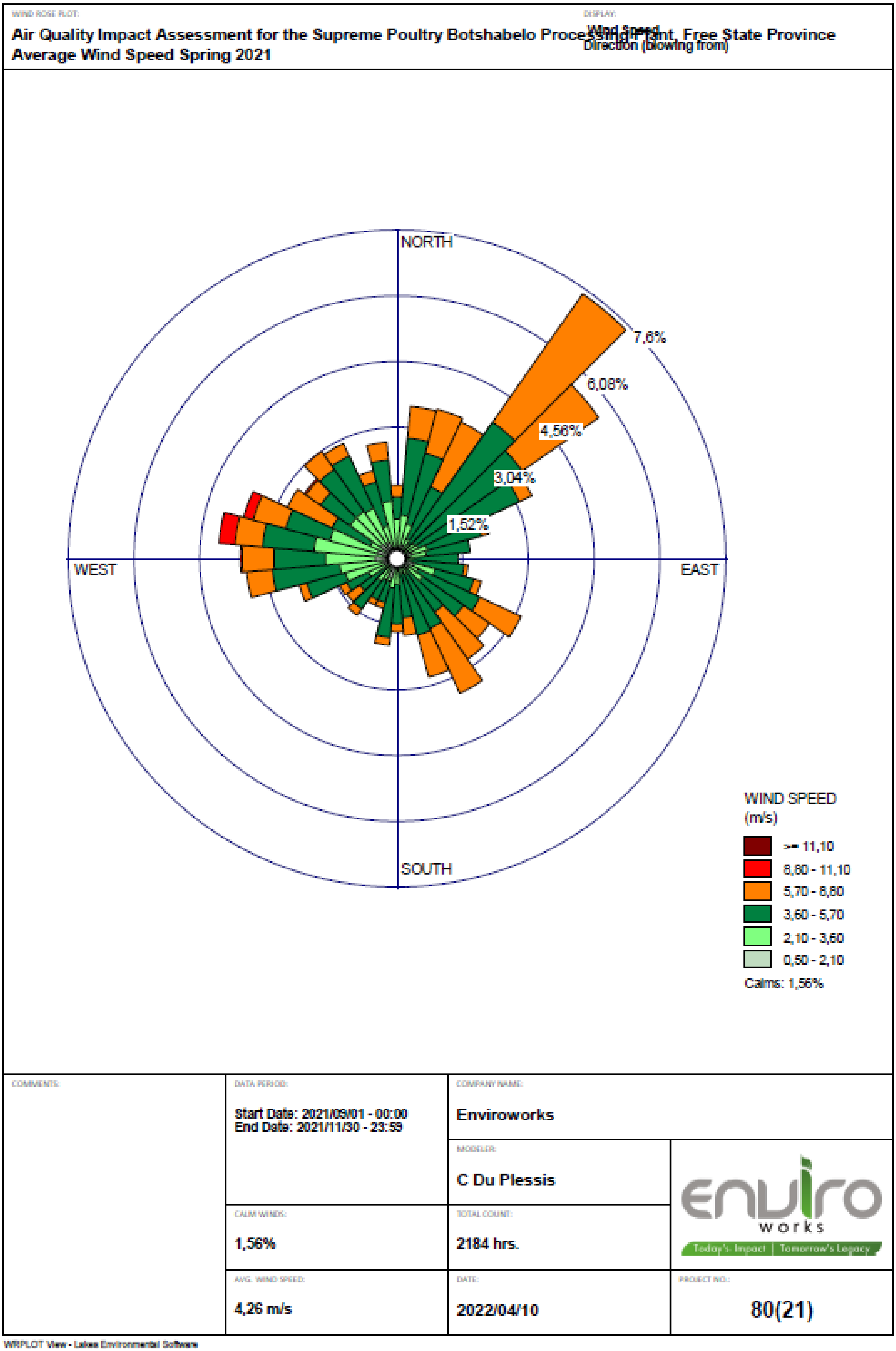

Figure 9: Wind Frequency Distribution Spring 2021.

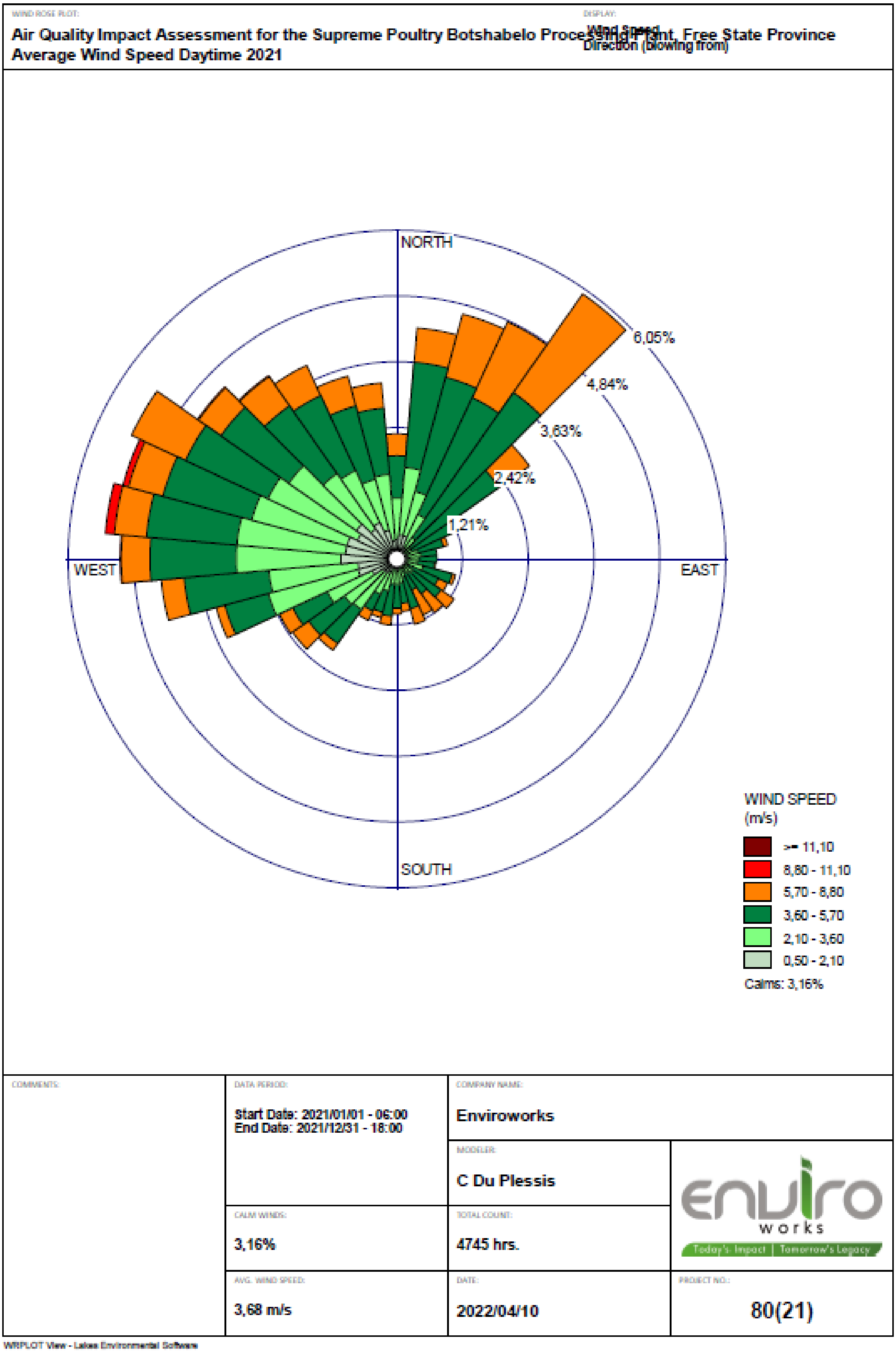

Figure 10: Wind Frequency Distribution Daytime 2021.

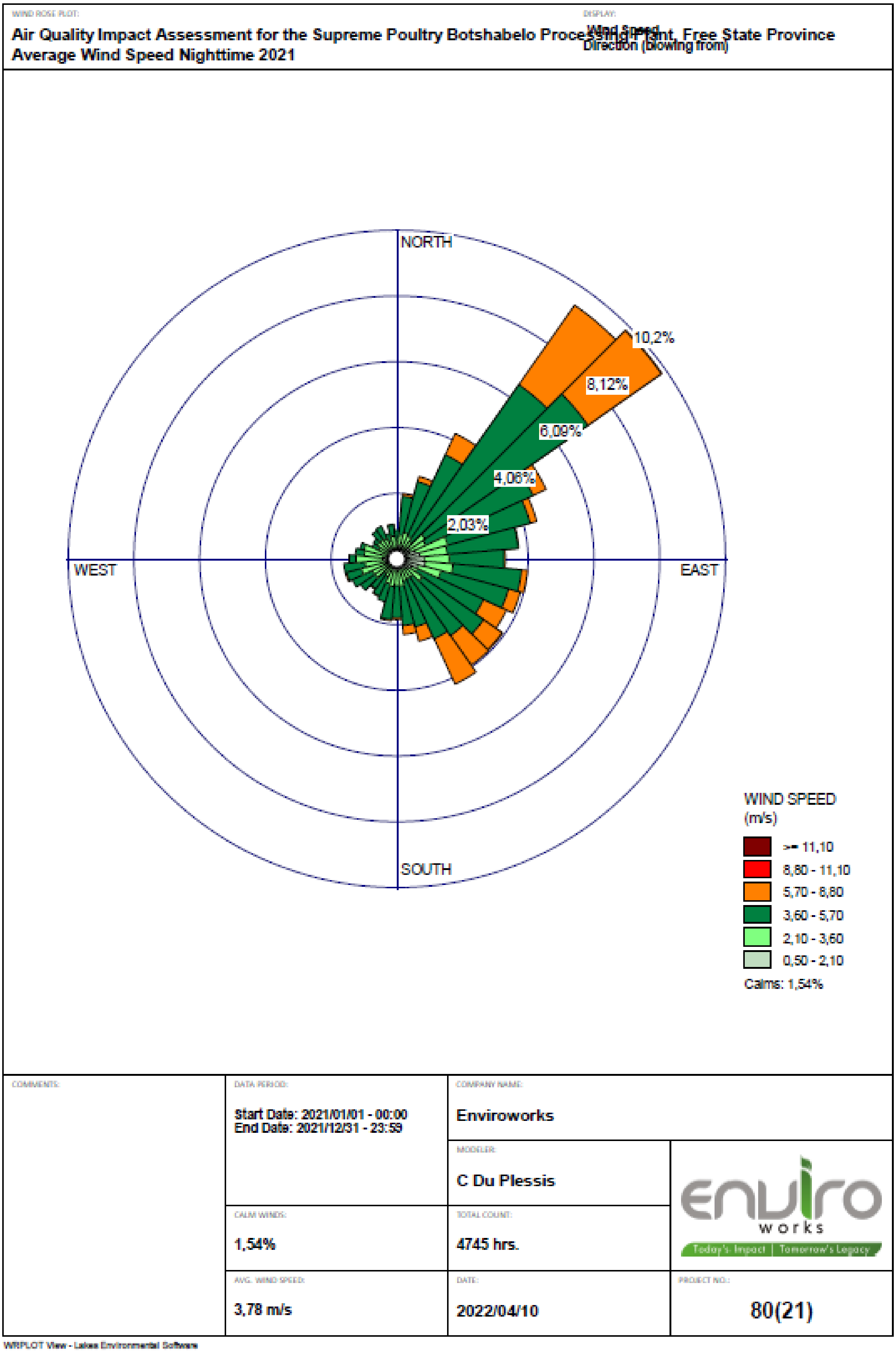

Figure 11: Wind Frequency Distribution Night-time 2021.

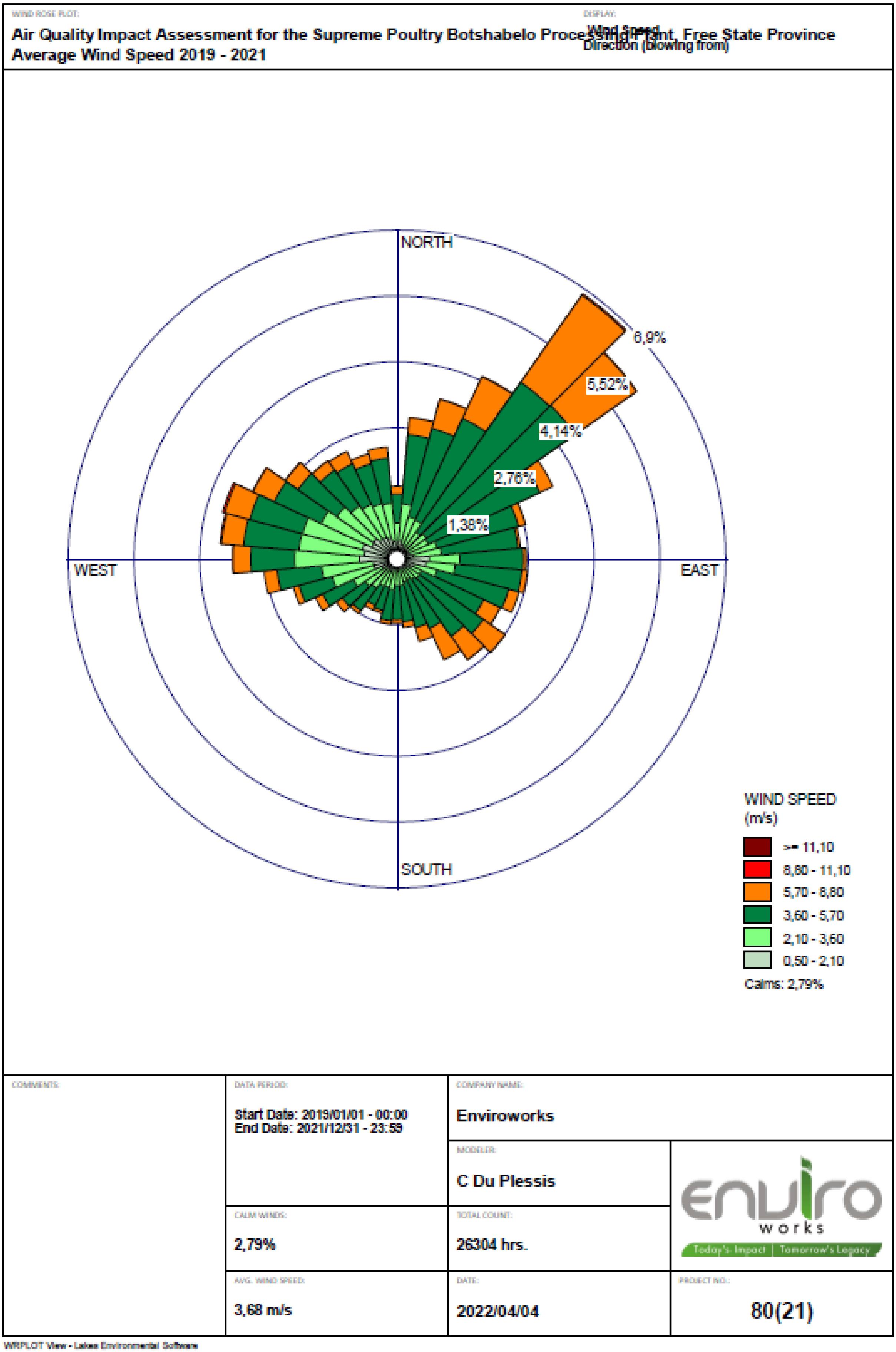

Figure 12: Wind Frequency Distribution January 2019 - December 2021.

7.1.3.2 AMBIENT TEMPERATURE

The air temperature is important for determining the development of the mixing and inversion layers. The mean, minimum and maximum temperatures recorded in Botshabelo during 2021 were sixteen point seven degrees Celsius (16.7 °C), minus two point nine degrees Celsius (-2.9 °C) and thirty-two point six degrees Celsius (32.6 °C) respectively. The month with the highest mean temperature was January 2021 (23.6 °C) while the coldest month was July 2021 (8.7 °C).

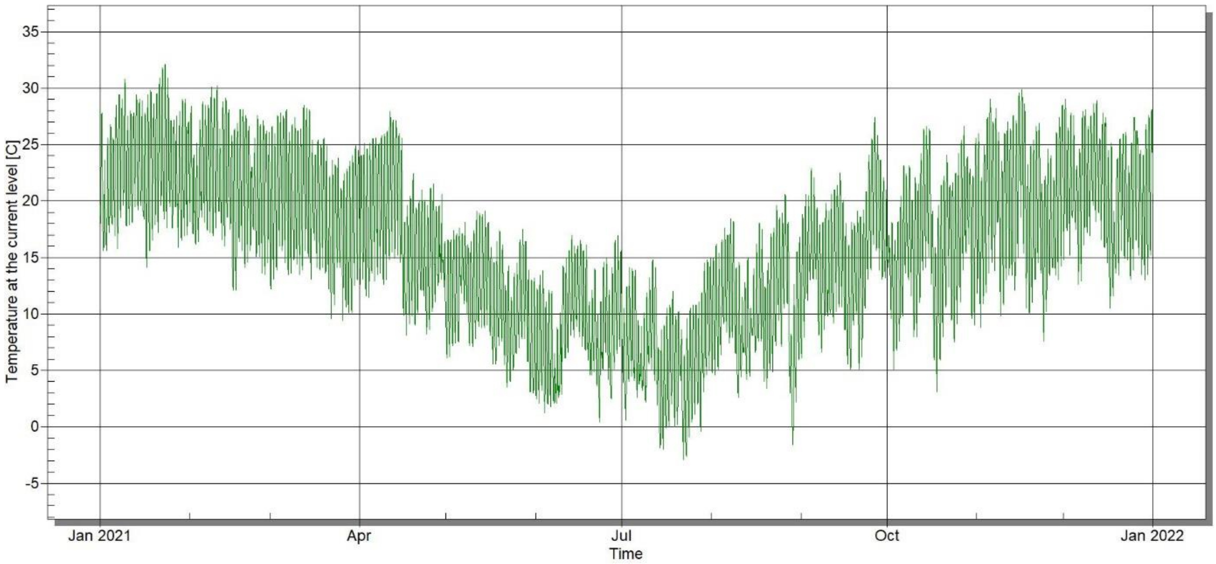

Figure 13: Ambient temperature captured between January 2021 and December 2021.

7.1.3.3 PRECIPITATION

Precipitation represents an effective removal mechanism of atmospheric pollutants. Moderate showers (usually of short duration) commonly occur in summer while the winters are dry. The maximum rainfall occurs during the December-January period. Figure 14 below illustrates the precipitation data recorded for Botshabelo for the period January 2021 to December 2021. The rainfall ranged from a quarter of a millimetre per hour (0.25 mm/hr) to thirteen point seven millimetres per hour (13.7 mm/hr).

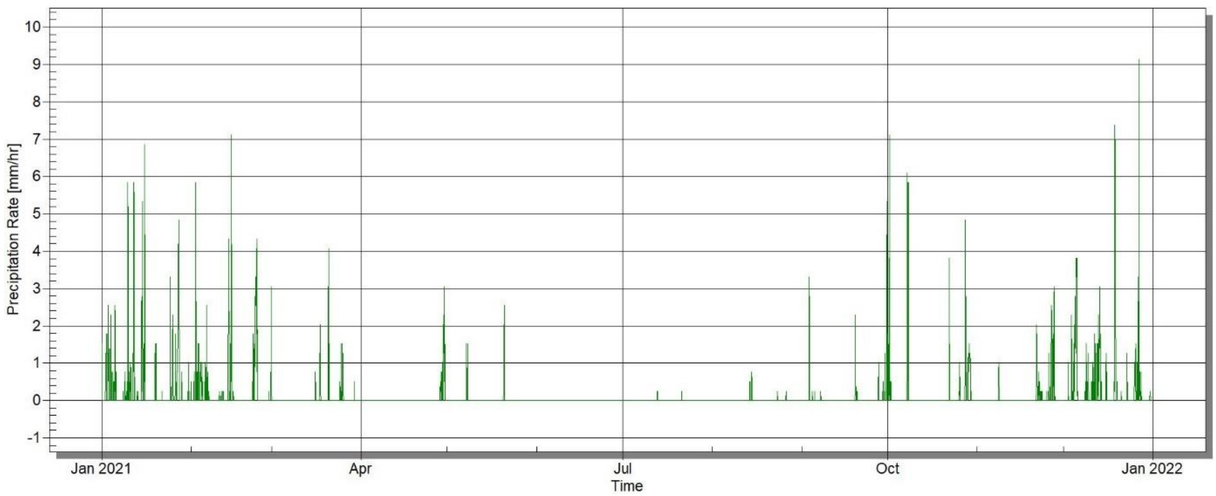

Figure 14: Precipitation data captured at Botshabelo for the period January 2021 to December 2021.

7.1.3.4 ATMOSPHERIC STABILITY

The atmospheric boundary layer properties are described by two parameters namely the boundary layer depth and the Monin-Obukhov length. The Monin-Obukhov length (LMo) provides a measure of the importance of buoyancy generated by the heating of the ground and mechanical mixing generated by the frictional effect of the earth's surface. Physically, it can be thought of as representing the depth of the boundary layer within which mechanical mixing is the dominant form of turbulence generation (CERC, 2004). The atmospheric boundary layer constitutes the first few hundred metres of the atmosphere. During daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface. Night-times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and lower dilution potential.

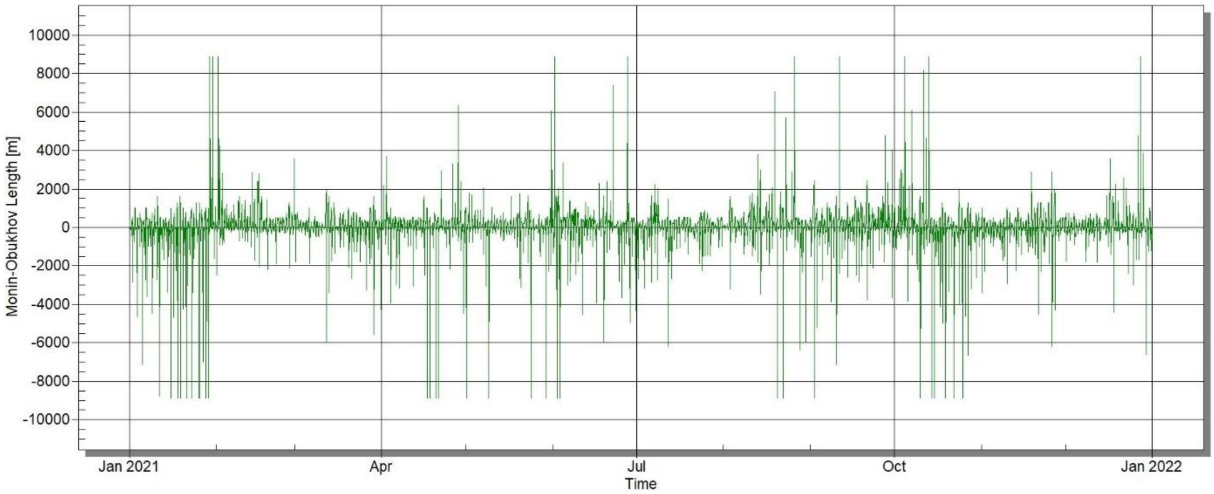

Figure 15: Atmospheric Stability captured at Botshabelo for the period January 2021 to December 2021.

7.1.3.5 PLUME BUOYANCY

Gases leaving a stack mix with ambient air and undergo three (3) phases namely the initial phase, the transition phase and the diffusion phase (Figure 16). The initial phase is greatly determined by the physical properties of the emitted gases. These gasses may have momentum as they enter the atmosphere and are often heated and as such warmer that the surrounding ambient air. Warmer gases are less dense than the ambient air and are therefore buoyant. A combination of the gases' momentum and buoyancy causes the gases to rise (vertical jet section, (Figure 16). In the Bent-Over Jet Section, entrainment of the cross flow is rapid since by this time appreciable growth of vortices has taken place.

The self-generated turbulence causes mixing and determines the growth of plume in the thermal Section. This is referred to as plume rise and allows air pollutants emitted in this gas stream to be lofted higher in the atmosphere. Since the plume is higher in the atmosphere and at a further distance from the ground, the plume will disperse more before it reaches ground level. With greater volumetric flow and increased exit gas temperatures, the plume centreline would be higher than if either the volumetric flow or the exit gas temperature is reduced. The subsequent ground level concentrations would therefore be lower. This is particularly important in understanding the dispersion model results discussed in the Sections below.

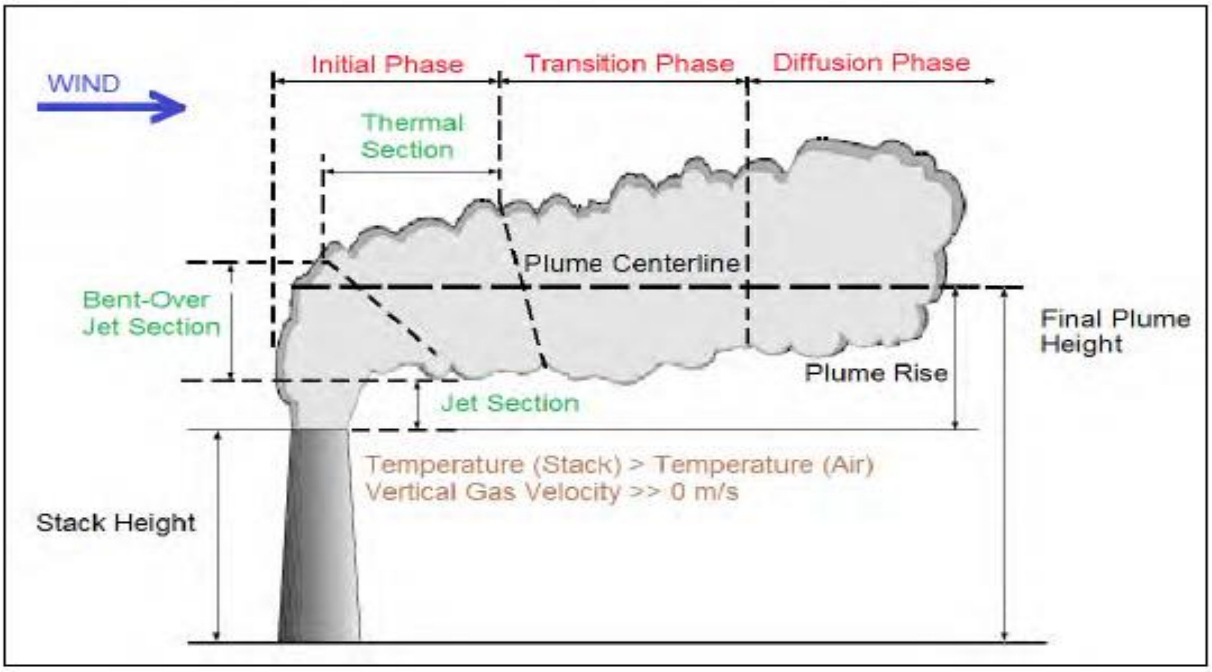

Figure 16: Graphical illustration of Plume Buoyancy.

8 AIR QUALITY MONITORING DATA

The Pelonomi-NAQI Monitoring station is owned by the Department of Fisheries, Forestry and Environment (DFFE) and maintained by the South African Weather Service. Data reported on at this station include SO_2 and PM_{10}; however, although provision has been made for the monitoring of CO no data has been captured to date. Data used for the purpose of this report includes the timeframe from 01 January 2021 to 31 December 2021 and includes all seasons. It is assumed that the pollutant concentrations measured at this urban station (closest to the proposed project) will likely be influenced by different emission sources, such as domestic fuel burning and vehicle exhaust emissions and agricultural activities other than pollutant concentration in the study area. These include seasonal sources of particulates such as vehicle dust entrainment on unpaved roads and dust storms during springtime. Below is a graphical representation of the measured pollutants from January 2021 to January 2022.

8.1 SULPHUR DIOXIDE (SO_2):

The highest concentration recorded for SO_2 at the Pelonomi-NAQI monitoring station was twenty-three parts per billion (23,044 ppb) with an annual average of one point eight parts per billion (1.8 ppb) and as such no exceedance on SO_2 emissions were recorded for the one-hour (1 hr) threshold of one hundred and thirty-four parts per billion (134 ppb).

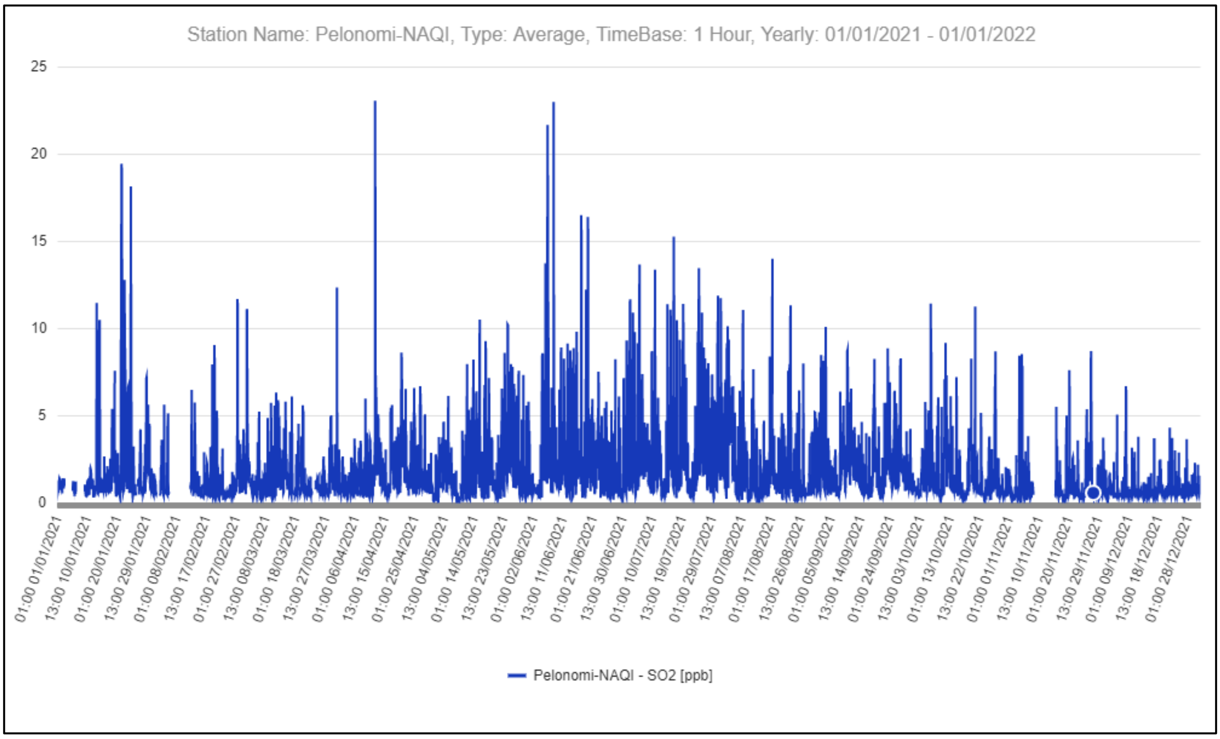

Figure 17: SO2 Concentrations measured at Pelonomi-NAQI Monitoring Station during 2021.

8.2 PARTICULATES (PM_{10})

The highest concentration of Particulates measured at the Pelonomi-HAQI Monitoring Station was one thousand four hundred and ninety-two micrograms per cubic metre (1 492 µg/m^3) for the period January 2021 to January 2022 with an average reading of one hundred micrograms per cubic metre (100.83 µg/m^3). As illustrated by Figure 18 multiple exceedances on PM_{10} emissions were recorded for the twenty-four-hour (24 hr) threshold of seventy-five micrograms per cubic metre (75 µg/m^3).

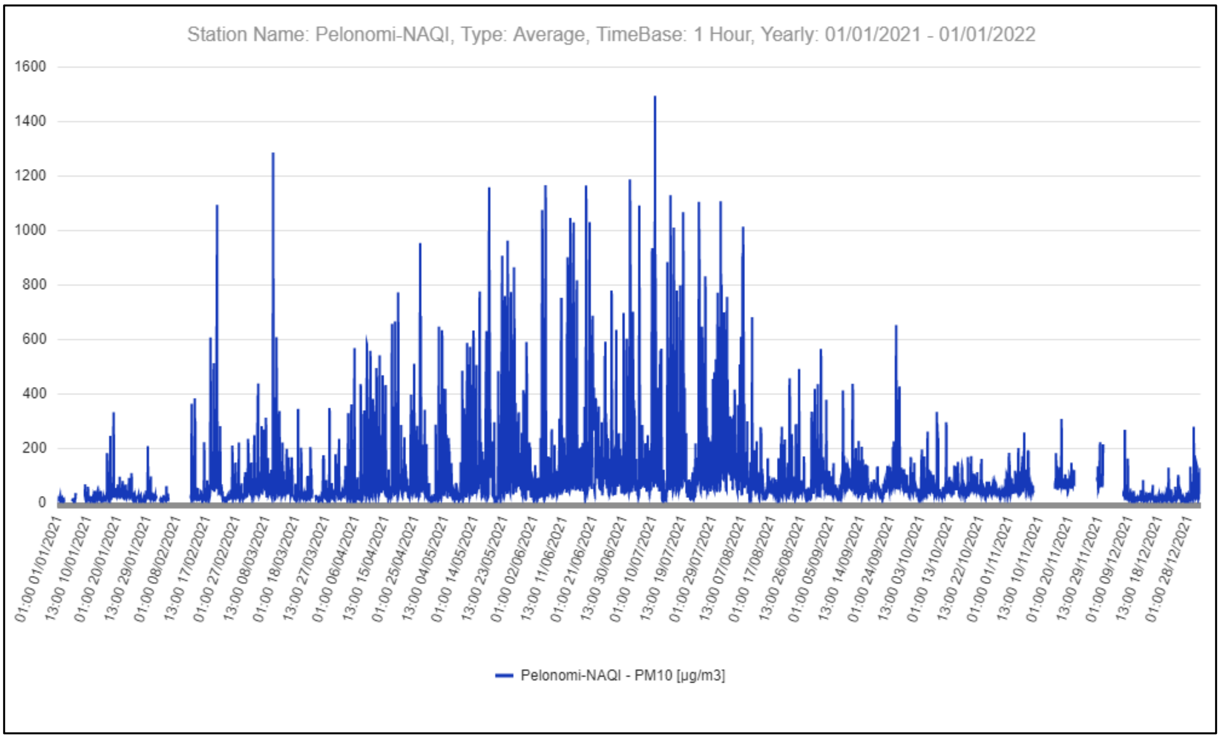

Figure 18: PM10 Concentrations measured at Pelonomi-NAQI Monitoring Station during 2021.

8.3 CARBON MONOXIDE (CO)

No data is available for Carbon Monoxide for the period January 2021 to January 2022.

8.4 OXIDES OF NITROGEN (NOX)

No data is available for Oxides of Nitrogen for the period January 2021 to January 2022.

9 DISPERSION MODELLING RESULTS

As the plant is already in operation and monitoring data is readily available the following parameters were applied during the dispersion modelling for Boiler Stack No. 1 & 2 as determined by K.C van Wyngaardt (Appendix A):

Table 14: Emission Point Source Details for Boiler Stack No. 1

DESCRIPTION	UNIT OF MEASUREMENT	PARAMETERS
Point Source Designation	-	No. 1 Boiler Stack
Point Source Code	-	STCK 1
Point Source Location	Decimal Degrees	S 29.20048 E 26.70594
Release height (above ground)	m	21
Height above nearby Building	m	10
Diameter at Stack Exit	m	0.555
Actual Gas Exit Temperature	°C	120
Actual Gas Volumetric Flow	m^3/hr	6340
	m^3/sec	1.7611
Actual Gas Exit Velocity	m/sec	7.28

Table 15: Emission Rates for Boiler Stack No. 1

DESCRIPTION	CONCENTRATIONS				EMISSION RATE	
	Normal mg/m^3_n	Actual mg/m^3	Adjusted mg/m^3	Limits mg/m^3 adj.	Kg/hr	g/sec
Particulate Matter	341.46	204.74	653.63	250.00	1.405302	0.390362
Sulphur dioxide	224.81	134.80	430.34	2 800.00	0.925226	0.257007
Nitrogen oxides as NO_2	151.89	91.07	290.75	Not specified	0.625118	0.173644
Carbon monoxide	233.69	140.12	447.34	Not specified	0.961773	0.267159

Table 16: Emission Point Source Details for Boiler Stack No. 2

DESCRIPTION	UNIT OF MEASUREMENT	PARAMETERS
Point Source Designation	-	No. 2 Boiler Stack
Point Source Code	-	STCK 2
Point Source Location	Decimal Degrees	S 29.20055 E 26.70632
Release height (above ground)	m	21
Height above nearby Building	m	10

DESCRIPTION	UNIT OF MEASUREMENT	PARAMETERS
Diameter at Stack Exit	m	0.850
Actual Gas Exit Temperature	°C	137
Actual Gas Volumetric Flow	m^3/hr	7272
	m^3/sec	2.0200
Actual Gas Exit Velocity	m/sec	3.56

Table 17: Emission Rates for Boiler Stack No. 2

DESCRIPTION	CONCENTRATIONS				EMISSION RATE	
	Normal mg/m^3_n	Actual mg/m^3	Adjusted mg/m^3	Limits mg/m^3 adj.	Kg/hr	g/sec
Particulate Matter	147.90	84.48	180.18	250.00	0.614401	0.170667
Sulphur dioxide	439.96	251.31	535.96	2800.00	1.827618	0.507672
Nitrogen oxides as NO_2	143.68	82.07	175.03	Not Specified	0.596853	0.165792
Carbon monoxide	1455.90	831.61	1773.58	Not Specified	6.047895	1.679971

9.1 SIMULATED AMBIENT SO_2 CONCENTRATIONS

Simulated SO_2 concentrations are low compared to the standards as listed within the SA NAAQS at all the identified sensitive receptor locations (as illustrated within Table 18). The highest concentration recorded during the one-hour (1 hr) averaging period was one hundred and thirty-nine micro-grams per cubic metre (139.52176 $\mu g/m^3$) from receptor 19 (Industrial Warehouse) situated one hundred and fifty-six metres (156 m) towards east northeast. The highest concentration captured during the twenty-four-hour cycle was from Receptor 13 (Industrial Warehouse) situated ninety-three metres (93 m) towards the west of the activity with a concentration of twenty-five micro-grams per cubic metre (25 $\mu g/m^3$). Receptor No 12 (Industrial Warehouse) situated one hundred and fifteen metres (115 m) towards the west southwest will experience the highest concentration of SO_2 over an annual period with a concentration of six point six micro-grams per cubic metre (6.6 $\mu g/m^3$). The concentrations for the period of one-hour, twenty-four-hours and annually are sixty-one percent (61 %), eighty percent (80 %) and eighty-seven percent (87%) respectively below the allowed threshold as stipulated within the NAAQS.

Table 18: Simulated ambient SO2 concentrations on sensitive receptors

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY SO_2 CONCENTRATION (in $\mu g/m^3$)	SIMULATED HIGHEST 24 HRS SO_2 CONCENTRATION (in $\mu g/m^3$)	SIMULATED HIGHEST ANNUAL SO_2 CONCENTRATION (in $\mu g/m^3$)
1	Industrial Warehouse	Industrial	104.42832	16.15173	5.14951
2	Industrial Warehouse	Industrial	134.46260	16.04097	4.73379
3	Industrial Warehouse	Industrial	107.15862	11.65211	2.87757
4	Ye-Dah Knitting	Industrial	65.42955	8.43303	1.83376

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY SO_2 CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST 24 HRS SO_2 CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST ANNUAL SO_2 CONCENTRATION (in µg/m^3)
5	Industrial Warehouse	Industrial	61.47594	6.91704	1.44845
6	Industrial Warehouse	Industrial	82.89160	11.70816	2.68758
7	Industrial Warehouse	Industrial	97.06529	15.11285	3.19909
8	Industrial Warehouse	Industrial	79.62633	18.55427	4.58950
9	Industrial Warehouse	Industrial	72.48377	14.58574	3.38689
10	Industrial Warehouse	Industrial	52.72378	14.26788	4.23466
11	Industrial Warehouse	Industrial	74.48103	19.91240	6.42636
12	Industrial Warehouse	Industrial	82.49900	21.40614	6.65340
13	Industrial Warehouse	Industrial	72.33870	25.00950	5.26484
14	JT Workshop	Industrial	135.36473	21.39115	4.35553
15	Industrial Warehouse	Industrial	64.36093	13.16774	4.00593
16	Industrial Warehouse	Industrial	56.80159	17.90906	3.57349
17	Industrial Warehouse	Industrial	69.31864	17.02926	2.78744
18	Industrial Warehouse	Industrial	81.42809	18.15603	2.96951
19	Industrial Warehouse	Industrial	139.52176	17.37627	4.15164
20	Botshabelo Mall	Mall	38.32987	4.37640	0.95089
21	Botshabelo H1 Neighbourhood	Residential	45.72396	3.80187	0.31735
22	Setjhaba Se Maketse Combined School	School	42.33041	3.57296	0.31964
23	Botshabelo H1 Neighbourhood	Residential	37.29800	2.32274	0.17051
24	Seithati Primary School	School	72.97742	5.73480	0.12596
25	Botshabelo H1 Neighbourhood	Residential	55.55486	4.74947	0.10580
26	Botshabelo Cemetery	Cemetery	38.41497	2.64551	0.06783
27	Botshabelo H1 Neighbourhood	Residential	41.36841	4.6177	0.26246
28	Lenyora La Thuto Secondary School	School	36.60918	3.65984	0.18661
29	Botshabelo H1 Neighbourhood	Residential	33.64277	3.28060	0.14682
30	Hohle Primary School	School	22.70281	1.69492	0.07648

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY SO_2 CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST 24 HRS SO_2 CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST ANNUAL SO_2 CONCENTRATION (in µg/m^3)
31	Botshabelo G Neighbourhood	Residential	21.56624	1.64460	0.05525
32	Grassland	Grassland	3.36925	0.16372	0.00633
33	Botshabelo District Hospital	Hospital	16.52186	1.06576	0.05040
34	Botshabelo Traffic Department	Traffic Department	14.56912	0.92462	0.04970
35	Industrial Warehouse	Industrial	40.69013	8.08094	0.39189
36	Botshabelo J Neighbourhood	Residential	24.47947	2.79282	0.11460
37	Bolokehang Intermediate School	School	19.35479	2.16508	0.09903
38	Kaizer Sebothelo Stadium	Stadium	15.28558	1.61601	0.06470
39	Botshabelo C Neighbourhood	Residential	10.81895	0.82042	0.03782
40	Industrial Warehouse	Industrial	45.49200	5.91602	0.73268
41	Botshabelo K Neighbourhood	Residential	32.91896	3.52315	0.29166
42	Reentseng Primary School	School	29.04968	2.78368	0.23519
43	Retsamaile Primary School	School	21.03243	1.55570	0.13516
44	Botshabelo F Neighbourhood	Residential	18.14699	1.49828	0.10384
45	Botshabelo F Neighbourhood	Residential	13.80758	1.18039	0.07364
46	Grassland	Grassland	11.55937	0.99639	0.06059
47	Botshabelo IA Neighbourhood	Industrial	55.97664	7.72473	0.68875
48	Grassland	Grassland	37.93641	3.91824	0.33133
49	Seemahale Secondary School	School	22.80714	1.96537	0.12687

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY SO_2 CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS SO_2 CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL SO_2 CONCENTRATION (in µg/m³)
50	Botshabelo Residential Area	Residential	16.55818	1.49815	0.10573
51	Industrial Warehouse	Industrial	49.95236	7.29412	0.72243
52	Grassland	Grassland	33.05913	4.02694	0.18655
53	Agricultural Farmland	Agricultural	12.99876	1.07084	0.05424
54	Grassland	Grassland	42.12152	3.51868	0.25785
55	Grassland	Grassland	13.26194	0.97734	0.04408
56	Grassland	Grassland	47.10066	2.72532	0.24711
57	Agricultural Farmland	Agricultural	22.75103	1.14884	0.06754

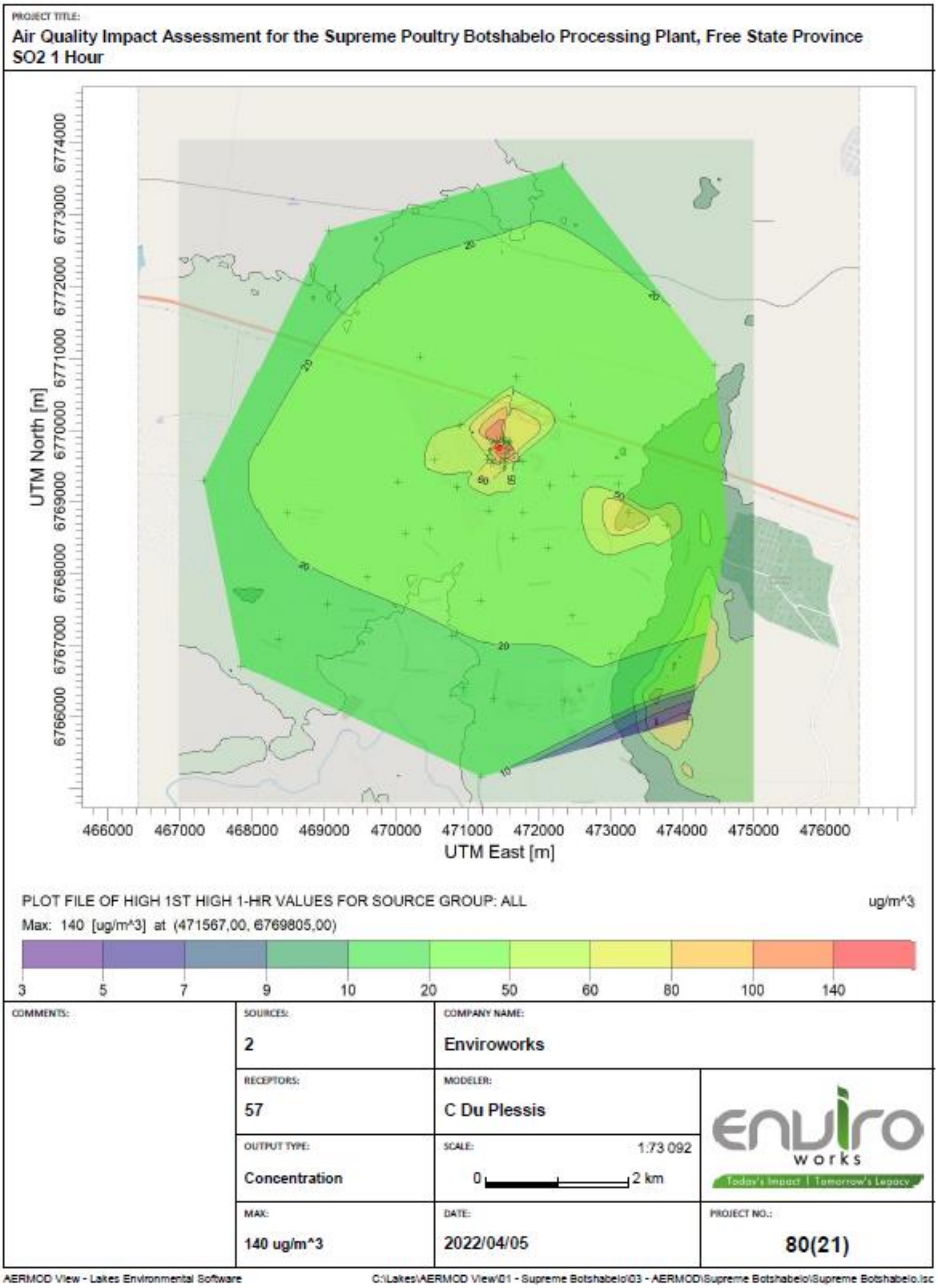

Figure 19: SO2 concentration over a one-hour period.

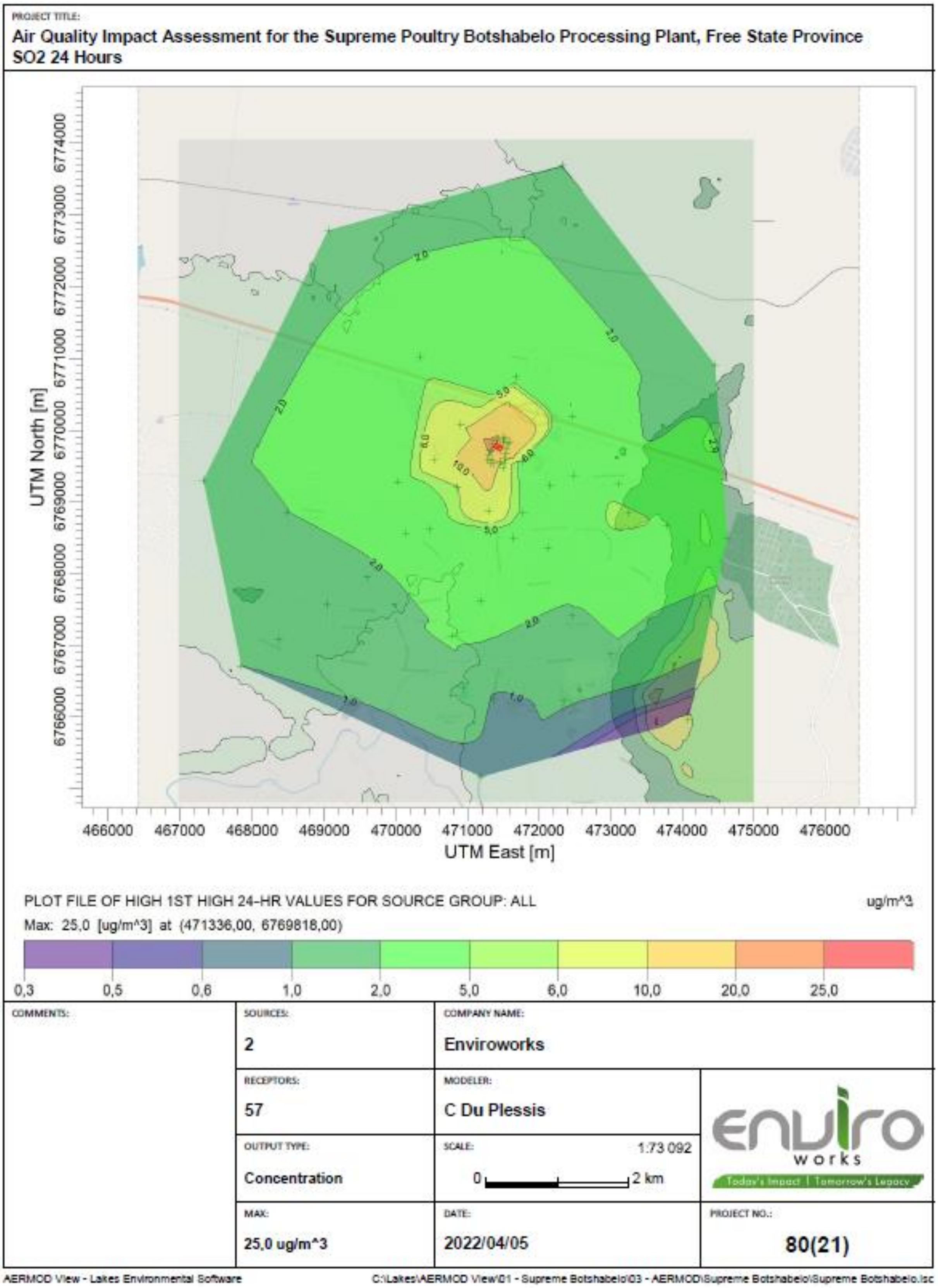

Figure 20: SO2 concentration over a twenty-four-hour period.

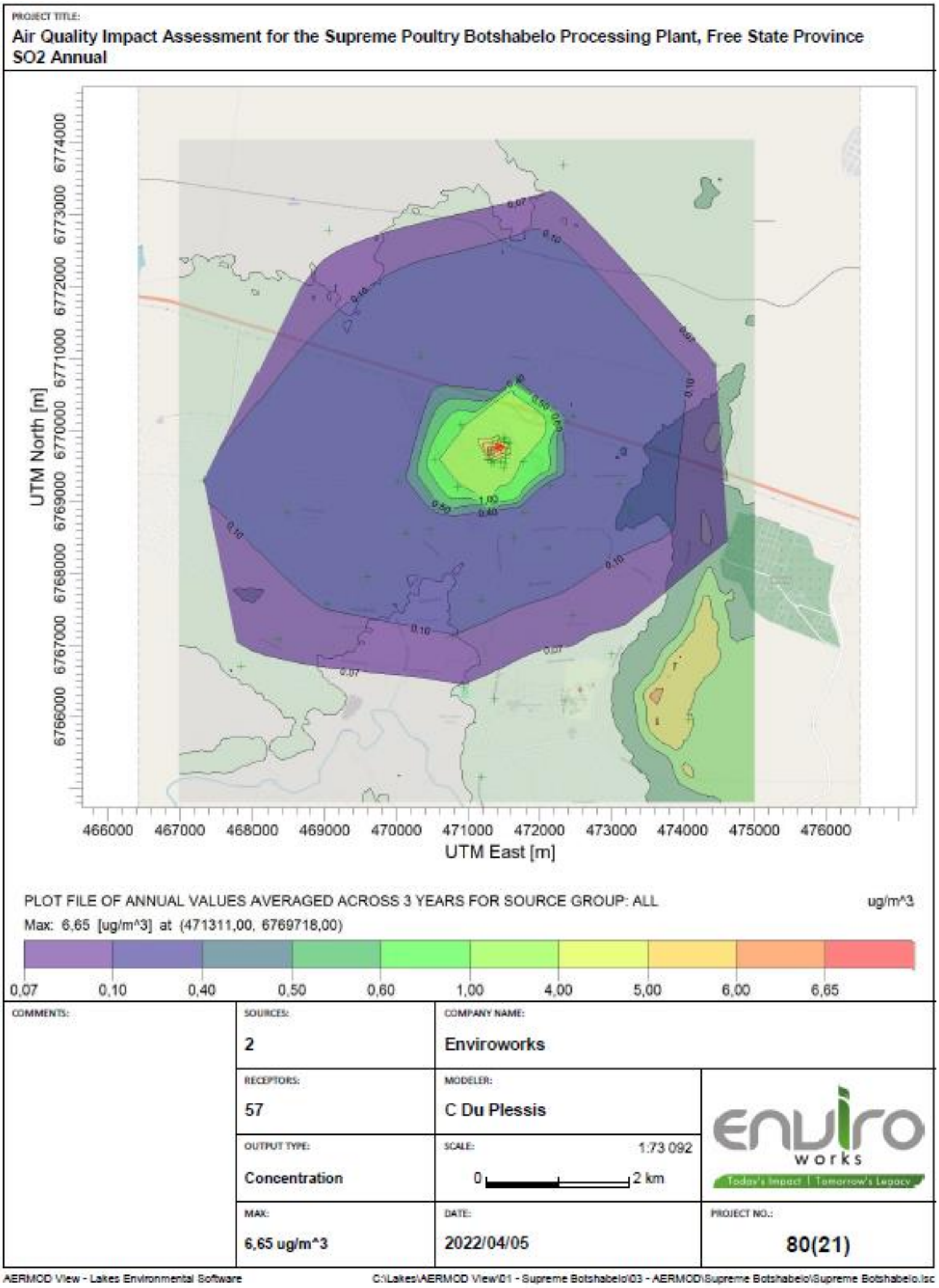

Figure 21: SO2 concentrations over an annual period.

9.2 SIMULATED AMBIENT NO_2 CONCENTRATIONS

Table 19 illustrates the concentration values for Nitrogen Oxides (NO_2) over a one-hour (1 hr), twenty-four-hour (24 h) and annual period respectively. Sixty-one point eight micro-grams per cubic metre (61 µg/m^3) was the highest concentration recorded over the hourly simulation and occurred as Receptor 19. Receptor 19 is situated one hundred and fifty-six metres (156 m) towards the east northeast and consist of an industrial warehouse. Over the twenty-four-hour (24 h) period the highest concentration captured was ten point nine micro-grams per cubic metre (10.9 µg/m^3) and was simulated at Receptor 13 (Industrial Warehouse). The highest annual concentration was simulated from Receptor 12 (Industrial Warehouse) with a peak of three micro-grams per cubic metre (3 µg/m^3). Receptor 12 is situated one hundred and fifteen metres (115 m) towards the west southwest of the activity. The concentration value over an hourly period is seventy percent (70 %) below the NAAQS thresholds and ninety-three percent (93 %) over an annual period.

Table 19: Simulated ambient NO2 concentrations on sensitive receptors.

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY NO_2 CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST 24 HRS NO_2 CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST ANNUAL NO_2 CONCENTRATION (in µg/m^3)
1	Industrial Warehouse	Industrial	50.51112	7.37724	2.17591
2	Industrial Warehouse	Industrial	59.44709	6.81929	1.98093
3	Industrial Warehouse	Industrial	45.51864	4.95366	1.21937
4	Ye-Dah Knitting	Industrial	29.21426	3.60280	0.78494
5	Industrial Warehouse	Industrial	26.31612	2.97550	0.62270
6	Industrial Warehouse	Industrial	33.04884	4.76543	1.13910
7	Industrial Warehouse	Industrial	43.97855	6.59566	1.36249
8	Industrial Warehouse	Industrial	35.19835	8.25775	1.99371
9	Industrial Warehouse	Industrial	31.45478	6.43978	1.47101
10	Industrial Warehouse	Industrial	22.52019	6.37479	1.89420
11	Industrial Warehouse	Industrial	28.99217	8.87304	2.91582
12	Industrial Warehouse	Industrial	34.59642	9.56315	3.05597
13	Industrial Warehouse	Industrial	28.60503	10.90871	2.31660
14	JT Workshop	Industrial	55.08197	8.78955	1.87923
15	Industrial Warehouse	Industrial	26.36295	6.36805	1.76251
16	Industrial Warehouse	Industrial	24.36369	8.17426	1.56316
17	Industrial Warehouse	Industrial	27.45005	7.67072	1.22105
18	Industrial Warehouse	Industrial	39.72450	7.48566	1.27770
19	Industrial Warehouse	Industrial	61.87193	7.25984	1.74932
20	Botshabelo Mall	Mall	16.75797	1.89730	0.41007
21	Botshabelo H1 Neighbourhood	Residential	20.05836	1.66605	0.13919

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY NO_2 CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS NO_2 CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL NO_2 CONCENTRATION (in µg/m³)
22	Setjhaba Se Maketse Combined School	School	18.61695	1.58847	0.14031
23	Botshabelo H1 Neighbourhood	Residential	16.52723	1.02168	0.07549
24	Seithati Primary School	School	33.79868	2.61107	0.05631
25	Botshabelo H1 Neighbourhood	Residential	22.50815	2.01150	0.04644
26	Botshabelo Cemetery	Cemetery	18.31333	1.21686	0.03055
27	Botshabelo H1 Neighbourhood	Residential	18.21712	1.99813	0.11555
28	Lenyora La Thuto Secondary School	School	16.18674	1.59632	0.08235
29	Botshabelo H1 Neighbourhood	Residential	14.85451	1.45753	0.06473
30	Hohle Primary School	School	10.03728	0.75546	0.03377
31	Botshabelo G Neighbourhood	Residential	9.49034	0.72722	0.02447
32	Grassland	Grassland	1.49898	0.07283	0.00281
33	Botshabelo District Hospital	Hospital	7.31285	0.47306	0.02227
34	Botshabelo Traffic Department	Traffic Department	6.47870	0.41189	0.02196
35	Industrial Warehouse	Industrial	18.07532	3.54861	0.17165
36	Botshabelo J Neighbourhood	Residential	10.83465	1.22627	0.05047
37	Bolokehang Intermediate School	School	8.57735	0.96227	0.04383
38	Kaizer Sebothelo Stadium	Stadium	6.75696	0.71347	0.02856
39	Botshabelo C Neighbourhood	Residential	4.83015	0.36024	0.01671
40	Industrial Warehouse	Industrial	20.11399	2.63745	0.32594

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY NO_2 CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS NO_2 CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL NO_2 CONCENTRATION (in µg/m³)
41	Botshabelo K Neighbourhood	Residential	14.55755	1.58433	0.12975
42	Reentseng Primary School	School	12.95780	1.21783	0.10462
43	Retsamaile Primary School	School	9.30854	0.69408	0.06008
44	Botshabelo F Neighbourhood	Residential	8.05156	0.65769	0.04610
45	Botshabelo F Neighbourhood	Residential	6.11368	0.52018	0.03270
46	Grassland	Grassland	5.14605	0.43988	0.02691
47	Botshabelo IA Neighbourhood	Industrial	24.84565	3.43125	0.30693
48	Grassland	Grassland	16.80779	1.74159	0.14705
49	Seemahale Secondary School	School	10.07851	0.86794	0.05662
50	Botshabelo Residential Area	Residential	7.30473	0.66186	0.04685
51	Industrial Warehouse	Industrial	21.82683	3.25659	0.32308
52	Grassland	Grassland	14.67716	1.77587	0.08285
53	Agricultural Farmland	Agricultural	5.78130	0.47420	0.02411
54	Grassland	Grassland	18.49404	1.53216	0.11387
55	Grassland	Grassland	5.87672	0.43259	0.01953
56	Grassland	Grassland	19.25573	1.18045	0.10845
57	Agricultural Farmland	Agricultural	10.10130	0.51012	0.03001

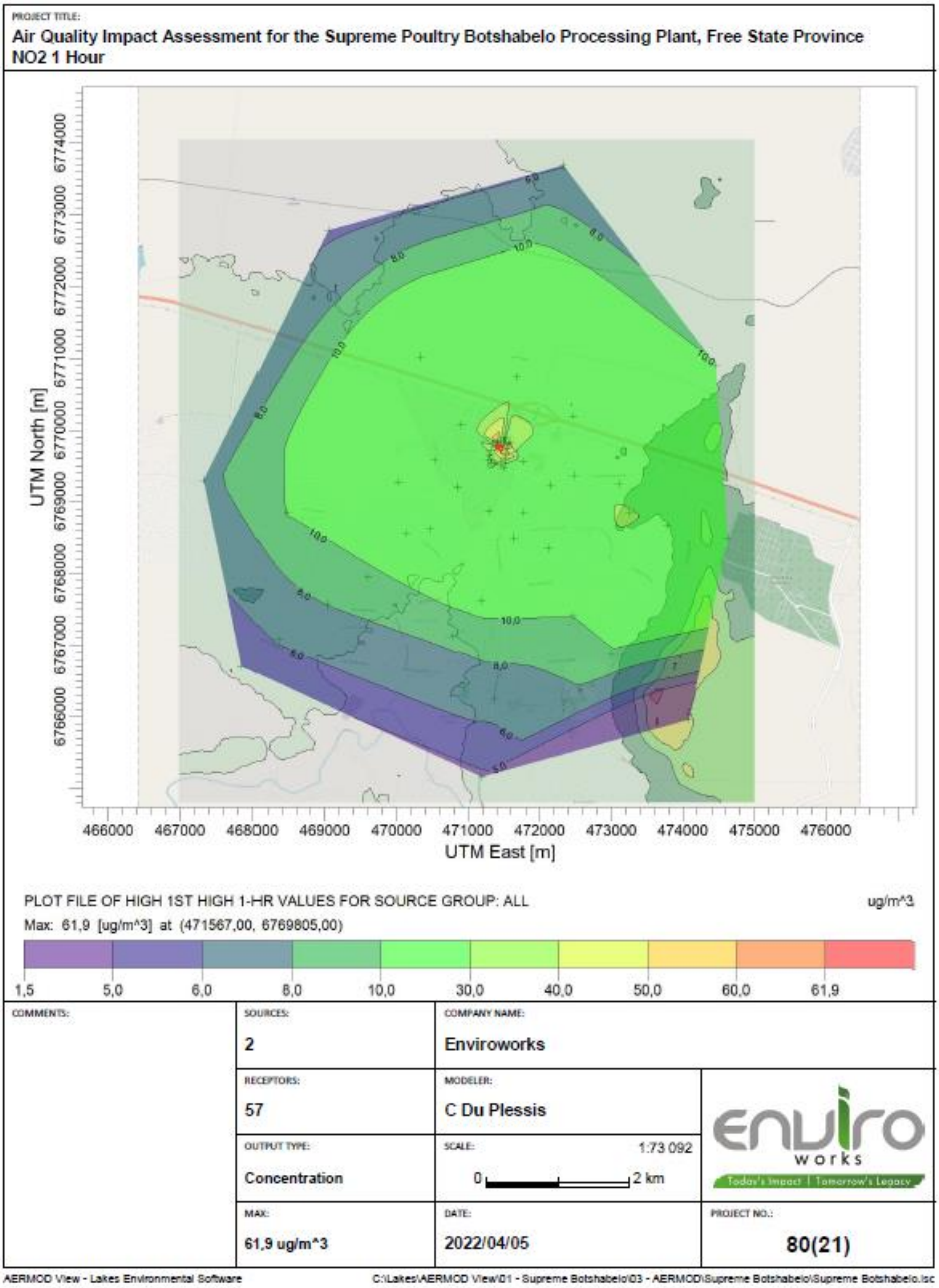

Figure 22: NO2 concentration over a one-hour period.

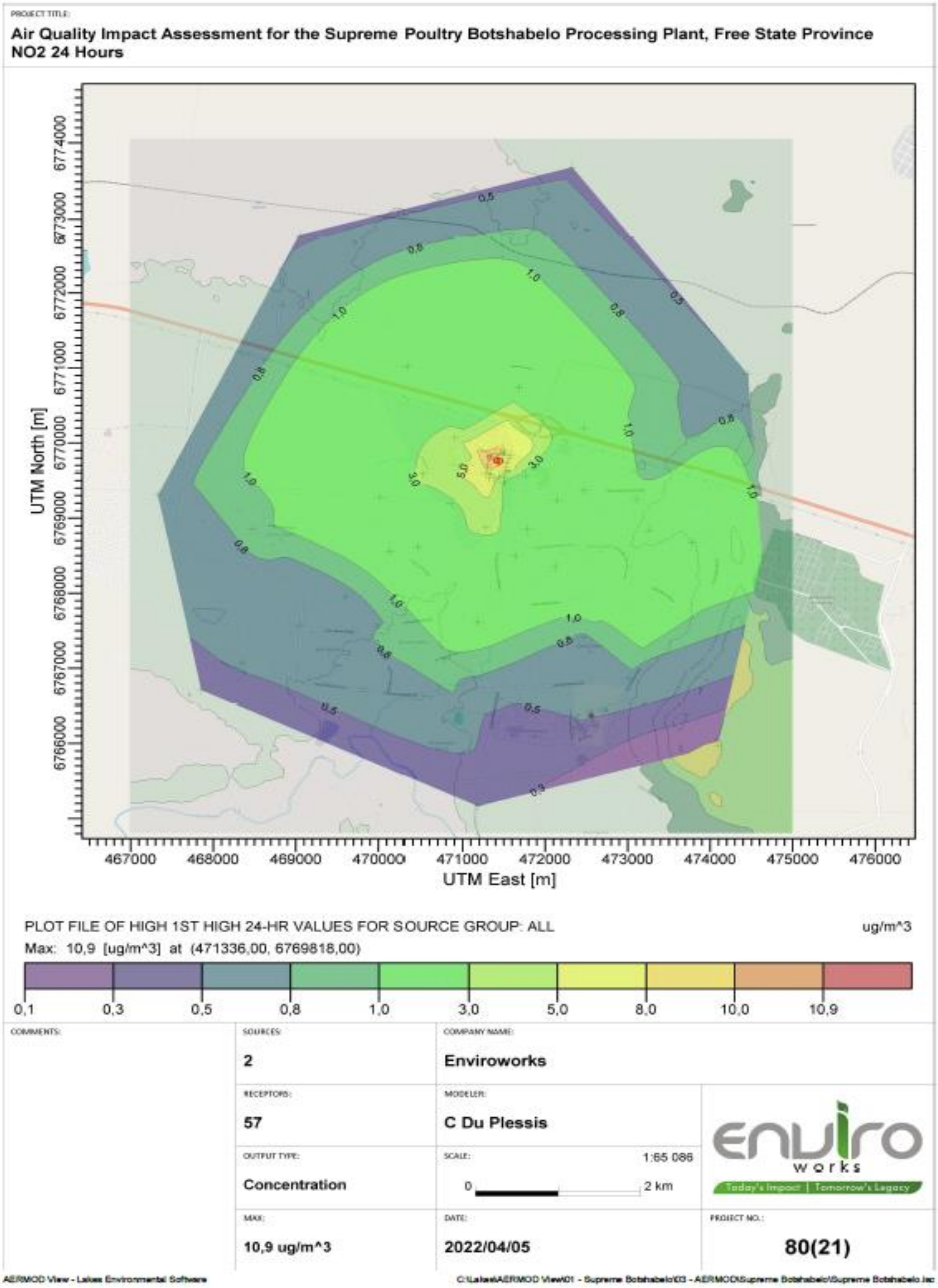

Figure 23: NO2 concentrations over a twenty-four-hour period.

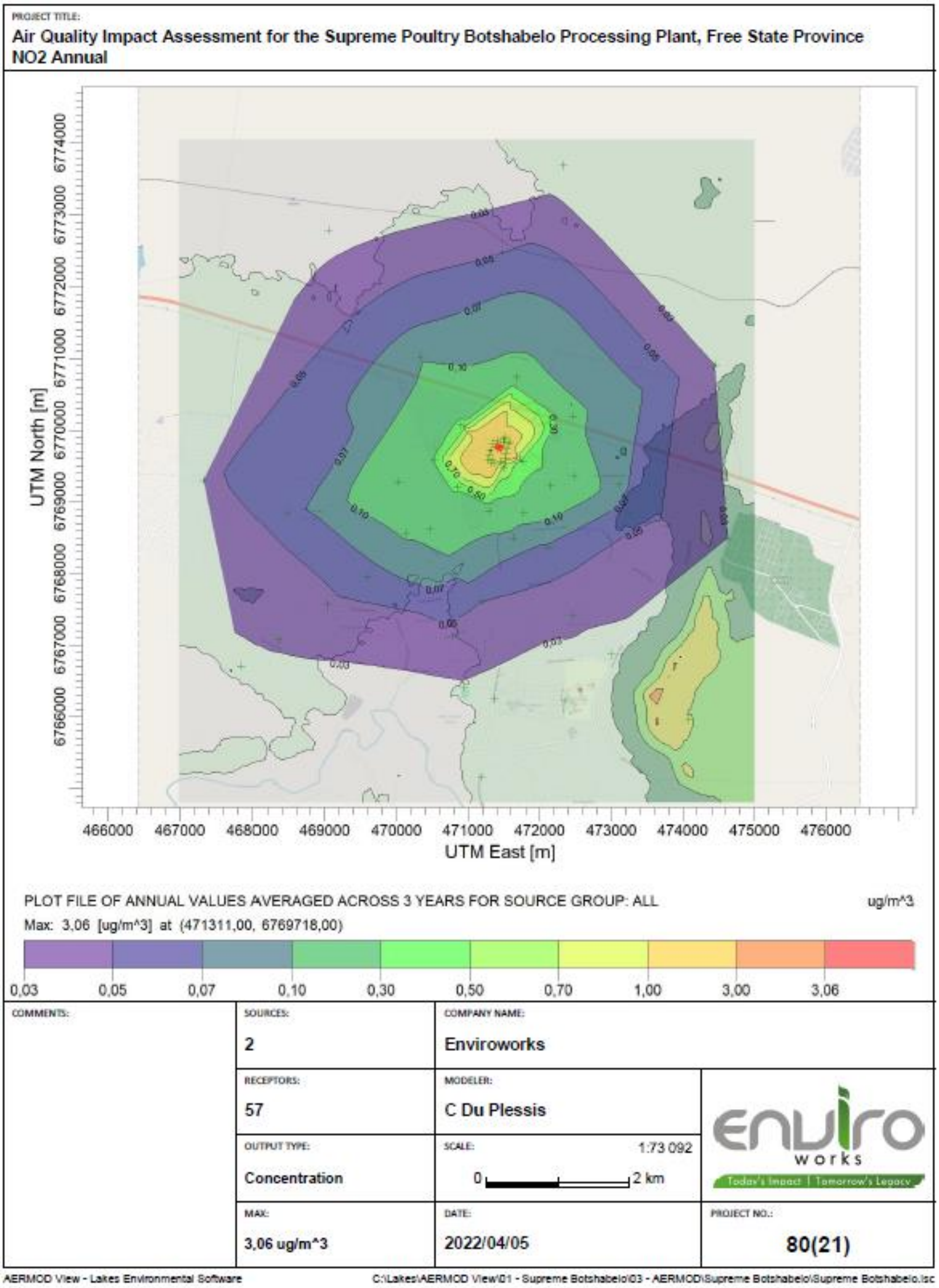

Figure 24: NO2 concentration on an annual period.

9.3 SIMULATED AMBIENT PM_{10} CONCENTRATIONS UNDER CONTROLLED CONDITIONS

Simulated PM_{10} concentrations for the hourly period won't exceed one hundred and two micro-grams per cubic metre (102 µg/m^3). The highest concentration during the hourly period will occur at Receptor 19 (Industrial Warehousing) situated one hundred and fifty-six metres (156 m) towards the east northeast of the activity. During the twenty-four-hour (24 hr) period the highest concentration will occur at Receptor 13 which consist of Industrial Warehousing and is situated ninety-three metres (93 m) towards the west. The concentration captured at Receptor 13 was seventeen point six micro-grams per cubic metre (17.6 µg/m^3). The highest concentration for Particulate Matter over an annual period was five point two micro-grams per cubic metre (5.2 µg/m^3) and was captured at Receptor 12 situated one hundred and fifteen metres (115 m) towards the west southwest of the activity. When compared against the NAAQS it was found that over a twenty-four-hour (24 hr) period the concentration was seventy-seven percent (77 %) below the threshold and eighty-seven percent (87 %) below the threshold over the annual period.

Table 20: Simulated ambient PM10 concentrations on sensitive receptors.

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY PM_{10} CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST 24 HRS PM_{10} CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST ANNUAL PM_{10} CONCENTRATION (in µg/m^3)
1	Industrial Warehouse	Industrial	90.69843	12.55355	3.40563
2	Industrial Warehouse	Industrial	97.83932	10.74843	3.06527
3	Industrial Warehouse	Industrial	71.67979	7.80812	1.91481
4	Ye-Dah Knitting	Industrial	48.58201	5.71089	1.24695
5	Industrial Warehouse	Industrial	41.80809	4.75326	0.99406
6	Industrial Warehouse	Industrial	48.12302	7.66796	1.78919
7	Industrial Warehouse	Industrial	74.23672	10.70567	2.15206
8	Industrial Warehouse	Industrial	57.92123	13.68616	3.21971
9	Industrial Warehouse	Industrial	50.73936	10.58356	2.37510
10	Industrial Warehouse	Industrial	38.84156	10.68213	3.15589
11	Industrial Warehouse	Industrial	51.75609	14.78447	4.92904
12	Industrial Warehouse	Industrial	59.41592	15.91227	5.22897
13	Industrial Warehouse	Industrial	49.82219	17.69556	3.79351
14	JT Workshop	Industrial	82.35454	13.74876	3.01205
15	Industrial Warehouse	Industrial	39.74443	12.15959	2.88589
16	Industrial Warehouse	Industrial	40.10105	14.26165	2.54358
17	Industrial Warehouse	Industrial	40.51919	13.44202	1.98994
18	Industrial Warehouse	Industrial	71.86876	11.37696	2.04161
19	Industrial Warehouse	Industrial	102.15796	12.28199	2.72895
20	Botshabelo Mall	Mall	27.25305	3.05720	0.65689

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY PM_{10} CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS PM_{10} CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL PM_{10} CONCENTRATION (in µg/m³)
21	Botshabelo H1 Neighbourhood	Residential	32.73964	2.71626	0.22714
22	Setjhaba Se Maketse Combined School	School	30.83641	2.62973	0.22918
23	Botshabelo H1 Neighbourhood	Residential	27.26613	1.67242	0.12442
24	Seithati Primary School	School	58.30067	4.42920	0.09377
25	Botshabelo H1 Neighbourhood	Residential	33.46708	3.15675	0.07584
26	Botshabelo Cemetery	Cemetery	32.45736	2.08507	0.05127
27	Botshabelo H1 Neighbourhood	Residential	29.85630	3.21290	0.18932
28	Lenyora La Thuto Secondary School	School	26.64310	2.58941	0.13528
29	Botshabelo H1 Neighbourhood	Residential	24.42467	2.41128	0.10622
30	Hohle Primary School	School	16.51988	1.25402	0.05551
31	Botshabelo G Neighbourhood	Residential	15.54227	1.19711	0.04034
32	Grassland	Grassland	2.48344	0.12066	0.00464
33	Botshabelo District Hospital	Hospital	12.05028	0.78183	0.03665
34	Botshabelo Traffic Department	Traffic Department	10.72824	0.68329	0.03613
35	Industrial Warehouse	Industrial	29.89834	5.79848	0.27970
36	Botshabelo J Neighbourhood	Residential	17.85292	2.00347	0.08273
37	Bolokehang Intermediate School	School	14.15237	1.59256	0.07220
38	Kaizer Sebothelo Stadium	Stadium	11.11913	1.17252	0.04693
39	Botshabelo C Neighbourhood	Residential	8.03146	0.58860	0.02748

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY PM_{10} CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS PM_{10} CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL PM_{10} CONCENTRATION (in µg/m³)
40	Industrial Warehouse	Industrial	33.15980	4.37897	0.53996
41	Botshabelo K Neighbourhood	Residential	23.96677	2.65407	0.21496
42	Reentseng Primary School	School	21.52605	1.98191	0.17330
43	Retsamaile Primary School	School	15.33750	1.15329	0.09944
44	Botshabelo F Neighbourhood	Residential	13.33621	1.07423	0.07621
45	Botshabelo F Neighbourhood	Residential	10.07810	0.85321	0.05406
46	Grassland	Grassland	8.53144	0.72285	0.04449
47	Botshabelo IA Neighbourhood	Industrial	41.06206	5.67525	0.50938
48	Grassland	Grassland	27.72497	2.88255	0.24300
49	Seemahale Secondary School	School	16.57919	1.42680	0.09412
50	Botshabelo Residential Area	Residential	11.99480	1.08846	0.07729
51	Industrial Warehouse	Industrial	35.86558	5.41518	0.53815
52	Grassland	Grassland	24.26302	2.91497	0.13702
53	Agricultural Farmland	Agricultural	9.57498	0.78179	0.03990
54	Grassland	Grassland	30.60118	2.48074	0.18717
55	Grassland	Grassland	9.69556	0.71285	0.03221
56	Grassland	Grassland	31.23191	1.90023	0.17711
57	Agricultural Farmland	Agricultural	16.69962	0.84341	0.04966

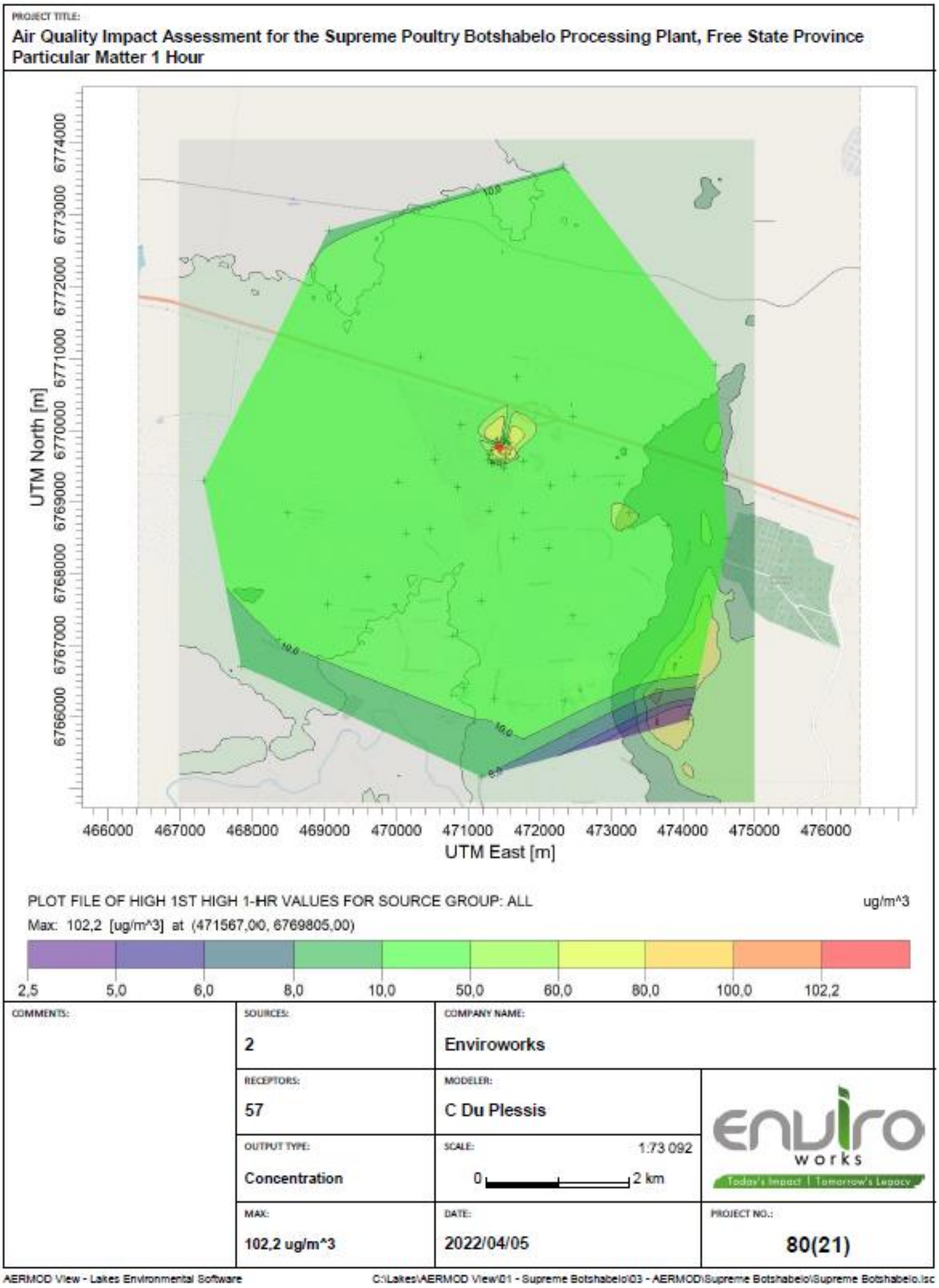

Figure 25: PM10 concentrations over a one-hour period.

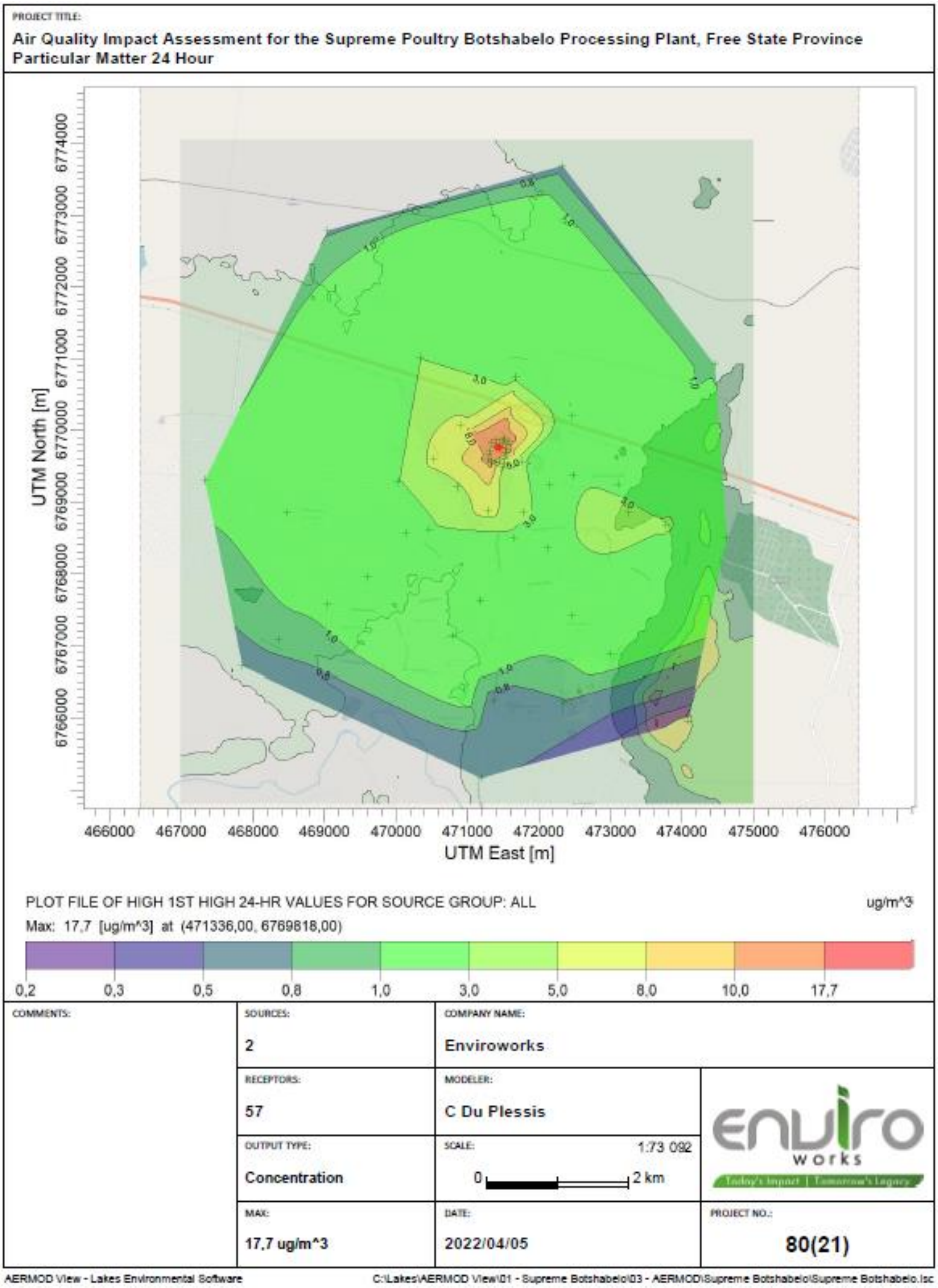

Figure 26: PM10 concentrations over a twenty-four-hour period.

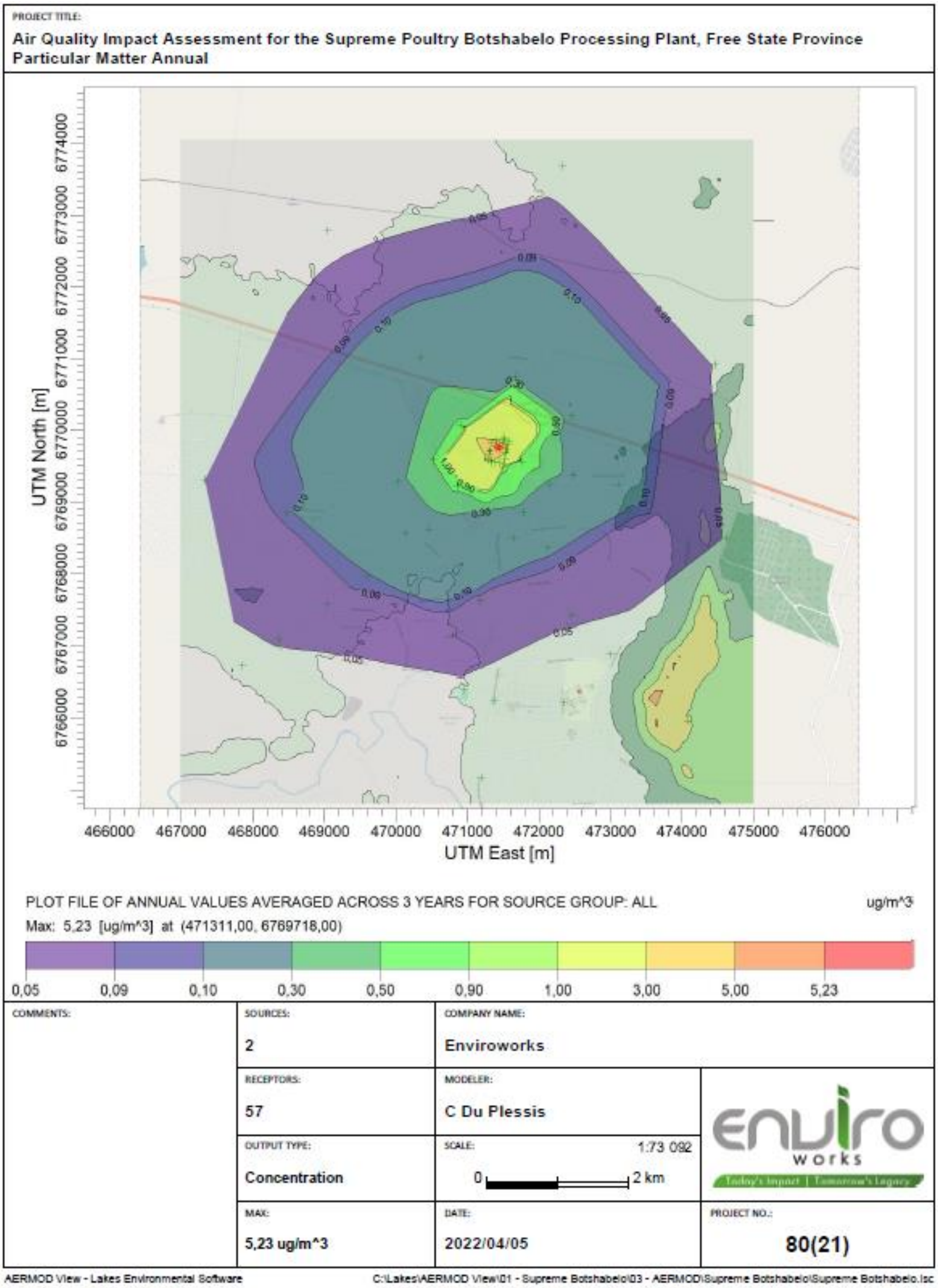

Figure 27: PM10 concentrations over an annual period.

9.4 SIMULATED AMBIENT CO CONCENTRATIONS UNDER CONTROLLED CONDITIONS

Simulated CO concentrations under controlled conditions illustrated that the highest concentration over an hourly period will be three hundred and seventy-seven micro-grams per cubic metre (377 µg/m^3) and will occur at Receptor 14 situated ninety-eight metres (98 m) towards the north northwest and consist of a workshop. The highest concentration over the twenty-four-hour (24 hr) period will occur from Receptor 13 with a concentration of sixty-four point nine micro-grams per cubic metre (64 µg/m^3). Simulated results for Carbon Monoxide over an annual period illustrated that the highest concentration will occur from Receptor 12 with a maximum concentration of sixteen point two micro-grams per cubic metre (16.2 µg/m^3). When compared against the NAAQS it was found that over a one-hour (1 hr) period the concentration was ninety-eight percent (98 %) below the threshold.

Table 21: Simulated ambient CO concentrations on all sensitive observers.

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY CO CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST 24 HRS CO CONCENTRATION (in µg/m^3)	SIMULATED HIGHEST ANNUAL CO CONCENTRATION (in µg/m^3)
1	Industrial Warehouse	Industrial	238.88640	39.77795	13.82715
2	Industrial Warehouse	Industrial	343.94737	42.80408	12.83642
3	Industrial Warehouse	Industrial	286.18059	31.09180	7.70417
4	Ye-Dah Knitting	Industrial	165.49698	22.38729	4.85829
5	Industrial Warehouse	Industrial	162.86269	18.23032	3.81998
6	Industrial Warehouse	Industrial	235.42807	32.97574	7.19399
7	Industrial Warehouse	Industrial	241.36161	39.21606	8.52025
8	Industrial Warehouse	Industrial	203.71292	47.10478	11.96951
9	Industrial Warehouse	Industrial	189.25145	37.36604	8.83484
10	Industrial Warehouse	Industrial	139.99741	36.06180	10.68883
11	Industrial Warehouse	Industrial	231.72375	50.48223	15.95271
12	Industrial Warehouse	Industrial	241.02992	56.66433	16.27493
13	Industrial Warehouse	Industrial	207.02217	64.93649	13.53882
14	JT Workshop	Industrial	377.23076	59.05851	11.44281
15	Industrial Warehouse	Industrial	178.23109	37.17933	10.30249
16	Industrial Warehouse	Industrial	165.60606	50.58753	9.24939
17	Industrial Warehouse	Industrial	198.09584	47.13624	7.20357
18	Industrial Warehouse	Industrial	184.07161	49.96150	7.82440
19	Industrial Warehouse	Industrial	355.66513	47.19367	11.17983
20	Botshabelo Mall	Mall	99.26795	11.43868	2.49950
21	Botshabelo H1 Neighbourhood	Residential	117.97739	9.82112	0.81902

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY CO CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS CO CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL CO CONCENTRATION (in µg/m³)
22	Setjhaba Se Maketse Combined School	School	109.22162	9.08198	0.82413
23	Botshabelo H1 Neighbourhood	Residential	95.16254	5.97536	0.43548
24	Seithati Primary School	School	176.69295	14.17728	0.31813
25	Botshabelo H1 Neighbourhood	Residential	155.45578	12.72288	0.27281
26	Botshabelo Cemetery	Cemetery	89.61714	6.45979	0.16984
27	Botshabelo H1 Neighbourhood	Residential	106.28751	12.09436	0.67453
28	Lenyora La Thuto Secondary School	School	93.63437	9.50290	0.47831
29	Botshabelo H1 Neighbourhood	Residential	86.18142	8.34513	0.37675
30	Hohle Primary School	School	58.07132	4.29570	0.19588
31	Botshabelo G Neighbourhood	Residential	55.45306	4.20596	0.14105
32	Grassland	Grassland	8.55717	0.41584	0.01614
33	Botshabelo District Hospital	Hospital	42.20736	2.71399	0.12895
34	Botshabelo Traffic Department	Traffic Department	37.02268	2.35985	0.12720
35	Industrial Warehouse	Industrial	103.52473	20.82692	1.01290
36	Botshabelo J Neighbourhood	Residential	62.53862	7.19890	0.29439
37	Bolokehang Intermediate School	School	49.37560	5.50519	0.25305
38	Kaizer Sebothelo Stadium	Stadium	39.10566	4.14008	0.16578
39	Botshabelo C Neighbourhood	Residential	27.36862	2.11463	0.09684
40	Industrial Warehouse	Industrial	118.16711	15.32434	1.86103

ID	RECEPTOR	LANDUSE	SIMULATED HIGHEST HOURLY CO CONCENTRATION (in µg/m³)	SIMULATED HIGHEST 24 HRS CO CONCENTRATION (in µg/m³)	SIMULATED HIGHEST ANNUAL CO CONCENTRATION (in µg/m³)
41	Botshabelo K Neighbourhood	Residential	84.18006	8.83831	0.74077
42	Reentseng Primary School	School	73.56447	7.20414	0.59745
43	Retsamaile Primary School	School	53.73517	3.93848	0.34364
44	Botshabelo F Neighbourhood	Residential	46.63711	3.86316	0.26437
45	Botshabelo F Neighbourhood	Residential	35.25899	3.03027	0.18745
46	Grassland	Grassland	29.33702	2.55283	0.15420
47	Botshabelo IA Neighbourhood	Industrial	142.54846	19.65483	1.74602
48	Grassland	Grassland	96.80647	9.96215	0.84384
49	Seemahale Secondary School	School	58.37003	5.03357	0.32105
50	Botshabelo Residential Area	Residential	42.45744	3.83534	0.26976
51	Industrial Warehouse	Industrial	131.52919	18.45115	1.82396
52	Grassland	Grassland	84.16390	10.32976	0.47472
53	Agricultural Farmland	Agricultural	33.02620	2.73416	0.13791
54	Grassland	Grassland	108.76412	9.15326	0.66045
55	Grassland	Grassland	33.83544	2.49669	0.11250
56	Grassland	Grassland	130.67522	7.13008	0.63724
57	Agricultural Farmland	Agricultural	57.91705	2.92430	0.17176

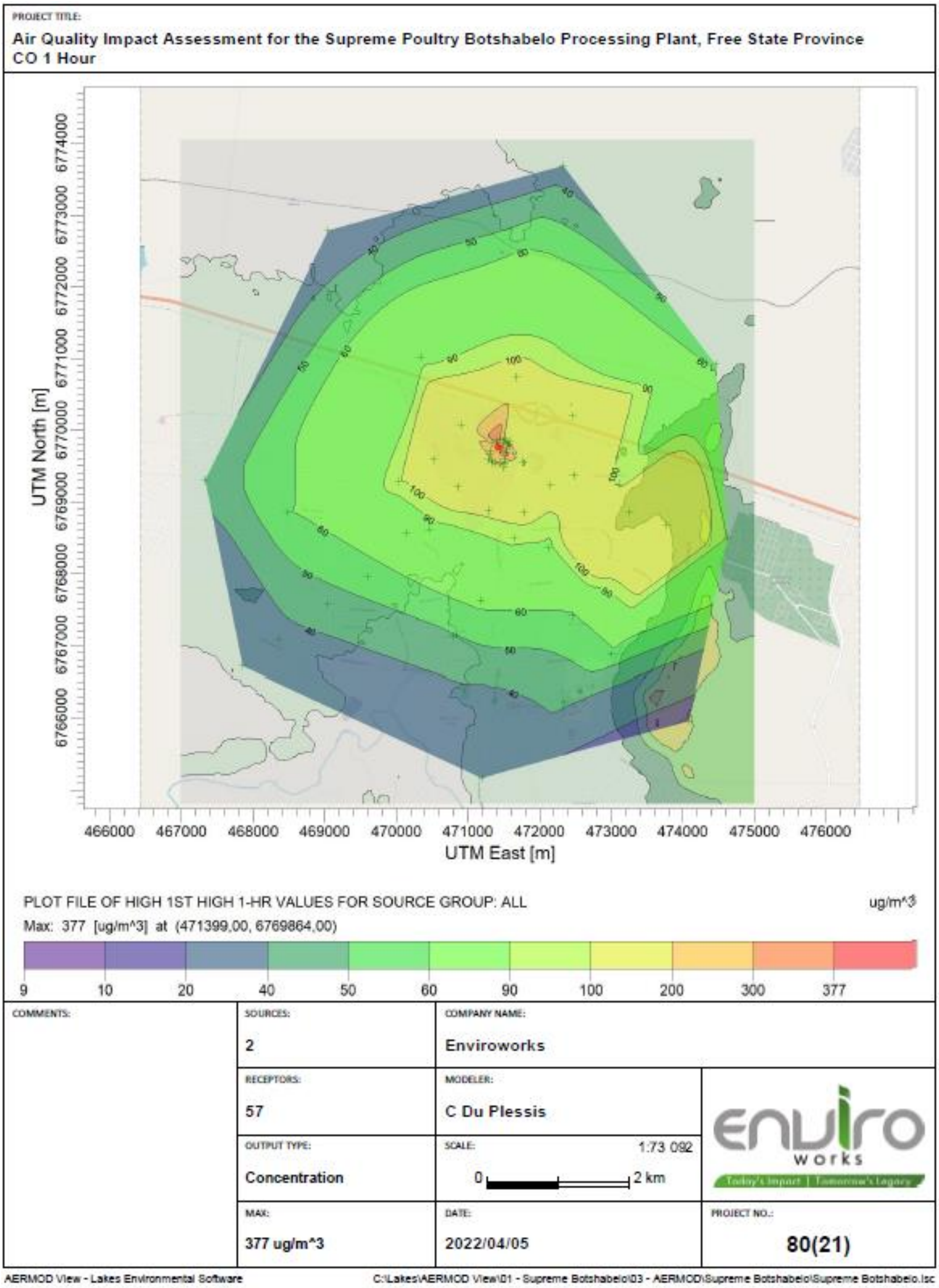

Figure 28: CO concentrations over a one-hour period.

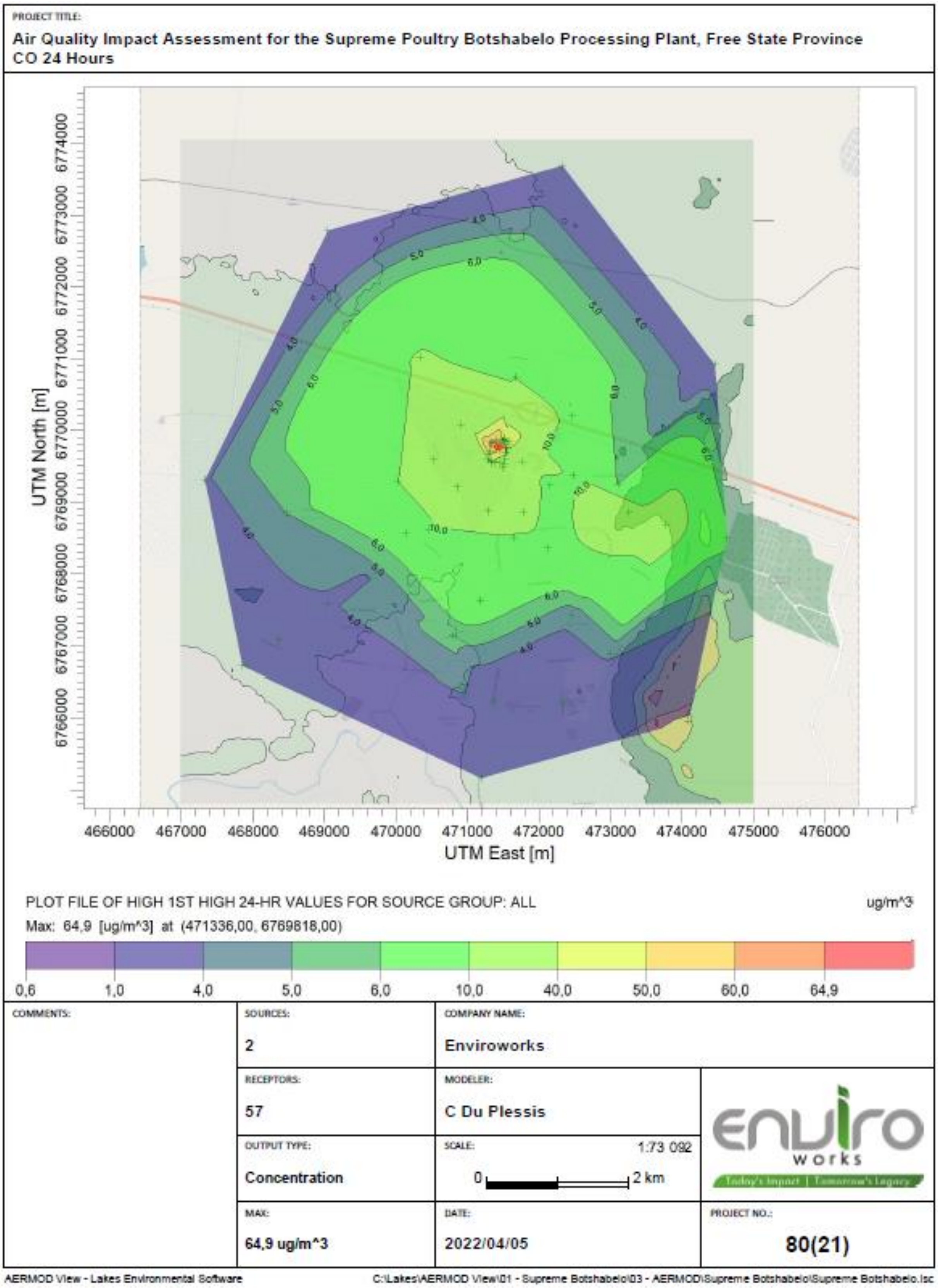

Figure 29: CO concentrations over a twenty-four-hour period.

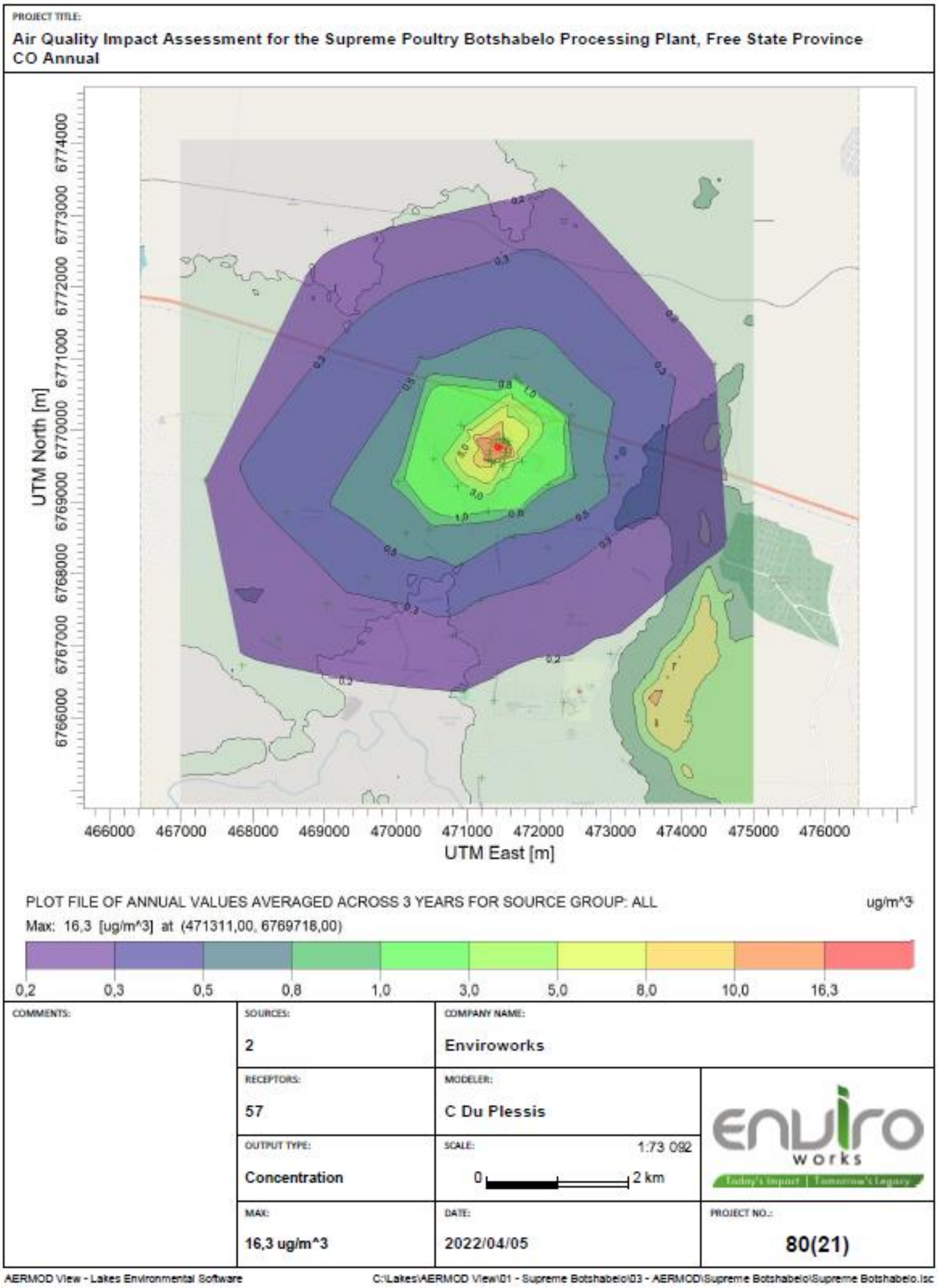

Figure 30: CO concentrations over an annual period.

9.5 SIMULATED METALS, HCL, HFL AND DIOXINS

Simulated metals, compound acids and dioxin concentrations due to the operation of the activity being applied for are undetectable at all identified sensitive receptor locations and as such is well below the listed thresholds described in Section 21 of the NEM:AQA.

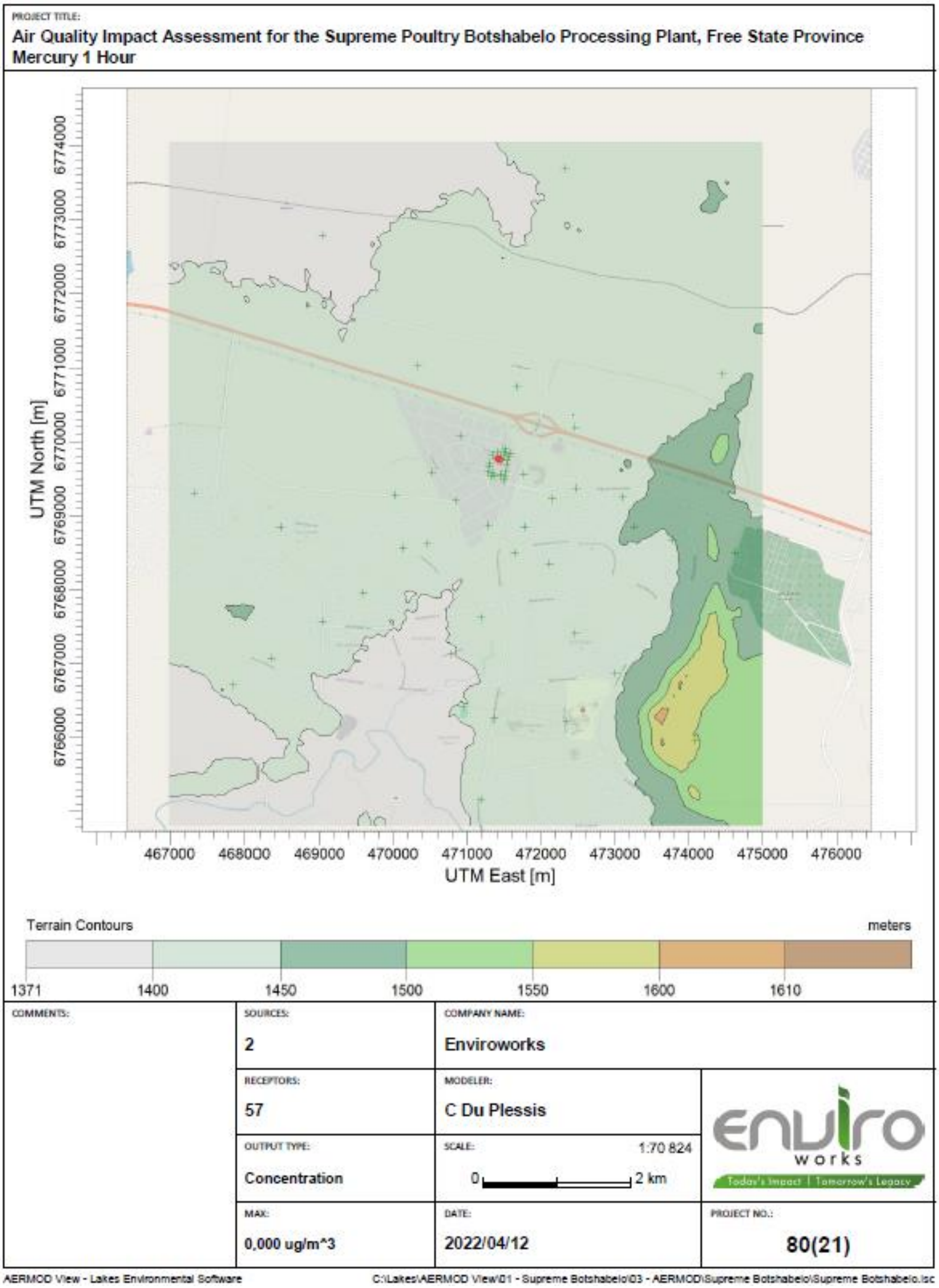

Figure 31: Concentration of Metals, HCL, HFL and Dioxins over a one-hour period.

9.6 UNCERTAINTY OF MODELLED RESULTS

There will always be some error in any geographical model; however, modelling is recognised as a credible method for evaluating impacts, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three (3) components namely the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere.

The stochastic uncertainty includes all errors or uncertainties in data such as source variability, observed concentrations, and meteorological data. Even if the field instrument accuracy is excellent, there can still be large uncertainties due to unrepresentative placement of the instrument (or taking of a sample for analysis). Model evaluation studies suggest that the data input error term is often a major contributor to total uncertainty. Even in the best tracer studies, the source emissions are known only with an accuracy of ± five percent (5 %), which translates directly into a minimum error of that magnitude in the model predictions. It is well known that wind direction errors are the major cause of poor agreement, especially for relatively short-term predictions (minutes to hourly) and long downwind distances. All of the above factors contribute to the inaccuracies not even associated with the mathematical models themselves.

Similar to the ISC model, a disadvantage of the model is that spatial varying wind fields, due to topography or other factors cannot be included. Although the model has been shown to be an improvement on the ISC model, especially short-term predictions, the range of uncertainty of the model predictions is fifty- to two hundred percent (50 % - 200 %). The accuracy improves with fairly strong wind speeds and during neutral atmospheric conditions. In quantifying the uncertainty of the modelled results for this assessment, measured ambient data is required which was not available for this study.

10 ANALYSIS OF EMISSIONS IMPACT ON HUMAN HEALTH

Few sensitivity receptors were identified around the project site; it is important to highlight the potential health impact considering wind direction and wind speed which will affect the dispersal of the pollutants. Drawing conclusions about the potential human health effects of these emissions is not straight forward; however, the following can be stated with a reasonable degree of confidence.

10.1 SULPHUR DIOXIDE (SO_2)

Simulated SO_2 concentrations are in general very low as compared to the set SA NAAQS. Most SO_2 only penetrates as far as the nose and throat, with minimal amounts reaching the lungs, unless the individual is breathing heavily, breathing only through the mouth, or if the concentration of SO_2 is rapid, within ten minutes (10 min) in people suffering from asthma (WHO, 2005).

Effects such as a reduction in lung function, an increase in airway resistance, wheezing and shortness of breath, are enhanced by exercise that increases the volume of air inspired, as it allows SO_2 to penetrate further into the respiratory tract (WHO, 1999). SO_2 reacts with cell moisture in the respiratory system to form sulphuric acid. This can lead to impaired cell function and effects such as coughing, broncho-constriction, exacerbation of asthma and reduced lung function. Baseline ambient concentrations of SO_2 at the proposed site are seen to be fully compliant with the NAAQS. However, this compliance cannot be argued to imply no health risks, but it has to be accepted as a permissible health risk. Areas of full compliance with the SO_2 NAAQS are again deemed not to be free of health risks necessarily; however, the health risks are permissible.

The impact is seen to be of a **very low significant level and may increase to relatively low** during the operation of the facility.

10.2 NITROGEN DIOXIDE (NO_2)

Exposure to NO_2 is typically inhalation and the seriousness of the effects depend more on the concentration than on the length of exposure. Roughly eighty- to ninety percent (80 % - 90 %) of inhaled nitrogen dioxide is absorbed through the lungs (CCINFO, 1998). Nitrogen dioxide (present in the blood stream as the nitrite ion) oxidises unsaturated membrane lipids and proteins, which then results in the loss of control of cell permeability. Nitrogen dioxide caused decrements in lung function, particularly increased airway resistance. People with chronic respiratory problems and people who work, or exercise outside will be more at risk to NO_2 exposure.

This impact is seen to be of a **very low significant level and may increase to relatively low** during the operation of the facility.

10.3 PARTICULATE MATTER (PM)

Particulate Matter (PM) may contain both organic and inorganic pollutants. The extent to which particulates are considered harmful depends on their chemical composition and size. Very fine particulates pose the greatest health risk as they can penetrate deep into the lung, as opposed to larger particles that may be filtered out through the airways natural mechanisms. PM_{10} is generally found relatively close to the source except in strong winds. Given that the pollutant is a nationwide concern it is; therefore, advisable to implement monitoring during the operational phase to quantify compliance with the NAAQS.

The impact is seen to be of a **very low significant level and may increase to relatively low** during the operation of the facility.

10.4 CARBON MONOXIDE

Carbon monoxide diffuses rapidly across alveolar, capillary, and placental membranes. Approximately eighty- to ninety percent (80 % - 90 %) of the absorbed carbon monoxide binds with haemoglobin for carbon monoxide, the COHb concentration increases rapidly at the onset of exposure, starts to level off after three (3) hours, and reaches a steady state after six (6) to eight (8) hours of exposure. The elimination half-life in the fetus is much longer in the pregnant mother. The simulated concentration of CO is fairly high as compared to the NAAQS, thus the **impact is anticipated to be high during the operation of the facility.**

10.5 ANALYSIS OF EMISSIONS IMPACT ON THE ENVIRONMENT

An assessment of air pollution impact on soil, water and receptors other than human were not included in the investigation since it was not specifically requested by the Air Quality Officer. Given the low simulated ambient concentration of NO_2 and SO_2, the impacts on soil and water receptors are expected to be of low significance.

11 COMPLAINTS

A Complaints Register is readily available on site and updated as complaints are received. During the time of the site inspection no active complaints were open.

12 CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS

A Standard Operating Procedure (Document No.: OHSaES 7.8.1.3P) is readily available on site and was approved by Management on 28 August 2019. The SOP states the following:

12.1 EMISSIONS

1. Stack emissions: Correct combustion procedure will be followed to produce a minimum of stack emissions.
2. Noise: Machinery will be effectively and sustainable maintained to prevent loose guards, machine parts etc, from rattling and open-door areas will be fitted with noise screens to prevent and/or mitigate excessive noise being emanated from the plant.
3. Odours: Odours being emanated from the factory will be prevented by:
   a. By having all waste removed at regular intervals as to prevent it from accumulating and decomposing on site.
   b. Where possible all effluent and sanitary drains will be covered with a solid type cover/lid.
   c. In the case of animal matter being processed it must be processed per day. In cases where it has to stand over for longer than a day, it must be effectively covered as to limit emanating of odours. Should this not be possible, the animal matter must be immediately disposed of and treated in an appropriate manner at a landfill registered for this purpose.
   d. In the case of effluent treatment systems, it must be ensured that the effluent is treated with recognisable chemical substances as to prevent odours. Where possible, effluent puts to be covered effectively with a canvas or lid.
4. **Botshabelo Processing Plant** will comply with all national laws and by-laws in terms of Emissions Management.

12.2 EXISTING MEASURES

1. The methods employed will be adequate.
2. Existing methods will be continually reviewed and upgraded if necessary.
3. An emissions survey will be conducted by an approved inspection authority, on a two (2) yearly basis.

12.3 MONITORING AND CONTROL OF STACK AND EXHAUST EMISSIONS

1. All stack and exhaust emissions shall be kept within the local by-laws and the national legal requirements. Listed below are the different stacks and exhaust emission points.
   a. Stacks for fuel burning equipment (NO_x, SO_x, CO_2 and Particulates):
      i. Boiler No. 1 Stack; and,
      ii. Boiler No. 2 Stack.

2. If any continuous visible emissions from any of the above emission points are noted, it must be reported to the **SHE Officer** and the **Maintenance Manager** in order to take the necessary corrective action. The log sheet must consist of the following points:
    a. The date of the incident;
    b. The time of the incident;
    c. The reason for the incident; and,
    d. The approximate time the incident was corrected.
3. Any poor combustion, besides causing pollution, results in large wastes of energy, and enormous escalation in cost of coal. Thus, besides remaining compliant, it is in our best interests to burn coal efficiently. For fuel burning equipment, an emissions violation or potential violation of the Local By-laws, would result in the Local Authorities being informed of the incident, and the following information would be conveyed to them:
    a. Where the emission stems from;
    b. The reason for the emission; and,
    c. The possible duration of non-conformances.

12.4 STACK EMISSIONS INTERNAL CONTROL

1. The boiler operator on shift must use the "Ringelman Smoke Chart" (OHSaES 7.8.1.3CHAR) to evaluate the emission density as to endeavour to not exceed Stack emissions for an aggregate period of three minutes (3 min) during any continuous period of thirty minutes (30 min), where the emissions exceed the First Schedule shade of two (2) on the smoke chart. This must be done per shift.
2. The above would not apply to smoke emanating from a fuel burning appliance during the start-up period, during night time or if such emissions could not reasonably have been prevented, due to such appliances is being overhauled or during the period of any breakdown or disturbance of such appliance.

12.5 SOURCE REDUCTION

1. This will be achieved by running all machinery and vehicles as optimum energy efficiency.
2. Employees are responsible to ensure efficient energy use within their Departments.
3. The more efficiently energy is used, the less fuel is required to produce the same results, the less emissions are produced.

12.6 RESPONSIBILITY

1. The **SHE Officer** will monitor air pollution control measures; and,
2. The **Maintenance Manager** will be responsible for the effective and sustainable management of emissions emanating from the site.

12.7 MANAGEMENT AND MITIGATION

The following objectives are implemented on site:

- To reduce SO_2, NO_2, CO and PM_{10} emissions from facility operations to ensure compliance with air quality emission thresholds and health exposure benchmarks;
- To reduce impacts of fugitive emissions; and,

- To ensure compliance with the set standards acceptable for human health.

12.8 ACTIONS AND RESPONSIBILITY

NO	ISSUE	MANAGEMENT AND MITIGATION PLAN	RESPONSIBILITY	FREQUENCY
		ACTIVITY: INCINERATOR		
1	NO_2, and SO_2 emissions Control	Install and implement a daily (continuous) monitoring system for NO_2 and SO_2 emissions from stacks.	Environmental Manager	Ongoing
2		Make use of wet scrubbers to absorb NO_2, SO_2 and CO.	Operations Director/ Environmental Manager	Ongoing
3		Regulate NO_2 and SO_2 emission levels in line with NAAQS and WHO standards. Any activities that lead to a sustained increase in NO_2 and SO_2 emissions levels above the RSA SANS (SANS: 1929, 2004) will not be allowed. Production and process engineering or optimisation changes where sustained increases within the allowable SANS NO_2 and SO_2 emissions window are a possibility, will be subjected to an environmental and health risk assessment prior to initiation to inform the decision on whether the activity is to be allowed.	Operations Director/ Environmental Manager	Ongoing
4		Continuous ambient monitoring of NO_2 and SO_2 to provide a warning system when levels are above the NAAQS.	Environmental Manager	Ongoing
5		Implement corrective management actions should NO_2 and SO_2 levels exceed guideline levels as per the RSA SANS limits (SANS:1929,2004), and in line with the accepted number of exceedances of NAAQS.	Operations Director/ Environmental Manager	Ongoing
6	Regular maintenance	Schedule adequate and regular maintenance activities across all operations in order to ensure stable operations of the plant and related emissions control of dust and gas.	Engineering Manager	Ongoing
		Activity: Emissions Monitoring		
7	Ambient Air Monitoring	Undertake stack emission testing for the full operational cycle of the Incinerator in order to validate theoretical emission estimates	Operations Director / Environmental Manager	On-going

NO	ISSUE	MANAGEMENT AND MITIGATION PLAN	RESPONSIBILITY	FREQUENCY
8		Undertake stack emissions testing on the outlet of the converter baghouse over the full converter cycle and at all other outlets to the atmosphere in order to monitor the efficiency of controls.	Operations Director / Environmental Manager	Ongoing
9		Measure facility fugitive emissions as well as determine the extent of fugitive emissions from the operational activities.	Operations Director / Environmental Manager	Ongoing
10		Improve data availability on the PM_{10} analysers installed at the site ambient monitoring stations and include additional equipment for monitoring the $PM_{2.5}$ parameter. Also maintain data availability for NO_2, SO_2 by establishing passive monitoring programme and ensuring that critical spare equipment is kept in stock.	Environmental Manager	Ongoing
11		Any anomalies or elevated levels in the ambient air quality monitoring station data should be immediately communicated to the site management team in order to ascertain the likely links of such anomalies with specific facility performance	Environmental Manager Ambient air quality data consultant	Ongoing
12		Consider extending the ambient air quality monitoring network to include two additional monitoring stations within the boundaries of the facility.	Environmental Manager	Within 1 year of approval

As part of this AQMP the following recommendations are made for the air quality monitoring procedure:

- Undertake continuous SO_2, NO_2, CO and PM monitoring at the plants' emission stacks;
- Continue with stack emission testing for the full operational cycle of the facility; and,
- Ensure to make use of wet scrubber to absorb gaseous emissions.

13 COMPLIANCE AND ENFORCEMENT HISTORY

Based on simulated results, the proposed facility is in compliance with the set emission standards for CO, SO_2 and NO_2, thus emissions are more than fifty percent (50%) below the NAAQS. However, measures to keep concentrations below threshold should be implemented during the operational phase.

14 ADDITIONAL INFORMATION

Additional information relating to the dispersion modelling will be made available on request by the Air Quality Officer.

15 CONCLUSION AND RECOMMENDATIONS

Simulated ambient criteria pollutant (SO_2, NO_x, CO and PM) concentrations were well below the SA NAAQS at all identified sensitive receptor locations as summarised in the Table below. **The level of impact is considered to be of low significance to human health.**

Table 22: Summary of simulated concentrations for each emission type.

EMISSION	NAAQS THRESHOLD	CONCENTRATION VALUE			SPARE CAPACITY
		HOURLY	24 HOUR	ANNUAL	
SO_2	50 µg/m³ (annual)	139.52176 µg/m³	25 µg/m³	6.6 µg/m³	87 % (annual)
NO_2	40 µg/m³ (annual)	61 µg/m³	10.9 µg/m³	3 µg/m³	93 % (annual)
PM_{10}	40 µg/m³ (annual)	102 µg/m³	17.6 µg/m³	5.2 µg/m³	77 % (annual)
CO	30 000 µg/m³ (hourly)	377 µg/m³	64 µg/m³	16.2 µg/m³	98 % (hourly)

The contribution from the proposed facility to cumulative ambient air quality is regarded insignificant based on the low simulated ground level concentrations and monitoring results from the nearby monitoring station (Pelonomi NAQI Monitoring Station). It is recommended that mitigation measures as stated within the Air Quality Management Plan be adhered to, to keep the concentrations below the thresholds during the operational phase of the Facility.

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