# Appendix F.2

## AIR QUALITY DESKTOP ASSESSMENT

Public

# DESKTOP AIR QUALITY IMPACT ASSESSMENT FOR THE ESKOM KOMATI SOLAR PHOTOVOLTAICS PROJECT

## INTRODUCTION

Eskom Holdings SOC (Ltd) (Eskom) is a South African utility that generates, transmits and distributes electricity. Eskom supplies about 95% of the country's electricity. Eskom's 2035 strategy encompasses the journey that Eskom intends to take in response to the changing energy environment and the impact this has towards a sustainable power utility. This strategy is necessitated by the challenges that Eskom faces as a business as well as the global and local shifts occurring in the energy sector particularly with respect to environmental and climate change challenges, difficulties in accessing financing and changes to the macro industry environment significantly altering the energy supply industry (ESI). The road to 2035 includes the shutting down of several coal-fired power stations, repurposing and repowering, delivering new clean generation projects, expanding the transmission grid, and rolling out micro grid solutions. Several power stations are reaching the end of life. These stations will go into extended cold reserve and are most likely to be fully decommissioned in the future. Eskom is considering a shutdown, dismantling and repurposing of some of its fleet as it reaches its end of life. Komati Power Station, situated in Mpumalanga, will reach its end of life expectancy in September 2022. As such, Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100 MW of Solar Photovoltaics (PV) and 150 MW of Battery Energy Storage System (BESS).

The first phase of the Komati Power Station repurposing programme, i.e. the installation of the Solar PV and BESS necessitates an Environmental and Social Impact Assessment (ESIA). As part of the ESIA a desktop Air Quality Impact Assessment is required.

*Importantly this ESIA is also being run concurrently with the scope of work for the shutdown and dismantling of the power station and is therefore treated as a separate assessment process to the shutdown and dismantling of the power station.*

## DESKTOP REVIEW

### LOCATION OF SITE AND IDENTIFICATION OF SENSITIVE RECEPTORS

The Komati Power Station is situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift on the Highveld in the Mpumalanga Province of South Africa. Komati is surrounded by farmlands mostly practicing agriculture (maize and livestock). It is near Komati Village which includes the business areas (shopping centre) and industrial areas (mines).

**Table 1** presents the sensitive receptors within the surrounding environment. Sensitive receptors are defined by the United States Environmental Protection Agency (USEPA) as areas where occupants are more susceptible to the adverse effects of exposure to pollutants. These areas include but are not limited to residential areas, hospitals/clinics, schools and day care facilities and elderly housing. The site layout and receptors are presented in **Figure 1**.

**Table 1: Sensitive receptors within a 10 km radius of the proposed project**

| ID. | Sensitive Receptor Name | Latitude (S) | Longitude (E) | Distance from Site Boundary (km) | Direction from Site |
|---|---|---|---|---|---|
| **SR1** | Komati Village | 26° 5'46.52" | 29°27'37.62" | Within the boundary | |
| **SR2** | Residential Area 1 | 26° 8'37.05" | 29°32'5.14" | 7.3 | Southeast |
| **SR3** | Residential Area 2 | 26° 4'9.85" | 29°25'16.62" | 3.7 | Northwest |
| **SR4** | Residential Area 3 | 26° 5'14.28" | 29°26'18.46" | 1.2 | Northwest |
| **SR5** | Residential Area 4 | 26° 5'24.70" | 29°26'47.50" | 0.4 | Northwest |
| **SR6** | Residential Area 5 | 26° 2'5.40" | 29°31'6.68" | 7.2 | Northeast |

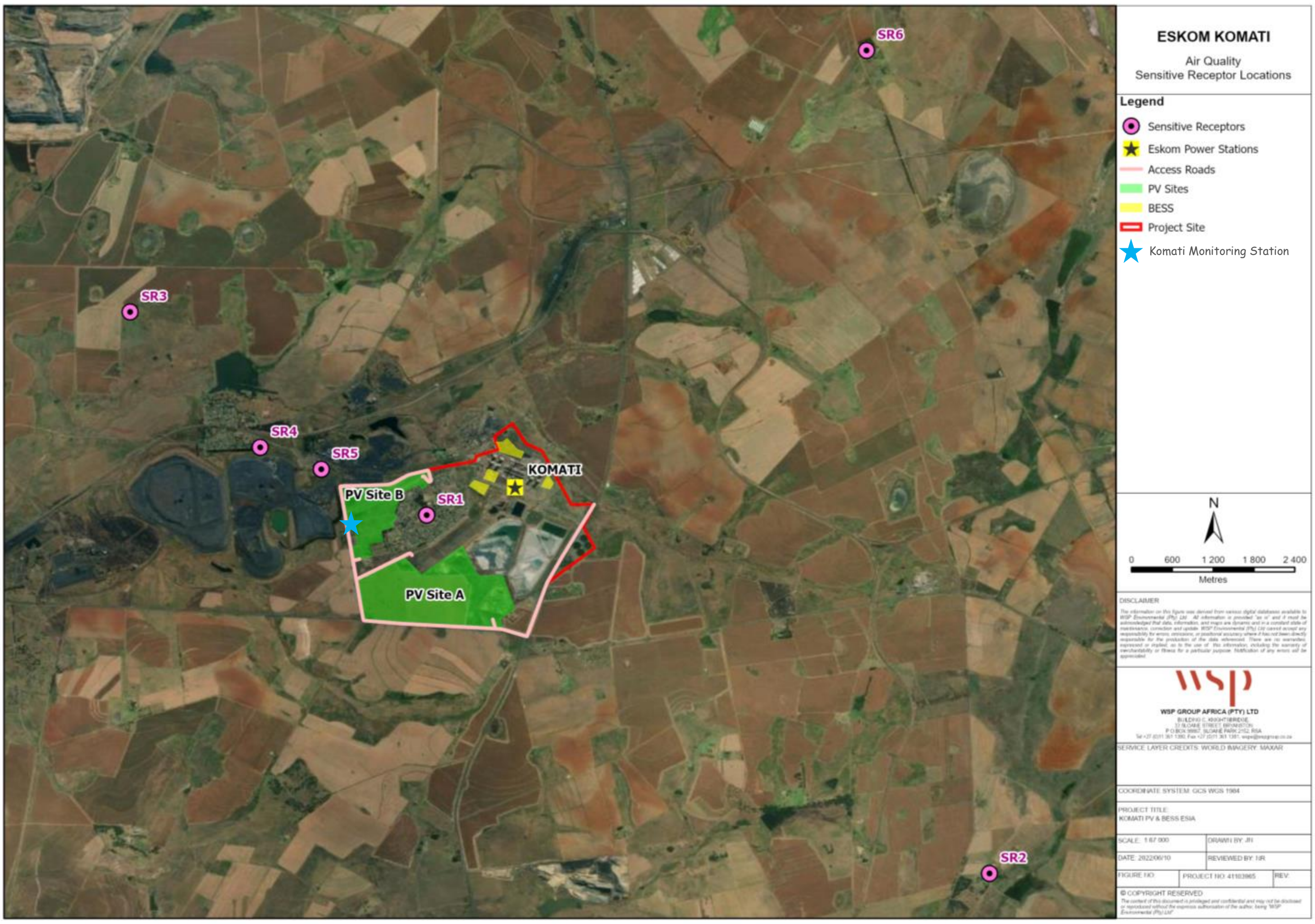


**Figure 1: Site layout and sensitive receptors for the proposed project**

## METEOROLOGICAL OVERVIEW

Since meteorological conditions affect how pollutants emitted into the air are directed, diluted and dispersed within the atmosphere, the use of reliable data in an air quality assessment is of the utmost importance. Mechanical turbulence also influences mixing, and is largely influenced by wind speed, in combination with surface roughness. To assess site-specific meteorological conditions, data was sourced from the South African Air Quality Information System (SAAQIS) for the Komati station and analysed for the best recovery period over the last five years; namely January to December 2018. The Komati station is owned by Eskom and is located on site.

The South African National Accreditation System (SANAS, 2012) TR 07-03 standards stipulate a minimum data recovery of 90% for the dataset to be deemed representative of conditions during a particular reporting period. The percentage recovery for parameters recorded is above 90 % and is thus considered reliable for use in this assessment. Data recovery information for the assessed period is given in **Table 2**.

**Table 2: Details of the Komati meteorological station**

| Station Name | Data Recovery | | | |
|---|---|---|---|---|
| | Temperature | Rainfall | Wind | Humidity |
| Komati | 99.9 | 99.9 | 99.9 | 99.8 |

## TEMPERATURE, RAINFALL AND HUMIDITY

- Summer temperatures for the region averaged at 20 °C while winter temperatures averaged at 11 °C (**Figure 2**).
- Komati received approximately 1082 mm of rainfall for 2018. Higher rainfall occurred during the warmer summer months (December, January and February), with drier conditions during cooler winter months (June, July and August). It was noted that the month of March also experienced high volumes of rainfall (**Figure 3**).
- Relative humidity was generally moderate for 2018 at 63% (**Figure 3**).

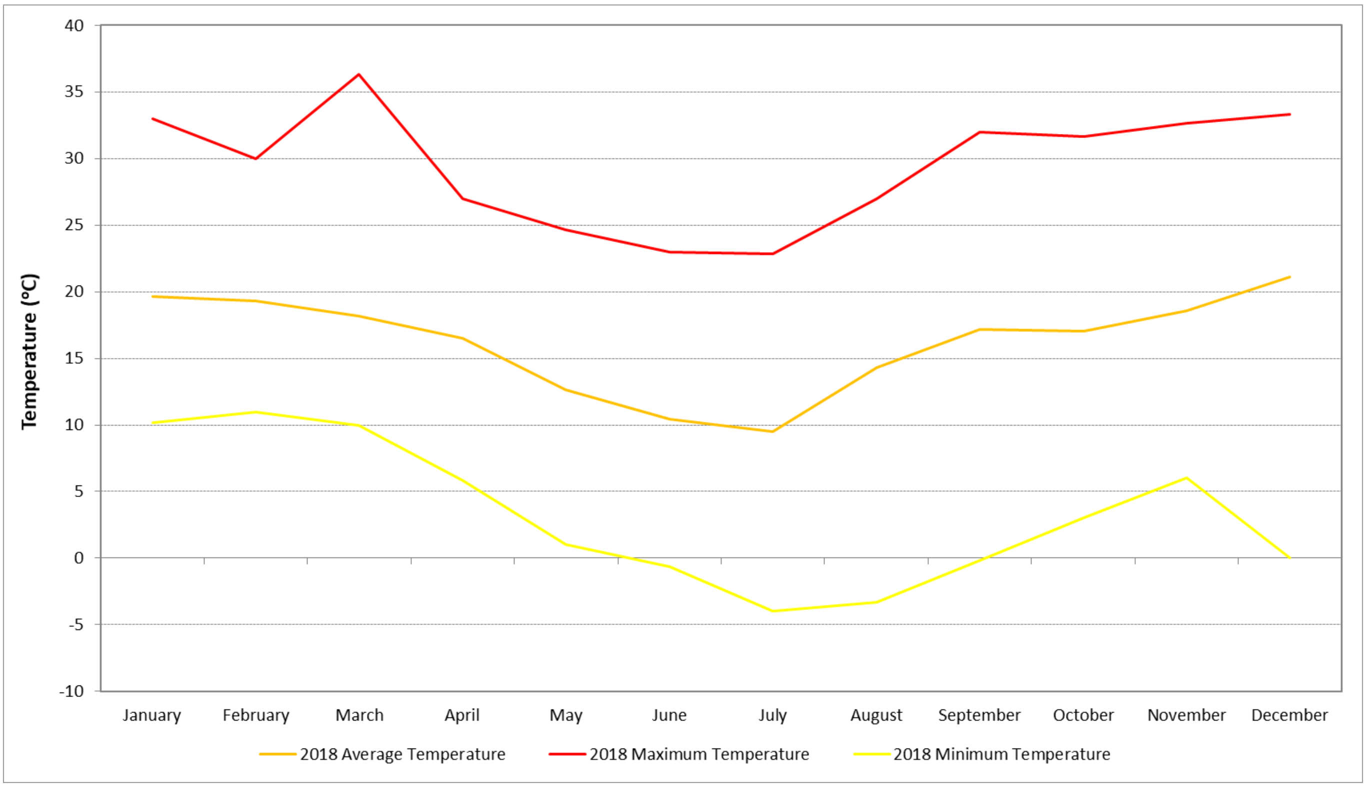


**Figure 2: Average, maximum and minimum temperatures for the period January to December 2018 from the Komati station (SAAQIS)**

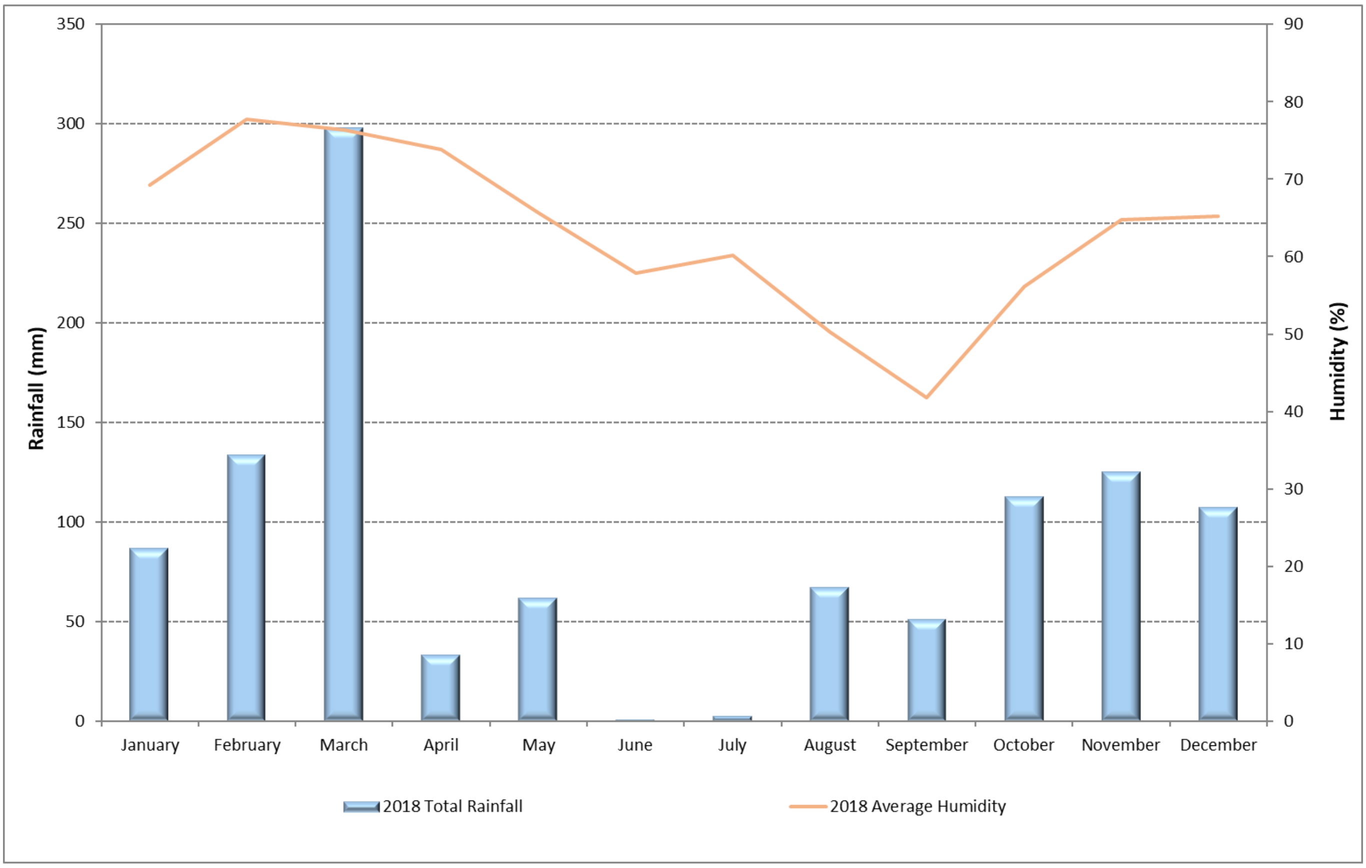


**Figure 3: Monthly rainfall and average humidity for the period January to December 2018 from the Komati station (SAAQIS)**

## LOCAL WIND FIELD

Wind roses summarize wind speed and directional frequency at a location. Calm conditions are defined as wind speeds less than 1.0 m/s. Each directional branch on a wind rose represents wind originating from that direction. Each directional branch is divided into segments of colour, each representative of different wind speeds.

Typical wind fields are analysed for the full period (January to December 2018); diurnally for early morning (00h00–06h00), morning (06h00–12h00), afternoon (12h00–18h00) and evening (18h00–23h00); and seasonally for summer (December, January and February), autumn (March, April and May), winter (June, July and August) and Spring (September, October and November).

Wind roses from the Komati meteorological station are presented in **Figure 4** and are further discussed below.

- During the January to December 2018 period, light to strong north-north-easterly and westerly winds prevail in the region (calm conditions occurring 17 % of the time), with average wind speeds of 2.7 m/s expected.
- During the early morning hours (00h00-06h00) north-north-easterly, north-north-westerly, north and north-westerly winds prevail.
- Towards the latter morning (06h00-12h00) hours, a shift in winds is experienced with dominant winds from the west.
- In the afternoon (12h00-18h00) the westerly wind prevails.
- During the night (18h00-00h00) the north-north-easterly wind prevails yet again.
- Highest winds are experienced during the 12h00-18h00 period.
- Winds from the north-north-easterly prevail during the summer and autumn months whilst the winter and spring months show great directional variability. Additionally, winter and spring experience the strongest winds.

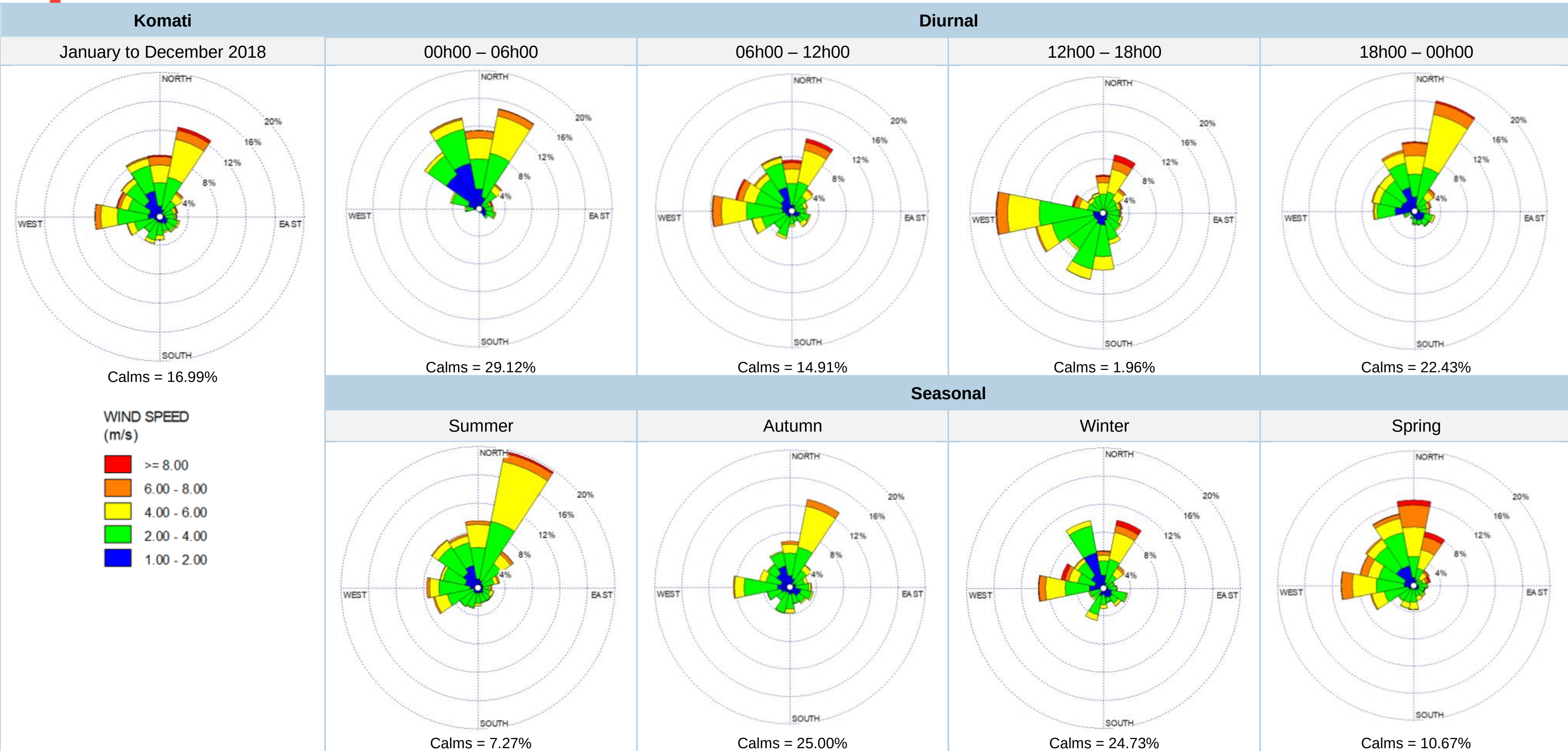


**Figure 4: Local wind conditions for the period January to December 2018 from the Komati station (SAAQIS)**

## AIR QUALITY IMPACTS

### EXISTING SOURCES OF EMISSIONS WITHIN THE PROJECT AREA

Existing air pollution sources in the vicinity of the proposed project include:

- Agricultural activities mostly from maize and livestock.
- Vehicle emissions from the R35, R542, nearby Goedehoop Colliery and internal Komati power station roads.
- Mining activities from the nearby Goedehoop Colliery.
- Industrial activities from the Komati Power Station.
- Domestic fuel burning from the Komati Village and nearby residential areas.
- Dust from unpaved roads from the nearby Goedehoop Colliery.
- Other fugitive dust sources such as wind erosion of exposed areas.

Background concentrations for particulate matter (i.e most specifically particle size of aerodynamic diameter of less than 10 and 2.5 microns ($PM_{10}$ and $PM_{2.5}$)) were also sourced from the SAAQIS for the Komati station to evaluate the current situation within the receiving environment. The best recovery period over the last five years; namely January to December 2018 was utilized. Annual averages for $PM_{10}$ and $PM_{2.5}$ were 62.7 µg/m$^3$ (above the annual average $PM_{10}$ standard of 40 µg/m$^3$) and 6.5 µg/m$^3$, respectively (below the annual average $PM_{2.5}$ standard of 20 µg/m$^3$). The ***high existing sources of emissions for $PM_{10}$ are likely a result of the abovementioned background sources***, however it must be noted that the ***background concentrations are likely to decrease once the existing Komati Power Station is fully decommissioned***, possibly resulting in compliance with the annual average $PM_{10}$ standard of 40 µg/m$^3$. Further, the data recovery for $PM_{10}$ and $PM_{2.5}$ was 82% and 85%, respectively, slightly below the recommended data recovery of 90% for the dataset to be deemed reliable.

### PROPOSED SOURCES OF EMISSIONS FROM THE CONSTRUCTION AND OPERATIONAL PHASE OF THE SOLAR PV PROJECT

### CONSTRUCTION PHASE

It is estimated that approximately 200-300 construction workers will be required on the site for this phase. During the construction phase of the proposed project the following activities are anticipated:

- **Site Preparation:** Vegetation and topsoil will be cleared for the footprint of the infrastructure as well as for the access roads to the Solar PV site, internal roads and the laydown yard, etc. The topsoil removed will need to be stored for rehabilitation purposes of the site.
- **Transportation of Equipment:** All equipment will be transported to site by means of national, provincial and district roads. This includes but is not limited to, transformers, Solar PV modules, inverters, excavators, graders, trucks, compacting equipment, construction material, etc.
- **Site Establishment Works:** The site will have temporary laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure e.g. use of generators and fuel storage that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of Solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- **Construction of the Solar PV Facility:** Trenches would need to be excavated for underground cabling to connect Solar PV arrays, inverter stations, and combiner substations. Foundations for the Solar PV array mounting structures and inverter stations may need to be excavated, with the final extent depending on the geotechnical studies that will be conducted. The geotechnical studies will determine the type of foundations that can be utilised at the PV site. Construction of access, perimeter, and internal gravel roads may require material to be imported from outside the site, from a permitted quarry.
- **Construction of Electrical Interconnection Line:** Construction and installation of overhead electrical interconnection lines, connecting the Solar PV facilities to the grid PoC.
- **Storage:** Storage of diesel and oil for construction activities.

Heavy construction activities, as outlined above, are a source of dust and $PM_{10}$ and $PM_{2.5}$ emissions that can have a temporary impact on the local ambient air quality. Dust and particulate emissions vary substantially on a daily basis, depending on the level of activity, the specific operations and the prevailing meteorological conditions (USEPA, 1995).

With dominant north-north-easterly winds in the project region, as observed in **Figure 4**, air quality impacts are predicted to be the greatest at SR1 (Komati Village). Receptors SR4 and SR5 are relatively close to the proposed site and are also likely to be impacted.

Although receptors SR2, SR3 and SR6 are within a 10 km radius of the proposed site, they are unlikely to be impacted significantly given the distance and dominant wind directions to the proposed project site. Importantly, the necessary mitigation measures must be implemented during the construction phase to reduce impacts at all nearby receptors, with particular reference to the Komati Village, SR4 and SR5. Furthermore, it must be noted that emissions from construction activities are highly uncertain due to the site specific and erratic nature of construction activities. The construction phase is also expected to occur during daytime hours only and as such is considered to be limited and short-lived to the local project site area.

### OPERATIONAL PHASE

The Solar PV plant is expected to have a minimum design life of 25 years. During the life of the Solar PV facility, there will be normal maintenance of all electrical and mechanical components of the plant. Thus, limiting the number of vehicle movements in and around the site. In addition, there will be periodic cleaning and washing of the Solar PV modules. This PV module cleaning will be performed when required, and it is estimated to occur two to four times a year, limiting the emissions to atmosphere to a minimum.

As such, minimal air quality impacts are anticipated during the operational phase of the proposed project, with changes in air quality unlikely to occur at the nearest sensitive receptors.

### CUMULATIVE IMPACTS AS A RESULT OF THE PROPOSED SOLAR PV PROJECT

Cumulative impacts at the nearby receptors as a result of the construction phase of the proposed project (given the current background concentrations discussed above and the shutdown and decommissioning of the Komati Power Station) are likely to be low, below the annual average $PM_{10}$ and $PM_{2.5}$ standards. Further, the construction phase is anticipated to be short-lived and thus will result in a restoration of current background conditions once the construction phase is completed.

## MITIGATION MEASURES

### CONSTRUCTION PHASE

Notwithstanding that impacts to ambient air quality associated with the construction phase of the project are considered to be of transient nature, the following mitigation measures would serve to further reduce such impacts to the receiving environment and sensitive receptors:

- Information regarding construction activities should be shared with all local communities (such as the Komati Village). Such information includes:
  - Proposed working times.
  - How long the activity is anticipated to take place.
  - What is being done, or why the activity is taking place.
  - Contact details of a responsible person on site should complaints arise to reduce emissions in a timely manner.
- Complaint's register must be kept to record all events.
- When working near (within 100 m) a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible.
- Speed limits (approximately 20-40 km/hr) can be enforced to control open dust sources.
- Wind speed reduction is a common method used to control open dust sources at construction sites as wind barriers and windbreaks tend to be readily available. It is also recommended to cease high dust construction activities, for e.g. land-clearing, during high wind speed events.
- Application of water can be used to reduce dust emissions.

General control methods for open dust sources, as recommended by the USEPA, are given in **Table 3**.

**Table 3: Mitigation measures for general construction (USEPA, 1995)**

| Emission Source | Recommended Control Method |
| --- | --- |
| Debris handling | Wind speed reduction |
| | Wet suppression(1) |
| Truck transport(2) | Wet suppression |
| | Paving |
| | Chemical stabilisation(3) |
| Bulldozers | Wet suppression(4) |
| Pan scrapers | Wet suppression |
| Cut/fill material handling | Wind speed reduction |
| | Wet suppression |
| Cut/fill haulage | Wet suppression |
| | Paving |
| | Chemical stabilisation |
| General construction | Wind speed reduction |
| | Wet suppression |
| | Early paving of permanent roads |

Notes:

(1) Dust control plans should contain precautions against watering programs that confound trackout problems.
(2) Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.
(3) Chemical stabilisation usually cost-effective for relatively long-term or semi-permanent unpaved roads
(4) Excavated materials may already be moist and may not require additional wetting.

### OPERATIONAL PHASE

Minimal air quality impacts are anticipated during the operational phase of the proposed project therefore no mitigation measures are deemed necessary during the operational phase of the proposed project.

## IMPACT ASSESSMENT RATING

All impacts of the proposed project operations were evaluated using a semi-quantitative risk assessment methodology. This system derives an environmental impact significance level on the basis of the magnitude, reversibility, extent, duration and probability of potentially significant impacts. The overall risk level is determined using professional judgement based on a clear understanding of the nature of the impact, potential mitigatory measures that can be implemented and changes in risk profile as a result of implementation of these mitigatory measures. Key localised air quality impacts associated with the proposed project operations include:

- Construction phase impacts of air quality on sensitive receptors.

Outcomes of the air quality impact assessment are contained within **Table 4** outlining the impact of each parameter and the resulting risk level. *Important to note that impacts predicted here are from the proposed project operations only and not a result of cumulative impacts.*

The resultant environmental air quality risks for sensitive receptors were ranked “low” during the construction phase of the proposed project with mitigation in place.

**Table 4: Impact assessment of risks associated with the proposed project**

| Description | Without Mitigation | | | | | | | With Mitigation | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Duration | Extent | Magnitude | Reversibility | Significance | **Risk Level** | Probability | Duration | Extent | Magnitude | Reversibility | Significance | **Risk Level** |
| **Construction phase impacts of air quality on sensitive receptors** | 3 | 2 | 2 | 3 | 3 | 30 | **Low** | 2 | 2 | 1 | 2 | 3 | 16 | **Low** |

## CONCLUSION

Given the nature of the proposed project, with emissions during the construction phase expected to be transient in nature and minimal emissions anticipated during the operational phase, it is in our opinion that the proposed project can be authorised with the recommended mitigation measures implemented during the construction phase of the proposed project. Furthermore, no additional air quality studies are required for the proposed project.