Basic Air Quality Impact Assessment for the proposed Solar Energy Facility Project in Upington

Project done on behalf of **EOH Coastal & Environmental Services**

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Revision Record

Revision Number	**Date**	**Reason for Revision**
Rev 0	November 2016	Draft for client review

Abbreviations

AEL	Atmospheric Emissions License
Airshed	Airshed Planning Professionals (Pty) Ltd
Australian EPA	Australian Environmental Protection Agency
mamsl	mean sea level
MES	Minimum Emission Standards
m	metre
m^2	Metre squared
m/s	Metre per second
$mg/m^2.day$	Milligram per metre squared per day
NAAQS	National Ambient Air Quality Standards
NAEIS	National Atmospheric Emissions Inventory System
NDCR	National Dust Control Regulations
NPI	National Pollutant Inventory (Australia)
PM_{10}	Particulate Matter with an aerodynamic diameter of less than 10μ
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter of less than 2.5μ
PV	Photovoltaic
SAAQIS	South African Air Quality Information System
SANS	South African National Standards
tpa	Tonnes per annum
TSP	Total Suspended Particles
US-EPA	United States Environmental Protection Agency
WB	The World Bank
WHO	World Health Organisation
°C	Degrees Celsius
$\mu g/m^3$	Microgram per cubic metre

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1 INTRODUCTION

The Northern Cape Economic Development, Trade and Investment Promotion Agency (NCEDA) has appointed EOH Coastal & Environmental Services (EOH) to obtain Environmental Authorisation (EA) for the development of a Special Economic Zone (SEZ) which will include a Solar Energy Facility as well as other industrial and commercial development in Upington located in the Northern Cape Province (EOH, 2016). The SEZ development will require an EA from the Provincial Department of Environment and Nature Conservation (DENC) while the Solar Energy Facility will require a separate EA from the National Department of Environmental Affairs (DEA), as required by South Africa's environmental legislation. It was decided that the two processes will be separated in order to obtain two separate EAs.

Airshed Planning Professionals (Pty) Ltd was appointed by EOH to conduct a basic air quality assessment. The main objective of the study is to qualitatively assess the potential for air quality related impacts on the surrounding environment and human health.

1.1 Brief process description

The proposed project entails the development of 440ha of land located north of Upington, Northern Cape as a new SEZ as well as the provision of bulk and internal services (electricity, water, sewer and road/street infrastructure) within the SEZ. Electricity for the new SEZ will be provided through the development of a new Photovoltaic (PV) plant with an output of over 20MW, located on 72 hectares within the SEZ while other bulk services (water and sewage) will be upgraded from the existing services in Upington. The development will occur in six (6) phases with Phase 1 already approved.

Electricity generation from solar technologies results in negligible atmospheric emissions during operation since no fuels are combusted; however, air pollution in the form of particulate emissions will occur during the construction phase. Activities associated with particulate emissions during the construction phase include: vegetation removal and land clearing; scraping and grading; and the construction of buildings and roads. Gaseous emissions would primarily be a result of tailpipe emissions from construction equipment. The construction phase was assumed to extend over a period of 12 to 24 months.

1.2 Site Description

The proposed project will be located north of the town of Upington in the Northern Cape Province (Figure 1-1). The nearest residential suburb to the proposed solar facility is Paballelo (Figure 1-2).

The economic activities around Upington are dominated by the farming of crop. It is both a holiday town with all the amenities required for the many tourists who stay in Upington as well as an agricultural hub for one of the most intensive sultana grape farming areas in the country.

The topography of the surrounding area is flat, ranging between 830 mean sea level (mamsl) to 820 mamsl.

It is located in an arid sandy region of South Africa with an average annual rainfall of less than 200 mm and a potential evaporation in excess of 2 500 mm per annum.

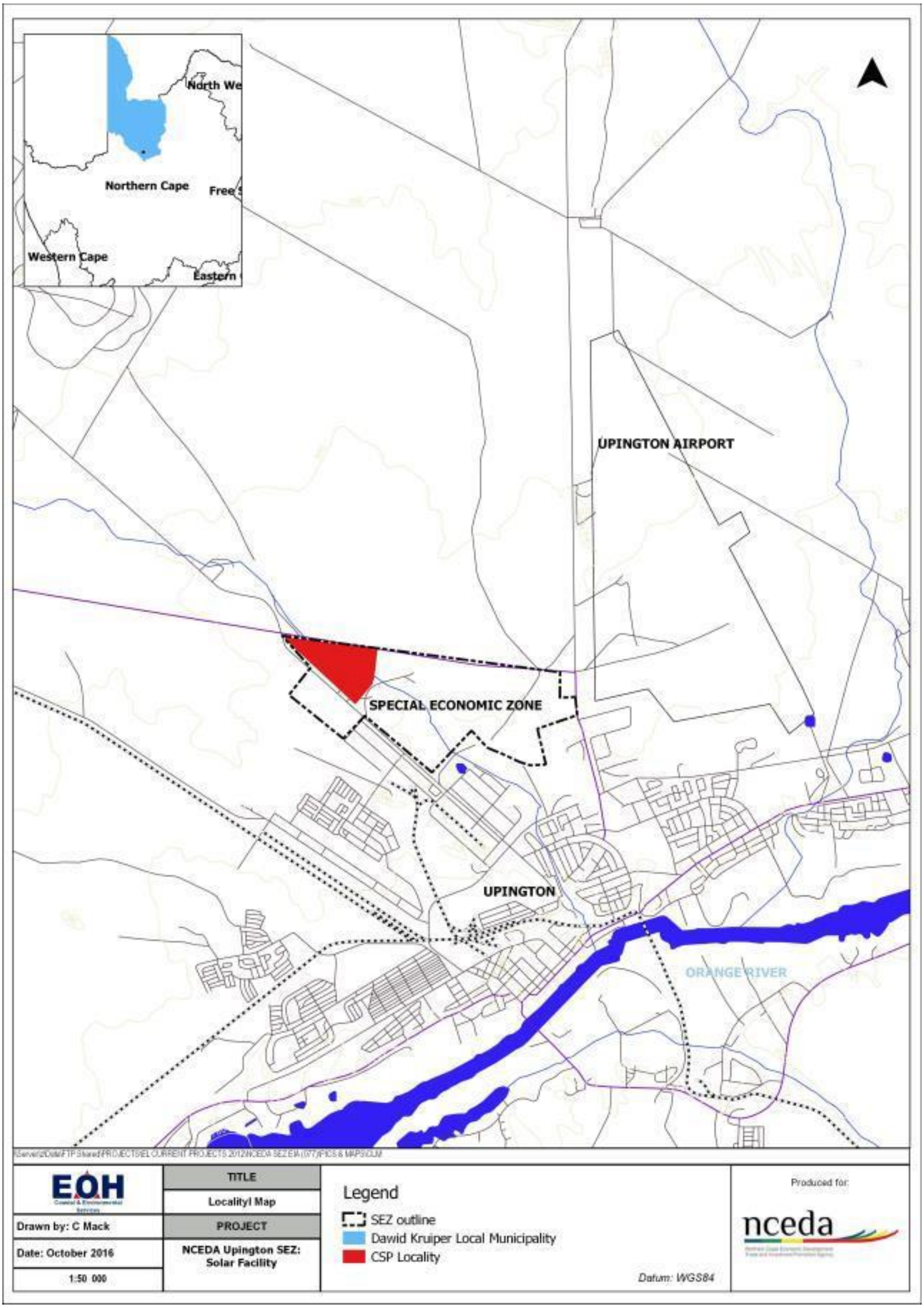

Figure 1-1: Location of the proposed solar energy project, near Upington

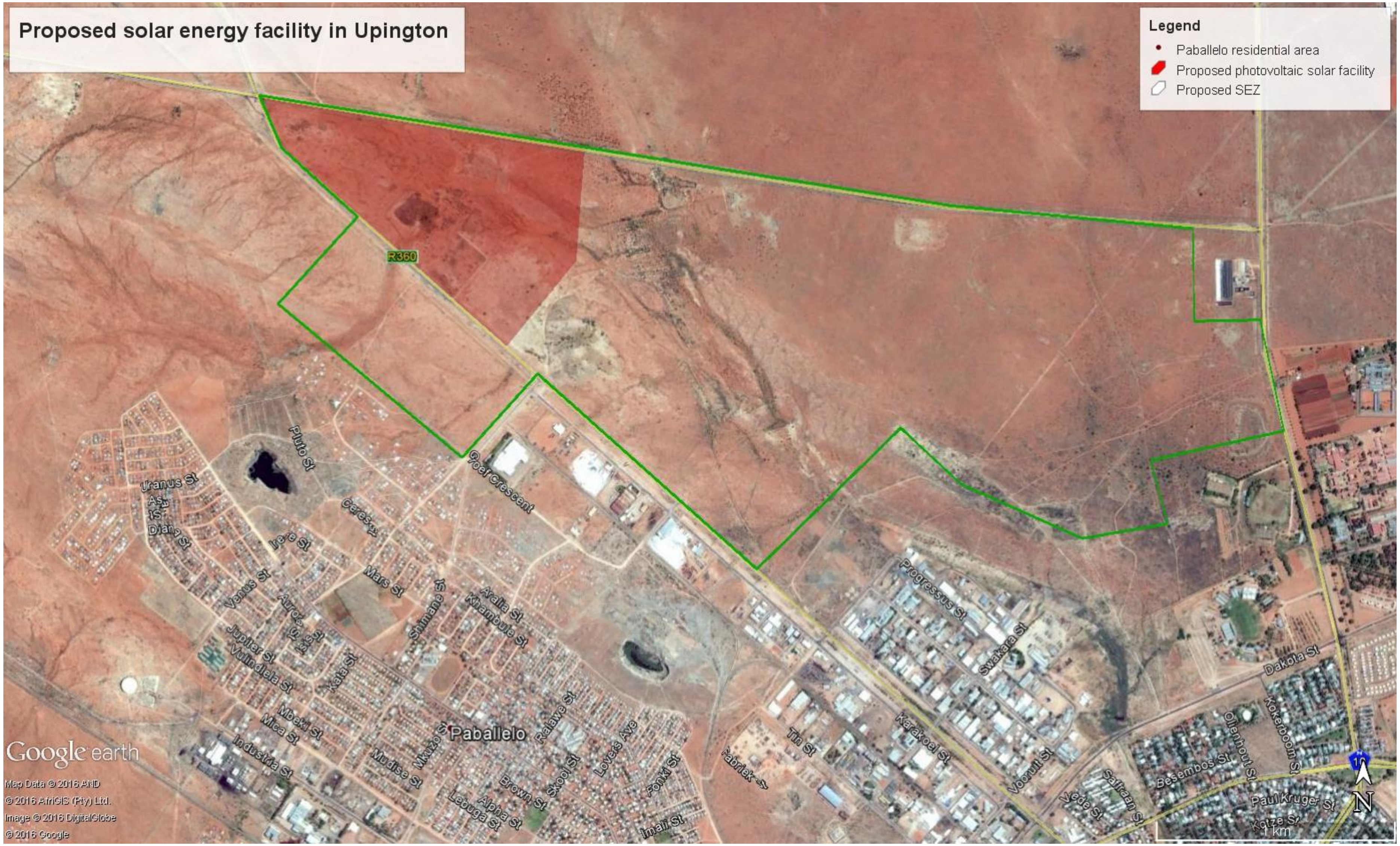

Figure 1-2: Location of the proposed solar energy project, near Upington

1.3 Air Quality Evaluation Approach

The study follows a qualitative approach, using available meteorological data and pollutants typically associated with the current and proposed activities to evaluate the potential for off-site impacts.

The various tasks undertaken as part of the study include:

- A brief description of the weather patterns in Upington;
- Identification of existing sources of emission and characterisation of ambient air quality within the region based on observational data recorded to date;
- The legislative and regulatory context, including ambient air quality standards and dust fall classifications.
- Identify all potential sources of atmospheric emissions associated with the solar energy operations.
- Qualitatively assess the potential for impacts from the solar energy facilities.
- Recommendations for a dust management plan for the operations.

2 Legal Overview

The environmental regulations and guidelines governing the emissions and impact of the fugitive dust emissions need to be considered prior to developing a management plan so that National standards and guidelines are met by the actions recommended within the management plan.

The National Environmental Management: Air Quality Act (Act no.39 of 2004) commenced with on 11 September 2005 as published in the Government Gazette on 9 September 2005. Sections omitted from the implementation were Sections 21, 22, 36 to 49, 51(1)(e),51(1)(f), 51(3), 60 and 61. The Act was fully implemented on 1 April 2010, including Section 21 on the Listed Activities and Minimum National Emission Standards. The revised Listed Activities and Minimum Emission Standards were published on 22 November 2013 (Government Gazette 37054, Notice No. 893). Amendments to the Act, primarily pertaining to administrative aspects, were published in 2014 (Government Gazette 37666, Notice No. 390 on 14 May 2014).

The National Framework (first published in Government Gazette Notice No. 30284 of 11 September 2007, and updated in 2013) underpins the Air Quality Act (AQA), providing national norms and standards for air quality management to ensure compliance. The National Framework states that aside from the various spheres of government responsibility towards good air quality, industry too has a responsibility not to impinge on everyone's right to air that is not harmful to health and well-being. Industries therefore should take reasonable measures to prevent such pollution order degradation from occurring, continuing or recurring.

In terms of AQA, certain industries have further responsibilities, including:

- Compliance with any relevant national standards for emissions from point, non-point or mobile sources in respect of substances or mixtures of substances identified by the Minister, MEC or municipality.
- Compliance with the measurements requirements of identified emissions from point, non-point or mobile sources and the form in which such measurements must be reported and the organs of state to whom such measurements must be reported.
- Compliance with relevant emission standards in respect of controlled emitters if an activity undertaken by the industry and/or an appliance used by the industry is identified as a controlled emitter.
- Compliance with any usage, manufacture or sale and/or emissions standards or prohibitions in respect of controlled fuels if such fuels are manufactured, sold or used by the industry.
- Comply with the Minister's requirement for the implementation of a pollution prevention plan in respect of a substance declared as a priority air pollutant.
- Comply with an Air Quality Officer's legal request to submit an atmospheric impact report in a prescribed form.
- Taking reasonable steps to prevent the emission of any offensive odour caused by any activity on their premises.
- Furthermore, industries identified as Listed Activities have further responsibilities, including:
- Making application for an AEL and complying with its provisions.
- Compliance with any minimum emission standards in respect of a substance or mixture of substances identified as resulting from a listed activity.
- Designate an Emission Control Officer **if** required to do so.

Section 51 of the Air Quality Act lists possible offences according to the requirements of the Act with Section 52 providing for penalties in the case of offences.

2.1 Listed activities

The Solar Energy Facility is not a Listed Activity and will not require an AEL.

2.2 National Ambient Air Quality Standards

Air quality guidelines and standards are fundamental to effective air quality management, providing the link between the source of atmospheric emissions and the user of that air at the downstream receptor site. The ambient air quality limits are intended to indicate safe daily exposure levels for the majority of the population, including the very young and the elderly, throughout an individual's life-time. Air quality guidelines and standards are normally given for specific averaging periods.

The South African Bureau of Standards (SABS) assisted the DEA in the development of ambient air quality standards. National Ambient Air Quality Standards (NAAQS) were determined based on international best practice for $PM_{2.5}$ PM_{10}, SO_2, NO_2, ozone (O_3), CO, lead (Pb) and benzene. The NAAQS were published in the Government Gazette (no. 32816) on 24 December 2009. With the focus of this assessment on particulate emissions from construction activities, only the NAAQS for PM_{10} and $PM_{2.5}$ are listed in Table 2-1.

Table 2-1: South African national ambient air quality standards (Government Gazette 32816, 2009)

Pollutant	Averaging Period	Limit Value (µg/m³)	Limit Value (ppb)	Frequency of Exceedance [1]	Compliance Date [2]
Benzene	1 year	10	-	0	Immediate – 31 Dec 2014
	1 year	5[b]	-	0	1 Jan 2015
CO	1 hour	30 000	26 000	88	Immediate
	8 hour[c]	10 000	8 700	11	Immediate
NO_2	1 hour	200	106	88	Immediate
	1 year	40	21	0	Immediate
PM_{10}	24 hour	120	-	4	Immediate – 31 Dec 2014
	24 hour	75	-	4	1 Jan 2015
	1 year	50	-	0	Immediate – 31 Dec 2014
	1 year	40	-	0	1 Jan 2015
$PM_{2.5}$	24 hour	65		4	Immediate – 31 Dec 2015
	24 hour	40	-	4	1 Jan 2016 – 31 Dec 2029
	24 hour	25	-	4	1 Jan 2030
	1 year	25	-	0	Immediate – 31 Dec 2015
	1 year	20	-	0	1 Jan 2016 – 31 Dec 2029
	1 year	15	-	0	1 Jan 2030
SO_2	10 minutes	500	191	526	Immediate
	1 hour	350	134	88	Immediate
	24 hour	125	48	4	Immediate
	1 year	50	19	0	Immediate

Notes:

[1]The number of averaging periods where exceedance of limit is acceptable.

[2]Date after which concentration limits become enforceable.

2.3 National Regulations for Dust Deposition

South Africa's Draft National Dust Control Regulations were published on the 27 May 2011 with the dust fallout standards passed and subsequently published on the 1st of November 2013 (Government Gazette No. 36974). These are called the National Dust Control Regulations (NDCR). The purpose of the regulations is to prescribe general measures for the control of dust in all areas including residential and light commercial areas. Acceptable dustfall rates according to the regulation are summarised in Table 2-2.

Table 2-2: Acceptable dustfall rates

Restriction areas	Dustfall rate (D) in mg/m^2-day over a 30 day average	Permitted frequency of exceedance
Residential areas	D < 600	Two within a year, not sequential months.
Non-residential areas	600 < D < 1 200	Two within a year, not sequential months.

The regulation also specifies that the method to be used for measuring dustfall and the guideline for locating sampling points shall be ASTM D1739 (1970), or equivalent method approved by any internationally recognized body. It is important to note that dustfall is assessed for nuisance impact and not inhalation health impact.

3 AIR QUALITY BASELINE EVALUATION

The baseline evaluation primarily comprises the assessment of near-site surface meteorology and available ambient concentrations and/ dust fallout rates as reported on previously.

3.1 Influencing meteorological conditions

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 ventilation potential of the site. 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.

Meteorological data from the South African Weather Services (SAWS) weather station in Upington was used in this assessment. The data set provided extended over the period 1 January 2013 to 31 October 2016. The data set included wind speed, wind direction, temperature, humidity, pressure and rainfall.

The prevailing wind field at the site is from the north and south-southwest with higher wind speeds dominating during the day (Figure 3-1). Calm conditions (wind speeds <1 m/s) are more frequent at night (7%) than during the day (5%).

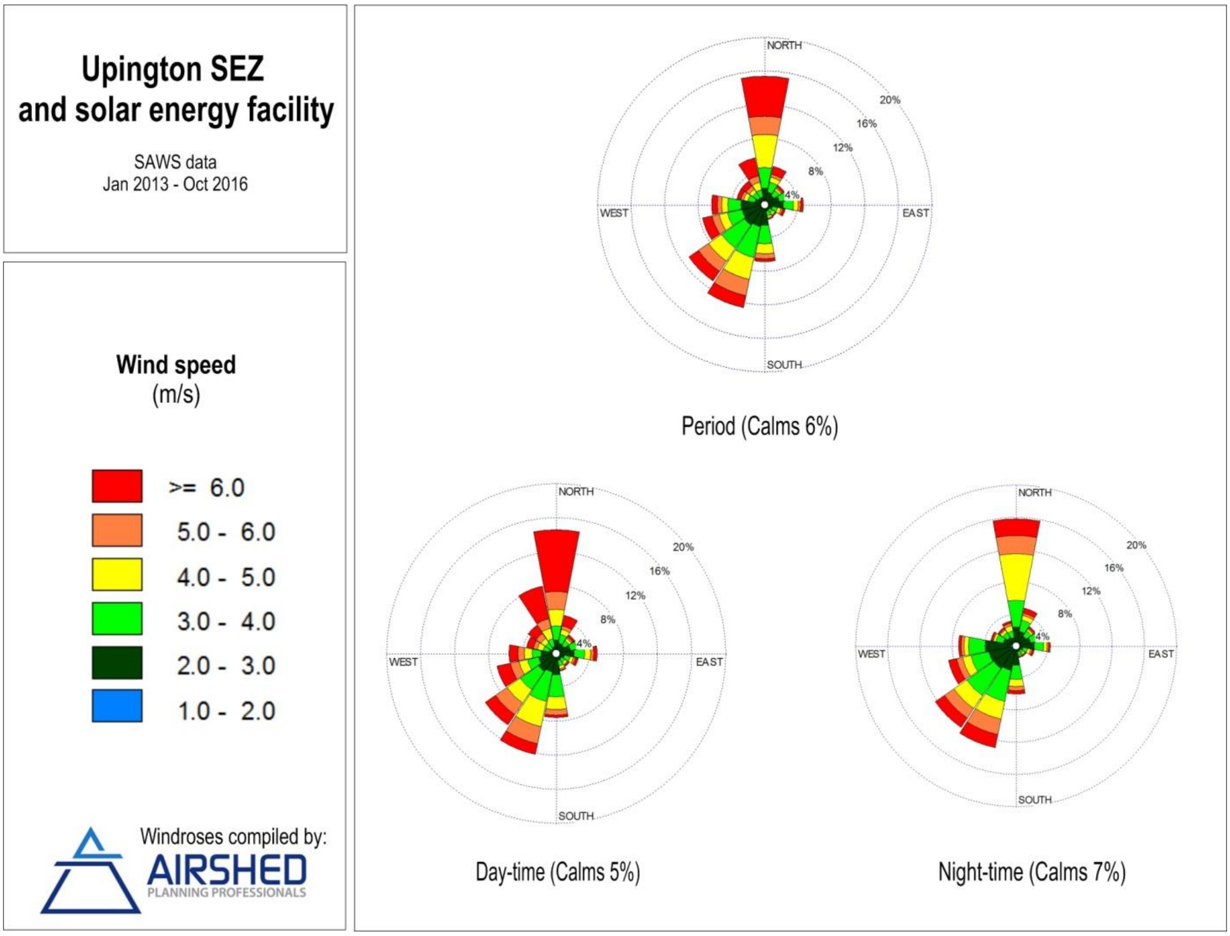

Figure 3-1: Period, day-, and night-time wind roses (SAWS Upington station, Jan 2013 to Oct 2016)

Air temperature is an important parameter for the development of the mixing and inversion layers. It also determines the rate of dissipation of pollutants before it reaches ground level. Incoming solar radiation determines the rate of development and dissipation of the mixing layer. Relative humidity is an inverse function of ambient air temperature, increasing as ambient air temperature decreases. Temperatures during the period January 2013 and October 2016 ranged between -4°C (July) to 45°C (January). The average hourly temperature profile across the year is shown in Figure 3-2.

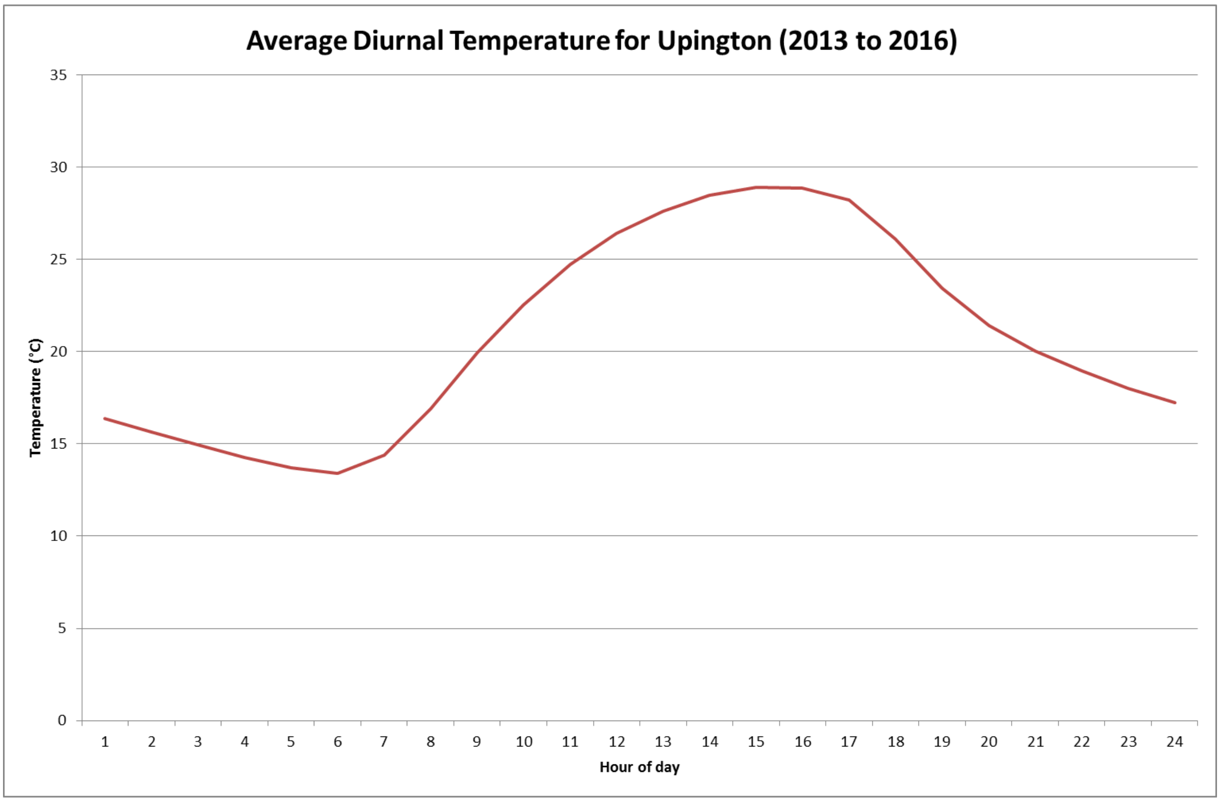

Figure 3-2: Diurnal temperature profile for Upington (SAWS station, Jan 2013 to Oct 2016)

Precipitation represents an effective removal mechanism of atmospheric pollutants and is therefore frequently considered during air pollution studies. Rainfall data was included in the data set provided by SAWS. During the period January 2013 and October 2016 an annual average of 213 mm was recorded at the station, with the highest monthly rainfall recorded in January to March (Figure 3-3).

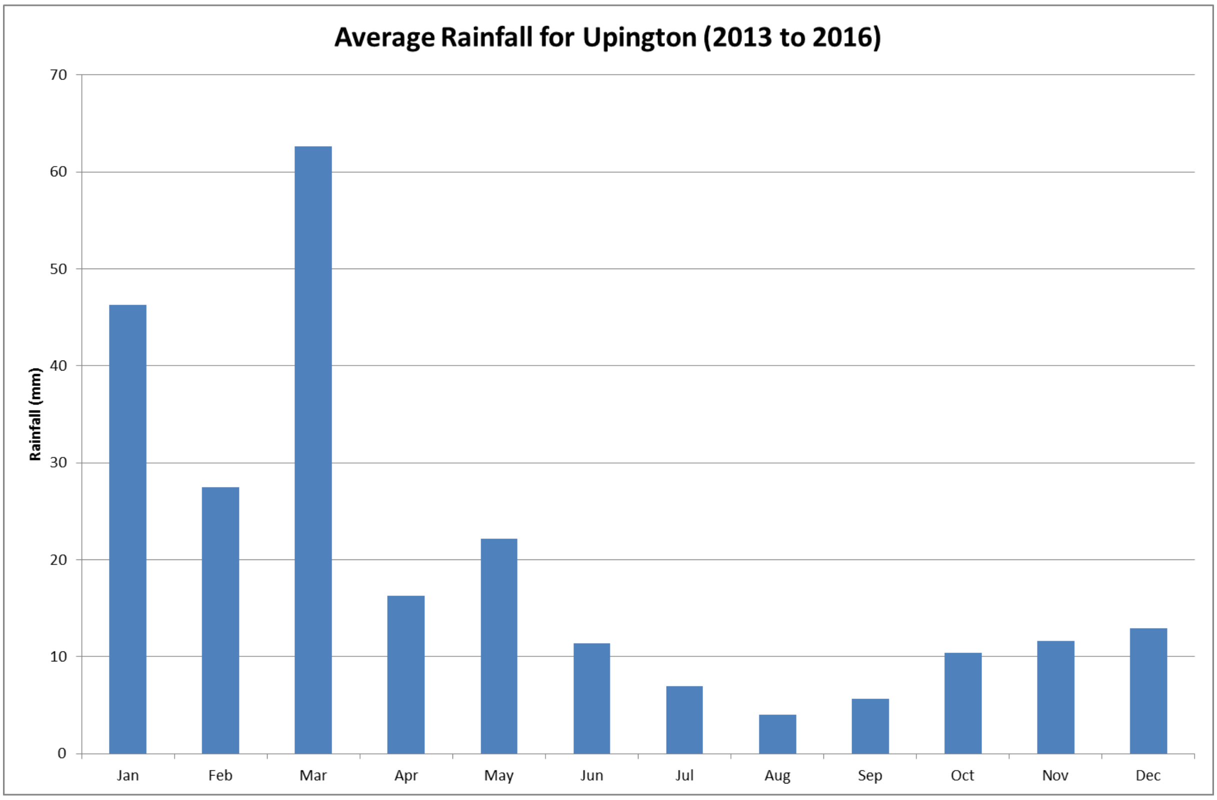

Figure 3-3: Rainfall (mm) recorded at the Upington SAWS station (Jan 2013 to Oct 2016)

3.2 Status Quo of Air Quality

Agricultural activities and vehicle traffic on gravel roads are most likely the largest contributor to particulate emissions in the vicinity.

Particulates represent the main pollutant of concern from the current activities in the region – quarrying operations, existing industrial operations, vehicles and trucks on gravel roads, agricultural field tilling and windblown dust from exposed surfaces. Airborne particulate matter comprises a mixture of organic and inorganic substances, ranging in size, shape and density. These can be divided into Total Suspended Particulates (TSP), thoracic particles or PM_{10} (particulate matter with an aerodynamic diameter of less than 10 µm) and respirable particles or $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than 2.5 µm). PM_{10} and $PM_{2.5}$ are associated with health impacts with TSP associated with nuisance dust.

Gaseous emissions derive from the haul trucks, public vehicles, existing industrial operations and domestic fuel burning. These gaseous emissions include primarily sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x) and hydrocarbons. Vehicles on the roads in the town, and on the R360 and N10 will also contribute to these gaseous emissions but it is expected that it is not a busy road and therefore the contribution is negligible. Similarly domestic fuel burning can be significant contributors to specifically indoor air pollution.

No ambient air quality data is currently available for the area.

4 Qualitative Air Quality Assessment

4.1 Solar Energy Facility – construction phase

Table 4-1 provides a list of sources of air pollution associated with the proposed construction activities expected in preparation of the project. The subsequent sections provide a generic description of the parameters influencing particulate emission generation from the various aspects identified.

Table 4-1: Activities and aspects identified for the construction phase of the proposed Solar Energy Facility.

Pollutant(s)	Aspect	Activity
Particulates	Construction of buildings and infrastructure	Land clearing activities such as dozing of vegetation and topsoil
		Grading of cleared land surfaces
		Windblown dust from exposed surface
	Vehicle activity on on-site temporary unpaved roads	Vehicle and construction equipment activity on the unpaved roads
	Increased vehicle activity on N10 and R360 main and secondary roads	Vehicle entrained dust from paved road
Gases and particles	Vehicle and construction equipment activity	Tailpipe emissions from vehicles and construction equipment such as graders, scrapers and dozers

The construction phase normally comprises a series of different operations including land clearing, topsoil removal, road grading, material loading and hauling, stockpiling, compaction, etc. Each of these operations will have their own duration and potential for particulate emission generation. It is anticipated that the extent of dust emissions would vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing meteorological conditions.

Grading and scraping of unpaved road surfaces will give rise to particulate emissions. Graders typically have a blade at the bottom of the equipment removing the top layer of material from the surface. Scrapers work on the same basis but with the blade usually in front. Particulate emissions from graders can be calculated using the US-EPA emission factor for graders and take into account the average speed at which it travels (US EPA, 1996).

Clearing of vegetation and topsoil for the infrastructure is likely to be done with bulldozers. The US-EPA equation for particulate emissions, as a result of bulldozing activities, includes the silt and moisture content of the material (US EPA, 1996).

4.1.1 Emission Quantification

If detailed information regarding the construction phase of the proposed project had been available, the construction process would have been broken down into component operations as shown in Table 4-1, for emissions quantification and dispersion simulations. Without detailed information available at this stage, emissions from the construction activities were instead estimated on an area wide basis. This approach estimates construction emissions for the entire affected area without regard to the actual plans of the individual construction project.

In the quantification of releases from the construction phase, use was made of emission factors published by the US-EPA (US EPA, 1995). The approximate emission factors for construction activity operations are given as:

$$E_{TSP} = 2.69 \text{ Mg/hectare/month of activity}$$

This emission factor is most applicable to construction operations with (i) medium activity levels, (ii) moderate silt contents, and (iii) semi-arid climates and it applies to TSP. Thus, it will result in conservatively high estimates when applied to PM_{10}. Also, because the derivation of the factor assumes that construction activity occurs 30 days per month, it is also regarded as conservatively high for TSP (US EPA, 1995). The emission factor does not provide an indication of which type of activity during construction would result in the highest impacts thus not providing information to develop an effective particulate control plan. For example, secondary particulate sources during construction might be far more significant than the actual on-site construction operations. Such secondary sources may include vehicle activity on off-site roads, quarry operations and stockpiles located away from the actual site (US EPA, 1995).

The total TSP generated during the proposed construction phase when applying the above mentioned emission factor is provided in Table 4-2. These emissions assume that all construction activities would take place simultaneously and over the entire area. This is unlikely to be the case. The construction period was assumed to last between 12 and 24 months.

Table 4-2: Source information and associated emission rates for the construction operations

Facility	Footprint (m^2)	Emission rate (tpa)*
Solar facility (20 MW; 72 ha)	720 000	2 324

Notes:
* representative of TSP

4.1.1.1 Materials handling

The handling of topsoil and gravel for construction operations could be a potential significant source of particulates at the various transfer points. The quantity of particulate emitted depends on various climatic parameters, such as wind speed and precipitation, in addition to non-climatic parameters, such as the nature and volume of the material handled. Fine particulates are most readily disaggregated and released to the atmosphere during the material transfer process, as a result of exposure to strong winds. Increases in the moisture content of the material being transferred will decrease the potential for particulate emission, since moisture promotes the aggregation and cementation of fines to the surfaces of larger particles.

The number of transfer points, the quantify of material, the moisture content of the material and the hourly wind speed will determine the TSP, PM_{10} and $PM_{2.5}$ emissions derived from the various transfer points. The construction operations are assumed to be a 24-hour, seven day a week operation for the 12 to 24 month period.

Materials handling operations can be mitigated through water sprays that can result in a 50% reduction in particulate emissions (NPI, 2011).

4.1.1.2 Vehicle entrainment on unpaved roads on-site

Vehicle-entrained particulate emissions from unpaved roads are significant sources of dust, especially where there are high traffic volumes on a road. The force of the wheels travelling on unpaved roads causes the pulverisation of surface material. Particles are lifted and dropped from the rotating wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. The quantity of particulate emissions from unpaved roads will vary linearly with the volume of traffic expected on a road.

The magnitude of particulate emissions from paved and unpaved roads is a function of the "silt loading" present on the road surface, and to a lesser extent of the average weight of vehicles travelling on the road (Cowherd and Engelhart,1984; US EPA, 1996). Silt loading refers to the mass of silt-size material (i.e. equal to or less than 75 microns in diameter) per unit area of the travel surface. Silt loading is the product of the silt fraction and the total loading. The amount of particulates (TSP, PM_{10} and $PM_{2.5}$) can be estimated using the available EPA emission equations accounting for vehicle weight, number of trips and silt content (US EPA, 2006).

The capacity of the construction trucks is not known at this stage. The traffic on the temporary unpaved roads is likely to be significant sources of dust generation if uncontrolled. The trucks using any paved roads around the proposed site during construction are likely to contribute less to the particulate emissions load in comparison but could also be significant source of particulates generation depending on the silt loading on the road. Mitigation measures indicate control efficiencies between 50% and 75% through water sprays and a 100% for sealed roads (NPI, 2011).

4.1.1.3 Windblown particulates

Wind erosion is a complex process, including three different phases of particle entrainment, transport and deposition. It is primarily influenced by atmospheric conditions (e.g. wind, precipitation and temperature), soil properties (e.g. soil texture, composition and aggregation), land-surface characteristics (e.g. topography, moisture, aerodynamic roughness length, vegetation and non-erodible elements), and land-use practice (e.g. farming, grazing and mining) (Shao, 2008).

Windblown particulates are generated from natural and anthropogenic sources. For wind erosion to occur, the wind speed needs to exceed a certain threshold, called the threshold velocity. This relates to gravity and the inter-particle cohesion that resists removal. Surface properties such as soil texture, soil moisture and vegetation cover influence the removal potential. Conversely, the friction velocity, or wind shear at the surface, is related to atmospheric flow conditions and surface aerodynamic properties. Thus, for particles to become airborne the wind shear at the surface must exceed the gravitational and cohesive forces acting upon them, called the threshold friction velocity (Shao, 2008).

The main sources of windblown particulates associated with the construction of the proposed project are likely to be: topsoil storage piles, and cleared land that would be prone to wind-blown particulate emissions. Estimating the quantity of windblown particles to be generated from these sources is not a trivial task and requires detailed information on the particle size distribution, moisture content, silt content and bulk density.

Wind erosion will occur during strong wind conditions when wind speeds exceed the critical threshold required to lift and suspend the particles. This threshold is determined by the parameters that resist removal such as the particle size distribution of the bed material, moisture content and vegetation. A typical wind speed threshold is given as 5.4 m/s for storage piles (US EPA, 1995). Wind data for Upington show an average wind speed of 3.5 m/s, however the threshold wind speed (5.4 m/s) is exceeded for 15% during the period. Thus there is the likelihood of wind-blown dust, especially during periods of high wind speeds (more typical in spring and summer).

Moisture will act as a binding agent and reduce wind erosion emission by around 50%, depending on the amount of water applied. Alternatives include re-vegetation of temporarily exposed surfaces on which infrastructure will not be constructed (NPI, 2011).

4.1.2 Qualitative Impact Assessment

The temporary nature of the construction activities, and the likelihood that these activities will be localised and on small areas at any given time, reduces the potential for significant off-site impacts. According to the Australian Environmental Protection Agency on recommended separation distances from various activities, a buffer zone of 300 m from the nearest sensitive receptor is required when quarry type operations occur without blasting and a distance of 500 m when blasting will take place (AEPA, 2000).

This may result in impacts on the residential area of Paballelo to the south of the proposed project site. The closest residential receptors are located ~500 m from the proposed project location. Windblown particulates may be a problem in this area, but only under conditions of high wind speeds which, based on the one year weather dataset, is only likely to occur for a short duration throughout the year. It is difficult to estimate the distance of impact but other studies conducted reported that PM_{10} particles are unlikely to impact on receptors more than 1 km from the source of emissions. Larger particles of between 10 and 30 μm would settle within 500 m with coarse particles (greater than 30 μm) would deposit within 100 m from the source.

4.1.3 Dust Management Plan

Based on the qualitative evaluation of the proposed PV Solar Energy project, generic management objectives are provided in Table 4-3. The management and monitoring of all operations at the proposed facility should be evaluated on a daily basis and appropriate actions taken to minimise particulate emissions and impacts.

It is recommended that a dustfall monitoring network be established prior to and during construction of the proposed solar energy project. Initiation of the dustfall network prior to construction (approximately three months) would give an indication of baseline conditions and should be the target dustfall during construction and operational phases through the application of effective mitigation measures. The responsibility of management of the dustfall network could be subcontracted prior to construction. During and after the construction phase management responsibility of the dustfall network can pass to the Site or Environmental Management team.

The dustfall network would ideally use eight dustfall units deployed at or near the property boundary in the cardinal wind directions. Fine particulate monitoring (PM_{10}) would ideally be located at a secure location, with power supply, with easy access, and if possible close to the potential receptors.

Table 4-3: Air Quality Management Plan for the proposed Photovaltaic (Solar) Energy Project in Upington

ASPECT	IMPACT	MANAGEMENT ACTIONS/OBJECTIVES	RESPONSIBLE PERSON(S)	TARGET DATE
Construction of the proposed photovoltaic (solar) energy project				
Land clearing activities such as dozing and scraping of vegetation and topsoil	PM_{10} and $PM_{2.5}$ concentrations and dustfall	Water sprays to be applied at the area to be cleared should significant amounts of dust be generated. Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. Ensure travel distance between clearing area and topsoil piles to be at a minimum.	SM/EM Contractor(s)	Pre- and during construction
Wind erosion from exposed areas	PM_{10} and $PM_{2.5}$ concentrations and dustfall	Ensure exposed areas remain moist through regular water spraying during dry, windy periods. Existing dust buckets DB1, DB2 and DB3 should be used to monitor monthly dustfall rates, which should not exceed 1 200 mg/m²/day[(a)]. DB7 and DB8 should be monitor dustfall rates further from the construction activities where dustfall rates should not exceed 600 mg/m²/day[(b)]	SM/EM Contractor(s)	Ongoing and post-operational
Decommissioning phase				
Wind erosion from exposed areas	PM_{10} concentrations and dustfall	Reshape all disturbed areas to their natural contours. Cover disturbed areas with previously collected topsoil and replant native species.	SM/EM Contractors	Ongoing and post-operational

Notes:

SM = Site Manager / EM = Environmental Manager

(a) Non-residential dustfall standard (1 200 mg/m².day) for heavy commercial and industrial sites not to be exceeded for two sequential months and not more than three exceedances in a year.

(b) Residential dustfall standard (600 mg/m².day) not to be exceeded for two sequential months and not more than three exceedances in a year.

5 CONCLUSION

5.1 Photovoltaic (Solar) Energy project

The main findings from the qualitative assessment of the proposed PV Solar Energy project are as follows:

- **Construction operations:** There is a possibility for elevated off-site dustfall rates, as well as PM_{10} and $PM_{2.5}$ concentrations due to the close proximity of the proposed site to the residential area of Paballelo. The potential exists for exceedances of the residential dustfall limit (600 mg/m^2.day) at the closest residential receptors. With mitigation in place, primarily comprising of water sprays, these impacts would be controlled and brought into compliance.
- **Operational Phase operations:** Emissions to air associated with the operational phase would only result from maintenance vehicles. These are regarded as insignificant.
- **Decommissioning phase:** The decommissioning phase will mainly include materials handling activities, wind erosion and to a lesser extent vehicle and equipment movement on-site and on the access road.

The advantages and disadvantages of the proposed PV Solar Project are provided in order to support the selection of an appropriate social development project for the town (Table 5-1).

Table 5-1: Advantages and disadvantages of the proposed Solar Energy Project

Advantages	Disadvantages
Creation of skilled and semi-skilled employment opportunities.	Relatively small permanent work-force required.
Relatively quick construction of facility.	Potential for dustfall masking the PV cell surfaces, especially during mining operations, which may require additional maintenance for optimal efficiency of the solar plant.
Low-cost electricity for the SEZ.	Additional atmospheric emissions from the transport of PV cells to site, and off-site at the end of the life of the PV cells.
Significant atmospheric emissions only likely during the short-term construction phase (12 to 24 months).	Initial capital investment cost of solar project may be higher than alternatives.

5.2 Conclusion

In conclusion, from an air quality perspective the proposed PV Solar Energy project is likely to have insignificantly low impacts on the receiving environment and human health.

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