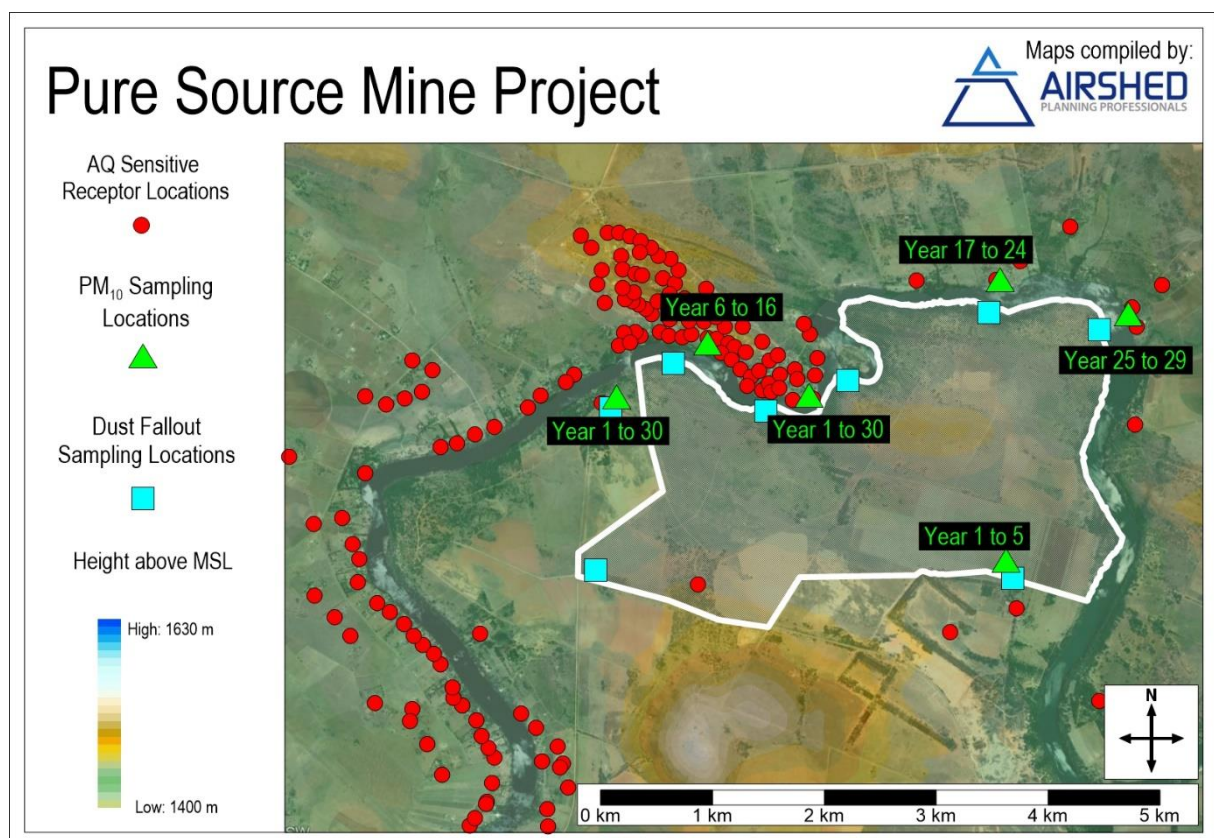


## Air Quality Management Measures

- Emission rates from the dryer stack must comply with the Subcategory 5.2 (Drying) “New Plant” Minimum Emission Standards. The plant must be designed, or additional abatement equipment implemented, to make sure emission from the dryer stack are in compliance with these standards.
- Based on the dispersion modelling results, it is highly unlikely that daily average PM<sub>10</sub> concentrations would be in compliance with the SA NAAQS at Vaal Oewer and other sensitive receptor locations to the north of Vaal river, especially during hot, dry and windy conditions, regardless of the mitigation measures employed, due to the relatively small distance between these receptors and the northern and south western aggregate resources.
- Based on simulated dust fallout rates, it is recommended that no mining activities, including crushing and screening, be undertaken within 400 m to the south, east and west of any sensitive receptor location and within 800m to the north of any sensitive receptor locations.
- It is recommended that, if possible, aggregate crushing not be conducted in the gravel pits but rather located closer to the plant and further from any sensitive receptor locations. If crushing is conducted at a fixed site rather than with a mobile crusher, better and more effective mitigation could be implemented on crushing and screening activities.
- It is recommended that any disturbed areas be immediately rehabilitated to avoid wind erosion emission during periods of high wind speeds.
- Best practice mitigation measures such as wind breaks and wet suppression must be implemented around in-pit material handling, crushing and screening activities. Air quality impacts at nearby sensitive receptor locations could be very high if mining operations proceed without adequate mitigation measures in place.
- A complaints register should be kept on-site as well as at secure locations in Vaal Oewer and Lindiquesdrift once operations commence. An example complaints register is shown in Table 1. Staff and the neighbouring communities should be encouraged to report all air quality related problems. Frequent community liaison meetings should be held with the neighbouring communities to address air quality related concerns. Complainants should be encouraged to note down as much details as possible regarding incidents, including the nature of incident, the approximate area where the incident occurs, the time of the incident and the perceived meteorological conditions during the incident.
- It is recommended that an on-site meteorological station be installed. The station could be used to pre-emptively apply additional mitigation measures during adverse meteorological conditions (such as periods with high winds). Additionally, recorded meteorological data can be used, together with monitoring data and the complaints register, to identify problem areas where additional mitigation might be required.
- Wet suppression techniques must be used to control dust emissions, especially in areas where dry material is handled or stockpiled. A Generac Dust Fighter has been proposed by the client for in-pit mitigation of dust emissions in both the sand and gravel pits.
- Exposed soils and other erodible materials should be re-vegetated, covered or otherwise rendered non-dust forming immediately;
- New areas should be cleared and opened-up only when absolutely necessary;
- Storage for dusty materials should be enclosed on at least three sides, or operated with efficient dust suppressing measures;
- Loading, transfer, and discharge of materials should take place with a minimum height of fall, and be shielded against the wind, and the use of dust suppression spray systems should be considered;
- Vehicles should be fitted with catalytic converters and low sulfur fuel should be used to minimise NO<sub>2</sub> and SO<sub>2</sub> impacts.
- Vehicle idle times should be kept to a minimum to minimise CO, NO<sub>2</sub>, SO<sub>2</sub>, diesel particulate and greenhouse gas emissions.

- Strict speed limits should be imposed to reduce entrained emissions and fuel consumption rates.
- The vehicle fleet should be regularly serviced and maintained to minimise CO, NO<sub>2</sub>, SO<sub>2</sub>, diesel particulate and greenhouse gas emissions.
- Older vehicles in the fleet should be regularly replaced with newer, more fuel-efficient alternatives where feasible.
- Based on the evaporation rate in the study area, the optimum watering rate on all unpaved roads is 20 litres per square meter of road per day to minimise dust emissions. It is recommended that a water bowser be employed with a watering rate of at least 650 litres per minute to ensure adequate mitigation of entrained dust from unpaved roads. It is furthermore recommended that chemical dust suppressants be applied to all roads at least once per month, but preferably every two weeks.
- Allowance should be made for the use of 1150 litres per minute (or 300 000 m<sup>2</sup> per annum) of water for dust suppression. This would be sufficient for a net watering rate of 10 mm/day on 48000 m<sup>2</sup> of roads (650 litres per minute) as well as the operation of two Generac Dust Fighters, each consuming 180 litres per minute of water. A further 150 litres per minute of water is allowed for mitigation on crushers, screens and conveyor transfer points.
- PM<sub>10</sub> and dust fallout monitoring is recommended for the duration of the mining and rehabilitation phases. Dust fallout monitoring should be conducted at all recommended locations while PM<sub>10</sub> monitoring can be moved to sample concentrations at the closest sensitive receptor locations. Monitoring of both dust fallout rates and PM<sub>10</sub> concentrations should be started before the mining activities commence in order to establish baseline levels.
- If PM<sub>10</sub> concentrations are found to be in exceedance of the NAAQS or dust fallout rates found to be in exceedance of the NDCR residential limit at the closest sensitive receptor locations additional dust suppression measures must be investigated and implemented timeously until recorded concentration and dust fallout rates are in compliance with the NAAQS and NDCR respectively. If the mitigation measures employed are considered best practise, additional offset measures should be considered. Such offset measures include upgrading of public road surfaces, electrification of houses for cooking and heating or supply of cleaner burning fuel for cooking and heating purposes. Offsets should be in line with the Air Quality Offsets Guidelines.



### Figure 1: Recommended Dust Fallout and PM<sub>10</sub> Monitoring Locations

- Diligent record should be kept of all mitigation measures implemented. This includes a water spray log book (Table 2) on unpaved haul roads and a cleaning logbook for paved areas or spillages where re-entrainment of dust might occur.
- A dust inspection logbook (an example is given in Table 3) should be established, with a dedicated officer conducting dust inspections during every shift.

Based on the findings and provided that all of the above recommendations, buffer zones, mitigation measures and monitoring measures are implemented, it is the specialist opinion that the project can be authorised.

A summary of mitigation, management and monitoring measures discussed above are given in the format requested by Shango Solutions in Table 4.

**Table 1: Complaints Register Example**

Complaint Number	Complainant	Contact Details	Date and Time	Description (as detailed as possible)	Results	Resolution
0	Someone Example	082 111 1111 (someone@example.co.za)	20/12/2012 15:06	High fugitive dust levels were observed from the Aggregate Pit to the south west of Vaal Oewer. The wind was moderate and from the south at the time.	Exceptionally high wind speeds resulted in dust emissions from the material handling operations, this is a rare occurrence	Resolved

**Table 2: Water spray or cleaning logbook**

Date			
Operator's name:			
Location	Water spray applied/Area cleaned		
	Frequency of watering	Frequency of cleaning	Problems
Access Road			
Road to sand pit			
Road to gravel pit			
Sand stockpiles			

**Table 3: Dust inspection logbook**

Date						
Inspector's name:						
Location	Surface dust assessment			Visible Dust Plume Assessment		
	Very little	Thin coating	Thick coating	No Visible Plume	Slightly Visible Plume	Clearly Visible Plume
Access Road						
Road to sand pit						
Road to gravel pit						
Stockpiles						
Washing and drying plant						

**Table 4. Mitigation and Management measures including timeframes, roles and responsibilities**

No	Mitigation Measures	Phase	Timeframe	Responsibility	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
<b>Mitigation Measures</b>							
A	Design of the drying plant (and possible corresponding abatement equipment) to	Planning and design. Construction	Prior to construction of the drying plant	Plant designers.	External – Annual monitoring or as per AEL issued	Compliance with the relevant MES	Compliance with the Subcategory 5.1 New Plant MES for particulate matter, SO <sub>2</sub> and NO <sub>x</sub>
B	Best practise mitigation measures (as per recommendation in	Operation	Throughout lifespan of mine	Applicant	<b>As per monitoring recommendations below</b>		
C	Management and mitigation measures of vehicle fleet emissions as per	Construction Operation	During construction and throughout lifespan of mine	Applicant	<b>As per monitoring recommendations below</b>		
D	Covering and rehabilitation of any exposed areas to minimise wind erosion emissions.	Construction Operation Decommissioning Post closure	During and post mining operations	Applicant	<b>As per monitoring recommendations below</b>		
<b>Monitoring Measures</b>							
E	Monitoring of ambient PM <sub>10</sub> concentrations at sensitive receptor locations	Pre-construction Construction Operation Decommissioning Post	Sampling to be conducted prior to construction to determine baseline levels. Sampling to be continued throughout the life of mine at	Applicant	External – Daily Sampling	Compliance with the SA NAAQS	Daily and annual PM <sub>10</sub> concentrations should be in compliance with the SA NAAQS at all sensitive receptor locations, including at those closest to the mining operations. If PM <sub>10</sub> concentrations exceed the SA NAAQS

F	<b>Monitoring of dust fallout rates at the property boundary.</b>	<b>Pre-construction Construction Operation Decommissioning Post closure</b>	the closest sensitive receptor locations	<b>Applicant</b>	<b>External – Monthly Sampling</b>	<b>Compliance with the SA NDCR</b>	Monthly dust fallout rates should be below the SA NDCR non-residential limit at the property boundary and below the SA NDCR residential limit at all sensitive receptor locations.
G	Frequent dust inspections, diligent record keeping of mitigation measures, detailed complaints register, meteorological monitoring	<b>Operation</b>	<b>Throughout lifespan of mine</b>	Applicant	Mine Manager – per Shift	Compliance with the SA NAAQS and NDCR limits.	Limited complaints from surrounding communities.