

# *Keysbrook Mineral Sands Project*

## Air Quality and Dust Management Plan

February 2020

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PTY LTD**

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Approver		Signature	Date
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## GLOSSARY

Term	Definition
<b>AER</b>	Annual Environmental Report (as required under the site Part V Licence)
<b>BAM</b>	Beta Attenuation Dust Monitor
<b>CAR</b>	Compliance Assessment Report
<b>DWER</b>	Department of Water and Environment Regulation
<b>DMP</b>	Nephelometer Dust Monitor
<b>EP Act</b>	Environmental Protection Act 1986
<b>PM<sub>10</sub></b>	Particulate Matter less than 10 micron
<b>TSP</b>	Total Suspended Particulates
<b>µg/m<sup>3</sup></b>	Micrograms per cubic metre

## SUMMARY

This Air Quality and Dust Management Plan (AQDMP) is prepared in accordance with Conditions 15-2, 15-3 and 15-5 of Ministerial Statement No. 810 for the Keysbrook Mineral Sands Mine (the Project). The proponent for the Project is Keysbrook Leucoxene Pty Ltd (KLPL). KLPL is a 100% owned subsidiary of Doral Mineral Sands Pty Ltd.

Table 1 below presents the environmental criteria to measure achievement of the conditioned environmental outcome that must be met through implementation of this Condition EMP.

**Table 1: Environmental Criteria**

Title of Proposal	Keysbrook Mineral Sands Mine	
Proponent	Keysbrook Leucoxene Propriety Limited	
Ministerial Statement Number	810	
Purpose of this Condition EMP	Fulfil the requirements of Implementation Conditions	
EPA Key Environmental Factor	Air Quality	
EPA Objective	To maintain air quality and minimise emissions so that environmental values are protected.	
Implementation Condition Clauses	Conditions 15-2 to 15-8	
Key Provisions of the Plan	<div><div>1.</div><div>Management measures to minimise dust emissions and ensure compliance with National Environmental Protection Measure Standards for particulates, as set in Condition 15-2.</div></div> <div><div>2.</div><div>Monitoring programme to (i) characterise local dust environment; (ii) inform management measures and (iii) enable assessment of compliance</div></div>	
Environmental Criteria		
Trigger Criteria	<div>Total Suspended Particulates (TSP):<div><div>•</div><div>600 µg/m<sup>3</sup> 15 minute average</div></div></div>	<div>Particulate Matter less than 10 micron (PM<sub>10</sub>):<div><div>•</div><div>200 µg/m<sup>3</sup> 15-minute average</div></div><div><div>•</div><div>40 µg/m<sup>3</sup> 6 hour rolling average</div></div></div>
Threshold Criteria	<div>Total Suspended Particulates (TSP):<div><div>•</div><div>1,000 µg/m<sup>3</sup> 15 minute average</div></div></div>	<div>Particulate Matter less than 10 micron:<div><div>•</div><div>50 µg/m<sup>3</sup> 24 hour average (in excess of five (5) times per year</div></div></div>

# 1. CONTEXT, SCOPE AND RATIONALE

## 1.1 Proposal Description

Keysbrook Leucoxene Proprietary Limited (KLPL), operate a mineral sands mine and primary processing plant (the Project) within an area of rural land near the townships of Keysbrook and North Dandalup, 70 km south of Perth (Figure 1). The Project is within the Shire of Murray and the Shire of Serpentine-Jarrahdale.

MZI Resources Ltd (MZI) subsidiary Keysbrook Leucoxene Pty Ltd (KLPL) commenced operating a mineral sands mine between Keysbrook and North Dandalup in late 2015. In April 2019 MZI announced that administrators were being appointed, and the company was listed for sale. KLPL was acquired from MZI Resources Ltd (formerly the parent company of KLPL) by Doral Mineral Sands on 1 July 2019.

An application to change the nominated proponent from MZI Resources Ltd to Keysbrook Leucoxene Pty Ltd was submitted following the acquisition of KLPL by Doral Mineral Sands Pty Ltd and approved on 3 September 2019.

The Keysbrook Mineral Sands Mine targets a deposit containing high grade leucoxene. Leucoxene is a fine, granular, weathered titanium mineral used as feedstock for titanium pigment plants. The surface mining operation migrates across the land, and the shallow mine void is generally backfilled to pre-disturbance contours and rehabilitated within two years following mining.

The Project is on privately owned land, used for grazing and other rural pursuits. The approved mining area covers 1,379 hectares. Of this, 1,197 hectares (87%) is open pasture and 182 hectares (13%) is native vegetation ranging in condition from good to degraded. A further 75 hectares in two parcels has been secured through conservation covenants and is the subject of a vegetation enhancement program. The area for mining approved under Ministerial Statement No. 810 provided for 8 years of mining, which commenced in October 2015.

## 1.2 Key Environmental Factors

The key environmental factor relevant to this Management Plan is air quality, focussed on airborne dust. Potential sources of dust from the Project are summarised in Table 2:

**Table 2: Potential Air Emission Generating Activities at Keysbrook**

Source	Activity	Potential Pollutants	Inherent Risk
Mining & Exploration	Clearing and grubbing	Dust TSP, PM <sub>10</sub>	High
	Topsoil removal		
	Excavating		
	Truck loading		
	Heavy and light vehicle movements		
	General materials handling		
	Exposed areas susceptible to wind		
Processing Area	Land rehabilitation works		
	Fixed plant	Dust TSP, PM <sub>10</sub>	Medium
	General materials handling		
	Exposed areas susceptible to wind	Dust TSP, PM <sub>10</sub>	Low
	Heavy mineral concentrate stockpiling		

Source	Activity	Potential Pollutants	Inherent Risk
Fuel consumption	Fixed and mobile plant Pumps and compressors Heavy and light vehicles	Exhaust emissions NOx, SOx, CO, VOC's, PM <sub>10</sub>	Low <sup>1</sup>
Ancillary	Fuel storage (venting)	VOC's, PAH's	Negligible <sup>2</sup>

### 1.3 Approvals and Condition Requirements

The Project was assessed and approved under Part IV of the *Environmental Protection Act 1986* (EP Act), through Ministerial Statement 810, and subsequently revised via Section 46C and 45C in June 2011 and February 2013 respectively. A Section 46 amendment to extend the time limit for commencement of the Project was made in October 2014.

This AQDMP has been prepared to address the following Ministerial Conditions prescribed in Statement 810.

**Table 3: Condition Requirements**

Condition No.	Condition	Relevant Section of AQDMP
15-1	Prior to the commencement of operations, the proponent shall revise the Air Quality and Dust Management Plan to the requirements of the CEO.	Completed (MZI Resources, 2013)
15-2	<p>The objectives of the Plan are to:</p> <ul style="list-style-type: none"> <li>a. ensure dust emissions from activities undertaken in implementing the proposal do not cause ambient dust concentration levels outside the boundary of the proposal area that are: <ul style="list-style-type: none"> <li>i. higher than 1,000 µg/m<sup>3</sup> of Total Suspended Particulates as a 15 minute average; or</li> <li>ii. higher than 50 µg/m<sup>3</sup> of Particulate Matter smaller than 10 microns as a 24 hour average, in excess of five times per year;</li> </ul> </li> <li>b. identify measures to reduce dust emissions; and</li> <li>c. ensure that dust emissions do not harm or adversely affect environmental values or the health, welfare and amenity of people and land uses.</li> </ul>	<ul style="list-style-type: none"> <li>a) 2.2</li> <li>b) 2.1</li> <li>c) 2.1.1</li> </ul>
15-3	<p>The Plan shall:</p> <ul style="list-style-type: none"> <li>a. outline the results of on-site baseline dust monitoring and modelling;</li> <li>b. identify dust management measures for a range of predicted weather forecasts, including avoiding, ameliorating and protecting from dust impacts;</li> <li>c. identify dust management measures according to actual winds experienced at the site;</li> <li>d. identify a plan for each pit, which details the times of day and weather conditions under which parts of the pit could be mined;</li> <li>e. identify a monitoring program, incorporating trigger values for the implementation of management measures to ensure dust emissions from activities undertaken in implementing the proposal do not cause ambient dust concentration levels outside the boundary of the proposal area that are:</li> </ul>	<ul style="list-style-type: none"> <li>a) 1.4.1</li> <li>b) 2.2.1</li> <li>c) 2.1.1, 2.1.4</li> <li>d) 2.1.4</li> <li>e) 1.4, 2.2.1</li> <li>f) 2.1.3, 2.1.5</li> <li>g) 5.1</li> <li>h) 2.1.2 and Figure 2</li> </ul>

<sup>1</sup> This AQDMP focusses on management and monitoring high and medium risk activities only. Impacts from low or negligible risk activities are manageable through standard industry practice, a rigorous equipment maintenance plan and energy efficiency measures implemented by KLPL.

Condition No.	Condition	Relevant Section of AQDMP
	<ul style="list-style-type: none"> <li>i. higher than 1,000 µg/m<sup>3</sup> of Total Suspended Particulates as a 15 minute average; or</li> <li>ii. higher than 50 µg/m<sup>3</sup> of Particulate Matter smaller than 10 microns as a 24 hour average, in excess of five times per year;</li> <li>f. identify management measures to ensure dust emissions from activities undertaken in implementing the proposal do not cause ambient dust concentration levels outside the boundary of the proposal area that are: <ul style="list-style-type: none"> <li>i. higher than 1,000 ug/m<sup>3</sup> of Total Suspended Particulates as a 15 minute average; or</li> <li>ii. higher than 50 ug/m<sup>3</sup> of Particulate Matter smaller than 10 microns as a 24 hour average, in excess of five times per year;</li> </ul> </li> <li>g. identify a complaint management procedure; and</li> <li>h. describe the outcomes of landowner agreements when mining in close proximity to occupied residences.</li> </ul>	
15-4	The proponent shall implement the Air Quality and Dust Management Plan.	Refer Annual CARs
15-5	The proponent shall review and revise the Air Quality and Dust Management Plan as and when directed by the CEO.	4
15-6	The proponent shall implement revisions of the Air Quality and Dust Management Plan required by condition 15-5.	Refer Annual CARs
15-7	The proponent shall make the Air Quality and Dust Management Plan (including any revisions) and the results of monitoring publicly available in a manner approved by the CEO.	The approved AQDMP will be available at: <a href="http://www.doral.com.au">www.doral.com.au</a>
15-8	To the extent that the proposal is subject to a licence issued under Part V of the Act, that licence may impose conditions which are different from, or additional to, the requirements of this Statement.	N/A <sup>2</sup>

<sup>2</sup> The Project is licenced by the Department of Water and Environmental Regulation (DWER) under L8918/2015/1 for prescribed Category 6 (Mine Dewatering) and Category 8 (Mineral Sands Mining or Processing – 5.2 mtpa). No licence conditions relating to dust or air quality are applicable.





Figure 1: Regional Location

## **1.4 Rationale and Approach in Meeting the Environmental Outcome**

### **1.4.1 Baseline Dust Monitoring (2007)**

Baseline monitoring for particulate matter less than 10 microns in diameter (PM<sub>10</sub>) was carried out by SKM between 21 February and 17 April 2007. A Tapered Element Oscillating Microbalance (TEOM) fitted with a PM<sub>10</sub> inlet was located in an open paddock, with no livestock in the immediate vicinity, south west of the Keysbrook townsite. The unit was located far enough from the South West Highway that vehicle emissions from this road would not be a factor, although it was noted that some local vehicle emissions may still be experienced at the monitoring site.

Readings were taken every five minutes, with these values used to calculate hourly and daily averages.

All averaged 24-hour readings for PM<sub>10</sub> were below the NEPM value of 50 micrograms per cubic metre with the highest recording being 37.9 micrograms per cubic metre (79.4% of the NEPM value).

A comparison between dust concentrations and wind speed and direction indicated that the highest dust concentrations occurred with southerly or westerly winds, in contrast with the modelling which predicted easterly winds would generate higher dust concentrations. Additionally, the majority of high concentration readings coincided with wind speeds between 0.9 and 2.3 metres per second, though the highest concentrations were recorded during much higher wind speeds of 4.4 metres per second.

### **1.4.2 Results of Air Quality Modelling 2013**

As part of the initial environmental impact assessment for the Project, modelling of air quality impacts from mining operations at Keysbrook was undertaken using the Victorian EPA's AUSPLUME (Version 6.0) air dispersion model (MZI Resources, 2013). The model used three years of meteorological data to predict potential worst case ground-level concentrations of particulates and determined that without management and mitigation measures, there was potential for air quality and dust impacts on those residences that are within 300 metres of active mining.

In areas where residences are relatively close to operations, it was recommended that a monitoring network be established between the operations and the nearest residence such that if high dust concentrations occur, an alert is raised and additional management measures can be implemented.

### **1.4.3 Operational Air Quality Monitoring Experience**

Construction of the project commenced in January 2015 and operations commenced following commissioning in October 2015. Monitoring ambient dust concentrations commenced in May 2015 in accord with an approved Air Quality and Dust Management Plan (March 2012) as amended through an approved Air Quality and Dust Management Plan Addendum (October 2013).

Monitoring was conducted using three nephelometers (DMP) and one Beta Attenuation Monitor (BAM) each measuring ambient PM<sub>10</sub> concentrations over a 15-minute averaging period, with the BAM also measuring ambient TSP concentrations over a 15-minute averaging period. The results of the monitoring indicated that no discernible trend was observed between PM<sub>10</sub> and TSP concentration and that the ratio of PM<sub>10</sub>:TSP is dependent on wind conditions and particulate concentration.

Through a review of actual mining activities, processing experience and monitoring data gained since the commencement of operations, a number of opportunities to improve dust management and monitoring practices have been identified and are reflected in this updated Air Quality and Dust Management Plan.



The data confirms that the key predictions in the original modelling remain valid: namely that the highest risk of dust generation is from cleared or active areas exposed to easterly and south westerly winds during dry periods. Monitoring to date has also indicated elevated background dust levels at times above threshold values which is attributed to surrounding agricultural land and activities (i.e. cattle grazing, crop harvesting and strong winds across open paddocks). Appendix A presents monitoring data that includes periods of elevated dust levels upwind of operational areas. These graphs, demonstrate that, at times, background dust levels contribute significantly to observed PM<sub>10</sub> and TSP concentrations. Appendix 1 indicates the location the of the DMPs and the BAM during January 2018.

#### 1.4.4 Australian Standards

Dust monitoring will be undertaken in accordance with the applicable Australian Standards relevant to the technology used, including:

- AS/NZS 3580.1.1:2016 - Methods for Sampling and Analysis of Ambient Air – Guide to Siting Air Monitoring Equipment.
- AS/NZS 3580.9.11:2016 - Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM<sub>10</sub> beta attenuation monitors.
- AS/NZS 3580.12.1:2015 - Methods for sampling and analysis of ambient air - Determination of light scattering - Integrating nephelometer method.
- AS/NZS 3580.14:2014 - Methods for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications.
- National Environment Protection (Ambient Air Quality) Measure (as amended, 2016), 24 hour PM<sub>10</sub> goal.

#### 1.4.5 Monitoring Equipment

Through review of monitoring data from the initial period of operations, KLPL have identified some improvements to monitoring equipment and data capture systems which are incorporated into this revised Plan.

Monitoring equipment has been selected to allow for more direct and accurate monitoring of parameters at a frequency and averaging period prescribed in Ministerial Condition 15.

Monitoring data will continue to be analysed in conjunction with meteorological data and logs of site activities to investigate potential exceedances and community concerns.

Validated monitoring data will be utilised in analyses of results for internal and external regulatory reporting requirements.

Monitoring equipment will be solar powered and operate continuously with a target availability of 95% to account for planned servicing and maintenance and unplanned downtime.

##### 1.4.5.1 Total Suspended Particulates (TSP)

In accordance with Ministerial Statement 810, dust monitoring at the Project will be undertaken for Total Suspended Particulates (TSP) using an E-BAM operated and maintained in accordance with AS/NZS 3580.9.11:2016 - Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM<sub>10</sub> beta attenuation monitors.

The E-BAM will be configured to directly measure TSP concentrations over a 15 minute averaging period.

### **1.4.5.2 PM<sub>10</sub> Monitoring**

In accordance with Ministerial Statement 810, dust monitoring at the Keysbrook Mine will be undertaken for particulate matter smaller or equal to 10 microns (PM<sub>10</sub>).

KLPL proposes to utilise three nephelometers operated and maintained in accordance with AS/NZS 3580.12.1:2015 - Methods for sampling and analysis of ambient air - Determination of light scattering - Integrating nephelometer method.

The current nephelometers utilised on site are Dust Master Pro's. The nephelometers will be configured to measure PM<sub>10</sub> concentrations over a 15-minute averaging period.

In addition, one BAM may be deployed opportunistically to supplement the dust monitoring network, or as a substitute for one of the nephelometers in the event of equipment downtime. The BAM will measure PM<sub>10</sub> over a 1 hour averaging period.

### **1.4.6 Monitoring Locations**

The monitoring equipment will be located around the periphery of the proposal area, with placement guided by:

- The location of proposed mining and rehabilitation activities;
- Prevailing seasonal wind conditions;
- Proximity of mining activity to sensitive human receptors; and
- An objective of characterising airborne dust concentrations upwind and downwind of the disturbance footprint. The upwind and downwind locations will be based on seasonal wind roses. Wind roses generated from the Bureau of Meteorology (BoM) Mandurah station 9977 are provided as Appendix B.

The locations of the monitoring points will change in sympathy with the moving mining operation and may also be adapted in response to ongoing data analysis and community feedback. The fluidity of the monitoring locations is pivotal in maximising the value and reliability of data.

The positioning of instruments will be cognisant of the likelihood of vandalism and theft. Monitoring locations will be chosen based on potential visual obscurity and where public access is minimised. To further minimise the risk of theft, all monitoring equipment will be equipped with anti-theft wheel clamps.

### **1.4.7 Telemetry and Alerts**

Monitoring equipment will be configured to include the following capabilities:

- Automated remote warning system that can send alerts when dust concentrations exceed the trigger values.
- Telemetry system to allow for remote downloading of monitoring data.
- Solar power or high capacity battery system to provide continuous power.

### **1.4.8 Meteorological Monitoring**

A standard three-cup and vane anemometer records wind speed and direction in association with dust levels at the nephelometers and BAM.

In addition, an automated meteorological station located in proximity of the processing site provides a more comprehensive suite of weather data valuable for the interrogation of dust data. The equipment is mounted on a 10-metre mast and includes transducers for wind speed, wind direction, relative humidity and rainfall installed to Bureau of Meteorology standards.

#### **1.4.9 Monitoring Equipment Calibration**

All equipment will be subject to a scheduled servicing and maintenance program managed via KLPL's PRONTO scheduling system. Servicing and calibration of dust monitors and the meteorological station will be in accordance with applicable Australian Standards or manufacturer specifications. This will typically occur on at least a quarterly basis by a trained monitoring technician. An annual calibration of all monitoring equipment will also be undertaken with records maintained by KLPL within a calibration register.

#### **1.4.10 Rationale for Choice of Environmental Criteria**

Environmental assessment criteria are prescribed in Ministerial Conditions 15-2 and 15-3 of Statement 810 and relate to PM<sub>10</sub> and TSP dust. Accordingly, dust monitoring and the management of potential dust impacts focus on these parameters in order to ensure that environmental criteria are met.

##### **1.4.10.1 Total Suspended Particulate (TSP)**

Total Suspended Particulates (TSP) is a measure of all detectable particles in the atmosphere. TSP measurements tend to be skewed by the inclusion of larger more massive particles which by their nature and size are less likely to be inhaled into the lungs. As a result, TSP monitoring is primarily a measure of impact on amenity more so than on health. Examples of amenity values that can potentially be affected by TSP dust include:

- Visual impacts;
- Preventing members of the community from undertaking outdoor activities in comfort;
- Soiling clothing on washing lines; and
- Dust build-up on buildings, including roofs and vehicles requiring frequent washing.

##### **1.4.10.2 Particulate Matter (PM<sub>10</sub>)**

Particulate Matter PM<sub>10</sub>, includes only particles smaller than 10 µm in aerodynamic diameter and are considered 'respirable'. These particles may enter through the nose and throat and be deposited in the trachea and bronchia sections of the respiratory tract, and have the potential to lead to adverse health effects.

Heavy deposition of finer particulates has the potential to affect vegetation health by limiting photosynthesis (leaf smothering) and gaseous exchange (blocked stomata). Blocked stomata can reduce the ability of a plant to transpire, thus increasing internal leaf temperature, which can result in a down regulation in photosynthesis (Turner, 2013).

#### **1.4.11 Rationale for Choice of Trigger Level Actions and Threshold Contingency Actions**

Trigger levels have been determined for short term monitoring parameters to facilitate investigation and pre-emptive preventative measures, where relevant, to minimise dust emissions in the event of an adverse trend and to maintain compliance with prescribed limits defined in Section 1.3.

Internal triggers are defined in Section 3.2 and have been determined through:

- Initial air dispersion modelling data;
- Assessment of monitoring data collated to date;
- Review of verified dust complaints from sensitive receptors;
- Identification of the activities and conditions that had contributed to significant dust events.

Triggers are then set as early response indicators so that significant dust events can be ameliorated where attributable to KLPL operations.

## 2. AQDMP PROVISIONS

### 2.1 Management Approach

The following actions describe the overall management approach for dust control.

- Identification of activities and meteorological conditions conducive to dust generation;
- Establishment of standard practices to minimise dust generation. These practices reflect the risk of potential dust impacts on residents including their proximity to active mining;
- Use of weather forecasting to refine short term mine planning and associated activities;
- Monitoring of wind speed and direction, TSP and PM<sub>10</sub> dust emissions from mining activities at selected boundary locations as well as at other locations within the Project area in order to identify and mitigate operational dust emissions;
- Implementation of a proactive consultation and communication procedure to inform residents of proposed mining activities in proximity to their dwellings and/or to respond to complaints efficiently; and,
- Development and implementation of contingency measures in the event of verified elevated dust events.

#### 2.1.1 Mining Activities Near Residences

There is one residence within 300 metres of the project boundary. When this area is being actively mined there is potential for dust impacts to this residence. Previous versions of this plan referenced six residences within 300 meters of the project boundary, however due to land acquisitions these residences are no longer tenanted.

Based on the result of modelling undertaken by SKM in 2007, an air quality buffer of 300 metres between mining active mining areas and occupied houses has been established. Mining may occur up to these buffers under any wind conditions. These air quality buffers correspond to the buffers established by noise modelling undertaken to educate the original Noise Management Plan developed for the site.

Under revised Ministerial Statement 1089 (Feb, 2019), Condition 14 governing noise management was revised to extend the buffers for mineral processing and daytime mining to 2km. The revised statement did not apply to areas of the approved mining area that have already been mined.

The revised statement provides relief from the 2km buffer in the form of amenity agreements. Therefore, amenity agreements have been sought with all residences within 2km of the remaining approved mining area, to provide compensation for potential reduced amenity through noise and dust emissions from the project. Figure 2 indicates the residences within 2km of the remaining approved mining area that have existing amenity agreements in place.

While amenity agreements do provide some relief for the project from imposed noise and air quality restrictions, the project is still required to adhere to the noise emissions levels and air quality exceedance thresholds stipulated in Ministerial Statement 810 and 1089.

Therefore, if mining is to occur within 300 metres of a residence the following will apply:

- The residence is not occupied. This may be as a result of a commercial agreement between KLPL and the residences owner and occupier; or

- Mining is undertaken during times of wet soil and/or conditions i.e. winter and autumn. Any such decision to mine within these areas would be based on assessment of the moisture content at the time as this is likely to be highly variable depending on climatic conditions; or
- Mining is undertaken during periods where winds are away from residences. Any such decision would be assessed at the time and would be subject to air quality standards documented in this Plan being complied with.
- If mining does occur within these areas (i.e. within 300 metres of a residence), additional dust management measures may be required depending on the weather, wind direction and speed and moisture content of the soil materials.

It is not expected that additional measures will be required during the winter months (May to October) as soil moisture and rainfall will be sufficient to minimise dust lift off. During late spring, summer and early autumn (mid October to late April) it is expected that soil conditions will be dry with insufficient moisture to prevent dust lift off during windy conditions.



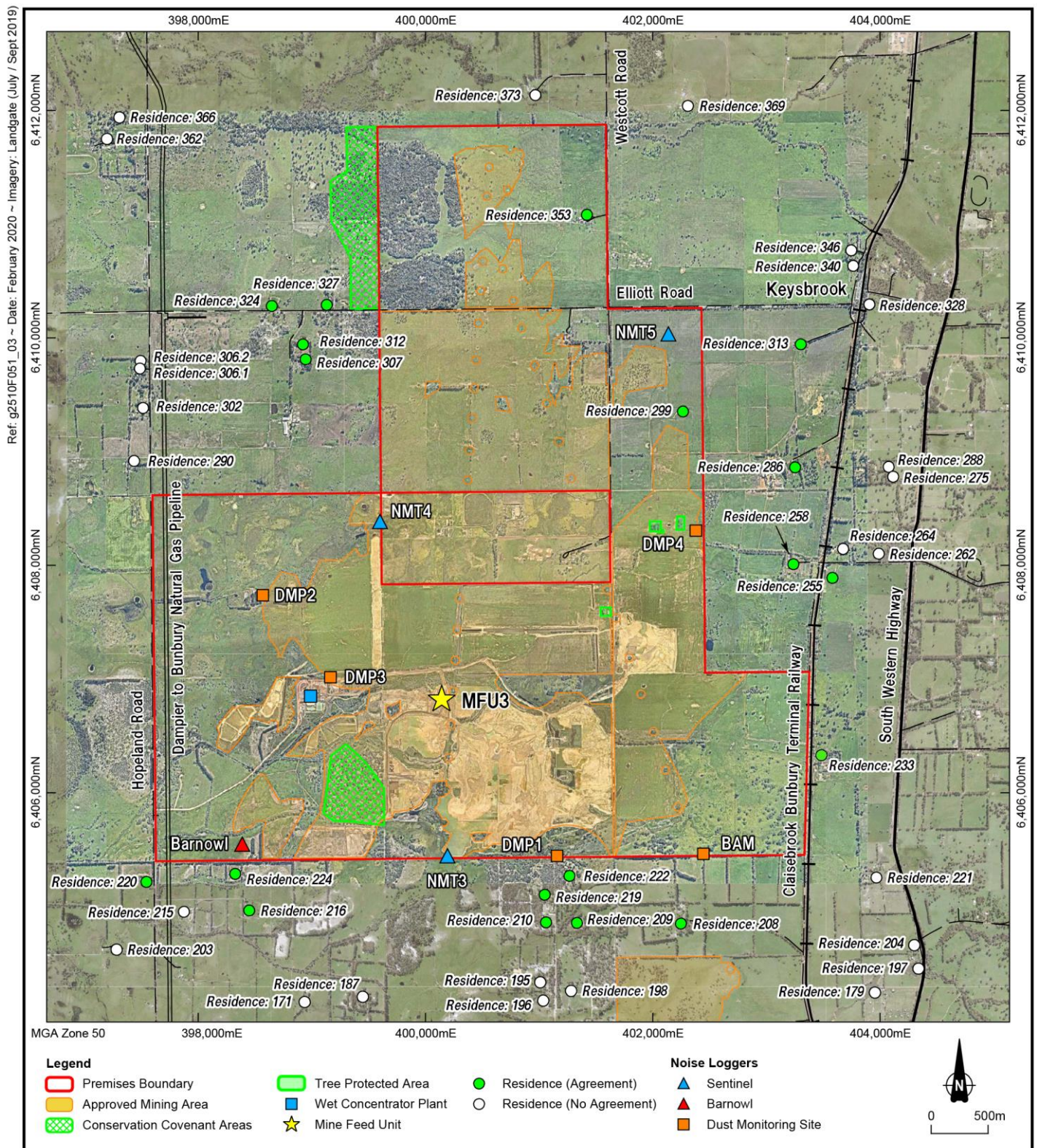


Figure 2: Residences within 2km of the approved mine area



## 2.1.2 Use of Weather Forecasts

Weather forecasts will be obtained and used on site as a proactive management tool. While not used as a primary management tool, weather forecasts are considered, in unison with other standard proactive measures, to assist in limiting potential dust generation when scheduling activities. Local weather forecast data for up to 4 days in advance will be accessed via proprietary products which enable easier data integration with site planning tools.

## 2.1.3 Standard Dust Control Actions

The following initiatives will be implemented to reduce the potential for dust impacts during operations:

- Use of weather forecasts to identify potentially high-risk conditions conducive to dust generation, and initiation of proactive dust management practices;
- Restriction of mining within 300 m of a residence without agreement with the owner and occupier of the residence. Any mining within 300 m of a residence will occur in accord with the agreement, which will include provisions for minimising dust emissions (such as seasonal mining, appropriate soil moisture conditions, weather conditions and dust suppression).
- Use of water trucks over exposed areas susceptible to dust generation including active mining and rehabilitation areas, topsoil stockpiles, haul roads and access tracks;
- Restricting vehicles to designated roads and tracks;
- Limiting vehicle speeds on unsealed roads and tracks;
- Limit the area open ahead of mining and at the mine front to no more than 30 ha at any one time;
- Progressive rehabilitation to reduce the duration of land exposed and susceptible to dust generation;
- Stabilisation of disturbed areas and topsoil stockpiles using a clay/water slurry (which dries to a thin clay veneer resistant to wind erosion) or other stabilising agents, where possible;
- Growing of temporary 'stubble' crops to bind soil and decrease wind velocity at ground level where appropriate, where groundworks for rehabilitation are partially completed;
- Regular housekeeping to remove spilled product or materials conducive to dusting;
- Covering heavy mineral concentrate product prior to despatch from site.

## 2.1.4 Timing of Mining

Mining occurs 7 days a week, during daytime hours only. Table X below details the weather conditions under which each pit can be mined and whether further dust management measures are required to be implemented to ensure mining can conditions unimpeded. The original buffers zones developed by SKM during dust modelling, as detailed in the Air Quality and Dust Management Plan (MBS, March 2012), were modelled on a number of residences that are no longer tenanted, or no longer within the mine plan, with the exception of Buffer 2 as indicated in Figure 3. Therefore, with exception of Buffer 2, locations of mining and associated dust management measures are based on Lot numbers as indicated in Figure 4.

Air quality buffer areas have been defined based on the location of the lot to be mined, residence and wind direction required to cause an impact at the nearest residence. These buffer areas, together with the likelihood of winds above 23 kilometres per hour and management implications are shown in Table 4. A threshold wind speed of 23 kilometres per hour has been selected in line with the dust lift off threshold value of 6.5 metres per second (approximately 23.4 kilometre per hour) used by SKM during dust emission modelling.

**Table 4: Likelihood of Wind Directions within Air Quality Buffer Zones**

Buffer ID / Lot Number	Impacting Wind Direction	Likelihood of Winds >23 km/h – Morning	Likelihood of Winds >23 km/h – Afternoon	Management
2a (Lot 1)	North West	Likely: March – May	Likely: March – May	Avoid mining during March and April unless additional management measures are undertaken.
2b (Lot 52)	South to South West	Unlikely	Unlikely	No additional management measures required
Lot 101 Lot 103 Lot 104 Lot 105	North west to North East	North west to North East	Unlikely	Avoid mining during mornings in March and April unless additional management measures are undertaken.
Lot 101 Lot 103 Lot 104 Lot 105	South West to South East	Likely: September – May	Likely: December – February	Avoid mining during mornings from October to April and afternoons during summer unless additional management measures are undertaken.
Lot 57	South West to North West	Likely: March – May	Likely: March – May	Avoid mining during March and April unless additional management measures are undertaken.
Lot 57	South West to South East	Likely: September – May	Likely: December – February	Avoid mining during mornings from October to April and afternoons during summer unless additional management measures are undertaken.
Lot 57	South	Likely: September – May	Likely: December – February	Avoid mining during mornings from October to April and afternoons during summer unless additional management measures are undertaken.
Lot 57	North East to South East	Likely: September – May	Likely: September – May	Avoid mining between October and April unless additional management measures are undertaken.

### 2.1.5 Management of Mining Areas

Where wind speeds on site are expected to (or actually do) exceed 23 kilometres per hour and are from the pre-determined “Impacting Wind Direction” for that buffer / Lot number as outlined in Table 4, additional management is required. The Site Manager is responsible for implementing the following hierarchy of management actions:

- Reduce vehicle speeds in the area until wind speeds reduce;
- Where reduction of vehicle speed does not result in decreased dust generation, increase the rate of watering to prevent dust lift off; and,
- When all other management actions have not resulted in decreased dust generation, cease mining activities within the buffer area and/or move to areas outside of the buffer.

To assist in managing dust impacts, a series of real time dust monitors will be established to provide a warning if dust emissions exceed trigger values outlined in Section 1.4.5. The Mining Superintendent is responsible for implementing additional management measures once an alert is raised. If these measures do not result in a decrease in dust emissions, the Mining Superintendent is responsible for moving mining

operations outside of the 300-metre buffer area until wind conditions abate. Management measures may still be required within the buffer if conditions are such that wind generated dust lift off creates high dust concentrations in the absence of excavation activities.



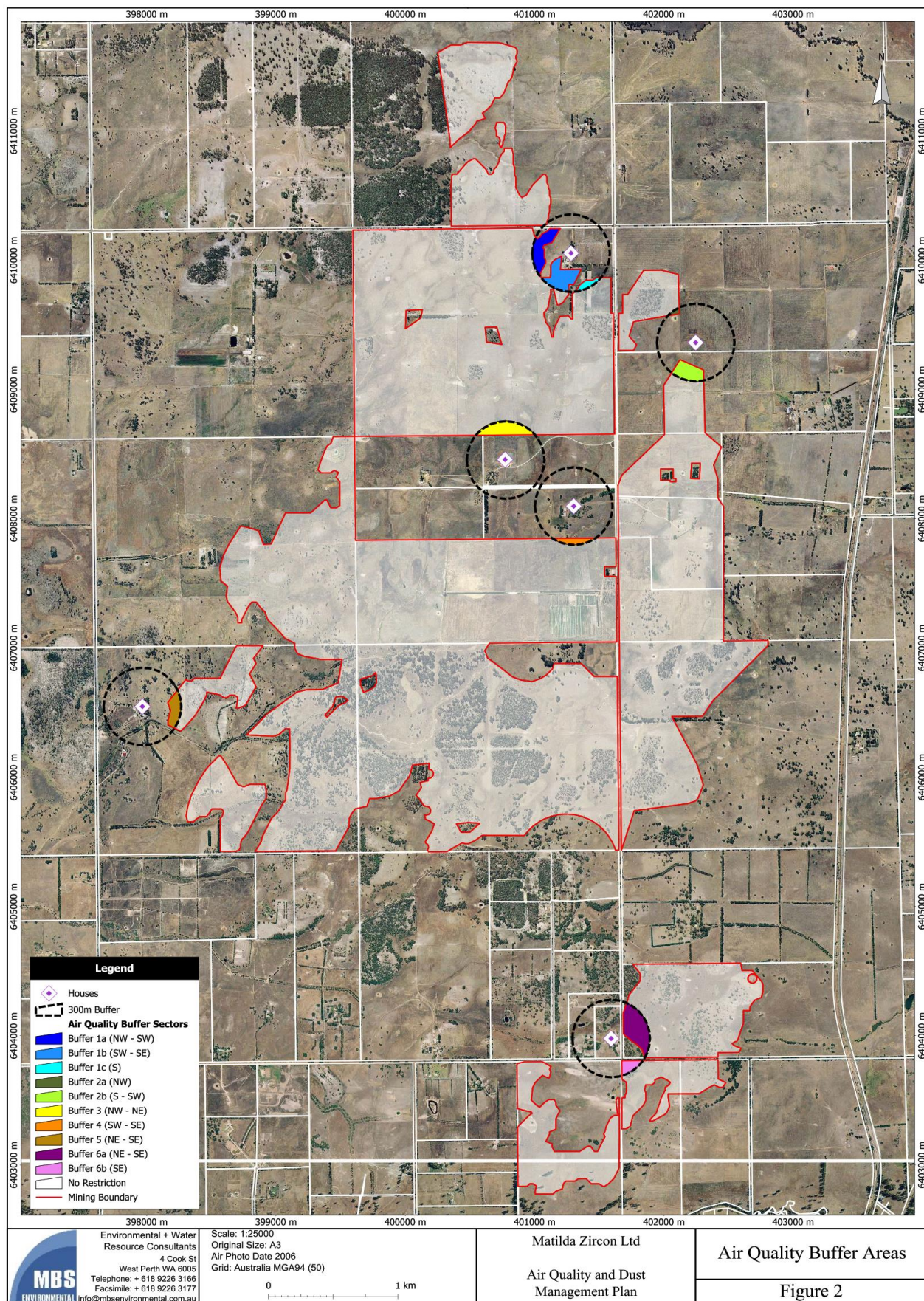


Figure 3: Original Air Quality Buffers (SKM 2007)



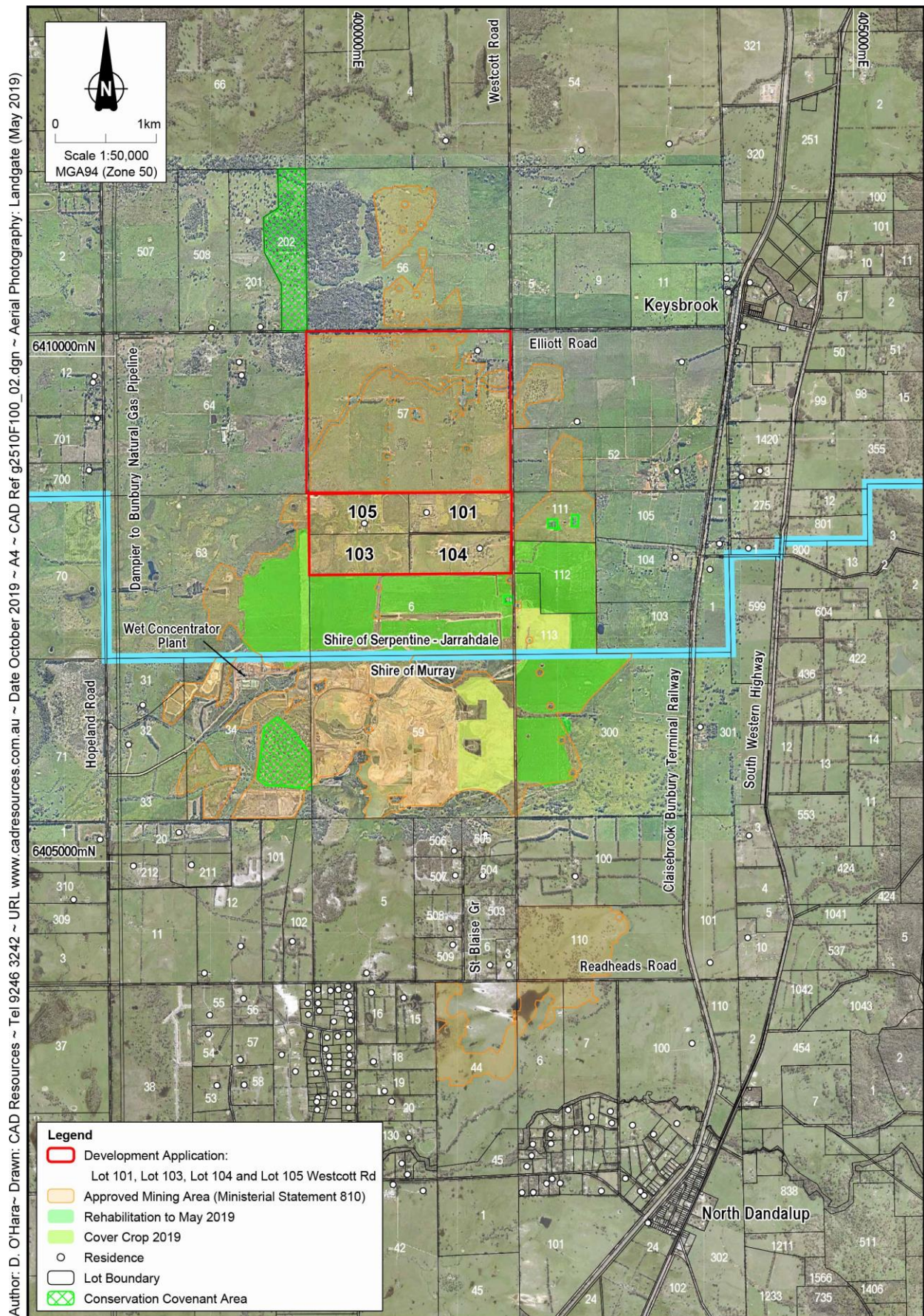


Figure 4: Approved mined area



## 2.2 Trigger Levels

### 2.2.1 Trigger Level Actions

The following trigger level and threshold criteria have been adopted:

**Table 5: Monitoring Trigger Values**

Parameter	Trigger Values	
	Trigger Criteria <sup>3</sup>	Threshold Criteria/Limit
Total Suspended Particles (TSP)	600 µg/m <sup>3</sup> 15 minute average	1,000 µg/m <sup>3</sup> 15 minute average
Particulate Matter less than 10 micron (PM <sub>10</sub> )	40 µg/m <sup>3</sup> 6 hour rolling average	50 µg/m <sup>3</sup> 24 hour average (in excess of five (5) times per year)

In the event that real time particulate monitoring identifies that ambient TSP or PM<sub>10</sub> trigger criteria are reached at any monitor, an alert will automatically be initiated to the Mining Superintendent, Shift Team Leader and the Senior Environmental Officer.

If Trigger Criteria are reached or exceeded, and after review there are grounds, based primarily on wind direction to believe KLPL land or activities are the cause or significant contributor to the elevated dust, the following measures will be implemented to limit the risk of escalation of the dust event:

- A site inspection will be undertaken to identify the source(s) of the elevated results relative to wind conditions, mining activities and/or inactive exposed areas at the time. The presence of non-operational dust generating activities will also be checked (such as stock activity, fertilizing, ploughing, harvesting);
- Where dust generation is determined to be attributable to KLPL ongoing activities, implementation of additional dust controls such as increased rate of application of water over the source area;
- Consideration given to ceasing mining activity in relevant areas until prevailing conditions subside and the risk of elevated dust concentrations exceeding threshold criteria is removed;
- Consideration given to liaison with potentially affected residents who may be susceptible to the dust event.

## 2.3 Reporting Provisions

### 2.3.1 Annual Regulatory Reporting

KLPL will prepare a Compliance Assessment Report (CAR) for the period 20 July (of the previous year) to 19 July, which outlines performance and compliance in accordance with a Compliance Assessment Plan approved under Condition 4 of Ministerial Statement 810. The report will be submitted within 3 months of the end of the report period (i.e. by 19 October). This report will include:

- Evidence of compliance with Condition 15;
- An assessment of monitoring data collated in accordance with this AQDMP;
- A summary of identified exceedances of threshold criteria and associated mitigation measures; and
- Actions undertaken to address potential non-conformances associated with key plan provisions in Table 6 of this AQDMP.

<sup>3</sup> Trigger criteria may be revised following collation and review of ongoing monitoring data in 2018

### 2.3.2 Reporting on Exceedance of Threshold Criteria

Verified exceedance with the threshold criteria defined in Table 5 will be reported to the Department of Water and Environmental Regulation (DWER). Verification involves confirming the result is valid (i.e. not caused by smoke or instrument interference) and that there is a reasonable likelihood that KLPL land or activities caused, or significantly contributed to, the elevated dust level.

The number of exceedances of the PM<sub>10</sub> target per calendar year will be tracked by the Environmental Officer. More than five PM<sub>10</sub> verified exceedances in a calendar year, or one verified exceedance of the TSP threshold criterion will be reported to DWER as a (potential) non-compliance with Condition 15-3(e) within two business days of verification (in accord with Condition 4-5).

Dust complaints and remedial actions will be summarised in the Annual Environmental Report (AER) as required under the site Part V EP Act licence.

### 2.3.3 Internal Reporting

The Senior Environmental Officer will report to the Occupational Safety, Health and Environment Superintendent on a monthly basis or at an alternative agreed interval:

- Summary graphs of TSP and PM<sub>10</sub> data;
- Number of alert level triggers and regulatory limit exceedances (if any); and
- Circumstances leading to triggers and regulatory limit exceedances.

### 2.3.4 Table of Provisions

The Table of Provisions outline the key components of this document and are the legal requirements to be met by KLPL. The provisions in this document are predominantly outcome-based. Table 5, below outlines the provisions to meet the obligations under Condition 15 of Ministerial Statement No. 810.



**Table 6: Key Management Actions for Management of Air Quality and Dust**

Objective 1	Management measures to minimise dust emissions and ensure compliance with National Environmental Protection Measure Standards for particulates, as set in Condition 15-2.				
Reference	Management Action	Performance Indicators/Triggers	Reporting	Timing	Responsibility
1.1	Use of weather forecasts to identify potentially high-risk conditions conducive to dust generation, and with reference to Table 4, plan mining to suit the potential wind conditions and initiate of proactive dust management practices;	<ul style="list-style-type: none"> <li>Daily weather report</li> <li>Supervisor shift report</li> </ul>	<ul style="list-style-type: none"> <li>AER (Annual Environmental Report)</li> </ul>	Daily	Senior Environmental Officer/Team Leader
1.2	If wind conditions are in excess of 23km/per hr initiate the following additional management actions: <ul style="list-style-type: none"> <li>Reduce vehicle speeds in the area until wind speeds reduce;</li> <li>Where reduction of vehicle speed does not result in decreased dust generation, increase the rate of watering to prevent dust lift off; and,</li> <li>When all other management actions have not resulted in decreased dust generation, cease mining activities within the buffer area and/or move to areas outside of the buffer.</li> </ul>	<ul style="list-style-type: none"> <li>Current wind conditions</li> </ul>	<ul style="list-style-type: none"> <li>CAR</li> </ul>	Annual	Senior Environmental Officer
1.2	No mining within 300 m of a residence without the agreement of the owner and residents.	<ul style="list-style-type: none"> <li>Mined footprint in relation to residences</li> </ul>	<ul style="list-style-type: none"> <li>CAR</li> </ul>	Annual	Senior Environmental Officer
1.3	Regular use of water trucks during dry periods;	<ul style="list-style-type: none"> <li>Supervisor shift report</li> <li>Site rainfall records</li> </ul>	<ul style="list-style-type: none"> <li>Monthly report (internal)</li> <li>AER</li> </ul>	Ongoing	Senior Environmental Officer
1.4	Limit area open ahead of mining and at the mining front to no more than 30 ha at any one time;	<ul style="list-style-type: none"> <li>Mined footprint (monthly updates)</li> </ul>	<ul style="list-style-type: none"> <li>CAR</li> </ul>	Ongoing	Senior Environmental Officer
1.5	Stabilisation of trafficable open areas post mining through full rehabilitation or interim stubble crop.	<ul style="list-style-type: none"> <li>Annual areas of rehabilitation and stabilisation seeding</li> </ul>	<ul style="list-style-type: none"> <li>CAR</li> </ul>	February to October	Senior Environmental Officer

Objective 2	Monitoring programme to (i) characterise local dust environment; (ii) inform management measures and (iii) enable assessment of compliance				
Reference	Management Action	Performance Indicators/Triggers	Reporting	Timing	Responsibility
2.1	Maintain a network of automated dust monitoring stations	<ul style="list-style-type: none"> <li>PM<sub>10</sub> continuously measured a minimum of 300 days/year (including period October – June) at minimum of 2 sites around project boundary</li> <li>TSP continuously measured a minimum of 300 days (including period October – June) at higher risk downwind site by one monitor.</li> </ul>	<ul style="list-style-type: none"> <li>Monthly report (internal)</li> <li>CAR</li> </ul>	Ongoing	Senior Environmental Officer
2.2	Regularly assess data in relation to land and weather conditions and report	<ul style="list-style-type: none"> <li>Monthly report</li> </ul>	<ul style="list-style-type: none"> <li>Monthly report (internal)</li> </ul>	Ongoing	Senior Environmental Officer
2.3	Report potential exceedences of threshold criteria	Threshold criteria <ul style="list-style-type: none"> <li>TSP - 1,000 µg/m<sup>3</sup> 15-minute average</li> <li>50 µg/m<sup>3</sup> 24-hour average (PM<sub>10</sub>) in excess of five (5) times per year</li> </ul>	<ul style="list-style-type: none"> <li>CAR</li> <li>AER</li> <li>Potential non-compliance reports to DWER</li> </ul>	As necessary	Senior Environmental Officer

### 3. RESPONSIBILITY AND ACCOUNTABILITY ALLOCATION

The Mine Manager has overall accountability and responsibility for management of operations of the site and is therefore responsible for the implementation of this AQDMP.

The Occupational Safety, Health and Environment Superintendent has responsibility for ensuring implementation of the AQDMP, auditing and reporting environmental performance, and periodic reviews to of the plan to ensure its ongoing effectiveness.

The Senior Environmental Officer has responsibility for implementing the monitoring, data review and reporting elements of this plan.

Responsibilities and accountability allocation are defined in the following table.

**Table 6: Accountabilities and Responsibility Allocation**

Role Description	Responsibility
Allocation of resources to implement AQDMP	Mine Manager
Assessment of dust generation potential relative to short and medium mine plan, proximity to sensitive receptors, forecasted meteorological conditions.	Mining Superintendent Senior Environmental Officer
Implementation of dust controls during mining activities.	Mining Superintendent
Implementation of contingency measures in the event that monitoring triggers are reached or a validated complaint is received.	Mining Superintendent Senior Environmental Officer
Coordination of dust monitoring program	Senior Environmental Officer
Review and analysis of monitoring data.	Senior Environmental Officer
Internal reporting of dust incidents and complaints.	Mining Superintendent
External reporting to regulatory agencies.	Senior Environmental Officer
Community and stakeholder liaison.	Senior Environmental Officer
Training of personnel on aspects of this AQDMP relevant to their role	HSEC Advisor
Annual review of this AQDMP	Senior Environmental Officer

### 4. REVIEW OF THE AQDMP

The AQDMP will be reviewed annually or in the event of a significant change to the dust emission risk. The plan may also be revised on the instruction of the CEO of DWER in accordance with Condition 15-5.

The review of the AQDMP will consider:

- Any change in relevant standards, codes of practice or regulatory limits;
- Monitoring data including trends and anomalies;
- Applicability of adopted trigger criteria;
- Effectiveness of management measures, documented procedures and equipment to ongoing operations and control of environmental risks;
- The ability of the AQDMP to achieve defined objectives and targets;
- The efficacy in achieving compliance with Condition 15;
- Maintenance of records of monitoring data and dust incidents, and follow-up action that had been implemented; and
- Outcomes of inspections.

## 5. STAKEHOLDER ENGAGEMENT

KLPL's Stakeholder Interaction Policy and Procedure enables the company to adequately manage and address concerns and grievances raised by stakeholders. The Policy provides a framework for implementation of KLPL's Community Engagement Plan which identifies opportunities for proactive stakeholder engagement to communicate timely and accurate information in relation to key activities.

### 5.1 Complaints management

KLPL has established internal protocols to receive, investigate and respond to community complaints. On being notified of a concern or complaint, the call or interaction is logged by KLPL personnel using the Stakeholder Interaction Report Form (SIRF) (Appendix C).

The matter of each contact is investigated and where appropriate measures are taken to rectify substantive issues as soon as possible, with actions recorded. Initial feedback will be provided to the complainant within a 24-hour period. This may be to advise the matter has been rectified, or to advise that the matter continues to be being investigated. The aim is to close out all investigations and provide notice in writing within 5 working days.

Analysis of feedback and complaints will be reviewed as required to identify trends and possible concentration of complaints and target areas of improvement.

## REFERENCES

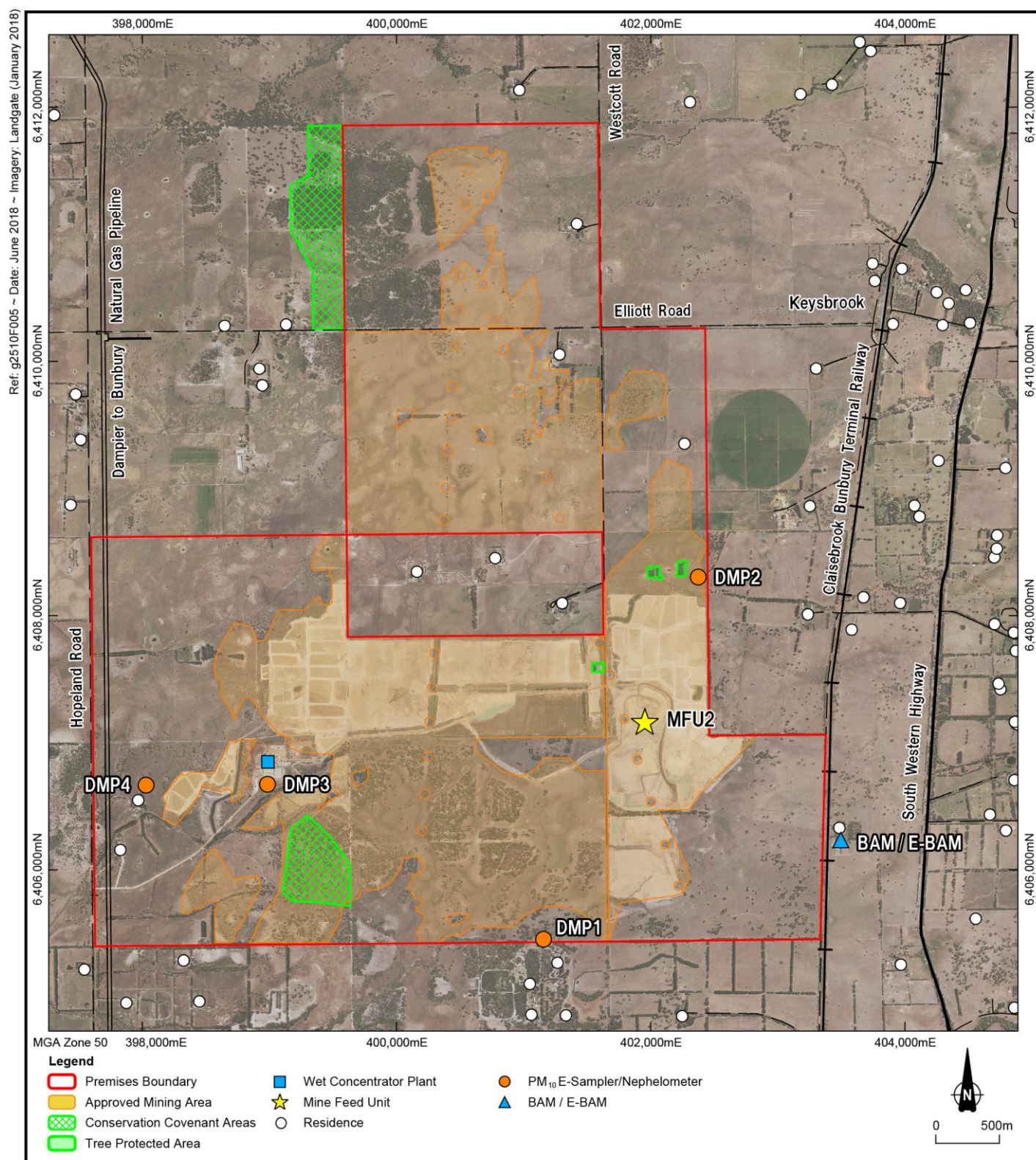
MZI Resources. (2013, October 8). Air Quality & Dust Management Plan Addendum. Perth, WA.

Turner, Gillian Frances. 2013. 'Vulnerability of Vegetation to Mining Dust at the Jack Hills, Western Australia', pp. 8-9. Master of Science Thesis, School of Plant Biology, University of Western Australia.

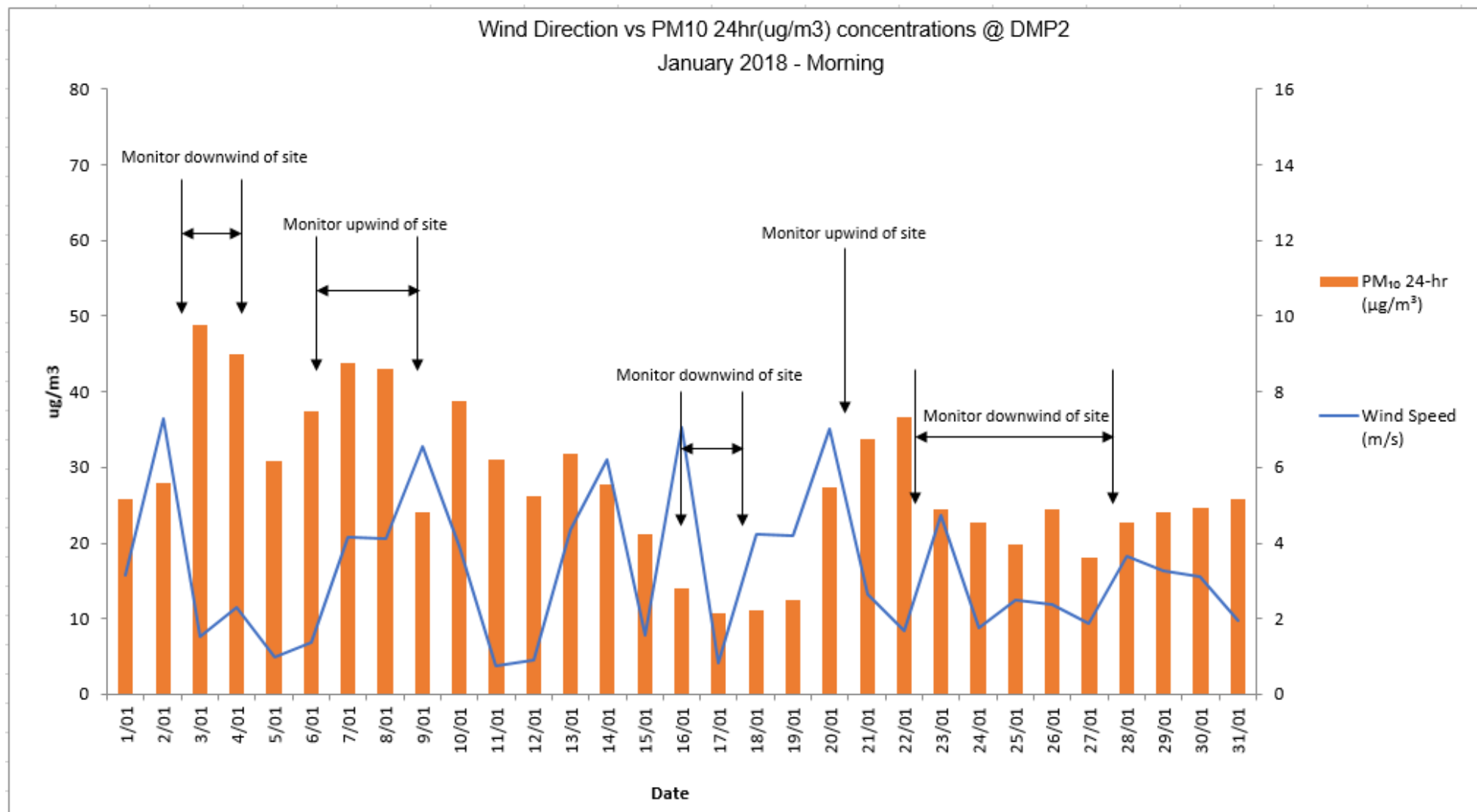
# APPENDICES

## **Appendix A: Keysbrook Mine Wind and Dust Monitoring Data and Locations**



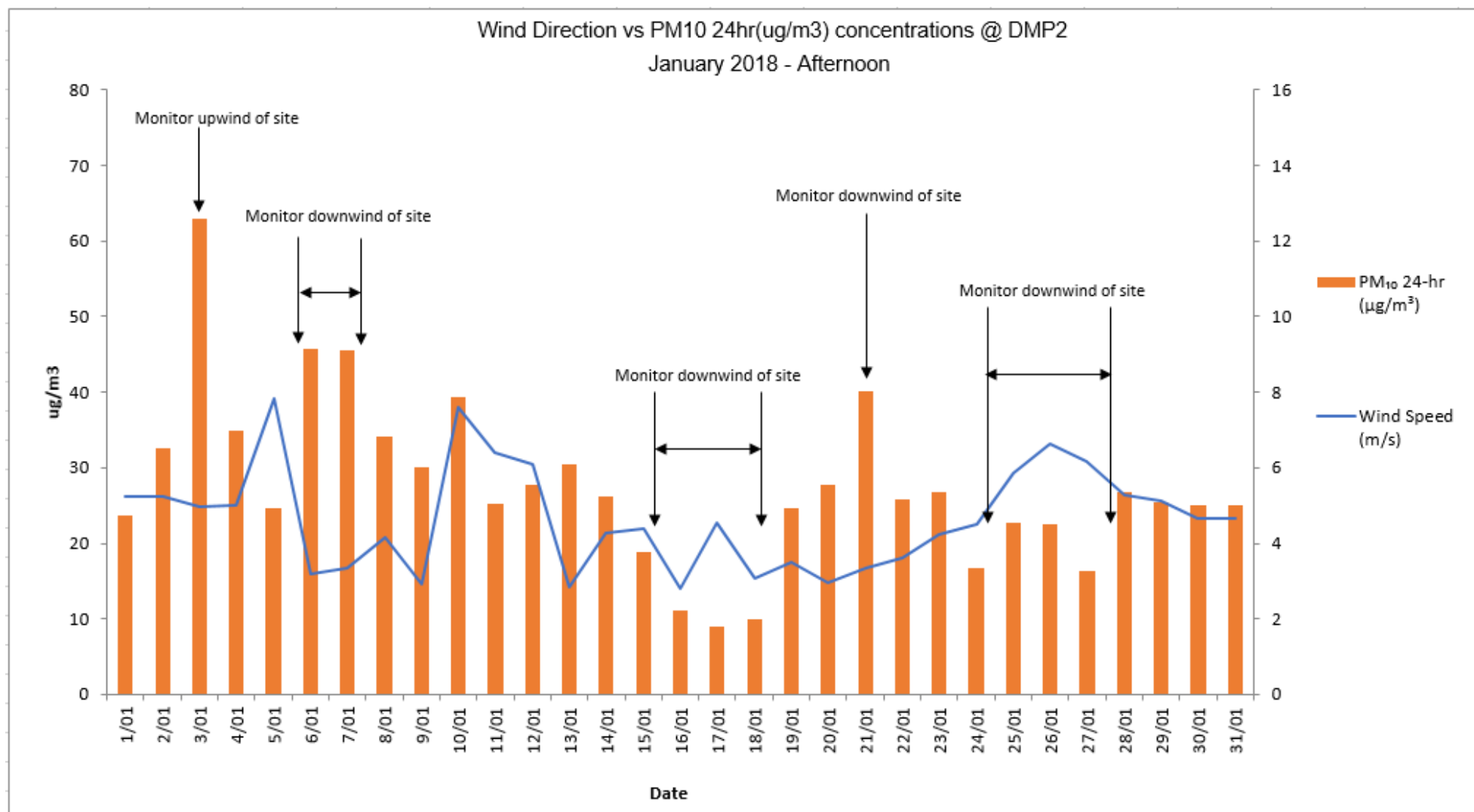


**Location of nephelometers (DMPs) and Beta Attenuation Monitor (BAM/E-BAM) Jan 2018**



**Graph A – Wind Direction vs PM10 24hr ( $\mu\text{g}/\text{m}^3$ ) from nephelometer DMP2 during morning wind conditions**





**Graph B – Wind Direction vs PM10 24hr (ug/m<sup>3</sup>) at nephelometer DMP2 during afternoon wind conditions**

## **Appendix B: Seasonal Wind Roses (BoM Station 9977 Mandurah)**

# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

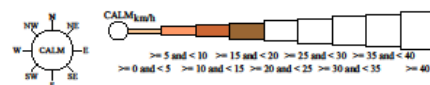
Custom times selected, refer to attached note for details

## MANDURAH

Site No: 009977 • Opened Oct 2001 • Still Open • Latitude: -32.5219° • Longitude: 115.7119° • Elevation 3m

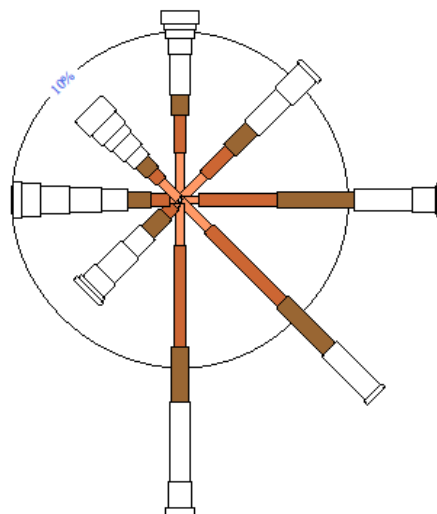
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Spring  
793 Total Observations

Calm 1%



# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

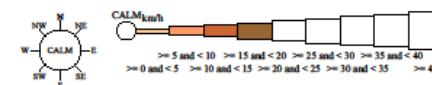
Custom times selected, refer to attached note for details

## MANDURAH

Site No: 009977 • Opened Oct 2001 • Still Open • Latitude: -32.5219° • Longitude: 115.7119° • Elevation 3m

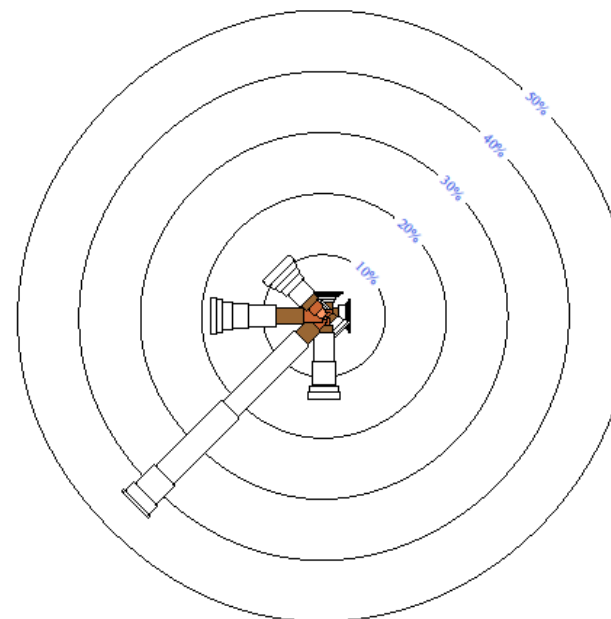
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Spring  
791 Total Observations

Calm \*



# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

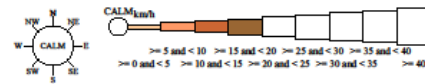
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## MANDURAH

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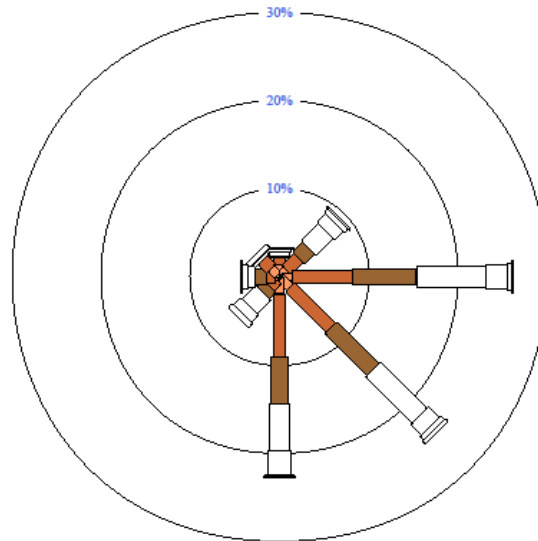
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Summer  
812 Total Observations

Calm \*



# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

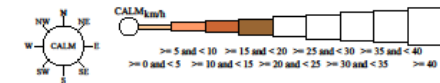
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## MANDURAH

Site No: 009977 • Opened Oct 2001 • Still Open • Latitude: -32.5219° • Longitude: 115.7119° • Elevation 3m

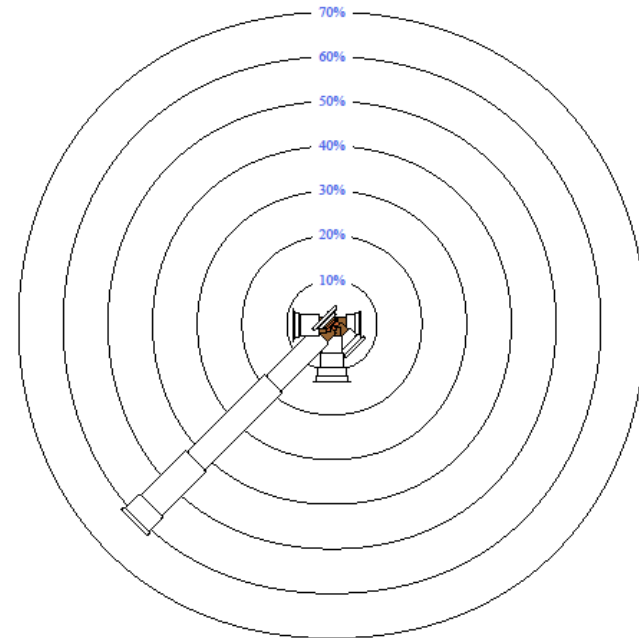
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Summer  
811 Total Observations

Calm \*



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# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

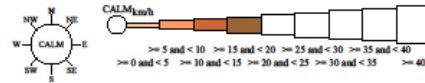
Custom times selected, refer to attached note for details

## MANDURAH

Site No: 009977 • Opened Oct 2001 • Still Open • Latitude: -32.5219° • Longitude: 115.7119° • Elevation 3m

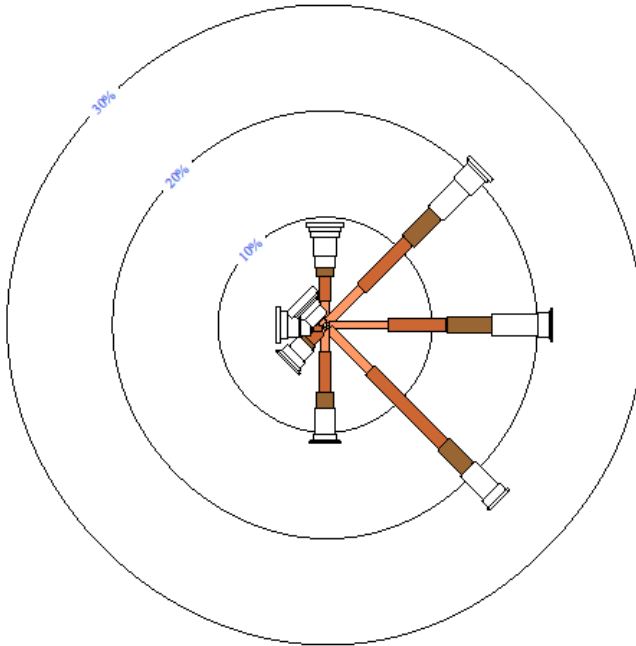
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Autumn  
826 Total Observations

Calm 1%



# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

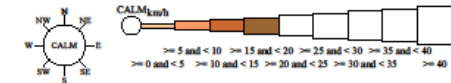
Custom times selected, refer to attached note for details

## MANDURAH

Site No: 009977 • Opened Oct 2001 • Still Open • Latitude: -32.5219° • Longitude: 115.7119° • Elevation 3m

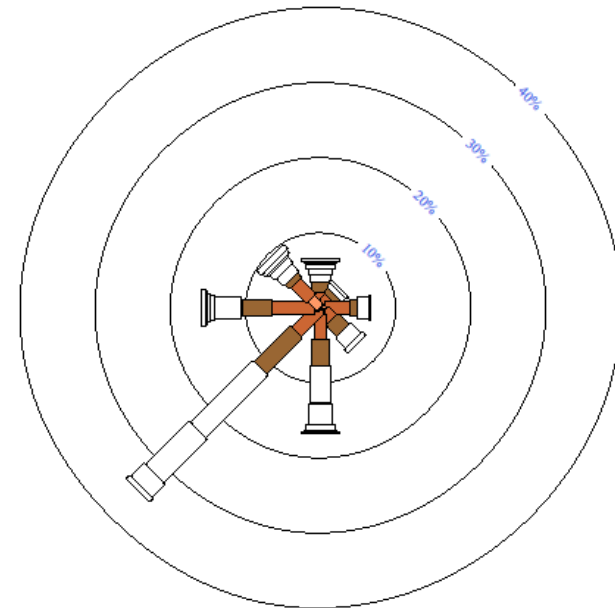
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Autumn  
828 Total Observations

Calm \*



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# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

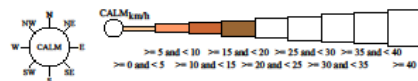
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## MANDURAH

Site No: 009977 • Opened Oct 2001 • Still Open • Latitude: -32.5219° • Longitude: 115.7119° • Elevation 3m

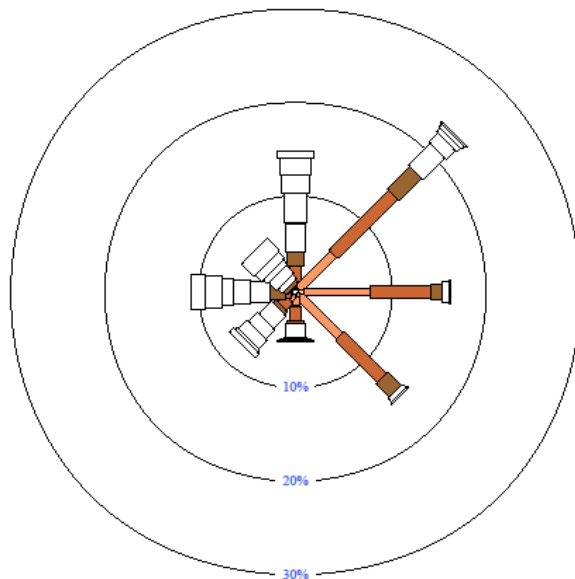
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Winter  
826 Total Observations

Calm 1%



# Rose of Wind direction versus Wind speed in km/h (25 Oct 2001 to 30 Sep 2010)

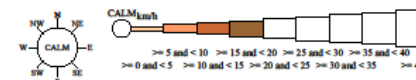
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## MANDURAH

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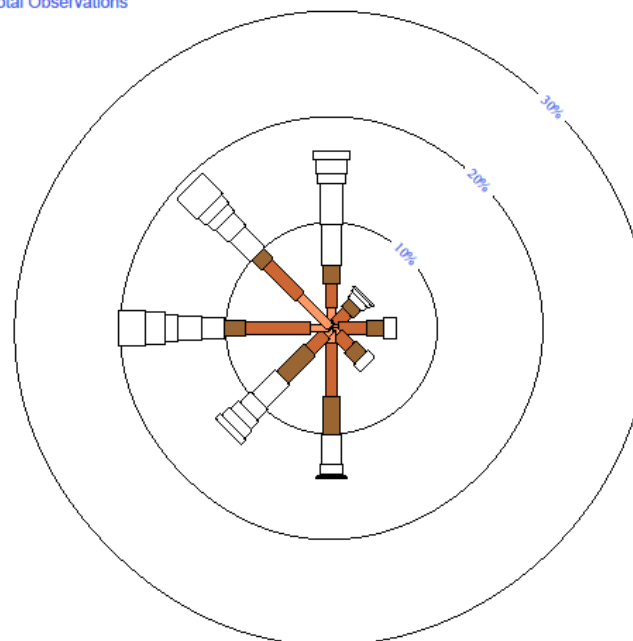
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Winter  
822 Total Observations

Calm \*



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# Appendix C: Stakeholder Interaction Report Form



## KLPL STAKEHOLDER INTERACTION REPORT FORM

*Note: Stakeholder responded to within 24 hours, written close out within 5 business days*

**DOCUMENT NO**

**Date:**

**Time:**

**Call taken by:**

**Stakeholder Name:**

**Phone Number:**

**Address:**

**Subject of contact:** *i.e. environmental (dust, noise, water, light), economic, social etc.*

**Details:** *effects, frequency, time of event, location etc.*

**# Action taken** *(if any)* # Take immediate action to rectify matter if reasonable and practical to do so, let stakeholder know what you have done

**Action Completed by:** *(KLPL personnel)*

**Phone Number**

**Date**

**Email this form to:** *community@klpl.com.au*

**Company investigation / stakeholder feedback / close out action:**

**Response to stakeholder:** *(KLPL personnel with 5 business days)*

**Date**

**Time**

**Signed by:** *(KLPL personnel)*

**Date**

**Time**

**Logged as a complaint?**

**Yes / No**

**Logged in Radix and Consultation Manager:** *(by MZI Administration Assistant)*

**Date**

**Reference**

**ADDITIONAL NOTES IF REQUIRED:**