

KEYSBROOK MINERAL SAND PROJECT,
DUST MANAGEMENT PLAN

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PREPARED FOR

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BY

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

Olympia Resources Limited (Olympia) proposes to mine mineral sands at Keysbrook, Western Australia. The project area is located approximately 70 kilometres south of Perth and four kilometres west of Keysbrook.

The project area and surrounding land is currently used for agricultural purposes. The dominant industry of the area is dairy and beef cattle farming, though there is a small area of intensive horticulture.

Proposed commencement of mining operations is early 2007, with an expected mine life of up to eight years. The mine area covers 1,234 hectares. Of this, 930 hectares (75.4%) is open pasture, 244 hectares (19.8%) is parkland cleared remnant vegetation and 60 hectares (4.8%) is remnant vegetation in good condition.

Mineral sand mining and processing operations are straightforward and well proven. Olympia Resources intends to carry out its mineral sand mining and processing operations in a manner similar to current practices used by mining companies in the south-west of Western Australia. This will require development of shallow pits to access the ore body and construction of a small screening and concentration plant. Ore will be accessed using free digging methods (removed without the aid of blasting) before being screened and the heavy mineral sand component concentrated to remove uneconomic fractions. The heavy mineral concentrate will be transported off site for further processing where gravity, magnetic and electrostatic separation are undertaken to produce separate mineral products for sale.

1.2 PURPOSE

The Dust Management Plan has been prepared in fulfilment of commitments made by Olympia in the Keysbrook Public Environmental Review (PER) (MBS Environmental, 2006), and to address anticipated conditions set by the Minister for the Environment in approving the proposal.

The plan applies during the construction, operation and decommissioning phases of the project. The plan will be subject to ongoing review and therefore will be subject to change to ensure that it remains relevant and effective in light of past results and technological advances throughout the life of the operation.

All commitments and procedures contained within this plan and the performance of Olympia against the Minister's Conditions and DOE operating licence conditions will be audited internally by Olympia and externally by the Department of Environment.

1.2.1 Proponent Commitments

Olympia made the following commitments to dust management in the PER:

1. Minimising clearing and open area.
2. Not stripping topsoil during periods of high winds.
3. Watering of internal roads and dust generating disturbed areas as required.
4. Growing of temporary ‘stubble’ crops to bind soil and decrease wind velocity at ground level.
5. Re-establishment of pasture as soon as possible after mining has been completed.
6. Using sprinkler systems around high activity infrastructure areas.
7. Installing a high wind warning system to enable the site to initiate dust control mechanisms in a timely manner.
8. The establishment of dust monitoring sites at strategic locations around the operation.
9. Regularly review monitoring data and investigate high results. Implement corrective actions to eliminate the causal factors.
10. Reporting of monitoring results will occur as required in the DoE operating licence, expected to be on an annual basis.
11. Regular communications will be held with adjacent landowners and a complaints management system, including investigation, action and feedback, implemented.

1.3 OBJECTIVES

The objective of this Dust Management Plan is to minimise significant impacts on amenity and environmental impact.

1.4 RELEVANT LEGISLATION AND GUIDELINES

Legislation, policy and guidelines relevant to the Dust Management Plan are presented in Table 1.

Table 1: Relevant Legislation and Guidelines

Relevant Legislation or Guideline	Application
State Government Legislation	
<i>Environmental Protection Act 1986</i>	EPS Assessment and Ministerial Approval Process
<i>Mines Safety and Inspection Act 1994</i>	Assigns responsibility for worker health and safety on mining operations
<i>National Environment Protection Council (Western Australia) Act 1996</i>	Establishes National Environmental Protection Measures (NEPM)

Relevant Legislation or Guideline	Application
State Government Guidelines	
Land Development Sites and Impacts on Air Quality	Management of on-site air quality issues during construction
EPA (March 2000). Guidance for the Assessment of Environmental Factors No. 18: Prevention of air quality impacts from land development sites.	Management of dust emissions from development sites
Commonwealth Government Guidelines	
Ambient Air Quality NEPM	Prescription of acceptable air pollutant concentrations
National Pollutant Inventory NEPM	

There is no single regulatory standard for ambient dust levels for residential areas. A review of a range of standards is provided below:

1. The Environmental Protection (Kwinana Atmospheric Wastes) Policy 1992 (“Kwinana EPP”) has specified levels of pollutants (including particulates) in defined zones around the Kwinana industrial area as shown in Table 2.

Table 2: Kwinana EPP Atmospheric Wastes Policy

Area	Description	Standard (TSP ug/m ³)	Limit (TSP ug/m ³)	Averaging Period
A	Central industrial area.	150	260	1 day
B	‘Transition area’. Some residential	90	260	1 day
C	Residential areas	90	150	1 day

2. The National Environment Protection Council (NEPC), in 1998, set health-based ambient air quality standards for six pollutants, including particles as PM₁₀. The standards and goal are shown in Table 3.

Table 3: NEPC Air Quality Standard

Pollutant	Averaging Period	Maximum Concentration	Goal Within 10 Years Maximum Allowable Exceedance
Particles as PM ₁₀	1 day	50µg/m ³	5 days
Particles as PM _{2.5}	1 day	25µg/m ³	Goal is to gather sufficient data nationally to facilitate a review of the standard as part of the review of this Measure scheduled to commence in 2005
	1 year	8µg/m ³	

NPI emission estimation techniques provide a relationship between Total Suspended Particulates (TSP) and PM₁₀ for fugitive dust emissions as shown in Table 4.

Table 4: NPI Conversion factors

Factor	Reference	
Blasting	A1.1.1.9	PM ₁₀ = 52% of TSP
Drilling	A1.1.1.8	PM ₁₀ = 0.31/0.59 (52.5%) of tsp
Wind erosion	A1.1.15	PM ₁₀ = 50% of TSP

Using the NPI factor of PM₁₀ = 52% x TSP, the Kwinana EPP standards and limit can be converted as shown below.

- Area B & C standard: TSP 90 micrograms per cubic metre equates to PM₁₀ 47 micrograms per cubic metre
 - Area A standard & Area C limit: 150 micrograms per cubic metre equates to PM₁₀ 78 micrograms per cubic metre
 - Area A & B limit: 260 micrograms per cubic metre equates to PM₁₀ 135 micrograms per cubic metre
3. The DoE (1996) established an interim PM₁₀ target of 150 micrograms per cubic metre for Port Hedland. Using the NPI conversion formula above, this equates to an approximate TSP of 290 micrograms per cubic metre.

The review of various guidelines, targets and standards above demonstrates:

- There is no single standard currently being applied specifying “acceptable” residential/sensitive area dust levels.
- There is currently a 300% range in standards currently being applied (50 to 150 micrograms per cubic metre PM₁₀).

1.5 DEFINITIONS

Dust is considered to be any particle suspended within the atmosphere. Particles can range in size from as small as a few nanometres to 100 microns (µm) and can become airborne through the action of wind turbulence, by mechanical disturbance of fine materials or through the release of particulate rich gaseous emissions.

Dust is measured using a variety of methods, the most common being Total Suspended Particulates (TSP), which nominally measures up to 50µm, and PM₁₀ or PM_{2.5} (particulate matter less than 10µm or 2.5µm in size, respectively). Deposited matter measures the mass of any particulate falling out of suspension expressed in mass per area per time, and is the least commonly used in determining dust concentrations (Environment Australia, 1998).

Other definitions include:

- **Land Development Site** – sites larger than 2,000m² on which the clearing of vegetation and/or topsoil, recontouring (bulk earthworks), trenching and/or road construction is undertaken to develop the land for any use.
- **Nuisance Dust** – describes dust particles ranging in size from 1mm to 50µm, which reduce environmental amenity without necessarily resulting in material environmental harm. This form of dust generally originates from mining processes (among others) and is often the form of dust that affects neighbouring land users.
- **Fugitive Dust** – refers to dust derived from a mixture of sources or a source not easily defined and includes dust generated from vehicular traffic on unpaved roads, materials transport and handling and un-vegetated soils and surfaces. Mine dust is commonly derived from such non-point sources.
- **PM₁₀** – a criteria air pollutant consisting of small particles with an aerodynamic diameter less than or equal to a nominal 10 microns. Their small size allows them to make their way to the air sacs deep within the lungs where they may be deposited and result in adverse health effects.
- **PM_{2.5}** – includes tiny particles with an aerodynamic diameter less than or equal to a nominal 2.5 microns. This fraction of particulate matter penetrates most deeply into the lungs.

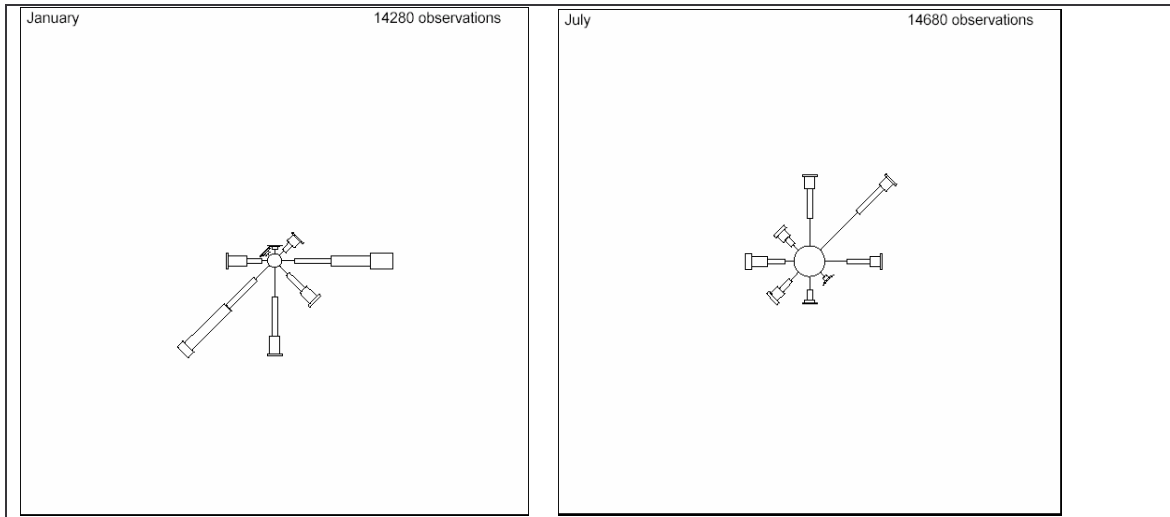
1.6 CLIMATE

The severity and extent of dust emissions is largely influenced by climate. Hot, dry conditions result in more favourable conditions for dust lift, while dust deposition is strongly influenced by wind strength and direction.

The project area experiences a Mediterranean climate characterised by cool wet winters and warm to hot dry summers. The project area lies between the 1,000 and 1,100 millimetres rainfall isohyets (Heddle *et al.*, 1980).

The Perth airport has a prevailing wind regime similar to the project area. The summer (January) and winter (July) month are shown in Figure 1 to demonstrate the differences in wind strength, predominant direction and calm conditions (centre circle) between these seasons. Table 5 shows the Beaufort scale, which provides a description of wind speed.

Figure 1: Wind Roses for Perth Airport



January										July									
Calm 11										Calm 25									
A total of 14280 observations analysed										A total of 14680 observations analysed									
km/h	N	NE	E	SE	S	SW	W	NW	All	km/h	N	NE	E	SE	S	SW	W	NW	All
1-10	1	1	3	2	6	4	1	*	18	6	11	4	1	3	2	2	2	2	30
11-20	1	2	7	4	8	8	3	*	33	6	7	5	1	2	3	4	2	2	28
21-30	*	2	8	3	4	11	4	*	31	2	2	2	*	1	2	3	2	1	14
>30	*	*	4	1	*	2	*	*	7	*	*	*	*	*	1	1	1	1	4
All	2	5	22	10	17	24	8	1	100	14	20	11	2	5	7	10	6	6	100

Table 5: Wind Speeds (Beaufort Scale) Related to Readily Observed Field Conditions

	Beaufort No.	Description	Wind Speed Equivalent*		Specification for Estimating Speed over Land
			m/sec	km/hr	
	0	Calm	0-0.2	<1	Calm, smoke rises vertically
	1	Light air	0.3-1.5	1-5	Direction of wind shown by smoke drift but not by wind vanes
	2	Light breeze	1.6-3.3	6-11	Wind felt on face, leaves rustle, ordinary vane moved by wind
	3	Gentle breeze	3.4-5.4	12-19	Leaves and small twigs in constant motion, wind extends light flag
	4	Moderate breeze	5.5-7.9	20-28	Raises dust and loose paper, small branches move
Erosive winds	5	Fresh breeze	8.0-10.7	29-38	Small trees in leaf begin to sway, crested wavelets form on inland waters
	6	Strong breeze	10.8-13.8	39-49	Large branches in motion, whistling heard in telegraph wires, umbrellas used with difficulty
	7	Near gale	13.9-17.1	50-61	Whole trees in motion, inconvenience felt when walking against the wind
	8	Gale	17.3-20.7	62-74	Twigs break off trees, generally impedes progress
	9	Strong gale	20.8-24.4	75-88	Slight structural damage occurs (chimney pots and slates removed)
	10	Storm	24.5-28.4	89-102	Seldom experienced inland, trees uprooted, considerable structural damage occurs
	11	Violent storm	28.5-32.6	103-117	Very rarely experienced. Accompanied by widespread damage
	12	Hurricane	>32.7	>118	Severe and extensive damage

* Wind speed equivalent at a standard height of 10 m above the ground.

Source: Moore, G (2004) Table 7.1.2 pg 214

2. RESPONSIBILITY AND REPORTING

Overall responsibility for ensuring that the site environmental management requirements are met during the life of the operation will rest with Olympia's Mine Manager. In respect of the Dust Management Plan, this responsibility will include:

- Ensuring that all construction and operational personnel, both the proponent's workforce and contract personnel, conform with requirements pursuant to the Management Plan.
- Ensuring that personnel on site are fully inducted and aware of their environmental responsibilities and obligations.
- Ensuring that monitoring requirements are being met.

Contracting companies undertaking construction or operational roles will be required to:

- Maintain routine contact with the Mine Manager to ensure that environmental objectives of this plan are being met.
- Provide reports to the Mine Manager on environmental issues and conduct regular audits.
- Ensure that all management aims and monitoring requirements of the Dust Management Plan are being met.

3. PREDICTED IMPACTS

Dust associated with mining activity is usually generated as a result of the disturbance of fine particles derived from soil and rock, and the handling of bulk materials. Removal of the layer of vegetation and stable soil that would normally form a seal against wind dispersion also contributes to this process. Consequent environmental effects are usually localised and depend on the size of the dust particles and the strength of distributing factors and usually decrease rapidly with separation from the source. Under adverse weather conditions, however, dust can travel considerable distances, potentially resulting in its deposition in otherwise remote locations.

In the immediate vicinity of the source, dust can stress vegetation through blocking stomata (adversely affecting gas exchange) and reducing light availability (reducing photosynthetic ability and limiting plant growth). Depending on the type and size of dust particles, it can also pose a human health risk through inhalation.

Mining activities are likely to generate dust as a result of activities such as:

- Removal of vegetation and topsoil.
- Light and heavy vehicle movements over unsealed surfaces.
- Mining operations.
- Ore handling and transport.

The project is located in a Mediterranean climate, experiencing dry summer months, during which time dust generation is expected to be at a peak. The distance between the project site and the adjacent landowner residents is variable, depending on the exact location of the mine pit. The closest mine pit to adjacent houses will be approximately 300 metres.

Potential impacts include:

- Reduced visual amenity;
- Risk to human health; and
- Nuisance.

4. MANAGEMENT ACTIONS

4.1 MINIMISING DUST

The area open will be minimised by not stripping areas until necessary for the continuation of operations. Dust generated from the site can be minimised by the careful planning of the development and operation of the site. The following planning activities will be undertaken:

- Topsoil stripping during summer will be kept to the minimum possible.
- Topsoil stripping will be conducted in calm wind conditions or when winds are blowing away from adjacent residents.
- A dedicated water truck will be in operation during stripping.
- Visual monitoring will be conducted and stripping will cease if suppression methods employed are unsuccessful in preventing dust from crossing the boundary of the premises.

The following activities are incorporated within the operational management on site to reduce dust generated from the operations:

- Topsoil is not disturbed until absolutely necessary.
- Bund walls will be stabilized by grass or mulch to form an erosion resistant surface.
- Water trucks and water sources are available on site for dust suppression as required.
- Water is applied to internal traffic areas to minimise dust generated by vehicle movement.
- All site traffic is required to adhere to the site speed limit to minimise dust generated by vehicle movement.
- Clay fines, a by-product of the mineral processing will be utilised on open areas during the summer period to form an erosion resistant crust.
- Mulch and stubble will be used on open areas as temporary stabilization.
- Topsoil stockpiles will be sown with appropriate cover crop (e.g. cereal rye or oats) or hydromulched to form an erosion resistant surface.
- Temporary “stubble” crops will be established on refilled mine pits.
- Pasture will be re-established as soon as practicable after mining.
- Initiate proactive additional dust control measures and visual inspections when the wind speed alarm indicates erosive wind speeds.

5. PERFORMANCE INDICATORS

Olympia will ensure that all realistic, best practice measures to prevent or minimise the generation of dust from mining activities will be implemented for the duration of the project. The effectiveness of the Dust Management Programme will be reviewed against the following indicators:

- Compliance with licence criteria and guideline values for ambient air quality.
- The level of complaints received and registered.
- The level of complainant satisfaction achieved.
- The absence of fugitive dust originating from cleared areas, product stockpiles and other nodes of mining activities.

Using these performance indicators, the proponent will undergo continuous review of its dust management procedures and will adjust target levels as improved resources, capability or technical understanding is achieved.

6. MONITORING

Dust monitoring will be undertaken by Olympia throughout the duration of the project. Monitoring will include:

1. Continuous real time weather monitoring will be undertaken on site, linked to an alarm when the wind speed threshold value of 45 kilometres per hour is reached.
2. A variety of dust monitoring equipment will be used to measure concentrations and deposition of dust and may include:
 - i. Dust deposition gauges;
 - ii. High volume samplers or approved substitutes; and
 - iii. Continuous particulate monitors.
3. Monitoring will conform to the relevant methods outlined in Table 6. Dust samplers will be located adjacent to neighbouring residents around the project area.
4. A complaints register will be maintained, any complaints received will be investigated, and the dust suppression methods employed reviewed. Suitable remedial actions will be undertaken as necessary and practicable.

Table 6: Australian Standards for Particulate Monitoring

Pollutant	Method Title	Method Number
All	Ambient Air – Guide for the Siting of Sampler Units	AS 2922
All	Workplace Atmospheres – Methods for Sampling Respirable Dust	AS 2985
All	Workplace Atmospheres – Methods for Sampling Inspirable Dust	AS 3640
Total Suspended Particles (TSP)	Determination of Total Suspended Particles	AS 2724.3
Particles as PM ₁₀	Determination of Suspended Particulate Matter - PM ₁₀ High Volume Sampler with Size-Selective Inlet - Gravimetric Method	AS 3580.9.6:2003
	Determination of Suspended Particulate Matter – PM ₁₀ Dichotomous Sampler – Gravimetric Method	AS 3580.9.7:1990
	Determination of Suspended Particulate Matter - PM ₁₀ Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance (TEOM) Analyser	AS 3580.9.8:2001
Particles as PM _{2.5}	Tapered Element Oscillating Microbalance (TEOM)	No Australian Standard available

7. TIMING

7.1 GENERAL MINING ACTIVITIES

Dust control procedures pertaining to general mining activities are to be employed at all times during the construction and operational phases of the project. Particular attention is to be given to dust control procedures during dry periods, where dry soils and lengthy periods of high winds enhance the potential for dust lift.

7.2 TRAFFIC AREAS

Water spraying of traffic areas is to be undertaken as required, based on measured dust levels and visual observations. The effectiveness of the spraying regime is to be periodically reviewed. Particular attention is to be given to dust control procedures during dry periods, where dry soils and lengthy periods of high winds enhance the potential for dust lift.

7.3 MONITORING

Initially, dust monitoring will be undertaken continuously for a seven day period within each month for the first 12 months at the closest residence to the mine operations. The first annual review will report on the monitoring data and any complaints received and establish a schedule for ongoing monitoring of the operations.

8. DECOMMISSIONING

During decommissioning, all rehabilitation and decommissioning activities will be undertaken in accordance with the procedures outlined in this Dust Management Plan, consistent with the requirements of the final Decommissioning and Closure Plan.

9. AUDITING

Olympia will conduct internal compliance audits on a periodical basis in accordance company standards. External audits will be accomplished by annual reporting to regulatory agencies as required by licence condition.

10. REPORTING

10.1 INTERNAL REPORTING

All Olympia employees and contractors will be required to report generation of significant dust plumes to the Mine Manager via their supervisor.

10.2 ENVIRONMENTAL REPORTING

All records of dust monitoring kept in accordance with this plan will be summarised in the Annual Environmental Review (AER), which will be submitted to the Department of Environment.

All dust complaints and remedial actions undertaken will also be summarised in the AER.

In accordance with the DOE site operating licence any incidents that constitute a breach of the licence will be reported to the Department of Environment.

10.3 PERFORMANCE REVIEW

Performance reviews will be undertaken following audits in accordance with section 9 above.

11. TRAINING

All employees and subcontractors will be required to undergo a site-specific induction, outlining environmental controls to be implemented during construction and operation. The induction will provide necessary awareness of dust management and the procedures and work practices to minimise and report dust generation.

Regular toolbox meetings will also be held to reinforce a positive attitude towards dust management and to highlight any issues that arise during the course of operation.

12. MANAGEMENT PROGRAMME SUMMARY

Table 7: Summary of Management Actions

Objective	Item	Relevant Phase	Task/Requirement	Timing	Performance Indicators	Responsibility	Related Plans / Procedures	Section Reference
Minimise the impact of dust from general mining activities	12.1	Construction and Operation	Implement a minimum clearing policy to ensure that vegetation is cleared only when and where necessary. In instances where the clearing of extensive areas is unavoidable, additional dust suppression techniques will be employed to ensure stabilisation of the cleared surfaces.	Ongoing	No unnecessarily cleared areas evident	Mine Manager	Vegetation Management Plan Staff induction/training	4.1
	12.2	Construction and Operation	Progressively rehabilitate disturbed areas, where practicable and consistent with operational requirements	Ongoing	Successful establishment of vegetation on rehabilitated surfaces	Mine Manager	Rehabilitation Plan Decommissioning and Closure Plan Staff induction/training	4.1
	12.3	Construction and Operation	Watering by truck mounted sprays or dribble bars of regularly trafficked areas such as access tracks and work areas as conditions require.	Ongoing	Minimal dust lift during traffic movements	Mine Manager	Staff induction/training	4.1

Objective	Item	Relevant Phase	Task/Requirement	Timing	Performance Indicators	Responsibility	Related Plans / Procedures	Section Reference
	12.4	Construction and Operation	Monitoring of ambient dust levels	Ongoing	Dust levels remain within the relevant criteria	Mine Manager	Staff induction/ training	4.1
	12.5	Construction and Operation	Employ routine housekeeping practices to contain and collect any spillages that could contribute to dust generation around conveyors, loading / unloading areas and sediment traps	Ongoing	No evidence of accumulation of dust generating material	Mine Manager	Staff induction/ training	4.1
	12.6	Construction and Operation	In the event of acceptable dust levels being exceeded, undertake immediate review of dust suppression methods and employ more stringent methods or cease activity	Ongoing	Dust levels return to acceptable limits	Mine Manager	Emergency Response Procedures	4.1
	12.7	Construction and Operation	Identify and, where practicable, control previously unidentified dust sources	Ongoing	Additional sources of dust are controlled	Mine Manager	Staff induction/ training Dust Monitoring Programme	4.1
	12.8	Construction and Operation	Inform all Olympia employees and contractors of their responsibilities regarding reporting and minimising dust generation	Ongoing	Employees and contractors are proactive in reporting dust generation	Mine Manager	Staff induction/ training	4.1

Objective	Item	Relevant Phase	Task/Requirement	Timing	Performance Indicators	Responsibility	Related Plans / Procedures	Section Reference
	12.9	Construction and Operation	Review and, where practicable, implement alternative dust management procedures in response to complaints received	Ongoing	Complaints acted on promptly	Mine Manager	Complaints Procedure	4.1
	12.10	Construction and Operation	Restrict vehicle speeds on unsealed surfaces	Ongoing	Dust lift from unsealed surfaces is minimal	Mine Manager		4.2
	12.11	Construction and Operation	Apply water to unsealed traffic areas via controlled sprays or dribble bars	Ongoing	Dust lift from unsealed surfaces is minimal	Mine Manager		4.2
	12.12	Operation	Cover loads of HMC leaving the site	Ongoing	Spillage from loads bound for Geraldton is negligible	Mine Manager		4.2
	12.13	Operation	Monitor climatic conditions and utilise data to assist with operational planning	Ongoing	Prevailing winds do not direct dust plumes towards environmentally sensitive locations	Mine Manager		4.3

13. SUMMARY OF DUST MONITORING PROGRAMME

Table 8: Summary of Dust Monitoring Programme

Objective	Item	Monitoring Action	Criteria	Frequency	Responsibility
Determine background dust levels	13.21	Install dust monitoring equipment as soon as practicable.	AS 2922 AS 2985 AS 3640	Ongoing	Mine Manager
Measure effectiveness of dust management strategies	13.22	Employ the use of a variety of monitoring equipment, including: <ul style="list-style-type: none"> Dust deposition gauges. High volume samplers or approved substitutes. Continuous particulate monitors. 	AS 2724.3 AS 3580.9.6:2003 AS 3580.9.7:1990 AS 3580.9.8:2001	Ongoing	Mine Manager
Ensure management methods are protecting environmentally locations	13.23	Visual assessment of dust and degree of dust deposition.	Dust levels within licence or guideline values	Ongoing	Mine Manager
Review and respond to complaints as applicable	13.24	Maintain a register of complaints. Review and act on complaints as and when required.	Complaints are kept to a minimum	Ongoing	Mine Manager

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