# ENVIRONMENTAL IMPACT STATEMENT

RED HILL
MINING LEASE

## Section 11
Air Quality

# Section 11 Air Quality

## 11.1 Introduction

BHP Billiton Mitsubishi Alliance (BMA), through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill mining lease application (MLA) 70421 to a mining lease and thus enable the continuation and potential future expansion of existing mining operations associated with the Goonyella, Riverside and Broadmeadow (GRB) mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing Broadmeadow underground mine (BRM).
- A future incremental expansion option of the existing Goonyella Riverside Mine (GRM).
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRB mine complex.

The proposed Broadmeadow extension will not require any additional mining infrastructure and will not cause a material contribution to existing levels of dust. The air quality assessment for the project considered the release of dust due to earth moving and mining activities associated with the construction and operation of the GRM incremental expansion and RHM underground expansion option. The BRM extension will not generate any significant dust impacts and is not considered further in this assessment.

In particular, three dust particle size ranges that are of concern in relation to the potential to impact on human health were considered. These include total suspended particulates (TSP), particulate matter with an equivalent aerodynamic diameter of less than 10 microns ($PM_{10}$) and particulate matter with an equivalent aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$). Additionally, dust deposition has been estimated in consideration of its potential to impact on environmental amenity. Dust deposition on plants is discussed in **Section 9** of this environmental impact statement (EIS).

The assessment evaluated the impact of identified dust emission sources together with the proposed mitigation measures in order to quantify the potential impact of dust from the project on air quality at nearby receptor locations.

The existing environment in relation to particulate matter has been considered by estimating background levels of dust for both natural and significant anthropogenic dust emission sources within the local airshed. Three years of numerically simulated meteorological fields for the local airshed were developed (2007, 2008 and 2009). As meteorology plays an important role in the transport and dispersion of dust away from the mine site, an understanding of the local meteorological environment is crucial when assessing the impact on emissions from the mine at nearby receptor locations. Importantly, the use of multiple years of meteorology captures a wider range of atmospheric conditions that influence dust impacts within the local airshed.

Dispersion modelling has been performed using the Department of Environment and Heritage Protection (EHP) approved CALMET/CALPUFF modelling tools. CALMET is a meteorological model originally developed with sponsorship from the California Air Resources Board to provide wind field data for the CALPUFF dispersion model. CALPUFF is a dispersion model developed to simulate dispersion taking account of conditions that vary in space and time. A detailed emissions inventory has been established using expected activity data, in conjunction with emission factors from both the

Australian National Pollutant Inventory (NPI) emission estimation manual and USEPA AP-42 emission estimation manual, which are used in the absence of site-specific data.

The predicted impacts from the proposed mine operation on local air quality incorporating BMA's proposed air quality control methods, are presented in this assessment.

Mining activities for the project have been evaluated for four scenarios (refer to **Table 11-1**):

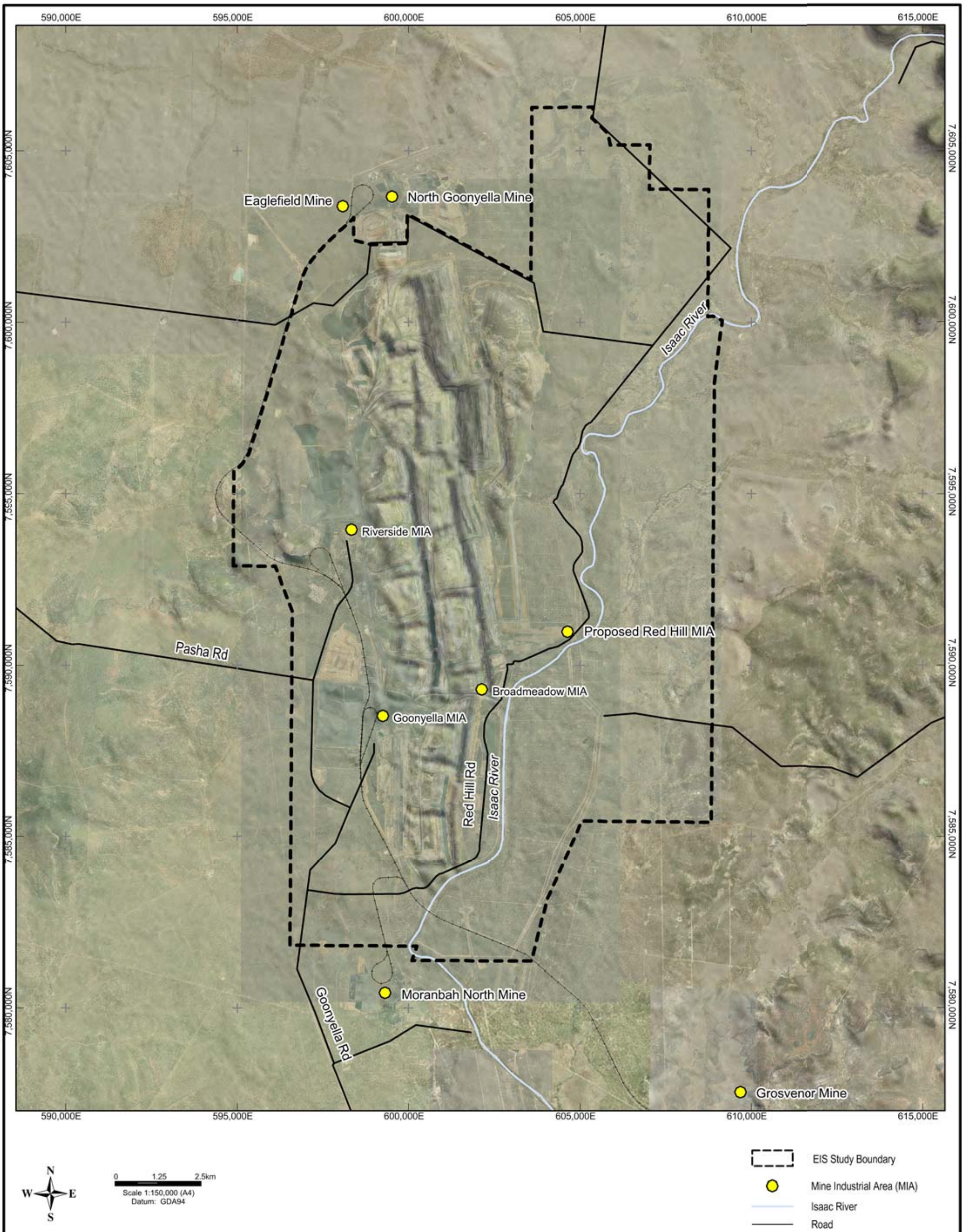
- **RHM Scenario:** RHM based on a single worst-case dust emissions scenario corresponding to the maximum predicted annual emissions based on the maximum run of mine (ROM) tonnes of coal mined. The air quality assessment focussed on dust emissions from the RHM component of the project, including the Red Hill mine industrial area (MIA), Red Hill conveyors and Red Hill coal handling and preparation plant (CHPP). The Broadmeadow underground mine extension (Broadmeadow extension) component was not considered separately from the Broadmeadow underground mine (BRM) (existing mining scenario). Coal produced from this component of the project will be processed through the existing coal handling and processing facilities and is, therefore, considered as part of the existing mining scenario emissions.
- **Existing Mining Scenario (based on approved BMA operations):** GRB mine complex with production based on current approvals and plans for FY2015, FY2030, FY2040 and FY2050 mining operations. Included in this scenario is an estimate of naturally occurring dust levels based on continuous monitoring data from BMA's Moranbah Airport monitoring station.
- **Future Mining Scenario (based on approved BMA operations and the project):** GRB mine complex, RHM and an estimate of naturally occurring background levels of dust. Results for the four mine configurations for GRB mine complex (i.e. FY2015, FY2030, FY2040, and FY2050) are presented.
- **Cumulative Future Mining Scenario**: GRB mine complex, RHM, and naturally occurring dust levels, have been considered in combination with impacts associated with non-BMA emission sources: Eaglefield Mine (Peabody Energy), Grosvenor Mine (Anglo Coal), and Moranbah North Mine (Anglo Coal). Refer to **Figure 11-1**.

Estimates of dust emissions for activities associated with each of these scenarios have been assessed and used in dispersion modelling to predict impacts at nearby receptor locations.

Table 11-1 Modelled Scenarios

| Scenario | RHM | GRM | BRM | EFM | Gros and MNM |
|---|---|---|---|---|---|
| RHM only | √ | x | x | x | x |
| Existing mining scenario[1,2] | x | √ | √ | x | x |
| Future mining scenario[1] | √ | √ | √ | x | x |
| Cumulative future mining scenario[1] | √ | √ | √ | √ | √ |

*GRM – Goonyella Riverside mine; EFM – Eaglefield Mine; Gros – Grosvenor Mine; MNM – Moranbah North Mine.
Note 1: Consists of four scenarios, one each for FY2015, FY2030, FY2040, FY2050.
Note 2: This is the scenario calculated in **Section 11.3.3.2**.

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RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**PROJECTS CONSIDERED IN THE MINING SCENARIOS**

URS

**AIR QUALITY**

Figure: **11-1**

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## 11.2 Pollutants Considered in the Assessment

Emissions from the project are generated primarily from activities that move overburden and coal and, to a lesser extent, from combustion of diesel fuel in mobile equipment. The emissions and impacts of dust comprising TSP, $PM_{10}$, $PM_{2.5}$, and dust deposition have been assessed in detail.

Air pollutants from diesel combustion may release other air pollutants such as sulphur dioxide, nitrogen dioxide and trace quantities of volatile organic compounds. These substances are not considered to be emitted from project-related sources in sufficient quantities to affect air quality at the nearest off-site receptors; therefore impacts from pollutants generated by combustion were not considered further in the air quality assessment.

The emission of combustion pollutants in terms of greenhouse gas emissions is addressed in **Section 12** of this EIS.

## 11.3 Description of Environmental Values

Environmental values in the form of the existing air quality in the vicinity of the project and legislation applicable to the ambient air quality in Queensland for the pollutants considered in the assessment are described in this section.

The climate at the EIS study area has been documented in **Section 4** of this EIS. The data for wind speed, wind direction, temperature, temperature inversion, stability class and mixing height are derived from meteorological modelling that has been conducted for the project.

### 11.3.1 Legislative Framework

Ambient air quality objectives that have been adopted for the project have considered both national guidelines and state legislative criteria for air quality. As the primary pollutant of concern from the project is dust, the presentation of ambient air criteria focuses on TSP, $PM_{10}$, $PM_{2.5}$ and dust deposition. A comparison of Australian ambient air quality criteria with selected international criteria for particulate matter is presented in **Appendix L**.

#### 11.3.1.1 National Guidelines

National air quality guidelines are specified by the National Environment Protection Council (NEPC). The National Environment Protection Measure (NEPM) (Ambient Air Quality) was released in 1998 (with an amendment in 2003), and sets standards for ambient air quality in Australia (NEPM 2003).

The NEPM (Ambient Air Quality) specifies national ambient air quality standards and goals for the following common air pollutants: carbon monoxide, nitrogen dioxide, sulphur dioxide, ozone, particulates (as $PM_{10}$ and $PM_{2.5}$), and lead.

In 2004 the NEPM (Air Toxics) was released which included monitoring investigation guidelines for five compounds classified as air toxics: benzene, benzo(a)pyrene, formaldehyde, toluene and xylenes. These toxic air pollutants are not released in significant quantities from the project and have not been addressed in the air quality assessment.

Potential particulate emissions and impacts are addressed through consideration of the impacts of total suspended particulates and $PM_{10}$.

Ambient concentrations of $PM_{2.5}$ are addressed only by advisory reporting standards in the NEPM, which are not applied as goals. The objective of the advisory standard was to collect sufficient information by which to develop a future standard for $PM_{2.5}$.

The NEPM standards are intended to be applied at monitoring locations that represent air quality for a region or sub-region of more than 25,000 people, and are not intended to guide air quality goals at locations near industrial facilities.

A summary of the Ambient Air Quality NEPM standards and goals are presented in **Table 11-2**. It is noted that the Ambient Air NEPM is currently under review.

Table 11-2 Ambient Air Quality NEPM Goals and Standards

| Pollutant | Averaging Period | Maximum Concentration (µg/m$^3$) | Goal within 10 years – Maximum Allowable Exceedences |
|---|---|---|---|
| $PM_{10}$ | 24 hour | 50 | 5 days per year |
| $PM_{2.5}$ | 24 hour | 25 | None |
| | Annual | 8 | None |

### 11.3.1.2 Queensland Legislation

In Queensland, air quality is managed under the *Environmental Protection Act 1994* (EP Act), the Environmental Protection Regulation 2008 (EP Regulation) and the *Environmental Protection (Air) Policy 2008* (EPP (Air)) which came into effect on January 1, 2009.

The EP Act provides for long-term protection for the environment in Queensland in a manner that is consistent with the principles of ecologically sustainable development. The primary purpose of the EPP (Air) is to achieve the objectives of the EP Act in relation to Queensland's air environment. As noted in the EPP (Air) these objectives are achieved through:

- identification of environmental values to be enhanced or protected;
- specification of air quality indicators and goals to protect environmental values; and
- provision of a framework for making consistent and fair decisions about managing the air environment and involving the community in achieving air quality goals that best protect Queensland's air environment.

The EPP (Air) applies *'…to Queensland's air environment*' but the air quality objectives specified in the EPP (Air) do not extend to workplaces as defined in the *Work Health and Safety Act 2011* (Section 8 of the EPP (Air)). Although the *Coal Mining Safety and Health Act 1999* (CMSH Act) is not specified in the EPP (Air), it is considered that the EPP (Air) does not apply to occupational exposure to dust. Occupational exposure to dust at all on-lease locations is managed by BMA under the CMSH Act.

Hence, the air quality assessment presented in this report addresses off-site ambient air quality impacts only and does not cover workplace health and safety exposure.

Schedule 1 of the EPP (Air) specifies the air quality objectives that are to be progressively achieved, though no timeframe for achievement of these objectives is specified. The schedule includes objectives designed to protect the environmental values of:

- health and well-being;

- aesthetic environment;
- health and biodiversity of ecosystems; and
- agriculture.

While there is no dust deposition criterion in the EPP (Air) the Queensland EHP has adopted a guideline for dust deposition of 120 milligrams per square metre per day (mg/m$^2$/day) to nearby coal mining activities in relation to nuisance levels of dust. This level was derived from ambient monitoring of dust conducted in the Hunter Valley, NSW in the 1980s (NSW DEC 2005). The former NSW State Pollution Control Commission set the level to avoid a loss of amenity in residential areas, based on the levels of dust fallout that cause complaints.

A summary of the relevant ambient air quality objectives and criterion is presented in **Table 11-3**.

Table 11-3 Ambient Air Quality Objectives and the Criterion for Dust Deposition

| Pollutant | Averaging Period | Objective/Criterion | Allowable Exceedences | Source |
|---|---|---|---|---|
| TSP | Annual | 90 µg/m$^3$ | None | Qld EPP(Air) |
| $PM_{10}$ | 24 hour | 50 µg/m$^3$ | 5 days per year | Qld EPP(Air) |
| $PM_{2.5}$ | 24 hour | 25 µg/m$^3$ | None | Qld EPP(Air) |
| | Annual | 8 µg/m$^3$ | None | Qld EPP(Air) |
| Dust Deposition | Monthly | 120 mg/m$^2$/day | None | Qld EHP |

### 11.3.2 Receptor Locations

The receptor locations that have been considered for the purposes of the air quality assessment are outlined in **Table 11-4** and depicted in **Figure 11-2**, and consist of isolated residences on rural properties.

Table 11-4 Proximity of Receptors to the EIS Study Area

| Location Number | Receptor – Property Reference | Distance to EIS Study Area (km) | Notes |
|---|---|---|---|
| R1 | Denham Park | 6.1 | Owned by BHP Billiton Mitsui Coal (BMC) |
| R2 | Burton Downs | 4.6 | Owned by BMA |
| R3 | Lapunyah | 1.2 | Owned by BMC |
| R4 | Red Hill | 0.9 | Owned by BMA |
| R5 | Riverside Homestead | 0 [1] | Privately owned – subject to negotiation with the landowner |
| R6 | Broadmeadow Cottage 2 | 0 [1] | Privately owned – subject to negotiation with the landowner |
| R7 | Broadmeadow Homestead | 0 [1] | Privately owned – subject to negotiation with the landowner |
| R8 | Broadmeadow Cottage 1 | 0 [1] | Privately owned – subject to negotiation with the landowner |

| Location Number | Receptor – Property Reference | Distance to EIS Study Area (km) | Notes |
|---|---|---|---|
| R9 | Kimberley | 18.7 | Privately owned |
| R10 | Wavering Downs | 25.5 | Privately owned |
| R11 | Sondells | 18.2 | Privately owned |
| R12 | Nibbereena | 16 | Privately owned |
| R13 | Pretoria | 14.9 | Privately owned |
| R14 | Wyena | 26.5 | Privately owned |
| R15 | Broadlea | 12.6 | Privately owned |
| R16 | Rugby | 14.4 | Privately owned |
| R17 | Watunga | 22.5 | Privately owned |
| R18 | Moranbah water treatment plant | 14.5 | Privately owned |

Note 1: Property currently lies within the boundary of the EIS study area or project mining lease and is therefore given a zero kilometre distance.

In accordance with the EHP *Guideline for Mining Model Mining Conditions* (130626 EM944), accommodation villages located on a mining lease are not considered sensitive receptors. Occupational exposure to dust at all on-lease locations is managed by BMA under the CMSH Act.

### 11.3.3 Existing Air Quality Environment

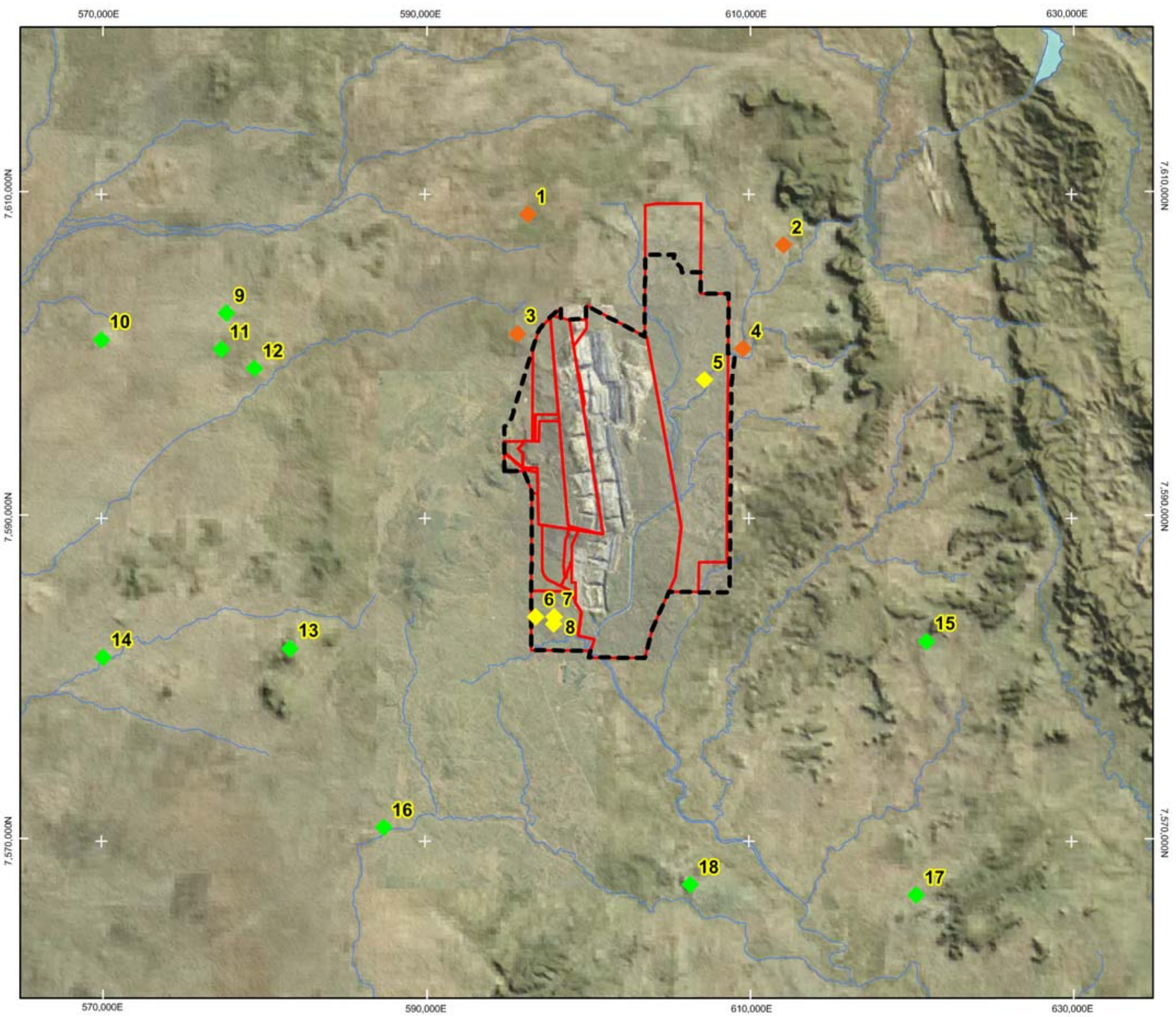
Quantification of current levels of dust in the vicinity of the project is complicated as it is the result of a combination of natural and anthropogenic dust emission sources, the impacts from which are both temporally and spatially varying.

Adding to the complexity of the interpretation of current dust levels within the local airshed is the existence of both BMA and non-BMA mining operations. Publicly available information for non-BMA operations is limited and thus for this assessment a conservative approach has been adopted when representing these emission sources (**Appendix L**). The relative conservatism of the applied modelling approach to predict dust impacts from both BMA and non-BMA existing mining operations is not able to be assessed due to the lack of a comprehensive ambient air monitoring data set by which to validate model predictions. These limitations of the assessment are discussed further in **Appendix L.**

For the purposes of quantifying the existing air quality environment, the contribution from natural dust emission sources is estimated from monitoring data for the period January 2011 through January 2013 obtained from BMA's Moranbah Airport monitoring station.

The contribution of dust from operation of the GRB mine complex to ground level concentrations of dust within the local airshed is then predicted using dispersion modelling (refer to **Section 11.3.3.2**). Existing and future air quality due to approved BMA mining operations was then determined by adding the impacts from natural dust emissions sources and those from dust emissions associated with those from the GRB mine complex (refer to **Section 11.3.3.3**).

Prediction of cumulative impacts from BMA and non-BMA mining operations as well as estimates of background levels, are discussed in **Section 21** of this EIS.




| ID | Receptor | ID | Receptor |
|---|---|---|---|
| 1 | Denham Park | 12 | Nibbereena |
| 2 | Burton Downs | 13 | Pretoria |
| 3 | Lapunyah | 14 | Wyena |
| 4 | Red Hill | 15 | Broadlea |
| 5 | Riverside Homestead | 16 | Rugby |
| 6 | Broadmeadow Cottage 2 | 17 | Watunga |
| 7 | Broadmeadow Homestead | 18 | Moranbah Water treatment plant |
| 8 | Broadmeadow Cottage 1 | | |
| 9 | Kimberley | | |
| 10 | Wavering Downs | | |
| 11 | Sondells | | |

BMA Tenure/Tenement
EIS Study Boundary
Receptor Location - BMA/BMC controlled
Receptor Location - Privately Owned Homestead (subject to negotiation with landowner)
Receptor Location - Privately Owned Homestead

N E S W
0 5 10Km
Scale 1:400,000 (A4)
Datum: GDA 94, MGA Zone 55

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RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**RECEPTOR LOCATIONS**

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**AIR QUALITY**

Figure: 11-2

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#### 11.3.3.1 Estimate of Background Levels

In theory, background levels of pollutants are the concentrations of these pollutants that would occur in the absence of anthropogenic emission sources (including land clearing). In practice, the practicalities and limitations associated with the establishment of ambient air monitoring stations means that air quality is rarely measured at locations which are not influenced to some degree by anthropogenic emission sources.

Estimating background levels within the local airshed is further complicated by the fact that background levels of pollutants can be highly variable over time and at different locations. This is because the emission rate of pollutants from natural sources is often a function of a number of meteorological factors including for example, frequency of rain, wind speed and atmospheric stability, as well as natural phenomena such as dust storms and bushfires. The Victorian Environmental Protection Authority (EPA) recommend the use of the 70$^{th}$ percentile measurement of dust levels as an estimate for the background level and while this allows for a conservatively based input into modelling of air quality, this approach masks spatial and temporal variability.

For the purposes of this assessment, data from BMA's ambient air monitoring station at the Moranbah Airport has been used. Established in 2010 the Moranbah Airport monitoring site includes continuous monitoring of particulate matter using tapered element oscillating microbalances (TEOM) as well as the monitoring of meteorological parameters. Data for the period January 2011 through January 2013 were analysed to estimate background levels of TSP, particulate matter as $PM_{10}$, and particulate matter as $PM_{2.5}$.

Due to the lack of dust deposition data at the airport, a background estimate of dust deposition has been sourced from the Caval Ridge Mine Project EIS (BMA, 2010).

Adopted background levels are summarised in **Table 11-5**, details of the data analysis including the limitations of the data sets are provided in **Appendix L**.

Table 11-5 Estimate of Background Levels (Natural Emission Sources)

| Pollutant | Averaging Period | Objective/Criterion | Estimated Background Level | Source |
|---|---|---|---|---|
| TSP | Annual(2) | 90 µg/m$^3$ | 39.8 µg/m$^3$ | Moranbah Airport |
| $PM_{10}$ | 24 hour(1) | 50 µg/m$^3$ | 29.6 µg/m$^3$ | Moranbah Airport |
| $PM_{2.5}$ | 24 hour(1) | 25 µg/m$^3$ | 7.0 µg/m$^3$ | Moranbah Airport |
| | Annual(2) | 8 µg/m$^3$ | 6.6 µg/m$^3$ | Moranbah Airport |
| Dust deposition | Monthly | 120 mg/m$^2$/day | 50 mg/m$^2$/day(3) | CRM EIS |

Note 1: Based on the 70$^{th}$ percentile 24-hour average concentration.
Note 2: Based on two years of data.
Note 3: Based on CRM EIS.

#### 11.3.3.2 Contributions to the Air Quality Environment due to GRB Mine Complex

In addition to naturally occurring sources of dust, the RHM is proposed to be located adjacent to the GRB mine complex open-cut and underground mining operations. Activities associated with the current open-cut mining operations at the GRB mine complex are predicted to be significant local anthropogenic dust emission sources. Activities associated with other nearby mines operated by others are included in the cumulative impact assessment in **Section 21**.

To quantify the impact of the contribution of dust from current mining operations on local air quality, emission sources associated with GRM and BRM have been estimated using predictive modelling. This modelling took into account current mining operations as well as future mining operations as open-cut operations progress eastwards. The modelling for future operations takes into account changes in coal production and overburden handling where this was appropriate for the open-cut operations.

Specifically, dispersion modelling of dust emissions associated with the GRM has considered emission sources and emission rates for four snap-shots during mining operations: FY2015, FY2030, FY2040 and FY2050. Based on available information, the FY2015 scenario was considered to be most representative of present-day mining operations. As the existing mining operations progress eastward with the coal located at increasing depths, the stripping ratio of overburden to coal will increase and thus the FY2030 and FY2040 scenarios associated with the highest predicted overall site dust emissions totals. By FY2050, open-cut mining operations at the site are predicted to be winding down with the depletion of the coal reserve that is accessible on the current mining lease (ML). Details of the modelling methodology of emission sources associated with the GRB mine complex are presented in **Appendix L**.

In order to compare the predicted impacts with the project air quality objectives and the criterion for dust deposition, results for the existing mining scenario are presented in **Appendix L** for each of the four GRM open-cut mining operational scenarios (FY2015, FY2030, FY2040 and FY2050) in combination with impacts from BRM for the following:

- the maximum and $5^{th}$ highest 24-hour average concentration of $PM_{10}$ at receptor locations;
- the maximum 24-hour average concentration of $PM_{2.5}$ at receptor locations;
- number of predicted exceedences of the 24-hour average concentration of $PM_{10}$ and $PM_{2.5}$ at receptor locations;
- annual average concentration of TSP and $PM_{2.5}$ at receptor locations;
- dust deposition at receptor locations; and
- regional contour plots which include background estimates of particulate matter due to natural sources of dust which were summarised in **Table 11-5**.

### Background Creep

Presented in **Table 11-6** and **Table 11-7** is a summary of the predicted incremental contribution of emissions from the GRB mine complex to the $70^{th}$ percentile ground-level concentration of $PM_{10}$ and $PM_{2.5}$ (respectively) (**Appendix L**).

Based on the Victorian EPA recommended use of the $70^{th}$ percentile as an estimate of background levels, the results presented in **Table 11-6** and **Table 11-7** are representative of the amount of 'background creep' that is associated with mining operations at the GRB mine complex. The estimate of background creep provides an indication of the persistent nature of elevated levels of dust above those that would be measured in the absence of the considered dust emission source, in this case the GRB mine complex with ground level impacts exceeding the noted contour level 30 per cent of the time.

In particular, the 70th percentile 24-hour average concentration of $PM_{10}$ (i.e. background creep) is predicted to exceed the EPP (Air) objective of 50 µg/m$^3$ at Lapunyah Homestead (R3) for the FY2015 and FY2030 scenarios. Lapunyah (R3) is located in close proximity and downwind of mining operations in the northern part of the GRB mine complex.

Table 11-6 Incremental Contribution of Emissions from GRB Mine Complex to the 70th Percentile 24-Hour Average Concentration of $PM_{10}$ which Represents Background Creep

| Receptor | Scenario FY2015 | Scenario FY2030 | Scenario FY2040 | Scenario FY2050 |
|---|---|---|---|---|
| R1 - Denham Park | 0 | 0 | 0 | 0 |
| R2 - Burton Downs | 0 | 0 | 0 | 0 |
| R3 - Lapunyah | 65.8 | 55.5 | 41.8 | 39 |
| R4 - Red Hill | 0 | 0 | 0 | 0 |
| R5 - Riverside Homestead | 0 | 0 | 0 | 0 |
| R6 - Broadmeadow Cottage 2 | 6.2 | 7.5 | 16.9 | 11.3 |
| R7 - Broadmeadow Homestead | 4.1 | 5.0 | 15.6 | 15.7 |
| R8 - Broadmeadow Cottage 1 | 3.3 | 4.2 | 11.3 | 14.4 |
| R9 - Kimberley | 9.4 | 10.2 | 10.1 | 4.8 |
| R10 - Wavering Downs | 4.7 | 5.0 | 5.1 | 2.6 |
| R11 - Sondells | 9.1 | 9.8 | 9.7 | 4.8 |
| R12 - Nibbereena | 11.9 | 12.4 | 11.8 | 6.1 |
| R13 - Pretoria | 5 | 5.7 | 6.7 | 3.1 |
| R14 - Wyena | 1.6 | 1.7 | 2.0 | 1.0 |
| R15 - Broadlea | 0 | 0 | 0 | 0 |
| R16 - Rugby | 0.5 | 0.6 | 0.9 | 0.5 |
| R17 - Watunga | 0 | 0 | 0 | 0 |
| R18 - Moranbah water treatment plant | 0 | 0 | 0 | 0 |

Notes: Estimated background level of 29.6 µg/m$^3$.
EPP (Air) objective is 50 µg/m$^3$ not to be exceeded more than 5 days per year.
Receptor locations are shown on **Figure 11-2.**

Results for the 24-hour average ground-level concentration of $PM_{2.5}$ are within the EPP (Air) objective of 25 µg/m$^3$; however, significant background creep due to operations at the GRB mine complex is predicted at Lapunyah (R3) (**Table 11-7**).

Table 11-7 Incremental Contribution of Emissions from GRB Mine Complex to the 70$^{th}$ Percentile 24-Hour Average Concentration of $PM_{2.5}$ which Represents Background Creep (µg/m$^3$)

| Receptor | Scenario FY2015 | Scenario FY2030 | Scenario FY2040 | Scenario FY2050 |
|---|---|---|---|---|
| R1 - Denham Park | 0 | 0 | 0 | 0 |
| R2 - Burton Downs | 0 | 0 | 0 | 0 |
| R3 - Lapunyah | 12.6 | 10.4 | 7.5 | 7.4 |
| R4 - Red Hill | 0 | 0 | 0 | 0 |
| R5 - Riverside Homestead | 0 | 0 | 0 | 0 |
| R6 - Broadmeadow Cottage 2 | 0.8 | 1 | 2.6 | 1.9 |
| R7 - Broadmeadow Homestead | 0.6 | 0.8 | 2.7 | 3.1 |
| R8 - Broadmeadow Cottage 1 | 0.4 | 0.6 | 2 | 2.8 |
| R9 - Kimberley | 1.3 | 1.4 | 1.3 | 0.6 |
| R10 - Wavering Downs | 0.6 | 0.6 | 0.6 | 0.3 |
| R11 - Sondells | 1.2 | 1.3 | 1.3 | 0.6 |
| R12 - Nibbereena | 1.5 | 1.6 | 1.5 | 0.8 |
| R13 - Pretoria | 0.6 | 0.7 | 0.8 | 0.4 |
| R14 - Wyena | 0.2 | 0.2 | 0.2 | 0.1 |
| R15 - Broadlea | 0 | 0 | 0 | 0 |
| R16 - Rugby | 0.1 | 0.1 | 0.1 | 0.1 |
| R17 - Watunga | 0 | 0 | 0 | 0 |
| R18 - Moranbah water treatment plant | 0 | 0 | 0 | 0 |

Notes: Estimated background level of 7.0 µg/m$^3$.
EPP (Air) objective is 25 µg/m$^3$.

Presented in **Table 11-8** is a summary of the incremental contribution of dust emissions from GRB mine complex to the annual average concentration of TSP.

Results of the dispersion modelling suggest that the annual average concentration of TSP due to emissions of dust from the GRB mine complex in isolation of natural background levels will not exceed the EPP (Air) objective of 90 µg/m$^3$ at any receptor location, although a modelled concentration of 89 µg/m$^3$ is predicted at Lapunyah (R3) for the 2015 scenario.

Table 11-8 Incremental Contribution to the Annual Average Concentration of TSP due to Operations at the GRB Mine Complex (µg/m$^3$)

| Receptor | Scenario FY2015 | Scenario FY2030 | Scenario FY2040 | Scenario FY2050 |
|---|---|---|---|---|
| R1 - Denham Park | 7.4 | 6.9 | 6 | 5.9 |
| R2 - Burton Downs | 1.4 | 1.5 | 1.4 | 0.9 |
| R3 - Lapunyah | 89.0 | 71.8 | 54.4 | 54 |
| R4 - Red Hill | 2.3 | 2.8 | 3 | 1.4 |
| R5 - Riverside Homestead | 3.9 | 5.1 | 5.9 | 2.4 |
| R6 - Broadmeadow Cottage 2 | 14.3 | 17.5 | 24.7 | 15.6 |
| R7 - Broadmeadow Homestead | 16.1 | 19.9 | 30.1 | 23.8 |
| R8 - Broadmeadow Cottage 1 | 13.8 | 17.2 | 25.4 | 21 |
| R9 - Kimberley | 8.3 | 8.7 | 8.3 | 4.4 |
| R10 - Wavering Downs | 4.1 | 4.4 | 4.3 | 2.3 |
| R11 - Sondells | 8.2 | 8.6 | 8.3 | 4.4 |
| R12 - Nibbereena | 10.5 | 11 | 10.3 | 5.6 |
| R13 - Pretoria | 5.6 | 6.2 | 6.5 | 3.1 |
| R14 - Wyena | 1.8 | 2 | 2.1 | 1 |
| R15 - Broadlea | 0.4 | 0.5 | 0.5 | 0.3 |
| R16 - Rugby | 1.9 | 2.2 | 2.6 | 1.2 |
| R17 - Watunga | 0.4 | 0.4 | 0.5 | 0.2 |
| R18 - Moranbah water treatment plant | 1.3 | 1.5 | 1.7 | 0.8 |

Notes: Estimated background level of 39.8 µg/m$^3$.
EPP (Air) objective is 90 µg/m$^3$.

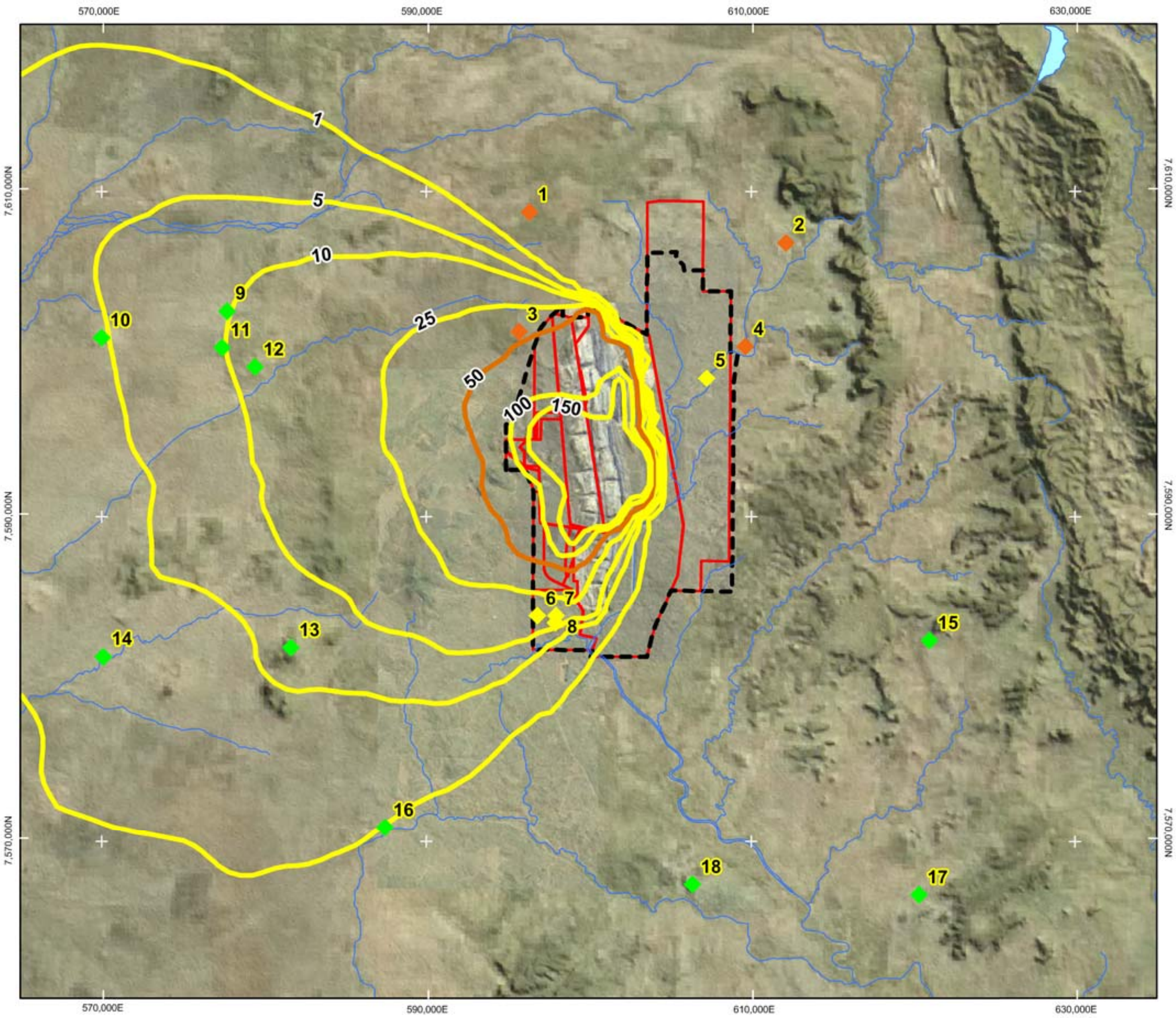
Presented in **Table 11-9** are the results for the incremental contribution of emissions from the GRB mine complex to the annual average ground-level concentration of $PM_{2.5}$ which, in isolation of other dust emissions sources, is not predicted to exceed the EPP(Air) objective of 8 µg/m$^3$ with the exceptions of Lapunyah (R3) in the 2015 scenario.

Table 11-9 Incremental Contribution to the Annual Average Concentration of $PM_{2.5}$ due to Operations at the GRB Mine Complex (µg/m$^3$)

| Receptor | Scenario FY2015 | Scenario FY2030 | Scenario FY2040 | Scenario FY2050 |
|---|---|---|---|---|
| R1 - Denham Park | 0.7 | 0.7 | 0.6 | 0.6 |
| R2 - Burton Downs | 0.1 | 0.1 | 0.1 | 0.1 |
| R3 - Lapunyah | **8.9** | 7.2 | 5.4 | 5.4 |
| R4 - Red Hill | 0.2 | 0.3 | 0.3 | 0.1 |
| R5 - Riverside Homestead | 0.4 | 0.5 | 0.6 | 0.2 |
| R6 - Broadmeadow Cottage 2 | 1.4 | 1.8 | 2.5 | 1.6 |
| R7 - Broadmeadow Homestead | 1.6 | 2 | 3 | 2.4 |
| R8 - Broadmeadow Cottage 1 | 1.4 | 1.7 | 2.5 | 2.1 |
| R9 - Kimberley | 0.8 | 0.9 | 0.8 | 0.4 |
| R10 - Wavering Downs | 0.4 | 0.4 | 0.4 | 0.2 |
| R11 - Sondells | 0.8 | 0.9 | 0.8 | 0.4 |
| R12 - Nibbereena | 1.1 | 1.1 | 1 | 0.6 |
| R13 - Pretoria | 0.6 | 0.6 | 0.7 | 0.3 |
| R14 - Wyena | 0.2 | 0.2 | 0.2 | 0.1 |
| R15 - Broadlea | 0 | 0 | 0.1 | 0 |
| R16 - Rugby | 0.2 | 0.2 | 0.3 | 0.1 |
| R17 - Watunga | 0 | 0 | 0 | 0 |
| R18 - Moranbah water treatment plant | 0.1 | 0.2 | 0.2 | 0.1 |

Notes: Estimated background level of 6.6 µg/m$^3$.
EPP (Air) objective is 8 µg/m $^3$.

Presented in **Figure 11-3** is a plot of the 70$^{th}$ percentile 24-hour average concentration of $PM_{10}$ for the FY2040 scenario. This figure highlights the spatial variability in the predicted incremental contribution due to dust emission from GRB mine complex based on current mining operations. The effect of the predominant easterly winds is noted with elevated background levels limited to the western side of the mine site.




Mines included: GRM, BRM.

BMA Tenure/Tenement
EIS Study Boundary
Receptor Location - BMA/BMC controlled
Receptor Location - Privately Owned Homestead (subject to negotiation with landowner)
Receptor Location - Privately Owned Homestead
Background Creep 24 hr Average $PM_{10}$ Concentration (µg/m³)
The EPP (Air) Objective (50 µg/m³)

N W E S

0 5 10Km

Scale 1:400,000 (A4)

Datum: GDA 94, MGA Zone 55

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RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**BACKGROUND CREEP OF THE 24-HR AVERAGE CONCENTRATION OF $PM_{10}$ DUE TO CURRENT GRB MINE COMPLEX OPERATIONS, FY2040**

URS

**AIR QUALITY**

Figure: 11-3

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#### 11.3.3.3 Existing Air Quality Environment

In order to quantify the existing air quality environment at receptor locations within the local airshed, the background level as determined from the Moranbah Airport data is added to the dust levels predicted at each receptor from approved operations at the GRB mine complex.

Presented in **Table 11-10** is a summary of the receptor locations for which exceedences of the relevant ambient air quality objectives are predicted for the four GRM open-cut mining snap-shots (FY2015, FY2030, FY2040, and FY2050). Note that these results include the estimate for naturally occurring background levels plus modelled impacts from the GRB mine complex.

The results presented in **Table 11-10** indicate receptor locations at which the specified EPP (Air) air quality objective or EHP criterion for dust deposition is predicted to be exceeded. In general, exceedences of the EPP (Air) objectives for the 24-hour average concentration of $PM_{10}$ and $PM_{2.5}$ are predicted to occur under light wind conditions in association with increased atmospheric stability. The specific wind and atmospheric conditions depends on the location of the receptor in relation to the dust generating activities. A detailed investigation into worst-case meteorological conditions is provided in **Appendix L**.

The contour plot presented in **Figure 11-4** (FY 2040) highlights the spatial extent of predicted exceedences of the EPP (Air) objective of 50 µg/m$^3$ for the 24-hour average concentration of $PM_{10}$. The FY2040 scenario has been presented as it is indicative of the worst-case results for receptors located to both west and east of the GRB mine complex. Note that the contours for the 5$^{th}$ highest 24-hour average concentration of $PM_{10}$ are presented. Those receptors that lie inside the 50 µg/m$^3$ contour are predicted to exceed the EPP (Air) objective on at least five days of the year.

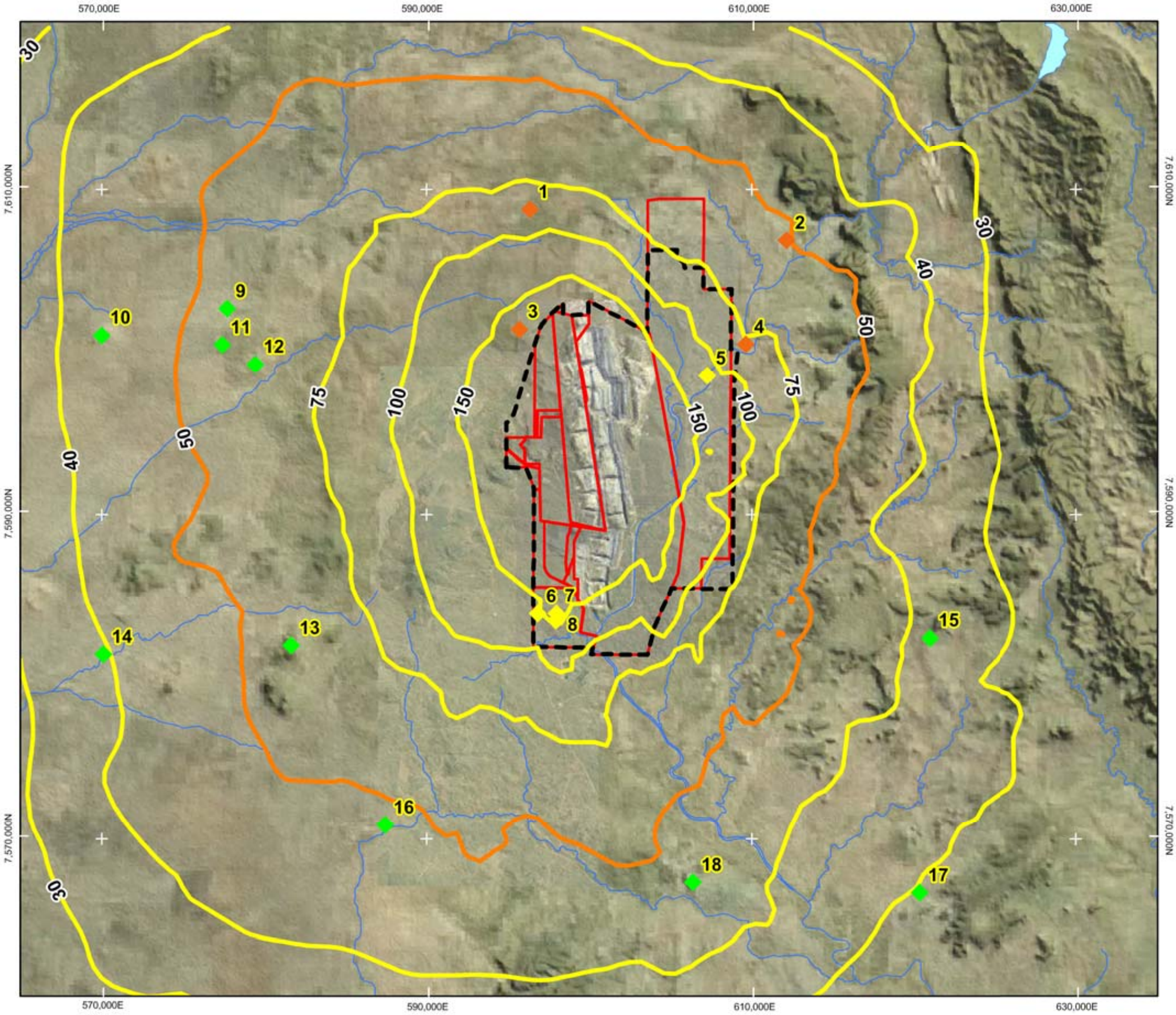
A contour plot of the maximum 24-hour average concentration of $PM_{2.5}$ for the approved development scenario for FY2040 is presented in **Figure 11-5**.

Additional contour plots for the approved development scenario are presented in **Appendix L**.

Note that the relative conservatism of predicted ground-level concentrations is currently not able to be determined due to the lack of a comprehensive data set suitable for model validation purposes. In order to obtain more accurate information, BMA has a continuous monitoring program for $PM_{10}$ and $PM_{2.5}$ located on the western side of GRM. The program gathers information on dust levels from current operations, but sufficient data are not currently available for model validation purposes. However, the data suggest $PM_{10}$ emissions from approved operations are compliant with the GRB mine complex environmental authority limit of 150 µg/m$^3$ for the 24-hour average concentration.

Table 11-10 Receptors Predicted to Exceed Pollutant Criteria at least once for the Existing Mining Scenario

| Scenario | Receptor | Existing Mining Scenario | | | |
|---|---|---|---|---|---|
| **Pollutant** | | **2015** | **2030** | **2040** | **2050** |
| **TSP** Annual average | R3 - Lapunyah | √ | √ | √ | √ |
| **$PM_{10}$** 24-hour average | R1 - Denham Park | √ | √ | √ | √ |
| | R2 - Burton Downs | √ | √ | √ | √ |
| | R3 - Lapunyah | √ | √ | √ | √ |
| | R4 - Red Hill | √ | √ | √ | √ |
| | R5 - Riverside Homestead | √ | √ | √ | √ |
| | R6 - Broadmeadow Cottage 2 | √ | √ | √ | √ |
| | R7 - Broadmeadow Homestead | √ | √ | √ | √ |
| | R8 - Broadmeadow Cottage 1 | √ | √ | √ | √ |
| | R9 - Kimberley | √ | √ | √ | - |
| | R11 - Sondells | √ | √ | √ | - |
| | R12 - Nibbereena | √ | √ | √ | √ |
| | R13 - Pretoria | √ | √ | √ | - |
| | R16 - Rugby | - | - | √ | - |
| | R18 – Moranbah Water treatment plant | √ | √ | √ | - |
| **$PM_{2.5}$** 24-hour average | R3 - Lapunyah | √ | √ | √ | √ |
| | R5 - Riverside Homestead | √ | √ | √ | - |
| | R7 - Broadmeadow Homestead | - | √ | √ | - |
| | R8 - Broadmeadow Cottage 1 | - | - | √ | - |
| **$PM_{2.5}$** Annual average | R3 - Lapunyah | √ | √ | √ | √ |
| | R6 - Broadmeadow Cottage 2 | √ | √ | √ | √ |
| | R7 - Broadmeadow Homestead | √ | √ | √ | √ |
| | R8 - Broadmeadow Cottage 1 | - | √ | √ | √ |
| **Dust Deposition** Monthly average | R3 - Lapunyah | √ | √ | √ | √ |




Mines included: GRM, BRM.

BMA Tenure/Tenement
EIS Study Boundary
Receptor Location - BMA/BMC controlled
Receptor Location - Privately Owned Homestead (subject to negotiation with landowner)
Receptor Location - Privately Owned Homestead
Predicted 24 Hour Average $PM_{10}$ Concentration (µg/m³)
The EPP (Air) Objective (50 µg/m³)

Scale 1:400,000 (A4)
Datum: GDA 94, MGA Zone 55

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RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**THE 5TH HIGHEST 24-HR AVERAGE CONCENTRATION OF $PM_{10}$ FOR THE EXISTING MINING SCENARIO, FY2040**

URS

**AIR QUALITY**

Figure: 11-4

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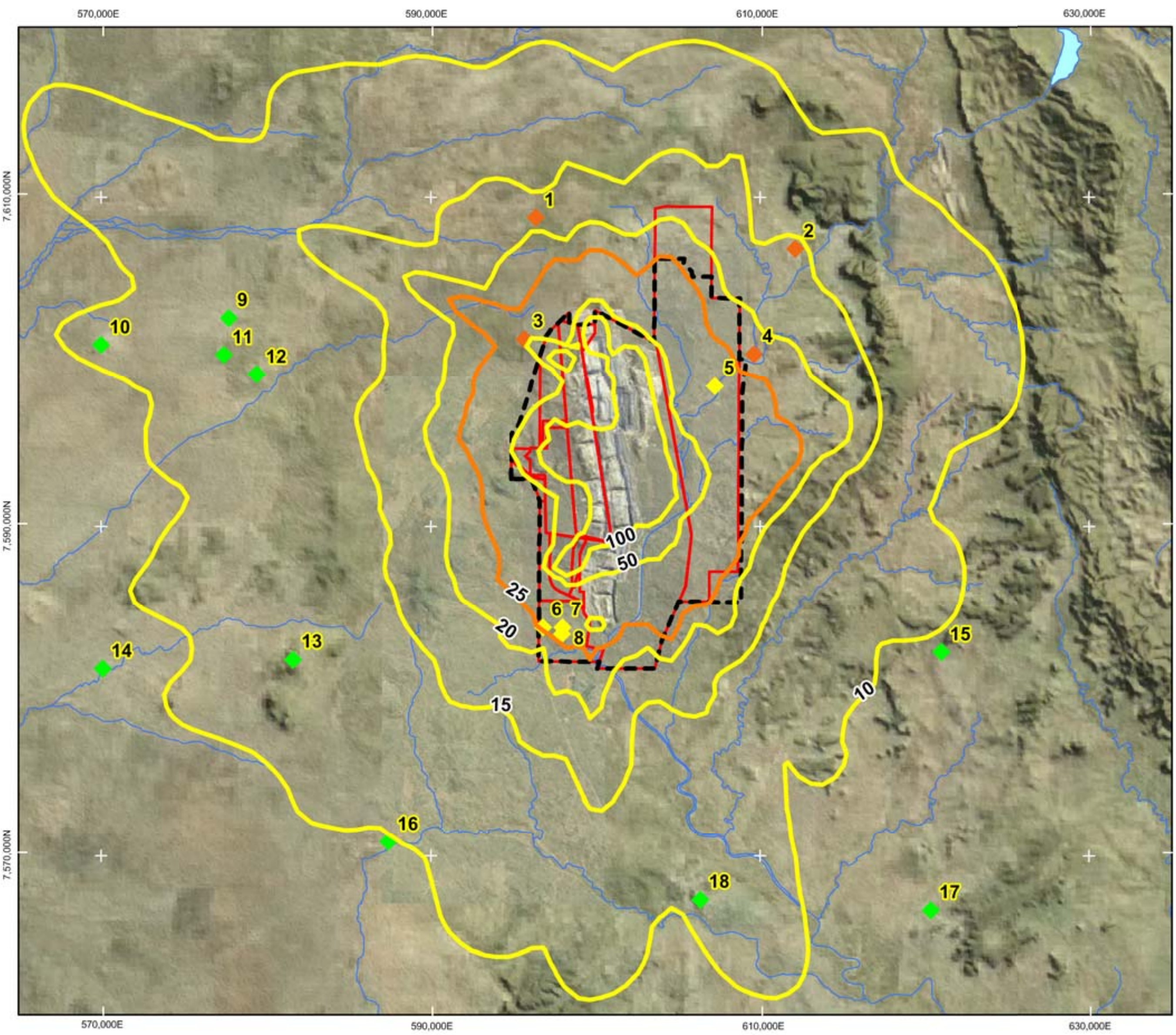


Mines included: GRM, BRM.

BMA Tenure/Tenement

EIS Study Boundary

Predicted 24 Hour Average $PM_{2.5}$ Concentration (µg/m³)

The EPP (Air) Objective (25 µg/m³)

Receptor Location - BMA/BMC controlled

Receptor Location - Privately Owned Homestead (subject to negotiation with landowner)

Receptor Location - Privately Owned Homestead

N S W E

0 5 10Km

Scale 1:400,000 (A4)

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RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**THE MAXIMUM 24-HR AVERAGE CONCENTRATION OF $PM_{2.5}$ FOR THE EXISTING MINING SCENARIO, FY2040**

URS

AIR QUALITY

Figure: 11-5

File No: 42627136-g-1097b.wor Drawn: VH Approved: CT Date: 17-09-2013 Rev. B A4

## 11.4 Potential Impacts

### 11.4.1 Sources of Air Emissions from the Project

#### 11.4.1.1 Emission Sources during Construction

As noted in **Section 3.6.2** of the EIS, access to the underground workings will be via a drift of about 2,000 metres in length which will start near the MIA and intersect the GMS at an approximate depth of 200 metres. Construction will probably commence with a cut and cover style construction method, progressing to an underground tunnelling construction method such as road header machinery. Drift construction is expected to take up to two years.

Once the target depth has been reached, the main entrance to the mine, known as pit bottom, will be established and ventilation systems installed. Conveyors will be installed in the drift to bring coal to the surface, and roadways and other infrastructure requirements will also be established.

The primary source of dust emissions associated with the construction phase of the project is associated with the construction of the drift, and clearing and grading of the Red Hill MIA, conveyor foundations, Red Hill CHPP and the proposed Red Hill accommodation village. Dust emissions may also be generated in association with the installation of the gas drainage system but these are considered to be minimal.

In general, dust emissions during the mine construction phase are anticipated to be small, particularly when compared with current dust-generating activities from open-cut mining. Emissions will be managed through use of water sprays to suppress dust. The impacts due to construction have not been explicitly quantified as the effects of these operations and associated emissions would be expected to be undetectable at any of the receptors identified in this EIS.

#### 11.4.1.2 Emission Sources during Operation

Sources of dust related to the operations of the project included:

- processing of coal at the Red Hill CHPP;
- coal breaking and crushing at the sizing stations;
- conveyors, transfer points and surge bins;
- stockpile loading and reclaiming;
- wind generated dust from stockpiles;
- dozers operating on coal in stockpiles;
- wheel generated dust associated with rejects hauling;
- truck dumping of rejects;
- train load-out; and
- exhaust associated with the underground ventilation shafts.

### 11.4.2 Production Rates

As noted in **Section 3** of this EIS, the project will increase coal production at the mine complex by up to 14 million tonnes per annum (mtpa) to approximately 32.5 mtpa over an estimated life of mine of 25 years.

### 11.4.3 Dust Reduction Measures

In relation to dust from project-related emission sources (refer to **Section 3**), dust reduction measures that will be considered for the RHM underground expansion option and GRM incremental expansion include:

- partial enclosure of conveyors (operation);
- partial enclosure and water sprays at transfer points (operations);
- watering of unsealed roads at a rate of more than two litres per square metre per hour (construction and operation);
- partially enclosed surge bins (operations); and
- water sprays on coal stockpiles (operation).

The need for these measures will be reviewed during the detailed design stage and further modelling undertaken to optimise dust minimisation.

### 11.4.4 Emissions during Operation

As impacts from dust emissions from the project were anticipated to be minor compared with existing dust emission sources, a single emissions scenario for the operational phase of the project was developed. It was based on estimates of maximum tonnages of material handling and processing, a production rate of 15.5 mtpa of ROM coal from RHM and adopted dust control measures (**Section 11.4.3**).

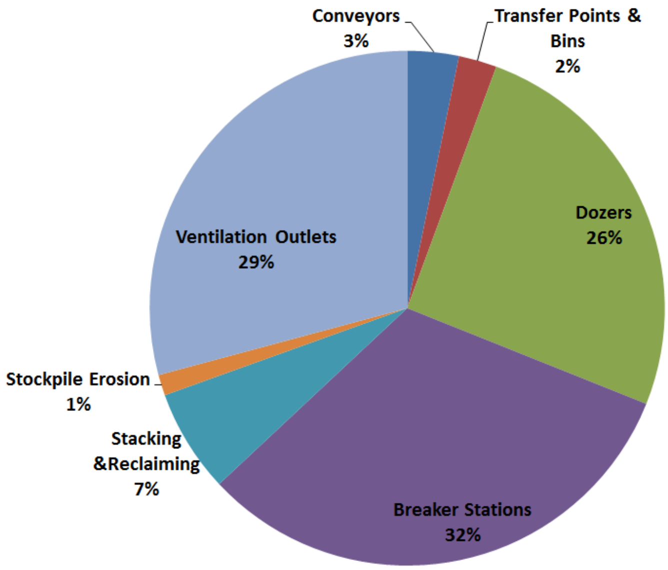
The project emissions inventory was developed based on the information and methodology outlined in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Mining (version 3) (NPI 2010). The NPI EETM is intended to provide data on emissions of air pollutants during typical operations. They are based on measurements of dust emissions from other operational coal mines in Australia and the United States. The NPI EETM for Mining has been used to provide data to estimate the amount of TSP and $PM_{10}$ emitted from the various project-related activities. The NPI emission factors were supplemented by those from the USEPA's AP42 as required (USEPA 1995).

Emission factors were developed for coal breaking and crushing, stockpile loading and unloading, dozer operations, conveying of coal to the CHPP and dust emissions from transfer points. Wind speed dependent emission factors were developed for the erosion of stockpiles. Emission factors for the release of dust from the ventilation outlets were sourced from other similar studies. Details of the development of the emission factors are provided in **Appendix L**.

Presented in **Figure 11-6** is a summary of the breakdown of the emissions inventory of an estimated 240 tonnes of dust per year associated with RHM operations. This amount of dust generated as a result of mining 15.5 mtpa of ROM coal is equivalent to an airshed loading of 0.015 kilograms of dust per tonne of ROM coal.

Results of the emissions inventory suggest that coal crushing and breaking at the sizing stations, dozer activities, and the ventilation outlets are the main source of dust emissions during the operational phase of the project.

**Figure 11-6 Breakdown of Emissions Inventory for Red Hill Mine**




### 11.4.5 Modelling Methodology and Emissions Scenarios

The development of predicted ground level impacts from dust emissions associated with the project was based on the use of the US EPA approved dispersion model CALPUFF (Scire *et al*. 2000a).

Regional three-dimensional wind fields that are used as input into the dispersion model were developed using a combination of TAPM from the Commonwealth Scientific and Industrial Research Organisation (Hurley 2008), and CALMET, the meteorological pre-cursor for CALPUFF (Scire *et al*. 2000b). A total of three years of meteorology was developed corresponding to years 2007, 2008, and 2009. These years were selected as a subset of an initial five years of meteorology (2005 through 2009) considered during some preliminary studies for this project.

Presented in **Table 11-11** is a summary of the emissions scenarios that have been considered for this assessment. Mining operations that have been included are the RHM, GRM, BRM, Eaglefield Expansion open-cut mine (EFM) and the Grosvenor (Gros) and Moranbah North (MNM) underground mines. Other localised dust emission sources such as those associated with local agricultural activities have not been explicitly accounted for in the modelling.

These mining operations have been assessed both in isolation and in combination in order to develop an estimate of impacts relating to the RHM, the existing mining operations (GRB mine complex), the future mining operation (GRB mine complex and RHM) and the cumulative future mining operations (BMA and non-BMA mining operations). The results of the existing mining scenario were presented in **11.3.3.2**. All scenarios include the background levels from non-mining sources as set out in **Section 11.3.3.1**.

Table 11-11 Emission Scenarios

| Site | Emissions Scenarios | Source of Information |
|---|---|---|
| RHM | Worst-case – ROM 15.5mtpa | BMA |
| GRM | FY2015, FY2030, FY2040, FY2050 | BMA |
| BRM | Worst-case | BMA |
| EFM | Worst-case | Eaglefield EIS |
| Grosvenor & MNM | Worst-case | Grosvenor EIS |

EFM – Eaglefield Mine; MNM – Moranbah North Mine.

## 11.4.6 Dispersion Modelling Results

### 11.4.6.1 Red Hill Mine

**Table 11-12** summarises predicted concentrations and deposition rates for particulates from the RHM-only scenario at selected receptor locations. Due to the low level of above-ground activities associated with RHM, impacts of dust emissions for the RHM in isolation of other dust emission sources are not predicted to lead to exceedences of the relevant EPP (Air) objectives or the EHP criterion for dust deposition at any receptor location. The predicted incremental increase in dust levels would not be directly measureable as impacts are well within the fluctuation of natural background levels.

Additional results for the RHM-only scenario are presented in **Appendix L**.

Table 11-12 Project-Only Impacts at Receptor Locations

| Receptor | Parameter | | | | |
|---|---|---|---|---|---|
| | TSP[1] | $PM_{10}$[2] | $PM_{2.5}$[3,4] | $PM_{2.5}$[3,4] | Dust Deposition[5] |
| Period | Annual | 24 hour(6) | 24 hour(6) | Annual | Monthly |
| Units | µg/m³ | µg/m³ | µg/m³ | µg/m³ | mg/m²/day |
| R1 - Denham Park | 0.1 | 1.1 | 0.1 | 0 | 0.2 |
| R2 - Burton Downs | 0.0 | 1.0 | 0.1 | 0 | 0.1 |
| R3 - Lapunyah | 0.2 | 2.5 | 0.3 | 0 | 0.5 |
| R4 - Red Hill | 0.0 | 1.7 | 0.2 | 0 | 0.2 |
| R5 - Riverside Homestead | 0.1 | 3 | 0.4 | 0 | 0.3 |
| R6 - Broadmeadow Cottage 2 | 0.4 | 2 | 0.2 | 0 | 0.5 |
| R7 - Broadmeadow Homestead | 0.4 | 2.5 | 0.3 | 0 | 0.6 |
| R8 - Broadmeadow Cottage 1 | 0.4 | 2.3 | 0.3 | 0 | 0.5 |

Note 1: EPP (Air) objective for the annual average concentration of TSP is 90 µg/m³.
Note 2: EPP (Air) objective for the 24-hour average concentration of $PM_{10}$ is 50 µg/m³, to be exceeded no more than 5 days per year.
Note 3: EPP (Air) objective for the 24-hour average concentration of $PM_{2.5}$ is 25 µg/m³.
Note 4: EPP (Air) objective for the annual average concentration of $PM_{2.5}$ is 8 µg/m³.
Note 5: EHP criterion for dust deposition is 120 mg/m²/day.
Note 6: Based on the maximum 24-hour average.

**Figure 11-7** presents the maximum predicted 24-hour average concentration of $PM_{10}$ due to RHM in isolation. An estimate of naturally occurring background levels has not been included. Contour plots for TSP and $PM_{2.5}$ are presented in **Appendix L**. Results for the RHM in combination with existing dust emission sources are presented in **Section 11.4.6.2**.

#### 11.4.6.2 Future Mining Scenario

**Table 11-13** presents a summary of the receptor locations for the exceedences of the relevant ambient air criteria that are predicted for the future mining scenarios. This scenario is based on dust impacts from current approved mining for the GRB mine complex and RHM, including an estimate of naturally occurring background levels.

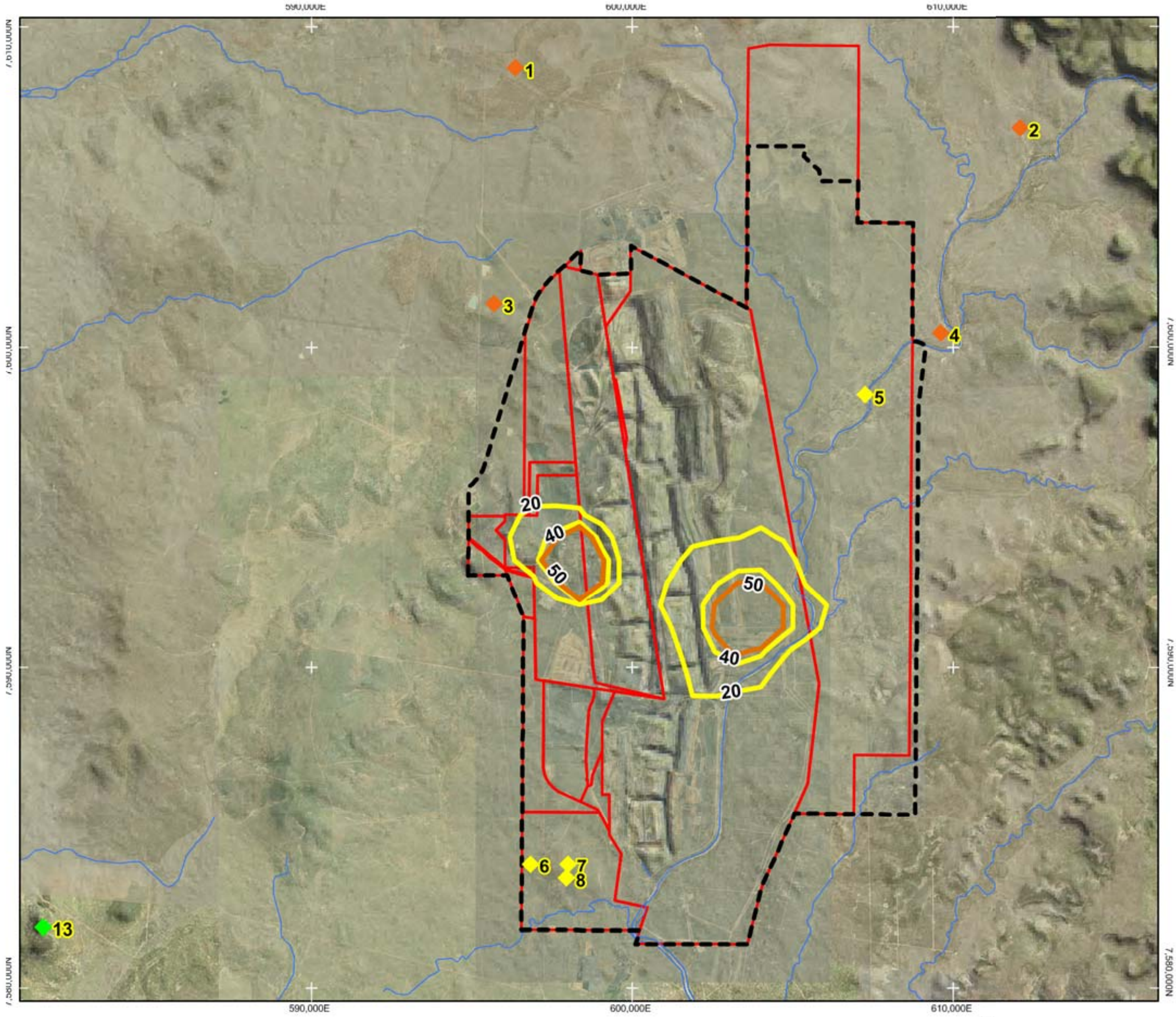
The results highlight the spatial extent of predicted exceedences of the EPP (Air) objective of 50 $\mu g/m^3$ for the 24-hour average concentration of $PM_{10}$. Additional results are presented in **Appendix L**.

A contour plot of the $5^{th}$ highest 24-hour average concentration of $PM_{10}$ for the future environment scenario for FY2040 is presented in **Figure 11–8**. A comparison of the contours presented in **Figure 11–8** and that presented in **Figure 11-4** for the existing environment FY2040 scenario highlights the minimal impact of RHM operations on local air quality.

Locations where the EPP (Air) objectives are exceeded do not differ from those presented in **Section 11.3.3.2**, as the project is predicted to have little impact on the air quality within the local airshed.

Additional contour plots for the future environment scenarios are presented in **Appendix L**.

The results of the modelling indicate that the proposed project makes minimal contribution to overall levels of dust from natural sources and existing approved mining operations.




Mines included: RHM.

- BMA Tenure/Tenement
- EIS Study Boundary
- Receptor Location - BMA/BMC controlled
- Receptor Location - Privately Owned Homestead (subject to negotiation with landowner)
- Receptor Location - Privately Owned Homestead
- Predicted 24 Hour Average $PM_{10}$ Concentration (µg/m³)
- The EPP (Air) Objective (50 µg/m³)

N W E S

0 2.5 5km

Scale 1:200 000 (A4)

Datum: GDA 94, MGA Zone 55

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RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**THE MAXIMUM 24-HR AVERAGE CONCENTRATION OF $PM_{10}$ FOR THE RED HILL MINE SCENARIO**

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AIR QUALITY

Figure: 11-7

File No: 42627136-g-1098b.wor Drawn: VH Approved: CT Date: 17-09-2013 Rev. B A4

Table 11-13 Receptors Where Pollutant Criteria is Predicted to be Exceeded At Least Once for the Future Mining Scenarios

| Scenario / Pollutant | Location | Project Only: Maximum Throughput | Future Mining Scenario: 2015 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|
| **TSP**[1] Annual average | R3 - Lapunyah | - | √ | √ | √ | √ |
| **$PM_{10}$**[2] 24-hour average[3] | R1 - Denham Park | - | √ | √ | √ | √ |
| | R2 - Burton Downs | - | √ | √ | √ | √ |
| | R3 - Lapunyah | - | √ | √ | √ | √ |
| | R4 - Red Hill | - | √ | √ | √ | √ |
| | R5 - Riverside Homestead | - | √ | √ | √ | √ |
| | R6 - Broadmeadow Cottage 2 | - | √ | √ | √ | √ |
| | R7 - Broadmeadow Homestead | - | √ | √ | √ | √ |
| | R8 - Broadmeadow Cottage 1 | - | √ | √ | √ | √ |
| | R9 - Kimberley | - | √ | √ | √ | - |
| | R11 - Sondells | - | √ | √ | √ | - |
| | R12 - Nibbereena | - | √ | √ | √ | √ |
| | R13 - Pretoria | - | √ | √ | √ | - |
| | R16 - Rugby | - | - | - | √ | - |
| | R18 – Moranbah Water treatment plant | - | √ | √ | √ | - |
| **$PM_{2.5}$**[4] 24-hour average[5] | R3 - Lapunyah | - | √ | √ | √ | √ |
| | R5 - Riverside Homestead | - | √ | √ | √ | - |
| | R7 - Broadmeadow Homestead | - | - | √ | √ | - |
| | R8 - Broadmeadow Cottage 1 | - | - | - | √ | - |

| Scenario | Location | Project Only | Future Mining Scenario | | | |
|---|---|---|---|---|---|---|
| Pollutant | | Maximum Throughput | 2015 | 2030 | 2040 | 2050 |
| **$PM_{2.5}$**(6) Annual average | R3 - Lapunyah | - | √ | √ | √ | √ |
| | R6 - Broadmeadow Cottage 2 | - | √ | √ | √ | √ |
| | R7 - Broadmeadow Homestead | - | √ | √ | √ | √ |
| | R8 - Broadmeadow Cottage 1 | - | √ | √ | √ | √ |
| **Dust Deposition** Monthly average | R3 - Lapunyah | - | √ | √ | √ | √ |

Note 1: EPP (Air) objective for the annual average concentration of TSP is 90 µg/m$^3$.
Note 2: EPP (Air) objective for the 24-hour average concentration of $PM_{10}$ is 50 µg/m$^3$.
Note 3: EHP criterion for dust deposition is 120 mg/m$^2$/day.
Note 4: EPP (Air) objective for the 24-hour average concentration of $PM_{2.5}$ is 25 µg/m$^3$.
Note 5: Based on the maximum 24-hour average.
Note 6: EPP (Air) objective for the annual average concentration of $PM_{2.5}$ is 8 µg/m$^3$.

## 11.5 Mitigation Measures and Management Strategies

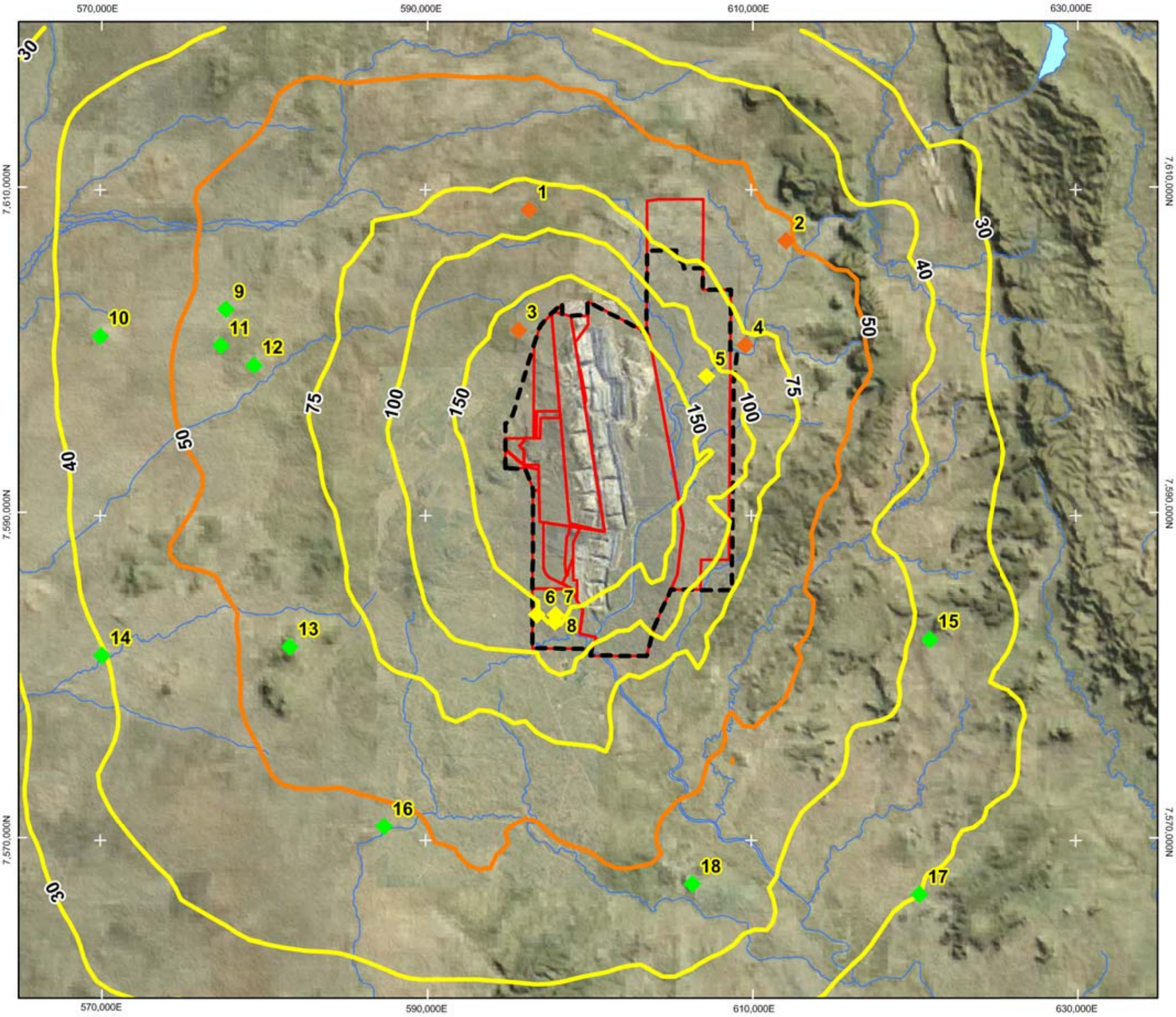
### 11.5.1 Construction Phase

As noted in **Section 11.3.1.1**, dust emissions during the construction phase of the RHM are considered to be small when compared with modelled open-cut mining dust-generating activities. Nonetheless, the minimisation of any potential adverse impacts will be managed during the construction phase of the project through adherence to the dust mitigation measures set out in the construction management plan.

### 11.5.2 Operations Phase

Although dust emissions from the project are predicted to have a small incremental impact on air quality at receptor locations, dust mitigation may be considered in the detailed design phase to minimise overall dust emissions. In line with good practice, dust mitigation measures would be considered in the following:

- Engineering control measures which are designed to minimise dust emissions. Some of the engineering controls available are listed in **Table 11-14**. Detailed design studies will determine which, if any, of these controls may be required.
- Dust suppression measures and other operational procedures to manage activities that typically give rise to dust emissions.




Mines included: GRM, BRM,RHM.

BMA Tenure/Tenement
EIS Study Boundary

Receptor Location - BMA/BMC controlled
Receptor Location - Privately Owned Homestead (subject to negotiation with landowner)
Receptor Location - Privately Owned Homestead

Predicted 24 Hour Average $PM_{10}$ Concentration (µg/m³)
The EPP (Air) Objective (50 µg/m³)

N W E S

0 5 10Km
Scale 1:400,000 (A4)
Datum: GDA 94, MGA Zone 55

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BMA
BHP Billiton Mitsubishi Alliance

RED HILL MINING LEASE
ENVIRONMENTAL IMPACT STATEMENT

**THE 5TH HIGHEST 24-HOUR AVERAGE CONCENTRATION OF $PM_{10}$ FOR THE FUTURE MINING SCENARIO, FY2040**

URS

**AIR QUALITY**

Figure: **11-8**

File No: **42627136-g-1099b.wor** Drawn: **VH** Approved: **CT** Date: **17-09-2013** Rev. **B** A4

Table 11-14 Potential Options for Engineering Controls (if required)

| Component | Mitigation Options |
|---|---|
| Conveyors[1] | Partial or full enclosure |
| | Belt scrapers |
| | Water sprays / foggers |
| Transfer Points | Partially or fully enclose |
| | Water sprays |
| | Belt scrapers |
| Bins | Limit drop height into surge bin |
| | Enclose chute |
| Stacking and Reclaiming | Water sprays |
| | Use of low dust-generating techniques such as telescopic stackers with chutes and scraper reclaimers |
| Ventilation Outlets | Use of dust collection system [2] |

Note 1: Final requirements for conveyor dust controls will depend on the moisture content of the underground ROM coal.
Note 2: Need for dust collection system on ventilation outlets will depend on final location and design of these outlets.

Operational procedures set out how the project will meet targets for air quality performance. In relation to air quality, the following may be incorporated into site-based operational procedures if required, to manage dust emissions:

- use of water trucks to achieve sufficient watering of unsealed trafficked roads;
- use of water sprays and foggers on stockpiles, conveyors, transfer points, and crushers as directed, with additional use as determined by ambient conditions;
- maintenance of water spray equipment and engineering controls to minimise dust emissions; or
- operating sizing station equipment in a way that minimises dust during breaking and crushing of coal at the sizing station.

The above procedures will be included in the site's operational management plan as contingency measures if dust issues arise.

A meteorological monitoring station will be established in the vicinity of the project ROM coal stockpiles, located to the east of the current open-cut mining operations to identify potentially adverse meteorological conditions.

Note that no additional controls are required for the Broadmeadow extension as coal produced from this underground mine extension will be handled in existing coal handling facilities on site.