APPENDIX B

AIR QUALITY IMPACT ASSESSMENT

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WILPINJONG COAL MINE
MODIFICATION 6

Wilpinjong Coal Pty Ltd

3 June 2014

Job Number 14020285

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Air Quality Impact Assessment

Wilpinjong Coal Project Modification 6

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1 INTRODUCTION

Todoroski Air Sciences has prepared this report for Wilpinjong Coal Pty Ltd (hereafter referred to as WCPL). It provides an assessment of the potential air quality impacts associated with the proposed modifications to the Wilpinjong Coal Mine (WCM) (hereafter referred to as the Modification).

The Modification seeks an increase in the approved run-of-mine (ROM) production rate from 15 million tonnes per annum (Mtpa) up to approximately 16Mtpa.

To assess the potential air quality impacts associated with the proposed Modification, this report incorporates the following aspects:

- A background to the WCM and description of the Modification;
- A review of the existing meteorological and air quality environment surrounding the WCM site;
- A description of the dispersion modelling approach used to assess potential air quality impacts;
- Presentation of the predicted results, including a comparison with the currently approved operation; and
- Discussion of the potential air quality impacts as a result of the Modification.

2 LOCAL SETTING

The WCM is located in the Western Coalfields of New South Wales (NSW), approximately 40 kilometres (km) northeast of Mudgee and 4km west-northwest of Wollar (see **Figure 2-1**). Coal mining operations and agricultural activities dominate the land use in the surrounding area. The mine is bounded by the Goulburn River National Park to the north, the Munghorn Gap Nature Reserve to the southwest and Moolarben Coal mine to west. To the east and southeast of the mine, land use is predominantly agricultural properties and areas of Crown Land.

Figure 2-1 also presents the location of the WCM in relation to privately-owned and mine-owned sensitive receptors of relevance to this assessment. **Appendix A** provides a detailed list of all the privately-owned sensitive receptors assessed in this report.

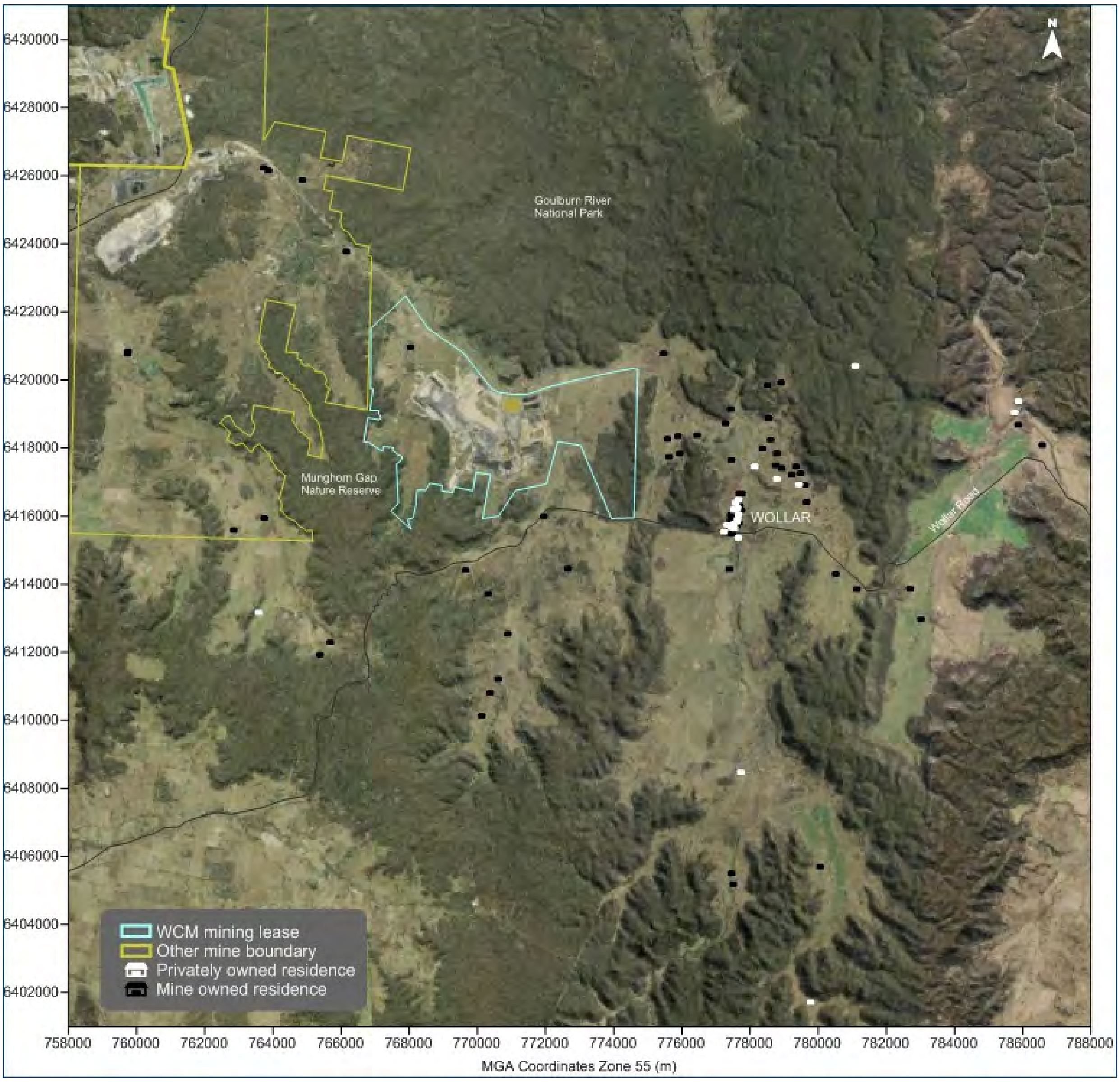

Figure 2-1: WCM location

Figure 2-2 presents a representative three-dimensional (3D) visualisation of the topography in the general vicinity of the WCM area. The area can be characterised as complex hilly terrain with the majority of the elevated areas forming the Goulburn River National Park and the Munghorn Gap Nature Reserve. To the east and southeast of the site, steep sided valleys open to flat agricultural land. Notable ridgelines separate the mine from sensitive receptors in Wollar. The presence of the complex local terrain would have a significant effect on the distribution of wind patterns for the area.

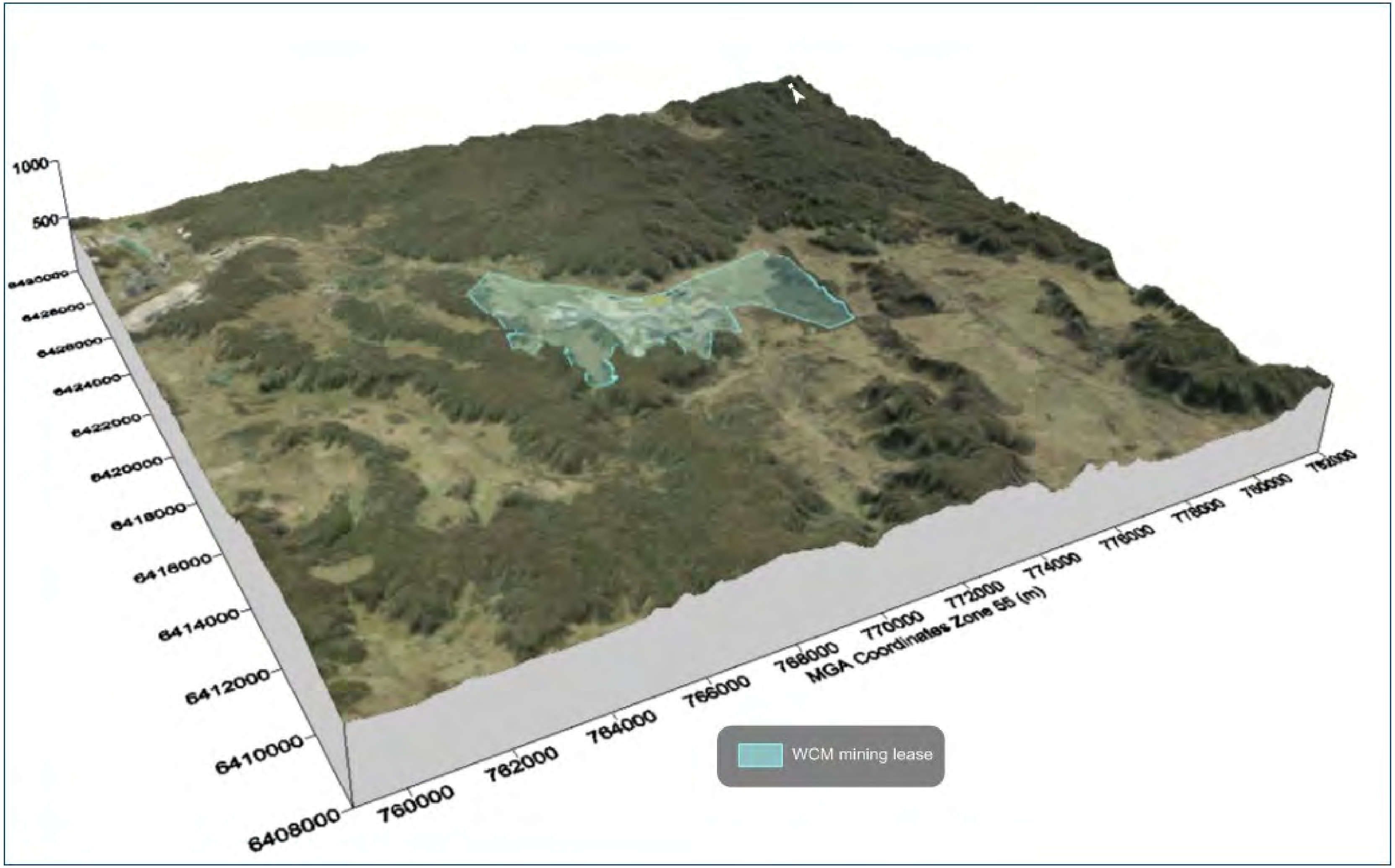

Figure 2-2: Topography of the WCM location

3 EXISTING OPERATIONS AND MODIFICATION DESCRIPTION

3.1 Existing operations

Mining at the WCM commenced in September 2006 as an approved open cut coal mining operation consisting of six open cuts and associated contained infrastructure area, comprising an area of approximately 1,990 hectares. The mining operation utilises bulk push dozers and hydraulic excavators to mine coal and overburden in a strip mine configuration. ROM coal is mined 24 hours per day, seven days per week, at an approved rate of up to 15Mtpa. The WCM produces up to 12.5Mtpa of washed and unwashed (i.e. bypass) coal products.

The Coal Handling and Preparation Plant (CHPP) at the WCM operates up to 24 hours per day, seven days per week. Unwashed ROM is bypassed (i.e. crushed only). ROM coal stockpiles have a capacity of over 1.5 million tonnes (Mt) and product coal stockpiles have a combined capacity of approximately 500,000 tonnes for washed and unwashed coal products.

Tailings produced from the CHPP consist of fine rejects and slimes from the thickener. CHPP tailings are pumped as slurry and deposited in purpose-built tailing dams constructed within mined-out voids. CHPP coarse coal reject material is hauled back to the mining operation and deposited in the mined-out voids.

A train loading facility is located at the head of the rail loop within the mine infrastructure area and is capable of loading coal at a rate of 4,000 tonnes per hour. Coal is reclaimed from two alternative product feed conveyors that run the length of the product coal stockpiles. Product coal is loaded onto trains 24 hours per day, seven days per week. An average of six trains is loaded each day and a maximum of 10 trains per day are loaded during peak coal transport periods. Coal is railed east to domestic power generation customers and the Port of Newcastle for export. No coal is railed west of the WCM.

3.2 Proposed modifications

Since transitioning to an owner-operator mine in 2013, WCPL has been implementing a continuous improvement programme for materials handling/mining. The outcomes of this programme indicate a higher ROM coal production rate could be achieved with only minor changes to the existing mining fleet. An increased rate of annual ROM coal production would provide operational flexibility to maintain WCPL's competitive advantage as a low cost thermal coal producer.

WCPL has determined that a number of minor alterations to the approved WCM are therefore required, including:

- An increase in the upper rate of ROM coal production (from 15Mtpa to approximately 16Mtpa);
- A minor increase in the upper annual rate of waste rock production (from 33.3 million bank cubic metres (Mbcm) up to approximately 34.1Mbcm);
- Mine sequencing revisions associated with updated geological modelling/mine planning and the accelerated re-mining of a temporary waste rock emplacement.

There would be no change arising from the Modification to the following aspects of the approved WCM:

- Open cut and contained infrastructure area;
- Mine life;
- Saleable coal transport off-site (12.5Mtpa) or associated average or maximum rail movements; and
- Operational workforce (up to approximately 550 people).

3.3 Purpose of this air quality impact assessment

It is relatively clear from the scale of the proposed changes described above that the Modification would only have limited capacity to greatly affect air emissions relative to the approved WCM.

However, some of the changes proposed would increase the annual intensity of mining activity in the short term. These changes have the potential to increase the level of dust that may arise from the mine at receptor locations.

Whilst the potential change in dust levels that may arise from the Modification is expected to be relatively small, it is important to examine in sufficient detail what the extent of the potential change may be and to also confirm whether or not any unacceptable impact could arise should the Modification proceed. This is the key purpose of this assessment.

The assessment applies advanced air dispersion modelling approaches which allow spatially varying winds and the interaction of the prevailing winds with the local terrain to be considered. In this way a secondary purpose of the assessment is to provide a more accurate estimate of the existing mine dust levels at receptor locations and to update the likely effect of the existing approved mine on air quality in the area.

4 AIR QUALITY ASSESSMENT CRITERIA

4.1 Preamble

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. **Sections 4.2** to **4.4** below identify the potential air emissions generated by the Modification and the applicable air quality criteria.

4.2 Particulate matter

Particulate matter consists of dust particles of varying size and composition. Air quality goals refer to measures of the total mass of all particles suspended in air defined as the Total Suspended Particulate matter (TSP). The upper size range for TSP is nominally taken to be 30 micrometres (µm) as in practice particles larger than 30 to 50µm will settle out of the atmosphere too quickly to be regarded as air pollutants.

The TSP is defined further into two sub-components. They are PM_{10} and $PM_{2.5}$ particles, particulate matter with aerodynamic diameters of 10µm or 2.5µm or less respectively.

Mining activities generate particles in all the above size categories. The great majority of the particles generated are due to the abrasion or crushing of rock and coal and general disturbance of dusty material. These particulate emissions will be generally larger than 2.5µm as these fine particulates are often only generated through combustion processes.

Combustion particulates can be harmful to human health as the particles have the ability to penetrate deep into the human respiratory system and generally include acidic and carcinogenic substances.

A study of the distribution of particle sizes near mining dust sources in 1986 conducted by the State Pollution Control Commission (SPCC) found that the average of approximately 120 samples showed $PM_{2.5}$ comprised 4.7 percent (%) of the TSP, and PM_{10} comprised 39.1% of the TSP in the samples (**SPCC, 1986**). The emissions of $PM_{2.5}$ occurring from mining activities are small in comparison to the total dust emissions.

4.2.1 New South Wales Environment Protection Authority impact assessment criteria

Table 4-1 summarises the air quality goals that are relevant to this study as outlined in the NSW Environment Protection Authority (NSW EPA) document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**DEC, 2005**). The air quality goals for total impact relate to the total dust burden in the air and not just the dust from the Modification. Consideration of background dust levels needs to be made when using these goals to assess potential impacts.

Table 4-1: NSW EPA air quality impact assessment criteria

Pollutant	Averaging Period	Impact	Criterion
TSP	Annual	Total	90µg/m³
PM_{10}	Annual	Total	30µg/m³
	24-hour	Total	50µg/m³
Deposited dust	Annual	Incremental	2g/m²/month
		Total	4g/m²/month

Source: DEC, 2005
µg/m³ = micrograms per cubic metre
g/m²/month = grams per square metre per month

The criteria for 24-hour average PM_{10} originate from the National Environment Protection Measure (NEPM) goals (**NEPC, 1988**). These goals apply to the population as a whole, and are not recommended to be applied to "hot spots" such as locations near industry, busy roads or mining. However, in the absence of alternative measures, NSW EPA does apply the criteria to assess the potential for impacts to arise at such locations. The NEPM permits five days annually above the 24-hour average PM_{10} criterion to allow for bush fires and similar events. Similarly, it is normally the case that, on days where ambient dust levels are affected by such events they are excluded from assessment as per the NSW EPA criterion.

4.3 $PM_{2.5}$ concentrations

The NSW EPA currently do not have impact assessment criteria for $PM_{2.5}$ concentrations, however the National Environmental Protection Council (NEPC) has released a variation to the NEPM (**NEPC, 2003**) to include advisory reporting standards for $PM_{2.5}$ (see **Table 4-2**). The advisory reporting standards for $PM_{2.5}$ are a maximum 24-hour average of 25µg/m^3 and an annual average of 8µg/m^3, and as with the NEPM goals, apply to the average, or general exposure of a population, rather than to "hot spot" locations.

Predictions have been made as to the likely contribution that emissions from the Modification would make to ambient $PM_{2.5}$ concentrations and are presented in **Section 7**.

Table 4-2: Advisory standard for $PM_{2.5}$ concentrations

Pollutant	Averaging Period	Criterion
$PM_{2.5}$	Annual	8µg/m^3
	24-hour	25µg/m^3

Source: NEPC, 2003

4.4 Other air pollutants

Emissions of carbon monoxide, sulphur dioxide and nitrogen dioxide will also arise from mining activities. These emissions are generally too low to generate any significant off-site concentrations and have not been assessed further in this report.

5 EXISTING ENVIRONMENT AND AIR QUALITY MANAGEMENT

This section describes the existing climate and air quality in the general area surrounding the WCM.

5.1 Local climate

Long-term climatic data from the closest Bureau of Meteorology (BoM) weather station at Gulgong Post Office (Site No. 062013) were analysed to characterise the local climate in the proximity of the WCM. The Gulgong Post Office station is located approximately 30km west of WCM.

Table 5-1 and **Figure 5-1** present a summary of data from the Gulgong Post Office weather station collected over an approximate 39-year period.

The data indicate that January is the hottest month with a mean maximum temperature of 31 degrees Celsius (°C) and July as the coldest month with a mean minimum temperature of 2.6°C.

Humidity levels exhibit variability and seasonal flux across the year. Mean 9am humidity levels range from 61% in October to 84% in June and July. Mean 3pm humidity levels range from 36% in December to 57% in June.

Rainfall peaks during the months of spring and summer and declines during winter. The data indicate that January is the wettest month with an average rainfall of 70.2 millimetres (mm) over 5.1 days and April is the driest month with an average rainfall of 43.9mm over 3.9 days.

Mean 9am wind speeds range from 4.4km/h in June to 9.1km/h in October and November. Mean 3pm wind speeds range from 7.8km/h in April to 11.7km/h in August.

Table 5-1: Monthly climate statistics summary - Gulgong Post Office

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Mean max. temperature (°C)	31.0	29.7	27.3	23.4	19.1	15.4	14.7	16.5	19.8	23.4	26.6	29.6
Mean min. temperature (°C)	16.7	16.3	13.7	9.7	6.2	3.6	2.6	3.4	6.1	9.2	12.3	14.8
Rainfall												
Rainfall (mm)	70.2	62.4	55.0	43.9	45.2	50.8	49.1	46.2	46.8	55.9	59.8	67.2
Mean No. of rain days (≥1mm)	5.1	4.9	4.5	3.9	4.7	6.0	6.1	5.7	5.2	5.6	5.5	5.5
9am conditions												
Mean temperature (°C)	21.7	20.6	18.9	15.8	11.3	7.7	6.7	8.5	12.6	16.5	18.3	20.8
Mean relative humidity (%)	64	71	71	70	79	84	84	76	70	61	63	62
Mean wind speed (km/h)	8.2	6.7	6.2	5.9	5.0	4.4	4.9	6.1	7.7	9.1	9.1	8.9
3pm conditions												
Mean temperature (°C)	29.5	28.4	26.2	22.3	18.0	14.3	13.5	15.3	18.5	22.1	25.1	28.2
Mean relative humidity (%)	37	42	41	42	49	57	54	46	44	40	39	36
Mean wind speed (km/h)	9.6	8.5	7.9	7.8	9.0	8.8	9.9	11.7	11.4	11.5	11.4	11.2

Source: **Bureau of Meteorology, 2014**

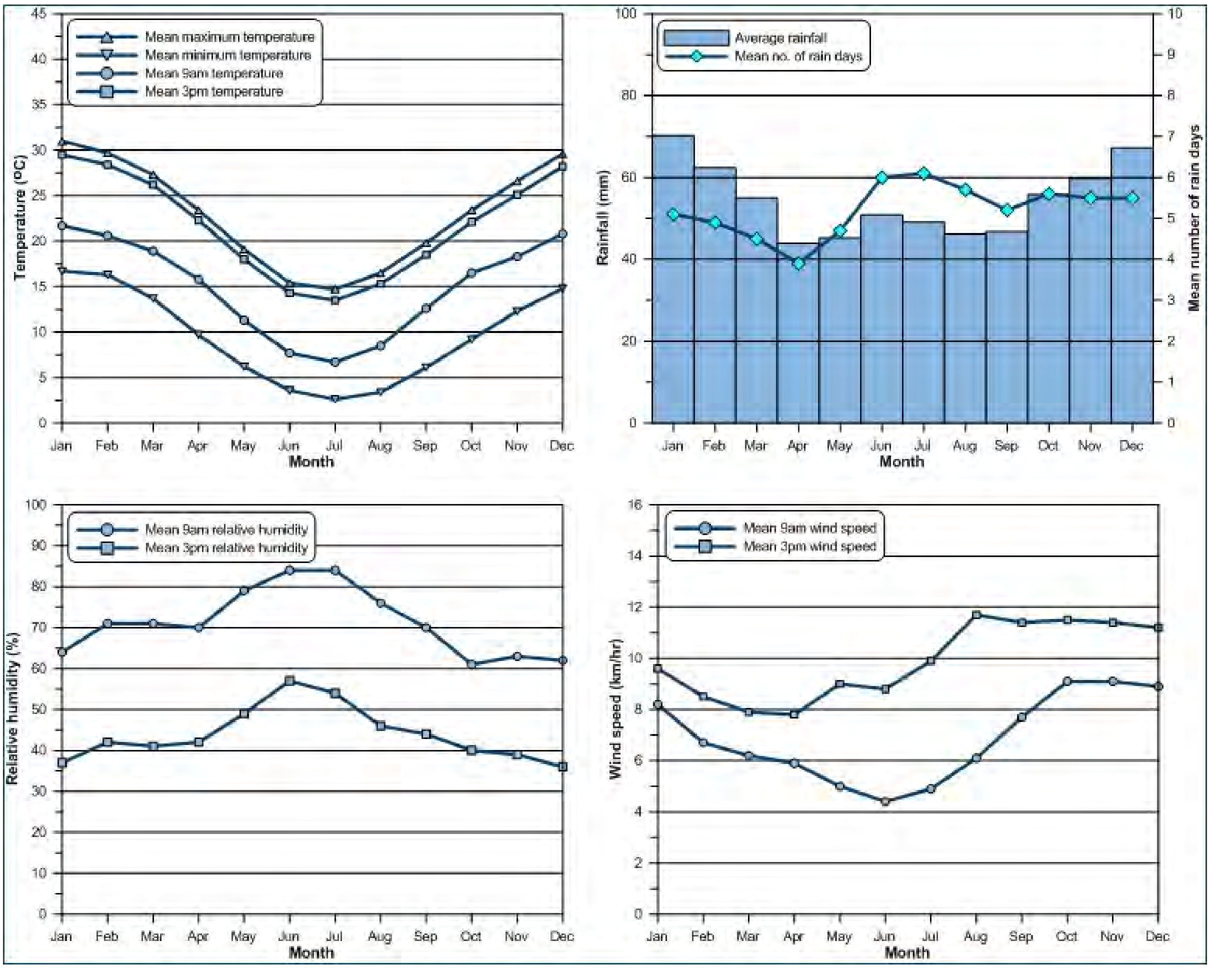

Figure 5-1: Monthly climate statistics summary - Gulgong Post Office

5.2 Local meteorological conditions

WCM operates a 10m weather station to assist with the environmental management of site operations. Annual and seasonal windroses prepared from data collected during the 2013 calendar period are presented in **Figure 5-2**. In addition, WCPL operates a 60 metre temperature inversion tower to monitor temperature lapse rates.

Analysis of the windroses shows the most common winds on an annual basis are from the east-southeast and east with a lesser portion of winds from the northwest quadrant. Very few winds originate from the northeast and southwest sectors. This wind distribution pattern is as expected of the local area considering the location of the station in relation to the terrain features.

In the summertime the winds predominately occur from the east-southeast. During winter, winds are most frequent from the west-northwest and northwest sectors. The autumn wind distribution shows dominant winds from the east-southeast. The spring windrose shares similar wind distribution patterns to the annual distribution with winds from the west-northwest and east.

Figure 5-2: Annual and seasonal windroses for Wilpinjong (2013)

5.3 Local air quality monitoring

The main sources of particulate matter in the wider area of the WCM include active mining, agricultural activities, emissions from local anthropogenic activities (such as motor vehicle exhaust, dust from dirt roads, and domestic wood heaters) and various other rural activities. This section reviews the available ambient monitoring data collected from the WCM ambient air quality monitoring program from 2012 and 2014 to characterise the existing background levels of the surrounding area.

5.3.1 Existing air quality monitoring network description

The air quality monitors operating in the WCM's air quality monitoring network includes four Tapered Element Oscillating Microbalances (TEOMs), five High Volume Air Samplers (HVAS) measuring either TSP or PM_{10}, and ten dust deposition gauges. It is noted that some monitoring locations have changed over the life of the WCM to reflect operational and land ownership changes (e.g. by moving monitors closer to the nearest private receivers).

Table 5-2 lists the monitoring stations reviewed in this section and **Figure 5-3** shows the approximate location of each of the monitoring stations. **Appendix B** provides a summary of all monitoring data reviewed in this assessment.

Table 5-2: Summary of ambient monitoring stations

Monitoring site ID	Type	Monitoring data analysed
TEOM 1 (Slate Gully)	TEOM - PM_{10}	January 2012 – December 2013
TEOM 2 (Mittaville)	TEOM - PM_{10}	January 2012 – December 2012*
TEOM 3 (Wollar)	TEOM - PM_{10}	January 2013 – December 2013
TEOM 4 (Araluen Road)	TEOM - PM_{10}	January 2013 – December 2013
HV1 (Wollar)	HVAS – PM_{10}	January 2012 – January 2014
HV2 (Reids)	HVAS – PM_{10}	January 2012 – January 2013*
HV3 (Mahers)	HVAS – TSP	January 2012 – January 2014
HV4 (Robinsons)	HVAS – PM_{10}	January 2012 – January 2014
HV5 (Araluen Drive)	HVAS – PM_{10}	January 2013 – January 2014
DG4	Dust gauge	January 2012 – December 2013
DG5	Dust gauge	January 2012 – December 2013
DG7	Dust gauge	January 2012 – December 2012*
DG8	Dust gauge	January 2012 – December 2013
DG10	Dust gauge	January 2012 – December 2013
DG11	Dust gauge	January 2012 – December 2013
DG12	Dust gauge	January 2012 – December 2013
DG13	Dust gauge	January 2012 – December 2013
DG14	Dust gauge	January 2012 – December 2013
DG15	Dust gauge	January 2013 – December 2013

* Decommissioned

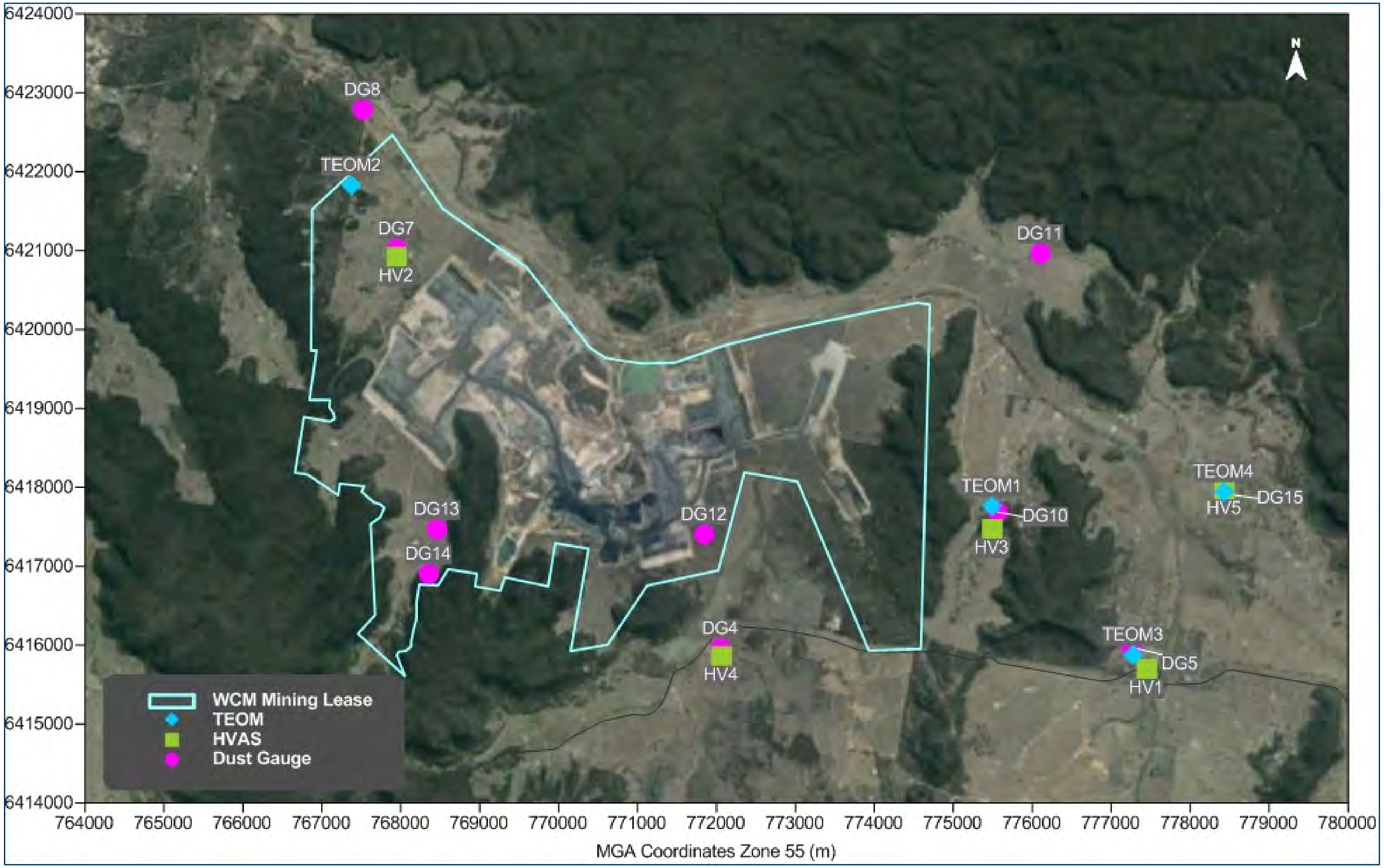

Figure 5-3: Ambient air monitoring locations

5.3.2 PM_{10} monitoring

Ambient PM_{10} monitoring using TEOM's is currently conducted for the WCM at three locations; TEOM 1, TEOM 3 and TEOM 4 (see **Figure 5-3**). A fourth location, TEOM 2, was used in the past.

TEOM 3 and TEOM 4 are located close to private receptors and are used to assess compliance levels. A summary of the data from these monitoring stations collected between 2012 and 2013 is presented in **Table 5-3** and **Figure 5-5**.

TEOM 1, located in Slate Gully, was previously a compliance point. However, following WCPL's purchase of all privately-owned properties in Slate Gully, TEOM 1 is used for management purposes only (i.e. as it is no longer representative of air quality levels at privately-owned receiver locations).

A review of **Table 5-3** indicates that the annual average PM_{10} concentrations for each monitoring station were below the criteria of 30µg/m^3 for all relevant years, indicating that overall, air quality in the area is good in relation to PM_{10} dust levels.

Table 5-3: PM_{10} levels from TEOM monitoring (µg/m³)

Year	Annual average				Criteria	Maximum 24-hour average				Criteria
	TEOM 1	TEOM 2[(1)]	TEOM 3[(2)]	TEOM 4[(2)]		TEOM 1	TEOM 2[(1)]	TEOM 3[(2)]	TEOM 4[(2)]	
2012	13.3	11.5	-	-	30	60.3	50.8	-	-	50
2013	17.9	-	13.6	17.2	30	80.1	-	51.7	71.6	50

[(1)]Data available till December 2012

[(2)]Data available from January 2013

With respect to short-term concentrations there was one day during 2012 when the maximum 24-hour average PM_{10} concentration recorded was above the 50µg/m^3 criterion at the TEOM 1 and TEOM 2 station (**Table 5-3** and **Figure 5-5**). The recorded exceedance on this day was investigated and actions were undertaken to reduce dust emissions from the WCM (e.g. apart from one dozer and the water carts, all equipment was shut down). However, as the cessation of mining activities did not significantly affect monitored dust levels, it is considered that the elevated dust concentrations were caused by a regional dust event. It is noted that the majority of dust monitors in the Hunter Valley also recorded similarly elevated levels on this day, indicating the possibility of a wide spread dust event.

There were six days of elevated 24-hour PM_{10} levels recorded at compliance monitors in 2013 (**Figure 5-5**). Three of these days are related to bushfire events, and on the remaining three days local dust sources and WCM activities may have contributed to the total levels that were recorded. Further detail is provided below.

TEOM 4 recorded two days above the criterion on 29 and 30 April 2013. An analysis of prevailing wind on these days indicate that the wind speeds were relatively low and wind directions were varied with a predominance of winds from the south-southwest. Due to the varied wind conditions on these days is it difficult to identify the source and may include local dust sources, including activities at WCM and dust generated from the unsealed Araluen Road may have contributed to these readings.

TEOM 4 recorded one day above the criterion on 26 September. An analysis of wind direction on this day indicates that the predominant wind directions occurred from the west and would indicate that local activities, activities at WCM and dust generated from the unsealed Araluen Road may have contributed to the reading.

TEOM 4 recorded three days above the criterion on 18 to 20 October and TEOM 3 recorded one day above the criterion on 18 October.

An analysis indicates that on 18 to 20 October, widespread bushfire events occurred in the Blue Mountains and upper Hunter Valley regions and are the likely cause of the elevated levels at all monitors in October. Notably the wind also blew in a direction from the monitors towards WCM. The bushfire smoke and wind direction is evident in the available satellite imagery presented in **Figure 5-4**, noting that the red patches in the images indicate the position of the active fire.

Each of the exceedances of the 24-hour average PM_{10} criterion were reported to the NSW Department of Planning & Environment (DP&E) and NSW EPA, along with the outcomes of the investigations of the exceedances, in accordance with the requirements of the Project Approval (**WCPL, 2014**)

Source: **NASA, 2014**

Figure 5-4: Satellite imagery of area around WCM during bushfires on 18th and 19th October 2013

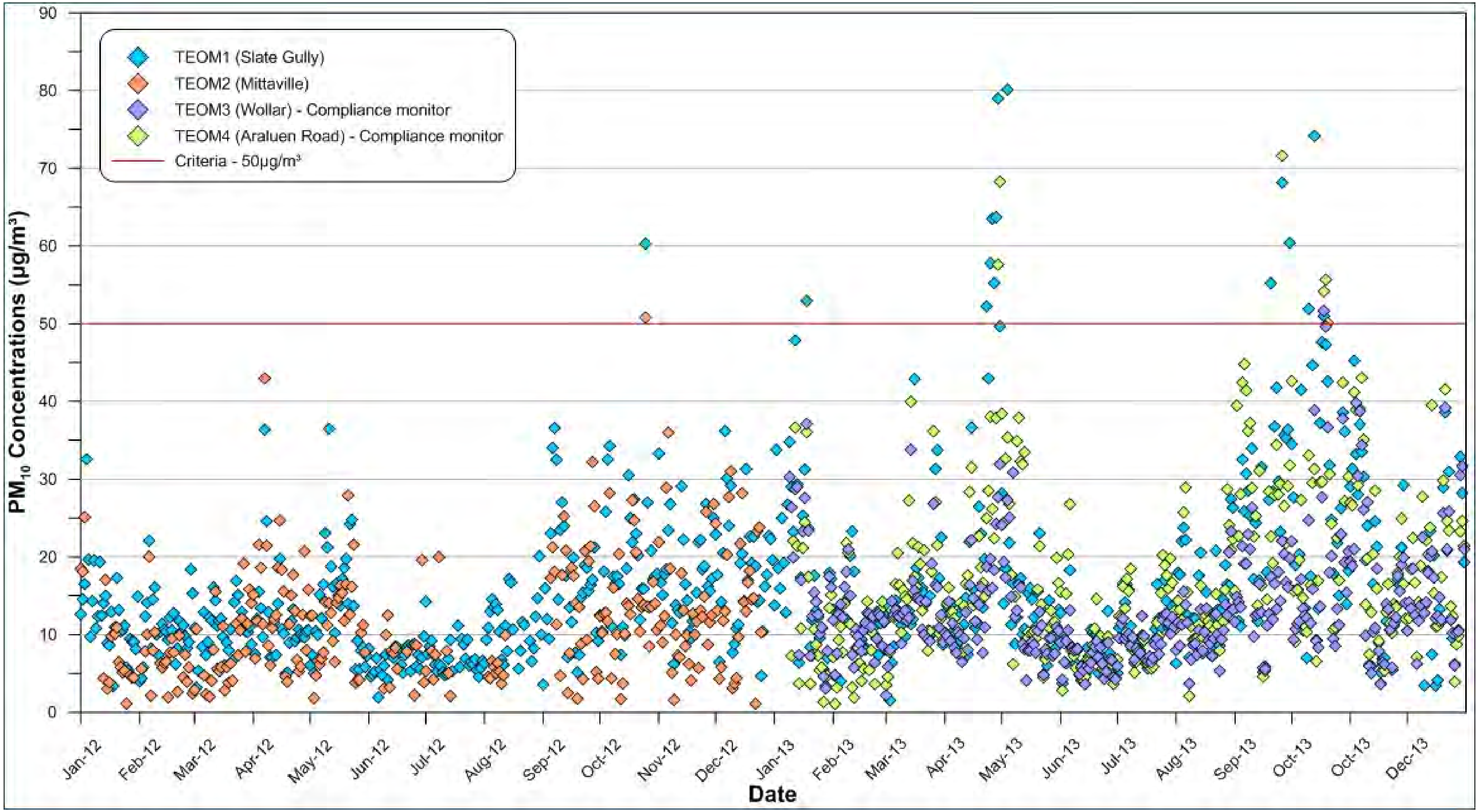

Figure 5-5: TEOM 24-hour average PM_{10} concentrations

A summary of the results from the four HVAS monitoring stations available during 2012 to 2014 is presented in **Table 5-4** and **Figure 5-6**. The monitoring results in **Table 5-4** indicate that annual average PM_{10} levels at these monitors are below the criteria of 30µg/m^3 and are comparable to the annual average TEOM monitoring results for the same periods.

Figure 5-6 indicates that there was only one period when the recorded levels were above the 24-hour average PM_{10} criterion level of 50µg/m^3. This occurs in 2013 at the HV 4 station on 18 October. This event corresponds with the elevated levels recorded at the TEOM monitors that were due to bushfires.

Table 5-4: PM10 levels from HVAS monitoring (µg/m³)

Year	Annual average				Criteria	Maximum 24-hour average				Criteria
	HV 1	HV 2	HV 4	HV5[(2)]		HV 1	HV 2	HV 4	HV5	
2012	9.0	13.6	9.6	-	30	21.7	47.6	21.8	-	50
2013	10.8	22.0	12.8	15.7	30	43.7	22.0	55.1	49.8	50
2014[(1)]	20.0	-	19.6	22.7	30	41.2	-	37.7	47.8	50

[(1)]Data available till January 2014

[(2)]Data available from January 2013

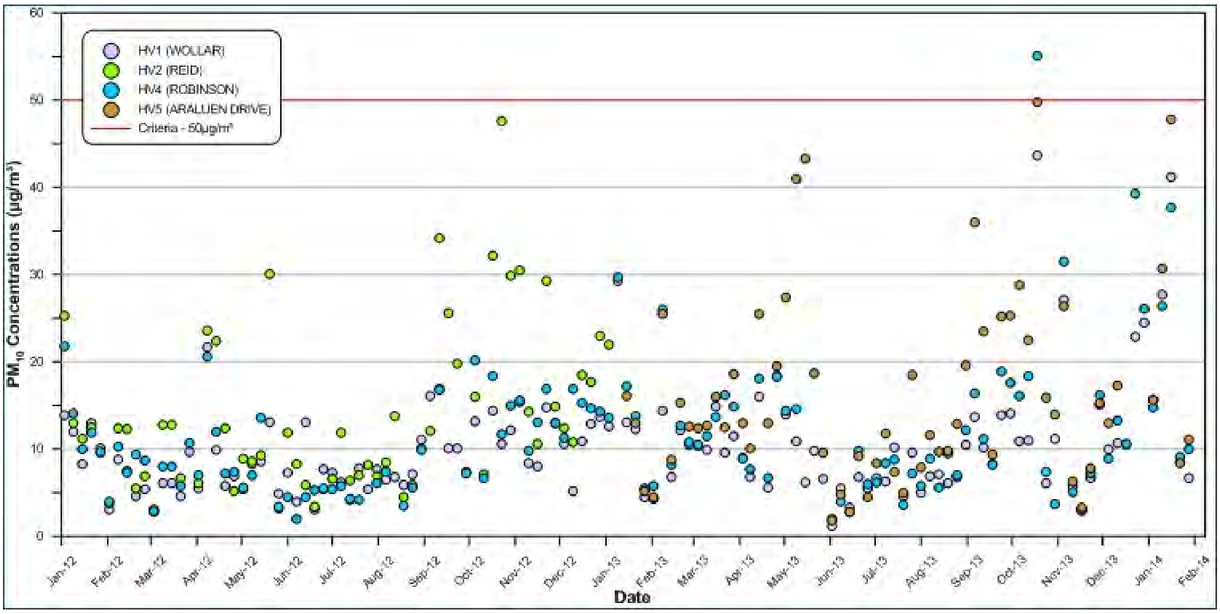

Figure 5-6: HVAS 24-hour average PM_{10} concentrations

5.3.3 TSP monitoring

TSP monitoring data are collected by WCM using one HVAS monitor, the available monitoring data collected between 2012 and 2014 are summarised in **Table 5-5** and **Figure 5-7.**

The monitoring data summarised in **Table 5-5** indicate that the annual average TSP concentrations for the HV 3 monitoring station were well below the criterion of 90µg/m^3. **Figure 5-7** shows that the annual average concentrations are low and are typically less than half of the criteria.

Table 5-5: TSP levels from HVAS monitoring (µg/m³)

Year	Annual average	Criteria
	HV 3	
2012	18.9	90
2013	27.5	90
2014(1)	32.4	90

(1)Data available till January 2014

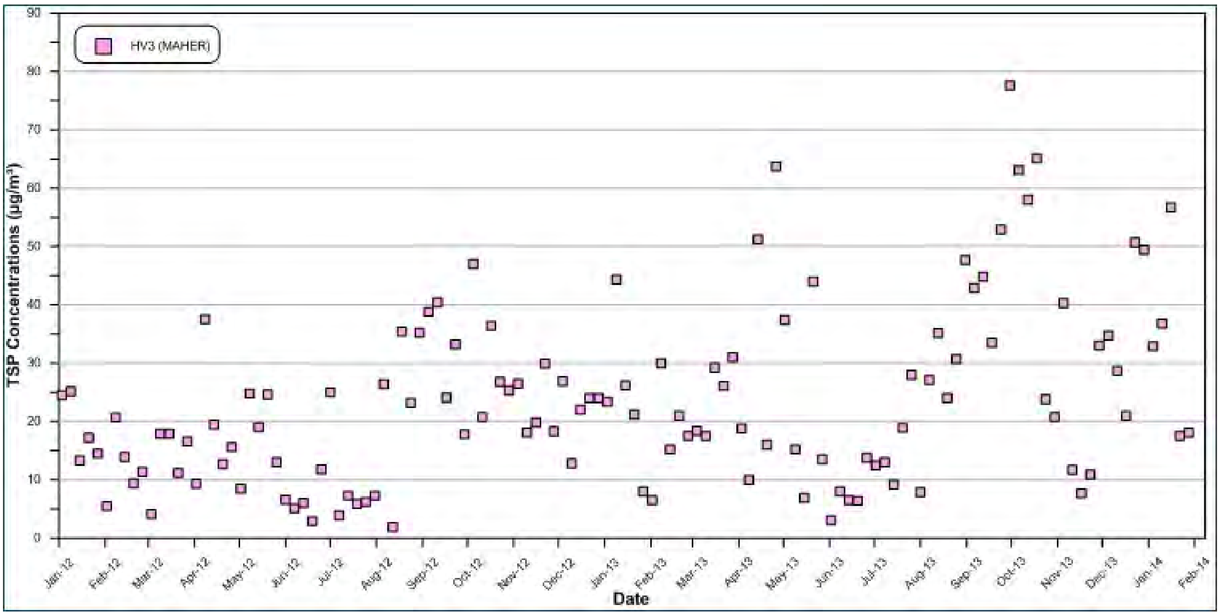

Figure 5-7: HVAS 24-hour average TSP concentrations

5.3.4 Dust deposition monitoring

Figure 5-3 shows the location of the dust deposition gauge monitoring network. It is observed that many of the gauges are located in generally close proximity to the mine or receptor locations. These locations are likely to show the highest levels of deposited dust in the area due to the close proximity of dust sources such as mining activity and traffic on unsealed roads and driveways.

Table 5-6 shows the annual average dust deposition levels at each gauge between 2012 and 2013. The majority of dust gauges recorded annual average insoluble deposition levels below the criterion of 4g/m^2/month, with the exception of DG12 during 2012, which is located within the ML (**Figure 5-3**).

Table 5-6: Annual average dust deposition (g/m²/month)

Year	DG4	DG5	DG7	DG8	DG10	DG11	DG12	DG13	DG14	DG15	Criteria
2012	1.1	0.7	1.5	1.0	1.2	1.4	6.5	2.4	2.2	-	4
2013	0.9	0.6	-	1.4	2.0	2.0	3.3	1.9	1.0	0.9	4

DG5 is the dust gauge located in closest proximity to receivers in Wollar (and is located between the mine and Wollar). This gauge shows generally low levels of deposited dust, which are below the applicable criteria in all years.

5.4 Air quality management measures

Following approval of Modification 5 in early 2014, the existing WCM Air Quality and Greenhouse Gas Management Plan (AQGGMP) (**WCPL, 2011**) is currently under revision in consultation with the DP&E and EPA. Notwithstanding, the existing air quality management measures continue to be implemented at the WCM while the revision of the AQGGMP is being undertaken.

The WCM currently uses a combination of real-time air quality monitoring and meteorological monitoring data, and predictive meteorological data, to maintain air quality in the vicinity of the mine within acceptable levels.

The implementation of the real-time air quality management system and internal performance indicators has meant that WCM operations have been modified as necessary to limit dust levels or achieve compliance. Examples of operational modifications performed include the cessation or modification of certain operations, the increased frequency of water cart operation and the temporary shutdown of all operations.

The monitoring data recorded during this period (see **Figure 5-5**) indicates that dust concentrations have generally been low (i.e. below relevant criteria), and therefore, it would appear that current strategies employed at WCM are effective.

Figure 5-8 graphically presents a comparison of the number of lost operation hours that occurred as a direct result of the implementation of the WCM Standard Protocol during the latter half of 2012 and 2013.

The decrease in downtime incidence in 2013 can be attributed to TEOM 1 no longer being a compliance point (i.e. shut downs are no longer required to maintain PM_{10} concentrations below $50\mu g/m^3$ at TEOM 1 given that there are no privately-owned receivers in the vicinity).

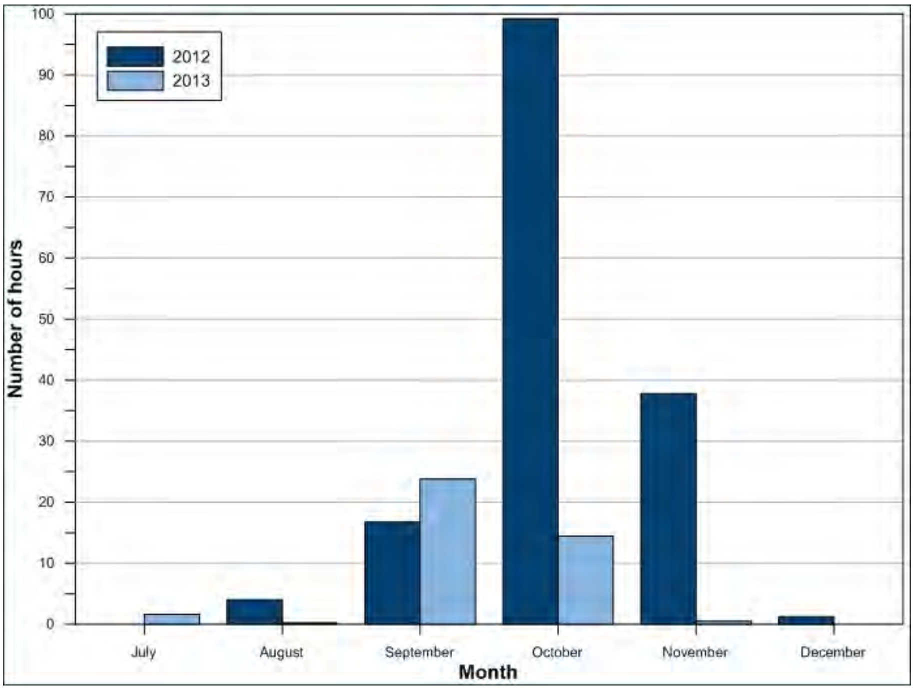

Figure 5-8: Summary of lost excavator hours due to response protocols during the latter half of 2012 and 2013

5.5 Odour

The spontaneous combustion of carbonaceous material has the potential to cause off-site odour impacts.

The WCM has experienced spontaneous combustion incidents in a ROM coal stockpile (Stockpile 11) and out-of-pit emplacement areas (i.e. waste dumps).

The ROM coal in question (Stockpile 11) has since been washed through the CHPP, and therefore, this material does not represent an ongoing spontaneous combustion risk, or require further management. Current coal stockpiles are being actively managed through a risk identification system, whereby stockpiles that have a higher propensity to spontaneously combust are monitored and prioritised for washing in the CHPP prior to these stockpiles reaching a designated storage time on-site.

Out-of-pit waste dumps were constructed at the commencement of mining and included carbonaceous waste material. To address the ongoing spontaneous combustion propensity of these stockpiles, WCM is progressively encapsulating or rehandling the temporary waste rock material and placing the material at the bottom of available mine voids, and covering it with inert material to prevent ongoing spontaneous combustion.

The rehandling of the dump material will result in some episodic spontaneous combustion events until all the material has been disposed of. It is expected that the management of these existing high risk spontaneous combustion areas will be complete in 2015 due to mine void space limitations.

WCPL is also conducting further test work on the coal seams to further refine the understanding of the propensity for spontaneous combustion, to manage the material accordingly.

5.6 History of complaints

The WCM has been operating since 2006 and has maintained a complaints register as part of Project Approval requirements. **Figure 5-9** presents a summary of the number of air quality related complaints between 2006 and 2013.

During 2010 to 2013 the number of complaints received regarding odour has increased, from two complaints in 2008 and 2009 to 35 in 2013. The increase in odour complaints in 2013 can be attributed to the progressive rehandling of the out-of-pit waste dumps to address the ongoing spontaneous combustion propensity of these stockpiles (**Section 5.5**).

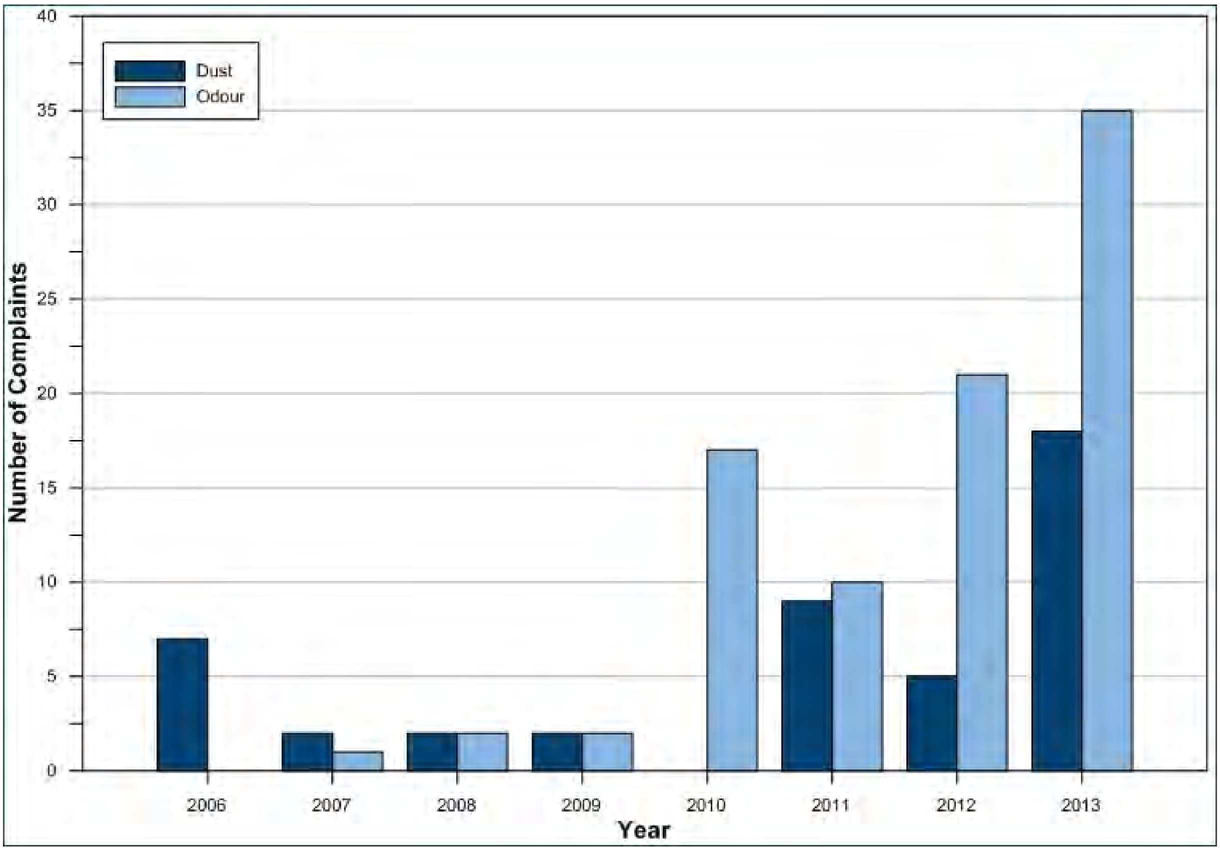

Figure 5-9: Summary of air quality related complaints

During 2011, 2012 and 2013, the reasons for dust complaints ranged from dust depositing on properties to visible dust from the mine site and equipment. For each dust complaint received in 2013, the compliance monitoring results demonstrate that WCM has operated in compliance with the 24-hour average PM_{10} criterion on these days.

All complaints received at WCM are managed in accordance with the Complaints Response Procedure outlined in the Environmental Management Strategy.

6 DISPERSION MODELLING APPROACH

6.1 Modelling methodology

Modelling was undertaken using a combination of TAPM and the CALPUFF Modelling System. The CALPUFF Modelling System includes three main components: CALMET, CALPUFF and CALPOST and a large set of pre-processing programs designed to interface the model to standard, routinely available meteorological and geophysical datasets.

CALMET is a meteorological model that uses the geophysical information and observed/simulated surface and upper air data as inputs and develops wind and temperature fields on a 3D gridded modelling domain.

CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion processes along the way. It typically uses the 3D meteorological field generated by CALMET.

CALPOST is a post processor used to process the output of the CALPUFF model and produce tabulations that summarise the results of the simulation.

TAPM is a prognostic air model used to simulate the upper air data for CALMET input. The meteorological component of TAPM is an incompressible, non-hydrostatic, primitive equation model with a terrain-following vertical coordinate for 3D simulations. The model predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analysis.

6.1.1 Meteorological modelling

The TAPM model was applied to the available data to generate a 3D upper air data file for use in CALMET. The centre of analysis for the TAPM modelling used is 32deg20min south and 149deg52.5min east (770772mE, 6418737mN). The simulation involved four nesting grids of 30km, 10km, 3km and 1km with 35 vertical grid levels.

CALMET modelling used a nested approach where the 3D wind field from the coarser grid outer domain is used as the initial guess (or starting) field for the finer grid inner domain. This approach has several advantages over modelling a single domain. Observed surface wind field data from the near field as well as from far field monitoring sites can be included in the model to generate a more representative 3D wind field for the modelled area. Off domain terrain features for the finer grid domain can be allowed to take effect within the finer domain, as would occur in reality, also the coarse scale wind flow fields give a better set of starting conditions with which to operate the finer grid run.

The coarser grid domain was run on a 75 x 75km area with a 1.5km grid resolution. The available meteorological data for the 2013 calendar from four surrounding meteorological monitoring sites were included in this run.

Table 6-1 outlines the parameters used from each station. 3D upper air data were sourced from TAPM output. The finer grid domain was run on a 30 x 30km grid with 0.3km grid resolution for each modelled year. Local land use and detailed topographical information was included to produce realistic fine scale flow fields (such as terrain forced flows) in surrounding areas, as shown in **Figure 6-1**. Further detail regarding the CALMET input variables are presented in **Appendix C**.

Table 6-1: Surface observation stations

Station ID	Parameters
WCM Weather Station	Wind speed, Wind direction, Temperature, Humidity
Merriwa (Roscommon) Automatic Weather Station (BoM) (Station No. 061287)	Wind speed, Wind direction, Cloud height, Cloud Amount, Temperature, Humidity, Sea level pressure
Mudgee Airport Automatic Weather Station (BoM) (Station No. 062101)	Wind speed, Wind direction, Temperature, Humidity, Sea level pressure
Nullo Mountain Automatic Weather Station (BoM) (Station No. 062100)	Wind speed, Wind direction, Temperature, Humidity

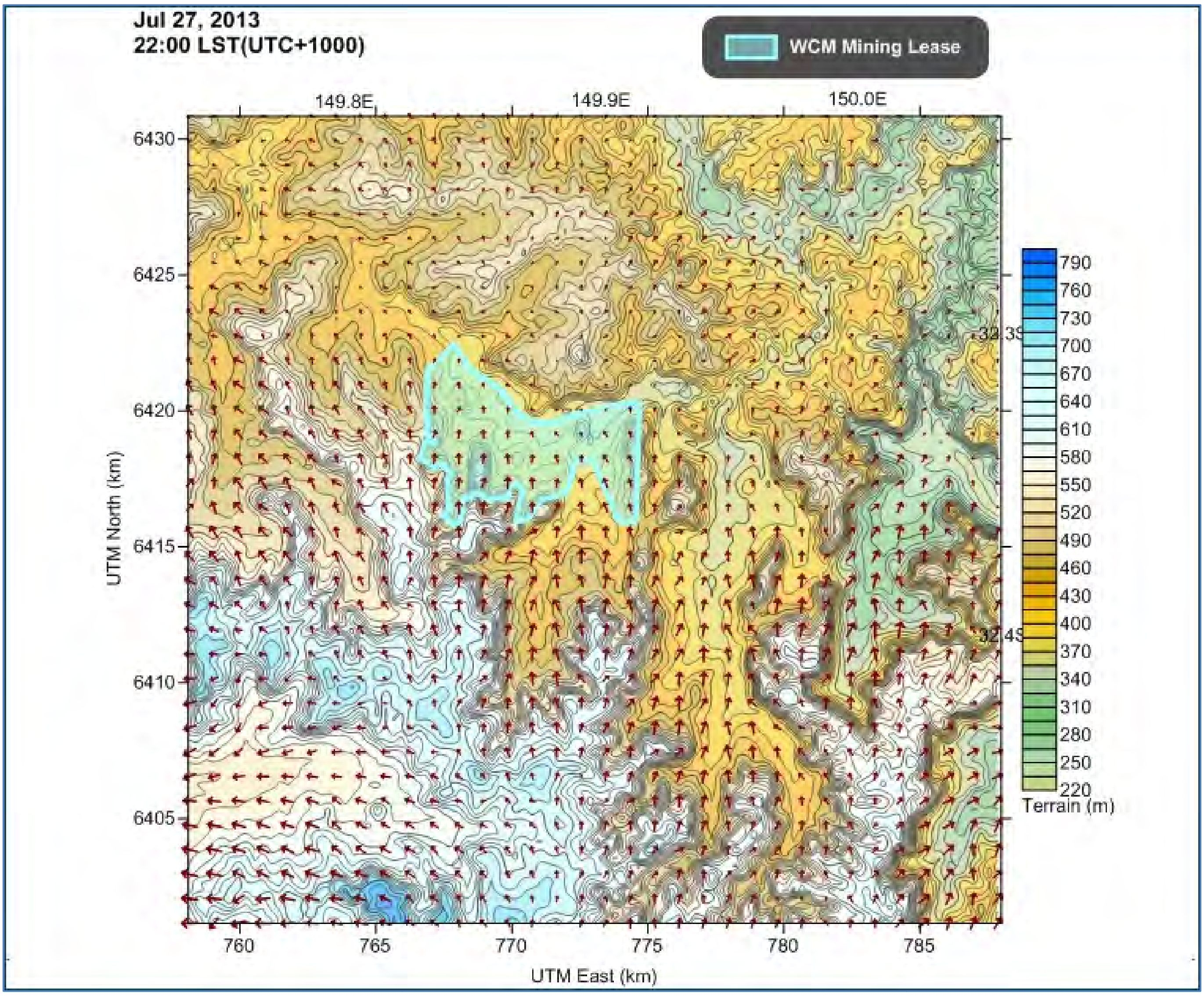

Figure 6-1: Representative snapshot of modelling wind field for WCM

CALMET generated meteorological data were extracted from a point within the CALMET domain and are graphically represented in **Figure 6-2** and **Figure 6-3**.

Figure 6-2 presents the annual and seasonal windroses from the CALMET data. On an annual basis, winds from the east-southeast are most frequent followed by winds from the west-southwest and east. During summer, winds from the east-southeast dominate with a lesser portion of wind from the east. Autumn presents winds predominately from the east-southeast with lesser winds ranging to the southwest and northwest quadrants. In winter, west-southwest and west-northwest winds dominate the wind distribution with a lesser portion of winds from the west and northwest sectors. Winds during spring predominantly occur from the west-southwest to the northwest.

Overall the windroses generated in the CALMET modelling reflect the expected wind distribution patterns of the area as determined based on the available measured data and the expected terrain effects on the prevailing winds. **Figure 6-3** includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and show sensible trends considered to be representative of the area.

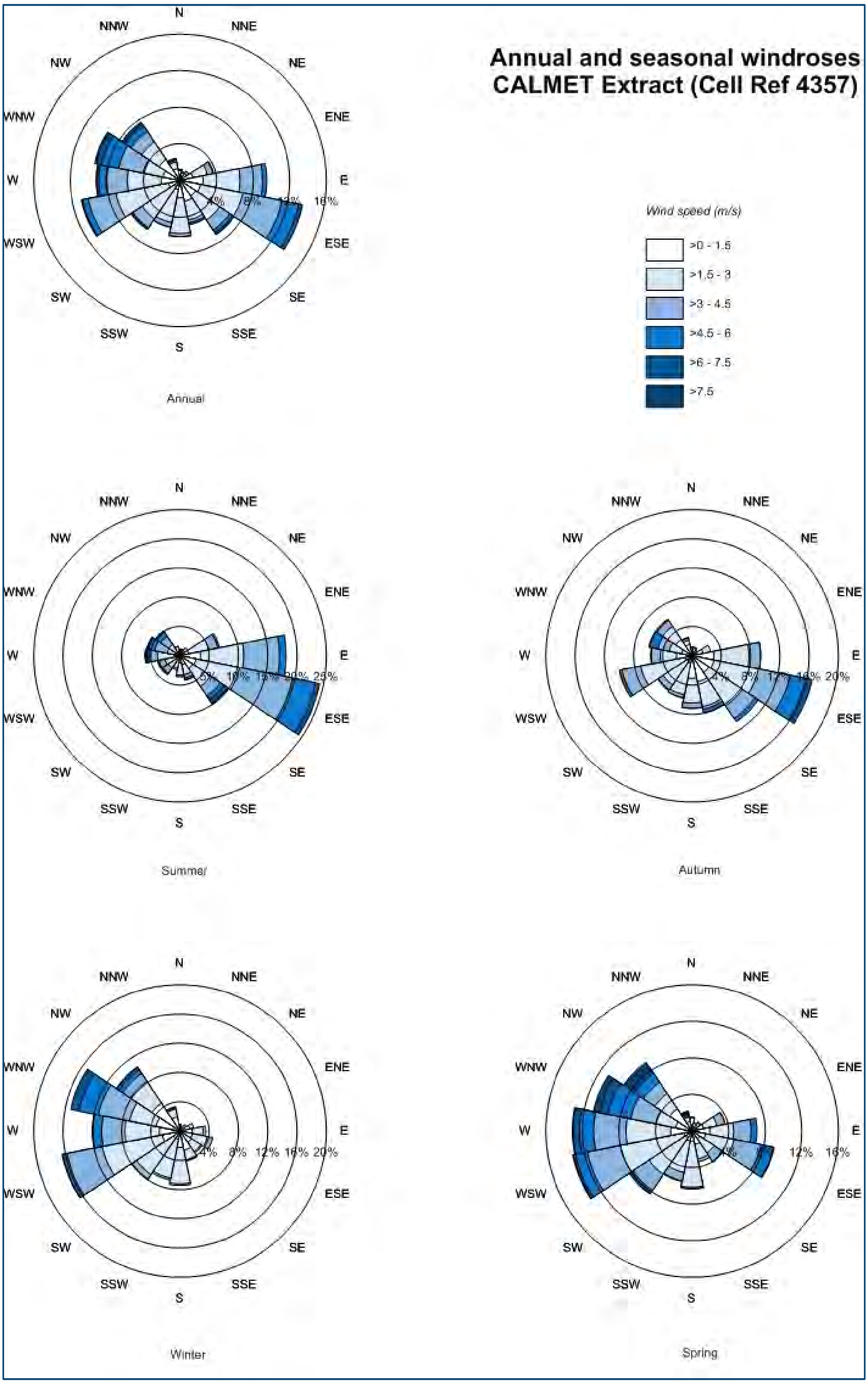

Figure 6-2: Windroses from CALMET extract (Cell Ref 4357)

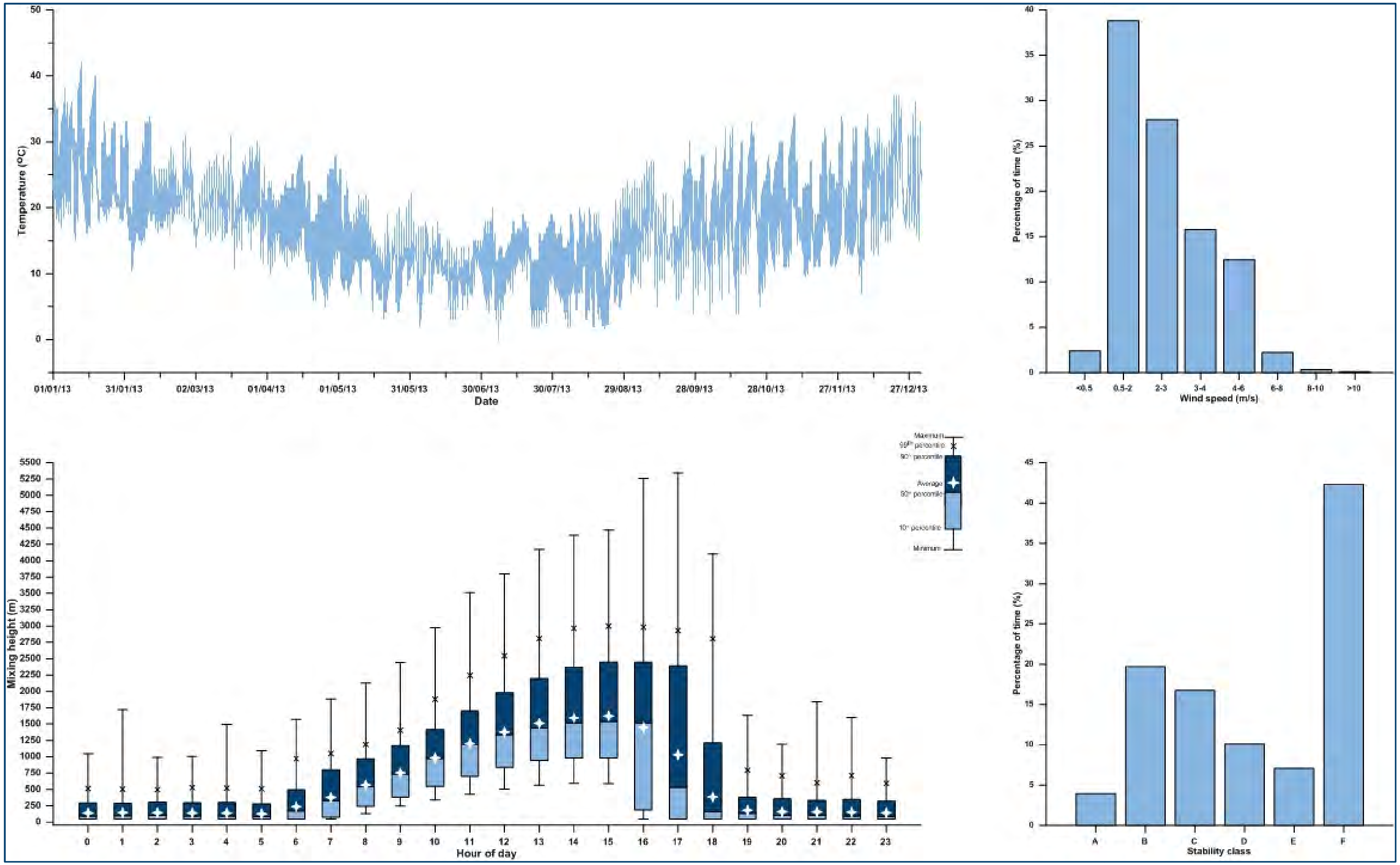

Figure 6-3: Meteorological analyses of CALMET extract (Cell Ref 4357)

6.1.2 Dispersion modelling

CALPUFF modelling is based on the application of three particle size categories Fine particulates (FP), Coarse Matter (CM) and Rest (RE). The estimated emissions are presented in **Section 6.2.1**. The distribution of particles for each particle size category was derived from measurements in the **SPCC (1986)** study and is presented in **Table 6-2**.

Table 6-2: Distribution of particles

Particle category	Size range	Distribution
Fine particulates (FP)	0 to 2.5µm	4.68% of TSP
Coarse matter (CM)	2.5 to 10µm	34.4% of TSP
Rest (RE)	10 to 30µm	60.92% of TSP

Emissions from each activity occurring at the WCM (incorporating the Modification) were represented by a series of volume sources and were included in the CALPUFF model via an hourly varying emission file. Meteorological conditions associated with dust generation (such as wind speed) and levels of dust generating activity were considered in calculating the hourly varying emission rate for each source. It should be noted that as a conservative measure, the effect of the precipitation rate (rainfall) in reducing dust emissions has not been considered in this assessment. Further detail regarding the CALPUFF input variables are presented in **Appendix C**.

Each particle-size category is modelled separately and later combined to predict short-term and long-term average concentrations for $PM_{2.5}$, PM_{10}, and TSP. Dust deposition was predicted using the proven dry deposition algorithm within the CALPUFF model. Particle deposition is expressed in terms of atmospheric resistance through the surface layer, deposition layer resistance and gravitational settling (**Slinn and Slinn, 1980** and **Pleim *et al.*, 1984**). Gravitational settling is a function of the particle size and density, simulated for spheres by the Stokes equation (**Gregory, 1973**).

CALPUFF is capable of tracking the mass balance of particles emitted into the modelling domain. For each hour CALPUFF tracks the mass emitted, the amount deposited, the amounts remaining in the surface mixed layer or the air above the mixed layer and the amount advected out of the modelling domain. The versatility to address both dispersion and deposition algorithms in CALPUFF, combined with the 3D meteorological and land use field generally result in a more accurate model prediction compared to other Gaussian plume models (**Pfender *et al.*, 2006**).

6.2 Modelling Scenarios

This assessment has considered two mine plan years (scenarios) to represent the WCM incorporating the Modification. The scenarios modelled were chosen to represent potential worst-case impacts in regard to the potential to generate dust at receptors. The scenarios represent the year with the maximum amount of material handled and also the year where activity is concentrated in the closest proximity to sensitive receptors.

The modelled Year 10 (2015) scenario represents a maximum amount of material handled case. During this period, waste rock material handled peaks at 34.1Mbcm and ROM coal extracted reaches 16Mt. Active mining occurs in Pits 1, 2, 3, 4 and 5 (see **Figure 6-4**).

The Year 13 (2018) scenario has been selected as active mining occurs in areas closest to sensitive receptors (see **Figure 6-4**), in particular those located to the east and north-east including Wollar. This scenario would represent the highest concentration of mining activity likely to occur in the eastern section of the WCM.

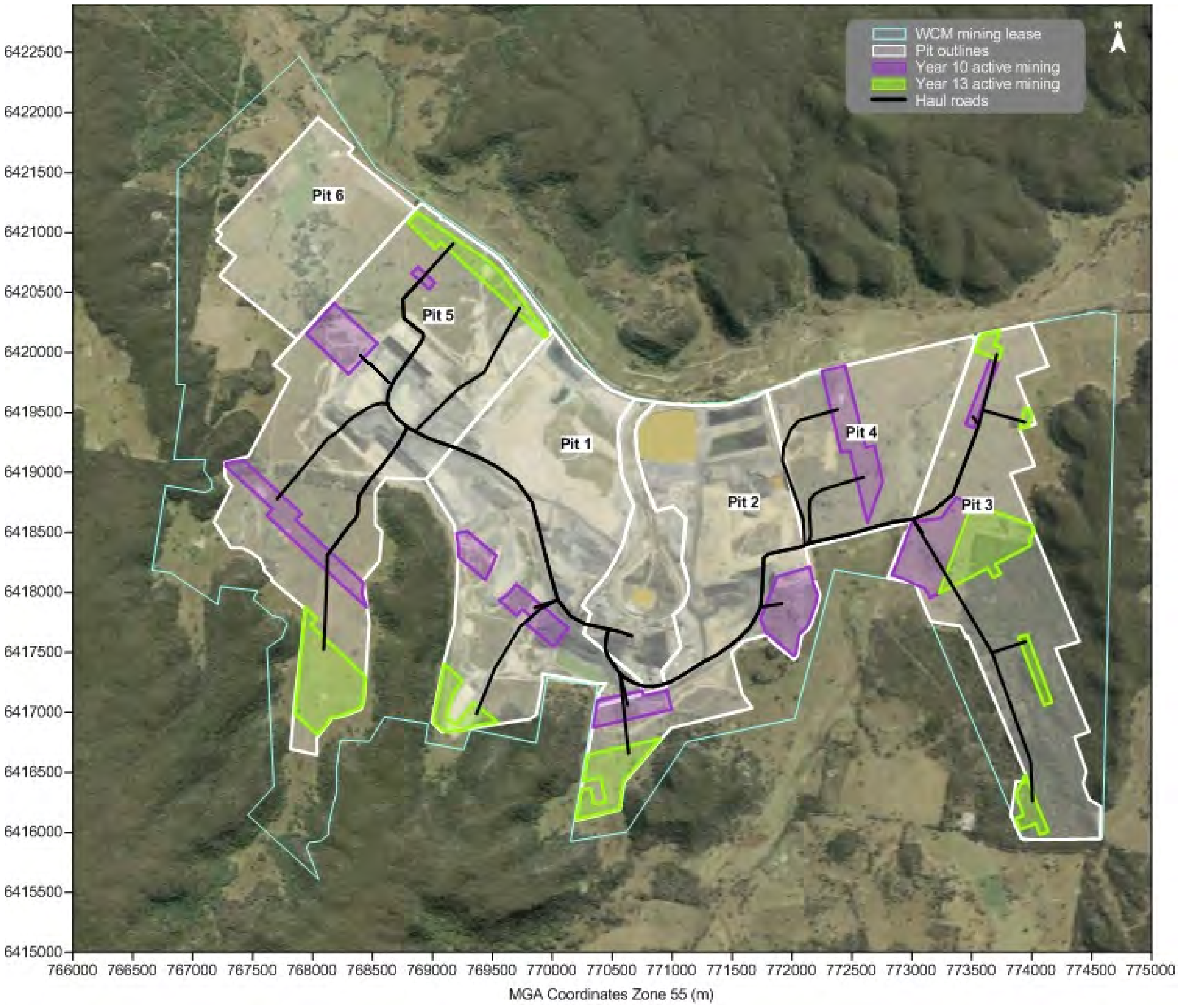

Figure 6-4: Mine plan for the Modification

6.2.1 Emission estimation

For each of the chosen modelling scenarios, dust emission estimates have been calculated by analysing the various types of dust generating activities taking place and utilising suitable emission factors.

The emission factors applied are considered the most applicable and representative for determining dust generation rates for the proposed activities. The emission factors were sourced from both locally developed and United States EPA (US EPA) developed documentation. Total dust emissions from all significant dust generating activities for the WCM incorporating the Modification are presented in **Table 6-3**. Detailed emission inventories and emission estimation calculations are presented in **Appendix D**.

Notwithstanding, after the completion of air quality modelling for this assessment, additional site-specific analysis for haul roads became available which indicated that the hauling emissions in **Table 6-3** are conservative. Further detail is provided in **Section 7.6**.

The dust emissions presented in **Table 6-3** are commensurate with a best practice mining operation utilising reasonable and feasible best practice dust mitigation applied where applicable. Further details on the dust control measures applied for the Modification are outlined in **Section 6.2.3**.

6.2.2 Emissions from other mines

In addition to the estimated dust emissions from the WCM incorporating the Modification, all nearby approved or proposed mining operations were included in the modelling to assess potential cumulative dust effects. The operations include:

- Ulan Coal Continued Operations; and
- Moolarben Coal Mine (as amended – i.e. including predictions for Stage 1 and Stage 2).

Emissions estimates from these sources were derived from information provided in the most up to date air quality assessments available in the public domain at the time of modelling. These estimates are likely to be conservative as in many cases mines do not operate at the maximum extraction rates assessed in their respective assessments. **Table 6-4** summarises the emissions adopted in this assessment for each of the nearby mining operations.

Emissions from nearby mining operations would contribute to the background level of dust in the area surrounding the WCM, and these emissions are explicitly included in the modelling. Additionally, there would be numerous smaller or very distant sources that contribute to the total background dust level. Modelling these non-mining sources explicitly is impractical, however the residual level of dust due to all other such non-modelled sources (as estimated in **Section 6.3**) has been included in the cumulative results, as discussed in **Section 7.**

Table 6-3: Estimated emissions for the WCM incorporating the Modification (kg of TSP)

Activity	Year 10	Year 13
OB - Stripping Topsoil (Pit 1) - Scraper removing topsoil	1,256	726
OB - Stripping Topsoil (Pit 2) - Scraper removing topsoil	2,343	1,336
OB - Stripping Topsoil (Pit 3) - Scraper removing topsoil	2,206	2,994
OB - Stripping Topsoil (Pit 4) - Scraper removing topsoil	1,663	-
OB - Stripping Topsoil (Pit 5) - Scraper removing topsoil	2,836	3,608
OB - Loading topsoil to haul truck (Pit 1)	14	8
OB - Loading topsoil to haul truck (Pit 2)	26	15
OB - Loading topsoil to haul truck (Pit 3)	24	33
OB - Loading topsoil to haul truck (Pit 4)	18	-
OB - Loading topsoil to haul truck (Pit 5)	31	39
OB - Hauling to emplacement from Pit 1	765	442
OB - Hauling to emplacement from Pit 2	1,426	813
OB - Hauling to emplacement from Pit 3	1,343	1,822
OB - Hauling to emplacement from Pit 4	1,012	-
OB - Hauling to emplacement from Pit 5	1,726	2,196
OB - Emplacing topsoil at dump (Pit 1)	14	8
OB - Emplacing topsoil at dump (Pit 2)	26	15

Activity	Year 10	Year 13
OB - Emplacing topsoil at dump (Pit 3)	24	33
OB - Emplacing topsoil at dump (Pit 4)	18	-
OB - Emplacing topsoil at dump (Pit 5)	31	39
OB - Dozers on topsoil (Pit 1)	2,400	1,651
OB - Dozers on topsoil (Pit 2)	4,478	3,037
OB - Dozers on topsoil (Pit 3)	4,216	6,804
OB - Dozers on topsoil (Pit 4)	3,179	-
OB - Dozers on topsoil (Pit 5)	5,420	8,201
OB - Drilling (Pit 1)	1,127	805
OB - Drilling (Pit 2)	3,221	1,450
OB - Drilling (Pit 3)	2,738	5,154
OB - Drilling (Pit 4)	3,221	-
OB - Drilling (Pit 5)	5,799	8,698
OB - Blasting (Pit 1)	32,080	22,914
OB - Blasting (Pit 2)	91,657	41,246
OB - Blasting (Pit 3)	77,909	146,652
OB - Blasting (Pit 4)	91,657	-
OB - Blasting (Pit 5)	164,983	247,475
OB - Excavator loading OB to haul truck (Pit 1)	4,540	2,302
OB - Excavator loading OB to haul truck (Pit 2)	12,972	4,144
OB - Excavator loading OB to haul truck (Pit 3)	11,026	14,735
OB - Excavator loading OB to haul truck (Pit 4)	12,972	-
OB - Excavator loading OB to haul truck (Pit 5)	23,349	24,866
OB - Hauling to dump from Pit 1	33,700	17,090
OB - Hauling to dump from Pit 2	96,286	30,762
OB - Hauling to dump from Pit 3	81,843	109,377
OB - Hauling to dump from Pit 4	96,286	-
OB - Hauling to dump from Pit 5	173,315	184,573
OB - Emplacing at dump (Pit 1)	4,540	2,302
OB - Emplacing at dump (Pit 2)	12,972	4,144
OB - Emplacing at dump (Pit 3)	11,026	14,735
OB - Emplacing at dump (Pit 4)	12,972	-
OB - Emplacing at dump (Pit 5)	23,349	24,866
OB - Dozers on OB in pit (Pit 1)	73,887	52,777
OB - Dozers on OB in pit (Pit 2)	211,106	94,998
OB - Dozers on OB in pit (Pit 3)	179,440	337,770
OB - Dozers on OB in pit (Pit 4)	211,106	-
OB - Dozers on OB in pit (Pit 5)	379,991	569,987
CL - Dozers ripping/pushing/clean-up (Pit 1)	9,710	6,797
CL - Dozers ripping/pushing/clean-up (Pit 2)	21,363	8,739
CL - Dozers ripping/pushing/clean-up (Pit 3)	15,537	32,044
CL - Dozers ripping/pushing/clean-up (Pit 4)	16,508	-
CL - Dozers ripping/pushing/clean-up (Pit 5)	33,986	49,523
CL - Loading ROM coal to haul truck (Pit 1)	110,193	60,471
CL - Loading ROM coal to haul truck (Pit 2)	242,424	77,749
CL - Loading ROM coal to haul truck (Pit 3)	176,308	285,079
CL - Loading ROM coal to haul truck (Pit 4)	187,327	-
CL - Loading ROM coal to haul truck (Pit 5)	385,674	440,577
CL - Hauling ROM to hopper from Pit 1	20,565	23,834
CL - Hauling ROM to hopper from Pit 2	78,463	20,504

Activity	Year 10	Year 13
CL - Hauling ROM to hopper from Pit 3	160,260	328,818
CL - Hauling ROM to hopper from Pit 4	161,313	-
CL - Hauling ROM to hopper from Pit 5	325,281	414,680
CHPP - Unloading ROM to hopper (all pits)	826,444	647,908
CHPP - Rehandle ROM at hopper	771,348	604,714
CHPP - Screening	17,567	13,772
CHPP - Crushing	9,582	7,512
CHPP - Sized Coal Unloading to Exisiting Product/Raw Stockpiles	1,494	1,171
CHPP - Loading from RAW to CHPP	1,726	437
CHPP - Loading from RAW to trains (BYPASS)	1,187	2,013
CHPP - Unloading from CHPP to Product Stockpile	1,338	318
CHPP - Loading from Product Stockpile to trains	2,676	637
CHPP - Dozer on ROM Stockpiles	18,253	18,253
CHPP - Dozer on Product/Raw Stockpiles	48,851	48,851
CHPP - Loading coarse rejects	463	131
CHPP - Hauling coarse and fine rejects (Pit 1)	109,355	16,195
CHPP - Unloading coarse rejects	463	131
WE - Overburden emplacement areas (Pit 1)	24,977	142,905
WE - Overburden emplacement areas (Pit 2)	89,669	26,574
WE - Overburden emplacement areas (Pit 3)	250,165	119,765
WE - Overburden emplacement areas (Pit 4)	102,954	3,673
WE - Overburden emplacement areas (Pit 5)	200,244	214,562
WE - Open pit (Pit 1)	31,617	18,283
WE - Open pit (Pit 2)	58,978	33,638
WE - Open pit (Pit 3)	55,530	75,356
WE - Open pit (Pit 4)	41,865	-
WE - Open pit (Pit 5)	71,384	90,829
WE - ROM stockpiles	56,064	56,064
WE - Product stockpiles	17,520	17,520
Grading roads	32,349	32,349
Grading roads	9,884	9,884
Total TSP emissions (kg/yr)	**6,976,426**	**5,940,022**

OB - overburden, CL - coal, WE - wind erosion

Note: Totals may vary slightly due to rounding.

Table 6-4: Estimated emissions for nearby mining operations (kg of TSP)

Mining operation	Year 10	Year 13
Moolarben Coal Mine(1)	3,579,833	5,930,324
Ulan Coal Mine(2)	4,137,255	2,842,032

(1) **TAS (2013)**

(2) **PAEHolmes (2009)**

6.2.3 Best practice operational dust mitigation measures

WCPL has carefully considered the possible range of air quality mitigation measures that are feasible and can be applied to achieve a standard of mine operation consistent with current best practice for the control of dust emissions from coal mines in NSW, as outlined in the recent NSW EPA document, "*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*", prepared by Katestone Environmental (**Katestone Environmental, 2010**).

The NSW EPA has also implemented a Pollution Reduction Program (PRP) at the WCM which requires identification and assessment of the practicability of implementing further best practice measures. The identified best practice controls based on PRP have been reviewed and were considered in this assessment.

A summary of the key current dust controls, which would continue to be applied for the Modification, is shown in **Table 6-5**. Where applicable these controls have been applied in the dust emission estimates shown in **Table 6-3**. Further detail on the level of control applied is set out in **Appendix D**.

Table 6-5: Best practice dust mitigation measures

Activity	Dust Control
Scrapers on topsoil and Bulldozers on, overburden and rehabilitation	✦ Manage according to dust alarms
Hauling on unsealed roads	✦ Watering roads ✦ Use the largest practical truck size ✦ Road edges to be clearly defined with marker post or equivalent to control locations ✦ Obsolete roads will be ripped and re-vegetated as soon as practical
Drilling (overburden and coal)	✦ Water curtains
Blasting (overburden and coal)	✦ Meteorological conditions assessed prior to blasting ✦ Adequate stemming
Bulldozers on coal	✦ Manage according to dust alarms
Loading/unloading coal	✦ Water sprays on ROM bin
Conveyor transfers (CHPP)	✦ Water sprays ✦ Belt cleaning and spillage minimisation ✦ Enclosures
Wind erosion on stockpiles and exposed surfaces	✦ Profiling of surfaces to reduce surface speed ✦ Contouring of dump shape where practical to avoid strong wind flows and smooth gradients to reduce turbulence at surface ✦ Rehabilitation as soon as practical ✦ Topsoil stockpiles not regularly used to be re-vegetated
Road grading	✦ Watering grader routes

6.3 Accounting for background dust levels

All significant dust generating operations in the vicinity of the WCM (i.e. estimated emissions from the Ulan and Moolarben coal mines) were included in the dispersion model to assess the total potential dust impact.

Other, non-mining sources of particulate matter in the wider area would also contribute to existing ambient dust levels. These sources have not been included in the dispersion modelling as it is impractical to do so; however an allowance for their contribution to total dust levels is required to fully assess the total potential impact.

For annual average predictions, the contribution to the prevailing background dust level of other non-modelled dust sources was estimated by modelling the past (known) mining activities (including Moolarben and Ulan) during January 2013 to December 2013 and comparing the model predictions with the actual measured data from the monitoring stations. The average difference between the measured and predicted PM_{10}, TSP and deposited dust levels from each of the monitoring points was considered to be the contribution from other non-modelled dust sources, and was added to the future predicted values to account for the background dust levels (not explicitly in the model that would be due to the numerous small or distant, non-modelled dust sources).

This approach is preferable to modelling WCM alone and adding a single constant background level at all points across the modelling domain to estimate cumulative impacts. This is because the approach includes modelling of other major sources (i.e. mines) that more reliably represent the higher dust levels near such sources, and also accounts for the seasonal and time varying changes in the background levels that arise from these major dust sources. In addition, to account for any underestimation from not including every source (as it is not possible to do that reasonably), the relatively smaller contribution arising from the other non-modelled dust sources, as determined above, was added to the results to obtain the most accurate predictions of future cumulative impacts across the modelled domain.

Using the approach described above, the estimated annual average contribution from other non-modelled dust sources is presented in **Table 6-6**.

Table 6-6: Estimated contribution from other non-modelled dust sources

Pollutant	Averaging period	Unit	Estimated contribution
TSP	Annual	µg/m³	20.2
PM_{10}	Annual	µg/m³	11.9
Dust deposition	Annual	µg/m³	1.1

It is important that the above values are not confused with measured background levels, background levels excluding only the proposal, or the change in existing levels as a result of the proposal. The values above are not background levels in that sense, but are the residual amount of the background dust that is not accounted for directly in the air dispersion modelling.

To account for background levels when assessing total (cumulative) 24-hour average PM_{10} concentration impacts, the 24-hour average project only incremental levels are added to the total measured 24-hour average ambient dust levels (per the NSW EPA guidelines). Further details are provided in **Section 7.3**.

7 DISPERSION MODELLING RESULTS

The dispersion model predictions for each of the assessed years are presented in this section. The results show the estimated maximum 24-hour average $PM_{2.5}$ concentrations, annual average $PM_{2.5}$ concentrations, maximum 24-hour average PM_{10} concentrations, annual average PM_{10} concentrations, annual average TSP concentrations and annual average dust (insoluble solids) deposition rates for the WCM (incorporating the Modification) operating in isolation, as well for the WCM (incorporating the Modification) operating with other sources (cumulative impact).

It is important to note that when assessing impacts per maximum 24-hour average PM_{10} criteria the predictions show the highest predicted 24-hour average concentrations that were modelled at each point within the modelling domain for the worst day (a 24-hour period) in the one year long modelling period. When assessing the total (cumulative) 24-hour average impacts based on model predictions, challenges arise with identification and quantification of emissions from non-modelled sources over the 24-hour period. Due to these factors, the 24-hour average impacts need to be calculated differently to annual averages and as such, the predicted total (cumulative) impacts for maximum 24-hour average PM_{10} concentrations have been addressed specifically in **Section 7.3**.

Each of the sensitive receptors (residences) shown in **Figure 2-1** and detailed in **Appendix A** were assessed individually as discrete receptors with the predicted results presented in tabular form for each of the assessed years.

Associated isopleth diagrams of the dispersion modelling results are presented in **Appendix E**.

For sources not explicitly included in the model, and to fully account for all cumulative dust levels, the unaccounted fractions of background dust levels (which arise from the other non-modelled sources), were added to the annual average model predictions as described in **Section 6.3** with the results presented in the following sections for each of the assessed years.

7.1 Comparison of approved operations to proposed operations

The proposed modifications would result in a relatively small increase in total ROM coal extraction and there would also be a revised mining sequence that may bring operations somewhat closer to private receivers in the peak mining years. The net outcome in terms of an increase or decrease in potential impact is not intuitively easy to estimate, given that the quantity of material handled changes by a relatively small amount but also the position changes. Meaning that the changes can both increase or decrease the level of dust at specific receptors.

It is also important to consider that in this assessment it was chosen to use the most recent (2013) meteorological and dust monitoring data. This year shows some of the highest monitored dust levels in the area, and would be expected to represent a potential overestimate of impacts, relative to an alternative year with lower dust levels.

To show the effect of the proposed changes relative to the approved operations, the key results have been overlayed on the results for the previous assessment, see **Figure 7-1** and **Figure 7-2**.

The results show that generally any potential PM_{10} impacts would be somewhat lower in most areas around the mine. This outcome appears to be due largely to the position of the proposed mining activity and the meteorological data, more so than the proposed change in the quantity of material handled.

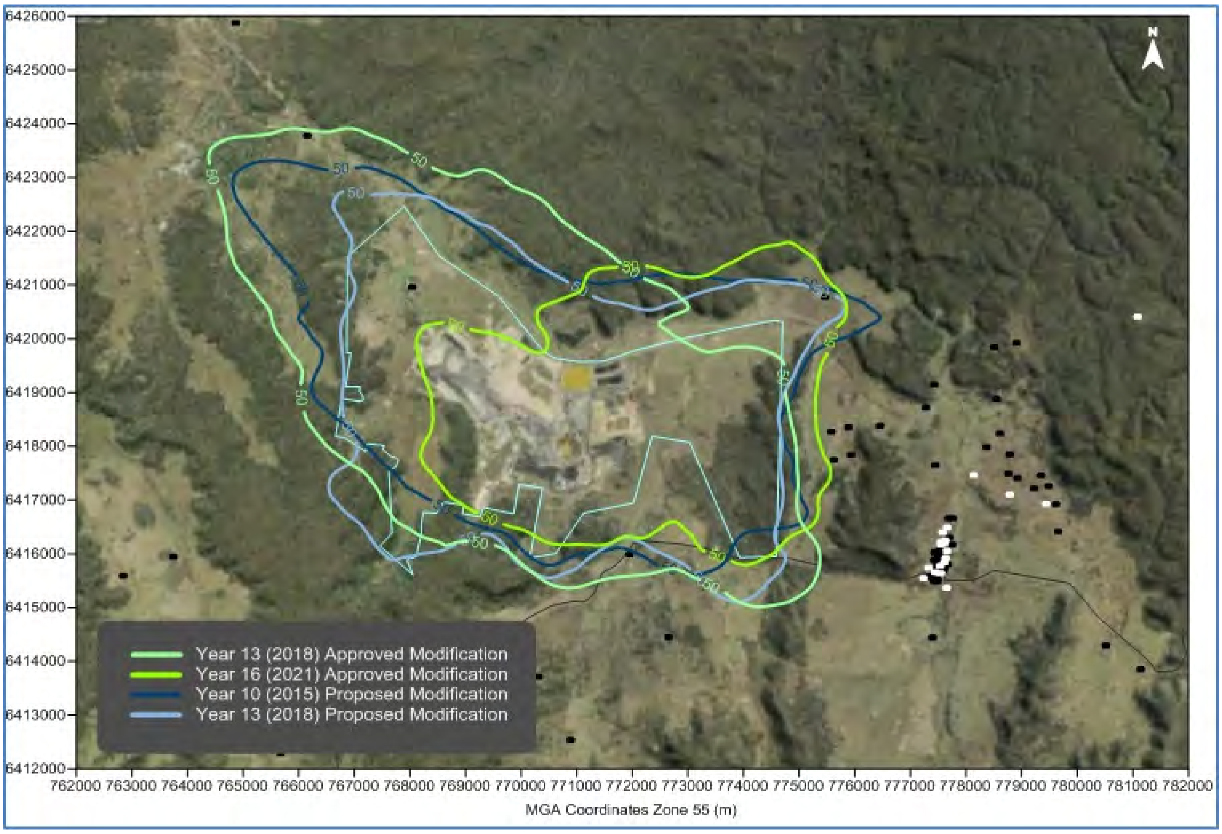

Figure 7-1: Comparison of approved and proposed impacts – 24-hour average PM_{10}

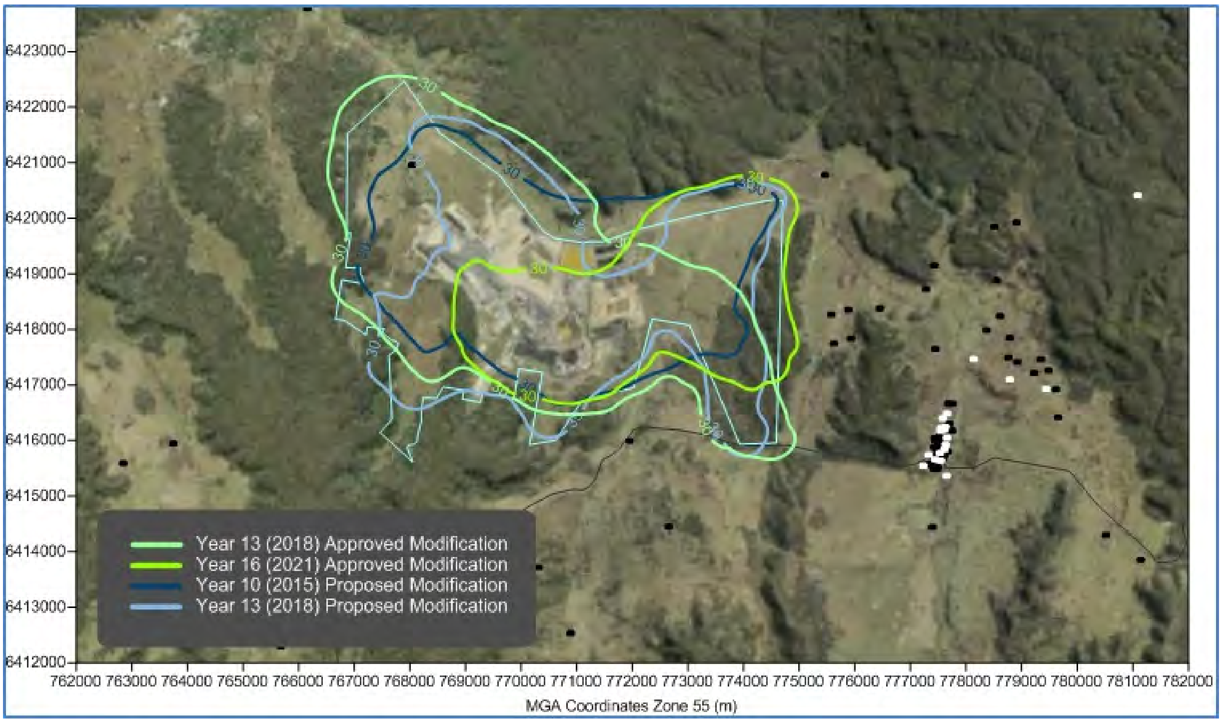

Figure 7-2: Comparison of approved and proposed impacts – Annual average PM_{10}

7.2 Year 10 (2015)

Table 7-1 presents the model predictions at each of the privately-owned receptors. The values presented in **bold** indicate predicted values above the relevant criteria (no results above criteria in this case.)

Table 7-2 presents the model predictions at each of the mine-owned receptors, the values presented in **bold** indicate predicted values above the relevant criteria.

Figure E-1 to **Figure E-9** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 10 (2015).

Table 7-1: Modelling predictions for Year 10 (2015) of the Modification (privately-owned receptors)

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
69	0.6	0.0	4.7	0.3	0.5	0.0	12.4	21.0	1.1
102	2.0	0.2	16.2	1.4	2.4	0.1	13.8	23.2	1.2
129^	2.3	0.3	18.3	2.5	4.2	0.1	14.7	24.9	1.2
135^	2.2	0.3	17.4	2.1	3.5	0.1	14.3	24.2	1.2
137	2.0	0.2	15.4	1.8	3.0	0.1	14.0	23.6	1.2
150A	3.4	0.2	27.1	1.7	2.9	0.1	13.9	23.5	1.2
153	0.8	0.0	6.0	0.3	0.5	0.0	12.4	20.9	1.1
157	0.3	0.0	1.7	0.1	0.1	0.0	12.0	20.4	1.1
160A	0.9	0.1	7.0	0.7	1.1	0.0	12.8	21.6	1.1
160B	0.9	0.1	6.9	0.7	1.1	0.0	12.8	21.6	1.1
900	3.6	0.3	28.7	2.0	3.4	0.1	14.2	24.0	1.3
901	3.0	0.3	24.2	2.2	3.7	0.1	14.4	24.3	1.3
903	3.6	0.3	28.9	1.9	3.3	0.1	14.1	23.9	1.2
908	3.5	0.3	28.0	1.9	3.2	0.1	14.1	23.9	1.2
914	3.4	0.2	27.5	1.9	3.1	0.1	14.0	23.8	1.2
921	3.4	0.3	27.2	1.9	3.3	0.1	14.1	23.9	1.2
933	3.3	0.3	26.4	1.9	3.3	0.1	14.1	23.9	1.2
935	3.2	0.3	25.8	2.0	3.3	0.1	14.2	24.0	1.2
942	3.1	0.3	24.7	2.0	3.4	0.1	14.2	24.1	1.2
944	3.1	0.3	24.7	2.1	3.6	0.1	14.3	24.3	1.3
947	3.0	0.3	23.8	2.1	3.6	0.1	14.3	24.3	1.3
952	2.8	0.3	22.3	2.2	3.8	0.2	14.4	24.5	1.3
953	2.6	0.3	20.8	2.2	3.8	0.1	14.4	24.5	1.3

^Property under contract of sale to Peabody Energy.
*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 4.3**).
DD = dust deposition.

Table 7-2: Modelling predictions for Year 10 (2015) of the Modification (mine-owned receptors)

Receptor ID	PM2.5 (µg/m³)		PM10 (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM10 (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
1_18	2.7	0.3	22.3	2.6	4.3	0.1	14.9	25.2	1.2
1_19	3.0	0.4	24.2	2.9	5.0	0.1	15.3	25.9	1.2
1_25	2.9	0.5	23.4	3.5	6.0	0.2	15.8	26.9	1.3
1_26	3.2	0.5	24.8	3.6	6.2	0.2	16.0	27.1	1.3
1_28C	2.6	0.4	20.9	2.9	4.9	0.2	15.1	25.7	1.3
1_30	2.4	0.3	18.9	2.5	4.3	0.1	14.8	25.0	1.2
1_31	3.6	0.5	28.8	3.9	6.8	0.2	16.3	27.7	1.3
32_12	2.2	0.2	17.2	1.3	2.0	0.0	**47.9**	81.3	2.3
32_13	2.3	0.2	17.7	1.3	2.0	0.0	**42.2**	71.2	2.1
32_14	2.7	0.2	21.3	1.4	2.2	0.0	28.6	47.7	1.6
32_29A	1.2	0.1	9.8	0.8	1.2	0.0	13.1	22.0	1.1
32_29B	1.0	0.1	8.0	0.6	0.9	0.0	12.8	21.6	1.1
32_48A	0.6	0.0	4.2	0.3	0.4	0.0	12.4	20.9	1.1
32_48B	0.7	0.0	4.6	0.3	0.4	0.0	12.4	21.0	1.1
32_32C	4.9	0.6	36.3	4.7	7.6	0.1	22.1	37.3	1.5
32_33A	1.7	0.2	12.8	1.7	2.7	0.1	14.7	24.5	1.2
32_33B_5	1.7	0.2	12.9	1.7	2.7	0.1	14.7	24.6	1.2
1_45	7.8	1.5	**60.2**	11.8	20.7	0.4	24.4	41.9	1.5
1_49	2.6	0.2	17.2	1.3	2.1	0.1	13.5	22.8	1.2
1_52A	4.0	0.6	31.5	4.3	7.5	0.3	16.6	28.3	1.4
1_53	4.0	0.6	31.6	4.5	7.9	0.3	16.9	28.8	1.4
1_55	4.2	0.6	33.6	4.9	8.7	0.3	17.3	29.5	1.4
1_58	4.6	0.6	36.5	4.7	8.3	0.3	17.1	29.2	1.4
1_83	2.5	0.3	19.5	2.5	4.2	0.1	14.7	24.9	1.2
1_100B	2.1	0.1	16.5	0.8	1.2	0.0	12.9	21.7	1.2
1_127	2.4	0.4	19.3	2.7	4.5	0.1	15.0	25.3	1.2
1_131	2.2	0.3	17.3	2.3	3.9	0.1	14.5	24.6	1.2
1_133	2.1	0.3	16.3	2.2	3.7	0.1	14.4	24.4	1.2
1_136	2.0	0.3	15.8	1.9	3.2	0.1	14.1	23.9	1.2
1_140	2.1	0.2	17.0	1.6	2.6	0.1	13.8	23.3	1.2
1_142	1.9	0.2	15.0	1.7	2.9	0.1	13.9	23.5	1.2
1_143	2.1	0.3	16.2	2.1	3.6	0.1	14.3	24.2	1.2
1_145	1.9	0.3	14.8	2.0	3.3	0.1	14.2	24.0	1.2
1_151	0.6	0.0	4.4	0.3	0.4	0.0	12.4	20.9	1.1
1_152	1.9	0.2	15.1	1.9	3.1	0.1	14.1	23.8	1.2
1_154	0.5	0.0	3.1	0.2	0.3	0.0	12.2	20.6	1.1
1_155	0.5	0.0	2.9	0.2	0.2	0.0	12.2	20.6	1.1
1_156	0.5	0.0	3.8	0.2	0.3	0.0	12.2	20.7	1.1
1_158	1.8	0.1	14.0	0.7	1.1	0.0	12.7	21.5	1.2
1_159	1.3	0.1	10.1	0.5	0.9	0.0	12.6	21.3	1.1
1_162	0.9	0.1	6.9	0.7	1.0	0.0	12.8	21.6	1.1
1_163	0.7	0.1	5.8	0.6	0.9	0.0	12.6	21.3	1.1
1_164	5.4	0.6	40.5	4.5	7.5	0.3	16.8	28.3	1.4

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
1_905	3.6	0.3	28.6	1.9	3.2	0.1	14.1	23.9	1.2
1_907	3.5	0.3	28.3	1.9	3.2	0.1	14.1	23.8	1.2
1_910	3.5	0.2	27.9	1.8	3.1	0.1	14.0	23.7	1.2
1_912	3.5	0.2	27.8	1.8	3.1	0.1	14.0	23.7	1.2
1_913	3.5	0.2	27.7	1.8	3.0	0.1	14.0	23.7	1.2
1_915	3.5	0.3	28.1	2.0	3.3	0.1	14.1	23.9	1.2
1_916	3.4	0.3	27.4	1.9	3.2	0.1	14.1	23.8	1.2
1_917	3.4	0.3	27.2	1.9	3.2	0.1	14.1	23.8	1.2
1_920	3.4	0.3	26.9	1.9	3.2	0.1	14.1	23.8	1.2
1_923	3.4	0.3	27.4	2.0	3.3	0.1	14.2	24.0	1.2
1_926	3.3	0.3	26.4	1.9	3.2	0.1	14.1	23.9	1.2
1_927	3.3	0.3	26.2	1.9	3.2	0.1	14.1	23.8	1.2
1_929	3.4	0.3	27.2	2.0	3.4	0.1	14.2	24.0	1.2
1_931	3.4	0.3	27.6	2.0	3.4	0.1	14.2	24.1	1.3
1_934	3.3	0.3	26.6	2.0	3.4	0.1	14.2	24.1	1.3
1_937	3.3	0.3	26.4	2.0	3.5	0.1	14.2	24.1	1.3
1_938	3.3	0.3	26.9	2.1	3.6	0.1	14.3	24.2	1.3
1_939	3.3	0.3	26.7	2.1	3.6	0.1	14.3	24.2	1.3
1_941	3.2	0.3	25.8	2.1	3.5	0.1	14.3	24.2	1.3
1_946	2.9	0.3	23.0	2.0	3.5	0.1	14.2	24.1	1.2
1_950	2.8	0.3	22.2	2.1	3.6	0.1	14.3	24.3	1.3
1_956	2.5	0.3	20.3	2.3	3.9	0.2	14.5	24.6	1.3
1_957	2.5	0.3	19.9	2.3	3.9	0.1	14.5	24.6	1.3
1_W88A	0.7	0.0	4.9	0.3	0.5	0.0	12.4	21.0	1.1
1_W88B	0.8	0.0	5.3	0.4	0.5	0.0	12.5	21.0	1.1
1_WA	**29.8**	5.3	**226.8**	41.1	71.1	1.1	**54.7**	**94.0**	2.3
1_WF	2.1	0.1	14.4	0.9	1.3	0.0	13.1	22.0	1.1
1_WJ	1.7	0.1	11.8	0.7	1.1	0.0	12.9	21.7	1.1
1_WK	1.1	0.1	7.3	0.5	0.8	0.0	12.6	21.3	1.1
1_WR	2.1	0.2	16.9	1.3	2.2	0.1	13.5	22.8	1.2
1_WT	2.4	0.1	19.1	0.9	1.4	0.1	13.0	21.9	1.2

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 4.3**).

DD = dust deposition.

7.2.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-1 and **Figure E-2** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 10 (2015) due to emissions from the WCM incorporating the Modification.

The results in **Table 7-1** indicate that all privately-owned receptors are predicted to experience maximum 24-hour average and annual average $PM_{2.5}$ concentrations below the advisory reporting standards of 25µg/m³ and 8µg/m³, respectively in Year 10 (2015).

The results in **Table 7-2** indicate that one mine-owned receptor, Receptor 1_WA, is predicted to experience levels above the maximum 24-hour average advisory standard in Year 10 (2015). This receptor is located in close proximity to significant mining activity.

7.2.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-3 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 10 (2015) due to emissions from the WCM incorporating the Modification.

The results in **Table 7-1** indicate that all privately-owned receptors are predicted to experience maximum 24-hour average PM_{10} concentrations below the NSW EPA impact assessment criteria of 50µg/m^3 in Year 10 (2015).

The results in **Table 7-2** indicate that two mine-owned receptors, Receptor 1_45 and 1_WA, are predicted to experience maximum 24-hour average PM_{10} concentrations above the NSW EPA impact assessment criteria of 50µg/m^3 in Year 10 (2015).

7.2.3 Predicted annual average PM_{10} concentrations

Figure E-4 shows the predicted annual average PM_{10} concentrations for Year 10 (2015) due to emissions from the WCM incorporating the Modification. **Figure E-5** shows the predicted cumulative impact from the WCM incorporating the Modification and other sources.

The results in **Table 7-1** indicate that all privately-owned receptors are predicted to experience annual average PM_{10} concentrations below the NSW EPA impact assessment criteria of 30µg/m^3 in Year 10 (2015), inclusive of the contribution from estimated background levels.

The results in **Table 7-2** indicate that three mine-owned receptors, Receptor 32_12, 32_13, and 1_WA, are predicted to experience annual average PM_{10} concentrations above the NSW EPA impact assessment criteria of 30µg/m^3 in Year 10 (2015), inclusive of the contribution from estimated background levels.

7.2.4 Predicted annual average TSP concentrations

Figure E-6 shows the predicted annual average TSP concentrations for Year 10 (2015) due to emissions from the WCM incorporating the Modification. **Figure E-7** shows the predicted cumulative impact from the WCM incorporating the Modification and other sources.

The results in **Table 7-1** indicate that all privately-owned receptors are predicted to experience annual average TSP concentrations below the NSW EPA impact assessment criteria of 90µg/m^3 in Year 10 (2015), inclusive of the contribution from estimated background levels.

The results in **Table 7-2** indicate that one mine-owned receptor, Receptor 1_WA, is predicted to experience annual average TSP concentrations above 90µg/m^3 in Year 10 (2015).

7.2.5 Predicted annual average dust deposition (insoluble solids)

Figure E-8 shows the predicted annual average dust deposition levels for Year 10 (2015) due to emissions from the WCM incorporating the Modification. **Figure E-9** shows the predicted cumulative impact from the WCM incorporating the Modification and other sources.

The results in **Table 7-1** indicate that all privately-owned receptors are predicted to experience an annual average dust deposition level below the NSW EPA impact assessment criteria of 2g/m^2/month in Year 10 (2015) due to the WCM incorporating the Modification.

All privately-owned receptors are also predicted to experience a cumulative annual average dust deposition level below 4g/m^2/month in Year 10 (2015), inclusive of the contribution from estimated background levels.

The results in **Table 7-2** indicate that all mine-owned receptors are predicted to experience an annual average dust deposition level below the NSW EPA impact assessment criteria of 2g/m^2/month in Year 10 (2015) due to the WCM incorporating the Modification.

All mine-owned receptors are also predicted to experience a cumulative annual average dust deposition level below 4g/m^2/month in Year 10 (2015), inclusive of the contribution from estimated background levels.

7.3 Year 13 (2018)

Table 7-3 presents the model predictions at each of the privately-owned receptors, the values presented in **bold** indicate predicted values above the relevant criteria (no results above criteria in this case.)

Table 7-3: Modelling predictions for Year 13 (2018) of the Modification (privately-owned receptors)

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
69	0.5	0.0	4.2	0.3	0.4	0.0	12.5	21.1	1.1
102	1.6	0.2	12.7	1.2	2.0	0.1	13.6	23.0	1.2
129^	1.7	0.3	11.3	2.0	3.3	0.1	14.3	24.2	1.2
135^	1.6	0.2	10.4	1.7	2.7	0.1	14.0	23.6	1.2
137	1.3	0.2	9.6	1.4	2.3	0.1	13.7	23.1	1.2
150A	2.2	0.2	17.4	1.6	2.6	0.1	13.9	23.4	1.2
153	0.7	0.0	5.0	0.3	0.4	0.0	12.4	20.9	1.1
157	0.2	0.0	1.4	0.1	0.1	0.0	12.1	20.4	1.1
160A	0.7	0.1	5.5	0.5	0.9	0.0	12.7	21.4	1.1
160B	0.6	0.1	5.1	0.5	0.9	0.0	12.7	21.4	1.1
900	2.2	0.2	17.3	1.8	3.1	0.1	14.1	23.9	1.2
901	1.9	0.2	13.7	1.9	3.1	0.1	14.2	24.0	1.2
903	2.3	0.2	18.4	1.8	3.0	0.1	14.1	23.8	1.2
908	2.1	0.2	17.0	1.7	2.9	0.1	14.1	23.7	1.2
914	2.1	0.2	16.6	1.7	2.8	0.1	14.0	23.7	1.2
921	2.0	0.2	16.0	1.7	2.9	0.1	14.1	23.8	1.2
933	1.9	0.2	15.2	1.7	2.9	0.1	14.0	23.7	1.2
935	1.9	0.2	14.6	1.8	2.9	0.1	14.1	23.8	1.2
942	1.9	0.2	13.6	1.8	3.0	0.1	14.1	23.8	1.2
944	1.9	0.2	13.5	1.9	3.1	0.1	14.2	24.0	1.2
947	1.9	0.2	13.4	1.8	3.1	0.1	14.2	23.9	1.2

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
952	1.9	0.3	13.8	1.9	3.2	0.1	14.2	24.1	1.2
953	1.9	0.3	13.4	1.9	3.2	0.1	14.2	24.0	1.2

^Property under contract of sale to Peabody Energy.
*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 4.3**).
DD = dust deposition

Table 7-4 presents the model predictions at each of the mine-owned receptors.

Figure E-10 to **Figure E-18** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 13 (2018).

Table 7-4: Modelling predictions for Year 16 (2021) of the Modification (mine-owned receptors)

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
1_18	2.0	0.3	16.0	2.2	3.7	0.1	14.7	24.8	1.2
1_19	2.1	0.3	17.1	2.5	4.2	0.1	15.0	25.3	1.2
1_25	1.9	0.4	15.0	2.9	4.9	0.1	15.4	26.0	1.3
1_26	2.3	0.4	17.8	3.0	5.1	0.1	15.6	26.2	1.3
1_28C	1.9	0.3	13.8	2.3	3.9	0.1	14.7	24.9	1.3
1_30	1.6	0.3	12.3	2.0	3.4	0.1	14.4	24.3	1.2
1_31	2.4	0.4	18.3	3.4	5.7	0.2	15.9	26.8	1.3
32_12	1.8	0.2	12.8	1.1	1.8	0.0	**43.9**	74.4	2.2
32_13	1.8	0.2	13.2	1.1	1.8	0.0	**39.5**	66.7	2.0
32_14	2.3	0.2	17.7	1.2	1.9	0.0	27.9	46.4	1.6
32_29A	1.2	0.1	9.6	0.8	1.3	0.0	13.4	22.5	1.2
32_29B	0.9	0.1	7.2	0.6	0.9	0.0	13.0	21.9	1.1
32_48A	0.6	0.0	4.0	0.3	0.4	0.0	12.5	21.0	1.1
32_48B	0.7	0.0	4.6	0.3	0.4	0.0	12.5	21.1	1.1
32_32C	3.8	0.5	28.6	3.9	6.5	0.1	25.5	43.3	1.5
32_33A	1.1	0.2	9.0	1.5	2.4	0.1	22.4	38.1	1.5
32_33B_5	1.1	0.2	8.9	1.5	2.4	0.1	23.3	39.8	1.5
1_45	7.3	1.6	**57.1**	12.2	21.5	0.3	25.0	43.0	1.5
1_49	2.5	0.2	19.9	1.5	2.5	0.1	13.9	23.4	1.2
1_52A	2.9	0.5	22.4	3.8	6.4	0.2	16.3	27.5	1.3
1_53	2.8	0.5	20.2	3.9	6.7	0.2	16.4	27.9	1.4
1_55	3.0	0.6	21.6	4.3	7.4	0.3	16.9	28.6	1.4
1_58	3.0	0.5	23.7	4.2	7.2	0.2	16.7	28.3	1.4
1_83	1.6	0.3	12.3	2.0	3.3	0.1	14.4	24.3	1.2
1_100B	1.6	0.1	12.5	0.7	1.1	0.0	12.8	21.7	1.2

Receptor ID	PM2.5 (µg/m³)		PM10 (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM10 (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
1_127	1.7	0.3	13.6	2.2	3.7	0.1	14.7	24.7	1.2
1_131	1.5	0.2	11.5	1.8	3.0	0.1	14.2	23.9	1.2
1_133	1.5	0.2	10.6	1.8	2.9	0.1	14.1	23.8	1.2
1_136	1.4	0.2	9.2	1.5	2.5	0.1	13.9	23.4	1.2
1_140	1.4	0.2	10.5	1.3	2.1	0.1	13.6	22.9	1.2
1_142	1.3	0.2	9.4	1.4	2.3	0.1	13.7	23.1	1.2
1_143	1.5	0.2	10.0	1.7	2.8	0.1	14.0	23.6	1.2
1_145	1.3	0.2	9.4	1.6	2.6	0.1	13.9	23.4	1.2
1_151	0.6	0.0	4.2	0.2	0.4	0.0	12.4	21.0	1.1
1_152	1.3	0.2	8.8	1.5	2.4	0.1	13.8	23.2	1.2
1_154	0.4	0.0	2.6	0.2	0.2	0.0	12.2	20.7	1.1
1_155	0.4	0.0	2.5	0.1	0.2	0.0	12.2	20.6	1.1
1_156	0.4	0.0	3.2	0.2	0.3	0.0	12.2	20.7	1.1
1_158	1.2	0.1	9.3	0.6	0.9	0.0	12.7	21.5	1.2
1_159	1.1	0.1	8.5	0.5	0.7	0.0	12.6	21.3	1.1
1_162	0.6	0.1	4.9	0.5	0.8	0.0	12.7	21.4	1.1
1_163	0.5	0.1	4.2	0.5	0.7	0.0	12.6	21.2	1.1
1_164	4.8	0.7	34.7	5.4	9.1	0.4	17.9	30.2	1.5
1_905	2.3	0.2	18.0	1.8	3.0	0.1	14.1	23.8	1.2
1_907	2.2	0.2	17.6	1.8	2.9	0.1	14.1	23.7	1.2
1_910	2.2	0.2	17.7	1.7	2.8	0.1	14.0	23.6	1.2
1_912	2.2	0.2	17.3	1.7	2.8	0.1	14.0	23.6	1.2
1_913	2.2	0.2	17.5	1.7	2.8	0.1	14.0	23.6	1.2
1_915	2.1	0.2	16.9	1.8	3.0	0.1	14.1	23.8	1.2
1_916	2.0	0.2	16.4	1.7	2.9	0.1	14.0	23.7	1.2
1_917	2.0	0.2	16.2	1.7	2.8	0.1	14.0	23.7	1.2
1_920	2.0	0.2	15.9	1.7	2.8	0.1	14.0	23.7	1.2
1_923	2.0	0.2	16.0	1.8	3.0	0.1	14.1	23.8	1.2
1_926	1.9	0.2	15.3	1.7	2.9	0.1	14.0	23.7	1.2
1_927	1.9	0.2	15.2	1.7	2.8	0.1	14.0	23.7	1.2
1_929	2.0	0.2	15.7	1.8	3.0	0.1	14.1	23.8	1.2
1_931	2.0	0.2	16.0	1.8	3.1	0.1	14.1	23.9	1.2
1_934	1.9	0.2	15.2	1.8	3.0	0.1	14.1	23.9	1.2
1_937	1.9	0.2	14.9	1.8	3.1	0.1	14.1	23.9	1.2
1_938	2.0	0.2	15.2	1.9	3.1	0.1	14.2	24.0	1.2
1_939	2.0	0.3	15.0	1.9	3.1	0.1	14.2	24.0	1.2
1_941	1.9	0.2	14.3	1.8	3.1	0.1	14.2	23.9	1.2
1_946	1.9	0.2	13.0	1.8	3.0	0.1	14.1	23.8	1.2
1_950	1.9	0.2	13.3	1.8	3.1	0.1	14.2	23.9	1.2
1_956	1.9	0.3	13.2	1.9	3.2	0.1	14.3	24.1	1.2
1_957	1.9	0.3	13.0	1.9	3.2	0.1	14.2	24.0	1.2
1_W88A	0.7	0.0	4.7	0.3	0.4	0.0	12.5	21.1	1.1
1_W88B	0.7	0.0	5.1	0.3	0.5	0.0	12.6	21.2	1.1
1_WA	12.2	2.6	**92.6**	20.4	36.0	0.8	**35.1**	60.8	2.0

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	WCM incorporating the Modification impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	Advisory*		Air quality impact criteria						
	25	8	50	-	-	2	30	90	4
1_WF	1.9	0.1	12.9	1.0	1.5	0.0	13.4	22.5	1.2
1_WJ	1.5	0.1	10.1	0.7	1.1	0.0	13.1	22.0	1.1
1_WK	0.9	0.1	6.6	0.5	0.7	0.0	12.8	21.5	1.1
1_WR	1.8	0.2	14.5	1.3	2.1	0.1	13.5	22.8	1.2
1_WT	1.7	0.1	13.3	0.8	1.2	0.0	13.0	21.9	1.2

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 4.3**).
DD = dust deposition

7.3.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-10 and **Figure E-11** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 13 (2018) due to emissions from the WCM incorporating the Modification.

The results in **Table 7-3** indicate that all privately-owned receptors are predicted to experience maximum 24-hour average and annual average $PM_{2.5}$ concentrations below the advisory reporting standards of 25µg/m³ and 8µg/m³, respectively in Year 13 (2018).

The results in **Table 7-4** indicate that all mine-owned receptors are also predicted to experience levels below the maximum 24-hour average and annual average $PM_{2.5}$ advisory standards in Year 13 (2018).

7.3.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-12 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 13 (2018) due to emissions from the WCM incorporating the Modification.

The results in **Table 7-3** indicate that all privately-owned receptors are predicted to experience maximum 24-hour average PM_{10} concentrations below the NSW EPA impact assessment criteria of 50µg/m³ in Year 13 (2018).

The results in **Table 7-4** indicate that two mine-owned receptors, Receptor 1_45 and 1_WA, are predicted to experience maximum 24-hour average PM_{10} concentrations above the NSW EPA impact assessment criteria of 50µg/m³ in Year 13 (2018).

7.3.3 Predicted annual average PM_{10} concentrations

Figure E-13 shows the predicted annual average PM_{10} concentrations for Year 13 (2018) due to emissions from the WCM incorporating the Modification. **Figure E-14** shows the predicted cumulative impact from the WCM incorporating the Modification and other sources.

The results in **Table 7-3** indicate that all privately-owned receptors are predicted to experience annual average PM_{10} concentrations below the NSW EPA impact assessment criteria of 30µg/m³ in Year 13 (2018), inclusive of the contribution from estimated background levels.

The results in **Table 7-4** indicate that three mine-owned receptors, Receptor 32_12, 32_13, and 1_WA, are predicted to experience annual average PM_{10} concentrations above the NSW EPA impact assessment criteria of 30µg/m^3 in Year 13 (2018).

7.3.4 Predicted annual average TSP concentrations

Figure E-15 shows the predicted annual average TSP concentrations for Year 13 (2018) due to emissions from the WCM incorporating the Modification. **Figure E-16** shows the predicted cumulative impact from the WCM incorporating the Modification and other sources.

The results in **Table 7-3** indicate that all privately-owned receptors are predicted to experience annual average TSP concentrations below the NSW EPA impact assessment criteria of 90µg/m^3 in Year 13 (2018), inclusive of the contribution from estimated background levels.

The results in **Table 7-4** indicate that all mine-owned receptors are predicted to experience annual average TSP concentrations below the NSW EPA impact assessment criteria of 90µg/m^3 in Year 13 (2018), inclusive of the contribution from estimated background levels.

7.3.5 Predicted annual average dust deposition (insoluble solids)

Figure E-17 shows the predicted annual average dust deposition levels for Year 13 (2018) due to emissions from the WCM incorporating the Modification. **Figure E-18** shows the predicted cumulative impact from the WCM incorporating the Modification and other sources.

The results in **Table 7-3** indicate that all privately-owned receptors are predicted to experience an annual average dust deposition level below the NSW EPA impact assessment criteria of 2g/m^2/month in Year 13 (2018) due to the WCM incorporating the Modification.

All privately-owned receptors are also predicted to experience a cumulative annual average dust deposition level below the NSW EPA impact assessment criteria of 4g/m^2/month in Year 13 (2018), inclusive of the contribution from estimated background levels.

The results in **Table 7-4** indicate that all mine-owned receptors are predicted to experience annual average dust deposition levels below 2g/m^2/month in Year 13 (2018) due to the WCM incorporating the Modification.

All mine-owned receptors are also predicted to experience a cumulative annual average dust deposition level below the NSW EPA impact assessment criteria of 4g/m^2/month in Year 13 (2018), inclusive of the contribution from estimated background levels.

7.4 Assessment of total (cumulative) 24-hour average PM_{10} concentrations

The NSW EPA contemporaneous assessment method was applied to examine the potential maximum total (cumulative) 24-hour average PM_{10} impacts arising from the WCM incorporating the Modification. This analysis has focused on the privately-owned sensitive receptor locations in Wollar that would be the most likely locations to experience maximum cumulative impacts due to the WCM incorporating the Modification.

An assessment of cumulative 24-hour average PM_{10} impacts was undertaken in accordance with methods outlined in Section 11.2 of the *Approved Methods for the Modelling and Assessment of Air*

Pollutants in New South Wales (**NSW DEC, 2005**). The "Level 2 assessment – Contemporaneous impact and background approach" was applied to assess potential impacts at private receptors near monitoring locations.

As shown in **Section 4**, maximum background levels have in the past reached levels near to the 24-hour average PM_{10} criterion level (depending on the monitoring location and time). As a result, the screening Level 1 NSW EPA approach of adding maximum background levels to maximum predicted Modification only levels would show levels above the criterion.

In such situations, (where a Level 1 assessment indicates that an impact may be possible) the NSW EPA approach requires a more thorough Level 2 assessment whereby the measured background level on a given day is added contemporaneously with the corresponding Modification-only level predicted using the same day's weather data. This method factors into the assessment the spatial and temporal variation in background levels affected by the weather and existing sources of dust in the area on a given day. However, even with a detailed Level 2 approach, any air dispersion modelling has limitations (as described in **Section 6.3**) in predicting short term impacts which may arise many years into the future, and these limitations need to be understood when interpreting the results.

Ambient (background) dust concentration data for January 2013 to December 2013 from the TEOM stations have been applied in the Level 2 contemporaneous 24-hour average PM_{10} assessment and represent the prevailing measured background levels in the vicinity of WCM and surrounding sensitive receptor locations.

As the existing mine was operational during 2013, it would have contributed to the measured levels of dust in the area on some occasions. Due to this it is important to account for these existing activities in the cumulative assessment. Modelling of the actual mining scenario for the 2013 period (in which the weather and background dust data were collected) was conducted to estimate the existing contribution to the measured levels of dust. The results were applied in the cumulative assessment to minimise potential double counting of existing mine emissions (as they would occur in both the measured data and in the predicted levels), and thus to make a more reliable prediction of the likely cumulative total dust level.

Table 7-5 provides a summary of the findings of the contemporaneous assessment at each monitoring location. The results in **Table 7-5** indicate that it is unlikely that cumulative impacts would arise at receptors near the monitoring locations, TEOM1, TEOM3 and TEOM4, during the assessed years (i.e. no additional exceedances of the 24-hour average PM10 criterion are predicted as a result of the Modification).

Detailed tables of the full assessment results are provided in **Appendix F**.

Table 7-5: NSW EPA contemporaneous assessment – maximum number of additional days above 24-hour average criterion depending on background level at monitoring sites

Location	Year 10 (2015)	Year 13 (2018)
TEOM1	0	0
TEOM3	0	0
TEOM4	0	0

The contemporaneous assessment thus indicates only low potential for any cumulative 24-hour average PM_{10} impacts to occur at the monitoring locations. The monitoring locations are considered to represent areas where the highest cumulative impacts are most likely to occur. Given these locations show little potential for any significant impact to occur, it can be inferred that there would also be little prospect of any significant impact to occur at all other receptor locations.

This result is consistent with the relative comparison that shows that generally lower potential dust levels in the vicinity of Wollar may arise due to the proposed changes.

8 DUST MITIGATION AND MANAGEMENT

The existing operations at WCM implement dust mitigation measures, including real-time controls, in accordance with the existing AQGGMP (which is currently under revision in consultation with the DP&E and EPA) (see **Section 5.4**).

In addition to the AQGGMP, a recent PRP implemented at the WCM identified best practice dust mitigation measures for the WCM. These best practice dust mitigation measures were incorporated in the emission estimates for this assessment, where relevant. This assessment has applied conservative assumptions in the estimation of dust levels (**Section 6.3**).

The monitoring data presented in **Section 5.3** indicates that WCM has been generally in compliance with NSW EPA air quality criteria. Where exceedances have occurred, these have typically been associated with regional events and not WCM activities.

Relative to the existing operations, the proposed modifications to the mining activities at the WCM are unlikely to lead to any significant change in dust levels at receptors.

This is supported by the air quality assessment for the Modification which predicts that there would be no exceedances of EPA air quality criteria at any privately-owned receptor due to the WCM incorporating the Modification and background sources (including other mining operations).

Given this, and given the demonstrated performance of existing operations, it is considered that the continued implementation of the AQGGMP management measures (as updated in the current plan revisions), including real-time controls with implementation of the best practice mitigation measures identified in the PRP, would be suitable to manage potential air quality impacts from the WCM incorporating the Modification.

9 SUMMARY AND CONCLUSIONS

This study has examined potential air quality (i.e. dust) impacts that may arise from the proposed Modification. The Modification seeks to increase the approved ROM production rate of 15Mtpa to 16Mtpa through improved efficiency of the mining operations. This would also marginally increase the upper annual rate of waste rock production of 34.1Mbcm. There would be no change to the amount of product coal transported by rail off-site (12.5Mtpa).

Whilst the changes proposed are relatively small, there is nevertheless scope for some small increase in impact to arise. Hence it was considered appropriate to conduct air dispersion modelling to assess potential impacts using contemporary methods and to assess whether compliance with EPA criteria would be achieved if the Modification proceeds.

The assessment applies advanced air dispersion modelling that is able to account for the varying meteorological conditions that arise due to the interaction of the prevailing winds with the terrain in the area.

The assessment of dust impacts incorporates the predicted effects of the dust emissions from the WCM incorporating the Modification, and finds that all privately-owned receptors would not be subjected to adverse impacts above any EPA criteria.

The existing air quality management measures and monitoring network at WCM are considered appropriate for the Modification and would continue to be implemented for the proposed Modification.

10 REFERENCES

Bureau of Meteorology (2014)

Climate Averages Australia, Bureau of Meteorology website. <http://www.bom.gov.au/climate/averages>

Gregory P. H. (1973)

"The microbiology of the atmosphere", Halstead Press, New York.

Katestone Environmental Pty Ltd (2010)

"NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining", Katestone Environmental Pty Ltd prepared for DECCW, 2010.

NASA (2014)

NASA Worldview Alpha website. <https://earthdata.nasa.gov/labs/worldview/>, accessed May 2014.

NEPC (1988)

"Ambient Air - National Environmental Protection Measure for Ambient Air Quality", National Environment Protection Council, Canberra, 1988

NEPC (2003)

"Variation to the National Environment Protection (Ambient Quality) Measure for Particles as PM2.5", National Environment Protection Council, Canberra, May 2003.

NPI (2012)

"Emission Estimation Technique Manual for Mining Version 3.1", National Pollutant Inventory, January 2012. ISBN 0 642 54700 9

NSW DEC (2005)

"Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales", Department of Environment and Conservation (NSW), August 2005

PAEHolmes (2009)

"Air Quality Impact Assessment Ulan Coal - Continued Operations", Prepared for Umwelt (Australia) Pty Limited on behalf of Ulan Coal Mines Limited by PAEHolmes, September 2009

Pfender W., Graw R., Bradley W., Carney M. And Maxwell L. (2006)

"Use of a complex air pollution model to estimate dispersal and deposition of grass stem rust urendiniospores at landscape scale", Agriculture and Forest Meteorology, Vol 139.

Pleim J., Venkatram A. and Yamartino R. J. (1984)

"ADOM/TADAP model development program, Vol 4, The Dry Deposition Model", Ministry of the Environment, Rexdale, Ontario, Canada.

Slinn S. A. and Slinn W. G. N. (1980)
"Predictions for particle deposition on natural waters", Atmospheric Environment, Vol 14.

SPCC (1983)
"Air Pollution from Coal Mining and Related Developments", State Pollution Control Commission.

SPCC (1986)
"Particle size distributions in dust from opencut mines in the Hunter Valley", Report Number 10636-002-71. Prepared for the State Pollution Control Commission of NSW by Dames & Moore, 41 McLaren Street, North Sydney, NSW, 2060.

TAS (2013)
"Moolarben Coal Project Stage 1 Optimisation Modification Air Quality and Greenhouse Gas Assessment", prepared for EMGA Mitchell McLennan on behalf of Moolarben Coal Operations Pty Limited, May 2013.

US EPA (1985 and updates)
"Compilation of Air Pollutant Emission Factors", AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

WCPL (2011)
"Wilpinjong Coal Mine - Air Quality and Greenhouse Gas Management Plan", Wilpinjong Coal Pty Limited, September 2011

WCPL (2014)
Project Approval for Wilpinjong Coal Pty Limited. Application No. 05-0021, dated February 2014.

Appendix A

Sensitive Receptors

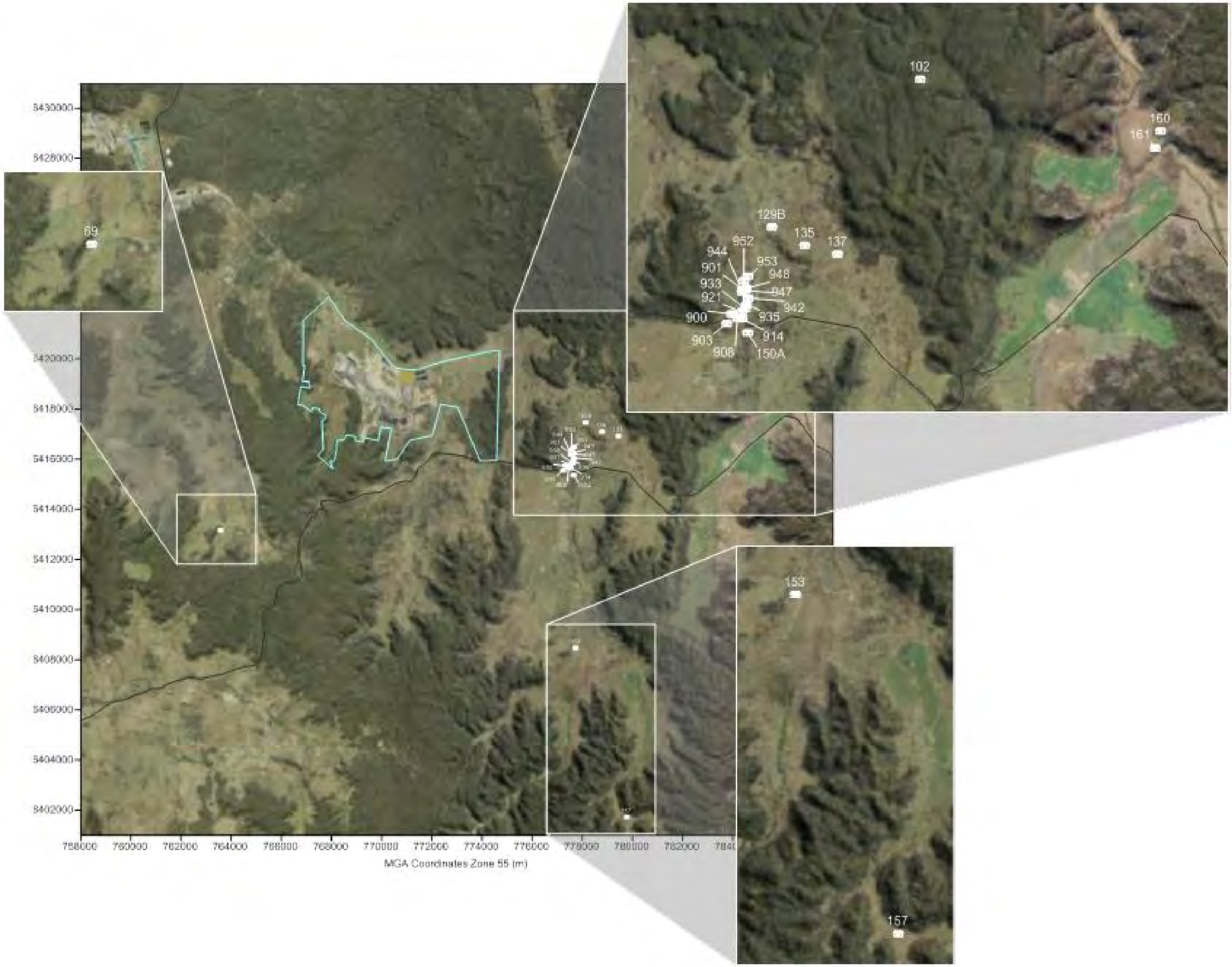

Figure A-1: Privately owned receptors

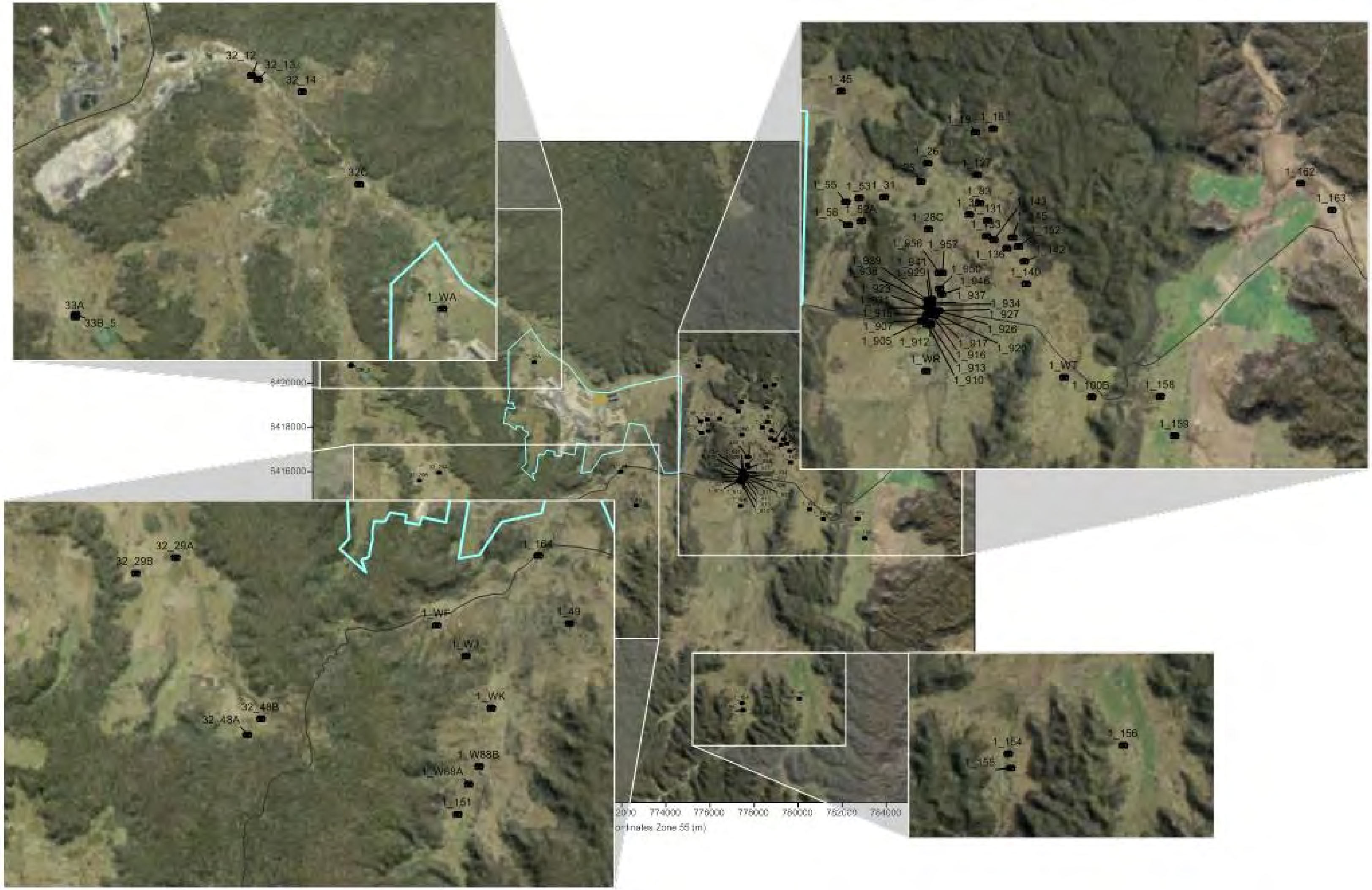

Figure A-2: Mine owned receptors

Table A-1: List of sensitive receptors assessed in the study

ID	Easting (m)	Northing (m)	Ownership	ID	Easting (m)	Northing (m)	Ownership
900	777326.4	6415738.375	Private	1_907	777358.7	6415587	Peabody Energy
150A	777653.5	6415364.8	Private	908	777444.2	6415660	Private
1_917	777583.56	6415700.4	Peabody Energy	1_910	777418.2	6415491	Peabody Energy
935	777632.5167	6415922.014	Community	1_912	777486	6415527	Peabody Energy
1_25	777277.1523	6418726.408	Peabody Energy	1_913	777483.4	6415485	Peabody Energy
1_45	775463.17	6420779.87	Peabody Energy	914	777544.2	6415640	Private
1_49	772652.4	6414452.4	Peabody Energy	1_915	777410.3	6415720	Peabody Energy
1_53	775883.3886	6418355.982	Peabody Energy	1_916	777533.1	6415707	Peabody Energy
1_55	775575.9843	6418269.318	Peabody Energy	1_920	777608.2	6415735	Peabody Energy
1_58	775623.7182	6417748.295	Peabody Energy	921	777533.5	6415777	Private
69	763578.5	6413175.31	Private	1_923	777488.7	6415820	Peabody Energy
1_83	778607.57	6418242.596	Peabody Energy	1_926	777626.2	6415817	Peabody Energy
102	781086.9881	6420412.054	Private	1_927	777674.5	6415806	Peabody Energy
1_18	778908.105	6419925.622	Peabody Energy	1_929	777489.6	6415863	Peabody Energy
1_19	778508.5863	6419847.675	Peabody Energy	1_931	777422.5	6415880	Peabody Energy
1_26	777427.336	6419148.205	Peabody Energy	933	777610.9	6415840	Private
1_30	778368.858	6417985.526	Peabody Energy	1_934	777508.7	6415939	Peabody Energy
1_131	778785.918	6417847.321	Peabody Energy	1_937	777510.2	6415979	Peabody Energy
1_133	778761.112	6417492.39	Peabody Energy	1_938	777439.2	6416006	Peabody Energy
135^	778787.2254	6417101.773	Private	1_939	777434.5	6416041	Peabody Energy
137	779441.087	6416928.983	Private	1_941	777517.2	6416064	Peabody Energy
1_142	779616.175	6416920.596	Peabody Energy	942	777658.2	6416052	Private
1_143	778923.522	6417411.939	Peabody Energy	1_946	777749.8	6416175	Peabody Energy
129^	778134.088	6417466.32	Private	947	777627.9	6416245	Private
1_145	779348.181	6417463.526	Peabody Energy	952	777578.1	6416399	Private
1_136	779221.513	6417218.86	Peabody Energy	953	777659.8	6416492	Private
1_28C	777446.82	6417650.4	Peabody Energy	1_956	777684.2	6416665	Peabody Energy
1_31	776447.8	6418380	Peabody Energy	1_957	777758.8	6416664	Peabody Energy
32_12	763718.6	6426238.7	Moolarben	32_33A	759734.3	6420774	Moolarben
32_13	763859.18	6426157.7	Moolarben	1_151	770123.8	6410133	Peabody Energy
32_14	764861.2	6425875.65	Moolarben	1_152	779483.7	6417262	Peabody Energy
32_32C	766153.5834	6423779.226	Moolarben	1_154	777451.2	6405506	Peabody Energy
32_33B_5	759739.6	6420835.09	Moolarben	1_155	777506.8	6405187	Peabody Energy
1_52A	775932.23	6417837.7	Peabody Energy	1_156	780057.1	6405697	Peabody Energy
32_29B	762840.6	6415592.28	Moolarben	1_158	782692.6	6413867	Peabody Energy
32_29A	763745.75	6415947.25	Moolarben	1_159	783017.2	6412974	Peabody Energy
32_48A	765370.2	6411929.3	Moolarben	1_162	785864.5	6418687	Peabody Energy
32_48B	765679.75	6412291.9	Moolarben	1_163	786574.4	6418088	Peabody Energy
1_W88A	770375.6	6410813.8	Peabody Energy	153	777729.1	6408478	Private
1_W88B	770610.6	6411217.42	Peabody Energy	157	779778.3	6401722	Private
1_WA	768038.45	6420963.69	Peabody Energy	160A	785872	6419380	Private
1_WF	769652.0072	6414414.137	Peabody Energy	160B	785767.7	6419042	Private
1_WJ	770311.98	6413713.59	Peabody Energy	1_127	778549.3	6418884	Peabody Energy
1_WK	770889.96	6412538.44	Peabody Energy	1_140	779655.6	6416414	Peabody Energy
1_WR	777394.78	6414443.9	Peabody Energy	1_950	777695.7	6416304	Peabody Energy
1_WT	780517.2194	6414296.609	Peabody Energy	901	777546.9	6416227	Private
1_100B	781138.6	6413853.3	Peabody Energy	944	777543.5	6416175	Private
903	777235.1	6415546.6	Private	1_164	771950	6415993	Peabody Energy
1_905	777297.2209	6415568.87	Peabody Energy				

^Property under contract of sale to Peabody Energy.

Appendix B

Monitoring data

Table B-1: TEOM monitoring data

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
1/01/2012	12.6	18.5	-	-	1/01/2013	13.8	-	-	-
2/01/2012	14.5	18.1	-	-	2/01/2013	33.8	-	-	-
3/01/2012	16.5	25.1	-	-	3/01/2013	18.6	-	-	-
4/01/2012	32.6	-	-	-	4/01/2013	15.9	-	-	-
5/01/2012	19.7	-	-	-	5/01/2013	25.0	-	-	-
6/01/2012	9.7	-	-	-	6/01/2013	19.2	-	-	-
7/01/2012	14.3	-	-	-	7/01/2013	12.8	-	-	-
8/01/2012	19.5	-	-	-	8/01/2013	26.7	-	-	-
9/01/2012	10.8	-	-	-	9/01/2013	34.8	-	30.3	-
10/01/2012	12.4	-	-	-	10/01/2013	29.1	-	26.4	7.3
11/01/2012	19.4	-	-	-	11/01/2013	23.2	-	19.9	22.0
12/01/2012	12.5	-	-	-	12/01/2013	47.9	-	28.7	36.6
13/01/2012	14.0	4.4	-	-	13/01/2013	29.3	-	29.0	21.4
14/01/2012	15.0	17.0	-	-	14/01/2013	6.4	-	7.4	3.7
15/01/2012	8.9	3.0	-	-	15/01/2013	17.3	-	17.0	10.8
16/01/2012	8.6	3.8	-	-	16/01/2013	25.3	-	23.3	21.1
17/01/2012	12.9	9.8	-	-	17/01/2013	31.2	-	27.6	24.4
18/01/2012	3.4	-	-	-	18/01/2013	53.0	-	37.1	36.1
19/01/2012	11.0	10.1	-	-	19/01/2013	23.7	-	23.4	17.4
20/01/2012	17.3	10.9	-	-	20/01/2013	8.4	-	7.2	3.7
21/01/2012	13.2	6.5	-	-	21/01/2013	11.9	-	12.4	7.3
22/01/2012	10.4	5.8	-	-	22/01/2013	17.6	-	15.4	10.7
23/01/2012	10.6	5.1	-	-	23/01/2013	13.0	-	14.2	8.7
24/01/2012	11.2	5.3	-	-	24/01/2013	12.2	-	12.6	7.3
25/01/2012	5.8	1.1	-	-	25/01/2013	9.6	-	10.1	5.4
26/01/2012	5.4	-	-	-	26/01/2013	10.8	-	10.9	5.8
27/01/2012	9.5	4.8	-	-	27/01/2013	5.5	-	4.6	1.3
28/01/2012	9.1	4.5	-	-	28/01/2013	3.4	-	3.1	-
29/01/2012	9.1	4.5	-	-	29/01/2013	7.0	-	7.9	4.7
30/01/2012	8.1	-	-	-	30/01/2013	18.0	-	17.5	13.4
31/01/2012	14.9	-	-	-	31/01/2013	17.2	-	16.1	15.1
1/02/2012	4.0	-	-	-	1/02/2013	13.2	-	11.9	7.1
2/02/2012	4.4	5.6	-	-	2/02/2013	4.7	-	4.8	1.1
3/02/2012	5.8	-	-	-	3/02/2013	7.6	-	7.6	3.2
4/02/2012	12.4	7.9	-	-	4/02/2013	12.9	-	12.7	9.3
5/02/2012	14.1	10.0	-	-	5/02/2013	4.0	-	13.9	11.0
6/02/2012	22.1	20.0	-	-	6/02/2013	-	-	12.2	7.7
7/02/2012	8.2	2.1	-	-	7/02/2013	14.1	-	16.2	14.0
8/02/2012	14.5	8.0	-	-	8/02/2013	12.0	-	18.1	21.8
9/02/2012	16.1	10.3	-	-	9/02/2013	14.8	-	21.0	20.5
10/02/2012	10.0	-	-	-	10/02/2013	20.1	-	15.0	11.3
11/02/2012	7.4	-	-	-	11/02/2013	23.3	-	7.4	3.2
12/02/2012	10.4	6.3	-	-	12/02/2013	18.1	-	5.7	1.9
13/02/2012	11.4	5.7	-	-	13/02/2013	8.3	-	10.7	10.2
14/02/2012	10.6	6.3	-	-	14/02/2013	6.2	-	9.8	8.3
15/02/2012	10.4	6.5	-	-	15/02/2013	10.5	-	8.8	6.3
16/02/2012	9.3	1.9	-	-	16/02/2013	9.3	-	7.9	4.0
17/02/2012	12.2	7.7	-	-	17/02/2013	8.6	-	10.6	5.6
18/02/2012	10.6	9.5	-	-	18/02/2013	8.0	-	11.5	11.5
19/02/2012	12.8	7.7	-	-	19/02/2013	10.8	-	12.8	14.3
20/02/2012	6.2	-	-	-	20/02/2013	11.4	-	12.7	5.4
21/02/2012	8.2	2.6	-	-	21/02/2013	12.1	-	11.0	8.0
22/02/2012	11.8	9.9	-	-	22/02/2013	11.2	-	12.3	10.2
23/02/2012	10.4	-	-	-	23/02/2013	11.1	-	6.4	3.6
24/02/2012	11.2	4.5	-	-	24/02/2013	12.9	-	9.5	9.5
25/02/2012	9.8	7.4	-	-	25/02/2013	7.4	-	12.7	12.5
26/02/2012	8.3	3.9	-	-	26/02/2013	11.5	-	12.4	13.2

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
27/02/2012	9.0	5.8	-	-	27/02/2013	12.1	-	8.5	14.2
28/02/2012	18.4	-	-	-	28/02/2013	12.5	-	11.7	11.6
29/02/2012	15.3	2.4	-	-	1/03/2013	8.0	-	2.2	3.5
1/03/2012	10.8	2.9	-	-	2/03/2013	13.7	-	5.9	4.6
2/03/2012	3.2	10.7	-	-	3/03/2013	1.5	-	8.1	7.8
3/03/2012	5.3	-	-	-	4/03/2013	6.3	-	14.3	13.1
4/03/2012	-	-	-	-	5/03/2013	8.5	-	12.5	12.2
5/03/2012	8.4	-	-	-	6/03/2013	14.4	-	13.1	16.5
6/03/2012	12.9	4.8	-	-	7/03/2013	13.1	-	12.5	20.5
7/03/2012	7.4	2.3	-	-	8/03/2013	12.9	-	12.3	16.4
8/03/2012	9.0	-	-	-	9/03/2013	11.3	-	8.9	10.3
9/03/2012	12.2	2.0	-	-	10/03/2013	12.0	-	12.7	15.7
10/03/2012	11.8	4.1	-	-	11/03/2013	9.8	-	13.1	14.9
11/03/2012	16.1	8.1	-	-	12/03/2013	13.0	-	11.8	14.6
12/03/2012	14.4	15.5	-	-	13/03/2013	13.0	-	12.2	27.2
13/03/2012	11.1	5.6	-	-	14/03/2013	11.3	-	33.8	40.0
14/03/2012	11.8	5.3	-	-	15/03/2013	12.0	-	16.9	21.8
15/03/2012	12.1	5.8	-	-	16/03/2013	42.9	-	15.7	17.5
16/03/2012	9.7	11.1	-	-	17/03/2013	18.6	-	14.7	16.2
17/03/2012	6.1	2.8	-	-	18/03/2013	17.3	-	14.7	21.3
18/03/2012	9.0	5.8	-	-	19/03/2013	14.6	-	14.4	19.1
19/03/2012	8.0	3.8	-	-	20/03/2013	16.0	-	10.7	13.1
20/03/2012	10.7	6.3	-	-	21/03/2013	15.3	-	10.0	20.9
21/03/2012	6.6	4.1	-	-	22/03/2013	9.8	-	14.2	14.0
22/03/2012	14.2	-	-	-	23/03/2013	10.5	-	9.4	7.9
23/03/2012	16.9	11.4	-	-	24/03/2013	15.0	-	9.2	10.4
24/03/2012	15.1	7.3	-	-	25/03/2013	10.1	-	19.1	18.1
25/03/2012	11.5	10.6	-	-	26/03/2013	10.4	-	26.9	36.2
26/03/2012	12.9	12.1	-	-	27/03/2013	31.3	-	16.4	27.0
27/03/2012	11.8	19.1	-	-	28/03/2013	33.7	-	16.1	21.5
28/03/2012	10.4	7.8	-	-	29/03/2013	17.2	-	10.9	10.2
29/03/2012	10.3	11.4	-	-	30/03/2013	22.5	-	12.5	12.1
30/03/2012	11.0	15.8	-	-	31/03/2013	8.7	-	9.0	9.3
31/03/2012	8.8	14.1	-	-	1/04/2013	12.7	-	10.2	10.3
1/04/2012	15.2	15.1	-	-	2/04/2013	13.7	-	9.9	14.0
2/04/2012	7.5	6.9	-	-	3/04/2013	9.7	-	14.2	16.1
3/04/2012	12.0	11.7	-	-	4/04/2013	10.1	-	9.2	12.8
4/04/2012	15.5	21.6	-	-	5/04/2013	13.9	-	11.5	13.0
5/04/2012	13.4	18.6	-	-	6/04/2013	8.9	-	8.3	12.1
6/04/2012	9.7	11.3	-	-	7/04/2013	8.6	-	7.7	7.8
7/04/2012	36.4	43.0	-	-	8/04/2013	12.6	-	10.4	10.8
8/04/2012	24.6	21.4	-	-	9/04/2013	9.3	-	9.9	14.0
9/04/2012	12.9	8.6	-	-	10/04/2013	7.2	-	6.5	7.6
10/04/2012	7.1	6.1	-	-	11/04/2013	11.3	-	9.5	13.7
11/04/2012	7.1	10.9	-	-	12/04/2013	14.7	-	12.9	16.5
12/04/2012	11.5	11.9	-	-	13/04/2013	7.5	-	8.1	17.6
13/04/2012	7.4	12.5	-	-	14/04/2013	21.9	-	16.4	28.4
14/04/2012	14.0	18.6	-	-	15/04/2013	36.6	-	22.2	31.5
15/04/2012	19.8	24.7	-	-	16/04/2013	15.9	-	14.7	13.8
16/04/2012	10.7	18.3	-	-	17/04/2013	10.9	-	11.7	11.7
17/04/2012	10.1	15.6	-	-	18/04/2013	11.5	-	9.4	14.0
18/04/2012	4.9	4.6	-	-	19/04/2013	26.5	-	13.9	22.7
19/04/2012	5.1	3.9	-	-	20/04/2013	23.0	-	16.1	18.7
20/04/2012	8.9	11.3	-	-	21/04/2013	13.5	-	7.7	16.7
21/04/2012	11.7	15.1	-	-	22/04/2013	19.7	-	10.9	14.9
22/04/2012	13.3	17.7	-	-	23/04/2013	52.2	-	18.7	25.0
23/04/2012	9.2	13.0	-	-	24/04/2013	43.0	-	15.7	28.5
24/04/2012	9.6	6.8	-	-	25/04/2013	57.8	-	19.7	38.0

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
25/04/2012	10.6	5.3	-	-	26/04/2013	63.5	-	16.0	26.2
26/04/2012	10.0	5.9	-	-	27/04/2013	55.3	-	18.3	22.4
27/04/2012	9.8	12.5	-	-	28/04/2013	63.7	-	24.2	37.9
28/04/2012	9.6	20.7	-	-	29/04/2013	79.0	-	27.7	57.6
29/04/2012	10.4	8.0	-	-	30/04/2013	49.7	-	31.9	68.3
30/04/2012	10.6	15.8	-	-	1/05/2013	28.2	-	24.1	38.4
1/05/2012	6.0	12.4	-	-	2/05/2013	14.0	-	19.4	24.4
2/05/2012	7.4	12.5	-	-	3/05/2013	18.5	-	17.4	32.6
3/05/2012	5.0	1.8	-	-	4/05/2013	80.1	-	27.3	35.4
4/05/2012	10.5	4.7	-	-	5/05/2013	21.8	-	25.1	26.8
5/05/2012	10.0	6.6	-	-	6/05/2013	11.3	-	14.9	17.7
6/05/2012	15.1	6.2	-	-	7/05/2013	16.6	-	30.8	6.2
7/05/2012	12.1	6.9	-	-	8/05/2013	8.8	-	12.3	14.9
8/05/2012	16.5	7.7	-	-	9/05/2013	12.2	-	13.1	34.9
9/05/2012	23.1	14.2	-	-	10/05/2013	16.6	-	16.4	37.9
10/05/2012	21.2	11.2	-	-	11/05/2013	17.3	-	16.1	32.3
11/05/2012	36.5	14.1	-	-	12/05/2013	10.1	-	8.8	31.9
12/05/2012	18.8	12.8	-	-	13/05/2013	10.7	-	8.1	33.5
13/05/2012	16.2	9.2	-	-	14/05/2013	8.3	-	4.1	9.4
14/05/2012	10.2	6.5	-	-	15/05/2013	15.3	-	8.0	10.3
15/05/2012	16.6	14.1	-	-	16/05/2013	16.0	-	7.9	8.9
16/05/2012	15.1	14.7	-	-	17/05/2013	14.5	-	9.1	10.2
17/05/2012	13.7	16.3	-	-	18/05/2013	12.2	-	8.7	10.4
18/05/2012	17.2	15.4	-	-	19/05/2013	11.0	-	7.7	9.5
19/05/2012	18.6	11.8	-	-	20/05/2013	15.6	-	10.5	15.8
20/05/2012	19.7	16.5	-	-	21/05/2013	23.0	-	12.9	21.4
21/05/2012	14.0	27.9	-	-	22/05/2013	13.2	-	11.2	13.9
22/05/2012	24.2	12.6	-	-	23/05/2013	4.9	-	4.8	4.5
23/05/2012	24.8	16.2	-	-	24/05/2013	7.1	-	8.1	6.8
24/05/2012	13.7	21.6	-	-	25/05/2013	6.0	-	7.5	8.0
25/05/2012	5.5	3.8	-	-	26/05/2013	14.4	-	9.5	10.9
26/05/2012	9.2	4.2	-	-	27/05/2013	10.8	-	9.5	13.1
27/05/2012	5.5	4.2	-	-	28/05/2013	7.9	-	7.3	11.5
28/05/2012	7.9	10.2	-	-	29/05/2013	8.2	-	7.6	11.7
29/05/2012	8.3	11.2	-	-	30/05/2013	9.5	-	11.0	19.9
30/05/2012	5.8	7.7	-	-	31/05/2013	13.2	-	10.5	16.6
31/05/2012	7.2	-	-	-	1/06/2013	12.8	-	9.0	15.5
1/06/2012	8.2	-	-	-	2/06/2013	3.7	-	4.2	2.8
2/06/2012	4.6	-	-	-	3/06/2013	9.4	-	6.5	8.9
3/06/2012	4.9	-	-	-	4/06/2013	6.3	-	9.2	15.3
4/06/2012	5.2	-	-	-	5/06/2013	-	-	10.6	20.3
5/06/2012	7.0	-	-	-	6/06/2013	18.3	-	13.1	26.8
6/06/2012	1.9	-	-	-	7/06/2013	8.4	-	8.3	7.9
7/06/2012	5.5	-	-	-	8/06/2013	7.6	-	8.0	7.3
8/06/2012	4.8	-	-	-	9/06/2013	6.3	-	8.0	5.7
9/06/2012	6.0	3.1	-	-	10/06/2013	8.1	-	8.1	8.2
10/06/2012	7.4	10.0	-	-	11/06/2013	5.5	-	4.9	4.8
11/06/2012	4.2	12.5	-	-	12/06/2013	4.1	-	5.9	5.7
12/06/2012	-	3.2	-	-	13/06/2013	6.2	-	5.4	4.1
13/06/2012	7.6	7.9	-	-	14/06/2013	4.9	-	3.6	4.6
14/06/2012	7.0	7.6	-	-	15/06/2013	8.3	-	6.0	6.7
15/06/2012	8.5	8.3	-	-	16/06/2013	7.2	-	5.6	6.6
16/06/2012	8.4	5.6	-	-	17/06/2013	10.6	-	6.4	7.6
17/06/2012	7.7	-	-	-	18/06/2013	10.2	-	7.7	8.6
18/06/2012	6.1	-	-	-	19/06/2013	10.0	-	8.5	10.8
19/06/2012	5.1	-	-	-	20/06/2013	10.0	-	9.1	14.6
20/06/2012	7.4	-	-	-	21/06/2013	5.0	-	7.1	9.4
21/06/2012	8.5	7.8	-	-	22/06/2013	6.6	-	8.4	9.8

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
22/06/2012	8.6	-	-	-	23/06/2013	6.3	-	6.3	5.6
23/06/2012	5.3	-	-	-	24/06/2013	7.1	-	4.3	5.4
24/06/2012	8.7	-	-	-	25/06/2013	4.7	-	5.2	5.0
25/06/2012	8.8	2.2	-	-	26/06/2013	13.0	-	9.0	9.8
26/06/2012	5.9	8.6	-	-	27/06/2013	7.6	-	6.8	5.1
27/06/2012	7.4	-	-	-	28/06/2013	6.7	-	6.7	6.2
28/06/2012	5.6	-	-	-	29/06/2013	5.0	-	4.5	3.6
29/06/2012	7.1	19.6	-	-	30/06/2013	4.8	-	4.2	4.4
30/06/2012	9.8	3.8	-	-	1/07/2013	5.0	-	5.9	6.8
1/07/2012	14.2	5.3	-	-	2/07/2013	10.9	-	9.5	12.4
2/07/2012	7.5	-	-	-	3/07/2013	9.5	-	11.4	12.2
3/07/2012	8.5	-	-	-	4/07/2013	16.6	-	12.1	16.2
4/07/2012	9.2	7.9	-	-	5/07/2013	14.1	-	9.4	13.4
5/07/2012	7.5	4.2	-	-	6/07/2013	16.4	-	9.8	17.2
6/07/2012	6.1	7.4	-	-	7/07/2013	15.8	-	10.1	15.6
7/07/2012	5.3	-	-	-	8/07/2013	11.1	-	8.5	18.5
8/07/2012	6.1	20.0	-	-	9/07/2013	9.4	-	9.7	8.1
9/07/2012	5.9	-	-	-	10/07/2013	6.4	-	6.8	5.1
10/07/2012	5.1	-	-	-	11/07/2013	6.9	-	8.2	6.5
11/07/2012	4.8	-	-	-	12/07/2013	8.2	-	7.8	7.9
12/07/2012	4.9	7.9	-	-	13/07/2013	8.0	-	7.6	7.6
13/07/2012	6.9	5.0	-	-	14/07/2013	9.9	-	12.4	9.7
14/07/2012	9.3	2.1	-	-	15/07/2013	9.2	-	9.8	9.3
15/07/2012	5.3	-	-	-	16/07/2013	6.6	-	6.8	6.3
16/07/2012	-	-	-	-	17/07/2013	5.6	-	6.6	6.2
17/07/2012	-	-	-	-	18/07/2013	6.5	-	7.2	6.6
18/07/2012	11.2	-	-	-	19/07/2013	6.1	-	6.5	5.6
19/07/2012	5.8	-	-	-	20/07/2013	9.1	-	7.0	5.9
20/07/2012	9.4	-	-	-	21/07/2013	10.7	-	8.7	7.0
21/07/2012	8.7	-	-	-	22/07/2013	16.5	-	9.5	11.6
22/07/2012	6.9	-	-	-	23/07/2013	12.1	-	7.5	9.8
23/07/2012	9.4	-	-	-	24/07/2013	10.9	-	8.8	15.4
24/07/2012	6.0	-	-	-	25/07/2013	12.2	-	11.9	20.2
25/07/2012	6.5	-	-	-	26/07/2013	17.1	-	12.6	18.9
26/07/2012	6.1	-	-	-	27/07/2013	14.3	-	12.7	17.6
27/07/2012	6.8	-	-	-	28/07/2013	10.9	-	11.5	16.0
28/07/2012	5.4	-	-	-	29/07/2013	11.1	-	10.1	19.8
29/07/2012	4.6	-	-	-	30/07/2013	13.6	-	12.2	16.7
30/07/2012	5.7	-	-	-	31/07/2013	11.3	-	11.0	13.0
31/07/2012	6.6	-	-	-	1/08/2013	6.3	-	8.0	10.8
1/08/2012	6.3	-	-	-	2/08/2013	17.9	-	11.5	14.4
2/08/2012	9.3	-	-	-	3/08/2013	17.7	-	8.6	13.2
3/08/2012	10.9	4.6	-	-	4/08/2013	22.0	-	11.3	11.9
4/08/2012	13.0	4.3	-	-	5/08/2013	23.7	-	15.6	25.7
5/08/2012	14.6	6.6	-	-	6/08/2013	22.2	-	13.9	28.9
6/08/2012	13.6	5.8	-	-	7/08/2013	12.5	-	11.5	15.5
7/08/2012	13.9	5.0	-	-	8/08/2013	7.1	-	3.7	2.1
8/08/2012	13.2	6.4	-	-	9/08/2013	11.6	-	6.8	11.1
9/08/2012	10.4	5.2	-	-	10/08/2013	12.1	-	8.7	9.4
10/08/2012	6.8	3.7	-	-	11/08/2013	12.0	-	8.8	9.4
11/08/2012	6.1	4.7	-	-	12/08/2013	11.0	-	7.4	9.5
12/08/2012	11.1	9.9	-	-	13/08/2013	17.6	-	10.6	11.3
13/08/2012	7.9	-	-	-	14/08/2013	20.6	-	13.3	16.3
14/08/2012	17.2	-	-	-	15/08/2013	7.6	-	7.9	9.7
15/08/2012	16.7	-	-	-	16/08/2013	11.0	-	10.3	12.6
16/08/2012	10.7	-	-	-	17/08/2013	15.5	-	13.4	13.1
17/08/2012	-	-	-	-	18/08/2013	11.5	-	9.2	11.7
18/08/2012	-	-	-	-	19/08/2013	12.7	-	8.9	11.2

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
19/08/2012	5.6	-	-	-	20/08/2013	8.1	-	7.2	7.2
20/08/2012	7.9	-	-	-	21/08/2013	12.3	-	9.5	10.7
21/08/2012	11.6	-	-	-	22/08/2013	20.8	-	12.7	15.2
22/08/2012	11.2	-	-	-	23/08/2013	13.2	-	10.1	11.3
23/08/2012	-	-	-	-	24/08/2013	8.6	-	5.3	8.0
24/08/2012	-	-	-	-	25/08/2013	13.3	-	9.4	12.0
25/08/2012	9.2	-	-	-	26/08/2013	14.5	-	10.6	11.7
26/08/2012	6.6	-	-	-	27/08/2013	19.0	-	13.9	15.8
27/08/2012	8.2	-	-	-	28/08/2013	16.4	-	12.5	28.7
28/08/2012	12.3	-	-	-	29/08/2013	16.3	-	20.6	24.1
29/08/2012	14.7	-	-	-	30/08/2013	27.4	-	23.3	20.9
30/08/2012	20.1	-	-	-	31/08/2013	26.3	-	13.2	22.3
31/08/2012	10.0	-	-	-	1/09/2013	15.1	-	11.6	15.6
1/09/2012	3.6	-	-	-	2/09/2013	13.4	-	14.9	39.5
2/09/2012	16.0	-	-	-	3/09/2013	11.8	-	14.2	22.7
3/09/2012	12.0	-	-	-	4/09/2013	11.1	-	13.5	28.1
4/09/2012	9.5	-	-	-	5/09/2013	32.5	-	21.4	42.4
5/09/2012	23.0	17.3	-	-	6/09/2013	25.9	-	19.1	44.8
6/09/2012	34.0	21.2	-	-	7/09/2013	30.7	-	19.1	41.4
7/09/2012	36.6	18.1	-	-	8/09/2013	28.5	-	22.9	36.2
8/09/2012	32.5	11.3	-	-	9/09/2013	25.3	-	21.0	37.2
9/09/2012	14.5	-	-	-	10/09/2013	34.0	-	26.3	28.9
10/09/2012	23.5	4.7	-	-	11/09/2013	17.1	-	9.7	22.6
11/09/2012	27.0	17.7	-	-	12/09/2013	24.4	-	12.5	25.2
12/09/2012	24.0	25.2	-	-	13/09/2013	11.8	-	12.7	13.8
13/09/2012	17.6	20.8	-	-	14/09/2013	17.0	-	16.5	31.1
14/09/2012	7.1	2.5	-	-	15/09/2013	31.6	-	12.9	16.3
15/09/2012	13.5	7.6	-	-	16/09/2013	5.2	-	5.7	4.6
16/09/2012	11.6	18.6	-	-	17/09/2013	5.9	-	5.6	5.4
17/09/2012	19.9	17.6	-	-	18/09/2013	18.0	-	11.2	14.5
18/09/2012	7.7	14.0	-	-	19/09/2013	27.3	-	12.7	28.4
19/09/2012	5.1	1.8	-	-	20/09/2013	55.2	-	17.4	22.6
20/09/2012	7.4	13.5	-	-	21/09/2013	28.4	-	12.0	19.2
21/09/2012	14.8	8.8	-	-	22/09/2013	36.8	-	16.6	27.9
22/09/2012	15.4	4.3	-	-	23/09/2013	41.8	-	13.3	34.4
23/09/2012	18.9	20.8	-	-	24/09/2013	29.7	-	18.0	28.0
24/09/2012	18.6	9.3	-	-	25/09/2013	23.2	-	14.3	29.4
25/09/2012	15.6	19.5	-	-	26/09/2013	68.2	-	22.1	71.6
26/09/2012	16.4	21.4	-	-	27/09/2013	35.7	-	20.4	26.5
27/09/2012	17.1	32.2	-	-	28/09/2013	35.3	-	16.7	21.8
28/09/2012	21.2	26.5	-	-	29/09/2013	36.4	-	16.1	29.1
29/09/2012	10.2	5.2	-	-	30/09/2013	60.4	-	19.8	31.8
30/09/2012	9.2	4.3	-	-	1/10/2013	34.5	-	22.0	42.6
1/10/2012	12.5	12.4	-	-	2/10/2013	27.7	-	9.4	15.6
2/10/2012	10.4	10.2	-	-	3/10/2013	19.0	-	10.7	9.1
3/10/2012	18.1	12.7	-	-	4/10/2013	15.8	-	11.4	15.8
4/10/2012	25.8	12.8	-	-	5/10/2013	20.3	-	11.7	19.6
5/10/2012	32.5	11.7	-	-	6/10/2013	41.5	-	17.1	27.3
6/10/2012	34.3	28.2	-	-	7/10/2013	10.6	-	13.3	14.7
7/10/2012	11.1	4.4	-	-	8/10/2013	13.4	-	12.5	11.1
8/10/2012	17.5	16.0	-	-	9/10/2013	7.0	-	12.1	10.3
9/10/2012	16.5	7.5	-	-	10/10/2013	51.9	-	24.7	33.1
10/10/2012	17.5	10.0	-	-	11/10/2013	17.5	-	11.5	16.4
11/10/2012	16.5	20.4	-	-	12/10/2013	44.7	-	15.9	29.5
12/10/2012	7.4	1.7	-	-	13/10/2013	74.2	-	38.9	31.3
13/10/2012	11.0	3.7	-	-	14/10/2013	9.3	-	9.2	6.6
14/10/2012	9.9	10.1	-	-	15/10/2013	13.3	-	8.3	16.9
15/10/2012	18.5	14.0	-	-	16/10/2013	37.2	-	13.6	29.6

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
16/10/2012	30.5	13.7	-	-	17/10/2013	47.6	-	27.7	29.7
17/10/2012	25.0	12.6	-	-	18/10/2013	51.0	-	51.7	54.2
18/10/2012	21.9	27.3	-	-	19/10/2013	47.3	-	49.6	55.7
19/10/2012	27.4	24.7	-	-	20/10/2013	42.6	-	36.7	50.1
20/10/2012	23.0	20.6	-	-	21/10/2013	31.8	-	18.0	30.7
21/10/2012	20.2	14.6	-	-	22/10/2013	24.8	-	20.1	24.3
22/10/2012	11.9	10.4	-	-	23/10/2013	17.8	-	9.5	10.7
23/10/2012	15.9	13.5	-	-	24/10/2013	10.7	-	8.5	10.9
24/10/2012	15.9	13.8	-	-	25/10/2013	21.8	-	13.3	22.4
25/10/2012	60.3	50.8	-	-	26/10/2013	15.0	-	11.2	17.0
26/10/2012	27.0	13.6	-	-	27/10/2013	26.3	-	22.9	22.9
27/10/2012	13.5	8.5	-	-	28/10/2013	38.6	-	37.8	42.4
28/10/2012	20.8	13.6	-	-	29/10/2013	36.1	-	19.3	27.2
29/10/2012	17.1	16.8	-	-	30/10/2013	13.9	-	15.4	19.2
30/10/2012	17.5	14.0	-	-	31/10/2013	18.2	-	20.7	30.3
31/10/2012	17.8	10.6	-	-	1/11/2013	29.1	-	19.4	27.0
1/11/2012	33.3	21.9	-	-	2/11/2013	31.3	-	18.8	26.6
2/11/2012	16.7	11.2	-	-	3/11/2013	45.3	-	21.0	41.2
3/11/2012	15.1	9.0	-	-	4/11/2013	33.2	-	39.8	38.9
4/11/2012	17.8	12.4	-	-	5/11/2013	28.0	-	30.4	29.2
5/11/2012	18.4	28.9	-	-	6/11/2013	37.1	-	38.8	39.0
6/11/2012	23.4	36.0	-	-	7/11/2013	33.5	-	34.4	43.0
7/11/2012	26.8	18.5	-	-	8/11/2013	30.3	-	26.1	35.1
8/11/2012	11.5	5.1	-	-	9/11/2013	19.6	-	9.9	13.9
9/11/2012	6.2	1.6	-	-	10/11/2013	24.0	-	27.1	19.8
10/11/2012	13.8	10.0	-	-	11/11/2013	6.1	-	6.0	7.4
11/11/2012	13.2	7.3	-	-	12/11/2013	5.9	-	5.0	12.9
12/11/2012	12.8	7.1	-	-	13/11/2013	16.5	-	10.3	20.4
13/11/2012	29.1	17.9	-	-	14/11/2013	24.6	-	10.9	28.5
14/11/2012	22.2	13.1	-	-	15/11/2013	21.3	-	18.5	15.9
15/11/2012	16.5	8.5	-	-	16/11/2013	8.9	-	7.9	9.2
16/11/2012	14.4	9.9	-	-	17/11/2013	5.1	-	3.6	3.7
17/11/2012	10.4	6.2	-	-	18/11/2013	6.9	-	6.4	6.1
18/11/2012	9.5	4.1	-	-	19/11/2013	7.0	-	6.2	5.4
19/11/2012	11.7	12.7	-	-	20/11/2013	11.7	-	13.9	12.9
20/11/2012	12.2	10.0	-	-	21/11/2013	13.3	-	13.3	16.5
21/11/2012	15.4	11.7	-	-	22/11/2013	10.6	-	10.6	11.4
22/11/2012	21.9	5.7	-	-	23/11/2013	5.5	-	5.8	10.2
23/11/2012	22.2	13.1	-	-	24/11/2013	11.2	-	11.5	13.9
24/11/2012	18.4	12.3	-	-	25/11/2013	11.8	-	12.2	13.5
25/11/2012	18.8	14.9	-	-	26/11/2013	17.1	-	17.6	17.9
26/11/2012	26.8	25.8	-	-	27/11/2013	16.4	-	15.6	20.0
27/11/2012	16.2	8.7	-	-	28/11/2013	21.2	-	19.0	24.9
28/11/2012	15.6	11.6	-	-	29/11/2013	29.2	-	19.9	16.5
29/11/2012	17.2	12.5	-	-	30/11/2013	-	-	14.1	12.0
30/11/2012	25.0	26.8	-	-	1/12/2013	-	-	10.5	10.5
1/12/2012	22.9	24.3	-	-	2/12/2013	-	-	14.2	12.2
2/12/2012	17.7	13.1	-	-	3/12/2013	-	-	13.3	18.4
3/12/2012	6.5	4.3	-	-	4/12/2013	-	-	18.5	22.4
4/12/2012	14.2	5.8	-	-	5/12/2013	-	-	12.5	16.7
5/12/2012	20.5	11.8	-	-	6/12/2013	-	-	6.2	7.1
6/12/2012	36.2	13.0	-	-	7/12/2013	-	-	11.8	14.2
7/12/2012	30.1	20.3	-	-	8/12/2013	-	-	13.7	18.9
8/12/2012	24.0	27.7	-	-	9/12/2013	-	-	22.5	27.8
9/12/2012	29.2	31.0	-	-	10/12/2013	3.5	-	12.8	13.8
10/12/2012	7.7	3.1	-	-	11/12/2013	-	-	14.2	22.1
11/12/2012	8.8	3.7	-	-	12/12/2013	18.2	-	18.0	20.3
12/12/2012	10.8	4.4	-	-	13/12/2013	23.3	-	20.1	23.8

Date	TEOM1	TEOM2	TEOM3	TEOM4	Date	TEOM1	TEOM2	TEOM3	TEOM4
13/12/2012	11.3	9.7	-	-	14/12/2013	7.5	-	20.7	39.5
14/12/2012	19.2	21.7	-	-	15/12/2013	20.2	-	17.3	15.3
15/12/2012	20.4	28.2	-	-	16/12/2013	3.4	-	12.1	11.1
16/12/2012	14.3	14.2	-	-	17/12/2013	4.1	-	12.4	11.1
17/12/2012	31.3	13.0	-	-	18/12/2013	13.3	-	14.8	11.7
18/12/2012	17.0	16.7	-	-	19/12/2013	11.7	-	11.9	17.4
19/12/2012	22.6	18.2	-	-	20/12/2013	28.9	-	25.6	29.8
20/12/2012	19.2	14.5	-	-	21/12/2013	38.6	-	39.2	41.6
21/12/2012	22.6	14.7	-	-	22/12/2013	20.8	-	21.0	24.6
22/12/2012	18.8	1.1	-	-	23/12/2013	31.0	-	25.8	23.4
23/12/2012	14.2	23.3	-	-	24/12/2013	11.9	-	11.9	13.6
24/12/2012	14.4	23.8	-	-	25/12/2013	9.5	-	10.2	12.4
25/12/2012	4.7	10.3	-	-	26/12/2013	6.2	-	6.0	3.9
26/12/2012	10.4	-	-	-	27/12/2013	9.8	-	10.3	8.7
27/12/2012	16.2	-	-	-	28/12/2013	10.6	-	10.4	9.8
28/12/2012	17.7	-	-	-	29/12/2013	32.9	-	30.5	23.3
29/12/2012	22.7	-	-	-	30/12/2013	28.2	-	31.7	24.6
30/12/2012	22.3	-	-	-	31/12/2013	19.3	-	21.0	21.4
31/12/2012	19.6	-	-	-					

Table B-1: HVAS monitoring data

DATE	HV1	HV2	HV3	HV4	HV5
3/01/2012	13.9	25.3	24.5	21.8	-
9/01/2012	12	13	25.2	14.1	-
15/01/2012	8.3	11.2	13.3	10	-
21/01/2012	13	12.5	17.2	11.9	-
27/01/2012	10.1	9.6	14.5	9.7	-
2/02/2012	3.1	3.8	5.5	4	-
8/02/2012	8.8	12.4	20.7	10.3	-
14/02/2012	7.5	12.3	13.9	7.3	-
20/02/2012	4.6	5.5	9.4	9.4	-
26/02/2012	5.4	6.9	11.4	8.7	-
3/03/2012	2.8	3.1	4.1	2.9	-
9/03/2012	6.1	12.8	17.9	8	-
15/03/2012	6.1	12.8	17.9	8	-
21/03/2012	4.6	6.7	11.2	5.8	-
27/03/2012	9.7	-	16.6	10.7	-
2/04/2012	5.5	6.1	9.3	7	-
8/04/2012	21.7	23.6	37.5	20.6	-
14/04/2012	9.9	22.4	19.5	12	-
20/04/2012	5.8	12.4	12.7	7.2	-
26/04/2012	6.9	5.2	15.6	7.4	-
2/05/2012	5.4	8.9	8.5	5.6	-
8/05/2012	8.3	8.6	24.8	7	-
14/05/2012	8.6	9.3	19	13.6	-
20/05/2012	13.1	30.1	24.6	-	-
26/05/2012	4.9	3.2	13	3.4	-
1/06/2012	7.3	11.9	6.6	4.5	-
7/06/2012	4	8.3	5.1	2	-
13/06/2012	13.1	5.9	6	4.5	-
19/06/2012	3.1	3.4	2.9	5.3	-
25/06/2012	7.7	5.4	11.8	5.5	-
1/07/2012	7.3	6.6	25	5.4	-
7/07/2012	6.2	11.9	3.9	5.8	-
13/07/2012	4.2	6.4	7.3	4.3	-
19/07/2012	7.8	7	5.9	4.2	-
25/07/2012	5.4	8.2	6.2	-	-
31/07/2012	7.7	6.9	7.3	6.1	-

DATE	HV1	HV2	HV3	HV4	HV5
6/08/2012	6.5	8.5	26.4	7.4	-
12/08/2012	6.8	13.8	1.9	-	-
18/08/2012	5.9	4.5	35.4	3.5	-
24/08/2012	7.1	5.9	23.2	5.6	-
30/08/2012	11.1	10.1	35.2	9.9	-
5/09/2012	16.1	12.1	38.8	-	-
11/09/2012	16.9	34.2	40.4	16.8	-
17/09/2012	10.1	25.6	24.1	-	-
23/09/2012	10.1	19.8	33.2	-	-
29/09/2012	7.3	7.4	17.8	7.2	-
5/10/2012	13.2	16	47	20.2	-
11/10/2012	-	7.1	20.8	6.7	-
17/10/2012	14.4	32.2	36.4	18.4	-
23/10/2012	10.6	47.6	26.8	11.7	-
29/10/2012	12.2	29.9	25.3	15	-
4/11/2012	15.4	30.5	26.5	15.6	-
10/11/2012	8.4	14.3	18.1	9.8	-
16/11/2012	8	10.6	19.8	13.1	-
22/11/2012	14.8	29.3	29.9	16.9	-
28/11/2012	13	14.9	18.3	13	-
4/12/2012	10.6	12.4	26.9	11.3	-
10/12/2012	5.2	10.8	12.8	16.9	-
16/12/2012	10.9	18.5	22	15.3	-
22/12/2012	12.9	17.7	24	14.7	-
28/12/2012	13.7	23	24	14.3	-
3/01/2013	12.6	22	23.4	13.6	-
9/01/2013	29.3	-	44.3	29.7	-
15/01/2013	13.1	-	26.2	17.2	16.1
21/01/2013	12.3	-	21.2	13.8	13
27/01/2013	4.5	-	8	5.5	5.2
2/02/2013	4.3	-	6.5	5.8	4.5
8/02/2013	14.4	-	30	26	25.5
14/02/2013	6.8	-	15.2	8.2	8.8
20/02/2013	12.2	-	21	12.7	15.3
26/02/2013	10.5	-	17.5	10.8	12.6
4/03/2013	10.4	-	18.4	10.5	12.4
10/03/2013	9.9	-	17.5	11.5	12.7
16/03/2013	14.9	-	29.2	13.7	16
22/03/2013	9.6	-	26.1	16.2	12.5
28/03/2013	11.5	-	31	14.9	18.6
3/04/2013	9	-	18.8	8.9	13
8/04/2013	6.8	-	10	7.7	10.1
14/04/2013	16	-	51.2	18.1	25.5
20/04/2013	5.6	-	16	6.7	13
26/04/2013	18.4	-	63.7	18.3	19.5
2/05/2013	14	-	37.4	14.4	27.4
9/05/2013	10.9	-	15.2	14.6	41
15/05/2013	6.2	-	6.9	-	43.3
21/05/2013	9.8	-	44	-	18.7
27/05/2013	6.6	-	13.5	-	9.6
2/06/2013	1.2	-	3.1	2	1.8
8/06/2013	5.5	-	8	4	4.8
14/06/2013	3.3	-	6.5	2.8	2.8
20/06/2013	6.8	-	6.4	9.8	9.2
26/06/2013	5.5	-	13.8	6	4.5
2/07/2013	6.7	-	12.5	6.2	8.4
8/07/2013	6.3	-	13	8.4	11.8
14/07/2013	10.2	-	9.2	8.8	7.4

DATE	HV1	HV2	HV3	HV4	HV5
20/07/2013	4.6	-	18.9	3.6	5
26/07/2013	9.6	-	28	7.2	18.5
1/08/2013	5	-	7.9	5.8	7.9
7/08/2013	6.9	-	27.1	8.9	11.6
13/08/2013	7.1	-	35.1	5.6	9.7
19/08/2013	6.1	-	24	9.5	9.8
25/08/2013	6.8	-	30.7	7	12.9
31/08/2013	10.5	-	47.7	12.2	19.6
6/09/2013	13.7	-	42.9	16.4	36
12/09/2013	10.2	-	44.8	11.2	23.5
18/09/2013	8.3	-	33.5	8.2	9.4
24/09/2013	13.9	-	52.9	18.9	25.2
30/09/2013	14.1	-	77.6	17.6	25.3
6/10/2013	10.9	-	63.1	16.1	28.8
12/10/2013	11	-	58	18.4	22.5
18/10/2013	43.7	-	65.1	55.1	49.8
24/10/2013	6.1	-	23.8	7.4	15.9
30/10/2013	11.2	-	20.8	3.7	14
5/11/2013	27.1	-	40.3	31.5	26.4
11/11/2013	5.8	-	11.7	5.1	6.3
17/11/2013	2.9	-	7.7	3.1	3.3
23/11/2013	6.7	-	10.9	7.2	7.8
29/11/2013	15.1	-	33	16.2	15.3
5/12/2013	10	-	34.7	8.9	13
11/12/2013	10.7	-	28.7	13.3	17.3
17/12/2013	10.5	-	21	10.6	-
23/12/2013	22.9	-	50.7	39.3	-
29/12/2013	24.5	-	49.4	26.1	-
4/01/2014	15.7	-	32.9	14.8	15.6
10/01/2014	27.7	-	36.8	26.4	30.7
16/01/2014	41.2	-	56.7	37.7	47.8
22/01/2014	8.5	-	17.5	9.1	8.4
28/01/2014	6.7	-	18.1	10	11.1

Appendix C
CALMET/CALPUFF Input Variables

Table C-1: CALMET input variables

Parameter	Value
Terrain radius of influence (TERRAD)	10km
Vertical extrapolation of surface wind observations (IEXTRP)	-4
Layer dependent weighting factor of surface vs. upper air wind observations (BIAS [NZ])	-1,-0.5,-0.25,0,0,0,0,0
Weighting parameter for Step 1 wind field vs. Observations	R1 = 0.5km, R2 = 0.5km
Maximum radius of influence for meteorological stations in Layer 1 and layers aloft	RMAX1=1.0km, RMAX2=1.0km

Table C-2: CALPUFF input variables

Parameter	Used option	Value
Aqueous phase transformation modelled?	No	0
Boundary conditions modelled?	No	0
CGRUP (Species groups)	PM2.5, PM10 and TSP	-
Chemical transformation	Not modelled	0
Dry deposition modelled?	Yes	1
Gravitational settling (plume tilt) modelled?	No	0
Horizontal size of puff (m) beyond which time-dependent dispersion equations (Heffter) are used to determine sigma-y and sigma-z	Default	550
Individual source conditions saved?	No	0
Maximum length of a slug (met. grid units)	Default	1
Maximum mixing height	Default	3000
Maximum number of sampling steps for one puff/slug during one time step	-	60
Maximum number of slugs/puffs release from one source during one time step	-	60
Maximum sigma z allowed to avoid numerical problem in calculating virtual time or distance	Default	5.00E+06
Maximum travel distance of a puff/slug during one sampling step	Default	1
Method used to compute dispersion coefficients?	Internally calculated sigma v, sigma w using micrometeorological variables	2
Method used for lagrangian timescale for Sigma-y	Draxler default 617.284	0
Method used to compute turbulence sigma-v & sigma-w using micrometeorological variables	Standard CALPUFF subroutines	1
Minimum mixing height	Default	50
Minimum sigma y for a new puff/slug	Default	1
Minimum sigma z for a new puff/slug	Default	1
Minimum turbulence velocities sigma-v and sigma-w for each stability class over land and over water	Default	-
Near-field puffs modelled as elongated slugs?	No	0
Plume path coefficients for each stability class	Default	-
Potential temperature gradient for stable classes E, F	Default	-
Puff splitting allowed?	No	0
Range of land use categories for which urban dispersion is assumed	Default	-
Slug - to - puff transition criterion factor	Default	10
Stability class used to determine plume growth rates for puffs above the boundary layer	Default	5
Sub grid-scale complex terrain	Not Modelled	0
Switch for using Heffter equation for sigma-z	Default(Not use Heffter)	0
Terrain adjustment method	Default(Partial plume path adjustment)	3
Vegetation state in unirrigated areas	Default(Active and unstressed)	1
Vertical dispersion constant for stable conditions	Default	0.01
Vertical distribution used in the near field	Default (Gaussian)	1
Wet removal modelled?	No	0
Wind speed classes	Default	-
Wind speed profile power-law exponents for stabilities	Default	-

Appendix D

Emission Inventory

WCM - Emission Calculation

The mining schedule and mine plan designs provided by WCPL have been combined with emissions factor equations that relate to the quantity of dust emitted from particular activities based on intensity, the prevailing meteorological conditions and composition of the material being handled.

Emission factors and associated controls have been sourced from the United States (US) EPA AP42 Emission Factors (**US EPA, 1985 and Updates**), the National Pollutant Inventory (NPI) document "*Emission Estimation Technique Manual for Mining, Version 3.1*" (**NPI, 2012**), the State Pollution Control Commission document "*Air Pollution from Coal Mining and Related Developments*" (**SPCC, 1983**) and the Office of Environment and Heritage document, "*NSW Coal Mining Benchmarking Study: International Best Practise Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*", prepared by Katestone Environmental (**Katestone Environmental, 2010**).

The emission factor equations used for each dust generating activity are outlined in **Table D-1** below. Detailed emission inventories for each modelled year are presented in **Table D-2** to **Table D-3**.

Table D-1: Emission factor equations

Activity	Emission factor equation	Variables	Control	Source
Drilling (overburden/coal)	$EF = 0.59\ kg/hole$	-	90% - water sprays	US EPA, 1985 NPI, 2012
Blasting (overburden/coal)	$EF = 0.00022\ \times A^{1.5}\ kg/blast$	A = area to be blasted (m²)	-	US EPA, 1985
Loading / emplacing overburden	$EF = k\ \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right)\ kg/tonne$	Ktsp = 0.74 U = wind speed (m/s) M = moisture content (%)	-	US EPA, 1985
Hauling on unsealed surfaces	$EF = \left(\frac{0.4536}{1.6093}\right) \times k \times (s/12)^{0.7} \times (1.1023 \times M/3)^{0.45}\ kg/VKT$	S = silt content (%) M = average vehicle gross mass (tonnes)	80% - watering of trafficked areas	US EPA, 1985
Dozers on overburden	$EF = 2.6\ \times \frac{s^{1.2}}{M^{1.3}}\ kg/hour$	S = silt content (%) M = moisture content (%)	20% - travelling on watered routes	US EPA, 1985
Dozers on coal	$EF = 35.6\ \times \frac{s^{1.2}}{M^{1.4}}\ kg/hour$	S = silt content (%) M = moisture content (%)	-	US EPA, 1985
Loading / emplacing coal	$EF = \frac{0.58}{M^{1.2}}\ kg/tonne$	M = moisture content (%)	25% - water sprays at dump hopper	US EPA, 1985
Loading product coal to stockpile / train	$EF = k\ \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right)\ kg/tonne$	Ktsp = 0.74 U = wind speed (m/s) M = moisture content (%)	75% - telescopic chute with water sprays	US EPA, 1985
Wind erosion on exposed areas / stockpiles	$EF = 0.4\ kg/ha\ /hour$	-	21% - vegetation on 30% of area / 50% - water sprays	SPCC, 1983
Grading roads	$EF = 0.0034\ \times s^{2.5}\ kg/VKT$	S = speed of grader (km/hr)	75% - travelling on watered routes	US EPA, 1985

Table D-2: Emissions inventory - Year 10

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Stripping Topsoil (Pit 1) - Scraper removing topsoil	1,256	43,310	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 2) - Scraper removing topsoil	2,343	80,792	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 3) - Scraper removing topsoil	2,206	76,068	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 4) - Scraper removing topsoil	1,663	57,350	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 5) - Scraper removing topsoil	2,836	97,786	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 6) - Scraper removing topsoil	-	-	tonnes/year	0.03	kg/t												
OB - Loading topsoil to haul truck (Pit 1)	14	43,310	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 2)	26	80,792	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 3)	24	76,068	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 4)	18	57,350	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 5)	31	97,786	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 6)	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Hauling to emplacement from Pit 1	765	43,310	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (tonn	80	% Control
OB - Hauling to emplacement from Pit 2	1,426	80,792	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (tonn	80	% Control
OB - Hauling to emplacement from Pit 3	1,343	76,068	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (tonn	80	% Control
OB - Hauling to emplacement from Pit 4	1,012	57,350	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (tonn	80	% Control
OB - Hauling to emplacement from Pit 5	1,726	97,786	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (tonn	80	% Control
OB - Hauling to emplacement from Pit 6	-	-	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (tonn	80	% Control
OB - Emplacing topsoil at dump (Pit 1)	14	43,310	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 2)	26	80,792	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 3)	24	76,068	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 4)	18	57,350	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 5)	31	97,786	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 6)	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Dozers on topsoil (Pit 1)	2,400	734	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 2)	4,478	1,369	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 3)	4,216	1,289	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 4)	3,179	972	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 5)	5,420	1,657	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 6)	-	-	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Drilling (Pit 1)	1,127	19,110	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 2)	3,221	54,600	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 3)	2,738	46,410	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 4)	3,221	54,600	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 5)	5,799	98,280	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 6)	-	-	holes/year	0.59	kg/hole											90	% Control
OB - Blasting (Pit 1)	32,080	18	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 2)	91,657	52	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 3)	77,909	44	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 4)	91,657	52	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 5)	164,983	94	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 6)	-	-	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Excavator loading OB to haul truck (Pit 1)	4,540	3,150,840	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 2)	12,972	9,002,400	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 3)	11,026	7,652,040	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 4)	12,972	9,002,400	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 5)	23,349	16,204,320	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 6)	-	-	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Hauling to dump from Pit 1	33,700	3,150,840	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (tonn	80	% Control
OB - Hauling to dump from Pit 2	96,286	9,002,400	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (tonn	80	% Control
OB - Hauling to dump from Pit 3	81,843	7,652,040	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (tonn	80	% Control
OB - Hauling to dump from Pit 4	96,286	9,002,400	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (tonn	80	% Control
OB - Hauling to dump from Pit 5	173,315	16,204,320	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (tonn	80	% Control
OB - Hauling to dump from Pit 6	-	-	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (tonn	80	% Control
OB - Emplacing at dump (Pit 1)	4,540	3,150,840	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 2)	12,972	9,002,400	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 3)	11,026	7,652,040	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 4)	12,972	9,002,400	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 5)	23,349	16,204,320	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 6)	-	-	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Dozers on OB in pit (Pit 1)	73,887	5,519	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 2)	211,106	15,768	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 3)	179,440	13,403	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 4)	211,106	15,768	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 5)	379,991	28,382	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 6)	-	-	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 1)	9,710	2,102	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 2)	21,363	4,625	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 3)	15,537	3,364	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 4)	16,508	3,574	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 5)	33,986	7,358	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 6)	-	-	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Loading ROM coal to haul truck (Pit 1)	110,193	1,597,000	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 2)	242,424	3,513,400	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 3)	176,308	2,555,200	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 4)	187,327	2,714,900	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 5)	385,674	5,589,500	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 6)	-	-	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Hauling ROM to hopper from Pit 1	20,565	1,597,000	tonnes/year	0.064	kg/t	181	tonnes/load	1.8	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 2	78,463	3,513,400	tonnes/year	0.112	kg/t	181	tonnes/load	3.1	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 3	160,260	2,555,200	tonnes/year	0.314	kg/t	181	tonnes/load	8.8	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 4	161,313	2,714,900	tonnes/year	0.297	kg/t	181	tonnes/load	8.3	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 5	325,281	5,589,500	tonnes/year	0.291	kg/t	181	tonnes/load	8.2	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 6	-	-	tonnes/year	0.000	kg/t	181	tonnes/load	-	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CHPP - Unloading ROM to hopper (all pits)	826,444	15,970,000	tonnes/year	0.069	kg/t	5.895	moisture content in %									25	% Control
CHPP - Rehandle ROM at hopper	771,348	11,179,000	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CHPP - Screening	17,567	15,970,000	tonnes/year	0.0011	kg/Mg												
CHPP - Crushing	9,582	15,970,000	tonnes/year	0.0006	kg/Mg												
CHPP - Sized Coal Unloading to Exisiting Product/Raw Stockpiles	1,494	15,970,000	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.24	moisture content in %							75	% Control
CHPP - Loading from RAW to CHPP	1,726	9,227,427	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.24	moisture content in %							50	% Control
CHPP - Loading from RAW to trains (BYPASS)	1,187	6,343,567	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.24	moisture content in %							50	% Control
CHPP - Unloading from CHPP to Product Stockpile	1,338	6,168,725	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	4.715	moisture content in %							50	% Control
CHPP - Loading from Product Stockpile to trains	2,676	6,168,725	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	4.715	moisture content in %								
CHPP - Dozer on ROM Stockpiles	18,253	3,500	hours/year	5.2	kg/h	1.49	silt content in %	5.55	moisture content in %								
CHPP - Dozer on Product/Raw Stockpiles	48,851	8,000	hours/year	6.1	kg/h	1.405	silt content in %	4.715	moisture content in %								
CHPP - Loading coarse rejects	463	3,058,702	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %								
CHPP - Loading fine rejects from belt filter press	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	35	moisture content in %								
CHPP - Hauling coarse and fine rejects (Pit 1)	109,355	3,058,702	tonnes/year	0.179	kg/t	181	tonnes/load	5.0	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CHPP - Unloading coarse rejects	463	3,058,702	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %								
CHPP - Unloading fine rejects	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	35	moisture content in %								
WE - Overburden emplacement areas (Pit 1)	24,977	9	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 2)	89,669	32	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 3)	250,165	90	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 4)	102,954	37	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 5)	200,244	72	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 6)	-	-	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Open pit (Pit 1)	31,617	9	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 2)	58,978	17	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 3)	55,530	16	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 4)	41,865	12	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 5)	71,384	20	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 6)	-	-	ha	0.40	kg/ha/hour	8,760	hours										
WE - ROM stockpiles	56,064	32	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
WE - Product stockpiles	17,520	10	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
Grading roads	32,349	210,240	km	0.62	kg/VKT	8	speed of graders in km/h									75	% Control
Grading roads	9,884	64,240	km	0.62	kg/VKT	8	speed of graders in km/h									75	% Control
Total TSP emissions (kg/yr)	**6,976,426**																

Table D-3: Emissions inventory - Year 13

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Stripping Topsoil (Pit 1) - Scraper removing topsoil	726	25,046	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 2) - Scraper removing topsoil	1,336	46,080	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 3) - Scraper removing topsoil	2,994	103,227	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 4) - Scraper removing topsoil	-	-	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 5) - Scraper removing topsoil	3,608	124,423	tonnes/year	0.03	kg/t												
OB - Stripping Topsoil (Pit 6) - Scraper removing topsoil	-	-	tonnes/year	0.03	kg/t												
OB - Loading topsoil to haul truck (Pit 1)	8	25,046	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 2)	15	46,080	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 3)	33	103,227	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 4)	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 5)	39	124,423	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Loading topsoil to haul truck (Pit 6)	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Hauling to emplacement from Pit 1	442	25,046	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (ton	80	% Control
OB - Hauling to emplacement from Pit 2	813	46,080	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (ton	80	% Control
OB - Hauling to emplacement from Pit 3	1,822	103,227	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (ton	80	% Control
OB - Hauling to emplacement from Pit 4	-	-	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (ton	80	% Control
OB - Hauling to emplacement from Pit 5	2,196	124,423	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (ton	80	% Control
OB - Hauling to emplacement from Pit 6	-	-	tonnes/year	0.088	kg/t	40	tonnes/load	1.0	km/return trip	3.5	kg/VKT	7.1	% silt c	50	Ave GMV (ton	80	% Control
OB - Emplacing topsoil at dump (Pit 1)	8	25,046	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 2)	15	46,080	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 3)	33	103,227	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 4)	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 5)	39	124,423	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Emplacing topsoil at dump (Pit 6)	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.915	moisture content in %								
OB - Dozers on topsoil (Pit 1)	1,651	505	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 2)	3,037	929	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 3)	6,804	2,081	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 4)	-	-	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 5)	8,201	2,508	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Dozers on topsoil (Pit 6)	-	-	hours/year	4.1	kg/h	10	silt content in %	5.915	moisture content in %							20	% Control
OB - Drilling (Pit 1)	805	13,650	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 2)	1,450	24,570	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 3)	5,154	87,360	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 4)	-	-	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 5)	8,698	147,420	holes/year	0.59	kg/hole											90	% Control
OB - Drilling (Pit 6)	-	-	holes/year	0.59	kg/hole											90	% Control
OB - Blasting (Pit 1)	22,914	13	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 2)	41,246	23	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 3)	146,652	83	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 4)	-	-	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 5)	247,475	140	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Blasting (Pit 6)	-	-	blasts/year	1763	kg/blast	40,040	Area of blast in square metres										
OB - Excavator loading OB to haul truck (Pit 1)	2,302	1,597,860	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 2)	4,144	2,876,148	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 3)	14,735	10,226,304	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 4)	-	-	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 5)	24,866	17,256,888	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Excavator loading OB to haul truck (Pit 6)	-	-	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Hauling to dump from Pit 1	17,090	1,597,860	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
OB - Hauling to dump from Pit 2	30,762	2,876,148	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
OB - Hauling to dump from Pit 3	109,377	10,226,304	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
OB - Hauling to dump from Pit 4	-	-	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
OB - Hauling to dump from Pit 5	184,573	17,256,888	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
OB - Hauling to dump from Pit 6	-	-	tonnes/year	0.053	kg/t	181	tonnes/load	1.5	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
OB - Emplacing at dump (Pit 1)	2,302	1,597,860	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 2)	4,144	2,876,148	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 3)	14,735	10,226,304	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 4)	-	-	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 5)	24,866	17,256,888	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Emplacing at dump (Pit 6)	-	-	tonnes/year	0.001	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Dozers on OB in pit (Pit 1)	52,777	3,942	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 2)	94,998	7,096	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 3)	337,770	25,229	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 4)	-	-	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 5)	569,987	42,574	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
OB - Dozers on OB in pit (Pit 6)	-	-	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 1)	6,797	1,472	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 2)	8,739	1,892	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 3)	32,044	6,938	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 4)	-	-	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 5)	49,523	10,722	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Dozers ripping/pushing/clean-up (Pit 6)	-	-	hours/year	5.8	kg/h	1.74	silt content in %	5.895	moisture content in %							20	% Control
CL - Loading ROM coal to haul truck (Pit 1)	60,471	876,400	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 2)	77,749	1,126,800	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 3)	285,079	4,131,600	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 4)	-	-	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 5)	440,577	6,385,200	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Loading ROM coal to haul truck (Pit 6)	-	-	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CL - Hauling ROM to hopper from Pit 1	23,834	876,400	tonnes/year	0.136	kg/t	181	tonnes/load	3.8	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 2	20,504	1,126,800	tonnes/year	0.091	kg/t	181	tonnes/load	2.6	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 3	328,818	4,131,600	tonnes/year	0.398	kg/t	181	tonnes/load	11.2	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 4	-	-	tonnes/year	0.000	kg/t	181	tonnes/load	-	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 5	414,680	6,385,200	tonnes/year	0.325	kg/t	181	tonnes/load	9.1	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CL - Hauling ROM to hopper from Pit 6	-	-	tonnes/year	0.000	kg/t	181	tonnes/load	-	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CHPP - Unloading ROM to hopper (all pits)	647,908	12,520,000	tonnes/year	0.069	kg/t	5.895	moisture content in %									25	% Control
CHPP - Rehandle ROM at hopper	604,714	8,764,000	tonnes/year	0.069	kg/t	5.895	moisture content in %										
CHPP - Screening	13,772	12,520,000	tonnes/year	0.0011	kg/Mg												
CHPP - Crushing	7,512	12,520,000	tonnes/year	0.0006	kg/Mg												
CHPP - Sized Coal Unloading to Exisiting Product/Raw Stockpiles	1,171	12,520,000	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.24	moisture content in %							75	% Control
CHPP - Loading from RAW to CHPP	437	2,336,024	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.24	moisture content in %							50	% Control
CHPP - Loading from RAW to trains (BYPASS)	2,013	10,760,762	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	5.24	moisture content in %							50	% Control
CHPP - Unloading from CHPP to Product Stockpile	318	1,467,796	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	4.715	moisture content in %							50	% Control
CHPP - Loading from Product Stockpile to trains	637	1,467,796	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	4.715	moisture content in %								
CHPP - Dozer on ROM Stockpiles	18,253	3,500	hours/year	5.2	kg/h	1.49	silt content in %	5.55	moisture content in %								
CHPP - Dozer on Product/Raw Stockpiles	48,851	8,000	hours/year	6.1	kg/h	1.405	silt content in %	4.715	moisture content in %								
CHPP - Loading coarse rejects	131	868,228	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %								
CHPP - Loading fine rejects from belt filter press	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	35	moisture content in %								
CHPP - Hauling coarse and fine rejects (Pit 1)	16,195	868,228	tonnes/year	0.093	kg/t	181	tonnes/load	2.6	km/return trip	6.5	kg/VKT	7.1	% silt c	191	Ave GMV (ton	80	% Control
CHPP - Unloading coarse rejects	131	868,228	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	10	moisture content in %								
CHPP - Unloading fine rejects	-	-	tonnes/year	0.000	kg/t	1.217	average of (wind speed/2.2)^1.3 in m/s	35	moisture content in %								
WE - Overburden emplacement areas (Pit 1)	142,905	52	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 2)	26,574	10	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 3)	119,765	43	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 4)	3,673	1	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 5)	214,562	78	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Overburden emplacement areas (Pit 6)	-	-	ha	0.40	kg/ha/hour	8,760	hours									21	% Control
WE - Open pit (Pit 1)	18,283	5	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 2)	33,638	10	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 3)	75,356	22	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 4)	-	-	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 5)	90,829	26	ha	0.40	kg/ha/hour	8,760	hours										
WE - Open pit (Pit 6)	-	-	ha	0.40	kg/ha/hour	8,760	hours										
WE - ROM stockpiles	56,064	32	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
WE - Product stockpiles	17,520	10	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
Grading roads	32,349	210,240	km	0.62	kg/VKT	8	speed of graders in km/h									75	% Control
Grading roads	9,884	64,240	km	0.62	kg/VKT	8	speed of graders in km/h									75	% Control
Total TSP emissions (kg/yr)	**5,940,022**																

Appendix E

Isopleth Diagrams

Figure E-1: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Modification - Year 10 (2015)

Figure E-2: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Modification - Year 10 (2015)

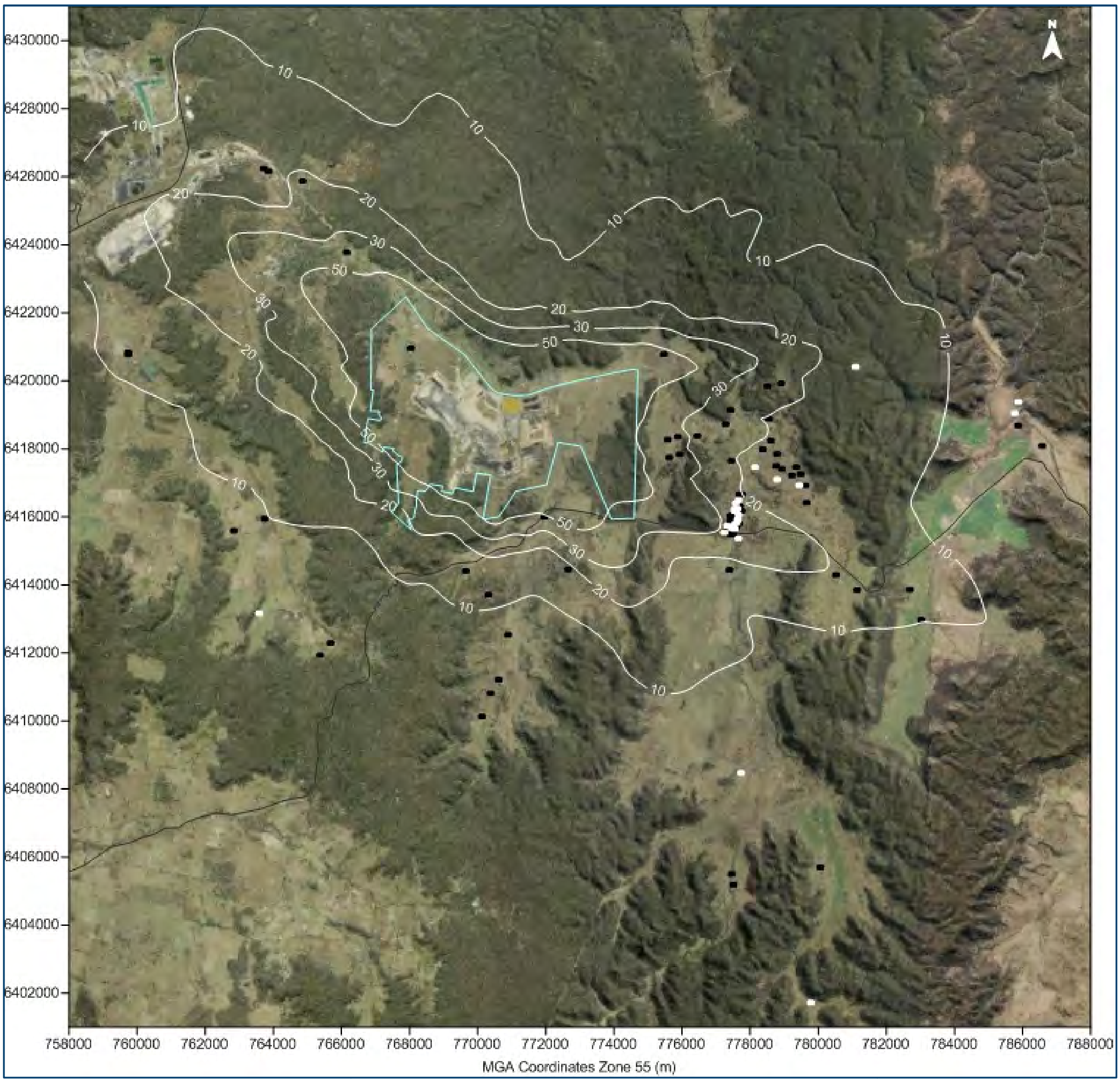

Figure E-3: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Modification - Year 10 (2015)

Figure E-4: Predicted annual average PM_{10} concentrations due to emissions from the Modification - Year 10 (2015)

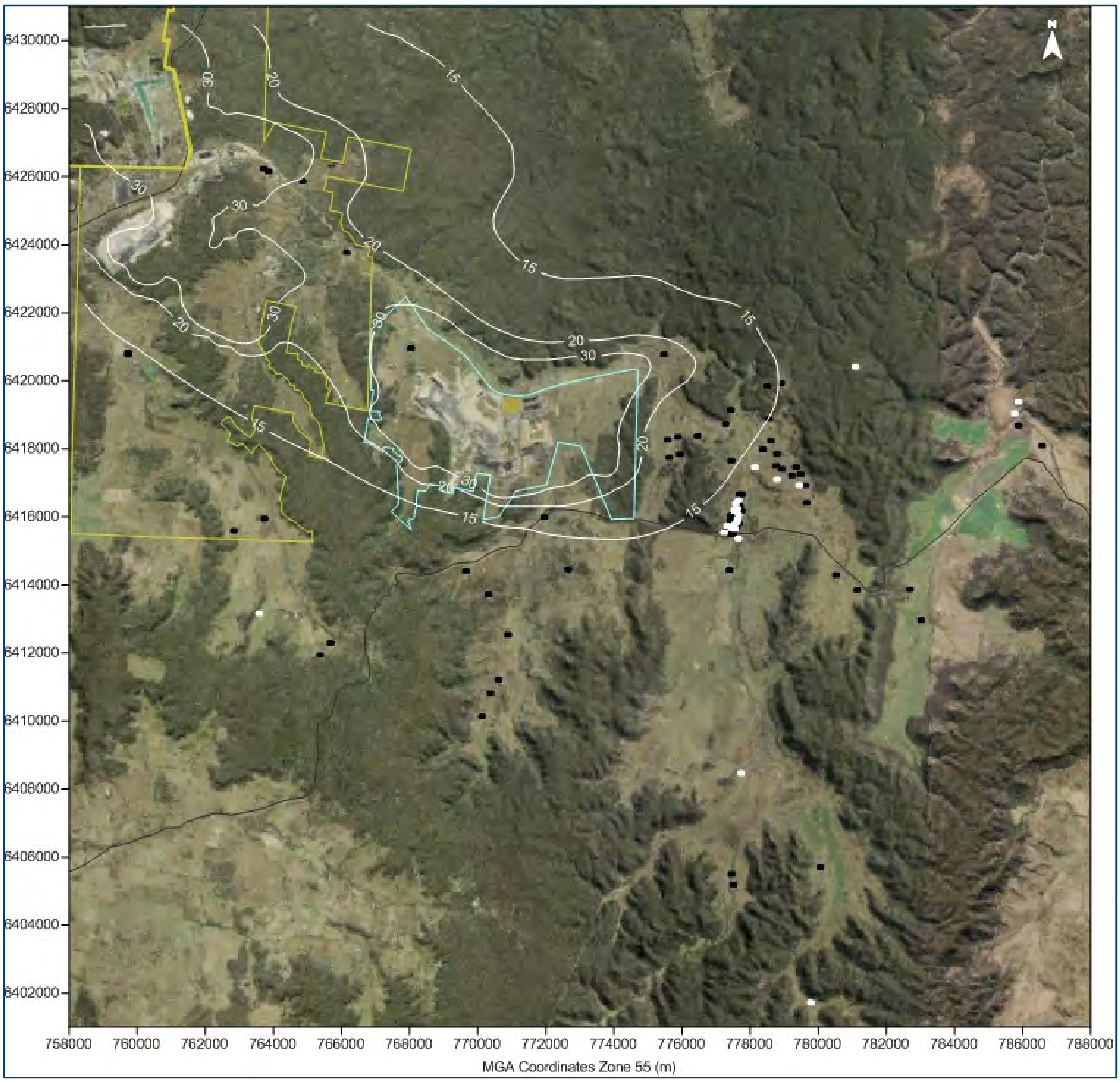

Figure E-5: Predicted annual average PM_{10} concentrations due to emissions from the Modification and other sources - Year 10 (2015)

Figure E-6: Predicted annual average TSP concentrations due to emissions from the Modification - Year 10 (2015)

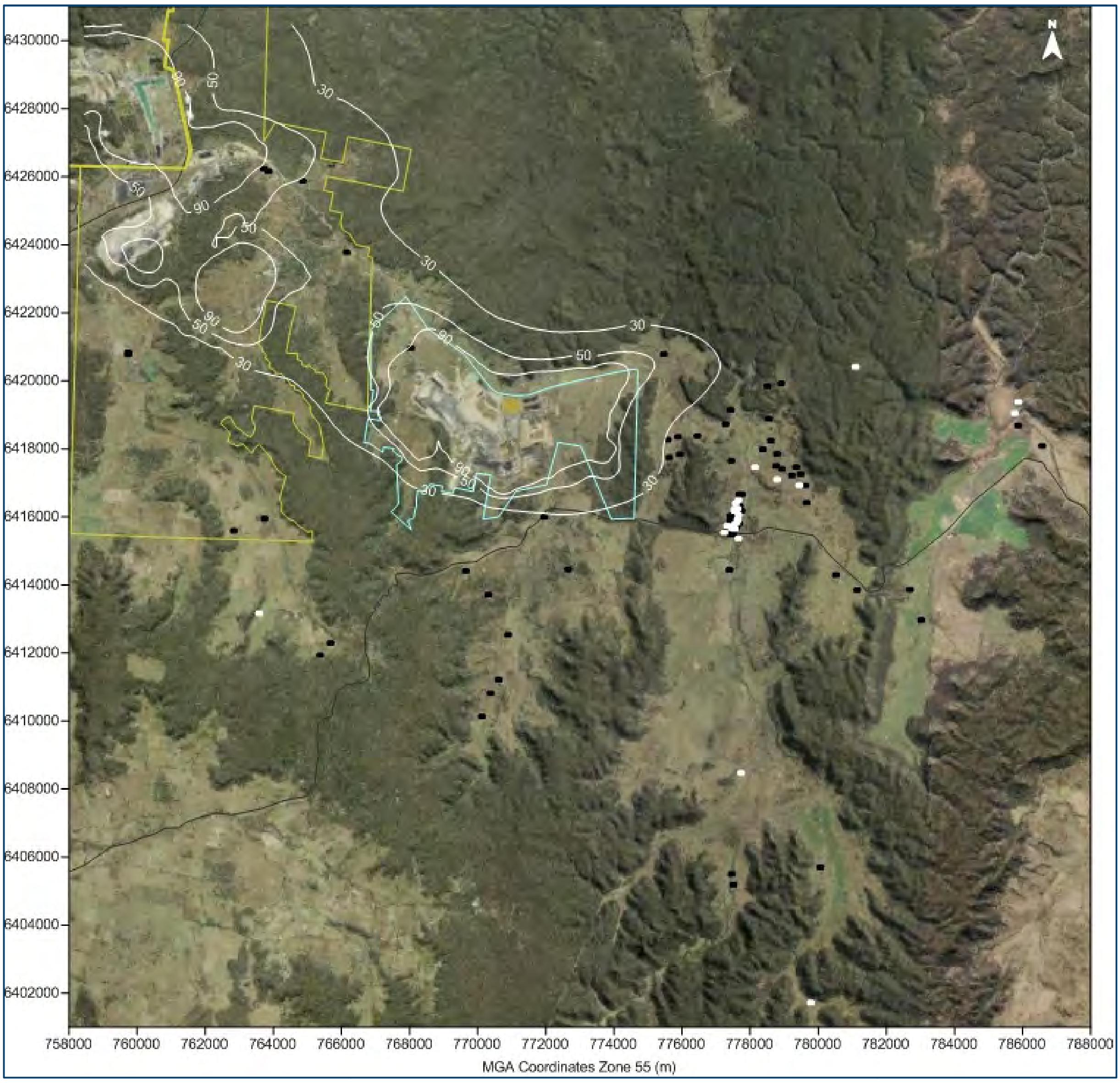

Figure E-7: Predicted annual average TSP concentrations due to emissions from the Modification and other sources - Year 10 (2015)

Figure E-8: Predicted annual average dust deposition levels due to emissions from the Modification - Year 10 (2015)

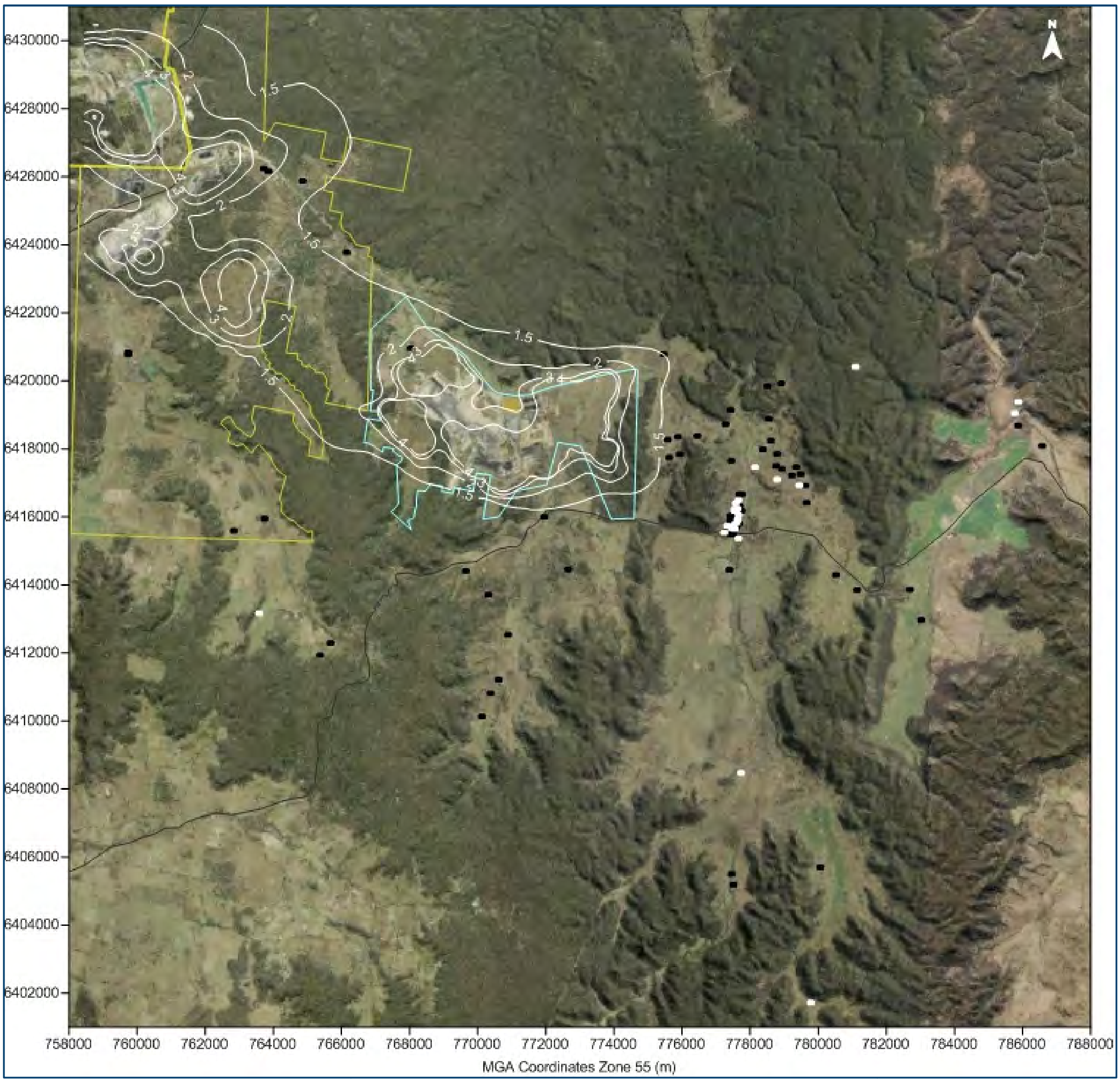

Figure E-9: Predicted annual average dust deposition levels due to emissions from the Modification and other sources - Year 10 (2015)

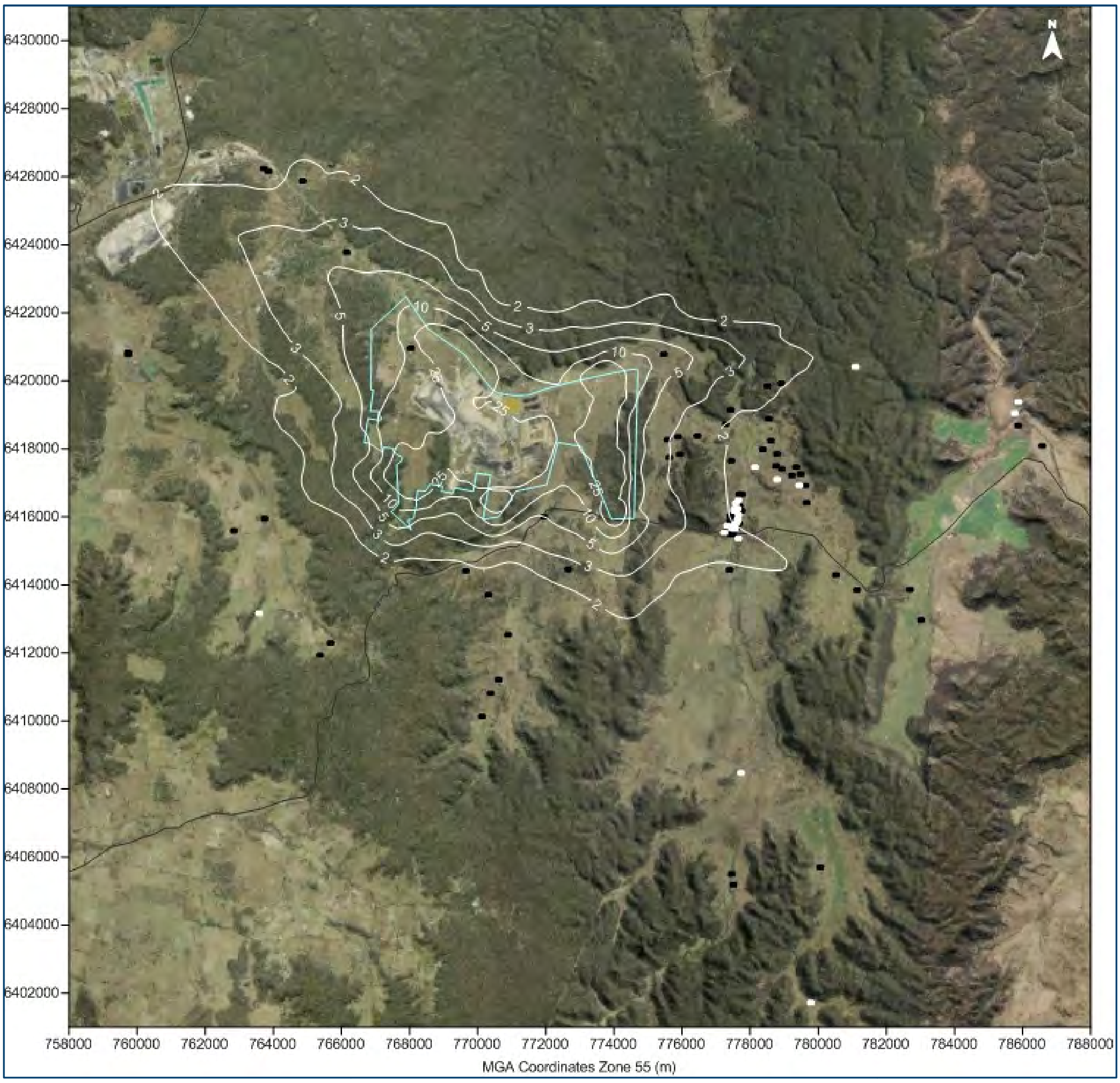

Figure E-10: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Modification - Year 13 (2018)

Figure E-11: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Modification - Year 13 (2018)

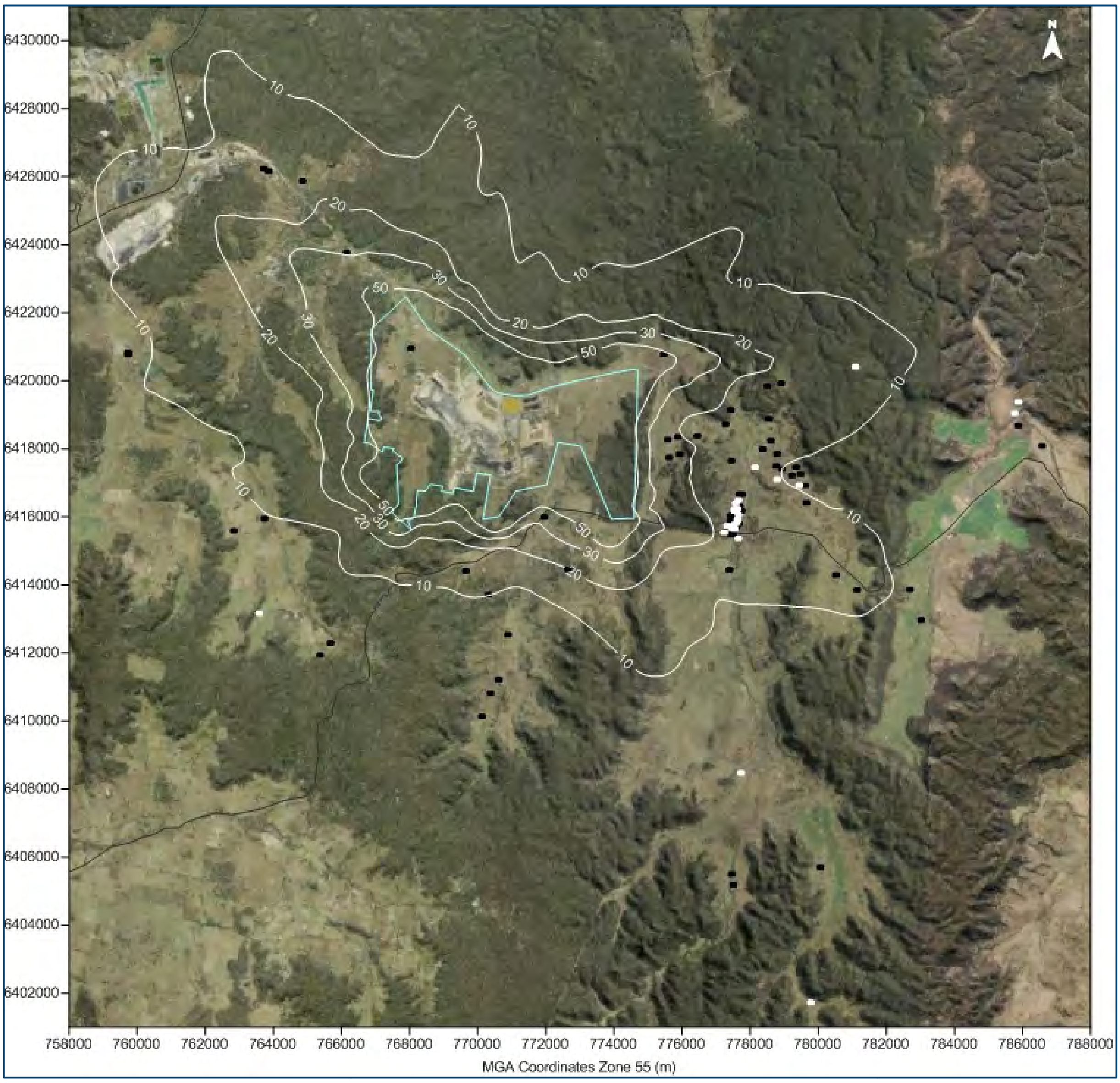

Figure E-12: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Modification - Year 13 (2018)

Figure E-13: Predicted annual average PM_{10} concentrations due to emissions from the Modification - Year 13 (2018)

Figure E-14: Predicted annual average PM_{10} concentrations due to emissions from the Modification and other sources - Year 13 (2018)

Figure E-15: Predicted annual average TSP concentrations due to emissions from the Modification - Year 13 (2018)

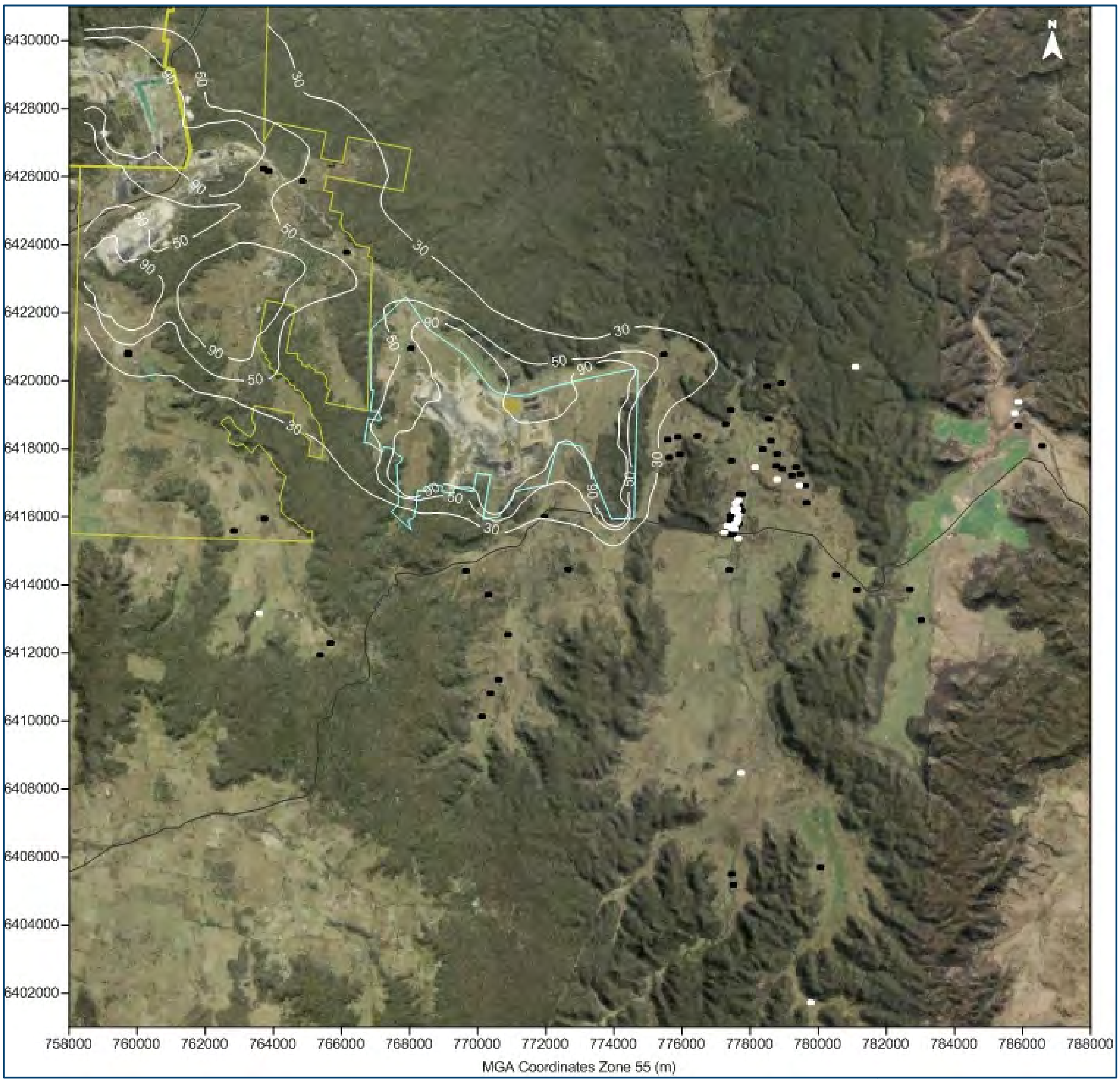

Figure E-16: Predicted annual average TSP concentrations due to emissions from the Modification and other sources - Year 13 (2018)

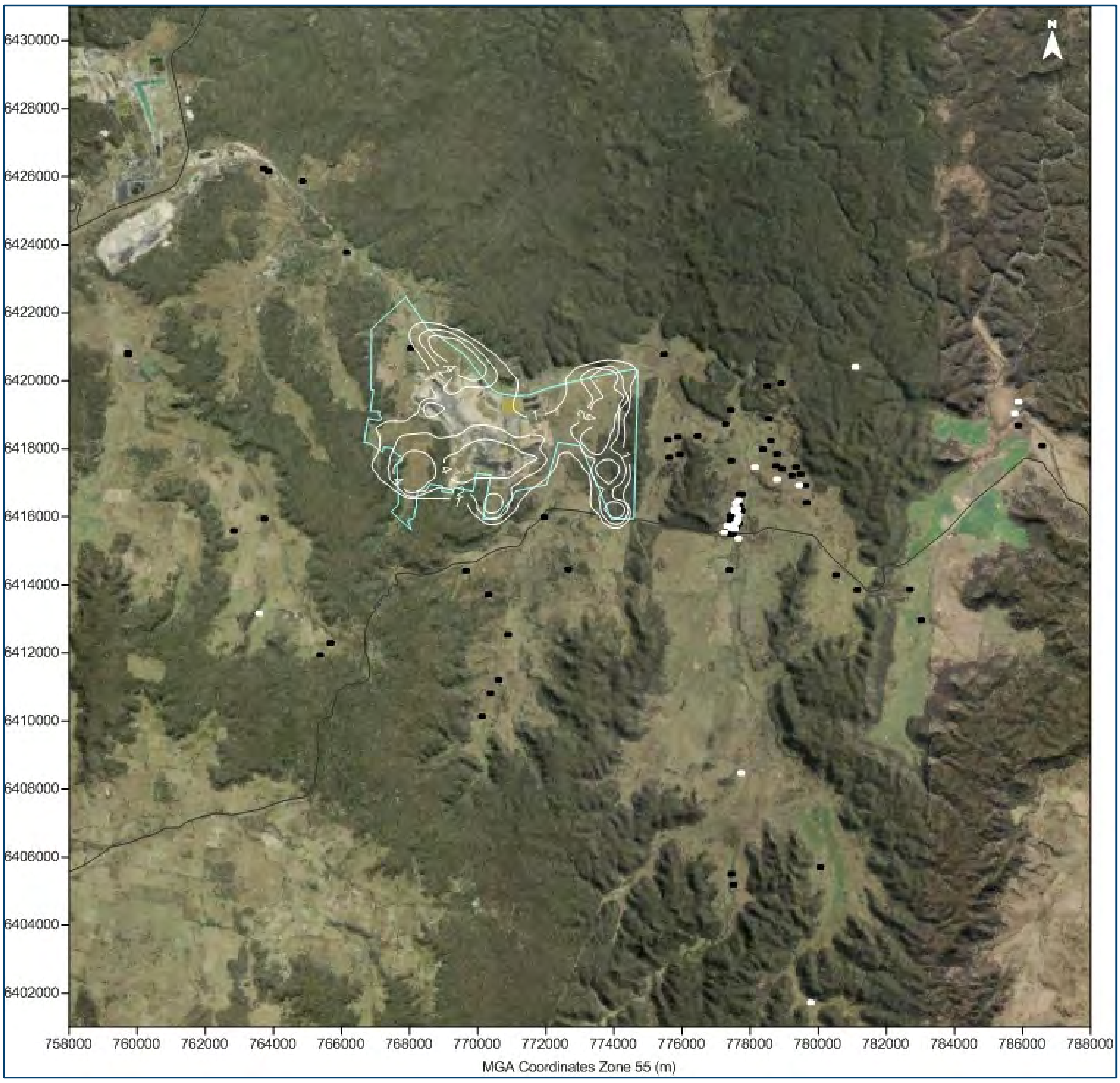

Figure E-17: Predicted annual average dust deposition levels due to emissions from the Modification - Year 13 (2018)

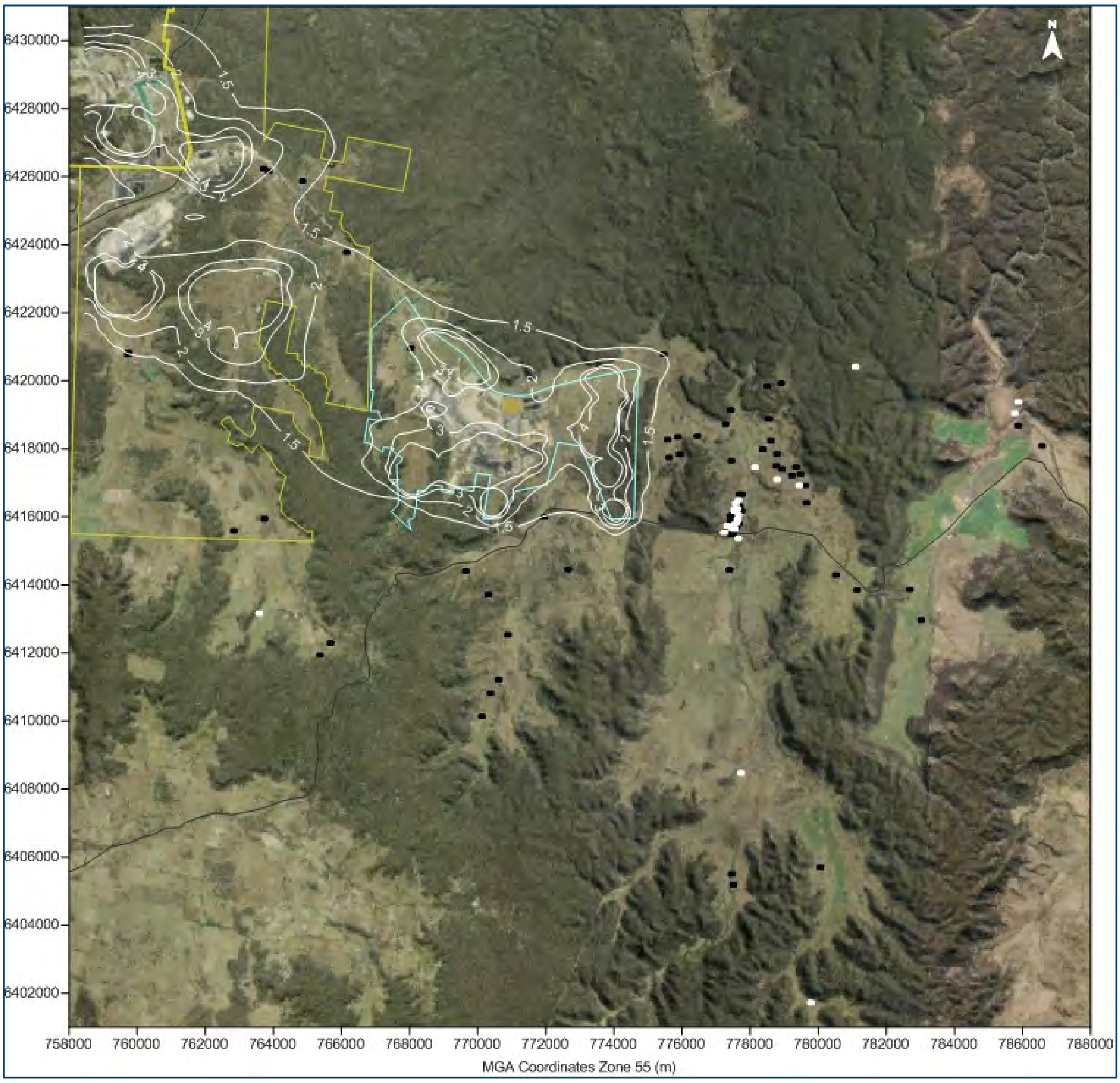

Figure E-18: Predicted annual average dust deposition levels due to emissions from the Modification and other sources - Year 13 (2018)

Appendix F

Further detail regarding 24-hour PM_{10} analysis

Table F-1: TEOM1 – Year 10 (2015)

Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
4/05/2013	**80.1**	0.8	**80.9**	16/05/2013	16.0	9.4	25.4
29/04/2013	**79.0**	2.0	**81.0**	17/06/2013	10.6	7.3	17.9
13/10/2013	**74.2**	4.0	**78.2**	3/08/2013	17.7	6.7	24.5
26/09/2013	**68.2**	1.4	**69.6**	15/06/2013	8.3	6.3	14.6
28/04/2013	**63.7**	1.8	**65.5**	23/08/2013	13.2	5.9	19.1
26/04/2013	**63.5**	0.6	**64.1**	8/08/2013	7.1	5.9	13.0
30/09/2013	**60.4**	1.8	**62.2**	18/06/2013	10.2	5.8	16.0
25/04/2013	**57.8**	1.1	**58.9**	5/08/2013	23.7	5.5	29.3
27/04/2013	**55.3**	2.0	**57.2**	17/05/2013	14.5	5.4	19.9
20/09/2013	**55.2**	2.8	**58.0**	28/03/2013	33.7	4.5	38.2
18/01/2013	**53.0**	1.7	**54.7**	6/07/2013	16.4	4.4	20.8
23/04/2013	**52.2**	0.7	**53.0**	21/07/2013	10.7	4.2	14.9
10/10/2013	**51.9**	0.4	**52.3**	10/06/2013	8.1	4.2	12.2
18/10/2013	**51.0**	0.0	**51.0**	30/08/2013	27.4	4.1	31.6
30/04/2013	49.7	0.0	49.7	6/08/2013	22.2	4.1	26.3
12/01/2013	47.9	0.2	48.0	13/10/2013	**74.2**	4.0	**78.2**
17/10/2013	47.6	1.7	49.4	5/09/2013	32.5	3.9	36.4
19/10/2013	47.3	0.0	47.3	22/09/2013	36.8	3.9	40.6
3/11/2013	45.3	1.7	46.9	8/12/2013	ND	3.8	3.8
12/10/2013	44.7	1.6	46.3	4/08/2013	22.0	3.7	25.7
24/04/2013	43.0	2.7	45.7	19/08/2013	12.7	3.7	16.4
16/03/2013	42.9	1.2	44.1	5/12/2013	ND	3.5	3.5
20/10/2013	42.6	2.6	45.2	21/05/2013	23.0	3.4	26.5
23/09/2013	41.8	2.5	44.2	15/07/2013	9.2	3.3	12.5

ND – No data

Table F-2: TEOM3 – Year 10 (2015)

Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
18/10/2013	**51.7**	0.0	**51.7**	13/06/2013	5.4	4.8	10.2
19/10/2013	49.6	0.0	49.6	20/07/2013	7.0	3.6	10.6
4/11/2013	39.8	0.0	39.8	17/09/2013	5.6	3.6	9.2
21/12/2013	39.2	0.0	39.2	10/10/2013	24.7	2.7	27.4
13/10/2013	38.9	1.1	40.0	15/05/2013	8.0	2.6	10.5
6/11/2013	38.8	0.0	38.8	21/07/2013	8.7	2.5	11.3
28/10/2013	37.8	0.3	38.1	23/09/2013	13.3	2.4	15.7
18/01/2013	37.1	1.0	38.1	7/06/2013	8.3	2.3	10.7
20/10/2013	36.7	0.7	37.4	14/06/2013	3.6	2.3	5.9
7/11/2013	34.4	0.6	35.0	9/12/2013	22.5	2.3	24.8
14/03/2013	33.8	0.0	33.8	10/06/2013	8.1	2.3	10.4

Table F-3: TEOM4 – Year 10 (2015)

Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
26/09/2013	**71.6**	1.5	**73.1**	17/06/2013	7.6	4.0	11.5
30/04/2013	**68.3**	0.0	**68.3**	5/08/2013	25.7	3.6	29.3
29/04/2013	**57.6**	0.5	**58.1**	13/06/2013	4.1	3.2	7.3
19/10/2013	**55.7**	0.0	**55.7**	5/07/2013	13.4	3.2	16.6
18/10/2013	**54.2**	0.0	**54.2**	3/08/2013	13.2	3.2	16.4
20/10/2013	**50.1**	0.2	**50.3**	18/06/2013	8.6	2.8	11.4
6/09/2013	44.8	0.9	45.7	23/10/2013	10.7	2.7	13.3
7/11/2013	43.0	0.3	43.3	8/08/2013	2.1	2.6	4.7
1/10/2013	42.6	0.4	43.0	20/07/2013	5.9	2.4	8.3
28/10/2013	42.4	0.1	42.5	6/07/2013	17.2	2.4	19.6
5/09/2013	42.4	0.8	43.2	2/06/2013	2.8	2.3	5.1
21/12/2013	41.6	0.5	42.1	17/05/2013	10.2	1.8	12.0
7/09/2013	41.4	1.0	42.4	24/09/2013	28.0	1.8	29.9
3/11/2013	41.2	0.5	41.7	22/09/2013	27.9	1.8	29.7
14/03/2013	40.0	0.1	40.0	23/09/2013	34.4	1.8	36.2
14/12/2013	39.5	0.2	39.7	4/08/2013	11.9	1.7	13.6

Table F-4: TEOM1 – Year 13 (2018)

Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
4/05/2013	**80.1**	2.8	**82.9**	16/06/2013	7.2	7.3	14.5
29/04/2013	**79.0**	6.8	**85.8**	29/04/2013	**79.0**	6.8	**85.8**
13/10/2013	**74.2**	0.7	**74.9**	19/07/2013	6.1	6.2	12.3
26/09/2013	**68.2**	0.5	**68.7**	7/08/2013	12.5	6.0	18.4
28/04/2013	**63.7**	3.1	**66.8**	23/03/2013	10.5	5.8	16.3
26/04/2013	**63.5**	4.7	**68.2**	6/07/2013	16.4	5.7	22.2
30/09/2013	**60.4**	0.6	**61.1**	12/07/2013	8.2	5.6	13.8
25/04/2013	**57.8**	3.5	**61.3**	23/07/2013	12.1	5.2	17.3
27/04/2013	**55.3**	2.4	**57.7**	19/08/2013	12.7	5.2	17.8
20/09/2013	**55.2**	3.6	**58.9**	18/06/2013	10.2	5.1	15.3
18/01/2013	**53.0**	-0.1	**52.8**	7/10/2013	10.6	4.8	15.3
23/04/2013	**52.2**	2.7	**55.0**	26/04/2013	**63.5**	4.7	**68.2**
10/10/2013	**51.9**	0.7	**52.6**	1/06/2013	12.8	4.6	17.3
18/10/2013	**51.0**	0.0	**51.0**	6/12/2013	ND	4.6	4.6
30/04/2013	49.7	0.0	49.7	7/07/2013	15.8	4.5	20.3
12/01/2013	47.9	0.0	47.8	15/07/2013	9.2	4.4	13.7
17/10/2013	47.6	1.6	49.2	25/07/2013	12.2	4.4	16.6
19/10/2013	47.3	0.0	47.3	10/02/2013	20.1	4.2	24.3
3/11/2013	45.3	1.5	46.7	21/08/2013	12.3	4.1	16.4
12/10/2013	44.7	1.3	45.9	31/10/2013	18.2	4.0	22.3
24/04/2013	43.0	0.4	43.3	20/05/2013	15.6	3.8	19.4
16/03/2013	42.9	1.0	43.8	31/01/2013	17.2	3.7	20.9
20/10/2013	42.6	2.6	45.2	29/07/2013	11.1	3.7	14.8
23/09/2013	41.8	-1.2	40.6	20/09/2013	**55.2**	3.6	**58.9**

ND – No data

Table F-5: TEOM3 – Year 13 (2018)

Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
18/10/2013	**51.7**	0.0	**51.7**	23/08/2013	10.1	3.6	13.7
19/10/2013	49.6	0.0	49.6	15/06/2013	6.0	2.4	8.4
4/11/2013	39.8	0.0	39.8	17/06/2013	6.4	2.3	8.7
21/12/2013	39.2	-0.2	39.0	10/10/2013	24.7	2.2	26.9
13/10/2013	38.9	-1.7	37.2	19/09/2013	12.7	2.2	14.9
6/11/2013	38.8	0.0	38.8	5/08/2013	15.6	2.2	17.8
28/10/2013	37.8	0.1	37.9	22/09/2013	16.6	2.2	18.7
18/01/2013	37.1	0.0	37.1	3/08/2013	8.6	2.2	10.8
20/10/2013	36.7	0.2	36.9	21/05/2013	12.9	1.9	14.8
7/11/2013	34.4	0.3	34.6	26/07/2013	12.6	1.9	14.5
14/03/2013	33.8	0.0	33.8	24/08/2013	5.3	1.8	7.1

Table F-6: TEOM4 – Year 13 (2018)

Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
26/09/2013	**71.6**	1.1	**72.7**	16/06/2013	6.6	1.9	8.5
30/04/2013	**68.3**	0.0	**68.3**	7/07/2013	15.6	1.9	17.5
29/04/2013	**57.6**	0.6	**58.2**	23/07/2013	9.8	1.5	11.3
19/10/2013	**55.7**	0.0	**55.7**	6/07/2013	17.2	1.5	18.6
18/10/2013	**54.2**	0.0	**54.2**	2/06/2013	2.8	1.5	4.3
20/10/2013	50.1	0.1	50.2	18/05/2013	10.4	1.4	11.8
6/09/2013	44.8	-0.7	44.1	20/05/2013	15.8	1.4	17.2
7/11/2013	43.0	0.0	43.0	17/09/2013	5.4	1.3	6.7
1/10/2013	42.6	-1.5	41.2	1/06/2013	15.5	1.3	16.8
28/10/2013	42.4	-0.1	42.3	26/04/2013	26.2	1.2	27.4
5/09/2013	42.4	-3.1	39.3	20/09/2013	22.6	1.2	23.8
21/12/2013	41.6	0.1	41.7	26/09/2013	**71.6**	1.1	**72.7**
7/09/2013	41.4	0.1	41.5	8/01/2013	ND	1.0	1.0
3/11/2013	41.2	0.6	41.8	27/10/2013	22.9	1.0	23.9
14/03/2013	40.0	0.0	40.0	25/04/2013	38.0	1.0	39.0
14/12/2013	39.5	0.0	39.5	12/07/2013	7.9	0.9	8.8

ND – No data