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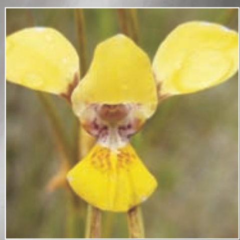
Modifications to Mangoola Coal Mine Plans and Relocation of 500kV Electricity Transmission Line

environmental assessment



xstrata coal Mangoola Coal

Umwelt Environmental Consultants

DECEMBER 2010

VOLUME 4

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Appendix C6

Air Quality Impact Assessment

Mangoola Coal Proposed Mine Plan Modifications

AIR QUALITY IMPACT ASSESSMENT

- Final
- 19 July 2010

Mangoola Coal Proposed Mine Plan Modifications

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1. Introduction

This report has been prepared by Sinclair Knight Merz (SKM) for Umwelt (Australia) Pty Limited (Umwelt), who in turn is acting on behalf of Xstrata Mangoola Pty Limited (trading as Mangoola Coal). The purpose of the report is to quantitatively assess the potential air quality impacts of proposed modifications to the Mangoola Coal mine plan (the Project).

The Mangoola Coal site (formerly the Anvil Hill Project) is located approximately 20 kilometres (km) to the west of Muswellbrook in the upper Hunter Valley. The mining operations were approved in 2007.

Mangoola Coal has since purchased the mine and is now seeking to streamline operations via various modifications to the original mine plan. Approval will be sought to modify the original Project Approval (PA06-004), under Section 75W of the *Environmental Planning and Assessment Act 1979*, and Mangoola Coal has engaged Umwelt to prepare an Environmental Assessment (EA).

The air quality assessment follows the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, published by the Department of Environment, Climate Change and Water (DECCW) (**DEC, 2005**). A computer-based dispersion model has been used to predict ground-level dust concentrations and deposition levels due to the mining activities and model predictions have been compared with relevant air quality criteria to assess the effect that the Project would have on the existing air quality environment.

In summary, the report includes information on the following:

- Approved and proposed mining operations;
- Existing air quality, as characterised by relevant monitoring data;
- Meteorological conditions in the study area;
- Methods used to estimate dust emissions from proposed mining activities;
- Methods used to predict off-site dust impacts;
- Expected air quality impacts, as determined by comparison of model results with air quality assessment criteria; and
- Potential cumulative impacts.

In addition, one of the main objectives of this assessment is to compare predicted air quality impacts for the approved mining operations with predicted impacts for proposed mining operations.

2. Project Description

The Mangoola Coal site is located near Wybong, approximately 20 km to the west of Muswellbrook and approximately 10 km north of Denman in the upper Hunter Valley of NSW. Approval to construct and operate the mine was granted in June 2007. The mine was originally approved as the Anvil Hill Project, but was renamed when Xstrata Mangoola Pty Limited, a subsidiary of Xstrata Coal (NSW) Pty Limited, purchased the mine from Centennial Hunter Pty Limited in October 2007. Xstrata Mangoola Pty Limited (trading as Mangoola Coal) manages the mine on behalf of Xstrata Coal.

Early works commenced at the site in January 2009, which included the development of the site access road, replacement of water lines, upgrades on Wybong Road East, establishment of site infrastructure for workers and the establishment of a borrow pit and internal roads.

Mangoola Coal formally notified the Department of Planning on 11 November 2009 that full construction had commenced.

Figure 1 shows the location of the Mangoola Coal site, including the approved project disturbance boundary and nearest residential properties. Some of the properties shown in **Figure 1** are now owned by Mangoola Coal and **Figure 2** shows the property and land ownership status, as of July 2010.

The study area (as defined by the extent of **Figure 1**) consists of undulating terrain as well as rocky outcrops. **Figure 3** shows a pseudo three-dimensional representation of the local terrain. There are scattered rural residential properties in the immediate vicinity of the mine site while the broader area supports coal mining operations, pastoral grazing, agriculture and vineyards.

Mangoola Coal is approved to extract and process up to 10.5 million tonnes per annum (Mtpa) of Run-of-Mine (ROM) coal for a period of 21 years, but is now seeking to streamline operations via various modifications to the original mine plan.

Mangoola Coal is proposing to implement a new mine plan in 2010 with mining continuing for 15 years. There will be no increase to the approved production rate of 10.5 Mtpa of ROM coal.

Mining will be undertaken using conventional truck and shovel activities but with some changes to the number and type of equipment that will be used. Some changes to the mine infrastructure and layout are also proposed. Mining operations will continue to be conducted for up to 24 hours per day, seven days per week. Construction activities will be carried out during the daylight hours for up to seven days per week.

As for the original mine plan proposal, the activities will include:

- Removal of vegetation and topsoil in advance of each mining strip;
- Drill and blasting of overburden prior to excavation;
- Strip mining using hydraulic excavators, assisted by dozers to uncover the coal seams;
- Loading to rear dump trucks; and
- Progressive rehabilitation of the overburden emplacements.

Four air quality modelling scenarios have been developed, consistent with the scenarios modelled in the original assessment. **Table 1** shows the proposed overburden and coal production rates that were the subject of this assessment. These scenarios cover mining activities in various locations of the proposed disturbance boundary and for a range of material volumes and tonnages.

- **Table 1: Estimated overburden and coal production rates for assessment scenarios**

Mining year[1]	Total waste moved (Mbcm)	Total ROM coal mined (Mt)	Product coal (Mt)
Year 2 (2012)	17.419	8.5	7.008
Year 5 (2015)	30.495	10.5	7.665
Year 10 (2020)	30.557	10.5	7.665
Year 15 (2025)	0.077	0.688	0.575

Mbcm = Million bank cubic metres, Mt = Million tonnes.
Note 1: These are conceptual mine stages and estimated production schedules used for assessment purposes. Timing and production (up to 10.5 Mtpa ROM) may change as final mine plans and operations progress.

There will be concurrent operation of two (previously four) pits for most of the mine life, with rehabilitation commencing as soon as possible after disturbance from mining.

Figure 4 shows the proposed mine staging for the four years selected to represent key stages for assessment. This figure includes the location of active mining areas, active overburden emplacement areas, active tailings dams and proposed haul routes. The figure also shows the location of dust sources that were used for the dispersion modelling (discussed later in **Section 6**).

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3. Assessment Criteria

The DECCW has set criteria to assess the air quality impacts of existing or proposed facilities. These criteria are outlined in the DECCW's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**DEC, 2005**).

Of particular relevance to the proposed activities at the Mangoola Coal site are criteria for particulate matter. There are various classifications of particulate matter, with the DECCW providing assessment criteria for the following:

- Total suspended particulates (TSP);
- Particulate matter with equivalent aerodynamic diameter less than or equal to 10 microns (PM_{10}); and
- Deposited dust.

Table 2 summarises the current air quality assessment criteria for particulate matter, as noted by the DECCW. In general, these criteria relate to the total burden of dust in the air and not just the dust from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts. A detailed discussion of background levels in the study area is provided in **Section 4.2**.

Table 2: DECCW assessment criteria for particulate matter

Pollutant	Averaging time	Criterion	Application
TSP	Annual average	90 µg/m^3	Cumulative
PM_{10}	Annual average	30 µg/m^3	Cumulative
	Maximum 24-hour average	50 µg/m^3	Project only*
Deposited dust	Annual average (maximum increase)	2 g/m^2/month	Project only
	Annual average (maximum total)	4 g/m^2/month	Cumulative

** This criterion is taken to be non-cumulative for assessment purposes, provided the mine operates with best-practice dust control measures. This approach is consistent with the conditions of consent for the Anvil Hill, and other recent mining projects.*

The DECCW's criteria for TSP and deposited dust have been set to protect against nuisance impacts, while the PM_{10} criteria have been set to protect against adverse health effects.

There is an increasing body of evidence to suggest that criteria for finer particulate matter (for example, $PM_{2.5}$) may be more important for protecting against adverse health impacts, however, at this stage the DECCW has not set criteria for $PM_{2.5}$ that are applied on a project-specific basis.

The criteria listed in **Table 2** are numerically identical to the impact assessment criteria outlined in the conditions of consent for the Anvil Hill Coal Project (PA 06_0014). The adoption of 50 µg/m^3 as a project-only criterion for maximum 24-hour average PM_{10} is also consistent with the short-term land acquisition criteria specified in the consent conditions for the approved mine.

4. Existing Environment

This section describes the dispersion meteorology and existing air quality in the area. The local meteorological and air quality conditions have been determined from a monitoring program that commenced in 2002. At the time of the Anvil Hill Project EA (**Umwelt, 2006**), monitoring data were available up to approximately March 2006. The current study updates and assesses data available until the end of 2009.

4.1. Dispersion Meteorology

Meteorological conditions are important for determining the direction and rate at which pollutant emissions will disperse. The key meteorological requirements of air dispersion models are typically hourly records of wind speed, wind direction, temperature, atmospheric stability class and mixing height.

For air quality assessments, a minimum of one year of hourly data is usually required which ensures that almost all possible meteorological conditions, including seasonal variations, are considered in the simulations.

In NSW, the DECCW have listed requirements for meteorological data that are used for air dispersion modelling in their *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**DEC, 2005**). The DECCW requirements for meteorological data are as follows:

- Data must span at least one year;
- Data must be at least 90% complete; and
- Data must be representative of the area in which emissions are modelled.

Two meteorological stations were installed in the vicinity of the mine site; Coolabah Road and Wybong Road (refer **Figure 5** for locations). These stations have been collecting data since April 2002. The data available for this study included 10 minute (Wybong Road) and 15-minute (Coolabah Road) records of temperature, wind speed and wind direction, among other parameters.

Table 3 shows the data recovery rates from the two meteorological stations since monitoring began. Data for 2004 and 2005 were not available.

- **Table 3: Data recovery rates from the two meteorological monitoring sites**

Year	Coolabah Road	Wybong Road
2002	72%	65%
2003	77%	96%
2004	N/A	N/A
2005	N/A	N/A
2006	100%	97%
2007	77%	91%
2008	100%	68%
2009	72%	75%

Two points were noted about the meteorological data collected from the Coolabah Road site. Firstly, the wind direction data were only collected on the 16 compass points, and not at the one degree resolution that is commonly measured by weather stations collecting data for air quality applications. Also, the data collected at the Coolabah Road site did not contain sufficient parameters for the calculation of atmospheric stability, such as sigma-theta (a measure of the fluctuation of the horizontal wind direction). For these reasons, the data from the Wybong Road are more suitable for dispersion modelling than the Coolabah Road data.

The data collected from the Wybong Road site included all necessary parameters required for the development of a file suitable for dispersion modelling.

Wind-roses have been prepared from the meteorological data to show the pattern of winds that are experienced in the area. **Figure 6** shows the annual wind-roses from wind speed and wind direction data collected from the Coolabah road site, while **Figure 7** shows the wind-roses for the Wybong Road site. At both sites the wind patterns are consistent with the northwest-southeast alignment of winds that are measured in many parts of the Upper Hunter Valley, albeit with a slight rotation anti-clockwise. There is consistency from year to year and between the Coolabah Road and Wybong Road monitoring sites. One clear abnormality is observed in the Coolabah Road data for 2006 where there was an increased proportion of winds from the north. Inspection of the data revealed that a large proportion of recurring zero wind directions were recorded in 2006 – these data were likely to be erroneous.

In the air quality assessment for the approved Anvil Hill Project (**Holmes Air Sciences, 2006a**), meteorological data from the Wybong Road site for 2003 were selected for the dispersion modelling. **Figure 6** and **Figure 7** show that the 2003 data are representative of more recent years, and for consistency with the original assessment, these data were selected for the dispersion modelling of the proposed modifications to the mine plan. The data recovery in 2003 from the Wybong Road site was 96% (**Table 3**), which satisfies the DECCW's 90% criteria.

Figure 8 shows the annual and seasonal wind-roses for the Wybong Road 2003 data. These show that the prevailing winds in summer and autumn are from the east-southeast while in winter and spring, winds from the west to west-northwest prevail. The area experiences a relatively high proportion of calm conditions (that is, winds less than or equal to 0.5 m/s) at around 28%.

Atmospheric stability class has been determined for each hour in the Wybong Road 2003 dataset using sigma-theta and the method recommended by the US EPA (**US EPA, 2000**). Stability class is a measure of the turbulence of the atmosphere and, in the Pasquill-Gifford stability class assignment scheme, ranges from Class A to Class F. Class A is associated with highly unstable or turbulent conditions, while class F relates to stable conditions and typically at night.

Table 4 shows the annual distribution of stability classes, estimated for the Wybong Road 2003 data. The high frequency of F class conditions (30%) suggests that dust emissions will disperse slowly for a large proportion of the time.

- **Table 4: Frequency of occurrence of atmospheric stability classes**

Stability class	Wybong Road 2003
A	15.8%
B	5.6%
C	13.1%
D	27.4%
E	7.8%
F	30.3%
Total	**100%**

As per the assessment for the approved Anvil Hill Project, hourly mixing height was estimated using schemes by **Powell (1976)** for day-time conditions and **Venkatram (1980)** for night-time conditions. This approach provides a reasonable estimate of mixing height in the absence of locally-collected upper air data.

Statistics on the frequency of wind speed, wind direction, stability class and mixing height are provided in **Appendix A**.

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4.2. Existing Air Quality

The DECCW air quality assessment criteria (see **Table 2**) refer to pollutant levels which are either project-specific or include the contribution from existing pollutant sources (that is, cumulative). To assess impacts for criteria which include the contribution from existing pollutant sources, it is therefore necessary to have information on existing dust concentrations and deposition levels in the area in which the project is likely to contribute to these levels.

This section discusses the existing air quality environment, as determined by results from an environmental monitoring program. Since 2004, dust concentrations have been measured in the area by high volume air samplers and dust fallout levels by deposition gauges. **Figure 5** shows the location of the monitoring sites.

Holmes Air Sciences reviewed air quality monitoring data collected between 2004 and 2006 (**Holmes Air Sciences, 2006a**). These data, as well as data collected up until December 2009 are discussed below.

4.2.1. Dust Concentration

There are three high volume air samplers in the study area; two measuring PM_{10} concentrations and one measuring TSP concentrations. Data from these instruments can be used to determine the existing background dust concentration levels, prior to the commencement of mining activities.

As discussed in **Section 2**, construction commenced in November 2009 but no mining activities have commenced at the site. The results from the TSP and PM_{10} monitoring until the end of October 2009 will therefore not include any project-related dust sources but will include all other background sources of particulate matter that are relevant to the monitoring locations. The monitoring data will include contributions from other mining activities, traffic on unsealed roads, local building and construction activities, rural land uses including farming and animal grazing activities, and to a lesser extent traffic from the other local roads.

The PM_{10} data collected since monitoring began are shown in **Figure 9**. One 24-hour average concentration has been measured every sixth day, in accordance with Australian Standards.

It can be seen from **Figure 9** that the highest PM_{10} concentrations are in the summer months, which are not usually the driest months, but the warmer weather raises the potential for drier ground, convective meteorological conditions and more windblown dust. The summer months are also when bushfires prevail, which can significantly influence dust concentrations in the ambient air.

Table 5 provides a summary of the measured TSP and PM_{10} concentrations. Annual and maximum 24-hour averages have been presented for comparison with the DECCW's air quality criteria.

Table 5: Summary of measured dust concentrations in the study area

Year	Measured concentrations (µg/m^3)				
	TSP 1	PM10-1		PM10-2	
	Annual average	Maximum 24-hour average	Annual average	Maximum 24-hour average	Annual average
2004	36	39	16	45	19
2005	35	**52**	17	45	14
2006	35	34	15	36	16
2007	36	**54**	17	**63**	20
2008	32	**53**	17	48	16
2009	42	**67**	19	**60**	20
All years	36	54	17	63	17
Criteria	90	50	30	50	30

The TSP data show very little variation from year to year with average concentrations ranging between 32 and 42 µg/m^3. These levels are well below the DECCW's 90 µg/m^3 criterion, suggesting good air quality with respect to long-term particulate matter concentrations. Over all years, the average was 36 µg/m^3, which is similar to the value (35 µg/m^3) assumed as the background TSP level in the Anvil Hill Project EA (**Umwelt, 2006**).

Maximum 24-hour average PM_{10} concentrations have exceeded the 50 µg/m^3 criterion at both monitoring sites, as can be seen from **Figure 9**. At PM10-1, 50 µg/m^3 was exceeded six times since 2004; once in early 2005 (52 µg/m^3), once in late 2007 (54 µg/m^3), twice in 2008 (53 and 52 µg/m^3 in early and mid 2008 respectively) and twice in 2009 (67 and 63 µg/m^3 in March and May respectively). The 50 µg/m^3 criterion was exceeded four times at PM10-2; on three occasions in the summer of 2007/2008 and once in May 2009 (60 µg/m^3). These exceedances occurred prior to any works commencing on the Mangoola Coal site, with the exception of the exceedances that occurred in 2009.

The 24-hour average PM_{10} records show that exceedances of the short-term criteria can occur on many occasions, even in the absence of a specific project. Hot, dry and windy days are often precursors to high short-term PM_{10} concentrations but smoke from bushfires and dust storms can also cause very high levels.

Average PM_{10} concentrations have been below the DECCW's 30 µg/m^3 criterion at both monitoring sites. At PM10-1 there has been little variation from year to year with the annual averages ranging between 15 and 19 µg/m^3. Annual averages at PM10-2 have showed a slightly larger variation than PM10-1 with levels ranging between 14 and 20 µg/m^3. The data show compliance with the 30 µg/m^3 criterion for all years since 2004.

For assessment of annual average PM_{10} concentrations due to the proposed mining activities, a background PM_{10} needs to be established. From the data available at the time of the Anvil Hill Project EA, Holmes Air Sciences determined that the representative background PM_{10} level was 15 µg/m^3. With the data collected since 2006, the PM_{10} concentrations have increased slightly, and by taking the average of data from both PM10-1 and PM10-2, a revised estimate of average background PM_{10} levels is 17 µg/m^3. The slight increase in PM_{10} concentrations can be largely attributed to less rainfall and drier weather over recent years.

4.2.2. Dust Deposition

Dust deposition data have been collected in the area surrounding the Mangoola site since March 2002. **Figure 5** shows the location of the monitoring sites. Annual averages of the monthly records, up to 2009, are shown in **Table 6**.

As for the earlier records, there were several months in the recent data where the results from gauges were deemed contaminated, for example, contamination from insects, vegetation or bird droppings. The contaminated records were excluded from the calculations of annual averages.

Only one of the 20 gauges has recorded annual average deposition levels above the DECCW's 4 g/m^2/month criterion; DG14 in 2004 (10.3 g/m^2/month) and 2005 (6 g/m^2/month). Cultivation in the area surrounding this gauge at the time was thought to have influenced the monitored levels (**Holmes Air Sciences, 2006a**). In subsequent years, DG14 has measured levels below 4 g/m^2/month.

With the exception of DG14, all gauges have recorded annual average dust deposition below 4 g/m^2/month in all years. The average deposition for all years and from all sites is 1.6 g/m^2/month, which is close to the value (1.5 g/m^2/month) used as the background deposition level for air quality assessment purposes in the Anvil Hill Project EA (**Umwelt, 2006**).

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▪ **Table 6: Summary of measured dust deposition in the study area**

Gauge	Insoluble solids (g/m^2/month). Criterion = 4 g/m^2/month								
	2002	2003	2004	2005	2006	2007	2008	2009	Average (all years)
1	1.3	0.7	1.4	1.0	1.7	1.5	1.3	2.6	1.4
2	1.7	1.3	2.4	1.4	1.7	1.7	2.7	3.8	2.1
3	0.9	1.2	0.8	0.9	1.6	1.4	1.5	2.2	1.3
4	1.3	0.9	1.1	1.1	2.1	1.5	1.1	1.6	1.3
5	0.9	0.6	0.8	0.7	1.6	0.9	0.7	1.6	1.0
6	1.2	0.9	1.6	1.0	1.3	1.3	1.8	2.4	1.4
7	1.1	1.1	0.8	1.0	1.3	1.4	1.4	2.0	1.2
8	1.2	1.1	0.8	2.0	1.2	0.9	1.4	1.6	1.3
9	1.6	1.2	0.7	1.1	1.2	1.6	1.6	2.4	1.4
10	1.2	1.6	0.9	1.1	1.2	1.1	1.1	1.8	1.3
11	1.7	1.3	1.1	1.1	1.3	1.0	1.0	2.1	1.3
12	2.0	1.7	0.8	1.2	1.2	1.6	1.3	1.5	1.4
13	1.4	1.0	1.1	1.0	1.2	0.9	0.9	2.3	1.2
14	2.3	3.6	**10.3**	**6.0**	3.0	1.2	1.2	2.4	3.7
15	2.3	1.2	1.0	2.3	1.6	1.9	2.3	2.0	1.8
16	1.5	0.8	1.0	1.7	1.3	1.5	1.3	2.1	1.4
17	1.9	1.3	2.4	2.3	2.2	1.7	2.1		2.0
18	2.4	1.3	1.5	1.7	2.1	1.8	1.3	2.4	1.8
19	1.2	1.1	0.9	2.0	1.3	1.4	1.7	1.8	1.4
20	2.7	1.4	0.8	2.2	2.0	1.5	1.2	3.3	1.9
Average (all sites)	1.6	1.3	1.6	1.6	1.6	1.4	1.4	2.2	**1.6**

4.2.3. Summary of Existing Air Quality

The existing air quality environment, with respect to dust, has been well quantified from the measurements of dust deposition and dust concentration in the study area. Discussion of the monitoring data, provided above, has led to the following conclusions about the existing air quality environment:

- Annual average PM_{10} and TSP concentrations are in compliance with the DECCW's air quality assessment criteria;
- Short-term (that is, 24-hour average) PM_{10} concentrations have exceeded the 50 µg/m^3 criterion on occasions at both monitoring sites in the past five years; and
- Average dust deposition levels are in compliance with the DECCW's air quality assessment criteria.

The monitoring data have been used to establish background levels that apply at the nearest receptors for assessment purposes. The assumed levels are as follows:

- Annual average TSP of 36 µg/m^3;
- Annual average PM_{10} of 17 µg/m^3; and
- Annual average dust deposition of 1.6 g/m^2/month.

The assumed background levels are very close to the levels used for the Anvil Hill Project EA (**Umwelt, 2006**). It is noted that annual average PM_{10}, has increased slightly from 15 to 17 µg/m^3. The background PM_{10} levels will fluctuate slightly from year to year, due to climatic variations in rainfall, and adopting 17 µg/m^3 as the average background PM_{10} concentration is consistent with recent data.

For DECCW assessment criteria that need consideration of background levels, these values have been added to dispersion model predictions. The result is then compared with the relevant DECCW assessment criteria.

5. Estimated Dust Emissions

Dust emissions arise from various activities at open-cut mines. Total dust emissions due to the Mangoola Coal mining activities have been estimated by analysing the material handling schedule, equipment listing and mine plans for selected years of operation and identifying the location and intensity of dust generating activities.

Proposed operations have been combined with emissions factors developed both locally and by the US EPA. The emission factors used for this assessment are consistent with those applied in the Anvil Hill Project EA and have been drawn largely from the following:

- *Emission Estimation Technique Manual for Mining* (**NPI, 2001**); and
- AP 42 (**US EPA, 1985 and updates**).

There has been very little change to the techniques for estimating dust emissions from mining operations since the Anvil Hill Project EA was published. The most recent developments are that the US EPA emission factors for mining operations were subject to significant revisions in 2003 and an update to the NPI manual is currently under consideration[1]. The emission factors applied are considered to be the most up to date methods for determining dust generation rates.

This assessment has considered four key conceptual operational scenarios; namely Year 2, Year 5, Year 10 and Year 15. These four scenarios are considered to be representative mine stages for the life of the Mangoola Coal Mine. The mine plans have been used to determine haul road distances and routes, stockpile areas and locations, activity operating hours, truck sizes and other details necessary to estimate dust emissions for each of these scenarios.

Table 7 shows the annual dust emission estimates for each assessment scenario. Details of the dust emission calculations are presented in **Appendix B**.

As the emission estimation techniques are consistent with those adopted for the Anvil Hill Project EA, any changes to the total dust emissions would be a result of changes to the mine planning.

As per the assessment of the approved mine, the emission calculations assume that a high level of dust control efficiency (90%) can be achieved on the internal haul roads. This level of control will need to be implemented through the application of water and/or chemical dust suppressants.

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[1] In 2005, SKM also undertook a review of the NPI mining emission factors in *Improvements of NPI Fugitive Particulate Matter Emissions Estimation Techniques* (SKM, 2005).

Table 7: Estimate dust emissions for each assessment scenario

Activity	Annual TSP emissions (kg/y)			
	Year 2	Year 5	Year 10	Year 15
OB - Stripping topsoil in NORTHERN pit	462	1411	378	0
OB - Stripping topsoil in SOUTHERN pit	378	157	462	0
OB - Drilling in NORTHERN pit	3674	10499	5295	100
OB - Drilling in SOUTHERN pit	3006	1167	6471	0
OB - Blasting in NORTHERN pit	6075	17359	8754	165
OB - Blasting in SOUTHERN pit	4970	1929	10699	0
OB - Sh/Ex/FELs loading in NORTHERN pit	28385	81317	40768	228
OB - Sh/Ex/FELs loading in SOUTHERN pit	23224	9035	49827	0
OB - Hauling to emplace from NORTHERN pit	148236	459088	161113	1159
OB - Hauling to emplace from SOUTHERN pit	196676	17853	196916	0
OB - Emplacing at dumps in NORTHERN pit	28385	81317	40768	228
OB - Emplacing at dumps in SOUTHERN pit	23224	9035	49827	0
OB - Dozers on O/B in NORTHERN pit	123882	378346	172235	7456
OB - Dozers on O/B in SOUTHERN pit	101358	42038	210510	0
CL - Drilling in NORTHERN pit	8762	17656	8828	1328
CL - Drilling in SOUTHERN pit	7169	1962	10790	0
CL - Blasting in NORTHERN pit	9792	19733	9867	1484
CL - Blasting in SOUTHERN pit	8012	2193	12059	0
CL - Dozers ripping in NORTHERN pit	183728	269312	115613	11226
CL - Dozers ripping in SOUTHERN pit	150323	29924	141305	0
CL - Loading ROM to trucks in NORTHERN pit	393048	794503	397252	57843
CL - Loading ROM to trucks in SOUTHERN pit	321585	88278	485530	0
CL - Hauling ROM coal to dump hopper from NORTHERN pit	72722	142800	111300	10091
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	20400	14933	84700	0
CL - unloading ROM coal at pile/hopper all pits	85000	105000	105000	6880
CL - ROM rehandle pile to hopper	25245	23100	23100	1514
CL - Handling coal at CHPP	8878	9711	9711	729
CL - Dozer pushing ROM coal	69348	75849	75849	7671
CL - Dozer pushing product coal	27477	30053	30053	3039
CL - Loading product coal stockpile	671	734	734	55
WE - OB dumps at NORTHERN pit	252176	556321	467634	358242
WE - OB dumps at SOUTHERN pit	0	59636	81493	0
WE - NORTHERN pit	322547	494716	194962	158406
WE - SOUTHERN pit	105809	33764	282695	0
WE - ROM stockpiles	13404	6093	6093	6093
WE - Product stockpiles	3509	3509	3509	3509
Loading coal to trains	671	734	734	55
Grading roads	36928	36928	36928	36928
Total dust (kg)	**2,819,141**	**3,927,993**	**3,649,760**	**674,428**
Annual ROM production (Mt)	**8.5**	**10.5**	**10.5**	**0.688**

OB = Operation on overburden. CL = Operation on coal. WE = Wind erosion.

6. Assessment Methodology

This assessment has followed the DECCW's *Approved Methods of the Modelling and Assessment of Air Pollutants in New South Wales* (**DEC, 2005**), which specifies how assessments based on the use of air dispersion models should be undertaken. The "Approved Methods" include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

The approach taken in this assessment follows as closely as possible to the approaches suggested by the DECCW. The only deviation relates to the use of a modified version of the ISCST3 model (referred to as ISCMOD) instead of the AUSPLUME, CALPUFF or TAPM models which are listed in the *Approved Methods*. The modification to ISCST3 was initiated to improve the performance in predicting short-term (that is, 24-hour average) PM_{10} concentrations and results from ISCMOD show closer agreement to the AUSPLUME model. For the Anvil Hill Project air quality assessment a simple correction factor (1.6) was applied to 24-hour average predictions in an effort to improved the ISCST3 results. Since that time, use of ISCMOD has been used as a more scientifically sound approach.

ISCMOD has been accepted for use in NSW by the DECCW for a number of recently completed mining and quarry assessments.

The dispersion modelling was based on meteorological information (**Section 4.1**) and the dust emission estimates (**Section 5**) to predict dust concentrations and deposition levels at 529 receptors in the study area. The model receptors included 309 residential locations and incorporated terrain elevations.

Mining operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. **Figure 4** shows the location of the modelled sources, where the emissions from the dust generating activities listed in **Table 7** were assigned to one or more of these source locations (refer **Appendix B**).

The volume sources were given TSP emission rates and duplicated into three source groups, representing three particle size categories; namely, $PM_{2.5}$ (particles in size range 0 to 2.5 µm), $PM_{2.5\text{-}10}$ (particles in size range 2.5 to 10 µm) and $PM_{10\text{-}30}$ (particles in size range 10 to 30 µm). Each source was assumed to have an aerodynamic particle diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have a particle size of 1 µm.

Once the model had completed each simulation, the three output files from each source group were combined according to the distribution of particles in each particle size range. The distribution of particles in each size range has been derived from measurements published by the State Pollution Control Commission (**SPCC, 1986**) and is as follows:

- $PM_{2.5}$ is 4.7% of TSP;
- $PM_{2.5\text{-}10}$ is 34.4% of TSP; and
- $PM_{10\text{-}30}$ is 60.9% of TSP.

Emissions from each source were developed on an hourly time step, taking into account the level of activity at that location and the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

Emissions associated with blasting have been confined to day-time hours (6 am to 6 pm for the purposes of the modelling) while all other activities have been modelled for 24 hours per day.

As per the Anvil Hill Project air quality assessment, pit retention (that is, retention of dust particles within the open pit) has been included in the model simulations. The pit retention calculation determines the fraction of dust emitted in the pit which would escape the pit. The "escaped fraction" is a function of the gravitational settling velocity of the particles and the wind speed and is shown by the following relationship (**US EPA, 1995**).

Equation 1:

$$\varepsilon = \frac{1}{\left(1 + \frac{v_g}{(\alpha U_r)}\right)}$$

where:
ε = escaped fraction for the particle size category
V_g = gravitational settling velocity (m/s)
U_r = approach wind speed at 10 m (m/s)
α = proportionality constant in the relationship between flux from the pit and the product of U_r and concentration in the pit (0.029)

To model the effect of pit retention, the emissions from sources within the open pits have been reduced, as per the approach above, to account for the fact that much of the coarser dust would remain trapped in the pit.

To assess the impacts of the Mangoola Coal Mine, the model predictions have been compared with the current DECCW air quality assessment criteria, including background levels where relevant to the criteria. Contour plots have also been created to show the spatial distribution of model predictions.

7. Assessment of Impacts

7.1. Preamble

Holmes Air Sciences undertook the air quality assessment for the approved mine (**Holmes Air Sciences, 2006a**). The key objective of this study was to predict the extent of air quality (that is, dust) impacts due to the originally proposed mining activities. The study was based on the use of an air dispersion model to predict off-site dust impacts and the results were compared with relevant air quality assessment criteria. Contour plots showed the areas in which adverse dust impacts were predicted.

The current study of the proposed mine plan modifications has the same objective as the Holmes Air Sciences' study; namely, to predict the extent of air quality impacts due to proposed mining activities. As discussed in earlier sections of this report, the same approach in terms of meteorological data, emission estimation and modelling approach has been adopted.

Results from the dispersion modelling for each assessment scenario have been prepared into contour plots of dust concentration and deposition levels, shown in **Figure 10** through to **Figure 13**. These figures include:

- Predicted maximum 24-hour average PM_{10} concentrations;
- Predicted annual average PM_{10} concentrations;
- Predicted annual average TSP concentrations; and
- Predicted annual average dust deposition levels.

The 24-hour average PM_{10} plots do not show the dispersion pattern for any particular day, rather they show the highest 24-hour average PM_{10} concentration that was predicted at each location in the model domain over the entire simulation year.

The air quality criteria used for deciding which areas are likely to experience air quality impacts are specified by the DECCW and are listed in **Table 2**. The criteria (minus background levels) are also represented on the plots as enhanced contour lines. As an example, the DECCW's annual average PM_{10} criteria is 30 $\mu g/m^3$ which, by definition, should include project-specific and background sources. Since the average background PM_{10} concentration has been determined to be 17 $\mu g/m^3$, the dust contribution from the mining activities could be up to 13 $\mu g/m^3$, before the 30 $\mu g/m^3$ criteria will be shown to be exceeded.

7.2. Model Predictions

Figure 10 through to **Figure 13** show the dispersion model predictions for each assessment scenario. The contour plots show predicted concentrations and deposition levels due only to modelled dust sources associated with the proposed mine plan modifications. That is, the predictions do not include contributions from other sources. As discussed above the air quality assessment criteria are represented on these plots as enhanced contour lines. For clarity, the residences that are identified as “Mine-owned” or “Xstrata Mangoola Pty Limited” are all owned by Xstrata Mangoola and have therefore been removed from the contour plots.

As expected, the contour plots show that the highest levels are predicted to be centred around the location of the major dust generating activities – that is, around the active pits, overburden dumps, haul routes, and coal preparation plant.

The model predictions for all 309 residential locations are provided in **Appendix C**. Analysis of all results, for residences not identified as “Mine-owned” or “Xstrata Mangoola Pty Limited”, showed the following:

- Maximum 24-hour average PM_{10} concentrations are predicted to comply with the 50 µg/m^3 (project-only) criterion at all private residences for all assessment years.
- Annual average PM_{10} concentrations are predicted to comply with the 30 µg/m^3 (cumulative) criterion at all private residences for all assessment years.
- Annual average TSP concentrations are predicted to comply with the 90 µg/m^3 (cumulative) criterion at all private residences for all assessment years.
- Annual average dust deposition levels are predicted to comply with the 2 g/m^2/month (project increment) and 4 g/m^2/month (cumulative) criteria at all private residences for all assessment years.

7.3. Comparison with Approved Project

Figure 14 shows the predicted extent of air quality impacts, as defined by the DECCW criteria, for the approved and proposed mining activities. The contour lines represent the maximum extent of impacts predicted for the four assessment scenarios.

From examination of **Figure 14**, the overall predicted extent of air quality impacts vary slightly, depending on the location and dust classification. For maximum 24-hour average PM_{10} concentrations, the predicted extent of impacts for the modified mine (as defined by the DECCW’s 50 µg/m^3 criterion) are slightly lower than the expected impacts for the approved mine to the south and west of the disturbance boundary. Slight increases are predicted to the north and northeast. Annual average PM_{10}, TSP and dust deposition impacts are very similar for approved and proposed mining activities and from a dispersion modelling perspective the results are very similar. One of the key drivers to predicted reductions in the extent of impacts is a reduction to the active overburden emplacement areas during stages of anticipated maximum production (that is, Year 5 and Year 10).

Under the proposed mine plan modifications, the predicted impacts do not extend over any private residences that are not already within the extent of impacts for the approved mine activities. Note that, for clarity, the plots in this figure do not show residences identified as "Mine-owned" or "Xstrata Mangoola Pty Limited".

7.4. Cumulative and Regional Impacts

The dust monitoring program for the Mangoola Coal site captures the effects that dust emissions from other existing mining operations have on air quality in the study area. The monitoring program has not however captured the effects of dust emissions from expected changes in future activities from other mining operations.

The nearest mining operations to the Mangoola Coal site which are known to commence or undergo significant modifications to activities are as follows:

- Bengalla Mine; an existing operation approximately 12 km to the east of Mangoola Coal site. In 2006, Bengalla Mine was approved to increase production from 8.7 to 10.7 Mtpa of ROM coal.
- Mt Pleasant Mine; an approved operation approximately 15 km to the east-northeast of Mangoola Coal site. Approval has been granted to extract up to 10.5 Mtpa of ROM coal. At this stage, a date to commence mining is not publicly available.
- Mt Arthur Coal Mine; a large open-cut mine approximately 15 km to the east-southeast of the Mangoola Coal site which has approval to extract up to 20 Mtpa of ROM coal. Recently (2008), approval was granted for the extension of the existing South Pit Extension (producing up to 3 Mtpa ROM coal) and operation of an underground coal mine (producing up to 8 Mtpa).

Air quality impacts due to modifications to the Bengalla Mine were assessed by **Holmes Air Sciences (2006b)**. The assessment used computer-based dispersion modelling to predict the contribution of dust emissions from the Bengalla activities to the local air quality environment. The modelling showed that annual average PM_{10} and TSP concentrations would reduce to less than 1 $\mu g/m^3$ by the time emissions reached the receptors in the current assessment. Annual average dust deposition due to Bengalla Mine was predicted to have reduced to below 0.1 g/m^2/month at these receptors.

The Mount Pleasant Mine EIS (**ERM, 1997**) provided predictions of the air quality impacts of the Mt Pleasant Mine activities. As mining has not commenced it is not possible to match to development stages of this mine with the development stages of the Mangoola Coal Mine, although some analysis of potential cumulative impacts can be inferred.

The model results in the Mount Pleasant Mine EIS indicated that there would be almost no transport of emissions from the mine towards the area around the Mangoola Coal site. This was due to the prevailing winds which are typically from the northwest in winter and from the southeast in summer. Under these winds, the cumulative impacts of the Mangoola Coal site and the Mt Pleasant Mine are expected to be minimal. This analysis is supported by the earlier assessment of the approved mining activities (**Holmes Air Sciences, 2006a**).

At Mt Arthur Coal Mine, the air quality impacts of the (now) approved South Pit Extension and Underground projects were assessed by **Holmes Air Sciences (2006c and 2007)**. For the South Pit Extension the dispersion modelling (Figures 10 to 12 of Holmes Air Sciences, 2006c) showed very little change to off-site dust concentrations and deposition levels from the then approved operations.

Similarly, the air quality assessment for the underground project provided a comparison of impacts with the approved operations at Mt Arthur Coal Mine. Again, dispersion modelling showed very little change to off-site dust concentrations and deposition levels. The assessments of future changes to Mt Arthur Coal Mine operations have suggested that the off-site air quality impacts will not vary significantly from the approved activities.

The monitoring around the Mangoola Coal site will contain some contribution from Mt Arthur Coal mine activities and, from the discussion above, the existing data will contain information that is generally representative of the dust contribution from future activities at the Mt Arthur Coal Mine.

Based on the review above, the potential cumulative effects of emissions from other mines in the vicinity of the Mangoola Coal site are considered to be insignificant and will not affect the conclusions of this assessment. Dust emissions from existing mining operations are captured by the monitoring program undertaken for the Mangoola Coal site and these data have been included as background levels in **Section 7.2** and **7.3**.

8. Dust Monitoring and Mitigation

Mangoola Coal has developed an Air Quality Monitoring Plan (AQMP) to address the project approval conditions. The AQMP (**Mangoola Coal, 2008**) outlines the regulatory requirements of site activities, and lists the commitments for managing air quality impacts.

In summary, the AQMP was developed from the following process:

- Identification of the main dust generating sources;
- Identification of the potentially affected off-site locations, with respect to relevant air quality criteria;
- Review of existing air quality and meteorological monitoring data; and
- Assessment of potential dust mitigation measures.

The main objective of the AQMP is to provide details of the monitoring equipment and locations that will be used during construction and early works activities. The monitoring program may then be extended to the operations.

The air quality monitoring program will be based on the following:

- One (1) high volume air sampler measuring PM_{10} concentrations, located off the northern side of Wybong Hall Road;
- One (1) high volume air sampler measuring TSP concentrations, located off the northern side of Wybong Hall Road;
- One (1) high volume air sampler measuring PM_{10} concentrations, to be relocated off the northern side of the Golden Highway, to the south of the Mangoola Coal site; and
- 21 dust deposition gauges in their present position (refer **Figure 5**).

In addition, four (4) real-time continuous dust monitoring instruments will be situated to the south, east, north and west of the mine. The locations have not yet be finalised but will consider the local topography, the nearest residences, and the predominant wind directions. The existing Wybong Road and Coolabah Road weather stations will be operated for the life of the mine.

Mangoola Coal are proposing to use a monitoring system that allows for automatic download and reporting of data from the continuous dust monitoring instruments.

Air quality management procedures to cover operational activities will be developed prior to the commencement of mining, but are expected to include:

- Water sprays at coal handling transfer points;

- Defining all roads and limiting access to minor roads;
- Imposition of speed limits on all internal roads;
- Water carts on active haul roads;
- Disturbance of the minimum area practicable;
- Reshaping and rehabilitating as soon as practicable;
- Dust suppressants fitted to drills;
- Design blasts to minimise dust; and
- Consideration of weather conditions prior to blasting.

Given that the dispersion modelling of the modified mining activities has shown a similar level of dust impact to the approved activities (**Section 7**), no changes to the originally planned dust management and control strategies are required.

9. Conclusions

This report has assessed the potential air quality impacts associated with the proposed modifications to the Mangoola Coal mine plan. The modifications have been developed to streamline operations and to provide for a more efficient mine layout.

Dispersion modelling has been used to predict off-site dust concentration and dust deposition levels due to the dust generating activities associated with the mine activities. The dispersion modelling took into account meteorological conditions and terrain information and used dust emission estimates to predict the air quality impacts for four mine operational mining scenarios. One objective of the assessment was to compare the predicted air quality impacts for the modified mine with the approved mine.

The dispersion modelling showed that no residential properties (not identified as “Mine-owned” or “Xstrata Mangoola Pty Limited”) are expected to be adversely affected by dust emissions during each stage of the proposed mine life. This conclusion was based on comparisons of the model predictions with DECCW air quality assessment criteria. Background dust concentrations and deposition levels were considered, where relevant.

The model predictions are summarised as follows:

- Maximum 24-hour average PM_{10} concentrations are predicted to comply with the 50 $\mu g/m^3$ (project-only) criterion at all private residences for all assessment years.
- Annual average PM_{10} concentrations are predicted to comply with the 30 $\mu g/m^3$ (cumulative) criterion at all private residences for all assessment years.
- Annual average TSP concentrations are predicted to comply with the 90 $\mu g/m^3$ (cumulative) criterion at all private residences for all assessment years.
- Annual average dust deposition levels are predicted to comply with the 2 g/m^2/month (project increment) and 4 g/m^2/month (cumulative) criteria at all private residences for all assessment years.

The predicted air quality impacts for the proposed mine plan were also compared with the predicted impacts for the approved mine. The modelling showed that the air quality impacts for the proposed mine plan would be similar to those predicted for the approved mine and, under the proposed mine plan, the predicted impacts would not extend over any private residences that were not already within the extent of impacts for the approved mine activities.

Dust monitoring and mitigation measures were reviewed in the context of the proposed activities. Given that the dispersion modelling of the proposed mining activities predicted a similar level of

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dust impact to the approved activities (see **Section 7**), no changes to the originally planned dust management and control strategies were deemed necessary.

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10. References

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Appendix A Meteorological data statistics

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STATISTICS FOR FILE:  I:\ENVR\Projects\EN02627\Technical\metdata\wyb2003.isc
MONTHS: All
HOURS : All
OPTION: Frequency
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ALL PASQUILL STABILITY CLASSES

WIND SECTOR	Wind Speed Class (m/s) 0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.010119	0.000952	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.011190
NE	0.024167	0.001190	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.025476
ENE	0.022262	0.004524	0.000476	0.000238	0.000000	0.000000	0.000000	0.000000	0.027500
E	0.021667	0.030357	0.012262	0.004167	0.001548	0.000000	0.000000	0.000000	0.070000
ESE	0.024762	0.060000	0.054643	0.026310	0.006190	0.000714	0.000000	0.000000	0.172619
SE	0.019643	0.034286	0.021429	0.007619	0.002262	0.000238	0.000000	0.000000	0.085476
SSE	0.009643	0.007619	0.002857	0.000119	0.000000	0.000000	0.000000	0.000000	0.020238
S	0.009167	0.001905	0.000714	0.000119	0.000000	0.000000	0.000000	0.000000	0.011905
SSW	0.013690	0.002262	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.016190
SW	0.016905	0.004643	0.001548	0.000000	0.000000	0.000000	0.000000	0.000000	0.023095
WSW	0.010714	0.008452	0.005476	0.002262	0.000595	0.000357	0.000000	0.000000	0.027857
W	0.009762	0.017976	0.022976	0.015952	0.007619	0.003690	0.000476	0.000000	0.078452
WNW	0.006786	0.016548	0.020952	0.015238	0.008095	0.002381	0.000000	0.000000	0.070000
NW	0.008571	0.014762	0.009286	0.005119	0.001548	0.000595	0.000000	0.000000	0.039881
NNW	0.011429	0.009048	0.004286	0.002381	0.001548	0.000952	0.000000	0.000000	0.029643
N	0.009167	0.004167	0.000238	0.000119	0.000119	0.000000	0.000000	0.000000	0.013810
CALM									0.276667
TOTAL	0.228452	0.218690	0.157619	0.079643	0.029524	0.008929	0.000476	0.000000	1.000000

MEAN WIND SPEED (m/s) = 2.14

NUMBER OF OBSERVATIONS = 8400

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.002024	0.000357	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.002500
NE	0.004405	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004762
ENE	0.004762	0.002143	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.007024
E	0.007381	0.009524	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.017143
ESE	0.007381	0.011071	0.001190	0.000119	0.000000	0.000000	0.000000	0.000000	0.019762
SE	0.005238	0.005476	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.010952
SSE	0.003333	0.001190	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004524
S	0.004405	0.000238	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.004762
SSW	0.006429	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006905
SW	0.006071	0.000952	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007024
WSW	0.005238	0.001786	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.007262
W	0.003571	0.003095	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.006905
WNW	0.002381	0.002024	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.004524
NW	0.002976	0.002024	0.000238	0.000119	0.000000	0.000000	0.000000	0.000000	0.005357
NNW	0.003214	0.000952	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.004286
N	0.002976	0.001548	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004524
CALM									0.039881
TOTAL	0.071786	0.043214	0.002976	0.000238	0.000000	0.000000	0.000000	0.000000	0.158095

MEAN WIND SPEED (m/s) = 1.24
NUMBER OF OBSERVATIONS = 1328

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000119	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000357
NE	0.000119	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000238
ENE	0.001548	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001905
E	0.000833	0.005357	0.001548	0.000119	0.000000	0.000000	0.000000	0.000000	0.007857
ESE	0.001190	0.007143	0.006190	0.000476	0.000000	0.000000	0.000000	0.000000	0.015000
SE	0.001548	0.002976	0.000833	0.000000	0.000000	0.000000	0.000000	0.000000	0.005357
SSE	0.000119	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000476
S	0.000119	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000595
SSW	0.001310	0.000595	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001905
SW	0.001667	0.000833	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.002857
WSW	0.000357	0.002381	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.003214
W	0.000000	0.003095	0.001905	0.000119	0.000000	0.000000	0.000000	0.000000	0.005119
WNW	0.000238	0.000833	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.001548
NW	0.000357	0.001310	0.000714	0.000595	0.000000	0.000000	0.000000	0.000000	0.002976
NNW	0.000476	0.000476	0.000357	0.000119	0.000000	0.000000	0.000000	0.000000	0.001429
N	0.000238	0.000952	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.001429
CALM									0.003810
TOTAL	0.010238	0.027500	0.013095	0.001429	0.000000	0.000000	0.000000	0.000000	0.056071

MEAN WIND SPEED (m/s) = 2.36
NUMBER OF OBSERVATIONS = 471

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000238
NE	0.000357	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000595
ENE	0.000952	0.000000	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.001071
E	0.000714	0.003810	0.005119	0.002024	0.000000	0.000000	0.000000	0.000000	0.011667
ESE	0.000833	0.008214	0.020595	0.013095	0.000000	0.000000	0.000000	0.000000	0.042738
SE	0.001190	0.005238	0.008810	0.003214	0.000000	0.000000	0.000000	0.000000	0.018452
SSE	0.000595	0.001905	0.001667	0.000119	0.000000	0.000000	0.000000	0.000000	0.004286
S	0.000357	0.000238	0.000595	0.000119	0.000000	0.000000	0.000000	0.000000	0.001310
SSW	0.001548	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001905
SW	0.001905	0.001429	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.003810
WSW	0.000119	0.001310	0.002738	0.001190	0.000000	0.000000	0.000000	0.000000	0.005357
W	0.000476	0.002976	0.008333	0.006071	0.000000	0.000000	0.000000	0.000000	0.017857
WNW	0.000357	0.002143	0.003214	0.002857	0.000000	0.000000	0.000000	0.000000	0.008571
NW	0.000119	0.001429	0.002857	0.002500	0.000000	0.000000	0.000000	0.000000	0.006905
NNW	0.000357	0.000595	0.001429	0.001667	0.000000	0.000000	0.000000	0.000000	0.004048
N	0.000357	0.000357	0.000000	0.000119	0.000000	0.000000	0.000000	0.000000	0.000833
CALM									0.001667
TOTAL	0.010476	0.030238	0.055952	0.032976	0.000000	0.000000	0.000000	0.000000	0.131310

MEAN WIND SPEED (m/s) = 3.59
NUMBER OF OBSERVATIONS = 1103

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000714	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000833
NE	0.003810	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003929
ENE	0.002024	0.001071	0.000238	0.000238	0.000000	0.000000	0.000000	0.000000	0.003571
E	0.002500	0.009048	0.005238	0.002024	0.001548	0.000000	0.000000	0.000000	0.020357
ESE	0.003571	0.024524	0.026667	0.012619	0.006190	0.000714	0.000000	0.000000	0.074286
SE	0.002381	0.013095	0.011548	0.004405	0.002262	0.000238	0.000000	0.000000	0.033929
SSE	0.001190	0.002262	0.001190	0.000000	0.000000	0.000000	0.000000	0.000000	0.004643
S	0.000119	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000595
SSW	0.000238	0.000476	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000952
SW	0.000952	0.000952	0.000714	0.000000	0.000000	0.000000	0.000000	0.000000	0.002619
WSW	0.000595	0.002381	0.001905	0.001071	0.000595	0.000357	0.000000	0.000000	0.006905
W	0.000714	0.006310	0.012262	0.009762	0.007619	0.003690	0.000476	0.000000	0.040833
WNW	0.000238	0.008214	0.017143	0.012381	0.008095	0.002381	0.000000	0.000000	0.048452
NW	0.000238	0.006429	0.005357	0.001905	0.001548	0.000595	0.000000	0.000000	0.016071
NNW	0.000714	0.004405	0.002024	0.000595	0.001548	0.000952	0.000000	0.000000	0.010238
N	0.000357	0.000952	0.000000	0.000000	0.000119	0.000000	0.000000	0.000000	0.001429
CALM									0.004167
TOTAL	0.020357	0.080833	0.084524	0.045000	0.029524	0.008929	0.000476	0.000000	0.273810

MEAN WIND SPEED (m/s) = 3.81
NUMBER OF OBSERVATIONS = 2300

PASQUILL STABILITY CLASS 'E'

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001548	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001548
NE	0.005238	0.000238	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.005595
ENE	0.005119	0.000595	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005714
E	0.003690	0.001905	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.005714
ESE	0.005000	0.007143	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012143
SE	0.004167	0.005952	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010119
SSE	0.002024	0.001429	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003452
S	0.000833	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001071
SSW	0.001667	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001905
SW	0.001071	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001429
WSW	0.001429	0.000476	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.002024
W	0.000714	0.001190	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.002143
WNW	0.000833	0.001667	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002500
NW	0.000833	0.002143	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.003095
NNW	0.000952	0.001310	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.002619
N	0.001190	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001310
CALM									0.015714
TOTAL	0.036310	0.025000	0.001071	0.000000	0.000000	0.000000	0.000000	0.000000	0.078095

Wind Speed Class (m/s)

MEAN WIND SPEED (m/s) = 1.27
NUMBER OF OBSERVATIONS = 656

PASQUILL STABILITY CLASS 'F'

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.005476	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005714
NE	0.010238	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010357
ENE	0.007857	0.000357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008214
E	0.006548	0.000714	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007262
ESE	0.006786	0.001905	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008690
SE	0.005119	0.001548	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006667
SSE	0.002381	0.000476	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002857
S	0.003333	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003571
SSW	0.002500	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002619
SW	0.005238	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005357
WSW	0.002976	0.000119	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003095
W	0.004286	0.001310	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005595
WNW	0.002738	0.001667	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004405
NW	0.004048	0.001429	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005476
NNW	0.005714	0.001310	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007024
N	0.004048	0.000238	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004286
CALM									0.211429
TOTAL	0.079286	0.011905	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.302619

Wind Speed Class (m/s)

MEAN WIND SPEED (m/s) = 0.65
NUMBER OF OBSERVATIONS = 2542

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FREQUENCY OF OCCURENCE OF STABILITY CLASSES
-------------------------------------------
  A : 15.8%
  B : 5.6%
  C : 13.1%
  D : 27.4%
  E : 7.8%
  F : 30.3%


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STABILITY CLASS BY HOUR OF DAY
------------------------------
Hour    A    B    C    D    E    F
  01 0000 0000 0000 0080 0054 0216
  02 0000 0000 0000 0081 0042 0227
  03 0000 0000 0000 0065 0049 0236
  04 0000 0000 0000 0075 0047 0228
  05 0000 0000 0000 0067 0045 0238
  06 0031 0007 0012 0056 0033 0211
  07 0088 0023 0046 0055 0018 0120
  08 0169 0043 0079 0048 0001 0010
  09 0169 0045 0090 0046 0000 0000
  10 0163 0044 0101 0042 0000 0000
  11 0158 0048 0106 0038 0000 0000
  12 0144 0054 0101 0051 0000 0000
  13 0130 0055 0110 0055 0000 0000
  14 0121 0055 0114 0060 0000 0000
  15 0093 0049 0137 0071 0000 0000
  16 0046 0033 0130 0115 0008 0018
  17 0016 0015 0077 0186 0033 0023
  18 0000 0000 0000 0245 0046 0059
  19 0000 0000 0000 0215 0039 0096
  20 0000 0000 0000 0180 0043 0127
  21 0000 0000 0000 0153 0042 0155
  22 0000 0000 0000 0119 0055 0176
  23 0000 0000 0000 0107 0046 0197
  24 0000 0000 0000 0090 0055 0205

--------------------------------
STABILITY CLASS BY MIXING HEIGHT
--------------------------------
Mixing height     A    B    C    D    E    F
    <=500 m     0330 0080 0139 0316 0611 2500
   <=1000 m     0541 0163 0393 0739 0011 0020
   <=1500 m     0457 0228 0571 0993 0034 0022
   <=2000 m     0000 0000 0000 0184 0000 0000
   <=3000 m     0000 0000 0000 0066 0000 0000
    >3000 m     0000 0000 0000 0002 0000 0000
```

MIXING HEIGHT BY HOUR OF DAY

Hour	0000 to 0100	0100 to 0200	0200 to 0400	0400 to 0800	0800 to 1600	1600 to 3200	Greater than 3200
01	0227	0046	0007	0021	0035	0014	0000
02	0241	0030	0009	0019	0041	0010	0000
03	0251	0034	0009	0009	0036	0011	0000
04	0246	0034	0007	0016	0037	0010	0000
05	0271	0025	0006	0014	0026	0008	0000
06	0190	0081	0063	0002	0011	0003	0000
07	0103	0061	0111	0072	0003	0000	0000
08	0000	0054	0126	0170	0000	0000	0000
09	0000	0000	0083	0187	0080	0000	0000
10	0000	0000	0000	0222	0128	0000	0000
11	0000	0000	0000	0126	0224	0000	0000
12	0000	0000	0000	0079	0271	0000	0000
13	0000	0000	0000	0000	0350	0000	0000
14	0000	0000	0000	0000	0350	0000	0000
15	0000	0000	0000	0000	0350	0000	0000
16	0000	0000	0000	0000	0350	0000	0000
17	0013	0016	0002	0007	0310	0002	0000
18	0047	0024	0011	0023	0234	0011	0000
19	0105	0032	0010	0028	0136	0039	0000
20	0134	0035	0007	0029	0120	0025	0000
21	0157	0042	0002	0024	0103	0022	0000
22	0177	0051	0005	0021	0083	0013	0000
23	0204	0039	0006	0023	0068	0010	0000
24	0216	0046	0009	0017	0052	0010	0000

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Appendix B Dust emission calculations

The dust emission inventories have been formulated from the operational description of the proposed mining activities provided by Umwelt. Estimated emissions are presented for all significant dust generating activities associated with the operations. The relevant emission factors used for the study are described below.

Dozers stripping topsoil

An emission rate of 14 kg/h has been used for dozers stripping topsoil and shaping overburden dumps (SPCC, 1983).

Drilling overburden

The emission factor used for drilling has been taken to be 0.59 kg/hole (US EPA, 1985 and updates).

Blasting overburden

TSP emissions from blasting were estimated using the US EPA (1985 and updates) emission factor equation given in Equation 1.

Equation 1

$$E_{TSP} = 0.00022 \times A^{1.5} \quad \text{kg/blast}$$

where,
A = area to be blasted in m^2

Loading material / dumping overburden

Each tonne of material loaded will generate a quantity of TSP that will depend on the wind speed and the moisture content. Equation 2 shows the relationship between these variables.

Equation 2

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right) \quad kg/t$$

where,
E_{TSP} = *TSP emissions*
$k = 0.74$
U = *wind speed (m/s)*
M = *moisture content (%)*
[where $0.25 \leq M \leq 4.8$]

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Hauling material / product on unsealed surfaces

After the application of water and/or chemical dust suppressant the emission factor used for trucks hauling overburden or ROM coal on unsealed surfaces was 0.4 kg per vehicle kilometre travelled (kg/VKT). This represents 90% control efficiency.

Dozers on overburden

Emissions from dozers on overburden have been calculated using the US EPA emission factor equation (US EPA, 1985 and updates). The equation is as follows:

Equation 3

$$\mathrm{E_{TSP}} = 2.6 \times \frac{s^{1.2}}{M^{1.3}} \quad \text{kg/hour}$$

where,

$\mathrm{E_{TSP}} = TSP\ emissions$

s = silt content (%), and

M = moisture (%)

Dozers on coal

The US EPA (1985 and updates) emission factor equation has been used. It is given below in Equation 4.

Equation 4

$$E_{TSP} = 35.6 \times \frac{s^{1.2}}{M^{1.3}} \quad \text{kg/hour}$$

Loading coal

The US EPA (1985 and updates) emission factor equation has been used. It is given below in Equation 5.

Equation 5

$$\mathrm{E_{TSP}} = \frac{0.580}{M^{1.2}} \quad \text{kg/t}$$

where,

$\mathrm{E_{TSP}} = TSP\ emissions$

M = moisture (%)

Unloading ROM coal and re-handling

The emission factor has been taken to be 0.01 kg/t (NPI, 2001).

Loading coal to stockpiles

See equation 2.

Loading coal to trains

See equation 2.

Wind erosion

The emission factor for wind erosion is given in Equation 6 below.

Equation 6

$$E_{TSP} = 1.9 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) \qquad \text{kg/ha/day}$$

where,
s = silt content (%)
p = number of raindays per year, and
f = percentage of the time that wind speed is above 5.4 m/s

Grading roads

Estimated of TSP emissions from grading roads have been made using the US EPA (1985 and updates) emission factor equation (Equation 7).

Equation 7

$$E_{TSP} = 0.0034 \times S^{2.5} \qquad \text{kg/VKT}$$

where,
S = speed of the grader in km/h (taken to be 8 km/h)

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Year 2:

ACTIVITY	TSP emission/year	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units
OB - Stripping topsoil in NORTHERN pit	462	33	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	378	27	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	3,674	6,228	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	3,006	5,095	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	6,075	37	blasts/	165	kg/blas	8250	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	4,970	30	blasts/	165	kg/blas	8250	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	28,385	22,035,035	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	23,224	18,028,665	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	148,236	22,035,035	t/y	0.00673	kg/t	220	t/truck load	3.7	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	196,676	18,028,665	t/y	0.01091	kg/t	220	t/truck load	6	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	28,385	22,035,035	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	23,224	18,028,665	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	123,882	7,402	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	101,358	6,057	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	8,762	14,850	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	7,169	12,150	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	9,792	59	blasts/	165	kg/blas	8250	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	8,012	49	blasts/	165	kg/blas	8250	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	183,728	7,121	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	150,323	5,826	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	393,048	4,675,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	321,585	3,825,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	72,722	4,675,000	t/y	0.01556	kg/t	180	t/load	7	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	20,400	3,825,000	t/y	0.00533	kg/t	180	t/load	2.4	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	85,000	8,500,000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	25,245	2,524,500	t	0.01	kg/t						
CL - Handling coal at CHPP	8,878	9,600,000	t	0.00092	kg/t	1.088	average of (wind spee	8	moisture content of coal in %		
CL - Dozer pushing ROM coal	69,348	5,190	h/y	13.4	kg/h	5	silt content in %	8	moisture content in %		
CL - Dozer pushing product coal	27,477	5,190	h/y	5.3	kg/h	4	silt content in %	12.8	moisture content in %		
CL - Loading product coal stockpile	671	7,008,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	252,176	103.48	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	-	-	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	322,547	132.35	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	105,809	43.42	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	13,404	11.00	ha	1218.5	kg/ha/	66	Average number of rair	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3,509	3.60	ha	974.8	kg/ha/	66	Average number of rair	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	671	7,008,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
Grading roads	36,928	60,000	km	0.61547	kg/VK	8	speed of graders in km/h				

Year 5:

ACTIVITY	TSP emission/year	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units
OB - Stripping topsoil in NORTHERN pit	1,411	101	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	157	11	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	10,499	17,796	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	1,167	1,977	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	17,359	105	blasts/	165	kg/blas	8250	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	1,929	12	blasts/	165	kg/blas	8250	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	81,317	63,124,650	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	9,035	7,013,850	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	459,088	63,124,650	t/y	0.00727	kg/t	220	t/truck load	4	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	17,853	7,013,850	t/y	0.00255	kg/t	220	t/truck load	1.4	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	81,317	63,124,650	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	9,035	7,013,850	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	378,346	22,608	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	42,038	2,512	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	17,656	29,925	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	1,962	3,325	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	19,733	120	blasts/	165	kg/blas	8250	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	2,193	13	blasts/	165	kg/blas	8250	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	269,312	10,438	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	29,924	1,160	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	794,503	9,450,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	88,278	1,050,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	142,800	9,450,000	t/y	0.01511	kg/t	180	t/load	6.8	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	14,933	1,050,000	t/y	0.01422	kg/t	180	t/load	6.4	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	105,000	10,500,000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	23,100	2,310,000	t	0.01	kg/t						
CL - Handling coal at CHPP	9,711	10,500,000	t	0.00092	kg/t	1.088	average of (wind spee	8	moisture content of coal in %		
CL - Dozer pushing ROM coal	75,849	5,676	h/y	13.4	kg/h	5	silt content in %	8	moisture content in %		
CL - Dozer pushing product coal	30,053	5,676	h/y	5.3	kg/h	4	silt content in %	12.8	moisture content in %		
CL - Loading product coal stockpile	734	7,665,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	556,321	228.28	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	59,636	24.47	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	494,716	203.00	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	33,764	13.85	ha	2437.0	kg/ha/	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	6,093	5.00	ha	1218.5	kg/ha/	66	Average number of rair	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3,509	3.60	ha	974.8	kg/ha/	66	Average number of rair	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	734	7,665,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
Grading roads	36,928	60,000	km	0.61547	kg/VK	8	speed of graders in km/h				

SKM

Year 10:

ACTIVITY	TSP emission/year	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units
OB - Stripping topsoil in NORTHERN pit	378	27	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	462	33	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	5,295	8,974	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	6,471	10,968	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	8,754	53	blasts/y	165	kg/blas	8250	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	10,699	65	blasts/y	165	kg/blas	8250	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	40,768	31,647,195	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	49,827	38,679,905	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	161,113	31,647,195	t/y	0.00509	kg/t	220	t/truck load	2.8	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	196,916	38,679,905	t/y	0.00509	kg/t	220	t/truck load	2.8	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	40,768	31,647,195	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	49,827	38,679,905	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	172,235	10,292	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	210,510	12,579	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	8,828	14,963	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	10,790	18,288	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	9,867	60	blasts/y	165	kg/blas	8250	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	12,059	73	blasts/y	165	kg/blas	8250	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	115,613	4,481	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	141,305	5,476	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	397,252	4,725,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	485,530	5,775,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	111,300	4,725,000	t/y	0.02356	kg/t	180	t/load	10.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	84,700	5,775,000	t/y	0.01467	kg/t	180	t/load	6.6	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	105,000	10,500,000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	23,100	2,310,000	t	0.01	kg/t						
CL - Handling coal at CHPP	9,711	10,500,000	t	0.00092	kg/t	1.088	average of (wind spee	8	moisture content of coal in %		
CL - Dozer pushing ROM coal	75,849	5,676	h/y	13.4	kg/h	5	silt content in %	8	moisture content in %		
CL - Dozer pushing product coal	30,053	5,676	h/y	5.3	kg/h	4	silt content in %	12.8	moisture content in %		
CL - Loading product coal stockpile	734	7,665,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	467,634	191.89	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	81,493	33.44	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	194,962	80.00	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	282,695	116.00	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	6,093	5.00	ha	1218.5	kg/ha/y	66	Average number of rair	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3,509	3.60	ha	974.8	kg/ha/y	66	Average number of rair	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	734	7,665,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
Grading roads	36,928	60,000	km	0.61547	kg/VKT	8	speed of graders in km/h				

Year 15:

ACTIVITY	TSP emission/year	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units
OB - Stripping topsoil in NORTHERN pit	-	-	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	-	-	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	100	169	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	-	-	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	165	1	blasts/y	165	kg/blas	8250	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	-	-	blasts/y	165	kg/blas	8250	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	228	177,100	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	-	-	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	1,159	177,100	t/y	0.00655	kg/t	220	t/truck load	3.6	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	-	-	t/y	0.00000	kg/t	220	t/truck load	0	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	228	177,100	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	-	-	t/y	0.00129	kg/t	1.088	average of (wind spee	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	7,456	446	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	-	-	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	1,328	2,250	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	-	-	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	1,484	9	blasts/y	165	kg/blas	8250	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	-	-	blasts/y	165	kg/blas	8250	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	11,226	435	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	-	-	h/y	25.8	kg/h	5	silt content in %	5	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	57,843	688,000	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	-	-	t/y	0.08407	kg/t	5	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	10,091	688,000	t/y	0.01467	kg/t	180	t/load	6.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	-	-	t/y	0.00000	kg/t	180	t/load	0	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	6,880	688,000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	1,514	151,360	t	0.01	kg/t						
CL - Handling coal at CHPP	729	788,000	t	0.00092	kg/t	1.088	average of (wind spee	8	moisture content of coal in %		
CL - Dozer pushing ROM coal	7,671	574	h/y	13.4	kg/h	5	silt content in %	8	moisture content in %		
CL - Dozer pushing product coal	3,039	574	h/y	5.3	kg/h	4	silt content in %	12.8	moisture content in %		
CL - Loading product coal stockpile	55	575,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	358,242	147.00	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	-	-	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	158,406	65.00	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	-	-	ha	2437.0	kg/ha/y	66	Average number of rair	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	6,093	5.00	ha	1218.5	kg/ha/y	66	Average number of rair	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3,509	3.60	ha	974.8	kg/ha/y	66	Average number of rair	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	55	575,000	t	0.00010	kg/t	1.088	average of (wind spee	12.8	moisture content of coal in %		
Grading roads	36,928	60,000	km	0.61547	kg/VKT	8	speed of graders in km/h				

A summary of dust emission estimates for each activity, activity type, location of emission sources and activity hours is provided below. The location of the sources can be obtained from **Figure 4**. Only information for Year 2 has been provided here to save paper. Information for other years, as well as ISCST3 model input files, can be provided on request.

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 -------------------------------      21-Sep-2009 15:18
  DUST EMISSION CALCULATIONS V2
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 Output emissions file  : D:\Projects\EN02627_Mangoola\emissions\emiss.dat
 Meteorological file    : D:\Projects\EN02627_Mangoola\emissions\wyb2003.isc
 Number of dust sources : 77
 Number of activities   : 38
 No-blast conditions    : None
 Wind sensitive factor  : 1.088 (1.088 adjusted for activity hours)
 Wind erosion factor    : 37.144

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : OB - Stripping topsoil in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 462 kg/y
 FROM SOURCES  : 26
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 51 52 53 54 55 56 57 58 59 60
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Stripping topsoil in SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 378 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Drilling in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3674 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Drilling in SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3006 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Blasting in NORTHERN pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 6075 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : OB - Blasting in SOUTHERN pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 4970 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : OB - Sh/Ex/FELs loading in NORTHERN pit
 ACTIVITY TYPE : Wind sensitive
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```
 DUST EMISSION : 28385 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Sh/Ex/FELs loading in SOUTHERN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 23224 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Hauling to emplace from NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 148236 kg/y
 FROM SOURCES  : 16
18 19 20 21 27 28 31 34 36 38 40 41 45 46 47 51
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Hauling to emplace from SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 196676 kg/y
 FROM SOURCES  : 13
9 11 12 36 38 40 41 45 47 74 75 76 77
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Emplacing at dumps in NORTHERN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 28385 kg/y
 FROM SOURCES  : 19
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Emplacing at dumps in SOUTHERN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 23224 kg/y
 FROM SOURCES  : 19
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Dozers on O/B in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 123882 kg/y
 FROM SOURCES  : 19
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : OB - Dozers on O/B in SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 101358 kg/y
 FROM SOURCES  : 19
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Drilling in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 8762 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Drilling in SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
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 DUST EMISSION : 7169 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Blasting in NORTHERN pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 9792 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : CL - Blasting in SOUTHERN pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 8012 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : CL - Dozers ripping in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 183728 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Dozers ripping in SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 150323 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Loading ROM to trucks in NORTHERN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 393048 kg/y
 FROM SOURCES  : 16
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Loading ROM to trucks in SOUTHERN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 321585 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Hauling ROM coal to dump hopper from NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 72722 kg/y
 FROM SOURCES  : 19
18 19 56 57 59 61 62 63 64 65 66 67 71 72 73 74 75 76 77
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Hauling ROM coal to dump hopper from SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 20400 kg/y
 FROM SOURCES  : 6
11 12 67 68 69 70
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - unloading ROM coal at pile/hopper all pits
 ACTIVITY TYPE : Wind sensitive
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 DUST EMISSION : 85000 kg/y
 FROM SOURCES  : 2
4 5
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - ROM rehandle pile to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 25245 kg/y
 FROM SOURCES  : 2
4 5
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 8878 kg/y
 FROM SOURCES  : 1
3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Dozer pushing ROM coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 69348 kg/y
 FROM SOURCES  : 2
4 5
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Dozer pushing product coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 27477 kg/y
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : CL - Loading product coal stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 671 kg/y
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : WE - OB dumps at NORTHERN pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 252176 kg/y
 FROM SOURCES  : 19
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : WE - OB dumps at SOUTHERN pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y
 FROM SOURCES  : 19
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : WE - NORTHERN pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 322547 kg/y
 FROM SOURCES  : 26
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 51 52 53 54 55 56 57 58 59 60
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : WE - SOUTHERN pit
 ACTIVITY TYPE : Wind erosion
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 DUST EMISSION : 105809 kg/y
 FROM SOURCES  : 8
6 8 9 10 11 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : WE - ROM stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 13404 kg/y
 FROM SOURCES  : 2
4 5
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : WE - Product stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 3509 kg/y
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 671 kg/y
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 36928 kg/y
 FROM SOURCES  : 72
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources: 36
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 51 52 53 54 55 56 57 58 59 60
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Appendix C Dispersion model results tables

Maximum 24-hour average PM_{10} predictions ($\mu g/m^3$)

ID	Due to project emissions only			
	Year 2	Year 5	Year 10	Year 15
103	10.9	13.9	16.3	1.5
104	5.7	7.5	7.7	1.1
106A	8.3	10.8	14.2	0.9
106B	8.8	11.3	14.7	1.0
110	13.3	17.7	22.1	1.6
111	13.9	19.0	8.0	0.8
112A	8.0	10.3	11.5	0.8
112B	8.1	10.6	11.1	0.8
112C	8.1	10.6	10.8	0.8
112D	8.1	10.6	10.8	0.8
114	8.0	10.0	12.8	0.9
116A	13.7	19.1	19.9	1.7
116B	13.6	19.4	19.7	1.7
116C	13.6	18.9	19.9	1.7
116D	13.6	19.2	19.7	1.7
116E	13.6	19.0	19.6	1.7
116F	13.6	18.8	19.6	1.7
116G	13.5	18.6	19.6	1.7
121	5.5	7.0	10.6	1.0
124	10.8	15.1	17.1	1.3
125A	7.3	10.3	11.9	1.7
125B	7.6	10.7	12.2	1.7
125C	8.0	10.8	12.4	1.7
125D	8.4	11.1	11.1	1.8
125E	8.4	11.0	11.1	1.7
125F	8.4	11.1	11.2	1.8
126A	11.5	12.7	6.8	0.6
126B	11.0	12.0	6.7	0.5
128	15.7	19.0	9.2	0.7
130	15.7	21.6	25.4	1.7
132	6.9	8.9	9.3	1.4
134A	11.3	17.2	17.8	1.4
134B	11.8	18.0	18.9	1.5
134C	11.5	17.2	17.8	1.4
134D	9.7	13.7	15.3	1.2
135	8.0	10.8	9.9	0.8
139	17.7	20.6	8.9	0.7
141	6.1	8.1	9.8	0.6
144	15.9	20.5	10.8	0.8
147	5.6	7.1	7.9	0.5
148	15.9	20.8	24.0	1.7
151	7.2	9.0	11.9	0.8
156	9.3	12.5	13.5	0.9
157	17.2	18.2	8.1	0.6
162	15.8	20.2	8.5	0.8
164	6.8	8.6	9.8	0.7
165	11.9	16.7	14.0	1.0
166	8.5	11.4	11.1	0.9
168	11.7	14.7	8.4	1.2
170	14.5	16.8	8.0	0.6
171	12.9	14.1	7.6	0.5
172	11.6	16.2	13.5	1.0
173B	11.2	12.6	6.7	0.6
173C	5.3	6.1	4.4	0.3
174A	10.2	12.9	7.1	0.6
174B	10.1	12.6	7.3	0.6
175	10.6	13.1	7.7	0.6
176	12.7	17.5	20.7	1.4
177	5.3	7.2	6.8	0.5
178	5.6	6.5	7.1	0.5
182	9.0	11.2	11.8	1.4

ID	Due to project emissions only			
	Year 2	Year 5	Year 10	Year 15
183A	5.7	7.8	6.8	1.0
183B	5.7	7.8	6.8	1.0
183C	5.7	7.8	6.9	1.0
184	5.1	6.4	8.3	0.9
185	5.7	7.6	7.6	0.8
187	5.7	7.5	7.5	0.8
189	5.8	7.5	7.3	0.8
19	4.3	5.5	5.3	0.4
190	8.9	14.5	9.7	1.5
191	5.8	7.7	7.7	1.1
192	6.8	8.8	8.6	1.2
193	6.1	8.0	8.2	1.2
194	4.2	5.9	6.1	0.9
195	5.5	8.8	6.3	1.1
198	9.9	14.3	9.9	1.8
199	4.1	5.2	7.2	0.7
200	4.1	4.9	7.1	0.7
201A	4.7	6.5	6.5	0.8
201B	4.8	6.3	6.6	0.8
201C	4.7	6.4	6.5	0.8
202	5.8	7.5	5.4	0.8
203H	4.3	5.6	5.4	0.8
203I	4.1	5.3	5.2	0.8
203J	3.6	5.2	4.0	0.7
203K	2.6	3.5	3.8	0.6
204	4.5	5.8	6.6	0.6
205	11.0	12.7	6.9	0.5
206	11.7	13.6	7.0	0.6
207	9.5	11.8	6.7	0.5
208	8.4	11.3	8.5	0.7
209	12.2	16.9	20.4	1.8
210	6.4	8.4	8.4	0.7
211	6.6	8.7	7.4	0.6
212A	6.1	7.8	6.9	0.5
212B	6.1	7.8	6.9	0.6
212C	6.1	7.9	7.0	0.6
213	4.3	5.4	4.9	0.4
214	3.0	3.7	4.2	0.3
215	2.7	3.6	4.1	0.3
216	2.7	3.6	4.1	0.3
217	2.8	3.7	4.2	0.3
218	3.0	3.8	5.9	0.6
219	3.2	4.2	6.3	0.6
21B	7.8	10.3	9.5	0.7
220	3.4	4.3	6.2	0.5
222	3.6	4.7	5.3	0.6
223	3.7	4.7	5.3	0.6
224A	3.9	5.2	5.7	0.6
224B	4.3	5.5	6.0	0.6
227	5.3	7.5	7.4	1.2
228	5.1	7.3	7.0	1.2
229A	4.3	6.0	5.6	1.0
229B	6.1	7.9	9.1	1.2
229C	4.4	6.4	7.2	1.1
230	4.8	7.0	7.6	1.2
231	4.8	6.9	7.7	1.2
232A	4.7	6.5	7.8	1.1
232B	4.7	6.5	7.8	1.1
232C	5.0	6.8	8.1	1.1
233	4.7	6.5	7.8	1.1
235A	5.3	7.0	8.2	1.1
235B	5.2	6.9	8.1	1.1
235C	5.2	6.9	8.1	1.1
236A	5.1	6.7	7.9	1.1
236B	5.0	6.7	7.9	1.1
236C	5.3	6.9	7.8	1.0
237	6.1	7.9	9.5	1.3
238	6.3	8.0	9.4	1.2

ID	Due to project emissions only			
	Year 2	Year 5	Year 10	Year 15
240	6.5	8.9	10.8	1.5
241A	8.1	10.7	12.0	1.6
241B	8.6	10.7	12.0	1.4
241C	8.8	10.9	11.9	1.4
242	6.6	9.0	8.1	1.1
243	6.6	8.4	7.1	1.2
244	5.5	8.4	6.3	1.1
245B	5.9	9.0	6.2	1.1
246	5.5	7.0	6.2	0.7
248	7.6	9.5	6.3	0.7
249	9.1	10.8	7.7	0.9
25	11.5	12.6	26.2	3.2
250	9.5	11.5	8.7	1.1
251	11.2	13.9	8.7	1.2
252A	5.4	6.5	5.9	0.6
252B	4.6	5.6	5.1	0.5
253	5.6	7.5	8.8	0.5
254A	6.9	9.4	11.6	0.8
255	8.6	11.2	13.4	1.1
256	9.7	12.8	14.5	1.0
257A	10.2	13.9	10.2	0.8
257B	10.1	13.7	10.0	0.8
257C	10.1	13.6	9.8	0.8
258	11.7	14.8	8.2	0.6
259	11.3	13.0	6.8	0.5
260	11.1	12.7	6.6	0.5
261	7.8	9.6	4.8	0.4
262	8.5	10.3	6.2	0.4
263	9.4	11.4	6.2	0.5
264	5.3	6.0	5.5	0.5
265	7.1	9.6	11.8	0.7
266	7.3	9.3	9.3	0.7
270	3.7	5.0	5.1	0.4
273A	4.6	6.1	7.1	1.0
273B	4.6	6.1	7.1	1.0
273C	5.4	7.1	7.3	0.9
275	4.7	6.4	7.5	1.0
281A	4.6	5.9	5.9	0.4
283	4.5	5.6	5.1	0.4
284A	3.9	5.3	5.0	0.4
284B	3.9	5.3	4.9	0.4
285	3.6	4.1	5.3	0.4
286	3.6	4.1	5.4	0.4
287	3.5	4.7	5.5	0.4
288	3.4	4.0	4.9	0.4
289	11.5	11.0	7.5	0.4
290	5.0	6.3	6.7	0.6
291	3.4	4.7	5.1	0.4
292	3.2	4.0	4.7	0.3
293	3.9	5.3	5.2	0.4
294	3.4	4.3	6.0	0.6
295	5.2	8.2	5.9	1.1
30	5.6	6.3	11.2	1.2
34	8.9	11.2	10.7	1.6
39	19.7	21.7	8.4	0.7
54	8.7	11.6	11.5	0.9
56	16.7	31.9	49.1	2.6
66	14.6	13.4	8.6	0.4
71	19.3	16.4	10.0	0.5
79	7.1	8.9	11.6	0.8
81	19.4	32.3	38.9	1.9
83	17.2	24.1	34.2	5.6
91	20.4	28.5	39.9	1.9
96A	12.3	15.8	8.5	1.2
96B	11.7	14.8	8.4	1.2

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Annual average PM_{10} predictions ($\mu g/m^3$)

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
103	2.9	3.8	4.7	0.4	19.9	20.8	21.7	17.4
104	0.6	0.8	0.8	0.1	17.6	17.8	17.8	17.1
106A	1.8	2.3	3.2	0.2	18.8	19.3	20.2	17.2
106B	1.8	2.4	3.3	0.3	18.8	19.4	20.3	17.3
110	2.8	3.9	4.0	0.3	19.8	20.9	21.0	17.3
111	1.8	2.4	1.4	0.1	18.8	19.4	18.4	17.1
112A	1.2	1.8	2.1	0.1	18.2	18.8	19.1	17.1
112B	1.2	1.9	2.2	0.2	18.2	18.9	19.2	17.2
112C	1.2	1.9	2.1	0.2	18.2	18.9	19.1	17.2
112D	1.2	1.9	2.1	0.2	18.2	18.9	19.1	17.2
114	1.2	1.9	2.1	0.1	18.2	18.9	19.1	17.1
116A	2.2	3.0	3.8	0.3	19.2	20.0	20.8	17.3
116B	2.2	3.0	3.8	0.3	19.2	20.0	20.8	17.3
116C	2.2	3.0	3.8	0.3	19.2	20.0	20.8	17.3
116D	2.2	3.0	3.8	0.3	19.2	20.0	20.8	17.3
116E	2.2	3.0	3.7	0.3	19.2	20.0	20.7	17.3
116F	2.2	3.0	3.7	0.3	19.2	20.0	20.7	17.3
116G	2.2	3.0	3.7	0.3	19.2	20.0	20.7	17.3
121	0.8	1.1	1.5	0.1	17.8	18.1	18.5	17.1
124	2.2	3.0	2.0	0.2	19.2	20.0	19.0	17.2
125A	0.9	1.3	1.2	0.1	17.9	18.3	18.2	17.1
125B	1.0	1.3	1.2	0.2	18.0	18.3	18.2	17.2
125C	1.0	1.3	1.2	0.1	18.0	18.3	18.2	17.1
125D	1.0	1.3	1.3	0.2	18.0	18.3	18.3	17.2
125E	0.9	1.3	1.3	0.2	17.9	18.3	18.3	17.2
125F	0.9	1.3	1.3	0.2	17.9	18.3	18.3	17.2
126A	1.6	2.0	1.2	0.1	18.6	19.0	18.2	17.1
126B	1.5	1.9	1.1	0.1	18.5	18.9	18.1	17.1
128	1.7	2.0	1.2	0.1	18.7	19.0	18.2	17.1
130	2.8	3.8	4.9	0.3	19.8	20.8	21.9	17.3
132	0.7	0.9	1.0	0.1	17.7	17.9	18.0	17.1
134A	2.4	3.3	3.0	0.2	19.4	20.3	20.0	17.2
134B	2.5	3.5	3.0	0.2	19.5	20.5	20.0	17.2
134C	2.4	3.3	2.7	0.2	19.4	20.3	19.7	17.2
134D	2.0	2.6	1.8	0.2	19.0	19.6	18.8	17.2
135	1.4	2.0	2.7	0.2	18.4	19.0	19.7	17.2
139	1.9	2.2	1.3	0.1	18.9	19.2	18.3	17.1
141	0.9	1.3	1.5	0.1	17.9	18.3	18.5	17.1
144	1.9	2.3	1.3	0.1	18.9	19.3	18.3	17.1
147	0.8	1.1	1.2	0.1	17.8	18.1	18.2	17.1
148	2.8	3.8	4.7	0.3	19.8	20.8	21.7	17.3
151	1.1	1.7	1.8	0.1	18.1	18.7	18.8	17.1
156	1.6	2.0	1.3	0.1	18.6	19.0	18.3	17.1
157	1.8	2.1	1.3	0.1	18.8	19.1	18.3	17.1
162	2.0	2.7	1.5	0.1	19.0	19.7	18.5	17.1
164	1.0	1.5	1.6	0.1	18.0	18.5	18.6	17.1
165	1.9	2.3	1.4	0.1	18.9	19.3	18.4	17.1
166	1.3	2.0	2.4	0.2	18.3	19.0	19.4	17.2
168	1.3	1.7	1.2	0.1	18.3	18.7	18.2	17.1
170	1.5	1.8	1.1	0.1	18.5	18.8	18.1	17.1
171	1.4	1.7	1.1	0.1	18.4	18.7	18.1	17.1
172	1.8	2.2	1.4	0.1	18.8	19.2	18.4	17.1
173B	1.5	1.9	1.1	0.1	18.5	18.9	18.1	17.1
173C	0.8	1.0	0.7	0.0	17.8	18.0	17.7	17.0
174A	1.8	2.3	1.3	0.1	18.8	19.3	18.3	17.1
174B	1.8	2.3	1.3	0.1	18.8	19.3	18.3	17.1
175	1.9	2.5	1.4	0.1	18.9	19.5	18.4	17.1
176	3.1	4.3	5.5	0.4	20.1	21.3	22.5	17.4
177	0.8	1.2	1.3	0.1	17.8	18.2	18.3	17.1
178	0.7	1.0	1.1	0.1	17.7	18.0	18.1	17.1
182	1.0	1.4	1.1	0.1	18.0	18.4	18.1	17.1
183A	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
183B	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
183C	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
184	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
185	0.5	0.7	0.6	0.1	17.5	17.7	17.6	17.1
187	0.5	0.7	0.6	0.1	17.5	17.7	17.6	17.1
189	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
19	0.5	0.8	0.8	0.1	17.5	17.8	17.8	17.1
190	1.1	1.5	1.0	0.1	18.1	18.5	18.0	17.1
191	0.6	0.8	0.8	0.1	17.6	17.8	17.8	17.1
192	0.7	0.9	0.9	0.1	17.7	17.9	17.9	17.1
193	0.6	0.8	0.8	0.1	17.6	17.8	17.8	17.1
194	0.5	0.6	0.6	0.1	17.5	17.6	17.6	17.1
195	0.7	0.9	0.6	0.1	17.7	17.9	17.6	17.1
198	1.3	1.7	1.1	0.1	18.3	18.7	18.1	17.1
199	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
200	0.5	0.7	1.0	0.1	17.5	17.7	18.0	17.1
201A	0.5	0.6	0.6	0.1	17.5	17.6	17.6	17.1
201B	0.5	0.6	0.6	0.1	17.5	17.6	17.6	17.1
201C	0.4	0.6	0.6	0.1	17.4	17.6	17.6	17.1
202	0.5	0.7	0.5	0.1	17.5	17.7	17.5	17.1
203H	0.4	0.5	0.4	0.1	17.4	17.5	17.4	17.1
203I	0.4	0.5	0.4	0.0	17.4	17.5	17.4	17.0
203J	0.3	0.4	0.3	0.0	17.3	17.4	17.3	17.0
203K	0.3	0.3	0.3	0.0	17.3	17.3	17.3	17.0
204	0.4	0.6	0.6	0.1	17.4	17.6	17.6	17.1
205	1.2	1.5	1.0	0.1	18.2	18.5	18.0	17.1
206	1.2	1.4	0.9	0.1	18.2	18.4	17.9	17.1
207	0.9	1.2	0.7	0.1	17.9	18.2	17.7	17.1
208	1.0	1.2	0.8	0.1	18.0	18.2	17.8	17.1
209	2.7	3.6	4.6	0.3	19.7	20.6	21.6	17.3
210	1.2	1.6	2.1	0.1	18.2	18.6	19.1	17.1
211	1.0	1.4	1.7	0.1	18.0	18.4	18.7	17.1
212A	0.9	1.2	1.4	0.1	17.9	18.2	18.4	17.1
212B	0.8	1.2	1.4	0.1	17.8	18.2	18.4	17.1
212C	0.9	1.2	1.5	0.1	17.9	18.2	18.5	17.1
213	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
214	0.4	0.5	0.6	0.0	17.4	17.5	17.6	17.0
215	0.4	0.5	0.6	0.0	17.4	17.5	17.6	17.0
216	0.4	0.5	0.6	0.0	17.4	17.5	17.6	17.0
217	0.4	0.5	0.6	0.1	17.4	17.5	17.6	17.1
218	0.4	0.5	0.6	0.1	17.4	17.5	17.6	17.1
219	0.4	0.6	0.6	0.1	17.4	17.6	17.6	17.1
21B	1.2	1.7	2.2	0.2	18.2	18.7	19.2	17.2
220	0.4	0.5	0.6	0.1	17.4	17.5	17.6	17.1
222	0.4	0.6	0.6	0.0	17.4	17.6	17.6	17.0
223	0.4	0.6	0.6	0.0	17.4	17.6	17.6	17.0
224A	0.4	0.5	0.5	0.0	17.4	17.5	17.5	17.0
224B	0.4	0.5	0.5	0.0	17.4	17.5	17.5	17.0
227	0.6	0.8	0.8	0.1	17.6	17.8	17.8	17.1
228	0.6	0.8	0.8	0.1	17.6	17.8	17.8	17.1
229A	0.5	0.6	0.6	0.1	17.5	17.6	17.6	17.1
229B	0.6	0.9	0.8	0.1	17.6	17.9	17.8	17.1
229C	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
230	0.6	0.8	0.7	0.1	17.6	17.8	17.7	17.1
231	0.6	0.8	0.7	0.1	17.6	17.8	17.7	17.1
232A	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
232B	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
232C	0.6	0.8	0.7	0.1	17.6	17.8	17.7	17.1
233	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
235A	0.6	0.8	0.7	0.1	17.6	17.8	17.7	17.1
235B	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
235C	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
236A	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
236B	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
236C	0.5	0.7	0.6	0.1	17.5	17.7	17.6	17.1
237	0.7	0.9	0.8	0.1	17.7	17.9	17.8	17.1
238	0.7	0.9	0.8	0.1	17.7	17.9	17.8	17.1
240	0.8	1.1	1.0	0.1	17.8	18.1	18.0	17.1
241A	0.9	1.3	1.1	0.1	17.9	18.3	18.1	17.1
241B	1.0	1.3	1.1	0.1	18.0	18.3	18.1	17.1
241C	1.0	1.4	1.1	0.1	18.0	18.4	18.1	17.1

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
242	0.7	0.9	0.8	0.1	17.7	17.9	17.8	17.1
243	0.7	0.9	0.7	0.1	17.7	17.9	17.7	17.1
244	0.7	0.9	0.6	0.1	17.7	17.9	17.6	17.1
245B	0.6	0.8	0.6	0.1	17.6	17.8	17.6	17.1
246	0.5	0.7	0.5	0.0	17.5	17.7	17.5	17.0
248	0.8	1.1	0.8	0.1	17.8	18.1	17.8	17.1
249	0.9	1.2	0.9	0.1	17.9	18.2	17.9	17.1
25	1.8	2.6	3.3	0.3	18.8	19.6	20.3	17.3
250	0.9	1.2	0.9	0.1	17.9	18.2	17.9	17.1
251	1.2	1.5	1.1	0.1	18.2	18.5	18.1	17.1
252A	0.5	0.6	0.5	0.0	17.5	17.6	17.5	17.0
252B	0.4	0.6	0.4	0.0	17.4	17.6	17.4	17.0
253	0.8	1.2	1.3	0.1	17.8	18.2	18.3	17.1
254A	1.6	2.2	2.7	0.2	18.6	19.2	19.7	17.2
255	2.2	2.9	3.5	0.2	19.2	19.9	20.5	17.2
256	2.3	3.1	3.7	0.2	19.3	20.1	20.7	17.2
257A	1.3	1.6	1.0	0.1	18.3	18.6	18.0	17.1
257B	1.3	1.5	1.0	0.1	18.3	18.5	18.0	17.1
257C	1.2	1.5	1.0	0.1	18.2	18.5	18.0	17.1
258	1.2	1.5	0.9	0.1	18.2	18.5	17.9	17.1
259	1.1	1.4	0.9	0.1	18.1	18.4	17.9	17.1
260	1.1	1.4	0.9	0.1	18.1	18.4	17.9	17.1
261	0.9	1.1	0.8	0.0	17.9	18.1	17.8	17.0
262	1.0	1.2	0.8	0.1	18.0	18.2	17.8	17.1
263	1.1	1.3	0.9	0.1	18.1	18.3	17.9	17.1
264	0.6	0.9	1.0	0.1	17.6	17.9	18.0	17.1
265	1.6	2.1	2.7	0.2	18.6	19.1	19.7	17.2
266	1.0	1.6	1.7	0.1	18.0	18.6	18.7	17.1
270	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
273A	0.5	0.6	0.6	0.1	17.5	17.6	17.6	17.1
273B	0.5	0.6	0.6	0.1	17.5	17.6	17.6	17.1
273C	0.5	0.7	0.6	0.1	17.5	17.7	17.6	17.1
275	0.5	0.7	0.6	0.1	17.5	17.7	17.6	17.1
281A	0.5	0.8	0.8	0.1	17.5	17.8	17.8	17.1
283	0.5	0.8	0.8	0.1	17.5	17.8	17.8	17.1
284A	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
284B	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
285	0.5	0.6	0.8	0.1	17.5	17.6	17.8	17.1
286	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
287	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
288	0.4	0.6	0.7	0.1	17.4	17.6	17.7	17.1
289	1.1	1.4	1.0	0.1	18.1	18.4	18.0	17.1
290	0.6	1.0	1.1	0.1	17.6	18.0	18.1	17.1
291	0.5	0.7	0.7	0.1	17.5	17.7	17.7	17.1
292	0.4	0.6	0.6	0.0	17.4	17.6	17.6	17.0
293	0.5	0.7	0.8	0.1	17.5	17.7	17.8	17.1
294	0.4	0.6	0.7	0.1	17.4	17.6	17.7	17.1
295	0.6	0.8	0.6	0.1	17.6	17.8	17.6	17.1
30	0.8	1.1	1.5	0.1	17.8	18.1	18.5	17.1
34	0.8	1.1	1.2	0.1	17.8	18.1	18.2	17.1
39	2.1	2.4	1.4	0.1	19.1	19.4	18.4	17.1
54	1.4	2.0	2.5	0.2	18.4	19.0	19.5	17.2
56	4.6	6.3	10.7	0.4	21.6	23.3	27.7	17.4
66	1.5	1.8	1.2	0.1	18.5	18.8	18.2	17.1
71	2.1	2.5	1.6	0.1	19.1	19.5	18.6	17.1
79	1.1	1.7	1.8	0.1	18.1	18.7	18.8	17.1
81	4.6	6.8	4.5	0.3	21.6	23.8	21.5	17.3
83	5.1	7.0	12.3	1.3	22.1	24.0	29.3	18.3
91	4.4	6.4	5.2	0.3	21.4	23.4	22.2	17.3
96A	1.5	1.8	1.3	0.1	18.5	18.8	18.3	17.1
96B	1.3	1.7	1.2	0.1	18.3	18.7	18.2	17.1

Annual average TSP predictions ($\mu g/m^3$)

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
103	2.9	3.9	4.8	0.4	38.9	39.9	40.8	36.4
104	0.6	0.9	0.9	0.1	36.6	36.9	36.9	36.1
106A	1.8	2.4	3.2	0.2	37.8	38.4	39.2	36.2
106B	1.9	2.5	3.4	0.3	37.9	38.5	39.4	36.3
110	2.9	4.1	4.3	0.3	38.9	40.1	40.3	36.3
111	1.9	2.5	1.5	0.1	37.9	38.5	37.5	36.1
112A	1.2	1.9	2.1	0.1	37.2	37.9	38.1	36.1
112B	1.3	1.9	2.2	0.2	37.3	37.9	38.2	36.2
112C	1.3	1.9	2.2	0.2	37.3	37.9	38.2	36.2
112D	1.3	1.9	2.2	0.2	37.3	37.9	38.2	36.2
114	1.2	1.9	2.1	0.2	37.2	37.9	38.1	36.2
116A	2.3	3.2	4.0	0.3	38.3	39.2	40.0	36.3
116B	2.3	3.2	4.0	0.3	38.3	39.2	40.0	36.3
116C	2.3	3.2	4.0	0.3	38.3	39.2	40.0	36.3
116D	2.3	3.2	4.0	0.3	38.3	39.2	40.0	36.3
116E	2.3	3.1	4.0	0.3	38.3	39.1	40.0	36.3
116F	2.3	3.1	3.9	0.3	38.3	39.1	39.9	36.3
116G	2.3	3.1	3.9	0.3	38.3	39.1	39.9	36.3
121	0.8	1.2	1.6	0.1	36.8	37.2	37.6	36.1
124	2.3	3.1	2.2	0.2	38.3	39.1	38.2	36.2
125A	1.0	1.4	1.3	0.2	37.0	37.4	37.3	36.2
125B	1.0	1.4	1.3	0.2	37.0	37.4	37.3	36.2
125C	1.0	1.4	1.3	0.2	37.0	37.4	37.3	36.2
125D	1.0	1.4	1.4	0.2	37.0	37.4	37.4	36.2
125E	1.0	1.4	1.4	0.2	37.0	37.4	37.4	36.2
125F	1.0	1.4	1.4	0.2	37.0	37.4	37.4	36.2
126A	1.7	2.1	1.2	0.1	37.7	38.1	37.2	36.1
126B	1.6	2.0	1.2	0.1	37.6	38.0	37.2	36.1
128	1.8	2.1	1.2	0.1	37.8	38.1	37.2	36.1
130	2.9	4.0	5.3	0.3	38.9	40.0	41.3	36.3
132	0.7	1.0	1.0	0.1	36.7	37.0	37.0	36.1
134A	2.5	3.5	3.2	0.2	38.5	39.5	39.2	36.2
134B	2.6	3.7	3.2	0.2	38.6	39.7	39.2	36.2
134C	2.5	3.5	2.9	0.2	38.5	39.5	38.9	36.2
134D	2.1	2.8	1.9	0.2	38.1	38.8	37.9	36.2
135	1.5	2.0	2.7	0.2	37.5	38.0	38.7	36.2
139	2.0	2.3	1.3	0.1	38.0	38.3	37.3	36.1
141	0.9	1.4	1.5	0.1	36.9	37.4	37.5	36.1
144	2.0	2.4	1.3	0.1	38.0	38.4	37.3	36.1
147	0.8	1.2	1.2	0.1	36.8	37.2	37.2	36.1
148	2.9	4.1	5.0	0.3	38.9	40.1	41.0	36.3
151	1.1	1.7	1.8	0.1	37.1	37.7	37.8	36.1
156	1.7	2.1	1.4	0.1	37.7	38.1	37.4	36.1
157	1.9	2.2	1.3	0.1	37.9	38.2	37.3	36.1
162	2.1	2.8	1.6	0.1	38.1	38.8	37.6	36.1
164	1.0	1.6	1.7	0.1	37.0	37.6	37.7	36.1
165	2.0	2.5	1.5	0.1	38.0	38.5	37.5	36.1
166	1.4	2.0	2.4	0.2	37.4	38.0	38.4	36.2
168	1.4	1.8	1.2	0.1	37.4	37.8	37.2	36.1
170	1.6	1.9	1.1	0.1	37.6	37.9	37.1	36.1
171	1.5	1.8	1.1	0.1	37.5	37.8	37.1	36.1
172	1.9	2.3	1.4	0.1	37.9	38.3	37.4	36.1
173B	1.6	2.1	1.2	0.1	37.6	38.1	37.2	36.1
173C	0.9	1.1	0.8	0.0	36.9	37.1	36.8	36.0
174A	1.9	2.4	1.4	0.1	37.9	38.4	37.4	36.1
174B	1.9	2.5	1.4	0.1	37.9	38.5	37.4	36.1
175	2.0	2.6	1.5	0.1	38.0	38.6	37.5	36.1
176	3.2	4.4	5.6	0.4	39.2	40.4	41.6	36.4
177	0.8	1.2	1.3	0.1	36.8	37.2	37.3	36.1
178	0.7	1.0	1.1	0.1	36.7	37.0	37.1	36.1
182	1.1	1.5	1.2	0.2	37.1	37.5	37.2	36.2
183A	0.5	0.8	0.7	0.1	36.5	36.8	36.7	36.1
183B	0.5	0.8	0.8	0.1	36.5	36.8	36.8	36.1
183C	0.5	0.8	0.8	0.1	36.5	36.8	36.8	36.1
184	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
185	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
187	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
189	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
19	0.5	0.8	0.9	0.1	36.5	36.8	36.9	36.1
190	1.2	1.7	1.1	0.1	37.2	37.7	37.1	36.1
191	0.6	0.9	0.8	0.1	36.6	36.9	36.8	36.1
192	0.7	1.0	1.0	0.1	36.7	37.0	37.0	36.1
193	0.6	0.9	0.9	0.1	36.6	36.9	36.9	36.1
194	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
195	0.7	0.9	0.7	0.1	36.7	36.9	36.7	36.1
198	1.4	1.8	1.2	0.2	37.4	37.8	37.2	36.2
199	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
200	0.6	0.8	1.0	0.1	36.6	36.8	37.0	36.1
201A	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
201B	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
201C	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
202	0.6	0.8	0.6	0.1	36.6	36.8	36.6	36.1
203H	0.4	0.6	0.4	0.1	36.4	36.6	36.4	36.1
203I	0.4	0.6	0.4	0.1	36.4	36.6	36.4	36.1
203J	0.3	0.4	0.3	0.0	36.3	36.4	36.3	36.0
203K	0.3	0.4	0.3	0.0	36.3	36.4	36.3	36.0
204	0.4	0.6	0.6	0.1	36.4	36.6	36.6	36.1
205	1.3	1.6	1.0	0.1	37.3	37.6	37.0	36.1
206	1.2	1.5	0.9	0.1	37.2	37.5	36.9	36.1
207	1.0	1.2	0.8	0.1	37.0	37.2	36.8	36.1
208	1.0	1.3	0.9	0.1	37.0	37.3	36.9	36.1
209	2.7	3.7	4.7	0.3	38.7	39.7	40.7	36.3
210	1.2	1.7	2.1	0.1	37.2	37.7	38.1	36.1
211	1.0	1.4	1.8	0.1	37.0	37.4	37.8	36.1
212A	0.9	1.2	1.4	0.1	36.9	37.2	37.4	36.1
212B	0.9	1.2	1.4	0.1	36.9	37.2	37.4	36.1
212C	0.9	1.3	1.5	0.1	36.9	37.3	37.5	36.1
213	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
214	0.4	0.5	0.6	0.0	36.4	36.5	36.6	36.0
215	0.4	0.5	0.6	0.0	36.4	36.5	36.6	36.0
216	0.4	0.5	0.6	0.0	36.4	36.5	36.6	36.0
217	0.4	0.5	0.7	0.1	36.4	36.5	36.7	36.1
218	0.4	0.6	0.6	0.1	36.4	36.6	36.6	36.1
219	0.4	0.6	0.7	0.1	36.4	36.6	36.7	36.1
21B	1.2	1.8	2.2	0.2	37.2	37.8	38.2	36.2
220	0.4	0.6	0.6	0.1	36.4	36.6	36.6	36.1
222	0.4	0.6	0.6	0.1	36.4	36.6	36.6	36.1
223	0.4	0.6	0.6	0.1	36.4	36.6	36.6	36.1
224A	0.4	0.6	0.5	0.0	36.4	36.6	36.5	36.0
224B	0.4	0.6	0.5	0.0	36.4	36.6	36.5	36.0
227	0.6	0.9	0.9	0.1	36.6	36.9	36.9	36.1
228	0.6	0.9	0.8	0.1	36.6	36.9	36.8	36.1
229A	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
229B	0.7	0.9	0.8	0.1	36.7	36.9	36.8	36.1
229C	0.5	0.8	0.7	0.1	36.5	36.8	36.7	36.1
230	0.6	0.8	0.8	0.1	36.6	36.8	36.8	36.1
231	0.6	0.8	0.8	0.1	36.6	36.8	36.8	36.1
232A	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
232B	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
232C	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
233	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
235A	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
235B	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
235C	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
236A	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
236B	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
236C	0.6	0.8	0.7	0.1	36.6	36.8	36.7	36.1
237	0.7	1.0	0.9	0.1	36.7	37.0	36.9	36.1
238	0.7	1.0	0.9	0.1	36.7	37.0	36.9	36.1
240	0.9	1.2	1.1	0.1	36.9	37.2	37.1	36.1
241A	1.0	1.4	1.2	0.2	37.0	37.4	37.2	36.2
241B	1.0	1.4	1.2	0.2	37.0	37.4	37.2	36.2
241C	1.1	1.5	1.2	0.2	37.1	37.5	37.2	36.2

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
242	0.7	1.0	0.8	0.1	36.7	37.0	36.8	36.1
243	0.8	1.0	0.7	0.1	36.8	37.0	36.7	36.1
244	0.7	0.9	0.7	0.1	36.7	36.9	36.7	36.1
245B	0.7	0.9	0.6	0.1	36.7	36.9	36.6	36.1
246	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
248	0.9	1.2	0.9	0.1	36.9	37.2	36.9	36.1
249	1.0	1.3	0.9	0.1	37.0	37.3	36.9	36.1
25	1.8	3.2	3.6	0.4	37.8	39.2	39.6	36.4
250	1.0	1.3	1.0	0.1	37.0	37.3	37.0	36.1
251	1.3	1.6	1.1	0.1	37.3	37.6	37.1	36.1
252A	0.5	0.7	0.6	0.0	36.5	36.7	36.6	36.0
252B	0.4	0.6	0.5	0.0	36.4	36.6	36.5	36.0
253	0.8	1.2	1.3	0.1	36.8	37.2	37.3	36.1
254A	1.7	2.2	2.8	0.2	37.7	38.2	38.8	36.2
255	2.2	3.0	3.5	0.2	38.2	39.0	39.5	36.2
256	2.3	3.2	3.8	0.2	38.3	39.2	39.8	36.2
257A	1.4	1.7	1.1	0.1	37.4	37.7	37.1	36.1
257B	1.3	1.6	1.1	0.1	37.3	37.6	37.1	36.1
257C	1.3	1.6	1.0	0.1	37.3	37.6	37.0	36.1
258	1.3	1.6	1.0	0.1	37.3	37.6	37.0	36.1
259	1.2	1.5	0.9	0.1	37.2	37.5	36.9	36.1
260	1.2	1.4	0.9	0.1	37.2	37.4	36.9	36.1
261	0.9	1.2	0.8	0.1	36.9	37.2	36.8	36.1
262	1.0	1.3	0.9	0.1	37.0	37.3	36.9	36.1
263	1.1	1.4	1.0	0.1	37.1	37.4	37.0	36.1
264	0.6	0.9	1.0	0.1	36.6	36.9	37.0	36.1
265	1.6	2.2	2.7	0.2	37.6	38.2	38.7	36.2
266	1.1	1.6	1.8	0.1	37.1	37.6	37.8	36.1
270	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
273A	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
273B	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
273C	0.5	0.7	0.6	0.1	36.5	36.7	36.6	36.1
275	0.5	0.7	0.7	0.1	36.5	36.7	36.7	36.1
281A	0.6	0.8	0.8	0.1	36.6	36.8	36.8	36.1
283	0.5	0.8	0.9	0.1	36.5	36.8	36.9	36.1
284A	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
284B	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
285	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
286	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
287	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
288	0.4	0.6	0.7	0.1	36.4	36.6	36.7	36.1
289	1.2	1.5	1.1	0.1	37.2	37.5	37.1	36.1
290	0.7	1.0	1.1	0.1	36.7	37.0	37.1	36.1
291	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
292	0.4	0.6	0.7	0.1	36.4	36.6	36.7	36.1
293	0.5	0.7	0.8	0.1	36.5	36.7	36.8	36.1
294	0.5	0.6	0.7	0.1	36.5	36.6	36.7	36.1
295	0.7	0.9	0.6	0.1	36.7	36.9	36.6	36.1
30	0.8	1.1	1.5	0.1	36.8	37.1	37.5	36.1
34	0.9	1.3	1.3	0.2	36.9	37.3	37.3	36.2
39	2.2	2.6	1.5	0.1	38.2	38.6	37.5	36.1
54	1.4	2.1	2.6	0.2	37.4	38.1	38.6	36.2
56	4.8	6.6	11.7	0.5	40.8	42.6	47.7	36.5
66	1.5	1.9	1.3	0.1	37.5	37.9	37.3	36.1
71	2.2	2.7	1.7	0.1	38.2	38.7	37.7	36.1
79	1.1	1.7	1.8	0.1	37.1	37.7	37.8	36.1
81	4.9	7.4	4.8	0.4	40.9	43.4	40.8	36.4
83	5.2	7.2	12.7	1.5	41.2	43.2	48.7	37.5
91	4.6	6.9	5.6	0.4	40.6	42.9	41.6	36.4
96A	1.6	2.0	1.3	0.1	37.6	38.0	37.3	36.1
96B	1.4	1.8	1.2	0.1	37.4	37.8	37.2	36.1

SKM

Annual average dust deposition predictions (g/m^2/month)

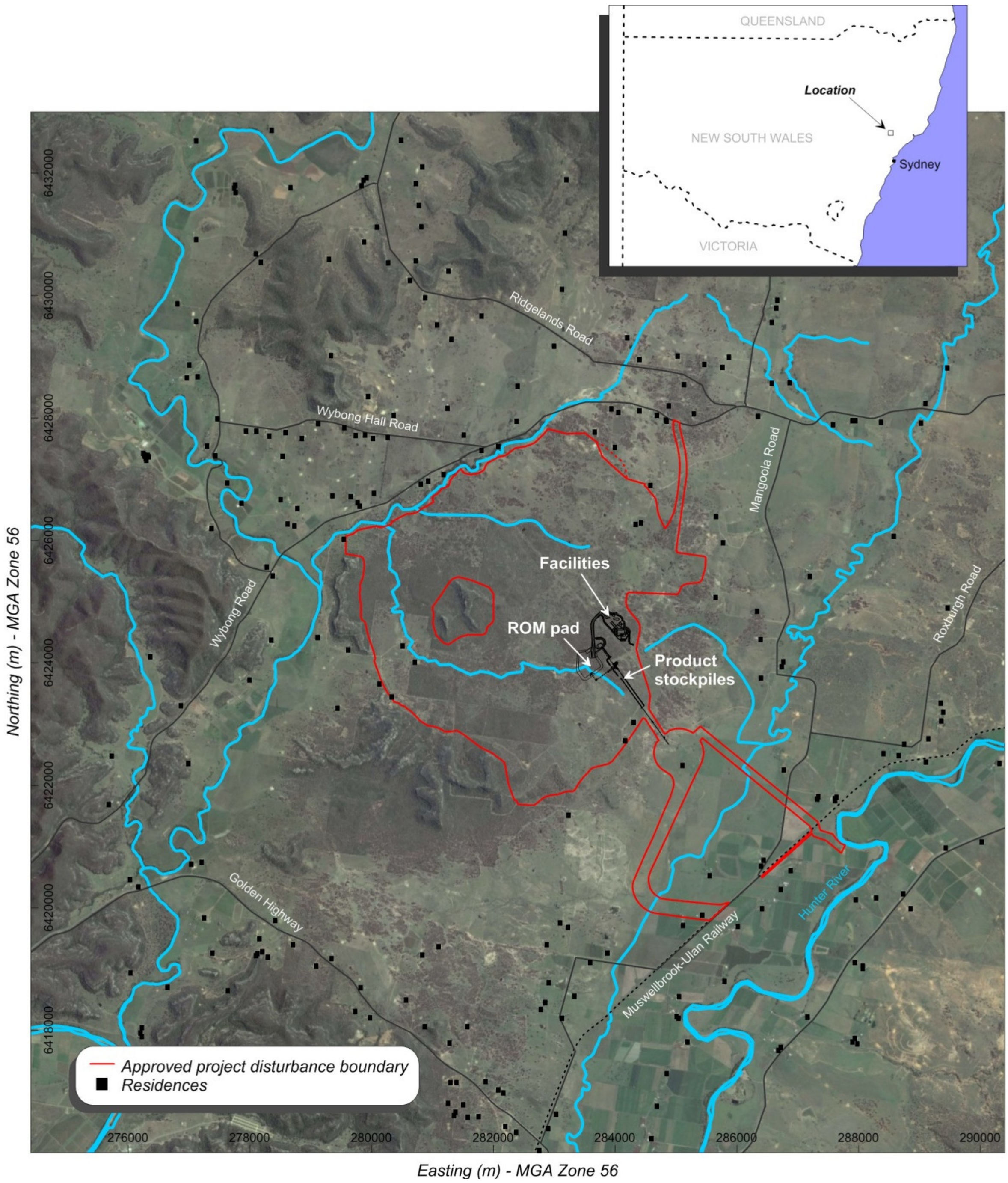
ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
103	0.02	0.03	0.04	0.01	1.62	1.63	1.64	1.61
104	0.03	0.05	0.05	0.01	1.63	1.65	1.65	1.61
106A	0.01	0.02	0.02	0.00	1.61	1.62	1.62	1.60
106B	0.01	0.02	0.02	0.00	1.61	1.62	1.62	1.60
110	0.11	0.19	0.21	0.03	1.71	1.79	1.81	1.63
111	0.05	0.05	0.02	0.00	1.65	1.65	1.62	1.60
112A	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
112B	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
112C	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
112D	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
114	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
116A	0.07	0.11	0.19	0.03	1.67	1.71	1.79	1.63
116B	0.07	0.11	0.18	0.03	1.67	1.71	1.78	1.63
116C	0.07	0.11	0.18	0.03	1.67	1.71	1.78	1.63
116D	0.07	0.11	0.18	0.03	1.67	1.71	1.78	1.63
116E	0.07	0.11	0.18	0.03	1.67	1.71	1.78	1.63
116F	0.07	0.11	0.18	0.03	1.67	1.71	1.78	1.63
116G	0.07	0.11	0.18	0.03	1.67	1.71	1.78	1.63
121	0.01	0.01	0.02	0.01	1.61	1.61	1.62	1.61
124	0.09	0.14	0.08	0.02	1.69	1.74	1.68	1.62
125A	0.07	0.10	0.11	0.03	1.67	1.70	1.71	1.63
125B	0.07	0.11	0.12	0.03	1.67	1.71	1.72	1.63
125C	0.07	0.11	0.11	0.03	1.67	1.71	1.71	1.63
125D	0.06	0.10	0.11	0.03	1.66	1.70	1.71	1.63
125E	0.06	0.10	0.11	0.03	1.66	1.70	1.71	1.63
125F	0.06	0.10	0.11	0.03	1.66	1.70	1.71	1.63
126A	0.02	0.02	0.01	0.00	1.62	1.62	1.61	1.60
126B	0.01	0.02	0.01	0.00	1.61	1.62	1.61	1.60
128	0.05	0.05	0.02	0.00	1.65	1.65	1.62	1.60
130	0.10	0.17	0.28	0.03	1.70	1.77	1.88	1.63
132	0.03	0.05	0.05	0.01	1.63	1.65	1.65	1.61
134A	0.10	0.16	0.14	0.02	1.70	1.76	1.74	1.62
134B	0.10	0.17	0.14	0.02	1.70	1.77	1.74	1.62
134C	0.10	0.16	0.13	0.02	1.70	1.76	1.73	1.62
134D	0.08	0.12	0.07	0.01	1.68	1.72	1.67	1.61
135	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
139	0.05	0.06	0.02	0.01	1.65	1.66	1.62	1.61
141	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
144	0.07	0.08	0.03	0.01	1.67	1.68	1.63	1.61
147	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
148	0.10	0.17	0.25	0.03	1.70	1.77	1.85	1.63
151	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
156	0.06	0.08	0.04	0.01	1.66	1.68	1.64	1.61
157	0.04	0.05	0.02	0.00	1.64	1.65	1.62	1.60
162	0.05	0.05	0.02	0.00	1.65	1.65	1.62	1.60
164	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
165	0.08	0.10	0.04	0.01	1.68	1.70	1.64	1.61
166	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
168	0.06	0.07	0.03	0.01	1.66	1.67	1.63	1.61
170	0.04	0.04	0.02	0.00	1.64	1.64	1.62	1.60
171	0.03	0.03	0.01	0.00	1.63	1.63	1.61	1.60
172	0.07	0.09	0.04	0.01	1.67	1.69	1.64	1.61
173B	0.02	0.02	0.01	0.00	1.62	1.62	1.61	1.60
173C	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
174A	0.02	0.03	0.02	0.00	1.62	1.63	1.62	1.60
174B	0.02	0.03	0.02	0.00	1.62	1.63	1.62	1.60
175	0.02	0.03	0.02	0.00	1.62	1.63	1.62	1.60
176	0.02	0.04	0.05	0.01	1.62	1.64	1.65	1.61
177	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
178	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
182	0.08	0.12	0.10	0.03	1.68	1.72	1.70	1.63
183A	0.02	0.03	0.03	0.01	1.62	1.63	1.63	1.61
183B	0.02	0.03	0.03	0.01	1.62	1.63	1.63	1.61
183C	0.02	0.03	0.03	0.01	1.62	1.63	1.63	1.61
184	0.01	0.02	0.02	0.01	1.61	1.62	1.62	1.61

ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
185	0.01	0.02	0.03	0.01	1.61	1.62	1.63	1.61
187	0.01	0.02	0.02	0.01	1.61	1.62	1.62	1.61
189	0.02	0.03	0.03	0.01	1.62	1.63	1.63	1.61
19	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
190	0.09	0.14	0.09	0.03	1.69	1.74	1.69	1.63
191	0.02	0.04	0.04	0.01	1.62	1.64	1.64	1.61
192	0.03	0.05	0.05	0.01	1.63	1.65	1.65	1.61
193	0.03	0.05	0.05	0.01	1.63	1.65	1.65	1.61
194	0.02	0.03	0.04	0.01	1.62	1.63	1.64	1.61
195	0.06	0.08	0.04	0.01	1.66	1.68	1.64	1.61
198	0.12	0.16	0.08	0.03	1.72	1.76	1.68	1.63
199	0.01	0.01	0.02	0.01	1.61	1.61	1.62	1.61
200	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
201A	0.02	0.02	0.02	0.01	1.62	1.62	1.62	1.61
201B	0.02	0.02	0.02	0.01	1.62	1.62	1.62	1.61
201C	0.01	0.02	0.02	0.01	1.61	1.62	1.62	1.61
202	0.04	0.05	0.03	0.01	1.64	1.65	1.63	1.61
203H	0.03	0.04	0.03	0.01	1.63	1.64	1.63	1.61
203I	0.03	0.04	0.03	0.01	1.63	1.64	1.63	1.61
203J	0.02	0.03	0.02	0.01	1.62	1.63	1.62	1.61
203K	0.02	0.02	0.02	0.01	1.62	1.62	1.62	1.61
204	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
205	0.02	0.03	0.01	0.00	1.62	1.63	1.61	1.60
206	0.03	0.03	0.01	0.00	1.63	1.63	1.61	1.60
207	0.02	0.03	0.01	0.00	1.62	1.63	1.61	1.60
208	0.03	0.04	0.02	0.00	1.63	1.64	1.62	1.60
209	0.03	0.04	0.06	0.02	1.63	1.64	1.66	1.62
210	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
211	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
212A	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
212B	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
212C	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
213	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
214	0.00	0.00	0.01	0.00	1.60	1.60	1.61	1.60
215	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
216	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
217	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
218	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
219	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
21B	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
220	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
222	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
223	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
224A	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
224B	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
227	0.03	0.06	0.06	0.02	1.63	1.66	1.66	1.62
228	0.03	0.05	0.06	0.02	1.63	1.65	1.66	1.62
229A	0.02	0.04	0.04	0.01	1.62	1.64	1.64	1.61
229B	0.05	0.07	0.07	0.02	1.65	1.67	1.67	1.62
229C	0.03	0.05	0.05	0.01	1.63	1.65	1.65	1.61
230	0.04	0.06	0.06	0.02	1.64	1.66	1.66	1.62
231	0.04	0.06	0.06	0.02	1.64	1.66	1.66	1.62
232A	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
232B	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
232C	0.04	0.06	0.06	0.01	1.64	1.66	1.66	1.61
233	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
235A	0.04	0.06	0.06	0.01	1.64	1.66	1.66	1.61
235B	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
235C	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
236A	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
236B	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
236C	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
237	0.05	0.08	0.07	0.02	1.65	1.68	1.67	1.62
238	0.05	0.08	0.07	0.02	1.65	1.68	1.67	1.62
240	0.06	0.09	0.10	0.02	1.66	1.69	1.70	1.62
241A	0.07	0.10	0.10	0.03	1.67	1.70	1.70	1.63
241B	0.07	0.11	0.10	0.03	1.67	1.71	1.70	1.63
241C	0.07	0.11	0.10	0.03	1.67	1.71	1.70	1.63

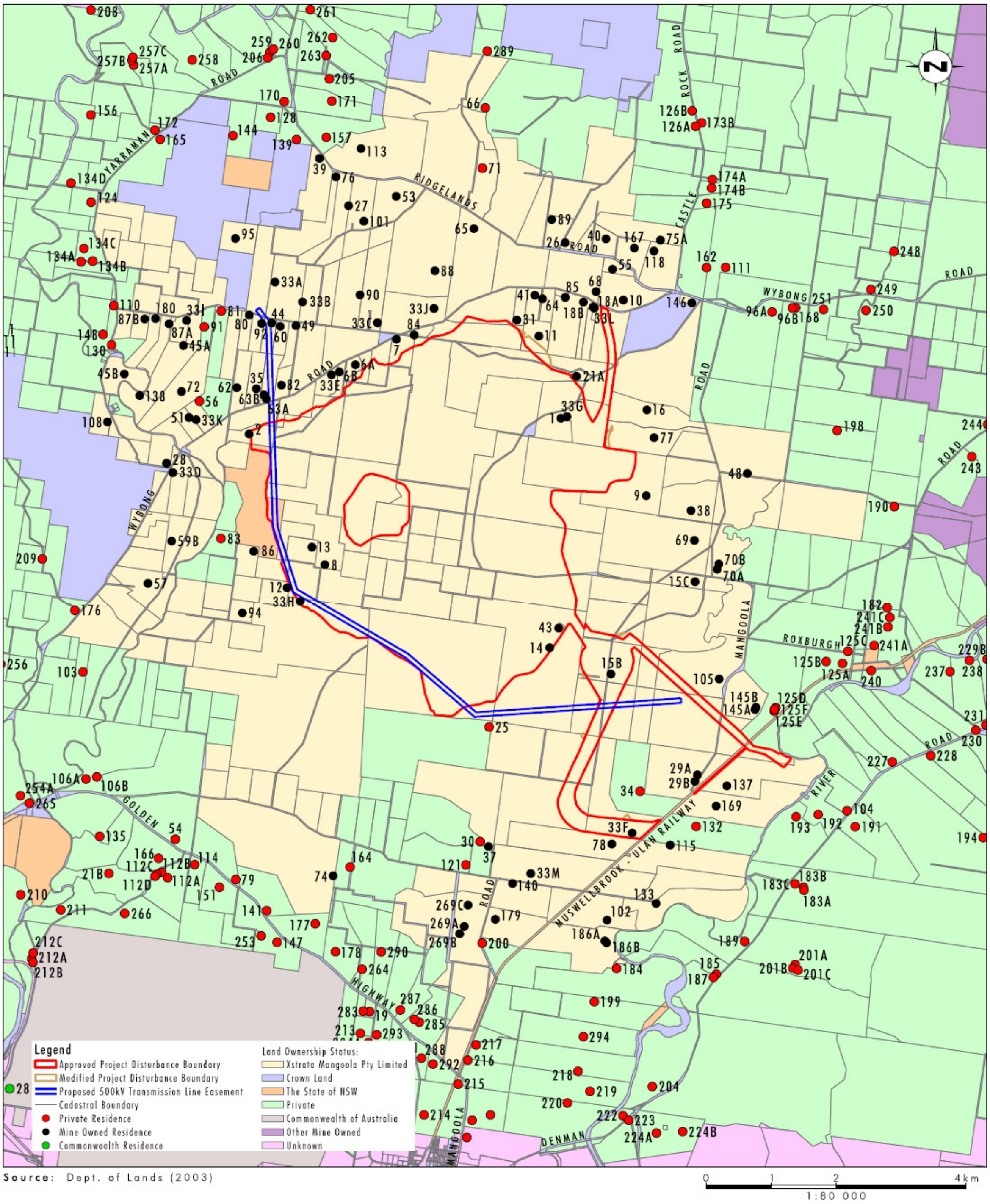
ID	Due to project emissions only				Cumulative, with background levels			
	Year 2	Year 5	Year 10	Year 15	Year 2	Year 5	Year 10	Year 15
242	0.06	0.09	0.07	0.02	1.66	1.69	1.67	1.62
243	0.06	0.09	0.05	0.02	1.66	1.69	1.65	1.62
244	0.06	0.08	0.05	0.01	1.66	1.68	1.65	1.61
245B	0.05	0.07	0.04	0.01	1.65	1.67	1.64	1.61
246	0.03	0.03	0.02	0.01	1.63	1.63	1.62	1.61
248	0.03	0.03	0.02	0.00	1.63	1.63	1.62	1.60
249	0.04	0.05	0.02	0.01	1.64	1.65	1.62	1.61
25	0.02	0.07	0.15	0.05	1.62	1.67	1.75	1.65
250	0.05	0.06	0.03	0.01	1.65	1.66	1.63	1.61
251	0.06	0.07	0.03	0.01	1.66	1.67	1.63	1.61
252A	0.02	0.03	0.02	0.00	1.62	1.63	1.62	1.60
252B	0.02	0.02	0.01	0.00	1.62	1.62	1.61	1.60
253	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
254A	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
255	0.01	0.02	0.02	0.00	1.61	1.62	1.62	1.60
256	0.02	0.02	0.03	0.00	1.62	1.62	1.63	1.60
257A	0.04	0.05	0.02	0.01	1.64	1.65	1.62	1.61
257B	0.04	0.05	0.02	0.01	1.64	1.65	1.62	1.61
257C	0.04	0.05	0.02	0.01	1.64	1.65	1.62	1.61
258	0.04	0.04	0.02	0.00	1.64	1.64	1.62	1.60
259	0.02	0.03	0.01	0.00	1.62	1.63	1.61	1.60
260	0.02	0.03	0.01	0.00	1.62	1.63	1.61	1.60
261	0.01	0.02	0.01	0.00	1.61	1.62	1.61	1.60
262	0.02	0.02	0.01	0.00	1.62	1.62	1.61	1.60
263	0.02	0.02	0.01	0.00	1.62	1.62	1.61	1.60
264	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
265	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
266	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
270	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
273A	0.03	0.05	0.04	0.01	1.63	1.65	1.64	1.61
273B	0.03	0.05	0.04	0.01	1.63	1.65	1.64	1.61
273C	0.04	0.06	0.05	0.01	1.64	1.66	1.65	1.61
275	0.03	0.05	0.05	0.01	1.63	1.65	1.65	1.61
281A	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
283	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
284A	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
284B	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
285	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
286	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
287	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
288	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
289	0.01	0.02	0.01	0.00	1.61	1.62	1.61	1.60
290	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
291	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
292	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
293	0.00	0.01	0.01	0.00	1.60	1.61	1.61	1.60
294	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
295	0.05	0.07	0.04	0.01	1.65	1.67	1.64	1.61
30	0.01	0.01	0.03	0.01	1.61	1.61	1.63	1.61
34	0.04	0.07	0.07	0.02	1.64	1.67	1.67	1.62
39	0.06	0.06	0.02	0.01	1.66	1.66	1.62	1.61
54	0.01	0.01	0.02	0.00	1.61	1.61	1.62	1.60
56	0.14	0.23	0.75	0.05	1.74	1.83	2.35	1.65
66	0.02	0.02	0.01	0.00	1.62	1.62	1.61	1.60
71	0.02	0.03	0.02	0.00	1.62	1.63	1.62	1.60
79	0.01	0.01	0.01	0.00	1.61	1.61	1.61	1.60
81	0.22	0.40	0.20	0.04	1.82	2.00	1.80	1.64
83	0.07	0.09	0.24	0.17	1.67	1.69	1.84	1.77
91	0.19	0.36	0.28	0.04	1.79	1.96	1.88	1.64
96A	0.07	0.08	0.03	0.01	1.67	1.68	1.63	1.61
96B	0.06	0.07	0.03	0.01	1.66	1.67	1.63	1.61

Figures

- **Figure 1: Location of the Mangoola Coal Site**

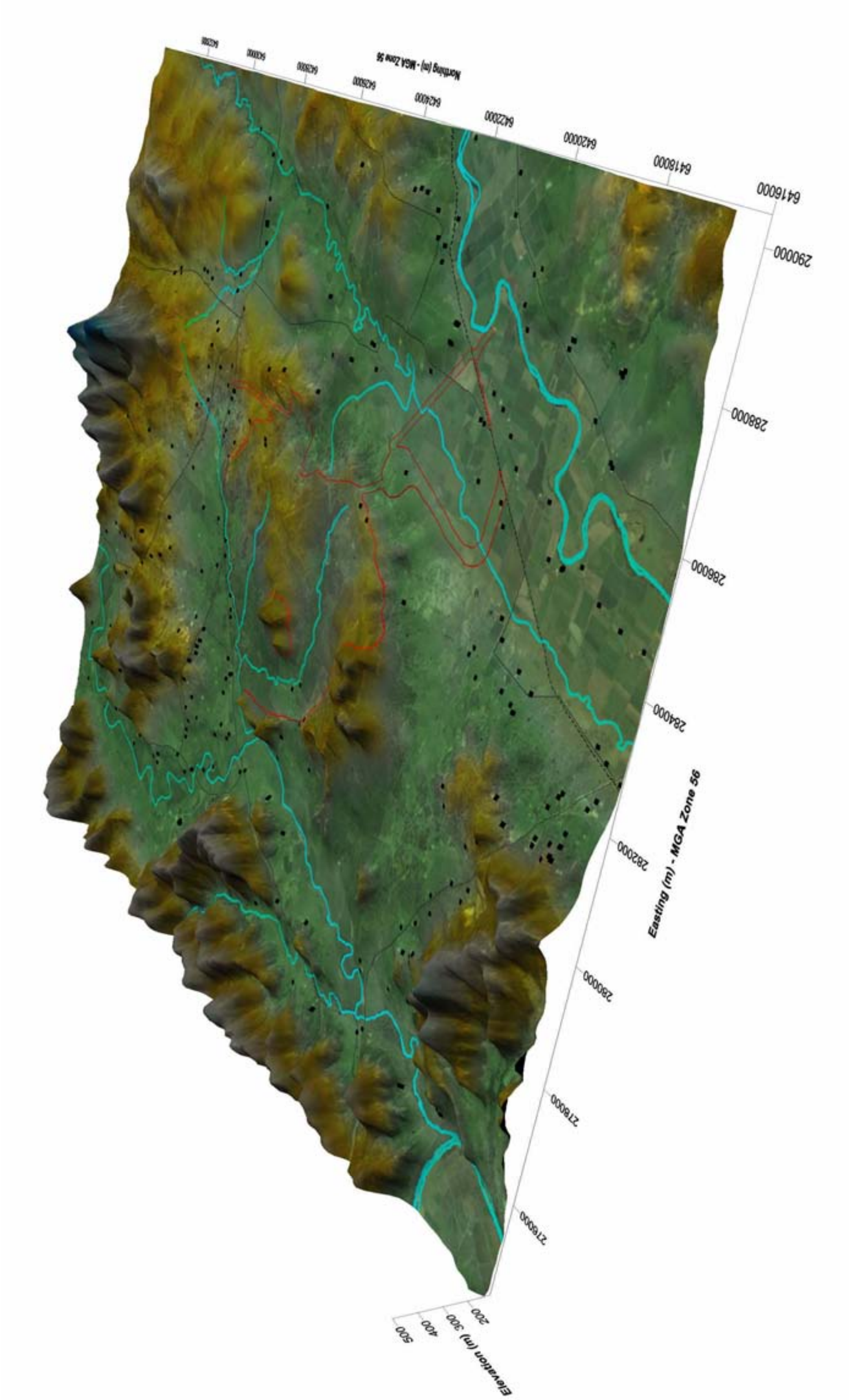


- **Figure 2: Land ownership and residences**



Source: Dept. of Lands (2003)

- **Figure 3: Pseudo three-dimensional representation of the local terrain**



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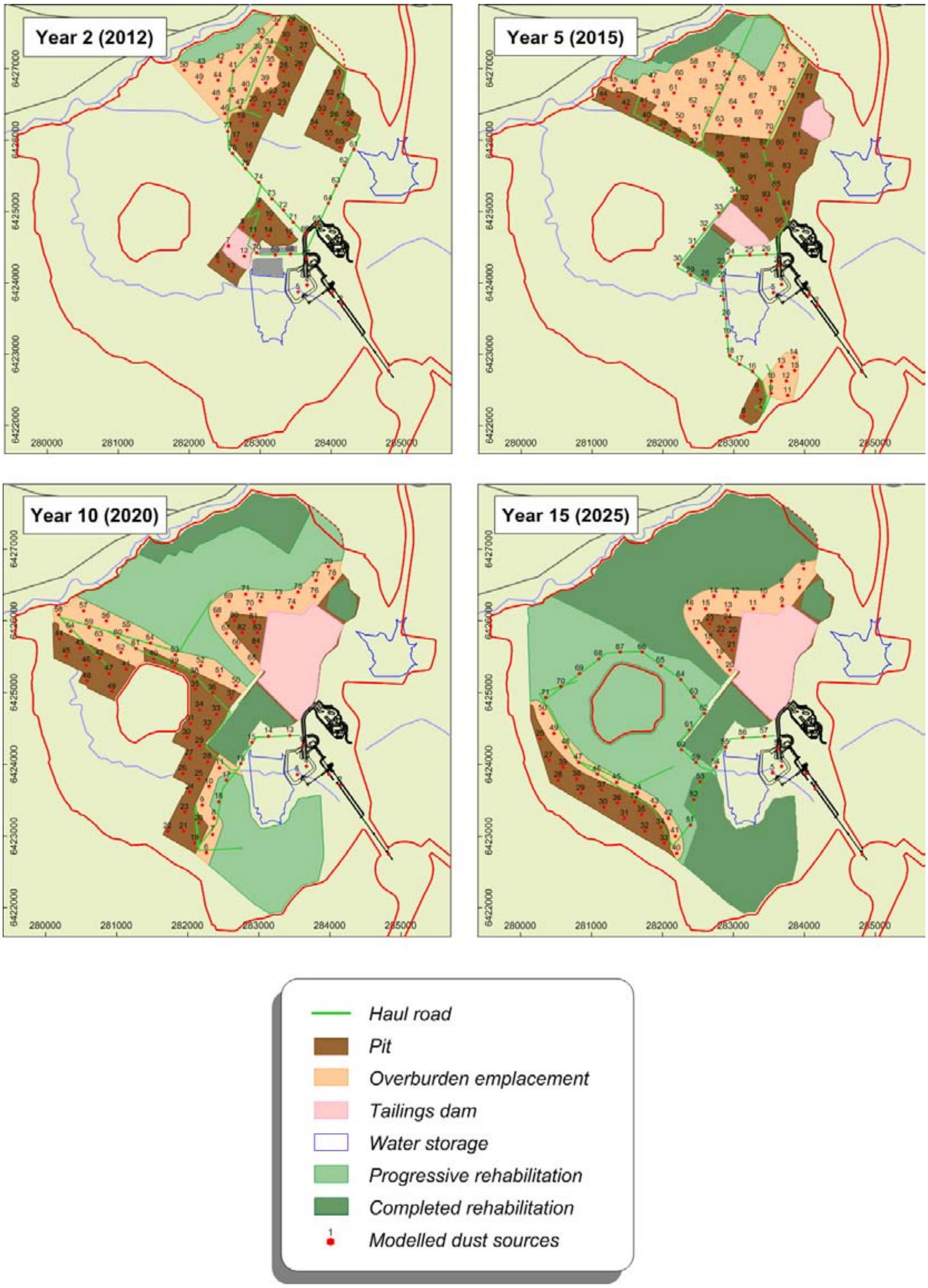
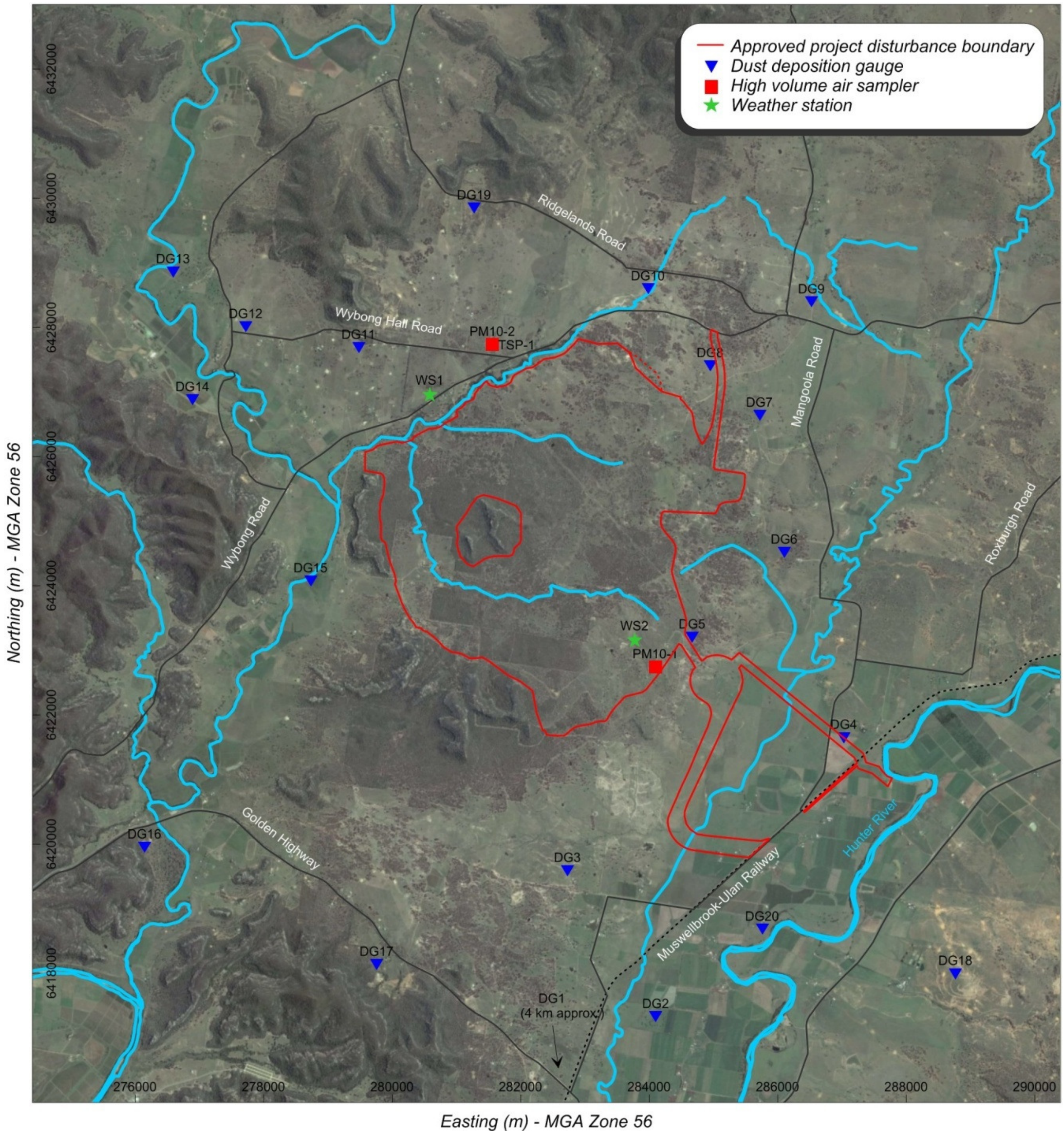
- **Figure 4: Proposed mine staging and location of modelled dust sources**



■ **Figure 5: Location of current air quality and meteorological monitoring sites**



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■ **Figure 6: Annual windroses for Coolabah Road**

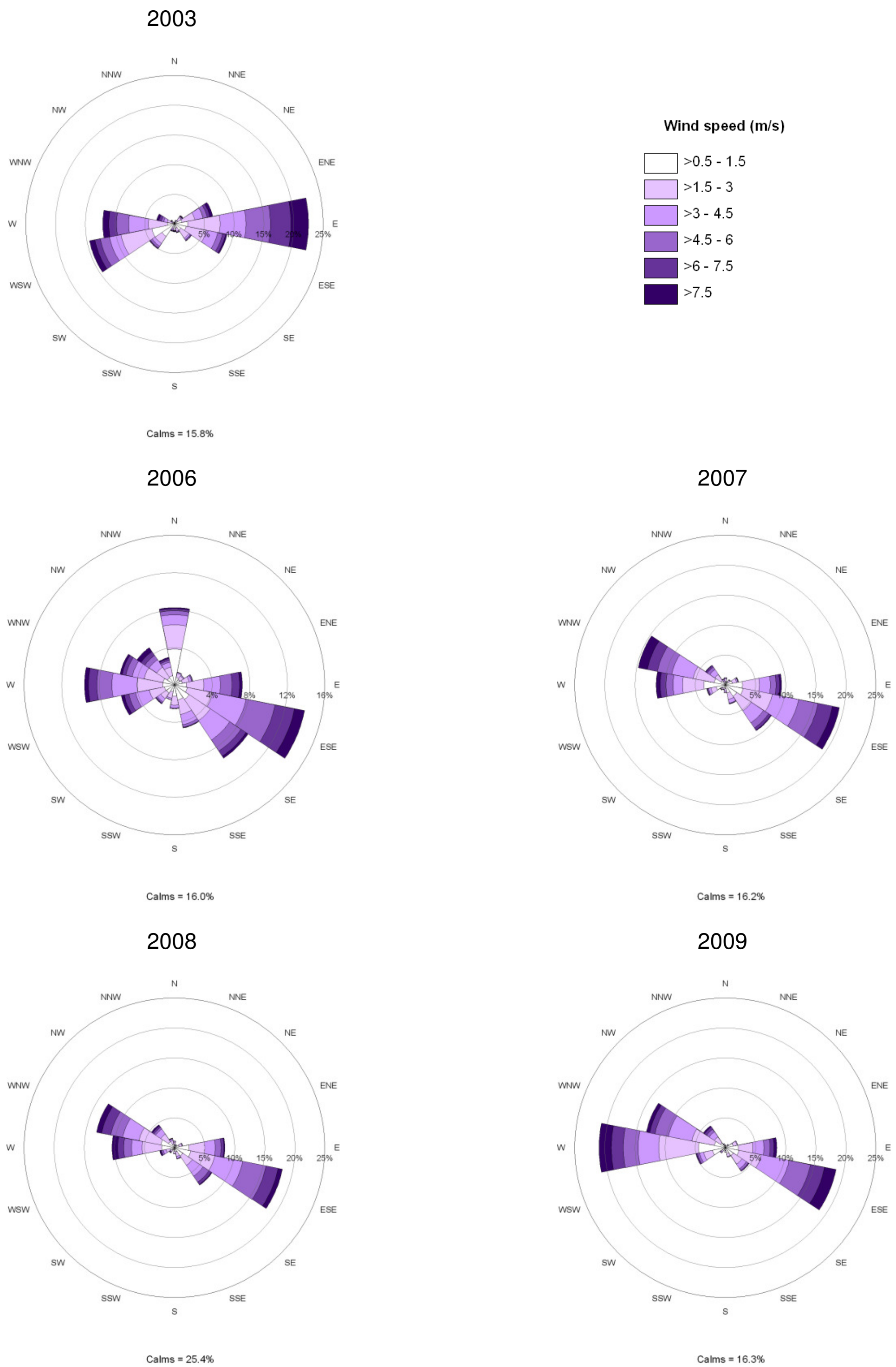
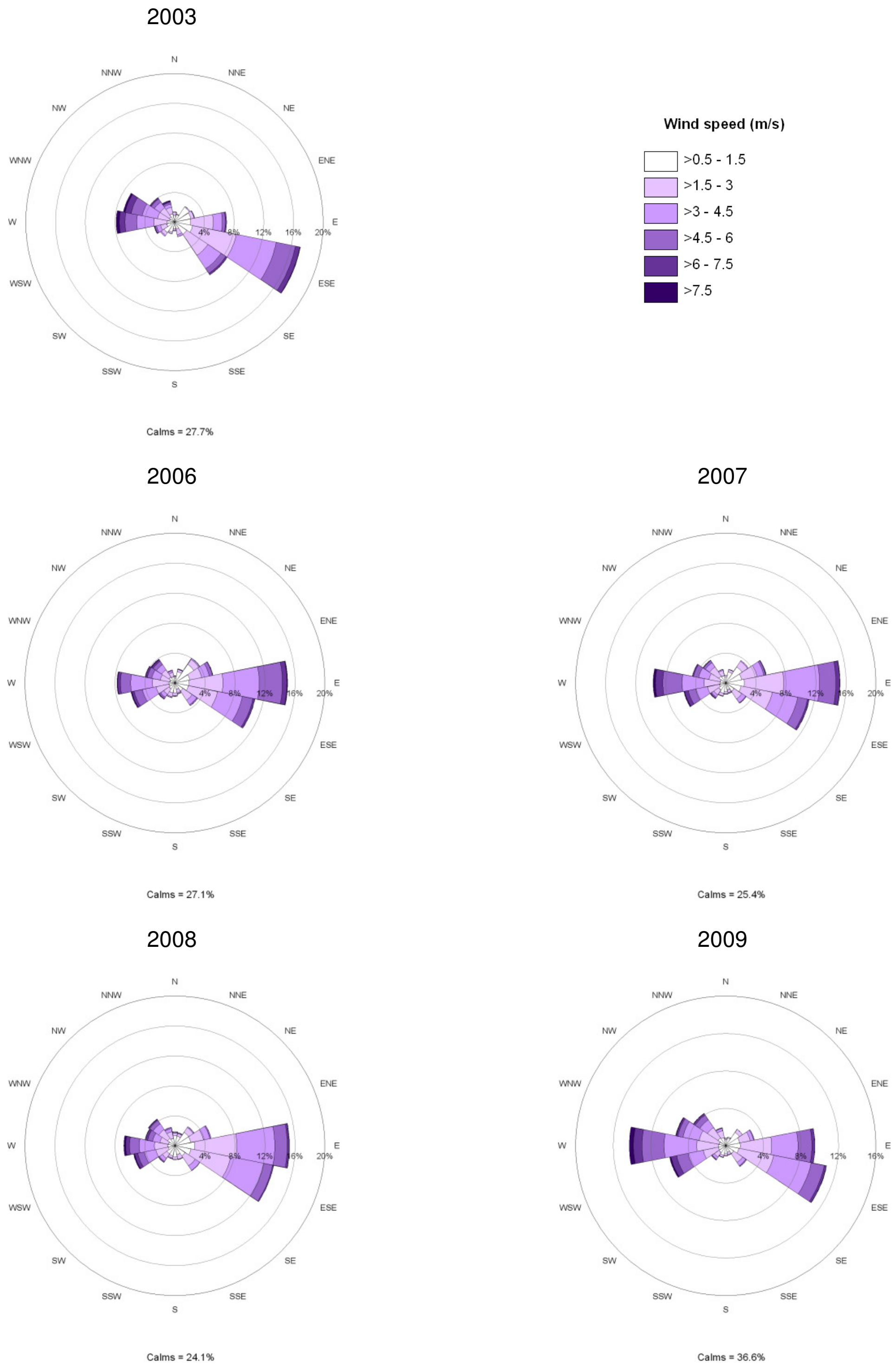


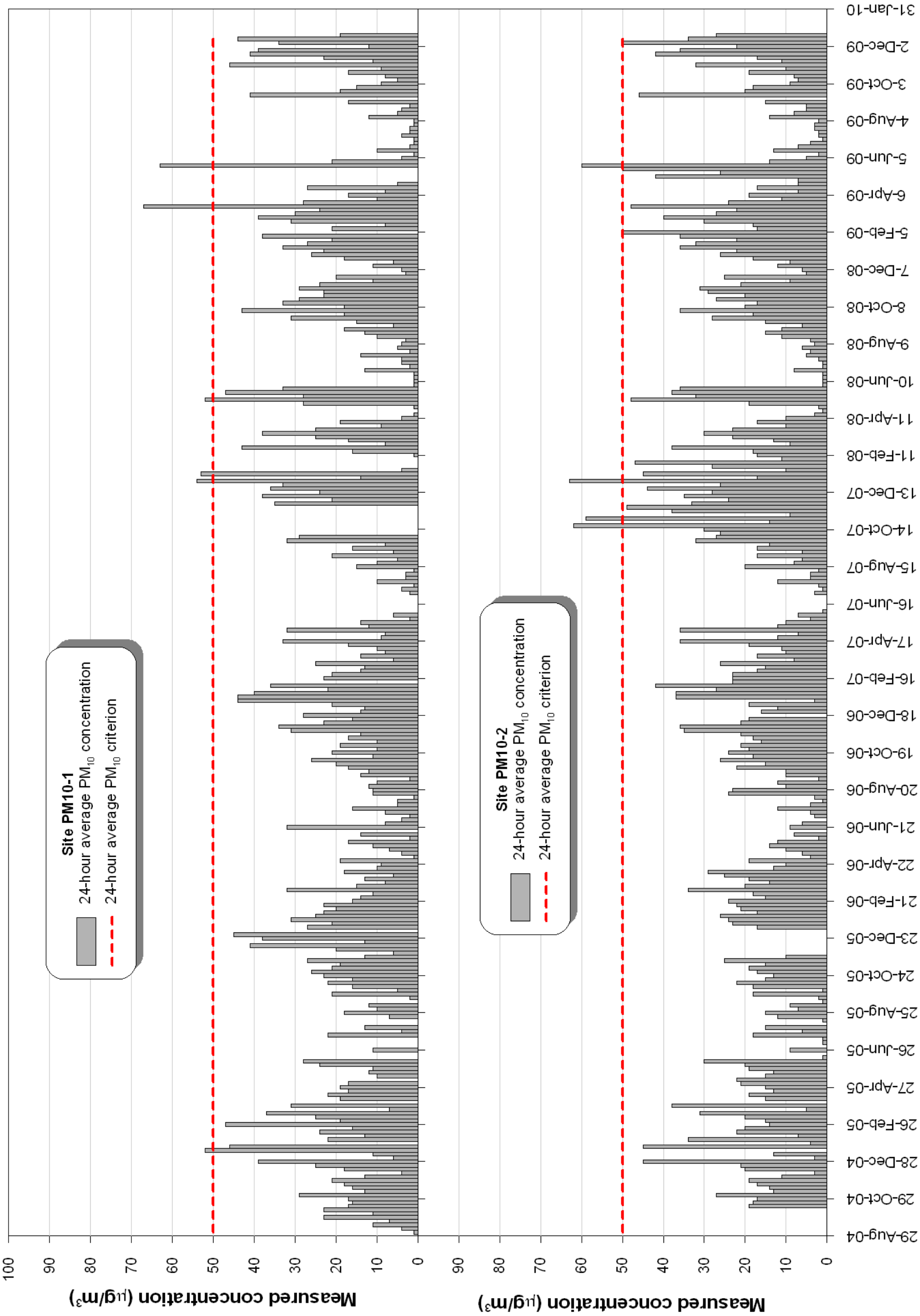
Figure 7: Annual windroses for Wybong Road



SKM

Figure 8: Annual and seasonal windroses for Wybong Road (2003)

- **Figure 9: Measured PM_{10} concentrations in the study area**



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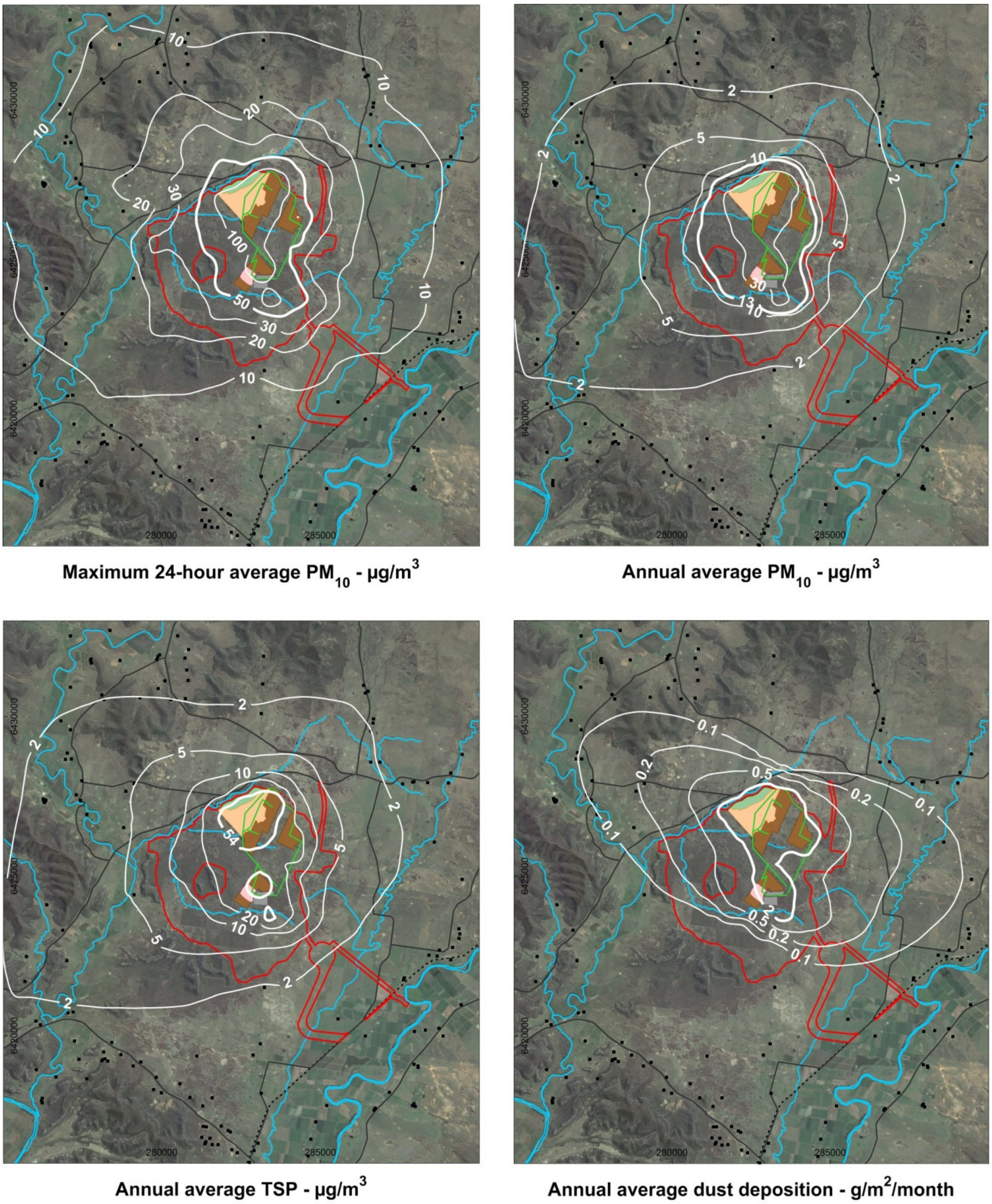
■ **Figure 10: Dispersion model predictions for the proposed Year 2 operations**



The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.
(Note: only private residences are shown)

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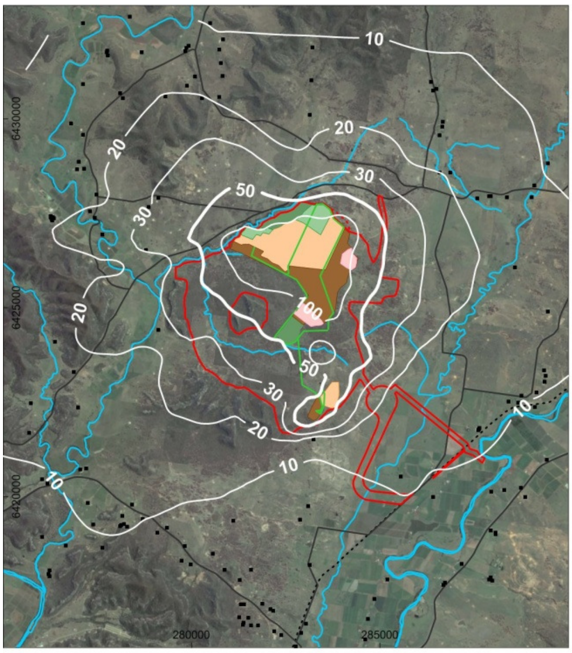
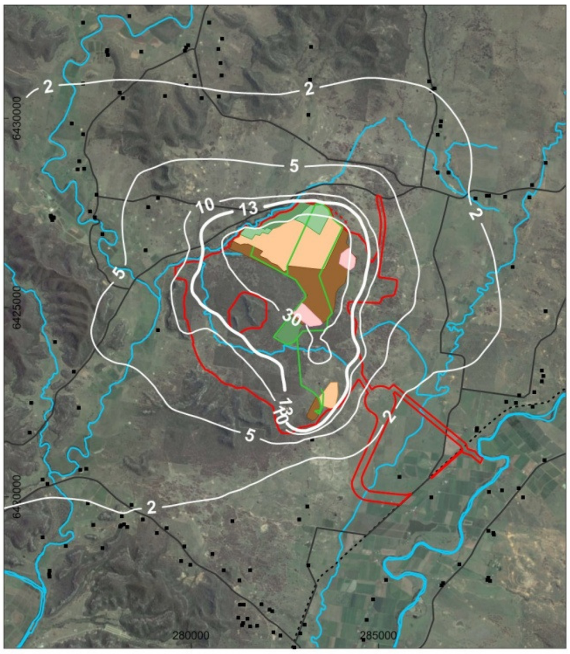
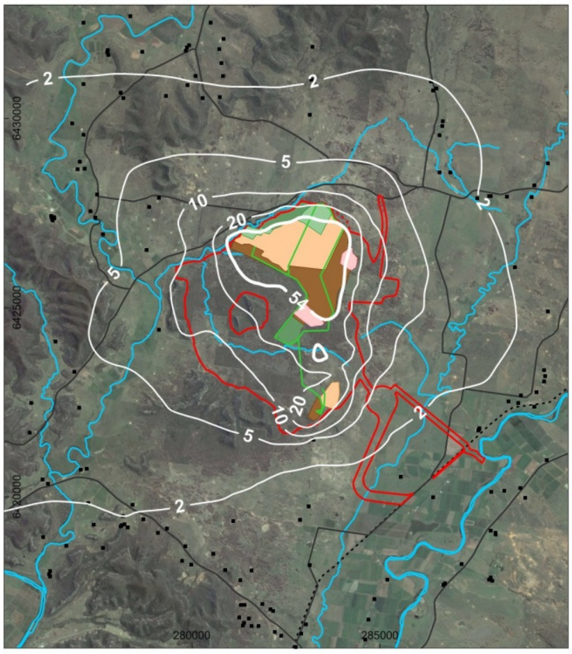
- **Figure 11: Dispersion model predictions for the proposed Year 5 operations**



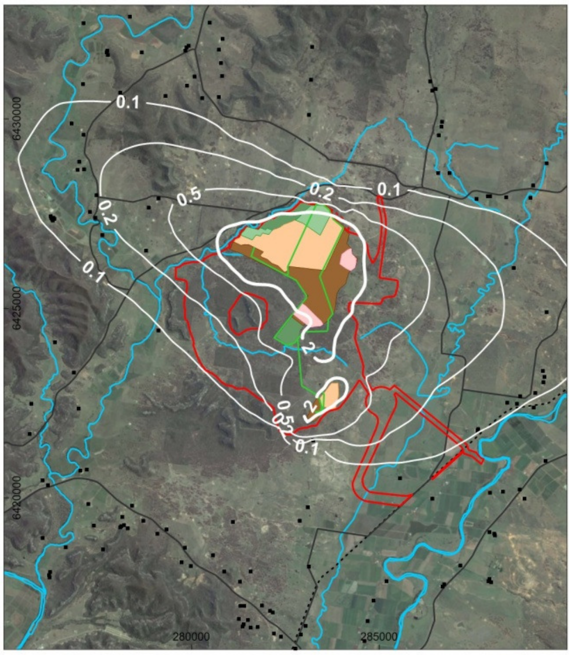
Maximum 24-hour average PM_{10} - µg/m^3



Annual average PM_{10} - µg/m^3



Annual average TSP - µg/m^3



Annual average dust deposition - g/m^2/month

The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.
(Note: only private residences are shown)

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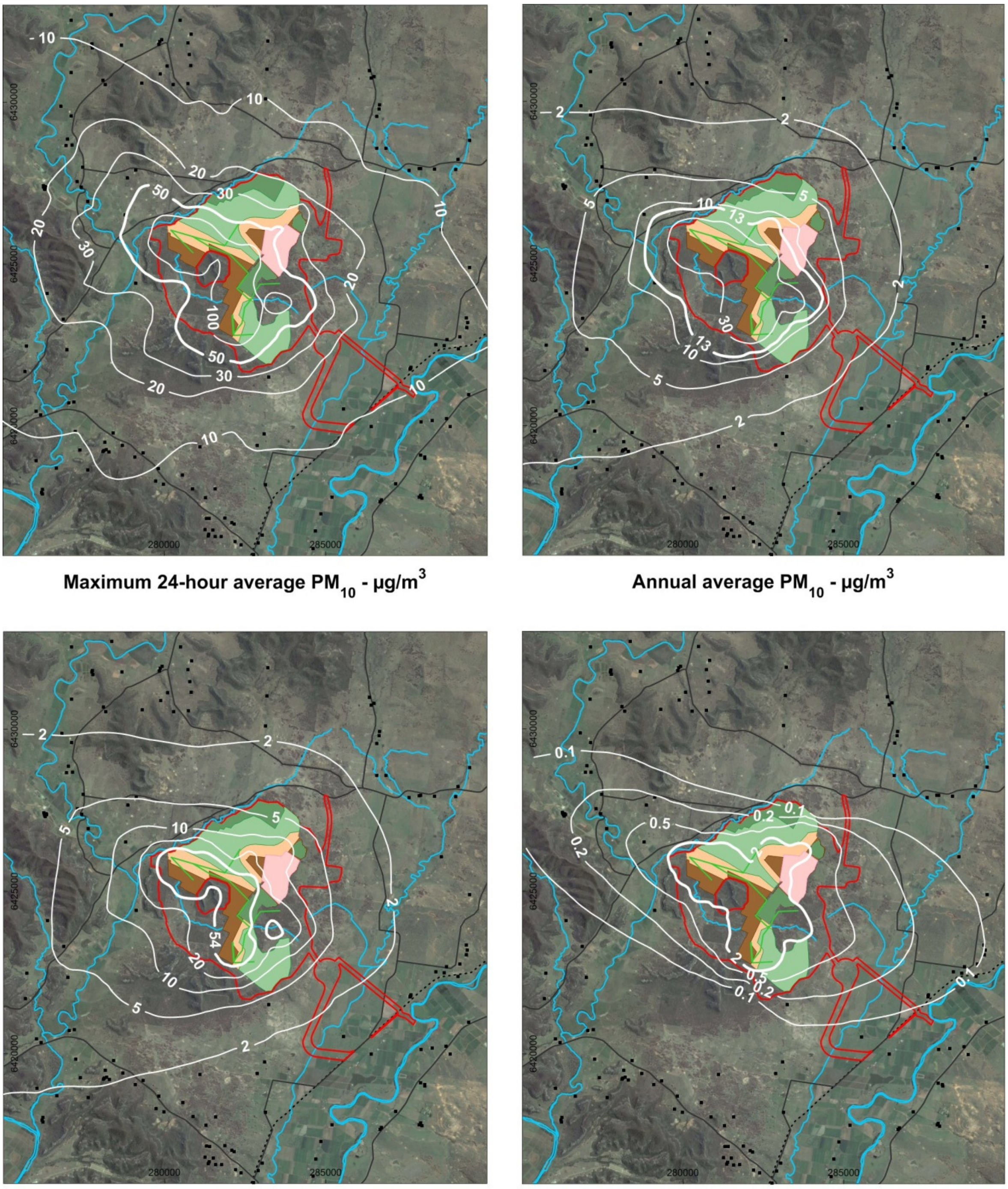
■ **Figure 12: Dispersion model predictions for the proposed Year 10 operations**



Maximum 24-hour average PM_{10} - µg/m^3

Annual average PM_{10} - µg/m^3

Annual average TSP - µg/m^3

Annual average dust deposition - g/m^2/month

The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.
(Note: only private residences are shown)

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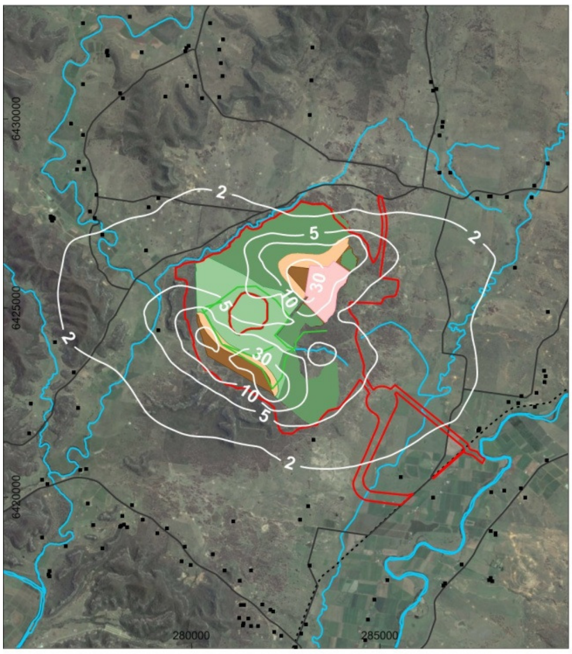
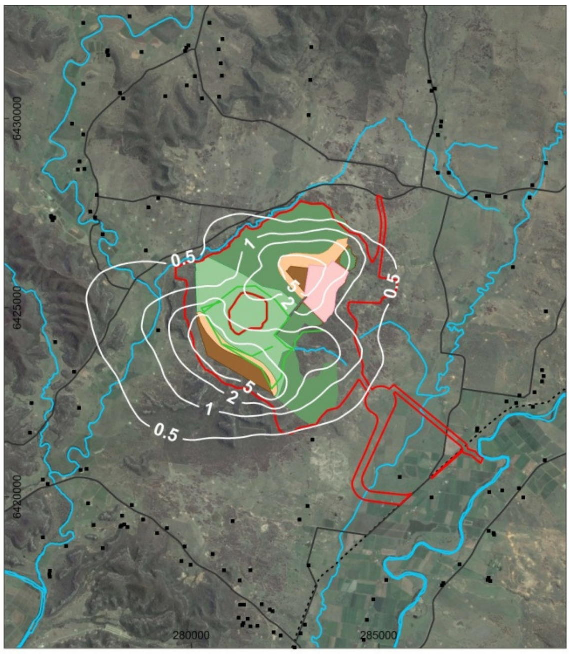
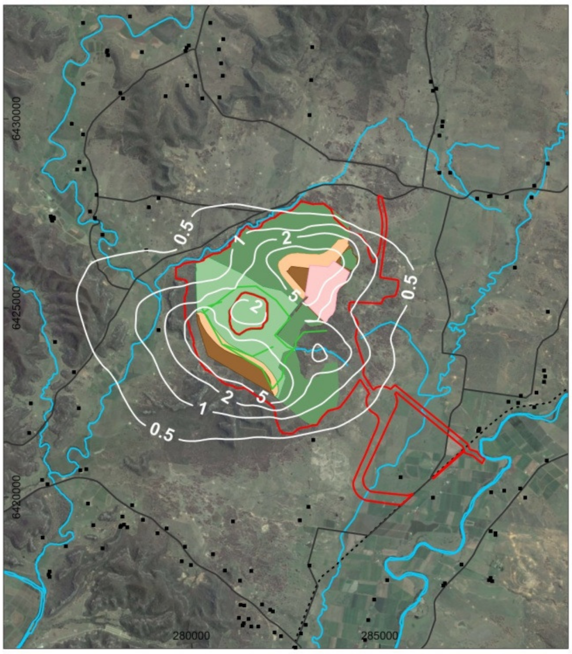
- **Figure 13: Dispersion model predictions for the proposed Year 15 operations**



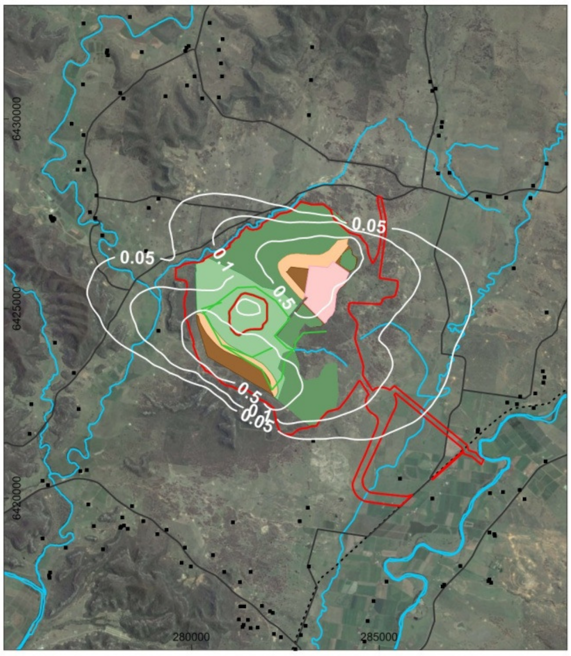
Maximum 24-hour average PM_{10} - µg/m^3



Annual average PM_{10} - µg/m^3



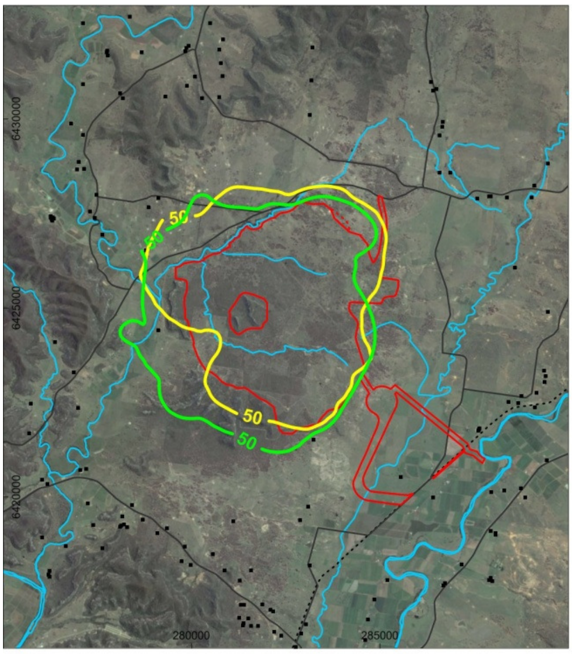
Annual average TSP - µg/m^3



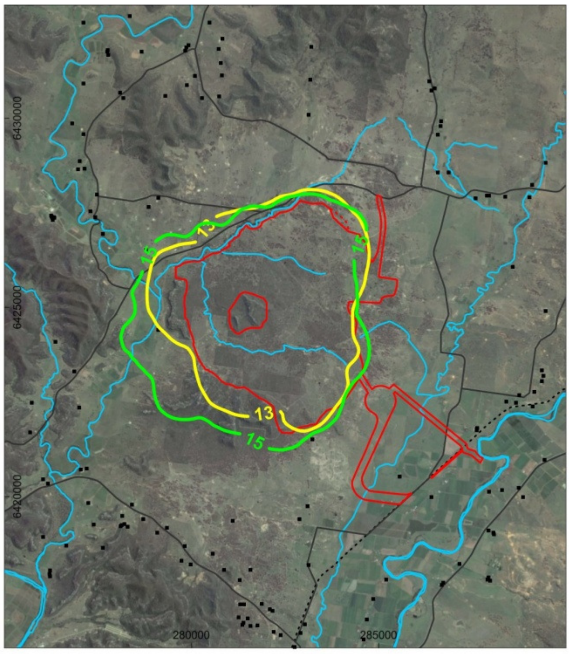
Annual average dust deposition - g/m^2/month

The enhanced contour lines represent the relevant air quality criteria,
including the addition of background levels where relevant.
(Note: only private residences are shown)

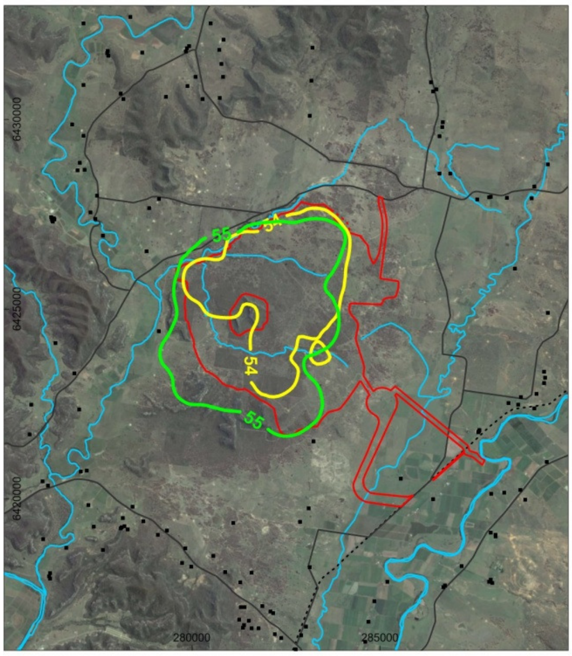
■ **Figure 14: Comparison of air quality impact extents with Approved Project**



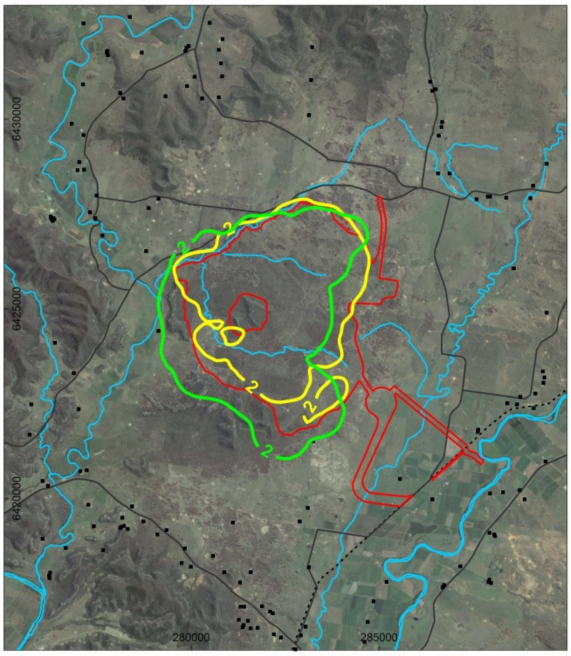
Maximum 24-hour average PM_{10} - µg/m^3



Annual average PM_{10} - µg/m^3



Annual average TSP - µg/m^3



Annual average dust deposition - g/m^2/month

Approved mine plan
Proposed mine plan

Contour lines represent the relevant air quality criteria, including the addition of background levels where relevant. (Note: only private residences are shown)