Air Quality Assessment

Appendix 10

AIR QUALITY IMPACT ASSESSMENT:
ANVIL HILL PROJECT

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Prepared for
Umwelt (Australia) Pty Limited

by
Holmes Air Sciences

Suite 2B, 14 Glen St
Eastwood NSW 2122
Phone : (02) 9874 8644
Fax : (02) 9874 8904
Email : has@holmair.com.au

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1. INTRODUCTION

This report has been prepared by Holmes Air Sciences for Umwelt (Australia) Pty Limited (Umwelt). Umwelt is preparing an Environmental Assessment (EA) for the proposed Anvil Hill Project ("the Project") on behalf of Centennial Hunter Pty Limited (Centennial). The Project involves the development of an open-cut coal mine in the upper Hunter Valley of New South Wales (NSW). The purpose of this report is to quantitatively assess the air quality impacts of the Project.

The Project area and nearby receptors are shown on **Figure 1**. **Figure 2** shows the identification label for each receptor.

The assessment is based on the use of a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the mine. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality goals.

The assessment is based on a conventional approach following the procedures outlined in the NSW Department of Environment and Conservation's (DEC's, formerly Environment Protection Authority) document titled "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (**DEC, 2005**).

In summary, the report provides information on the following:

- the way in which mining is to be undertaken, with a focus on describing those aspects that will assist in understanding how the mine will affect air quality;
- air quality goals that need to be met to protect the air quality environment;
- meteorological and climatic conditions in the area;
- discussion of the existing air quality conditions in the area;
- methods used to estimate dust emissions and the way in which dust emissions from the proposal would disperse and fallout;
- expected dispersion and dust fallout patterns due to emissions from the mine and a comparison between the predicted dust concentration and fallout levels and the relevant air quality criteria;
- control methods which can be used to reduce dust impacts;
- likely impacts of construction; and
- potential cumulative impacts.

2. LOCAL SETTING AND PROJECT DESCRIPTION

Centennial proposes to establish an open cut coal mine and ancillary facilities including a Coal Preparation Plant (CPP) and rail loop in the Wybong area, 20 kilometres west of Muswellbrook and approximately 10 kilometres north of the township of Denman. The proposal is based on a large, undeveloped coal reserve of approximately 150 million tonnes (Mt) that is suitable for production of thermal coal for both domestic and export markets.

Figure 1 shows the location the Project Application Area, mine facilities and nearest residences. The Anvil Hill Project is located in the Upper Hunter Valley, on the margin of the valley floor. The Project Area has been extensively used for agriculture since the 1800s and is dominated by rolling grazing land with remnant and regrowth woodland. The locality immediately surrounding the Project Area consists of mostly smaller rural holdings, dominated by rural residential land use, but also includes more intensive agricultural land uses such as vineyards, irrigation for lucerne and dairies.

The topography of the Proposed Disturbance Area varies from the lower slopes of the Hunter River, through to undulating and hilly lands to rocky outcrops. **Figure 3** shows a pseudo three-dimensional representation of terrain in the study area. A notable topographical feature within this area is Anvil Hill itself which rises approximately 70 metres above the surrounding area at its highest point. It is located at the centre of the proposed mining area and consists of two hills connected by a saddle. Anvil Hill is not proposed to be mined. The lower areas of the Proposed Disturbance Area are currently used for pastoral grazing and a 500 kV TransGrid powerline crosses the site in a southeast/northwest direction.

The topography of the area surrounding the Proposed Disturbance Area is dominated by a row of hills to the west and south. The hills to the west are not named, although they are known locally as "Wallaby Rocks". Wallaby Rocks rise to a height of 264 metres AHD, being approximately 100 metres above the surrounding area and contain a visually dominant escarpment along the western side. The rocky area to the south known as Limb of Addy Hill rises to a height of 302 metres AHD, which is also approximately 100 metres above the surrounding area.

Land use in the vicinity of the Project consists of a combination of coal mining operations, agricultural land uses (primarily grazing), scattered residential properties and the rural towns of Denman and Muswellbrook.

In summary, the Project will include:

- An open cut coal mine
- Coal handling and crushing facilities, and a preparation plant (washery) and stockpile areas
- Water management, supply and distribution infrastructure
- Handling and placement of mine wasteoverburden (rock)

- Mine access road including a new intersection on Wybong Road, internal access roads and haul roads

- Infrastructure including offices, staff amenities, coal crushing facility, workshop, conveyors, and ancillary servicesstockpile areas and conveyors

- A 66kV transmission line and switchyard

- A rail loop and rail loading infrastructure for the transport of all product coal.

A 21 year mine plan has been developed with a maximum mining rate of up to 10.5 Mtpa of ROM coal. It is estimated that the operations would require excavation of approximately 430 million bank cubic metres (Mbcm) of overburden (including all waste rock). As mining progresses the overburden will be initially deposited in out-of-pit emplacement areas and then in the mined out voids. Detailed mine and project planning has been undertaken to develop a Conceptual Mine Plan, with indicative stages modelled at years 2, 5, 10, 15 and 20.

Scheduling has allowed for concurrent operation of four pits for most of the mine life. The proposed mining method has been adapted to this layout and is planned to provide for an efficient operation in which environmental impacts can be minimised.

Rehabilitation will be scheduled to commence as soon as possible after mining disturbance, to minimise the disturbed area at any point in time.

Figure 4 shows the mine plan for the years chosen for the air quality assessment. These figures include the active mining areas, the active mine overburden emplacement areas and proposed haul routes. Also shown on these figures are the location of dust sources used for the dispersion modelling. These are discussed later in this report (see **Section 6**).

The 21 year conceptual mine schedule used for assessment purposes is presented below in **Table 1**.

Table 1 : Anvil Hill Project conceptual mine schedule

Year	Open cut overburden (kbcm)	Open cut ROM coal (ktpa)	Product coal (ktpa)
1	3,173	200	152
2	11,432	3,200	2,432
3	11,442	4,800	3,648
4	24,769	9,000	6,840
5	29,336	10,500	7,980
6	28,839	9,000	6,840
7	30,750	9,000	6,840
8	30,760	9,000	6,840
9	30,566	9,000	6,840
10	29,545	8,500	6,460
11	30,034	8,000	6,080
12	29,643	7,000	5,320
13	29,520	7,000	5,320
14	30,135	7,000	5,320
15	30,381	7,000	5,320
16	30,750	7,000	5,320
17	30,750	7,000	5,320
18	30,750	7,000	5,320
19	30,590	7,000	5,320
20	24,386	3,917	2,977
21	0	0	0
Total	**527,550**	**140,117**	**106,489**

The highlighted years indicate the years selected for the assessment

The mining method is described below:

- Removal of vegetation and topsoil in advance of each mining strip. Stripped topsoil and subsoil would be used directly in progressive rehabilitation or placed in temporary stockpiles;
- Strip mining using hydraulic excavators, assisted by dozers, loading rear dump trucks to sequentially uncover the coal seams;
- Drilling and blasting of overburden prior to excavation;
- Progressive rehabilitation of the overburden emplacements.

In all stages of the Project, mining is proposed for 24 hours per day, seven days per week. Construction activities would be carried out during the daylight hours up to seven days per week.

3. AIR QUALITY ASSESSMENT CRITERIA

Table 2 and **Table 3** summarise the air quality assessment criteria that are relevant to this study. The air quality criteria or goals relate to the total airborne dust and not just the dust from the Project. In other words, some consideration of background levels needs to be made when using these goals to assess impacts. This will be discussed in **Section 7.2**.

Table 2 : Air quality assessment criteria for particulate matter concentrations

Pollutant	Standard/Goal	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 $\mu g/m^3$	Annual mean	NHMRC
Particulate matter < 10 μm (PM_{10})	50 $\mu g/m^3$ #	24-hour maximum	DEC (see paragraph below)
	30 $\mu g/m^3$	Annual mean	DEC long-term reporting goal
	50 $\mu g/m^3$	(24-hour average, 5 exceedances permitted per year)	NEPM (see paragraph below)

 # Non cumulative for purposes of impact assessment (refer Section 7.2)

Because short-term ambient air quality can be determined by many factors (for example bushfires and dust storms in remote area) and not simply by emissions from the proposal, the application of the air quality assessment criteria is not a simple matter of comparing measured or predicted concentrations with the assessment criteria. Conditions of consent for mining projects in recent years have required that the predicted 24-hour average PM_{10} concentrations due to the project alone should not exceed 50 $\mu g/m^3$ and the cumulative 24-hour PM_{10} concentration should not exceed 150 $\mu g/m^3$ (at the 99% level averaged over three years). This latter criterion is derived from the US EPA's 24-hour PM_{10} concentration standard. Conditions of consent will normally require compliance with the annual average criteria (PM_{10}, TSP and deposition) at all residences not owned by the proponent. In some cases third parties may enter into agreements with the proponent allowing exceedance of annual average criteria. In some cases a property is considered affected if more than 25% of the land is predicted to experience an exceedance of any one of the annual average assessment criteria.

The sulfur content of Australian diesel is too low and mining equipment is too widely dispersed over mine sites to cause sulfur dioxide goals to be exceeded even in mines that use large quantities of diesel. For this reason no detailed study of SO_2 emissions from the mine has been undertaken. For the same reason, NO_x and CO emissions have not undergone a detailed modelling assessment.

Thus, the main focus of the study is on the potential effects of particulate matter (PM) emissions. Particulate matter has the capacity to affect human health and to cause nuisance effects. The potential harmful effects of particulate matter depend on both the particulate matter size and/or on the chemical composition.

The human respiratory system has in-built defensive systems that prevent particles larger than approximately 10 μm from reaching the more sensitive parts of the respiratory system. Particles with an equivalent aerodynamic diameter less than 10 μm are referred to as PM_{10}. Particles larger than 10 μm, while generally not associated with health effects, can deposit on materials and generally degrade aesthetic elements of the environment. For this reason air quality goals make reference to measures of the total mass of all particles suspended in the air. This is referred to as Total Suspended Particulate matter (TSP). In practice particles larger than 30 to 50 μm settle out of the atmosphere too quickly to be regarded as air pollutants. The upper size range for TSP is usually taken to be 30 μm. TSP includes PM_{10}.

Epidemiological studies (**Dockery *et al.*, 1993** for example) indicate that it is the finer particles, that is those below 2.5 μm in equivalent aerodynamic diameter[1] and referred to as $PM_{2.5}$, that cause health impacts as they can be taken deeper into the lung. As yet, Australia has no ambient goal for $PM_{2.5}$ applied on a project basis.

The National Environmental Protection Council (NEPC) has developed an advisory National Environmental Protection Measure (NEPM) for $PM_{2.5}$.

The numerical values for the NEPM are:

- A maximum 24-hour average $PM_{2.5}$ concentration of 25 $\mu g/m^3$, and
- An annual average $PM_{2.5}$ concentration of 8 $\mu g/m^3$.

At this stage, the advisory $PM_{2.5}$ standards are not part of the NSW DEC assessment criteria. The standards are intended to facilitate the collection of data with an objective of developing air quality goals that can be adopted by state regulatory authorities. For this Project, the $PM_{2.5}$ standards listed are above are not project specific goals.

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 3** shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts (**DEC, 2005**).

Table 3 : NSW DEC criteria for dust fallout (insoluble solids)

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

[1] A particle is said to have an equivalent aerodynamic diameter of 2.5 μm if it behaves in the same way as a sphere of density 1 g/cm^3 and diameter 2.5 μm regardless of its shape and physical size.

4. EXISTING ENVIRONMENT

This section describes the dispersion meteorology, local climatic conditions and existing dust levels in the area.

4.1 Dispersion Meteorology

The Gaussian dispersion model used for this assessment, ISCST3, requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class[2] and mixing height[3].

Two meteorological stations have been collecting data in the vicinity of Anvil Hill Project area since April 2002. The sites are referred to as Wybong Road (WS1) and Coolabah Road (WS2) with the location of these sites marked on **Figure 5**. Data from each site have been examined to determine the most suitable dataset for use in the dispersion modelling.

The Wybong Road site provides information every 10-minutes on temperature, relative humidity, rainfall, wind speed, wind direction and sigma-theta (the standard deviation of horizontal wind direction). The data available from this site cover a period from April 2002 to September 2004. Data for the 2003 calendar year have been processed into a file suitable for use in the ISCST3 dispersion model. A total of 8,400 valid hours of data are available from 2003 for the analysis which represents 96% of the data that could have been collected over the year.

Ten-minute meteorological data are also collected at the Coolabah Road site, which, in addition to the parameters measured by the Wybong Road site, collects barometric pressure. Sigma-theta, which is commonly used for the determination of atmospheric stability, is not recorded by this station. An examination of the data collected at this site indicated that the 10-minute wind direction data were rounded to the nearest wind sector, assuming there are 16 wind sectors. The resolution of these data were not considered to be sufficient for the purposes of dispersion model predictions. There were also a substantial number of hours missing from the 2003 dataset such that the 90% complete requirement of the DEC would not be satisfied. For these reasons, data from the Wybong Road site have been used for the dispersion modelling.

Figures 6 to **8** shows annual and seasonal windroses prepared from the Wybong Road wind data for 2002 to 2004.

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[2] In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

[3] The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

Winds in the central to upper Hunter Valley are commonly aligned along a northwest-southeast axis. It can be seen from each year of wind data from the the Wybong Road site generally follow this pattern albeit rotated anticlockwise slightly. The steep topography surrounding the Wybong Road site is likely to be the main reason for the wind direction deviation from other sites in the Hunter Valley.

From year to year the differences in wind patterns are minor. The 2003 data from the Wybong Road site are considered representative of the area over which dust emissions from the mine are expected to be transported.

In summer, winds are generally from the east to southeast, depending on the site in question. The pattern of winds in winter show that the east to southeast winds reduce and are replaced by winds from the west-southwest to northwest. Winds in autumn and spring exhibit a combination of summer and winter patterns at both sites.

The annual average wind speed in 2003 at Wybong Road was 2.1 m/s. The percentage of hours that wind speeds exceeded 5.4 m/s[4] was 6% at Wybong Road.

Joint wind speed, wind direction and stability class frequency tables for the 2003 Wybong Road dataset are provided in **Appendix A.**

Information on hourly mixing height and stability class are required as input to the dispersion model. Intensive sonde studies of the upper atmosphere around the Liddell Power Station have been undertaken on behalf of the Electricity Commission of NSW (now Pacific Power) by **Malfroy (1989)** and **Malfroy (1992)**. However, no long-term direct measurements on mixing height are available for the area and theoretically derived values have been used. The theoretical values in the day have been estimated by assuming that the maximum mixing height reached during the day was 1500 m in summer, 1200 m in autumn and spring and 1000 m in winter. At night theoretical values based on wind speed and stability have been derived. These give mixing height values that are consistent with the values reported by Malfroy.

Sigma-theta has been used to calculate atmospheric stability for every available hour of data according to the method recommended by the US EPA (**US EPA, 1986**). Stability class is used by dispersion models to determine the rate at which the plume grows by the process of turbulent mixing. Each stability class is associated with a dispersion curve, which is used by the model to calculate the plume dimension and dust concentration at points downwind of the source. In the model used here, the Pasquill-Gifford dispersion curves have been used.

The frequency of occurrence of particular stability classes in the 2003 Wybong Road dataset, which was used in the dispersion modelling, is shown in **Table 4**.

[4] 5.4 m/s is a critical threshold wind speed used in estimating the quantity of dust generated annually by wind erosion.

Table 4 : Frequency of occurrence of stability classes

Stability class	Frequency of occurrence in percent (Wybong Road, 2003)
A	15.8
B	5.6
C	13.1
D	27.4
E	7.8
F	30.3
TOTAL	**100**

4.2 Local Climatic Conditions

The Bureau of Meteorology also collects climatic information in the vicinity of the study area. A range of climatic information collected from Jerrys Plains Post Office (located approximately 20 km to the southeast of the Anvil Hill Project area) are presented in **Table 5** (**Bureau of Meteorology, 2005**).

Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean and median monthly rainfall and the average number of rain days per month.

Table 5 : Climate information for the study area

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean 9 am dry-bulb temperature (deg C)	23.3	22.7	21.3	17.9	13.5	10.5	9.2	11.3	15.2	18.9	21.1	23.1	17.3
Mean 9 am wet-bulb temperature (deg C)	19.2	19.3	17.9	14.9	11.5	8.9	7.6	8.9	11.7	14.4	16.2	18.1	14
Mean 9 am humidity (%)	67	72	71	71	77	79	78	72	65	60	59	60	69
Mean 3 pm dry-bulb temperature (deg C)	29.6	28.9	27.1	24.2	20	17.1	16.3	18.2	21.1	23.9	26.8	29	23.5
Mean 3 pm wet-bulb temperature (deg C)	21	21.1	19.6	17.1	14.5	12.2	11.1	12	13.9	16.1	17.8	19.6	16.3
Mean 3 pm relative humidity (%)	46	50	50	47	51	53	50	45	43	43	41	42	47
Mean daily maximum temperature (deg C)	31.8	30.9	29	25.3	21.2	17.9	17.3	19.4	22.8	26.2	29.3	31.4	25.2
Mean daily minimum temperature (deg C)	17.1	17.1	15	10.8	7.4	5.2	3.7	4.4	6.9	10.2	13.1	15.7	10.5
Mean rainfall (mm)	78.2	71.7	58.2	44.7	41.3	45.3	44.3	36.6	41.3	51.9	58.2	67.3	638.8
Median rainfall (mm)	65.5	46	45.7	32.5	29.9	28.8	36.3	30.5	33.8	47.6	48.9	55	644.1
Mean number of rain days	7.9	7.3	7.3	6.3	6.6	7.3	7	7	6.6	7.5	7.6	7.5	86

Source: Climate averages for Station 061086 JERRYS PLAINS POST OFFICE, Commenced: 1884; Last record: 2004; Latitude (deg S): -32.4972; Longitude (deg E): 150.9093; State: NSW.: ***Bureau of Meteorology (2005)***

Temperature data show that January is typically the warmest month with a mean daily maximum of 31.8°C. July is the coldest month with a mean daily minimum of 3.7°C.

Rainfall data collected at Jerrys Plains show that January is the wettest month with a mean rainfall of 78 mm over 8 rain days. Annually the area experiences, on average, 639 mm of rain.

4.3 Existing Air Quality

Emissions from the Project will comprise PM_{10}, TSP and larger particles that will contribute to deposited particulate matter. In addition, there will be emissions of CO and small quantities of NO_2 from diesel equipment and blasting and trace amounts of SO_2. As discussed in **Section 3**, in practice, the sources of CO, NO_2 and SO_2 in mining operations are too small and too widely dispersed to give rise to significant concentrations of these pollutants and will not be considered in detail in this assessment.

Air quality standards and goals refer to pollutant levels which include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration 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.

An Environmental Monitoring Program has commenced which provides monthly averages of dust fallout levels. Dust concentrations are also measured by high volume air samplers. **Figure 5** shows the locations of the relevant monitoring sites in the area surrounding the Proposed Disturbance Area. Discussion of the available data from high volume air samplers and dust deposition gauges is provided below.

4.3.1 Dust Concentration

TSP and PM_{10} concentrations are measured in the study area by high volume air samplers. **Figure 5** shows the location of the monitors. The monitoring results will include all background sources relevant to that location, including any contribution which may occur from mining and local activities. Sources of particulate matter in the area would include 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.

Data collected from the high volume air samplers are shown below in **Table 6**. **Figure 9** presents the measured 24-hour average PM_{10} concentrations.

Table 6 : Dust concentrations in the study area

Date	PM10-1 (µg/m³)	PM10-2 (µg/m³)	TSP 1 (µg/m³)
5-Sep-04	1	-	-
11-Sep-04	4	-	-
17-Sep-04	11	-	-
23-Sep-04	7	-	-
29-Sep-04	23	-	-

Date	PM10-1 (μg/m³)	PM10-2 (μg/m³)	TSP 1 (μg/m³)
5-Oct-04	11	-	-
11-Oct-04	23	-	-
17-Oct-04	17	19	34
23-Oct-04	16	18	26
29-Oct-04	17	17	44
4-Nov-04	29	27	53
10-Nov-04	13	13	19
16-Nov-04	16	14	33
22-Nov-04	18	17	33
28-Nov-04	21	19	46
4-Dec-04	13	11	38
10-Dec-04	4	3	11
16-Dec-04	18	20	40
22-Dec-04	25	21	46
28-Dec-04	39	45	81
3-Jan-05	6	3	2
9-Jan-05	11	13	30
15-Jan-05	52	-	97
21-Jan-05	46	45	93
27-Jan-05	-	4	3
2-Feb-05	22	34	40
8-Feb-05	13	7	45
14-Feb-05	24	22	71
20-Feb-05	16	20	29
26-Feb-05	47	14	83
4-Mar-05	19	15	39
10-Mar-05	25	20	64
16-Mar-05	37	31	97
22-Mar-05	7	5	15
28-Mar-05	31	38	80
3-Apr-05	0	0	0
9-Apr-05	19	15	45
15-Apr-05	22	19	60
21-Apr-05	17	13	44
27-Apr-05	19	15	53
3-May-05	17	21	45
9-May-05	-	22	-
15-May-05	10	15	21
21-May-05	12	13	27
27-May-05	11	19	35
2-Jun-05	24	20	58
8-Jun-05	28	30	72
14-Jun-05	0	1	1
20-Jun-05	0	0	0
26-Jun-05	11	9	17
2-Jul-05	0	0	0
8-Jul-05	-	1	-
14-Jul-05	0	1	3
20-Jul-05	22	18	39
26-Jul-05	4	6	8
1-Aug-05	13	15	29

Date	PM10-1 (μg/m³)	PM10-2 (μg/m³)	TSP 1 (μg/m³)
7-Aug-05	0	0	0
13-Aug-05	0	1	4
19-Aug-05	7	12	19
25-Aug-05	18	15	42
31-Aug-05	10	7	29
6-Sep-05	12	9	22
12-Sep-05	0	1	4
18-Sep-05	2	2	5
24-Sep-05	21	18	37
30-Sep-05	5	1	7
6-Oct-05	16	18	28
12-Oct-05	22	22	37
Average (first 12 months)*	**16.3**	**14.6**	**35.3**
18-Oct-05	16	15	25
24-Oct-05	23	13	29
30-Oct-05	26	17	29
5-Nov-05	21	19	25
11-Nov-05	19	15	33
17-Nov-05	27	25	46
23-Nov-05	13	10	21
29-Nov-05	6	-	12
5-Dec-05	20	-	23
11-Dec-05	41	-	60
17-Dec-05	13	-	25
23-Dec-05	38	-	74
29-Dec-05	45	-	75
4-Jan-06	-	-	92
10-Jan-06	27	17	47
16-Jan-06	21	23	35
22-Jan-06	31	24	54
28-Jan-06	25	26	48
3-Feb-06	23	17	45
9-Feb-06	20	21	49
15-Feb-06	23	22	74
21-Feb-06	16	24	33
27-Feb-06	14	15	35
5-Mar-06	11	18	18
11-Mar-06	32	34	61
17-Mar-06	15	20	45
23-Mar-06	8	14	38
29-Mar-06	13	19	36

** From 17 October 2004, when data from all three monitors became available.*

The average TSP concentration for the first 12 months of monitoring was 35.3 μg/m³ which is below the annual average air quality goal of 90 μg/m³.

The highest 24-hour average PM_{10} concentrations were 52 and 45 μg/m³ at PM10-1 and PM10-2, respectively. The PM_{10} concentration above the 50 μg/m³ DEC goal (52 μg/m³ at PM10-1) was measured on 15 January 2005 following two 40°C days in the Hunter Valley. Exceedances of the 50 μg/m³ goal are commonly measured during periods of hot dry days in summer. Bushfires and dust storms can also contribute to very high PM_{10} concentrations.

Average PM_{10} concentrations for the first 12 months of monitoring were 16.3 and 14.6 $\mu g/m^3$ at PM10-1 and PM10-2, respectively. Given that the monitors are at two different locations surrounding the Project, these statistics suggest that there is little spatial variation in existing PM_{10} concentrations over the study area. These levels are below the 30 $\mu g/m^3$ goal but consume a larger fraction of the goal than the TSP measurements and the respective TSP goal.

Figure 9 shows that the highest PM_{10} levels were generally in the summer months when bushfires prevail. The correlation between measured PM_{10} concentrations is shown by **Figure 10**. This figure shows a good correlation between measurements at the two locations.

4.3.2 Dust Deposition

Dust deposition data has been collected in the area surrounding the Project since March 2002. The locations of the 20 dust deposition gauges are shown in **Figure 5**. The data are presented in **Table 7**. There were several months where the results from gauges were deemed contaminated. Some examples of contamination included insects, vegetation and bird droppings. Annual averages have been calculated by excluding the data that were marked as contaminated.

There appears to be little spatial variation for the annual averages although, in 2004 and 2005, gauge DG14 to the west-northwest of the Project Area experienced considerably higher levels, on average, than the other sites. Cultivation in the areas surrounding this gauge was thought to have influenced the monitored levels.

Table 7 : Dust deposition in the study area

Gauge	Insoluble solids (g/m²/month)				
	2002	2003	2004	2005	Average (2002 to 2005)
1	1.3	0.7	1.4	1.0	1.1
2	1.7	1.3	2.4	1.4	1.7
3	0.9	1.2	0.8	0.9	0.9
4	1.3	0.9	1.1	1.1	1.1
5	0.9	0.6	0.8	0.7	0.7
6	1.2	0.9	1.6	1.0	1.2
7	1.1	1.1	0.8	1.0	1.0
8	1.2	1.1	0.8	2.0	1.3
9	1.6	1.2	0.7	1.1	1.1
10	1.2	1.6	0.9	1.1	1.2
11	1.7	1.3	1.1	1.1	1.3
12	2.0	1.7	0.8	1.2	1.4
13	1.4	1.0	1.1	1.0	1.1
14	2.3	3.6	**10.3**	**6.0**	5.5
15	2.3	1.2	1.0	2.3	1.7
16	1.5	0.8	1.0	1.7	1.2
17	1.9	1.3	2.4	2.3	2.0
18	2.4	1.3	1.5	1.7	1.7
19	1.2	1.1	0.9	2.0	1.3
20	2.7	1.4	0.8	2.2	1.8
Average	1.6	1.3	1.6	1.6	1.5

Figure 11 shows the spatial variation of annual average dust deposition. Analysis of this figure indicates little spatial variation over the study area with annual average dust deposition levels ranging between 1 and 3 g/m²/month. Gauge DG14 is the most notable exception with elevated levels (that is 10 and 6 g/m²/month) in 2004 and 2005.

4.3.3 Summary of Existing Air Quality

The existing air quality environment, with respect to dust, is 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:

- There appears to be relatively uniform dust concentrations and deposition levels in the study area, apart from some very localised areas where high deposition rates are measured;
- Annual average TSP and PM_{10} concentrations at the monitoring locations are below air quality goals; and
- 24-hour PM_{10} concentrations above the air quality goal have been recorded as occurring occasionally.

For assessment of the air quality impacts due to a project the general approach recommended by the DEC is to add dispersion model predictions to existing background levels. The result is then compared with the relevant air quality goal. Clearly the monitoring data will represent the cumulative effect of the all dust sources relevant to the monitoring locations, including the agricultural activities and other mines.

The measured dust deposition and suspended particulate levels in the Project area are considered typical of a rural area remote from industrial emission sources. Air quality in the area is largely determined by emissions from natural sources, road traffic and community and agricultural activities. From time to time particulate matter levels would be expected to be affected by smoke from bushfires and dust from regional dust storms.

In summary, from the monitoring data available it has been assumed that the following background concentrations apply at the nearest receptors:

- Annual average TSP of 35 $\mu g/m^3$
- Annual average PM_{10} of 15 $\mu g/m^3$
- Annual average dust deposition of 1.5 g/m^2/month

In addition, the DEC guidelines require an assessment against 24-hour PM_{10} concentrations. This assessment adopts the approach that the predicted 24-hour average PM_{10} concentration from the development should be less than 50 $\mu g/m^3$ at the nearest receptors.

5. ESTIMATED DUST EMISSIONS

Dust emissions arise from various activities at open-cut coal mines. Total dust emissions due to the proposed mine have been estimated by analysing the activities taking place at the site during selected years of operation.

The operations which apply in each case have been combined with emission factors developed, both locally and by the US EPA, to estimate the amount of dust produced by each activity. There have been significant revisions to the US EPA emission factors for mining operations in 2003. The emission factors applied are considered to be the most up to date methods for determining dust generation rates. The fraction of fine, inhalable and coarse particles for each activity has been taken into account for the dispersion modelling.

The assessment has considered five selected years during the proposed mining (year 2, 5, 10, 15 and 20). These cover impacts arising for a range of product coal and overburden quantities. The selected years also cover mining activities in various locations of the Project area . The operational description for the Project has been used to determine haul road distances and routes, stockpile and pit areas, activity operating hours, truck sizes and other details that are necessary to estimate dust emissions for each year of assessment.

The most significant dust generating activities from the proposed operations have been identified and the dust emission estimates during the five years are presented below in **Table 8**.

Details of the calculations of the dust emissions are presented in **Appendix B**. The estimated emissions take account of proposed air pollution controls including passive controls such as those inbuilt into the mine plan, such as stockpile size and alignment, length of haul roads and active controls which would include the intensity of watering and extent of rehabilitation.

The development of this emissions inventory has assumed that a high level of control on dust emissions from haul roads can be maintained. For the purposes of the calculations it has been assumed that 90% control efficiency can be achieved by watering and/or chemical dust suppressants.

Table 8 : Estimated dust emissions due to proposed mining operations

ACTIVITY	Calculated TSP emission (kg/y)				
	Year 2	Year 5	Year 10	Year 15	Year 20
OB - Stripping topsoil in NORTHERN pit	5110	5110	5110	0	0
OB - Stripping topsoil in MAIN pit	5110	5110	5110	5110	5110
OB - Stripping topsoil in TAILINGS pit	5110	5110	5110	5110	0
OB - Stripping topsoil in SOUTHERN pit	5110	5110	5110	5110	0
OB - Drilling in NORTHERN pit	639	959	339	0	0
OB - Drilling in MAIN pit	852	1329	1960	2001	2426
OB - Drilling in TAILINGS pit	216	630	356	148	0
OB - Drilling in SOUTHERN pit	188	731	284	873	0
OB - Blasting in NORTHERN pit	2544	3823	1352	0	0
OB - Blasting in MAIN pit	3397	5293	7810	7974	9667

ACTIVITY	Calculated TSP emission (kg/y)				
	Year 2	Year 5	Year 10	Year 15	Year 20
OB - Blasting in TAILINGS pit	862	2509	1417	590	0
OB - Blasting in SOUTHERN pit	750	2911	1133	3480	0
OB - Sh/Ex/FELs loading in NORTHERN pit	7661	15350	6788	0	0
OB - Sh/Ex/FELs loading in MAIN pit	10229	21254	39197	40021	48520
OB - Sh/Ex/FELs loading in TAILINGS pit	2597	10074	7111	2963	0
OB - Sh/Ex/FELs loading in SOUTHERN pit	2258	11690	5688	17464	0
OB - Hauling to emplace from NORTHERN pit	25128	50347	22263	0	0
OB - Hauling to emplace from MAIN pit	33549	69712	128562	131265	159141
OB - Hauling to emplace from TAILINGS pit	17457	59581	42057	17524	0
OB - Hauling to emplace from SOUTHERN pit	7406	38341	18657	57280	0
OB - Emplacing at dumps in NORTHERN pit	7661	15350	6788	0	0
OB - Emplacing at dumps in MAIN pit	10229	21254	39197	40021	48520
OB - Emplacing at dumps in TAILINGS pit	2597	10074	7111	2963	0
OB - Emplacing at dumps in SOUTHERN pit	2258	11690	5688	17464	0
OB - Dozers on O/B in NORTHERN pit	166757	218509	85386	0	0
OB - Dozers on O/B in MAIN pit	222641	302551	493072	505383	794569
OB - Dozers on O/B in TAILINGS pit	56533	143396	89449	37415	0
OB - Dozers on O/B in SOUTHERN pit	49144	166403	71555	220532	0
CL - Drilling in NORTHERN pit	8121	15304	7142	0	0
CL - Drilling in MAIN pit	5907	21681	28312	22446	19982
CL - Drilling in TAILINGS pit	1530	4846	2296	3061	0
CL - Drilling in SOUTHERN pit	765	11733	5611	10203	0
CL - Blasting in NORTHERN pit	18013	33944	15840	0	0
CL - Blasting in MAIN pit	13102	48087	62795	49784	44319
CL - Blasting in TAILINGS pit	3394	10749	5092	6789	0
CL - Blasting in SOUTHERN pit	1697	26023	12446	22629	0
CL - Dozers ripping in NORTHERN pit	36098	60483	18997	0	0
CL - Dozers ripping in MAIN pit	48196	83745	109702	90050	98698
CL - Dozers ripping in TAILINGS pit	12238	39692	19901	6667	0
CL - Dozers ripping in SOUTHERN pit	10638	46060	15920	39295	0
CL - Loading ROM to trucks in NORTHERN pit	107545	202660	94575	0	0
CL - Loading ROM to trucks in MAIN pit	78227	287101	374921	297234	264606
CL - Loading ROM to trucks in TAILINGS pit	20266	64176	30399	40532	0
CL - Loading ROM to trucks in SOUTHERN pit	10133	155373	74309	135107	0
CL - Hauling ROM coal to dump hopper from NORTHERN pit	29359	55325	25818	0	0
CL - Hauling ROM coal to dump hopper from MAIN pit	22859	83896	109558	86857	77323
CL - Hauling ROM coal to dump hopper from TAILINGS pit	779	5429	3974	8727	0
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	2571	39429	18857	34286	0
CL - unloading ROM coal at pile/hopper all pits	32000	105000	85000	70000	39170
CL - ROM rehandle pile to hopper	1600	5250	4250	3500	1959
CL - Handling coal at CHPP	4427	14527	11760	9685	5419

ACTIVITY	Calculated TSP emission (kg/y)				
	Year 2	**Year 5**	**Year 10**	**Year 15**	**Year 20**
CL - Dozer pushing ROM coal	174628	174628	174628	174628	174628
CL - Dozer pushing product coal	65348	65348	65348	65348	65348
CL - Loading product coal stockpile	329	1080	874	720	403
WE - OB dumps at NORTHERN pit	106879	166003	347924	0	0
WE - OB dumps at MAIN pit	109153	227401	445706	270607	241045
WE - OB dumps at TAILINGS pit	0	0	0	0	0
WE - OB dumps at SOUTHERN pit	38658	200113	295621	270607	111427
WE - NORTHERN pit	61398	29562	36384	0	0
WE - MAIN pit	47527	54576	50710	68220	21148
WE - TAILINGS pit	36384	59124	8414	13644	0
WE - SOUTHERN pit	9551	28198	56850	45480	0
WE - ROM stockpiles	5685	5685	5685	5685	5685
WE - Product stockpiles	3275	3275	3275	3275	3275
Loading coal to trains	329	1080	874	720	403
Grading roads	36928	36928	36928	36928	36928
Annual ROM production (t)	**3,200,000**	**10,500,000**	**8,500,000**	**7,000,000**	**3,917,000**
Total dust (kg)	**1,819,535**	**3,677,713**	**3,770,360**	**3,013,405**	**2,279,720**
Ratio Dust:ROM Production (kg/t)	0.57	0.35	0.44	0.43	0.58

Key: OB= Operations on overburden, CL = Operations on coal, WE = Dust due to wind erosion

6. APPROACH TO ASSESSMENT

In August 2005, the DEC published new guidelines for the assessment of air pollution sources using dispersion models (**DEC, 2005**). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data to be used in dispersion models, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal. The approach taken in this assessment follows as closely as possible the approaches suggested by the guidelines.

This section is provided so that technical reviewers can appreciate how the modelling of different particle size categories was carried out.

The model used was the US EPA ISCST3 model. The model is fully described in the user manual and the accompanying technical description (**US EPA, 1995**). The modelling has been based on the use of three particle-size categories (0 to 2.5 μm - referred to as $PM_{2.5}$, 2.5 to 10 μm - referred to as CM (coarse matter) and 10 to 30 μm - referred to as the Rest). Emission rates of TSP have been calculated using emission factors derived from **US EPA (1985)** and **NERDDC (1988)** work (see **Appendix B**).

The distribution of particles has been derived from measurements in the **SPCC (1986)** study. The distribution of particles in each particle size range is as follows:

- $PM_{2.5}$ (FP) is 4.68% of the TSP;
- $PM_{2.5\text{-}10}$ (CM) is 34.4% of TSP; and
- $PM_{10\text{-}30}$ (Rest) is 60.9% of TSP.

Modelling was done using three ISC source groups. Each group corresponded to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic 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. The predicted concentration in the three plot output files for each group were then combined according to the weightings in the dot points above to determine the concentration of PM_{10} and TSP.

The ISC model also has the capacity to take into account dust emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions on mining or quarry operations where wind speed is an important factor in determining the rate at which dust is generated.

For the current study, the operations were represented by a series of volume sources located according to the location of activities for the modelled scenario. **Figure 4** shows the location of the modelled sources for each year of assessment. Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of activity and the wind speed. It is important to do this in the ISC model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds at a mine site would correspond with periods of low dust generation (because wind erosion and other wind dependent emissions rates will be low) and also correspond with periods of poor dispersion. If these measures are not taken then the model has the potential to significantly overstate impacts.

Dust concentrations and deposition rates have been predicted over the area shown in **Figure 1**. Local terrain has been included in the modelling.

The modelling has been performed using the meteorological data discussed in **Section 4.1** and the dust emission estimates from **Section 5**. It has been assumed that each activity will occur for 24-hours per day as indicated in the operational description provided by Umwelt. Dust emissions from wind erosion sources have been modelled for 24 hours per day in all modelling scenarios. Model predictions have been made at 343 discrete receptors, including residential locations, located in the study area. The location of these receptors has been chosen to provide finer resolution closer to the dust sources and nearby receptors.

Pit retention was considered an important factor to include in the dispersion modelling given that the height difference between the local ground level and the pit floor can be quite significant. For the purposes of the dispersion modelling the calculation determines the fraction of dust emitted in the pit which will escape the pit. The relationship used is dependant on the gravitational settling velocity of the particles and wind speed and is given by the equation below (**US EPA, 1995**).

$$\varepsilon = \frac{1}{\left(1 + \frac{V_g}{(\alpha U_r)}\right)} \qquad \textbf{Equation 1}$$

where:
ε = escape 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

To model the effect of pit retention the emissions of sources within the mine pits have therefore been reduced to account for the fact that much of the coarser dust remains trapped in the pit.

The model ISCST3 was used in this instance as it has been the most widely used model in NSW for assessing the dust impacts of extractive industries. AUSPLUME is the DEC's model of first choice but it has had limited use in dust modelling applications. AUSPLUME is also not able to handle the large number of sources that have to be included to realistically represent the mine and its time-varying emissions. Dust impacts and model predictions using ISCST3 are presented as contour plots in **Figures 12** to **16**.

An objective of most air dispersion models is to predict off-site pollutant levels as close as possible to levels that would be measured by conventional monitoring techniques. In situations where detailed information on existing operations are available as well as concurrent ambient air quality monitoring data, there have been opportunities to assess the performance of a model by comparing model predictions with measured values. Differences between modelled and measured values may be due to the model itself, the emission estimates or from the modelling approach. Depending on the difference between modelled and measured values, a correction to the model results may then be considered necessary to provide reliable predictions for future scenarios.

A calibration study was undertaken as part of the EIS for the Warkworth mine in the Hunter Valley (**Holmes Air Sciences, 2002**). The calibration was done by comparing the predicted maximum 24-hour average PM_{10} concentrations at the several mine operated monitors. The maximum measured PM_{10} concentrations were then determined by inspection of the monitoring data. From these investigations the average extent of over-prediction was found to be a factor of 2.6; that is, unadjusted model predictions appear to over predict 24-hour PM_{10} concentrations by 260%. This factor was used to adjust the model predictions for the Warkworth EIS downwards to obtain a calibrated prediction of the worst-case 24-hour PM_{10} concentrations for all scenarios that were assessed.

Further studies to develop a more scientifically robust methodology for dealing with the over-prediction of short-term concentrations by the ISCST3 model are to be conducted as part of the approval conditions for the Mt Owen Mine. At this time the results of these studies are not available.

Comparisons between ISCST3 and AUSPLUME (see **Holmes Air Sciences, 2003** for example) have suggested that a correction factor is appropriate for short term (that is, 24-hour average) ISCST3 predictions. Although the comparison between AUSPLUME and ISCST3 shows varying difference, AUSPLUME has consistently predicted almost 50% lower than uncorrected ISCST3 predictions. Thus AUSPLUME may have some advantages over ISCST3 in that it more accurately predicts 24-hour average concentrations of PM_{10}, which are known to be consistently overestimated by ISCST3.

Results from a simplified model comparison of AUSPLUME and ISCST3 suggested that 1-hour average PM_{10} concentrations downwind of a source and along the plume centreline were between 2.8 and 3.5 times higher using ISCST3 than for AUSPLUME (see **Appendix C**). The difference between the models had some dependence on the meteorological conditions. Different results from the two models were largely explained by the way in which each model has interpreted plume dispersion curves.

The approach taken in this study has been to make use of a recent model calibration analysis conducted as part of an assessment for the Bengalla Mine (**Holmes Air Sciences, 2006**). This study used monitoring data around the Bengalla Mine to develop a site specific relationship between predictions and measurements of 24-hour PM_{10} concentrations. It was concluded from the Bengalla analysis that model predictions of 24-hour average PM_{10} concentrations due to the mining operations were 1.6 times greater than measured concentrations. The approach to the emission estimates and modelling for the Bengalla Mine was similar to the approach adopted for this assessment, thus the same calibration factor has been used. Model results for 24-hour average PM_{10} concentrations have therefore been divided by 1.6 to account for model over-prediction.

7. ASSESSMENT OF IMPACTS

7.1 Introduction

This section provides an interpretation of the predicted dust concentrations and deposition levels.

Dust concentrations and deposition rates due to the selected years of assessment have been presented as isopleth diagrams showing the following:

1. Predicted maximum 24-hour average PM_{10} concentration;
2. Predicted annual average PM_{10} concentration;
3. Predicted annual average TSP concentration; and
4. Predicted annual average dust deposition.

The maximum 24-hour average contour plots do not represent the dispersion pattern for any particular day, but show the highest predicted 24-hour average concentration that occurred at each location. The maxima are used to show concentrations which can possibly be reached under the modelled conditions. It should be noted that the contour plots show predicted concentrations and deposition levels due only to modelled dust sources for the mine. That is, the predictions do not include contributions from existing non-mine sources.

Model predictions for each year of assessment have also been presented in tabular form for the nearest receptors that are not on Centennial owned land or properties over which Centennial has a contractual right to purchase at the time of production of this report. **Figure 2** shows the identification label given to each receptor.

The enhanced contour lines on the plots represent the relevant air quality criteria, including the addition of background levels where relevant. Interpretation and analysis of the model predictions for each year of assessment is provided below.

7.2 Assessment Criteria

The air quality criteria used for deciding which properties are likely to experience air quality impacts are those specified in the DEC's modelling guidelines (refer to **Table 2** and **Table 3**). Recent conditions of consent for mines in the Hunter Valley have assisted with the interpretation of these air quality criteria.

The air quality criteria are:

- 50 µg/m³ for 24-hour PM_{10} for the mine considered alone
- 30 µg/m³ for annual average PM_{10} due to the mine and other sources
- 90 µg/m³ for annual TSP concentrations due to the mine and other sources
- 2 g/m²/month for annual average deposition (insoluble solids) due to the mine considered alone, and
- 4 g/m²/month for annual predicted cumulative deposition (insoluble solids) due to the mine and other sources.

7.3 Assessment of Impacts

Dispersion model predictions for the proposed Year 2, 5, 10, 15 and 20 mining operations are shown in **Figures 12** to **16** respectively. It can be seen from these figures that the highest concentrations and deposition levels are centered around the activities taking place during that year. Contour lines representing the relevant air quality criteria, including the consideration of background levels, have been enhanced using a thicker line.

To further assist in assessing the air quality impacts at places of special interest the dispersion model results have been presented in tabular form showing the predictions at each of the nearest receptors. **Table 9** to **Table 12** shows this information. For clarity and ease of reading, only the private property locations where there are predicted exceedances of air quality criteria are shown in the main body of this report. These results do not include exceedances on Centennial owned land or properties over which Centennial has a contractual right to purchase. **Appendix D** provides a copy of the model predictions at all residence locations included in the assessment.

Table 9 : Predicted maximum 24-hour average PM_{10} concentrations at residences

ID*	Concentration due to mine operation only (µg/m³). Goal = 50 µg/m³				
	Year 2	Year 5	Year 10	Year 15	Year 20
60	41.0	**54.2**	36.9	20.4	16.5
82	30.6	47.3	**83.9**	37.4	16.2
35	30.9	42.8	**72.8**	**67.6**	21.1
62	28.3	37.6	**52.0**	**62.1**	24.5
63A	35.6	48.3	**88.2**	**67.4**	17.9
56	23.4	38.5	43.2	**54.0**	34.0
59B	17.4	29.3	32.9	40.1	**58.7**
84	**67.1**	**63.5**	29.4	18.9	14.0
11	25.8	41.6	**71.0**	16.7	13.6
31	25.9	42.8	**60.7**	17.3	16.8
1	22.9	**52.3**	39.8	18.9	19.3
13	22.1	31.7	29.8	**82.0**	**412.3**
12	20.5	30.1	32.4	**67.3**	**688.1**
94	16.3	22.4	25.0	37.8	**84.0**
43	36.5	**53.5**	37.4	32.5	34.5

ID*	Concentration due to mine operation only (μg/m³). Goal = 50 μg/m³				
	Year 2	Year 5	Year 10	Year 15	Year 20
21A	18.4	45.2	**66.9**	15.2	14.5
63B	38.6	48.6	**83.2**	**64.7**	18.4
83	17.2	25.4	31.7	41.9	**54.3**

** Only private properties with predicted exceedances of criteria are presented. See **Appendix D** for predictions at all properties considered in the assessment.*

Table 10 : Predicted annual average PM_{10} concentrations at residences

ID*	Concentration due to mine operation and other sources (μg/m³). Goal = 30 μg/m³				
	Year 2	Year 5	Year 10	Year 15	Year 20
82	26.8	**33.6**	**34.8**	23.8	19.0
35	24.2	29.3	**35.3**	24.7	18.9
62	22.8	27.1	**33.3**	24.7	18.9
63A	24.9	**30.1**	**40.4**	26.0	19.1
56	21.8	25.8	**30.1**	28.2	20.7
59B	22.2	26.4	28.5	**32.4**	**31.8**
84	**32.9**	**32.3**	**31.1**	20.4	18.8
11	20.6	26.5	**35.2**	19.3	18.5
31	21.4	26.0	**32.2**	19.2	18.3
13	24.1	**33.0**	**31.3**	**54.3**	**144.4**
12	22.6	**31.8**	**31.3**	**46.3**	**372.2**
94	20.6	25.8	24.9	**31.6**	**52.1**
21A	19.9	25.1	**31.8**	19.4	18.6
63B	24.9	**30.3**	**38.7**	25.7	19.1
83	22.6	27.4	29.8	**37.1**	**37.8**

** Only private properties with predicted exceedances of criteria are presented. See **Appendix D** for predictions at all properties considered in the assessment.*

Table 11 : Predicted annual average TSP concentrations at residences

ID*	Concentration due to mine operation and other sources (μg/m³). Goal = 90 μg/m³				
	Year 2	Year 5	Year 10	Year 15	Year 20
13	44.3	53.7	53.0	77.0	**267.5**
12	42.7	52.2	51.6	67.2	**466.1**

** Only private properties with predicted exceedances of criteria are presented. See **Appendix D** for predictions at all properties considered in the assessment.*

Table 12 : Predicted annual average dust deposition at residences

ID*	Deposition due to mine operation only (μg/m³). Goal = 2 g/m²/month					Deposition due to mine operation and other sources (μg/m³). Goal = 4 g/m²/month				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
13	0.11	0.45	0.49	1.54	**33.50**	1.61	1.95	1.99	3.04	**35.00**
12	0.06	0.22	0.25	0.57	**17.79**	1.56	1.72	1.75	2.07	**19.29**
21A	0.18	0.30	**2.43**	0.05	0.03	1.68	1.80	3.93	1.55	1.53

** Only private properties with predicted exceedances of criteria are presented. See **Appendix D** for predictions at all properties considered in the assessment.*

Comparing the model predictions with air quality goals, the following conclusions can be made as to air quality at receptors:

- Based on maximum 24-hour average PM_{10} predictions, there are 18 receptors where concentrations are above the 50 $\mu g/m^3$ goal for at least one year during the mine operation.
- Based on annual average PM_{10} predictions, there are 15 receptors where concentrations are above the 30 $\mu g/m^3$ goal for at least one year during the mine operation.
- Based on annual average TSP predictions, there are 2 receptors where concentrations are above the 90 $\mu g/m^3$ goal for at least one year during the mine operation.
- Based on annual average dust deposition predictions, there are 3 receptors where concentrations are above either the 2 g/m^2/month (Project only) or 4 g/m^2/month (cumulative) goals for at least one year during the mine operation.

There are 18 receptors predicted to observe adverse air quality impacts due to the operations at some stage of the Project. This is based on predictions above the DEC air quality criteria. The results indicate that consultation with the occupants of these residences is likely to be required during at least part of the Project. Air quality at the remaining properties (refer **Appendix D**) could be managed so that the DEC assessment criteria would not be exceeded due to emissions from the mine. However, based on results from existing air quality monitoring, exceedances of the DEC's 24-hour PM_{10} criterion may still be observed from time to time due to emissions from existing sources of particulate matter, including agriculture and natural sources, such as dust storms.

The Project will require management measures to address potential impacts on residences (refer to **Section 10**).

8. CUMULATIVE IMPACTS

The effect of existing emissions from the other mining operations in the area has been captured by the existing dust monitoring program operated for the Project. Bengalla Mine is the closest operation at approximately 12 km to the east of the Project Area. Bengalla has approval to produce up to 8.7 Mtpa of coal however the effect of emissions from Bengalla Mine operating at a production level of 10.7 Mtpa has recently been assessed by **Holmes Air Sciences (2006)**.

The Bengalla modelling results indicated that dispersion would have reduced the concentration of the annual average PM_{10} and TSP emission contribution from the Bengalla Mine to less than 1 $\mu g/m^3$ by the time these emissions have been carried to the receptors assessed for the Anvil Hill Project[5]. Similarly, annual dust deposition contributions from Bengalla Mine are predicted to have reduced to below 0.1 g/m^2/month at these receptors.

An EIS for the Mount Pleasant Mine has been prepared (**ERM, 1997**) and the project has approval. However, mining at the Mount Plesant Mine has not commenced and at this stage it is not possible to make use of the information in the EIS to determine how the development stages in the Mount Pleasant EIS will match up with those for the Anvil Hill proposal.

The Mount Pleasant EIS shows predicted annual average TSP and deposition levels over the area surrounding the Mount Pleasant Mine for Years 2, 5, 10, 15 and 20. The lowest contours shown are the 10 $\mu g/m^3$ and 0.5 $\mu g/m^3$ contours for TSP and dust deposition respectively. Prevailing winds in the Mount Pleasant area cause the emissions from the Mount Pleasant Mine to be transported to the northwest in summer and southeast in winter. There is almost no transport of emissions from the Mount Pleasant Mine towards the Anvil Hill area. Emissions from the Anvil Hill Mine are predicted to have a slightly greater impact in the Mount Pleasant area and could produce annual average PM_{10} concentrations of the order of 1 $\mu g/m^3$ at the Mount Pleasant Mine's western boundary. However, even in the worst-case year, the Mount Pleasant Mine would be unlikely to cause annual TSP concentrations to increase by more than 0.1 $\mu g/m^3$ at any location on **Figures 12** to **16**. Assuming that annual average PM_{10} concentrations are 40% of the annual TSP concentrations the effect of emissions from the Mount Plesant Mine in the area affected by emissions from the Anvil Hill Mine would be negligible. The same comments apply to deposition levels that might arise from emissions from the Mount Pleasant Mine.

Based on the above, the cumulative effects of emissions from other existing mines in the Project area are considered to be small. The only other known future mine (Mount Pleasant Mine) will have a negligible affect on air quality in the Project area. The dust emissions from the existing mining operations would have been captured by the monitoring program undertaken for the Anvil Hill Project to date and are already included in the background concentrations referred to in **Section 7.3**.

[5] Note that the modelling for Bengalla covered an area extending 6 km to the west of the most western dust source. At a distance of 6 km west of Bengalla Mine the contour lines decreased to 2 $\mu g/m^3$ for both the annual average PM_{10} and TSP predictions in the scenario that would represent the highest impacts on the Anvil Hill Project area. Based on the decrease in the contour levels it was deduced that the 1 $\mu g/m^3$ contour was about 8 km from Bengalla and therefore at the eastern edge of the modelling domain for the Anvil Hill study.

9. CONSTRUCTION

A number of construction activities are proposed as part of the Project. These would include construction of the mine access road, CHPP, mine facilities area, coal handling and train loading infrastructure and the rail spur and loop. Construction work would be expected to be completed over a twelve month period.

These activities would not be expected to generate significant quantities of dust and dust emissions would be readily controlled using water sprays (that is, water trucks) and standard dust control measures used on construction sites.

The construction of the rail loop will involve the clearing of vegetation and the placement of track. Dust emissions from works of this type have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts using dispersion modelling. To do so would require knowledge of weather conditions for the few weeks that work will be taking place in each location along the track.

Proper dust management will require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme unfavourable weather conditions.

10. MONITORING AND MITIGATION MEASURES

The modelling results are based on the assumption that the Project applies dust control measures that are standard practice for NSW mines. This section outlines procedures proposed for the management and control of dust emissions.

The dust emission calculations can only partially account for the dust control measures that are adopted on the mining operation. For this study the most significant inclusion of mitigation measures into the calculations was the assumed 90% control efficiency on the haul roads due to the application of water and/or chemical dust suppressants.

The aim of the procedures is to minimise the emission of dust. Dust can be generated from two primary sources as follows:

- wind blown dust from exposed areas and from locations where there is no vegetation cover, and
- dust generated by mining activities.

Table 13 and **Table 14** list the different sources of wind blown and mining generated dust respectively, and the control procedures that are typically employed.

A monitoring program would be undertaken to verify environmental performance for the duration of the mining operation. The monitoring program would be developed in consultation with the DEC but would be expected to incorporate the following:

- One meteorological station within the immediate vicinity of the Project area.
- High volume $PM_{10;}$ monitors would be retained at the two existing locations or at nearby locations.
- Deposition gauges would be retained at the existing locations to provide adequate coverage for the operational phase of mining.

Table 13 : Control procedures for wind blown dust

Source	Control Procedures
Areas disturbed by mining	Disturb only the minimum area necessary for mining. Reshape, topsoil and rehabilitate completed overburden emplacement areas as soon as practicable after the completion of overburden tipping.
Coal handling areas	Maintain coal-handling areas in a moist condition using water carts to minimise wind blown and traffic generated dust.
Coal Product Stockpiles	Maintain water sprays on, product coal stockpiles and use sprays to reduce the risk of airborne dust.

Table 14 : Mine generated dust and controls

Source	Control procedures
Haul Road Dust	All active roads and traffic areas will be watered using water carts to minimise the generation of dust. To further minimise dust generation, chemical dust suppressants, increased utilisation of water carts and/or fixed irrigation will be used on selected haul roads to maintain high moisture levels. The haul roads assumed to be subject to this high level of dust control, for the purposes of the dispersion modelling, include to and from the pit and overburden dumps and to and from the pit and ROM stockpile. Active haul roads will be minimised and clearly defined. Obsolete roads will be rehabilitated.
Minor roads	Development of minor roads will be limited and the locations of these will be clearly defined. For example, minor roads used regularly for access will be constructed so as to minimise dust generation (well compacted select material) and watered as required. Obsolete roads will be rehabilitated.
Topsoil Stripping	Access tracks used by topsoil stripping equipment during their loading and unloading cycle will be watered.
Topsoil Stockpiling	Establishment of a cover crop over topsoil stockpiles that are not to be used in less than 6 months. This would minimise the potential for dust emissions due to wind erosion.
Drilling	Dust aprons will be lowered during drilling. Drill rigs will be equipped with dust suppression equipment and it will be operated whenever the potential for high levels of dust generation is identified.
Blasting	Stemming will be designed to provide optimum confinement of the blast charge.
Raw Coal Bins	Automatic sprays or other dust control mechanisms will be used when tipping raw coal generates excessive dust quantities.
Coal Preparation Plant	Spillage of material will be cleaned up to prevent dust. Dust suppression systems will be fitted at transfer points to prevent high dust levels where necessary.

In addition, a real-time dust management system may include measures that would minimise high dust generating activities at times when adverse weather conditions occurred. In this context adverse weather means unfavourable winds for particular residential properties when conditions are dry.

Real-time dust management procedures may be effective for reducing potential short-term (say, 24-hour average) air quality impacts, but would have less effect on longer-term (annual average) impacts.

11. CONCLUSIONS

This report has assessed the air quality impacts associated with the operation of the proposed Anvil Hill coal mine in the NSW Hunter Valley. 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. The dispersion modelling took account of the local meteorology and terrain information and used dust emission estimates to predict the air quality impacts for five periods over the life of the mine. The periods were selected to cover a range of mine production quantities and active pit location combinations.

The outcomes of the modelling are summarised below:

- Based on maximum 24-hour average PM_{10} predictions, there are 18 receptors where concentrations are above the 50 $\mu g/m^3$ goal for at least one year during the mine operation.
- Based on annual average PM_{10} predictions, there are 15 receptors where concentrations are above the 30 $\mu g/m^3$ goal for at least one year during the mine operation.
- Based on annual average TSP predictions, there are 2 receptors where concentrations are above the 90 $\mu g/m^3$ goal for at least one year during the mine operation.
- Based on annual average dust deposition predictions, there are 3 receptors where concentrations are above either the 2 g/m^2/month (Project only) or 4 g/m^2/month (cumulative) goals for at least one year during the mine operation.

The cumulative effects of dust emissions from other mining operations in the Project Area were considered be small and do not change the conclusions for the assessment.

Results from the dispersion modelling have suggested that 18 residences are predicted to observe adverse air quality impacts at some stage during the life of the Project.

The dispersion modelling has assumed that a high level of dust control on haul roads can be achieved and the Project applies dust control measures that are standard practice for NSW mines. Also, the implementation of a real-time management system will ensure that high dust generating events are kept to a minimum.

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APPENDIX A
JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS FREQUENCY TABLES

STATISTICS FOR FILE: C:\Jobs\AnvilH\metdata\wyb2003.isc
MONTHS: All
HOURS : All
OPTION: Frequency

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 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	0.001548	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

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

PASQUILL STABILITY CLASS 'F'

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	0.005476	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

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

ALL PASQUILL STABILITY CLASSES

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	0.010119	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

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 15.8%
B : 5.6%
C : 13.1%
D : 27.4%
E : 7.8%
F : 30.3%

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

APPENDIX B
ESTIMATED DUST EMISSIONS

ESTIMATED DUST EMISSIONS : ANVIL HILL

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	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in MAIN pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in TAILINGS pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	5110	365	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	639	1082	holes/y	0.59	kg/hole						
OB - Drilling in MAIN pit	852	1445	holes/y	0.59	kg/hole						
OB - Drilling in TAILINGS pit	216	367	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	188	319	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	2544	5	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in MAIN pit	3397	6	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in TAILINGS pit	862	2	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	750	1	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	7661	5947391	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in MAIN pit	10229	7940490	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in TAILINGS pit	2597	2016242	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	2258	1752737	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	25128	5947391	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from MAIN pit	33549	7940490	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from TAILINGS pit	17457	2016242	t/y	0.00866	kg/t	231	t/truck load	5	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	7406	1752737	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	7661	5947391	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in MAIN pit	10229	7940490	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in TAILINGS pit	2597	2016242	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	2258	1752737	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	166757	9964	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in MAIN pit	222641	13304	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in TAILINGS pit	56533	3378	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	49144	2937	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	8121	13765	holes/y	0.59	kg/hole						
CL - Drilling in MAIN pit	5907	10012	holes/y	0.59	kg/hole						
CL - Drilling in TAILINGS pit	1530	2594	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	765	1297	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	18013	34	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in MAIN pit	13102	25	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in TAILINGS pit	3394	6	blasts/y	531	kg/blast	18000	Area of blast in square metres				

CL - Blasting in SOUTHERN pit	1697	3	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	36098	1806	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in MAIN pit	48196	2411	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in TAILINGS pit	12238	612	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	10638	532	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	107545	1592000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in MAIN pit	78227	1158000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in TAILINGS pit	20266	300000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	10133	150000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	29359	1592000	t/y	0.01844	kg/t	154	t/load	7.1	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from MAIN pit	22859	1158000	t/y	0.01974	kg/t	154	t/load	7.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from TAILINGS pit	779	300000	t/y	0.00260	kg/t	154	t/load	1.0	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	2571	150000	t/y	0.01714	kg/t	154	t/load	6.6	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	32000	3200000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	1600	160000	t	0.01	kg/t						
CL - Handling coal at CHPP	4427	3200000	t	0.00138	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	6	moisture content of coal in %		
CL - Dozer pushing ROM coal	174628	8736	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozer pushing product coal	65348	8736	h/y	7.5	kg/h	4	silt content in %	10	moisture content in %		
CL - Loading product coal stockpile	329	2432000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	106879	47	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at MAIN pit	109153	48	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at TAILINGS pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	38658	17	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	61398	27	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - MAIN pit	47527	21	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - TAILINGS pit	36384	16	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	9551	4	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	5685	5	ha	1137.0	kg/ha/y	86	Average number of raindays	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3275	4	ha	909.6	kg/ha/y	86	Average number of raindays	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	329	2432000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
Grading roads	36928	60000	km	0.61547	kg/VKT	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	5110	365	h/y	14.0	kg/h						

OB - Stripping topsoil in MAIN pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in TAILINGS pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	5110	365	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	959	1626	holes/y	0.59	kg/hole						
OB - Drilling in MAIN pit	1329	2252	holes/y	0.59	kg/hole						
OB - Drilling in TAILINGS pit	630	1067	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	731	1238	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	3823	7	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in MAIN pit	5293	10	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in TAILINGS pit	2509	5	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	2911	5	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	15350	11916207	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in MAIN pit	21254	16499381	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in TAILINGS pit	10074	7820000	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	11690	9074652	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	50347	11916207	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from MAIN pit	69712	16499381	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from TAILINGS pit	59581	7820000	t/y	0.00762	kg/t	231	t/truck load	4.4	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	38341	9074652	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	15350	11916207	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in MAIN pit	21254	16499381	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in TAILINGS pit	10074	7820000	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	11690	9074652	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	218509	13057	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in MAIN pit	302551	18079	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in TAILINGS pit	143396	8568	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	166403	9943	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	15304	25939	holes/y	0.59	kg/hole						
CL - Drilling in MAIN pit	21681	36747	holes/y	0.59	kg/hole						
CL - Drilling in TAILINGS pit	4846	8214	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	11733	19886	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	33944	64	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in MAIN pit	48087	91	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in TAILINGS pit	10749	20	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	26023	49	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	60483	3026	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in MAIN pit	83745	4189	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in TAILINGS pit	39692	1986	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	46060	2304	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	202660	3000000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in MAIN pit	287101	4250000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in TAILINGS pit	64176	950000	t/y	0.06755	kg/t	6	moisture content of coal in %				

CL - Loading ROM to trucks in SOUTHERN pit	155373	2300000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	55325	3000000	t/y	0.01844	kg/t	154	t/load	7.1	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from MAIN pit	83896	4250000	t/y	0.01974	kg/t	154	t/load	7.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from TAILINGS pit	5429	950000	t/y	0.00571	kg/t	154	t/load	2.2	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	39429	2300000	t/y	0.01714	kg/t	154	t/load	6.6	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	105000	10500000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	5250	525000	t	0.01	kg/t						
CL - Handling coal at CHPP	14527	10500000	t	0.00138	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	6	moisture content of coal in %		
CL - Dozer pushing ROM coal	174628	8736	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozer pushing product coal	65348	8736	h/y	7.5	kg/h	4	silt content in %	10	moisture content in %		
CL - Loading product coal stockpile	1080	7980000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	166003	73	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at MAIN pit	227401	100	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at TAILINGS pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	200113	88	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	29562	13	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - MAIN pit	54576	24	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - TAILINGS pit	59124	26	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	28198	12	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	5685	5	ha	1137.0	kg/ha/y	86	Average number of raindays	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3275	4	ha	909.6	kg/ha/y	86	Average number of raindays	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	1080	7980000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
Grading roads	36928	60000	km	0.61547	kg/VKT	8	speed of graders in km/h				

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	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in MAIN pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in TAILINGS pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	5110	365	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	339	575	holes/y	0.59	kg/hole						
OB - Drilling in MAIN pit	1960	3322	holes/y	0.59	kg/hole						
OB - Drilling in TAILINGS pit	356	603	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	284	482	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	1352	3	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in MAIN pit	7810	15	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in TAILINGS pit	1417	3	blasts/y	531	kg/blast	18000	Area of blast in square metres				

OB - Blasting in SOUTHERN pit	1133	2	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	6788	5269262	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in MAIN pit	39197	30428130	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in TAILINGS pit	7111	5520000	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	5688	4415783	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	22263	5269262	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from MAIN pit	128562	30428130	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from TAILINGS pit	42057	5520000	t/y	0.00762	kg/t	231	t/truck load	4.4	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	18657	4415783	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	6788	5269262	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in MAIN pit	39197	30428130	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in TAILINGS pit	7111	5520000	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	5688	4415783	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	85386	5102	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in MAIN pit	493072	29463	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in TAILINGS pit	89449	5345	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	71555	4276	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	7142	12105	holes/y	0.59	kg/hole						
CL - Drilling in MAIN pit	28312	47987	holes/y	0.59	kg/hole						
CL - Drilling in TAILINGS pit	2296	3891	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	5611	9511	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	15840	30	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in MAIN pit	62795	118	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in TAILINGS pit	5092	10	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	12446	23	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	18997	950	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in MAIN pit	109702	5488	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in TAILINGS pit	19901	996	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	15920	796	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	94575	1400000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in MAIN pit	374921	5550000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in TAILINGS pit	30399	450000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	74309	1100000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	25818	1400000	t/y	0.01844	kg/t	154	t/load	7.1	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from MAIN pit	109558	5550000	t/y	0.01974	kg/t	154	t/load	7.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from TAILINGS pit	3974	450000	t/y	0.00883	kg/t	154	t/load	3.4	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	18857	1100000	t/y	0.01714	kg/t	154	t/load	6.6	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	85000	8500000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	4250	425000	t	0.01	kg/t						

CL - Handling coal at CHPP	11760	8500000	t	0.00138	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	6	moisture content of coal in %		
CL - Dozer pushing ROM coal	174628	8736	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozer pushing product coal	65348	8736	h/y	7.5	kg/h	4	silt content in %	10	moisture content in %		
CL - Loading product coal stockpile	874	6460000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	347924	153	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at MAIN pit	445706	196	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at TAILINGS pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	295621	130	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	36384	16	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - MAIN pit	50710	22	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - TAILINGS pit	8414	4	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	56850	25	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	5685	5	ha	1137.0	kg/ha/y	86	Average number of raindays	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3275	4	ha	909.6	kg/ha/y	86	Average number of raindays	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	874	6460000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
Grading roads	36928	60000	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	0	0	h/y	14.0	kg/h						
OB - Stripping topsoil in MAIN pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in TAILINGS pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	5110	365	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	0	0	holes/y	0.59	kg/hole						
OB - Drilling in MAIN pit	2001	3392	holes/y	0.59	kg/hole						
OB - Drilling in TAILINGS pit	148	251	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	873	1480	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in MAIN pit	7974	15	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in TAILINGS pit	590	1	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	3480	7	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in MAIN pit	40021	31067935	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in TAILINGS pit	2963	2300022	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	17464	13556974	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	0	0	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from MAIN pit	131265	31067935	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from TAILINGS pit	17524	2300022	t/y	0.00762	kg/t	231	t/truck load	4.4	km/return trip	0.4	kg/VKT

OB - Hauling to emplace from SOUTHERN pit	57280	13556974	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in MAIN pit	40021	31067935	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in TAILINGS pit	2963	2300022	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	17464	13556974	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	0	0	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in MAIN pit	505383	30199	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in TAILINGS pit	37415	2236	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	220532	13178	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	0	0	holes/y	0.59	kg/hole						
CL - Drilling in MAIN pit	22446	38044	holes/y	0.59	kg/hole						
CL - Drilling in TAILINGS pit	3061	5188	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	10203	17293	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in MAIN pit	49784	94	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in TAILINGS pit	6789	13	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	22629	43	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	0	0	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in MAIN pit	90050	4505	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in TAILINGS pit	6667	334	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	39295	1966	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	0	0	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in MAIN pit	297234	4400000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in TAILINGS pit	40532	600000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	135107	2000000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	0	0	t/y	0.01844	kg/t	154	t/load	7.1	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from MAIN pit	86857	4400000	t/y	0.01974	kg/t	154	t/load	7.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from TAILINGS pit	8727	600000	t/y	0.01455	kg/t	154	t/load	5.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	34286	2000000	t/y	0.01714	kg/t	154	t/load	6.6	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	70000	7000000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	3500	350000	t	0.01	kg/t						
CL - Handling coal at CHPP	9685	7000000	t	0.00138	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	6	moisture content of coal in %		
CL - Dozer pushing ROM coal	174628	8736	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozer pushing product coal	65348	8736	h/y	7.5	kg/h	4	silt content in %	10	moisture content in %		
CL - Loading product coal stockpile	720	5320000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at MAIN pit	270607	119	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at TAILINGS pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4

											m/s
WE - OB dumps at SOUTHERN pit	270607	119	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - MAIN pit	68220	30	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - TAILINGS pit	13644	6	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	45480	20	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	5685	5	ha	1137.0	kg/ha/y	86	Average number of raindays	5	silt content in %	6.2143	% of winds above 5.4 m/s
WE - Product stockpiles	3275	4	ha	909.6	kg/ha/y	86	Average number of raindays	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	720	5320000	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
Grading roads	36928	60000	km	0.61547	kg/VKT	8	speed of graders in km/h				

Year 20

ACTIVITY	TSP emission / year	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units
OB - Stripping topsoil in NORTHERN pit	0	0	h/y	14.0	kg/h						
OB - Stripping topsoil in MAIN pit	5110	365	h/y	14.0	kg/h						
OB - Stripping topsoil in TAILINGS pit	0	0	h/y	14.0	kg/h						
OB - Stripping topsoil in SOUTHERN pit	0	0	h/y	14.0	kg/h						
OB - Drilling in NORTHERN pit	0	0	holes/y	0.59	kg/hole						
OB - Drilling in MAIN pit	2426	4112	holes/y	0.59	kg/hole						
OB - Drilling in TAILINGS pit	0	0	holes/y	0.59	kg/hole						
OB - Drilling in SOUTHERN pit	0	0	holes/y	0.59	kg/hole						
OB - Blasting in NORTHERN pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in MAIN pit	9667	18	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in TAILINGS pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Blasting in SOUTHERN pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
OB - Sh/Ex/FELs loading in NORTHERN pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in MAIN pit	48520	37665578	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in TAILINGS pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Sh/Ex/FELs loading in SOUTHERN pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Hauling to emplace from NORTHERN pit	0	0	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from MAIN pit	159141	37665578	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from TAILINGS pit	0	0	t/y	0.00970	kg/t	231	t/truck load	5.6	km/return trip	0.4	kg/VKT
OB - Hauling to emplace from SOUTHERN pit	0	0	t/y	0.00423	kg/t	231	t/truck load	2.44	km/return trip	0.4	kg/VKT
OB - Emplacing at dumps in NORTHERN pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in MAIN pit	48520	37665578	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in TAILINGS pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Emplacing at dumps in SOUTHERN pit	0	0	t/y	0.00129	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %		
OB - Dozers on O/B in NORTHERN pit	0	0	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in MAIN pit	794569	47479	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		

OB - Dozers on O/B in TAILINGS pit	0	0	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
OB - Dozers on O/B in SOUTHERN pit	0	0	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %		
CL - Drilling in NORTHERN pit	0	0	holes/y	0.59	kg/hole						
CL - Drilling in MAIN pit	19982	33868	holes/y	0.59	kg/hole						
CL - Drilling in TAILINGS pit	0	0	holes/y	0.59	kg/hole						
CL - Drilling in SOUTHERN pit	0	0	holes/y	0.59	kg/hole						
CL - Blasting in NORTHERN pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in MAIN pit	44319	83	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in TAILINGS pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Blasting in SOUTHERN pit	0	0	blasts/y	531	kg/blast	18000	Area of blast in square metres				
CL - Dozers ripping in NORTHERN pit	0	0	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in MAIN pit	98698	4937	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in TAILINGS pit	0	0	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozers ripping in SOUTHERN pit	0	0	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Loading ROM to trucks in NORTHERN pit	0	0	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in MAIN pit	264606	3917000	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in TAILINGS pit	0	0	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Loading ROM to trucks in SOUTHERN pit	0	0	t/y	0.06755	kg/t	6	moisture content of coal in %				
CL - Hauling ROM coal to dump hopper from NORTHERN pit	0	0	t/y	0.01844	kg/t	154	t/load	7.1	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from MAIN pit	77323	3917000	t/y	0.01974	kg/t	154	t/load	7.6	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from TAILINGS pit	0	0	t/y	0.00519	kg/t	154	t/load	2.0	km/return trip	0.4	kg/VKT
CL - Hauling ROM coal to dump hopper from SOUTHERN pit	0	0	t/y	0.01714	kg/t	154	t/load	6.6	km/return trip	0.4	kg/VKT
CL - unloading ROM coal at pile/hopper all pits	39170	3917000	t	0.01	kg/t						
CL - ROM rehandle pile to hopper	1959	195850	t	0.01	kg/t						
CL - Handling coal at CHPP	5419	3917000	t	0.00138	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	6	moisture content of coal in %		
CL - Dozer pushing ROM coal	174628	8736	h/y	20.0	kg/h	5	silt content in %	6	moisture content in %		
CL - Dozer pushing product coal	65348	8736	h/y	7.5	kg/h	4	silt content in %	10	moisture content in %		
CL - Loading product coal stockpile	403	2976920	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
WE - OB dumps at NORTHERN pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at MAIN pit	241045	106	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at TAILINGS pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - OB dumps at SOUTHERN pit	111427	49	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - NORTHERN pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - MAIN pit	21148	9	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - TAILINGS pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - SOUTHERN pit	0	0	ha	2274.0	kg/ha/y	86	Average number of raindays	10	silt content in %	6.2143	% of winds above 5.4 m/s
WE - ROM stockpiles	5685	5	ha	1137.0	kg/ha/y	86	Average number of raindays	5	silt content in %	6.2143	% of winds above 5.4 m/s

WE - Product stockpiles	3275	4	ha	909.6	kg/ha/y	86	Average number of raindays	4	silt content in %	6.2143	% of winds above 5.4 m/s
Loading coal to trains	403	2976920	t	0.00014	kg/t	1.088	average of (wind speed/2.2)^1.3 in m/s	10	moisture content of coal in %		
Grading roads	36928	60000	km	0.61547	kg/VKT	8	speed of graders in km/h				

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

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

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

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

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

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

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

where,

$E_{TSP} = TSP\ emissions$

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

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

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

Equation 5

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

where,

$E_{TSP} = TSP\ emissions$

M = moisture (%)

Unloading ROM coal and re-handling
The emission factor has been taken to be 0.01 kg/t.

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)

A summary of dust emission estimates for each activity, activity type, location of emission sources and activity hours are 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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-------------------------------      27-Apr-2006 17:08
  DUST EMISSION CALCULATIONS V2
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 Output emissions file  : C:\Jobs\AnvilH\iscst3r2\y02\emiss.dat
 Meteorological file    : C:\Jobs\AnvilH\metdata\wyb2003.isc
 Number of dust sources : 55
 Number of activities   : 66
 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 in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 5110 kg/y
 FROM SOURCES  : 4
35 36 37 38
 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 in MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 5110 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 in TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 5110 kg/y
 FROM SOURCES  : 3
31 32 33
 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 in SOUTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 5110 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 639 kg/y
 FROM SOURCES  : 4
35 36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 852 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 216 kg/y
 FROM SOURCES  : 3
31 32 33
 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 : 188 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 2544 kg/y
 FROM SOURCES  : 4
35 36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 3397 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 862 kg/y
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 FROM SOURCES  : 3
31 32 33
 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 : 750 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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
 DUST EMISSION : 7661 kg/y
 FROM SOURCES  : 4
35 36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 10229 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2597 kg/y
 FROM SOURCES  : 3
31 32 33
 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 : 2258 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 25128 kg/y
 FROM SOURCES  : 9
36 37 38 39 40 41 42 43 44
 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 MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 33549 kg/y
 FROM SOURCES  : 11
45 46 47 48 49 50 51 52 53 54 55
 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 TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 17457 kg/y
 FROM SOURCES  : 13
30 31 32 33 34 45 46 47 48 49 50 51 52
 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 : 7406 kg/y
 FROM SOURCES  : 10
7 8 9 10 11 12 13 14 15 16
 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 : 7661 kg/y
 FROM SOURCES  : 6
39 40 41 42 43 44
 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 MAIN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 10229 kg/y
 FROM SOURCES  : 6
48 49 50 51 52 55
 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 TAILINGS pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2597 kg/y
 FROM SOURCES  : 5
48 49 50 51 52
 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 : 2258 kg/y
 FROM SOURCES  : 3
10 11 12
 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
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 ACTIVITY NAME : OB - Dozers on O/B in NORTHERN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 166757 kg/y
 FROM SOURCES  : 6
39 40 41 42 43 44
 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 MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 222641 kg/y
 FROM SOURCES  : 6
48 49 50 51 52 55
 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 TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 56533 kg/y
 FROM SOURCES  : 5
48 49 50 51 52
 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 : 49144 kg/y
 FROM SOURCES  : 3
10 11 12
 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 : 8121 kg/y
 FROM SOURCES  : 3
36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 5907 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1530 kg/y
 FROM SOURCES  : 3
31 32 33
 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
 DUST EMISSION : 765 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 18013 kg/y
 FROM SOURCES  : 3
36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 13102 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Blasting
 DUST EMISSION : 3394 kg/y
 FROM SOURCES  : 3
31 32 33
 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 : 1697 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 36098 kg/y
 FROM SOURCES  : 3
36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 48196 kg/y
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 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 12238 kg/y
 FROM SOURCES  : 3
31 32 33
 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 : 10638 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 107545 kg/y
 FROM SOURCES  : 3
36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 78227 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 TAILINGS pit
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 20266 kg/y
 FROM SOURCES  : 3
31 32 33
 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 : 10133 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 29359 kg/y
 FROM SOURCES  : 11
5 6 26 27 28 29 30 35 36 37 38
 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 MAIN pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 22859 kg/y
 FROM SOURCES  : 17
5 6 26 27 28 29 30 34 45 46 47 48 51 52 53 54 55
 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 TAILINGS pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 779 kg/y
 FROM SOURCES  : 10
5 6 26 27 28 29 30 31 32 33
 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 : 2571 kg/y
 FROM SOURCES  : 18
5 6 7 8 15 16 17 18 19 20 21 22 23 24 25 26 27 28
 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
 DUST EMISSION : 32000 kg/y
 FROM SOURCES  : 2
5 6
 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 : 1600 kg/y
 FROM SOURCES  : 2
5 6
 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 : 4427 kg/y
 FROM SOURCES  : 1
4
 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 : 174628 kg/y
 FROM SOURCES  : 2
5 6
 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 : 65348 kg/y
 FROM SOURCES  : 3
2 3 4
 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 : 329 kg/y
 FROM SOURCES  : 3
2 3 4
 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 : 106879 kg/y
 FROM SOURCES  : 6
39 40 41 42 43 44
 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 MAIN pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 109153 kg/y
 FROM SOURCES  : 6
48 49 50 51 52 55
 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 TAILINGS pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y
 FROM SOURCES  : 5
48 49 50 51 52
 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 : 38658 kg/y
 FROM SOURCES  : 3
10 11 12
 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 : 61398 kg/y
 FROM SOURCES  : 4
35 36 37 38
 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 - MAIN pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 47527 kg/y
 FROM SOURCES  : 5
45 46 47 53 54
 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 - TAILINGS pit
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 36384 kg/y
 FROM SOURCES  : 3
31 32 33
 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
 DUST EMISSION : 9551 kg/y
 FROM SOURCES  : 4
7 8 15 16
 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 : 5685 kg/y
 FROM SOURCES  : 2
5 6
 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 : 3275 kg/y
 FROM SOURCES  : 3
2 3 4
 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 : 329 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  : 54
2 3 4 5 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
 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
```

APPENDIX C
DISCUSSION OF MODEL RESULTS USING AUSPLUME AND ISCST3

DISCUSSION OF MODEL RESULTS USING AUSPLUME AND ISCST3

A simple modelling exercise has been undertaken to compare short-term concentrations of PM_{10} from the AUSPLUME and ISCST3 dispersion models. The approach taken has been to compare hourly average predictions from the AUSPLUME and ISCST3 models for a single volume source with an arbitrary dust emission.

The terrain was taken to be flat for the purpose of the modelling exercise. Predictions were made up to 3 km downwind of the source and 500 m in the cross-wind directions. Rural wind profile exponents were used for the modelling and the mixing height was set to 5000 m. Dry depletion was modelled.

There were seven meteorological conditions examined. These are listed below:

1. A class with 1 m/s wind
2. B class with 2 m/s wind
3. C class with 3 m/s wind
4. D class with 4 m/s wind
5. D class with 10 m/s wind
6. E class with 2 m/s wind
7. F class with 1 m/s wind

Figure C1 shows the model predictions for AUSPLUME and ISCST3 along the plume centerline and downwind of the source. It can be seen from this figure that the ISCST3 predictions are higher than the AUSPLUME predictions for each meteorological condition examined. The magnitude of each prediction is not relevant as an arbitrary emission was used.

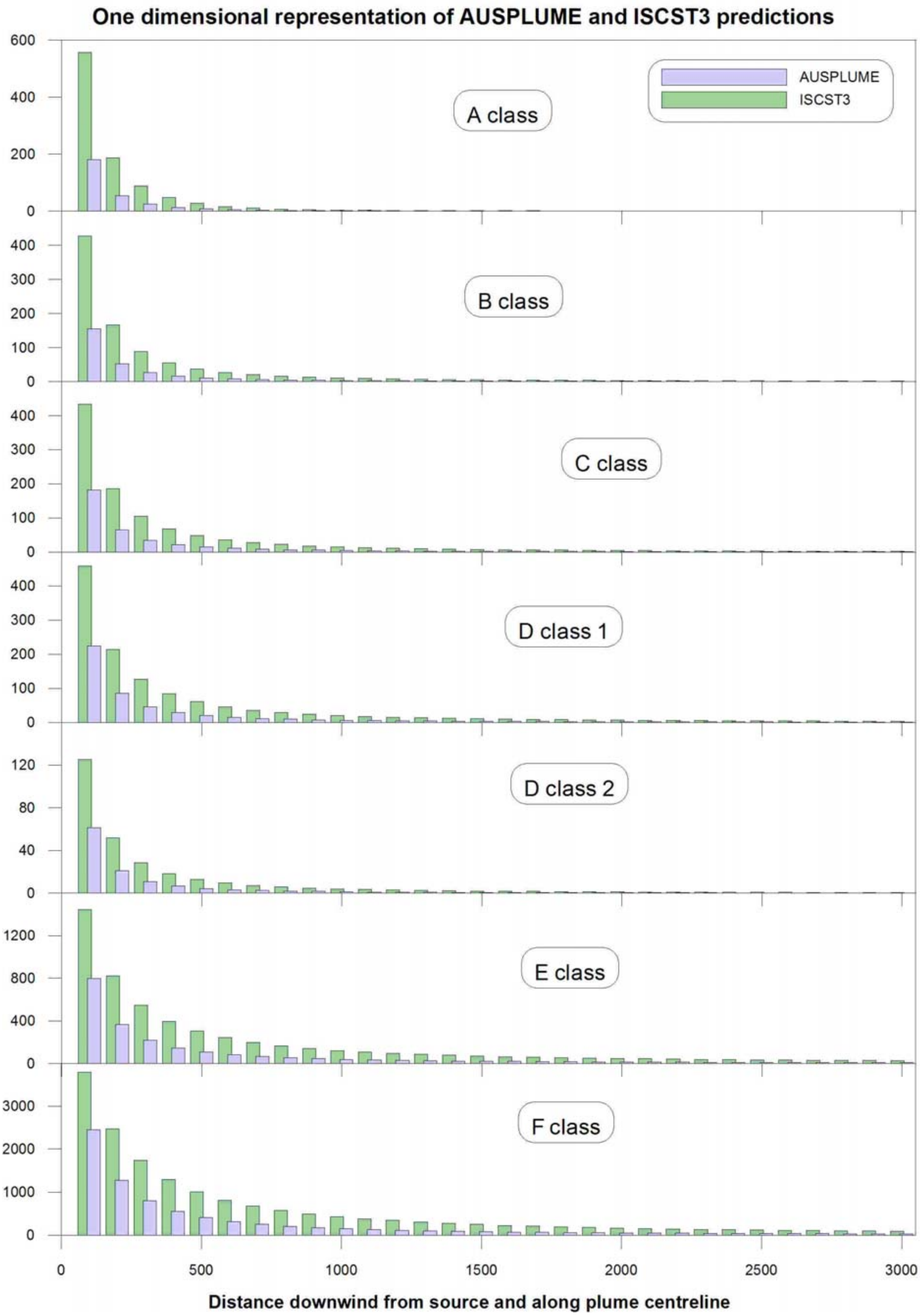

One dimensional representation of AUSPLUME and ISCST3 predictions
AUSPLUME
ISCST3
A class
B class
C class
D class 1
D class 2
E class
F class
Distance downwind from source and along plume centreline

FIGURE C1

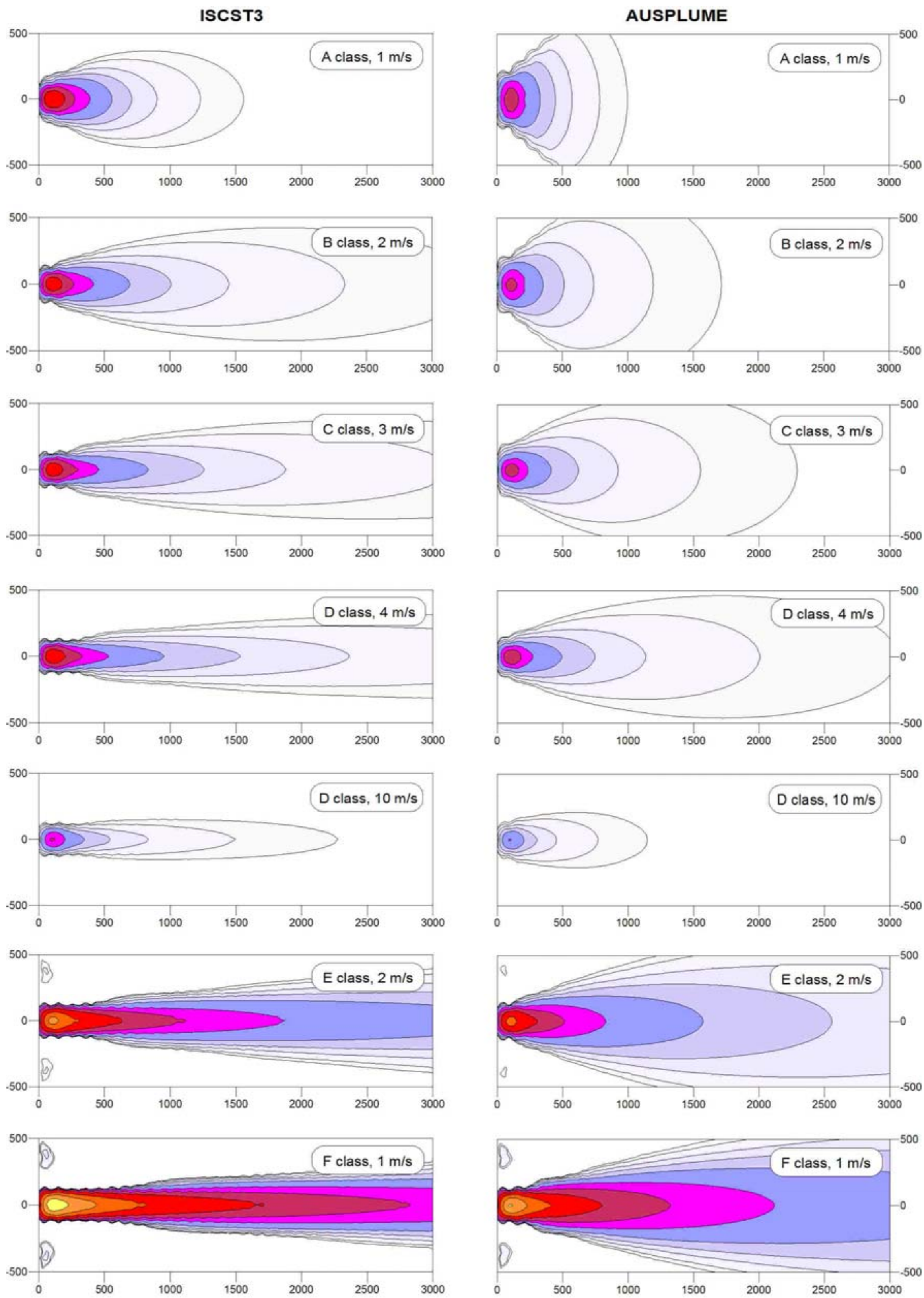
The model results on the plume centerline have been compared by calculating the ratio between the ISCST3 and AUSPLUME predictions. **Table C1** shows the results for distances up to 3000 m.

Table C1 : Ratio of ISCST3 to AUSPLUME predictions

Distance (m)	Ratio of ISCST3 to AUSPLUME prediction						
	A class, 1 m/s	B class, 2 m/s	C class, 3 m/s	D class, 4 m/s	D class, 10 m/s	E class, 2 m/s	F class, 2 m/s
100	3.1	2.8	2.4	2.0	2.1	1.8	1.6
200	3.5	3.2	2.9	2.5	2.4	2.2	1.9
300	3.6	3.4	3.1	2.8	2.7	2.5	2.2
400	3.6	3.5	3.2	2.9	2.8	2.7	2.3
500	3.7	3.5	3.3	3.0	2.9	2.8	2.5
600	3.7	3.6	3.4	3.1	2.9	2.9	2.6
700	3.7	3.6	3.4	3.1	2.9	3.0	2.7
800	3.7	3.6	3.4	3.2	3.0	3.1	2.7
900	3.7	3.6	3.4	3.2	3.0	3.1	2.8
1000	3.7	3.6	3.5	3.2	3.0	3.2	2.9
1100	3.7	3.6	3.5	3.2	3.1	3.2	2.9
1200	3.7	3.6	3.5	3.2	3.1	3.2	2.9
1300	3.7	3.6	3.5	3.3	3.1	3.2	2.9
1400	3.7	3.6	3.5	3.3	3.1	3.3	3.0
1500	3.7	3.6	3.5	3.3	3.1	3.3	3.0
1600	3.7	3.6	3.5	3.3	3.1	3.3	3.0
1700	3.7	3.6	3.5	3.3	3.1	3.3	3.0
1800	3.7	3.6	3.5	3.3	3.1	3.3	3.0
1900	3.6	3.6	3.5	3.3	3.1	3.3	3.1
2000	3.6	3.6	3.5	3.3	3.1	3.3	3.1
2100	3.6	3.6	3.5	3.3	3.1	3.3	3.1
2200	3.6	3.6	3.5	3.3	3.1	3.3	3.1
2300	3.5	3.6	3.5	3.3	3.1	3.3	3.1
2400	3.4	3.6	3.5	3.3	3.1	3.3	3.1
2500	3.3	3.6	3.5	3.3	3.1	3.3	3.1
2600	3.2	3.6	3.5	3.3	3.1	3.4	3.1
2700	3.1	3.6	3.5	3.3	3.1	3.4	3.1
2800	3.0	3.6	3.5	3.3	3.1	3.4	3.1
2900	2.9	3.6	3.5	3.3	3.1	3.3	3.1
3000	2.9	3.6	3.5	3.3	3.1	3.3	3.1
Average	**3.5**	**3.6**	**3.4**	**3.1**	**3.0**	**3.1**	**2.8**

The model results have indicated that the AUSPLUME and ISCST3 models could differ by a factor of about three on the plume centreline with ISCST3 resulting in higher concentrations. The reason for this difference is almost certainly due to the different ways the AUSPLUME and ISCST3 interpret the Pasquill-Gifford dispersion curves, which are used to estimated the horizontal and vertical spreading of a dispersing plume. The AUSPLUME model adopted recommendations made by the American Meteorological Society in 1977 that the curves related to 3-minute average conditions whereas the ISCST3 model assumed that they relate to 1-hour average concentrations. This causes ISCST3 to simulate the dispersing plume as a narrower more concentrate plume than does AUSPLUME all other things being equal.

Figure C2 shows the model results in two dimensions.



Two dimensional representation of AUSPLUME and ISCST3 predictions
(Arbitrary emission)

FIGURE C2

It can be seen from **Figure C2** that the plume is represented differently by the two models.

For time periods longer than one hour the differences arising from the two models at a particular location will be less significant due to fluctuations in the wind direction, but for particularly persistent winds, which will be the conditions that give rise to the worst-case 24-hour average concentrations at a particular receptors it can be seen that ISCST3 will predict concentrations that are significantly higher than those predicted by AUSPLUME. For cases where the plume centreline passes persistently over the receptor, the exact extent of the difference could be determined for a given set of meteorological conditions by using the information in Table C1.

This result invites the question as to why AUSPLUME is not used in the assessment of dust from mines in place of ISCST3. The reasons are:

1. The way that the external time-varying emissions file in AUSPLUME is structured means that it is not able to handle the large number of sources that are required to accurately represent the emissions on an open cut mine;

2. AUSPLUME is not as efficient as ISCST3 in the sense that dust deposition and dust concentrations need to be determined in separate model runs;

3. AUSPLUME takes significantly longer to run a given simulation when the dust depletion options are selected than ISCST3.

Point 1 above is a fatal flaw in most coalmine assessments while Points 2 and 3 are significant inconveniences in a consulting context where as many as 20 model runs may be required with each taking over 48 hours of run time on the fastest PCs currently available.

APPENDIX D
DISPERSION MODEL RESULTS FOR ALL RESIDENCE LOCATIONS

Anvil Hill – Dispersion Model Results

ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
290	3.3	6.2	5.8	8.4	10.4	15.9	16.7	16.5	16.7	16.8	35.9	36.7	36.5	36.8	36.9	1.51	1.51	1.51	1.51	1.51
125F	5.9	9.6	10	8.2	7.8	15.9	16.7	16.6	16.6	16.2	36	36.8	36.7	36.7	36.3	1.54	1.61	1.62	1.61	1.58
201B	6.4	8	5	6.9	6	15.5	15.9	15.8	15.8	15.7	35.5	35.9	35.8	35.8	35.7	1.51	1.52	1.52	1.52	1.52
201C	6.8	8.3	5.1	6.8	6.2	15.5	15.9	15.8	15.8	15.7	35.5	35.9	35.8	35.9	35.7	1.51	1.52	1.52	1.52	1.52
257B	9.8	17.1	10.5	8.3	6.5	16.1	17	16.9	16.1	15.8	36.2	37	37	36.1	35.9	1.52	1.53	1.53	1.51	1.51
257C	10	16.7	10.4	8.3	6.3	16.1	17	16.9	16.1	15.8	36.2	37	36.9	36.1	35.9	1.52	1.53	1.53	1.51	1.51
7	**57.2**	**56**	30.9	20.1	14.4	**37.6**	**37.5**	**31.2**	20.8	18.9	61.4	60.8	53.1	41.1	39.1	2.89	3.12	2.6	1.55	1.54
6B	**59.6**	**109.9**	**55.4**	35.4	14.9	**41.9**	**37.9**	**30.4**	23.2	19	65.6	60.8	51.5	43.6	39.3	3.64	2.82	1.89	1.59	1.55
6A	**97.7**	**56.9**	35	23.9	19.2	**46.3**	**34.2**	29.6	22.2	19	74.1	56.4	50.8	42.6	39.3	**4.89**	2.39	1.96	1.58	1.55
86	21.4	31.8	36.9	**56.6**	**178.2**	23.4	**33**	**33.4**	**45.2**	**99.2**	43.5	53.4	53.8	66	**127.7**	1.58	1.74	1.76	2.06	**5.27**
33B	37	49.5	26.2	16.2	15.5	23.1	25.7	23.6	19	17.8	43.5	46.2	44.1	39.1	37.9	1.81	1.86	1.81	1.54	1.53
33I	17.4	29	30.7	35.2	20.7	20.7	24.5	23.6	20	18	41	44.9	44.1	40.2	38.1	1.72	1.87	1.84	1.6	1.54
87A	16.7	25.4	31.7	31.2	21.3	20.1	23.5	23.5	19.9	18.3	40.4	43.9	44	40.1	38.4	1.68	1.83	1.86	1.61	1.55
33A	29.9	44.5	25.8	15.2	11.6	20.9	23.6	22.2	18.4	17.4	41.2	44	42.5	38.5	37.5	1.71	1.76	1.74	1.54	1.52
87B	15.4	21.6	29.1	26.5	20.2	19.4	22.2	22.7	19.6	18.3	39.6	42.6	43.1	39.8	38.4	1.65	1.78	1.83	1.63	1.55
33C	46	41.1	27.9	18.1	17.1	27.3	28.5	27.3	20.2	18.5	48.2	49.5	48.4	40.5	38.7	1.91	2.08	2.17	1.55	1.53
33E	**57.6**	**109**	44.6	26.2	20.7	**39.3**	**41.9**	**31.2**	23.3	19.2	61.8	65.6	52.3	43.8	39.4	3.07	3.43	1.9	1.6	1.55
33K	19.2	28.6	48.7	43.4	36.5	21.4	24.5	28.7	30	20.5	41.6	45	49.5	51.1	40.8	1.61	1.76	2.07	2.34	1.62
33D	18.3	23.3	30.9	42.2	35.9	21.4	24.4	26.7	30	25.3	41.5	44.7	47.1	50.6	46.2	1.57	1.68	1.72	1.98	2.02
33J	39.3	36	27.3	18.5	11.6	25	25.7	29	19.5	18.3	45.5	46.3	50.7	39.7	38.5	1.6	1.62	2.43	1.54	1.53
41	22.2	33.9	30.8	14.9	12.6	20.1	23.3	23.9	18.6	18	40.3	43.7	44.4	38.8	38.1	1.55	1.58	1.61	1.53	1.53
33G	22.4	46.8	41.6	18.7	17.7	21.5	28.5	28.2	20.7	19.4	42	49.7	50	41	39.6	1.87	2.49	2.68	1.58	1.54
33H	16.6	31.4	35.9	**74.1**	**593.8**	22.6	**32.3**	**32.3**	**48.9**	**325**	42.7	52.7	52.7	69.8	**383**	1.56	1.71	1.74	2.1	**11.49**
33M	3.5	5.8	5.3	10.5	9.4	15.7	16.1	16.1	16.1	16	35.7	36.2	36.1	36.3	36	1.51	1.52	1.52	1.55	1.54
33F	6.4	9	6.7	7.7	6.3	15.7	16.2	16.1	16.1	16	35.7	36.3	36.2	36.2	36.1	1.52	1.56	1.55	1.55	1.54
33L	15.6	23.9	28.8	11.3	11.5	18.6	21.9	22.2	18.4	17.8	38.7	42.2	42.6	38.6	37.9	1.55	1.58	1.63	1.53	1.52
247	3.1	6.4	4.6	3.9	3.9	15.6	16	15.9	15.8	15.6	35.6	36.1	35.9	35.8	35.7	1.51	1.51	1.51	1.51	1.51
188B	2.5	4.6	5.6	4.3	3.9	15.4	15.7	15.7	15.6	15.5	35.4	35.7	35.7	35.7	35.5	1.51	1.52	1.52	1.52	1.52
188A	2.8	5.3	4.8	5.3	5.9	15.4	15.9	15.8	15.7	15.6	35.5	35.9	35.8	35.7	35.6	1.52	1.54	1.54	1.54	1.52
203D	4.5	8.1	6.7	6.9	7.2	15.6	16.1	16	15.7	15.5	35.6	36.2	36.1	35.8	35.6	1.53	1.55	1.56	1.53	1.52
203E	3.3	6.3	6.1	4.7	4.4	15.5	15.9	15.8	15.6	15.4	35.5	35.9	35.9	35.6	35.4	1.52	1.55	1.55	1.53	1.52
203C	3.9	7.2	6.1	5.4	3.5	15.4	15.8	15.7	15.6	15.5	35.4	35.8	35.7	35.6	35.5	1.51	1.51	1.51	1.51	1.51
203A	4.2	7.2	6.2	4.6	4.2	15.5	16	15.9	15.7	15.5	35.6	36	35.9	35.7	35.6	1.51	1.52	1.53	1.51	1.51
203B	3.8	7.6	7.3	4.3	4.8	15.6	16	16	15.7	15.5	35.6	36.1	36	35.7	35.5	1.52	1.54	1.55	1.52	1.51
220	1.9	3.3	3.6	4.6	5.3	15.4	15.6	15.6	15.7	15.6	35.4	35.7	35.6	35.7	35.6	1.5	1.51	1.51	1.51	1.51
266	5.6	9.5	7.8	9.8	12.1	16.5	17.9	17.3	17.9	17.7	36.5	37.9	37.3	38	37.8	1.51	1.52	1.51	1.52	1.51
76	12.6	19.7	12.2	10.2	10.9	16.9	18.3	18.3	16.9	16.5	37	38.4	38.4	37	36.6	1.52	1.53	1.55	1.52	1.51
27	16.1	22.2	13.3	10.4	11.7	17.4	19	19.1	17.3	16.7	37.5	39.2	39.3	37.4	36.8	1.52	1.54	1.58	1.52	1.52
101	16	21.9	13.8	9.6	12.8	17.8	19.5	19.8	17.6	16.9	37.9	39.6	40	37.7	37	1.53	1.55	1.6	1.52	1.52
53	12.9	16.2	11.9	8.5	7.9	17.4	18.6	18.9	17.2	16.8	37.5	38.8	39	37.3	36.9	1.52	1.53	1.55	1.52	1.52
90	35.5	39.1	19.8	13.3	14.8	22.2	24.1	24.8	19.2	18	42.5	44.6	45.4	39.4	38.1	1.63	1.72	1.91	1.54	1.53
49	41.3	**55.7**	32.6	17.6	16.6	26.5	27.8	24.8	19.8	18.1	47.3	48.5	45.3	40	38.3	2.06	1.99	1.81	1.55	1.53
60	41	**54.2**	36.9	20.4	16.5	25.6	27.8	24.7	19.7	18.1	46.4	48.5	45.2	39.9	38.2	2.02	2.01	1.79	1.56	1.53
44	35.8	47.6	41.7	22.4	13.2	24.8	27.3	24.3	19.6	18	45.4	48	44.7	39.8	38.1	1.97	1.98	1.78	1.56	1.53
92	29.8	43.4	43.3	26.6	14.4	24.4	27.2	24.1	19.7	18	45	47.9	44.5	39.8	38.1	1.94	2	1.78	1.56	1.53

ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
80	26.7	40.5	37.3	24.8	14	23.2	26.1	23.5	19.4	17.8	43.7	46.7	43.9	39.6	37.9	1.87	1.93	1.76	1.56	1.53
81	20	39.5	37.1	27.4	18.1	21.8	25.2	23.1	19.7	17.7	42.2	45.8	43.5	39.9	37.8	1.79	1.9	1.77	1.57	1.53
91	19.1	31.6	33.2	36.8	19.1	21.5	25.4	24.3	20.4	18	41.8	46	44.8	40.6	38.1	1.76	1.93	1.86	1.59	1.54
45A	19.7	27	36.6	36	23.8	20.8	24.7	25.8	21.1	18.8	41	45.2	46.4	41.4	38.9	1.69	1.88	1.99	1.66	1.55
95	19.2	31.5	24	15	11.2	18.6	20.7	20.1	17.5	16.8	38.7	40.9	40.3	37.6	36.9	1.6	1.65	1.66	1.53	1.52
180	15.8	22.8	29.7	27.5	19.8	19.7	22.7	22.8	19.6	18.3	39.9	43	43.3	39.8	38.4	1.67	1.8	1.84	1.62	1.55
110	13.7	18.9	25.1	24.1	23.3	18.7	21.2	21.6	19.2	17.8	38.9	41.4	41.9	39.4	37.9	1.62	1.73	1.77	1.62	1.54
148	12.4	18.3	21.9	23	18.6	18.7	21.4	22.3	20.7	18.2	38.8	41.7	42.6	41	38.3	1.6	1.71	1.8	1.7	1.56
130	13.3	18.1	22.9	23.4	17.5	18.7	21.1	22.2	21	18.1	38.8	41.3	42.6	41.3	38.2	1.61	1.72	1.82	1.73	1.56
134A	10.6	17.1	21.7	19.9	20	18.1	20.2	20	18.1	17.2	38.2	40.5	40.2	38.2	37.3	1.6	1.68	1.68	1.57	1.53
134B	10.8	19.6	21.1	18.8	18.5	18.3	20.4	20	18	17.3	38.4	40.6	40.3	38.2	37.4	1.61	1.68	1.68	1.57	1.53
45B	18.6	25.5	25.7	25.3	23.5	19.1	21.7	23	22.8	18.8	39.3	42	43.4	43.3	38.9	1.6	1.71	1.84	1.83	1.59
82	30.6	47.3	**83.9**	37.4	16.2	26.8	**33.6**	**34.8**	23.8	19	47.6	55.2	56.6	44.2	39.2	1.96	2.6	2.59	1.65	1.56
35	30.9	42.8	**72.8**	**67.6**	21.1	24.2	29.3	**35.3**	24.7	18.9	44.7	50.3	57.3	45.2	39.1	1.79	2.21	2.86	1.72	1.57
62	28.3	37.6	**52**	**62.1**	24.5	22.8	27.1	**33.3**	24.7	18.9	43.2	47.8	54.8	45.3	39.1	1.73	2.04	2.67	1.79	1.57
63A	35.6	48.3	**88.2**	**67.4**	17.9	24.9	**30.1**	**40.4**	26	19.1	45.4	51.2	63.3	46.6	39.3	1.78	2.23	3.47	1.77	1.57
2	27.3	31.7	**87.1**	**98.7**	30.1	25.3	29.3	**43.2**	**45.7**	20.7	45.6	49.9	64.9	71.3	41	1.65	1.87	2.73	**4.41**	1.61
56	23.4	38.5	43.2	**54**	34	21.8	25.8	**30.1**	28.2	20.7	42	46.2	51	49.2	40.9	1.64	1.82	2.23	2.15	1.6
51	18.7	29	44.9	42.2	34.6	21.1	24.2	27.8	29	20.3	41.3	44.5	48.5	50.1	40.6	1.61	1.76	2.02	2.26	1.62
72	22.2	36.2	35.1	45.4	34.5	20.8	24.3	27.2	25.9	19.9	41	44.7	48	46.6	40.1	1.63	1.8	2.1	2.01	1.59
138	17	27.8	29.1	32.3	27.3	19.4	22.2	23.7	24.3	19.3	39.5	42.5	44.2	44.8	39.6	1.59	1.71	1.86	1.93	1.62
108	13	23.8	30.9	25.5	30.2	19.1	22.2	23	23.8	21.8	39.3	42.4	43.3	44.2	42.1	1.56	1.65	1.71	1.83	1.72
28	16.9	22.7	31.3	43.6	35.5	21.1	24.1	26.1	28.6	24.6	41.3	44.3	46.5	49.3	45.3	1.57	1.68	1.73	1.99	1.94
59B	17.4	29.3	32.9	40.1	**58.7**	22.2	26.4	28.5	**32.4**	**31.8**	42.4	46.6	48.7	52.8	52.8	1.56	1.63	1.65	1.76	2.15
57	15.3	20	23.6	26.7	38.8	20.5	24.2	25.1	27.3	29	40.6	44.4	45.2	47.6	49.4	1.54	1.59	1.59	1.64	1.73
84	**67.1**	**63.5**	29.4	18.9	14	**32.9**	**32.3**	**31.1**	20.4	18.8	55.8	54.8	53.5	40.7	39.1	1.93	2.08	2.65	1.55	1.54
88	26.4	29.4	24	14.6	10.9	20.5	22.1	23.2	18.7	17.7	40.8	42.4	43.6	38.8	37.8	1.55	1.57	1.68	1.53	1.53
65	14.3	20.2	17.3	10.6	9.6	18.7	20	20	17.9	17.3	38.9	40.3	40.3	38.1	37.4	1.53	1.54	1.55	1.53	1.52
71	11.5	16.6	12.7	7.2	7.9	17.3	18.5	18.3	17.2	16.7	37.4	38.7	38.5	37.3	36.8	1.52	1.53	1.53	1.52	1.52
11	25.8	41.6	**71**	16.7	13.6	20.6	26.5	**35.2**	19.3	18.5	40.9	47	57.4	39.5	38.7	1.6	1.64	2.88	1.54	1.53
31	25.9	42.8	**60.7**	17.3	16.8	21.4	26	**32.2**	19.2	18.3	41.7	46.5	55.4	39.4	38.5	1.58	1.61	2.07	1.54	1.53
64	21.7	32.6	34.5	15.3	12.8	19.9	23.3	23.9	18.7	18	40.1	43.7	44.4	38.9	38.1	1.55	1.58	1.61	1.53	1.53
85	17.9	26.7	32.9	11.9	12.1	19.1	22.5	23	18.4	17.8	39.3	42.9	43.4	38.6	37.9	1.55	1.57	1.61	1.53	1.52
18B	15.7	23.9	28.4	11.4	11.5	18.6	22	22.3	18.4	17.8	38.8	42.3	42.6	38.6	37.9	1.55	1.58	1.62	1.53	1.52
68	14.5	22.4	25.1	11.1	10.7	18.4	21.5	21.6	18.3	17.6	38.6	41.8	41.9	38.4	37.8	1.54	1.56	1.59	1.53	1.52
10	11.9	21.5	25.1	9.8	8.7	17.9	20.8	20.5	18	17.4	38	41	40.8	38.2	37.5	1.54	1.56	1.59	1.53	1.52
55	13.4	19.2	20.4	9.6	9	18	20.6	20.5	17.9	17.3	38.1	40.8	40.7	38	37.4	1.53	1.55	1.56	1.53	1.52
40	10.6	18.4	16.4	8.5	9.8	17.9	20.1	19.8	17.7	17.2	38.1	40.3	40	37.8	37.3	1.53	1.55	1.55	1.52	1.52
167	11	16	15.1	8.8	7.6	17.5	19.7	19.5	17.5	17	37.6	39.9	39.7	37.7	37.1	1.53	1.54	1.55	1.52	1.52
118	11	15.1	16.1	9.7	8	17.4	19.4	19.1	17.5	17	37.5	39.6	39.3	37.7	37.1	1.52	1.54	1.55	1.52	1.52
75A	10.3	14.4	14.1	9.5	8	17.3	19.2	18.9	17.4	16.9	37.4	39.4	39.1	37.5	37	1.52	1.54	1.54	1.52	1.52
162	8.5	16.4	16.8	8.5	7.9	16.9	18.5	18.1	17.2	16.9	37	38.7	38.2	37.3	36.9	1.52	1.54	1.54	1.52	1.52
111	6.9	15.3	13.3	7.6	7.7	16.8	18.2	17.8	17.1	16.8	36.8	38.4	37.9	37.2	36.9	1.52	1.54	1.54	1.52	1.52
26	13.6	20.9	19.9	10.5	10	18.4	20.6	20.4	17.8	17.3	38.5	40.9	40.7	37.9	37.4	1.53	1.55	1.55	1.53	1.52
89	13.3	18.2	19.8	11	10.2	18.2	20	19.8	17.6	17.2	38.4	40.3	40.1	37.8	37.4	1.53	1.54	1.54	1.52	1.52
1	22.9	**52.3**	39.8	18.9	19.3	22	29.8	29.5	20.9	19.6	42.5	51.1	51.7	41.2	39.8	1.9	2.66	2.97	1.58	1.54
16	13.2	27.5	20.7	16.8	15.7	18.7	21.8	21.6	18.9	18	38.9	42.2	42.1	39.1	38.1	1.65	1.8	1.98	1.56	1.53
9	15.5	28.1	23.7	16.5	17.9	19.3	22.4	21.1	19.3	18.2	39.6	42.9	41.5	39.6	38.3	1.72	1.9	1.82	1.62	1.56
38	10.4	17.3	18.8	13.6	15.3	17.5	19.3	18.7	17.6	16.9	37.7	39.7	39	37.8	37	1.66	1.79	1.75	1.61	1.56
69	13.2	22.5	20	21.3	19.4	17.5	19.4	18.7	18	17.1	37.7	39.7	39	38.2	37.2	1.64	1.78	1.76	1.66	1.59

ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
70A	9.6	14	15	14.1	12.2	16.7	18	17.7	17.2	16.6	36.9	38.2	37.9	37.4	36.8	1.61	1.73	1.73	1.67	1.6
15C	10.8	16.6	18.6	15.7	12	16.8	18.1	17.8	17.5	16.8	37	38.4	38.1	37.7	37	1.63	1.76	1.77	1.71	1.63
13	22.1	31.7	29.8	**82**	**412.3**	24.1	**33**	**31.3**	**54.3**	**144.4**	44.3	53.7	53	77	**267.5**	1.61	1.95	1.99	3.04	**35**
8	22.4	31	29.7	**85.5**	**324.3**	23.5	**32.8**	**31.7**	**60.4**	**136.5**	43.7	53.5	53.2	83.3	**239.2**	1.61	1.98	2.06	2.91	**12.72**
12	20.5	30.1	32.4	**67.3**	**688.1**	22.6	**31.8**	**31.3**	**46.3**	**372.2**	42.7	52.2	51.6	67.2	**466.1**	1.56	1.72	1.75	2.07	**19.29**
94	16.3	22.4	25	37.8	**84**	20.6	25.8	24.9	**31.6**	**52.1**	40.7	46	45.1	52	73.7	1.54	1.61	1.61	1.72	1.97
14	29.2	**53.2**	36.4	28.9	32.7	22.4	29.3	25.8	25.1	22.4	42.9	50.6	46.7	45.9	42.8	1.9	2.63	2.43	2.14	1.85
34	7.9	8.4	6.6	8.8	7.1	15.7	16.3	16.2	16.3	16	35.8	36.5	36.3	36.5	36.1	1.53	1.58	1.57	1.58	1.55
30	4.4	5.6	5.3	9	10.3	15.9	16.4	16.4	16.6	16.3	35.9	36.5	36.4	36.9	36.4	1.51	1.52	1.52	1.54	1.55
78	5.5	8.9	7.7	7.7	7.4	15.7	16.2	16.1	16.1	16	35.7	36.3	36.1	36.2	36.1	1.52	1.55	1.56	1.55	1.53
179	3.5	5.2	5	6.9	11.6	15.7	16.1	16.1	16.3	16.1	35.7	36.2	36.1	36.3	36.1	1.51	1.51	1.51	1.52	1.53
121	4.4	6.6	6.2	7.8	15.1	15.9	16.5	16.4	16.7	16.5	35.9	36.5	36.4	36.8	36.6	1.51	1.51	1.51	1.53	1.54
269A	4	7	5.5	7.7	10.3	15.8	16.4	16.3	16.6	16.6	35.8	36.5	36.4	36.6	36.6	1.51	1.51	1.51	1.52	1.52
145A	7.1	10.3	12	8.8	8.2	16	17	16.8	16.8	16.4	36.1	37.1	36.9	36.9	36.5	1.54	1.62	1.63	1.63	1.58
105	7.1	10.6	11.8	9.5	11.1	16.1	17.1	16.9	16.9	16.5	36.2	37.3	37.1	37.1	36.7	1.56	1.67	1.68	1.67	1.61
125D	5.7	9.6	10.2	8.2	8	15.9	16.7	16.6	16.6	16.2	36	36.8	36.7	36.7	36.3	1.54	1.61	1.62	1.62	1.58
29A	6.8	7.3	7.5	9.1	8.1	15.7	16.2	16.2	16.2	16.1	35.7	36.3	36.3	36.4	36.1	1.53	1.58	1.58	1.58	1.56
137	5	7.5	6.8	7.8	7.7	15.6	16.2	16.1	16.1	16	35.7	36.3	36.2	36.2	36	1.52	1.56	1.57	1.57	1.55
169	6.5	7.1	7.1	8.2	7.9	15.6	16.1	16.1	16.1	15.9	35.7	36.2	36.1	36.2	36	1.52	1.56	1.56	1.56	1.54
132	6.2	7.8	6	8.6	6.8	15.6	16.1	16	16.1	15.8	35.6	36.1	36.1	36.1	35.9	1.52	1.55	1.55	1.55	1.54
115	7	7.8	5.6	8.9	6.2	15.6	16.1	16	16	15.9	35.6	36.2	36	36.1	35.9	1.52	1.55	1.55	1.55	1.53
176	13.2	20.3	20.3	21.5	33.2	19.5	22.7	23.2	24.1	24.6	39.5	42.8	43.3	44.2	44.8	1.53	1.56	1.56	1.58	1.59
74	7.7	11.9	8.5	13.3	12.4	16.4	17.8	17.2	17.9	17.7	36.4	37.8	37.2	37.9	37.8	1.51	1.52	1.51	1.52	1.52
177	6.6	10.5	7.6	10.2	10.2	16.1	17.2	16.8	17.2	17.1	36.1	37.2	36.8	37.3	37.1	1.51	1.51	1.51	1.51	1.51
178	4	8.2	5.2	7.1	9.5	16	16.8	16.5	16.9	16.8	36	36.9	36.5	36.9	36.8	1.51	1.51	1.51	1.51	1.51
18A	15.9	24.6	27.2	11.7	10	18.8	22.1	22.4	18.5	17.8	38.9	42.4	42.8	38.7	37.9	1.54	1.57	1.61	1.53	1.52
146	8.9	19.2	16	9.3	8.3	17.1	19.1	18.6	17.6	17.1	37.3	39.2	38.8	37.7	37.2	1.53	1.55	1.57	1.53	1.52
43	36.5	**53.5**	37.4	32.5	34.5	23.4	29.5	26.6	26.3	23.6	44.1	50.7	47.6	47.2	44.2	1.94	2.37	2.25	2.08	1.87
15B	12.8	15.5	14.5	15.1	16.1	16.5	17.9	17.8	17.8	17.3	36.9	38.7	38.4	38.5	37.6	1.63	1.88	1.87	1.85	1.71
172	10.7	18.5	14.4	10.4	8.2	16.6	17.7	17.7	16.5	16.1	36.6	37.8	37.8	36.5	36.1	1.53	1.55	1.56	1.52	1.51
144	12.6	16.7	12.8	8.7	6.8	16.8	17.8	17.6	16.5	16.2	36.8	37.9	37.7	36.6	36.3	1.52	1.54	1.55	1.51	1.51
128	10.1	17.1	11.1	7.9	7	16.5	17.4	17.3	16.5	16.2	36.5	37.5	37.3	36.5	36.2	1.52	1.53	1.53	1.51	1.51
170	9	12.8	10.3	6.7	8.6	16.3	17.2	17	16.3	16.1	36.3	37.3	37.1	36.4	36.1	1.51	1.52	1.53	1.51	1.51
139	11.4	16.5	11.4	7.3	9.7	16.6	17.7	17.6	16.6	16.2	36.6	37.8	37.6	36.6	36.3	1.52	1.53	1.54	1.51	1.51
39	11.3	17.7	11.4	9.6	9	16.8	17.9	17.8	16.8	16.4	36.8	38	37.9	36.8	36.4	1.52	1.53	1.54	1.52	1.51
171	8.6	12.7	8	8	8.7	16.2	17.1	17.1	16.4	16.1	36.3	37.2	37.2	36.5	36.2	1.51	1.52	1.52	1.51	1.51
113	9.2	14	10.2	7.9	9.7	16.7	17.7	17.8	16.7	16.4	36.7	37.8	37.9	36.8	36.5	1.52	1.52	1.53	1.52	1.51
157	11.5	16.3	10	9	9.2	16.5	17.6	17.5	16.6	16.3	36.6	37.7	37.6	36.7	36.4	1.51	1.53	1.53	1.51	1.51
66	7.8	12.6	9.5	6.5	6.5	16.6	17.5	17.4	16.7	16.3	36.7	37.6	37.5	36.8	36.4	1.51	1.52	1.52	1.52	1.51
175	8.3	11.7	10.3	7.7	6.3	16.8	18.2	17.9	17	16.6	36.9	38.4	38.1	37.1	36.6	1.52	1.53	1.53	1.52	1.51
174B	6.8	10.8	10.1	7.4	6.2	16.7	18.1	17.8	16.9	16.5	36.8	38.2	37.9	37	36.6	1.52	1.53	1.53	1.52	1.51
174A	6.7	10.4	10	7.7	6.7	16.7	18	17.8	16.9	16.5	36.8	38.2	37.9	37	36.6	1.52	1.53	1.53	1.52	1.51
173B	7	11.1	9.9	5.5	6.3	16.5	17.6	17.3	16.6	16.3	36.5	37.8	37.5	36.7	36.4	1.51	1.52	1.52	1.51	1.51
126A	7	11.3	10.1	5.5	6.5	16.5	17.7	17.4	16.6	16.3	36.6	37.8	37.5	36.7	36.4	1.51	1.52	1.52	1.51	1.51
21A	18.4	45.2	**66.9**	15.2	14.5	19.9	25.1	**31.8**	19.4	18.6	40.2	45.6	54.2	39.7	38.8	1.68	1.8	3.93	1.55	1.53
133	5.1	8.4	6.1	6.3	6.8	15.6	15.9	15.9	15.9	15.8	35.6	36	35.9	35.9	35.9	1.52	1.54	1.54	1.53	1.52
37	4	5.1	4.7	9.7	9.2	15.8	16.4	16.3	16.5	16.3	35.9	36.4	36.4	36.7	36.3	1.51	1.52	1.52	1.55	1.55
140	3.4	4.9	4.2	8.9	7.6	15.7	16.1	16.1	16.2	16	35.7	36.2	36.1	36.3	36	1.51	1.51	1.52	1.54	1.54
79	6	9.9	8.5	9.8	11	16.4	17.9	17.3	17.9	17.6	36.4	38	37.3	38	37.6	1.51	1.52	1.51	1.52	1.52
151	5.4	10.2	8.1	10	10.8	16.4	18	17.3	18	17.6	36.4	38	37.3	38	37.6	1.51	1.52	1.51	1.52	1.51

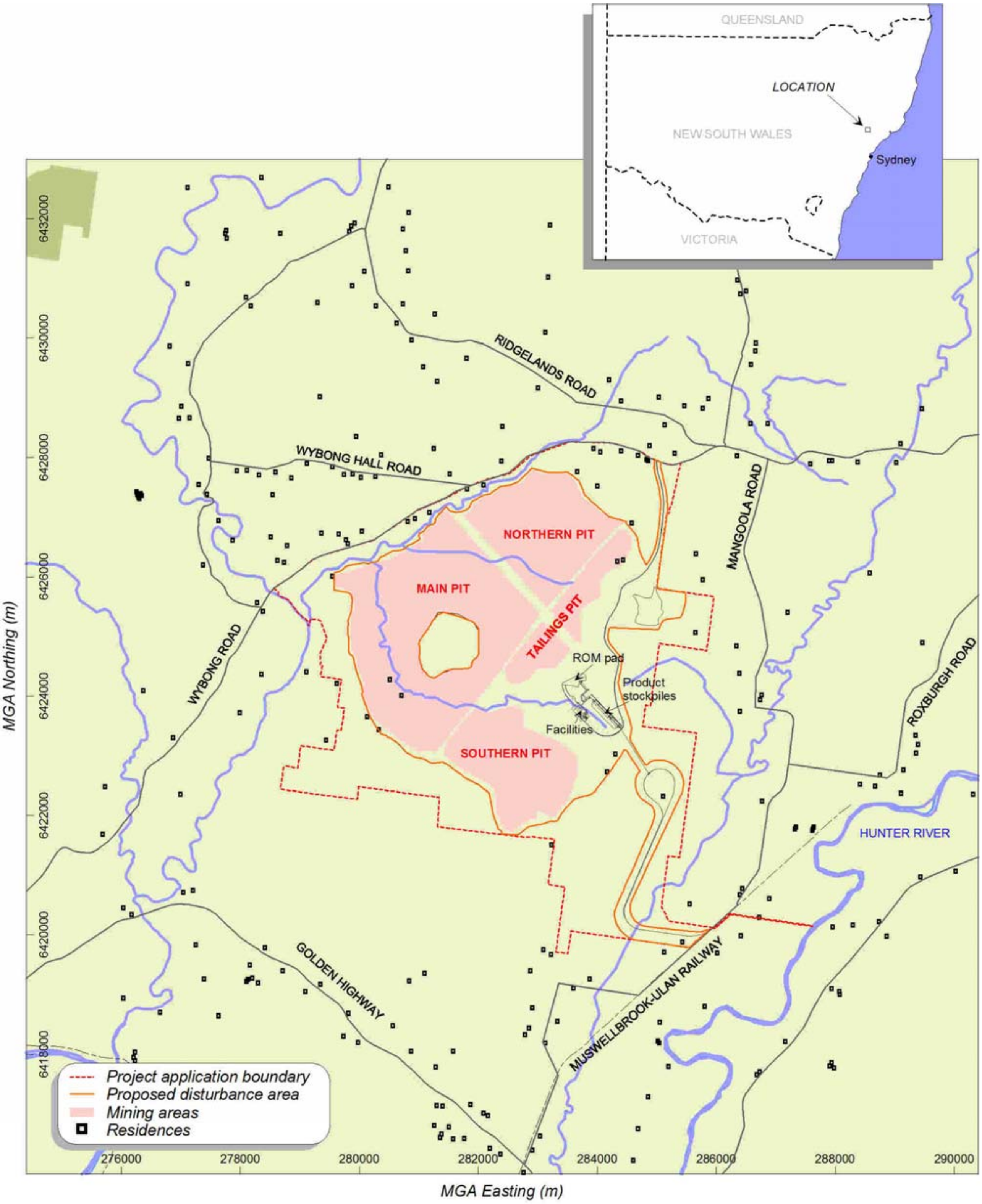
ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
114	6.6	10.4	9.5	11.1	14.2	16.7	18.5	17.8	18.6	18.2	36.8	38.6	37.8	38.6	38.2	1.51	1.52	1.52	1.52	1.52
112A	6.9	10.3	9.9	12	14.8	16.8	18.6	17.8	18.8	18.3	36.8	38.6	37.8	38.8	38.3	1.51	1.52	1.52	1.52	1.52
166	6.4	11.9	9.6	12.1	16.2	17	19	18.1	19.3	18.8	37	39	38.2	39.3	38.8	1.51	1.52	1.52	1.52	1.52
54	6.4	11.3	9.6	12.8	16.4	17.1	18.9	18.1	19.1	18.9	37.1	39	38.2	39.2	38.9	1.51	1.52	1.52	1.52	1.52
21B	4.9	10.3	7.3	9.3	14.6	16.7	18.1	17.5	18.2	18.1	36.7	38.1	37.6	38.2	38.1	1.51	1.52	1.51	1.52	1.52
164	7.1	12.6	8.8	13.7	14	16.5	17.9	17.3	18.1	17.8	36.5	38	37.4	38.1	37.9	1.51	1.52	1.51	1.52	1.52
102	3.9	6	7	7.6	5.8	15.6	16	15.9	15.9	15.8	35.6	36.1	35.9	36	35.8	1.51	1.53	1.53	1.54	1.52
200	3.7	5.7	4.6	6.8	9.2	15.7	16.1	16.1	16.3	16.2	35.7	36.2	36.1	36.3	36.3	1.51	1.51	1.51	1.51	1.52
264	3.5	6.3	5.3	7.2	10.1	15.8	16.6	16.3	16.6	16.6	35.8	36.6	36.4	36.7	36.7	1.51	1.51	1.51	1.51	1.51
141	7	11.4	8.6	12.6	10.7	16.2	17.4	17	17.5	17.3	36.2	37.4	37	37.5	37.3	1.51	1.51	1.51	1.51	1.51
253	5.8	10.3	7.7	11.4	9.8	16.1	17.2	16.8	17.3	17	36.1	37.2	36.8	37.3	37	1.51	1.51	1.51	1.51	1.51
147	4.3	9.4	7.6	8.7	7.5	16	17	16.7	17.2	16.9	36	37.1	36.7	37.2	36.9	1.51	1.51	1.51	1.51	1.51
106B	8.3	12.7	12.3	12.2	17.6	17.3	19.2	18.7	20.1	21.2	37.3	39.3	38.8	40.2	41.3	1.51	1.53	1.52	1.53	1.54
254A	6.7	9.6	9.7	9.4	12.4	16.8	18.3	17.9	18.8	19.7	36.8	38.3	38	38.8	39.8	1.51	1.52	1.52	1.52	1.53
255	7.3	12.9	13.6	14.9	23.9	17.8	20.1	19.9	20.6	22	37.8	40.2	40	40.7	42.1	1.52	1.53	1.53	1.53	1.54
256	9.1	14.8	15.7	15.9	21.1	18.3	20.5	20.6	21.1	21.6	38.3	40.6	40.7	41.2	41.7	1.52	1.53	1.53	1.54	1.54
63B	38.6	48.6	**83.2**	**64.7**	18.4	24.9	**30.3**	**38.7**	25.7	19.1	45.4	51.4	61.2	46.3	39.3	1.79	2.25	3.22	1.74	1.57
156	9.7	14.4	14.4	11.5	8.1	16.5	17.5	17.4	16.6	16	36.5	37.6	37.5	36.7	36.1	1.53	1.55	1.56	1.52	1.51
124	12.9	17.7	16.4	18	12.1	17.6	19.2	18.5	17.2	16.8	37.7	39.4	38.7	37.3	36.8	1.58	1.63	1.61	1.54	1.52
134D	11.7	15.6	14.9	15.5	12.5	17.3	18.7	18.1	17	16.7	37.4	38.8	38.2	37	36.7	1.57	1.61	1.6	1.53	1.52
165	11.4	18.7	14.8	10.7	8.4	16.7	17.9	17.8	16.5	16.1	36.7	37.9	37.9	36.6	36.2	1.53	1.55	1.57	1.52	1.51
257A	9.8	17.5	10.7	8.3	6.5	16.2	17	17	16.1	15.9	36.2	37.1	37	36.2	35.9	1.52	1.53	1.54	1.51	1.51
258	8.5	12.1	10.6	7.9	6	16.2	16.9	16.7	16.1	15.9	36.3	37	36.8	36.2	36	1.51	1.52	1.53	1.51	1.51
259	7.3	10.7	8.8	5.9	6.7	16	16.7	16.6	16.1	15.9	36	36.7	36.6	36.2	36	1.51	1.52	1.52	1.51	1.51
260	7.7	10.8	8.6	5.7	6.9	16	16.6	16.5	16.1	15.9	36	36.7	36.6	36.1	36	1.51	1.52	1.52	1.51	1.51
261	5.9	9.7	6.4	5.4	6.2	15.8	16.4	16.4	16	15.8	35.8	36.5	36.4	36	35.8	1.51	1.51	1.51	1.51	1.51
262	5.6	9.4	7.2	6.8	7.3	16	16.6	16.5	16.1	15.9	36	36.6	36.6	36.2	35.9	1.51	1.51	1.51	1.51	1.51
263	6.6	10.9	7.1	7	7	16	16.7	16.7	16.2	15.9	36	36.8	36.7	36.2	36	1.51	1.52	1.52	1.51	1.51
126B	6.3	11.1	9.6	5.5	6.4	16.4	17.6	17.3	16.5	16.3	36.5	37.7	37.4	36.6	36.4	1.51	1.52	1.52	1.51	1.51
173C	4.4	6.5	6	4.8	4.4	16	16.7	16.6	16.2	16	36.1	36.8	36.7	36.2	36	1.51	1.52	1.51	1.51	1.51
70B	8.3	13.1	13.7	13.1	12.5	16.7	18	17.7	17.2	16.6	36.9	38.3	37.9	37.4	36.7	1.61	1.73	1.73	1.66	1.6
222	2.9	5	3.6	4.7	5.9	15.4	15.7	15.6	15.6	15.5	35.4	35.7	35.6	35.7	35.5	1.5	1.51	1.51	1.51	1.51
223	3	5.2	3.6	4.9	5.8	15.4	15.7	15.6	15.6	15.5	35.4	35.7	35.7	35.7	35.5	1.5	1.51	1.51	1.51	1.51
185	5.8	7.8	6	5.6	7.2	15.5	15.9	15.8	15.8	15.7	35.5	35.9	35.8	35.8	35.8	1.51	1.53	1.53	1.52	1.52
187	5.7	8	6	6.2	7.2	15.5	15.9	15.8	15.8	15.7	35.5	35.9	35.8	35.8	35.8	1.51	1.53	1.53	1.52	1.52
189	4.5	6	4.4	5.9	4.6	15.4	15.8	15.7	15.7	15.7	35.4	35.8	35.7	35.7	35.7	1.51	1.53	1.53	1.52	1.52
183C	5.6	6.1	6	5.5	5.5	15.5	15.9	15.9	15.9	15.7	35.5	36	35.9	35.9	35.7	1.51	1.53	1.53	1.53	1.52
183B	5.1	6.1	5.9	5.5	5.8	15.5	15.9	15.9	15.9	15.7	35.5	36	35.9	35.9	35.7	1.51	1.53	1.53	1.53	1.52
183A	5.3	6	5.9	5.4	5.6	15.5	15.9	15.9	15.9	15.7	35.5	36	35.9	35.9	35.7	1.51	1.53	1.53	1.53	1.52
192	4.8	7.9	8.7	7.6	5.9	15.7	16.2	16.1	16.1	15.9	35.7	36.3	36.2	36.1	36	1.52	1.55	1.55	1.55	1.54
104	4.2	8.2	8.7	7.6	7.3	15.7	16.3	16.1	16.1	15.9	35.7	36.3	36.2	36.1	36	1.52	1.55	1.55	1.55	1.54
191	4.3	8	8.3	7.6	6.7	15.7	16.2	16.1	16.1	15.9	35.7	36.3	36.1	36.1	35.9	1.52	1.54	1.54	1.54	1.53
227	3.8	7.1	8.2	5.8	4.8	15.6	16.1	16	16	15.8	35.6	36.2	36.1	36.1	35.8	1.52	1.56	1.56	1.56	1.54
194	3.7	7.1	6.4	5.8	4.7	15.5	16	15.9	15.9	15.7	35.5	36	35.9	35.9	35.7	1.51	1.53	1.53	1.53	1.52
230	3.7	6.1	6.4	6.5	6.8	15.6	16.1	16	15.9	15.8	35.6	36.1	36.1	36	35.8	1.52	1.55	1.56	1.55	1.54
231	3.7	6	6.1	6.4	7.1	15.6	16.1	16	15.9	15.7	35.6	36.1	36	36	35.8	1.52	1.55	1.56	1.55	1.54
232A	3.4	5.9	5.6	6.1	6.9	15.5	16	15.9	15.8	15.7	35.5	36	36	35.9	35.7	1.52	1.55	1.55	1.55	1.53
229C	3.3	5.7	5.4	5.9	6.5	15.5	16	15.9	15.8	15.7	35.5	36	35.9	35.9	35.7	1.52	1.55	1.55	1.55	1.53
229A	3.3	6.6	7.3	5.3	4.4	15.5	16	15.9	15.9	15.7	35.5	36.1	36	35.9	35.7	1.52	1.54	1.54	1.54	1.53
232B	3.3	5.9	5.6	6.1	6.9	15.5	16	15.9	15.8	15.7	35.5	36	35.9	35.9	35.7	1.52	1.55	1.55	1.55	1.53

ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
228	3.7	7.1	7.5	6.1	5	15.6	16.1	16.1	16	15.8	35.6	36.2	36.1	36.1	35.8	1.52	1.55	1.56	1.56	1.54
201A	6.8	8.2	5.1	6.7	6.2	15.5	15.9	15.8	15.8	15.7	35.5	35.9	35.8	35.9	35.7	1.51	1.52	1.52	1.52	1.52
224A	3.8	5.5	3.8	6.3	5.5	15.4	15.7	15.7	15.6	15.5	35.4	35.8	35.7	35.7	35.5	1.5	1.51	1.51	1.51	1.51
216	2.5	3.7	2.9	3.9	6.8	15.4	15.7	15.7	15.8	15.8	35.4	35.7	35.7	35.8	35.8	1.5	1.51	1.51	1.51	1.51
217	2.3	4	2.8	4.3	7.4	15.4	15.7	15.7	15.8	15.8	35.4	35.7	35.7	35.8	35.8	1.5	1.51	1.51	1.51	1.51
292	2.2	3.9	3.3	4.1	6.4	15.5	15.8	15.8	15.9	15.9	35.5	35.8	35.8	35.9	35.9	1.5	1.51	1.51	1.51	1.51
288	2.3	4	3.4	4.5	6.3	15.5	15.9	15.8	15.9	16	35.5	35.9	35.8	36	36	1.5	1.51	1.51	1.51	1.51
285	2.4	4.2	3.8	4.9	7.9	15.6	16	15.9	16	16.1	35.6	36	35.9	36.1	36.1	1.5	1.51	1.51	1.51	1.51
286	2.3	4.3	4	4.9	7.8	15.6	16	15.9	16.1	16.2	35.6	36.1	36	36.1	36.2	1.5	1.51	1.51	1.51	1.51
287	3.3	5.4	4.4	5	7.2	15.6	16.2	16	16.2	16.3	35.6	36.2	36.1	36.2	36.3	1.5	1.51	1.51	1.51	1.51
241A	5.4	9.4	9.6	11	9.3	16	16.9	16.6	16.5	16.1	36	37	36.7	36.5	36.2	1.54	1.6	1.6	1.59	1.56
241C	6.5	10.9	11.4	11.2	8.3	16	16.9	16.7	16.5	16	36.1	37	36.8	36.5	36.1	1.55	1.6	1.6	1.58	1.55
190	6.8	11.1	8.5	10	9.3	16.1	17	16.7	16.2	15.8	36.1	37.1	36.8	36.2	35.9	1.55	1.6	1.6	1.54	1.53
243	4.5	7.8	8	5.1	5.7	15.7	16.3	16.2	15.8	15.6	35.7	36.4	36.3	35.8	35.6	1.53	1.56	1.57	1.52	1.52
195	4.6	9.6	7.7	5.5	7.4	15.6	16.2	16.1	15.8	15.6	35.7	36.3	36.2	35.8	35.6	1.53	1.55	1.56	1.52	1.51
244	4.2	8.9	7.9	5.2	6.7	15.6	16.2	16.1	15.8	15.6	35.7	36.2	36.2	35.8	35.6	1.53	1.55	1.56	1.52	1.51
245B	5	9.5	7.2	6.3	7.3	15.6	16.2	16.1	15.8	15.6	35.7	36.2	36.1	35.8	35.6	1.52	1.54	1.55	1.52	1.51
202	4.2	8.3	6.8	4.9	3.6	15.6	16	15.9	15.7	15.5	35.6	36.1	36	35.7	35.6	1.52	1.53	1.54	1.51	1.51
233	3.2	5.9	5.6	6.1	6.8	15.5	16	15.9	15.8	15.7	35.5	36	35.9	35.8	35.7	1.52	1.55	1.55	1.55	1.53
215	2.6	3.6	3	3.3	5.1	15.4	15.7	15.6	15.7	15.7	35.4	35.7	35.7	35.8	35.8	1.5	1.51	1.51	1.51	1.51
125C	5.7	9.1	9.2	10.4	9.8	16	16.8	16.7	16.5	16.2	36	36.9	36.8	36.6	36.3	1.55	1.61	1.61	1.6	1.56
125A	4.9	8.2	8.2	9.2	9.2	15.9	16.6	16.5	16.4	16.1	35.9	36.7	36.6	36.5	36.2	1.54	1.6	1.61	1.6	1.56
241B	6.5	10.6	11	11.6	8.3	16	16.9	16.7	16.5	16.1	36.1	37	36.8	36.6	36.1	1.55	1.6	1.6	1.58	1.55
182	6.4	11	11.6	10.7	8.6	16	16.9	16.7	16.5	16	36.1	37	36.8	36.5	36.1	1.55	1.6	1.6	1.58	1.55
246	5.2	8.8	8	7	4.6	15.5	16	15.9	15.8	15.6	35.6	36	35.9	35.8	35.6	1.51	1.52	1.52	1.51	1.51
252A	5	8.9	7.5	6.7	6	15.6	16	15.9	15.8	15.6	35.6	36.1	35.9	35.8	35.6	1.51	1.52	1.52	1.51	1.51
242	4.8	7.7	7.9	7	6.5	15.7	16.2	16.2	15.9	15.7	35.7	36.3	36.2	36	35.7	1.54	1.57	1.57	1.55	1.53
232C	3.1	6.2	5.8	6.4	6.6	15.5	16	15.9	15.8	15.7	35.5	36	35.9	35.8	35.7	1.52	1.55	1.56	1.55	1.53
235A	3.3	6.5	6	6.7	6.1	15.5	16	15.9	15.8	15.7	35.6	36	35.9	35.8	35.7	1.52	1.55	1.56	1.55	1.53
236A	3.2	6.3	5.9	6.5	6.1	15.5	15.9	15.9	15.8	15.7	35.5	36	35.9	35.8	35.7	1.52	1.55	1.55	1.54	1.53
229B	4.2	7.5	7.2	7.9	6.5	15.6	16.1	16	15.9	15.7	35.7	36.2	36.1	36	35.8	1.53	1.57	1.57	1.55	1.53
238	4	7.3	7.1	7.7	6.6	15.6	16.1	16	15.9	15.7	35.6	36.2	36.1	36	35.8	1.53	1.57	1.57	1.56	1.54
237	3.6	6.8	6.6	7.2	6.6	15.6	16.1	16	15.9	15.8	35.6	36.2	36.1	36	35.8	1.53	1.57	1.57	1.56	1.54
240	4.8	7.7	7.8	8.5	8.7	15.8	16.5	16.3	16.2	16	35.8	36.5	36.4	36.3	36.1	1.54	1.59	1.6	1.59	1.56
125B	4.8	8.5	8.3	9.5	9.6	15.9	16.7	16.6	16.4	16.2	36	36.8	36.7	36.5	36.3	1.55	1.61	1.62	1.61	1.57
193	4.4	7.6	6.7	6.9	5.3	15.5	16	16	15.9	15.8	35.6	36.1	36	36	35.9	1.52	1.54	1.55	1.55	1.53
204	4	5.3	4.3	7.5	6.2	15.5	15.8	15.7	15.7	15.6	35.5	35.8	35.7	35.7	35.6	1.51	1.51	1.51	1.52	1.51
218	2.5	4.3	4.1	4.7	6.9	15.4	15.7	15.7	15.7	15.6	35.4	35.7	35.7	35.8	35.6	1.5	1.51	1.51	1.51	1.51
294	3	5.3	4.2	5.4	6.5	15.4	15.8	15.7	15.8	15.6	35.5	35.8	35.7	35.8	35.6	1.5	1.51	1.51	1.52	1.52
219	2.7	4.6	4.3	4.5	6.7	15.4	15.7	15.7	15.7	15.6	35.4	35.7	35.7	35.7	35.6	1.5	1.51	1.51	1.51	1.51
199	3.8	5.8	4.1	7.7	6	15.5	15.8	15.8	15.8	15.6	35.5	35.9	35.8	35.8	35.7	1.51	1.51	1.51	1.52	1.52
184	3.8	5.3	6.1	7.1	7.2	15.5	15.9	15.8	15.8	15.7	35.6	36	35.8	35.8	35.7	1.51	1.52	1.52	1.53	1.52
186A	4	5.8	6.7	7.1	7.3	15.6	16	15.9	15.9	15.8	35.6	36	35.9	35.9	35.8	1.51	1.52	1.53	1.54	1.52
106A	7.6	11.9	12	11.6	15.5	17.1	18.8	18.4	19.6	20.6	37.1	38.9	38.5	39.7	40.6	1.51	1.52	1.52	1.53	1.53
135	8.1	11	9.2	10.3	15.3	17	18.7	18.1	19	19	37.1	38.7	38.2	39.1	39.1	1.51	1.52	1.52	1.52	1.52
291	3.1	5.2	4	4.8	7.4	15.6	16.1	16	16.1	16.1	35.6	36.1	36	36.1	36.2	1.5	1.51	1.51	1.51	1.51
293	3.2	5.8	4.7	5.8	8.1	15.6	16.2	16.1	16.2	16.2	35.6	36.2	36.1	36.2	36.3	1.5	1.51	1.51	1.51	1.51
213	2.8	5.1	4.1	5.7	8.6	15.7	16.3	16.1	16.3	16.3	35.7	36.3	36.1	36.3	36.3	1.5	1.51	1.51	1.51	1.51
198	6.5	12.2	10.4	9.7	6.9	16.2	17	16.9	16.3	16	36.2	37.1	37	36.4	36	1.55	1.6	1.62	1.53	1.52
48	10.9	16.8	11.8	11.6	12.8	16.9	18.2	17.7	16.8	16.4	37	38.4	37.9	36.9	36.5	1.61	1.7	1.69	1.56	1.53

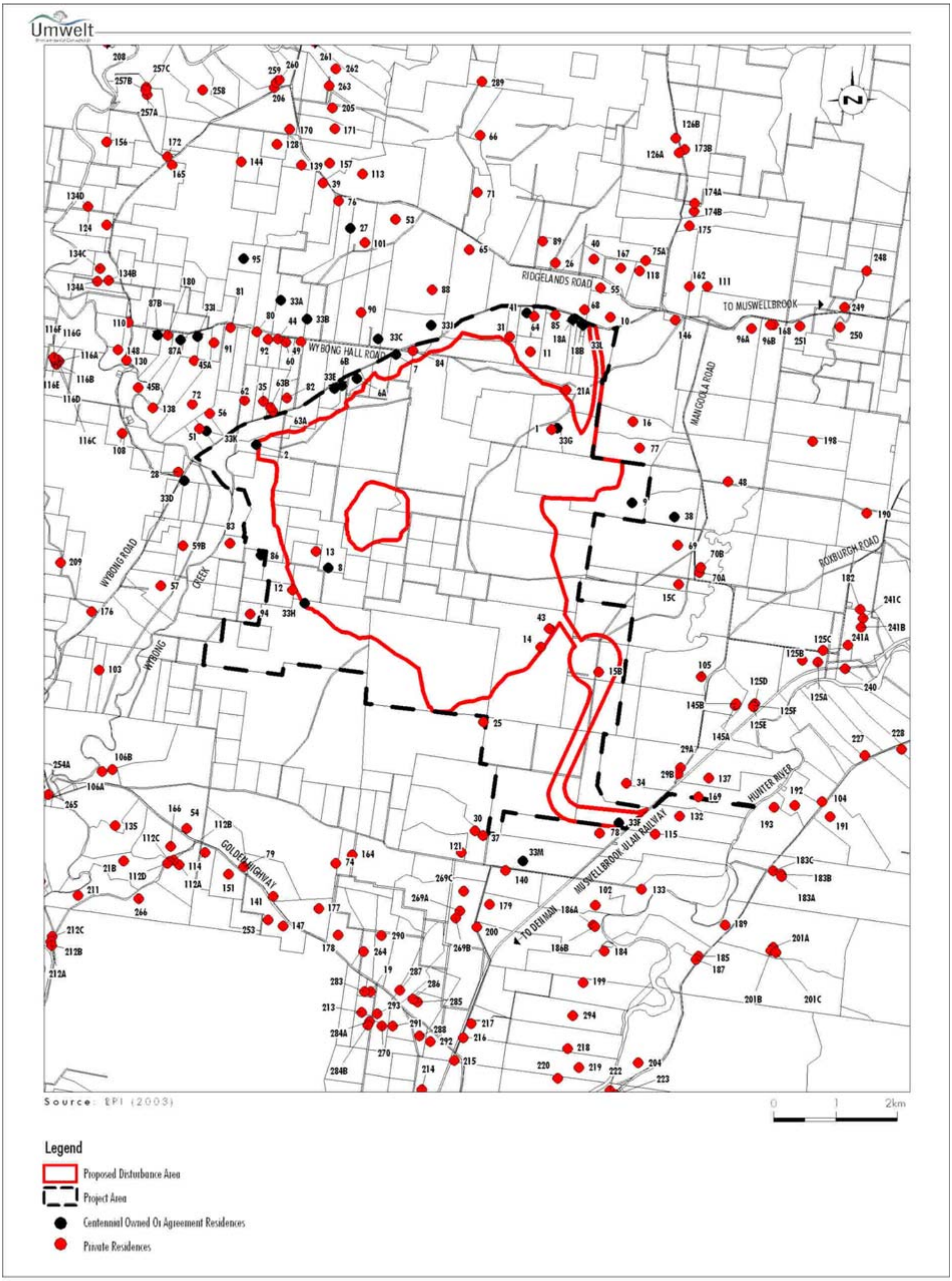
ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
96A	6.5	10.5	11.9	7.8	8.4	16.4	17.5	17.2	16.8	16.5	36.5	37.6	37.3	36.9	36.6	1.53	1.54	1.56	1.52	1.51
168	8.1	12	12	9.5	8.4	16.3	17.3	17.1	16.7	16.4	36.3	37.4	37.2	36.7	36.4	1.52	1.54	1.55	1.52	1.51
251	5.4	10.1	11.5	7.5	8.2	16.2	17.1	16.8	16.5	16.2	36.2	37.2	36.9	36.6	36.3	1.52	1.54	1.55	1.52	1.51
250	5.9	10.1	9.8	8.8	8.4	15.9	16.7	16.5	16.2	16	36	36.7	36.6	36.3	36.1	1.52	1.53	1.54	1.52	1.51
249	4.8	9.2	10	7.5	7.9	15.9	16.7	16.5	16.3	16	36	36.8	36.5	36.3	36.1	1.52	1.53	1.54	1.51	1.51
248	4.2	6.6	7.2	5	6.9	15.9	16.6	16.4	16.2	16	35.9	36.6	36.4	36.2	36	1.51	1.52	1.52	1.51	1.51
289	4.8	11.1	8.4	5.9	6.3	16.2	16.9	16.8	16.3	16.1	36.3	37	36.9	36.4	36.2	1.51	1.52	1.52	1.51	1.51
205	7.5	11.9	7.2	7.5	7.9	16.1	16.9	16.9	16.3	16	36.2	36.9	36.9	36.3	36.1	1.51	1.52	1.52	1.51	1.51
206	7.1	10.7	9	6.2	6.6	16	16.7	16.6	16.1	15.9	36	36.8	36.7	36.2	36	1.51	1.52	1.52	1.51	1.51
207	6.4	9.9	8.2	6.6	5.3	16	16.5	16.3	15.9	15.8	36	36.5	36.4	36	35.8	1.51	1.52	1.52	1.51	1.51
208	7.9	14.1	9.1	7.1	7.3	15.9	16.6	16.5	15.9	15.7	35.9	36.6	36.6	36	35.7	1.51	1.52	1.53	1.51	1.51
134C	9.8	20.2	18.7	17.2	17.3	18.1	20	19.6	17.8	17.2	38.2	40.2	39.8	37.9	37.3	1.6	1.67	1.66	1.56	1.53
209	12	19.9	22.3	20.6	30.8	18.9	21.4	21.8	22.3	22	38.9	41.5	41.9	42.4	42.2	1.53	1.56	1.56	1.59	1.62
103	9.5	16.4	17.7	21	37.7	18.6	21.9	21.5	22.8	26.4	38.6	42	41.6	42.9	46.6	1.52	1.54	1.54	1.55	1.57
210	6.1	10.4	9	8.9	13.8	16.7	18.3	17.8	18.6	18.5	36.7	38.3	37.8	38.7	38.5	1.51	1.52	1.51	1.52	1.52
211	5.8	8.6	6.7	7.1	11.6	16.3	17.4	17	17.4	17.3	36.4	37.4	37	37.5	37.3	1.51	1.51	1.51	1.51	1.51
212A	4.8	7.7	6.1	6.4	10.8	16.1	17	16.6	17	16.8	36.1	37	36.7	37	36.9	1.51	1.51	1.51	1.51	1.51
214	2	3.6	2.9	3.9	5	15.4	15.8	15.7	15.8	15.8	35.4	35.8	35.7	35.8	35.8	1.5	1.51	1.51	1.51	1.51
224B	4.2	5.3	4.5	7.3	6.4	15.4	15.8	15.7	15.6	15.6	35.5	35.8	35.7	35.7	35.6	1.5	1.51	1.51	1.52	1.51
83	17.2	25.4	31.7	41.9	**54.3**	22.6	27.4	29.8	**37.1**	**37.8**	42.8	47.7	50.2	57.8	62.1	1.57	1.69	1.71	1.93	3.14
77	16.4	28.2	26	15.9	14.7	19	22.3	21.4	19.1	18.1	39.3	42.8	41.9	39.3	38.3	1.69	1.88	1.87	1.57	1.54
116A	13	17.3	19.1	17.7	15.9	17.8	19.9	20.3	20.3	18.5	37.9	40.1	40.6	40.5	38.6	1.57	1.64	1.69	1.69	1.59
116B	13.2	18.7	18.7	18.2	16.2	17.8	19.9	20.3	20.3	18.6	37.9	40.1	40.5	40.6	38.8	1.56	1.64	1.69	1.69	1.6
265	6.1	9	9.3	9.3	11	16.7	18.1	17.7	18.6	19.3	36.7	38.1	37.8	38.6	39.3	1.51	1.52	1.52	1.52	1.53
269B	3.8	6.8	5.5	7.6	10	15.8	16.4	16.3	16.5	16.6	35.8	36.5	36.3	36.6	36.7	1.51	1.51	1.51	1.51	1.52
269C	3.9	6.3	5.2	7.4	11.6	15.8	16.3	16.2	16.5	16.4	35.8	36.3	36.3	36.5	36.5	1.51	1.51	1.51	1.52	1.53
25	11.8	17.5	16.5	26.3	21.2	17.6	19.9	19.1	19.8	19.3	37.7	41.2	39.7	40.8	39.5	1.52	1.65	1.67	1.85	1.65
96B	8.1	12.1	11.9	9.6	8.4	16.3	17.3	17.1	16.7	16.4	36.3	37.4	37.2	36.7	36.4	1.52	1.54	1.56	1.52	1.51
284A	2.8	5.5	4.5	5.6	8.1	15.6	16.2	16	16.2	16.2	35.6	36.2	36.1	36.2	36.2	1.5	1.51	1.51	1.51	1.51
270	3.4	5.9	4.4	5.3	7.7	15.6	16.1	16	16.1	16.2	35.6	36.2	36	36.2	36.2	1.5	1.51	1.51	1.51	1.51
284B	2.8	5.5	4.5	5.5	8.1	15.6	16.2	16	16.2	16.2	35.6	36.2	36.1	36.2	36.2	1.5	1.51	1.51	1.51	1.51
273B	3.2	6.2	5.6	6.2	5.7	15.5	15.9	15.8	15.7	15.6	35.5	35.9	35.8	35.7	35.6	1.52	1.54	1.54	1.54	1.52
273C	3.8	6.7	6.5	6.3	4.9	15.5	15.9	15.8	15.7	15.5	35.5	35.9	35.9	35.7	35.6	1.52	1.55	1.55	1.54	1.52
275	3	6.1	5.6	6.3	6.2	15.5	15.9	15.8	15.7	15.6	35.5	36	35.9	35.8	35.7	1.52	1.55	1.55	1.54	1.53
295	4.1	8.8	7.5	5	6.4	15.6	16.1	16	15.7	15.5	35.6	36.2	36.1	35.8	35.5	1.52	1.54	1.55	1.52	1.51
252B	4.7	8.1	6.9	6.1	4.7	15.5	15.9	15.7	15.7	15.5	35.5	35.9	35.8	35.7	35.5	1.51	1.51	1.52	1.51	1.51
236C	3.8	6.8	6.4	6.8	5.7	15.5	15.9	15.8	15.8	15.6	35.5	36	35.9	35.8	35.6	1.52	1.55	1.55	1.54	1.53
19	2.9	5.1	4.7	6.5	9	15.7	16.3	16.2	16.3	16.4	35.7	36.4	36.2	36.4	36.4	1.5	1.51	1.51	1.51	1.51
283	3	5.3	4.3	6.4	8.8	15.7	16.4	16.2	16.4	16.4	35.7	36.4	36.2	36.4	36.4	1.5	1.51	1.51	1.51	1.51
273A	3.2	6.2	5.6	6.2	5.7	15.5	15.9	15.8	15.7	15.6	35.5	35.9	35.8	35.7	35.6	1.52	1.54	1.54	1.54	1.52
236B	3.1	6.2	5.8	6.4	6.2	15.5	15.9	15.9	15.8	15.7	35.5	36	35.9	35.8	35.7	1.52	1.55	1.55	1.54	1.53
235B	3.3	6.4	6	6.6	6	15.5	16	15.9	15.8	15.7	35.5	36	35.9	35.8	35.7	1.52	1.55	1.55	1.54	1.53
235C	3.3	6.5	6	6.7	6	15.5	16	15.9	15.8	15.7	35.5	36	35.9	35.8	35.7	1.52	1.55	1.55	1.54	1.53
29B	7	7.8	7.9	9.6	8.2	15.7	16.2	16.2	16.2	16	35.7	36.3	36.3	36.3	36.1	1.53	1.57	1.57	1.58	1.55
212B	4.7	8	6.2	6.6	11.3	16.1	17	16.7	17.1	16.9	36.1	37.1	36.7	37.1	36.9	1.51	1.51	1.51	1.51	1.51
212C	5	7.8	6.2	6.5	10.8	16.1	17	16.7	17	16.9	36.1	37	36.7	37.1	36.9	1.51	1.51	1.51	1.51	1.51
112B	7.1	11	10	12.2	14.4	16.8	18.7	17.9	19	18.4	36.9	38.7	38	39	38.5	1.51	1.52	1.52	1.52	1.52
112C	6.9	11.1	9.8	12	14.4	16.8	18.7	17.9	18.9	18.4	36.8	38.7	37.9	39	38.5	1.51	1.52	1.52	1.52	1.52
112D	6.8	11	9.7	11.9	14.3	16.8	18.6	17.9	18.9	18.4	36.8	38.7	37.9	38.9	38.4	1.51	1.52	1.52	1.52	1.52
116C	12.9	17	19.1	17.5	15.8	17.8	19.9	20.3	20.2	18.4	37.9	40	40.5	40.5	38.6	1.57	1.64	1.69	1.69	1.59

ID	Maximum 24-hour average PM10 – project only					Annual average PM10 - cumulative					Annual average TSP - cumulative					Annual average dust deposition - cumulative				
	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20	Year 2	Year 5	Year 10	Year 15	Year 20
116D	13	18	18.9	17.9	16	17.8	19.9	20.3	20.3	18.6	37.9	40.1	40.5	40.5	38.7	1.56	1.64	1.69	1.69	1.59
116E	12.9	17.2	19	17.5	15.9	17.8	19.9	20.3	20.2	18.5	37.9	40	40.5	40.4	38.6	1.56	1.64	1.69	1.69	1.59
116F	12.8	17	19.1	17.4	15.8	17.8	19.8	20.2	20.2	18.5	37.9	40	40.5	40.4	38.6	1.56	1.64	1.69	1.69	1.59
116G	12.6	16.6	19.1	17.1	15.6	17.8	19.8	20.2	20.1	18.4	37.8	40	40.4	40.4	38.5	1.57	1.64	1.69	1.68	1.59
186B	4	5.7	6.7	7.1	7.2	15.6	16	15.9	15.9	15.8	35.6	36	35.9	35.9	35.8	1.51	1.52	1.53	1.54	1.52
125E	6	9.5	10	8.1	7.6	15.9	16.7	16.6	16.6	16.2	36	36.8	36.7	36.7	36.3	1.54	1.61	1.62	1.61	1.58
145B	7.1	10.4	11.9	8.9	8.4	16	17	16.8	16.8	16.4	36.1	37.1	36.9	36.9	36.5	1.54	1.62	1.63	1.63	1.58
281B	3.7	6.7	5.8	7.6	7	15.7	16.4	16.2	16.4	16.3	35.7	36.4	36.2	36.4	36.3	1.5	1.51	1.51	1.51	1.51
281A	2.8	6.2	4.9	5.3	6.3	15.6	16.2	16	16.2	16.1	35.6	36.2	36	36.2	36.2	1.5	1.51	1.51	1.51	1.51

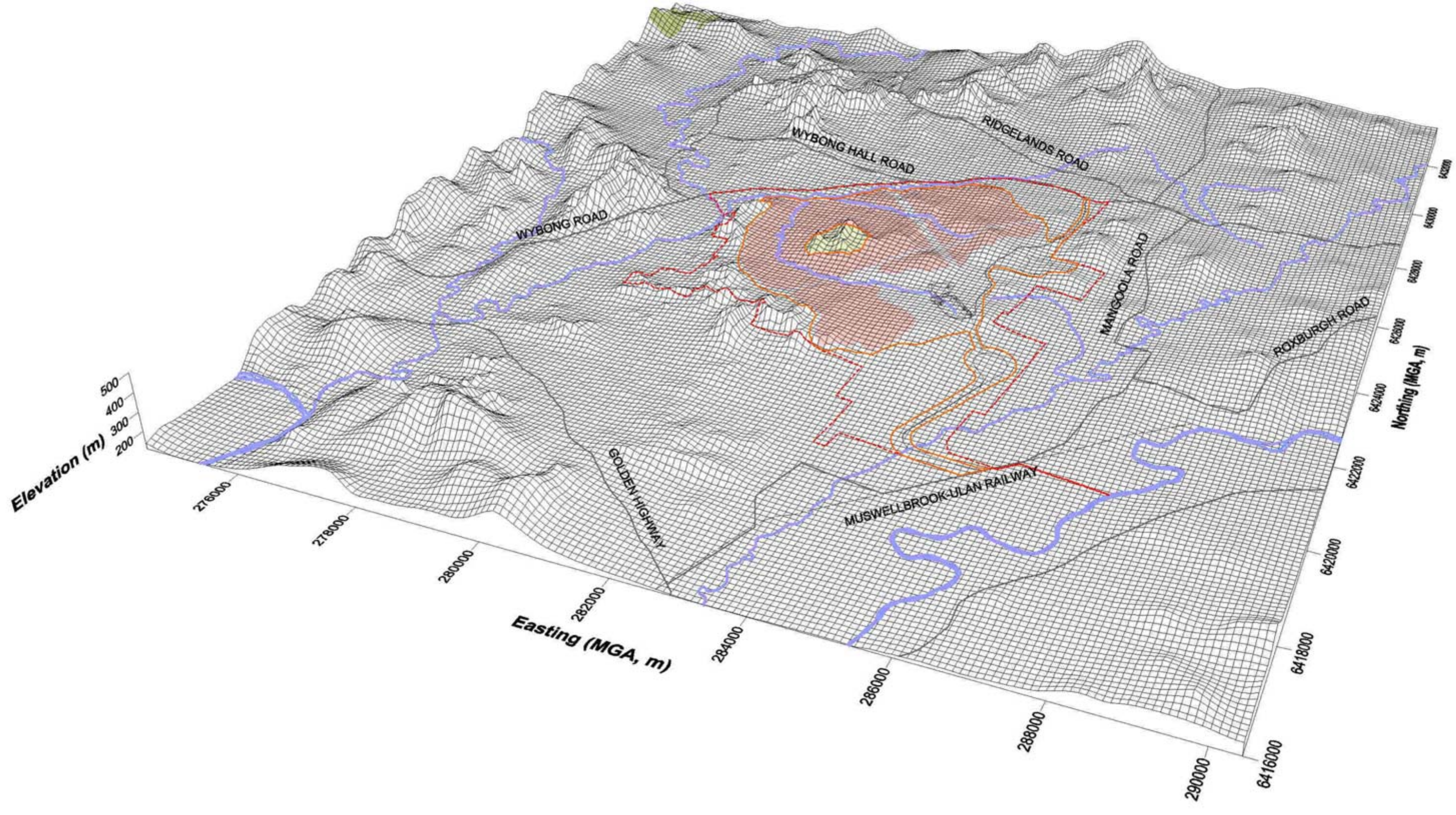
FIGURES



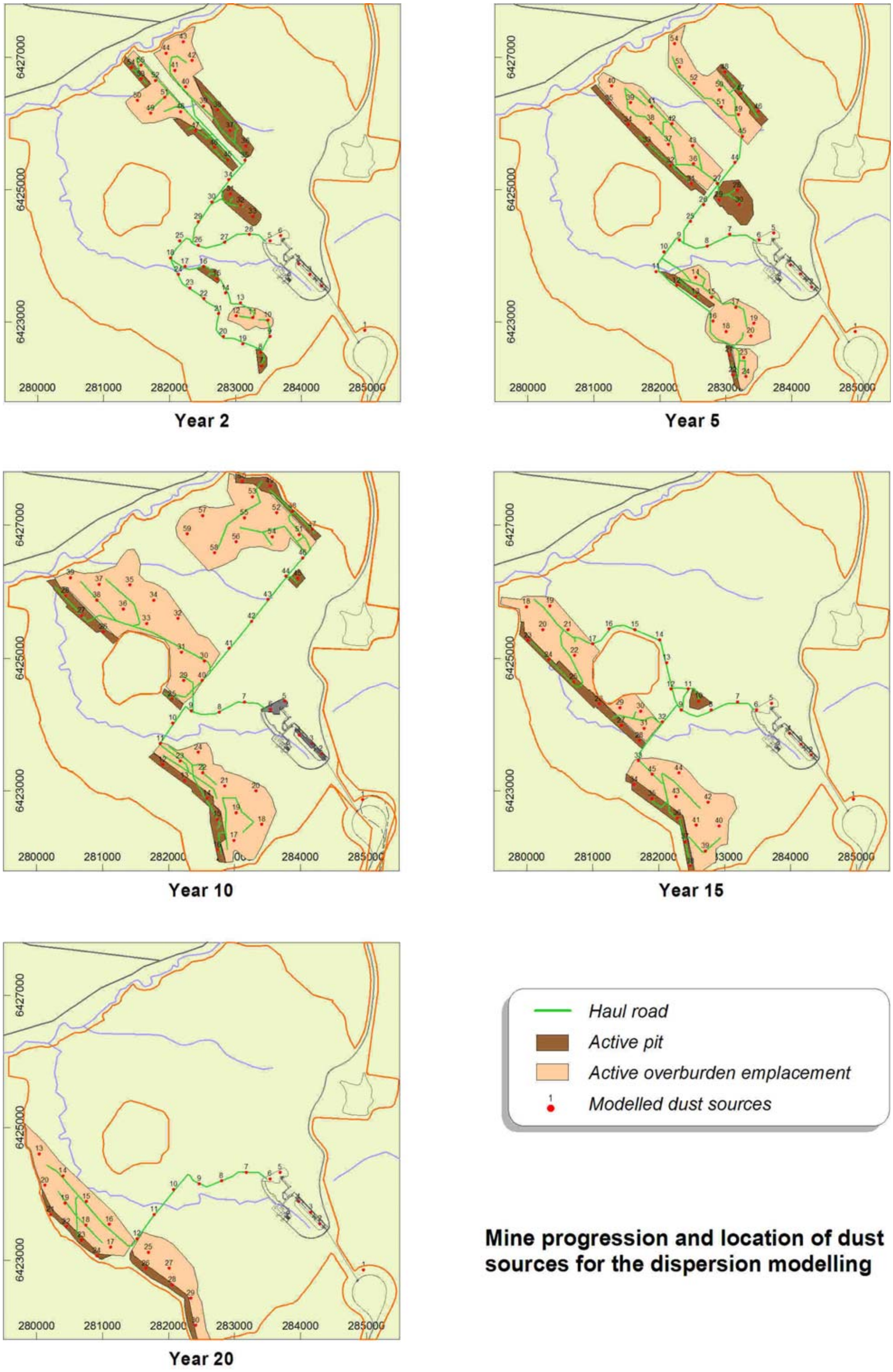
Location of Anvil Hill Project



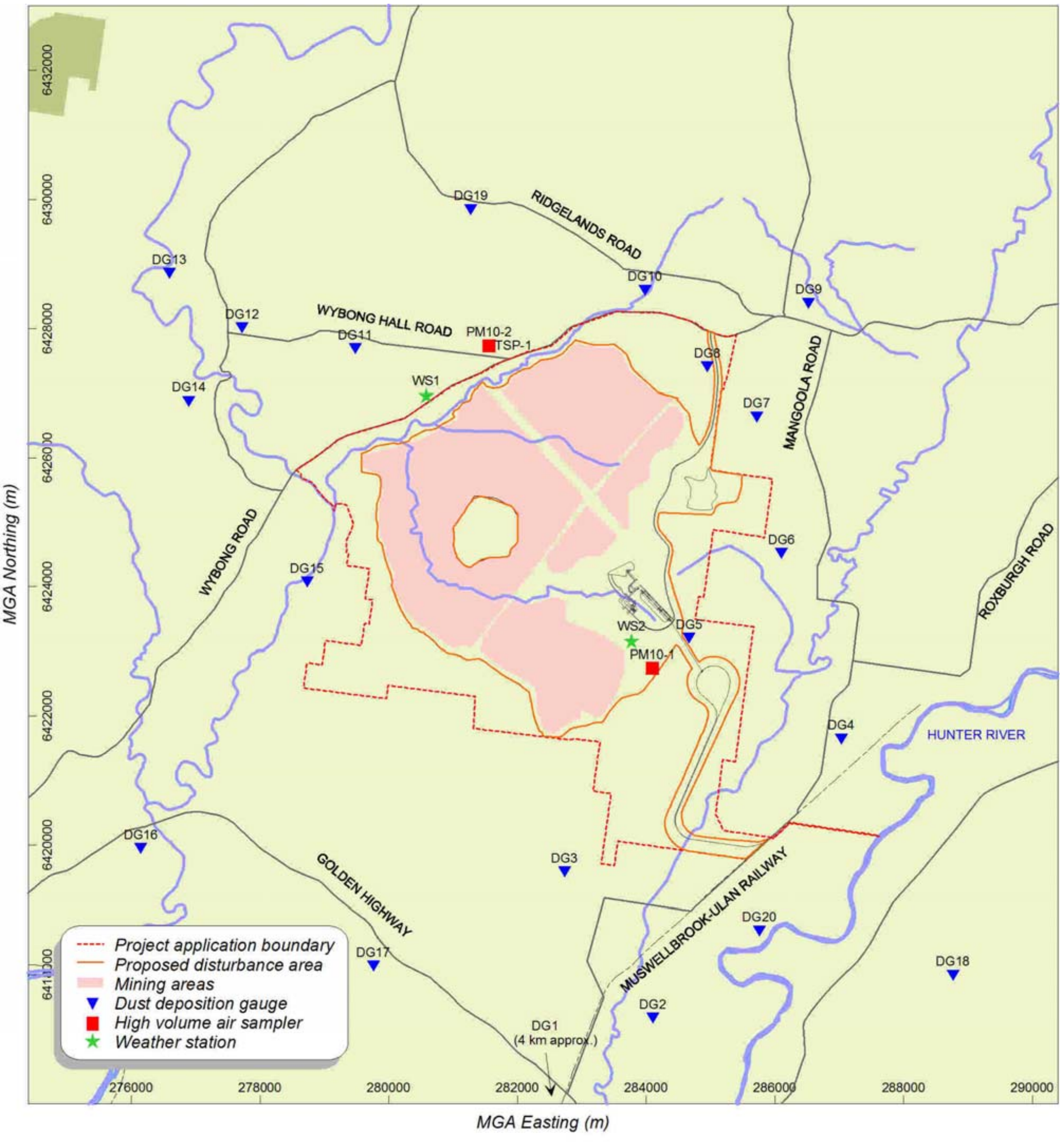
Residence locations and identification labels



Pseudo 3-dimensional representation of terrain in the study area



Mine progression and location of dust sources for the dispersion modelling



Monitoring for the Anvil Hill Project

Annual and seasonal windroses for Wybong Road (2002)

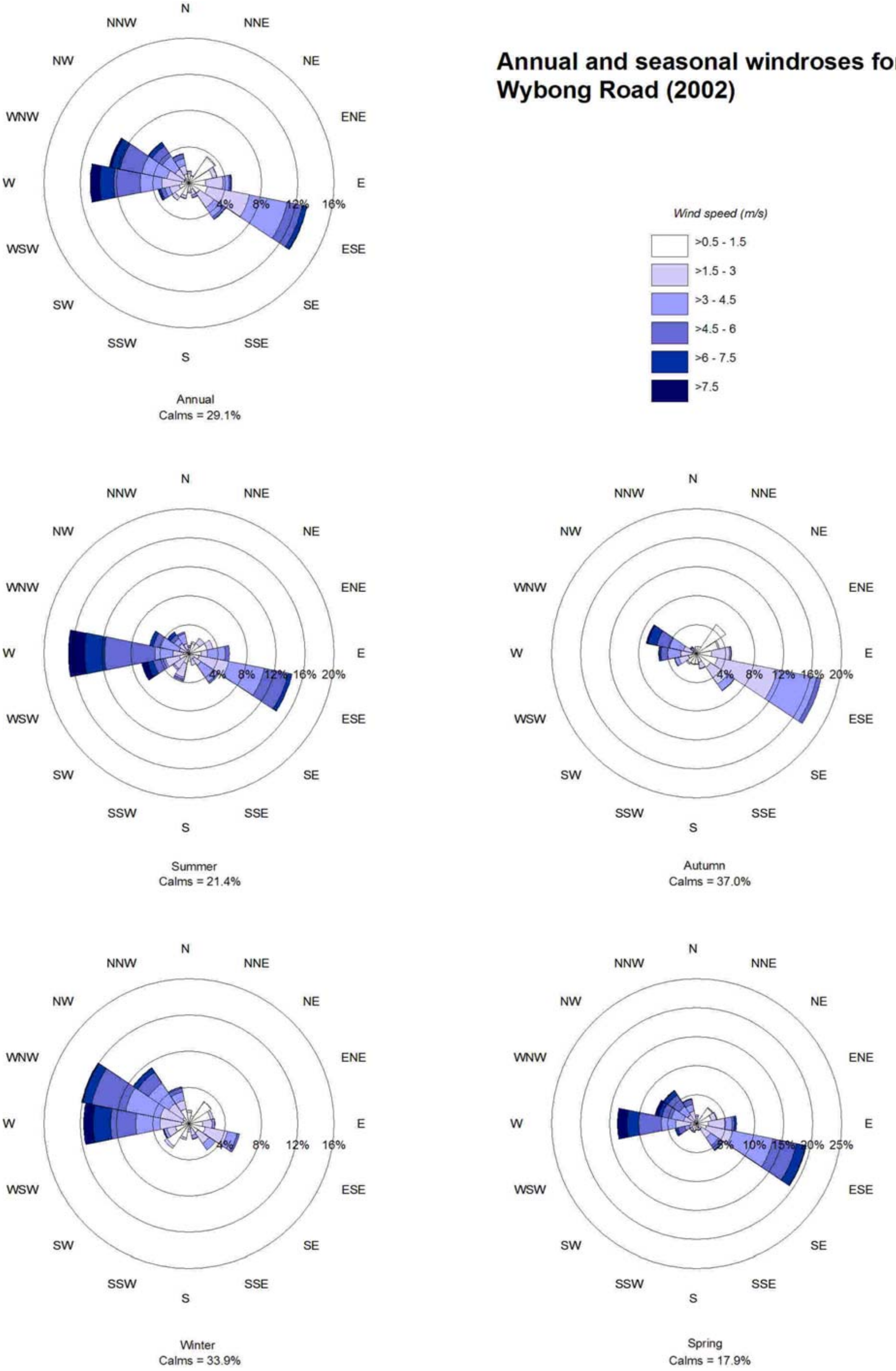
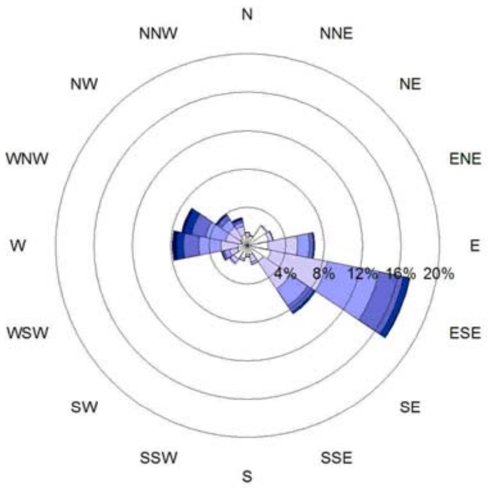
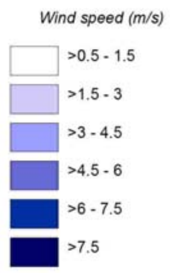


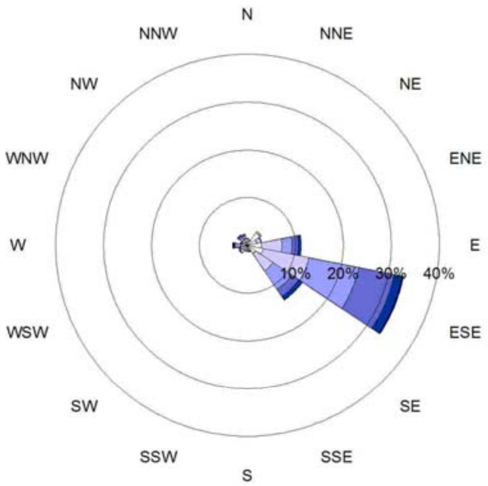
FIGURE 6

Annual and seasonal windroses for Wybong Road (2003)

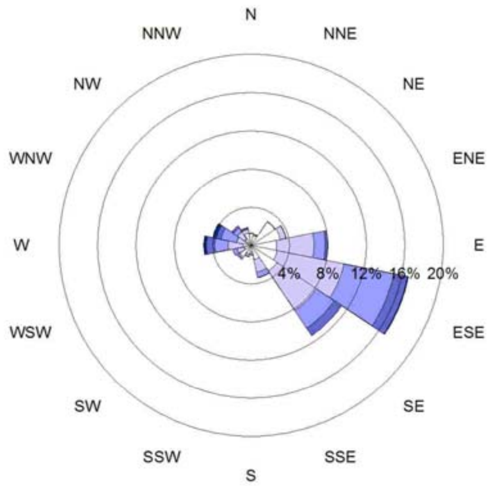


Annual
Calms = 27.7%

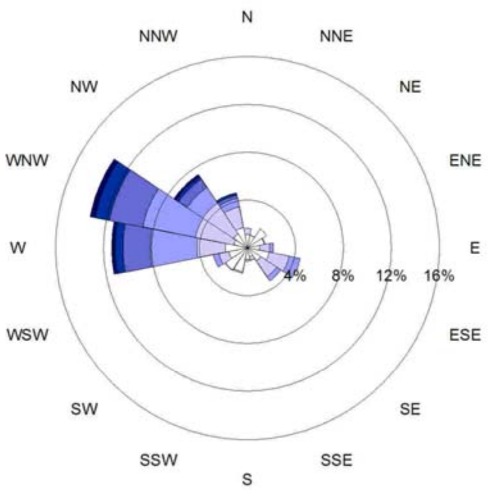




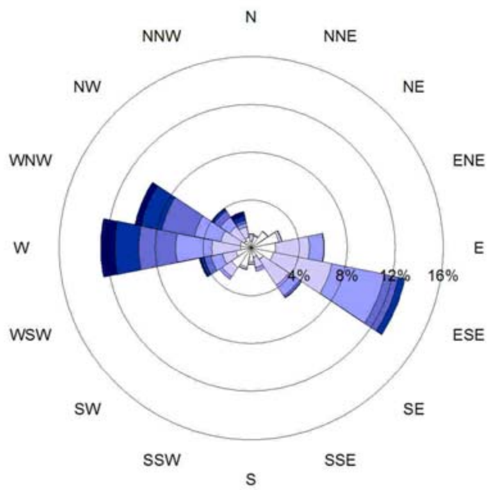
Summer
Calms = 15.2%



Autumn
Calms = 32.1%



Winter
Calms = 37.7%



Spring
Calms = 26.9%

FIGURE 7

Annual and seasonal windroses for Wybong Road (2004)

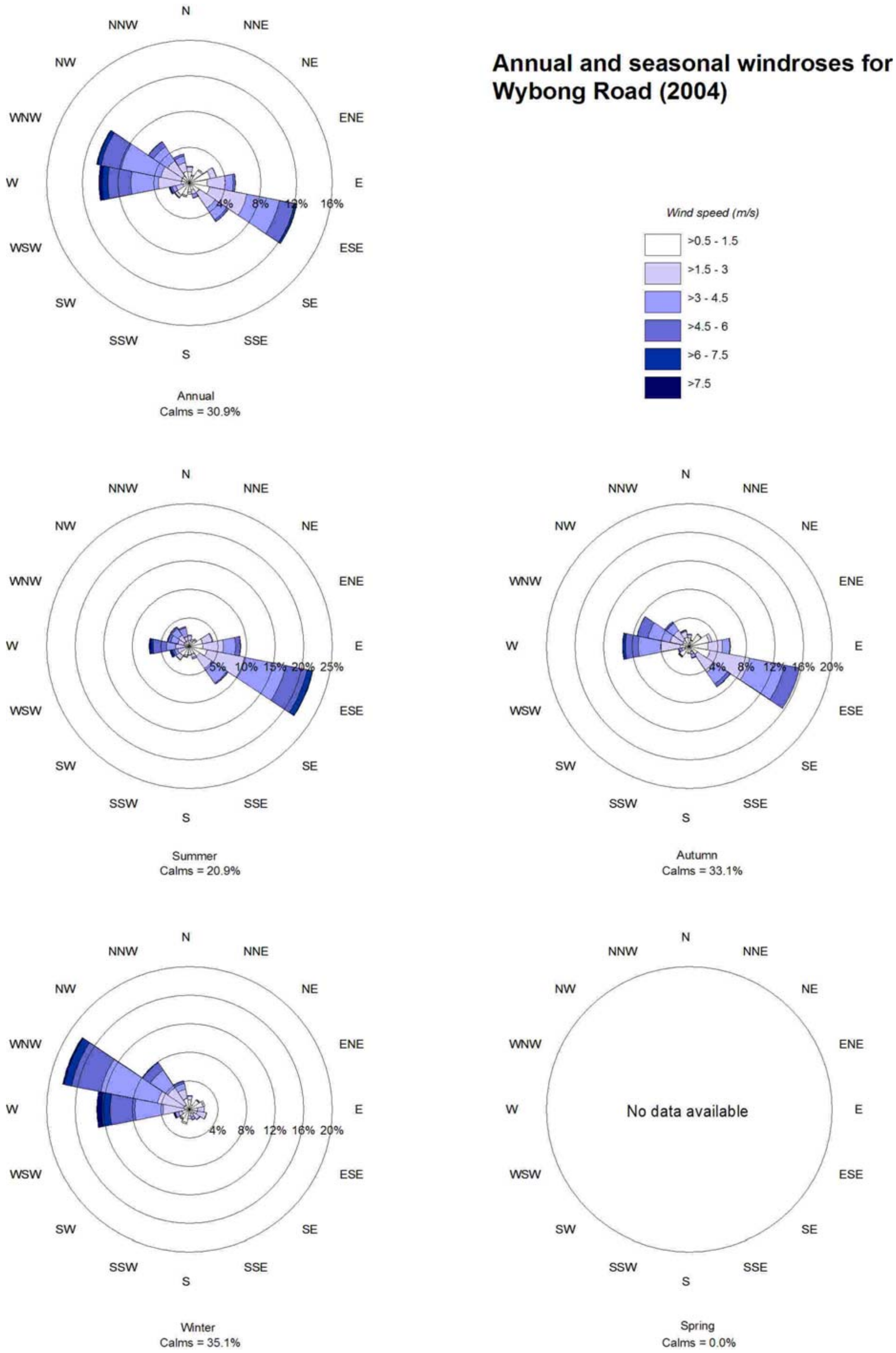
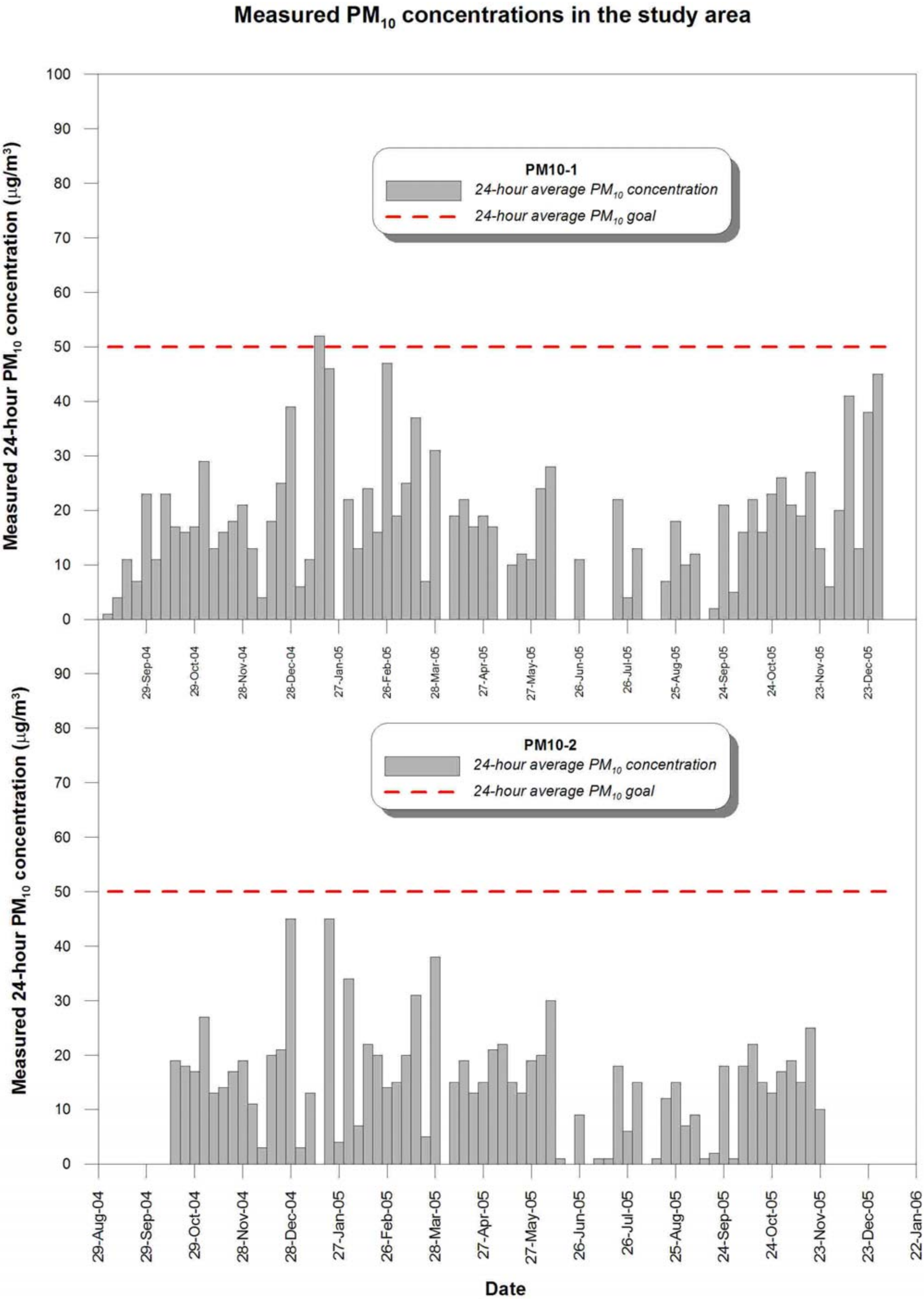
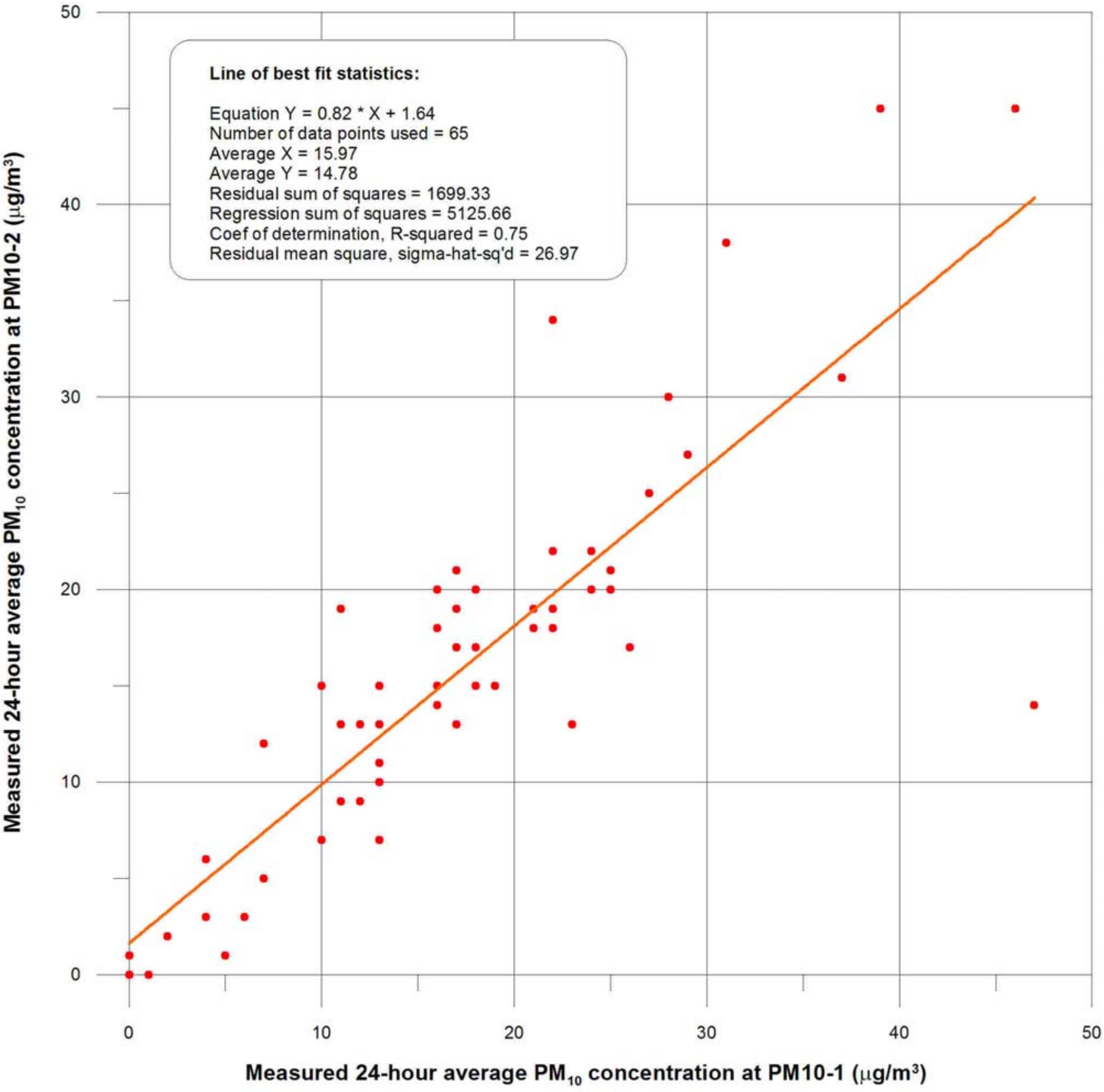


FIGURE 8

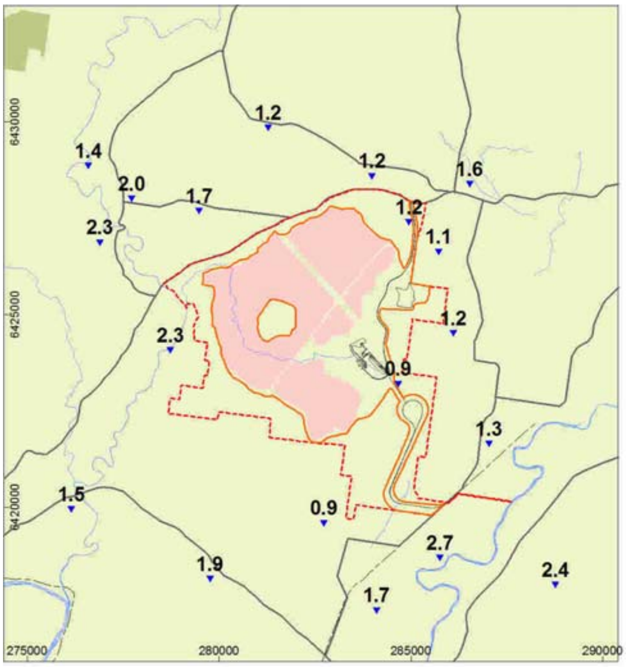


Measured PM10 concentrations in the study area
PM10-1
24-hour average PM10 concentration
24-hour average PM10 goal
PM10-2
24-hour average PM10 concentration
24-hour average PM10 goal
Measured 24-hour PM10 concentration (µg/m3)
Date
29-Aug-04
29-Sep-04
29-Oct-04
28-Nov-04
28-Dec-04
27-Jan-05
26-Feb-05
28-Mar-05
27-Apr-05
27-May-05
26-Jun-05
26-Jul-05
25-Aug-05
24-Sep-05
24-Oct-05
23-Nov-05
23-Dec-05
22-Jan-06

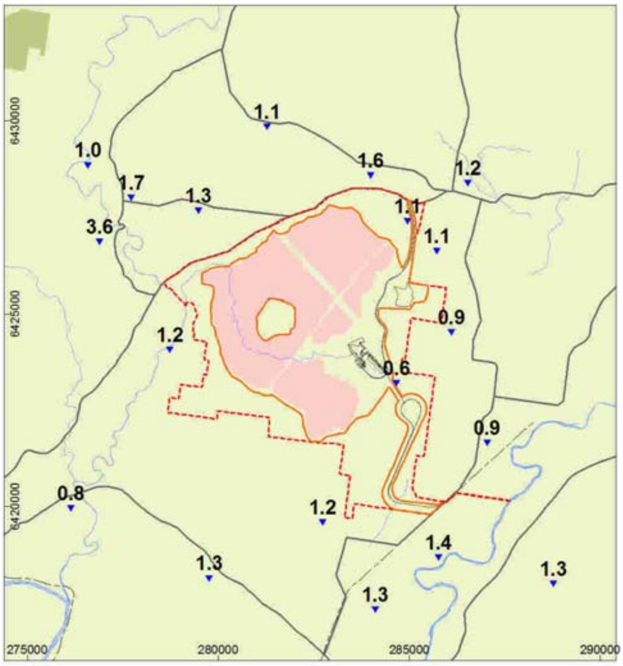
FIGURE 9



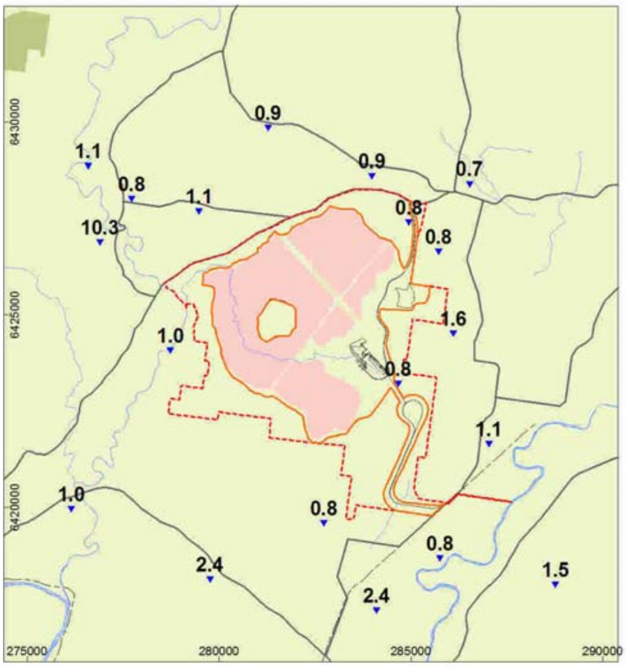
Correlation between PM_{10} concentrations at the two monitoring sites



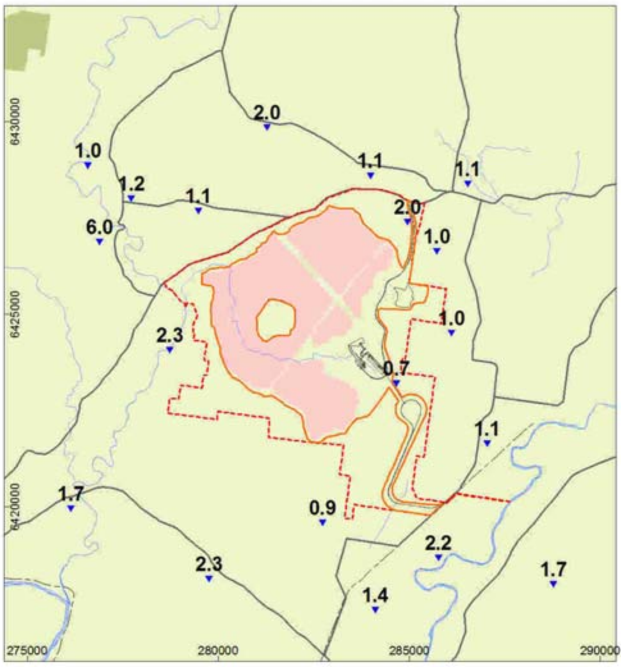
2002 (g/m^2)



2003 (g/m^2)



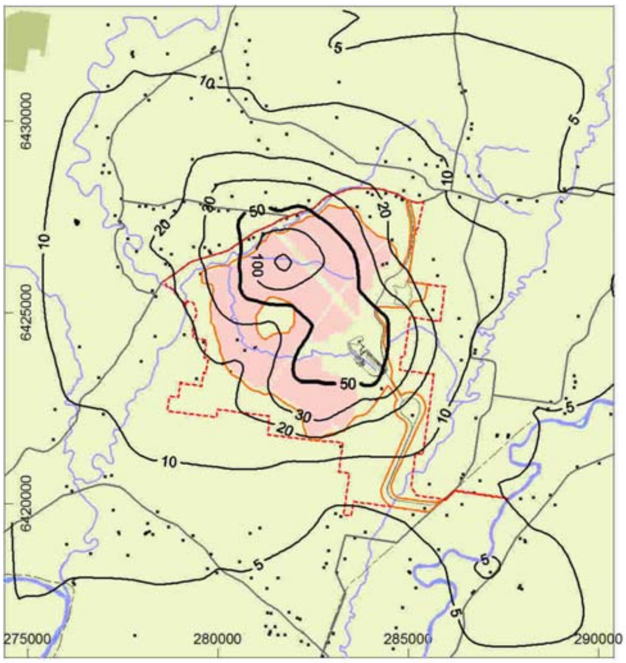
2004 (g/m^2)



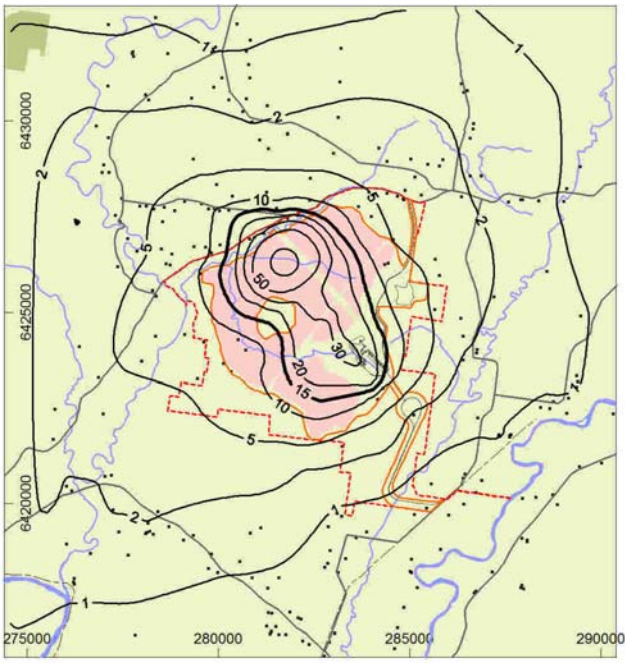
2005 (g/m^2)

Measured annual average dust deposition

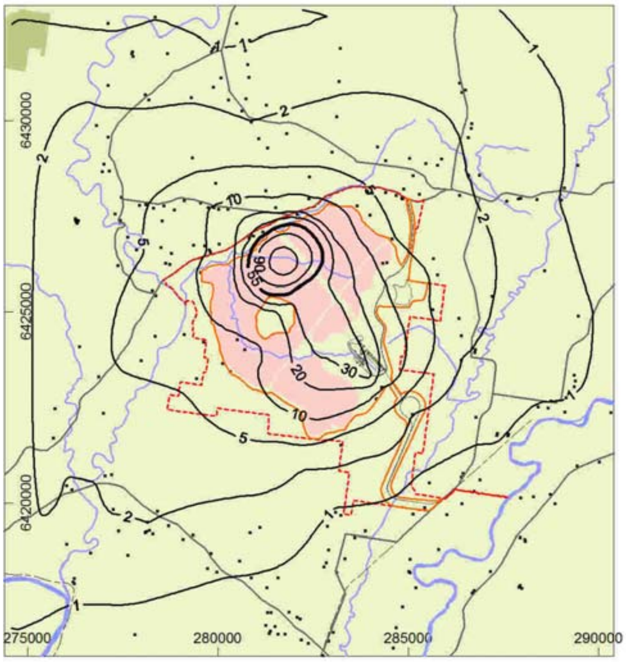
FIGURE 11



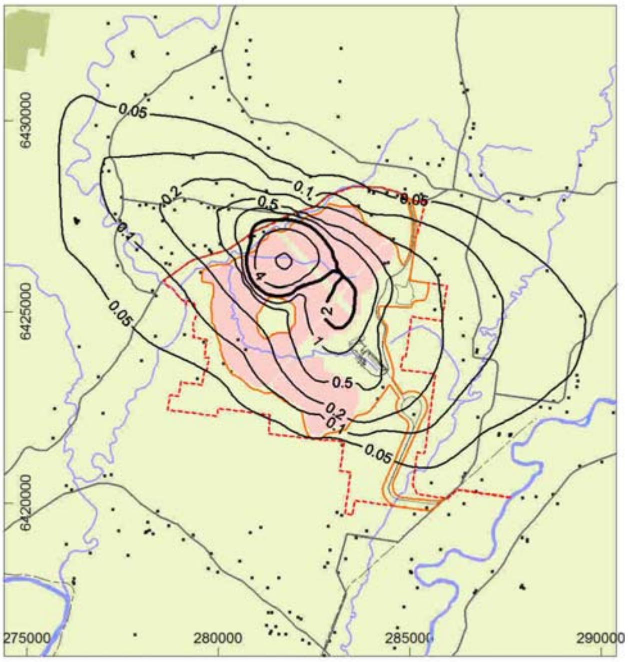
Maximum 24-hour average PM_{10} - μg/m^3



Annual average PM_{10} - μg/m^3



Annual average TSP - μg/m^3

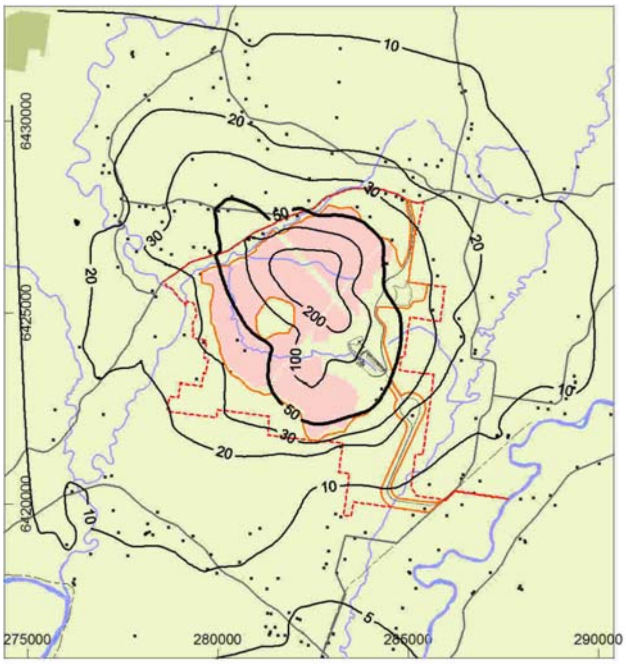


Annual average dust deposition - g/m^2/month

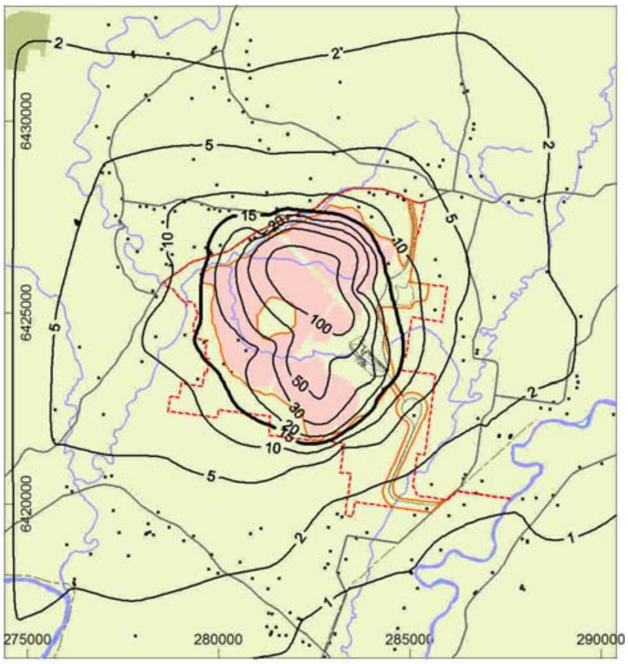
The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.

Dispersion model predictions for Year 2 mining operations

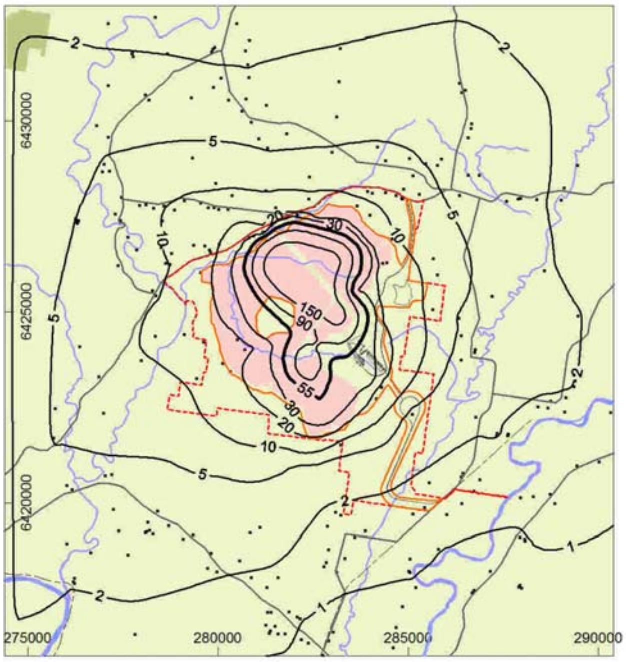
FIGURE 12



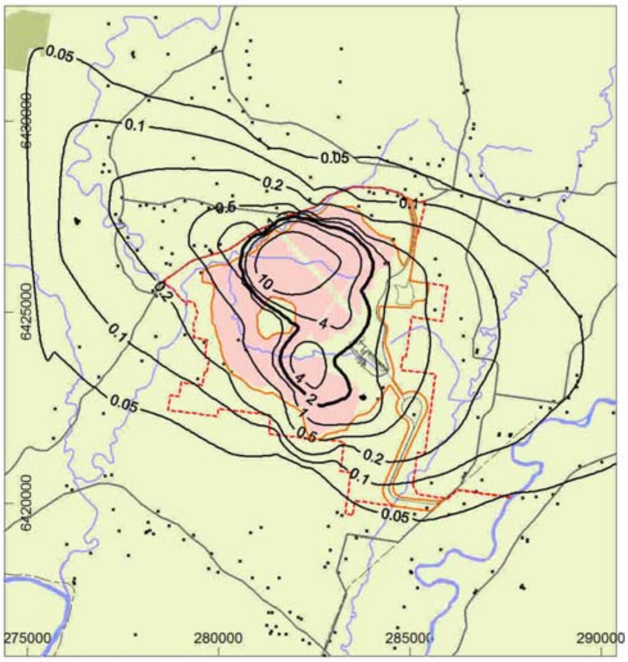
Maximum 24-hour average PM_{10} - µg/m^3



Annual average PM_{10} - µg/m^3



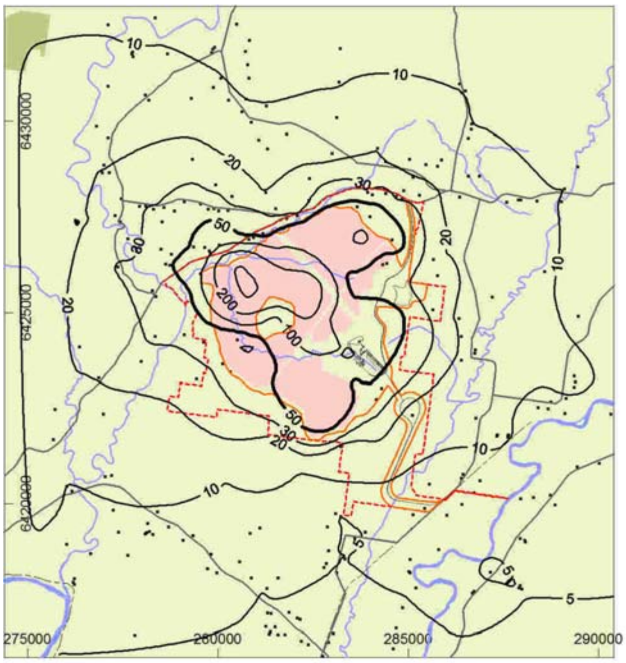
Annual average TSP - µg/m^3



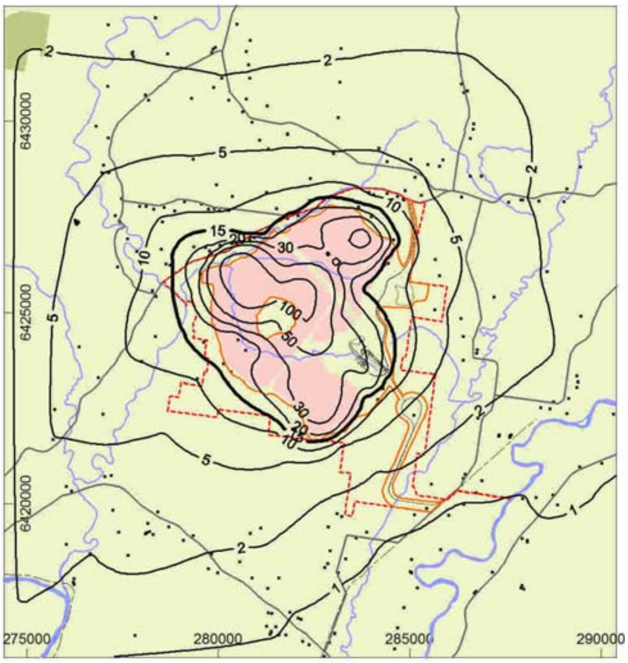
Annual average dust deposition - g/m^2/month

The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.

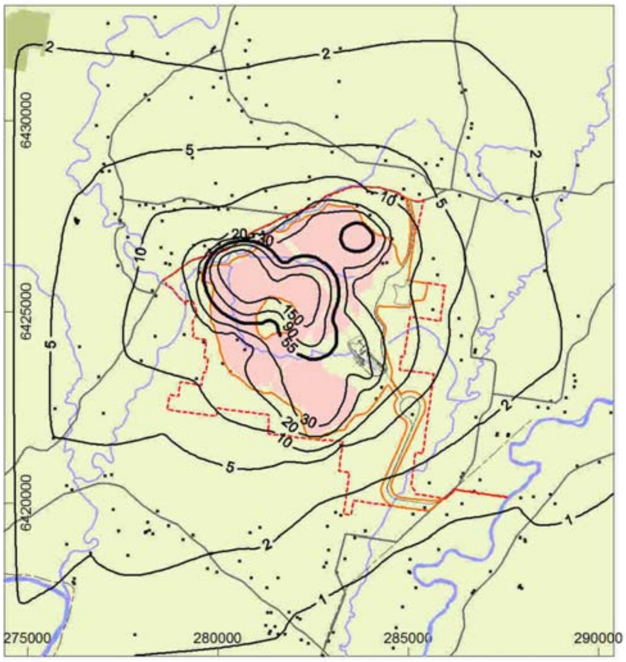
Dispersion model predictions for Year 5 mining operations



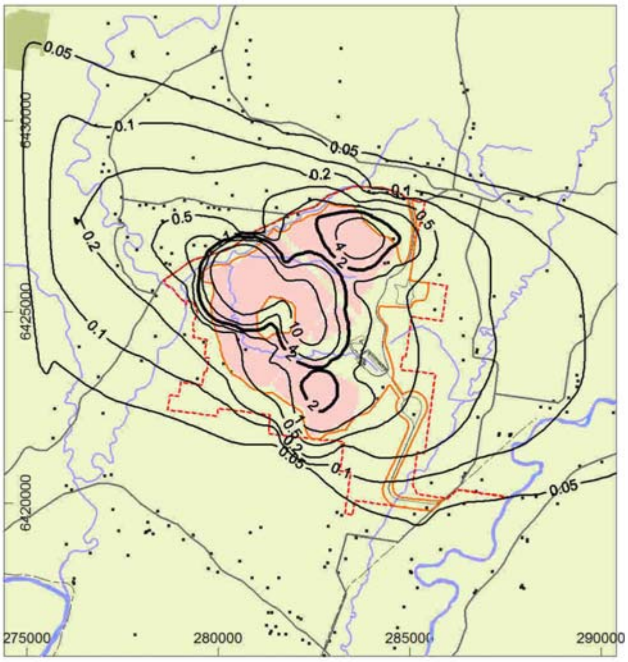
Maximum 24-hour average PM_{10} - µg/m^3



Annual average PM_{10} - µg/m^3



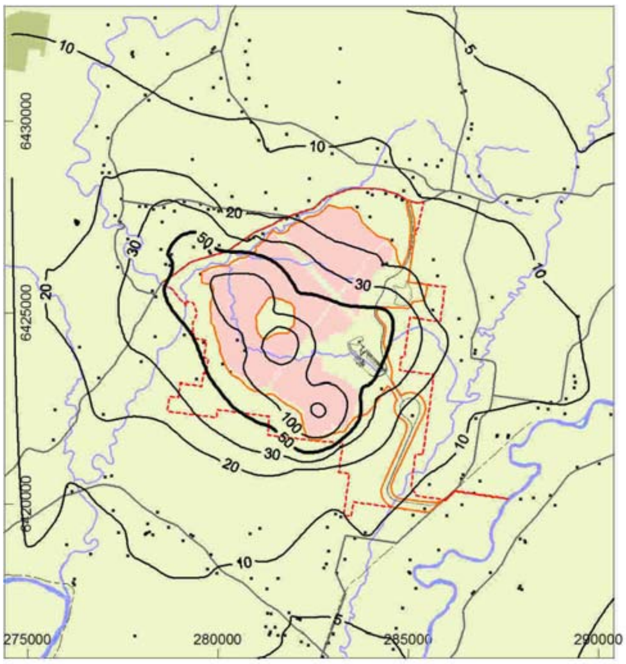
Annual average TSP - µg/m^3



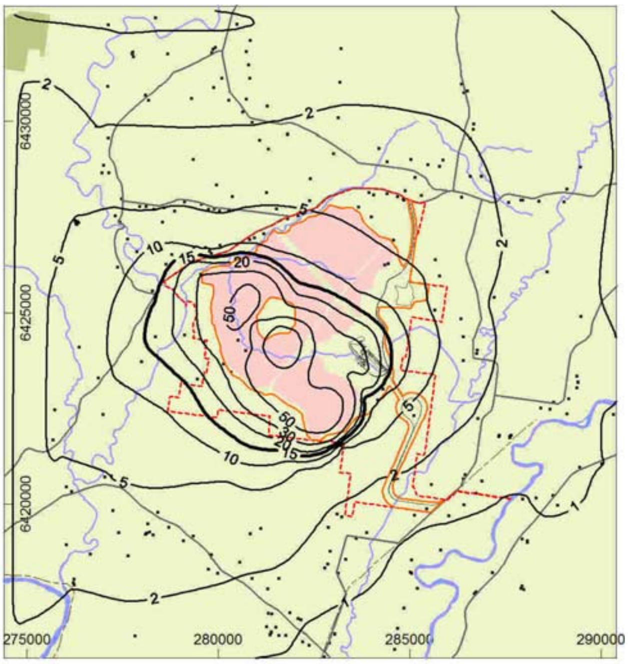
Annual average dust deposition - g/m^2/month

The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.

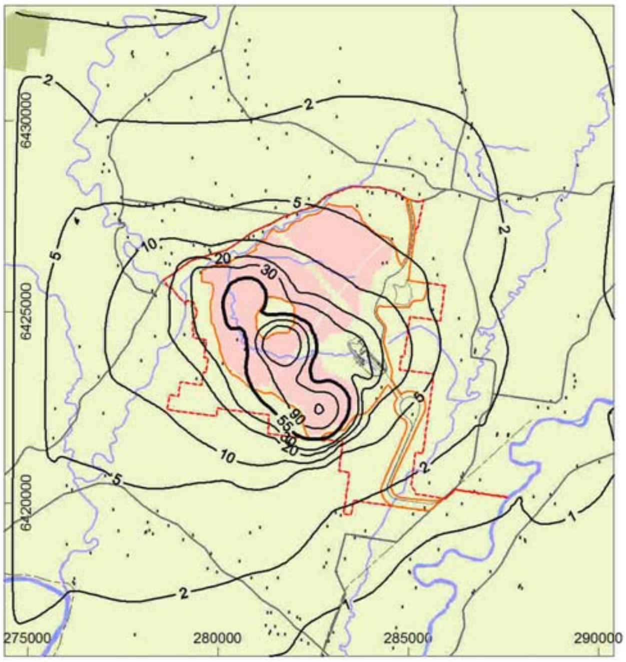
Dispersion model predictions for Year 10 mining operations



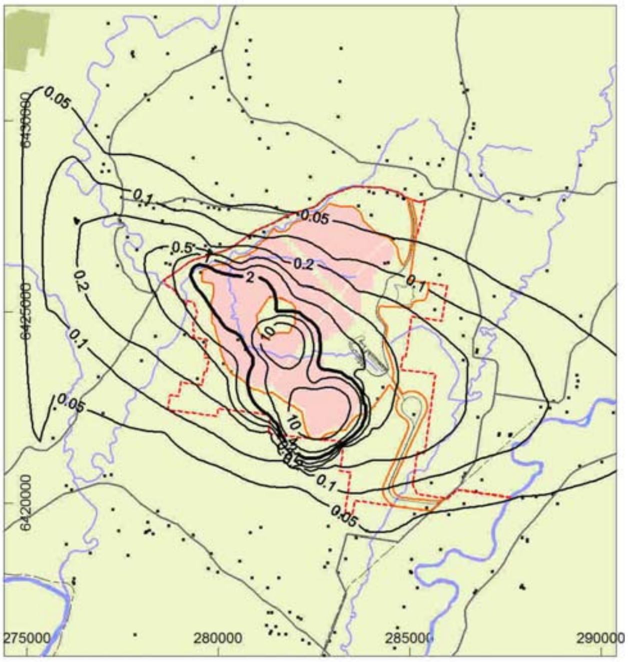
Maximum 24-hour average PM_{10} - µg/m^3



Annual average PM_{10} - µg/m^3



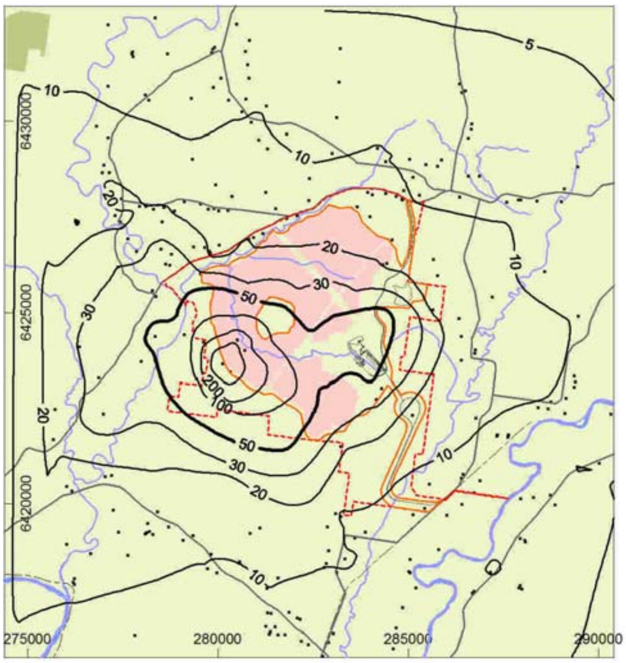
Annual average TSP - µg/m^3



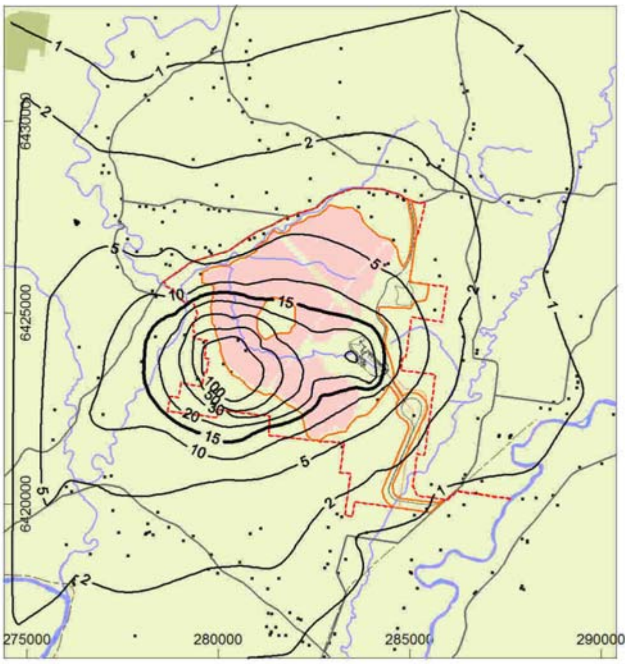
Annual average dust deposition - g/m^2/month

The enhanced contour lines represent the relevant air quality criteria, including the addition of background levels where relevant.

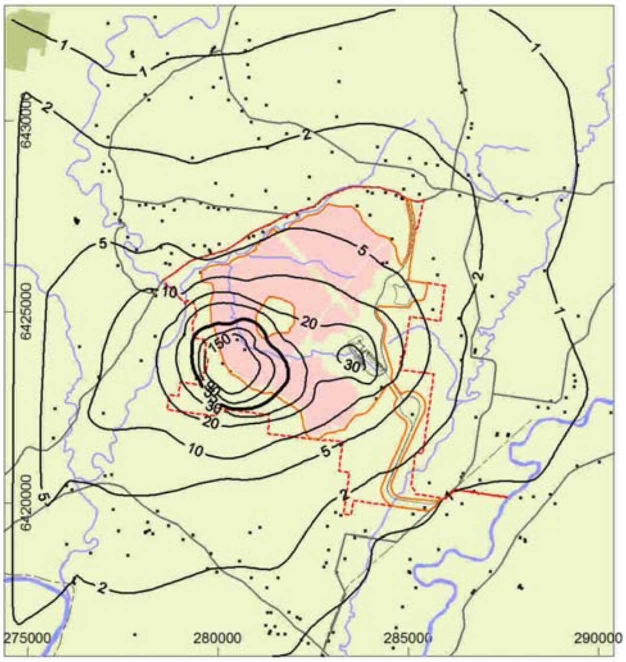
Dispersion model predictions for Year 15 mining operations



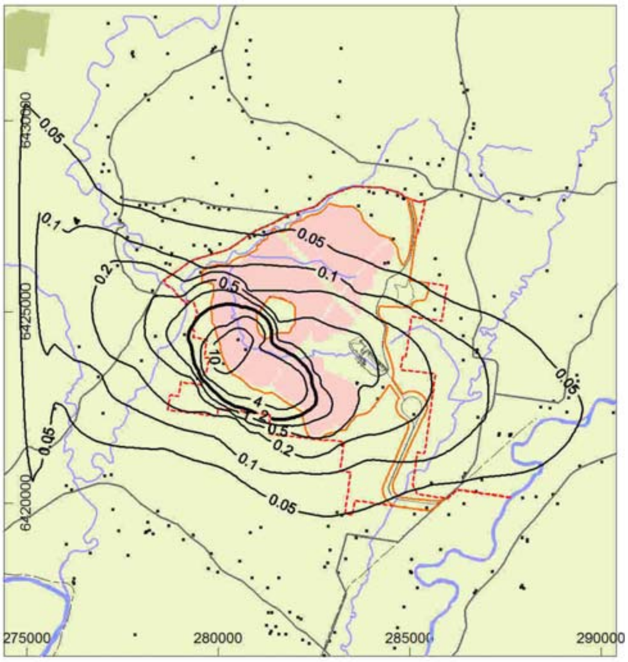
Maximum 24-hour average PM_{10} - µg/m^3



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.

Dispersion model predictions for Year 20 mining operations