HANCOCK PROSPECTING PTY LTD

Alpha Coal Project Supplementary Environmental Impact Statement

P | Coal Mine – Air Quality

Report

Alpha Coal Mine Project Air Quality Assessment - Supplementary Report

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Prepared for

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Introduction

1.1 Modifications to the Project Description

Since the release of the Environmental Impact Statement (EIS), updates have been made to the geological model whereby a more detailed understanding of the stratigraphy and coal quality of the proposed mine area is now known. Improvements have been made to coal recovery procedures to increase coal mining efficiency through the use of best industry practices thereby decreasing the percentage of coal loss. Furthermore, current Coal Handling and Preparation Plant (CHPP) yield (recovery) numbers are up to 4% greater on average than those presented in the EIS. This increase in recovery reflects the latest coal quality simulations from the ongoing drilling program. This updated information has enabled mining methods to be modified, which in turn have driven changes to the mine design, optimisation of mining output, a decrease operational costs and a reduced environmental footprint of mining activities.

The changes to mining methods and the mine design that impact on the air quality assessment are described below.

Table 1-1 Changes to the Mining Methods and Mine Design that Impact the Air Quality Assessment

Project Description Change	Result of Change	Advantage
Introduction of In-Pit Crushing and Conveying (IPCC)	Reduced overburden volumes requiring trucking	Reduction in wheel generated dust from unpaved roads
Coal mine layout changed due to updates to geological model, methods to mine modified	Reduced number of draglines, excavators and shovels	Reduction in dust from draglines, excavators and shovels
Increase in land bridges included in layout	Reduced travel distance for trucks Reduction in dragline rehandle	Reduction in wheel generated dust from unpaved roads Reduction in dust from dragline rehandle

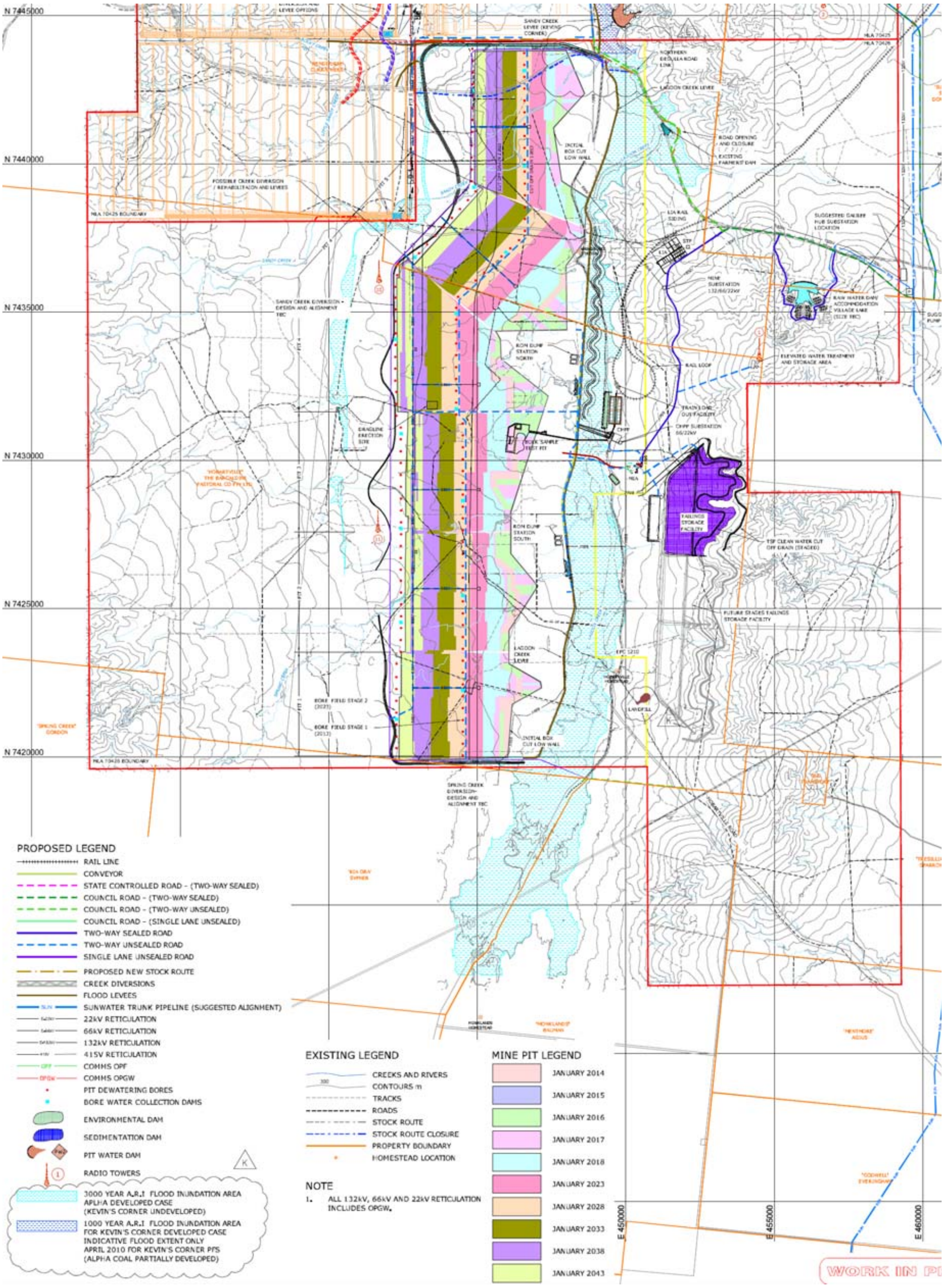
The Project will now consist of six open cut pits, instead of four, (totalling approximately 24 km in total length) oriented in a north-south direction along the centre of Mine Lease Application (MLA) 70426. The layout of the Alpha Coal Project (Mine) is presented in Figure 1-1.

In-pit Crushing and Conveying (IPCC) of overburden will now occur. The overburden will be crushed in the pit and conveyed to the overburden stockpiles, instead of being transported using trucks.

The process from the CHPP onwards remains unchanged, however it is expected the volumes of rejects and tailings will decrease due to increases in product yield. Predicted annual volumes of ROM coal and overburden are also expected to change due to the new mine layout.

The location of the Accommodation Village has also moved.

Figure 1-1 Layout of the Alpha Coal Project (Mine)



1.2 Modifications to the Meteorological Model

In the EIS it was identified that no meteorological monitoring stations recording hourly wind speed and direction, temperature, mixing height and stability class data were located in the vicinity of the Project. Accordingly the three-dimensional prognostic meteorological model The Air Pollution Model (TAPM), developed by the CSIRO (Hurley, 2005) was used to generate meteorological data for the site location.

TAPM grids were established for the region around the Project to simulate wind flows at 1 km resolution. Output data files were used as direct inputs to the CALMET meteorological model. The resultant three-dimensional wind fields from CALMET were used as inputs to the dispersion model CALPUFF.

In order to increase the accuracy of the meteorological modelling in the Supplementary Environmental Impact Statement (SEIS), meteorological measurements from the Bureau of Meteorology station located at the Emerald Airport (approximately 170 km from the Project site) were incorporated into TAPM and CALMET. This allowed for the observed data to nudge the model predictions making the model simulations more representative of local wind conditions. Two other BOM stations are in the region of the Project, the Clermont Sirius Street monitoring site (approximately 130 km from the Project site), and the Barcaldine Post Office monitoring site (approximately 135 km from the Project site). However, neither of these monitoring stations collects necessary parameters at a suitable sampling frequency for inclusion in the models.

In addition to supplementary monitoring data from Emerald Airport, the modelling has been increased from a 61 x 61 grid to 99 x 99 grid at 1 km resolution. This has allowed for the prediction of the dispersion of plumes over a larger area.

Further detail on the meteorological model setup is provided in Appendix A.

1.3 Modifications to the Air Quality Assessment Methodology

The methodology applied for the SEIS has not changed from the EIS. The pollutants modelled include TSP, PM_{10} and dust deposition. Emission rates for each dust source on site were derived using the methodology described in Section 2. The emission sources identified from the data provided by the Proponent were modelled for average and peak 24-hour emissions for the year.

Model results for PM_{10} were used to predict the impact of emissions of $PM_{2.5}$ from mine-related dust generating activities based on a conservative estimate of 20% of PM_{10} as $PM_{2.5}$.

Alpha Coal Project (Mine) Inventory

2.1 Emission Source

Dust emission sources associated with the Alpha Coal Project (mine) include (but may not be limited to):

Construction Phase:

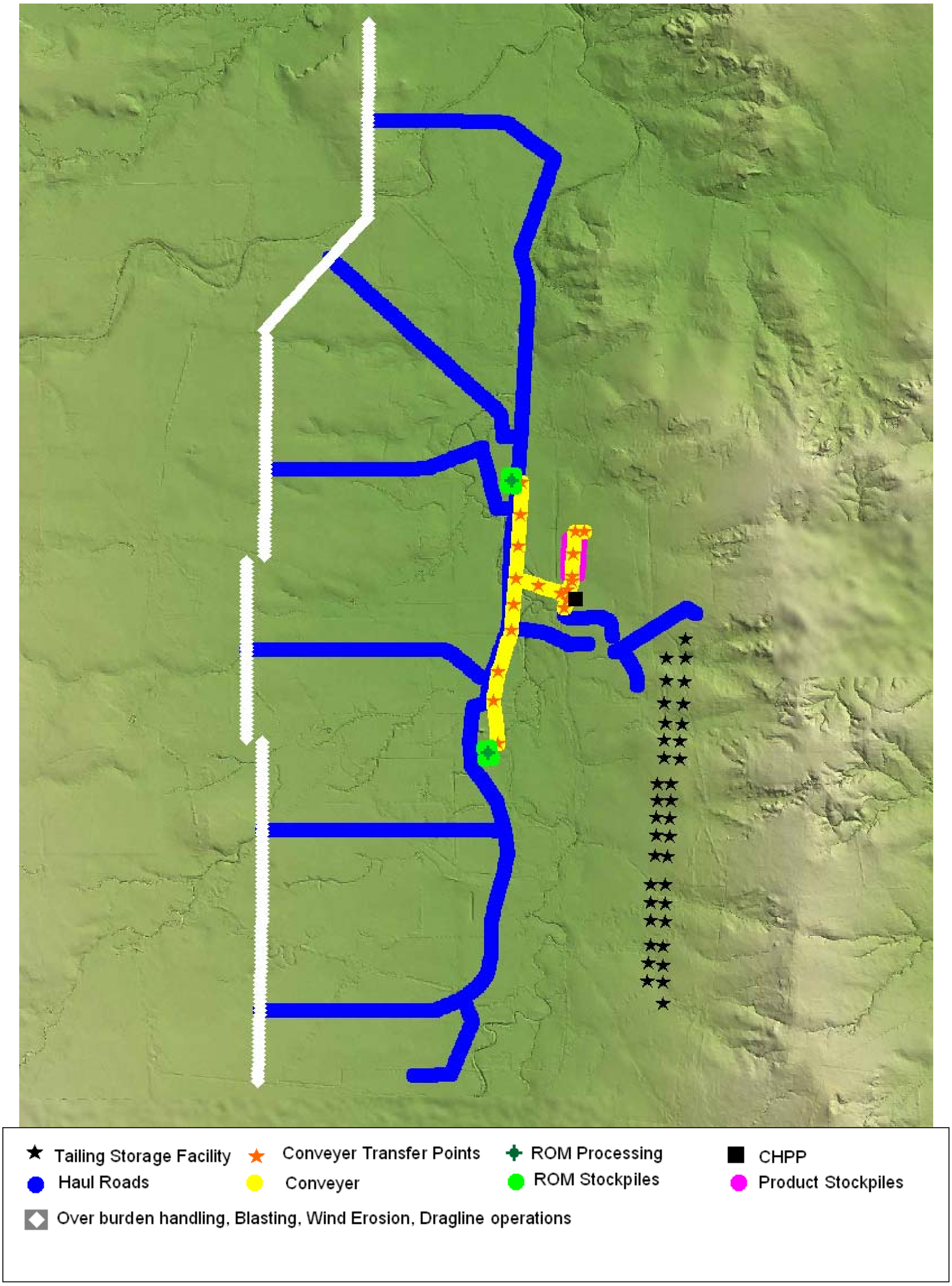
- Clearing of vegetation;
- Infrastructure construction (processing area, haul roads etc);
- Topsoil disturbance and removal;
- Transport of materials to site; and
- Onsite quarrying activities.

Operational Phase:

- Graders;
- Scrapers;
- Dozers operating on overburden, interburden and coal;
- Blasting;
- IPCC;
- Front end loading (FEL) of material to trucks;
- Excavators and shovels;
- Truck dumping of material;
- Loading and unloading of stockpiles;
- Draglines;
- Transport of material (overburden, coal, rejects);
- Conveying of coal to:
  - ROM,
  - CHPP;
- Wind erosion from
  - The product stockpiling area,
  - Exposed surfaces, and
  - Tailings dam;
- The train load-out;
- Rehabilitation; and
- Transfer points.

The locations of emission sources modelled for operational year 30 are presented in Figure 2-1. Additional figures indicating the location of modelled dust emission sources for years 5, 10, 15, 20, and 25 are presented in Appendix B.

Figure 2-1 Location of Dust Emission Sources for Year 30



2.2 Emission Factors

Emission Factors for the SEIS have not changed from the EIS. Uncontrolled emission factors for TSP and PM_{10} are listed in Table 2-1. Details are provided in Appendix C.

Table 2-1 Summary of Uncontrolled TSP and PM_{10} Emission Factors

Source Description	Working Material	Final Emission Factors		
		TSP	PM_{10}	Unit
Dragline	Overburden	0.06	0.009	kg/bcm
Exc/Shov/FEL	Overburden	0.0004	0.0002	kg/t
Exc/Shov/FEL	Coal	0.016	0.008	kg/t
Bulldozers	Coal	16.4	4.7	kg/h
Bulldozers	Overburden	7.6	1.9	kg/h
Trucks (dumping overburden)	Overburden	0.01	0.004	kg/t
Trucks (dumping coal)	Coal	0.01	0.004	kg/t
Drilling	-	0.59	0.31	kg/hole
Blasting	Interburden	220.0	114.4	(kg/blast)(ha^1.5)
Wheel generated dust (full)	Overburden	7.07	1.74	kg/VKT
Wheel generated dust (empty)	Overburden	4.92	1.21	kg/VKT
Wheel generated dust (full)	Interburden	4.68	1.15	kg/VKT
Wheel generated dust (empty)	Interburden	3.28	0.81	kg/VKT
Wheel generated dust (full)	Coal	6.88	1.69	kg/VKT
Wheel generated dust (empty)	Coal	5.15	1.27	kg/VKT
Wheel generated dust (full)	Rejects	5.68	1.4	kg/VKT
Wheel generated dust (empty)	Rejects	3.89	0.96	kg/VKT
Scrapers	Overburden	2.81	0.94	kg/VKT
Graders	Roads	0.2	0.09	kg/VKT
Loading Stockpiles	-	0.004	0.002	kg/t
Unloading from Stockpiles	-	0.03	0.01	kg/t
Loading to Trains	-	0.0004	0.0002	kg/t
Miscellaneous Transfer Points	-	0.0003	0.0001	kg/t
Erosion from exposed areas and stockpiles	-	Wind speed dependent	Wind speed dependant	kg/ha/h

2.3 Dust Reduction Measures

Dust control measures that will be implemented on site have been identified by the Proponent. These consisted of a mixture of engineering controls (such as partial enclosure of conveyors) and control measures (such as watering of haul roads and stockpiles). For inclusion in the atmospheric dispersion modelling, the description of control measures to be used for the Project have been matched to estimates of the control efficiency as described in the National Pollutant Inventory (NPI) manual.

2.4 Sensitive Receptors

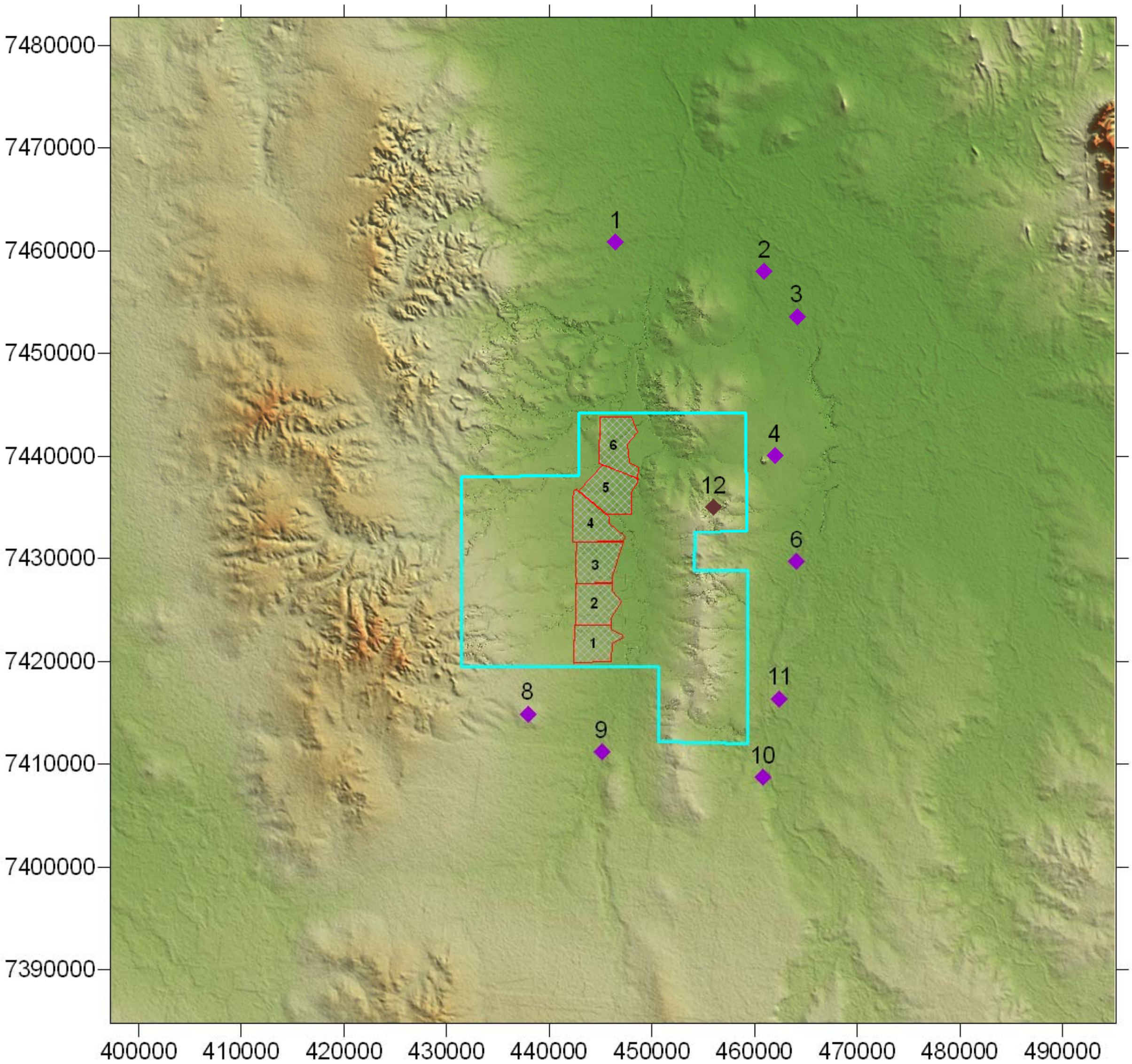
Sensitive receptor locations were included in the CALPUFF modelling for the prediction of air quality impacts. Table 2-2 provides the location of the sensitive receptors modelled Figure 2-2 provides their locations. The only modification to the sensitive receptors since the EIS was the relocation of the Accommodation Village. There are currently two other residences within the study area (Hobartville and Wendouree Homesteads), however these two residences are within the boundary of MLA 70426 and will be acquired by the Proponent.

Table 2-2 Sensitive Receptor Locations in the Vicinity of the Alpha Coal Project (Mine)

Receptor ID[1]	Receptor Description	UTM Easting (M)	UTM Northing (M)
1	Forrester Homestead	446462	7460888
2	Surbiton Station	460936	7458001
3	Eullmbie Homestead	464135	7453631
4	Surbiton Homestead	461950	7440055
6	Burtle Homestead	464057	7429716
8	Kia Ora Homestead	437918	7414891
9	Monklands Homestead	445097	7411185
10	Mentmore Homestead	460780	7408727
11	Tressillian Homestead	462419	7416374
12	Accommodation Village - Alpha	455989.5	7435052

Note (1): Receptors 5 and 7 are excluded as these refer to the Hobartville and Wendouree Homesteads. These are not considered as sensitive receptors. Receptor 12 is the Accommodation Village which has moved since the EIS.

Figure 2-2 Sensitive Receptor Locations



2.5 Averaging Time and Percentiles for Compliance

The modelling results have been analysed for the same averaging periods as the relevant air quality goals presented in the EIS, and those presented in Table 2-3.

Table 2-3 Summary of Project Goals for Particulate Matter

Pollutant	Averaging Period	Objective or Goal	Jurisdiction
Total Suspended Particulates	Annual	90 µg/m^3	EPP (Air)
PM_{10}	24-hour	50 µg/m^3 (five exceedences allowed per year)	EPP (Air)
$PM_{2.5}$	24-hour	25 µg/m^3	EPP (Air)
	Annual	8 µg/m^3	EPP (Air)
Dust Deposition	Monthly	140 mg/m^2/day	Queensland DERM

Schedule 1 of the Environmental Protection (Air) Policy 2008 (EPP (Air)) indicates an allowance of five exceedences of the air quality objective of 50 µg/m^3 for the 24-hour average concentration of PM_{10}. Thus for this assessment, the 5th highest 24-hour average ground level concentration of PM_{10} at each receptor location will be presented.

The maximum 24-hour average ground-level concentration of $PM_{2.5}$ will be presented.

The Queensland Department of Environment and Resource Management (DERM) has also adopted a guideline for dust deposition of 4 g/m²/month (c.140 mg/m^2/day) to ensure adequate protection from nuisance levels of dust. This level was derived from ambient monitoring of dust conducted in the Hunter Valley, NSW in the 1980's. The former New South Wales (NSW) State Pollution Control Commission set the level to avoid a loss of amenity in residential areas, based on the levels of dust fallout that cause complaints. The current guideline level adopted in NSW[1] is that the maximum total dust deposition level should not exceed 4 g/m²/month, and that the maximum increase in deposited dust is 2 g/m²/month.

[1] NSW Department of Environment and Conservation, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, August 2005

Air Emissions from the Alpha Coal Project (Mine)

3.1 Annual Emissions Scenarios

Presented in Table 3-1 is a summary of the site emissions inventory for PM_{10} based on level 2 watering of haul road (i.e. greater than 2 litres/m^2 per hour as required). The key sources of dust emissions are estimated to be associated with the transport of overburden and overburden dumping.

Table 3-1 Site-specific PM_{10} Emissions during Operation (kg/year)

Activity	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30[1]
Topsoil						
Disturbance & Rehabilitation	31,754	29,884	29,948	32,632	32,186	24,005
Overburden & In-Pit						
IPCC	-	51,362	52,353	51,760	52,973	53,196
Drilling & Blasting	156,472	138,431	183,368	196,778	197,210	197,584
Dragline	302,290	815,659	890,273	887,162	901,273	866,758
FEL of Overburden into Trucks	68,456	38,917	47,996	62,261	71,647	69,605
Transport of Overburden to dumps	2,659,904	2,631,022	2,831,201	3,168,048	3,457,314	3,374,092
Truck Dumping at Overburden Dumps	1,996,904	1,979,382	2,131,100	2,399,169	2,639,220	2,576,595
FEL of coal trucks	283,610	298,626	298,734	303,829	306,115	309,293
Dozers	271,461	198,379	142,543	148,773	183,413	164,875
Graders	23,239	10,790	11,456	14,891	17,748	14,504
ROM Activities						
Processing	48,779	-	-	-	-	-
Truck Dumping at ROM	151,575	159,600	159,658	162,381	163,603	165,301
FEL at ROM	56,722	59,725	59,747	60,766	61,223	61,859
Dozer hours – Coal at ROM (total)	18,669	19,245	19,359	19,692	19,478	19,788
Wind Erosion from Stockpiles	1,457	1,457	1,457	1,457	1,457	1,457
ROM to CHPP Conveyor						
Conveyors	416	416	416	416	416	416
Misc Transfer Points	35,306	37,175	37,189	37,823	38,108	38,503
CHPP Activities						
Processing	97,558	102,723	102,760	104,513	105,299	106,393
FEL at CHPP	56,722	59,725	59,747	60,766	61,223	61,859
Dozer hours – Coal at CHPP	18,669	19,245	19,359	19,692	19,478	19,788
Loading Stockpiles	29,285	30,397	30,203	30,511	30,547	30,571
Unloading from Stockpiles	223,947	232,447	230,961	233,322	233,595	233,782
CHPP Conveyors	401	401	401	401	401	401
Misc Transfer Points	21,066	21,866	21,726	21,948	21,974	21,991

Activity	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30[1]
Wind Erosion from Stockpiles	25,773	25,773	25,773	25,773	25,773	25,773
Main Haul Roads						
Transport of Coal to ROM	505,345	502,972	571,081	645,616	695,418	711,260
Transport of Rejects to Dumps	102,544	-	-	-	-	-
Tailing Storage Facility						
Wind Erosion from Tailings Storage Facility	126,791	126,791	126,791	126,791	126,791	126,791
TOTAL (kg/year)	**7,315,114**	**7,592,409**	**8,085,599**	**8,817,171**	**9,463,882**	**9,276,440**

Note (1): Year 29 has been reported as Year 30 as this was the last year of data provided.

Appendix D provides the site-specific emissions inventory for PM_{10} developed for all years of the mine. It is presented as the percentage contribution of dust from each of the activities to the site total given in kg/year.

Dispersion Model Limitations

4.1 General Limitations

Modelling of complex physical systems is based on the use of numerical techniques to solve a set of governing equations. In general, the more complicated the system modelled, the more parameterisations (or approximations) are required in order to solve these equations; particularly in relation to the representation of sub-grid scale processes. Thus, there are inherently a number of 'tuneable' parameters that are required as input into the models. Model developers often suggest default values for these parameters which may be based on observational data, laboratory experiments or professional experience. Depending on the scale of the mine, assessing the sensitivity of model results to input data and/or the value of tuneable parameters can be prohibitive, either in terms of computational requirements, timeframes for completion of the assessment and/or budgetary constraints.

Validation is a critical component to both model development and application. Rarely however does a suitable data set exist with which to conduct a detailed, statistically meaningful model validation study. The CALPUFF dispersion model has been developed to estimate the impact of emissions from a range of source types including: point sources (tall and short stacks), buoyant line sources (aluminium smelters), buoyant area sources (i.e. forest fires), area sources and volume sources. Model validation exercises have tended to focus on the impacts of emissions from point sources (i.e. stacks). Non-buoyant line sources such as haul roads are not explicitly included as a source type in CALPUFF. Instead, these types of sources are typically represented as a series of volume sources whose separation distance is taken as a function of the minimum distance to the nearest. This follows the simulated line source methodology used in regulatory approved dispersion model AUSPLUME developed by the EPA Victoria. Model validation of low level emissions of pollutants (such as dust generated by large-scale mining activities) is additionally complicated by the near-surface release of emissions, the non-stationality of emission sources and the variability in the locale of activities (such as blasting events).

In general, models have difficulty in accurately predicting dispersion under light wind speeds (i.e. less than 1 m/s) due to the dominance of physical processes other than advection and or turbulent diffusion under such conditions. The inability to accurately predict the minimum mixing height is another limiting factor of dispersion modelling and is particularly important when dealing with low level, non-buoyant (or low buoyancy) emission sources such as those present on a coal mine.

Further limitations in dispersion modelling are the uncertainties relating to the precision and applicability of input data, and the lack of observational data with which to validate the predicted concentrations.

4.2 Project Specific Limitations

This assessment relies on the completeness, accuracy and/or representativeness of a number of input data sets including:

- Alpha Coal Project information used to develop the inventory;
- Regulatory supplied ambient air and meteorological monitoring data;
- Client and supplied monitoring data;
- NPI emission factors; and
- Non site-specific default parameters used in the development of the emission factors.

4 Dispersion Model Limitations

Other limitations of the assessment include (but may not be limited to):

- The accuracy of the characterisation of the background environment;
- The sensitivity of the dispersion modelling results to model input parameters such as surface roughness and albedo; and
- The accuracy of the modelled meteorological fields incorporated into the dispersion model.

Air Quality Impacts

Predicted concentrations from the dispersion modelling have been analysed at discrete receptor locations in the locality of the Alpha Coal Project (Mine) and across the region through the use of contour plots.

5.1 Interpretations of Results

When reviewing dispersion model outputs, it is important to interpret the results presented in the context of the limitations outlined in Section 4. In particular, the limitations associated with validating the relevance and applicability of both the model input data sets and model output should be considered.

Dispersion modelling should be regarded as a tool for the identification of potential air quality issues within the study region. However, the confirmation of a model-predicted impact (either adverse or beneficial) can only be definitively assessed by the detailed comparison against observational data.

Other minor comments noted include:

- The software graphics package SURFER has been used in this assessment to develop the regional contour plots. Contouring techniques involve the interpolation of results onto a grid which is a source of spatial uncertainty. The results presented in tabular form are extracted directly from model output and are thus a better representation of predicted impacts at receptor locations.
- Tabulated results are reported to the nearest whole number. However, this suggests a level of accuracy of model predictions which is not realisable, nor verifiable. Reporting (for example) a concentration of 24 $\mu g/m^3$ implies an accuracy of ±1 $\mu g/m^3$. Quantifying the uncertainty in the results presented is in general, not undertaken for the reasons discussed in Section 4.

Results presented in the following sections include both the Project-related incremental contribution to ground level concentrations of dust at receptor locations as well as combined impacts that incorporate the estimates of background levels of dust.

5.2 Results

Predicted concentrations are presented for Year 5 and Year 30 which represent the worst-case impacts at receptor locations. The results for Years 10, 15, 20, and 25 are included as Appendix E.

Due to the lack of site-specific data, estimates of background concentrations are considered to be uncertain. As it is likely that there will be development of other mines within the area (such as Waratah Coal Mine and Kevins Corner Coal Mine), an assessment of cumulative impacts is required in order to more accurately estimate future air quality. As sufficient emissions data regarding other proposed Projects in the area is unavailable, this report does not undertake a cumulative impact assessment but presents both Project-only (i.e. incremental) and total (Project plus estimates of background levels) scenarios. The total estimate for the ground-level concentration of pollutants is then compared against the ambient air criteria shown in Volume 2, Section 13 of the EIS.

Adjustment of estimated ‘background’ concentrations may be warranted should sufficient additional information such as site-specific monitoring data become available.

5.2.1 Particulate Matter as PM_{10}

Presented in Table 5-1 is a summary of predicted fifth highest 24-hour average ground-level concentration of PM_{10}. The table shows an exceedence of the Project goals at eight receptor locations during Year 5 and Year 30 with receptors to the south of the site predicted to be the most affected by dust emissions from the mine.

Contour plots for year 5 and year 30 are presented as Figure 5-1 and Figure 5-2 respectively and highlight the areal extent of the region predicted to exceed the EPP (Air) objective of 50 µg/m^3.

Table 5-1 Predicted 5th highest 24-hour Average Ground Level Concentration of PM_{10}

Receptor	Y5			Y30		
	Project	Total[2]	% of EPP (Air)	Project	Total[2]	% of EPP (Air)
1	88.8	**115.8**	232%	105.5	**132.5**	265%
2	36.8	**63.8**	128%	35.7	**62.7**	125%
3	29.7	**56.7**	113%	29.8	**56.8**	114%
4	70.7	**97.7**	195%	58.9	**85.9**	172%
6	25.8	**52.8**	106%	18.9	45.9	92%
8	171.2	**198.2**	396%	300.3	**327.3**	655%
9	258.9	**285.9**	572%	147.6	**174.6**	349%
10	15.9	42.9	86%	13.1	40.1	80%
11	15.5	42.5	85%	16.3	43.3	87%
12	130.9	**157.9**	316%	145.2	**172.2**	344%
EPP (Air) Objective	**50**		100%	**50**		100%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective
Note (2): Background concentration estimated at 27 µg/m^3.

Table 5-2 shows the estimated frequency of exceedences of the ambient air objective of 50 µg/m^3 for the 24-hour average ground-level concentration of PM_{10}. Receptors 8 and 9 located to the south of the mine and Receptor 1 located to the north are predicted to be the most affected with elevated levels of dust above the EPP (Air) objective are predicted to occur 40%, 20% and 23% of the days in a year respectively. Note that Receptor 12 is the Accommodation Village located within the mine lease area. The predicated number of exceedences is not reported for this receptor.

Table 5-2 Predicted Frequency of Exceedences of the PM_{10} 24-hour Average Criteria Per Year.

Year	Percentage of exceedance days in the year								
	1	2	3	4	6	8	9	10	11
5	22.3%	4.1%	3.6%	6.3%	1.6%	39.0%	24.7%	0.8%	0.5%
10	21.7%	3.6%	3.0%	5.2%	1.1%	37.9%	23.4%	0.8%	0.5%
15	23.1%	3.6%	2.7%	5.2%	1.1%	39.3%	22.8%	0.8%	0.5%
20	22.8%	3.6%	2.7%	5.2%	0.8%	40.4%	21.7%	0.8%	0.5%
25	22.8%	3.6%	3.0%	5.2%	0.8%	39.6%	21.2%	0.8%	0.8%
30	20.3%	3.3%	2.5%	5.2%	0.5%	40.1%	20.1%	0.8%	0.5%

Figure 5-1 Year 5: The predicted fifth highest 24-hour average ground-level concentration of PM_{10}. The EPP (Air) Objective is 50 µg/m^3 (background concentration estimated at 27 µg/m^3 has been included)

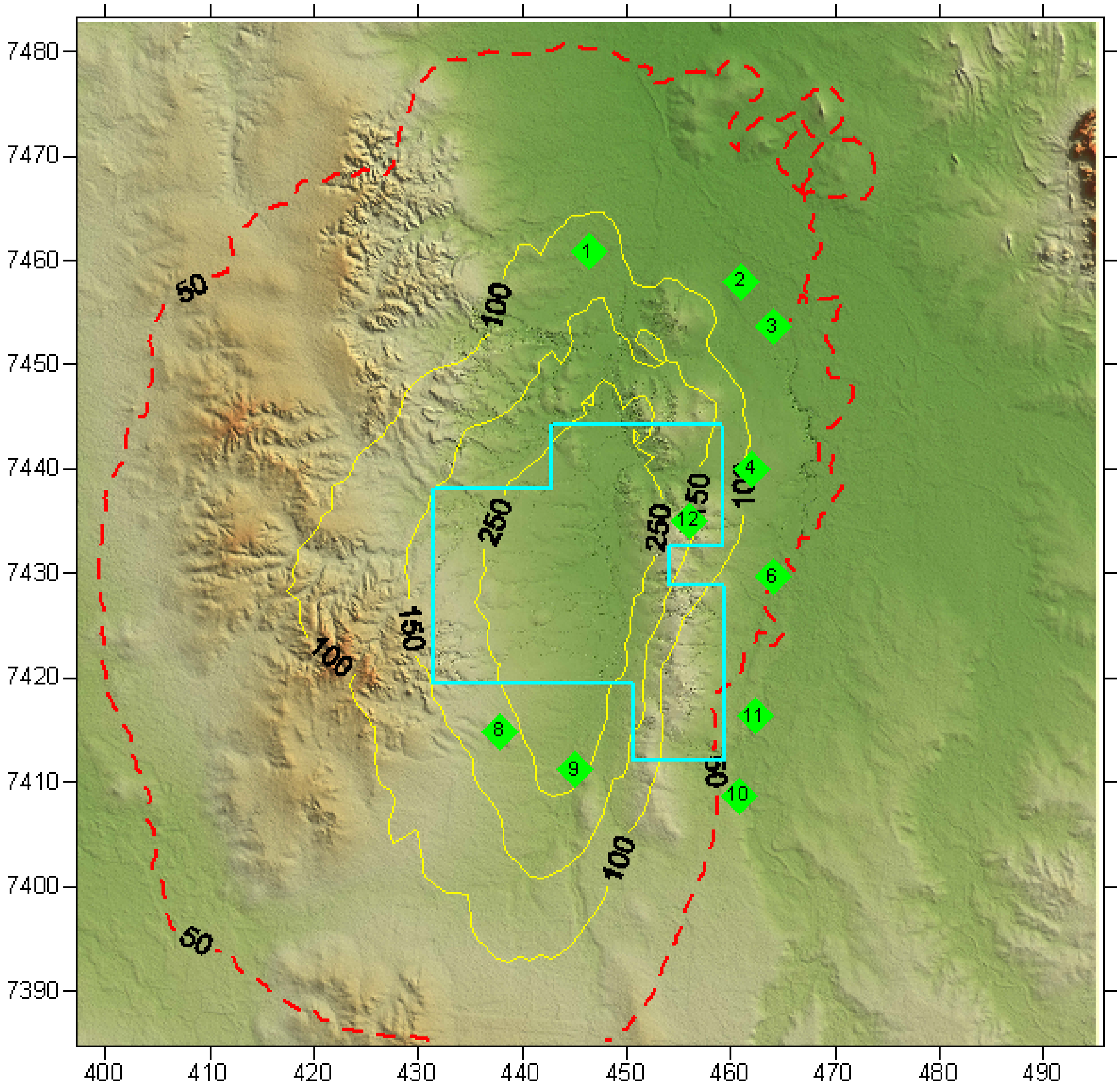
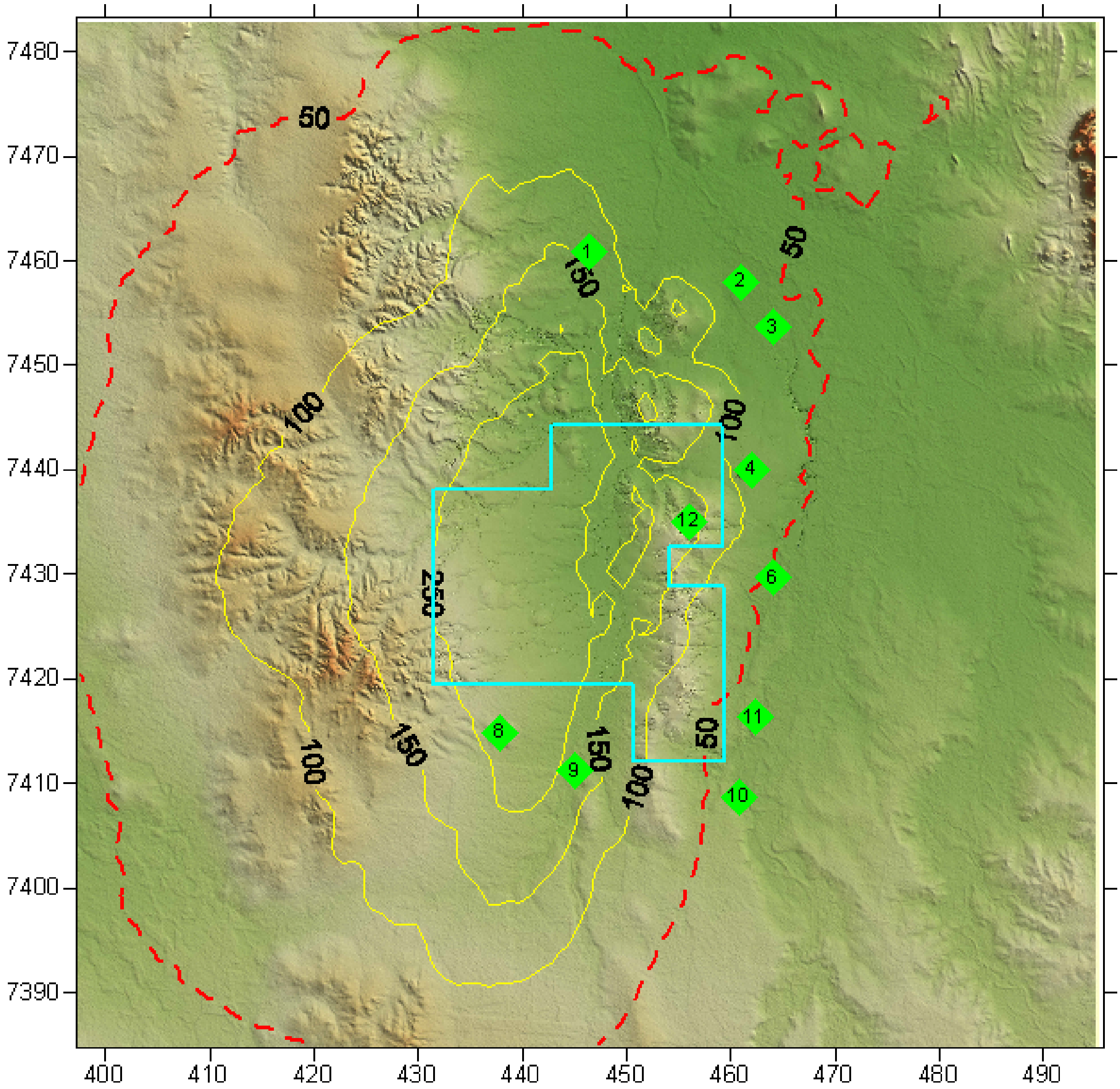


Figure 5-2 Year 30: The predicted fifth highest 24-hour average ground-level concentration of PM_{10}. The EPP (Air) Objective is 50 µg/m^3 (background concentration estimated at 27 µg/m^3 has been included)



5.2.2 Particulate Matter as $PM_{2.5}$

5-3 shows the predicted maximum 24-hour average ground-level concentration of $PM_{2.5}$ at receptor locations. Both the Project only and total ground-level concentrations are presented. Predicted concentrations indicate that elevated levels of dust above the EPP (Air) objective of 25 µg/m^3 may occur at receptors 4 and 12 (to the east of the mine), receptors 8 and 9 located to the south and receptor 1 to the north.

Table 5-3 Predicted maximum 24-hour average ground level concentration of $PM_{2.5}$

Receptor	Y5			Y30		
	Project	Total[1]	% of EPP (Air)	Project	Total[1]	% of EPP (Air)
1	22.9	**28.3**	113%	25.1	**30.5**	122%
2	10.3	15.7	63%	8.5	13.9	56%
3	9.6	15.0	60%	8.7	14.1	57%
4	24.4	**29.8**	119%	19.5	24.9	100%
6	10.4	15.8	63%	7.9	13.3	53%
8	40.9	**46.3**	185%	67.9	**73.3**	293%
9	64.6	**70.0**	280%	37.5	**42.9**	171%
10	10.2	15.6	62%	10.3	15.7	63%
11	14.7	20.1	80%	12.5	17.9	72%
12	40.9	**46.3**	185%	35.8	**41.2**	165%
EPP (Air) Objective	25		100%	**25**		100%

Note (1): Background concentration estimated at 5.4 µg/m^3.

Note (2): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

The results for the annual average ground-level concentration of $PM_{2.5}$ are presented in Table 5-4. An exceedance of the EPP (Air) objective of 8 µg/m^3 is predicted to occur at receptors 8 and 9 in year 5, and receptor 8 in year 30. No other exceedances are predicted to occur at sensitive receptor locations during these two scenarios.

Contour plots for year 30 are presented in Figure 5-3 (24-hour average) and Figure 5-4 (annual average).

The remaining results are presented in Appendix E.

Table 5-4 Predicted annual average ground level concentration of $PM_{2.5}$.

Receptor	Y5			Y30		
	Project	Total[1]	% of EPP (Air)	Project	Total[1]	% of EPP (Air)
1	2.7	5.5	68%	2.6	5.4	68%
2	0.5	3.3	41%	0.4	3.2	40%
3	0.4	3.2	40%	0.3	3.1	39%
4	0.7	3.5	44%	0.6	3.4	43%
6	0.2	3.0	38%	0.2	3.0	37%
8	7.0	**9.8**	123%	11.9	**14.7**	183%
9	6.9	**9.7**	121%	3.3	6.1	76%
10	0.2	3.0	38%	0.2	3.0	37%
11	0.2	3.0	37%	0.2	3.0	37%
12	1.7	4.5	56%	1.5	4.3	53%
EPP (Air) Objective	8		100%	8		100%

Note (1): Background concentration estimated at 2.8 μg/m^3.
Note (2): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

Figure 5-3 Year 30: The predicted maximum 24-hour average ground-level concentration of $PM_{2.5}$. The EPP (Air) Objective is 25 µg/m^3 (background concentration estimated at 5.4 µg/m^3 has been included)

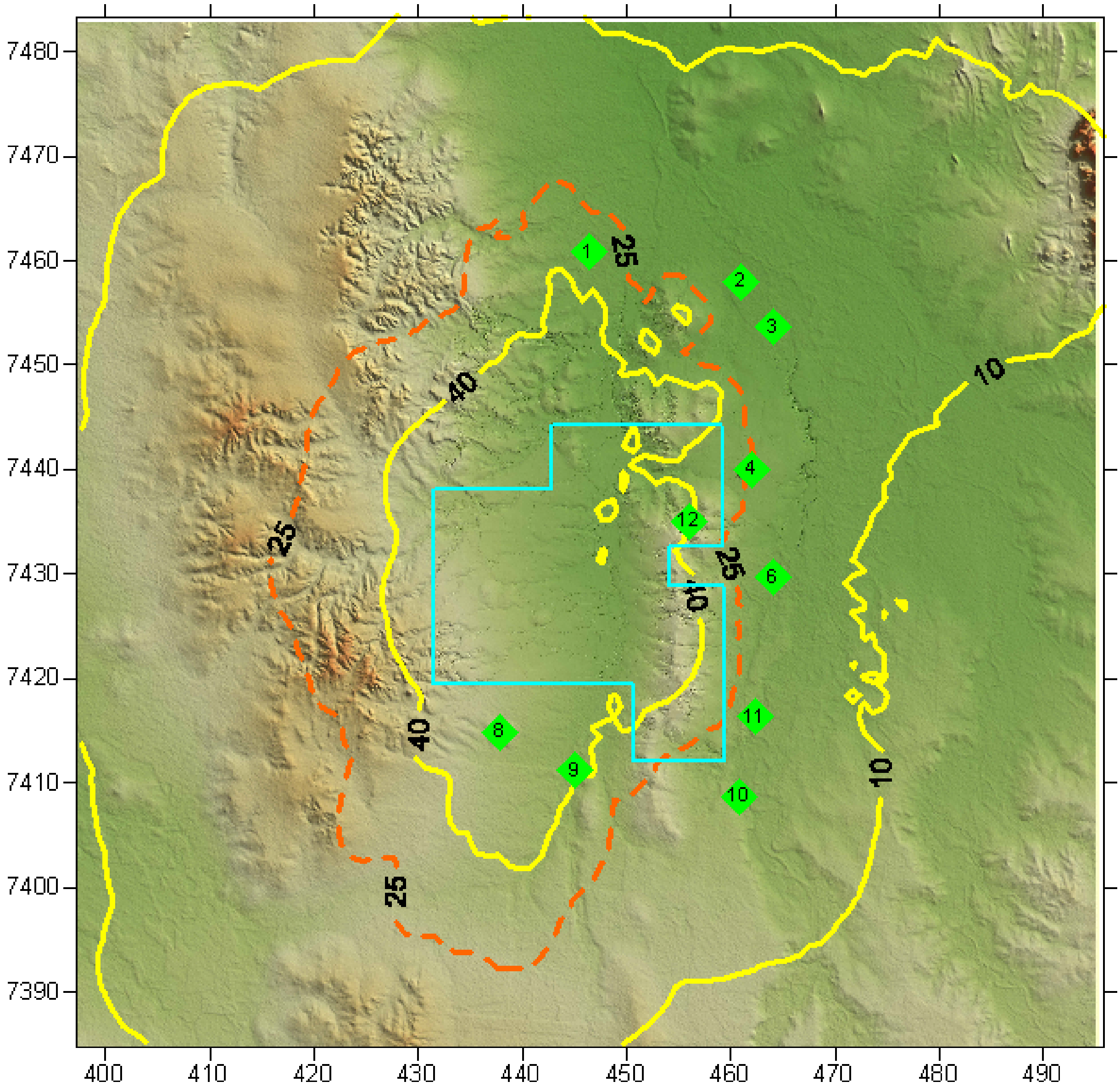
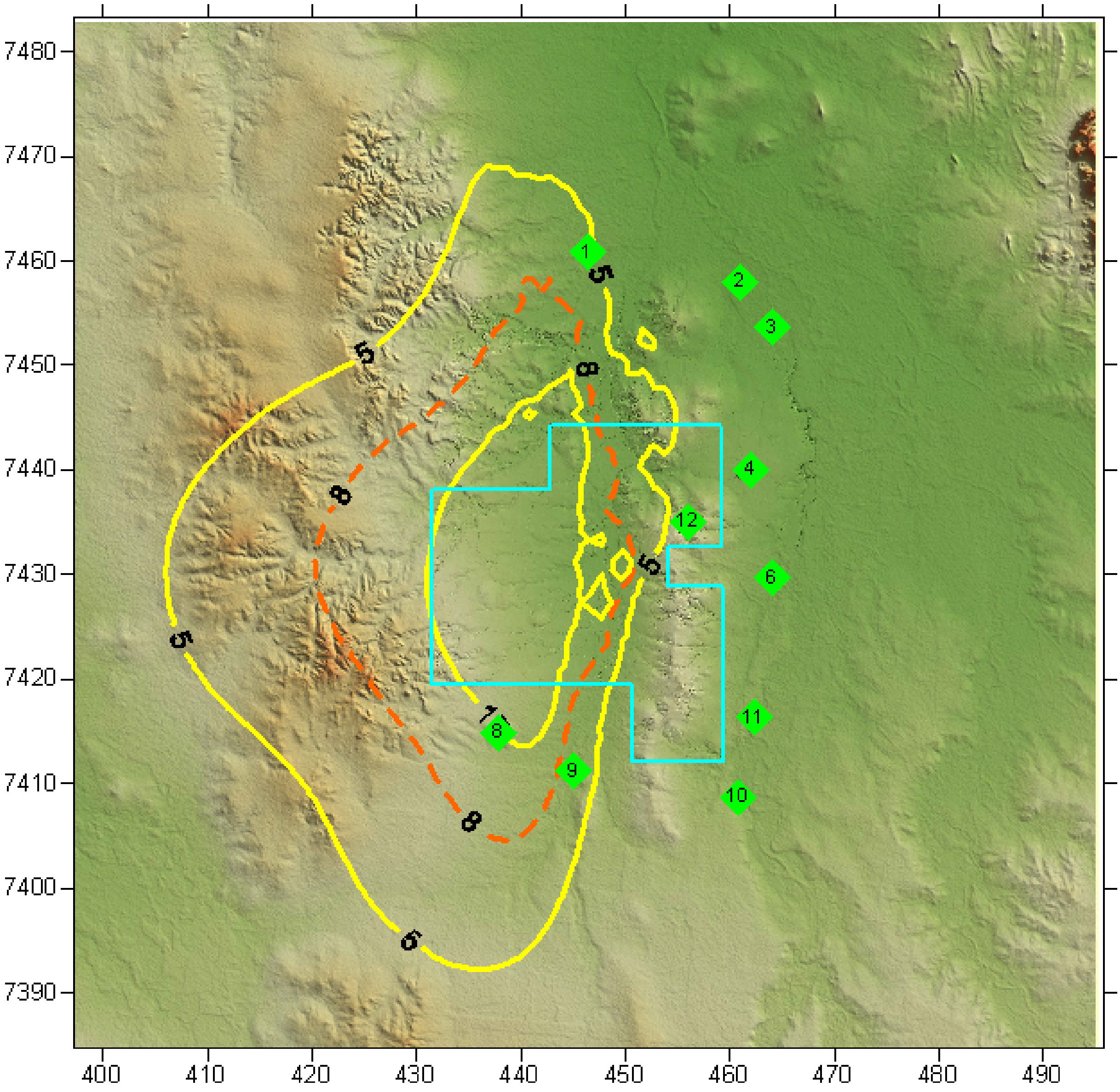


Figure 5-4 Year 30: The predicted annual average ground-level concentration of $PM_{2.5}$. The EPP (Air) Objective is 8 µg/m^3 (background concentration estimated at 2.8 µg/m^3 has been included)



5.2.3 Particulate Matter as TSP

Presented in Table 5-5 are the predicted annual average ground level concentration of TSP. The only exceedance of the EPP (Air) objective of 90 µg/m^3 is predicated to occur at receptor 8 for year 30. No other exceedances are predicted at sensitive receptor locations during these years five and thirty.

Results for the other modelled years are given in Appendix E.

Table 5-5 Predicted annual average ground level concentration of TSP.

Receptor	Y5			Y30		
	Project	Total[1]	% of EPP (Air)	Project	Total[1]	% of EPP (Air)
1	16.2	44.2	49%	16.8	44.8	50%
2	3.1	31.1	35%	2.7	30.7	34%
3	2.5	30.5	34%	2.3	30.3	34%
4	4.7	32.7	36%	3.9	31.9	35%
6	1.4	29.4	33%	1.1	29.1	32%
8	45.3	73.3	81%	78.0	**106.0**	118%
9	44.4	72.4	80%	20.0	48.0	53%
10	1.2	29.2	32%	1.1	29.1	32%
11	1.1	29.1	32%	1.0	29.0	32%
12	11.2	39.2	44%	9.8	37.8	42%
EPP (Air) Objective	90		100%	90		100%

Note (1) Background concentration estimated at 28 µg/m^3 has been included.
Note (2): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

5.2.4 Dust Deposition

Table 5-6 is a summary of the predicted rates of dust deposition at sensitive receptors. No exceedances of the objective value for rates of deposition of dust at sensitive receptor locations are predicted.

The results for the remaining modelled years are given in Appendix E.

Table 5-6 Predicted Daily Rate of Dust deposition.

Receptor	Y5			Y30		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	2.7	70.7	50%	3.2	71.2	51%
2	1.0	69.0	49%	0.8	68.8	49%
3	0.7	68.7	49%	0.8	68.8	49%
4	1.4	69.4	50%	1.2	69.2	49%
6	0.4	68.4	49%	0.3	68.3	49%
8	12.6	80.6	58%	22.5	90.5	65%
9	18.0	86.0	61%	6.5	74.5	53%
10	0.2	68.2	49%	0.2	68.2	49%
11	0.2	68.2	49%	0.1	68.1	49%
12	3.5	71.5	51%	3.0	71.0	51%
Project goal	140		100%	140		100%

Note (1): Background concentration estimated at 68 mg/m^2/day has been included.

5.3 Cumulative Impacts

It is possible that there will be development of other mines within the area such as Waratah Coal Mine and Kevin's Corner Coal Mine. Therefore, an assessment of cumulative impacts would be required in order to more accurately estimate the likely cumulative impact on the future air quality environment. However, as sufficient information regarding other proposed Projects in the area is currently unavailable, it is not possible to assess the cumulative impact on air quality at this time.

Discussion

6.1 Inventory Reductions

Modifications to the Project Description as described in Section 1-1 have had direct implications for the Air Quality Assessment. These changes have included:

- The inclusion of IPCC leading to the reduction in wheel generated dust;
- A modified layout (six pits instead of four) leading to a reduction in wheel generated dust;
- A modified pit setup (inclusion of land bridges) leading to the reduction in wheel generated and dragline rehandle dust.

These changes have lead to clear reductions in the predicted emissions from sources in the EIS which are reflected in the SEIS inventory. Table 6-1 provides summary emissions the EIS inventory in comparison to the SEIS inventory for year 5 and 30.

Table 6-1 Comparison of Predicted Site-specific PM_{10} emissions for Years 5 and 30 for the Alpha Coal Mine Project, EIS phase and SEIS phase (kg/year)

Activity	Year 5			Year 30		
	EIS	SEIS	Reduction	EIS	SEIS	Reduction
Topsoil	129,493	31,754	75%	90,058	24,005	73%
Overburden & In Pit	7,586,646	5,762,334	24%	9,157,392	7,626,503	17%
ROM Activities	326,282	277,202	15%	351,351	248,405	29%
ROM to CHPP Conveyor	64,917	35,722	45%	69,825	38,919	44%
CHPP Activities	503,767	473,421	6%	519,614	500,557	4%
Main Haul Roads	632,830	607,889	4%	1,368,900	711,260	48%
Tailing Storage Facility	556,276	126,791	77%	556,276	126,791	77%
Total (kg/year)	9,800,210	7,315,114	25%	12,113,416	9,676,440	20%

Table 6-1 demonstrates that changes made to the project have produced a direct reduction in emissions from the mine. The most significant reduction is a product of changes to the handling of overburden and in-pit activities which in year 5 is predicted to result in a saving of approximately 1.8 million kg/year of PM_{10} and 1.5 million kg/year of PM_{10}.

6.2 Results at Sensitive Receptor Locations

Concentrations predicted in the SEIS phase dispersion modelling assessment are generally higher than those in the EIS. Table 6-2 is a comparison of 5th highest 24-hour average ground level concentrations of PM_{10}.

Table 6-2 Comparison of Predictions for Receptor Locations for 5th highest 24-hour average ground level concentration of PM_{10} for Years 5 and 30 for the Alpha Coal Mine Project, EIS phase and SEIS phase (µg/m³)

Receptor	Year 5 (µg/m³)			Year 30 (µg/m³)		
	EIS	SEIS	Increase	EIS	SEIS	Increase
1	78	116	33%	76	133	43%
2	51	64	20%	50	63	21%
3	49	57	14%	49	57	14%
4	82	98	16%	82	86	5%
6	48	53	9%	48	46	-4%
8	123	198	38%	199	327	39%
9	166	286	42%	131	175	25%
10	37	43	14%	38	40	5%
11	38	43	12%	38	43	12%

Note (1): Inclusive of estimated background concentration of 27 µg/m³

Note (2): Receptor 12 is excluded from the comparison as the Accommodation Village has been moved.

Table 6-3 is a comparison of annual average ground level concentrations of TSP.

Table 6-3 Comparison of Predictions for Receptor Locations for annual average ground level concentration of TSP for Years 5 and 30 for the Alpha Coal Mine Project, EIS phase and SEIS phase (µg/m³)

Receptor	Year 5 (µg/m³)			Year 30 (µg/m³)		
	EIS	SEIS	Increase	EIS	SEIS	Increase
1	36	44	19%	36	45	20%
2	31	31	0%	31	31	-1%
3	31	31	-2%	30	30	1%
4	32	33	2%	32	32	0%
6	29	29	1%	29	29	0%
8	56	73	24%	75	106	29%
9	53	72	27%	47	48	2%
10	29	29	1%	29	29	0%
11	29	29	0%	29	29	0%

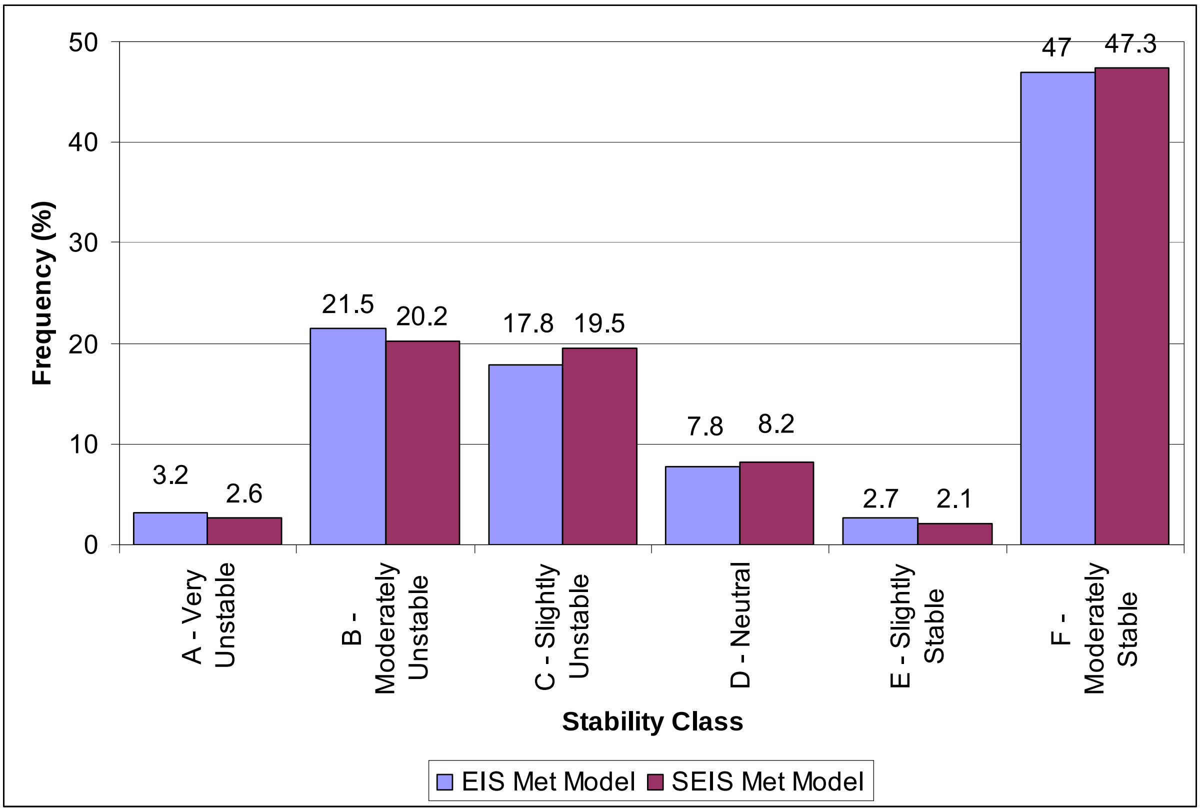
The increase in predicted particulate concentrations can be explained by an updated and more accurate approach to the following:

- Meteorological modelling; and
- The calculation of Wind Speed Dependant (WSD) Emissions.

6.2.1 Meteorological Model

Meteorological data from the BOM monitoring station located at Emerald Airport has been incorporated into the meteorological model for the SEIS (Section 1-2). These changes are designed to provide a more realistic representation of local atmospheric dispersion conditions and, therefore, more accurate predictions of both short term and long term impacts. Figure 6-1 shows that the proportion of wind speeds in stability classes A and B, which represent conditions of high instability and turbulence, have reduced with the incorporation of observational data from Emerald Airport. This indicates a reduction in local turbulence and therefore pollutant mixing which is likely to be related may increase downwind concentrations. However, the proportion of wind speeds in each stability class has not changed significantly between the modelled fields and so the main driver behind the increases is likely to be the re-calculation of WSD emissions.

Figure 6-1 Stability Classes Comparison between EIS and SEIS Meteorological Models



6.2.2 Wind Speed Dependant Emissions

WSD emissions have been calculated and distributed over the year based upon a trigger wind speed for each source type (Appendix C.2). This process requires an extra input file into CALPUFF which specifies for each hour of the year what the emission for that source should be.

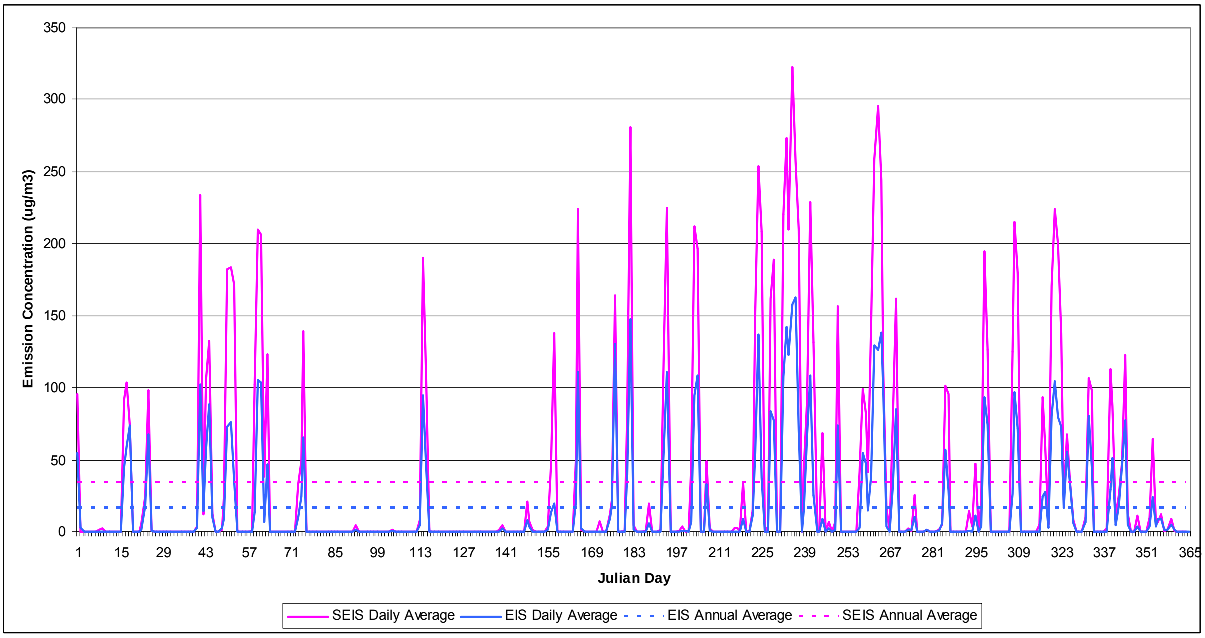
For both the EIS and SEIS, this extra input file was calculated for the release of WSD emissions from 1 hectare. After CALPUFF is run, a program called CALSUM (which is part of the CALPUFF series) is used to multiply the output file of the CALPUFF model by the correction factor. For the EIS, the correction factor was incorrectly applied. This has lead to the underestimate of Wind Speed Dependant emissions in the model by the following orders of magnitude:

- Disturbance & Rehabilitation- 129 times
- Wind Erosion from ROM Stockpiles- 658 times
- Wind Erosion from CPP Stockpiles- 186 times
- Wind Erosion from Tailings Dam- 16 times

While WSD emissions are only attributable to approximately 7% of the SEIS inventory, the nature of how those emissions are released has affected results of the model more significantly. Because WSD emissions are concentrated over high wind conditions, they are more likely to create peaks at sensitive receptor locations. For example, releases from the tailings dam only occur at wind speeds greater than 5.4 m/s for 77 hours (0.9%) in the year. This means that the emissions calculated in the inventory for the tailings dam are distributed over those 77 hours exclusively. Therefore, when a receptor is downwind during a high wind speed event, the plume is likely to be highly concentrated at this location. Such is the concentration of the plume during these events, the 24-hour and annual averages are measurably impacted.

By underestimating the emissions during peak conditions, the results for the short term averaging periods were underestimated which impacted on the long term averaging period predictions. Figure 6-2 demonstrates this principle.

Figure 6-2 Comparison of EIS and SEIS results of daily and annual average PM_{10} Concentrations at Receptor 9



This issue was identified in the SEIS phase and has been applied to the updated modelling assessment.

6.3 Refinements to the Assessment Methodology

The assessment methodology includes a number of conservative assumptions that may have lead to elevated predicted concentrations. These assumptions represent the application of professional judgement in the absence of specific project data. As such, there are a number of opportunities for refinement of the assessment methodology including (but not limited to):

- Estimates of the proportion of tailing storage facility areas that are dry;
- Blasting hole depth;
- Moisture content of in situ coal, ROM coal and product coal;
- Moisture content of overburden and interburden;
- Silt content of materials (of tailings, coal, overburden, haul roads);
- Site-specific emission factors (for example truck dumping and dozers operating hours);
- Estimated of background concentrations based on site-specific monitoring data; and
- Pit retention factors for activities below 50 m.

6.4 Environmental Management Plan (Air Quality)

The updated Environmental Management Plan including Air Quality management measures is appended to the Alpha Coal Mine SEIS.

6.5 Consultation

As part of the Proponent's community consultation program, discussions are continuing with landowners and occupiers in the vicinity of the project site, including those noted in Section 2.4. The discussions will include the provision of information from this air quality assessment and the provision of additional relevant information as the implementation plans for the project are further developed. The discussions will include appropriate compensation arrangements to ensure that the landholders specific requirements are properly satisfied.

Air Quality Monitoring Program

The proposed Ambient Air Monitoring and Operational Monitoring Programs which were presented in the EIS have been refined and developed in the SEIS phase of the environmental assessment. This section presents the updated programs.

7.1.1 Objectives

The objective of the proposed operational monitoring program is to monitor air quality within the region predicted to be directly impacted upon by dust generating activities. The monitoring program will allow the Proponent to monitor local air quality and implement additional mitigation measures dependent on the impacts measured. It will also allow validation of the dispersion modelling undertaken to predict the impacts.

Data from the operational monitoring programme will be used to demonstrate compliance with the Project goals.

7.1.2 Monitoring Standards

Ambient air monitoring will be conducted in accordance with and/or in consideration of:

- AS/NZS 3580.1.1:2007, Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment;
- AS/NZS 3580.9.10:2006, Methods for sampling and analysis of ambient air Method 9.10: Determination of suspended particulate matter—$PM_{2.5}$ low volume sampler— Gravimetric method;
- AS/NZS 3580.9.9:2006, Determination of suspended particulate matter – PM_{10} Low volume sampler – Gravimetric method;
- AS/NZS 3580.9.3.2003 Determination of suspended particulate matter-Total suspended particulate matter (TSP) - High volume sampler gravimetric method;
- AS/NZS 3580.9.6:2003, Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM_{10} High Volume sampler with size selective inlet - Gravimetric method;
- AS/NZS 3580.10.1:2003, Methods for sampling and analysis of ambient air – Determination of ambient air - Determination of suspended particulate matter – Deposited matter – Gravimetric method;
- Queensland Government, Air Quality Sampling Manual; and
- A method determined in consultation with the QLD DERM.

7.1.3 Monitoring Locations

The precise location of monitoring equipment will be dependent on Australian Standard siting requirements (Section 7.1.2) specific to the instrumentation to be implemented at each site.

Presented in Figure 7-1 and Table 7-1 are proposed monitoring locations for the Project which are approximate and subject to field inspection. The proposed monitoring locations correspond to receptor locations and the on-site Accommodation Village which are locations where human exposure is likely. It should be noted that the re-location of the Accommodation Village (location 12) has been reflected in the monitoring programme in the SEIS. The revision of the site monitoring program may be warranted based on future development within the regional airshed.

Figure 7-1 Proposed Monitoring Locations (indicative only)

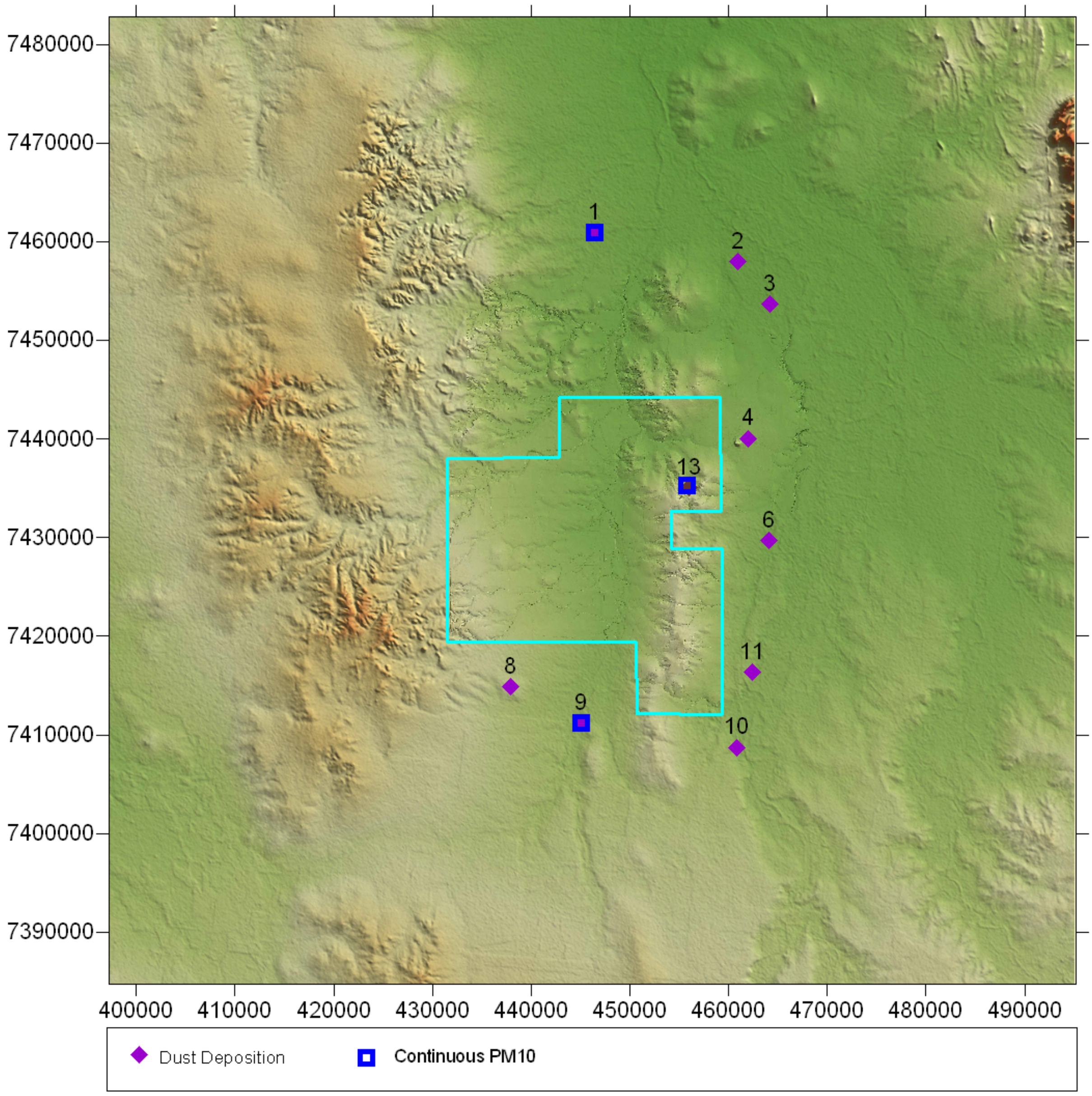


Table 7-1 Proposed monitoring locations (indicative only)

ID	Receptor Description	Description
1	Receptor 1	Forrestor Homestead
2	Receptor 2	Surbiton Station
3	Receptor 3	Eullmbie Homestead
4	Receptor 4	Surbiton Homestead
6	Receptor 6	Burtle Homestead
8	Receptor 8	Kia Ora Homestead
9	Receptor 9	Monklands Homestead
10	Receptor 10	Mentmore Homestead
11	Receptor 11	Tressillian Homestead
12	Receptor 12	Alpha Coal Project Accommodation Village
* Monitoring locations are indicative only. Actual siting of the monitoring stations is subject to field inspection		

7.1.4 Ambient Air Monitoring Program

Presented in Table 7-2 is a summary of the proposed frequency of monitoring for PM_{10} and dust deposition.

Monitoring of PM_{10} is proposed to be undertaken using the TEOM sampling methodology at the specified locations. Dust deposition gauges will be used to monitor dust nuisance.

Table 7-2 Pollutant and frequency of monitoring at specified locations (indicative only)

ID	Description	PM_{10}	Dust Deposition
1	Forrestor Homestead	Continuous	Monthly
2	Surbiton Station	--	Monthly
3	Eullmbie Homestead	--	Monthly
4	Surbiton Homestead	--	Monthly
6	Burtle Homestead	--	Monthly
8	Kia Ora Homestead	--	Monthly
9	Monklands Homestead	Continuous	Monthly
10	Mentmore Homestead	--	Monthly
11	Tressillian Homestead	--	Monthly
12	Alpha Coal Project Accommodation Village	Continuous	Monthly

Monitoring of ambient particulate concentrations and rates of dust deposition will commence as soon as possible in order to establish a representative baseline prior to the commencement of construction. Although not the same as a proper validation study, monitored ambient particulate concentrations during construction (particularly of the box cut) and operation will provide some insight into the relative level of conservatism that is inherent in the modelling methodology. Based on the results of the dispersion modelling, the effective management of mine-related dust as determined by measurements of dust at locations 8 (Kia Ora Homestead), 9 (Monklands Homestead) and the 12 (Alpha Coal Project Accommodation Village) will lead to improved air quality outcomes at other receptor locations.

7.1.5 Operational and On-Site Meteorological Monitoring Program

Presented in Table 7-3 is a summary of the proposed frequency of monitoring of on-site meteorology for the purposes of minimising off-site impacts. Dust monitoring at location 12 (Alpha Coal Project Accommodation Village) will assist in the assessment of the effectiveness of implement dust mitigation measures.

It is noted that due to the prevailing wind direction and the relative location of receptors and mining activities, the Accommodation Village is not predicted to be the most affective sensitive receptor. Thus air quality within the Accommodation Village will not be representative of worst-case impacts which is predicted to occur to the south of the mine reflected at monitoring location 9 (Figure 7-1).

Meteorological monitoring is proposed to include (as a minimum) wind speed, wind direction, relative humidity, and air temperature. Additional meteorological parameters may include (but may not be limited to): solar radiation, rainfall, differential temperature, and differential wind speed.

Table 7-3 Operational Meteorological Monitoring Program

ID	PM_{10}	Dust Deposition	Meteorology
1	Continuous	Monthly	Continuous
9	Continuous	Monthly	Continuous
12	Continuous	Monthly	Continuous
CHPP	--	--	Continuous

It should be noted that on-site meteorological monitoring will be undertaken at the CHPP but this is not marked in Figure 7-1 and Table 7-1as no particulate monitoring is proposed at this location.

Due to the level of impacts predicted at the location of receptors 8 and 9 in the SEIS, particular attention will be afforded to the pollutant and meteorological monitoring data from the corresponding monitoring location 9 (Figure 7-1). If the data indicates that the project goals are being exceeded by Project activities, the mitigation of local dust emission will be considered. This could include the incorporation of actions based upon real time pollutant and meteorological monitoring data.

Summary

The Proponent has updated their project description to reflect the most efficient “project” based on the latest geological modelling. Changes to mining methods and the mine design that impact on the air quality assessment are described below.

Table 8-1 Changes to the Mining Methods and Mine Design that Impact the Air Quality Assessment

Project Description Change	Result of Change	Advantage
Introduction of In-Pit Crushing and Conveying (IPCC)	Reduced overburden volumes requiring trucking	Reduction in wheel generated dust from unpaved roads
Coal mine layout changed due to updates to geological model, methods to mine modified	Reduced number of draglines, excavators and shovels	Reduction in dust from draglines, excavators and shovels
Increase in land bridges included in layout	Reduced travel distance for trucks Reduction in dragline rehandle	Reduction in wheel generated dust from unpaved roads Reduction in dust from dragline rehandle

The Project will now consist of six open cut pits instead of four and be approximately 25 km in total length oriented in a north-south direction along the centre of MLA 70426. The location of the Accommodation Village has also moved. A site-specific emissions inventory has been developed for all 30 years of the life of the mine using the same emission factors as the EIS.

In addition to these project description changes, the three-dimensional meteorological fields have been updated. In order to increase the accuracy of the meteorological modelling, observations from the BOM station located at Emerald Airport (approximately 170 km from the Project site) were incorporated into TAPM and CALMET. This allowed for the real data to nudge the results of the model, increasing the accuracy. In addition to the incorporation of monitoring data into TAPM, the grid for the model has also been increased from a 61 x 61 to 99 x 99 grid at 1 km resolution. This has allowed for the prediction of the dispersion of plumes over a larger area.

A review of the modelling approach identified underestimation of emissions from WSD emission sources in the EIS due to a miscalculation in the application of the emission factors. This resulted in under prediction of 24-hour and annual average concentrations in the EIS at the majority of sensitive receptors and across the modelling domain. This issue was identified and has been corrected in the SEIS modelling assessment. Therefore, it should be noted that the significant reduction in the production of emissions from the site due to the modifications to the project description are not reflected in the concentrations predicted at the sensitive receptors.

Ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition have been predicted at each of the nine off-site receptor locations as well as for the proposed on-site accommodation village. Impacts from dust emissions associated with mining activities at these receptor locations have been estimated for six years of the mine life (years 5, 10, 15, 20, 25, 30).

The results of the dispersion modelling suggest that air quality at location of receptors 8 and 9 located to the south of the mine lease, will be most affected by dust emissions from the site. The air quality impacts predicted by the dispersion model can only be validated by comparing predicted concentrations against observational data which is currently unavailable.

The results of the dispersion modelling indicate that:

8 Summary

- Emissions of dust from the Alpha Coal Project (Mine) (in isolation of background dust sources) are predicted to result in elevated levels of particulate matter that exceed the EPP (Air) objective of 50 $\mu g/m^3$ for the 24-hour average ground-level concentration of PM_{10} at receptor locations 1, 4, 8, 9, and 12. The frequency of exceedence days is predicted to range between 5% and 40% of all days in the year at these locations with receptors to the south of the mine site (receptor 8 and receptor 9) and those to the north (receptor 1) most affected.
- During the life of the mine, the ground-level concentration of $PM_{2.5}$ is predicted to exceed the EPP (Air) objective of 25 $\mu g/m^3$ for the 24-hour average ground-level concentration at receptors 1, 4, 8, 9 and 12. The annual average concentration of $PM_{2.5}$ is not predicted to exceed the EPP (Air) objective of 8 $\mu g/m^3$ at any sensitive receptor location with the exception of Receptor 8, and Receptor 9 in year five.
- Ground-level concentrations of TSP are not predicted to exceed the EPP (Air) objective of 90 $\mu g/m^3$ for the annual average at any sensitive receptor location with the exception of receptor 8.
- Ground-level concentrations of dust deposition are not predicted to exceed the relevant mine goals at any of the receptor locations included in the dispersion modelling.

Mitigation measures for the Alpha Coal Project (Mine) have been proposed and are included in the Environmental Management Plan. Some of these measures have been incorporated into the air quality modelling, such as the engineering controls and dust suppression measures, which are predicted to reduce the predicted impacts from the site. Other measures may need to be implemented during Project operation, such best practice operational procedures and the rehabilitation strategy.

The proposed ambient operational monitoring programme will be used to assess compliance against the Project goals and the effectiveness of the proposed control measures.

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Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Hancock Prospecting Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 28 January 2011.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 7 February 2011 and 25 March 2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A Modelling Methodology – Additional Details

A.1 Meteorological Modelling

A.1.1 TAPM

The Air Pollution Model (TAPM) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations, with no local data inputs required.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations.

Additionally, the TAPM model may assimilate actual local wind observations so that they can optionally be included in a model solution. The wind speed and direction observations are used to realign the predicted solution towards the observation values. This function of accounting for actual meteorological observations within the region of interest is referred to as “data assimilation”. Data from the Bureau of Meteorology’s (BOM) Emerald Airport monitoring site for 2009 were assimilated into TAPM in order to provide improved results for the meteorological parameters in the vicinity of the study site.

TAPM was set up for the region around the Alpha Coal Project to simulate wind flows around the location to a 1 km resolution. The table below details the parameters used in the meteorological modelling for this assessment.

Table A-1 TAPM Model Parameters

Parameter	Value
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	99 x 99 x 25
Year of analysis	2009
Centre of analysis	446250m E, 7433750m N (UTM zone 55)
Data assimilation	Emerald Airport Meteorological Station (BOM)

TAPM has limitations which are a result of the necessity to simplify many of the processes within the atmosphere, subgrid-scale parameterisation and the application of boundary conditions. The earth curvature is not included in TAPM and hence any weather phenomena resulting from earth curvature are not modelled. TAPM uses climate average sea-surface temperature and hence may not adequately simulate land and/or sea breezes.

The data files were used as direct inputs to the CALMET meteorological model by extracting the modelled data at the centre of the grid for the surface and upper air data files.

A.1.2 CALMET

CALMET is a meteorological model that is used to incorporate observational wind measurement into a gridded three-dimensional wind field. It allows enhanced treatment of local terrain effects on wind flows and minimises convergence/divergence of wind flow. It also allows the atmospheric mixing height and stability conditions to be influenced by the differential heating of the land surface depending on the angle of the sun and the amount of cloud cover. CALMET outputs hourly atmospheric parameters such as wind speed and direction (three-dimensional), mixing height and stability class. The outputs from CALMET were used as inputs to the dispersion model CALPUFF.

In order to improve the accuracy of the model two CALMET models were run nesting a higher level regional grid down into a local project specific grid. The CALMET model parameters specified for these two grids are presented below:

Table A-2 CALMET Model Parameters

Parameter	Regional Grid	Local Grid
Grid Spacing	10 km	1 km
Number of grid points	49 x 49 x 25	99 x 99 x 25
Year of analysis	2009	2009
Centre of analysis	446250m E, 7433750m N (UTM zone 55)	446250m E, 7433750m N (UTM zone 55)
Data Assimilation	Emerald Airport Meteorological Station (BOM) Centre of TAPM grid	Regional Grid

The CALMET model domain is of sufficient size to include all mining activities and the individual homesteads that may be affected by the proposed mining operations. The CALMET model features enhanced treatment of terrain effects around the site and allows the wind fields to be influenced by the differential heating of the land surface depending on the angle of the sun. Its non steady-state formulation also allows the wind fields to travel around or over obstacles such hills, depending on the strength of the wind and to recirculate pollutants within the model domain as the prevailing wind directions change through the day. CALMET calculates parameters such as mixing height and stability class that are used in the model to determine the dispersion conditions for every hour of the year.

The limitations associated with the use of CALMET are related to sub-grid scale parameterisation, grid resolution, domain sizes and boundary conditions. For example, sub-grid scale terrain effects may not be fully captured and the minimum mixing height of 50 m used in the modelling may vary in the project area, depending on the weather condition.

A.2 Dispersion Modelling

A.2.1 Model Setup

The model domain was 99 km by 99 km, with the dispersion results calculated at a resolution of 1 km. The dispersion parameters specified in the model include the use of dispersion coefficients based on turbulence data determined from the modelled micrometeorology and partial plume path adjustment for terrain correction of plume impacts.

A.2.2 Source Types and Locations

The selection of source type to represent an air emission source is matched by the nature of the dust generating activities and release. The source type options in CALPUFF are point, area, volume and lines. Volume sources have been used for dispersion modelling of all sources of dust from the site which best represent the scale of the activities conducted on open-cut mines. Activities such as excavating of coal or dropping of overburden from a dragline bucket result in the instantaneous creation of a cloud of dust, which is clearly visible from the edge of an operating open-cut pit.

Likewise, the plume of dust that is generated by a truck moving on unpaved roads is mixed in the wake of the vehicle to form a visible dust cloud that rises above the vehicle height. The volume source is the most representative of the nature of these activities, as it accounts for the dispersion of an amount of dust that is well mixed in the air immediately at the source.

The sensitive receptor locations are at some distance from the mining activities (a minimum of approximately 2.5 km from the mine boundary). This separation of the sources and receptors lessens the influence of the initial source type selection and results over 1 km from the source should be relatively independent of this selection for near-surface sources such as those in coal mines.

Source emission parameters, such as the height of release and the initial spread of the plume from each release point, were estimated from data provided by the proponent on the height of sources and the source types. These data have been used to derive the source height and initial spread of the plume, used in the dispersion modelling setup, as noted in **Table A-3**.

Table A-3 Source Height and Initial Horizontal and Vertical Spread of Plumes as used in Dispersion Modelling

Source Type	Source Height Above Ground Level (m)	Initial Horizontal Spread (m)	Initial Vertical Spread (m)
Overburden handling	10	15	5
Coaling	10	15	5
Blasting	15	100	7.5
Wind erosion	3	50	1.5
CHPP	10	20	5
ROM stockpiles	4	50	2
ROM processing	5	10	2.5
Conveyor from ROM to CHPP	3	3	1.5
Conveyor from CHPP to product stockpiles	10	3	5
Product stockpiles	10	50	5
Haul roads	10	50	5
Tailing dams	3	50	1.5

The location of each source was derived from the mine plan that was developed for the site. Haul road locations do not change throughout operation of the mine, however the progression of the mine westward results into increase in length of haul roads within the pits.

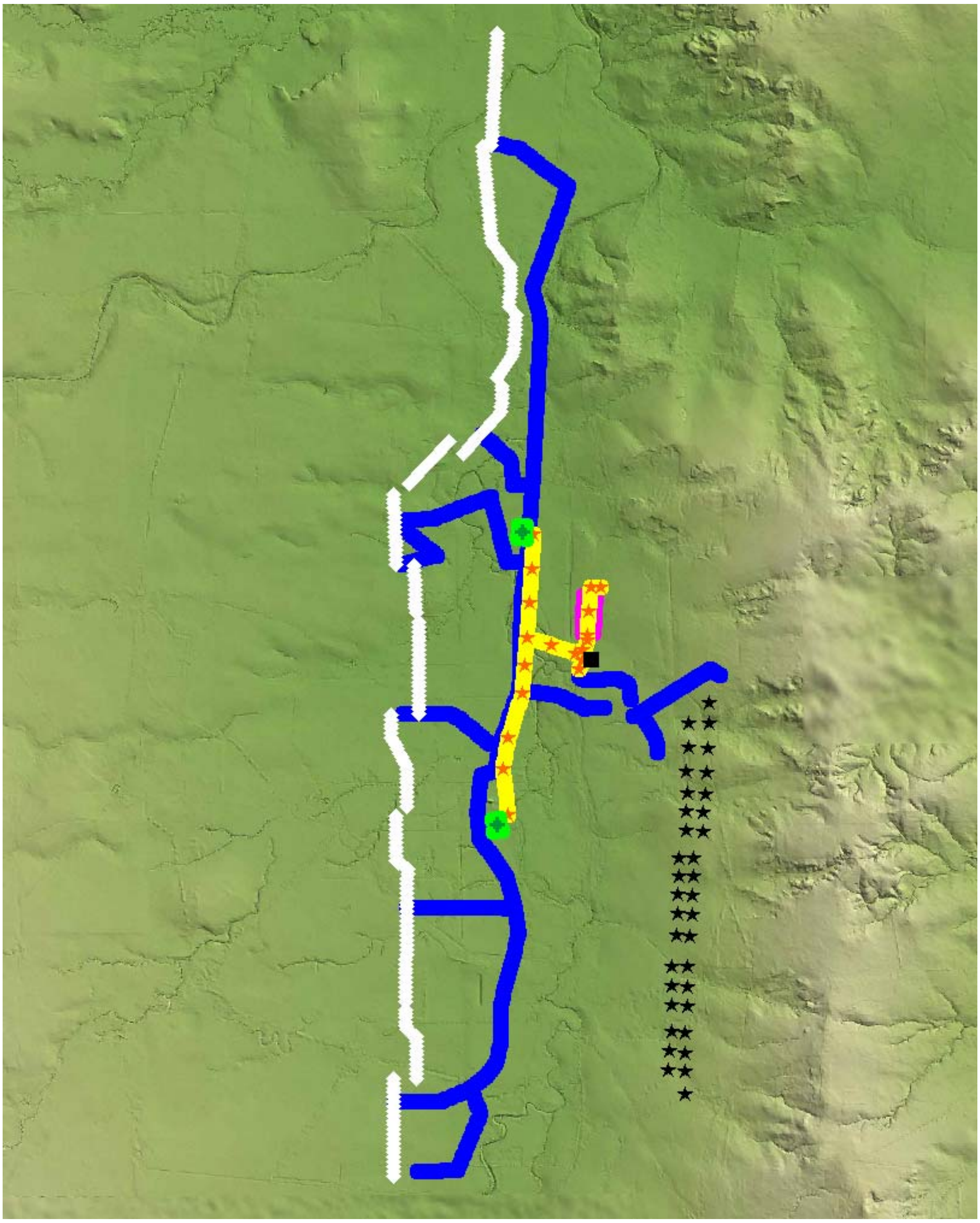
Haul roads were modelled as individual volume sources spread along the haul routes at approximately 100 m intervals. The emissions for each road section were determined from the number of vehicle movements on the section and the distance travelled for the return journey.

Sources that are located in the pit, including draglines, truck and shovel, coaling equipment and blasting, were modelled as volume sources. For modelling of typical operations from the Mine, the source locations were spread out along the pit length at 100 m intervals, with emission rates corresponding to the appropriate pit activities.

Activities at the CHPP, such as ROM coal dumping and stockpile movements were modelled as volume sources located at the centre of each dust-generating activity.

Appendix B Locations of Modelled Sources

Figure B-1 Location of Modelled Sources- Year 5



★ Tailing Storage Facility
● Haul Roads
★ Conveyer Transfer Points
● Conveyer
✚ ROM Processing
● ROM Stockpiles
■ CHPP
● Product Stockpiles
◆ Over burden handling, Blasting, Wind Erosion, Dragline operations

Figure B-2 Location of Modelled Sources- Year 10

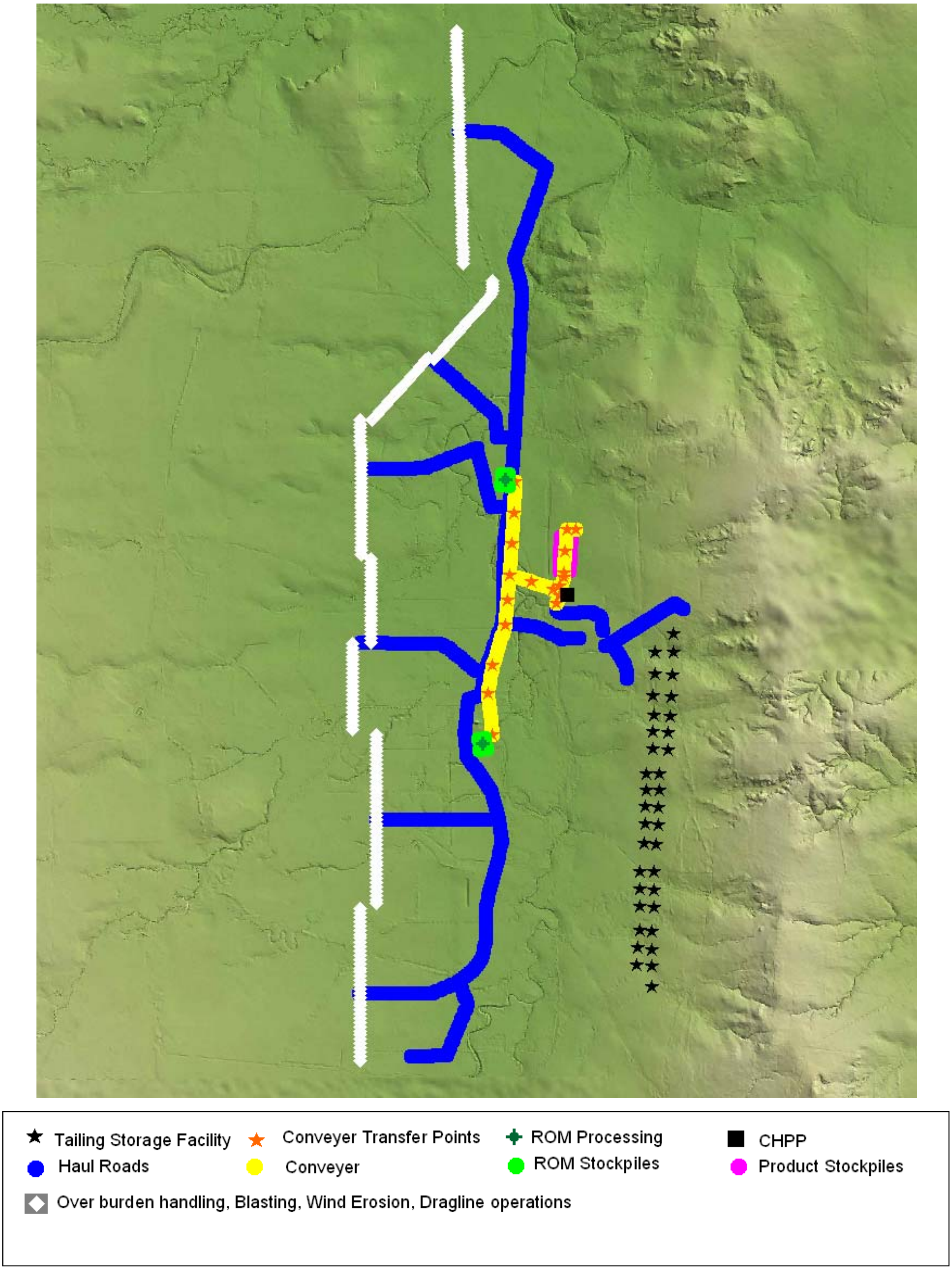
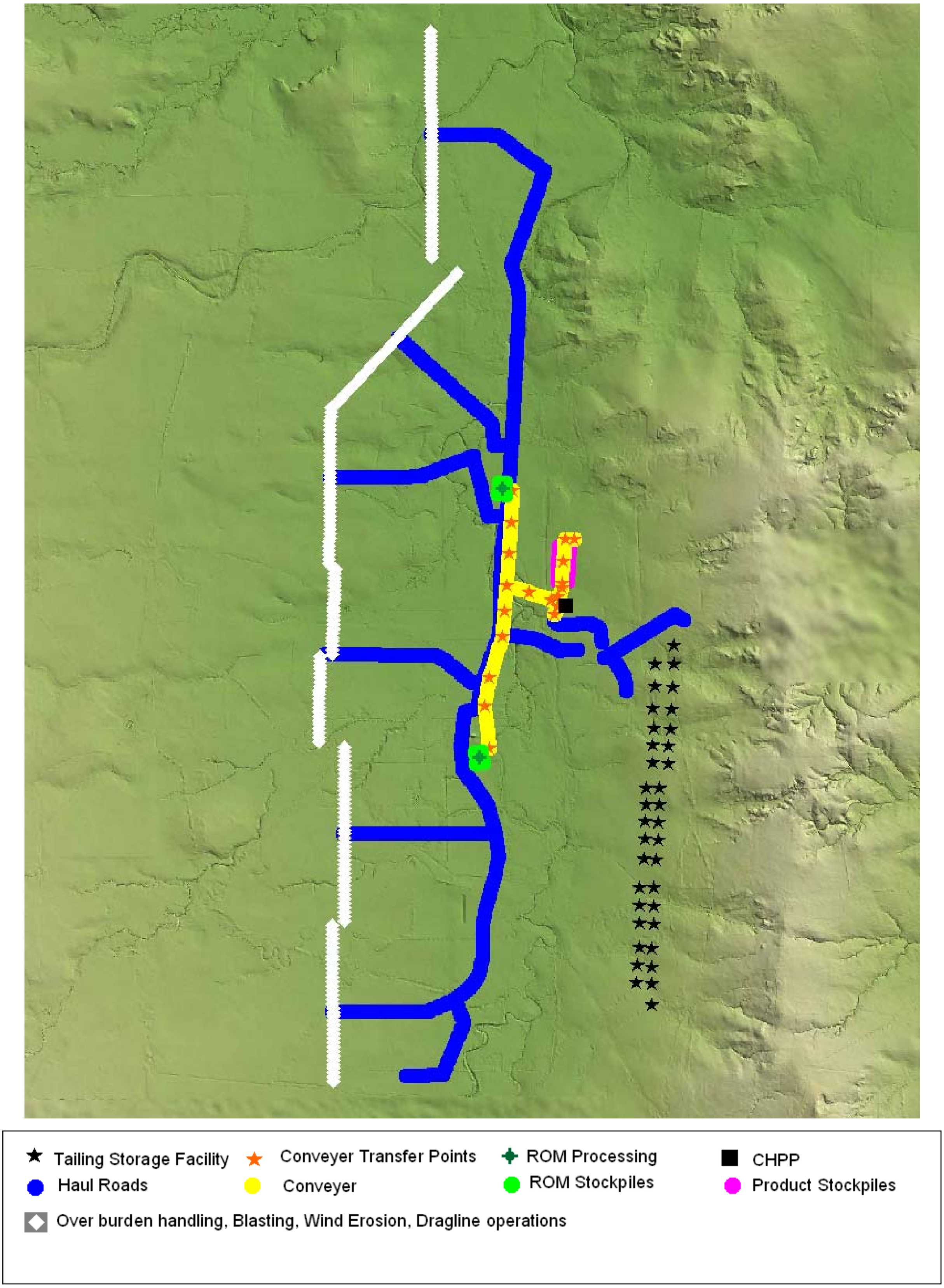


Figure B-3 Location of Modelled Sources- Year 15



Appendix B

Figure B-4 Location of Modelled Sources- Year 20

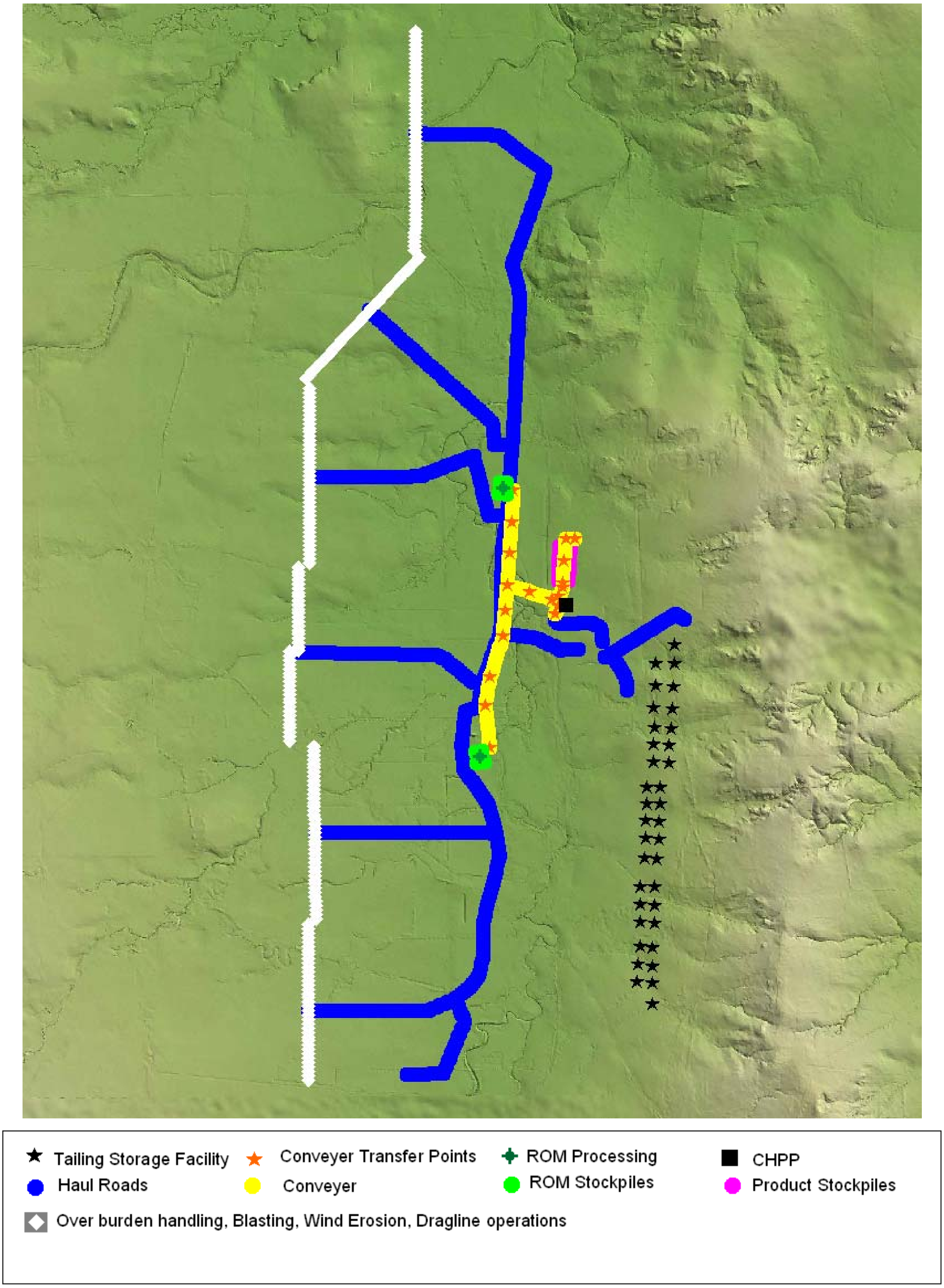
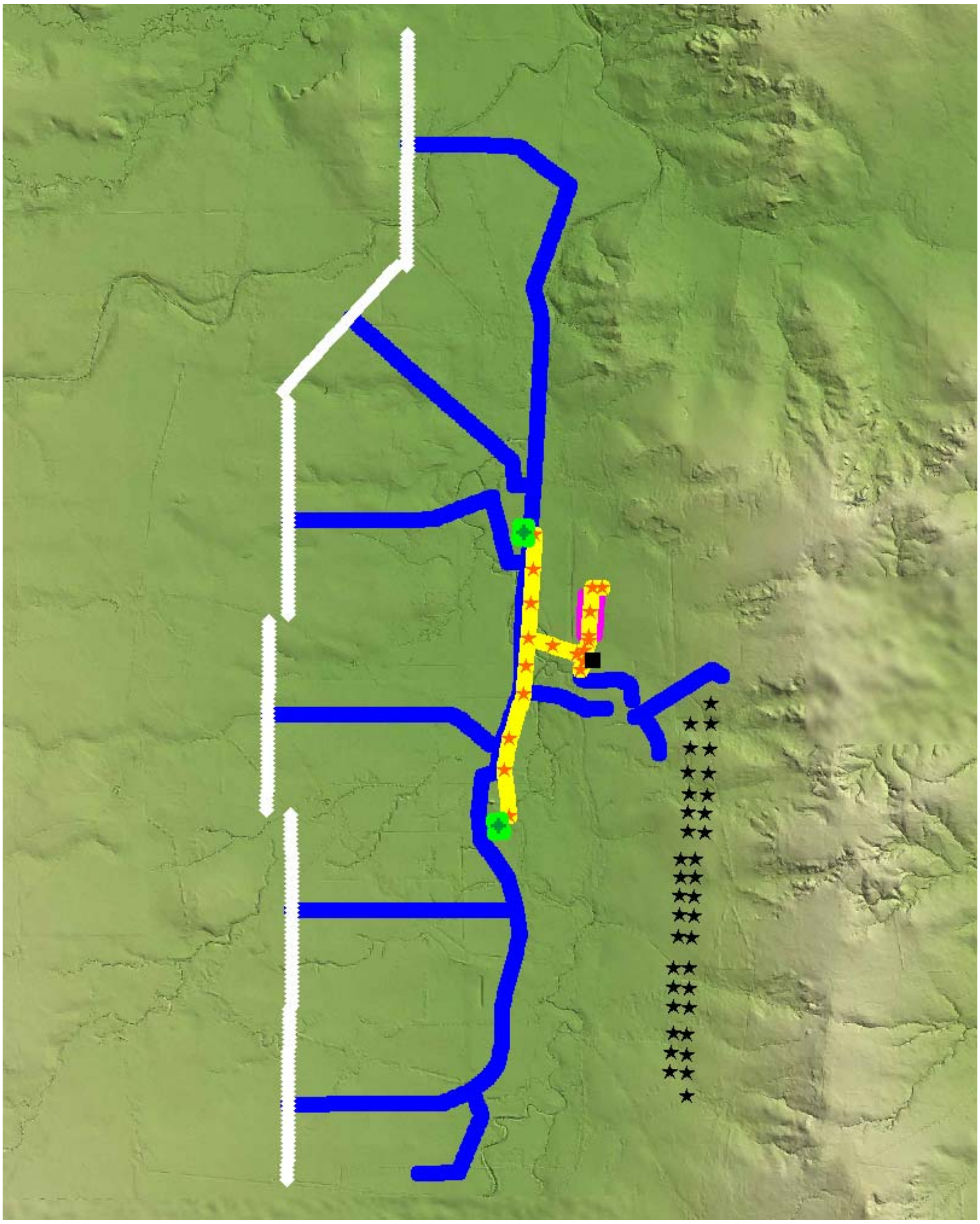


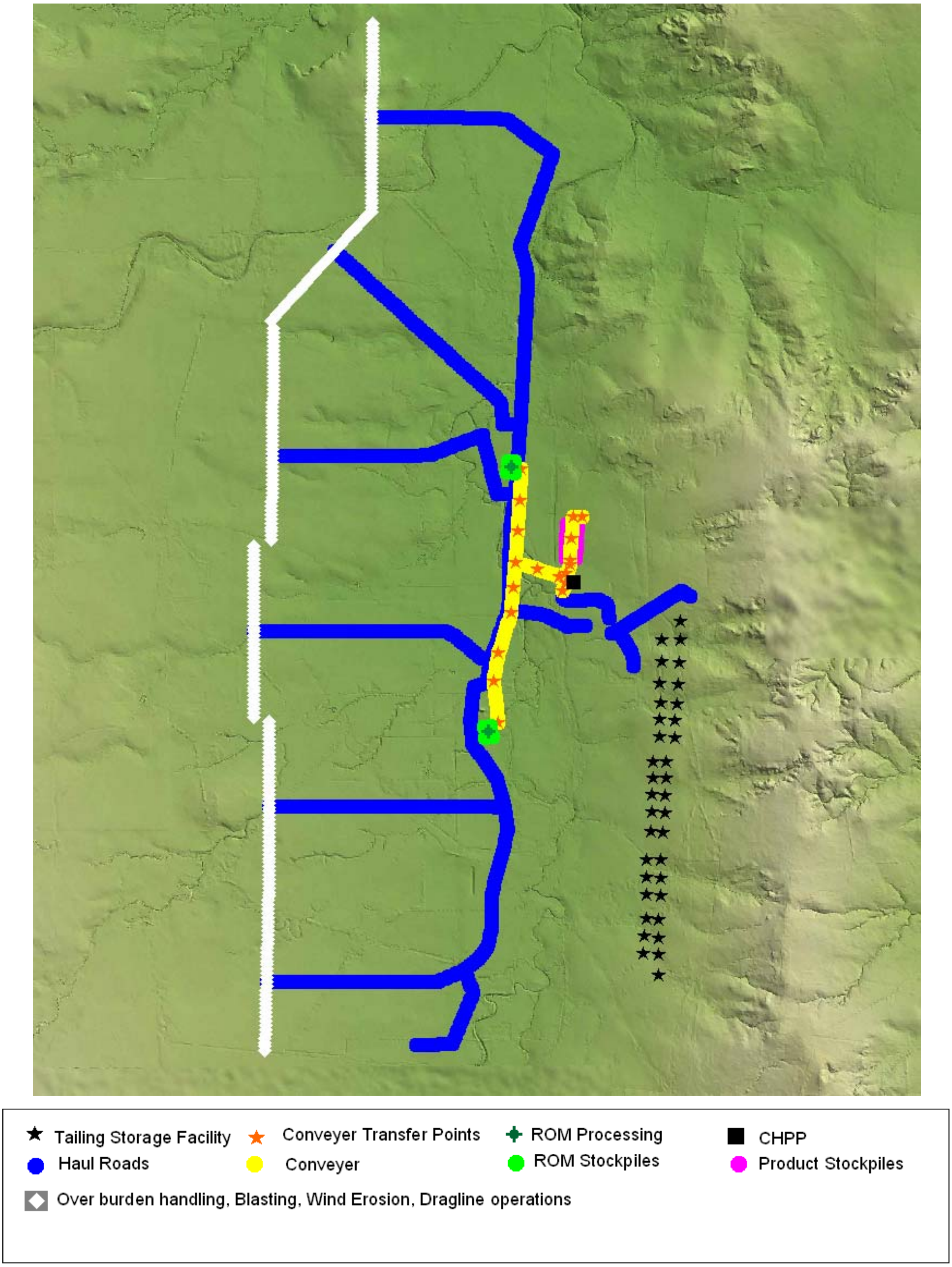
Figure B-5 Location of Modelled Sources- Year 25



★ Tailing Storage Facility	★ Conveyer Transfer Points	✚ ROM Processing	■ CHPP
● Haul Roads	● Conveyer	● ROM Stockpiles	● Product Stockpiles

◆ Over burden handling, Blasting, Wind Erosion, Dragline operations

Figure B-6 Location of Modelled Sources- Year 30



Appendix C Emission Estimation Methodology

C.1 Emissions Estimation

The quantity of emissions of dust from the proposed mine cannot be determined from direct measurement, as the mine is not yet operational. The National Pollutant Inventory (NPI) has a series of Emission Estimation Technique Manuals that are intended to provide data on emissions of air pollutants during typical operations, and which are based on measurements of dust emissions from other operational coal mines in Australia. The NPI Emission Estimation Technique Manual for Mining (NPI, 2001) has been used to provide data to estimate the amount of TSP and PM_{10} emitted from the various activities on a mine site, based on the amount of coal and overburden material mined as provided by the Proponent. The emission factor for truck movements on haul roads has been derived from the US EPA's AP42 emission estimation manual for unpaved roads.

C.1.1 Input Parameters

Site-specific parameters were used to derive emission factors for trucks on unpaved roads, draglines, excavators, shovels, graders, dozers and blasting. The input parameters used for the assessment are listed in Table C-4. Silt content data were obtained from publicly available information for an analogous coal mine in the Bowen Basin (BMA's Caval Ridge Mine Project). For estimation of dust emissions from unpaved roads, the average loaded and unloaded vehicle masses for the various hauling operations on site are listed in Table C-5.

Table C-4 Emission Factor Input Parameters

Parameter	Material					Units
	Overburden	Coal			Road Material	
		In Situ	ROM	Product		
Moisture Content	5	6.9	6.9	6.9	6.9	%
Silt Content	14	5	5	5	4	%
Blasting Area	Variable					m^2
Dragline Drop Distance	15					m
Mean Wind Speed	2.6					m/a
Density	2.4	1.4			-	t/bcm

Table C-5 Vehicle Masses for Hauling Fleet

Vehicle Mass	Overburden Hauling CAT797B	Interburden Hauling CAT785C	Coal Hauling K200 C II	Reject Hauling CAT793 D	Units
Empty	279	113	308	166	Tonnes
Payload	345	136	280	218	Tonnes
Full	624	259	588	384	Tonnes

Table C-6 Source Area

Source	Area	Units
Tailing storage facility- North	290	ha (dry)
Tailing storage facility- Centre	182	ha (dry)
Tailing storage facility- South	215	ha (dry)
Stockpiles- ROM South	10	ha
Stockpiles- ROM North	10	ha
Stockpiles- Product	172	ha

C.1.2 Emission Factors

Dragline operation

For TSP, the following NPI equation is used:

$$EF = 0.0046 \times \frac{d^{1.1}}{M^{0.3}}, \qquad kg/bcm$$

where

- d = drop distance in metres
- M = moisture content of overburden in %
- bcm = bank cubic metre

For PM_{10}, the following NPI equation is used:

$$EF = 0.0022 \times \frac{d^{0.7}}{M^{0.3}}, \qquad kg/bcm$$

For the Alpha Coal Project, a 15 m dragline drop height and 5% overburden moisture content was used.

Loading truck with overburden using excavators/shovel/front-end loaders

The following NPI equation is used to estimate dust emission:

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

where

- k = 0.74 for TSP and 0.35 for PM_{10}
- U = mean wind speed (m/s)
- M = moisture content of overburden (%)

For the Alpha Coal Project, a mean wind speed of 2.6 m/s and moisture content of 5% was used.

Loading truck with coal using excavators/shovel/front-end loaders

The following NPI equation is used to estimate dust emission:

$$EF = k \times 0.0596 \times M^{0.9} \qquad kg/t$$

where

- k = 1.56 for TSP and 0.75 for PM_{10}
- M = moisture content of coal (%)

For the Alpha Coal Project, a moisture content of 6.9% was used.

Bulldozer on coal

For TSP, use the following NPI equation

$$EF = 35.6\frac{s^{0.9}}{M^{1.4}} \qquad kg/h$$

where

- s = silt content (%)
- M = moisture content of overburden (%)

For PM_{10}, use the following NPI equation

$$EF = 6.33\frac{s^{1.5}}{M^{1.4}} \qquad kg/h$$

Using values of 5% for silt content and 6.9% for moisture content gives an emission rate of 16.4 kg/h for TSP and 4.7 kg/h for PM_{10}.

Bulldozer on overburden

For TSP, use the following NPI equation

$$EF = 2.6\frac{s^{1.2}}{M^{1.3}} \qquad kg/h$$

For PM_{10}, use the following NPI equation

$$EF = 0.34\frac{s^{1.5}}{M^{1.4}} \qquad kg/h$$

Using values of 14% for silt content and 5% for moisture content gives an emission rate of 7.6 kg/h for TSP and 1.9 kg/h for PM_{10}.

Trucks dumping (unloading) overburden or coal

For trucks dumping overburden, use a default NPI value of 0.012 kg/t for TSP and of 0.0043 for PM_{10}. For trucks dumping coal, the default values are 0.010 kg/t for TSP and of 0.0042 for PM_{10}. No equations are recommended by NPI.

Drilling

Emissions from drilling are a relatively minor component from an open cut mine. Default NPI emission factors have been used for drilling, which are 0.59 kg/hole for TSP and 0.31 kg/hole for PM_{10}.

Clearly other variables such as the depth and diameter of the hole and moisture and silt content of the material are also relevant. However, no equations were available for NPI to recommend.

Blasting

Due to the limited information available, estimates of dust emissions associated with blasting were developed using the following formula from the current USEPA-AP42 - Vol.1, 5th edition Section 13.2.2

$$EF = 0.00022 * A^{1.5} \qquad kg/blast$$

where

- A = area of blasting (m²)

For PM_{10}, multiply the value calculated for TSP by 0.52.

For the Alpha Coal Project, information associated with the average blast area plus the number of blasts per year was provided by the Proponent.

Wheel-generated dust from unpaved roads

USEPA-AP42 formula has been used to estimate dust emission from wheel generated dust over unpaved roads:

$$EF = 1.381\left(\frac{s}{12}\right)^{A}\left(\frac{W}{3}\right)^{B} \qquad kg/VKT$$

where

- s = silt content in % of road material = 4%
- W = vehicle gross mass in tonnes as per truck below
-

Truck	W (Vehicle Gross Mass)
Overburden truck (full)	624 tonnes
Overburden truck (empty)	279 tonnes
Interburden truck (full)	250 tonnes
Interburden truck (empty)	114 tonnes
Coal truck (full)	588 tonnes
Coal truck (empty)	308 tonnes
Reject truck (full)	384 tonnes
Reject truck (empty)	166 tonnes

-

Exponentials are

- A = 0.7 (TSP) and 0.9 (PM_{10})

- B = 0.45 (TSP) and 0.45 (PM_{10})

Use of grader

The following NPI formulas have been used to estimate grader dust emission:

$$EF = 0.0034S^{2.5} \qquad kg/VKT \qquad \text{for TSP}$$

$$EF = 0.0034S^{2.0} \qquad kg/VKT \qquad \text{for } PM_{10}$$

Where:

- S = mean vehicle speed in km/h (5 km/h)

Miscellaneous transfer and conveying

For conveyor belt transfer points, the following NPI formula has been used:

$$EF = k0.0016(\frac{U}{2.2})^{1.3}(\frac{M}{2})^{-1.4} \qquad kg/t$$

where

- U = mean wind speed (m/s)
- M = material moisture content (%)
- k = 0.74 for TSP and 0.35 for PM_{10}

For this assessment, a mean wind speed of 2.6 m/s and moisture content of 6.9% results in emission factors of 0.00026 kg/t for TSP and 0.00012 kg/t for PM_{10}.

Coal crushing and screening

The NPI does not provide methods to estimate emissions from crushing and screening of coal. US EPA's AP42 emission estimation manual for Mineral Products Industry (Chapter 11.19.2) provides emission factors for crushing stone – tertiary crushing, which are 0.0027 kg/t for TSP and 0.0012 kg/ton for PM_{10}. Note that in AP42, the emission factors for primary and secondary crushing stone are not determined. Hence the tertiary crushing is a conservative value for primary and secondary crushing activities.

In the absence of more representative information, emission factors of 0.0034 kg/t (TSP) and 0.00135 kg/t (PM_{10}) have been adopted for this assessment based on those used in the assessment of the Metropolitan Coal Project NSW (Holmes Air, 2008). It is noted that the contribution to the site emission inventory is c.0.25% and is considered immaterial.

C.1.3 Production Data

Production data were provided by the Proponent. This provided detailed data for Alpha Coal Project on the following items for each year of operation:

- Tonnes of ROM and Product coal moved;
- Volume of overburden removed by dragline, dozer and truck and shovel;

- Area of disturbed land;
- Volume of coal and overburden material blasted;
- Total metres of coal and overburden material drilled; and
- Tonnes of reject material from the CHPP.

C.2 Wind Speed Dependant Wind Erosion

C.2.1 Introduction

In an evaluation of fugitive particulate matter emission estimation techniques, SKM (2005) recommended not using the current default emission factors in the NPI Mining Manual (2001), which are a constant value of 0.4 kg/ha/h for TSP and 0.2 kg/ha/hr for PM_{10}, as crucial environmental factors such as wind and surface wetness are not considered. SKM (2005) suggested retaining the current NPI equation, presented here as Equation 1, to account for the climate variations across Australia while recognising the uncertainty and indicative nature of the NPI equation.

$$E = 1.9(\frac{s}{1.5})365(\frac{365-p}{235})(\frac{f}{15})$$ **Equation 1**

Where:

- s is the silt content (%)
- f is the percentage of time that wind speed is greater than 5.4 m/s at the mean height of the stock pile
- p is the number of days when rainfall is greater than 0.25 mm

Equation 1 is used in the revised modelling of the impacts of dust emissions from the Alpha Coal Project to provide an estimate for the annual total emissions of dust associated with wind erosion. The local meteorological data was then used to distribute the total annual emissions equally to those hours for which the wind speed is greater than a critical wind speed using the methodology outlined in the following sections.

C.2.2 Wind Erosion for Stockpiles

NPI Mining Manual (2001) suggested the use of Equation 1 to calculate annual dust emission from active coal stockpiles. Equation 1 is for estimating emissions for total suspended particles (TSP). Emissions of PM_{10} are estimated from TSP using a PM_{10} to TSP ratio of 1/2. Equation 1 represents the annual total emissions.

Equation 2 (SKM, 2005, Eq 5.14) was then used to distribute the total annual emissions into hourly emissions

$$F = ku^3(1-\frac{u^2}{u_0^2}) \text{ when } u > u_0 \text{, otherwise F = 0}$$ **Equation 2**

Where:

- k is a constant
- u is hourly average wind speed at root mean square height of the stockpile (m)
- u_0 is a wind speed threshold velocity.

The critical wind speed u_0 is calculated based on a critical wind speed of 5.4 m/s at the root mean square height of the stockpile, corrected to 10 m based on logarithmic wind speed profile as shown in Equation 3.

$$u_0 = 5.4 \ln\left(\frac{10 - z_0}{z - z_0}\right) \quad \textbf{Equation 3}$$

Where:

- z is the root mean square height of a stockpile (m)
- z_0 is the surface roughness (0.05 m)

The constant k in Equation 2 is obtained based on the relationship that the cumulative hourly emissions calculated from Equation 2 are equal to the total annual emissions calculated from Equation 1.

C.2.3 Wind Erosion for Exposed Areas

The methodology for the development of wind speed dependent dust emissions for exposed areas is identical to that for stockpiles with a critical wind speed of 5.4 m/s at 10 m height used in Equation 2.

C.2.4 Wind Speed Dependent Emission Factors

Presented in Figure C-7 is an example of the wind speed dependent wind erosion emission factors used in the Alpha Coal Project air quality assessment. A summary of the annual wind speed dependent erosion for stockpiles and exposed areas is presented in Table C-7.

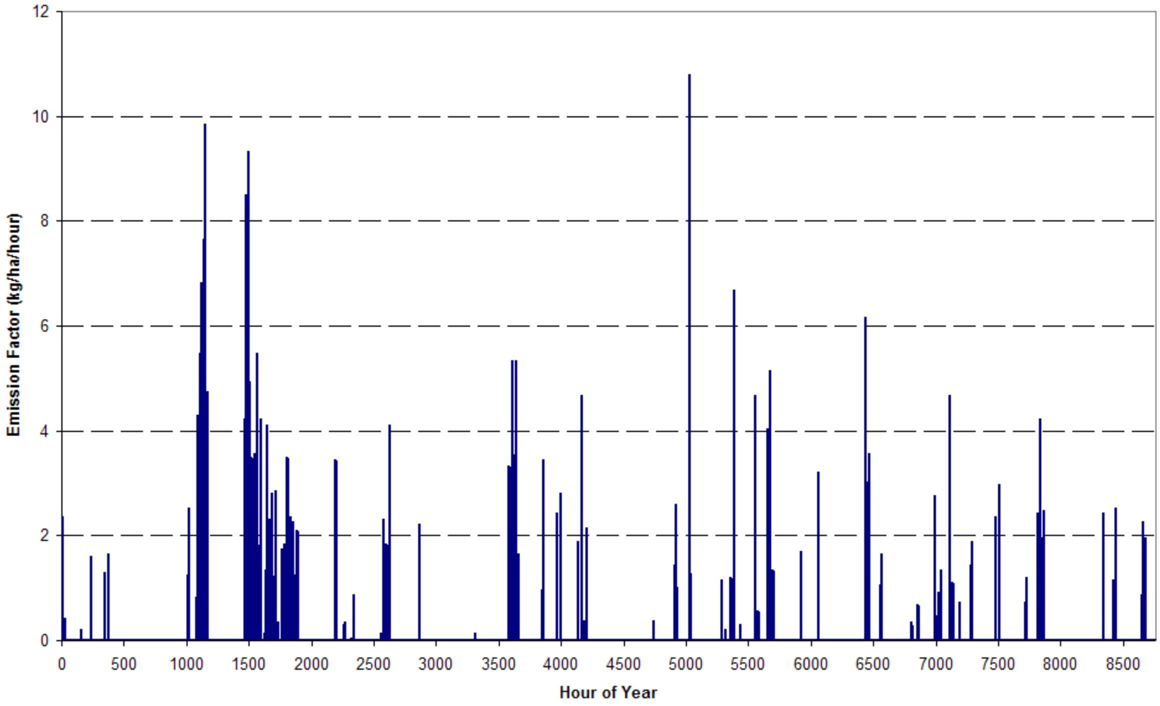


Figure C-7 (Example) Wind Speed Dependent Emission Factor for Stockpiles

Table C-7 Summary of Parameters used to Calculate Wind Erosion Emission Factors

Parameter	Units	Product Stockpiles	ROM Stockpiles	Tailing Dams	Exposed Areas
Source height	m	20	4	-	-
Source root mean square height	m	14.1	2.8	10	10
Wind speed at source height	m/s	5.4	4.1	5.4	5.4
Critical wind speed @ 10 m (m/s)	m/s	5.1	5.4	5.4*	5.4*
Hours over critical wind speed	%	1.5	0.7	0.7	0.7
Silt content	%	5	5	30	14
F (kg/ha/year)	kg/ha/year	299.9	145.3	871.7	406.8
k		0.06	0.06	0.36	0.17

* A conservative approach has been adopted which will overestimate the frequency of emissions from exposed areas.

Appendix D Site Emissions Inventory

Presented in this appendix is the site-specific emissions inventory for PM_{10} developed for all years of the mine.

The inventory is presented as the percentage contribution of dust from each of the activities to the site total given in kg/year.

Table D-8 Ratio of PM_{10} to TSP

Activity	Ratio of PM_{10}/TSP
Topsoil	
Disturbance & Rehabilitation	0.50
Overburden & In-Pit	
Processing (IPCC)	0.39
Drilling & Blasting	0.52
Dragline	0.16
FEL of Overburden into Trucks	0.47
Transport of Overburden to dumps	0.25
Truck Dumping at Overburden Dumps	0.36
FEL of coal trucks	0.48
Dozers	0.25
Graders	0.45
ROM Activities	
Processing	0.39
Truck Dumping at ROM	0.42
FEL at ROM	0.48
Dozer hours – Coal at ROM (total)	0.29
Wind Erosion from Stockpiles	0.50
ROM to CHPP Conveyor	
Conveyors	0.50
Misc Transfer Points	0.47
CHPP Activities	
Processing	0.39
FEL at CHPP	0.48
Dozer hours – Coal at CHPP	0.29
Loading Stockpiles	0.43
Unloading from Stockpiles	0.43
CHPP Conveyors	0.50
Misc Transfer Points	0.47
Wind Erosion from Stockpiles	0.50
Main Haul Roads	
Transport of Coal to ROM	0.25
Transport of Rejects to Dumps	0.25
Tailing Storage Facility	
Wind Erosion from Tailing Storage Facility	0.50
Site Average	**0.28**

Table D-9 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10}

Summary – PM_{10}	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Topsoil										
Disturbance & Rehabilitation	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%
Overburden & In-Pit										
Processing (IPCC)	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%
Drilling & Blasting	0%	0%	1%	1%	2%	2%	3%	3%	2%	2%
Dragline	0%	0%	1%	3%	4%	7%	9%	9%	10%	11%
FEL of Overburden into Trucks	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Transport of Overburden to dumps	43%	39%	39%	37%	36%	36%	35%	34%	34%	35%
Truck Dumping at Overburden Dumps	33%	29%	29%	28%	27%	27%	27%	26%	26%	26%
FEL of coal trucks	1%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Dozers	4%	4%	4%	4%	4%	3%	3%	3%	3%	3%
Graders	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM Activities										
Processing	0%	1%	1%	1%	1%	0%	0%	0%	0%	0%
Truck Dumping at ROM	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%
FEL at ROM	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours – Coal at ROM (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM to CHPP Conveyor										
Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Misc Transfer Points	0%	0%	0%	1%	0%	0%	0%	1%	1%	0%
CHPP Activities										
Processing	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%

Summary – PM_{10}	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
FEL at CHPP	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours – Coal at CHPP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unloading from Stockpiles	1%	3%	3%	3%	3%	3%	3%	3%	3%	3%
CHPP Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Misc Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Main Haul Roads										
Transport of Coal to ROM	3%	7%	6%	8%	7%	7%	6%	7%	7%	7%
Transport of Rejects to Dumps	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%
Tailing Storage Facility										
Wind Erosion from Tailing Storage Facility	8%	3%	2%	2%	2%	2%	2%	2%	2%	2%
Site Average	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table D-10 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10} (continued)

Summary – PM_{10}	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20
Topsoil										
Disturbance & Rehabilitation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Overburden & In-Pit										
Processing (IPCC)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Drilling & Blasting	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%
Dragline	10%	11%	11%	10%	11%	11%	10%	11%	10%	10%
FEL of Overburden into Trucks	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

Appendix D

Summary – PM_{10}	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20
Transport of Overburden to dumps	34%	35%	35%	35%	35%	35%	35%	35%	35%	36%
Truck Dumping at Overburden Dumps	26%	26%	26%	26%	26%	26%	27%	27%	26%	27%
FEL of coal trucks	4%	4%	4%	4%	4%	4%	4%	4%	4%	3%
Dozers	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Graders	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM Activities										
Processing	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Truck Dumping at ROM	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
FEL at ROM	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours – Coal at ROM (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM to CHPP Conveyor										
Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Misc Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CHPP Activities										
Processing	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
FEL at CHPP	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours – Coal at CHPP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unloading from Stockpiles	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
CHPP Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Misc Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Main Haul Roads										
Transport of Coal to ROM	7%	7%	7%	7%	7%	7%	7%	7%	8%	7%

Summary – PM10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20
Transport of Rejects to Dumps	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tailing Storage Facility										
Wind Erosion from Tailing Storage Facility	2%	2%	2%	2%	2%	2%	1%	2%	1%	1%
Site Average	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table D-11 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10} (continued)

Summary – PM10	Y21	Y22	Y23	Y24	Y25	Y26	Y27	Y28	Y29
Topsoil									
Disturbance & Rehabilitation	0%	0%	0%	0%	0%	0%	0%	0%	0%
Overburden & In-Pit									
Processing (IPCC)	1%	1%	1%	1%	1%	1%	1%	1%	1%
Drilling & Blasting	2%	2%	2%	2%	2%	2%	2%	2%	2%
Dragline	10%	10%	10%	10%	10%	9%	9%	9%	9%
FEL of Overburden into Trucks	1%	1%	1%	1%	1%	1%	1%	1%	1%
Transport of Overburden to dumps	36%	36%	36%	36%	37%	37%	37%	37%	36%
Truck Dumping at Overburden Dumps	27%	27%	28%	28%	28%	28%	28%	28%	28%
FEL of coal trucks	3%	3%	3%	3%	3%	3%	3%	3%	3%
Dozers	2%	2%	2%	2%	2%	2%	2%	2%	2%
Graders	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM Activities									
Processing	0%	0%	0%	0%	0%	0%	0%	0%	0%
Truck Dumping at ROM	2%	2%	2%	2%	2%	2%	2%	2%	2%
FEL at ROM	1%	1%	1%	1%	1%	1%	1%	1%	1%

Summary – PM_{10}	Y21	Y22	Y23	Y24	Y25	Y26	Y27	Y28	Y29
Dozer hours – Coal at ROM (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM to CHPP Conveyor									
Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Misc Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%
CHPP Activities									
Processing	1%	1%	1%	1%	1%	1%	1%	1%	1%
FEL at CHPP	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours – Coal at CHPP	0%	0%	0%	0%	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unloading from Stockpiles	3%	3%	3%	3%	2%	2%	3%	2%	3%
CHPP Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Misc Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Main Haul Roads									
Transport of Coal to ROM	7%	7%	7%	7%	7%	7%	7%	7%	8%
Transport of Rejects to Dumps	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tailing Storage Facility									
Wind Erosion from Tailing Storage Facility	1%	1%	1%	1%	1%	1%	1%	1%	1%
Site Average	100%	100%	100%	100%	100%	100%	100%	100%	100%

Appendix E Site Emissions Inventory

Presented in this appendix are the results of the dispersion modelling for:

- The 5th highest 24-hour average ground-level concentration of PM_{10}
- The maximum 24-hour average ground-level concentration of $PM_{2.5}$
- The annual average ground-level concentration of $PM_{2.5}$
- The annual average ground-level concentration of TSP
- Dust deposition

For:

- Year 10
- Year 15
- Year 20
- Year 25

At each of the receptor locations.

Table E-12 The 5th Highest 24-hour Average Ground-level Concentration of PM_{10} (ug/m^3)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	94.9	**121.9**	244%	107.7	**134.7**	269%	112.1	**139.1**	278%	123.2	**150.2**	300%
2	36.9	**63.9**	128%	37.0	**64.0**	128%	38.7	**65.7**	131%	41.4	**68.4**	137%
3	25.9	**52.9**	106%	31.6	**58.6**	117%	33.0	**60.0**	120%	33.6	**60.6**	121%
4	65.1	**92.1**	184%	64.4	**91.4**	183%	66.0	**93.0**	186%	66.3	**93.3**	187%
6	21.4	48.4	97%	20.1	47.1	94%	21.0	48.0	96%	19.9	46.9	94%
8	177.9	**204.9**	410%	193.2	**220.2**	440%	241.2	**268.2**	536%	266.0	**293.0**	586%
9	203.0	**230.0**	460%	198.4	**225.4**	451%	192.0	**219.0**	438%	185.4	**212.4**	425%
10	14.7	41.7	83%	15.2	42.2	84%	15.1	42.1	84%	15.2	42.2	84%
11	14.0	41.0	82%	14.6	41.6	83%	16.1	43.1	86%	16.4	43.4	87%
12	135.7	**162.7**	325%	132.8	**159.8**	320%	139.8	**166.8**	334%	145.1	**172.1**	344%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

Table E-13 The Maximum 24-hour Average Ground-level Concentration of $PM_{2.5}$ (ug/m^3)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	24.2	**29.6**	118%	26.9	**32.3**	129%	27.5	**32.9**	132%	28.7	**34.1**	137%
2	9.7	15.1	60%	9.2	14.6	59%	9.2	14.6	58%	9.7	15.1	60%
3	10.0	15.4	61%	9.5	14.9	60%	9.7	15.1	60%	9.9	15.3	61%
4	23.1	**28.5**	114%	20.4	**25.8**	103%	20.7	**26.1**	104%	20.2	**25.6**	102%
6	10.3	15.7	63%	9.6	15.0	60%	9.4	14.8	59%	9.5	14.9	60%
8	41.2	**46.6**	186%	43.8	**49.2**	197%	52.2	**57.6**	230%	57.9	**63.3**	253%
9	44.2	**49.6**	198%	41.2	**46.6**	186%	42.8	**48.2**	193%	41.8	**47.2**	189%
10	9.6	15.0	60%	9.7	15.1	61%	10.6	16.0	64%	10.8	16.2	65%
11	13.2	18.6	75%	13.2	18.6	74%	13.7	19.1	76%	13.8	19.2	77%
12	33.8	**39.2**	157%	33.7	**39.1**	156%	35.5	**40.9**	163%	34.6	**40.0**	160%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

Table E-14 The Annual Average Ground-level Concentration of $PM_{2.5}$ (ug/m^3)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	2.7	5.5	69%	3.0	5.8	72%	3.0	5.8	73%	3.2	6.0	75%
2	0.4	3.2	41%	0.4	3.2	40%	0.4	3.2	41%	0.4	3.2	41%
3	0.4	3.2	39%	0.4	3.2	40%	0.4	3.2	40%	0.4	3.2	40%
4	0.7	3.5	43%	0.7	3.5	43%	0.7	3.5	43%	0.7	3.5	43%
6	0.2	3.0	37%	0.2	3.0	37%	0.2	3.0	37%	0.2	3.0	37%
8	7.1	**9.9**	124%	8.0	**10.8**	135%	9.7	**12.5**	157%	10.7	**13.5**	169%
9	5.1	7.9	99%	4.7	7.5	94%	4.4	7.2	91%	4.0	6.8	85%
10	0.2	3.0	37%	0.2	3.0	37%	0.2	3.0	37%	0.2	3.0	38%
11	0.2	3.0	37%	0.2	3.0	37%	0.2	3.0	37%	0.2	3.0	37%
12	1.4	4.2	53%	1.5	4.3	53%	1.5	4.3	54%	1.5	4.3	54%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

Table E-15 The Annual Average Ground-level Concentration of TSP (ug/m^3)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	16.7	44.7	50%	18.8	46.8	52%	18.9	46.9	52%	20.2	48.2	54%
2	2.9	30.9	34%	2.9	30.9	34%	3.0	31.0	34%	3.0	31.0	34%
3	2.4	30.4	34%	2.5	30.5	34%	2.5	30.5	34%	2.6	30.6	34%
4	4.3	32.3	36%	4.1	32.1	36%	4.2	32.2	36%	4.2	32.2	36%
6	1.2	29.2	32%	1.2	29.2	32%	1.2	29.2	32%	1.2	29.2	32%
8	45.6	73.6	82%	51.5	79.5	88%	63.4	**91.4**	102%	69.3	97.3	108%
9	32.0	60.0	67%	29.5	57.5	64%	27.7	55.7	62%	24.6	52.6	58%
10	1.1	29.1	32%	1.1	29.1	32%	1.2	29.2	32%	1.2	29.2	32%
11	1.0	29.0	32%	1.0	29.0	32%	1.0	29.0	32%	1.1	29.1	32%
12	9.8	37.8	42%	9.7	37.7	42%	10.2	38.2	42%	10.1	38.1	42%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

Table E-16 Dust Deposition (mg/m^2/day)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	2.9	70.9	51%	3.4	71.4	51%	3.4	71.4	51%	3.8	71.8	51%
2	1.0	69.0	49%	0.9	68.9	49%	0.9	68.9	49%	0.9	68.9	49%
3	0.7	68.7	49%	0.7	68.7	49%	0.8	68.8	49%	0.8	68.8	49%
4	1.3	69.3	49%	1.2	69.2	49%	1.3	69.3	49%	1.3	69.3	49%
6	0.3	68.3	49%	0.3	68.3	49%	0.3	68.3	49%	0.3	68.3	49%
8	12.5	80.5	57%	14.3	82.3	59%	18.0	86.0	61%	19.5	87.5	62%
9	12.8	80.8	58%	11.8	79.8	57%	10.6	78.6	56%	8.7	76.7	55%
10	0.2	68.2	49%	0.2	68.2	49%	0.2	68.2	49%	0.2	68.2	49%
11	0.1	68.1	49%	0.1	68.1	49%	0.2	68.2	49%	0.2	68.2	49%
12	3.1	71.1	51%	3.0	71.0	51%	3.1	71.1	51%	3.0	71.0	51%

Note (1): Numbers highlighted in bold exceed the relevant Project Goal

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