Appendix I: Air Quality Impact and Greenhouse Gas Assessment

Colton Mine Project

Air Quality Impact & Greenhouse Gas Assessment

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Prepared for

AARC

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1 Introduction

ASK Consulting Engineers was commissioned by AustralAsian Resource Consultants (AARC) on behalf of Northern Energy Corporation Limited (NEC) to carry out an air quality impact and greenhouse gas assessment for the construction and operation of the proposed Colton Mine Project.

ASK has previously undertaken an air quality and greenhouse gas assessment of the proposed Colton Mine, which was submitted to DERM as part of the EIS. Since that time there have been a number of changes to the mine and its operation including a relocation of the fixed plant and rail loop. This report reflects these changes.

The purpose of this report is:

- Present background air pollutant level data provided to ASK;
- Determine appropriate air quality criteria for the project;
- Determine the air pollutant emission levels of the proposed fixed and mobile plant;
- Assess operational and construction air pollutant levels in accordance with the relevant air quality criteria;
- Prepare greenhouse gas inventory; and
- Provide recommendations for inclusion in the Environmental Management Plan.

2 Project Description

2.1 Project Description

NEC proposes to develop the Colton Mine Project approximately 11km north of Maryborough, Queensland. The location of the proposed Colton Mine Project is shown on Figure 2.1.

The proposed total movement for the mine including Run of Mine (ROM), interburden and overburden is approximately 2.9Mt to 18.2Mt per year over a projected life of 8 years. The maximum mine throughput is proposed for Year 8 being 18.2 Mt which includes ROM and inter/overburden. The coal handling and process plant (CHPP) will treat 200t of coal per hour. Coal crushing will be conducted when the CHPP is in operation. The project will include a single main pit area.

The proposed project infrastructure and pit layout is shown in Figure 2.2. Mining will be open pit.

Coal will be hauled to the treatment plant via haul roads from the pit. Waste material will be stacked in waste dumps adjacent to the pit. Trucking will be conducted using Caterpillar 785 dump trucks. Product from the mine will be transported via the rail loop proposed for the mine (via coal freight train). On average 1 freight train would be required per day.

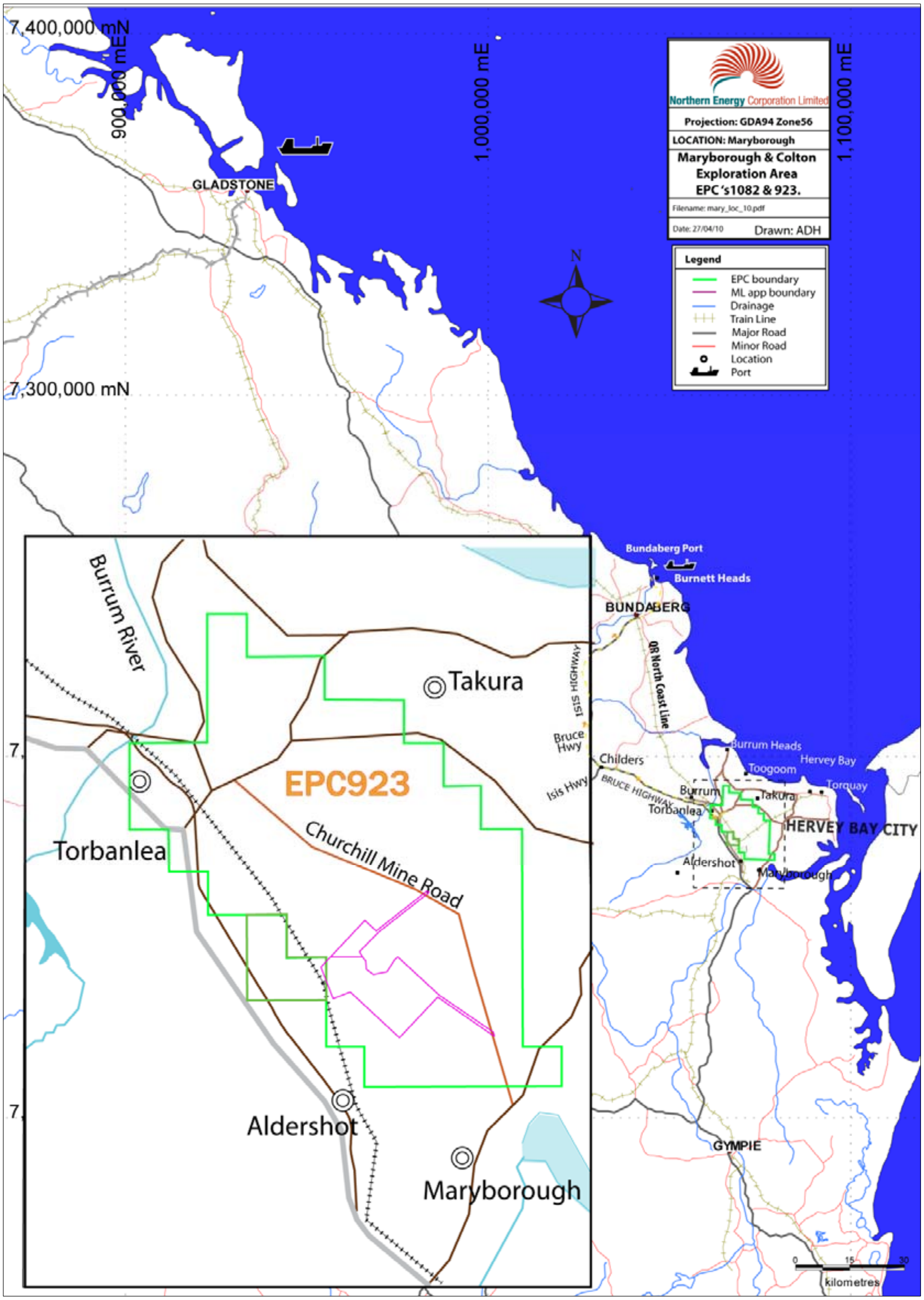


Figure 2.1 Location of Colton Mine Project (North to Top)

The proposed mining fleet and major equipment are shown in **Table 2.1**. The equipment utilisation for Day (D), Evening (E) and Night (N) of Year 8 is included in **Table 2.1**.

Table 2.1 Equipment Utilisation – Year 8 Production Year

Type	Equipment	Details	Location	# of			Vehicle Utilisation (h/veh/year)			Av. Speed (km/hr)	Av. Fuel Use (L/hr)	kw
				D	E	N	D	E	N			
Mobile	Excavator	EX 2500	In Pit	1	1	1	2952	1073	2415	0.025	150	NA
	Excavator	EX 1250	In Pit	1	1	1	2952	1073	2415	0.025	75	
	Track Dozer	CAT D11 T	Surface	1	1	1	2952	1073	2415	3	118	
	Track Dozer	CAT D9 T	Pit/Dump	1	1	1	2952	1073	2415	3	118	
	Dump Truck	CAT 785 C/D	Pit/Dump	4	4	4	2214	805	1811	15	108	
			Pit/CHPP	2	2	2	2952	1073	2415	15	108	
	Grader	CAT 16 M	In Pit	1	1	1	2952	1073	2415	5	25	
	Front End Loader	WA 800	ROM	1	1	1	1222	444	1000	2	90	
			Product	1	1	1	978	356	800	1	90	
			Train Load	2	0	0	506	0	0	2.5	90	
	Scraper	-	Surface	2	0	0	855	0	0	10	25	
	Blasthole Drill	Drilltech D25K	Pit	1	0	0	1351	0	0	1	110	
	Water Truck	10 kL truck	In Pit	1.5	1.5	1	2952	1073	2415	8	15	
	Light Vehicle	Landcruiser	Admin	3	2	2	2952	1073	2415	3	10	
Fixed	CHPP	Crusher/DMC	Plant	1	1	1	NA			NA	-	-
	Pumps	30kW	Plant	3	3	3					5	131

The main treatment plant consists of:

- Primary Crusher (200 t/hr)
- DMC/Spirals/Floatation

Blasting would be conducted 4 to 20 times a year with the following typical characteristics for each blast:

- 15,600 m^2 area
- Stemming Height 5.0m and burden would be 8.0m
- Blast hole diameter of 0.226m
- 195 holes
- 1.3 to 8.7 Mt of overburden blasted each year
- Approximate mass instantaneous charge (MIC) of 256 kg

2.2 Sensitive Locations

The nearest sensitive locations (see **Figure 2.2**) are summarised in **Table 2.2** including the approximate distances from:

(i) the nearest pit
(ii) the main plant.

Table 2.2 Nearest Sensitive Receivers (Refer Figure 2.2)

Location	Receiver Type	Location Coordinates (AMG Zone 56)		Distance from Project (km)	
		East	North	Pit	Main Plant
L1	Single Residence – Bruce Highway	461629	7189497	4.1	3.8
L2	Single Residence – Colton Rd	465580	7186014	2.2	2.8
L3	Nearest Residence – Marshall Rd, Aldershot	466318	7184272	3.2	4.6
L4	Single Residence – Peridge Rd	470761	7184180	3.8	7.0
L5	Nearest Residence – Corner of Churchill Mine Road & Peridge Rd	472405	7184190	5.0	8.3
L6	Nearest Residence – Corner of Maryborough Hervey Bay Rd & Peridge Rd	473214	7184412	5.6	8.9
L7	Single Residence – Maryborough Hervey Bay Rd	474935	7187942	6.6	9.6

ASK has been advised that the buildings to the northeast of the proposed pit are within the shooting range property boundary and are not used as residences. Hence these buildings are not considered further in this report.

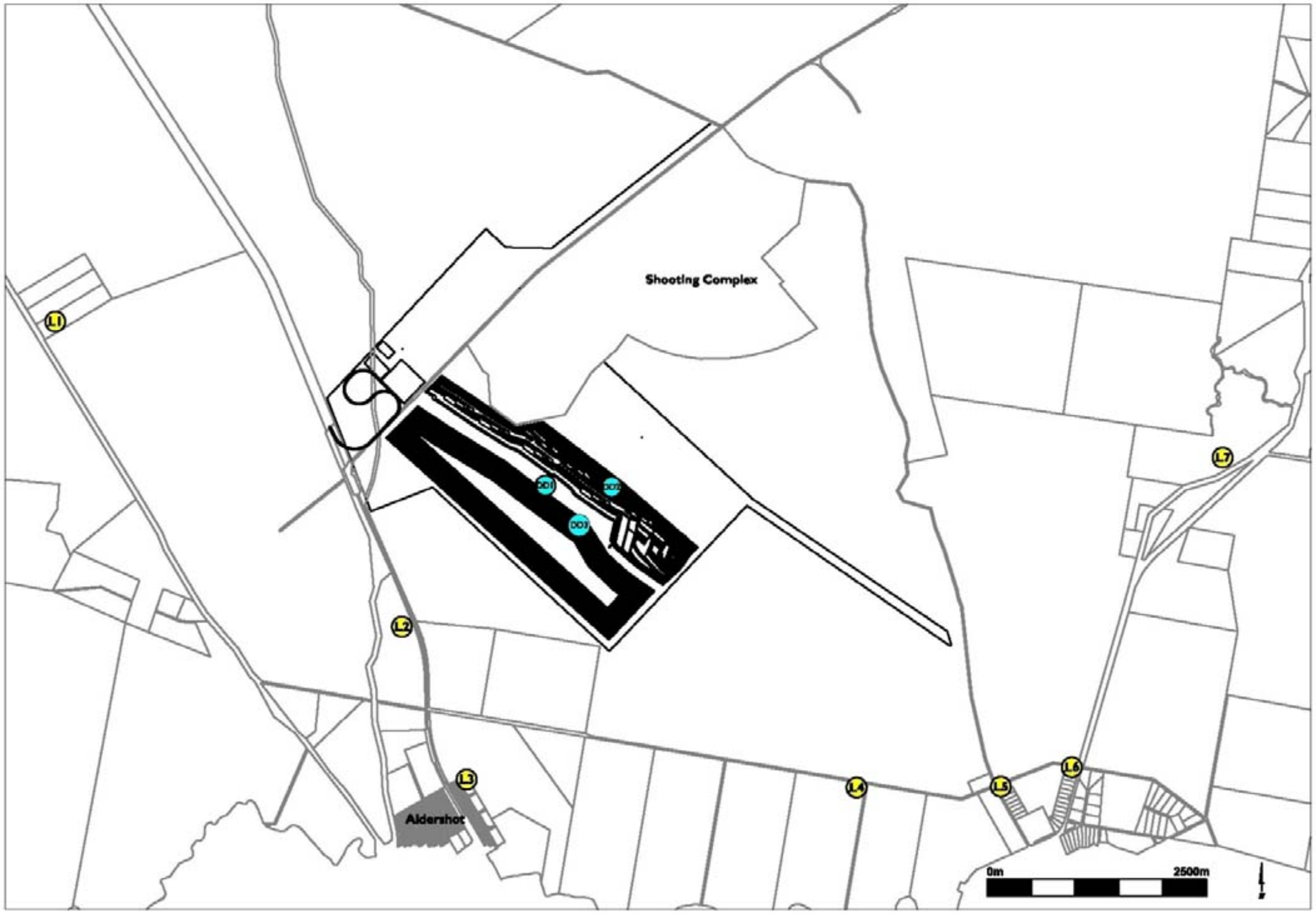


Figure 2.2 Monitoring and Sensitive Receiver Locations

3 Air Quality Environmental Values

The proposed mining operations will result in the emission of a number of classes of particulate matter namely total suspended particulate matter (TSP), particulate matter with equivalent aerodynamic diameters of 10 µm or less (PM_{10}), and particles with equivalent aerodynamic diameters of 2.5 µm and less ($PM_{2.5}$). These emissions would occur primarily as fugitive dust from open cut mining operations.

There will also be exhaust emissions from diesel powered haul trucks and other open cut mining equipment. These emissions will include carbon monoxide (CO), minor quantities of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), Volatile Organic Carbons (VOC) and PM_{10}. In practice, the gaseous emissions will be minor and are not considered further. As such the project's potential to generate photochemical smog and acid rain would also be minor and are not considered further. Particulate matter emissions from the exhausts of diesel powered mining equipment are included within the assessment of dust emissions as they are part of the fugitive emissions calculations.

The focus of the assessment will be on potential impacts due to emissions of particulate matter.

The air quality assessment has been undertaken with reference to air quality limits specified in the Environmental Protection (Air) Policy 2008 (EPP(Air)) and other relevant Environmental Protection Agency (EPA) guidelines have been summarised in Table 3.1. The relevant air quality indicators for particulate emissions are shown. The EPP(Air) has incorporated the particulate matter goals nominated within the National Environmental Protection Measure (NEPM).

Dust deposition limits are based on acceptable dust fallout values, in relation to nuisance, and are expressed in terms of g/m^2/month.

The concentrations of Arsenic, Cadmium, Lead, Manganese, Nickel and Vanadium within sampled spoil and ROM material have been supplied to ASK. Based on the supplied concentrations within the samples and their respective EPP(Air) criterion level, Arsenic was determined to be a limiting factor for compliance and has been assessed further within this report. The other pollutants have not been considered further.

The arsenic concentration in the spoil and ROM sample material has been supplied by AARC and ranges from 5 ppm to 63 ppm and 1.58 ppm to 11.24 ppm respectively. The average spoil concentration value of 23.4 ppm has been used to estimate the annual average concentration of arsenic as PM_{10} at sensitive receivers.

The National Health and Medical Research Council (NHMRC) 'National guidelines for control of emissions of air pollutants from new stationary sources' was rescinded on 8/11/1999 and therefore has not been considered further.

Table 3.1 Air Quality Criteria

Air Quality Indicator	Units	Design Ground Level	Averaging Period	Source	Allowable Exceedances
Particulate $PM_{2.5}$	µg/m³	25	24 hours	EPP(Air)	-
		8	1 year		-
Particulate PM_{10}	µg/m³	50	24 hours	EPP(Air)	5 days each year
Total Suspended Particulate (TSP)	µg/m³	90	1 year	EPP(Air)	-
Arsenic as PM_{10}	ng/m³	6	1 year	EPP(Air)	-
Particles (deposited)	g/m²/month	4	30 days	DERM	-

4 Existing Environment

It is expected that the air quality for the study area would be reasonably good, with acceptable levels of pollutants for the majority of the time. The existing air quality for the subject area would be influenced by sporadic traffic on unsealed roads as well as bushfires and controlled burning. Localised or short-term degradation of the air quality environment would most likely be due to smoke and dust from bushfires.

Background pollutant levels were based on available measured results provided by AARC and also previous Queensland studies. These background pollutant levels are considered to be a reasonable estimate of the existing air quality in the study area.

Meteorology for the site has been simulated using TAPM with regard for observations obtained at the nearest Bureau of Meteorology (BOM) weather station at Maryborough.

4.1 Existing Air Quality

4.1.1 Dust Concentration

As the majority of the project sensitive receivers are within a rural environment, background dust concentration data relating to typical rural environments are considered appropriate. Dust monitoring in the area has been conducted for dust deposition only with no dust concentration data available. The EPA operates an air pollutant monitoring network within Queensland, however the majority of locations are within highly populated areas (EPA, 2007) with extensive traffic. Therefore these values are not considered appropriate for a rural site but would represent an upper bound for typical dust concentrations within the project area. Based on the EPA monitoring an assumed 24 hour average and annual average background PM_{10} concentration of 20 $\mu g/m^3$ and 10 $\mu g/m^3$ have been utilised for the project area.

Based on a typical ratio of PM_{10} to TSP around Australian mines being 0.39 (ACARP, 1999), a ratio of 0.4 has been used to estimate the annual average TSP concentration, being 25 $\mu g/m^3$. A $PM_{2.5}$ to PM_{10} ratio of 0.25 has been used to determine background $PM_{2.5}$ concentrations. Based on the assumed PM_{10} values, the 24 hour and annual average $PM_{2.5}$ concentrations have been estimated to be 5 $\mu g/m^3$ and 3 $\mu g/m^3$ respectively.

It is assumed that negligible background concentrations of arsenic are present.

4.1.2 Dust Deposition

Ambient dust deposition levels are based on data supplied by AARC at Locations DD1, DD2 and DD3 (see Figure 2.2) and summarised in Table 4.2.

Table 4.2 Measured Dust Deposition Data

Date	Measured Deposition g/m²/month			
	DD1	DD2	DD3	Average
29-05-08	1.6	1.4	2	1.7
28-06-08	0.5	0.2	1.1	0.6
06-11-08	4.8	1.8	4.5	3.7
06-12-08	2.8	3.3	1.3	2.5
06-01-09	NA - W	17.1	9.1	-
05-02-09	NA - W	NA - W	NA - W	-
03-03-09	NA - W	3.1	2.9	3.0
02-04-09	2.9	2.5	2.9	2.8
30-04-09	3.3	2.5	2.9	2.9
28-05-09	2.2	2.1	2.5	2.3
Average				2.4

Note: NA - W denotes overflowed with rain water

Atypical measurements collected on 06/01/09 are excluded from the average.

Based on the dust deposition data contained in Table 4.2 an average background deposition rate of 2.4 g/m^2/month has been assumed.

4.2 Meteorology Simulation

Currently no measured site specific data exists for the subject mine, therefore the meteorological component of The Air Pollution Model (TAPM) was used to simulate local wind data for the site. The TAPM modelling scenario included observations from the closest BOM meteorological station to the site (Maryborough).

The databases required to run TAPM are provided by CSIRO and include global and Australian terrain height data, vegetation and soil type datasets, sea surface temperature datasets and synoptic scale meteorological datasets.

The global terrain and land characterisation data is in the form of 30-second grid spacing (approximately 1 km) and is based on public domain data available from the US Geological Survey, Earth Resources Observation Systems (EROS) Data Centre Distributed Active Archive Centre (EDC DAAC). The Australian terrain data is in the form of 9-second grid spacing (approximately 0.3 km) and is based on licensed data available from Geoscience Australia. Australian vegetation and soil type data is on a longitude/latitude grid at 3-minute grid spacing (approximately 5 km) and is public domain data provided by CSIRO Wildlife and Ecology.

The sea surface temperature dataset is based on Rand's global long-term monthly mean sea surface temperatures on a longitude/latitude grid at 1-degree grid spacing (approximately 100 km). They are based on public domain information available from the US National Center for Atmospheric Research (NCAR).

The synoptic scale meteorology datasets used are a six-hourly synoptic scale analyses on a longitude/latitude grid at 0.75 or 1.0-degree grid spacing (approximately 75 km or 100 km). The database is derived from LAPS or GASP analysis data from the Bureau of Meteorology (BoM).

TAPM dynamically fits the gridded data for the selected region to finer grids taking into account terrain, surface type and surface moisture conditions. TAPM produces detailed fields of hourly estimated temperature, winds, pressure, turbulence, cloud cover and humidity at various levels in the atmosphere as well as surface solar radiation and rainfall.

Seasonal wind rose diagrams based on the TAPM predictions are presented in Appendix A.

They indicate the following:

- Highest speeds are normally associated with winds from the southeast
- During the night the wind speed decreases resulting in a large percentage of the lower wind speeds
- Winds are predominantly from the southeastern quadrant
- In summer, winds are predominately from the north and southeast
- In autumn, winds are mainly from the southeastern quadrant
- In winter, winds are mainly from the southeast and southwest quadrants
- In spring, winds are mainly from the northeast quadrant
- Winds during the morning are predominantly from the southeast and south
- Winds during the afternoon are predominantly from the southeast and east-southeast

Plume dispersion is affected by atmospheric stability. Plumes are more readily dispersed during unstable atmospheric conditions, such as on a hot summer's day, than during stable atmospheric conditions, such as on a cool winter's night. Very unstable conditions are denoted as Stability Class A, with very stable conditions denoted as Stability Class F. Neutral conditions, such as those that typically occur during cloudy conditions, are denoted as Stability Class D.

A graph of Stability Class TAPM predictions is also presented in Appendix A. The stability data is presented as a frequency distribution for a full year. It can be seen that stability classes D (neutral) and F (very stable) are dominant with frequencies of 31.0% and 22.6% respectively. Stable conditions being Class E result in 18.6% of the distribution while unstable Classes A to C results in the remainder of the distribution for the year.

5 Air Quality Modelling

5.1 Methodology

The dust predictions undertaken for this assessment are based on the following:

- Dust emissions estimates were based on accepted methods and data consolidated by the National Pollutant Inventory (NPI) and the Environmental Protection Agency of The United States of America (USEPA) Shown in Appendix B
- Prediction of input meteorology using TAPM developed by the CSIRO Division of Atmospheric Research. TAPM has a prognostic three dimensional meteorological component which can be used to generate hourly meteorological data for input into Gaussian plume models
- Prediction of dust concentrations and depositions with CALPUFF developed by Earth Tech
- Predicted levels are compared against criteria presented in Section 3

CALPUFF is a model which is accepted by the DERM for regulatory applications. Predictive models of airborne pollutant dispersion are simplifications of reality. The CALPUFF model provides useful and adequate indications of ground level concentrations for most practical purposes.

TAPM is a prognostic three-dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. TAPM uses synoptic, terrain and surface characteristics (temperature, vegetation and moisture content) to predict meteorology. Nested grids are used within a large domain, this allows the meteorological resolution to be refined to a local scale. TAPM predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows. These fields can then be used to produce the ISC meteorological files that are utilised in the CALPUFF dispersion model, as was done for this study.

One scenario has been used to assess the maximum air pollutant impacts on the surrounding sensitive receivers being Year 8 of mining operations as per Section 2.1.

Coal trains would enter the site via a rail loop and be loaded by a front end loader adjacent to the plant. Dump trucks would transfer the ROM material to the stockpiles and waste to waste dumps. Excavators would load material from the pits into dump trucks for transport to the stockpiles. Front end loaders would be operating at the processing area to load the material into the processing plant. Associated pieces of equipment such as drills would also be operating at the face. Service vehicles and water trucks would operate on the haul roads. These sources were included in the model.

5.2 Dust Emission Sources and Controls

The project operations have been characterised into the main particulate generating activities. This allows the estimation of dust emissions to be undertaken. A particulate emissions summary of the main dust generating activities used as input into the CALPUFF dispersion model presented in Tables 5.1. Tables 5.1 do not include the dust emission control factors.

Table 5.1 Mining Dust Emissions Year 1 (No Control Technology)

Activity	TSP Emissions (kg/yr)	PM_{10} Emissions (kg/yr)	$PM_{2.5}$ Emissions (kg/yr)
Loading to trucks with Overburden	38,466	18,193	1,274
Loading to trucks with Coal	38,334	18,131	2,176
Bulldozing Coal	599,319	172,704	20,724
Bulldozers on Overburden	46,912	9,276	4,916
Truck Unloading Overburden	38,466	18,193	7,641
Truck Unloading Coal	2,340	1,107	55
Drilling	41,993	22,064	1,324
Blasting	263,694	137,121	8,227
Wheel Dust Generation from Unpaved Roads	3,938,179	1,235,662	123,566
Use of Grader	1,387	621	87
Plant Activities	5,882	2,513	277
Wind Erosion From Stockpiles	37,362	18,681	934
Total	5,052,334	1,654,266	171,202

Table 5.2 lists the dust suppression techniques/controls to be utilised to reduce particulate emissions, as well as the estimated reduction in the dust emissions.

Table 5.2 Mining Dust Emission Controls (Environment Australia, 2001)

Emission Source	Control(s) Utilised	Control Efficiency Applied
Loading to trucks with Overburden	No control Utilised	0%
Loading to trucks with Coal	No control Utilised	0%
Bulldozing Coal	No control Utilised	0%
Bulldozers on Overburden	No control Utilised	0%
Truck Unloading Overburden	No control Utilised	0%
Truck Unloading Coal	No control Utilised	0%
Drilling	No control Utilised	0%
Blasting	No control Utilised	0%
Wheel Dust Generation from Unpaved Roads	Watering roads at >2L/m^2/hour	75%
Use of Grader	No control Utilised	0%
Plant Activities	No control Utilised	0%
Wind Erosion from Stockpiles	No control Utilised	0%

Pit retention factors of 50% for TSP and 5% for PM_{10} were also utilised for activities located within the pit.

5.2.1 Arsenic

The average spoil concentration value of 23.4 ppm, as discussed in Section 3 has been used to estimate the annual average concentration of arsenic as PM_{10} at sensitive receivers. The estimated concentration of Arsenic has been applied to the project emissions presented in Table 5.1 and control technologies in Table 5.2 to determine the Arsenic emissions.

6 Air Quality Assessment

The modelling of dust impacts was based on Year 8 of mining as the potential for impacts onto the surrounding sensitive receivers would be highest during the operations at this time.

6.1 Impacts at Sensitive Receptors

The predicted mining case dust concentrations and depositions at the nearest sensitive receptors to the project are shown in Table 6.1 for production Year 8. For a cumulative assessment against the project air quality criteria the predicted levels include the assumed background levels for dust concentration (TSP, PM_{10} and $PM_{2.5}$) and deposition as outlined in Section 4.

The predicted regional results of the CALPUFF dispersion modelling for the project are presented as dust contour plots in Appendix C. The dust contours show the predicted dust concentrations for Year 8 of the proposed project. The predicted dust contours are to visually show the predicted regional influence of the proposed mining operation and do not include the assumed background levels identified in Section 4.

The annual average concentrations are the average of 8760 one hour concentrations, the monthly average concentrations are the average of 720 one hour concentrations while the 24 hour concentration is the 24 hour midnight to midnight concentration. Maximum 24 hour averaged concentrations are generally experienced under adverse meteorological conditions when mixing height is reduced due to a winter inversion.

Table 6.1 Predicted Dust Concentrations & Deposition – Year 8

Location	TSP Annual Average Concentration ($\mu g/m^3$)	PM_{10} Concentrations 24h Average ($\mu g/m^3$)		$PM_{2.5}$ Concentrations ($\mu g/m^3$)		Annual Deposition ($g/m^2/month$)	Arsenic Annual Average Concentration (as PM_{10}) ng/m^3
		Highest	6th Highest	Annual Average	24h Average (Highest)		
L1	27.7	35.2	29.1	3.1	7.5	2.51	0.02
L2	30.7	33.1	31.3	3.3	7.0	2.65	0.05
L3	28.4	31.1	27.8	3.2	6.5	2.60	0.03
L4	25.8	28.3	23.7	3.0	6.3	2.45	0.01
L5	25.4	42.1	21.7	3.0	7.7	2.42	0.00
L6	25.4	31.3	21.6	3.0	6.4	2.42	0.00
L7	25.3	22.0	21.3	3.0	5.3	2.41	0.00
Criterion	90	-	50	8	25	4	6

6.1.1 $PM_{2.5}$

The predicted annual average $PM_{2.5}$ concentrations for Year 8 are below the EPP(Air) guideline value of 8 $\mu g/m^3$ (refer to **Table 6.1**).

The predicted maximum annual average $PM_{2.5}$ concentration for Year 8 is 3.3 $\mu g/m^3$ at Location L2.

The predicted highest $PM_{2.5}$ 24 hour concentrations for Year 8 are below the EPP(Air) guideline value of 25 $\mu g/m^3$ (refer to **Table 6.1**).

The predicted maximum 24 hour $PM_{2.5}$ concentration for Year 8 is 7.7 $\mu g/m^3$ at Location L5.

The predicted $PM_{2.5}$ concentrations are within the nominated guidelines.

6.1.2 PM_{10}

The predicted 6th highest PM_{10} 24 hour concentrations for Year 8 are below the EPP(Air) guideline value of 50 $\mu g/m^3$ (refer to **Table 6.1**).

The predicted 6th highest 24 hour PM_{10} level for Year 8 at Location L2 is 31.3 $\mu g/m^3$.

The predicted PM_{10} concentrations for Year 8 are within the nominated guidelines.

6.1.3 TSP

The predicted annual average TSP concentrations for Year 8 are below the EPP(Air) guideline value of 90 $\mu g/m^3$ (refer to **Table 6.1**).

The predicted maximum annual average TSP concentration for Year 8 is 30.7 $\mu g/m^3$ at Location L2.

The predicted TSP concentrations are within the nominated guidelines.

6.1.4 Dust Deposition

The predicted annual average depositions for Year 8 are below the DERM guideline value of 4 g/m^2/month (refer to **Table 6.1**).

The predicted maximum annual average deposition for both scenarios is 2.65 g/m^2/month at Location L2.

The predicted dust deposition rates are within nominated guidelines.

6.1.5 Arsenic as PM_{10}

The predicted annual average Arsenic as PM_{10} concentrations for production Year 8 are below the EPP(Air) guideline value of 6 ng/m^3 (refer to **Table 6.1**).

The predicted maximum annual average Arsenic as PM_{10} concentration is 0.05ng/m^3 at Location L2.

Therefore, the Arsenic as PM_{10} concentrations are predicted to be within acceptable guidelines.

6.1.6 Other Potential Impacts

From a regional airshed perspective, there are no significant air quality issues relevant to the proposed mining activities apart from dust. Unlike an urban airshed, the region's air quality is not significantly affected by anthropogenic emissions of products of combustion or air toxics.

Approximately 4km to the north of the proposed Colton mine are two water storages for Wide Bay Water. The predicted dust depositions rates from the proposed operations at the water storages of Cassava 1 (2750 ML) and Cassava 2 (426 ML) are 0.07 g/m^2/month and 0.06 g/m^2/month. When compared to the existing ambient dust deposition rate of 2.4 g/m^2/month the mining operations are predicted to contribute 3.1% and 2.3% of the deposited dust to Cassava 1 and Cassava 2 respectively. As a result, the contributions of Arsenic in deposited dust is predicted to be 0.0017 mg/m^2/month and 0.0013 mg/m^2/month for Cassava 1 and Cassava 2 respectively.

6.2 Discussion

The air pollutant impacts from the proposed Colton mine were assessed against typical DERM dust deposition guidelines and Environmental Protection (Air) Policy 2008 goals. Predictions of TSP, PM_{10}, Arsenic as PM_{10} and $PM_{2.5}$ are presented in **Section 6.1** and assessed against the criteria nominated in **Section 3**.

The results of the assessment are:

- Compliance with the maximum 24 hour average $PM_{2.5}$ concentrations and annual average $PM_{2.5}$ criteria at Location L1 to L7
- Compliance with the 24 hour average PM_{10} criterion at Location L1 to L7
- Compliance with the annual average TSP criterion at Location L1 to L7
- Compliance with the annual average Arsenic as PM_{10} criterion at Location L1 to L7
- Compliance with the annual average deposition criterion at Location L1 to L7
- Predicted contribution of dust deposition at the water storages to the north of the proposed mine ranges between approximately 2 – 3% of the existing background dust deposition rate.

7 GHG Legislative Requirements

The National Greenhouse and Energy Reporting Act 2007, the Regulations under that Act and the National Greenhouse and Energy Reporting (Measurement) Determination 2008 establish the legislative framework for a national greenhouse and energy reporting system.

These Technical Guidelines embody the latest methods for estimating emissions and are based on the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (DCC, 2008d) as amended ('the Determination') by the National Greenhouse and Energy Reporting (Measurement) Amendment Determination 2009 (No. 1) (DCC, 2009d). Technical Guidelines provide additional guidance and commentary to assist in estimating greenhouse gas emissions for reporting under the NGER system.

The objectives for the NGER system are set out in the National Greenhouse and Energy Reporting Act 2007 (the Act) and include:

- Informing government policy formulation and the Australian public
- Meeting Australia's international reporting obligations
- Assisting Commonwealth, State and Territory government programs and activities
- Underpinning the introduction of an emissions trading scheme in the future
- Avoiding duplication of similar reporting requirements in the States and Territories

The Act makes reporting mandatory for corporations whose energy production, energy use, or greenhouse gas emissions meet certain specified thresholds. These thresholds are detailed in the Regulations and reproduced in the National Greenhouse and Energy Reporting Guidelines, prepared by the Department of Climate Change. Section 7.1 in this report summarises the reporting thresholds.

The Determination was made under subsection 10 (3) of the Act and provides methods, and criteria for methods, for the estimation and measurement of the following items arising from the operation of facilities:

1. Greenhouse gas emissions
2. The production of energy
3. The consumption of energy

Greenhouse gas emissions are defined in the NGER Regulation as:

> *(2) Emissions of greenhouse gas, in relation to a facility, means the release of greenhouse gas into the atmosphere as a direct result of 1 of the following:*
>
> > *(a) an activity, or series of activities (including ancillary activities) that constitute the facility (scope 1 emissions);*
> >
> > *(b) 1 or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (scope 2 emissions).*

Coverage of Scope 1 emission sources in the Determination is given by the following categories:

- Fuel combustion, which deals with emissions released from fuel combustion
- Fugitive emissions from fuels, which deals with emissions mainly released from the extraction, production, processing and distribution of fossil fuels
- Industrial processes emissions, which deals with emissions released from the consumption of carbonates and the use of fuels as feedstocks or as carbon reductants, and the emission of synthetic gases in particular cases
- Waste emissions, which deals with emissions mainly released from the decomposition of organic material in landfill or wastewater handling facilities

The most important source of Scope 1 emissions is fuel combustion, which accounts for over 60 per cent of the emissions reported in the national greenhouse gas inventory.

7.1 Reporting Thresholds

National Greenhouse and Energy Reporting Act 2007 sets thresholds for reporting for the operation of a facility or corporations. Section 13 of the NGER Act is repeated below as follows:

> *13 Thresholds*
>
> *(1) A controlling corporation's group meets a threshold for a financial year if in that year:*
>
> > *(a) the total amount of greenhouse gases emitted from the operation of facilities under the operational control of entities that are members of the group has a carbon dioxide equivalence of:*
> >
> > > *(i) if the financial year starts on 1 July 2008—125 kilotonnes or more; or*
> > >
> > > *(ii) if the financial year starts on 1 July 2009—87.5 kilotonnes or more; or*
> > >
> > > *(iii) if the year is a later financial year—50 kilotonnes or more; or*
> >
> > *(b) the total amount of energy produced from the operation of facilities under the operational control of entities that are members of the group is:*
> >
> > > *(i) if the financial year starts on 1 July 2008—500 terajoules or more; or*
> > >
> > > *(ii) if the financial year starts on 1 July 2009—350 terajoules or more; or*
> > >
> > > *(iii) if the year is a later financial year—200 terajoules or more; or*
> >
> > *(c) the total amount of energy consumed from the operation of facilities under the operational control of entities that are members of the group is:*
> >
> > > *(i) if the financial year starts on 1 July 2008—500 terajoules or more; or*
> > >
> > > *(ii) if the financial year starts on 1 July 2009—350 terajoules or more; or*
> > >
> > > *(iii) if the year is a later financial year—200 terajoules or more; or*
> >
> > *(d) an entity that is a member of the group has operational control of a facility the operation of which during the year causes:*
> >
> > > *(i) emission of greenhouse gases that have a carbon dioxide equivalence of 25 kilotonnes or more; or*

(ii) production of energy of 100 terajoules or more; or

(iii) consumption of energy of 100 terajoules or more.

The thresholds can also be summarised as shown in Figure 7.1.

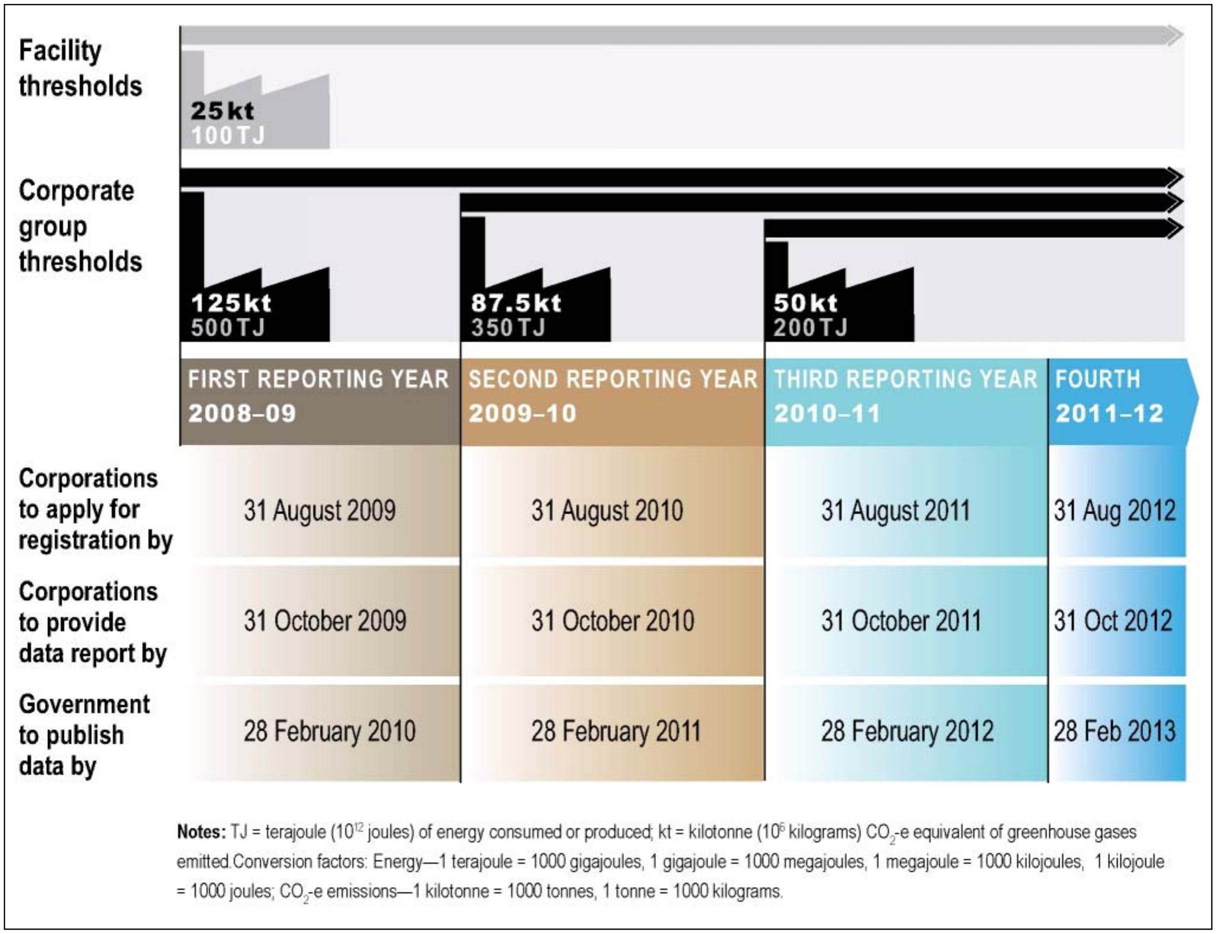


Figure 7.1 The National Greenhouse and Energy Reporting Thresholds (DCC ,2008b)

7.2 Greenhouse Gases Considered

Consistent with the Kyoto Protocol and the National Greenhouse and Energy Reporting Regulations 2008 (NGER Regulation)(DCC, 2008a), minimisation of greenhouse gas emissions has concentrated on six key greenhouse gases:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Specified Hydrofluorocarbons (HFC's)
- Specified Perfluorocarbons (PFC's)
- Sulphur hexafluoride (SF_6)

These gases differ in their capacity to trap heat and contribute to the greenhouse effect. The capacity of each gas to contribute to global warming is referred to as its global warming potential (GWP) relative to that of carbon dioxide. The GWP's of the six Kyoto greenhouse gases are provided in Table 7.1.

Table 7.1 Global Warming Potential of Greenhouse Gases

Greenhouse Gas	GWP
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFC's)	140 -11,700
Perfluorocarbons (PFC's)	6,500 – 9,200
Sulphur hexafluoride (SF_6)	23,900

Because of the variation in GWP between different gases, the emission factors used to calculate greenhouse gas emissions from the Project are stated in terms of carbon dioxide equivalents (CO2-e) and consider the various GWP's of the different greenhouse gases.

8 GHG Assessment

An assessment of the greenhouse gas emissions associated with the project was conducted and involved:

- Identification of the likely sources of greenhouse gas emissions
- Estimating the likely quantities of greenhouse gases from these sources
- Nominating emission factors for the GHG sources
- Identification of possible emission abatement measures

Emissions of greenhouse gases were calculated in accordance with methods provided by the Australian Department of Climate Change formerly Australian Greenhouse Office (AGO). GHG emission estimates are based on the following:

- Operational data supplied by Northern Energy Corporation Limited
- GHG emission factors nominated in National Greenhouse and Energy Reporting System Measurement Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia, June 2009 (DCC, 2009a)

8.1 Emission Sources

The Determination (DCC, 2008d) indentifies sources of emissions which are to be reported under the *National Greenhouse and Energy Reporting Act 2007* (DCC, 2007). The activities to be reported are discussed below. It should be noted that land use change and forestry activities (e.g. land clearing) are not reportable under the current Determination.

The following greenhouse gas emission sources were included in the assessment:

- Fuel consumption by mining equipment
- Fuel consumption of stationary sources (pumps and lights)
- Combustion of Ammonium Nitrate Fuel Oil (ANFO) for blasting
- Coal seam gas emissions
- Processing of waste water (100EP)
- Consumption of purchased electricity

8.2 GHG and Energy Emission Factors

8.2.1 Liquid Fuel Emissions

Diesel fuel will be used by mining equipment during operations. Light vehicles as well as lighting will also consume diesel.

Estimates of annual diesel use by the plant/equipment have been supplied to ASK 7,607 kL for the mobile equipment and 131 kL for stationary equipment. In addition consumption of 45.0 kL of Lubricants and 35.0 kL of waste oil. Emission factors for diesel consumption are shown in Table 8.1.

Table 8.1 Diesel Emission Factors

Fuel Type	Energy Content (GJ/kL)	Scope 1 Emission Factor (kg CO2-e/GJ)
Diesel (stationary)	38.6	69.5
Diesel (mobile)	38.6	69.9
Petroleum based oils (other than petroleum based oil used as fuel)	38.8	27.9
Petroleum based greases	38.8	27.9

8.2.2 Explosive Emissions

The combustion of fossil fuels within explosives proposed to be used in the mining process will result in emissions of greenhouse gases. As the explosives are manufacturing onsite emission factors are base on the consumption of material to make Ammonium Nitrate/Fuel Oil (ANFO) and Emulsion blast products. Emission factors are based on the fuel oil content of ANFO and are taken as stationary emissions from Table 8.1. Quantities of fuel oil in the manufacturing process are based on a 5.7% of ratio of fuel oil. The annual consumption of fuel oil to make ANFO would be approximately 126 kL.

8.2.3 Coal Extraction Emissions

Open-pit coal extraction releases gaseous emission. In addition energy production is based on the energy potential of the ROM coal. ASK has been provided information regarding the extraction of black coal being 1.04 Mt for Year 8.

Emission factors associated with extraction of black coal are shown in Table 8.2.

Table 8.2 Coal Extraction Emission Factors

Fuel Type	Energy Content (GJ/t)	Scope 1 Emission Factor Qld (t CO2-e/t ROM Coal)
Black Coal	27.0	0.017

8.2.4 Onsite Wastewater Treatment Emissions

Waste water from the mining administration facilities is to be treated onsite. Emission estimates are based on a facility which services 100 equivalent persons (EP). Emission factors are presented in Table 8.3. As no detailed facility data is present formulae contained in Appendix 4 National Greenhouse Accounts (NGA) Factors November 2008 (AGO, 2008c) are used to estimate the emissions.

Table 8.3 Onsite Wastewater Treatment Emission Factors

Wastewater Type	Scope 1 Emission Factor (t CO2-e/EP)
Domestic	0.2635

8.2.5 Consumption of Electricity

Consumption of purchased electricity is to occur in order to power the processing plant. ASK has been provided information regarding the consumption of purchased electricity being 16,000 MWh.

Emission factors associated with consumption of purchased electricity are shown in Table 8.4.

Table 8.4 Consumption of Purchased Electricity Emission Factors

State, Territory or grid description	Scope 2 Emission factor (kg CO2-e/kWh)
Queensland	0.89

8.3 GHG & Energy Summary

The emission factors outlined in **Section 8.2** have been used to estimate the greenhouse gas emissions for the maximum production year of the Project (Year 8). **Table 8.5** summarises the emissions expressed as kilo-tonnes of CO_2 equivalent and energy expressed as terajoules (TJ).

Table 8.5 Greenhouse Gas Emissions Summary

Year	Source	Type	Quantity	Scope 1			Scope 2	
				CO2-e kt	Energy Consumption TJ	Energy Production TJ	Energy Consumption TJ	Energy Production TJ
8	Liquid Fuel	Diesel - Mobile (kL)	7,607	39.0	306.7	28,130	14.2	57.6
		Diesel - Stationary (kL)	131					
		ANFO Diesel - Stationary (kL)	126					
		Waste Oil/Lubricant (kL)	80					
		Energy Consumption (TJ)	307					
	Coal	ROM (Mt)	1.04					
		Energy Production (TJ)	28,130					
	Waste Water Treatment	Domestic (EP)	100					
	Purchased Electricity	Qld MWh	16,000					
Total	CO2-e kt			53.3				
	Energy	Consumption TJ		364.3				
		Production TJ		28130				

The Project as shown in **Table 8.5** is estimated to consume annual maximum energy of 364.3 TJ. Through the extraction of coal energy production is estimated to be 28,130 TJ.

The Project is expected to generate annual maximum emissions of 53.3 kt CO_2-e (see **Table 8.5**). The annual maximum emissions represent a contribution of less than 0.0293% to the reported QLD greenhouse gas emissions in 2007 (DCC, 2009b) and less than 0.0097% of Australia's reported greenhouse emissions in 2008 (DCC, 2009c).

The effects of global warming and associated climate change are the cumulative effect of many thousands of such sources and it is the cumulative effects that ultimately bring about climate change.

8.4 GHG Abatement

To ensure that the emissions of greenhouse gas emissions are minimised, the following management measures should be considered:

- The inventory of emissions developed for this assessment should be regularly updated and maintained because reporting may be required, as an individual facility or as part of a corporate group
- During procurement of both diesel and electric powered equipment, the efficiency of the equipment should be considered
- Equipment should be maintained to retain high levels of energy efficiency
- An internal review should be conducted annually to ensure that the mine is applying best practice techniques to minimise energy use

9 Conclusions

The Colton Mine Project is a proposed open pit coal mine. Mining, processing and handling are proposed to be conducted 7 days a week, 24 hours a day.

The air pollutant impacts from the Project were assessed against typical DERM dust deposition guidelines and Environmental Protection (Air) Policy 2008 goals with the following results, including dust control measures as per Table 5.2:

- Compliance with TSP, PM_{10}, Arsenic as PM_{10} and $PM_{2.5}$ concentration goals
- Compliance with the deposition goal.

A greenhouse gas assessment has been conducted for the Colton Mine Project in accordance with the guidelines set out by the Department of Climate Change (DCC).

The Colton Mine Project as shown in Table 8.5 is estimated to produce a maximum of:

- 53.3 kt CO_2-e greenhouse gas emissions per year
- Consume annual maximum energy of 364.3 TJ
- Production of annual maximum energy of 28,130 TJ through the extraction of coal

Thresholds for reporting for an individual facility and corporate group are as follows:

- Individual Facility
    - Emissions of 25 kt CO_2-e
    - Consumption of 100 TJ
- Corporate Group
    - Emissions of 50 kt CO_2-e
    - Consumption of 200 TJ

The estimated emissions from the Project exceed both the CO_2-e and energy consumption thresholds for reporting as an individual facility. The facility alone also exceeds the reporting thresholds for a corporate group. As thresholds are exceeded, the inventory of emissions developed for this assessment should be regularly updated and maintained, because reporting would be required as an individual facility or as part of a corporate group.

Typical greenhouse gas emission abatement measures are summarised in Section 8.4.

Please contact the undersigned with any queries on 07 3255 3355.

Yours faithfully

ASK Consulting Engineers

Dave Claughton

Project Engineer

10 References

ACARP (1999), *Fine Dust and the Implications for the Coal Industry*, Report C7009.

Department of Climate Change (2007), *National Greenhouse and Energy Reporting Act 2007*. Office of Legislative Drafting and Publishing, Attorney-General's Department, Canberra.

Department of Climate Change (2008a), *National Greenhouse and Energy Reporting Regulations 2008.* Office of Legislative Drafting and Publishing, Attorney-General's Department, Canberra.

Department of Climate Change (2008b), *National Greenhouse and Energy Reporting Guidelines*. Department of Climate Change, Canberra.

Department of Climate Change (2008c), *National Greenhouse Accounts (NGA) Factors November 2008*. Department of Climate Change, Canberra.

Department of Climate Change (2008d), *National Greenhouse and Energy Reporting (Measurement) Determination 2008*. Office of Legislative Drafting and Publishing, Attorney-General's Department, Canberra.

Department of Climate Change (2009a). *National Greenhouse and Energy Reporting System Measurement Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia, June 2009*, Department of Climate Change, Canberra

Department of Climate Change (2009b), *State and Territory Greenhouse Gas Inventories 2007*. Department of Climate Change, Canberra.

Department of Climate Change (2009c), *National Greenhouse Gas Inventory accounting for the KYOTO target May 2009*. Department of Climate Change, Canberra.

Department of Climate Change (2009d), *National Reporting Guidance National Greenhouse and Energy Reporting (Measurement) Amendment Determination 2009 (No. 1)*. Office of Legislative Drafting and Publishing, Attorney-General's Department, Canberra.

EPA (2007), *Queensland 2007 air monitoring report.* Queensland Environmental Protection Agency.

EPA (2008), *Environmental Protection Air Policy*, Queensland Environmental Protection Agency.

Environment Australia (1999), *National Pollutant Inventory Emission Estimation Technique Manual for Fugitive Emissions.*

Environment Australia (2001), *National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 2.3.*

National Environmental Protection Council (NEPC) (2003). *National Environment Protection (Ambient Air Quality) Measure*, Attorney-General's Department, Canberra.

NHMRC (1985), *National guidelines for control of emissions of air pollutants from new stationary sources*, Canberra.

Scire J, Strimaitis D, Yamartino R (2000a), *A User's Guide for the CALPUFF Dispersion Model (Version 5).* Earth Tech Inc., Concord.

USEPA (1999), *Compilation of Air Pollutant Emission Factors*, EPA AP-42, Emission Factor and Inventory Group, 7th Ed.

Appendix A – Wind Roses

Wind rose diagrams for wind data simulated by TAPM are presented in Figure A.1, Figure A.2 and Figure A.3. The data illustrated by the wind roses consists of average annual (January 2005 - December 2005), summer, and winter data respectively.

Wind speed and direction data is in the form of m/s and blowing from respectively. Also frequency indicators on the roses specify percentage of occurrence.

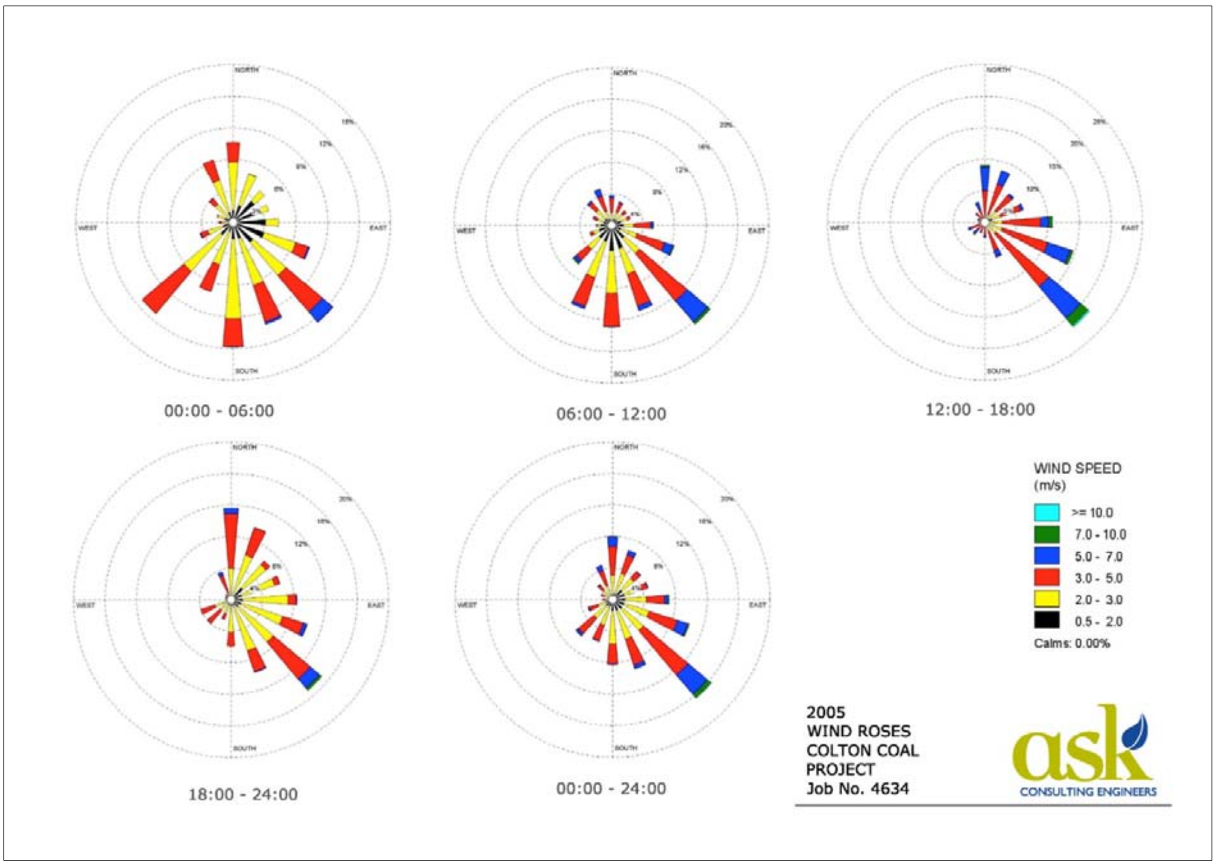


Figure A.1 Average Annual Wind Rose (Source: TAPM 2005)

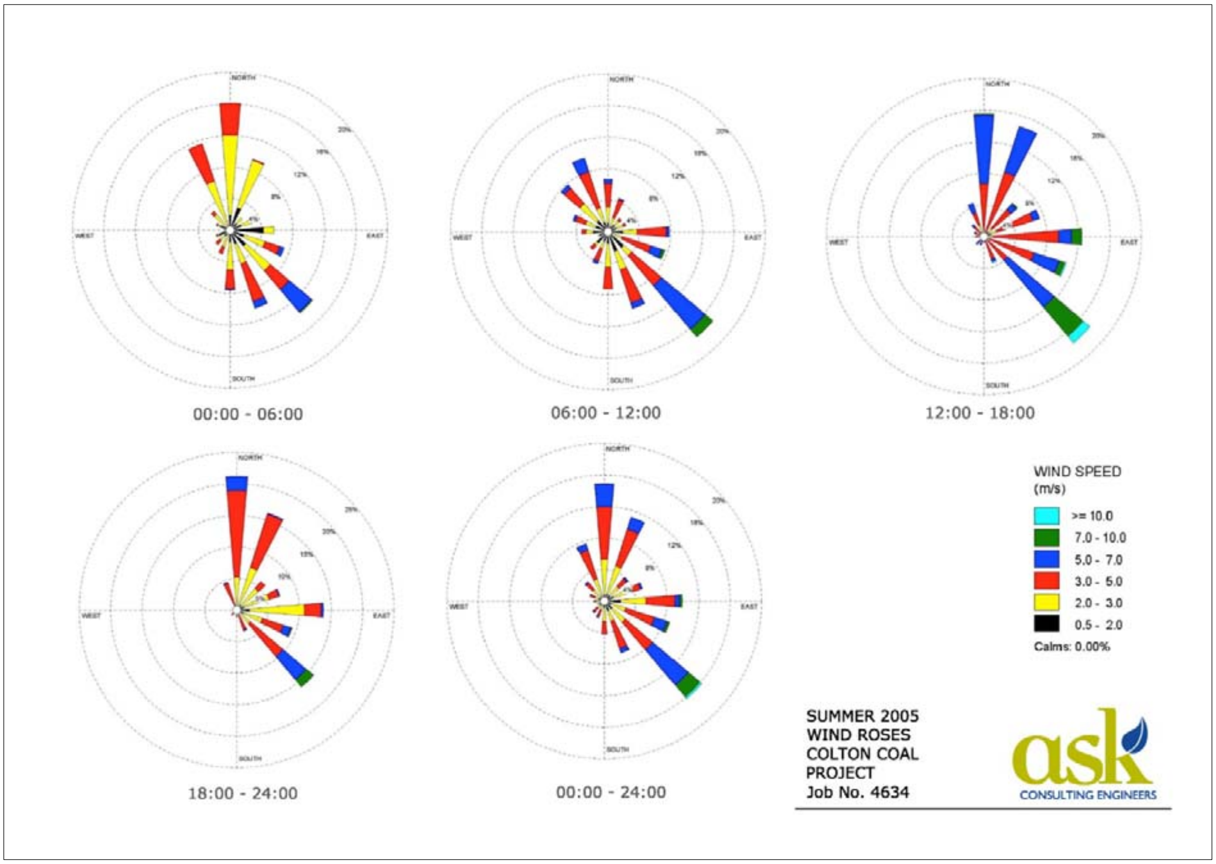


Figure A.2 Average Summer Wind Rose (Source: TAPM 2005)

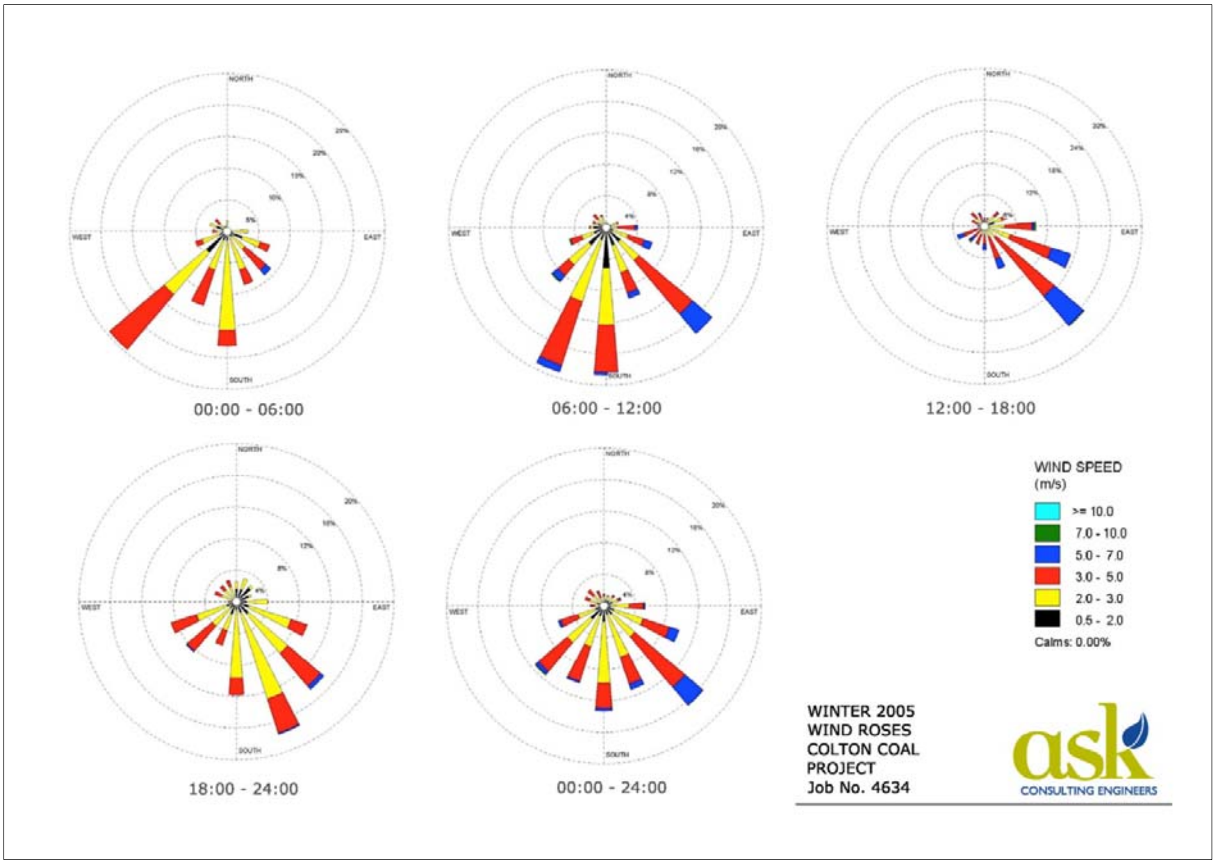


Figure A.3 Average Winter Wind Rose (Source: TAPM 2005)

A graph of stability class for data simulated by TAPM is presented in Figure B.4. The data illustrated by the graph is frequency distribution of stability class (January 2005 - December 2005).

Stability Class data is presented in the form of Pasquill-Gifford-Turner (PGT) scheme (A to F).

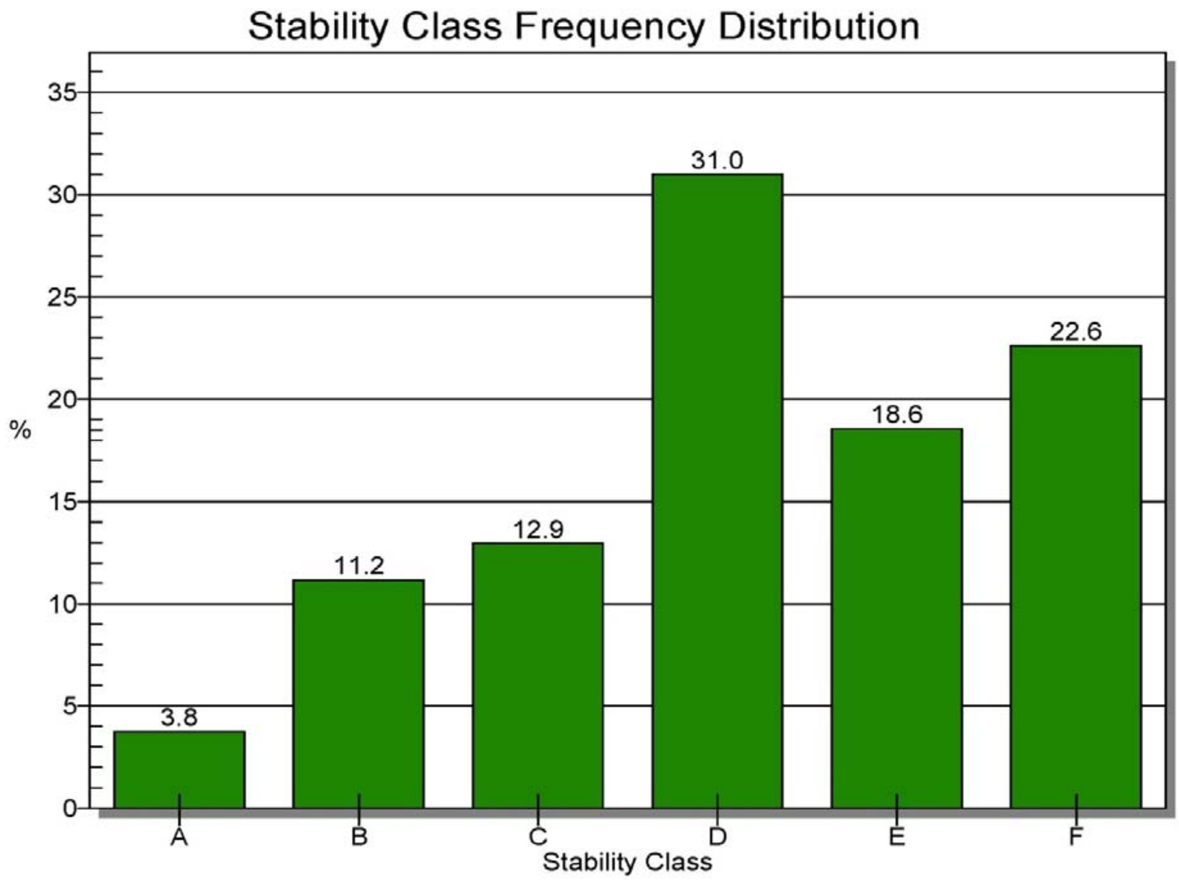


Figure A.4 Annual Frequency Distribution Stability Class (Source: TAPM 2005)

Appendix B – Emission Estimates

Emission rate estimation equations for significant dust generating activities are provided below.

Transfer Points

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

Where: E = Emission factor
k = Particle size multiplier (0.74 for TSP and 0.35 for PM_{10})
U = Mean wind speed (m/s)
M = Soil moisture content (%)

Coal Loading by Shovel or Front End Loader

$$E = k \times \frac{0.0596}{(M)^{0.9}} \{kg/t\}$$

Where: E = Emission factor
k = Particle size multiplier (1.56 for TSP and 0.74 for PM_{10})
M = Soil moisture content (%)

Bulldozing Coal

TSP

$$E = 35.6 \times \frac{(s)^{1.2}}{(M)^{1.4}} \{kg/hr\}$$

PM_{10}

$$E = 6.33 \times \frac{(s)^{1.5}}{(M)^{1.4}} \{kg/hr\}$$

Where: E = Emission factor
s = Material silt content (%)
M = Soil moisture content (%)

Bulldozing Overburden

TSP

$$E = 2.6 \times \frac{(s)^{1.2}}{(M)^{1.3}} \{kg/hr\}$$

PM_{10}

$$E = 0.45 \times \frac{(s)^{1.5}}{(M)^{1.4}} \{kg/hr\}$$

Where: E = Emission factor
s = Material silt content (%)
M = Soil moisture content (%)

Drilling

Emission rate factors of 0.59 kg/hole for TSP and 0.31 kg/hole for PM_{10} as outlined in the NPI emission estimation technique manual.

Blasting

$$E = 344 \times \frac{(A)^{0.8}}{(M)^{1.9} \times (D)^{1.8}} \{kg/blast\}$$

Where: E = Emission factor
A = Area blasted (m^2)
M = Soil moisture content (%)
D = Depth of the blast holes (m)

Wheel Dust Generation from Unpaved Roads

$$E = k \times \left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b} \{lb/VMT\}$$

Where: E = Emission factor
k = Constant (4.9 for TSP and 1.5 for PM_{10})
a = Constant (0.7 for TSP and 0.9 for PM_{10})
b = Constant (0.45 for TSP and 0.45 for PM_{10})
s = Material silt content (%)
W = mean vehicle weight (tons)
Note – lb/VMT was converted to kg/VKT by multiplying lb/VMT by 0.2819

Use of Grader

$$E = 0.0034 \times S^{k} \{kg/VKT\}$$

Where: E = Emission factor
k = Constant (2.5 for TSP and 2.0 for PM_{10})
S = Mean Vehicle Speed (km/hr)

Miscellaneous Transfer and Conveying

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

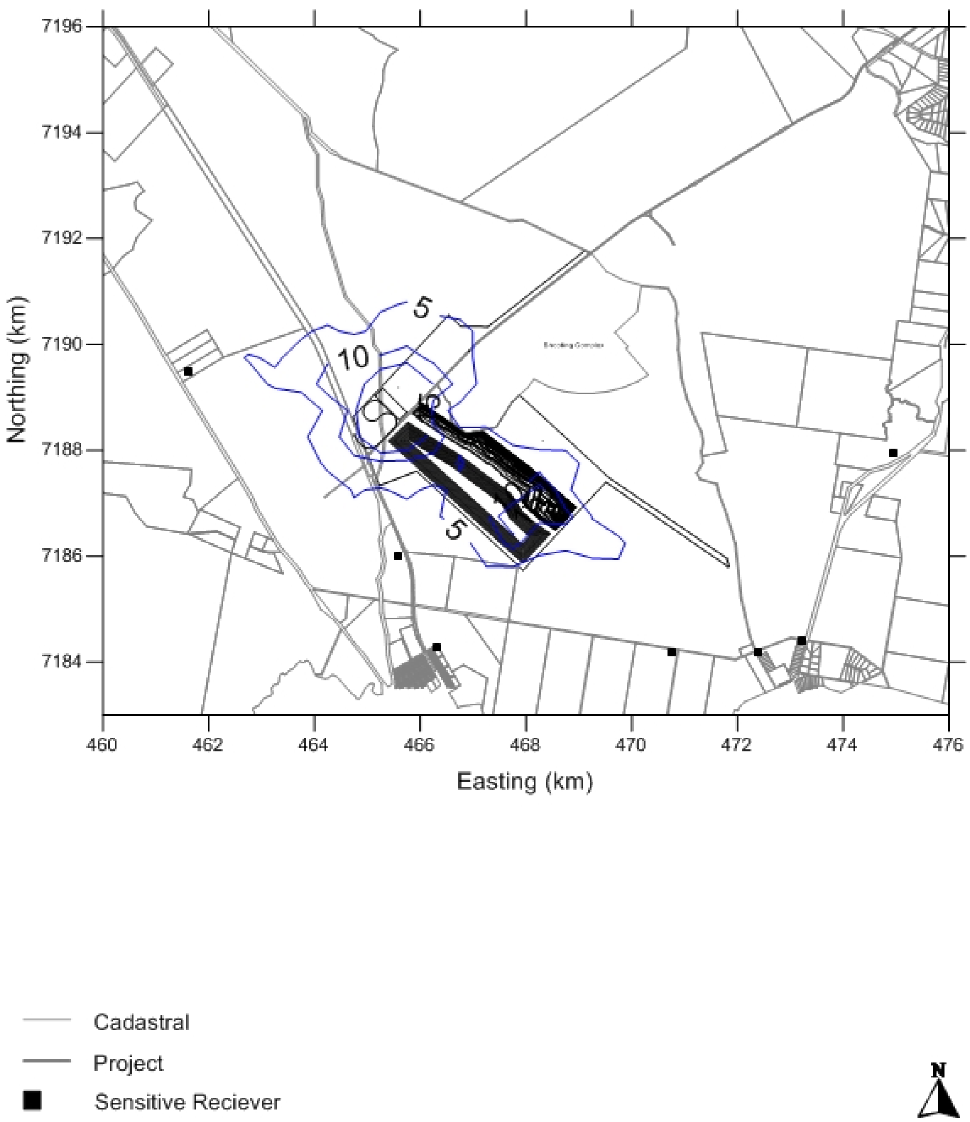
Where: E = Emission factor
k = Constant (0.74 for TSP and 0.35 for PM_{10})
U = Mean wind speed (m/s)
M = Material moisture content (%)

Wind Erosion from Active Stockpiles

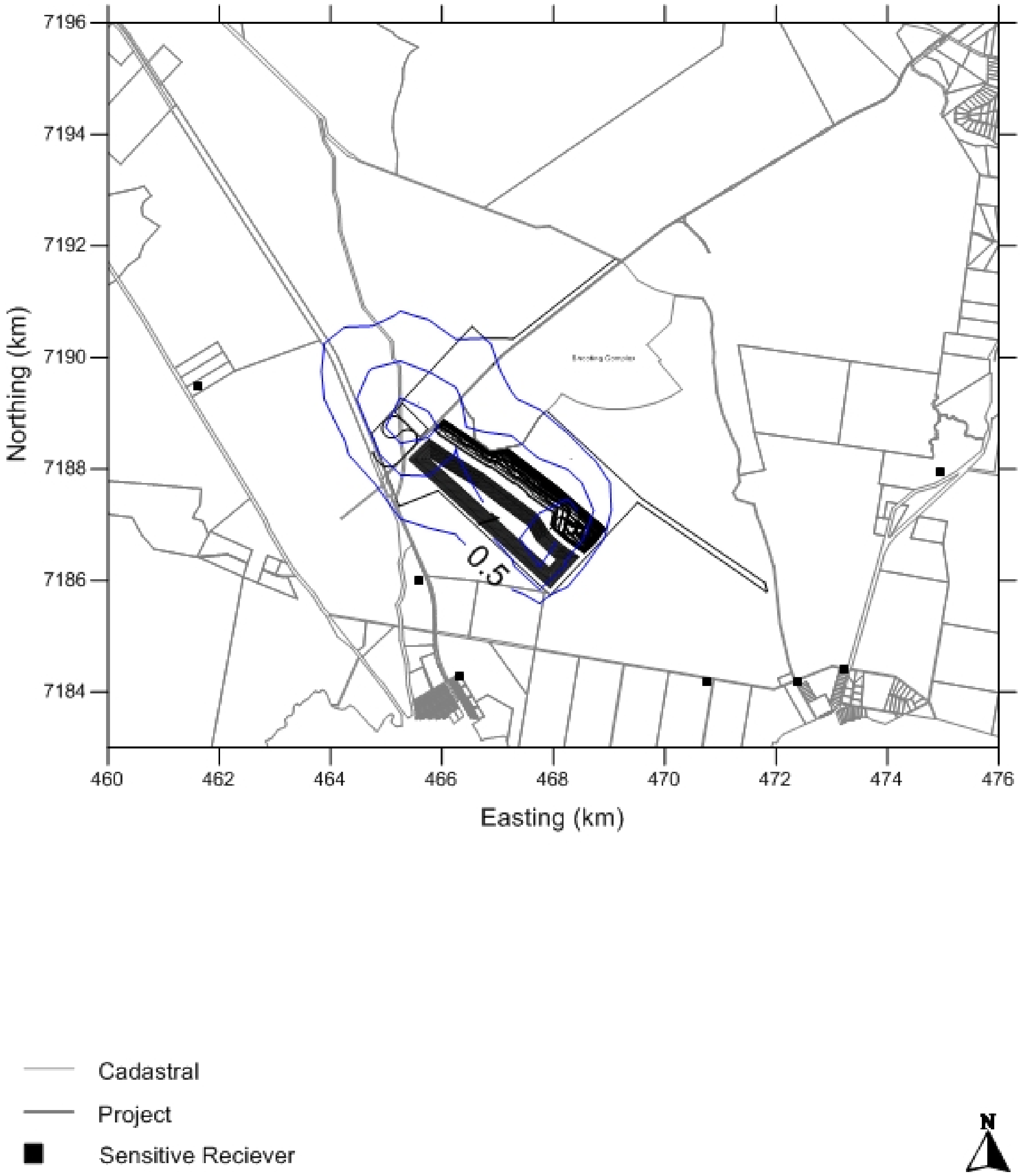
$$E = 1.9 \times \left(\frac{s}{1.5}\right) \times 365 \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) \{kg/ha/yr\}$$

Where: E = Emission factor
k = Constant (0.74 for TSP and 0.35 for PM_{10})
U = Mean wind speed (m/s)
M = Material moisture content (%)

Appendix C – Predicted Dust Contour Levels

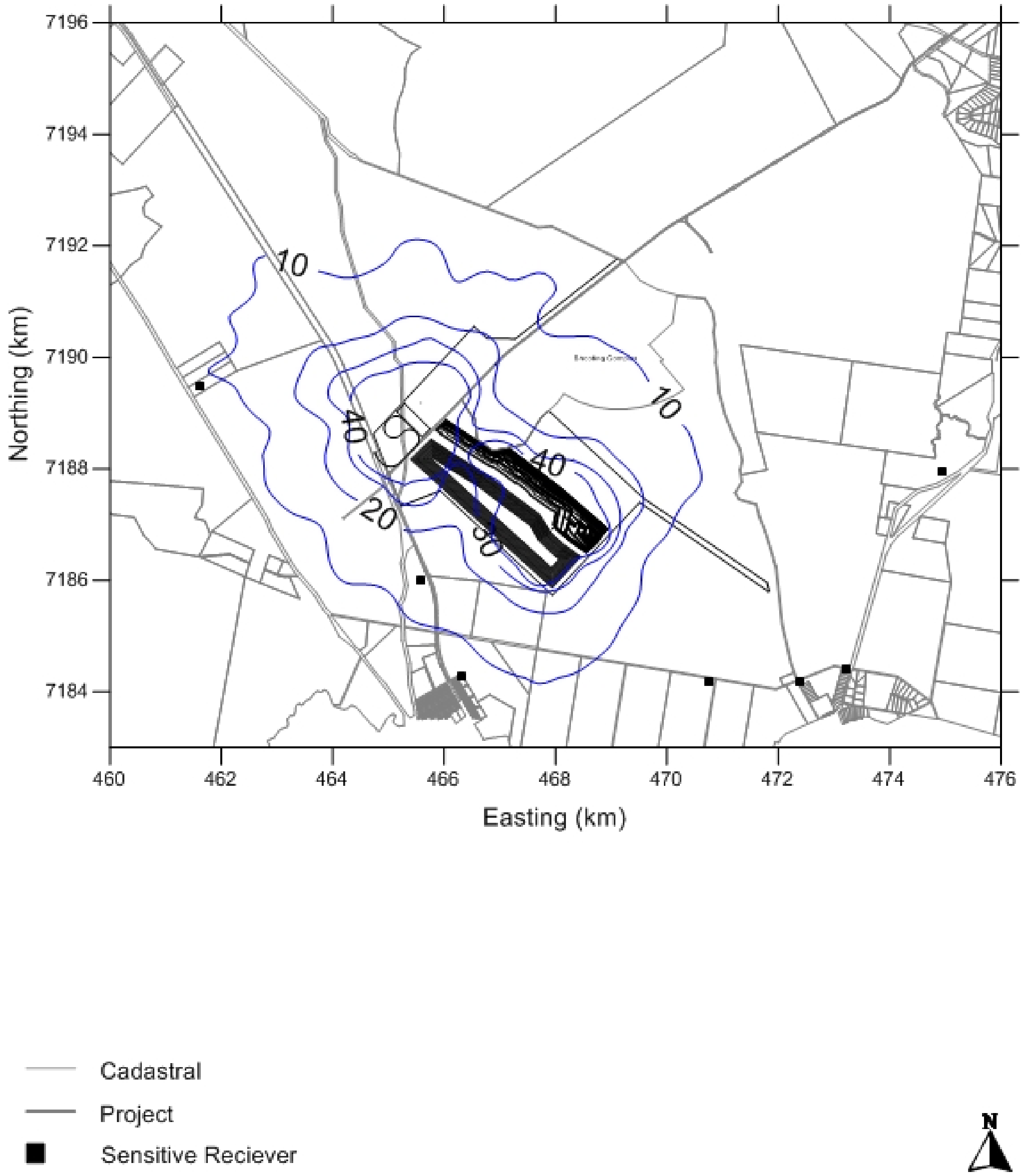


ask CONSULTING ENGINEERS	Year 8 Predicted Maximum 24-hour Average PM2.5 Dust Concentrations (ug/m3)	Figure C.1

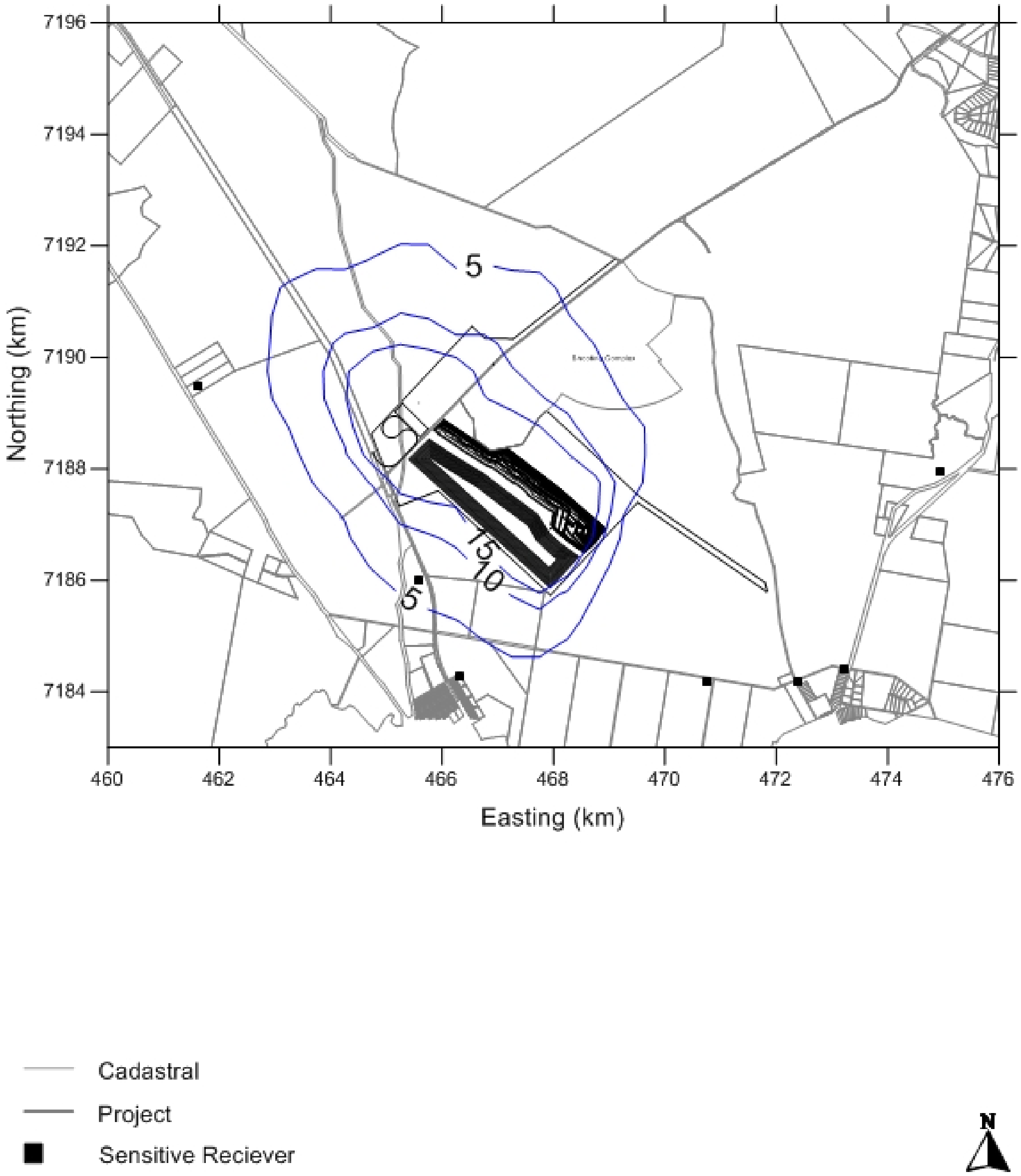


Year 8
Predicted Annual Average PM2.5
Dust Concentrations (ug/m3)

Figure C.2



ask CONSULTING ENGINEERS	Year 8 Predicted 6th Highest 24-hour Average PM10 Dust Concentrations (ug/m3)	Figure C.3



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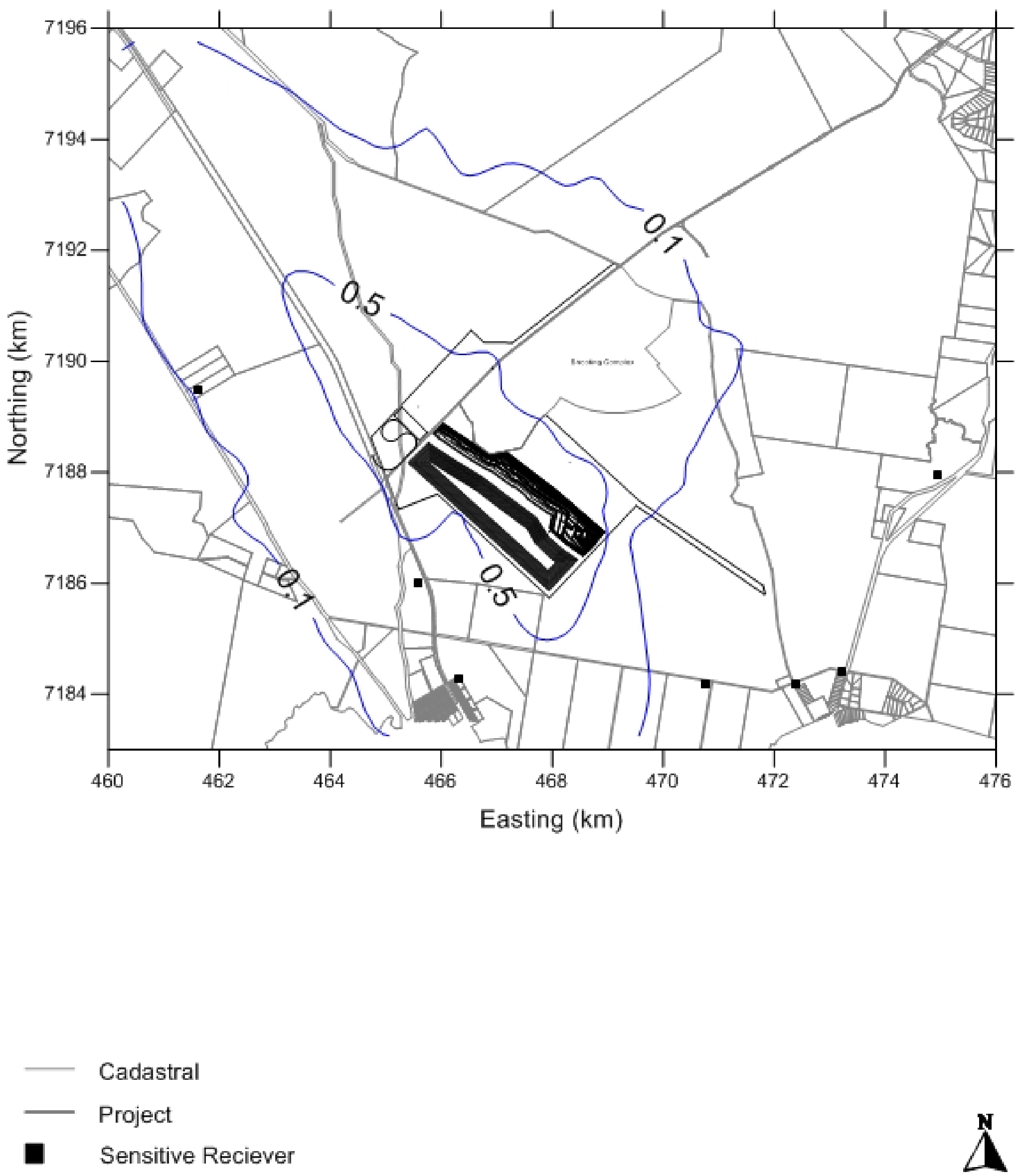
Year 8
Predicted Annual Average TSP
Dust Concentrations (ug/m3)

Figure C.4



Year 8
Predicted Annual Dust Deposition
(g/m2/month)

Figure C.5