Metromix Pty Ltd
ABN: 39 002 886 839

Teralba Quarry Extensions

Air Quality Assessment

Prepared by

SLR Consulting Pty Ltd

November 2011

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Air Quality Assessment

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EXECUTIVE SUMMARY

SLR Consulting Pty Ltd (SLR) has been commissioned by R.W. Corkery and Co Pty Ltd (RWC) on behalf of Metromix Pty Ltd (Metromix) to undertake an Air Quality Impact Assessment (AQIA) for the proposed Teralba Quarry Extensions (hereafter referred to as "the Project Site") within an area located adjacent to Rhonda Road, Teralba, NSW.

This AQIA has been prepared in accordance with the NSW Department of Environment, Climate Change and Water's (DECCW) *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW Department of Environment and Conservation, 2005) and required the following steps.

1. Description of local topographic features and sensitive receptor locations (**Sections 3.1** and **3.2**).
2. Establishment of air quality assessment criteria for identified pollutants, namely Total Suspended Particulate (TSP), Particulate Matter less than 10 micron (PM_{10}), Particulate Matter less than 2.5 micron ($PM_{2.5}$) and deposited dust (**Section 4**).
3. Analysis of climate and dispersion meteorology for the region (**Section 5**).
4. Description of existing air quality environment (**Section 6**).
5. Compilation of a comprehensive emissions inventory for proposed operations using approved emission estimation techniques taken from the National Pollutant Inventory or the United States Environmental Protection Agency (USEPA) Compilation of Air Pollutant Emission Factors AP-42 (**Section 7.2**).
6. Completion of atmospheric dispersion modelling using TAPM and CALPUFF (**Section 8)** and analysis of results against assessment criteria established in (**Section 4**).
7. Discussion on the best available control technology for emission control (**Section 9**).

The outcome of the AQIA is that for all pollutants and all averaging periods the Project Site is not predicted to exceed the DECCW guideline values. 24 hour average PM_{10} are predicted to exceed the DECCW guideline value of 50 µg/m³ at and just beyond the northern most border of the Project Site in an area that is not used for residential purposes and rather forms part of a coal mining operation.

Given that the project is not predicted to impact upon the nearby residences it is anticipated that the level of emission control technology outlined in this assessment will be sufficient for this project.

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1. INTRODUCTION

SLR Consulting Pty Ltd (SLR) has been commissioned by R.W. Corkery and Co Pty Ltd (RWC) on behalf of Metromix Pty Ltd (Metromix) to undertake an Air Quality Impact Assessment (AQIA) for the Teralba Quarry Project (hereafter referred to as "the Project Site") located on Rhonda Road, Teralba, NSW.

This AQIA has been prepared in accordance with the NSW Department of Environment, Climate Change and Water's (DECCW) Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW Department of Environment and Conservation, 2005) (hereafter the Approved Methods). The Approved Methods outline the requirements for conducting an AQIA, as follows:

1. Description of local topographic features and sensitive receptor locations (**Sections 3.1** and **3.2**).
2. Establishment of air quality assessment criteria (**Section 4**).
3. Analysis of climate and dispersion meteorology for the region (**Section 5**).
4. Description of existing air quality environment (**Section 6**).
5. Compilation of a comprehensive emissions inventory for proposed operations (**Section 7.2**).
6. Completion of atmospheric dispersion modelling and analysis of results (**Section 8)**.
7. Preparation of an air quality impact assessment report comprising of the above.

This AQIA describes the existing environment of the area surrounding the Project Site and contains detailed information relating to Items 1 to 7 above in the sections noted. This report also presents a greenhouse gas assessment for the Project, in **Section 10.**

Table 1 paraphrases the requirements for this assessment set by the Director General and other government agencies. The table also summaries where each of the requirements is addressed within this assessment report.

Additional policies, guidelines and plans referenced within this assessment are the Protection of the Environment Operations (Clean Air) Regulation 2002 and the *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC, 2007).

2. PROJECT OVERVIEW

2.1 PROJECT LOCALITY

The project site is located to the west of the Newcastle suburb of Teralba, approximately 7 km north of Toronto and 6 km south of the village of Edgeworth in the Parish of Teralba, in the County of Northumberland. The locality of the Project Site is illustrated in **Figure 1**.

The Project Site encompasses the freehold land incorporating the full area of the existing Teralba Quarry extraction and processing operations, the proposed southern and northern extensions and a section of Rhondda Road. The Project Site covers an area of approximately 130 ha and is located entirely within an area of freehold land Metromix leases from the landowner, Mr A.C. Fowkes.

Table 1
DECCW and Director Generals Requirements

Requirement	Relevant Section
A description of the existing air quality including the following parameters: • Dust deposition; • Total suspended particulates; and • PM_{10} particulate matter.	**6**
Identification and location of all fixed and mobile sources of air emissions from the development including: • Location of all emission sources; • Identification of all pollutants of concern; and • Estimation of emissions quantity.	7
Details of the project essential for predicting and assessing impacts on air quality.	2
A description of the topography and surrounding land uses	3
Details of exact locations of dwellings.	**3.2**
Estimation of resulting ground level concentrations of all pollutants.	8
Detailed description of the methodology used to assess air quality impacts including: • Justification and discussion of choice of dispersion model and model parameters; and • Dispersion model input/output file summary.	**8.1, 8.2 and Appendix 2**
Air quality impact predictions including plans showing projected incremental levels of; • 24-hour average PM_{10} concentrations; • annual average dust deposition rates; and • annual average total suspended particulate concentrations.	9
Air quality impact predictions should be include plans showing projected incremental levels of 24-hour average PM_{10} concentrations, annual average dust deposition rates and annual average total suspended particulate concentrations throughout the life of the operation.	9
Assessment of cumulative air quality impacts and a description of the methodology used.	**6.3 and** 9

2.2 PROJECT DESCRIPTION

The Project Site incorporates four extraction areas (see **Figure 2**). The first area, referred to as the “existing Southern Extraction Area,” encompasses all approved extraction and processing operations south of Rhondda Road. The second area is referred to as the “approved Mid-Pit Area” which is located north of Rhondda Road. The two areas not yet approved and the subject of the project application are referred to as the “proposed Southern Extension” and the proposed Northern Extension” (**Figure 2**).

The Project Site excludes two areas (non project related commercial operations) within the existing Southern Extraction Area, namely:

- The Civil Lakes Operation.
- Downer EDI Operation.

Figure 1
Project Locality

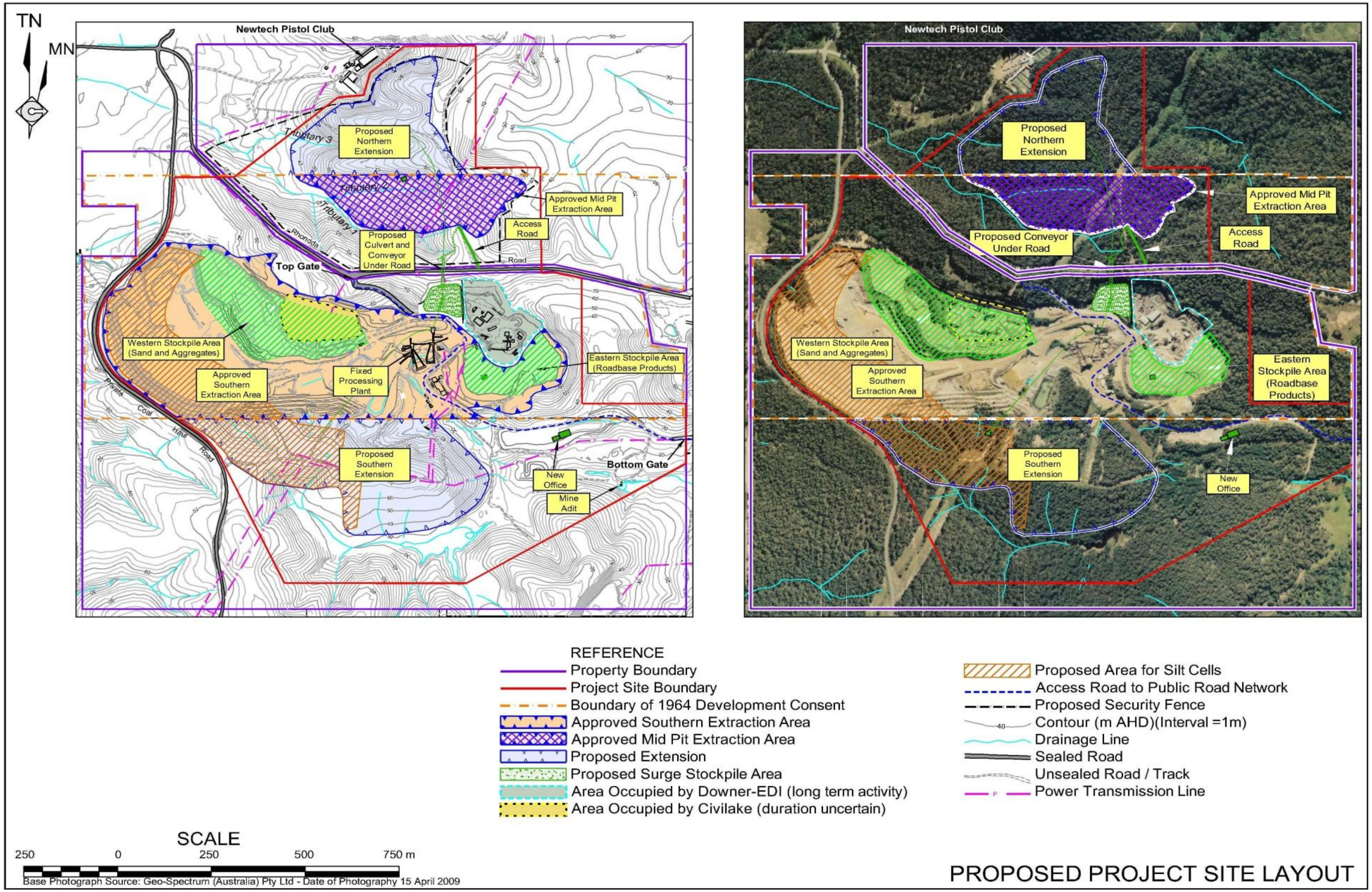


Figure 2
Project Site

2.2.1 Existing Southern Extraction Area

This area encompasses the area almost but not yet fully extracted and all stockpiling and processing facilities, site offices, crib rooms, workshop and weighbridge associated with the existing quarry. **Figure 2** presents the locations of each of these project areas together with the private coal haul road leased to Oceanic Coal and the various transmission lines that traverse the Project Site. The southern boundary of the existing Southern Extraction Area coincides with the boundary nominated in Development Consent DA 130/42.

The existing Southern Extraction Area will be fully extracted by 2012. The area remaining for extraction lies within the floor of the extraction area where the remaining 10 m to 12 m of conglomerate above the underlying coal seam remains to be extracted. The total area of the existing Southern Extraction Area is approximately 40 ha.

It is noted that in addition to Metromix's quarry operations conducted on the southern side of Rhondda Road, there are currently two other operations undertaken by other companies within the existing Southern Extraction Area (see Section 0).

The existing Southern Extraction Area also encompasses infrastructure related to the existing quarry operations. This infrastructure includes an access road from the quarry operations to Railway Street, Teralba. This sealed road is used by laden heavy vehicles to exit the Project Site to the east and avoid descending the steep downhill section of Rhondda Road. This road is leased from the owner, Teralba Engineering. Metromix is responsible for maintenance of this road, although it is also used by laden heavy vehicles transporting products for Downer EDI and Civilake.

2.2.2 Existing Mid Pit Extraction Area

The existing Mid Pit Extraction Area covers approximately 7.5 ha. Extraction is scheduled to commenced in this area during the third quarter of 2010 to supplement the resources extracted from the existing Southern Extraction Area over the next 2 to 3 years.

2.2.3 Proposed Southern Extension

The proposed Southern Extension covers approximately 14 ha and is located entirely within Lot 2 DP 224037. This lot is traversed by a number of transmission line easements and a small area is leased to Oceanic Coal for the purposes of a private coal haul road between various coal mines to the north and the Eraring Power Station to the south.

2.2.4 Proposed Northern Extension

The proposed Northern Extension is located entirely within Lot 1 DP 224037, on the northern side of Rhondda Road and comprises an area covering approximately 8.7 ha. The Newtech Pistol Club is located beyond the northwestern boundary of the proposed Northern Extension within the land leased by Metromix.

2.2.5 Non-Project related Commercial Operations

Two non-Project-related commercial operations are located in areas within the Project Site that, for the purposes of this document, are not included as components of the Project although their environmental impacts are considered in a cumulative sense (see Section 6). These two commercial operations are undertaken by companies independent of Metromix, who hold agreements with Metromix for their tenure on site. **Figure 2** displays the locations of the Downer EDI asphalt plant and Civilake pugmill.

- Downer EDI – The asphalt plant occupies a 3 ha area within the existing quarry. The plant operates under a separate development consent issued by LMCC and in accordance with Dangerous Goods Licence 35/026468. The plant typically produces approximately 70,000 tonnes of bitumen products annually. The aggregate raw materials for the asphalt plant are all supplied by external sources and are stockpiled immediately north of the Metromix stockpile area. A number of the laden product trucks from this plant also use the road leased through Teralba Engineering to allow trucks to exit via Railway Street and avoid laden trucks travelling down Rhondda Road towards Teralba.
- Civilake Pugmill – Civilake, as part of Lake Macquarie City Council, operates a road base pugmill within a 2.1 ha area within the existing quarry area. Products from Teralba Quarry and various recycled materials are mixed with a cementitious binder in the pugmill for use in construction products throughout the local government area. The pugmill is also used with the reclamation of asphalt. The pugmill operates under a separate development consent issued by LMCC and the plant is operated in accordance with Environment Protection Licence 13015 for Recovery of General Waste and Waste Storage. The pugmill typically produces up to 100 000tpa of products. Civilake recycles concrete and asphalt through the pugmill, bringing in specialised crushing plant for this purpose, when required. This is a wet process that will not impact upon the impact assessment.

These two operations operate completely independently to the Metromix Quarry. The operation of these plants and their environmental impact and any impact mitigation employed at these plants is not addressed in this document, except in the assessment of cumulative impacts for the entire Project Site.

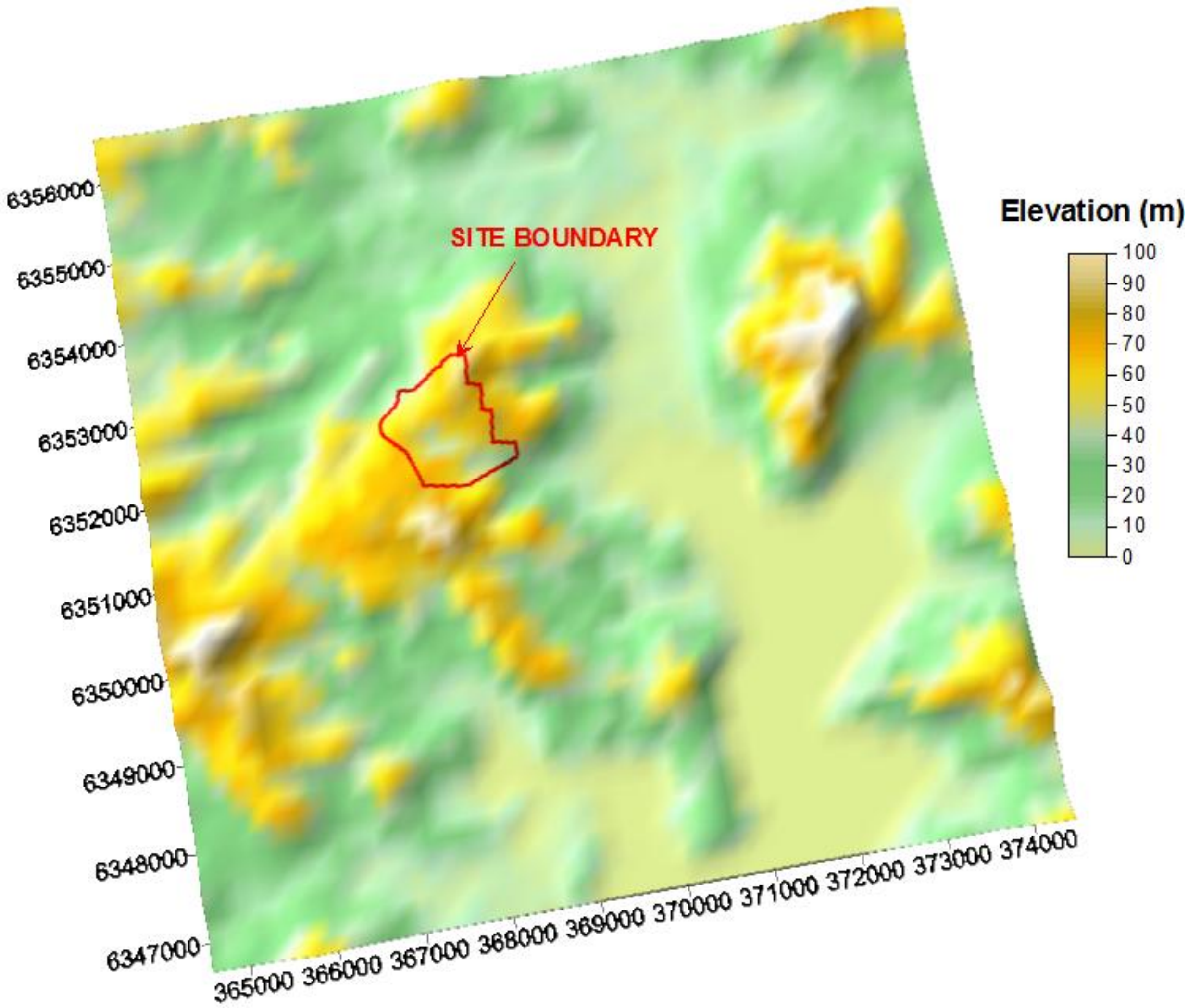
2.3 AIR QUALITY COMPLAINTS

SLR consulting are not aware of any air quality complaints associated with the current operations.

3. PROJECT SETTING

3.1 LOCAL TOPOGRAPHY

A figure showing the topography of the local region surrounding the quarry is presented in **Figure 3**. As shown by **Figure 3** the Project Site is located on a slightly elevated area compared to the surrounding terrain.



All coordinates in MGA (m)

Figure 3
Topography Surrounding the Project Site

3.2 NON-PROJECT RELATED PROPERTIES AND RESIDENCES

A number of non-project related residential dwellings are situated in the area surrounding the Project Site. The nearest dwellings have been identified as sensitive receptor locations to be taken into account during the assessment.

Properties and residences that were used as assessment locations within the dispersion modelling study for the Project to determine compliance with air quality regulations surrounding the Project Site are shown in **Figure 4**. These residences were chosen as they were determined to be representative of the air quality environment at different locations surrounding the Project Site. Details relating to each of the assessed properties' locations in relation to the Project Site are provided in **Table 2**.

Table 2
Surrounding Sensitive Receptor Locations

Receptor ID *	Ownership	Distance to Processing Area (km)	Location (m, MGA)	
			Easting	Northing
A	K and B Weatherstone	1.1	369 090	6 351 462
B	S. Muller and J. Cowand	1.0	369 256	6 351 919
C	Mr and Mrs Tate	0.9	369 165	6 352 010
D	Lake Macquarie City Council	0.9	369 137	6 352 120
E	D.P and S.I Black	0.9	369 054	6 352 650
F	N.W Green	1.1	369 148	6 352 960
G	Oceanic Coal Australia Pty Ltd, Marubeni Coal Pty Ltd, Ocal Macquarie Pty Ltd, J.F.E Mineral (Australia) Pty Ltd	2.4	366 126	6 352 959
H	R Donnelly	2.0	366 236	6 352 482
I	P.J.G Enterprises Pty Ltd	2.5	365 787	6 351 888

* See Figure 4

3.3 NEIGHBOURING POLLUTANT SOURCES

3.3.1 Local Sources

Within the wider region of Lake Macquarie, there are a number of mining-related operations. It is not considered likely that these other coal mining operations in the area would have the potential to cause cumulative impacts upon receptors surrounding the Project Site due to the topography of the local area creating natural barriers between those mines and sources associated with the Project Site.

3.3.2 Regional Sources

Concentrations of pollutants can be elevated under certain conditions, such as bushfires or dust storms. Although these events are relatively unusual, they do occur and can result in elevated concentrations of particulates over several days in some instances. These events are easily identified through the use of a network of air quality monitors as simultaneous elevations of particulate will be noted across an area (refer **Section 4**).

4. AMBIENT AIR QUALITY CRITERIA

4.1 PARTICULATE MATTER

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP).

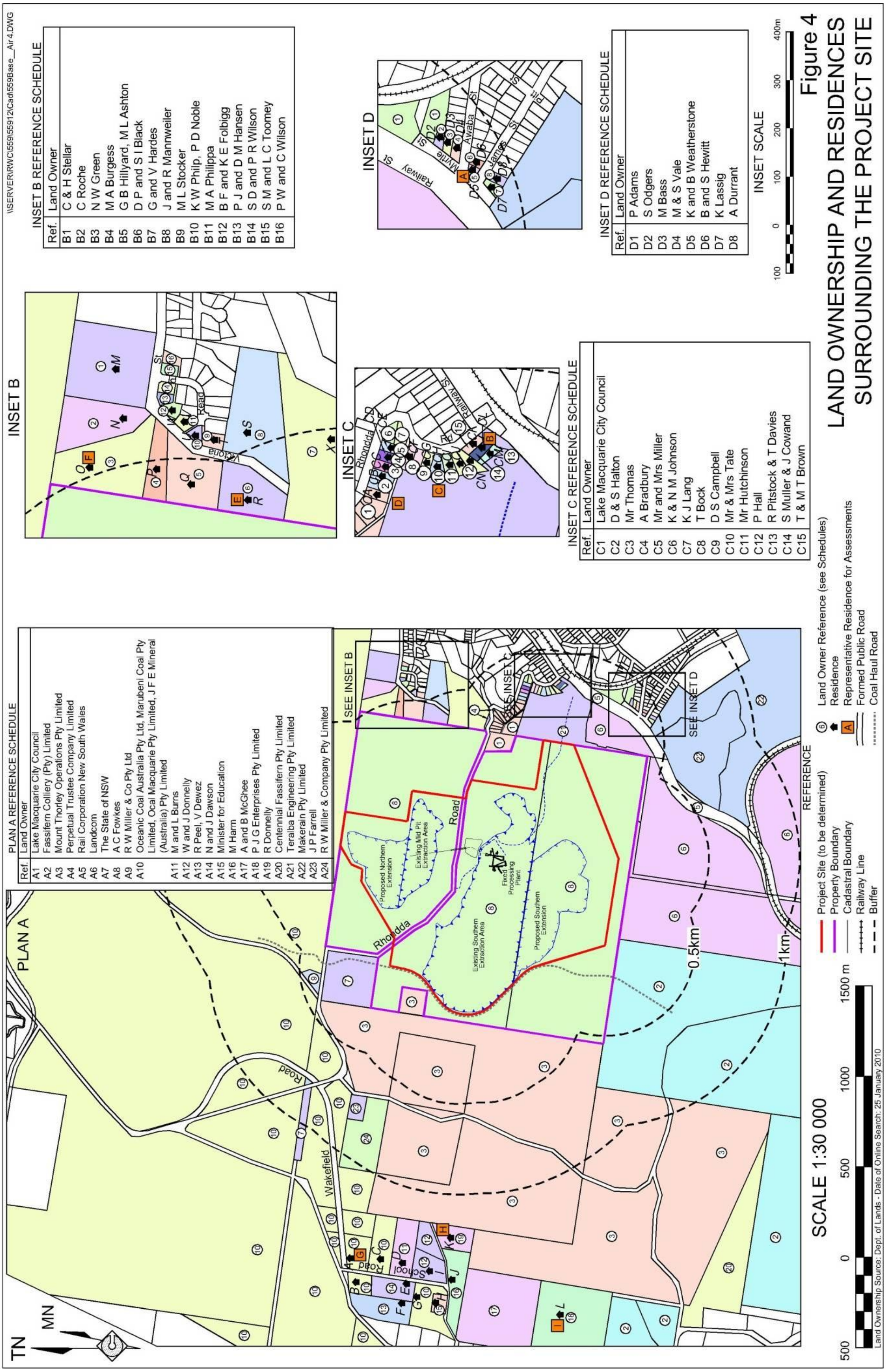


Figure 4
LAND OWNERSHIP AND RESIDENCES
SURROUNDING THE PROJECT SITE
\\SERVER\RWC\559\55912\Cad\559Base__Air4.DWG
PLAN A
SCALE 1:30 000
500 0 500 1000 1500 m
TN
MN
PLAN A REFERENCE SCHEDULE
Ref. Land Owner
A1 Lake Macquarie City Council
A2 Fassifern Colliery (Pty) Limited
A3 Mount Thorley Operations Pty Limited
A4 Perpetual Trustee Company Limited
A5 Rail Corporation New South Wales
A6 Landcom
A7 The State of NSW
A8 A C Fowkes
A9 R W Miller & Co Pty Ltd
A10 Oceanic Coal Australia Pty Ltd, Marubeni Coal Pty Limited, Ocal Macquarie Pty Limited, J F E Mineral (Australia) Pty Limited
A11 M and L Burns
A12 W and J Donnelly
A13 R Peel, V Dewez
A14 N and J Dawson
A15 Minister for Education
A16 M Harm
A17 A and B McGhee
A18 P J G Enterprises Pty Limited
A19 R Donnelly
A20 Centennial Fassifern Pty Limited
A21 Teralba Engineering Pty Limited
A22 Makerain Pty Limited
A23 J P Farrell
A24 R W Miller & Company Pty Limited
SEE INSET B
SEE INSET C
SEE INSET D
Rhondda
Road
Wakefield
School
Proposed Northern Extension
Existing Mid Pit Extraction Area
Fixed Processing Plant
Existing Southern Extraction Area
Proposed Southern Extension
0.5km
1km
REFERENCE
Project Site (to be determined)
Property Boundary
Cadastral Boundary
Railway Line
Buffer
Land Owner Reference (see Schedules)
Residence
Representative Residence for Assessments
Formed Public Road
Coal Haul Road
Land Ownership Source: Dept. of Lands - Date of Online Search: 25 January 2010
INSET B
Victoria
Road
St
INSET B REFERENCE SCHEDULE
Ref. Land Owner
B1 C & H Stellar
B2 C Roche
B3 N W Green
B4 M A Burgess
B5 G B Hillyard, M L Ashton
B6 D P and S I Black
B7 G and V Hardes
B8 J and R Mannweiler
B9 M L Stocker
B10 K W Philip, P D Noble
B11 M A Philippa
B12 B F and K E Folbigg
B13 P J and D M Hansen
B14 S D and P R Wilson
B15 S M and L C Toomey
B16 P W and C Wilson
INSET C
Rhondda
Rd
Railway St
INSET C REFERENCE SCHEDULE
Ref. Land Owner
C1 Lake Macquarie City Council
C2 D & S Halton
C3 Mr Thomas
C4 A Bradbury
C5 Mr and Mrs Miller
C6 K & N M Johnson
C7 K J Lang
C8 T Bock
C9 D S Campbell
C10 Mr & Mrs Tate
C11 Mr Hutchinson
C12 P Hall
C13 R Pitstock & T Davies
C14 S Muller & J Cowand
C15 T & M T Brown
INSET D
Railway St
Myrtle St
Awaba St
James St
INSET D REFERENCE SCHEDULE
Ref. Land Owner
D1 P Adams
D2 S Odgers
D3 M Bass
D4 M & S Vale
D5 K and B Weatherstone
D6 B and S Hewitt
D7 K Lassig
D8 A Durrant
INSET SCALE
100 0 100 200 300 400m

The annual goal for Total Suspended Particulate (or TSP) is given as 90 µg/m^3, as recommended by the National Health and Medical Research Council (NHMRC) at their 92nd session in October 1981. It was developed before the more recent results of epidemiological studies suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

Emissions of particulate matter less than 10 and 2.5 microns in diameter (referred to as PM_{10} and $PM_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

The NSW PM_{10} assessment goals as expressed in the Approved Methods are:

- a 24-hour maximum of 50 µg/m^3; and
- an annual average of 30 µg/m^3.

The 24-hour PM_{10} reporting standard of 50 µg/m^3 is numerically identical to the equivalent National Environment Protection Measure (or NEPM) reporting standard except that the NEPM reporting standard allows for five exceedances per year. These NEPM goals were developed by the National Environmental Protection Council (NEPC) in 1998 to be achieved within 10 years of commencement (i.e. by 2008).

In December 2000, the NEPC initiated a review to determine whether a new ambient air quality criterion for $PM_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. The review found that:

- there are health effects associated with these fine particles;
- the health effects observed overseas are supported by Australian studies; and
- fine particle standards have been set in Canada and the USA, and an interim criterion is proposed for New Zealand.

The review concluded that there is sufficient community concern regarding $PM_{2.5}$ to consider it an entity separate from PM_{10}.

As such, in July 2003 a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$. This document references the following reporting goals for $PM_{2.5}$:

- a 24-hour average concentration of 25 µg/m^3; and
- an annual average concentration of 8 µg/m^3.

It is noted that the goals relating to $PM_{2.5}$ particles are reporting guidelines only at the present time.

4.2 NUISANCE IMPACTS OF FUGITIVE EMISSIONS

The preceding sections are concerned in large part with the health impacts of particulate matter. Nuisance impacts need also to be considered, mainly in relation to dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 g/m^2/month.

Table 3 presents the DECCW impact assessment goals for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level which would be acceptable so that dust nuisance could be avoided.

Table 3
DECCW Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month
Source: Approved Methods, DECCW 2005.		

4.3 PROJECT AIR QUALITY GOALS

In view of the foregoing, the air quality goals adopted for this assessment, which conform to current DECCW and federal air quality criteria, are summarised in **Table 4**.

Table 4
Project Air Quality Goals

Pollutant	Averaging Time	Goal
TSP	Annual	90 $\mu g/m^3$
PM_{10}	24 hours Annual	50 $\mu g/m^3$ 30 $\mu g/m^3$
$PM_{2.5}$	24 hours Annual	25 $\mu g/m^3$ 8 $\mu g/m^3$
Dust Deposition	Annual	Maximum incremental (Project only) deposition rate of 2 g/m^2/month Maximum cumulative (Project and other sources) deposition rate of 4 g/m^2/month
Source: Approved Methods, DECCW 2005.		

5. PREVAILING DISPERSION METEOROLOGY

5.1 METEOROLOGICAL MODELLING

5.1.1 TAPM

In the absence of adequate meteorological monitoring data in the vicinity of Teralba, meteorological modelling using The Air Pollution Model (TAPM) meteorological model (Version 4) has been performed. 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.

TAPM model 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 at user-defined levels within the atmosphere.

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. However, in this situation there were no available monitoring stations to include in the modelling. **Table 5** details the parameters used in the TAPM meteorological modelling for this assessment.

Table 5
Meteorological Parameters used for this Study (TAPM v4)

Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	25 x 25 x 25
Year of analysis	2008
Centre of analysis	368,510 m E, 6,352,252 m S (-32° 57', 151° 35')
Data assimilation	No data assimilation

5.1.2 CALMET

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and land uses.

The modelling domain for CALMET consisted of a grid extending 10 km east-west and 10 km north-south with a 200 m grid spacing, with the southwest corner of the domain located at 364.495 km E and 6346.591 km S in Universal Transverse Mercator (UTM) zone 56.

Due to an absence of local monitoring data, CALTAPM was used to create three dimensional gridded data from TAPM to provide an initial guess field across the modelling domain for use by CALMET.

5.2 METEOROLOGICAL CONDITIONS

5.2.1 Wind Regime

A summary of the 2008 calendar year annual wind behaviour experienced at the Project Site is presented as wind roses in **Figure 5**. The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points – N, NNE, NE, etc. The bar pointing vertically upwards in the wind rose diagram represents winds blowing from the north (i.e., northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

Figure 5 indicates that winds experienced at Teralba are generally light to moderate (between 1.5 m/s and 5.5 m/s), predominantly occurring from the western quadrant. The seasonal wind roses indicate that wind direction is seasonally dependent. Winds occur more frequently from the west during winter and from the northwest during spring. During summer, winds predominantly blow from the east, while in autumn there is a high frequency of winds from the northwest to west-southwest and the southeast east.

Calm wind conditions (wind speeds less than 0.5 m/s) were predicted to occur 1.4% of the time throughout 2008. It is recognised however, that TAPM V4 tends to overestimate the number of low wind events hence in reality the frequency of calm wind conditions is likely to be lower than this.

5.2.2 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, “A” to “F”, to categorise the degree of atmospheric stability. These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models **Table 6**.

The calculated frequency of each stability class at the Project Site is presented in **Figure 6**. The results indicate a fairly even spread of Stability Class conditions, with Stability Class F occurring most frequently. Stability Class “F” is indicative of highly stable night-time conditions, which represent a low potential for pollutant dispersion. Stability Class A (calm, hot day-time conditions) are predicted to occur relatively infrequently.

5.2.3 Mixing Depth

Diurnal variations in the mixing depths predicted by TAPM at the Project Site are illustrated in **Figure 7**. As shown by the plot, an increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of convective mixing layer.

6. EXISTING AIR QUALITY ENVIRONMENT

6.1 AVAILABILITY OF AIR QUALITY MONITORING DATA

An air quality monitoring network comprising three dust deposition gauges (DDG) has been established in the area surrounding the Project Site since 2004. Two additional gauges have been recently installed to supplement the long term gauges. The locations of all five DDGs are shown in **Figure 8**. These gauges provide monthly measurements of the dust deposition rate attributable to all sources around Teralba.

A DECCW air quality monitoring station, which includes a continuous PM_{10} monitor, is also located at the Newcastle City Council Swimming Pool off Frances Street in Wallsend, just under 9 km to the northeast of the Project Site (see **Figure 9**). PM_{10} monitoring data has been obtained from this station for use in this assessment to provide an indication of the existing air quality environment.

No monitoring data is currently available for the area for TSP or $PM_{2.5}$.

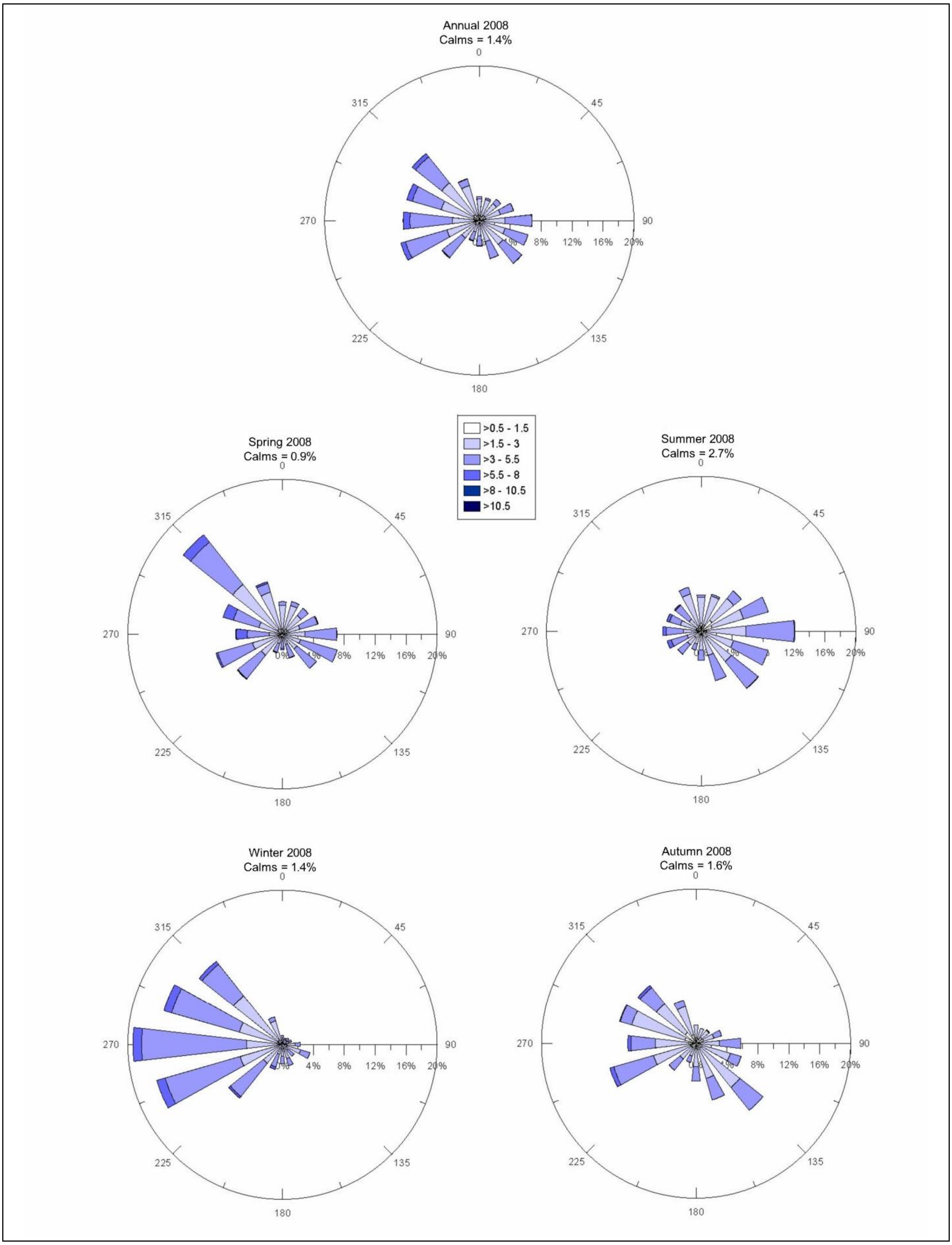


Figure 5
Annual and Seasonal Wind Roses for the Project Site, 2008

Table 6
Description of Atmospheric Stability Classes

Stability Class	Category	Description
A	Very unstable	Low wind, clear skies, hot daytime conditions
B	Unstable	Clear skies, daytime conditions
C	Moderately unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very stable	Low winds, clear skies, cold night-time conditions

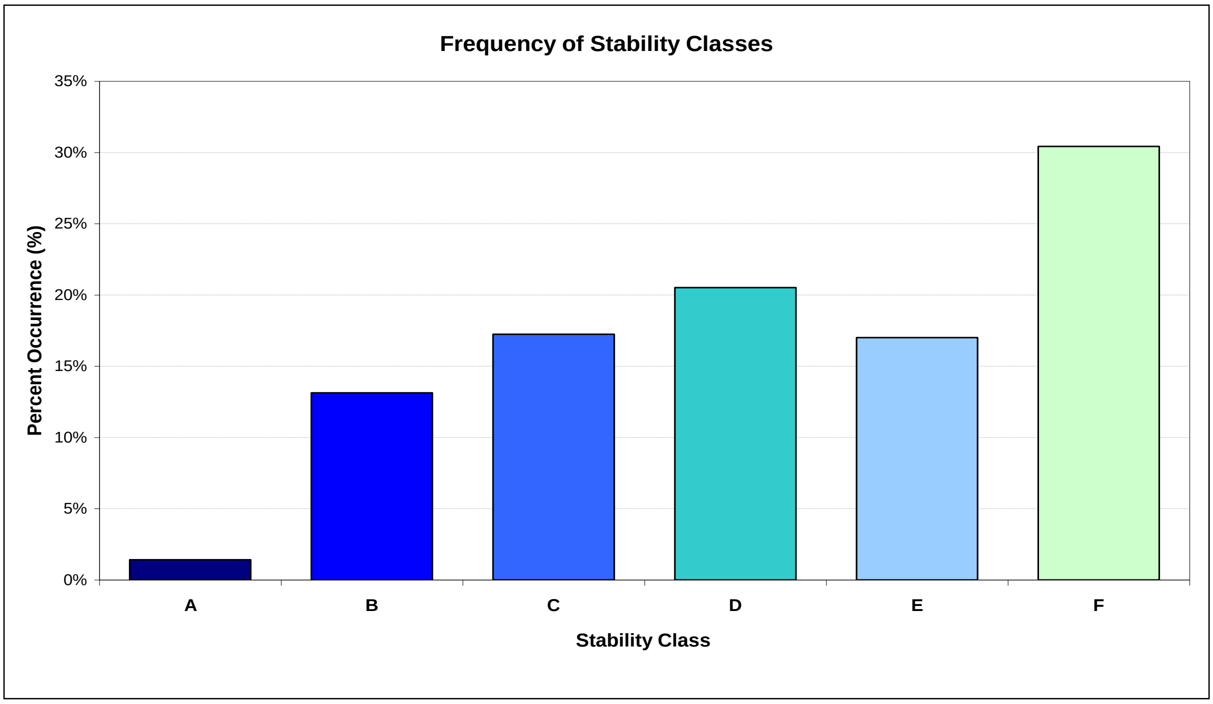
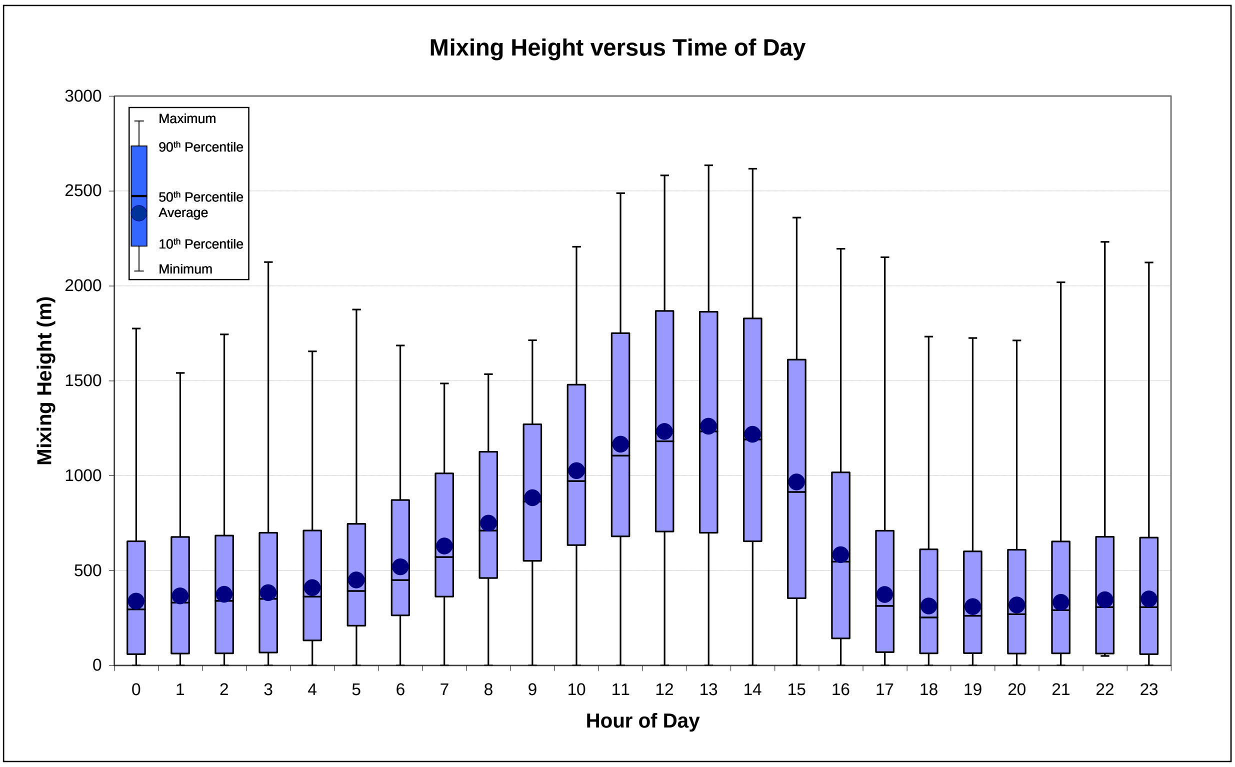


Figure 6
Annual Stability Class Distributions for the Project Site, 2008

Figure 7
TAPM-Predicted Diurnal Variation in Mixing Depth for the Project Site, 2008



6.2 REVIEW OF MONITORING DATA

Wallsend is the closest monitoring location to the project and monitoring data contemporaneous to the meteorological modelling was selected to represent background data.

6.2.1 PM_{10}

The ambient PM_{10} concentrations (24-hour averages) recorded at Wallsend between January - December 2008, are summarised in **Table 7** and presented in **Figure 10**.

The data indicates that the highest 24-hour average PM_{10} concentration measured by the DECCW's Wallsend air quality monitoring site during 2008 was 56.5 µg/m^3, recorded on 16 September 2008. During this mid-September period in 2008 there were several major regional dust storms and the single exceedance is almost certainly associated with one of these events.

The annual average PM_{10} concentration for the 2008 Wallsend dataset was 15.7 µg/m^3.

Table 7
Measured 24-hour Average PM_{10} Concentrations: Wallsend 2008

Station	Maximum Measured Concentration (µg/m^3)	6th Highest Measured Concentration (µg/m^3)	Average Concentration (µg/m^3)	Days with No Results
Wallsend	57	33	16	63

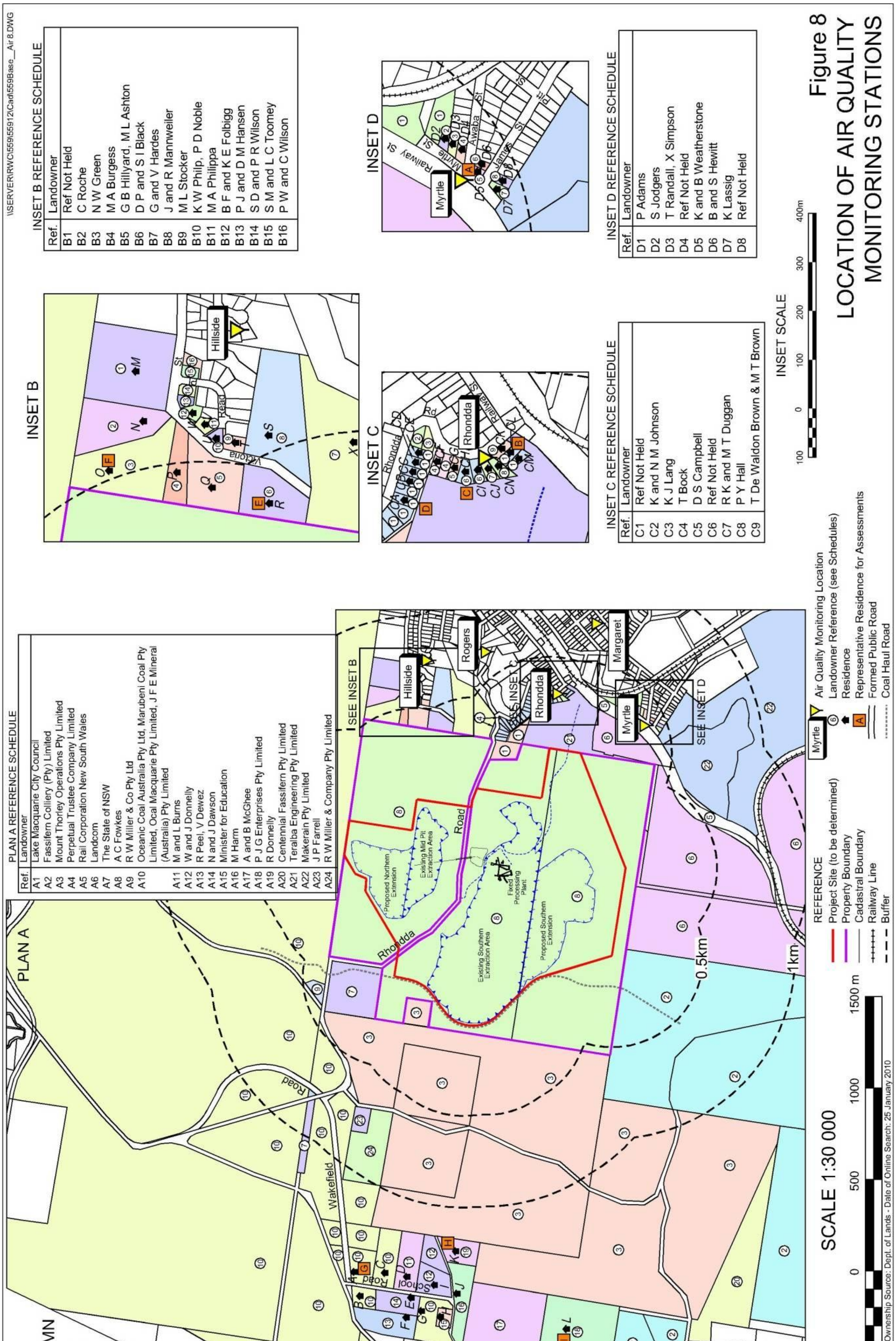


Figure 8
LOCATION OF AIR QUALITY MONITORING STATIONS

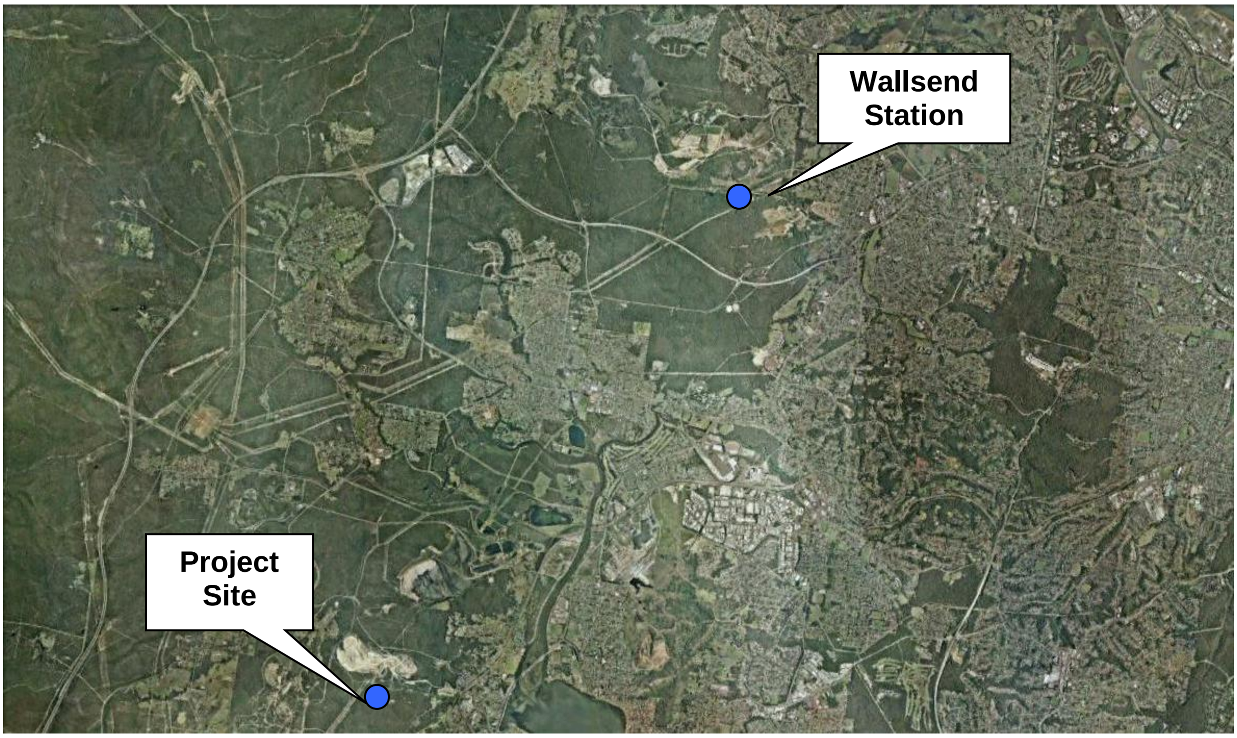
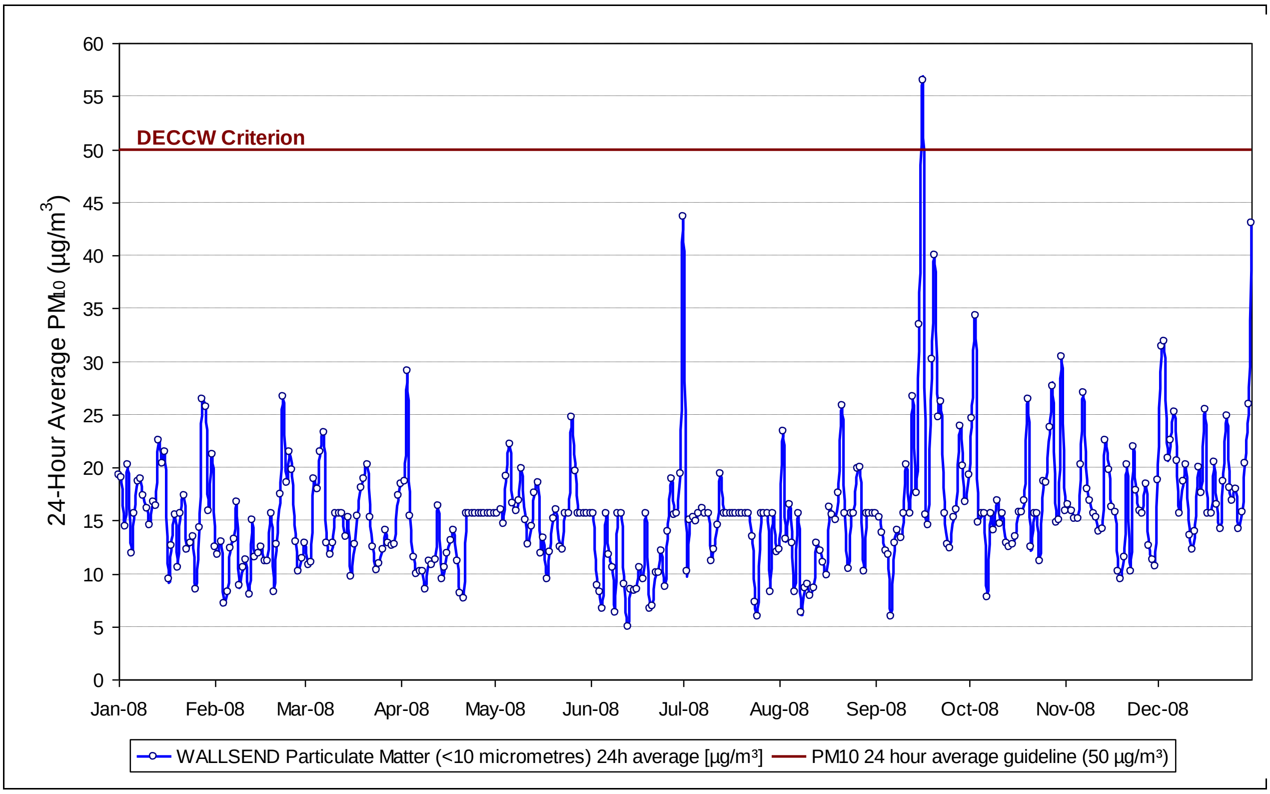


Image source: Google Earth

Figure 9
Location of Nearest DECCW Air Quality Monitoring Station



Note: During periods of missing data, the average of the dataset has been substituted.

Figure 10
Measured 24-Hour Average PM_{10} Concentrations: Wallsend 2008

6.2.2 $PM_{2.5}$

$PM_{2.5}$ monitoring data has been obtained from the Wallsend station for use in this assessment to provide an indication of the existing air quality environment. As with the PM_{10} dataset regional scale dust events have been excluded from the Wallsend dataset (see Figure 11). An hourly averaged daily varying file was used in the dispersion modelling. The annual average $PM_{2.5}$ concentration for 2008 Wallsend dataset was 5.9 µg/m^3.

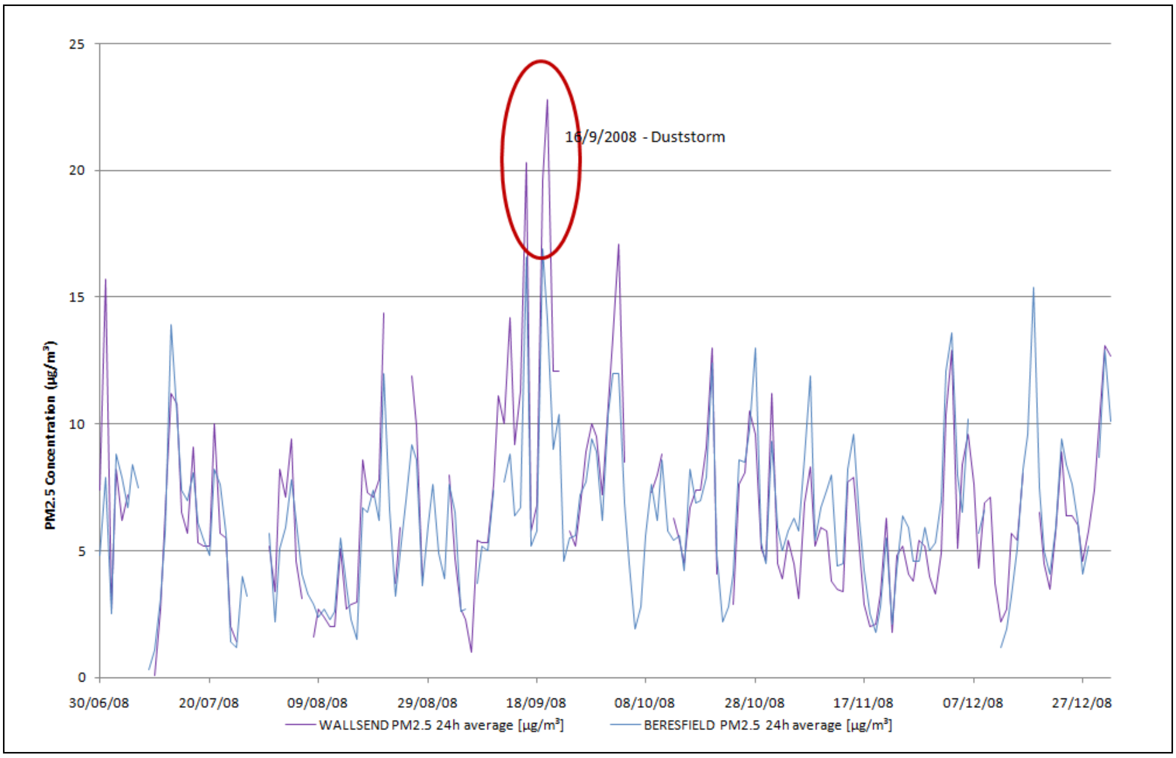


Figure 11
Measured 24-Hour Average $PM_{2.5}$ Concentrations: Wallsend 2008

6.2.3 TSP

No monitored TSP data was available so a conservative assumption that PM_{10} comprises 40% of the total TSP has been applied to this assessment. Therefore, based upon the annual average PM_{10} concentration of 15.7µg/m³ presented in **Section 6.2.1** the assumed background annual average TSP concentration would be 39.3 µg/m³.

6.2.4 Deposited Particulate Matter

The dust deposition rates measured by the Teralba Quarry dust monitoring network are presented graphically in **Figure 11** and a summary of the results can be found in **Table 8**. As shown by the graph, the annual average dust deposition rates measured at all stations are well below the annual average criterion of 4 g/m^2/month set by DECCW. Short-term (monthly) elevated deposition rates have been measured on occasion, however these appear to be isolated events are most likely due to specific activities occurring in close proximity to the gauge, given that all three gauges did not record elevated levels at the same time.

Table 8 presents long term monitoring averages for the site. It shows that long term the average deposited dust flux is similar at all three monitoring locations however the ash content[1] increases with distance from the Project Site. As the ash content is considered to be the mineral content of the deposited matter this suggest that the Project Site is contributing more to the Rhondda Road site and other sources such as background sources are contributing proportionally more to the Hillside Cres site.

Based on the data summarised in **Figure 11** and **Table 8**, a conservative background level of 2 g/m^2/month has been used in this assessment.

6.3 BACKGROUND AIR QUALITY FOR ASSESSMENT PURPOSES

For the purposes of assessing the potential cumulative air quality impacts from the Project, an estimation of background air quality levels is required. The site-specific ambient air quality levels adopted for this assessment are summarised in **Table 9** and are based on the discussion above.

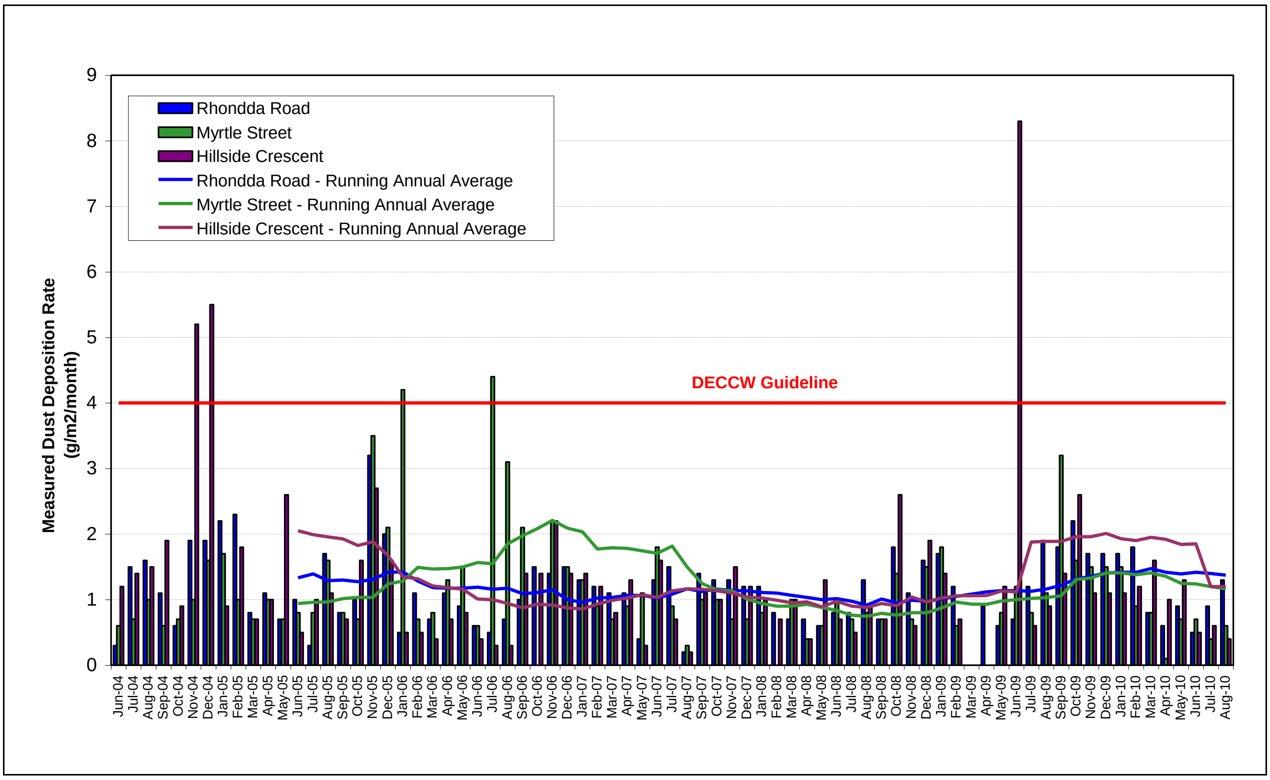


Figure 12
Measured Dust Deposition Rates – Teralba Quarry (June 2004 – August 2010)

[1] The component of the deposited matter that remains after the sample is combusted in a furnace. Assumed to be the mineral component of the sample.

Table 8
Deposition monitoring result summary

	RHONDDA RD			MYRTLE ST			HILLSIDE CRES		
	Insoluble Solids	Ash Fraction	% Ash	Insoluble Solids	Ash Fraction	% Ash	Insoluble Solids	Ash Fraction	% Ash
DECCW Guideline	4.0 (Annual Av)			4.0 (Annual Av)			4.0 (Annual Av)		
Total Monitoring Average	**1.2**	**0.7**	**67.0**	**1.2**	**0.7**	**62.5**	**1.3**	**0.7**	**55.8**

Table 9
Background Particulate Levels Used in this Assessment

Air Quality Parameter	Averaging Period	Assumed Background Ambient Level	Data Source
TSP	Annual	39.3 µg/m³	Assumed [a]
PM_{10}	24-Hour	Daily varying file	DECCW Wallsend
	Annual	15.7 µg/m³	
$PM_{2.5}$	24-Hour	None assumed	-
	Annual	None assumed	-
Dust Deposition	Annual	2 g/m²/month	Site Monitoring

a Assumes that PM_{10} makes up 40% of TSP and the annual average PM_{10} is 15.7 µg/m³.

7. ESTIMATION OF EMISSIONS

This assessment has considered emissions of particulate matter from:

- Extraction activities (drilling/blasting, front-end loaders, bulldozers, truck loading and conveyors);
- Crushing and Screening (dry only);
- Conveyors;
- Vehicle movements on unsealed roads;
- Product loading and despatch; and
- Wind erosion from disturbed areas.

Emissions have been estimated for TSP, PM_{10} and $PM_{2.5}$ based on emission factors sourced from the Commonwealth of Australia Document "*National Pollutant Inventory (NPI) for Mining, Version 2.3 (2001)*" and US EPA AP42 Emission Factors where suitable factors do not exist within the NPI documentation. Details of the operational scenarios, emission factors and activity data used in the calculations are provided below.

7.1 MODELLED SCENARIOS

This assessment has considered potential off-site impacts associated with three different operating scenarios. These are:

- Operational Scenario 1B – Extraction in Southern Extension (Stage A) and Mid-Pit Area (Stage E) only;
- Operational Scenario 4A – Extraction in Northern Extension (Stage C) only; and
- Operational Scenario 5A – Extraction in the Southern Extension Area (Stage C) only.

These scenarios are considered to capture the worst case impacts for operations in the northern, southern and mid pit extraction areas.

7.1.1 Operational Scenario 1B

Operational Scenario 1B includes extraction in the Southern Extension (Stage A) between the hours of 6:00am to 10:00pm and extraction in the Mid Pit Extraction Area (Stage E) between the hours of 7:00am to 6:00pm. The plant and equipment assumed to be operating for this scenario is detailed below, and a site layout plan is included as **Figure 12**.

A Extraction Operations: Southern Extension

- EX1: Hitachi 650 Excavator operating in blasted rock;
- DT1: Laden Komatsu 405 Dump Truck travelling towards existing primary crusher;
- DT2: Unladen Cat 775B Dump Truck departing from the fixed primary crusher; and
- WT: Komatsu 405 Water Truck undertaking dust suppression on internal haul road.

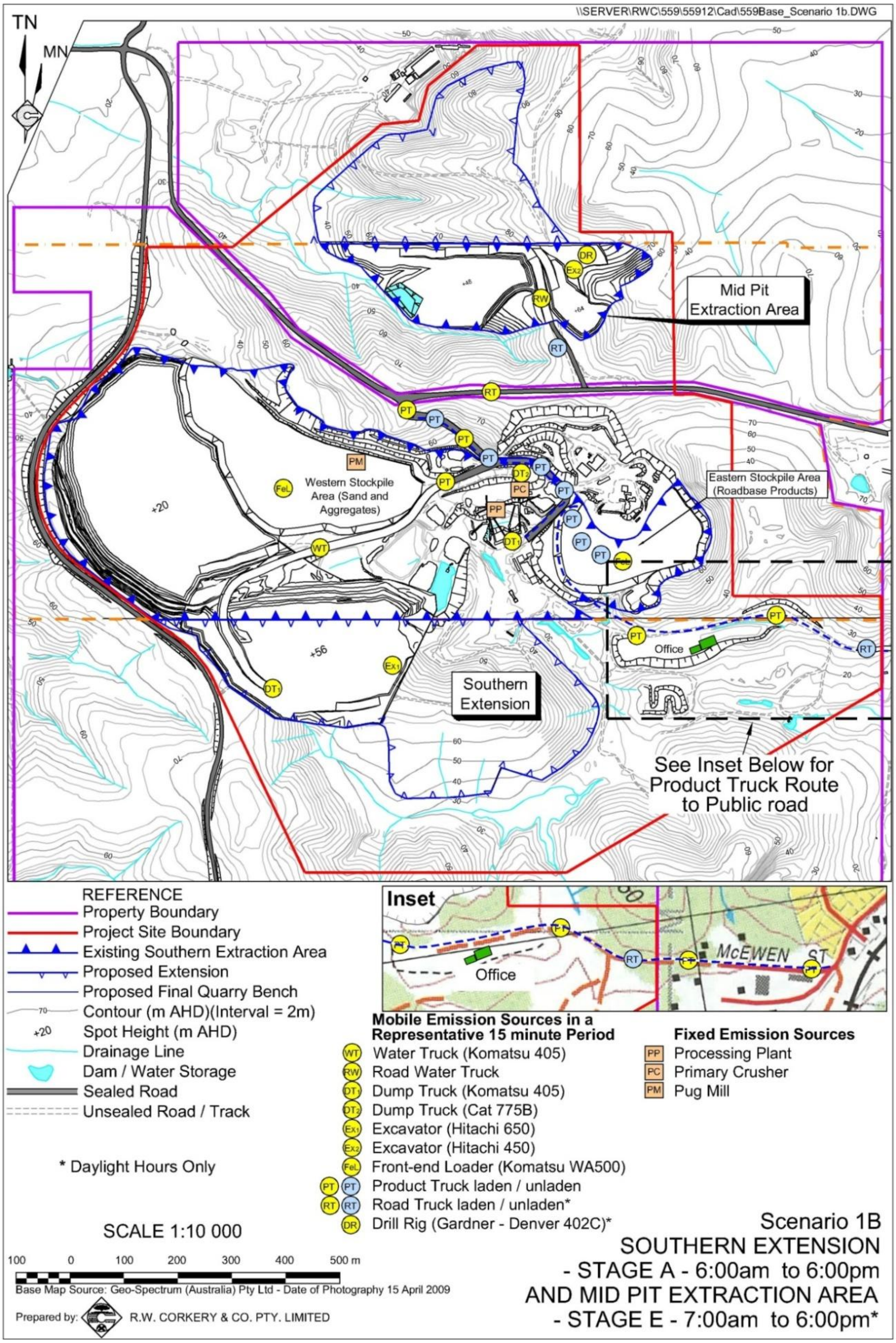


Figure 13
Scenario 1B – Southern Extension – Stage A – 6:00am to 6:00pm and Mid Pit Extraction Area – Stage E – 7:00am to 6:00pm

B Extraction Operations: Mid Pit Extraction Area

- DR: Gardner-Denver 402G Drilling Rig (Daylight hours only);
- EX2: Hitachi 450 Excavator loading trucks in eastern area;
- RW: Road Water Truck undertaking dust suppression on internal road; and
- RT: Unladen road truck returning to be loaded.

C Extraction Operations: Northern Extension

- No Activities

D Processing Operations

- PC: Fixed primary crusher;
- PP: Fixed Processing Plant; and
- PM: Pugmill operated by Civilake.

E Product Loading and Despatch

- FEL: Komatsu WA500 Front-end loader loading trucks in Eastern Stockpile Area;
- FEL: Komatsu WA500 Front-end Loader loading trucks in Western Stockpile Area;
- DT1: Komatsu 405 Dump Truck, operating adjacent to Processing Plant;
- PT: Seven (7) unladen product trucks entering the site from Rhondda Road and travelling to the Eastern and Western Stockpile Areas;
- PT: Three (3) laden product trucks leaving the site from the Rhondda Road entrance;
- PT: Four (4) laden product trucks leaving the site from the eastern entrance; and
- RT: One (1) unladen road truck leaving the site from the eastern entrance.

7.1.2 Operational Scenario 4A

Operational Scenario 4A includes extraction in the Northern Extension Area (Stage C) during the hours of 7:00am to 6:00pm. The plant and equipment assumed to be operating for this scenario is detailed below, and a site layout plan is included as **Figure 13**.

A Extraction Operations: Southern Extension

- No Activities

B Extraction Operations: Mid Pit Extraction Area

- No Activities

C Extraction Operations: Northern Extension

- DR: Gardner-Denver 402G Drilling rig operating in the north of the Northern Extension (Daylight hours only);
- EX1: Hitachi 650 Excavator operating;
- DT1: Komatsu 405 Dump Truck operating;

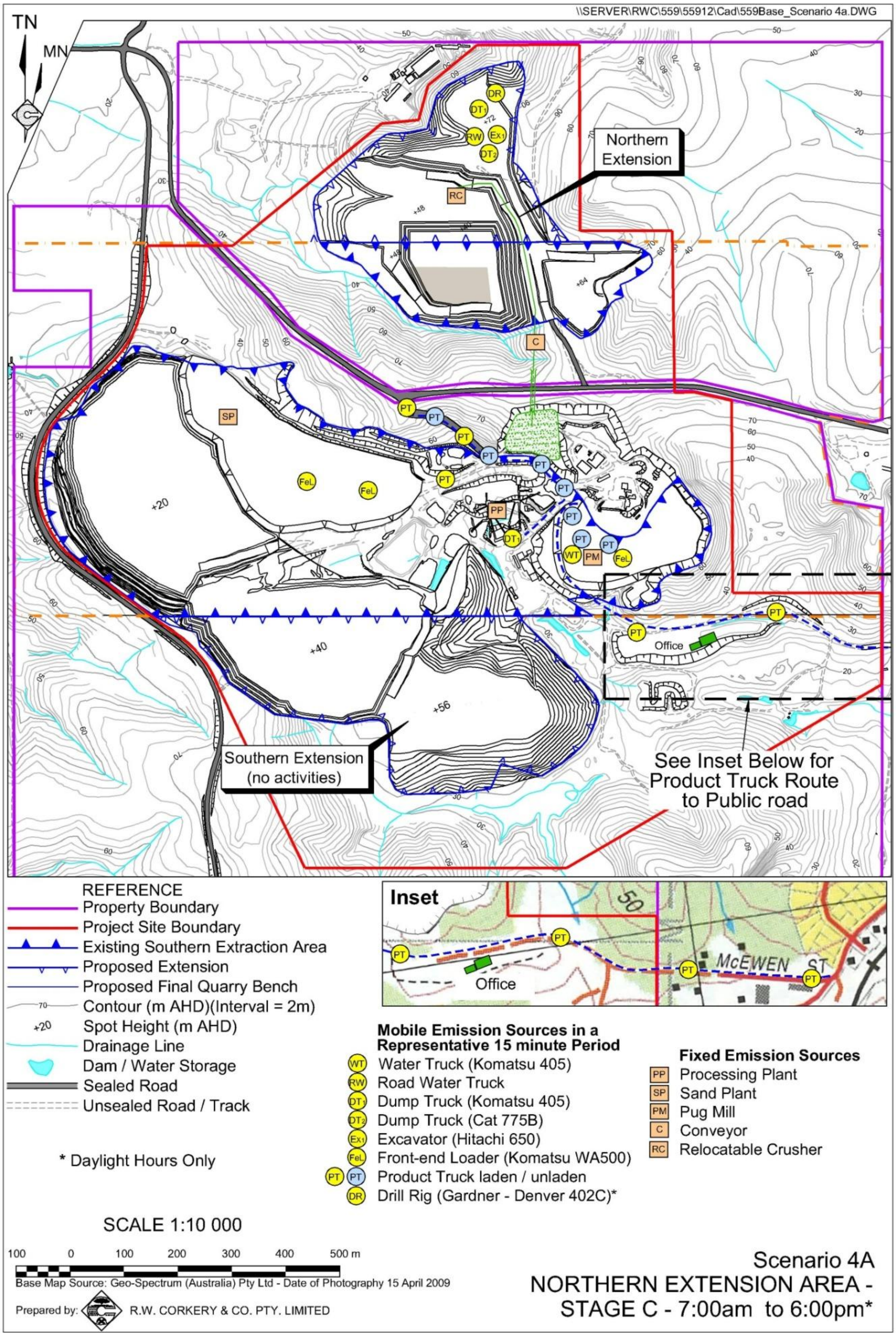


Figure 14
Scenario 4A Northern Extension Area – Stage C 7:00am to 6:00pm

DT2: Cat 775B Dump Truck operating;

- RW Road Water Truck undertaking dust suppression;
- RC: Re-locatable Crusher operating at margin with northern pit extension; and
- C: Conveyor despatching materials from re-locatable crusher to Fixed Processing Plant.

D Processing Operations

- PP: Fixed Processing Plant;
- PM: Pugmill operated by Metromix in Eastern Stockpile Area; and
- SP: Sand Plant operating in Western Stockpile Area.

E Product Loading and Despatch

- FEL: Komatsu WA500 Front-end loader loading trucks in Eastern Stockpile Area;
- FEL: two (2) Komatsu WA500 Front-end Loaders loading trucks in Western Stockpile Area;
- PT: Seven (7) unladen product trucks entering the site from Rhondda Road and travelling to the Eastern and Western Stockpile Areas;
- PT: Three (3) laden product trucks leaving the site from the Rhondda Road entrance;
- PT: Four (4) laden product trucks leaving the site from the eastern entrance; and
- RT: One (1) unladen road truck leaving the site from the eastern entrance.
- DT1: Komatsu 405 Dump Truck, operating in the main processing area; and
- WT: Komatsu 405 Water Truck undertaking dust suppression in the main processing area.

7.1.3 Operational Scenario 5A

Operational Scenario 5A includes extraction in the Southern Extension Area (Stage C) during the hours of 6:00am to 6:00pm. The plant and equipment assumed to be operating for this scenario is detailed below, and a site layout plan is included as **Figure 14**.

A Extraction Operations: Southern Extension

- DR: Gardner-Denver 402G Drilling rig operating near the east of the Southern Extension (Daylight hours only);
- EX1: Hitachi 650 Excavator operating;
- DT1: Komatsu 405 Dump Truck operating;
- DT2: Cat 775B Dump Truck operating; and
- RC: Re-locatable Crusher operating.

B Extraction Operations: Mid Pit Extraction Area

- No Activities

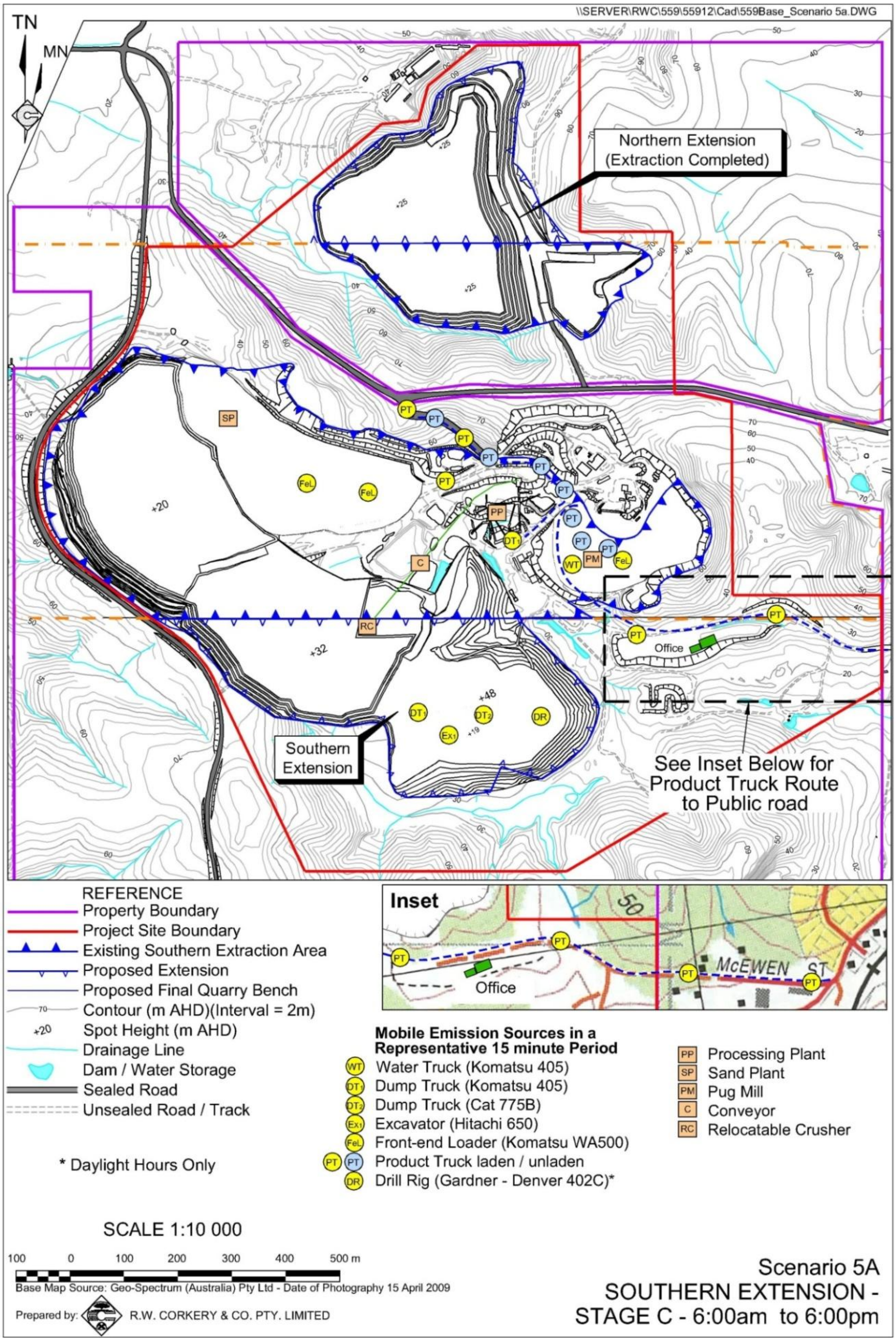


Figure 15
Scenario 5A southern Extension – Stage C 6:00am to 6:00pm

C Extraction Operations: Northern Extension

- Extraction Completed

D Processing Operations

- PP: Fixed Processing Plant;
- PM: Pugmill operated by Metromix in Eastern Stockpile Area;
- SP: Sand Plant operating in Western Stockpile Area; and
- C: Conveyor operating.

E Product Loading and Despatch

- FEL: Komatsu WA500 Front-end loader loading trucks in Eastern Stockpile Area;
- FEL: two (2) Komatsu WA500 Front-end Loaders loading trucks in Western Stockpile Area;
- PT: Seven (7) unladen product trucks entering the site from Rhondda Road and travelling to the Eastern and Western Stockpile Areas;
- PT: Three (3) laden product trucks leaving the site from the Rhondda Road entrance;
- PT: Four (4) laden product trucks leaving the site from the eastern entrance; and
- WT: Komatsu 405 Water Truck undertaking dust suppression in the main processing area; and
- DT1: Komatsu 405 Dump Truck, operating in the main processing area.

7.2 ESTIMATION OF EMISSIONS

Based on the information presented in **Section 7**, a particulate emissions inventory has been compiled for each modelled scenario. Full details of these inventories are provided in **Appendix D** with a summary of modelled emissions presented in **Table 12, Table 13** and **Table 14**.

Emission factors have been sourced from the Commonwealth of Australia Document “National Pollutant Inventory (NPI) for Mining, Version 2.3 (2001)” and US EPA AP42 Emission Factors where suitable factors do not exist within the NPI documentation.

The emission factors used are presented **Table 11**, which were derived using the assumptions discussed in **Section 7**. Total calculated emissions of TSP, PM_{10} and $PM_{2.5}$ are presented in **Table 12, Table 13** and **Table 14** for plant and equipment sources, **Table 15** for wind erosion sources with a summary presented in **Table 15** and **Figure 15**.

Table 10
Emission Factor Equations

Activity	Emission Factor Equation	Units	Source	Variables	Controls Applied*
Drilling	Default of 0.59 for total suspended particulates (TSP) Default of 0.31 for particulate matter less than 10 microns in size (PM_{10})	kg/hole	NPI EETM v2.3 (p11)		**Pit Retention - (50% for TSP, 5% for PM_{10})**
Blasting	$= 344 \times A^{0.8} \times M^{-1.9} \times D^{-1.8}$ for TSP As above multiplied by 0.52 for PM_{10}	kg/blast	NPI EETM v2.3 (p11)	A = Area Blasted (m^2) M = Moisture content (%) D = Depth of blast holes (m)	**Pit Retention - (50% for TSP, 5% for PM_{10})**
Excavator/ Front End Loader	$= k \times 0.0016 \times (U/2.2)^{1.3} \times (M/2)^{-1.4}$	kg/t	NPI EETM v2.3 (p11)	k = 0.74 (TSP) k = 0.35 (PM_{10}) U = mean wind speed (m/s) M = Moisture content (%)	**Pit Retention - (50% for TSP, 5% for PM_{10})**
Unpaved haul route wheel dust	$EF = k \times \left(\frac{s}{12}\right)^{0.7} \times \left(\frac{W}{3}\right)^{0.45} \times \left(\frac{281.9}{1000}\right) \times \left(\frac{365-p}{365}\right)$	kg/vehicle kilometres travelled (VKT)	USEPA AP42 - Wheel Generated Dust from Unpaved Roads (2003)	k = 4.9 (TSP) k = 1.5 (PM_{10}) s = silt content (%), W = vehicle gross mass (tonnes) p = number of days in year with rainfall greater than 0.25mm	**Pit Retention - (50% for TSP, 5% for PM_{10}))** **Level 1 watering (2 $l/m^2/hr$) - (50%)** **Speed Restrictions – (40 km/hr) 44%**
Trucks dumping waste rock / overburden	Default of 0.012 for TSP Default of 0.0043 for PM_{10}	kg/t	NPI EETM v2.3 (p11)		
Primary Crusher (includes emissions from screens, crusher, feeder, surge bin and conveyor transfer points)	Default of 0.01 for TSP (Emission Factor for Primary Crushing, High Moisture Ore) Default of 0.004 for PM_{10} (Emission Factor for Primary Crushing, High Moisture Ore)	kg/t	NPI EETM v2.3 (p14)		**Water sprays – 50%**
Secondary Crusher (includes emissions from screens, crusher, feeder, surge bin and conveyor transfer points)	Default of 0.03 for TSP (Emission Factor for Secondary Crushing, High Moisture Content Ore) Default of 0.0012 for PM_{10} (Emission Factor for Secondary Crushing, High Moisture Content Ore)	kg/t	NPI EETM v2.3 (p14)		**Water sprays – 50%**
Wind Erosion	TSP=0.4 PM_{10}=As above multiplied by 0.5	kg/ha	NPI EETM v2.3 (p14)	Emission taken to occur with wind speeds over 5.4 m/s	**Gravel Covered – 84%**
	While the US EPA's AP42 (US EPA, 2006) emission control factor would normally be used it has been found that TAPM V4 does not predict many wind speeds sufficiently strong to trigger the wind speed threshold friction velocity used in this method. Rather than arbitrarily decide on a lower threshold friction velocity it was decided to use the NPI methodology.				

* - Controls not applied to all sources, only to those of relevance e.g. pit retention control factor only applied to those sources within the pit.

Table 11
Scenario 1B emission inventory

		Length	Material Handled	Activity/hr		Operation			Control Factors			Emission (kg/annum)		
Source Type	**Model Ref**	**(m)**	**(tonnes)**		**Units**	**Hr/Day**	**Day/Yr**	**OpHrs**	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Blasting - overburden	N-BLAO1			1	blasts	1	60	60	50%	95%	95%	810	798	120
Excavator on overburden	N-ESFO1			240	tonnes	11	262	2882	50%	95%	95%	197	177	27
Excavator on overburden	N-ESFO2			120	tonnes	11	262	2882	50%	95%	95%	99	89	13
FEL on overburden	N-FELO1			180	tonnes	11	262	2882	50%	95%	95%	148	133	20
FEL on overburden	N-FELO2			180	tonnes	11	262	2882	50%	95%	95%	148	133	20
Drilling	N-DRIL1			2	holes	11	180	1980	50%	95%	95%	1,150	1,150	170
Truck dumping overburden	N-TRUO1			400	tonnes	11	262	2882	50%	95%	95%	6,920	4,710	710
Primary crushing - HMCO - Default Factor	N-PCRHM1			400	tonnes	11	262	2882	50%	95%	95%	5,760	4,380	660
Screening - LMCO	N-SCREEN1			400	tonnes	11	262	2882	50%	95%	95%	46,100	65,700	9,900
Tertiary crushing - HMCO - Default factor	N-TCRHM1			180	tonnes	11	262	2882	50%	95%	95%	7,780	4,930	740
Loading stockpiles - Default Factor	N-LSTO1			400	tonnes	11	262	2882	50%	95%	95%	2,310	1,860	280
Handling, transferring and conveying including wheel and bucket reclaimers (except bauxite) - HMCO - Default factor	N-HTCH1			400	tonnes	11	262	2882	50%	95%	95%	2,880	2,190	330
Asphalt Plant	Asphalt			25	tonnes	11	365	4015	50%	95%	95%	29	26	4
Hauling - Southern excavation to receival hopper	URE	1,042	800,000	0.7	VKT/hr	11	262	2882	25%	25%	25%	1,768	470	47
Hauling - Mid pit to receival hopper	ROAD	250	400,000	0.2	VKT/hr	11	262	2882	25%	25%	25%	445	118	12
Hauling - Product offsite eastern stockpile	HR	670	338,650	0.1	VKT/hr	11	262	2882	50%	50%	50%	445	118	12
Hauling - Product offsite western stockpile	HR	1,136	861,350	1.2	VKT/hr	11	262	2882	50%	50%	50%	5,336	1,417	142

Table 12
Scenario 4A emission inventory

Source Type	Model Ref	Length (m)	Material Handled (tonnes)	Activity	Units	Operation Hr/Day	Day/Yr	OpHrs	Control Factors TSP	PM_{10}	$PM_{2.5}$	Emission (kg/annum) TSP	PM_{10}	$PM_{2.5}$
Blasting - overburden	N-BLAO1			1	blasts	1	60	60	50%	95%	95%	810	798	120
Excavator on overburden	N-ESFO1			240	tonnes	11	262	2882	50%	95%	95%	197	177	27
Excavator on overburden	N-ESFO2			120	tonnes	11	262	2882	50%	95%	95%	99	89	13
FEL on overburden	N-FELO1			180	tonnes	11	262	2882	50%	95%	95%	148	133	20
FEL on overburden	N-FELO2			180	tonnes	11	262	2882	50%	95%	95%	148	133	20
Drilling	N-DRIL1			2	holes	11	180	1980	50%	95%	95%	1,150	1,150	170
Truck dumping overburden	N-TRUO1			400	tonnes	11	262	2882	50%	95%	95%	6,920	4,710	710
Primary crushing - HMCO - Default Factor	N-PCRHM1			400	tonnes	11	262	2882	50%	95%	95%	5,760	4,380	660
Screening - LMCO	N-SCREEN1			400	tonnes	11	262	2882	50%	95%	95%	46,100	65,700	9,900
Tertiary crushing - HMCO - Default factor	N-TCRHM1			180	tonnes	11	262	2882	50%	95%	95%	7,780	4,930	740
Loading stockpiles - Default Factor	N-LSTO1			400	tonnes	11	262	2882	50%	95%	95%	2,310	1,860	280
Handling, transferring and conveying including wheel and bucket reclaimers (except bauxite) - HMCO - Default factor	N-HTCH1			400	tonnes	11	262	2882	50%	95%	95%	2,880	2,190	330
Asphalt Plant	Asphalt			25	tonnes	11	365	4015	50%	95%	95%	29	26	4
Hauling - Product offsite eastern stockpile	URE	670	338,650	1.8	VKT/hr	24	262	6288	28%	28%	28%	9,801	2,603	260
Hauling - Product offsite western stockpile	ROAD	1136	861,350	7.8	VKT/hr	24	262	6288	28%	28%	28%	42,269	11,227	1,123
Hauling - In pit transport 1	DT1	200	600,000	1.4	VKT/hr	11	262	2882	14%	14%	14%	1,963	521	52
Hauling - In pit transport 2	DT2	200	600,000	1.4	VKT/hr	11	262	2882	14%	14%	14%	1,963	521	52
Hauling - Dump truck processing plant	DTPP	200	200,000	0.5	VKT/hr	11	262	2882	28%	28%	28%	1,309	348	35

Table 13
Scenario 5A emission inventory

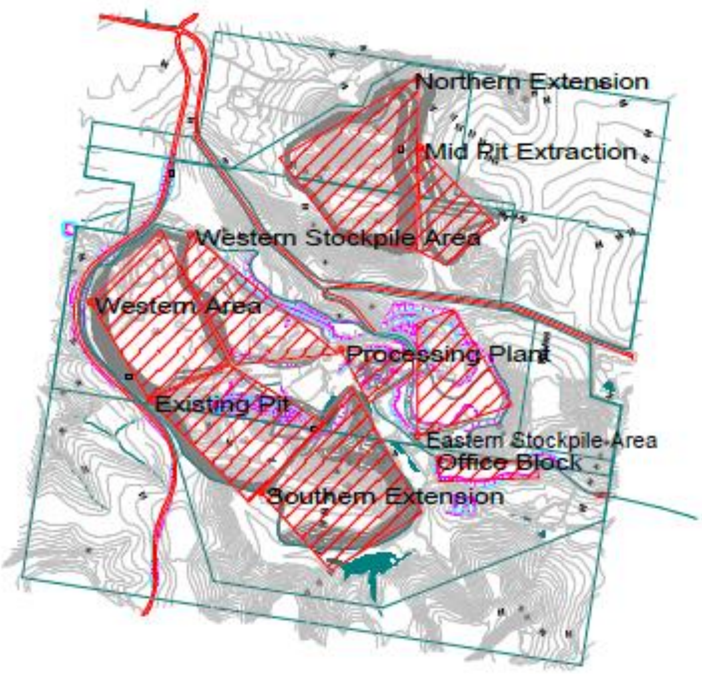
Source Type	Model Ref	Length (m)	Material Handled (tonnes)	Activity	Units	Operation Hr/Day	Day/Yr	OpHrs	Control Factors TSP	PM_{10}	$PM_{2.5}$	Emission (kg/annum) TSP	PM_{10}	$PM_{2.5}$
Blasting - overburden	N-BLAO1			1	blasts	1	60	60	50%	95%	95%	810	798	120
Excavator on overburden	N-ESFO1			240	tonnes	11	262	2882	50%	95%	95%	197	177	27
Excavator on overburden	N-ESFO2			120	tonnes	11	262	2882	50%	95%	95%	99	89	13
FEL on overburden	N-FELO1			180	tonnes	11	262	2882	50%	95%	95%	148	133	20
FEL on overburden	N-FELO2			180	tonnes	11	262	2882	50%	95%	95%	148	133	20
Drilling	N-DRIL1			2	holes	11	180	1980	50%	95%	95%	1,150	1,150	170
Truck dumping overburden	N-TRUO1			400	tonnes	11	262	2882	50%	95%	95%	6,920	4,710	710
Primary crushing - HMCO - Default Factor	N-PCRHM1			400	tonnes	11	262	2882	50%	95%	95%	5,760	4,380	660
Screening - LMCO	N-SCREEN1			400	tonnes	11	262	2882	50%	95%	95%	46,100	65,700	9,900
Tertiary crushing - HMCO - Default factor	N-TCRHM1			180	tonnes	11	262	2882	50%	95%	95%	7,780	4,930	740
Loading stockpiles - Default Factor	N-LSTO1			400	tonnes	11	262	2882	50%	95%	95%	2,310	1,860	280
Handling, transferring and conveying including wheel and bucket reclaimers (except bauxite) - HMCO - Default factor	N-HTCH1			400	tonnes	11	262	2882	50%	95%	95%	2,880	2,190	330
Asphalt Plant	Asphalt			25	tonnes	11	365	4015	50%	95%	95%	29	26	4
Hauling - South boot hopper	URE	670	338,650	1.8	VKT/hr	24	262	6288	28%	28%	28%	9,801	2,603	260
Hauling - Mid boot hopper	ROAD	1136	861,350	7.8	VKT/hr	24	262	6288	28%	28%	28%	42,269	11,227	1,123
Hauling - Off site east	HR	200	600,000	1.4	VKT/hr	11	262	2882	14%	14%	14%	1,963	521	52
Hauling - Dump truck processing plant	HR	200	600,000	1.4	VKT/hr	11	262	2882	14%	14%	14%	1,963	521	52
Hauling - Off site west	HR	200	200,000	0.5	VKT/hr	11	262	2882	28%	28%	28%	1,309	348	35

Table 14
Area sources modelled

Source		X km	Y km	Release Height m	Base Elevation m(MSL)	Sigma Z m	Area m²	Annual Emission kg/annum		
								TSP	PM_{10}	$PM_{2.5}$
Western Area	WA	367.646	6352.407	0.1	57.4	0.1	97200	2700	2600	400
Existing Pit	EP	367.877	6352.126	0.1	50.8	0.1	94000	2600	2500	400
Southern Extension	SE	368.170	6351.934	0.1	56.5	0.1	120600	3400	3200	500
Western Stockpile Area	WSA	367.871	6352.459	2	54.4	0.5	66700	1900	1800	300
Office Area	OA	368.586	6351.993	0.1	47.1	0.1	15000	400	400	100
Eastern Stockpile	ES	368.479	6352.279	2	64.9	0.5	59600	1700	1600	200
Processing Plant	PP	368.291	6352.276	2	57.7	0.5	18700	500	500	100
Northern Extension	NE	368.231	6352.812	0.1	71.5	0.1	115800	3200	3100	500
Mid Pit Extraction	MPE	368.463	6352.694	0.1	83.6	0.1	39200	1100	1000	200

7.2.1 Pug Mill Emission Estimates

The pug mill is considered to be a wet operation and therefore no emissions are expected.



All coordinates MGA (m)

Figure 16
Layout of area sources

8. ATMOSPHERIC DISPERSION MODELLING

8.1 MODEL SELECTION

Emissions from the Teralba Quarry have been modelled using the US EPA's CALPUFF (Version 6.267) modelling system. CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain either hourly concentration or hourly deposition fluxes evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

CALPUFF was run using a sub-domain of the CALMET (see **Section 5.1.2**) domain that had a southwest corner located at 364.595 km E and 6348.492 km S, extended 7 km east-west and 8 km north-south, and had a grid spacing of 200 m.

More advanced dispersion models (such as CALPUFF) are approved for use by the DECCW in situations where these models may be more appropriate than use of the Ausplume model.

8.2 MODEL CONFIGURATION

Details of the model set up can be found in **Appendix 2.**

9. DISPERSION MODELLING RESULTS

Dispersion modelling predictions of dust deposition and TSP, PM_{10} and $PM_{2.5}$ concentrations for the privately-owned residences/properties nominated in **Section 3.2** attributable to the Project Site are presented in **Section 9.1** to **Section 9.4**.

The results are presented as an increment due to on-site operations or a cumulative value which is the sum of all operations plus the background concentrations adopted in **Section 6.4** dependent upon background concentration availability.

Pollutant isopleth plots in **Appendix 1** are also provided which show the maximum concentrations and depositions of the pollutants assessed.

9.1 TOTAL SUSPENDED PARTICULATE (TSP RESULTS)

Table 16 presents the results of the dispersion modelling for TSP from the Project Site at each of the nominated residences/properties using the emission rates calculated in **Section 7**. As discussed in **Section 6.3**, a conservative background concentration of 39.3 µg/m³ has been assumed for the Project Site.

Table 15
Discrete Receptor TSP Annual Average Concentrations

	TSP Concentration- Annual Average (µg/m³)					
Receptor ID *	**Scenario 1B**		**Scenario 4A**		**Scenario 5A**	
	Incremental	**Cumulative**	**Incremental**	**Cumulative**	**Incremental**	**Cumulative**
A	1	40	1	41	1	41
B	3	42	4	43	4	43
C	7	46	8	47	8	47
D	2	42	3	42	3	42
E	1	41	1	41	1	41
F	1	40	1	40	1	40
G	0	40	0	40	0	40
H	0	40	0	40	0	40
I	0	40	0	40	0	40
Guideline	**90**					
* See Figure 4						

Annual average TSP concentrations are well within the criterion of 90 µg/m³ at all modelled residences/properties. As the nominated residences/properties were chosen as being indicative of any surrounding residences/properties, it can be determined that the annual average TSP concentrations at residences/properties surrounding those modelled would also be within the relevant criterion of 90 µg/m³.

Contour plots of the incremental increase in TSP concentrations attributable to the Project Site (Scenarios 1B, 4A and 5A) are presented in **Appendix 1**.

9.2 PM_{10} RESULTS

Table 17 and **Table 18** presents the results of the dispersion modelling for PM_{10} from the Project Site at each of the nominated residences/properties using the emission rates calculated in **Section 7**. As discussed in **Section 6.3**, background data from the Wallsend monitoring station has been used as background for the Project Site.

Annual average PM_{10} concentrations are well within the criterion of 30 µg/m³ at all modelled residences/properties. As the nominated residences/properties were chosen as being indicative of any surrounding residences/properties, it can be determined that the annual average PM_{10} concentrations at residences/properties surrounding those modelled would also be within the relevant criterion of 30 µg/m³.

24 hour average PM_{10} concentrations are well within the criterion of 50 µg/m³ at all modelled residences/properties. As the nominated residences/properties were chosen as being indicative of any surrounding residences/properties, it can be determined that the 24 hour average PM_{10} concentrations at residences/properties surrounding those modelled would also be within the relevant criterion of 50 µg/m³. It can be seen in **Figure 22** and **Figure 23** in **Appendix 1** that there are a small number of offsite exceedances in the vicinity of northern most boundary. This land is currently not used for residential purposes and rather forms part of a coal mining operation.

Contour plots of the incremental increase in PM_{10} concentrations attributable to the Project Site (Scenarios 1B, 4A and 5A) are presented in **Appendix 1**.

Table 16
Discrete Receptor PM_{10} Annual Average Concentrations

	PM_{10} Concentration- Annual Average (µg/m^3)					
Receptor ID *	**Scenario 1B**		**Scenario 4A**		**Scenario 5A**	
	Incremental	**Cumulative**	**Incremental**	**Cumulative**	**Incremental**	**Cumulative**
A	0.4	16	0.4	16	0.5	16
B	0.9	16	0.9	16	1.0	16
C	1.2	17	1.4	17	1.6	17
D	0.8	16	0.9	16	0.9	16
E	0.6	16	0.7	16	0.6	16
F	0.4	16	0.5	16	0.4	16
G	0.1	16	0.1	16	0.2	16
H	0.1	16	0.1	16	0.2	16
I	0.1	15	0.1	15	0.1	16
Guideline	**30**					
* See Figure 4						

Table 17
Discrete Receptor PM_{10} 24 Hour Average Concentrations

	PM_{10} Concentration- 24 Hour Average (µg/m^3)					
Receptor ID *	**Scenario 1B**		**Scenario 4A**		**Scenario 5A**	
	Incremental	**Cumulative**	**Incremental**	**Cumulative**	**Incremental**	**Cumulative**
A	0.7	40	0.6	40	0.9	40
B	1.3	41	1.4	41	1.5	41
C	1.7	41	1.8	42	1.9	43
D	1.1	40	1.2	41	1.2	41
E	0.5	40	0.8	40	0.3	40
F	0.3	40	0.5	40	0.2	40
G	0.0	39	0.0	39	0.0	39
H	0.0	39	0.0	39	0.0	39
I	0.0	39	0.0	39	0.0	39
Guideline	**50**					
* See Figure 4						

9.3 $PM_{2.5}$ RESULTS

Table 19 and **Table 20** presents the results of the dispersion modelling for $PM_{2.5}$ from the Project Site at each of the nominated residences/properties using the emission rates calculated in **Section 7**. As discussed in **Section 6.3**, a background concentration of 5.7 µg/m^3 annual average and an hourly varying average for 24 hour concentrations have been assumed for the Project Site.

Annual average $PM_{2.5}$ concentrations are well within the criterion of 8 µg/m^3 at all modelled residences/properties. As the nominated residences/properties were chosen as being indicative of any surrounding residences/properties, it can be determined that the annual average $PM_{2.5}$ concentrations at residences/properties surrounding those modelled would also be within the relevant criterion of 8 µg/m³.

Contour plots of the incremental increase in TSP concentrations attributable to the Project Site (Scenarios 1B, 4A and 5A) are presented in **Appendix 1**.

Table 18
Discrete Receptor $PM_{2.5}$ Annual Average Concentrations

	$PM_{2.5}$ Concentration- Annual Average (µg/m³)					
Receptor ID *	**Scenario 1B**		**Scenario 4A**		**Scenario 5A**	
	Incremental	**Cumulative**	**Incremental**	**Cumulative**	**Incremental**	**Cumulative**
A	0.1	5.8	0.1	5.8	0.1	5.8
B	0.2	5.9	0.2	5.9	0.2	5.9
C	0.3	6.0	0.4	6.1	0.3	6.0
D	0.1	5.8	0.1	5.8	0.2	5.9
E	0.1	5.8	0.1	5.8	0.1	5.8
F	0.1	5.8	0.1	5.8	0.1	5.8
G	0.0	5.7	0.0	5.7	0.0	5.7
H	0.0	5.7	0.0	5.7	0.0	5.7
I	0.0	5.7	0.0	5.7	0.0	5.7
Guideline	**8**					
* See Figure 4						

Table 19
Discrete Receptor 24 Hour Average $PM_{2.5}$ Concentrations

	$PM_{2.5}$ Concentration- Annual Average (µg/m³)					
Receptor ID *	**Scenario 1B**		**Scenario 4A**		**Scenario 5A**	
	Incremental	**Cumulative**	**Incremental**	**Cumulative**	**Incremental**	**Cumulative**
A	0.9	18	0.9	18	1.2	18
B	1.4	19	1.5	19	1.5	19
C	2.2	19	2.2	19	2.3	19
D	1.4	19	1.4	19	1.8	19
E	0.9	18	1.0	18	1.0	18
F	0.6	18	0.9	18	0.5	18
G	0.6	18	0.5	18	0.7	18
H	0.3	17	0.3	17	0.5	17
I	0.3	17	0.3	17	0.3	17
Guideline	**25**					
* See Figure 4						

9.4 DEPOSITED DUST RESULTS

Table 21 presents the results of the dispersion modelling for deposited dust from the Project Site at each of the nominated residences/properties using the emission rates calculated in **Section 7**. As discussed in **Section 6.3** a conservative background flux of 2 g/m²/month has been assumed for the Project Site.

Annual average deposited concentrations are well within the criterion of 4 g/m²/month at all modelled residences/properties. As the nominated residences/properties were chosen as being indicative of any surrounding residences/properties, it can be determined that the annual average TSP concentrations at residences/properties surrounding those modelled would also be within the relevant criterion of 4 g/m²/month.

Contour plots of the incremental increase in TSP concentrations attributable to the Project Site (Scenarios 1B, 4A and 5A) are presented in **Appendix 1**.

Table 20
Discrete Receptor Annual Average Deposited Dust Flux

	Deposited Dust Flux - Annual Average (g/m²/month)					
Receptor ID *	**Scenario 1B**		**Scenario 4A**		**Scenario 5A**	
	Incremental	**Cumulative**	**Incremental**	**Cumulative**	**Incremental**	**Cumulative**
A	0.1	2.1	0.1	2.1	0.1	2.1
B	0.2	2.2	0.2	2.2	0.2	2.2
C	0.0	2.0	0.0	2.0	0.0	2.0
D	0.1	2.1	0.1	2.1	0.1	2.1
E	0.1	2.1	0.1	2.1	0.1	2.1
F	0.0	2.0	0.0	2.0	0.0	2.0
G	0.0	2.0	0.0	2.0	0.0	2.0
H	0.0	2.0	0.0	2.0	0.0	2.0
I	0.0	2.0	0.0	2.0	0.0	2.0
Guideline	**2 incremental or 4 cumulative**					
* See Figure 4						

10. MITIGATION AND MINIMISATION

Metromix has been successfully operating a quarrying operation at this site for many years. `The site has not received any complaints relating to air quality throughout this period of operation. This partly due to the natural mitigation provided by the elevated terrain on three sides of the quarry that will inhibit wind speed in the immediate vicinity of the quarry. The naturally high moisture content in the conglomerate assists to limit dust generation. Additional dense vegetative buffers on the boundaries of the operational areas act to dampen wind speeds and filter dust particles from emissions from the site.

The operations within the proposed quarry extensions will continue to adopt the same mitigation practices that have been effective to date. Metromix in fact intends to improve on these though the use of conveyors rather haul trucks during the extraction operations in the Southern and Northern Extension. The following mitigation methods are currently adopted by Metromix and will be adopted under the proposed operation associated with the quarry extension:

Current mitigation includes:

- During periods of extended dry weather and/or high winds, when dust nuisance has the potential to occur as a result of quarrying activities, dust is managed through the use of a water truck to suppress emissions;
- Material stockpiles are located in sheltered locations and not close to sensitive receptors;
- Wind shielding of conveyors;

- Conveyor transfer enclosures; and
- Internal roads will be surfaced with well graded materials to limit dust lift-off.

Internal vehicle movements

- All vehicles travelling on internal unsealed roads will be limited to a speed appropriate for the conditions and safety i.e. less than 40 km/hr.
- Limiting load sizes to ensure that product does not extent above truck sidewalls.
- Care will be taken to avoid spillage during loading.

Additional controls that will be implemented to the proposed quarry extensions are as follows:

- Ceasing or modification of activities on dry windy days when plumes of dust are visible;
- Minimisation of dump heights from trucks, front-end loaders and conveyors;
- Watering of exposed areas that are not covered in gravel under dry and windy conditions (visible dust plumes being the trigger for this action);
- Blasts are scheduled so that they do not occur in very high wind conditions;
- A complaints management system will be adopted to ensure that all complaints are dealt with through investigation and implementation of corrective treatments;
- Truck queuing, unnecessary idling of trucks and unnecessary trips will be reduced through logistical planning, where possible;
- The on-site wheel wash would reduce mud tracking caused by trucks travelling eastwards along Railway Street; and
- Any mud tracking onto Rhondda Road will be cleaned as soon as practicable.

11. GREENHOUSE GAS ASSESSMENT

A quantitative greenhouse gas assessment has been undertaken to estimate potential greenhouse gas emissions associated with the Project.

11.1 DIRECT AND INDIRECT EMISSIONS (EMISSION SCOPES)

The National Greenhouse Accounts Factors (NGA Factors) (DCC, 2009) defines two types of greenhouse gas emissions:

> ***Direct emissions*** *are produced from sources within the boundary of an organisation and as a result of the organisation's activities.*
>
> ***Indirect emissions*** *are emission generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation.*

The NGA Factors identifies three 'scopes' of emissions for greenhouse gas accounting and reporting purposes, defined as follows:

- *Direct (or point-source) emission factors give the kilograms of carbon dioxide equivalent (CO2-e) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, on-site waste disposal, etc.). These factors are used to calculate scope 1 emissions.*

- *Indirect emission factors are used to calculate scope 2 emissions from the generation of the electricity purchased and consumed by an organisation as kilograms of CO2-e per unit of electricity consumed. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station.*
- *Various emission factors can be used to calculate scope 3 emissions. For ease of use, specific 'scope 3' emission factors are reported for organisations that:*
  - *(a) burn fossil fuels: to estimate their indirect emissions attributable to the extraction, production and transport of those fuels; or*
  - *(b) consume purchased electricity: to estimate their indirect emissions from the extraction, production and transport of fuel burned at generation and the indirect emissions attributable to the electricity lost in delivery in the T&D network.*

11.2 GREENHOUSE GAS CALCULATION METHODOLOGY

Quantification of potential emissions from the Project has been undertaken in relation to both carbon dioxide (CO_2) and other non-CO_2 greenhouse gas emissions.

For comparative purposes, non-CO_2 greenhouse gases are awarded a "CO_2-equivalence" ($CO_{2\text{-e}}$) based on their contribution to the enhancement of the greenhouse effect. The $CO_{2\text{-e}}$ of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO_2 greenhouse gases are contained within the Intergovernmental Panel on Climate Change (IPCC), (1996) document Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

The GWPs of relevance to this assessment are:

- methane (CH_4): GWP of 21 (21 times more effective as a greenhouse gas than CO_2); and
- nitrous oxide (N_2O): GWP of 310 (310 times more effective as a greenhouse gas than CO_2).

The short-lived gases such as carbon monoxide (CO), nitrogen dioxide (NO2), and non-methane volatile organic compounds (NMVOCs) vary spatially and it is consequently difficult to quantify their global radiative forcing impacts. For this reason, GWP values are generally not attributed to these gases nor have they been considered further as part of this assessment.

The greenhouse gas emissions associated with the Project have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential.

A summary of the potential Project greenhouse gas emission sources is provided in **Table 22**.

Activity Data

To assess the GHG impact of the proposed Project (to 1 Mtpa extraction rate), activity data has been scaled as outlined in **Table 23**. Average activity data for the years 2007 to 2009, associated with an average of 665,215 tpa hard rock extraction rate has been provided by the Proponent and scaled to reflect the 1 Mtpa extraction rate proposed as part of the Project.

Table 24 presents the percentages of product being transported by Metromix, Holcim, Hanson and others trucks to market. In the calculation of fuel consumed during this transportation, it has been assumed that each vehicle has a capacity of 30 t and a fuel economy of 30 litres/100 km (VTT, 2005).

Table 21
Summary of Potential Project Greenhouse Gas Emissions

Project Component	Direct Emissions	Indirect Emissions	
	Scope 1	**Scope 2**	**Scope 3**
Diesel	Emissions from the combustion of diesel at the Project (stationary energy and transport purposes).	N/A	Estimated emissions attributable to the extraction, production and transport of diesel consumed at the Project Site.
Explosives	Emissions from explosives used as part of the Project.	N/A	N/A
Electricity	N/A	Emissions associated with the consumption of generated and purchased electricity at the Project Site.	Estimated emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed at the Project Site and the electricity lost in delivery in the transmission and distribution network.
Road Product Transport	Emissions from the combustion of diesel consumed by Metromix owned vehicles transporting product from Quarry.	N/A	Emissions from the combustion of diesel consumed by trucking contractors transporting product from Quarry.
Employee Travel	N/A	N/A	Emissions from the combustion of fuel consumed by staff travelling to and from Quarry.

N/A = Not applicable

Table 22
Summary of Project Related Activity Data Relevant to GHG Emissions (Current and Proposed Operations)

Activity	**Quantity (Operations – Average 2007 to 2009 [665,215 tpa])**	**Quantity (Project [1 Mtpa])**	**Scaling Factor Applied**
Annual conglomerate production (t)	665,215 tpa	1,000,000 tpa	1.5 (1 Mt/0.66 Mt)
Annual Electricity Consumption (kWh)	1,595,002	2,397,726	1.5
Annual Diesel Consumption (litres [L]) On-site	392,099	589,432	1.5
Annual Diesel Consumption (L) Product transport by Road (see Table 23)	476,028	715,600	Extrapolated from fuel used for transportation of 2 Mtpa
Explosive Use (tonnes)	333	500	1.5
Annual fuel consumption (L) due to employee vehicle movements (see **Table 24**)	23,712	33,512	Assumed employee increase from 24 to 34

Table 23
Percentages and Quantities of Product Transported to Market (Current and Proposed)

Market	% of Product to Market	Distance to Market (km)	Quantity of Product to Market (Current)	Quantity of Product to Market (Proposed)
Lake Macquarie	55	20	365,868	550,000
Newcastle	24	19	159,652	240,000
Port Stephens	3	70	19,956	30,000
Cessnock	2	44	13,304	20,000
Maitland	3	36	19,956	30,000
Central Coast	5	88	33,261	50,000
Sydney	7	147	46,565	70,000
Other	1	147	6,652	10,000

Note 1: “Other” assumed to be Sydney for the purpose of providing a conservative assessment.
Note 2: The percentage of product being transported to the Sydney market will increase into the future due to the upcoming closure of the Penrith Lakes quarry. Impacts upon the quantity of material transported to Sydney is currently unclear and the status quo has been retained for the purposes of this assessment.

Table 24
Calculated Fuel Consumption in Employee Vehicles

Variable	Current Production Rate (665,215 tpa)	Proposed Production Rate (1 Mtpa)
Employee Numbers	24	34
Number of vehicle movements per year (assumed 260 day operation)	12,480	17,680
Total vehicle km’s per year (assumed residence Newcastle)	237,120	335,920
Total fuel consumption (L) (assumed 10 L/100km fuel efficiency)	23,712	33,592

11.2.1.1 Scope 1: Direct Emissions

Diesel Usage

Scope 1 greenhouse gas emissions attributable to diesel relate to the use of on-site machinery and transport.

The primary fuel source for the vehicles, plant and equipment operating at the Project is diesel. Diesel consumption for all mobile and fixed equipment for the Project is estimated as 393,000 litres (L) for a sales level of 665 000t increasing to 590 000 L per annum for a sales level of 1 Mtpa. Diesel usage for off-site product transport by road is estimated to be 476,028 L per annum currently, increasing to 715,600 L per annum for the 1 Mtpa extraction scenario.

It is noted that road transport sources are not all within the direct control of the Proponent, however, for the purposes of this assessment, it has been assumed that all road transport sources are within direct control of the Proponent and have therefore been calculated as Scope 1 emissions.

The annual emissions of CO_2 and other greenhouse gas from this source have been estimated using emission factors for diesel-fuelled vehicles (as a worst case) contained in Tables 3 and 4 of the NGA Factors (DCC, 2009). It has been assumed that the energy content of diesel is 38.6 mega joules per litre (MJ/L) (DCC, 2009).

Explosives

The use of explosives in quarrying leads to the release of greenhouse gases. The activity level is the mass of explosive used (in tonnes). The quantity of explosives to be used as part of the Project are detailed within Table 22.

The current edition of the NGA Factors (DCC, 2009) does not include emission factors for CO_{2-e} resulting from the use of ANFO or emulsion explosives. However, an emission factor of 0.17 t CO_{2-e} per t of explosive (t CO_{2-e}/t explosive) has been sourced from the February 2008 edition of the NGA Factors for use in this assessment.

11.2.1.2 Scope 2: Electricity Indirect Emissions

Emissions of GHG result from the consumption of purchased electricity generated at off-site locations.

State emission factors are used because electricity flows between states are significantly constrained by the capacity of the inter-state interconnectors and in some cases there are no interconnections.

Electricity consumption for the Project has been calculated as (approximately) 1,595,000 Kilowatt-hours (kWh) currently, increasing to approximately 2 400 000 kWh when sales reach 1 Mtpa.

The emission factor for Scope 2 (0.89 tonnes of CO2-equivalents per kilowatt hour [t CO_{2-e}/kWh]) represents the consumption of purchased electricity in NSW.

11.2.1.3 Scope 3: Other Indirect Emissions

Extraction, Production and Transport of Diesel Consumed as part of the Project

Scope 3 greenhouse gas emissions attributable to diesel used at the Project relate to its extraction, production and transport.

The annual emissions of CO_2 and other greenhouse gases from this source have been estimated using Table 38 of the NGA Factors (DCC, 2009).

Vehicle Use by Employees

Based on information provided by the Proponent, employees at the Project travel an average of 19 km to work (calculated based on 100% of workforce living in Newcastle). The number of employees associated with the Project would be 34, an increase of 10 from current operations. Based on these assumptions, employees would travel approximately 1,292 km to and from work per day as part of the Project operations, or 335,920 km each year. Assuming a diesel fuel consumption rate of 10 litres/100 km, this employee travel would result in the combustion of approximately 33 600 litres of diesel fuel per annum.

11.3 GREENHOUSE GAS CALCULATION RESULTS

Calculated Scope 1, Scope 2 and Scope 3 emissions of greenhouse gas resulting from the emissions sources outlined above for the Project are presented in **Table 26**, **Table 27** and **Table 28**, respectively. Total annual Project emissions have been calculated and are presented in **Table 29**. Also presented are the emissions calculated to be attributable to operations associated with 665,215 tpa conglomerate extraction, for comparison.

The most significant direct emissions are associated with the combustion of diesel in site vehicles and equipment and in off site distribution of product. The total direct (Scope 1) emissions from the Project are estimated to be approximately 3,521 t CO_{2-e} per annum, an increase of approximately 1,179 tonnes per annum, on the current extraction rate.

Table 25
Scope 1 Greenhouse Gas Emissions from the Project

Emissions Source	Activity Rate		Units	Emission Factor	Units	Calculated Emissions t CO_2-e /annum		
	665,215 tpa	1 Mtpa				665,215 tpa	1 Mtpa	Difference
Diesel Combustion - Onsite	392	589	kL	69.9	kg CO_2-e/GJ	1,058	1,590	532
Diesel Combustion - Road Transport	476	716	kL	69.9	kg CO_2-e /GJ	1,284	1,931	646
Explosive Use	0	0	tonnes	0.17	t CO_2-e /t	0	0	0
Total Scope 1						**2,342**	**3,521**	**1,179**

Table 26
Scope 2 Greenhouse Gas Emissions from the Project

Emissions Source	Activity Rate		Units	Emission Factor	Units	Calculated Emissions t CO_2-e /annum		
	665,215 tpa	1 Mtpa				665,215 tpa	1 Mtpa	Difference
Electricity Consumption	1,595,002	2,397,726	kwh	0.89	kg CO_2-e /kwh	1,420	2,134	714
Total Scope 2						**1,420**	**2,134**	**714**

Table 27
Scope 3 Greenhouse Gas Emissions from the Project

Emissions Source	Activity Rate		Units	Emission Factor	Units	Calculated Emissions t CO_2-e /annum		
	665,215 tpa	1 Mtpa				665,215 tpa	1 Mtpa	Difference
Electricity Consumption	1,595,002	2,397,726	kwh	0.18	kg CO_2-e /kwh	287	432	144
Diesel Combustion - Onsite	392	589	kL	5.3	kg CO_2-e /GJ	80	121	40
Diesel Combustion - Road Transport	476	716	kL	5.3	kg CO_2-e /GJ	97	146	49
Diesel Combustion - employees	24	34	kL	5.3	kg CO_2-e /GJ	5	7	2
Total Scope 3						**470**	**705**	**236**

Table 28
Scope 1, 2 and 3 Greenhouse Gas Emissions Attributable to the Project (t $CO_{2\text{-}e}$/annum)

Operations	**GHG Emissions t $CO_{2\text{-}e}$/annum**			
	Scope 1	**Scope 2**	**Scope 3**	**Total**
665,215 tpa	2,342	1,420	470	4,231
1 Mtpa	3,521	2,134	705	6,361
Emission Increase	**1,179**	**714**	**236**	**2,129**

A comparison of the predicted direct (Scope 1) emissions against Australia's 2007 net emissions of 597 Mt $CO_{2\text{-}e}$ demonstrates the Project would represent approximately 0.001 % of the total annual Australian emissions (DCC, 2008). A comparison of the predicted Scope 1 emissions against NSW emissions in 2007 (162.7 Mt CO2-e) demonstrates that the Project would represent approximately 0.002% of NSW emissions (DCC, 2007).

11.4 GREENHOUSE GAS MITIGATION MEASURES

The Australian Government Department of Resources, Energy and Tourism 2002 document Best Practice Environmental Management in Mining - Energy Efficiency and Greenhouse Gas Reduction was created to "promote best practice in energy efficiency and GHG gas management in the mining industry". The following list details some methods from this document that could assist in the reduction of GHG emissions from operations at the Teralba Quarry.

Relating to Diesel Consumption

- Minimise the use of haul trucks by overland conveyors where possible. Trade off is increased electricity consumption;
- Optimisation of incline/decline of haul routes to reduce transport distance from extraction area;
- Reduce vehicle idling time; and
- Maintain optimum tyre pressure.

Regarding Electricity Consumption

- Installation of most efficient crusher and other processing plant technology available should be a priority;
- Close regulation of the daily operation of lighting; and
- Implement solar-powered lighting about site where possible.

11.5 RECOMMENDATIONS BASED ON GREENHOUSE GAS ASSESSMENT

It is recommended that the Proponent continue to monitor consumption of diesel fuel, explosives, electricity and the destination of product. Continual calculation of GHG emissions resulting from both current and proposed operations will allow the identification of those areas where opportunities exist for reduction.

12. CONCLUSIONS

SLR Consulting Pty Ltd (SLR) has been commissioned by R.W. Corkery and Co Pty Ltd on behalf of Metromix Pty Ltd to undertake an Air Quality Impact Assessment (AQIA) for the Teralba Quarry Extensions Project.

Dispersion modelling using the CALPUFF modelling suite was conducted for a full year (2008) using three dimensional terrain, prognostic meteorology and where possible locally measured background pollutant concentration data.

The dispersion modelling predicted that including conservative background concentrations concentrations of annual average TSP and annual average PM_{10} concentrations would meet DECCW guidelines at all of the identified discrete receptors and at the boundaries of the Project Site. Annual average deposited dust fluxes were also predicted to meet DECCW guidelines at all sensitive receiving environments.

Annual average and 24 hour average $PM_{2.5}$ were predicted to be 3% and 5% of the DECCW guidelines respectively without the addition of background concentrations at the worst affected sensitive receivers. This indicates that exceedances of the DECCW guidelines for $PM_{2.5}$ at the nearest receptors are likely to be driven by sources other than the quarry.

24 hour average PM_{10} are predicted to exceed the DECCW guideline value of 50 µg/m³ at and just beyond the northern-most border of the Project Site. This area forms part of a neighbouring coal mining operation and will not be used for residential purposes. There is a ridge to the north east of this northern most border that separates Teralba Quarry from the mining operation which would act as an effective barrier separating the two operations.

Given that the project is not predicted to impact upon the nearby residences, it is anticipated that the level of emission control technology outlined in this assessment will be sufficient for this Project. However, it is recommended that a dust management plan be implemented for the site.

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Appendices

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Appendix 1

Contour Plots

(No. of pages including blank pages = 20)

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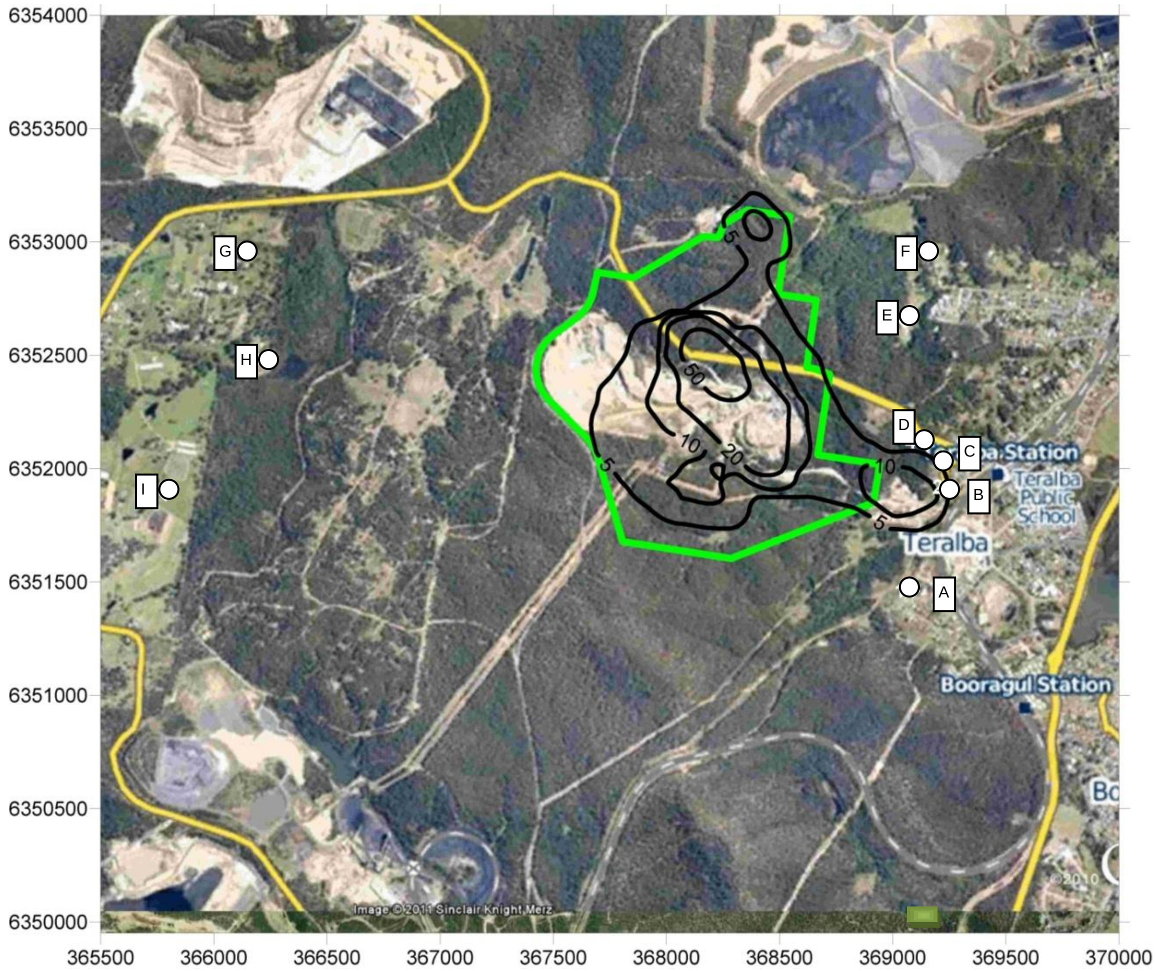

Figure 17: Scenario 1B - Predicted annual average TSP concentrations

(all concentrations in µg/m³, guideline concentration is 90 µg/m³, excludes background)

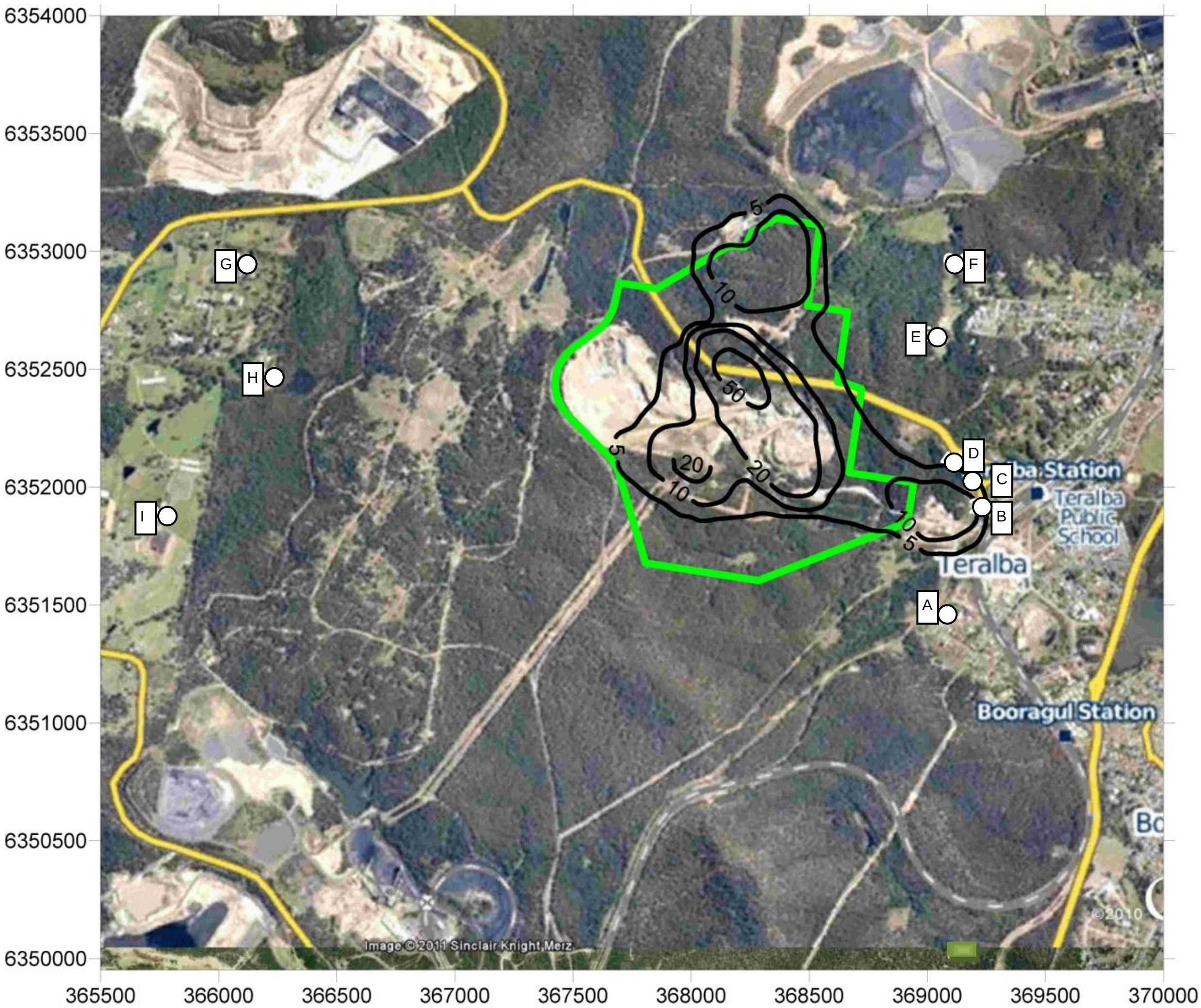

Figure 18: Scenario 4A - Predicted annual average TSP concentrations

(all concentrations in µg/m³, guideline concentration is 90 µg/m³, excludes background)

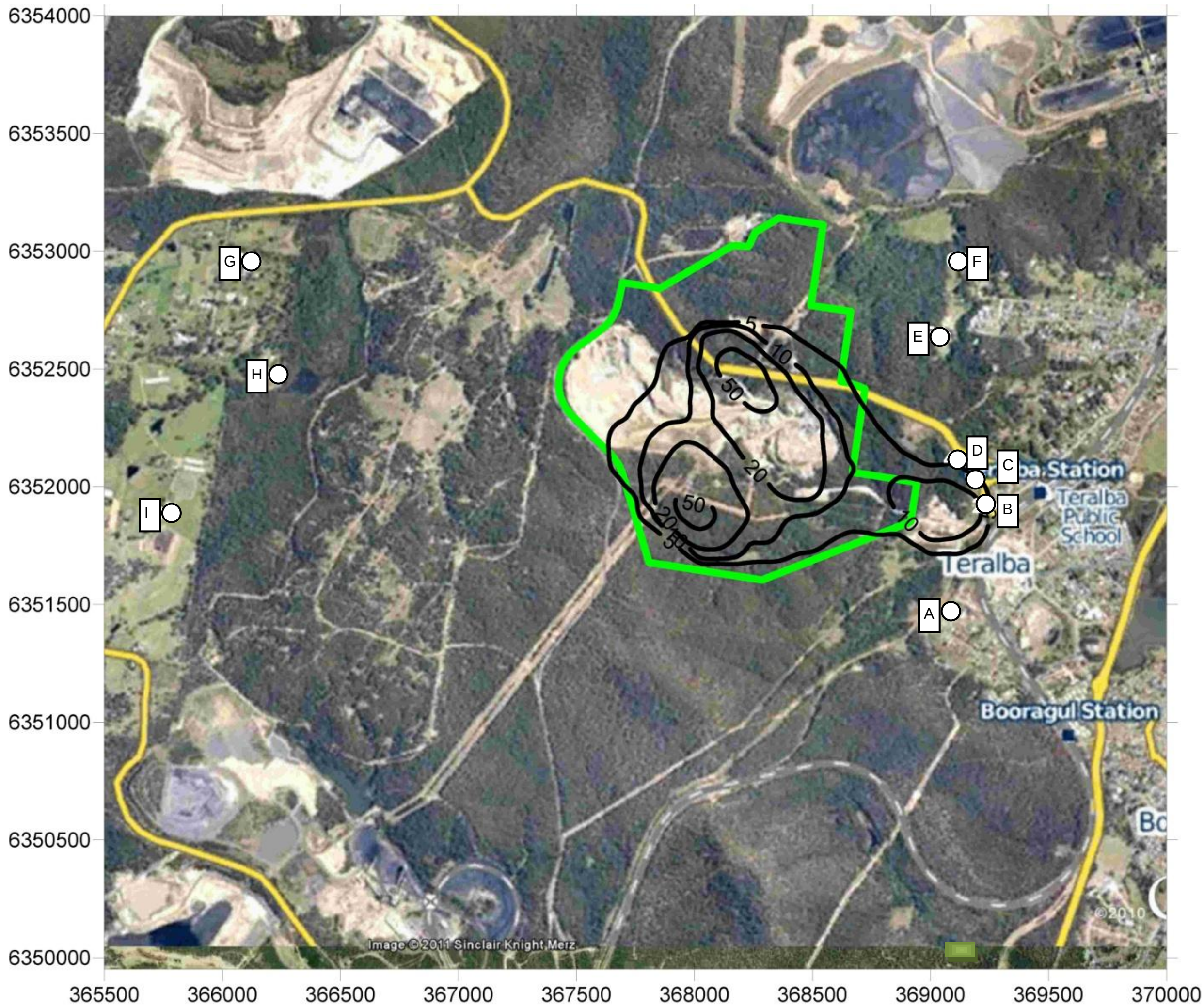

Figure 19: Scenario 5A - Predicted annual average TSP concentrations

(all concentrations in µg/m³, guideline concentration is 90 µg/m³, excludes background)

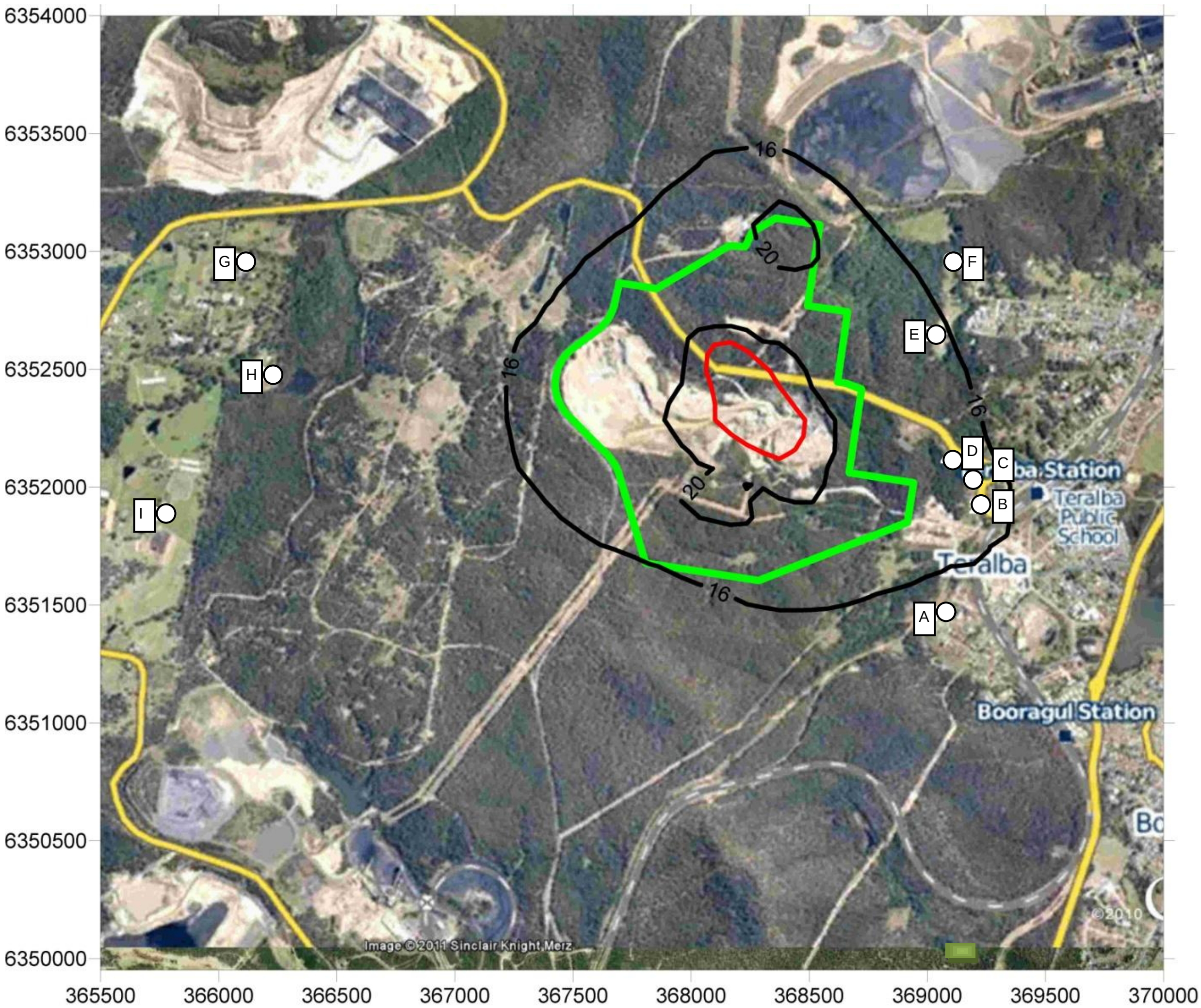

Figure 20: Scenario 1B - Predicted annual average PM_{10} concentrations

(all concentrations in µg/m³, guideline concentration is 30 µg/m³ indicated by red line, includes background)

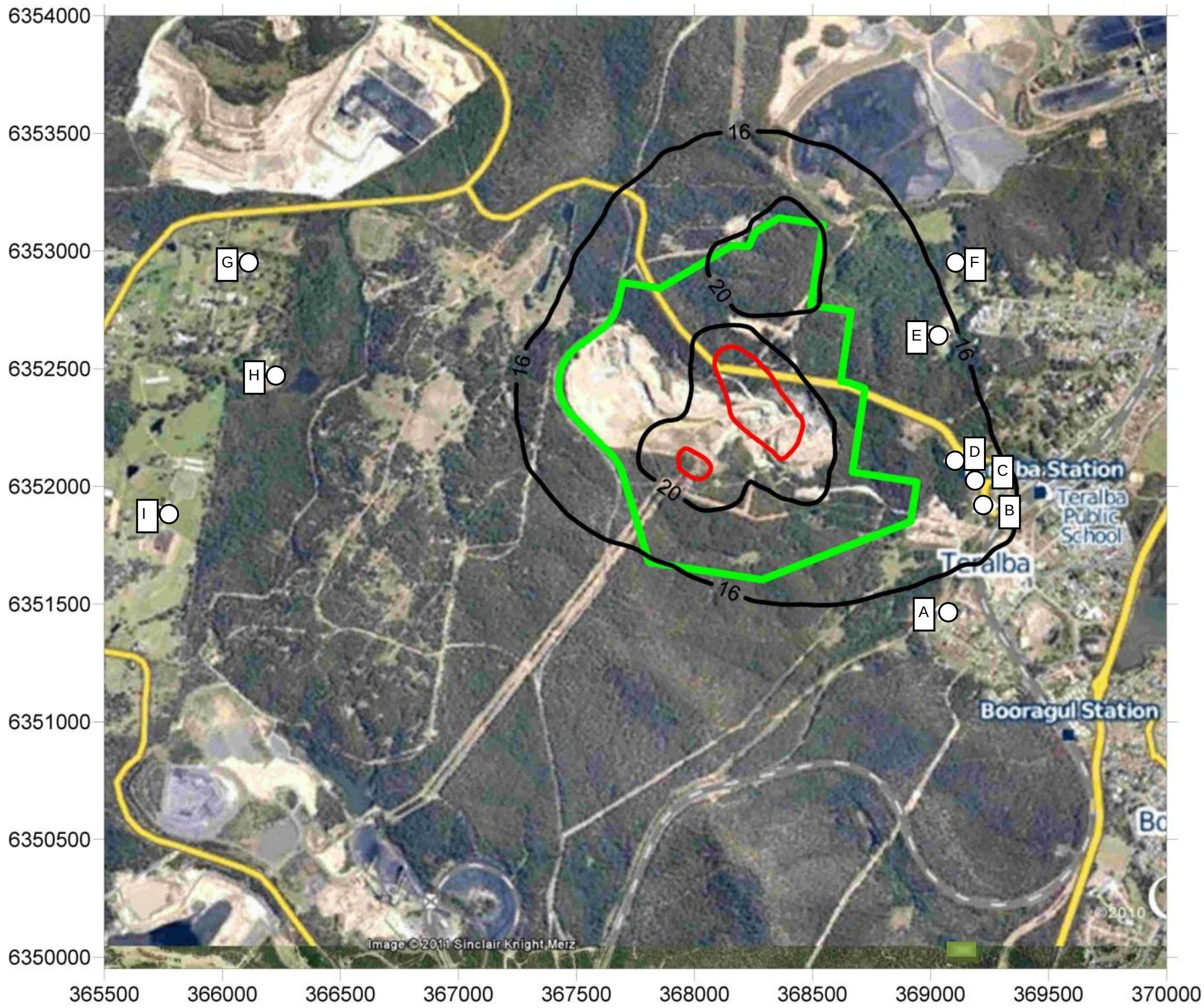

Figure 21: Scenario 4A - Predicted annual average PM_{10} concentrations

(all concentrations in µg/m³, guideline concentration is 30 µg/m³ indicated by red line, includes background)

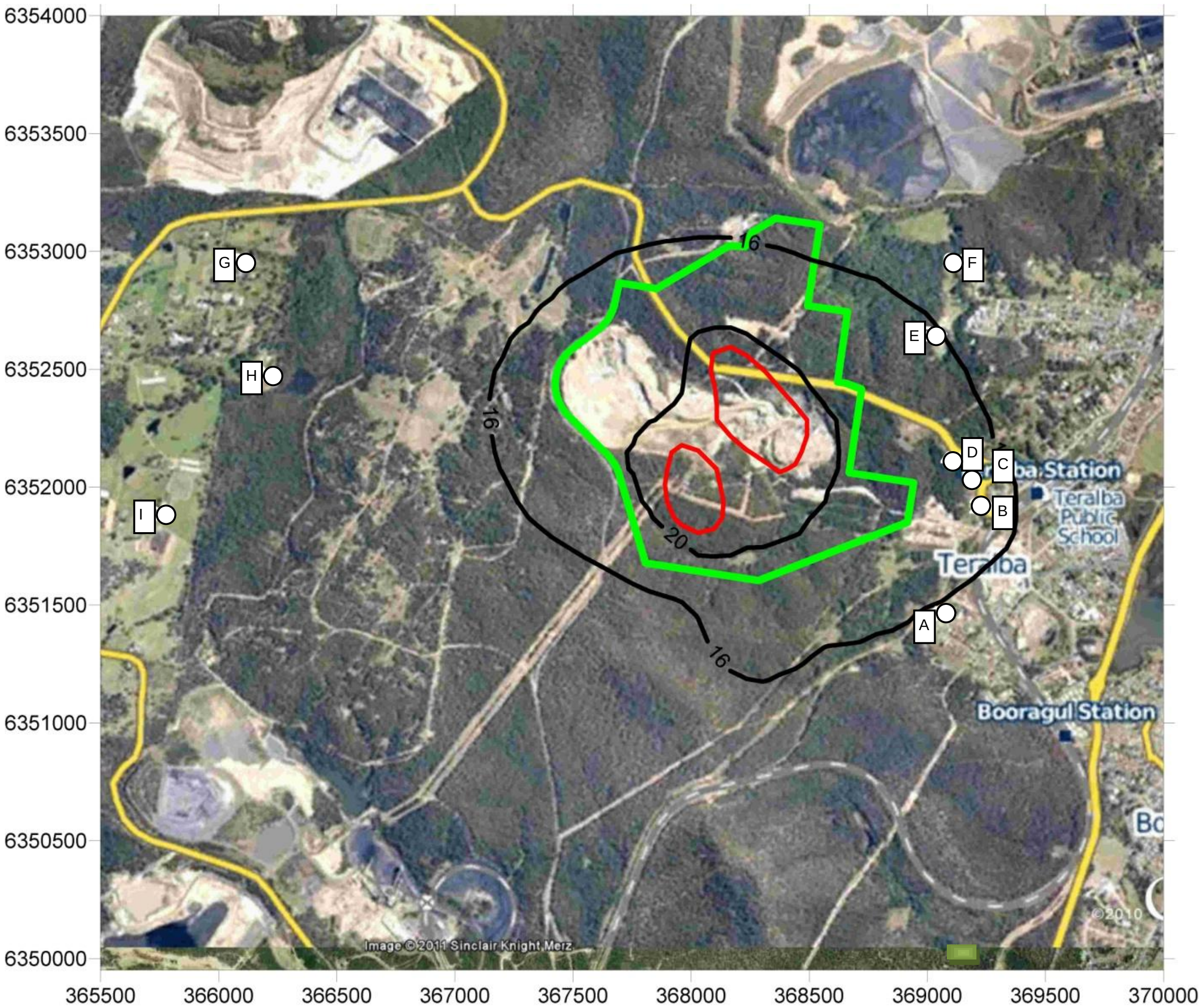

Figure 22: Scenario 5A - Predicted annual average PM_{10} concentrations

(all concentrations in µg/m³, guideline concentration is 30 µg/m³ indicated by red line, includes background)

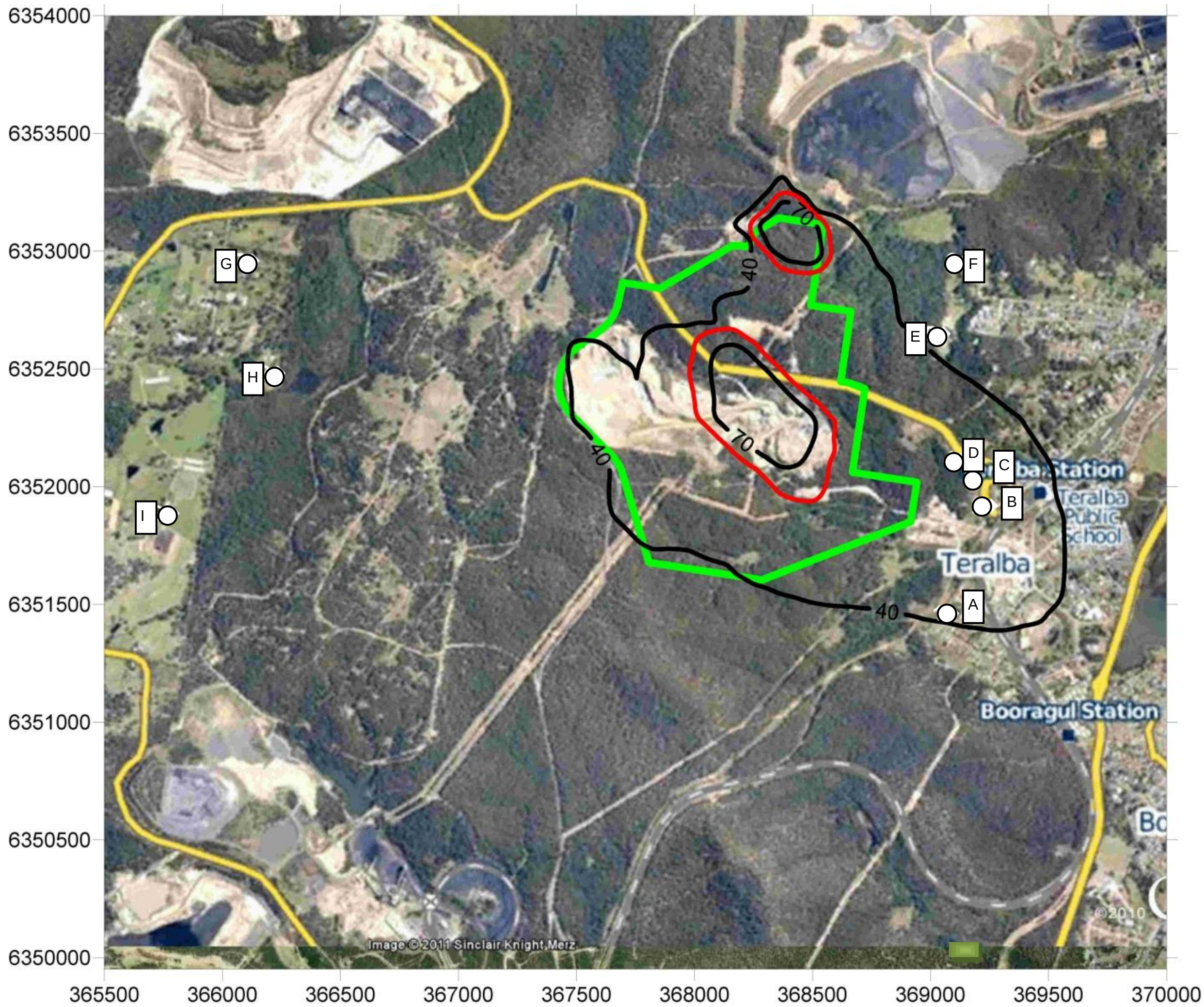

Figure 23: Scenario 1B - Predicted 24 hour average PM_{10} concentrations

(all concentrations in µg/m³, guideline concentration is 50 µg/m³ indicated by red line, includes background)

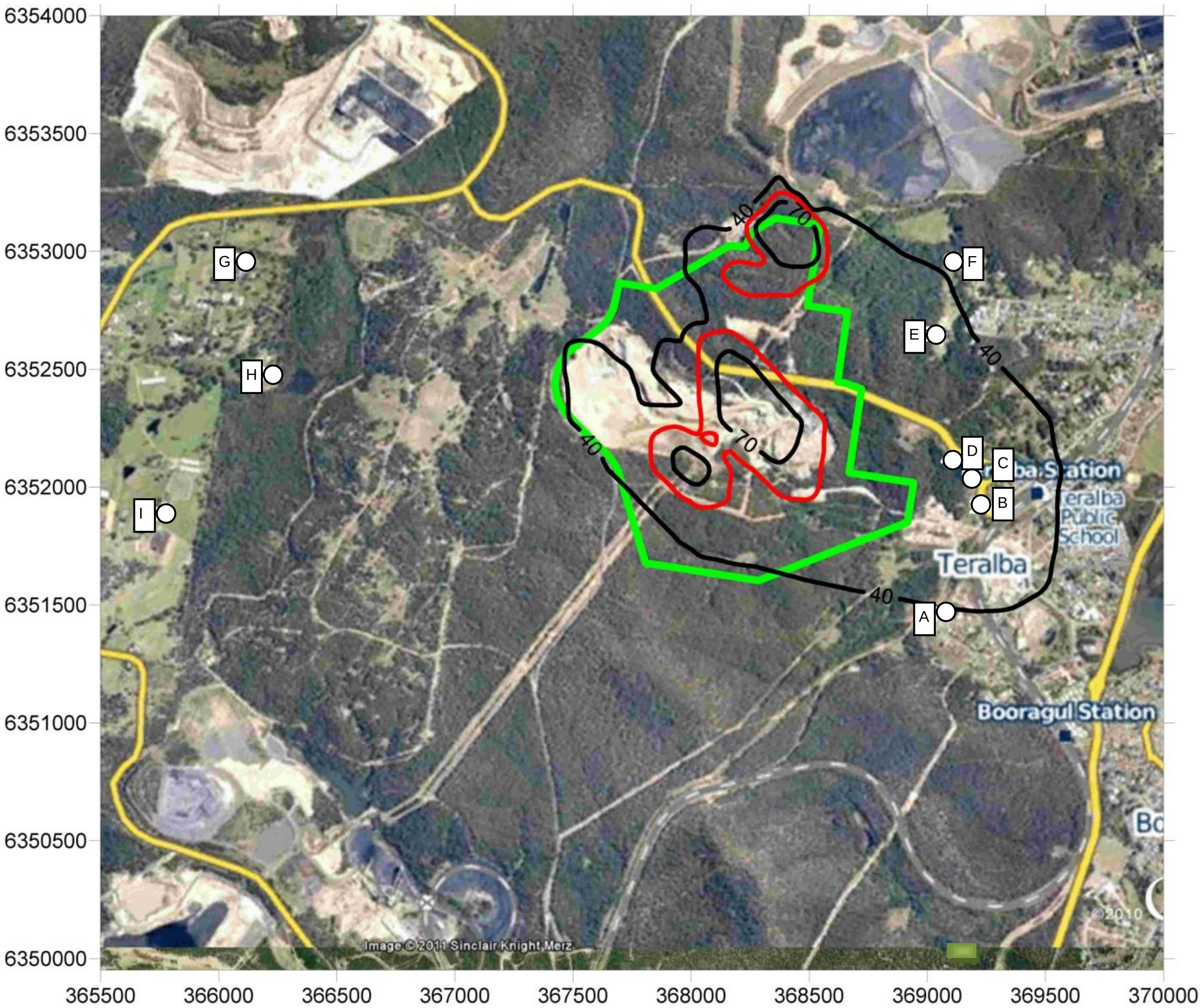

Figure 24: Scenario 4A - Predicted 24 hour average PM_{10} concentrations

(all concentrations in µg/m³, guideline concentration is 50 µg/m³ indicated by red line, includes background)

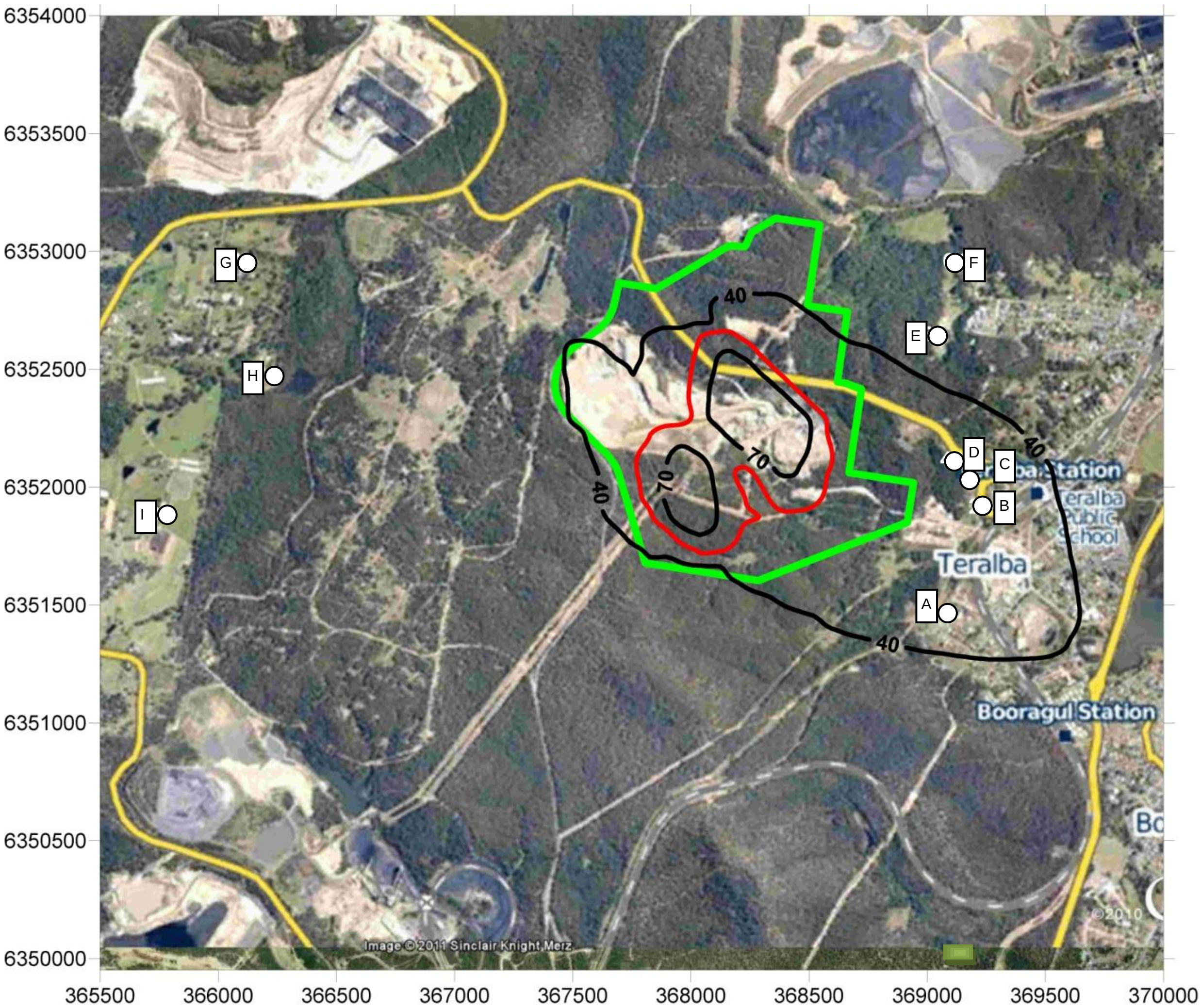

Figure 25: Scenario 5A - Predicted 24 hour average PM_{10} concentrations

(all concentrations in µg/m³, guideline concentration is 50 µg/m³ indicated by red line, includes background)

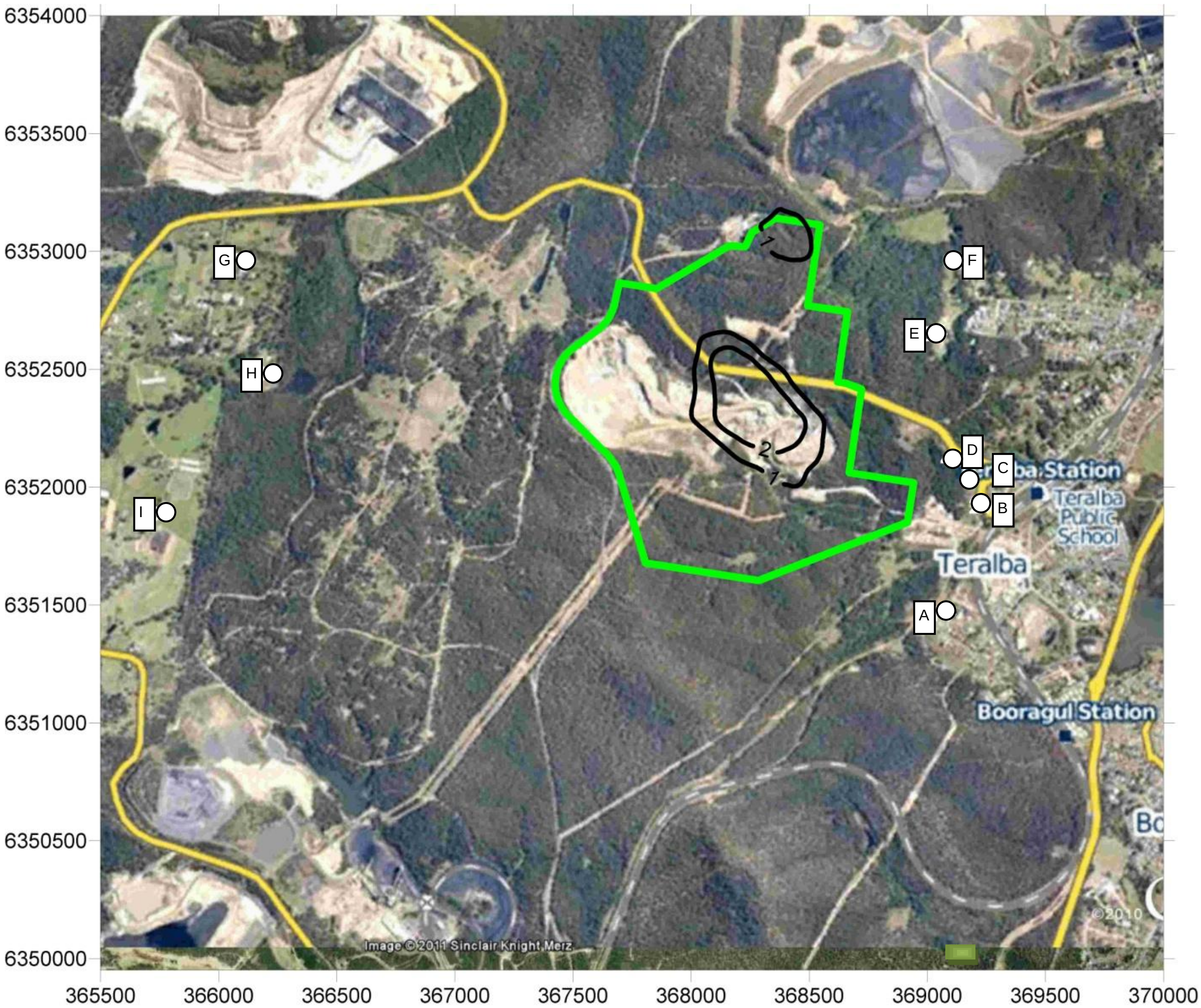

Figure 26: Scenario 1B - Predicted annual average $PM_{2.5}$ concentrations

(all concentrations in µg/m³, guideline concentration is 8 µg/m³, excludes background)

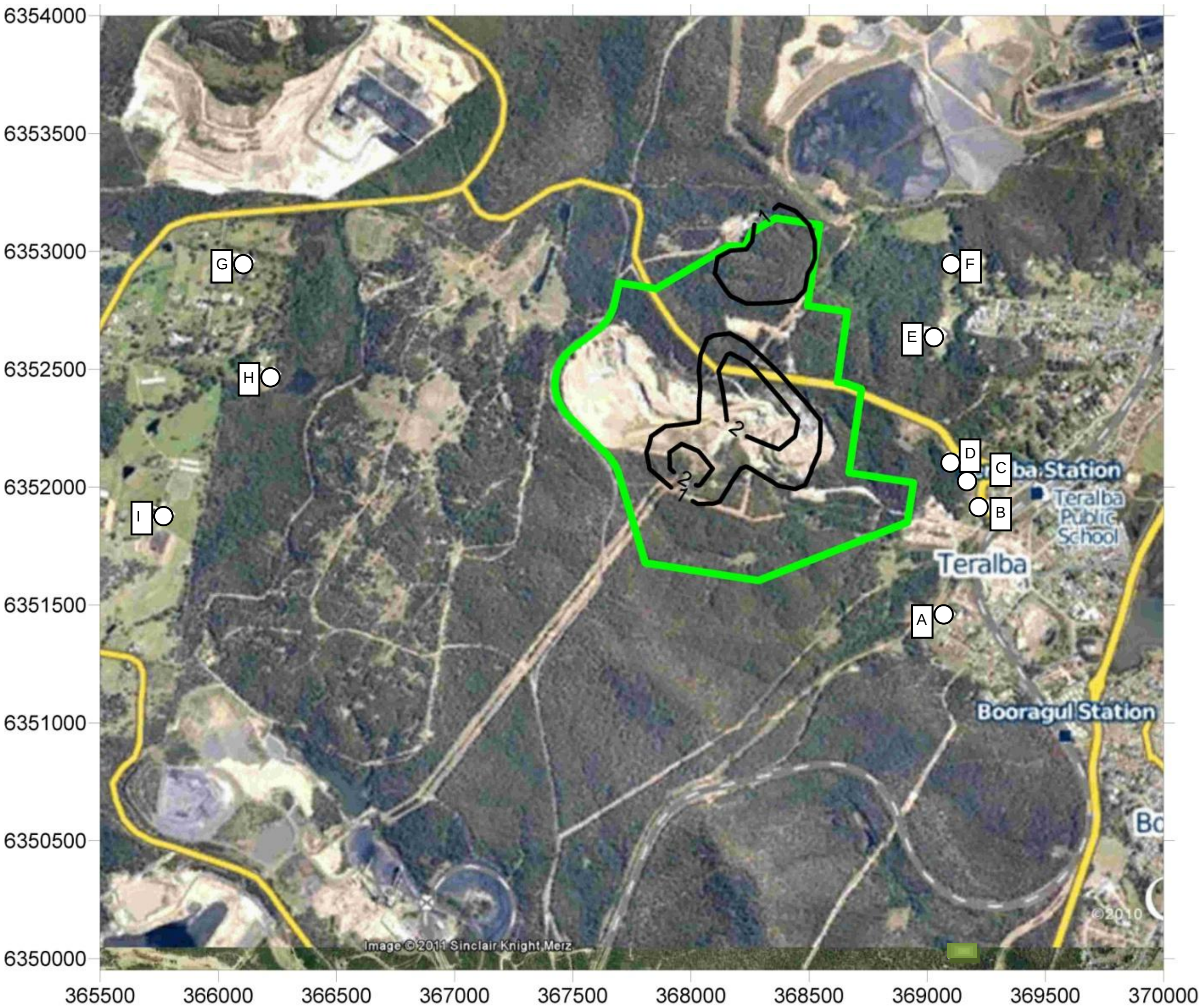

Figure 27: Scenario 4A - Predicted annual average $PM_{2.5}$ concentrations

(all concentrations in µg/m³, guideline concentration is 8 µg/m³, excludes background)

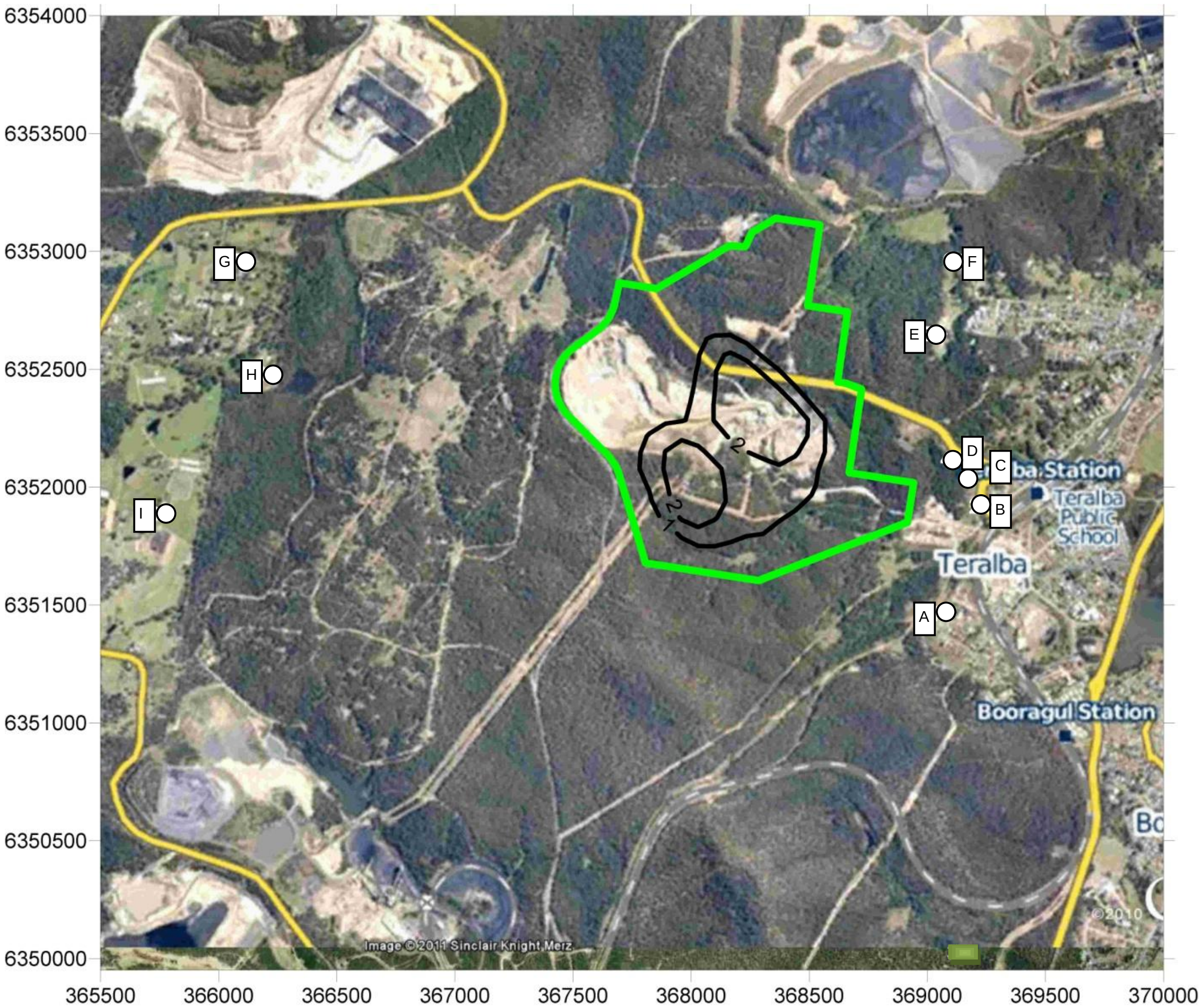

Figure 28: Scenario 5A - Predicted annual average $PM_{2.5}$ concentrations

(all concentrations in µg/m³, guideline concentration is 8 µg/m³, excludes background)

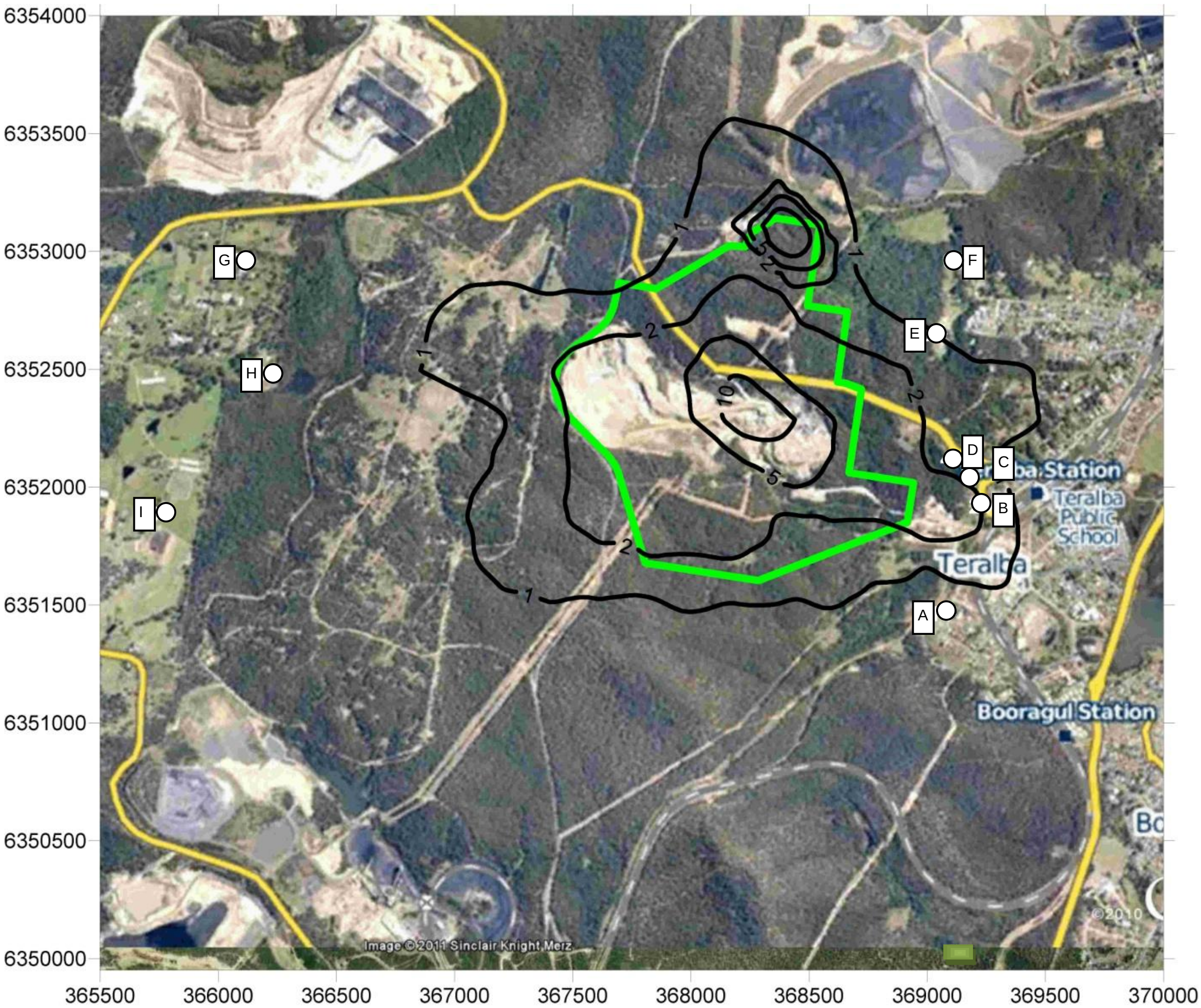

Figure 29: Scenario 1B - Predicted 24 hour average $PM_{2.5}$ concentrations

(all concentrations in µg/m³, guideline concentration is 25 µg/m³, excludes background)

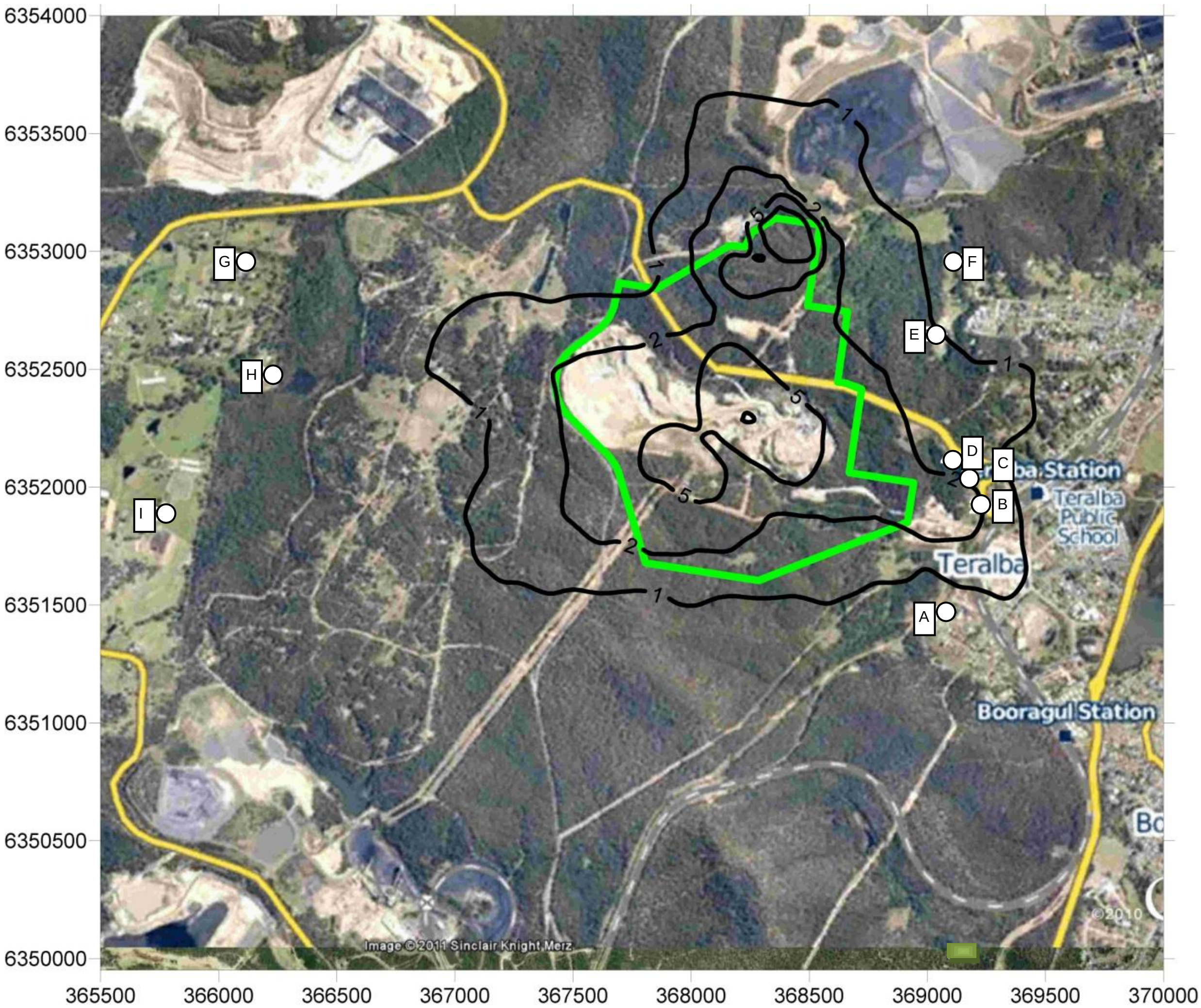

Figure 30: Scenario 4A - Predicted 24 hour average $PM_{2.5}$ concentrations

(all concentrations in µg/m³, guideline concentration is 25 µg/m³, excludes background)

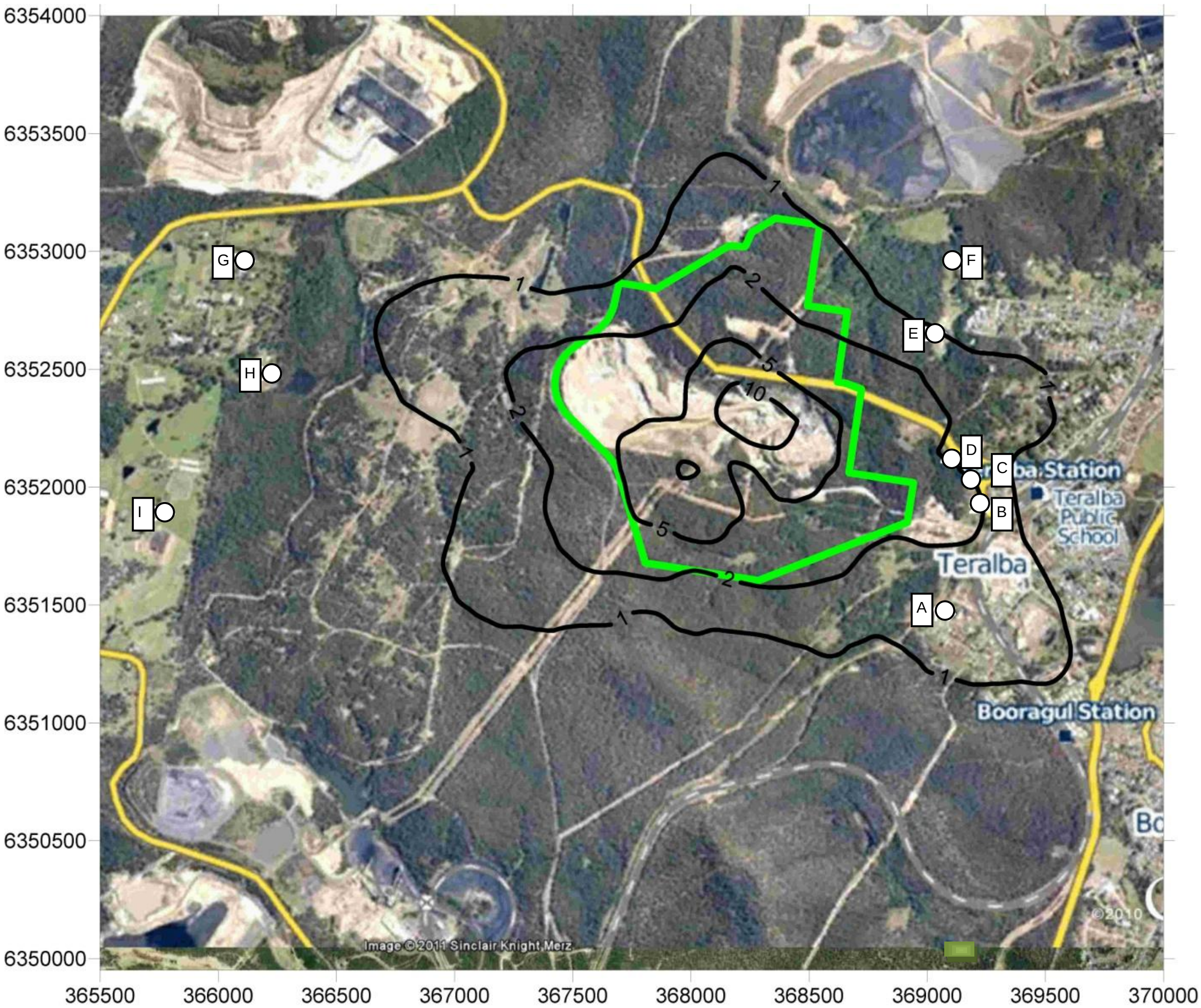

Figure 31: Scenario 5A - Predicted 24 hour average $PM_{2.5}$ concentrations

(all concentrations in µg/m³, guideline concentration is 25 µg/m³, excludes background)

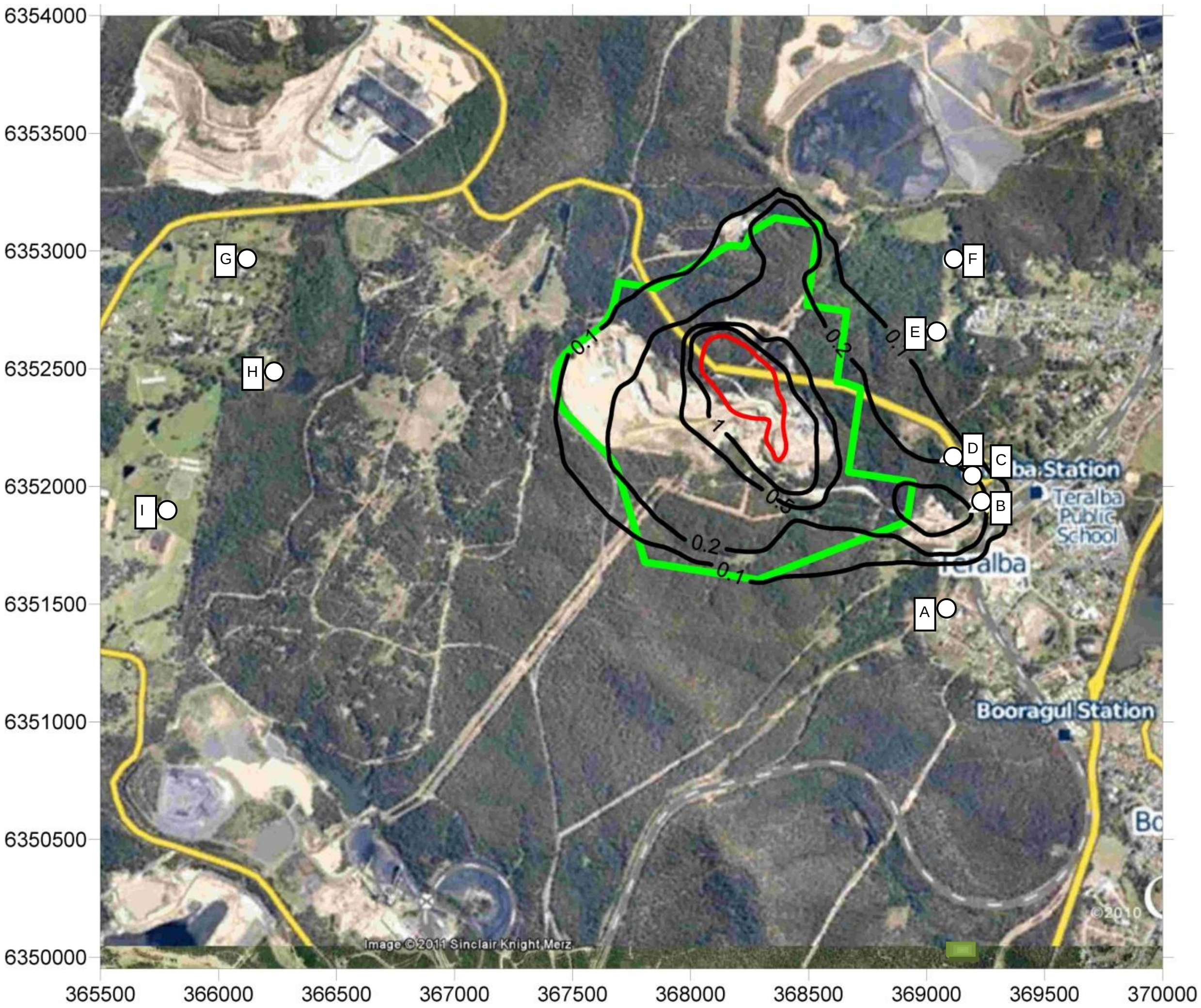

Figure 32: Scenario 1B - Predicted annual average deposited dust

(all concentrations in, guideline concentration is 2 g/m²/mth incremental impact, excludes background)

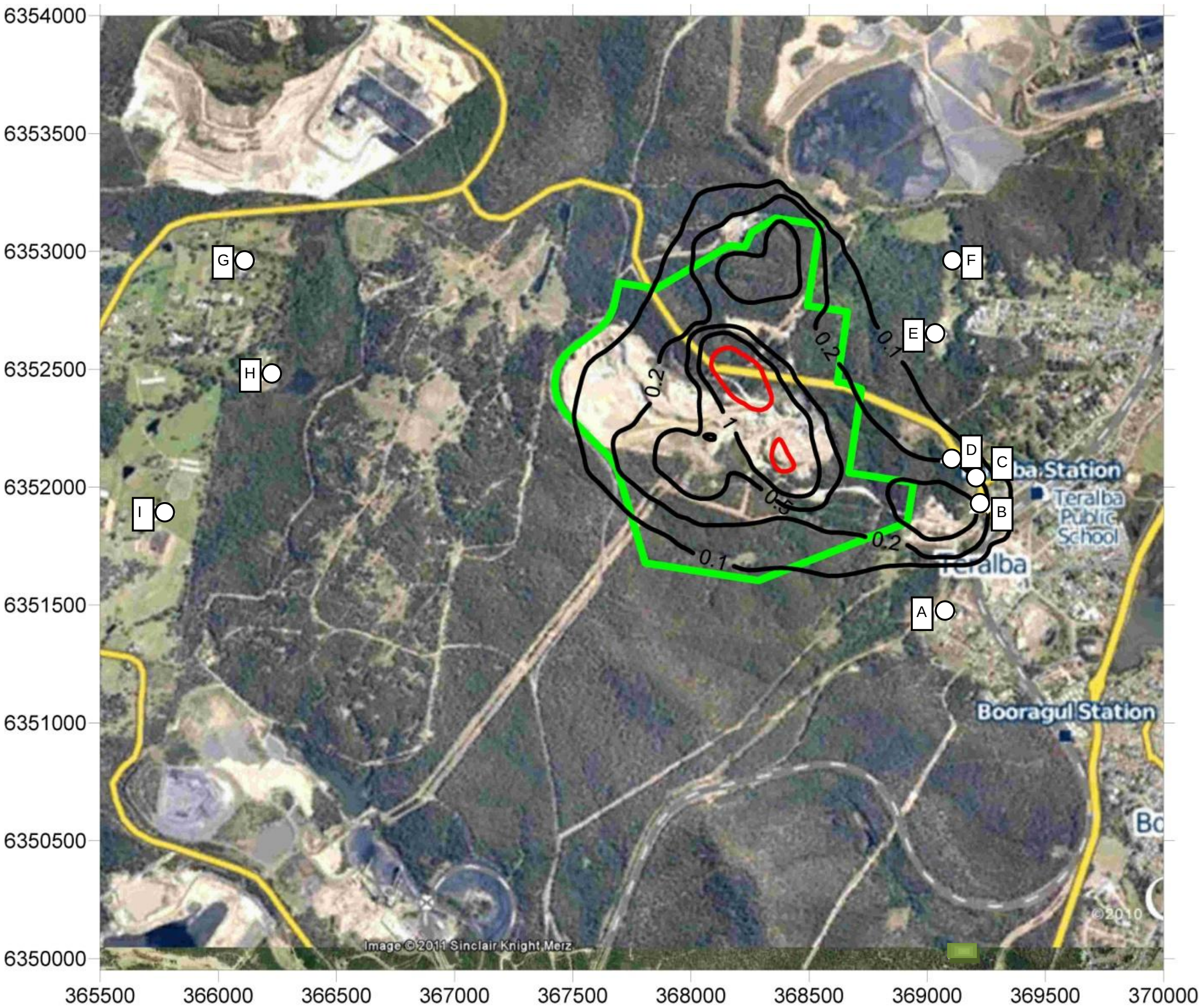

Figure 33: Scenario 4A - Predicted annual average deposited dust

(all concentrations in, guideline concentration is 2 g/m²/mth incremental impact, excludes background)

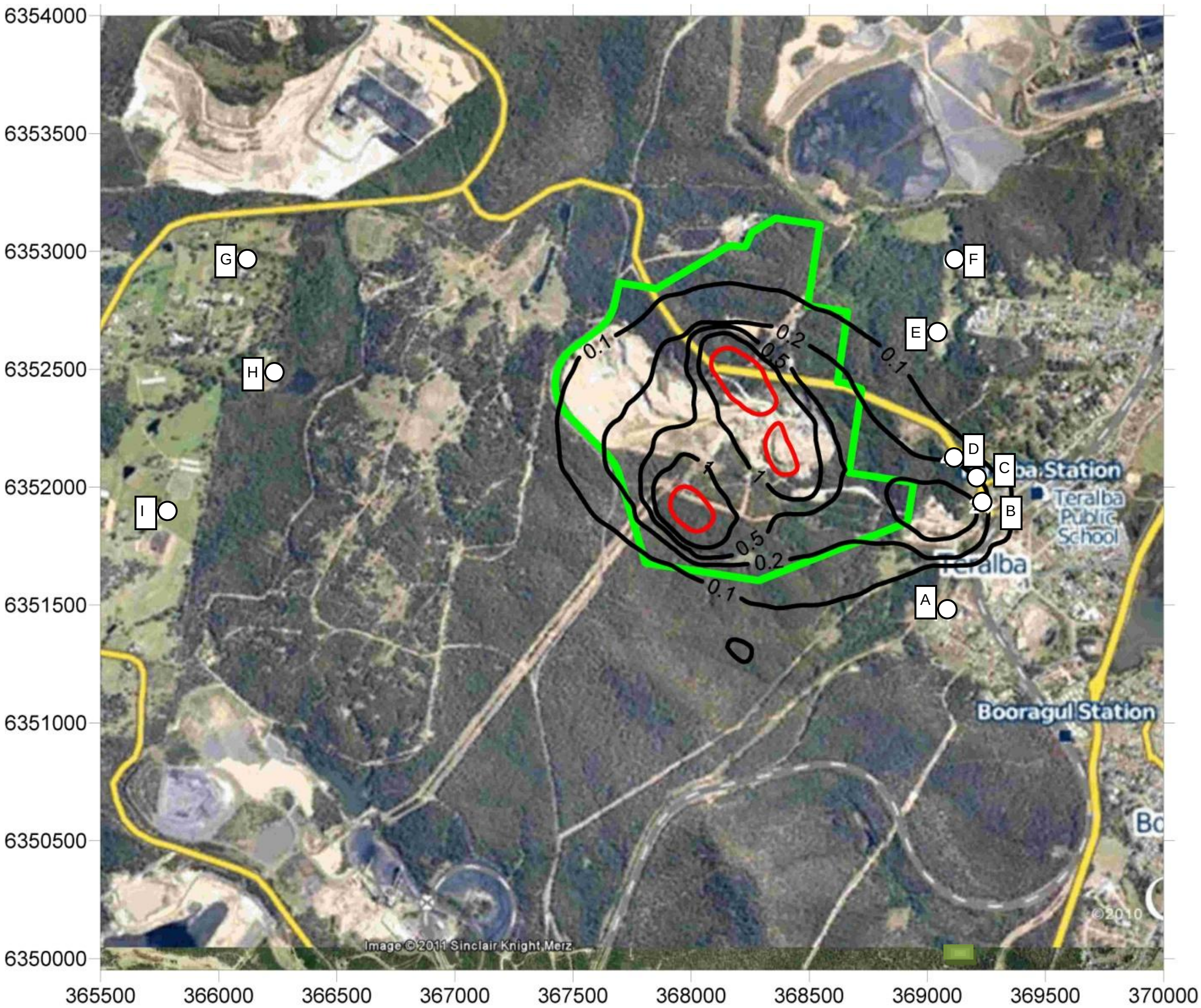

Figure 34: Scenario 5A - Predicted annual average deposited dust

(all concentrations in, guideline concentration is 2 g/m²/mth incremental impact, excludes background)

Appendix 2

Dispersion Model Setting Summary

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Scenario 1b Model Configuration

```
CALPUFF Model Configuration
---------------------------


File Examined: E:\30-2060\1BPUFF.CON


Titles:
 Produced by CALPUFF Version: 6.263  Level: 080827
 Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99   Level: 070921


Time Period:
 Data BEGIN on 01 Jan 2008 at 00:00:00 (hh:mm:ss)     UTC+1000
 Data   END on 02 Jan 2009 at 00:00:00 (hh:mm:ss)     UTC+1000


Number of periods    =       8808
Averaging time (sec) =       3600




Species:
   DUST            (g/m3)
   TSP             (g/m3)
   PM10            (g/m3)
   PM2_5           (g/m3)


Grid Configuration:
  NX Cells        =  50
  NY Cells        =  50
  Cell Size (km)  =  0.200000003
  SW Corner (km)  =  364.495453 6346.59180


Coordinate System:
  DATUM Code               = WGS-84
  Map Projection           = UTM
  UTM Zone         (1-60) =  56
  Hemisphere               = S




Sources:
```

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   Number of Points    =  0

   Number of Volumes   =  81

   Number of Areas     =  27

   Number of Lines     =  0


 Receptors:

   Grid (ngx,ngy)      =  35 31

   Discrete            =  9
```

CALPUFF Model Options

MGAUSS	MSLUG	MCHEM	MAQCHEM	MWET	MDRY	MTILT	MDISP	MDISP2	MPDF	MTURBVW	MTAULY	MTAUADV	MCTURB	MROUGH	MBDW	MTRANS	MTIP	MSHEAR	MPARTL	MTINV	MCTADJ	MCTSG	MSPLIT	MSGTIBL	MBCON	MSOURCE	MFOG	MREG
1	0	0	0	0	1	0	3	3	0	3	0	0	1	0	1	0	1	0	1	0	3	0	0	0	0	1	0	0

CALPUFF Source Details

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM_{10} Rate	$PM_{2.5}$ Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
WA	AREA	367.6465	6352.407	0.1	57.4	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
EP	AREA	367.8773	6352.127	0.1	50.8	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
SE	AREA	368.1705	6351.934	0.1	56.5	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
WSA	AREA	367.8718	6352.459	2	54.4	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
OA	AREA	368.5868	6351.993	0.1	47.1	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
ES	AREA	368.4795	6352.279	2	64.9	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
PP	AREA	368.291	6352.276	2	57.7	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
NE	AREA	368.2315	6352.812	0.1	71.5	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
MPE	AREA	368.4637	6352.694	0.1	83.6	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
N-BLAO1	VOLUME	368.362	6353.03	4	46.5	57	1	kg/h	1.70E-02	1.68E-02	2.51E-03	12PM daily
N-ESFO1	VOLUME	368.258	6351.884	4	63.5	82.6	1	kg/h	4.63E-03	4.15E-03	6.34E-04	1
N-ESFO2	VOLUME	368.355	6352.909	2	42.5	74.4	0.5	kg/h	2.31E-03	2.07E-03	3.11E-04	1
N-FELO1	VOLUME	367.936	6352.41	4	54.6	80.3	1	kg/h	3.46E-03	3.11E-03	4.66E-04	1
N-FELO2	VOLUME	368.015	6352.355	4	56.8	70.8	1	kg/h	3.46E-03	3.11E-03	4.66E-04	1
N-DRIL1	VOLUME	368.362	6353.03	4	46.5	57	1	kg/h	3.65E-02	3.65E-02	5.39E-03	1
N-TRUO1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	2.19E-01	1.49E-01	2.25E-02	1
N-PCRHM1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	1.83E-01	1.39E-01	2.09E-02	1
N-SCREEN1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	2.01E-02	1.28E-02	8.56E-04	1
N-TCRHM1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	4.95E-03	4.22E-03	7.93E-04	1
N-LSTO1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	7.32E-02	5.90E-02	8.88E-03	1
N-HTCH1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	9.13E-02	6.94E-02	1.05E-02	1
N-FELO3	VOLUME	368.015	6352.355	4	50.3	83.3	1	kg/h	3.79E-02	3.40E-02	5.10E-03	1
ASPHALT	VOLUME	368.46	6352.363	4	71.7	47.6	1	kg/h	4.03E-01	3.82E-01	4.21E-02	1
ROAD1	VOLUME	368.165	6352.468	2	71.9	38	1	kg/d	2.44E+01	6.54E+00	6.54E-01	2
ROAD2	VOLUME	368.258	6352.397	2	68.9	38	1	kg/d	2.44E+01	6.54E+00	6.54E-01	2
ROAD3	VOLUME	368.362	6352.351	2	67	38	1	kg/d	2.44E+01	6.54E+00	6.54E-01	2

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM_{10} Rate	$PM_{2.5}$ Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
URE1	VOLUME	368.339	6352.257	2	57.6	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE2	VOLUME	368.32	6352.15	2	50.1	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE3	VOLUME	368.393	6352.063	2	47.8	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE4	VOLUME	368.533	6352.011	2	47.3	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE5	VOLUME	368.669	6352.013	2	48.4	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE6	VOLUME	368.809	6351.975	2	44.9	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE7	VOLUME	368.912	6351.922	2	42.9	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE8	VOLUME	369.033	6351.899	2	42	30	1	kg/d	5.31E+00	1.02E+00	2.43E-01	2
URE9	VOLUME	369.146	6351.866	2	34.7	30	1	kg/d	5.31E+00	1.02E+00	2.43E-01	2
HR1	VOLUME	368.388	6352.809	2	89	30	1	kg/d	2.24E-01	1.11E-01	1.11E-02	1
HR2	VOLUME	368.421	6352.637	2	84	30	1	kg/d	2.24E-01	1.11E-01	1.11E-02	1
HR3	VOLUME	368.12	6351.888	2	63.2	30	1	kg/d	9.36E-01	4.63E-01	4.63E-02	1
HR4	VOLUME	367.923	6352.012	2	56.9	30	1	kg/d	9.36E-01	4.63E-01	4.63E-02	1
HR5	VOLUME	367.923	6352.258	2	44.8	30	1	kg/d	9.36E-01	4.63E-01	4.63E-02	1
HR6	VOLUME	368.125	6352.308	2	53.3	30	1	kg/d	9.36E-01	4.63E-01	4.63E-02	1

[a] see end of this Appendix for details

Scenario 4A Model configuration

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CALPUFF Model Configuration
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 Produced by CALPUFF Version: 6.263  Level: 080827
 Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99   Level: 070921


Time Period:
 Data BEGIN on 01 Jan 2008 at 00:00:00 (hh:mm:ss)     UTC+1000
 Data   END on 02 Jan 2009 at 00:00:00 (hh:mm:ss)     UTC+1000


Number of periods    =       8808
Averaging time (sec) =       3600


Species:
   DUST            (g/m3)
   TSP             (g/m3)
   PM10            (g/m3)
   PM2_5           (g/m3)


Grid Configuration:
  NX Cells        =  50
  NY Cells        =  50
  Cell Size (km)  =  0.200000003
  SW Corner (km)  =  364.495453 6346.59180


Coordinate System:
  DATUM Code              = WGS-84
  Map Projection          = UTM
  UTM Zone         (1-60) =  56
  Hemisphere              = S


Sources:
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Number of Points    =  0
Number of Volumes   =  49
Number of Areas     =  18
Number of Lines     =  0
```

```
Receptors:
  Grid (ngx,ngy)    =  35 31
  Discrete          =  9
```

CALPUFF Model Options

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G	S	C	A	W	D	T	D	D	P	T	T	T	C	R	B	T	T	S	P	T	C	C	S	S	B	S	F	R
A	L	H	Q	E	R	I	I	I	D	U	A	A	T	O	D	R	I	H	A	I	T	T	P	G	C	O	O	E
U	U	E	C	T	Y	L	S	S	F	R	U	U	U	U	W	A	P	E	R	N	A	S	L	T	O	U	G	G
S	G	M	H			T	P	P		B	L	A	R	G		N		A	T	V	D	G	I	I	N	R		
S			E					2		V	Y	D	B	H		S		R	L		J		T	B		C		
			M							W		V												L		E		
1	0	0	0	0	1	0	3	3	0	3	0	0	1	0	1	0	1	0	1	0	3	0	0	0	0	1	0	0

CALPUFF Source Details

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
WA	AREA	367.6465	6352.407	0.1	57.4	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
EP	AREA	367.8773	6352.127	0.1	50.8	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
SE	AREA	368.1705	6351.934	0.1	56.5	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
WSA	AREA	367.8718	6352.459	2	54.4	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
OA	AREA	368.5868	6351.993	0.1	47.1	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
ES	AREA	368.4795	6352.279	2	64.9	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
PP	AREA	368.291	6352.276	2	57.7	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
NE	AREA	368.2315	6352.812	0.1	71.5	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
MPE	AREA	368.4637	6352.694	0.1	83.6	-	0.1	kg/h	4.00E-06	2.00E-06	3.00E-07	Continuous
N-BLAO1	VOLUME	368.362	6353.03	4	46.5	57	1	kg/h	3.70E-02	3.64E-02	5.47E-03	12PM daily
N-ESFO1	VOLUME	368.355	6352.909	4	63.5	82.6	1	kg/h	1.59E-02	1.43E-02	2.15E-03	1
N-PCRHM1	VOLUME	367.984	6352.098	2	42.5	74.4	0.5	kg/h	4.19E-01	3.18E-01	4.77E-02	1
N-FELO1	VOLUME	367.936	6352.41	4	54.6	80.3	1	kg/h	1.10E-02	9.85E-03	1.48E-03	1
N-FELO2	VOLUME	368.503	6352.147	4	56.8	70.8	1	kg/h	1.10E-02	9.85E-03	1.48E-03	1
N-DRIL1	VOLUME	368.362	6353.03	4	46.5	57	1	kg/h	1.31E-01	1.31E-01	1.97E-02	1
N-TRUO1	VOLUME	368.286	6352.852	4	56.5	70.8	1	kg/h	7.90E-01	5.38E-01	8.06E-02	1
N-PCRHM2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	6.58E-01	5.00E-01	7.50E-02	1
N-HTCH1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	3.29E-01	2.50E-01	3.75E-02	1
N-TCRHM1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	8.88E-01	5.63E-01	8.44E-02	1
N-LSTO1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	2.63E-01	2.13E-01	3.19E-02	1
N-HTCH2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	5.23E-01	3.98E-01	5.97E-02	1
N-FELO3	VOLUME	368.015	6352.355	4	50.3	83.3	1	kg/h	1.53E-02	1.37E-02	2.06E-03	1
ASPHALT	VOLUME	368.46	6352.363	4	71.7	47.6	1	kg/h	1.12E-01	1.06E-01	1.17E-02	1
ROAD1	VOLUME	368.165	6352.468	2	71.9	38	1	kg/d	15.43	4.36	0.44	2
ROAD2	VOLUME	368.258	6352.397	2	68.9	38	1	kg/d	15.43	4.36	0.44	2
ROAD3	VOLUME	368.362	6352.351	2	67	38	1	kg/d	15.43	4.36	0.44	2

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
URE1	VOLUME	368.339	6352.257	2	57.6	30	1	kg/d	6.15	1.64	0.164	2
URE2	VOLUME	368.32	6352.15	2	50.1	30	1	kg/d	6.15	1.64	0.164	2
URE3	VOLUME	368.393	6352.063	2	47.8	30	1	kg/d	6.15	1.64	0.164	2
URE4	VOLUME	368.533	6352.011	2	47.3	30	1	kg/d	6.15	1.64	0.164	2
URE5	VOLUME	368.669	6352.013	2	48.4	30	1	kg/d	6.15	1.64	0.164	2
URE6	VOLUME	368.809	6351.975	2	44.9	30	1	kg/d	6.15	1.64	0.164	2
URE7	VOLUME	368.912	6351.922	2	42.9	30	1	kg/d	6.15	1.64	0.164	2
URE8	VOLUME	369.033	6351.899	2	42	30	1	kg/d	5.31	1.02	0.243	2
URE9	VOLUME	369.146	6351.866	2	34.7	30	1	kg/d	5.31	1.02	0.243	2

Scenario 5A Model configuration

```
CALPUFF Model Configuration
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 File Examined: E:\30-2060\5APUFF.CON


 Titles:
  Produced by CALPUFF Version: 6.263  Level: 080827
  Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99   Level: 070921


 Time Period:
  Data BEGIN on 01 Jan 2008 at 00:00:00 (hh:mm:ss)     UTC+1000
  Data   END on 02 Jan 2009 at 00:00:00 (hh:mm:ss)     UTC+1000


 Number of periods    =       8808
 Averaging time (sec) =       3600


 Species:
    DUST            (g/m3)
    TSP             (g/m3)
    PM10            (g/m3)
    PM2_5           (g/m3)


 Grid Configuration:
   NX Cells        =  50
   NY Cells        =  50
   Cell Size (km)  =  0.200000003
   SW Corner (km)  =  364.495453 6346.59180


 Coordinate System:
   DATUM Code              = WGS-84
   Map Projection          = UTM
   UTM Zone         (1-60) =  56
   Hemisphere              = S


 Sources:
```

```
   Number of Points    =  0
   Number of Volumes   =  23
   Number of Areas     =  9
   Number of Lines     =  0

 Receptors:
   Grid (ngx,ngy)      =  50 50
   Discrete            =  9
```

CALPUFF Model Options

MGAUSS	MSLUG	MCHEM	MAQCHEM	MWET	MDRY	MTILT	MDISP	MDISP2	MPDF	MTURBVW	MTAULY	MTAUADV	MCTURB	MROUGH	MBDW	MTRANS	MTIP	MSHEAR	MPARTL	MTINV	MCTADJ	MCTSG	MSPLIT	MSGTIBL	MBCON	MSOURCE	MFOG	MREG
1	0	0	0	0	1	0	3	3	0	3	0	0	1	0	1	0	1	0	1	0	3	0	0	0	0	1	0	0

CALPUFF Source Details

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
WA	AREA	367.6465	6352.407	0.1	57.4	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
EP	AREA	367.8773	6352.127	0.1	50.8	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
SE	AREA	368.1705	6351.934	0.1	56.5	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
WSA	AREA	367.8718	6352.459	2	54.4	–	0.5	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
OA	AREA	368.5868	6351.993	0.1	47.1	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
ES	AREA	368.4795	6352.279	2	64.9	–	0.5	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
PP	AREA	368.291	6352.276	2	57.7	–	0.5	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
NE	AREA	368.2315	6352.812	0.1	71.5	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
MPE	AREA	368.4637	6352.694	0.1	83.6	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
N-BLA01	VOLUME	368.326	6351.883	4	46.5	57	1	kg/h	1.70E-02	1.68E-02	2.51E-03	12PM daily
N-ESF01	VOLUME	368.11	6351.874	4	63.5	82.6	1	kg/h	6.44E-03	5.77E-03	8.56E-04	1
N-PCRHM1	VOLUME	367.984	6352.098	2	42.5	74.4	0.5	kg/h	1.16E-01	8.85E-02	1.33E-02	1
N-FEL01	VOLUME	367.936	6352.41	4	54.6	80.3	1	kg/h	4.41E-03	3.96E-03	6.02E-04	1
N-FEL02	VOLUME	368.503	6352.147	4	56.8	70.8	1	kg/h	4.41E-03	3.96E-03	6.02E-04	1
N-DRIL1	VOLUME	368.326	6351.883	4	46.5	57	1	kg/h	3.65E-02	3.65E-02	5.39E-03	1
N-TRU01	VOLUME	367.984	6352.098	4	56.5	70.8	1	kg/h	2.19E-01	1.49E-01	2.25E-02	1
N-PCRHM2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	1.83E-01	1.39E-01	2.09E-02	1
N-HTCH1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	2.01E-02	1.28E-02	8.56E-04	1
N-TCRHM1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	4.95E-03	4.22E-03	7.93E-04	1
N-LST01	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	7.32E-02	5.90E-02	8.88E-03	1
N-HTCH2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	1.46E-01	1.10E-01	1.65E-02	1
N-FEL03	VOLUME	368.015	6352.355	4	50.3	83.3	1	kg/h	3.79E-02	3.40E-02	5.10E-03	1
ASPHALT	VOLUME	368.46	6352.363	4	71.7	47.6	1	kg/h	4.03E-01	3.82E-01	4.21E-02	1
ROAD1	VOLUME	368.165	6352.468	2	0	38	1	kg/d	1.54E+01	4.36E+00	4.40E-01	2
ROAD2	VOLUME	368.258	6352.397	2	0	38	1	kg/d	1.54E+01	4.36E+00	4.40E-01	2
ROAD3	VOLUME	368.362	6352.351	2	0	38	1	kg/d	1.54E+01	4.36E+00	4.40E-01	2

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
URE1	VOLUME	368.339	6352.257	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE2	VOLUME	368.32	6352.15	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE3	VOLUME	368.393	6352.063	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE4	VOLUME	368.533	6352.011	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE5	VOLUME	368.669	6352.013	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE6	VOLUME	369.146	6351.866	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2

Diurnal Cycles

Hour	Cycle 1	Cycle 2
1	0	0.016667
2	0	0.016667
3	0	0.016667
4	0	0.016667
5	0	0.01667
6	0	0.01667
7	0	0.01667
8	1	0.07273
9	1	0.07273
10	1	0.07273
11	1	0.07273
12	1	0.07273
13	1	0.07273
14	1	0.07273
15	1	0.07273
16	1	0.07273
17	1	0.07273
18	1	0.07273
19	0	0.0125
20	0	0.0125
21	0	0.0125
22	0	0.0125
23	0	0.01667
24	0	0.01667

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Appendix 3

Details of Fugitive Dust Emissions

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DETAILS OF FUGITIVE DUST EMISSIONS

12.1 DRILLING

Default emission factors for drilling were derived in accordance with Table 1 Default Emission Factors for Various Operations at Coal Mines of the NPI EETMM. Two holes per hour have been assumed for the drilling operations.

12.2 BLASTING

The emission factor for blasting is estimated from Table 1 of the NPI EETMM for blasting and is dependent on blast area, moisture content and blast hole depth, as follows:

$EF_{TSP} = 344 \times A^{0.8} \times M^{-1.9} \times D^{-1.8}$ and $EF_{PM10} = 0.52 \times EF_{TSP}$ (units: kg/blast)

Where;

A is the blast area;

M is the moisture content (%); and

D is the blast hole depth.

For this assessment the blasts were assumed to be 100 m^2 with a depth of 8 m and a moisture content of 4.6 %. Blasts were assumed to occur once per day (for worst case 24 hour emissions).

12.3 EXCAVATORS, SHOVELS, AND FRONT END LOADERS

The emission factor for these activities were derived in accordance with Appendix B of the NPI EETMM.

$$EF_{TSP} = k \times 0.0016 \times (U/2.2)^{1.3} \times (M/2)^{-1.4}$$

Where:

k = dimensionless constant (0.74 for TSP and 0.35 for PM_{10});

U = mean wind speed for the site (2.4 m/s); and

M = moisture content of the product (4.6 %).

Hours of operation are detailed in Table 11, Table 12 and Table 13.

12.4 UNLOADING TRUCKS

Default emission factors for these activities were derived in accordance with Table 1 Default Emission Factors for Various Operations at Coal Mines of the NPI EETMM. Activity and hours of operation are detailed in Table 11, Table 12 and Table 13.

12.5 PROCESSING

Default emission factors crushing and screening were derived in accordance with Table 2 Default Emission Factors for Various Operations at Metalliferous Mines of the NPI EETMM. Activity and hours of operation are detailed in Table 11, Table 12 and Table 13.

12.6 WHEEL GENERATED DUST (UNPAVED ROADS)

The emission factor for wheel generated dust is estimated from the USEPA emission equation for Wheel Generated Dust from Unpaved Roads (2006) as follows:

$$EF_{TSP} = (0.282) \times 4.9 \times (s/12)0.7 \times (W/3)0.45$$

and $$EF_{PM10} = (0.282) \times 1.5 \times (s/12)0.9 \times (W/3)0.45 \qquad \text{(units: kg/VKT)}$$

Where:

s is the silt content (Assumed to be 8%); and

W is the vehicle gross mass (tonnes).

Vehicle gross mass was assumed to be:

- Komatsu 405 — 74 t fully loaded and 34 t empty.
- Caterpillar 775b — 102 t fully loaded and 42 t empty.
- Standard semi trailers — 45 t fully loaded and 16 t empty.

Scenario 4A Model configuration

```
CALPUFF Model Configuration
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File Examined: E:\30-2060\4APUFF.CON


Titles:
 Produced by CALPUFF Version: 6.263  Level: 080827
 Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99   Level: 070921


Time Period:
 Data BEGIN on 01 Jan 2008 at 00:00:00 (hh:mm:ss)     UTC+1000
 Data   END on 02 Jan 2009 at 00:00:00 (hh:mm:ss)     UTC+1000


Number of periods    =       8808
Averaging time (sec) =       3600




Species:
   DUST            (g/m3)
   TSP             (g/m3)
   PM10            (g/m3)
   PM2_5           (g/m3)


Grid Configuration:
  NX Cells        =  50
  NY Cells        =  50
  Cell Size (km)  =  0.200000003
  SW Corner (km)  =  364.495453 6346.59180


Coordinate System:
  DATUM Code               = WGS-84
  Map Projection           = UTM
  UTM Zone         (1-60) =  56
  Hemisphere               = S




Sources:
```

```
Number of Points    =  0
Number of Volumes   =  49
Number of Areas     =  18
Number of Lines     =  0
```

```
Receptors:
  Grid (ngx,ngy)    =  35 31
  Discrete          =  9
```

CALPUFF Model Options

MGAUSS	MSLUG	MCHEM	MAQCHEM	MWET	MDRY	MTILT	MDISP	MDISP2	MPDF	MTURBVW	MTAULY	MTAUADV	MCTURB	MROUGH	MBDW	MTRANS	MTIP	MSHEAR	MPARTL	MTINV	MCTADJ	MCTSG	MSPLIT	MSGTIBL	MBCON	MSOURCE	MFOG	MREG
1	0	0	0	0	1	0	3	3	0	3	0	0	1	0	1	0	1	0	1	0	3	0	0	0	0	1	0	0

CALPUFF Source Details

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
WA	AREA	367.6465	6352.407	0.1	57.4	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
EP	AREA	367.8773	6352.127	0.1	50.8	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
SE	AREA	368.1705	6351.934	0.1	56.5	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
WSA	AREA	367.8718	6352.459	2	54.4	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
OA	AREA	368.5868	6351.993	0.1	47.1	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
ES	AREA	368.4795	6352.279	2	64.9	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
PP	AREA	368.291	6352.276	2	57.7	-	0.5	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
NE	AREA	368.2315	6352.812	0.1	71.5	-	0.1	$kg/m^2/hr$	4.00E-06	2.00E-06	3.00E-07	Continuous
MPE	AREA	368.4637	6352.694	0.1	83.6	-	0.1	kg/h	4.00E-06	2.00E-06	3.00E-07	Continuous
N-BLA01	VOLUME	368.362	6353.03	4	46.5	57	1	kg/h	3.70E-02	3.64E-02	5.47E-03	12PM daily
N-ESF01	VOLUME	368.355	6352.909	4	63.5	82.6	1	kg/h	1.59E-02	1.43E-02	2.15E-03	1
N-PCRHM1	VOLUME	367.984	6352.098	2	42.5	74.4	0.5	kg/h	4.19E-01	3.18E-01	4.77E-02	1
N-FEL01	VOLUME	367.936	6352.41	4	54.6	80.3	1	kg/h	1.10E-02	9.85E-03	1.48E-03	1
N-FEL02	VOLUME	368.503	6352.147	4	56.8	70.8	1	kg/h	1.10E-02	9.85E-03	1.48E-03	1
N-DRIL1	VOLUME	368.362	6353.03	4	46.5	57	1	kg/h	1.31E-01	1.31E-01	1.97E-02	1
N-TRU01	VOLUME	368.286	6352.852	4	56.5	70.8	1	kg/h	7.90E-01	5.38E-01	8.06E-02	1
N-PCRHM2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	6.58E-01	5.00E-01	7.50E-02	1
N-HTCH1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	3.29E-01	2.50E-01	3.75E-02	1
N-TCRHM1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	8.88E-01	5.63E-01	8.44E-02	1
N-LST01	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	2.63E-01	2.13E-01	3.19E-02	1
N-HTCH2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	5.23E-01	3.98E-01	5.97E-02	1
N-FEL03	VOLUME	368.015	6352.355	4	50.3	83.3	1	kg/h	1.53E-02	1.37E-02	2.06E-03	1
ASPHALT	VOLUME	368.46	6352.363	4	71.7	47.6	1	kg/h	1.12E-01	1.06E-01	1.17E-02	1
ROAD1	VOLUME	368.165	6352.468	2	71.9	38	1	kg/d	15.43	4.36	0.44	2
ROAD2	VOLUME	368.258	6352.397	2	68.9	38	1	kg/d	15.43	4.36	0.44	2
ROAD3	VOLUME	368.362	6352.351	2	67	38	1	kg/d	15.43	4.36	0.44	2

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
URE1	VOLUME	368.339	6352.257	2	57.6	30	1	kg/d	6.15	1.64	0.164	2
URE2	VOLUME	368.32	6352.15	2	50.1	30	1	kg/d	6.15	1.64	0.164	2
URE3	VOLUME	368.393	6352.063	2	47.8	30	1	kg/d	6.15	1.64	0.164	2
URE4	VOLUME	368.533	6352.011	2	47.3	30	1	kg/d	6.15	1.64	0.164	2
URE5	VOLUME	368.669	6352.013	2	48.4	30	1	kg/d	6.15	1.64	0.164	2
URE6	VOLUME	368.809	6351.975	2	44.9	30	1	kg/d	6.15	1.64	0.164	2
URE7	VOLUME	368.912	6351.922	2	42.9	30	1	kg/d	6.15	1.64	0.164	2
URE8	VOLUME	369.033	6351.899	2	42	30	1	kg/d	5.31	1.02	0.243	2
URE9	VOLUME	369.146	6351.866	2	34.7	30	1	kg/d	5.31	1.02	0.243	2

Scenario 5A Model configuration

```
CALPUFF Model Configuration
 ---------------------------


 File Examined: E:\30-2060\5APUFF.CON


 Titles:
  Produced by CALPUFF Version: 6.263  Level: 080827
  Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99   Level: 070921


 Time Period:
  Data BEGIN on 01 Jan 2008 at 00:00:00 (hh:mm:ss)     UTC+1000
  Data   END on 02 Jan 2009 at 00:00:00 (hh:mm:ss)     UTC+1000


 Number of periods    =       8808
 Averaging time (sec) =       3600


 Species:
    DUST            (g/m3)
    TSP             (g/m3)
    PM10            (g/m3)
    PM2_5           (g/m3)


 Grid Configuration:
   NX Cells        =  50
   NY Cells        =  50
   Cell Size (km)  =  0.200000003
   SW Corner (km)  =  364.495453 6346.59180


 Coordinate System:
   DATUM Code               = WGS-84
   Map Projection           = UTM
   UTM Zone         (1-60) =  56
   Hemisphere               = S


 Sources:
```

```
   Number of Points    =  0
   Number of Volumes   =  23
   Number of Areas     =  9
   Number of Lines     =  0

 Receptors:
   Grid (ngx,ngy)      =  50 50
   Discrete            =  9
```

CALPUFF Model Options

MGAUSS	MSLUG	MCHEM	MAQCHEM	MWET	MDRY	MTILT	MDISP	MDISP2	MPDF	MTURBVW	MTAULY	MTAUADV	MCTURB	MROUGH	MBDW	MTRANS	MTIP	MSHEAR	MPARTL	MTINV	MCTADJ	MCTSG	MSPLIT	MSGTIBL	MBCON	MSOURCE	MFOG	MREG
1	0	0	0	0	1	0	3	3	0	3	0	0	1	0	1	0	1	0	1	0	3	0	0	0	0	1	0	0

CALPUFF Source Details

Source	Type	Mean X	Mean Y	Release Height	Base Elev	Sigma Y	Sigma Z	Units	TSP Rate	PM10 Rate	PM2.5 Rate	Diurnal Cycle[a]
		km	km	m	m(MSL)	m	m					
WA	AREA	367.6465	6352.407	0.1	57.4	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
EP	AREA	367.8773	6352.127	0.1	50.8	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
SE	AREA	368.1705	6351.934	0.1	56.5	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
WSA	AREA	367.8718	6352.459	2	54.4	–	0.5	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
OA	AREA	368.5868	6351.993	0.1	47.1	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
ES	AREA	368.4795	6352.279	2	64.9	–	0.5	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
PP	AREA	368.291	6352.276	2	57.7	–	0.5	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
NE	AREA	368.2315	6352.812	0.1	71.5	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
MPE	AREA	368.4637	6352.694	0.1	83.6	–	0.1	kg/m^2/hr	4.00E-06	2.00E-06	3.00E-07	Continuous
N-BLAO1	VOLUME	368.326	6351.883	4	46.5	57	1	kg/h	1.70E-02	1.68E-02	2.51E-03	12PM daily
N-ESFO1	VOLUME	368.11	6351.874	4	63.5	82.6	1	kg/h	6.44E-03	5.77E-03	8.56E-04	1
N-PCRHM1	VOLUME	367.984	6352.098	2	42.5	74.4	0.5	kg/h	1.16E-01	8.85E-02	1.33E-02	1
N-FELO1	VOLUME	367.936	6352.41	4	54.6	80.3	1	kg/h	4.41E-03	3.96E-03	6.02E-04	1
N-FELO2	VOLUME	368.503	6352.147	4	56.8	70.8	1	kg/h	4.41E-03	3.96E-03	6.02E-04	1
N-DRIL1	VOLUME	368.326	6351.883	4	46.5	57	1	kg/h	3.65E-02	3.65E-02	5.39E-03	1
N-TRUO1	VOLUME	367.984	6352.098	4	56.5	70.8	1	kg/h	2.19E-01	1.49E-01	2.25E-02	1
N-PCRHM2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	1.83E-01	1.39E-01	2.09E-02	1
N-HTCH1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	2.01E-02	1.28E-02	8.56E-04	1
N-TCRHM1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	4.95E-03	4.22E-03	7.93E-04	1
N-LSTO1	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	7.32E-02	5.90E-02	8.88E-03	1
N-HTCH2	VOLUME	368.276	6352.26	4	56.5	70.8	1	kg/h	1.46E-01	1.10E-01	1.65E-02	1
N-FELO3	VOLUME	368.015	6352.355	4	50.3	83.3	1	kg/h	3.79E-02	3.40E-02	5.10E-03	1
ASPHALT	VOLUME	368.46	6352.363	4	71.7	47.6	1	kg/h	4.03E-01	3.82E-01	4.21E-02	1
ROAD1	VOLUME	368.165	6352.468	2	0	38	1	kg/d	1.54E+01	4.36E+00	4.40E-01	2
ROAD2	VOLUME	368.258	6352.397	2	0	38	1	kg/d	1.54E+01	4.36E+00	4.40E-01	2
ROAD3	VOLUME	368.362	6352.351	2	0	38	1	kg/d	1.54E+01	4.36E+00	4.40E-01	2

		Mean	Mean	Release	Base	Sigma	Sigma		TSP	PM10	PM2.5	Diurnal
Source	Type	X	Y	Height	Elev	Y	Z	Units	Rate	Rate	Rate	Cycle[a]
		km	km	m	m(MSL)	m	m					
URE1	VOLUME	368.339	6352.257	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE2	VOLUME	368.32	6352.15	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE3	VOLUME	368.393	6352.063	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE4	VOLUME	368.533	6352.011	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE5	VOLUME	368.669	6352.013	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2
URE6	VOLUME	369.146	6351.866	2	0	30	1	kg/d	6.15E+00	1.64E+00	1.64E-01	2

Diurnal Cycles

Hour	Cycle 1	Cycle 2
1	0	0.016667
2	0	0.016667
3	0	0.016667
4	0	0.016667
5	0	0.01667
6	0	0.01667
7	0	0.01667
8	1	0.07273
9	1	0.07273
10	1	0.07273
11	1	0.07273
12	1	0.07273
13	1	0.07273
14	1	0.07273
15	1	0.07273
16	1	0.07273
17	1	0.07273
18	1	0.07273
19	0	0.0125
20	0	0.0125
21	0	0.0125
22	0	0.0125
23	0	0.01667
24	0	0.01667

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