DRAFT REPORT

PHOTOCHEMICAL SMOG ASSESSMENT FOR THE MINERALOGY EXPANSION PROJECT

Mineralogy Pty. Ltd

Job No: 2455d

17 August 2009

A PEL Company

PROJECT TITLE:	PHOTOCHEMICAL SMOG ASSESSMENT FOR THE MINERALOGY EXPANSION PROJECT
JOB NUMBER:	2455D
PREPARED FOR:	Phil Scott
	MINERALOGY PTY. LTD
PREPARED BY:	Peter D'Abreton
QA PROCEDURES CHECKED BY:	N/A
APPROVED FOR RELEASE BY:	Robin Ormerod
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Queensland Environment Pty Ltd trading as
PAEHolmes ABN 86 127 101 642

BRISBANE:
Level 1, La Melba, 59 Melbourne Street South Brisbane Qld 4101
PO Box 3306 South Brisbane Qld 4101
Ph: +61 7 3004 6400
Fax: +61 7 3844 5858

SYDNEY:
Suite 2B, 14 Glen Street
Eastwood NSW 2122
Ph: +61 2 9874 8644
Fax: +61 2 9874 8904

Email: info@paeholmes.com

Website: www.paeholmes.com

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1 INTRODUCTION

Mineralogy Pty. Ltd. (Mineralogy) appointed PAEHolmes to conduct a photochemical smog assessment for the further staged development forming part of the Mineralogy Cape Preston Iron Ore Project near Cape Preston, Western Australia.

1.1 Background

Mineralogy proposes to develop a magnetite iron ore mine, processing facility and associated infrastructure in the Cape Preston region of Western Australia, 80km southwest of Karratha - *Mineralogy Expansion Proposal* (MEP). There are currently two other proposals being developed or implemented at this location as the first two stages of the Mineralogy Cape Preston Iron Ore Project as follows:

- Stage 1 - Sino Iron Project which is being implemented in accordance with Statement 635 for the Original Proposal as assessed by EPA and subsequent S45C amendments to the Original Proposal; and
- Stage 2 - Balmoral South Proposal which is currently being assessed by EPA at the level of PER.

PAEHolmes conducted the photochemical smog assessment for the proposed pellet and power plant forming part of the Balmoral South (BS) project (PAE, 2008).

The MEP project involves further staged development of the Mineralogy Cape Preston Iron Ore Project adjoining the above proposals as follows:

- Stage 3 – Extension of the Sino Iron Project ;
- Stage 4 – The Mineralogy Project; and
- Stage 5 – The Austeel Project.

To assess the air quality impacts, Mineralogy have contracted PAEHolmes to undertake photochemical smog assessment of the regional impacts of nitrogen dioxide (NO_2) and ozone (O_3) from the MEP as well as the cumulative impacts including the first two stages.

1.2 Scope of Work

The Scope of Work is to conduct a photochemical modelling study for the following scenario:

- Existing plus approved projects - this includes current sources in the region plus emissions from the Stage 1 and Stage 2 projects; plus
- Proposed projects - this includes emissions from the proposed sources forming part of the MEP.

1.3 General Approach to the Assessment

This air quality impact assessment has involved gathering, processing and presenting information on emissions in the region from previous work undertaken, and:

- using TAPM to predict photochemical smog over the region as a whole;
- assessing predicted nitrogen dioxide (NO_2) and ozone (O_3) against relevant WA air quality guidelines; and
- presenting and discussing the input data, methodology and results in a report.

For this study, the impact of emissions from the site is based on current best practice modelling technology. The assessment of impacts is also based on stringent criteria that provide for a high level of environmental and human health protection.

1.4 Units Used in the Report

Two systems for expressing the concentrations of air pollution are now in common use. Firstly, concentrations may be expressed in parts per million (ppm) or as parts per billion (ppb).

The second option is to use either mg/m^3, or $\mu g/m^3$. These units are consistent with the System International. In order to convert between ppb and $\mu g/m^3$, a conversion factor is used that contains the molecular weight of the pollutant.

Some authorities use only one system (the European Union and World Health Organisation use $\mu g/m^3$), while others use both systems of units for standards. Conversion from one system to another can generate awkward numbers, and authorities using both systems often round off converted numbers for the sake of simplicity. The modelling output for this study is in ppb for all pollutants.

2 PROJECT LOCATION

The proposed projects are located at Cape Preston in the Pilbara, Western Australia. The location of the projects is shown in Figure 2.1.

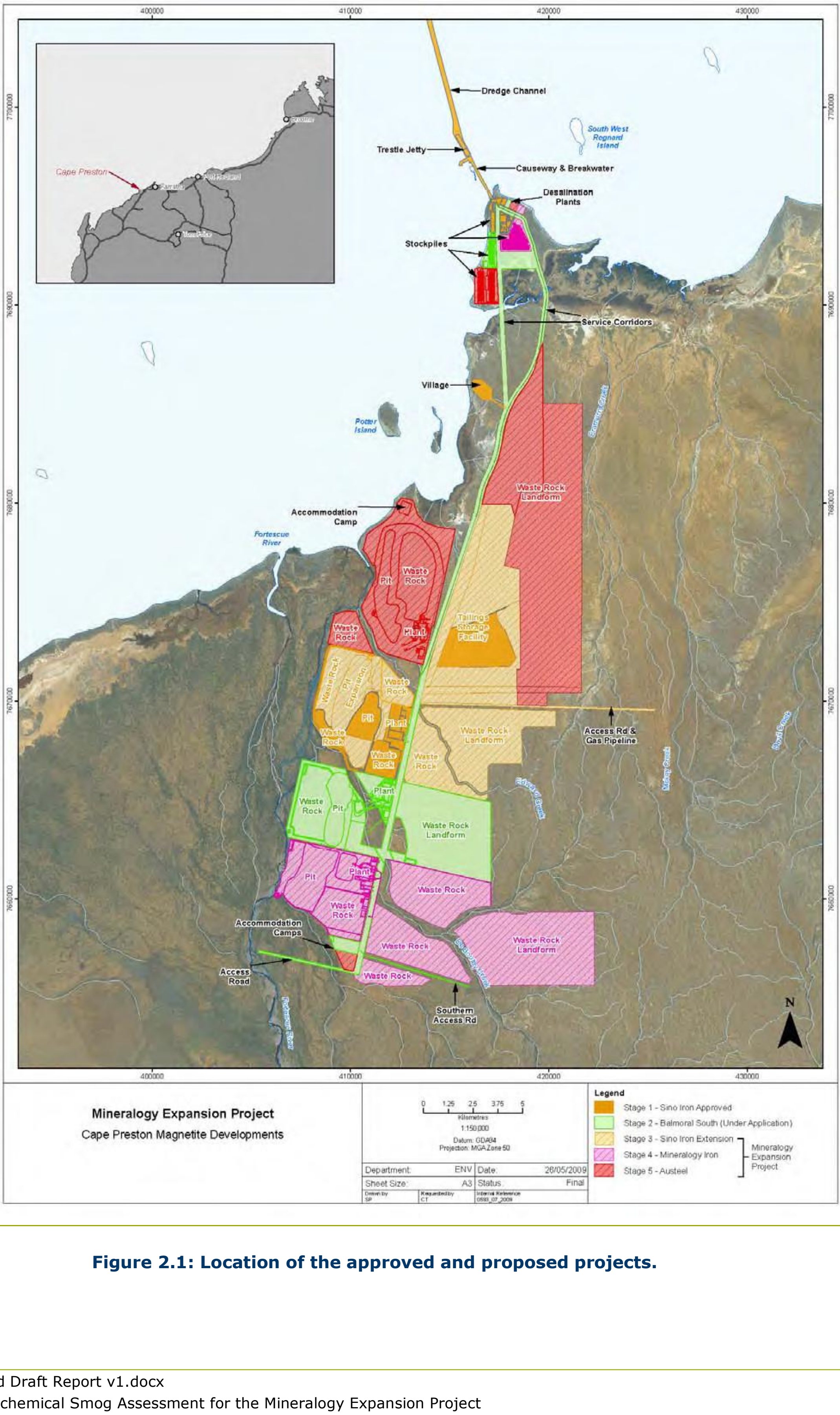


Figure 2.1: Location of the approved and proposed projects.

3 CLIMATE OF THE AREA

Cape Preston is a peninsula on the Pilbara coast. Rainfall is low throughout the region and quite variable. Annual totals vary from 200 -450mm, and many years without significant rainfall occur. The lower totals are typical of the south where tropical cyclone effects are less frequent. Most of the summer rain comes from scattered thunderstorms and the occasional tropical cyclone. A secondary peak in the monthly rainfall occurs in May/June as a result of rainfall caused by tropical cloud bands which intermittently affect the area mostly in these months. These events can also produce low maximum temperatures particularly away from the coast. The number of thunderstorms average 20-30 per annum over most of the area but 15-20 is more common near the coast. Almost all storms occur in the summer.

This region contains some of Australia's consistently hottest places. The coast is 2-3°C cooler but usually more humid due to the sea breezes. Winter maximum temperatures are mild/warm with temperatures in the 23-27°C range in the south. Minimum temperatures range from 25C in midsummer to 12°C in July near the coast.

Climate averages for Mardie (approximately 25 km to the south-west of the BS project) are presented in Table 3.1. January and February are the warmest months with average maximum temperatures of approximately 31°C. Winters are warm with average minimum temperatures of 12°C and maximum temperatures of 27.7°C in July. Annual average rainfall is 237 mm, with February, March, May and June producing the highest monthly totals on average (Table 3.1). The average number of rain days for each of these months is still below 3. The wind speed at 9 am averages 14 km/h (3.9 m/s) for the year, with August to November being the windiest months on average (Table 3.1). Wind speed at 3 pm averages 23.7 km/h (6.6 m/s) with October to January being the windiest months in the afternoon.

Average (1956 - 2007) wind roses for Mardie at 9 am and 3 pm are shown in Figure 3.1. The morning (9 am) wind directions are predominantly from the east to south (57% of the time), while afternoon winds (3 pm) are predominantly from the west to north (73% of the time). The afternoon winds most likely represent sea breeze conditions, especially during the summer months.

Table 3.1: Climate averages for Mardie – 1956 to 2007 (source: Bureau of Meteorology).

Month	Average Minimum Temperature (°C)	Average Maximum Temperature (°C)	Median Rainfall (mm)	Rain Days (>1mm)	Average 9 AM Wind Speed (km/h)	Average 3 PM Wind Speed (km/h)
January	24.8	38.0	7.5	2.0	13.9	27.7
February	25.2	37.7	25.3	3.0	12.9	24.9
March	24.1	37.6	17.2	2.3	13.0	23.4
April	21.0	35.9	1.0	1.1	12.3	20.4
May	16.9	31.5	13.7	2.0	13.2	18.2
June	13.8	28.1	18.7	2.1	13.1	16.6
July	11.7	27.7	5.1	1.2	12.8	17.6
August	12.3	29.5	0.0	0.8	14.0	21.1
September	14.3	32.2	0.0	0.2	15.6	25.4
October	17.2	34.9	0.0	0.1	16.8	29.1
November	20.0	36.4	0.0	0.2	15.9	30.0
December	22.9	37.7	0.0	0.5	14.9	29.4
Annual	18.7	33.9	236.9	15.5	14.0	23.7

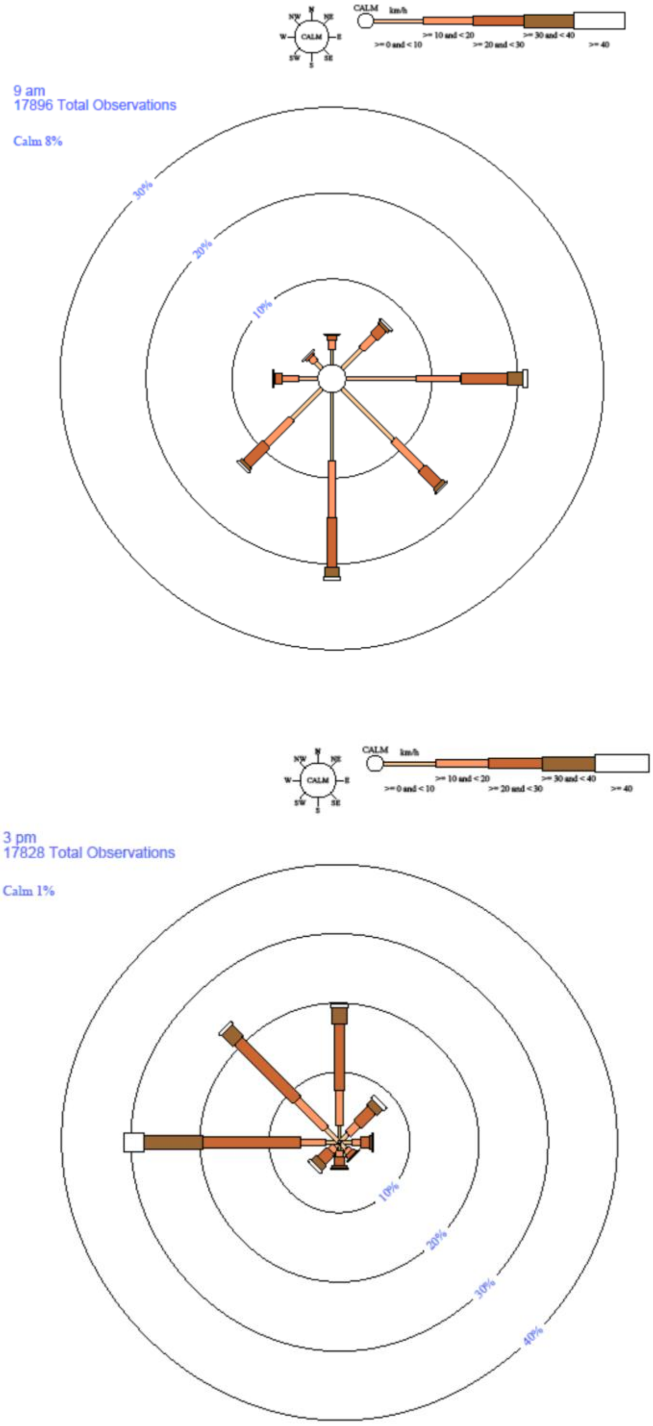


Figure 3.1: Climate wind roses for Mardie for 9 am (upper) and 3 pm (lower) – 1956 to 2007 (source: Bureau of Meteorology).

4 AMBIENT AIR QUALITY GUIDELINES

Many regulatory authorities publish guidance documents on air quality assessment and management. These guidelines usually include ground level concentration values for specific contaminants that should normally not be exceeded in the receiving environment. Guidelines typically specify how often the quoted concentration values can be exceeded without causing unreasonable levels of impact. Typically, the impacts of concern are related to human health or amenity. In some cases, the relevant impacts relate to other environmental values such as the protection of vegetation. Most guidelines aim to provide a very high level of protection against environmental harm.

4.1 NEPM for Ambient Air Quality

The National Environment Protection Council (NEPC), now incorporated into the Environment Protection and Heritage Council (EPHC), developed the Ambient Air Quality NEPM in 1998. The Ambient Air Quality NEPM refers to the so-called criteria or common air contaminants that have for many years been the core set of pollutants for air quality regulation and monitoring. The Ambient Air Quality NEPM comprises a monitoring-based set of standards, and was not designed to be applied to 'beyond the boundary' regulation of specific industrial facilities. Compliance with the Ambient Air Quality NEPM is a state and territory responsibility, and is to be demonstrated by monitoring programs that represent the exposure of relatively large population groups to ambient levels of the nominated contaminants.

Despite this specific design, state and territory environmental authorities have to varying degrees adopted the Ambient Air Quality NEPM goals as assessment criteria that should be complied with in all receiving environments beyond industrial site boundaries. There are some issues arising from this approach, relating mainly to extractive industries with significant dust emissions. In 2000, the Western Australia Department of Environmental Protection (DEP) adopted the Ambient Air Quality NEPM standards for general application to air quality management (WA EPA, 2001). Consequently, predicted ambient ground-level concentrations will be assessed against these standards. The relevant Air NEPM standards are listed in Table 4.1.

Table 4.1: Ambient Air Quality NEPM Goals

Pollutant	Averaging Period	Maximum Concentration (ppb)	Goal Within 10 Years - Maximum Allowable Exceedances
Nitrogen dioxide (NO_2)	1 hour	120	1 day a year
	1 year	30	None
Photochemical oxidants (as O_3)	1 hour	100	1 day a year
	4 hours	80	1 day a year

Source: NEPC 1998

5 STUDY APPROACH AND METHODOLOGY

5.1 Photochemical Modelling

The Air Pollution Model, or TAPM V4, is a three dimensional meteorological and air pollution model produced by the CSIRO Division of Atmospheric Research (Hurley, 2008a, 2008b).

TAPM incorporates the following databases for input to its computations:

- Gridded database of terrain heights on a longitude/latitude grid of 30 second grid spacing, (approximately 1 km). This default dataset is supplemented by finer resolution data at 9 second spacing for this study.
- Australian vegetation and soil type data at 3 minute grid spacing, (approximately 5 km).
- Rand's global long term monthly mean sea-surface temperatures on a longitude/latitude grid at 1 degree grid spacing, (approximately 100 km).
- Six-hourly synoptic scale analyses on a longitude/latitude grid at 0.75-degree grid spacing, (approximately 75 km), derived from the LAPS analysis data from the Bureau of Meteorology.

The air pollution component of TAPM includes gas-phase photochemical reactions based on the Generic Reaction Set (GRS) of Azzi *et al*. (1992). There are ten reactions for thirteen species: smog reactivity (Rsmog), the radical pool (RP), hydrogen peroxide (H_2O_2), nitric oxide (NO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), stable non-gaseous organic carbon (SNGOC), stable gaseous nitrogen products (SGN), stable non-gaseous nitrogen products (SNGN), stable non-gaseous sulfur products (SNGS), plus airborne particulate matter (APM) and fine particulate matter (FPM) that include secondary particulate concentrations consisting of SNGOC, SNGN and SNGS.

The GRS is a much more simplified version of complex atmospheric chemistry than either CB-IV or SAPRC. The GRS offers smog formation modelling with low data requirements and low computational overheads, but without a detailed understanding of atmospheric chemistry processes. It negates the need for lumped speciated VOC emissions. Instead, the mechanism describes emissions of smog reactivity (Rsmog), which is defined as a reactivity coefficient multiplied by VOC concentration. Rsmog is used to estimate the smog forming potential of the atmosphere.

5.1.1 TAPM Configuration

TAPM was used in a nested mode with 45 x 45 x 17 grid points and 15 km, 5 km and 2.5 km spaced grids for meteorology and for pollution[a]. The area covered by each pollution grid is slightly less than the area of the corresponding meteorological grid. In this way, the pollution grids avoid the boundary regions of the nested meteorological grids, where spurious vertical velocities can sometimes occur. TAPM was run for the period 1 January 1999 to 31 December 1999 for comparison to the CSIRO's *Summary of TAPM Verification for the Pilbara Region* (2004).

[a] The model configuration was identical to that used by CSIRO (2004).

To improve model accuracy, observed wind conditions from Cape Preston Mainland and Island were used to nudge[b] the TAPM solution.

The relatively coarse grid used for the modelling precludes the use of the results to assess localised impacts due to specific facilities. The modelling presented here presents regional impacts only.

5.2 Receptors

Receptors are the locations at which the model calculates concentration or deposition. The grid can be either spaced regularly to reflect the topography, population distribution patterns, and other site-specific factors or irregularly spaced as discrete receptors to represent sensitive locations not included by the receptor grid (e.g. schools, hospitals and houses). The model will calculate concentration or deposition for each point on the grid, and then use a suitable interpolation method to draw a continuous contour line.

Ground level concentrations were calculated over a grid of uniformly spaced receptor points 2.5 km apart over an area of approximately 12,656 km^2.

In addition to the gridded receptors, 3 sensitive receptors were identified, the locations of which are shown in Figure 5.1

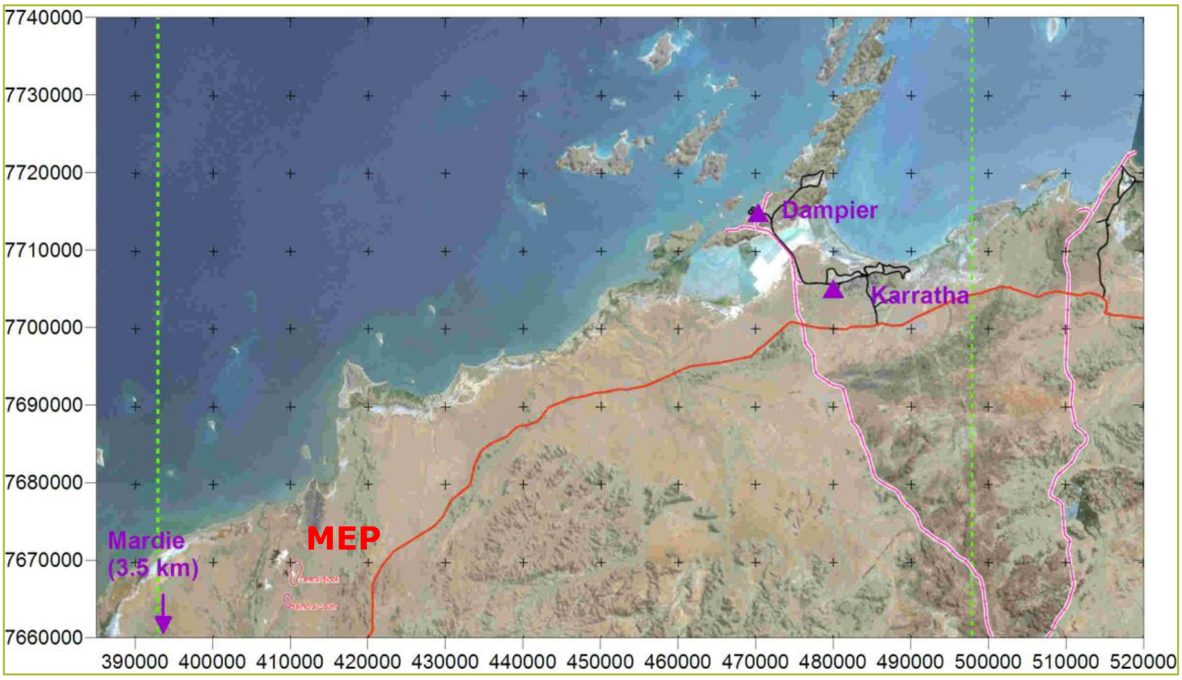


Figure 5.1: Location of the sensitive (discrete) receptors relevant to the MEP Project.

[b] Nudging a model forces it towards the meteorological observations. The main benefit of nudging is to correct the possible drift of the large-scale winds calculated by model from the fields used for initialization and boundary conditions.

5.3 Discharges to Air

5.3.1 Existing Emissions

Existing point source emissions as at 1999 were sourced from the CSIRO's Summary of TAPM Verification for the Pilbara Region (2004).

Subsequent to the CSIRO study, a number of additional sources were added in the region (sourced from SKM, 2006). These include:

- the NWSV Karratha Gas Plant Train 4;
- the NWSV Karratha Gas Plant Train 5;
- the Burrup Fertilisers Ammonia Plant; and
- the Pluto LNG Development.

These additional sources are included in the modelling assessment to determine the current levels of photochemical pollutants in the region. A list of all the point source emissions utilised in the modelling is presented in Table 5.1.

Biogenic (NO_X and VOC) and gridded surface emissions have been supplied by the CSIRO for this study. This dataset is identical to that used by CSIRO in their 2004 modelling study.

5.3.2 Stage 1 & 2 Emissions

Emissions for Stage 1 & 2 include the Sino Iron Project and the Balmoral South Proposal are summarised in Table 5.2. These were sourced from the Mineralogy Expansion Proposal Air Quality Assessment (Air Assessments, 2009).

5.3.3 Stage 4 & 5 Emissions

Emissions for Stage 4 & 5 are summarised in Table 5.2. These were sourced from the Mineralogy Expansion Proposal Air Quality Assessment (Air Assessments, 2009).

Table 5.1: Air emissions data for existing point sources used in the modelling.

Src ID	Source	Easting m	Northing m	Height m	Stack Radius m	Velocity m/s	Temp K	PM_{10} g/s	NO_x g/s	SO_2 g/s	Rsmog g/s
OGP Plant	GT4001	476910	7722765	40	1.98	20.2	777	0	13.46	0.04	0
OGP Plant	GT4002	476910	7722800	40	1.98	20.2	777	0	13.46	0.04	0
OGP Plant	GT4003	476910	7722810	40	1.98	20.2	777	0	13.46	0.04	0
OGP Plant	GT4004	476910	7722845	40	1.98	20.2	777	0	13.46	0.04	0
OGP Plant	GT4005	476910	7722855	40	1.98	20.2	777	0	13.46	0.04	0
OGP Plant	GT4006	476910	7722890	40	1.98	20.2	777	0	13.46	0	0
OGP Plant	1KT1410	476540	7722965	40	1.94	23.9	790	0	15.77	0.05	0
OGP Plant	1KT1420	476590	7722965	40	1.94	23.9	790	0	15.6	0.05	0
OGP Plant	1KT1430	476610	7722965	40	1.87	25.8	790	0	15.26	0.05	0
OGP Plant	1KT1440+1V1104	476660	7722965	40	1.87	26.3	806	0	15.53	0.05	0.421
OGP Plant	1KT1450	476510	7722960	40	1.36	21.2	784	0	9.44	0.02	0
OGP Plant	2KT1410	476540	7722845	40	1.94	23.9	790	0	15.77	0.05	0
OGP Plant	2KT1420	476590	7722845	40	1.94	23.9	790	0	15.6	0.05	0
OGP Plant	2KT1430	476610	7722845	40	1.87	25.8	790	0	15.26	0.05	0
OGP Plant	2KT1440+2V1104	476660	7722845	40	1.87	26.3	806	0	15.53	0.05	0.421
OGP Plant	2KT1450	476510	7722840	40	1.36	21.2	784	0	9.44	0.02	0
OGP Plant	3KT1410	476540	7722610	40	1.94	23.9	790	0	15.77	0.05	0
OGP Plant	3KT1420	476590	7722610	40	1.94	23.9	790	0	15.6	0.05	0
OGP Plant	3KT1430	476610	7722610	40	1.87	25.8	790	0	15.26	0.05	0
OGP Plant	3KT1440+3V1104	476660	7722610	40	1.87	26.3	806	0	15.53	0.05	0.421
OGP Plant	3KT1450	476510	7722605	40	1.36	21.2	784	0	9.44	0.02	0
OGP Plant	1F2001	477152	7722915	33	0.73	6	700	0	0.3	0	0

Src ID	Source	Easting	Northing	Height	Stack Radius	Velocity	Temp	PM_{10}	NO_x	SO_2	Rsmog
OGP Plant	2F2001	477152	7722905	33	0.73	6	700	0	0.3	0	0
OGP Plant	3F2001	477152	7722895	33	0.73	6	700	0	0.3	0	0
OGP Plant	4F2001	476968	7722880	33	0.73	6	700	0	0.3	0	0
OGP Plant	5F2001	476968	7722870	33	0.73	6	700	0	0.3	0	0
OGP Plant	1KT2420	477035	7722698	24	1	40.7	816	0	9.44	0.02	0
OGP Plant	1KT2430	477050	7722698	24	1.45	30.6	620	0	20.26	0.04	0
OGP Plant	2KT2420	477065	7722698	24	1	40.7	816	0	9.44	0.02	0
OGP Plant	2KT2430	477080	7722698	24	1.45	30.6	620	0	20.26	0.04	0
OGP Plant	Seal Oil	476500	7722500	20	1	0	400	0	0	0	0.12
Hammersley Power Station	HAM_Stack1	471500	7717000	60	1.3	Time Varying					
Hammersley Power Station	HAM_Stack2	471500	7717000	60	1.3						
NWSV Karratha Gas Plant Train 4	4KT1430a	476664	7722465	40	1.45	28.2	490	0.000	5.000	0.300	0.000
NWSV Karratha Gas Plant Train 4	4KT1430b	476664	7722461	40	1.45	28.2	490	0.000	5.000	0.300	0.000
NWSV Karratha Gas Plant Train 4	4KT1410	476650	7722461	40	3.05	23.4	814	0.000	10.600	0.600	0.000
NWSV Karratha Gas Plant Train 4	1F1251	476933	7722944	40	1.46	21.3	1373	0.000	0.800	2.800	0.000
NWSV Karratha Gas Plant Train 4	GT4007	476972	7722702	40	1.65	23	694	0.000	3.300	0.200	0.000
NWSV Karratha Gas Plant Train 4	GT4008	476972	7722668	40	1.65	23	694	0.000	3.300	0.200	0.000
NWSV Karratha Gas Plant Train 5	GT4009	476972	7722626	40	1.65	23	694	0.000	3.300	0.200	0.000
NWSV Karratha Gas Plant Train 5	GT4010	476972	7722592	40	1.65	23	694	0.000	3.300	0.200	0.000
NWSV Karratha Gas Plant Train 5	5KT1430a	476664	7722335	40	1.45	28.2	490	0.000	5.000	0.300	0.000
NWSV Karratha Gas Plant Train 5	5KT1430b	476664	7722331	40	1.45	28.2	490	0.000	5.000	0.300	0.000
NWSV Karratha Gas Plant Train 5	5KT1410	476560	7722331	40	3.05	23.4	814	0.000	10.600	0.600	0.000
NWSV Karratha Gas Plant Train 5	2F1251	476953	7722944	40	1.46	21.3	1373	0.000	0.800	2.800	0.000
Burrup Fertilizers Ammonia Plant	BF1	476915	7718833	36	1.78	12.7	413	0.300	15.400	0.000	0.000
Burrup Fertilizers Ammonia Plant	BF2	477060	7718820	15	0.85	5	450	0.000	1.300	0.000	0.000

Src ID	Source	Easting	Northing	Height	Stack Radius	Velocity	Temp	PM_{10}	NO_x	SO_2	Rsmog
Pluto LNG Train 1	PR Compressor Frame 7 Turbine	475609	7720460	40	1.75	23.5	493	0.000	3.850	0.300	0.000
Pluto LNG Train 1	PR Compressor Frame 7 Turbine	475621	7720466	40	1.75	23.5	493	0.000	3.850	0.300	0.000
Pluto LNG Train 1	MR Compressor Frame 7 Turbine	475509	7720422	40	2.5	23	816	0.000	7.700	0.600	0.000
Pluto LNG Train 1	Frame 6 Power Generator	475528	7720311	40	1.65	16.5	438	0.000	2.700	0.450	0.000
Pluto LNG Train 1	Frame 6 Power Generator	475565	7720329	40	1.65	16.5	438	0.000	2.700	0.450	0.000
Pluto LNG Train 1	Frame 6 Power Generator	475602	7720342	40	1.65	16.5	438	0.000	2.700	0.450	0.000
Pluto LNG Train 1	Frame 6 Power Generator	475646	7720360	40	2.25	16.6	821	0.000	2.700	0.450	0.000
Pluto LNG Train 1	Frame 6 Power Generator	475683	7720379	40	2.25	16.6	821	0.000	2.700	0.450	0.000
Pluto LNG Train 1	Frame 5 Liquefaction	475963	7720205	40	1.9	25	791	0.000	3.000	0.300	0.000
Pluto LNG Train 1	Thermal Oxidiser	475826	7720671	40	1.45	20	873	0.000	1.600	1.000	0.000
Pluto LNG Train 1	Fired Heater	475590	7720677	33	0.75	11	761	0.000	0.800	0.100	0.000
Pluto LNG Train 2	PR Compressor Frame 7 Turbine	475720	7720177	40	1.75	23.5	493	0.000	3.850	0.300	0.000
Pluto LNG Train 2	PR Compressor Frame 7 Turbine	475733	7720183	40	1.75	23.5	493	0.000	3.850	0.300	0.000
Pluto LNG Train 2	MR Compressor Frame 7 Turbine	475615	7720137	40	2.5	23	816	0.000	7.700	0.600	0.000
Pluto LNG Train 2	Frame 6 Power Generator	475547	7720280	40	1.65	16.5	438	0.000	2.700	0.450	0.000

Src ID	Source	Easting	Northing	Height	Stack Radius	Velocity	Temp	PM_{10}	NO_x	SO_2	Rsmog
Pluto LNG Train 2	Frame 6 Power Generator	475578	7720298	40	1.65	16.5	438	0.000	2.700	0.450	0.000
Pluto LNG Train 2	Frame 6 Power Generator	475621	7720317	40	1.65	16.5	438	0.000	2.700	0.450	0.000
Pluto LNG Train 2	Frame 6 Power Generator	475665	7720329	40	2.25	16.6	821	0.000	2.700	0.450	0.000
Pluto LNG Train 2	Frame 6 Power Generator	475702	7720348	40	2.25	16.6	821	0.000	2.700	0.450	0.000
Pluto LNG Train 2	Frame 5 Liquefaction	475851	7720106	40	1.9	25	791	0.000	3.000	0.300	0.000
Pluto LNG Train 2	Thermal Oxidiser	475975	7720301	40	1.45	20	873	0.000	1.600	1.000	0.000
Pluto LNG Train 2	Fired Heater	475739	7720727	33	0.75	11	761	0.000	0.800	0.100	0.000
Flares	Cold Dry Flare	475286	7720329	160	0.7	20	773	0.048	0.300	0.000	0.006
Flares	Warm Wet Flare	475311	7720329	160	0.7	20	773	0.048	0.300	0.000	0.006
Flares	Marine Flare	475106	7720966	36.6	1.525	20	1273	3.260	20.000	0.016	0.410

Table 5.2: Air emissions and source data for the Sino Iron and Balmoral South Projects (source: Air Assessments, 2009).

Source	Easting m	Northing m	Height m	Stack Radius m	Velocity m/s	Temp K	PM_{10} g/s	NO_x g/s	SO_2 g/s	Rsmog g/s
Sino Iron										
Pellet Plant 1 Main Stack	417795	7693780	60	2.75	35.0	383	27	127	22	NA
Pellet Plant 2 Main Stack	417795	7694330	60	2.75	35.0	383	27	127	22	NA
One DRI Plant (Total 1.35 Mtpa of HBI)										
Main Stack A	412668	7669570	60	2.92	16.0	613	3.48	28.7	1.22	NA
Power Station (6 Combine Cycle, Total 640MW)										
Unit 1&2	412542	7669042	30	1.825	13.2	372	0	6.3	0.37	NA
Unit 3&4	412558	7669119	30	1.825	13.2	372	0	6.3	0.37	NA
Unit 5&6	412575	7669198	30	1.825	13.2	372	0	6.3	0.37	NA
Balmoral South										
Pellet Plant 1 Main Stack	411830	7666040	60	2.75	35.0	383	27	126.6	21.6	NA
Pellet Plant 2 Main Stack	412080	7666040	60	2.75	35.0	383	27	126.6	21.6	NA
Power Station (2x 240MW and 2x60MW steam turbines)										
Unit 1 – 240 MW	411855	7664248	35	3.0	23.0	289	Neg	49	2	NA
Unit 2 – 240MW	411804	7664259	35	3.0	23.0	289	Neg	49	2	NA
60 MW	411855	7664148	25	1.5	23.1	387	0.16	5.5	0.2	NA
60 MW	411804	7664159	25	1.5	23.1	387	0.16	5.5	0.2	NA

Table 5.3: Air emissions and source data for the Stage 4 and Stage 5 MEP (source: Air Assessments, 2009).

Source	Easting m	Northing m	Height m	Stack Radius m	Velocity m/s	Temp K	PM_{10} g/s	NO_x g/s	SO_2 g/s	Rsmog g/s
Stage 4										
Pellet Plant 1 Main Stack	411120	7662080	60	2.75	35.0	383	27	126.6	21.6	NA
Pellet Plant 2 Main Stack	410320	7660320	60	2.75	35.0	383	27	126.6	21.6	NA
Power Station (2 x 240 MW and 2 x 60 MW)										
Unit 1 – 240 MW	410760	7659760	35	3.0	23.0	379	Neg	21.2	0.845	NA
Unit 2 – 240 MW	410719	7659771	35	3.0	23.0	379	Neg	21.2	0.845	NA
60 MW	410760	7659660	25	1.5	23.1	387	0.16	5.5	0.203	NA
60 MW	410719	7659671	25	1.5	23.1	387	0.16	5.5	0.203	NA
Stage 5										
Pellet Plant 1 Main Stack	413850	7674230	60	2.75	35.0	383	27	126.6	21.6	NA
Pellet Plant 2 Main Stack	413892	7674426	60	2.75	35.0	383	27	126.6	21.6	NA
Power Station (2 x 240 MW and 2 x 60 MW)										
Unit 1 – 240 MW	413700	7672540	35	3.0	23.0	379	Neg	21.2	0.85	NA
Unit 2 – 240 MW	413659	7672551	35	3.0	23.0	379	Neg	21.2	0.85	NA
60 MW	413700	7672440	25	1.5	23.1	387	0.16	5.5	0.2	NA
60 MW	413659	7672451	25	1.5	23.1	387	0.16	5.5	0.2	NA

6 MODELLING RESULTS

The results from dispersion modelling are presented in the form of contour plots for the following pollutants and averaging periods[c]:

- annual average NO_2;
- maximum 1-hour NO_2;
- maximum 1-hour O_3.

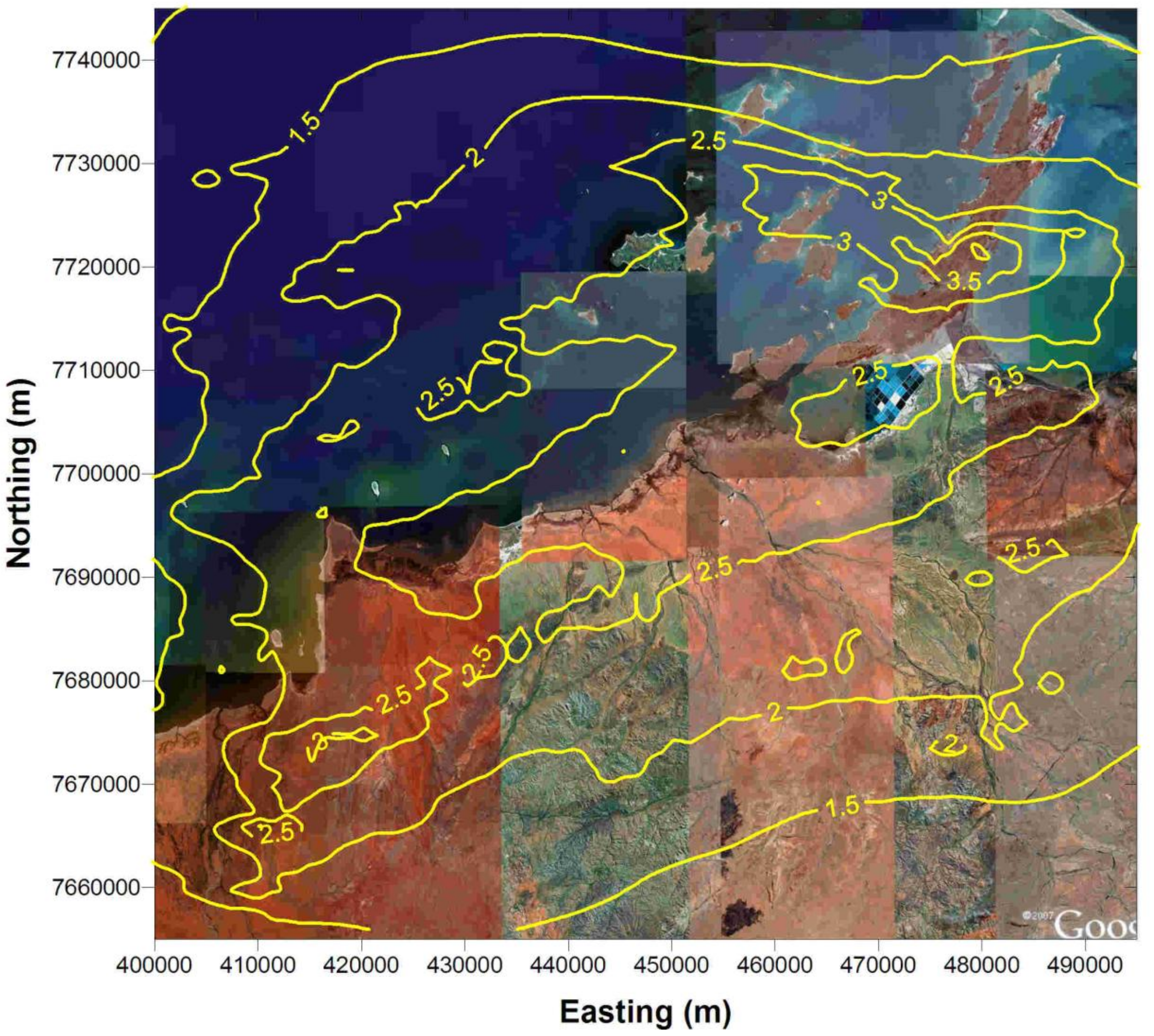
6.1 Nitrogen Dioxide

The predicted annual average ground-level NO_2 concentration contours are presented in Figure 6.1. Highest concentrations of 3 ppb are predicted to occur over the MEP. Areas of concentrations exceeding 4 ppb include parts of the Burrup Peninsula. All concentrations are well within the relevant air quality guideline.

Predicted 2[nd] highest 1-hour NO_2 concentrations are shown in Figure 6.2. Modelling indicates that the 2[nd] highest 1-hour concentration of 49 ppb occurs over the MEP. Over parts of the Burrup Peninsula, predicted 1-hour concentration is approximately 86 ppb. The NEPM guideline of 120 ppb is not exceeded at any location in the study domain.

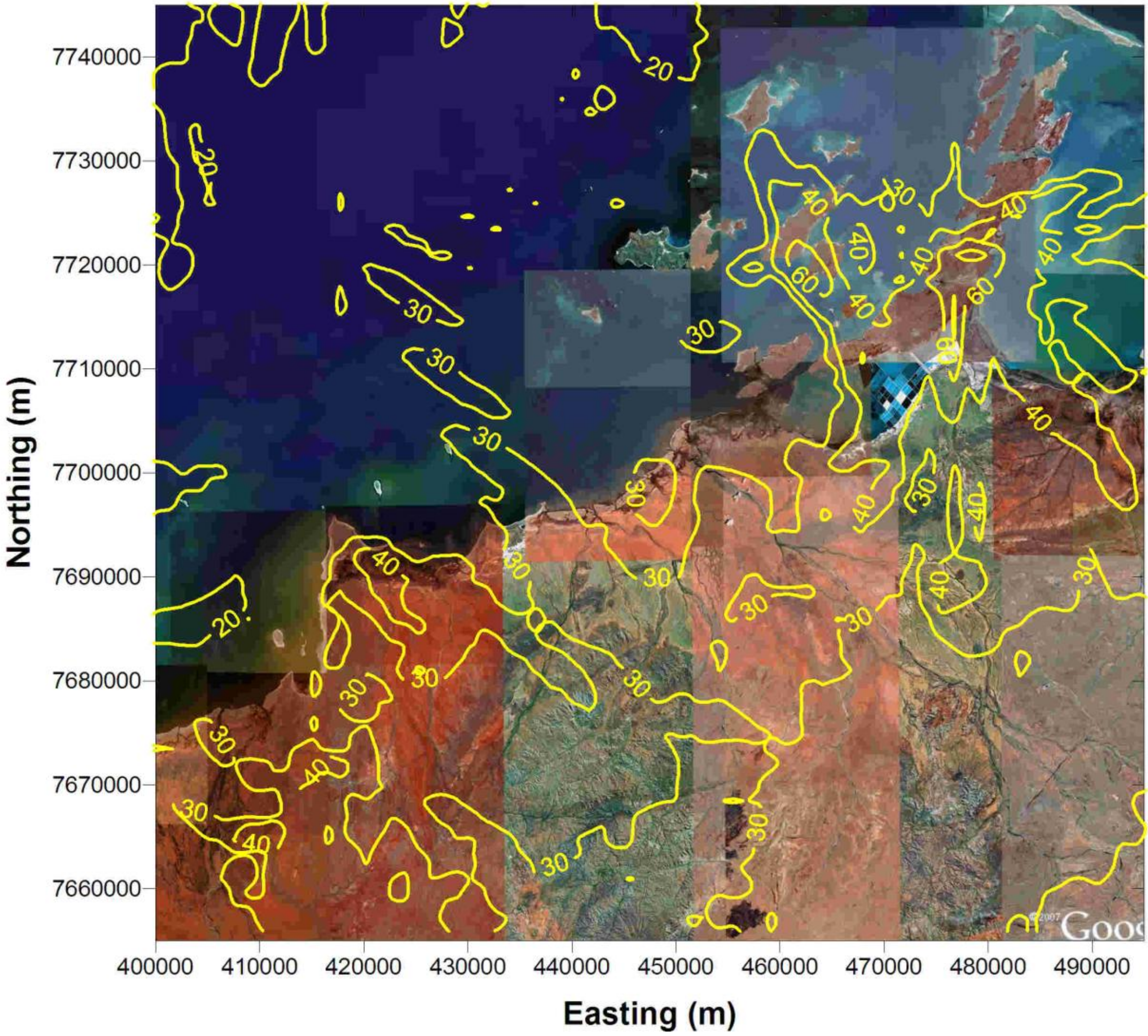
Statistics of predicted NO_2 concentration at the sensitive (discrete) receptors in the region are shown in Figure 6.3. Dampier has the highest annual average concentration (5.7 ppb) and the highest short-term (1-hour) concentration of 65 ppb. The concentrations at the sensitive receptors are within the relevant air quality guidelines.

[c] These are based on the averaging periods as specified by the NEPM Guidelines



Species:	**Location:**	**Scenario:**	**Percentile:**	**Averaging Time:**
NO_2	Pilbara	Existing, approved & MEP Project	-	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
TAPM V3	ppb	NEPM =30 ppb	1999 TAPM-Generated	P D'Abreton

Figure 6.1: Predicted annual average NO_2 concentrations.



Species:	Location:	Scenario:	Percentile:	Averaging Time:
NO_2	Pilbara	Existing, approved & MEP Project	2nd Highest	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
TAPM V3	ppb	NEPM =120 ppb	1999 TAPM-Generated	P D'Abreton

Figure 6.2: Predicted 2nd highest 1-hour NO_2 concentrations.

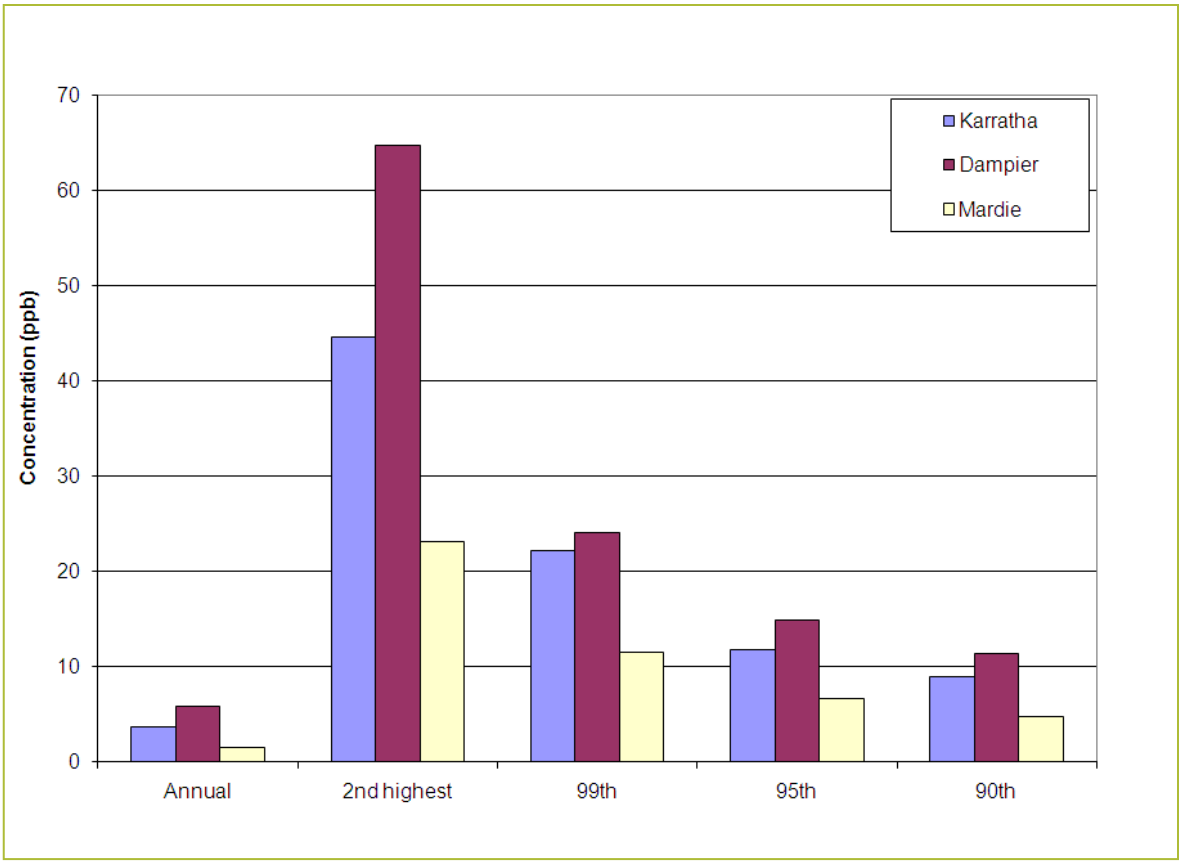


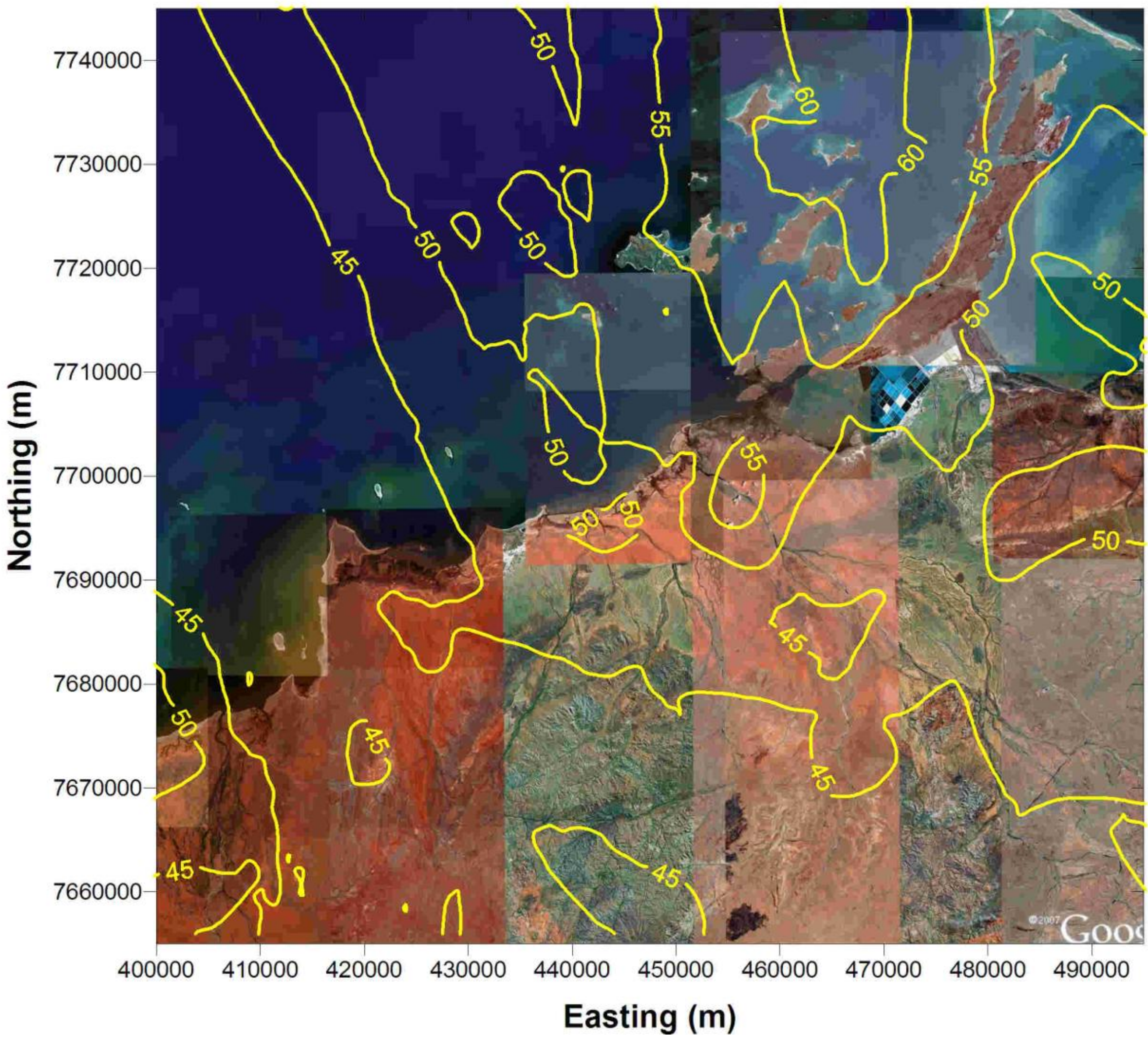
Figure 6.3: NO_2 concentration statistics at the discrete receptors.

6.2 Ozone

The predicted 2nd highest 4-hour O_3 concentrations are shown in Figure 6.4. Modelling indicates that the 2nd highest 4-hour concentration of 60 ppb occurs over the ocean to the northwest of the Burrup Peninsula. The NEPM guideline of approximately 80 ppb is not exceeded at any location in the study domain.

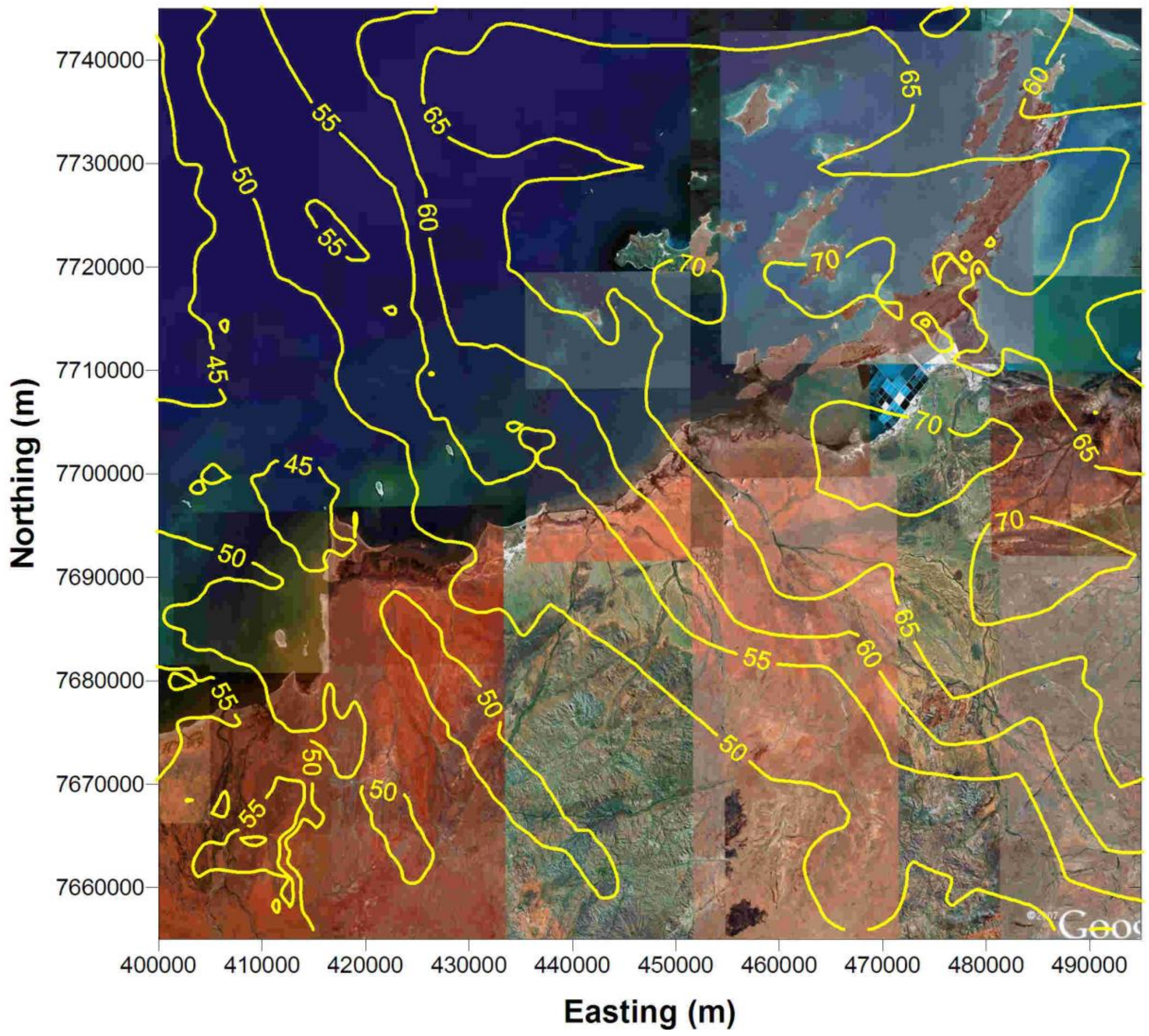
Predicted 2nd highest 1-hour O_3 concentrations are shown in Figure 6.5. Modelling indicates that the 2nd highest 1-hour concentration of 60 ppb occurs over the MEP. Over parts of the Burrup Peninsula and adjacent mainland areas, predicted 1-hour concentration is approximately 70 ppb. The NEPM guideline of 100 ppb is not exceeded at any location in the study domain.

Statistics of predicted O_3 concentration at the sensitive receptors in the region are shown in Figure 6.6. Annual average concentration of approximately 20 ppb occurs at all three receptors. Karratha has the highest short-term (1-hour) concentration of 71 ppb. The concentrations at the sensitive receptors are within the relevant air quality guidelines.



Species: O_3	**Location:** Pilbara	**Scenario:** Existing, approved & MEP Project	**Percentile:** 2nd Highest	**Averaging Time:** 4-hour
Model Used: TAPM V3	**Units:** ppb	**Guideline:** NEPM =80 ppb	**Met Data:** 1999 TAPM-Generated	**Plot:** P D'Abreton

Figure 6.4: Predicted 2nd highest 4-hour O_3 concentrations.



Species:	Location:	Scenario:	Percentile:	Averaging Time:
O_3	Pilbara	Existing, approved & MEP Project	2nd Highest	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
TAPM V3	ppb	NEPM =100 ppb	1999 TAPM-Generated	P D'Abreton

Figure 6.5: Predicted 2nd highest 1-hour O_3 concentrations.

Figure 6.6: O_3 concentration statistics at the discrete receptors.

7 CONCLUSIONS

Photochemistry modelling of the air shed over the Burrup Peninsula has been performed to assess the likely impact on the regional air quality from the proposed pellet and power plant forming part of the Mineralogy Expansion Project near Cape Preston.

Use was made of the TAPM V4 model. Emissions from current sources in the region, from the first two stages of the Mineralogy Cape Preston Iron Ore Project, and from the proposed staged development (Stage 3 to 5) were utilised in the modelling.

The results of the modelling (for existing, approved and proposed developments) indicate the following:

- The highest annual average NO_2 concentration of 3 ppb occurs over the MEP and the domain maximum of 4 ppb occurs over the Burrup Peninsula. The predictions are within the air quality guideline.
- The 2nd highest 1-hour NO_2 concentration of 49 ppb occurs over the MEP while over parts of the Burrup Peninsula, predicted 1-hour concentration is approximately 86 ppb. The predictions are within the air quality guideline.
- The 2nd highest 1-hour concentration of 60 ppb occurs over the MEP. Over parts of the Burrup Peninsula and adjacent mainland areas, predicted 1-hour concentration is approximately 70 ppb. The predictions are within the air quality guideline.
- The 2nd highest 4-hour concentration of 60 ppb occurs over the ocean to the northwest of the Burrup Peninsula. Predicted O_3 concentration is within the guideline value over the entire modelling domain.
- Further, the following are evident at the sensitive receptors:
    - Predicted NO_2 concentrations are within the air quality guideline at all three receptors.
    - Highest predicted 1-hour O_3 concentrations at the three sensitive receptors are within the air quality guideline.

The results of the photochemistry modelling show that increased NO_x emissions (with inclusion of Stages 3 to 5 of the MEP) into the air shed is unlikely to lead to exceedance of the NO_2 and O_3 air quality guidelines. It is important to note that the results presented in this report represent regional impacts, and are not to be interpreted as representing localised source-specific impacts.

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