

APPENDIX B

**NEWCASTLE COAL INFRASTRUCTURE GROUP
COAL EXPORT TERMINAL**

**AIR QUALITY IMPACT ASSESSMENT:
NEWCASTLE COAL EXPORT TERMINAL**

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1. INTRODUCTION

This report has been prepared by Holmes Air Sciences for Newcastle Coal Infrastructure Group (NCIG). NCIG proposes the construction and operation of a coal export terminal (CET) (the Project) to be located on Kooragang Island in Newcastle. The purpose of this report is to quantitatively assess the potential air quality impacts of the CET.

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

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

In summary, the report provides information on the following:

- the proposed operations and the local setting;
- air quality goals that need to be met to protect the air quality environment;
- meteorological and climatic conditions in the area;
- the existing air quality conditions in the area;
- the methods used to estimate dust emissions and the way in which dust emissions from the CET would disperse and fallout;
- the expected dispersion and dust fallout patterns due to emissions from the operations and a comparison between the predicted dust concentration and fallout levels and the relevant air quality criteria; and
- the recommended control methods to be used by NCIG to reduce dust impacts.

In addition, construction impacts and emissions of greenhouse gases and odour from the Project are discussed.

2. LOCAL SETTING PROJECT DESCRIPTION

NCIG has proposed the construction and operation of a 66 million tonnes per annum (Mtpa) CET on Kooragang Island. **Figure 1** shows the study area and location of the Project. **Figure 2** shows the local terrain of Kooragang Island and surrounds, which is generally flat and accommodates mainly industrial facilities and natural habitats. The nearest residential areas are Mayfield, approximately 2 kilometres (km) to the southwest of the Project, and Fern Bay, approximately three km to the east.

The main activities associated with the development of the CET would include:

- foundation preparation/capping of a rail corridor traversing the existing Kooragang Island Waste Emplacement Facility for the development of the rail spurs, rail sidings and rail loops;
- construction of rail spurs, rail sidings and rail loops, rail overpass, train unloading stations and connecting conveyors;
- re-use of dredged materials from the south arm of the Hunter River as preload and engineering fill for construction of the coal storage area, rail corridor and wharf facilities;
- construction of a coal storage area including coal stockpiles, conveyors, transfer points and combined stacker/reclaimers;
- construction of wharf facilities, shiploaders, conveyors and buffer bins;
- development of water management infrastructure including site drainage works, stormwater settlement ponds, primary and secondary settling ponds, site water pond, water tanks and stockpile spray system;
- installation of electricity supply, reticulation and control systems;
- development of access roads and internal roads;
- construction of administration and workshop buildings;
- other associated minor infrastructure, plant, equipment and activities; and
- operation of the CET up to a capacity of 66 Mtpa, including the unloading of coal trains from the Kooragang Island mainline, the stockpiling of coal, and the loading of coal to ships via the wharf facilities and shiploaders.

Figure 3 shows the proposed site layout and associated facilities. Once operational, the CET would have a throughput capacity of 66 Mtpa of coal. All coal would be received by rail.

Coal trains from the Hunter Valley would enter the CET site from the west and proceed in a clockwise direction around the rail loop. Coal would be unloaded from below each wagon to a hopper at the unloading station where it is then drawn out by a belt feeder and transferred by conveyor to the coal storage area. For operations at 66 Mtpa there would be two unloading stations, each designed to operate at up to 8,500 tonnes per hour (tph). An average of 26 trains would be unloaded per day and the maximum number of trains unloaded would be 40. The unloading station structure would be partially enclosed – that is, open at each end to accommodate train passage.

The coal storage area would be located to the east of the unloading station and would comprise a series of parallel pads and intermediate berms. As the capacity of the CET is increased up to 66 Mtpa the stockpiles would be developed from south to north. Coal would be stacked up to a maximum height of 25 metres (m) above the pads. There would be four rail-mounted combined stack/reclaimers working on the stockpiles. At peak capacity coal could be stockpiled at a rate of approximately 8,500 tph per stacker. Bucket wheels would be used to reclaim coal at a rate of up to 10,500 tph per reclaimer.

There would be a network of belt conveyors and transfer points around the site. These would facilitate the transfer of coal from the unloading station to the storage area and from the storage area to the wharf facilities and shiploaders. Buffer bins near the wharf would be used for temporary coal storage while ships are being loaded.

The CET would operate 24 hours per day, seven days per week.

The dust generating activities associated with the construction and operation of the CET will include:

- wind erosion from areas disturbed by construction activities and from the surfaces of stockpiled construction materials;
- material loading and unloading points;
- stacking and reclaim to and from coal stockpiles, and
- wind erosion from coal stockpiles.

The CET site is adjacent to the existing CET and facilities operated by Port Waratah Coal Services (PWCS). The PWCS operations include unloading of coal from trains, coal storage in stockpiles and transfer and loading of ships. The maximum consented capacity of the PWCS, Kooragang Island operation is 77 Mtpa.

3. AIR QUALITY GOALS

Table 1 and **Table 2** summarise the air quality assessment criteria that are relevant to this study. The air quality goals relate to the total dust burden in the air and not just the dust from the Project. In other words, some consideration of background levels needs to be made when using these goals to assess impacts. This is discussed further in **Section 8**.

Table 1 : Air quality assessment criteria for particulate matter concentrations

Pollutant	Standard/Goal	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 µg/m ³	Annual mean	NHMRC ¹
Particulate matter <10 µm (PM ₁₀)	50 µg/m ³	24-hour maximum [#]	DEC
	30 µg/m ³	Annual mean	DEC
	50 µg/m ³	(24-hour average, 5 exceedances permitted per year)	NEPM ²
Particulate matter <2.5 µm (PM _{2.5})	8 µg/m ³	Annual mean	NEPM ^{*2}
	25 µg/m ³	24-hour maximum	NEPM ^{*2}

* Long-term reporting goal. Not applicable to projects in NSW.

Non-cumulative for the purposes of impact assessment (refer to **Section 7**).

¹ National Health and Medical Research Council

² National Environment Protection Measure

Also included in **Table 1** are the NEPM goals for the fine fraction of PM₁₀ namely PM_{2.5}. PM_{2.5} has not been assessed as this part of the study as New South Wales has no ambient goal for PM_{2.5} applied on a project basis.

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 2** shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts (**DEC, 2005a**).

Table 2 : NSW DEC criteria for dust fallout

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

4. EXISTING ENVIRONMENT

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

4.1 Dispersion Meteorology

The Gaussian dispersion model used for this assessment, AUSPLUME, requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class¹ and mixing height². Meteorological data collected in the study area are discussed below.

Six years of meteorological information have been made available for this study by the Steel River Industrial Estate on the southern side of the Hunter River (south arm) (approximately 1 km from the Project). Steel River operates a weather station (see **Figure 1** for location) which collects 10-minute records of temperature, wind speed, wind direction and sigma-theta (a measure of the fluctuation of the horizontal wind direction). These data have been prepared into a form suitable for the AUSPLUME dispersion model.

Annual and seasonal wind-roses prepared from the 2000 to 2005 data are shown in **Figures 4 to 9** respectively. It can be seen from the wind-roses that, annually, the most common winds are from the WNW and NW. Winds from the east are also common, but to a lesser extent. In the summer months winds from the east indicate the direction of the sea-breeze while winds in winter are predominantly from the WNW. The wind patterns from year to year are considered to be quite similar, especially in summer and winter.

Wind data from Beresfield, Newcastle and Wallsend have also been examined in this study. These data were collected by the DEC in 2000 and wind-roses are provided in **Figures 10 to 12** to allow comparison with the Steel River data to be made. All of these three sites exhibit some similarities to the Steel River data to various extents. For example, all sites indicated that winds from the NW are common. Wallsend is perhaps the most different, with winds from the SW occurring most often.

Meteorological data have also been collected at the PWCS Kooragang Island site by Zib and Associates (see **Figure 1** for location). **Figure 13** shows the annual and seasonal wind-roses from 2004 and 2005 data. The pattern of winds from this site are consistent with the winds measured at the Steel River site.

The subtle differences in the wind patterns measured at each of the meteorological monitoring sites could be explained by differences in either the topography or landuse in which the meteorological station is located.

¹ In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

² The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

To use the wind data to assess dispersion it is necessary to also have available data on atmospheric stability. A stability class was calculated for each hour of the meteorological data using sigma-theta (a measure of the fluctuation of the horizontal wind direction) according to the method recommended by the United States Environmental Protection Agency (**US EPA, 1986**). **Table 3** shows the frequency of occurrence of the stability categories expected in the area as well as a summary of statistics for each year of data available from the Steel River site. The most common stability occurrences at the Steel River site were calculated to be D class stabilities (between around 51 and 57%) which suggests that dust emissions will disperse rapidly for a significant proportion of the time.

Table 3 : Summary of Steel River meteorological data

Year	2000	2001	2002	2003	2004	2005
Hours available for year	8477	8760	8612	8757	8594	8559
Mean wind speed (m/s)	3.6	3.5	3.4	3.4	3.2	3.2
Winds less than or equal to 0.5 m/s (%)	0.8	1.8	0.8	0.7	0.6	0.7
Occurrence of A class stabilities (%)	1.9	2.8	2.7	3.8	6.4	2.7
Occurrence of B class stabilities (%)	1.8	2.1	2.0	2.9	3.2	2.6
Occurrence of C class stabilities (%)	5.9	5.5	6.3	7.0	6.7	7.7
Occurrence of D class stabilities (%)	54.5	53.9	54.3	52.7	51.3	57.1
Occurrence of E class stabilities (%)	29.1	28.5	27.3	25.8	23.4	23.3
Occurrence of F class stabilities (%)	6.7	7.2	7.4	7.7	8.9	6.7

Mixing height was determined using a scheme defined by **Powell (1976)** for day-time conditions and an approach described by **Venkatram (1980)** for night-time conditions. These two methods provide a good estimate of mixing height in the absence of upper air data.

Given the proximity of the Steel River site to the Project site, these data are considered to contain meteorological conditions that are representative of the conditions experienced at the Project site. The 2001 data have been used in the dispersion modelling given that this dataset has the highest data capture.

Joint wind speed, wind direction and stability class frequency tables for the Steel River 2001 data are presented in **Appendix A**.

4.2 Local Climatic Conditions

The Bureau of Meteorology collects climatic information from Nobbys Head Signal Station at Newcastle. A range of meteorological data collected from this station are presented in **Table 4 (Bureau of Meteorology, 2005)**.

Table 4 : Climate information for the study area

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily maximum temperature - deg C	25.6	25.4	24.7	22.8	19.9	17.4	16.7	18	20.1	22.1	23.5	24.9	21.8
Mean no. of days where Max Temp >= 40.0 deg C	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1
Highest daily Max Temp - deg C	40.8	40.9	39	36.8	28.5	26.1	26.3	29.9	34.4	36.7	41	42	42
Mean daily minimum temperature - deg C	19.1	19.3	18.2	15.3	11.9	9.6	8.4	9.2	11.4	13.9	16	18	14.2
Mean no. of days where Min Temp <= 0.0 deg C	0	0	0	0	0	0	0	0	0	0	0	0	0
Lowest daily Min Temp - deg C	12	10.3	11.1	7.4	4.7	3	1.8	3.3	5	6.5	7.2	11	1.8
Mean 9am air temp - deg C	21.9	21.8	20.8	18	14.6	12	10.8	12.1	15	17.8	19.5	21.1	17.1
Mean 9am wet bulb temp – deg C	19.2	19.5	18.5	15.7	12.6	10.2	8.9	9.7	12.1	14.5	16.4	18.2	14.6
Mean 9am dew point - deg C	17.5	18.2	16.9	14.1	10.9	8.3	6.5	7	9	11.5	13.8	16.2	12.6
Mean 9am relative humidity - %	76	80	78	78	79	79	77	73	70	68	71	74	75
Mean 9am wind speed - km/h	21.2	21.2	21.1	21.6	23.9	26.9	26.9	26.1	25.6	24	23.5	21.9	23.7
Mean 3pm air temp - deg C	23.3	23.5	22.9	21.3	18.8	16.5	15.9	16.9	18.5	19.8	20.9	22.4	20.1
Mean 3pm wet bulb temp - deg C	19.9	20.3	19.5	17.3	14.9	12.7	11.7	12.3	13.9	15.6	17.2	18.8	16.2
Mean 3pm dew point - deg C	17.7	18.5	17.2	14.3	11.6	9.3	7.2	7.5	9.3	12.1	14.3	16.3	13
Mean 3pm relative humidity - %	72	74	72	66	64	63	59	56	59	64	68	71	66
Mean 3pm wind speed - km/h	33.9	33.2	31.1	28.3	26.6	28.9	29.5	31	34.7	35	36.1	35.9	32
Mean monthly rainfall – mm	91.4	105.6	121.9	115.9	118.6	117.8	97.2	76.2	73.7	74.3	69.5	82.4	1144.6
Median (5th decile) monthly rainfall - mm	72.2	84.4	95.6	90.9	103.4	84.8	80.8	59	57.4	63.7	63.3	62.7	1068
Mean no. of raindays	11.1	11.1	12.2	11.9	12.1	11.7	10.8	10.3	10	10.9	10.5	10.5	133
Highest monthly rainfall – mm	404	559.2	544.4	546.4	441.3	485.7	351.1	545.3	283.1	277.5	203.9	326.5	-
Lowest monthly rainfall – mm	2	0.5	2.8	0	2.1	3.6	0	0.8	1.6	4.6	2.4	4.6	-
Highest recorded daily rainfall – mm	144.8	252.7	283.7	231.1	181.9	190.3	118.6	168.9	157.5	96.5	103.7	177.5	283.7
Mean no. of clear days	6.3	5.3	6.4	7.4	6.9	7.5	9.7	10.8	9.3	7.4	5.5	6.3	88.7
Mean no. of cloudy days	12.4	12.1	11.7	10.7	11.9	11.7	9.5	8.3	9	12.1	12.3	11.7	133.4
Highest recorded wind gust - km/h	142.6	140.8	137.2	114.8	170.6	151.9	139	135.4	131.4	140.8	144.7	129.6	170.6

Climate averages for Station: 061055 Newcastle Nobbys Signal station. Commenced: 1862; Last record: 2004; Latitude (deg S): 32.9185; Longitude (deg E): 151.7985; State: NSW

Source : Bureau of Meteorology (2005)

Temperature data show that January is typically the warmest month with a mean daily maximum of 25.6°C. July is the coldest month with a mean daily minimum of 8.4°C. Rainfall data collected at Nobbys Head show that March is the wettest month with a mean rainfall of 122 millimetres (mm) over 12 rain days. Annually the area experiences, on average, 1,145 mm of rain per year.

4.3 Existing Air Quality

Air quality standards and goals refer to pollutant levels which include the Project and existing sources. To fully assess impacts against all the relevant air quality standards and goals (see **Section 3**) it is necessary to have information on or estimates of existing dust concentration and deposition levels in the area in which the Project is likely to contribute to these levels.

The DEC operate air quality monitoring stations at Beresfield, Newcastle and Wallsend (refer **Figure 1** for locations). These three sites measure concentrations of PM₁₀ by high volume air sampler (HVAS) and tapered element oscillating microbalance (TEOM) however, no TSP measurements are made. Summaries of these data are published in quarterly air quality monitoring reports by the DEC (**DEC, 2005b**). Monitoring data from the three DEC monitoring locations in the vicinity of Newcastle since 2000 are shown below in **Table 5**.

At Beresfield the annual average PM₁₀ concentration by HVAS has ranged between 18 and 25 µg/m³ for the years 2000 to 2003. Using a TEOM the range was between 18 and 26 µg/m³. The Beresfield site is located at a school, approximately 10 km to the northwest of the Project site.

At Newcastle the annual average PM₁₀ concentration by HVAS has ranged between 20 and 23 µg/m³, for all complete years, and has been 22 µg/m³ since monitoring using a TEOM commenced in October 2004. The Newcastle site is located at the athletics field, approximately 6 km to the south of the Project site.

At Wallsend the annual average PM₁₀ concentration has ranged between 17 and 21 µg/m³ using both the HVAS and TEOM. The Wallsend site is located near the Wallsend swimming pool, approximately 7 km to the southwest of the Project site.

All annual averages for complete years were below the DEC air quality goal of 30 µg/m³.

Maximum 24-hour average PM₁₀ concentrations have been above the DEC 50 µg/m³ goal on several occasions at all three monitoring locations using either the HVAS or TEOM. The highest 24-hour average PM₁₀ concentrations were generally measured in spring and summer.

Table 5 : Summary of PM₁₀ monitoring in the Newcastle area

Month	Beresfield (µg/m ³)				Newcastle (µg/m ³)				Wallsend (µg/m ³)			
	HVAS		TEOM		HVAS		TEOM		HVAS		TEOM	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Jan-00	21.0	21.0	17.0	-	24	32	-	-	26	31	18	-
Feb-00	25.0	33.0	20.0	-	29	40	-	-	18	32	19	-
Mar-00	18.0	24.0	18.0	-	20	27	-	-	16	19	17	-
Apr-00	15.0	17.0	16.0	-	17	20	-	-	14	17	15	-
May-00	18.0	30.0	17.0	-	17	26	-	-	15	26	15	-
Jun-00	17.0	22.0	16.0	-	18	26	-	-	17	25	13	-
Jul-00	15.0	22.0	16.0	-	14	22	-	-	14	19		-
Aug-00	14.0	31.0	15.0	-	16	25	-	-	12	20		-
Sep-00	19.0	35.0	24.0	-	23	41	-	-	17	31		-
Oct-00	18.0	33.0	19.0	-	20	42	-	-	16	34		-
Nov-00	15.0	18.0	17.0	-	19	25	-	-	15	17	15	-
Dec-00	20.0	35.0	20.0	-	24	40	-	-	21	33	20	-
Annual Ave	17.9	35.0	17.9	-	20.1	42.0	-	-	16.8	34.0	16.5	-
Jan-01	23.0	44.0	21.0	-	24	33	-	-	24	34	22	-
Feb-01	14.0	24.0	19.0	-	19	28	-	-	15	24	20	-
Mar-01	20.0	30.0	19.0	-	26	36	-	-	22	33	19	-
Apr-01	16.0	23.0	21.0	-	18	26	-	-	15	19	18	-
May-01	14.0	19.0	17.0	-	14	19	-	-	13	17	15	-
Jun-01	21.0	31.0	22.0	-	23	34	-	-	19	28	16	-
Jul-01	22.0	33.0	18.0	-	17	24	-	-	14	22	13	-
Aug-01	17.0	26.0	21.0	-	14	19	-	-	14	22	15	-
Sep-01	18.0	35.0	20.0	-	16	23	-	-	15	19	16	-
Oct-01	16.0	20.0	30.0	-	15	24	-	-	12	16	15	-
Nov-01	23.0	50.0	22.0	-	22	30	-	-	16	24	18	-
Dec-01	24.0	38.0	30.0	-	33	68	-	-	27	52	27	-
Annual Ave	19.0	50.0	21.7	-	20.1	68.0	-	-	17.2	52.0	17.8	-

Month	Beresfield ($\mu\text{g}/\text{m}^3$)				Newcastle ($\mu\text{g}/\text{m}^3$)				Wallsend ($\mu\text{g}/\text{m}^3$)			
	HVAS		TEOM		HVAS		TEOM		HVAS		TEOM	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Jan-02	25	43	27	59	22	34	-	-	19	25	24	64
Feb-02	20	25	16	25	20	24	-	-	19	24	16	23
Mar-02	27	41	23	55	25	36	-	-	26	33	19	38
Apr-02	14	15	18	35	18	20	-	-	12	14	15	22
May-02	18	23	19	38	15	19	-	-	14	17	15	24
Jun-02	14	25	20	51	20	33	-	-	18	23	17	51
Jul-02	25	34	26	47	16	23	-	-	18	28	19	30
Aug-02	19	26	23	36	19	24	-	-	16	23	18	24
Sep-02	25	31	26	52	23	36	-	-	21	34	19	41
Oct-02	30	45	41	149	29	43	-	-	23	36	29	45
Nov-02	54	81	40	83	43	57	-	-	39	54	33	60
Dec-02	29	58	31	166	29	52	-	-	22	39	30	157
Annual Ave	25.0	81.0	25.8	166.0	23.3	57.0	-	-	20.6	54.0	21.2	157.0
Jan-03	27	38			32	45	-	-	20	30	31	89
Feb-03	25	35	20	39	26	35	-	-	15	25	21	49
Mar-03	25	53	19	59	25	43	-	-	16	31	17	41
Apr-03	17	31	16	34	19	32	-	-	11	18	11	17
May-03	17	22	16	30	20	25	-	-	13	18	13	21
Jun-03	20	28	18	31	20	34	-	-	14	21	14	24
Jul-03	18	29	17	27	15	19	-	-	13	18	13	19
Aug-03	19	35	20	35	18	26	-	-	17	21	18	31
Sep-03	26	41	25	51	27	40	-	-	21	32	21	44
Oct-03	29	82	17	88	29	72	-	-	24	76	17	105
Nov-03	21	45	17	49	21	42	-	-	18	34	17	37
Dec-03	16	24	20	34	18	22	-	-	15	19	19	32
Annual Ave	21.7	82.0	18.6	88.0	22.5	72.0	-	-	16.4	76.0	17.7	105.0
Jan-04	-	-	20	33	-	-	-	-	-	-	22	29
Feb-04	-	-	25	44	-	-	-	-	-	-	24	43
Mar-04	-	-	22	40	-	-	-	-	-	-	21	34
Apr-04	-	-	22	48	-	-	-	-	-	-	19	34

Month	Beresfield ($\mu\text{g}/\text{m}^3$)				Newcastle ($\mu\text{g}/\text{m}^3$)				Wallsend ($\mu\text{g}/\text{m}^3$)			
	HVAS		TEOM		HVAS		TEOM		HVAS		TEOM	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
May-04	-	-	28	44	-	-	-	-	-	-	20	38
Jun-04	-	-	19	34	-	-	-	-	-	-	15	20
Jul-04	-	-	19	38	-	-	-	-	-	-	15	25
Aug-04	-	-	17	33	-	-	-	-	-	-	15	29
Sep-04	-	-	16	30	-	-	-	-	-	-	15	29
Oct-04	-	-	18	49	-	-	20	26	-	-	18	43
Nov-04	-	-	22	38	-	-	22	44	-	-	19	36
Dec-04	-	-	22	56	-	-	25	47	-	-	21	53
Annual Ave	-	-	20.8	56.0	-	-	22.3	47.0	-	-	18.7	53.0
Jan-05	-	-	20	35	39	-	22	85	-	-	21	35
Feb-05	-	-	25	53	43	-	26	189	-	-	24	36
Mar-05	-	-	16	30	29	-	20	93	-	-	15	26
Apr-05	-	-	20	46	38	-	24	149	-	-	18	28
May-05	-	-	20	40	32	-	21	93	-	-	16	25
Jun-05	-	-	20	38	39	-	21	91	-	-	17	28
Jul-05	-	-	-	-	-	-	-	-	-	-	-	-
Aug-05	-	-	-	-	-	-	-	-	-	-	-	-
Sep-05	-	-	-	-	-	-	-	-	-	-	-	-
Oct-05	-	-	-	-	-	-	-	-	-	-	-	-
Nov-05	-	-	-	-	-	-	-	-	-	-	-	-
Dec-05	-	-	-	-	-	-	-	-	-	-	-	-
Annual Ave	-	-	20.2	53.0	36.7	-	22.3	189.0	-	-	18.5	36.0

Neither TSP concentrations nor dust deposition are measured by the DEC in the vicinity of Newcastle, however dust deposition data are collected for the Steel River Industrial Estate. **Table 6** summarises these data. It should be noted that some of these data have been affected by construction activities associated with the Steel River Industrial Estate. Therefore, the data may have captured the very localised activities and may not necessarily be representative of the broader, regional dust fallout levels.

Table 6 : Dust deposition monitoring from the Steel River operations

Month	g/m ² /month						
	SR1	SR2	SR3	SR4	SR5	SR6	SR7
Jan-03	1.5	1.5	1.8	21.4*	1.5	3.4	2.6
Feb-03	-	-	-	-	-	-	-
Mar-03	0.5	0.5	1.3	-	0.7	1.1	3.5
Apr-03	0.8	0.9	0.8	-	0.7	0.5	0.9
May-03	-	-	-	-	-	-	-
Jun-03	1.5	1.2	0.7	-	0.6	0.9	3
Jul-03	1.6	1.2	1.6	-	1.1	1.3	4.9
Aug-03	0.9	0.3	0.3	-	0.1	0.3	3.4
Sep-03	1.2	2.2	0.8	-	0.6	1	5.6
Oct-03	0.9	0.7	1	-	0.5	1.3	4.1
Nov-03	1.3	1.5	1.5	-	1	1.8	-
Dec-03	1.5	7.2	2.2	-	0.9	1.9	6.7
Annual Ave	1.2	1.7	1.2	-	0.8	1.4	3.9
Jan-04	1.6	1.5	2.1	-	2.6	2.1	-
Feb-04	1.1	0.7	1.2	-	0.8	0.9	3.9
Mar-04	1.1	0.9	-	-	0.9	-	-
Apr-04	1.6	-	1.6	-	1.5	1.7	1.8
May-04	0.7	0.8	0.7	-	0.5	0.8	0.7
Jun-04	1.4	0.7	1	-	0.6	0.1	0.7
Jul-04	1	1.4	1.4	-	1.1	1.3	1.2
Aug-04	-	-	1.1	-	0.9	1.3	1.1
Sep-04	3.3	-	1.8	-	1.1	1.3	-
Oct-04	2.4	1.9	-	-	2	2.2	27.5*
Nov-04	1.2	1.7	1.6	-	1.2	2	1.8
Dec-04	1.9	1.5	1.9	-	2.1	2.7	2.4
Annual Ave	1.6	1.2	1.4	-	1.3	1.5	1.7
Jan-05	1.2	-	1.5	-	2.4	1.4	4.8
Feb-05	2.9	2.1	1.6	-	1.7	2.4	2.7
Mar-05	1	1	2.1	-	1.1	2	1
Apr-05	-	0.7	1.2	-	0.8	1.6	0.8
May-05	0.9	1	1.6	-	1	1.5	0.9
Jun-05	2.1	3.1	1.3	-	0.9	1.8	1.3
Jul-05	0.7	2.2	1	-	0.4	0.7	0.5
Aug-05	1.4	0.8	1.1	-	1	1	1.8
Sep-05	1.2	1.1	1.7	-	1.6	2.1	2.1
Oct-05	1.9	1.6	2.4	-	1.4	2.1	4.8
Nov-05	1.4	1.3	2.8	-	1.5	2.3	1.8
Dec-05	1.5	1.5	2.5	-	2	5	2.6
Annual	1.5	1.5	1.7	-	1.3	2.0	2.1
Jan-06	0.9	2.4	4.1	-	2.6	3.3	1.3

Source: Connell-Wagner (2006)
* nearby construction activities

The dust deposition data from the Steel River site show that annual average levels have been below the DEC goal of 4 g/m²/month. There were, however, occasions when local construction activities contributed to the very high monthly levels. The average of all the data from all gauges is 1.6 g/m²/month.

Monitoring data from areas in the Hunter Valley where co-located TSP and PM₁₀ monitors have been operated for reasonably long periods of time indicate that long term average PM₁₀ concentrations are approximately 40% of the corresponding long-term TSP concentration (**NSW Minerals Council, 2000**). A value of 53 µg/m³ for annual average TSP has been derived from the annual average PM₁₀ (21 µg/m³) and assumes that 40% of the TSP is PM₁₀.

Annual average dust deposition has been conservatively taken to be 2 g/m²/month, based on the average from the Steel River data.

In summary, from the available monitoring data it has been assumed that the following background concentrations apply in the vicinity of the Project.

- Annual average TSP of 53 µg/m³;
- Annual average PM₁₀ of 21 µg/m³; and
- Annual average dust deposition of 2 g/m²/month.

In addition, the DEC guidelines require an assessment against 24-hour PM₁₀ concentrations. This assessment adopts the approach that the predicted 24-hour average PM₁₀ concentration from the development should be less than 50 µg/m³ at the nearest residences.

The PWCS Kooragang Island also monitor TSP, PM₁₀ and dust deposition in the area. At the PWCS HVAS site at Fern Bay, to the east of the Project site, the average TSP and PM₁₀ concentrations from 2000 to present are 46 and 22 µg/m³ respectively. These results suggest that the assumed background TSP level of 53 µg/m³, used for this study, is conservative while the PM₁₀ results of 21 and 22 µg/m³ are comparable.

5. ESTIMATED DUST EMISSIONS

Dust emissions will arise from a range of activities associated with the CET. Total dust emissions due to the Project have been estimated by analysing the activities taking place at the site for operations at maximum throughput, that is, at 66 Mtpa.

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

The operational description for the Project has been used to determine material quantities, equipment locations, stockpile locations and areas, activity operating hours and other details that are necessary to estimate dust emissions.

The most significant dust generating activities from the Project have been identified and the dust emission estimates are presented below in **Table 7**. Details of the calculations of the dust emissions are provided in **Appendix B**.

Table 7 : Estimated dust emissions due to the Project

Activity	Annual TSP emission rate (kg/y)	
	66 Mtpa operations	33 Mtpa operations
Trains unloading to unloading station	21,454	10,727
1st transfer between unloading station and stockpiles	21,454	10,727
2nd transfer between unloading station and stockpiles	21,454	10,727
Stacking to coal stockpiles	21,454	10,727
Reclaiming coal from stockpiles	18,192	9,096
1st transfer between stockpile and shiploader	18,192	9,096
2nd transfer between stockpile and shiploader	18,192	9,096
Transfer to buffer bins (enclosed)	0	0
3rd transfer between stockpile and shiploader	18,192	9,096
Loading coal to ships	18,192	9,096
Wind erosion from coal stockpiles	127,839	62,524
Dozer working on coal stockpiles	1,595 (Maximum of 31 kg/day)	1,595 (Maximum of 31 kg/day)
Diesel train exhausts	894	447
TOTAL	307,103	152,953

It can be seen from **Table 7** that wind erosion from the coal storage stockpiles has been determined to generate the most dust on an annual basis. Clearly the 66 Mtpa operations have the potential to cause higher dust impacts than operations at 33 Mtpa.

It is relevant to note that the predicted emission due to wind erosion from coal stockpiles does not take into account the use of water sprays. Hence, the predicted emissions from wind erosion are considered to be conservative.

Coal dust emissions from the transfer points, unloading and loading activities in **Table 7** have some dependence on the coal moisture content. A review of the publication “*NSW Coal Industry Profile 2005*” (**Department of Primary Industries, 2005**) indicated that coal moisture contents are typically around 8 – 9 %. Therefore, moisture contents have been assumed as 8% for in-bound coal (that is, from the train unloading station to coal stockpiles) and 9% for out-bound coal (that is, from stockpiles to the shiploading facilities). Given that rain gun type water sprays would be used on coal stockpiles, it is expected that the assumed out-bound coal moisture content would be conservative in practice.

6. DUST CONTROL MEASURES

The controls that are available for the CET Project can be summarised in three broad categories:

1. Engineering controls;
2. Planning controls (which increase the separation between dust emission sources at the CET and sensitive areas); and
3. Operational controls which vary operations when adverse meteorological conditions occur.

Engineering controls involve measures such as:

- covering and enclosing conveyors and transfer points;
- using dust collection systems at the rail unloading station; and
- installation of spray systems on transfer points and stockpiles.

Planning controls include the maintenance of adequate buffer distances between dust sources and sensitive receptors. In this respect the major dust generating activities at the CET (i.e. coal storage area) would have a reasonable separation distance of over 2 km from the nearest residential areas of Mayfield.

The specific dust control measures that are proposed for the Project include:

- moisture levels of the coal stockpiles would be monitored and maintained to minimise dust emissions;
- a dust extraction system would be provided at the train unloading stations, with the hopper designed for dust containment;
- coal transfer conveyors would be covered or enclosed on three sides, except for yard and wharf conveyors;
- conveyors over roads would be fully enclosed;
- transfer points would be fully enclosed;
- buffer bins would be fully enclosed; and
- water sprays would be used on stockpiles and immediately after transfer points.

The water sprays for the coal stockpiles would include rain gun type sprays mounted on the berms approximately 60 m apart on each side of the coal stockpiles. The system would be controlled by software integrated with an on-site weather station. The moisture status of stockpiles and relevant meteorological conditions would be monitored and dust suppression sprays would be automatically activated on the coal stockpiles to minimise dust emissions.

7. APPROACH TO ASSESSMENT

In August 2005 the DEC published new guidelines for the assessment of air pollution sources using dispersion models (**DEC, 2005a**). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data to be used in dispersion models, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal. This assessment has been undertaken in general accordance with the new DEC guidelines.

Off-site dust concentration and dust deposition levels due to the proposed CET have been predicted using AUSPLUME. AUSPLUME (Version 6.0) is an advanced Gaussian dispersion model developed on behalf of the Victorian EPA (**VEPA, 1986**) and is based on the US EPA's Industrial Source Complex (ISC) model. It is widely used throughout Australia and is regarded as a "state-of-the-art" model. AUSPLUME is the model required for use by the DEC unless Project characteristics dictate otherwise (**DEC, 2005a**).

The modelling has been based on the use of three particle-size categories: 0 to 2.5 μm - referred to as $\text{PM}_{2.5}$ or fine particles (FP), 2.5 to 10 μm - referred to as CM (coarse matter) and 10 to 30 μm - referred to as the Rest. Emission rates of TSP have been calculated using emission factors derived from **US EPA (1985)** and **NERDDC (1988)** work (see **Appendix B**).

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

- $\text{PM}_{2.5}$ (FP) is 4.7% of the TSP;
- $\text{PM}_{2.5-10}$ (CM) is 34.4% of TSP; and
- PM_{10-30} (Rest) is 60.9% of TSP.

Modelling was done using three AUSPLUME source groups. Each group corresponded to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range, except for the $\text{PM}_{2.5}$ group, which was assumed to have a particle size of 1 μm . The predicted concentration in the three plot output files for each group were then combined according to the weightings in the above dot points to determine the concentration of PM_{10} and TSP.

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

For the current study the operations were represented by a series of volume sources located according to the site layout. **Figure 14** shows the location of the modelled sources. Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depended upon the level of activity and the wind speed. It is important to do this in the AUSPLUME model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds at a CET site would correspond with periods of low dust generation (because wind erosion and other wind dependent emissions rates will be low) and also correspond with periods of poor dispersion. If these measures are not taken the model has the potential to significantly overstate impacts.

Dust concentrations and deposition rates have been predicted in the vicinity of the Project area. Receptor heights have been obtained from information on the local terrain.

The modelling has been performed using the meteorological data discussed in **Section 4.1** and the dust emission estimates from **Section 5**. All dust sources have been modelled assuming 24-hour per day operations, except for the dozer which has been modelled for day-time hours only – that is, between 6 am and 6 pm. For predictions of maximum 24-hour averages the dozer (working on coal stockpiles) has been assumed to operate for three hours every day of the year, instead of the three hours per week that is estimated that the dozer will actually be required.

As an example the AUSPLUME model output file is provided in **Appendix C**.

8. ASSESSMENT OF IMPACTS

8.1 Preamble

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

Dust concentrations and deposition rates due to the operation of the CET at 66 Mtpa have been presented as isopleth diagrams in **Figure 15** showing the following:

1. Predicted maximum 24-hour average PM₁₀ concentration;
2. Predicted annual average PM₁₀ concentration;
3. Predicted annual average TSP concentration; and
4. Predicted annual average dust deposition.

The maximum 24-hour average contour plots do not represent the dispersion pattern for any particular day, but show the highest predicted 24-hour average concentration that occurred at each location. The maxima are used to show concentrations which can possibly be reached under the modelled conditions.

8.2 Assessment of Impacts

Figure 15 includes plots showing the predicted maximum 24-hour average PM₁₀ concentrations due to the CET operations. At the residential areas of Mayfield to the southwest of the site, the predicted concentrations are of the order of 2 µg/m³. The prediction at each location on the plot represents the worst day due to emissions from the CET. The nearest residential areas are approximately 2 km from the major Project dust sources (i.e. coal storage area). These predicted concentrations are well below the DEC 50 µg/m³ goal at the nearest residential areas and at industrial receptors on Kooragang Island.

Predicted annual average PM₁₀ concentrations due to the CET operations are less than 2 µg/m³ offsite and less than 0.2 µg/m³ at the nearest residential areas of Mayfield to the southwest and Fern Bay to the east (**Figure 15**). Taking account of an average PM₁₀ background concentration of 21 µg/m³, the predicted concentrations are well below the air quality goal (30 µg/m³) at the nearest residential areas and at industrial receptors on Kooragang Island.

Predicted annual average TSP concentrations are shown in **Figure 15**. The model predictions show that the nearest residential areas would experience annual average TSP concentrations less than 0.5 µg/m³ due to the operations of the CET. Taking account of an average TSP background concentration of 53 µg/m³, the predicted concentrations are well below the air quality goal (90 µg/m³) at the nearest residential areas and at industrial receptors on Kooragang Island.

Figure 15 includes the predicted annual average dust deposition. The contribution of dust emissions to existing dust deposition levels is predicted to be low at less than 0.05 g/m²/month at the nearest residential area. It is unlikely that the operation of the CET would be the cause of exceedances of the 4 g/m²/month air quality goal. Also, the air quality impact at nearest residential areas due to the Project on its own is predicted to be less than the 2 g/m²/month “maximum increase” goal noted by the DEC. The predicted concentrations are also well below the dust deposition criteria at industrial receptors on Kooragang Island.

Operations at 33 Mtpa have also been modelled, with the results shown in **Figure 16**. As expected, model predictions for the 33 Mtpa scenario are lower than for the 66 Mtpa scenario. Given that compliance with air quality goals is predicted for the 66 Mtpa operations, it follows that compliance with air quality goals for 33 Mtpa operations is also predicted.

8.3 Cumulative Impacts

The air quality assessment adopted the approach that the predicted 24-hour average PM₁₀ concentrations from the development should be less than 50 µg/m³ at the nearest sensitive receptors. Recent conditions of consent for mines in New South Wales have assisted with the interpretation of this criterion.

The conventional approach to the assessment of air quality impacts from a proposal is to add the predicted incremental impact of the Project to background levels and to compare the result with the relevant air quality goal. This approach is referred to as a cumulative assessment and for annual averages, this approach has been adopted.

For a cumulative assessment it is also relevant to consider approved developments, that is, the subject of a development consent, whether or not the development has commenced. Below is a summary of potentially significant developments in the vicinity of the Project that have not been commenced to date or are understood to be not currently operating to their full consented capacity:

- PWCS Kooragang Island operations have a current capacity of 64 Mtpa and a maximum consented capacity of 77 Mtpa. Upgrade to full consented capacity is scheduled to be completed during 2007 (PWCS website).
- The Cargill Oilseed facility expansion has recently been granted development consent. The facility is located on Kooragang Island.
- The Multi Purpose Terminal is a consented bulk export facility on the former BHP steelworks site, located across the Hunter River (south arm) adjacent to the Project. Whilst the Multi Purpose Terminal has development consent, it is understood that there are no current plans to develop the terminal.
- The Proposed Extension of Shipping Channels Project (proponent NSW Waterways) relates to dredging of the Hunter River (south arm) and would be temporary in nature.

Dust emissions from PWCS Kooragang Island would be expected to incrementally increase following the commissioning of the expansion from the existing capacity (64 Mtpa) to the maximum consented capacity of 77 Mtpa.

Due to the nature of the Cargill Oilseed facility operation, the Environmental Assessment (**Cargill, 2005**) for its expansion did not consider particulate matter in the air quality assessment. The expansion is not expected to increase dust emissions in the locality.

Dust emissions from the Multi Purpose Terminal are expected to be predominantly from the construction of the facility and from the associated demolition of existing infrastructure associated with the former BHP steelworks. It was noted in the accompanying Environmental Impact Statement (EIS) (**URS, 2000**) that the construction activities would be temporary and that an Environmental Management Plan (EMP) would be prepared. The EMP would include dust mitigation measures to ensure that off-site impacts would be at acceptable levels.

The South Arm Dredging Operations EIS (**GHD, 2003**) included a number of recommendations for mitigating dust impacts from the operations. The EIS concluded that with the implementation of these measures, dust impacts would not be significant.

Based on the above, the approved PWCS Kooragang Coal Terminal was included quantitatively in the assessment of cumulative air quality impacts.

Assessment of cumulative 24-hour average PM₁₀ air quality impacts is often complicated as there may be many occasions when background concentrations are already above the 24-hour average air quality goal. For a more refined analysis, the DEC recommends (**DEC, 2005a**) that there should be no additional exceedances of the 50 µg/m³ goal. Contemporaneous hourly PM₁₀ monitoring data are required for this assessment and these data are available for Beresfield, to the west of the Project site (**Figure 1**). These data were collected by the DEC in 2001.

The approach to address potential cumulative PM₁₀ impacts is summarised below:

- re-run the AUSPLUME dispersion model for 66 Mtpa operations for three sensitive receptor locations in the area;
- predict 24-hour average PM₁₀ concentrations at the three sensitive receptor locations and match the predictions with contemporaneous TEOM PM₁₀ monitoring data from Beresfield;
- tabulate results of 24-hour average PM₁₀ concentrations at each location showing highest background with corresponding increment from Project and highest predicted increment with corresponding background; and
- assess the model predictions in the context of proposed contribution of expanded PWCS Kooragang Island operations.

The three sensitive receptor locations used for this assessment are shown in **Figure 17**. Receptors have been chosen to represent the nearest residential areas of Mayfield, Stockton and Fern Bay. Incremental dust emissions from the Project was modelled at the three receptors.

Figure 18 shows a time series of the background 24-hour average PM₁₀ as well as the increment from the modelled sources at the three receptor locations. It can be seen from this figure that the measured background levels at Beresfield were above the 50 µg/m³ goal on five days in 2001. The exceedances were generally in the warmer months, towards the end of the year. There were also a few occasions when measured concentrations were between 40 and 50 µg/m³. The predicted increment from the Project at all three receptor locations represents a small fraction of background levels.

Table 8 summarises the dispersion model results for 24-hour average PM₁₀ concentrations at the selected sensitive receptor locations. The top 10 background levels and predicted PM₁₀ increments are shown.

Table 8 : Summary of dispersion model results for PM₁₀ at sensitive receptors

Date	Background levels ranked			Model predictions ranked			
	Beresfield PM ₁₀ – RANKED	Increment from Project	TOTAL cumulative impact	Date	Beresfield PM ₁₀	Increment from Project - RANKED	TOTAL cumulative impact
Mayfield receptor (µg/m³)							
27/12/2001	82.0	0.12	82.1	6/11/2001	37.2	2.36	39.5
30/12/2001	62.6	0.00	62.6	1/10/2001		2.20	2.2
24/12/2001	53.0	0.11	53.1	3/2/2001	20.5	2.17	22.7
2/11/2001	52.3	0.00	52.3	14/3/2001	19.5	2.00	21.5
29/10/2001	51.1	0.01	51.1	15/3/2001	15.2	1.77	17.0
29/12/2001	46.4	0.84	47.2	3/1/2001	19.5	1.64	21.1
28/12/2001	45.1	0.23	45.3	8/4/2001	11.7	1.60	13.3
19/4/2001	44.9	0.12	45.0	5/11/2001	32.2	1.58	33.8
25/12/2001	44.8	0.00	44.8	22/10/2001	30.5	1.55	32.0
30/10/2001	44.0	0.34	44.4	1/9/2001	21.3	1.53	22.8
Stockton receptor (µg/m³)							
27/12/2001	82.0	0.00	82.0	20/6/2001	22.4	2.20	24.6
30/12/2001	62.6	0.42	63.0	4/9/2001	19.5	1.82	21.3
24/12/2001	53.0	0.51	53.5	8/7/2001	9.6	1.78	11.4
2/11/2001	52.3	0.01	52.4	25/5/2001	28.7	1.76	30.4
29/10/2001	51.1	0.43	51.5	10/8/2001	26.1	1.73	27.9
29/12/2001	46.4	0.04	46.4	21/8/2001	16.7	1.73	18.4
28/12/2001	45.1	0.22	45.3	23/4/2001	17.3	1.70	19.0
19/4/2001	44.9	0.46	45.4	13/5/2001	23.0	1.70	24.7
25/12/2001	44.8	0.57	45.4	16/9/2001		1.69	1.7
30/10/2001	44.0	0.14	44.2	26/5/2001	19.3	1.62	20.9
Fern Bay receptor (µg/m³)							
27/12/2001	82.0	0.01	82.0	10/9/2001	26.0	1.19	27.2
30/12/2001	62.6	0.14	62.7	23/6/2001	19.2	0.86	20.1
24/12/2001	53.0	0.20	53.2	6/8/2001	16.7	0.85	17.6
2/11/2001	52.3	0.10	52.4	28/8/2001	8.9	0.82	9.8
29/10/2001	51.1	0.05	51.1	18/8/2001	28.4	0.76	29.1
29/12/2001	46.4	0.37	46.7	31/10/2001	40.6	0.74	41.3
28/12/2001	45.1	0.04	45.1	30/5/2001	15.6	0.69	16.3
19/4/2001	44.9	0.07	45.0	14/7/2001	15.6	0.67	16.2
25/12/2001	44.8	0.48	45.3	17/7/2001	27.2	0.67	27.9
30/10/2001	44.0	0.20	44.2	27/10/2001	22.1	0.63	22.8

* 0.00 means less than 0.005

It can be seen from **Table 8** that, by this methodology, there are no instances whereby the predicted increment from the Project causes the total cumulative impact to be above 50 µg/m³. This assessment cannot, however, dismiss the possibility of a scenario where the background is close to the goal, say 49 µg/m³, with an additional contribution from the Project of around 2 or 3 µg/m³. The occurrence of any exceedance such as this would be when the background PM₁₀ concentrations are already close to the goal. Given that the highest 24-hour PM₁₀ prediction at any of the three receptor locations is 3 µg/m³, this scenario is unlikely to occur.

Further, the expansion of PWCS Kooragang Island operations would see an additional 13 Mtpa (that is, 64 to 77 Mtpa) of coal handled on Kooragang Island. This would essentially represent an increase of 20% over the modelled increment from the Project (at 66 Mtpa) shown in **Table 8** [from (13/66)]. Although this increase is an indicative estimate, that could only be verified with detailed emission estimates and modelling for PWCS, the increase of the modelled increment results in **Table 8** by 20% would not present any additional instances where the total cumulative impacts are above the 50 $\mu\text{g}/\text{m}^3$ goal.

With respect to the other key criteria, namely annual average PM_{10} , TSP and dust deposition; it is noted from **Section 8.2** that the predicted contribution from the Project at the nearest residential areas are as follows:

- Annual average PM_{10} - 0.2 to 0.5 $\mu\text{g}/\text{m}^3$ (criterion 30 $\mu\text{g}/\text{m}^3$);
- Annual average TSP - 0.2 to 1 $\mu\text{g}/\text{m}^3$ (criterion 90 $\mu\text{g}/\text{m}^3$); and
- Annual average dust deposition – 0.02 to 0.05 $\text{g}/\text{m}^2/\text{month}$ (criterion 2 $\text{g}/\text{m}^2/\text{month}$).

Allowing for the increase in Project emissions of 20% to represent the expansion of PWCS Kooragang Island operations (as described above), and in consideration of the background air quality, the criteria for annual average PM_{10} , TSP and dust deposition would not be exceeded at the nearest residential areas. The predicted impacts from the Project are considerably lower than the air quality criteria. This allows for some variation to the assumed background levels without changing the conclusions of the assessment.

Therefore, the cumulative impacts of the Project, including the consented expansion of PWCS operations, are taken to be acceptable.

8.4 Construction Issues

A number of construction activities are proposed as part of the Project. These would include construction of the rail spurs, rail loops and overpasses, unloading stations, conveyors, coal storage areas, wharf facilities, ship-loaders and other infrastructure. The Project would be initially constructed to a capacity of 33 Mtpa. Following commissioning of the 33 Mtpa CET, development of the Project up to 66 Mtpa would occur on a progressive basis. Construction work for the 33 Mtpa CET would be expected to be completed over a 33 month period before coal could be loaded to ships. **Table 9** provides an indicative timetable for construction of each Project component.

Table 9 : Indicative timetable for construction activities

Component	Estimated duration*
Construction of administration and workshop buildings, access roads and internal roads	6 months
Construction of rail spur, rail sidings, rail loop and rail overpass	18 months
Preloading of the coal storage area using dredged material	18 months
Construction of coal storage areas	21 months
Construction of wharf facilities and ship-loaders	20 months
Installation of conveyors, transfer points and combined stack/reclaimers	24 months

* This timetable is for construction of a 33 Mtpa CET.

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities. The total amount of dust generated would depend on the silt and moisture content of the soil, the types of operations being carried out, exposed area, frequency of water spraying and speed of machinery. The detailed approach to construction would depend on decisions that would be made by the successful contractor and subtle changes to the construction methods and sequences are expected to take place during the detailed design development.

These activities would not be expected to generate significant quantities of dust, in comparison to the operational stage, and dust emissions would be readily controlled using water sprays (for example, water trucks in unfavourable weather conditions for dust generation) and standard dust control measures used on construction sites. The construction activity with the greatest potential for total dust generation would be the construction of the coal storage areas since these activities would take place for the longest period of time and the exposed surface area would be large in comparison with other activities. However, in the early stages of the coal storage area construction, dust generation would be low as dredged materials would be wet.

As the construction of the coal storage area progresses, the exposed area would increase and the moisture content in the surface would reduce. Dust emissions from works of this type may then have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts from such activities using dispersion modelling. To do so would require knowledge of weather conditions for the few weeks that work will be taking place in each location.

As construction is likely to continue for up to 33 months, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. It is desirable that monitoring be carried out during the construction phase of the Project to assess compliance with DEC goals. A minimum of three dust deposition gauges would be required, ideally at the closest residences, other sensitive receptors, or at the boundary of the Project site.

Construction activities would be undertaken on land that has been used in the past as an industrial landfill. The disturbance of such land could have the potential to cause contaminated particulates to become airborne. One of the more significant contaminants susceptible to becoming airborne on the site is Basic Oxygen Steelmaking (BOS) flue dust. Lead is the major component of BOS dust.

It is understood that BOS flue dust disposal occurred on land in the vicinity of the proposed rail loop due to BHP operations. Capping of the BOS dust occurred as part of the ongoing site management. The BOS dust area is currently covered with a layer of coal washery reject.

A Soil and Excavation Management Plan (SEMP) would be prepared for this Project. The SEMP would describe the measures to control contaminated soils and dust generation/volatilisation potential. These measures would include:

- using water sprays to control dust;
- minimising the surface area disturbed by excavation at any one time;
- confining vehicle movements to designated access routes;
- limiting the speed of vehicles on unpaved roads; and
- immediate encapsulation of materials considered unsuitable for use as construction fill.

8.5 Odour

Emissions of odours can occur if self-heating of the coal is allowed to occur without proper control. Self-heating of coal occurs at different rates depending on the composition of the coal and how it is managed. Self-heating that gives rise to smoldering fires in stockpiles can lead to significant emissions of smoke and odour, but these would be able to be brought under control rapidly.

Self-heating of the coal in the stockpiles would be reduced through the use of water sprays and prudent stockpile management. The potential for odour generation is therefore considered to be low and it follows that the frequency of odour events would also be low. Given the sporadic nature of such events, the odours from the proposed operations are difficult to quantify. However, since the nearest residential receptors are of the order of 2 km from the coal storage area, the potential for adverse odour impacts to be observed is considered to be negligible.

Based on the frequency of potential odour generating events and the distance to the nearest sensitive receptors, the Project is unlikely to cause any adverse odour impacts.

A Spontaneous Combustion Management Plan would be prepared for the Project which would include:

- coal stockpile management measures;
- commitments to monitor potential causes of spontaneous combustion events; and
- corrective action in the event of spontaneous combustion.

Odour may also arise from dredging operations during the Project construction phase. Construction would include the reuse of dredged sands from the south arm of the Hunter River as preload and engineering fill for construction of the coal storage area and rail corridor. Dredged material would be pumped via a dedicated pipe from the dredging operations to the proposed coal storage area for use as preload. The dredging operations would be undertaken in accordance with an existing Development Consent (DA 134-3-2003-i) held by the NSW Waterways Authority (trading as NSW Maritime).

The Environmental Odour Laboratory at the University of New South Wales have carried out an odour impact assessment of the proposed extension of shipping channels at the Port of Newcastle (**EOL, 2003**). This study assessed odour emissions and potential impacts from the dredging operations. It was concluded from the assessment that odour impacts at nearest sensitive receptors would be maintained at acceptable levels. Given that the proposed dredging activities associated with the Project would be undertaken in accordance with the existing development consent, odour from the dredged materials would not be expected to be a significant air quality issue. In addition, DA 134-3-2003-i requires that an Odour Monitoring Program be prepared prior to the commencement of dredging operations.

9. GREENHOUSE ISSUES

Greenhouse gas inventories are calculated according to a number of different methods. The procedures specified under the Kyoto Protocol United Nations Framework Convention on Climate Change are the most common.

The Kyoto Protocol identifies greenhouse gases as follows:

- Carbon dioxide (CO₂);
- Methane (CH₄);
- Nitrous oxide (N₂O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Sulphur hexafluoride (SF₆).

Carbon dioxide and N₂O are formed and released during the combustion of gaseous, liquid and solid fuels. The most significant gases for the Project are CO₂ and N₂O, which would be liberated when fuels are burnt in diesel powered equipment and in the generation of the electrical energy that will be used by the Project.

Inventories of greenhouse gas emissions can be calculated using published emission factors. Different gases have different greenhouse warming effects (potentials) and emission factors take into account the global warming potentials of the gases created during combustion.

The global warming potentials assumed in the Australian Greenhouse Office (AGO) (**AGO, 2005**) emission factors are as follows:

- CO₂ – 1
- CH₄ – 21
- N₂O – 310
- NO₂ – not included

When the global warming potentials are applied to the estimated emissions, then the resulting estimate is referred to in terms of CO₂-equivalent (CO₂-e) emissions.

The emission factors published by the AGO (**AGO, 2005**) have been used to convert fuel usage and electricity consumption into CO₂-equivalent emissions. The relevant emission factors are:

- 3.0 kg of CO₂-equivalent/litre for diesel usage – based on full fuel cycle analysis;
- 2.8 kg of CO₂-equivalent/litre for petrol usage – based on full fuel cycle analysis; and
- 0.985 kg of CO₂-equivalent/kWh of electrical energy used in NSW.

The Project would liberate greenhouse gases as a result of the combustion of diesel and petrol to power equipment and the use of electrical energy both during the construction and operational phases. Estimates of fuel consumption and electricity usage for construction and operation are summarised in **Table 10**.

Table 10 : Diesel and electricity consumption associated with the Project

Item	Annual consumption		
	Construction	Operations at 33 Mtpa	Operations at 66 Mtpa
Diesel	500,000 litres/year	150,000 litres/year	200,000 litres/year
Electricity	1.5 MWhrs/year	40,000 MWhrs/year	70,000 MWhrs/year
Petrol	100,000 litres/year	50,000 litres/year	75,000 litres/year

Source: NCIG (2006).

The CO₂-e emission factors provided above have been used to estimate the annual quantity of CO₂-e per year. **Table 11** provides the results of the calculations.

Table 11 : Summary of estimated CO₂-e emissions

Item	Tonnes CO ₂ -e/year		
	Construction	Operations at 33 Mtpa	Operations at 66 Mtpa
Diesel	1,500	450	600
Electricity	1.5	39,400	68,950
Petrol	280	140	210
TOTAL	1,782	39,990	69,760

Therefore, at 66 Mtpa, the operations are estimated to liberate 69,760 t of CO₂-e per year. This estimate can be compared with the estimated total CO₂-equivalent emissions for Australia in 2003 of 550,000,000 t of CO₂-e calculated using the Kyoto protocol calculation methods (AGO web site).

10. CONCLUSIONS

This report has assessed the air quality impacts associated with the operation of the proposed CET on Kooragang Island, Newcastle. Dispersion modelling has been used to assess the impact that dust emissions from the operations would have on the local air quality. It is concluded that air quality impacts would be at acceptable levels and that air quality goals would not be exceeded at sensitive receptors due to the operation of the CET at 66 Mtpa. It follows also that air quality impacts would be acceptable for the initial 33 Mtpa operations.

The implementation of proposed dust control measures should ensure that the actual air quality impacts are lower than those predicted in this study.

Air quality monitoring data have indicated that existing short-term dust concentrations are above air quality goals on occasions. Particulate matter concentrations arising from non-Project related sources, such as bushfires and dust storms, may continue to result in elevated levels on occasions.

Based on the frequency of potential odour generating events and the distance to the nearest sensitive receptors, the Project is unlikely to cause any adverse odour impacts. Odour generating events should be able to be managed by limiting the self-heating potential of the coal stockpiles.

Emissions of greenhouse gases have been estimated to be up to 69,760 t of CO₂-e annually for 66 Mtpa operations. This figure can be compared with the estimated total CO₂-equivalent emissions for Australia in 2003 of 550,000,000 t of CO₂-e calculated using the Kyoto protocol calculation methods (AGO - web site).

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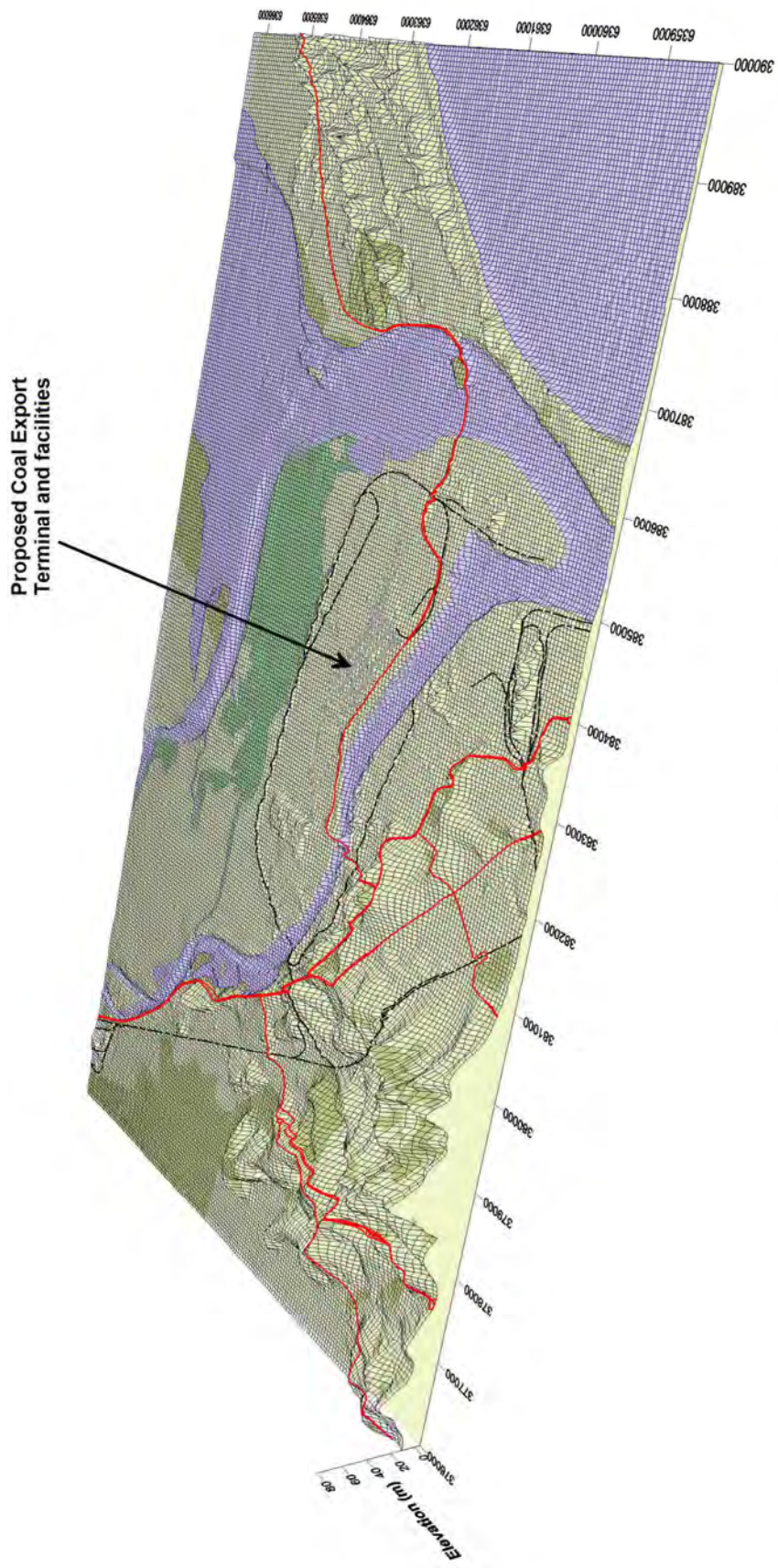
FIGURES





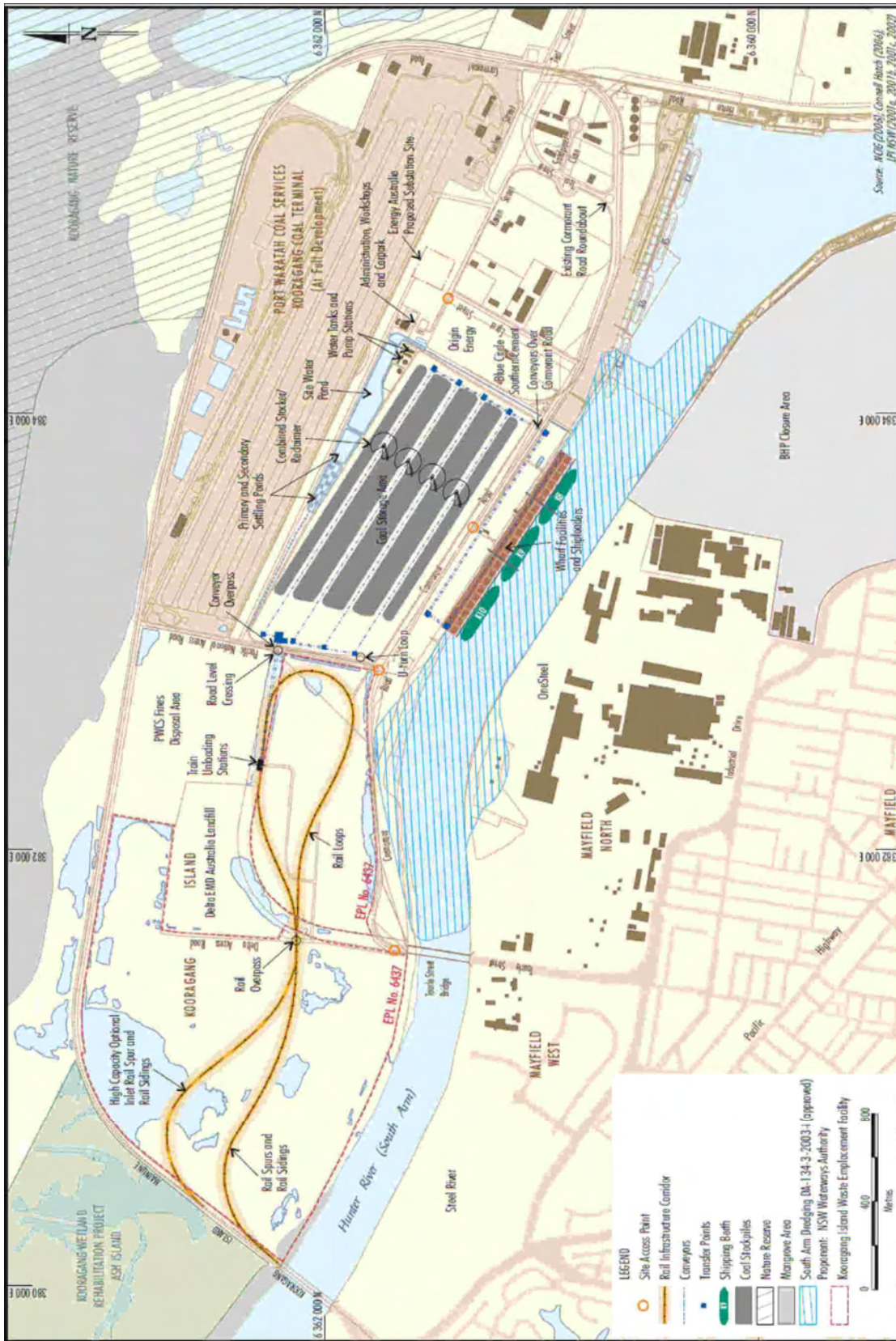
Location of study area

FIGURE 1



Pseudo 3-dimensional representation of terrain in the study area

FIGURE 2



Proposed site layout and facilities

FIGURE 3

Annual and seasonal windroses for Steel River (2000)

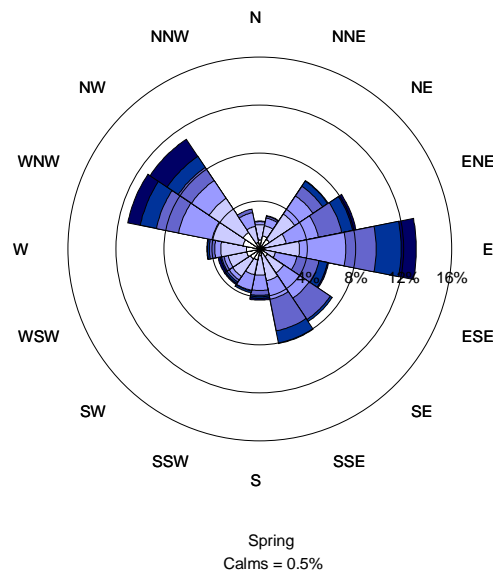
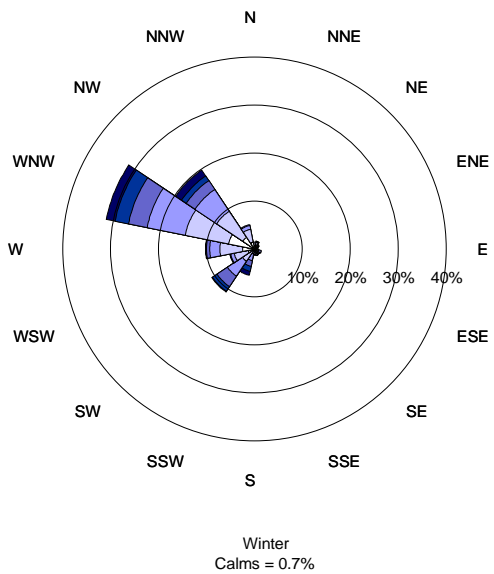
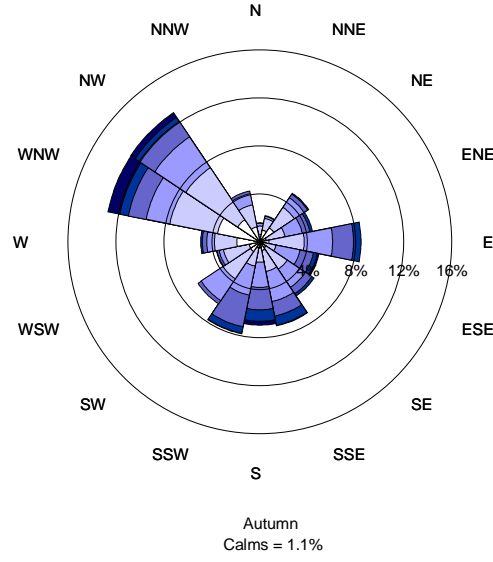
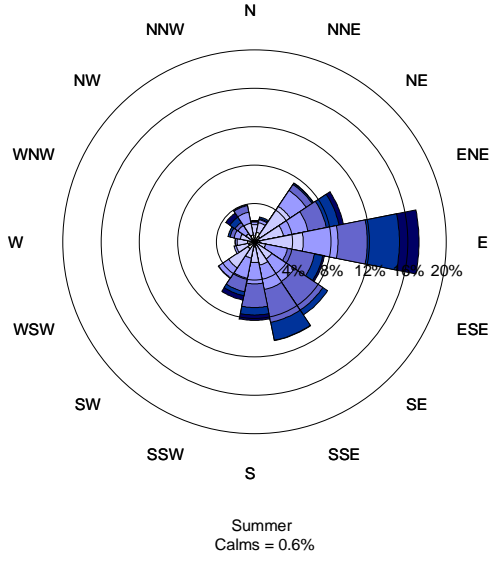
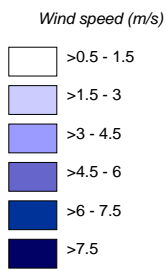
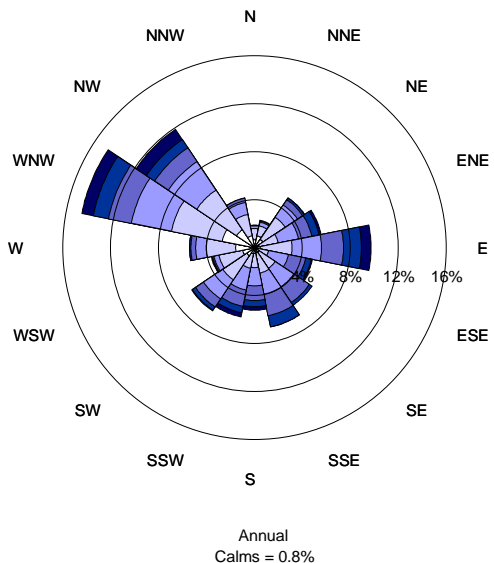


FIGURE 4

Annual and seasonal windroses for Steel River (2001)

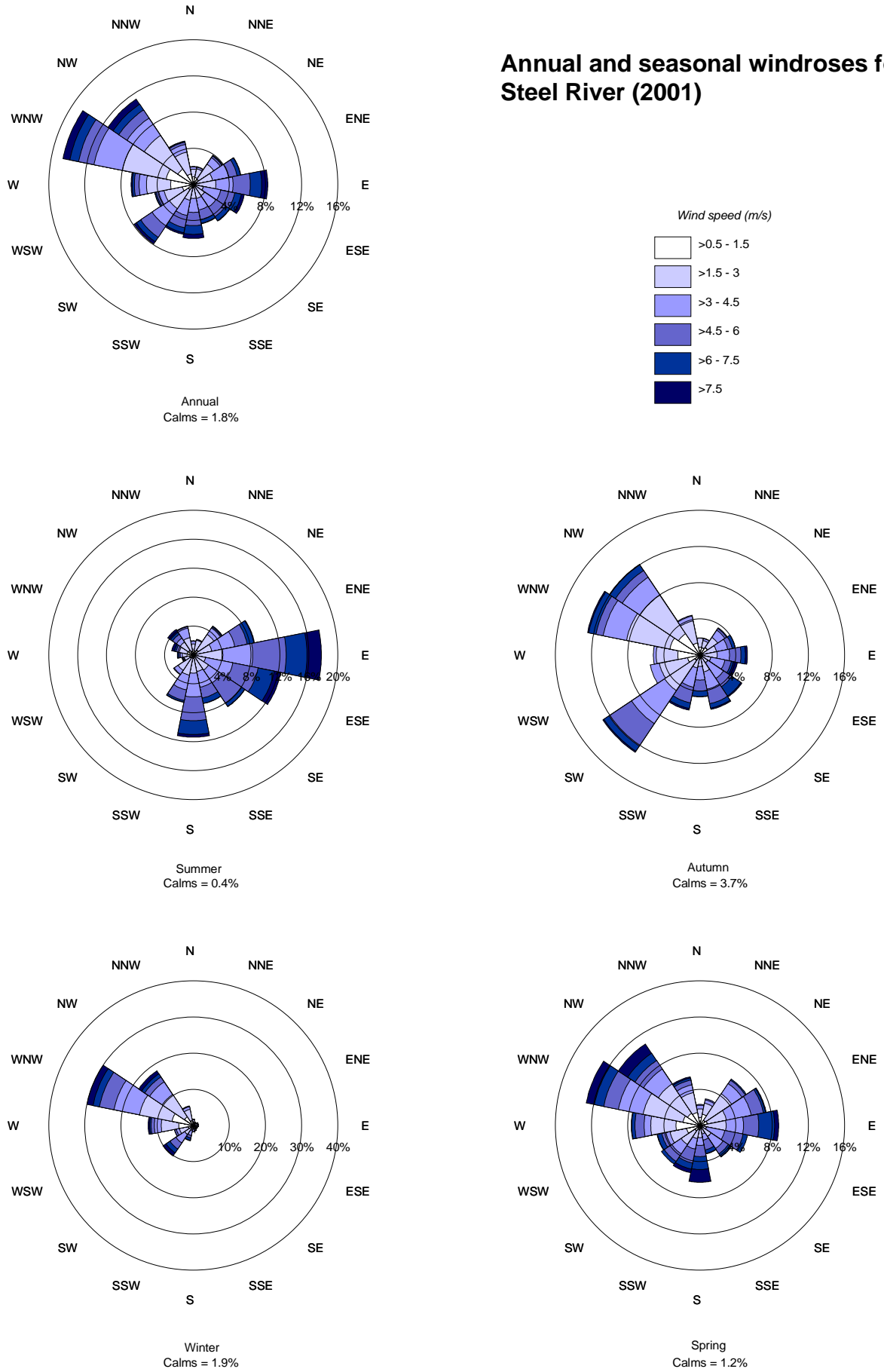


FIGURE 5

Annual and seasonal windroses for Steel River (2002)

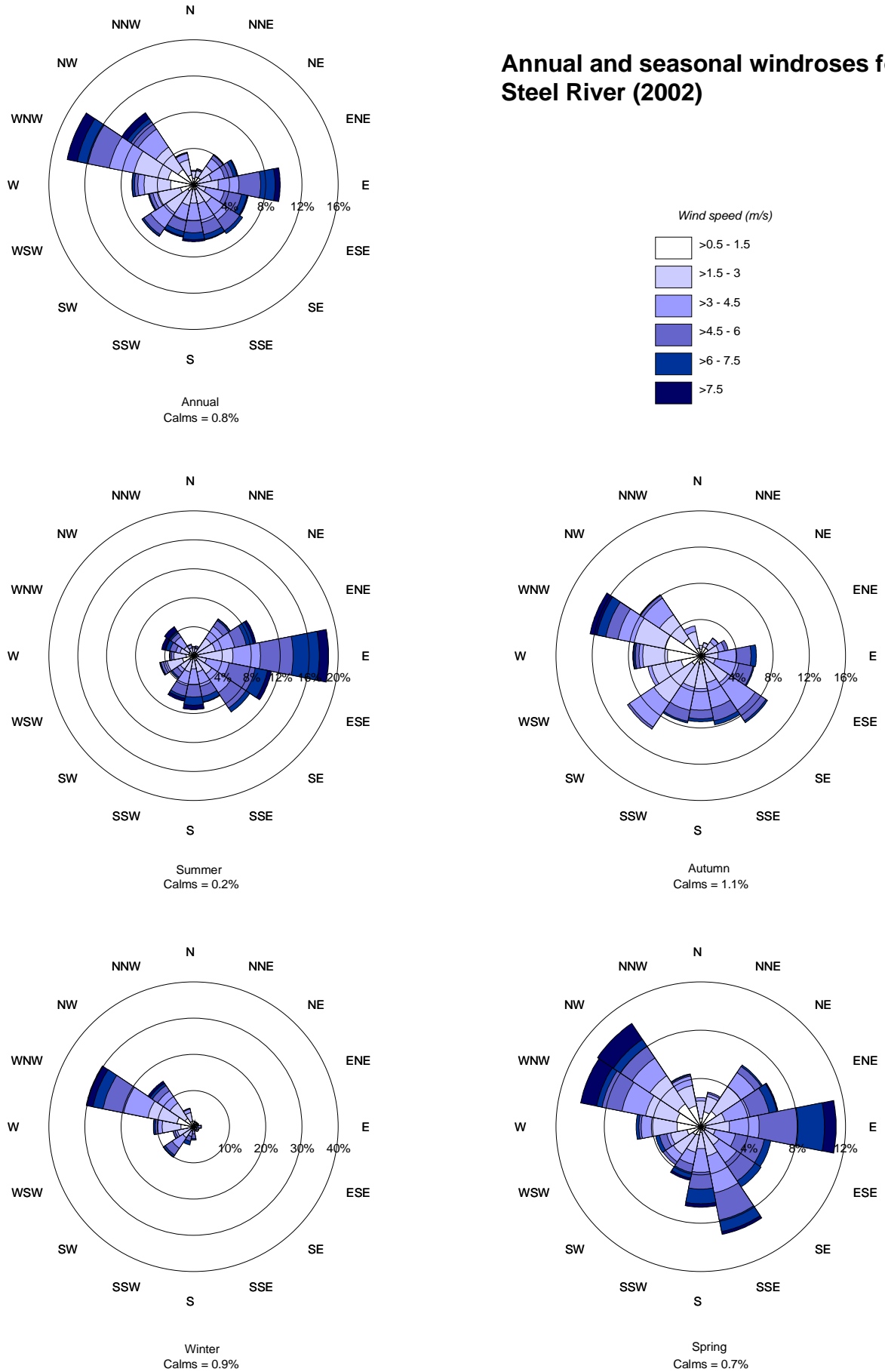


FIGURE 6

Annual and seasonal windroses for Steel River (2003)

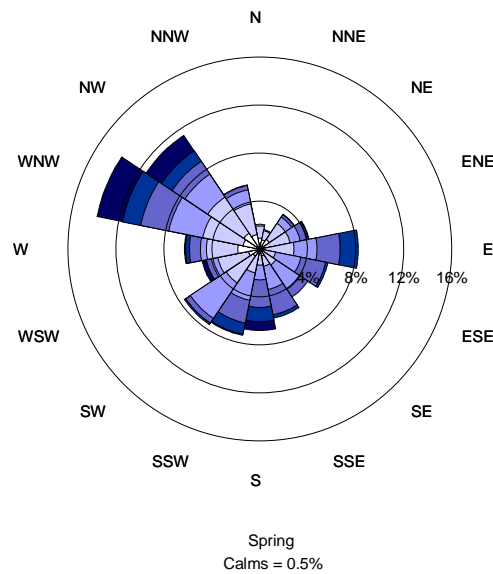
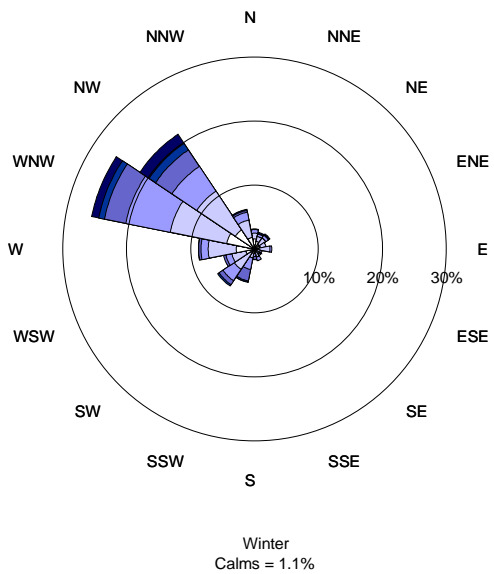
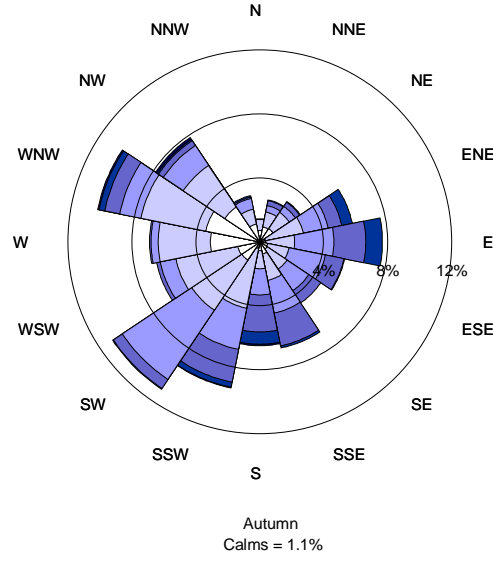
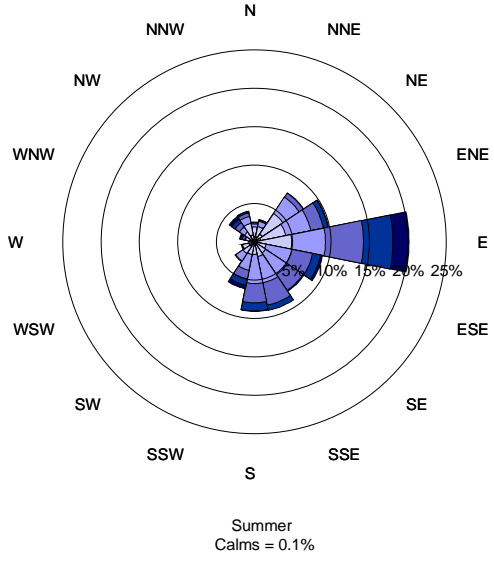
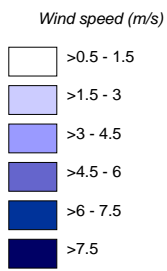
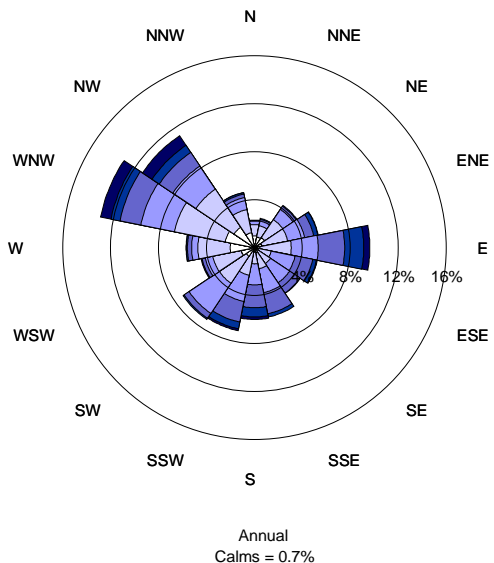


FIGURE 7

Annual and seasonal windroses for Steel River (2004)

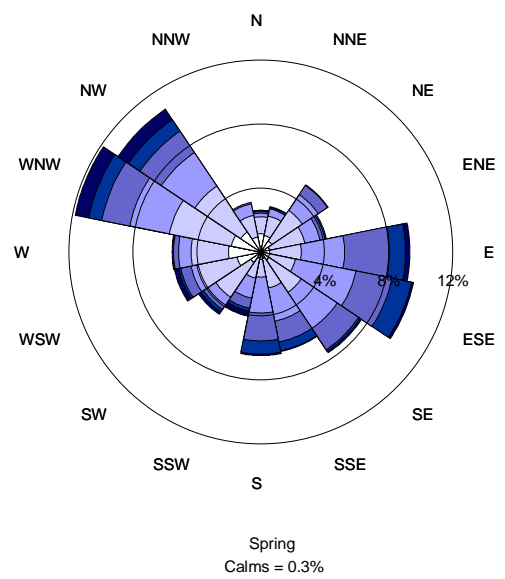
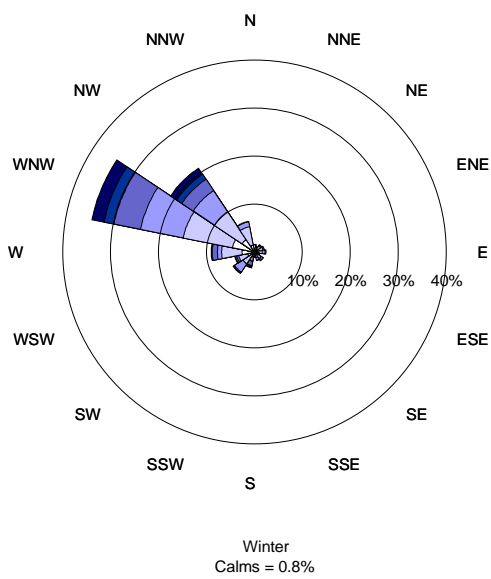
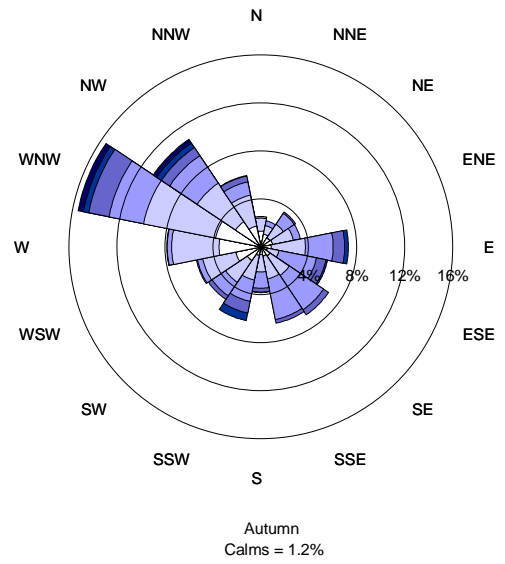
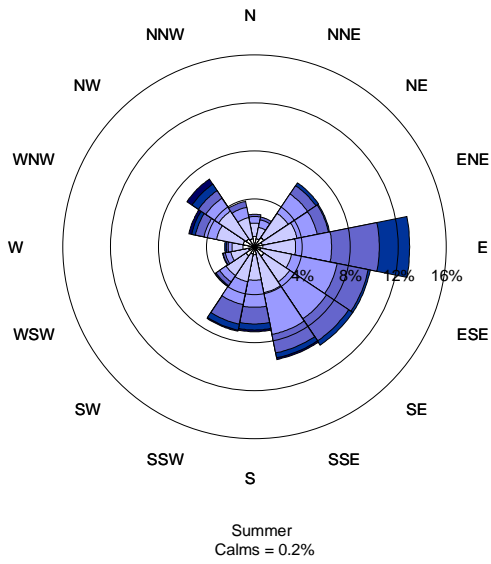
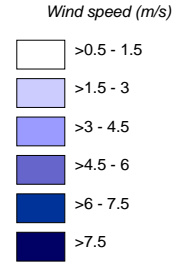
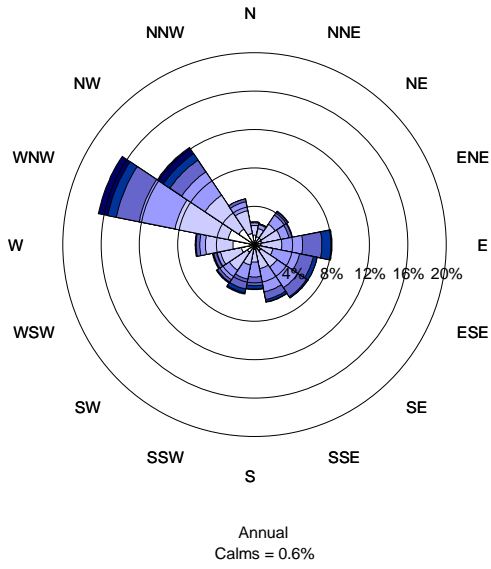


FIGURE 8

Annual and seasonal windroses for Steel River (2005)

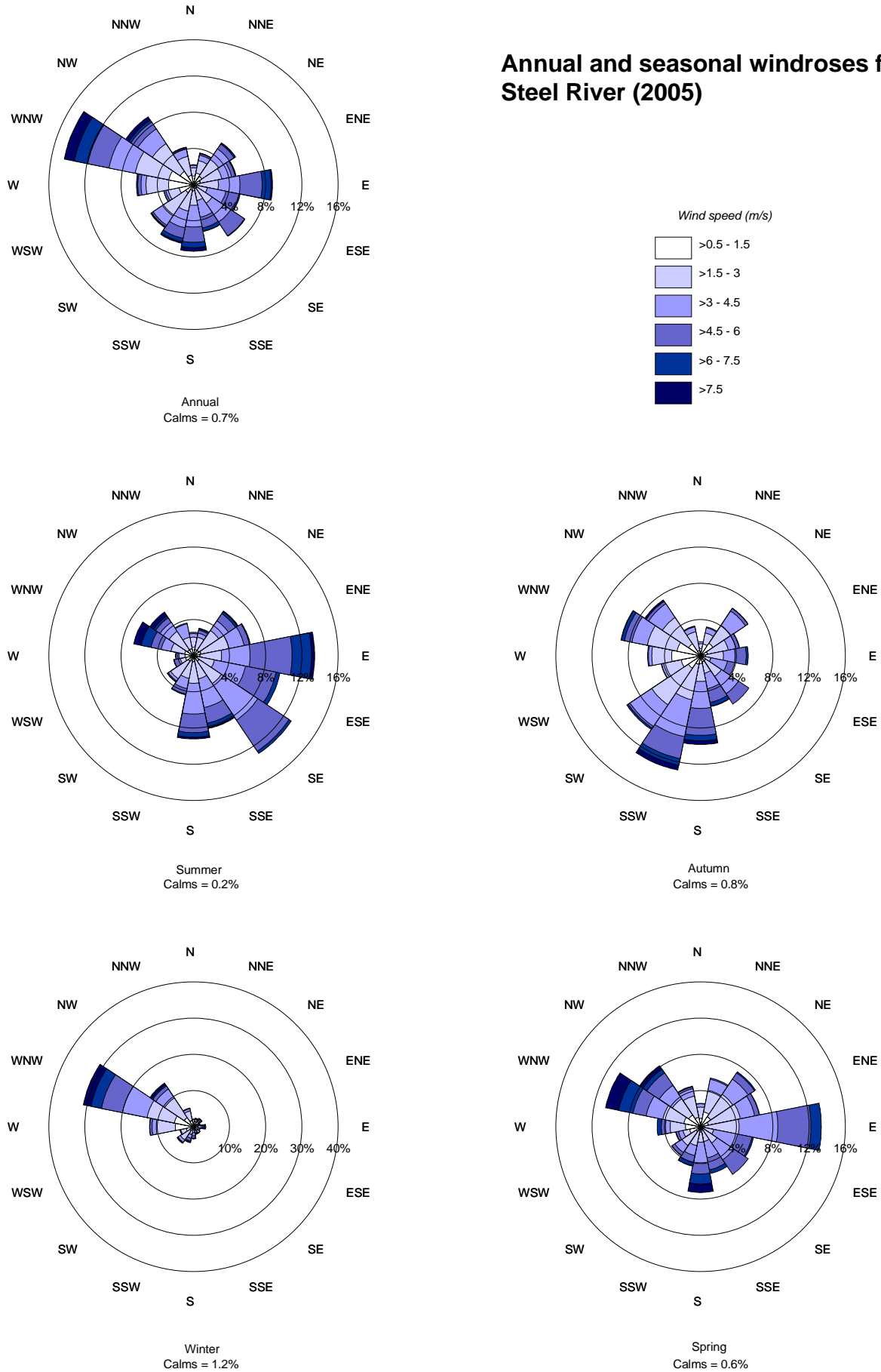


FIGURE 9

Annual and seasonal windroses for Beresfield (2000)



FIGURE 10

Annual and seasonal windroses for Newcastle (2000)

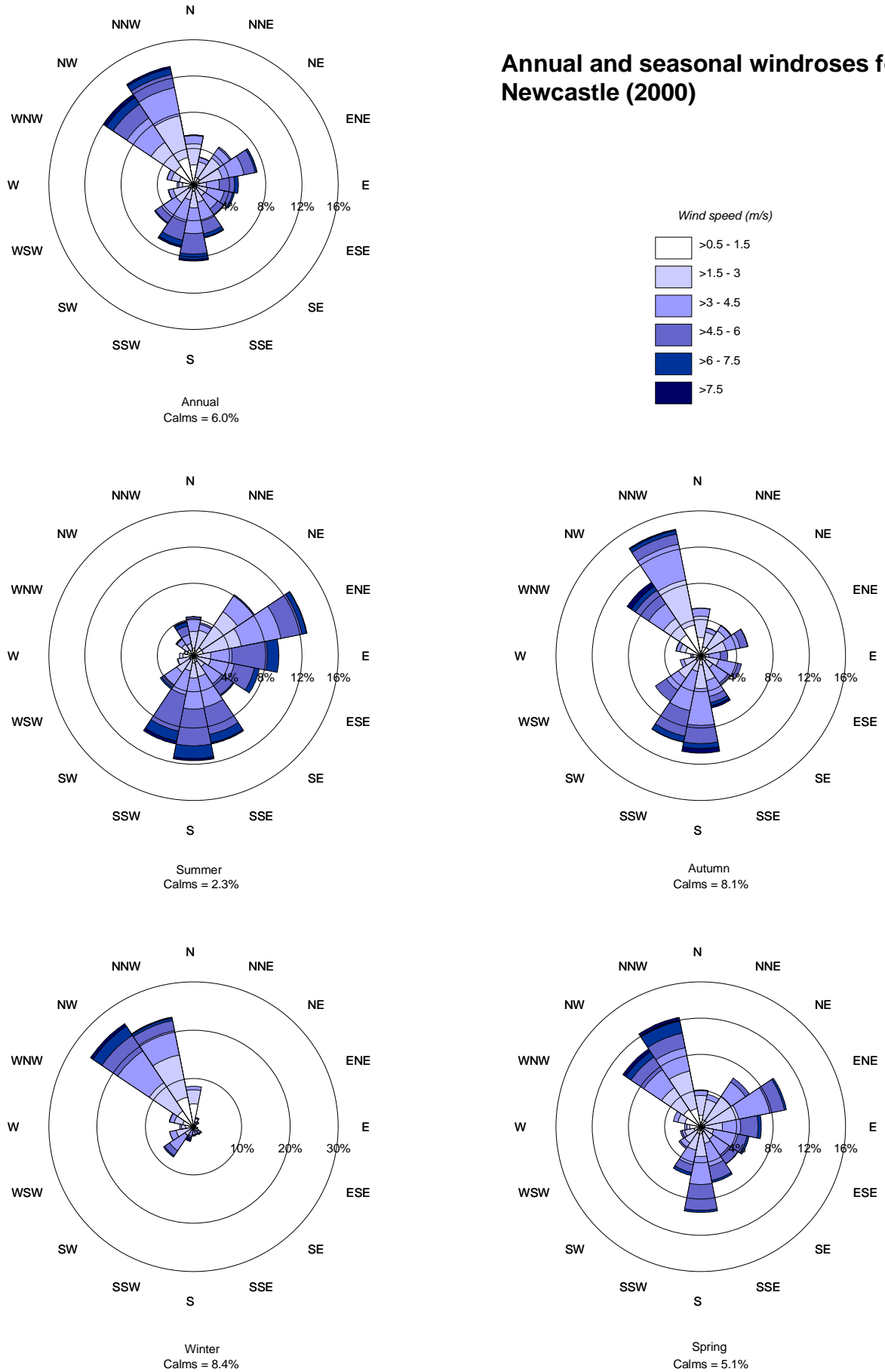


FIGURE 11

Annual and seasonal windroses for Wallsend (2000)

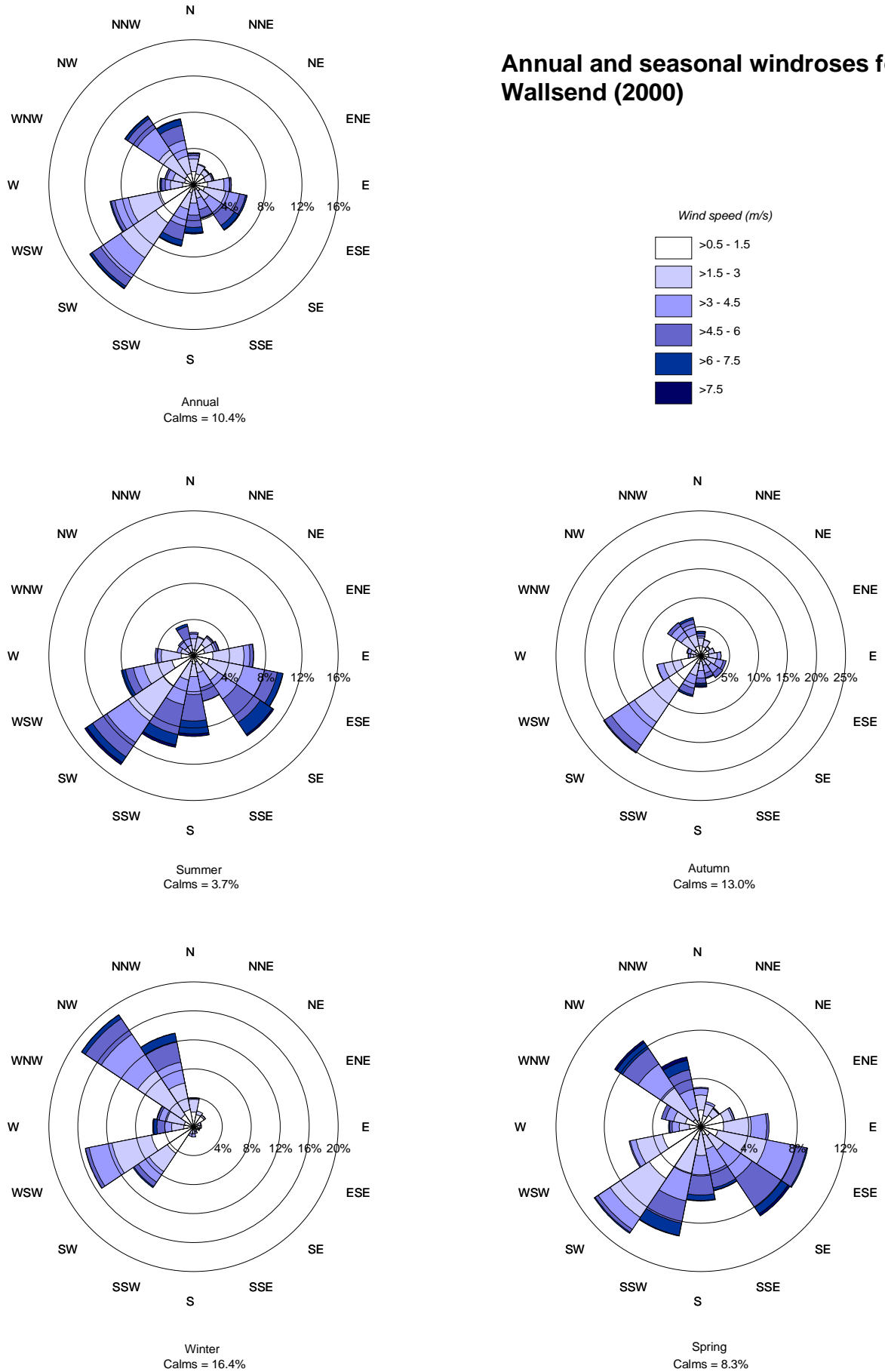


FIGURE 12

Annual and seasonal windroses for PWCS - Kooragang Island (2004/2005)

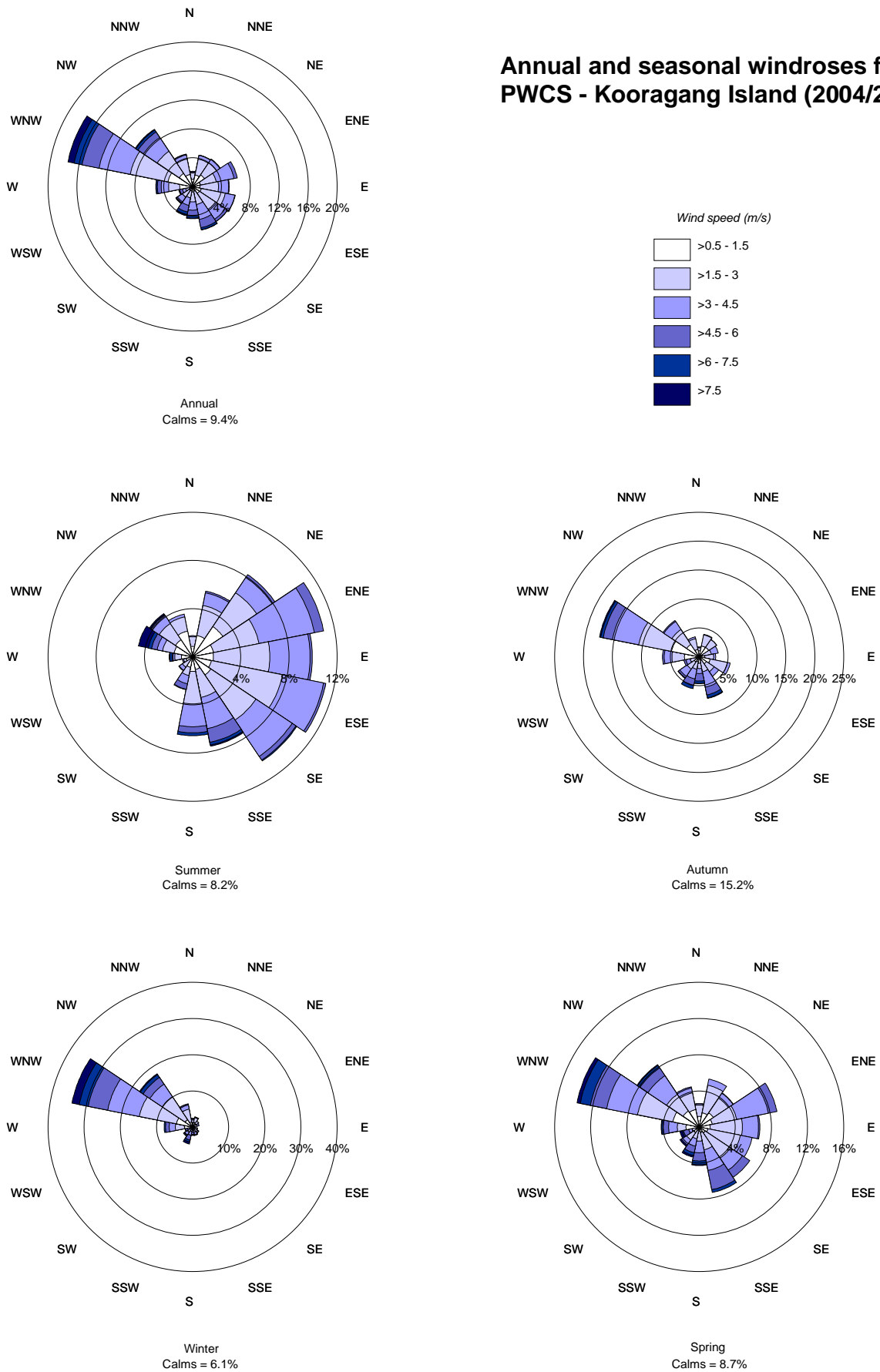
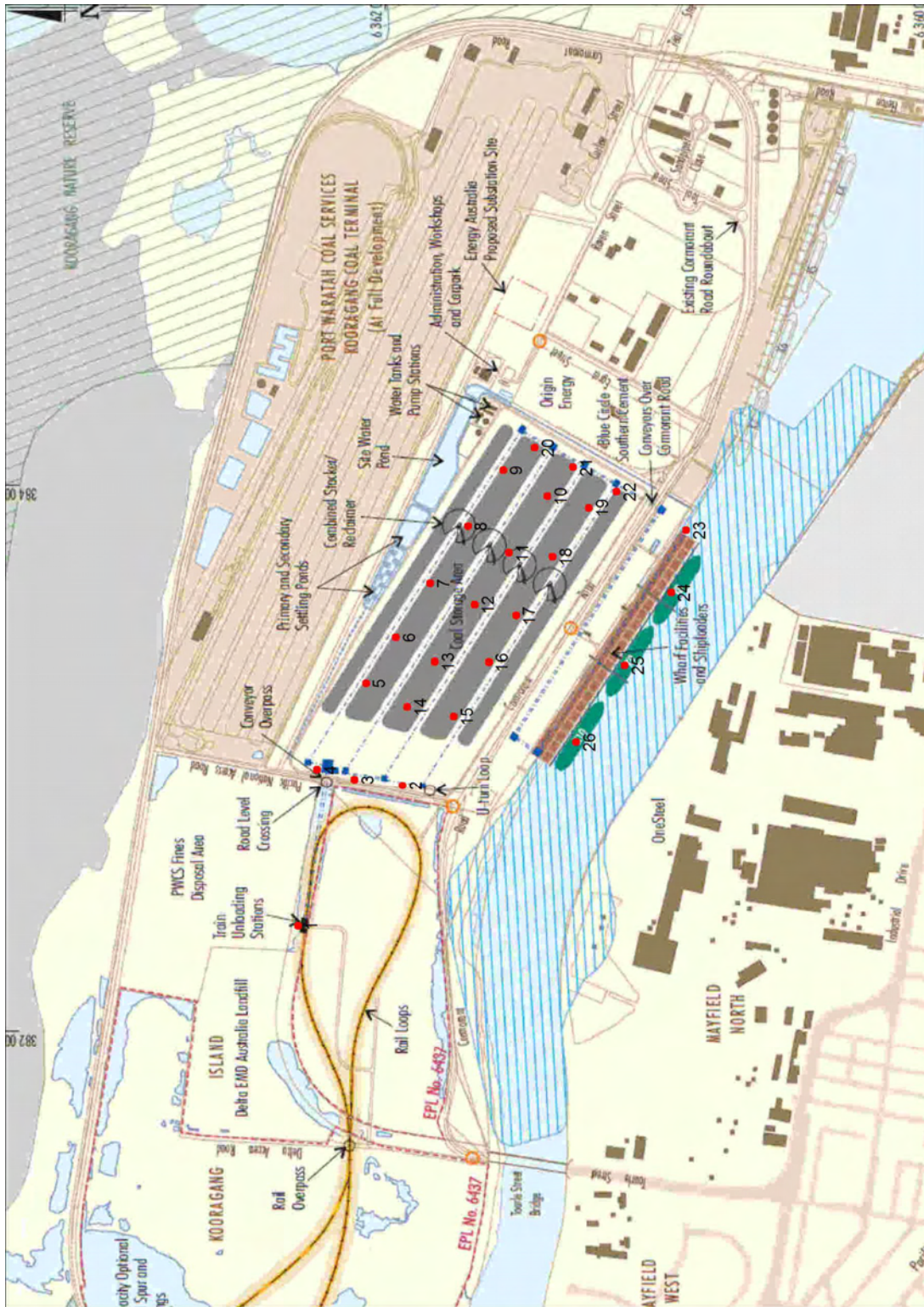
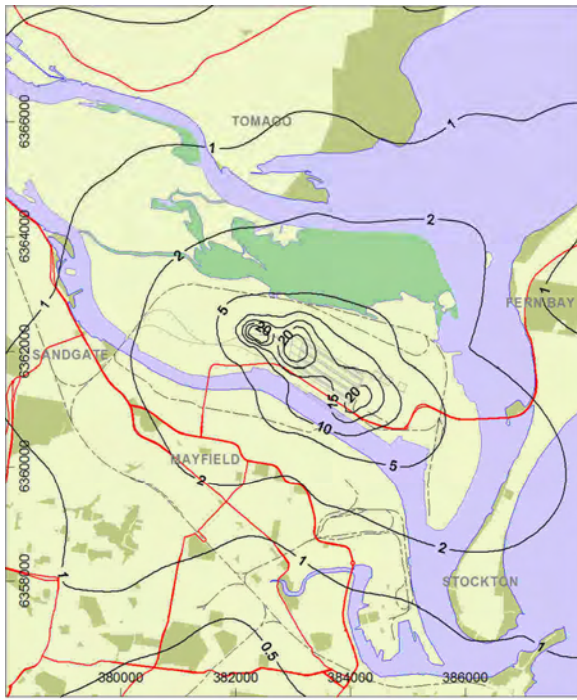


FIGURE 13

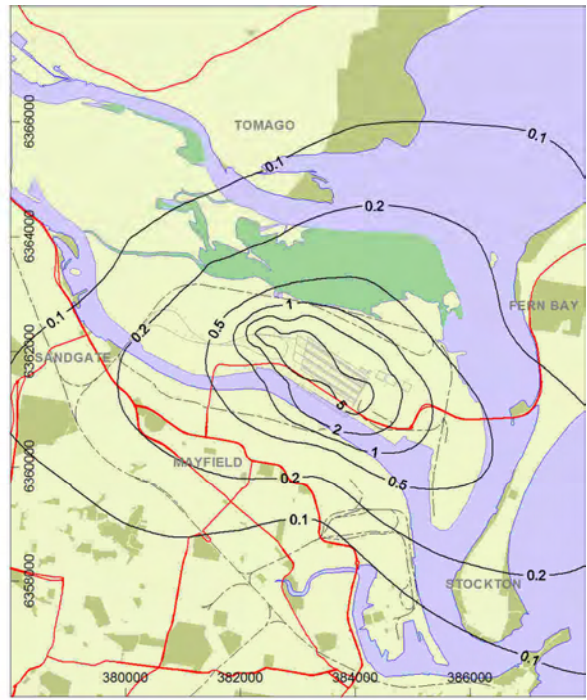


Location of modelled dust emission sources

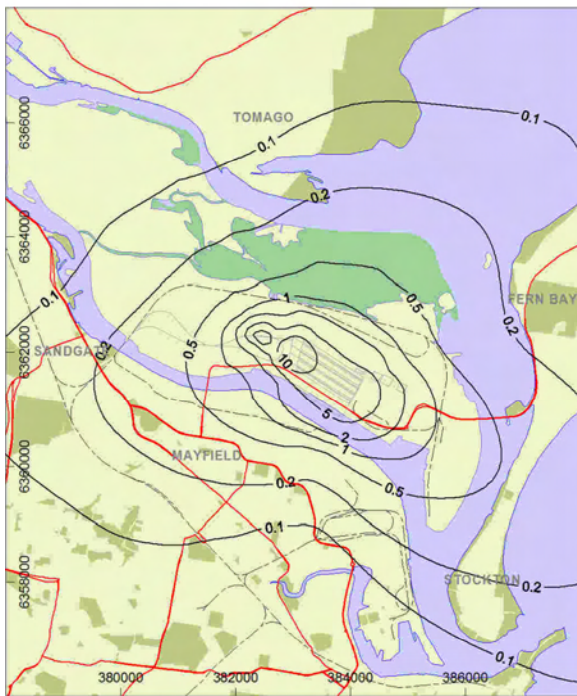
FIGURE 14



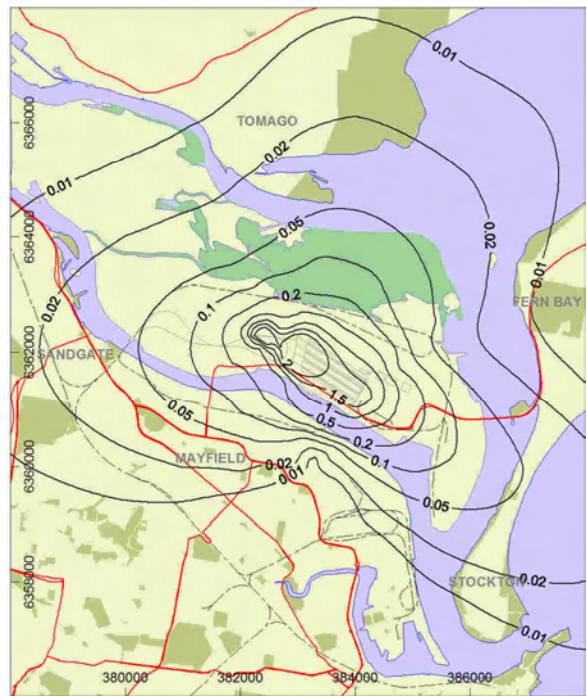
Maximum 24-hour average PM_{10} - $\mu\text{g}/\text{m}^3$



Annual average PM_{10} - $\mu\text{g}/\text{m}^3$



Annual average TSP - $\mu\text{g}/\text{m}^3$

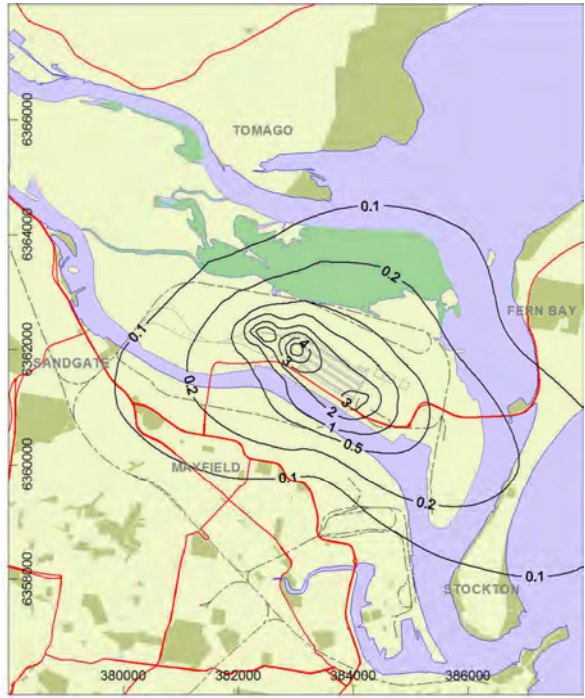


Annual average dust deposition - $\text{g}/\text{m}^2/\text{month}$

Dispersion model predictions for proposed operations at 66 Mtpa



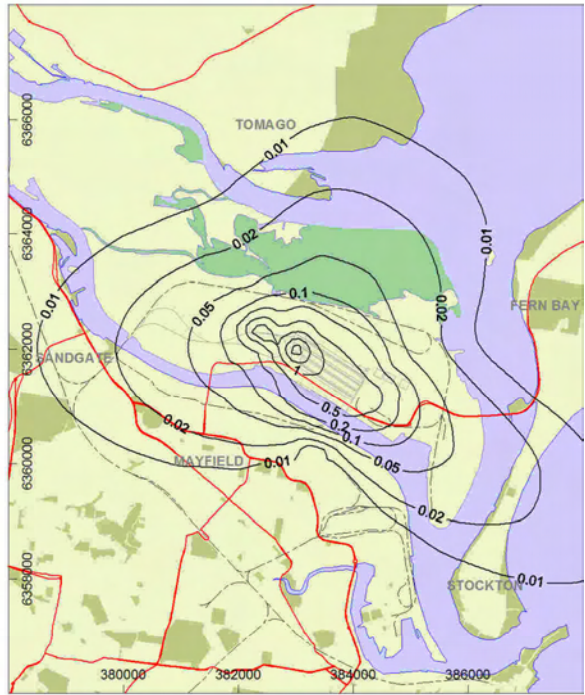
Maximum 24-hour average PM_{10} - $\mu\text{g}/\text{m}^3$



Annual average PM_{10} - $\mu\text{g}/\text{m}^3$



Annual average TSP - $\mu\text{g}/\text{m}^3$



Annual average dust deposition - $\text{g}/\text{m}^2/\text{month}$

Dispersion model predictions for proposed operations at 33 Mtpa



MGA Zone 56 (GDA-94)

Sensitive receptor locations chosen for the assessment

FIGURE 17

Time series of predicted PM₁₀ concentrations at nearest sensitive locations

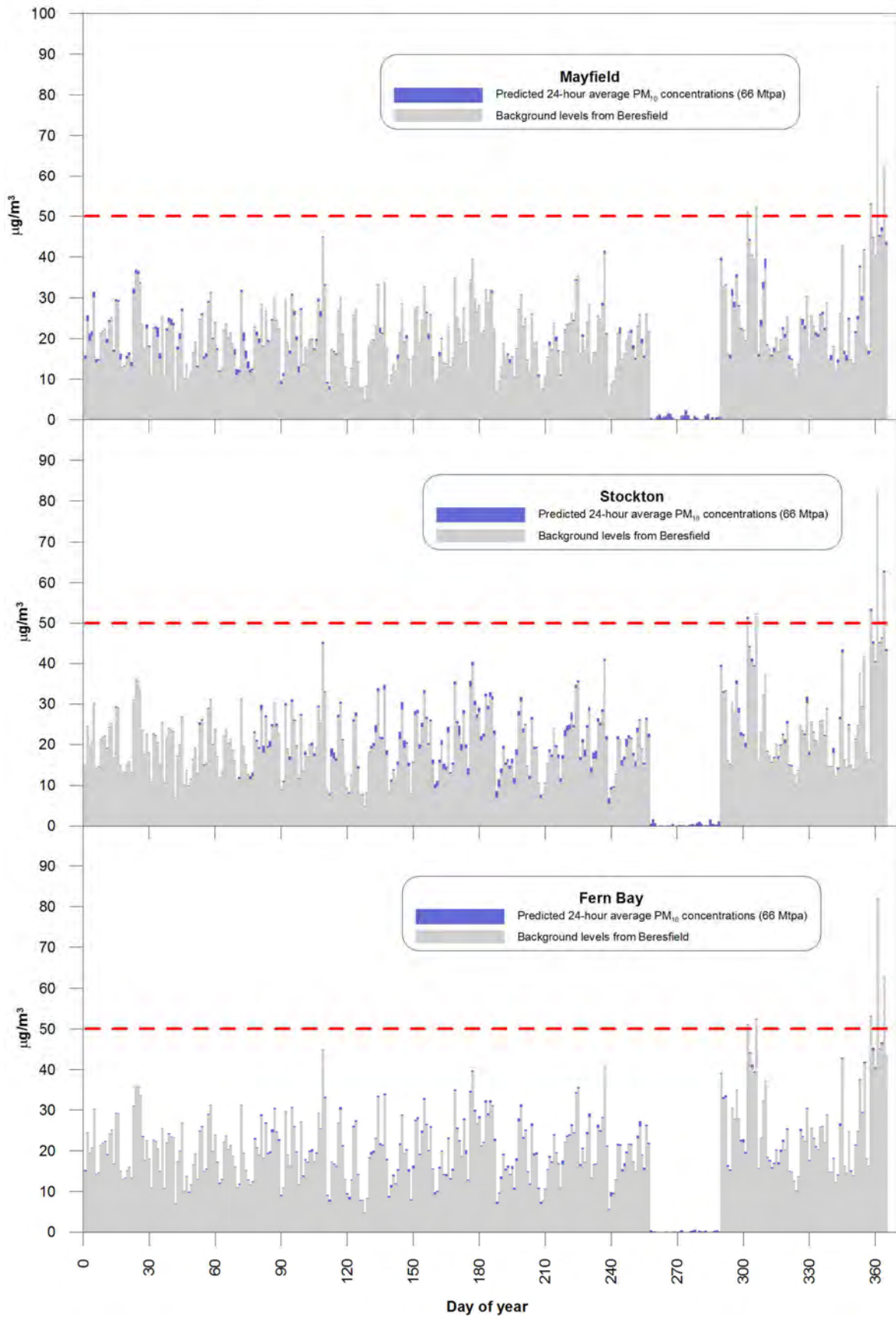


FIGURE 18

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

STATISTICS FOR FILE: C:\Jobs\NCIG\metdata\SteelRiver\sr2001.aus
 MONTHS: All
 HOURS : All
 OPTION: Frequency

PASQUILL STABILITY CLASS 'A'

		Wind Speed Class (m/s)								
WIND	0.50	1.50	3.00	4.50	6.00	7.50	9.00	GREATER		
SECTOR	TO	TO	TO	TO	TO	TO	TO	THAN	TOTAL	
	1.50	3.00	4.50	6.00	7.50	9.00	10.50	10.50		
NNE	0.000571	0.001256	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.001941	
NE	0.000342	0.001142	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.001712	
ENE	0.000342	0.001142	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.002169	
E	0.000114	0.000571	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
ESE	0.000342	0.001484	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001826	
SE	0.000000	0.000571	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000799	
SSE	0.000228	0.000571	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
S	0.000228	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
SSW	0.000114	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000342	
SW	0.000457	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001027	
WSW	0.000913	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001256	
W	0.000913	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001370	
WNW	0.000913	0.002169	0.000000	0.000114	0.000000	0.000000	0.000000	0.000000	0.003196	
NW	0.000913	0.001484	0.000228	0.000114	0.000000	0.000000	0.000000	0.000000	0.002740	
NNW	0.001826	0.001598	0.000114	0.000114	0.000000	0.000000	0.000000	0.000000	0.003653	
N	0.001370	0.001712	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003082	
CALM									0.000342	
TOTAL	0.009589	0.015982	0.001941	0.000342	0.000000	0.000000	0.000000	0.000000	0.028196	

MEAN WIND SPEED (m/s) = 1.92
 NUMBER OF OBSERVATIONS = 247

PASQUILL STABILITY CLASS 'B'

		Wind Speed Class (m/s)								
WIND	0.50	1.50	3.00	4.50	6.00	7.50	9.00	GREATER		
SECTOR	TO	TO	TO	TO	TO	TO	TO	THAN	TOTAL	
	1.50	3.00	4.50	6.00	7.50	9.00	10.50	10.50		
NNE	0.000114	0.001027	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.001256	
NE	0.000114	0.000457	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
ENE	0.000000	0.001256	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.001941	
E	0.000000	0.000799	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.001027	
ESE	0.000000	0.000571	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
SE	0.000000	0.000685	0.000228	0.000228	0.000000	0.000000	0.000000	0.000000	0.001142	
SSE	0.000228	0.000571	0.000228	0.000114	0.000000	0.000000	0.000000	0.000000	0.001142	
S	0.000114	0.000228	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000685	
SSW	0.000114	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000457	
SW	0.000000	0.000913	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
WSW	0.000114	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000571	
W	0.000457	0.000457	0.000114	0.000000	0.000000	0.000000	0.000000	0.000000	0.001027	
WNW	0.000571	0.001370	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.002511	
NW	0.000342	0.001142	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.001941	
NNW	0.000228	0.002626	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.003425	
N	0.000228	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913	
CALM									0.000000	
TOTAL	0.002626	0.013584	0.004224	0.000342	0.000000	0.000000	0.000000	0.000000	0.020776	

MEAN WIND SPEED (m/s) = 2.46
 NUMBER OF OBSERVATIONS = 182

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000342	0.000913	0.000457	0.000228	0.000000	0.000000	0.000000	0.000000	0.001941
NE	0.000000	0.001712	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.002397
ENE	0.000114	0.001484	0.001142	0.000114	0.000000	0.000000	0.000000	0.000000	0.002854
E	0.000000	0.000342	0.001712	0.000342	0.000000	0.000000	0.000000	0.000000	0.002397
ESE	0.000000	0.000799	0.002626	0.001370	0.000000	0.000000	0.000000	0.000000	0.004795
SE	0.000114	0.000685	0.002283	0.001256	0.000000	0.000000	0.000000	0.000000	0.004338
SSE	0.000228	0.001027	0.001941	0.001142	0.000000	0.000000	0.000000	0.000000	0.004338
S	0.000114	0.000685	0.001941	0.000342	0.000000	0.000000	0.000000	0.000000	0.003082
SSW	0.000000	0.000685	0.000228	0.000114	0.000000	0.000000	0.000000	0.000000	0.001027
SW	0.000000	0.001598	0.000913	0.000571	0.000000	0.000000	0.000000	0.000000	0.003082
WSW	0.000000	0.000913	0.000457	0.000571	0.000000	0.000000	0.000000	0.000000	0.001941
W	0.000457	0.001484	0.001027	0.000342	0.000000	0.000000	0.000000	0.000000	0.003311
WNW	0.001256	0.001598	0.002055	0.000685	0.000000	0.000000	0.000000	0.000000	0.005594
NW	0.000457	0.003311	0.001027	0.000342	0.000000	0.000000	0.000000	0.000000	0.005137
NNW	0.001142	0.003539	0.000799	0.000342	0.000000	0.000000	0.000000	0.000000	0.005822
N	0.000685	0.001370	0.001027	0.000114	0.000000	0.000000	0.000000	0.000000	0.003196
CALM									0.000000
TOTAL	0.004909	0.022146	0.020320	0.007877	0.000000	0.000000	0.000000	0.000000	0.055251

MEAN WIND SPEED (m/s) = 3.20
NUMBER OF OBSERVATIONS = 484

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.003767	0.002968	0.000913	0.000342	0.000000	0.000000	0.000000	0.000000	0.007991
NE	0.002626	0.005822	0.002626	0.001484	0.000913	0.000114	0.000000	0.000000	0.013584
ENE	0.000913	0.006507	0.004795	0.006621	0.003767	0.000457	0.000000	0.000000	0.023059
E	0.000799	0.004795	0.006164	0.017466	0.012671	0.005822	0.000799	0.000000	0.048516
ESE	0.000571	0.002854	0.010616	0.013584	0.007420	0.002511	0.000799	0.000114	0.038470
SE	0.000342	0.005708	0.009932	0.010731	0.005251	0.000571	0.000000	0.000000	0.032534
SSE	0.000457	0.007306	0.010274	0.009475	0.004110	0.000457	0.000114	0.000000	0.032192
S	0.001484	0.006735	0.010845	0.013356	0.009703	0.003311	0.001027	0.000228	0.046689
SSW	0.001142	0.006393	0.011530	0.012785	0.005594	0.001941	0.000000	0.000000	0.039384
SW	0.001256	0.007192	0.009018	0.011986	0.005822	0.002854	0.000000	0.000114	0.038242
WSW	0.003425	0.007078	0.003311	0.002169	0.001484	0.000228	0.000114	0.000000	0.017808
W	0.008219	0.010616	0.004566	0.004452	0.002397	0.001027	0.000228	0.000000	0.031507
WNW	0.011187	0.017352	0.013584	0.014041	0.009817	0.004110	0.002968	0.000685	0.073744
NW	0.007078	0.018721	0.014612	0.008904	0.007648	0.003539	0.001598	0.001712	0.063813
NNW	0.003196	0.010160	0.006735	0.001941	0.000913	0.000342	0.000000	0.000000	0.023288
N	0.001941	0.002854	0.001027	0.000342	0.000000	0.000000	0.000000	0.000000	0.006164
CALM									0.001712
TOTAL	0.048402	0.123059	0.120548	0.129680	0.077511	0.027283	0.007648	0.002854	0.538699

MEAN WIND SPEED (m/s) = 4.34
NUMBER OF OBSERVATIONS = 4719

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.002283	0.003082	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.005594
NE	0.002055	0.009817	0.004795	0.000571	0.000000	0.000000	0.000000	0.000000	0.017237
ENE	0.002169	0.006393	0.011187	0.002283	0.000000	0.000000	0.000000	0.000000	0.022032
E	0.000457	0.013927	0.010616	0.001256	0.000000	0.000000	0.000000	0.000000	0.026256
ESE	0.000342	0.003196	0.005936	0.000913	0.000000	0.000000	0.000000	0.000000	0.010388
SE	0.001027	0.004224	0.002397	0.000571	0.000000	0.000000	0.000000	0.000000	0.008219
SSE	0.001027	0.003082	0.000457	0.000114	0.000000	0.000000	0.000000	0.000000	0.004680
S	0.000913	0.002626	0.002397	0.000799	0.000000	0.000000	0.000000	0.000000	0.006735
SSW	0.000799	0.005708	0.005479	0.000799	0.000000	0.000000	0.000000	0.000000	0.012785
SW	0.002854	0.012671	0.013014	0.002740	0.000000	0.000000	0.000000	0.000000	0.031279
WSW	0.003881	0.009475	0.002283	0.000000	0.000000	0.000000	0.000000	0.000000	0.015639
W	0.007877	0.012329	0.002397	0.000457	0.000000	0.000000	0.000000	0.000000	0.023059
WNW	0.008333	0.025000	0.015982	0.002397	0.000000	0.000000	0.000000	0.000000	0.051712
NW	0.007420	0.016210	0.006735	0.001484	0.000000	0.000000	0.000000	0.000000	0.031849
NNW	0.003196	0.005708	0.000457	0.000114	0.000000	0.000000	0.000000	0.000000	0.009475
N	0.001941	0.001370	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.003767
CALM									0.004452
TOTAL	0.046575	0.134817	0.084817	0.014498	0.000000	0.000000	0.000000	0.000000	0.285160

MEAN WIND SPEED (m/s) = 2.63
NUMBER OF OBSERVATIONS = 2498

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000913	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001370
NE	0.001712	0.001370	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003082
ENE	0.001142	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001370
E	0.001484	0.001598	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003082
ESE	0.000571	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001027
SE	0.001142	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001484
SSE	0.000685	0.000228	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000913
S	0.000913	0.000571	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001484
SSW	0.001712	0.000457	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002169
SW	0.002055	0.002283	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004338
WSW	0.003995	0.002511	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006507
W	0.007192	0.001484	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008676
WNW	0.008447	0.001826	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010274
NW	0.004452	0.003767	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008219
NNW	0.002397	0.000913	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003311
N	0.002511	0.000342	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002854
CALM									0.011758
TOTAL	0.041324	0.018836	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.071918

MEAN WIND SPEED (m/s) = 1.22
NUMBER OF OBSERVATIONS = 630

ALL PASQUILL STABILITY CLASSES

WIND SECTOR	Wind Speed Class (m/s)								TOTAL
	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	
NNE	0.007991	0.009703	0.001826	0.000571	0.000000	0.000000	0.000000	0.000000	0.020091
NE	0.006849	0.020320	0.008676	0.002055	0.000913	0.000114	0.000000	0.000000	0.038927
ENE	0.004680	0.017009	0.018493	0.009018	0.003767	0.000457	0.000000	0.000000	0.053425
E	0.002854	0.022032	0.018950	0.019064	0.012671	0.005822	0.000799	0.000000	0.082192
ESE	0.001826	0.009361	0.019521	0.015868	0.007420	0.002511	0.000799	0.000114	0.057420
SE	0.002626	0.012215	0.015068	0.012785	0.005251	0.000571	0.000000	0.000000	0.048516
SSE	0.002854	0.012785	0.013014	0.010845	0.004110	0.000457	0.000114	0.000000	0.044178
S	0.003767	0.011530	0.015525	0.014498	0.009703	0.003311	0.001027	0.000228	0.059589
SSW	0.003881	0.013813	0.017237	0.013699	0.005594	0.001941	0.000000	0.000000	0.056164
SW	0.006621	0.025228	0.022945	0.015297	0.005822	0.002854	0.000000	0.000114	0.078881
WSW	0.012329	0.020776	0.006050	0.002740	0.001484	0.000228	0.000114	0.000000	0.043721
W	0.025114	0.026826	0.008105	0.005251	0.002397	0.001027	0.000228	0.000000	0.068950
WNW	0.030708	0.049315	0.032192	0.017237	0.009817	0.004110	0.002968	0.000685	0.147032
NW	0.020662	0.044635	0.023059	0.010845	0.007648	0.003539	0.001598	0.001712	0.113699
NNW	0.011986	0.024543	0.008676	0.002511	0.000913	0.000342	0.000000	0.000000	0.048973
N	0.008676	0.008333	0.002511	0.000457	0.000000	0.000000	0.000000	0.000000	0.019977
CALM									0.018265
TOTAL	0.153425	0.328425	0.231849	0.152740	0.077511	0.027283	0.007648	0.002854	1.000000

MEAN WIND SPEED (m/s) = 3.46
NUMBER OF OBSERVATIONS = 8760

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 2.8%
B : 2.1%
C : 5.5%
D : 53.9%
E : 28.5%
F : 7.2%

STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0125	0188	0052
02	0000	0000	0000	0129	0179	0057
03	0000	0000	0000	0126	0179	0060
04	0000	0000	0000	0105	0189	0071
05	0000	0000	0000	0131	0175	0059
06	0003	0005	0012	0161	0151	0033
07	0011	0007	0024	0220	0089	0014
08	0012	0020	0046	0287	0000	0000
09	0025	0018	0054	0268	0000	0000
10	0038	0024	0056	0247	0000	0000
11	0045	0022	0072	0226	0000	0000
12	0041	0025	0068	0231	0000	0000
13	0035	0026	0050	0254	0000	0000
14	0022	0019	0048	0276	0000	0000
15	0008	0013	0033	0311	0000	0000
16	0006	0000	0017	0320	0021	0001
17	0001	0003	0004	0275	0073	0009
18	0000	0000	0000	0192	0154	0019
19	0000	0000	0000	0158	0174	0033
20	0000	0000	0000	0141	0189	0035
21	0000	0000	0000	0123	0200	0042
22	0000	0000	0000	0136	0182	0047
23	0000	0000	0000	0136	0179	0050
24	0000	0000	0000	0141	0176	0048

 STABILITY CLASS BY MIXING HEIGHT

Mixing height	A	B	C	D	E	F
<=500 m	0019	0028	0065	1183	2393	0624
<=1000 m	0134	0097	0249	1544	0029	0002
<=1500 m	0094	0057	0170	1694	0076	0004
<=2000 m	0000	0000	0000	0225	0000	0000
<=3000 m	0000	0000	0000	0069	0000	0000
>3000 m	0000	0000	0000	0004	0000	0000

 MIXING HEIGHT BY HOUR OF DAY

Hour	0000 to 0100	0100 to 0200	0200 to 0400	0400 to 0800	0800 to 1600	1600 to 3200	Greater than 3200
01	0070	0167	0028	0053	0033	0014	0000
02	0068	0165	0031	0048	0039	0014	0000
03	0079	0157	0032	0051	0033	0013	0000
04	0090	0161	0033	0036	0032	0013	0000
05	0129	0134	0026	0043	0024	0009	0000
06	0087	0136	0099	0017	0016	0010	0000
07	0118	0057	0115	0075	0000	0000	0000
08	0000	0058	0127	0180	0000	0000	0000
09	0000	0000	0089	0192	0084	0000	0000
10	0000	0000	0000	0233	0132	0000	0000
11	0000	0000	0000	0136	0229	0000	0000
12	0000	0000	0000	0092	0273	0000	0000
13	0000	0000	0000	0000	0365	0000	0000
14	0000	0000	0000	0000	0365	0000	0000
15	0000	0000	0000	0000	0365	0000	0000
16	0000	0000	0000	0000	0365	0000	0000
17	0008	0026	0006	0017	0305	0003	0000
18	0022	0099	0017	0024	0190	0013	0000
19	0033	0158	0031	0036	0073	0034	0000
20	0038	0172	0022	0053	0058	0022	0000
21	0057	0171	0028	0043	0046	0019	0001
22	0063	0160	0021	0067	0037	0017	0000
23	0066	0159	0029	0051	0042	0018	0000
24	0064	0153	0032	0065	0035	0016	0000

 STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0097	0079	0189
02	0000	0000	0000	0099	0076	0190
03	0000	0000	0000	0100	0066	0199
04	0000	0000	0000	0105	0056	0204
05	0000	0000	0000	0091	0064	0210
06	0026	0009	0007	0084	0035	0204
07	0087	0022	0039	0078	0016	0123
08	0176	0038	0059	0060	0005	0027
09	0191	0054	0072	0048	0000	0000
10	0198	0054	0076	0037	0000	0000
11	0209	0052	0072	0032	0000	0000
12	0199	0059	0081	0026	0000	0000
13	0202	0047	0085	0031	0000	0000
14	0168	0058	0100	0039	0000	0000
15	0120	0074	0118	0053	0000	0000
16	0054	0068	0116	0091	0009	0027
17	0024	0034	0080	0143	0027	0057
18	0004	0007	0015	0199	0059	0081
19	0000	0000	0000	0148	0093	0124
20	0000	0000	0000	0122	0093	0150
21	0000	0000	0000	0103	0079	0183
22	0000	0000	0000	0117	0067	0181
23	0000	0000	0000	0101	0088	0176
24	0000	0000	0000	0100	0077	0188

 STABILITY CLASS BY MIXING HEIGHT

Mixing height	A	B	C	D	E	F
<=500 m	0346	0076	0092	0772	0930	2421
<=1000 m	0688	0226	0336	0738	0012	0038
<=1500 m	0624	0274	0492	0566	0047	0054
<=2000 m	0000	0000	0000	0027	0000	0000
<=3000 m	0000	0000	0000	0001	0000	0000
>3000 m	0000	0000	0000	0000	0000	0000

 MIXING HEIGHT BY HOUR OF DAY

Hour	0000 to 0100	0100 to 0200	0200 to 0400	0400 to 0800	0800 to 1600	1600 to 3200	Greater than 3200
01	0211	0067	0036	0028	0023	0000	0000
02	0215	0056	0030	0042	0020	0002	0000
03	0227	0045	0034	0042	0016	0001	0000
04	0222	0043	0039	0040	0020	0001	0000
05	0266	0038	0022	0025	0012	0002	0000
06	0190	0075	0075	0013	0011	0001	0000
07	0115	0058	0114	0077	0000	0001	0000
08	0000	0071	0120	0174	0000	0000	0000
09	0000	0000	0101	0182	0082	0000	0000
10	0000	0000	0000	0235	0130	0000	0000
11	0000	0000	0000	0140	0225	0000	0000
12	0000	0000	0000	0092	0273	0000	0000
13	0000	0000	0000	0000	0365	0000	0000
14	0000	0000	0000	0000	0365	0000	0000
15	0000	0000	0000	0000	0365	0000	0000
16	0000	0000	0000	0000	0365	0000	0000
17	0026	0008	0004	0013	0314	0000	0000
18	0056	0042	0005	0034	0225	0003	0000
19	0115	0080	0015	0031	0121	0003	0000
20	0155	0089	0025	0042	0051	0003	0000
21	0194	0068	0030	0046	0027	0000	0000
22	0197	0057	0041	0039	0031	0000	0000
23	0201	0073	0029	0039	0023	0000	0000
24	0207	0061	0038	0035	0024	0000	0000

APPENDIX B
ESTIMATED DUST EMISSIONS

ESTIMATED DUST EMISSIONS : NCIG COAL LOADER

The dust emission inventories have been formulated from the operational description provided by NCIG. Estimated emissions are presented for all significant dust generating activities associated with the operations. The relevant emission factors used for the study are described below.

Loading, unloading and transferring material

The dust emission from this activity will depend on wind speed according to the **US EPA (1985)** emission factor equation. This means that the emissions will vary with wind speed. The actual emission is given by Equation 1.

Equation 1

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

where,

E_{TSP} = TSP emissions

$k = 0.74$

U = wind speed (m/s)

M = moisture content (%)

[where $0.25 \leq M \leq 4.8$]

In cases where transfer points include some form of enclosure a reduction to emissions of 70% (Table 3 of **NPI, 2001**) has been used.

Wind erosion from exposed areas and stockpiles

The emission factor for wind erosion is given in Equation 2 below.

Equation 2

$$E_{TSP} = 1.9 \times \left(\frac{s}{1.5} \right) \times \left(\frac{365 - p}{235} \right) \times \left(\frac{f}{15} \right) \quad \text{kg/ha/day}$$

where,

s = silt content (%)

p = number of raindays per year, and

f = percentage of the time that wind speed is above 5.4 m/s

Dozer working on stockpiles

The **US EPA (1985 and updates)** emission factor equation has been used. It is given below in Equation 3.

Equation 3

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

Diesel train exhausts

The emission factor was taken to be 0.034 kg/h for a locomotive in notch 1 (**Lilley, 1996**).

Emissions inventory: NCIG CET (66 Mtpa)

ACTIVITY	TSP (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units
Trains unloading to unloading station	21,454	66,000,000	t/y	0.00033	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	8	moisture content (%)	-	bcm
1st transfer between unloading station and stockpiles	21,454	66,000,000	t/y	0.00033	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	8	moisture content (%)	-	bcm
2nd transfer between unloading station and stockpiles	21,454	66,000,000	t/y	0.00033	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	8	moisture content (%)	-	bcm
Stacking to coal stockpiles	21,454	66,000,000	t/y	0.00033	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	8	moisture content (%)	-	bcm
Reclaiming coal from stockpiles	18,192	66,000,000	t/y	0.00028	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	9	moisture content (%)	-	bcm
1st transfer between stockpile and shiploader	18,192	66,000,000	t/y	0.00028	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	9	moisture content (%)	-	bcm
2nd transfer between stockpile and shiploader	18,192	66,000,000	t/y	0.00028	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	9	moisture content (%)	-	bcm
Transfer to buffer bins (enclosed)	-										
3rd transfer between stockpile and shiploader	18,192	66,000,000	t/y	0.00028	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	9	moisture content (%)	-	bcm
Loading coal to ships	18,192	66,000,000	t/y	0.00028	kg/t	1.912	average of (wind speed/2.2) ^{1.3} in m/s	9	moisture content (%)	-	bcm
Wind erosion from coal stockpiles	127,839	62.13	ha	2057.8	kg/ha/y	133	Average number of raindays	4	silt content in %	16.9064	% of winds above 5.4 m/s
Dozer working on coal stockpiles	1,595	156	h/y	10.2	kg/h	4	silt content in %	8	moisture content in %		
Diesel train exhausts	894	8760	h/y	0.034	kg/h	3	No locos				

APPENDIX C
AUSPLUME MODEL OUTPUT FILE

AUSPLUME MODEL OUTPUT FILE:

Some parts of this file have been deleted to save paper. The complete model input and output files can be provided on request.

1

NCIG - 66 Mtpa - concentration

```

Concentration or deposition          Concentration
Emission rate units                 grams/second
Concentration units                 microgram/m3
Units conversion factor             1.00E+06
Constant background concentration   0.00E+00
Terrain effects                     Egan method
Plume depletion due to dry removal mechanisms included.
Smooth stability class changes?     No
Other stability class adjustments ("urban modes") None
Ignore building wake effects?      Yes
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height                  10 m
Roughness height at the wind vane site 0.500 m
    
```

DISPERSION CURVES

```

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height                    0.500m
Adjustment for wind directional shear None
    
```

PLUME RISE OPTIONS

```

Gradual plume rise?                 Yes
Stack-tip downwash included?        Yes
Building downwash algorithm:        Schulman-Scire method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No
    
```

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class					
	A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES

Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES

24 hours
average over all hours

NCIG - 66 Mtpa - concentration

SOURCE GROUPS

Group No.	Members						
1	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	#####	#####
	#####	#####	#####	#####	#####	#####	#####
	#####	#####	#####	#####	#####	#####	#####

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 2

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
382925	6361938	2m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 3

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
382947	6362115	2m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 4

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
382985	6362253	1m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 5

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
383303	6362073	2m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 6

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
383471	6361963	3m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 7

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
383670	6361836	4m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 8

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
383882	6361698	3m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50

VOLUME SOURCE: 9

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
384089	6361568	4m	2m	20m	2m

(Constant) emission rate = 1.00E+00 grams/second

Hourly multiplicative factors will be used with this emission factor.

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
1.0000	1.0	2.50