Appendix F

Air Quality Assessment

AECOM

Air Quality Impact Assessment

Mayfield Site Port-Related Activities Concept Plan

Air Quality Impact Assessment

Mayfield Site Port-Related Activities Concept Plan

Prepared for

Newcastle Port Corporation

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Quality Information

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Executive Summary

AECOM Australia Pty Ltd (AECOM) was commissioned by Newcastle Port Corporation (NPC) to undertake an environmental assessment to support an application seeking Concept Plan Approval for the Mayfield port-side lands. This stand alone air quality impact assessment (AQIA) was prepared to support the application. It is anticipated that development at the proposed concept site would commence in 2011 and that peak operations would be reached by approximately 2034.

The site would have the following five key land-based operational precincts;

- **NPC Operations Precinct** would be used by NPC for managing all operations within the Port of Newcastle.
- **Bulk and General Precinct** would be used for handling and storing bulk goods such as grain and other dry bulk goods.
- **General Purpose Precinct** would be used for handling and storing cargo containers, heavy machinery, break bulk and Roll on / Roll off cargo.
- **Container Terminal Precinct** would be used for container storage and transfer.
- **Bulk Liquid Precinct** would be used for receival, storage, blending and distribution of fuels.

The proposed concept also includes a Berth Precinct which would contain up to seven berths to support operations within the five land-based operational precincts described above. An access corridor accommodating the necessary infrastructure to service the facilities would also be provided.

NPC is seeking to ensure the proposed concept site is developed in accordance with the NSW *Ports Growth Plan*, of which one of the core directions is for the entire BHP Steelworks site, including the site, to be secured for port use, and developed in accordance with NPC's strategic planning for the site. The proposed concept would enable the site to be developed in a co-ordinated manner that promotes highest and best use of the site for port uses, whilst minimising adverse impacts with surrounding interface activities, particularly nearby residential development located to the south of Industrial Drive.

The AQIA examines the likely sources of air pollution during both the construction phase (qualitative assessment) and operational phase (quantitative assessment) of the proposed concept, and investigates the local and regional air quality characteristics to determine the capacity of the local air-shed to absorb emissions from the proposed concept. Air dispersion modelling was undertaken to predict the likely air quality impacts that the operational phase of the proposed concept may have on the surrounding area. The assessment considered the operations of the five land-based precincts and the Berth Precinct including increased train, truck and shipping vessel movements, bulk material handling including stockpile emissions, and emissions from the Bulk Liquid Precinct.

A quantitative analysis of the regional air shed was undertaken using existing pollution data for particulate matter (TSP, PM_{10} and $PM_{2.5}$), volatile organic compounds (e.g. benzene, toluene, ethylbenzene, xylenes (BTEX)), carbon monoxide, nitrogen dioxide, sulphur dioxide and odour. The analysis showed that with the exception of short term episodic particulate matter (short term concentrations of PM_{10} can on occasion exceed the assessment criteria), there is the capacity to increase the pollutants of concern in the air shed without exceeding relevant criteria. The analysis has shown that there may be a constraint on those operations that have the potential to emit fine particulates in the air shed during the construction and operation phases.

The meteorological data collected for the region suggests that the emission of pollutants during night time may have a higher impact on the surrounding area when the winds are more stable and hence there is less dispersion of pollutants. Future operations of the proposed concept will have to consider this night time affect when planning developments, particularly in relation to particulate emissions.

The modelling results for operation of the proposed concept suggest that with the exception of short term (24 hour) PM_{10} concentrations, all pollutants comply with the relevant criteria. The worst case background PM_{10} level (65.6 $\mu g/m^3$) already exceeds the DECCW criteria of 50 $\mu g/m^3$ for 24 hour PM_{10}. As such, operation of the Concept Plan combined with worst case background PM_{10} would result in 24 hour PM_{10} levels exceeding the DECCW criteria at all of the 14 discrete receptors surrounding the site. The modelling demonstrated that the criteria would be exceeded by up to 21 $\mu g/m^3$ at Receptor 1 which is located at Selwyn Street. It should be noted that while the proposed concept would generate PM_{10} emissions and contribute to exceedance of the criteria, the contribution from the proposed concept alone is minor (less than 11 percent of the assessment criteria and 8 percent of the predicted cumulative concentration.

Recommendations for the mitigation of pollutants from the site are provided in the assessment and include measures to control emissions of particulates such as watering exposed surfaces and covering loads during transportation, and measures to minimise fuel combustion emissions. Monitoring of ambient pollutant levels, in particular PM_{10}, should be undertaken during the operation phase and an appropriate air quality mitigation plan (AQMP) should be prepared and updated based on these results.

Future analysis and atmospheric dispersion modelling by project applicants may be required to re-assess the impact using updated background air pollutant levels and meteorological data once the Port and other local developments are operational. A case by case approach is recommended for new developments not included in this assessment to assess worst case air pollution scenarios.

1.0 Introduction

1.1 Background

AECOM Australia Pty Ltd (AECOM) was commissioned by Newcastle Port Corporation (NPC) to undertake an environmental assessment to support an application seeking Concept Plan Approval for the Mayfield portside lands (the Site). This stand alone air quality impact assessment (AQIA) was prepared to support the application. It is anticipated that development at the proposed concept site would commence in 2011 and that peak operations would be reached by approximately 2034.

The site would have the following five key land-based operational precincts;

- **NPC Operations Precinct** would be used by NPC for managing all operations within the Port of Newcastle.
- **Bulk and General Precinct** would be used for handling and storing bulk goods such as grain and other dry bulk goods.
- **General Purpose Precinct** would be used for handling and storing cargo containers, heavy machinery, break bulk and Roll on / Roll off (Ro/Ro) cargo.
- **Container Terminal Precinct** would be used for container storage and transfer.
- **Bulk Liquid Precinct** would be used for receival, storage, blending and distribution of fuels.

The proposed concept also includes a Berth Precinct which would contain up to seven berths to support operations within the five land-based operational precincts described above. An access corridor accommodating the necessary infrastructure to service the facilities would also be provided.

The AQIA examines the likely sources of air pollution during both the construction phase (qualitative assessment) and operational phase (quantitative assessment) of the proposed concept, and investigates the local and regional air quality characteristics to determine the capacity of the local air-shed to absorb emissions from the proposed concept.

Air dispersion modelling was undertaken to predict the likely air quality impacts that the operational phase of the proposed concept may have on the surrounding area. The assessment considered the operations of the five land-based precincts and the Berth Precinct including increased train, truck and shipping vessel movements, bulk material handling including stockpile emissions, and emissions from the Bulk Liquid Precinct resulting from the proposed concept.

1.2 Project Overview

NPC is seeking to ensure the site is developed in accordance with the NSW *Ports Growth Plan*, of which one of the core directions is for the entire BHP Steelworks site, including the site, to be secured for port use, and developed in accordance with NPC's strategic planning for the site. The proposed concept would enable the site to be developed in a co-ordinated manner that promotes highest and best use of the site for port uses, whilst minimising adverse impacts with surrounding interface activities, particularly nearby residential development located to the south of Industrial Drive.

It is anticipated the site would be dedicated predominately to handling containers and break bulk. There would also need to be provisions for bulk storage and handling, including solid and liquids and Ro/Ro cargo. Berths would be required along the waterfront, and covered and open hardstand storage areas would be required to support ship loading and unloading activities. Road and rail freight infrastructure would also be required to service the site.

1.3 Scope of Assessment

This air quality assessment qualitatively considers the construction works and quantitatively considers the operation of the proposed concept (expected to be completed and fully operational in 2034). A summary of the air quality assessment scope of works is as follows:

- Ambient background pollutant concentrations were investigated for the area surrounding the Port. This review also considered the impacts of proposed developments that are yet to impact on local background pollutant concentrations.
- Identification of the major potential sources of air emissions and pollutants of concern from the Port.
- Local topography, meteorology and location of sensitive receptors were examined to assess how these factors may affect the proposed concept pollution envelope.
- Quantitative air dispersion modelling was undertaken to predict the likely air quality impacts that the proposed concept may have on the surrounding area. The assessment considered the operations of the five land-based precincts and the Berth Precinct including increased traffic emissions from trains, trucks and shipping vessels, bulk material handling including stockpile emissions and emissions from the Bulk Liquid Precinct. The modelling results were combined with ambient pollutant concentrations (where available) and compared to NSW Department of Environment, Climate Change and Water (DECCW) assessment criteria.
- Recommendations for further investigation and mitigation measures are considered.

The air quality assessment was prepared with reference to the Director-Generals Requirements (DGRs) and Adequacy Review comments.

2.0 Site Description

2.1 Introduction

This section summarises the site information relevant to the air quality assessment. Further details may be found in the environmental assessment report. Sensitive receptors have been discussed in **Section 8.3**.

2.2 Site Location and Existing Development

The site is located approximately seven kilometres north of the Newcastle CBD along the South Arm of the Hunter River. The site is relatively flat and is largely devoid of vegetation. The majority of the site has been sealed with asphalt as part of the land based remediation works for the former BHP Steelworks site. An elevated pipeline structure owned by Koppers and firewater supply pipeline runs west to east through the site roughly parallel to the South Arm of the Hunter River.

A general cargo handling facility, also known as Mayfield No.4 Berth, was approved by the Minister for Planning on 21 November 2009 as a modification to the 2001 consent (DA-293-08-00 (MOD-56-7-2008)). Construction of the facility (including refurbishment of the existing Mayfield No.4 Berth) within the General Purpose Precinct has been completed, and operation of the facility commenced in 2010. The facility handles a range of cargo types, including ammonium nitrate, which have been included in the total 1.35 MTPA throughput estimated for the precinct. Mayfield No.4 Berth is located within the General Purpose Precinct.

2.3 Surrounding Land Use

Significant industrial land use surrounding the site includes the OneSteel facility at Mayfield, the Orica and Incitec plants on Kooragang Island and the Tomago Aluminium smelter at Tomago (to the north). Additional pollutant sources include dust emissions from the coal and grain terminals, and odour from seed processing (Cargill). There are three fuel storage facilities in Newcastle: Caltex (Wickham), BP (Carrington) and Shell (Hamilton), which are located adjacent to or near residential areas.

Existing industrial developments on Kooragang Island include Port Waratah Coal Service, wharf facilities, coal and woodchip loaders, Orica Mining Services (recently acquired from Incitec Ltd), Simsmetal Ltd, Cargill, BOC Gases, Cleanaway, Boral, A. J. Meyer, and Transfield Pty Ltd.

Additional information on existing air quality surrounding the site has been summarised in **Section 6.3**.

2.4 Sensitive Receptors

The closest residential area to the site is Mayfield East (approximately 900 m to the south-west), Stockton (2 kilometres to the south east) and Tighes Hill (2 kilometres to the south). The South Arm of the Hunter River is to the north.

The DECCW considers sensitive receptors to be areas where people are likely to either live or work, or engage in recreational activities (DEC, 2005). On this basis, representative sensitive receptors were selected surrounding the site and included in the modelling. The receptors were chosen from local residential and commercial buildings. A detailed description of the chosen sensitive receptors is provided in **Section 8.3**.

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3.0 Project Description

3.1 Construction Activities

The detailed programme of works for site preparation and construction had not been finalised prior to the preparation of this assessment. However, an estimation of the potential impacts as a result of the construction phase has been made based on discussions with NPC.

Anticipated activities to be undertaken during the construction phase would include:

- Excavation of areas for foundations.
- Preparation of the site ready for construction.
- Installation of services and infrastructure, including stormwater drainage lines.
- Construction of the following:
  - Reinforced concrete bund walls;
  - Hardstand;
  - Berthing facilities;
  - Internal roadways (excavation, compacting of road base, pouring of concrete pavement (reinforced) for main driveway) and rail lines;
  - Storage facilities and associated buildings; and
  - A pipeline and conveyors to transfer materials between the berth and the storage facilities.

3.2 Operational Activities

Consistent with the *NSW Ports Growth Plan* and current strategic planning by NPC for the site, NPC is seeking Concept Plan Approval for the construction and operation of port-related activities on the portion of the former BHP Steelworks site adjacent to the South Arm of the Hunter River which occupies an area of approximately 90 hectares. It is anticipated that construction at the site would commence in 2011 and that peak operations would be reached by approximately 2034.

The site would have five key land-based operational precincts which are described below and shown on **Figure 1**:

- **NPC Operations Precinct**. The NPC Operations Precinct would be used by NPC for managing all operations within the Port of Newcastle. The precinct would be located at the south eastern end of the site, fronting Berth 1. Various buildings and small-scale facilities, including vehicle and marine equipment maintenance areas, would be located in the precinct. The precinct would also likely be the location of the NPC dredging vessel.
- **Bulk and General Precinct**. The Bulk and General Precinct would be used for handling and storing bulk goods such as grain and other dry bulk goods, including cement, fertilizer, and coke cargoes, and for other general purposes. The precinct would be located in the south eastern portion of the site, immediately to the north west of the NPC Operations Precinct and fronting Berth 2. Various buildings and infrastructure would be located in the precinct, including covered storage areas, storage silos, conveyor systems, and office buildings.
- **General Purpose Precinct**. The General Purpose Precinct would be used for handling and storing cargo containers, heavy machinery, break bulk and Ro/Ro cargo. The precinct would be located in the central and north eastern portion of the site, immediately to the north west of the Bulk and General Precinct and fronting Berths 3 and 4. Various buildings and infrastructure would be located in the precinct, including covered storage areas and areas of hardstand.
- **Container Terminal Precinct**. The Container Terminal Precinct would be used for container storage and transfer. The precinct would be located in the central and north western portion of the site, immediately to the north west of the General Purpose Precinct and fronting Berths 5 and 6. Buildings and infrastructure including quayside and mobile cranes, rail mounted gantries, hardstand areas, and an administration building would be provided.

- **Bulk Liquid Precinct**. The Bulk Liquid Precinct would be used for receival, storage, blending and distribution of fuels. The precinct would be located in the far north western portion of the site, immediately to the north west of the Container Terminal Precinct and fronting Berth 7. Buildings and structures including tank farms with steel storage tanks, fuel distribution pipelines and administration buildings would be provided.

In addition to precinct specific buildings and infrastructure, the site would be supported by security entrance and exit points, designated quarantine and customs inspection and cleaning area, appropriate lighting (including tall lighting in areas of crane operations), staff amenities and parking areas and office facilities as required. It is important to note that NPC is planning to subdivide the BHP Steelworks site in order to separate the site from the remainder of the lands in the BHP Steelworks site. NPC would ultimately subdivide the site and land within the operational precincts when leasing out various parcels of land to developers.

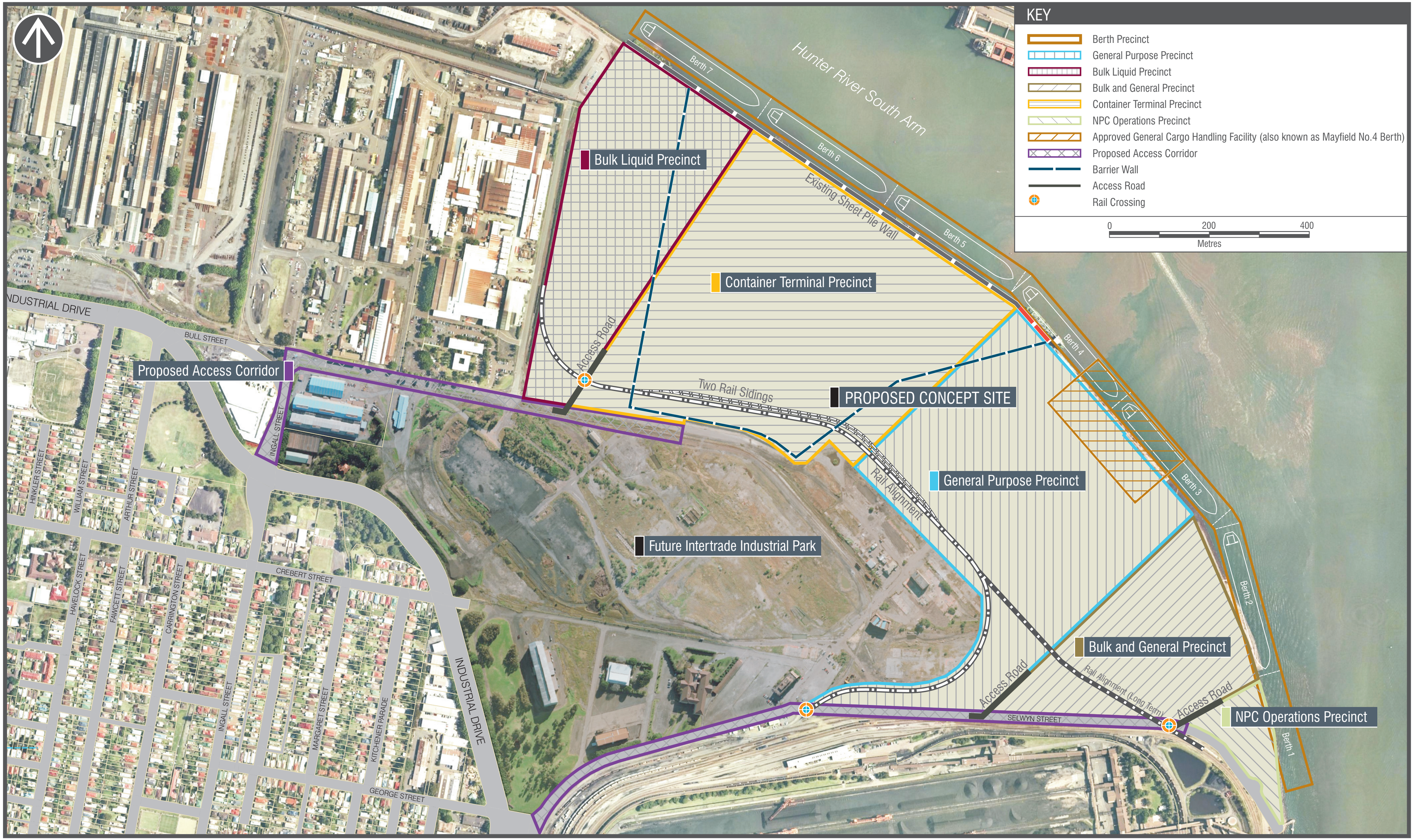
The proposed concept also includes a Berth Precinct which would contain up to seven berths to support operations within the five land-based operational precincts described above. An access corridor accommodating the necessary infrastructure (e.g. road and rail infrastructure, potable water, electricity, communications, gas and sewage) to service the facilities would also be provided.

The Container Terminal Precinct would require the use of three berths and the General Purpose Precinct, the Bulk and General Precinct, the Bulk Liquids Precinct and the NPC Operations Precinct would each require use of one berth. The Container Terminal Precinct and the General Purpose Precinct may share one berth (Berth 4). The seven berths are notionally between 48 and 55 metres wide, between 240 and 310 metres long and between 11.6 and 16.5 metres deep. All berths would require dredging to reach the required depth.

Based on the maximum trade volumes for each precinct outlined above, the following maximum ship movements are anticipated:

- 100 ships per annum for the General Purpose Precinct and the Bulk and General Precinct combined;
- 40 ships per annum for the Bulk Liquids Precinct; and
- 420 ships per annum for the Container Terminal Precinct.

The turn around time for ships to load and unload while at berth is normally between one to two days.



AECOM

CONCEPT PLAN

Air Quality Impact Assessment

Mayfield Site Port-Related Activities Concept Plan

Figure 1

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4.0 Regulatory Framework

4.1 Overview

Legislation relating to air quality in NSW exists as Acts of Parliament and associated Regulations. Council is responsible for the regulation of all non-scheduled premises and their activities under the Protection of the Environment Operations Act 1997 (POEO Act). The POEO Act, which combines earlier legislation regulating air, water, noise, waste and licensing, came into effect from 1 July 1999.

Action for Air: The NSW Government′s 25-Year Air Quality Management Plan published by the NSW Environment Protection Authority (EPA, now known as the Department of Environment, Climate Change and Water (DECCW)) in 1998 (and reviewed triennially, i.e. 2001, 2004 and was updated in August 2006), provides the strategic framework for improving air quality in the Greater Metropolitan Regions of NSW. The Action Plan includes a range of strategies including transport, education and regulatory initiatives as well as actions to reduce household and industrial emissions. The specific objectives applicable to the Port relate to the promotion of cleaner business and reducing industrial emissions.

In 1994, Newcastle City Council (NCC) completed the Newcastle Environmental Management Plan (NEMP). One of the key actions of the NEMP was to develop an airshed management plan for the city. A working group was formed in 1997 and subsequently, in 1998, the Newcastle Airshed Management Plan (NAMAP) was adopted to improve the air quality of the local and regional airsheds. A review of the NEMP was undertaken in 2003 to address implementation and changes since the original NEMP. A prior action for air in the NEMP was to “review and implement NAMAP” (NCC, 2005).

4.2 Air Pollution Standards

4.2.1 National Environment Pollution Measure

In June 1998 the National Environment Protection Council (NEPC) released a National Environment Protection Measure (NEPM) for Ambient Air Quality, setting out national standards and goals for six common ambient air pollutants (known as the “criteria” air pollutants). These are sulphur dioxide (SO_2), particulate matter as PM_{10} , carbon monoxide (CO), lead (Pb), ozone (O_3) and nitrogen dioxide (NO_2). In May 2003, the NEPC also released a Variation to the Ambient Air Quality NEPM, which introduced advisory reporting standards for $PM_{2.5}$. These advisory reporting standards have been designed to assist in gathering sufficient data nationally on fine particles, with the information used to inform the review process for the Ambient Air Quality NEPM. Standards and goals for the Air Qualtiy NEPM and the Air Toxics NEPM have been summarised in **Table 4-1** and **Table 4-2** respectively.

When reviewing the standards and goals set out in the NEPM for Ambient Air Quality, it is important to note that the standards established as part of the NEPM are designed to be used to give an ‘average’ representation of general air quality for large urban populations. That is, the NEPM monitoring protocol was not designed to apply to assessing the air quality at locations adjacent to major roads and industrial premises.

In addition, the National Environment Protection (Ambient Air Toxics) Measure (i.e. Air Toxics NEPM) was set by the NEPC in 2004. The Air Toxics NEPM includes monitoring investigation levels specified for five compounds: benzene, toluene, xylenes, formaldehyde and benzo(a)pyrene (as a marker for polycyclic aromatic hydrocarbons). The monitoring investigation levels are those below which lifetime exposure, or exposure for a given averaging time, does not constitute a significant health risk (not odour and amenity). They are not compliance standards but provide guidelines in order to assess the significance of the monitored levels of air toxics with respect to protection of human health. However, if these limits are exceeded in the short-term it does not mean that adverse health effects have occurred.

A formal requirement of the Air NEPM is that the responsible agency of each State or Territory will establish monitoring procedures and commence assessment and reporting on pollutant levels in accordance with the protocols set out in the Air NEPM.

Table 4-1: NEPM Ambient Air Guidelines

Pollutant	Averaging period	Maximum (ambient) concentration	Maximum allowable exceedences [1]
Carbon monoxide	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
	1 year	0.03 ppm	none
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year
	4 hours	0.08 ppm	1 day a year
Sulfur dioxide	1 hour	0.20 ppm	1 day a year
	1 day	0.08 ppm	1 day a year
	1 year	0.02 ppm	none
Lead	1 year	0.50 $\mu g/m^3$	none
Particles as PM_{10}	1 day	50 $\mu g/m^3$	5 days a year
Particles as $PM_{2.5}$ [2]	1 day 1 year	25 $\mu g/m^3$ 8 $\mu g/m^3$	Nil

1 The maximum allowable exceedance is an ambient assessment goal set by NEPC to reach within 10 years of developing the standard in 2003.
2 Goal of this standard is to gather sufficient data nationally to facilitate a review of the standard as part of the review of this measure scheduled to commence in 2005.

Table 4-2: Air Toxics NEPM Monitoring Investigation Levels

Substance	Averaging period	Monitoring investigation level	Goal
Benzene	Annual average	0.003 ppm (3 ppb)	Goal is to gather sufficient data nationally by 2008 to facilitate development of a standard.
Toluene	24 hours	1 ppm (1000 ppb)	Goal is to gather sufficient data nationally by 2008 to facilitate development of a standard.
	Annual average	0.1 ppm (100 ppb)	
Formaldehyde	24 hours	0.04 ppm (40 ppb)	Goal is to gather sufficient data nationally by 2008 to facilitate development of a standard.
Xylenes (as total of ortho-, meta- and para-isomers)	24 hours	0.25 ppm (250 ppb)	Goal is to gather sufficient data nationally by 2008 to facilitate development of a standard.
	Annual average	0.2 ppm (200 ppb)	
Benzo(a)pyrene as a marker for polycyclic aromatic hydrocarbons	Annual average	0.3 $\mu g/m^3$	Goal is to gather sufficient data nationally by 2008 to facilitate development of a standard.

4.3 NSW DECCW Impact Assessment Criteria

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') was revised by the DECCW on 26 August 2005. The Approved Methods provide guidance for the selection and configuration of air dispersion models, methodologies to be used to compile meteorological datasets and emissions data, and specifies the assessment criteria to be used to evaluate compliance. Impacts of SO_2, NO_2, O_3, Pb, PM_{10},, Total Suspended Particulate (TSP), deposited dust, CO and Hydrogen Fluoride (HF) (refer to **Section 5.0** for description of pollutants) must be combined with existing background levels before comparison with the relevant impact assessment criteria. **Table 4-3** summarises the criteria set for these pollutants.

Table 4-3: NSW DECCW Impact Assessment Criteria

Pollutant	Averaging period	Concentration		Source
		pphm	**µg/m³**	
SO_2	10 minutes	25	712	NHMRC (1996)
	1 hour	20	570	NEPC (1998)
	24 hours	8	228	NEPC (1998)
	Annual	2	60	NEPC (1998)
NO_2	1 hour	12	246	NEPC (1998)
	Annual	3	62	NEPC (1998)
O_3	1 hour	10	214	NEPC (1998)
	4 hours	8	171	NEPC (1998)
Pb	Annual	-	0.5	NEPC (1998)
PM_{10}	24 hours	-	50	NEPC (1998)
	Annual	-	30	EPA (1998)
TSP	Annual	-	90	NHMRC (1996)
		g/m².month	**g/m².month**	
Deposited dust	Annual	2(1)	4(1)	NERDDC (1988)
		ppm	**mg/m³**	
CO	15 minutes	87	100	WHO (2000)
	1 hour	25	30	WHO (2000)
	8 hours	9	10	NERDDC (1998)
		µg/m³(2)	**µg/m³(3)**	
HF	90 days	0.5	0.25	ANZECC (1990)
	30 days	0.84	0.4	ANZECC (1990)
	7 days	1.7	0.8	ANZECC (1990)
	24 hours	2.9	1.5	ANZECC (1990)

(1) Deposited dust criteria allow for a maximum increase of 2 g/m².month with a total cumulative rate of 4 g/m².month.

(2) Fluoride criteria refer to non sensitive land use

(3) Fluoride criteria refer to sensitive land use e.g. grapes, stone fruit etc.

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5.0 Pollutants of Potential Concern

5.1 Introduction

The pollutants of potential concern (POPC) which may be generated during the construction and operation of a port have been identified in this section along with the characteristics of the pollutants and their potential health effects. The sources of these pollutants and their significance to this project have been outlined in **Section 7.0**.

The list of POPC for the proposed concept include:

- Particulate matter (TSP, PM_{10} and $PM_{2.5}$);
- Volatile organic compounds (e.g. benzene, toluene, ethylbenzene, xylenes (BTEX) etc.);
- Carbon monoxide (CO);
- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2); and
- Odour.

5.2 Particulate Matter

Dust emissions comprise two components: suspended and deposited particulate matter.

Deposited particulate matter refers to the mostly larger fractions that fall from the air close to emission sources. In general terms, most deposited particles have aerodynamic diameters greater than about 20 μm. The main adverse effect associated with this material is dust nuisance, primarily due to soiling of clothes or building surfaces, but, depending on its physical or chemical characteristics, it may also cause surface deterioration of materials due to its abrasive or corrosive properties.

Suspended particulate matter refers to the fraction of particles that remain suspended in the atmosphere for relatively long periods of time and is typically smaller than 20 μm. Particulate matter greater than 10 μm in diameter is non-inhalable, as these particles do not penetrate further than the mouth and nose. Particulate matter smaller than 10 μm in diameter (PM_{10}) is inhalable and smaller fractions (particulate matter less than 2.5 μm in diameter, $PM_{2.5}$) can enter the respiratory system. There is currently no assessment criteria for $PM_{2.5}$ set by the NSW DECCW.

In general, the smaller particles (e.g. PM_{10} and $PM_{2.5}$) are more strongly associated with potential health effects. If contaminated, these particles may pose a further risk through the absorption of the chemicals on the particles into the bloodstream.

Information from various sources such as the World Health Organisation and the United States Environmental Protection Agency indicates numerous scientific studies have linked particle pollution exposure to a variety of health effects, including:[1]

- Increased respiratory symptoms, such as irritation of the airways, aggravated asthma, development of chronic bronchitis and breathing difficulty through decreased lung function;
- Irregular heartbeat;
- Non-fatal heart attacks;
- Premature death in people with heart or lung disease;
- Toxic effects by absorption of the toxic material into the blood (e.g. cadmium, zinc, lead); and
- Allergic or hypersensitivity effects.

[1] Draft – A guideline for the development and implementation of a dust management program. *Western Australia Department of Environment and Conservation May 2008*.

These effects are often more pronounced for vulnerable groups, such as the very young, chronically ill and the elderly. Sensitive groups such as people with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even healthy people may experience temporary symptoms from exposure to elevated levels of particle pollution. Recent epidemiological research suggests that there is no threshold at which health effects do not occur[2].

5.3 Volatile Organic Compounds

Organic compounds with a vapor pressure at 20°C exceeding 0.13 kPa are referred to as volatile organic compounds (VOCs). VOCs have been implicated as a major precursor in the production of photochemical smog, which causes atmospheric haze, eye irritation and respiratory problems. VOC emissions are typical for oil processing, petrochemical and chemical plants and include emissions from point sources (storage tanks and filling stations vents) and fugitive emissions from pipelines and process equipment leaks.

5.4 Carbon Monoxide

CO is a colourless, odourless gas produced by the incomplete combustion of fuels containing carbon (e.g. oil, gas, coal and wood). CO is absorbed through the lungs of humans, where it reacts to reduce the blood's oxygen-carrying capacity. In urban areas, motor vehicles account for up to 90 percent of all CO emissions.

5.5 Nitrogen Dioxide

NO_2 is a brownish gas with a pungent odour. It exists in the atmosphere in equilibrium with nitric oxide. The mixture of these two gases is commonly referred to as nitrogen oxides (NO_x). NO_x is a product of combustion processes. In urban areas, motor vehicles and industrial combustion processes are the major sources of ambient NO_x. NO_2 can cause damage to the human respiratory tract, increasing a person's susceptibility to respiratory infections and asthma. NO_2 can also cause damage to plants, especially in the present of other pollutants such as O_3 and SO_2. NO_x are also primary ingredients in the reactions that lead to photochemical smog formation.

5.6 Sulfur Dioxide

SO_2 is a colourless gas with a sharp, irritating odour. It is formed in combustion processes through burning fossil fuel containing sulfur, in petroleum refining and smelting mineral ores. SO_2 may be oxidised in the atmosphere to form sulfuric acid, which contributes to acid rain. SO_2 affects human health by causing respiratory tract infections. People with pre-existing respiratory conditions such as asthma are most sensitive to SO_2 exposure. The simultaneous presence of airborne particulate matter can compound these effects. SO_2 and its aerosols can also damage vegetation and some materials.

5.7 Odour

Odour is a sensory response to the inhalation of one or more chemicals in the air we breathe. A person's perception of an odour can vary significantly depending on the sensitivity of the person, the acuteness of the person's sense of smell and the connotations that the odour bestows on that person. Odour primarily affects a person's quality of life and can have a large range of adverse effects including stress and other physical symptoms.

Odour is not monitored by the DECCW nor by industry. However, odour emissions need to be taken into account in any air pollution assessment, as many air pollution complaints in residential (and sometimes industrial) areas often relate to odour. Many industries in and around the assessment area contain potential odour sources.

[2] Ibid.

6.0 Existing Environment

6.1 Introduction

The major factors of the existing environment that can influence the level of air pollutants in the ambient environment include:

- Meteorological, such as still air and inversions (where cold air is trapped below warm air), can slow down the removal of pollutants and increase the impacts of air pollution;
- Terrain features, such as valleys which can influence the transport of the pollutants; and
- Existing air quality, due to local or regional sources of air pollution.

This section describes the meteorology and terrain features and existing air quality of the study area.

6.2 Meteorological and Terrain Features

Meteorology in the area surrounding the Port is affected by several factors such as terrain and land use. Wind speed and direction are largely affected by topography at the small scale, while factors such as synoptic scale winds (which are modified by sea breezes near the Newcastle coast in the daytime) and complex valley drainage flows that develop during night hours, affect wind speed and direction on the larger scale. As the proposed expansion is located in a coastal environment, varying wind patterns would be expected due to onshore and offshore winds.

The Bureau of Meteorology (BoM) collects meteorological data from sites in the Newcastle area. The closest BoM site to the study area that records long term meteorological data is at Williamtown Airport, approximately 12 kilometres to the north west. The meteorological data collected from the BoM site includes hourly records of temperature, wind speed and wind direction. A range of long term average data collected from this station are provided in **Table 6-1**.

In summer the average maximum temperature ranges from 27.2°C to 27.9°C and the minimum temperature ranges from 16.5°C to 18.1°C. In winter the average maximum temperature ranges from 17.0°C to 18.6°C and the average minimum temperature ranges from 6.3°C to 7.9°C.

The annual average humidity reading collected at 9 AM from the site is 73 percent, and at 3 PM the annual average is 57 percent. Rainfall data collected at Williamtown Airport shows, on average, that the wettest months are February to June, with average rainfall of greater than 100 millimetres for each of the months.

Long term average wind rose diagrams for data collected at Williamtown are provided in **Figure 2** and **Figure 3**. The wind roses show the frequency of occurrence of winds by direction and strength. The bar at the top of each wind rose diagram represents winds blowing from the north (i.e., northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds.

Figure 2 shows that in the morning winds are lighter than average and dominated by north westerly flows representing a land breeze generated on clear nights with light prevailing wind conditions, most common in winter. Winds from the east coming from the coast in the afternoon are generally stronger than the land breeze winds. By afternoon (**Figure 3**), winds are stronger and most frequently from the south east to north east, representing both common synoptic scale influences and some sea breeze effects, respectively.

Seasonal wind rose diagrams for data collected at Williamtown in 2006 are also provided in **Figure 4** to **Figure 8**. Significant seasonal differences in the wind conditions measured at the site are displayed by the diagrams. In the warmer months (i.e. summer and spring) the winds are predominantly from the north east to south direction and in the cooler months north westerly winds dominate.

In summary, the flat terrain surrounding the Port and the sea breeze-land breeze influences affect the local wind regime, and this is consistent with expectations.

Rose of Wind direction versus Wind speed in km/h (10 Sep 1942 to 31 Jan 2007)
WILLIAMTOWN RAAF
Site No: 061078 • Opened Jan 1942 • Still Open • Latitude: -32.7932° • Longitude: 151.8359° • Elevation 9m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

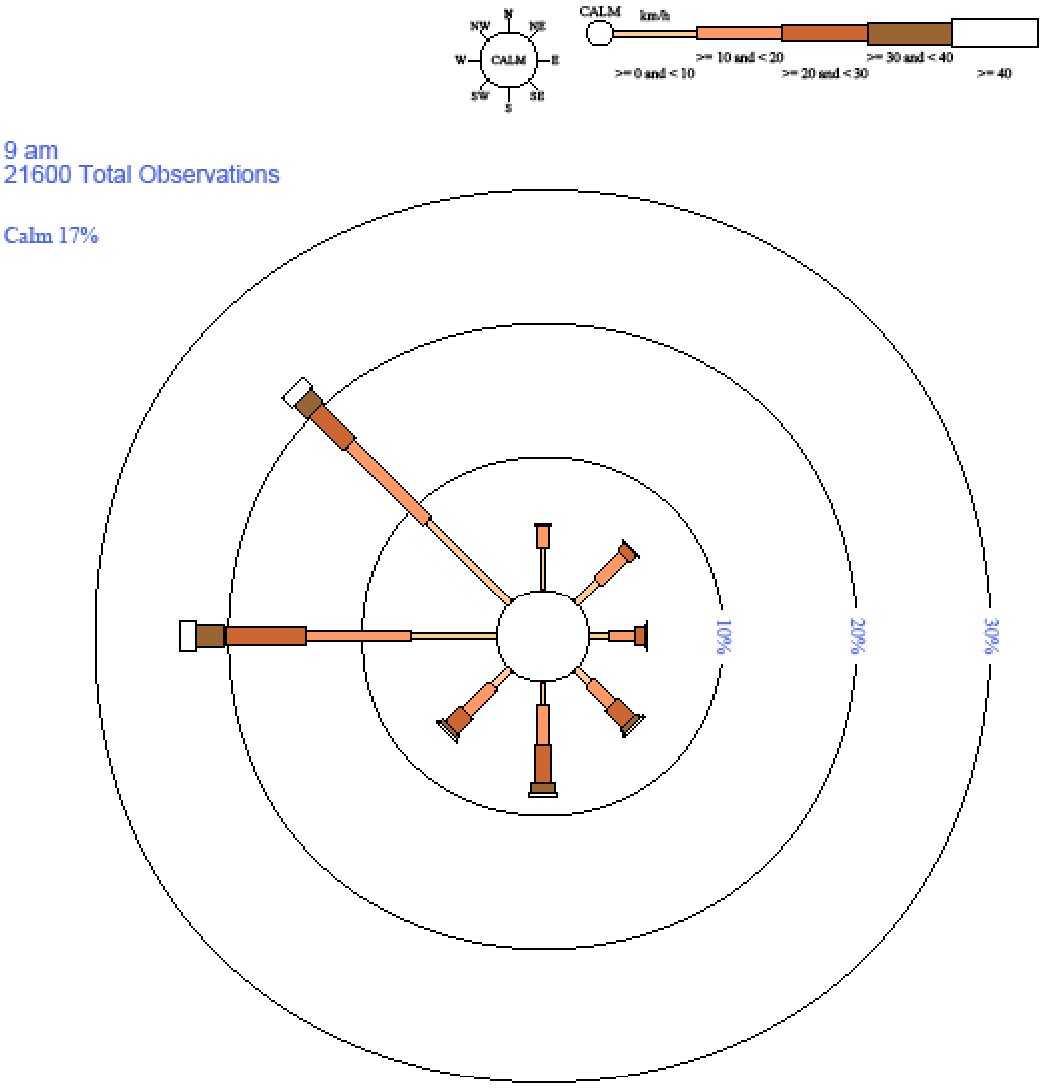

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Figure 2: Wind Rose for BoM Data Measured at Williamtown Airport at 9 am

Rose of Wind direction versus Wind speed in km/h (10 Sep 1942 to 31 Jan 2007)
WILLIAMTOWN RAAF
Site No: 061078 • Opened Jan 1942 • Still Open • Latitude: -32.7932° • Longitude: 151.8359° • Elevation 9m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

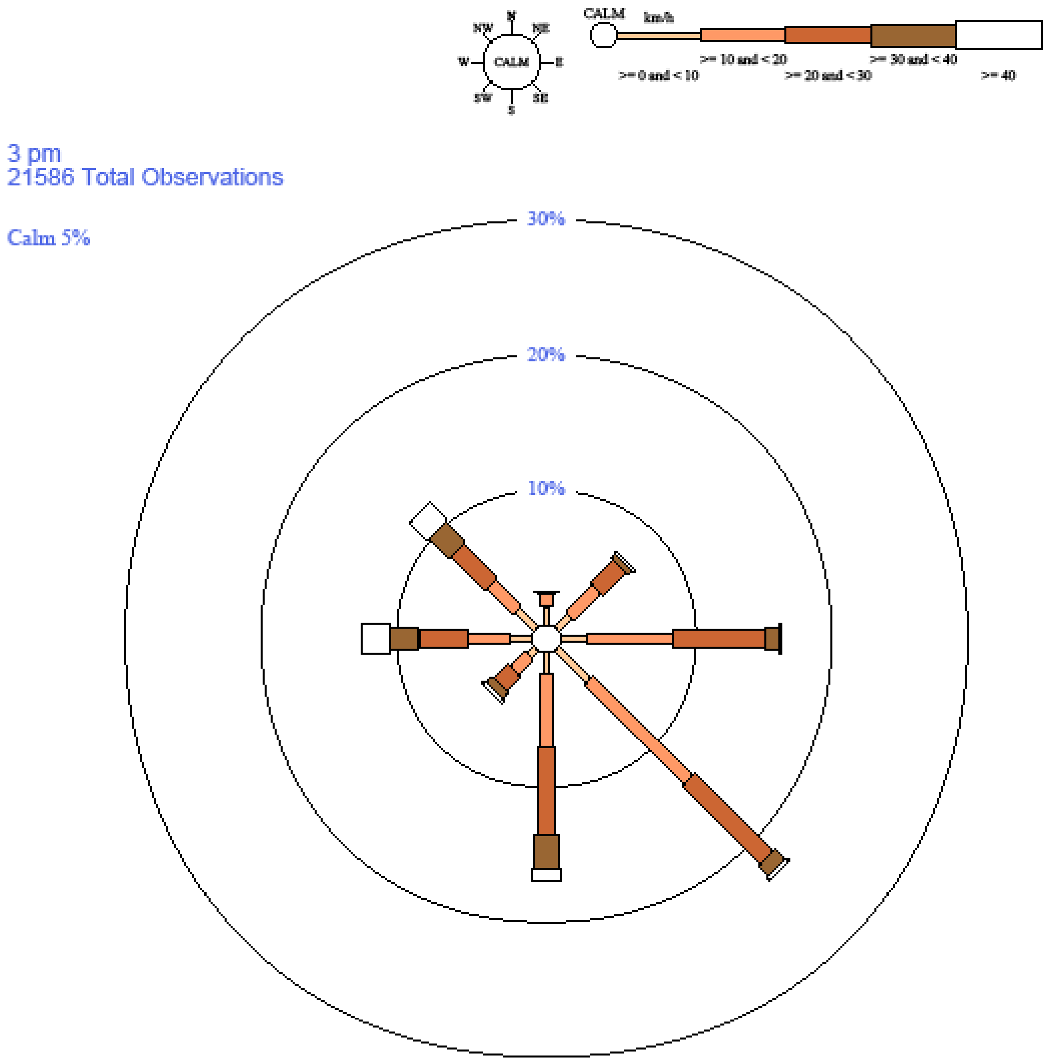

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Figure 3: Wind Rose for BoM Data Measured at Williamtown Airport at 3 pm

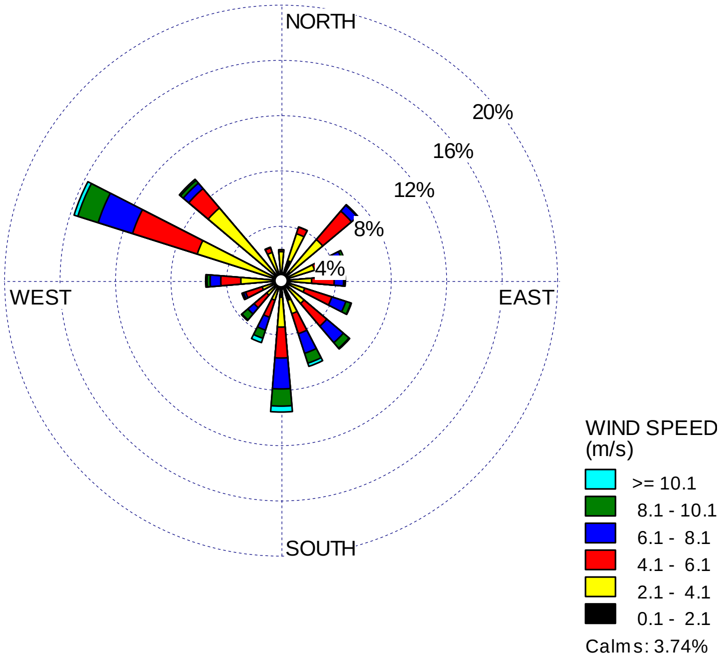

Figure 4: Wind rose diagram for Williamtown Airport, 2006

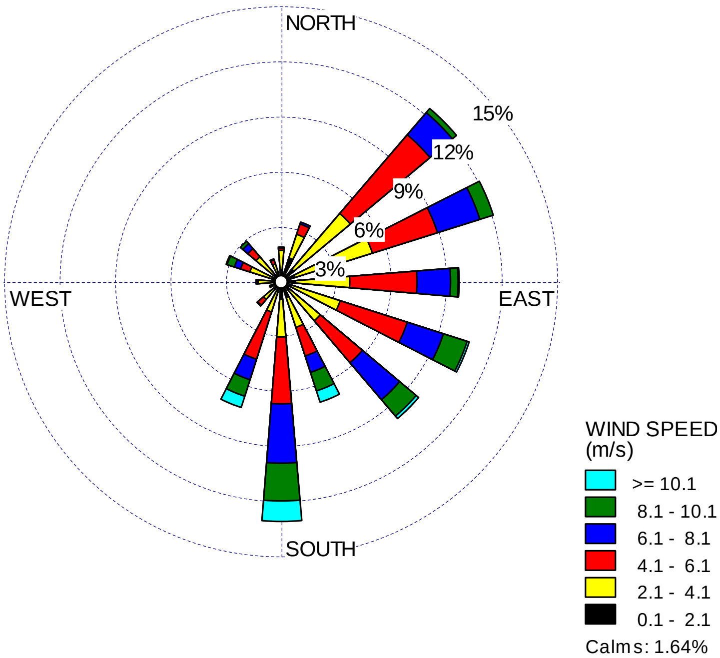

Figure 5: Wind rose diagram for Williamtown Airport, Summer 2006

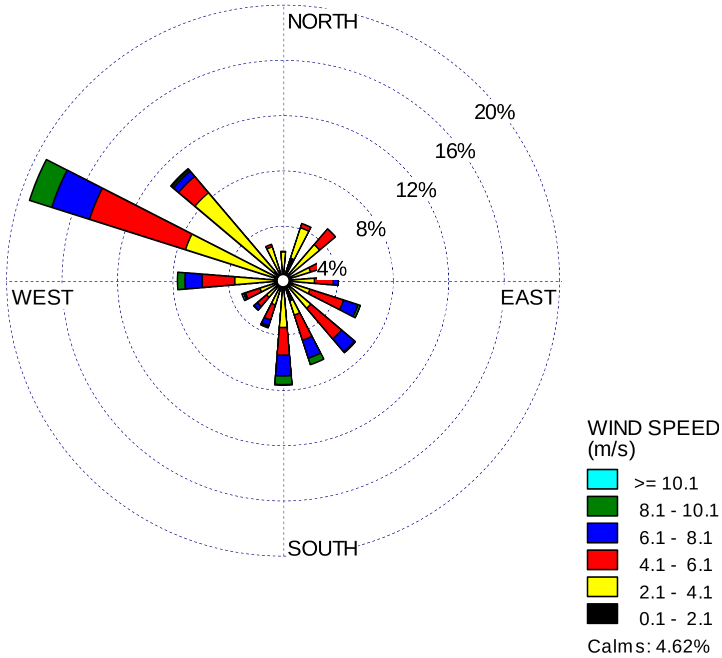

Figure 6: Wind rose diagram for Williamtown Airport, Autumn 2006

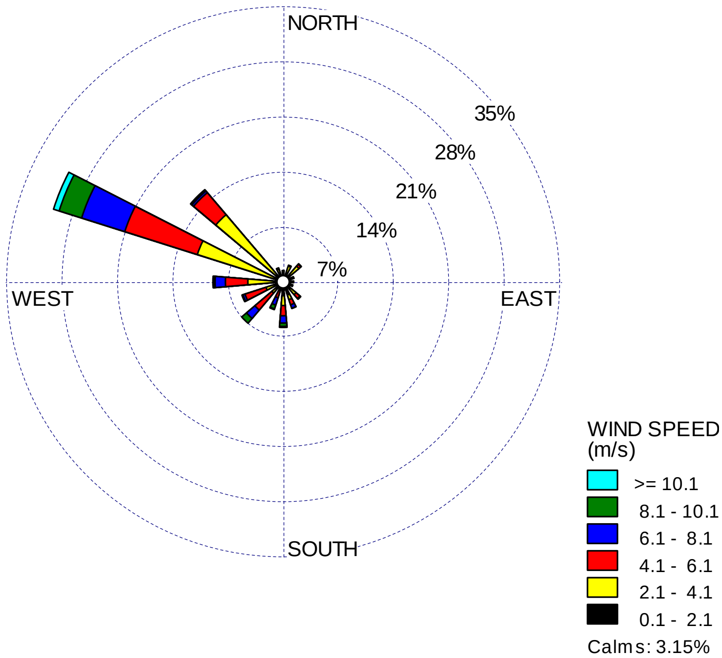

Figure 7: Wind rose diagram for Williamtown Airport, Winter 2006

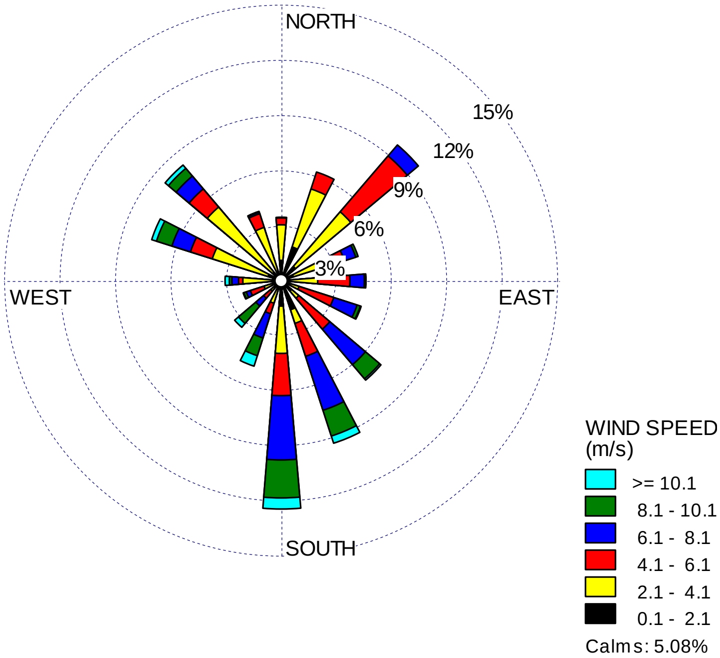

Figure 8: Wind rose diagram for Williamtown Airport, Spring 2006

Table 6-1: Summary of Long Term Data Collected at Williamtown Airport, 1942 to 2009

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Maximum Temperature (^oC)	27.9	27.5	26.2	23.6	20.2	17.6	17.0	18.6	21.2	23.6	25.4	27.2	23.0
Mean Minimum Temperature (^oC)	18.0	18.1	16.3	13.2	10.1	7.9	6.3	6.8	9.0	12.0	14.3	16.5	12.4
Mean 9 AM WSPD (km/h)	11.8	10.5	10.2	11.3	13.6	15.9	16.4	16.6	15.1	14.3	14.4	12.9	13.6
Mean 3 PM WSPD (km/h)	21.9	20.5	18.8	17.1	15.8	17.5	18.7	20.8	22.0	22.4	23.5	23.4	20.2
Mean 9 AM Relative Humidity (%)	72	76	77	76	79	80	77	71	66	64	66	68	73
Mean 3 PM Relative Humidity (%)	59	62	61	59	59	60	55	50	51	54	55	56	57
Mean rainfall (mm)	98.6	123.2	120.6	105.8	113.7	121.4	71.9	77.4	61.3	74.5	81.0	80.2	1127.5

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6.3 Regional Air Quality

Air quality at the Port of Newcastle is dominated by the major industry located around the Port and transport emissions from major arterial roads feeding Newcastle. Primary industrial sources of air emissions likely to affect the Port include the OneSteel and Smorgon facility at Mayfield, the Orica and Incitec plants on Kooragang Island and the Tomago Aluminium smelter at Tomago (to the north). Additional pollutant sources include emissions from the coal and grain terminals and oil seed and fat manufacturing (Cargill). There are three fuel storage facilities in Newcastle: Caltex (Wickham), BP (Carrington) and Shell (Hamilton), which are located adjacent to or near to residential areas.

Ambient pollutant concentrations derived from available monitoring data were used to provide a preliminary assessment of the existing air quality in the study area. In order to get a general idea of the existing air quality, reference was made to the following sources of information:

- Hourly monitoring data for 2006 from the NSW DECCW operated ambient monitoring station at an athletics field in Smith Street, Newcastle.
- Tabulated data presented in Quarterly *Air Quality Monitoring Reports, NSW* DECCW.
- Graphed historical monitoring data presented in *Draft Monthly July 2008 Environmental Report*, HDC.

6.3.1 DECCW Monitoring

The NSW DECCW operates an ambient air monitoring station at an athletics field in Smith Street, Newcastle. The station is approximately five kilometres to the south of the Port. The following pollutants are currently measured at the station:

- O_3
- NO, NO_2 and NO_x
- CO
- SO_2
- Fine particles (PM_{10} using a tapered element oscillating microbalance)
- Fine particles (by nephelometry)

A summary of the key statistics for the monthly data monitored from 2006 to 2007 at the Smith Street site is shown in **Table 6-2** and **Table 6-3**. The tabulated data show that the 24 hour PM_{10} guideline was the only NEPM level breached at the site (in November 2006 and May 2007). However, the NEPM goal of five days allowable exceedances per year, as outlined in **Section 4.2.1**, was met.

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Table 6-2: Summary Statistics for Pollutants Monitored at the Smith Street, Newcastle Air Quality Monitoring Station, 2006

Pollutant	Statistic	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	NEPM Standard[1]
CO	Average	ppm	0.17	0.15	0.15	0.11	0.23	0.27	0.17	0.29	0.15	0.16	0.16	0.13	0.18	**n/a**
	Max 8 Hour	ppm	0.7	0.4	0.5	0.9	1.5	2.2	1.1	1.7	0.8	0.6	0.6	0.3	2.2[5]	**9**
NO_2	Average	pphm	0.4	0.5	0.5	1.1	1.2	1.1	1.2	1.2	1.0	0.7	0.6	0.5	0.8	**3[2]**
	Max 1 Hour	pphm	3.2	3.0	2.3	3.3	3.2	2.7	3.1	4.1	4.2	3.4	3.2	1.9	4.2[5]	**12**
O_3	Average	pphm	1.8	1.9	1.8	1.5	1.2	0.8	1.4	1.7	2.2	2.3	2.2	1.9	1.7	**n/a**
	Max 1 Hour	pphm	1.8	1.9	1.8	1.5	1.2	0.8	1.4	1.7	2.2	2.3	2.2	1.9	2.3[5]	**10**
	Max 4 Hour	pphm	6.4	5.7	4.9	4.3	3.5	2.8	3.4	3.9	4.4	5.4	5.8	4.0	6.4[5]	**8**
PM_{10}	Average	$\mu g/m^3$	23	22	20	17	17	16	16	21	24	27	27	23	21	**30[4]**
	Max 1 Day	$\mu g/m^3$	37	34	29	27	28	36	25	36	43	41	**51 (1)[3]**	37	51[5]	**50**
SO_2	Average	pphm	0.04	0.08	0.05	0.17	0.18	0.15	0.22	0.19	0.18	0.12	0.11	0.09	0.13	**2[2]**
	Max 1 Hour	pphm	1.0	1.3	1.3	2.8	2.0	2.1	3.1	1.8	3.4	3.0	1.9	1.6	3.4[5]	**20**
	Max 1 Day	pphm	0.3	0.3	0.2	0.5	0.5	0.5	0.9	0.5	0.5	0.4	0.4	0.3	0.9[5.]	**8**

n/a not applicable

1 Further information outlining NEPM requirements is provided in **Section 4.2.1.**

2 As an annual average.

3 Value in brackets identifies the number of exceedances of the relevant standard. Exceedances are indicated in bold.

4 Only relevant when compared with annual average value.

5 Refers to the maximum value reported for that statistic from the 12 months. This does not refer to the annual average.

Table 6-3: Summary Statistics for Pollutants Monitored at the Smith Street, Newcastle Air Quality Monitoring Station, 2007

Pollutant	Statistic	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	NEPM Standard[1]
CO	Average	ppm	0.1	0.1	0.1	0.2	0.3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.2	n.d.	**n/a**
	Max 8 Hour	ppm	0.3	0.3	0.4	1.1	1.7	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.8	n.d.	**9**
NO_2	Average	pphm	0.5	0.4	0.7	0.8	1.3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	**3**[2]
	Max 1 Hour	pphm	1.1	0.9	1.5	2.5	3.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	**12**
O_3	Average	pphm	1.8	1.5	1.8	1.8	1.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.4	n.d.	**n/a**
	Max 1 Hour	pphm	5.1	4.2	5.3	4.9	4.4	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	3.3	n.d.	**10**
	Max 4 Hour	pphm	4.2	3.5	4.7	4.6	4.1	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	2.7	n.d.	**8**
PM_{10}	Average	µg/m^3	31	21	23	20	21	19	n.d.	n.d.	n.d.	n.d.	n.d.	22	n.d.	**30**[4]
	Max 1 Day	µg/m^3	49	33	33	33	**58 (2)**[3]	26	n.d.	n.d.	n.d.	n.d.	n.d.	32	n.d.	**50**
SO_2	Average	pphm	0.1	0.1	0.1	0.1	0.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.4	n.d.	**2**[2]
	Max 1 Hour	pphm	1.5	1.6	2.8	2.3	4.3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	2.5	n.d.	**20**
	Max 1 Day	pphm	0.3	0.2	0.5	0.4	0.6	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.2	n.d.	**8**

n/a not applicable

n.d. no data

1 Further information outlining NEPM requirements is provided in **Section 4.2.1.**

2 As an annual average.

3 Value in brackets identifies the number of exceedances of the relevant standard. Exceedances are indicated in bold.

4 Only relevant when compared with annual average value.

6.3.2 HDC Monitoring

Air quality monitoring data collected from May 2006 to August 2008 on behalf of the *Hunter Development Corporation (HDC)* provides information relevant to the assessment of the existing air quality in the immediate vicinity of the Port. As shown in **Figure 9**, three monitoring sites are monitored, consisting of the following locations:

- Mayfield;
- Steel River; and
- Stockton.

The parameters measured at each monitoring site are summarised in **Table 6-4** with results of the Mayfield monitoring outlined in **Table 6-5**.

Table 6-4: HDC Air Quality Monitoring Program

Monitoring site	Measured parameters
Steel River	PM_{10} by high volume air sampler Dust deposition Sulphur dioxide (SO_2) and oxides of nitrogen (NO_x)
Mayfield	TSP, PM_{10} and $PM_{2.5}$ by high volume air sampler Dust deposition TSP and PM_{10} by Tapered Element Oscillating Microbalance (TEOM) Benzene, toluene, ethylbenzene and xylenes using a carbon absorbent tube
Stockton	TSP and PM_{10} by high volume air sampler

As shown in **Table 6-5**, the HDC reports identified two days in the monitoring period that the 24-hour average PM_{10} concentration exceeded the relevant DECCW criterion (55 µg/m^3 on 3 October 2007 and 56 µg/m^3 on 1 July 2008). It was noted in the report that exceedances of 24-hour average PM_{10} concentrations are not uncommon and often attributed to natural sources such as bushfires or dust storms. The annual average TSP and PM_{10} concentrations were below the relevant DECCW assessment criteria.

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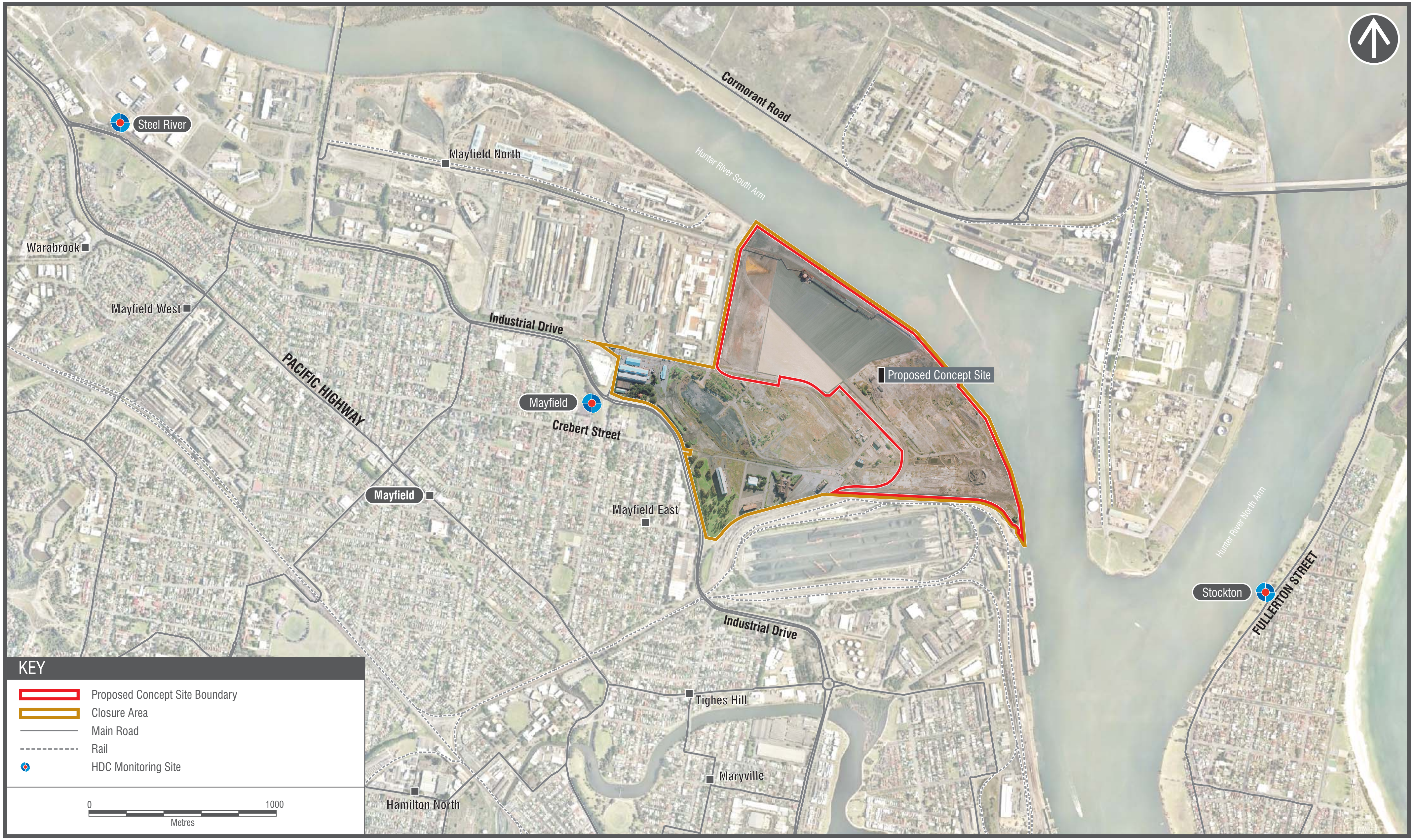

AECOM

HDC MONITORING SITES

Air Quality Impact Assessment

Mayfield Site Port-Related Activities Concept Plan

Figure 9

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Table 6-5: Summary of the HDC Monitoring Data from the Mayfield Site

Month	Maximum 24-hour average PM_{10} (μg/m^3)	Average PM_{10} (μg/m^3)	Average TSP (μg/m^3)
Sep-07	37	22	31
Oct-07	**55**	30	39
Nov-07	34	18	25
Dec-07	36	22	26
Jan-08	35	23	28
Feb-08	34	17	20
Mar-08	31	20	26
Apr-08	30	15	21
May-08	31	20	25
Jun-08	29	15	20
Jul-08	**56**	18	24
Aug-08	33	15	21
Maximum	56	n/a	n/a
Average	n/a	20	26
NSW DECCW Assessment Criteria	**50**	**30**	**90**

n/a: not applicable
Bold denotes exceedance of criteria

Table 6-6 summarises the results of the BTEX sampling undertaken at Mayfield from June to August 2008. The sampled BTEX concentrations are all significantly lower than the Air Toxics NEPM monitoring investigation levels.

Table 6-6: BTEX at Mayfield, July 2008

Start date	End date	Sampling period (days)	Volume sampled (m^3)	24 hour average concentration (ppm)			
				Benzene	Toluene	Ethyl benzene	Xylenes
12/06/08	02/07/08	20	7.23	0.00010	0.00006	0.000009	0.00004
02/07/08	23/07/08	21	7.71	0.00010	0.00008	0.000011	0.00005
23/07/08	18/08/08	26	9.73	0.00006	0.00003	0.000005	0.00002
24 hour average Air Toxics NEPM Criteria				**n/a**	**1**	**n/a**	**0.25**
Annual average Air Toxics NEPM Criteria				**0.003**	**0.1**	**n/a**	**0.2**

6.3.3 Summary

The findings from the review of the available monitoring data are summarised as follows:

- With the exception of PM_{10}, the review of the available NSW DECCW data and HDC reports identified no exceedances of ambient air criteria.
- PM_{10} is the only monitored pollutant for which ambient air criteria are exceeded (in October 2007 and July 2008 at the HDC Mayfield site and one day in November 2006 and two days in May 2007 at the NSW DECCW Smith Street site). No discussion of the exceedances of the NEPM standard level is provided in the reviewed NSW DECCW monitoring report. However, it is noted that the NEPM goal of five days allowable exceedances per year was met. In addition, as discussed above, it was noted in the HDC report that exceedances of 24-hour average PM_{10} concentrations are not uncommon and often attributed to natural sources such as bushfires or dust storms.
- BTEX concentrations measured at the Mayfield site from June to August 2008 are all significantly lower than the Air Toxics NEPM monitoring investigation levels.

7.0 Potential Air Pollution Sources

7.1 Construction

During construction, potential emissions to air include products of fuel combustion from vehicles and equipment used in construction and transportation activities; dust and odour emissions from construction activities and other air pollutants (toxics) from contaminated soils disturbed during construction works.

- Specific construction vehicle and equipment details were not available; impacts discussed here are based on the use of conventional construction equipment. Further assessment of construction impacts should be undertaken as part of subsequent Project applications when construction details are available.

7.1.1 Fuel Combustion Emissions

Emissions from fuel combustion from vehicles and equipment would largely be diesel engine based and depend on the grade and composition of the fuel and the status of equipment maintenance. Fuel combustion emissions of concern include:

- Particulate matter
- CO
- NO_2
- SO_2
- Organic compounds such as VOCs and polyatomic aromatic hydrocarbons (PAHs)

7.1.2 Dust Emissions

As with any construction site, dust may be generated as a result of earthworks including earth moving and materials handling operations. Internal site traffic moving on unmade roads within the site may cause sufficient mechanical disturbance of loose surface materials to generate dust. Significant atmospheric dust arises from the mechanical disturbance of granular material exposed to the air. Dust generated from these open sources is termed "fugitive" because it is not discharged to the atmosphere in a confined flow stream. Common sources of fugitive dust include unpaved roads, aggregate storage stockpiles, and heavy construction operations.

The dust-generation process is caused by two basic physical phenomena:

- Pulverization and abrasion of surface materials by application of mechanical force through implements (wheels, blades, etc.).
- Entrainment of dust particles by the action of turbulent air currents, such as wind erosion of an exposed surface, for example by wind speeds over 19 kilometres per hour (~5.3 metres per second).

7.1.3 Other Air Pollutants

Emissions of other air pollutants other than dust such as VOCs, vapour phase PAHs and acidic aerosols may also occur during construction works where the ground is contaminated. The chemical composition of these pollutants has the potential to further exacerbate potential short term and long term health effects associated with inhalation of particles.

It is expected that the emissions of specific pollutants of concern from the contaminated soils would be addressed by the site Remedial Action Plan (RAP) and Contaminated Site Management Plan (CSMP). Remediation of the site is ongoing and due for completion in 2012.

7.1.4 Odour

During the construction stages of the project, odour can be generated from earthworks, disturbance of potentially anoxic or contaminated material, construction of primary and ancillary infrastructure and vehicle exhaust emissions.

7.2 Operational Activities

Potential impacts during the operational phase of the development would include:

- Fuel combustion emissions associated with handling cargo and the operation of site machinery.
- Fugitive dust emissions from the mechanical disturbance of granular material (e.g. from roads, stockpiles, conveyors, transfer points and materials handling).
- Emissions of VOCs associated with the transfer and storage of fuels and other bulk liquids.

7.2.1 Fuel Combustion Emissions

Emissions from fuel combustion from vehicles (road, marine and rail) used to transport cargo and equipment would impact on air quality at the Port. These emissions would largely be diesel based and the pollutants of concern would be the same as those specified for the construction activities. It should be noted that the majority of the plant at the site (such as cranes and forklifts) would be electric or powered by compressed natural gas and are not expected to significantly contribute to pollutant emissions.

7.2.2 Fugitive Dust Emissions

The storage, transport, loading and unloading of cargo in the Bulk and General Cargo Precinct (i.e. feed grain, coke, cement, coal, soda ash, fertiliser and sand), in particular if uncovered, may be a significant source of fugitive dust emissions at the Port. It has been assumed in the assessment that all fugitive dust sources, including conveyors, would be covered with the exception of the bulk material stockpile used for soil and boutique coal materials.

7.2.3 Emissions Associated with the Transfer and Storage of Fuels

The expected sources of VOCs associated with the transfer and storage of the fuels and other bulk liquids include:

- Storage tank losses
- Potential pipeline losses
- Emissions during loading

Storage Tank Losses

Fuels and organic liquids are typically volatile and evaporation of these liquids during storage has the potential to generate odour and VOCs. The nature and potential for emissions depends significantly on the nature of the fuel in the tanks. Highly volatile compounds such as ULP have a much higher potential for emissions than the relatively low volatility fuels such as diesel, fuel oil or crude oil.

Highly volatile fuels would be stored in internal floating roof tanks aimed at reducing emissions from the tanks. This measure would reduce the potential for accumulation of vapours within the tanks significantly reducing the potential for emissions.

Potential Pipeline Losses

Minor quantities of fugitive emissions (hydrocarbon based) may occur due to potential pipeline losses from flanges, valves, pump seals and other fittings. Total emission rate from these sources depends primarily on the age of the equipment and on maintenance routine in the plant.

Given that the design of the pipeline is centred on leak prevention and that the plant is to be new, total emissions from pipelines are expected to be negligible.

Loading

Product and tank vapour emissions of VOCs are also generated during filling operations. Vapour Recovery Units can be used for vapour recovery during tanker truck loading with removal efficiencies of greater than 99.9 percent. Based on assessments of similar operations, emissions from truck loading operations when a VRU with a removal efficiency of greater than 99.9 percent is used are minor relative to emissions from storage tanks. It is assumed that VRUs would be used by operators within the Bulk Liquids Precinct.

7.2.4 Fumigant Emissions

The Bulk and General Precinct would be used for grain storage, and for handling other bulk cargos such as cement, fertilizer, and coke cargoes. Fumigation operations for grain storage may be performed in this precinct using methyl bromide. Fumigant recapture equipment is available for fumigation operations. It is assumed that recapture equipment would be used to minimise the impacts from releases of fumigant gases at the Port.

The General Purpose Precinct would handle cargo containers, heavy machinery, Ro/Ro and break bulk cargo. Handling shipping containers in this precinct may require fumigation operations using methyl bromide. However, it is assumed that recapture equipment would be used to minimise the impacts from releases of fumigant gases.

The Container Terminal Precinct would be used for container storage and transfer, and would include an area to accommodate up to 1 million TEU per annum. Once berthed, the ships would unload the cargo using ship-mounted lifting equipment which lowers the containers to the wharf where they are transported to the container storage area. A percentage of these containers would be fumigated, which requires dosing the containers with a charge of methyl bromide (up to 100 kilograms per container). It is assumed that recapture equipment would be used to minimise the impacts from releases of fumigant gases.

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8.0 Air Dispersion Modelling Methodology

8.1 Introduction

Dispersion modelling was undertaken to predict the potential air quality impacts from the proposed concept (expected to be completed and fully operational in 2034). It should be noted at this point that this modelling is based on current understanding of the proposed port side activities. Any minor changes to the proposed activities (such as layout) would be expected to have only a minor impact on predicted emissions and ground level impacts. However, any major changes to material throughput or industry mix etc may have the potential to impact on the predictions made by this assessment.

The scope of work undertaken by AECOM to assess the potential air quality impacts from the proposed concept is as follows:

- **Development of an Emissions Inventory**. The inventory contains all emissions information required to undertake dispersion modelling. The inventory was generated using operational information supplied by NPC and the emission factors supplied in relevant documents (Commonwealth 2008a and 2008b, EPA 1997a). The ENSR (AECOM) report *Air Quality Impact Assessment Proposed Bulk Liquid Fuel Storage Facility* (ENSR, 2008) was used to include emission rates from the proposed bulk liquid fuel storage facility at Mayfield.
- **Dispersion Modelling**. The CALPUFF dispersion model was used in the AQIA. Model inputs include meteorology, source characteristics, modelling scenarios and pollutant emissions data.

The AQIA was conducted in accordance with the following guideline:

- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Department of Environment and Conservation New South Wales (DEC) 2005.

The Approved Methods outlines the requirements for developing air dispersion modelling methodology, analysing meteorological data, and the criteria applicable when considering the potential impacts as a result of a site's operation. The document prescribes calculation modes for accounting for terrain effects, building wake effects, horizontal and vertical dispersion curves, buoyancy effects, surface roughness, plume rise, wind speed categories and wind profile exponents.

8.2 Dispersion Model Overview

The CALPUFF air dispersion model was used in the AQIA in accordance with the DECCW Approved Methods (DEC, 2005). CALPUFF is a non steady-state three dimensional Gaussian puff model developed for the US Environmental Protection Agency (EPA) for use in situations where the basic Gaussian plume models are not effective. Situations where basic steady-state Gaussian plume models typically do not work well are areas with complex meteorological or topographical conditions, such as coastal areas with re-circulating sea breezes. The Approved Methods provides conditions when basic Gaussian plume models are not suitable. Based on these conditions CALPUFF was chosen as the most suitable model for the AQIA.

The air dispersion modelling conducted for this assessment utilised the CALMET meteorology models to overcome the basic limitations of the steady-state Gaussian plume models. CALMET, the meteorological pre-processor for the dispersion model CALPUFF, calculates three-dimensional meteorological data based upon observed ground and upper level meteorological data, as well as modelled data. CALPUFF then calculates the dispersion of plumes within this three-dimensional meteorological field.

Input parameters used in the CALPUFF dispersion modelling are summarised in **Table 8-1**.

Table 8-1: Summary of CALPUFF Input Parameters

Parameter	Input
CALPUFF Version	6.262
Modelling Domain	25 km x 25 km
Modelling Grid Resolution	0.2 km
Number of Sensitive Receptors	14
Terrain Data	Included in CALMET
Building Wake Data	Not included in model
Dispersion Algorithm	PG (Rural, ISC curves) & MP Coeff. (urban)
Hours Modelled	8760 hours (365 days)
Meteorological Data Period	1 January 2006 – 31 December 2006

CALPUFF requires six main categories of data to determine the dispersion of pollutants:

- Meteorology;
- Terrain effects;
- Building wake effects;
- Modelling scenarios;
- Source characteristics; and
- Emissions inventory.

The above inputs are addressed separately in the following sections.

8.2.1 Meteorology

Meteorology in the area surrounding the Port is affected by several factors such as terrain and land use. Wind speed and direction are largely affected by topography at the small scale, while factors such as synoptic scale winds (which are modified by sea breezes near the Newcastle coast in the daytime) and complex valley drainage flows that develop during night hours, affect wind speed and direction on the larger scale.

As the site is located in a coastal environment, varying wind patterns would be expected due to onshore and offshore winds. The closest BoM monitoring station at Williamtown Airport provides a good indication of regional meteorological conditions for the area. Meteorological data from three selected stations (detailed below) and topographical data were used to develop the CALMET wind fields to ensure the data used in the dispersion modelling were representative of local conditions.

The CALMET meteorological model uses actual meteorological observations to generate three dimensional wind fields on an hourly time step at a grid of points covering the area under investigation. Topographical features and land use factors are then used to further refine the wind fields, which are subsequently used in the CALPUFF dispersion model.

- Meteorological data for January to December 2006 for the modelling was developed using measured data from surface meteorological stations as follows:
- A local meteorological station operated by Port Waratah Coal Services (PWCS) at Carrington;
- A BoM operated station at Williamtown; and
- NSW DECCW operated stations at Beresfield, Wallsend and Newcastle.
- The CSIRO developed prognostic model TAPM (The Air Pollution Model) was used to define the upper air meteorology for the area surrounding Carrington. To ensure the meteorological data was as representative as possible of the local environment, TAPM data was generated for 36 points on a grid including the site. Surface and upper air files were generated for all of the 36 nodes and entered into the CALMET model.

When using a single year of meteorological data for dispersion modelling, questions arise as to whether the year in question is representative of long-term average meteorological conditions and representative of expected regional behaviour. Selected long-term parameters for the Williamtown BoM weather station have been compared with the same parameters from the TAPM-CALMET generated meteorological dataset for 2006 in **Appendix A**. The two sets of data showed a good correlation and the meteorological data used in the assessment is considered representative of regional conditions.

8.2.2 Terrain Effects

Digital terrain data was obtained from the TAPM 9 second DEM data base covering an area of 25 kilometres by 25 kilometres on a 1 kilometre grid including the site. A Cartesian receptor grid (origin (371.611 kilometre MGA east; 6351.036 kilometre MGA north) with a 200 metre spacing and nesting of 1, extending 25 kilometres east west and 25 kilometres north south, was used in the CALPUFF modelling.

8.2.3 Building Wake Effects

The dispersion of pollutants can be affected by aerodynamic wakes generated by winds having to flow around buildings or stacks. Wake effects result in the decrease of pollutants with distance downwind where the plume approaches the ground. This may result in higher ground level pollutant concentrations closer to the source of emission. Building wakes can only be applied to point sources in dispersion modelling.

Building wake effects were not considered in this assessment due to the primary sources of pollutants being modelled as volume and area sources.

8.2.4 Modelling Scenarios

One modelling scenario was included in the AQIA; final Concept Plan (estimated to be completed and fully operational in 2034). The assessment considered the operations of the five land-based precincts and the Berth Precinct including emissions from the following sources:

- Ships at berth.
- Trains breaking, forming, shunting and idling on the site.
- Trucks on the site.
- Bulk material stockpile (wind erosion, loading and unloading operations).
- Bulk liquid precinct (including two bulk liquid operators with a total fuel storage volume of approximately 1,010 Mega Litres).

8.2.5 Source Characteristics

The source characteristics for each of the volume sources are provided in **Table 8-2**. The train and truck line sources are modelled by arranging a set of volume sources along the centre line of the road or rail line. The horizontal (lateral) and vertical dimensions of each volume source are calculated dependent on the length of the line source and the distance chosen between volume sources.

Table 8-2: Modelling Volume Source Characteristics

Sources	CALPUFF Source ID	Horizontal Spread (m)	Vertical Spread (m)	Centre Height (m)
Ships	SH8 – SH11	1	1	35
Trains	RA1 – RA10	70	0.5	3
Trucks	TR1 – TR11	70	0.2	1
Bulk Liquid Tanks	MA1, MA2, MA 5, MA6	2	30	17
	MA4, MA8	2	44	17
	MA3, MA7	2	16	17

The point source (stack) characteristics for the bulk liquid precinct (based on data provided in ENSR 2008) including two bulk liquid operators with a total fuel storage volume of approximately 1,010 Mega Litres are provided in **Table 8-3.**

Table 8-3: Bulk Liquid Facility Stack Characteristics

Parameters		CALPUFF Source ID	Units	Value
Source Coordinates	Stack 1 Easting	P1	km	383.703
	Stack 1 Northing	P1	km	6360.312
	Stack 2 Easting	P2	km	383.663
	Stack 2 Northing	P2	km	6360.072
Source Dimensions	Stack Base Elevation		m	P1 = 6; P2 = 3
	Stack Height		m	6
	Exit Diameter		m	0.2
	Exit Area		m^2	0.031
Stack Parameters	Temperature		°C	25
	Maximum Exit Velocity		m/s	2
	Maximum Flow Rate		m^3/s	0.063

8.2.6 Emissions Inventory

The emissions from train, truck and ship operations and the bulk material stockpile on site were estimated using the following manuals and studies:

- Emission Estimation Technique Manual for Railway Yard Operations Version 2, June 2008 (Commonwealth 2008a).
- Emission Estimation Technique Manual for Maritime Operations Version 2, July 2008 (Commonwealth 2008b).
- Emission Estimation Technique Manual for Mining Operations Version 2.3, December 2001 (Commonwealth 2001).
- AP42 Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources *Large Stationary Diesel and All Stationary Dual-fuel Engines* (US EPA, October 1996).
- Environment Protection Authority New South Wales (EPA) (1997a) Metropolitan Air Quality Study: Air Emissions Inventory.
- Train controllers guide to fuel conservation with train operation published by V/Line (1986).

In addition, the following report was used to gain source characteristics and emission rates for the bulk liquid precinct including two bulk liquid operators with a total fuel storage volume of approximately 1,010 Mega Litres:

- Air Quality Impact Assessment Proposed Bulk Liquid Fuel Storage Facility (ENSR 2008).

The following general comments and assumptions have been made in relation to generating the emissions inventory and modelling inputs for the Port AQIA:

- The modelling is based on the Concept Plan (refer to **Figure 1**).
- It is assumed that construction activities are subject to appropriate routine mitigation measures and any impacts would be short term. As such they have been omitted from the modelling but will be addressed as part of future Project applications.
- The PM_{10} emission rates from combustion engines (trucks and ships) have been calculated using the NPI manuals (Commonwealth, 2008a and 2008b). The manuals do not provide emission factors for TSP for these sources, and as such TSP emissions from combustion sources are assumed to be equal to PM_{10} emissions in the AQIA.

- The contribution of pollutant emissions from staff cars is considered to be minor and has been omitted from the modelling. The omission is based on the following; small cars are expected to travel very small distances within the site boundary, operate for small time periods, operate mostly within day time hours when air dispersion is good, and use relatively efficient combustion engines.
- It should be noted that the majority of the plant at the site (such as cranes and forklifts) would be electric or powered by compressed natural gas and are not expected to significantly contribute to pollutant emissions. As such they have not been considered further in the modelling.
- The emission rates for all sources (excluding the bulk liquids precinct) are provided in **Table 8-4**. The emission rates for each train and truck source have been modelled as separated volume sources (refer to **Section 8.2.5**), and as such the emission rates supplied are for each of the volume sources for each source type. To calculate the total emission rate for a pollutant from a source, multiply the pollutant emission rate by the number of volume sources.

Table 8-4: Modelling Emissions Inventory

Source	CALPUFF Source ID	Hrs/ day	CALPUFF Source Type	No. of Volume Sources[1]	Emission Rate per Volume/Area Source (g/s)				
					NO_x	CO	SO_2	PM_{10}	TSP
Ships	SH8 – SH11	24	Volume	4	2.46	0.20	0.19	0.17	0.17
Trains	RA1 – RA5	NA*	Volume	5	NA[2]				
Trucks (Daytime)	TR1 – TR11	15	Volume	11	0.04	0.02	0.0001	0.0003	0.0003
Trucks (Night time)	TR1 – TR11	9	Volume	11	0.02	0.01	0.00007	0.0002	0.0002
Bulk Material Stockpile (Wind Erosion)	ST1	24	Area	NA	0	0	0	0.000003	0.000006
Bulk Material Stockpile (Active Area)	ST2	24	Area	NA	0	0	0	0.0002	0.0005

1 Number of volume sources is for modelling purposes and does not relate to the number of vehicles (ships, trains or trucks).

2 Refer to Table 8-7 for train hours per day and emission rates.

The emissions inventory for the bulk liquids storage precinct, as provided in ENSR 2008, is presented below. Table 8-5 presents the stack emission rates and Table 8-6 presents the volume source emission rates from the site.

Table 8-5: Stack Emissions Inventory

Source	CALPUFF Source ID	Hrs/ day	VOC Emissions (g/s)			
			Benzene[1]	Ethanol [2]	Toluene [3]	Xylenes [4]
VSU Stack	P1, P2	24	0.004	0.04	0.06	0.08

[1] Benzene emissions based on maximum benzene content in VOC of 1%.

[2] Ethanol emissions based on maximum ethanol content in VOC of 10%.

[3] Toluene emissions based on maximum toluene content in VOC of 15%. Levels above this concentration have been found to cause problems in car engines.

[4] Xylenes emissions based on maximum xylenes content in VOC of 20%. This is a likely maximum concentration allowable in fuel. The combined aromatic content in fuel is to be set at approximately 35%; assuming 1% benzene, 15% toluene, the maximum amount of xylenes is 20% (allowing for a 1% margin for error).

Table 8-6: Storage Tank (Volume source) Emissions Inventory

Source	CALPUFF Source ID	Benzene (g/s)	Ethanol (g/s)	H_2S (g/s)
Unleaded Petrol Tank	MA1, MA5	0.0005	0.005	0
Premium Unleaded Petrol Tank	MA2, MA6	0.0002	0.002	0
Ethanol Tank	MA3, MA7	0	0.003	0
Fuel Oil Tank	MA4, MA8	0.00001	0.0001	0.000002

Train Emissions

The emission rates for on-site trains were based on estimated train operations for the Port in regards to the time that selected throttle levels are used on-site. The fuel consumption values used below were gained from the handbook *Train controllers guide to fuel conservation with train operation* published by V/Line (1986). These fuel consumption values were then applied to the NPI manual (Commonwealth 2008a) emission rate calculation method. A summary of the throttle fuel consumptions applied in the AQIA are provided below:

- Idle fuel consumption of 24 Litres per hour per locomotive
- Throttle 3 fuel consumption of 146 Litres per hour per locomotive (breaking, forming and shunting activities).

The number of trains, locations and times at each throttle speed for each scenario has been provided in the following assumptions section. The assumptions listed provide more information regarding the development of the emissions inventory.

The emission rates for trains applied in the AQIA have been included in the modelling as variable emission rates. The model lists the emission rate for each source for each hour of the modelling period for each pollutant based of train movements and throttle levels. A predicted schedule of the movements and throttle levels of each of the four trains is provided in **Appendix C**.

A summary of the train emissions inventory for each hour for both the on-site sidings and the Morandoo Siding is provided in **Table 8-7**. The emission rates for each train source have been modelled as separated volume sources (refer to **Section 8.2.5**), and as such the emission rates supplied are for each of the volume sources for each source. To calculate the total emission rate for each hour for a pollutant from a source, multiply the pollutant emission rate by the number of volume sources.

Table 8-7: Train Emissions Inventory

Location	No. of Volume Sources *	Hour	Pollutant Emission Rate g/s				
			NO_x	CO	SO_2	PM_{10}	TSP
On-site Siding	5 *	0100	0.2	0.1	0.00007	0.01	0.01
		0400	0.2	0.1	0.00008	0.02	0.02
		0900	0.06	0.03	0.00002	0.005	0.005
		1000	0.4	0.2	0.00016	0.03	0.03
		1400	0.09	0.1	0.00003	0.01	0.01
		1500	0.4	0.2	0.0001	0.03	0.03
		1900	0.06	0.03	0.00002	0.005	0.005
		2000	0.4	0.2	0.0002	0.03	0.03
		2400	0.09	0.1	0.00003	0.01	0.01
Morandoo Siding	5 *	1000	0.06	0.03	0.00002	0.005	0.005
		2000	0.06	0.03	0.00002	0.005	0.005

* Number of volume sources is for modelling purposes and does not relate to the number of trains

Assumptions and Comments

- The train movement schedule provided in **Appendix C** was used to calculate the train fuel consumption for use with the NPI emission equations.
- The train line source was modelled as multiple volume sources spread over the on-site train siding and the Morandoo siding.
- The following operational information has been used in the assessment:
  - Four trains per day arriving and departing according to the schedule presented in **Appendix C**;
  - Two locos per train; and
  - Operational 365 days per year.

Truck Emissions

The emissions from truck movements on the site have been estimated using the NSW EPA document *Metropolitan Air Quality Study: Air Emissions Inventory* (MAQS) (1997a). The MAQS was undertaken to develop a computerised air emission inventory, analyse meteorological data/modelling of air movements, investigation of air chemistry and urban air-shed modelling. The study provides vehicle emission rates for various types of vehicles and fuels.

Assumptions and Comments

- The MAQS emission factors for Heavy Duty diesel fuel engines (trucks) were applied in the modelling (MAQS, 1997a).
- The SO_2 and PM_{10} vehicle emission rates applied in the AQIA provided by the MAQS (EPA 1997a) were based on the total vehicle fleet as individual vehicle types are not detailed. The residential/minor road emission rate category was chosen due to the Ports low speed limits.
- The following operational information has been used in the assessment:
  - 24 hour operation for 365 days per year;
  - 520,052 trucks per year, which equates to approximately 1,425 trucks per day;
  - Operational time split of 75percent of trucks during the day (nominally 15 hours) and 25percent of trucks during the night (nominally 9 hours); and
  - 71 trucks per daytime hour, 40 trucks per night time hour.
- The final location of the haul roads within the site are not known and as such the truck line source was modelled as multiple volume sources spread over the length of the site and running alongside the rail tracks. The alignment of the haul road is located on the site boundary closest to receptors and therefore is considered to be a conservative approach.
- The distance travelled on-site by each truck has been estimated to be 1.5 kilometres (assumed travelling entire length of site) per trip. This assumption is likely to be conservative and may lead to over predictions in ground level concentrations from truck movements.
- All transport roads have been assumed to be sealed and therefore wheel generated dust has not been considered in this assessment.
- It has been assumed that the majority of other equipment on the site would be electric or powered by compressed natural gas. Any impacts would therefore be minor and short term, and as such have been omitted from the modelling.

Ship Emissions

The emissions from ship operations were estimated using the NPI manual for Maritime Operations (Commonwealth 2008b). Due to a lack of information regarding stack flow rates, emission concentrations etc, the ship stacks were modelled as volume sources and are likely to result in conservative predicted impacts.

Assumptions and Comments

- It was assumed in the model that a maximum of four ships would be at berth at any one time. The berths chosen to be representative of operation of the site were berths 1, 3, 5 and 7. Each ship would be at berth the entire day (24 hours). Due to the close proximity of each of the berths (approximately 300 metres from centre to centre of adjacent berths), the operation of vessels at berths not chosen above would not have a significant impact on the modelled impacts.
- Ships operate for 365 days per year, 24 hours per day.
- The height of the bulk and container ship stacks (35 metres) was based on the typical stack height from the water of the Panamax style cargo ship while berthing in ballast.
- The default NPI values for ship auxiliary power (600kW) and auxiliary boiler fuel consumption (0.0125 tonnes/hour) were applied in the modelling of bulk and container ships.
- The NPI weighted average fuel burn (marine diesel oil and marine gas oil) was applied in the modelling of dredging, bulk and container ships.

Bulk Material Stockpile Emissions

- It has been estimated that 0.1 MTPA of sand for export and 0.5 MTPA of boutique coal for export, totalling 0.6 MTPA of bulk material, will potentially be stored as an uncovered stockpile within the Bulk and General Precinct.
- The emissions from the bulk material stockpile operations were estimated using the NPI manual for Mining Operations (Commonwealth 2001). The manual provides emission rates to be applied to mining activities, including wind erosion and the loading and unloading from stockpiles. The manual also provided emissions reduction factors for applied mitigation measures where appropriate. The stockpile size has been estimated in the model as final parameters for the stockpile are not available.

Assumptions and Comments

- The stockpile has been assumed to be present 24 hours a day, 365 days per year.
- It has been assumed that a maximum of 10 percent of the total material will be present on the site at any one time, resulting in a stockpile volume of 60,000 TPA. Assuming a material density of 1.5 tonnes per cubic metre, the calculated stockpile size is 40,000 metres cubed. The size of the stockpile has been assumed to be 100 metres long, 40 metres wide and 10 metres high. This results in a total exposed surface area, including the sides of the stockpile, to be 6800 metres square.
- In order to realistically model the minor part of the stockpile that is affected by loading / unloading activities at any one time (the active section), the bulk material stockpile has have been modelled as two volume sources in the AQIA;
  - The total stockpile size for wind erosion; and
  - The active section of the stockpile (assumed to be 10 percent of the total) for dust sources from loading/unloading activities.
- It has been assumed that the bulk material stockpile will be watered. As such dust emission reductions provided in the NPI manual for mining table 3 (Commonwealth 2001) have been applied to stockpile loading and unloading activities (50 percent reduction).

Bulk Liquid Fuel Storage Facility Emissions

The ENSR report *Air Quality Impact Assessment Proposed Bulk Liquid Fuel Storage Facility* (2008) was used to generate emission rates for pollutants from the bulk liquid precinct including two bulk liquid operators with a total fuel storage volume of approximately 1,010 Mega Litres. All emission rates, stack and volume source parameters were maintained with only additional coordinates and elevations for each source added to represent the increase in facilities and storage tanks.

The Bulk Liquid Precinct would be used for receival, storage, blending and distribution of fuels and biofuels for customers in the local region. The precinct would be located in the far north western portion of the proposed concept site, immediately to the north west of the Container Terminal Precinct and fronting Berth 7. The precinct would have an area of approximately 15 hectares.

Buildings and structures including tank farms with steel storage tanks, fuel distribution pipelines, truck loading/unloading facilities, bunded areas, workshops, and administration buildings would be provided within the Bulk Liquid Precinct. The precinct would be occupied by two independent operators. Each operator would have an annual throughput of approximately 505 Mega Litres of fuel, for a total throughput of approximately 1,010 Mega Litres per year. Fuel types received, stored, blended and distributed would include unleaded petrol, diesel, biodiesel, fuel oil and ethanol. It is anticipated that delivery of unleaded petrol, diesel and fuel oil would be by ship and that biodiesel and ethanol would be delivered by road.

8.3 Sensitive Receptors

The closest residential area to the site is Mayfield East (approximately 900 metres to the south west), Stockton (2 kilometres to the south east) and Tighes Hill (2 kilometres to the south). The South Arm of the Hunter River is to the north at its closest point to the site.

Within the gridded modelling domain, discrete sensitive receptors were modelled. The DECCW considers sensitive receptors to be areas where people are likely to either live or work, or engage in recreational activities (DEC, 2005). On this basis, representative sensitive receptors were selected at 14 locations surrounding the site. The receptors were chosen from local residential and commercial buildings. Industrial facilities were not chosen as these locations are less sensitive to industrial emissions. However, these locations can still be assessed using the Ground Level Concentration (GLC) contours produced in the modelling.

A summary of the sensitive receptor locations is provided below in **Table 8-8** and shown in **Figure F2** in the Figures section of this document.

Table 8-8: Sensitive Receptor Locations

Receptor Number	Sensitive Receptor Description	Type
1	Selwyn St	Commercial
2	George Bp. Drive	Commercial
3	Selwyn St	Commercial
4	Industrial Dr and Crebert St Crossroad	Residential
5	Industrial Drive	Residential
6	Industrial Drive and Ingall St Crossroad	Residential
7	Dead End of Arthur St	Residential
8	Industrial Drive and George Street Crossroad	Residential
9	George Street and Margaret Street Crossroad	Residential
10	Crebert Street and Ingall Street Crossroad	Residential
11	Havelock Street and Crebert Street T-Section	Residential
12	Phoenix Sports Club	Commercial
13	Industrial Drive and Bull Street T-Section	Residential
14	Kerr Street Dead End	Residential

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9.0 Air Dispersion Modelling Results

9.1 Overview

The predicted pollutant GLCs are provided in **Table 9-2**, **Table 9-3**, **Table 9-4** and **Table 9-5**. Where background data is available, the predicted cumulative pollutant GLCs (predicted GLC combined with the background concentration) are shown in brackets. Note that deposited dust results are expressed as deposition rates and not concentrations.

Where an averaging period of less than 1 hour (60 minutes) is required, the following power law (Schnelle and Dey, 1999) has been utilised to convert the hourly averaged results to the smaller averaging period:

$$C_s = C_k(t_k/t_s)^p$$

Where:

C_s = concentration for time t_s

C_k = concentration for time t_k

t_k = longer averaging time

t_s = shorter averaging time

p = power (assumed value of 0.17)

9.2 Prediction of Cumulative Impacts of Other Major Developments

A review of the major developments surrounding the Port area was undertaken to ascertain the predicted impact levels as a result of these developments. The following developments were reviewed:

- Orica Ammonium Nitrate Upgrade;
- PWCS Kooragang Coal Loader Expansion Stage 4;
- Manildra Park Bulk Liquids Facility - Kooragang Island;
- PWCS Kooragang Coal Loader Expansion;
- Marstel Bulk Liquids Facility - Kooragang Island;
- NCIG Koorangang Coal Loader;
- Cargill Oilseed Processing Plant; and
- GrainCorp Operations Ltd and P&O Ports Agri-Products Storage Facility and Associated Export Facility.

Published impact assessment reports were reviewed and a summary of the predicted pollutant impacts from each development on the Mayfield area has been provided in **Appendix B**. Where a result is less than the Limit Of Reporting (LOR) half the LOR was applied. These predicted values, together with the locally measured values, were included in the calculation of the background levels to predict the cumulative impact of the proposed concept on the local area.

A summary of the background values for HDC data, other developments and the total cumulative background value including HDC monitoring data is provided in **Table 9-1**. Background data for dust deposition and CO are not available. NO_2 background values are applied in the modelling as monthly maximum values for assessment of cumulative values (refer to **Section 9.4**), with the results assessed using the DECCW approved Ozone Limiting Method described in **Section 9.3**.

Table 9-1: Background Concentrations

Pollutant	Worst Case 1 Hour Background Concentration (ug/m3)		
	HDC Data[1]	Other Developments[2]	Total
PM_{10}	56	9.6	66
TSP	26	3.1	29
SO_2	123	0.5	123

[1] Refer to Section 6.3.2.

[2] Refer to Appendix B.

9.3 Ozone Limiting Method (OLM)

Nitrogen oxides are produced in most combustion processes and are formed during the oxidation of nitrogen in fuel and nitrogen in the air. During high-temperature processes a variety of oxides are formed including NO and NO_2. Generally, at the point of emission NO will comprise the greatest proportion of the emission with 95 percent by volume of the NO_x. The remaining NO_x will consist of NO_2. Ultimately, however, all nitric oxides emitted into the atmosphere are oxidised to NO_2 and then further to other higher oxides of nitrogen.

The USEPA's Ozone Limiting Method (OLM) has been used to predict ground-level concentrations of NO_2. The OLM is based on the assumption that approximately 10 percent of the initial stack NO_X emissions are emitted as NO_2. If the O_3 concentration is greater than 90 percent of the predicted NO_X concentrations, all the NO_X is assumed to be converted to NO_2, otherwise NO_2 concentrations are predicted using the equation $NO_2 = 46/48 * O_3 + 0.1 * NO_X$. This method assumes instant conversion of NO to NO_2 in the plume, which overestimates concentrations close to the source since conversion usually occurs over periods of hours. This method is described in detail in the Approved Methods.

Background O_3 data from the Newcastle DECCW Monitoring Station (refer to **Section 6.3**) were used to convert the modelled NO_2 concentrations in accordance with the DECCW approved OLM.

9.4 Modelling Results

The predicted pollutant GLCs are provided in **Table 9-2**, **Table 9-3**, **Table 9-4** and **Table 9-5**.

Table 9-2: Maximum Predicted GLC at the Discrete Sensitive Receptors for PM_{10}, TSP and Dust Deposition

Receptor Number	PM_{10} ($\mu g/m^3$)		TSP ($\mu g/m^3$)	Dust Deposition (g/m^2.month) [1]
	24 Hour	**Annual**	**Annual**	**Annual**
1	5.4 (**71.0**)	1.1 (22.1)	1.3 (30.4)	< 0.01
2	4.2 (**69.8**)	0.5 (21.5)	0.7 (29.8)	< 0.01
3	5.0 (**70.6**)	0.8 (21.8)	1.0 (30.1)	< 0.01
4	5.1 (**70.7**)	0.6 (21.6)	0.8 (29.9)	< 0.01
5	4.1 (**69.7**)	0.6 (21.6)	0.7 (29.8)	< 0.01
6	3.2 (**68.8**)	0.4 (21.4)	0.5 (29.6)	< 0.01
7	3.1 (**68.6**)	0.3 (21.3)	0.4 (29.5)	< 0.01
8	3.9 (**69.5**)	0.5 (21.6)	0.6 (29.7)	< 0.01
9	2.6 (**68.2**)	0.4 (21.4)	0.4 (29.5)	< 0.01
10	3.6 (**69.2**)	0.4 (21.4)	0.5 (29.6)	< 0.01
11	2.6 (**68.2**)	0.3 (21.3)	0.3 (29.4)	< 0.01
12	2.5 (**68.1**)	0.3 (21.3)	0.3 (29.4)	< 0.01
13	1.6 (**67.1**)	0.2 (21.2)	0.2 (29.3)	< 0.01
14	1.5 (**67.0**)	0.1 (21.1)	0.2 (29.3)	< 0.01
Criteria	50	30	90	2

Bold denotes exceedence of criteria

[1] < 0.01 is the limit of detection (LOD) for dust gauge measurement in the field. All predictions were less than this level and hence have been designated less than the LOD.

The modelling results presented in **Table 9-2** show that with the exception of PM_{10} 24 hour average cumulative values, all selected pollutants met the DECCW criteria at the discrete sensitive receptors. **Figures 3** to **5** in the figures section of the report graphically present the selected pollutant GLCs, in isolation from background values, as contour plots. Note that due to the low values for dust deposition the pollutant was not included in the figures. Further discussion of the results, including the cumulative exceedance of PM_{10}, is provided in **Section 10.0**.

Table 9-3: Maximum Predicted GLC at the Discrete Sensitive Receptors for NO_x (as NO_2) and SO_2

Receptor Number	Oxides of Nitrogen (as NO_2) ($\mu g/m^3$)		Sulfur Dioxide (SO_2) ($\mu g/m^3$)			
	1 Hour	Annual	10min	1 hour	24 hour	Annual
1	78.3 (133.6)	13.3 (29.7)	7.3 (7.3)	9.8 (133.3)	1.8 (36.2)	0.3 (4.1)
2	69.4 (153.5)	7.0 (26.4)	19.0 (19.0)	25.7 (149.2)	2.5 (36.9)	0.3 (4.1)
3	57.0 (112.4)	10 (29.3)	13.5 (13.5)	18.3 (141.8)	1.6 (36.1)	0.3 (4.1)
4	69.3 (132.9)	8.2 (27.6)	8.5 (8.5)	11.5 (134.9)	2.3 (36.7)	0.2 (4.1)
5	65.4 (128.9)	7.9 (27.2)	12.8 (12.8)	17.4 (140.9)	1.9 (36.3)	0.3 (4.1)
6	67.6 (133.2)	5.9 (25.2)	12.8 (12.8)	17.4 (140.8)	2.2 (36.6)	0.3 (4.1)
7	60.3 (123.9)	4.5 (23.8)	11.4 (11.4)	15.5 (139)	2.3 (36.7)	0.3 (4.1)
8	65.5 (131.1)	7.0 (26.4)	12.5 (12.5)	17.0 (140.5)	2.4 (36.9)	0.3 (4.1)
9	70.4 (156.5)	5.1 (24.5)	9.7 (9.7)	13.1 (136.6)	2.0 (36.4)	0.3 (4.1)
10	78.1 (164.2)	5.8 (25.2)	13.0 (130)	17.6 (141.1)	2.2 (36.6)	0.3 (4.1)
11	46.6 (112.2)	3.7 (23.0)	7.4 (7.4)	10.0 (133.5)	1.8 (36.2)	0.2 (4.0)
12	50.9 (114.4)	3.5 (22.9)	11.1 (11.1)	15.1 (138.6)	2.0 (36.4)	0.2 (4.0)
13	43.1 (106.6)	2.1 (21.4)	5.8 (5.8)	7.8 (131.3)	1.3 (35.7)	0.1 (3.9)
14	43.6 (111.2)	1.8 (21.2)	7.2 (7.2)	9.7 (133.2)	1.3 (35.7)	0.1 (3.9)
Criteria	246	62	712	570	228	60

Bold denotes exceedence of criteria

The modelling results presented in **Table 9-3** show that all selected pollutants met the DECCW criteria at the discrete sensitive receptors. The average 1 hour NO_2 and annual values were calculated using the DECCW approved OLM method. For the NO_2 1 hour averages, the OLM was calculated using the relevant monthly maximum background NO_2 and O_3 values from 2006 to gain representative predicted ground level concentrations. The 2006 annual average background NO_2 and O_3 values were applied to the OLM calculation for the NO_2 annual average.

Figures 6 to **8** in the figures section of the report graphically present the SO_2 pollutant GLCs, in isolation from background values, as contour plots. Note that due to the OLM calculation NO_2 could not be graphically presented in the figures. Further discussion of the results is provided in **Section 10.0**.

Table 9-4: Maximum Predicted GLC at the Discrete Sensitive Receptors for CO

Receptor Number	Carbon Monoxide (CO) ($\mu g/m^3$)		
	15 Minutes	**1 hour**	**8 Hours**
1	241.8	306.1 (306.1)	96.2 (98.9)
2	134.4	170.1 (170.1)	36.9 (39.7)
3	156.3	197.8 (197.8)	67.5 (70.2)
4	137.2	173.7 (173.7)	52.8 (55.6)
5	134.7	170.5 (170.5)	56.5 (59.2)
6	99.8	126.3 (126.3)	41.4 (44.1)
7	78.6	99.5 (99.5)	35.3 (38.1)
8	116.3	147.2 (147.2)	53.4 (56.2)
9	95.5	120.9 (120.9)	28.9 (31.7)
10	108.7	137.6 (137.6)	34.7 (37.4)
11	69.3	87.7 (87.7)	22.9 (25.6)
12	57.5	72.8 (72.8)	27.6 (30.4)
13	35.1	44.5 (44.5)	16.6 (19.4)
14	30.4	38.4 (38.4)	15.0 (17.7)
Criteria	100,000	30,000	10,000

Bold denotes exceedence of criteria

The modelling results presented in **Table 9-4** show that all selected pollutants met the DECCW criteria at the discrete sensitive receptors. **Figures 9** to **10** in the figures section of the report graphically present the selected pollutant GLCs, in isolation from background values, as contour plots. Further discussion of the results is provided in **Section 10.0**.

Table 9-5: Maximum Predicted GLC at the Discrete Sensitive Receptors for Benzene, Toluene, Xylenes, Ethanol and H_2S

Receptor Number	Benzene (μg/m^3)	Toluene (μg/m^3)	Xylenes (μg/m^3)	Ethanol (μg/m^3)	H_2S (μg/m^3)
	1 hour	1 hour	1 hour	1 hour	1 hour
1	1.9 (2.5)	28 (28.3)	37.4 (37.6)	18.8	0.4
2	1.7 (2.3)	25.7 (26.0)	34.2 (34.4)	17.9	0.4
3	2.2 (2.8)	32.6 (32.9)	43.5 (43.7)	21.9	0.5
4	1.7 (2.2)	25.0 (25.4)	33.4 (33.6)	16.7	0.3
5	1.3 (1.8)	18.9 (19.2)	25.1 (25.4)	12.6	0.3
6	0.6 (1.2)	8.4 (8.7)	11.2 (11.4)	6.2	0.1
7	0.4 (0.9)	4.9 (5.2)	6.6 (6.8)	3.9	0.07
8	0.9 (1.5)	13.1 (13.4)	17.4 (17.7)	9.3	0.2
9	0.5 (1.1)	7.5 (7.9)	10 (10.3)	5.6	0.1
10	0.5 (1.1)	6.9 (7.2)	9.2 (9.4)	5.2	0.1
11	0.3 (0.9)	4.3 (4.6)	5.7 (6.0)	3.3	0.06
12	0.3 (0.9)	4.2 (4.5)	5.5 (5.8)	3.2	0.06
13	0.2 (0.8)	2.4 (2.7)	3.2 (3.5)	1.9	0.03
14	0.2 (0.7)	2.0 (2.3)	2.6 (2.9)	1.6	0.03
Criteria	29	360	190	2100	1.38

Bold denotes exceedence of criteria

The modelling results presented in **Table 9-5** show that all selected pollutants met the DECCW criteria at the discrete sensitive receptors. **Figures 11** to **15** in the figures section of the report graphically present the selected pollutant GLCs, in isolation from background values, as contour plots. Further discussion of the results is provided in **Section 10.0**.

9.5 Limitations of Dispersion Modelling

Best efforts have been made to estimate the likely numbers and operational parameters (including fuel type and consumption etc) of ships, trains and trucks in the AQIA. The numbers used have been based on current information and may change to reflect the detailed design of the site. The numbers used in the model are considered as conservative and as such any minor changes in the future are not likely to have a significant impact on the modelling results. If major changes are proposed in regards to pollutant emitting activities during construction or operation, then further modelling of the project incorporating these changes may be required.

Air dispersion modelling of ship emissions is not typically undertaken in Australia. Best efforts have been made to approach the modelling in a reasonable and realistic way, however there is likely to be a degree of uncertainty in the results. Ship operational details, including stack flow rate and emission concentrations, are limited and conservative assumptions have been applied during the modelling. These conservative assumptions, such as modelling ship emissions as volume sources instead of stack sources, are likely to overestimate the pollutant impacts on the local community.

Activities such as truck movements, and stockpile loading and unloading are likely to be of an intermittent nature, and together with equipment ‘down-time’ caused by maintenance, shift breaks, public holidays etc, it is considered unlikely that all pollutant emitting activities would occur simultaneously during the worst case meteorological conditions required to cause the modelled maximum predicted GLCs. The predicted maximum GLCs are therefore considered conservative and the actual impact the development will have on the local community is expected to be less than that predicted by the modelling.

10.0 Discussion and Mitigation Measures

10.1 Discussion

Analysis of the regional air shed using existing pollution data shows that with the exception of short term episodic particulate matter (short term concentrations of PM_{10} can on occasion exceed the assessment criteria), there is the capacity to increase the pollutants of concern in the air shed without exceeding relevant criteria. The analysis has shown that there may be a constraint on those operations that have the potential to emit fine particulates in the air shed during the construction and operation phases.

The meteorological data suggests that the emission of pollutants during night time may have a higher impact on the surrounding area when the winds are more stable and there is less dispersion of pollutants. Operations which form part of the proposed concept would have to consider this night time affect when planning developments, particularly in relation to particulate emissions.

The modelling results for operation of the proposed concept suggest that with the exception of short-term (24-hour) PM_{10} concentrations, all pollutants comply with the relevant criteria. The worst case background PM_{10} level (65.6 $\mu g/m^3$) already exceeds the DECCW criteria of 50 $\mu g/m^3$ for 24 hour PM_{10}. As such, operation of the proposed concept combined with worst case background PM_{10} would result in 24 hour PM_{10} levels exceeding the DECCW criteria at all of the 14 discrete receptors surrounding the site. The modelling demonstrated that the criteria would be exceeded by up to 21 $\mu g/m^3$ at Receptor 1 which is located at Selwyn Street. It should be noted that while the proposed concept would generate PM_{10} emissions and contribute to exceedance of the criteria, the contribution from the proposed concept alone is minor (less than 11 percent of the assessment criteria (max isolated predicted value 5.4 $\mu g/m^3$ / criteria 50 $\mu g/m^3$ = 10.9 percent) and 8 percent of the predicted cumulative concentration (max isolated predicted value 5.4$\mu g/m^3$ / max cumulative value 71 $\mu g/m^3$ = 7.7 percent)).

Monitoring of ambient pollutant levels, in particular PM_{10}, should be undertaken during operation and an appropriate air quality mitigation plan (AQMP) be prepared and updated based on these results. The AQMP should consider the mitigation measures recommended in the **Section 10.2**.

Future analysis and atmospheric dispersion modelling may be required to re-assess the impact using updated background particulate levels and meteorological data once the proposed concept and other local developments are operational. A case by case approach may also be required for new developments not included in this assessment to identify worst case air pollution scenarios and pollutant impact hot spots.

10.2 Mitigation Measures

Emissions of dust from construction and operational phases of the proposed concept, pollutant emissions from transport (fuel combustion from trains, trucks and ships) and VOC emissions from the operation of the Bulk Liquid Precinct have been identified as predominant sources of emissions. This section discusses the potential impacts from these emissions and mitigation measures for their control.

Table 10-1 summarises the main management measures to address emissions of dust and other pollutants from the construction and operational activities from the site. These measures can be evaluated at any time during a project life and reviewed accordingly. Typically, emissions from construction activities are not modelled due to the variability and transient nature of the sources involved. It should be noted that the list is not comprehensive and would need to be supplemented with additional specific measures depending on the final characteristics of individual Project applications within each precinct.

The mitigation measures referenced should be incorporated into the AQMP.

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Table 10-1: Impact Management Measures

Trigger	Impact	Pollutant	Control Measure	Construction	Operation
Fuel combustion emissions from vehicles and equipment	Increased risk to human health	NO_x CO SO_2 PM_{10} TSP BTEX	Turn engines off whilst parked onsite	X	X
			Vehicular access confined to designated access roads	X	X
			Equipment, plant and machinery regularly tuned, modified or maintained to minimise visible smoke and emissions	X	X
			Site speed limits implemented	X	X
			Minimising haul road lengths	X	X
Fugitive dust and odour from exposed surfaces and vehicles	Nuisance (dust and odour) Discoloration of buildings or structures Increased risk to human health	PM_{10} TSP Odour	Cover stockpiles at the end of each shift and during dry / windy conditions	X	
			Covering loads during transport	X	X
			Erection of windbreak barriers on the Site boundary	X	X
			Watering of exposed surfaces and roads	X	X
			Surface stabilisation to minimise wind blown dust	X	X
			Sealing regularly trafficked surfaces as soon as possible	X	X
			Vehicular access confined to designated access roads	X	X
			Prompt clean up of spills	X	X
			Complaints management system in place	X	X
			Adjusted work practices (as required) based on wind observations and dust monitoring results	X	X
			Periodic dust monitoring	X	X

Trigger	Impact	Pollutant	Control Measure	Construction	Operation
Hazardous and other air pollutants (from disturbance of potentially contaminated ground)	Increased risk to human health Nuisance (dust and odour)	NO_x CO SO_2 PM_{10} TSP Odour BTEX	Covering stockpiles at the end of each shift and during dry / windy conditions	X	
			Covering loads during transport	X	
			Erection of windbreak barriers on the Site boundary	X	
			Watering of exposed surfaces and roads	X	
			Surface stabilisation to minimise wind blown dust	X	

BTEX refers to benzene, toluene, ethylbenzene, xylenes

10.2.1 Fugitive Dust

The key objectives of any management program are to protect human health and the environment. Best practice management should be employed at all times. From a construction perspective, it is essentially a management exercise. For a long term construction activity, the focus should be on implementing a strict dust management regime supplemented by the use of ambient pollutant monitoring. Monitoring enables the assessment (in particular) of health impacts and the effectiveness of management measures.

PM_{10} is a dominant fraction of dust generated by construction and some operational activities. Based on the assessment to date, the implementation of a PM_{10} measurement program during the construction and operational activities is recommended. If new information or regulation supports monitoring of other particle size fractions (such as $PM_{2.5}$), this recommendation can be reviewed at a later date. The selection of appropriate instruments is an integral part of the monitoring program and is directly related to the scale and significance of the environmental effects and the sensitivity of the receiving environment.

10.2.2 Transport Emissions

- Whilst direct mitigation measures (primarily relating to particulates) have been identified in **Table 10-1**, additional measures are available to minimise the emission of other pollutants such as SO_2 and NO_X from transport activities, in particular shipping. The following measures are expected to aid in the reduction of combustion related emissions over time:
- Fuel standards have and will continue to improve, which will lead to lower SO_x, NO_x and particulate emissions. In 2008 the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) unanimously adopted amendments to the MARPOL Annex VI regulations to reduce harmful emissions from ships. (see http://www.imo.org/environment/mainframe.asp?topic_id=233). Some of the main changes include:
  - Progressive reductions in SO_x emissions from ships, with the global sulphur cap reduced initially to 3.50 percent (from the current 4.50 percent), effective from 1 January 2012; then progressively to 0.50 percent, effective from 1 January 2020.
  - Progressive reductions in NO_x emissions from marine engines.
- A Fuel Standards Consultative Committee was established under the *Fuel Quality Standards Act 2000* as a formal consultation mechanism to promote uniformity in Australian fuel standards, to facilitate investment in new fuels and technology, and to be a champion for new fuel standards. From an historical perspective, fuel standards have been modified a number of times since the *Fuel Quality Standards Act 2000* came into force in 2002 with the introduction of uniform fuel standards. An example of action taken on fuel standards since their inception in 2002 can be noted in the committee's action in reducing the national standard for sulphur content in diesel. The allowable content in 2002 was set at a maximum of 500 parts per million, which was reduced to 50 parts per million in 2006 and further reduced to 10 parts per million in 2009. There has been no further action proposed as of the date of this report for fuel standards but given the historical trends toward further tightening of standards further improvements in fuel quality could be expected (although the scope and nature of these changes cannot be predicted at this stage).
- Berth design would include allowance for alternative marine power (AMP) for vessels (also known as cold-ironing) while at berth. The success of AMP would depend upon suitable international standards being adopted for the supply of shore-based electricity to ships and a "critical mass" of vessels to be equipped so as to receive shore power. The adoption of AMP would effectively remove emissions from ship boilers whilst in berth, eliminating a significant source of NO_X and particulate emissions.

10.2.3 Volatile Organic Compounds

The transfer and storage of the fuels and other bulk liquids has been identified as a predominant source of VOC emissions during the operation of the Bulk Liquid Precinct at the site. An air quality assessment was undertaken by ENSR Australia Pty Limited (ENSR) on behalf of Marstel Terminals Newcastle Pty Limited (Marstel) to assess the potential effects on air quality from a proposed bulk liquid fuel storage facility to be located at the precinct (ENSR, 2008). The purpose of the assessment was to determine the air emissions associated with the construction and operation of the proposed facility, and the potential impacts on sensitive receptors and local air quality. The results of the dispersion modelling of emissions from the operation of the facility at full capacity indicated that no significant air pollutant impacts on the surrounding environment would be expected from the proposed facility.

As discussed in **Section 8.2.6**¸ the assessment was developed considering the impacts of two bulk liquid operators with a total fuel storage volume of approximately 1,010 Mega Litres on the basis that fuels would be stored in atmospheric steel storage tanks of various sizes with internal floating roofs to minimise vapour emissions and maintain quality.

All tanks would be designed to meet the requirements of the *Protection of the Environment Operations (Clean Air) Regulation* in relation to the control of volatile organic liquids. In addition, it is anticipated that each tank would have:

- Auto level gauging;
- High/low level alarms;
- Multi-level temperature measurement;
- Multi-level sampling equipment;
- Water draining; and
- Low-level product drains for maintenance purposes.

It is recommended that VRUs be used by operators within the Bulk Liquids Precinct. VRUs can be used for vapour recovery during tanker truck loading with removal efficiencies of greater than 99.9 percent. Based on assessments of similar operations, emissions from truck loading operations when a VRU with a removal efficiency of greater than 99.9 percent is used are minor relative to emissions from storage tanks.

11.0 Conclusions

The AQIA examined the proposed activities associated with construction and operation of the proposed concept and along with existing environmental data predicted the potential air quality impacts that may occur.

A qualitative assessment of the potential impacts associated with construction was undertaken because details on construction vehicles and equipment were not available at the Concept Plan stage. Construction could potentially result in emissions from fuel combustion from vehicles and equipment, dust emissions as a result of earthworks and other construction activities, and odour emissions from the disturbance of anoxic or contaminated material. Mitigation measures such as watering exposed surfaces, covering loads of loose material during transportation, and switching off equipment when it is not in use would minimise these potential impacts. It is recommended that further assessment of construction impacts be undertaken as part of subsequent Project applications when construction details are available.

A quantitative assessment was undertaken to assess the impacts of operation of the proposed concept. The assessment was undertaken using the CALPUFF dispersion model and the inputs were based on the known aspects of the project i.e. shipping numbers, train numbers, truck numbers, bulk material quantities, fuel storage quantities etc, along with other relevant factors such as meteorology, receptor locations and terrain surrounding the site.

The modelling results for operation of the proposed concept suggest that with the exception of short term (24 hour) PM_{10} concentrations, all pollutants comply with the relevant criteria. The worst case background PM_{10} level (65.6 $\mu g/m^3$) already exceeds the DECCW criteria of 50 $\mu g/m^3$ for 24 hour PM_{10}. As such, operation of the proposed concept combined with worst case background PM_{10} would result in 24 hour PM_{10} levels exceeding the DECCW criteria at all of the 14 discrete receptors surrounding the site. The modelling demonstrated that the criteria would be exceeded by up to 21 $\mu g/m^3$ at Receptor 1 which is located at Selwyn Street. It should be noted that while the proposed concept would generate PM_{10} emissions and contribute to exceedance of the criteria, the contribution from the proposed concept alone is minor (less than 11 percent of the assessment criteria and 8 percent of the predicted cumulative concentration).

Emissions of PM_{10} during the operation phase can be limited by implementing site specific ‘best practice’ dust mitigation measures which should be incorporated into the site’s AQMP. A variety of management measures have been recommended including covering loads of loose material during transportation, switching off equipment when it is not in use, and adjusting work practices as needed and based on wind observations. The recommended measures can be evaluated at any time during the project life and reviewed accordingly.

As PM_{10} is a dominant fraction of dust generated by construction and some operational activities, it is recommended that a PM_{10} measurement and monitoring program be implemented during the construction and operational activities. If new information or regulation supports monitoring of other particle size fractions (such as $PM_{2.5}$), this recommendation can be reviewed at a later date and incorporated into the monitoring program as appropriate. The monitoring program would be an integral part of the AQMP.

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12.0 References

ENSR, 2008. (now merged with AECOM), *Air Quality Impact Assessment Proposed Bulk Liquid Fuel Storage Facility*, prepared on behalf of Marstel Terminals Newcastle Pty Limited.

ANZECC, 1990. *National Goals for Fluoride in Ambient Air and Forage,* Australian and New Zealand Environment and Conservation Council, Canberra.

Commonwealth Government of Australia (Commonwealth), 2001. *National Pollution Inventory Emission Estimation Technique Manual for Mining Version 2.3*, December 2001.

Commonwealth of Australia (Commonwealth), 2003. *National Environmental Protection (Ambient Air Quality) Measure*.

Commonwealth of Australia (Commonwealth), 2004. *National Environment Protection (Air Toxics) Measure*.

Commonwealth of Australia (Commonwealth), 2008a. *National Pollution Inventory Emission Estimation Technique Manual for Railway Yard Operations Version 2*, June 2008

Commonwealth Government of Australia (Commonwealth), 2008b. *National Pollution Inventory Emission Estimation Technique Manual for Maritime Operations Version 2*, July 2008.

Environment Protection Authority New South Wales (EPA), 1997a. *Metropolitan Air Quality Study: Air Emissions Inventory*.

Environment Protection Authority New South Wales (EPA), 1997b. *Protection of the Environment Operations Act (1997).*

Environment Protection Authority New South Wales (EPA), 1998. *Action for Air: The NSW Government's 25-Year Air Quality Management Plan,* NSW Environment Protection Authority, Sydney.

Environment Protection Authority New South Wales (EPA), 2002. Ambient Air Quality Research Report (1996-2001); Dioxins, Organics, Polycyclic Aromatic Hydrocarbons and Heavy Metals.

HD, 2008. *Draft Monthly July 2008 Environmental Report. Hunter Development Corporation.*

NEPC, 1998. *Ambient Air – National Environment Protection Measure for Ambient Air Quality,* National Environment Protection Council, Canberra.

NERDDC, 1988. *Air Pollution from Surface Coal Mining: Measurement, Modelling and Community Perception, Project No. 921.* National Energy Research Development and Demonstration Council, Canberra.

NHMRC, 1996. *Ambient Air Quality Goals Recommended by the National Health and Medical Research Council,* National Health and Medical Research Council, Canberra.

Newcastle Port Corporation (NPC), 2008a. *Vision, 2030 - the strategic development of the Port of Newcastle.*

Newcastle Port Corporation (NPC), 2008b. *Traffic impact statement – proposed bulk liquid storage depot, Mayfield North, NSW.*

NSW Department of Environment and Conservation (DEC), 2005. *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

NSW Department of Environment, and Climate Change (DECC), 2006. *NSW State of the Environment 2006,* DECC.

NSW Department of Environment, and Climate Change (DECC)*, 2007. Quarterly Air Quality Monitoring Reports. New South Wales Department of Environment and Climate Change. 2007.*

NSW Department of Environment, and Climate Change (DECC), 2008. Quarterly Air Quality Monitoring Reports. New South Wales Department of *Environment and Climate Change. 2008.*

New South Wales Minerals Council, 2000. *Particulate Matter and Mining; A NSW Minerals Council Technical Paper*, Version 3.

Schnelle, K. and Dey, P., 1999. Atmospheric dispersion modelling compliance guide, McGraw-Hill, New York.

US EPA, October 1996. *AP42 Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources Large Stationary Diesel and All Stationary Dual-fuel Engines, Supplement B.*

V/Line, 1986. *Train controllers guide to fuel conservation with train operation*.

WHO, 2000, *WHO Air Quality Guidelines for Europe, 2nd Edition,* World Health.Organization, Geneva.