Warehousing Facility, Horsley Drive Business Park (SSD 7078)

Air Quality Impact Assessment

Report Number 610.15399-R1

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Australand Industrial Constructions Pty Ltd
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Air Quality Impact Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
2 Lincoln Street
Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
T: +61 2 9427 8100   F: +61 2 9427 8200
sydney@slrconsulting.com   www.slrconsulting.com

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Executive Summary

SLR Consulting Australia Pty Ltd was commissioned by Australand Industrial Constructions Pty Ltd on behalf of The Martin Brower Company to perform an Air Quality Impact Assessment for the proposed construction and operation of a warehousing facility located on the corner of Horsley Drive and Cowpasture Road, Wetherill Park. This assessment forms a part of the Environmental Impact Statement (EIS) for the Project.

The objective of this Air Quality Impact Assessment was to defined the sources of emissions from the proposed construction and operation of the warehousing facility and assess the impacts against applicable air quality criteria to determine any requirement for further mitigation and control, and to identify any residual impacts. Air quality emissions from the operations associated with the warehousing facility were assessed in accordance with the NSW Environment Protection Authority document "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*".

The potential impacts on local air quality from construction activities were assessed qualitatively, using the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management. This qualitative risk based assessment of the potential impacts upon surrounding sensitive receptors during the construction phase has indicated that following implementation of dust management measures, impacts are anticipated to be negligible.

The quantitative assessment of the potential impacts of emissions from the Project site on local air quality involved the estimation of emissions from all related site activities and subsequent dispersion modelling of these emissions. The assessment methodology included meteorological and dispersion modelling using established and recognised modelling techniques. The emission rates and source parameters defined for the modelling scenarios were based on site specific plant and equipment, operating hours, and recognised emission rate calculations and factors.

The quantitative assessment addressed the impacts on air quality from the on-site activities from emissions of; particulate matter less than 10 µm in diameter (PM_{10}), particulate matter less than 2.5 µm in diameter ($PM_{2.5}$), total suspended particulates (TSP), dust deposition, nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2).

The quantitative assessment of potential impacts has reflected a worst case scenario which is not anticipated to be realised during the operation of the Project. Even given the level of conservatism applied within the assessment, the predicted impacts resulting from the Project operation are not predicted to cause any exceedance of any air quality criteria and consequently, comply with the requirements of the POEO Act.

Due to the nature and quantum of emissions, ongoing monitoring is not warranted, particularly given no manufacturing is proposed on-site.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Australand Industrial Constructions Pty Ltd (Australand) on behalf of The Martin Brower Company (Martin Brower) to perform an Air Quality Impact Assessment (AQIA) for the proposed construction and operation of a warehousing facility located on the corner of Horsley Drive and Cowpasture Road, Wetherill Park (the Project site). This assessment forms a part of the Environmental Impact Statement (EIS) for the Project.

The Environmental Planning and Assessment Act 1979 (EP&A Act) forms the statutory framework for planning approval and environmental assessment in NSW. The project is considered 'State Significant Development' (SSD 7078) in accordance with Division 4.1 of Part 4 of the EP&A Act, as it is a type listed in Schedule 1 of the State Environmental Planning Policy (SEPP) - State and Regional Development.

1.1 Secretary's Environmental Assessment Requirements

NSW Department of Planning and Environment (DPE) issued Secretary's Environmental Assessment Requirements (SEARs) for the Project on 24 June 2015. **Table 1** below identifies the SEARs relevant to this Air Quality Assessment report and the relevant sections of the report in which they have been addressed.

Table 1 Secretary's Environmental Assessment Requirements – Warehousing Facility, Martin Brower – Horsley Drive Business Park (Application number SSD 7078)

Key Issue	Assessment Requirement	Addressed in Section
Air Quality and Odour	A description of all potential odour sources and predicted odour emissions from the construction and operation of the facility.	**Section 2**
	Details of air quality and odour impacts on private properties, in accordance with relevant Environmental Protection Authority guidelines.	**Section 8**
	Details of mitigation, management and monitoring measures for preventing and minimising emissions.	**Section 8.1.3 & Section 8**

Issued: 24 June 2015; Department of Planning & Environment, NSW Government, File Reference: SSD 7078.

The SEARs require that the assessment be performed in accordance with relevant policies, guidelines and plans including:

- *Protection of Environment Operations (Clean Air) Regulation* (2010);
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005); and,
- *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (2006).

This assessment addresses the key issues raised within the SEARs and is performed in accordance with the relevant policies and guidelines.

1.2 Outline of Assessment

The NSW Office of Environment and Heritage (OEH) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (DEC 2005) (hereafter the Approved Methods) outline the requirements for conducting an AQIA, as follows (with identification of where each requirement has been met):

- Description of local topographic features and sensitive receptor locations (**Section 3.1** & **Section 3.2** respectively).
- Establishment of air quality assessment criteria (**Section 4**).
- Analysis of climate and dispersion meteorology for the region (**Section 6.2**).
- Description of existing air quality environment (**Section 5**).
- Compilation of a comprehensive emissions inventory for existing and proposed operations (**Section 5**).
- Completion of atmospheric dispersion modelling and analysis of results (**Section 6** and **Section 8**).
- Preparation of an air quality impact assessment report comprising the above.

2 PROJECT OVERVIEW

2.1 Proposed Project

Martin Brower proposes to operate a distribution facility that receives palletised goods, picks customer orders, loads outbound palletised trucks and delivers direct to customers. Products are primarily made up of food and packaging in three temperature zones (frozen, chilled and ambient temperature).

It is proposed that the facility will operate 24 hours per day, seven days per week and will hold between 6,500 and 10,000 pallets of product at any one time. Product is expected to be split as follows:

- Ambient food products in corrugated packaging (liquid and solid) 21%
- Ambient paper and plastic products in corrugate packaging 26%
- Ambient hard goods (paper, plastic or metal) in corrugate packaging 25%
- Chilled food products (fresh and packaged) in corrugate packaging 8%
- Frozen food products in corrugate packaging 20%

Product is accepted and delivered by Class 3, 4, 5, 7, 8, 9 and 10 vehicles (two axle trucks to B-Doubles) with trucks carrying between 6 to 22 pallets per load. An estimate of potential truck numbers split between vehicle class is presented in **Table 2**.

Table 2 Estimated Daily Truck Numbers

Vehicle Category	Number	
	Incoming	Outgoing
Class 3, 4 and 5	10	28
Class 8 and 9	46	57
Class 10	10	0
Totals	66	85

2.2 Identification of Potential Emissions to Atmosphere

2.2.1 Construction Phase

The main emissions to air during the construction phase will be emissions of particulate matter (dust), from construction activities, including material handling activities. Dust from the construction activities will be managed using the best management practices outlined in **Section 8.1.3**.

2.2.2 Operational Phase

During the operational phase, wheel-generated dust from vehicles travelling on sealed roads and road traffic exhaust emissions are considered likely to be the main sources of emissions to air. On this basis, particulate emissions (TSP, PM_{10} and $PM_{2.5}$) resulting from traffic movements on paved roads and emissions resulting from the combustion of fuel (oxides of nitrogen (NO_X), carbon monoxide (CO), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and lead (Pb)) have been identified as key pollutants and have been assessed in **Section 8.2**.

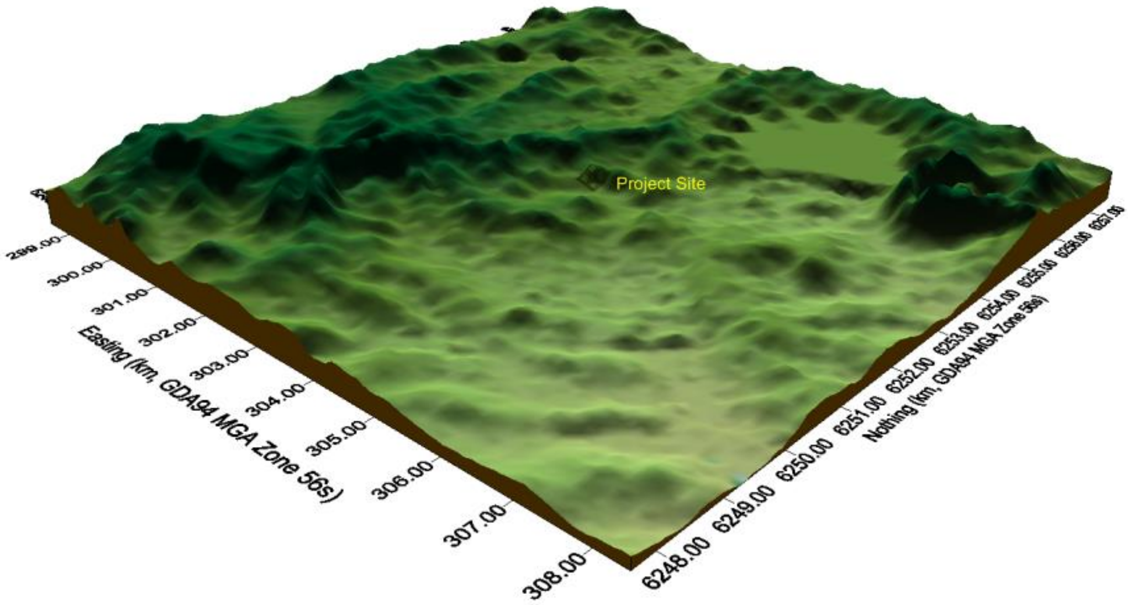
Emissions of odour are not anticipated to be of concern, given that no food preparation occurs on-site, and stored products are frozen, chilled or sealed. Correspondingly, potential impacts of odour are not considered further in this assessment.

3 STUDY AREA

3.1 Local Topography

The topography in the area surrounding the Project site ranges from 15 m Australian Height Datum (AHD) to approximately 150 m AHD. The Project site is at an elevation of approximately 65 m to 75 m AHD. A representation of the surrounding topography is presented in **Figure 1**.

Figure 1 3-Dimensional Representation of Surrounding Topography



3.2 Sensitive Receptors

The Project site is surrounded by industrial development to the east and northeast, high density residential development in Bossley Park to the south and southeast, single residential dwellings and Western Sydney Parklands to the southwest, low density rural dwellings to the north and east in Wetherill Park and Horsley Park.

The closest identified residential receptor is located 35 metres (m) north of the site boundary and the closest residential area is approximately 230 m to the southeast at Derwent Place, Bossley Park.

The surrounding sensitive receptors identified for this assessment and presented in **Figure 2** and are listed in **Table 3**.

Figure 2 Surrounding Sensitive Receptors

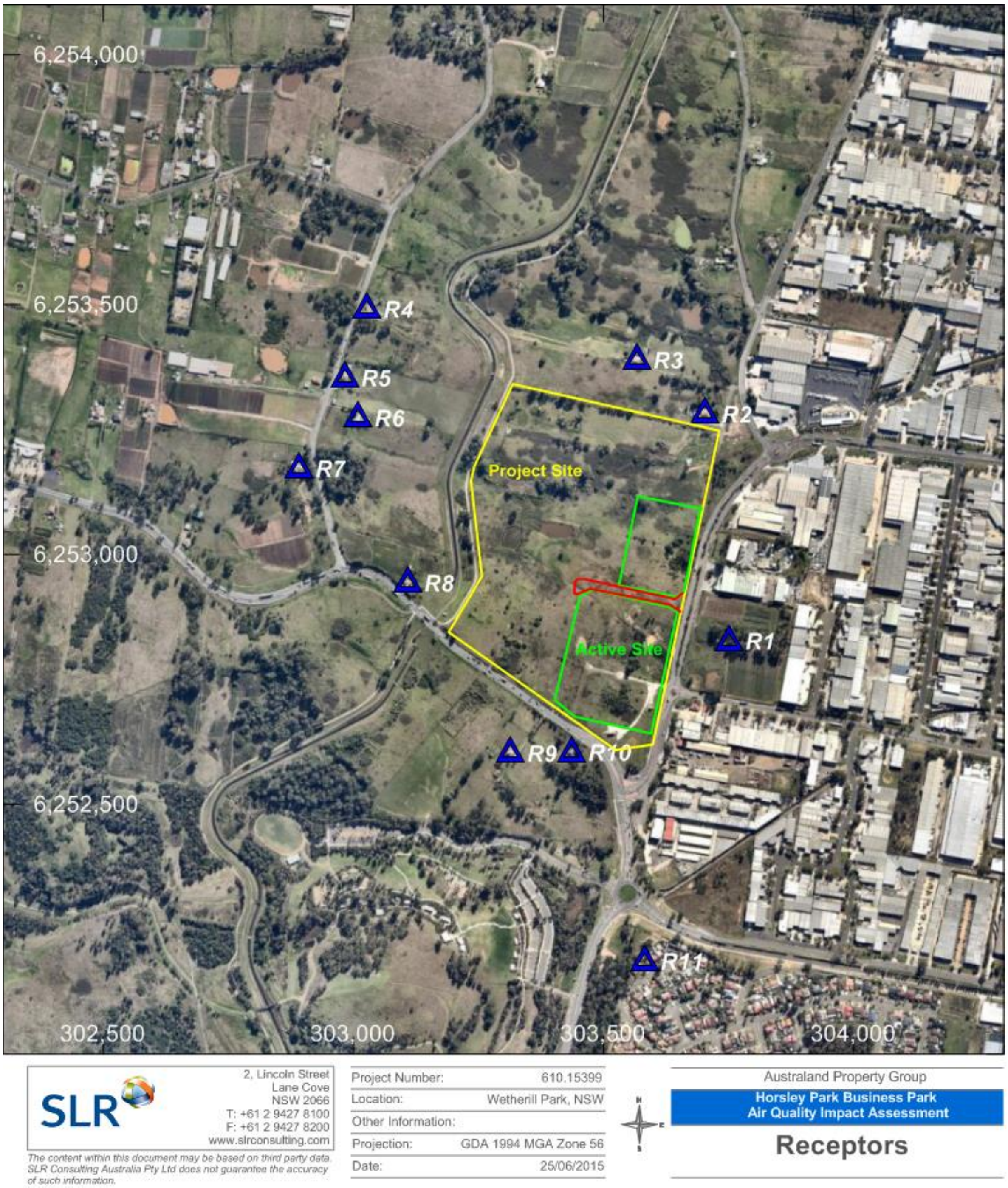


Table 3 List of Identified Sensitive Receptors

Receptor ID	Easting (km)	Northing (km)	Address	Distance to Project Site Boundary (m) and Direction
R1	303,750	6,252,826	189-203 Cowpasture Road, Wetherill Park 2164	100 m E
R2	303,703	6,253,280	144-154 Cowpasture Road, Wetherill Park 2164	35 m N
R3	303,566	6,253,388	132-142 Cowpasture Road, Wetherill Park 2164	110 m N
R4	303,027	6,253,490	70-84 Ferrers Road, Horsley Park 2175	320 m NW
R5	302,982	6,253,352	46-56 Ferrers Road, Horsley Park 2175	310 m WNW
R6	303,009	6,253,272	34-44 Ferrers Road, Horsley Park 2175	360 m W
R7	302,891	6,253,171	31-37 Ferrers Road, Horsley Park 2175	340 m W
R8	303,108	6,252,942	1570 The Horsley Drive, Horsley Park 2175	130 m W
R9	303,314	6,252,601	1538 The Horsley Drive, Abbotsbury 2176	130 m SW
R10	303,436	6,252,603	1532 The Horsley Drive, Abbotsbury 2176	50 m SSW
R11	303,581	6,252,185	9 Derwent Place, Bossley Park 2176	230 m SE

4 ASSESSMENT CRITERIA

State air quality guidelines adopted by the NSW EPA are published in the The Approved Methods which has been consulted during the preparation of this assessment report.

The Approved Methods lists the statutory methods that are to be used to model and assess emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Project. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC and WHO). The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting.

No impact assessment criteria exist in Australia for bioaerosols at the present time. Discussion regarding the potential impacts of bioaerosols is provided in the *Environmental Guidelines – Composting and Related Organics Processing Facilities* document (NSW DEC, 2004). Within (NSW DEC, 2004) reference is made to a UK Environment Agency document entitled *Monitoring of Particulate Matter in Ambient Air around Waste Facilities*, a draft of which was published in 2003. This document has since been updated and includes a method for monitoring of biological matter and also includes guideline limits for bioaerosols (Environment Agency, 2013). These guidelines have been adopted for the purposes of this assessment.

4.1 Particulate Matter

4.1.1 Particulates (as TSP, PM_{10} and $PM_{2.5}$)

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulates. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” specifically refers to a category of airborne particles, typically less than 30 micrometres (µm) in diameter and ranging down to 0.1 µm and is also termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air (µg/m^3) (NHMRC, 1996).

The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

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

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are as follows:

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

The Approved Methods do not set any assessment goals for $PM_{2.5}$. In December 2000, the National Environment Protection Council (NEPC) initiated a review to determine whether a national ambient air quality criterion for $PM_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. The review found that:

- there are health effects associated with these fine particles;
- the health effects observed overseas are supported by Australian studies; and

- fine particle standards have been set in Canada and the USA, and an interim criterion is proposed for New Zealand.

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

As such, in July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$, setting the following Interim Advisory Reporting Standards for $PM_{2.5}$ (NEPC, 2003):

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

It is noted that the NEPM Advisory Reporting Standards relating to $PM_{2.5}$ particles are reporting guidelines only at the present time and not intended to represent air quality criteria. A summary of the particulate guidelines is shown in **Table 4**.

Table 4 EPA Goals for Particulates

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m^3
PM_{10}	24 Hours Annual	50 µg/m^3 30 µg/m^3
$PM_{2.5}$	24 Hours Annual	25 µg/m^3 (interim advisory reporting standard only) 8 µg/m^3 (interim advisory reporting standard only)

Source: (NSW DEC, 2005), (NEPC, 2003)

4.1.1.1 Potential Changes to the Ambient Air Quality NEPM

On 29 April 2014, Environment Ministers signalled their intent to vary the Ambient Air Quality NEPM based on the latest scientific understanding of the health risks resulting from airborne particulate pollution. The variation to the Ambient Air Quality NEPM was the subject of consultation with the wider affected community until 10 October 2014 although the standards presented in **Table 5** have been proposed as a potential ‘preferred option’ (NEPC, 2014).

Table 5 Proposed Variation to the Ambient Air Quality NEPM

Metric	Averaging Period	Current Standard	Options for Standard	Allowed Exceedances
PM_{10}	Annual average	None	No standards with consideration of 20 µg/m^3	N/A
	24-hour mean	50 µg/m^3	50 µg/m^3, with consideration of 45 µg/m^3 and 40 µg/m^3	See note below
$PM_{2.5}$	Annual average	8 µg/m^3 (advisory)	8 µg/m^3	N/A
	24-hour mean	25 µg/m^3 (advisory)	25 µg/m^3	See note below

Source: (NEPC, 2014)

The four options for the form of the 24-hour standards, and specifically the treatment of exceedances, for both PM_{10} and $PM_{2.5}$ are as follows:

- Business as usual option; a rule that allows a fixed number of exceedances of a PM standard in a given year, with no exclusion of data for exceptional events.
- A rule that allows a fixed number of exceedances of a PM standard in a given year, but with exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, with no exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, but with exclusion of data for exceptional events.

It has been identified by the NEPC that it is likely that jurisdictions will want to identify local issues that affect the form of the standards and therefore the options for this standard have been left open for the consultation phase which closed in October 2014.

For the purposes of this assessment, discussion is provided on the basis of an adopted annual average PM_{10} concentration of 20 µg/m^3 and adoption of the current advisory $PM_{2.5}$ standards (24-hour and annual average).

Limited discussion is provided on the potential 24-hour PM_{10} standard of 40 µg/m^3 (in addition to the current standard of 50 µg/m^3). Only limited discussion is provided as the current background PM_{10} concentrations in the local area are already shown to be in exceedance of the potential 40 µg/m^3 criterion and the adopted standard will likely require consideration of this.

4.1.2 Particulates (as Deposited Dust)

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

Table 6 presents the impact assessment goals set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 6 EPA Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month

Source: (NSW DEC, 2005)

4.2 Products of Combustion

Emissions associated with road traffic and the combustion of automotive fuel (diesel, petrol, etc.) will include carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_x), particulates (TSP and PM_{10}), volatile organic compounds (VOCs) and lead (Pb).

Oxides of nitrogen (NO_X) is a general term used to describe any mixture of nitrogen oxides formed during combustion. In atmospheric chemistry, NO_X generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 in the atmosphere soon after leaving a car exhaust.

CO is an odourless, colourless gas formed from the incomplete combustion of fuels in motor vehicle engines. It can be a common pollutant at the roadside and highest concentrations are found at the kerbside with concentrations decreasing rapidly with increasing distance from the road. CO in urban areas results almost entirely from vehicle emissions and its spatial distribution follows that of traffic flow.

The incomplete combustion of fuel in diesel powered cars can generate particulate in the form of black soot (also known as ‘diesel particulate matter’) . Particulates may also be generated due to brake and tyre wear, and road abrasion.

Vehicle exhausts can contain emissions of sulphur dioxide (SO_2) due to impurities in the fuel, although the emission of SO_2 from road traffic exhaust emissions has been significantly reduced due to the introduction of lower sulphur-content fuels.

Volatile organic compounds (VOC) are emitted from the incomplete combustion of fuel. VOC emissions are reducing significantly due to the improved combustion processes offered by modern engines. Typically, aside of industrial emissions, a location with elevated VOC concentrations will be neighbouring a petrol station and the introduction of reciprocating pumps has significantly reduced VOC exposure.

The emission of lead from road traffic has reduced significantly with the increased use of unleaded fuels. A diminishing proportion of cars in NSW still use leaded fuel, although this is reducing over time.

The NSW OEH has established ground level air quality impact assessment criteria for criteria air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health (as published in the Approved Methods). A summary of the relevant impact assessment criteria is given in **Table 7**. Reference should be made to **Table 4** for the criteria relating to particulates.

Table 7 EPA Goals for Combustion Related Pollutants

Pollutant	Averaging Period	Concentration		Source
		(pphm)	($\mu g/m^3$)	
Sulphur dioxide (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)
Nitrogen dioxide (NO_2)	1 hour	12	246	NEPC (1998)
	Annual	3	62	NEPC (1998)
Lead	Annual	-	0.5	NEPC (1998)
		ppm	**mg/m^3**	
Carbon monoxide (CO)	15 minutes	87	100	WHO (2000)
	1 hour	25	30	WHO (2000)
	8 hours	9	10	NEPC (1998)

Note: Particulate criteria as presented in **Table 4**

Experience in performing assessments of the impact of road traffic exhaust emissions determines that the principal 'indicator' pollutants from road traffic are NO_2 and PM_{10}, and the risk of non-compliance with the relevant criteria is typically associated with the short-term criteria rather than the annual averages. However, to provide a comprehensive assessment, predicted concentrations are compared to all relevant averaging periods.

4.3 Summary of Project Air Quality Goals

The air quality goals adopted for this assessment, which confirm to current EPA and Commonwealth air quality criteria, are summarised in **Table 8**. All criteria are referenced as mass concentration.

Table 8 Project Air Quality Goals

Pollutant	Averaging Time	Goal (µg/m³)	Source
Sulphur dioxide (SO_2)	10 minutes	712	NHMRC (1996)
	1 hour	570	NEPC (1998)
	24 hours	228	NEPC (1998)
	Annual	60	NEPC (1998)
Nitrogen dioxide (NO_2)	1 hour	246	NEPC (1998)
	Annual	62	NEPC (1998)
Lead	Annual	0.5	NEPC (1998)
PM_{10}	24 hours	50	NEPC (1998)
	Annual	30	EPA (1998)
$PM_{2.5}$	24 hours	25	NEPC (2003)
	Annual	8	NEPC (2003)
TSP	Annual	90	NHMRC (1996)
		Goal (g/m²/month)	
Deposited dust	Annual	2 (maximum increase in deposited dust level) 4 (maximum total deposited dust level)	NERDDC (1988)
		Goal (mg/m³)	
Carbon monoxide (CO)	15 minutes	100	WHO (2000)
	1 hour	30	WHO (2000)
	8 hours	10	NEPC (1998)

Source: Approved Methods, NSW DEC 2005, WHO 2005.

The impact assessment criteria are required to be applied as follows:

- At the nearest existing or likely future off-site sensitive receptor.
- The incremental impact (predicted impacts due to the pollutant source alone) for each pollutant must be reported in units and averaging periods consistent with the impact assessment criteria.
- Background concentrations must be included using the procedures specified in Section 5 of the Approved Methods.

5 EMISSIONS ESTIMATION

5.1 Pollutants of Interest

As previously discussed, the most significant air quality emissions from the operation of the Project will be associated with road traffic exhaust emissions which will be generated from the incoming and outgoing trucks. Other potential pollutants that will be emitted as a result of the Project include products of fuel combustion from the vehicles (as discussed in **Section 2**), including:

- carbon monoxide (CO)
- oxides of nitrogen (NO_X);
- sulphur oxides (SO_x);
- volatile organic compounds (VOCs);
- dioxins and furans (PCDD/DF); and
- polyaromatic hydrocarbons (PAHs).

Given the small scale of the operations, the small emission rates of VOCs, dioxins and furans, and PAHs, and the relative distances between the Project and nearby sensitive receptors, the proposed operation would not be expected to result in a significant increase in ambient concentrations of these pollutants at surrounding sensitive receptors and therefore have not been quantitatively assessed in this study (NPI, 2008) (National Dioxins Program, 2004).

Based on the discussion above, this assessment focusses on the following key pollutants of interest:

- particles (as PM_{10});
- particles (as $PM_{2.5}$);
- carbon monoxide (CO);
- oxides of nitrogen (NO_x);
- sulphur oxides (SO_x);

5.2 Scenarios

Two scenarios have been constructed for the purposes of this AQIA:

Scenario 1 This scenario was derived as an appropriate approximation of likely site operations. This scenario is suitable to assess longer-term impacts, such as the annual average and 24-hour average approval criteria. The scenario is described by average daily truck movements, which include 66 incoming vehicles per day and 85 outgoing vehicles per day (reference **Table 2**). Incoming vehicles arrive laden and drop-off product and leave the site. Outgoing vehicles arrive on-site empty and pick-up a load before exiting the site. There are 10 receival bays for the incoming vehicles and 19 bays for the outgoing vehicles. While it is proposed that trucks will turn off their engines once docked in bays, this assessment has conservatively included emissions from idling trucks. This scenario assumes that an average number of bays are occupied by idling trucks per hour (ie total trucks per day divided by 24 hours of proposed operation).

Scenario 2 This scenario was derived as an appropriate approximation of worst case hourly site operations. This scenario is suitable to assess 1-hour and sub-hourly average approval criteria, which apply only to NO_2, CO and SO_2. The scenario is described by the average daily truck movements all occurring in a one hour time period. This scenario assumes that all bays are occupied by idling trucks (ie all 29 bays are occupied). It is noted that this is unlikely, however it represents a ‘worst case’ condition that needs to be demonstrated.

Potential emissions from the operations were estimated based on the emission factors presented in the following documents:

- *Emission Estimation Technique Manual for Combustion Engines* (hereafter, “NPI Manual”), Version 3.0 (NPI, 2008) and;
- *Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transport Conformity* (US EPA, 2004).

Details of the emission factors and emission estimation techniques used to estimate the potential emissions to air are provided below.

5.3 Emissions from Hauling on Paved Roads

Potential particulate emissions from vehicle travel on a dry paved road were estimated based on the emission factors presented in US EPA AP42 document for paved roads (**Section 13.2.1**). Details of the emission factors and equations used in estimating the potential emissions are provided below (US EPA, 2011).

Haul Truck Wheel Dust on Paved Roads

The quantity of particulate emissions from re-suspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression.

$$EF = k \times (sL)^{0.91} \times (W)^{1.02} \text{ kg/VKT}$$

Where:

EF = particulate emission factor (having units matching the units of k)
k = particle size multiplier for particle size range and units of interest (Table 9)
sL = road surface silt loading (grams per square meter) (g/m^2)
W = average weight (tonnes) of the vehicles traveling the road.

Note: VKT = Vehicle Kilometers Travelled.
Source: USEPA AP-42

The information used to derive the emission factors for particulate matter emissions from hauling on paved roads is listed in **Table 9**. The corresponding emission rates (kg/y) are displayed in **Table 10**. The source parameters for the haul road volume sources used in dispersion modelling are detailed in **Table 11**.

Table 9 Emission Factors for Hauling on Paved Roads

Vehicles	Emission Factor (kg/VKT)			Silt Loading	Average Gross Vehicle Mass	Particle Size Multiplier (k)		
	TSP	PM_{10}	$PM_{2.5}$	g/m^2	tonnes	PM_{30} (TSP)	PM_{10}	$PM_{2.5}$
Incoming	0.071	0.014	0.003	0.6	32.67	3.23	0.62	0.15
Outgoing	0.054	0.010	0.003	0.6	24.75			

Table 10 Emission Rates from Hauling on Paved Roads

Scenario	TSP emission (kg/y)	PM_{10} emission (kg/y)	$PM_{2.5}$ emission (kg/y)	Truck Movements per day - one way[1]	Total length of Road - one way (Km)	Total VKT per year[2]
Scenario 1 - incoming	1,635	314	76	66	0.96	23,006
Scenario 1 - outgoing	1,587	305	74	85	0.96	29,629
Scenario 2 - incoming	39,243	7,533	1,822	1,584	0.96	552,143
Scenario 2 - outgoing	38,080	7,309	1,768	2,040	0.96	711,093

Notes:

1. Scenario 2 calculated by assuming the daily average of vehicles arrive every hour.
2. Based on 365 days/year operational

Table 11 Summary of Haulage Volume Source Parameters

Haul Road Volume Source Parameters		
Overall width of truck	2.9	m
Overall height of truck	4.0	m
Top of Plume Height	5.7	m
Release Height	2.8	m
Width of plume	8.9	m
Initial Sigma Y	4.1	m
Initial Sigma Z	2.6	m

Notes:

1. Calculated using the Haul Road Workgroup Final Report Submission to EPA-OAQPS (Haul Road Workgroup, 2012)
2. Based off a 6 axle articulated truck, which represents the medium size of vehicles entering and exiting the site.

5.4 Emissions from Road Transport Vehicles

To estimate the combustion emissions from road transport vehicles, the vehicle type (namely heavy goods vehicles) and distance travelled by the vehicle are required.

Equation 1 Emission Rate Equation for Road Transport Vehicles - NPI

$$Ei = Ly \times EFi$$

Where:

Ei = Emission of substance i for a specific engine type (kg/y)

Ly = Distance travelled per year (km/y)

EFi = Emission factor of substance i, for a given engine and fuel type (kg/km)

i = Substance i

The NPI Manual for Combustion engines is dated 2008 (NPI, 2008). For heavy goods vehicles an emission factor was presented in the NPI manual in kg/m^3. Fuel quantity per year was calculated by multiplying the distance travelled (km/y) by a volumetric fuel consumption per km (m^3/km), which was determined to be 47 l/100km. The quantity of fuel consumed (m^3/y) was then multiplied by the emission factor (kg/m^3) to provide the emission rate (kg/y). The source parameters for the used in dispersion modelling to describe the combustion emissions are the same as those described for the trucks hauling on paved roads (**Section 5.3**).

Table 12 Emission Factors for Combustion Emissions from Hauling

Operational Activities	NPI Emission Factors (kg/m^3)					
	TSP	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2
Combustion emission from Hauling - incoming	2.3	1.2	1.1	22	8.5	0.017
Combustion emission from Hauling - outgoing	2.3	1.2	1.1	22	8.5	0.017

5.5 Emissions from Idling of Road Transport Vehicles

The idling of trucks provides a different source of emission and must also be considered. The emission rate of pollutants from idling vehicles can be calculated using emission factors, the time spent idling per hour, the vehicles/day, and the number of operating hours/day. The emission factors are listed in **Table 13**.

Equation 2 Emission Rate Equation for Idling Trucks

$$E = \frac{EF \times Vd}{Hd}$$

Where:

E = Emission rate of NO_X, PM_{10} or $PM_{2.5}$ (g/sec)

EF = Emission factor of NO_X, PM_{10} or $PM_{2.5}$ (g/hr/vehicle)

Vd = The number of idling vehicles in a day (vehicles/day)

Hd = Number of operating hours per day

The emission factors were taken from the guidance document on idling emissions (US EPA, 2004).

Table 13 Idling Emission Factors

Operational Activities	Idling Emission Factors (g/hr/vehicle)		
	PM_{10}	$PM_{2.5}$	NO_X
Emissions from idling trucks	0.89	0.89	135

The source parameters for the idling truck volume sources used in dispersion modelling are detailed in **Table 14**.

Table 14 Summary of Idling Truck Volume Source Parameters

Idling Truck Volume Source Parameters		
Overall width of truck	2.9	m
Overall height of truck	4.0	m
Release Height	2.0	m
Initial Sigma Y	0.67	m
Initial Sigma Z	0.46	m

Table 15 Emission Rates

Activity	Emission Rate (g/s/source)					
	TSP	**PM_{10}**	**$PM_{2.5}$**	**NOx**	**CO**	**SO_2**
Scenario 1						
Wheel Generated Dust - Hauling						
Hauling on internal paved road – incoming (15 sources)	3.46E-03	6.63E-04	1.61E-04	-	-	-
Hauling on internal paved road – outgoing (15 sources)	3.35E-03	6.44E-04	1.56E-04	-	-	-
Combustion Emissions – Hauling						
Hauling on internal paved road – incoming (15 sources)	5.33E-05	2.78E-05	2.55E-05	5.10E-04	1.97E-04	3.94E-07
Hauling on internal paved road – outgoing (15 sources)	6.86E-05	3.58E-05	3.28E-05	6.56E-04	2.54E-04	5.07E-07
Combustion Emissions - Idling						
Idling trucks in bays – incoming and outgoing (6 sources)	2.47E-04	2.47E-04	2.47E-04	3.75E-02	-	-
Scenario 2						
Wheel Generated Dust - Hauling						
Hauling on internal paved road – incoming (15 sources)	8.30E-02	1.59E-02	3.85E-03	-	-	-
Hauling on internal paved road – outgoing (15 sources)	8.05E-02	1.55E-02	3.74E-03	-	-	-
Combustion Emissions - Hauling						
Hauling on internal paved road – incoming (15 sources)	1.28E-03	6.67E-04	6.11E-04	1.22E-02	4.72E-03	9.45E-06
Hauling on internal paved road – outgoing (15 sources)	1.65E-03	8.59E-04	7.87E-04	1.57E-02	6.08E-03	1.22E-05
Combustion Emissions - Idling						
Idling trucks in bays – incoming and outgoing (29 sources)	2.47E-04	2.47E-04	2.47E-04	3.75E-02	-	-

6 AIR DISPERSION MODELLING METHODOLOGY

6.1 Model Selection

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

The advantages of using CALPUFF (rather than using a steady state Gaussian dispersion model such as AUSPLUME) is its ability to handle calm wind speeds (<0.5 m/s) and the effects of complicated terrain on plume dispersion. Steady state models assume that meteorology is unchanged by topography over the modelling domain and may result in significant over or under estimation of air quality impacts.

More advanced dispersion models (such as CALPUFF) are approved for use by many regulatory authorities in situations where these models may be more appropriate than use of the AUSPLUME model. Such situations include those noted above (i.e. high frequency of calm wind conditions and/or complicated terrain).

6.2 Meteorological Modelling

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading.

Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Oke, 1988).

To adequately characterise the dispersion meteorology of the study site, information is needed on the prevailing wind regime, mixing depth and atmospheric stability and other parameters such as ambient temperature, rainfall and relative humidity.

Meteorological data collected over the period 2009-2013 at the nearest BOM station (Horsley Park [station number 67119]) were analysed to select a representative year for dispersion modelling.

6.2.1 Selection of Representative Meteorological Data

In dispersion modelling, one of the key considerations is the representativeness of the meteorological data used. Once emitted to atmosphere, emissions will:

- rise according to the momentum and buoyancy of the emission at the discharge point relative to the prevailing atmospheric conditions;

- be advected from the source according to the strength and direction of the wind at the height which the plume has risen in the atmosphere;
- be diluted due to mixing with the ambient air, according to the intensity of turbulence; and
- possibly be chemically transformed and/or depleted by deposition processes.

Dispersion is the combined effect of these processes.

Dispersion modelling is used as a tool to simulate the air quality effects of specific emission sources, given the meteorology typical for a local area together with the expected emissions. Selection of a year when the meteorological data is atypical means that the resultant predictions may not appropriately represent the corresponding air quality impacts.

The year of meteorological data used for the dispersion modelling was selected by reviewing the most recent five years of historical surface observations at Horsley Park AWS (2009 to 2013 inclusive) to determine the most representative year of long-term conditions. Wind speed, ambient temperature and relative humidity were compared to long term averages for the region to determine the most representative year.

Data collected from 2009 to 2013 is summarised in **Figure 3** to **Figure 8**. Examination of the data indicates the following:

- **2009**
  - **Figure 3** and **Figure 4** indicate that 2009 exhibits wind speeds in autumn and spring that are above the long term average and the four other years of data.
  - **Figure 5** and **Figure 6** show that temperature is higher than the long term average in November and December.
- **2010**
  - **Figure 5** and **Figure 6** show that temperature is higher than the long term average in late summer.
  - **Figure 7** indicates that the 2010 9 am relative humidity is slightly lower than the long term average in the late summer months.
- **2011**
  - **Figure 3** and **Figure 4** indicate that 2011 exhibits wind speeds that are below the long term average.
  - **Figure 7** and **Figure 8** indicate that relative humidity at 3 pm in 2011 is higher than the long term average.
- **2012**
  - **Figure 3** and **Figure 4** indicate that 2012 exhibits wind speeds that are below the long term average.
  - **Figure 7** indicates that the 2012 9 am relative humidity is slightly higher than the long term average in a few months.
- **2013**
  - **Figure 3** and **Figure 4** indicate that 2013 exhibits wind speeds that are below the long term average.
  - **Figure 6** shows that 3 pm temperature is higher than the long term average in spring in 2013.

Figure 3 Wind Speed at 9 am at Horsley Park AWS for 2009 – 2013

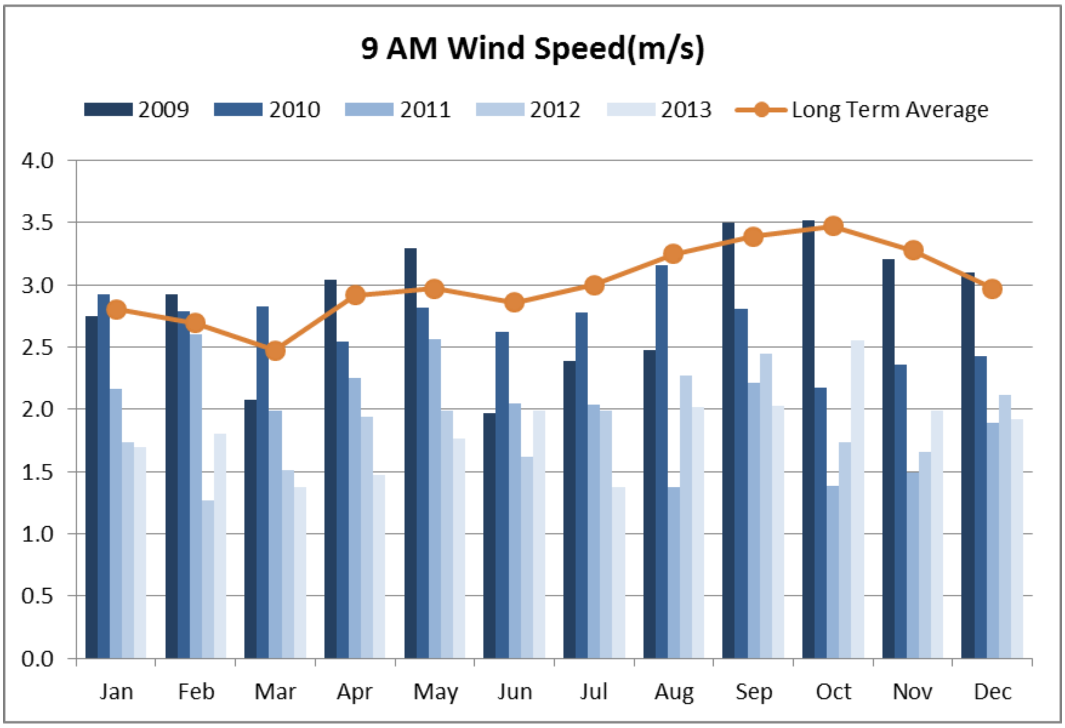


Figure 4 Wind Speed at 3 pm at Horsley Park AWS for 2009 – 2013

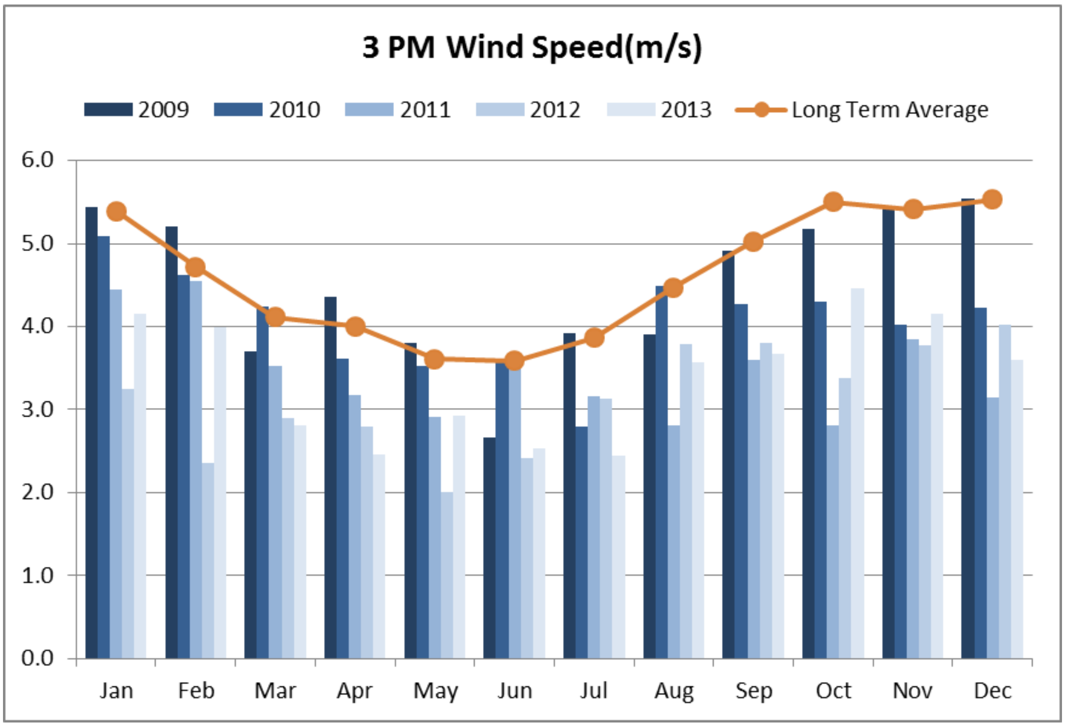


Figure 5 Temperature at 9 am at Horsley Park AWS for 2009-2013

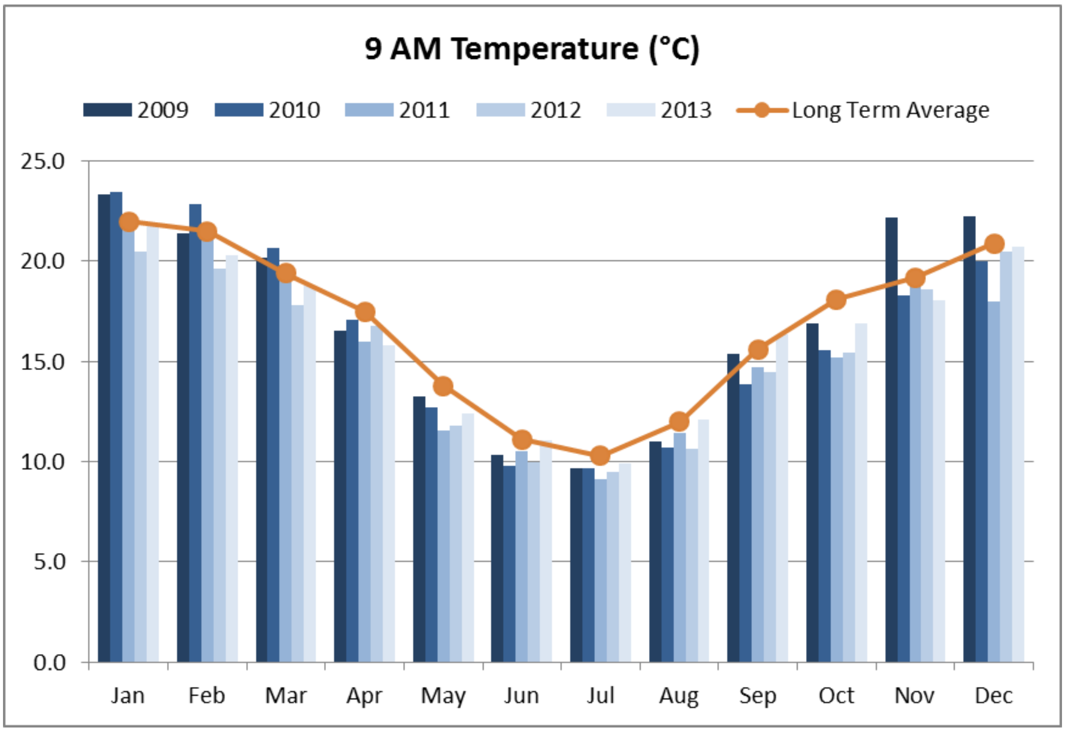


Figure 6 Temperature at 3 pm at Horsley Park AWS for 2009-2013

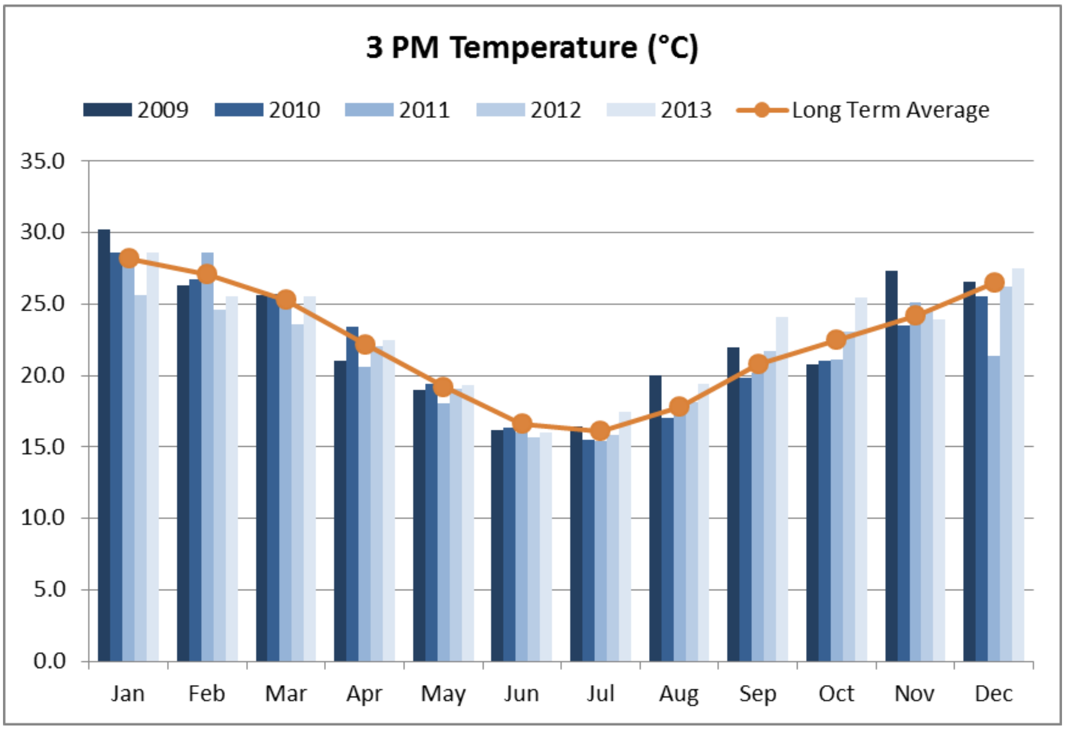


Figure 7 Relative Humidity at 9 am Horsley Park AWS for 2009 – 2013

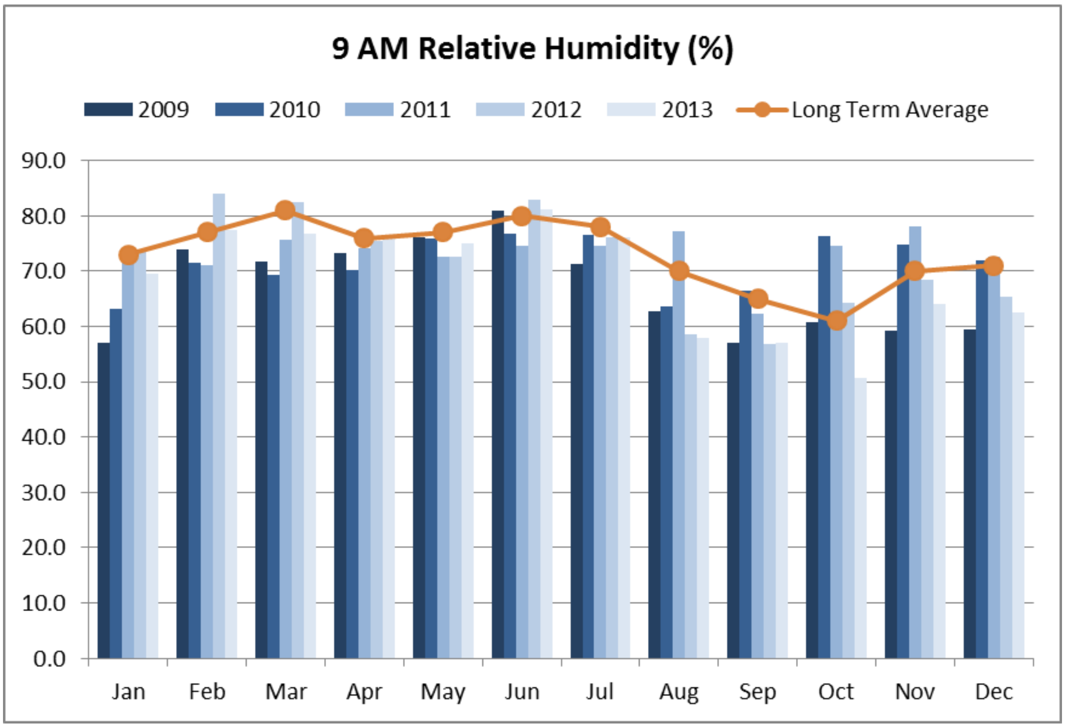
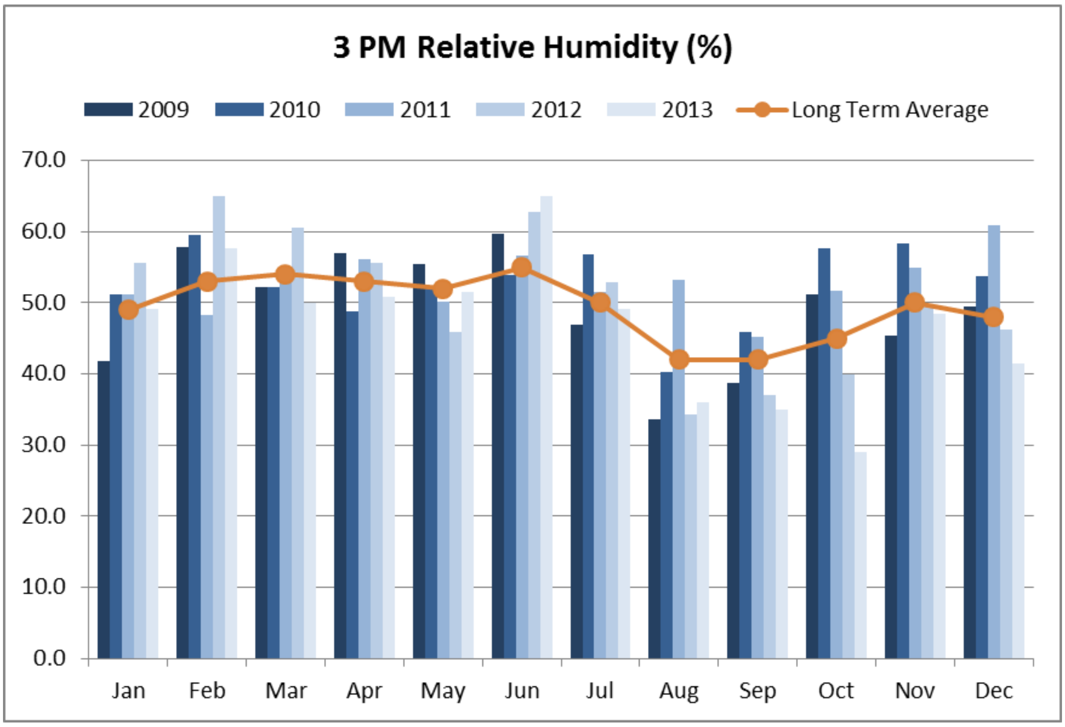


Figure 8 Relative Humidity at 3 pm Horsley Park AWS for 2009 – 2013



Years 2011, 2012 and 2013 all indicate wind speeds that are lower than the long term average. Using these years as the representative year would be a conservative approach because low wind speeds are associated with less effective plume dispersion. No other parameters significantly deter the use of any one of these years of data. Where data sets are deemed equally representative, the most recent data set is selected. Consequently, 2013 was selected as a suitably representative year of meteorology.

6.2.2 TAPM

In order to calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM, v 4.0.4) has been performed. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM model predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

TAPM model may assimilate actual local wind observations so that they can optionally be included in a model solution. However, given that TAPM is acknowledged to under-predict calm wind conditions, the wind speed and direction observations obtained from the nearest BoM stations have also been used in the subsequent CALMET component of the modelling as described in **Section 6.2.3** below.

Table 16 Meteorological Parameters used for this Study (TAPM v 4.0.4)

Modelling Period	1 January 2013 to 31 December 2013
Centre of analysis	295,309 mE 6,255,681 mN (UTM Coordinates)
Number of grid points	40 × 40 × 25
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Penrith Lakes AWS (Station # 67113) Badgery's Creek AWS (Station # 67108) Horsley Park Equestrian Centre AWS (Station # 67119)
Terrain	AUSLIG 9 second DEM

The three dimensional upper air data from TAPM output was used as input for the diagnostic meteorological model (CALMET).

6.2.3 CALMET

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

CALMET modelling was conducted using the 'with Obs' CALMET approach. TAPM generated upper air data and available surface weather observations in the area were used to refine the wind field predetermined by TAPM data. Hourly surface meteorological data from the nearest BoM stations were incorporated in the CALMET modelling.

A horizontal grid spacing of 100 m was used to adequately represent the important local terrain features and land use. **Table 17** details the parameters used in the meteorological modelling.

Table 17 CALMET Configuration Used for this Study

Modelling Period	1 January 2013 to 31 December 2013
Centre of analysis – outer grid Centre of analysis – mid grid Centre of analysis – inner grid	295,309 mE 6,255,681 mN (UTM Coordinates) 303,500 mE 6,252,500 mN (UTM Coordinates) 303,500 mE 6,252,600 mN (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	38 km x 38 km (1 km) 15 km x 15 km (0.3 km) 10 km x 10 km (0.1 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Penrith Lakes AWS (Station # 67113) Badgery's Creek AWS (Station # 67108) Horsley Park Equestrian Centre AWS (Station # 67119) Bankstown Airport AWS (Station # 66137)* Holsworthy Aerodrome AWS (Station # 66161)* TAPM - upper air data (313,309 mE; 6,273,681 mN)

Note: *Holsworthy Aerodrome AWS was included to utilise cloud cover data

6.2.4 Meteorological Data Used in Modelling

6.2.4.1 Wind Speed and Direction

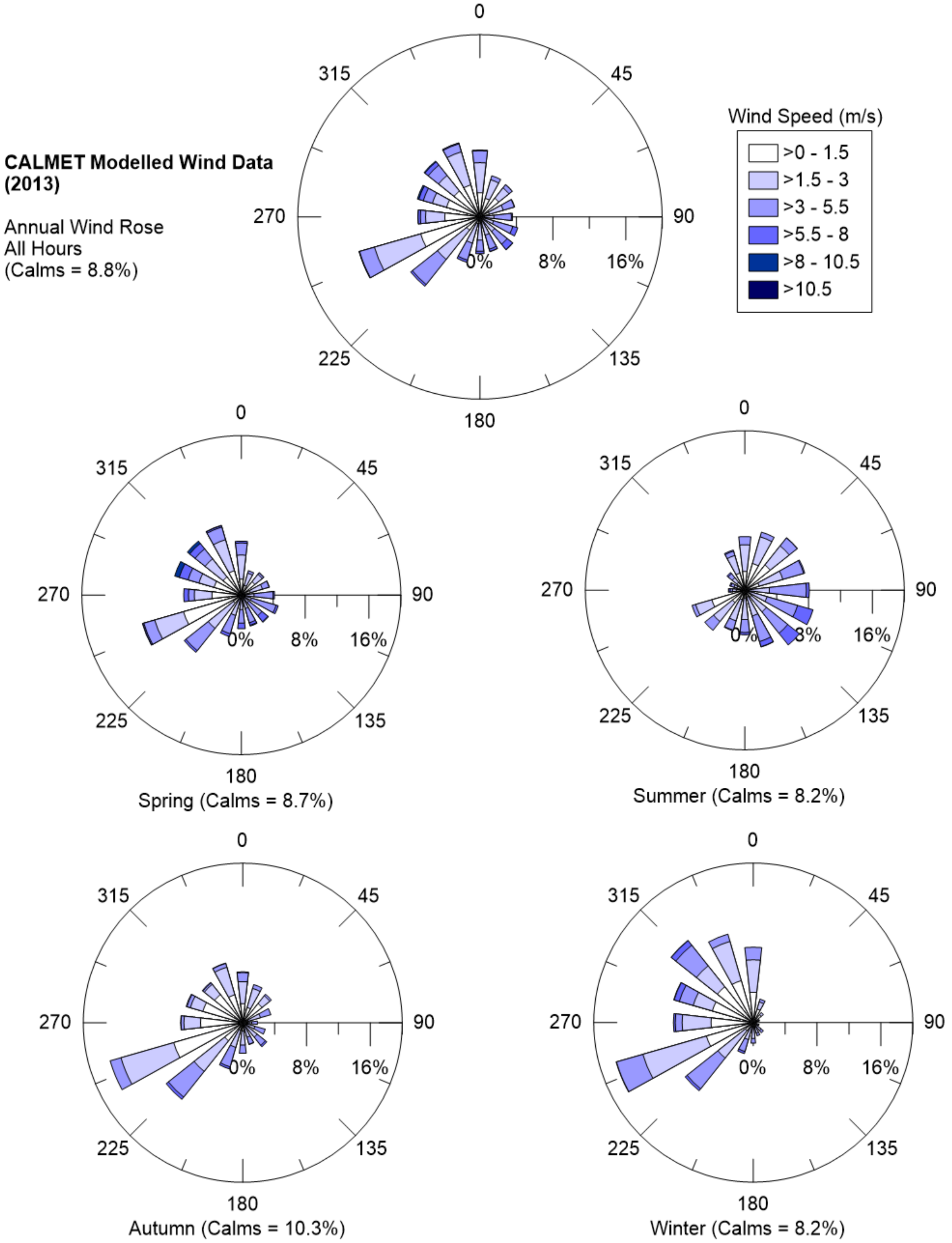
A summary of the annual wind behaviour predicted by CALMET at the Project Site is presented as wind roses in **Figure 9**.

Figure 9 indicates that winds experienced at the site are predominantly moderate to high (between 1.5 m/s and 8 m/s) and wind direction is seasonally dependent. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur approximately 8.8% of the time throughout the modelling period.

The seasonal wind roses indicate that typically:

- In summer, winds are moderate to strong predominantly from between the northeast and southeast with very few winds from the western quadrant.
- In autumn, winds are moderate predominantly from the west southwest.
- In winter, moderate winds from the west southwest still predominate with a contribution from moderate winds from the north west quadrant.
- In spring, winds are moderate to strong with high percentage of winds from northern, western and southern quadrants and strong winds experienced only from the north-western quadrant.

Figure 9 Predicted Seasonal Wind Roses for the Project Site (CALMET predictions, 2013)



6.2.4.2 Atmospheric Stability

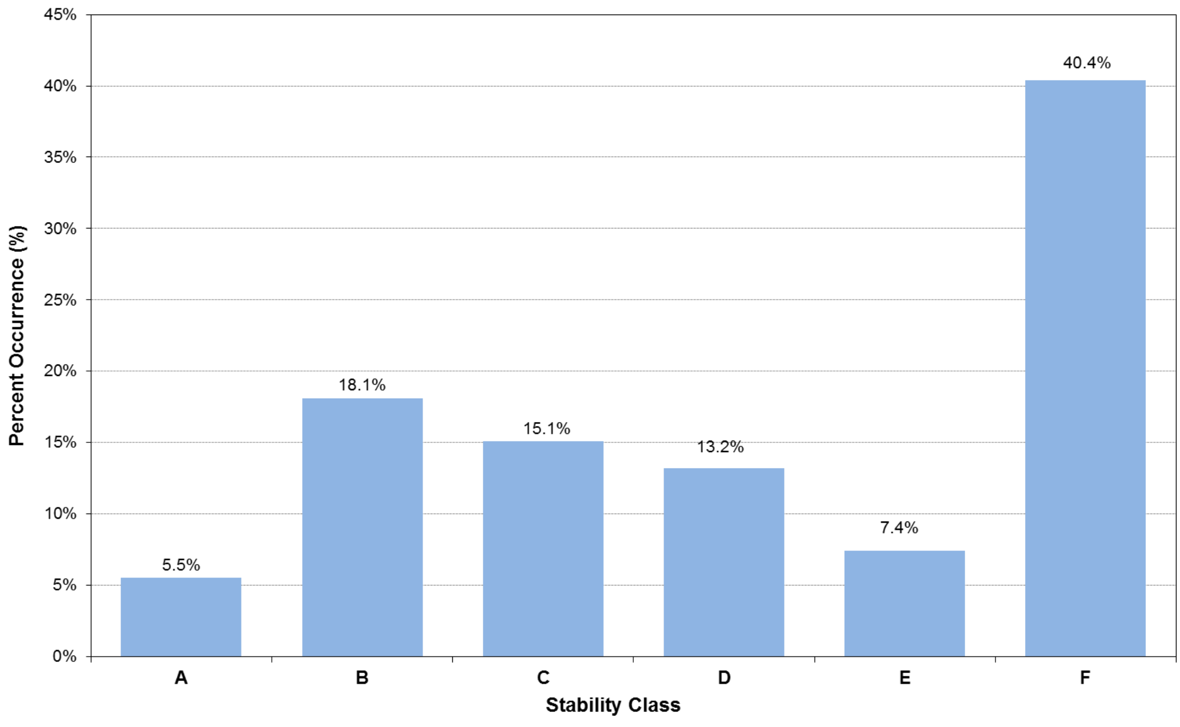
Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability (see **Table 18**). These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models.

Table 18 Description of Atmospheric Stability Classes

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

The frequency of each stability class predicted by CALMET during the modelling period, extracted at the centre of the Project Site, is presented in **Figure 10**. The results indicate a high frequency of conditions typical to Stability Class F. Stability Class F is indicative of stable night time conditions, which will inhibit pollutant dispersion resulting in higher pollutant concentrations.

Figure 10 Predicted Stability Class Frequencies at the Project Site (CALMET predictions, 2013)

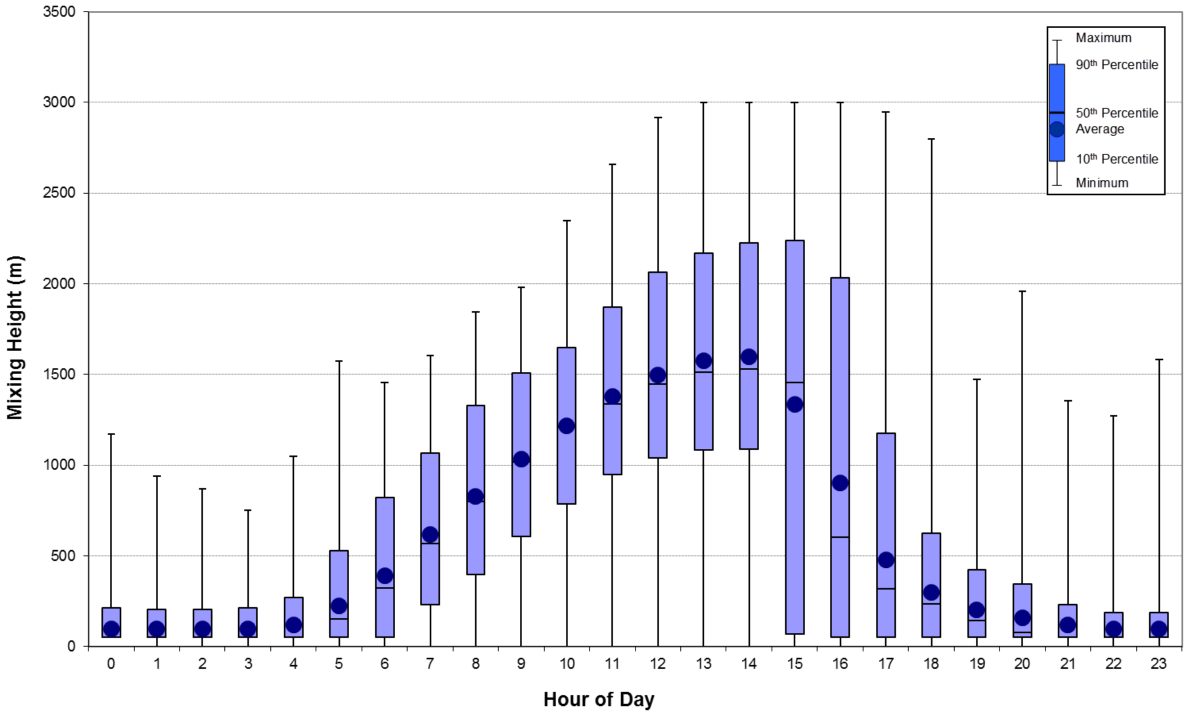


6.2.4.3 Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Project Site during the 2013 modelling period are illustrated in **Figure 11**.

As would be expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground based temperature inversions and growth of the convective mixing layer.

Figure 11 Predicted Mixing Heights at the Project Site (CALMET predictions, 2013)

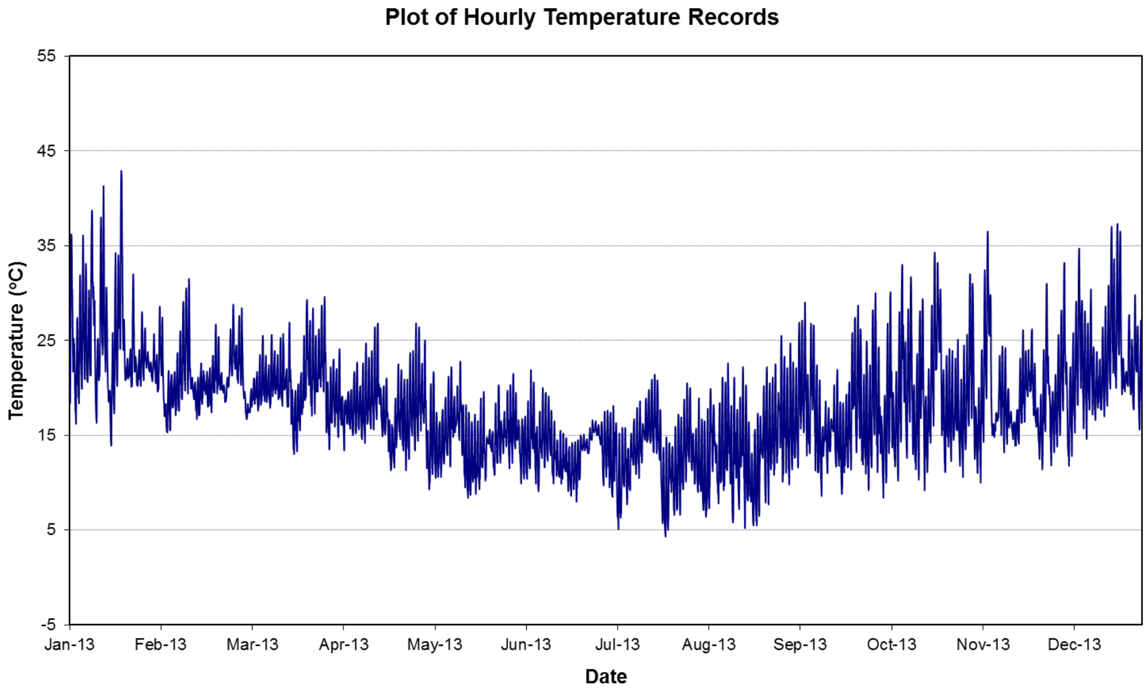


6.2.4.4 Temperature

The modelled temperature variations as predicted at the Project Site during 2013 are illustrated in **Figure 12**.

The maximum temperature (42.9°C) was predicted on 18 January 2013 and the minimum temperature (4.3°C) was predicted on 22 July 2013.

Figure 12 Predicted Temperatures at the Project site (CALMET predictions, 2013)



6.2.4.5 Modelled Meteorological Data Validation

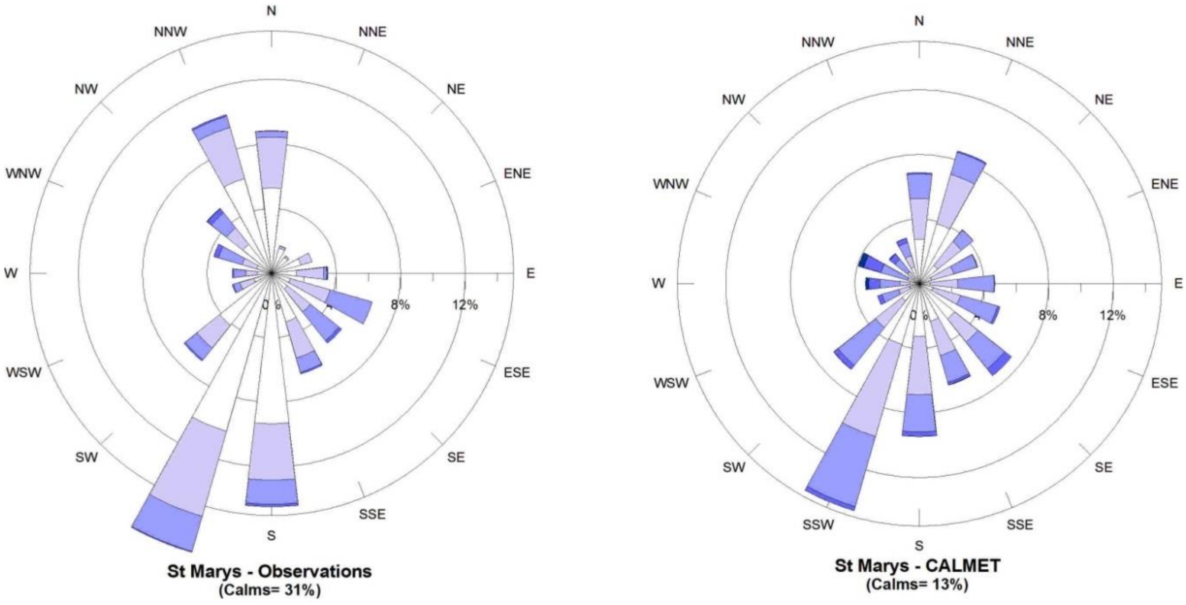
NSW OEH operates air quality network across various locations in NSW and the nearest such station is located at Mamre Road in St Mary's (approximately 3 km from the Project Site). It is noted that meteorological data (wind speed, wind direction, sigma theta and ambient temperature) are also monitored at St Marys monitoring station. The location of the St Marys monitoring station is shown in **Figure 13**.

Figure 13 Location of the St Marys Monitoring Station

Source: Google Earth (2014)

In the absence of any site specific meteorological data, the meteorological data from St Marys monitoring station has been used to validate the meteorological modelling approach. A summary of the comparison between modelled meteorological data and observed meteorological data at St Marys monitoring station is presented as wind roses and is shown in **Figure 14**.

Figure 14 Comparison of Wind Roses at St Marys Monitoring Station – Observed Vs CALMET



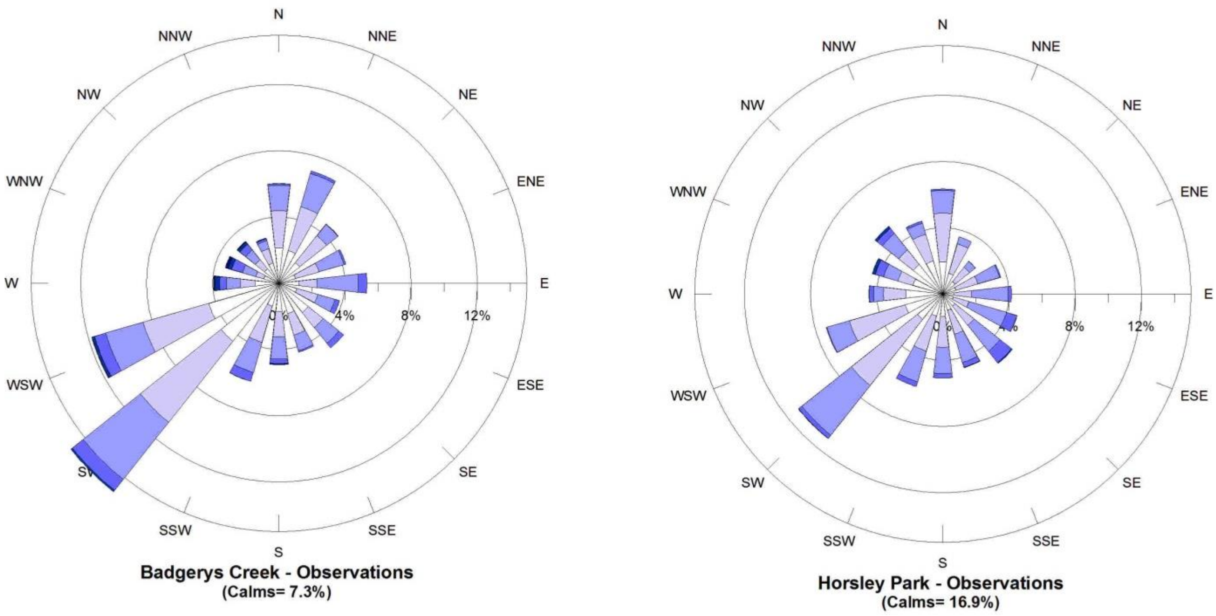
Notes:

1. The CALMET predicted wind rose was extracted from an inner meteorological file centred on a different location but was run using the same outer meteorological file, which contained all the observed data from surrounding BoM stations.

It is noted that the observed meteorological data broadly compares well with the modelled meteorological data at St Marys monitoring station, with the exception of winds from north northeast direction and significantly higher calm conditions (31% compared to 13%) for Observed Data.

It is considered appropriate to analyse the monitored meteorological data in a regional context to analyse the north northeast component of winds. The nearest BoM stations are located at Horsley Park and Badgerys Creek stations. The observed meteorological data at Badgerys Creek and Horsley Park is shown in **Figure 15**.

Figure 15 Observed Meteorological Data Monitored at Badgerys Creek and Horsley Park (2013)



It is noted from the observed meteorological data at Badgerys Creek and Horsley Park station that there is a consistent northeast and southwest wind component in the region, which has been predicted by the CALMET meteorological modelling at St Marys monitoring station.

It can be concluded from the above analysis that at St Marys monitoring station, the low percentage of winds from the north northeast direction and higher percentage of calm conditions can be attributed to the obstruction (large building) present in the northeast direction of the St Marys monitoring station (shown in **Figure 13**).

7 EXISTING AIR QUALITY

The air quality in the region surrounding the Project Site is influenced by emissions generated by a range of sources, originating from both within and outside of the local area. Specifically, for the area surrounding the Project, air quality will be influenced by pollution transported into the area from more distant "regional" sources, emissions from other commercial and industrial sources in the area, non-Project related traffic-generated pollution and pollution generated by the Project itself, once operational.

To determine the *incremental* impact of particulate emissions from the Project on the surrounding environment and sensitive receptors, a dispersion modelling exercise has been performed.

To appropriately assess the *cumulative* impact of the Project, a background dataset for the local area has been constructed.

Air quality monitoring is performed by the NSW OEH at two Air Quality Monitoring Stations (AQMS) within a 10 km radius of the Project Site. Details of these stations are provided in **Table 19**.

Table 19 Details of AQMS surrounding the Project Site

AQMS Name	Distance / Direction from Project Site	Location (km, Australian Map Grid, zone 56)		Parameters Measured	AQMS Commissioned
		Easting	Northing		
Prospect	~6.5 km / NE	306.9	6258.7	Ozone (O_3) NO, NO_2, NO_X CO Fine particles (by nephelometry) Fine particles (PM_{10} using a TEOM) Wind speed, wind direction and sigma theta) Ambient temperature Relative humidity Solar radiation	February 2007 -
Liverpool Located off Rose St.	~10 km / SE	306.4	6243.3	O_3 NO, NO_2, NO_X CO Fine particles (by nephelometry) Fine particles (PM_{10} and $PM_{2.5}$ using a TEOM) Wind speed, wind direction and sigma theta) Ambient temperature Relative humidity Solar radiation	1990

Note: TEOM – Tapered Element Oscillating Microbalance

Available air quality monitoring data has been obtained for each of these AQMS for the years 2010, 2011, 2012 and 2013 and is presented in **Table 20**. The 1-hour, 8-hour and 24-hour values shown are maximum concentrations recorded for each pollutant for the relevant averaging period in each year. Also shown is the percentage of the appropriate criterion represented by each measured value.

It can be seen that for NO_2, SO_2 and CO, the maximum measured values represent between 4% and 42% of the relevant criteria. Particulate matter (PM_{10}) measurements are closer to criteria values and are shown to exceed these values in some instances. Exceedances of particulate matter criteria are often due to regional dust and haze events (notably bush fires).

No monitoring of lead, TSP, $PM_{2.5}$ or deposited dust is performed in the area surrounding the Project site and existing background concentrations/levels cannot be quantified.

Table 20 Air Quality Monitoring Data – Prospect and St Mary's 2010 to 2013

Pollutant	Averaging Time	Goal (µg/m^3)	Prospect				St Mary's			
			2010	2011	2012	2013	2010	2011	2012	2013
Sulphur dioxide (SO_2)	1 hour	**570**	51.5 (9%)	40.0 (7%)	34.3 (6%)	57.2 (10%)	-	-	-	-
	24 hours	**228**	11.4 (5%)	8.6 (4%)	8.6 (4%)	11.4 (5%)	-	-	-	-
	Annual	**60**	2.9 (5%)	2.9 (5%)	2.9 (5%)	2.9 (5%)	-	-	-	-
Nitrogen dioxide (NO_2)	1 hour	**246**	88.2 (36%)	80.0 (33%)	102.5 (42%)	100.5 (41%)	73.8 (30%)	73.8 (30%)	88.2 (36%)	75.9 (31%)
	Annual	**62**	24.6 (40%)	20.5 (33%)	20.5 (33%)	22.6 (36%)	12.3 (20%)	12.3 (20%)	10.3 (17%)	10.3 (17%)
PM_{10}	24 hours	**50**	40.1 (80%)	41.5 (83%)	38.7 (77%)	***81.8*** (***164%***)	***52.1*** (***104%***)	***73.9*** (***148%***)	34.3 (69%)	***93.0*** (***186%***)
	Annual	**30**	14.9 (50%)	15.1 (50%)	16.3 (54%)	17.6 (59%)	15.1 (50%)	14.7 (49%)	14.5 (48%)	16.0 (53%)
Carbon monoxide (CO)	8 hours	**10**	2.4 (24%)	2.1 (21%)	2.3 (23%)	2.0 (20%)	-	-	-	-

Note: All values are presented as µg/m^3 with the exception of CO which is presented as mg/m^3. Values in exceedance of the stated criterion are highlighted in ***bold red***.

8 POTENTIAL AIR QUALITY IMPACTS OF THE PROPOSAL

Air quality impacts in the area surrounding the Project site may be potentially anticipated during both the construction and operational phases. The following sections outline a qualitative approach to the assessment of the potential risks associated with construction phase and a quantitative approach to the assessment of the potential risks associated with operational phase of the proposed development.

In the absence of detailed information on the construction schedule, a qualitative risk based approach to assess the potential for construction-phase impacts has been undertaken and is presented in **Section 8.1**. A quantitative assessment of the risks associated with Project operation has been performed as outlined in **Section 6** and is presented in **Section 8.2**. Given the nature of the development, it is considered that air quality impacts during construction works would present a greater risk to health and amenity than those during ongoing operation.

It is noted that the wider Horsley Drive Business Park will be developed and include tenants other than Martin Brower. The potential that construction of multiple warehouse developments will occur concurrently has been considered. No consideration of multiple operation can be performed at the current time due to the unknown uses of the remainder of the Business Park.

8.1 Construction Phase

The proposed construction works would involve:

- Construction of multiple warehouse structures and distribution related facilities across the site;

The following qualitative risk-based assessment has been performed to determine the potential risks of construction on air quality at nearby sensitive receptors.

The risk assessment methodology adopted for use in this AQIA is described below.

8.1.1 Construction Air Quality Risk Assessment Methodology

Construction of the warehouse structures will result in the generation of fugitive dust emissions. These emissions have the potential to result in elevated TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates in the vicinity of the works. Elevations in emissions of combustion related pollutants due to site vehicle operations would also be anticipated but operations due to construction activities of the scale proposed would generally be limited to impacts of dust.

For this assessment, the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) developed in the United Kingdom by the Institute of Air Quality Management (IAQM) has been used to provide a qualitative assessment method. The IAQM method uses a five-step process for assessing dust impacts from construction activities:

- **Step 1**: Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2**: Assess risk of dust effects from activities based on:
    a. the scale and nature of the works, which determines the potential dust emission magnitude; and
    b. the sensitivity of the area surrounding dust-generating activities.
- **Step 3**: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4**: Assess significance of remaining activities after management measures have been considered.

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the site, more than 50 m from the route used by construction vehicles on public roads and more than 500 m from the site entrance. This step is noted as having deliberately been chosen to be conservative, and will require assessments for most projects. No receptors identified in **Section 3.2** can be screened from further assessment based on the IAQM screening criteria.

Step 2a of the assessment provides “dust emissions magnitudes” for each of four dust generating activities; demolition, earthworks, construction, and trackout (the movement of site material onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for construction activities, which are most relevant to this Project, are as follows (note that demolition and earthworks have previously been approved):

- Construction:
  - ***Large***: Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting.
  - ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (e.g., concrete), piling, on site concrete batching.
  - ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (e.g., metal cladding or timber).

Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:

- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts.
- The proximity and number of those receptors.
- In the case of PM_{10}, the local background concentration.
- Other site-specific factors, such as whether there are natural shelters such as trees, to reduce the risk of wind-blown dust.

Individual receptors are to be classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors have not been addressed in this assessment). The IAQM methodology provides the following guidance on the sensitivity of different receptor types to dust soiling and health effects (IAQM, 2014). This guidance is summarised in **Table 21**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Based on the criteria listed in **Table 21**, the sensitivity of the identified receptors in the study area (dwellings) is concluded to be of *high* sensitivity for health impacts and *high* sensitivity for dust soiling, based upon the following assumptions:

- The identified sensitive receptor locations are dwellings where members of the local community have the potential to be exposed to PM_{10} concentrations for eight hours (or more) in a day.
- In general, the local population could reasonably expect a high level of amenity (i.e. low annual average TSP concentrations and dust deposition rates) given the medium level vegetated nature of the area which would result in little natural wind-blown dust and low background dust levels.
- Given the location and nature of the receptors, the properties would not reasonably be expected to be significantly diminished in appearance, aesthetics or value by dust deposition.

According to the IAQM methodology, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown **Table 22**.

Table 21 IAQM Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	• Users can reasonably expect a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • The appearance, aesthetics or value of their property could be diminished by soiling; or • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	• The enjoyment of amenity would not reasonably be expected; or • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: dwellings, museums, medium and long term car parks and car showrooms.	*Examples: parks and places of work.*	*Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	• Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where human exposure is transient.
	Examples: residential properties, hospitals, schools and residential care homes.	*Examples: office and shop workers, but will generally not include workers occupationally exposed to PM10.*	*Examples: public footpaths, playing fields, parks and shopping street.*

Table 22 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note: Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered.

The IAQM guidance for assessing the sensitivity of an area to health impacts is shown in **Table 23**. As noted above, for high sensitivity receptors, the methodology takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account. The classifications are also based on the air quality objectives for PM_{10} in the UK set by the Department for Environment, Food and Rural Affairs. As these objectives differ from the ambient air quality criteria adopted for use in this assessment, and given that site-specific background monitoring data are not available for the sensitive receptors considered in this assessment, the IAQM methodology has been adapted slightly, based on the adoption of conservative values for the background PM_{10} level thresholds. All receptors have been classified based on the sensitivity classifications for a background annual average PM_{10} concentration of 17.6 µg/m^3 for Prospect during 2013 as outlined in **Table 20**.

This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table 23 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM_{10} conc	Number of receptors a,b	Distance from the source (m)			
			<20	<50	<100	<350
High	15-22.5 µg/m^3	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<15 µg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low
	-	1-10	Medium	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m), noting that only the highest level of area sensitivity from the table needs to be considered.

(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

(c) The estimated background annual average PM_{10} concentration is taken from monitoring data as outlined within **Table 20**.

On the basis of the information provided above, the sensitivity of the areas surrounding the proposed construction activities has been determined as shown in **Table 24**.

Table 24 Assessment of Sensitivity of Areas Surrounding Key Construction Activities

Value	Area	Sensitivity of receptors	Number of receptors	Sensitivity of the surrounding area
Dust soiling	Receptors between 50 m and 100 m from the development	High	~3 dwellings	Low
	Receptors between 100 m and 350m from the development	High	6 to 10 dwellings	Low
Human Health	Receptors between 50 m and 100 m from the development	High	~3 dwellings	Low
	Receptors between 100 m and 350m from the development	High	6 to 10 dwellings	Low

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table 26** to determine the risk category with no mitigation applied. Once the risk categories are determined for each of the relevant activities, site-specific management measures (Step 3) can be identified based on whether the site is a low, medium or high risk site. Following this, the residual impact can be determined after management measures have been considered (Step 4).

Table 25 Risk Category from Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

8.1.2 Risk Assessment

A preliminary risk assessment (i.e. no application of mitigation measures) has been performed for each element of the construction works using the tables presented in the preceding sections. The resultant risk ratings are presented below in **Table 26**.

Table 26 Risk of Air Quality Impacts from Construction

Sensitivity of Area	Preliminary Risk
	Construction
Low	Low Risk

The results indicate that there is a *low* risk of adverse air quality impacts occurring at offsite receptor locations where no mitigation is applied during the construction works.

A negligible or low level risk rating does not preclude the requirement for suitable mitigation measures to be implemented during redevelopment works. The following section provides a range of appropriate mitigation measures that should be applied during the redevelopment works to ensure that all risks are minimised where ever practicable.

8.1.3 Mitigation Measures

8.1.3.1 Nuisance Dust Control Measures

Ambient dust emissions from wheel-generated dust, truck loading and unloading, and wind erosion areas will be the primary focus of dust control during construction works at the Project construction site. Typically, emissions from these processes can be minimised through the implementation of water spraying, particularly during periods of heavy on-site activity.

Other dust mitigation measures that may be implemented during the construction phase include:

- Removal of silt and other material from around erosion and sediment control structures to ensure deposits do not become a dust source.
- Amending dust-generating construction activities during adverse wind conditions blowing in the direction of sensitive receptors. A wind sock should be made available and be visible to all areas of an active construction site to assist in reactive response procedures (i.e. to determine when construction activities should be postponed, minimised or relocated in windy conditions).
- Minimising the use of material stockpiles and ensuring sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Erecting solid screens or barriers around dusty activities or the site boundary to prevent windblown dust being transported offsite.
- Ensuring fine powder materials are delivered in enclosed tankers and stored in silos to prevent escape of material during delivery.
- Ensuring smaller bags of powder materials are sealed after use and stored appropriately.
- Minimising drop heights from loading shovels and other loading / unloading equipment and using fine water sprays on such equipment where appropriate.
- Ensuring vehicles entering/exiting the site are covered to prevent escape of materials during transport.
- Reducing vehicle speeds on site will reduce wheel generated dust.
- If dirt track out is causing problems, avoiding dry sweeping of large areas. Manual brushing of the truck’s flanks and wheels could be implemented as a further precaution.

8.1.3.2 Plant and Machinery

Control measures relating to plant and machinery that may be utilised during the construction phase include:

- Ensuring vehicles and machinery are maintained in accordance with manufacturer’s specifications.
- Minimising truck queuing and unnecessary trips through logistical planning of materials delivery and work practices.
- Ensure all vehicles switch off engines when stationary so that there are no idling vehicles.
- Fixed plant should be located as far from local receptors as practicable.

8.1.3.3 Fuel Storage Areas

The storage of fuels should be performed in accordance with the relevant Australian Standards. The Australian Institute of Petroleum's document, *Guidance for the Safe Above Ground Fuel Storage on Farms and Industrial Sites* (AIP GL12-2003), provides a succinct summary of the above requirements and a checklist to appraise whether the fuel storage facility is deigned and operated in compliance with the relevant Australian Standards. The Australian Capital Territory (ACT) Government has also produced a guidance document entitled *Environmental guidelines for service station sites and hydrocarbon storage* (2011), which provides further clarification and advice concerning environmental monitoring around fuel storage facilities.

Control measures that may be implemented during the construction phase will be referenced from the above AS, and will include:

- Storage areas for all liquids should be appropriately bunded.
- Spill kits including absorbing materials should be provided nearby handling and storage areas.
- Where possible, the delivery of liquid fuels should utilise reciprocal feeds, so that tank vapours are displaced into the delivery vehicle rather than being emitted to the atmosphere as a fugitive emission.
- Empty containers should be managed and disposed of in appropriate manner.

8.1.3.4 Site Management

Air emissions associated with all construction activities should also be managed through compliance with the Construction Environmental Management Plan (CEMP). The CEMP would be implemented so that:

- The works are conducted in a manner that minimises the generation of air emissions.
- The effectiveness of the controls being implemented is monitored.
- Additional measures are implemented where required.

Construction contractors should also undertake daily environmental inspections of their works and worksite. The daily environmental inspection reports should include the below observations, with remedial or corrective actions noted (as appropriate).

Any remedial or corrective actions should be reported to the Site Manager as soon as is practicable. Inspections may include, but not be limited to:

- Visual inspection of dust generation.
- Ensure roads leaving the site are free of soil, and prevention of soil tracking onto the road network.
- Inspection of the erosion and sediment controls.
- Inspection of the waste storage areas.
- Inspection of any rehabilitated areas (where relevant).
- Ensure all hazardous goods, including fuel and oil, are adequately stored or bunded.
- Ensure spill kits are appropriately located and stocked.

8.1.3.5 Complaints Handling

An effective complaints logging system should be maintained by Council and the Construction Contractor to monitor complaints, to effectively manage any requests for information or respond to any public concerns in relation to the proposed redevelopment activities throughout the construction phase, and to ensure identified incidents are dealt with through investigation and implementation of corrective treatments.

8.1.4 Residual Impacts

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. These are termed “residual impacts”.

The results of the reappraisal are presented below in **Table 27**.

Table 27 Residual Risk of Air Quality Impacts from Construction

Sensitivity of Area	Residual Risk
	Construction
Low	Negligible Risk

The mitigated dust deposition and human health impacts of Project construction works is anticipated to be *negligible*. A detailed CEMP should be constructed and implemented prior to construction works, and should include contingency plans and response procedures (eg proactive response procedures, non-compliance and continued non-compliance response procedures, complaints handling procedures) and suitable reporting and performance monitoring procedures.

8.2 Operational Phase

Table 28 presents the predicted incremental and cumulative annual average dust levels and TSP, PM_{10} and $PM_{2.5}$ concentrations predicted at surrounding representative sensitive receptors resulting from the operation of the Project. No background data for TSP or $PM_{2.5}$ is available in the area surrounding the Project site and therefore only incremental concentrations are compared to the relevant criterion.

It is demonstrated in **Table 28** that the predicted incremental impacts of all modelled annual average particulate levels and concentrations are minor, and all easily meet the respective criterion.

Given the minor predicted concentrations, no contour plots are provided.

Table 28 Predicted Annual Average Dust Deposition Levels, and Particulate Concentrations at Sensitive Receptors - Operation

Receptor ID	Annual Average Dust Deposition		Annual Average TSP Concentration		Annual Average PM_{10} Concentration		Annual Average $PM_{2.5}$ Concentration	
	Incremental Impact (g/m²/month)	Cumulative Impact (g/m²/month)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)
R1	0.1	2.1	5.0	-	1.3	18.9	0.4	-
R2	<0.1	<2.1	0.4	-	0.1	17.7	<0.1	-
R3	<0.1	<2.1	0.3	-	0.1	17.7	<0.1	-
R4	<0.1	<2.1	0.1	-	<0.1	17.6	<0.1	-
R5	<0.1	<2.1	0.1	-	<0.1	17.6	<0.1	-
R6	<0.1	<2.1	0.2	-	<0.1	17.6	<0.1	-
R7	<0.1	<2.1	0.1	-	<0.1	17.6	<0.1	-
R8	<0.1	<2.1	0.4	-	0.1	17.7	<0.1	-
R9	<0.1	<2.1	1.0	-	0.3	17.9	0.1	-
R10	<0.1	<2.1	2.9	-	0.7	18.3	0.2	-
R11	<0.1	<2.1	0.4	-	0.1	17.7	<0.1	-
Criterion	**2**	**4**		**90**		**30**		**8**

To assess the maximum cumulative 24-hour average PM_{10} concentrations at each of the identified sensitive receptors, a contemporaneous analysis was performed following the requirement in the Approved Methods. At each receptor, individual incremental predictions have been added to the corresponding measured background concentration from the Prospect AQMS to allow prediction of the cumulative maximum 24-hour average PM_{10} impacts.

An assessment of the maximum potential cumulative concentrations at each receptor is presented, along with an assessment of the maximum cumulative concentrations on those days when the maximum incremental impact from the Project is experienced (refer **Table 29**).

The maximum predicted incremental concentrations are all less than 5 µg/m³ (10% of the criterion). The maximum predicted cumulative concentrations are predicted to be below the 50 µg/m³ criterion with the exception of Receptor 10. However, the exceedance is driven by the current background air quality, with the contribution from the Project on this day of predicted exceedance being less than 1 µg/m³.

It is noted that four exceedances of the 24 hour PM_{10} criterion were measured at the Prospect AQMS during 2013, although review of the NEPM Compliance report for this year identified that all exceedances (on 25 August, 21 October, 3 November and 8 November 2013) were due to hazard reduction burns (25 August) or bushfire emergencies and have been excluded from this study. This is acceptable practice as abnormal events such as these are not considered in any assessment of exceedance.

A contour plot of the predicted maximum incremental 24 hour PM_{10} concentrations is presented in **Figure 16**.

Table 29 Summary of 24-Hour PM_{10} Cumulative Impact Analysis – Operation

Receptor ID	Date	PM_{10} 24-Hour Average Concentrations (µg/m³)			Date	PM_{10} 24-Hour Average Concentrations (µg/m³)		
		Highest Background	Increment	Maximum Cumulative Impact		Background	Maximum Incremental Impact	Cumulative Impact
R1	22-10-2013	49.2	0.5	49.7	10-06-2013	22.0	4.3	26.3
R2	22-10-2013	49.2	0.1	49.3	16-04-2013	10.7	0.5	11.2
R3	22-10-2013	49.2	0.1	49.3	29-06-2013	7.9	0.5	8.4
R4	22-10-2013	49.2	0.0	49.2	30-01-2013	24.5	0.3	24.8
R5	22-10-2013	49.2	0.0	49.2	30-01-2015	24.5	0.4	24.9
R6	22-10-2013	49.2	0.0	49.2	30-01-2015	24.5	0.4	24.9
R7	22-10-2013	49.2	0.1	49.3	25-12-2013	11.5	0.4	11.9
R8	22-10-2013	49.2	0.2	49.4	25-12-2013	11.5	0.9	12.4
R9	22-10-2013	49.2	0.3	49.5	27-01-2013	8.2	1.5	9.7
R10	22-10-2013	49.2	0.8	50.0	30-05-2013	16.6	2.7	19.3
R11	22-10-2013	49.2	0.2	49.4	15-07-2013	21.9	0.7	22.6
Criterion				**50**				**50**

Note: Data recorded on 25 August, 21 October, 3 November and 8 November 2013 has been excluded from use as background as the high concentrations were due to hazard reduction burns (25 August) or bushfire emergency and have been excluded from this study.

Figure 16 Predicted Maximum Incremental 24 hour PM_{10} Concentrations

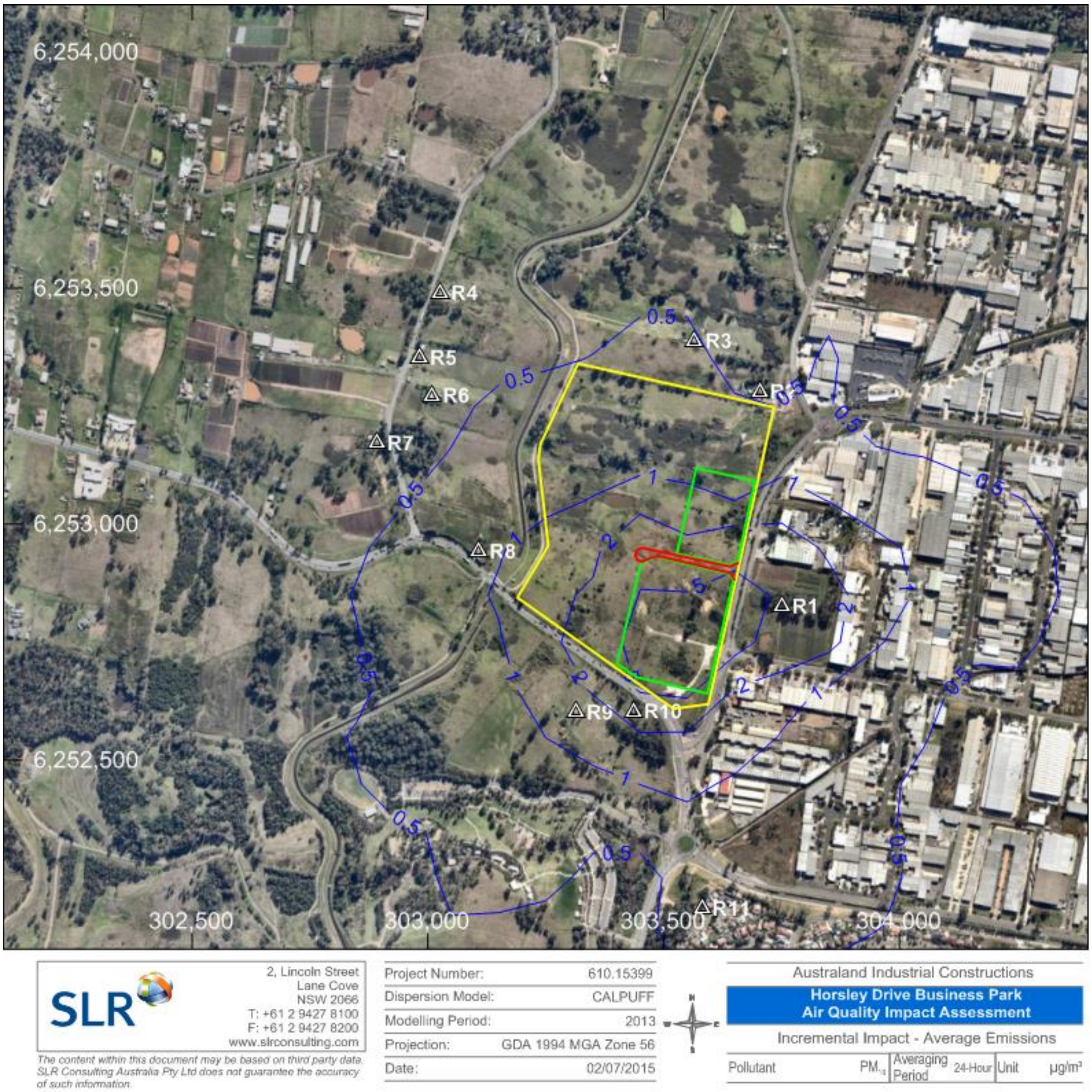


Table 30 presents the maximum predicted 24 hour $PM_{2.5}$ concentrations at all identified sensitive receptors, resulting from the Project operation. No background data for $PM_{2.5}$ is available for the region and therefore the predicted incremental impact from the Project is compared to the criterion.

The dispersion modelling results indicate that the predicted incremental 24 hour maximum $PM_{2.5}$ impact resulting from Project operation are less than 1.5 µg/m^3 at all receptor locations, less than 6% of the relevant criterion. Given the minor predicted concentrations, no contour plots are provided.

Table 30 Maximum Predicted 24-Hour Average $PM_{2.5}$ Concentrations – Operation

Receptor ID	Maximum 24 Hour Average $PM_{2.5}$ Concentration (µg/m^3)
R1	1.4
R2	0.2
R3	0.2
R4	0.1
R5	0.1
R6	0.1
R7	0.1
R8	0.3
R9	0.5
R10	0.9
R11	0.2
Criterion	**25 (Cumulative)**

Presented in **Table 31** are the predicted incremental and cumulative concentrations of NO_2, SO_2 and CO for the relevant averaging periods. Predictions of NO_X have been converted to NO_2 using the Level 1 Ozone Limiting Method (OLM) as outlined in the Approved Methods. An annual average ozone concentration of 33.3 µg/m^3 was used in these calculations.

The results presented in **Table 31** indicate that all pollutants are well below the relevant criteria values with Project operation predicted to result in a negligible impact on existing concentrations of SO_2 and CO. It is noted that the assessment represents the potential worst case impact in the assessment of 1 hour maximum concentrations, with impacts expected to be significantly lower than those modelled during operation. Given the minor predicted concentrations, no contour plots are provided.

Table 31 Summary of NO_2, SO_2 and CO Cumulative Impact Analysis - Operation

Receptor ID	NO_2				SO_2						CO	
	Maximum 1-hour Average		Annual Average		Maximum 1-hour Average		Maximum 24-hour Average		Annual Average		Maximum 8 hour Average	
	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (mg/m³)	Cumulative Impact (mg/m³)
R1	52.8	153.3	0.5	23.1	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R2	9.3	109.8	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R3	9.5	110.0	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R4	5.5	106.0	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R5	8.0	108.5	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R6	11.2	111.7	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R7	9.8	110.3	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R8	36.6	137.1	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R9	43.5	144.0	0.1	22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R10	52.4	152.9	0.4	23.0	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
R11	5.5	106.0	<0.1	<22.7	<0.1	<57.3	<0.1	<11.5	<0.1	<3.0	<0.1	<2.1
Criteria		**246**		**62**		**570**		**228**		**60**		**10**

8.2.1 Mitigation Measures and Ongoing Air Quality Monitoring

The operation of the Project is a closed system with no manufacturing or exhaust air from manufacturing processes generated. Therefore there is no need to specify or require any operational air quality monitoring. The only requirement is to ensure the operation of the Project is undertaken to comply with the *Protection of Environment Operations Act 1997.*

Due to the nature and quantum of emissions, ongoing monitoring is not warranted, particularly given no manufacturing is proposed on-site.

9 CONCLUSION

SLR Consulting Australia Pty Ltd has been engaged by Australand Industrial Constructions Pty Ltd on behalf of The Martin Brower Company (Martin Brower) to perform an Air Quality Impact Assessment for the proposed construction and operation of a warehousing facility located on the corner of Horsley Drive and Cowpasture Road, Wetherill Park. This assessment forms a part of the Environmental Impact Statement for the Project.

The Air Quality Impact Assessment has considered the potential emissions to air during both (i) the construction phase and (ii) the operational phase of the development.

A qualitative risk based assessment of the potential impacts upon surrounding sensitive receptors during the construction phase has indicated that following implementation of dust management measures, impacts are anticipated to be negligible.

A quantitative assessment of the potential impacts during Project operation has been performed. The assessment of potential impacts has reflected a worst case scenario which is not anticipated to be realised during the operation of the Project. Even given the level of conservatism applied within the assessment, the predicted impacts resulting from the Project operation are not predicted to cause any exceedance of any air quality criteria and consequently, comply with the requirements of the POEO Act.

Due to the nature and quantum of emissions, ongoing monitoring is not warranted, particularly given no manufacturing is proposed on-site.

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