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Resource Recovery Facility
13 Pembury Road, Minto
Air Quality Impact Assessment

Report Number 610.14692-R01

29 March 2017

Skylife Properties Pty Ltd c/- APP Corporation Pty Ltd

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Resource Recovery Facility

13 Pembury Road, Minto

Air Quality Impact Assessment

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Table of Contents

1	INTRODUCTION	6
1.1	Background	6
2	PROJECT DESCRIPTION	8
2.1	Overview	8
2.2	Site Location and Local Topography	8
2.3	Proposed Operations	11
2.3.1	Proposed Storage Arrangements	12
2.3.2	Hours of Operation	14
2.4	Sensitive Receptors	14
3	EMISSIONS TO AIR	17
3.1	Identification of Emission Sources	17
3.2	Emission Controls	17
4	ASSESSMENT CRITERIA	18
4.1	Particulate Matter	18
4.1.1	Total Suspended Particulate	18
4.1.2	PM ₁₀ and PM _{2.5}	18
4.1.3	Deposited Dust	18
4.2	Summary of Project Air Quality Goals	19
5	CLIMATE AND METEOROLOGY	19
5.1	Meteorological Data Used in Modelling Assessment	19
5.1.1	Wind Speed and Direction	20
5.1.2	Atmospheric Stability	22
5.1.3	Mixing Heights	24
5.1.4	Temperature	25
6	EXISTING AIR QUALITY	26
6.1	Particulate Matter	26
6.1.1	PM ₁₀	26
6.1.2	PM _{2.5}	27
6.1.3	Total Suspended Particulates (TSP)	29
6.1.4	Dust Deposition	29
6.2	Summary of Background Air Quality for Assessment Purposes	29
7	EMISSIONS ESTIMATION	30
7.1	Worst Case Scenario	31
8	AIR QUALITY IMPACT ASSESSMENT	34
8.1	Assessment Methodology	34

Table of Contents

8.2	Total Suspended Particulate (TSP) and Dust Deposition Rates	34
8.3	Particulate Matter < 10 µg/m ³ (PM ₁₀)	38
8.3.1	Sensitive Receptors	41
8.3.2	Industrial Receptors	41
8.4	Particulate Matter <2.5 µg/m ³ (PM _{2.5})	43
8.5	Odour Impact Assessment	46
9	GREENHOUSE GAS ASSESSMENT	47
9.1	Greenhouse Gas Emissions	47
9.1.1	Emission Types	47
9.1.2	Emission Scopes	48
9.2	Assessment Methodology	48
9.2.1	Source Identification and Boundary Definition	48
9.2.2	Quantitative Assessment	49
9.3	Source Data and Emission Factors	49
9.3.1	Source Data	49
9.3.2	Aggregated Source Data	50
9.4	Emission Factors	50
9.5	Greenhouse Gas Assessment	50
10	MITIGATION AND MANAGEMENT MEASURES	51
10.1	Air Quality	51
10.2	Greenhouse Gases	51
11	CONCLUSIONS	52
12	REFERENCES	53
13	GLOSSARY	54

APPENDICES

Appendix A Modelling Methodology

Table of Contents

TABLES

Table 1	Response to NSW DPE's Information Request	7
Table 2	Sensitive Receptor Locations Used in this Assessment	15
Table 3	NSW EPA Goals for Particulates	18
Table 4	NSW EPA Goals for Allowable Dust Deposition	19
Table 5	Project Air Quality Goals	19
Table 6	Meteorological Conditions Defining Pasquill Stability Classes	23
Table 7	Summary of PM ₁₀ Data Recorded at Campbelltown West (2013 – 2015)	27
Table 8	Summary of PM _{2.5} Data Recorded at Campbelltown West (2015)	28
Table 9	Summary of PM _{2.5} Data Recorded at Camden (2013 - 2015)	28
Table 10	Background Ambient Air Quality Environment for Assessment Purposes	29
Table 11	Assumptions adopted for Air Quality Impact Assessment - Particulates	30
Table 12	Estimated Emissions from the Project Site	32
Table 13	Emission Factors and Input Assumptions	32
Table 14	Intensity of Each Activity	33
Table 15	Annual Average TSP Concentrations and Dust Deposition Rates Predicted at Receptor Locations	35
Table 16	24-Hour and Annual Average PM ₁₀ Concentrations Predicted at Receptor Locations	38
Table 17	Contemporaneous Impact and Background Analysis – Receptor R7	41
Table 18	8-Hour Average PM ₁₀ Concentrations Predicted at Industrial Receptor Locations	42
Table 19	24-Hour and Annual Average PM _{2.5} Concentrations Predicted at Receptor Locations	43
Table 20	Greenhouse Gas Emission Types	47
Table 21	Greenhouse Gas Scopes	48
Table 22	Scope 1 and 2 Emission Sources	49
Table 23	Electricity Consumption Source Data	49
Table 24	Aggregated Source Data – Proposed Operations	50
Table 25	Emission Factors	50
Table 26	Annual Project GHG Emissions – Proposed Operations	50

FIGURES

Figure 1	Regional Location of the Project Site	9
Figure 2	Project Site Layout	10
Figure 3	Topography Surrounding the Site	11
Figure 4	Proposed Flow Diagram – Waste and Vehicle Movements	13
Figure 5	Sensitive Receptor Locations	16
Figure 6	Seasonal Wind Roses for the Minto Site (CALMET predictions, 2014)	21
Figure 7	Wind Speed Frequencies at the Project Site (CALMET predictions, 2014)	22
Figure 8	Predicted Stability Class Frequencies at Project Site (CALMET predictions, 2014)	23
Figure 9	Predicted Mixing Heights at Project Site (CALMET predictions, 2014)	24
Figure 10	Predicted Temperatures at the Project Site (CALMET predictions, 2014)	25
Figure 11	24-Hour Average PM ₁₀ Monitoring Results for Campbelltown West (2013 - 2015)	26
Figure 12	24-Hour Average PM _{2.5} Monitoring Results for Campbelltown West (2013-2015)	27
Figure 13	24-Hour Average PM _{2.5} Monitoring Results for Camden (2013-2015)	28
Figure 14	Predicted Incremental Annual Average TSP Concentrations	36
Figure 15	Predicted Incremental Annual Average Dust Deposition Rate	37
Figure 16	Maximum Predicted Incremental 24 Hour Average PM ₁₀ Concentrations	39
Figure 17	Predicted Incremental Annual Average PM ₁₀ Concentrations	40
Figure 18	Maximum Predicted Incremental 24 Hour Average PM _{2.5} Concentrations	44
Figure 19	Predicted Incremental Annual Average PM _{2.5} Concentrations	45

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by APP Corporation (APP) on behalf of its client Skylife Properties Pty Ltd to prepare an Air Quality Impact Assessment (AQIA) to accompany an Environmental Impact Statement (EIS) to be submitted to the Department of Planning and Environment (DPE) for a proposed increase in the recycling capacity for the existing Resource Recovery Facility at 13 Pembury Street, Minto, NSW (the Project site).

The nature and scale of the development is such that it will be captured as State Significant Development under Clause 8 of SEPP (State and Regional Development) 2011 and correspondingly the application will need to be supported by a comprehensive EIS prepared in response to SEARs issued by the DPE (SSD 7462).

The Resource Recovery Facility currently accepts waste materials for the purpose of resource recovery and the proposed upgrades include an increase in the processing capacity and building amendments.

It is understood that the current approval for the site permits 30,000 tonnes/annum of non-putrescible waste to be processed at the Project site, and the objective of the study is to seek approval to accept and process up to 220,000 tonnes/annum of non-putrescible waste.

1.1 Background

In 2016, SLR has prepared an AQIA for this Project based on a proposed throughput of 300,000 tonnes/annum, with operating hours of 24 hours/day for processing and 6 am to 10 pm for transporting waste and product materials. Following the EIS submission, DPE issued the following information request regarding the AQIA on 17 Feb 2017.

- *The modelling is based off a worst case meteorological scenario. However, no details on this scenario have been provided.*
- *The modelling should be based off the maximum daily processing capacity and the worst case scenario assumptions should be detailed.*

The AQIA states that 24 hour average PM₁₀ concentrations recorded in 2013 period are significantly higher than those recorded over the 2014 period due to bushfires. However, the data shows high concentrations of PM₁₀ recorded in 2015 which have not been explained. Since the EIS was submitted, the Proponent has revised the Project design to reduce the annual throughput and operating hours of processing materials.

This report presents an updated AQIA for the revised Project design and also addresses the information request issued by DPE on 17 Feb 2017. A brief summary of how each issue raised by DPE has been addressed is presented in **Table 1**.

Table 1 Response to NSW DPE's Information Request

Issue	Response
<p>The modelling is based off a worst case meteorological scenario. However, no details on this scenario have been provided.</p>	<p>The dispersion model was run with three dimensional meteorological data for a full calendar year (365 days of hourly meteorological data, equivalent to 8,760 different meteorological conditions). Ground level particulate concentrations are predicted for every hour of the year at each receptor point and the maximum predicted off-site 24 hour average particulate concentrations given by the modelling are presented in Section 8. These results therefore represent the concentrations associated with the worst case meteorological conditions within the modelled year.</p>
<p>The modelling should be based off the maximum daily processing capacity and the worst case scenario assumptions should be detailed.</p>	<p>The emission inventory used in this AQIA has been updated to represent a potential worst case scenario based on :</p> <ul style="list-style-type: none"> • The maximum daily processing capacity for emissions associated with processing activities; and • The maximum anticipated daily on-site traffic movements for wheel- generated dust. <p>Further details of the worst case scenario are provided in Section 7.1</p>
<p>The AQIA states that 24 hour average PM₁₀ concentrations recorded in 2013 period are significantly higher than those recorded over the 2014 period due to bushfires. However, the data shows high concentrations of PM₁₀ recorded in 2015 which have not been explained</p>	<p>Clarification on the elevated PM₁₀ concentrations recorded in 2015 are provided in Section 6.1.1</p>

2 PROJECT DESCRIPTION

2.1 Overview

Approval is sought to increase the processing capacity of the existing resource recovery facility from 30,000 tonnes per annum to permit up to 220,000 tonnes per annum. The facility will continue to process general solid waste (non-putrescible), as described in with the Waste Classification Guidelines, 2014, prepared by the NSW Environmental Protection Authority (EPA).

The existing operations include:

- three sheds with push walls and machinery used for tipping, processing and storage of waste materials
- site office
- two weighbridges.

Approval is also sought for the following works on site:

- Construction of new 600 kw substation, site office and amenities block
- Installation of a new in-ground weighbridge (20 m x 3.5 m) for large trucks
- Ten car parking spaces.

2.2 Site Location and Local Topography

The site comprises an area of 8,957 m², is legally described as Lot 1 in DP 1013852 and known generally as 13 Pembury Road, Minto. The site is situated in the IN1 General Industrial zone under the Campbelltown Local Environmental Plan 2015.

The regional locality of the Project site is shown in **Figure 1**. The proposed layout of the Project site is shown in **Figure 2**.

The ground elevation ranges from approximately 5 – 10 m within 500 m of the site. The most significant topographical feature in the vicinity of the site is the Georges River, located approximately 3 km to the southeast.

The topographical data used in the air quality impact assessment was sourced from the United States Geological Service's Shuttle Radar Topography Mission (SRTM) database that has recorded topography across Australia with a 3 arc second (~90 m) spacing. **Figure 3** illustrates the topography of the region surrounding the Project Site based on the SRTM data.

Figure 1 Regional Location of the Project Site

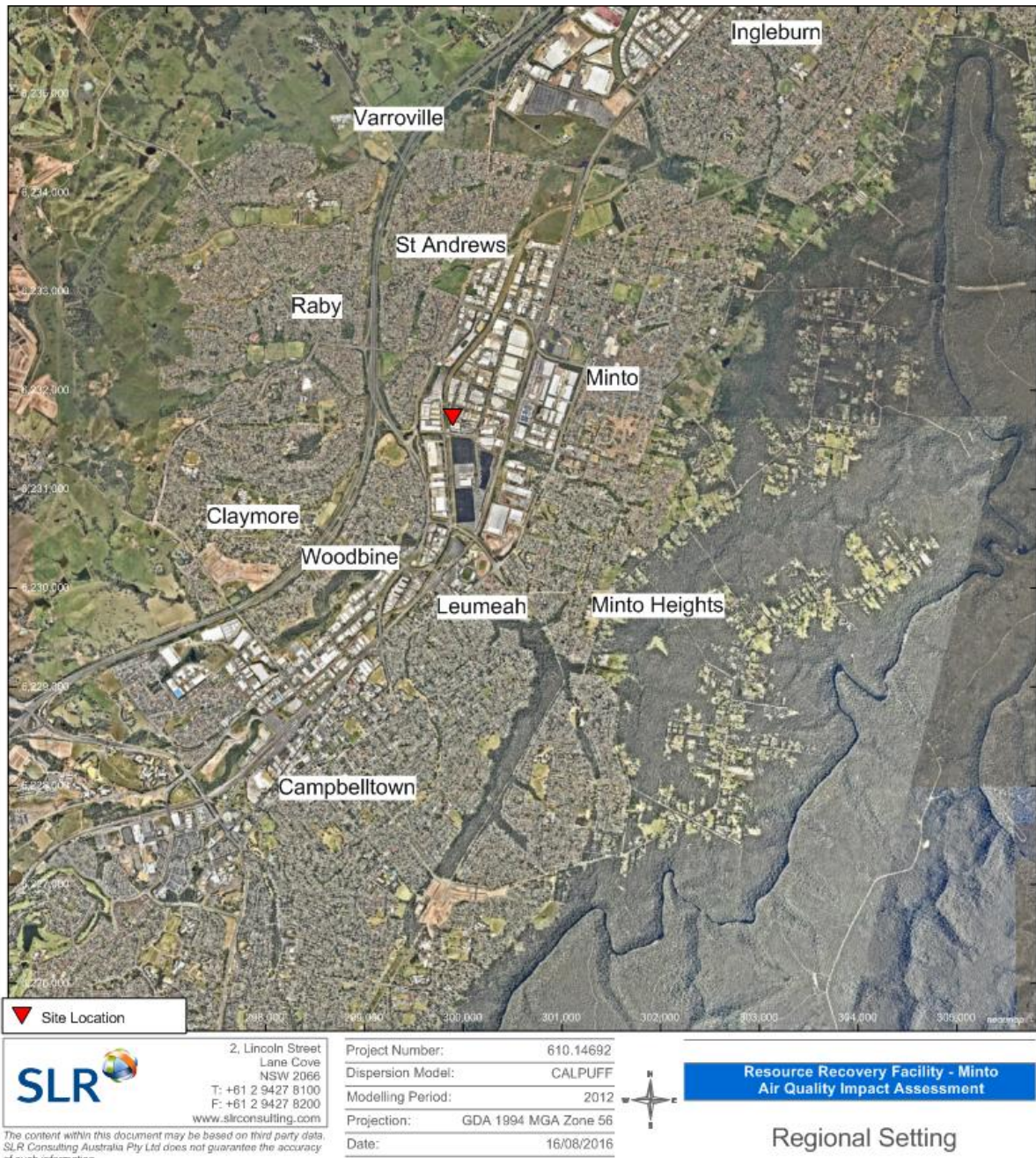
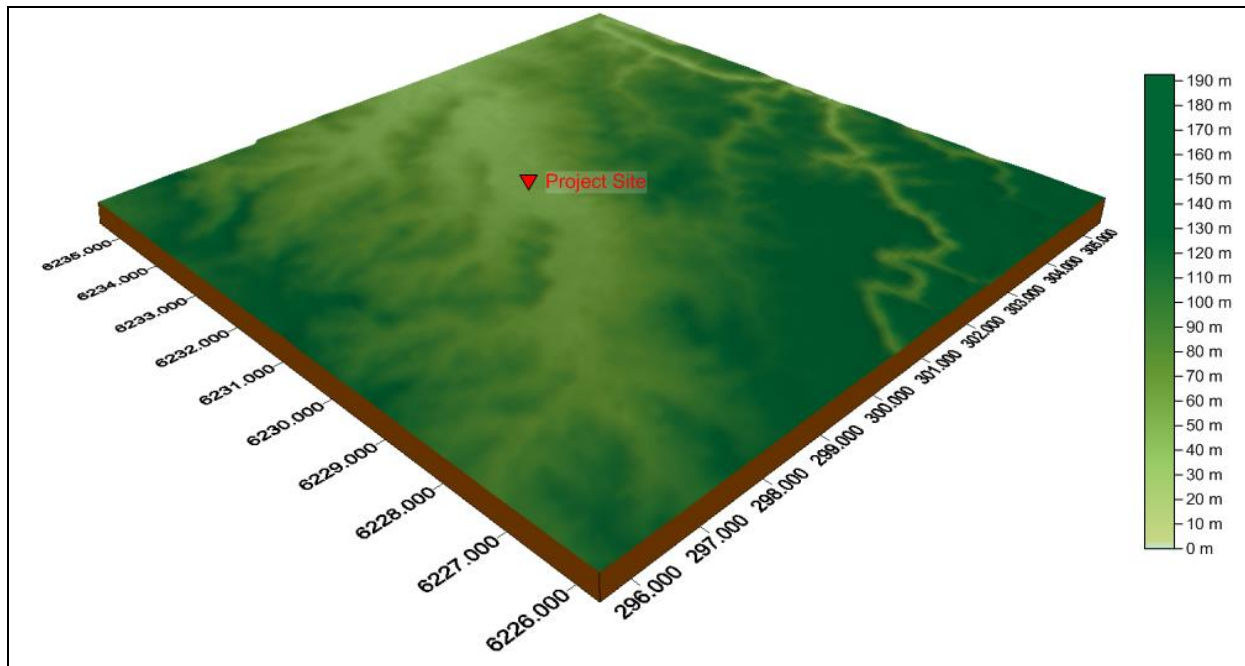


Figure 3 Topography Surrounding the Site



2.3 Proposed Operations

All waste will enter the site via the driveway crossing with Pembury Road, where they will be weighed on arrival on the 'eastern' weigh bridge. The contents of trucks will also be visually inspected at this point by the weigh bridge operator. Trucks will then enter into the covered shed / awning and unload. Trucks are then offloaded by either tipping or through bins being tipped to remove contents wholly within the covered shed / awning area. The load will be inspected again on the tipping floor during and after unloading to determine waste acceptability.

Covered bins containing wastes may also be stored in the designated bin storage area and moved to the processing area when operations permit processing. An example of this would involve construction waste being received outside of permitted processing hours. Under such circumstances, the bin would be covered and held in the designated bin storage area until such time as it can be accepted for processing/transported offsite. **Figure 4** shows the proposed flow of waste and vehicle movements through the facility.

All loading, unloading and sorting activities are to be carried out within the processing shed and awning. Any non-complying waste identified will be managed in accordance with SEQ procedures and the adopted Operations Environmental Management Plan and *Asbestos and Non Complying Waste Management Procedure*.

Once trucks have exited the unloading area operations staff commence to separate waste into streams of recyclable and recoverable products and stockpiled in the designated material bays situated adjacent to the northern property boundary. Sorting and processing operations will result in wastes being separated into the following products, for example within the designated material bays:

- Metals;
- Concrete, Brick and Tile;
- Aggregate;
- Wood Products;

- Plastics;
- Paper and Cardboards;
- Soils (including VENM, ENM and Recovered Fines)
- Glass;
- Non recoverable / recyclable materials.

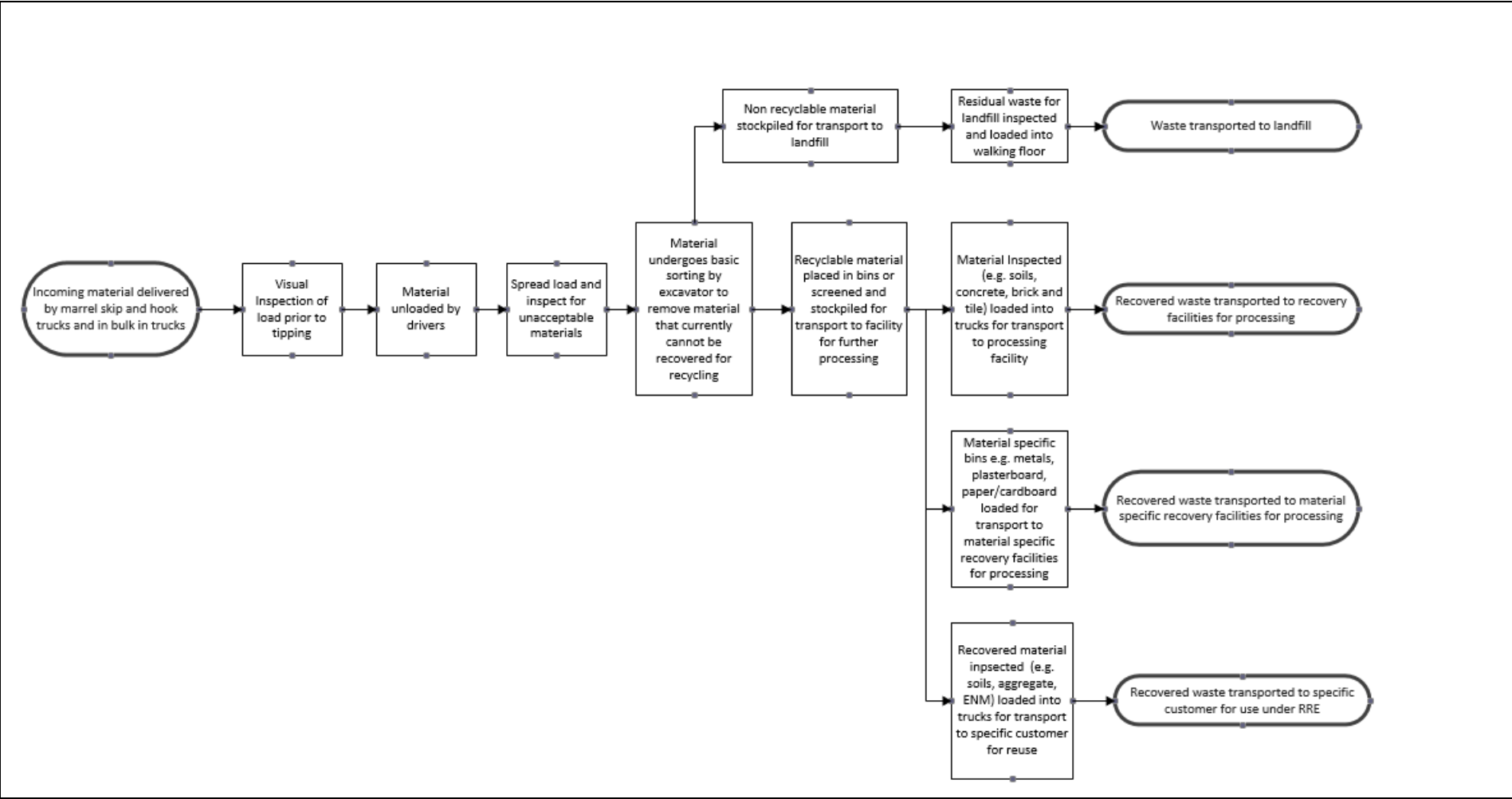
After sorting and processing, the product materials are reloaded and transported off site via the 'western' weighbridge for reuse elsewhere. Based on existing operations and other facilities owned, approximately 10 - 15 percent of waste will be transported to landfill.

2.3.1 Proposed Storage Arrangements

Unprocessed waste will be contained within Shed B in stockpiles prior to processing. Processed waste (separated and sorted) will be stockpiled in the designated material bins.

Any waste streams not permitted to be kept on site will either be rejected at the eastern weigh bridge or within the processing area and subsequently reloaded before leaving the site.

Figure 4 Proposed Flow Diagram – Waste and Vehicle Movements



2.3.2 Hours of Operation

The proposed hours of operations are:

- Monday to Saturday: 6 am to 10 pm
- Sunday and Public Holidays: No operation

2.4 Sensitive Receptors

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, issued by the Department of Environment and Conservation in August 2005 defines a sensitive receptor as:

“A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors.”

The surrounding development of the Project Site is characterised by a mix of industrial developments. The industrial nature of the surrounding development means they would not be considered as sensitive in the way that an office, school or hospital would be, hence this report focusses on potential impacts at the nearest residential and recreational areas.

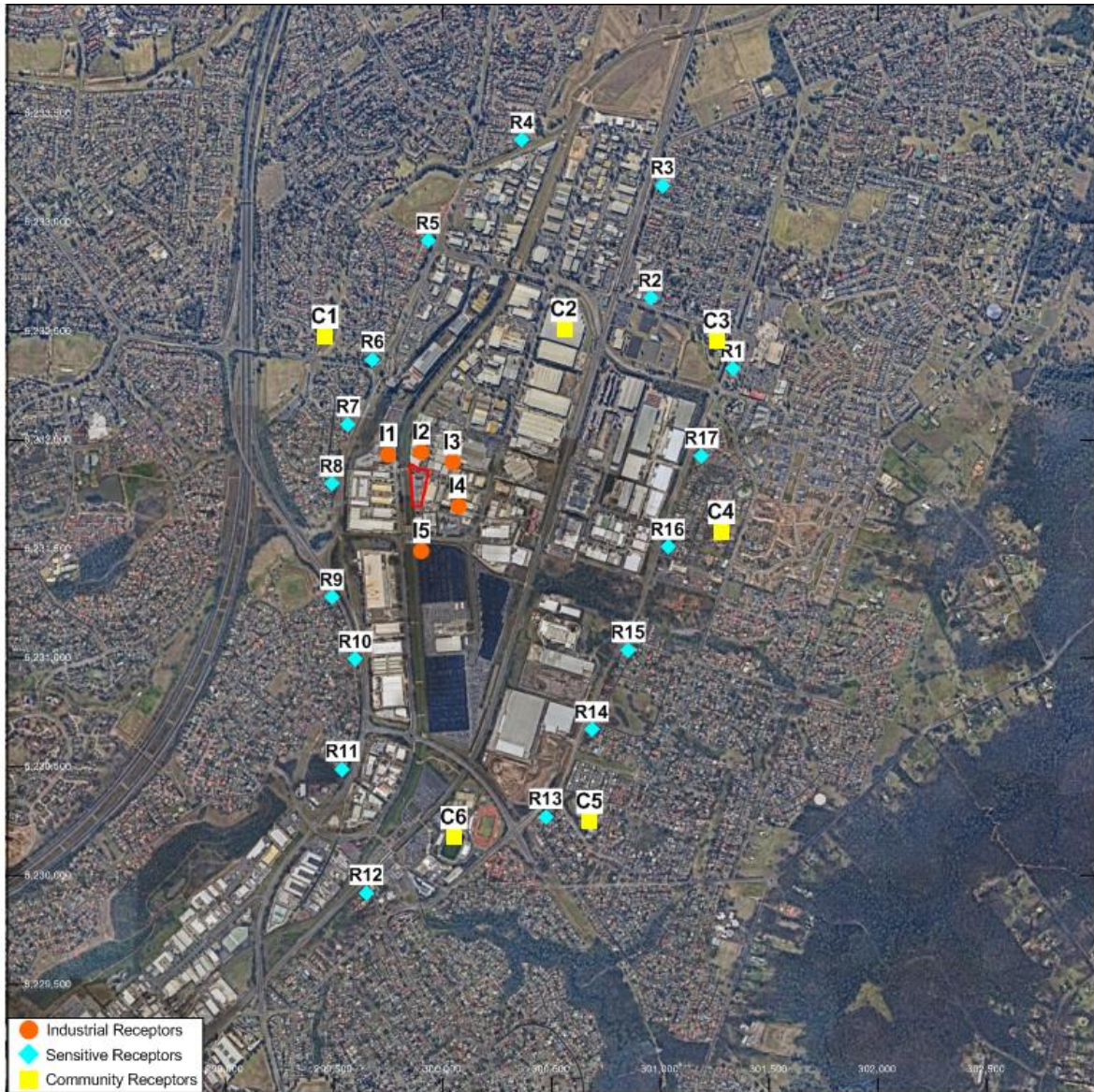
Seventeen discrete receptor locations were used in this study to assess the potential impacts on air quality of the site operations. In addition, six community receptors have also been identified and included in this assessment. These locations are presented in **Table 2** and **Figure 5**.

As outlined in **Section 2.2**, the site is located in general industrial zone and surrounded by a number of industrial units. Five industrial receptors have also been identified and included in this assessment. The locations of these industrial receptors are also presented in **Table 2** and **Figure 5**.

Table 2 Sensitive Receptor Locations Used in this Assessment

Receptor ID	UTM Zone 56H		Receptor Type
	Easting (m)	Northing (m)	
Residential Receptors			
R1	301,332	6,232,327	Residential
R2	300,956	6,232,650	Residential
R3	301,012	6,233,168	Residential
R4	300,365	6,233,376	Residential
R5	299,933	6,232,914	Residential
R6	299,679	6,232,370	Residential
R7	299,567	6,232,073	Residential
R8	299,491	6,231,799	Residential
R9	299,491	6,231,277	Residential
R10	299,600	6,230,993	Residential
R11	299,540	6,230,488	Residential
R12	299,649	6,229,921	Residential
R13	300,474	6,230,271	Residential
R14	300,685	6,230,670	Residential
R15	300,854	6,231,036	Residential
R16	301,035	6,231,508	Residential
R17	301,190	6,231,927	Residential
Community Receptors			
C1	299,460	6,232,477	Community
C2	300,558	6,232,509	Community
C3	301,261	6,232,456	Community
C4	301,280	6,231,579	Community
C5	300,675	6,230,249	Community
C6	300,052	6,230,176	Community
Industrial Receptors			
I1	299,751	6,231,935	Industrial
I2	299,903	6,231,943	Industrial
I3	300,045	6,231,899	Industrial
I4	300,070	6,231,698	Industrial
I5	299,903	6,231,491	Industrial

Figure 5 Sensitive Receptor Locations



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Project Number:	610.14692
Dispersion Model:	CALPUFF
Modelling Period:	2012
Projection:	GDA 1994 MGA Zone 56
Date:	16/08/2016



**Resource Recovery Facility - Minto
 Air Quality Impact Assessment**

Receptor Locations

3 EMISSIONS TO AIR

3.1 Identification of Emission Sources

The key atmospheric pollutants likely to be generated by operational activities at the Project Site are fugitive emissions of particulate matter. From the information provided in the preceding sections and an inspection of the site by SLR staff, the emission sources and major pollutants identified at the Project Site are as follows:

- Particulate emissions from loading/unloading of waste material
- Particulate emissions from waste material handling/sorting/processing activities
- Particulate emissions from onsite vehicle movements
- Particulate emissions from wind erosion from onsite stockpiles and exposed areas.

Emissions of products of fuel combustion from delivery trucks and other fixed and mobile equipment at the site are anticipated to be minor. These emissions are most appropriately managed through equipment maintenance programs, including ongoing servicing of vehicle engines in accordance with manufacturer's recommendations.

Odorous materials such as putrescible waste will not be accepted at the site and any hidden putrescible waste discovered in tipped material will be stored in vermin-proof containers for lawful disposal off-site. A qualitative impact assessment of potential odour from the site is presented in **Section 8.5**.

3.2 Emission Controls

An operator-activated sprinkler system is currently used as the primary dust control measures across the site. An overhead sprinkler system is located both inside the shed and on the hardstand area at the entrance to the shed. Handheld hoses are used in areas not controlled by the sprinkler system. The site supervisor also has the authority to cease operations if weather conditions have a major negative impact on the operation.

All processing of materials will be carried out within the enclosure (onsite building). Processed materials will be unloaded at different bays located under the awning with fogging and sprinkler controls to minimise potential dust emissions. It was assumed this will achieve an average of 90% emission reduction for dust emissions from this activity.

Vehicle speed will be limited to less than 5 km/hr on onsite roads. It was assumed this will achieve an additional 40% reduction in on-site wheel generated dust emissions. It is noted that 40% control efficiency is based on limiting vehicle speed to 30 km/hr and no published emission factors are available for limiting vehicle speeds to 5 km/hr. Due to this, the calculated emissions associated with the onsite traffic movements are likely to be overestimated.

Other air quality protection measures implemented at the site are as follows:

- Paved roadways, hard stand areas and driveways are kept clean by use of a sweeper and hoses as required to prevent dust from vehicle movements;
- All vehicles are checked for mud and soil on tyres prior to leaving site and where mud or soil is detected on the entrance road (i.e. "track out"), staff are deployed to sweep the road;
- All on-site, fixed and mobile diesel powered plant (excluding road vehicles) are maintained in accordance with the manufacturers' specifications;
- Water sprays are used to dampen material as it is moved around the site and loaded into bins and also to minimise emissions from on-site stockpiles, supported by the use of hand-held hoses; and
- A high pressure fogging/misting system that can effectively remove breathable and fugitive dust particles from 10 to 100 µm.

4 ASSESSMENT CRITERIA

NSW State air quality guidelines formulated by the NSW Environment Protection Authority (NSW EPA) are published in January 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, hereafter 'the Approved Methods'. A summary of the guidelines relevant to the Project Site is presented below.

4.1 Particulate Matter

4.1.1 Total Suspended Particulate

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

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. The TSP guideline is more appropriately used as an indicator of potential nuisance impacts.

4.1.2 PM_{10} and $\text{PM}_{2.5}$

Emissions of particulate matter less than 10 μm and 2.5 μm in diameter (referred to as PM_{10} and $\text{PM}_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $\text{PM}_{2.5}$ 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 $\text{PM}_{2.5}$ 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} and $\text{PM}_{2.5}$ assessment goals set out in the Approved Methods are outlined in **Table 3**

Table 3 NSW EPA Goals for Particulates

Pollutant	Averaging Period	Assessment Goal
PM_{10}	24 Hours	50 $\mu\text{g}/\text{m}^3$
	Annual	25 $\mu\text{g}/\text{m}^3$
$\text{PM}_{2.5}$	24 Hours	25 $\mu\text{g}/\text{m}^3$
	Annual	8 $\mu\text{g}/\text{m}^3$

Source: NSW EPA (2017)

4.1.3 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 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 $\text{g}/\text{m}^2/\text{month}$.

Table 4 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 4 NSW 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: Approved Methods, NSW EPA 2017.

4.2 Summary of Project Air Quality Goals

The air quality goals adopted for this assessment, which conform to current NSW EPA air quality criteria, are summarised in **Table 5**.

Table 5 Project Air Quality Goals

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m ³
PM ₁₀	Maximum 24 Hours	50 µg/m ³
	Annual	25 µg/m ³
PM _{2.5}	Maximum 24 Hours	25 µg/m ³
	Annual	8 µg/m ³
Dust Deposition	Annual	Maximum incremental increase of 2 g/m ² /month
		Maximum cumulative of 4 g/m ² /month (Project and other sources)

5 CLIMATE AND METEOROLOGY

Sydney has warm, sometimes hot summers and mildly cool winters. Summer highs average at around 27°C to 30°C, and winter highs at 17°C to 21°C.

While the eastern suburbs of Sydney do not experience extreme seasonal differences as the weather is moderated by proximity to the ocean, more extreme temperatures are recorded in the inland western suburbs. As a result, the Sydney CBD, eastern suburbs and North Shore are classified as having a temperate oceanic climate, whereas the inland western suburbs have a humid subtropical climate. The Project site is located approximately 30 km inland from the coastline, and 25 km inland from Botany Bay and Bate Bay, hence may be expected to experience the moderating influences of sea breezes.

Rainfall is generally spread evenly throughout the year, but tends to be highest in late summer and early autumn. Long-term rainfall data recorded at Camden Airport AWS (12 km to the west of the Project site) from 1943 to 2016 gives an average annual rainfall of 789 mm.¹

Sydney has 104 clear days annually and gets around 30 thunderstorms per year. The area is prone to heat waves and drought, which have become more common in recent years.

5.1 Meteorological Data Used in Modelling Assessment

A one year, site-representative meteorological dataset, containing hourly records of key meteorological parameters, has been compiled for the Project Site using the methodology outlined in **Appendix A**. This dataset has been used in the air dispersion modelling study to assess the potential impacts on local air quality of operations at the site.

¹ http://www.bom.gov.au/climate/averages/tables/cw_068192.shtml

The meteorological dataset used in this study is based on observational data collected in the region during the 2014 calendar year. The 2014 calendar year was selected as being representative of typical conditions in the area, based on a review of long term meteorological data for the region. Key characteristics of the meteorological dataset, as relevant to the dispersion of air emissions from the Project Site are presented below.

5.1.1 Wind Speed and Direction

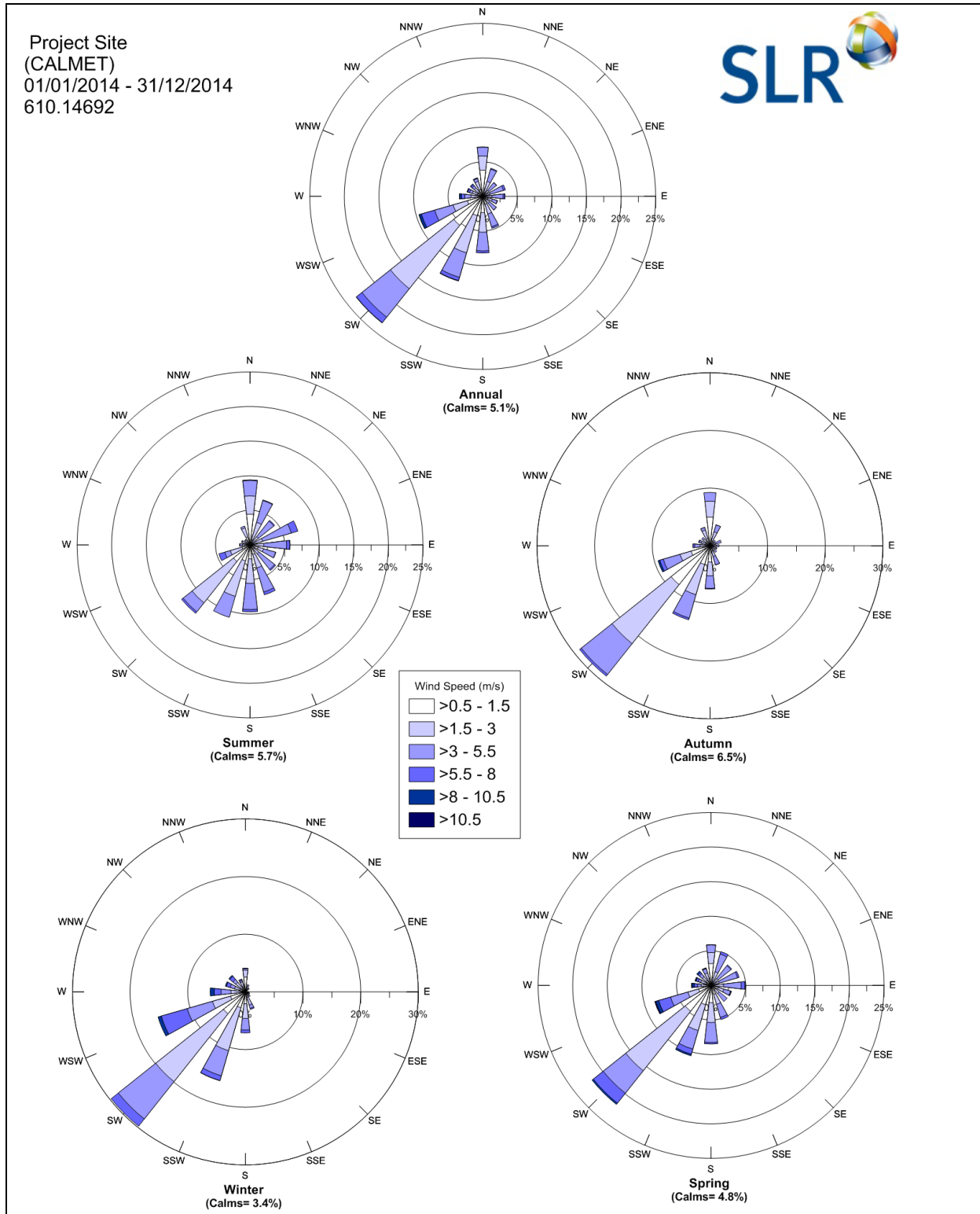
A summary of the annual wind behaviour predicted at the Project Site for the 2014 calendar year is presented as wind roses in **Figure 6**.

The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). 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. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

Figure 6 indicates that winds experienced at the site are seasonally dependent. The seasonal wind roses indicate that typically:

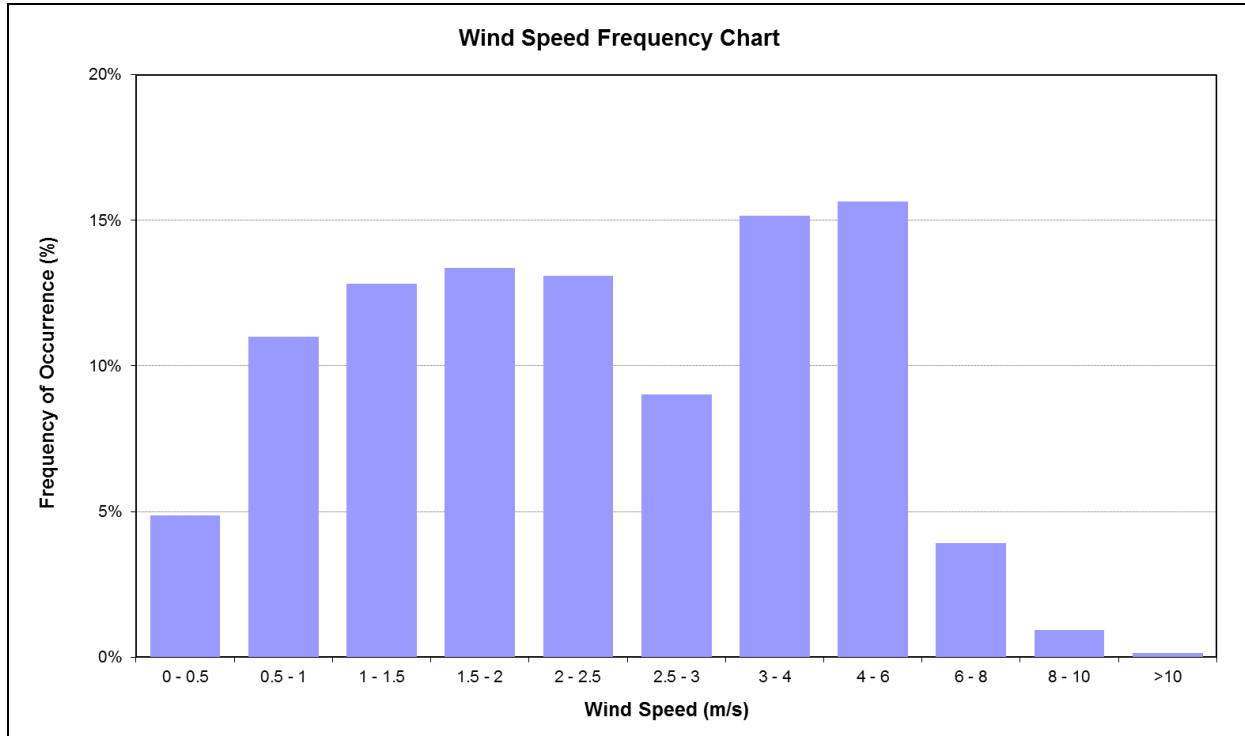
- In summer, winds were predominantly low with contributions from the southwest, south and north.
- In autumn, winds were low to moderate with winds predominantly from the southwest. Slightly higher wind speeds were detected from the west-southwest.
- In spring, the low to moderate winds intensified to include a small proportion of high winds. Winds were predominantly from the southwesterly quadrant.
- In winter, winds were low to moderate and were experienced predominantly from the southwest, with significant contributions from the west-southwest and the south-southwest.

Figure 6 Seasonal Wind Roses for the Minto Site (CALMET predictions, 2014)



A wind speed frequency chart is shown in **Figure 7**. This chart shows that the Project Site is predicted to experience predominantly low wind speeds (approximately 42% less than 2 m/s).

Figure 7 Wind Speed Frequencies at the Project Site (CALMET predictions, 2014)



5.1.2 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 categorize the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each Pasquill stability class are shown in **Table 6**.

Table 6 Meteorological Conditions Defining Pasquill Stability Classes

Surface wind speed (m/s)	Daytime insolation			Night-time conditions	
	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	<= 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

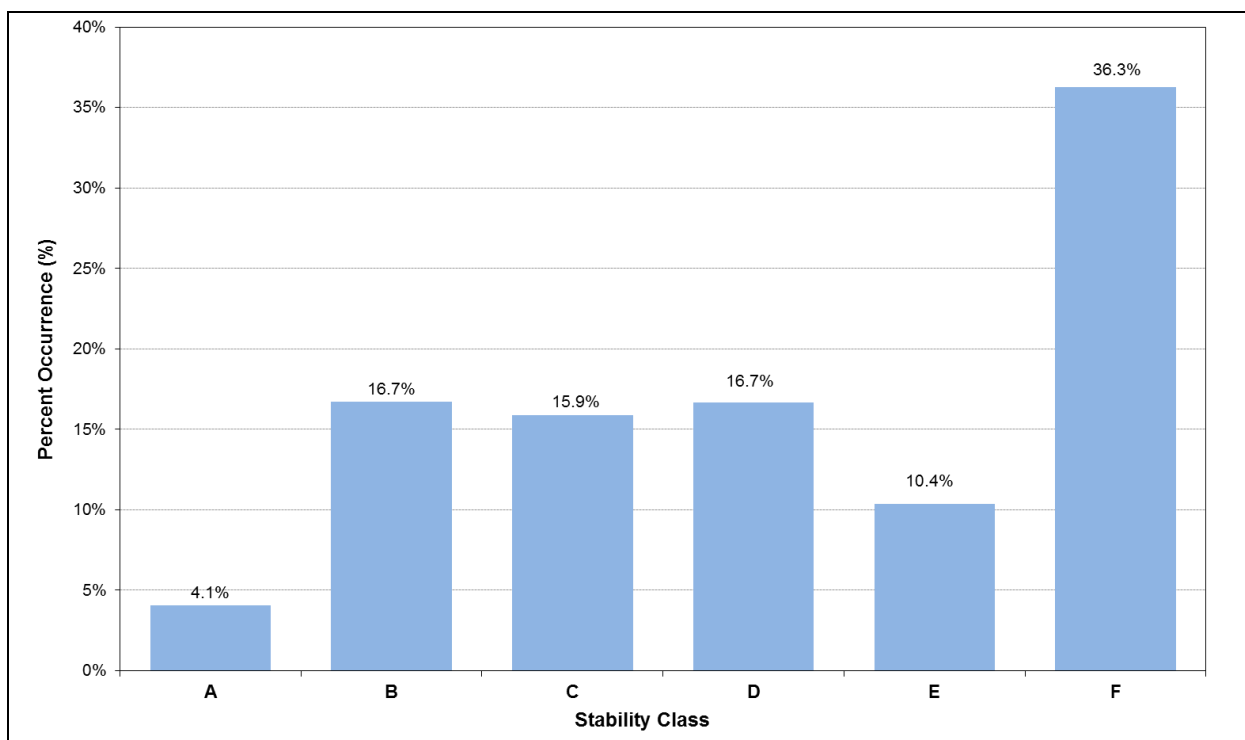
(Source: Pasquill, 1961)

Notes:

1. Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter.
2. Night refers to the period from 1 hour before sunset to 1 hour after sunrise.
3. The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above.

The frequency of each stability class predicted by CALMET for 2014, extracted at the centre of the Project site, is presented in **Figure 8**. 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 8 Predicted Stability Class Frequencies at Project Site (CALMET predictions, 2014)

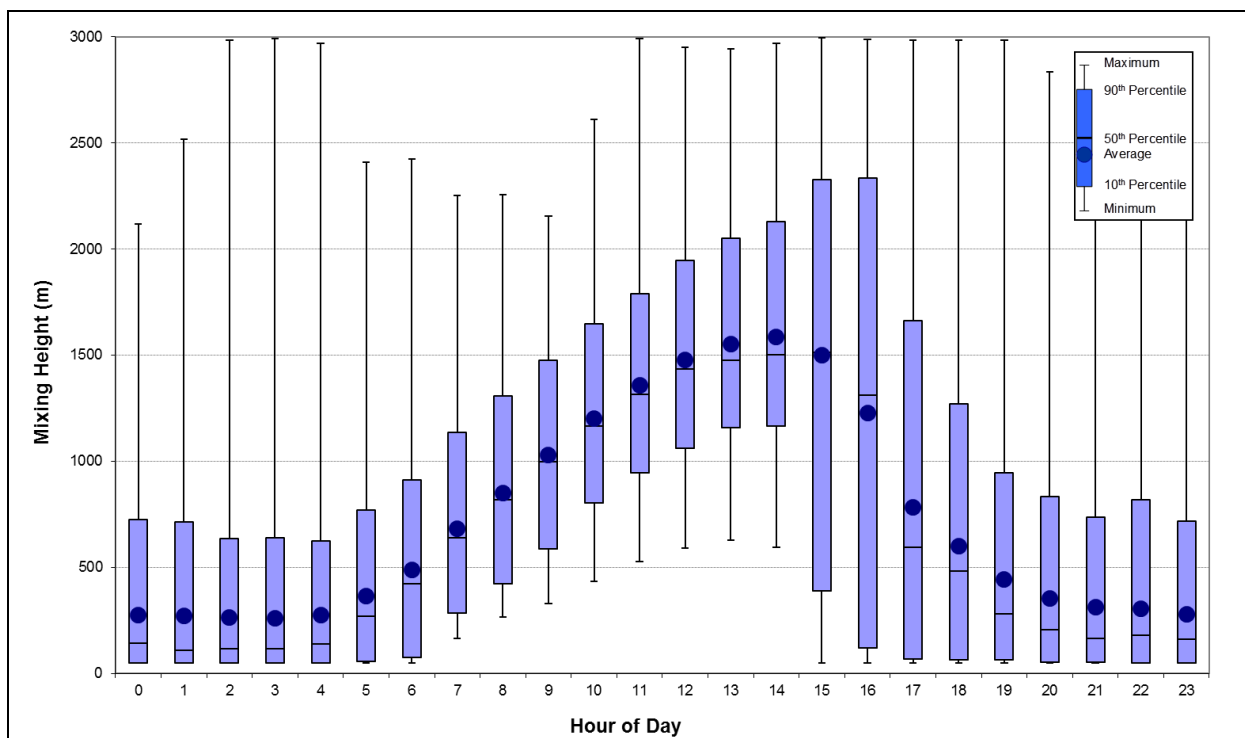


5.1.3 Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Project site during the 2014 modelling period are illustrated in **Figure 9**.

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.

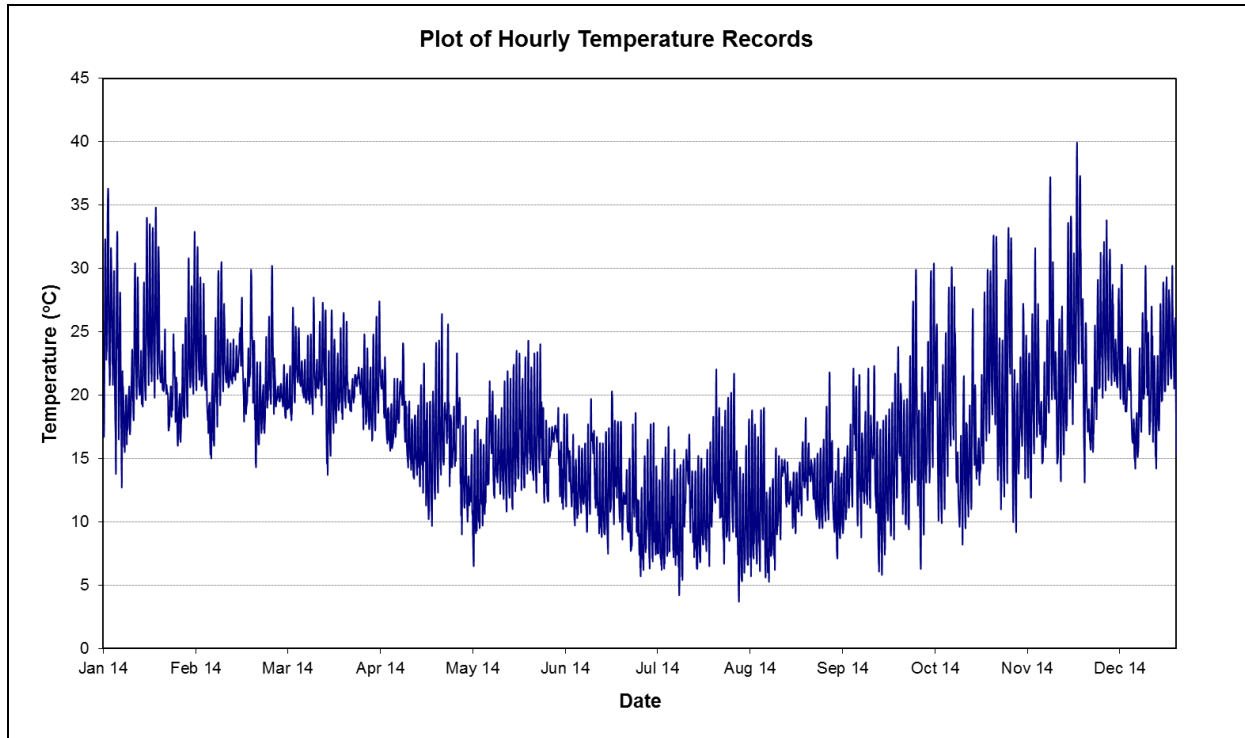
Figure 9 Predicted Mixing Heights at Project Site (CALMET predictions, 2014)



5.1.4 Temperature

The hourly average ambient temperatures predicted at the Project site during 2014 are illustrated in **Figure 10**. The maximum temperature (39.9°C) was predicted at 4:00pm on 23 November 2014 and the minimum temperature (3.7°C) was predicted at 6:00am on 2 August 2014.

Figure 10 Predicted Temperatures at the Project Site (CALMET predictions, 2014)



6 EXISTING AIR QUALITY

The quantification of cumulative air pollution concentrations and the assessment of compliance with ambient air quality limits necessitate the characterisation of baseline air quality. In regards to the background concentrations of particulate, NSW Office of Environment and Heritage (NSW OEH) regulates and maintains a number of monitoring stations across NSW. Data from these stations and other publicly available monitoring data have been reviewed to provide an assessment of background air quality at the Project Site, as discussed below.

6.1 Particulate Matter

6.1.1 PM₁₀

The nearest monitoring station recording ambient concentrations of PM₁₀ is located in Campbelltown West (approximately 4.8 km southwest of the Project Site). The 24-hour average PM₁₀ concentrations recorded at this air quality monitoring station for the three year period 1 January 2013 to 31 December 2015 are presented in **Figure 11**. This graph shows that generally 24-hour average PM₁₀ concentrations in the region are well below the OEH air quality criterion of 50 µg/m³.

A brief summary of the monitoring data recorded at this station is presented in **Table 7**. The monitoring data showed that the maximum 24 hour average PM₁₀ concentrations recorded during 2013 were significantly higher than those recorded during 2014. A desktop review of publicly available information revealed that there were a number of bushfire and hazard reduction burning events in the surrounding area in 2013, which is likely to have resulted in the elevated concentrations recorded during this year. Similarly, the exceedances recorded in 2015 was due to a state-wide dust storm that originated from the Victorian Mallee and southern NSW region and travelled throughout NSW during 5 and 6 May (NSW OEH 2015).

Figure 11 24-Hour Average PM₁₀ Monitoring Results for Campbelltown West (2013 - 2015)

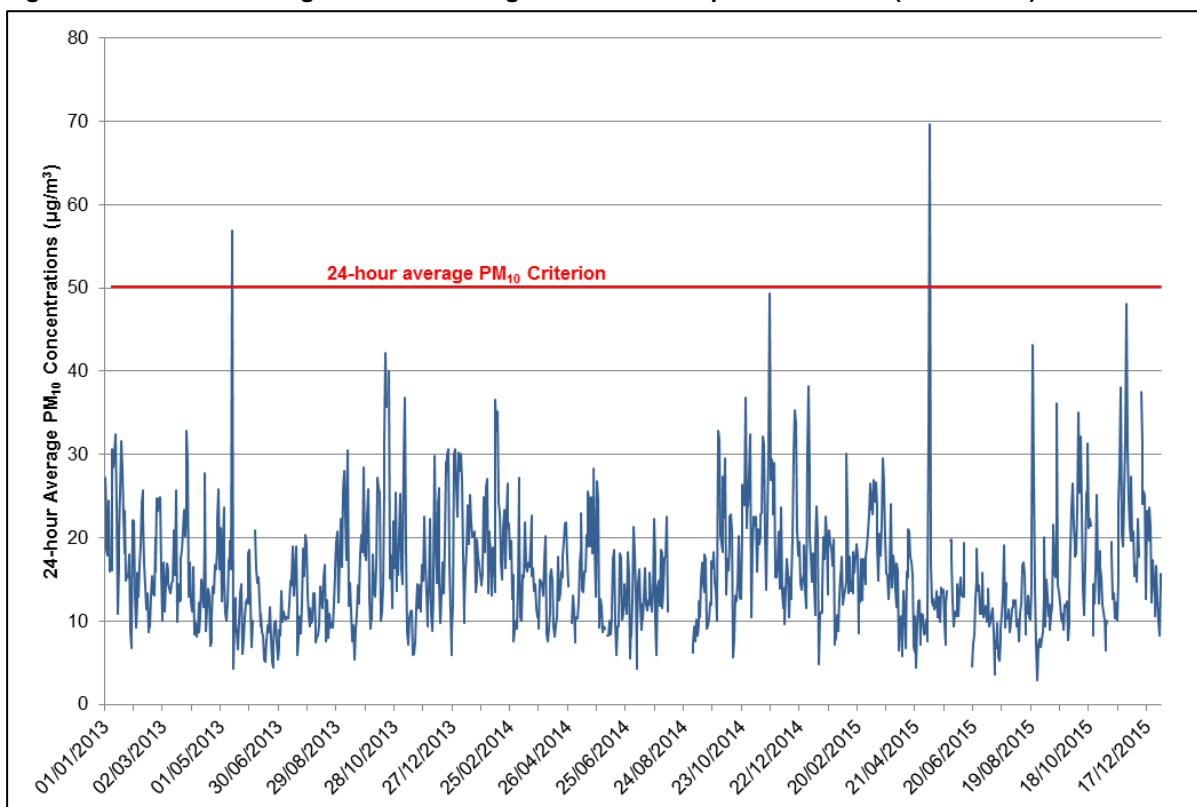


Table 7 Summary of PM₁₀ Data Recorded at Campbelltown West (2013 – 2015)

Year	2013	2014	2015	Criteria	Unit
Maximum PM ₁₀ Concentration	56.9	49.4	48.1	50	µg/m ³
6 th Highest PM ₁₀ Concentration	32.8	35.2	36.2	50	
Annual Average PM ₁₀ Concentration	15.5	17.0	15.6	30	

Based on the information presented above and in order to provide a contemporaneous analysis with the meteorological data file used in the dispersion modelling (2014 calendar year), monitoring data recorded by the Campbelltown West monitoring station during 2014 were used to estimate background PM₁₀ levels in this study.

6.1.2 PM_{2.5}

The nearest monitoring station recording ambient concentrations of PM_{2.5} is the Campbelltown West (monitoring station discussed above). However, the recording of 24-hour average PM_{2.5} concentrations at the Campbelltown West air quality monitoring station only started from 2 September 2015 to 31 December 2015 (**Figure 12**). The data recorded shows that 24-hour average PM_{2.5} concentrations in the region are generally below the OEH air quality criterion of 25 µg/m³. A brief summary of maximum and annual average PM_{2.5} concentrations measured at Campbelltown West is shown in **Table 8**.

Figure 12 24-Hour Average PM_{2.5} Monitoring Results for Campbelltown West (2013-2015)

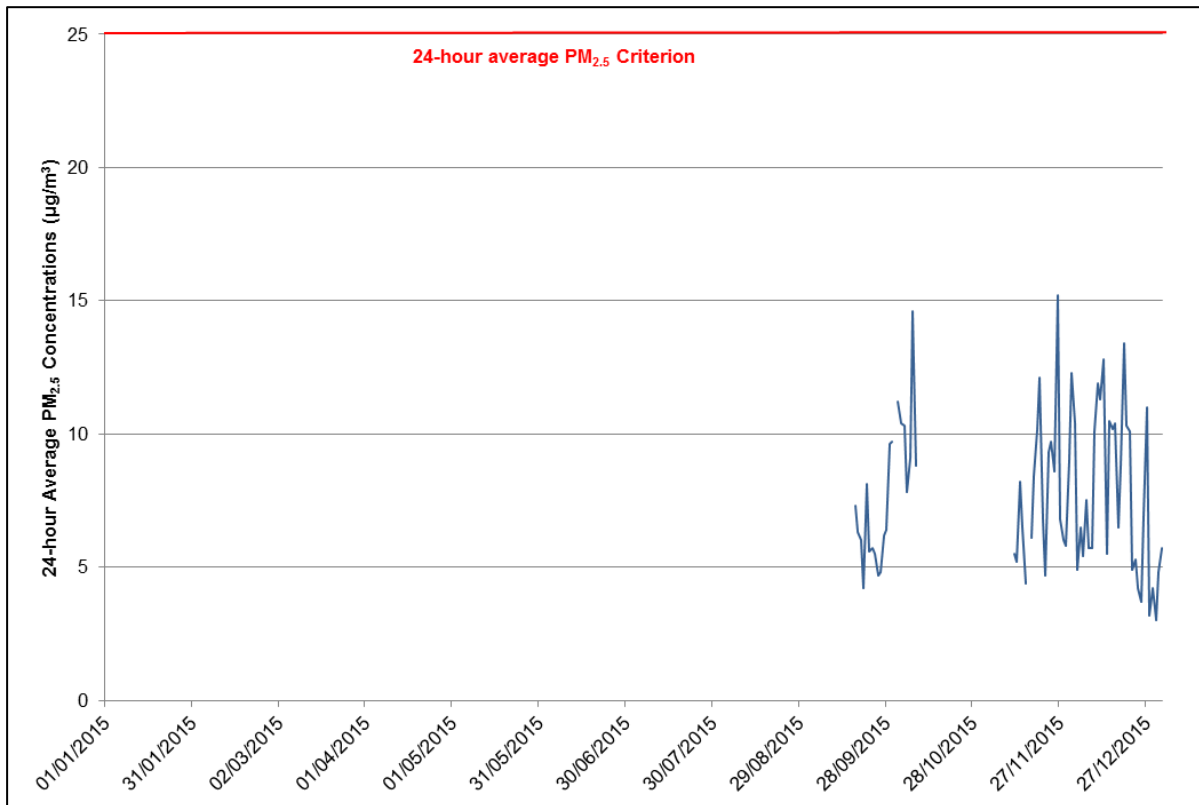


Table 8 Summary of PM_{2.5} Data Recorded at Campbelltown West (2015)

Year	2015	Criteria	Unit
Maximum PM _{2.5} Concentration	15.7	25	µg/m ³
6 th Highest PM _{2.5} Concentration	12.3	25	
Annual Average PM _{2.5} Concentration	7.9	8	

It is expected that the background air quality experienced at the nearest surrounding receptors to the Project Site will also be comparable to that measured by the Camden ambient air quality monitoring station which is presented in **Figure 13** and a summary provided in **Table 9**. Elevated levels have been recorded on occasion, especially in 2013. In most cases, the elevated concentrations were associated with by bushfire and hazard reduction burning events in the surrounding areas.

Data from the 2014 calendar year measured at Camden ambient air quality monitoring station were used to enable a contemporaneous analysis with the meteorological dataset used in the modelling.

Figure 13 24-Hour Average PM_{2.5} Monitoring Results for Camden (2013-2015)

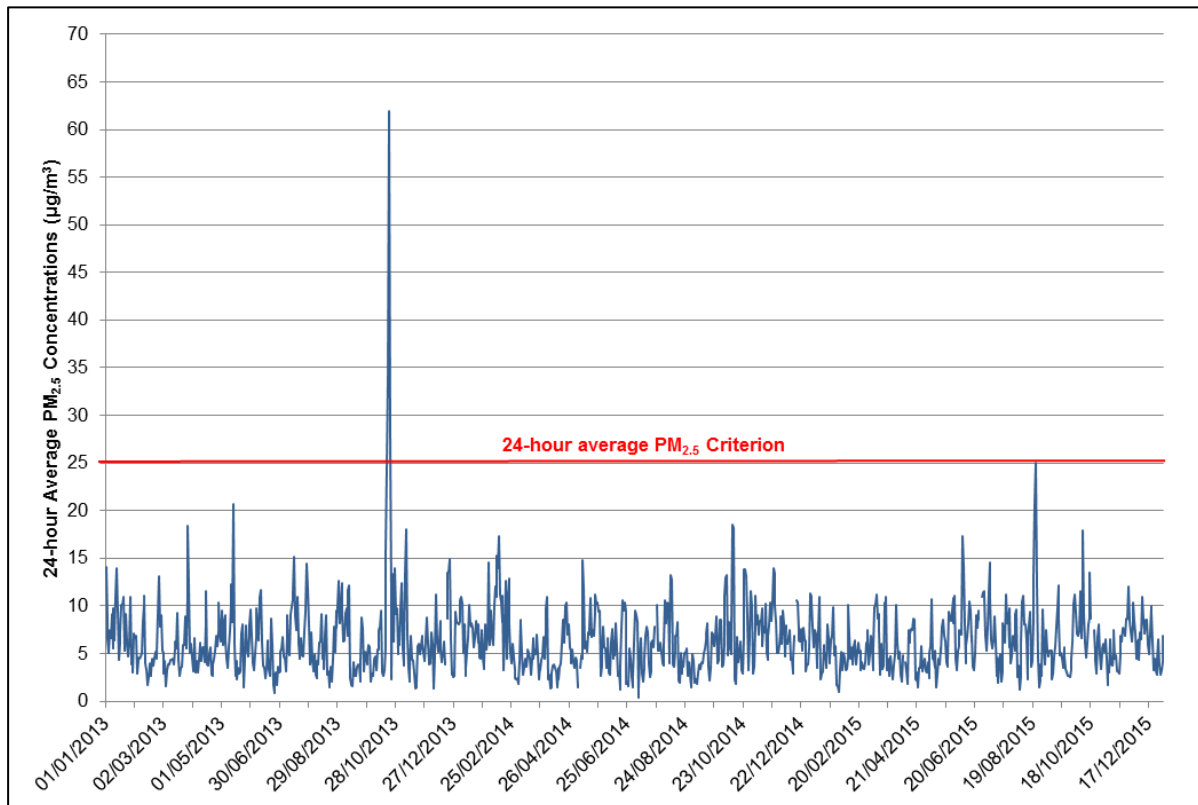


Table 9 Summary of PM_{2.5} Data Recorded at Camden (2013 - 2015)

Year	2013	2014	2015	Criteria	Unit
Maximum PM _{2.5} Concentration	61.9	18.5	25.0	25	µg/m ³
6 th Highest PM _{2.5} Concentration	18.4	14.5	14.2	25	
Annual Average PM _{2.5} Concentration	6.5	6.3	6.2	8	

6.1.3 Total Suspended Particulates (TSP)

No TSP monitoring data is available for the Project Site or for the wider region. However, it is conservatively assumed that the ambient PM₁₀ concentrations represent 50% of the total TSP concentrations. This is a typical ratio measured in areas where windblown dust is a major source, hence it will overestimate TSP concentrations for a more urbanised environment such as the Project Site where the smaller size fractions of combustion-related particulate matter will predominate. Using this approach, the annual average background TSP concentration has been estimated to be 34 µg/m³, based on the measured annual average PM₁₀ concentration of 17.0 µg/m³.

6.1.4 Dust Deposition

No dust monitoring data is available for the Project Site or for the wider region. Based on SLR's experience in measuring dust deposition rates in both rural and urban environments, a conservative background dust deposition rate of 2 g/m²/month has been assumed for the site. This results in the cumulative assessment criterion of 4 g/m²/month being the defining criterion for the Project.

6.2 Summary of Background Air Quality for Assessment Purposes

For the purposes of assessing the potential cumulative air quality impacts from the Project Site, an estimation of ambient air quality levels is required. The ambient air quality levels assumed for this assessment are summarised in **Table 10**.

Table 10 Background Ambient Air Quality Environment for Assessment Purposes

Parameter	Averaging Period	Background Level Assumed	Source
TSP ¹	Annual	34 µg/m ³	Estimated from measured PM ₁₀ concentration based on a PM ₁₀ /TSP ratio of 0.5
PM ₁₀	24-Hour	Daily varying	Campbelltown West Monitoring station NSW OEH (2014)
	Annual	17.0 µg/m ³	
PM _{2.5}	24-Hour	Daily varying	Camden Monitoring station NSW OEH (2014)
	Annual	6.3 µg/m ³	
Dust Deposition	Annual	2 g/m ² /month	Assumed

7 EMISSIONS ESTIMATION

Potential emissions of particulate matter from each source identified in **Section 3.1** have been quantified for input into the dispersion modelling exercise as outlined below.

A review has been carried out of the potential for particulate generation during the operation of the Project (refer **Section 3**). In summary, the activities which may give rise to particulate emissions into the ambient environment from the Project include:

- loading/unloading and handling/processing of waste material;
- onsite vehicle movements; and
- wind erosion from waste stockpiles and exposed areas.

All material handling/processing activities will be carried out in an enclosed environment (within the shed) and all waste will be stored in an undercover or enclosed environment. In addition, trucks will be covered until waste removal (i.e. unloading) as a further mitigation measure to reduce potential for windblown dust.

Emission factors contained within the NPI for Mining and USEPA AP42 have been adopted in the absence of industry-specific factors relating to waste handling. The emission factors outlined in the USEPA AP42 document for aggregate handling are related to the handling of overburden material and it is considered that the material to be handled as part of the Project operations will result in the emission of significantly less (but unquantifiable) particulate emissions. The resulting modelled particulate concentrations should therefore be viewed as a conservative representation of the potential impacts due to Project activities.

The assumptions outlined in **Table 11** have been used in the development of the particulate emissions inventory for the Project Site.

Table 11 Assumptions adopted for Air Quality Impact Assessment - Particulates

Parameter	Value	Units	Comments
Operating hours	96	hours/week	6 am to 10 pm Mon-Sat No operation on Sunday
Operating days	312	days/year	Equivalent to 6 days/week
Total material throughput	220,000	tonnes/year	Annual maximum
	705	tonnes/day	Daily average (220,000 t/yr ÷ 312 days/yr)
	2,000	tonnes/day	Daily maximum
Area of exposed area/stockpiles	0.4	ha	-
Total length of internal road	300	m	
Silt loading of paved road	1.1	g/m ²	Assumed (USEPA AP42 13.2.1 – relevant to municipal solid waste landfill site)
Average weight of vehicles	15	tonnes	

Potential emissions resulting from loading/unloading/material handling activities were estimated using the USEPA AP42 emission factor for aggregate handling as outlined below.

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

Where

$k = 0.74$ (TSP)

$k = 0.35$ (PM₁₀)

$k = 0.053$ (PM_{2.5})

U = Mean wind Speed (m/s)

M = Moisture content of material (%)

Emissions from heavy vehicles travelling on paved roads have been derived using the USEPA AP42 emission factors (Wheel Generated Dust from Paved Roads [2006]) as outlined below.

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

where

$k = 3.23$ (TSP)

$k = 0.62$ (PM₁₀)

$k = 0.15$ (PM_{2.5})

sL = silt loading (g/m²) taken to be 0.6 g/m² (from Table 13.2.1-2)

W = average vehicle gross mass (tonnes)

VKT = Vehicle Kilometre Travelled

As discussed in **Section 3.2**, the following mitigation measures were included in estimating potential dust emission from the Project Site.

- All processing of materials will be carried out within the enclosure (onsite building) – 90% reduction
- Level 1 water spray on haul road and stockpile/exposed areas – 50% reduction
- Vehicle speed will be limited to less than 5 km/hr on onsite roads – additional 40% reduction
- Minimisation of wind erosion due to wind speed reduction provided by the existing infrastructure surrounding the site – 30% reduction (control factor for “wind breaks”)

It is noted that the following mitigation measures are also applied at the Project Site but haven't been considered in estimating dust emissions to provide a conservative approach:

- CoolMist systems that are designed to remove breathable and fugitive dust particles from 10 to 100 µm. The water droplets can be dispersed across most types of material to bond with dust particles assisting in the suppression process.

7.1 Worst Case Scenario

To estimate the potential worst case impact at surrounding sensitive receptors, a worst case scenario based on the operational data presented in **Table 11** was compiled. The worst case scenario assumes the following:

- A maximum daily processing capacity of 2,000 tonnes per day (i.e. 624,000 tonnes per annum); and
- The maximum number of onsite traffic movements (776 trips/day) for transporting waste and product materials.

It is noted that the downwind concentrations given by the modelling using the above assumptions assume that the Project Site will operate at the maximum daily capacity with maximum number of truck movement on every day of the year, which will not be the case. This approach will result in the predicted short term (maximum 24-hour average) downwind concentrations being representative of the impacts that could occur based on the worst-case level of emissions under the worst-case meteorological conditions, and will therefore provide a conservative assessment of potential off-site impacts. As noted earlier in this report, the site will operate 6 days a week (312 days per annum) with an annual throughput of 220,000 tonnes per annum. Therefore, this approach will also overestimate the long term (annual average) downwind concentrations as the site will not operate at the maximum daily capacity on every day of the year.

A summary of the estimated emission rates are presented in **Table 12**. The emission factors for each activity and all input parameters utilised to estimate emissions are presented in **Table 13**. The assumed intensity of each activity, including material throughput, annual vehicle kilometres travelled (vkt) onsite and exposed areas are outlined in **Table 14**.

Table 12 Estimated Emissions from the Project Site

Activity	Peak Emission Rate (kg/annum)		
	TSP	PM ₁₀	PM _{2.5}
Unloading materials from truck	126	60	9
Material sorting/handling	252	119	18
Loading product material to truck	101	48	7
Onsite hauling	1,215	233	56
Wind erosion	492	246	23
Total emissions	2,186	705	114

Table 13 Emission Factors and Input Assumptions

Activity	Emission Factor			Unit	Input Assumptions	Emission Factor Source
	TSP	PM ₁₀	PM _{2.5}			
Unloading materials from truck	0.0002	0.0001	0.00001	kg/t	Wind speed factor – 1.39 Moisture content – 10% Control efficiency – 90% ¹	USEPA AP42
Material sorting/handling	0.0002	0.0001	0.00001	kg/t		
Loading product material to truck	0.0002	0.0001	0.00001	kg/t		
Onsite hauling	0.056	0.011	0.003	kg/vkt	Mean Vehicle weight – 15 t Onsite road length – 0.3 km/return trip Silt loading – 1.1 g/m ² Control efficiency – 70% ²	
Wind erosion	0.40	0.20	0.02	kg/ha/hour	Control efficiency – 65% ³	NPI

¹ All processing activities will be carried out within the enclosure (onsite building). Processed materials will be stored in different bays under the awning with fogging and sprinkler controls to minimise potential dust emissions.

² An overall 70% control efficiency on haul roads will be achieved through the application of water sprays and limiting the onsite vehicle speeds to 5 km/hr.

³ 65% control efficiency will be achieved through the application of water spray and wind barrier effect achieved due to the fence at the site boundary and buildings/infrastructure within the site.

Table 14 Intensity of Each Activity

Activity	Peak Intensity	Unit
Unloading materials from truck	2,000	tonnes/day
Material sorting/handling ¹	4,000	tonnes/day
Loading product material to truck	1,600	tonnes/day
Onsite hauling ²	72,634	VKT/annum
Wind erosion	0.4	ha

¹ Assumes material will be handled twice at the site

² Based on a truck capacity of 10 tonnes/load and onsite trip distance of 0.3 km/return trip

8 AIR QUALITY IMPACT ASSESSMENT

8.1 Assessment Methodology

The estimated particulate emissions for the proposed operations at the Project Site have been modelled using the US EPA's CALPUFF (Version 6.42) 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. 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 hourly concentrations or deposition values 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.

8.2 Total Suspended Particulate (TSP) and Dust Deposition Rates

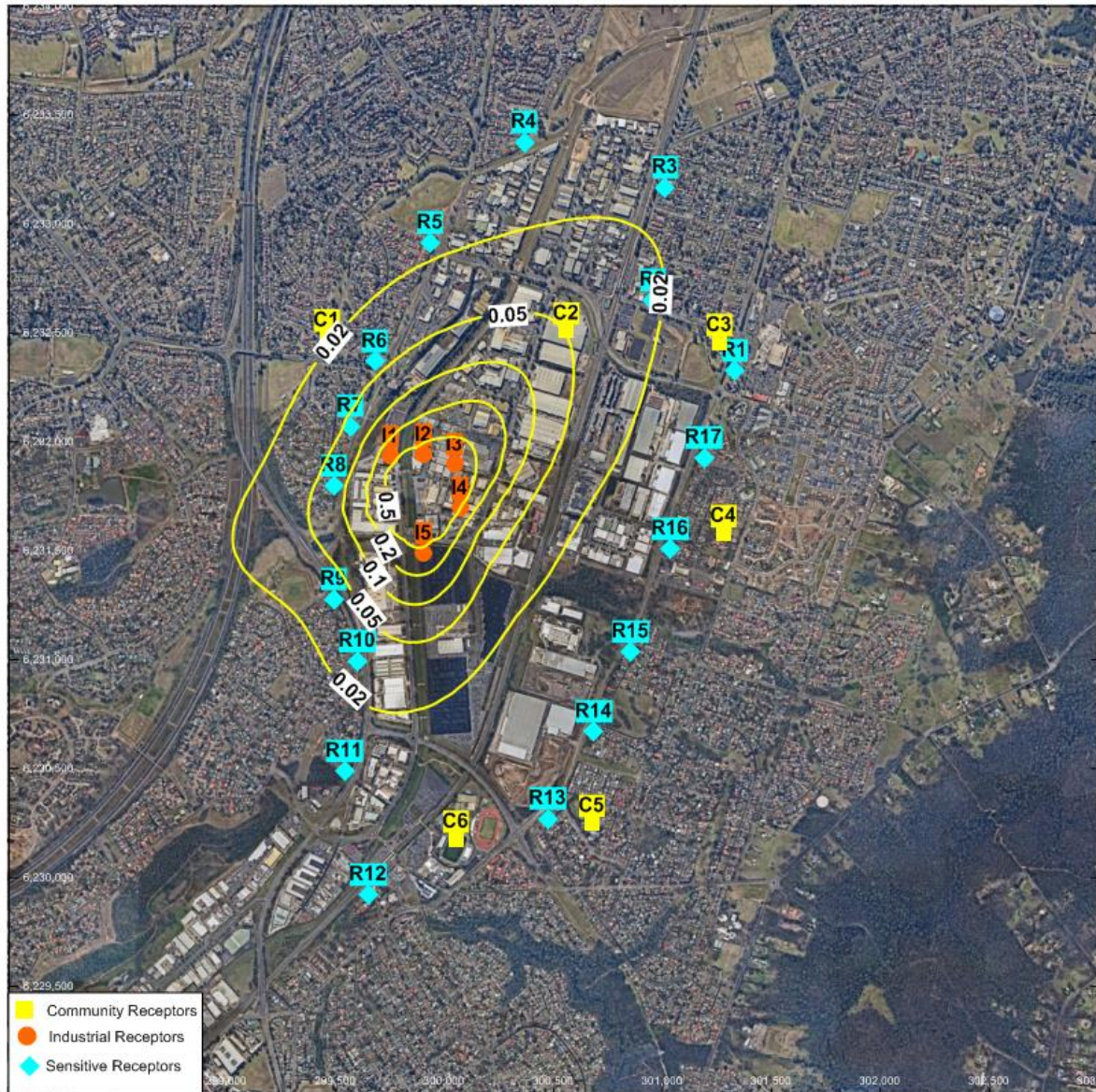
The annual average incremental and cumulative TSP concentrations and dust deposition rates predicted at the surrounding receptor locations are presented in **Table 15**. The predicted incremental annual average TSP concentrations and dust deposition rate are presented as contour plots in **Figure 14** and **Figure 15**.

The modelling results show that the incremental annual average TSP concentrations and dust deposition rates predicted at all surrounding sensitive (residential) receptors are negligible. The cumulative annual average TSP concentrations and dust deposition levels predicted at all surrounding residential, industrial and community receptor locations comply with the relevant ambient air quality criteria outlined in **Table 5**.

Table 15 Annual Average TSP Concentrations and Dust Deposition Rates Predicted at Receptor Locations

Receptor ID	Receptor Type	TSP ($\mu\text{g}/\text{m}^3$)		Dust Deposition ($\text{g}/\text{m}^2/\text{month}$)	
		Increment	Cumulative	Increment	Cumulative
R1	Residential	<0.1	<34.1	<0.1	<2.1
R2	Residential	<0.1	<34.1	<0.1	<2.1
R3	Residential	<0.1	<34.1	<0.1	<2.1
R4	Residential	<0.1	<34.1	<0.1	<2.1
R5	Residential	<0.1	<34.1	<0.1	<2.1
R6	Residential	<0.1	<34.1	<0.1	<2.1
R7	Residential	<0.1	<34.1	<0.1	<2.1
R8	Residential	<0.1	<34.1	<0.1	<2.1
R9	Residential	<0.1	<34.1	<0.1	<2.1
R10	Residential	<0.1	<34.1	<0.1	<2.1
R11	Residential	<0.1	<34.1	<0.1	<2.1
R12	Residential	<0.1	<34.1	<0.1	<2.1
R13	Residential	<0.1	<34.1	<0.1	<2.1
R14	Residential	<0.1	<34.1	<0.1	<2.1
R15	Residential	<0.1	<34.1	<0.1	<2.1
R16	Residential	<0.1	<34.1	<0.1	<2.1
R17	Residential	<0.1	<34.1	<0.1	<2.1
Community Receptors					
C1	Community	<0.1	<34.1	<0.1	<2.1
C2	Community	<0.1	<34.1	<0.1	<2.1
C3	Community	<0.1	<34.1	<0.1	<2.1
C4	Community	<0.1	<34.1	<0.1	<2.1
C5	Community	<0.1	<34.1	<0.1	<2.1
C6	Community	<0.1	<34.1	<0.1	<2.1
Industrial Receptors					
I1	Industrial	0.4	34.4	<0.1	<2.1
I2	Industrial	0.8	34.8	<0.1	<2.1
I3	Industrial	1.1	35.1	<0.1	<2.1
I4	Industrial	0.5	34.5	<0.1	<2.1
I5	Industrial	0.4	34.4	<0.1	<2.1
CRITERIA		-	90.0	2.0	4.0

Figure 14 Predicted Incremental Annual Average TSP Concentrations



- ◆ Community Receptors
- ◆ Industrial Receptors
- ◆ Sensitive Receptors

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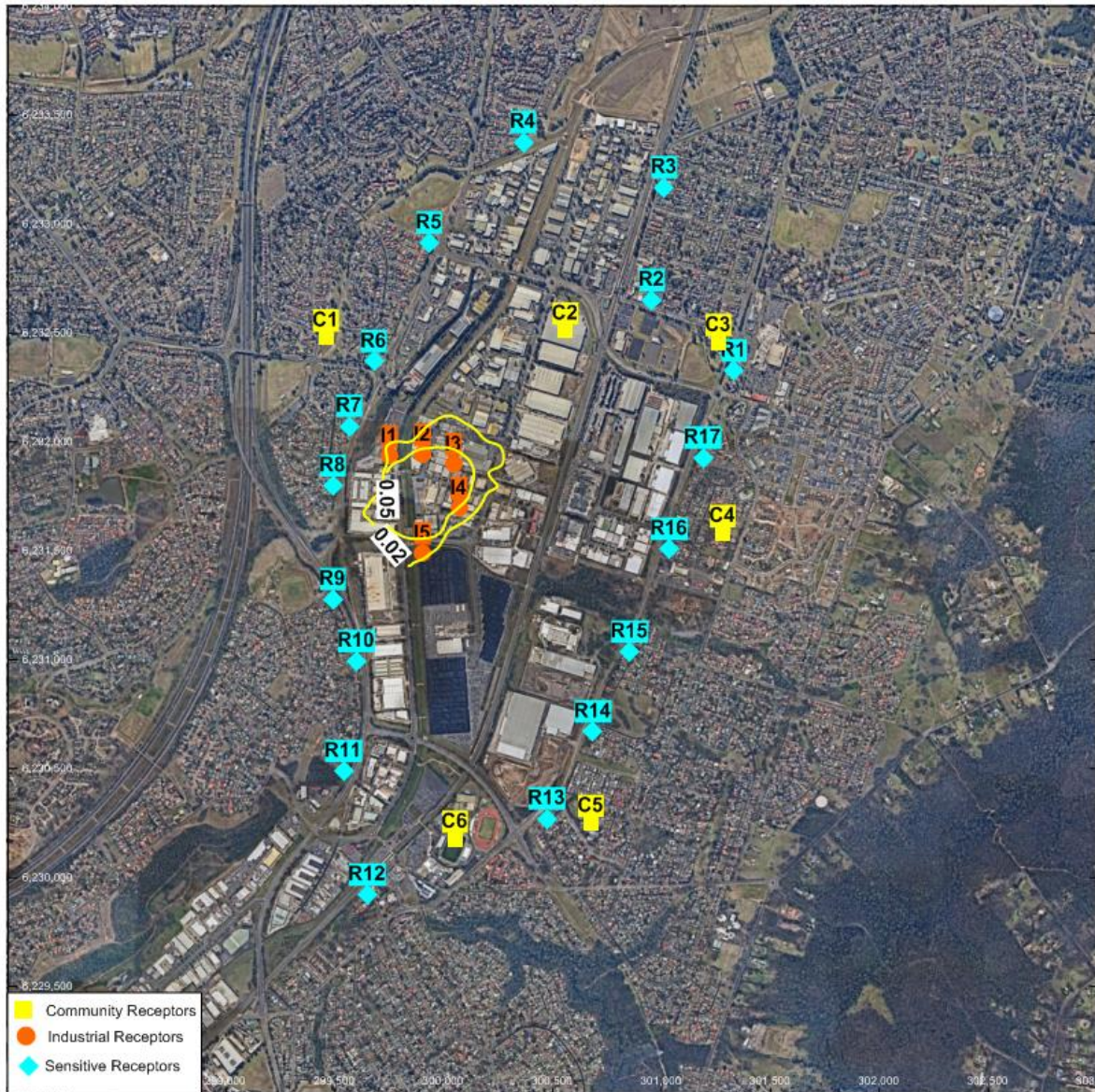
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Project Number: 610.14692
 Dispersion Model: CALPUFF
 Modelling Period: 2012
 Projection: GDA 1994 MGA Zone 56
 Date: 17/03/2017



Resource Recovery Facility - Minto Air Quality Impact Assessment				
Incremental Impact				
Pollutant	TSP	Averaging Period	Annual	Unit
				µg/m ³

Figure 15 Predicted Incremental Annual Average Dust Deposition Rate



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Resource Recovery Facility - Minto Air Quality Impact Assessment			
Incremental Impact			
Pollutant	Dust Deposition	Averaging Period	Annual
			Unit g/m ² /month

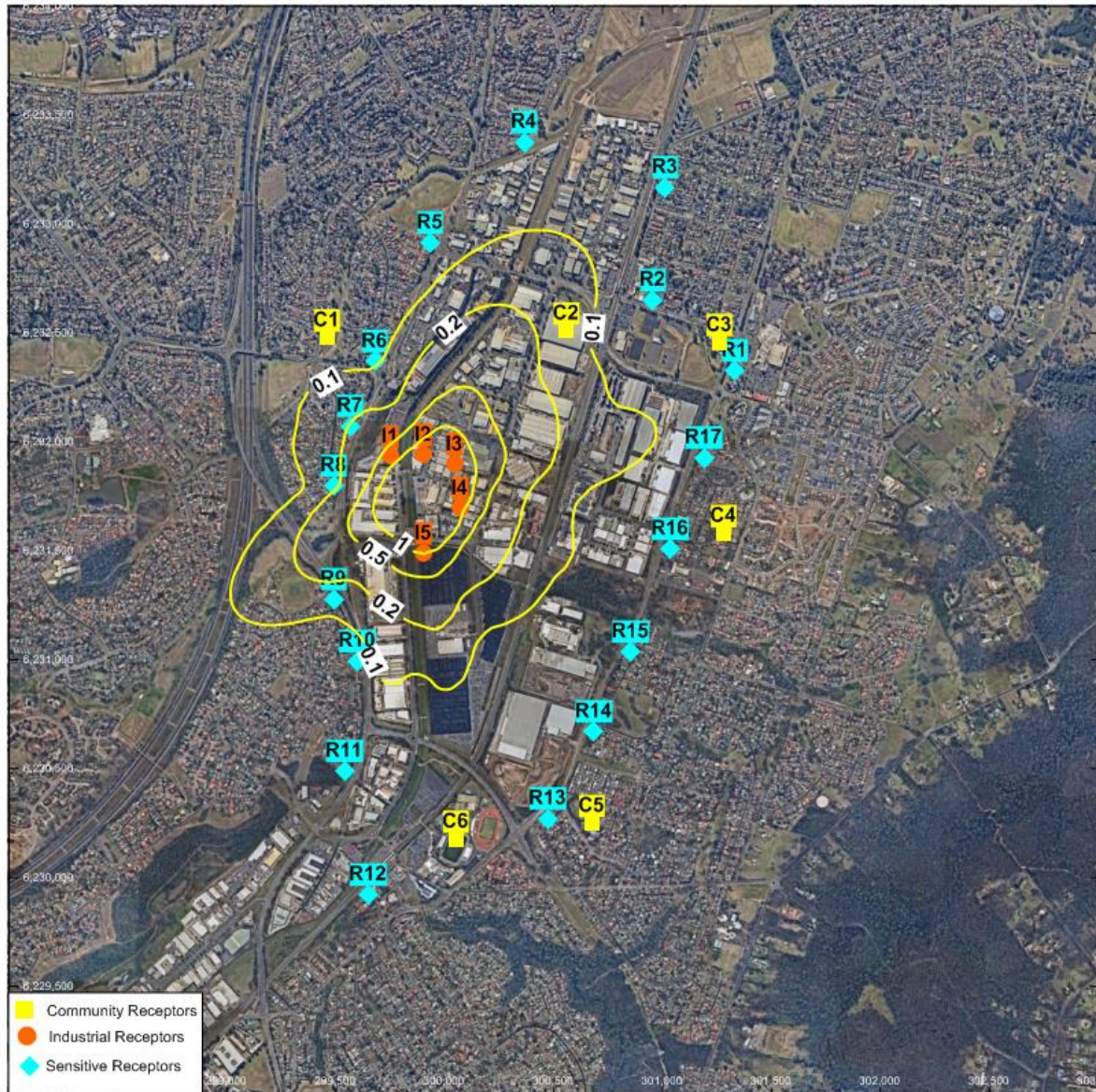
8.3 Particulate Matter < 10 µg/m³ (PM₁₀)

The maximum 24-hour and annual average incremental and cumulative PM₁₀ concentrations predicted at the identified surrounding receptor locations are presented in **Table 16**. The predicted incremental and cumulative 24 hour and annual average PM₁₀ concentrations are presented as contour plots in **Figure 16** and **Figure 17**.

Table 16 24-Hour and Annual Average PM₁₀ Concentrations Predicted at Receptor Locations

Receptor ID	Receptor Type	Incremental PM ₁₀ (µg/m ³)		Cumulative PM ₁₀ (µg/m ³)	
		24-Hr	Annual	24-Hr	Annual
R1	Residential	0.1	<0.1	49.4	<17.1
R2	Residential	0.1	<0.1	49.4	<17.1
R3	Residential	0.1	<0.1	49.4	<17.1
R4	Residential	<0.1	<0.1	49.4	<17.1
R5	Residential	0.1	<0.1	49.4	<17.1
R6	Residential	0.1	<0.1	49.4	<17.1
R7	Residential	0.2	<0.1	49.4	<17.1
R8	Residential	0.2	<0.1	49.4	<17.1
R9	Residential	0.1	<0.1	49.4	<17.1
R10	Residential	0.1	<0.1	49.4	<17.1
R11	Residential	0.1	<0.1	49.4	<17.1
R12	Residential	<0.1	<0.1	49.4	<17.1
R13	Residential	<0.1	<0.1	49.4	<17.1
R14	Residential	<0.1	<0.1	49.4	<17.1
R15	Residential	<0.1	<0.1	49.4	<17.1
R16	Residential	<0.1	<0.1	49.4	<17.1
R17	Residential	0.1	<0.1	49.4	<17.1
Community					
C1	Community	0.1	<0.1	49.4	<17.1
C2	Community	0.1	<0.1	49.4	<17.1
C3	Community	0.1	<0.1	49.4	<17.1
C4	Community	0.1	<0.1	49.4	<17.1
C5	Community	<0.1	<0.1	49.4	<17.1
C6	Community	0.1	<0.1	49.4	<17.1
Industrial					
I1	Industrial	0.7	0.1	49.4	17.1
I2	Industrial	1.7	0.3	49.6	17.3
I3	Industrial	1.6	0.4	49.4	17.4
I4	Industrial	1.2	0.2	49.6	17.2
I5	Industrial	1.0	0.1	49.5	17.1
CRITERIA		-	-	50	25

Figure 16 Maximum Predicted Incremental 24 Hour Average PM₁₀ Concentrations



◆ Community Receptors
◆ Industrial Receptors
◆ Sensitive Receptors

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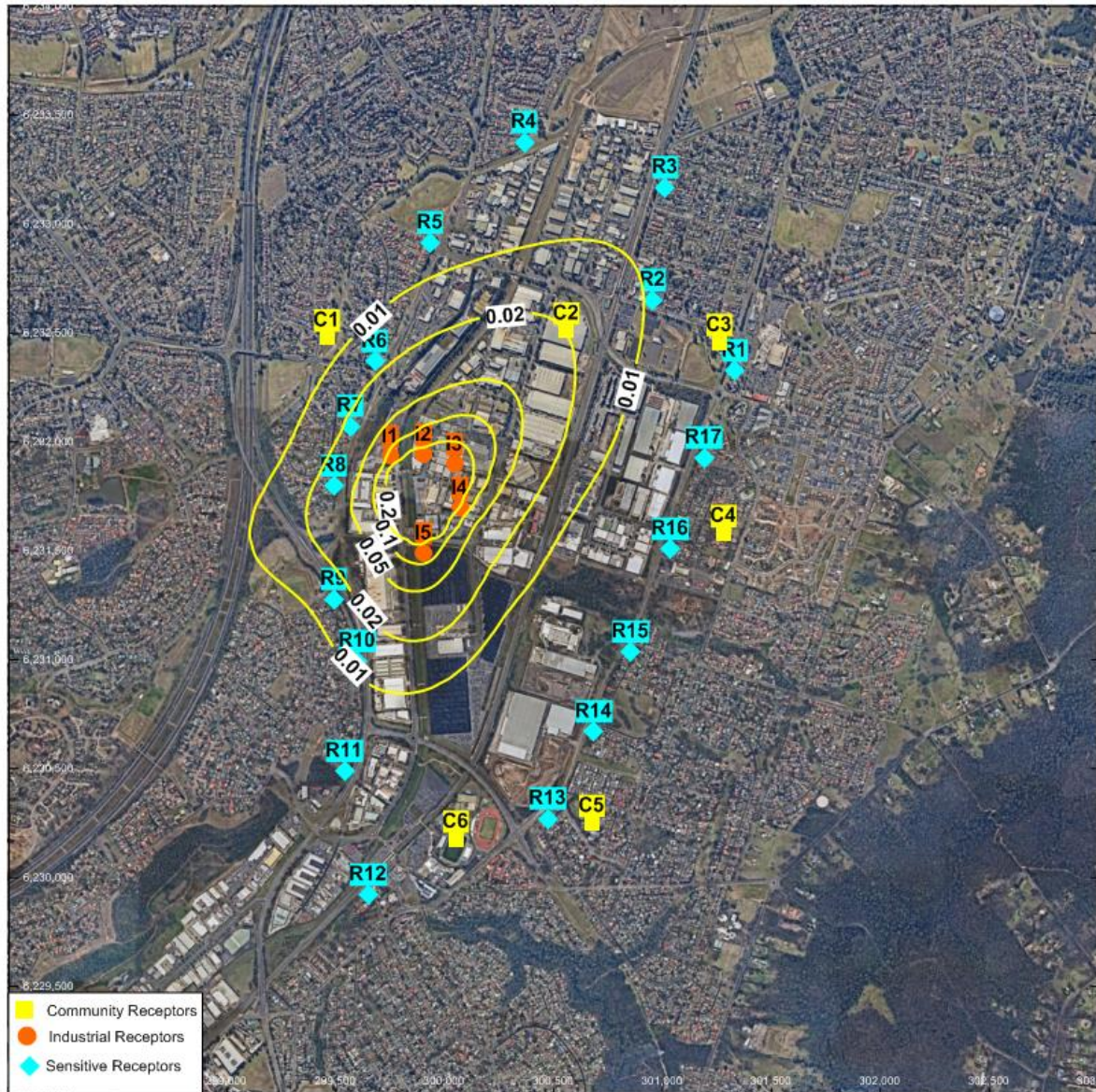
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Resource Recovery Facility - Minto Air Quality Impact Assessment			
Incremental Impact			
Pollutant	PM ₁₀	Averaging Period	24-Hour
Unit	µg/m ³		

Figure 17 Predicted Incremental Annual Average PM₁₀ Concentrations



◆ Community Receptors
◆ Industrial Receptors
◆ Sensitive Receptors


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 Air Quality Impact Assessment**

Incremental Impact			
Pollutant	PM ₁₀	Averaging Period	Annual

Unit	µg/m ³
------	-------------------

8.3.1 Sensitive Receptors

The modelling results indicate that the incremental annual average PM₁₀ concentration attributable to emissions from the Project Site is negligible (<0.1 µg/m³) at all surrounding sensitive receptors. The cumulative annual average PM₁₀ concentrations predicted at all surrounding sensitive receptor locations comply with the relevant ambient air quality criterion of 25 µg/m³.

The cumulative 24-hour average PM₁₀ concentrations predicted by the modelling at all surrounding sensitive receptors comply with the relevant criterion of 50 µg/m³. Receptors R7 and R8, located to the west of the Project Site, are predicted to be the worst impacted residential receptors with incremental and cumulative 24-hour average PM₁₀ concentrations of 0.2 µg/m³ and 49.4 µg/m³ respectively predicted at both locations.

A summary of contemporaneous 24-hour average PM₁₀ impact and background at R7 is presented in **Table 17**. This analysis shows that the incremental impact predicted due to emissions from the project site at R7 on days with a high background level is negligible, while the background level on days with the highest predicted increment is relatively low.

Table 17 Contemporaneous Impact and Background Analysis – Receptor R7

Date	PM ₁₀ 24 Hour Average (µg/m ³)			Date	PM ₁₀ 24 Hour Average (µg/m ³)		
	Highest Measured Background	Predicted Increment	Total		Background	Highest Predicted Increment	Total
18-02-1900	49.4	0.0	49.4	09-01-1900	9.8	0.2	10.0
07-02-1900	38.2	0.0	38.2	27-01-1900	27.4	0.2	27.6
05-02-1900	36.8	0.0	36.8	31-01-1900	31.3	0.1	31.4
05-02-1900	36.5	0.0	36.5	17-01-1900	17.6	0.1	17.7
04-02-1900	35.3	0.0	35.3	17-01-1900	17.7	0.1	17.8
CRITERIA			50				50

8.3.2 Industrial Receptors

The cumulative annual average PM₁₀ concentrations predicted at the industrial receptor locations comply with the relevant ambient air quality criterion of 25 µg/m³.

The results also show that the maximum predicted cumulative 24-hour average PM₁₀ concentrations comply with the ambient air quality criterion at all industrial receptor locations.

It is noted that these industrial receptors are located in close proximity of the site. As a result, given the close proximity to the emission sources within the model, it can be expected that the PM₁₀ concentrations predicted by CALPUFF at this location overestimate the levels that would be expected to occur in reality.

In addition, as noted in **Section 7**, the potential dust emissions from the site were estimated based on the daily maximum throughput and assumed that the Project Site will operate at the maximum daily capacity every day of the year, which will not be the case. Furthermore, all material handling activities at the site will be undertaken within the shed with a CoolMist system as a dust mitigation measure. However as a conservative approach no control factors for the CoolMist system were adopted in estimating the potential dust emissions. Therefore the estimated dust emissions used in this assessment are likely to be overestimated.

It is also noted, that as industrial sites, the relevant air quality criteria would be occupational exposure levels rather than ambient air quality criteria developed for the wider population. This is due to the fact that:

- As places of work, people would not be expected to be present at these locations for 24-hours a day; and
- The people present in these work places would not be expected to include the very young or elderly, which the ambient air quality criteria have been developed to protect.

Occupational exposure criteria for particulate matter vary depending upon the nature of the dust and contaminants present in the source material. The following substances have an exposure standard (8 hour average concentrations) set by Safe Work Australia based upon the respirable dust fraction:

- Quartz
- Cristobalite
- Tridymite
- Fumed Silica
- Coal dust (<5% silica)
- Soapstone

Dust generated by the proposed operations at the Project Site is not anticipated to contain appreciable quantities of any of the above contaminants. Where no specific exposure standard has been assigned and the substance is both of inherently low toxicity and free from toxic impurities, Safe Work Australia states that exposure to dusts should be maintained below 10 mg/m^3 (ie, $10,000 \text{ }\mu\text{g/m}^3$) measured as inhalable dust (8-hour TWA) (Safe Work Australia, 2012). The maximum 8-hour average PM_{10} concentrations predicted at the industrial receptors surrounding the Project Site are shown in **Table 18**. The predicted incremental concentrations are less than 0.1% of this guideline, hence it can be concluded there would be no potential for exceedances of the occupational exposure guideline for respirable dust at the surrounding industrial sites, even under conditions of elevated background levels.

Table 18 8-Hour Average PM_{10} Concentrations Predicted at Industrial Receptor Locations

Receptor ID	Incremental 8-Hour Average PM_{10} Concentration ($\mu\text{g/m}^3$)
I1	1.8
I2	4.2
I3	4.2
I4	3.3
I5	2.4
I6	1.8

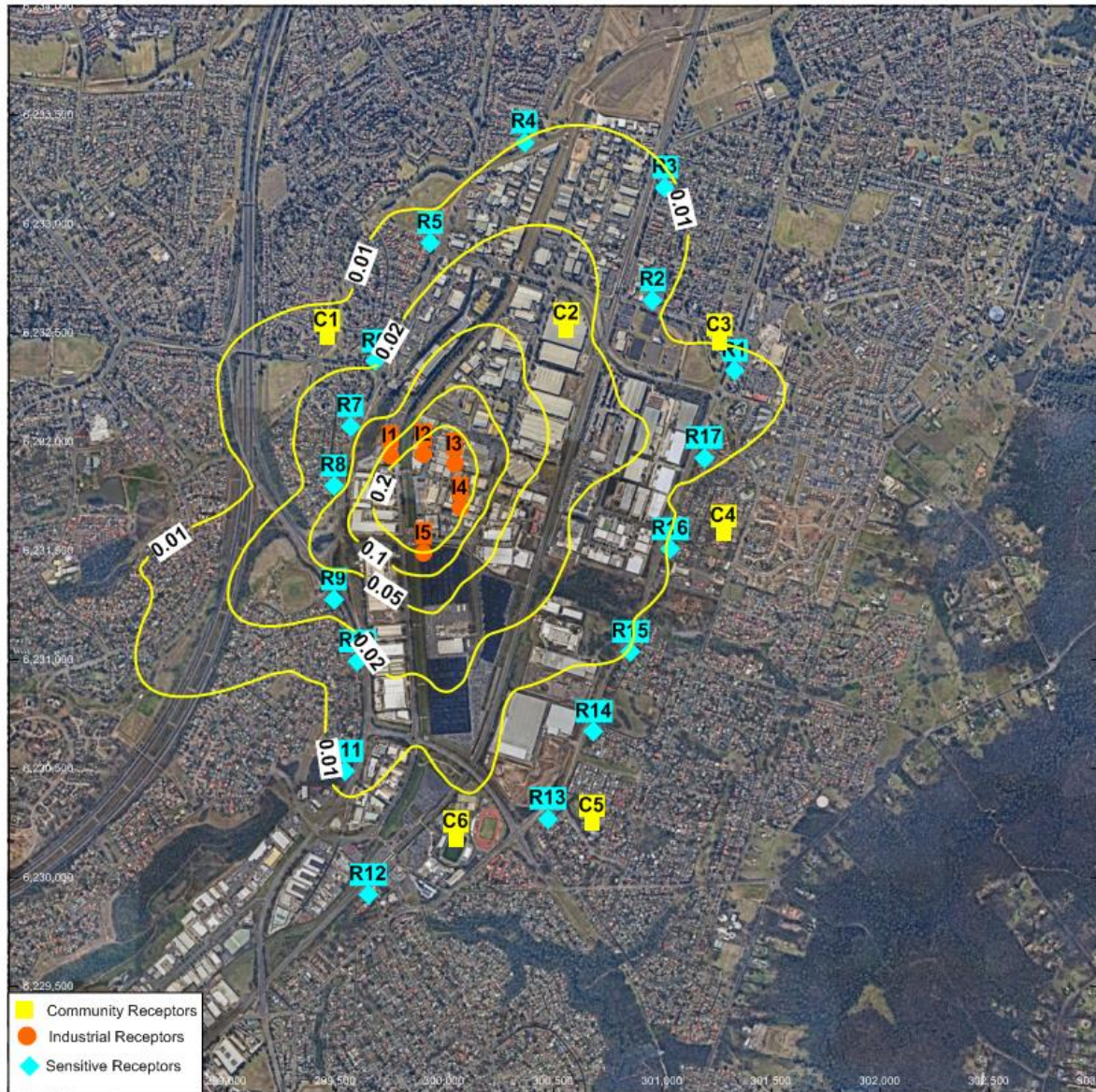
8.4 Particulate Matter <2.5 µg/m³ (PM_{2.5})

The maximum 24-hour and annual average incremental and cumulative PM_{2.5} concentrations predicted at the surrounding receptor locations are presented in **Table 19**. The predicted incremental and cumulative 24 hour and annual average PM_{2.5} concentrations are presented as contour plots in **Figure 18** and **Figure 19**.

Table 19 24-Hour and Annual Average PM_{2.5} Concentrations Predicted at Receptor Locations

Receptor ID	Receptor Type	Incremental PM _{2.5} (µg/m ³)		Cumulative PM _{2.5} (µg/m ³)	
		24-Hour Average	Annual Average	24-Hour Average	Annual Average
R1	Residential	0.01	<0.1	18.5	<6.4
R2	Residential	0.01	<0.1	18.5	<6.4
R3	Residential	0.01	<0.1	18.5	<6.4
R4	Residential	0.01	<0.1	18.5	<6.4
R5	Residential	0.01	<0.1	18.5	<6.4
R6	Residential	0.02	<0.1	18.5	<6.4
R7	Residential	0.04	<0.1	18.5	<6.4
R8	Residential	0.03	<0.1	18.5	<6.4
R9	Residential	0.03	<0.1	18.5	<6.4
R10	Residential	0.02	<0.1	18.5	<6.4
R11	Residential	0.01	<0.1	18.5	<6.4
R12	Residential	<0.01	<0.1	18.5	<6.4
R13	Residential	<0.01	<0.1	18.5	<6.4
R14	Residential	0.01	<0.1	18.5	<6.4
R15	Residential	0.01	<0.1	18.5	<6.4
R16	Residential	0.01	<0.1	18.5	<6.4
R17	Residential	0.01	<0.1	18.5	<6.4
Community					
C1	Community	0.01	<0.1	18.5	<6.4
C2	Community	0.03	<0.1	18.5	<6.4
C3	Community	0.01	<0.1	18.5	<6.4
C4	Community	0.01	<0.1	18.5	<6.4
C5	Community	<0.01	<0.1	18.5	<6.4
C6	Community	0.01	<0.1	18.5	<6.4
Industrial					
I1	Industrial	0.13	<0.1	18.5	<6.4
I2	Industrial	0.34	<0.1	18.5	<6.4
I3	Industrial	0.34	<0.1	18.5	<6.4
I4	Industrial	0.24	<0.1	18.5	<6.4
I5	Industrial	0.20	<0.1	18.5	<6.4
CRITERIA		-	-	25	8

Figure 18 Maximum Predicted Incremental 24 Hour Average PM_{2.5} Concentrations



■ Community Receptors
● Industrial Receptors
◆ Sensitive Receptors



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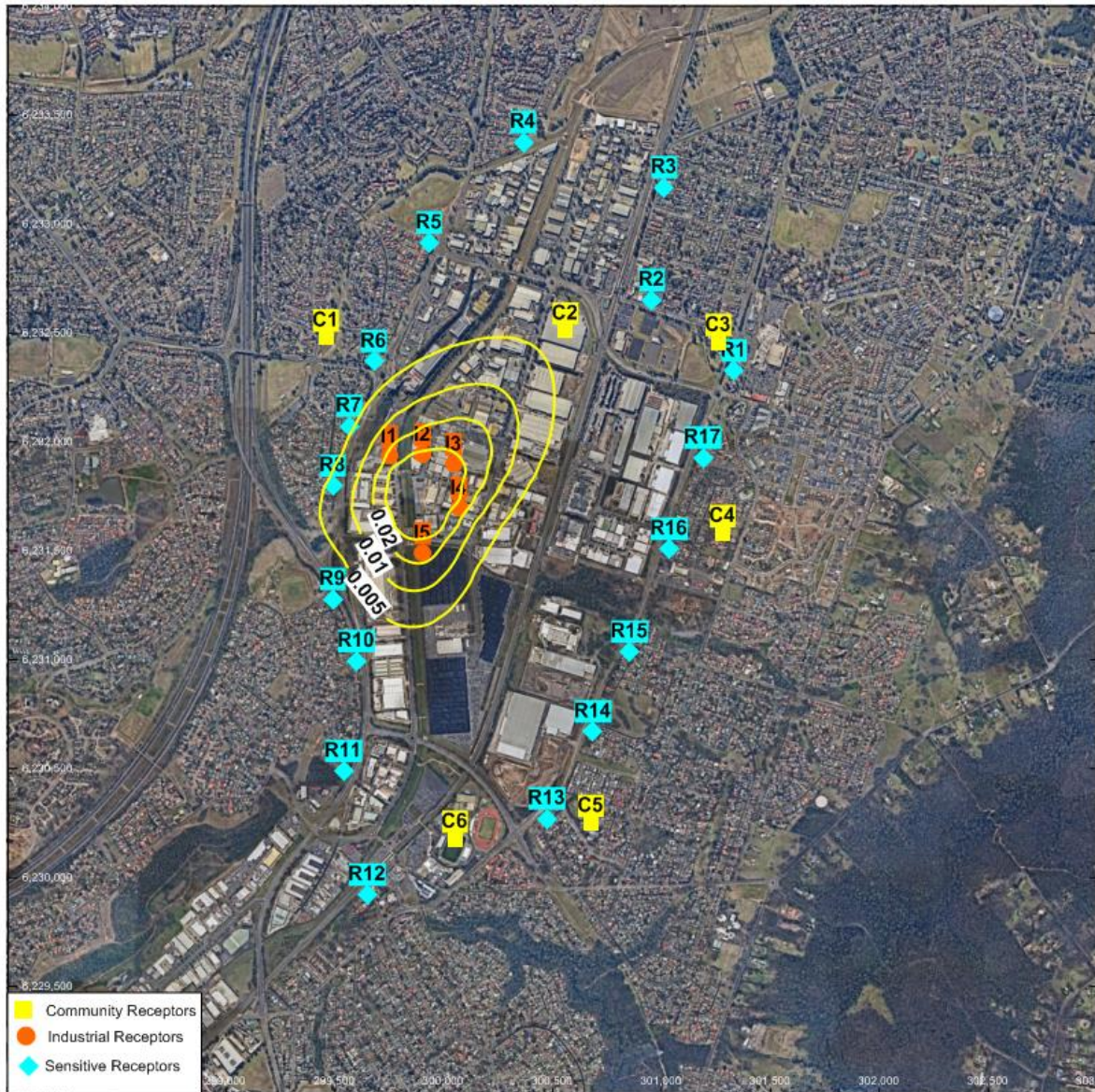
Project Number: 610.14692
 Dispersion Model: CALPUFF
 Modelling Period: 2012
 Projection: GDA 1994 MGA Zone 56
 Date: 17/03/2017



Resource Recovery Facility - Minto Air Quality Impact Assessment			
Incremental Impact			
Pollutant	PM _{2.5}	Averaging Period	24-Hour
Unit	µg/m ³		

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Figure 19 Predicted Incremental Annual Average PM_{2.5} Concentrations



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Project Number: 610.14692
 Dispersion Model: CALPUFF
 Modelling Period: 2012
 Projection: GDA 1994 MGA Zone 56
 Date: 17/03/2017



Resource Recovery Facility - Minto Air Quality Impact Assessment				
Incremental Impact				
Pollutant	PM _{2.5}	Averaging Period	Annual	Unit
				µg/m ³

The modelling results indicate that incremental annual average $PM_{2.5}$ concentrations predicted as a result of emissions from the Project Site are negligible ($<0.1 \mu\text{g}/\text{m}^3$) at all surrounding industrial and residential receptor locations. The cumulative annual average $PM_{2.5}$ concentrations predicted at all surrounding industrial and residential receptor locations comply with the relevant ambient air quality criterion of $8 \mu\text{g}/\text{m}^3$.

The cumulative 24-hour average $PM_{2.5}$ concentrations predicted at all surrounding industrial and residential receptors comply with the relevant criterion of $25 \mu\text{g}/\text{m}^3$. Among the residential receptors, Receptor R7, located to the west of the site, is predicted to be the worst-impacted receptor with incremental and cumulative 24-hour average $PM_{2.5}$ concentration of $0.04 \mu\text{g}/\text{m}^3$ and $18.5 \mu\text{g}/\text{m}^3$ predicted. Among the industrial receptors, Receptor I3 located to the east of the site is predicted to be the worst-impacted receptors with incremental and cumulative 24-hour average $PM_{2.5}$ concentrations of $0.34 \mu\text{g}/\text{m}^3$ and $18.5 \mu\text{g}/\text{m}^3$ predicted respectively.

8.5 Odour Impact Assessment

As noted earlier, odorous materials such as putrescible waste will not be accepted at the site. Any hidden putrescible waste later found in a waste delivery will be stored in vermin-proof containers for lawful off-site disposal as soon as possible.

Any green waste received at the site is sorted and transferred off site for processing. No green waste processing or decomposition will occur on site, hence there is no potential for significant odours to be generated from this waste stream.

Given the above, the site is unlikely to generate any significant odour. Given the very low potential for odour generation from the site activities, the potential for odour nuisance at surrounding sensitive receptors is concluded to be very low. The Proponent will be required undertake an odour impact assessment only if any odour is generated from the site during operation.

9 GREENHOUSE GAS ASSESSMENT

This assessment has also included a greenhouse gas (GHG) assessment, including:

- A quantitative assessment of the potential scope 1 and 2 greenhouse gas emissions of the development, and a qualitative assessment of the potential impacts of these emissions on the environment; and
- A detailed description of the measures that would be implemented on-site to ensure that the development is energy efficient.

The following outlines the calculation methodology, activity data and calculated GHG emissions associated with the Project.

9.1 Greenhouse Gas Emissions

Increased emissions of GHG are widely accepted to exert a warming influence on climate. Increasing concentrations of the long-lived GHG's (CO₂, CH₄, N₂O, halocarbons and SF₆) have led to a combined radiative forcing (RF) of +2.63 [\pm 0.26] Watts per square metre (W m⁻²) (IPCC 2007). A 9% increase in this RF since the publication of the Third Assessment Report of the IPCC (IPCC 2007) is the result of concentration changes since 1998 (IPCC 2007). The IPCC state that it is very likely that there has been a substantial anthropogenic (man-made) contribution to surface temperature increases in every continent except Antarctica since the middle of the 20th Century, although difficulties exist in the attribution of temperature changes on smaller than continental scales and on timescales of less than 50 years.

Scientists at the 2005 conference, 'Avoiding Dangerous Climate Change: Symposium on Stabilisation of Greenhouse Gases' concluded that at the level of 550 parts per million (ppm) CO₂ concentration, a 2°C increase in global mean temperature above present levels would be experienced, and that stabilisation at a concentration of 400 ppm would be necessary to avoid a 2°C warming. IPCC reports (IPCC 2007) have suggested that stabilising concentrations at 450 ppm by 2020 would only result in a 50% likelihood of limiting global warming to 2°C.

9.1.1 Emission Types

The Australian Government Department of the Environment (DoE) document, '*National Greenhouse Accounts Factors Workbook December 2014 Update*' (DoE, 2014) (hereafter the NGA Factors) defines two types of greenhouse gas emissions (see **Table 20**), termed *direct* and *indirect*. This assessment seeks to consider both the direct emissions and indirect emissions associated with the Project.

Table 20 Greenhouse Gas Emission Types

Emissions	Definition
Direct	Produced from sources within the boundary of an organisation and as a result of those organisation activities (e.g. consumption of diesel in on-site vehicles).
Indirect	Generated in the wider economy as a consequence of an organisations activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation (e.g. consumption of purchased electricity).

Note: Adapted from NGA Factors 2014

9.1.2 Emission Scopes

The NGA Factors identifies two ‘scopes’ of emissions for greenhouse gas accounting and reporting purposes as shown in **Table 21**.

Table 21 Greenhouse Gas Scopes

Scope	Definition
Scope 1	Direct (or point-source) emission factors give the kilograms of carbon dioxide equivalent (CO ₂ -e) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, on-site waste disposal, etc.). These factors are used to calculate scope 1 emissions.
Scope 2	Indirect emission factors are used to calculate scope 2 emissions from the generation of the electricity purchased and consumed by an organisation as kilograms of CO ₂ -e per unit of electricity consumed. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station.

Note: Adapted from NGA Factors 2014

A third scope of emissions – *Scope 3 Emissions* are also recognised in some greenhouse gas assessments. The *Greenhouse Gas Protocol (GHG Protocol)* (World Business Council for Sustainable Development 2004) defines Scope 3 emissions as “*other indirect GHG emissions*”:

“Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.”

Scope 3 emissions have been considered in this assessment for the transport of waste and recyclable materials to and from the site by contractors and transport of non-recyclable material from the site to landfill.

9.2 Assessment Methodology

This assessment considers Scopes 1, 2 and limited Scope 3 emissions from the operation of the Project site.

Potential fuel and electricity usage data for the proposed operation was not available at the time of this assessment. Fuel and electricity data used to estimate potential greenhouse gas emissions for a similar facility with identical throughput located at Mortdale was used to estimate the potential greenhouse gas emissions from the proposed operation (SLR, 2016).

9.2.1 Source Identification and Boundary Definition

The boundary for the project was determined to be the geographical boundary of the recycling transfer station site for Scope 1 and 2 emission sources. Scope 3 emissions associated with transport of material to and from site by non-company owned vehicles have also been included.

9.2.1.1 Emission Sources

The emission sources identified for the assessment are shown in **Table 22**.

Table 22 Scope 1 and 2 Emission Sources

Scope	Activity	Source
Scope 1	Facility operations	Consumption of diesel for stationary energy purposes ¹
Scope 2	Facility operations	Consumption of purchased electricity
Scope 3	Transport of recyclables to and from facility	Consumption of diesel for transport energy purposes by other vehicles ¹
	Transport of residual waste material to landfill	Consumption of diesel for transport energy purposes ¹

1. Stationary purposes include machinery and vehicles which by law cannot drive on the road or are not typically road-registered. Transport purposes include machinery and vehicles which by law can drive on the road.

9.2.2 Quantitative Assessment

The quantitative assessment of GHG emissions has used the source data and emissions factors as outlined in **Section 9.3** to determine the overall emissions for each source.

9.3 Source Data and Emission Factors

9.3.1 Source Data

The source data for each activity was calculated based on data from a similar facility with identical throughput located at Mortdale. Emissions for each source were determined by estimating potential fuel usage from a number of key activities as outlined in **Section 9.2.1.1**.

9.3.1.1 On-Site Plant and Equipment (Diesel)

Based on information from a similar facility, the annual diesel consumption by on-site equipment is anticipated to be 182,078 L per annum for the proposed onsite operation.

9.3.1.2 Electricity Consumption

The source data for annual electricity consumption during operations is shown in **Table 23**. This consumption rate has been estimated based on an annual daily use of 335.14 kWh as reported at a similar facility.

Table 23 Electricity Consumption Source Data

Facility	Source	Quantity
Transfer Station	Electricity	122,325 kWh/annum

9.3.1.3 Transport of Materials (Diesel – Scope 3)

Based on data from a similar facility, the estimated annual fuel consumption used by trucks transporting waste and recycling materials to and from site will increase to 266,506 L following the upgrade.

9.3.2 Aggregated Source Data

The aggregated estimates for source data are shown in **Table 24**.

Table 24 Aggregated Source Data – Proposed Operations

Scope	Source	Quantity	Unit
Scope 1	Stationary Diesel	182.08	kL
Scope 2	Electricity	122,325	kWh
Scope 3	Transport Diesel	266.5	kL

9.4 Emission Factors

Emissions factors used for calculation of emissions associated with operation of the Project were taken from the NGA Factors (2014) (**Table 25**).

Table 25 Emission Factors

Scope	Source	Emissions factor	Energy Content Factor ²
Scope 1	Diesel fuel for stationary energy purposes	69.5 kg CO ₂ -e /GJ	38.6 GJ/kL
Scope 2	Electricity (NSW)	0.86 kg CO ₂ -e/kWh	N/A
Scope 3	Diesel fuel for transport energy purposes	69.9 kg CO ₂ -e /GJ	38.6 GJ/kL

1. Stationary purposes include machinery and vehicles which by law cannot drive on the road or are not typically road-registered. Transport purposes include machinery and vehicles which by law can drive on the road.
2. n/a – not applicable

9.5 Greenhouse Gas Assessment

This assessment presents estimated annual GHG emissions for the operation of the Project. Calculated emissions are presented in **Table 26**.

Table 26 Annual Project GHG Emissions – Proposed Operations

	Quantity	Unit	Emissions (t CO ₂ -e / yr)
Scope1			
Stationary Diesel	182.08	kL	488
Scope 2			
Electricity	122,325	kWh	105
Scope 3			
Transport Diesel	266.5	kL	719
Total			1,313

The total estimated annual operational GHG emissions for the Project are 1,313 t CO₂-e per year. The NSW OEH has published the NSW state emissions profile for 2012/13 as 141.8 million t CO₂-e. Therefore in the NSW state context the Project represents approximately 0.0009% of the total state emissions, which is a negligible contribution.

10 MITIGATION AND MANAGEMENT MEASURES

10.1 Air Quality

The following mitigation and management measures will be implemented at the site to minimise off-site air quality impacts:

- A CoolMist fogging system will be installed in the shed. This system pressurises water through nozzles designed to produce fine water droplets that encapsulate and suppress dust particles present in the atmosphere, so that they settle out of the air.
- Water sprays will be used to dampen dusty materials as they are moved around the site and loaded into bins and also to minimise emissions from on-site stockpiles, supported by the use of hand-held hoses.
- Paved roadways, hard stand areas and driveways will be kept clean by use of the onsite sweeper and dampened using hoses as required to prevent dust from the vehicle movements.
- Hand held hoses will also be used in areas not controlled by the sprinkler system.
- The site supervisor has the authority to cease operations if weather conditions have a major negative impact on the operation.
- A general vehicle speed limit of 5 km/hr will be imposed across all areas of the site.
- All vehicles are checked for mud and soil on tyres prior to leaving site and where mud or soil is detected on the entrance road (i.e. "track out"), staff will be deployed to sweep the road.
- All on-site, fixed and mobile diesel powered plant (excluding road vehicles) will be maintained in accordance with the manufacturers' specifications.
- Trucks will remain covered until waste removal (unloading).
- A wind anemometer will be located on site to monitor wind strength and direction.
- An Operational Environment Management Plan (OEMP) will be developed for site which will assign roles and responsibilities for the management of environmental issues, including air quality. The OEMP will cover issues such as dust suppression and will outline the mitigation measures to be implemented to minimise the generation of air pollutants, including the measures outlined above.

10.2 Greenhouse Gases

The following mitigation and management measures will be implemented at the site to minimise greenhouse gas emissions:

- Energy efficiency options relating to mobile plant and equipment will minimise GHG emissions attributable to the site operations. The use of diesel fuel can be minimised through good engine maintenance practices as listed above for local air quality and by reducing idling times of trucks.
- Use of energy-efficient lighting and energy-efficient appliances in the site office spaces.
- Garden waste materials received on site (ie. low volumes contained in skip bins from household clean up or demolition sites) are picked and stored separately, then transported off site to a local facility for recycling (ie. mulched, chipped and/or composted). The diversion of organic residues from landfill prevents the emission of greenhouse gases in the order of 900-1,300 kg CO₂-equivalents per tonne of garden or food organics landfilled (Compost Victoria, 2010).

11 CONCLUSIONS

Particulate emissions from the proposed operation were estimated using relevant NPI or USEPA AP42 emission factors/equations. In the absence of site-specific data, a number of conservative assumptions were used in estimating the emissions to provide a worst case emissions scenario. Short-term (24-hour) suspended particulate concentrations were predicted for the proposed operations based on modelling the peak daily emission rates (calculated based on the proposed maximum daily throughput) for every day of the 1-year site-representative meteorological dataset. This approach means that the predicted downwind concentrations are representative of the impacts that could occur for worst-case level of emissions under the worst-case meteorological conditions, and will therefore provide a conservative assessment of potential off-site short-term (24-hour) impacts.

The modelling results indicated the following:

- Maximum 24-hour average cumulative (i.e. including background) PM_{2.5} concentrations predicted at surrounding sensitive receptor locations are below the relevant ambient air quality criterion of 25 µg/m³.
- Annual average cumulative PM_{2.5} concentrations predicted as a result of the proposed operation at surrounding sensitive receptor locations are also very low and well below the relevant ambient air quality criterion of 8 µg/m³.
- Maximum 24-hour average cumulative PM₁₀ concentrations predicted at surrounding sensitive receptor locations are below the relevant ambient air quality criterion of 50 µg/m³, when a contemporaneous maximum background and increment analysis is performed.
- Annual average cumulative PM₁₀ concentrations predicted as a result of the proposed operation are very low at all locations downwind and well below the relevant ambient air quality criterion of 25 µg/m³.
- Annual average cumulative dust deposition levels predicted as a result of the proposed operation are also very low at all locations downwind and well below the relevant ambient air quality criterion of 4 g/m²/month.

The modelling study also included the prediction of particulate concentrations at neighbouring industrial sites. These modelling results have shown that the predicted TSP and dust deposition rates, which would indicate the potential for nuisance impacts are below the relevant criteria at the locations assessed. Maximum 24-hour and annual average PM₁₀ and PM_{2.5} concentrations were also predicted to be below the relevant criteria.

In addition, the potential dust emissions from the site were estimated based on the daily maximum throughput and assumed that the Project Site will operate at the maximum daily capacity every day of the year, which will not be the case. Furthermore, all material handling activities at the site will be undertaken within the shed with a CoolMist dust control system as a dust mitigation measure. However as a conservative approach no control factors for the CoolMist system was adopted in estimating the potential dust emissions. Therefore the estimated dust emissions used in this assessment are likely to be overestimated.

The GHG assessment has been conducted with conservative operational data and annual Scope 1, Scope 2 and limited Scope 3 GHG emissions have been calculated. The total annual GHG emissions for the Project are estimated to be 1,313 tCO₂-e per year. A comparison of the estimated annual Scope 1 GHG emissions from the Project against recently published net total GHG emissions for NSW was performed, which showed that they represent approximately 0.0009% of total NSW 2010 emissions, which is considered negligible.

12 REFERENCES

- NPI 2011, *National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 2.3*, Department of Sustainability, Environment, Water, Population and Communities.
- NSW EPA 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, 2017, Environment Protection Agency NSW, January 2017.
-
- SLR 2016, *Air Quality Impact Assessment, Resource Recovery Facility – Mortdale*, Report Number 610.14692-R2, 3 May 2016.
- TAPM 2008, *TAPM v4 User Manual*, CSIRO Marine and Atmospheric Research Internal Report No.5, Peter Hurley, October 2008.
- Compost Victoria, *Soil Carbon Sequestration in Victoria, Enquiry by the Environment and Natural Resources Committee, Submission by Compost Victoria*, 14 February 2010.

13 GLOSSARY

air dispersion model	A computer-based software program which provides a mathematical prediction of how pollutants from a source will be distributed in the surrounding area under specific conditions of wind, temperature, humidity and other environmental factors
ambient	Pertaining to the surrounding environment or prevailing conditions
atmosphere	A gaseous mass surrounding the planet Earth that is retained by Earth's gravity. It is divided into five layers. Most of the weather and clouds are found in the first layer
atmospheric stability	The tendency of the atmosphere to resist or enhance vertical motion
atmospheric pressure	The force per unit area exerted against a surface by the weight of air above that surface in the Earth's atmosphere
background	The existing air quality in the Project area excluding the impacts from the proposed development
CALMET	A meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain
CALPOST	A post-processor used to process CALPUFF files, producing tabulations that summarize results of the simulation for user-selected averaging periods
CALPUFF	A transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes
dust deposition	Settling of particulate matter out of the air through gravitational effects (dry deposition) and scavenging by rain and snow (wet deposition)
dispersion	The spreading and dilution of substances emitted in a medium (e.g. air or water) through turbulence and mixing effects
diurnal	Relating to or occurring in a 24-hour period; daily
downwind	The direction in which the wind is blowing
emission factor	A measure of the amount of a specific pollutant or material emitted by a specific process, fuel, equipment, or source based on activity data such as the quantity of fuel burnt, hours of operation or quantity of raw material consumed.
emissions inventory	A database that lists, by source, the amount of air pollutants discharged into the atmosphere from a facility over a set period of time (e.g. per annum, per hour)
fugitive emissions	Pollutants which escape from an industrial process due to leakage, materials handling, transfer, or storage
guideline	A general rule, principle, or piece of advice. A statement or other indication of policy or procedure by which to determine a course of action.
meteorological	The science that deals with the phenomena of the atmosphere, especially weather and weather conditions
mixing height	The height to which the lower atmosphere will undergo mechanical or turbulent mixing, producing a nearly homogeneous air mass
modelling domain	The area over which the model is making predictions
particulate	Of, relating to, or formed of minute separate particles. A minute separate particle, as of a granular substance or powder
plume	A space in air, water, or soil containing pollutants released from a source
pollutant	A substance or energy introduced into the environment that has undesired effects,

	or adversely affects the usefulness of a resource
prognostic	A prediction of the value of variables for some time in the future on the basis of the values at the current or previous times
receptor	Coordinate locations specified in an air dispersion model where ground level pollutant concentrations are calculated by the model
sensitive receptor	Locations such as residential dwellings, hospitals, churches, schools, recreation areas etc where people (particularly the young and elderly) may often be present, or locations with sensitive vegetation and crops.
spatial variation	Pertaining to variations across an area
synoptic meteorological data	A surface weather observation, made at periodic times (usually at 3-hourly and 6-hourly intervals), of sky cover, state of the sky, cloud height, atmospheric pressure reduced to sea level, temperature, dew point, wind speed and direction, amount of precipitation, hydrometeors and lithometeors, and special phenomena that prevail at the time of the observation or have been observed since the previous specified observation
temporal variation	Pertaining to variations with time
topography	Detailed mapping or charting of the features of a relatively small area, district, or locality
wind direction	The direction from which the wind is blowing
wind erosion	Detachment and transportation of loose topsoil or sand due to action by the wind
wind rose	A meteorological diagram depicting the distribution of wind direction and speed at a location over a period of time

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 2004).

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 2011-2014 at the nearest BOM station (Camden Airport AWS [station number 68192]) were analysed to select a representative year for dispersion modelling. The analysis showed that data collected during the 2014 calendar year are in reasonably good agreement with long term averages compared to other years and was therefore selected for use in this assessment.

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 known 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 below.

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

Table A-1 details the parameters used in the TAPM meteorological modelling.

Table A-1 Meteorological Parameters used for this Study (TAPM v 4.0.4)

Modelling Period	1 January 2014 to 31 December 2014
Centre of analysis	301,512 mE 6,232,063 mN (UTM Coordinates)
Number of grid points	25 x 25 x 35
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Camden Airport AWS (Station # 68192)
Terrain	AUSLIG 9 second DEM

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. The final wind field thus 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 A-2** details the parameters used in the CALMET meteorological modelling.

Table A-2 CALMET Configuration Used for this Study

Modelling Period	1 January 2014 to 31 December 2014
Centre of analysis (SW corner)	295,528 mE 6,225,631 mN (UTM Coordinates)
Meteorological grid domain	10 km x 10 km
Meteorological grid resolution	100 m
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	TAPM – 3D upper air data