Appendix 7

Air Quality Impact Assessment

CONCRETE RECYCLERS

AIR QUALITY IMPACT ASSESSMENT

A C O U S T I C S A N D A I R

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PREPARED FOR

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50 YEARS 1962–2012

TABLE OF CONTENTS

GLOSSARY OF AIR QUALITY TERMS

Air Pollution – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare or produce other harmful environmental effects.

Air Quality Standards – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Air Toxics – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

Airborne Particulates – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

Area Source – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

Concentration – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

Emission – Release of pollutants into the air from a source. We say sources emit pollutants.

Emission Factor – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

Emission Inventory – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

Flow Rate – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

Fugitive Emissions – Emissions not caught by a capture system.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (H_2S) – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

Inhalable Particles – All dust capable of entering the human respiratory tract.

Nitric Oxide (NO) – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

Nitrogen Dioxide (NO_2) – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Nitrogen Oxides (NO_x) – A criteria air polluant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

Mobile Sources – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

Particulates; Particulate Matter (PM-10) – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Parts Per Billion (ppb)/Parts Per Million (ppm) – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

PM10/PM2.5 – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Scrubber – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

Source – Any place or object from which pollutants are released.

Stack – A chimney, smokestack, or vertical pipe that discharges used air.

Stationary Source – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

Temperature Inversion – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

1 INTRODUCTION

Camolaw Pty Ltd proposes to construct and operate a materials recycling facility at 7 Montore Road, Minto. The site is located within an existing industrial area.

The general operation of the site will consist of raw material deliveries (building waste and sand) following by crushing, screening, washing as required and then stockpiling of the different grades of product. The finished product will then be loaded on to trucks and transported off site.

Wilkinson Murray Pty Limited has been engaged to prepare an Air Quality Impact Assessment (AQIA) for the Proposal. This AQIA has been conducted in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

This report is structured to allow the reader to understand predicted air quality impacts from the proposed development by:

- Reviewing the local meteorology and ambient air quality for the Site;
- Identifying the dust generating activities and quantifying the emissions from the development;
- Developing an air dispersion model for the site;
- Calculating suspended particulates levels for the proposal at the sensitive receivers; and
- Providing an interpretation of the calculated suspended particulates and dust deposition levels to establish potential impacts at sensitive receivers.

2 SITE DESCRIPTION

2.1 Site Location

The site is located on the eastern side of Bow Bowing Creek with the closest residences located approximately 280 metres to the west in St Andrews on the other side of Campbelltown Road. Figure 2-1 shows the location of the site.

The local topography is relatively flat with the surrounding land use being predominantly industrial. Five residential properties and three industrial receivers have been identified surrounding the proposed site and each of these has been specified as discrete receptors in the dispersion model to allow specific model predictions to be made at each receptor. The residences located approximately 300 metres to the west of the site have their back yards facing Campbelltown Road with a vegetation industrial buffer between the site and the residences.

Figure 2-1 Aerial of Site

2.2 Surrounding Land Use and Sensitive Receptors

2.3 Project Description

The proposed site layout is shown in Figure 2-2. The crusher and screen are located in a shed towards the northern boundary of the site and the sand washing plant the proposed site layout is shown in Figure 2-3. The crusher and screen are located in a shed towards the northern boundary of the site and the sand washing plant, also within a smaller shed, is located on the southern end of the site. A pugmill will also be located on the western boundary.

The proposed resource recovery facility is intended to crush and process building waste material and wash sand. The site will have a total capacity of 450,000 tonnes per annum. The proposed facility will receive concrete, brick, asphalt, sandstone and sand from the building and construction industry.

Waste material would be delivered to the Site by truck, usually with an average capacity of 16 tonnes. Product from the Site will be transported in vehicles of average capacity of 20 tonnes.

Incoming trucks would stop at a receival point where the load would be inspected to ensure loads comply with the materials that the facility is licensed to receive pursuant to the Environment Protection Licence. If accepted, the drive would be instructed to proceed to the weighbridge office where a docket would be issued. After the material is tipped, the loaded spreads it for further inspection. If contamination is found, the material is reloaded to the truck and the driver would be instructed to turn around and leave the Site.

Once a docket is issued, the truck driver would be directed to a designated stockpile depending on the type of waste the truck is carrying. The load would be tipped, and the ruck would leave the Site via the wheel wash.

A wheel loaded would push the deposited waste up into the main stockpile awaiting processing.

If waste received is too large for the primary crusher, it would be broken down in size using a mechanical pulveriser fitted to an excavator or a hydraulic rock breaker prior to loading into the primary crusher.

Sprinkler systems would be utilised to dampen the waste material in order to control dust.

The site layout plan is shown in Figure 2-2.

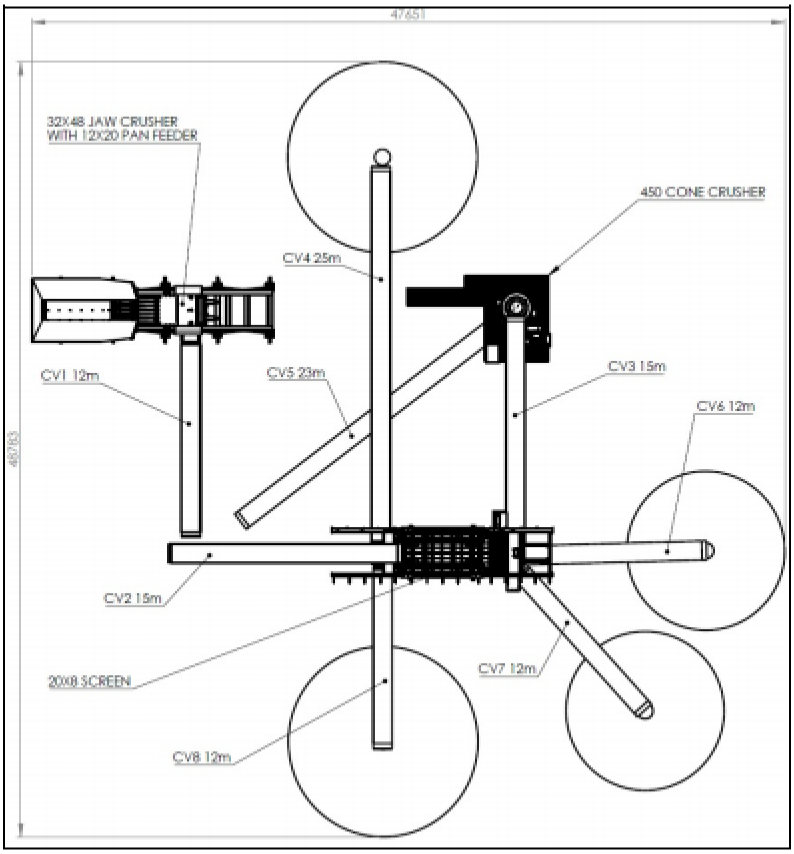
Figure 2-2 Site Layout

2.3.1 Concrete and Brick Crushing Plant

The crushing plant is made up of a number of components. A layout plan of the crushing plant is shown in Figure 2-3.

The primary crusher would be contained within a purpose-built building, approximately 11 metres high. The crushing plant would be controlled by an employee in a control room on the primary crusher.

Figure 2-3 General Layout of Crushing Plant



Primary (Jaw) Crusher

The demolition bricks and concrete are loaded into a hopper by a hydraulic excavator. The hopper conveys this material into the primary crusher with the use of a vibrating grizzly feeder. The grizzly feeder separates the fine material from the material stream by circulating the bricks and concrete in an elliptical movement over the top of bars spaced with a 75 mm opening which lets fine material fall onto the conveyor below, thereby by-passing the jaw crusher and lowering the energy provided.

The primary crusher is designed the crush the incoming material down to a nominal 0-100 mm product before downstream processing.

The jaw crusher reduces large size rocks by placing the rock under compression. A fixed jaw, mounted in a "V" alignment, is the stationary breaking surface, while the swinging jaw exerts force on the rock by forcing it against the stationary plate. The swinging jaw is moved by an eccentric shaft which spins at low rpm with large counterweights to compress the rocks.

The space at the bottom of the jaw plates is the crusher product gap size. The rock remains in the jaws until is crushed small enough to pass through the gap at the bottom of the jaws.

Figure 2-4 shows the operation of a typical jaw crusher.

Figure 2-4 Typical Jaw Crusher Operation

Overband Magnet

The crushed material is transferred by the first in a series of conveyors to the primary magnet. The magnet lifts the steel reinforcing off the conveyor, and with the use of a suspended conveyor, moved the steel to a chute for stockpiling of the steel.

Figure 2-5 shows a typical overband magnet.

Figure 2-5 Overband Magnet

Screening of Crushed Material

A screen is used to separate the fines it large and small sized fractions.

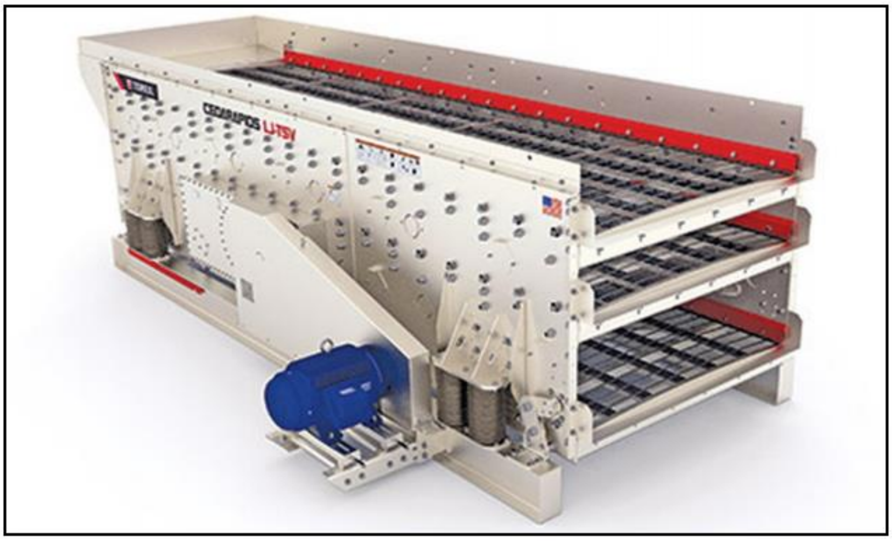
The screening machine consists of an eccentric drive which induces vibration. Three separate sets of screening media of reducing aperture cause particle separation. A deck holds the screening media.

Depending upon the setup of the crushing plant, the screen can separate the materials into four different fractions with the largest material returning to the plant for further crushing and the material passing through the screening media making sand, 10 mm aggregate and 20 mm aggregate.

To make road base, the sand and aggregates are mixed back together before being discharged to a stockpile.

Figure 2-6 shows the typical type of screening device to be utilised in the proposed development.

Figure 2-6 Screening Device



Secondary (Cone) Crusher

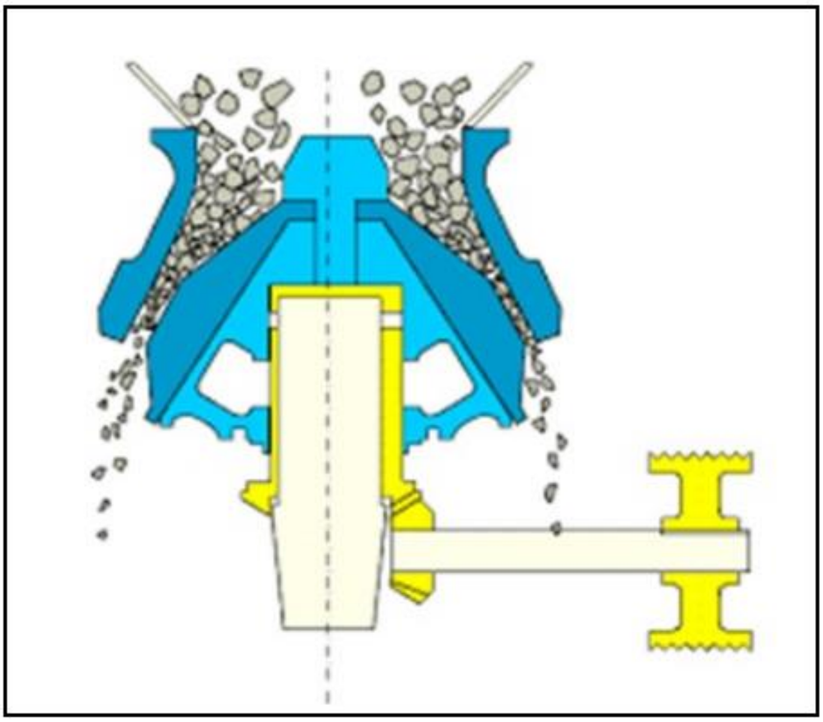
The oversize material from the screening process is conveyed to the secondary cone crusher, a diagram of which is shown in Figure 2-7.

The cone crusher reduces the fee material size by means of pressure. The adjustable gap width can be carried by a hydraulic piston, which is located in the lower part of the housing. The upper section of the housing accommodates the wedge-shaped crushing liner. The crusher drive is situated between these two sections. The crushing force is produced by an eccentric bush, which moves the crushing cone towards the crushing shell in a circular oscillating motion.

The variation of the gap width and resulting crushed product size is performed by the hydraulic piston.

After crushing by the cone crusher, the material is again conveyed to the vibrating screen to continue until is passes the aperture size in the "closed loop" crushing process.

Figure 2-7 Cone Crusher Configuration



3 AIR QUALITY CRITERIA

3.1 Introduction

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the Approved Methods) sets out applicable impact assessment criteria for a number of air pollutants. Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the pollutants of interest in this study and the application air quality criteria for each pollutant.

3.2 Pollutants of Interest

Potential air pollutants associated with the Project comprise dust and particulate matter. Specifically, the following pollutants are identified:

- Total Suspended Particulates (TSP);
- Particulate Matter (PM_{10} and $PM_{2.5}$); and
- Respirable crystalline silica (RCS).

3.3 Impact Assessment Criteria

The EPA Approved Methods specifies air quality assessment criteria for assessing impacts from dust generating activities. These criteria are consistent with the National Environment Protection Measures for Ambient Air Quality (NEPC, 1998).

Table 3-1 summarises the air quality goals for dust and particulate matter that are relevant to this study. The air quality goals relate to the total concentrations of dust and particulate matter in the air and not just that from the project. Therefore, some consideration of background levels needs to be made when using these goals to assess impacts.

Table 3-1 Impact Assessment Criteria – Dust and Particulate Matter

Pollutant	Averaging period	Impact	Criteria
Total suspended particulates (TSP)	Annual	Total	90 µg/m³
Particulate matter ≤10 µm (PM_{10})	Annual	Total	25 µg/m³
	24-hour	Total	50 µg/m³
Particulate matter ≤2.5 µm ($PM_{2.5}$)	Annual	Total	8 µg/m³
	24-hour	Total	25 µg/m³

The Approved Methods does not include impact assessment criteria for RCS. Accordingly, goals from the Victoria Environmental Protection Agency (Vic EPA) have been adopted for this study. The Vic EPA criterion for RCS is presented in Table 3-2.

Table 3-2 Impact Assessment Criterion – Respirable Crystalline Silica

Pollutant	Averaging period	Impact	Criteria
Respirable crystalline silica (as $PM_{2.5}$)	Annual	Total	3 µg/m³

4 EXISTING ENVIRONMENT

4.1 Local Meteorology

Meteorological conditions strongly influence air quality. Most significantly, wind speed, wind direction, temperature, relative humidity, and rainfall affect the dispersion of air pollutants, and are key inputs into dispersion models. The following sub-sections discuss the local meteorology near the Proposal site and identify a representative set of meteorological data for use in the dispersion modelling to be undertaken for this assessment.

4.1.1 Long-Term Climate

Long-term meteorological data for the area surrounding the site is available from the Camden Airport automatic weather station (AWS) operated by the Bureau of Meteorology (BoM) since 1943. The Camden Airport AWS is located approximately 13 km west of the Proposal site.

Long-term climate statistics are presented in Table 4-1. Temperature data recorded at the Camden Airport AWS indicates that January is the hottest month of the year, with a mean daily maximum temperature of 29.7°C. July is the coolest month with a mean daily minimum temperature of 2.9°C. February is the wettest month with an average rainfall of 97 mm falling over 5 days. There are, on average, 48 rain days per year, delivering 782 mm of rain.

Table 4-1 Climate Averages for Camden Airport AWS

Obs.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9am Mean Observations													
Temp (°C)	21.6	20.9	19.6	16.9	13.0	9.6	8.6	10.7	14.6	17.7	18.7	20.9	16.1
Hum (%)	72	78	77	77	81	82	81	73	66	64	69	68	74
3pm Mean Observations													
Temp (°C)	27.7	26.9	25.4	22.5	19.3	16.5	16.0	17.7	20.3	22.4	24.3	26.8	22.2
Hum (%)	49	52	52	52	52	53	50	43	44	47	50	46	49
Daily Minimum and Maximum Temperatures													
Min (°C)	16.9	16.8	14.9	11.1	7.0	4.6	2.9	3.9	6.8	10.0	13.0	15.3	10.3
Max (°C)	29.7	28.7	26.8	23.9	20.7	17.7	17.4	19.1	22.0	24.3	26.3	28.6	23.8
Rainfall													
Rain (mm)	79.8	97.3	89.6	67.1	53.0	66.6	35.5	40.7	38.3	61.8	75.4	57.9	782.1
Rain (days)	4.8	4.9	4.7	4.1	3.5	3.5	2.9	2.9	3.2	4.2	4.7	4.3	47.7

4.1.2 Wind

Figure 4-1 to Figure 4-5 present annual and seasonal "wind rose" plots for the Campbelltown West OEH meteorological station for the period 2014 to 2018, inclusive. The plots show similar patterns of wind speed and wind direction over the five-year period, with north-easterly winds being somewhat prevalent in summer and spring, south westerly winds being prevalent all year round. Wind speed and wind direction during 2017 are generally representative of the five-year period and have therefore been adopted for assessment purposes.

Figure 4-1 OEH Campbelltown West Wind Roses, 2014

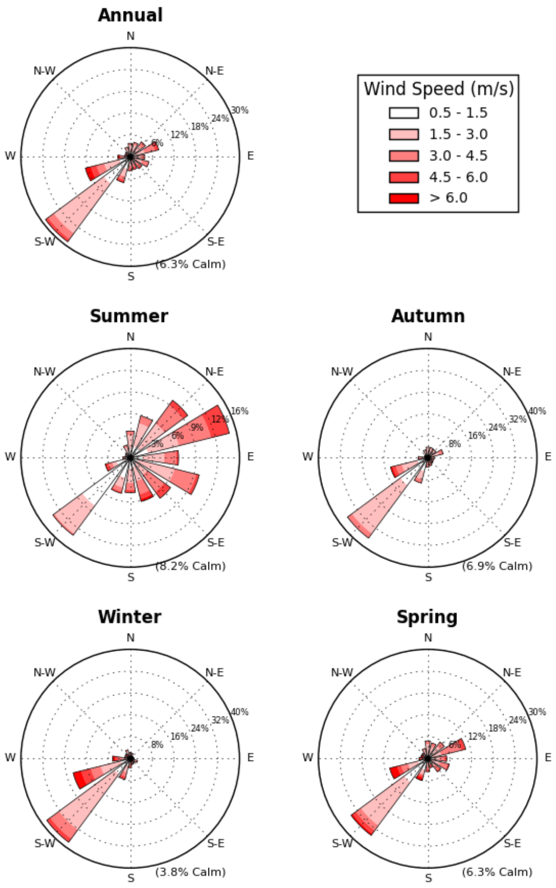


Figure 4-2 OEH Campbelltown West Wind Roses, 2015

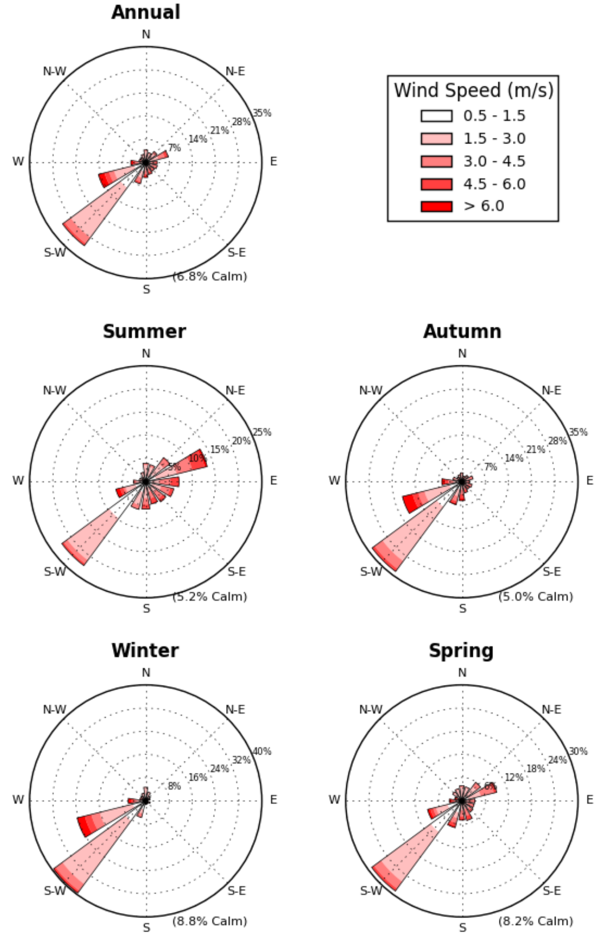


Figure 4-3 OEH Campbelltown West Wind Roses, 2016

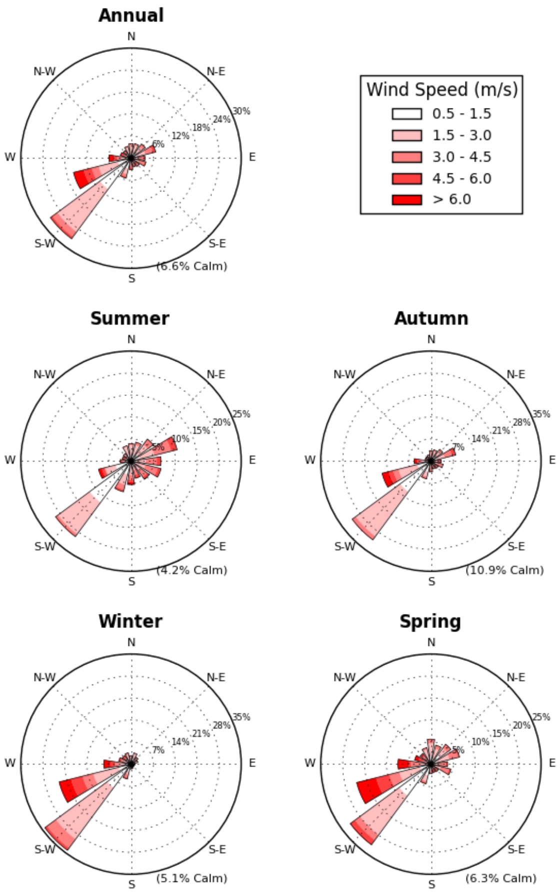


Figure 4-4 OEH Campbelltown West Wind Roses, 2017

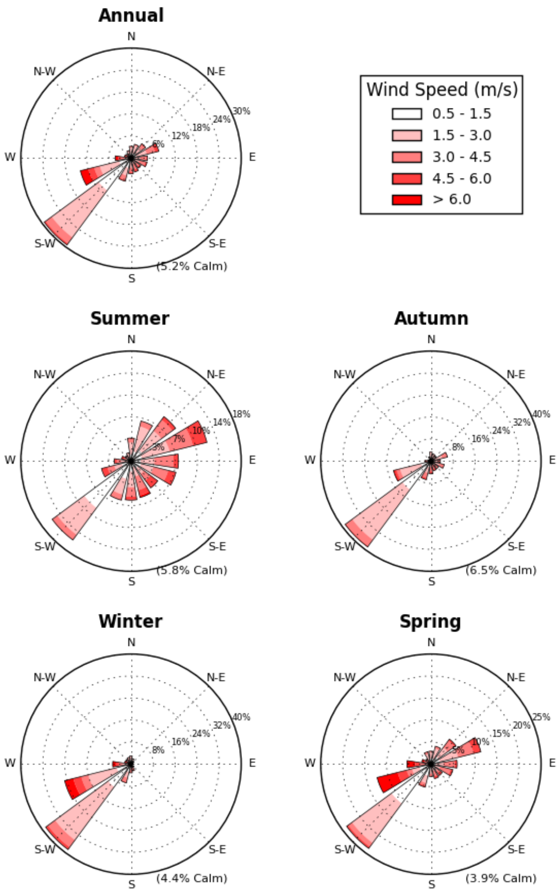


Figure 4-5 OEH Campbelltown West Wind Roses, 2018

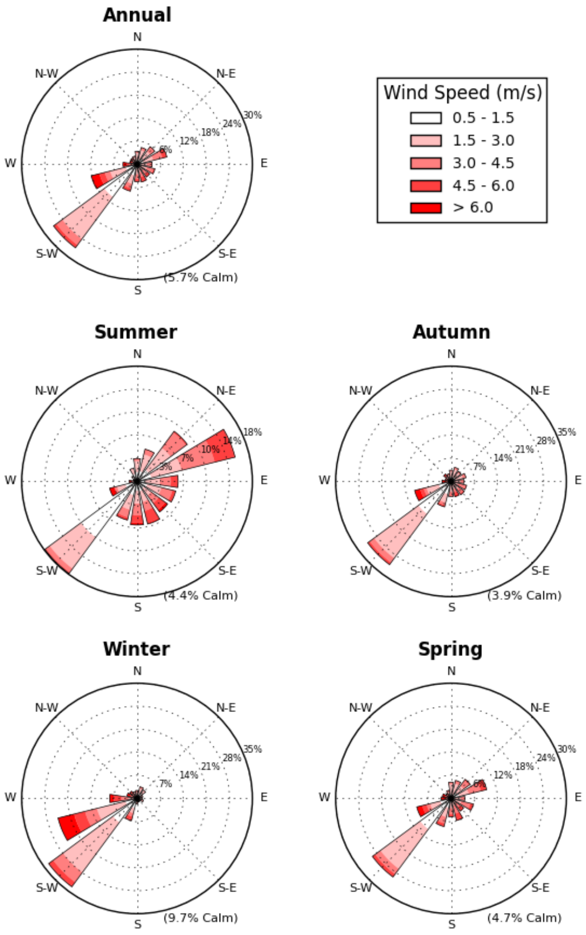
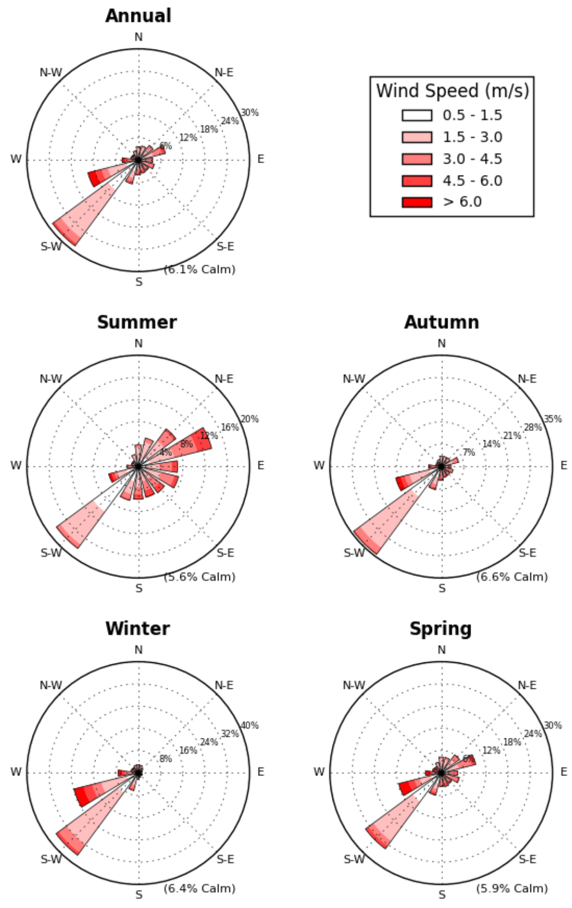


Figure 4-6 OEH Campbelltown West Wind Roses, 2014-2018



4.2 Local Ambient Air Quality

No site-specific data are available to determine the existing concentrations of dust and particulate matter at sensitive receptors near the Proposal. The NSW Office of Environment and Heritage (OEH) operates a network of air quality monitoring stations across NSW. The nearest OEH monitoring station is located at Campbelltown West. The Campbelltown West monitoring station is located approximately 2.2 kilometres south of the Proposal site.

A summary of the PM_{10} and $PM_{2.5}$ monitoring results collected at the Campbelltown West monitoring site during 2017 is presented in Figure 4-7 and Table 4-2.

Table 4-2 2017 Particulate matter monitoring results – Campbelltown West

Pollutant	Annual Average (µg/m3)	24-hour Average (µg/m3)	
		Maximum	95th Percentile
PM_{10}	15.7	53.1 (32.1)	27.7
$PM_{2.5}$	7.4	25.0 (16.9)	12.7

When characterising typical ambient air quality, impacts from extreme events such as bushfires and dust storms are usually excluded. The highest 24-hour average PM_{10} and $PM_{2.5}$ concentrations measured at Campbelltown West during 2017 were 53.1 µg/m^3 and 25.0 µg/m^3 and were due to hazard reduction burns. The values in brackets in Table 4-2 represent the maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations measured at Campbelltown West, unaffected by extreme events. These values will be adopted for assessment purposes.

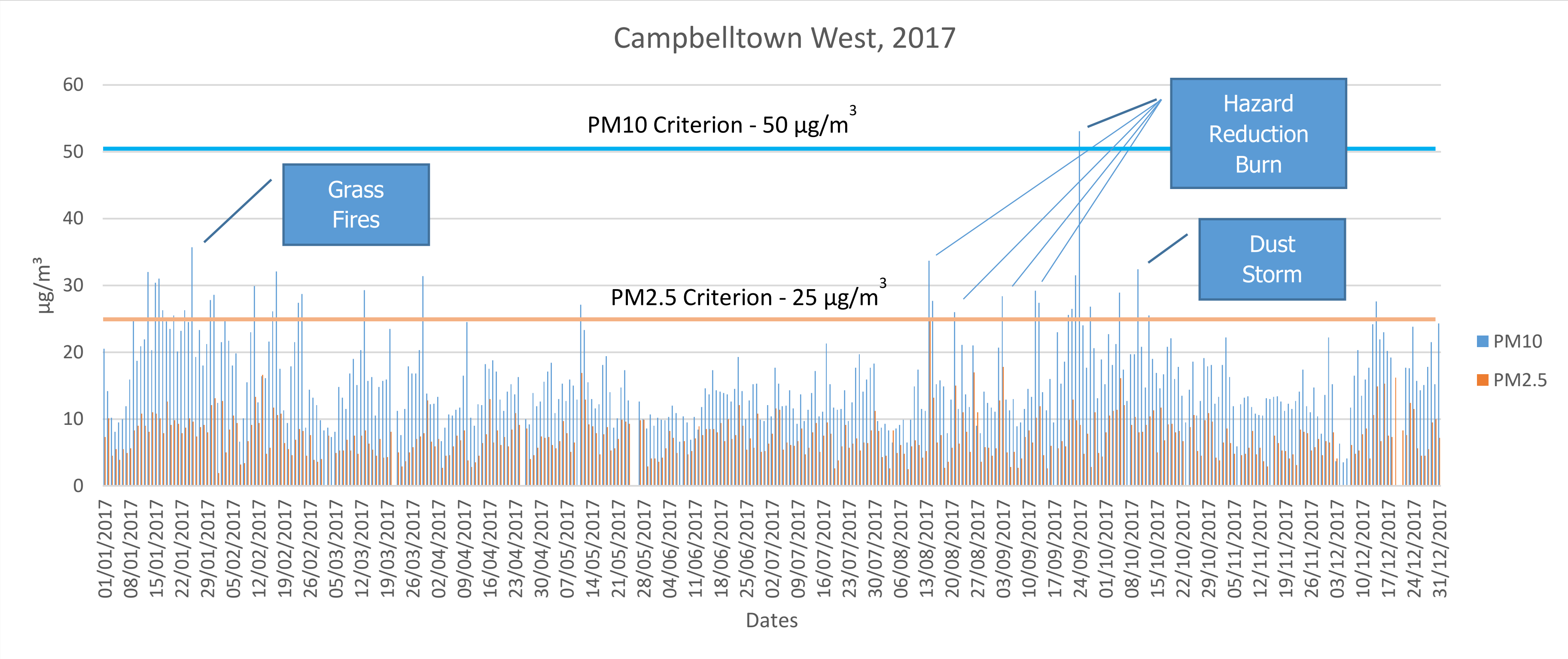
There are no readily available site specific Total Suspended Particulates (TSP) and deposited dust monitoring data. The Campbelltown West monitoring site does not measure these components; however, estimates of the background levels for the area are required to assess the impacts of the Proposal on TSP and deposited dust.

Estimates of the annual average background TSP concentrations can be determined from a relationship between measured PM_{10} concentrations. This relationship assumes that 40% of the TSP is PM_{10} and was established as part of a review of ambient monitoring data collected by co-located TSP and PM_{10} monitors operated for reasonably long periods of time in the Hunter Valley (NSW Minerals Council, 2000). Applying this relationship with the 2017 annual average PM_{10} concentration of 16.1 µg/m3 at the Campbelltown West monitoring station estimates an annual average TSP concentration of 40.3 µg/m3. Table 4-3 summarises the background air quality adopted for assessment purposes.

Table 4-3 Background Air Quality Adopted for Assessment

Pollutant	Averaging Period	Adopted Background Concentration/Level
TSP	Annual	39.3 µg/m^3
PM_{10}	24-hour	32.1 µg/m^3
	Annual	15.7 µg/m^3
$PM_{2.5}$	24-hour	16.9 µg/m^3
	Annual	7.4 µg/m^3

Figure 4-7 Ambient PM10 and PM2.5 concentrations measured at Campbelltown West in 2017



5 DISPERSION MODELLING

5.1 Meteorological Modelling

5.1.1 TAPM

No meteorological observation data is available for the site. Therefore, site-specific meteorological data was generated through the use of a prognostic model. The prognostic model used was The Air Pollution Model (TAPM), developed and distributed by the Commonwealth Scientific and industrial Research Organisation (CSIRO).

TAPM is an incompressible, non-hydrostatic, primitive equations prognostic model with a terrain-following vertical coordinate for three-dimensional simulations. It predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of large-scale meteorology provided by synoptic analyses. TAPM benefits from having access to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analyses for various regions around the world.

The prognostic modelling domain was centred at 34.03° S, 151.18° E and involved four nesting grids of 30 km, 10 km, 3 km and 1km with 41 grids in the lateral dimensions and 25 vertical levels.

The TAPM model included assimilation of wind data collected at the Kurnell BoM Station during 2017.

5.1.2 AERMET

The TAPM results, including predictions of wind speed, wind direction, temperature, humidity, cloud cover, solar radiation, and rainfall, were used as inputs to AERMET – AERMOD's meteorological pre-processor. AERMET uses the TAPM data, along with land use data, to calculate mixing heights and velocity scaling parameters.

5.2 Dispersion Modelling

5.2.1 AERMOD

The dispersion model chosen for this assessment was AERMOD – the US EPA regulatory Gaussian plume air dispersion model.

AERMOD is a steady state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts. It includes treatment of both surface and elevated sources, and both simple and complex terrain.

AERMOD was selected by the Victorian EPA to replace AUSPLUME from 1 January 2014, and its use is accepted by NSW EPA.

6 EMISSIONS TO AIR

Dust emissions from the proposed Project have been estimated for all significant dust generating activities based on information provided by the Proponent, using emission factors sourced from both locally developed and US EPA developed documentation. PM_{10} dust emissions from all significant dust generating activities for the Project are presented in Table 6-1. Detailed emission inventory and emission estimation calculations are presented in Appendix A.

Table 6-1 Estimated PM_{10} emissions (kg/year)

Activity	Emissions (kg/year)
Loaded delivery trucks arriving (paved)	164
Delivery truck round trip (unpaved)	538
Unloaded delivery trucks leaving (paved)	97
Material unloaded from truck	85
Concrete loaded into primary crusher	56
Crushing (concrete)	24
Screening (concrete)	33
Unloaded to stockpile (concrete)	56
Loaded into pugmill (concrete)	56
Unloaded to stockpile (road base)	56
Loading product material (road base) to truck	56
Loading raw material (sand) to screen	28
Screening material (sand)	56
Unloading material (sand) to stockpile	28
Loading product material (sand) to truck	28
Unloaded dispatch trucks arriving (paved)	78
Dispatch truck (concrete/road base) round trip (unpaved)	590
Dispatch truck (sand) round trip (unpaved)	147
Loaded dispatch truck leaving (paved)	144
Wind erosion from stockpiles	833
Total	3,155

The distribution of particles in each particle size range is as follows (SPCC, 1983):

- PM2.5 (FP) is 4.7% of the TSP;
- PM2.5-10 (CM) is 34.4% of TSP; and
- PM10-30 (Rest) is 60.9% of TSP.

These fractions of fine, inhalable and coarse particle were used to estimate the TSP and PM2.5 concentrations.

7 ASSESSMENT OF IMPACTS

This section presents the predicted impacts on air quality arising from pollutants generated by activities related to the Project for each relevant metric.

Table 7-1 presents the dispersion modelling results at each of the discrete receptors shown in Figure 2-1. The incremental impacts refer to the potential impacts from activities only associated with the operation of the Project (i.e. those activities associated with the emissions detailed in Table 6-1). The total impacts refer to the cumulative impacts of the Project and the estimated background levels as described in Section 4.

The primary dust sources identified from the Project are:

- vehicles travelling on unsealed roads; and
- wind-blown dust from stockpiles or exposed areas.

The following mitigation measures were included in estimating potential dust emission from the Project Site.

- Level 2 (>2 l/m²/hr) water spray or chemical suppressant on unsealed haul roads – 84%.
- Watering stockpile/exposed areas – 50% 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").
- Traffic speed restrictions of 10 km/hr for all onsite vehicles.

Table 7-1 Summary of Dispersion Modelling Results

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)
	Incremental Impact					Total Impact				
	24-hr Ave.	Ann. Ave.	24-hr Ave.	Ann. Ave.	Ann. Ave.	24-hr Ave.	Ann. Ave.	24-hr Ave.	Ann. Ave.	Ann. Ave.
	Air Quality Impact Assessment Criteria									
	-	-	-	-	-	25	8	50	25	90
Residential Receiver 1	0.55	0.08	3.99	0.57	1.46	17.45	7.48	36.09	16.27	40.76
Residential Receiver 2	1.01	0.08	7.41	0.61	1.56	17.91	7.48	39.51	16.31	40.86
Residential Receiver 3	0.66	0.08	4.80	0.60	1.53	17.56	7.48	36.90	16.30	40.83
Residential Receiver 4	0.50	0.08	3.67	0.55	1.41	17.40	7.48	35.77	16.25	40.71
Residential Receiver 5	0.59	0.06	4.33	0.41	1.05	17.49	7.46	36.43	16.11	40.35
Industrial Receiver 1	2.98	1.76	21.78	12.91	33.02	19.88	**9.16**	**53.88**	**28.61**	72.32

Receptor ID	$PM_{2.5}$ ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$)		TSP ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$)		TSP ($\mu g/m^3$)
	Incremental Impact					Total Impact				
	24-hr Ave.	Ann. Ave.	24-hr Ave.	Ann. Ave.	Ann. Ave.	24-hr Ave.	Ann. Ave.	24-hr Ave.	Ann. Ave.	Ann. Ave.
	Air Quality Impact Assessment Criteria									
	-	-	-	-	-	25	8	50	25	90
Industrial Receiver 2	4.13	1.23	30.23	8.98	22.97	21.03	**8.63**	**62.33**	24.68	62.27
Industrial Receiver 3	3.26	1.27	23.83	9.29	23.76	20.16	**8.67**	**55.93**	24.99	63.06

The predicted results in Table 7-1 show minimal incremental impact from the proposed operations at the nearby residential receptors. Predicted total results for $PM_{2.5}$, PM_{10} or TSP are below impact assessment criteria when compared with NSW EPA guidelines at the residential receivers.

The cumulative annual average PM_{10} and $PM_{2.5}$ concentrations predicted at the industrial receiver locations marginally exceed relevant impact assessment criteria. The results also show that the maximum predicted total 24-hour average PM_{10} concentrations exceed the impact assessment criterion at the three closest industrial receivers (I1, I2 and I3).

The predicted exceedance of the impact assessment criterion for 24-hour average PM_{10} at the closest industrial receivers (I1, I2 and I3) is largely due to the conservative assessment methodology whereby the maximum predicted incremental concentration, due to the Proposal, is added to the maximum ambient concentration. Therefore, in accordance with the Approved Methods, a "contemporaneous" assessment has been conducted to provide a more detailed analysis of the potential impacts of the Proposal.

The highest expected $PM_{2.5}$ annual average concentration at Industrial Receiver 1 was 1.76$\mu g/m^3$. This represents approximately 20% of the $PM_{2.5}$ criteria and is considered an acceptable contribution to the airshed in an industrial area. To assess the implications of the PM2.5 annual average exceedance a "contemporaneous" assessment has been conducted to provide a more detailed analysis of the potential impacts of the Proposal.

The contemporaneous assessment of 24-hour average PM_{10} and $PM_{2.5}$ concentrations involves adding the existing background PM_{10} concentration, observed at the OEH monitoring site in Campbelltown West, to the predicted incremental concentration for each day of the simulation period.

Figure 7-1, Figure 7-2, Figure 7-3, Figure 7-4, Figure 7-5 and Figure 7-6 presents the results of the contemporaneous assessment of 24-hour average PM_{10} and $PM_{2.5}$ concentrations at the industrial receivers I1, I2 and I3, respectively. The contemporaneous assessment shows that the contribution of the Proposal to total PM_{10} and $PM_{2.5}$ concentrations is low, and that any exceedances of the impact assessment criterion are largely due to high ambient PM_{10} and $PM_{2.5}$ concentrations. The high ambient concentration on the 24 September 2017 was due to fire reduction burns in NSW.

A contour plot of the incremental 24-hour and annual average PM_{10} concentrations are presented in Figure 7-7.

7.1 Respirable Crystalline Silica

The assessment results in Table 7-1 show that the most affected residential and/or industrial receiver is Industrial Receiver I1 and it is predicted to experience annual average PM2.5 concentrations of 1.76µg/m³ due to the Project. This level is due to the total dust from the site, and only a small portion of this dust could contain silica. As the total level is below the Victorian EPA criterion of 3µg/m³ for respirable crystalline silica, the actual level from the Project would be much lower and thus, the Project would not result in an unacceptable level respirable crystalline silica in the ambient air at any residential and industrial receiver.

Figure 7-1 Contemporaneous 24-hour Average PM_{10} Concentrations at Industrial Receiver I1

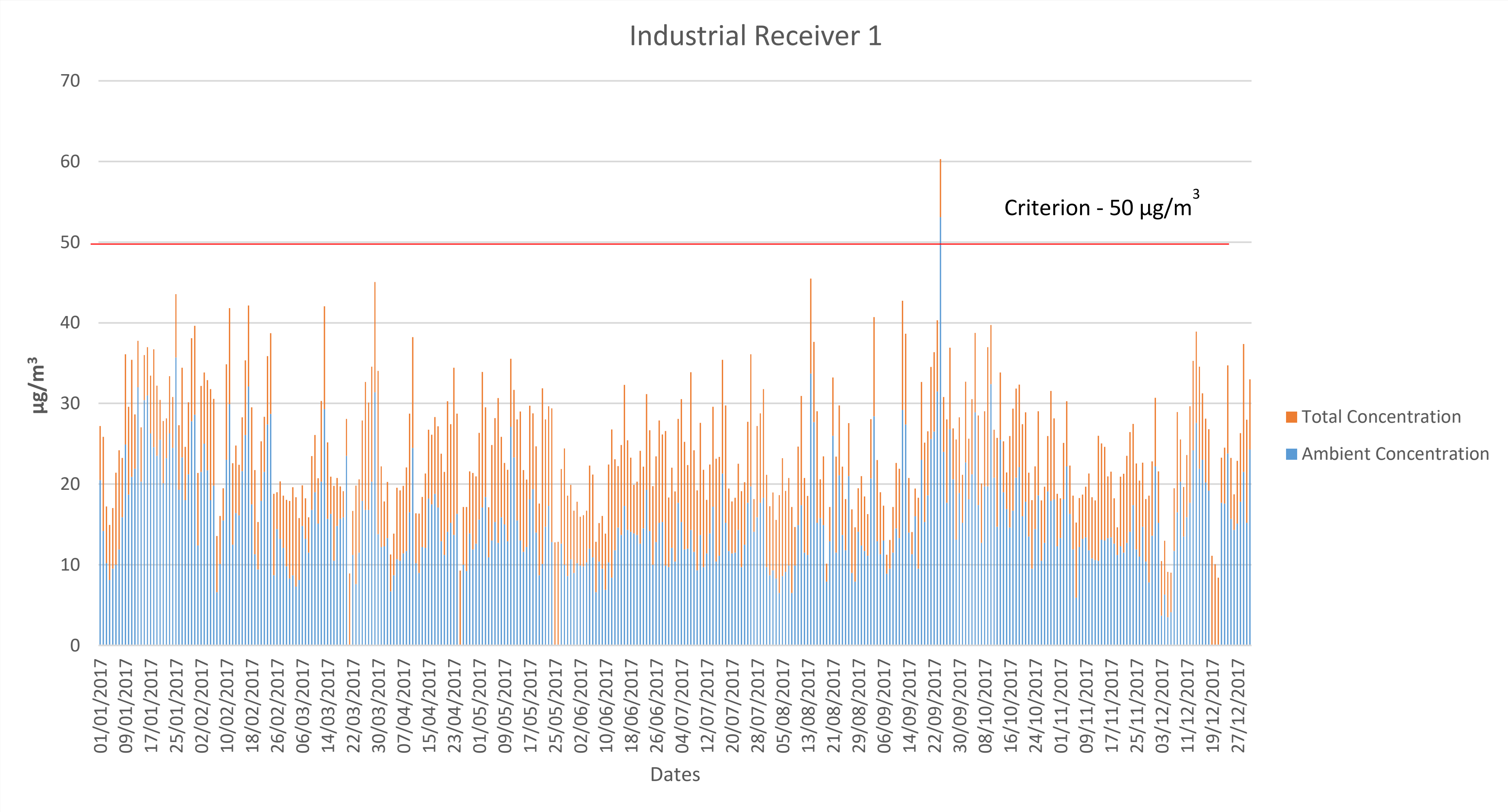


Figure 7-2 Contemporaneous 24-hour Average $PM_{2.5}$ Concentrations at Industrial Receiver I1

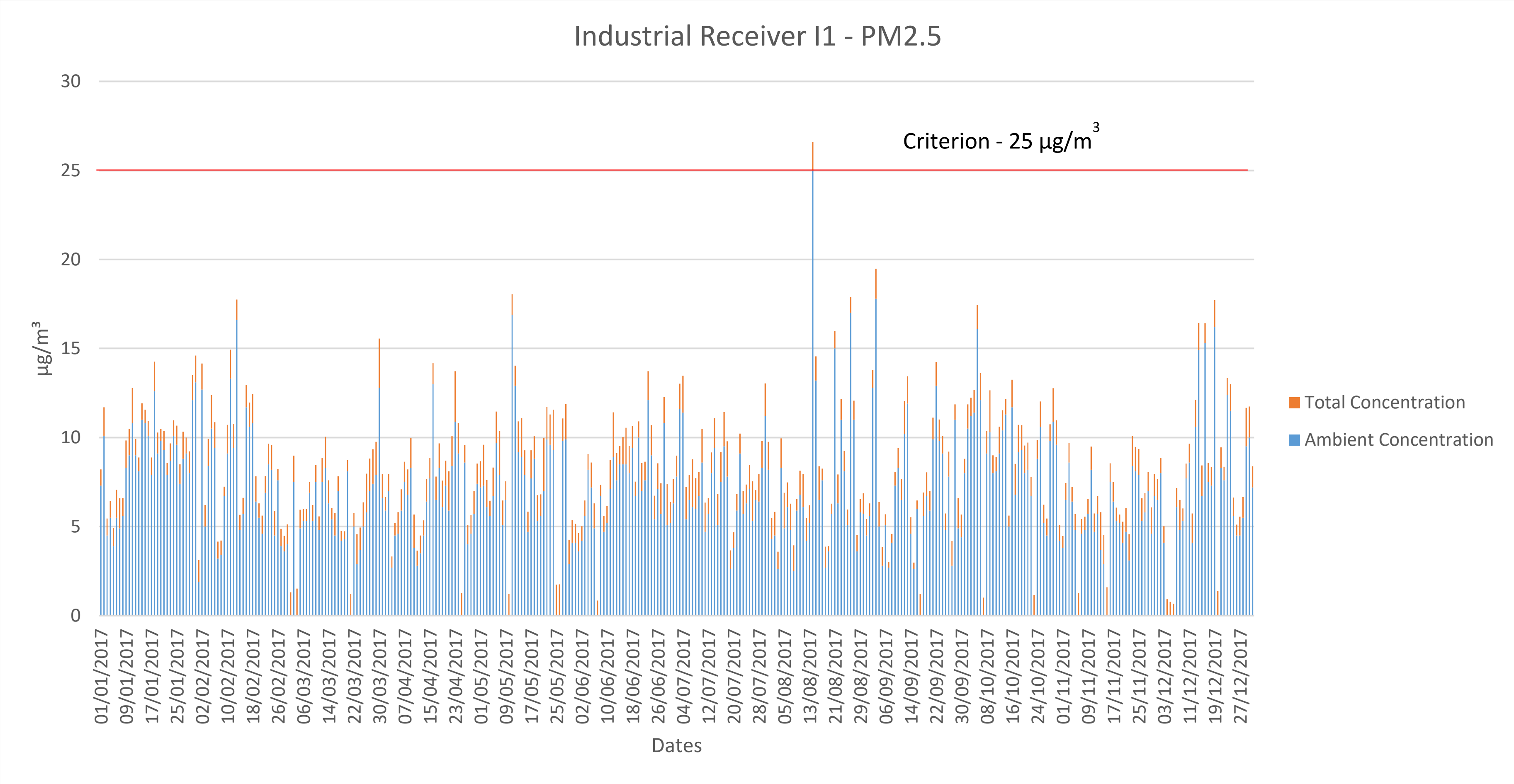


Figure 7-3 Contemporaneous 24-hour Average PM_{10} Concentrations at Industrial Receiver I2

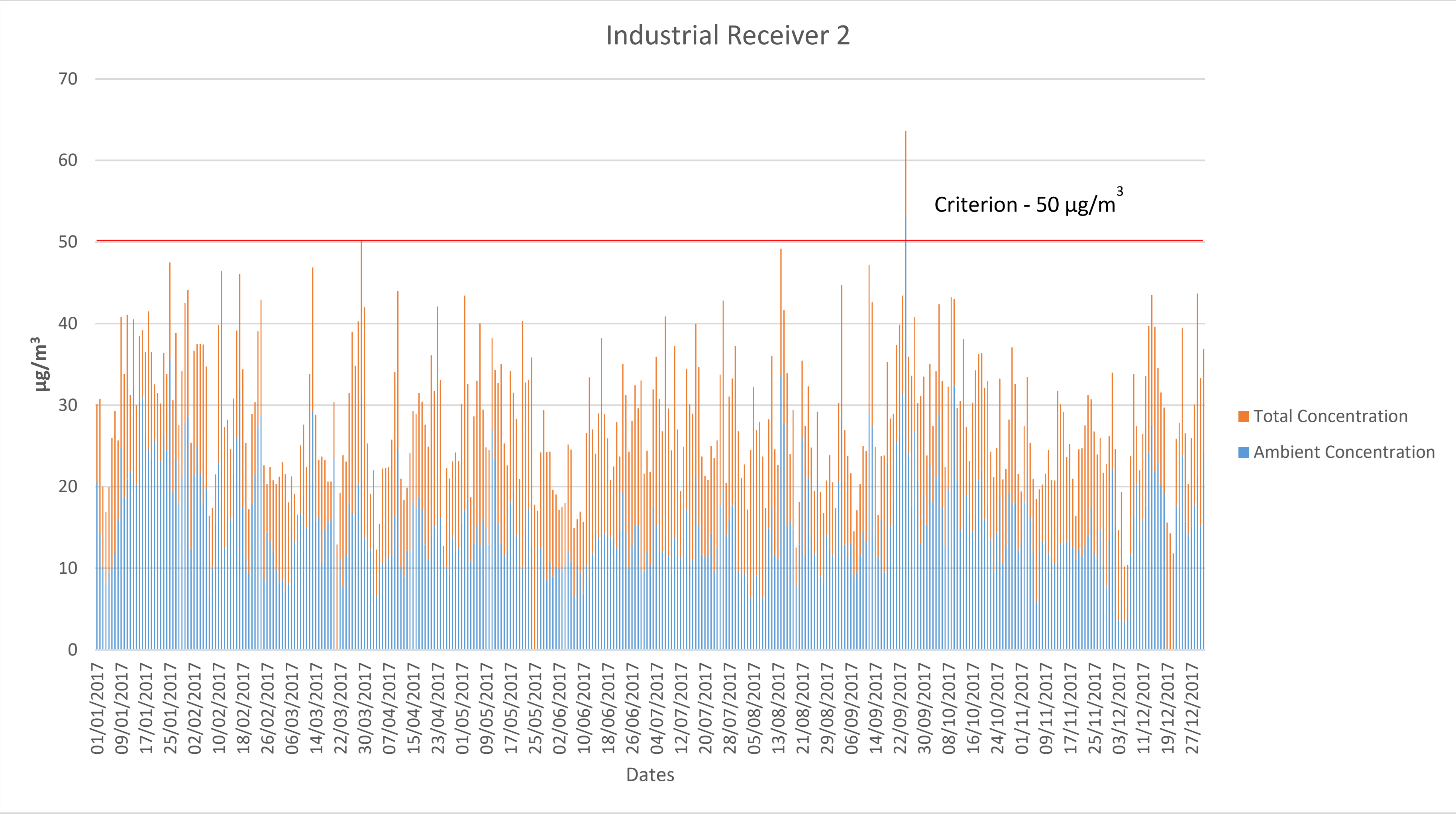


Figure 7-4 Contemporaneous 24-hour Average $PM_{2.5}$ Concentrations at Industrial Receiver I2

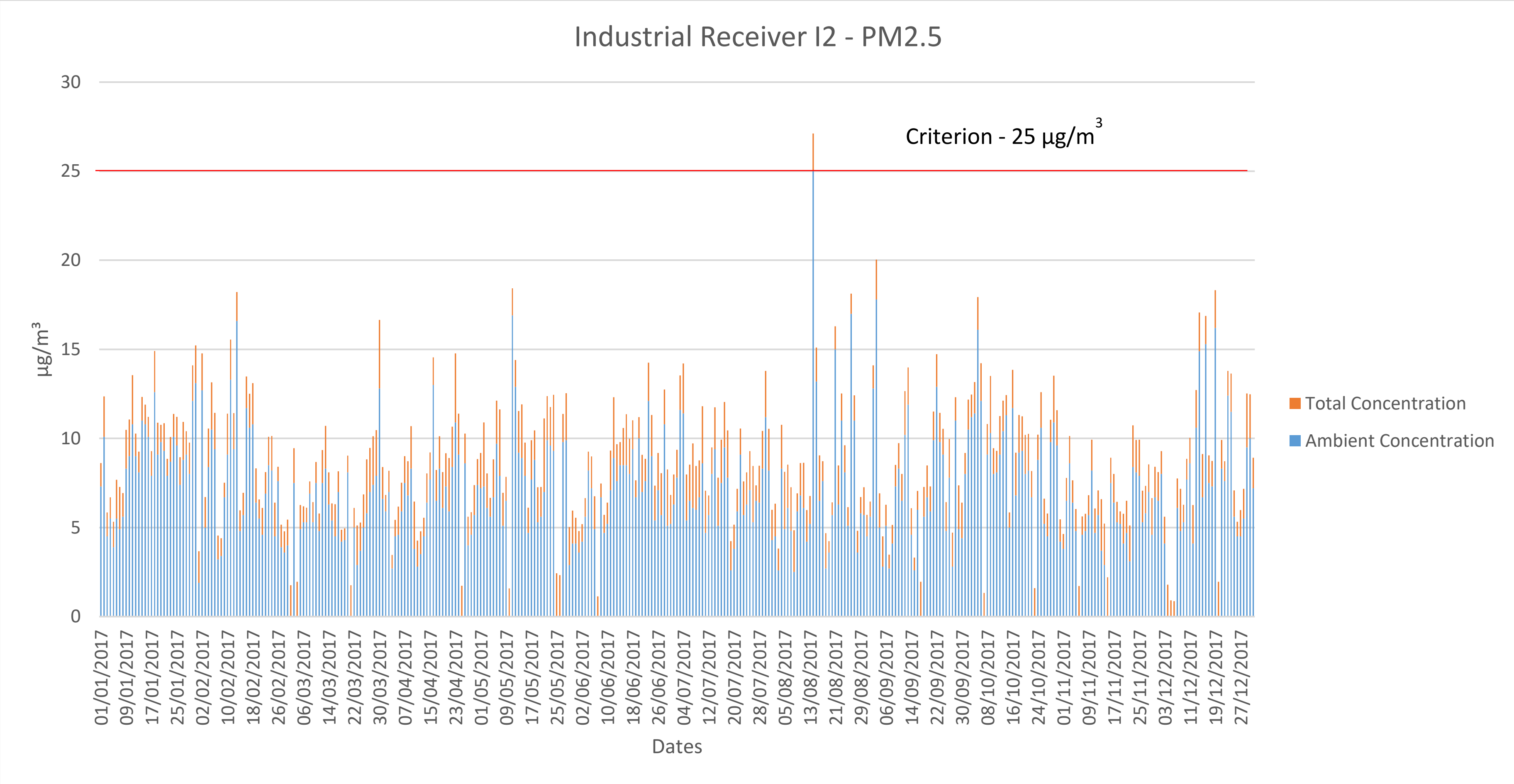


Figure 7-5 Contemporaneous 24-hour Average PM_{10} Concentrations at Industrial Receiver I3

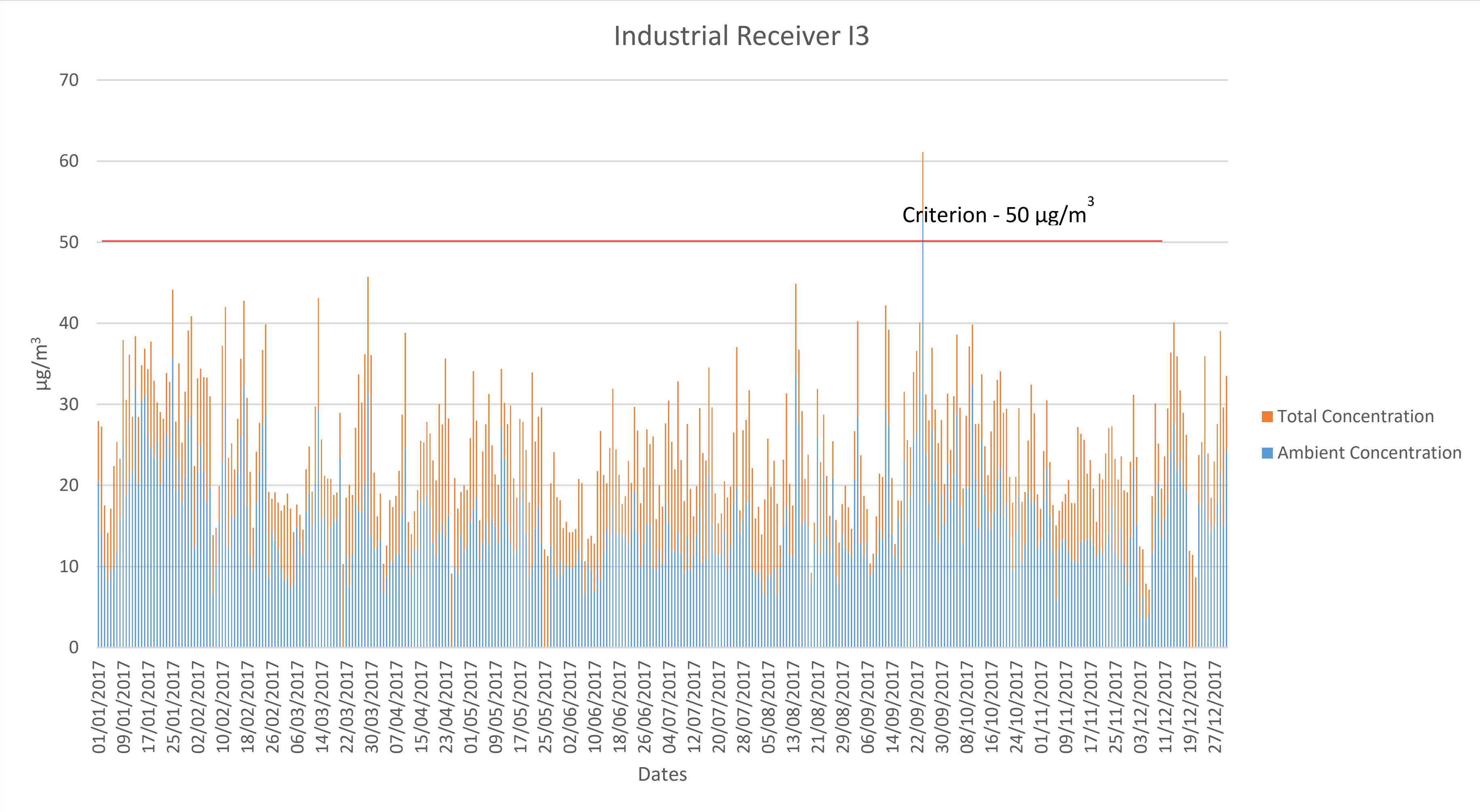


Figure 7-6 Contemporaneous 24-hour Average $PM_{2.5}$ Concentrations at Industrial Receiver I3

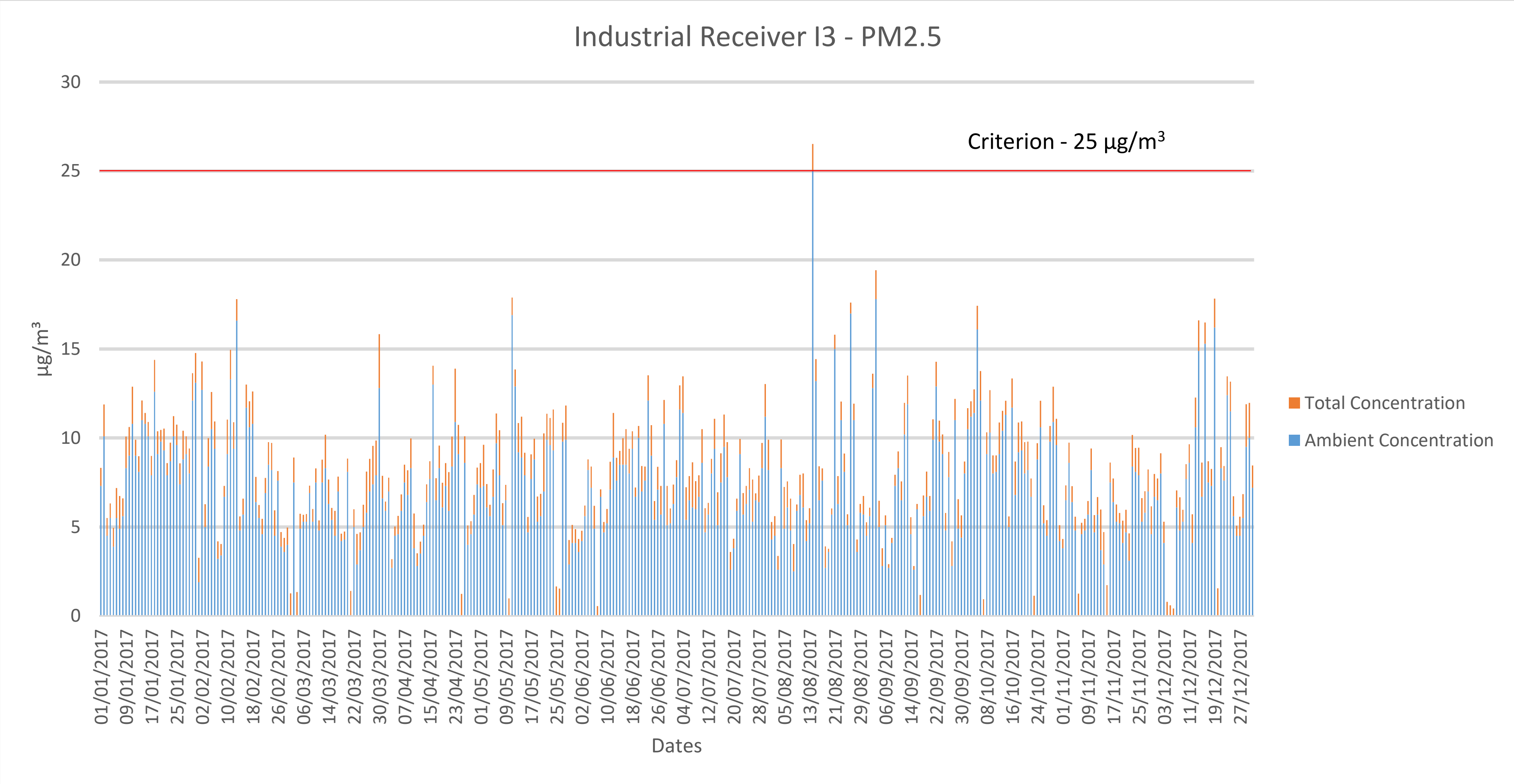
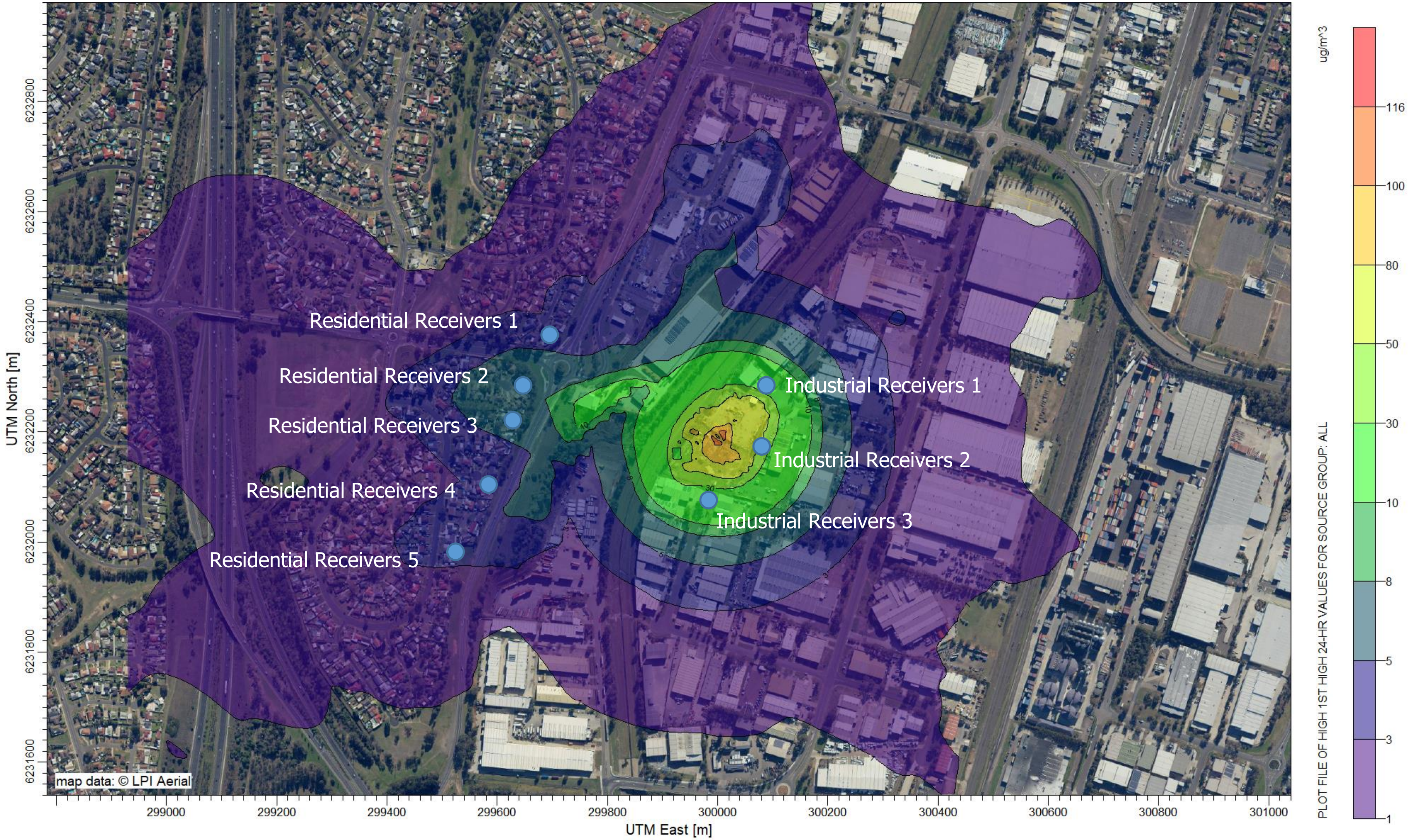


Figure 7-7 Predicted Incremental 24-hour Average PM_{10} Concentration



8 CONCLUSION

This report has assessed the potential dust impacts associated with the proposed Minto Concrete Recycling Facility.

Potential dust impacts associated with the day-to-day operational activities for the Proposal have been assessed in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

Quantitative assessments of potential dust impacts from the operation of the Proposal have been conducted, based on TAPM meteorological simulations and the AERMOD dispersion modelling system.

The deployment of appropriate dust mitigation and operational measures as outlined in Section 7 will minimise the potential occurrence of excessive dust emissions from the Project and ensure that air quality impacts are lower than those predicted in this study.

The results of the dispersion modelling indicate that dust and particulate matter concentrations due to the operation of the Proposal can be adequately managed on site to mitigate impacts.

9 REFERENCES

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APPENDIX A

EMISSIONS INVENTORY

A.1 Particulate Emission Factor Equations

Haul roads

Wheel generated particulate emissions associated with material haulage are estimated using the following US EPA emission factors (US EPA, 1985 and updates):

$$E[kg/VKT] = 0.2819 \times a \times \left(\frac{s}{12}\right)^b \times \left(\frac{1.1023 \times W}{3}\right)^{0.45}$$

Where:

a = 4.9 for TSP, 1.5 for PM_{10} and 0.15 for $PM_{2.5}$

b = 0.7 for TSP and 0.9 for PM_{10} and $PM_{2.5}$

s = silt content [%] of road surface

W = weight of vehicle [t]

Particulate emissions from vehicles travelling along sealed haul roads have been estimated using the above equations, and including a control factor of 90%.

Loading / unloading / transferring material

Each tonne of material handles will generate quantities of particulate matter that will depend on the wind speed and the moisture content of the material according to the US EPA emission factor (US EPA, 1985 and updates) shown below:

$$E[kg/t] = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2.0}\right)^{1.4}}\right)$$

Where:

k = 0.74 for TSP, 0.35 for PM_{10} and 0.053 for $PM_{2.5}$

U = wind speed [ms^{-1}]

M = moisture content [%]

The wind speed is taken as the average wind speed from the TAPM dataset.

Dozers shaping fill material

Particulate emissions for dozers have been estimated using US EPA emission factor equations (US EPA, 1985 and updates) for dozers on overburden as follows:

$$E[kg/h] = a \times \left(\frac{s^b}{M^c}\right)$$

Where:

a = 2.6 for TSP, 0.8775 for PM_{10} and 0.273 for $PM_{2.5}$

b = 1.2 for TSP, 1.5 for PM_{10} and 1.2 for $PM_{2.5}$

c = 1.3 for TSP, 1.4 for PM_{10} and 1.3 for $PM_{2.5}$

s = silt content [%]

M = moisture content [%]

Graders levelling fill

Particulate emissions from graders levelling filled areas have been estimated using US EPA emission factor equations (US EPA, 1985 and updates) for graders on unsealed roads as follows:

$$E[kg/VKT] = a \times S^b$$

Where:

a = 0.0034 for TSP, 0.00336 for PM_{10} and 0.0001054 for $PM_{2.5}$

b = 2.5 for TSP, 2.0 for PM_{10} and 2.5 for $PM_{2.5}$

S = vehicle speed [km/h]

Wind erosion

Particulate emission factors for wind erosion, taken from the NPI (NPI, 2012), are 0.4 kg/ha/h for TSP and 0.2 kg/ha/h for PM_{10}

Crushing and screening

Particulate emission factors for crushing and screening concrete have been taken from the US EPA (US EPA, 1985 and updates) and are summarised below:

Activity	Emission Factor [kg/t]		
	TSP	PM_{10}	$PM_{2.5}$
Tertiary crushing (uncontrolled)	0.0027	0.0012	*
Screening (uncontrolled)	0.0125	0.0043	*

* No emissions data available

Project Info	Intensity
Total material in	450000
Concrete	300000
Sand	150000
Delivery truck payload	16
Dispatch truck payload	20
Truck	24
Paved road length	0.105
Unpaved delivery road length	0.205
Unpaved dispatch road length	0.41
Paved road silt loading	2
Unpaved road silt content	5
Average wind speed	2.55
Incoming material moisture content	5

Activity	PM10 Emissions (kg/year)	Intensity	Units	Emission Factor	Units	Var1	Units	Var2	Units	Var3	Units	Var4	Units	Var5	Units	Var6	Units	Assumptions / Comment
Loaded delivery trucks arriving (paved)	164	450000	tonnes/year	0.000363618	kg/t	16	tonnes/load	0.105	km/trip	0.055408	kg/VKT	40	t	2	g/m^2			
Delivery truck round trip (unpaved)	538	450000	tonnes/year	0.007469266	kg/t	16	tonnes/load	0.205	km/trip	0.582967	kg/VKT	32	t	5	%	84	% control	watering
Unloaded delivery trucks leaving (paved)	97	450000	tonnes/year	0.000215953	kg/t	16	tonnes/load	0.105	km/trip	0.032907	kg/VKT	24	t	2	g/m^2			
Material unloaded from truck	85	450000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Concrete loaded into primary crusher	56	300000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Crushing (concrete)	24	300000	tonnes/year	0.00027	kg/t											70		
Screening (concrete)	33	300000	tonnes/year	0.00037	kg/t											70		
Unloaded to stockpile (concrete)	56	300000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Loaded into pugmill (concrete)	56	300000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Unloaded to stockpile (road base)	56	300000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Loading product material (road base) to truck	56	300000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Loading raw material (sand) to screen	28	150000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Screening material (sand)	56	150000	tonnes/year	0.00037	kg/t													
Unloading material (sand) to stockpile	28	150000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									

Activity	PM10 Emissions (kg/year)	Intensity	Units	Emission Factor	Units	Var1	Units	Var2	Units	Var3	Units	Var4	Units	Var5	Units	Var6	Units	Assumptions / Comment
Loading product material (sand) to truck	28	150000	tonnes/year	0.000188116	kg/t	2.55	m/s	5	%									
Unloaded dispatch trucks arriving (paved)	78	450000	tonnes/year	0.000172763	kg/t	20	tonnes/load	0.105	km/trip	0.032907	kg/VKT	24	t	2	g/m^2			
Dispatch truck (concrete/road base) round trip (unpaved)	590	300000	tonnes/year	0.012281345	kg/t	20	tonnes/load	0.41	km/trip	0.59909	kg/VKT	34	t	5	%	84	% control	watering
Dispatch truck (sand) round trip (unpaved)	147	150000	tonnes/year	0.006140673	kg/t	20	tonnes/load	0.205	km/trip	0.59909	kg/VKT	34	t	5	%	84	% control	watering
Loaded dispatch truck leaving (paved)	144	450000	tonnes/year	0.000320594	kg/t	20	tonnes/load	0.105	km/trip	0.061066	kg/VKT	44	t	2	g/m^2			
Wind erosion from stockpiles	833	3.3	ha	721	kg/ha/year	5	silt content in %	92	(p)	8.06	(f)					65	% control	water