

AIR QUALITY IMPACT ASSESSMENT

Eastern Creek Data Centre
17 Roberts Road, Eastern Creek
SSD-10330

Prepared for:
Canberra Data Centres Pty Ltd
PO Box 304
JERABOMBERRA NSW 2619

SLR Ref: 610.18883-R03
Version No: -v3.0
October 2019



EXECUTIVE SUMMARY

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122 Australia

T: +61 3 9249 9400
E: melbourne@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Canberra Data Centres Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.18883-R03-v3.0	25 October 2019	Jason Shepherd	Kirsten Lawrence	Jeremy Pepper
610.18883-R03-v2.0	22 October 2019	Jason Shepherd	Kirsten Lawrence	Jeremy Pepper
610.18883-R03-v1.0	23 August 2019	Jason Shepherd	Graeme Starke	Jeremy Pepper

CONTENTS

1	INTRODUCTION	5
1.1	Background.....	5
1.2	Project Location	5
2	GLOSSARY AND ABBREVIATIONS.....	7
3	PROJECT DESCRIPTION	8
4	POTENTIAL SOURCES OF AIR EMISSIONS.....	11
5	RELEVANT POLLUTANTS AND AIR QUALITY CRITERIA.....	12
5.1	Pollutants of Concern.....	12
5.2	Ambient Air Quality Criteria	12
6	EXISTING ENVIRONMENT	14
6.1	Local Meteorology	14
6.2	Background Air Quality	18
7	ASSESSMENT OF DUST EMISSIONS DURING CONSTRUCTION.....	20
7.1	Construction Impact Assessment Methodology.....	20
7.2	Step 1 – Screening Based on Separation Distance.....	20
7.3	Step 2a – Assessment of Scale and Nature of the Works	21
7.4	Step 2b – Risk Assessment	22
7.4.1	Receptor Sensitivity	22
7.4.2	Sensitivity of an Area.....	22
7.4.3	Risk Assessment	22
7.5	Step 3 - Mitigation Measures	23
7.6	Step 4 - Residual Impacts	25
8	AIR QUALITY MONITORING PROGRAM	26
9	MITIGATION MEASURES.....	27
10	REFERENCES	29

CONTENTS

Document References

TABLES

Table 1	Glossary.....	7
Table 2	Abbreviations	7
Table 3	NSW EPA Criteria	13
Table 4	Summary of PM ₁₀ Monitoring Data at St Marys AQMS (2014 – 2018).....	18
Table 5	Categorisation of Dust Emission Magnitude.....	22
Table 6	Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)	23
Table 7	Proactive Dust Mitigation Measures	23
Table 8	Residual Risk of Air Quality Impacts from Construction	25
Table 9	Nuisance Dust Monitoring Program	26
Table 10	Nuisance Dust Contingency Management Plan for Project	26
Table 11	Risk Descriptors	27
Table 12	Risk Matrix.....	27
Table 13	Risk Assessment and Mitigation Measures.....	28

FIGURES

Figure 1	Project Location.....	6
Figure 2	Planning Zones	8
Figure 3	Aerial Image of the Site.....	9
Figure 4	Proposed Site Plan.....	10
Figure 5	Annual Wind Roses for Horsley Park (2014 to 2018)	15
Figure 6	Annual and Seasonal Wind Roses for Horsley Park (2018)	16
Figure 7	Wind Speed Frequency Chart for Horsley Park AWS – 2014-2018	17
Figure 8	Long term Mean Rainfall for Horsley Park AWS – 1997 to 2018.....	17
Figure 9	Measured 24-Hour Average PM ₁₀ Concentrations at St Marys AQMS (2014 – 2018).....	19

APPENDICES

Appendix A IAQM Construction Assessment Methodology

1 Introduction

1.1 Background

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Canberra Data Centres Pty Ltd (CDC) to prepare an Air Quality Impact Assessment (AQIA) to accompany the State Significant Development (SSD) application for a proposed Data Centre (the Project) at 17 Roberts Road, Eastern Creek.

It is understood that the operation of the Data Centre, including ventilation and cooling, will be powered by electricity from the grid, such that there will be no significant emissions to air during operation. An operational assessment is therefore not required. The AQIA is therefore limited to emissions to air associated with the construction of the Data Centre.

1.2 Project Location

The Project is located at 17 Roberts Road, Eastern Creek, within the Eastern Creek Business Park (the Site, Figure 1). The Site is formally described as Lot 2 DP 1159804, and has an approximate area of 14.5 hectares. The Site is bordered by Roberts Road in the west, Capicure Drive in the north, transmission line easement in the south and a vacant lot in the east. The portion of the Site relevant to this project is the Project footprint located in the central and western portions of the Site.

SLR has identified the nearest sensitive receptors as residences in a rural setting on Flavex Lane, approximately 900 m to the southeast. The nearest human receptor (a location where a person or property may experience adverse effects of airborne dust or dust soiling) is the distribution centre 50 m beyond the northwest boundary of the Project.

2 Glossary and Abbreviations

Table 1 below shows the glossary of terms and their definitions used in this AQIA.

Table 1 Glossary

Term	Definition
The Site	Canberra Data Centres Pty Ltd owns the site at 17 Roberts Road, Eastern Creek and is legally known as Lot 2 in Deposited Plan 1159804.
The Project	The construction of a new Data Centre and ancillary office space to expand the operation of the existing Data Centre to the east of the site.

Table 2 below shows the abbreviations and their definitions used in this AQIA.

Table 2 Abbreviations

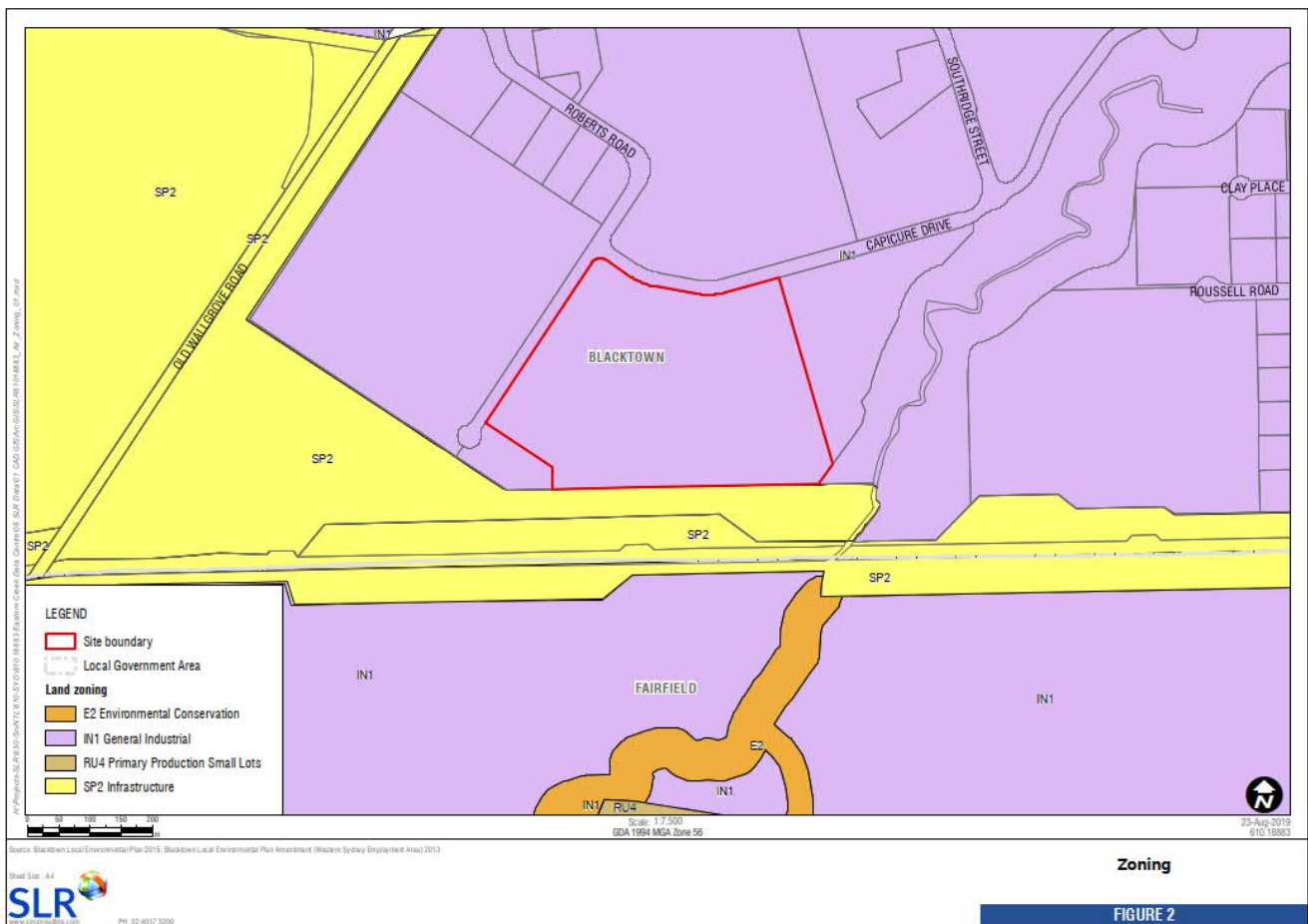
Term	Definition
AQIA	Air Quality Impact Assessment
AQMS	Air Quality Monitoring Station
AWS	Automatic weather station
BoM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
g/m ² /month	Grams per meter squared per month
IAQM	Institute of Air Quality Management
IN1	General industrial land (planning zone)
m/s	Metres per second
OEH	Office of Environment and Heritage
PM _{2.5}	Particulate matter with an aerodynamic diameter of 2.5 microns or less
PM ₁₀	Particulate matter with an aerodynamic diameter of 10 microns or less
SP2	Infrastructure (planning zone)

3 Project Description

The Site is formally identified as Lot 2 in DP 1159804 and is zoned as IN1 General Industrial land (NSW Department of Planning, 2019), as is the land immediately to the west, north and east (Figure 2). The land to the south is zoned SP2 Infrastructure.

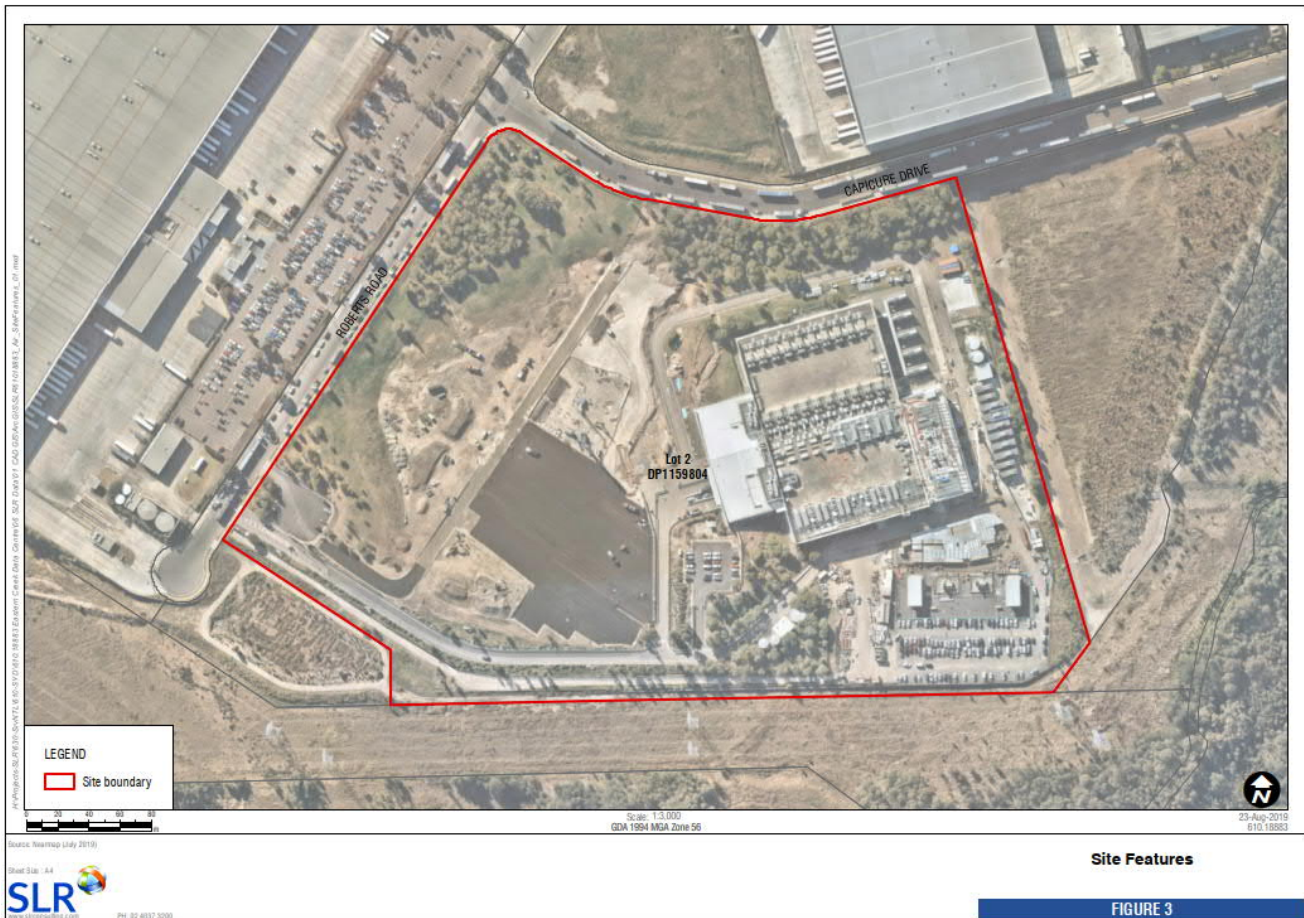
From aerial imagery provided in Figure 3, currently on the eastern side of the Site are nine operational data halls with a rear annexe building, an administrative building, internal roads, car parks and other evidence of Site development activities.

Figure 2 Planning Zones



Source: NSW ePlanning Spatial Viewer 2019. Image dated 23 July 2019.

Figure 3 Aerial Image of the Site



The SSDA proposes the construction of a new Data Centre and ancillary office space to expand the operation of the existing Data Centre to the east of the site (Figure 4). The proposed Data Centre including three large warehouse buildings and ancillary office space, which will deliver economic benefits and employment generation for Western Sydney and the Greater Sydney Region.

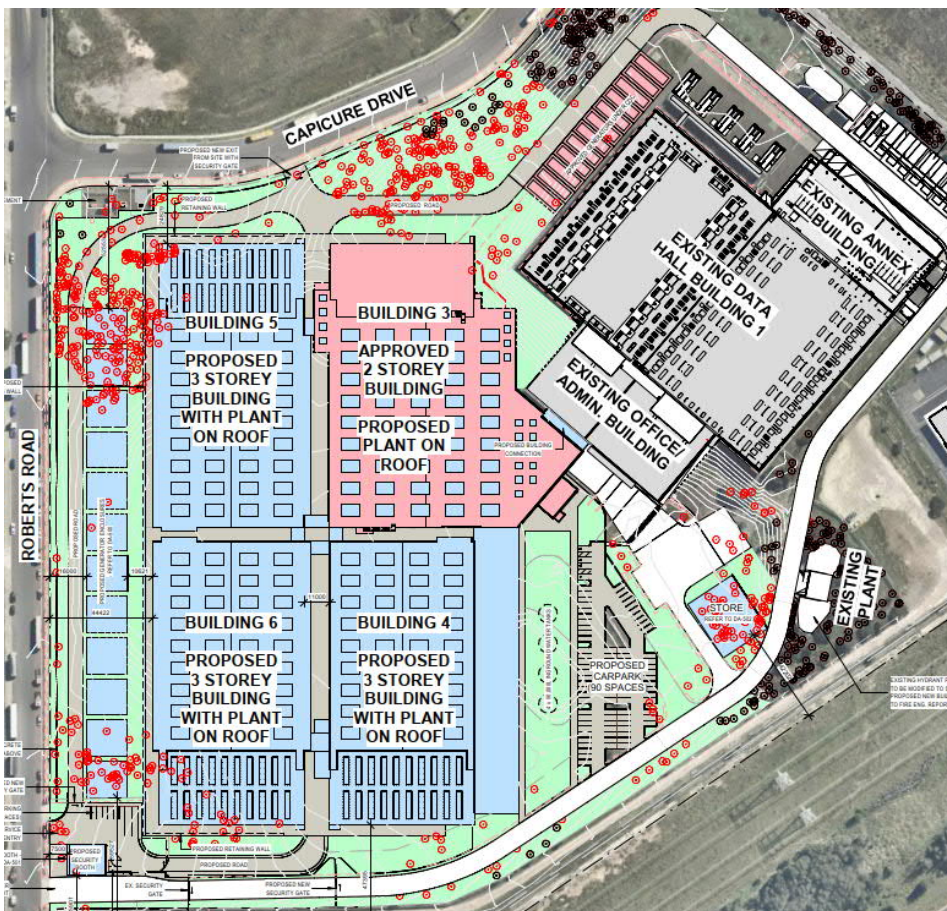
Specifically, the SSDA seeks consent for:

- Site preparation works comprising:
 - Site preparation and mobilisation including clearing of land and importation of fill material
 - Bulk and detail earthworks and support structures
 - Estate stormwater management including construction of detention basins
 - Construction of site access and estate internal roads
 - Service and infrastructure augmentation
 - Perimeter fencing
 - Retaining wall
 - Removal of trees
 - Environmental protection and management measures

- Staged construction of buildings for a Data Centre with 24 hour per day, seven day per week operation:
 - Construction of three 3 storey warehouse facilities (E4, E5, E6) including ancillary office spaces
 - Additional rooftop plant and equipment for Building E3 in associated with Data Centre use
 - Fit out of buildings
 - Construction of a store room
 - Security booth
 - Generator within generator enclosures
 - Landscaping works
 - Construction of hardstand, loading area and a new car park

The proposal does not involve the installation of any form of signage to the façade of the building.

Figure 4 Proposed Site Plan¹



¹ Adapted from EJE Architecture's drawing DA-100 dated 15 October 2019

4 Potential Sources of Air Emissions

During the construction works, fugitive dust emissions are considered to be the primary emission type, which could give rise to nuisance and/or health impacts for the surrounding sensitive areas.

The main emissions to air during the construction phase are likely to be emissions of suspended particulate matter and nuisance dust from the movement of vehicles and construction equipment, excavation and rehabilitation, demolition, clearing and grading, truck loading and unloading and wind erosion.

The risk of construction dust emissions causing nuisance impacts at the off-site sensitive receptor locations is subject to management and mitigation measures, along with contingency plans, response procedures and monitoring and reporting protocols.

During the operational phase, the emergency generators would be a source of products of combustion in the event they are required to operate (ie during a power failure). As this would occur very infrequently and for a limited time period, further detailed assessment of these emissions has not been performed as part of this study.

5 Relevant Pollutants and Air Quality Criteria

5.1 Pollutants of Concern

Potential air pollutants of interest for the construction of the Project are considered to be both:

- Suspended particulate matter
- Deposited dust.

In common usage, the terms “dust” and “particulates” are often used interchangeably. The health effects of particulate matter are strongly influenced by the size of the airborne particles. Smaller particles can penetrate further into the respiratory tract, with the smallest particles having a greater impact on human health as they penetrate to the gas exchange areas of the lungs. Larger particles primarily cause nuisance associated with coarse particles settling on surfaces and possessions, affecting visibility and contaminating tank water supplies. High rates of dust deposition can also adversely affect vegetation by blanketing leaf surfaces..

Particulate matter with an aerodynamic diameter of 10 microns or less is referred to as PM₁₀. The PM₁₀ size fraction is sufficiently small to penetrate the large airways of the lungs, while PM_{2.5} (2.5 microns or less) particulates are generally small enough to be drawn in and deposited into the deepest portions of the lungs. Potential adverse health impacts associated with exposure to PM₁₀ and PM_{2.5} include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children. In an urban setting, the emission of PM_{2.5} is primarily associated with vehicles exhausts resulting from the incomplete combustion of diesel. It is anticipated that the primary particle fraction associated with construction will be PM₁₀.

The key potential health and amenity issues associated with construction of Project are, respectively:

- Elevated PM₁₀ concentrations
- Nuisance due to dust deposition and visible dust plumes.

5.2 Ambient Air Quality Criteria

State air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in Section 5.1 are published in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA, 2017) (the Approved Methods). The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in the state. It is referred to in Part 5: Air Impurities Emitted from Activities and Plant in the Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW Parliament, 2010) (the Regulation). Industry has an obligation to ensure compliance with the requirements specified in the Regulation.

The ground level air quality impact assessment criteria listed in Section 7 of the Approved Methods have been established by NSW EPA to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. They have been derived from a range of sources and are the defining ambient air quality criteria for NSW and are appropriate for use in this assessment.

A summary of the relevant impact assessment criteria for particulate matter is provided in Table 3.

Table 3 NSW EPA Criteria

Pollutant	Averaging Period	Criterion
PM ₁₀	24 Hours	50 µg/m ³
	Annual	25 µg/m ³
Dust Deposition	Month	2 g/m ² /month (maximum increase in deposited dust level)
		4 g/m ² /month (maximum total deposited dust level)

6 Existing Environment

6.1 Local Meteorology

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station recording wind speed and wind direction data is the Horsley Park Automatic Weather Station (AWS) (Station ID 67119), located approximately 4 kilometres (km) southeast of the Project. Considering the relatively flat terrain between the Project and Horsley Park AWS, wind conditions recorded at the Horsley Park AWS can be considered representative of the wind conditions experienced at the Project.

Wind

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) will also influence dispersion.

Annual wind roses for the years 2014 to 2018 compiled from data recorded by the Horsley Park AWS are presented in Figure 5, with seasonal wind roses for 2018 presented in Figure 6. 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.

The annual wind roses for the years 2014 to 2018 indicate that predominant wind directions in the area are consistently from the southwest quadrant. Very low frequencies of winds from the northeastern quadrant were recorded across all years. The annual frequency of calm wind conditions was recorded to be approximately 12%-14.5% for all the years between 2014 and 2018.

The seasonal wind roses for the year 2018 indicate that:

- In summer, the majority of winds originated from eastern and southeastern quadrants, with very few winds from west and northwest.
- In autumn, the majority of winds originated from southwest quadrant, with very few winds from northeastern quadrant.
- In winter, the majority of winds originated from the western sector, with very few winds from the eastern directions.
- In spring, the majority of winds originated from the southern sector.

Wind erosion of dust from exposed surfaces is usually initiated when wind speeds exceed the threshold friction velocity for a given surface or material, however a general rule of thumb is that wind erosion can be expected to occur above 5 m/s. The frequency of wind speeds for the period of 2014-2018 is presented in Figure 7. The plot showed that the frequency of wind speeds exceeding 5 m/s for the period 2014-2018 at Horsley Park AWS was approximately 6%.

Figure 5 Annual Wind Roses for Horsley Park (2014 to 2018)

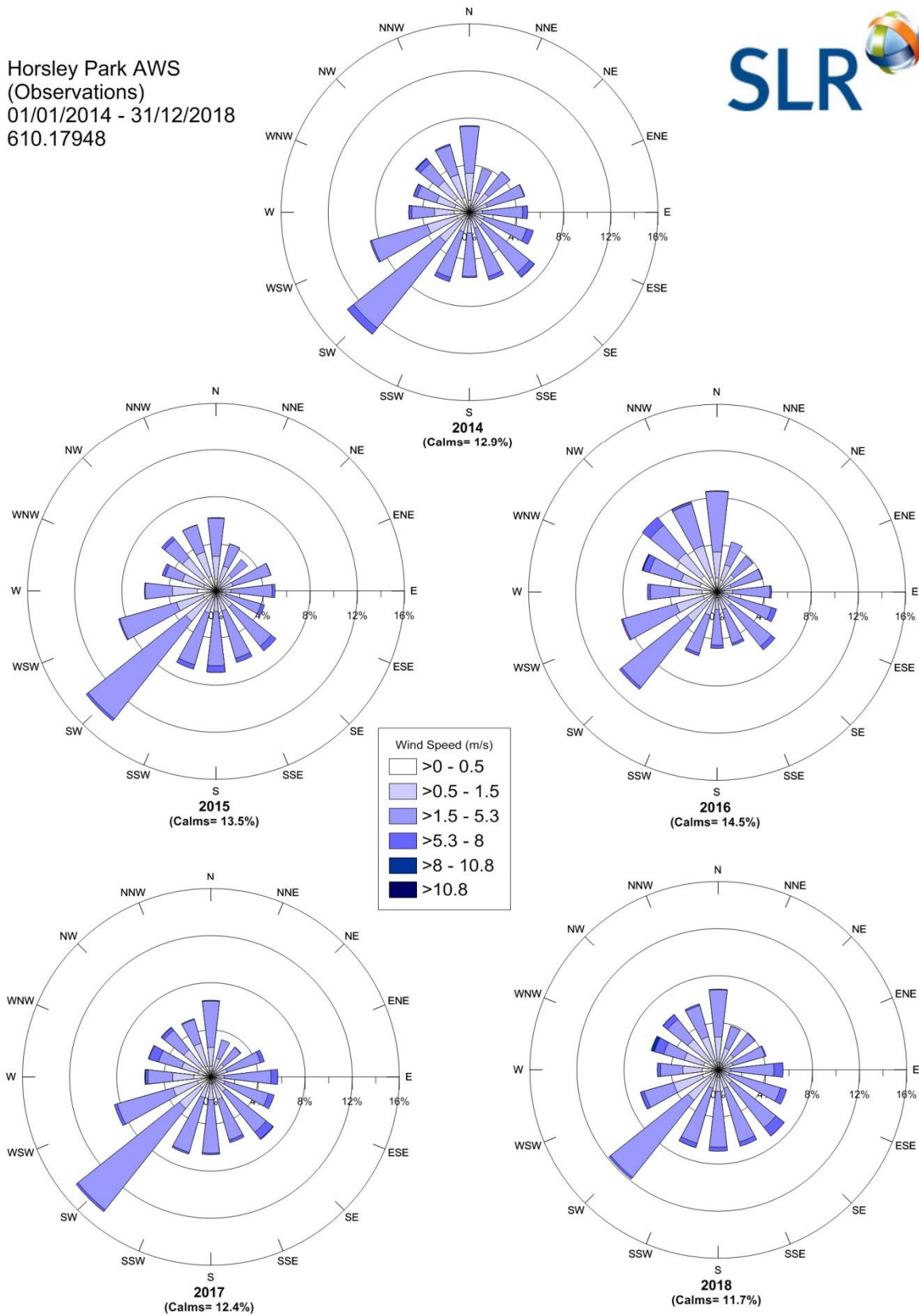


Figure 6 Annual and Seasonal Wind Roses for Horsley Park (2018)

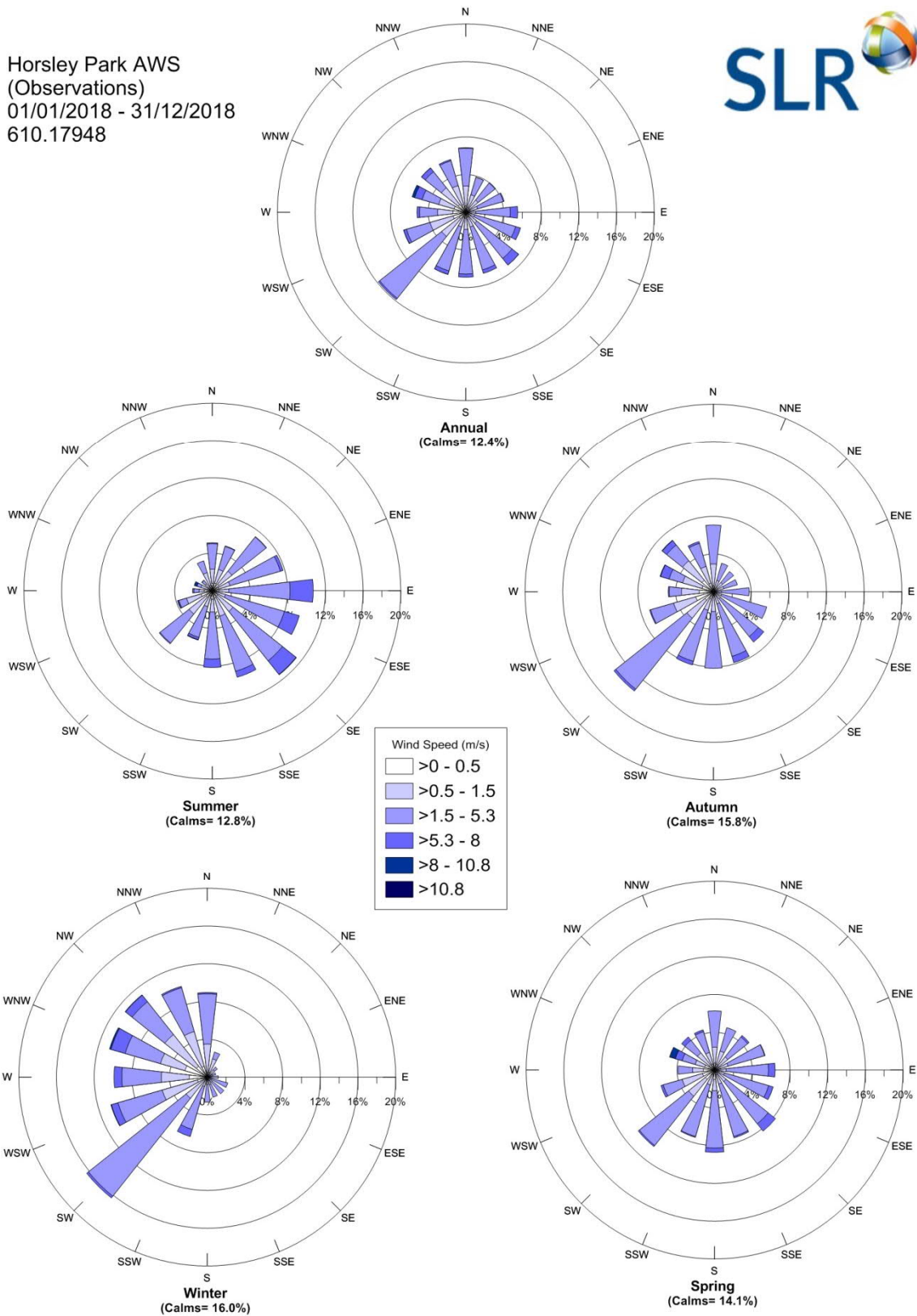
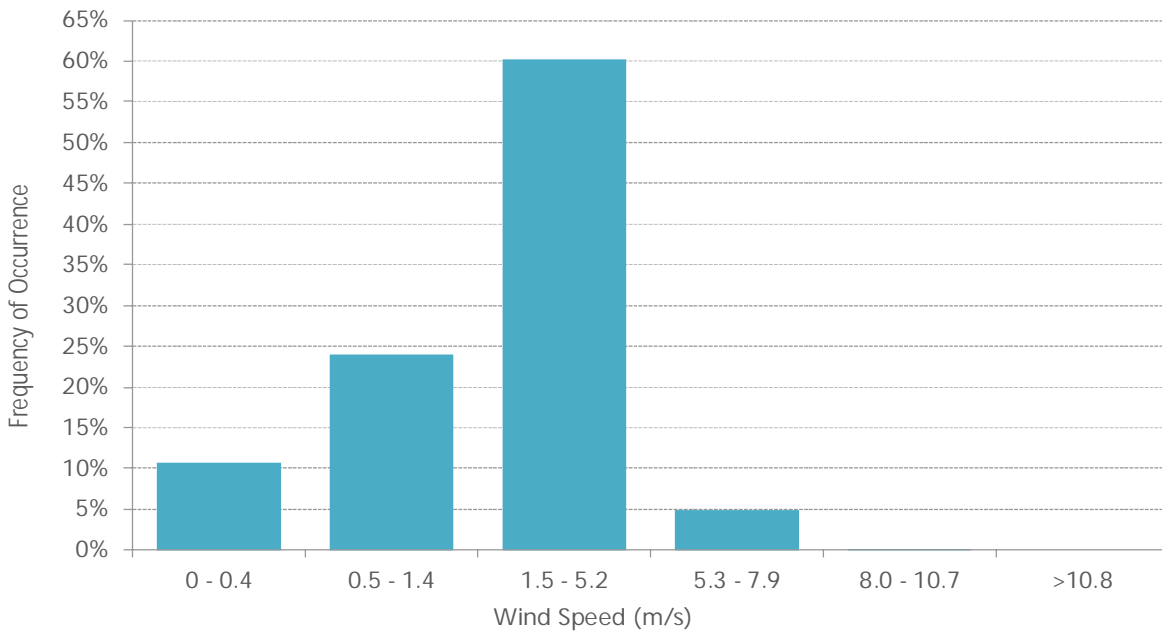


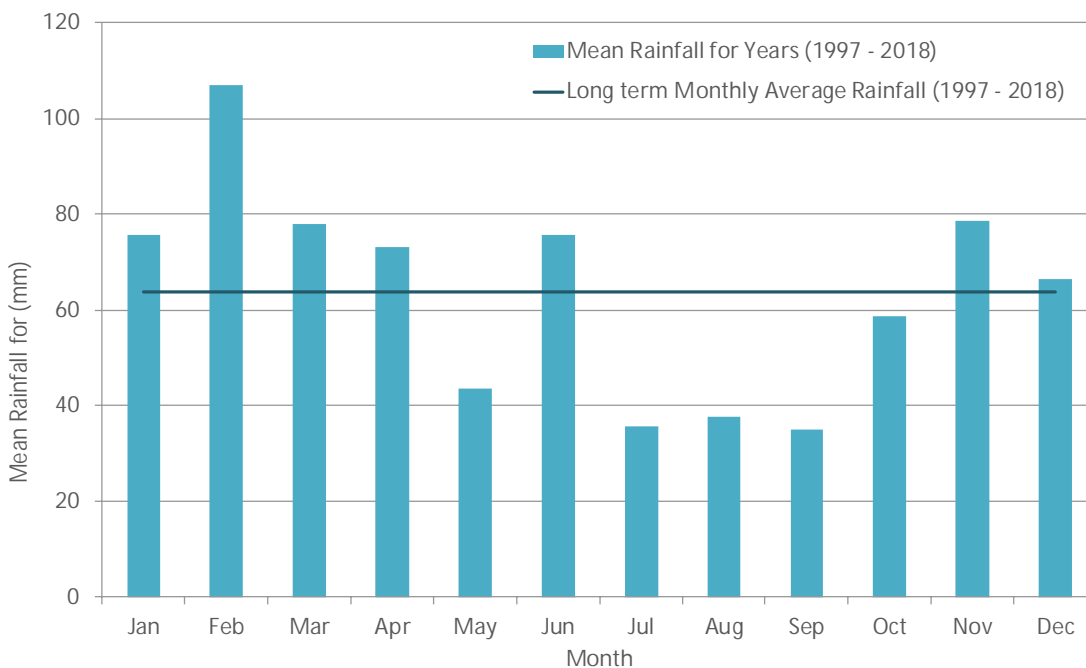
Figure 7 Wind Speed Frequency Chart for Horsley Park AWS – 2014-2018



Rainfall

Dry periods (no rainfall) have a greater risk of generating fugitive dust emissions during construction as moisture binds dust particles together. The long-term monthly rainfall averages recorded by the Horsley Park AWS rain gauge are shown in Figure 8. Generally, rainfall is lowest in the mid-winter to mid spring period.

Figure 8 Long term Mean Rainfall for Horsley Park AWS – 1997 to 2018



6.2 Background Air Quality

The NSW Office of Environment and Heritage (OEH) maintains a network of Air Quality Monitoring Stations (AQMS) across NSW. The nearest such station is located at St Marys, approximately 7 km west northwest of the Project. The St Marys AQMS was commissioned in 1992 and is located on a residential property in close proximity to horticulture, agriculture and the vehicle activity along Mamre Road, St Marys. It is situated in the centre of the Hawkesbury Basin and is at an elevation of 29 m. PM₁₀ is monitored by the St Marys AQMS.

A summary of the PM₁₀ concentrations for the last five years (2014-2018) is tabulated in Table 4 and presented graphically in Figure 9. There were no exceedances of the 24-hour average criterion recorded in 2014 and 2017, one exceedance in 2015, three exceedances in 2016 and two exceedances in 2018.

Table 4 Summary of PM₁₀ Monitoring Data at St Marys AQMS (2014 – 2018)

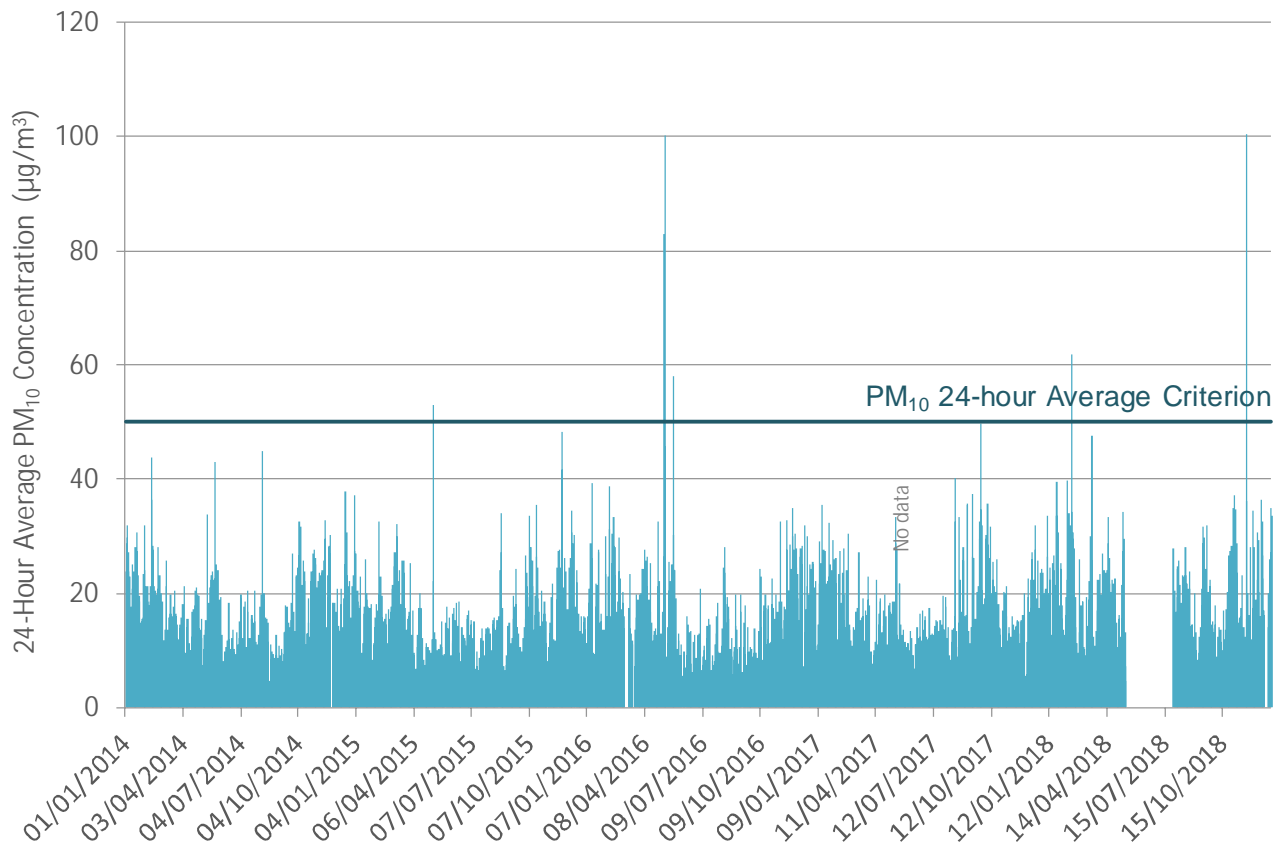
Period	Maximum 24-hour Average	Annual Average
	µg/m ³	µg/m ³
2014	45.0	16.7
2015	53.0 ^a	15.0
2016	100.2 ^b	16.1
2017	49.8	16.2
2018	100.5 ^c	19.4
Criterion	50	25

^a Recorded on 6 May 2015

^b Recorded on 8 May 2016

^c Recorded on 22 November 2018

Figure 9 Measured 24-Hour Average PM₁₀ Concentrations at St Marys AQMS (2014 – 2018)



A review of the exceedances recorded during 2015 (NSW OEH, 2017), 2016 (NSW OEH, 2017), 2017 (NSW OEH, 2018) and 2018 (NSW OEH, 2019) indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns. For 2018, the air quality was generally 'good', and air quality standards were met for 98% of the days in Sydney.

PM₁₀ concentrations vary across years with higher levels and more exceedances occurring in bushfire and dust storm affected years. Dry El Niño years (2002–2007) have been associated with a greater frequency of bushfires and dust storms and therefore higher particle pollution levels. Lower particle pollution levels have occurred during wetter La Niña years (2010–2012).

7 Assessment of Dust Emissions During Construction

The key potential health and amenity issues associated with construction of Project are, respectively:

- Elevated suspended particulate concentrations (PM₁₀).
- Nuisance due to dust deposition (soiling of surfaces) and visible dust plumes.

7.1 Construction Impact Assessment Methodology

Quantitatively assessing impacts of fugitive dust emissions from construction projects using predictive modelling is seldom considered appropriate, primarily due to the uncertainty in the details of the construction activities, including equipment type, number, location and scheduling, which are unlikely to be available at the time of the assessment. Furthermore, they are also likely to change as construction progresses. In comparison, the equipment and operations of a mine or quarry are determined during the planning stages and more likely to remain consistent for long periods (several months or years).

Instead, it is considered appropriate to conduct a qualitative assessment. Potential impacts of dust emissions associated with proposed demolition and construction activities at the Site has been performed based on the methodology outlined in the Institute of Air Quality Management (UK) (IAQM) document, "Assessment of dust from demolition and construction" (Holman et al 2014). This guidance document provides a structured approach for classifying construction sites according to the risk of air quality impacts, to identify relevant mitigation measures appropriate to the risk (see Appendix A for full methodology).

The IAQM approach has been used widely in Australia for the assessment of air quality impacts from construction projects and the identification of appropriate mitigation measures and has been accepted by regulators across all states and territories for a variety of construction projects.

The IAQM method uses a four-step process for assessing dust impacts from construction activities:

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

7.2 Step 1 – Screening Based on Separation Distance

As noted in Section 1.2, the nearest sensitive receptor is located approximately 900 m from the nearest Site boundary.

The screening criteria for detailed assessment are:

- a 'human receptor'² within:
 - 350 m of the boundary of the site; or
 - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).
- an 'ecological receptor'³ within:
 - 50 m of the boundary of the site; or
 - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

The Project does not meet any of these criteria and therefore a detailed assessment is not deemed necessary. However, it is noted that immediately beyond the northwest boundary of the Site there is a large car park for the distribution centre workers. A common impact of nuisance dust is the soiling of vehicles stored on neighbouring properties. It is therefore considered appropriate to progress the assessment, but only in relation to impacts on amenity, or dust soiling.

In relation to the wind roses presented in Section 6.1, it is apparent that winds that would blow fugitive dust emissions from the demolition/construction works towards the receptor are most likely to occur during the summer months and least likely to occur during the winter months.

7.3 Step 2a – Assessment of Scale and Nature of the Works

Based on the IAQM definitions presented in Appendix A, dust emission magnitudes for the anticipated works have been categorised as presented in Table 5.

² A 'human receptor', refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM₁₀ over a time period. In terms of annoyance effects, this will most commonly relate to dwellings, but may also refer to other premises such as buildings housing cultural heritage collections (e.g. museums and galleries), vehicle showrooms, food manufacturers, electronics manufacturers, amenity areas and horticultural operations (e.g. salad or soft-fruit production).

³ An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats).

Table 5 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Demolition	Small	Total building volume <20,000 m ³ , construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months. There are no buildings to be demolished as part of the Project.
Earthworks	Large	Total site area greater than 10,000 m ² , potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t. Total area where the earthworks will be undertaken for the Project, including removal of carparks and internal roads is estimated to be greater than 30,000 m ² .
Construction	Large	Total building volume greater than 100,000 m ³ , potentially dusty construction material (e.g. concrete), piling, on site concrete batching. The total building area is estimated to be greater than 25,000 m ² . Therefore, the total volume is likely to be greater than 100,000 m ³ .
Trackout	Large	More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length. The unpaved road length is estimated to be greater than 100 m.

7.4 Step 2b – Risk Assessment

7.4.1 Receptor Sensitivity

Based on the criteria listed in Table A1 in Appendix A, the sensitivity of the identified receptor in this study is conservatively classified medium for dust soiling, as it is a place of work where users would expect to enjoy a reasonable level of amenity. Table A1 also describes short-term carparks as a low sensitivity.

7.4.2 Sensitivity of an Area

Based on the classifications shown in Table A2 and Table A3 in Appendix A, the sensitivity of the area to dust soiling may be classified as low.

7.4.3 Risk Assessment

Table 6 presents the preliminary risk of air quality impacts from uncontrolled construction activities determined using the risk matrix provided in Table A4 in Appendix A, based on the identified receptor sensitivity and sensitivity of the area.

Table 6 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

Impact	Sensitivity of Area	Dust Emission Magnitude				Preliminary Risk			
		Demolition	Earthworks	Construction	Trackout	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Small	Large	Large	Large	Negligible	Low	Low	Low

The results indicate that there is a low risk of adverse dust soiling occurring at the off-site sensitive receptor locations if no mitigation measures were to be applied to control emissions during the works.

7.5 Step 3 - Mitigation Measures

For almost all construction activity, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

The IAQM document provides guidance on appropriate mitigation measures for construction activities determined to have low, medium and high preliminary risk of adverse air quality impacts. Table 7 lists the relevant mitigation measures by the IAQM methodology for a project shown to have a low risk of adverse impacts. Not all these measures would be practical or relevant for the Project, hence a detailed review of the recommendations should be performed as part of the development of the Construction Environmental Management Plan (CEMP) and the most appropriate measures adopted.

Table 7 Proactive Dust Mitigation Measures

#	Mitigation Measure
1	Communications
1.1	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
1.2	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the Site Manager.
1.3	Display the head or regional office contact information.
2	Site Management
2.1	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
2.2	Make the complaints log available to the Local Authority when requested.
2.3	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
3	Preparing and Maintaining the Site
3.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.

#	Mitigation Measure
3.2	Erect solid screens or barriers around dusty activities or the site boundary that they are at least as high as any stockpiles on site.
3.3	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
3.4	Avoid site runoff of water or mud.
3.5	Keep site fencing, barriers and scaffolding clean using wet methods.
3.6	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
3.7	Cover, seed or fence stockpiles to prevent wind erosion.
4	Operating Vehicle/Machinery and Sustainable Travel
4.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable.
4.2	Stationary trucks will switch off engines if idling time on-site is likely to exceed 2 minutes.
4.3	Avoid using the local road network during peak traffic periods, where possible.
4.4	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
4.5	Minimise truck queuing and unnecessary trips through logistical planning.
5	Operations
5.1	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
5.2	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate.
5.3	Use enclosed chutes and conveyors and covered skips.
5.4	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
6	Waste Management
6.1	No on-site burning of waste materials.
7	Excavation
7.1	Only the minimum area necessary is disturbed at any one time.
7.2	Where applicable, rehabilitation of disturbed areas will be undertaken as soon as practicable.
7.2	If unanticipated strong odours are encountered or significant dust emissions are noted on site, stop related work and seek advice from the Environmental Coordinator or equivalent role.
7.3	Carry out excavation works and vehicle loading/unloading when weather conditions are favourable (i.e. receptors are upwind from the works).
8	Construction
8.1	Avoid scabbling (roughening of concrete surfaces) if possible.
8.2	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
9	Trackout
9.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.

#	Mitigation Measure
9.2	Avoid dry sweeping of large areas.
9.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
9.4	Record all inspections of haul routes and any subsequent action in a site log book.
9.5	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site).
10	Contingency Plan for Prolonged Dust Events
10.1	Deployment of additional water sprays where practicable
10.2	Relocation or modification of dust-generating sources, where possible
10.3	Temporary halting of activities and resuming when conditions have improved

In addition to the mitigation measures proposed in Table 7, daily site inspections will be carried out during construction works (see Section 7). Daily environmental inspections will include, but not be limited to:

- Visual inspection of any airborne dust being generated on-site or being observed blowing off-site
- Ensuring roads leaving the Site are free of soil, and that there is no observable soil tracking onto the road network
- Inspection of the erosion and sediment control systems for silt build-up
- Inspection of stockpiles and waste storage areas to ensure no significant wind erosion is observable.

Any environmental inspection reports will include the above observations, with remedial or corrective actions noted (as appropriate). Any remedial or corrective actions must be reported to the Site Manager as soon as is practicable.

7.6 Step 4 - Residual Impacts

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. These are termed 'residual impacts'. The results of the reappraisal are presented below in Table 8.

Table 8 Residual Risk of Air Quality Impacts from Construction

Impact	Sensitivity of Area	Residual Risk			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Negligible	Negligible	Negligible	Negligible

The dust deposition for mitigated activities are anticipated to be negligible.

8 Air Quality Monitoring Program

The AQIA concluded that the risk of construction dust emissions causing nuisance impacts at off-site sensitive receptor locations is low. It is also noted that any impacts will be temporary and managed through the implementation of appropriate mitigation measures.

Considering the low risk from the construction dust emissions to cause nuisance at off-site sensitive receptor locations, dust monitoring at the nearest sensitive receptors is not considered necessary.

However utilising static dust gauge(s) for the duration of Project construction, started at least one month before commencement of construction work, would be an inexpensive monitoring method that could be used to demonstrate that dust emissions are being managed effectively.

A summary of the proposed nuisance dust monitoring program is shown in Table 9.

Table 9 Nuisance Dust Monitoring Program

Parameter	Methodology	Duration	Location	Frequency
Deposited dust	AS/NZS 3580.1.1:2016 - Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment	During Site preparation, earthworks, construction	Inside Project Site boundary along Roberts Road	Monthly

An air quality contingency management plan for the Project construction, based on the monitoring approach outlined above, is provided in Table 10.

Table 10 Nuisance Dust Contingency Management Plan for Project

Trigger	Dust Deposition Rate <4 g/m ² /month	Dust Deposition Rate >4 g/m ² /month
Response	No response required. Continue monitoring program	Review and investigate construction activities and respective control measures, where appropriate. Implement additional remedial measures, such as: <ul style="list-style-type: none"> • Deployment of additional water sprays. • Relocation or modification of dust-generating sources. • Temporary halting of activities and resuming when conditions have improved.

9 Mitigation measures

The SEARs require an environmental risk analysis to identify potential environmental impacts associated with the Project. The following represents the way in which risks, impacts and mitigation measures are identified and quantified in relation to dust management at the Project.

This analysis comprises a qualitative assessment consistent with AS/NZS ISO 31000:2009 Risk Management–Principles and Guidelines (Standards Australia 2009). The level of risk was assessed by considering the potential impacts of the Project prior to application of any mitigation or management measures.

Risk comprises the likelihood of an event occurring and the consequences of that event. For the Project, the descriptors shown in Table 11 were adopted for ‘likelihood’ and ‘consequence’.

Table 11 Risk Descriptors

Likelihood		Consequence	
A	Almost certain	1	Widespread and/or irreversible impact
B	Likely	2	Extensive but reversible (within 2 years) impact or irreversible local impact
C	Possible	3	Local, acceptable or reversible impact
D	Unlikely	4	Local, reversible, short term (<3 months) impact
E	Rare	5	Local, reversible, short term (<1 month) impact

The risk levels for likely and potential impacts were derived using the risk matrix shown in Table 12.

Table 12 Risk Matrix

Consequence	Likelihood				
	A	B	C	D	E
1	High	High	Medium	Low	Very Low
2	High	High	Medium	Low	Very Low
3	Medium	Medium	Medium	Low	Very Low
4	Low	Low	Low	Low	Very Low
5	Very Low	Very Low	Very Low	Very Low	Very Low

The risk assessment and mitigations measures are shown in Table 13.

Table 13 Risk Assessment and Mitigation Measures

Matter	Potential Impact	Likelihood	Consequence	Risk Level	Proposed Mitigation Measures
Air Quality	PM ₁₀ health impacts on nearby sensitive receptors from construction phase	E	4	Very Low	No mitigation required for PM ₁₀ specifically. Note that measures for dust soiling (below) will likely also reduce the potential impact of PM ₁₀ .
	Dust soiling (nuisance) impacts on nearby receptors from construction phase	D	4	Low	Develop a Construction Environmental Management Plan (CEMP) adopting appropriate and relevant measures from Section 7.5 of the AQIA, including monitoring as proposed in Section 8 of the AQIA.

10 References

- NSW Department of Planning. (2019, July 23). ePlanning Spatial Viewer. Retrieved from <https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address>
- NSW EPA. (2017, January). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
- NSW OEH. (2017). New South Wales Annual Compliance Report 2015.
- NSW OEH. (2017). Towards Cleaner Air: NSW Air Quality Statement 2016.
- NSW OEH. (2018). Clearing the Air: New South Wales Air Quality Statement 2017.
- NSW OEH. (2019). NSW Annual Air Quality Statement 2018.
- NSW Parliament. (2010). Protection of the Environment Operations (Clean Air) Regulation 2010.

APPENDIX A

IAQM Construction Assessment Methodology

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the Site, more than 50 m from the route used by construction vehicles on public roads and more than 500 m from the Site entrance. This step is noted as having deliberately been chosen to be conservative, and will require assessments for most projects.

Step 2a – Assessment of Scale and Nature of the Works

Step 2a of the assessment provides “dust emissions magnitudes” for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of soils and dusty materials onto public roads by vehicles). The magnitudes are: Large; Medium; or Small, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, which are most relevant to this Project, are as follows:

Demolition (Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time):

- Large: Total building volume >50,000 m³, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- Medium: Total building volume 20,000 m³ – 50,000 m³, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- Small: Total building volume <20,000 m³, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks (Covers the processes of soil-stripping, ground-levelling, excavation and landscaping):

- Large: Total site area greater than 10,000 m², potentially dusty soil type (eg clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
- Medium: Total site area 2,500 m² to 10,000 m², moderately dusty soil type (eg silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
- Small: Total site area less than 2,500 m², soil type with large grain size (eg sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.

Construction (Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc):

- Large: Total building volume greater than 100,000 m³, piling, on site concrete batching; sandblasting.
- Medium: Total building volume 25,000 m³ to 100,000 m³, potentially dusty construction material (eg concrete), piling, on site concrete batching.
- Small: Total building volume less than 25,000 m³, construction material with low potential for dust release (eg metal cladding or timber).

Track-out (The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network):

- Large: More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length.
- Medium: Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.
- Small: Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length.

In order to provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

Step 2b – Risk Assessment

Assessment of the Sensitivity of the Area

- Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:
- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts
- The proximity and number of those receptors
- In the case of PM₁₀, the local background concentration
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

Individual receptors are classified as having high, medium or low sensitivity to dust deposition and human health impacts (ecological receptors are not addressed using this approach). The IAQM method provides guidance on the sensitivity of different receptor types to dust soiling and health effects as summarised in Table A-1. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table A-1 IAQM Guidance for Categorising Receptor Sensitivity

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

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the sensitivity of the area surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM₁₀ concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- Any history of dust generating activities in the area
- The likelihood of concurrent dust generating activity on nearby sites

- Any pre-existing screening between the source and the receptors
- Any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place
- Any conclusions drawn from local topography
- The duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts)
- Any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in Table A-2. The sensitivity of the area should be derived for each of activity relevant to the project (i.e. construction and earthworks).

Table A-2 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

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

Note: Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors < 20m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors < 50 m is 102. The sensitivity of the area in this case would be high.

A modified version of the IAQM guidance for assessing the sensitivity of an area to health impacts is shown in Table A-3. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM₁₀ (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM₁₀ in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (i.e. an annual average of 25 µg/m³ for PM₁₀) the IAQM method has been modified slightly.

- This approach is consistent with the IAQM guidance, which notes that in using the tables to define the sensitivity of an area, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:
 - Any history of dust generating activities in the area
 - The likelihood of concurrent dust generating activity on nearby sites
 - Any pre-existing screening between the source and the receptors
 - Any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place
 - Any conclusions drawn from local topography
 - Duration of the potential impact
 - Any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A-3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM ₁₀ conc.	Number of receptors ^{a,b}	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m ³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m ³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

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

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

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in Table A-4 (demolition), Table A-5 (earthworks and construction) and Table A-6 (track-out) to determine the risk category with no mitigation applied.

Table A-4 Risk Category from Demolition Activities

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

Table A-5 Risk Category from Earthworks and Construction Activities

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

Table A-6 Risk Category from Track-out Activities

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

Step 3 - Site-Specific Mitigation

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the Site is a low, medium or high risk site.

Step 4 – Residual Impacts

Following Step 3, the residual impact is then determined after management measures have been considered.

ASIA PACIFIC OFFICES

BRISBANE

Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA

GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN

Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST

Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY

21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE

Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE

10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH

Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY

2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE

Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

TOWNSVILLE SOUTH

12 Cannan Street
Townsville South QLD 4810
Australia
T: +61 7 4772 6500

WOLLONGONG

Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 404 939 922

AUCKLAND

68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

NELSON

6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628