QANTAS FLIGHT TRAINING CENTRE

Air Quality Impact Assessment

Prepared for:

Qantas Airways Limited
c/- APP Corporation Pty Ltd
Level 7, 116 Miller Street
North Sydney NSW 2060

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Qantas Airways Limited (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.

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DOCUMENT CONTROL

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ABBREVIATIONS

%	percent
µg	microgram
$µg/m^3$	microgram per cubic metre of air
AQIA	air quality impact assessment
AQMS	Air Quality Monitoring Station
CO	carbon monoxide
g/m^2/month	grams per square metre per month
km	kilometre
m	metre
m/s	metre per second
m^2	square metre
m^3	cubic metre
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PM_{10}	particular matter with an equivalent aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particular matter with an equivalent aerodynamic diameter of 2.5 microns or less
SSD	State Significant Development
SSDA	State Significant Development Application
TSP	total suspended particulate matter
UTM	Universal Transverse Mercator

GLOSSARY

ambient	Pertaining to the surrounding environment or prevailing conditions
background	The existing air quality in the Project area excluding the impacts from the proposed development
combustion	The process of thermal oxidation. A chemical change, especially oxidation, accompanied by the production of heat and light
dust deposition	Settling of particulate matter out of the air through gravitational effects (dry deposition) and scavenging by rain and snow (wet deposition)
dispersion	The spreading and dilution of substances emitted in a medium (e.g. air or water) through turbulence and mixing effects
guideline	A general rule, principle, or piece of advice. A statement or other indication of policy or procedure by which to determine a course of action.
meteorological	The science that deals with the phenomena of the atmosphere, especially weather and weather conditions
particulate	Of, relating to, or formed of minute separate particles. A minute separate particle, as of a granular substance or powder
plume	A space in air, water, or soil containing pollutants released from a point source
pollutant	A substance or energy introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource
receptor	Coordinate locations specified in an air dispersion model where ground level pollutant concentrations are calculated by the model
sensitive receptor	Locations such as residential dwellings, hospitals, churches, schools, recreation areas etc where people (particularly the young and elderly) may often be present, or locations with sensitive vegetation and crops.
standard	The prescribed level of a pollutant in the outside air that should not be exceeded during a specific time period to protect public health
topography	Detailed mapping or charting of the features of a relatively small area, district, or locality
wind direction	The direction from which the wind is blowing
wind erosion	Detachment and transportation of loose topsoil or sand due to action by the wind
wind rose	A meteorological diagram depicting the distribution of wind direction and speed at a location over a period of time

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Qantas Airways Limited (Qantas) to prepare an Air Quality Impact Assessment (AQIA) report for the proposed construction and operation of a Qantas Flight Training Centre (the Development) to be located at 297 King Street, Mascot (the Development Site), within the Bayside Local Government Area.

The Development Site has been selected to accommodate the new Flight Training Centre due to its proximity to Sydney Airport and Qantas' existing operations within the broader Mascot Campus. The new Flight Training Centre will replace the existing Flight Training Centre located on the Qantas Jetbase within Sydney Kingsford Smith Airport, which will be demolished as part of Roads and Maritime Service's (RMS) Sydney Gateway project.

This report has been prepared to form part of a State Significant Development Application (SSDA 10154) for the construction and operation of the new Flight Training Centre, including demolition works, construction of a multi-level car park and associated internal road works and landscaping.

The Department of Planning and Environment (DPE) issued the Secretary's Environmental Assessment Requirements (SEARs) on 29 March 2019. This report addresses the SEARs, which require the following matters to be addressed in relation to air quality:

- An assessment of the air quality impacts at private properties during construction and operation of the development, in accordance with the relevant Environment Protection Authority guidelines; and
- Details of any mitigation, management and monitoring measures required to prevent and/or minimise emissions.

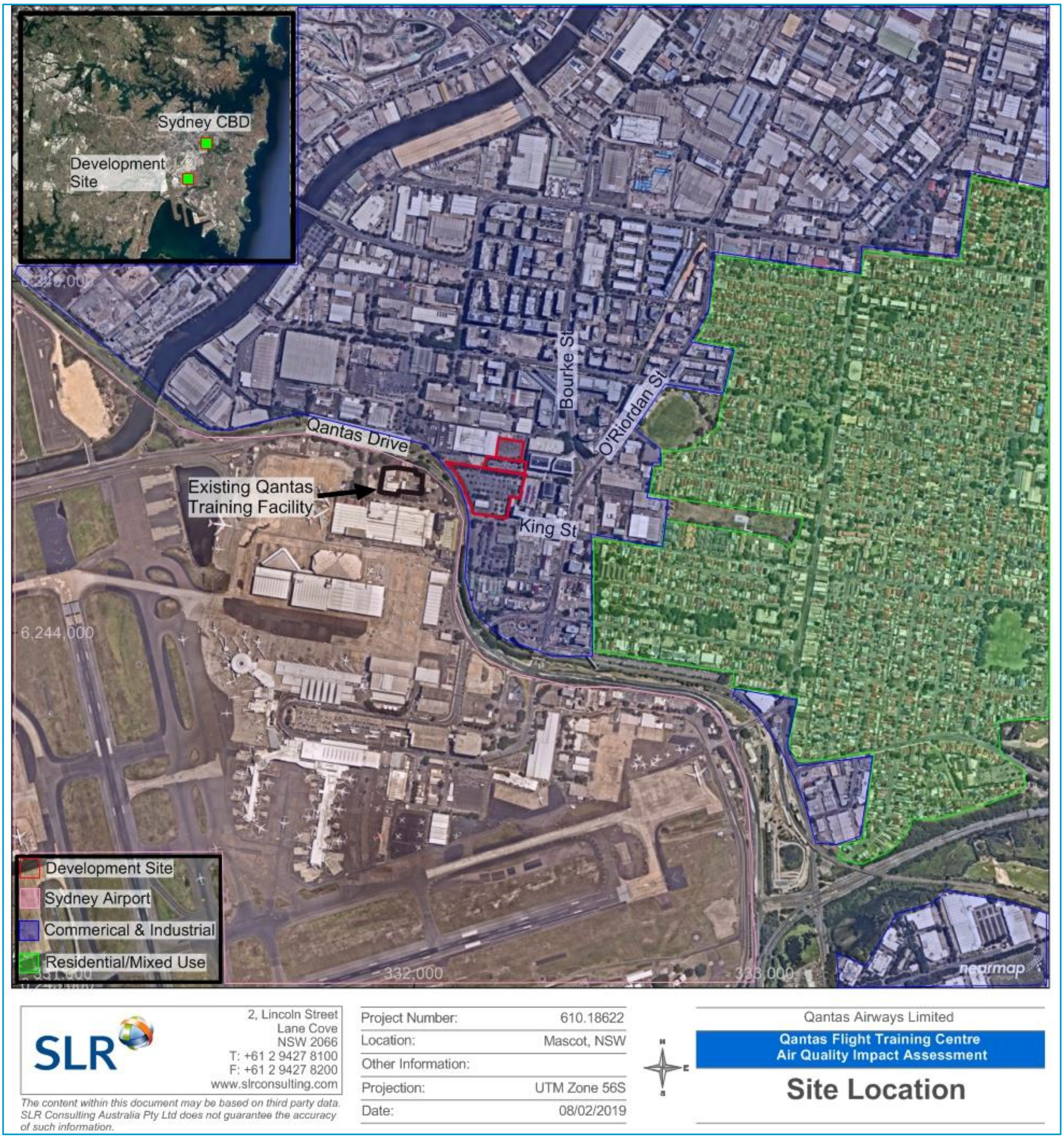
The aim of this AQIA is to assess the risks associated with the potential air quality impacts during construction and operation of the proposed Development.

2 Project Overview

2.1 Regional Setting

The Development Site is located at 297 King Street, Mascot within the Bayside LGA. The location of the Development Site in context to the surrounding industrial and residential land uses is shown in **Figure 1**.

Figure 1 Satellite Image of the Proposed Development Site



The Development Site is bounded by Qantas-owned land to the north, Travelodge Hotel to the east, King Street to the south and Port Botany Freight Line to the west. The Development Site is located within a 'General Industrial' (IN1) zone in the Botany Bay Local Environmental Plan 2013 (LEP), and is surrounded by a mixture of industrial and commercial buildings.

The Travelodge Hotel is located towards the southeast boundary of the Development Site, approximately 20 m from the eastern Development Site boundary (shown in **Figure 2**). The Travelodge Hotel is regarded as a sensitive receptor as it has potential to be adversely impacted by nuisance dust.

For the purpose of this assessment, the industrial facilities are referred to as medium sensitivity receptors and the Travelodge Hotel is referred to as a high sensitivity receptor.

2.2 The Proposed Development

The indicative layout of the Development Site is shown in **Figure 2**. It is noted that the existing 'Qantas Catering' and the 'Tri-Generation Plant' buildings located north of Development Site will remain with no changes from current activities, and do not form part of the SSDA.

Figure 2 Indicative Site Layout of the Proposed Development Site

Source: Appendix A (Preliminary Scheme Plans) NoxonGiffen 2018.

2.2.1 Construction Activities

Qantas expects that the new Flight Training Centre would take approximately 16 months to construct and then a further 7 months for the installation, commissioning and calibration of the simulators.

During the demolition and construction activities, the Development Site will be accessed via King Street from the southern side and Kent Road from the northern side. Specifically, the following construction and demolition activities are proposed as part of the Project (refer to **Figure 2** for Lot numbers):

- Demolition of all existing site improvements on Lots 2 &4 of DP 234489 and Lot B of DP 164829;
- Demolition of existing hardstand areas on Lot 1 of DP 202747 and Lot 133 of DP 659434; and
- Construction of the proposed Flight Training Centre, staged construction of the multi-deck car park and associated supportive/facilitating works, including internal road works and landscaping.

The proposed multi-deck car park will be located to the northeast of the Flight Training Centre and adjacent to the existing Qantas catering facility and tri-generation plant. The proposed car park will have 13 levels and will provide 2,059 spaces for Qantas staff. Vehicle access to the car park will be provided via King Street, Kent Road and from Qantas Drive via the existing catering bridge.

The proposed working hours for the construction period are 6:00am to 8:00pm, Monday to Sunday due to the critical nature of the project.

An investigation of recent site visit of the area concluded that no other similar construction activities currently exist in the area.

2.2.2 Existing Operational Activities

A site visit was performed by Varun Marwaha and Danny Echeverri, consultants in SLR’s Air Quality Team, on 7 February 2019. The main purpose of the site visit was to observe the existing training activities undertaken and to identify any potential sources of air emissions that may be relevant for the proposed new Flight Training Centre.

Photos taken during the site visit are shown in **Figure 3**.

Based on observations of the training facilities and activities undertaken at the existing Flight Training Centre, no activities were identified as having the potential to have any ambient air quality impacts.

Figure 3 Photos Showing Activities at the Existing Qantas Training Centre

2.2.3 Proposed Operational Activities

The Development Site is proposed to be utilised as a training facility for Qantas employees, and will operate on a 24/7 basis. It will enable pilots and flight crews to undertake periodic testing to meet regulatory requirements, by simulating both aircraft and emergency procedural environments. A summary of the proposed operational activities is provided below:

The proposed Flight Training Centre building will occupy the southern portion of the site and will comprise four core elements as follows:

- An emergency procedures hall that contains;
  - cabin evacuation emergency trainers
  - an evacuation training pool
  - door trainers
  - fire trainers
  - slide descent towers
  - security room
  - aviation medicine training and equipment rooms
- A flight training centre that contains:
  - a flight training hall with 14 bays that will house aircraft simulators
  - integrated procedures training rooms, computer rooms, a maintenance workshop, storerooms, multiple de-briefing and briefing rooms, pilot's lounge and a shared lounge.
- Teaching Space that contains:
  - training rooms
  - classrooms and two computer-based exam rooms
- Office Space:
  - Office space for staff and associated shared amenities including multiple small, medium and large meeting rooms, think tank rooms, informal meeting spaces, a video room and lunch/tea room.

There will also be ancillary spaces, including the reception area at the ground floor, toilets, roof plant and vertical circulation.

The external ground floor layout will include a loading dock, at-grade car parking for approximately 39 spaces and a bus drop-off zone at the northern site boundary.

3 Potential Sources of Air Emissions

3.1 Potential Sources of Dust Emissions During Construction

The potential for dust to be emitted during the demolition/construction phase will be directly influenced by the nature of the activities being performed at any given time. Generally, the activities that are most likely to lead to short-term emissions of dust, include:

- Concrete cutting and breaking up of the existing road/footpath surfaces;
- Grading;
- Loading and unloading of materials;
- Wheel-generated dust and combustion emissions from construction equipment;
- Wheel-generated dust from trucks travelling on unpaved surfaces; and
- Wind erosion of exposed surfaces.

Temporary elevations in local dust levels are most likely to occur when construction activities are undertaken during periods of low rainfall and/or windy conditions. The impact of elevated dust emissions is dependent upon the potential for particulates to become and remain airborne prior to being deposited as dust or experienced as an ambient particulate concentration.

A number of environmental factors may affect the generation and dispersion of dust emissions, including:

- Wind direction - determines whether dust and suspended particles are transported in the direction of the sensitive receptors;
- Wind speed - determines the potential suspension and drift resistance of particles;
- Surface type - more erodible surface material types have an increased soil or dust erosion potential;
- Surface material moisture - increased surface material moisture reduces soil or dust erosion potential; and
- Rainfall or dew - rainfall or heavy dew that wets the surface of the soil reduces the risk of dust generation.

Where diesel-powered mobile machinery and vehicles are being used, localised elevations in ambient concentrations of combustion-related pollutants may occur, however any potential for the relevant impact assessment criteria for these pollutants to be exceeded at surrounding sensitive areas will be minimal. Fugitive dust emissions are generally considered to have the greatest potential to give rise to downwind air quality impacts at construction sites and combustion emissions during construction have not been considered further.

Potential air quality impacts associated with fugitive dust emissions from the construction phase of the project have been addressed in **Section 6**.

3.2 Potential Sources of Emissions During Operations

Potential sources of air emissions associated with the operation of the Development Site have been identified as follows:

- Products of fuel combustion (including particulates) from the fire trainer cabins ; and
- Products of fuel combustion and wind-generated dust from vehicle movements entering and leaving the site and idling in the carpark building.

The fire trainer cabins have been identified as a potential new source of air emissions for the proposed Flight Training Centre. Qantas has advised that a *Flame Aviation V9000 Commander™* will be procured for the new training facility. The V9000 Commander™ can be used to train staff in a range of fire scenarios, such as seat fire, oven fire, lavatory fire, overhead luggage bin fire, smartphone fire and laptop fire. Images showing the setup and layout of these cabins are shown in **Figure 4**.

Figure 4 Proposed Fire Training Cabins to be Installed at the New Qantas Training Facility

Source: https://www.flame-aviation.com/products/v9000-commander , accessed on 11 February 2019.

4 Relevant Air Quality Criteria and Guidelines

4.1 Pollutants of Concern

As identified in **Section 3**, potential air pollutants of interest for the construction and operation of the Development Site include:

- Suspended particulate matter;
- Deposited dust; and
- Products of fuel combustion (including particulates).

The following sections outline the potential health and amenity issues associated with the above pollutants, while **Section 4.2** outlines relevant air quality assessment criteria.

4.1.1 Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The 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.

The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter is termed as total suspended particulate (TSP). Particulate matter with an aerodynamic diameter of 10 microns or less is referred to as PM_{10}. The PM_{10} 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 PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

4.1.2 Deposited Dust

Section 4.1.1 is concerned in large part with the health impacts of particulate matter. Nuisance impacts need also to be considered, mainly in relation to deposited dust. Dust can cause nuisance by 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.

The rate of dust deposition is measured by means of a collection gauge, which catches the dust settling over a fixed surface area and over a period of about 30 days.

4.1.3 Products of Combustion

Emissions associated with road traffic and the combustion of automotive fuel (diesel, petrol, etc.) will include carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and volatile organic compounds (VOCs).

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

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

Vehicle exhausts can contain emissions of sulfur dioxide (SO_2) due to impurities in the fuel. The sulfur content in diesel fuel has significantly reduced over the years ambient SO_2 concentrations in Australian cities are typically well below regulatory criteria.

Volatile organic compounds (VOC) may be emitted as a result of the incomplete combustion of fuel. VOC emissions are reducing significantly due to the improved combustion processes offered by modern engines.

4.2 Ambient Air Quality Criteria

4.2.1 Particulate Matter and Products of Combustion

Air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in **Section 4.1** are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2017a) [hereafter 'Approved Methods']. 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. They have been derived from a range of sources and are the defining ambient air quality criteria for NSW and are considered to be appropriate for use in this assessment.

A summary of the relevant impact assessment criteria for particulate matter and products of combustion is provided in **Table 1**.

Table 1 NSW EPA Goals for Particulate Matter and Combustion Gases

Pollutant	Averaging Period	Concentration	
CO	15 minutes	87 ppm	100 mg/m^3
	1 hour	25 ppm	30 mg/m^3
	8 hours	9 ppm	10 mg/m^3
NO_2	1 hour	12 pphm	246 µg/m^3
	Annual	3 pphm	62 µg/m^3
PM_{10}	24 Hours	-	50 µg/m^3
	Annual		25 µg/m^3
$PM_{2.5}$	24 Hours	-	25 µg/m^3
	Annual		8 µg/m^3
SO_2	10 minutes	25 pphm	712 µg/m^3
	1 hour	20 pphm	570 µg/m^3
	24 hours	8 pphm	228 µg/m^3
	Annual	2 pphm	60 µg/m^3

Source: EPA 2017a

4.2.2 Deposited Dust

A summary of the relevant impact assessment criteria for deposited dust is provided in **Table 2**.

Table 2 NSW EPA Approved Methods for Modelling & Assessment of Air Pollutants – Assessment Criteria

Pollutant	Averaging Period	Assessment Criteria (g/m^2/month)
Deposited dust	Annual	2 (maximum increase in deposited dust level) 4 (maximum total deposited dust level)

Source: EPA 2017a

4.3 Local Government Air Quality Toolkit

The NSW EPA has developed the Local Government Air Quality Toolkit (EPA 2018), in response to requests from local Council officers for information and guidance on the common air quality issues they manage. Guidance is available under Part 3 of the Local Government Air Quality Toolkit for Construction Sites. This document lists the common sources of emissions and mitigation and management measures to control airborne dust levels from construction sites, and has been consulted in the development of this AQIA.

5 Existing Environment

5.1 Local Meteorological Conditions

5.1.1 Wind Speed and Wind Direction

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) affects the degree of mechanical turbulence, which also influences the rate of dispersion of air pollutants.

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 Sydney Airport Automatic Weather Station (AWS), located approximately 2.5 kilometres (km) southwest of the Development Site (Station ID 66037). Considering the relatively flat terrain between Development Site and Sydney Airport AWS, it may be assumed that the wind conditions recorded at the Sydney Airport AWS are a reasonable representation of the wind conditions experienced at the Development Site.

Annual wind roses for the years 2014 to 2018 compiled from data recorded by the Sydney Airport AWS are presented in **Figure 5**, with seasonal wind roses for 2017 presented in **Figure 6**. The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day. The 'Beaufort Wind Scale' (consistent with terminology used by the BoM) was used to describe the wind speeds experienced at the Development site, outlined in **Table 3**.

Table 3 Beaufort Wind Scale

Beaufort Scale #	Description	m/s	Description on land
0	Calm	0-0.5	Smoke rises vertically
1	Light air	0.5-1.5	Smoke drift indicates wind direction
2-3	Light/gentle breeze	1.5-5.3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
4	Moderate winds	5.3-8.0	Raises dust and loose paper, small branches are moved
5	Fresh winds	8.0-10.8	Small trees in leaf begin to sway, crested wavelets form on inland waters
6	Strong winds	>10.8	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

Source: http://www.bom.gov.au/lam/glossary/beaufort.shtml

Figure 5 Sydney Airport AWS Annual Wind Roses, 2014-2018

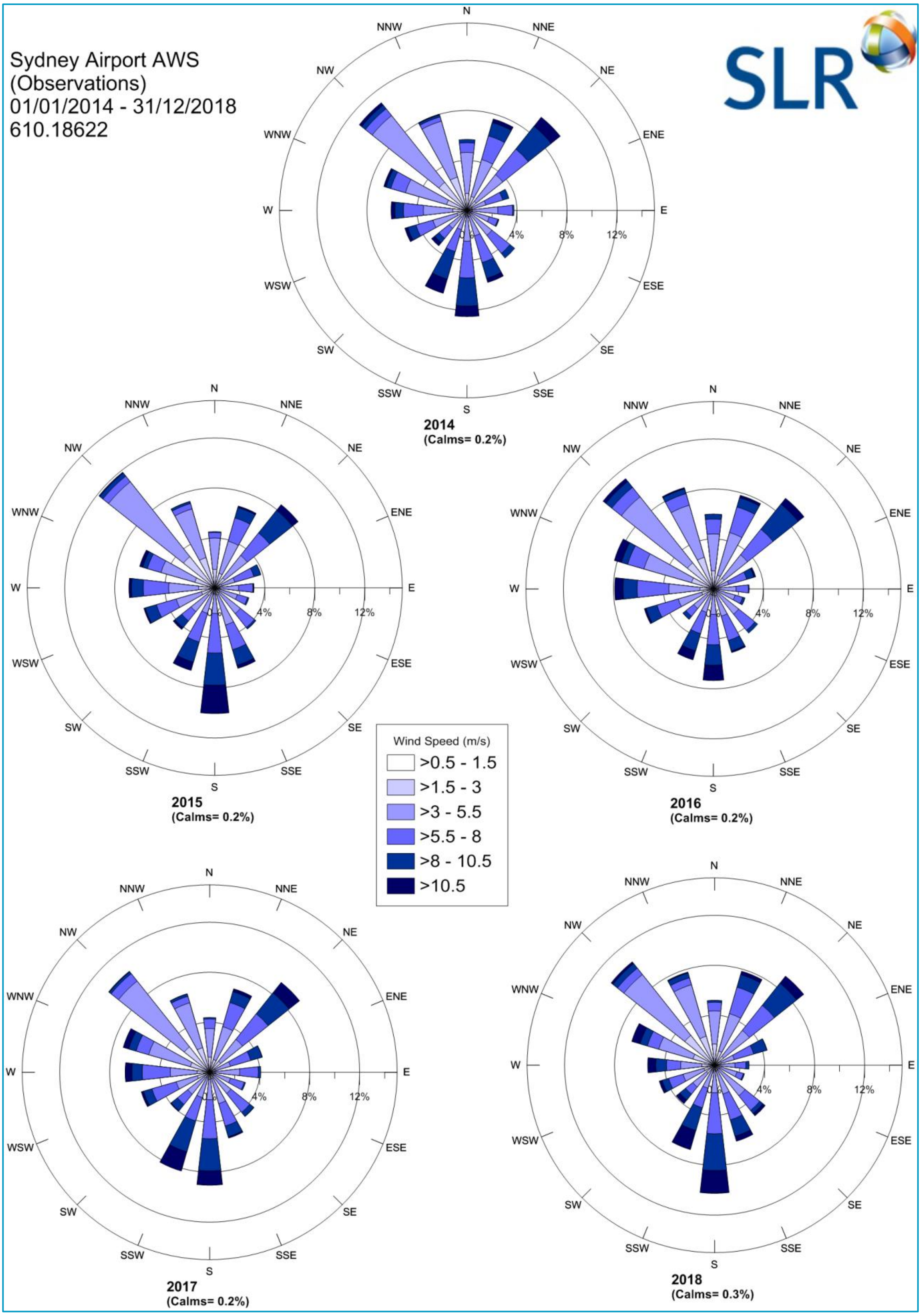
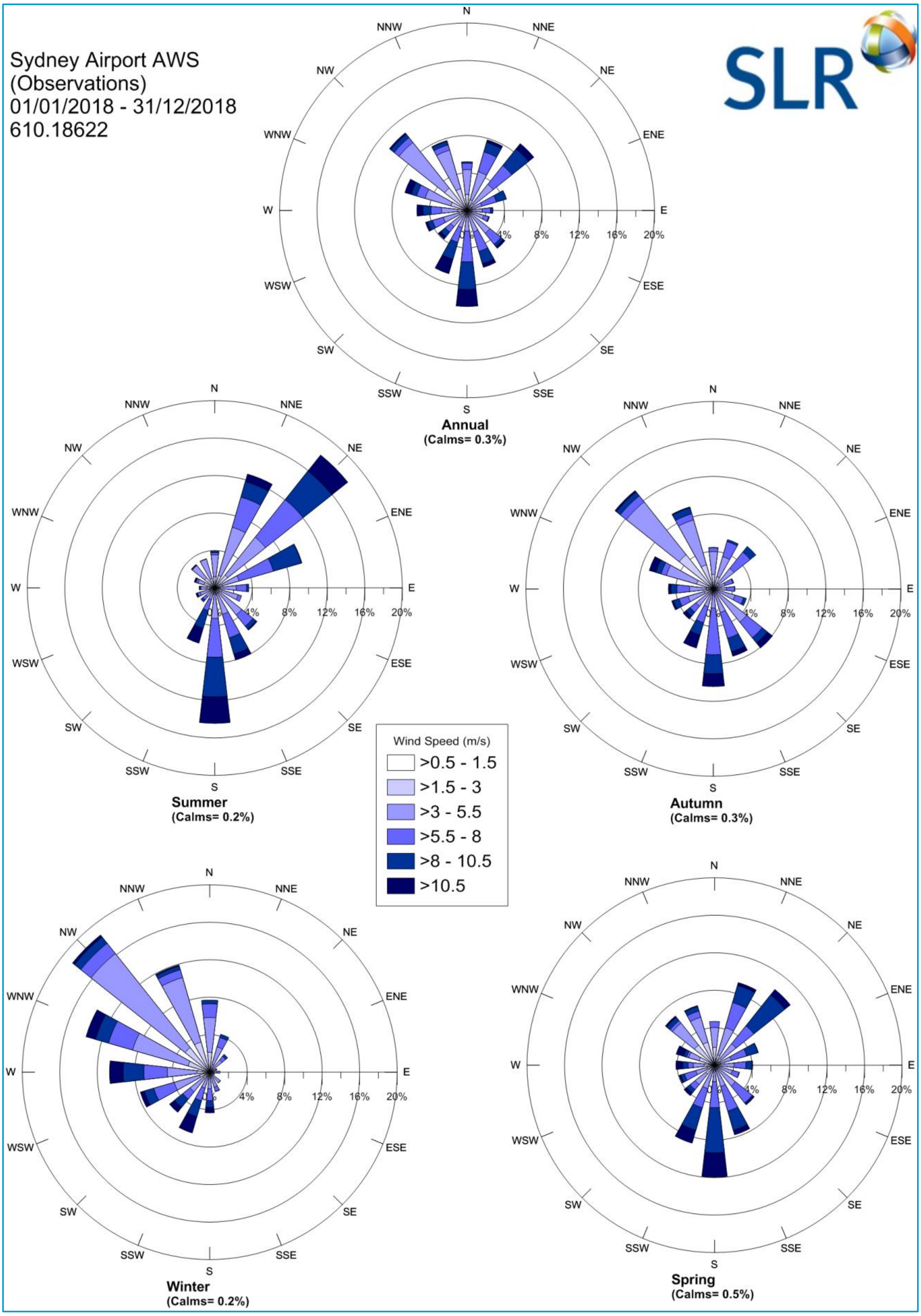


Figure 6 Sydney Airport AWS Seasonal Wind Roses, 2018



The annual wind roses for the years 2014 to 2018 (**Figure 5**) indicate that predominant wind directions in the area are consistently from the northeast, south and northwest directions. Very low frequencies of winds from the east were recorded across all years. The annual frequency of calm wind conditions was recorded to be less than 1% for all the years between 2014 and 2018.

Winds from the northwest, which would blow air emissions from the Development Site towards the nearest sensitive receptors, including the adjacent Travelodge Hotel, occur approximately 8%-12% of the time.

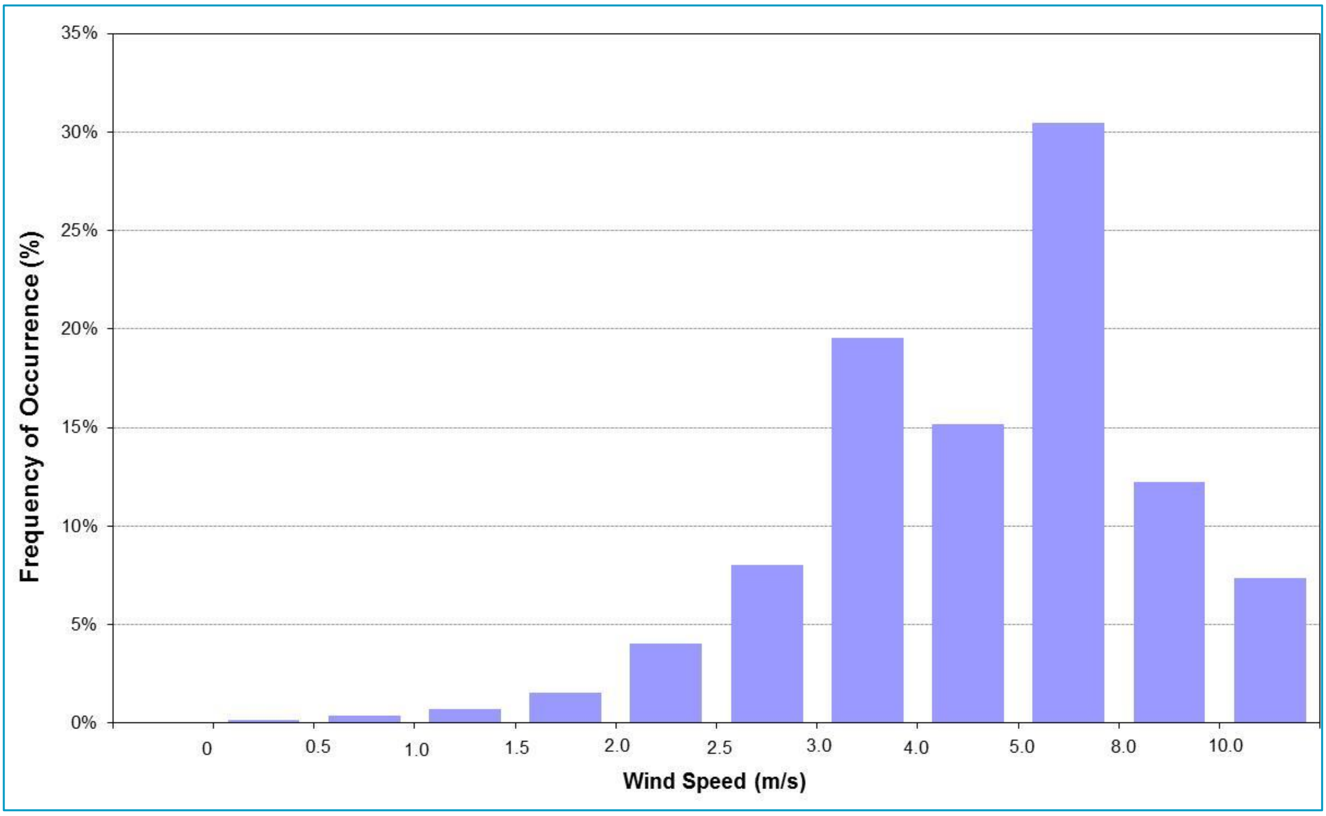
The seasonal wind roses for the year 2018 (**Figure 6**) indicate that:

- In summer, wind speeds ranged from light to strong winds (between 0.5 m/s and 16.3 m/s). The majority of winds blew from the north-northeast, northeast and south directions, with very few winds from the west and north. Calm wind conditions were observed to occur less than 1% of the time during summer. This indicates a low potential for impacts from air emissions from the Development Site at the nearest sensitive receptors during summer.
- In autumn, wind speeds ranged from light to strong winds (between 0.5 m/s and 14.3 m/s). The majority of winds blew from the south and northwest directions (potentially carrying air emissions from Development Site to the nearest sensitive receptors), with very few winds from the east direction. Calm wind conditions were observed to occur less than 1% of the time during autumn.
- In winter, wind speeds ranged from light to strong winds (between 0.5 m/s and 15.6 m/s). The majority of winds blew from between the south-southwest and north-northwest directions (potentially carrying air emissions from Development Site to the nearest sensitive receptors), with very few winds from the northeast, east and southeast directions. Calm wind conditions were observed to occur less than 1% of the time during winter.
- In spring, wind speeds ranged from light to strong winds (between 0.5 m/s and 16.3 m/s). The majority of winds blew from the northeast and south directions. Calm wind conditions were observed to occur less than 1% of the time during spring. This indicates a low potential for impacts from air emissions from the Development Site at the nearest sensitive receptors during spring.

Overall, the seasonal wind roses indicate that winds that would blow emissions from the Development Site towards the nearest sensitive receptors are more likely to occur during the months of autumn and winter. However as the wind speeds are expected to be higher, the dispersion of pollutants can be expected to be higher resulting in lower downwind pollutant concentrations.

The wind speed frequency chart for the period 2014-2018 is shown in **Figure 7**. Wind erosion of dust from exposed surfaces (ie, during the construction phase of the development) 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 (USEPA 2006). The frequency of wind speeds exceeding 5 m/s for the period 2018 recorded by the Sydney Airport AWS was, relatively high at approximately 50%.

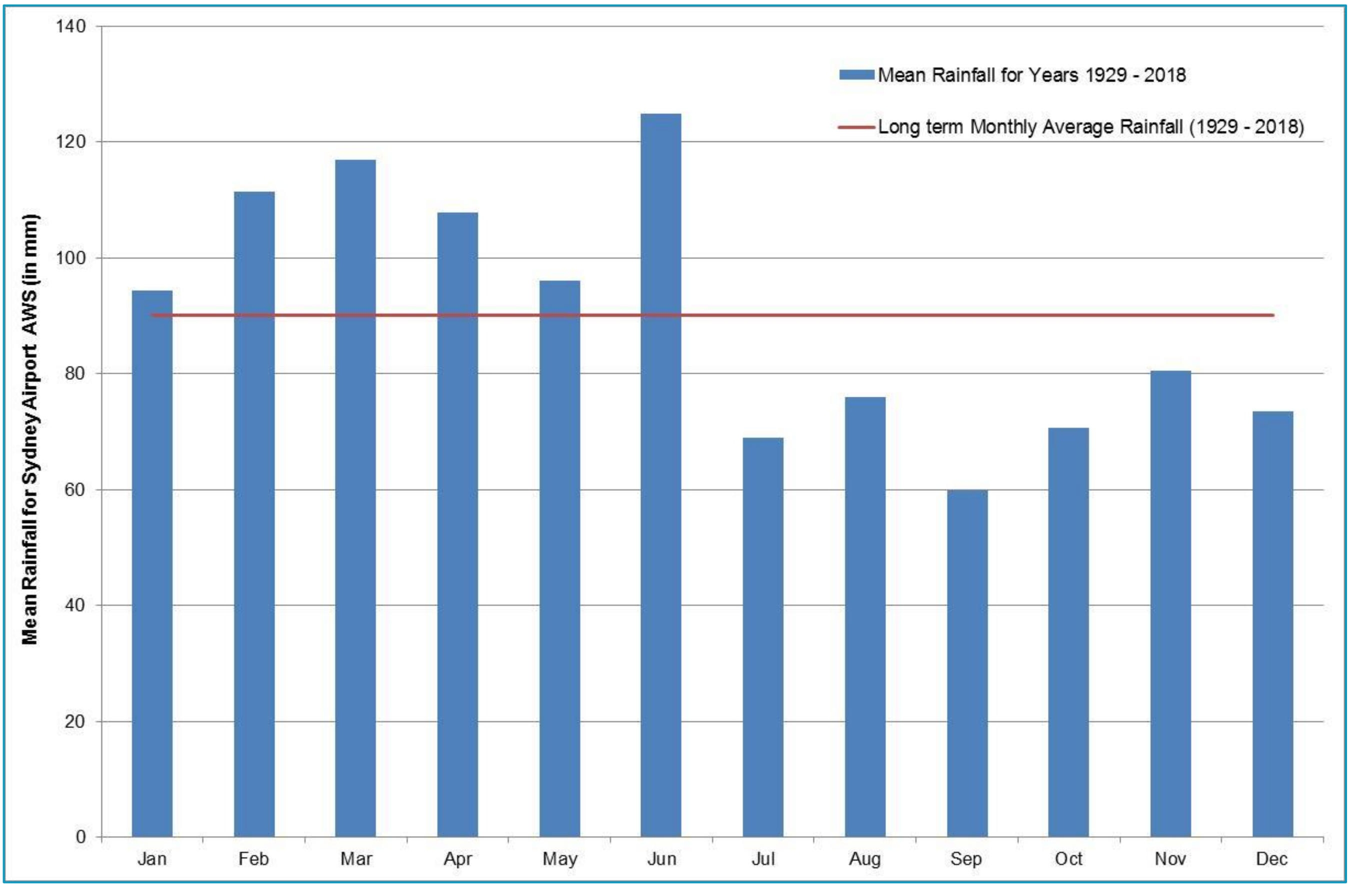
Figure 7 Wind Speed Frequency Chart for Sydney Airport AWS – 2014-2018



5.1.2 Rainfall

Dry periods (no rainfall) have the greatest potential for fugitive dust emissions during construction. The long term monthly rainfall averages recorded at Sydney Airport AWS is shown in **Figure 8**. It is noted that generally the periods between July to December have recorded the lowest monthly rainfalls compared to long term monthly average rainfall.

Figure 8 Long term Mean Rainfall for Sydney Airport AWS – 1995 to 2017



5.1.3 Summary of Meteorological Conditions

The long term wind and rainfall patterns suggest that construction at the Development Site has the greatest potential to impact on surrounding sensitive receptors during the months of winter.

5.2 Background Air Quality

Air quality monitoring is performed by the NSW Office of Environment and Heritage (OEH) at a number of monitoring stations across NSW. The closest such station is the Randwick Air Quality Monitoring Station (AQMS) (approximately 5.4 km to the east of the Development Site). The following air pollutants are monitored by the Randwick AQMS:

- Carbon monoxide (CO);
- Oxides of nitrogen (NO, NO_2 and NO_X);
- Fine particles ($PM_{2.5}$ and PM_{10}); and
- Sulfur dioxide (SO_2).

It is noted however that Randwick AQMS started monitoring $PM_{2.5}$ concentrations as recently as March 2017, and is deemed unsuitable for long term analysis. Therefore, $PM_{2.5}$ data from the Earlwood AQMS (located approximately 4.8 km northwest of the Development Site) has instead been used to characterise $PM_{2.5}$ background levels.

A summary of the air pollutants and the respective AQMSs reviewed as part of this assessment is presented in **Table 4**.

Table 4 Air Pollutants and the Respective AQMSs

Air Pollutant	Randwick AQMS	Earlwood AQMS
Carbon monoxide (CO)	✓	×
Oxides of nitrogen (NO, NO_2 & NO_X)	✓	×
Fine particles less than 10 microns (PM_{10})	✓	×
Fine particles less than 2.5 microns ($PM_{2.5}$)	×	✓
Sulfur dioxide (SO_2)	✓	×

Air quality monitoring data recorded by the Randwick AQMS were obtained for the calendar years 2014 - 2018 and are summarised in **Table 5**.

A review of the data shows that ambient concentrations of NO_2 were below the relevant criteria for all years of available data.

Exceedances of the 24-hour average PM_{10} criterion were recorded by the Randwick AQMS in 2015, 2017 and 2018. A review of the exceedances recorded during 2015 (OEH 2017) and 2017 (OEH 2018b) indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns. At the time of writing this report, the OEH compliance report for the year 2018 is not available.

$PM_{2.5}$ data recorded by the Earlwood AQMS was obtained for the calendar years 2014 - 2018 and is also summarised in **Table 5**.

Exceedances of the 24-hour average $PM_{2.5}$ criterion were recorded at the Earlwood AQMS in 2015, 2016 and 2017. Exceedances of the annual average $PM_{2.5}$ criterion were recorded by the Earlwood AQMS in 2015 and 2016.

A review of the exceedances recorded during 2015 (OEH 2017), 2016 (OEH 2018a) and 2017 (OEH 2018b) indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns. At the time of writing this report, the OEH compliance report for the year 2018 is not available.

It has been noted by NSW EPA in their publication *Air Quality in NSW* (EPA 2017b), that in the period July 2013 to June 2017, air quality has been generally good in NSW based on information from the 43 station NSW Air Quality Monitoring Network. The air quality was 'very good' or 'good' for 70-85% of days in Sydney. During this time, exceedances of the national air quality standards for particle pollution have usually been associated with regional dust storms and vegetation fires.

Annual average $PM_{2.5}$ levels in Sydney are comparable to levels in other Australian cities and are low by world standards, according to a global comparison of air pollution levels conducted by the World Health Organisation (WHO) in 2016. The Australian annual average $PM_{2.5}$ standard is more stringent than standards or guideline values set by the European Union, United States and the WHO.

PM_{10} 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). Regional dust storms, bushfires and planned burns contributed significantly to particle levels in 2009, 2013 and 2016 respectively.

Table 5 Summary of Randwick AQMS Data (2014 - 2018)

Pollutant	Averaging Period	Criteria	Year	Randwick AQMS		Units
				Maximum Concentration	Number of Exceedances	
NO_2	1-hour	12 pphm	2014	4.7	0	pphm
			2015	4.3	0	pphm
			2016	4.4	0	pphm
			2017	4.1	0	pphm
			2018	4.0	0	pphm
	Annual	3 pphm	2014	0.6	0	pphm
			2015	0.9	0	pphm
			2016	0.8	0	pphm
			2017	0.7	0	pphm
			2018	0.7	0	pphm
PM_{10}	24-hour	50 µg/m³	2014	46	0	µg/m³
			2015	77[1]	1	µg/m³
			2016	44	0	µg/m³
			2017	56[1]	1	µg/m³
			2018	96[1]	5	µg/m³
	Annual	25 µg/m³	2014	18	0	µg/m³
			2015	19	0	µg/m³
			2016	18	0	µg/m³
			2017	19	0	µg/m³
			2018	21	0	µg/m³
Pollutant	**Averaging Period**	**Criteria**	**Year**	**Earlwood AQMS**		**Units**
				Maximum Concentration	**Number of Exceedances**	
$PM_{2.5}$	24-hour	25 µg/m³	2014	23	0	µg/m³
			2015	28[2]	2	µg/m³
			2016	33[2]	5	µg/m³
			2017	51[2]	2	µg/m³
			2018	29[2]	1	µg/m³
	Annual	8 µg/m³	2014	7.8	0	µg/m³
			2015	8.5	1	µg/m³
			2016	8.1	1	µg/m³
			2017	7.3	0	µg/m³
			2018	7.8	0	µg/m³

Notes:

1 The maximum 24-hour average PM_{10} concentrations were recorded on 6 May 2015 and 14 August 2017, 15 February 2018, 19 March 2018, 18 July 2018, 21 November 2018 and 22 November 2018.

2 The maximum 24-hour average $PM_{2.5}$ concentrations were recorded on 21 August 2015, 9 May 2016, 14 August 2017, 29 May 2018.

6 Assessment of Dust Emissions During Construction

6.1 Construction Dust Risk Assessment Methodology

For this assessment, the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management ([IAQM], Holman *et al* 2014) has been used to provide a qualitative assessment method (refer to **Appendix A** for full methodology). 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.

6.2 Construction Phase Dust Risk Assessment

6.2.1 Step 1 – Screening Based on Separation Distance

As noted in **Section 2.1**, the nearest sensitive receptor (the Travelodge Hotel) is located approximately 20 m (adjacent plot) from the nearest Development Site boundary.

As sensitive receptors are located within 350 m from the boundary of the site, less than 50 m from the route to be used by construction vehicles on public roads and within 500 m from the site entrance, further assessment is required.

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

Based upon the above assumptions and the IAQM definitions presented in **Appendix A**, the dust emission magnitudes for each phase of the construction works have been categorised as presented in **Table 6**.

Table 6 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. *Only one (1) building is to be demolished, assuming an area of 800 m^2 (40 m x 20 m) and height of 10 m, equates to a total volume of ~8,000 m^3.*
Earthworks	Large	Total site area greater than 10,000 m^2, 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. *Total area where the earthworks will be undertaken at the Development Site is estimated to be approximately 30,000 m^2.*
Construction	Large	Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting. *The total volume of new buildings is estimated to be approximately 153,000 m^3, including:* *~60,500 m^3 for the 'Sims' building (103.5m x 48m x 12.15m);* *~19,000 m^3 for the 'Admin' building (24m x 12.15m) x (45m + 18m): and* *~73,500 m^3 for the 'car park' building (assuming 3.5 m/level and total of 5 levels)*
Trackout	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.

6.2.3 Step 2b – Risk Assessment

Receptor Sensitivity

Based on the criteria listed in **Table A1** in **Appendix A**, the sensitivity of the identified receptors in this study is concluded to be *high* for health impacts and *high* for dust soiling, as they include residential areas where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

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 and health effects may be classified as '*high*' and '*high*' respectively. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM_{10} concentration of 19 µg/m^3 recorded at Randwick AQMS (see **Section 5.2**) and the anticipated number of sensitive receptors present in the vicinity of the Development Site (a hotel is regarded as a '>100' receptor category).

Risk Assessment

Given the sensitivity of the general area is classified as '*high*' for dust soiling and '*high*' for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 6**, the resulting risk of air quality impacts is as presented in **Table 7**.

Table 7 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	High	Small	Large	Large	Medium	Medium Risk	High Risk	High Risk	Medium Risk
Human Health	High					Medium Risk	High Risk	High Risk	Medium Risk

The results indicate that there is a high risk of adverse dust soiling and a high risk of human health impacts occurring at the off-site sensitive receptor locations if no mitigation measures were to be applied to control emissions during the earthworks and construction phases of the works. The demolition phase and trackout have a medium risk of impacts.

6.2.4 Step 3 - Mitigation Measures

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'.

Table 8 lists the relevant mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the IAQM methodology for a development shown to have a high risk of adverse impacts. Not all these measures would be practical or relevant to the proposed Development Site therefore a detailed review of the recommendations should be performed, and the most appropriate measures be adopted as part of the Construction Environmental Management Plan (CEMP). 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.

Table 8 Site-Specific Management Measures Recommended by the IAQM

	Activity	
1	**Communications**	
1.1	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	H
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.	H
1.3	Display the head or regional office contact information.	H
1.4	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	H
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.	H
2.2	Make the complaints log available to the local authority when asked.	H

	Activity	
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.	H
3	**Monitoring**	
3.1	Perform daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary.	H
3.2	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.	H
3.3	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
4	**Preparing and Maintaining the Site**	
4.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
4.2	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	H
4.3	Keep site fencing, barriers and scaffolding clean using wet methods.	H
4.4	Cover, seed or fence stockpiles to prevent wind erosion	H
5	**Operating Vehicle/Machinery and Sustainable Travel**	
5.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
5.2	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
5.3	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable	H
6	**Operations**	
6.1	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.2	Use enclosed chutes and conveyors and covered skips	H
6.3	Minimise drop heights from loading shovels and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
7	**Waste Management**	
7.1	Avoid bonfires and burning of waste materials.	H
7.2	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	H
7.3	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H
8	**Trackout**	
8.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	H
8.2	Avoid dry sweeping of large areas.	H
8.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
8.4	Record all inspections of haul routes and any subsequent action in a site log book.	H
8.5	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H

	Activity	
9	**Demolition**	
9.1	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust)	D
9.2	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H
9.3	Avoid explosive blasting, using appropriate manual or mechanical alternatives	H
10	**Construction**	
10.1	Avoid scabbling (roughening of concrete surfaces) if possible	H
10.2	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.	H
10.3	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	H
10.4	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust	D

H = Highly recommended; D = Desirable

6.2.5 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 9**.

Table 9 Residual Risk of Air Quality Impacts from Construction

Impact	Sensitivity of Area	Residual Risk			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	Low Risk	Medium Risk	Medium Risk	Low Risk
Human Health	High	Low Risk	Medium Risk	Medium Risk	Low Risk

The mitigated dust deposition and human health impacts for demolition and trackout activities are anticipated to be *low,* whereas for earthworks and construction activities are anticipated to be *medium*.

7 Assessment of Impacts from Operations

As discussed in **Section 2.2.3**, air quality issues associated with the proposed Development Site operations predominantly relate to:

- Products of fuel combustion (including particulates) from the fire trainer cabins ; and
- Products of fuel combustion and wind-generated dust from the vehicle movements entering and moving around the site.

For each potential source of air pollution, a *qualitative* risk-based impact assessment was undertaken of the potential air quality impacts. The risk-based assessment takes account of a range of impact descriptors, including the following (refer to **Appendix B** for full methodology):

- **Nature of Impact**: does the impact result in an adverse, neutral or beneficial environment?
- **Receptor Sensitivity**: how sensitive is the receiving environment to the anticipated impacts?
- **Magnitude**: what is the anticipated scale of the impact?

7.1 Fire Trainer Cabins

As discussed in **Section 3.2**, fire trainer cabins will be stand-alone compartments, where airline crew will be able to simulate cabin fire scenarios. The air quality impacts generated from the fire trainer cabins are dependent on the type of fuel burnt, and the frequency and duration of the fire training drills.

As this is a new facility, no historical data on the frequency of usage is available from the existing Qantas training facility. Qantas has advised that the frequency of the fire training drills is anticipated to be daily, during business hours only.

In regards to the type of fuel, the manufacturer's instructions on the V9000 Commander™[1] states that:

> *"The fire trainers operate entirely environmentally friendly by using natural propane gas for the fires, water-based smoke fluid for creating the smoke and water, and compressed air to simulate the Halon fire extinguishers."*

The assessment of potential impacts associated with air emissions from this source has been assessed as follows:

- **Nature of Impact**: does the impact result in an adverse, neutral or beneficial environment?

  Given the low toxicity of the air emissions anticipated to be generated from use of the materials listed above (ie propane, water-based smoke fluid and compressed air) the nature of impact is anticipated to be *neutral* to the environment.

- **Receptor Sensitivity**: how sensitive is the receiving environment to the anticipated impacts?

  The nearest sensitive receptors to the Development Site include the Travelodge Hotel 20 m southeast to the closest Development Site boundary (see **Section 2.1**). The sensitivity of the surrounding residential areas to emissions from the Development Site is considered to be *high*.

- **Magnitude**: what is the anticipated scale of the impact?

[1] Source: https://www.flame-aviation.com/products/v9000-commander , accessed on 11 February 2019

Given the minimal quantities of air pollutants anticipated to be generated from use of the materials listed above (ie propane, water-based smoke fluid and compressed air), the magnitude of these emissions considered to be *negligible*.

Given the above considerations, and the scale of operations, the potential impact of air emissions from the fire trainer cabins on the local sensitive receptors is concluded to be ***neutral*** (see **Table 11**).

Table 10 Impact Significance - Fire Trainer Cabins

Magnitude / Sensitivity	Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

7.2 Onsite Vehicle Movements

These emissions will be of a similar nature to existing emissions from traffic on King Street and Qantas Drive (a major road in the area). However the scale and magnitude of emissions from the Development Site will be significantly lower. The estimated annual average daily traffic on Qantas Drive is approximately 55,000 vehicles[2], which is significantly higher than the anticipated onsite vehicle traffic at the Development Site of 750 vehicles per day. It is noted that the traffic volumes sourced from RMS Traffic Volume Viewer for Qantas Drive are estimated based on 2018 traffic volumes available at Wentworth Avenue and General Holmes Drive.

The assessment of potential impacts associated with air emissions from this source has been assessed as follows:

- **Nature of Impact**: does the impact result in an adverse, neutral or beneficial environment?

  The nature of impact is anticipated to be *adverse* to the environment.

- **Receptor Sensitivity**: how sensitive is the receiving environment to the anticipated impacts?

  The nearest sensitive receptors to the Development Site include Travelodge Hotel 20 m southeast to the closest Development Site boundary (see **Section 2.1**). The sensitivity of the surrounding residential areas to emissions from the Development Site should be considered *high*.

- **Magnitude**: what is the anticipated scale of the impact?

  Based on the small amount of traffic movements on site, the magnitude of these emissions considered to be *negligible*.

[2] http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=14&lat=-33.945046075046136&lon=151.19657873535152&id=16129

Given the above considerations, and the scale of operations, the potential impact of the Development Site on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 11**).

Table 11 Impact Significance - Onsite Vehicle Movements

Magnitude / Sensitivity	Substantial Magnitude	Moderat Magnitude	Slight Magnitude	Negligible Magnitude
Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

8 Conclusion

SLR was commissioned by Qantas to prepare an AQIA report for the proposed construction and operation of a Qantas Flight Training Centre to be located at 297 King Street, Mascot within the Bayside Local Government Area (Development Site).

The Development Site has been selected to accommodate the new Flight Training Centre given its proximity to the Sydney Airport and Qantas' existing operations within the broader Mascot Campus. The new Flight Training Centre will replace the existing facility that will be demolished as part of Roads and Maritimes (RMS) Sydney Gateway Project.

This report has been prepared to form part of a State Significant Development Application (SSDA) for the construction and operation of the new Flight Training Centre. The aim of this AQIA is to assess the risks associated with the potential air quality impacts due to construction and operation of the proposed development.

Available meteorological data from nearest meteorological station located at Sydney Airport have been examined to provide an estimate of the prevailing wind environment in the local area. This review indicated that the winds from northwest, which would blow air emissions from the Development Site towards the nearest residential receptors, occur approximately 8%-12% of the time. In addition, construction activities at the Development Site have the greatest potential to impact on receptors located towards the southeast of the Development Site during winter, based on the low rainfall and conducive predominant wind directions during this season. Additional controls may be required (higher levels of watering for example) if construction occurs at these times.

The findings of the assessment are as follows:

- Off-site impacts associated with dust deposition and human health impacts during demolition and trackout activities are anticipated to be *low,* whereas for earthworks and construction activities are anticipated to be *medium.* A range of mitigation measures have been recommended for consideration as part of the CEMP.
- Air quality issues associated with the proposed Development Site operations predominantly relate to products of fuel combustion from the fire trainer cabins and onsite vehicle movements. The potential for offsite air impacts from these emission sources are concluded to be *neutral*.

Based on the above, it is concluded that the risk of any exceedances of air quality criteria at nearby industrial or residential receptors due to air emissions from the Development Site is expected to be minimal.

9 References

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APPENDIX A

CONSTRUCTION PHASE RISK 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 site material onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, which are most relevant to this Development, 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 m^3, 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 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- ***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.

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

- ***Large***: Total site area greater than 10,000 m^2, 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 m^2 to 10,000 m^2, 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 m^2, 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 m^3, piling, on site concrete batching; sandblasting.

- ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (eg concrete), piling, on site concrete batching.
- ***Small***: Total building volume less than 25,000 m^3, 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.

Note: No demolition of existing structures will be performed as part of this Development.

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 PM_{10}, the local background concentration; and
- 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 A1**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table A1 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 PM10.*	*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 PM_{10} 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); and

- 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 A2**. The sensitivity of the area should be derived for each of activity relevant to the project (ie construction and earthworks).

Table A2 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 A3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (ie an annual average of 19.8 $\mu g/m^3$ for PM_{10}) 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 derive 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; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A3 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 A4** (earthworks and construction) and **Table A5** (track-out) to determine the risk category with no mitigation applied.

Table A4 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 A5 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

Table A6 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

APPENDIX B

OPERATIONAL PHASE RISK ASSESSMENT METHODOLOGY

Nature of Impact

Predicted impacts may be described in terms of the overall effect upon the environment:

- **Beneficial**: the predicted impact will cause a beneficial effect on the receiving environment.
- **Neutral**: the predicted impact will cause neither a beneficial nor adverse effect.
- **Adverse**: the predicted impact will cause an adverse effect on the receiving environment.

Receptor Sensitivity

Sensitivity may vary with the anticipated impact or effect. A receptor may be determined to have varying sensitivity to different environmental changes, for example, a high sensitivity to changes in air quality, but low sensitivity to noise impacts. Sensitivity may also be derived from statutory designation which is designed to protect the receptor from such impacts.

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with the following broad categories - Very high, High, Medium and Low.

Table B1 outlines the methodology used in this study to define the sensitivity of receptors to air quality impacts.

Table B1 Methodology for Assessing Sensitivity of a Receptor

Sensitivity	Criteria
Very High	Receptors of very high sensitivity to air pollution (e.g. dust or odour) such as: hospitals and clinics, and retirement homes.
High	Receptors of high sensitivity to air pollution, such as: schools, residential areas, food retailers, glasshouses and nurseries.
Medium	Receptors of medium sensitivity to air pollution, such as: farms / horticultural land, offices/recreational areas, painting and furnishing, hi-tech industries and food processing, and outdoor storage (ie new cars).
Low	All other air quality sensitive receptors not identified above, such as light and heavy industry.

Magnitude

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions. Magnitude may be described quantitatively or qualitatively. Where an impact is defined by qualitative assessment, suitable justification is provided in the text.

Table B2 Magnitude of Impacts

Magnitude	Description
Substantial	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Moderate	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Slight	Predicted impact may be tolerated.
Negligible	Impact is predicted to cause no significant consequences.

Significance

The risk-based matrix provided below illustrates how the definition of the sensitivity and magnitude interact to produce impact significance.

Table B3 Impact Significance Matrix

Magnitude / Sensitivity		[Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by TableB1]	Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

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