44-50 TENCH AVENUE, JAMISONTOWN

Air Quality Impact Assessment

Prepared for:

Mkt Cafe Pty Ltd
c/o Killing Matt Woods
1/160 Rochford St
Erskineville, NSW 2043

SLR Ref: 610.19103-R02
Version No: -v1.0
December 2019

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Grd Floor, 2 Lincoln Street
Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
T: +61 2 9427 8100
E: sydney@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 Mkt Cafe 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
610.19103-R02-v1.0	9 December 2019	Varun Marwaha	Kirsten Lawrence	Varun Marwaha

CONTENTS

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 Introduction

SLR Consulting Pty Ltd (SLR) was engaged by MKT Cafe Pty Ltd (the Client) to prepare an Air Quality Impact Assessment (AQIA) to accompany a development application for land located at 44-50 Tench Avenue, Jamisontown, New South Wales [NSW] (the Development Site).

The purpose of the AQIA is to address the issues raised by Penrith City Council (the Council) in a pre-lodgement meeting for the Development, and to assess suitability of the Development Site for a restaurant including an 'animal enclosures' attraction for patrons, eateries/farmers markets and a large (100+ car) gravel carpark. The pre-lodgement advice was issued by the Council at a meeting on 27 August 2019. The Council requested that a Statement of Environmental Effects (SEE) be submitted that includes an AQIA. Specifically, the Council requested that:

a. *"The environmental impacts associated with the construction and operational phases of the development will also need to be addressed, such as water quality, noise, **dust**, **air quality** and erosion and sediment control. This can be included in the Statement of Environmental Effects." (see **Section 6**)*

b. *"A section on how the keeping of animals complies with the Local Government (General) Regulation 2005, specifically Schedule 2 – distances to dwellings and food businesses." (see **Section 6.2.1**)*

c. *"A section on how odour will be managed and responded to in the event of complaints being received. The odour to be addressed in the plan is from the keeping of animals and mechanical ventilation from the food preparation areas." (see **Section 8**)*

This AQIA has been prepared to assess the risk of potential air quality impacts associated with the construction and operations of the proposed Development on nearby sensitive receptors.

This assessment has been performed with reference to relevant standards, guidelines and resources, including:

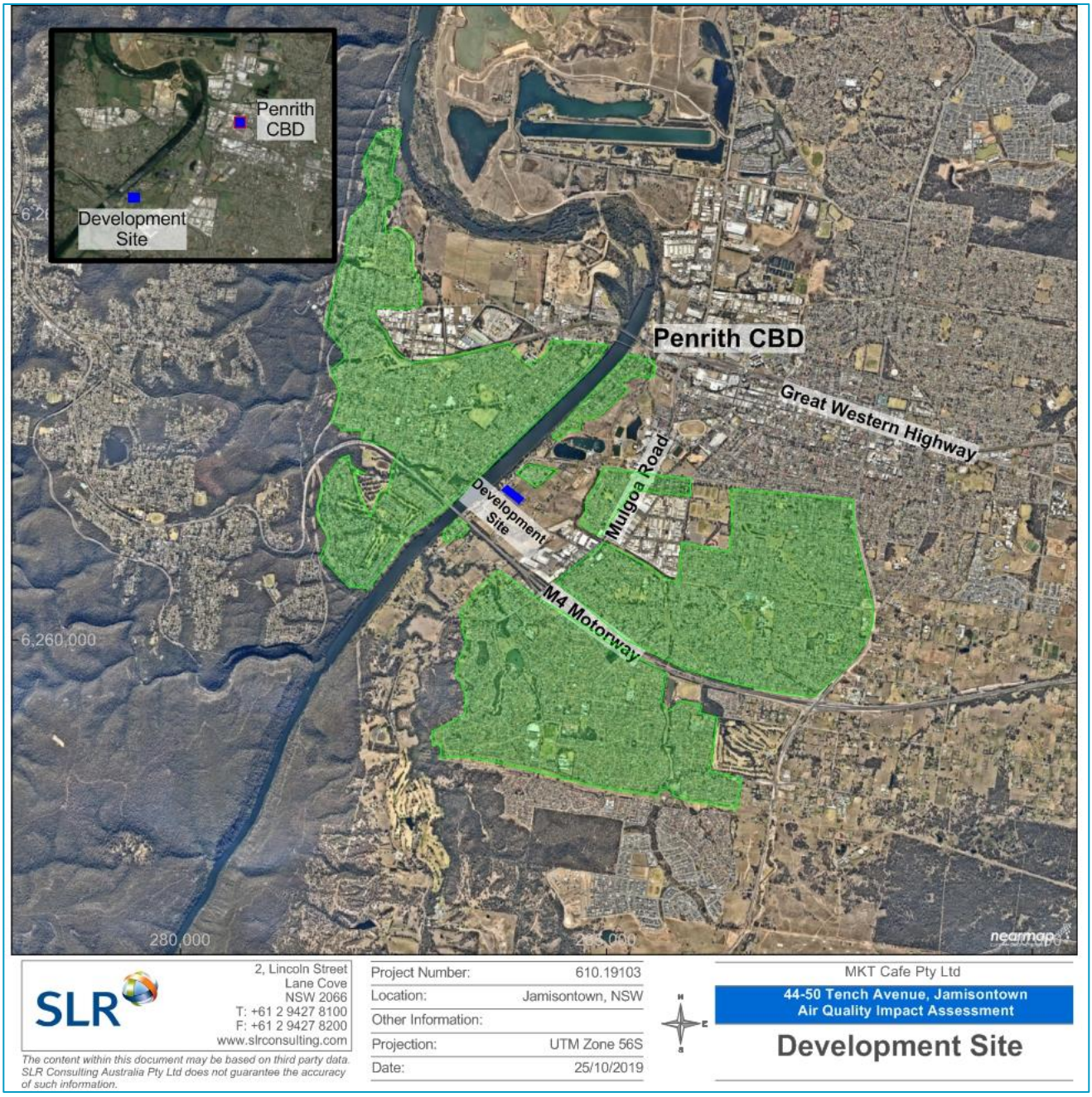
- *Local Government (General) Regulation* 2005, under the *Local Government Act* 1993, published by NSW Government, latest version dated 18 July 2013.
- Institute of Air Quality Management's *Guidance on the assessment of odour for planning* (Bull et al 2018).
- Institute of Air Quality Management's *Guidance on the assessment of dust from demolition and construction (*Holman *et al* 2014).
- Environmental assessment guidelines for separation distances between industrial and sensitive land uses, prescribed by states and territories.

2 Project Overview

2.1 Regional Setting and Site Layout

The Development Site is located at 44-50 Tench Avenue, Jamisontown, approximately 3 kilometres (km) southwest of the Penrith Central Business District (CBD) in the western Sydney region of NSW. The regional setting of the Development Site is shown in **Figure 1**. The Development Site is predominantly surrounded by residential receptors, with the nearest residences located on adjacent plots.

Figure 1 Regional Setting of the Proposed Development Site



2.2 Sensitive Receptors

A number of residential properties have been identified as sensitive receptors in the area surrounding the Development Site, the nearest of which are located approximately 20 m southwest and 60 m northeast of the Development Site boundary. The locations of these closest identified representative sensitive receptors are shown in **Figure 2**. The outdoor dining areas at the East Bank Restaurant Precinct located 280 m to the southwest would also be sensitive to any potential dust and odour emissions from the Development Site.

Figure 2 Location of the Residential Receptors near the Development Site

2.3 Construction Activities

The following construction activities are proposed as part of the Development:

- Demolition of existing tin sheds onsite;
- Removal of existing vegetation, including a few trees;
- Earthworks across the site, including excavations for building foundations and drainage systems;
- Building works, including construction of the restaurant, dining pavilions, playground, livestock enclosures, barn and seating pods.

The construction works are anticipated to take place over a 6 month period. The proposed working hours for the construction period are 7:00 am to 6:00 pm, Monday to Saturday.

2.4 Operational Activities

The indicative Development site layout plan is shown in **Figure 3**. The indicative site layout has the restaurant and kitchen areas located in the southwestern corner of the Development Site, approximately 20 m from the closest existing residential receptor building, and an onsite sewage treatment and pumping system located in the southeastern corner of the Development Site (next to carpark), approximately 200 m from the closest existing residential receptor building. The type of restaurant proposed is seasonal Australian dining cuisine. The kitchen ventilation design will be finalised before construction commences. The animal enclosures are also proposed to be located at the northern end of the Development Site, while the carparking area will be at the southern end of the Development Site.

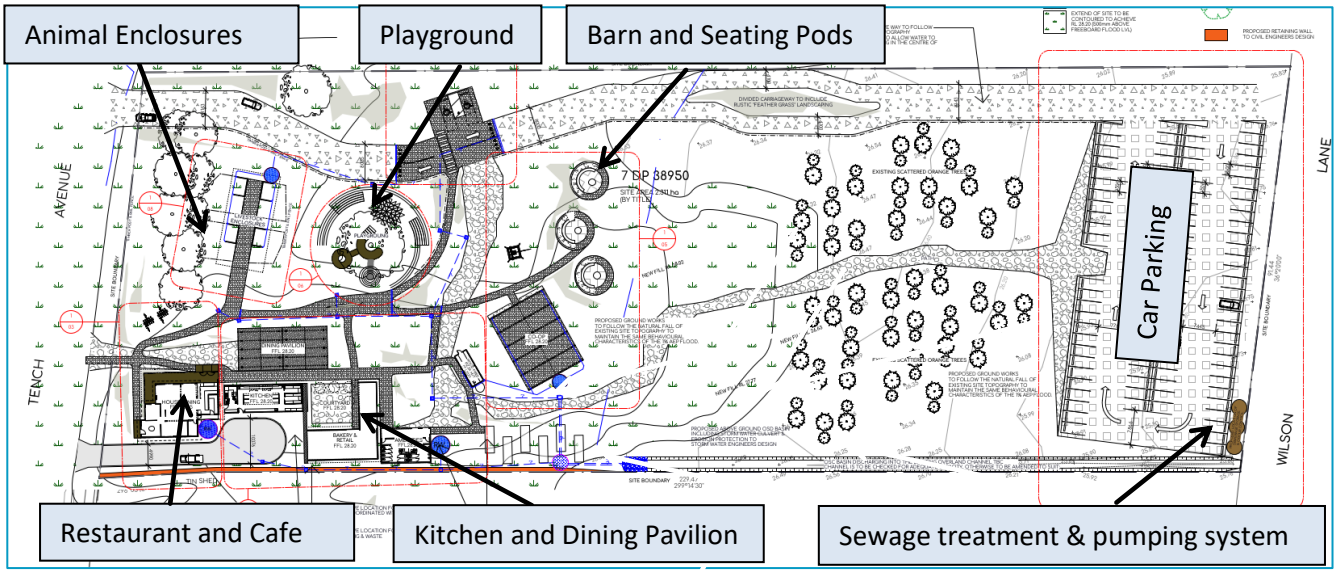
The various operational components of the project, along with their indicative proposed hours of operations, are:

- Café – operating 7 days a week, from 7:00 am to 3:00 pm;
- Restaurant – Sunday to Thursday, from 6:00 pm to 9:00 pm and Friday to Saturday from 6:00 pm to 12:00 am.

In regards to the animal enclosures, the animals will be housed in their enclosures (24/7) which will be open to the public. The types and numbers of animals to be housed are proposed to be:

- 2 x Milking cows
- 10 x Chickens
- 2 x Goats
- 2 x Llamas

Figure 3 Indicative Site Layout of the Proposed Development Site



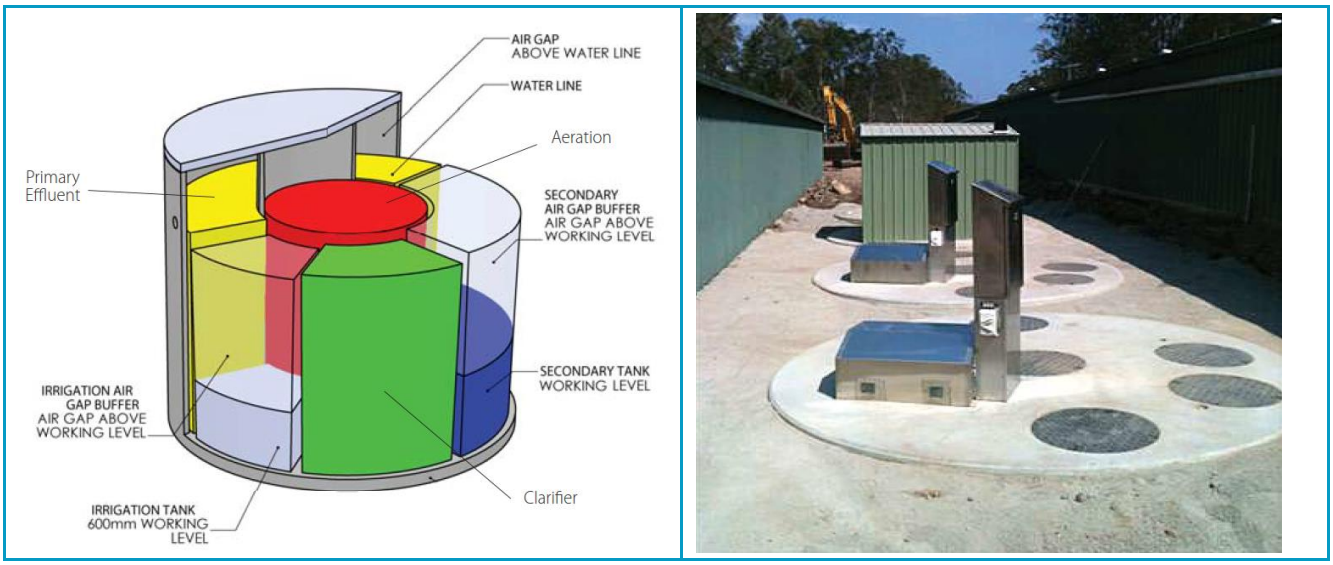
The wastewater management report completed by SLR (610.19103-R01-v0.2) recommends the use of gravity pipe to drain sewage to the sewage treatment and pumping station, before the treated sewage is pumped to a receiving manhole in Sydney Water's reticulation system. A schematic of the proposed onsite sewage storage system is shown in **Figure 4**.

Figure 4 On-Site Package Pumping Station Discharging to the Nepean Shores Development Manhole

Source: SLR Wastewater Management Report 610.19103-R01-v0.2.

The Commercial Advanced Blower System (CABS) is the nominated sewage treatment system for the Development Site. CABS is a self-sufficient enclosed system with minimal potential for odour generation. A schematic and photograph of the proposed CABS is shown in **Figure 5**.

Figure 5 Schematic of the CABS



Two CABS are proposed to be installed in series at the Development Site. The wastewater management report completed by SLR (610.19103-R01-v0.2) estimates the maximum capacity of the onsite sewage treatment system to be 116 equivalent persons (EP) per day.

3 Identification of Potential Air Emission Sources

3.1 Construction

Fugitive dust emissions from construction activities have potential to give rise to nuisance and/or health impacts at surrounding sensitive areas. The following key sources of dust associated with the construction of the Development Site have been identified:

- Wind-generated dust from disturbed surfaces and stockpiles, particularly during site stripping and proof rolling;
- Mechanically-generated dust from the excavation and loading/unloading of soil; and
- Wheel-generated dust from equipment during site stripping and earthworks.

The key dust-generating activities are likely to only to occur for a limited period of time (approximately 4-6 weeks) as the site is stripped of existing vegetation and the major earthworks are completed, however the potential for wind erosion and wheel-generated dust to occur will continue until the site is sealed/stabilised.

In addition to the types of construction activities being carried out at any point in time, a number of other environmental factors may also 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 the potential for exceedances of relevant air quality criteria at surrounding sensitive areas is minimal for most construction projects. Fugitive dust emissions are generally considered to have the greatest potential to give rise to downwind air quality impacts at construction sites.

Potential air quality impacts associated with the construction phase of the project have been addressed in **Section 6.1**.

3.2 Operations

During the operations of the café and the restaurant, the key emissions to air will be cooking odours associated with the kitchen exhaust systems. There is also the potential for odour emissions from the storage and handling of food waste, and the onsite sewage treatment system.

The animal enclosures are likely to be potential source of odour associated with animal manure, waste and food organics within the enclosures.

Vehicle exhaust emissions from cars entering and exiting the site, and idling in the car park, also have potential to impact on local air quality. The main criteria pollutant from vehicle exhaust emissions are the oxides of nitrogen (NO_X).

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 form NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. Long term exposure to NO_2 can lead to lung disease. NO will be converted to NO_2 in the atmosphere after leaving a car exhaust.

Based on SLR's experience in modelling traffic related air quality impacts from roads, the number of vehicles expected to enter/leave the Development Site, and the distance of the car park from existing sensitive receptors is not expected to result in exceedances of the short term or long term criteria.

Emissions of NO_X from vehicles entering the Development Site are therefore not considered to have any potential for adverse off-site impacts.

3.3 Summary

Based on the above, the emissions to atmosphere that have been considered in this assessment are shown in **Table 1**.

Table 1 Summary of Identified Potential Air Pollutants

Project Component	Pollutants
Construction	PM_{10}, $PM_{2.5}$, nuisance dust
Operations	
Café and Restaurant	Cooking odours
Animal Enclosures	Animal manure odours
Onsite Sewage Storage	Sewage odours

4 Regulatory Framework

4.1 Relevant Legislation, Policy and Guidance

The following air quality policy and guidance documents have been referenced within this assessment and have been used to identify the relevant air quality criteria (see **Section 4.2**).

4.1.1 Protection of the Environment Operations Act 1997 & Amendment Act 2011

The POEO Act 1997 (and Amendment Act 2011) (hereafter the POEO Act) is a key piece of environment protection legislation administered by the NSW EPA which enables the Government to establish instruments for setting environmental standards, goals, protocols and guidelines.

The following sections of the POEO Act are of general relevance to the Project:

- Section 124 and 125 of the POEO Act states that any plant located at a premise should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 126 of the POEO Act requires that materials (eg building and maintenance materials at the Development Site) are managed in a proper and efficient manner to prevent air pollution (eg odour).
- Section 128 of the POEO Act states:
  - The occupier of a premises must not carry out any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.
  - Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.

4.1.2 Local Government Air Quality Toolkit

The Local Government Air Quality Toolkit (AQ Toolkit) has been developed by the EPA to assist local government in their management of air quality issues and provides guidelines for air quality management and for the use of air pollution control techniques. The AQ Toolkit includes an air quality guidance note for kitchens.

4.1.3 Building Code of Australia and Australian Standards

The Building Code of Australia (BCA) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of efficiently achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives.

The BCA contains mandatory technical provisions for the design and construction of BCA class buildings. Australian Standard (AS) 1668.2-2012 *The use of ventilation and air conditioning in building, Part 2: Ventilation design for indoor air contaminant control* sets design requirements for mechanical ventilation systems. Mechanical ventilation is required in enclosures where specific health and ventilation amenity requirements cannot be met by natural means.

Section 3.10.1 states of the AS states "*All exhaust air shall be discharged to atmosphere in such a manner not to cause danger or nuisance to occupants in the building, occupants of neighbouring buildings or members of the public.*"

Section 5 of the AS states the following:

- 5.2.2 Exhaust locations: As far as practicable, exhaust-air intakes used for general exhaust-air collection shall be located on the opposite sides of the enclosure from the sources of make-up air, to ensure that the effluents are effectively removed from all parts of the enclosure.
- 5.3.2.1 General requirements: The effluent shall be collected as it is being produced, as close as practicable to the source of generation.
- 5.10.1 Air discharges: Where discharges are deemed to be objectionable (ie nuisance related), discharges shall:
  - Be emitted vertically with discharge velocities not less than 5 m/s.
  - Be situated at least 3 m above the roof at point of discharge.
  - Treated to reduce the concentration of contaminants where required.
  - Be emitted to the outside at velocities and in a direction that will ensure, to the extent practicable, a danger to health or a nuisance will not occur.
  - Be situated a minimum separation distance of 6 m (where the airflow rate is ≥ 1,000 L/s) from any outdoor) air intake opening, natural ventilation device or opening, and boundary to an adjacent allotment, except that where the dimensions of the allotment make this impossible, then the greatest possible distance shall apply.

4.2 Relevant Air Quality Criteria

Ambient air quality criteria relevant to the key pollutants associated with the Project (as identified in **Section 3**) are discussed in the following sections.

The Approved Methods lists the statutory methods that are to be used to model and assess emissions of air pollutants from stationary sources in NSW. The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for this Project.

4.2.1 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 term "particulate matter" refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air (µg/m^3).

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

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

The PM_{10} and $PM_{2.5}$ impact assessment criteria set out in the Approved Methods are as follows:

- PM_{10} - 24-hour maximum of 50 µg/m^3;
- PM_{10} - annual average of 25 µg/m^3;
- $PM_{2.5}$ - 24-hour maximum of 25 µg/m^3; and
- $PM_{2.5}$ - annual average of 8 µg/m^3.

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

4.2.2 Odour

Nuisance odour may be defined as an odour which is perceived to be offensive by an individual. A nuisance odour is largely dependent on an individual's sensitivity to a particular odour as everyone experiences odour differently.

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. The odour detection threshold is the minimum concentration of an odorous substance in air that can be detected by the sense of smell in an individual with normal olfactory activity. The strength and intensity of an odour experienced in an environmental setting depends heavily on the type and magnitude of contributing sources and the prevailing weather conditions, and will vary with small changes in wind speed and direction.

Odour concentration is measured in terms of odour units (ou). 1 ou is the concentration of odour-containing air that can just be detected by 50% of members of an odour panel (persons chosen as representative of the average population sensitivity to odour). This process is defined within Australian Standard AS4323.3: *Stationary Source Emissions – Part 3: Determination of Odour Concentration by Dynamic Olfactometry (Standards Australia 2001).*

In practice, the nuisance potential of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range significantly depending on a combination of the following factors:

- *Odour Quality*: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- *Population sensitivity:* any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.

- *Background level:* whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources, particularly sources emitting odours of a similar character, it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive, particularly in a rural or semi-rural environment, until a higher threshold is reached than for odours from a landfill facility.
- *Source characteristics:* whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment.
- *Health Effects:* whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

4.3 Recommended Separation Distances

The application of minimum recommended separation distances (or 'buffer' distances) provides a valuable screening tool to judge whether a detailed assessment is required to evaluate the potential risk of conflicting land uses. Separation distances provide guidance on the appropriate level of separation between a source of emissions and sensitive land uses in order to mitigate the impacts of intended and unintended emissions on people. This approach relies on the knowledge that impacts on the environment generally decrease with increasing distance from the source of emissions. Separation distances are based on an understanding of the types of emissions associated with various industries and their potential impacts on people. These distances can vary based on the scale and size of the industry, location topography, prevailing winds and other factors.

There are no separation guidelines issued by NSW EPA, hence the following sections refer to guidelines set by other regulatory agencies in Australia. These recommended separation distances have been developed to be applied to sensitive uses, such as residential dwellings, schools, hospitals and childcare centres.

4.3.1 Local Government (General) Regulation 2005

Part 5 of Schedule 2 (Standards enforceable by orders), of the Local Government (General) Regulation 2005 prescribes the separation distances between places where animals are kept and certain premises such as dwelling, shop, office, factory, church or other place of public worship, workshop, school or public place in a city, town, village or other urban part of an area. Specifically, it states that:

- poultry (other than fowls) must not be kept within 30 m; and
- cattle must not be kept within 9 m;

of a dwelling, public hall, or premises used for the manufacture, preparation, sale or storage of food.

4.3.2 Australian Capital Territory EPA

The document '*Separation distance guidelines for air emissions*', published by ACT EPA (ACT EPA 2018) includes recommended minimum separation distances for relevant activities identified in **Section 3.3**, as shown in **Table 2**.

Table 2 Recommended Separation Distances, ACT EPA

Project Component	Relevant Industry	Activity Notes	Separation Distance (metres)
Café and Restaurant	NA	NA	NA
Animal enclosures	Saleyards	Throughput >25,000 but <50,000 sheep equivalent units per year 1 sheep or goat = 1 unit 1 cattle (<40 kg) = 3 units 1 cattle (40−400 kg) = 6 units 1 cattle (>400 kg) = 8 units	200
Onsite sewage storage	Sewage pumping stations	Facilities including, pumps and equipment, for pumping sewage to processing sites	100

Source: ACT EPA 2018

The separation distance recommended by ACT EPA cannot be considered applicable to the Development Site operations, considering the animal numbers provided in **Section 2.4** gives the total sheep equivalent units of less than 150 units (assuming worst case 8 units per animal).

4.3.3 Victoria EPA

The Victoria EPA document '*Recommended separation distances for industrial residual air emissions*', Publication No. AQ 1518 (VIC EPA 2013) includes minimum recommended separation distances for relevant activities identified in **Section 3.3**, as shown in **Table 3**.

Table 3 Recommended Separation Distances, VIC EPA

Project Component	Relevant Industry	Activity Notes	Separation Distance (metres)
Café and Restaurant	NA	NA	NA
Animal enclosures	Stock saleyards	Where pigs, cattle or other stock are temporarily confined for sale, transport or processing (>500 head)	500
Onsite sewage storage	Sewage treatment plant	Premises on or from which sewage (including sullage) effluent, is treated, discharged or deposited (>5,000 litres per day)	$10n^{1/3}$

Source: VIC EPA 2013

The separation distance recommended by VIC EPA in regard to animal enclosures cannot be considered applicable to the Development Site operations, considering the animal numbers provided in **Section 2.4** (ie a total of 16 animals).

The separation distance recommended by VIC EPA for the proposed onsite sewage treatment system is estimated to be approximately 50 m.

4.3.4 South Australia EPA

The document '*Evaluation distances for effective air quality and noise management*' published by South Australian EPA (SA EPA 2016) includes recommended evaluation distances for relevant activities identified in **Section 3.3**, as shown in **Table 4**.

Table 4 Recommended Separation Distances, SA EPA

Project Component	Relevant Industry	Activity Notes	Separation Distance (metres)
Café and Restaurant	NA	NA	NA
Animal enclosures	Saleyards	Throughput >25,000 but <50,000 sheep equivalent units per year 1 sheep or goat = 1 unit 1 cattle (<40 kg) = 3 units 1 cattle (40−400 kg) = 6 units 1 cattle (>400 kg) = 8 units	200
Onsite sewage storage	Mechanical wastewater plants	<1,000 EP >1,000 EP and <5,000 EP >5,000 EP and <15,000 EP	100 200 300

Source: SA EPA 2016

The separation distance recommended by SA EPA in regard to animal enclosures cannot be considered applicable to the Development Site operations, considering the animal numbers provided in **Section 2.4** gives the total sheep equivalent units of less than 150 units (assuming worst case 8 units per animal).

The separation distance recommended by SA EPA in regard to onsite sewage treatment system is estimated to be approximately 100 m (based on 116 EP).

4.3.5 Summary

The separation distances prescribed by the Local Government (General) Regulation for poultry and cattle are considered to be most relevant to this project.

The separation distances prescribed by other state regulatory authorities relate to the much larger scale activities than those proposed at the Development Site, and hence are not considered to be relevant for this Project.

The separation distance prescribed by ACT EPA and SA EPA for the onsite sewage pumping station and sewage treatment system (ie 100 m) is concluded to be the most relevant to this Project.

5 Existing Environment

5.1 Local Meteorological Conditions

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) will also influence dispersion.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station to the Development Site is the Penrith Lakes Automatic Weather Station (AWS), which is located approximately 4.5 km north of the Development Site, and records wind speed and wind direction. Considering the distance between the Development Site and Penrith Lakes AWS, and absence of any significant intervening topographical features, it may be assumed that the wind conditions recorded at the Penrith Lakes AWS are a reasonable representation of the wind conditions experienced at the Development Site.

Annual wind roses for the years 2014 to 2018, as well as seasonal wind roses compiled from data recorded by the Penrith Lakes AWS during 2018, are presented in **Figure 6** and **Figure 7** respectively. 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 following description of wind speeds at the Development Site references the Beaufort Wind Scale, as outlined in **Table 5**. Use of the Beaufort Wind Scale is consistent with terminology used by the BoM.

Table 5 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 6 Annual Wind Roses for Penrith Lakes AWS (2014 to 2018)

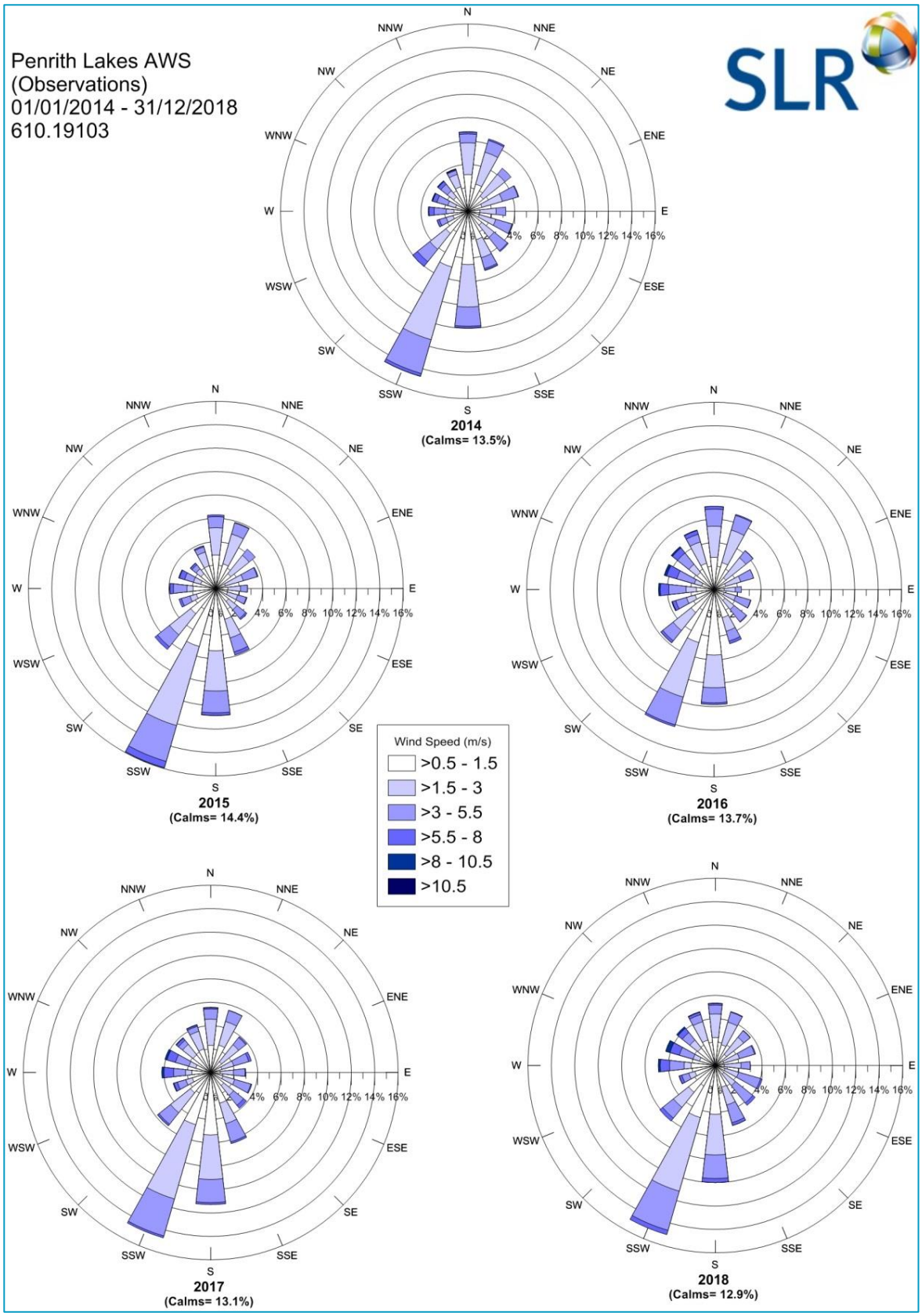
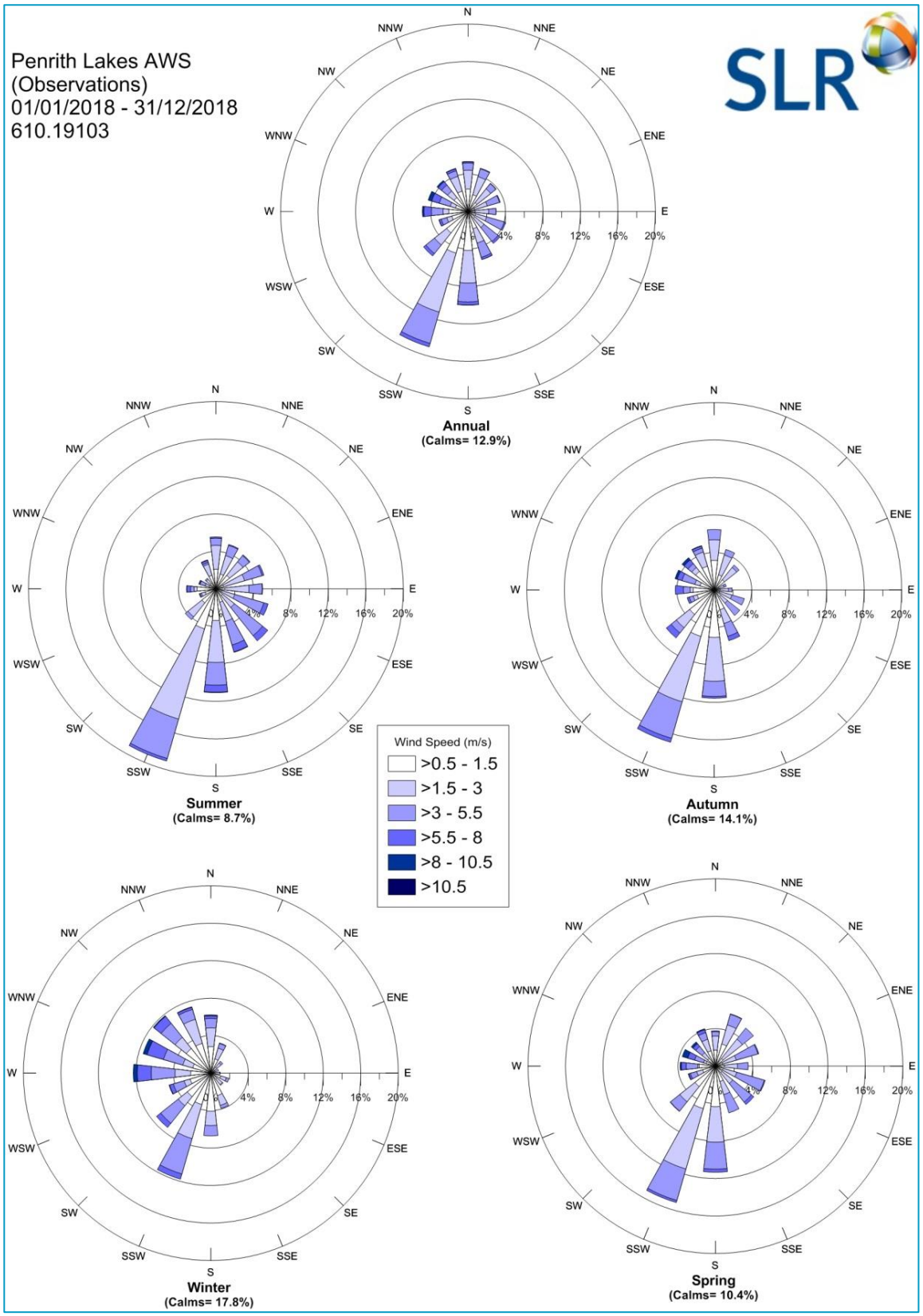


Figure 7 Annual and Seasonal Wind Roses for Penrith Lakes AWS (2018)



The wind roses for the years 2014 to 2018 (**Figure 6**) indicate the predominant wind directions in the area are consistently from the south-southwest and south. A very low frequency of winds from the east was recorded across all years. The annual frequency of calm wind conditions was recorded to be between 13% to 14.5% for the 2014 to 2018 period.

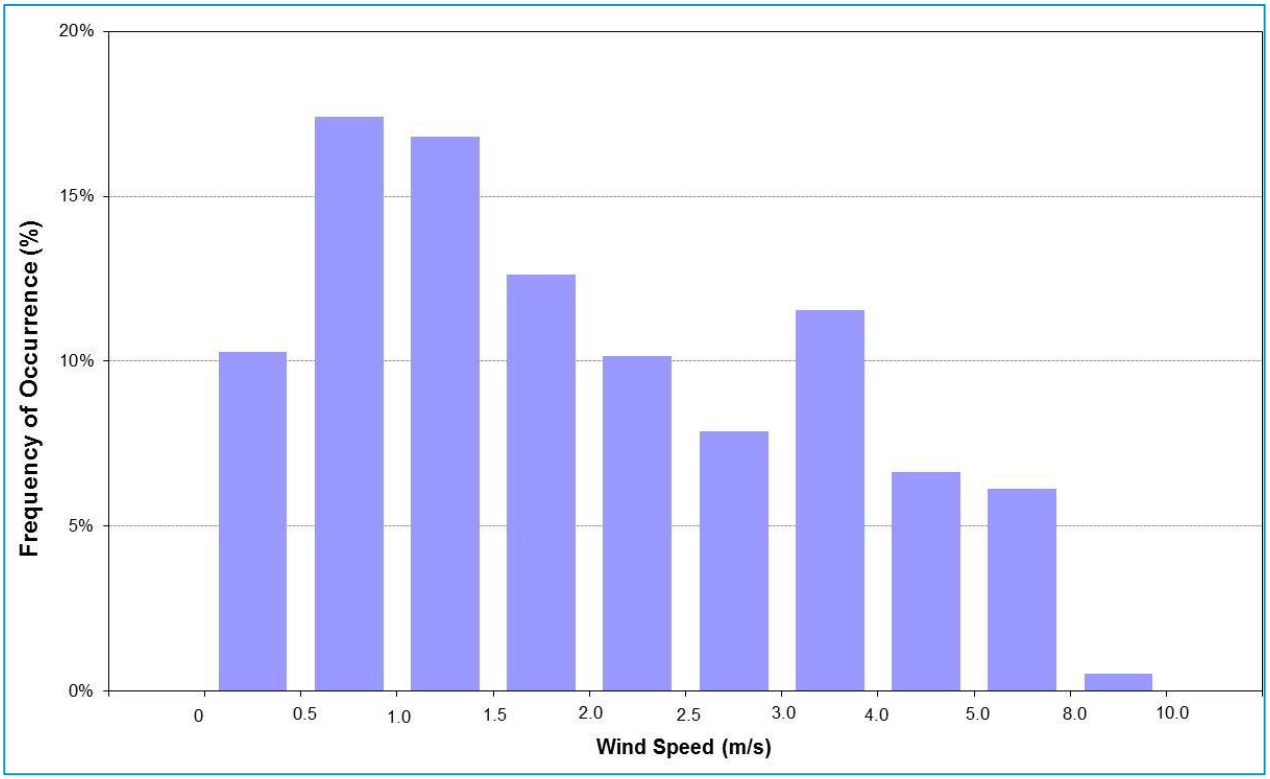
Winds from the northeast and southwest directions, which would blow air emissions from the Development Site towards the nearest sensitive receptors (towards the southwest and northeast), occur approximately 5% -6%.

The seasonal wind roses for the year 2018 (**Figure 7**) indicate that:

- In summer, autumn and spring, wind speeds ranged from light to fresh winds (between 0.5 m/s and 10.5 m/s). The majority of winds blew from between the south and south-southwest directions, with very few winds from the northwest. Calm wind conditions occurred approximately 8%, 14% and 10.5% of the time during summer, autumn and spring respectively.
- In winter, wind speeds ranged from light to fresh winds (between 0.5 m/s and 10 m/s). The majority of winds blew from the western quadrant, with very few winds from the east. Calm wind conditions occurred approximately 18% during winter.

A wind speed frequency chart for the period 2014 to 2018 is shown in **Figure 8**. 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 over the years 2014 to 2018 at Penrith Lakes AWS was relatively low (approximately 7%).

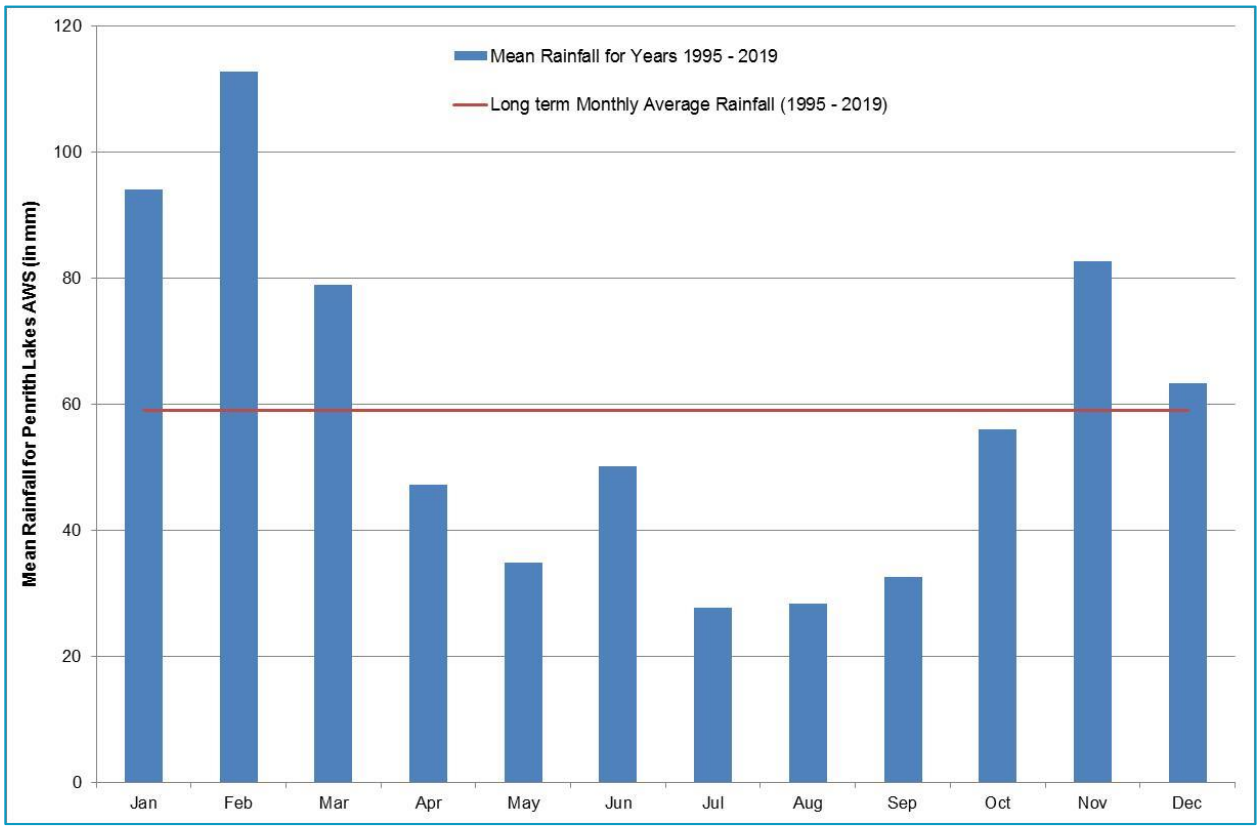
Figure 8 Wind Speed Frequency Chart for Penrith Lakes AWS – 2014 to 2018



Rainfall

Dry periods (no rainfall) have the greatest potential for fugitive dust emissions during construction. The long term monthly rainfall averages recorded at Penrith Lakes AWS are shown in **Figure 9**. This chart shows that generally the late autumn/winter period between April and August records the lowest rainfalls.

Figure 9 Long term Mean Rainfall for Penrith Lakes AWS – 1957 to 2017



Summary

The 2018 wind patterns suggest that the construction and earthworks at the Development Site have the greatest potential to impact on receptors located northeast of the Development Site.

The residential receptor identified to the southwest of the Development Site is likely to be less impacted than the residential receptor located to the northeast, based on the lower percentage of winds occurring from the northeast compared to south-southwest and southwest directions.

5.2 Background Air Quality

The NSW Department of Planning, Industry and Environment (DPIE) maintains a network of Air Quality Monitoring Stations (AQMSs) across NSW. The nearest such station is located at St Marys, approximately 10 km southeast of the Development Site. The St Marys AQMS was commissioned in 1992 and is located on a residential property off Mamre Road, St Marys. It is situated in the centre of the Hawkesbury Basin and is at an elevation of 29 m.

A summary of the available measured ambient PM_{10} and $PM_{2.5}$ concentrations measured by the St Marys AQMS for the last five years (2014-2018) is tabulated in **Table 6** and presented graphically in **Figure 10** and **Figure 11**.

Table 6 Summary of Air Quality Monitoring Data at St Marys AQMS (2014 – 2018)

Pollutant	PM_{10}		$PM_{2.5}$	
Averaging Period	Maximum 24-hour	Annual	Maximum 24-hour	Annual
Units	µg/m³	µg/m³	µg/m³	µg/m³
2014	45.0	16.7	NA	NA
2015	53.0[a]	15.0	NA	NA
2016	100.2[b]	16.1	93.2[b]	7.8
2017	49.8	16.2	38.2[c]	7.0
2018	100.5[d]	19.4	80.5[d]	7.8
Criterion	50	25	25	8

[a] For 2015, the maximum 24-hour average PM_{10} was recorded on 6 May

[b] For 2016, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 8 May

[c] For 2017, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 24 September and 28 May respectively

[d] For 2018, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 22 November and 15 August respectively

Figure 10 Measured 24-Hour Average PM_{10} Concentrations at St Marys AQMS (2014 – 2018)

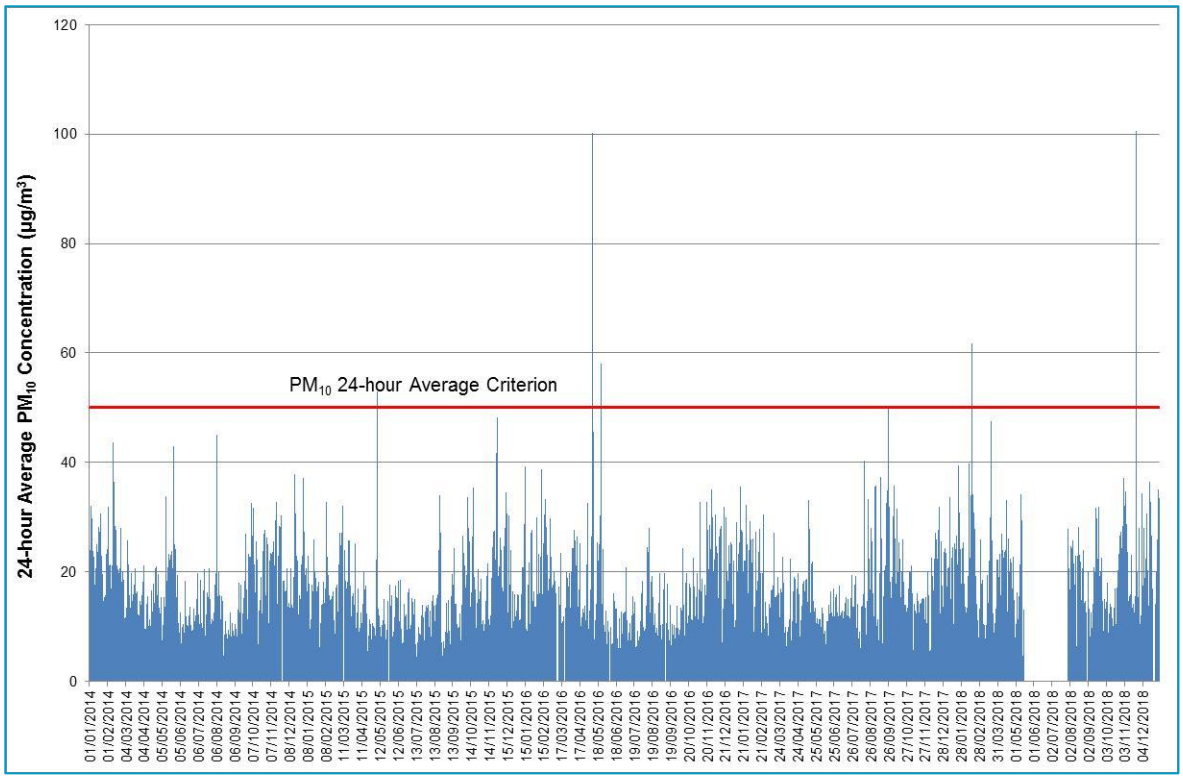
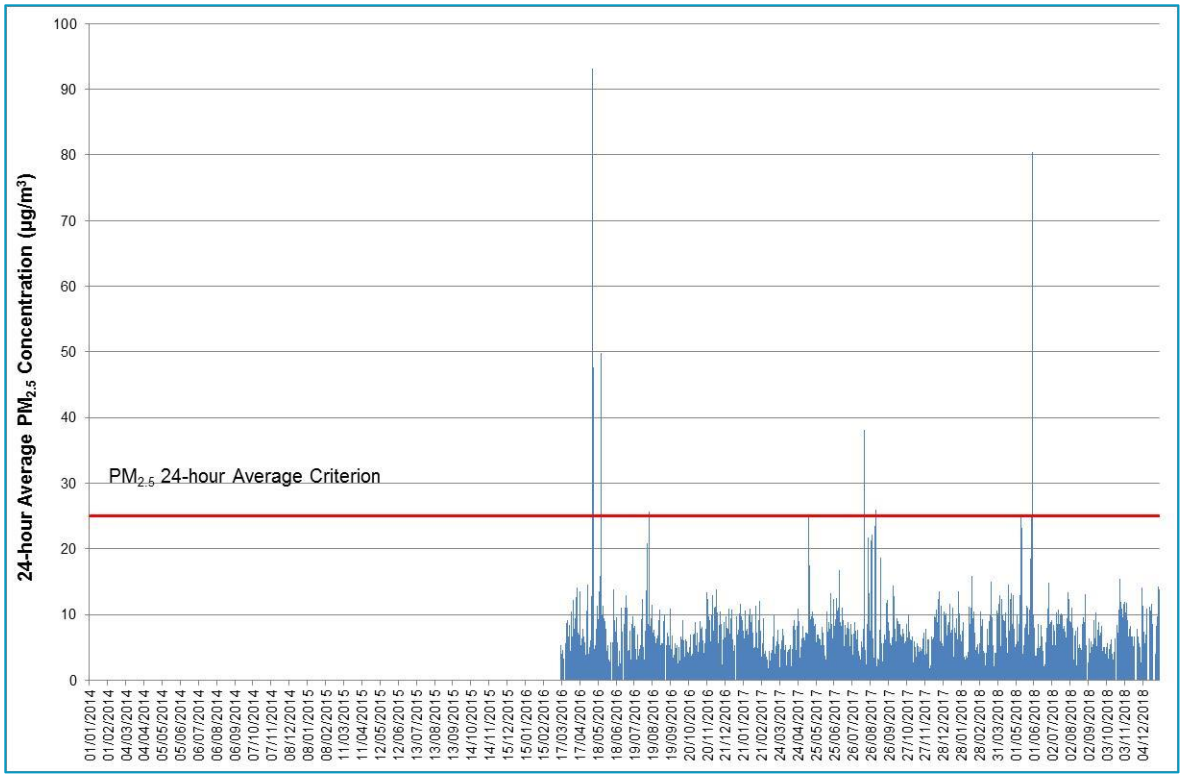


Figure 11 Measured 24-Hour Average $PM_{2.5}$ Concentrations at St Marys AQMS (2014 – 2018)



A review of the exceedances recorded during 2015 (OEH 2017a), 2016 (OEH 2018a), 2017 (OEH 2018b) and 2018 (OEH 2019) indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns.

In their publication – *NSW Annual Air Quality Statement 2018* (OEH 2019) the NSW OEH concluded that air quality is generally good in New South Wales based on information from the 43 station NSW Air Quality Monitoring Network. For 2018, the air quality was generally 'good', and air quality standards were met for 98% of the days in Sydney. During this time, exceedances of the national air quality standards for particle pollution were usually associated with regional dust storms and vegetation fires.

5.3 Other Local Sources

A preliminary review of the area shows that there are currently no significant construction projects underway within a 1 km radius. On this basis, it is concluded that there is no potential for cumulative impacts during the construction phase. However, Tench Avenue contains a number of potential development sites (including the adjacent property to the west which is for sale), hence the potential for cumulative dust impacts should be reviewed based on current activities in the area prior to construction commencing.

As noted in **Section 2.2**, the recently constructed East Bank Precinct is located 280 m to the southwest, which contains a number of restaurants, including outdoor dining areas. These existing activities will potentially emit cooking odours associated with the kitchen exhaust systems, and from the storage and handling of food waste.

6 Air Quality Impact Assessment

6.1 Construction

6.1.1 Step 1 – Screening Based on Separation Distance

As noted in **Section 2.2**, the nearest existing residential receptor is located approximately 20 m from the closest Development Site boundary. As a 'human receptor' is located within 350 m of the boundary of the site, and within 500 m of the site entrance, further assessment is required.

For the purpose of this assessment, the number of existing sensitive receptors potentially impacted is estimated to be less than 10 within 20 m of the Development Site.

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

Based upon the available Project information 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 7**.

Table 7 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Demolition	Small	**IAQM Definition:** 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. **Relevance to this Project:** Demolition activities will be limited to removal of existing tin sheds within the site boundary.
Earthworks	Small	**IAQM Definition:** 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. **Relevance to this Project:** *Total area of the site is approximately 2.3 ha, however earthworks will only be undertaken for areas covering the animal enclosures, playground, barn and seating pods, kitchen and dining pavilion, and the car park. This area is estimated to be approximately 2,400 m^2.*
Construction	Small	**IAQM Definition:** Total building volume less than 25,000 m^3, construction material with low potential for dust release (eg metal cladding or timber). **Relevance to this Project:** *The new buildings proposed on site are kitchen, takeaway and coffee retail, courtyard, animal enclosures. In addition, infrastructure such as carpark and gravel road will be constructed. The materials to be used for building construction are likely to mostly be concrete and steel.*

Activity	Dust Emission Magnitude	Basis
Trackout	Small	**IAQM Definition:** 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. **Relevance to this Project:** *It is estimated that a maximum of 10 vehicles movements per day will occur during construction.*

6.1.3 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 as the closest receptors are residential areas where people may be expected to be present continuously over a time period relevant to the air quality objectives for PM_{10}.

The sensitivity of the identified receptors to dust soiling has also been categorised as *high*, as residential sites would expect to enjoy a high level of amenity.

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 is classified as '*medium*' and '*low*' respectively. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM_{10} concentration of 15.0 µg/m^3 – 19.4 µg/m^3 recorded by the St Marys AQMS (see **Section 5.2**) and the anticipated number of sensitive receptors potentially impacted due to the construction works (ie less than 10 within 20 m).

Risk Assessment

Given the sensitivity of the general area is classified as '*medium*' for dust soiling and '*low*' for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 7**, the resulting risk of air quality impacts is as presented in **Table 8**.

Table 8 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	Medium	Small	Small	Small	Small	Low Risk	Low Risk	Low Risk	Negligible Risk
Human Health	Low					Low Risk	Low Risk	Negligible Risk	Negligible Risk

The results indicate that there is a *low* to *negligible* risk of adverse dust soiling and human health impacts occurring at the off-site sensitive receptor locations, even if no mitigation measures were to be applied to control emissions during the construction phase of the works.

6.1.4 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 9 lists the relevant mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the IAQM methodology for a development shown to have a low risk of adverse impacts. Not all these measures would be practical or relevant to construction of Development Site, so these measures should be reviewed in consultation with the construction contractor before their implementation. For almost all construction activities, 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 9 Site-Specific Management Measures Recommended by the IAQM

	Activity	
1	**Communications**	
1.1	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
1.2	Display the head or regional office contact information.	H
1.3	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	D
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
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.	D
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	Erect solid screens or barriers around dusty activities or the site boundary that is at least as high as any stockpiles on site.	H
4.3	Keep site fencing, barriers and scaffolding clean using wet methods.	D
4.4	Cover, seed or fence stockpiles to prevent wind erosion	D
5	**Operating Vehicle/Machinery and Sustainable Travel**	

	Activity	
5.1	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
5.2	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).	D
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	**Construction**	
8.1	Avoid scabbling (roughening of concrete surfaces) if possible	D
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.	D
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.	D
9.2	Avoid dry sweeping of large areas.	D
9.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
9.4	Record all inspections of haul routes and any subsequent action in a site log book.	D
9.5	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	D
10	**Earthworks**	
10.1	Only the minimum area necessary is disturbed at any one time.	
10.2	Revegetate/Rehabilitation of disturbed areas to stabilise surfaces as soon as practicable.	
10.3	If unanticipated significant dust emissions are noted on site, related works will be stopped and the Contractor's Project Manager will be contacted.	
10.4	Carry out excavation works and vehicle loading/unloading when weather conditions are favourable (i.e. receptors are upwind from the works).	

H = Highly recommended; D = Desirable

6.1.5 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 10**.

Table 10 Residual Risk of Air Quality Impacts from Construction

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

The mitigated dust soiling and human health impacts for construction of the Development Site are anticipated to be *negligible*.

6.2 Operations

In terms of the odour nuisance risk, a qualitative odour assessment methodology has been adopted for this assessment. The following broad risk-based approach prescribed by the Institute of Air Quality Management (Bull et al 2018) has been adopted:

- **Nature of Impact**: does the impact result in an adverse or beneficial environment?
- **Receptor Sensitivity**: how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude**: what is the anticipated scale of the impact?

The integration of sensitivity with impact magnitude is used to derive the predicted **significance** of that change. Full details of the methodology can be found in **Appendix B**.

The nearest sensitive receptor to the Development Site is an existing residence approximately 20 m southwest of the Development Site (see **Section 2.2**). In terms of the methodology in **Appendix B**, the sensitivity of the surrounding residential areas to odours generated by the Development Site is considered to be ***high***.

6.2.1 Animal Enclosures

As discussed in **Section 3**, air quality issues associated with animal enclosures predominantly relate to emissions of odour. A total of approximately 16 animals (including 10 chickens and two cows, two goats and two llamas) are proposed to be kept on site.

As discussed in **Section 4.3.1**, a separation distance of 30 m (for poultry) and 9 m (for cattle) between the enclosures and sale or storage of food is prescribed by the Local Government (General) Regulation 2005. There are no separation distances prescribed for goats or llamas, therefore they are assumed to be 30 m to be conservative. The enclosures are proposed be located at least30 m east of the dining pavilion, which would mean they will be more than 60 m from the nearest sensitive receptor. Therefore the animal enclosures are considered to be compliant with relevant separation distance requirements.

Assessment of Odour Impacts

In regards to the odour nuisance impacts, by addressing the FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) factors, the potential for odour impacts from this source at the sensitive receptors may be evaluated.

- Frequency – the closest residential areas have the potential to experience impacts whenever the odour is generated and when the wind direction is northeasterly or southwesterly. Northeasterly or southwesterly winds occur approximately 5%-6% of the time, therefore there is a *low* likelihood these receptors would experience frequent potential odour impacts.
- Intensity – The odour intensity from animal enclosures is expected to be highest at the beginning of the day shift, as there is more potential for odour generation after animals' night stay. Given the small numbers of animals proposed to be housed on-site, the potential for significant odours is considered to be relatively low. In addition, as the enclosures will be accessible to the public, a high level of housekeeping will be required to ensure that they meet customer expectations. Given this, odours from the animal enclosures are likely to be of *low* intensity and generally of intermittent nature.
- Duration – the duration of a potential odour impact may last as long as the animals are kept in the enclosures and for as long as the wind blowing in a direction over the Development Site towards the receptors. Given that conducive wind directions only occur approximately 5% of the time, the potential duration of any odour impacts is concluded to be *low*.
- Offensiveness – while odours from animal manure can be offensive at high concentrations, the very low intensity odours that may be detectable beyond the boundary of the Development Site would be expected to have a *low* level of offensiveness.
- Location – the impact of location on the acceptability of odours from the site has been accounted for by the receptor sensitivity classifications detailed above in this section (*high*).

Given the above, the potential impact of odour emissions from proposed animal enclosures is considered to be ***negligible*** (ie Impact is predicted to cause no significant consequences) for all residential receptors. Correspondingly, the potential impact significance for the local receptors is concluded to be ***negligible*** for all receptors (see **Table 12**).

Table 11 Impact Significance – Odour from Animal Enclosures

Potential Odour Exposure Impact	Receptor Sensitivity		
	Low	Medium	High
Very Large	Moderate adverse	Substantial adverse	Substantial adverse
Large	Slight adverse	Moderate adverse	Substantial adverse
Medium	Negligible	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse
Negligible	Negligible	Negligible	Negligible

In line with the IAQM method, it is concluded that the overall effect is **'not significant'**.

6.2.2 Café and Restaurant

As discussed in **Section 3**, cooking odours will also be emitted from the kitchen exhaust within the Development Site. At the time of writing this report, no site-specific details of the types of cooking are available and the ventilation system is still in the design phase.

Assessment of Odour Impacts

By addressing the FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) factors, the potential for odour impacts from this source at the sensitive receptors may be evaluated.

- Frequency – the closest residential areas have the potential to experience impacts whenever the odour is generated and when the wind direction is northeasterly or southwesterly. Northeasterly or Southwesterly winds occur approximately 5%-6% of the time, therefore there is a *low* likelihood they would experience frequent potential odour impacts.
- Intensity - cooking odours from cafes and restaurants can often be of sufficient intensity to be easily detectable within the immediate vicinity of the building. The nearest sensitive receptor is 30 m from the restaurant building on the Development Site. Odours would be not be significantly diluted by the time they travel this far downwind. However, odours emitted from the kitchen exhaust ventilation system can be minimised by fitting filtration systems, should it be required.
- Duration – the duration of a potential odour impact may last as long as the kitchen exhaust is operational and for as long as the wind blowing in a direction over the site to the receptors. While conducive wind directions occur only approximately 5% of the time, the operational hours for the café (7:00 am to 3:00 pm) and restaurant (6:00 pm to 9:00 pm) cover a large portion of the day, hence the potential duration of any odour impacts is concluded to be *low*.
- Offensiveness – the offensiveness of cooking odours is considered to be *low*, compared to other potential odours (eg, waste water treatment facilities, landfills, piggeries etc).
- Location – the impact of location on the acceptability of odours from the site has been accounted for by the receptor sensitivity classifications detailed above in this section (*high*).

Given the above, the potential impact of odour emissions from proposed café and restaurant is considered to be ***negligible*** (ie Impact is predicted to cause no significant consequences) for all residential receptors. Correspondingly, the potential impact significance for the local receptors is concluded to be ***negligible*** for all receptors (see **Table 12**).

Table 12 Impact Significance – Kitchen Exhaust Emissions

Potential Odour Exposure Impact	Receptor Sensitivity		
	Low	Medium	High
Very Large	Moderate adverse	Substantial adverse	Substantial adverse
Large	Slight adverse	Moderate adverse	Substantial adverse
Medium	Negligible	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse
Negligible	Negligible	Negligible	Negligible

In line with the IAQM method, it is concluded that the overall effect is **'not significant'**.

The impact of air emissions upon nearby sensitive receptors is dependent on the prevailing meteorological conditions (primarily wind speed and direction) but also the distance from the source to the receiver and any mitigation between the source and receiver. Such mitigation might be in the form of barriers that may act as a physical obstacle or result in changes to airflow, which may help in reducing air quality impacts (see **Section 7**).

6.2.3 Onsite Sewage Storage

As discussed in **Section 3**, odours will be emitted from the proposed on-site sewage treatment and pumping system .

Assessment of Odour Impacts

By addressing the FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) factors, the potential for odour impacts from this source at the sensitive receptors may be evaluated.

- Frequency – the closest residential areas have the potential to experience impacts whenever the odour is generated and when the wind direction is southeasterly. Southeasterly winds occur approximately 5%-6% of the time, therefore there is a *low* likelihood they would experience frequent potential odour impacts.
- Intensity – sewage odours from sewage treatment systems can often be of sufficient intensity to be easily detectable within the immediate vicinity, however CABS will be a enclosed system, hence the potential for any significant odour emissions is very low. The nearest sensitive receptor is approximately 200 m from the sewage treatment system location.
- Duration – the duration of a potential odour impact may last as long as the sewage treatment system is operational and for as long as the wind blowing in a direction over the site to the receptors. While conducive wind directions occur only approximately 5% of the time and the operational hours for the sewage treatment system are continuous (24/7), due to the enclosed nature of the proposed sewage treatment system, the odours (if any) will only be expected during the upset conditions only. Therefore, the duration of odour impacts is considered to be *low*.
- Offensiveness – the offensiveness of sewage odours is considered to be *high*.
- Location – the impact of location on the acceptability of odours from the site has been accounted for by the receptor sensitivity classifications detailed above in this section (*high*).

Given the above, the potential impact of odour emissions from proposed sewage treatment system is considered to be ***negligible*** (ie Impact is predicted to cause no significant consequences) for all residential receptors. Correspondingly, the potential impact significance for the local receptors is concluded to be ***negligible*** for all receptors (see **Table 13**).

Table 13 Impact Significance – Onsite Sewage Treatment System

Potential Odour Exposure Impact	Receptor Sensitivity		
	Low	Medium	High
Very Large	Moderate adverse	Substantial adverse	Substantial adverse
Large	Slight adverse	Moderate adverse	Substantial adverse
Medium	Negligible	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse
Negligible	Negligible	Negligible	Negligible

In line with the IAQM method, it is concluded that the overall effect is **'not significant'**.

7 Mitigation Measures

7.1 Construction

A list of mitigation measures are recommended to be implemented during the construction of the Development Site, as shown in **Section 6.1.4**.

7.2 Operations

7.2.1 Animal Enclosures

Some generic mitigation measures for the animal enclosures are recommended to ensure that the potential for odour generation is minimised:

- The animal enclosures are cleaned and maintained daily.
- The storage areas for animal manure and kitchen waste are kept as far away as practical from the nearest neighbours.
- A waste management plan (or similar) is developed which lists the measures to be put in place for handling, storage and disposal of waste generated onsite to ensure that adverse off-site odour impacts do not occur.

7.2.2 Restaurant

Odour emissions from the restaurant can be minimised by their capture in exhaust ventilation systems and their discharge via filtered exhaust systems using the latest technology.

7.2.3 General Waste

Odour emissions from general waste are expected to be very minor and are easily minimised using standard waste storage, covering, screening, and removal practices.

7.2.4 Vegetation Screening

A vegetative screen currently exists between the Development Site and the closest sensitive receptor toward south. This will assist in screening the existing resident from the on-site activities. Where possible, this vegetation should be retained and added to, to promote dispersion and filtration of air emissions from the site. Scented plants are also recommended to be considered for planting to assist in masking any odours from the on-site operational activities.

8 Odour Complaint Management

A complaints register is to be maintained and kept on Site at all times. The complaints register is to include prompts to note down the following details:

- the date/time of the complaint;
- details of the staff member logging the complaint;
- the contact details of the complainant;
- detailed description of the incident;
- nature of the complaint (eg dust impacts, odour intensity, odour character);
- activities occurring on Site at the time of the complaint (if relevant);
- perceived or assumed source of the dust/odour/other emissions giving rise to the complaint (if known);
- weather conditions (ie wind, rainfall, temperature) experienced on the day of the complaint (if relevant).

An investigation is to be carried out in the event of a complaint being received to identify whether it is related to Site activities. If the Site operations are identified as the source of the emissions, the actions taken to rectify the situation and prevent a reoccurrence are to be documented alongside the complaint record.

If a substantiated air pollution complaint is made to the Council that cannot be rectified through the above procedures, a suitably qualified person will be engaged to develop mitigation measures and ongoing management strategies to prevent such impacts occurring in future. The developed mitigation measures and ongoing management strategies will be submitted to the Council's Environment and Health Unit for review and approval. Until suitable remedial control measures are in place, activities at the Site will be managed to the satisfaction of an authorised officer of the Council in order to reduce emissions to a level that does not cause a continuation of unacceptable nuisance.

9 Conclusion

SLR was engaged by MKT Cafe Pty Ltd (the Client) to prepare an Air Quality Impact Assessment (AQIA) to accompany a development application for land located at 44-50 Tench Avenue, Jamisontown, New South Wales [NSW] (the Development Site).

The purpose of the AQIA is to address the issues raised by Penrith City Council (the Council) in pre-lodgement meeting, and to assess suitability of the Development Site for a restaurant including 'animal enclosures' attraction for patrons, eateries/farmers markets and a large (100+ car) gravel carpark. The pre lodgement advice was issued by the Council at its meeting on 27 August 2019. The Council requested that a Statement of Environmental Effects (SEE) be submitted which includes an AQIA.

The assessment has considered the requirements of the NSW EPA, and other state guidelines relating to minimum recommended separation distances between the types of activities proposed at the Development Site. Available meteorological data and air quality data collected in the vicinity of the Development site have been examined to identify predominant wind directions etc, and to provide an estimate of the background air quality environment in the region. The findings of the assessment are as follows:

- There are no relevant odour-based separation guidelines available for 'animal enclosures'. A separation distance of 30 m (for poultry) and 9 m (for cattle) between animal enclosures and areas used for the sale or storage of food is prescribed by the Local Government (General) Regulation 2005. There is no separation distances prescribed for goats or llamas, therefore they are assumed to be 30 m to be conservative. The enclosures are proposed be located more than 60 m away from the nearest off-site sensitive receptor, therefore the animal enclosures are considered to be compliant with the most relevant separation distance requirements.
- The odour intensity from animal enclosures is likely to be high towards the end of day shift when the enclosures are due to be cleaned. As the Development Site is located in a semi-urban environment, the closest residences may be immune to the odours from animal enclosures. In addition, odours emitted from the animal enclosures can be minimised by good housekeeping and best management measures. The duration of a potential odour impact may last as long as the animals are kept in the enclosures and for as long as the wind blowing in a direction over the site to the receptors. Given that conducive wind directions occur approximately 5% of the time, the risk associated with odours from animal enclosures was concluded to be **negligible risk** for all receptors.
- Cooking odours from café and restaurant can often be of sufficient intensity to be easily detectable within the immediate vicinity of the building. The duration of a potential odour impact may last as long as the kitchen exhaust is operational and for as long as the wind blowing in a direction over the site to the receptors. Given that conducive wind directions occur approximately 5% of the time, and the operational hours for café (7:00 am to 3:00 pm) and restaurant (6:00 pm to 9:00 pm) are split over a day the potential duration of any odour impacts is concluded to be high. In addition, odours emitted from the kitchen exhaust ventilation system can be minimised by fitting filtration systems should it be required. Given this, the potential impact significance of odour emissions from the proposed café and restaurant is concluded to be **negligible risk** for all receptors.
- Sewage odours from onsite sewage treatment systems can often be of sufficient intensity to be easily detectable within the immediate vicinity. However considering the enclosed nature of the proposed CABS sewage treatment system, and the relatively large distance between the sewage treatment system and the nearest existing residences, the potential impact significance of odour emissions from the proposed sewage treatment system is concluded to be **negligible risk** for all receptors

- Vehicle exhaust emissions from cars entering and exiting the site, and idling in the car park, are not considered to have any potential for adverse off-site impacts.

Based on the above, it is concluded that air quality issues do not pose a significant constraint for the proposed Development.

10 References

- ACT EPA 2018, Separation Guidelines for Air Emissions, Australian Capital Territory - Environment Protection Authority, November 2018.
- Bull et al 2018, IAQM Guidance on the assessment of odour for planning – version 1.1, Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/odour-guidance-2018.
- EPA 2017b, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Environment Protection Authority NSW, January 2017.
- Holman *et al* 2014, *IAQM Guidance on the assessment of dust from demolition and construction,* Institute of Air Quality Management, London. http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf.
- SA EPA 2016, Evaluation distances for effective air quality and noise management, South Australian Environment Protection Authority, August 2016.
- VIC EPA 2013, *Recommended separation distances for industrial residual air emissions*, Publication number 1518, March 2013, authorised and published by EPA Victoria, 200 Victoria Street, Carlton.
- WA EPA 2015, Draft Environmental Assessment Guidelines for Separation distances between Industrial and Sensitive Land Uses, Western Australian Environmental Protection Authority, September 2015.

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.

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 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 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 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; 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/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m³	>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

Odour Impact 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 Receptor Sensitivity to Odours

Sensitivity	Criteria
High	Surrounding land where: • users can reasonably expect enjoyment of a high level of amenity; and • people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium	Surrounding land where: • users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • people 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. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low	Surrounding land where: • the enjoyment of amenity would not reasonably be expected; or • there is transient exposure, where the people 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 may include industrial use, farms, footpaths and roads.

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
Very Large	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Large	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Medium	Predicted impact may be tolerated for most of the days, but maybe intolerable for some days.
Small	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

Potential Odour Exposure Impact	Receptor Sensitivity		
	Low	Medium	High
Very Large	Moderate adverse	Substantial adverse	Substantial adverse
Large	Slight adverse	Moderate adverse	Substantial adverse
Medium	Negligible	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse
Negligible	Negligible	Negligible	Negligible

Where the overall effect is greater than “slight adverse”, the effect is likely to be considered significant. Note that this is a binary judgement: either it is “significant” or it is “not significant”. Concluding that an effect is significant should not mean, of itself, that a development proposal is unacceptable and the planning application should be refused; rather, it should mean that careful consideration needs to be given to the consequences, scope for securing further mitigation, and the balance with any wider environmental, social and economic benefits that the proposal would bring.

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