ASPECT INDUSTRIAL ESTATE

Air Quality and Odour Impact Assessment

Prepared for:

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Level 28
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SLR

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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 Mirvac Projects 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.

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DOCUMENT CONTROL

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Mirvac Projects Pty Ltd (Mirvac) to undertake an air quality and odour impact assessment to accompany a planning proposal for a stage significant development (SSD) on the land located on Mamre Road, Kemps Creek, New South Wales (NSW). The subject land of this assessment is proposed for the development of Aspect Industrial Estate (hereafter 'the AIE Site').

Air quality at the AIE Site is likely to be impacted by existing and future infrastructure in the surrounding area, such as:

- the existing Elizabeth Drive Landfill (owned and operated by SUEZ);
- existing poultry farms;
- existing construction projects; and
- future infrastructure projects.

This report provides a desktop assessment of the potential impacts of all existing and future air emission sources on air quality on the AIE Site. The desktop assessment relies on:

- publicly available air quality impact assessments; and
- recommended minimum separation distances for relevant activities.

This assessment has been prepared to support a planning proposal for the AIE Site, and presents a high level assessment of air quality impacts from existing and future air emission sources on the AIE Site, and those of future AIE Site on the neighbouring properties.

This document has been prepared in consideration of the Planning Secretary's Environmental Assessment Requirements (SEARs) and NSW Environmental Protection Authority's (EPA) requirements issued for the proposal (SSD-10448) on 30 April 2020 and 20 April 2020 respectively. **Table 1** below summaries all key issues relevant to this report and how they have been addressed in this report.

Table 1 Regulatory Requirements – Air Quality

Secretary's Environmental Assessment Requirements	Section
An assessment of air quality impact at sensitive receivers during construction and operation in accordance with NSW Environment Protection Authority guidelines and details of mitigation, management and monitoring measures.	**Section 5.4** (Construction) **Section 5.5** (Operation) **Section 5.4.4** (Mitigation Measures)
NSW EPA's Requirements	**Section**
• Sources of all potential air emissions from the site, including vehicle movements, during construction and operation;	**Section 2.3** (Construction) **Section 2.4** (Operations)
• Identification of sensitive receivers potentially impacted by air emissions during construction and operation;	**Section 2.1**
• Assessment of potential impacts on identified sensitive receivers; and	**Section 5.4** (Construction) **Section 5.5** (Operations)
• Details of air quality management and monitoring procedures proposed to minimise any impacts to the environment and human health during construction and operation.	**Section 5.4.4** (Construction) **Section 5.5** (Operations)

2 Project Overview

2.1 Site Location

The AIE Site is located at Lots 54 to 58 of DP259135Kemps Creek, NSW, and is located within the Penrith Local Government Area (LGA), approximately 13 kilometres (km) from the Penrith Central Business District (CBD) and 40 km from the Sydney CBD.

The AIE Site is located within the Mamre Road Precinct, which is a part of the wider Western Sydney Employment Area (WSEA). The AIE Site is currently zoned IN1 and E2 under the WSEA State Environmental Planning Policy (SEPP) (see **Section 4.4**). The regional location of the AIE Site is shown in **Figure 1**. The AIE Site is surrounded by other rural properties with multiple existing residences located within 100 m of the nearest AIE Site boundary. The closest sensitive receptors that have potential to be affected by air emissions during construction and operations are shown in **Figure 2**.

Figure 1 Regional Location of the Aspect Industrial Estate

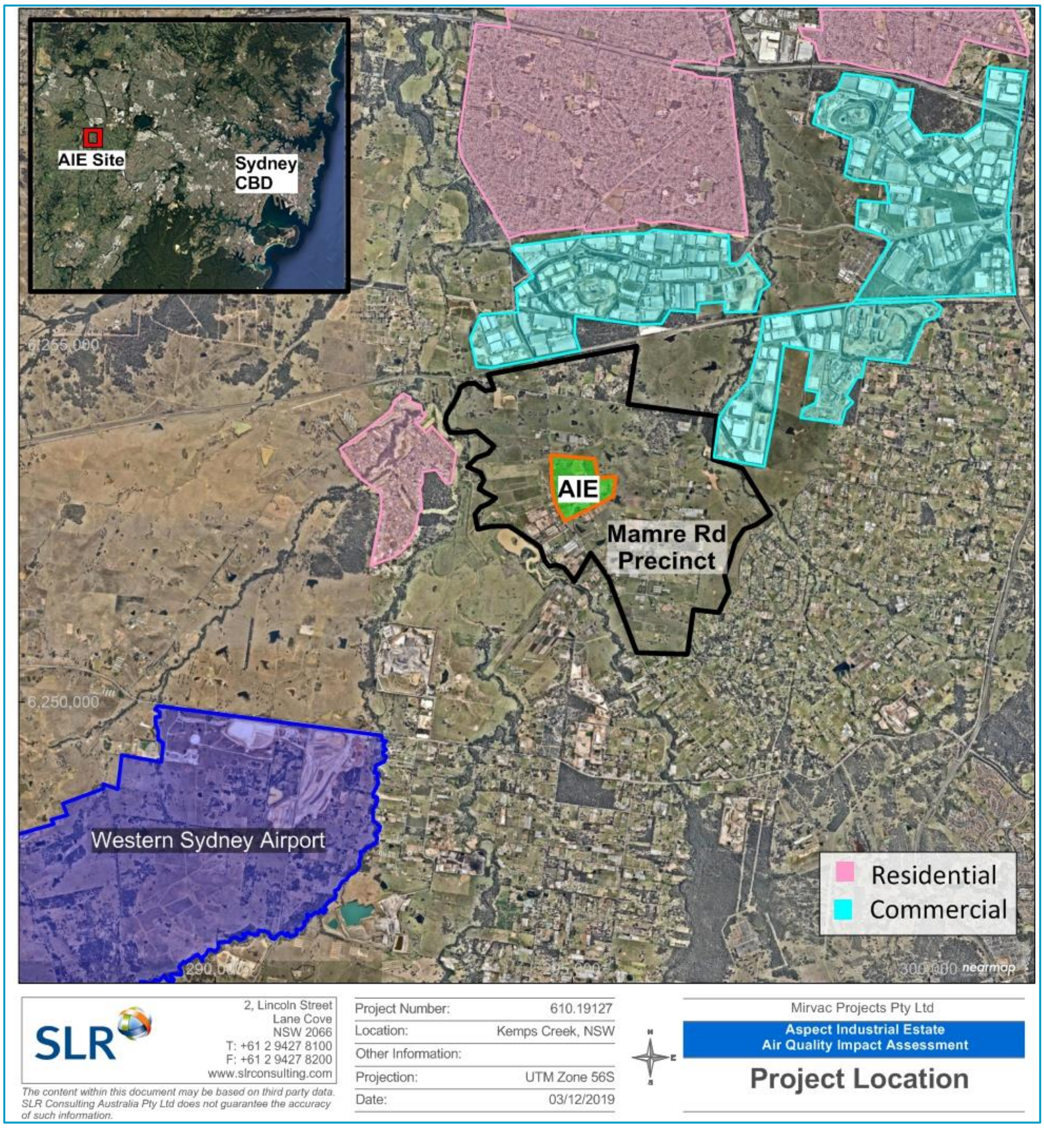
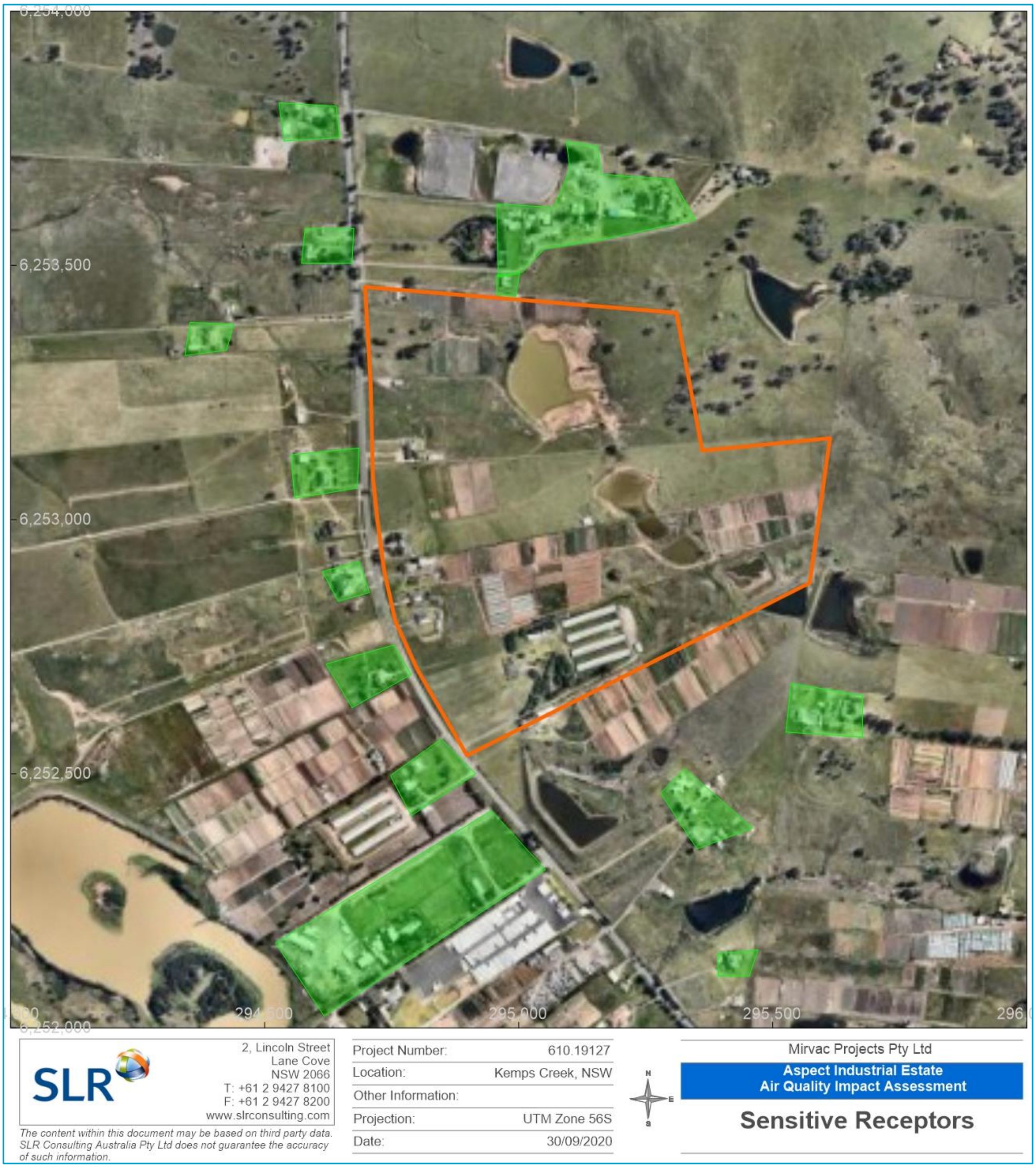


Figure 2 Location of the Sensitive Receptors



2.2 Concept Masterplan

This report has been prepared to support a development application for the purpose of a Concept Masterplan comprising 11 industrial buildings, internal road network layout, building locations, gross floor area (GFA), car parking, concept landscaping, building heights, setbacks and built form parameters. The Concept Masterplan of the AIE Site is shown in **Figure 3**.

Figure 3 Concept Masterplan of the Aspect Industrial Estate

Source: SBA Architects, Drawing number: MP 02, dated: 22.09.2020

2.3 Potential Sources of Air Emissions During Construction

The main air quality issue associated with construction works (including remediation works) relate to emissions of fugitive dust. The potential for dust to be emitted during the construction works 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:

- 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 also 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.

The activities relevant to air quality impacts within the Remediation Action Plan (RAP) (Arcadis 2020) are related to the earthworks and material handling activities. The potential air quality impact associated with fugitive dust emissions from the construction phase (including remediation) of the project have been addressed in **Section 5.4**.

2.4 Potential Sources of Air Emissions During Warehousing Operations

During the operational phase, the main source of air emissions would be emissions of products of fuel combustion and particulate matter (associated with brake and tyre wear as well as re-entrainment of road dust) associated with the trucks and other vehicles entering and leaving the AIE Site, or idling at the site during loading/unloading operations. At the time of writing this report, information on the site specific operations (eg, vehicle numbers and types) is not available. Therefore, a general risk assessment associated with warehousing operations is presented in **Section 5.5**.

2.5 Identified Local Air Emission Sources

A desktop review was undertaken to identify existing and future air emission sources in the locality. This review included:

- A review of aerial imagery of the region surrounding AIE Site location; and
- A search of current and future projects listed on the NSW Major Projects Portal.

The locations of the identified existing and future sources of air pollutants relative to the AIE Site are listed in **Table 2** and shown in **Figure 4**.

Table 2 Existing and Future Potential Air Emission Sources

Source ID	Status	Description	Address	Distance from Nearest AIE Site Boundary
1	Existing	Poultry sheds (x 5)	365 Luddenham Road, Kemps Creek	3,000 m
2		Poultry sheds (x 3)	879 Mamre Road, Kemps Creek	175 m
3		Poultry sheds (x 4)	Abbots Road, Kemps Creek	1,500 m
4		Poultry sheds (x 8)	Western Road, Kemps Creek	2,500 m
5		Elizabeth Drive Landfill	1,725 Elizabeth Drive, Kemps Creek	2,600 m
6	Future	Western Sydney Airport (WSA)	Elizabeth Drive, Luddenham	4,250 m
7		Kemps Creek Industrial Estate	657-769 Mamre Road, Kemps Creek	1,000 m
8		Oakdale West Estate	Bakers Lane, Kemps Creek	1,250 m
9		North-South Rail Line	-	5,500 m
10		M12 Motorway (Interchange)	-	3,000 m
11		M9 Motorway (Outer Sydney orbital corridor)	-	5,000 m

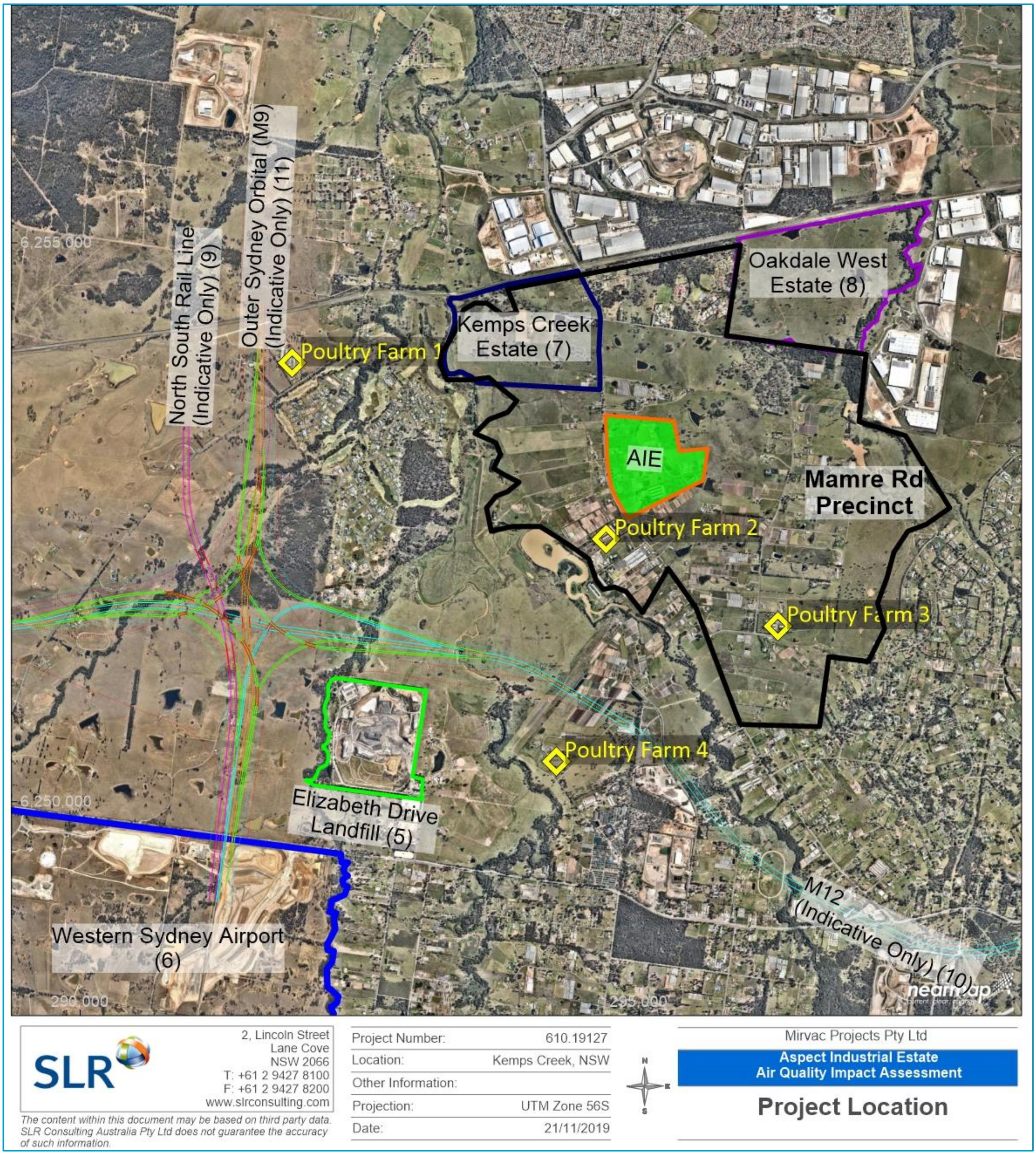
It is noted that a poultry farm currently also exists within the AIE Site boundary, however this poultry farm has ceased operations as part of the land acquisition for this Project.

Based on the types of existing and future sources of air pollution identified above, the air pollutants of interest have been identified as:

- Products of fuel combustion (including particulates) from local road and air traffic;
- Nuisance dust from construction projects in the area (ie Kemps Creek and Oakdale West Estates);

- Odour and dust from the existing Elizabeth Drive Landfill; and
- Odour from the existing poultry farms in the region.

Figure 4 Identified Local Air Emission Sources



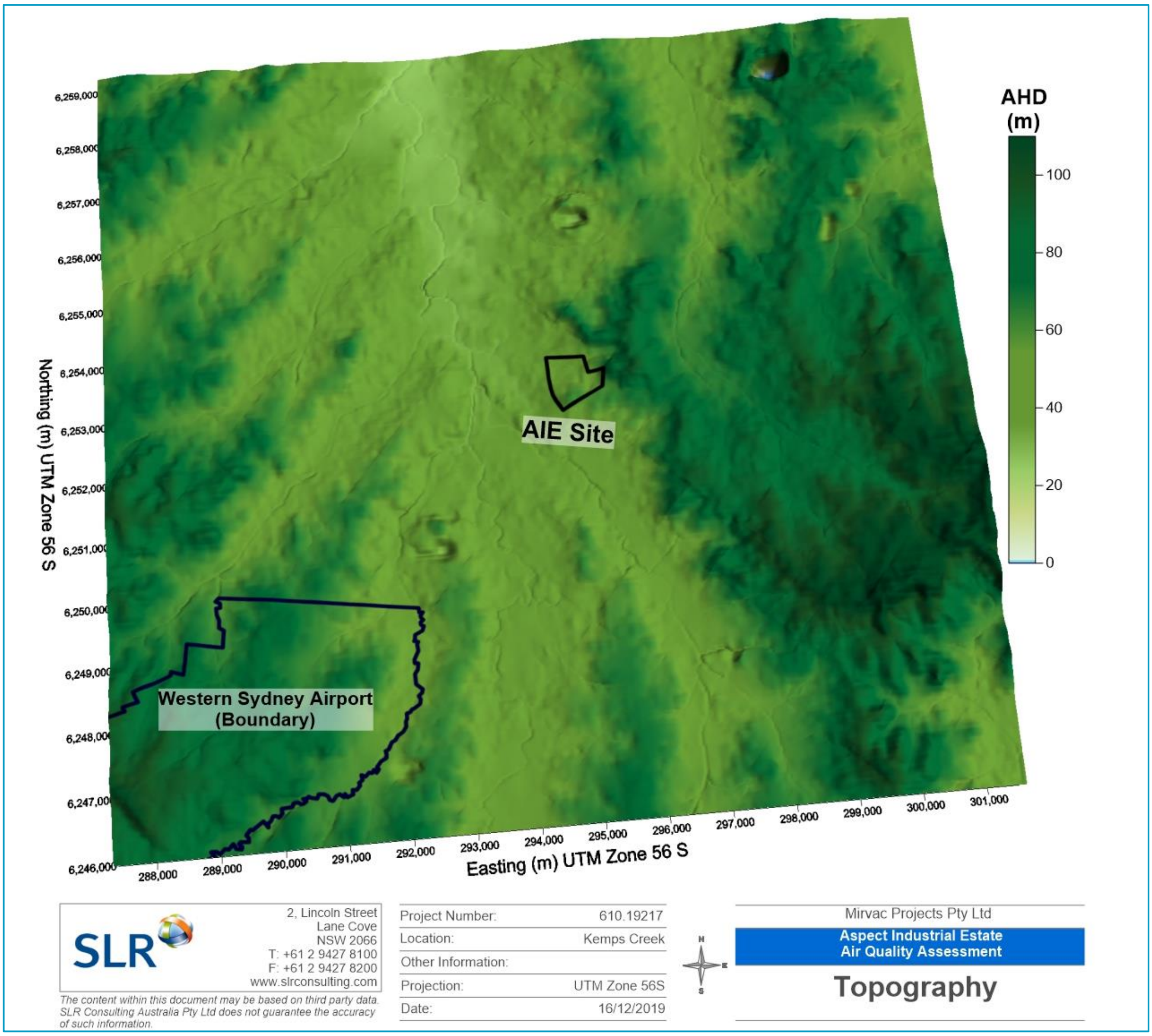
3 Receiving Environment

3.1 Topography

Local topography is important in air quality studies as local atmospheric dispersion can be influeced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies.

As shown in **Figure 5**, the elevation of the AIE Site ranges from approximately 20 m to 40 m Australian Height Datum (AHD). The AIE Site is located within a valley, with potential for light air drainage flows along the north-south channel, under calm conditions.

Figure 5 Regional Topography



3.2 Local Wind Conditions

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 recording wind speed and wind direction data is the Horsley Park Automatic Weather Station (AWS), located approximately 5.5 km east of the AIE Site (Station ID 67119). For the purpose of this assessment, it is assumed that the wind conditions recorded at the Horsley Park AWS are representative of the wind conditions experienced at the AIE Site.

Annual wind roses for the years 2014 to 2018 compiled from data recorded by the Horsley Park AWS are presented in **Figure 6**, with seasonal wind roses for 2018 presented in **Figure 7**. 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) presented in **Table 3** was used to describe the wind speeds experienced at the AIE Site.

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

The annual wind roses for the years 2014 to 2018 (**Figure 6**) indicate that predominant wind directions in the area are consistently from the southwest quadrant. Very low frequencies of winds from the northeastern quadrant were recorded across all years. The annual frequency of calm wind conditions was recorded to be approximately 12.5%-14.5% for all the years between 2014 and 2018.

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

- In summer, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 9.8 m/s). The majority of winds originated from eastern and south eastern quadrants, with very few winds from western directions. Calm wind conditions were recorded approximately 12% of the time during summer.
- In autumn, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 8.9 m/s). The majority of winds originated from southwest quadrant, with very few winds from other directions. Calm wind conditions were observed to occur approximately 12.5% of the time during autumn.
- In winter, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 8.6 m/s). The majority of winds originated from southwest quadrant, with very few winds from other directions. Calm wind conditions were observed to occur approximately 11% of the time during winter.
- In spring, wind speeds ranged from calm to fresh winds (between 0.5 m/s and 9.8 m/s). The frequency of winds are generally even in each direction, except for a relatively low frequency of winds originating from southern quadrant. Calm wind conditions were observed to occur approximately 11.5% of the time during spring.

Figure 6 Annual Wind Roses for Horsley Park (2013 to 2017)

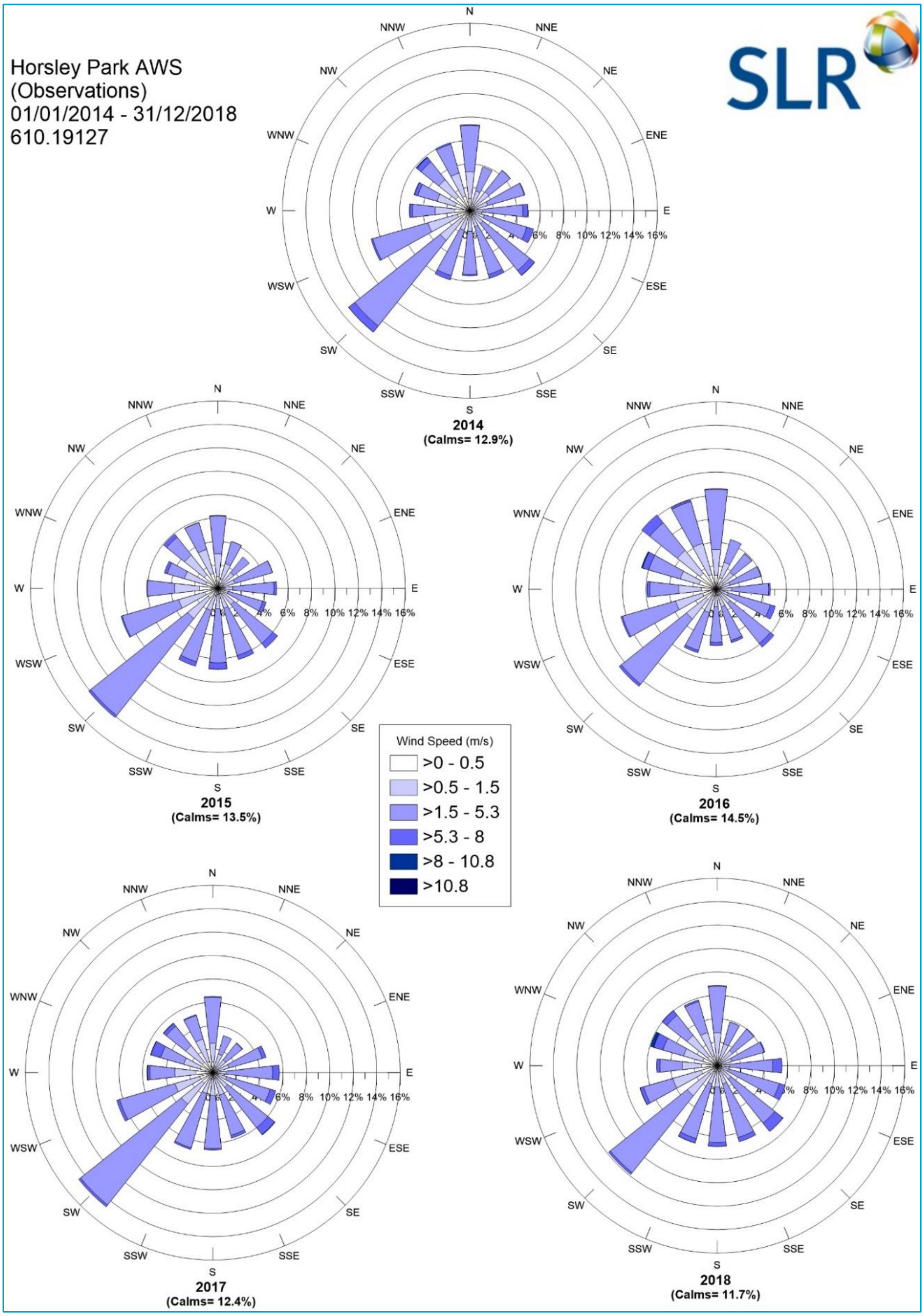
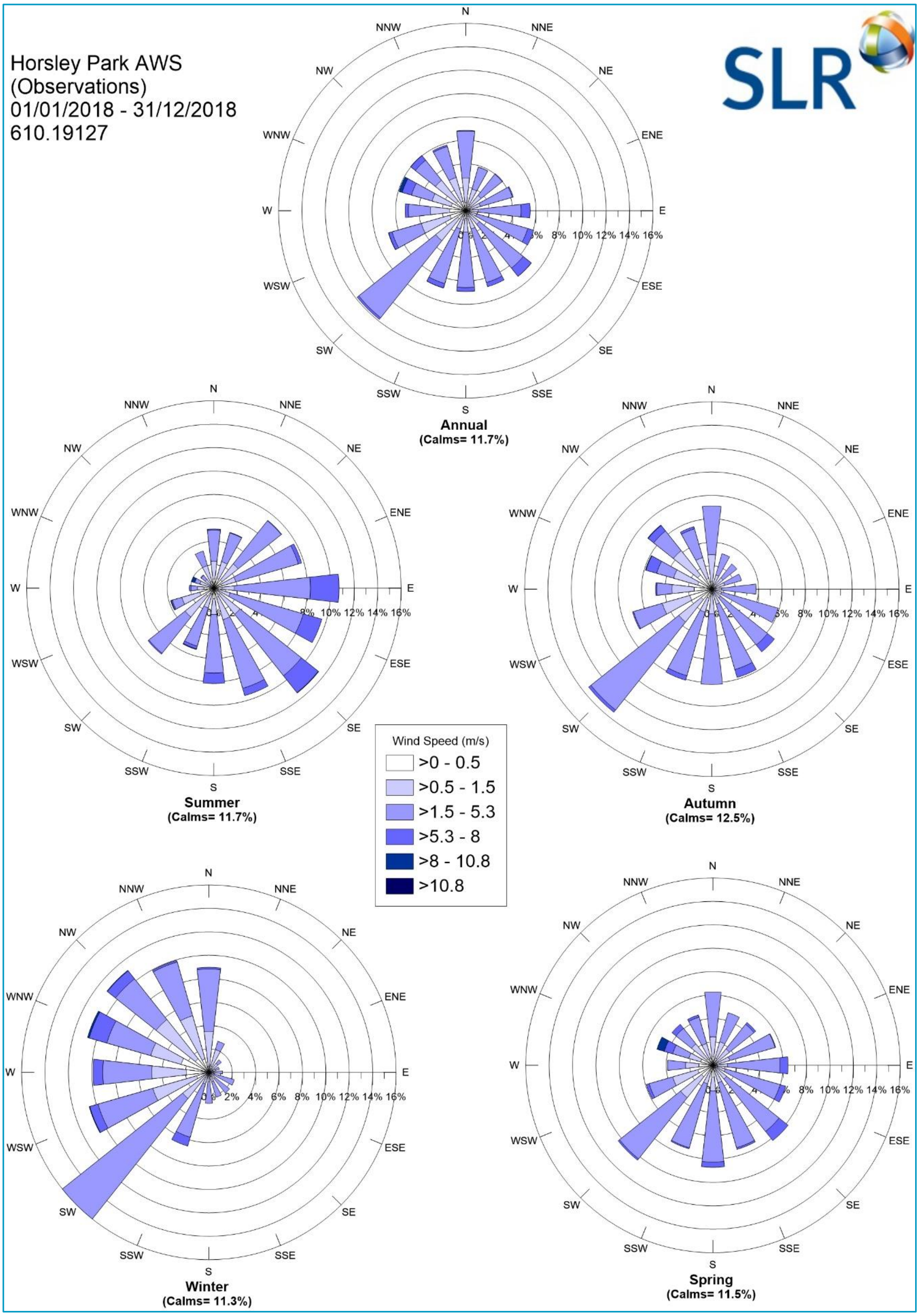


Figure 7 Annual and Seasonal Wind Roses for Horsley Park (2018)



4 Legislation, Regulation and Guidance

4.1 Pollutants of Concern

As identified in **Section 2.3**, the key air pollutants of interest are considered to be:

- Products of fuel combustion (including particulates) from vehicles on existing and future roads in the area, as well as aircraft movements and ground equipment at the future WSA;
- Nuisance dust from construction of Kemps Creek Industrial Estate and Oakdale West Estate; and
- Odour from the existing Elizabeth Drive Landfill and the poultry farms in the region.

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

4.1.1 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 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 and ranging down to 0.1 µm and is termed 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 Products of Combustion

Emissions associated with road traffic and the combustion of fossil fuels (diesel, petrol, AVGAS 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 the engine exhaust.

Engine exhausts can also 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 and currently ambient SO_2 concentrations in Australian cities are typically well below regulatory criteria.

4.1.3 Odour

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally not intended to achieve “no odour”.

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the *odour threshold* and defines one odour unit (ou). An odour goal of less than 1 ou would theoretically result in no odour impact being experienced.

In practice, the character 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 from 2 ou to 10 ou 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 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 until a higher threshold is reached than for odours from a wastewater treatment works.
- *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. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations.
- *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.

An example for this can be shown in a theoretical case of a bakery. A person walking past the bakery may smell the bakery odours and 'like' these baking odours (it can be shown that people generally react positively to baking odours). However, a person living next to the bakery and who experiences the baking odours throughout their house and garden on a continuous basis may find the baking odours a nuisance to the point where they complain to local authorities.

4.2 Air Quality Criteria

4.2.1 Particulate Matter and Products of Combustion

State 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 2017) [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 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 4**.

Table 4 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 Annual	- -	50 µg/m^3 30 µg/m^3
$PM_{2.5}$	24 Hours Annual	- -	25 µg/m^3 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 2017

4.2.2 Odour

The equation used by the NSW EPA to determine the appropriate impact assessment criteria for complex mixtures of odorous air pollutants, as specified in the document '*Technical framework: assessment and management of odour from stationary sources in NSW*' (hereafter the Odour Framework [DEC 2006a]), is expressed as follows:

$$\text{Impact assessment criterion (ou)} = (\log_{10}(\text{population})-4.5)/-0.6$$

A summary of the impact assessment criteria given for various population densities, as drawn from the Odour Framework, is given in **Table 5**. Based on the future development in the area, a criterion of 2 ou would be appropriate for the AIE Site.

Table 5 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odours (ou) (nose-response-time average, 99th percentile)
Urban area (≥ 2000)	2.0
~300	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence (≤ 2)	7.0

Source: DEC 2006

4.3 Minimum Separation Distances

In situations where the specifics of a development are unknown (eg the potential locations of residential developments, or the nature, scale and potential impact of industrial or commercial land uses), 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.

Technical Notes

The NSW EPA document '*Technical Notes: Assessment and Management of odour from stationary sources in NSW*' (hereafter the 'Technical Notes' [DEC 2006b]) sets out how to calculate separation distances for proposed broiler chicken farms that would use current standard production technology.

This methodology prescribed by the Technical Notes allows broiler chicken shed numbers to be varied according to the management standards proposed and achieved. The distance between the broiler chicken sheds and impact areas is not increased proportionally to the number of broiler chicken sheds but is more in accordance with the probable pattern of odour dispersion. This means that large broiler chicken farms are not sited unnecessarily long distances away from impact areas.

An assessment of the recommended separation distances is presented in **Section 5.2.3**, with additional details of the methodology used included in **Appendix A**.

4.4 State Environmental Planning Policy (Western Sydney Employment Area) 2009

The aim of this policy is to protect and enhance the land to which this Policy applies (the *Western Sydney Employment Area*) for employment purposes. Specifically, the particular aims of this Policy are as follows:

a. to promote economic development and the creation of employment in the Western Sydney Employment Area by providing for development including major warehousing, distribution, freight transport, industrial, high technology and research facilities,

b. to provide for the co-ordinated planning and development of land in the Western Sydney Employment Area,

c. to rezone land for employment or environmental conservation purposes,

d. to improve certainty and regulatory efficiency by providing a consistent planning regime for future development and infrastructure provision in the Western Sydney Employment Area,

e. to ensure that development occurs in a logical, environmentally sensitive and cost-effective manner and only after a development control plan (including specific development controls) has been prepared for the land concerned,

f. to conserve and rehabilitate areas that have a high biodiversity or heritage or cultural value, in particular areas of remnant vegetation.

The AIE Site is located within the WSEA and therefore the aims of the WSEA SEPP apply to the AIE Site. There are no air quality specific development standards or provisions identified in the WSEA SEPP, however the broader environmental protection context defined in (e) above is considered relevant to this air quality and odour assessment. In addition, clause 33H is considered relevant to the potential air quality impacts during construction and is reproduced below.

Clause 33H - Earthworks

The objectives of this clause are as follows:

- to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land,
- to allow earthworks of a minor nature without separate development consent.

The air quality impacts during earthworks at the whole AIE Site are assessed separately in **Section 5.4**.

5 Air Quality Assessment

Air quality at the AIE Site will be affected by regional background air quality, as well as the localised impacts of air emission sources within the surrounding area. The following section presents a summary of ambient air quality monitoring data available for the region, as well as an assessment of the potential impacts of the emission sources identified in **Section 2.3**.

5.1 Background Air Quality

Air quality monitoring is performed by the NSW OEH at a number of monitoring stations across NSW. The nearest such station is located at St Marys, approximately 4.5 km northwest of the AIE 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. The St Marys AQMS monitors the concentration levels of following air pollutants:

- Oxides of nitrogen (NO, NO_2 and NO_X); and
- Fine particles ($PM_{2.5}$ and PM_{10}); and

A summary of the monitored pollutant concentrations for the last five years (2015-2019) is presented in **Table 6** and the data are presented graphically in **Figure 8** to **Figure 10**

Table 6 Summary of Air Quality Monitoring Data at St Marys AQMS (2015– 2019)

Pollutant	NO_2		PM_{10}		$PM_{2.5}$	
	Maximum 1-hour	Annual	Maximum 24-hour	Annual	Maximum 24-hour	Annual
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2015	65.6	8.3	53.0	15.0	ND	ND
2016	86.1	7.5	100.2	16.1	93.2	7.8
2017	75.9	8.7	49.8	16.2	38.2	7.0
2018	75.9	10.3	100.5	19.4	80.5	7.8
2019	67.7	7.6	159.8	24.7	88.3	9.8
Criterion	**246**	**62**	**50**	**25**	**25**	**8**

Figure 8 Measured Daily Maximum 1-Hour Average NO_2 Concentrations at St Marys AQMS (2015– 2019)

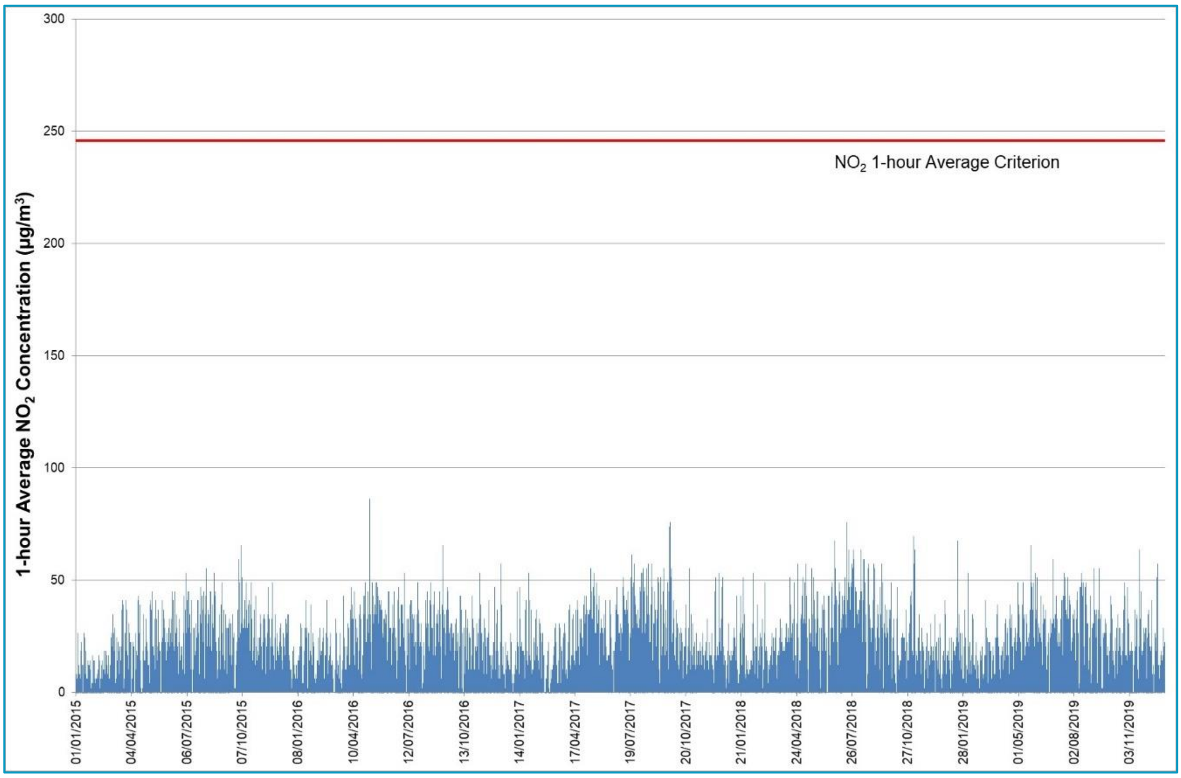


Figure 9 Measured 24-Hour Average PM_{10} Concentrations at St Marys AQMS (2015– 2019)

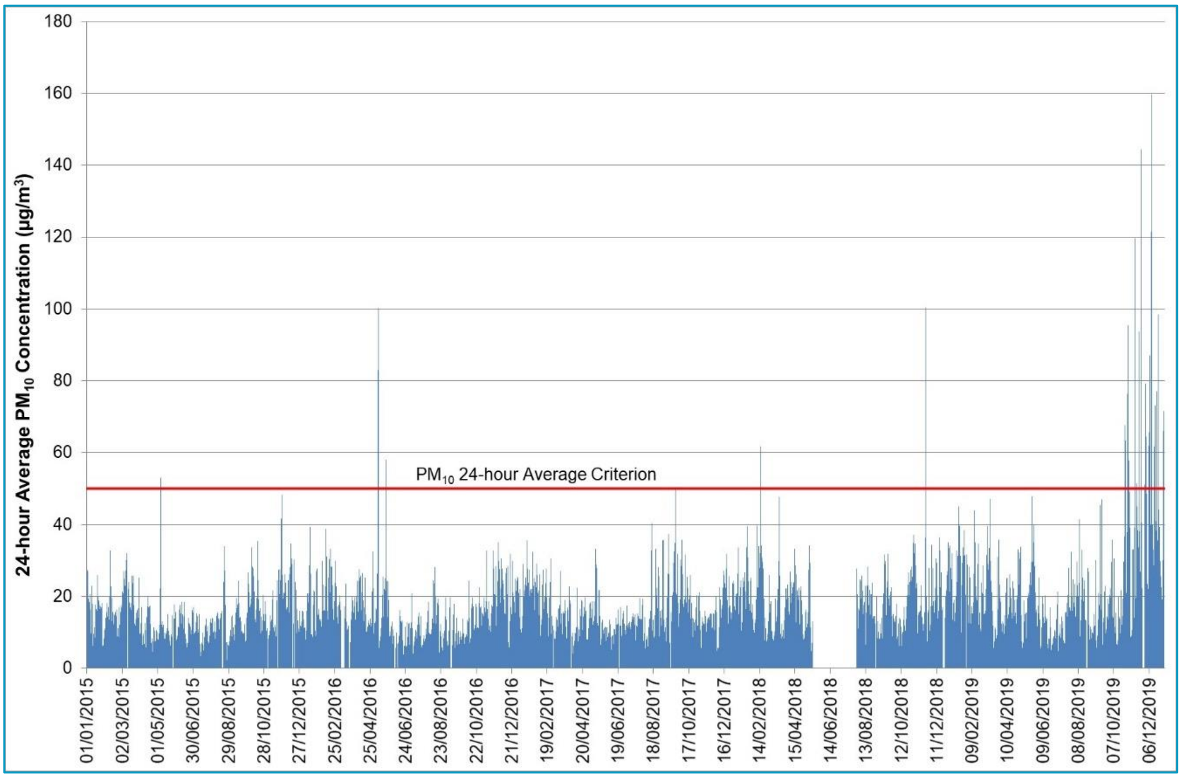
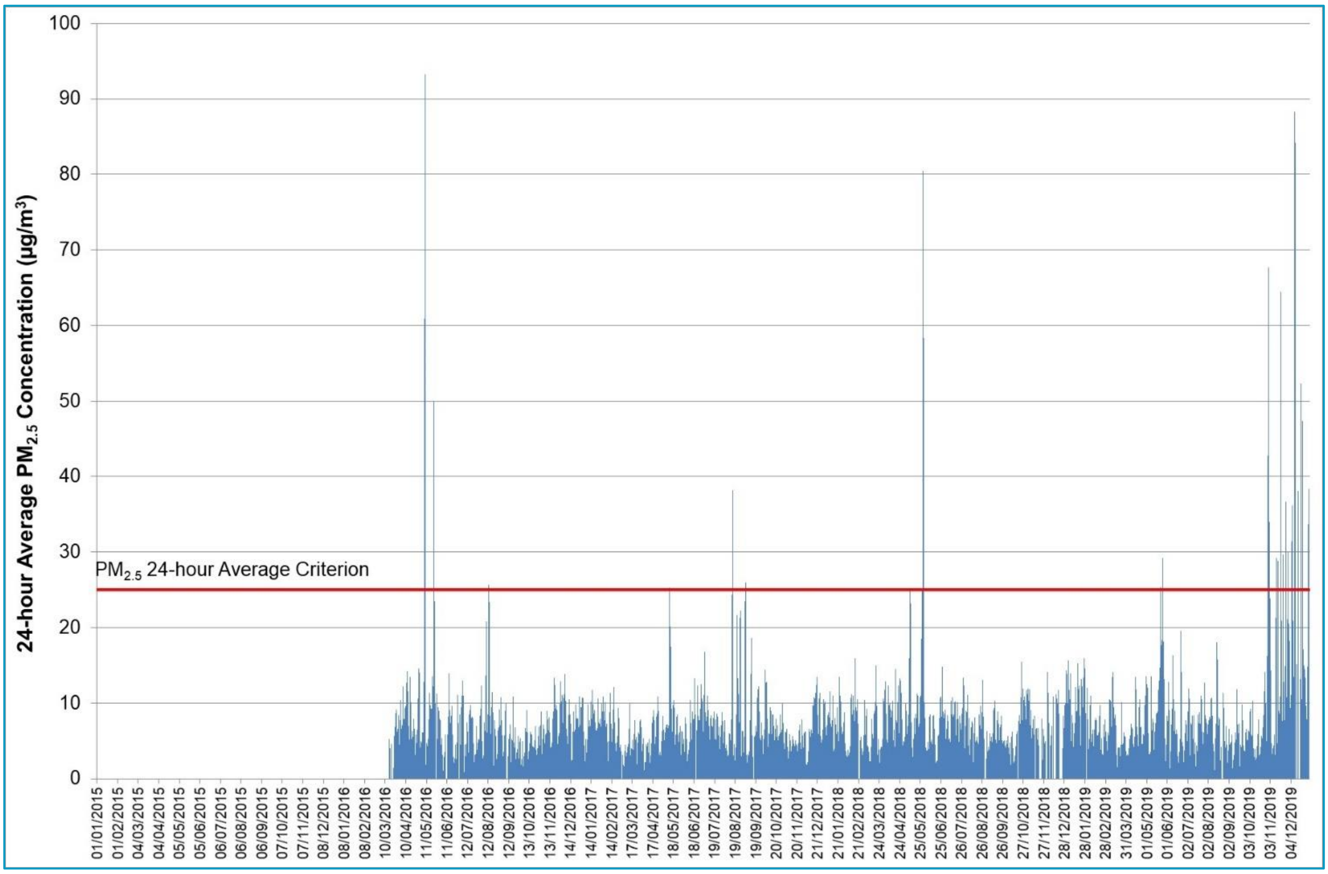


Figure 10 Measured 24-Hour Average $PM_{2.5}$ Concentrations at St Marys AQMS (2015– 2019)



The monitoring data for NO_2 indicate that the respective air quality criteria (short term and long term) for this pollutant are easily achieved at the St Marys AQMS site.

Exceedances of the 24-hour average PM_{10} criterion were recorded by the St Marys AQMS in all years except 2017. A review of the exceedances recorded during 2015, 2016, 2018 and 2019 indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns.

Based on their review of ambient monitoring data from their 43 station air quality monitoring network, NSW EPA (in their publication *NSW* Annual Air Quality Statement 2018 [OEH 2019]), concluded that the air quality index was in the 'very good', 'good' or 'fair' category for at least 87% of the time in any Sydney region.

However, even though the air quality is generally good in Sydney region, there is potential for fugitive dust emissions from the future construction projects in the vicinity of the AIE Site to elevate local ambient particulate concentrations and contribute to additional exceedances of the 24-hour average criteria.

5.2 Localised Impacts of Existing Sources of Airborne Pollutants

5.2.1 Products of Combustion

The main existing sources of products of combustion identified in the local air shed are exhaust emissions from local traffic in the area. Given the similar level of urban development between the AIE Site and St Marys AQMS, any air impacts due to local traffic can be assumed to be captured within the background levels monitored by the St Marys AQMS (see **Section 5.1**). On this basis, ambient concentrations of gaseous air pollutants can be expected to be well within the relevant ambient air quality criteria, while concentrations of PM_{10} and $PM_{2.5}$ may be elevated at times due to regional events.

5.2.2 Nuisance Dust

As identified in **Section 2.3**, the construction of Kemps Creek Industrial Estate and Oakdale West Estate can potentially affect the short terms air quality at the AIE Site. The potential for dust to be emitted during the demolition/construction phase and from these projects in the surrounding area 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 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.

The publicly available information indicates that the construction of Kemps Creek Industrial Estate and Oakdale West Estate is likely to be undertaken and completed during 2020. The AIE Site is still going through the development application process, and its construction and operations are unlikely to coincide with the construction of Kemps Creek Industrial Estate and Oakdale West Estate, therefore reducing the likelihood of cumulative impacts.

5.2.3 Odour

As identified in **Section 2.3**, multiple odour generating sources exist in the vicinity of the AIE Site; including the Elizabeth Drive Landfill and a number of poultry farms. However, as odours from the poultry farms will have a different characteristic compared to odours from the Elizabeth Drive Landfill, it is not appropriate to assume that the odours are directly cumulative. The *Technical Notes: Assessment and management of odour from stationary sources in NSW* (DEC 2006b) only requires:

> *"Where it is likely that two or more facilities with **similar odour character** will result in cumulative odour impacts, the combined odours due to emissions resulting from all nearby facilities should also be assessed against the odour assessment criteria."*

Similarly, the Queensland Department of Environment and Science Guideline *Odour Impact Assessment from Developments* (DEHP 2013) states:

> *One of the drawbacks of dispersion modelling with multiple sources of odour is that the model assumes that the odours are additive. While this is correct for single chemical contaminants, it is not correct for odour units because the actual downwind odour concentration will depend on the various concentrations of the chemical constituents in the odour mixture. If the two sources were of quite different make-up, then the combined, diluted mixture of these two odour sources can have quite a different cumulative impact on the receiving environment. In some cases the effects may be additive and in other cases it may be positively or negatively synergistic. The modelling of multiple odour sources is quite complex and a little is currently understood about the cumulative impacts of multiple odour sources. It is reasonable to expect multiple sources of the same type of odorant (eg. multiple sheds on a poultry farm) to be additive in nature. An example of different type of odorant would be the rendering plant cooking odour via a chimney and the diffuse source odour from a wastewater treatment system.*

On this basis, the potential impacts of odour emissions from the landfill and poultry farms have been addressed separately below.

Elizabeth Drive Landfill

An odour impact assessment was completed by AECOM for the installation of an Advanced Waste Treatment Facility (AWTF) within the Elizabeth Drive Landfill in March 2013 (AECOM 2013). As part of that assessment, dispersion modelling was undertaken for odour sources associated with the proposed AWTF and the existing landfill cumulatively. Only one scenario was modelled, which assessed potential odour impacts from the expanded operations at full capacity (ie material input of 220,000 tonnes per annum) based on waste projections for 2016.

The dispersion modelling showed that 2 ou odour contour levels were predicted approximately 600 m north of the Elizabeth Drive Landfill. It was noted in the AECOM report that these exceedances reflect contributions from the landfill rather than the proposed AWTF.

As noted in **Section 2.3**, the AIE Site is approximately 2,600 m away from the Elizabeth Drive Landfill, therefore, based on the AECOM modelling it is concluded that the likelihood of odours from Elizabeth Drive Landfill being detected as far as the AIE Site is extremely low.

Poultry Farms

Poultry shed odour emissions consist of a complex mixture of odorous molecules. Based on the measurement of several natural and tunnel ventilated poultry sheds, Jiang et al (Jiang and Sands 2000) concluded that ammonia [NH_3] and dimethyl sulphide [$(CH_3)_2S$] were, by volume, the major odorous constituents inside the broiler sheds investigated and that the biodegradation of accumulated faecal matter within the poultry sheds was the most significant source of odour. Gaseous odorous compounds from the litter and chicken bodies are transferred into the shed air at varying rates depending on a range of environmental conditions in the shed. Water is also known to act as a catalyst in the processes of odour generation, transfer and transport.

Chapter 5 of the Odour Technical Notes (DEC 2006) sets out the following methodology to calculate separation distances for poultry farms using current standard production technology. Details of this methodology and how it has been applied to the poultry farms identified in the vicinity of the AIE Site are presented in **Appendix A**. The Odour Technical notes states that the use of this methodology gives prescribed distances that have been found to lead to an acceptable air quality impact on the amenity of the local environment.

Equation 1 (refer to **Appendix A**) has been used derive the minimum recommended separation distance between the existing poultry farms and any future development, assuming an odour performance criterion of 2 ou or less. The calculated separation distances are provided in **Table 7**.

A comparison of actual versus calculated minimum separation distances is also provided in **Table 7**. The actual separation distances are shown to be greater than the calculated separation distance for all poultry farms except the poultry sheds located at 879 Mamre Road (ie Source 2). This is the poultry farm located across the road from the AIE Site.

Table 7 Calculated Minimum Separation Distances for Surrounding Poultry Farms

Source ID	Address	# of Sheds	Shed Area[1] (m^2)	# of Standard Sheds[2]	Separation Distance (m)	
					Calculated[3]	Actual
1	365 Luddenham Road	5	9,935	7.6	1,974	3,000
2	879 Mamre Road	3	6,306	4.9	1,429 (1,715)	175
3	Abbots Road, Kemps Creek	4	4,320	3.3	1,311	1,500
4	Western Road, Kemps Creek	2	9,490	7.3	2,292	2,500

1 Estimated from aerial imagery.

2 Number of standard sheds based on standard shed area of 1,300 m^2.

3 A 20% increase in separation distance applies for poultry farms in close proximity to one another. Total separation distance including 20% increase given in brackets.

Figure 11 illustrates the estimated separation distance for Source 2. This plot shows that the minimum recommended separation distances for Source 2 covers the whole area of the AIE Site. Based on the screening assessment, it is therefore concluded that there is potential for odour impacts across the AIE Site, as a result of the existing poultry farm operations located across the road.

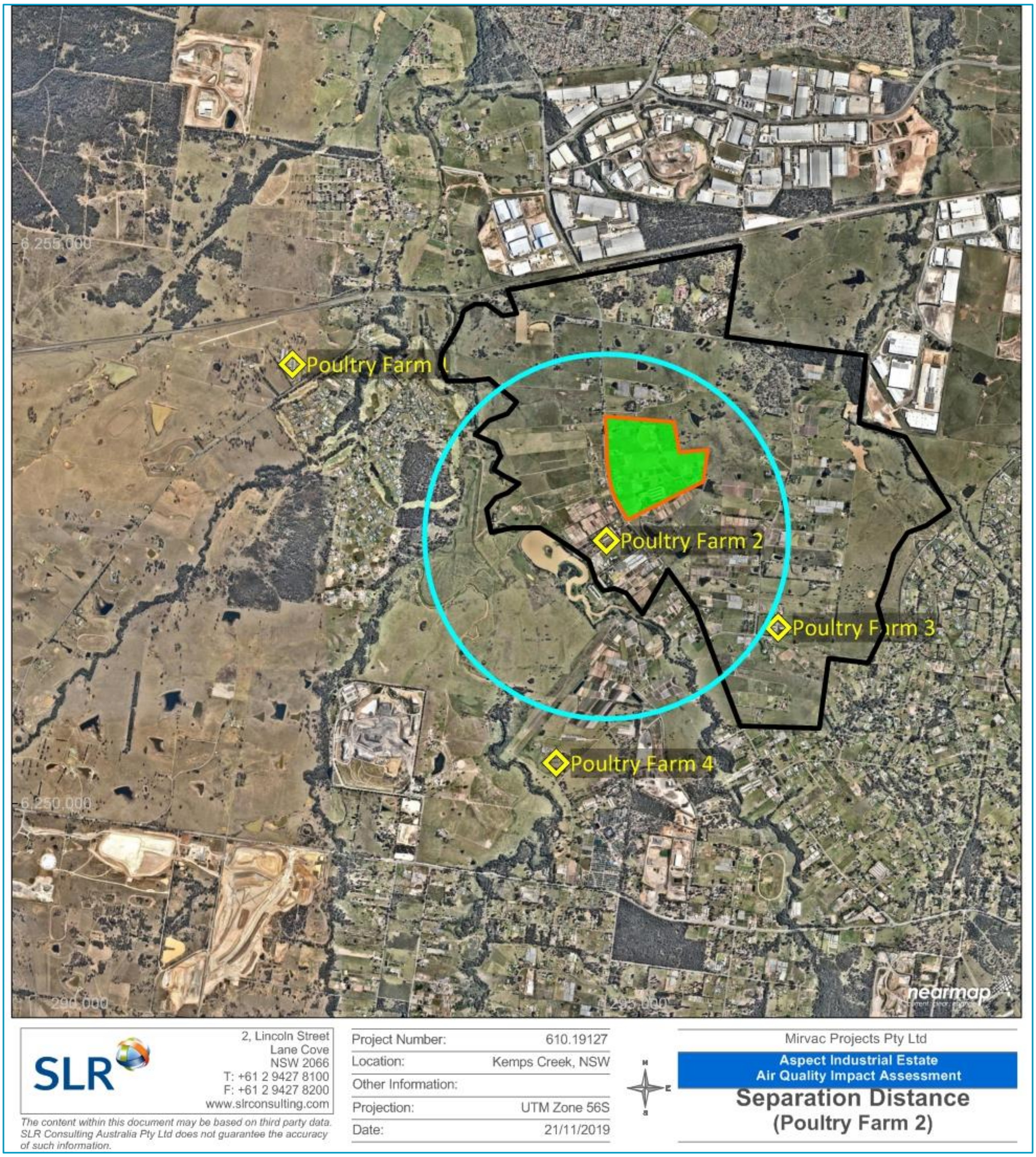
As discussed in **Section 4.3**, the purpose of separation distances approach is to provide a screening tool, and is not intended to 'sterilise' land from development. The following should be considered when interpreting the results of this screening level assessment:

- This assessment has been used as an initial 'screening' assessment for estimating odour impacts and is based on a range of generic conservative assumptions;
- A number of semi-rural residential properties already exist in the vicinity of Source 2 (see **Section 2.1**) and SLR is not aware of any existing odour complaints history in the area associated with this poultry farm.
- The proposed development is an industrial development, which can be expected to be less sensitive to odour impacts.

Given the above factors, it is concluded that there is a low risk for nuisance odour impacts from the existing poultry farm located at 879 Mamre Road on the AIE Site.

As noted in **Section 2.1**, the AIE Site and the wider Mamre Road Precinct are rezoned as IN1. The rezoning of the wider Mamre Road Precinct may facilitate higher order urban development which could see the existing farm uses change over time. For instance, Source 2 is located within the area rezoned as IN1, which may result in these poultry farms ceasing operations.

Figure 11 Calculated Separation Distances for Poultry Operations



5.3 Localised Impacts of Proposed Sources of Airborne Pollutants

5.3.1 Products of Combustion

Western Sydney Airport

An AQIA was completed by Pacific Environment Limited in August 2016 (PEL 2016), which assessed air quality impacts associated with WSA operations, including aircraft exhausts, auxiliary power units (APUs), ground support equipment (GSE) (such as air climate units, aircraft tugs, conveyor belts, fork lifts, tractors and cargo loaders) and an onsite waste water treatment plant.

The contribution of WSA operations to local air pollution was estimated using the AERMOD dispersion modelling program for three (3) separate scenarios; namely, Stage 1 development (year 2030), Long term development (year 2063) and construction impacts. In addition, the modelling also incorporated estimated emissions associated with on-road vehicles relating to 'terminal traffic' and 'external roadways'. 'Terminal traffic' was defined as traffic travelling to and from the airport, whereas 'external roadways' included all roads outside the airport boundary, extending as far as the M4, M7 and the proposed M12.

The pollutants investigated in this assessment included particulate matter (as TSP, PM_{10} and $PM_{2.5}$), NO_2, CO, SO_2 and VOCs (benzene, toluene, ethyl benzene and xylenes), as well as odour from aircraft exhaust emissions and from the waste water treatment plant. It was concluded that:

> *There were no predicted exceedances of the NSW EPA criteria or NEPM AAQ standards at the residential receptors investigated for Stage 1 operations.*

As a conservative approach, to assess the cumulative impacts from WSA operations, the worst case pollutant impacts predicted for 'Long term development' (year 2063) have been reviewed.

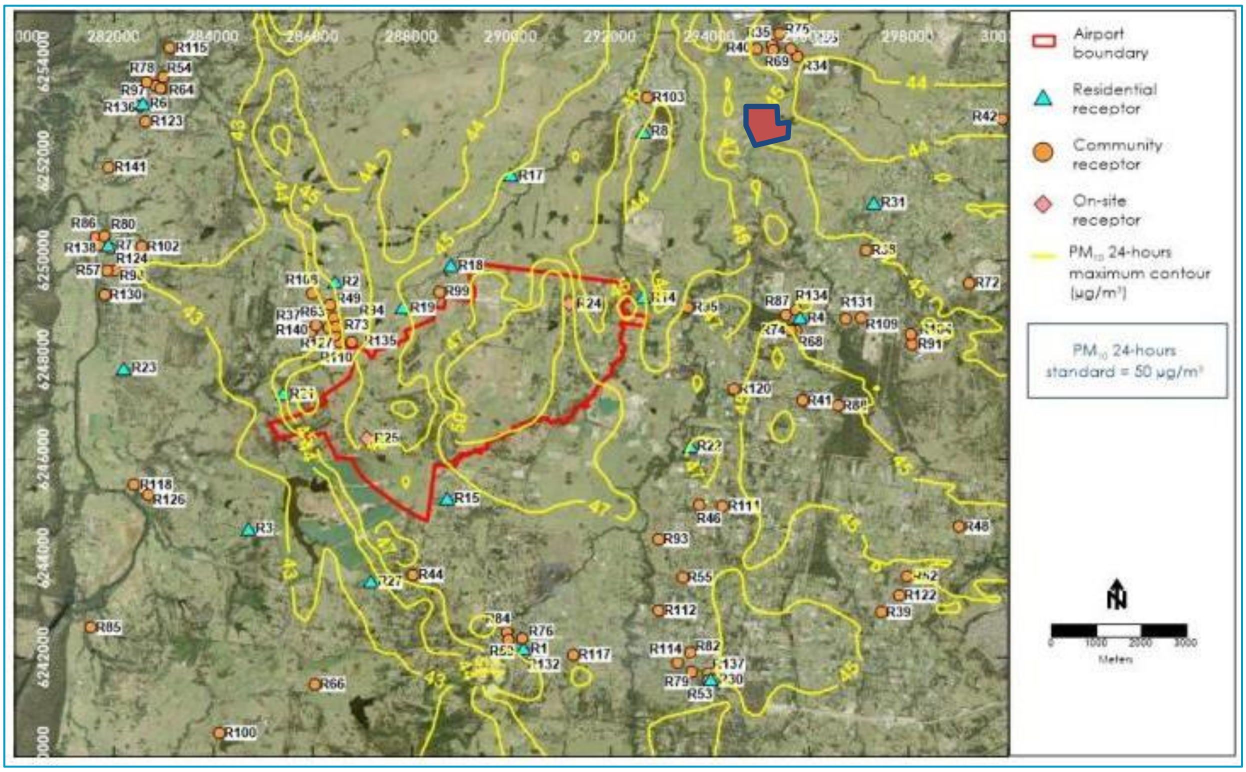
The ground level concentrations of CO, SO_2 and air toxics were predicted to be significantly lower than the respective project criteria for these pollutants and are not considered further. Contour plots of the predicted cumulative 24-hour average PM_{10}, 24-hour average $PM_{2.5}$ and 1-hour average NO_2 concentrations are shown in **Figure 12**, **Figure 13** and **Figure 14** respectively.

The contour plots show that the cumulative 24-hour average concentrations of PM_{10} and $PM_{2.5}$ are below the respective criteria within the AIE Site boundary, however exceedances of the cumulative 1-hour average NO_2 criterion (~320 µg/m^3) are predicted across AIE Site.

The PEL 2016 report identified that the cumulative 1-hour average NO_2 concentrations were predicted to exceed the criterion at six existing residential receptors, however the frequency of exceedance was limited to only between one and two hours per year.

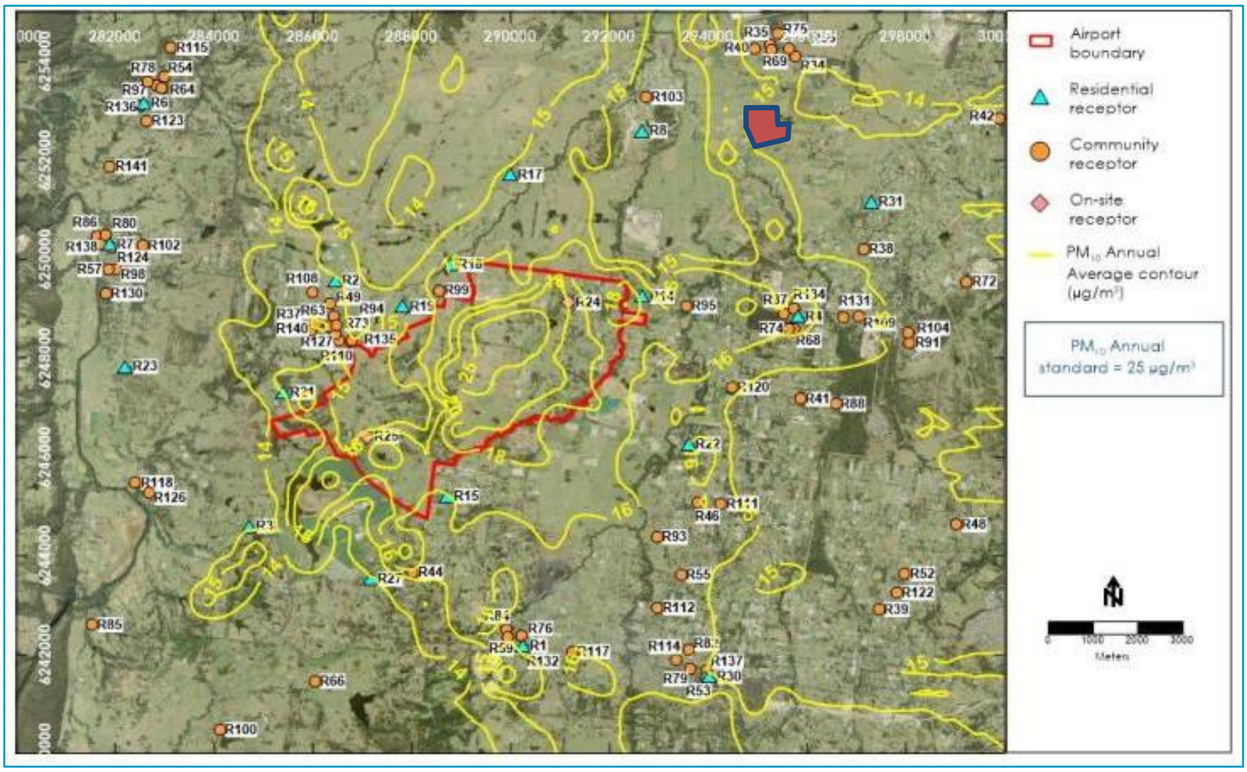
A number of mitigation measures were recommended in the PEL 2016 report to mitigate NO_2 impacts from the proposed WSA operations, including the implementation of ambient air quality monitoring in the vicinity of the WSA. The implementation of such monitoring would provide scientifically robust data to demonstrate any changes in local air quality due to operations of the WSA.

Figure 12 Cumulative PM_{10} 24-Hour Contour Plot for the WSA - Long Term Development



Source: Figure F61 of PEL 2016.

Figure 13 Cumulative 24-Hour $PM_{2.5}$ Contour Plot for the WSA - Long Term Development



Source: Figure F67 of PEL 2016.

Figure 14 Cumulative Maximum 1-Hour NO_2 Contour Plot for the WSA - Long Term Development

Source: Figure F55 of PEL 2016.

The Airport Plan for WSA was published by the Australian Government in December 2016 (DIRD 2016). Part 3 (Specific Developments) of the Airport Plan includes conditions and mitigation measures relating to how the development is to be undertaken and operated. The mitigation measures relating to air quality to reduce air emissions and the potential for ground level ozone formation during WSA operations are reproduced below:

- *Using ground support equipment powered by electric, hydrogen, compressed natural gas or compressed air, including belt loaders, pushback tractors, bag tugs, and cargo loaders, where appropriate;*
- *Providing remote ground power facilities for remote aircraft parking positions, where practicable;*
- *Installing co-generation or tri-generation in-lieu of traditional gas fired boilers or solar hot water systems to replace gas fired boilers;*
- *Where possible, avoiding certain activities, such as training fires and maintenance (spray painting) during ozone seasons;*
- *Using underground fuel hydrant systems and/or vapour recovery systems for refuelling and fuel storage; and*
- *Promoting the use of public transport to the airport for workers, passengers and other airport users.*

With the implementation of these mitigation measures, it is expected that lower air quality impacts will be experienced than the levels shown above.

M12

The M12 interchange is proposed to be located approximately 3 km southwest of the AIE Site (see **Figure 4**). Air quality impacts from the M12 were included in the WSA air quality impact assessment conducted by Pacific Environment Limited (PEL 2016).

Outer Sydney Orbital Transport Corridor (M9)

The OSO corridor is approximately 80 km long (equivalent to the M7 and M5 motorways combined), running from Box Hill in Sydney's northwest to the Hume Highway near Menangle in Sydney's southwest. It is intended to comprise a motorway standard road and a dedicated freight rail line, with the capability to accommodate sections of the North South Rail Line connecting WSA with St Marys.

At the time of writing this report, no detailed design has been completed for the OSO corridor and the alignment shown in **Figure 4** is noted as being indicative only. A Draft Strategic Environmental Assessment was completed by AECOM in March 2018 (AECOM 2018). In regards to air quality impacts from road network, the assessment states:

> *"In combination with the future OSO infrastructure, there is a risk of cumulative impacts associated with $PM_{2.5}$ concentration and to a lesser degree the PM_{10} and NO_2 concentrations. A greater risk of impact associated with NO_2 concentrations exists in the central section of the recommended corridor. There is a risk of cumulative impacts occurring in this area of the recommended corridor when the airport has been built and all infrastructure is operational."*

In regards to rail freight, the assessment states:

> *"The Screening Assessment showed that predicted incremental impacts from the corridor were below the NSW EPA assessment criteria for NO_2 and particulates; however as noted previously, short and long term average ambient $PM_{2.5}$ concentrations are close to NSWEPA criteria, therefore further detailed modelling and assessment of air quality impacts would be needed during the future environmental impact assessment."*

It is concluded that while air emissions from the OSO corridor have the potential to contribute to the existing levels of pollutants in the local airshed, insufficient information is currently available to assess the potential level of impact that may be expected at the AIE Site. In the event that an air quality impact assessment is prepared for the OSO prior to the AIE Site Masterplan being finalised, it should be reviewed to identify if it has the potential to impact on air quality within the AIE Site. However, given the proposed development of AIE Site as an employment precinct, the risks of any unacceptable air quality impacts being identified are considered to be low.

North South Rail Line Corridor

The North South Rail Line corridor would connect the T1 Western Line near St Marys and T8 South Line near Macarthur via the future WSA site. At the time of writing this report, no detailed design has been completed for the North South Rail Line corridor. A Draft Strategic Environmental Assessment was completed by Aurecon in January 2018 (Aurecon 2018). In regards to air quality impacts from North South Rail Line corridor operations, the assessment states:

> *"Protection of the recommended North South Rail Line corridor would have a negligible impact on air quality and greenhouse gases within the air shed as there would be no direct changes to emission sources. While operation of a future rail infrastructure is not expected to generate significant quantities of air emissions, the tunnel would require access and air circulation outlets to be provided above it. The location of these outlets would be determined during detailed design, and documented in the environmental impact statement prior to delivery of the infrastructure.*
>
> *Overall, the operation of public transport infrastructure within the recommended corridors is expected to contribute to a significant reduction in air quality and greenhouse gas emissions compared to the increased car travel that would otherwise be expected to occur in its absence.*
>
> *Construction of future infrastructure would generate temporary air quality and greenhouse gas impacts."*

It is concluded that the air quality impacts from the North South Rail Line corridor do not have the potential to contribute to the elevated levels of pollutants within AIE Site. Although construction of the North South Rail Line corridor has the potential to give rise to short-term elevated dust concentrations, it is concluded that these emissions should not be considered as a constraint to the AIE Site Masterplan.

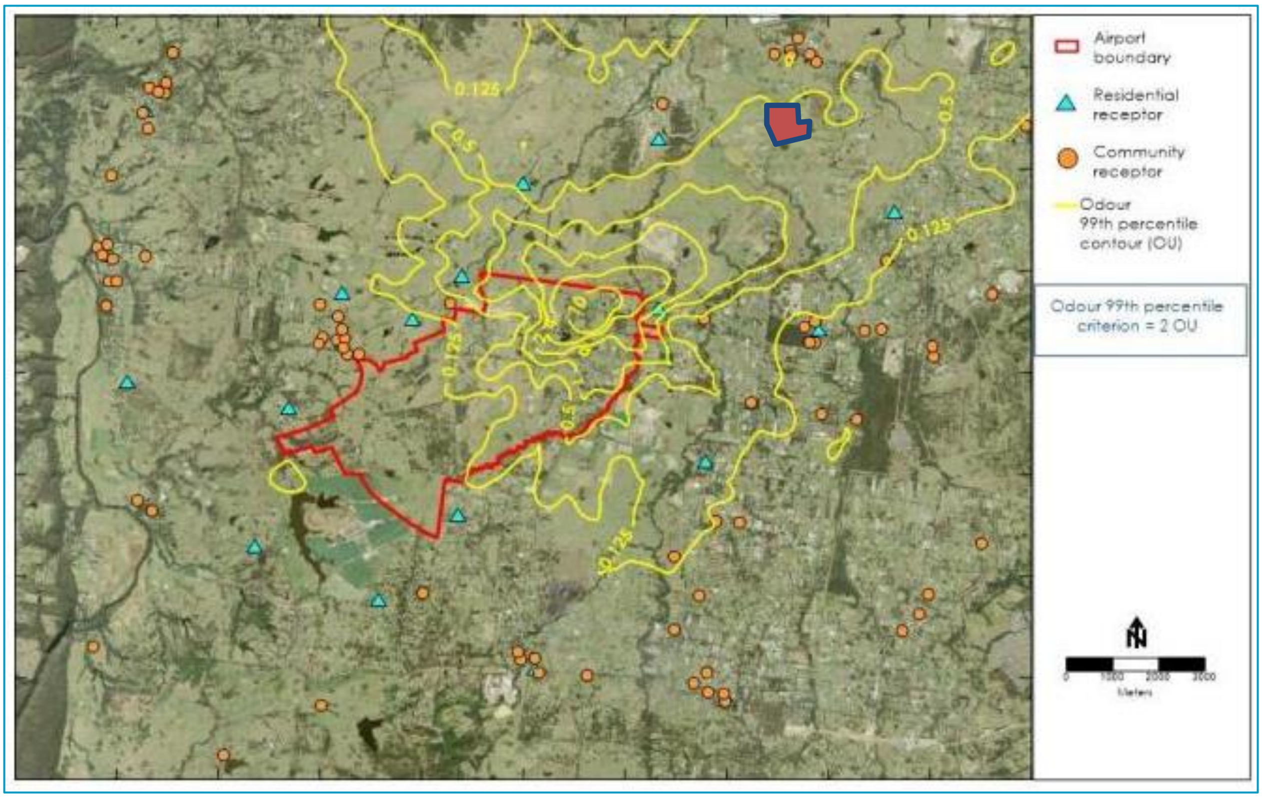
5.3.2 Odour

Potential future odour sources not considered in **Section 5.2.3** have also been considered here. Although transient in nature, one future source of odour identified is the asphalt plant proposed to be used at the WSA site during construction activities. There is also the potential for odours associated with the aircraft exhaust fumes once the WSA is operational.

The 99^{th} percentile predicted odour concentrations predicted by the modelling performed by Pacific Environment Limited (PEL 2016) for the asphalt plant are shown in **Figure 15**. It can be seen that odour concentrations predicted within AIE Site range from 1 ou to 0.5 ou. The predicted levels are lower than the project criterion of 2 ou and are therefore not considered to have any constraint on the AIE Site land use.

Odour impacts predicted from aircraft exhaust fumes were less than 0.1 ou at all the identified sensitive receptors assessed by Pacific Environment Limited. On this basis they would not be expected to have any impact on air quality at the AIE Site.

Figure 15 Predicted 99th Percentile Odour from Asphalt Plant Contour Plot



Source: Figure G17 of PEL 2016

5.4 Assessment of Dust Emissions During Construction

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 B** 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.

5.4.1 Step 1 – Screening Based on Separation Distance

As noted in **Section 2.1**, a number of sensitive receptors (residential) are located within 100 m from the nearest AIE Site boundary.

The IAQM screening criteria for further assessment is the presence of a 'human receptor' within:

- 350 m of the boundary of the site; or
- 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

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 sensitive receptors is estimated to be between 10 and 100 within 100 m of the AIE Site boundary.

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

Based upon the above assumptions and the IAQM definitions presented in **Appendix B**, the dust emission magnitudes for each phase of the construction works have been categorised as presented in **Table 8**. No significant demolition activities are proposed as part of the works, hence the risk of dust impacts from demolition activities have not been assessed.

Table 8 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Demolition	Medium	**IAQM Definition:** Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level. **Relevance to this Project:** *Total volume of the buildings to be demolished within the AIE Site is estimated to be approximately 50,000 m^3.*
Earthworks	Large	**IAQM Definition:** 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. **Relevance to this Project:** *Total area of the AIE Site is estimated to be approximately 558,000 m^2.*
Construction	Large	**IAQM Definition:** Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting. **Relevance to this Project:** *Multiple warehouses buildings are proposed at the AIE Site, the total building volume is estimated to be approximately 2,745,000 m^3 (total buildings are of 274,500 m^2 and average height of 10 m).*
Trackout	Large	**IAQM Definition:** 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. **Relevance to this Project:** *It is estimated that more than 50 heavy vehicles movements per day will occur during the peak construction period.*

5.4.3 Step 2b – Risk Assessment

Receptor Sensitivity

Based on the criteria listed in **Table B1** in **Appendix B**, the sensitivity of the identified receptors in this study is concluded to be *high* for health impacts and *high* for dust soiling, as they are located 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 B2** and **Table B3** in **Appendix B**, the sensitivity of the area to both dust soiling and health effects may be classified as *low*. This categorisation has been made taking into account the individual receptor sensitivities derived above, the 5-year mean background PM_{10} concentration of 18.3 µg/m^3 recorded at St Marys AQMS (see **Section 5.1**) and the existing number of sensitive receptors present in the vicinity of the AIE Site (ie 10-100 within 100 m).

Risk Assessment

Given the sensitivity of the general area is classified as '*low'* for dust soiling and for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 8**, the resulting risk of air quality impacts is as presented in **Table 9**.

Table 9 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

Impact	Sensitivity of Area	Dust Emission Magnitude				Preliminary Risk			
		Demolition	Earthworks	Construction	Trackout	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Medium	Large	Large	Large	Low Risk	Low Risk	Low Risk	Low Risk
Human Health	Low					Low Risk	Low Risk	Low Risk	Low Risk

The results indicate that there is a low risk of adverse dust soiling and 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, construction and trackout phases of the works.

5.4.4 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 10 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 AIE 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 10 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**	
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

	Activity	
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
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

H = Highly recommended; D = Desirable

5.4.5 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 11**.

Table 11 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 deposition and human health impacts for earthworks, construction and trackout phases of the works are anticipated to be *negligible*.

5.5 Assessment of Impacts from Warehouse Operations

As discussed in **Section 2.4**, air quality issues associated with the proposed warehouse operations predominantly relate to emissions of products of combustion and particulate matter and from trucks and other vehicles accessing and idling at the site.

These emissions will be of a similar nature to existing emissions from traffic on Mamre Road and other local roads connecting the industrial operations in the area. The scale and magnitude of emissions from the AIE Site is anticipated to be significantly lower compared to the estimated annual average daily traffic on Mamre Road. To assess the risk of air emissions from the AIE Site impacting on surrounding sensitive receptors during the operational phase, the following "risk based" approach has been adopted.

The risk-based assessment takes account of a range of impact descriptors, including the following:

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

  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 AIE Site include residences within 100 m of the boundary (see **Section 2.1**). In terms of the methodology in **Appendix C**, the sensitivity of the surrounding residential areas to emissions from the AIE Site should be considered *high*.

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

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

Given the above considerations, and the scale of operations, the potential impact of the AIE Site on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 12**).

Table 12 Impact Significance

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

It is noted that this assessment is based on warehousing operations only (ie storage and receival/dispatch of goods). If at the development stage, other industrial uses are proposed with potential to generate air quality emissions, then site specific air quality impact assessment should be prepared.

6 Conclusions

SLR was commissioned by Mirvac to undertake an air quality assessment to accompany a planning proposal to rezone the land located at 880-890 Mamre Road, Kemps Creek, New South Wales (NSW).

A desktop review has been undertaken to identify existing and proposed air emission sources in the locality of the AIE Site. The following existing and proposed sources of air pollutants were identified in the area surrounding the Site:

- existing poultry farms in the area;
- existing Elizabeth Drive Landfill (owned and operated by SUEZ);
- proposed Western Sydney Airport;
- proposed North-South Rail Line;
- proposed M12 Motorway; and
- proposed M9 Motorway (Outer Sydney Orbital corridor).

The potential impacts of these existing and proposed emission sources on air quality at AIE Site have been assessed based on publicly available air quality impact assessments and recommended minimum separation distances for relevant activities.

It was concluded that:

- Off-site impacts associated with dust deposition and suspended particulate during the construction phase (including remediation) are anticipated to be *low* for demolition, earthworks, building construction and trackout activities. A range of mitigation measures have been recommended for consideration as part of the CEMP.
- Based on the anticipated warehousing activities (storage and distribution) at the AIE Site, the potential for offsite air impacts from the operations is concluded to *neutral*.
- The poultry farm located across the road from AIE Site has the potential to create odour impacts across an area stretching beyond the AIE Site. Given the presence of existing residences in the area, the absence of odour complaints in the area (to SLR's knowledge), the nature of the development (ie industrial, which will have a lower sensitivity to odours), the conservative nature of the adopted separation distance guidelines, the latest rezoning of Mamre Road Precinct and development changes over the coming years to facilitate higher order urban development of the whole Mamre Road Precinct (which may see the existing farm uses be removed over time), the risk of odour nuisance impacts is lessened.
- Odour modelling studies performed in 2013 indicate that the existing Elizabeth Drive Landfill does not have the potential to result in nuisance odour impacts at the AIE Site.
- An air quality impact assessment performed in 2016 for the proposed WSA operations (PEL 2016) showed that cumulative 24-hour average concentrations of PM_{10} and $PM_{2.5}$ are predicted to be below the respective criteria within the AIE Site boundary, however exceedances of the cumulative 1-hour average NO_2 criterion are predicted within the AIE Site boundary. Air quality impacts from the M12 were included in the WSA air quality impact assessment conducted by Pacific Environment Limited (PEL 2016).

The PEL report noted that the cumulative 1-hour average NO_2 concentrations were predicted to exceed the criterion at six existing residential receptors in the area, but these exceedances were limited to only one to two hours per year. A number of mitigation options were recommended to mitigate NO_2 impacts from the proposed WSA operations, including provision of ambient air quality monitoring in the vicinity of WSA, which would provide robust data to demonstrate any changes in the air pollution levels. Given the very low number of exceedances predicted, and the conservative nature of the modelling assessment performed, it is considered unlikely that the proposed WSA would represent a significant constraint for development of AIE Site as an employment precinct.

- The operations of the proposed North-South Rail Line are not considered to be a constraint for development of the AIE Site.
- Previous assessments of potential air quality impacts from the OSO corridor indicate that these emissions do not have the potential to contribute to elevated levels of pollutants within the AIE Site. However, in the event that an air quality impact assessment is prepared for the OSO prior to the AIE Site Masterplan being finalised, it should be reviewed to confirm that it has no potential to adversely impact on air quality within the AIE Site.
- The construction of other projects in the area (ie Kemps Creek Industrial Estate and Oakdale West Estate) is likely to have been completed and therefore unlikely to coincide with the construction and operations of AIE Site, therefore reducing the likelihood of cumulative impacts.

In summary, it is concluded that there is a low risk for nuisance odour impacts from the existing poultry farm located at 879 Mamre Road on the AIE Site.

7 References

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APPENDIX A

Separation Distance Calculation Methodology

Isolated Poultry Farms

Variable separation distances are measured from the closest point of the poultry farm to the closest point of a receptor. Variable separation distances are based on the dispersion of odours from their source. They are used to determine the allowable numbers of poultry sheds and the management practices necessary to satisfy air quality objectives. A weighting factor allows for different types of premises.

Equation 1 below is specified for calculating separation distance for a given number of poultry sheds, as derived from Equation 5.2 of the Odour Technical Notes.

Equation 1, Separation distance, given the number of poultry sheds

$$D = N^{0.71} \times S$$

Where:

D is the separation distance in metres between the closest points of the poultry sheds and the most sensitive receptor or impact location

N is the number of poultry sheds

S Composite site factor = S1 x S2 x S3 x S4 x S5. Site factors S1, 52, 53, S4 S5 relate to shed design, receptor, terrain, vegetation and wind frequency.

Composite Site Factor (S)

The value of S to apply in **Equation 1** depends on site-specific information pertaining to the proposed shed type, receptor, terrain, vegetation and wind frequency, as set out in the following tables. Site factors shown in bold have been adopted for the purpose of this assessment.

Shed Factor (S1)

The shed factor, S1, depends on the method of shed ventilation. Details of the ventilation system design are not available for the shed identified in the vicinity of the Site, however based on the fact that they are all existing sheds and relatively small operations (up to ten sheds only), it has been assumed they are all naturally ventilated.

Table A1 Shed Factor (S1)

Shed type	Value
Controlled fan ventilation without barriers*	980
Controlled fan ventilation with barriers	690
Natural ventilation	**690**

* Barriers – e.g. walls or hedges designed to mitigate dust and odour emissions from controlled fan ventilated sheds.

Receptor Factor (S2)

The receptor factor, S2, varies depending on the likely impact area and is determined from **Table A2** (eg for a town, the distance is measured from the closest point of the proclaimed town boundary).

An S2 factor corresponding to medium towns (500- 2,000 persons) is chosen for this assessment. This is considered appropriate as the Site is located within a semi-rural region, with residences located sporadically.

Table A2 Receptor Factor (S2)

Receptor type	Value
Large towns, greater than 2000 persons	1.05
Medium towns, 500—2000 persons	**0.75**
Medium towns, 125—500 persons	0.55
Small towns, 30—125 persons	0.45
Small towns, 10—30 persons	0.35
Rural residence	0.30
Public area (occasional use)	0.05*

* The value for a public area would apply to areas subject to occasional use. Higher values may be appropriate for public areas used frequently or sensitive in nature, such as frequently-used halls and recreation areas. These should be assessed individually.

Terrain Factor (S3)

The terrain factor, S3, varies according to topography and its ability to disperse odours and is determined from **Table A3**.

- **High relief** is regarded as up-slope terrain or a hill that projects above the 10% rising slope from the poultry sheds. Thus the receptor location will be either uphill from the poultry sheds, behind a significant obstruction or have significant hills and valleys between the sheds and the receptor.
- **Low relief** is regarded as terrain, which is generally below the 2% falling slope from the poultry sheds. Thus the receptor will be downhill from the poultry sheds.
- **Undulating hills** is regarded as terrain where the topography consists of continuous rolling, general low level hills and valleys with minimal vegetation, but without sharply defined ranges, ridges or escarpments.
- **A valley drainage zone** has topography at low relief (as above) with significant confining sidewalls.

Topographical features at the selected site may adversely affect the odour impact under certain circumstances. During the early evening or night time, under low wind speed conditions, population centres located in a valley at a lower elevation than a poultry farm may be subject to higher odour concentrations as a result of down-valley wind or the occurrence of low-level inversions. Unless site-specific information has been gathered under conditions dominated by low wind speeds, the value for the factor S3 should apply.

Based on the topographical data review in **Section 3.1**, a terrain factor of 1.0 (corresponding to terrain with less than 10% upslope, 2% downslope and not in valley drainage zone) has been selected for this assessment.

Table A3 Terrain Factor (S3)

Terrain	Value[1]
Valley drainage zone	2.0
Low relief (greater than 2% downslope from site)	1.2
Flat (less than 10% upslope, 2% downslope and not in valley drainage zone)	**1.0**
Undulating country between poultry farm and receptor	0.9
High relief (greater than 10% upslope from site) or significant hills and valleys between poultry farm and receptor	0.7

Note[1] For sources 5, 6a and 6b, a terrain factor of 0.9 was used as there is undulating terrain between these sources and the Precinct boundary.

Vegetation Factor (S4)

The vegetation factor, S4, varies according to vegetation density and is determined from **Table A4**. The vegetation density is assessed by the effectiveness with which the vegetation stand will reduce odour by dispersion.

Table A4 Vegetation Factor (S4)

Vegetation	Value
Crops only, no tree cover	1.0
Few trees, long grass	**0.9**
Wooded country	0.7
Heavy timber	0.6
Heavy forest (both upper and lower storey)	0.5

Based on the available aerial imagery, a vegetation factor of 0.9 (corresponding to 'few trees, long grass') has been selected for this assessment.

Wind Frequency Factor (S5)

The wind frequency factor, S5 is determined from **Table A5**. The wind speed and direction varies annually and diurnally (that is by the season and by the hour of the day). Although there is generally one direction that is the most frequently observed (prevailing wind), the wind direction usually blows from all directions at some time.

The wind can be classed as high frequency towards the receptor if the wind is blowing towards the receptor (± 40 degrees) with a frequency of at least 60 % of the time for all hours over a whole year. The wind can be classed as low frequency towards the receptor if the wind is blowing towards the receptor (± 40 degrees) with a frequency of less than 5 % of the time for all hours over a whole year.

The poultry farms are located in a range of wind directions relative to the Site. Based on the windroses shown in **Section 3.2**, a wind factor of 1.0 (between 5% – 60%) was selected for this assessment.

Table A5 Wind Factor (S5)

Wind frequency	Value
High frequency towards receptor (greater than 60%)	1.5
Normal wind conditions (between 5% and 60%)	**1.0**
Low frequency towards receptor (less than 5%)	0.7

Summary of Site factors (S1 to S5)

Based on the discussion presented above, the site factors chosen for the current assessment are summarised in **Table A6**.

Table A6 Summary of Level 1 Odour Impact Assessment Site Factors

Site Factor	Value
Shed Factor, S1	690
Receptor Factor, S2	0.75
Terrain Factor, S3	1.0
Vegetation Factor, S4	0.9
Wind Frequency Factor, S5	1.0
Composite Site Factor, S (S1 x S2 x S3 x S4 x S5)	**466**

Separation Distance Calculation Methodology –Two Poultry Farms in Close Proximity

Two poultry farms may be considered as one single odour source if they are closer than half the shortest separation distance from each poultry farm to the receptor.

For poultry farms considered as separate entities, a 20% increase in separation distance may apply.

Number of Poultry Sheds, N

For the purposes of **Equation 1**, the number of poultry sheds (N) assumes that a standard shed is 100 m x 13 m (area of 1,300 m^2) and contains 22,000 chickens. Alternatively, the value of N may be derived as the total number of chickens at the farm divided by 22,000.

As the number of birds at each farm identified in the area surrounding the Site is unknown, this assessment has estimated the area of each shed at each farm using aerial photography, and the total shed area for each farm was divided by 1,300 m^2 to calculate a value for N for use in the calculations.

APPENDIX B

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 B-1**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table B-1 IAQM Guidance for CategorisiTable Ang 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 B-2**. The sensitivity of the area should be derived for each of activity relevant to the project (i.e. construction and earthworks).

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

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

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

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table B-3**. 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 (i.e. an annual average of 25 µg/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 B-3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM_{10} conc.	Number of receptors [a,b]	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/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 B-4** (demolition), **Table B-5** (earthworks and construction) and **Table B-6** (track-out) to determine the risk category with no mitigation applied.

Table B-4 Risk Category from Demolition Activities

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

Table B-5 Risk Category from Earthworks and Construction Activities

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

Table B-6 Risk Category from Track-out Activities

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

Step 3 - Site-Specific Mitigation

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

Step 4 – Residual Impacts

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

APPENDIX C

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 C1 outlines the methodology used in this study to define the sensitivity of receptors to air quality impacts.

Table C1 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 C2 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 C3 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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