ESR HORSLEY LOGISTICS PARK

Air Quality Impact Assessment
6 Johnston Crescent, Horsley Park

Prepared for:

ESR
Level 29
20 Bond Street
Sydney NSW 2000

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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 ESR (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 ESR Australia (ESR) to undertake an air quality impact assessment (AQIA) to accompany a state significant development application (SSDA) for the land located on 6 Johnston Crescent, Horsley Park, New South Wales (NSW). The subject land of this assessment is also called the Horsley Logistics Park (hereafter 'the Development Site').

The SSDA 10436 is seeking consent for the Development Site Master Plan, including construction and operation of warehousing buildings and associated landscaping works. The Department of Planning and Environment (DPE) issued the Secretary's Environmental Assessment Requirements (SEARs) in June 2020 (SEAR 10436). This report addresses the SEARs, which require the following matters to be addressed in relation to air quality:

- an assessment of air quality impact at sensitive receivers during construction and operation in accordance with NSW Environment Protection Authority guidelines (see **Section 5.3** and **Section 5.4**); and
- details of mitigation, management and monitoring measures (see **Section 5.3.4**).

The aim of this AQIA is to assess the risks associated with the potential air quality impacts during construction and operation of the proposed Development Site. In addition, a high level desktop assessment is also presented to identify the current pollutant levels at the Development Site due to existing and anticipated future air emission sources in the local airshed.

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

- existing Austral Bricks Plant (#3);
- existing CSR brick manufacturing facility;
- existing poultry farms;
- existing construction projects; and
- future industrial projects.

The desktop assessment relies on:

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

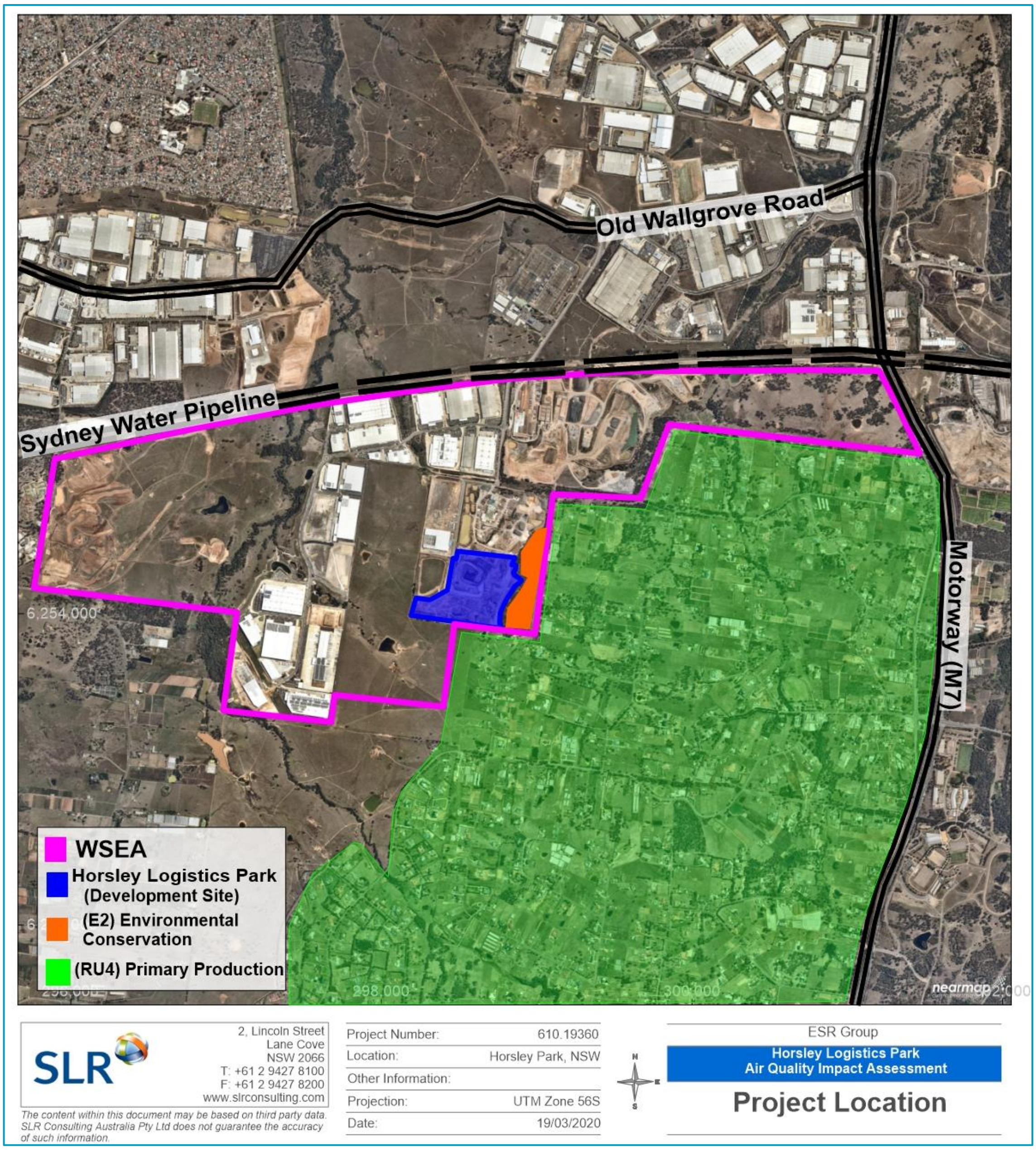
2 Project Overview

2.1 Site Location

The Development Site is located at 6 Johnston Crescent, Horsley Park, and is located within the Fairfield Local Government Area (LGA), approximately 40 kilometres (km) west of the Sydney Central Business District.

The Development Site is located within the Western Sydney Employment Area (WSEA) and is currently zoned IN1 General Industry under the WSEA State Environmental Planning Policy (SEPP). The regional location of the Development Site is shown in **Figure 1**.

Figure 1 Regional Location of the Development Site



The Development Site is surrounded by the following:

- The Oakdale Central business Hub (SSD 6078) immediately to the north;
- Land zoned RU4 – Primary Production land that includes a number of rural residential lots to the east;
- Land zoned RU4 – Primary Production land and the residential subdivision Greenway Place to the south; and
- Horsley Park Warehousing Hub (MP 10_0129 & MP 10_0130) to the west.

The Development Site comprises a single allotment – Lot 103 DP 1214912 and is irregular in shape with a south-eastern boundary that follows the alignment of the E2 – Environmental Conservation corridor. The Development Site is currently used for a quarry (with the associated brickworks plant located within the Stage 3 area). These operations will cease prior to commencement of construction works at the Development Site.

2.2 Concept Masterplan

The Development Site comprises a large 20.8 hectare (ha) estate, that is proposed to be subdivided into four industrial lots. The construction on Stage 1 land of the Horsley Logistics Park is already underway, Stage 2 land is the subject of this assessment, and Stage 3 land will be the subject of a future application. The Draft Concept Masterplan of the Development Site is shown in **Figure 2**. The nearest residential receptor is identified to be located at 41-43 Greenway Place, approximately 50 m south of the southern Development Site boundary.

Figure 2 Draft Concept Masterplan of the Horsley Logistics Park

Source: Urbis 2020

2.3 Potential Sources of Air Emissions During Construction

The main air quality issue associated with construction 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.

Potential air quality impacts associated with fugitive dust emissions from the construction phase of the project have been addressed in **Section 5.3**.

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 Development 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 5.4**.

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 Development 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 Development Site are listed in **Table 1** and shown in **Figure 3**.

In addition to the emission sources identified in **Table 1**, there is also potential for wind erosion of disturbed surfaces (quarry pit, haul roads and stockpile areas etc) within the Development Site itself to give rise to elevated particulate levels under dry and windy conditions, even once the quarrying activities have ceased. These emissions will cease as the site is developed and have not been considered further.

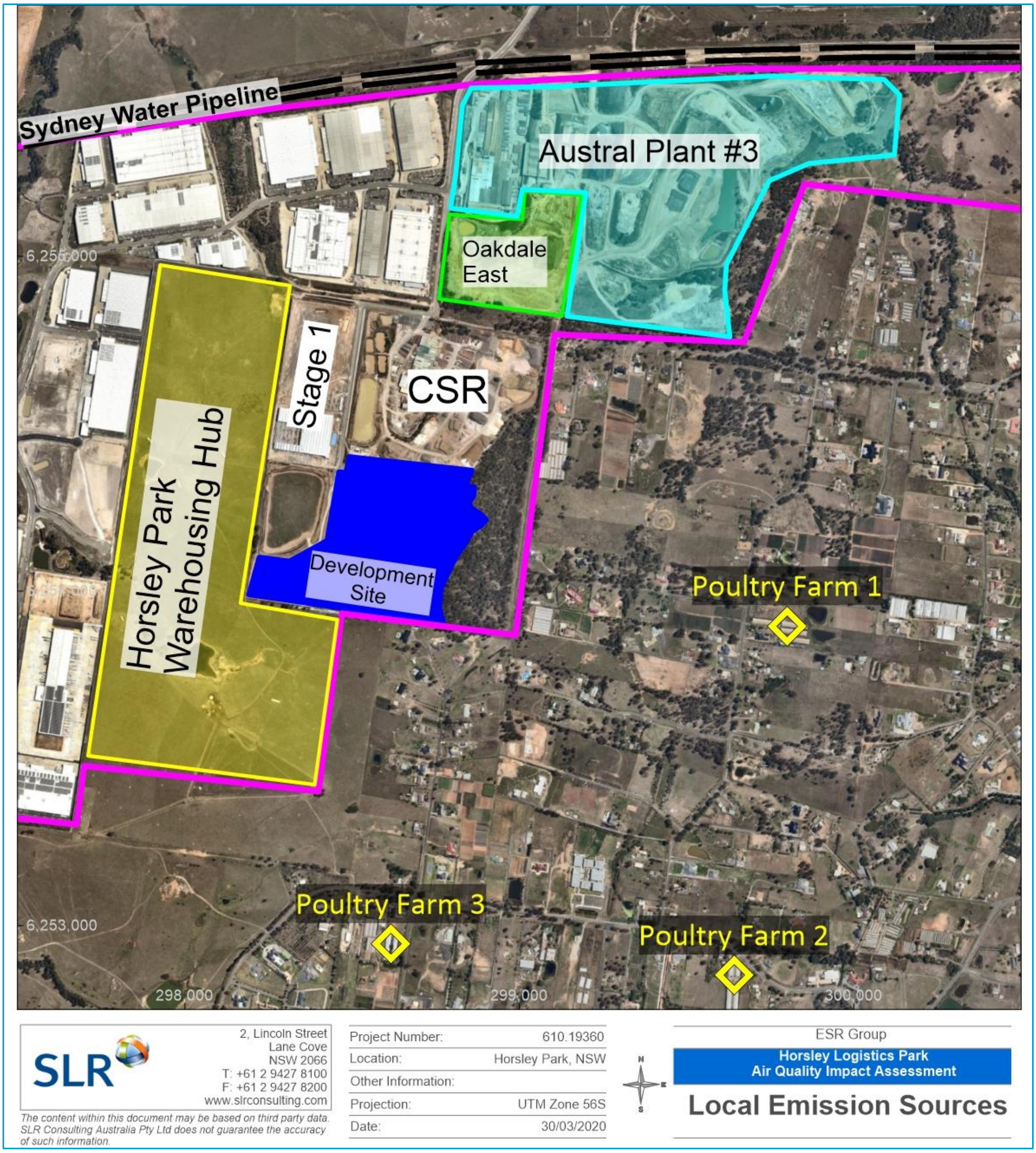
Table 1 Existing and Future Potential Air Emission Sources

Source ID	Status	Description	Address	Distance from Nearest Development Site Boundary
1	Existing	Poultry sheds (x 4)	Delaware Road, Horsley Park	1,050 m
2		Poultry sheds (x 4)	Horsley Road, Horsley Park	1,450 m
3		Poultry sheds (x 2)	Garfield Road, Horsley Park	950 m
4		PGH Manufacturing Facility	Johnston Crescent, Horsley Park	20 m
5		Austral Bricks Plant #3	Milner Ave, Horsley Park	250 m
6		Stage 1 of Horsley Logistics Park	Johnston Crescent, Horsley Park	20 m
7	Future	Oakdale East Project	Milner Ave, Horsley Park	100 m
8		Horsley Park Warehousing Hub	Burley Road, Horsley Park	50 m

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

- Odour from the existing poultry farms;
- Emissions of particulate matter, oxides of nitrogen, sulfur oxides and hydrogen fluoride from the Austral Bricks Plant 3 (Airlabs 2019) and fugitive dust emissions from the associated quarrying operations;
- Products of fuel combustion (including particulate matter) and fugitive dust from the proposed Oakdale East Project oerations, which includes a masonry plant and five warehouses; and
- Fugitive dust from construction projects in the area (ie the existing Stage 1 of Horsley Logistics Park and the proposed Horsley Park Warehousing Hub).

Figure 3 Identified Local Air Emission Sources

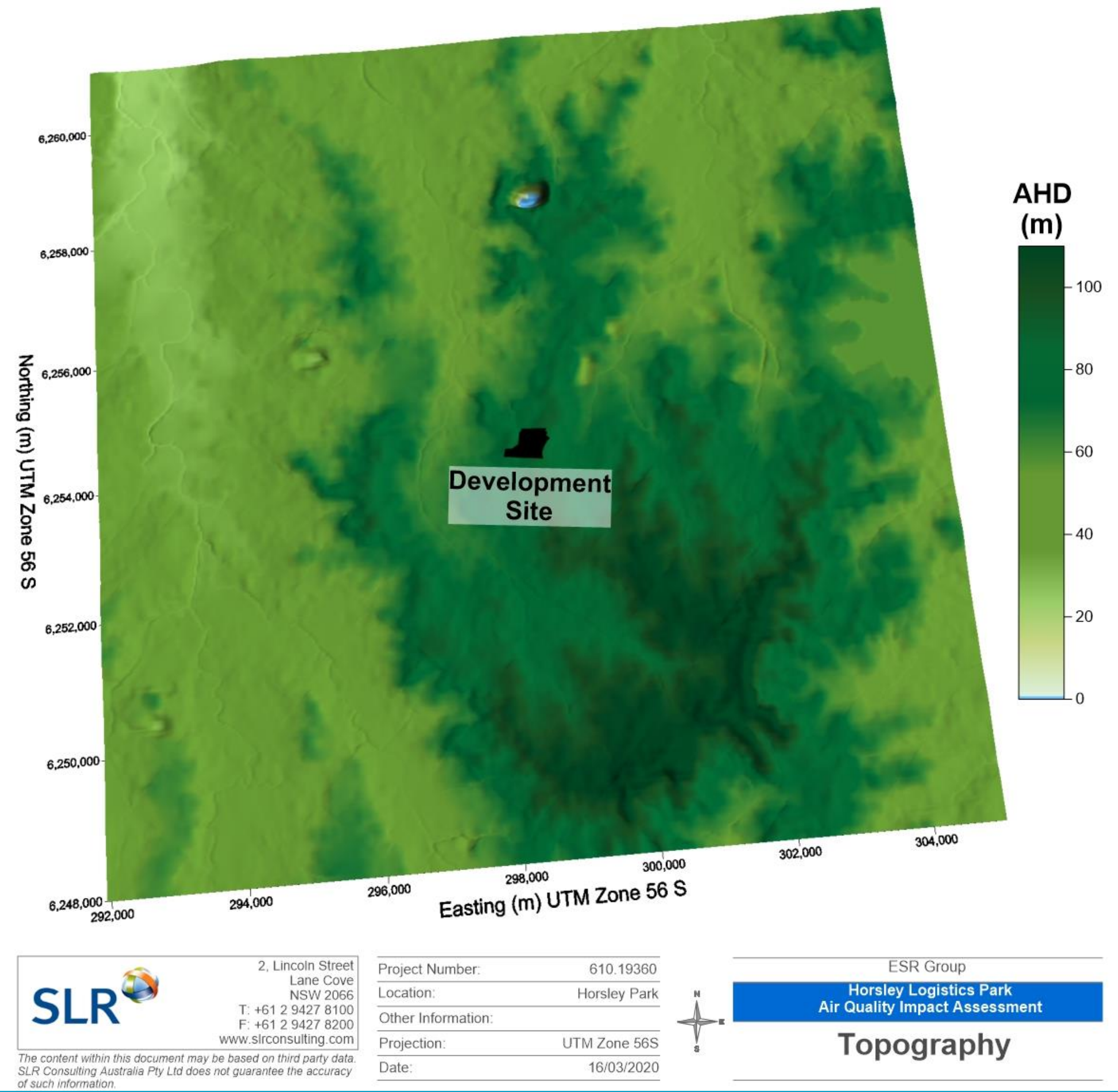


3 Receiving Environment

3.1 Topography

Local topography is important in air quality studies as local atmospheric dispersion can be influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies. The topography of the region surrounding the Development Site is shown in **Figure 4**.

Figure 4 Regional Topography



The overall elevation of the Development Site ranges from approximately 60 m to 80 m Australian Height Datum (AHD) with the quarry pit and stockpiles contributing to the complexity of the terrain within the site. This will be graded and levelled as part of the construction works. The Development Site is located on a ridge, with potential for light air drainage flows along the north-south channel, under calm conditions.

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 Development Site (Station ID 67119). For the purpose of this assessment, it is assumed that the wind conditions recorded by the Horsley Park AWS are representative of the wind conditions experienced at the Development Site.

Annual wind roses for the years 2015 to 2019 compiled from data recorded by the Horsley Park AWS are presented in **Figure 5**, with seasonal wind roses for 2019 presented in **Figure 6**. Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The 'Beaufort Wind Scale' (consistent with terminology used by the BoM) presented in **Table 2** was used to describe the wind speeds experienced at the Development Site.

Table 2 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 2015 to 2019 (**Figure 5**) 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 11.5%-14.5% for all the years between 2015 and 2019.

The seasonal wind roses for the year 2019 (**Figure 6**) 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 15% 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 13% 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 12% of the time during spring.

Figure 5 Annual Wind Roses for Horsley Park (2013 to 2017)

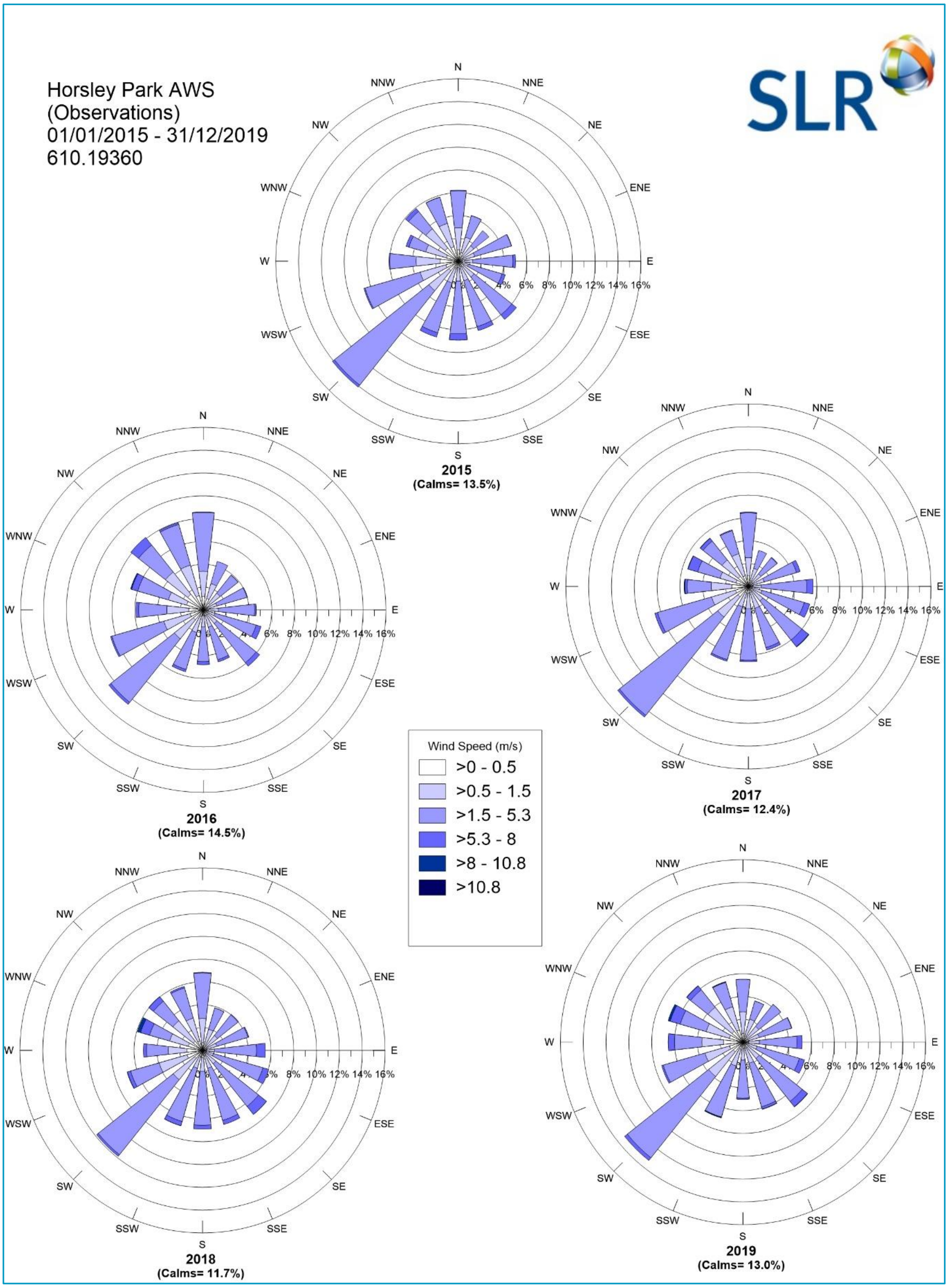
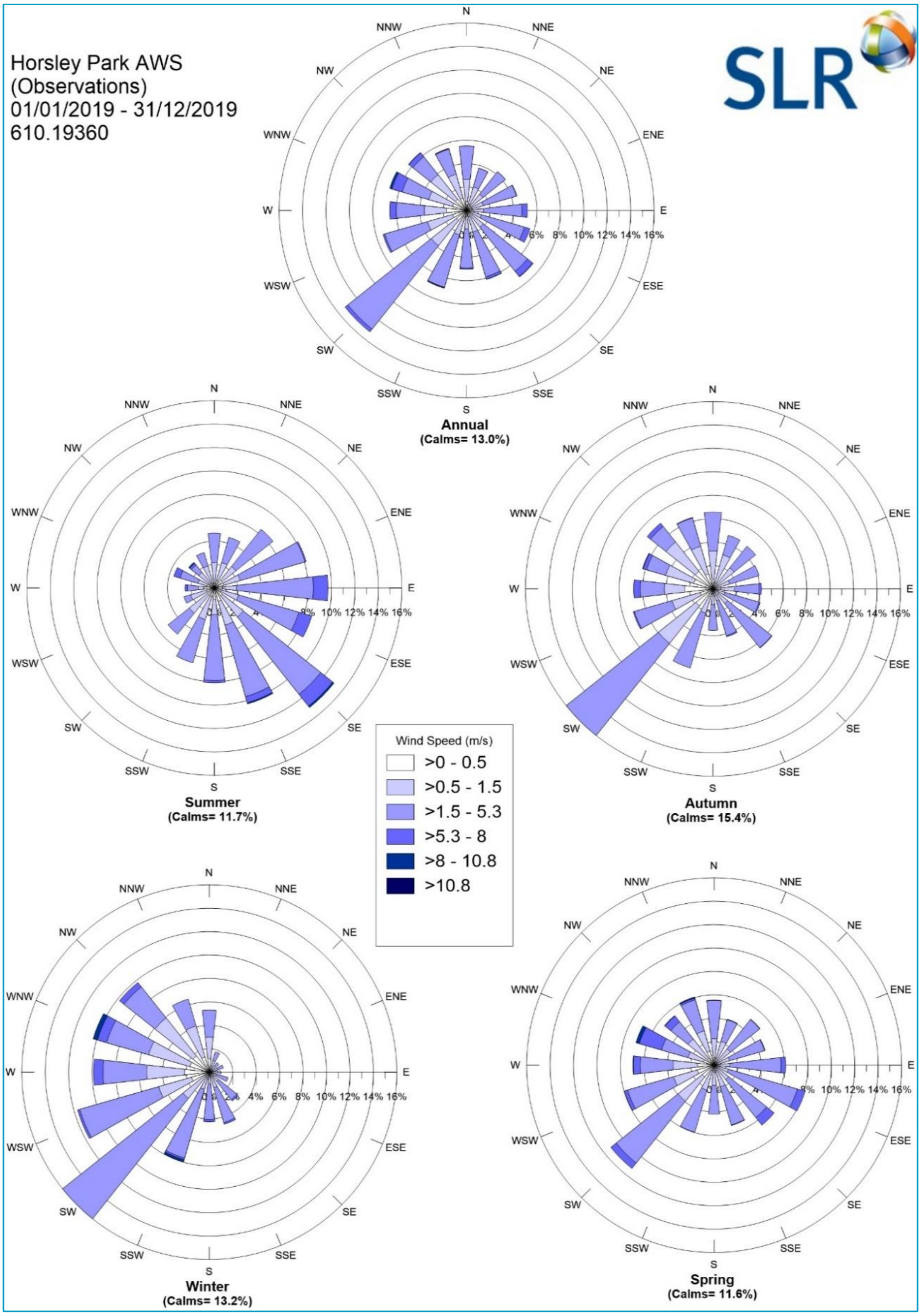


Figure 6 Annual and Seasonal Wind Roses for Horsley Park (2018)



4 Legislation, Regulation and Guidance

4.1 Pollutants of Concern

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

- Odour from the existing poultry farms;
- Process emissions from the brick kilns at the existing Austral Bricks Plant 3 and the CSR operations, including:
  - Particulate matter
  - oxides of nitrogen
  - sulfur dioxide
  - sulfuric acid mist
  - hydrogen fluoride and fluorine
  - hydrogen sulphide
  - hydrogen chloride
  - small quantities of heavy metals and volatile organic compounds;
- Products of fuel combustion (including particulate matter) from:
  - Gas-fired boilers from the proposed Oakdale East Masonry Plant
  - Vehicles travelling on the local road network
  - Trucks and vehicles travelling within the proposed Horsley Park Warehousing Hub
- Fugitive dust emissions from
  - Quarrying activities associated with the Austral Bricks Plant 3 and the CSR operations;
  - Construction of the proposed Horsley Park Warehousing Hub, Stage 1 of the Horsley Logistics Park, and Oakdale East Project;
  - Material handling activities at the proposed Oakdale East Project.

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 the combustion of fossil fuels in boilers (natural gas) and road traffic 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 Individual Air Toxics

The Approved Methods lists impact assessment criteria for individual toxic air pollutants, defined on the basis that they are carcinogenic, mutagenic, teratogenic, highly toxic or persistent in the environment. These include metals and compounds, dioxins and furans, polycyclic aromatic hydrocarbons etc.

4.1.4 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 3**.

Table 3 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 Individual Air Toxics

The impact assessment criteria for individual air toxics relevant to crematoria are presented in **Table 4**.

Table 4 NSW EPA Impact Assessment Criteria for Individual Air Toxics

Pollutant	Averaging Period	Concentration	
		(µg/m³)	(mg/m³)
Formaldehyde[1]	1-hour	20	0.020
Dioxins and furans[2]	1-hour	2.0x10^{-6}	2.0x10^{-9}
Hydrogen chloride (HCl)	1-hour	140	0.14
Polycyclic aromatic hydrocarbons (PAHs) as benzo [a] pyrene	1-hour	0.4	0.0004
Antimony & compounds	1-hour	9	0.009
Arsenic & compounds	1-hour	0.09	0.00009
Beryllium & compounds	1-hour	0.004	0.000004
Cadmium & compounds	1-hour	0.018	0.000018
Chromium III & compounds	1-hour	9	0.009
Chromium VI & compounds	1-hour	0.09	0.00009
Copper dusts (raw) or copper fumes	1-hour	3.7	0.0037
Mercury (inorganic)	1-hour	1. 8	0.0018
Nickel & compounds	1-hour	0.18	0.00018
Zinc chloride fumes	1-hour	18	0.018

[1] The criterion for formaldehyde has been selected to assess the total volatile organic compounds (VOCs) as it is the most stringent criterion out of all the VOCs.

[2] Dioxins and furans as toxic equivalent must be calculated according to the potency equivalency factors listed in the clause 40 of the (POEO) Regulation.

4.2.3 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 Development 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 ($\geq$ 2000)	2.0
~300	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence ($\leq$ 2)	7.0

Source: DEC 2006

4.3 Recommended 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.

4.3.1 Poultry Farms

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 enables the separation distance to be varied according to the broiler chicken shed numbers, and management standards proposed and achieved. The recommended minimum distance between the broiler chicken sheds and impact areas is not simply increased proportionally to the number of broiler chicken sheds but instead considers 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 for the poultry farm operations identified in the vicinity of the Development Site is presented in **Section 5.2.1**, with additional details of the methodology used included in **Appendix A**.

4.3.2 Brickworks and Ceramic Manufacturing

A number of state regulatory authorities in Australia have prescribed a separation distance for particular activities to be as a screening tool. Reference is made to the separation distances prescribed by the regulatory authorities, in Australian Capital Territory (ACT), Victoria (VIC) and South Australia (SA), and a summary is shown in **Table 6**.

Table 6 Recommended Separation Distances

Source	Relevant Industry	Activity Notes	Separation Distance (m)
CSR operations Oakdale East Project Austral Plant 3	Brick, tile, pipe, and refractory manufacturing[1]	Production of bricks, tiles, pipes, pottery goods or refractories, processed in dryers or kilns (>10,000 tonnes per year)	250
	Ceramic works[2]	Works for the production of ceramics or ceramic products such as bricks, tiles, pipes, pottery goods, refractories or glass that are manufactured or are capable or being manufactured in furnaces or kilns fired by any fuel with a total capacity for the production of products exceeding 100 tonnes per year	500
	Ceramic works[3]	Fluoride emissions from ceramic works may pose a risk of damage to vegetation and animal health at levels lower than those required to impact on human health. Due to the high temperatures used, odour can also be a potential concern. Fugitive dust may result from material handling operations.	750

Source: [1] VIC EPA 2013, [2] ACT EPA 2018, [3]SA EPA 2016

It is noted that the Austral Plant 3 complies with the recommended separation distance prescribed by VIC EPA, but not those prescribed by the ACT or SA EPA. The Oakdale East Project and the CSR brick manufacturing facility does not comply with any of the prescribed separation distances however, and therefore reference is made to the dispersion modelling results from an AQIA that was performed to assess off-site impacts from Oakdale East Project, and the findings of that study are discussed in **Section 5.2**.

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 Development Site (as well as the CSR operations, Austral Bricks Plant 3 and proposed Horsley Park Warehousing Hub and Oakdale East Project) is located within the WSEA and therefore the aims of the WSEA SEPP apply to the Development 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.

5 Air Quality Assessment

Air quality at the Development 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 Development Site. The St Marys AQMS was commissioned in 1992 and is located on a residential property off Mamre Road, St Marys. It is situated in the centre of the Hawkesbury Basin and is at an elevation of 29 m. 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 7** and the data are presented graphically in **Figure 7** to **Figure 9**

Table 7 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 7 Measured Daily Maximum 1-Hour Average NO_2 Concentrations at St Marys AQMS (2015 - 2019)

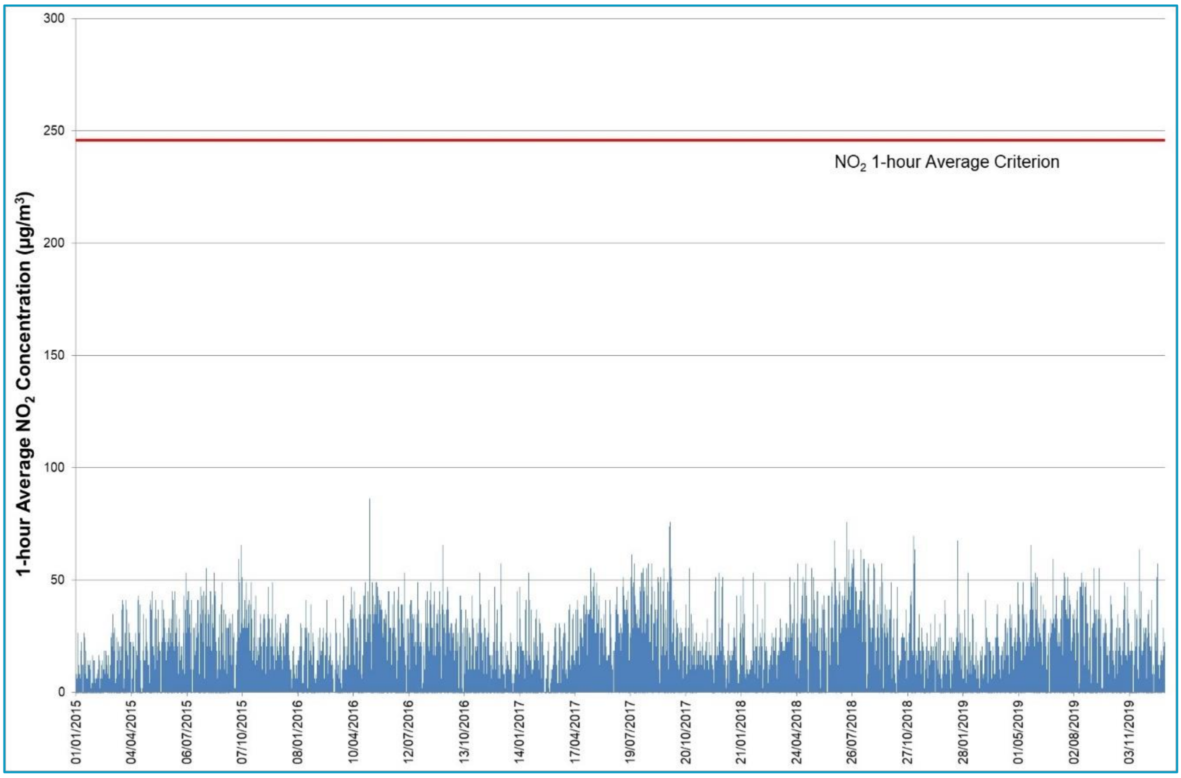


Figure 8 Measured 24-Hour Average PM_{10} Concentrations at St Marys AQMS (2015 - 2019)

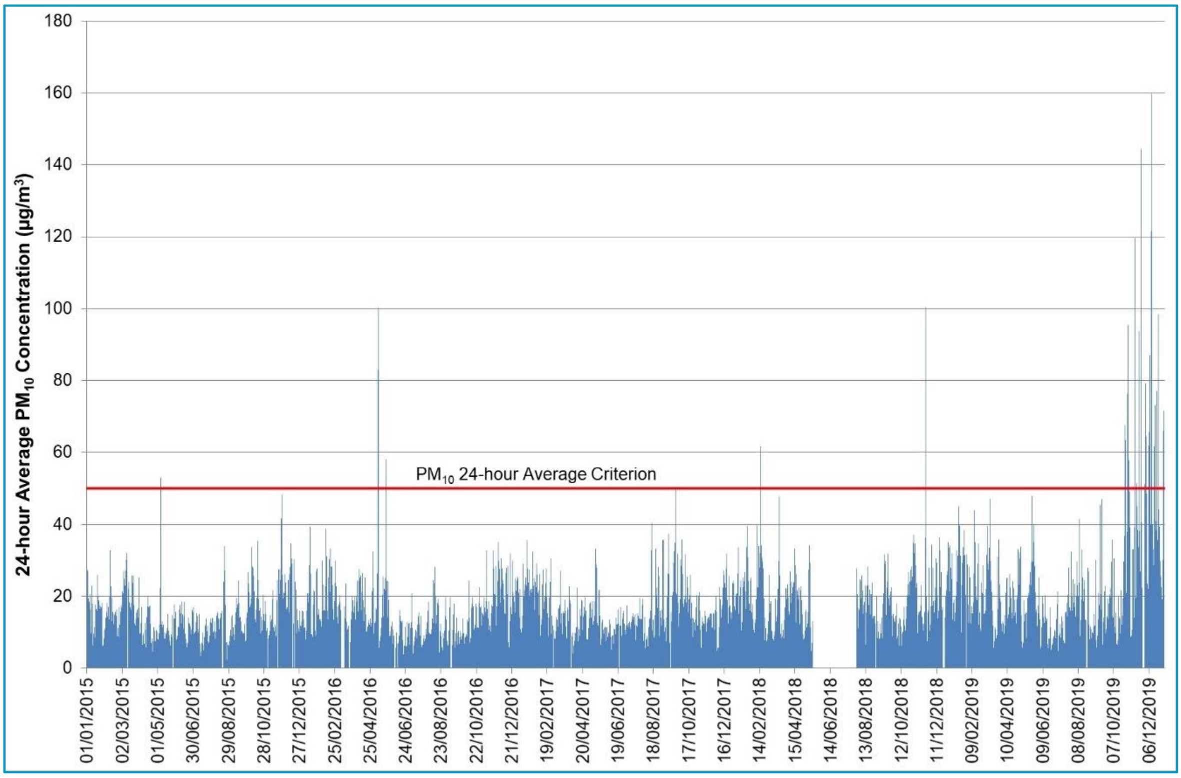
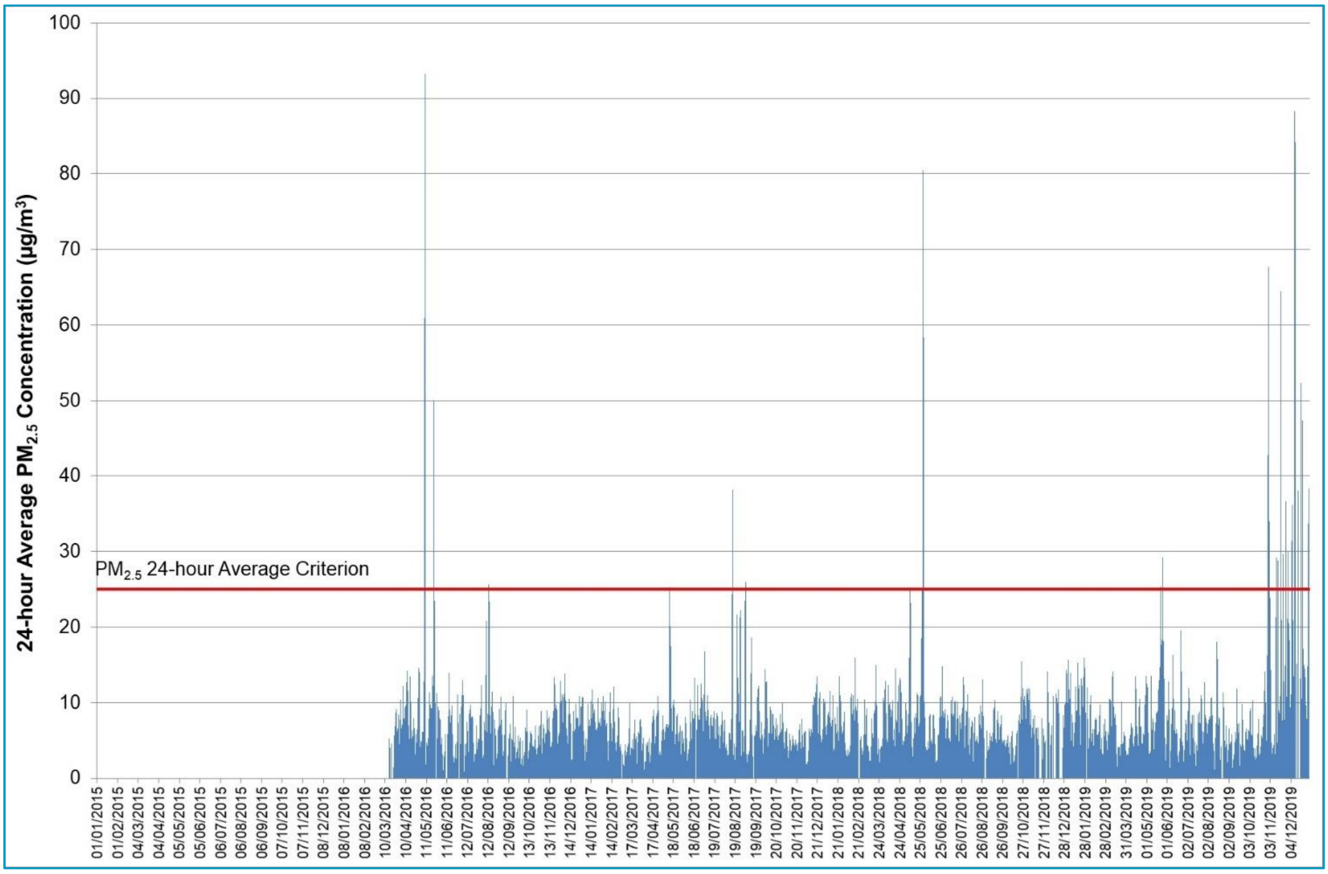


Figure 9 Measured 24-Hour Average $PM_{2.5}$ Concentrations at St Marys AQMS (2015 - 2019)



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 (OEH 2017), 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 proposed construction projects, proposed Oakdale East operations, the existing CSR operations, Austral Bricks quarrying operations in the vicinity of the Development Site to elevate local ambient particulate concentrations and contribute to additional exceedances of the 24-hour average criteria.

5.2 Localised Impacts of Existing and Proposed Sources of Airborne Pollutants

5.2.1 Odour

As identified in **Section 2.3**, multiple odour generating sources exist in the vicinity of the Development Site; including a number of poultry farms and the Oakdale East Masonry Plant. However, as odours from the poultry farms will have a different characteristic compared to odours from the Oakdale East Masonry Plant, 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 poultry farms and Oakdale East Masonry Plant have been addressed separately below.

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 Development 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 8**.

Table 8 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	Actual
1	Delaware Road, Horsley Park	4	4,147	3.2	1,061	1,050
2	Horsley Road, Horsley Park	4	4,335	3.3	1,095	1,450
3	Garfield Road, Horsley Park	2	1,950	1.5	621	950

[1] Estimated from aerial imagery.
[2] Number of standard sheds based on standard shed area of 1,300 m^2.

A comparison of actual versus calculated minimum separation distances is also provided in **Table 8**. The actual separation distances are shown to be greater than the calculated separation distance for all poultry farms except the poultry sheds located at Delaware Road (ie Source 1), for which the calculated separation distance is greater than the actual separation distance by 10 m only. It is also noted that a number of rural residential properties already exist in the vicinity of Source 1, and a vegetation buffer exists between the Development Site and the Source 1.

As discussed in **Section 4.3**, this assessment has been used as an initial 'screening' assessment for estimating odour impacts and is based on a range of generic conservative assumptions. Given the uncertainty in regards to operational details (such as bird numbers, production cycles etc) at this poultry farm, the already existing residential properties and the vegetative buffer, further detailed assessment is not recommended.

5.2.2 Nuisance Dust (Construction Projects)

As identified in **Section 2.3**, the existing construction of the Stage 1 of the Horsley Logistics Park, construction of the proposed Horsley Park Warehousing Hub, and construction of the proposed Oakdale East Project can potentially affect the short terms air quality at the Development Site.

The potential for dust to be emitted during the demolition/construction phase 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:

- Drilling and Excavation;
- 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:

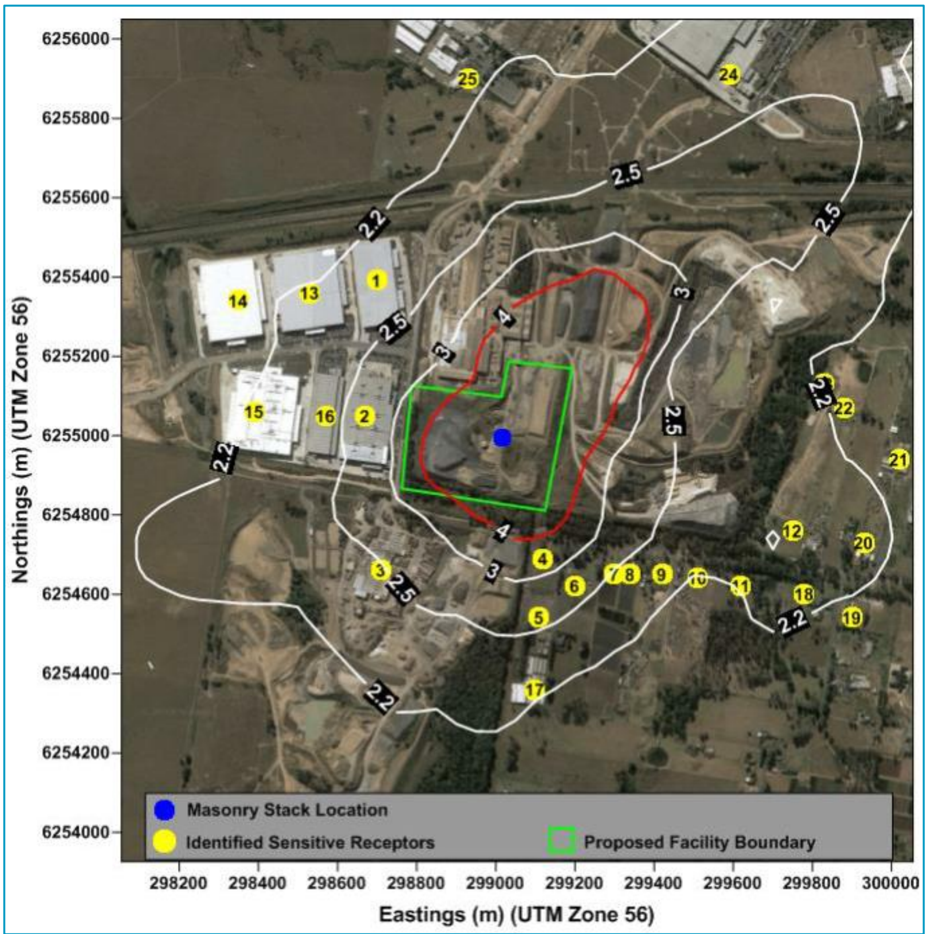
- the construction of the Stage 1 of the Horsley Logistics Park is to be completed by the end of 2020;
- the construction of proposed Horsley Park Warehousing Hub is likely to be undertaken and completed by the end of 2020; and
- the construction of the proposed Oakdale East Project is likely to be undertaken and completed during 2021.

The Development Site is still going through the application process, and its construction and operations are unlikely to coincide with the construction of stage 1 of the Horsley Logistics Park, Horsley Park Warehousing Hub or the Oakdale East Project, therefore reducing the likelihood of cumulative impacts.

5.2.3 Nuisance Dust (Quarrying Operations)

An AQIA was completed by Air Labs Environmental in March 2019 (Airlabs 2019), which assessed potential off-site air quality impacts associated with the proposed Oakdale East Project operations, CSR brick manufacturing plant and existing Austral Plant 3 operations. The cumulative annual average dust deposition levels predcited by the modelling are shown in **Figure 10**. It is noted that the predicted dust deposition levels are below the criterion of 4 g/m^2/month within the Development Site boundary.

Figure 10 Cumulative Annual Average Deposited Dust Levels the Oakdale East Project



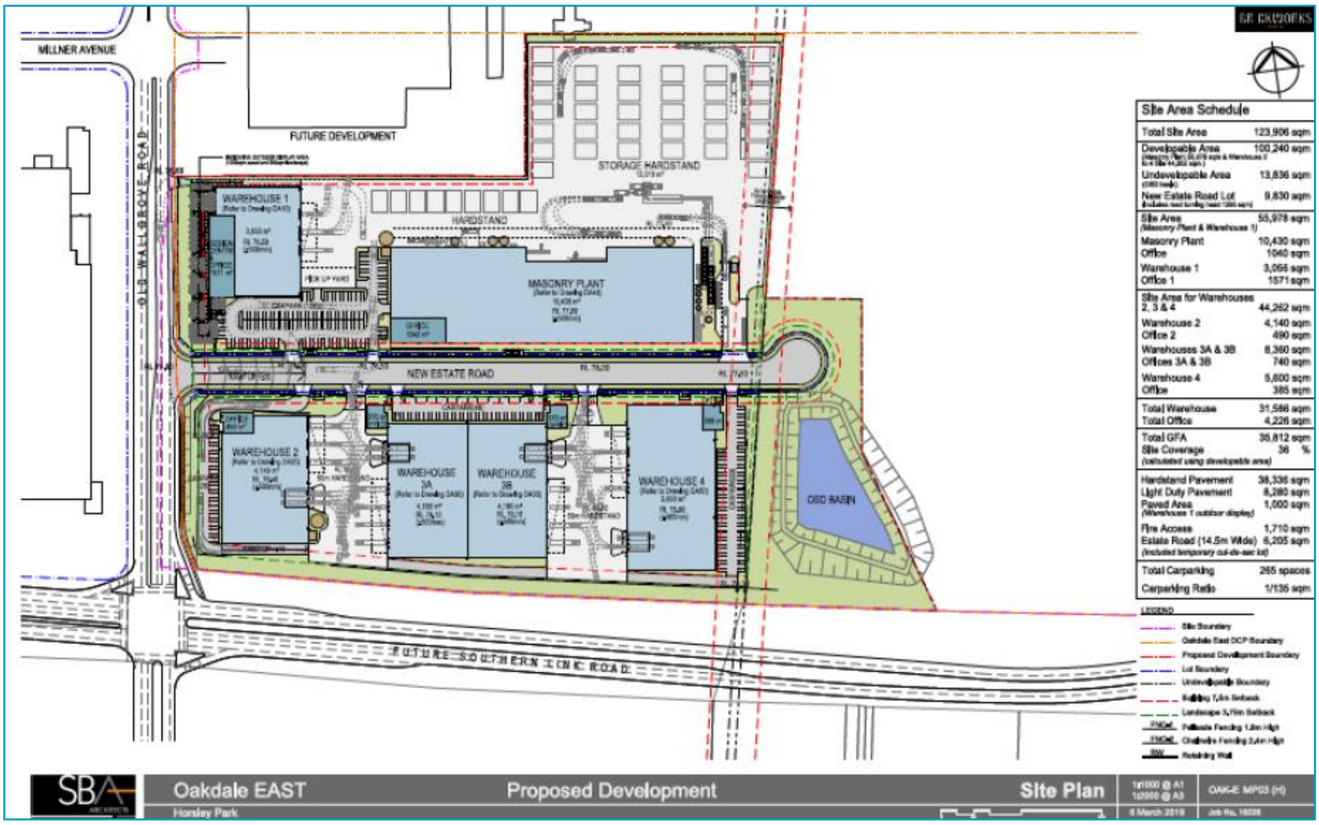
Source: Figure 23 of Airlabs 2019.

5.2.4 Particulate Matter

The main existing sources of airborne particulate matter identified in the local air shed are the fugitive emissions from operations of the existing CSR brick manufacturing plant, the proposed Oakdale East Project (including traffic) and existing Austral Plant 3 operations.

An AQIA was completed by Air Labs Environmental in March 2019 (Airlabs 2019), which assessed potential off-site air quality impacts associated with the proposed Oakdale East Project operations, CSR brick manufacturing plant and existing Austral Plant 3 operations. The Oakdale East Project includes construction and operation of a masonry plant and five warehouses. The proposed layout of the Oakdale East Project is shown in **Figure 11**.

Figure 11 Overall Site Plan of the Oakdale East Project



Source: Airlabs 2019

The Oakdale East Project proposes to produce 220,000 tpa of masonry products, including grey and coloured blocks, retaining walls and pavers, and operation of five warehouses intended for generic warehousing and distribution purposes. The main emissions sources were identified to be natural gas boiler emissions and fugitive dust emissions from masonry plant and warehousing operations.

The contribution of Oakdale East Project operations to local air pollution was estimated using the CALPUFF dispersion modelling program for one worst case scenario. The pollutants investigated in this assessment included particulate matter (as TSP, PM_{10} and $PM_{2.5}$), NO_2, CO, SO_2, VOCs (benzene, toluene, ethyl benzene and xylenes), metals, polycylic aromatic hydrocarbons (PAHs) and polychlorinated dioxins and furans (PCDF).

It was concluded that:

"Modelling shows that the incremental impacts (emissions generated from the proposed facility alone) are quite minimal, with predicted particulate matter impacts ranging from 0.6% (TSP annual average) to 3.2% ($PM_{2.5}$ 24-hour average) of the relevant assessment criteria."

The cumulative impacts were also assessed incorporating:

- Brick manufacturing and associated quarrying operations at the Austral Bricks Plant 3 site; and
- Brick manufacturing and associated quarrying operations at CSR Bricks.

Additionally, estimates of background pollutant concentration levels (ie ground level concentrations that would occur in the absence of any anthropogenic emission sources) were included in the cumulative assessment. The contemporaneous data recorded by the St Marys AQMS was used as the background pollutant level. A summary of the predicted maximum concentrations and deposited dust levels at the worst impacted receptor is shown in **Table 9**.

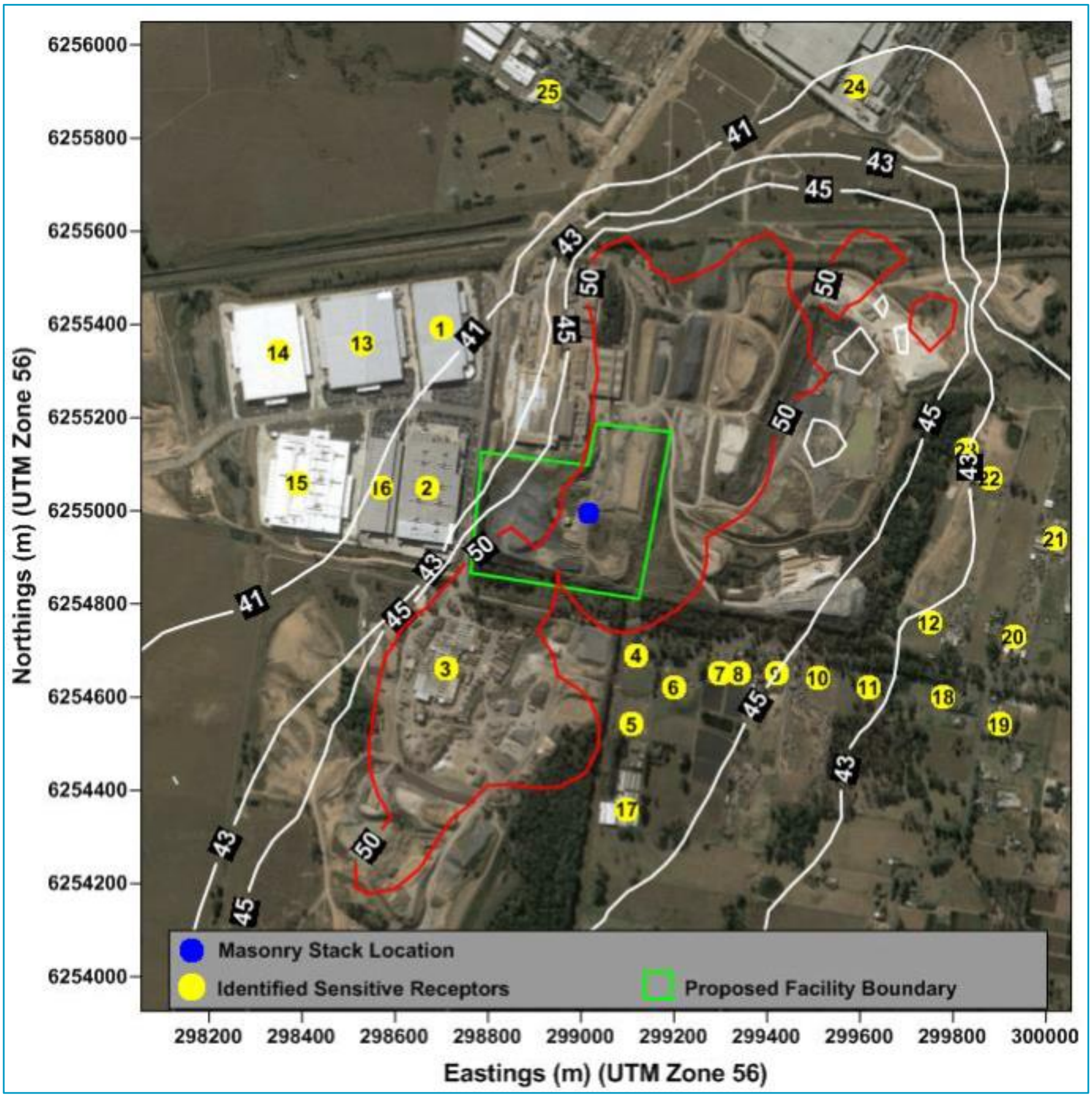
Table 9 Predicted Maximum Cumulative PM_{10}, $PM_{2.5}$, TSP Concentrations at the Worst Impacted Receptor for Oakdale East Project

Pollutant	Averaging Period	Assessment Criteria	Maximum Predicted Cumulative Concentration Across All Receptors
PM_{10}	24 Hours Annual	50 µg/m³ 30 µg/m³	49.2 µg/m³ 19.2 µg/m³
$PM_{2.5}$	24 Hours Annual	25 µg/m³ 8 µg/m³	23.0 µg/m³ 7.2 µg/m³
TSP	Annual	60 µg/m³	43.9 µg/m³

The maximum cumulative concentrations are predicted to be below the respective criteria at all sensitive receptor locations. Contour plots of the predicted cumulative 24-hour average PM_{10},and 24-hour average $PM_{2.5}$ concentrations are shown in **Figure 12** and **Figure 13** respectively.

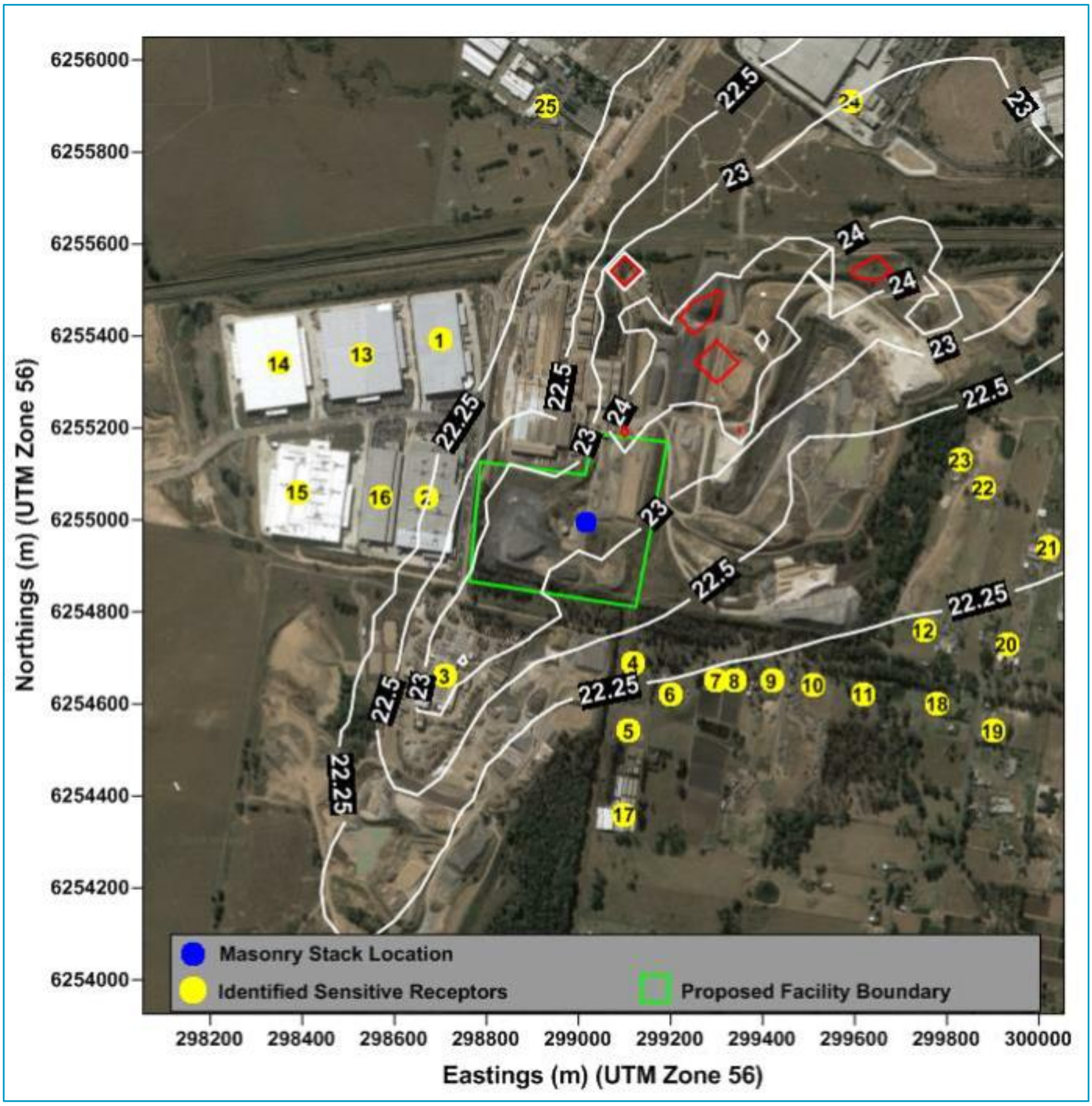
The contour plots show that the cumulative 24-hour average concentrations of PM_{10} and $PM_{2.5}$ and annual average deposited dust have the potential to encroach upon the Development Site boundary, however it is noted that these levels include the operations of the CSR brick manufacturing facility.

Figure 12 Cumulative PM_{10} 24-Hour Contour Plot for the Oakdale East Project



Source: Figure 18 of Airlabs 2019.

Figure 13 Cumulative 24-Hour $PM_{2.5}$ Contour Plot for the Oakdale East Project



Source: Figure 20 of Airlabs 2019.

On this basis, ambient concentrations of PM_{10} and $PM_{2.5}$ may be elevated at times due to regional events, and may well exceed the relevant ambient air quality criteria within the Development Site boundary.

5.2.5 Products of Combustion and Air Toxics

The main existing sources of products of combustion identified in the local air shed are stack emissions from operations of the existing CSR brick manufacturing plant, the proposed Oakdale East Project (including traffic) and existing Austral Plant 3 operations.

The pollutants investigated in the AQIA completed by in March 2019 (Airlabs 2019) included NO_2, CO, SO_2, VOCs (benzene, toluene, ethyl benzene and xylenes), metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated dioxins and furans (PCDF). It was concluded that:

> *"For the other pollutants, including SO_2, NO_2, CO the maximum predicted incremental concentrations across all sensitive receptors are 0.2% or below their respective assessment criteria.*
>
> *For individual air toxics, predicted impacts for all pollutants were found to be below 0.6% of their respective assessment criteria."*

On this basis, the ambient concentrations of products of combustion and air toxics are considered to be lower than the respective criteria in the airshed.

5.3 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.

5.3.1 Step 1 – Screening Based on Separation Distance

As noted in **Section 2.2**, the nearest sensitive receptor (residential) is located approximately 50 m from the nearest Development 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 Development Site boundary.

5.3.2 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 10**. 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 10 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
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 Development Site is estimated to be approximately 208,000 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 Development Site, the total building volume is estimated to be approximately 1,750,000 m^3 (total warehouse are of 117,500 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.*

5.3.3 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 Development Site (ie 10-100 within 100 m). The existing use of the land as a quarry also means that the construction activities are not likely to result in a significant change in local dust levels.

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 10**, the resulting risk of air quality impacts is as presented in **Table 11**.

Table 11 Preliminary Risk of Air Quality Impacts from Construction Activities (Uncontrolled)

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

5.3.4 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 12 lists the relevant mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the IAQM methodology for a development shown to have a high risk of adverse impacts. Not all these measures would be practical or relevant to the proposed Development Site therefore a detailed review of the recommendations should be performed, and the most appropriate measures be adopted as part of the Construction Environmental Management Plan (CEMP). For almost all construction activity, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Table 12 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

	Activity	
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
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

	Activity	
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

5.3.5 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 13**.

Table 13 Residual Risk of Air Quality Impacts from Construction

Impact	Sensitivity of Area	Residual Risk		
		Earthworks	Construction	Trackout
Dust Soiling	Low	Negligible Risk	Negligible Risk	Negligible Risk
Human Health	Low	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*.

5.4 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 Old Wallgrove Road and other local roads connecting the industrial operations in the area. The scale and magnitude of emissions from the Development Site is anticipated to be significantly lower compared to the estimated annual average daily traffic on Old Wallgrove Road. To assess the risk of air emissions from the Development 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 Development Site include residences approximately 50 m to the south (see **Section 2.2**). In terms of the methodology in **Appendix C**, the sensitivity of the surrounding residential areas to emissions from the Development Site should be considered *high*.

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

  Based on the 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 Development Site on the local sensitive receptors is concluded to be ***neutral*** for all receptors (see **Table 14**).

Table 14 Impact Significance

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

A vegetative buffer exists between the Development Site and the existing sensitive receptors located to the south. It is recommended that this vegetative buffer is retained and expanded, as this will assist in screening the existing residents to the south from any air impacts.

6 Conclusions

SLR was commissioned by ESR to undertake an air quality and odour impact assessment to accompany a state significant development (SSD) application for the land located on 6 Johnston Crescent, Horsley Park, New South Wales (NSW). The subject land of this assessment is located in the southern half (hereafter 'the Development Site') of the Horsley Logistics Park.

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

- Odour from the existing poultry farms;
- Emissions of particulate matter, oxides of nitrogen, sulfur oxides and hydrogen fluoride from the Austral Bricks Plant 3 (Airlabs 2019) and fugitive dust emissions from the associated quarrying operations;
- Products of fuel combustion (including particulate matter) and fugitive dust from the proposed Oakdale East Project oerations, which includes a masonry plant and five warehouses; and
- Fugitive dust from construction projects in the area (ie the existing Stage 1 of Horsley Logistics Park and the proposed Horsley Park Warehousing Hub).

The potential impacts of these existing and proposed emission sources on air quality at Development 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 are anticipated to be *low* for 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 Development Site, the potential for offsite air impacts from the operations is concluded to *neutral*. The existing vegetative buffer would also assist in screening any dust or other air emissions being blown towards the nearest existing residences to the south.
- Level 1 (screening) assessment indicates that the poultry farm located on Delaware Road has the potential to create odour impacts encroaching upon the Development Site. The 'screening' assessment for estimating odour impacts and is based on a range of generic conservative assumptions. Given the uncertainty in regard to operational details (such as bird numbers, production cycles etc) at this poultry farm, the already existing residential properties and the vegetative buffer, further detailed assessment is not recommended.
- An air quality impact assessment performed in 2019 for the proposed Oakdale East Project operations (Airlabs 2019) showed that cumulative 24-hour average concentrations of PM_{10} and $PM_{2.5}$ are predicted to be exceed respective criteria within the Development Site boundary, however cumulative impacts include the contributions of the existing CSR facility. Therefore, without the contributions from the CSR facility, the exceedances may only be limited to the northern boundary of the Horsley Logistics Park.

- The construction of other projects in the area (ie Horlsey Park Warehousing Hub) is likely to have been completed and therefore unlikely to coincide with the construction and operations of Development Site, therefore reducing the likelihood of cumulative impacts.

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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 3.1**, 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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