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Air Quality Impact Assessment

Oakdale South Estate

Report Number 610.15276-R2

21 September 2016

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NSW 2000

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Air Quality Impact Assessment

Oakdale South Estate

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1 INTRODUCTION

In 2015, SLR Consulting Australia Pty Ltd (SLR) was commissioned by Goodman Property Services (Australia) Pty Ltd (The Proponent) to perform an Air Quality Impact Assessment (AQIA) for the proposed development of the Oakdale South Estate (hereafter 'the Project site'), NSW. The AQIA (SLR 2015) formed a part of the Development Application (DA) for the Oakdale South Industrial Estate (SSDA 6917).

The Department of Planning and Environment (DP&E) approved the SSDA 6917 on 26 October 2016. The Proponent has proposed some amendments to the concept masterplan submitted as part of the SSDA 6917, driven by the end user priorities. This current report forms part of a Section 96 Application (S96) to the concept masterplan and Stage 1 DA for the Oakdale South Industrial Estate (SSDA 6917).

These amendments involve modifying the concept Master Plan layout in response to specific end user requirements as well as modifications to the Stage 1 DA. Specifically, the proposed modifications include:

- Modifications to Master Plan
  - Realignment of internal Estate Roads to facilitate access to the revised super lots;
  - Alterations to the layout of Precincts 3, 4 & 5 resulting in the reduction in total gross floor area (GFA) from 395,880 m^2 to 339,844 m^2.
- Modifications to Stage 1 DA
  - Amendments to reflect the changes made to the Master Plan;
  - Amend the subdivision layout to reflect changes to the Master Plan;
  - Changes to the Estate Road works to reflect the amended road alignment including the deletion of Estate Road 5; and
  - Deletion of buildings 4 & 5.

The aim of this assessment is to quantify the impacts on air quality due to the proposed operations of the specific end users of some of the precincts within the Project Site in conjunction with the rest of the Project Site.

The AQIA presented in this report references a significant amount of information and data compiled as part of the original AQIA for Oakdale South Industrial Estate (SLR 2015). Specifically, the following elements of this AQIA are either identical to or only slightly modified from, those applied within the original AQIA (SLR 2015):

- Receptor locations
- Air quality criteria
- Emission estimation methodology (including emission factors used)
- Meteorological data
- Background air quality data

Although a discussion of each of the above elements is provided within this AQIA, any additional detail should be sought from the original AQIA (SLR 2015).

1.1 Secretary's Environmental Assessment Requirements

As noted above, this current report forms part of a Section 96 Application (S96) to the concept masterplan and Stage 1 DA for the Oakdale South Industrial Estate (SSDA 6917), therefore the original SEARs issued for the Project Site (SLR 2015) are applicable for the current assessment.

The NSW Department of Planning and Environment (DPE) has issued Secretary's Environmental Assessment Requirements (SEARs) for the Project Site. **Table 1** below identifies the SEARs relevant to air quality issues and notes where they have been addressed in this report.

Table 1 Secretary's Environmental Assessment Requirements – Oakdale South Industrial Estate

Key Issue	Assessment Requirement	Addressed in Section
Air Quality and Odour	An assessment of the potential air quality impacts (particularly dust) of the development on surrounding receivers, including impacts from construction, operation and transport;	**Section 2.2.1** **Section 8.2** to **8.6**
	An assessment of the potential odour impacts; and	**Section 8.1**
	Details of the proposed mitigation, management and monitoring measures	**Section 9**

Source: Department of Planning and Environment, reference SSD 6917, 11 May 2015.

The SEARs require that the assessment be performed in accordance with relevant policies, guidelines and plans including:

- *Protection of Environment Operations (Clean Air) Regulation* (2010);
- *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (2006); and
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005).

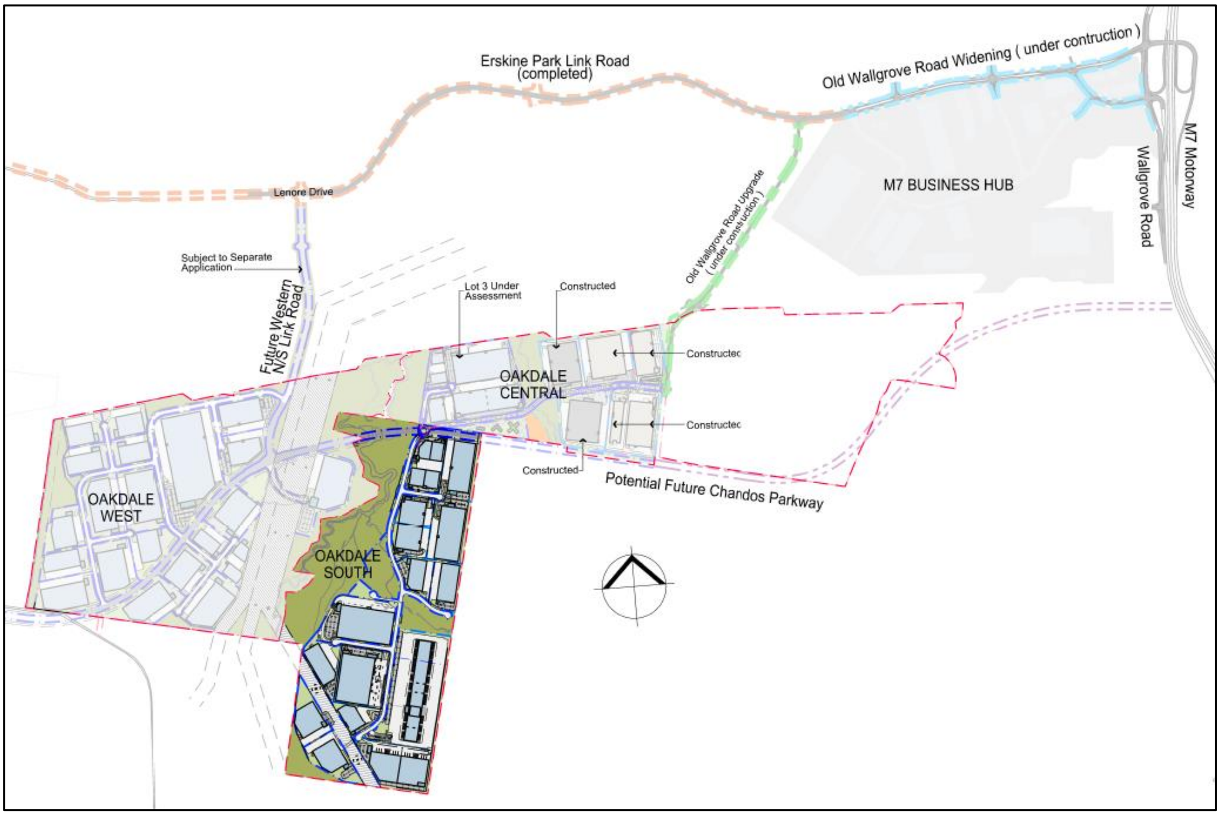
This assessment addresses the key issues raised within the SEARs and is performed in accordance with the relevant policies and guidelines listed above.

2 PROJECT OVERVIEW

The Oakdale Industrial Estate is zoned General Industrial, under the Western Sydney Employment Area SEPP (2009). The proponent is seeking to develop warehouse distribution centres within six precincts, consistent with the building footprints approved for Oakdale South Estate – revised Concept Masterplan (OAK MP 01 [M]).

The revised concept development masterplan for the Oakdale Industrial Estate is presented in **Figure 1**.

Figure 1 Concept Development Masterplan for the Oakdale Industrial Estate



Source: SBA Architects, Cover Sheet, OAK MP 01 (M), 8 July 2016

A brief description of each precinct within the Project Site is outlined in **Table 2** and shown in **Figure 2**.

Table 2 Oakdale South Estate – Precinct Development Description

Development Area	Area (ha)
Precinct 1	18.81
Precinct 2	5.43
Precinct 3	18.94
Precinct 4	14.27
Precinct 5	6.46
Precinct 6	6.84
Amenity Lot	0.58

Source: SBA Architects, SSDA Masterplan, 25 May 2016; NA – not available.

Figure 2 Oakdale South Estate – Detailed Site Layout

Source: SBA Architects, SSDA Masterplan, 21 September 2016

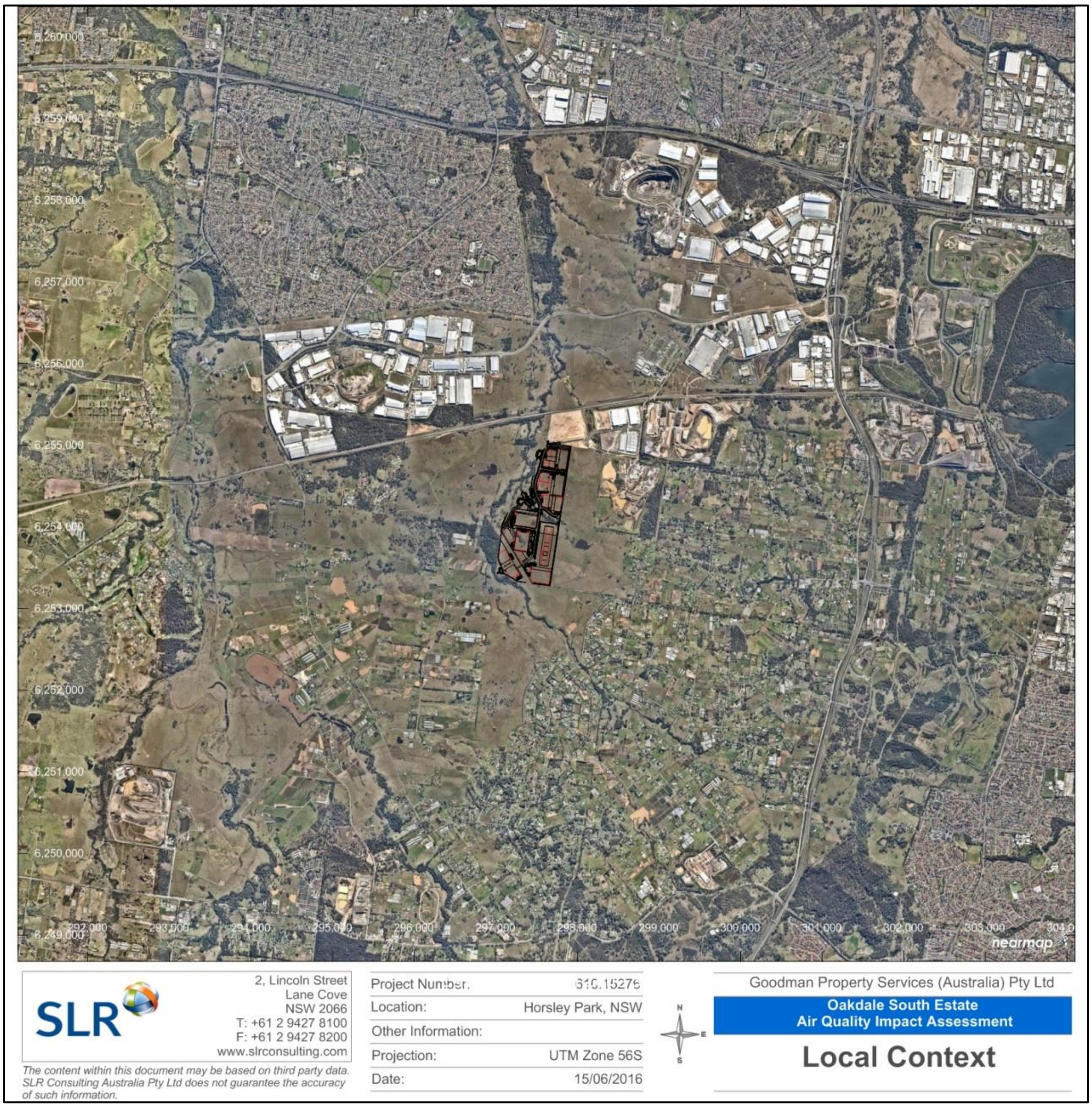
2.1 Local Setting

The Project site is located at Horsley Park in Fairfield, NSW and is regulated by the State Environmental Planning Policy (Western Sydney Employment Area). The site is an important regional hub for major logistics, distribution, warehousing and production industries, with strategic access to Sydney's key arterial road network including M7 and M4 motorways. The location of the Project site in relation to the local context is shown in **Figure 3**.

The surrounding topography of the Project site is relatively flat and comprises of an area of 117 hectares (ha). The site is surrounded by the following land uses.

- North: Precinct 3 of the Oakdale Central Industrial Estate;
- East: Austral's quarry/brickmaking plant and residences to further east of the brickmaking plant;
- South: Francis Road with no residences located on the Francis road and residences to further south along the Capitol Hill drive; and
- West: vacant land to the immediate west with residences located to further west along Bakers lane.

Figure 3 Oakdale South Estate – Local Context



Source: Nearmap (6 May 2016)

2.2 Proposed Project Activities

2.2.1 Construction Phase

The construction activities will include construction of buildings and associated infrastructure, such as sedimentation basins and estate roads across the entire Project site. Key construction works associated with the Project comprises of construction of twelve warehouses and associated infrastructure.

The construction of the Project Site along with the associated infrastructure, such as sedimentation basins and estate roads across the entire site has already been assessed under the DA SSDA 6917. It is noted that as part of the alterations to the already assessed Concept Masterplan, the total GFA will be reduced from 395,880 m^2 to 339,844 m^2.

Based on the slightly reduced total GFA from the already assessed SSDA 6917, dust emissions associated with construction of the Project Site are not anticipated to change significantly from the previously assessed development and are considered to be manageable using appropriate mitigation and management measures. Proposed mitigation and management measures are listed in **Section 9**. Given the above, air quality impacts during construction of the Project Site are not considered any further in this assessment.

2.2.2 Operational Activities

Operational activities that are anticipated to occur on the proposed Project site are receipt, storage and dispatch of products as part of the distribution centres' bulk warehousing and distribution services. These activities will involve:

- unloading and loading of goods via trucks and shipping containers;
- management of inventory in a racked and stacked environment;
- order fulfilment including picking and packing of finished orders for customers;
- loading of transport vehicles;
- management of product returns;
- inspection of goods for quality assurance purposes; and
- product embellishment.

The current plans show an overall area of approximately 339,844 m^2. According to the RMS Guide to Traffic Generating Developments (RTA 2002) and Traffic Impact Assessment (ASON 2015), the following rates are adopted in regards to the traffic generation at the Project Site:

- 1.89 vehicle trips per 100 m^2 per day, and
- 0.163 vehicles per 100 m^2 per hour.

Using the above traffic generation rates, and proposed floor areas for each development area, a summary of the vehicle movements estimated for the proposed development and assessed in this AQIA is presented in **Table 3**.

Table 3 Vehicle Volumes for Oakdale South Industrial Estate

Lot	Approximate GFA (m^2)	Vehicles per Hour (Peak)	Vehicles per day
3B	37,500	61	709
3A	41,000	67	775
4A	142,700	233	2,697
Rest of OSE	118,644	193	2,242
TOTAL OSE	**339,844**	**554**	**6,423**

From the advice provided by the proponent, it is assumed that the heavy vehicle movements will represent approximately 10% of the total vehicle movements.

The other activity data for the proposed operational phase are presented in **Table 4**.

Table 4 Operational Data - Oakdale South Estate

Variable	Data
Proposed hours of operation	24 hours/day, 7 days a week
Maximum on-site travel distances	3.7 km

Source: pers comm Andrew Johnson 15 June 2015

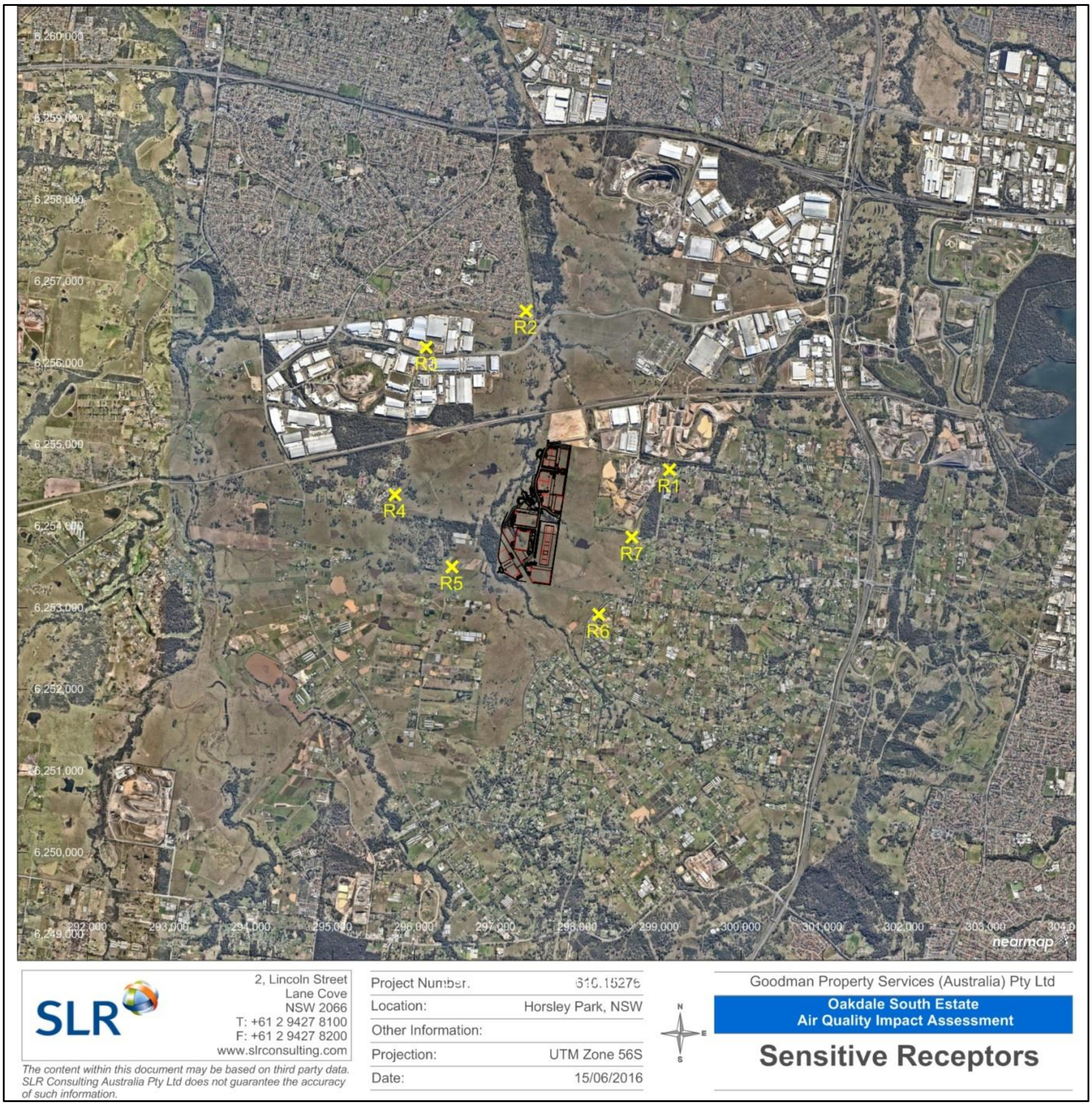
2.3 Sensitive Receptors

The Project site is surrounded by rural activities (grazing, market gardens etc) and rural residential houses to the southeast, south and west, residential areas to the north, extractive industries to the east and industrial zones at Eastern Creek to the northeast and Erskine Park to the northwest. The closest residential area is approximately 0.5 kilometres (km) to the east at Burley Road, Horsley Park. Surrounding sensitive receptors identified for this assessment are listed in **Table 5** and presented in **Figure 4**.

Table 5 List of Identified Sensitive Receptors

Receptor ID	Easting (km)	Northing (km)	Description
R1	299.124	6,254.696	315-321 Burley Road (Residential)
R2	297.367	6,256.640	Cetus Place (Residential)
R3	296.149	6,256.196	Ore Lane (Industrial)
R4	295.765	6,254.388	Emmaus Catholic College (Educational)
R5	296.458	6,253.501	Aldington Road (Agricultural - Farm)
R6	298.256	6,252.915	Capitol Hill Drive (Residential)
R7	298.665	6,253.864	41-43 Greenway Place (Residential)

Figure 4 Locations of Identified Sensitive Receptors



2.4 Pollutants of Interest

As mentioned in **Section 2.2.1**, based on the slightly reduced total GFA from the approved SSDA 6917, the dust emissions due to the construction of the Project Site are not considered any further in this assessment.

During the operational phase, exhaust emissions from heavy vehicles travelling to, from, and idling at the site and wheel-generated dust from vehicles travelling on sealed roads are likely to be the main sources of emissions. On this basis, pollutant emissions due to the combustion of fuels in vehicles (ie, road traffic exhaust emissions) have been identified as key pollutants during the operation of the Project. As such, oxides of nitrogen (NO_X), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and lead (Pb) have been considered in this assessment. Particulate emissions (TSP, PM_{10} and $PM_{2.5}$) resulting from traffic movements on paved roads have also been assessed.

3 ADOPTED STANDARDS AND GUIDELINES

State air quality guidelines adopted by the NSW EPA are published in the Approved Methods.

The guidance provided in the Approved Methods has been consulted during the preparation of this assessment report. The Approved Methods lists the statutory methods that are to be used to assess the emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Project. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC and WHO). The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting.

3.1 Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air ($\mu g/m^3$).

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

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

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are outlined in **Table 6**. The Approved Methods do not set any assessment goals for $PM_{2.5}$.

In December 2000, the NEPC initiated a review to determine whether a national ambient air quality criterion for $PM_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. In July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$, setting Interim Advisory Reporting Standards for $PM_{2.5}$ (NEPC, 2003).

The National Clean Air Agreement (NCAA) was endorsed by Commonwealth, state and territory Environment Ministers on 15 December 2015. Ministers agreed to strengthen national ambient air quality reporting standards for airborne fine particles as outlined in **Table 2**. All jurisdictions have agreed to implement strengthened standards for particles, as well as move to even tighter standards for annual average and 24-hour $PM_{2.5}$ in 2025.

As such, in February 2016, a variation to the Ambient Air Quality National Environment Protection Measure (NEPM) was made to extend its coverage to $PM_{2.5}$, setting reporting standards for $PM_{2.5}$ with no allowable exceedances (National Environment Protection Council, 2016) as outlined in **Table 2**. In addition, the Ambient Air Quality NEPM revised the standard for annual average PM_{10} to be in line with the NCAA.

These standards have not yet been adopted by NSW EPA. However, it is anticipated that the standards outlined in the Approved Methods will be aligned with the Ambient Air Quality NEPM in the near future. Therefore, this assessment is based on the assessment goals set out in the Ambient Air Quality NEPM (2016).

Table 6 Federal and State Assessment Goals for Suspended Particulate

Pollutant	Averaging Period	Assessment Goal (µg/m^3)		
		Approved Methods	National Clean Air Agreement	Ambient Air Quality National Environment Protection Measure (2016)
PM_{10}	Maximum 24-hour	50	50	50
	Annual	30	25	25
$PM_{2.5}$	Maximum 24-hour	-	25	25
	Annual	-	8	8

3.2 Deposited Particulate Matter

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

Table 7 presents the impact assessment goals set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 7 EPA Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month

Source: Approved Methods, NSW DEC 2005.

3.3 Combustion-Related Pollutants

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

3.3.1 Oxides of Nitrogen (NO_X)

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

3.3.2 Carbon Monoxide (CO)

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.

3.3.3 Sulphur Dioxide (SO_2)

Vehicle exhausts can contain emissions of sulphur dioxide (SO_2) due to impurities in the fuel. It is noted that most of the vehicles in operation at the Oakdale South precinct are likely to be industrial vehicles (ie diesel fuelled vehicles). The sulphur content in diesel fuel has significantly reduced over the years and a timeline of the sulphur content in diesel fuels in Australia is shown in **Table 8**.

Table 8 The Environmental and Operability Standard in Australia – Diesel Fuel Quality Standard

Pollutant	National Standard	Date of Effect	Test Method
Sulphur Content of Fuel	10 ppm (max)	1-Jan-09	ASTM D5453
	50 ppm (max)	1-Jan-06	
	500 ppm (max)	31-Dec-02	

Source: http://www.environment.gov.au/topics/environment-protection/fuel-quality/standards/diesel, accessed on 19 June 2015.

3.3.4 Volatile Organic Compounds (VOCs)

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

The approved methods prescribe the air quality criterion for individual VOCs such as benzene, 1,3-butadiene etc. Generally for VOCs, the most stringent criteria of the individual VOCs (i.e. benzene) is used to assess the air quality exceedances of the VOCs.

3.3.5 Lead (Pb)

On 15 March 2000, the Australian Government announced a phase-out of leaded petrol in Australia under the National Fuel Quality Standards Act 2000. On 1 January 2002, that phase-out was completed. The sale of leaded petrol in Australia is now prohibited, except in cases specifically authorised by the Minister.

3.3.6 Summary of Combustion Related Products

Experience in performing assessments of the impact of combustion-related emissions has shown that the principal ‘indicator’ pollutants from fuel combustion are NO_2 and PM_{10} (and to a lesser extent CO) and the risk of non-compliance with the relevant criteria is typically associated with the short-term criteria rather than the annual averages.

The NSW OEH has established ground level air quality impact assessment criteria for air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. A summary of the relevant impact assessment criteria for combustion related pollutants is provided in **Table 9**.

Table 9 EPA Goals for Combustion Related Pollutants

Pollutant	Averaging Period	Concentration		Source
Nitrogen dioxide (NO_2)	1 hour	12 pphm	246 µg/m^3	NEPC (1998)
	Annual	3 pphm	62 µg/m^3	NEPC (1998)
Carbon monoxide (CO)	15 minutes	87 ppm	100 mg/m^3	WHO (2000)
	1 hour	25 ppm	30 mg/m^3	WHO (2000)
	8 hours	9 ppm	10 mg/m^3	NEPC (1998)
Sulphur dioxide (SO_2)	10 minutes	25 pphm	712 µg/m^3	NHMRC (1996)
	1 hour	20 pphm	570 µg/m^3	NEPC (1998)
	24 hours	8 pphm	228 µg/m^3	NEPC (1998)
	Annual	2 pphm	60 µg/m^3	NEPC (1998)
Lead	Annual	-	0.5 µg/m^3	NEPC (1998)
Benzene	1 hour	0.009 ppm	29 µg/m^3	NEPC (1998)
TSP	Annual	90 µg/m^3		NEPC (1998)
PM_{10}	24 Hours Annual	50 µg/m^3 30 µg/m^3		NEPC (1998)
$PM_{2.5}$	24 Hours Annual	25 µg/m^3 (interim advisory reporting standard only) 8 µg/m^3 (interim advisory reporting standard only)		NEPC (1998)

3.4 Summary of Proposal Air Quality Goals

The air quality goals adopted for this assessment, which confirm to current EPA and Federal air quality criteria, are summarised in **Table 10**. All criteria are referenced as mass concentration.

The impact assessment criteria are required to be applied as follows:

- At the nearest existing or likely future off-site sensitive receptor.
- The incremental impact (predicted impacts due to the pollutant source alone) for each pollutant must be reported in units and averaging periods consistent with the impact assessment criteria.
- Background concentrations must be included using the procedures specified in Section 5 of the Approved Methods.
- Total impact (incremental impact plus background) must be reported as the 100th percentile (maximum) (or 99th percentile for odour) in concentration or deposition units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria.

Table 10 Summary of Air Quality Goals – Oakdale South Project

Pollutant	Averaging Time	Goal (µg/m³)	Source
Sulphur dioxide (SO_2)	10 minutes	712	NSW DEC (2005)
	1 hour	570	NEPC (2016)
	24 hours	228	NEPC (2016)
	Annual	60	NEPC (2016)
Nitrogen dioxide (NO_2)	1 hour	246	NEPC (2016)
	Annual	62	NEPC (2016)
Lead	Annual	0.5	NEPC (2016)
Benzene	1 hour	0.009 ppm	NSW DEC (2005)
PM_{10}	24 hours	50	NEPC (2016)
	Annual	25	NEPC (2016)
$PM_{2.5}$	24 hours	25	NEPC (2016)
	Annual	8	NEPC (2016)
TSP	Annual	90	NSW DEC (2005)
		Goal (g/m²/month)	
Deposited dust	Annual	2 (maximum increase in deposited dust level) 4 (maximum total deposited dust level)	NSW DEC (2005)
		Goal (mg/m³)	
Carbon monoxide (CO)	15 minutes	100	WHO (2000)
	1 hour	30	WHO (2000)
	8 hours	10	NEPC (2016)

Source: The Approved Methods, NSW DEC 2005, WHO 2005.

4 EXISTING ENVIRONMENT

A summary of the background air quality data used to assess the cumulative impacts for the proposed operations is presented in **Table 11**.

Table 11 St Mary's Background Air Quality Data (2011)

Pollutant	Averaging Period	Assumed Background Concentration	Source
TSP	Annual	29.4 µg/m^3	Estimated from the annual average PM_{10} concentration using a factor of 2
PM_{10}	24 hours	Daily varying	St Mary's AQMS
	Annual	14.7 µg/m^3	St Mary's AQMS (without the bushfire days)
$PM_{2.5}$	24 hours	NA	N/A
	Annual	NA	N/A
NO_2	1-hour	Varying daily maximum 1 hour average	St Mary's AQMS
	Annual	12.3 µg/m^3	St Mary's AQMS
Ozone	1-hour	Varying daily maximum 1 hour average	St Mary's AQMS

Note: [1] The dust concentration was monitored from 4 May 2010 to 6 November 2013.

Full details of the background air quality data are available in the original AQIA (SLR 2015).

5 IMPACT ASSESSMENT METHODOLOGY

5.1 Operational Phase

For this assessment, dispersion modelling was conducted using the US EPA's CALPUFF (Version 6) modelling system, as recommended by the NSW EPA. CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way.

Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. Observational meteorological data from the Horsley Park Equestrian Centre meteorological station, in conjunction with the cloud cover data from Bankstown Airport BOM station (Station # 66137), were used to generate a 1-year, hourly, site-representative meteorological file suitable for use in the CALPUFF model.

The primary output files from CALPUFF contain either hourly concentration or hourly deposition fluxes evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

The advantages of using CALPUFF (rather than using a steady state Gaussian dispersion model such as Ausplume) is its ability to handle calm wind speeds (<0.5 m/s), complicated terrain and cumulative pollution impacts. Steady state models assume that meteorology is unchanged by topography over the modelling domain and may result in significant over or under estimation of air quality impacts.

5.1.1 Pollutants Assessed

As discussed previously, road traffic exhaust emissions may be comprised of a large number of pollutants. In terms of this assessment, the focus has been upon a select number of key pollutants that are recognised as the key indicators of road traffic exhaust emissions, namely particulates (as TSP, PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2).

5.1.2 NO_X to NO_2 Conversion

For this assessment, off-site NO_2 concentrations have been estimated from the predicted NO_X concentrations using the Ozone Limiting Method (OLM).

This is in agreement with Method 2 for NO_2 assessment (Section 8.1.2) prescribed in the Approved Methods.

5.1.3 Accuracy of Modelling

Atmospheric dispersion models such as CALPUFF, Ausplume, AERMOD and even specialist models like DEGADIS, CALINE4 and SLAB all represent a simplification of the many complex processes involved in the dispersion of pollutants in the atmosphere. To obtain good quality results it is important that the most appropriate model is used and the quality of the input data (meteorological, terrain, source characteristics) is adequate.

The main sources of uncertainty in dispersion models, and their effects, are discussed below.

- **Oversimplification of physics:** This can lead to both under-prediction and over-prediction of ground level pollutant concentrations. Errors are greater in Gaussian plume models as they do not include the effects of non-steady-state meteorology (i.e., spatially- and temporally-varying meteorology).

- **Errors in emission rates:** Ground level concentrations are proportional to the pollutant emission rate. In addition, most modelling studies assume constant worst case emission levels or are based on the results of a small number of stack tests, however operations (and thus emissions) are often quite variable. Accurate measurement of emission rates and source parameters requires continuous monitoring.
- **Errors in source parameters:** Plume rise is affected by source dimensions, temperature and exit velocity. Inaccuracies in these values will contribute to errors in the predicted height of the plume centreline and thus ground level pollutant concentrations.
- **Errors in wind direction and wind speed**: Wind direction affects the direction of plume travel, while wind speed affects plume rise and dilution of plume. Errors in these parameters can result in errors in the predicted distance from the source of the plume impact, and magnitude of that impact. In addition, aloft wind directions commonly differ from surface wind directions. The preference to use rugged meteorological instruments to reduce maintenance requirements also means that light winds are often not well characterised.
- **Errors in mixing height:** If the plume elevation reaches 80% or more of the mixing height, more interaction will occur, and it becomes increasingly important to properly characterise the depth of the mixed layer as well as the strength of the upper air inversion.
- **Errors in temperature:** Ambient temperature affects plume buoyancy, so inaccuracies in the temperature data can result in potential errors in the predicted distance from the source of the plume impact, and magnitude of that impact.
- **Errors in stability estimates:** Gaussian plume models use estimates of stability class, and 3D models use explicit vertical profiles of temperature and wind (which are used directly or indirectly to estimate stability class for Gaussian models). In either case, errors in these parameters can cause either under-prediction or over-prediction of ground level concentrations. For example, if an error is made of one stability class, then the computed concentrations can be off by 50% or more.

The US EPA makes the following statement in its Modelling Guideline (US EPA, 2005) on the relative accuracy of models:

“Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. For example, errors in highest estimated concentrations of ±10 to 40% are found to be typical, i.e., certainly well within the often quoted factor-of-two accuracy that has long been recognised for these models. However estimates of concentrations that occur at a specific time and site, are poorly correlated with actually observed concentrations and are much less reliable.”

6 METEOROLOGY

6.1 Long Term Meteorology

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component.

The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field.

Spatial variations and diurnal and seasonal changes in the wind field and stability regime are functions of atmospheric processes operating at various temporal and spatial scales. Atmospheric processes at macro- and meso-scales need therefore be taken into account in order to accurately parameterise the atmospheric dispersion potential of a particular area.

Long-term meteorological data are available from the Bureau of Meteorology (BOM) station located at Horsley Park Equestrian Centre, which is located approximately 6.2 km to the south of the Project site.

The station has data available from 1997 to 2015 for the following parameters:

- Temperature (°C);
- Rainfall (mm);
- Relative humidity (%); and
- Wind speed (m/s) and wind direction (degrees).

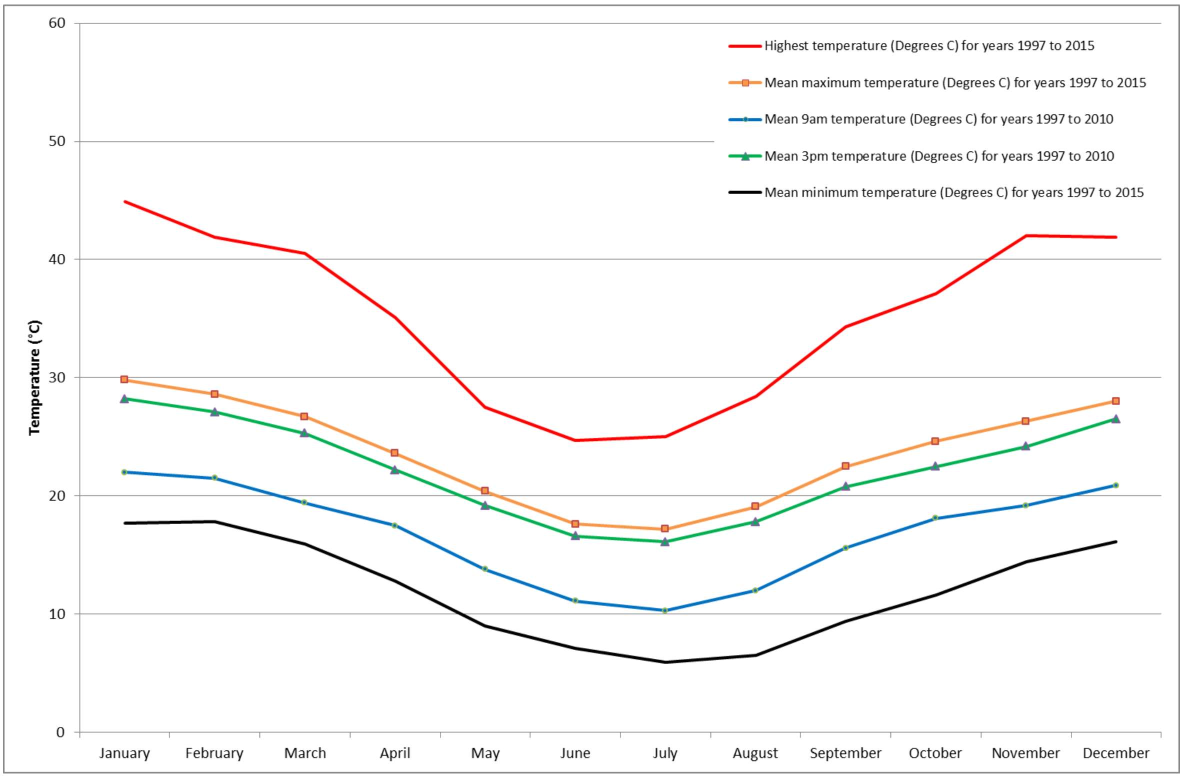
A review of the long term data collected is provided in the following sections.

6.1.1 Temperature

Long-term temperature statistics for Horsley Park Equestrian Centre are summarised in **Figure 5**.

Mean maximum temperatures range from 17.2°C in winter to 29.8°C in summer, while mean minimum temperatures range from 5.9°C in winter to around 17.8°C in summer. Maximum temperatures above 40°C and minimum temperatures less than -2°C have been recorded.

Figure 5 Long Term (1997-2015) Temperature Data for Horsley Park Equestrian Centre

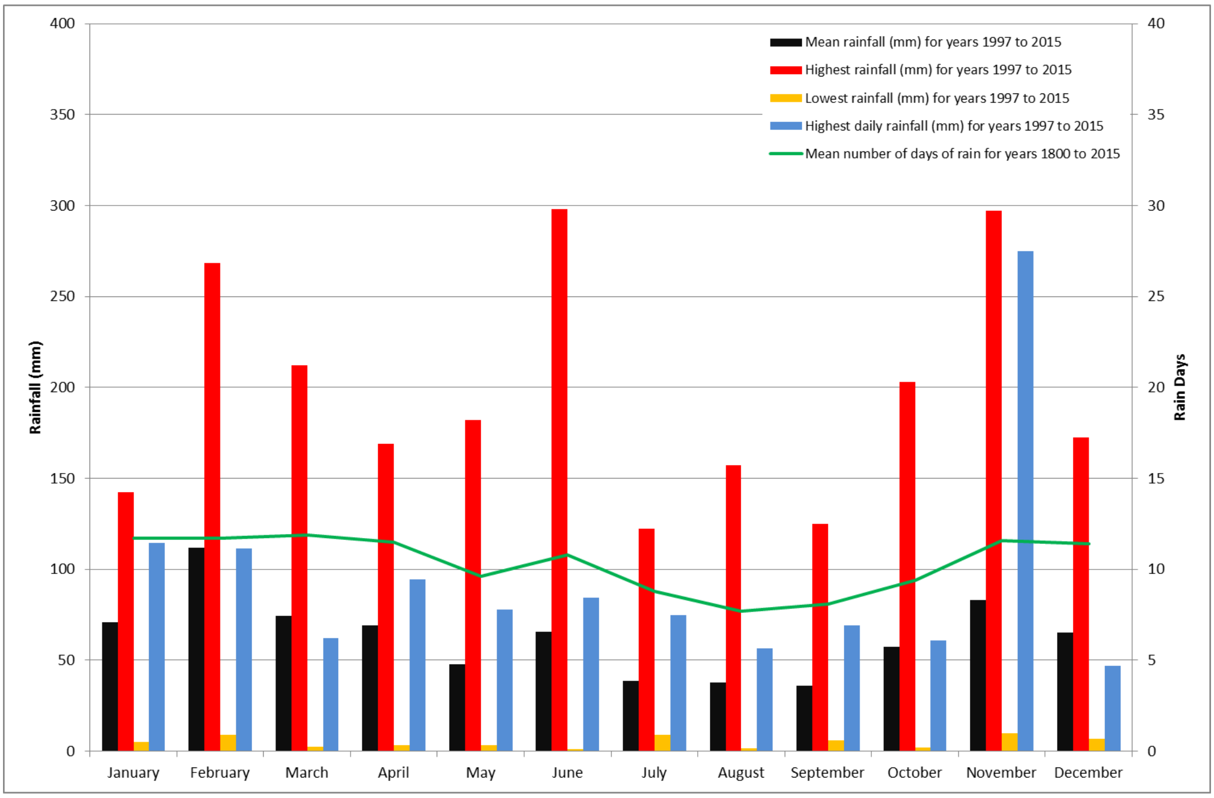


6.1.2 Rainfall

Long-term rainfall statistics for Horsley Park Equestrian Centre are summarised in **Figure 6**.

Mean rainfall is relatively high in summer, reducing from autumn to winter with the lowest average of 36.1 mm recorded during September. This month also recorded an average of around eight rain days per month. The highest rainfall was recorded in June 2007.

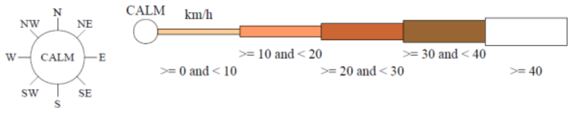
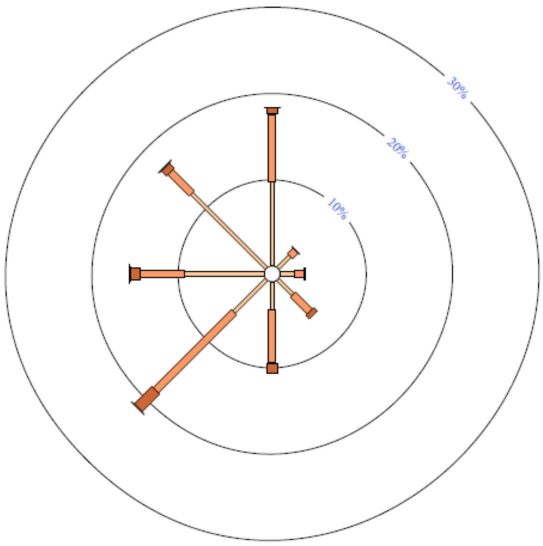
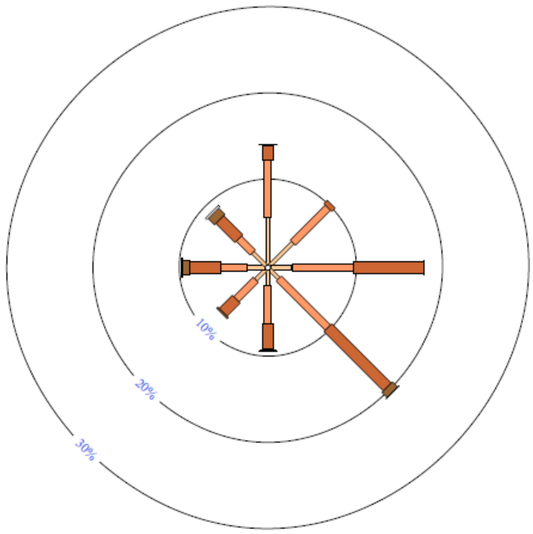
Figure 6 Long Term (1997-2015) Rainfall Data for Sydney Olympic Park



6.1.3 Wind Speed and Direction

Long term wind data (9 am and 3 pm) for Horsley Park Equestrian Centre are presented as windroses in **Figure 7**. The long term windroses show that winds from the southwestern quadrant are predominant in the morning and winds from the east to southeastern quadrant are predominant in the afternoon periods.

Figure 7 Long Term Wind Roses for Horsley Park Equestrian Centre (1997-2015)

<table>
<tr><th>9 AM</th><th>3 PM</th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Based on the review of long term climate statistics for the local area, emissions of air pollutants from the proposed development during construction and operation may be expected to be transported towards the receptors located on the west of the Project Site predominantly during the morning, and towards the receptors located on the east of the Project Site predominantly during the afternoon.

Material located in stockpiles, areas worked by equipment and exposed areas are more likely to become a source of particulate emissions in the summer months, when temperatures are higher. However, higher mean rainfall totals in the summer months may also provide some level of mitigation.

6.2 Meteorology used for Dispersion Modelling

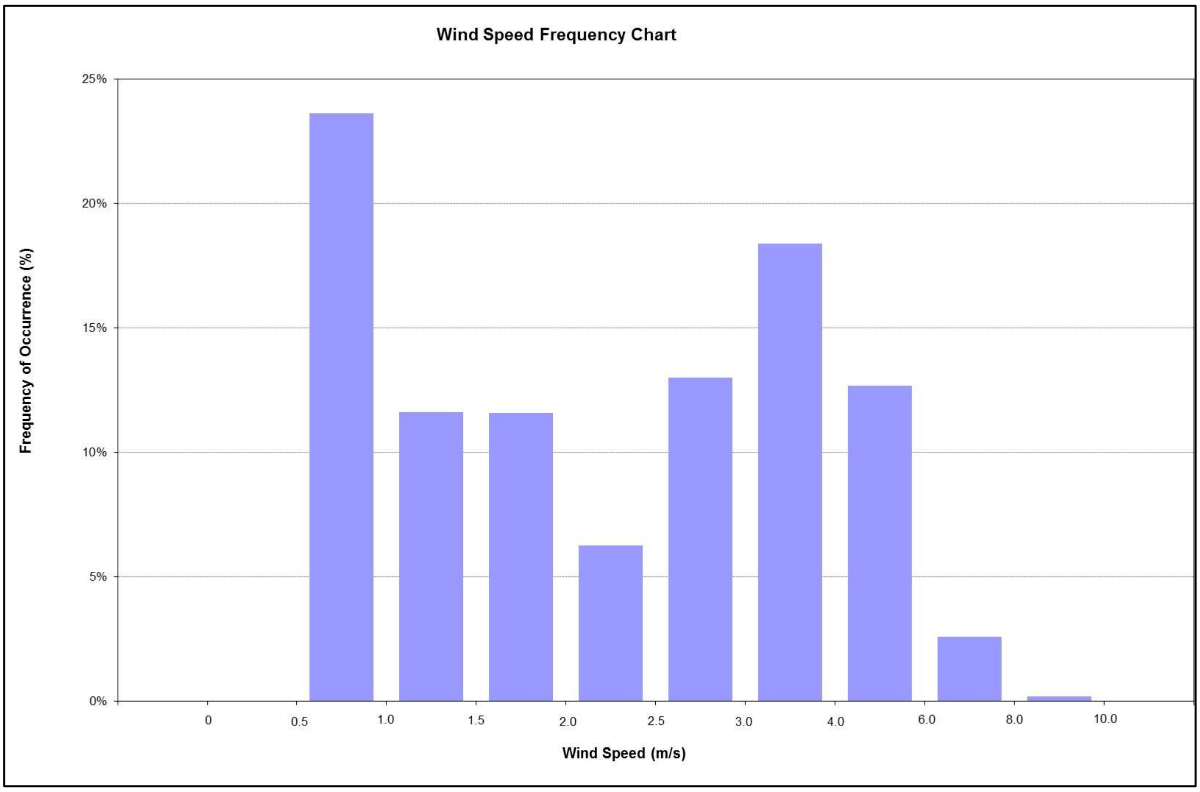
For the purposes of dispersion modelling, hourly meteorological data for years 2010 to 2014 were sourced from the nearby Bureau of Meteorology (BOM) station located at the Horsley Park Equestrian Centre (Station # 67119). A long term (2010 – 2014) meteorological data analysis was conducted to select the meteorological year for this study and it was concluded that the data measured during the year 2011 was representative of the region. Observational meteorological data from the Horsley Park Equestrian Centre meteorological station, in conjunction with the cloud cover data from Bankstown Airport BOM station (Station # 66137), were used to generate a 1-year, hourly, site-representative meteorological file suitable for use in the CALPUFF model.

6.2.1 Wind Conditions

A wind speed frequency plot of the year 2011 is presented in **Figure 8**.

A summary of the 2011 annual wind behaviour for the project site is presented as a wind rose in **Figure 9**.

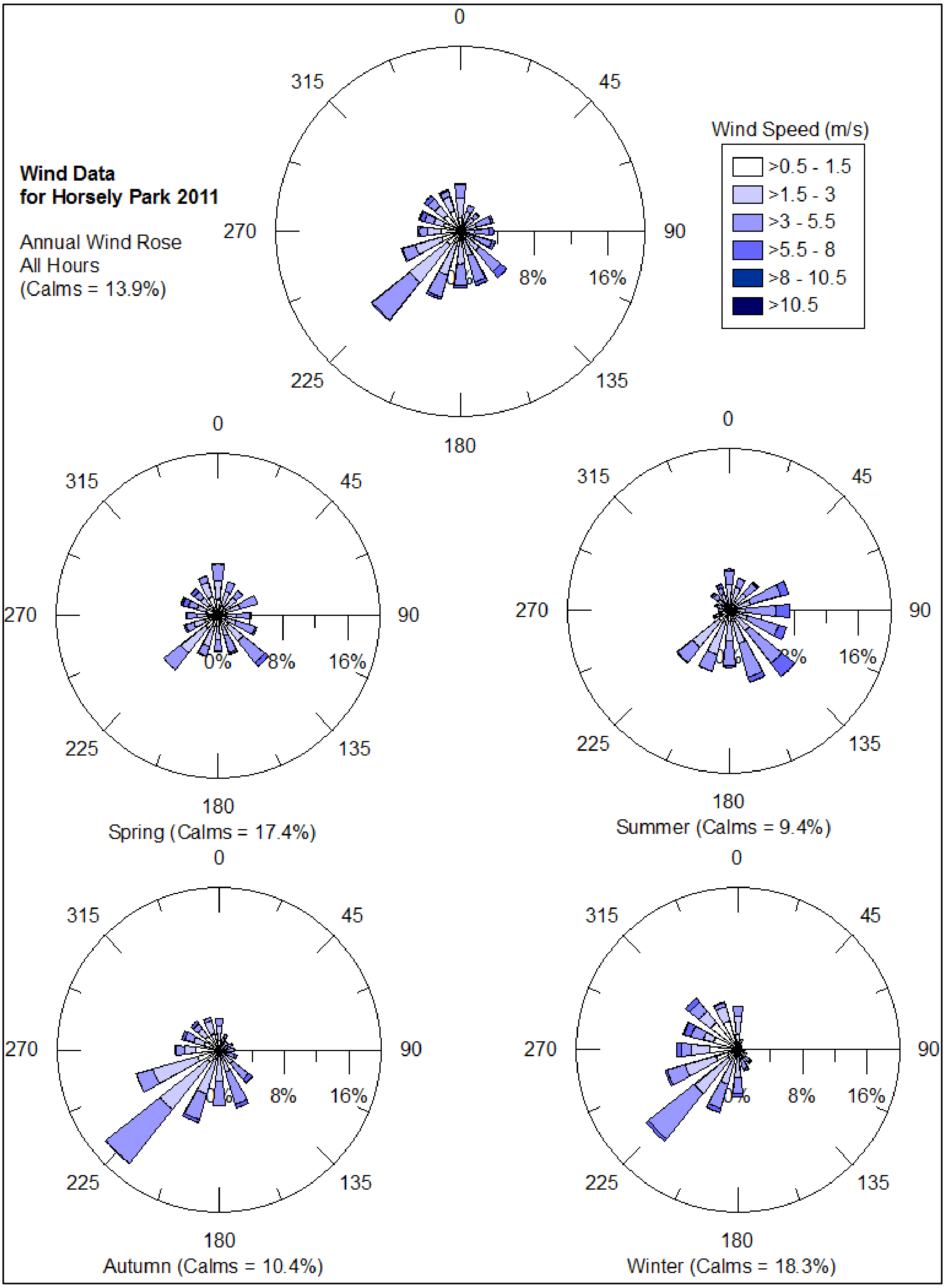
Figure 8 Wind Speed Frequency Distribution - Horsley Park Equestrian Centre (Station # 67119) - 2011



This wind rose is representative of the meteorological input file used in the modelling, and displays occurrences of winds from all quadrants.

The annual wind rose indicates the prevailing wind direction is from the southwest quadrant, occurring over 30% of the time. Winds experienced at the site are predominantly light to moderate. Winds for the dominant wind directions are also light to moderate in nature, having wind speeds ranging between 1.5 m/s and 8 m/s. Calm wind conditions (wind speeds less than 0.5 m/s) were predicted to occur 13.9% of the time throughout 2011.

Figure 9 Wind Roses - Horsley Park Equestrian Centre (Station # 67119) - 2011



6.2.2 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability (see **Table 12**). These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models.

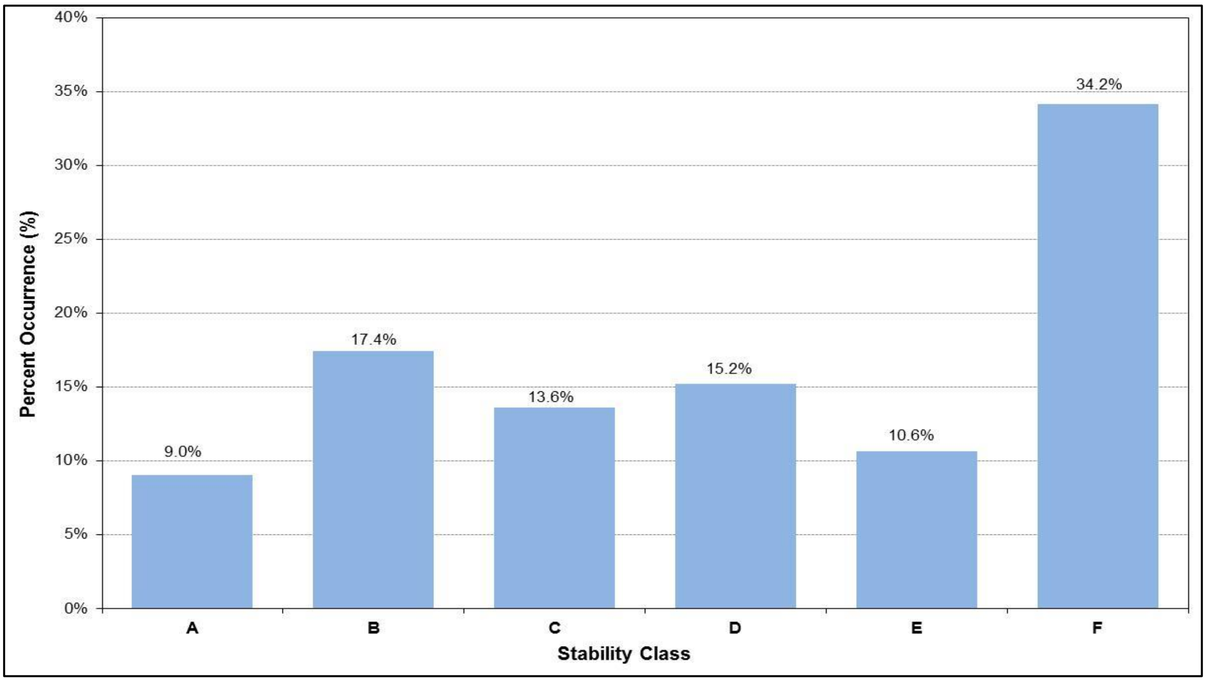
Table 12 Description of Atmospheric Stability Classes

Atmospheric stability class	Category description
A	Very unstable: Low wind, clear skies, hot daytime conditions
B	Unstable: Clear skies, daytime conditions
C	Moderately unstable: Moderate wind, slightly overcast daytime conditions
D	Neutral: High winds or cloudy days and nights
E	Stable: Moderate wind, slightly overcast night-time conditions
F	Very stable: Low winds, clear skies, cold night-time conditions

The frequency of each stability class for each hour was calculated following the methods prescribed by the United States Environmental Protection Agency's *Meteorological Monitoring Guidance for Regulatory Modelling Applications* (USEPA 2000). The stability classes were determined using the metrological parameters such as cloud cover and cloud ceiling height observed at the Bankstown Airport BOM station (Station # 66137) with empirical formulae. This is accordance with the methods prescribed by the Approved Methods (Section 4.2 of the Approved Methods).

The frequency of each stability class at the Project Site during 2011 is presented in **Figure 10**. The results indicate a high frequency of conditions typical to Stability Class F. Stability Class F is indicative of very stable night time conditions, conducive to a low level of pollutant dispersion due to mechanical mixing.

Figure 10 Stability Class Distribution - Horsley Park Equestrian Centre (Station # 67119) - 2011



7 EMISSION ESTIMATION

7.1 Operational Phase

As stated in **Section 2.4** wheel-generated dust from the on-site traffic movements and combustion emissions from road traffic exhaust emissions on-site have been identified as the main sources of potential emissions for the proposed operational phase.

Potential particulate emissions from the on-site traffic movements were estimated using emission factor equations sourced from the United States Environmental Protection Agency (US EPA) AP-42 Emission Factor Handbook (US EPA 2011). Potential NO_x and particulate emissions from idling trucks were sourced from US EPA documents on "*Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity*" (US EPA 2004). The emission factors used in estimating potential emissions from the proposed operations are summarised in **Table 13**.

Table 13 Emission Factors

Activity	Emission Factor Equation	Units	Source	Variables
Wheel generated dust	$EF_{TSP} = 3.23 \times (sL)^{0.91} \times (W \times 1.1023)^{1.02}$ $EF_{PM10} = 0.62 \times (sL)^{0.91} \times (W \times 1.1023)^{1.02}$ $EF_{PM2.5} = 0.15 \times (sL)^{0.91} \times (W \times 1.1023)^{1.02}$	g/VKT	US EPA (2011)	sL = road surface silt loading (0.06 g/m²) W = average weight of vehicles: 22.5 t for PUD's , 62.5 t for B Doubles 42.5 t for Semi trailers
Idling combustion	$EF_{NOx} = 135$ $EF_{PM10} = 3.68$	g/hr	US EPA (2004)	

The use of idling emission factors are considered to be conservative compared to the use of in motion emission factors for light commercial vehicles (90%) and diesel trucks (10%). Based on NPI EET Manual for Combustion Engines, the NO_X emissions from diesel engines (HGV) emit 23 kg/m^3 and diesel engines (MGV) emit 17 kg/m^3.

Assuming that heavy trucks (HGV) have an average mileage of 57.7 L/100 km and commercial vehicles (MGV) have an average mileage of 12 L/100 km (based on Survey of motor vehicle use in Australia, 12 months to June 2012, ABS 2015), the weighted average fuel consumption rate for the fleet is estimated to be 16.6 L/100 km.

Assuming that the vehicles were travelling at 30 km/h speed, it is estimated that the NO_X emissions will be approximately 114 g/h. This is lower than the idling truck fleet idling emission factor of 135 g/h adopted in this assessment for NO_X emissions. A summary of the estimated total emission rates for the proposed operations are presented in **Table 14**.

Table 14 Detailed Emissions Estimation

Lot	Approximate GFA (m^2)	Vehicles per day	# of Idling vehicles	TSP (kg/h)	PM_{10} (kg/h)	$PM_{2.5}$ (kg/h)	NOx (kg/h)
3B	37,500	709	1	0.7	0.1	0.04	0.4
3A	41,000	775	1	0.7	0.2	0.04	0.4
4A	142,700	2,697	1	2.6	0.5	0.1	0.4
Rest of OSE	118,644	2,242	12	2.2	0.5	0.1	4.9
TOTAL OSE	**339,844**	**6,423**	**15**	**6.2**	**1.4**	**0.3**	**6.1**

Note: Operational data such as the number of vehicles has been adopted from **Table 4**. It has been assumed that at least one vehicle is idling at each site within the Oakdale South Estate.

8 AIR QUALITY IMPACT ASSESSMENT

Air quality impacts in the area surrounding the Project site may be anticipated during both the construction and operational phases.

Dispersion modelling predictions of dust deposition rates, TSP, PM_{10}, $PM_{2.5}$ and NO_2 at the residences/properties nominated in **Section 2.3** are presented in **Section 8.2** to **Section 8.6**. Pollutant isopleth plots are also provided in the respective sections which show the maximum predicted incremental (Project operations only) concentrations and deposition rates of the pollutants assessed.

As discussed in **Section 4** a detailed assessment of the background concentrations in the area surrounding the Project site has been performed. Within this results section, the predicted contribution from the end users of the Project Site (Lots 3B, 3A and 4A) along with the rest of the development is shown. Where applicable, the impacts have been added to the background dataset in order to provide information on the cumulative impact of Project activities on the air quality within the local area.

8.1 Odour

Based on a review of available information regarding the proposed activities, no significant odour sources were identified at the Proposed Site.

At the time of writing this report, it has been informed by the proponent that the sewer system will be in place at the beginning of Operations at the Project Site. Therefore no on site waste water storage will be required.

8.2 Dust Deposition Rates

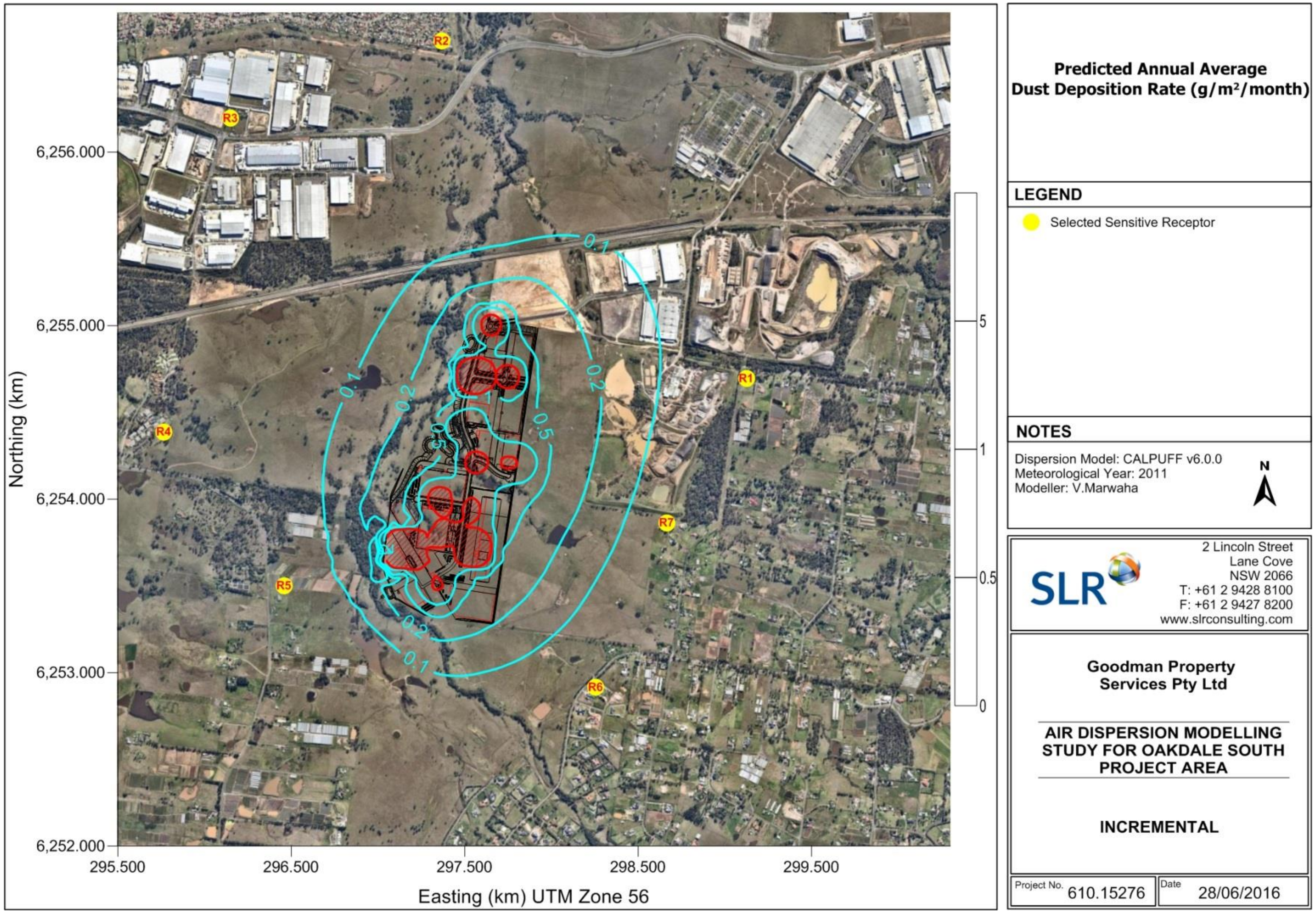
Table 15 presents the incremental annual average dust deposition rates predicted at surrounding representative sensitive receptors. It is noted that the predicted cumulative annual average dust deposition rates at all receptors are below the relevant OEH guideline (<75% of the criterion).

Contour plots of the predicted incremental annual average dust deposition rates are presented in **Figure 11**.

Table 15 Predicted Annual Average Dust Deposition Rates at Sensitive Receptors

Receptor ID	**Annual Average Dust (g/m^2/month)**					
	3B	**3A**	**4A**	**Rest of OSE**	**Background**	**Cumulative**
R1	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
R2	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
R3	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
R4	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
R5	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
R6	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
R7	<0.1	<0.1	<0.1	<0.1	2.9	<3.4
Criterion	**2**	**2**	**2**	**2**		**4**

Figure 11 Predicted Incremental Annual Average Dust Deposition Rates – Operation



8.3 Particulates (as TSP)

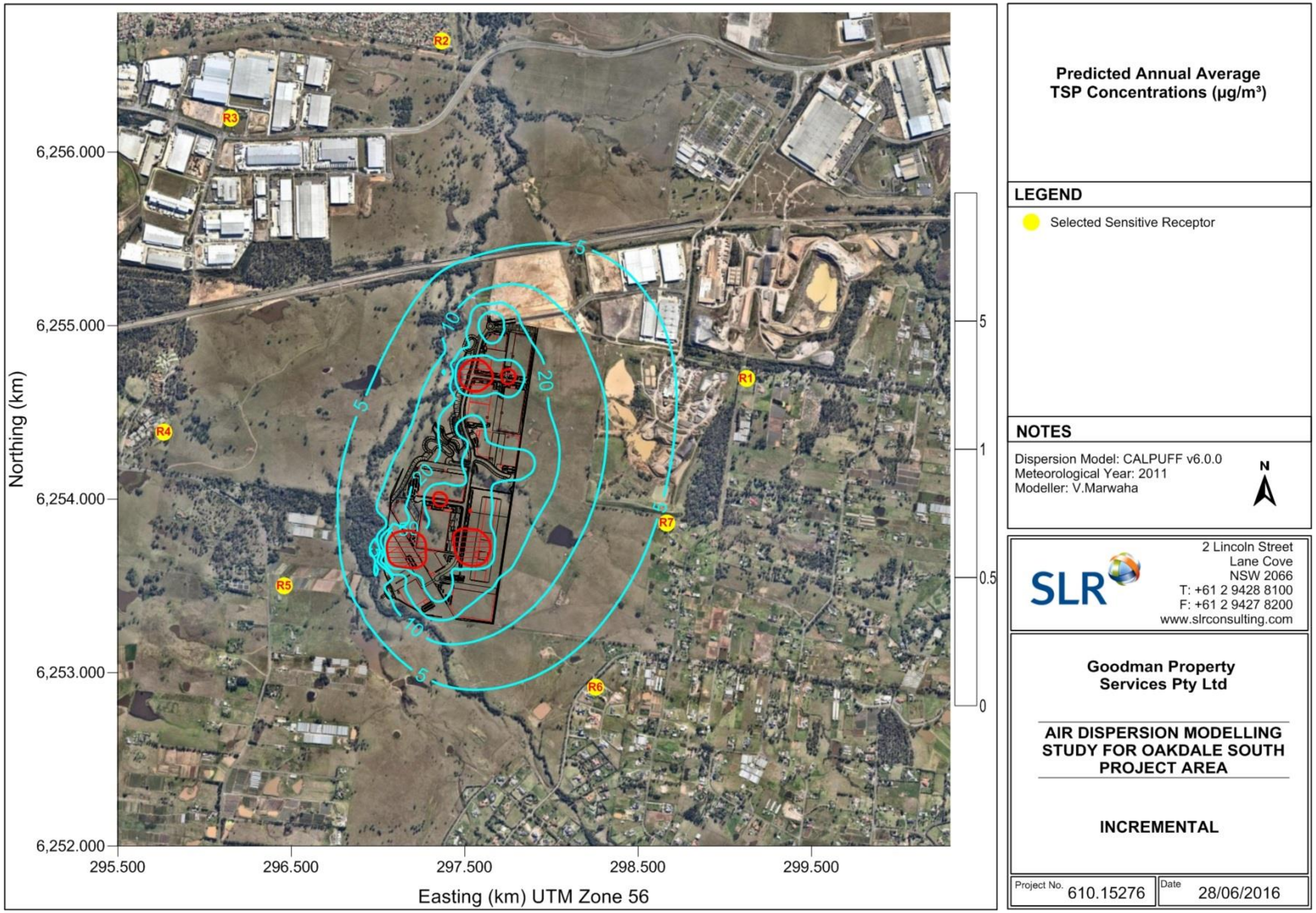
Table 16 presents the incremental and cumulative annual average TSP concentrations predicted at surrounding representative sensitive receptors. It can be observed from **Table 16** that the predicted cumulative annual average TSP concentrations at all receptors are well below the relevant OEH guideline (<40% of the criterion).

Contour plots of the predicted incremental annual average TSP concentrations are presented in **Figure 12**.

Table 16 Predicted Annual Average TSP Concentrations at Sensitive Receptors

Receptor ID	Annual Average TSP (µg/m^3)					
	3B	**3A**	**4A**	**Rest of OSE**	**Background**	**Cumulative**
R1	0.2	0.3	0.9	0.8	29.4	31.7
R2	0.1	0.1	0.3	0.2	29.4	30.1
R3	0.1	0.1	0.3	0.2	29.4	30.0
R4	0.1	0.1	0.3	0.2	29.4	30.0
R5	0.2	0.2	0.6	0.5	29.4	30.8
R6	0.2	0.3	0.9	0.9	29.4	31.7
R7	0.4	0.4	1.4	1.3	29.4	32.9
Criterion						**90**

Figure 12 Predicted Incremental Annual Average TSP Concentrations - Operation



8.4 Particulates (as PM_{10})

To assess the maximum cumulative 24-hour average PM_{10} concentrations at each of the identified sensitive receptors, a contemporaneous analysis was performed following the Approved Methods. At each receptor, each individual incremental prediction was added to the corresponding day's measured background concentration at the St. Marys OEH AQMS site to predict the cumulative 24-hour average PM_{10} impacts.

Table 17 presents a summary of the contemporaneous analysis at each receptor listed in **Section 2.3**. It can be observed from **Table 17** that the incremental and cumulative 24-hour average PM_{10} concentrations predicted at each surrounding sensitive receptor as a result of operational emissions are well below the relevant OEH guideline. Therefore it is concluded that the proposed operations are unlikely to cause any additional exceedences of the guideline at these locations.

Table 17 Summary of 24-Hour PM_{10} Cumulative Impact Analysis – Operation

Receptor ID	Maximum 24 hour Average PM_{10} ($\mu g/m^3$)					
	3B	**3A**	**4A**	**Rest of OSE**	**Background**	**Cumulative**
R1	0.6	0.7	2.3	2.5	35.7	41.8
R2	0.2	0.2	0.7	0.8	37.6	39.5
R3	0.2	0.2	0.7	0.8	37.6	39.5
R4	0.3	0.3	1.1	1.2	37.3	40.2
R5	0.5	0.6	1.9	2.0	37.3	42.3
R6	0.9	1.0	3.2	3.4	37.3	45.7
R7	1.2	1.3	4.2	4.5	33.4	44.6
Criterion						**50**

Table 18 presents a summary of the incremental and cumulative annual average PM_{10} concentrations predicted at each identified sensitive receptor location. It can be observed from **Table 18** that the incremental annual average PM_{10} impacts predicted as a result of the proposed operations are minimal and that the cumulative annual average PM_{10} concentrations predicted at all surrounding sensitive receptor locations are well below the relevant OEH guideline.

Table 18 Predicted Maximum Annual Average PM_{10} Concentrations at Sensitive Receptors – Operation

Receptor ID	Annual Average TSP ($\mu g/m^3$)					
	3B	**3A**	**4A**	**Rest of OSE**	**Background**	**Cumulative**
R1	0.1	0.1	0.5	0.5	14.7	16.0
R2	<0.1	<0.1	0.1	0.1	14.7	<15.1
R3	<0.1	<0.1	0.1	0.1	14.7	<15.1
R4	<0.1	<0.1	0.1	0.1	14.7	<15.1
R5	0.1	0.1	0.3	0.3	14.7	15.4
R6	0.1	0.2	0.5	0.6	14.7	16.1
R7	0.2	0.2	0.8	0.8	14.7	16.7
Criterion						**25**

Contour plots of the maximum 24-hour and annual average incremental PM_{10} concentrations are presented in **Figure 13** and **Figure 14**.

Figure 13 Maximum Predicted Incremental 24-Hour Average PM_{10} Concentrations – Operation

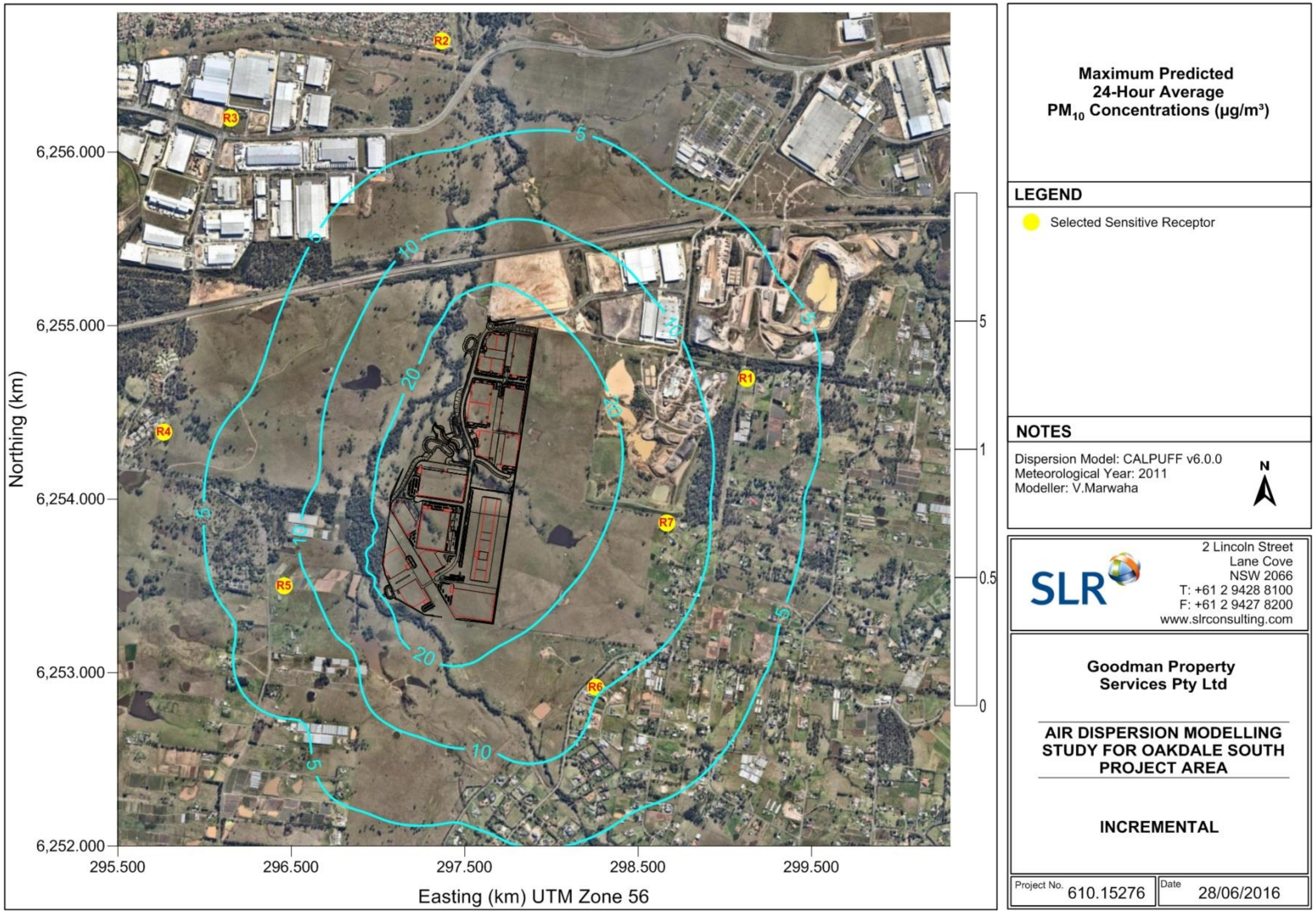
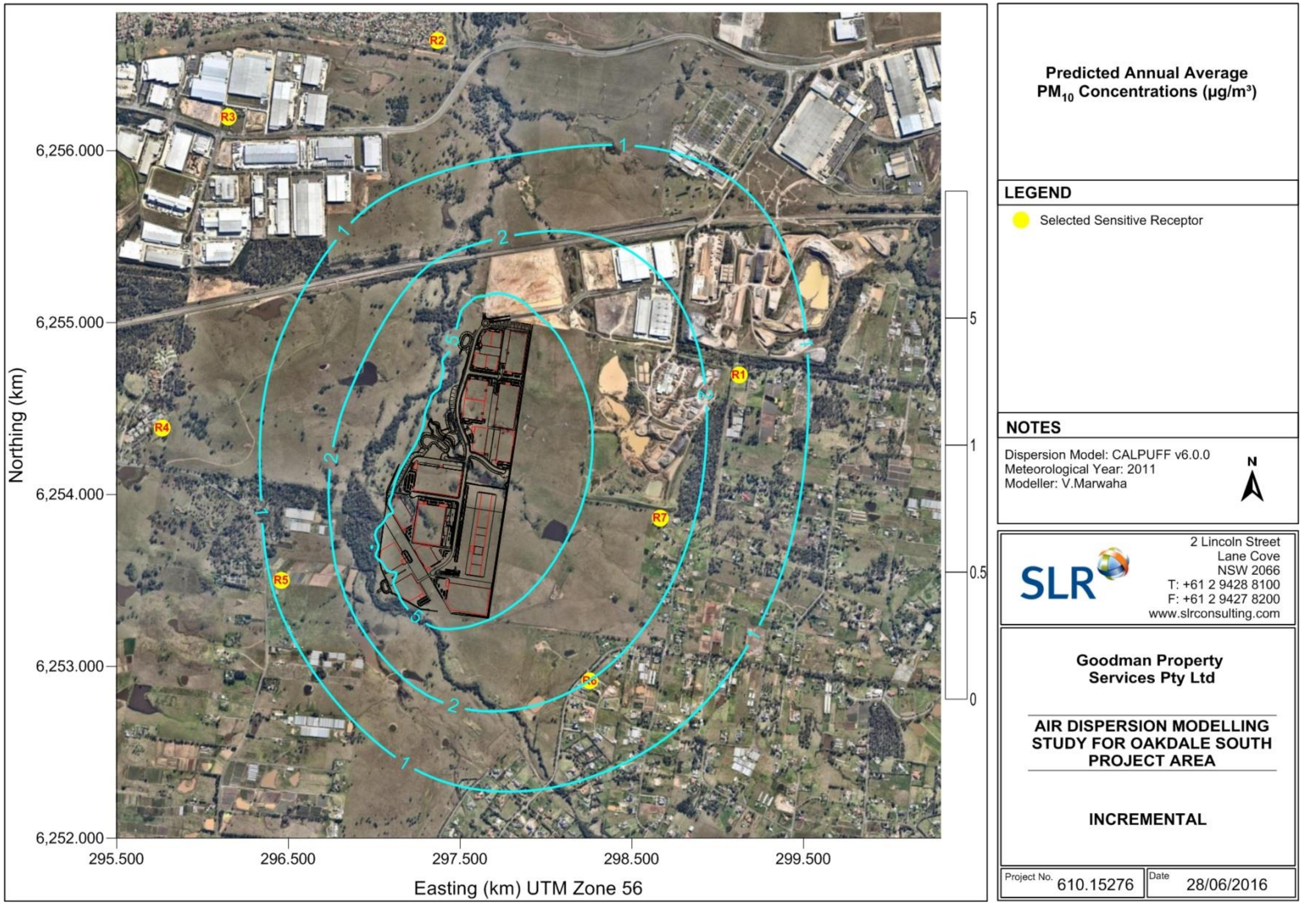


Figure 14 Predicted Incremental Annual Average PM_{10} Concentrations - Operation



8.5 Particulates (as $PM_{2.5}$)

Table 19 and **Table 20** show the predicted incremental impacts for 24-hour and annual average $PM_{2.5}$ concentrations respectively at each receptor identified in **Section 2.3**. The maximum 24-hour average and annual incremental $PM_{2.5}$ concentrations contour plots are presented in **Figure 15** and **Figure 16** respectively.

It can be observed from **Table 19** and **Table 20** that the predicted incremental 24-hour and annual average $PM_{2.5}$ concentrations at all receptors are minimal (<20%) compared to the relevant ambient air quality guideline. Considering the relatively small predicted incremental contribution from the proposed operations, it can be concluded that the proposed operational activities are unlikely to cause any exceedences of relevant 24-hour or annual average $PM_{2.5}$ criteria at any surrounding sensitive receptor locations.

Table 19 Maximum Predicted 24-Hour Average $PM_{2.5}$ Concentrations – Operation

Receptor ID	Maximum 24-hour Average $PM_{2.5}$ (µg/m^3)					
	3B	**3A**	**4A**	**Rest of OSE**	**Background**	**Total Site Incremental Impact**
R1	0.2	0.2	0.7	0.8	NA	1.8
R2	0.1	0.1	0.2	0.3	NA	0.6
R3	0.1	0.1	0.2	0.2	NA	0.5
R4	0.1	0.1	0.3	0.4	NA	0.8
R5	0.1	0.2	0.5	0.6	NA	1.5
R6	0.2	0.3	0.9	1.0	NA	2.4
R7	0.4	0.4	1.2	1.4	NA	3.4
Criterion						**25**

NA – Not available

Table 20 Predicted Annual Average $PM_{2.5}$ Concentrations – Operation

Receptor ID	Annual Average $PM_{2.5}$ (µg/m^3)					
	3B	**3A**	**4A**	**Rest of OSE**	**Background**	**Total Site Incremental Impact**
R1	<0.1	<0.1	0.1	0.2	NA	<0.5
R2	<0.1	<0.1	<0.1	<0.1	NA	<0.4
R3	<0.1	<0.1	<0.1	<0.1	NA	<0.4
R4	<0.1	<0.1	<0.1	<0.1	NA	<0.4
R5	<0.1	<0.1	0.1	0.1	NA	<0.4
R6	<0.1	<0.1	0.1	0.2	NA	<0.5
R7	0.1	0.1	0.2	0.3	NA	0.7
Criterion						**8**

NA – Not available

Figure 15 Maximum Predicted Incremental 24-Hour Average $PM_{2.5}$ Concentrations - Operation

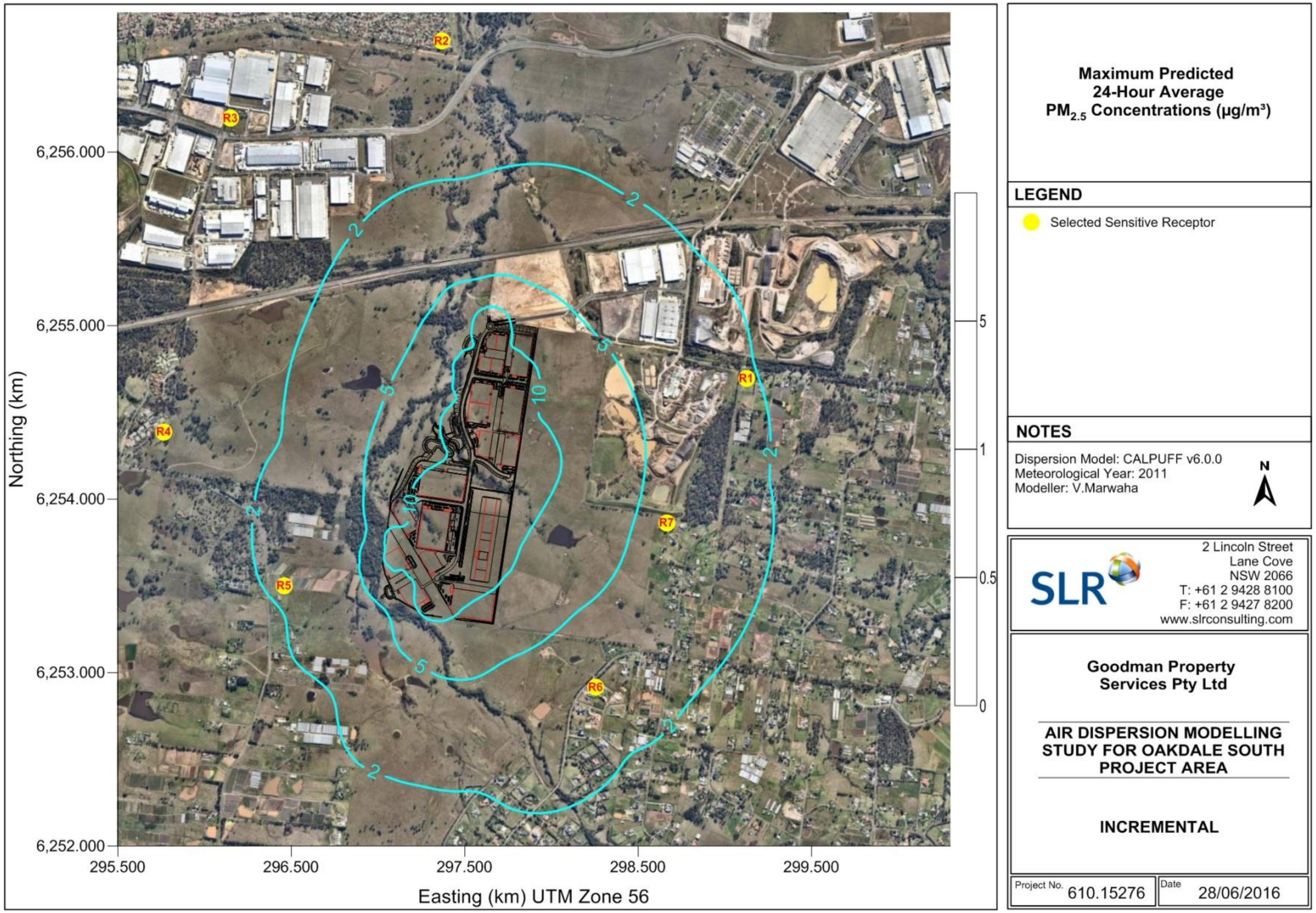
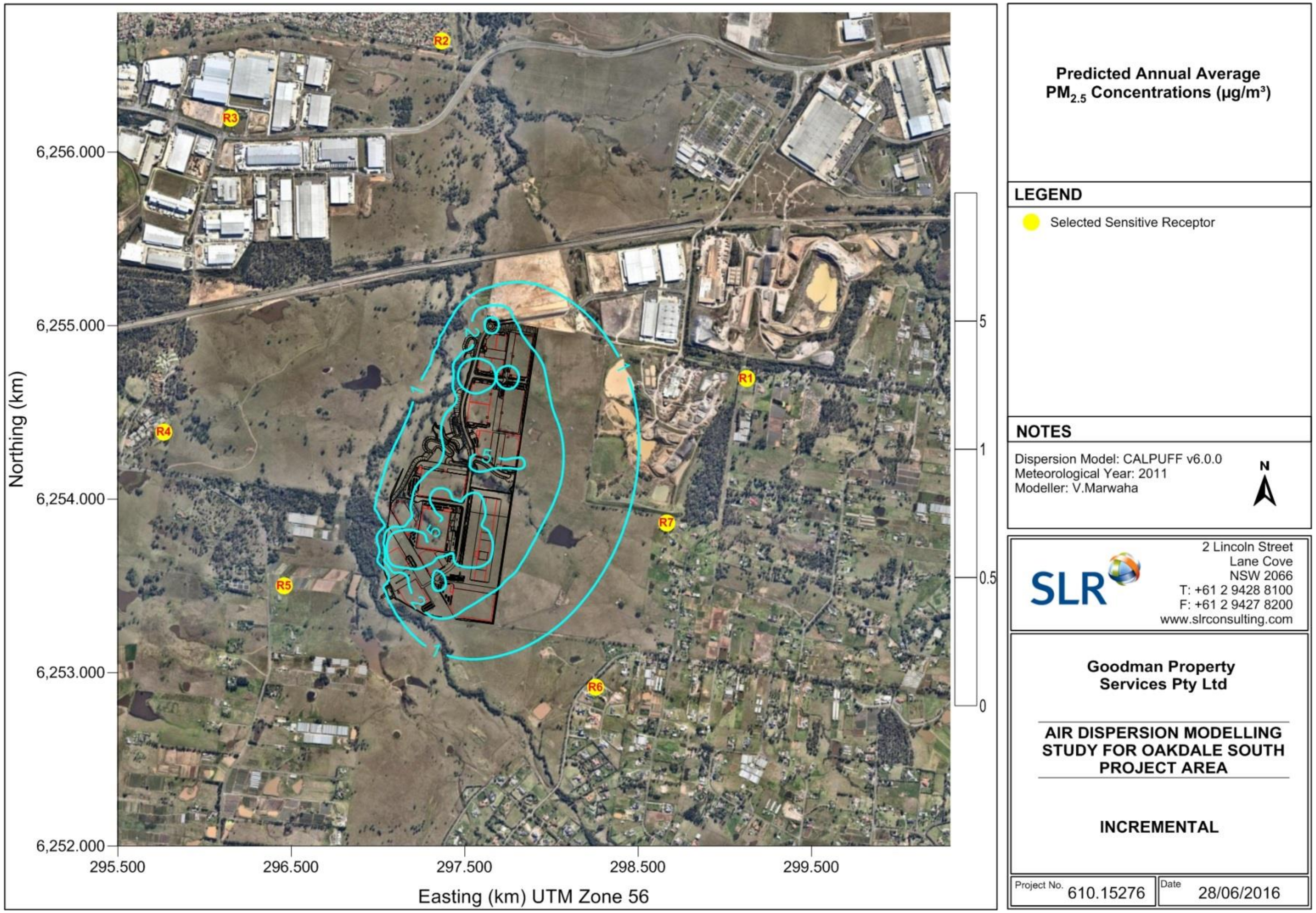


Figure 16 Predicted Incremental Annual Average $PM_{2.5}$ Concentrations - Operation



8.6 Nitrogen Dioxide (NO_2)

Table 21 and **Table 22** presents the incremental and cumulative 1-hour and annual average NO_2 concentrations respectively predicted at each receptor identified in **Section 2.3**. The NO_2 concentrations are estimated using the predicted NO_X concentrations and the OLM method, as prescribed by the Approved Methods.

The results presented in **Table 21** show that the predicted cumulative 1-hour and annual average NO_2 concentrations are well below the relevant OEH criteria at all receptors.

Table 21 Predicted Maximum 1-Hour NO_2 Concentrations at Sensitive Receptors

Receptor ID	Maximum 1-hour Average NOx (µg/m^3)				NO_2 (µg/m^3)
	3B	3A	4A	Rest of OSE	Cumulative
R1	5.1	5.1	5.1	61.3	124.6
R2	2.5	2.5	2.5	30.4	94.9
R3	1.8	1.8	1.8	22.0	94.3
R4	2.4	2.4	2.4	28.8	97.8
R5	5.4	5.4	5.4	64.9	144.0
R6	7.1	7.1	7.1	85.4	125.3
R7	6.8	6.8	6.8	81.1	131.9
Criterion					**246**

Table 22 Predicted Annual Average NO_2 Concentrations at Sensitive Receptors

Receptor ID	Annual Average NOx (µg/m^3)				NO_2 (µg/m^3)
	3B	3A	4A	Rest of OSE	Cumulative
R1	0.2	0.2	0.2	1.8	43.4
R2	<0.1	<0.1	<0.1	0.5	<41.8
R3	<0.1	<0.1	<0.1	0.4	<41.7
R4	<0.1	<0.1	<0.1	0.5	<41.8
R5	0.1	0.1	0.1	1.0	42.4
R6	0.2	0.2	0.2	2.0	43.6
R7	0.2	0.2	0.2	2.8	44.6
Criterion					**62**

The maximum predicted 1-hour and annual average incremental NO_X concentrations are presented as contour plots in **Figure 17** and **Figure 18**. It is noted that due to the incapacity of the dispersion model to incorporate OLM calculations, only incremental NO_X concentrations are presented in the contour plots.

Figure 17 Maximum Predicted Incremental 1-Hour Average NO_X Concentrations - Operation

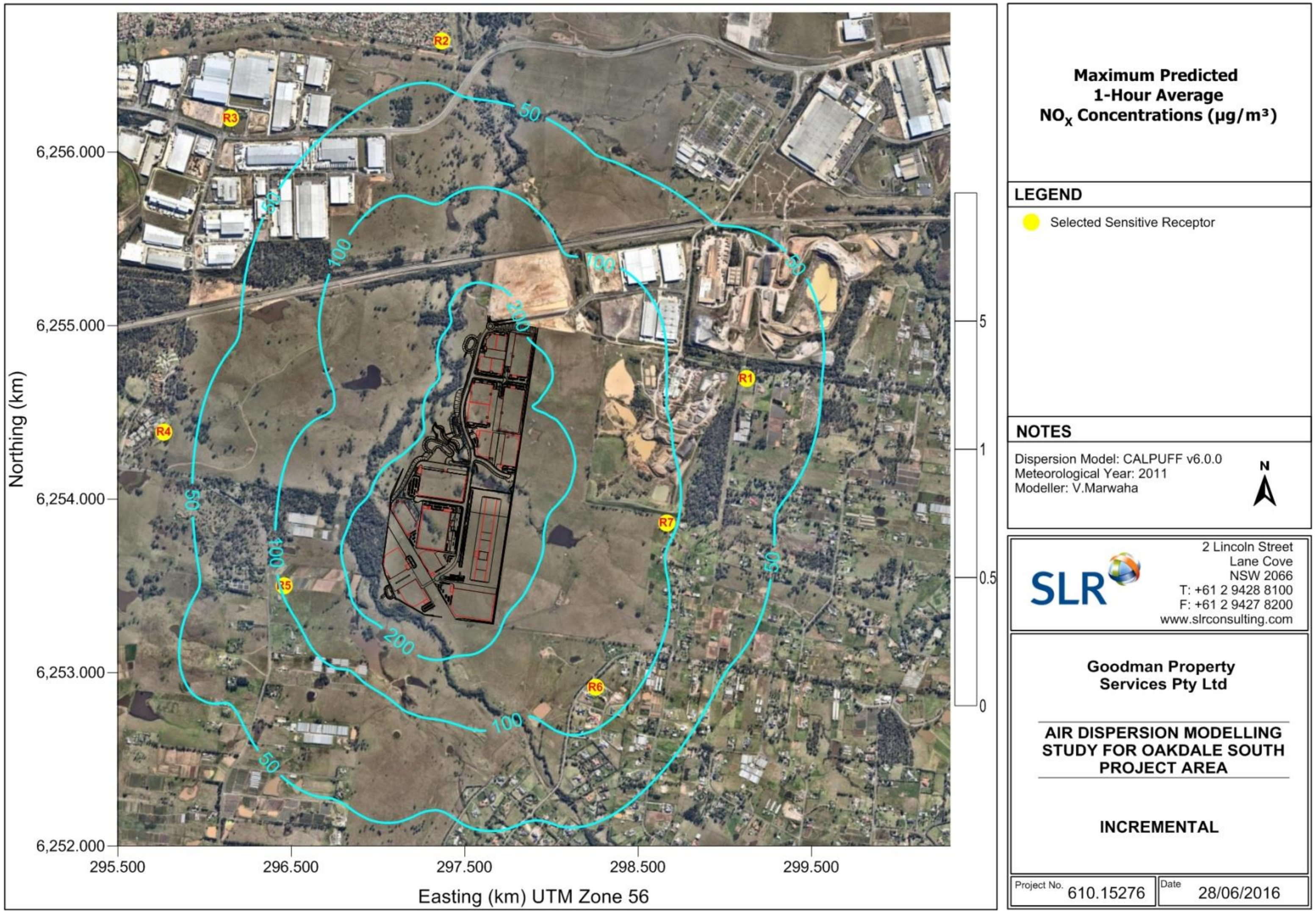
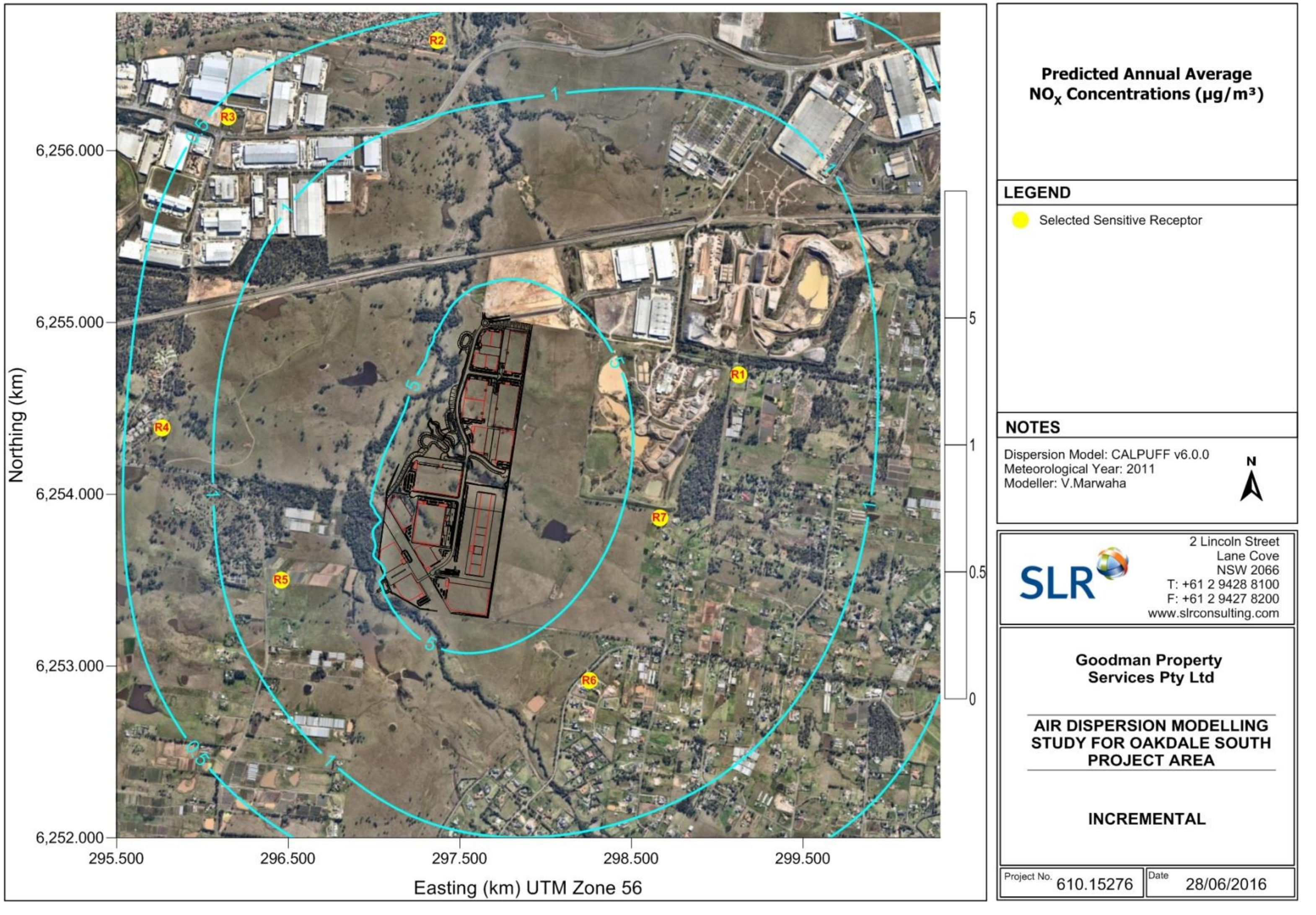


Figure 18 Predicted Incremental Annual Average NO_X Concentrations - Operation



9 MITIGATION MEASURES FOR CONSTRUCTION PHASE

9.1 Nuisance Dust Control Measures

Ambient dust emissions from wheel-generated dust, excavation and rehabilitation, demolition, clearing and grading, truck loading and unloading, and wind erosion areas will be the primary focus of dust control during construction works at the Project construction site. Typically, emissions from these processes can be minimised through the implementation of water spraying, particularly during periods of heavy on-site activity.

Other dust mitigation measures that may be implemented during the construction phase include:

- Removal of silt and other material from around erosion and sediment control structures to ensure deposits do not become a dust source.
- Amending dust-generating construction activities during adverse wind conditions blowing in the direction of sensitive receptors. A wind sock should be made available and be visible to all areas of an active construction site to assist in reactive response procedures (i.e. to determine when construction activities should be postponed, minimised or relocated in windy conditions).
- Minimising the use of material stockpiles and ensuring 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.
- Erecting solid screens or barriers around dusty activities or the site boundary to prevent windblown dust being transported offsite.
- Ensuring fine powder materials are delivered in enclosed tankers and stored in silos to prevent escape of material during delivery.
- Ensuring smaller bags of powder materials are sealed after use and stored appropriately.
- Minimising drop heights from loading shovels and other loading / unloading equipment and using fine water sprays on such equipment where appropriate.
- Ensuring vehicles entering/exiting the site are covered to prevent escape of materials during transport.
- Reducing vehicle speeds on site will reduce wheel generated dust.
- If dirt track out is causing problems, avoiding dry sweeping of large areas. Manual brushing of the truck’s flanks and wheels could be implemented as a further precaution.

9.2 Plant and Machinery

Control measures relating to plant and machinery that may be utilised during the construction phase include:

- Ensuring vehicles and machinery are maintained in accordance with manufacturer’s specifications.
- Minimising truck queuing and unnecessary trips through logistical planning of materials delivery and work practices.
- Ensure all vehicles switch off engines when stationary so that there are no idling vehicles.
- Fixed plant should be located as far from local receptors as practicable.

9.3 Fuel Storage Areas

The storage of fuels should be performed in accordance with the relevant Australian Standards. The Australian Institute of Petroleum's document, *Guidance for the Safe Above Ground Fuel Storage on Farms and Industrial Sites* (AIP GL12-2003), provides a succinct summary of the above requirements and a checklist to appraise whether the fuel storage facility is deigned and operated in compliance with the relevant Australian Standards. The Australian Capital Territory (ACT) Government has also produced a guidance document entitled *Environmental guidelines for service station sites and hydrocarbon storage* (2011), which provides further clarification and advice concerning environmental monitoring around fuel storage facilities.

Control measures that may be implemented during the construction phase will be referenced from the above AS, and will include:

- Storage areas for all liquids should be appropriately bunded.
- Spill kits including absorbing materials should be provided nearby handling and storage areas.
- Where possible, the delivery of liquid fuels should utilise reciprocal feeds, so that tank vapours are displaced into the delivery vehicle rather than being emitted to the atmosphere as a fugitive emission.
- Empty containers should be managed and disposed of in an appropriate manner.

9.4 Contaminated Soils

Where there is the potential for invasive ground works to cause the emission of odorous ground vapour or contaminated dust particles, these impacts would need to be specifically addressed in the Construction Environmental Management Plan (CEMP), and an odour assessment and management procedure developed to manage the risks of off-site odour impacts and/or health impacts from the volatilisation of ground contaminants.

General odour mitigation measures and controls that may be implemented during the construction phase include:

- Restricting ground invasive works to between the hours of 7am and 6pm, Monday to Friday, and between the hours of 8am and 1pm on Saturdays.
- Keeping excavation surfaces moist.
- Using appropriate covering techniques to cover excavation faces or stockpiles.
- Use of soil vapour extraction systems and regular monitoring of discharges.

9.5 Site Management

Air emissions associated with all construction activities should also be managed through compliance with the Construction Environmental Management Plan (CEMP). The CEMP should be implemented so that:

- The works are conducted in a manner that minimises the generation of air emissions.
- The effectiveness of the controls being implemented is monitored.
- Additional measures are implemented where required.

Construction contractors should also undertake daily environmental inspections of their works and worksite. The daily environmental inspection reports should include the below observations, with remedial or corrective actions noted (as appropriate).

  - Visual inspection of dust generation.

Any remedial or corrective actions should be reported to the Site Manager as soon as is practicable.

- Ensure roads leaving the site are free of soil, and prevention of soil tracking onto the road network.
- Inspection of the erosion and sediment controls.
- Inspection of the waste storage areas.
- Inspection of any rehabilitated areas (where relevant).
- Ensure all hazardous goods, including fuel and oil, are adequately stored or bunded.
- Ensure spill kits are appropriately located and stocked.

9.6 Complaints Handling

- An effective complaints logging system should be maintained by Council and the Construction Contractor to monitor complaints, to effectively manage any requests for information or respond to any public concerns in relation to the proposed redevelopment activities throughout the construction phase, and to ensure identified incidents are dealt with through investigation and implementation of corrective treatments.

10 CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR) was commissioned by Goodman Property Services (Australia) Pty Ltd (The Proponent) to perform an Air Quality Impact Assessment (AQIA) for the proposed development of the Oakdale South Estate (hereafter 'the Project site'), NSW. The AQIA (SLR 2015) formed a part of the Development Application (DA) for the Oakdale South Industrial Estate (SSDA 6917).

The SSDA 6917 approval was granted by the Department of Planning and Environment (DP&E) in early August 2016. Since approval, the Proponent has proposed some amendments to the concept masterplan driven by the end user priorities.

This current report forms a part of a Section 96 Application (S96) to the original approved concept masterplan and Stage 1 DA for the Oakdale South Industrial Estate (SSDA 6917). The aim of this assessment was to quantify the impacts due to the revised concept masterplan, including operations of the specific end users of some of the precincts within the Project Site along with the rest of the Project Site (Lots 3B, 3A and 4A).

The potential dust-generating and fuel combustion activities for the proposed future operations have been identified and potential emissions from these activities were estimated based on available Project information and emission factors from the literature. These estimated emissions from the proposed operations have then been assessed through a dispersion modelling.

The predicted results indicate that the proposed operational activities would comply with all relevant OEH ambient air quality criteria at all representative surrounding sensitive receptors. Also, the cumulative pollutant concentrations due to operations of the revised concept masterplan were within 18% of the predicted concentrations due to the original approved concept masterplan.

It is noted that the predicted impacts are based on worst case operational activity data and assume worst case background concentrations. As a result, all predictions in the assessment should be viewed as conservatively high, with levels expected to be lower during normal operation of the facility.

It is concluded that the proposed changes to the concept masterplan for the Project Site and the operations of the end users (Lots 3B, 3A and 4A), are not expected to result in any adverse air quality impacts at the identified sensitive receptors and that changes in air quality do not represent a constraint for the operation of the Project Site.

11 REFERENCES

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