APPENDIX 19

AIR QUALITY IMPACT ASSESSMENT

Air Quality Impact Assessment

Expansion of Existing Mainfreight Facility

Prestons, NSW

Report Number 630.10523

16 April 2013

Goodman Property Services (Aust) Pty Lth
Level 6 / 189 Kent Street Sydney New South Wales 2000

Version: Revision 0

Air Quality Impact Assessment

Expansion of Existing Mainfreight Facility

Prestons, NSW

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Suite 7, 240 Waterworks Road Ashgrove QLD 4060 Australia

(PO Box 844 Ashgrove QLD 4060 Australia)
T: 61 7 3858 4800   F: 61 7 3858 4801
E: brisbane@slrconsulting.com   www.slrconsulting.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
630.10523	Revision 0	16 April 2013	X Ling	K Lawrence	F Rahaman

Executive Summary

SLR Consulting Australia Pty Ltd (SLR Consulting) has conducted an Air Quality Impact Assessment (AQIA) at the request of Goodman Property Services (Aust) Pty Ltd on behalf of Mainfreight for their proposed extension of an existing warehouse at 30-50 Yarrawa Street, Prestons, NSW.

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 atmospheric dispersion modelling techniques. The predicted results indicate that the proposed operational activities would comply with all relevant OEH ambient air quality criteria at all surrounding sensitive receptors.

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.

Due to the irregularity and short duration of activities during the construction phase, a quantitative assessment has not been performed for these activities. Instead a range of control measures to minimise fugitive dust emissions have been outlined for inclusion in the Construction Environmental Management Plan for the project.

The principal source of GHG emissions at from the site is electricity usage, although the totals are relatively small when compared to NSW and Australian emissions totals.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned to perform an Air Quality Impact Assessment (AQIA) for Goodman Property Services (Aust) Pty Ltd on behalf of Mainfreight for a proposed extension of an existing warehouse located at 30-50 Yarrawa Street, in Prestons, Sydney, NSW.

The NSW Office of Environment and Heritage (OEH) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (DEC, 2005) (hereafter the 'Approved Methods') outline the requirements for conducting such AQIA, as follows:

- Description of local topographic features and sensitive receptor locations (**Section 2.1** and **Section 2.3** respectively).
- Establishment of air quality assessment criteria (**Section 3.2**).
- Analysis of climate and dispersion meteorology for the region (**Sections 5**).
- Description of existing air quality environment (**Section 3**).
- Compilation of a comprehensive emissions inventory for proposed operations (**Section 4**).
- Preparation of an air quality impact assessment report comprising the above.

Potential emissions to air from the proposed construction and operational phases of the project have been identified, and where appropriate estimated emission rates have been calculated using relevant emission factors published in the literature. These emission rates have then been used in an air dispersion modelling study to assess the potential for any off-site air quality impacts in the surrounding area.

2 PROJECT OVERVIEW

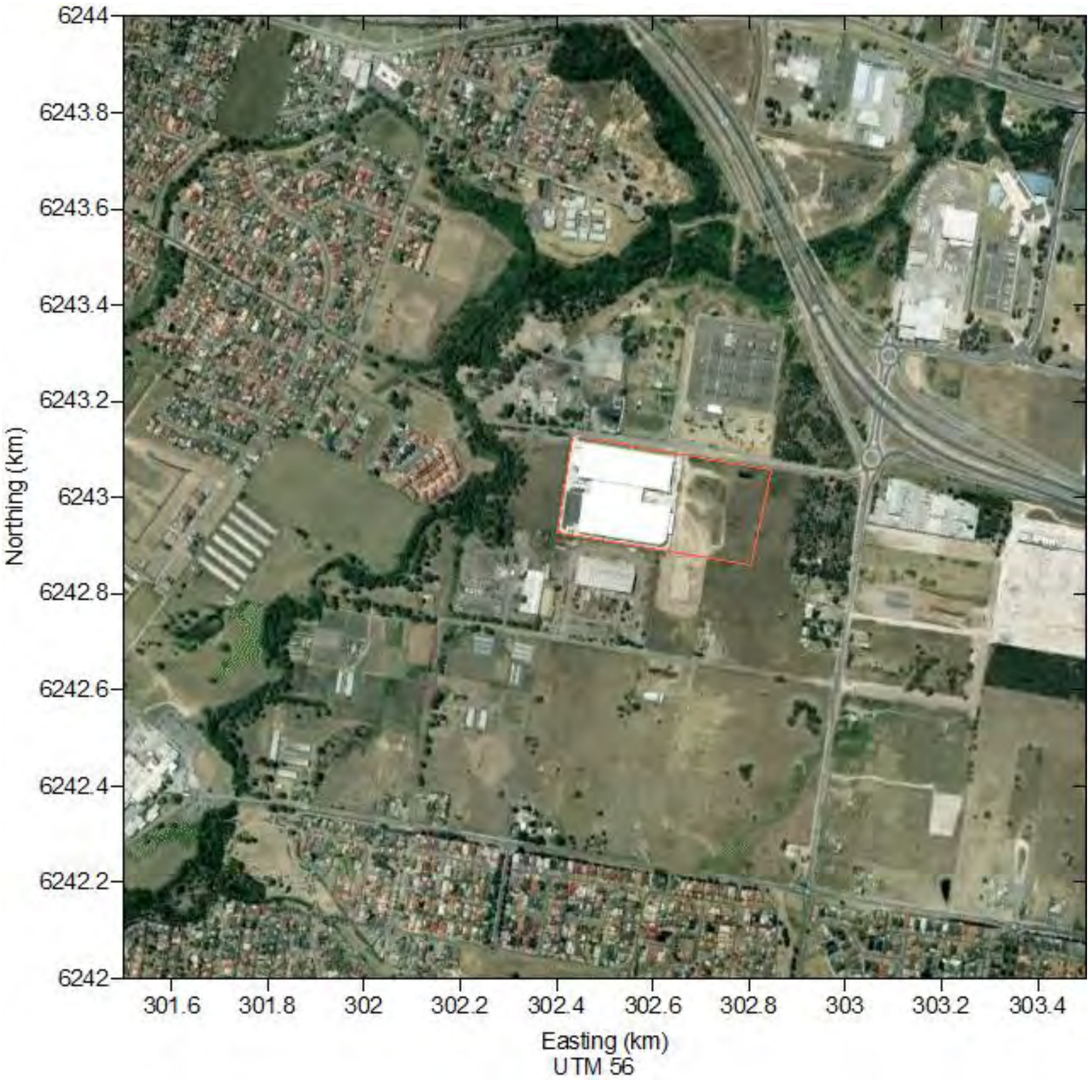
Mainfreight is planning to extend their existing warehouse and distribution centre at Prestons to consolidate with operations from their Moorebank site. The distribution centre provides pick up, storage, dispatch and delivering services from individual parcels to shipping containers, including the storage of dangerous goods. The proposed expansion is expected to improve the operational efficiency and safety, as well as provide economic benefits across the Sydney Region as result of reducing transportation costs between two separate sites.

2.1 Local Setting

The development site is located in the Liverpool Council planned industrial zone, at 30-50 Yarrawa Street, Prestons. The site at 50 Yarrawa Street is the existing Mainfreight Distribution Centre, and the proposed plan is to expand this facility immediately east onto 30-40 Yarrawa Street. The location of the site with respect to adjacent commercial and nearby residential properties is shown in **Figure 1.**

The site is located in an area of relatively flat terrain, with Gabramtta Creek to the west, Yarrawa Street on the northern boundary, Bernera Road to the east and Yarrunga Street to the south.

Figure 1 Local Setting of the Proposed Project



2.2 Proposed Project Activities

2.2.1 Construction Phase

An additional area of approximately 13,260 m^2 of new warehouse space will be built adjoining the eastern elevation of the existing Mainfreight warehouse at the rear of the site. The proposal also involves an extension of approximately 1,710 m^2 to the existing Transport Shed and a 2,350 m^2 central breezeway linking the two buildings to enable all-weather loading/unloading facilities. In addition, a range of hardstand and driveway areas will also be constructed, including approximately 15,910 m^2 of new hardstand area, 7,505 m^2 of heavy duty areas and 4,317 m^2 of light duty areas, replacement of the driveway off Yarrawa Street, and relocation of the existing truck wash bay to the eastern end of the expansion area.

Construction activities will occur over a 30 week period.

2.2.2 Operational Activities

Operational activities that will occur on the expanded site are receipt, storage and dispatch of products as part of the company's bulk warehousing and distribution services. This 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 QA purposes; and
- Product embellishment.

Due to the nature of the site operations, heavy vehicle movements are involved in most of activities. Available activity data for the proposed operational phase are presented in **Table 1**.

Table 1 Operational Data

Variable	Data
Proposed hours of operation	24 hours/day, with heavy vehicle movements only between the hours of 5am – 7pm
Expected number of vehicle movements per day	20 Semi-trailers 30 B-Doubles and 100 Pickup and Delivery vehicle (PUDs) (4,6,8,12 Tonnes)
Peak hours of operation and deliveries	6am – 9am & 3pm – 6pm
Peak hourly traffic frequency	9 Semi-trailers 14 B-Doubles and 67 PUDs
On-site travel distances	0.25 km for PUDs 1 km for B-Doubles and semi-trailers

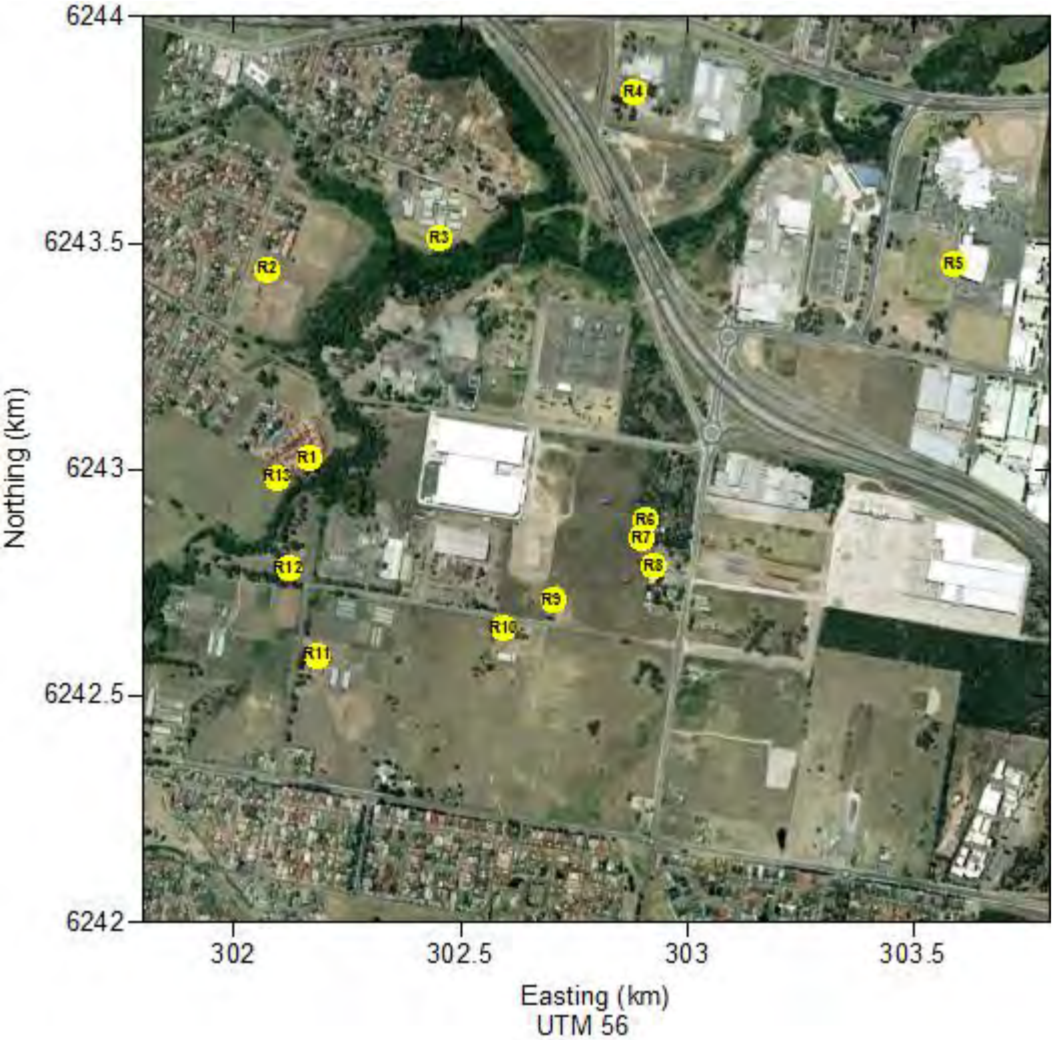
2.3 Sensitive Receptors

The site is surrounded by commercial buildings and residential houses. A summary of sensitive receptors identified for analysis in the air quality assessment is provided in **Table 2** and the locations of these receptors are presented in **Figure 2**.

Table 2 List of Identified Nearby Sensitive Receptors

ID	Easting (m)	Northing (m)	Description
R1	302,164	6,243,024	Residential
R2	302,074	6,243,443	Residential
R3	302,454	6,243,512	School
R4	302,884	6,243,834	Commercial
R5	303,590	6,243,452	Commercial
R6	302,908	6,242,887	Residential
R7	302,899	6,242,847	Residential
R8	302,925	6,242,785	Residential
R9	302,703	6,242,712	Residential
R10	302,596	6,242,648	Residential
R11	302,185	6,242,589	Residential
R12	302,121	6,242,783	Residential
R13	302,097	6,242,983	Residential

Figure 2 Identified Sensitive Receptor Locations



3 AIR QUALITY ENVIRONMENT

3.1 Pollutants of Interest

The main emissions to air during the construction phase will be emissions of particulate matter, or dust, from demolition, excavation, and material handling activities. Dust from construction activities will be controlled using the best management practices outlined in **Section 7**.

During the operational phase, wheel-generated dust and combustion emissions from heavy vehicles idling at the site are likely to be the main sources of emissions. On this basis, particulate emissions from traffic movements on paved roads and oxides of nitrogen (NO_x) emissions from vehicle exhausts are likely to be the key pollutants of concern from the proposed operations.

3.2 Criteria Applicable to Air Quality

The NSW Office of Environment and Heritage (OEH) has established ground level air quality impact assessment criteria for key air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the 2005 document, the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (the Approved Methods). A summary of the impact assessment criteria relevant to this project is given in **Table 3**.

Table 3 Project Specific Impact Assessment Criteria

Pollutant	Averaging Period	Concentration (µg/m³)	Source
PM_{10}	24-hours	50	NEPC (1998)
	Annual	30	EPA (1998)
Total suspended particulates (TSP)	Annual	90	NHMRC (1996)
NO_2	1-hour	246	NEPC (1998)
	Annual	62	NEPC (1998)

3.3 Background Air Quality

In order to conduct a cumulative impact assessment, monitoring data from the nearest OEH monitoring site at Liverpool, located approximately 4 km slightly northeast of the proposed site, was used in this assessment. Due to its close proximity to the project site, the ambient environment at the selected monitoring site is likely to be similar to the environment surrounding the project site and has therefore been considered as representative of background levels for this assessment.

Due to a high proportion of missing data being recorded during recent years (2011 and 2012) by the OEH monitoring stie at Liverpool, ambient monitoring data for the 2010 calendar year was used for this assessment.

The 24-hour average PM_{10} concentrations recorded at Liverpool during 2010 are presented in **Figure 3**. The data indicate that the highest 24-hour average PM_{10} concentration at the Liverpool monitoring site was 41.1 µg/m³, recorded on 27th November 2010. The annual average PM_{10} concentration recorded at the Liverpool monitoring site during 2010 was 17.0 µg/m³.

TSP is not measured at the Liverpool monitoring site, therefore the modelling results have been presented as incremental impacts only.

The 1-hour average NO_2 concentrations recorded at Liverpool during 2010 are presented in **Figure 4**. The data indicate that the highest 1-hour average NO_2 concentration at the Liverpool monitoring site was 99.6 µg/m³, recorded at 8pm on 23rd April 2010. The annual average NO_2 concentration recorded at the Liverpool monitoring site during 2010 was 19.3 µg/m³.

Figure 3 24–Hour Average PM_{10} Concentration (µg/m³) at Liverpool 2010

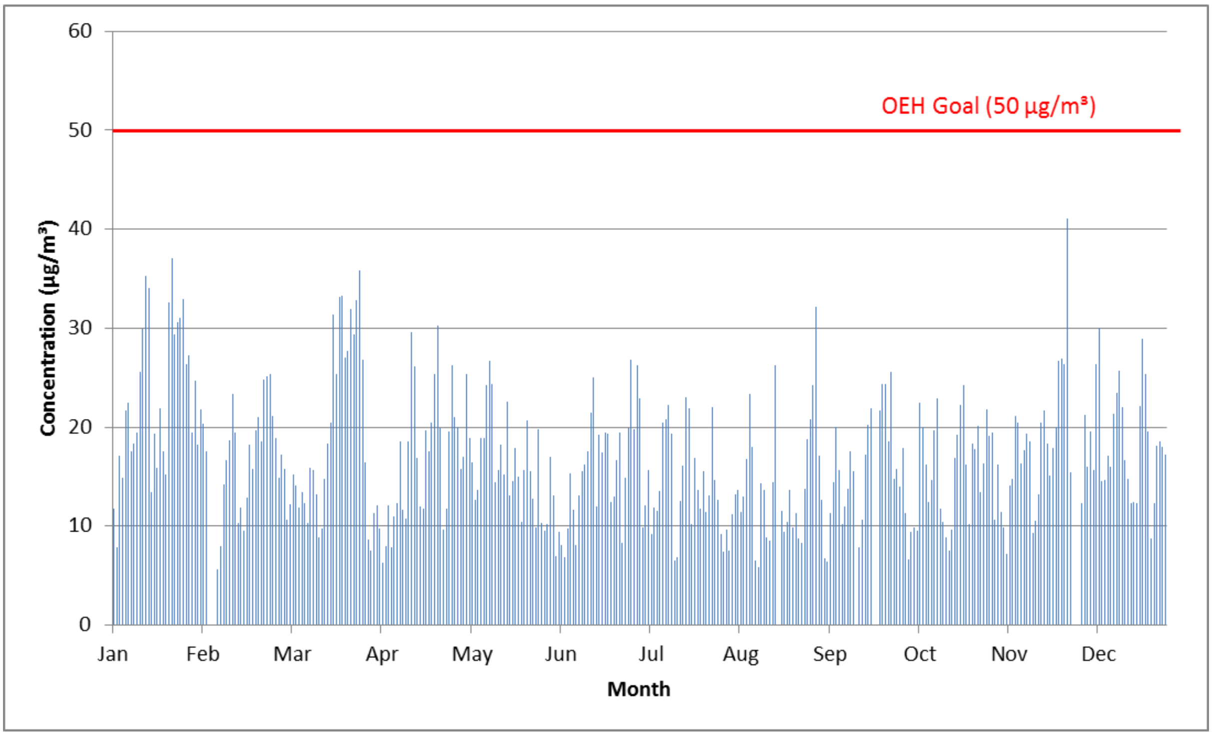
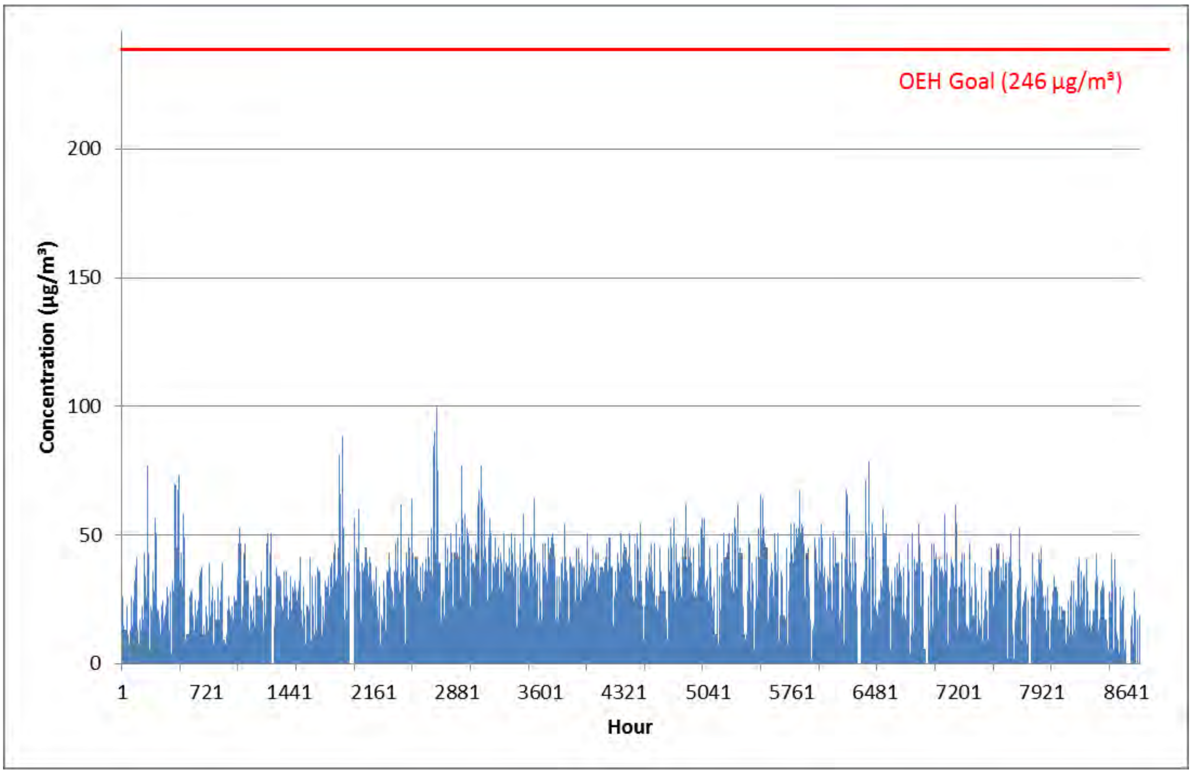


Figure 4 1–Hour Average NO_2 Concentration (µg/m³) at Liverpool 2010



A summary of the background air quality data used to assess the cumulative impacts for the proposed operations is presented in **Table 4**.

Table 4 Background Air Quality Data (2010)

Pollutant	Averaging Period	Data (µg/m³)
$PM_{2.5}$	24 – hour	21.8
	Annual	6.3
PM_{10}	24 – hour	41.1
	Annual	17.0
NO_2	1 – hour	Hourly varying
	Annual	19.3

4 EMISSION ESTIMATION

As stated in **Section 3.1**, wheel-generated dust from on-site traffic movements and combustion emissions from vehicles idling on-site are the main sources of potential emissions for the proposed operational phase. All on-site traffic movement areas will be sealed and the operational fleet includes pick-up and delivery vehicles (PUD's), semi-trailers and B-Doubles.

Potential particulate emissions from on-site traffic movements were estimated using the emission factor equations sourced from the United States Environmental Protection Agency (US EPA) AP-42 Emission Factor Handbook (US EPA 2006). 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). Emission factors used in estimating potential emissions from the site are summarised in **Table 5**. The estimated emission rates for on-site operations are presented in **Table 6**.

Table 5 Emission Factors

Activity	Emission Factor Equation	Units	Source	Variables
Wheel generated dust	$EF_{TSP} = 24 \times \left(\frac{SL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - 0.1317$ $EF_{PM10} = 4.6 \times \left(\frac{SL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - 0.1317$	g/VKT	US EPA 2006	SL = road surface silt loading (0.2 g/m²) W = average weight of vehicles (22.5 t for PUD's , 62.5 t for B Doubles and 42.5 t for Semi trailers)
Idling combustion	$EF_{PM10} = 3.68$ $EF_{NOx} = 135$	g/hr	US EPA 2004	

Table 6 Estimated Emission Rates

Pollutant	Emission Rate[1] (kg/hr)
PM_{10}	0.356
TSP	1.70
NO_x	2.43

[1]It has been assumed that up to 20% of the peak hourly traffic numbers will be idling on-site concurrently

5 LOCAL 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 (Oke, 2003; Sturman and Tapper, 2006).

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.

Hourly meteorological data for the 2010 calendar year were sourced from the nearby OEH operated monitoring station at Liverpool NSW. The observational dataset was used to generate a 1-year, hourly, site-representative meteorological file suitable for use in the AUSPLUME model. The 2010 calendar year was used for this modelling to be consistent with the available background pollutant data.

An analysis of the meteorological data used in this assessment is presented in the following sections.

5.1 Wind Conditions

A wind speed frequency plot of the year 2010 for the project site is presented in **Figure 5**. A summary of the 2011 annual wind behaviour for the project site is presented as a wind rose in **Figure 6**. 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 northeast quadrant, occurring over 50% 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.

Figure 5 Wind Speed Frequency Distribution for the Project Site

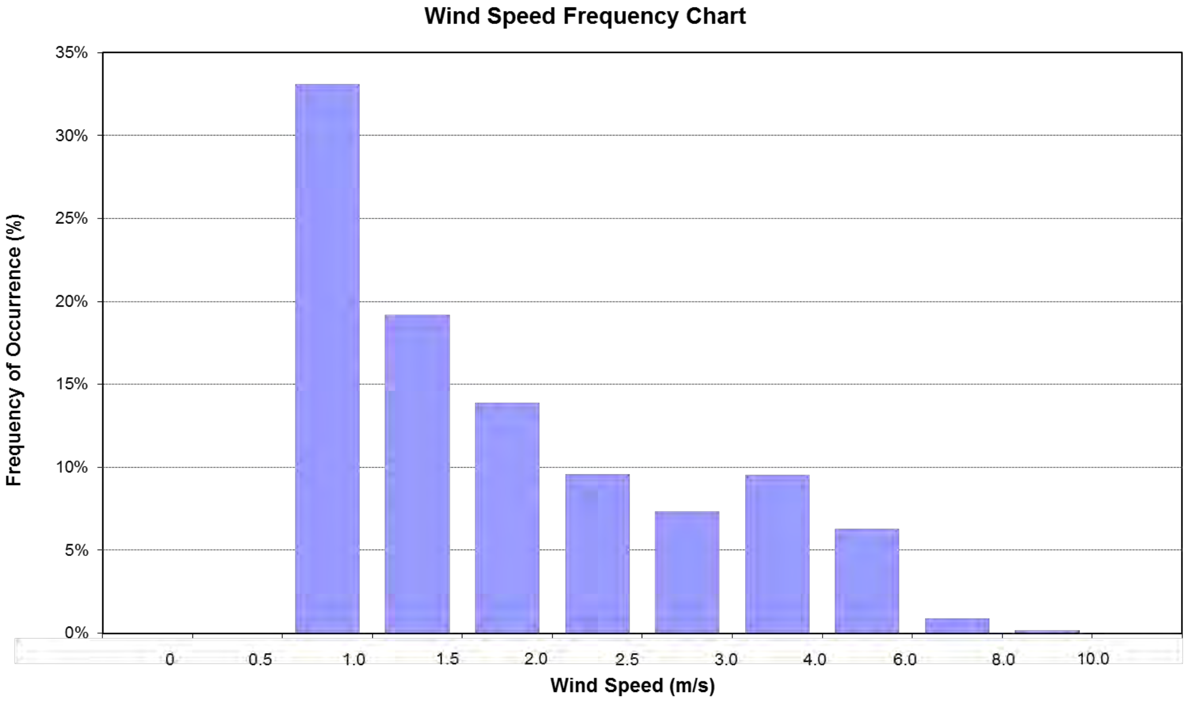
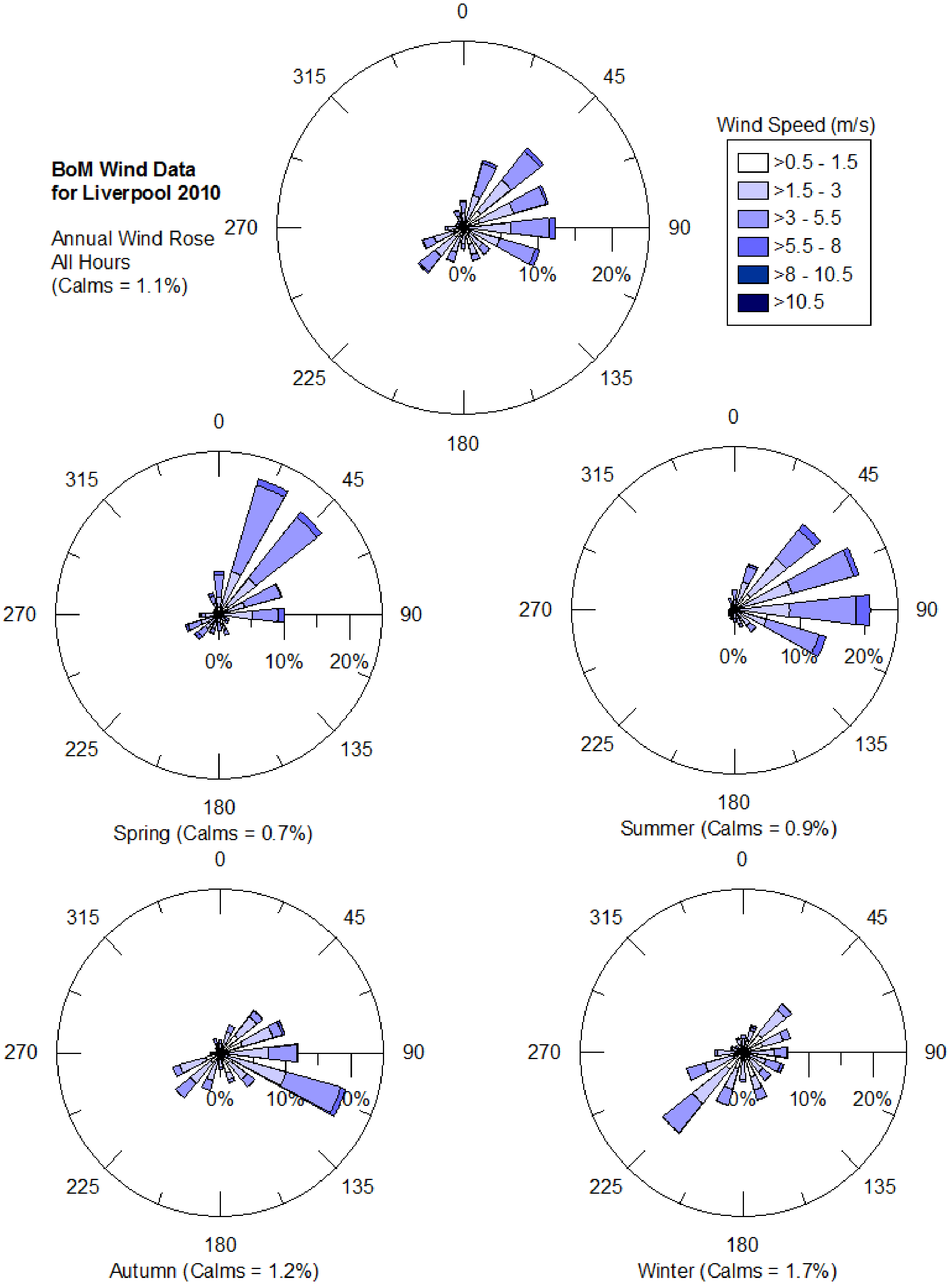


Figure 6 Wind Roses for the Project Site



5.2 Atmospheric Stability

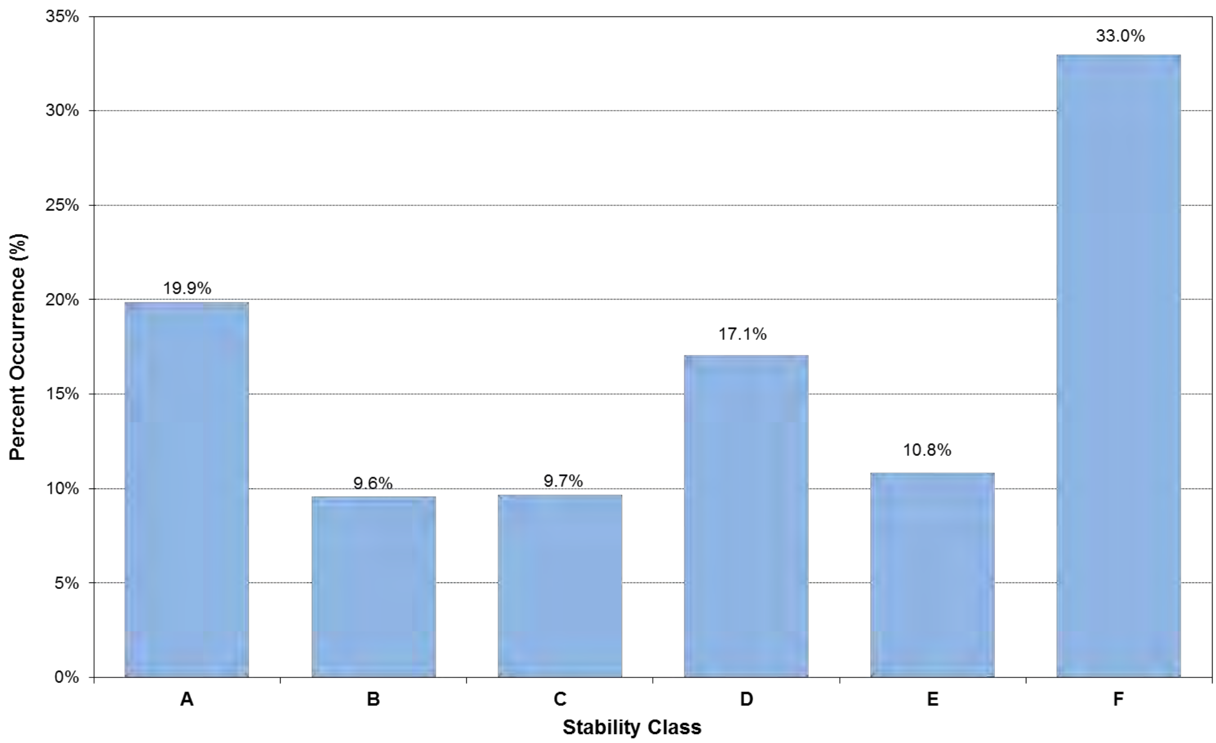
Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability (see **Table 7**). These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models.

The frequency of each stability class at the Project Site during 2010 is presented in **Figure 7**. 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.

Table 7 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

Figure 7 Stability Class Distribution for the Project Site (2010)



6 AIR QUALITY IMPACT ASSESSMENT

The pollutant dispersion modelling carried out in this assessment utilised the Ausplume Gaussian Plume Dispersion Model software developed by EPA Victoria, Version 6.0.

Ausplume is the approved dispersion model for use in the majority of applications in NSW. Default options specified in 'The Approved Methods" have been used to predict the operational-phase air quality impacts at surrounding sensitive receptors. The results of the modelling have been assessed based on compliance with ambient air quality goals set by the NSW OEH.

6.1 PM_{10} Emissions

Table 8 shows the predicted incremental and cumulative impact for 24-hour and annual average PM_{10} concentrations at each receptor identified in **Section 2.3**. It is noted that the cumulative 24 hour average concentrations are based on the sum of the maximum predicted incremental impact and maximum measured background concentrations. This is a highly conservative screening approach as it assumes that the worst case project-related impacts occur at the same time as the peak background levels.

The maximum 24-hour average and annual PM_{10} concentrations contour plots are shown in **Figure 8** and **Figure 9**. The contour plots do not include background and are presented as the incremental impacts from the Project Site only.

It can be observed from **Table 8** that the predicted cumulative 24-hour and annual average PM_{10} concentrations at all receptors are below the relevant ambient air quality guideline. Based on these modelling results, it is concluded that the proposed operational activities are unlikely to cause any exceedences of 24-hour or annual average PM_{10} air quality criteria at any surrounding sensitive receptor locations.

Table 8 Predicted Maximum 24-Hour and Annual Average PM_{10} Concentrations at Sensitive Receptors

Receptor ID	24-Hour Averages		Annual Averages	
	Incremental Impact (µg/m^3)	Cumulative Impact (µg/m^3)	Incremental Impact (µg/m^3)	Cumulative Impact (µg/m^3)
R1	6.7	47.8	0.4	17.4
R2	1.5	42.6	0.2	17.2
R3	1.8	42.9	0.2	17.2
R4	1.4	42.5	0.1	17.1
R5	1.6	42.7	0.1	17.1
R6	7.6	48.7	0.5	17.5
R7	7.4	48.5	0.4	17.4
R8	4.1	45.2	0.3	17.3
R9	2.1	43.2	0.2	17.2
R10	2.1	43.2	0.2	17.2
R11	1.8	42.9	0.1	17.1
R12	2.6	43.7	0.2	17.2
R13	3.5	44.6	0.3	17.3
Assessment Criteria		**50**		**30**

Figure 8 Maximum Predicted Incremental 24-Hour Average PM_{10} Concentrations

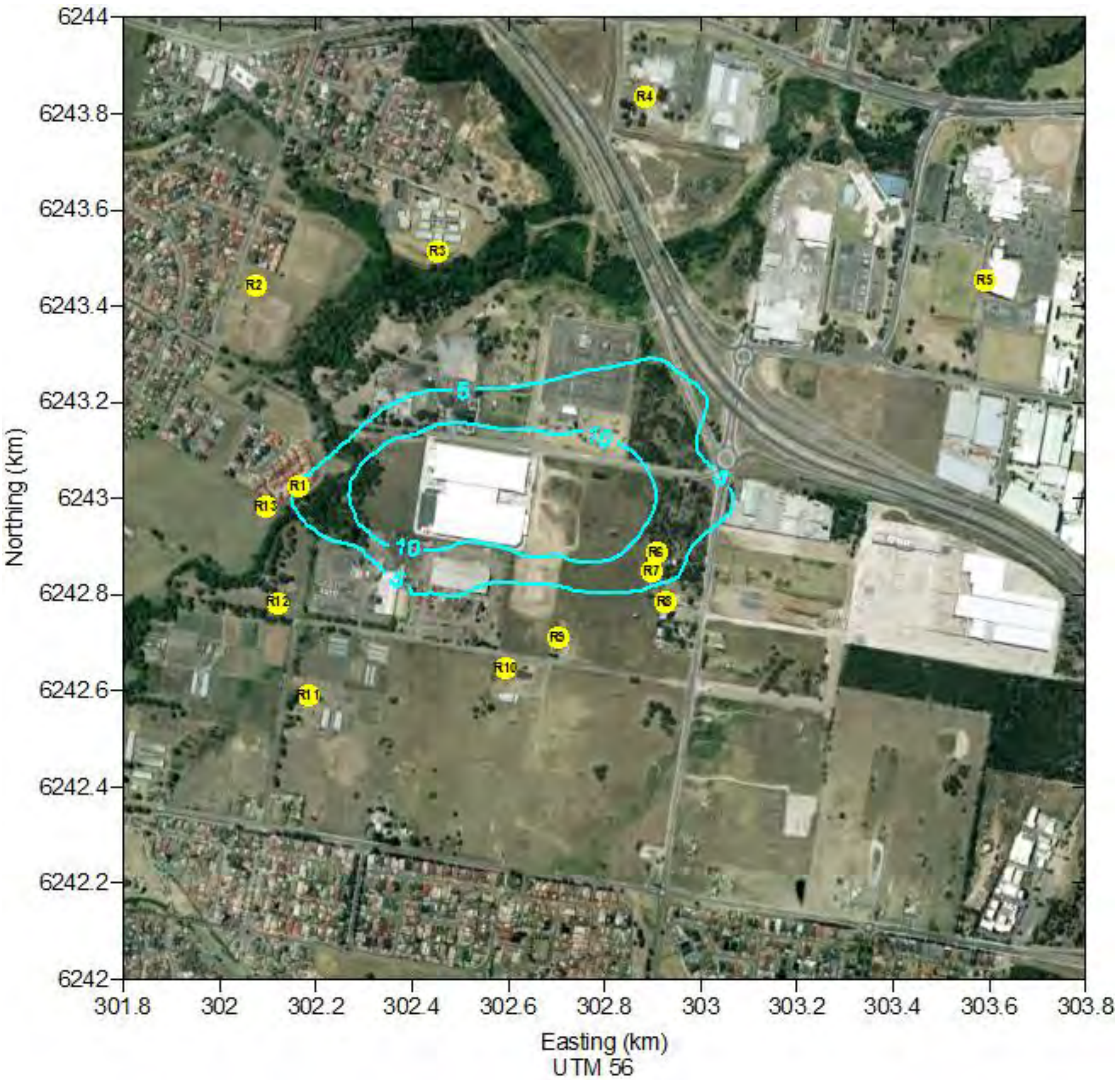
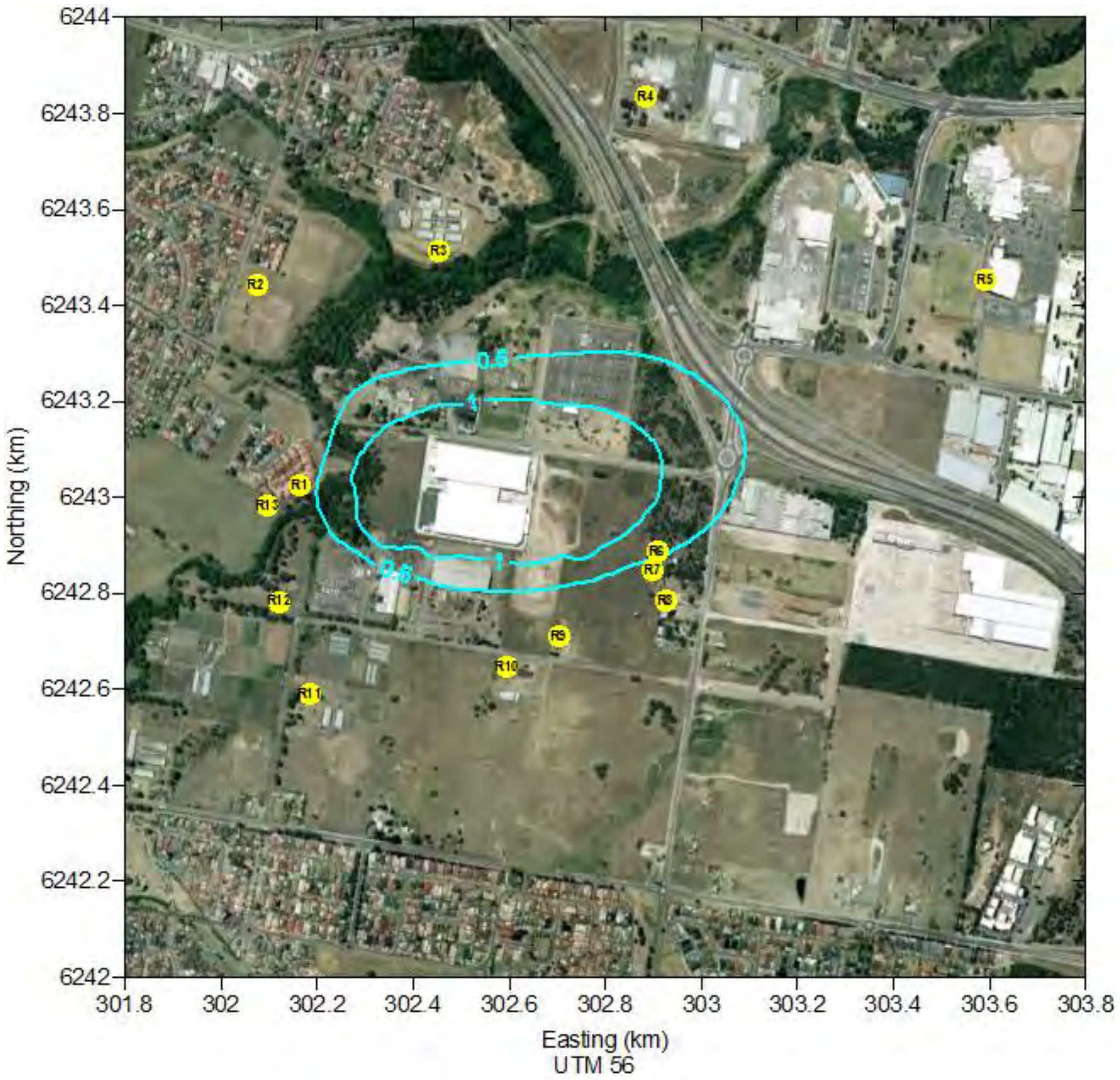


Figure 9 Predicted Incremental Annual Average PM_{10} Concentrations



6.2 TSP Emissions

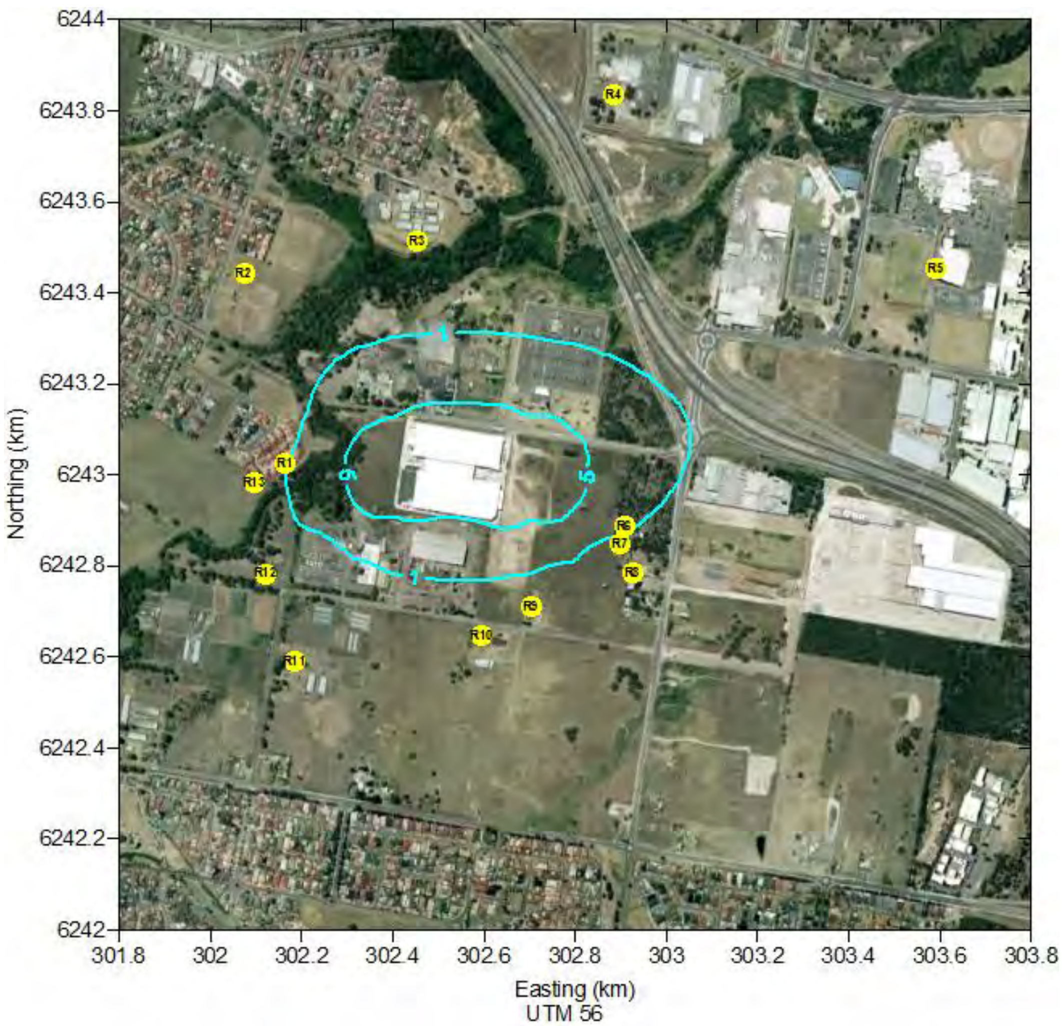
Table 9 presents the predicted incremental annual average TSP concentrations predicted at each receptor identified in Section 2.3. The spatial distribution of the predicted incremental annual average TSP concentrations is presented in **Figure 10**.

It can be observed from **Table 9** that the predicted incremental annual average TSP concentrations at all receptors are negligible in comparison to the ambient air quality guideline. Based on these modelling results, it is concluded that the proposed operational activities are unlikely to cause any exceedences of the annual average TSP criterion at any surrounding sensitive receptor locations.

Table 9 Predicted Annual Average TSP Concentrations at Selected Receptors

Receptor ID	Incremental Impact ($\mu g/m^3$)
R1	1.0
R2	0.2
R3	0.3
R4	0.1
R5	0.1
R6	1.1
R7	0.9
R8	0.5
R9	0.6
R10	0.4
R11	0.2
R12	0.5
R13	0.7
Criterion	**90 (cumulative)**

Figure 10 Predicted Incremental Annual Average TSP Concentrations



6.3 NO_2 Emissions

Table 10 presents the predicted incremental and cumulative 1-hour and annual average NO_2 concentrations at each receptor identified in **Section 2.3**. It is noted that the cumulative concentrations have been calculated using the hourly-varying background concentration file compiled from the observational data recorded by the OEH Liverpool air quality monitoring station. As a conservative approach, 100% conversion of NO_x to NO_2 was applied in predicting the incremental and cumulative impacts from the proposed development at the surrounding sensitive receptor locations.

The predicted maximum 1-hour average incremental and cumulative NO_2 concentrations are presented as contour plots in **Figure 11** to **Figure 14**.

The results indicate that the predicted cumulative 1-hour and annual average NO_2 concentrations at all receptors are below the criteria of 246 µg/m³ and 62 µg/m³ respectively. Based on the modelling results, the proposed operation is unlikely to give rise to any exceedences of air quality criteria for NO_2 at any surrounding sensitive receptor locations.

Table 10 Predicted Maximum 1-Hour and Annual Average NO_2 Concentrations at Selected Receptors

ID	1-Hour Average		Annual Average	
	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)	Incremental Impact (µg/m³)	Cumulative Impact (µg/m³)
R1	186	231	0.9	20.2
R2	71	115	0.4	19.7
R3	58	130	0.4	19.7
R4	38	100	0.4	19.5
R5	37	100	0.3	19.7
R6	210	240	1.3	20.6
R7	186	226	1.0	20.3
R8	141	166	0.7	20.0
R9	106	138	0.6	19.9
R10	81	130	0.4	19.7
R11	62	122	0.2	19.6
R12	94	142	0.4	19.8
R13	168	192	0.7	20.0
Criteria		**246**		**62**

Figure 11 Maximum Predicted Incremental 1-Hour Average NO_2 Concentrations

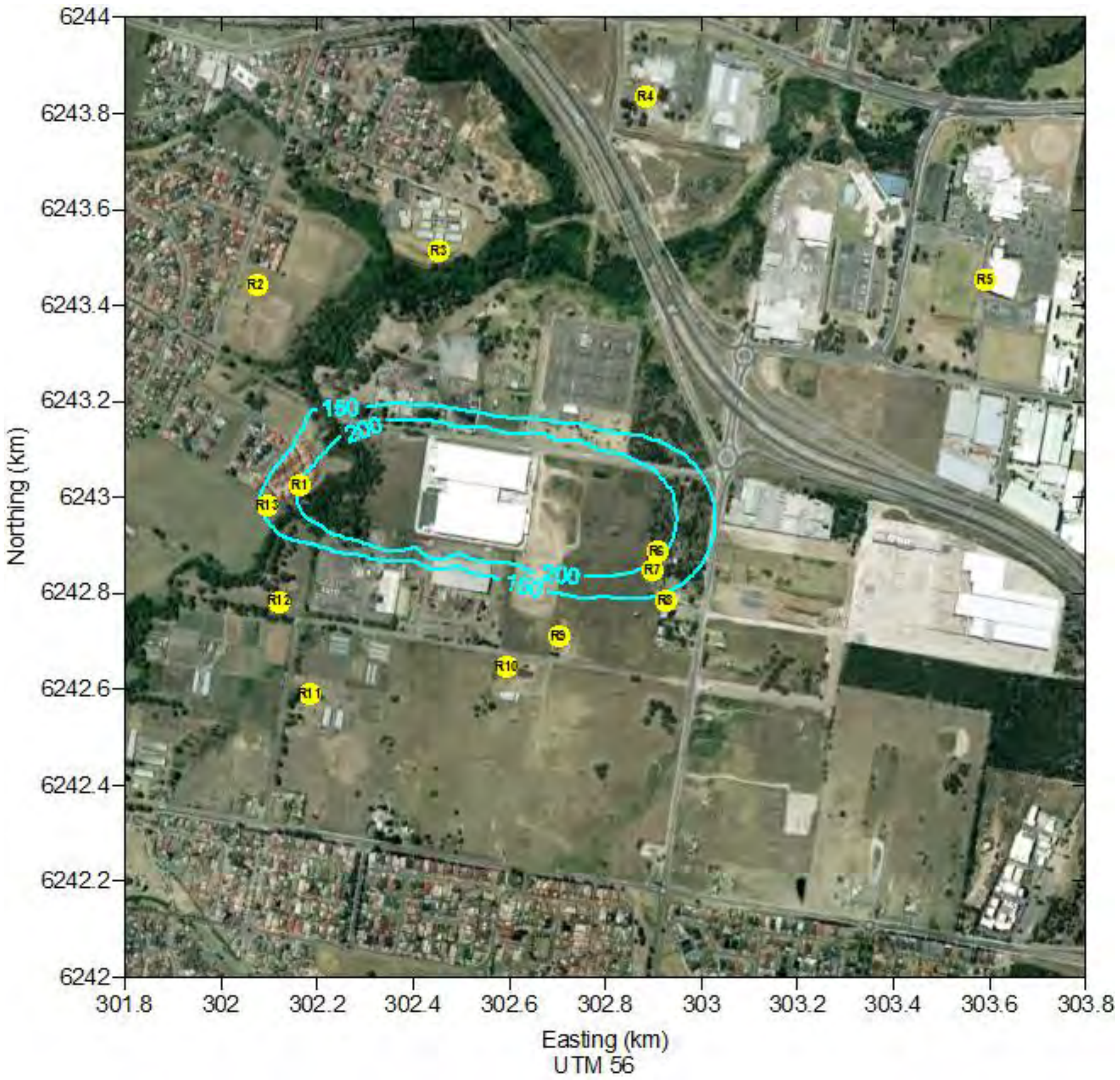


Figure 12 Maximum Predicted Cumulative 1-Hour Average NO_2 Concentrations

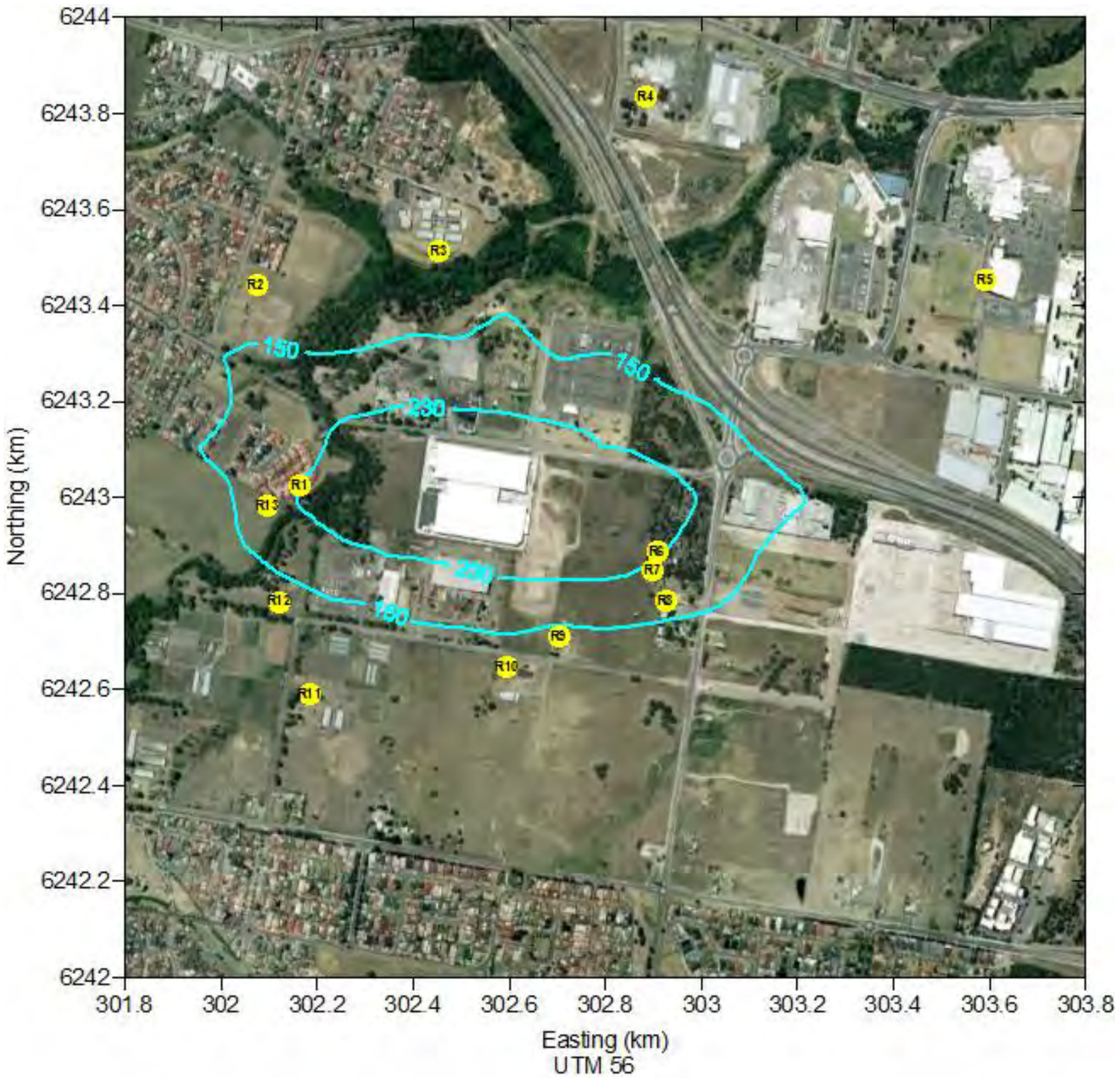


Figure 13 Predicted Incremental Annual Average NO_2 Concentrations

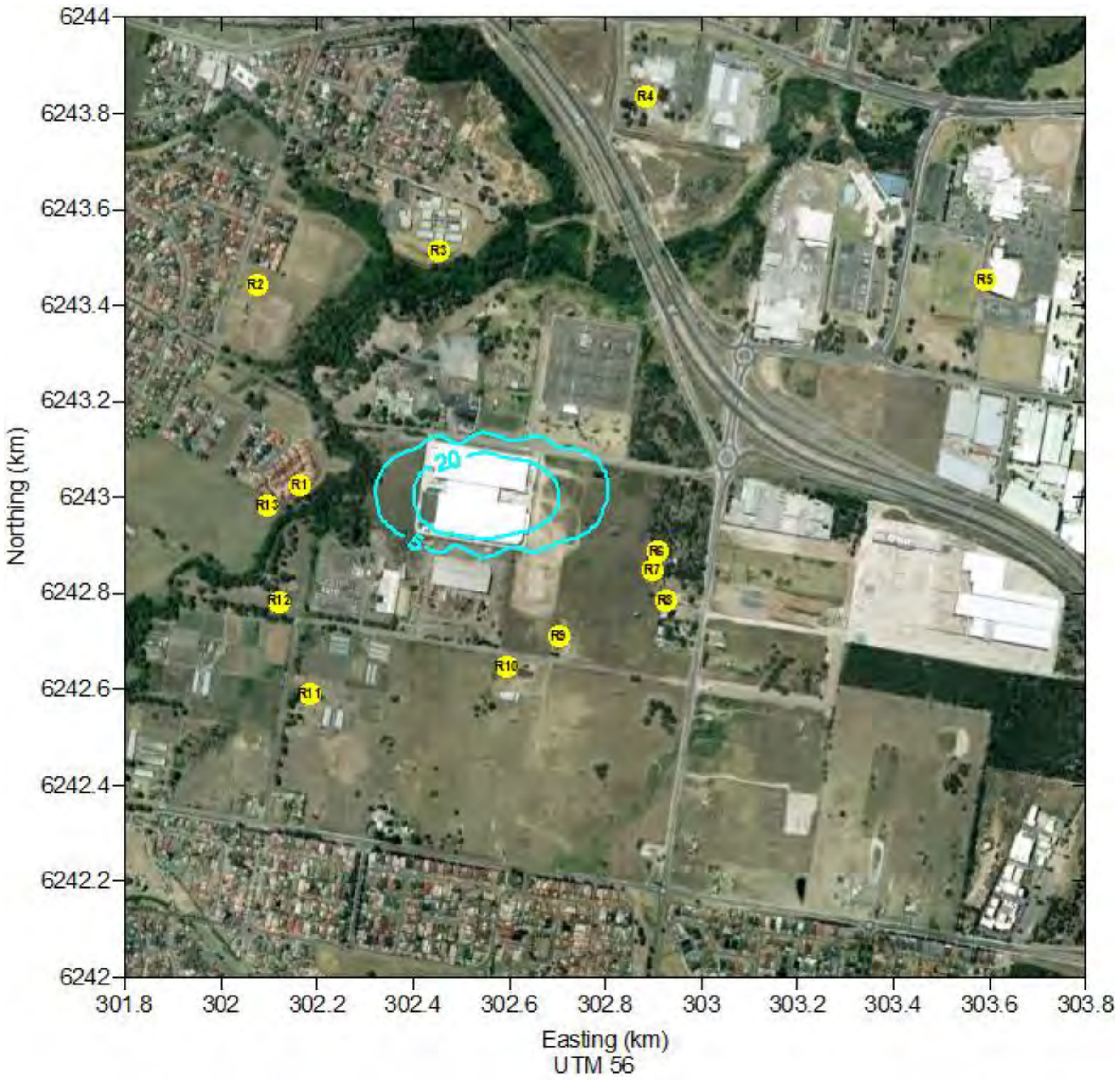
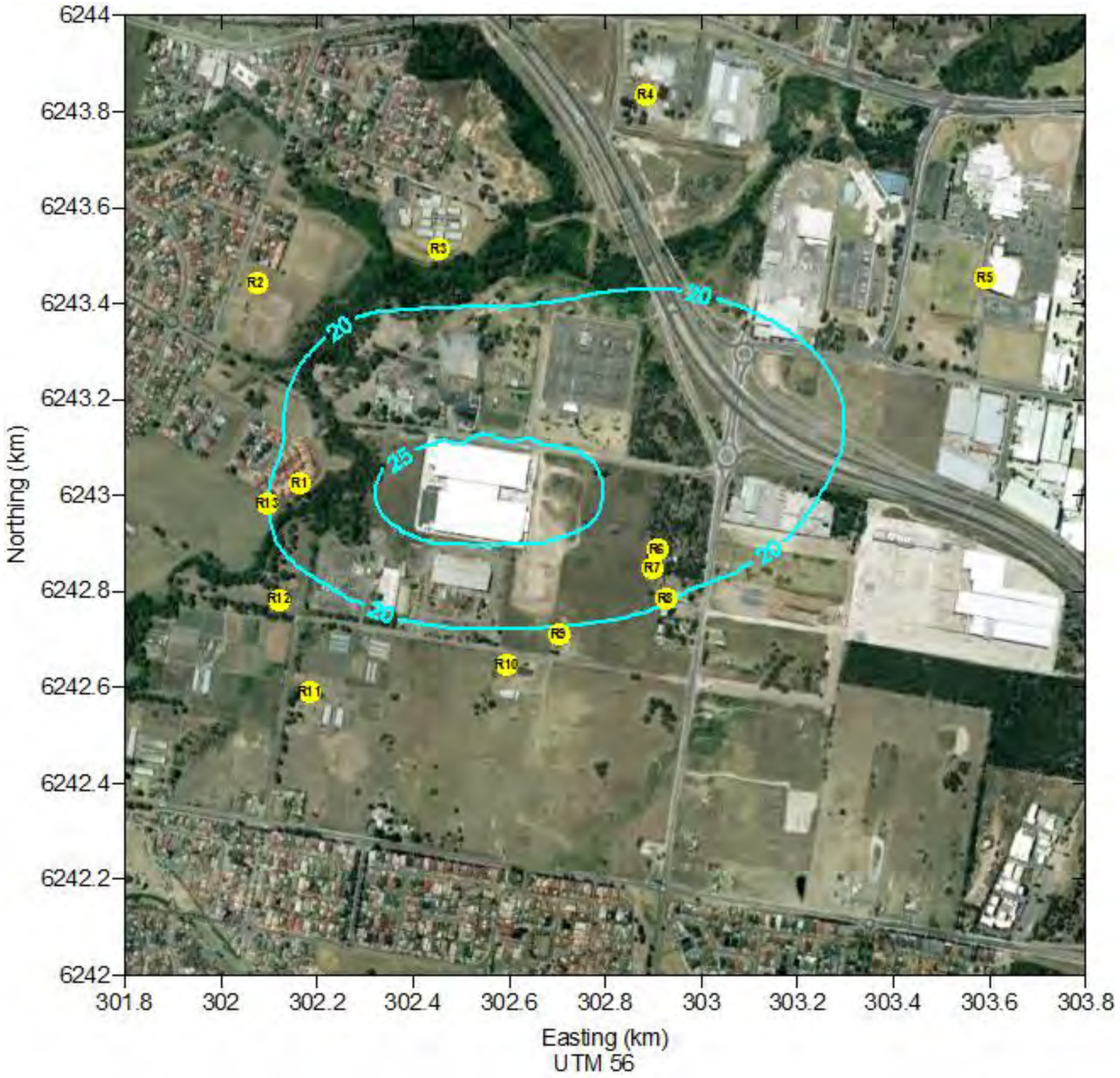


Figure 14 Predicted Cumulative Annual Average NO_2 Concentrations



7 CONSTRUCTION PHASE IMPACTS

The construction phase of the Project will comprise a series of different operations. Each of these operations has its own duration and potential for dust generation. The potential for dust generation varies significantly from day to day depending on the level of activity, the specific operations, and the prevailing meteorological conditions. This is in contrast to most other fugitive dust sources where emissions are either relatively steady or follow a discernible annual cycle.

Due to the irregularity and short duration of the emission sources during this phase, the works are not expected to have long-term health or ecological impacts beyond the Project boundaries. However, as these sources can result in high short-term releases of particulate matter, control measures should be put in place during this phase. The control techniques for fugitive dust sources generally involve watering, minimisation of exposed areas, chemical stabilisation (where necessary), wind sheltering and source activity management. Proposed controls include the use of water sprays, a cattle grid (i.e. a truck shaker grid) and silt fencing to minimise construction phase impacts.

7.1 Dust Management and Mitigation

Best Available Techniques (BAT) was introduced as a key principle of the European Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC). The European Commission produced BAT Reference Documents (BREFs) for a number of industries which are intended to be used as an input into determination of BAT for specific cases.

The essence of BAT is that the selection of techniques to protect the environment should achieve an appropriate balance between realising environmental benefits and the costs incurred by the person carrying out the activities. In other words, it would be possible to spend infinite time and money to attempt to reduce dust impacts to zero but the cost involved may be grossly disproportionate to the benefit gained.

While no legislative driver exists in Australia at present, some of the relevant BAT mitigation measures for dust control are summarised below:

- Water sprays are a commonly used control method for particulate matter emissions. The addition of dust control suppressants such as polymers and acrylics to the water increases the effectiveness of the spraying.
- Stockpiles can be sprayed with a lime slurry (or similar polymer) which forms a hard crust and prevents dust emissions.
- Spraying of the shovel/bucket for excavators/FELs when loading trucks.
- Spraying the bucket of trucks before loading.
- Direct water spraying of trucks.
- Sprays/atomisers to moisten ambient air during operations with the potential to generate high volumes of dust.
- Wheel-wash, truck shaker grids and visual inspection of trucks prior to exiting the construction site onto public roads.
- Vacuuming (or equivalent method) of dirt track-out out onto public roads.
- Use water sprays to moisten dusty surfaces on a systematic basis to maintain minimum moisture content at the potentially dusty surface.
- Design and install wind breaks, wind barriers and enclosures at key points, such as truck unloading stations, to avoid falling dusty material being exposed to external winds.

In addition to the above, the following procedures and requirements should be followed during the construction phase of the project to minimise the impact of dust and particulate generated in association with the proposed development:

- Sealing of roads (where possible) and regular watering of roads (as noted above) utilising water carts or a wet spray system.
- All unsealed trafficable areas should be kept sufficiently damp during working hours to minimise windblown or traffic generated dust emissions. Continued use of water on dirt roads helps the formation of a crust so that dust is not as easily generated.
- Trucks entering and leaving the site should be well maintained in accordance with the manufacturer's specification to comply with all relevant regulations. Fines may be imposed on vehicles which do not comply with smoke emission standards.
- If visible smoke can be seen from any equipment (while working on a construction site) for longer than 10 seconds duration, the equipment should be taken out of service and adequately repaired or tuned so that smoke is no longer visible for periods longer than 10 seconds.
- Hire agreements should contain provisions to stand down equipment which has excessively smoky exhaust.
- Truck movements should be controlled on site and restricted to designated roadways.
- Truck wheel washes or other dust removal procedures should be installed to minimise transport of dust off-site.
- Truck loads should always be covered with a lid or tarpaulin.
- No dust, soil or mud should be deposited from any vehicle on public roads. Where wheel washing facilities and/or truck shaker grids are provided at the construction works area, all drivers of construction vehicles shall utilise the wheel wash prior to leaving the works area and entering public roads.
- Any dust soil or mud deposited on public roads by sub-contractors construction activities and vehicle movements should be removed immediately and disposed of appropriately.
- If necessary, modifying construction activities during periods of high wind.
- Vegetated buffers should be considered for implementation around the site boundary to act as a physical barrier to the transport of pollutants in the direction of sensitive land uses (ie residences). Plant species considered should include primarily native, evergreen plant species of a diverse variety and height.

Additional dust control measures that should be considered during the construction phase of the project are provided in **Table 11**.

Table 11 Active Dust Control Measures

Source	Control Measures
General	
Visual Inspection	• Carry out visual inspections of the site during site preparatory/ construction activities and employ measures where necessary to minimise any visible air pollution generated by the Project.
Regular Maintenance	• Regularly inspect and perform maintenance on dust control technologies (ie water sprays nozzles) and measures to ensure the effectiveness of these controls.
Erosion Control Structures	• Silt and other material should be removed frequently from around erosion control structures to ensure deposits do not become a dust source.
Vegetated Buffers	• Retain existing and implement additional vegetated buffers around the boundary of the site to provide act as a physical barrier to the transport of pollutants in the direction of sensitive receptors.
Waste Materials	• Cleared vegetation, demolition materials and other combustible waste material should not be burnt on site. • All waste materials should be appropriately contained (in skips, bins) and covered during adverse weather conditions[1] and handled in accordance with the site's Waste Management Plan.
Wind-Blown Dust Sources	
Disturbed Areas	• Disturb only the minimum area necessary. • Stabilise all disturbed areas as soon as practicable to prevent or minimise windblown dust. • Rehabilitate disturbed areas as soon as practicable with a layer of inert material and vegetation (generally a minimum of 500mm). • Regularly assess weather conditions to identify adverse weather conditions[1] that are unfavourable in terms of dust levels at receptor locations surrounding the site (i.e. on dry days, during strong winds, and particularly north easterly winds blowing in direction of the school).
Stockpile/s	• Water sprays and/or covers will be employed for material stockpiles, particularly during adverse weather conditions, to minimise dust generation. • Stockpiles will be covered overnight. • Use of chemical dust suppressants will also be used where necessary. • Fencing, bunding or shelterbelts should be used to reduce ambient wind speeds (in some areas).
Transportation (Trucks)	• Truck loads must be covered with tarpaulin or lid prior to transport of dusty materials by road. • Minimise truck queuing and unnecessary trips through logistical planning of materials delivery and work practices. • Reduce vehicle / truck idling times. • Maintain a following distance of trucks of 20 seconds minimum to allow for dust clouds generated by the lead truck to dissipate. • Install a truck wheel wash or shaker grid to remove any loose dirt.
Activity-Generated Dust Sources	
Internal Road Dust	• Roads and trafficked areas will be watered down using a water cart and/or sprinklers to minimise the generation of dust. • Haulage vehicles will be restricted to the most direct route and minimal manoeuvring areas to prevent indiscriminate driving over non-active areas. • Haul roads and hard stand areas will have designated speed limits (ie generally 20 km/hour). • Enforce speed limits on all on-site vehicles to minimise wheel-generated dust. • Stabilise access roads and work areas as soon as practicable to prevent or minimise windblown dust.

Source	Control Measures
	• Maintain roads on a regular basis to ensure roads are clearly marked, pot holes and corrugations are eliminated, and extra material build up is removed or redistributed on the road. • Chemical dust suppressants will be used where necessary.
External Road Dust	• Vehicles causing dirt track out onto main roads will be cleaned up on a regular basis to prevent this becoming an additional source of dust. • Material spillages will be cleaned up promptly.
Excavation	• Apply water sprays to trucks and loading points for dust suppression.
Loading and Dumping	• Dump heights will be minimised wherever possible (reduce to 5 m).
Plant and Equipment	• All plant and equipment used during mining activities will be maintained and operated in a proper and efficient condition. • Reduce idling times of trucks and other machinery. • Fixed plant should be located as far from local receptors as possible.
Excessive Dust Events[2]	
Internal Roads	• Employ additional water spraying / water carts. • Further reduce speed on haul roads during high winds. • Halt traffic movements.
Stockpiles	• Cover stockpiles of material.
Project Site	• Temporarily halt activities and resume once weather conditions have improved.

Notes
1. Adverse weather conditions include hot, dry and windy conditions (i.e. winds over 5 m/s blowing in the direction of sensitive receptors).
2. An excessive dust event includes prolonged visual dust in a particular area and winds at 15 m/s.

7.2 Daily Environmental Inspections

The Site Manager (or delegated employee) should undertake daily environmental inspections of the works and worksite. This may include, but not be limited to:

- Visual inspection of airborne dust.
- Ensure roads leaving the site are free of soil, and prevention of soil tracking onto the road network.
- Inspection of erosion and sediment controls.
- Inspection of stockpiles.
- Inspection of internal roads.
- Inspection of waste storage areas.
- Inspection of any rehabilitated areas (where relevant).
- Ensure site signage is clear and appropriate.

The daily environmental inspection reports should include the above observations, with remedial or corrective actions noted (as appropriate). Any remedial or corrective actions should be reported to the Site Manager as soon as is practicable. These reports should be issued on a weekly basis to the Project Manager (or equivalent role) for review.

7.3 Weather Monitoring for Reactive Dust Management

A wind sock that is visible to each active area on site may be installed to assist in reactive response measures for dust control (i.e. to determine when activities should be postponed, minimised or relocated in windy conditions). In lieu of an on-site weather station, anemometer or wind sock, the nearest available BoM weather station should be referred to (i.e. Liverpool AWS).

During high wind conditions (> 5 m/s), additional dust mitigation measures should be carried out to ensure the minimisation of emissions off-site (refer to **Section 0** for dust control measures). An average wind speed of over 15 m/s is commonly used as the trigger for stopping certain dust-generating operations.

7.4 Dust Monitoring for Compliance

Where monitoring is required for compliance, it is recommended that dust deposition monitoring utilising Dust Deposition Gauges (DDGs) is undertaken. Dust Deposition Gauges (DDGs) record dust fallout and are a useful measure of changing air quality.

A baseline air quality monitoring program performed prior to site preparatory and construction works would enable suitable background concentrations and deposition levels of relevant pollutants to be derived so that the increment due to Project activities can be estimated. A minimum 3-month period utilising a minimum of three monitors (in case of sample loss, tampering or contamination) is recommended.

Dust deposition gauges are exposed for 30 days (± 2 days). At the end of each sampling period, an independent consultant collects and forwards the samples to a NATA accredited laboratory to be analysed. Dust deposition is reported as insoluble solids and is any matter which does not dissolve in water. The ash content value provides an indication of the mineral content of the sample (soil dust). Microscopic analysis of dust samples may also be undertaken when elevated dust levels are measured, with corrective actions determined once the source of the dust emissions is determined.

Dust deposition monitoring should be undertaken in accordance with AS/NZS 3580.10.1-2003 *Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method*.

All monitoring locations should conform to the requirements of AS/NZS 3580.1.1-2007 *Methods for sampling and analysis of ambient Air - Guide to siting air monitoring equipment,* subject to local site constraints.

8 GREENHOUSE GAS ASSESSMENT

8.1 Legislative Framework

8.1.1 The Greenhouse Gas Protocol

The Greenhouse Gas Protocol Initiative (hereafter the GHG Protocol) is a multi-stakeholder partnership of businesses, non-governmental organisations (NGOs), governments, and others convened by the World Resources Institute (WRI), a U.S.-based environmental NGO, and the World Business Council for Sustainable Development (WBCSD), a Geneva-based coalition of 170 international companies. Launched in 1998, the Initiative's mission is to develop internationally accepted greenhouse gas accounting and reporting standards for business and to promote their broad adoption (WBCSD, 2005).

The GHG Protocol comprises two separate but linked standards:

- *GHG Protocol Corporate Accounting and Reporting Standard* (provides a step-by-step guide for companies to use in quantifying and reporting their greenhouse gas emissions).
- *GHG Protocol Project Quantification Standard* (a guide for quantifying reductions from greenhouse gas mitigation projects).

There are three scopes of emissions that are established for greenhouse gas accounting and reporting purposes, defined as follows.

Scope 1 Emissions – Direct GHG Emissions

The GHG Protocol defines Scope 1 emissions as those which result from activities under the Proponent's control or from sources which they own. Scope 1 emissions are principally a result of the following activities:

- *Generation of electricity, heat or steam*. These emissions result from the combustion of fuels in stationary sources, e.g. boilers, furnaces or turbines.
- *Physical or chemical processing*. The majority of these emissions result from the manufacture or processing of chemicals and materials, e.g. the manufacture of cement, aluminium, adipic acid and ammonia, or waste processing.
- *Transportation of materials, products, waste, and employees*. These emissions result from the combustion of fuels in company owned/controlled mobile combustion sources (e.g. trucks, trains, ships, airplanes, buses, and cars).
- *Fugitive emissions*. These emissions result from intentional or unintentional releases, (e.g. equipment leaks from joints, seals, packing, and gaskets; carbon dioxide and methane emissions from coal mines and venting; hydrofluorocarbon (HFC) emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport).

Scope 2 Emissions – Indirect GHG Emissions (Electricity)

Scope 2 emissions are those which relate to the generation of purchased electricity consumed in owned or controlled equipment or operations. For many companies, purchased electricity represents one of the largest sources of GHG emissions and the most significant opportunity to reduce these emissions.

Scope 3 Emissions – Other indirect GHG Emissions

The GHG protocol states that Scope 3 reporting is optional and covers all other indirect GHG emissions. Scope 3 emissions are defined as those which do not result from the activities of a company although arise from sources not owned or controlled by the Proponent. Examples of Scope 3 emissions include the extraction and production of purchased materials, transportation of purchased fuels and the use of sold products and services.

The GHG protocol flags the issue that the reporting of Scope 3 emissions may result in the double counting of emissions. A second problem is that as their reporting is optional, comparisons between countries and / or projects may become difficult. The GHG protocol also states that compliance regimes are more likely to focus on the "point of release" of emissions (direct emissions) and / or indirect emissions from the use of electricity. However, for GHG risk management and voluntary reporting, double counting is less important.

8.1.2 National Greenhouse and Energy Reporting Act

The National Greenhouse and Energy Reporting Act (the NGER Act) was passed on 29 September 2007, establishing a mandatory reporting system for company greenhouse gas emissions and energy production and consumption.

The first reporting period under the Act commenced on 1 July 2008.

The NGER Act seeks to provide a national framework for the reporting of greenhouse gas emissions, abatement actions, energy consumption and production by corporations. The data generated under the Act will lay the foundation for Australia's Carbon Pollution Reduction Scheme and assist Australia to meet its relevant international reporting obligations.

From 1 July 2008, corporations are required to register and report for the 2008 – 2009 financial year where they exceed the reporting thresholds. There are two levels of thresholds at which corporations or enterprises are required to apply for registration and report, namely, facility thresholds and corporate thresholds, as follows:

- They control a facility that emits 25 kilotonnes (kt) or more of greenhouse gases (CO_2 equivalent), or produces or consumes 100 Terajoules (TJ) or more of energy.
- Their corporate group emits 125 kt or more greenhouse gases (CO_2 equivalent), or produces or consumes 500TJ or more of energy.

When a controlling corporation's group meets a facility or corporate threshold, the controlling corporation must apply for registration and report its greenhouse gas emissions and energy data to the Greenhouse and Energy Data Officer.

The National Greenhouse and Energy Reporting Guidelines have been developed to help corporations understand their obligations. The NGER Guidelines are applicable across industry sectors and cover important concepts under the Act and Regulations, including scheme participation, determining corporate, facility and operational control, registration and reporting obligations. The National Greenhouse and Energy Reporting (Measurement) 2008 provides methods and criteria for calculating greenhouse gas emissions and energy data under the act.

The range of emission sources covered in the Determination include:

- The combustion of fuels for energy
- Fugitive emissions from the extraction of coal
- Oil and gas
- Industrial processes (such as producing cement and steel)

- Waste management.

Reporting under the NGER Act is required for Scope 1 emissions and Scope 2 emissions, while reporting of Scope 3 emissions is voluntary. The methods are based on those used for the National Greenhouse Accounts (refer **Section 8.1.3**).

8.1.3 National Greenhouse Accounts (NGA) Factors

The Federal Department of Climate Change (DCC) has prepared the National Greenhouse Accounts (NGA) *Factors* (July 2012). The NGA Factors are used to estimate greenhouse gas emissions for reporting under various government programs, including the NGERS. The methods described for calculating emissions listed in the NGA Factors are "Method 1" from the National Greenhouse and Energy Reporting (Measurement) Determination 2008 and the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.1, which have been designed to support reporting under the NGER Act 2007.

The methods described for deriving emissions in the NGA factors are consistent with international guidelines (such as the GHG Protocol).

8.2 Greenhouse Gas Calculations

For comparative purposes, non-CO_2 greenhouse gases are awarded a "CO_2-equivalence" based on their contribution to the enhancement of the greenhouse effect. The CO_2-equivalence of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO_2 greenhouse gases are contained within the Intergovernmental Panel on Climate Change (IPCC) document *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*.

The GHG Emissions associated with the proposed Project have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential.

A summary of the potential project-related GHG emission sources is provided in **Table 12**.

Table 12 Summary of Potential Project-Related Greenhouse Gas Emissions

Project Component	Direct Emissions	Indirect Emissions	
	Scope 1	Scope 2	Scope 3
Diesel	Emissions from the combustion of diesel by plant, equipment and transport at the Project Site	NA	Estimated emissions attributable to the extraction, production and transport of diesel consumed at the Project Site
Use of Oils and Greases	Consumption (non-combustion) of oils and greases	N/A	N/A
Electricity	NA	Emissions from the generation of purchased electricity at the Project Site.	Estimated emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed at the Project Site and the electricity lost in delivery in the transmission and distribution network.
Employee Travel	NA	NA	Emissions from the combustion of petrol consumed by staff travelling to and from the Project Site.
Solid Waste	NA	NA	Emissions from the solid waste sent to landfill

8.2.1 Project Energy Consumption

Scope 1: Direct Emissions

Diesel Usage

Scope 1 GHG emissions attributable to diesel relate to the use of plant and equipment on site and transport.

All on-site traffic movement areas will be sealed and the operational fleet includes pick-up and delivery vehicles (PUD's), semi-trailers and B-Doubles.

Based on the information presented in **Table 1**, it is estimated that total vehicle kilometers travelled (VKT) on site was 75 km/day. Assuming this occurs 365 days per year, the total annual VKT is estimated to be 27,375 km per year.

It is further assumed that the mileage of the vehicle fleet is 10 L/100 km. Therefore, it is anticipated that the total diesel usage will be 2.74 kL/year.

Annual Scope 1 emissions of CO_2 and other GHG from diesel combustion have been estimated using emission factors contained in **Table 13** (DCCEE, 2010).

Table 13 Fuel Combustion Emission Factors – Fuel used for Transport Purposes

Fuel Combusted	Energy Content Factor (GJ/kL)	Emission Factor (kg CO_2-e/GJ)		
		CO_2	CH_4	N_2O
Diesel	38.6	69.2	0.2	0.5

The calculated Scope 1 diesel combustion related emissions for operations at the Project Site are presented in **Table 14**.

Table 14 Scope 1 Diesel Combustion Related GHG Emissions

Year	Consumption Rate (kL/year)	GHG Emissions (t CO_2-e / year)			Total Emissions (t CO_2-e year)
		CO_2	CH_4	N_2O	
Operation - high	2.74	7.5	0.02	0.05	7.6

Use of Oils and Greases

Oils and greases are used for lubrication of equipment and machinery. Scope 1 emissions from the use of oils and greases as defined by NGERS are normally estimated using the method detailed in Section 2.68 part b (iii) of the NGERS Measurement Determination 2008. The energy content of oil and grease is taken to be 38.8 GJ/kL with a Scope 1 emission factor of 27.9 kg CO_2-e/GJ (DCCEE 2011).

It is assumed that the amount of oils and greases to be used on site will be minimal and hence the GHG emissions due to oils and greases have not been considered any further in this assessment.

Scope 2: Indirect Emissions

Scope 2 GHG emissions associated with the Project relate to the consumption of purchased electricity. The NGA Factors provides Scope 2 emission factors for the consumption of purchased electricity by each state of Australia. State emission factors are used because electricity flows between states are significantly constrained by the capacity of the inter-state interconnectors and in some cases there are no interconnections.

The emission factor for Scope 2 (0.90 kg CO_2-e/kWh as per Table 5 of the NGA Factors) covers emissions from fuel combustion at power stations associated with the consumption of purchased electricity in New South Wales.

Information supplied by the proponent indicates an expected total of 2,321,496 kWh of annual electricity usage for the future.

Annual Scope 2 emissions of CO_2-equivalent (CO_2-e) from the consumption of purchased electricity for proposed operations at the Project Site are presented in **Table 15**.

Table 15 Scope 2 GHG Emissions – Purchased Electricity

Year	Consumption Rate (kWh/year)	Total Emissions (t CO_2-e year)
Operation	2,321,496	2,089

Scope 3: Other Indirect Emissions

Extraction, Production and Transport of Diesel Consumed at the Project

Scope 3 GHG emissions attributable to diesel used onsite at the Project Site relate to its extraction, production and transport. These emissions are associated with the diesel consumed by plant and equipment.

The annual emissions of CO_2 and other GHG from this source have been estimated using Table 4 of the NGA Factors. It has been assumed that an energy content of 38.6 GJ/kL for diesel is applicable. The Scope 3 emission factor for liquid fuel consumption (5.3 kg CO_2-e/GJ, as per Table 38 of the NGA Factors) has been applied to calculate total GHG emissions.

The calculated Scope 3 diesel combustion related emissions are presented in **Table 16**.

Table 16 Scope 3 Diesel Combustion Related GHG Emissions

Year	Consumption Rate (kL/year)	Total Emissions (t CO_2-e year)
Operation – proposed	2.74	0.6

Extraction, Production and Transport of Fuel Burned for the Generation of Electricity and Electricity Consumed in the Transmission and Distribution System

The NGA Factors provides Scope 3 emission factors for the consumption of purchased electricity by each state. The NSW Scope 3 emission factor (0.17 kg CO_2-e/kWh) covers both the emissions from the extraction, production and transport of fuels used in the production of the purchased electricity (i.e. fugitive emissions and stationary and mobile fuel combustion emissions) and also the emissions associated with the electricity lost in transmission and distribution on route to the customer.

Annual Scope 3 emissions of CO_2-equivalent from the consumption of purchased electricity for operations at the Project Site are presented in **Table 17**.

Table 17 Scope 3 GHG Emissions – Purchased Electricity

Year	Consumption Rate (kWh/year)	Total Emissions (t CO_2-e year)
Operation	2,321,496	394

Employee Travel

GHG emissions associated with the travel of employees to and from the Project Site need to be calculated and accounted for under Scope 3 emissions. For the pruposes of this study it has been assumed that the number of employees travelling to work will be 10 and the kilometres travelled by employee vehicles per week is 40 km/day, resulting in 146,000 km per year in total.

The annual emissions of CO_2 and other GHG from this source have been estimated using Table 4 of the NGA Factors. It has been assumed that an energy content of 34.2 GJ/kL for petrol is applicable for employee travel with passenger vehicles having a fuel efficiency of 10 L/100 km. The Scope 3 emission factor for liquid fuel consumption (5.3 kg CO_2-e/GJ, as per Table 39 of the NGA Factors) has been applied to calculate total GHG emissions. Total annual Scope 3 GHG emissions related with miscellaneous employee travel are presented in **Table 18**.

Table 18 Scope 3 GHG Emissions – Product Transportation and Employee Travel

Year	Consumption Rate (kL/year)	Total Emissions (t CO_2-e year)
	Petrol (Employee Cars)	
Operation	14.6	2.6

Sources not Included

The following Scope 3 GHG emission sources were not included within the assessment:

- Employee business travel; and
- Outsourced activities.

Solid Waste to Landfill

Scope 3 GHG emissions attributable to waste produced at the Project Site are broadly associated with the disposal of waste generated onsite. Recyclable wastes such as glass, paper, cardboard and timber, will be separated for collection by a recycling contractor. On this basis, the amount of non-inert waste that would be expected to be disposed to landfill as a result of the proposed site operations would be relatively minor and has not been considered further.

8.3 Greenhouse Gas Emissions Summary

Calculated Scope 1, Scope 2 and Scope 3 emissions of GHG resulting from the emissions sources outlined above are summarised in **Table 19**.

Table 19 Total GHG Emissions

Site	GHG Emissions by Scope (t CO_2-e/year)			Total Emissions (t CO_2-e/year)
	Scope 1	Scope 2	Scope 3	
Operation – proposed	7.6	2,089	397	2,494

A comparison of the total annual GHG emissions from the Project against published net total GHG emissions for NSW and Australia during 2009 has also been conducted. Net emissions of 160.6 Mt CO_2-e and 564.5 Mt CO_2-e were reported for 2009 for NSW and Australia respectively by the (DCCEE, 2011). Total emissions from the Project would represent approximately 0.001% of total NSW 2009 emissions and approximately 0.004% of total Australian 2009 emissions.

It is clear from the values presented in the preceding sections that the principal source of GHG emissions at the Project relates to electricity usage, although the totals are relatively small when compared to NSW and Australian emission totals.

8.4 Greenhouse Gas Mitigation

It has been identified that the electricity usage is the major contributor of greenhouse gas from the Project Site. The following list details some methods that could assist in the reduction of GHG emissions from operations at the Project Site:

8.4.1 GHG Mitigation relating to Electricity Consumption:

- Consider the use of renewable energy technologies, such as wind, solar or biomass for externally-sourced electricity;
- Close regulation of the daily operation of lighting; and
- Implement solar-powered lighting about site where practical.

9 CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR Consulting) has conducted an Air Quality Impact Assessment (AQIA) at the request of Goodman Property Services (Aust) Pty Ltd on behalf of Mainfreight for their proposed extension of an existing warehouse at 30-50 Yarrawa Street, Prestons, NSW.

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 atmospheric dispersion modelling techniques. The predicted results indicate that the proposed operational activities would comply with all relevant OEH ambient air quality criteria at all surrounding sensitive receptors.

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.

Due to the irregularity and short duration of activities during the construction phase, a quantitative assessment has not been performed for these activities. Instead a range of control measures to minimise fugitive dust emissions have been outlined for inclusion in the Construction Environmental Management Plan for the project.

It is clear from the values presented in the preceding sections that the principal source of GHG emissions at the Project is electricity usage, although the totals are relatively small when compared to NSW and Australian emissions totals.

10 REFERENCES

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