APPENDIX D

Air Quality Impact Assessment (SLR, 2015a)

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Air Quality Assessment

Proposed Small Stock Abattoir Development & Continued Operation of the Blayney SeaLink Cold Store Complex

Report Number 610.13744.00100-R1R1

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Metziya Pty Limited
Newbridge Road
Blayney NSW 2799

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Air Quality Assessment

Proposed Small Stock Abattoir Development & Continued Operation of the Blayney SeaLink Cold Store Complex

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Executive Summary

SLR Consulting Australia Pty Ltd was commissioned by Metziya Pty Limited to perform a Construction and Operational Air Quality Impact Assessment (including odour) for the proposed development of a small stock abattoir and continued operation of the existing Blayney SeaLink Cold Store Complex, located approximately one kilometre east of the Blayney township in the Central West region of New South Wales.

This study will inform the overall Environmental Impact Statement required to be submitted to the NSW Department of Planning and Environment. The specific requirements of this study are clearly outlined within the Secretary's Environmental Assessment Requirements as issued for State Significant Development 6594, issued on 14 August 2014.

The objective of this air quality impact assessment was to define the sources of emissions from the proposed construction and operation of the Project and assess the impacts against applicable air quality criteria to determine the requirement for further mitigation and control, and to identify any residual impacts.

The potential impacts on local air quality from construction activities were assessed qualitatively, using the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management.

The qualitative assessment of construction impacts considered the sensitivity of the receiving environment and the magnitude of the likely dust emissions from the construction of the abattoir and associated infrastructure. Overall, the risk of air quality impacts from earthworks, construction of infrastructure, and track-out of dust were determined to be *low* or *negligible* across the Project Site. In addition to the low risk of air quality impacts from construction activities, mitigation and management measures will be applied to further reduce the impact, and therefore it is considered that there will be no significant impact from generated dust emissions from the Project site.

In order to quantitatively assess the potential impacts of operational phase emissions on local air quality, emissions estimation and dispersion modelling were performed. The assessment methodology included meteorological and dispersion modelling using established and recognised modelling techniques. The emission rates and source parameters defined for the modelling scenarios were based on site specific information and assessments carried out for similar facilities.

The quantitative assessment addressed the impacts to air quality of emissions from the operation of the Blayney Cold Store Complex and Small Stock Abattoir, including nitrogen dioxide, particulate matter less than 10µm in diameter (PM_{10}), and odour.

The predicted ground level concentrations of the pollutants assessed met their respective guidelines for the appropriate averaging periods, with and without the inclusion of background air quality concentrations. The local topography and proximity to the Project Site indicate that the transient population visiting Athol Homestead would not be impacted by odour at concentrations in excess of the relevant odour impact assessment criterion, as specified by NSW OEH. Provided the abattoir is well managed it is reasonable to conclude that minimal adverse impacts would be anticipated.

Table of Contents

Table of Contents

Table of Contents

Table of Contents

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Metziya Pty Limited (Metziya) to perform a Construction and Operational Air Quality Impact Assessment (AQIA) (including odour) for the proposed development of a small stock abattoir and continued operation of the existing Blayney SeaLink Cold Store Complex (herein referred to as the Project). The Blayney SeaLink Cold Store Complex and proposed small stock abattoir (the Project site) is located approximately one kilometre (km) east of the Blayney township in the Central West region of New South Wales (NSW).

This study will inform the overall Environmental Impact Statement (EIS) required to be submitted with the Project Application to the NSW Department of Planning and Environment (DP&E). The specific requirements of this study are clearly outlined within the Secretary's Environmental Assessment Requirements (SEAR's) as issued for State Significant Development 6594, issued on 14 August 2014, and reproduced in **Section 1.2**.

1.1 Background

Metziya intends to seek a single new development consent under Part 4 of the *Environmental Planning and Assessment Act* (1979) (EP&A Act) for the continued operation of the Blayney SeaLink Cold Store Complex, previously approved by Blayney Shire Council under Development Applications 59-01-02, 29-02-03, 60-2006, 66-2005, 9-2009, 155-2008 and 8-2009, and to develop a small stock abattoir within the site. The abattoir will have the capacity to process up to 4,500 head per day, consisting primarily of rangeland goats and some sheep/lambs.

1.2 Secretary's Environmental Assessment Requirements for State Significant Development 6594

The SEAR's for the Project as they relate to air quality and odour are presented in **Table 1**.

Table 1 Key Assessment Requirements

Key Issue/Assessment Requirement	Where addressed in this report
Department of Planning and Environment (Secretary's Requirements)	
Air Quality and Odour – including	
• a quantitative air quality assessment of all potential air quality and odour sources from construction and operation of the abattoir and its wastewater treatment system, including details of air quality and odour impacts on private properties, in accordance with relevant Environment Protection Authority (EPA) guidelines;	Construction – Section 6 Operation – Section 7
• details of mitigation, management and monitoring measures for preventing and/or minimising both point and fugitive emissions;	Project Description – Section 2.2 Emission Estimation – Section 7.5
• and an assessment of the effectiveness of the proposed air quality and odour mitigation measures	Construction – Section 6 Operation – Section 7
EPA Recommended SEARs	
Air Quality and Odour – including	
• Point source emissions from processes/plant (i.e. stacks, vents etc), livestock and any waste steams such as offal, bone, fat and trimmings and blood	Emission Inventory – Section 7.5
• Fugitive source emissions from activities associated with truck movement, livestock movement, livestock holding, waste stockpiles and any other stockpiles	Emission Inventory – Section 7.5

Key Issue/Assessment Requirement	Where addressed in this report
• Assessment of odour, particularly odour associated with the livestock themselves (particularly any male goats), any waste stockpiles and any waste water holding, processing or disposal areas	Emission Inventory – Section 7.5 Operation – Section 7.7
• Identification of likely impacts	Construction – Section 6.4 Operation – Section 7.7
• Mitigation and management strategies	Project Description – Section 2 Mitigation Measures – Section 6.3
Blayney Shire Council	
Air Quality and Odour - including: • Odour assessment should have regard for seasonal climatic conditions, inversions etc.	Meteorological Model – Section 7.3
• The Briefing Paper states that most air quality issues relate to rendering. However significant odour issues can arise especially in wet or hot weather relating to accumulation of manures and to urine soaked damp ground.	Emissions Estimation – Section 7.5

A description of how these requirements have been met is presented in **Section 1.3**.

1.3 Study Scope

1.3.1 Construction Phase Impacts

Construction phase impacts are required to be assessed by the SEAR's. The scope of the construction phase component of the AQIA is limited to a high level risk-based (qualitative) assessment, the purpose of which is to identify potential impacts associated with the construction of the development with respect to air quality, and identify any constraints from existing and proposed sources of emissions to air from local industry and commerce proximate to the Project Site.

Recommendations provided in this report focus on air quality control and mitigation strategies that may be applied to the construction phase of the Project, to ensure that the proposed development does not result in a significant adverse impact upon air quality in the local area. This approach is considered appropriate for a high level qualitative study. No air quality monitoring or dispersion modelling has been undertaken as part of this assessment.

1.3.2 Operation Phase Impacts

Potential impacts on air quality resulting from the operation of the abattoir have been examined. Key emissions to air associated with the operation of the Project will comprise:

- Odour, particularly in relation to the operation of the abattoir; and
- Traffic-related dust and exhaust emissions, particularly in relation to road truck transport of stock/product.

1.4 Broad Methodology

1.4.1 Construction Phase (Qualitative) Air Quality Impact Assessment

The methodology performed for the Construction AQIA is as follows.

- Gather available and relevant information as made available by the client including, but not limited to: hours of operation, construction scenarios and timing, the number of truck movements per day, equipment inventory (both fixed and mobile), emission control equipment and management strategies currently proposed, and locations of general air pollution generating activities.
- Using the collated data, determine the area of land being worked, and the scale and nature of equipment and processes on site, the potential routes for fugitive emissions, the location of controlled emission points (i.e. exhausts).
- Perform a desktop study to identify separation distances between the facility and existing receptors/nearby sensitive land uses. Determine the sensitivity of the identified receptors to potential changes in air quality associated with emissions during construction phase activities.
- Obtain data from nearby, representative Office of Environment and Heritage (OEH) air quality monitoring stations to characterise the background ambient air environment and to determine whether local air quality objectives are likely to be exceeded as a result of construction activities.
- Characterise the local meteorological environment to determine the potential for air quality impacts, particularly in relation to the amount of rainfall typically received by the area. Generate annual and seasonal wind roses (plots of wind speed and direction) for the local area using data obtained from the nearest and/or most representative Bureau of Meteorology (BoM) Automatic Weather Station (AWS) to determine the potential for winds to transport pollutants in the direction of sensitive receptor locations during construction works.
- Determine the potential for cumulative impacts at receptor locations by undertaking a desk-based study to identify surrounding sources of emissions to air and perform a review of publicly available EIS documentation, National Pollutant Inventory (NPI) and Environment Protection Licence (EPL) database information to examine existing potential sources of air pollution.
- Perform a qualitative risk-based assessment of identified activities to determine the risk of air quality impacts with no mitigation applied and taking into account prevailing weather conditions.
- Based on the results of the assessment, prescribe appropriate air quality control measures and proactive/response management procedures (i.e. complaints handling, monitoring etc) as necessary for ensuring that adverse air quality impacts do not occur at off-site sensitive receptor locations. All recommendations for monitoring are based on the NSW Environment Protection Authority’s (EPA) document, *Approved Methods for Sampling and Analysis of Air Pollutants in NSW* (DEC 2007).

1.4.2 Operational Phase (Quantitative) Air Quality Impact Assessment

The methodology performed for the Operational AQIA is as follows.

- Identify the relevant air quality and odour criteria applicable to the Project.
- Identify all potential sources of odour, volatile organic compounds (VOCs) and particulate matter through review of existing plans, documentation for the proposed abattoir and discussion with the Client.
- Obtain meteorological data from the closest or most representative BoM site/s and use this dataset to analyse and describe the prevailing climatic conditions and provide input into the atmospheric dispersion modelling.
- Derive appropriate odour and other air pollutant emission rates to adequately describe the emissions from the nominated sources. This information will include the scale and nature of operations and emissions to air (such as the method of ventilation for intensive agricultural activities), air quality and odour controls proposed for implementation and other relevant information that may materially affect the conclusions of the Level 2/3 study. Emission inventories will be supplemented as necessary with published and publicly available emissions data.

- Develop scenarios to address the varying stages of development, the effectiveness of the proposed air quality and odour mitigation measures, and the potential for cumulative impacts. The scenario will cover:
    - peak operations assuming continuous emissions from all sources.
- Use TAPM/CALMET/CALPUFF dispersion modelling suite to infer predicted concentrations of air quality pollutants and odour arising as a result of the operations.
- Undertake consultation with the relevant regulatory bodies (including the EPA) to ensure that they agree with the model chosen and the assumptions made.
- Assess predicted air quality and odour impacts at the identified receptor locations and produce air quality contours to predict the extent of impact beyond the site boundary. All dispersion modelling to be undertaken in accordance with the EPA's documents, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC 2005) and Odour Policy documents, *Assessment and Management of Odour from Stationary Source in NSW*, Technical Framework (DEC 2005) and Technical Notes (DEC 2006).
- Make recommendations for appropriate air quality/ odour control and management given the above considerations.

Refer to **Section 6** for the Construction AQIA and **Section 7** for the Operational AQIA.

2 PROJECT OVERVIEW

2.1 Study Area and Surrounds

The existing Blayney SeaLink Cold Store Complex and site of the proposed small stock abattoir is located at 137 Newbridge Road, on Lots 103 to 105 and 107 in DP 1161062, east of the township of Blayney in the Central West region of NSW.

The 9.5 hectare (ha) Project Site is zoned IN1 General Industry, with the western extent (outside of the proposed development footprint) zoned RU2 Rural Landscape. Zone IN1 allows for the development of abattoirs with appropriate consent. The nearest residential dwellings are identified as the Athol Homestead approximately 380 metres[1] (m) away from the Project site on the southern side of Newbridge Road, and a residence approximately 500 m to the south west of the Project site.

The surrounding neighbourhood is characterised by traditional agricultural production, with the following additional land uses:

- Athol Gardens, located adjacent to the Project Site on the southern side of Newbridge Road, is a function centre and also offers a cottage for overnight accommodation. The Athol homestead, mill/stable and garden are listed in the Blayney LEP 2012 as local heritage items.
- The Great Western Railway Line traverses on an east-west alignment to the north of the site.
- Newcrest Mining Limited have approval (DA 06_029 dated 06-01-2010) to develop a minerals dewatering facility in the adjoining Lot 106 in DP 1161062 to treat the minerals concentrate from the company’s gold mine, known as Cadia Valley Operations, approximately 27 km to the north-west of the Project site. The concentrate will be de-watered and transported by rail to Port Kembla for export. It is understood that construction of the new facility is due to commence in 2015.

The location of the existing Blayney SeaLink facility and proposed abattoir development in relation to the surrounding land uses is presented in **Figure 1**.

1 Measured from activity zone boundary to property boundary of the sensitive use area in accordance with the Vic EPA guidelines.

Figure 1 Site Locality

Site Locality
FIGURE 1

2.2 Project Description

The existing Blayney SeaLink Cold Store Complex comprises six freezer rooms each 90 m long and 30 m wide, capable of operating at temperatures to minus 30 degrees centigrade (°C), two temperature controller loadout marshalling rooms with loading docks, a temperature controlled food packaging facility complete with automated cardboard recycling, internal offices and staff amenities. There is also a separate 2,700 square metre (m^2) dry goods warehouse and an administration building, which incorporates a food services call centre. Development consent has been granted to increase the dry goods warehouse by 19,128 m^2.

The proposed abattoir will have the capacity to process up to 4,500 head per day, comprising primarily rangeland goats and some sheep/lambs, for export markets. The disturbance footprint for the proposed new abattoir will be approximately 3.1 ha, including the roofed building area, vehicle manoeuvring and parking areas and wastewater treatment plant. The commercial activities associated with the abattoir will also be largely confined to this area.

The abattoir will have two different levels, with the primary areas or components on each level being:

- Ground level – undercover stock receipt and holding area, pelt sorting area, carton room and offal packing, along with staff amenities and offices; and
- Level 1 – raised stock pens, kill floor and boning room, and chillers along with staff amenities and lunch rooms.

The complex will produce three types of meat products as demanded by the serviced export markets: (i) whole bone-in carcass with skin on; (ii) whole bone-in carcass with skin off; and (iii) six way cut of carcass in cartons.

Importantly, there will be no on-site rendering of the raw animal waste products from the abattoir (offal, bone, blood, fat and trimmings) or any on-site skins processing.

2.2.1 Stock Holding Area

Livestock will be transported in to the Project Site in semi-trailers and/or B-doubles and off-loaded at ground level within the abattoir building via an undercover unloading bay. Animals will be mustered into a series of level enclosed holding pens split over the two levels of the abattoir building. Mesh fencing between pens will allow for adequate ventilation and observation.

The floor of the first level of stock holding pens will be constructed of concrete, while the floor of the second level of pens will be perforated/grated metal. The grated flooring will allow manure to be easily captured underneath and removed from site.

The enclosed stock pens will be dry cleaned (i.e. racking or scraping), with the collected manure regularly removed from the site by a licensed contractor for beneficial reuse (for example, composting and/or beneficial land application). The enclosed stock pens will also be adequately ventilated for animal welfare and the resulting air will exit the building via a stack to aid dispersion of any odours.

2.2.2 Slaughter Floor

Small stock will be corralled into the slaughter floor which will be cooled and will be maintained under positive pressure, with no additional odour control. Waste water from the slaughter floor, including residual blood products, will be diverted to the wastewater treatment process. Blood will be segregated, collected directly through a closed system and transported off-site in a tanker for processing. Animal skins from the abattoir will be collected in an open bin and transported to an off-site skins treatment facility in the Blayney Industrial Estate. By product from the slaughter floor will be gathered into open bins and will be collected by a licensed contractor daily for transport in enclosed trucks to an off-site licenced rendering facility.

The building is under positive pressure to maintain food safety requirements and will prevent odours and potential dust from the holding pens from entering the slaughter floor. Consequently, fugitive emissions of odour may potentially be emitted from open doors etc.

2.2.3 Carcass Preparation Room

From the slaughter floor, the carcasses are then conveyed into the carcass preparation room for further processing. The carcass preparation room is air conditioned. Non-edible offal from the carcass preparation room will be collected in open bins and collected by a licensed contractor daily for transport in enclosed trucks to an off-site licenced rendering facility.

Provision in the EIS has been made for a future extension to provide a boning room. The prospective boning room would be air conditioned with all by product collected in open bins and transported off site to a licenced facility by a licenced contractor in enclosed trucks. Given the boning room would be fully enclosed and provide no additional sources of odour or dust, the future extension would have no significant consequence on the air quality assessment.

2.2.4 Cold Storage Facility

The meat products are then conveyed into the cold storage facility for packaging. The cold storage facility is under active refrigeration. Trucks can back up to the cold storage facility at loading docks and the final product is loaded into refrigerated containers for transport to Port Botany sea terminal. There will be approximately 6 trucks leaving the site each day with containerised meat products.

2.2.5 Water and Wastewater Treatment

The water requirements of the development, including livestock watering, meat processing and staff amenities, has been calculated at approximately 585 kilolitres (kL) per day. Consultation with Central Tablelands Water has been undertaken and their reticulated water supply system and the site's existing connection will be able to meet this demand. Existing above-ground storage will serve as an operational reservoir for the facility. The capacity of the storage is approximately 500 kL.

All operational waste water generated by the development will be treated on-site in a wastewater treatment system designed specifically for the abattoir operations. The wastewater treatment system will involve anaerobic treatment, a membrane bioreactor and chlorination. As treated wastewater will be captured in a holding tank, no artificial ponding of wastewater will be required.

The treated wastewater will be piped from the holding tank to Newcrest Mining Limited's Cadia Valley Operations proposed new minerals dewatering facility adjoining the Blayney SeaLink site. From that facility it will be pumped via a return water line to the Cadia Valley Operation's mine, approximately 27 km to the north-west, for reuse (for example, dust suppression and within the mineral processing/wash plant).

2.2.6 Onsite Machinery

During operation of the facility there will be four (4) electric-powered forklifts used inside the cold storage facility.

Steam will be generated for sterilisation and cleaning uses through the operation of gas fired boilers, which are proposed to have an installed capacity of 1.5 megawatts (MW) to 3 MW. The boilers will be operational up to 24 hours a day.

2.3 Hours of Operation

The existing Blayney SeaLink Cold Store Complex will continue to operate 24 hours a day, seven days per week as approved. The abattoir is proposed to operate 24 hours a day, seven days per week.

2.4 Vehicular Access and Parking

Separate heavy vehicular ingress and egress from/to the adjoining Newbridge Road will be provided for the abattoir. Heavy vehicles will enter the site from Newbridge Road via a new access road to be constructed in front of the abattoir complex. Heavy vehicles loaded with product will exit the site via the existing access road as part of the Blayney SeaLink Cold Store Complex.

All new access roads and manoeuvring areas will be appropriately designed to carry the anticipated heavy vehicle movements and will be sealed.

2.5 Traffic Generation

The primary operational activities that will generate traffic to and from the Project Site are outlined in **Table 2**. With the exception of livestock delivery, all heavy vehicle activities should occur during daylight hours and they will be relatively evenly spread (i.e. no peak periods).

Table 2 Estimated Traffic Volumes

Activity	Vehicle Type	Daily Vehicles (Two Way Vehicle Trips)	Annual Vehicles (Two Way Vehicle Trips)
Heavy Vehicles			
Delivery of livestock	Semi-trailer and/or B-double	12	3,000
Delivery of consumables	Semi-trailer	2	500
Delivery of goods to Blayney SeaLink Cold Store Complex	Semi-trailer and/or B-double	12	3,000
Removal of meat products from the abattoir	Semi-trailer and/or B-double	6	1,500
Removal of other stored goods from the Blayney SealLink Cold Store Complex	Semi-trailer and/or B-double	12	3,000
Removal of meat waste products	Rigid truck	4	1,000
Removal of skins	Rigid truck	4	1,000
Removal of general garbage	Rigid truck	4	1,000
Maintenance	Rigid truck	2	500
Heavy Vehicle Sub-Total		**58**	
Light Vehicles			
Staff Blayney SealLink	Car	60	
Staff abattoir	Car	200	
Tradesman	Ute/Van	2	500
Hamper King packout	Car (2 months)	100	4,000
Light Vehicle Sub-Total		**362**	
TOTAL		**420**	

2.6 Identification of Key Air Quality Issues

2.6.1 Construction Phase Activities

The potential for a construction site to generate air quality impacts is related to the activities being undertaken (e.g. demolition, earthworks, construction, dirt trackout etc), and the duration, frequency and scale of these activities. The building type (i.e. construction materials used) and the staging and/or timing of construction activities during the year (i.e. seasonality) will also influence the potential for air quality impacts.

Emissions to air may be categorised as either controlled emission sources or uncontrolled ("fugitive") emissions. Controlled emission sources are typically directed into a vent or stack and emitted to atmosphere. Fugitive emissions are uncontrolled releases and may be due to accidental spillage, leakage, materials handling, transfer or storage.

Key potential air quality impacts associated with the construction phase works include:

- Nuisance dust and particulate matter emitted from the proposed redevelopment works, particularly where earthworks, site preparatory and demolition works are required.
- The emission of products of combustion (including oxides of nitrogen [NO_X], carbon monoxide [CO], carbon dioxide [CO_2], sulphur dioxide [SO_2], volatile organic compounds [VOCs] and particulate) in vehicle exhaust emissions from construction equipment (i.e. trucks, excavators, bulldozers, generators, etc) and worker transport (i.e. light vehicles).
- Fugitive release of VOC emissions from the storage, transfer or accidental spillage of diesel and other fuels.
- Emissions of dust and fumes from workshops (e.g. from sanding, welding and the use of solvents for cleaning equipment parts).
- Potential fugitive release of odorous emissions during demolition of old facilities or intrusive earthworks.

Section 3 provides an overview of the nuisance-related impacts and health issues associated with key pollutants noted above.

Information on redevelopment activities are presented in **Table 3**. Details of the construction works (see **Section 2.2**) and construction traffic has been provided. Details on earthwork areas have been estimated through a review of the architectural drawings provided, supplemented by a desk-top assessment from Google Earth aerial photography.

All roads will be surfaced with gravel during construction. Upon completion the access road from Newbridge Road to the car park will be sealed, and the rest of the internal roads around the abattoir will be concrete. All existing roads on site are sealed. Trucks travelling to/from the site will enter and exit the site via Newbridge Road, which is a sealed road.

Table 3 Construction Activity Details

Activity	Description	Detail
Construction (holding pens, goat processing, chilling facilities plus associated ancillary buildings, sheds etc)	Earthworks area for construction of buildings etc	14,281 m^2
	Holding Pen area	6,892 m^2
	Holding Pen volume	91,994 m^3
	Processing building area	7,389 m^2
	Processing building volume	109,527 m^3
Construction Traffic	Trucks transporting skips and waste from site	1 truck per day

Activity	Description	Detail
	Trucks transporting building materials and concrete to the site	14 per day (28 vehicle movements). This is highly conservative as it is unlikely this number of movements will be needed over the entire construction period.
	Trade utes/vans and workers cars travelling to/from the site	13 vehicles per day (27 FTE construction workers, assuming 50% car-pooling)
Vehicles / plant operational on site	Grader (1)	Operational time - 16 weeks
	Scraper (1)	Operational time - 6 weeks
	Dozer (1)	Operational time - 8 weeks
	Excavator (1)	Operational time - 16 weeks
	Tip Truck (4)	Operational time - 16 weeks
	Backhoe (1)	Operational time - 25 weeks
	Concrete trucks (2)	Operational time - 20 weeks
	Concrete pump (1)	Operational time - 5 weeks
	General cargo trucks (3)	Operational time - 35 weeks
	Mobile crane (1)	Operational time - 20 weeks

2.6.2 Operational Phase Activities

There are multiple sources that release air pollutants into the atmosphere from meat processing operations. The Blayney abattoir will not undertake on-site rendering nor will skins be processed on site. Therefore, key air quality impacts associated with the operation of the meat processing facility will primarily be limited to:

- Odour generation due to the operation of the wastewater processing system.
- Traffic-related exhaust emissions due to increased vehicle movements (i.e. road truck transport of stock/product).

The operations which have the potential to cause emissions to air, and the pollutants likely to be emitted are outlined in **Table 4**.

Table 4 Potential Air Pollutant Emissions from Integrated Meat Processing Plants

Operation	Type of Emission	Pollutants Emitted	Comments
Abattoir Sources			
Holding Pens/yards	Fugitive	Particulate matter	Holding pens are all hardstand with elevation of stock, dust emissions are expected to be minimal following dust management practices.
	Point	Odour	Yards are expected to be a source of odour from the collection of manure and goat odour. The shed will be enclosed and ventilation air will be directed up a stack.
Slaughter Floor	Fugitive	Odour	Building is under positive pressure. Therefore potential fugitive emissions of odour may be emitted from open doors.
Blood products	Fugitive	Odour	Blood will be segregated, collected and transported off-site for processing.

Operation	Type of Emission	Pollutants Emitted	Comments
Skins	Fugitive	Odour	Animal skins from the abattoir will be collected in bins and transported to an off-site skins treatment facility in the Blayney Industrial Estate. Bins will be located under slaughter floor, which is covered although open sides. Bins will be loaded onto enclosed trucks.
Paunch	Fugitive	Odour	Paunch will be transported off-site for beneficial re-use. Bins will be located under slaughter floor, which is covered although open sides. Bins will be loaded onto enclosed trucks.
Wastewater Sources			
Anaerobic treatment	Fugitive	Odour	If not covered strong sulphide odour. However some anaerobic systems have crust formation and this can aid in odour reduction.
Aerobic treatment	Fugitive	Odour	Aerobic treatment tank is subjected to air to encourage nitrification.
Membrane bioreactor	Fugitive	Odour	Slight odour of ammonia and sulphides if not managed properly and overloaded otherwise if managed to design criteria odour is relatively low.
Ancillary			
Boiler for generation of steam for cleaning	Point	Products of combustion	The boiler will ultimately be fuelled by gas. It will operate generally for 24 hours a day.
Onsite traffic			
exhaust	Fugitive	Products of combustion	Due to traffic numbers to site, exhaust emissions will be minimal in context of the surrounding environment. It is assumed these emissions are adequately captured in background data.
wheel generated dust	Fugitive	Particulate matter	All roads on site are sealed, therefore wheel generated dust will be minimal with adequate management practices.
transfer points and loading/unloading	Fugitive	Particulate matter	Minimal dust will be emitted from loading of trucks with product for transfer to market
Onsite machinery			
exhaust	Fugitive	Products of combustion	The number of internal vehicles on site will be minimal and emissions will likewise be minimal in context of the surrounding environment
wheel generated dust	Fugitive	Particulate matter	All roads on site are sealed, therefore wheel generated dust will be minimal with adequate management practices.
transfer points and loading/unloading	Fugitive	Particulate matter	Minimal dust will be emitted from loading/unloading of by-product from bins/trucks on site
transfer points and loading/unloading	Fugitive	Odour	By product from the slaughter floor is collected into open bins and will be collected by a licensed contractor daily for transport in enclosed trucks to an off-site licenced rendering facility. Bins will be located under slaughter floor, which is covered although open sides. Bins will be loaded onto enclosed trucks.

3 OVERVIEW OF KEY POLLUTANTS

A general overview of key pollutants associated with the proposed Project and the key air quality issues identified in **Section 2.6** is provided below.

3.1 Particulate Matter

The term “particulate matter” refers to a category of airborne particles (including solid particles, liquid droplets and aggregates of particles and liquids) that range from 0.1 microns (µm) to 50 µm in aerodynamic diameter and represents a complex mixture of organic and inorganic substances. Typical particle sizes are detailed in **Table 5**.

Table 5 Typical Particle Sizes for Particulate Matter

Pollutant	Example of Particle Sizes
Dust	> 30 - 50 microns
Total Suspended Particulates (TSP)	< 30 - 50 microns
PM_{10}	< 10 microns
$PM_{2.5}$	<2.5 microns

Note: A micron (µm) is one-millionth of a metre ($1x10^{-6}$m).

Sources of particulate matter can be attributed to anthropogenic and natural sources (i.e. bush fires and dust storms).

3.1.1 Particulate Matter (as PM_{10} and $PM_{2.5}$)

Particles less than 10 µm and 2.5 µm are referred to as PM_{10} and $PM_{2.5}$ respectively. Emissions of PM_{10} and $PM_{2.5}$ are considered important pollutants in terms of impact due to their ability to penetrate into the human respiratory system as this can lead to a variety of health effects including heart or lung disease. Smaller particles can remain suspended in the air for long periods of time and can travel significant distances until removed from the atmosphere by deposition or by removal by rain.

Sources of particles include combustion sources (i.e. residential wood burning, motor vehicles, agricultural burning, and some industrial processes), and a range of industrial emissions that includes (but is not limited to) coal mining, crushing and grinding, and materials handling and transfer.

3.1.2 Nuisance Dust and Total Suspended Particulate (TSP)

Amenity impacts from dust are usually associated with coarse particles and particles larger than PM_{10}. Amenity concerns can relate to “visibility” of dust plumes, and amenity impacts may include experience of dust depositing on fabrics (i.e. washing), balconies, window sills and cars, and the transport of dust from roofs to water tanks (i.e. ‘silting’).

TSP refers to all particulates suspended in the air and is a good indicator of nuisance dust impacts. The measurement of deposited dust is also a measure of nuisance dust impacts. Sources of nuisance dust include combustion sources (i.e. residential wood burning, motor vehicles from the wear of tyres and brakes, agricultural burning etc.) a range of industrial emissions including (but not limited to) coal mining and quarrying, and wind-blown dust.

3.2 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 form NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. Long term exposure to NO_2 can lead to lung disease.

NO will be converted to NO_2 soon after being emitted to atmosphere. The goals specified within the Approved Methods for NO_2 are provided in **Table 7**.

3.3 Carbon Monoxide (CO)

Carbon monoxide (CO) is an odourless, colourless gas formed from the incomplete burning of fuels in motor vehicles. CO bonds to the haemoglobin in the blood and reduces the oxygen carrying capacity of red blood cells, thus decreasing the oxygen supply to the tissues and organs, in particular the heart and the brain.

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 goals specified within the Approved Methods for CO are provided in **Table 7**.

3.4 Odour

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

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation in 50% of the population. This point is called the *odour threshold* and defines 1 odour unit (OU). An odour goal of less than 1 OU would theoretically result in no odour impact being experienced.

In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU depending on a combination factors including population sensitivity, background level, public expectation (considered offensive or easily tolerated), source characteristics (i.e. emitted from a stack or general area) and health effects.

Odour performance goals need to be designed to take into account the range in sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population.

It is often not possible or practical to determine and assess the cumulative odour impacts of all odour sources that may impact on a receptor in an urban environment. Therefore, the proposed odour performance goals allow for population density, cumulative impacts, anticipated odour levels during adverse meteorological conditions, and community expectations of amenity.

A summary of the impact assessment criteria given for various population densities, as drawn from the Approved Methods, is given in **Table 6**. The Approved Methods states that the impact assessment criteria for complex mixtures of odorous air pollutants must be applied at the nearest existing or likely future off-site sensitive receptor(s).

Section 5.1 details the sensitive receptors identified in the local environment. There are four (4) defined sensitive receptors (residential dwellings) within approximately 1 km of the site and a residential area with multiple receptors approximately 1.5 km away. While there are four identified sensitive receptors, only two of these residences are potentially affected by the odour likely to be emitted from the Project site. Therefore, the population of the affected, permanent members of the community is likely to be approximately 2 residences (population of approximately 4). The NSW EPA has requested that the transient population likely to be present at the Athol Homestead, (Receptor 3), be included in the population of the affected community and in the calculation of the impact assessment criterion. Therefore, the total population of the affected community is the 4 permanent residents and approximately 150 people likely to be present at Receptor 3 during events. The impact assessment criterion of 3.85 OU for the population of 154 was applied to this assessment.

Table 6 Impact Assessment Criteria - Complex Mixtures of Odorous Air Pollutants (nose-response-time average, 99th percentile)

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odours (OU)
Urban area (≥ 2000)	2
~500	3
~125	4
~30	5
~10	6
Single residence (≤ 2)	7

Source: Approved Methods 2005

3.4.1 Peak to Mean Ratios

It is a common practice to use dispersion models to determine compliance with odour goals. This introduces a complication because dispersion models are only able to directly predict concentrations over an averaging period of 1-hour or greater. The human nose, however, can respond to odours over periods of the order of one second. During longer periods, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine the ratio between the one-second peak concentrations and longer period average concentrations (referred to as the peak to mean ratio) that might be predicted by a dispersion model, the EPA commissioned a study by Katestone Scientific Pty Ltd (1995, 1998). This study recommended peak to mean ratios for a range of circumstances. The ratio is also dependent on atmospheric stability and the distance from the source. For area sources, as applies predominantly in this case, the peak to mean ratio is 2.3 for stability classes A to D, and 2.5 for E and F class stability. For volume sources, the factor is 2.3 and is not dependant on stability.

The Approved Methods take account of this peaking factor and the goals shown in **Table 6** are based on nose-response time.

3.5 Summary of Air Quality Impact Assessment Criteria

The EPA 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 EPA's document, *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005) (NSW OEH, 2005). A summary of the impact assessment criteria for the pollutants identified above is given in **Table 7**.

These criteria and guideline reporting goals for key air quality pollutants noted above have been sourced from the National Environmental Protection Council (NEPC); their published National Environment Protection Measure for Ambient Air Quality (Air NEPM) and Variation to Air NEPM, which outline agreed national objectives for protecting air quality for these criteria pollutants.

Table 7 Summary of Current Air Quality Impact Assessment Criteria

Pollutant	Averaging Period	Concentration (µg/m^3)	Source
PM_{10}	24 hours	50	NEPC (1998)
	Annual	30	EPA (1998)
$PM_{2.5}$	24 hours	25	NEPM (2003)
Total Suspended Particulate (TSP)	Annual	90	NHMRC (1996)
NO_2	1-hour	246	NEPC (1998)
	Annual	62	NEPC (1998)
Pollutant	**Averaging Period**	**Concentration (mg/m^3)**	**Source**
CO	15-min	100	WHO (2000)
	1-hour	30	WHO (2000)
	8-hour	10	NEPC (1998)
Pollutant	**Averaging Period**	**Incremental Increase / Total (g/m^2/month)**	**Source**
Deposited Dust	Annual	2 / 4	NERDDC (1988)
Pollutant		**Impact Assessment Criteria for Complex Mixtures of Odours (OU)**	**Source**
Nuisance Odour	-	3.85	EPA (2001)

4 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE

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

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

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

- Section 117 of the POEO Act states that the wilful or negligent release of ozone depleting substances such as chlorofluorocarbons (CFCs) to the atmosphere carries the highest of all penalties under NSW environmental law.
- Section 124 and 125 of the POEO Act state that any plant located at a premise should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 126 of the POEO Act requires that materials are managed in a proper and efficient manner to prevent air pollution.
- Section 128 of the POEO Act states:
    - The occupier of a premises must not carry on any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.
    - Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.
- Section 129 of the POEO Act states that offensive odours generated by operational activities should not be detectable beyond the site boundary.
- Section 133 of the POEO Act states that the EPA may prohibit the burning of fires in the open or burning of waste in an incinerator. These activities are illegal in most local Council areas.

Changes under the POEO Amendment Act 2011 include that the owner of a premises, the employer or any person carrying on the activity which causes a pollution incident is to *immediately* notify the relevant authorities when material harm to the environment is caused or threatened.

4.1.1 Protection of the Environment Operations (Clean Air) Regulation 2010

The POEO (Clean Air) Regulation 2010 (the Regulation) is the core regulatory instrument for air quality issues in NSW. In relation to industry, the Regulation:

- sets maximum limits on emissions from activities and plant for a number of substances.
- deals with the transport and storage of volatile organic liquids.
- restricts the use of high sulphur liquid fuel.
- imposes operational requirements for certain afterburners, flares, vapour recovery units and other treatment plant.

Part 5 (Division 3) of the Regulation deals with the emissions of air impurities from activities and plant and sets maximum limits on emissions for a number of substances (including solid particles and visible smoke). The standards of concentrations prescribed by Part 5, Division 3 do not apply to or in relation to any plant during start-up and shutdown periods, however are still subject to requirements of Section 128 (2) of the POEO Act in relation to the prevention and minimisation of air pollution.

The Regulation notes that the EPA may grant an exemption in relation to smoke emitted in the course of activities such as research to improve safety in relation to the flammability of materials and smoke reduction or testing undertaken to certify that manufactured or imported products comply with Australian Standards, International Standards or meet any legislative requirements place on them.

Part 6 of the Regulation outlines the control of VOCs and the requirement for any fuel burning equipment or industrial plant to be fitted with control equipment. Exemptions exist where approved by the EPA.

4.2 Approved Methods

The EPA's Approved Methods publication lists the statutory methods for modelling and assessing air pollutants from stationary sources and specifies criteria which reflect the environmental outcomes adopted by the EPA. The Approved Methods are referred to in the POEO (Clean Air) Regulation 2002 for assessment of impacts of air pollutants.

4.3 Odour Technical Framework and Notes

The EPA's Odour Policy publications provide a policy framework for assessing and managing activities that emit odour and offers guidance on dealing with odour issues.

4.4 Preliminary Assessment of Buffer Distances

In situations where the specifics of a development are unknown (i.e. the potential locations of residential developments, or the nature, scale and potential impact of industrial or commercial land uses), the application of buffer distances provide a valuable 'screening' tool to judge whether a detailed assessment is required to evaluate the potential risk of conflicting land uses.

Reference has been made to Victoria Environment Protection Authority (VIC EPA) documentation for relevant referenced buffer distances. The NSW EPA also makes reference to these buffer distances on their website at http://epa.nsw.gov.au/mao/abattoirs.htm.

4.4.1 Recommended Buffer Distances for Industrial Residual Air Emissions

In accordance with Clause 13.04-2 (Air Quality) of Victoria's State Planning Policy Framework, all planning must consider the VIC EPA's "*Recommended Separation Distances for Industrial Residual Air Emissions*" (2013). In their document, the VIC EPA makes recommendations for assessing appropriate separation distances where amenity may be reduced for sensitive or incompatible land uses. Sensitive land uses which warrant protection from amenity-reducing off-site effects of industry by maintenance of a buffer distance include residential areas and zones, hospitals and schools.

A summary of the industrial residual air emissions (IRAE) buffer distances that relate to the food, beverages and manufacturing industry are provided below in **Table 8**. These values have been provided for context only and are not regulatory guideline values.

Table 8 VIC EPA Recommended Buffer Distances for Industrial Residual Air Emissions[1]

Industry Type[2]	Recommended Buffer Distance (m)[3]
Abattoir – no rendering (>200 T per year)	500

Notes:

1. IRAEs are defined by the VIC EPA as unintended or accidental emissions (i.e. due to equipment failure, abnormal weather conditions etc) which are often episodic in occurrence and may originate near ground level.
2. For industries processing >200 tonnes per year.
3. Buffer distances are recommended for large scale operations. The NSW EPA should be consulted in relation to recommended buffer distances for smaller scale operations.

The ACT Government has issued a draft guidance document relating to the establishment of buffer distances between processes with significant emissions to air and sensitive land uses, as a tool for the development application process (EPA (2014) *Draft Separation Distance Guidelines for Air Emissions*). It is noted that the guidance document is still in a 'draft for consultation' phase. However the relevant draft guidance separation distance relating to abattoirs has been reproduced from EPA (2014) Appendix 1 in **Table 9** below.

Table 9 ACT EPA Recommended Separation Distances for Airborne Emissions

Activity	Description of Activity	Separation Distance (m)
Abattoirs or slaughterhouses	The conduct of slaughtering works for commercial purposes for the production of meat or meat products for human or animal consumption:	
	Other than poultry	500
	Poultry only	300

It is noted that the draft ACT EPA separation distance is numerically identical to that specified by VIC EPA.

5 THE EXISTING ENVIRONMENT

5.1 Sensitive Receptor Locations

The site is surrounded by traditional agricultural production, with the Great Western Railway Line traversing an east-west alignment to the north of the site, and a proposed minerals dewatering plant in the adjoining lot to the east of the site (Lot 106).

Four receptors representative of the surrounding land uses were included in the modelling study based on a desktop review of the Project area, as presented in **Table 10** and **Figure 2**. Receptors 1 to 4 represent the nearest residential properties/zones.

The closest two receptors to the Project Site, Receptor 2 and Receptor 3 are assumed to be home to two permanent residents each. However Receptor 3, Athol Homestead is noted to be a location for weddings during the warmer months which may have a transient population of approximately 150 people. The transient population likely to be periodically present at the Athol Homestead have also been addressed in the impact assessment.

Table 10 List of Surrounding Representative Receptors

Receptor ID	Easting (m, UTM)	Northing (m, UTM)	Type	Approximate Distance from Site (m) / Direction (degree true)[1]
Receptor 1	709604	6287610	Residential	960 m west
Receptor 2	710066	6287334	Residential	515 m south-west
Receptor 3	710343	6287153	Residential	380 m south south-west
Receptor 4	711833	6287031	Residential	1000 m south-east

Note :

1. Measured from activity zone boundary to property boundary of the sensitive use area in accordance with the VIC EPA guidelines.

Figure 2 Identified Sensitive Receptors

Identified Sensitive Receptor Locations

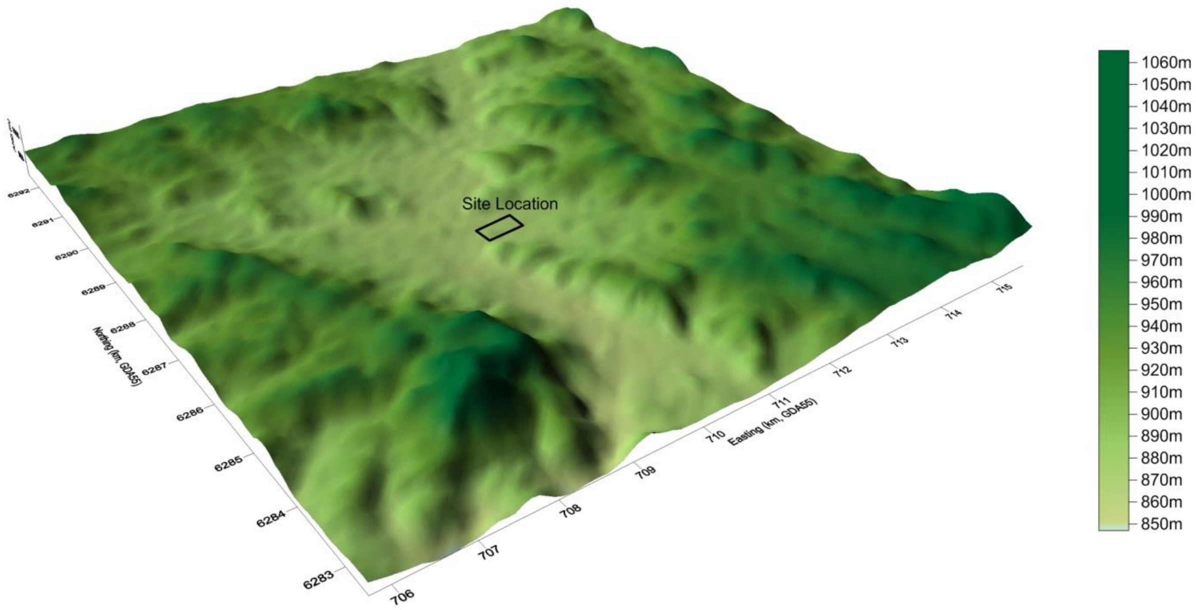
FIGURE 2

5.2 Local Topography

Topography is important in air quality studies as local atmospheric dispersion could be influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies around the Project site.

A three dimensional representation of the area is given in **Figure 3**. The topography of the Project site increases in a north-south direction from an approximate elevation range of 870 m to 910 m Australian Height Datum (AHD).

Figure 3 Topography of the Local Area



Note: Vertical exaggeration applied.

5.3 Local Meteorological Conditions

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) will also influence dispersion.

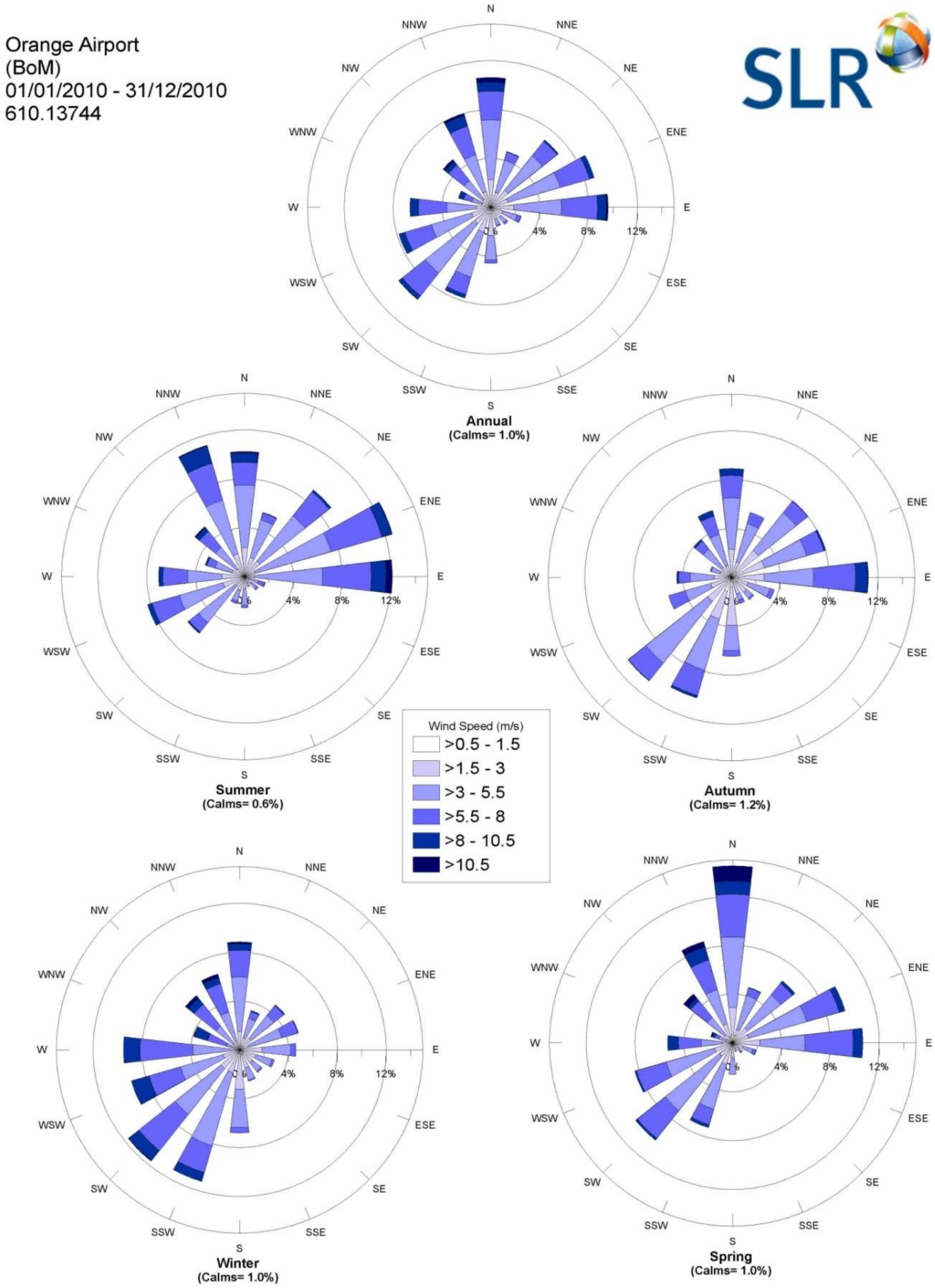
5.3.1 Wind Speed and Wind Direction

Annual and seasonal wind roses for the year 2010 are presented in **Figure 4**. The meteorological data was obtained from the BoM monitoring station located at Orange Airport.

On an annual basis, the dominant wind direction is quite scattered between northerly, easterly and south-westerly winds. Annually, 1.0% of wind speeds were recorded as calms. During summer, winds from the north-north-west to easterly quadrant predominate. By autumn, the easterly winds persist but the north-westerly component is less frequent compared with south-westerly winds. Winds in winter are predominantly westerly or south-westerly, reflecting the frequent passage of cold fronts and general westerly flow, while in spring a transition occurs again with easterly and northerly flows the most frequent.

The representativeness of 2010 as the modelled year of meteorology is discussed in **Section 7.1**.

Figure 4 Annual and Seasonal Windroses in 2010 at Orange Airport



5.4 Surrounding Industrial Sources of Airborne Pollutants

The following sources have been identified from desktop mapping study of sites regulated under by EPA and those that are required to report to the National Pollutant Inventory (NPI).

Environment Protection Licences (EPL) are issued under the POEO Act and are regulated by the NSW EPA. EPLs stipulate emission limits to water, land and/or air and provide operational protocols to ensure emissions/operations comply with relevant standards. General requirements of EPLs relating to air quality include:

- Plant and equipment to be maintained and operated in a proper and efficient manner.
- Emissions of dust and odour are to be minimised/prevented from the premises.

The NPI database provides details on industrial emissions of over 4,000 facilities across Australia. The requirement to return emissions estimates to the NPI is determined by the activities/processes being undertaken at the facility, and also whether those processes exceed process-specific thresholds in terms of activity rates (i.e. throughput and/or consumption). It is not intended to make a statement that impacts associated with those activities will be significant in terms of their potential for impact, generation of complaint, or constraint to the development of the Project site.

A search of the EPA public register and NPI database for the Blayney Shire Local Government Area (LGA) and postcode “2799” returned the following information for existing industries in the vicinity of the subject land, applying an arbitrary cut off distance of 2 km.

Table 11 provides an overview of those industries regulated by the EPA and two listed in the NPI data search.

Table 11 Surrounding Industrial Sources

Facility Name	Sector	Address	EPL/NPI Requirements
Blayney Filter Plant	Mining Support Services - Dewatering of copper slurry, rail yard	1 Maria Street	N/A
Australian Native Landscapes Pty Ltd	Waste storage and Composting	755 Browns Creek Road	EPL 1249 Scale for composting > 50,000 T, waste storage >0 T. Odour limits beyond the boundary. General conditions apply with respect to dust.
Blayney Shire Council	Sewage Treatment	3502 Hobby’s Yard Road	EPL 1648 Scale >219-1000 ML discharged. Sewage treatment processing by small plants. Water and land monitoring. Discharge monitoring. Odour limits beyond the boundary.
Blayney Shire Council	Waste Disposal	Mid Western Highway	EPL 6180 Waste disposal by application to land. Groundwater and surface water discharge monitoring. Odour limits beyond the boundary. General conditions apply with respect to dust.
Blayney Treated Pine Pty Ltd	Wood Preservation	134 Marshalls Lane	EPL 11709 Scale 0-10,000 m^3 processed. Discharge monitoring for air, water and land. General conditions apply with respect to dust.

Facility Name	Sector	Address	EPL/NPI Requirements
Environment Treatment Solutions Pty Ltd	Waste Processing and Storage	79 Marshalls Lane	EPL 13230 Non-thermal treatment of hazardous and other waste. Storage of hazardous, restricted soil, liquid, clinical and related waste and asbestos waste. General conditions apply with respect to dust. Odour limits beyond the boundary.
Nestle Australia Pty Ltd	Agricultural and Livestock Processing	Jarman Crescent	EPL 3252 Scale Agricultural >100,000 – 250,000 T, Animal Products 0-100,000 T. Discharge monitoring for air, water and land. General conditions apply with respect to dust.

Additional industries existing in the local area may operate below the activity threshold specified for the relevant industry type, and hence do not need to report under the NPI program. Sources that potentially fall under this category may still constitute a constraint to the development of surrounding incompatible land uses, but on a smaller scale than those required to report under the NPI program.

The above findings demonstrate the predominately agricultural nature of the area.

5.5 Background Air Quality

Background air quality data for PM_{10} has been provided for Bathurst air quality monitoring station (AQMS). This station measures particulate concentrations but other pollutants such as CO, SO_2 or NO_2 are not measured. The Office of Environment and Heritage (OEH) note on their website (http://www.environment.nsw.gov.au/air/nepm/305bathurst.htm) that monitoring data from Sydney and Newcastle regions allows screening of SO_2 and NO_2 and therefore monitoring of these parameters is not required in this region (encompassing Blayney). No monitoring of CO is proposed in Bathurst at this stage.

The Bathurst AQMS was commissioned in July 2000 and is located approximately 32 km north-east of the site and is located to the north west of the city centre. It is located in a relatively low-lying area where emissions from a substantial part of the City would be transported by katabatic air flows and by cold air drainage along the Macquarie River. It is in a position where it is also likely to receive emissions transported across the City by prevailing southerly and westerly winds. Given the Bathurst township has a population of greater than 26,000 people and the population of Blayney is of approximately 2,000 people, air quality data obtained for the region is considered conservative for the purposes of the air quality assessment.

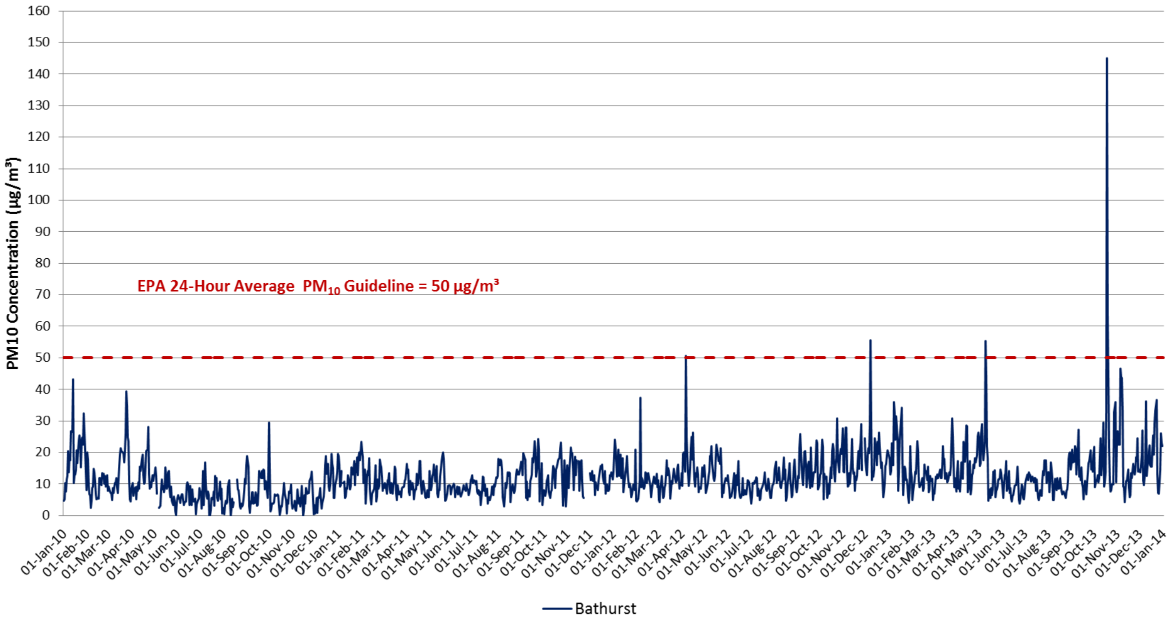
Figure 5 below shows PM_{10} levels measured at Bathurst AQMS for the years 2010 to 2013. The data indicates that the 24-hour average PM_{10} concentrations in the region are typically 12.2 µg/m^3 (see **Table 13**) however a number of exceedances of the NSW EPA 24-hour average guideline of 50 µg/m^3 were measured during this time with maximum 24-hour concentrations between 2010 and 2013 of 145 µg/m^3 for Bathurst (see **Table 12**).

Table 12 Maximum 24-hour PM_{10} Concentrations, 2010 – 2013

Year	Maximum 24-hour PM_{10} Concentration (µg/m^3)
2010	43.3
2011	24.3
2012	55.5
2013	145.0

There were three exceedances measured at Bathurst AQMS during 2013.

Figure 5 24-Hour Average PM_{10} Concentrations for the Region, 2010 – 2013



The annual average PM_{10} concentrations are shown in **Table 13**. The annual average PM_{10} concentrations measured at Bathurst represent 31% to 50% of the NSW EPA guideline of 30 µg/m^3.

Table 13 Annual Average PM_{10} Concentration, 2010 – 2013

Year	Annual Average PM_{10} Concentration (µg/m^3)
2010	9.4
2011	11.0
2012	13.4
2013	15.1
Average (2010 – 2013)	**12.2**

For air quality impact assessment purposes, it is standard practice to use background monitoring datasets take from the same year as the meteorological dataset chosen for use in the dispersion modelling assessment (refer to **Section 7.3**). The meteorological dataset for 2010 has been used in this case and therefore the highest background monitoring data measured during 2010 will be used further for calculation of cumulative impacts (i.e. the increase over background levels due to the operation of the proposed development) and are as follows:

- The 24-hour average PM_{10} concentration adopted as background for the purposes of this study is 43.3 µg/m^3.
- The annual average PM_{10} concentration adopted as background for the purposes of this study is 9.4 µg/m^3.
- The background level of odour is deemed to be minimal given the lack of industries with a similar character of odour in the immediate area.
- The background level of NO_X as NO_2 is deemed to be minimal given the lack of contributing industries in the immediate area. In addition, the treatment of all NO_X emissions as NO_2 is a conservative assumption that would account for any residual background concentration of NO_X.

6 CONSTRUCTION PHASE AIR QUALITY IMPACTS

As discussed in **Section 2**, construction of the abattoir and associated infrastructure is proposed to be carried out over an approximate period of ten months. The following *qualitative* risk-based assessment has therefore been carried out addressing the construction stage. The full risk assessment methodology is detailed in **Appendix B**. The overall approach is described below.

6.1 Overview

Predictions of air quality impacts are necessary when appraising potential future impacts on potentially sensitive land uses. Sensitive receptors (e.g. residences) have been identified through site-based investigations and are outlined in **Table 10**. Construction activities proposed as part of the development works and having the potential to generate air pollution have been confirmed in consultation with Metziya and are outlined in **Section 1.3.1** and **Section 2.6**.

Using the above information and taking into consideration local weather characteristics (local wind behaviour is discussed in **Section 5.3**) and natural shelters (e.g. vegetated buffers and terrain), a *qualitative* risk-based impact assessment has been undertaken of potential air quality impacts on surrounding receptors to identify a range of suitable control measures available to mitigate those impacts. The methodology adopted for this risk-based assessment (see **Appendix B**) has been adapted from UK guidance presented in the Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction* (February 2014). (IAQM, 2014)

The IAQM method uses a four step process for assessing dust impacts from construction activities:

- Step 1: Screening based on distance to nearest receptor.
- Step 2: Assess risk of dust effects from activities based on:
    - the scale and nature of the works, which determines the potential dust emission magnitude; and
    - the sensitivity of the area.
- Step 3: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- Step 4: Assess significance of remaining activities after mitigation has been considered.

It is noted that the adopted methodology is designed to provide an overall impact risk, and is not the defining determination for the requirement for mitigation and control. Impacts with a lower determined risk should also be minimised wherever possible. The approach may also underestimate the impact risk in environments which are assessed as having low sensitivity to impacts of a high magnitude, and therefore a pragmatic approach to the assessment should be applied. Any impacts identified as having a high risk should receive detailed appraisal of mitigation options.

Refer to following section for a preliminary risk assessment and **Section 6.4** for a reappraisal of the potential impacts (i.e. residual impacts) associated with each site where mitigation measures are applied.

6.2 Risk Assessment

6.2.1 Screening Assessment

Residential receptors R2 and R3 are located within 350 m from the nearest construction site boundary and require assessing for impacts from construction activities. However, residential receptors R1 and R4 are greater than 500m from the site exit and are greater than 50 m from roads used by construction traffic. According to the methodology outlined in **Appendix B**, receptors which meet with the screening criteria require no further assessment. Therefore, R1 and R4 are not included in the assessment of impacts from construction activities.

6.2.2 Impact Magnitude

In accordance with the guidance, the scale of the activities is rated as *'small*, *'medium'* and *'large'*, for each of the following construction phase activities:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

The scale of activity levels for the construction stage is outlined below and has been categorised based on **Appendix B**, **Table A**.

Table 14 Assessed Scale of Activity

Activities	Discussion	Justification	Scale of Activity
Demolition	No significant demolition works are proposed.	NA	Small
Earthworks	Total area involved in construction will be >10,000 m^2	Large – see Table A.	Large
	>10 heavy rigid vehicles (HRV) likely to be operational	Medium – not all vehicles will be operational at the same time	
	Soil type has a moderate grain size (e.g. silty clay/sandy loam – larger grain size than clay but smaller than sand)	Medium - see Table A.	
	Earthworks will be coordinated to limit activities occurring in the dry summer months as much as practicable	Small - see Table A.	
Construction	The volume of buildings to be constructed is > 100,000 m^3	Large - see Table A.	Medium
	No concrete batching or sandblasting	Small – concrete batching or sandblasting contribute more dust than construction of buildings.	
Trackout	Unpaved road length within the site during construction is > 100m	Large - see Table A.	Small
	10 - 50 HRV outward movements of trucks	Medium - see Table A.	
	Moderately dusty surface material (e.g. silty clay/sandy loam)	Medium - see Table A.	

Activities	Discussion	Justification	Scale of Activity
	Scale of trackout activities should be considered as small if receptors are located > 50 m from the road	Small – this criterion overrides the above three factors.	

It is not known if ground contamination is present at the site. However, earthworks involved in the construction of the main site buildings may have the potential to lead to emissions of odorous compounds. Appropriate remediation works and specific mitigation measures are therefore necessary to ensure that nuisance odour impacts are not realised during earthworks. Refer to **Section 6.3** for potential mitigation measures.

6.2.3 Receptor Sensitivity

Land Use Sensitivity

Receptor sensitivity may be classified as *'high'*, *'medium'* or *'low'* depending on the type of land use, the perception of amenity expectations, the aesthetic values of the properties. In this instance, it is assumed that the *land use receptor sensitivity* is *high* (examples of such sensitivities provided in the IAQM guidance include dwellings).

The *land use receptor sensitivity* is then used in conjunction with other factors such as: the history of dust generating activities; the likelihood of concurrent dust generation from neighbouring sites; screening between the source and receptors, prevailing meteorology, topography, the density of receptors in the area and the distance to the source to generate a *residual sensitivity of the receptors* classification, as illustrated in **Appendix B**, **Table B**.

Rural residential receptors are located primarily to the south-west (R2), south south-west (R3), west (R1) and east south-east (R4) of the site (see **Section 5.1**). Review of the prevailing wind conditions for the area (see **Section 5.3**) indicates that on an annual basis, the dominant wind direction is scattered between northerly, easterly and south-westerly winds for the local area. North-easterly winds, which may be capable of transporting particulate in the direction of receptors R2 and R3 to the south-west, are most prevalent during the warmer summer months of the year (7% annually, 9% summer). Easterlies, which may be capable of transporting particulate in the direction of receptor R1 to the west, are prevalent during summer, autumn and spring (9% annually, 12% summer, 11% autumn, 10% spring). West north-westerly winds which may be capable of transporting particulate in the direction of receptor R4 to the east south-east are not very prevalent throughout the year but peak during autumn (2% annually, 3% autumn).

West north-westerly winds (which may be capable of transporting particulate in the direction of receptor R4 to the east south-easterly) are rarely experienced in the local area and therefore this rural residential receptor is not considered further in this assessment.

Orange Airport AWS historic mean maximum temperatures indicate that mean maximums are at their highest during the summer months typically reaching between 24ºC and 27ºC. The terrain of the surrounding area is undulating. Vegetated buffers exist on properties to the west of the site and south-east along Newbridge Road.

The above considerations suggest that where suitable mitigation measures are not implemented at the redevelopment site for control of windblown dust and particulate matter, the potential may still exist for air quality impacts to be realised at receptors R2 and R3 to the south-west, particularly during strong winds and on hot, dry days when these receptors are located downwind of construction activities. The following risk assessment therefore addresses these two remaining receptors.

Residual Sensitivity of the Receptors

The sensitivity of people and their property can be identified based on a few general principles (see Table B of **Appendix B**). In this case, all receptors within 350 m of the construction site have been categorised as *low sensitivity* receptors as this most adequately reflects the nature of these receptors. Justification is provided in **Table 15**.

Table 15 Receptor Sensitivities

Receptor	Land Use Sensitivity	Justification for Residual Sensitivity	Residual Sensitivity of the Receptor
Residential (R2)	High	Applying the general principles from Table B of Appendix B, R2 is considered to have *low sensitivity* to changes in air quality given potential impact dust deposition might have on this receptor. The sensitivity has been deduced from the following information: • The receptor property is located within 350 m of the site boundary but approximately 500 m from the potential construction activities. • The receptor is located more than 50 m from the route used by construction vehicles and is more than 500 m away from the site entrance. • The frequency of north-easterly winds occurring in the local area is low (7%). • There is a row of well-established trees (natural shelters) along the border of the property and the abattoir. • The potential impact will occur over the ten month construction period however not all activities will take place at the same time.	Low
Residential (R3)	High	Applying general principles from Table B of Appendix B, R3 is considered to have a *low sensitivity* to changes in air quality given the potential impact dust deposition might have on this receptor. The sensitivity has been deduced from the following information: • The receptor property is located within 350 m of the site boundary but approximately 350 m from the potential construction activities. • The receptor is located more than 50 m from the route used by construction vehicles but is less than 500 m away from the site entrance. (Trackout activities should be considered negligible if receptor is located > 50 m from the road). • The frequency of north-easterly winds occurring in the local area is low (7%). • There is a row of poorly-established trees (natural shelters) along the border of the property and the abattoir. This row of trees will be fortified with additional plantings. • The potential impact will occur over the ten month construction period however not all activities will take place at the same time.	Low

Given the assessed *residual sensitivity of the receptor*, the identified receptors associated with each of the construction activities (i.e. demolition, earthworks, construction, trackout) are likely to have low sensitivity to dust deposition. The potential for adverse air quality impacts at these locations is determined in the proceeding section.

6.2.4 Preliminary Impacts

A preliminary risk assessment (i.e. no application of mitigation measures) has been undertaken for each stage of the redevelopment works using Matrices 1 to 4 of **Appendix B** and applying the scaled activities and receptor sensitivities determined from the previous sections. The resultant risk ratings are presented below in **Table 16** for the works.

Table 16 Preliminary Impacts – Dust Deposition / Impacts to Human Health

Potential Impact to Low Sensitivity Receptors	Preliminary Risk			
	Demolition	Earthworks	Construction	Trackout
Construction Activities	Negligible	Low Risk	Low Risk	Negligible

The results indicate that there is a *low risk* of adverse air quality impacts occurring at offsite receptor locations where no mitigation is applied during the redevelopment works.

A low level risk rating does not preclude the requirement for suitable mitigation measures to be implemented during redevelopment works. The following section provides a range of appropriate mitigation measures that should be applied during the redevelopment works to ensure that all risks are minimised where ever practicable.

6.3 Mitigation Measures

6.3.1 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 redevelopment site. Typically, emissions from these processes can be minimised through the implementation of water spraying, particularly during periods of heavy on-site activity.

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

- Silt and other material be removed from around erosion and sediment control structures to ensure deposits do not become a dust source.
- Soft strip inside buildings before demolition (i.e. retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Amending of 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.
- 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/exit the site are covered to prevent escape of materials during transport.
- Reducing the truck 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.

6.3.2 Plant and Machinery

Control measures relating to plant and machinery that may be implemented 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.

6.3.3 Fuel Storage Areas

The storage of fuels will 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 Australian Standards 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 appropriate manner.

6.3.4 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 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.

6.3.5 Site Management

Air emissions associated with all construction activities should also be managed through compliance with the CEMP. The CEMP would 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).

Any remedial or corrective actions should be reported to the Site Manager as soon as is practicable. Inspections may include, but not be limited to:

- Visual inspection of dust generation.
- 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.

6.3.6 Complaints Handling

An effective complaints logging system should be maintained by Council in conjunction with the Construction Contractor. This will allow for effective management of any requests for information, response 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.

6.4 Residual Impacts

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. These are termed “residual impacts”.

The results of the reappraisal are presented below in **Table 17**.

Table 17 Residual Impacts – Dust Deposition / Impacts to Human Health

Potential Impact to Low Sensitivity Receptors	Preliminary Risk			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Construction Activities	Negligible	Negligible	Negligible	Negligible

7 OPERATIONAL PHASE AIR QUALITY IMPACTS

The following approach was used for the dispersion modelling:

- Selection of representative meteorological data;
- Selection of the appropriate dispersion model;
- Development of the meteorological dataset for dispersion modelling;
- Verification of the meteorological dataset;
- Emissions estimation;
- Dispersion modelling; and
- Post-processing.

7.1 Selection of Representative Meteorological Data

In dispersion modelling, one of the key considerations is the representativeness of the meteorological data used. Once emitted to atmosphere, emissions will:

- Rise according to the velocity and temperature at the point of emission;
- Be advected from the source according to the strength and direction of the wind at the height which the plume has risen in the atmosphere;
- Be diluted due to mixing with the ambient air, according to the intensity of turbulence, and
- Possibly be chemically transformed and/or depleted by deposition processes.

Dispersion is the combined effect of these processes.

Dispersion modelling is used as a tool to simulate the air quality effects of specific emission sources, given the meteorology typical for a local area together with the expected emissions. Selection of a year when the meteorological data is atypical means that the resultant predictions may not appropriately represent air quality.

The year of meteorological data used for the dispersion modelling was selected by reviewing the most recent five years of historical surface observations at Blayney (2007 to 2011 inclusive) to determine the most representative year. Wind speed, ambient temperature and relative humidity were compared to long term averages for the region to determine the most representative year.

Data collected from 2007 to 2011 is summarised in **Figure 6** to **Figure 11**. Examination of the data indicates the following:

- **Figure 6** shows that wind speeds at 9 am in 2007 were above average. In addition, 2011 shows variable wind speeds at 9 am compared to the mean.
- **Figure 8** and **Figure 9** show a 9 am and 3 pm temperature in late summer 2008 was slightly lower than the climate mean, and early summer 2009 temperatures were above the climate mean.
- In 2007, relative humidity in early spring was below the climate mean. In addition, early summer of 2009 indicates that relative humidity was above the climate mean, as well as 3 pm relative humidity in 2011 (**Figure 10** and **Figure 11**).
- Overall, 2010 data is representative of the climate mean. On average, 2010 wind speeds at 9 am and 3 pm are slightly lower than the climate mean. Using 2010 as the representative year would be a conservative approach because low wind speeds are associated with less effective plume dispersion. Consequently, 2010 was selected as a suitably representative year of meteorology.

Figure 6 Wind Speed at 9 am at Orange Airport (2007-2011)

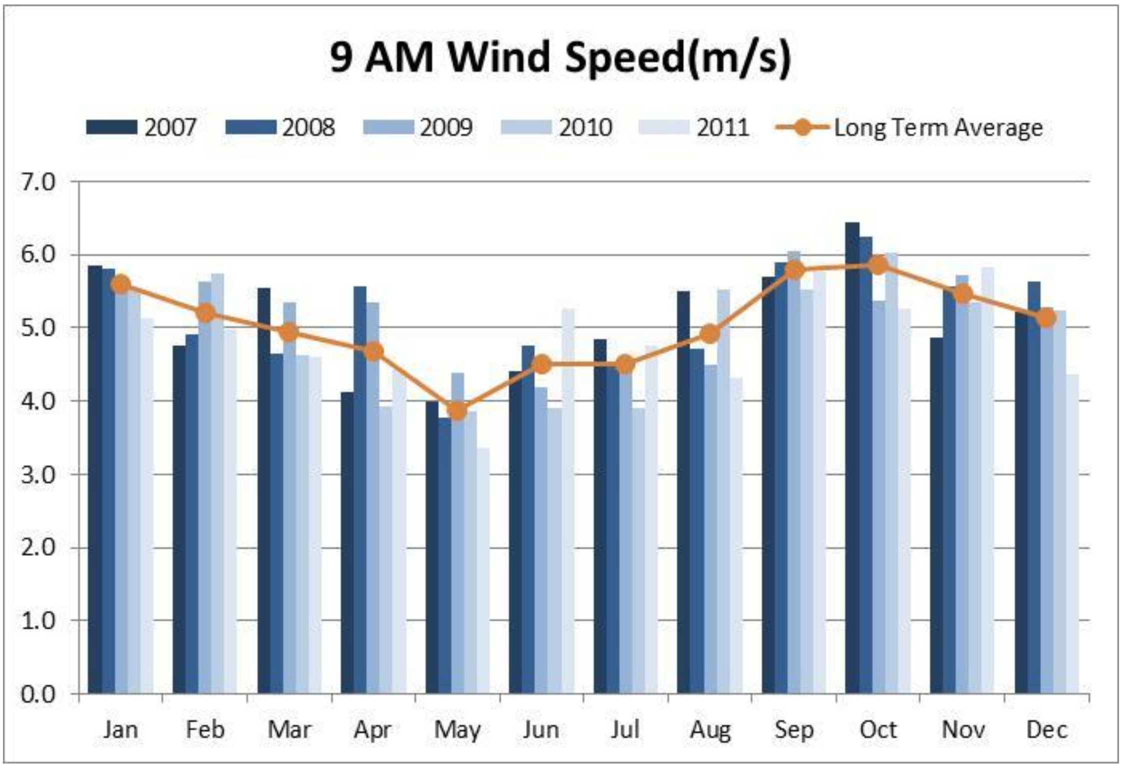


Figure 7 Wind Speed at 3 pm at Orange Airport (2007-2011)

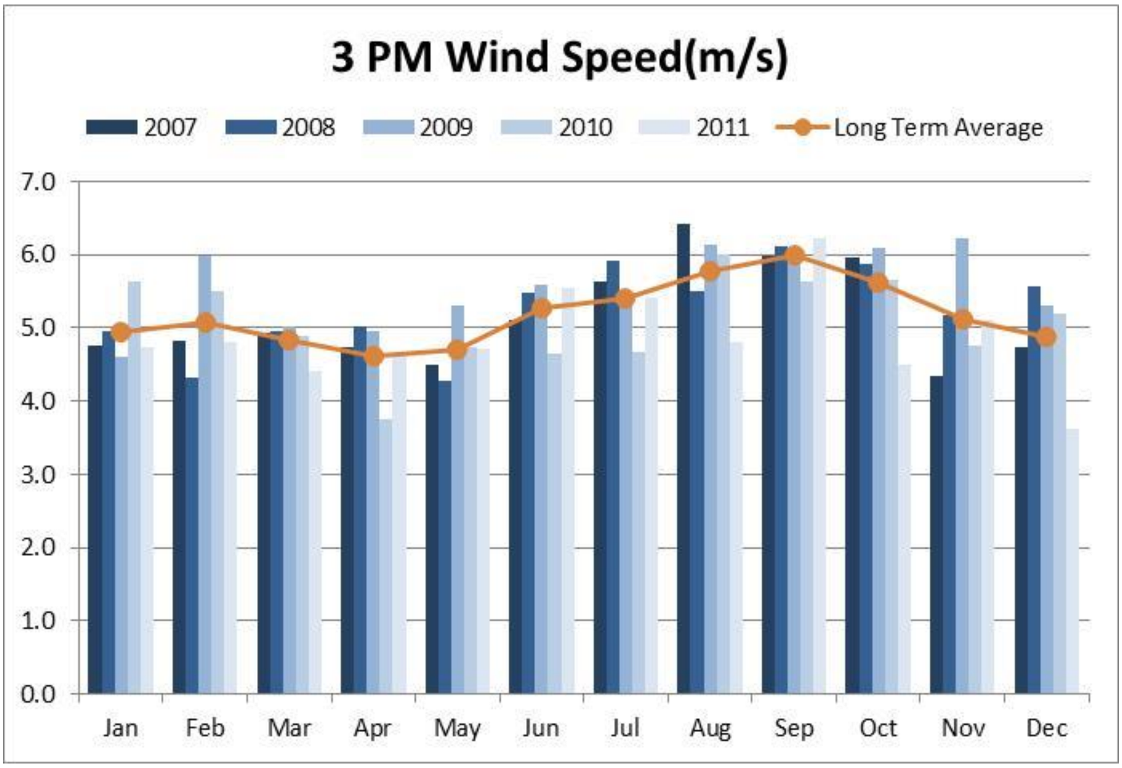


Figure 8 Temperature at 9 am at Orange Airport (2007-2011)

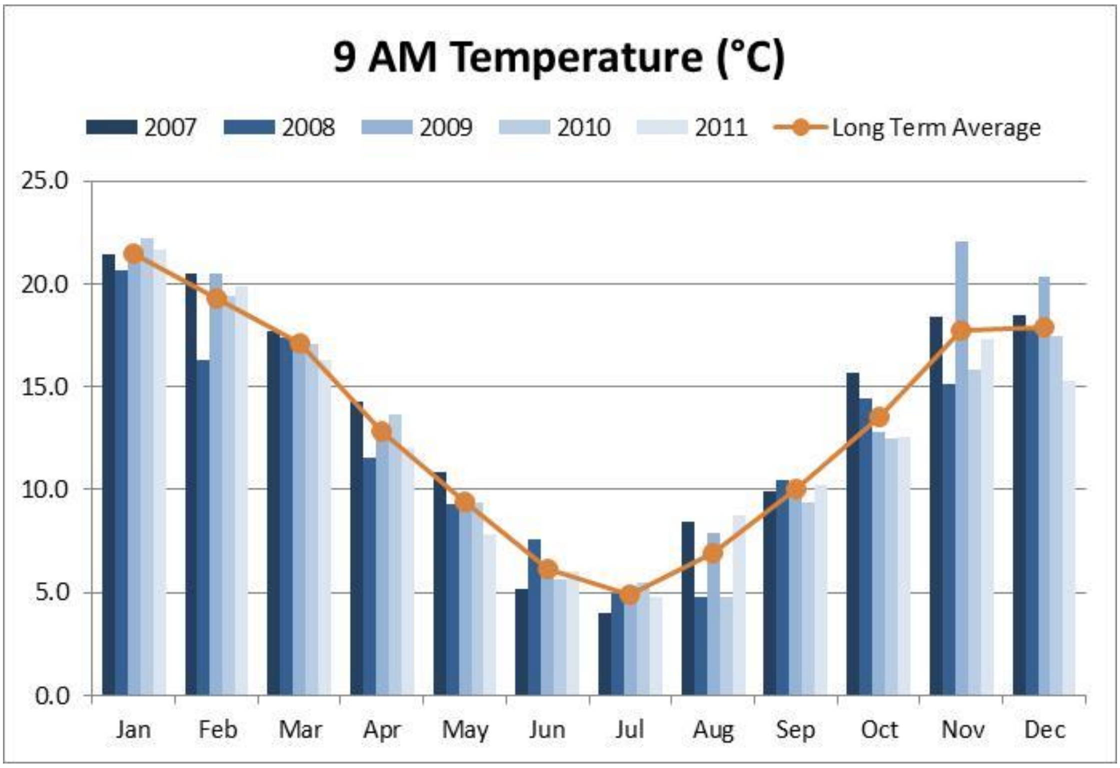


Figure 9 Temperature at 3 pm at Orange Airport (2007-2011)

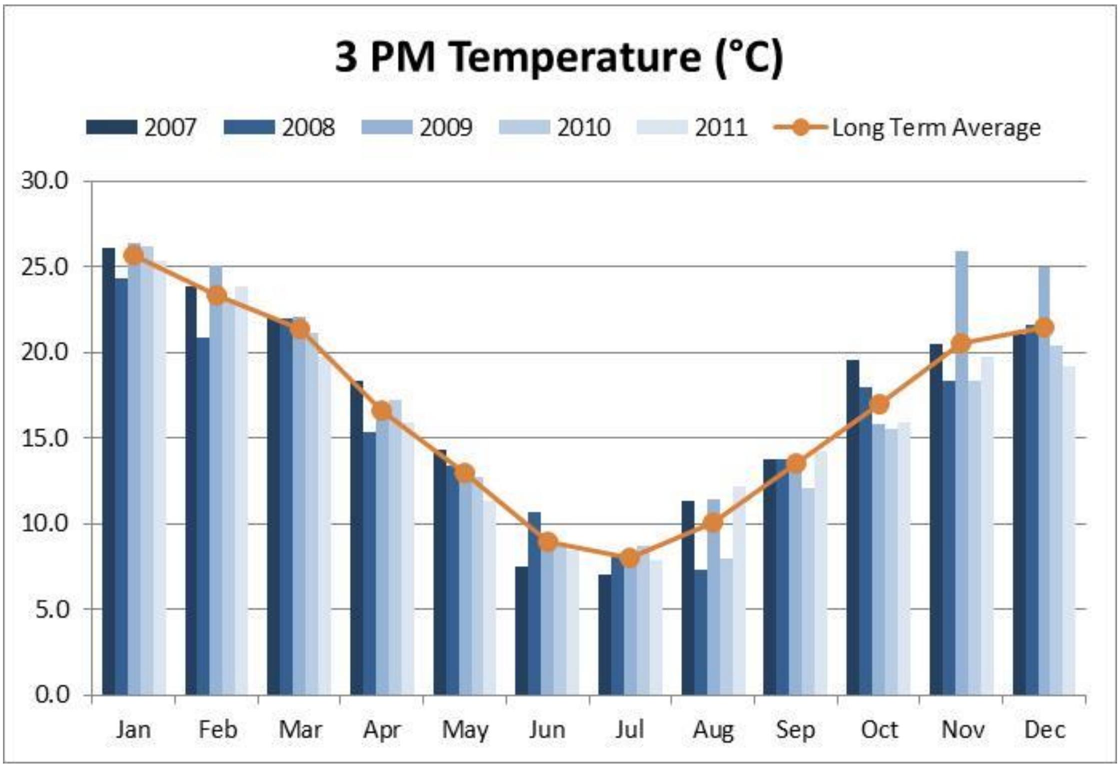


Figure 10 Relative Humidity at 9 am at Orange Airport (2007-2011)

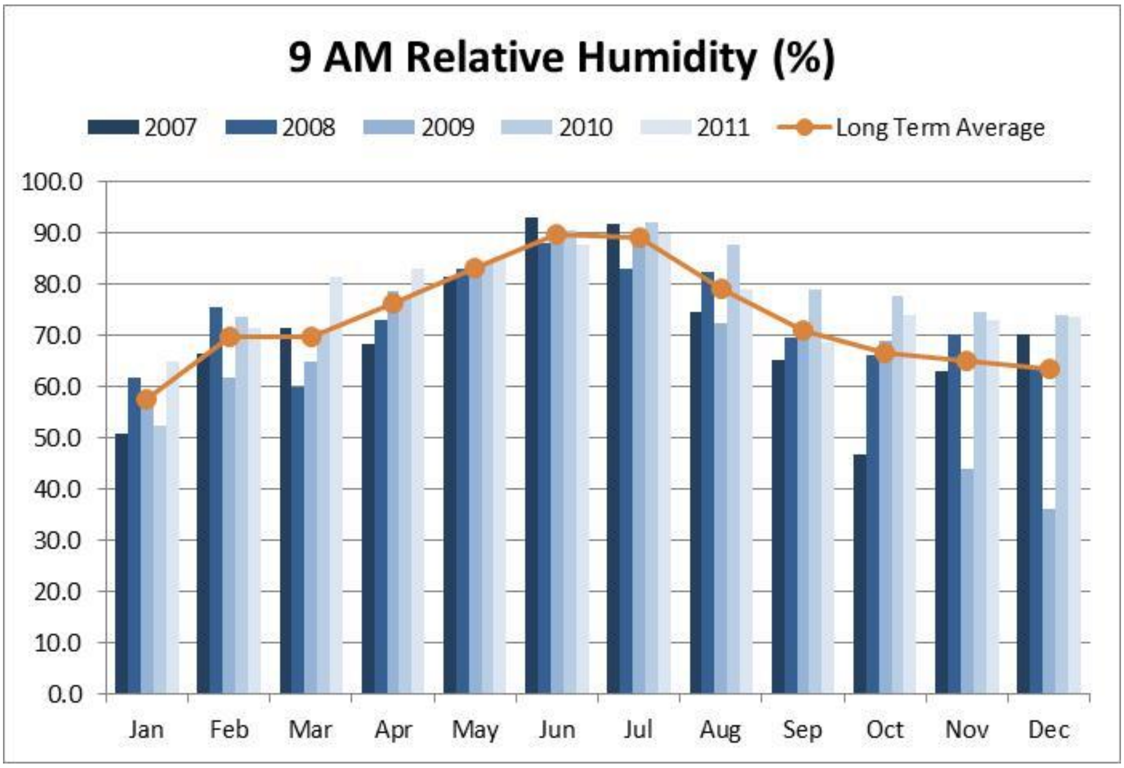
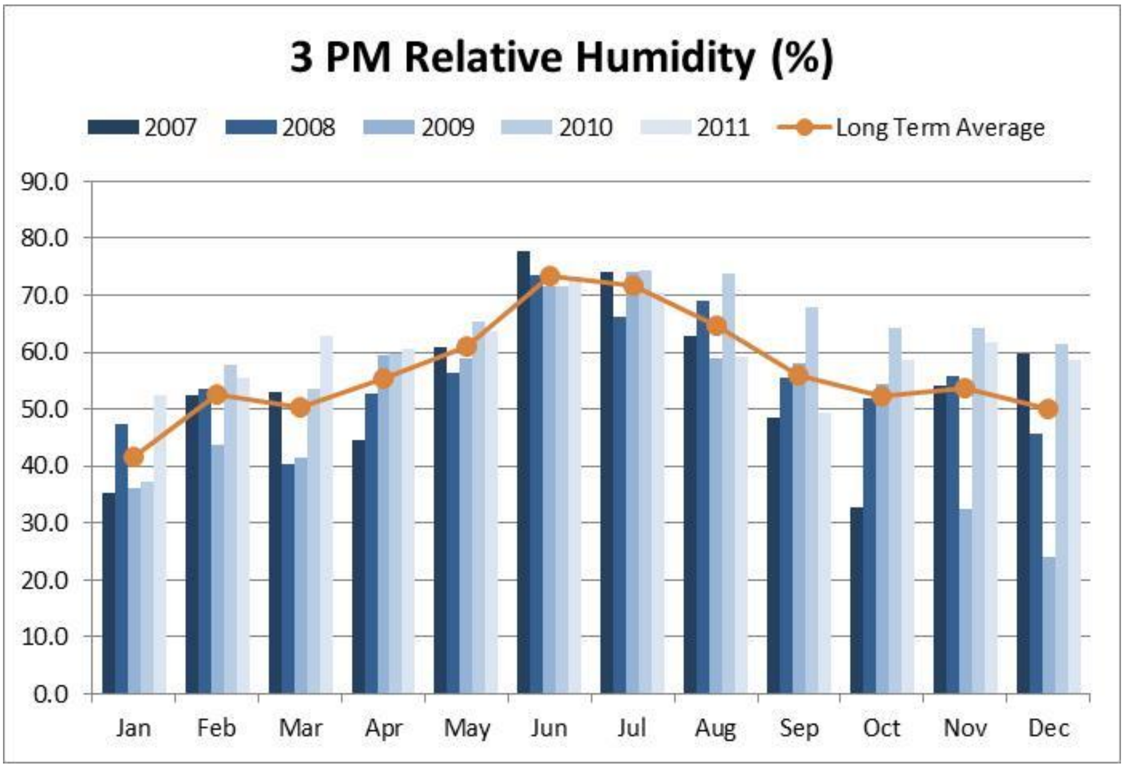


Figure 11 Relative Humidity at 3 pm at Orange Airport (2007-2011)



7.2 Model Selection

There are several notable dispersion model options available for use in NSW. They include:

- AUSPLUME;
- AERMOD; and
- CALPUFF.

7.2.1 AUSPLUME

AUSPLUME (Lorimer, 1986) is a steady state Gaussian plume dispersion model, whose mathematical basis derives from the ISC model (Bowers, et al., 1979), which is capable of simulating the effects of multiple sources, including stacks, volume sources and area sources. Their effects can be integrated over a long time period (>1 year), or evaluated for short-term maximum impacts. Gravitational effects (settling) can be accounted for in particle emissions by including information on particle characteristics. The terrain and gravitational options are not highly sophisticated, but for general purposes are considered to be useful and adequate.

Most State regulatory authorities in Australia recognise AUSPLUME Version 6.0 (v6.0) or later as an acceptable dispersion model for general use (EPA Victoria, 2001) (NSW OEH, 2005) (SA EPA, 2006). In January 2014, the EPA Victoria phased out AUSPLUME as the regulatory model in favour of AERMOD. AUSPLUME is not normally recommended for use in the following applications, noting that this is not an exhaustive list:

- Complex terrain where the height of any receptor exceeds the lowest release height (NSW OEH, 2005).
- Dispersion modelling beyond a distance of 10 kilometres.
- Where sensitive receptors are located at a distance from the source that is greater than the minimum distance travelled by the plume in one hour (under conditions critical to compliance).

AUSPLUME, like all Gaussian models, is limited as a dispersion model in the manner in which it operates, which is to:

- predict ensemble-average concentrations but not the transient peaks caused by downdrafts in thermal convection eddies
- ignore or only partly account for horizontal and vertical variation in turbulence, wind speed and wind direction within the boundary layer
- assume quasi-steady state conditions. This precludes simulation of events such as inversion breakup fumigation
- ignore longitudinal diffusion (parallel to the plume axis), which restricts applications to wind speeds above about 0.5 m/s
- use empirical dispersion parameters *sigma y* and *sigma z* that are difficult to determine experimentally beyond about 10 km from a source and become meaningless at distances sufficiently large for advection effects to dominate over diffusion (which may be only a kilometre in complex terrain)
- be unsuccessful in its ability to precisely parameterise the complex flow in the wake of buildings or other obstacles.

7.2.2 AERMOD

AERMOD stands for the AERMIC Dispersion Model. It was designed by the AERMIC Committee (the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee) to treat elevated and surface emission sources in terrain that is simple or complex (Perry & Cimorelli, 2005).

AERMOD has been built on the framework of the Industrial Source Complex (ISC3) model and retains the steady-state limitation of ISC3. However, its treatment of dispersion in the presence of complex terrain improves on that used in ISC3 and it contains advanced algorithms to describe turbulent mixing processes in both convective and stably stratified conditions. AERMOD also offers new and potentially improved algorithms for plume rise and buoyancy, as well as the computation of vertical profiles of wind, turbulence and temperature.

In November 2006 AERMOD replaced ISC3 model as the USEPA's regulatory model for near-field applications (less than 50 km) for simple and complex terrain (US EPA, 2008). Compared to ISC and AUSPLUME, AERMOD represents an advanced new-generation model which requires additional meteorological and land-use inputs to provide more refined predictions. However, given that AERMOD is essentially a more refined version of the ISC dispersion model the same limitations listed for AUSPLUME are likely to apply to AERMOD.

7.2.3 CALPUFF

CALPUFF (California Puff model) is a multi-layer, multi-species non-steady state puff dispersion model that can simulate the effects of time- and space-varying meteorological conditions on pollutant transport, transformation and removal (Scire, et al., 2000). CALPUFF is a highly versatile and widely-used model which can be run in three-dimensional or two-dimensional mode with respect to meteorology. The three-dimensional mode allows spatially varying wind fields, for example, to be incorporated: this can be important in coastal regions with seabreeze effects. CALPUFF also allows plumes to be tracked through time as they are transported by regional winds: in coastal regions recirculation of pollutants due to seabreeze and landbreeze cycles can also be important.

CALPUFF contains algorithms for near-source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as effects such as pollutant removal, chemical transformation, vertical wind shear, a Probability Distribution Function for dispersion in the convective boundary layer and coastal interaction effects (e.g. sea-breeze recirculation and fumigation within the Thermal Internal Boundary Layer).

Meteorological data used to drive CALPUFF are processed by the CALMET meteorological pre-processor (Scire, et al., 2000) . CALMET includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are used in CALPUFF. CALMET uses measured and/or modelled meteorological inputs in combination with land use and geophysical information for the modelling domain to predict gridded meteorological fields for the region of interest.

CALPUFF is an USEPA regulatory model (US EPA, 2008) and is widely used in Australia.

7.2.4 Site Specific Factors affecting Model Selection

The dispersion algorithms used by the models determines how the model simulates the dispersion of a plume. The Gaussian models assume that the average concentration distribution of the plume is based on a Gaussian distribution. However, at any particular instant, the actual concentration may be very different. In addition, the steady state nature implies that these models can't simulate the effects of time- and space-varying meteorological conditions. Non-steady state models can simulate the effects of time- and space-varying meteorological conditions on pollutant transport. AUSPLUME and AERMOD are steady-state Gaussian models whereas CALPUFF is a non-steady state puff model.

Another key modelling consideration is the specification of the Gaussian dispersion coefficients (σy and σz). These describe the horizontal and vertical dispersion parameters used to define the rate of turbulent diffusion of contaminants in the plume in the horizontal and vertical directions. AUSPLUME uses Pasquill-Gifford stability categories, whereas AERMOD and CALPUFF favour the more complex, Monin-Obukhov similarity theory.

An accurate characterisation of the sources of emission and their effective emission rates is crucial for adequate quantification of the pollutant concentrations. Sources described as volume sources have an initial horizontal and vertical spread. Area sources have an emission rate applied across the surface of the area (in $g/m^2/s$). This site has a high proportion of sources described as either area or volume sources. AUSPLUME does not adequately describe emissions from area sources and it is recommended that a volume source approximation be used to model area sources. Plume meander has not been implemented for area sources in AERMOD. As a result, concentration predictions for area sources may be overestimated under very light wind conditions. It is recommended that a volume source approximation be used to model area sources in AERMOD. However, CALPUFF uses a specialised algorithm to simulate concentrations within and downwind of area sources.

The dispersion algorithms, the treatment of turbulent diffusion, and the characterisation of sources inherent to CALPUFF are more sophisticated and more accurately simulate the real world dispersion of plumes. With regard to odour dispersion modelling in particular, AUSPLUME has pronounced limitations under the conditions often most critical for the prediction of maximum impacts, i.e., very light wind, stable conditions. Therefore, the CALPUFF dispersion model was selected for use in this assessment, as it is most critically able to better account for the behaviour of plumes under light wind, stable conditions.

7.3 Meteorological Modelling

Dispersion modelling conducted for this assessment included TAPM, CALMET and CALPUFF.

7.3.1 TAPM

Meteorological data was prepared for the dispersion modelling using The Air Pollution Model (TAPM) developed by CSIRO. TAPM v4 solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses. Detailed description of the TAPM model and its performance is provided elsewhere. The Technical Paper by Hurley (2008a) describes technical details of the model equations, parameterisations, and numerical methods. A summary of some verification studies using TAPM is also given in Hurley (2008b).

A meteorological dataset for 2010 was created using meteorological information and terrain data inherent to TAPM. TAPM v4 has a tendency to overpredict the incidence of light winds in some situations. However, this tendency is considered to lend a conservative bias as low wind speeds are conducive to higher ground level concentrations.

TAPM v4 was run with surface observations from Orange Airport.

7.3.2 CALTAPM

CALTAPM was developed to provide users of the TAPM model the ability to create an hourly, 3-dimensional data file of gridded meteorological parameters of the type 3D.DAT for direct use in the CALMET diagnostic meteorological model. When used this way the TAPM data can be used in CALMET to determine the initial guess wind field, prior to the weighting of true observations or even to run CALMET in no-observation mode. The TAPM output file was converted to a 3D.DAT file using CALTAPM for input into CALMET as an initial guess wind field.

7.3.3 CALMET

CALMET is a meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are used in the CALPUFF dispersion model.

CALMET requires several datasets in order to resolve the surface and upper air meteorology occurring for each hour of the year:

- Surface observations:
  - Wind speed;
  - Temperature;
  - Cloud cover amount;
  - Precipitation amount and type; and
  - Base cloud height.
- Upper air observations:
  - Height of observation;
  - Wind speed and direction at each height;
  - Temperature at each height; and
  - Barometric pressure at each height.
- Land Use data; and
- Topographical data.

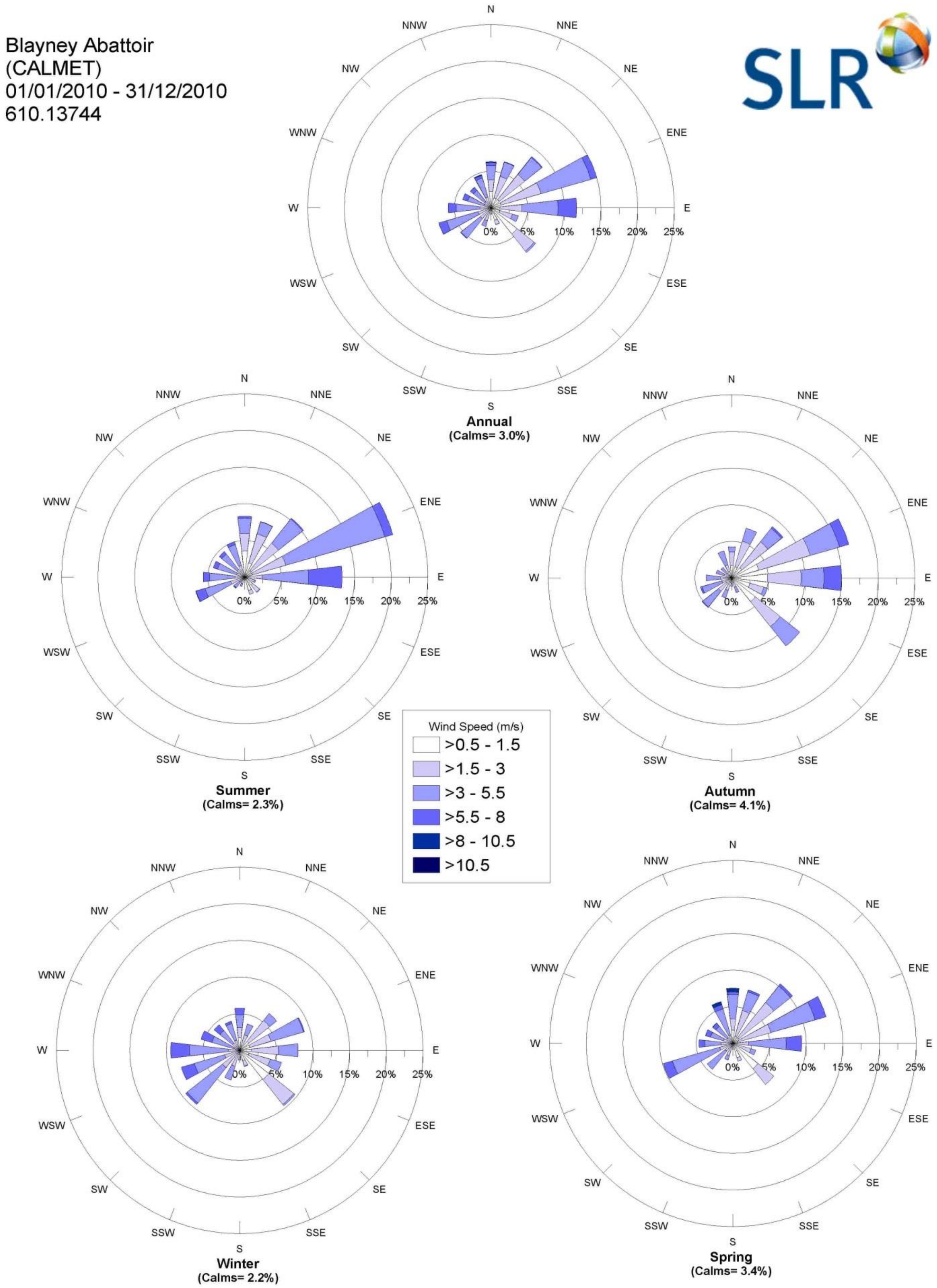
CALMET was run with surface observations from the Orange Airport. CALTAPM provided a 3D.DAT file containing surface and upper air observations at every grid point in the model domain.

7.4 Meteorological Model Verification

7.4.1 Wind Speed and Direction

Figure 12 shows the annual and seasonal wind roses extracted (from the CALMET generated data) for the area. The predominant predicted wind directions at the Project Site on an annual basis are in the east north-east quadrant. East north-easterly winds dominate in summer and tend easterly to south-easterly in the autumn. The cooler months show a significant percentage of winds from the west and south-west. Dominant spring winds were predicted to originate from the east north-east and west south-west. The CALMET generated data showed an annual average wind speed of 3.0 m/s and calm conditions occurring approximately 3.0% of the time. These wind directions will be mainly influenced by the local topography.

Figure 12 CALMET Generated Wind Roses at the Project Site



7.4.2 Stability Class

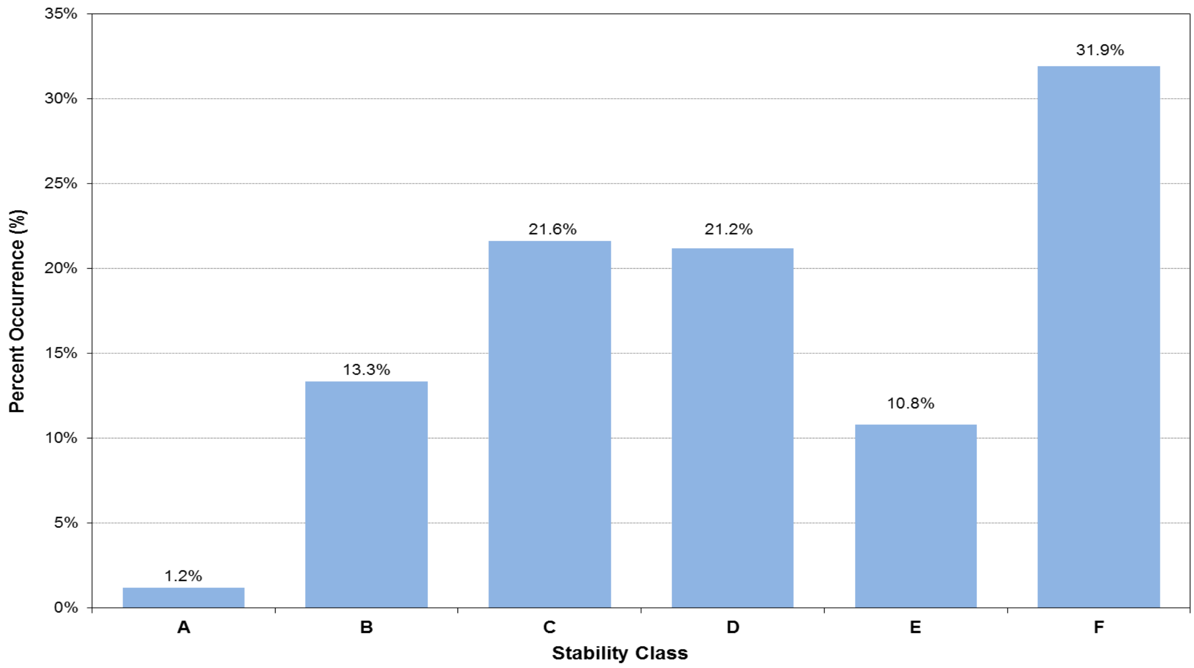
An important aspect of emissions dispersion is the level of turbulence in the atmosphere near the ground. Turbulence acts to dilute or diffuse a plume by increasing the cross-sectional area of the plume due to random motion. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits diffusion and is a critical factor in causing high plume concentrations downwind of a source. Turbulence is related to the vertical temperature gradient, the condition of which determines what is known as stability, or thermal stability. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe the dispersion conditions in the atmosphere.

The best known stability classification is the Pasquill-Gifford (P-G) scheme, which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, such as those that commonly occur under clear skies at night and in the early morning. Under these conditions plumes can remain relatively undiluted for considerable distances downwind. Intermediate stability classes grade from moderately unstable (B class), slightly unstable (C class), to neutral (D class) and then slightly stable (E class). Whilst classes A and F are closely associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is low.

The CALMET-generated meteorological data can be used to estimate stability classes and the frequency distribution of estimated stability classes is presented in **Figure 13**. The data show a high proportion of slightly unstable (class C), neutral conditions (class D), and night time stable conditions (class F). The high frequency of Class D and F conditions are due to the high number of hours a day where these conditions dominate (starting at sunset, progressing throughout the night and concluding after sunrise). The amount of turbulence in the atmosphere has a major effect on the dispersion because turbulence increases the entrainment and mixing. This high precedence of stable and neutral conditions represents the worst case for dispersion and allows for a conservative assessment.

It is noted that a turbulence based scheme within CALPUFF was used in the modelling and the P-G stability class frequency is shown for information only.

Figure 13 Frequency Distribution of Stability Classes at the Project Site



7.4.3 Mixing Height

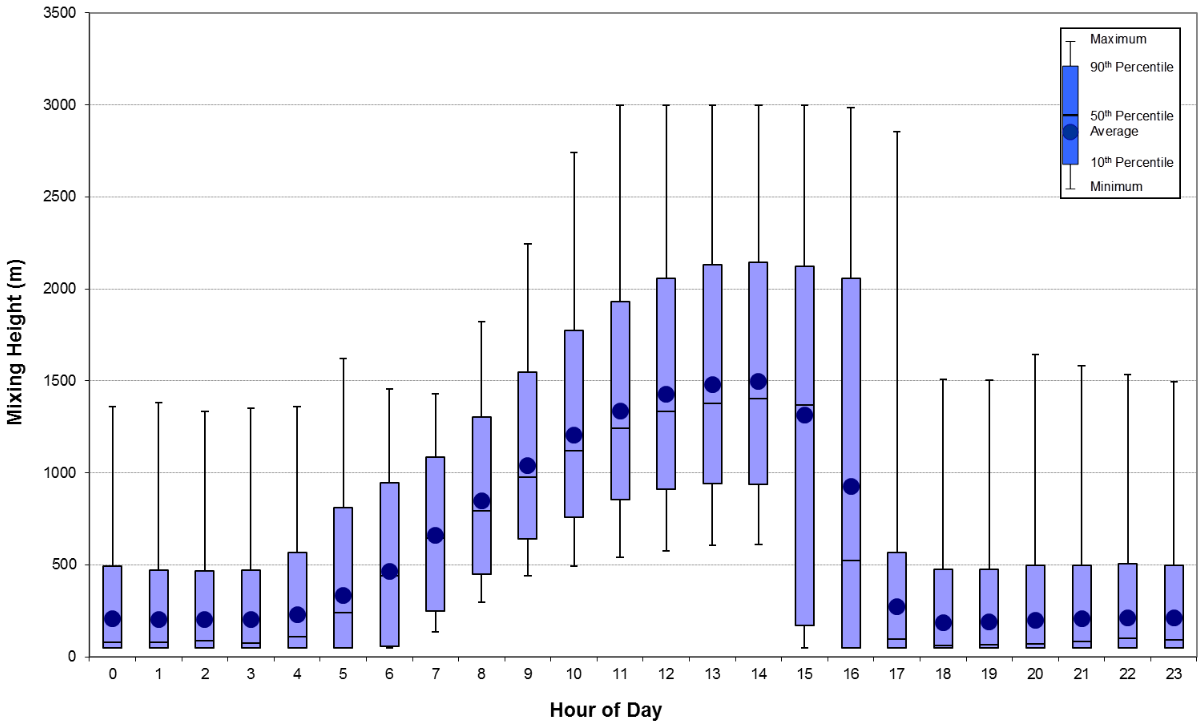
Mixing height is defined as the height above ground of a temperature inversion or statically stable layer of air capping the atmospheric boundary layer.

It is an important parameter within air pollution meteorology as vertical diffusion or mixing of a plume is generally considered to be limited by the mixing height, as the air above this layer tends to be stable, with restricted vertical motion.

It is often associated with, or measured by, a sharp increase of temperature with height, a sharp decrease of water-vapour, a sharp decrease in turbulence intensity and a sharp decrease in pollutant concentration. Mixing height is variable in space and time, and typically increases during fair-weather daytime over land from tens to hundreds of metres around sunrise up to 1-3 km in the mid-afternoon, depending on the location, season and day-to-day weather conditions.

Mixing heights show diurnal variation and can change rapidly after sunrise and at sunset. Diurnal variations in the minimum, maximum and average mixing depths, based on the CALMET-generated meteorological data close to the Project Site, are shown in **Figure 14**. As expected, mixing heights begin to grow following sunrise with the onset of vertical convective mixing with maximum heights reached in mid to late afternoon. The median, highest and lowest mixing heights for each hour are represented by the horizontal lines. The vertical bars represent the lower quartile and upper quartile of mixing heights. The dark blue points represent the average.

Figure 14 Mixing Heights at the Project Site



7.5 Emissions Estimation

The major activities giving rise to emissions of odour or dust to the atmosphere associated with the operation of an abattoir and rendering plant are outlined in **Table 18**. The potential emission sources associated with the abattoir are discussed in detail in **Section 7.5.1** to **Section 7.5.6**. The discussion includes which sources were deemed significant to include in the dispersion modelling.

Table 18 Sources of Emissions

Sources	Process
Abattoir Sources	Receiving and holding of livestock Slaughter and carcass dressing of animals Chilling of carcass product Carcass packaging Freezing of finished carcass and cartooned product Blood transporting Skins transporting Paunch transporting
Wastewater Sources	Treatment of wastewater
Ancillary Sources	Transport of by-product and processed material

7.5.1 Holding Pens

The holding pens are all hardstand areas with platforms to elevate stock and allow excrement to fall to the hardstand area below. The dust emissions from the holding pens are expected to be minimal following the implementation of appropriate dust mitigation measures. However, the pens are expected to be a source of odour from the collection of manure and from the presence of goats. In a move to employ best practice treatment of potential animal odour from the holding pens, the pens will be enclosed and the air within the shed will be vented through a stack. An appropriate odour emission rate from the holding pens of a similar facility has been applied to describe the manure odour in the dispersion modelling. An odour emission rate to describe the odour from goats was measured specifically by SLR for use in this assessment.

SLR performed odour sampling of approximately 300 goats in a sorting shed in accordance with AS/NZS 4323.3:2001 (SLR Consulting, 2014). A copy of the NATA Accredited monitoring report is presented in **Appendix C** of this report. Goats were taken into the sorting shed and allowed to stand for a period of one (1) hour before any sampling commenced. The floor of the sorting shed was constructed of wooden slats, which were elevated off the ground. The slats were separated by 5 millimetres (mm) to allow faecal matter to fall to the ground below for collection and removal. A 150 mm ventilation void existed between the top of the shed walls and the roof.

Three simultaneous samples were collected from inside the sorting shed (diagonally across the sorting shed floor; north to south). Odour samples were collected at approximately the average height of the goats. The process was repeated to obtain a total of six (6) odour samples collected for the sorting shed. Air velocities were measured over various 1 minute periods during monitoring and measured an average velocity of less than 0.1 m/s at the average goat height.

Odour Emission Rates (OER) calculated for the sorting shed were derived by using the sorting shed floor dimensions of 112 m^2 and the average air velocity at the goat height during the sampling period of 0.1 m/s. The average OER calculated was 233.3 OU.m^3/sec. This OER was measured from a 112 m^2 area containing 300 goats, an average density of 2.7 goats/m^2. The proposed space allocated to the Blayney abattoir's proposed maximum capacity of 10,000 goats is 6,685 m^2 or an average of 1.5 goats/m^2. The proposed density of goats in the Blayney Abattoir is likely to be 1.8 times less than the density of goats present when the odour monitoring was undertaken. Therefore, the odour emission rate was subsequently factored by 1.8 to reflect the proposed density of goats in the enclosed holding pens. The resulting odour emission rate to account for odour from goats is 130.3 OU.m^3/sec.

In addition to accounting for the density of goats in the holding pens, the turnover rate of air inside the shed was taken into account. During the monitoring exercise, goats were kept in the sorting shed for 1 hour prior to commencing sampling. However, the air flow inside the proposed holding pen is due to be exchanged once every 4 hours. This indicates that there is potential for four times as much odour to accumulate in the air inside the holding pen. Therefore, the odour emission rate described for odour from goats was multiplied by 4 to give 521.2 OU.m3/sec.

Table 19 Ambient Odour Concentration of Goats in the Sorting Shed

Parameter	Ambient Samples taken in the Sorting Shed					
Sample Number	1	2	3	4	5	6
Dimension (width) (m)	7					
Dimension (length) (m)	16					
Cross sectional area (m^2)	112					
Average air velocity measured (m/s)	0.1					
Number of Goats in Sorting Shed	300					
Odour Concentration (OU)	19	19	16	25	29	17

Parameter	Ambient Samples taken in the Sorting Shed					
Measured Odour Emission Rate (OER) ($OU.m^3/s$)	213	213	179	280	325	190
Average Measured OER ($OU.m^3/s$)	233.3					
Average OER Corrected for Goat Density ($OU.m^3/s$)	130.3					
Average OER Corrected for Goat Density and Air Exchange ($OU.m^3/s$)	521.2					

7.5.2 Slaughter Floor

The slaughter floor is under positive pressure therefore potential fugitive emissions of odour may be emitted from open doors and other unsealed openings. An odour emission rate equivalent to that expected in a holding pen has been included as an odour source from the slaughter floor in the dispersion model.

Blood will be segregated, collected directly through a closed system and transported off-site for processing. This source is fully contained and therefore no odour is expected to be emitted.

By-product from the slaughter floor is collected in open bins beneath the slaughter floor for transfer off-site. The bins will not be covered. There are three types of by-product collected in these bins: animal skins; paunch; and non-edible by-product.

- Animal skins from the abattoir will be transported to an off-site skins treatment facility in the Blayney Industrial Estate.
- Paunch will be removed from site by a licensed contractor for treatment and beneficial reuse such as composting and /or land application.
- Non-edible by-product will be collected by a licensed contractor daily for transport in enclosed trucks to an off-site licenced rendering facility.

An odour emission rate for fresh paunch has been allocated to each of these sources and the emissions modelled in the dispersion model.

Emissions of dust may occur at points where trucks are loaded or unloaded. For the loading of trucks to take by-product from the slaughter floor and transport it off-site, minimal dust will be emitted from loading and unloading given the nature of the by-product. This source of emissions was not modelled.

7.5.3 Carcass Preparation Room

The carcass preparation room is air conditioned. By-product from the carcass preparation room, including fat, is collected in bins discussed in **Section 7.5.2**. It is assumed that the odour is minimal in these areas given the nature of the operations and the cool temperature.

Emissions of dust may occur at points where trucks are loaded or unloaded. For the loading of trucks to take by-product from the carcass preparation room and transport it off-site, minimal dust will be emitted from loading and unloading given the nature of the by-product. In addition, minimal dust will be emitted from loading of trucks with product for transfer to market as the product will be packaged. These sources of emissions were not modelled.

7.5.4 Cold Storage Facility

The cold storage facility is under active refrigeration. No emissions of odour or dust are anticipated from the cold storage facility.

7.5.5 Wastewater

Wastewater will be generated in the holding pens and on the slaughter floor. All operational wastewater generated by the development will be treated on-site in a wastewater treatment system designed specifically for the abattoir operation. As treated wastewater will be captured in a holding tank, no artificial ponding of waste water will be required.

The wastewater treatment system will involve dissolved air floatation (DAF), anaerobic treatment, followed by aerobic treatment, filtration through a membrane bioreactor and finally, chlorination and each process is to be undertaken in a sequential series of tanks. The DAF, aerobic tank and membrane bioreactor are likely to emit fugitive emissions of odour to atmosphere. These sources have been defined in the model and emission rates have been attributed from similar facilities.

The dewatered wastewater sludge is collected in a bin and transported to landfill. An odour emission rate for fresh paunch has been allocated to this source and the emissions modelled in the dispersion model.

7.5.6 Ancillary Sources

On-site Machinery and Traffic Travelling Off-site

Exhaust emissions from on-site machinery and from trucks making deliveries or travelling off-site have been considered in this assessment. Details of the number of on-site vehicles and off-site truck movements are outlined in **Section 2.5**. During operation of the facility there will be four (4) electric forklifts used inside the cold storage facility. No emissions are anticipated from the electric forklifts and they have not been included in the modelling.

Given the low level of current vehicle traffic in the area, the local air quality is not heavily impacted by emissions of products of combustion from vehicle exhaust. The exhaust emissions from the types of vehicles on-site are therefore not considered significant as the impacts of the additional emissions associated with vehicles on-site will be short term in nature. Given the scale of this source, it is reasonable to assume that the exhaust emissions from on-site vehicles are unlikely to represent a significant impact on local air quality and therefore have not been included as sources in the dispersion modelling.

The number of external vehicles making deliveries to site and taking product off-site will be minimal in context of the surrounding environment. The background air quality has been sourced from Bathurst, which is the nearest representative location where monitoring is undertaken by NSW OEH. This location is likely to have a significantly higher number of vehicles in the vicinity of the monitoring location and therefore, it can be reasonably assumed that the impact from the increase in traffic emissions from the Project is captured in the use of conservative background air quality data.

Wheel generated dust from these on-site and off-site traffic movements will also be minimal as all roads post-construction on-site will be sealed. Therefore it can be assumed that wheel generated dust will be minimal with adequate management practices.

Boiler

Two boilers will be installed for the generation of steam for cleaning purposes. The boilers will be fuelled by gas and operate continuously.

7.5.7 Summary of Emission Estimates from Abattoir Sources

The source characteristics and emission estimations outlined in **Sections 7.5.1** to **7.5.6** are detailed in **Table 20**, **Table 21**, and **Table 22**.

Table 20 Emissions Estimations from Boilers

Source ID	Operation	Base Elevation	Source Coordinates (km)		Release Height	Stack Diameter	Exhaust Temp	Exhaust flowrate	Exhaust Velocity	NO_X	SO_2	Total PM (as PM_{10})
		m	X	Y	(m)	(m)	(K)	(m^3/sec)	(m/sec)	(g/sec)	(g/sec)	(g/sec)
SRC_1[1]	Boiler	868.83	710.603	6287.509	8	0.4	513	2.89	23	0.315	0.00	0.031
SRC_1B	Boiler	868.79	710.602	6287.507	8	0.4	513	2.89	23	0.315	0.00	0.031

Notes:

1. NOx concentration of 50 ppm per boiler was discharged from the low NOx burners. SO_2 concentrations will be nominally zero. Exhaust flow rate has been based on a stack diameter of 0.7 m with a nominal velocity of 15 m/s to give 5.77 m^3/sec (East Coast Steam Pty Ltd, 2014). The design then changed to vent the boiler emissions from two stacks with a stack diameter of 0.4 m each, to give an exhaust velocity of 23 m/s and flowrate of 2.89 m^3/sec. The PM_{10} emission rate was calculated by multiplying the flowrate (2.89 m3/sec) by the PM_{10} concentration from the Fonterra boilers described in the Fonterra Spreyton Facility assessment (0.0107 g/m^3). This was derived from an emission rate of 0.042 g/sec and a flowrate of 3.927 m^3/sec (PAEHolmes, 2011).

Table 21 Emission Estimations from Holding Pen

Source ID	Operation	Base Elevation	Source Coordinates (km)		Release Height	Stack Diameter	Exhaust Temp	Exhaust flowrate	Exhaust Velocity	Specific Odour Emission Rate	Odour Emission Rate
		m	X	Y	(m)	(m)	(K)	(m^3/sec)	(m/sec)	(OU.m^3/m^2/s)	(OU.m^3/s)
SRC_2A[1,2]	Holding Pen (manure)	870.97	710.691	6287.551	17.8223	1.2	293	4.17	3.68	0.53	3509.6
SRC_2F[3]	Holding Pen (goat odour)	870.97	710.691	6287.551	17.823	1.2	293	4.17	3.68	-	521.2

Notes:

1. Odour intensity for the meat processing industry - Katestone, for cattle yards (Katestone Environmental, 2004). Odour emission rates pertaining specifically to goat manure are unfortunately not publically available in Australia. Odour emission rates taken in Australia from cattle manure were deemed to be a conservative assumption on the basis of the following reasons:
   - The consistency of fresh goat manure is drier than cattle manure, leading to a reduction in the odour generated;
   - However, the surface area to volume ratio of goat manure is higher than cattle manure and this would give goat manure a larger surface area from which odour could escape into the atmosphere;
   - Subsequently, goat manure is likely to dry out at a faster rate than cattle manure and form a greater barrier to odour volatilisation than cattle manure.

- We also considered that cattle would produce a larger volume of manure than goats but, as a larger number of goats could fit in a square metre, the ratio of manure generated per square meter is likely to be similar for both goats and cattle.

2. The specific odour emission rate was sourced from Odour Intensity for the meat processing industry - Katestone, for cattle yards (Katestone Environmental, 2004). The specific odour emission rate (0.53 $OU.m^3/m^2/sec$) was multiplied by the area it was applied to (1600m^2) to give 840 $OU.m^3/sec$. Note, the figure of 840 has been rounded down by the Katestone report. This rounding was carried through into the calculations of emission rates for this report The odour emission rate of 840 $OU.m^3/sec$ was multiplied by a ratio of the area of the Holding Pens (6,685m^2/1600m^2) to give an odour emission rate of 3509.6 $OU.m^3/sec$ (this would be 3543.1 $OU.m^3/sec$ without the rounding down. However, it is deemed the difference between the two emission rates is inconsequential).
3. The odour emission rate was determined from monitoring of rangeland goats undertaken by SLR and described in **Section 7.5.1**.

Table 22 Emissions Estimations from Area and Volume Sources

Source ID	Operation	Base Elevation	Source Dimension		Area	Source Coordinates		Release Height	σY	σZ	Specific Odour Emission Rate
		m	Length	Width	m^2	X	Y	(m)			($OU.m^3/m^2/s$)
SRC_3[1]	Slaughter Floor	869.30	2	2	4	710.672	6287.500	1	0.47	0.47	0.53
SRC_4[2]	Non-edible	868.90	1	1	1	710.617	6287.510	1		0.25	36.3
SRC_5[2]	Skins	868.66	1	1	1	710.614	6287.500	1		0.25	36.3
SRC_6[2]	Paunch	869.09	1	1	1	710.639	6287.500	1		0.25	36.3
SRC_7[3]	DAF	867.87			28.27	710.587	6287.510	2		0.47	6.27
SRC_8[2]	Waste to landfill	867.70	1	1	1	710.582	6287.510	1		0.25	36.3
SRC_9[4]	Aerobic Tank	867.70			28.27	710.582	6287.510	2		0.47	0.08
SRC_10[5]	Membrane Bioreactor	867.53			28.27	710.574	6287.510	2		0.47	0.07

Notes:

1. Odour intensity for the meat processing industry - Katestone, for cattle yards (Katestone Environmental, 2004)
2. Primo Scone Abattoir - Heggies, literature value for fresh paunch (Heggies, 2006)
3. Primo Scone Abattoir - Heggies, DAF emission rate (Heggies, 2006)
4. Primo Scone Abattoir - Heggies, aeration pond emission rate (Heggies, 2006). This emission rate is considered a conservative when applied to the aerobic tank.
5. Primo Scone Abattoir - Heggies, maturation pond emission rate (Heggies, 2006). This emission rate is considered a conservative when applied to the membrane bioreactor.

7.5.8 Mitigation Measures

The emission estimates documented in **Section 7.5.7** have been sourced from facilities with published emission rates. It is unclear if the facilities where the measurements were taken applied best practices mitigation measures to reduce odour. Therefore, it's likely that some of the emission rates applied will lead to an over-estimation of the odour concentration predicted by the model outside the site boundary.

The abattoir has been designed specifically to reduce the potential for odour emissions to escape to the atmosphere. The wastewater treatment plant has been contained within tanks rather than in ponds to improve the treatment process and reduce the surface area available for interaction between the water and air environment. In addition, in an aim to reduce the odour emissions from the holding pens a best practice approach has been adopted. The holding pens will be enclosed in a shed and adequately ventilated to ensure appropriate conditions for animal welfare are maintained at all times. The resulting air will exit the building via a stack to aid dispersion of any odours. The air will be released from the stack at a height of 17.8 m above ground level and at a velocity of 3.68 m/s. At this point, the forces of diffusion act to passively dilute the odour in the air, and the forces of dispersion, mixing caused by the physical processes of wind flows, acts to actively dilute the odour in air. The aim of dispersion modelling is to understand, based on the local meteorology and terrain, how diffusion and dispersion act on the plume and what ground level concentrations of odour result.

The following mitigation measures will be implemented during the operation of the site to reduce the odour propagated from sources and activities:

- Regular cleaning of holding yards.
- Prompt removal of material from site.
- Waste to be transported around the site in enclosed systems wherever possible.
- Proper operation of water treatment systems to avoid odour generation.
- Non enclosed systems to be accessible for regular clean down.
- Traffic management procedures to co-ordinate the delivery schedule and avoid a queue of the incoming or outgoing trucks for extended periods of time.
- Spill management procedures to include immediate clean-up of any spill/leakage.
- Maintenance of an odour complaint logbook and in the event of a complaint immediately investigate any unusual odour sources within the site boundary and take appropriate action to eliminate these.

7.6 Dispersion Modelling

7.6.1 CALPUFF

CALPUFF (Scire, et al., 2000) is a multi-layer, multi-species, non-steady state puff dispersion model that can simulate the effects of time and space varying meteorological conditions on emissions transport, transformation and removal. The model contains algorithms for near-source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as longer-range effects such as substance removal, chemical transformation, vertical wind shear and coastal interaction effects. The model uses dispersion equations based on a Gaussian distribution of substances across the puff and takes into account the complex arrangement of emissions from point, area, volume, and line sources.

As with any air dispersion model, CALPUFF requires inputs in three major areas:

- Emission rates and source details;

- Meteorology; and
- Terrain and surface details, as well as specification of specific receptor locations.

7.6.2 Model Domain

The model domain encompassed a 10 x 10 km grid with 0.1 km resolution and was referenced to a south-west corner of 705700, 6282500 m. The 3D.DAT file generated by CALTAPM was used as an initial guess wind field for the meteorological modelling of the grid.

The following settings were used in the CALPUFF setup:

- Grid of 100 x 100 grid points at resolution of 100 m, with the south-west corner at 705700, 6282500 m (MGA);
- Partial plume adjustment for terrain effects;
- Chemical transformation was not included; and
- Deposition was not included.

7.6.3 Post-Processing

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

7.7 Modelling Results

7.7.1 Nitrogen Dioxide

Table 23 shows the predicted annual average and maximum 1-hour NO_2 concentrations, respectively, due to emissions from the gas fired boilers. It has been assumed that there is full oxidation of the NO_x to NO_2 whereas in reality, it is more likely to be approximately 20%. These predictions are therefore considered to be highly conservative.

The concentration contours of the predicted model results are presented in **Figure 15** and **Figure 16** in **Appendix D**. The predicted annual average NO_2 concentrations reach a maximum at Receptor 2 of 1.3 µg/m^3, which is below the 62 µg/m^3 criterion. The maximum 1-hour average NO_2 concentration of 81 µg/m^3 was predicted at Receptor 2 and is below the 246 µg/m^3 guideline.

Table 23 Predicted NO_2 Concentrations at Sensitive Receptors

Receptor ID	Coordinates (MGA, m)		NO_X as NO_2 Annual Average (µg/m^3)	NO_X as NO_2 Maximum 1-hour Average (µg/m^3)
	X	Y		
R1	709604	6287610	0.4	29
R2	710066	6287334	1.3	81
R3	710343	6287153	0.8	55
R4	711833	6287031	0.2	23
Guideline (µg/m^3)			**62**	**246**

7.7.2 Particulate Matter (PM_{10})

The predicted annual average and maximum 24-hour average PM_{10} concentrations at the sensitive receptors are presented in **Table 24**, with and without the contribution from background air quality. Emissions of total particulate matter from the boilers were all modelled as PM_{10} to provide a conservative approach. The background air quality contribution was sourced from the Bathurst air quality monitoring station (**Section 5.5**).

The concentration contours of the predicted model results are presented in **Figure 17** and **Figure 18**, and, **Figure 19** and **Figure 20** (inclusive of background), in **Appendix D**. The predicted annual average PM_{10} concentrations reach a maximum at Receptor 2 of 0.13 µg/m^3, which is below the 30 µg/m^3 criterion. Inclusive of background air quality contributions of 9.4 µg/m^3, the criterion is still met. The maximum 24-hour average PM_{10} concentration of 1.1 µg/m^3 was predicted at Receptor 2 and was predicted to be below the 50 µg/m^3 guideline. With the background air quality contribution of 43.3 µg/m^3, the appropriate criterion is met.

Table 24 Predicted PM_{10} Concentrations at Sensitive Receptors

Receptor ID	Incremental		Background		Cumulative	
	Annual Average (µg/m^3)	24-hour Average (µg/m^3)	Annual Average (µg/m^3)[1]	24-hour Average (µg/m^3)[1]	Annual Average (µg/m^3)	24-hour Average (µg/m^3)
R1	0.04	0.6	9.4	43.3	9.4	43.9
R2	0.13	1.1	9.4	43.3	9.5	44.4
R3	0.08	0.7	9.4	43.3	9.5	44.0
R4	0.02	0.4	9.4	43.3	9.4	43.7
Guideline (µg/m^3)	**30**	**50**	**-**	**-**	**30**	**50**

Notes:
1. Bathurst air quality monitoring station (**Section 5.5**)

7.7.3 Odour

The predicted ground level concentrations at the nearest representative receptors are summarised in **Table 25**. The 99th percentile of the predicted 1-second average ground level odour concentrations are presented as a contour plot in **Figure 21** in **Appendix D**, across the modelling domain.

Table 25 Predicted Peak 1-Second Average (99th percentile) Odour Concentrations at Sensitive Receptors

Receptor ID	Coordinates (MGA, m)		Odour Concentration (99th percentile, nose response time) (OU)
	X	Y	
R1	709604	6287610	0.2
R2	710066	6287334	1.0
R3	710343	6287153	1.3
R4	711833	6287031	0.1
Guideline (OU)			**3.85**

Table 25 shows the predicted 99th percentile peak 1-second average odour concentrations for the proposed facility only. Receptor 1, 2 and 4 are predicted to be impacted by odour concentrations of 1 OU or less. 1 OU is considered the theoretical minimum concentration that produces an olfactory response or sensation in 50% of the population under laboratory conditions. The character of an odour usually cannot be determined at this concentration. Therefore, it is unlikely any offensive

odours will be perceived at these locations. This is not to say that the odour will never be detectable (i.e. will never be above 1 OU), but that it is not predicted to be detected more than 1% of the time (as represented by the 99th percentile).

The highest 99th percentile odour concentration of 1.3 OU was predicted at Receptor 3, which is below the impact assessment criteria of 3.85 OU. An odour at a concentration of 1 OU is in reality so weak that it would not normally be detected outside the controlled environment of an odour laboratory by the majority of the population. Some guidance as to concentrations when the odour becomes apparent can be derived from laboratory measurements of intensity and is provided by the UK *Odour Guidance for Local Authorities* (Department for Environment, Food and Rural Affairs, 2010):

- 1 OU is the detection threshold for odour (by definition);
- 5 OU is a typical concentration for a faint odour; and
- 10 OU is a typical concentration for a distinct odour.

Therefore, odours may be detected at this location but are unlikely to be of such an intensity to be recognised or considered offensive.

Maximum concentrations of odour generally tend to occur when meteorological conditions are least favourable for dispersion. These times of day are usually characterised by low winds speeds (i.e. calm conditions) and a stable atmosphere, which typically occur during the evenings and overnight. These times are likely to coincide with the least amount of outdoor activity at the reception venue.

The further investigation of odour events predicted by the model indicates that the resident population and the transient population attending events at Athol Homestead may detect an odour but are unlikely to recognise the odour or deem it offensive. Provided the abattoir is well managed it is reasonable to conclude that minimal adverse impacts would be anticipated.

8 CONCLUSION

SLR Consulting Australia Pty Ltd was commissioned by Metziya Pty Limited to perform a Construction and Operational Air Quality Impact Assessment (including odour) for the proposed development of a small stock abattoir and continued operation of the existing Blayney SeaLink Cold Store Complex, located approximately one kilometre east of the Blayney township in the Central West region of New South Wales.

This study will inform the overall Environmental Impact Statement required to be submitted to the NSW Department of Planning and Environment. The specific requirements of this study are clearly outlined within the Secretary's Environmental Assessment Requirements as issued for State Significant Development 6594, issued on 14 August 2014.

The objective of this air quality impact assessment was to define the sources of emissions from the proposed construction and operation of the Project and assess the impacts against applicable air quality criteria to determine the requirement for further mitigation and control, and to identify any residual impacts.

The potential impacts on local air quality from construction activities were assessed qualitatively, using the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management.

The qualitative assessment of construction impacts considered the sensitivity of the receiving environment and the magnitude of the likely dust emissions from the construction of the abattoir and associated infrastructure. Overall, the risk of air quality impacts from earthworks, construction of infrastructure, and track-out of dust were determined to be *low* or *negligible* across the Project Site. In addition to the low risk of air quality impacts from construction activities, mitigation and management measures will be applied to further reduce the impact, and therefore it is considered that there will be no significant impact from generated dust emissions from the Project site.

In order to quantitatively assess the potential impacts of operational phase emissions on local air quality, emissions estimation and dispersion modelling were performed. The assessment methodology included meteorological and dispersion modelling using established and recognised modelling techniques. The emission rates and source parameters defined for the modelling scenarios were based on site specific information and assessments carried out for similar facilities.

The quantitative assessment addressed the impacts to air quality of emissions from the operation of the Blayney Cold Store Complex and Small Stock Abattoir, including nitrogen dioxide, particulate matter less than 10µm in diameter (PM_{10}), and odour.

The predicted ground level concentrations of the pollutants assessed met their respective guidelines for the appropriate averaging periods, with and without the inclusion of background air quality concentrations. The local topography and proximity to the Project Site indicate that the transient population visiting Athol Homestead would not be impacted by odour at concentrations in excess of the relevant odour impact assessment criterion, as specified by NSW OEH. Provided the abattoir is well managed it is reasonable to conclude that minimal adverse impacts would be anticipated.

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Abbreviations and Acronyms

µg	microgram (g x 10^{-6})
µm	micrometre or micron (metre x 10^{-6})
AHD	Australian Height Datum
AQMS	Air quality monitoring station
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
CASANZ	Clean Air Society of Australia and New Zealand
CO	Carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEC	Department of Conservation (now EPA)
DECC	Department of Environment and Climate Change (now EPA)
DECCW	Department of Environment, Climate Change and Water (now EPA)
DP&E	Department of Planning and Environment
DGRs	Director-General's Requirements
EETM	Emission Estimation Technique Manual
EPA	NSW Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
LGA	Local Government Area
m^3	cubic metre
m/s	metres per second
NO_x	Oxides of nitrogen
NO_2	Nitrogen dioxide
NO	Nitrous oxide
OEH	NSW Office of Environment and Heritage
OU	Odour Units; concentration of odorous mixtures in odour units. The number of odour units is the concentration of a sample divided by the odour threshold or the number of dilutions required for the sample to reach the threshold. This threshold is equivalent to when 50% of a testing panel correctly detect an odour
PAH	Polycyclic Aromatic Hydrocarbon
PCDD/DF	Polychlorinated dibenzo-*p*-dioxins and furans

$PM_{2.5}$	Particulate matter less than 2.5 microns
PM_{10}	Particulate matter less than 10 microns
SO_2	Sulphur dioxide
T	tonnes
TVOCs	Total Volatile Organic Compounds
VIC EPA	Victoria Environment Protection Authority
VKT	Vehicle Kilometres Travelled
VOC	Volatile Organic Compound

Commonly Used Terminology

airshed	The geographical area associated with a given air supply
ambient	Pertaining to the surrounding environment or prevailing conditions
anemometer	An instrument for measuring wind force and velocity
AUSPLUME	A steady state Gaussian dispersion model
atmosphere	A gaseous mass surrounding the planet Earth that is retained by Earth's gravity. It is divided into five layers. Most of the weather and clouds are found in the first layer
atmospheric stability	The tendency of the atmosphere to resist or enhance vertical motion
atmospheric pressure	The force per unit area exerted against a surface by the weight of air above that surface in the Earth's atmosphere
background	The existing air quality in the project area excluding the impacts from the proposed development
baseline monitoring program	A monitoring program designed to measure the ambient concentration levels which currently exist prior to the proposed development
calms	Refers to calm wind speeds of less than 0.5 m/s.
climatological	The science dealing with climate and climatic phenomena
combustion	The process of burning. A chemical change, especially oxidation, accompanied by the production of heat and light
crushers	A machine designed to reduce large rocks into smaller rocks, gravel, or rock dust
dust deposition	Settling of particulate matter out of the air through gravitational effects (dry deposition) and scavenging by rain and snow (wet deposition)
dispersion	The spreading and dilution of substances emitted in a medium (e.g. air or water) through turbulence and mixing effects
diurnal	Relating to or occurring in a 24-hour period; daily
downwind	The direction in which the wind is blowing
emission factor	A measure of the average amount of a specific pollutant or material emitted by a specific process, fuel, equipment, or source based on activity data such as the quantity of fuel burnt, hours of operation or quantity of raw material consumed.
emissions inventory	A database that lists, by source, the amount of air pollutants discharged into the

	atmosphere from a facility over a set period of time (e.g. per annum, per hour)
fugitive emissions	Pollutants which escape from an industrial process due to leakage, materials handling, transfer, or storage
guideline	A general rule, principle, or piece of advice. A statement or other indication of policy or procedure by which to determine a course of action.
meteorological	The science that deals with the phenomena of the atmosphere, especially weather and weather conditions
mitigate	To moderate (a, quality or condition) in force or intensity; alleviate
particulate	Of, relating to, or formed of minute separate particles. A minute separate particle, as of a granular substance or powder
point source	A pollution source that is fixed and/or uniquely identifiable, such as a stack, chimney, outlet pipe or vent
plume	A space in air, water, or soil containing pollutants released from a point source
pollutant	A substance or energy introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource
qualitative assessment	An assessment of impacts based on a subjective, non-statistical oriented analysis
quantitative assessment	An assessment of impacts based on estimates of emission rates and air dispersion modelling techniques to provide estimate values of ground level pollutant concentrations.
receptor	Coordinate locations specified in an air dispersion model where ground level pollutant concentrations are calculated by the model
sensitive receptor	Locations such as residential dwellings, hospitals, churches, schools, recreation areas etc where people (particularly the young and elderly) may often be present, or locations with sensitive vegetation and crops.
standard	The prescribed level of a pollutant in the outside air that should not be exceeded during a specific time period to protect public health
topography	Detailed mapping or charting of the features of a relatively small area, district, or locality
volatile organic compounds	All organic compounds (substances made up of predominantly carbon and hydrogen) with boiling temperatures in the range of 50-260°C, excluding pesticides. This means that they are likely to be present as a vapour or gas in normal ambient temperatures.
wind direction	The direction from which the wind is blowing
wind erosion	Detachment and transportation of loose topsoil or sand due to action by the wind
wind rose	A meteorological diagram depicting the distribution of wind direction and speed at a location over a period of time

RISK ASSESSMENT METHODOLOGY

Overview

The methodology adopted for this risk-based assessment has been adapted from UK guidance presented in the Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction* (February 2014).

The IAQM method uses a four step process for assessing dust impacts and impacts to human health from PM_{10} concentrations from construction activities:

Step 1: Screening based on distance to nearest receptor.

Step 2: Assess risk of effects from activities based on:

- the scale and nature of the works, which determines the potential emission magnitude; and
- the residual sensitivity of the area.

Step 3: Determine site-specific mitigation for remaining activities with greater than negligible effects.

Step 4: Assess significance of remaining activities after mitigation has been considered.

The assessor should apply a pragmatic approach to the assessment. There may be occasions where the examples provided are subject to exclusions.

Methodology

Step 1

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than:

- 350 m from the boundary of the site
- 50 m from the route used by construction vehicles on public roads more than 500 m from the site entrance.

This step is noted as having deliberately been chosen to be conservative, and will require assessment for applicability in all cases.

Step 2a

The Step 2a of the assessment provides “emission magnitudes” for four activities; demolition, earthworks, construction, and trackout. “Magnitude” describes the anticipated scale of proposed works and consequently, the potential scale of the predicted environmental change and the likelihood of the impact resulting in a change to existing (baseline) conditions. The magnitudes are: Large; Medium; or Small. Suggested definitions for each category provided in **Table A** for each activity.

Table A Scale of Activity Considerations

Scale of Activity	Demolition	Earthworks	Construction	Trackout[1, 2]
Large	Total building volume of >50,000 m^3	Total site area > 10,000 m^2	Total building volume > 100,000 m^3	Unpaved road length > 100 m
	Demolition activities > 20 m above ground	>10 heavy earth moving vehicles active at any one time		> 50 HRV outward movements (maximum one-way movements in one day)
	On-site crushing and screening	Total material moved >100,000 tonnes	On-site concrete batching or sandblasting.	
	Potentially dusty construction materials.	Potentially dusty soil type (e.g. clay)		Potentially dusty surface material (e.g. high clay content)
		Earthworks carried out during seasons typically associated with high wind speed components.		
Medium	Total building volume between 20,000 m^3 and 50,000 m^3	Total site area 2,500 m^2 - 10,000 m^2	Total building volume 25,000 m^3 – 100,000 m^3	Unpaved road length 50 m -100 m
	Demolition activities 10 - 20 m above ground	5 – 10 heavy earth moving vehicles active at any one time	On-site concrete batching	10 – 50 HRV outward movements (maximum one-way movements in one day)
	Potentially dusty construction materials.	Total material moved 20,000 T – 100,000 T	Potentially dusty construction materials used.	Moderately dusty surface material (e.g. medium clay content)
Small	Total building volume < 20,000 m^3	Total site area < 2,500 m^2	Total building volume < 25,000 m^3	Unpaved road length < 50 m
	Demolition activities < 10 m above ground	< 5 heavy earth moving vehicles active at any one time		< 10 HRV outward movements (maximum one-way movements in one day)
	Demolition performed during wetter months	Total material moved < 20,000 T		
	Construction material with low potential for dust release (e.g. primarily metal cladding or timber).	Soil type with large grain size (e.g. sand)	Construction material with low potential for dust release (e.g. metal cladding or timber).	Surface material with low potential for dust release (e.g. sand)
		Earthworks carried out during wetter months.		

Source: IAQM 2014

1. For vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto public roads / highway. HRV = Heavy Rigid Vehicle greater than 3.5 T truck.
2. Scale of trackout activities should be considered as negligible if receptor is located > 50 m from the road.

Step 2b

Step 2b of the assessment allows the residual sensitivity of the area to be defined and addresses different potential effects on the population and property, and human health. The sensitivity of the area takes into account:

- The specific sensitivities of receptors in the area.
- The proximity and number of those receptors.
- Site specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

- In the case of impacts to human health, the local background concentration of PM_{10} is considered.

Receptors may be classified as having high, medium or low sensitivity to dust deposition, or PM_{10} concentrations. Exposure to dust deposition may lead to nuisance impacts and exposure to PM_{10} has the potential to have impacts on human health.

Table B and **Table C** show how the residual sensitivity of an area may be may be determined considering the number of receptors and the distance of those receptors from the construction site for nuisance dust and human health impacts. When using these tables it should be noted that distances are to the source and so a different area may be affected by trackout than by on-site works.

Site specific circumstances should be taken into account in all cases so that the sensitivity that most adequately reflects the nature of the receptors is applied. Additional factors to consider when determining the residual sensitivity of the receptor include:

- Any history of dust generating activities in the area
- The likelihood of concurrent dust generating activities on nearby sites
- Any pre-existing screening between the source and the receptors
- Any conclusions drawn from analysing local meteorological data, and, if relevant, the season during which the works will take place
- Any conclusions drawn from local topography
- Duration of the potential impact, as a receptor may become more sensitive over time.

Table B Residual Sensitivity of the Area to Dust Deposition Impacts

Land Use Receptor Sensitivity		No. of Receptors	Residaul Receptor Sensitivity			
			Distance from Source (m)			
			<20	<50	<100	<350
High	• Receptors with high land use sensitivity to air pollution include: hospitals, retirement homes, painting and furnishing, hi-tech industries, food processing, schools, high density residential areas, food retailers, glasshouses and nurseries, horticultural land and offices, museums, car showrooms. • Users would reasonably be expected to be present continuously (or at least regularly) for extended periods at the property. • Users can reasonably expect a high level of amenity. • The appearance, aesthetics or value of a receptor would be diminished by soiling. • There is substantial risk that the impacts will generate nuisance complaints, resulting in regulatory action.	**>100**	High	High	Medium	Low
		10–100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
Medium	• Receptors with medium land use sensitivity to air pollution include: farms, outdoor storage, light and heavy industry, parks, places of work. • Users wouldn't reasonably be expected to be present at the property continuously or regularly for extended periods as part of the normal pattern of use of the land. • Users would expect to enjoy a reasonable level of amenity, but would not expect to enjoy the same level of amenity as in their home. • The appearance, aesthetics or value of a receptor could be diminished by dust deposition. • There is moderate to slight risk that the impacts will generate nuisance complaints, resulting in regulatory action.	**>1**	Medium	Low	Low	Low
Low	• All other air quality sensitive receptors not identified above • There is transient exposure where the receptors would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • The population is accustomed to transient changes in dust deposition due to natural occurrences and does not have high expectations regarding dust deposition in the area. • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by dust deposition. • Negligible risk that the impacts will generate nuisance complaints resulting in regulatory action.	**>1**	Low	Low	Low	Low

Source: IAQM 2014

1. Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total number of receptors <50 m is 102. The residual sensitivity in this case would be high.
2. See **Table A** for 'Trackout' activities.

Table C Residual Sensitivity of the Area to Human Health Impacts

Land Use Receptor Sensitivity		Annual Mean 24-hour PM_{10} Concentration	No. of Receptors	Residual Receptor Sensitivity				
				Distance from Source (m)				
				<20	<50	<100	<200	<350
High	• Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (i.e. where individuals may be exposed for eight hours or more) • Indicative examples include residential properties, hospitals, schools and retirement homes.	**>90% of criterion (>45 µg/m³)**	**>100**	High	High	High	Medium	Low
			10-100	High	High	Medium	Low	Low
			1-10	High	Medium	Low	Low	Low
		75 – 90% of criterion (37 µg/m³ to 45 µg/m³)	**>100**	High	High	Low	Low	Low
			10-100	High	Medium	Low	Low	Low
			1-10	High	Medium	Low	Low	Low
		50 – 75% of criterion (25 µg/m³ to 37 µg/m³)	**>100**	High	Medium	Low	Low	Low
			10-100	High	Medium	Low	Low	Low
			1-10	Medium	Low	Low	Low	Low
		<50% of criterion (<25 µg/m³)	**>100**	Medium	Low	Low	Low	Low
			10-100	Low	Low	Low	Low	Low
			1-10	Low	Low	Low	Low	Low
Medium	• Locations where the exposed population are workers and exposure is over a time period relevant to the air quality objective for PM_{10} (i.e. where individuals may be exposed for eight hours or more) • Indicative examples include offices and shops but don't include workers.	-	**>10**	High	Medium	Low	Low	Low
		-	**1-10**	Medium	Low	Low	Low	Low
Low	• Locations where human exposure is transient. • Indicative examples include public footpaths, playing fields, parks and shopping streets.	-	**>1**	Low	Low	Low	Low	Low

Source: IAQM 2014

1. Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total number of receptors <50 m is 102. If the annual mean 24-hour PM_{10} objective is between 75% and 90% of the criterion value, the sensitivity in this case would be high.
2. In the case of high land use sensitivity receptors with high occupancy (i.e. schools, hospitals) approximate the number of people likely to be present or assume > 100 people. In the case of residential dwellings, just include the number of properties.
3. See **Table A** for 'Trackout' related definitions and receptor distances.

Step 2c

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then applied to the matrices shown below (Matrix 1 – 4) to determine the risk category with no mitigation applied.

Matrix 1 Risk of Impacts - Demolition

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

Matrix 2 Risk of Impacts - Earthworks

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

Matrix 3 Risk of Impacts - Construction

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

Matrix 4 Risk of Impacts - Trackout

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

Step 3

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

Step 4

The residual impact can be determined after mitigation has been considered.

Matrix 5 Example Preliminary Risk Rating

Potential Impact	Preliminary Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Deposition	High	Medium	Low	Low
Human Health	Medium	Medium	Low	Low

Matrix 6 Example Residual Risk Rating

Potential Impact	Residual Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Deposition	Medium	Low	Negligible	Negligible
Human Health	Low	Low	Negligible	Negligible

Test Report of Ambient Monitoring of Goat Odour

Test Report 610.13744.00500-TR1

1 CLIENT DETAILS

Organisation:	Hornery & Associates Consulting Pty Ltd
Company Contact:	Ray Hornery
Site Address:	Bourke, NSW
Postal Address:	Level 10 32 Martin Place Sydney 2000 PO Box 742 KIAMA NSW 2533
Telephone Number:	0418 682 547
Email Address:	rhornery@hornery.com.au

2 PROJECT DETAILS AND SCOPE OF WORK REQUESTED

Project Name:	Blayney Abattoir - Goat Specific Odour Survey
Project Number:	610.13744.00500
Project Manager:	Nicole Armit
Monitoring Date(s):	13 October 2014
Conditions:	Normal operating conditions
Parameters requested:	Odour concentration
Sample Locations:	Ambient – Outdoor Holding Pen, Sorting Shed
Sample Identification Numbers:	Refer to Section 4

Signatory:

MICHAEL BRECKO

Issue Date: 13 November 2014

Accredited for Compliance with ISO/IEC 17025. The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Test Report 610.13744.00500-TR1

3 PROCESS EMISSIONS MONITORING - PARAMETER, SAMPLING AND ANALYSIS METHOD AND ANALYSIS LABORATORY

3.1 Test Methods and Analysis References

All sampling and monitoring was performed by SLR Consulting Australia Pty Ltd (SLR Consulting) unless otherwise specified. The following table outlines for each parameter requested to be tested, the relevant test method for sampling and analysis and the NATA Accredited Laboratory that completed the analysis.

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in **Section 4**.

3.1.1 Point Source

Parameter	Test Method Number for Sampling and Analysis	NATA Laboratory Analysis By: NATA Accreditation No. & Report No.
Odour	NSW OM-7, AS4323.3	The Odour Unit, NATA No. 14974, Report No. SYD20141014_088

3.2 Deviations from Test Methods

There were no deviations to the test methods with regards to sampling however there were deviations with the analysis.

Samples 3508, 3515 and 3519 (background samples), 3512 (holding pen sample), 3514 and 3518 (sorting shed samples) were not in compliance with AS4323.3 analysis due to the concentrations tested being at the lower limit of reporting and therefore unable to complete the third round of analysis in accordance with the standards. Results reported are based on the available rounds tested which are in accordance with AS4323.3.

3.3 Sampling Times

As per the relevant test reference method or State requirement.

3.4 Reference Conditions

As per relevant test reference method, State requirement, or Environment Protection Licence or equivalent.

3.5 Identification

All samples are individual labelled with reference number, location, sampling date and times.

Test Report 610.13744.00500-TR1

3.6 Methodology

3.6.1 Outdoor Holding Pen

SLR performed odour sampling of the outdoor holding pen in accordance with AS/NZS 4323.3:2001. Three simultaneous samples were collected from the holding pen (northern fence line) as shown in Photograph 1. Samples were collected downwind of predominant winds experienced on the day of testing and at approximately the average height of the goats.

Meteorological parameters were observed as grab samples during the monitoring period. Wind speed was measured over various 1 minute periods during monitoring and measured an average wind speed of 2.0 meters per second (m/s). A maximum wind speed of 6 m/s was measured during the monitoring period. Winds observed were predominantly from a southerly direction.

Odour Emission Rates (OER) calculated for the outdoor holding pen have been derived utilizing the outdoor holding pen perimeter dimensions of 10 meters (m) by 25 m and the average wind speed measured during the sampling period of 2.0 m/s.

Photograph 1 Outdoor Holding Pen Location

Test Report 610.13744.00500-TR1

3.6.2 Sorting Shed

SLR performed odour sampling of the sorting shed in accordance with AS/NZS 4323.3:2001. Goats were taken into the sorting shed at 1345 hours and allowed to stand for a period of one (1) hour before any sampling was undertaken.

The sorting shed is elevated off the ground and has wooden slat floor. Each slat has a space of 5 millimeters (mm) between slats to facilitate goat fecal matter and other waste to fall to the ground below. A ventilation void exists between the top of the shed walls and the roof. This void exists around all four walls and is 150 mm height.

Three simultaneous samples were collected from inside the sorting shed (diagonally across the sorting shed floor; North to South) as shown in Photograph 2. Odour samples were collected at approximately the average height of the goats. The process was repeated to obtain a total of six (6) odour samples collected for the sorting shed.

Grab samples of air velocity within the sorting shed during the monitoring period were observed. Air velocities were measured over various 1 minute periods during monitoring and measured an average velocity of less than 0.1 m/s at the average goat height. Additional air velocities were measured from the ventilation void and averaged 0.9 m/s however these velocities could only be observed in the upper portion of the shed.

Odour Emission Rates (OER) calculated for the sorting shed have been derived utilizing the sorting shed floor perimeter dimensions of 7 meters (m) by 16 m and the average air velocity at the goat height during the sampling period of 0.1 m/s.

Photograph 2 Sorting Shed Location

Test Report 610.13744.00500-TR1

3.6.3 Background

SLR performed odour sampling of ambient background levels in accordance with AS/NZS 4323.3:2001 as shown in Photograph 3. A total of three background samples were collected as follows;

- One (1) background sample measured simultaneously during sampling of the outdoor holding pen and

- Two (2) background samples measured simultaneously during the sampling of the sorting shed (one per round).

Background samples were collected 100 m upwind of any goat activity (holding pen and sorting shed). Background measurements may still have included other wild animals and activities that were out of SLRs control on the proposed monitoring site.

Photograph 3 Ambient Background Location

Test Report 610.13744.00500-TR1

3.7 Results

Results are presented at actual conditions unless otherwise stated.

Table 1 Summary of Ambient Goat Odour Concentration – Outdoor Holding Pen

Parameter	Unit	Reporting Conditions	Average Measured Value			
Location	--	--	**East**	**Middle**	**West**	**Background**
Date Tested	--	--	13-Oct-14	13-Oct-14	13-Oct-14	13-Oct-14
SLR Sample Number	--	--	3509	3510	3511	3508
Sampling start time	hours	AESTD	1310	1310	1310	1310
Sampling finish time	hours	AESTD	1325	1325	1325	1325
Holding pen width	m	actual	10	10	10	---
Holding pen length	m	actual	25	25	25	---
Cross sectional area	m^2	actual	250	250	250	---
Average ambient temperature	^oC	actual	36.5	36.5	36.5	36.5
Average ambient pressure	kPa	actual	99.59	99.59	99.59	99.59
Average air velocity	m/s	actual	2.0	2.0	2.0	2.0
Number of goats	--	actual	1,600	1,600	1,600	---
Odour concentration	**ou**	**actual**	**< 16**	**29**	**< 16**	**< 16**
Odour emission rate	ou.m^3/s	actual	< 8,000 [a]	14,500 [a]	< 8,000 [a]	---

Table 2 Summary of Goat Odour Concentration – Sorting Shed – Run 1

Parameter	Unit	Reporting Conditions	Average Measured Value			
Location	--	--	**North**	**Middle**	**South**	**Background**
Date Tested	--	--	13-Oct-14	13-Oct-14	13-Oct-14	13-Oct-14
SLR Sample Number	--	--	3512	3513	3514	3515
Sampling start time	hours	AESTD	1450	1450	1450	1450
Sampling finish time	hours	AESTD	1505	1505	1505	1505
Sorting shed width	m	actual	7	7	7	---
Sorting shed length	m	actual	16	16	16	---
Cross sectional area	m^2	actual	112	112	112	---
Average ambient temperature	^oC	actual	36.3	36.3	36.3	36.3
Average ambient pressure	kPa	actual	99.63	99.63	99.63	99.63
Average air velocity	m/s	actual	0.1	0.1	0.1	2.0
Number of goats	--	actual	300	300	300	---
Odour concentration	**ou**	**actual**	**19**	**19**	**< 16**	**< 16**
Odour emission rate	ou.m^3/s	actual	213 [b]	213 [b]	< 179 [b]	---

Test Report 610.13744.00500-TR1

Table 3 Summary of Ambient Goat Odour Concentration – Sorting Shed – Run 2

Parameter	Unit	Reporting Conditions	Average Measured Value			
Location	--	--	**North**	**Middle**	**South**	**Background**
Date Tested	--	--	13-Oct-14	13-Oct-14	13-Oct-14	13-Oct-14
SLR Sample Number	--	--	3516	3517	3518	3519
Sampling start time	hours	AESTD	1515	1515	1515	1515
Sampling finish time	hours	AESTD	1530	1530	1530	1530
Sorting shed width	m	actual	7	7	7	---
Sorting shed length	m	actual	16	16	16	---
Cross sectional area	m^2	actual	112	112	112	---
Average ambient temperature	^oC	actual	36.3	36.3	36.3	36.3
Average ambient pressure	kPa	actual	99.63	99.63	99.63	99.63
Average air velocity	m/s	actual	0.1	0.1	0.1	2.0
Number of goats	--	actual	300	300	300	---
Odour concentration	**ou**	**actual**	**25**	**29**	**17**	**17**
Odour emission rate	$ou.m^3/s$	actual	280 [b]	325[b]	190 [b]	---

Notes:

1. Field Blank (SLR ID 3520) measured below limit of reporting (< 16ou).
2. SLR performed an additional 3 samples for Outdoor Holding Pen which were not analysed in accordance with AS4323.3 to provide additional indicative results. The concentrations and OER measured were East – 16 ou (8,000 $ou.m^3/s$), Middle – 27 ou (13,500 $ou.m^3/s$) and West – 23 ou (11,500 $ou.m^3/s$).

Key:

[a] = Refer to Section 3.6.1
[b] = Refer to Section 3.6.2
^oC = degrees Celsius
< = less than
AESTD = Australian Eastern Standard Time Daylight Savings
kPa = kilopascals
OER = odour emission rate
ou = odour units
$ou.m^3/s$ = odour units cubic metre of air per second
m = metres
m/s = metres per second
m^2 = metres squared

3.8 Measurement Uncertainty

Parameter	Associated Test Method	Uncertainty
Odour concentration	OM-7, AS4323.3	± 50 - 124% (based upon a single determination)

Test Report 610.13744.00500-TR1

4 CERTIFICATES OF ANALYSIS

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ABN: 53 091 165 061

Accreditation Number: 14974

Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	SLR Consulting	Telephone	(02) 9428 8100
Contact	M. Brecko	Facsimile	(02) 9427 8200
Sampling Site	Undisclosed	Email	mbrecko@slrconsulting.com
Sampling Method	Undisclosed	Sampling Team	SLR Consulting

Order details:

Order requested by	M. Brecko	Order accepted by	A.Schulz
Date of order	Refer to correspondence	TOU Project #	N1869R
Order number	17878	Project Manager	J. Schulz
Signed by	M. Brecko	Testing operator	A. Schulz

Investigated Item Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.

Identification The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.

Method The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. NATA accredited for compliance with ISO/IEC 17025. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.

Measuring Range The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.

Environment The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between 22°C and 25°C.

Measuring Dates The date of each measurement is specified with the results.

Instrument Used The olfactometer used during this testing session was:
ODORMAT SERIES V05

Instrumental Precision The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001.
ODORMAT SERIES V05: $r = 0.2635$ (April 2014) Compliance – Yes

Instrumental Accuracy The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001.
ODORMAT SERIES V05: $A = 0.1843$ (April 2014) Compliance – Yes

Lower Detection Limit (LDL) The LDL for the olfactometer has been determined to be 16 ou (4 times the lowest dilution setting)

Traceability The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Tuesday, 14 October 2014 Panel Roster Number: SYD20141014_088

J. Schulz
NSW Laboratory Coordinator

A. Schulz
Authorised Signatory

Odour Sample Measurement Results
Panel Roster Number: SYD20141014_088

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate (ou.m^3/m^2/s)
East Pen Rd 2	SC14607	13/10/2014 1325hrs	14/10/2014 1036hrs	4	8	-	-	<16	<16	N/A
West Pen Rd 2	SC14608	13/10/2014 1325hrs	14/10/2014 1103hrs	4	8	-	-	<16	<16	N/A
Middle Pen Rd 2	SC14609	13/10/2014 1325hrs	14/10/2014 1124hrs	4	8	-	-	29	29	N/A
Background Pen 2	SC14610	13/10/2014 1325hrs	14/10/2014 1142hrs	4	8	-	-	<16	<16	N/A
North Shed Rd 3	SC14611	13/10/2014 1505hrs	14/10/2014 1159hrs	4	8	-	-	19	19	N/A
South Shed Rd 3	SC14612	13/10/2014 1505hrs	14/10/2014 1311hrs	4	8	-	-	<16	<16	N/A

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd. have performed the dilution of samples.
3. Insufficient sample to complete third round of testing, non-compliant with AS4323.3
   - SC14610 - SC14614
   - SC14611 - SC14617
   - SC14612 - SC14618

Odour Sample Measurement Results
Panel Roster Number: SYD20141014_088

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate (ou.m^3/m^2/s)
Middle Shed Rd 3	SC14613	13/10/2014 1505hrs	14/10/2014 1339hrs	4	8	-	-	19	19	N/A
Background Shed 3	SC14614	13/10/2014 1505hrs	14/10/2014 1357hrs	4	8	-	-	<16	<16	N/A
North Shed Rd 4	SC14615	13/10/2014 1530hrs	14/10/2014 1419hrs	4	8	-	-	25	25	N/A
Middle Shed Rd 4	SC14616	13/10/2014 1530hrs	14/10/2014 1429hrs	4	8	-	-	29	29	N/A
South Shed Rd 4	SC14617	13/10/2014 1530hrs	14/10/2014 1515hrs	4	8	-	-	17	17	N/A
Background Shed Rd 4	SC14618	13/10/2014 1530hrs	14/10/2014 1530hrs	4	8	-	-	17	17	N/A
System Blank	SC14619	14/10/2014 1530hrs	14/10/2014 1556hrs	4	8	-	-	<16	<16	N/A

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1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd. have performed the dilution of samples.
3. Insufficient sample to complete third round of testing, non-compliant with AS4323.3

- SC14610 - SC14614
- SC14611 - SC14617
- SC14612 - SC14618

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20141014_088	50,000	$20 \leq \chi \leq 80$	724	69	Yes

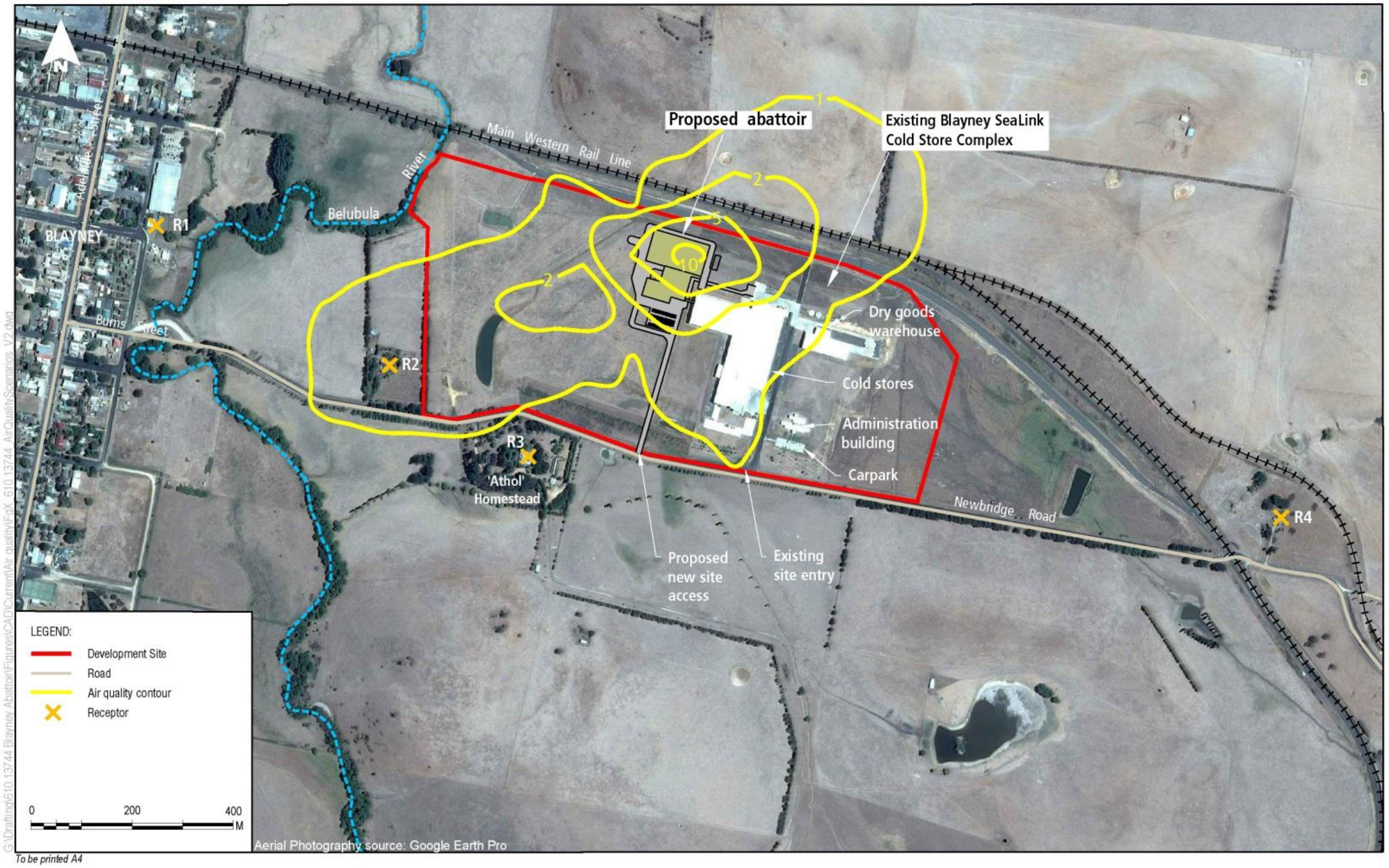
Comments

Disclaimer Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

Note This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd. Any attachments to this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.

END OF DOCUMENT

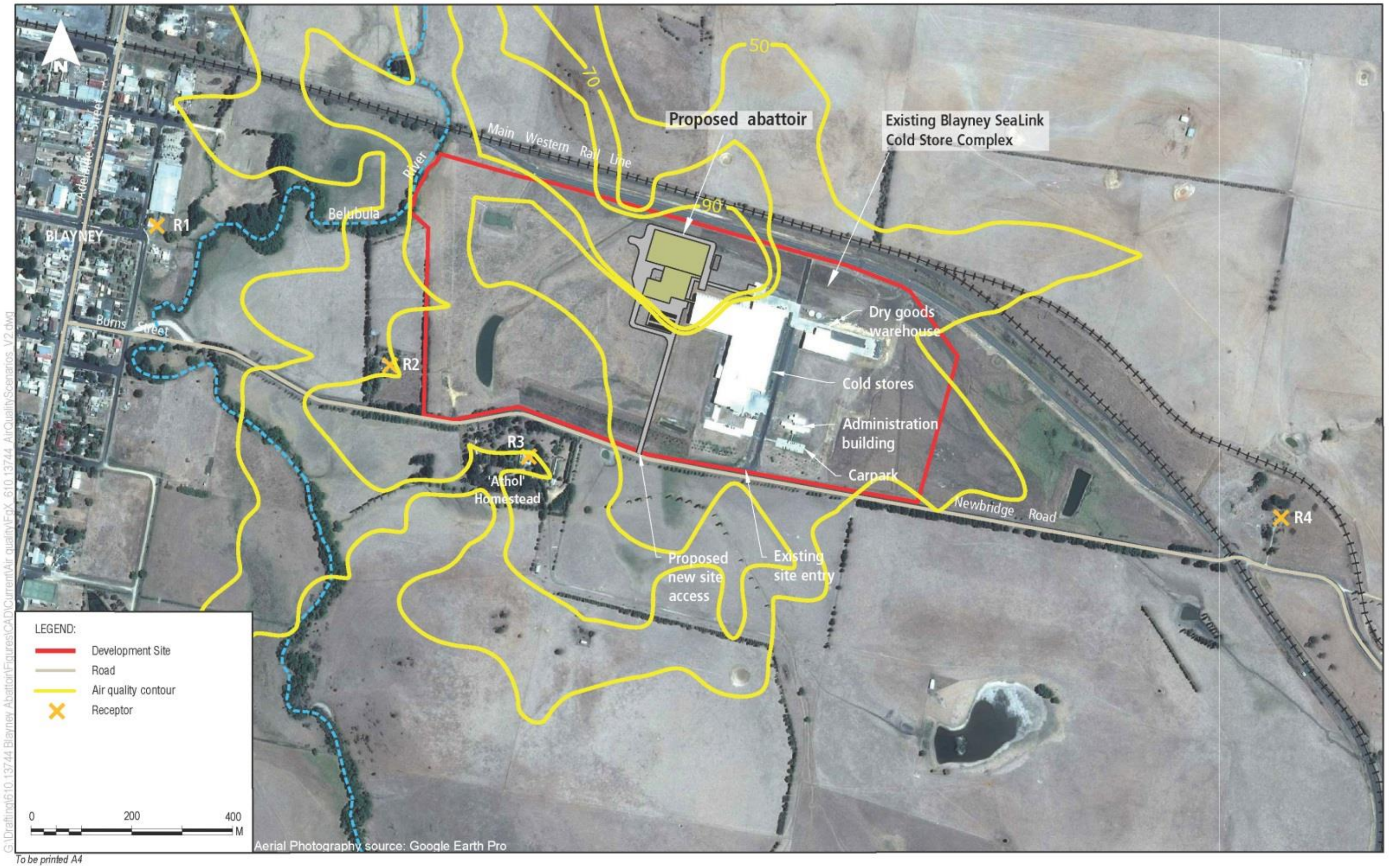
Figure 15 Annual Average NO_2 Concentrations (µg/m³)



Annual Average NO_2 Concentrations (µg/m³)

FIGURE 15

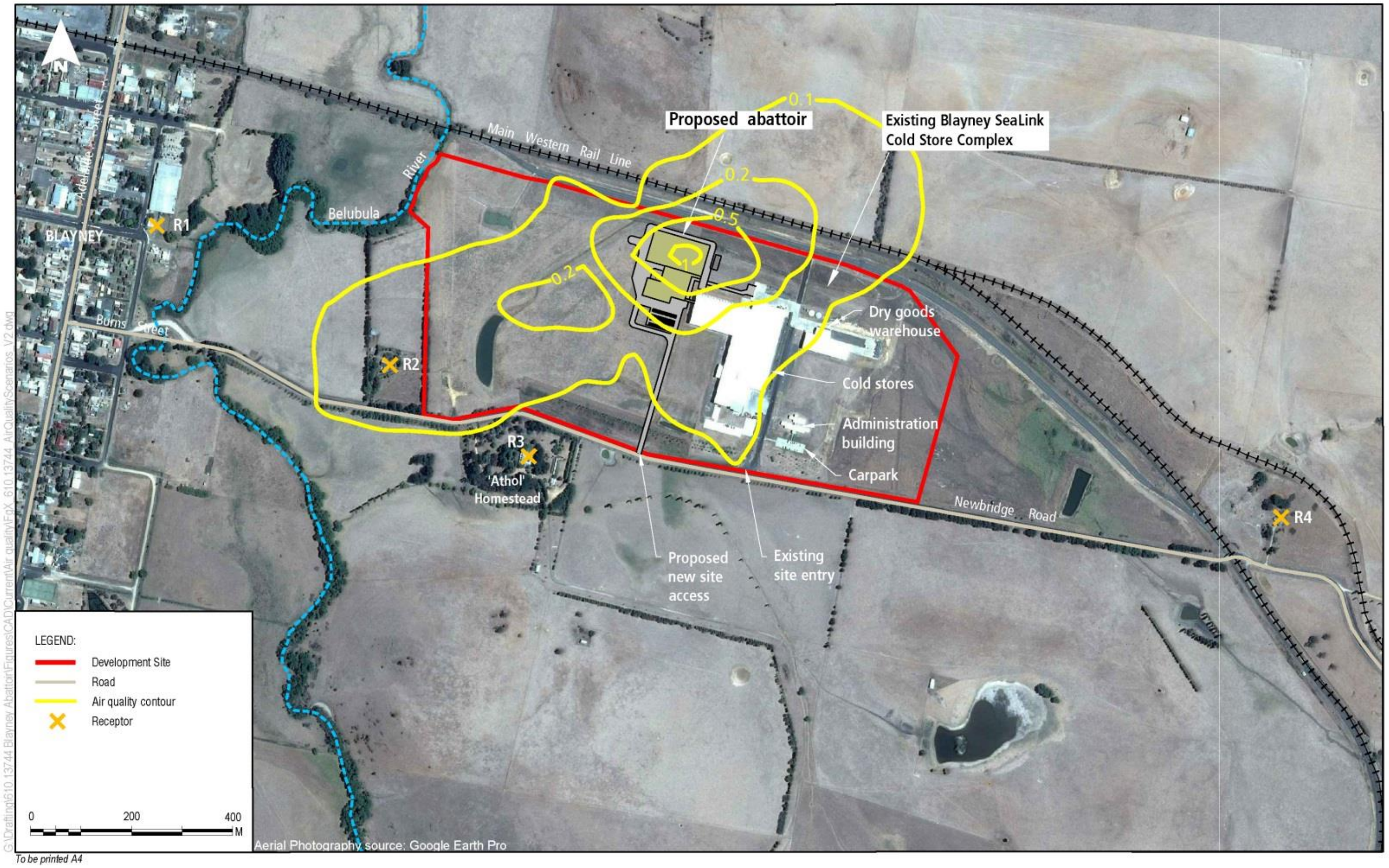
Figure 16 Maximum 1-hour NO_2 Concentration (µg/m³)



Maximum 1 Hour Average NO_2 Concentrations (µg/m³)

FIGURE 16

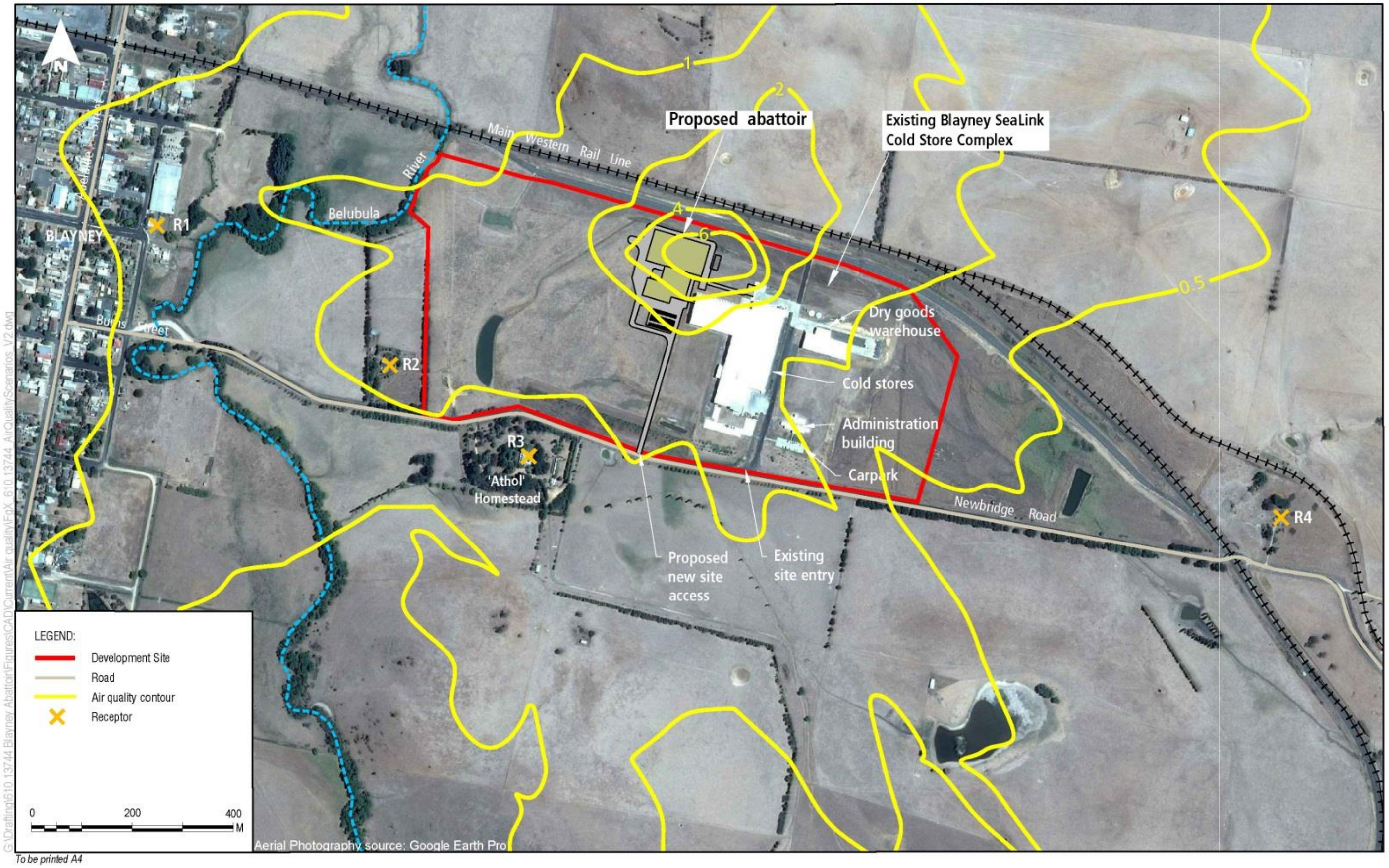
Figure 17 Annual Average PM_{10} concentrations (µg/m³)



Annual Average PM_{10} Concentrations (µg/m³)

FIGURE 17

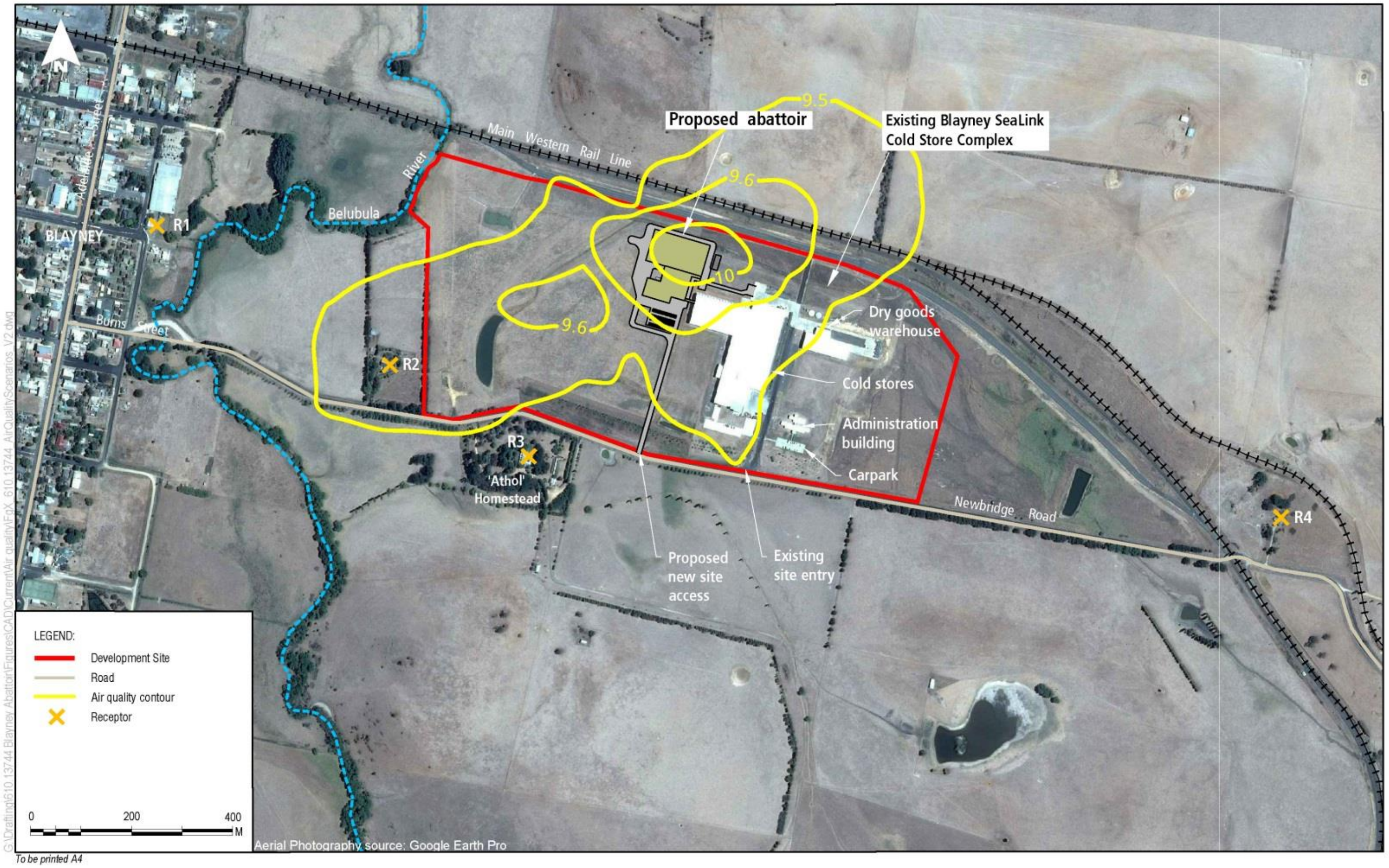
Figure 18 Maximum 24-hour Average PM_{10} concentrations (µg/m³)



Maximum 24 hour Average PM_{10} Concentrations (µg/m³

FIGURE 18

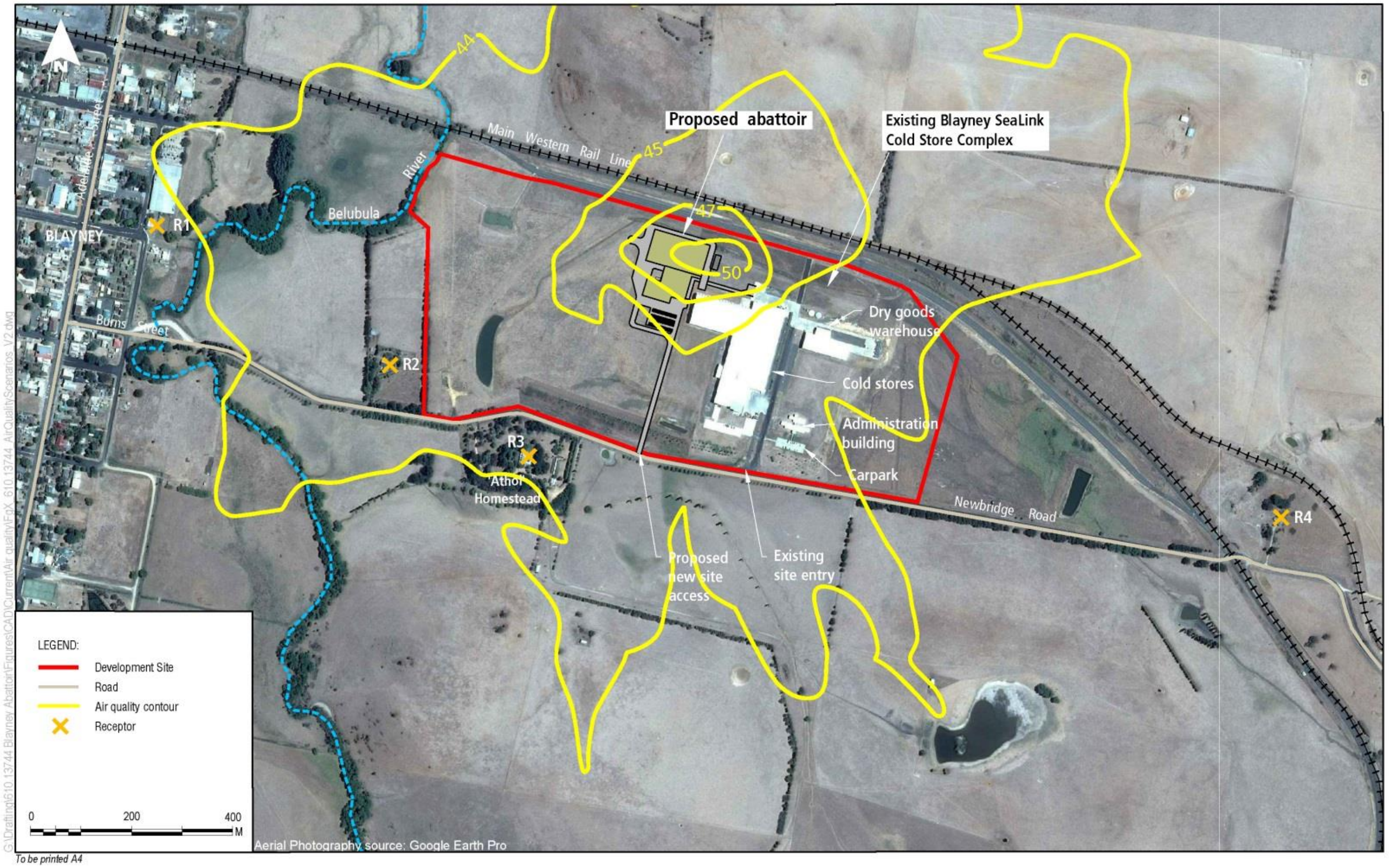
Figure 19 Annual Average PM_{10} concentrations (with background) ($\mu g/m^3$)



Annual Average PM_{10} Concentrations (with background) ($\mu g/m^3$)

FIGURE 19

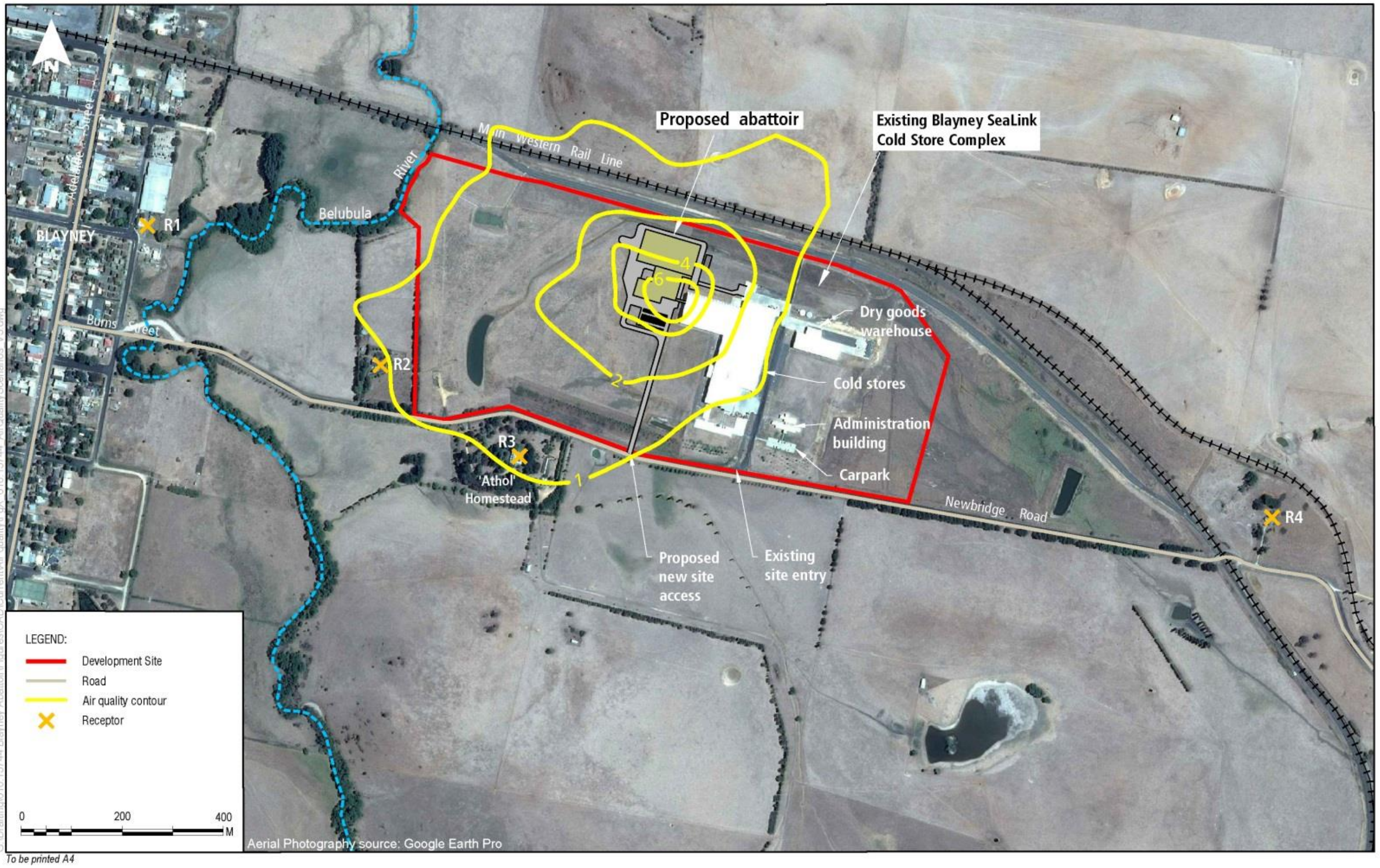
Figure 20 Maximum 24-hour Average PM_{10} concentrations (with background) (µg/m³)



Maximum 24hr Average PM_{10} Concentrations (with background) (µg/m³)

FIGURE 20

Figure 21 Peak 1-Second Average 99th Percentile Odour Concentrations (µg/m³)



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Peak 1 Second Average 99th Percentile Concentrations (OU)

FIGURE 21