THE NEW SYDNEY FISH MARKET

Stage 2 - Main Works (SSD 8925)
Air Quality Assessment

Prepared for: UrbanGrowth NSW Development Corporation

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PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
2 Lincoln Street
Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
T: +61 2 9427 8100 F: +61 2 9427 8200
E: sydney@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with the Client. Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.17553-R03-v3.0	1 April 2019	A Naghizadeh	K Lawrence	A Naghizadeh
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EXECUTIVE SUMMARY

SLR was commissioned by UrbanGrowth NSW Development Corporation (UrbanGrowth NSW) to perform an Air Quality Impact Assessment (AQIA) for the proposed development of the new Sydney Fish Market (the Site). The Site is located at the head of Blackwattle Bay between the Pyrmont Peninsula and the foreshore of Glebe, less than 2 km west of Sydney's CBD and partially within the City of Sydney Local Government Area.

This report has been prepared in response to the Secretary's Environmental Assessment Requirements (SEAR's) for Stage 2 of the development of the Site, which includes the construction and operation of the new Sydney Fish Market.

The main potential sources of air emissions from the new Sydney Fish Market were identified as fugitive dust emissions during the construction phase, and odour, VOC, products of combustion and particulates during the operational phase.

The potential for off-site dust impacts during the construction phase was assessed using a qualitative risk-based approach prescribed by the Institute of Air Quality Management (IAQM). The results of this assessment indicate that dust impacts due to the construction works can be adequately managed with the implementation of site-specific mitigation measures, and that the residual impacts are likely to be low for construction and earthworks activities and negligible for track-out of dust onto public roads.

The potential for off-site air quality impacts during the operation of the new Sydney Fish Market was also assessed using a qualitative risk-based approach. **Table E1** presents a summary of the identified risks of adverse air quality impacts on surrounding sensitive receptors, with and without mitigation measures being implemented. The risk of impacts after the application of mitigation measures is referred to as the "residual" risk.

Table E1 Identified Risks of Adverse Air Quality Impacts – Operational Phase

Pollutant	Source	Predicted Unmitigated Impact		Predicted Residual Impact	
		Magnitude	Impact Significance	Magnitude	Impact Significance
Odour / VOCs	Kitchen Operations	Moderate	Intermediate	Negligible	Neutral
	Handling/Processing/Storage of seafood and waste	Slight	Intermediate/ Minor	Negligible	Neutral
	Polystyrene Recycling*	Moderate	Intermediate	Negligible	Neutral
	Wastewater Treatment*	Moderate	Intermediate	Negligible	Minor to Neutral
Products of Combustion	Operational Phase Traffic	Negligible	Neutral	-	-
Particulates	Kitchen Operations	Negligible	Neutral	-	-

* Due to limitations in the data currently available for these activities, it is recommended that the potential for air quality impacts associated with these activities be reassessed upon completion of the detailed design for the Site.

Based on a review of the project information currently available, and given the nature and scale of the activities proposed at the Site, it is considered that provided the appropriate mitigation measures are implemented during the construction works and as part of the detailed design, the relevant air quality criteria will not be exceeded as a result of the construction and operation of the new Sydney Fish Market.

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1 INTRODUCTION AND OVERVIEW

1.1 Background

SLR Consulting (SLR) has been commissioned by UrbanGrowth NSW Development Corporation (UrbanGrowth NSW) to perform an Air Quality Impact Assessment (AQIA) for the development of the new Sydney Fish Market.

Sydney Fish Market is the largest of its kind in the Southern Hemisphere and among the three largest seafood markets in terms of variety in the world. The market sources product both nationally and internationally and trades approximately 14,500 tonnes (t) of seafood annually with up to one hundred sustainable seafood species traded every day and approximately 500 species traded annually. The site attracts over 3 million visits each year.

In November 2016, the NSW Premier announced a new fish market at the head of Blackwattle Bay, adjacent to the existing Fish Market. In June 2017, the NSW Premier announced the appointment of Danish architects 3XN to lead the design team, which includes Sydney firms BVN and Aspect Studios. They have been working with key stakeholders, including UrbanGrowth NSW and Sydney Fish Market Pty Ltd, to develop the design for the new fish market. As announced by the NSW Premier, works are planned to commence in late 2018.

1.2 Site and Context

The proposed new Sydney Fish Market site (the Site) is located at the head of Blackwattle Bay between the Pyrmont Peninsula and the foreshore of Glebe, less than 2 kilometres (km) west of Sydney's CBD and partially within the City of Sydney Local Government Area. **Figure 1** illustrates the location of the existing and new Sydney Fish Market sites.

The land to which the development application relates comprises Lots 3 - 5 in DP 1064339 part of lot 107 in DP 1076596 and part Lot 1 in DP835794. Works to connect to the existing waterfront promenade to the west of the site are located on Lot 3 in DP1018801. The development footprint is irregular in shape and has an area of approximately 36,800 m^2. The site is partly on land above mean high water mark and partly on water below mean high water mark.

The Site has a frontage to Bridge Road to the south and Blackwattle Bay to the north. Pyrmont Bridge Road is an arterial road that links to the Anzac Bridge to the northwest of the site. Sydney Secondary College Blackwattle Bay Campus is immediately southwest of the site and the existing Fish Market immediately northeast. Located directly opposite the site to the south is Wentworth Park, separated by Bridge Road.

Located approximately 400 m walking distance from the site are the Fish Market, Wentworth Park, and Glebe Light Rail stops, which are serviced by the Dulwich Hill Line. This is a 23 stop, 12.8 km route running from Dulwich Hill to Central Station via Pyrmont.

The Site's current uses include a concrete batching plant at the western end and a concrete hardstand and wharf area at the eastern end, which is currently vacant. The Site includes wharves and land-based structures. Part of the site is the water of Blackwattle Bay. Works will be undertaken on Bridge Road and its intersections with Wattle Street and Wentworth Park Road.

Figure 1 New Sydney Fish Market Location

SLR
2, Lincoln Street
Lane Cove
NSW 2066
T: +61 2 9427 8100
F: +61 2 9427 8200
www.slrconsulting.com

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Project Number:	610.17553
Location:	Sydney, NSW
Other Information:	
Projection:	GDA 1994 MGA Zone 56
Date:	05/11/2018

UrbanGrowth NSW Development Corporation
Sydney Fish Market
Air Quality Assessment

Project Location

1.3 Approval Strategy

Pursuant to the provisions of the *Environmental Planning and Assessment Act 1979* and *State Environmental Planning Policy (State and Regional Development) 2011* ("SEPP SRD"), the new Sydney Fish Market development is a State Significant Development and the Minister for Planning is the consent authority.

To deliver the new Sydney Fish Market, the following applications will be lodged:

1. A concept development application seeking approval for concept proposals for the new fish market. This is to meet the requirements for a master plan contained in clause 40 of SREP26. This concept development application will also set out details of the first stage of the development being the demolition of land and water-based structures on the site including removal of marine piles and any resulting repairs to the existing sea wall;
2. A development application for the construction of the new fish market; and
3. An application to amend the planning controls applying to the site to enable the proposed development to be a permissible use on all of the Site. This is to be achieved by an amendment to *Sydney Regional Environmental Plan No 26—City West* ("SREP26").

These applications are to be lodged concurrently.

1.4 Summary of the Development

The proposal is to build a new fish market with a contemporary urban design, provide unique experiences for visitors and world-class auction and wholesale facilities. The new facility will be set within an improved public domain, including the creation of a waterfront promenade with improved access to Blackwattle Bay and linking to surrounding areas and to public transport.

The development will expand and improve the functions of the existing Fish Market in a new setting designed to achieve design excellence, functional performance and environmental sustainability.

The new fish market will include retail and food and beverage premises, wholesale facilities and auction rooms, offices and commercial space, Sydney Seafood Schools, back-of-house facilities and car, truck and coach parking spaces. The new facility is to include a new foreshore promenade and wharves. The new fish market will be purpose-built and will be supported by a state of the art back-of-house plant and recycling/waste management facilities.

The new Sydney Fish Market will be a 7 day per week, 24-hour per day operation, like the existing Fish Market. It is anticipated that retail and food catering operations will operate between 7:00 am to 10:00 pm.

1.4.1 Concept Development Application

The concept development application seeks approval for:

- The use of the Site for the fish market including waterfront commercial and tourist facilities and ancillary uses and the distribution of uses;
- A gross floor area of up to 30,000 m^2 contained within a defined building envelope;
- Waterfront structures such as wharves;

- Concepts for improvements to the public domain including promenades, access to Blackwattle Bay and landscaping;
- Pedestrian, cycle and road access and circulation principles; and
- Principles for infrastructure provision and waste management.

This concept development application will also set out details of the first stage of the development, being the demolition of land and water-based structures on the Site, including removal of marine piles and any resulting repairs to the existing sea wall, and related services relocations.

1.1.1 Main Works Development Application

The Main Works development application seeks approval for:

- The construction of a new fish market including land and water-based structures;
- The use of the Site for the fish market, including waterfront commercial and tourist facilities and ancillary uses and the distribution of uses;
- A gross floor area of approximately 26,000 m^2 as calculated according to the definition of GFA under SREP 26 (approximately 25,600 m^2 as calculated according to the definition of GFA under the Standard Instrument);
- Public domain works including promenades access to Blackwattle Bay and landscaping;
- Pedestrian, cycle and road access and circulation;
- Infrastructure provision and waste management;
- Associated works as required.

The proposed uses comprise:

- Below Ground Level
    - Parking for service and delivery, and private vehicles up to approximately 417 vehicles;
    - Plant and storage;
    - Waste management facilities; and
    - End of journey facilities.
- Ground Level - Outside of Building Envelope
    - Up to three operational wharves for fishing fleet servicing and product unloading/loading, multi-purpose wharf space, private-operated ferry stop, recreational vehicles and the like;
    - Vehicular access driveways; and
    - Publicly accessible promenade.
- Ground Level - Within Building Envelope
    - Wholesale services space including product storage and processing;
    - Auction floor and associated refrigeration and handling space;
    - Loading dock including time-limited delivery and service vehicle parking area;

  - Waste management facilities;
  - Office space including buyers room; and
  - Staff amenities, plant and storage.
- Upper Ground Level (L1)
  - Retail premises including fresh food retail, food and drink premises including harbourside dining;
  - External/shared dining space;
  - Ancillary back of house space and staff amenities; and
  - Circulation areas.
- Upper Level 2 (Mezzanine)
  - Catering space;
  - The Sydney Seafood School;
  - Tenant and subtenant office space; and
  - Plant and storage space.

1.5 Purpose of this Report

The purpose of this report is to address the Secretary's Environmental Assessment Requirements (SEARs) pertaining to potential air quality and odour impacts as shown in **Table 1**. The scope of this AQIA is limited to the Stage 2 Works of the development, which as noted in **Section 1.3** relate to the construction and operation of the new Sydney Fish Market. A separate air quality assessment has been performed for the Stage 1 works covering the demolition of land and water-based structures on the Site, including removal of marine piles and any resulting repairs to the existing sea wall.

Table 1 Secretary's Environmental Assessment Requirements – New Sydney Fish Market

Key Issue	Assessment Requirement	Addressed in Section
Air Quality and Odour	Provide an air quality impact assessment to address the impacts of construction and operation on air quality in accordance with the relevant Environment Protection Authority guidelines.	**Section 6 & 7**
	Identify the key air emission generating sources and activities from the proposed construction and operation.	**Section 3**
	Identify measures to minimise and mitigate potential air quality and odour impacts on surrounding development.	**Section 6 & 7**

Source: SEAR for application number SSD 8925, 22 December 2017

1.6 Approach to Assessment

Detailed information on the proposed operational activities within the building (ventilation rates, pollution control systems, potential emission rates, location of ventilation stacks, etc.) is not yet available. A large number of assumptions would therefore be required to be used as input to any quantitative (i.e. air dispersion modelling) assessment. Similarly, a quantitative modelling assessment of potential dust emissions associated with the construction activities would also require a number of assumptions to be made to enable the estimation of particulate emission rates for input into the models. The uncertainty associated with the output of such studies means it would be of limited value, and would not (in itself) assist with the identification of dust and odour control measures to actively manage the risks.

SLR has therefore performed a qualitative (risk-based) assessment of both construction and operational impacts, based on the information available, to identify those activities that have the potential for off-site air quality impacts if not adequately controlled, so that appropriate mitigation measures can be identified and incorporated into the project design and relevant environmental management plans.

1.6.1 Construction Impact Assessment Methodology

For the assessment of construction phase impacts, the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (IAQM 2014) has been used to provide a qualitative assessment method (see **Appendix A** for full methodology). The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- **Step 1**: Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2**: Assess risk of dust effects from activities based on:
  - the scale and nature of the works, which determines the potential dust emission magnitude; and
  - the sensitivity of the area surrounding dust-generating activities.
- **Step 3**: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4**: Assess significance of remaining activities after management measures have been considered.

1.6.2 Operational Impact Assessment Methodology

A risk-based qualitative assessment approach has been adopted for the proposed operational activities at the new Sydney Fish Market site (see **Appendix B** for full methodology). This risk-based assessment methodology takes account of a range of impact descriptors, including the following:

- **Nature of Impact**: does the impact result in an adverse or beneficial environment?
- **Sensitivity**: how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude**: what is the anticipated scale of the impact?

The integration of sensitivity with impact magnitude is used to derive the predicted significance of that change. Given the nature of the operations proposed to be performed, and the limited design data currently available, it is considered that this approach is appropriate to identify those key activities that have the potential to give rise to off-site air quality impacts so that recommended mitigation measures may be identified. If appropriate, these recommendations may include further detailed modelling assessment of key activities to confirm that the proposed mitigation measures will ensure compliance with relevant air quality criteria, once detailed design data is available.

2 Project Setting

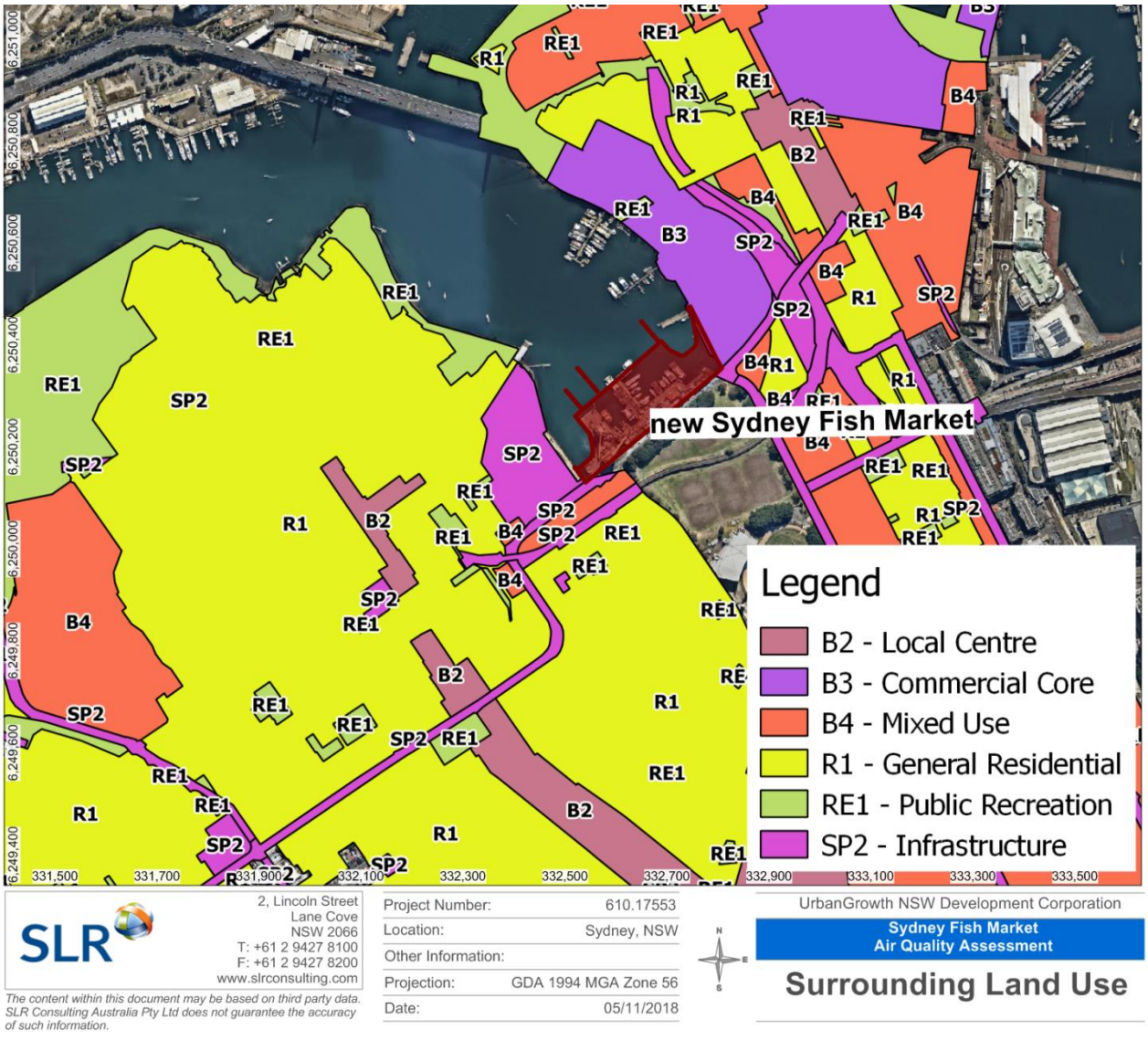
2.1 Sensitive Receptors

The area surrounding the Site includes lands zoned as local centre, commercial core, mixed use, general residential, public recreation and infrastructure as seen in **Figure 2.**

There are a number of existing residences located southwest and west of the Site. The nearest existing residential receptor is located approximately 50 m from the Site boundary, at the corner of Bridge Road and Wentworth Park Road.

In addition to areas currently zoned as mixed use and general residential, where sensitive residential receptors exist, additional residential units may be developed within the Blackwattle Bay investigation area currently zoned as commercial core as part of the renewal of the Blackwattle Bay investigation area (see **Figure 1**).

Figure 2 City of Sydney Local Environmental Plan – Area 5, Land Zoning Map



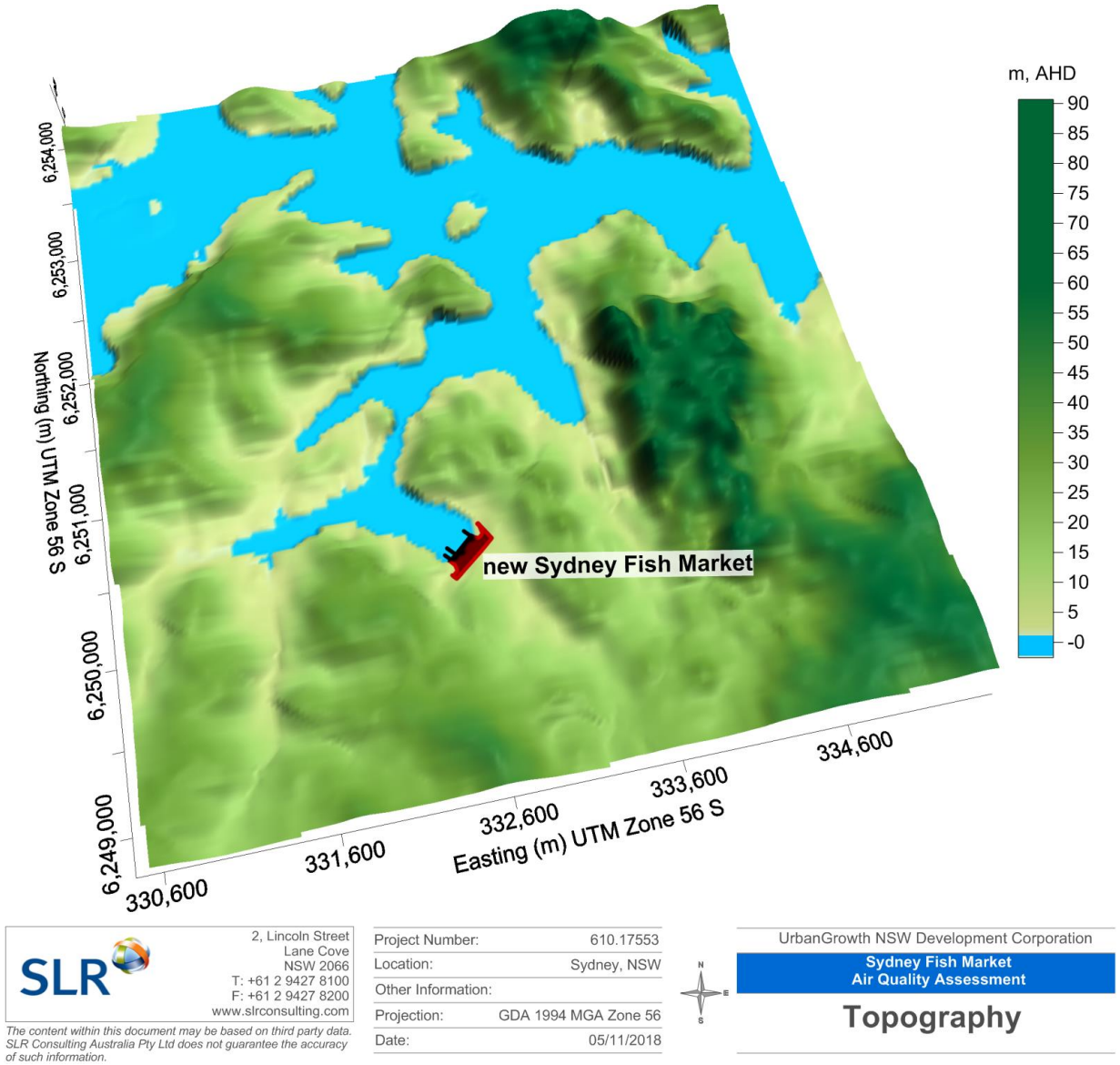
2.2 Local Topography

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

A three dimensional representation of the area surrounding the Site is given in **Figure 3**. The topography of the local area within a 2 km radius of the Site ranges from an approximate elevation of -2 metres (m) to 90 m Australian Height Datum (AHD).

The area immediately surrounding the Site gently slopes towards Blackwattle Bay and is relatively open, which will facilitate dispersion of air emissions and prevent 'pooling' of air pollutants.

Figure 3 Topography of Area Surrounding the Site



2.3 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.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station to the Site is the Sydney Observatory Hill Automatic Weather Station (AWS), which is located approximately 1.8 km to the northeast of the Site. However, this station does not record high definition data. Moreover, due to the location of the station within Sydney Harbour, the data would most likely not be representative of conditions at the Site.

Other nearby BoM weather stations include the Sydney Airport AWS (approximately 8 km south-southwest of the Site) and Canterbury Racecourse AWS (approximately 8 km west-southwest of the Site). Given the variable topographical features of the land between the Site and these two BoM weather stations, the recordings from these stations are also not considered to be a reasonable representation of the wind conditions experienced at the Site. Therefore, The Air Pollution Model (TAPM) and CALMET meteorological models have been used to compile a site-representative dataset. A summary of the methodology used to model wind patterns using TAPM and CALMET, including the long term meteorological analysis to select an appropriate modelling year, are presented in **Appendix C**.

A summary of the annual wind behaviour predicted by CALMET for the modelled year (2014) at the Site is presented as wind roses in **Figure 4**. Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

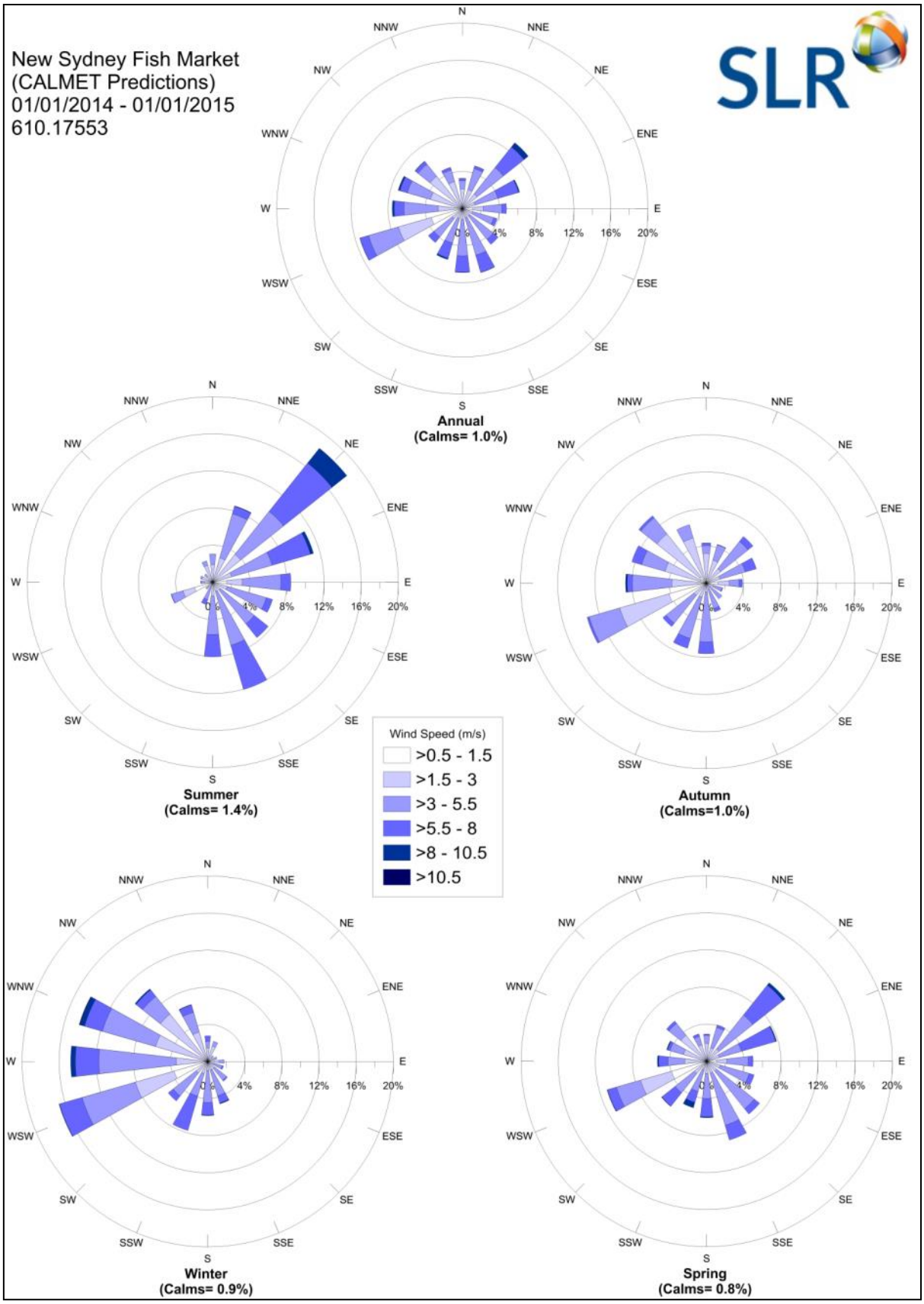
The annual wind rose indicates the predominant wind directions in the area are from west-southwest and northeast. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur approximately 1% of the time throughout the modelling period. The seasonal wind roses for the year 2014 indicate that:

- In summer, winds are mostly gentle to moderate (between 3.0 m/s and 8 m/s) predominantly from the northeast, with very few winds from the northwest and southwest quadrants. Calms were predicted to occur 1.4% of the time during the summer months.
- In autumn, winds are light to moderate (between 0.5 m/s and 8 m/s) predominantly from the west-southwest directions. Calms were predicted to occur 1.0% of the time during the autumn months.
- In winter, winds are mostly gentle to moderate (between 3.0 m/s and 8 m/s) and are from the western quadrant with very few winds from the eastern quadrant. Calms were predicted to occur 0.9% of the time during the winter months.
- In spring, winds are mostly gentle to moderate (between 3.0 m/s and 8 m/s) and predominantly blow from the northeast, west-southwest and south-southeast. Calms were predicted to occur 0.8% of the time during the summer months.

As identified in **Section 2.1**, the closest existing sensitive receptors are located southwest and west of the Site boundary. Additional sensitive receptors will be located to the east and northeast of the Site once the existing Fish Market site is redeveloped.

Winds from between the north and east directions, which would blow air emissions from the Site towards the existing residences, occur approximately 28% of the time. Winds from between the west and southwest directions, which would blow air emissions from the Site towards the existing Fish Market (future sensitive receptor location), occur approximately 17% of the time. The average annual speed of wind blowing towards the closest receptors is 4.4 m/s which is relatively high and would assist in the dispersion of pollutants from the Site.

Figure 4 New Sydney Fish Market Annual and Seasonal Wind Roses 2014



3 Pollutants of Concern

3.1 Air Emission Sources - Construction Phase

Potential air emissions associated with the construction phase include:

- Fugitive dust emissions from construction of buildings and other structures; and
- Products of combustion from construction plant and machinery.

3.1.1 Dust Emissions from Construction Phase Activities

During the construction phase, the potential for dust to be emitted from the Site will be directly influenced by the nature of the activities being performed. Activities that may lead to short-term emissions of dust, include:

- loading and unloading of materials;
- wheel-generated dust from trucks travelling along unpaved roads; and
- wind erosion of exposed surfaces and stockpiles.

These activities should be managed appropriately to ensure off-site impacts are minimised.

Temporary elevation in the emissions of particulate matter and local dust is considered to be inevitable as part of the construction works, particularly where those activities are undertaken during periods of low rainfall and/or windy conditions. The impact of elevated dust emissions is dependent upon the potential for particulates to become and remain airborne prior to being deposited as dust or experienced as an ambient particulate concentration.

The indicative construction schedule for the new Sydney Fish Market identifies that Stage 2 works may require up to approximately 3 years to complete (March 2019 to 2022). It is noted that dust-generating activities will not be occurring continuously throughout this period.

3.1.2 Products of Combustion from Construction Phase Plant and Machinery

Exhaust emissions from cranes, trucks, plant and other equipment associated with the construction of the new Sydney Fish Market will be a source of emissions to air (additional to existing emissions from the local road network) the Site during the construction phase.

Considering the size of the Site and the nature of the proposed development, air emissions from diesel-powered construction plant and machinery are anticipated to be relatively small compared to the existing background emission levels from vehicles on the surrounding road network.

3.2 Air Emission Sources - Operational Phase

Based upon a review of activities that are proposed to occur at the new Sydney Fish Market (presented in **Section 1.4)**, potential air emission sources associated with the operational phase have been identified as follows:

- Odours and particulates from retail kitchens;
- Odours from handling, processing and storage of seafood and waste;
- Odours and Volatile Organic Compounds (VOCs) from polystyrene recycling;

- Odours from sewage treatment;
- Products of combustion from operational phase road and marine traffic;
- Products of combustion from generator/fire pumps/hot water generators;
- VOCs from diesel storage room; and
- Refrigerant gases from plant rooms.

A comprehensive ventilation system is being designed in order to capture and, if necessary, treat the emissions prior to release via dedicated discharge vents located on the roof of the building.

As outlined in **Section 1.6.2** detailed information on the proposed air extractions and filtration system is not yet available. **Table 2** summarises preliminary details of the proposed exhaust systems for the new Sydney Fish Market. Further details of the potential contaminants that may be emitted from each exhaust point are provided in the following sections.

Table 2 Details of Proposed Exhaust Systems for the New Sydney Fish Market

Exhaust System	Description	Location	Key Pollutants
Grease arrestors/sewage pre-treatment exhaust	Exhaust from rooms housing grease arrestors and sewage pre-treatment systems	Roof	Odour
Dissolved Air Flotation (DAF) rooms exhaust	Exhaust from rooms that house DAF units	Roof	Odour
General waste facilities exhaust	Exhaust from rooms that house general waste facilities and Styrofoam packing waste	Roof	Odour, VOCs
End-of-trip and toilet exhaust	Exhaust from toilet facilities as well as end-of-trip areas	Roof	Odour
Oil arrestor room exhaust	Exhaust from room that houses oil arrestors, currently located in the basement	Roof	Odour
Retail kitchen exhausts	Exhausts from retail tenancy kitchens	Roof	Odour, particulates
Seafood cooking school kitchen exhausts	Exhaust from cooking areas within the new Sydney Fish Market seafood cooking school	Roof	Odour, particulates
Carpark exhaust	Exhaust of fumes generated by vehicles in the basement car park	Roof	Combustion gases[#]
Loading dock exhaust	Exhaust of fumes generated by vehicles in the loading dock, located at ground level	Roof	Combustion gases[#]
Fire pump room exhaust ventilation and flues	Exhaust from room that houses diesel fire pumps Exhaust flues from fire pumps This system would only operate during fire events or during testing as required by the authorities	Roof	Combustion gases[# §]
DHW and HHW exhaust	Exhaust from plant rooms housing hot water generators for Domestic Hot Water and Heating Hot Water Exhaust flues from such equipment (if natural gas fired systems are adopted)	Roof	Combustion gases[# §]
Diesel tank room exhaust	Exhaust from room that stores diesel for use in the generator	Roof	VOCs
Refrigeration plant room exhaust	Exhaust of rooms that house refrigeration equipment with potential to emit discharges from relief valves	Roof	Refrigerants [†]
Ice maker plant room exhausts	Exhausts from rooms that house ice making equipment, which may include refrigeration equipment	Roof	Refrigerants [†]
Chiller plant room exhaust	Exhaust from rooms housing chillers	Roof	Refrigerants [†]
Bilge pump-out room exhaust	Exhaust from rooms that house bilge pump-out equipment, currently proposed to be located in the basement	Roof	-
Gas and water meter room exhausts	Exhaust from meter rooms located at ground level	TBC	-

* includes oxides of nitrogen (NOx), carbon monoxide (CO), carbon dioxide (CO_2), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and particulate matter (predominantly $PM_{2.5}$ and PM_{10})

† Type of refrigerant to be used in these systems is not yet known and is subject to detailed design. Possible refrigerants to be used include ammonia, HFO's, etc.

§ Discharge from rooms housing the unit(s) have minimal combustion gases as exhaust flues will be discharged via dedicated vents

3.2.1 Odour and Particulate Emissions from Kitchens

Odour is the principal air emission of concern from kitchens and is primarily generated from the cooking process. Odorous emissions from kitchens are the result of complex mixtures of odorous VOCs which are formed in the cooking process as breakdown products of natural fats and oils.

Impacts from odorous air contaminants are often nuisance-related rather than health-related. There are various elements that are commonly regarded as combining to cause odour nuisance, which are listed below and are collectively known as the FIDOL factors:

- *Frequency:* how often the odour occurs;
- *Intensity:* how strong the odour is perceived to be;
- *Duration:* how long the odour is present for;
- *Offensiveness:* how offensive the odour is perceived to be; and
- *Location or Context:* where the person is experiencing the odour.

Other factors may also come into play when assessing odour impacts, such as:

- *Population sensitivity:* any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.
- *Background level:* whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.

In addition to odour, particulates are also emitted from kitchen operations in the form of smoke and fumes. Cooking methods such as deep frying, barbecuing, and solid fuel-fired cooking produce the most significant amount of particulates.

While emissions from kitchens (particularly odour emissions) can be directly released into the atmosphere through openings in the building, a well-designed air extraction system is capable of capturing and treating emissions prior to release to atmosphere. The air extraction systems for all kitchens at the Site will be designed to meet Australian Standards (AS) and Building Council of Australia (BCA) requirements. It is understood that it is currently proposed that all kitchen exhaust systems will discharge at roof level.

Odour emissions from kitchens may be effectively managed through the implementation of a combination of physical and management measures. This is discussed further in **Section 7.4**.

3.2.2 Odour Emissions from Handling, Processing and Storage of Seafood and Waste

A significant potential source of odour from the Site is the wholesale and retail activities associated with loose chilled fish. The fish will arrive at the Site on fishing vessels/delivery trucks, and will be unloaded and sorted before they are transferred to the auction rooms/chilled storage. Fish bought by traders during auction will be transferred to delivery vans and trucks for transport off-site. Certain seafood products are also processed on-site (scaled, filleted, skinned, etc.). This may also result in odour emissions.

In addition to the chilled seafood, wastewater, organic waste and by-products produced on site have the potential to be a significant source of odour emissions.

The most effective way to minimise odours from the processing, storage and handling areas is by ensuring all seafood and seafood waste are stored at appropriate temperatures and that all areas are well ventilated.

Odour emissions from seafood and waste handling, storage and processing can be directly released into the atmosphere through openings in the building. While not all such emissions can be captured by air extraction systems (e.g. slightly positive pressures are required for chiller and refrigeration rooms, and odour emissions from fish being transferred to delivery vans and trucks will be emitted directly to atmosphere, etc.), suitable air extraction systems are being designed for all processing and storage areas to ensure odorous air is extracted in compliance with AS 1668.2-2012 and BCA guidelines. Moreover, chillers, refrigerators and icemakers are being provisioned in order to ensure all seafood and waste material is kept at an appropriate temperature.

Odour emissions from seafood and waste handling, storage and processing may be effectively managed through the implementation of a combination of physical and management measures. Refer to **Section 7.4** for control measures.

3.2.3 Odour and VOC Emissions from Polystyrene Recycling

Waste polystyrene boxes will be transported to a dedicated waste management room where the polystyrene will be processed using a cold pressing Expanded Polystyrene (EPS) machine to reduce the volume and prepare it for transport. It is noted that a cold pressing EPS densifier generates significantly less VOCs than a hot melting EPS densifier.

Sources of odour and VOCs from the polystyrene recycling facility include waste material still in the packaging as well as VOCs released during the pressing process.

The polystyrene recycling activities are undertaken within the general waste facility located in the basement. This area is proposed to be ventilated via dedicated AS 1668.2-2012 and BCA compliant discharge vents located on the roof of the building.

Odour and VOC emissions from the polystyrene recycling room may be effectively managed through the implementation of a combination of physical and management measures. This is discussed further in **Section 7.4**.

3.2.4 Odour Emissions from Wastewater Treatment

Sources of wastewater from the Site include the defrosting, gutting, scaling, portioning and filleting of fish and the washing of fish products. These wastewater streams will contain high loads of organic matter due to the presence of oils, proteins and suspended solids, and could be a significant source of odour emissions.

Wastewater generated at the new Sydney Fish Market will be treated on-site using a combination of pre-treatment systems as well as Dissolved Air Flotation systems. The air from the rooms housing these treatment systems will be discharged to atmosphere via dedicated AS 1668.2-2012 and BCA compliant vents located on the roof of the building.

3.2.5 Products of Combustion from Operational Phase Traffic

Emissions associated with the combustion of fuel (diesel, petrol, etc.) in road vehicles and marine vessels will include carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and volatile organic compounds (VOCs).

The rate and composition of air pollutant emissions from road and marine vehicles is a function of a number of factors, including the type, size and age of the vehicles/boats, the type of fuel combusted, number and speed of vehicles/boats and (for road traffic) the road gradient.

The current design includes approximately 417 on-site car parking bays for private vehicles over a single level. The single level car park incorporates air extraction systems designed in accordance with AS 1668.2-2012 and BCA requirements. The current design also includes a loading dock on the ground floor to accommodate large vehicles, including one parking space for a B-Double vehicle and parking for coaches. This area will also be served by an AS 1668.2-2012 and BCA compliant ventilation system. In addition to road traffic, marine vessels will be using the proposed wharves to deliver fish stocks to the Site.

Combustion gas emissions from road vehicles and marine vessels may be effectively managed through the implementation of a combination of physical and management measures. This is discussed further in **Section 7.4**.

3.2.6 Products of Combustion from Plant Rooms

Based on the current design for the Site, the following combustion equipment is proposed to be installed at the Site:

- Diesel fired emergency fire pumps;
- Diesel fired standby generator; and
- Domestic Hot Water (DHW) and Heating Hot Water (HHW) plant.

Information is not currently available on the anticipated maximum rating (i.e. kW or MW) of these units. The type of systems, arrangement, redundancy, provision of back-up power and future expansion requirements are subject to further design development and systems options assessment.

In relation to the DHW and HHW plants, the following concepts are being considered:

- Gas-fired hot water generators
- Electrically driven heat pumps
- Additional heat pump stage added to the refrigeration plant
- Integration between the domestic and heating hot water systems.

Air pollutants associated with the combustion of natural gas and diesel include NO_x, CO, PM_{10}, $PM_{2.5}$, SO_2 and VOCs. No air pollutants will be emitted at the project site if electrically-driven heat pumps are adopted.

As outlined in **Section 4.1**, the Regulation exempts emergency standby plant comprising a stationary reciprocating internal combustion engine for generating electricity from the air impurities standard for NO_X specified in Schedule 4 (see **Table 4**) in relation to that plant if the plant is used for a total of not more than 200 hours per year. Given the proposed uses of the diesel fired equipment (i.e. on standby for emergency use only), these units are not considered to represent a significant constraint to the development or sufficient to warrant further assessment. Moreover, the DHW and HHW plants are anticipated to be relatively small in size and are not considered to represent a significant constraint to the development even if gas-fired hot water generators are adopted by the detailed design.

3.2.7 VOC Emissions from Diesel Storage Room

Based on information provided to SLR, the Site will include a dedicated Diesel Storage Room which will house a diesel fuel storage tank. The tank will be located in the Basement Level and will be sized for a 24-hour period operation of the standby generator.

The diesel storage room will be ventilated via an AS 1668.2-2012 and BCA compliant discharge vent located on the roof of the building.

Fuel storage results in evaporative emissions, known as working and standing losses. The primary pollutants associated with evaporative emissions from diesel storage tanks are VOCs (including benzene, toluene, ethyl benzene, and xylene). Working losses occur when the vapour in the vapour space over the liquid is displaced from the tank during tank filling. Working losses depend on the annual amount of material pumped, the vapour pressure of the material stored, and the ambient temperature. Standing losses occur because changes in temperature affect the vapour space pressure inside storage tanks. Vapours expand with an increase in temperature and contract with a decrease in temperature.

Due to the lower volatility of diesel compared to petrol, emissions of VOCs from diesel storage tanks are significantly lower than that from petrol storage. Considering only relatively small quantities of diesel are expected to be used on site and the air from the room housing the diesel storage tank is continuously extracted via a compliant ventilation system, the exhaust VOC concentrations are expected to be very low. The diesel storage room is therefore not considered to represent a significant constraint to the development or sufficient to warrant further assessment.

3.2.8 Refrigerant Emissions from Plant Rooms

The Refrigeration plant room, Ice Maker plant room and Chiller plant room will house refrigeration equipment and be served by dedicated AS 1668.2-2012 and BCA compliant discharge vents. Under normal operation, the exhaust ventilation only operates to remove heat from the plant room and all refrigerant is contained within the equipment. However, under emergency scenarios (accidental leakage), refrigerant may be discharged to through relief valves and emitted to atmosphere via the exhaust vents.

In light of Australia's commitment to a HFC phase-down, only refrigerants with a low-GWP will be evaluated for this project. Consideration is to be given to both natural and synthetic refrigerants. Where flammable and/or toxic refrigerants are used, their charge will be limited and confined to specifically designed areas with the appropriate safety systems in place.

Considering the nature of refrigerant gas release (i.e. accidental leakage) from the abovementioned plant rooms, refrigerant release is unlikely to significantly impact on local air quality and does not warrant further assessment.

4 Regulatory Framework

4.1 Relevant Legislation, Policy and Guidance

The following Air Quality Policy and Guidance documents have been referenced within this assessment and have been used to identify the relevant air quality criteria (see **Section 4.2**).

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

The POEO Act (and Amendment Act 2011) is a key piece of environment protection legislation administered by the NSW Office of Environment and Heritage (OEH) which enables the 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 Site:

- 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 states that any plant located at a premise (e.g. the kitchen exhaust fans at the Site) 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 (e.g. raw food and waste storage/disposal at the Site) are managed in a proper and efficient manner to prevent air pollution (e.g. odour).
- Section 128 of the POEO Act states:

    1. The occupier of a premises must not carry out 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.
    2. 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.

4.1.2 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; and
- imposes operational requirements for certain afterburners, flares, vapour recovery units and other treatment plant.

Part 5 of the POEO (Clean Air) Regulation 2010 (the Regulation) also deals with 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) as noted below in **Table 3** and **Table 4**. The standards of concentrations prescribed by Part 5, Division 3 do not apply to plant during startup and shutdown periods, however such emissions are still subject to the requirements of Section 128 (2) of the POEO Act in relation to the prevention and minimisation of air pollution.

Table 3 Schedule 6 Standards of Concentration for (Group C[1]) Non-Scheduled Premises

Air Impurity	Activity	Concentration [2]
Particles	Any activity/ plant	100 mg/m^3
Smoke	Solid fuel is burnt	Ringlemann 1 or 20% opacity
	Liquid fuel is burnt	Ringlemann 1 or 20% opacity

Note 1 Group C: Activity granted DA consent and commenced to operate after 1 September 2005.

Note 2 Reference conditions are: Dry, 273 K, 101.3 kPa for any activity.

Table 4 Schedule 4 Standards of Concentration for (Group 6[1]) Scheduled Premises

Air Impurity	Activity [2]	Concentration [3]
Solid Particles	Any activity/ plant	50 mg/m^3
NO_2 or NO or both, as NO_2 equivalent	Any turbine operating on gas, being a turbine used in connection with an electricity generating system with a capacity of less than 10 MW	70 mg/m^3
	Any turbine operating on gas, being a turbine used in connection with an electricity generating system with a capacity of 10 MW or greater but less than 30 MW	70 mg/m^3
	Stationary reciprocating internal combustion engines	450 mg/m^3
VOCs as n-propane	Any activity or plant involving combustion (except as listed below)	40 mg/m^3 VOCs or 125 mg/m^3 CO
	Any stationary reciprocating internal combustion engine using a gaseous fuel	40 mg/m^3 VOCs or 125 mg/m^3 CO
	Any stationary reciprocating internal combustion engine using a liquid fuel	1140 mg/m^3 VOCs or 5880 mg/m^3 CO
Smoke	An activity or plant in connection with which liquid or gaseous fuel is burnt	Ringlemann 1 or 20% opacity

Note 1 Group 6: Activity granted DA consent and commenced to operate after 1 September 2005.

Note 2 only concentration standards relevant to the operations at the Site have been listed.

Note 3 Reference conditions are: Dry, 273 K, 101.3 kPa for any activity.

The Regulation exempts emergency standby plant (comprising a stationary reciprocating internal combustion engine) for generating electricity from the air impurities standard for nitrogen dioxide and nitric oxide specified in Schedule 4 (see **Table 4**) relevant to that plant if the plant is used for a total of not more than 200 hours per year.

4.1.3 NSW Environment Protection Authority Air Quality Policy and Guidance

The EPA is the NSW regulatory authority responsible for air quality regulation and associated activities.

The EPA publication, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (the Approved Methods), 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. The air quality criteria set out in the Approved Methods have been reproduced and discussed in **Sections 4.2.1** to **4.2.6**.

4.1.4 Odour Technical Framework and Notes

The EPA publications, *Technical Framework: Assessment and management of odour from stationary sources in NSW* and the associated *Technical Notes* (the Odour Policy), provide a policy framework for assessing and managing activities that emit odour and offers guidance on dealing with odour issues. **Section 4.2.7** outlines relevant recommendations from these documents.

4.1.5 Local Air Quality Toolkit

The Local Government Air Quality Toolkit (AQ Toolkit) has been developed by the EPA to assist local government in their management of air quality issues and provides guidelines for air quality management and for the use of air pollution control techniques. Relevant AQ Toolkit air quality guidance notes include:

- Dust from urban construction sites (PDF 288KB)
- Construction sites (PDF 212KB)
- Food outlets (PDF 133KB)

4.1.6 Building Code of Australia and Australian Standards

The Building Code of Australia (BCA) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of efficiently achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives.

The BCA contains mandatory technical provisions for the design and construction of BCA class buildings. Australian Standard (AS) 1668.2-2012 *The use of ventilation and air conditioning in building, Part 2: Ventilation design for indoor air contaminant control* sets design requirements for mechanical ventilation systems. Mechanical ventilation is required in enclosures where specific health and ventilation amenity requirements cannot be met by natural means.

Section 3.10.1 states of the AS states “All exhaust air shall be discharged to atmosphere in such a manner not to cause danger or nuisance to occupants in the building, occupants of neighbouring buildings or members of the public.”

Section 5 of the AS states the following:

- 5.2.2 Exhaust locations: As far as practicable, exhaust-air intakes used for general exhaust-air collection shall be located on the opposite sides of the enclosure from the sources of make-up air, to ensure that the effluents are effectively removed from all parts of the enclosure.

- 5.3.2.1 General requirements: The effluent shall be collected as it is being produced, as close as practicable to the source of generation.
- 5.10.1 Air discharges: Where discharges are deemed to be objectionable (i.e. nuisance related), discharges shall:
  - Be emitted vertically with discharge velocities not less than 5 m/s.
  - Be situated at least 3 m above the roof at point of discharge.
  - Treated to reduce the concentration of contaminants where required.
  - Be emitted to the outside at velocities and in a direction that will ensure, to the extent practicable, a danger to health or a nuisance will not occur.
  - Be situated a minimum separation distance of 6 m (where the airflow rate is ≥ 1,000 L/s) from any outdoor) air intake opening, natural ventilation device or opening, and boundary to an adjacent allotment, except that where the dimensions of the allotment make this impossible, then the greatest possible distance shall apply.

4.2 Relevant Air Quality Criteria

Ambient air quality criteria for the pollutants identified in **Section 3.1** and **3.2** are prescribed by the NSW Environment Protection Authority document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (hereafter 'the Approved Methods') (EPA 2017).

Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for each of the above pollutants. The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting. Those relevant to the identified emission sources at the new Sydney Fish Market are discussed below.

4.2.1 Carbon Monoxide

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.

CO in urban areas results almost entirely from vehicle emissions and its spatial distribution follows that of traffic flow. The highest concentrations are found at the kerbside, with concentrations decreasing rapidly with increasing distance from the road.

The goals specified within the Approved Methods for CO are provided in **Table 5**.

Table 5 Assessment Criteria for Carbon Monoxide (CO)

Pollutant	Averaging Period	Criterion
CO	15-min	87 ppm (100 mg/m^3)
	8-hour	9 ppm (10 mg/m^3)

Note: ppm = parts per million

4.2.2 Oxides of Nitrogen

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 in the atmosphere after leaving a car exhaust. The goals specified within the Approved Methods for NO_2 are provided in **Table 6**.

Table 6 Assessment Criteria for Nitrogen Dioxide (NO_2)

Pollutant	Averaging Period	Criterion
NO_2	1-hour	12 pphm (246 µg/m^3)
	Annual	3 pphm (62 µg/m^3)

Note: pphm = parts per hundred million

4.2.3 Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP).

The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air (µg/m^3). The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

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

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are as follows:

- a 24-hour maximum of 50 µg/m^3; and,
- an annual average of 25 µg/m^3.

The NSW EPA $PM_{2.5}$ assessment goals set out in the Approved Methods are as follows:

- a 24-hour maximum of 25 µg/m^3; and,
- an annual average of 8 µg/m^3.

4.2.4 Deposited Particulate

Section 4.2.3 is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts also need to be considered, mainly in relation to deposited dust.

In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m^2/month).

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

Table 7 EPA Goals for Allowable Dust Deposition

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

Source: Approved Methods, EPA 2017

4.2.5 Sulphur Dioxide

Sulphur dioxide (SO_2) is a colourless, pungent gas with an irritating smell. When present in sufficiently high concentrations, exposure to SO_2 can lead to impacts on the upper airways in humans (i.e. the noise and throat irritation). SO_2 can also mix with water vapour to form sulphuric acid (acid rain) which can damage vegetation, soil quality and corrode materials.

Main sources of SO_2 in the air are industries that process materials containing sulphur (i.e. wood pulping, paper manufacturing, metal refining and smelting, textile bleaching, wineries etc.). SO_2 is also present in motor vehicle emissions, however since Australian fuels are relatively low in sulphur, high ambient concentrations are not common.

Table 8 Assessment Criteria for Sulphur Dioxide (SO_2)

Pollutant	Averaging Period	Criterion
SO_2	10-min	25 pphm (712 $\mu g/m^3$)
	1-hour	20 pphm (570 $\mu g/m^3$)
	24-hour	8 pphm (228 $\mu g/m^3$)
	Annual	2 pphm (60 $\mu g/m^3$)

Note: pphm = parts per hundred million

4.2.6 Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are organic compounds (i.e. contain carbon) that have high vapour pressure at normal room-temperature conditions. Their high vapour pressure leads to evaporation from liquid or solid form and emission release to the atmosphere.

VOCs are emitted by a variety of sources, including motor vehicles, chemical plants, automobile repair services, painting/printing industries, and rubber/plastics industries. VOCs that are often typical of these sources include benzene, cyclohexane, ethylbenzene, toluene and xylenes. Biogenic (natural) sources of VOC emissions are also significant (e.g. vegetation).

Impacts due to emissions of VOCs can be health or nuisance (odour) related. Benzene is a known carcinogen and a key VOC linked with the combustion of motor vehicle fuels.

4.2.7 Odour

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

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

In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 ou to 10 ou depending on a combination of the following factors:

- **Odour quality**: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity**: any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level**: whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- **Public expectation**: whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics**: whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations.
- **Health effects**: whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

Experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 ou is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours). On this basis, the NSW OEH recommends within the Technical framework: Assessment and Management of odour from stationary sources in NSW (hereafter the 'Odour Framework') (DEC 2006) that, as design goal, no individual be exposed to ambient odour levels of greater than 7 ou. This is expressed as the 99th percentile value, as a nose response time average (approximately one second).

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. As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent goals are necessary in these situations. In addition, the potential for cumulative odour impacts in relatively sparsely populated areas can be more easily defined and assessed than in highly populated urban areas. 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.

For urban areas such as that surrounding the Site, the relevant odour impact assessment criterion set by the Approved Methods for complex mixtures of odorous air pollutants is 2 ou (nose-response-time average, 99th percentile).

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).

5 Characterisation of the Existing Air Environment

5.1 Surrounding Sources of Emissions to Atmosphere

5.1.1 Road Traffic and Marine Vessels

The primary sources of air emissions in the area immediately surrounding the Site is expected to be vehicles travelling along Bridge Road. Engine exhaust emissions will also be generated by marine traffic within Blackwattle Bay and the wider Sydney Harbour, including ferries and water taxis, fishing trawlers, cruise ships visiting Darling Harbour and recreational boating.

As noted in **Section 3.2.5**, the rate and composition of air pollutant emissions from road vehicles and boats is a function of a number of factors, including the type, size and age of the vehicles/boats, the type of fuel combusted, number and speed of vehicles/boats and (for road traffic) the road gradient.

5.1.2 Industrial Sources

Industrial sites located in the area surrounding the Site with the potential to be significant emitters of air pollutants were identified through:

- Desktop mapping of industrial sites regulated by the EPA;
- A review of facilities required to report to the National Pollutant Inventory (NPI); and
- A site visit.

Environment Protection Licences (EPLs) 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 from the premises are to be minimised/prevented.

The NPI database provides details on industrial emissions of over 4,000 facilities across Australia. The requirement to return annual reports to the NPI quantifying a facility's emissions 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 the emissions associated with those activities will be significant in terms of their potential for impact and/or generation of complaint, however it provides a tool to identify significant emission sources in a specific area that then may be investigated further to assess their potential to impact on local air quality.

A search of the EPA public register and NPI database within a 3 km radius of the Site identified several industries which could potentially impact local air quality. Details of these facilities are presented in **Table 9** and their location relative to the Site is illustrated in **Figure 5**.

In addition to the facilities identified from the search of the EPA public register and NPI database, **Table 9** also includes the Hymix concrete batching facility, which is located inside the boundaries of the Blackwattle Bay investigation area. According to the NSW EPA POEO Public Register, the Environment Protection Licence for this facility has been surrendered and is no longer in force. However it is understood that concrete batching and possibly bulk shipping activities occur at the Hymix facility.

Table 9 Identified Sources of Air Emissions in the Vicinity of the Site

Licence Holder / Facility	Type of Activity	Approximate Distance from the Site	Air Pollutants Potentially Emitted	Likelihood of Significant Cumulative Impact
Malt Shovel Brewery	Brewing and packaging of beer	1.9 km (SW)	Odour	Low
Enwave Central Park Pty Ltd	Generation of electrical power from gas	1.4 km (SSE)	Products of gas combustion	Low
Hanson Construction Materials Pty Ltd	Shipping in bulk / concrete works	0 km	Particulate matter, products of combustion	High
Newcastle Port Corporation	Shipping in bulk	1.2 km (NE)	Particulate matter	Low
Sydney Ship Repair & Engineering Pty Ltd	Boat construction/maintenance (general)	2.5 km (NE)	TVOCs from painting/antifouling, particulate matter from sanding/blasting	Low
Cement Australia Holdings Pty Ltd	Cement or lime handling	1.4 km (NW)	Particulate matter	Low
Gypsum Resources Australia Pty. Limited	Shipping in bulk	1.5 km (NNW)	Particulate matter	Low
Harbour City Ferries Pty Ltd	Boat construction/maintenance (dry/floating docks)	2.0 km (N)	TVOCs from painting/antifouling, particulate matter from sanding/blasting	Low
Sydney City Marine Pty Limited	Boat construction/maintenance (general)	1.0 km (NNW)	TVOCs from painting/antifouling, particulate matter from sanding/blasting	Low
Roads And Maritime Services	Boat construction/maintenance (general)	1.0 km (NW)	TVOCs from painting/antifouling, particulate matter from sanding/blasting	Low
Rozelle Bay Pty Ltd	Boat mooring and storage	1.3 km (NW)	Products of combustion, TVOCs from fuel storage	Low
Sugar Australia Pty Limited	General agricultural processing / Shipping in bulk	1.3 km (NNW)	Particulate matter	Low
White Bay 6 Pty Ltd	Boat construction/maintenance (general)	1.5 km (N)	TVOCs from painting/antifouling, particulate matter from sanding/blasting	Low
Hymix Australia (not currently licenced)	Concrete batch plant	0.3 km (NNE)	Particulate matter	Low

Figure 5 Location of Nearby Industrial Sources

It is noted that the Hanson Construction Materials facility, which is located within the Site, will be relocated prior to the commencement of the Stage 1 works and will no longer operate in the Site. This will result in reduced particulate concentrations within the Site.

As shown in **Table 9**, considering the separation distances and activity types associated with the identified emission sources, significant cumulative air quality impacts from the identified facilities with the anticipated air emissions from the Site are considered unlikely.

5.2 Background Air Quality

5.2.1 NSW OEH Ambient Air Quality Monitoring Data

The NSW Office of Environment and Heritage (OEH) maintains a network of air quality monitoring stations (AQMS) across NSW. The nearest such OEH station is located at Rozelle, approximately 2.6 km to the northwest of the Site (see **Figure 3**).

The Rozelle AQMS was commissioned in 1978 and is located in the grounds of Rozelle Hospital, off Balmain Road, Rozelle. It is situated in a residential area in the Parramatta River valley and is at an elevation of 22 m.

Due to the presence of trees within 20 m of the Rozelle AQMS, the clear sky angle is less than 120°, which means this station does not currently comply with Australian Standard AS/NZS 3580.1.1:2007 - *Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*. However, in the absence of any other monitoring data and considering the qualitative nature of this assessment, the Rozelle AQMS data has been adopted for use as a background air quality dataset for this study.

A number of air pollutants and meteorological variables are currently measured by the Rozelle AQMS including:

- Ozone (O_3),
- Oxides of nitrogen (NO, NO_2 & NO_X);
- Sulphur dioxide (SO_2);
- Fine particles less than 10 microns (PM_{10});
- Fine particles less than 2.5 microns ($PM_{2.5}$); and
- Carbon monoxide (CO).

Air pollutant data recorded by the Rozelle AQMS was obtained for the calendar years 2012 - 2016 and is summarised in **Table 10**. To be consistent with the annual NSW compliance monitoring reports, the data for gaseous pollutants are presented in parts per hundred million (pphm) or parts per million (ppm), rather than $\mu g/m^3$ and mg/m^3.

A review of the data shows that exceedances of the 24-hour average PM_{10} criterion were recorded by the Rozelle AQMS in 2013, 2015 and 2016. A review of the compliance monitoring reports for the years 2013 (OEH 2014) and 2015 (OEH 2017) indicate that the exceedances recorded by the Rozelle AQMS were due to a bushfire emergency and as a result of a state-wide dust storm, respectively. For the year 2016 (OEH 2018), the compliance monitoring report states that the increase in the PM_{10} levels across NSW during May '*was due to a number of hazard reduction burns*'.

Exceedances of the 24-hour average $PM_{2.5}$ criterion were also recorded by the Rozelle AQMS in both 2015 and 2016 (the only two years during which $PM_{2.5}$ monitoring was performed by the Rozelle AQMS). Ambient $PM_{2.5}$ concentrations often exceed the 24 hour and annual average criteria set out in the Approved Methods across the Sydney Greater Metropolitan Area.

Ambient concentrations of the gaseous pollutants SO_2, NO_2, and CO were all below the relevant criteria for all years that data are available.

Table 10 Summary of Rozelle AQMS Data (2012 – 2016)

Pollutant	Averaging Period	Criteria	Year	Rozelle AQMS		Units
				Maximum Daily Level	Days Criteria Exceeded	
CO	1-hour	8 ppm	2012	2	0	ppm
			2013	2	0	ppm
			2014	1	0	ppm
			2015	1	0	ppm
			2016	1	0	ppm
NO_2	1-hour	12 pphm	2012	6.2	0	pphm
			2013	7.0	0	pphm
			2014	5.5	0	pphm
			2015	6.0	0	pphm
			2016	5.0	0	pphm
	Annual	3 pphm	2012	1.2	0	pphm
			2013	1.1	0	pphm
			2014	1.1	0	pphm
			2015	1.1	0	pphm
			2016	1.1	0	pphm
PM_{10}	24-hour	50 µg/m^3	2012	41	0	µg/m^3
			2013	59[1]	3	µg/m^3
			2014	44	0	µg/m^3
			2015	60[2]	1	µg/m^3
			2016	59[3]	1	µg/m^3
	Annual	25 µg/m^3	2012	17	0	µg/m^3
			2013	18	0	µg/m^3
			2014	18	0	µg/m^3
			2015	17	0	µg/m^3
			2016	17	0	µg/m^3
$PM_{2.5}$	24-hour	25 µg/m^3	2012	ND	ND	µg/m^3
			2013	ND	ND	µg/m^3
			2014	ND	ND	µg/m^3
			2015	33[4]	1	µg/m^3

Pollutant	Averaging Period	Criteria	Year	Rozelle AQMS		Units
				Maximum Daily Level	Days Criteria Exceeded	
			2016	49[5]	5	µg/m^3
	Annual	8 µg/m^3	2012	ND	ND	µg/m^3
			2013	ND	ND	µg/m^3
			2014	ND	ND	µg/m^3
			2015	7.2	0	µg/m^3
			2016	7.4	0	µg/m^3
SO_2	1-hour	20 pphm	2012	ND	ND	pphm
			2013	ND	ND	pphm
			2014	ND	ND	pphm
			2015	2.8	0	pphm
			2016	2.0	0	pphm
	24-hour	8 pphm	2012	ND	ND	pphm
			2013	ND	ND	pphm
			2014	ND	ND	pphm
			2015	0.5	0	pphm
			2016	0.5	0	pphm
	Annual	2 pphm	2012	ND	ND	pphm
			2013	ND	ND	pphm
			2014	ND	ND	pphm
			2015	0.1	0	pphm
			2016	0.1	0	pphm

Notes:

ND- No data

[1] For 2013, the maximum 24-hour average PM_{10} was recorded on 8 November 2013 at Rozelle AQMS.

[2] For 2015, the maximum 24-hour average PM_{10} was recorded on 6 May 2015 at Rozelle AQMS.

[3] For 2016, the maximum 24-hour average PM_{10} was recorded on 7 May 2016 at Rozelle AQMS.

[4] For 2015, the maximum 24-hour average $PM_{2.5}$ was recorded on 21 August 2015 at Rozelle AQMS.

[5] For 2016, the maximum 24-hour average $PM_{2.5}$ was recorded on 22 May 2016 at Rozelle AQMS.

It is noted that the Port Authority of NSW also runs an air monitoring program in the vicinity of the Site. The location of the monitoring site in relation to the Site is shown in **Figure 6**. The pollutants being monitored as part of this program are SO_2 and $PM_{2.5}$ only, in addition to meteorological parameters.

The data from this station were not utilised for this assessment, due to the monitoring location's proximity to the cruise ship terminal and berths. The pollutant concentrations recorded at this monitoring station will be significantly affected by emissions from fuel combustion in cruise ships and other industrial activities surrounding the White Bay terminal, which are not considered to be representative of the emission sources at the Site.

Figure 6 Location of White Bay Cruise Terminal Monitoring Stations and Berths

5.3 Ambient Odour Field Surveys

As part of an assessment of the current odour environment in the vicinity of the existing Fish Market, SLR performed ambient odour field surveys in the surrounding area in late 2017. The findings from these surveys are presented here, to provide information on the current impacts on local amenity levels associated with the activities and infrastructure at the existing Fish Market. As the new Sydney Fish Market will be purpose-built for the proposed activities and designed to achieve design excellence, functional performance and environmental sustainability, the capture and control of odours from operational activities can be expected to be significantly improved compared to the existing Fish Market.

A series of ambient odour field surveys was performed by SLR staff on three separate days over the period 25 – 29 September 2017 in order to identify sources of odour in the area and to assess the plume extent, strength and hedonic tone of odours within and surrounding Blackwattle Bay. These odour surveys were performed by staff trained in performing ambient odour surveys and whose odour sensitivity has recently (in the last 6 months) been confirmed by a NATA-certified odour laboratory as falling within the acceptable range for odour assessors (in compliance with *AS/NZS 4323.3:2001 Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry*). A report summarising the methodology and findings of the odour surveys is presented in **Appendix D**.

The surveys adopted a modified approach to the *BS EN 16841-2:2016 Ambient Air – Determination of odour in ambient air by using field inspection* and the VDI 3882:1992 *Part 1 Olfactometry – Determination of Odour Intensity*. Surveys were performed on 25, 27 and 29 September 2017, with multiple surveys being performed at different times of the day on each of these days (total of nine surveys).

A desktop review of the areas surrounding Blackwattle Bay was carried out prior to the first survey to identify the main sources of odour emissions. The existing Fish Market was identified as the main potential source of odour. However, in order to identify any additional odours that may impact upon the Blackwattle Bay investigation area, areas upwind of the existing Fish Market were surveyed in addition to areas downwind.

At the start of the surveys, site boundary observations were made at the existing Fish Market to provide an understanding of the characteristics of the odours emitted from the fish market on the day and time of the survey, to enable any downwind observations to be attributed to the existing Fish Market, if appropriate. Publicly accessible areas across the Blackwattle Bay investigation area and its immediate surrounds were surveyed (public roads and footpaths). Observations of the wind speed, wind direction were also recorded during each survey.

The results of the surveys confirmed that the most significant source of odour in the surveyed area is the existing Fish Market. The following observations are noted:

- 'Distinct' (intensity scale 3) odours from the existing Fish Market were detected in four out of the nine surveys. These odours extended approximately 430 m west, 80-105 m east and 70-120 south of the existing Fish Market. The hedonic tone of these 'distinct' odours ranged from +1 to -1 ('mildly pleasant' to 'mildly unpleasant').
- The predominant odour character from the existing Fish Market was cooked seafood odours which are attributable to the operation of food outlets and restaurants within the existing Fish Market. These odours could be detected at the boundary of the existing Fish Market site regardless of the wind direction during peak operation at these premises but were generally only detectable within 10 to 15 m from the boundary.
- Odours from other sources, including traffic and local restaurants were also detected. However, these odours were generally weak in intensity and only detectable in close proximity to the source (typically 1-5 m).

In summary, the surveys indicate that distinct and potentially mildly unpleasant odours do occur in the areas surrounding the existing Fish Market on occasion.

6 Assessment of Potential Impacts – Construction Phase

6.1 Products of Combustion due to Fuel Combustion

Ambient air quality monitoring performed in the Sydney area over the last few decades has shown that the city's air quality has improved and is continuing to improve. A major driver of this improvement in urban air quality is the fact that newer vehicles produce significantly less emissions than older vehicles. This is in part a result of improvements in the quality and composition of fuels as well as improved engine designs and fuel efficiency. According to Trends in Motor Vehicles and their Emissions (EPA 2014), cars built from 2013 onwards emit only 3% of the NO_X emissions compared to vehicles built in 1976, and diesel trucks built from 2011 onwards emit just 8% of the particles emitted by vehicles built in 1996. Thus even as Sydney's population and total vehicle kilometres travelled each year have increased (EPA 2014), key measures of air pollution have dropped significantly and this trend is expected to continue.

The results from the background air quality concentrations show that the monitored concentrations have been below the respective criteria for CO, NO_2 and SO_2 for five years running (2012-2016) (see **Section 5.1**).

Given the nature of the Stage 2 works, it is considered that the emissions generated due to the combustion of fuel in construction plant and machinery will be of limited duration and small compared to the emissions generated by road traffic on Bridge Road. Given the short term and low level of emissions of these pollutants from the Site during the Stage 2 works, they are considered unlikely to have significant impacts on local air quality and have not been considered any further in this assessment.

6.2 Dust Impacts from Stage 2 Works

The key potential air pollution and amenity issues associated with fugitive dust emissions from the proposed activities during Stage 2 works at the Site are:

- Annoyance due to dust deposition (soiling of surfaces) and visible dust plumes; and
- Elevated suspended particulate concentrations (PM_{10}).

Modelling of dust from construction activities is generally not considered appropriate, as emission rates can vary significantly depending on a combination of the activity and prevailing meteorological conditions (i.e., rainfall and wind speed), which cannot be reliably predicted. The following sections therefore present a qualitative assessment of the potential risks to air quality associated with dust from construction activities at the site. Details of the IAQM methodology used to perform the risk assessment are provided in **Appendix A**.

6.2.1 Step 1 – Screening Based on Separation Distance

The nearest existing residential receptors have been identified as being located approximately 50 m of the Project Site boundary, at the corner of Bridge Road and Wentworth Park Road.

As the sensitive receptors are located within 350 m from the boundary of the Site, and within 500 m from the Site entrance, further assessment is required.

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

Based upon the above assumptions and the IAQM definitions presented in **Appendix A**, the dust emission magnitudes have been categorised as presented in **Table 11**.

Table 11 Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Earthworks	Medium	Total site area 2,500 m^2 to 10,000 m^2, moderately dusty soil type (eg silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t. *Note: The total development footprint is approximately 32,000 m^2. Assuming a depth of 1.25 m for the whole pad, the volume of the pad material to be constructed is calculated to be approximately 40,000 m^3. Assuming the average density of material to be 1,500 kg/m^3, the total material moved is estimated to be ~60,000 tonnes. Even though the earthworks area is greater than 10,000 m^2, the dust emissions magnitude has been categorised based on the total material moved.*
Construction	Large	Total building volume greater than 100,000 m^3, piling *Note: The total building volumes, based on the new fish market building envelope is calculated to be approximately 539,000 m^3 (220 m x100 m x 24.5 m). While no on-site concrete batching or sandblasting is anticipated, the construction activities have ben categorised as large based on the building volume.*
Trackout	Small	Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length. *Note: The whole surface at the Project Site will be paved. Therefore, dust emissions magnitude for track-out is considered to be 'small'.*

6.2.3 Step 2b – Risk Assessment

6.2.3.1.1 Receptor Sensitivity

Based on the criteria listed in **Table A1** in **Appendix A**, the sensitivity of the identified receptors in this study is concluded to be *high* for health impacts and *high* for dust soiling, as they include residential areas where people may be reasonably expected to be present continuously as part of the normal pattern of land use.

6.2.3.1.2 Sensitivity of an Area

Using the classifications shown in **Table A2** in **Appendix A**, the sensitivity of the area to dust soiling is classified as '*medium* and the sensitivity of the surrounding area to health effects (**Table A3** in **Appendix A**) has also been classified as '*medium'*. This categorisation has been made taking into account the individual receptor sensitivities derived above, the annual mean background PM_{10} concentration of 17-18 µg/m^3 recorded at the Rozelle AQMS (see **Table 10**) and the anticipated number of receptors present, i.e. 10-100 within 50 m for both dust soiling and health impacts. It is noted that the closest residence identified at the corner of Bridge Road and Wentworth Park Road is a multi-apartment building. It has been assumed that it contains at least ten (10) apartments.

6.2.4 Risk Assessment

Given the sensitivity of the general area is classified as '*medium*' for dust soiling and *'medium'* for health effects, and the dust emission magnitudes for the various construction phase activities as shown in **Table 11**, the resulting risk of air quality impacts is as presented in **Table 12**.

The results indicate that there is a medium risk of adverse dust soiling and human health impacts occurring at the off-site sensitive receptor locations as a result of the proposed earthworks and construction activities, if no mitigation measures were to be applied to control emissions. There is a negligible risk of impacts due to trackout.

Table 12 Preliminary Risk of Air Quality Impacts from Stage 2 Works (Uncontrolled)

Impact	Sensitivity of Area	Dust Emission Magnitude			Preliminary Risk		
		Earthworks	Construction	Trackout	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium (**Table 11**)	Large (**Table 11**)	Small (**Table 11**)	Medium Risk	Medium Risk	Negligible Risk
Human Health	Medium				Medium Risk	Medium Risk	Negligible Risk

6.2.5 Step 3 - Mitigation Measures

Table 13 lists the relevant mitigation measures designated as *highly recommended* (H) or *desirable* (D) by the IAQM methodology for a development shown to have a medium risk of adverse impacts.

Not all these measures would be practical or relevant to the proposed works at the Site, hence a detailed review of the recommendations should be performed as part of the development of the Construction Environmental Management Plan (CEMP) and the most appropriate measures adopted.

Table 13 Site-Specific Management Measures Recommended by the IAQM

	Activity	
1	**Communications**	
1.1	Display the name and contact details of person(s) accountable for air quality and dust issues on the Site boundary. This may be the environment manager/engineer or the Site manager.	H
1.2	Display the head or regional office contact information.	H
1.3	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	H
2	**Site Management**	
2.1	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H
2.2	Make the complaints log available to the local authority when asked.	H
2.3	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	H

	Activity	
3	**Monitoring**	
3.1	Perform daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary.	D
3.2	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.	H
3.3	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
3.4	Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	H
4	**Preparing and Maintaining the Site**	
4.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
4.2	Erect solid screens or barriers around dusty activities or the Site boundary that are at least as high as any stockpiles on site.	H
4.3	Fully enclose site or specific operations where there is a high potential for dust production and the Site is active for an extensive period.	H
4.4	Avoid site runoff of water or mud.	H
4.5	Keep site fencing, barriers and scaffolding clean using wet methods.	H
4.6	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	H
4.7	Cover, seed or fence stockpiles to prevent wind erosion	H
5	**Operating Vehicle/Machinery and Sustainable Travel**	
5.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
5.2	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
5.3	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable	H
5.4	Impose and signpost a maximum-speed-limit of 25 km/hr on surfaced and 15 km/hr on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	D
5.5	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	H
5.6	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	D
6	**Operations**	
6.1	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	H

	Activity	
6.2	Ensure an adequate water supply on the Site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.3	Use enclosed chutes and conveyors and covered skips	H
6.4	Minimise drop heights from loading shovels and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
6.5	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
7	**Waste Management**	
7.1	Avoid bonfires and burning of waste materials.	H
8	**Earthworks**	
8.1	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	D
8.2	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	D
8.3	Only remove the cover in small areas during work and not all at once	D
9	**Construction**	
9.1	Avoid scabbling (roughening of concrete surfaces) if possible	D
9.2	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	H
9.3	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	D
9.4	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	D
10	**Trackout**	
10.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the Site.	D
10.2	Avoid dry sweeping of large areas.	D
10.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D
10.4	Record all inspections of haul routes and any subsequent action in a site log book.	D
10.5	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the Site where reasonably practicable).	D

H = Highly recommended; D = Desirable

6.2.6 Step 4 - Residual Impacts

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. These are termed 'residual impacts'. The results of the reappraisal are presented below in **Table 14**.

Table 14 Residual Risk of Air Quality Impacts from Stage 2 Works

Impact	Sensitivity of Area	Earthworks	Construction	Trackout
Dust Soiling	Medium	Low Risk	Low Risk	Negligible Risk
Human Health	Medium	Low Risk	Low Risk	Negligible Risk

The mitigated dust deposition and human health impacts for earthworks and construction activities are anticipated to be *low*. For almost all construction activity, the IAQM Methods notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

7 Assessment of Potential Impacts – Operational Phase

This section presents a high level assessment of the potential risks of adverse air quality impacts at sensitive receptors due to the proposed operations at the Site. The impact assessment uses the methodology summarised in **Section 1.6.2** of this report, which integrates the receptor sensitivity with impact magnitude to derive the potential significance of that change. Details of the operational risk assessment methodology used are provided in **Appendix B**. In the context of this methodology, the resultant risk is termed "impact significance".

7.1 Receptor Sensitivity

The nearest sensitive receptors to the Site are located approximately 50 m from the closest boundary (see **Section 2.1**). With regards to the methodology outlined in **Appendix B**, the sensitivity of the surrounding residential areas to air pollutant emissions generated by the Site has been classified as ***high***.

7.2 Potential Impacts Associated with Proposed On-site Sources

7.2.1 Odour and Particulate Emissions from Kitchens

As discussed in **Section 3.2.1**, odours and particulate emissions will occur from cooking activities on site. Odour surveys performed in the area surrounding the existing Fish Market indicate that the predominant odour character from the existing Fish Market is cooked seafood odours attributable to the operation of food outlets and restaurants within the existing Fish Market. All kitchens at the new Sydney Fish Market are proposed to be equipped with AS and BCA compliant air extraction systems. Electrostatic precipitators (ESP) are also proposed to be installed in order to control particulate, smoke and odour emissions.

By addressing the FIDOL factors, the potential for odour impacts from this source at the sensitive receptors may be determined.

- Frequency – the closest residential areas have the potential to experience impacts whenever the kitchens are operational and when winds blow towards the receptors. As outlined in **Section 2.3** winds blow in the direction of the existing and future sensitive receptors approximately 45% of the time during the year, therefore there is a medium likelihood they would experience frequent potential odour impacts.
- Intensity – The intensity of released odour is dependent on the level of filtration. It is understood that a combination of odour control measures are being considered for the kitchen exhaust systems. With no additional filtration integrated into the kitchen exhaust system the intensity would likely be medium.
- Duration – the duration of a potential odour impact may last as long as the kitchen exhaust is operational and for as long as the wind is blowing in the direction of the sensitive receptors. Given the kitchens will operate throughout the day, the duration of any odour impact is likely to be medium.
- Offensiveness – as noted in **Section 5.3**, the hedonic tone of 'distinct' odours identified during the odour surveys ranged from +1 to -1 ('mildly pleasant' to 'mildly unpleasant'), therefore the offensiveness is likely to be low.
- Location – the impact of location on the acceptability of odours from the Site has been accounted for by the receptor sensitivity classifications discussed in **Section 7.1**, as high.

Given the above considerations, the magnitude of odour is predicted to be of **moderate** magnitude (i.e. impact is predicted to possibly cause statutory objectives/standards to be exceeded, **Table B2**).

Given the **high sensitivity** of the potentially affected receptors and the **moderate magnitude** of the potential odour impact of the kitchen activities, the potential impact significance for the local receptors is concluded to be of ***intermediate significance***.

Table 15 Risk Assessment of Odour Impacts – Kitchen Operations

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Given the high particulate removal efficiency of ESPs, the magnitude of particulate emissions from the kitchen operations is predicted to be **negligible**.

Given the **high sensitivity** of the potentially affected receptors and the **negligible magnitude** of the potential particulate emission impact of the kitchen activities, the potential impact significance for the local receptors is concluded to be of ***neutral significance***.

Table 16 Risk Assessment of Particulate Impacts – Kitchen Operations

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

In order to further reduce the impact significance, additional mitigation can be put in place to reduce or remove these impacts (refer to **Section 7.4)**. The practicalities of the options available to minimise the potential for odours from kitchen exhausts will need to reviewed as part of the detailed design process. It is expected that by installing activated carbon filters on all kitchen exhausts, the residual risk of odour impacts would reduce to **neutral significance**.

7.2.2 Odour Emissions from Handling, Processing and Storage of Seafood and Waste

As discussed in **Section 3.2.2**, odour emissions could occur from handling, processing and storage of seafood and waste on site. All seafood and waste handling and processing areas are proposed to be equipped with AS and BCA compliant air extraction systems.

By addressing the FIDOL factors, the potential for odour impacts from these sources source at the sensitive receptors may be determined.

- Frequency – The closest residential areas have the potential to experience impacts when winds blow towards the receptors. As outlined in **Section 2.3** winds blow in the direction of the existing and future sensitive receptors approximately 45% of the time during the year, therefore there is a medium likelihood they would experience frequent potential odour impacts.
- Intensity – Odour surveys performed in the area surrounding the existing Fish Market did not identify significant odours associated with seafood waste or fresh seafood outside the boundary of the existing Fish Market. The new Sydney Fish Market which is proposed to be equipped with advanced ventilation systems and improved product and waste storage facilities is predicted to have significantly less odour emissions from handling and storage areas. Given the above, the intensity would likely be low.
- Duration – the duration of a potential odour impact may last as long as the wind is blowing in the direction of the sensitive receptors. Given that conducive winds occur approximately 45% of the time and the Site will be a 24/7 operation, the duration of any odour impact is likely to be medium.
- Offensiveness – as noted in **Section 5.3**, the hedonic tone of 'distinct' odours identified during the odour surveys ranged from +1 to -1 ('mildly pleasant' to 'mildly unpleasant'), therefore the offensiveness is likely to be low.
- Location – the impact of location on the acceptability of odours from the Site has been accounted for by the receptor sensitivity classifications discussed in **Section 7.1**, as high.

Given the above considerations, the magnitude of odour is predicted to be of **slight** magnitude (i.e. predicted impact may be tolerated, **Table B2**).

Given the **high sensitivity** of the potentially affected receptors and the **slight magnitude** of the potential odour impact of the handling and Storage activities, the potential impact significance for the local receptors is concluded to be of ***intermediate/minor significance***.

Table 17 Risk Assessment of Odour Impacts – Handling, Processing and Storage of Seafood and Waste

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

In order to further reduce the impact significance, additional mitigation can be put in place to reduce or remove these impacts (refer to **Section 7.4**). The practicalities of the options available to minimise the potential odour impact from handling, processing and storage areas will need to reviewed as part of the detailed design process. It is expected that the residual risk of odour impacts could be reduced to **neutral significance** if additional mitigation measures (such as the operational controls listed in **Section 7.4** for waste management and raw materials handling) are put in place to reduce the frequency and duration of any odour events.

7.2.3 Odour and VOC Emissions from Polystyrene Recycling

As discussed in **Section 3.2.3**, odour and VOC emissions could occur from the proposed on-site polystyrene recycling activities. Given sufficient information is not yet available in relation to the performance and operation of the proposed cold press EPS densifier machine, the FIDOL factors cannot be fully addressed. However given the potential for VOC and odour emissions from such system, it could be said that without adequate mitigation measures, the magnitude of impact for nearby receptors could potentially be **moderate** (i.e. impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse), **Table B2**).

Based on the **high sensitivity** of the potentially affected receptors and the **moderate magnitude** of the potential odour impact of the polystyrene recycling activities, the potential impact significance for the local receptors is concluded to be of ***intermediate significance***.

Given the nature of the emissions from the polystyrene recycling facility (volatile organics), control measures such as activated carbon filters should be very efficient in controlling these emissions. It is therefore anticipated that by installing activated carbon filters on the exhausts, the residual risk of odour impacts would reduce to **neutral significance**. It is recommended that the design of the ventilation system (including the need for carbon filters or other emissions controls) be reviewed once the capacity and operational parameters of the polystyrene densifier to be installed has been confirmed.

Table 18 Risk Assessment of Odour Impacts – Polystyrene Recycling

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

7.2.4 Odour Emissions from Wastewater Treatment

As discussed in **Section 3.2.4**, odour emissions could occur from on-site wastewater treatment activities. Given detailed design of the wastewater treatment system is not yet finalised, the FIDOL factors cannot be fully addressed. However given the high potential for odour emissions from such system, it could be said that without adequate pollution control and management measures, the magnitude of impact for nearby receptors could potentially be **moderate** (i.e. Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse), **Table B2**).

Given the **high sensitivity** of the potentially affected receptors and the **moderate magnitude** of the potential odour impact of the wastewater treatment activities, the potential impact significance for the local receptors is concluded to be of ***intermediate significance***.

Table 19 Risk Assessment of Odour Impacts – Wastewater Treatment Plant

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Given the nature of the emissions from the wastewater treatment plant (volatile organics), control measures such as activated carbon filters could be very efficient. It is anticipated that by installing activated carbon filters on the exhausts, and adoption of management measures such as prompt removal of sludge from the Site, the residual risk of odour impacts would reduce to **minor to neutral significance** depending on the scale of the system and adopted mitigation measures.

It is recommended that further assessment of potential odour impacts from the wastewater treatment facility be undertaken once the detailed design is completed.

7.2.5 Products of Combustion from Operational Phase Traffic

As outlined in **Section 6.1**, improvements in the quality and composition of fuels as well as improved engine designs and fuel efficiency, have led to continuously improving air quality in the Sydney area. According to Trends in Motor Vehicles and their Emissions (EPA 2014), cars built from 2013 onwards emit only 3% of the NO_X emissions compared to vehicles built in 1976, and diesel trucks built from 2011 onwards emit just 8% of the particles emitted by vehicles built in 1996.

Given the scale of on-site vehicle parking and wharf activities it is considered that the emissions generated due to the combustion of fuel in road vehicles and marine vessels are small compared to the emissions generated by traffic on Bridge Road and will not be significantly increased from the amount of emissions generated by vehicles currently visiting the existing Fish Market. The new Sydney Fish Market will be well-serviced by public transport which will assist in minimising the number of private vehicles accessing the Site.

Given the above considerations, the magnitude for nearby sensitive receptors is predicted to be **negligible** (i.e. Impact is predicted to cause no significant consequences, **Table B2**).

Given the **high sensitivity** of the potentially affected receptors and the **negligible magnitude** of the potential impacts from products of combustion from operational phase traffic activities, the potential impact significance for the local receptors is concluded to be of ***neutral significance*** for the closest receptors.

Table 20 Risk Assessment of Impacts from Products of Combustion – Operational Phase Traffic

Sensitivity		Impact Magnitude [Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

7.2.6 Products of Combustion from Plant Rooms

As discussed in **Section 3.2.6**, products of combustion will be emitted from on-site combustion systems. Given expected small scale of the gas fired DHW and HHW plants and the limited operation of the standby diesel generators and firewater pumps, these units are not considered to represent a significant constraint to the development or sufficient to warrant further assessment.

7.3 Predicted Impact Significance Summary

Table 21 presents a summary of predicted unmitigated and mitigated air quality impacts on sensitive receptors. The risk after the application of mitigation measures is referred to as a "residual" risk.

As outlined in **Section 7.1** , given the proximity of existing and potential future receptors to the Site, the sensitivity of the surrounding residential areas to all emissions generated by the Site has been classified as ***high***

Table 21 Impact Significance Residual Risks

Pollutant	Source	Predicted Unmitigated Impact		Predicted Residual Impact	
		Magnitude	Impact Significance	Magnitude	Impact Significance
Odour / VOCs	Kitchen Operations	Moderate	Intermediate	Negligible	Neutral
	Handling/Processing/Storage of seafood and waste	Slight	Intermediate/ Minor	Negligible	Neutral
	Polystyrene Recycling*	Moderate	Intermediate	Negligible	Neutral
	Wastewater Treatment*	Moderate	Intermediate	Negligible	Minor to Neutral
Products of Combustion	Operational Phase Traffic	Negligible	Neutral	-	-
Particulates	Kitchen Operations	Negligible	Neutral	-	-

* It is recommended that air quality impacts associated with these activities be reassessed upon completion of detailed design for the Site.

7.4 Mitigation Measures and Monitoring

In order to further reduce the potential for off-site air quality impacts during operation, additional mitigation measures can be put in place. The following sections outline a number of mitigation measures relevant to the proposed activities at the Site. It is noted that some of these measures are currently being considered by the detailed design team.

Mitigation measures for the construction phase are provided in **Section 6.2.5**.

7.4.1 Physical Controls

As outlined in **Section 3.2**, a comprehensive exhaust system is being designed for the Site in order to extract emissions and discharge them to atmosphere via dedicated discharge vents located on the roof of the building. The initial dispersion of pollutants to atmosphere from these vents will be influenced by a number of key factors, including: release height, gas buoyancy (a function of temperature) and gas momentum (a function of upward velocity). Pollutant emissions may also be managed by minimising the pollutant reaching the atmosphere through filtration or treatment at source.

7.4.1.1.1 Emission Height

It is understood that due to design considerations, it is currently proposed that all exhaust systems will discharge at roof level. Notwithstanding this design consideration, an effective increase in emission height could be achieved through the use of dilution fans.

Increasing the discharge height would improve dispersion by:

- Allowing more dilution of the emissions by simply increasing the physical separation distance between the discharge point and the sensitive receptor (if at ground level); and
- Reducing building wake effects. The wind flow at the point of discharge is affected by the interference that physical structures have on wind flow patterns. Buildings may cause a number of effects on air flow such that the air flow (i.e. wind) is increasingly turbulent as it passes over the building, and may lead to poor dispersion conditions through the effect of downwash. In simple terms, if the emission point is located within the turbulent flow zone, dispersion may be significantly hampered and rather than dispersing the pollutant may be washed down preferentially towards the roof.

7.4.1.1.2 Gas Buoyancy

Gas buoyancy is related to the temperature of the exhaust gases compared to the surrounding 'ambient' atmospheric temperature. A parcel of warm gas will rise due to buoyancy effects until the point at which it cools to equalise to ambient temperature, when it will achieve neutral buoyancy.

Clearly, this driver for dispersion is relatively minor for the majority of the Site's exhaust ventilation systems, which will most likely emit the extracted gas at low/ambient temperatures.

7.4.1.1.3 Gas Momentum

A significant influencing factor on plume dispersion is gas momentum, or the velocity of the gas being discharged. The lower the discharge velocity, the less effect initial gas momentum has on the rise of the plume before dispersion via dilution effects. Dispersion of exhausts may be significantly enhanced through physical changes to the discharge dimensions or through the fitting of devices to increase the discharge velocity (e.g. dilution fans). Where possible, horizontal discharge vents or raincaps that block the upward flow of the gases should be avoided.

7.4.1.1.4 Treatment

Commonly used emission control options that may be applicable to the types of air emissions that will occur at the Site during the operational phase include:

- Cyclonic Filters - use the cyclone separation principle in order to remove large grease particles.
- Electrostatic Precipitators (ESP) - are used to separate solid or liquid particles from ventilation air. The particles distributed in the gas are electrostatically charged so that they can be collected onto collection plates.
- Cold Water Spray / Water Mist Systems – work by removing particulates and condensable materials by means of cold water sprays that run continuously. The cold water spray/mist causes the grease particles in the extracted air to drop in temperature, solidify and drop out of the air stream via a drain.
- Ultraviolet (UV) Control Systems – work by breaking down organic particles can be effective in neutralising odorous organic compounds. Due consideration needs to be given to the residual ozone that may arise from these systems.
- Activated Carbon Adsorption - work by adsorbing odorous materials and other gaseous emissions such as VOCs into the pores of the carbon. The filters need to be replaced at appropriate intervals before they become saturated and their control efficiency begins to be compromised.
- Wet Scrubbing - involves a mass transfer between a soluble gas and a liquid in a gas-liquid tower. This process relies on the preferential solubility of the pollutants present in the exhaust stream. Due consideration needs to be given to disposal requirements for the additional wastewater stream that would be generated by this system.

7.4.1.1.5 Temperature Control

Temperature influences the degradation of waste and raw material and the volatilisation of odorous compounds. In order to reduce odour generation through temperature control it is recommended that:

- The temperature within the wholesale tenants processing areas and auction hall and associated areas (eg direct sales, bulk bin unpack, transhipment etc) be maintained at 15-18 degrees Centigrade (ºC); and
- A refrigerated room (maintained at 4ºC) be provisioned within the waste management room for storage of offal.

7.4.2 Operational Controls

It is recommended that good housekeeping be maintained on all areas of the Site, including regular cleaning of all internal and external areas of the Site. In addition to good housekeeping, the following operational controls should be considered for implementation at the Site to control odours and other air emissions.

7.4.2.1.1 Cleaning and Maintenance of Physical Controls

The physical controls (see **Section 7.4.1**) should be designed to allow for easy and safe cleaning and maintenance. Cleaning and maintenance procedures are recommended to include the following:

- Weekly visual inspection of the ventilation system including checking of all metal surfaces to ensure there is no accumulation of grease or dirt and that there is no surface damage.
- Regular equipment cleaning and maintenance in accordance with the manufacturers' recommendations for cleaning and maintenance of all air emission control systems.
- Periodic cleaning of all internal surfaces of the exhaust ductwork by a specialist contractor.

7.4.2.1.2 Waste Removal and Management

It is recommended that:

- All generated waste is identified and separated into common material streams or categories at the point of generation for separate collection. This would ensure that any waste that has the potential to cause odour emissions is dealt with appropriately.
- All organic waste is stored in closed containers and away from direct sun in the temperature-controlled waste management room.
- All fish offal is stored in the dedicated refrigerated room and removed from site promptly.
- All fish offal and putrescible waste is removed from site promptly (7 days per week).
- All waste materials are covered during transport.

7.4.2.1.3 Raw Material Handling

It is recommended that:

- All raw materials are covered during transport.
- All raw materials that have the potential to generate odours are stored in enclosed and chilled areas within the Site.

7.4.2.1.4 Staff, Tenant and Contractor Awareness and Training

It is recommended that general environmental awareness training be provided to relevant staff, tenants and contractors, including:

- Potential air quality and odour impacts which may be caused by activity during normal and abnormal circumstances;
- Prevention of accidental air emissions and actions to be taken when accidental emissions occur;
- Efficient and appropriate use and maintenance of equipment used on the Site (where relevant to their role); and

- Procedures for complaint handling.

All staff, tenants and contractors should be instructed to report any undue pollutant release (including odour) and visible emissions from the roof exhaust vents to the Site manager.

It is also recommended that signs be displayed in appropriate locations on the Site to communicate health and nuisance impacts of activities such as idling vehicles and misplacing waste to the general public.

7.5 Monitoring

Given the nature and scale of the Stage 2 works, it is not anticipated that any impacts upon human health or amenity values would be experienced during the construction or operational phases.

Regular site walk overs and boundary inspections are recommended to be performed during the construction phase and ongoing monitoring of air quality is not considered to be required.

8 Conclusions

SLR was commissioned by UrbanGrowth NSW Development Corporation (UrbanGrowth NSW) to perform an Air Quality Impact Assessment (AQIA) for the proposed development of the new Sydney Fish Market (the Site). The Site is located at the head of Blackwattle Bay between the Pyrmont Peninsula and the foreshore of Glebe, situated less than 2 km west of Sydney's CBD and is partially within the City of Sydney Local Government Area.

This report has been prepared in response to the Secretary's Environmental Assessment Requirements (SEAR's) for Stage 2 of the development of the Site, which includes the construction and operation of the development.

The main potential sources of air emissions were identified as dust impacts during the construction phase and odour, VOC, products of combustion and particulates during the operational phase.

The potential for off-site dust impacts was assessed using a qualitative risk-based approach prescribed by the Institute of Air Quality Management (IAQM). The results of this assessment indicate that dust impacts due to the construction works can be adequately managed with the implementation of site-specific mitigation measures, and that the residual impacts are likely to be low for construction and earthworks activities and negligible for trackout activities.

The potential for off-site air quality impacts due to operation phase activities was also assessed using a qualitative risk-based approach. Although a qualitative assessment has been performed, given the nature and scale of the operations proposed, it is considered that provided appropriate mitigation measures are implemented as part of the detailed design stage the relevant air quality criteria outlined in **Section 4.2** will not be exceeded as a result of the operation of the development.

9 References

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APPENDIX A

Construction Assessment Methodology

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the Site, more than 50 m from the route used by construction vehicles on public roads and more than 500 m from the Site entrance. This step is noted as having deliberately been chosen to be conservative, and will require assessments for most projects.

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

Step 2a of the assessment provides "dust emissions magnitudes" for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, which are most relevant to this Development, are as follows:

Demolition *(Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time)*:

- ***Large***: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- ***Medium***: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- ***Small***: Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks *(Covers the processes of soil-stripping, ground-levelling, excavation and landscaping)*:

- ***Large***: Total site area greater than 10,000 m^2, potentially dusty soil type (eg clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
- ***Medium***: Total site area 2,500 m^2 to 10,000 m^2, moderately dusty soil type (eg silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
- ***Small***: Total site area less than 2,500 m^2, soil type with large grain size (eg sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.

Construction *(Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc)*:

- ***Large***: Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting.
- ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (eg concrete), piling, on site concrete batching.
- ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (eg metal cladding or timber).

Track-out *(The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network)*:

- ***Large***: More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length.
- ***Medium***: Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.
- ***Small***: Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length.

Note: No demolition of existing structures will be performed as part of this Development.

In order to provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

Step 2b – Risk Assessment

Assessment of the Sensitivity of the Area

- Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:
- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.
- Individual receptors are classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors are not addressed using this approach). The IAQM method provides guidance on the sensitivity of different receptor types to dust soiling and health effects as summarised in **Table A1**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table A1 IAQM Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: Dwellings, museums, medium and long term car parks and car showrooms.	*Examples: Parks and places of work.*	*Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM10.*	*Examples: Public footpaths, playing fields, parks and shopping street.*

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place;
- any conclusions drawn from local topography;

- the duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts); and
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in **Table A2**. The sensitivity of the area should be derived for each of activity relevant to the project (ie construction and earthworks).

Table A2 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

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

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

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table A3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (ie an annual average of 20 $\mu g/m^3$ for PM_{10}) the IAQM method has been modified slightly.

- This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:
- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM_{10} conc.	Number of receptors [a,b]	Distance from the source (m)			
			<20	<50	<100	<350
High	15-22.5 µg/m^3	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<15 µg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low
	-	1-10	Medium	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m); noting that only the highest level of area sensitivity from the table needs to be considered.

(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table A4** (earthworks and construction) and **Table A5** (track-out) to determine the risk category with no mitigation applied.

Table A4 Risk Category from Earthworks and Construction Activities

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

Table A5 Risk Category from Track-out Activities

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

Step 3 - Site-Specific Mitigation

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

Step 4 – Residual Impacts

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

APPENDIX B

Operational Assessment Methodology

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

- **Nature of Impact**: does the impact result in an adverse or beneficial environment?
- **Sensitivity**: how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude**: what is the anticipated scale of the impact?

The integration of receptor sensitivity with impact magnitude is used to derive the predicted **significance** of that change.

Nature of Impact

Predicted impacts may be described in terms of the overall effect upon the environment:

- **Beneficial**: the predicted impact will cause a beneficial effect on the receiving environment.
- **Neutral**: the predicted impact will cause neither a beneficial nor adverse effect.
- **Adverse**: the predicted impact will cause an adverse effect on the receiving environment.

Receptor Sensitivity

Sensitivity may vary with the anticipated impact or effect. A receptor may be determined to have varying sensitivity to different environmental changes, for example, a high sensitivity to changes in air quality, but low sensitivity to noise impacts. Sensitivity may also be derived from statutory designation which is designed to protect the receptor from such impacts.

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with the broad categories outlined in **Table B1**, which has been used in this assessment to define the sensitivity of receptors to air quality impacts.

Table B1 Methodology for Assessing Sensitivity of a Receptor to Air Quality Impacts

Sensitivity	Criteria
Very High	Receptors of very high sensitivity to air pollution (e.g. dust or odour) such as: hospitals and clinics, retirement homes, painting and furnishing businesses, hi-tech industries and food processing.
High	Receptors of high sensitivity to air pollution, such as: schools, residential areas, food retailers, glasshouses and nurseries, horticultural land and offices.
Medium	Receptors of medium sensitivity to air pollution, such as: farms, outdoor storage, light and heavy industry.
Low	All other air quality sensitive receptors not identified above.

Magnitude of Impact

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions. **Table B2** outlines the methodology used in this assessment to define the magnitude of the identified potential air quality impacts.

Table B2 Methodology for Assessing Magnitude of Impacts

Magnitude	Description
Substantial	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Moderate	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Slight	Predicted impact may be tolerated.
Negligible	Impact is predicted to cause no significant consequences.

Significance of Impact

The risk-based matrix provided below illustrates how the definition of the sensitivity and magnitude interact to produce impact significance.

Table B3 Impact Significance Matrix

Sensitivity \ Magnitude		[Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

APPENDIX C

TAPM and CALMET Modelling Parameters

Meteorological Modelling - TAPM

TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia, is a prognostic model which can be used to compile a site-representative meteorological dataset in areas where there is limited observational data available, and has been widely used for meteorological and pollutant dispersion modelling studies throughout Australia. The model allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

The CSIRO has a global data set of synoptic meteorological data that is required as input to the TAPM model. It is derived from analysis data used by meteorological services for weather forecasting. The synoptic meteorological data used in the modelling has been obtained from the CSIRO for the Asia Pacific region for the years of 2012-2016 (inclusive). **Table B1** details the parameters used in the TAPM meteorological model for this assessment.

TAPM model may assimilate actual local wind observations so that they can optionally be included in a model solution. However, given that TAPM is known to under-predict calm wind conditions, the wind speed and direction observations obtained from the nearest BoM stations have also been used in the subsequent CALMET component of the modelling as described below.

Table B1 TAPM Input Parameters Used in this Study

Parameter	Value
Modelling Period	1 January 2014 to 31 December 2014
Centre of analysis	332750mE 6250232mN (UTM Coordinates)
Number of grid points	35 × 35 × 35
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Sydney Airport AWS (Station # 66037) Canterbury Racecourse AWS (Station # 66194)
Terrain	AUSLIG 9 second DEM

The three dimensional upper air data from TAPM output was used as input for the diagnostic meteorological model (CALMET).

Meteorological Modelling - CALMET

In the simplest terms, CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and current land uses.

CALMET modelling was conducted using the 'with Obs' CALMET approach. TAPM generated upper air data and available surface weather observations in the area were used to refine the wind field predetermined by TAPM data. Hourly surface meteorological data from the nearest BoM stations were incorporated in the CALMET modelling. This includes meteorological data collected by the OEH monitoring site at St Marys through the use of the revised meteorological dataset compiled in response to comments from OEH on the Stage 1 AQIA. The use of the St Marys meteorological observational data in the meteorological modelling was shown in the Stage 1 Response to Submissions to not have a material impact on the results of the Stage 1 assessment, but it has been used in this updated modelling study for completeness.

A horizontal grid spacing of 100 m was used to adequately represent the important local terrain features and land use. **Table A2** details the parameters used in the meteorological modelling.

Table B2 CALMET Configuration Used for this Study

Modelling Period	1 January 2013 to 31 December 2013
Centre of analysis	325,362 mE 6,241,993 mN (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	8.2 km x 10.12 km (40 m)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	Sydney Airport AWS (Station # 66037) Canterbury Racecourse AWS (Station # 66194) TAPM - upper air data (331,750 mE; 6,248,232 mS)

APPENDIX D

Field Odour Survey Report

23 October 2017

610.17553-L01-v1.0.docx

UrbanGrowth NSW
Level 12, MLC Centre
19 Martin Place
Sydney NSW 2000

Attention: Stephanie Ballango

Dear Stephanie

Bay Market District
Field Odour Survey Report

SLR Consulting Australia (SLR) was commissioned by UrbanGrowth NSW to conduct a series of ambient odour field surveys to assess the plume extent, intensity and hedonic tone of odours in the area surrounding potential odour sources in the vicinity of the Bays Market District, Sydney, NSW (the Investigation Area).

The purpose of the odour surveys was to identify the main sources of pollutants impacting upon the Investigation Area and assessing the baseline odour strength and hedonic tone in the areas surrounding the Investigation Area.

This letter outlines the methodology and results of the odour surveys and is accompanied by and should be read in conjunction with SLR Report 610.17553-R01, which summarises the findings of the odour surveys.

Yours sincerely

ALI NAGHIZADEH
Associate - Air Quality

Checked/
Authorised by: KL

SLR Consulting Australia Pty Ltd 2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia) +61 2 9427 8100 +61 2 9427 8200
E: sydney@slrconsulting.com www.slrconsulting.com
ABN 29 001 584 612

1 Location

The Investigation Area is located at the western edge of Pyrmont, less than two kilometres from Sydney CBD. **Figure 1** illustrates the location of the Bays Market District. The existing Sydney Fish Markets (SFM) is located at the western corner of the Investigation Area and is a potentially significant source of odours in the area.

Figure 1 Bays Market District Location

SLR
2, Lincoln Street
Lane Cove
NSW 2066
T: +61 2 9427 8100
F: +61 2 9427 8200
www.slrconsulting.com

The content within this document may be based on third party data. SLR Consulting Australia Pty Ltd does not guarantee the accuracy of such information.

Project Number:	610.17553
Location:	Sydney, NSW
Other Information:	
Projection:	GDA 1994 MGA Zone 56
Date:	27/09/2017

UrbanGrowth NSW
Bays Market District
Air Quality Assessment
Project Location

2 Methodology

A series of ambient odour field surveys was performed by SLR staff on 25, 27 and 29 September 2017, with multiple surveys being performed at different times of the day on each of these days (total of nine surveys). The purpose of these surveys was to assess:

- The odour plume extent;
- The odour intensity;
- The odour hedonic tone; and
- The characteristics of the perceived odour.

Survey days and times were selected with an aim to capture peak emissions from the existing SFM. This included early morning surveys to capture potential odours associated with the auction floor activities.

Publicly accessible areas upwind and downwind of the Investigation Area were surveyed (public roads and footpaths). Observations of the wind speed, wind direction were also recorded during each survey.

It is noted that an odour survey provides only a snap shot of the odour at these locations. However, the odour surveys performed provide an indication of the likely impact under a variety of meteorological conditions.

2.1 Odour Assessor

SLR utilised personnel to conduct the odour surveys who have successfully undertaken and comply with the odour assessor sensitivity screening protocol in accordance with:

- AS/NZS 4323.3:2001 *Stationary source emissions – Part 3: Determination of odour concentration by dynamic olfactometry*.

Refer to **Appendix B** for Certificates of Analysis of the results of the odour assessor sensitivity screening.

Both of the SLR odour assessors were near the middle of the sensitivity range of the AS4323.3:2001 criterion to qualify as an odour assessor.

2.2 Odour Plume Extent

During the odour surveys, SLR adopted a modified approach to the British Standard BS EN 16841-2:2016 *Ambient Air – Determination of odour in ambient air by using field inspection* to characterise the area surrounding the identified odour sources by the presence or absence of odour, and in order to determine the likely extent of potential exposure to recognisable odours from each site.

This method uses odour assessors to determine the extent of the downwind odour plume, under specific meteorological conditions.

It is noted that the British Standard does not include the measurement of intensity of ambient odours or the hedonic tone of the ambient odours. Modified approaches to German VDI standards were adopted for the assessment of odour intensity and hedonic tone as described below.

2.3 Odour Intensity

During the odour surveys, SLR adopted a modified approach to the German VDI 3882:1992 Part 1 *Olfactometry – Determination of Odour Intensity* to record odour intensity.

This method was utilised during the odour surveys as there is currently no Australian Standard for rating odour intensity. The German VDI 3882 standard is however the most commonly referred to standard by the Environment Protection Authority (EPA).

To assess the odour intensity at each location for any discernible odours detected, the odour assessor undertaking the survey would classify their perception of the odour intensity in accordance with the scale outlined in **Table 1**.

Table 1 Summary of Odour Intensity Scale Utilised during the Field Odour Surveys

Odour	Intensity Level
Extremely Strong	6
Very Strong	5
Strong	4
Distinct	3
Weak	2
Very Weak	1
Not perceptible	0

2.4 Odour Hedonic Tone

During the odour surveys SLR adopted a nine point scale of +4 to -4 to define the hedonic tone.

To assess the hedonic tone (degree of pleasantness/unpleasantness of odour) at each location for any odours detected, the odour assessor undertaking the survey would classify their perception of the odour hedonic tone in accordance with the scale outlined in **Table 1**.

It is noted that hedonic definition is subjective, which means the results may vary from one assessor to another.

Table 2 Summary of Odour Intensity Scale Utilised during the Field Odour Surveys

Odour	Intensity Level
Very Pleasant	+4
Pleasant	+3
Moderately Pleasant	+2
Mildly Pleasant	+1
Neutral Odour / No Odour	0
Mildly Unpleasant	-1
Moderately Unpleasant	-2
Unpleasant	-3
Very Unpleasant	-4

3 Odour Survey Results

3.1 Identified Odour Sources

Prior to the surveys, the existing SFM was identified as the main potential source of odour in the area. However, in order to identify any other additional existing sources of odour that currently impact upon the Investigation Area, odour surveys were conducted upwind of the SFM and across the full extent of the Investigation Area, as well as downwind of the SFM.

Odours identified during the surveys other than those associated with activities at the SFM included:

- Vehicle exhaust odours from road traffic; and
- Food/cooking odours from restaurants and cafes.

These additional odours, which were generally described as very weak to distinct, were very localised and were only detectable within a few meters from the source.

3.2 Odour Intensity, Hedonic Tone and Plume Extent

Refer to **Appendix A** for intensity and hedonic tone plots illustrating the observations recorded across the areas surveyed during the eight survey events. **Table 3** details the character of the perceived odours and the meteorological conditions at the time of each survey and summarises the maximum intensity and hedonic tone recorded during each survey at the survey locations upwind and downwind of the Investigation Area.

Table 3 Summary of Odour Plume Survey Results – Intensity, Hedonic Tone and Character

Survey No.	Date	Start Time	Finish Time	Wind Direction	Wind Speed (km/h)	Maximum Odour Intensity (0 to 6)	Hedonic Tone (-4 to +4)	Odour Character
1	25-Sep-17	12:00	13:30	WNW	26	3	-1	Cooked food / fish
2	25-Sep-17	15:00	16:30	WNW	33	3	-1	Cooked food / fish
3	25-Sep-17	17:30	19:00	W	26	2	0	No recognisable odours
4	27-Sep-17	05:30	08:00	ENE	11	2	0	Weak fresh fish odours
5	27-Sep-17	10:00	11:30	ESE/NE	6 - 26	2	0	Weak fresh fish odours
6	27-Sep-17	13:00	14:30	NE	30	3	0	Cooked food / fish
7	29-Sep-17	06:00	08:00	W	15	2	0	Fishy
8	29-Sep-17	10:30	12:00	W	20	2	-1	Fishy, car exhaust
9	29-Sep-17	13:00	14:30	W	6 - 20	3	-1	Fishy, garbage, cooked food

Table 4 summaries the approximate extent of the 'distinct' odour plume during each of the nine (9) odour surveys performed at the Investigation Area. During the odour surveys, the predominant odour character was identified as being attributable to activities at the existing SFM, including raw and cooked fish. The plume extents have therefore been estimated from the boundary of the existing SFM. It is noted that only areas that are publicly accessible by foot were surveyed upwind and downwind of the Investigation Area. Therefore, the plume extent in some directions, specifically northwest of the Investigation Area (ie, the bay and Glebe Island) could not be determined.

It is noted that during the peak operation hours of the restaurants located within the existing SFM, cooking odours were detectable within 10 -15 m of the existing SFM (ie. on Bridge Road) regardless of wind conditions.

Table 4 Summary of Odour Plume Survey Results – Plume Extent

Survey No.	Date	Start Time	Finish Time	Wind Direction	Approximate Distinct Downwind Odour Plume Extent (m)							
					N	NE	E	SE	S	SW	W	NW
1	25-Sep-17	12:00	13:30	WNW	ND	**130**	**80**	**35**	**100**	**15**	ND	ND
2	25-Sep-17	15:00	16:30	WNW	ND	**120**	**90**	**90**	**80**	**50**	ND	ND
3	25-Sep-17	17:30	19:00	W	ND	ND	ND	ND	ND	ND	ND	ND
4	27-Sep-17	05:30	08:00	ENE	ND	ND	ND	ND	ND	ND	ND	ND
5	27-Sep-17	10:00	11:30	ESE/NE	ND	ND	ND	ND	**10**	**15**	ND	ND
6	27-Sep-17	13:00	14:30	NE	ND	ND	ND	ND	**120**	**160**	**430**	ND
7	29-Sep-17	06:00	08:00	W	ND	ND	ND	ND	ND	ND	ND	ND
8	29-Sep-17	10:30	12:00	W	ND	ND	ND	ND	**10**	**15**	ND	ND
9	29-Sep-17	13:00	14:30	W	ND	**100**	**105**	**25**	**70**	**15**	ND	ND

ND: No distinct odours detected

4 Conclusions

This report outlines the findings of the field odour survey, identifies approximate extent of the odour plume downwind of the identified sources of odour that have the potential to impact upon the Investigation Area and presents the odour character and perceived pleasantness of the odours emitted from these sources.

The conducted odour surveys found that the main source of odour in the area surrounding the Investigation Area is the existing Sydney Fish Markets and that all other odour sources (e.g. local cafes, restaurants and traffic) have a relatively insignificant impact at the Investigation Area.

Hedonic Tone and Odour Intensity Plots

Hedonic Tone and Odour Intensity Plots

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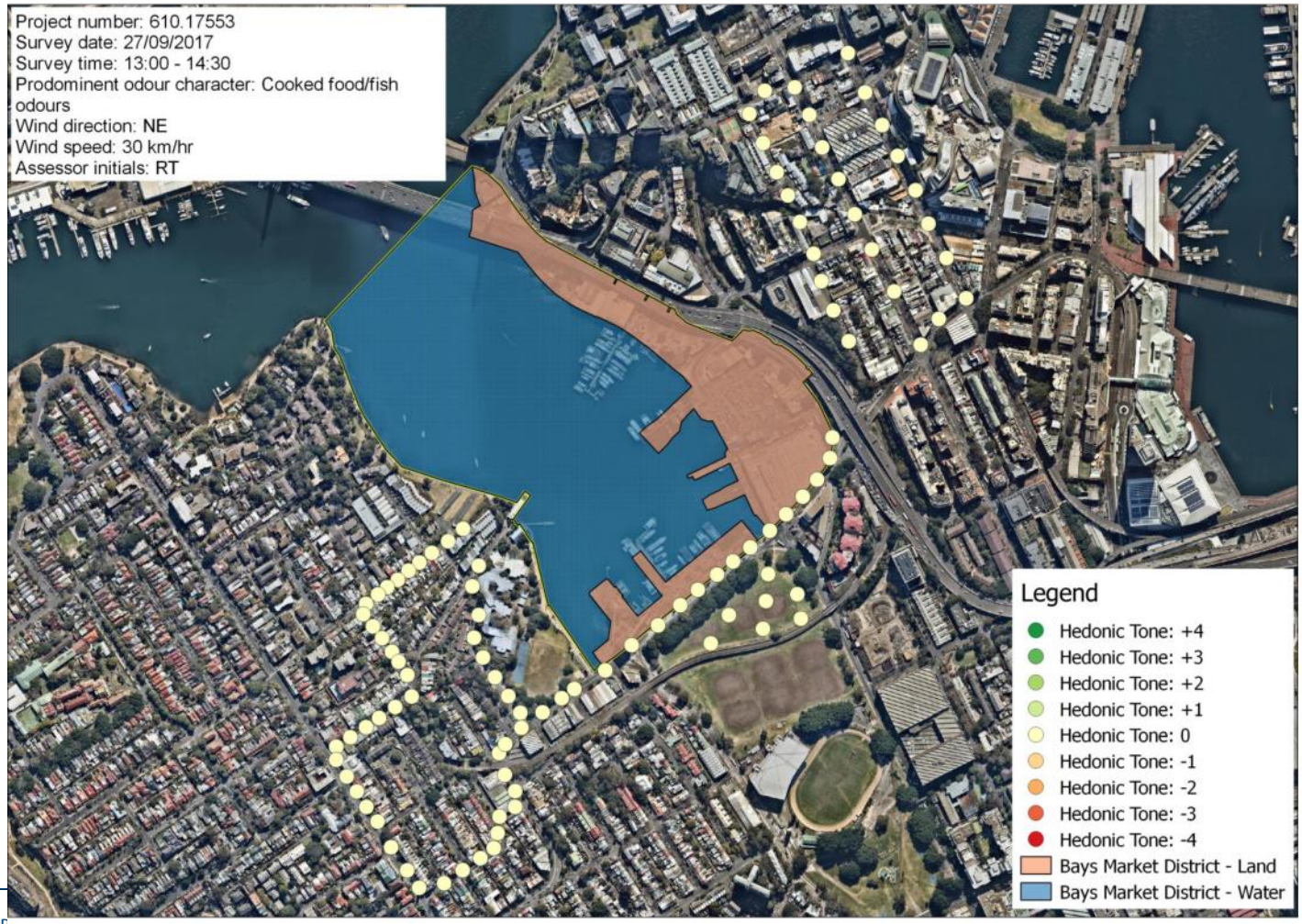
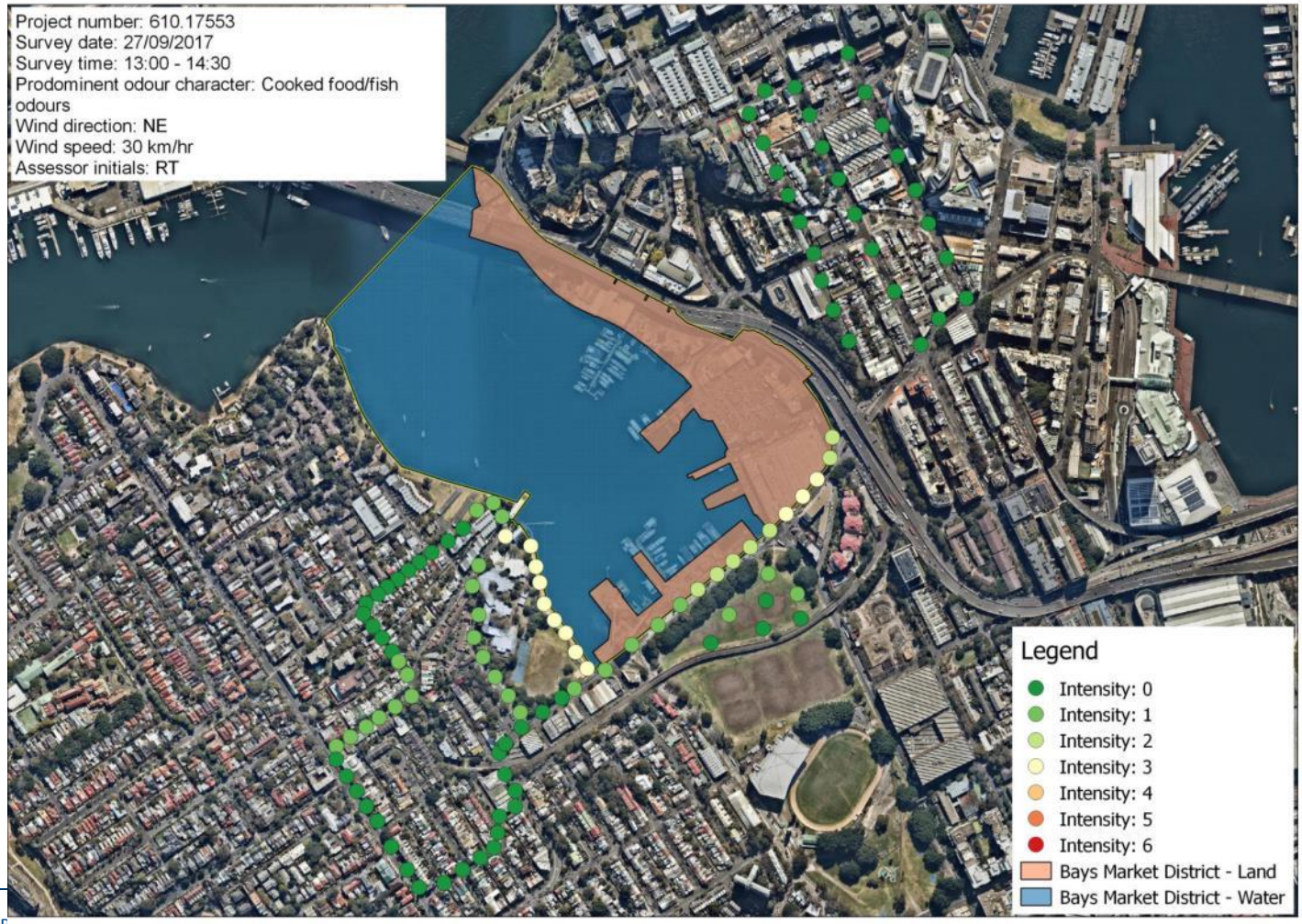
Hedonic Tone and Odour Intensity Plots

Hedonic Tone and Odour Intensity Plots

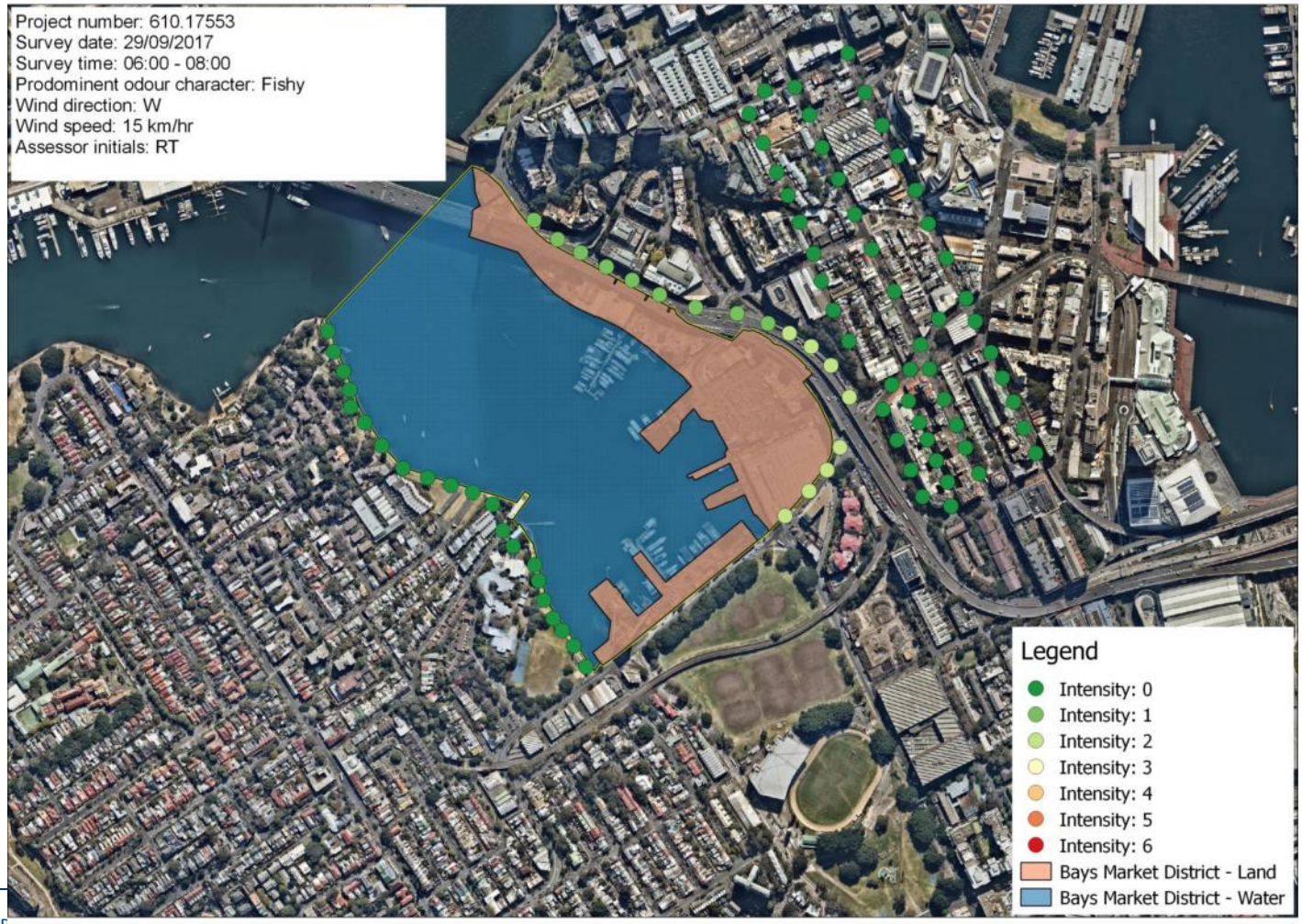


Hedonic Tone and Odour Intensity Plots



Hedonic Tone and Odour Intensity Plots

Hedonic Tone and Odour Intensity Plots



Hedonic Tone and Odour Intensity Plots

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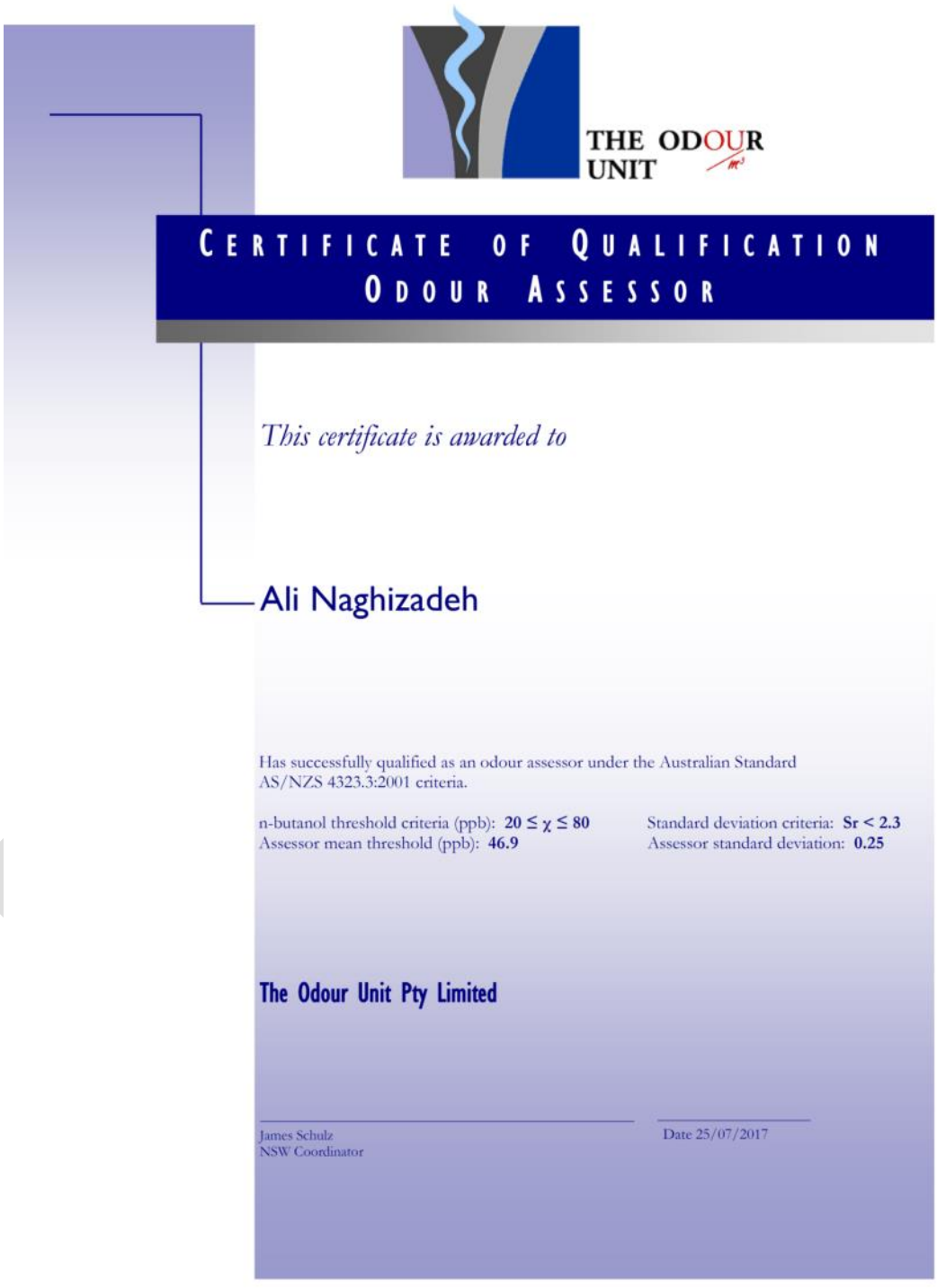
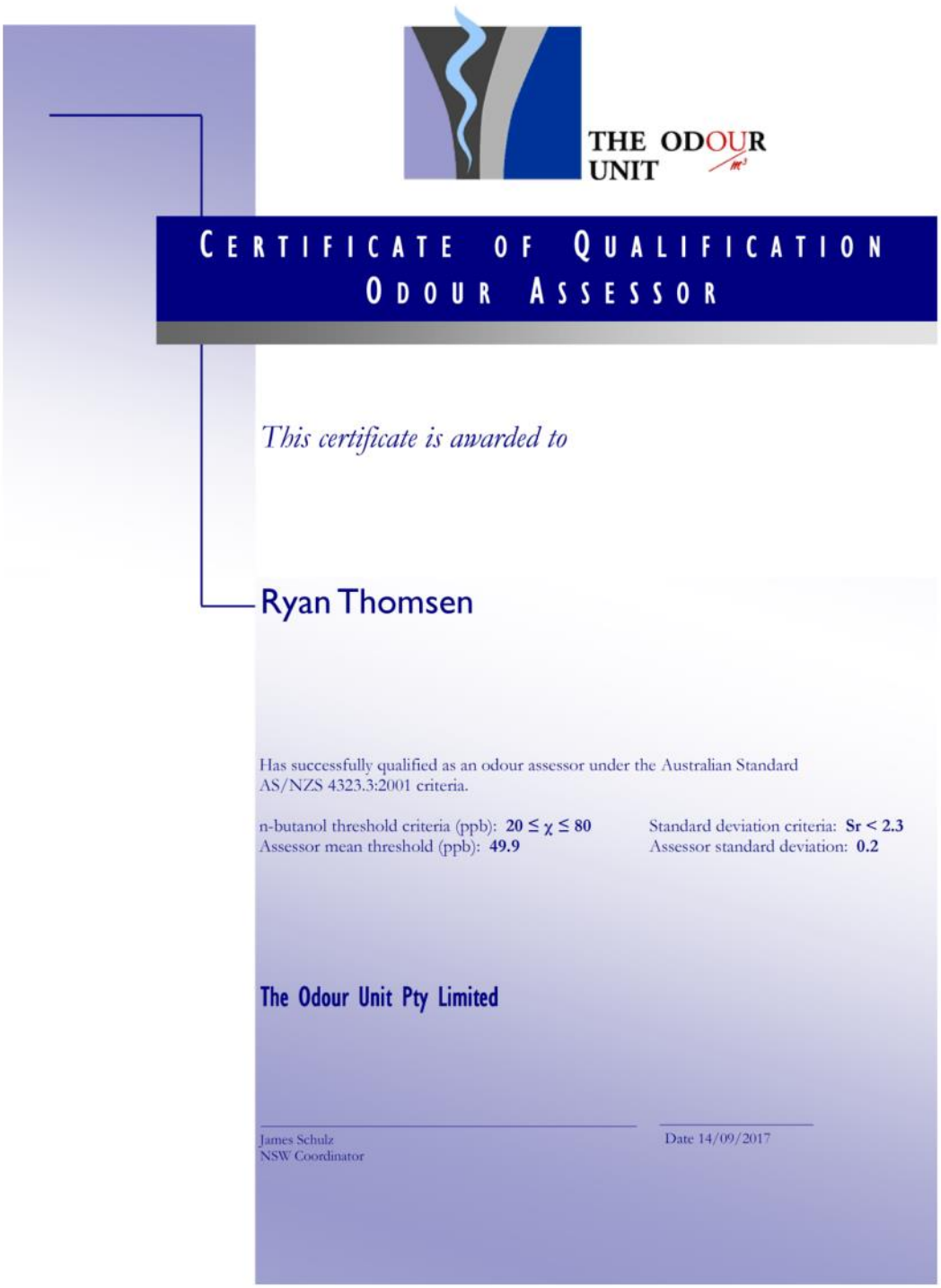
Hedonic Tone and Odour Intensity Plots

Certificates of Analysis for Odour Assessor Sensitivity Screening





THE ODOUR UNIT

CERTIFICATE OF QUALIFICATION
ODOUR ASSESSOR

This certificate is awarded to

Ryan Thomsen

Has successfully qualified as an odour assessor under the Australian Standard AS/NZS 4323.3:2001 criteria.

n-butanol threshold criteria (ppb): **$20 \leq \chi \leq 80$**
Assessor mean threshold (ppb): **49.9**

Standard deviation criteria: **Sr < 2.3**
Assessor standard deviation: **0.2**

The Odour Unit Pty Limited

James Schulz
NSW Coordinator

Date 14/09/2017

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
5 Foelsche Street
Darwin NT 0800
Australia
T: +61 8 8998 0100
F: +61 2 9427 8200

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

ROCKHAMPTON
rockhampton@slrconsulting.com
M: +61 407 810 417

SYDNEY
2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TAMWORTH
PO Box 11034
Tamworth NSW 2340
Australia
M: +61 408 474 248
F: +61 2 9427 8200

TOWNSVILLE
Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

NELSON
5 Duncan Street
Port Nelson 7010
New Zealand
T: +64 274 898 628

NEW PLYMOUTH
Level 2, 10 Devon Street East
New Plymouth 4310
New Zealand
T: +64 0800 757 695