ACOUSTICS AND AIR

# BANKSMEADOW TRANSFER TERMINAL

## AIR QUALITY IMPACT ASSESSMENT

**REPORT NO.** 13035-AIR
**VERSION** B

APRIL 2014

**PREPARED FOR**

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# DOCUMENT CONTROL

| Version | Status | Date | Prepared By | Reviewed By |
|---|---|---|---|---|
| A | Draft | 9 October 2013 | Phil Henschke | John Wassermann |
| A | Final Draft | 27 November 2013 | John Wassermann | John Wassermann |
| B | Final | 14 February 2014 | John Wassermann | John Wassermann |
| B | Final | 7 April 2014 | John Wassermann | John Wassermann |

**Note**



**Quality Assurance**

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

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Quality
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Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.

50 YEARS 1962–2012

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## APPENDICES

# GLOSSARY OF TERMS

**Air Pollution** – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

**Air Quality Standards** – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

**Air Toxics** – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

**Airborne Particulates** – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

**Area Source** – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

**Concentration** – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

**Emission** – Release of pollutants into the air from a source. We say sources emit pollutants.

**Emission Factor** – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

**Emission Inventory** – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

**Flow Rate** – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

**Fugitive Emissions** – Emissions not caught by a capture system.

**Hydrocarbons (HC)** – Chemical compounds that consist entirely of carbon and hydrogen.

**Hydrogen Sulphide ($H_2S$)** – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

**Inhalable Particles** – All dust capable of entering the human respiratory tract.

**Nitric Oxide (NO)** – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

**Nitrogen Dioxide ($NO_2$)** – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

**Nitrogen Oxides ($NO_x$)** – A criteria air pollutant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

**Mobile Sources** – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

**Particulates; Particulate Matter (PM-10)** – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

**Parts Per Billion (ppb)/Parts Per Million (ppm)** – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

**PM10/PM2.5** – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

**Point Source** – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

**Scrubber** – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

**Source** – Any place or object from which pollutants are released.

**Stack** – A chimney, smokestack, or vertical pipe that discharges used air.

**Stationary Source** – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

**Temperature Inversion** – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

# 1 INTRODUCTION

Veolia Environmental Services (Australia) Pty Ltd (Veolia) is proposing to develop the Banksmeadow Transfer Terminal (TT) and associated rail infrastructure at an existing industrial site in Banksmeadow, NSW, within the Local Government Areas of Botany Bay and Randwick (the Proposal).

The Proposal involves the construction of a transfer terminal that would containerise putrescible waste for rail haulage to the Woodlawn Eco-Project site, near Goulburn, NSW, for treatment, recycling and energy recovery. The terminal would also house an area where loads of non-putrescible waste would be consolidated into semi-trailers for transfer to resource recovery facilities, such as the proposed Camellia Recycling Centre, for further recovery of recyclable material.

The Proposal would, once operational, be capable of processing up to 400,000 tonnes (t) of putrescible waste per annum and 100,000 t of non-putrescible waste per annum for transfer to various resource recovery facilities.

## 1.1 Scope of Work and Limitations

Wilkinson Murray Pty Ltd (WM) has been commissioned to undertake an air quality assessment for the proposal. This assessment has been undertaken in accordance with the Director General's Requirements (DGRs) and relevant NSW Environment Protection Authority (EPA) air quality guidelines.

This report has been prepared and issued, subject to the limitations set out in Appendix B and is limited to the following scope of work:

- A brief description of the Project and the proposed operations;
- A review of the existing environment surrounding the Project site;
- A qualitative assessment of potential construction dust emissions;
- A description of odour modelling methodology and emission estimation technique;
- Presentation of the predicted odour dispersion modelling results; and
- A summary of measures to avoid or mitigate potential air quality impacts.

The assessment methodology generally follows the NSW Environmental Protection Authority (EPA) document "Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales" (NSW DEC 2005).

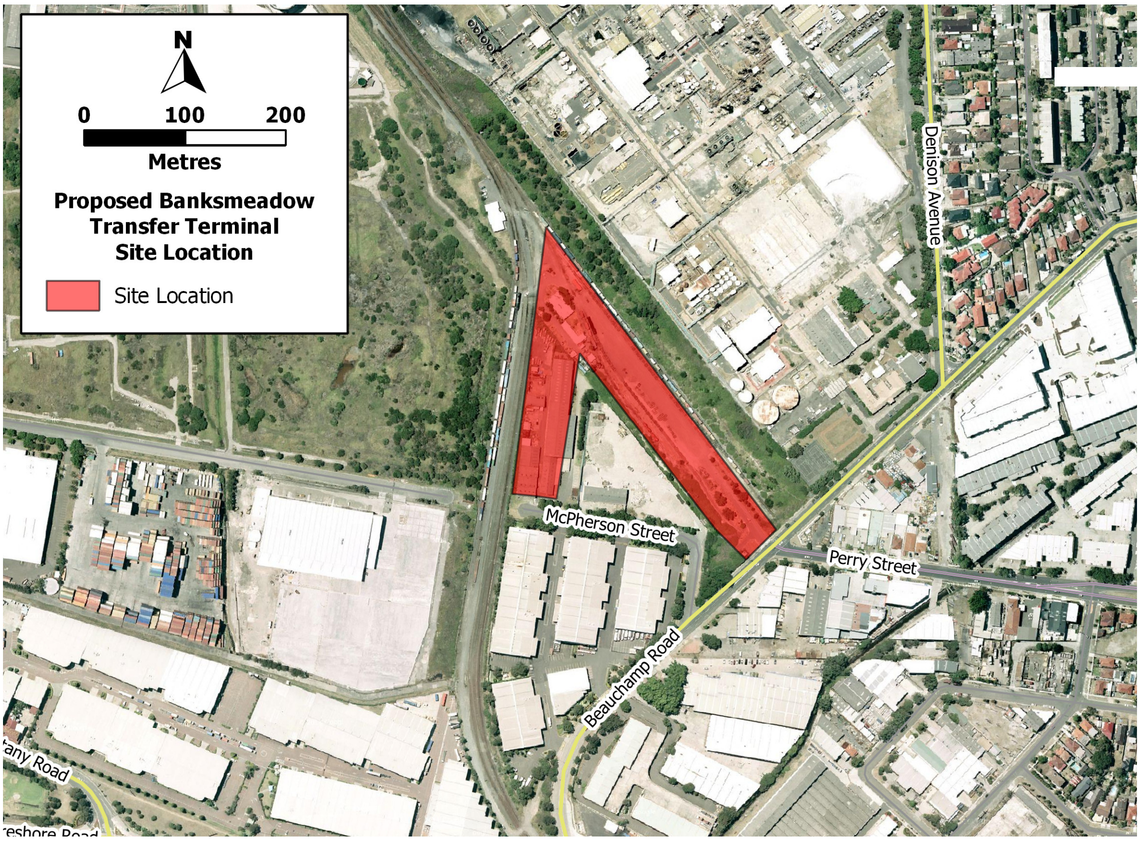
# 2 DESCRIPTION OF THE SITE & PROJECT

## 2.1 The Site

The Site is situated in Banksmeadow, on the western side of Beauchamp Road and the northern side of McPherson Street. Figure 2-1 shows the Site and surrounding area. Further to this Figure 2-2 identifies the existing land uses surrounding the proposed site.

The Site is located within the Port Botany Site and zoned IN1 - General Industrial under the State Environmental Planning Policy (Port Botany and Port Kembla) 2013. It is located mainly within the City of Botany Bay Local Government Area (LGA), with the proposed main entry at the intersection between Beauchamp Road and Perry Street located in the Randwick Council LGA.

**Figure 2-1 Proposed Site Location**



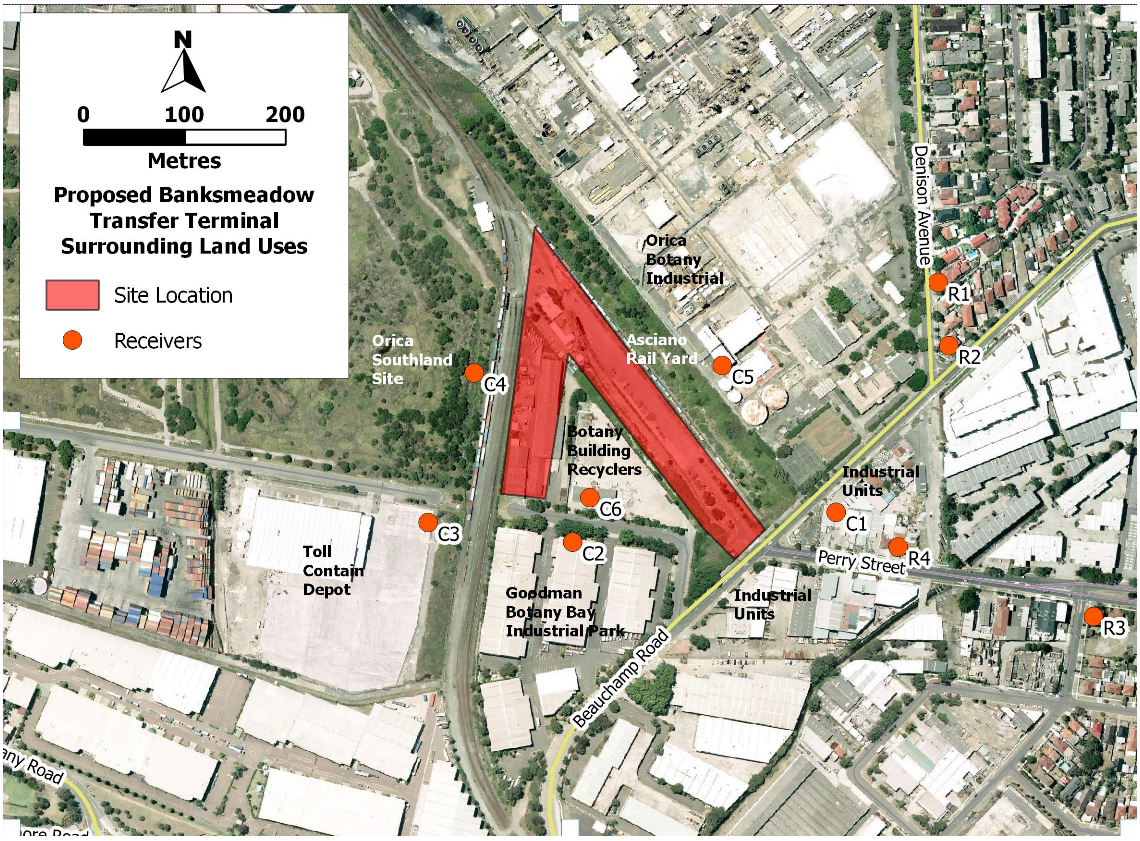

The Site currently includes a number of buildings, including a large warehouse building, some smaller factory and office buildings, mostly along the western portion of the Site, and some existing rail yard infrastructure along the eastern portion of the Site, including several rail sidings.

The eastern portion of the Site is currently occasionally used for rolling stock storage and container handling activities, however past rail terminal activities also included train shunting, minor wagon maintenance, container transfer between road and rail, and locomotive refuelling.

## 2.2 Surrounding Area

As shown in Figure 2-2, the Site is surrounded by a number of industrial and commercial land uses.

**Figure 2-2 Land Uses Surrounding the Site**




The surrounding land uses can be described as follows:

- The main freight rail line into Port Botany lies immediately to the west of the Site, beyond which is Orica's Southland site (which is currently undergoing remediation works).
- The Asciano Botany Site (shown as the Asciano Rail Yard) is located directly to the east of the Site. The Asciano Botany Site sidings connect to the Port Botany rail line to the north of the Proposal site. The Orica Botany Bay site is located further east, beyond the Asciano Botany Site.
- Adjacent to the Site on McPherson Street is a construction and demolition recycling yard, which is bounded by the proposed Site to its west, north and east.
- Further to the east of the Site, on the opposite side of Beauchamp Road are industrial units and warehouses.
- To the south of the Site, on the opposite side of McPherson Street is the Goodman Botany Bay Industrial Park, which comprises several warehouse and office units.
- Further west of the Goodman Industrial Park, on the other side of the freight line is a Toll shipping container depot.

## 2.3 Sensitive Receivers

WM undertook an inspection of the Site and surrounding area on 20 May 2013, to identify the closest residential and other sensitive receivers. This inspection identified three existing residential receiver groups located within approximately 1km from the Site, as well as the closest commercial/industrial receivers, as set out in Table 2-1 and identified in Figure 2-2.

**Table 2-1 Existing Sensitive Receivers within Approximately 1km of the Site**

| Receiver | Classification | Description | Distance from Site Boundary |
|---|---|---|---|
| Hillsdale Residential Area | Residential (R1 & R2) | Residential suburb, to the east of the Proposal site, with closest receivers located on the eastern side of Denison Street. | 250-500m (Approx) |
| Matraville Residential Area | Residential (R3) | Residential suburb, to the east-south-east of the Proposal site, with the closest receivers located along Perry Street at setback distances of typically >350 m. | >350m (Approx) |
| Perry Street Residences | Residential (R4) | Three industrially zoned properties on Perry Street (Nos 20, 22 and 24) are located within approximately 120-150m from the main Site entrance to the east-south-east. Whilst it has not been confirmed, these properties are potentially used for residential purpose. | Three receivers within 120-150 m (Approx) |
| Industrial Units Beauchamp Rd | Commercial (C1) | Commercial units located to the east of the Beauchamp Road Site entrance, on the eastern side of Beauchamp Road. | 30 m (Approx) |
| Goodman Botany Bay Industrial Park | Commercial (C2) | Commercial receivers located to the south of the McPherson Street site entrance, on the southern side of McPherson Street. | 30 m (Approx) |
| Toll Container Depot | Commercial (C3) | Commercial receivers located to the south-west of the Site, to the west of the existing freight rail line. | 65 m (Approx) |
| Orica Southlands | Industrial (C4) | Industrial receivers located to the west of the Site, to the west of the existing freight rail line. | 35 m (Approx) |
| Orica Botany Bay | Industrial* (C5) | Industrial receivers located to the east of the Site, beyond the Asciano Botany Site. | 50 m (Approx) |
| Botany Building Recyclers | Industrial (C6) | Industrial receiver (construction/ demolition/ recycling yard) abutting the Site to the south. | 0 m (Approx) |

* The Asciano Botany Site (also referred to as Asciano Rail Yard) operator has in-principle agreements with Veolia and operations would require mutual co-operation between these sites. For the purpose of this assessment, the Asciano Botany Site has not been considered as a sensitive/affected receiver.

# 3 PROJECT DESCRIPTION

The Banksmeadow TT would involve the development of a new waste transfer building, as well as associated road and rail infrastructure, as identified in the Site plans shown in Appendix C.

Once operating, the facility would be open to receive waste twenty four hours a day, seven days a week.

Municipal, commercial and industrial customers from within the Sydney region would transport waste to the Site by trucks, entering via the Beauchamp Road access road. The waste would be delivered, in two distinct streams, those being putrescible waste (including mixed household waste) and non-putrescible waste.

The putrescible and non-putrescible waste would be handled in two enclosed separate areas specifically divided by a full height wall. Putrescible waste would be unloaded within the northern end of the transfer building, whilst non-putrescible waste would be unloaded within the southern end. The terminal building would be enclosed, with the exception of vehicle access openings and an air extraction system that would have a single exhaust stack therefore minimising fugitive air emissions.

As identified by the Site plans, the proposed infrastructure on-site would include:

- an access road for putrescible and non-putrescible waste trucks entering and exiting the facility from Beauchamp Road;
- an access road from McPherson Street for semi-trailers entering and exiting the facility for collection of outbound non-putrescible waste;
- incoming and outgoing weighbridges to check the waste type and weight of the waste being delivered to the facility;
- an enclosed building for the unloading and handling of waste, with environmental controls such as dust suppression and odour control systems;
- a hardstand area for temporary storage and manoeuvring of full and empty sealed shipping containers prior to loading on to trains; and
- rail sidings for the loading of containers onto trains for rail transport to the Woodlawn Eco-Project site.

The management of putrescible waste is discussed further in Section 3.1, whilst the management of non-putrescible waste is further discussed in Section 3.2. Due to the material composition of the putrescible waste it is odorous, while the non-putrescible waste is much less odorous however contains some dust.

### 3.1 Putrescible Waste

The Banksmeadow TT would have the capacity to containerise approximately 189 t of putrescible waste per hour.

Once the waste has been deposited on the floor of the enclosed building, it would be pushed by a front end loader to one of two chutes that feed the waste compactors, located within the terminal building (to the west of the building). A scale with an electric display would inform the front end loader operator when the compactor is approaching the maximum capacity of 31.5 t.

Once the correct weight is loaded, the compactor would compress the waste into a consolidated bale that would be inserted into specially designed shipping containers, and the container would then be sealed. The containers used at the Banksmeadow TT would be specially constructed and have activated carbon filtration packs fitted to the air exhaust vent on the container.

The container would then be moved outside the terminal building where a container handler would lift it and transport it either directly to a waiting train, or to a container storage area, ready for transport on the next available train.

The compacting and filling process would take approximately 20 minutes per container. It is proposed that two compactors would operate at the Banksmeadow TT, allowing for regular maintenance of the compactors as part of the continued operation of the facility.

The specially constructed shipping containers would be railed, using ARTC's rail network, to the Crisps Creek Intermodal Facility near the Woodlawn Eco-Project site. From there the waste would be trucked approximately 8 km to the Woodlawn Eco-Project site. When the train returns to Sydney with the empty containers ready for re-loading, any surplus empty waste containers would be stored at the Banksmeadow TT site in the container storage area.

There would be up to six return train movements per week. Typically, the unloaded train would be expected to arrive at the Banksmeadow TT site at 12.30pm and depart loaded at 08.00am the following morning, though the timing of the train operations would be dependent to some extent on availability of train pathways on the main railway line.

### 3.2 Non-Putrescible Waste

The Banksmeadow TT would be designed to receive up to 100,000 t per annum of non-putrescible waste, which will be consolidated into semi-trailers within the transfer building for transfer to resource recovery facilities, such as the proposed Camellia Recycling Centre, for recovery of recyclables prior to re-processing.

The incoming waste (greenwaste, timber, concrete and scrap metal) would be deposited, sorted and stored within the terminal building. A front end loader would be used to organise the waste and an excavator with a grapple arm would be used to load segregated materials into semi-trailers.

Up to 16 unloaded semi-trailers per day will enter the Banksmeadow TT via McPherson Street. Once loaded these would exit the Site again by McPherson Street and transfer material to the appropriate recycling or reprocessing facility.

# 4 DIRECTOR GENERAL REQUIREMENTS

The DGRs pursuant to Section 78A(8A) of the *Environmental Planning and Assessment Act* 1979 for State Significant Development, identifies air quality as a key issue to be assessed. Table 4-1 sets out each of the relevant assessment matters identified in the DGRs and relevant assessment guideline/policies. All the assessment particulars are addressed in Chapter 8 of this report.

**Table 4-1 Assessment Particulars**

<table>
<tr><th>Assessment Matter</th><th>Relevant Guideline</th></tr>
<tr><td>A quantitative assessment of the potential air quality and odour impacts for all states of the proposal in accordance with relevant EPA guidelines and requirements;</td><td rowspan="5">Approved Methods for the Modelling and Assessment of Air Pollutants in NSW<br><br>Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW<br><br>Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW<br><br>Action for Air (DECC)<br><br>Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)<br><br>Protection of the Environment Operations (Clean Air) Regulation 2002</td></tr>
<tr><td>Detailed emission control techniques/ practices that will be employed by the proposal;</td></tr>
<tr><td>Details of ongoing management and monitoring measures for the prevention and/ or minimising both point source and fugitive emissions;</td></tr>
<tr><td>Consideration of cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment;</td></tr>
<tr><td>An assessment of the effectiveness of the proposed air quality and odour control measures (including those proposed for the containers used to transfer the waste) demonstrating compliance with relevant regulatory framework, specifically the Protection of the Environment Operations (POEO) Act 1997 and the POEO (Clean Air) Regulation (2002)</td></tr>
</table>

## 4.1 Modelling Methodology

The following section is included to provide the reader with an understanding of the model and modelling approach applied for this assessment.

Modelling was undertaken using a combination of the CALPUFF Modelling System and TAPM. The CALPUFF Modelling System includes three main components: CALMET, CALPUFF and CALPOST and a large set of pre-processing programs designed to interface the model to standard, routinely available meteorological and geophysical datasets. The CALPUFF model is an advanced "puff" model which can deal with the effects of complex local terrain on the dispersion meteorology over the entire modelling domain in a three-dimensional, hourly varying time step.

CALPUFF is approved by NSW EPA for use in air quality impact assessments. The model setup used is in general accordance with methods provided in the NSW EPA document "Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia" (TRC, 2011).

TAPM is a prognostic air model used to simulate the upper air data for CALMET input. The meteorological component of TAPM is an incompressible, non-hydrostatic, primitive equation model with a terrain-following vertical coordinates for three-dimensional simulations. The model predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analysis.

CALMET is a meteorological model that uses the geophysical information and observed/simulated surface and upper air data as inputs and develops wind and temperature fields on a three-dimensional gridded modelling domain.

CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion processes along the way. It typically uses the three dimensional meteorological field generated by CALMET.

CALPOST is a post processor used to process the output of the CALPUFF model and produce tabulations that summarise the results of the simulation.

# 5 EXISTING CLIMATE

Long-term climatic data from the Bureau of Meteorology weather station at Sydney Airport were analysed to characterise the local climate in the proximity of the Project. The Sydney Airport station is located approximately 4.5km west-northwest of the Project.

Table 5-1 and Figure 5-1 present a summary of data from the Sydney Airport weather station collected over an approximate 60-year period.

The data indicate that January is the hottest month with a mean maximum temperature of 26.5 ºC, July is the coldest month with mean minimum temperature of 7.2 ºC.

Humidity levels exhibit some variability over the day and seasonal fluctuations. Mean 9am humidity levels range from 61 per cent in October to 74 per cent in June. Mean 3pm humidity levels vary from 49 per cent in August to 63 per cent in February.

Rainfall peaks during the first half of the year declines during latter half. The data show June is the wettest month with an average rainfall of 122.9 mm over 8.8 days and September is the driest month with an average rainfall of 60.3 mm over 6.8 days.

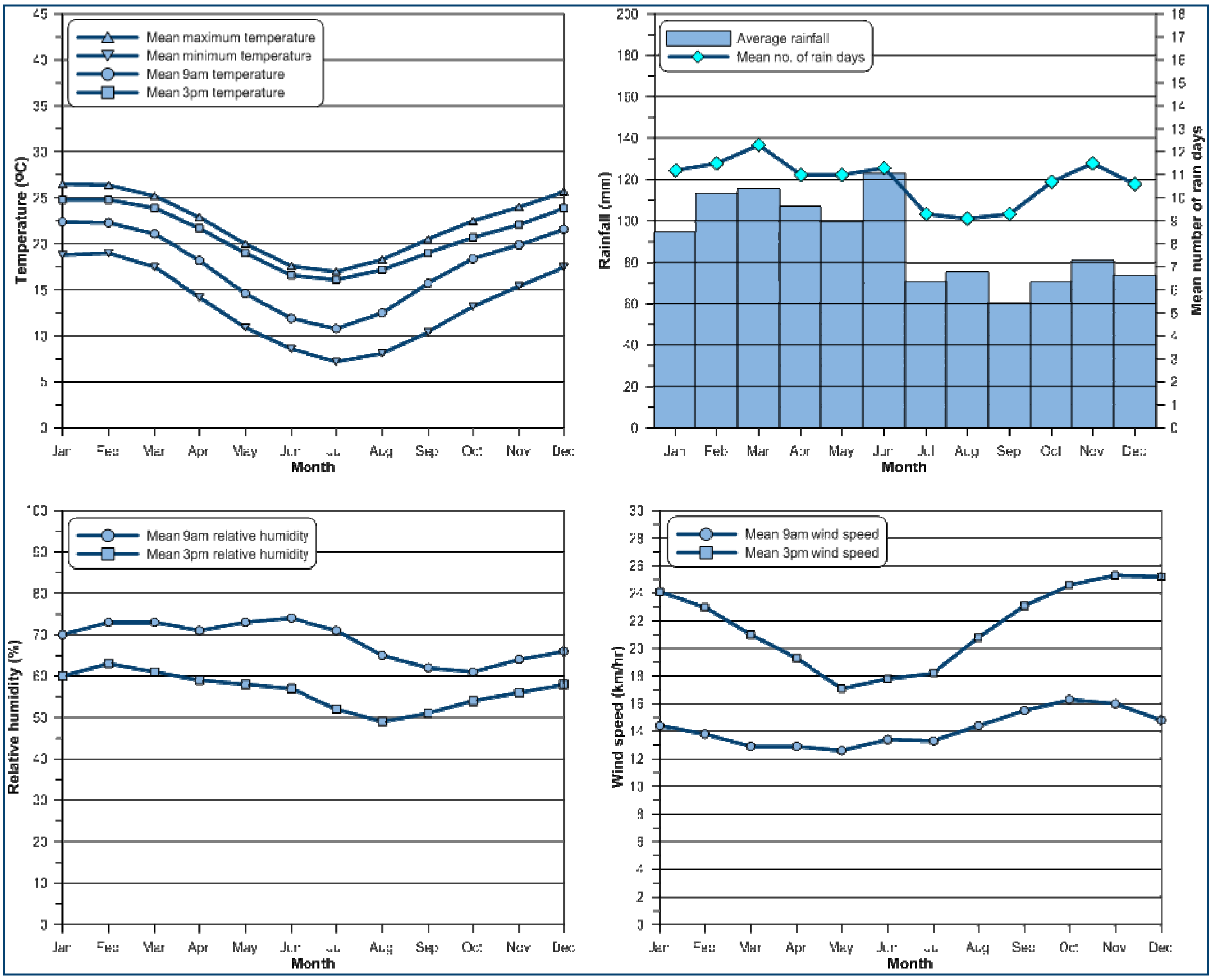
As expected, wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the colder months. The mean 9am wind speeds range from 12.6 km/h in May to 16.3 km/h in October. The mean 3pm wind speeds vary from 17.1 km/h in May to 25.3 km/h in November.

**Table 5-1 Monthly climate statistics summary – Sydney Airport**

| Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature** | | | | | | | | | | | | |
| Mean max. temperature (ºC) | 26.5 | 26.4 | 25.2 | 22.9 | 20.0 | 17.6 | 17.0 | 18.3 | 20.5 | 22.5 | 24.0 | 25.7 |
| Mean min. temperature (ºC) | 18.8 | 19.0 | 17.5 | 14.2 | 10.9 | 8.6 | 7.2 | 8.1 | 10.4 | 13.2 | 15.4 | 17.5 |
| **Rainfall** | | | | | | | | | | | | |
| Rainfall (mm) | 94.6 | 113.3 | 115.6 | 106.9 | 99.7 | 122.9 | 70.6 | 75.5 | 60.3 | 70.7 | 81.2 | 73.7 |
| Mean No. of rain days (≥1mm) | 11.2 | 11.5 | 12.3 | 11.0 | 11.0 | 11.3 | 9.3 | 9.1 | 9.3 | 10.7 | 11.5 | 10.6 |
| **9am conditions** | | | | | | | | | | | | |
| Mean temperature (ºC) | 22.4 | 22.3 | 21.1 | 18.2 | 14.6 | 11.9 | 10.8 | 12.5 | 15.7 | 18.4 | 19.9 | 21.6 |
| Mean relative humidity (%) | 70 | 73 | 73 | 71 | 73 | 74 | 71 | 65 | 62 | 61 | 64 | 66 |
| Mean wind speed (km/h) | 14.4 | 13.8 | 12.9 | 12.9 | 12.6 | 13.4 | 13.3 | 14.4 | 15.5 | 16.3 | 16.0 | 14.8 |
| **3pm conditions** | | | | | | | | | | | | |
| Mean temperature (ºC) | 24.8 | 24.8 | 23.9 | 21.7 | 19.0 | 16.6 | 16.1 | 17.2 | 19.0 | 20.7 | 22.1 | 23.9 |
| Mean relative humidity (%) | 60 | 63 | 61 | 59 | 58 | 57 | 52 | 49 | 51 | 54 | 56 | 58 |
| Mean wind speed (km/h) | 24.1 | 23.0 | 21.0 | 19.3 | 17.1 | 17.8 | 18.2 | 20.8 | 23.1 | 24.6 | 25.3 | 25.2 |

Source: Bureau of Meteorology, 2013

**Figure 5-1 Monthly climate statistics summary – Sydney Airport**




Meteorological data required for modelling includes wind speed, wind direction, temperature and an estimation of the stability class and mixing height for the area surrounding the subject site. Preferably, meteorological data is sourced from on-site dedicated meteorological stations which have recorded data over a number of years. Veolia does not have a monitoring station on-site at Banksmeadow (See Section 8.1).

# 6 EXISTING AMBIENT AIR QUALITY

## 6.1 Local air quality

Background ambient monitoring data obtained from the Randwick NSW EPA monitoring site that measures PM10 concentrations using a Tapered Element Oscillating Microbalance (TEOM) has been analysed and used to characterise the ambient air quality in the area as suitable site-specific air quality data are not available. The location of Randwick monitoring site is approximately 3 km northeast of the Project.

### 6.1.1 PM10 Concentrations

A summary of the PM10 monitoring data from 2010 to 2012 collected at the monitoring site is presented in Table 6-1 and Figure 6-1.

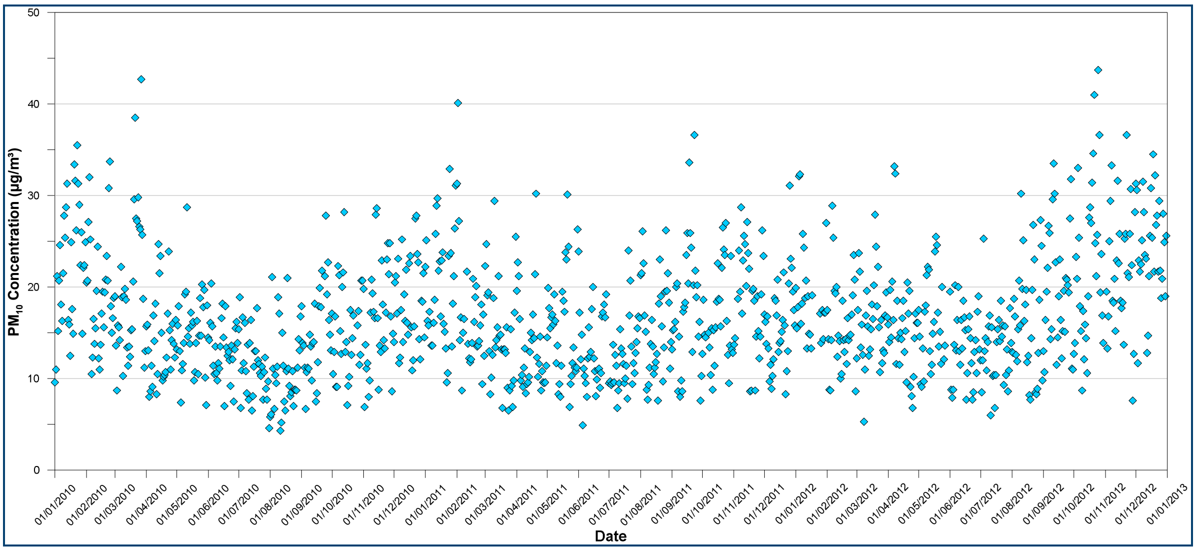
The monitoring data indicates that the annual average PM10 concentrations at this monitoring site are below the 30 µg/m³ criterion for all years reviewed. The maximum 24-hour average PM10 concentration at this site was also below the criterion of 50 µg/m³ for all years reviewed (see Figure 6-1).

It can be seen from Figure 6-1 that concentrations are nominally highest in the spring and summer months with the warmer weather raising the potential for drier ground and elevating the level of windblown dust, the occurrence of bushfires and pollen levels.

**Table 6-1 Summary of PM10 monitoring from Randwick NSW EPA monitoring site (µg/m³)**

| Year | Annual average | Maximum 24-hour average |
|---|---|---|
| 2010 | 16.0 | 42.7 |
| 2011 | 16.0 | 40.1 |
| 2012 | 17.9 | 43.7 |

**Figure 6-1 PM10 monitoring from Randwick NSW EPA monitoring site**



# 7 AIR QUALITY CRITERIA

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the applicable air quality criteria for the potential air emissions that would be generated by the Project.

The air quality goals that are relevant to this study are sourced from the NSW EPA document "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (NSW DEC, 2005).

## 7.1 Particulate matter

The air quality goals for the relevant particulate matter pollutants relate to the total pollutant burden in the air and not just the pollutants from the Project, as such, consideration of background pollutant levels is required when using these goals to assess potential impacts.

Table 7-1 shows the criteria for each of the relevant dust metric considered in this assessment.

**Table 7-1 NSW EPA Air Quality Impact Assessment Criteria**

| Pollutant | Averaging Period | Impact | Criterion |
|---|---|---|---|
| Total suspended particulates (TSP) | Annual | Total | 90 µg/m³ |
| Particulate matter ≤10 µg/m³ ($PM_{10}$) | Annual | Total | 30 µg/m³ |
| | 24-hour | Incremental | 50 µg/m³ |
| Deposited dust (DD) | Annual | Total | 2 g/m²/month |
| | Annual | Incremental | 4 g/m²/month |

Source: NSW DEC, 2005

## 7.2 Odour

### 7.2.1 Introduction

Odour in a regulatory context needs to be considered in two similar, but different ways depending on the situation.

NSW legislation prohibits emissions that cause offensive odour to occur at any off-site receptor. Offensive odour is evaluated in the field by authorised officers, who are obliged to consider the odour in the context of its receiving environment, frequency, duration, character and so on and to determine whether the odour would interfere with the comfort and repose of the normal person unreasonably. In this context, the concept of offensive odour is applied to operational facilities and relates to actual emissions in the air.

However, in the approval and planning process for proposed new operations or modifications to existing projects, no actual odour exists and it is necessary to consider hypothetical odour. In this context, odour concentrations are used and are defined in odour units. The number of odour units represents the number of times that the odour would need to be diluted to reach a level that is just detectable to the human nose. Thus by definition, odour less than odour unit (1 OU), would not be detectable to most people.

The range of a person's ability to detect odour varies greatly in the population, as does their sensitivity to the type of odour. Thus there can be a wide range of variability in the way odour response is interpreted. As a result the assessment of odour impacts and the application of specific air quality goals related to odour is a challenging aspect of air science.

It needs to be noted that odour refers to complex mixtures of odours, and not 'pure" odour arising from a single chemical. Odour from a single, know chemical very rarely occurs (when it does, it is best to consider that specific chemical in terms of its concentration in the air). In most situations, odour will be comprised of a cocktail of many substances that is referred to as a complex mixture of odour, or more simply odour.

For developments with potential for odour it may be necessary to predict the likely odour impact that may arise. This is done by using air dispersion modelling which can calculate the level of dilution of odours emitted from the source at the point that it reaches surrounding receptors. This approach allows the air dispersion model to produce results in terms of odour units.

The NSW criteria for acceptable levels of odour range from 2 to 7 OU, with the more stringent 2 OU criteria applicable to densely populated urban areas and the 7 OU criteria applicable to sparsely populated rural areas, as outlined below.

#### 7.2.2 Complex Mixtures of Odorous Air Pollutants

Table 7-2 presents the assessment criteria as outlined in the NSW EPA document "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (NSW DEC, 2005). This criterion has been refined to take into account population densities of specific areas and is based on a 99th percentile of dispersion model predictions calculated as 1-second averages (nose-response time).

**Table 7-2 Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants (Nose-Response-Time Average, 99th percentile)**

| Population of Affected Community | Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants (OU) |
|---|---|
| Urban (≥~2000) and/or schools and hospitals | 2.0 |
| ~500 | 3.0 |
| ~125 | 4.0 |
| ~30 | 5.0 |
| ~10 | 6.0 |
| Single rural residence (≤~2) | 7.0 |

Source: NSW DEC, 2005

The NSW odour goals are based on the risk of odour impact within the general population of a given area. In sparsely populated areas the criteria assume there is lower risk that some individuals within the community would find the odour unacceptable, hence higher criteria apply.

Odour criterion 2 OU is applied in this assessment for residential receivers in an urban environment.

There are no specific criteria for commercial/industrial receivers. In practice the character of a particular odour can be judged by the receiver's reaction to it. The level at which an odour is perceived to be of nuisance can range from 2 OU to 10 OU (NSW DEC, 2005) depending on a combination of many factors including: odour quality; odour intensity; odour frequency, timing and duration; population sensitivity; background odour level, public expectation; source characteristics; etc. For commercial/industrial receivers it can therefore be expected meeting the residential criteria would be an indicator that there is very little likelihood of odour nuisance, however in practice commercial/industrial receivers would typically have a higher tolerance for odour especially as many commercial/industrial receivers have some self generated odours. As such an odour level less than 7-10 OU in commercial/industrial areas is unlikely to create an odour nuisance.

Peak-to-mean factors are applied to account for any odour fluctuation above and below the mean odour level of the 1-hour averaging time. The criteria in Table 7-2 are compared with modelled results that include peaking factors to account for the time-averaging limitations of air dispersion models. The peak-to-mean factors developed by Katestone Scientific Pty Ltd (1995, 1998) for NSW EPA are applied to convert the modelled (1-hour) averaging time to 1-second peak concentrations which are appropriate.

A summary of the peak-to-mean values is provided in Appendix A.

# 8 AIR QUALITY MODELLING

## 8.1 Meteorological Modelling

The TAPM model was applied to the available data to generate a three dimensional upper air data file for use in CALMET. The centre of analysis for the TAPM modelling used is 33 deg 57.5 min south and 151 deg 13 min east. The simulation involved four nesting grids of 30 km, 10 km, 3 km and 1 km with 35 vertical grid levels.

The available meteorological data for January 2012 to December 2012 from four surrounding meteorological monitoring sites were included in this run. The 2012 calendar was chosen based on a long-term meteorological analysis (See Appendix E).

Table 8-1 outlines the parameters used from each station. Three dimensional upper air data were sourced from TAPM output. The CALMET grid domain was run on a 10 x 10 km grid with a 0.1 km grid resolution for the modelled year. Local land use and detailed topographical information was included to produce realistic fine scale flow fields (such as terrain forced flows) in surrounding areas.

**Table 8-1 Surface observation stations**

| Weather Stations | Parameters |
|---|---|
| Sydney Airport (BoM)<br>(Station No. 066037) | Wind speed, Wind direction, Cloud height, Cloud amount, Temperature, Humidity, Sea level pressure |
| Port Botany (Molineux Point AWS) (BoM)<br>(Station No. 066100) | Wind speed, Wind direction |
| Little Bay (The Coast Golf Club) (BoM)<br>(Station No. 066051) | Wind speed, Wind direction |
| Kurnell AWS (BoM)<br>(Station No. 066043) | Wind speed, Wind direction |

CALMET generated meteorological data were extracted from a point within the CALMET domain and are graphically represented in Figure 8-1 and Figure 8-2.

Figure 8-1 presents annual and seasonal windroses extracted from one point in the CALMET domain. Appendix F presents the annual and seasonal windroses for the four surrounding meteorological monitoring sites for comparison purposes with the CALMET generated meteorological data. On an annual basis, winds from the south, west and north-northeast were most frequent. During summer and spring, winds from the north-northeast and southeast were most dominant. The seasons of autumn and winter had fairly similar wind distributions, with a large proportion of wind from the west and south.

Figure 8-2 includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and shows sensible trends considered to be representative of the area.

**Figure 8-1 Windroses from CALMET Extract (cell ref. 5051)**

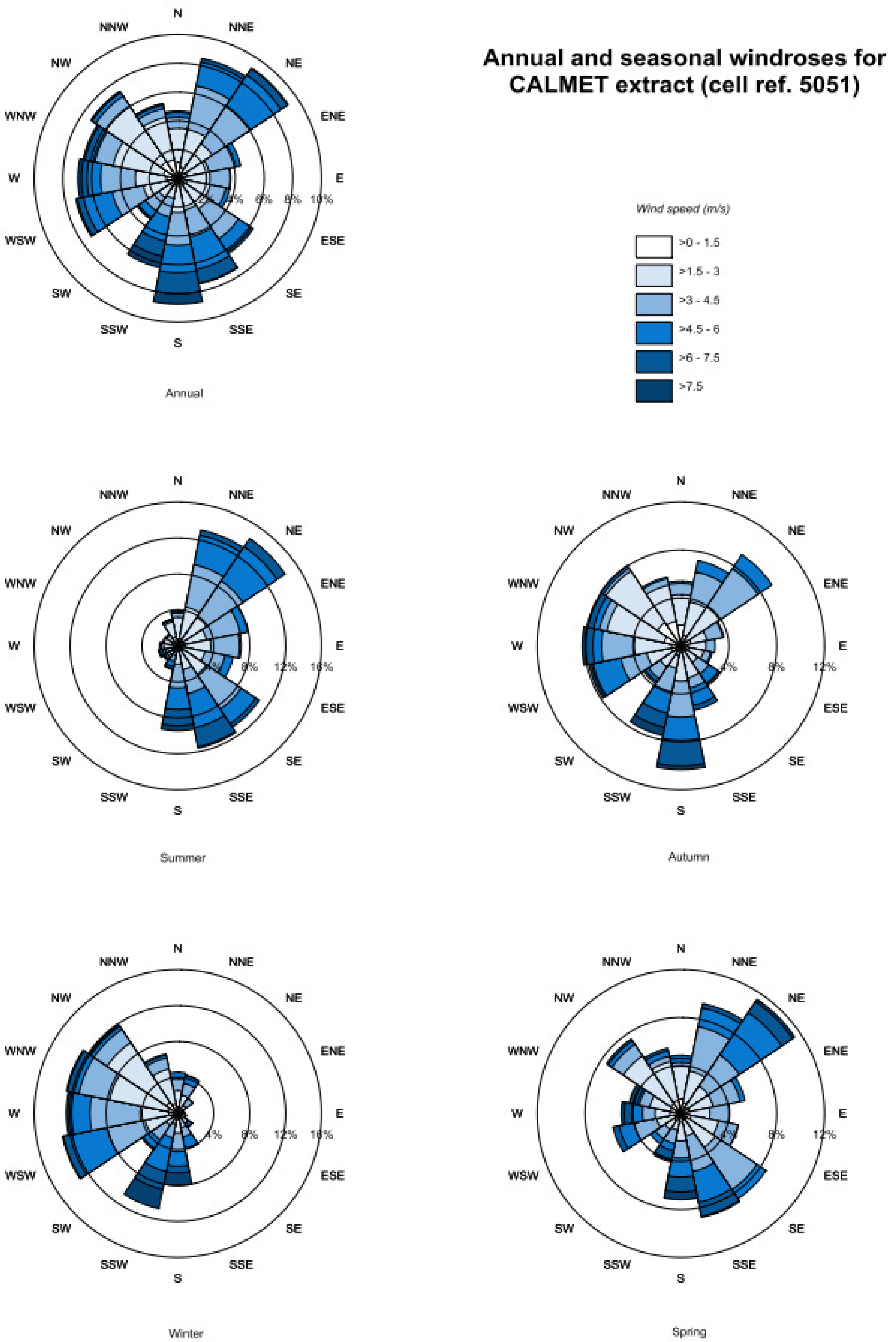
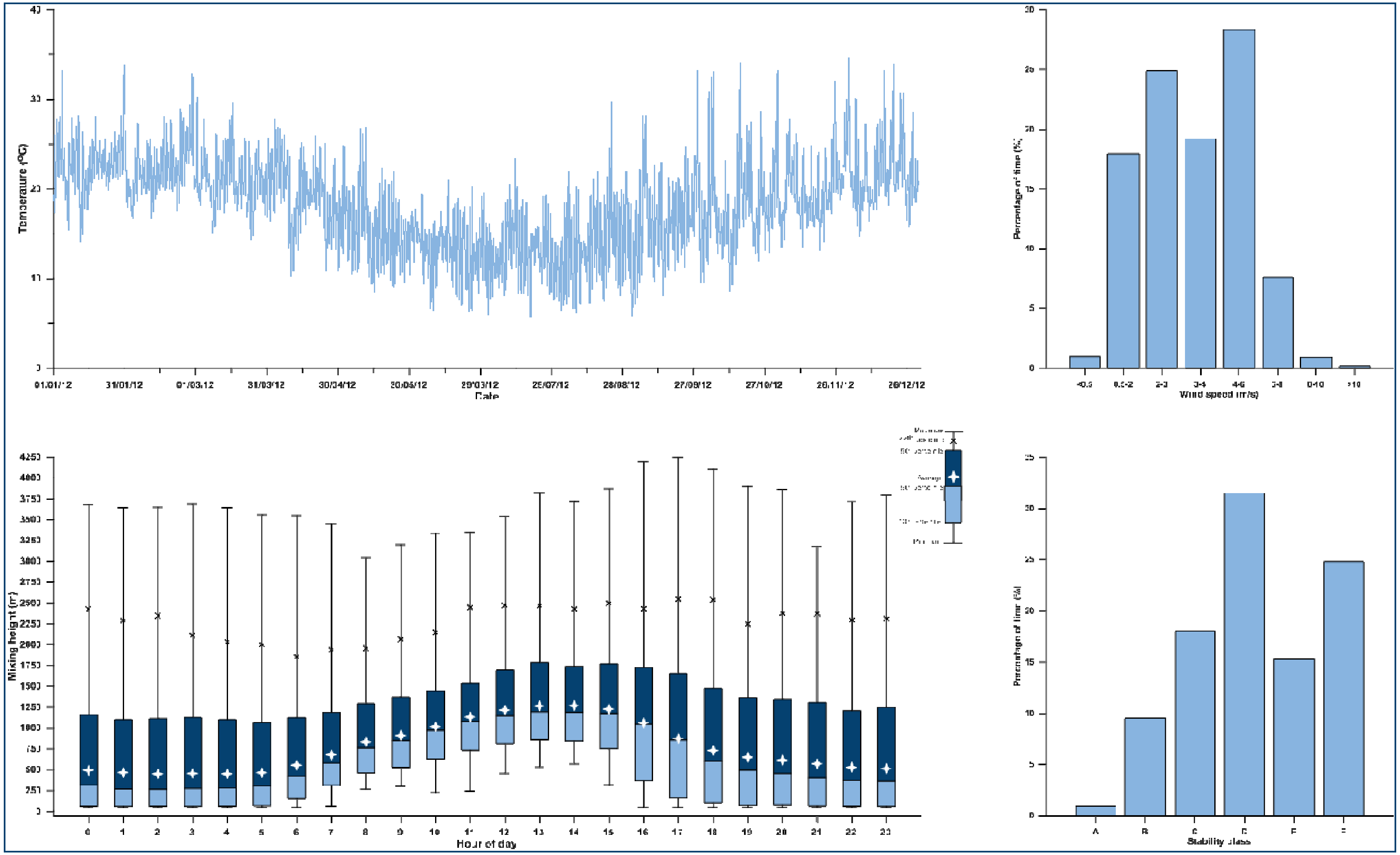


**Figure 8-2 Meteorological Analysis of CALMET Extract (Cell Ref 5051)**



## 8.2 Odour Emissions Estimation

The main source of potential significant odour emissions would be from the exhaust stack ventilating odour emissions captured from within the putrescible area of the facility, located on the northwest corner of the main facility building.

The building ventilation system is based on the system installed at an existing Veolia transfer terminal at Clyde NSW and is proposed to have similar parameters as the Clyde Transfer Terminal. Table 8-2 outlines the ventilation design rate and stack parameters used in the dispersion modelling.

**Table 8-2 Exhaust stack parameters**

| Parameter | Value |
|---|---|
| Stack diameter | 2.6 m |
| Building ventilation rate | 390,000 $m^3$/h (108 $m^3$/s) |
| Stack exit velocity | 20 m/s |
| Stack height (above ground level) | 21 m |

As stated earlier the terminal building would be enclosed, with the exception of vehicle access openings and an air extraction system that would have a single exhaust stack therefore minimising fugitive air emissions.

The ventilation system for the building has been designed to capture and disperse odour emissions from all significant odour sources within the structure including the putrescible area and compactors and containers area within the terminal building. The bulk air exchange rate is proposed to achieve approximately nine air changes per hour within the building.

The ventilation system inside the building will have a strong effect on reducing or negating odours escaping to atmosphere through the doorway or any small gaps in the building. It may be possible that fugitive emissions occur from the doorway when trucks are entering and exiting. Plastic strips are proposed to be installed to help contain odour within the building whilst practicably allowing the high rate of truck movements into and out of the tipping areas. These strips would cover the upper one-third of the opening area and have been shown to decrease air movement through the doorway.

When considering the percentage of air lost through the doorway and small leaks an estimate of 5% of total odour emissions was considered a sensible and conservative assumption for fugitive emissions (Refer to Appendix D).

The low flow and carbon filtered odour emission from the containers has a very small odour emission potential. Veolia's existing operations at Clyde Transfer station and the Crisps Creek Intermodal Facility, shows that any potential odour emissions sources from the enclosed containers during the transportation process are virtually eliminated (Refer to Appendix D).

The amount of waste on floor data was provided by the Proponent and assumed to be representative of daily waste levels at the Clyde Transfer Terminal with an annual putrescible tonnage of 500,000 tonnes which would represent a worst case daily level expected for the Project. An additional scenario has also been developed with 20 per cent reduction in waste material on the floor which represents the expected typical daily level of putrescible waste to be received at the Project (ie putrescible waste equivalent to 400,000 tonnes per annum) (See Table 8-3).

**Table 8-3 Waste profile for typical and worst case operating days**

| Hour | Typical Day putrescible waste on floor (tonnes/day) | Worst Case Day putrescible waste on floor based on Clyde (tonnes/day) |
|---|---|---|
| 1 | 37 | 47 |
| 2 | 43 | 54 |
| 3 | 77 | 96 |
| 4 | 148 | 184 |
| 5 | 151 | 189 |
| 6 | 132 | 165 |
| 7 | 110 | 137 |
| 8 | 27 | 34 |
| 9 | 23 | 29 |
| 10 | 57 | 71 |
| 11 | 12 | 16 |
| 12 | 37 | 46 |
| 13 | 33 | 41 |
| 14 | 72 | 90 |
| 15 | 87 | 109 |
| 16 | 12 | 15 |
| 17 | 0 | 0 |
| 18 | 4 | 5 |
| 19 | 1 | 2 |
| 20 | 3 | 4 |
| 21 | 10 | 12 |
| 22 | 17 | 21 |
| 23 | 52 | 64 |
| 24 | 73 | 92 |
| **Total daily waste** | **~1,200** | **~1,500** |

The odour emission rates for this assessment were based on measurements conducted by The Odour Unit Pty Ltd on 20th August 2008 at the Veolia Clyde Transfer Terminal (See Appendix D). A summary of odour measurement results with exhaust stack airflow and temperature measurements are shown in Table 8-4.

The odour sampling was carried out by the methods of AS/NZS 4323.3:2001. Analysis of the air samples for odour concentration was carried out the following day by dynamic olfactometry to Australian Standard AS/NZS 4323.3:2001. Four odour samples where tested and the mean result of the odour testing and air flow measurements was used to calculate an odour emission factor (odour units per tonne on floor per second – ou.$m^3$/t.s) based on the amount of waste on the floor in the terminal building as advised at the time by Veolia (250 tonnes). The odour concentration varied between 420 and 215 OU with the mean being 320 0OU.

**Table 8-4 Summary of odour measurement results**

| Parameter | Value |
|---|---|
| Mean odour concentration | 320 OU |
| Stack Diameter (m) | 2.64 |
| Mean stack gas temp | 21.4 °C |
| Mean stack gas flow rate @ 25 degrees C | 88.7 $m^3$/s |
| Waste in terminal | 250 tonnes |
| **Estimated odour emission rate** | **113.5 ou.$m^3$/s per tonne of waste** |

Based on the odour measurements taken, the estimated odour emission rate per tonne of waste, an hourly variable waste profile, ventilation rates and fugitive air losses an odour emissions profile was developed over a typical and worst case operating day and is shown in Table 8-5.

## Table 8-5 Odour emissions profile for typical operating day and Worst Case operating day

| Hour | Typical Day | | | | | Worst Case Day | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Putrescible waste on floor (tonnes/day)** | **Odour Emission Rate (ou.m$^3$/s)** | **Total Odour Emission with PM/60** | **Stack emission rate with PM/60** | **Fugitive emission with PM/60** | **Putrescible waste on floor based on Clyde (tonnes/day)** | **Odour Emission Rate (ou.m$^3$/s)** | **Total Odour Emission with PM/60** | **Stack emission rate with PM/60** | **Fugitive emission with PM/60** |
| 1 | 37 | 4,251 | 9,778 | 9288.7 | 488.9 | 47 | 5,314 | 12,222 | 11610.9 | 611.1 |
| 2 | 43 | 4,880 | 11,223 | 10662.1 | 561.2 | 54 | 6,099 | 14,029 | 13327.6 | 701.5 |
| 3 | 77 | 8,739 | 20,099 | 19093.5 | 1004.9 | 96 | 10,923 | 25,123 | 23866.9 | 1256.2 |
| 4 | 148 | 16,751 | 38,527 | 36600.9 | 1926.4 | 184 | 20,938 | 48,159 | 45751.1 | 2408.0 |
| 5 | 151 | 17,136 | 39,412 | 37442.2 | 1970.6 | 189 | 21,420 | 49,266 | 46802.7 | 2463.3 |
| 6 | 132 | 14,957 | 34,402 | 32682.3 | 1720.1 | 165 | 18,697 | 43,003 | 40852.9 | 2150.2 |
| 7 | 110 | 12,470 | 28,682 | 27248.3 | 1434.1 | 137 | 15,588 | 35,853 | 34060.4 | 1792.7 |
| 8 | 27 | 3,102 | 7,134 | 6777.0 | 356.7 | 34 | 3,877 | 8,917 | 8471.2 | 445.9 |
| 9 | 23 | 2,599 | 5,977 | 5678.0 | 298.8 | 29 | 3,248 | 7,471 | 7097.5 | 373.6 |
| 10 | 57 | 6,462 | 14,863 | 14120.1 | 743.2 | 71 | 8,078 | 18,579 | 17650.1 | 929.0 |
| 11 | 12 | 1,416 | 3,256 | 3093.2 | 162.8 | 16 | 1,769 | 4,070 | 3866.5 | 203.5 |
| 12 | 37 | 4,177 | 9,607 | 9126.1 | 480.3 | 46 | 5,221 | 12,008 | 11407.6 | 600.4 |
| 13 | 33 | 3,755 | 8,636 | 8203.4 | 431.8 | 41 | 4,693 | 10,794 | 10254.3 | 539.7 |
| 14 | 72 | 8,201 | 18,863 | 17920.1 | 943.2 | 90 | 10,252 | 23,579 | 22400.1 | 1179.0 |
| 15 | 87 | 9,926 | 22,830 | 21688.2 | 1141.5 | 109 | 12,407 | 28,537 | 27110.2 | 1426.9 |
| 16 | 12 | 1,395 | 3,209 | 3048.4 | 160.4 | 15 | 1,744 | 4,011 | 3810.5 | 200.6 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 4 | 430 | 990 | 940.2 | 49.5 | 5 | 538 | 1,237 | 1175.2 | 61.9 |
| 19 | 1 | 136 | 313 | 297.9 | 15.7 | 2 | 170 | 392 | 372.4 | 19.6 |
| 20 | 3 | 367 | 844 | 801.8 | 42.2 | 4 | 459 | 1,055 | 1002.3 | 52.8 |
| 21 | 10 | 1,104 | 2,539 | 2412.2 | 127.0 | 12 | 1,380 | 3,174 | 3015.3 | 158.7 |
| 22 | 17 | 1,916 | 4,407 | 4186.1 | 220.3 | 21 | 2,395 | 5,508 | 5232.6 | 275.4 |
| 23 | 52 | 5,846 | 13,445 | 12772.6 | 672.2 | 64 | 7,307 | 16,806 | 15965.7 | 840.3 |
| 24 | 73 | 8,323 | 19,142 | 18185.3 | 957.1 | 92 | 10,403 | 23,928 | 22731.6 | 1196.4 |
| **Total daily waste** | **~1,200** | | | | | **~1,500** | | | | |

## 8.3 Dispersion Modelling Results

Air dispersion modelling of the key odour emission sources from the Project (stack and fugitive emissions from the door) was conducted to predict potential air quality impacts on the surrounding environment. The CALPUFF air dispersion model was used to predict the odour levels in the ambient air in the wider area around the Project.

Modelling of the pollutants was conducted using the emission rates and parameters outlined in the previous section and utilising the meteorological data described in Section 7-1.

Figure 8-3 and Figure 8-4 presents odour concentration isopleths for the typical day and worst case day putrescible waste scenarios modelled. From review of Figure 8-3 and Figure 8-4 the following points are noted:

- The most significant extent of odour impacts are anticipated to occur to the east and north east of the Site. This is consequent of the predominance of southerly and south westerly wind directions during stable meteorological conditions;
- All residential and commercial/ industrial receivers are within 1.4 OU 99th percentile level.
- Table 8-6 presents the 99th percentile predicted odour concentrations for each of the residential and commercial locations shown in Figure 2-2.
- The dispersion modelling results indicate that the predicted ground level odour concentrations at all residential and commercial/ industrial receivers would be well below the applicable criteria for both the typical and worst case day putrescible waste scenarios modelled.

**Table 8-6 Predicted 99$^{th}$ percentile nose-response average odour concentrations (OU)**

| Receptor ID | Worst Case Day putrescible waste on floor based on Clyde (tonnes) | | | Typical Day putrescible waste on floor (tonnes) | | | Criteria |
|---|---|---|---|---|---|---|---|
| | Stack Portion | Fugitive Portion | Total | Stack Portion | Fugitive Portion | Total | |
| R1 | 0.19 | 0.12 | 0.31 | 0.15 | 0.09 | 0.24 | 2 |
| R2 | 0.2 | 0.12 | 0.32 | 0.16 | 0.09 | 0.25 | 2 |
| R3 | 0.12 | 0.09 | 0.21 | - | - | <0.2 | 2 |
| R4 | 0.16 | 0.2 | 0.36 | 0.13 | 0.16 | 0.29 | 2 |
| C1 | 0.16 | 0.28 | 0.44 | 0.12 | 0.22 | 0.34 | 2* |
| C2 | 0.1 | 0.7 | 0.8 | 0.08 | 0.53 | 0.61 | 2* |
| C3 | 0.28 | 0.2 | 0.48 | 0.22 | 0.16 | 0.38 | 2* |
| C4 | 0.05 | 0.55 | 0.6 | 0.04 | 0.47 | 0.51 | 2* |
| C5 | 0.29 | 0.46 | 0.75 | 0.23 | 0.36 | 0.59 | 2* |
| C6 | 0.54 | 0.86 | 1.4 | 0.42 | 0.68 | 1.1 | 2* |

* For commercial/industrial receivers it can be expected meeting the residential criteria would be an indicator that there is very little likelihood of odour nuisance, however in practice commercial/industrial receivers would typically have a higher tolerance, an odour level less than 7-10 OU in commercial/industrial areas is unlikely to create an odour nuisance.

### 8.3.1 Odour Management Measures

The Project would incorporate suitable odour mitigation and management strategies and good housekeeping practices to ensure the potential for any odour impacts are reduced. The odour management strategies that would be implemented at the Project are:

- Installing a ventilation system for the building with a single stack. The design captures and disperses odour emissions from all significant odour sources within the structure including the putrescible area and compactors and containers area. The bulk air exchange rate is proposed to achieve approximately nine air changes per hour within the building.
- Installing a 21 m stack;
- Installing plastic strips on the doorway to help contain odour within the building whilst practicably allowing the high rate of truck movements into and out of the tipping areas. These strips would cover the upper one-third of the opening area and have been shown to decrease air movement through the doorway.
- Keeping putrescible and non-putrescible waste stream(s) separate at the transfer station;
- Ensuring the floor area of the transfer station is cleaned daily;
- Containers used for the transport of putrescible waste would be specially constructed and have activated carbon filtration packs fitted to the air exhaust vent on the container.
- Minimising the amount of putrescible waste left on-site at the transfer station; and
- Maintaining an odour complaint logbook. When odour complaints are received, a Site investigation would be conducted to identify any unusual odour sources within the Site boundary and take appropriate action as required.

The Banksmeadow TT incorporates key learnings from Veolia's other waste management operations, in particular the Clyde TT. Changes, following Veolia's operational experience, which have been introduced to improve odour control at the Clyde TT, have included:

- a modification to air extraction systems, in response to clogging/blinding of filters in original design; and
- surfacing to avoid leachate penetration and subsequent odour emission, into the concrete tipping floor.

These, and other measures, have been adopted from the outset in this proposal. Veolia continually reviews its waste operations to improve environmental performance and, as necessary, undertakes alterations to operational management and facility design. The design of the Banksmeadow TT facility does not preclude the introduction of additional odour control measures in the future, in the unlikely event that they are required. Potential additional measures may include:

- Installation of rapid-close roller doors; and
- Adjusting ventilation rates (at present the air extraction system has been over-designed to accommodate this).

Any future implementation of additional odour management measures would be considered by Veolia based on operational performance of the facility.

**Figure 8-3 Predicted 99th percentile nose-response average ground level odour concentrations – Worst Case Day putrescible waste (OU)**

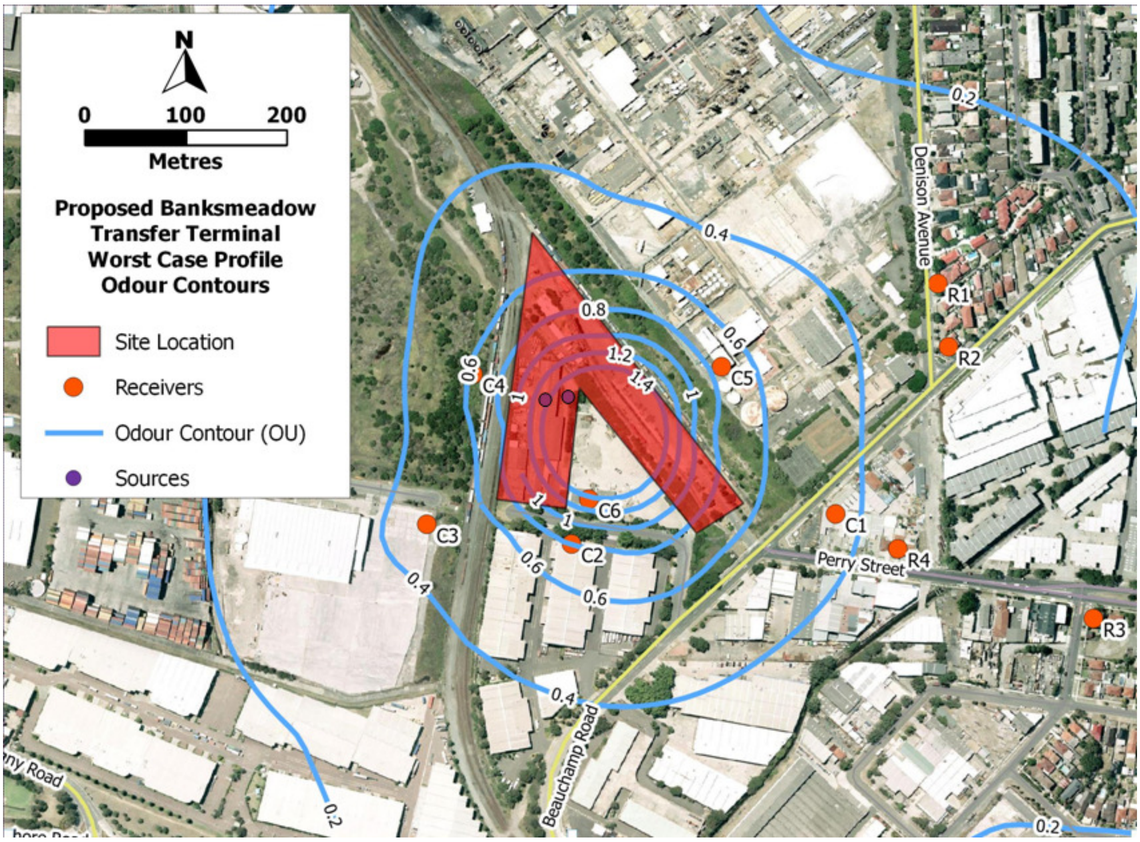
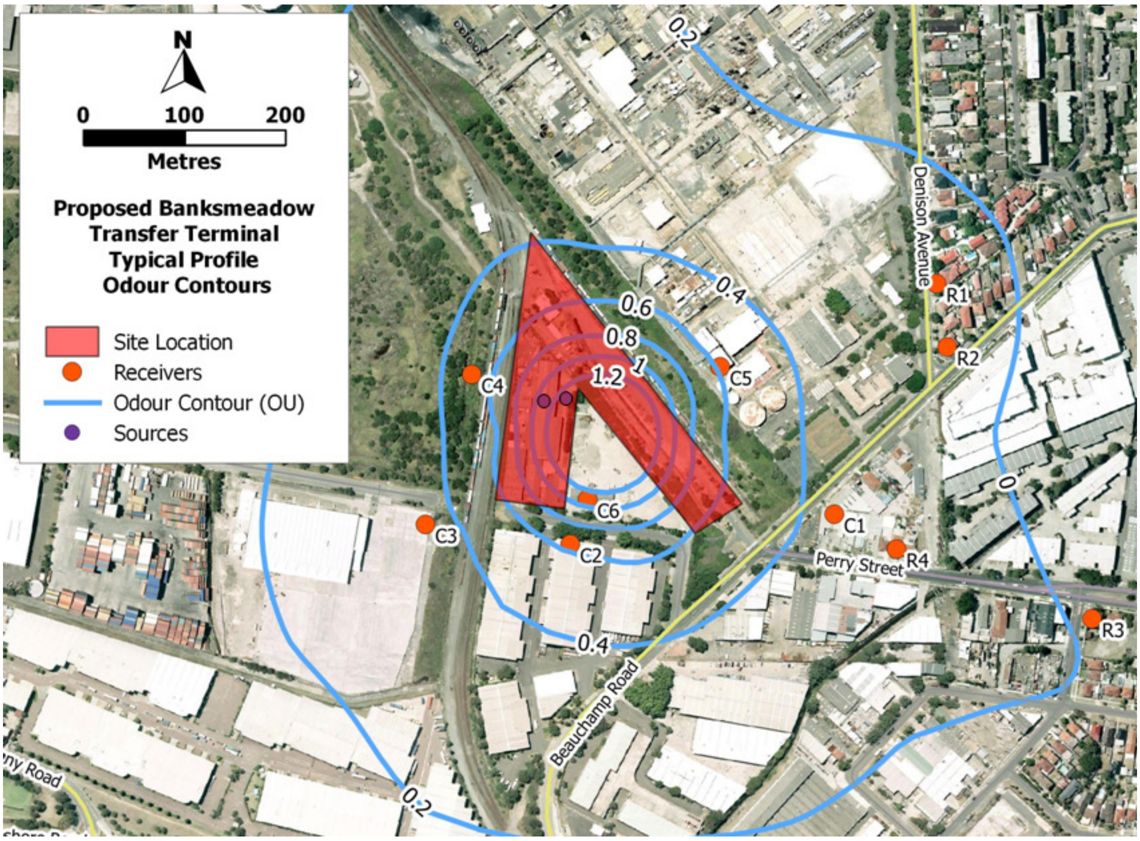


**Figure 8-4 Predicted 99th percentile nose-response average ground level odour concentrations – Typical Day Operation (OU)**



## 8.4 Sensitivity Analysis

To investigate the potential risk of an odour incidence from the site a sensitivity analysis has been conducted to model extremely unlikely upset condition where the waste on floor has accumulated well above expectations for every hour of every day of the entire year or particularly odorous waste was received exceeding the upper range tested (See Appendix D). The scenario modelled for the sensitivity analysis is a constant emission rate out of the stack and truck doorway at double the maximum odour emission.

With reference to Table 8-3 the maximum odour emission hour is between 5 to 6am in the morning with a putrescible waste on the floor of 189 tonnes/hour of waste. Based on the odour measurements taken, the estimated constant odour emission rate used for the sensitivity analysis is shown in Table 8-7.

**Table 8-7 Odour emissions rates used for the sensitivity analysis**

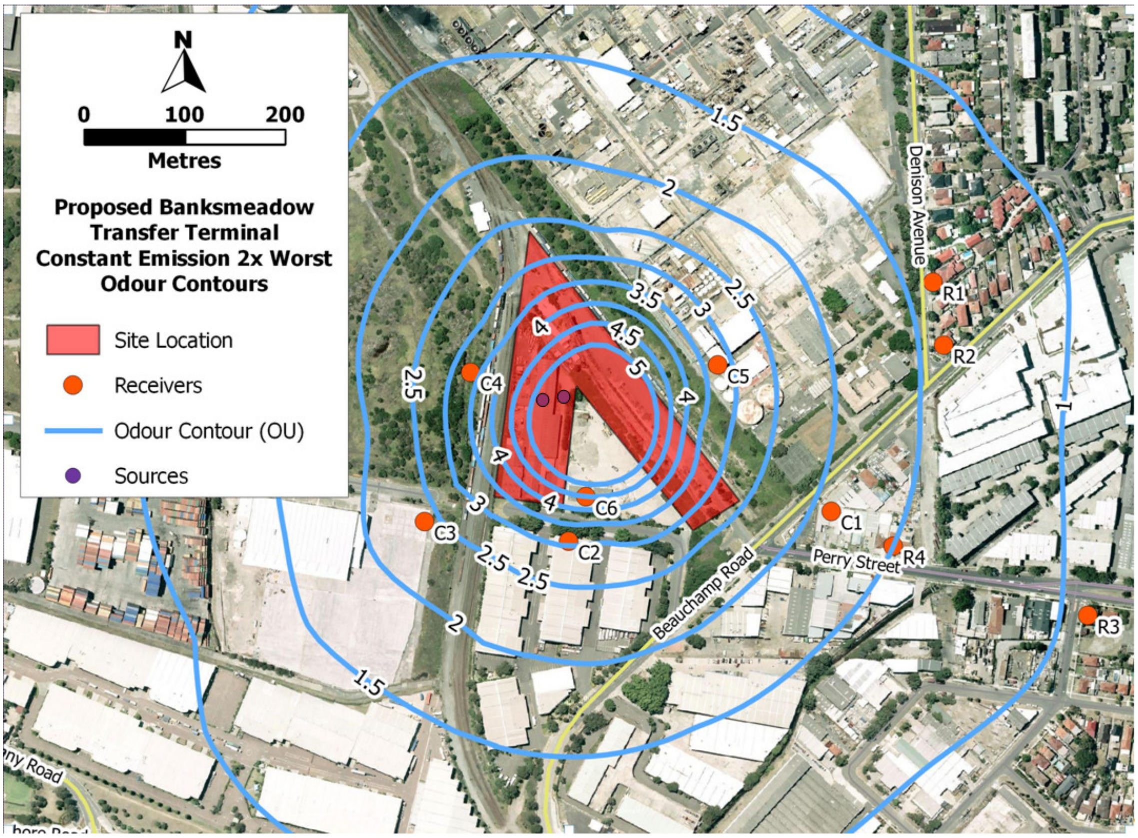
| Putrescible waste on floor (tonnes/day) | Odour Emission Rate (ou.m3/s) | Total Odour Emission with PM/60 | Stack emission rate with PM/60 | Fugitive emission with PM/60 |
|---|---|---|---|---|
| 378 | 42,840 | 98,532 | 93,605.4 | 4,926.6 |

The modelling result for the sensitivity analysis is presented in Figure 8-5.

From review of Figure 8-5 the following points are noted:

- The most significant extent of odour impacts are anticipated to occur to the east and north east of the Site. This is consequent of the predominance of southerly and south westerly wind directions during stable meteorological conditions;
- All residential receivers (R1, R2, R3 and R4) are within 1.5 OU 99th percentile level.
- All commercial receivers (C1, C2 and C3) are within 3.1 OU 99th percentile level.
- Industrial receivers C4 and C5 are within 3.2 OU 99th percentile level.
- Industrial receiver C6 being Botany Building Recyclers is within 4.5 OU 99th percentile level at the site building and up to 7 OU 99th percentile level at the site boundary with the project site.
- The dispersion modelling results indicate that the predicted ground level odour concentrations at all residential would be below the applicable criteria of 2 OU for an extremely unlikely condition simulation where the waste on floor has accumulated well above expectation.
- The level at which an odour is perceived to be of nuisance can range from 2 OU to 10 OU (NSW DEC, 2005) depending on a combination of many factors including: odour quality; odour intensity; odour frequency, timing and duration; population sensitivity; background odour level, public expectation; source characteristics; etc. Commercial/industrial receivers would typically have a higher tolerance for odour especially as many commercial/industrial receivers have some self generated odours. As the predicted odour levels at commercial/industrial receivers are less than 7 OU under extremely unlikely conditions where the waste on floor has accumulated well above expectation, it is considered unlikely that the project would create an odour nuisance at commercial/industrial receivers.

**Figure 8-5 Predicted 99th percentile nose-response average ground level odour concentrations - constant emission rate out of the stack and truck doorway at double the maximum odour emission.**



# 9 DUST EMISSIONS ESTIMATIONS'

The non-putrescible waste which has some potential to generate dust during unloading of the waste within the southern end of the transfer building. The terminal building would be enclosed, with the exception of vehicle access openings and an air extraction system. A dust suppression system that would emit a fine mist during dust generating activities would be installed within both the putrescible waste area of the terminal and the non-putrescible waste area of the terminal building. The dust suppression system would be activated when there are particularly dusty loads or noticeable dust levels within the terminal building.

Operational activities outside the building, such as container handling on sealed hardstand area for temporary storage of containers, are unlikely to generate applicable dust. Therefore dust generated as a result of the operation of the Project would be negligible. However, the Project involves the Site establishment and the construction of new infrastructure which could include activities with the potential to generate dust emissions.

To develop the Site, the temporary disturbance and demolition of existing Site buildings is required. Other activities associated with the construction of the Project involve the establishment of a number of buildings and related infrastructure.

Potential dust emissions may be generated during earthworks including loading/emplacing material, transport on-site, shaping operations and windblown dust generated from exposed areas and stockpiles. Exhaust emission from the operations of construction vehicles and plant would also generate particulate emissions.

The estimated dust emissions from the construction activities are summarised in Table 9-1 and the corresponding emission factors from the US EPA AP42 Emission Factors document (USEPA, 1985 and updates) and the State pollution Control Commission document (SPCC, 1983) that were applied to estimate the potential dust emission are outlined below in Table 9-1.

**Table 9-1 Estimated annual TSP emission rate – Construction activities**

| Activity | TSP emissions (kg/year) |
|---|---|
| Trucks travelling on-site | 3,570 |
| Loading / emplacing material | 238 |
| Dozers on various activities | 2,544 |
| Wind erosion from exposed areas and stockpiles | 4,231 |
| **Total** | **10,582** |

**Hauling on unsealed surfaces**

$$EF_{TSP} = \left( {}^{0.4536}/_{1.6093} \times \left({}^{s}/_{12}\right)^{0.7} \times 4.9 \times \left(M \times \left({}^{1.1023}/_{3}\right)^{0.45}\right)\right) \frac{kg}{VKT}$$

Where: s = silt content (%) and M = moisture content (%)

**Loading / emplacing material**

$$EF_{TSP} = k \times 0.0016 \times \left( \left(\frac{U}{2.2}\right)^{1.3} \Big/ \left(\frac{M}{2}\right)^{1.4} \right) \frac{kg}{tonne}$$

Where: k = 0.74, U =wind speed (m/s) and M = moisture content (%)**Dozer activity**

$$EF_{TSP} = \frac{2.6(s)^{1.2}}{M^{1.3}}$$

Where: s = silt content (%) and M = moisture content (%)

**Wind erosion**

$$EF_{TSP} = 0.4 \frac{kg/ha}{hour}$$

The potential dust impacts due to these activities are difficult to accurately quantify due to the short sporadic periods of dust generating activity that may occur over the construction time frame. The sources are considered temporary in nature and would be confined to the construction period.

The total amount of dust generated from the construction process is unlikely to be significant given the nature of the activities and as these activities would be located well away from the nearest off-site receptor, any potential dust impacts would be unlikely to be discernible beyond the existing levels of dust that currently occur. The calculation assumes that reasonable construction dust controls are implemented and that the Site is managed via a construction dust management plan. Given that the activities would occur for a limited period, it is unlikely that there would be any significant or prolonged effect at any off-site receiver.

To ensure dust generation during the construction activities is controlled and the potential for off-site impacts are reduced, appropriate operational and physical mitigation measures would be utilised.

The potential mitigation strategies which may be employed during the construction activity are outlined are:

**General**

- Assess activities during adverse weather conditions and modify as required;
- Engines of on-site vehicles and plant to be switched off when not in use;
- Maintain and service vehicles according to manufacturer’s specifications;

**Hauling activities**

- Watering of unsealed haul roads;
- Sealed haul roads to be cleaned regularly;
- Restrict vehicle traffic to designated routes;

- Impose speed limits;
- Covering vehicle loads when transporting material off-site;

**Material handling**

- Reduce drop heights from loading and handling equipment;

**Exposed areas and stockpiles**

- Minimise area of exposed surfaces;
- Water suppression on exposed areas and stockpiles;
- Minimise amount of stockpiled material;
- Where possible apply barriers, covering or temporary rehabilitation; and
- Rehabilitate completed sections as soon as practicable.

# 10 CONCLUSIONS

This study has assessed the potential dust and odour impacts associated with the proposed Banksmeadow Transfer Terminal.

The assessment of potential dust emissions indicates that the scale of emissions generated during the construction period and operation of the facility would likely be minor, and provided that reasonable dust controls are implemented and managed in an appropriate manner, there would not be any discernible effect at any off-site receptors above that of the existing levels.

Dispersion modelling has been used to predict potential off-site odour impacts from the potential odour generating sources.

The dispersion modelling results indicate that the predicted ground level odour concentrations are unlikely to exceed the applicable assessment criteria at the nearby residential receivers.

The Project would adopt suitable odour mitigation and management strategies to ensure the potential for any odour impacts are reduced.

Overall, the assessment shows that the Project can operate without causing any adverse air quality impacts in the surrounding environment.

# 11 REFERENCES

Bureau of Meteorology (2013) "Climate Averages Australia, Bureau of Meteorology website." http://www.bom.gov.au/climate/averages

Heggies (2010) "Woodlawn Bioreactor – Odour and Dust Impact Assessment Woodlawn Expansion Project", Prepared by Heggies Pty Ltd for Veolia Environmental Services (Australia) Pty Ltd, August 2010.

Katestone Scientific Pty Ltd (1995) "The evaluation of peak-to-mean ratios for odour assessments" Volume 1 – Main Report, May 1995

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NPI (2012) "Emission Estimation Technique Manual for Mining, Version 3.1", National Pollutant Inventory, January 2012. ISBN: 0 642 54700 9

US EPA (1985) "AP42 Chapter 11: Mineral Products Industry – Western Surface Coal Mining" United States Environmental Protection Agency, 1985.

US EPA (1998) "AP42 Chapter 1: External Combustion Sources – Bituminous and Subbituminous Coal Combustion" United States Environmental Protection Agency, 1998.

NSW DEC (2005) "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW", August 2005

PAEHolmes (2010) "Air Quality Assessment – Odour and Dust: Proposed Modification to the Northern Extension Landfill at Eastern Creek", Prepared by PAEHolmes for National Environmental Consulting Services, March 2010.

TRC (2011) "Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia", Prepared for the NSW Office of Environment and Heritage by TRC Environmental Corporation.

WHO (2005) "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide – Global Update 2005" World Health Organization, 2005.

# APPENDIX A

**Peak-to-mean ratios**

**Peak-to-mean ratios**

The following table shows the recommended factors to be applied for estimating peak concentrations from different source types, stabilities and distances.

| Source Type | Pasquil-Gifford stability class | Near field P/M 60* | Far field P/M 60* |
|---|---|---|---|
| Area | A, B, C, D | 2.5 | 2.5 |
| | E, F | 2.3 | 1.9 |
| Line | A-F | 6 | 6 |
| Surface point | A, B, C | 12 | 4 |
| | D, E, F | 25 | 7 |
| Tall wake-free point | A, B, C | 17 | 3 |
| | D, E, F | 35 | 6 |
| Wake-affected point | A-F | 2.3 | 2.3 |
| Volume | A-F | 2.3 | 2.3 |

*Ratio of peak 1-second average concentrations

# APPENDIX B

**Report Limitations**

Wilkinson Murray Pty Ltd (WM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use by Veolia Environmental Services and only those third parties who have been authorised by WM to rely on the report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal.

The methodology adopted and sources of information used by WM are outlined in this report. WM has made no independent verification of this information beyond the agreed scope of works and WM assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to WM was false.

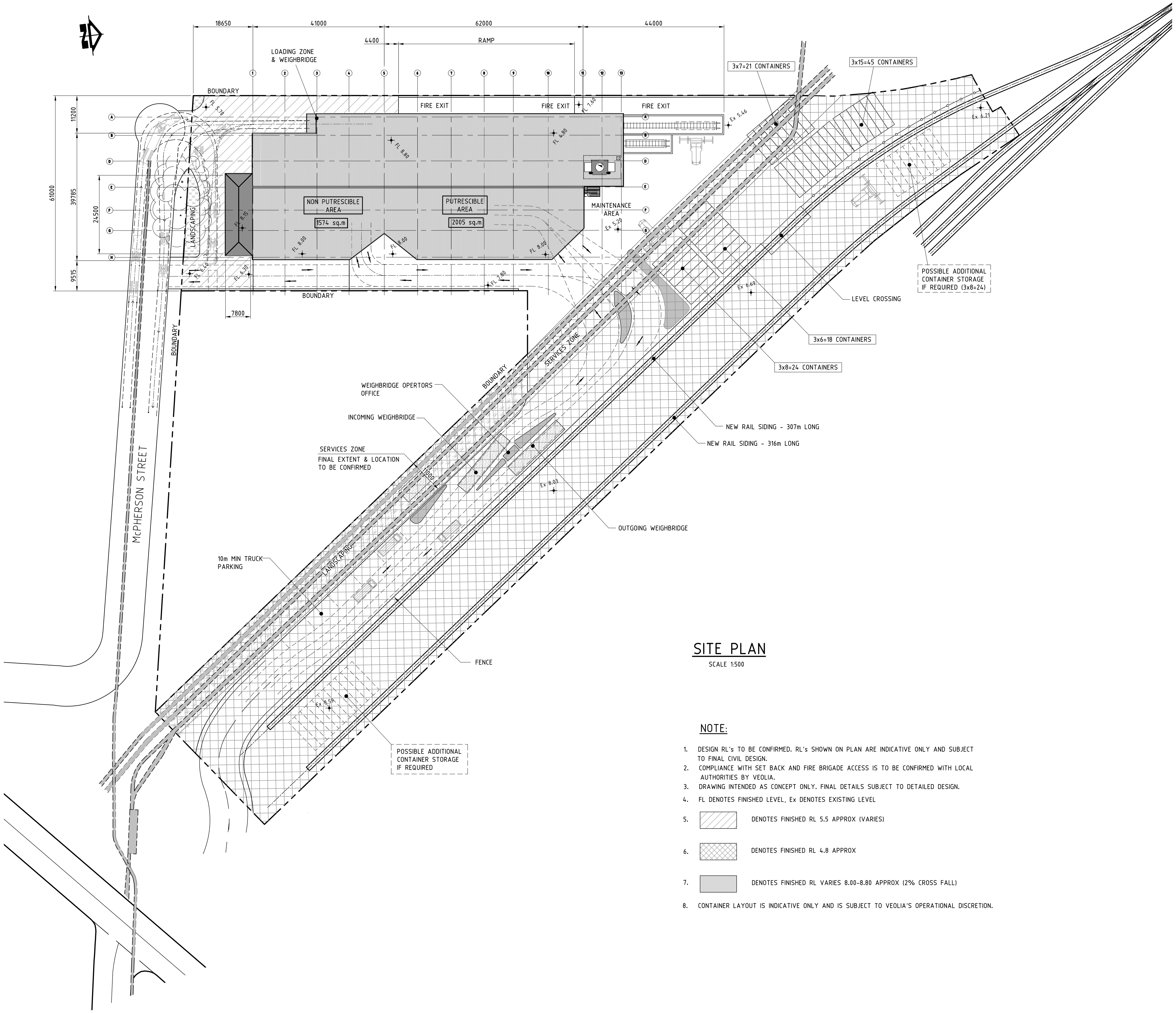
This report was prepared between September to October 2013 and is based on the conditions encountered and information reviewed at the time of preparation. WM disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

# APPENDIX C

**Site plans**




## SITE PLAN

SCALE 1:500

## NOTE:

1. DESIGN RL's TO BE CONFIRMED. RL's SHOWN ON PLAN ARE INDICATIVE ONLY AND SUBJECT TO FINAL CIVIL DESIGN.
2. COMPLIANCE WITH SET BACK AND FIRE BRIGADE ACCESS IS TO BE CONFIRMED WITH LOCAL AUTHORITIES BY VEOLIA.
3. DRAWING INTENDED AS CONCEPT ONLY. FINAL DETAILS SUBJECT TO DETAILED DESIGN.
4. FL DENOTES FINISHED LEVEL, Ex DENOTES EXISTING LEVEL
5. DENOTES FINISHED RL 5.5 APPROX (VARIES)
6. DENOTES FINISHED RL 4.8 APPROX
7. DENOTES FINISHED RL VARIES 8.00-8.80 APPROX (2% CROSS FALL)
8. CONTAINER LAYOUT IS INDICATIVE ONLY AND IS SUBJECT TO VEOLIA'S OPERATIONAL DISCRETION.

FOR INFORMATION

| Issue | Description | Date |
|---|---|---|
| D | ISSUED FOR INFORMATION | 21.02.14 |
| C | REVISED AND RE-ISSUED FOR CLIENT SIGN OFF | 24.07.13 |
| B | ISSUED FOR CLIENT SIGN OFF | 11.07.13 |
| A | ISSUED FOR INFORMATION | 16.05.13 |

Status
**PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

| | | | |
|---|---|---|---|
| Scales | 1:500 @ A0 | Current Issue Signatures | |
| | | Drawn JW | |
| Original Size | A0 | Designed AS | |
| Height Datum | AHD | Checked | |
| Grid | | Approved | |

Filename: AA005622-A001-E.dwg

Client

VEOLIA ENVIRONMENTAL SERVICES

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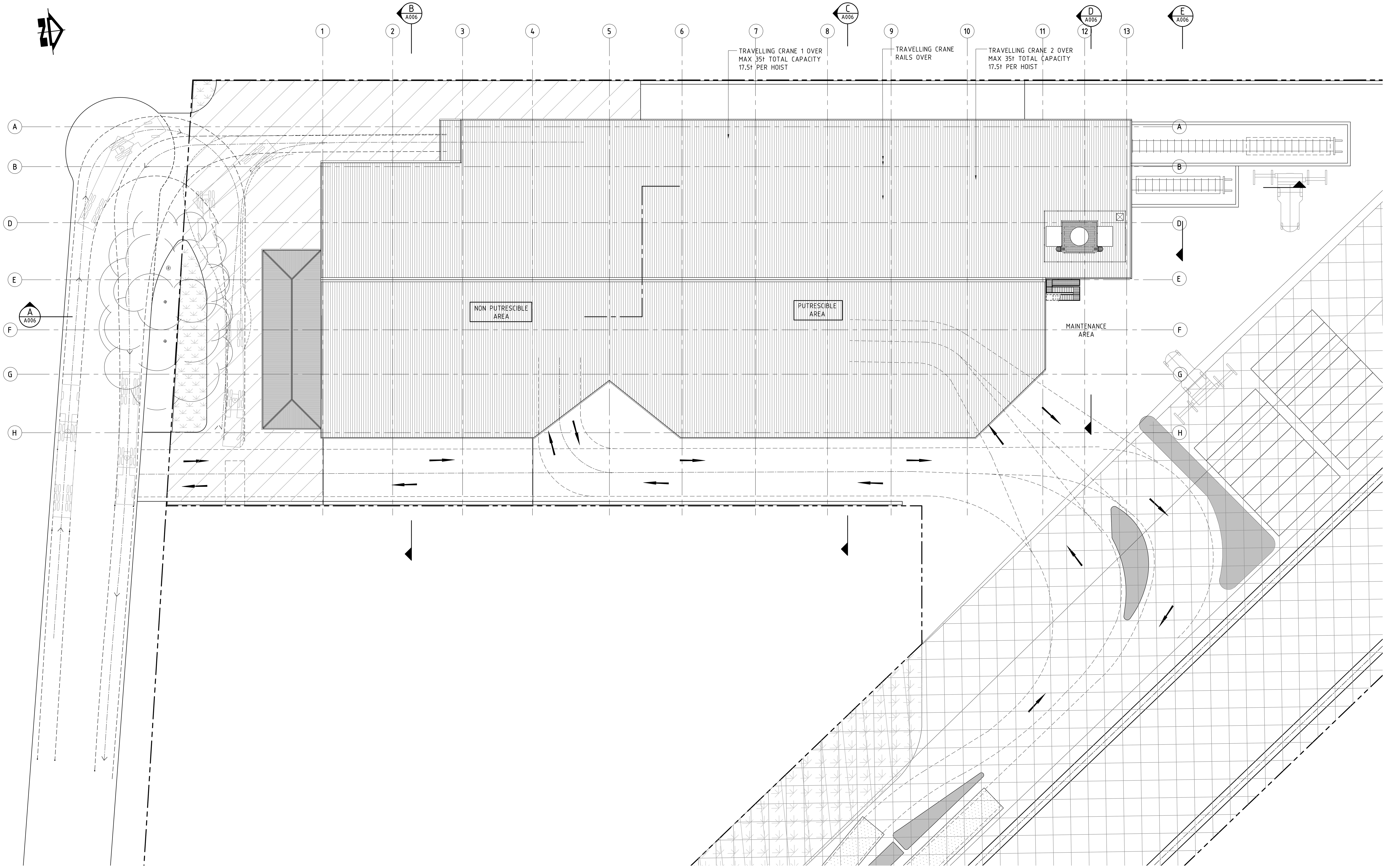
www.hyderconsulting.com


Project
**BANKSMEADOW TRANSFER TERMINAL INTERMODEL**

Title
**SITE LAYOUT OPTION 1**

| Drawing No. | Project No. | Issue |
|---|---|---|
| A001 | AA005622 | D |




| | | |
|---|---|---|
| C | ISSUED FOR INFORMATION | 21.02.14 |
| B | REVISED & RE-ISSUED FOR CLIENT SIGN-OFF | 24.07.13 |
| A | ISSUED FOR CLIENT SIGN-OFF | 11.07.13 |
| Issue | Description | Date |

Status
**PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

| | | | |
|---|---|---|---|
| Scales | 1:200 @ A0 | Current Issue Signatures | |
| | | Drawn JW | |
| Original Size | **A0** | Designed AS | |
| Height Datum | AHD | Checked | |
| Grid | | Approved | |

Filename: AA005622-A002-C.dwg

Client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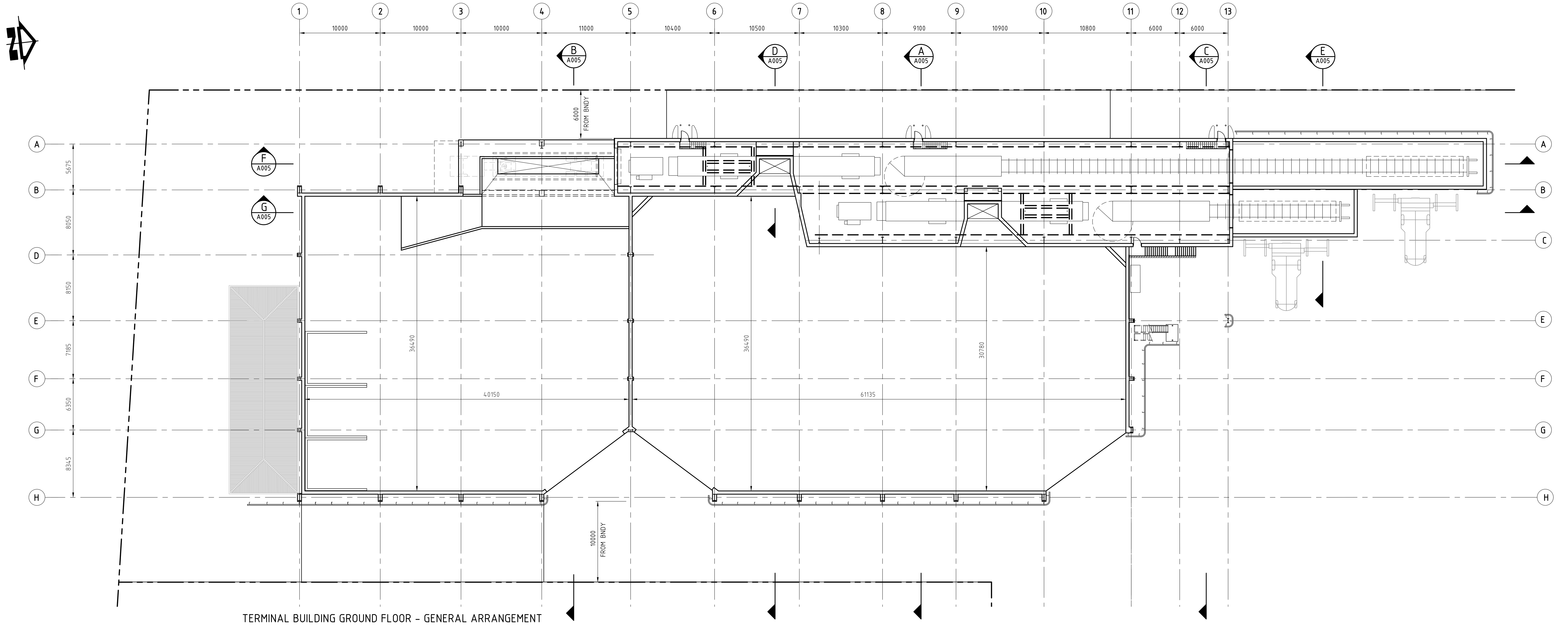
Project
**BANKSMEADOW TRANSFER TERMINAL INTERMODEL**

Title
**ARCHITECTURAL GENERAL ARRANGEMENT**

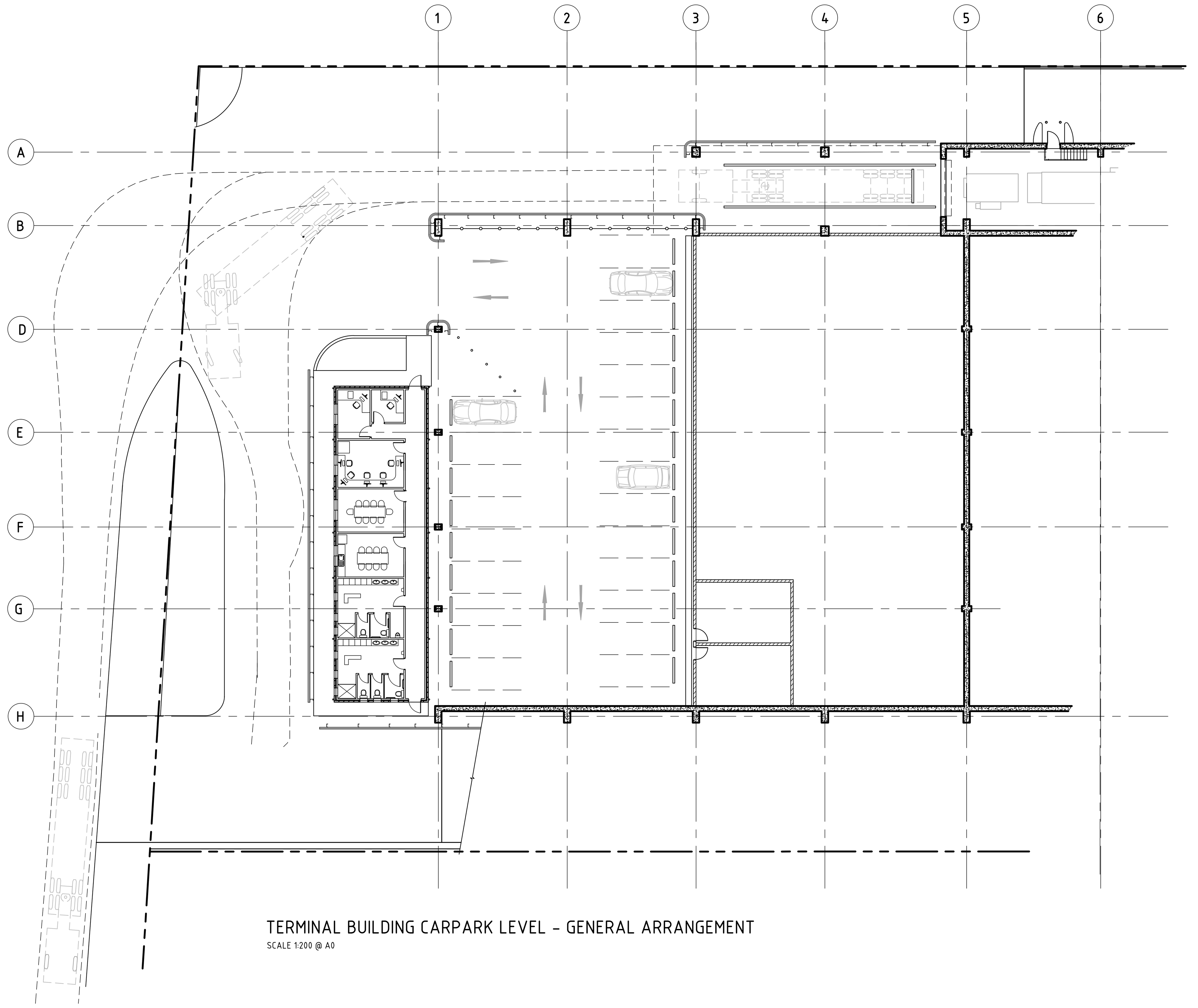
FOR INFORMATION

| Drawing No. | Project No. | Issue |
|---|---|---|
| A002 | AA005622 | C |




TERMINAL BUILDING GROUND FLOOR - GENERAL ARRANGEMENT

SCALE 1:200 @ A0



TERMINAL BUILDING CARPARK LEVEL - GENERAL ARRANGEMENT

SCALE 1:200 @ A0

FOR INFORMATION

| Issue | Description | Date |
|---|---|---|
| A | ISSUED FOR INFORMATION | 21.02.14 |

Status
**PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

| | | Current Issue Signatures | |
|---|---|---|---|
| Scales | 1:200 @ A0 | Drawn JW | |
| Original Size | A0 | Designed AS | |
| Height Datum | AHD | Checked | |
| Grid | | Approved | |

Filename: AA005622-A003-A.dwg

Client

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Project
**BANKSMEADOW TRANSFER TERMINAL INTERMODEL**

Title
**ARCHITECTURAL TRANSFER BUILDING LAYOUT AND SECTIONS**

| Drawing No. | Project No. | Issue |
|---|---|---|
| A003 | AA005622 | A |

# APPENDIX D

**The Odour Unit Pty Ltd Report**

# VEOLIA ENVIRONMENTAL SERVICES (AUSTRALIA)

## Banksmeadow Transfer Terminal

## Odour Emissions and Control

### Banksmeadow NSW

### Final Report

### February 2014

**THE ODOUR UNIT PTY LIMITED**

**ABN 53 091 165 061**
**ACN 091 165 061**
Australian Technology Park,
Locomotive Workshop,
Suite 16012, 2 Locomotive Street,
EVELEIGH NSW, 2015



Project Number: N1906R.06

| **Report Revision** | | |
|---|---|---|
| **Report Version** | **Date** | **Description** |
| 0.1 (Draft) | 17/09/13 | Draft report for comment. |
| 1.0 (Final) | 20/09/13 | Final Report. |
| 2.0 | 20/02/14 | Scope reduced to odour emissions and control. |
| 2.1 | 24/02/14 | Incorporating further feedback. Specification increased to 3 significant figures. |
| 2.2 (Final) | 25/02/14 | Final Report. |
| **Report Preparation** | | |
| Report Prepared By: S. Hayes | | Approved By: T. Schulz |
| Report Title: Veolia Environmental Services - Banksmeadow Transfer Terminal Odour Emissions and Control | | |

TABLE OF CONTENTS



APPENDICES

# 1 INTRODUCTION

The Odour Unit Pty. Ltd. (TOU) has been commissioned by Veolia Environmental Services (Australia) Pty. Ltd. (VES) to determine the odour emissions and provide analysis regarding the building ventilation system of the proposed municipal solid waste transfer terminal located at Banksmeadow NSW. The building ventilation system is based upon a system installed at an existing VES transfer terminal at Clyde NSW.

The primary objectives of this report are to discuss the effectiveness of the building ventilation system design in the dispersion of odour once discharged, supply calculations and test reports for the odour emissions factor based on waste mass on floor of tipping areas and to address some issues raised by the Environment Protection Authority (EPA) review of the Draft Environmental Impact Statement (SSD 13-5855) by providing further information on the calculation of emission rates and the development of the design of the ventilation system for the Banksmeadow Transfer Terminal proposal.

# 2 PROPOSED BUILDING VENTILATION SYSTEM

## 2.1 SITE PLAN

The Banksmeadow Transfer Terminal (BTT) is proposed to be located at McPherson Street, Banksmeadow NSW. The site operational area has been highlighted in yellow in **Figure 2.1.1**. The nearest sensitive places to the proposed BTT location are the residential and commercial zones within the suburbs of Hillsdale and Matraville on the eastern sides of Beauchamp Road and Denison Street. The topography immediately surrounding the site could be described as simple, low lying and flat.

The terminal structure containing the non-putrescible and putrescible tipping floors and compactor areas is planned to be constructed in the south-western sector of the site. The proposed location of the building ventilation system stack is on the north-east corner of the putrescible area shown in **Figure 2.2.2** (extracted from **Hyder Consulting Drawing No. A001-B**).


**Figure 2.1.1:** BTT site location

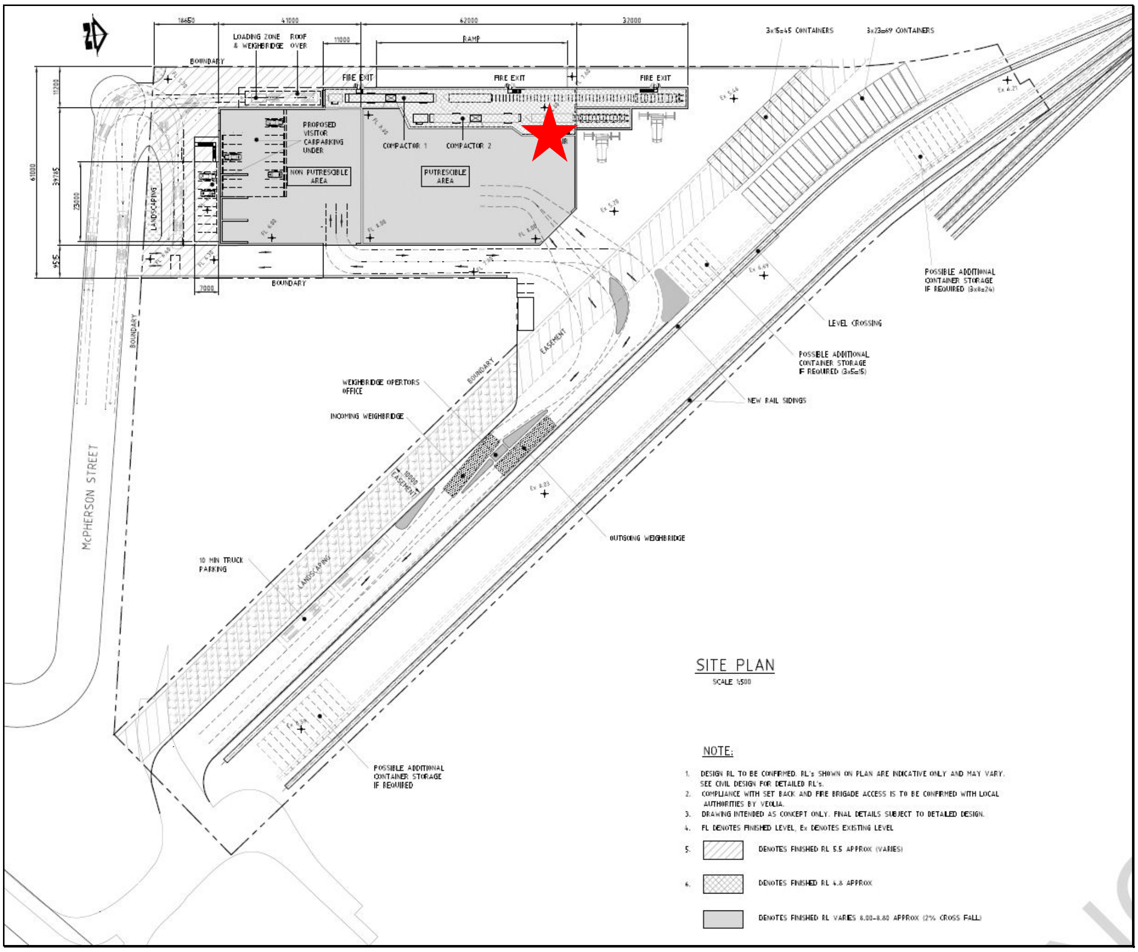


**Figure 2.1.2:** Site layout and approximate building ventilation stack location (image Hyder Consulting Drawing No. A001-B).

## 2.2 SPECIFICATION

The building ventilation system proposed for BTT is to be based on the same parameters as the stack at Clyde Transfer Terminal (CTT). The design parameters (3 significant figures) of the stack are:

- 21.0 m stack height above ground level.
- Stack diameter of 2.64 m (gives a);
- Stack cross-sectional area of 5.47 m$^2$ (multiplied by);
- 20.0 m/s design stack exit velocity (equals);
- 394,000 m$^3$/h (109 m$^3$/s) stack flow discharge rate;
    - Therefore, 394,000 m$^3$/h building ventilation rate (divided by an);
- Approximate building volume 43,800 m$^3$ (gives an);
- Approximate air exchange rate of nine air changes per hour;

This system is designed to ventilate the building, as well as capture and disperse odour emissions from all significant odour sources within the structure including the putrescible area and from compactors and containers. The bulk air exchange rate is proposed to achieve approximately nine air changes per hour based on a building volume of approximately 43,800 $m^3$.

The building ventilation system captures ventilation air from the putrescible tipping floors and compactor area to capture significant odour source emissions. The waste compaction units are housed within the fully enclosed compactor area, which is extracted by the building ventilation system and discharged and dispersed via the proposed stack.

Once waste has been loaded into the containers, the containers remain completely sealed and odour is controlled through activated carbon filtration packs fitted to the air exhaust vent in each container.

### 2.3 BEST AVAILABLE ODOUR CONTROL TECHNOLOGY

In the application of Waste Transfer Terminals and paired with best management practices, it is TOU's view that stack dispersion of building odour emissions offers the most practicable, affordable and proven odour control technology. A working demonstration of the proposed building system is already in operation at the VES operated CTT.

In August 2005, TOU completed a review for Collex (now VES) of the odour control system design and performance that it was operating at CTT. The transfer building was configured as a naturally ventilated system through breezeways in the walls and a large open doorway. It had an odour control system based upon six individual dust and carbon filter units discharging treated air through short stacks located along the roof of the building. A design bulk air exchange rate of seven air changes per hour was possible, excluding any air changes through the doorway and breezeways, equivalent to a stack velocities of 17.7 m/s (TOU, 2005).

It was found that the flow rate of air from the stacks was highly dependent on the condition of the dust and carbon filters. The air flow rates from the stacks were highly variable, due to excessive pressure losses across blocked dust and carbon filters. In the worst-case the total flow rate with six dirty dust filters reduced the bulk air exchange rate to just one air change per hour (TOU, 2005).

The activated carbon system was atypical of those commonly used in industrial odour control. In such applications, activated carbon filters were most commonly used for medium to high concentrations of odour in foul air streams having low air flow rates. In these cases granular activated carbon was used in vertical filter vessels. Such systems are typically designed with sufficient carbon capacity to ensure a reasonable filter life before carbon replacement. Granular activated carbon filter systems for very large airflows require a large capital investment and a very large and ongoing operating cost (TOU, 2005).

Following on from this review, TOU completed an odour mitigation study of CTT in December 2005. This study involved an odour emissions survey and a dispersion modelling study. A range of stack configurations were modelled, including a single external ventilation stack (TOU, 2005). In July 2006, a more refined modelling scenario found that a single external with stack height of 21 m, diameter of 2.64 m and stack exit velocity of 20 m/s, was the optimum design for CTT and met the EPA odour impact assessment criteria (TOU, 2006). The sealing of building breezeways and installation of plastic strips on the open truck doorway was also carried out. This design was accepted and successfully implemented and still under effective operation by VES at CTT.

It is TOU's view that it would be appropriate for VES to use of the design of the successful building ventilation system at CTT as a working model of the best available odour control technology that is practicable for waste transfer stations.

### 2.4 FUGITIVE EMISSIONS

The building would be sealed except for the open truck entrances to the non-putrescible tipping floor and putrescible tipping floors. A minor release of fugitive emissions may occur primarily out of the open truck entrances.

TOU has experienced other industries where large-volume buildings are fitted with fast-acting doors in the truck receival areas as a means of minimising fugitive odour releases. However when considering this approach for waste transfer terminals it is quickly evident that the large volume of truck traffic would not be suitable for a fast-acting door system. Plastic strips are proposed to be installed to help contain odour within the building whilst practicably allowing the high rate of truck movements into and out of the tipping areas. These strips would cover the upper one-third of the opening area. They have been shown by smoke testing at CTT to decrease air movement through the doorway.

There would also be a brief opening of doors to the compactor area to enable changeover of waste containers. TOU's recent audit of existing VES operations at the Crisps Creek Intermodal Facility, as part of Woodlawn Bioreactor Expansion Project, had found that the current measures used for the waste transport operations were very effective at mitigating any odour emissions. The low flow and carbon filtered odour emission from the containers had a very small, if not insignificant, odour emission potential. There was very little evidence of any waste-based odour being generated. The Audit determined that facility was very unlikely to generate problematical odour emissions. This was provided that the waste containers used in the process continue to be adequately maintained and remain fully sealed during waste transportation (TOU, 2014).

TOU recommend that a nominal average fugitive release of 5% of total odour emissions is a sensible and conservative assumption.

# 3 ODOUR EMISSION SCENARIOS

## 3.1 ODOUR EMISSION FACTOR

On 20th August 2008, TOU took airflow and temperature measurements and collected four air samples from the single stack system at CTT. The sampling was carried out by the methods of AS/NZS 4323.3:2001. Analysis of the air samples for odour concentration was carried out the following day by dynamic olfactometry to Australian Standard AS/NZS 4323.3:2001. The mean result of the odour testing and air flow measurements was used to calculate an odour emission factor (odour units per tonne on floor per second – ou.m$^3$/t.s) based on the amount of waste on the floor in the terminal building as advised at the time by VES (250 tonnes). A summary of the measurements and odour testing results has been provided in **Table 3.1.1**. The odour concentration test report has been provided in **Appendix A**.

**Table 3.1.1: Summary of stack measurements and odour testing results.**

| Mean Odour Conc$^n$ (ou) | Stack Diameter (m) | Mean Stack Gas Temp ($^0$C) | Mean Stack Gas Exit Velocity (m/s) | Mean Stack Gas Flowrate @ 25$^0$C (m$^3$/s) | Tonnes of garbage inside transfer building (Tonnes) | Odour emission factor per tonne of waste (ou.m$^3$/t.s) |
|---|---|---|---|---|---|---|
| 320 | 2.64 | 21.4 | 16.0 | 88.7 | 250 | 113.5 |

It should be noted that the odour emissions were measured directly from within the extraction stack in preference to collection from stockpiles using an Isolation Flux Chamber. The Isolation Flux Chamber method is an EPA approved method but is known to inherently give significantly lower emission rate values compared with more direct measurement techniques.

## 3.2 VARIABLE ODOUR EMISSIONS SCENARIOS

The OER per tonne factor (113.5 ou.m$^3$/t.s) was used to calculate hourly variable emissions over a typical operating day shown in **Table 3.2.2**. The hourly 'waste on floor' data was provided by VES as representative snapshot of daily waste levels at CTT. It is also expected to represent the peak levels for BTT.

| Table 3.2.1: CTT hourly variable emissions profile | | | | |
|---|---|---|---|---|
| **TIME** | **Tonnage on floor (t)** | **Odour Emission Rate (ou.m$^3$/s)** | **Hour of Day** | **Main Stack by Hour with P/M60** |
| 0000-0059 | 46.82 | 5,314 | 1 | 12,222 |
| 0100-0159 | 53.74 | 6,099 | 2 | 14,029 |
| 0200-0259 | 96.24 | 10,923 | 3 | 25,123 |
| 0300-0359 | 184.48 | 20,938 | 4 | 48,159 |
| 0400-0459 | 188.721 | 21,420 | 5 | 49,266 |
| 0500-0559 | 164.73 | 18,697 | 6 | 43,003 |
| 0600-0659 | 137.34 | 15,588 | 7 | 35,853 |
| 0700-0759 | 34.16 | 3,877 | 8 | 8,917 |
| 0800-0859 | 28.62 | 3,248 | 9 | 7,471 |
| 0900-0959 | 71.17 | 8,078 | 10 | 18,579 |
| 1000-1059 | 15.59 | 1,769 | 11 | 4,070 |
| 1100-1159 | 46 | 5,221 | 12 | 12,008 |
| 1200-1259 | 41.35 | 4,693 | 13 | 10,794 |
| 1300-1359 | 90.323 | 10,252 | 14 | 23,579 |
| 1400-1459 | 109.316 | 12,407 | 15 | 28,537 |
| 1500-1559 | 15.364 | 1,744 | 16 | 4,011 |
| 1600-1659 | 0 | 0 | 17 | 0 |
| 1700-1759 | 4.74 | 538 | 18 | 1,237 |
| 1800-1859 | 1.5 | 170 | 19 | 392 |
| 1900-1959 | 4.04 | 459 | 20 | 1,055 |
| 2000-2059 | 12.16 | 1,380 | 21 | 3,174 |
| 2100-2159 | 21.1 | 2,395 | 22 | 5,508 |
| 2200-2259 | 64.38 | 7,307 | 23 | 16,806 |
| 2300-2359 | 91.66 | 10,403 | 24 | 23,928 |

The use of this CTT data could be considered as refined and realistic simulations of potential odour impacts as a result of odour emissions from the BTT site.

## 3.3 CONSTANT ODOUR EMISSIONS SCENARIO – SENSITIVITY TEST

TOU believes that it is a reasonable approach to consider a sensitivity test with use of a constant emission rate out the stack and truck doorway at double the maximum odour emission hour given in **Table 3.2.1**. The results of this sensitivity test could be interpreted as an extremely unlikely upset condition simulation where the waste on floor has accumulated well above expectations for every hour of every day of the entire year.

The findings from this sensitivity test should be viewed in terms of the large extent of safety margin allowed for in the design of the waste transfer terminal.

# 4 REFERENCES


- AS/NZS 4323.3:2001, *Determination of odour concentration by dynamic olfactometry,* Jointly published by Standards Australia International Ltd, Sydney and Standards New Zealand, Wellington
- The Odour Unit, 2005, *Collex Waste Transfer Terminal – Odour Control System Design and Performance Review*, Eveleigh.
- The Odour Unit, 2005, *Collex Pty Limited – Clyde Waste Transfer Terminal - Odour Mitigation Study*, Eveleigh.
- The Odour Unit, 2006, *Collex Pty Limited – Clyde Waste Transfer Terminal - Odour Mitigation Study – Addendum to Final Report*, Eveleigh.
- The Odour Unit, 2014, *Veolia Environmental Services (Australia) Pty Limited Woodlawn Bioreactor Expansion Project – Independent Environmental Audit #2*, Eveleigh.

# Appendix A: Odour Concentration Test Reports

THE ODOUR UNIT PTY LIMITED

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Facsimile: +61 2 9209 4421
Email:tschulz@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 165 061

# Form 06 - Sydney Laboratory
# Odour Concentration Measurement Results

The measurement was commissioned by:

| | | | |
|---|---|---|---|
| Organisation | Veolia Environmental Services | Telephone | (02) 9841 2927 |
| Contact | S.Hambly, R. Bachu | Facsimile | (02) 9841 2992 |
| Sampling Site | Clyde Waste Transfer Terminal | Email | Steven.Hambly@veolia.com.au; Ramona.Bachu@veolia.com.au |
| Sampling Method | Drum and pump | Sampling Team | TOU |

Order details:

| | | | |
|---|---|---|---|
| Order requested by | T. Muddle | Order accepted by | S. Hayes |
| Date of order | 18/08/2008 | TOU Project # | 1230 |
| Order number | CT45-884468 | Project Manager | T. Schulz |
| Signed by | S. Lawrence | Testing operator | J. Schulz |

| | |
|---|---|
| Investigated Item | Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001. |
| Identification | The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required. |
| Method | The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report. |
| Measuring Range | The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting $2^{17}$. This is specifically mentioned with the results. |
| Environment | The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between 22°C and 25°C. |
| Measuring Dates | The date of each measurement is specified with the results. |
| Instrument Used | The olfactometer used during this testing session was:<br>ODORMAT SERIES V02 |
| Instrumental Precision | The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001.<br>ODORMAT SERIES V02: $r = 0.1217$ (19/20 March, 2008) Compliance – Yes |
| Instrumental Accuracy | The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001.<br>ODORMAT SERIES V02: $A =$ 0.1282 (19/20 March, 2008) Compliance – Yes |
| Lower Detection Limit (LDL) | The LDL for the olfactometer has been determined to be 23 ou (blank bag odour concentration) |
| Traceability | The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. |

Date: Friday, 22 August 2008

Report Number / Panel Roster Number: SYD20080821_075

**T. Schulz**
Principal and Managing Director

**J. Schulz**
Authorised Signatory

## Odour Sample Measurement Results

| Sample Location | TOU Sample ID | Sampling Date & Time | Analysis Date & Time | Panel Size | Valid ITEs | Nominal Sample Dilution | Actual Sample Dilution (Adjusted for Temperature) | Sample Odour Concentration (as received, in the bag) (ou) | Sample Odour Concentration (Final, allowing for dilution) (ou) | Odour Character |
|---|---|---|---|---|---|---|---|---|---|---|
| Stack - Sample 1 | SC80295 | 20/08/2008 1420 | 21/08/2008 1128 | 4 | 8 | No Dilution | No Dilution | 430 | 430 | Garbage. |
| Stack - Sample 2 | SC80296 | 20/08/2008 1138 | 21/08/2008 1208 | 4 | 8 | No Dilution | No Dilution | 332 | 332 | Garbage. |
| Stack - Sample 3 | SC80297 | 20/08/2008 1450 | 21/08/2008 1243 | 4 | 8 | No Dilution | No Dilution | 304 | 304 | Garbage. |
| Stack - Sample 4 | SC80298 | 20/08/2008 1505 | 21/08/2008 1326 | 4 | 8 | No Dilution | No Dilution | 215 | 215 | Garbage. |

## Odour Panel Calibration Results

| Reference Odorant | Reference Odorant Panel Roster Number | Concentration of Reference gas (ppb) | Panel Target Range for n-butanol (ppb) | Measured Concentration (ou) | Measured Panel Threshold (ppb) | Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No) |
|---|---|---|---|---|---|---|
| n-butanol | SYD20080821_075 | 49,600 | $20 \leq \chi \leq 80$ | 861 | 58 | Yes |

Comments None.

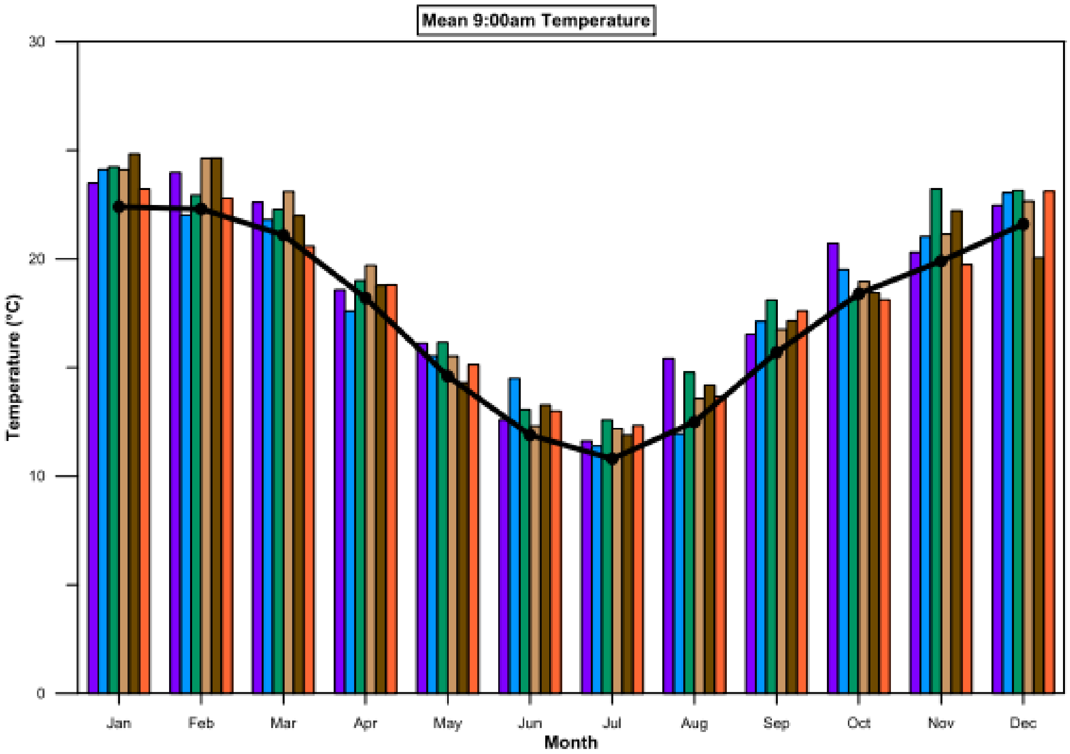
Disclaimer Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other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

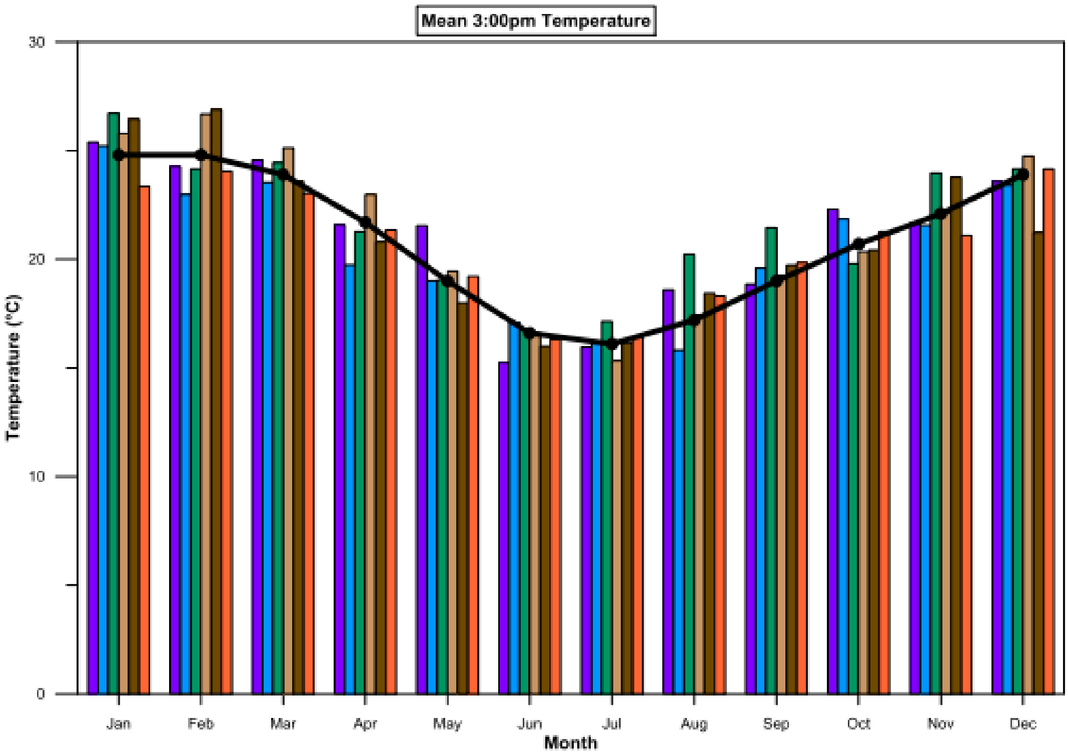
Note This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Limited.

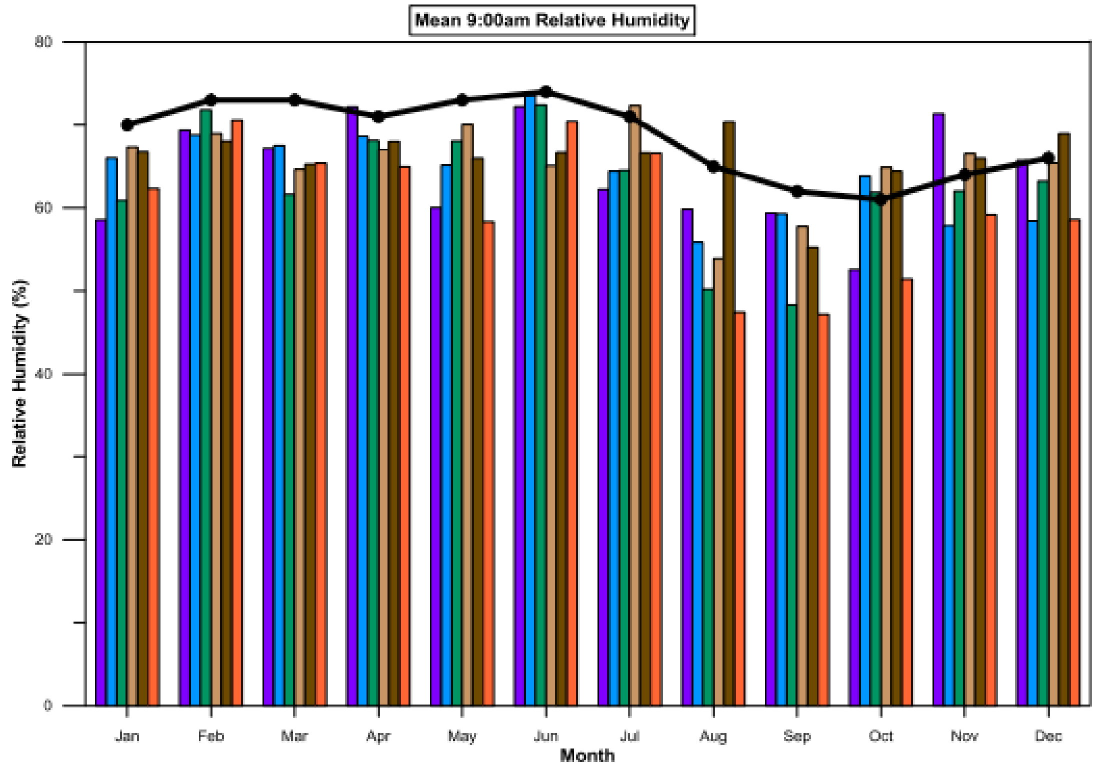
**END OF DOCUMENT**

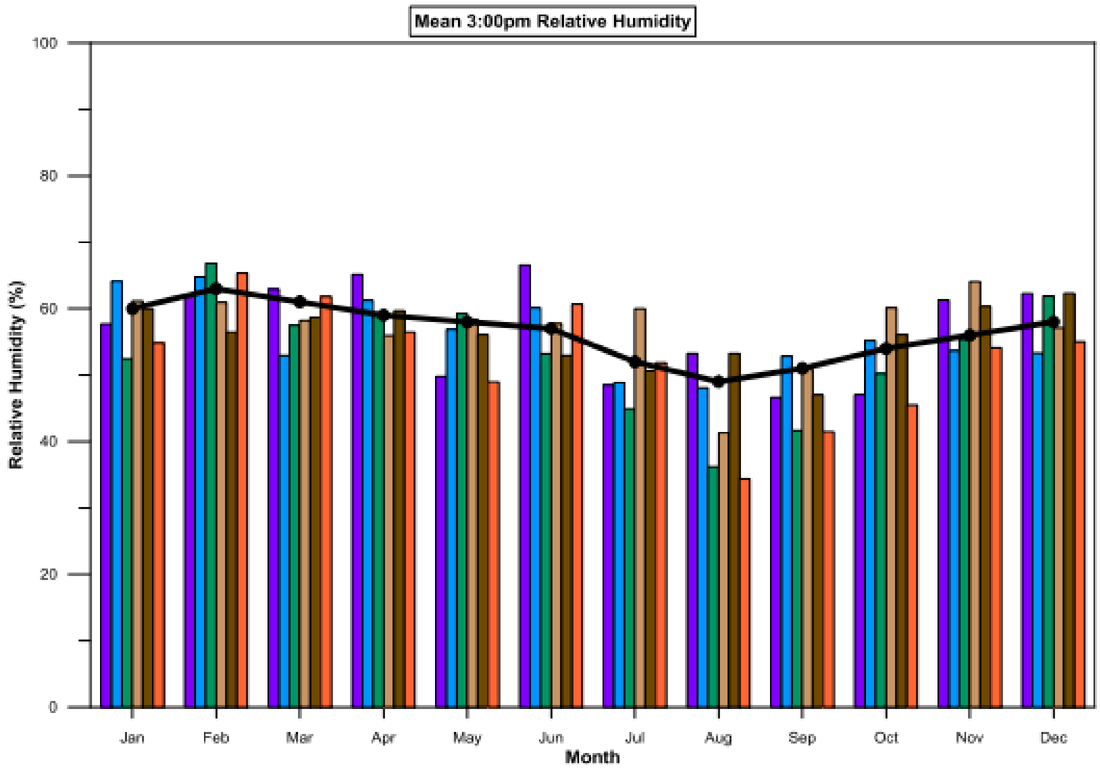
# APPENDIX E

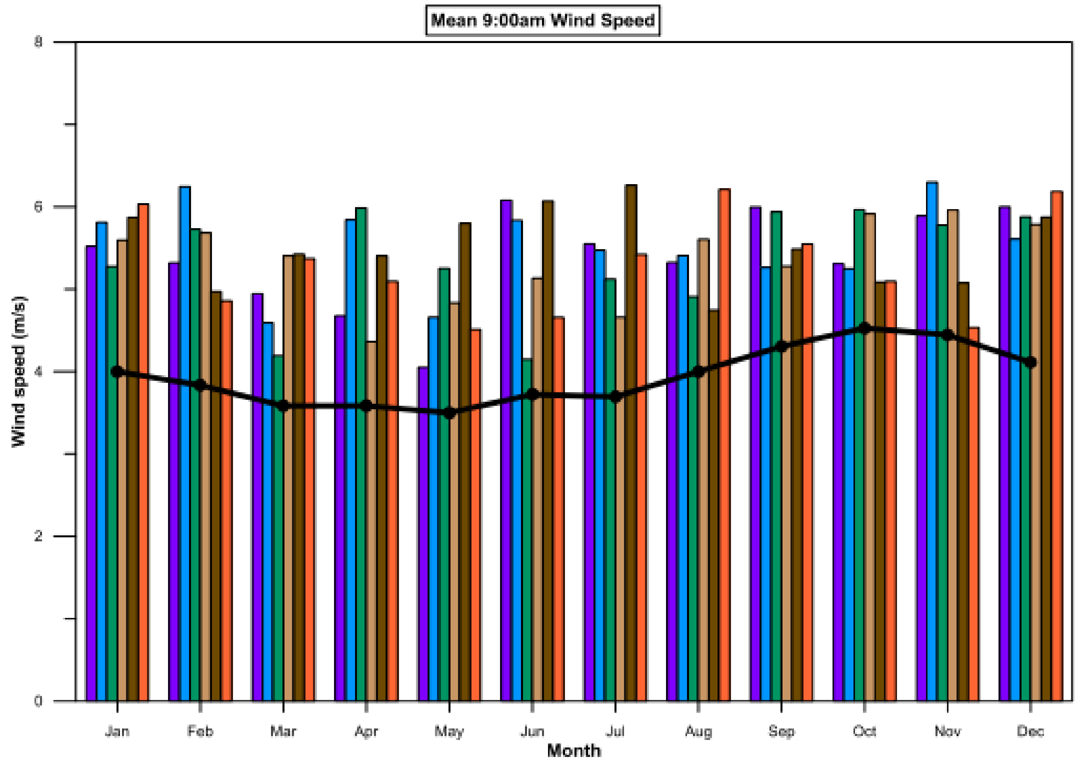
**Meteorological Comparison for Sydney Airport between - 2007, 2008, 2009, 2010, 2011 and 2012**

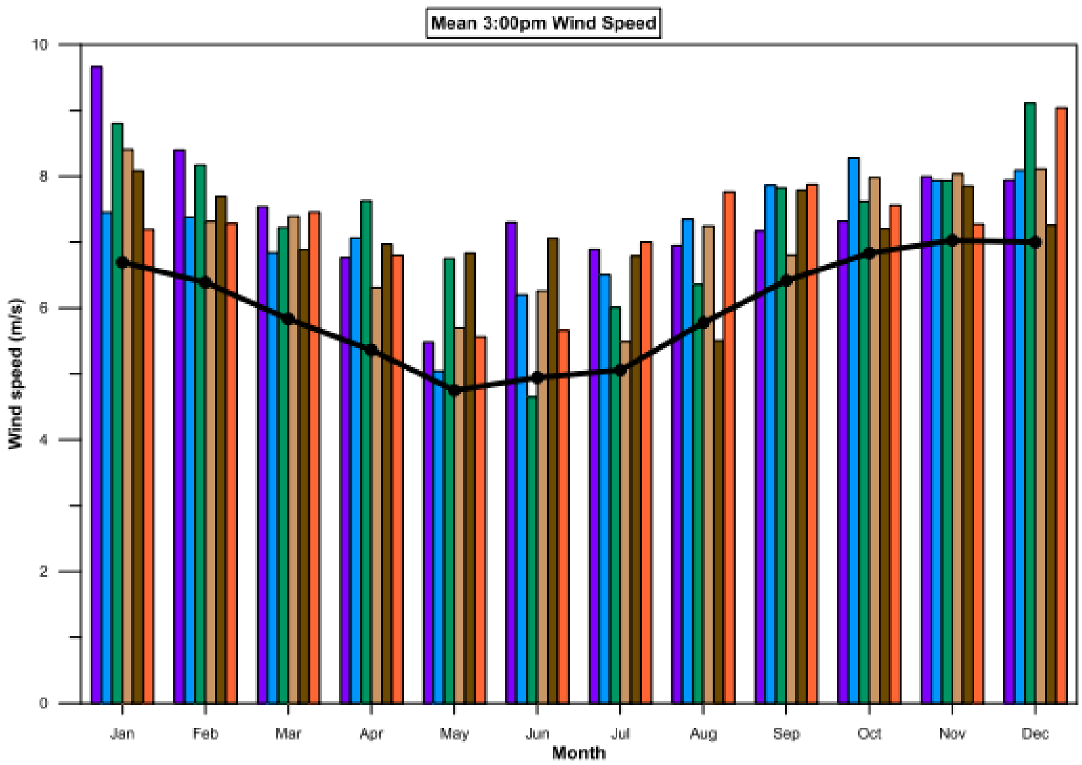

Mean 9:00am Temperature
30
20
10
0
Temperature (°C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

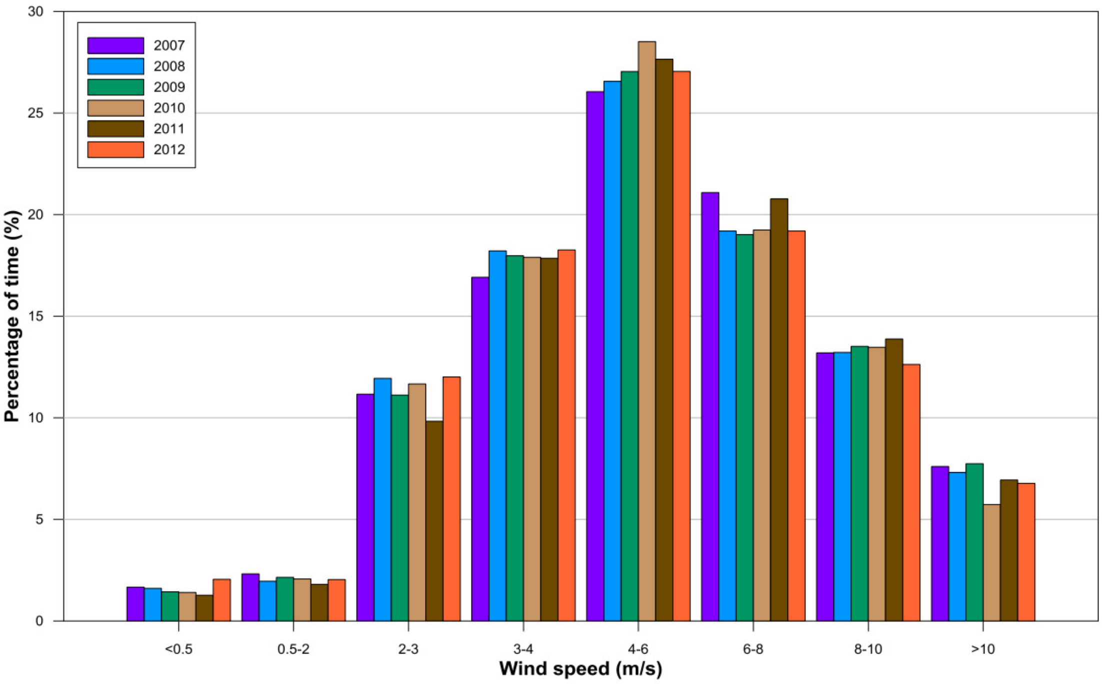

Mean 3:00pm Temperature
30
20
10
0
Temperature (°C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Mean 9:00am Relative Humidity
Relative Humidity (%)
0
20
40
60
80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Mean 3:00pm Relative Humidity
Relative Humidity (%)
0
20
40
60
80
100
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Mean 9:00am Wind Speed
Wind speed (m/s)
0
2
4
6
8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

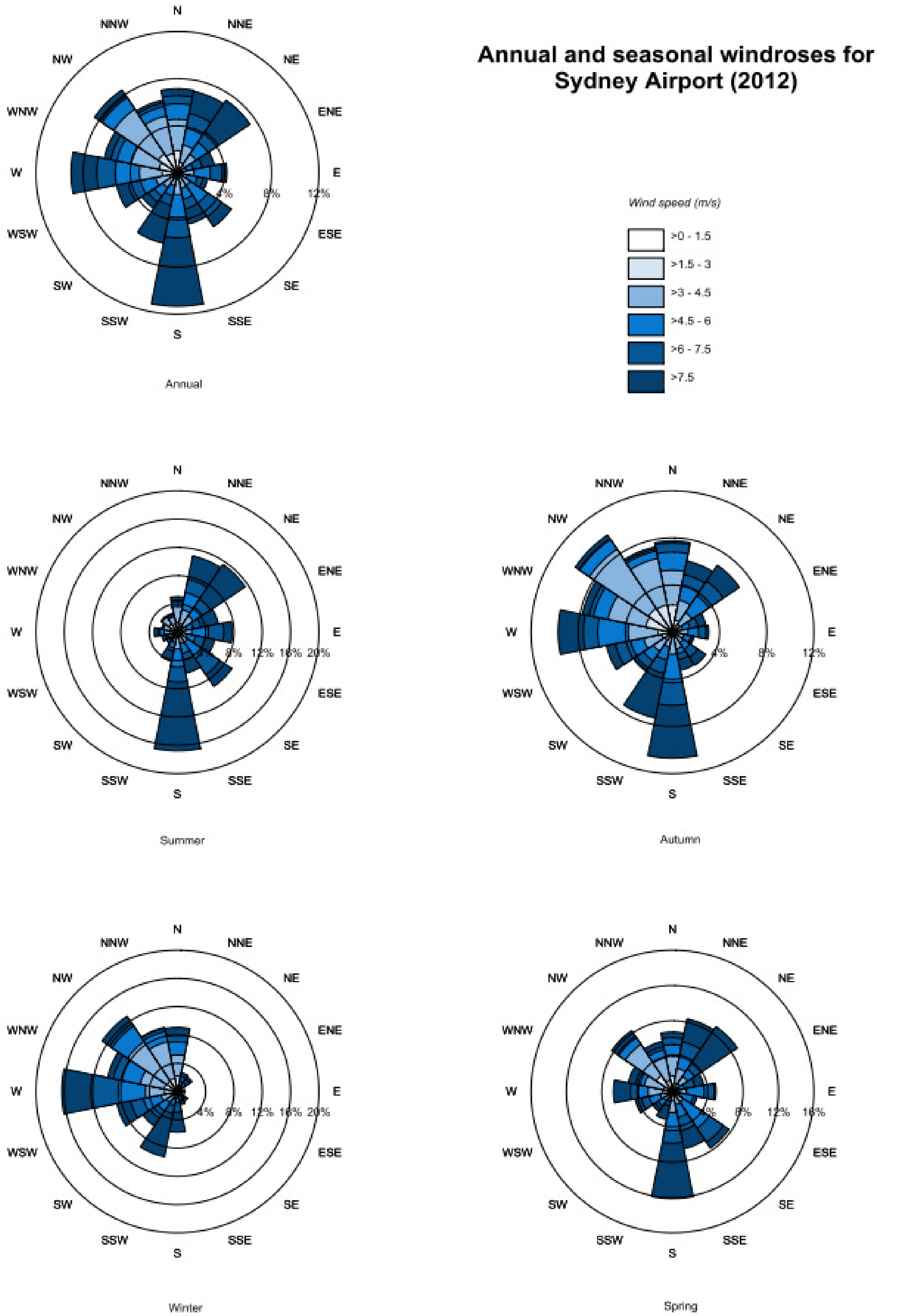

Mean 3:00pm Wind Speed
Wind speed (m/s)
0
2
4
6
8
10
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


30
25
20
15
10
5
0
2007
2008
2009
2010
2011
2012
Percentage of time (%)
<0.5
0.5-2
2-3
3-4
4-6
6-8
8-10
>10
Wind speed (m/s)

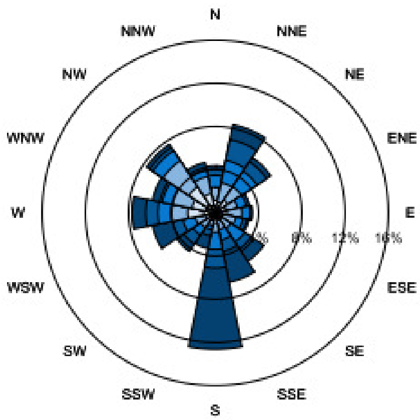
# APPENDIX F

**Wind rose comparison for Sydney Airport, Port Botany, Little Bay and Kurnell meteorological stations**

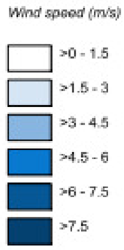
## Annual and seasonal windroses for Sydney Airport (2012)

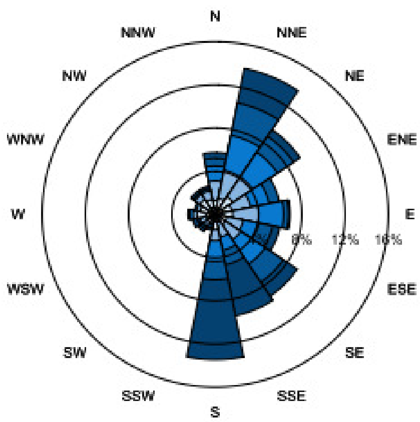


## Annual and seasonal windroses for Port Botany (2012)

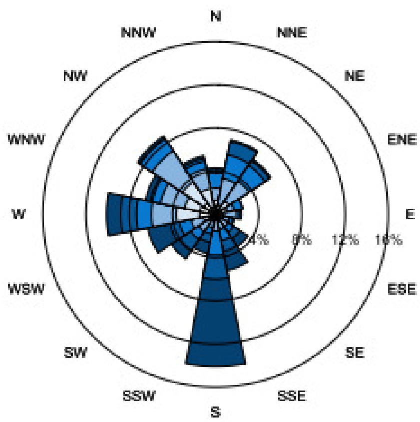



Annual

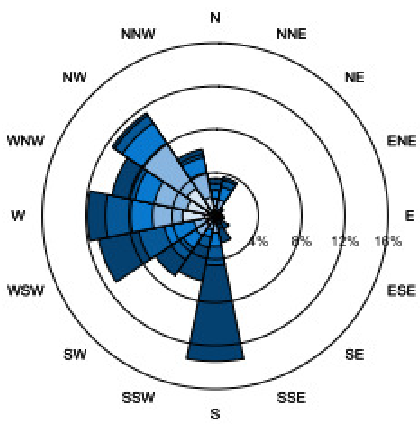


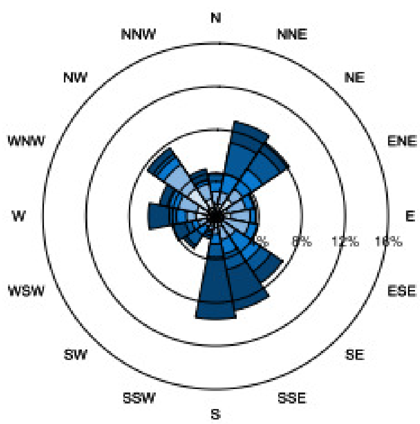

Summer




Autumn



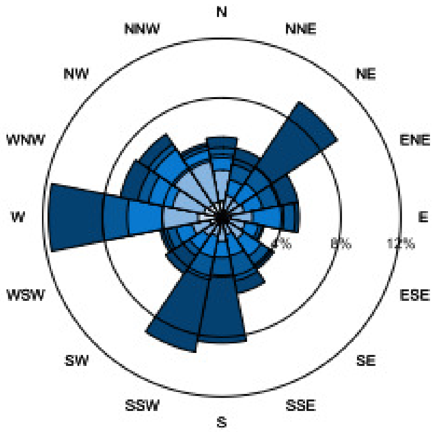

Winter



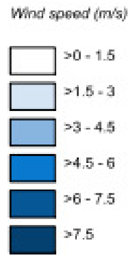

Spring

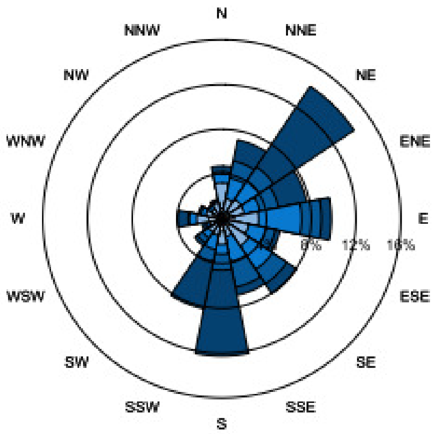
**Annual and seasonal windroses for Little Bay (2012)**

## Annual and seasonal windroses for Kurnell (2012)

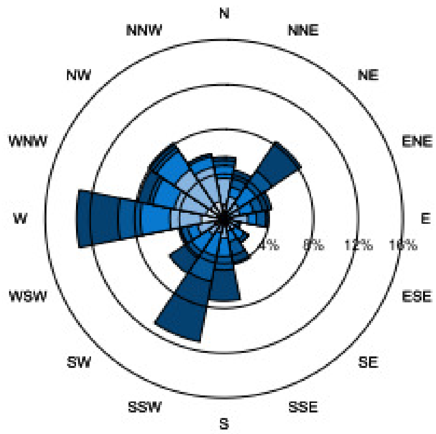



Annual

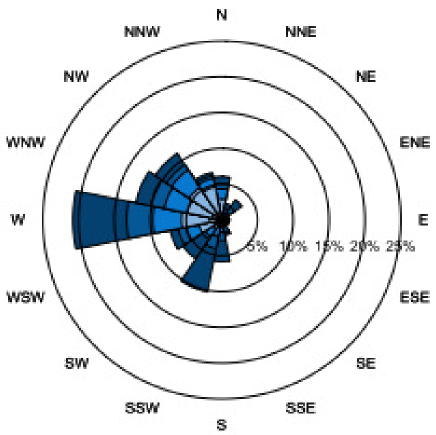


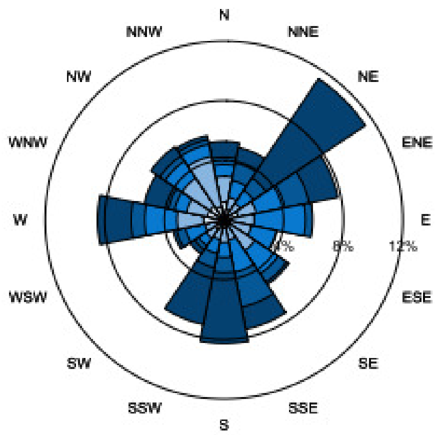

Summer




Autumn




Winter




Spring