Appendix E

Air Quality Impact Assessment

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Glebe Island Multi-User Facility

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Glebe Island Multi-User Facility

Client: Port Authority of NSW

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Executive Summary

In 2013, Sydney Ports Corporation (now Port Authority of NSW) undertook a Part 5 Determination (SPC Reference C13/115) including the preparation of a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act 1979 (NSW)* (the EP&A Act) for a Multi-User Facility at Glebe Island Berths 1 and 2, Sydney, NSW. The REF included an assessment of the potential environmental impacts from proposed operations at Berths 1 and 2 from unloading and loading bulk liquids and dry bulk materials from vessels for vehicle transport offsite and temporary stockpiling of dry bulk materials directly on the wharf deck. Consideration of potential environmental impacts from other ad hoc port related uses and vehicle servicing were also included in the REF. The 2013 REF did not include the installation/operation of a material storage and handing building and did not specifically provide allowance for sand and aggregate to be handled at the facility. The 2013 REF assessed transport impacts, including up to approximately 600 trucks per day (1200 one-way movements) associated with loading/unloading operations occurring at both berths. The movement of ships was also considered in the 2013 REF. Shipping is an existing activity in White Bay and Glebe Island which have operated since the 19th century for water based cargo transport / port facility.

The Port Authority of NSW, (the Port Authority) is now proposing a Multi-User Facility that includes additional bulk material handling equipment and a material storage building for bulk dry construction materials including sand and aggregate at Glebe Island Berths 1 and 2 (the Project).

AECOM have been commissioned by the Port Authority to prepare a REF under Part 5 of the EP&A Act for the Project. As part of the REF a qualitative Air Quality Impact Assessment (AQIA) was undertaken to address the potential construction and operational air quality impacts associated with the proposed Multi-User Facility for bulk dry construction materials primarily sand and aggregates.

Dust impacts from construction works associated with the storage facility were assessed using the semi-quantitative risk assessment methodology provided in the UK Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction*. A pre-mitigation dust impact risk rating of “low” was determined for dust soiling and human health impacts due to potential dust emissions from the Project. This rating was based on the potential dust emission magnitude from the Project, sensitivity of nearby receptors, proximity of receptors, and the sensitivity of the area as a whole to both dust soiling and human health impacts. Residual impacts were considered to be “not significant” once appropriate dust mitigation measures are implemented, in accordance with the post-mitigation reassessment guidance provided in the IAQM.

Operational air quality impacts were assessed qualitatively through the identification of potential air emission sources, factors influencing air dispersion of air pollutants, and the proximity of sensitive receivers to potential sources. Key findings of the assessment were as follows:

- Potential dust emissions from the transfer of bulk material from ship conveyors and mobile stackers would be transient in nature (occurring only when a ship is at berth and unloading). The potential for dust emissions along transfer points would be managed through the implementation of mitigation measures.
- Potential dust emissions from stockpiling activities would only occur during shipment unloading events, when the slot(s) from the storage building would be fully or partially open. The remainder of the time stockpiles would be enclosed within the building with the exception of truck access gates, resulting in a much lower potential for dust emissions when compared to the existing approved method of temporary stockpiling on the wharf deck.
- Combustion pollutant emission impacts are likely to me minimal with a limited inventory of diesel or petrol fuelled mobile equipment used at the facility with larger equipment such as radial stackers and conveyor drawing electricity from the grid.
- Local meteorological data indicates residents to the east to south east (Pyrmont), west (Rozelle) and south west (Glebe Point) are most likely to be impacted by air emissions during unfavourable wind conditions. However given the distance between the source and residential receptors, nature of potential pollutant sources, and local meteorological conditions aiding in dispersion of air pollutants, only minor impacts and nearby receptors would be anticipated.

- There is a potential for cumulative impacts associated the proposed development of Hanson's concrete batching plant adjacent to the Multi-User Facility. Hanson are currently undertaking an Environmental Assessment including an AQIA for the project in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the DP&E.
- There is the potential for cumulative impacts associated with demolition and construction works associated with the Rozelle Interchange as part of the WestConnex M4-M5 Link that would coincide with operation of the Multi-User Facility in 2019. A range of mitigation works have been proposed by RMS to minimise impacts on sensitive receptors during construction of the project.

Provided construction and operational mitigation measures recommended in this report are adopted, no significant air quality impacts are anticipated for the construction and operation of the Multi-User Facility storage facility at Glebe Island.

1.0 Introduction

1.1 Background

In 2013, Sydney Ports Corporation (now Port Authority of NSW) undertook a Part 5 Determination (SPC Reference C13/115) including the preparation of a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act 1979 (NSW)* (the EP&A Act) for a Multi-User Facility at Glebe Island Berths 1 and 2, Sydney, NSW. The REF included an assessment of the potential environmental impacts from proposed operations at Berths 1 and 2 from unloading and loading bulk liquids and dry bulk materials from vessels for vehicle transport offsite and temporary stockpiling of dry bulk materials directly on the wharf deck. Consideration of potential environmental impacts from other ad hoc port related uses and vehicle servicing were also included in the REF. The 2013 REF did not include the installation/operation of a material storage and handing building and did not specifically provide allowance for sand and aggregate to be handled at the facility. The 2013 REF assessed transport impacts, including up to approximately 600 trucks per day (1200 one-way movements) associated with loading/unloading operations occurring at both berths. The movement of ships was also considered in the 2013 REF. Shipping is an existing activity in White Bay and Glebe Island which have operated since the 19th century for water based cargo transport / port facility.

The Port Authority of NSW, (the Port Authority) is now proposing a Multi-User Facility that includes additional bulk material handling equipment and a material storage building, for bulk dry construction materials including sand and aggregate at Glebe Island Berths 1 and 2 (the Project).

AECOM have been commissioned by the Port Authority to prepare a REF under Part 5 of the EP&A Act for the Project. As part of the REF a qualitative Air Quality Impact Assessment (AQIA) was undertaken to address the potential construction and operational air quality impacts associated with the proposed Multi-User Facility for bulk dry construction materials primarily sand and aggregates.
Purpose of Report

The purpose of this report is to provide an AQIA for the potential impacts associated with the proposed Multi-User Facility on Glebe Island for inclusion into the REF.

The report provides a qualitative assessment of the air quality impacts associated with the development and includes:

- A description of the proposed Multi-User Facility.
- A review of local meteorology, climatic conditions and existing air quality.
- A review of nearby sensitive receivers and description of surrounding land use and terrain.
- A qualitative assessment of potential construction impacts using the methodologies outlined in the UK Institute of Air Quality Management (IAQM) documentation *Guidance on the Assessment of dust from demolition and construction 2014.*
- A qualitative assessment of operational impacts of the proposal based on identification of potential sources, factors influencing air dispersion and the proximity of nearby sensitive receptors.
- Recommendations and conclusion.

1.2 Report Framework

The report has been structured in the following sections:

- **Section 1** provides an introduction to the proposal and project history.
- **Section 2** provides a description of the Proposal.
- **Section 3** outlines the relevant air quality criteria in NSW.
- **Section 4** provides a description of local meteorology, climatic conditions, air quality and topography.
- **Section 5** provides an air quality impact assessment of the proposed development.
- **Section 6** provides a summary and conclusions of the report.

2.0 Project Description

2.1 Location

The site for the proposed Multi-User Facility is located at Glebe Island, Sydney, NSW, within the Inner West Council Local Government Area (LGA). The Multi-User Facility is sited on part of Lot 10 on DP 1170710 at Glebe Island Berth 1 and 2, and is located approximately two kilometres west of the centre of the Sydney Central Business District (CBD). The surrounding road network includes Port Access Road, Sommerville Road and James Craig Road.

Surrounding land uses include other port uses, such as gypsum, cement and sugar importation and dispatch at the Glebe Island silos and shed, cruise operations at White Bay Berths 4 and 5 and other port and maritime related uses. The nearest residents are located approximately 250m to the southeast and to the east across Jones Bay in Pyrmont on Bowmans Street and Refinery Drive. Additionally residential properties are located approximately 520m north across White Bay in Balmain, 810m to the west in Rozelle and 500m southwest at Glebe Point. In addition to existing land uses, future changes have been considered including a proposal for a concrete batching plant adjacent to the site and construction of the WestConnex M4-M5 Link.

Hanson Construction Materials Pty Ltd (Hanson) on 8 June 2017 lodged an application for Secretary Environmental Assessment Requirements (SEARs) with the NSW Department of Planning and Environment (DP&E) for a concrete batching plant at the Glebe Island Port facility[1] (SSD 17_8544). The proposal would involve relocation of Hanson's cement manufacturing plant on Bridge Road, Glebe, NSW to Glebe Island and would handle up to 1 million tonnes of concrete aggregates per annum.

Additionally NSW Roads and Maritime Services (RMS) propose to construct and operate the M4-M5 Link which comprises a new tolled multi-lane road link between the proposed M4 East at Haberfield and the Proposed New M5 at St Peters. The project includes interchanges at Lilyfield and Rozelle (Rozelle Interchange) and a tunnel connection between Anzac Bridge and Victoria Road. The Project is a State Significant Infrastructure (SSI) project under Section 115V of the EP&A Act (S11 16_7485)[2].

The location of the proposed Multi-User Facility is shown in **Figure 1**, and **Figure 2** shows the proposed site layout.

[1] Secretary's Environmental Assessment Requirements (SEARs) were issued by the DP&E on 7 July 2017 and Hanson are currently undertaking an Environmental Assessment for the project including an AQIA.
[2] The Environmental Impact Statement (EIS) was placed on Exhibition between 18 August 2017 and 16 October 2017. DP&E are currently collating the submissions received during the exhibition period.

Figure 1 Location of Multi-User Facility

Figure 2 Proposed Site Layout

2.2 Existing and Approved Operations

The Glebe Island Port facility currently consists of four operational shipping births, Glebe Island Berths 1, 2, 7 and 8. Glebe Island Berths 1 and 2 (GI1 and GI2) are operating as a multi-user facility for the unloading/loading of dry goods, as well as other occasional ad hoc port-related uses and laying-up of vessels. This multi-user facility has approval to operate 24 hours per day, seven days per week as required. Existing infrastructure at the site includes a concrete slab, an operational wharf and a range of utilities infrastructure (e.g. stormwater, potable water, fire water, sewerage, electricity). Vehicle access to Glebe Island is currently via James Craig Road and is restricted via a gatehouse and boom gate. Light vehicle parking is located in the southwest portion of Glebe Island.

In 2013, a Part 5 Determination (SPC Reference C13/115) under the EP&A Act was undertaken for the Multi-User Facility (and associated use of GI1 and GI2) and included assessment of the following operations:

- Unloading of dry bulk materials including salt and gypsum.
  - Gypsum would be unloaded from the vessel via crane and grab bucket or conveyor into mobile hoppers and loaded onto trucks for transport offsite.
  - Salt would be unloaded from the vessel via conveyor and either:
    - Temporarily stockpiled on the wharf deck before being loaded to trucks via a front end loader; or
    - Transferred directly from the conveyor to mobile hoppers and loaded onto trucks for transport offsite.
- Unloading of bulk liquids (vegetable oil, fatty acids, tallow and Lubrizol) from vessels to road tankers or river barges via flexible hoses for offsite transport.
- Movement of up to 600 trucks per day.
- Other related uses including maintenance and repair activities, occasional loading and unloading of special cargo (e.g. building materials and waste products) and vessel lay-up at births.

Shipping is an existing activity in White Bay and Glebe Island which have operated since the 19th century for water based cargo transport / port facility.

2.3 Proposed Operations

The Port Authority of NSW, (the Port Authority) is proposing the construction and operation of a Multi-User Facility for the import, storage and distribution of sand and other bulk construction materials on its land on Glebe Island. The project is intended to provide a storage facility for bulk dry construction materials imported via ship and distributed by road in to the Sydney market. Bulk construction materials would particularly be associated with the concrete supply chain primarily including sand and aggregate.

The proposed Multi-User Facility would operate 24 hours per day, seven days per week and would involve:

- An enclosed bulk material storage building consisting of storage bays and a building structure designed to allow products to be conveyor fed through wall/roof slot(s). The building slots(s) would be closed at times when material is not unloaded from the ship. The total storage capacity of the storage structure would be approximately 70,000m^3 distributed in stockpiles over the bays (e.g. 14,000m^3 per bay if it was operated in a five bay arrangement).
- Electrical radial stackers on the wharf edge, with a maximum of two stackers operating at any one time. The stackers would deliver bulk materials directly into the individual storage bays through the building slot(s). Bulk material would be fed into the radial stacker/s from moored ships.
- Truck-loading located internally to the storage building allowing multiple trucks to be loaded. Truck loading would involve the use of front end loader(s). The building and internal operations will be designed to minimise potential for dust and noise emissions.

- A weighbridge located next to the storage building to ensure truck and dogs are loaded to acceptable limits.
- Demountable offices and amenities block. The amenities block would likely be connected to town water and sewerage systems.
- Potentially a multi-user above ground diesel fuel tank of an approximate 20,000L capacity. The storage tank will be bunded (meeting the requirements of AS:1940) with in-built dispensers.
- Operational lighting, connection to existing services and associated plant and equipment.
- Common areas such as access ways and other areas where customer's users may interface with each other.

The facility will be constructed adjacent to GI1 and GI2 allowing for ships with self-discharge slewing conveyors to deliver the product into mobile stackers. The final internal configuration of the storage building would be dependent on demand and commercial arrangements with suppliers.

2.3.1 Ship Unloading

Depending on ship size, ships may take 24-36 hours to unload at an approximate rate of 1500 tonnes per hour. During this period the external stacker(s) would be operational discharging through the building slot(s) into the storage bays. The ship unloading system would discharge directly to the stackers or to intermediate conveyors and then to the stackers.

2.3.2 Vehicle Movements

Truck and dogs and light vehicles would both enter and exit the premises via James Craig Road. Truck loading would occur 24 hours per day 7 days per week and would be internal to the building. Trucks would be loaded by front end loaders. During peak operations up to 20 trucks and dogs per hour would enter site, totalling about 500 vehicle movements (one way) over a 24 hour period. Light vehicle movements are expected to be low, at approximately one vehicle movement per hour (one way).

2.4 Project Staging and Construction

Construction of the Multi-User Facility is expected to take approximately nine months followed by an additional month to commission the site. During construction the footprint of the Multi-User Facility would be enclosed using temporary fencing to minimise offsite impacts. A description of the construction methodology and project staging is provided in **Table 1**, while **Table 2** includes a list of mobile and stationary equipment that would be used during construction.

Table 1 Construction Methodology and Staging

Construction Activity	Description
Site establishment	· Erection of temporary small demountable buildings and amenities block and temporary fencing. · All demountable buildings would be transported by truck and then erected by small mobile crane or flatbed with truck mounted hiab. This would be performed in one mobilisation. · Small concrete footings would be placed below ground and block work would be placed on top of these footings to support the offices and amenities block.
Ground treatment works	· The existing slab would be cut for building footings and services where required, and around the footprint of the proposed building's concrete walls. · The majority of the existing slab would remain in place so minimal excavation would be required. Any required excavation would be approximately 1m deep. · Volume of spoil from excavation activities is approximately 5,000m^3. Material to be excavated in the area at the site are predominantly the existing slab, road base and crushed sandstone. No contamination has been identified at the site. · Spoil generated during excavation of parts of the existing slab would be stockpiled temporarily on site and waste classification of the material would be completed in accordance with NSW EPA Waste Classification Guidelines (EPA, 2014).

Construction Activity	Description
	· Stockpiles of excavated material would be located in the vicinity of the excavation area, away from stormwater drains and vehicle access areas. Controls to manage soil erosion and dust generation will be implemented in accordance with a project specific Construction Environmental Management Plan.
Building slab	· A new slab may be constructed over the existing retained slab, including steel reinforcement placement prior to the placement of the new slab. Alternatively, the retained slab would be protected with engineered structures designed to allow material stockpiling and the operation of the front end loaders.
Off-site fabrication	· Key structural components of the storage facility would be fabricated and then transported to site and erected.
Onsite building	· The bulk material storage building will likely be erected on site using mobile cranes or other suitable equipment. · Cranes would install support columns and a frame before installing wall and roof sheeting. · A portable weighbridge would be installed above the new slab within/near the storage building. No ground penetrating works are anticipated to be required for the weighbridge, but if required these would be minor.
Commissioning including electrical testing	· Installation of electrical components on elevated platform, testing and commissioning of materials handling equipment. · Minor defect rectification works.

Table 2 Construction Equipment List

Construction Activity	Plant and Equipment
Site establishment	Small mobile crane
Ground treatment works	Truck and dogs
	Excavator
	Grader
	Material and delivery trucks
Slab construction	Flatbed truck with crane
	Light delivery vehicles
	10 tonne smooth drum roller
	Material and delivery trucks
	20-40 tonne excavator with rock hammer
	Truck and dogs
	20,000L watercart
	10 tonne pad foot roller
	20 tonne compactor
	Concrete boom pump
	Concrete agitators
Off-Site fabrication	No onsite plant required, however fabricated materials and structures would be transported to site via trucks
Onsite building	Electricity generators
	50 tonne crane

Construction Activity	Plant and Equipment
	Elevated work platform / scissor lift
	Mobile electric welding sets and electric hand tools
	Concrete mixer
	Material and delivery trucks
Commissioning including electrical works testing	Elevated work platform / scissor lift

2.5 Potential Air Emission Sources

Potential pollutants of concern for construction and operation would include dust and combustion products including:

- Total suspended particulates (TSP).
- Particulate matter equal to or less than 10 microns in diameter (PM_{10}).
- Particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$).
- Oxides of Nitrogen (NO_x).
- Carbon Monoxide (CO).
- Sulphur Dioxide (SO_2).

Potential sources of air emissions from operation and construction of the Multi-User Facility excluding vessel and offsite vehicle movements include:

- Air emissions during construction including:
  - Dust emissions from excavation activities; and
  - Combustion emissions from mobile equipment.
- Air emissions during operational activities including:
  - Dust emissions from bulk material stockpiles;
  - Dust emissions from construction materials at loading and unloading transfer points; and
  - Combustion emissions from mobile equipment.

3.0 Assessment Criteria

3.1 Air Quality Criteria

Table 3 summarises the NSW EPA's environmental impact assessment criteria for the pollutants included in the assessment. In general, these criteria relate to the total burden of air pollutants in the air and not just the air pollutants from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts. A discussion of background levels in the study area is provided in **Section 4.3**

Table 3 NSW EPA Air Quality Impact Assessment Criteria (EPA 2017)

Pollutant	Averaging Period	Criteria
Total suspended particulates (TSP)	Annual average	90 mg/m^3
Particulate matter (PM_{10})	Maximum 24-hour average	50 mg/m^3
	Annual average	25 mg/m^3
Particulate matter ($PM_{2.5}$)	Maximum 24-hour average	25 mg/m^3
	Annual average	8 mg/m^3
Carbon monoxide (CO)	Maximum 1-hour average	30 mg/m^3
	Maximum 8-hour average	10 mg/m^3
Sulphur dioxide (SO_2)	Maximum 1-hour average	570 mg/m^3
	Maximum 24-hour average	228 mg/m^3
	Annual average	60 mg/m^3
Nitrogen dioxide (NO_2)	Maximum 1-hour average	246 mg/m^3
	Annual average	62 mg/m^3
µg/m^3 = micrograms per cubic metre		

Potential health and environmental effects for particulate matter, CO, SO_2 and NO_2 are presented in **Section 3.2**.

3.2 Potential Health Impacts and Environmental Effects

The following subsections provide a summary of the Australian Government, Department of the Environment and Energy, National Pollution Inventory (NPI) substance fact sheets for particulates, carbon monoxide, sulphur dioxide and nitrogen dioxide. The NPI fact sheets describe the potential environmental and health effects of pollutants of concern.

3.2.1 Particulate Matter (PM_{10} and $PM_{2.5}$)

Health Impacts

Particles within the PM_{10} fraction generally enter the body via inhalation. In the lungs particles can have a direct physical effect and/or be absorbed into the blood. Airborne particulate matter can be generated by vehicles from direct emissions from the burning of fuels (especially diesel powered vehicles) and from wear of tyres or vehicle-generated air turbulence on roadways. Particles may also be generated from earthworks, wind erosion, and construction activities.

The factors that may influence the health effects of exposure to particles include:

- The chemical composition and physical properties of the particles.
- The mass concentration of the airborne particles.
- The size of the particles (smaller particles may be associated with more adverse effects due to increased likelihood of deep inhalation into the lungs).

- The duration of exposure (acute and long term).

Potential health effects include irritation of mucous membranes, toxic effects by absorption of the toxic material into the blood and increased respiratory symptoms, aggravation of asthma and premature death. The risks are highest for sensitive groups such as the elderly and children.

Environmental Impacts

PM_{10} particles are easily entrained into the air by wind or disturbances. Airborne particulate matter may also react with other substances in the atmosphere, reduce visibility, increase the possibility of precipitation, fog and clouds and reduce solar radiation. Additionally, particulate matter may cause similar respiratory impacts in animals as to humans.

3.2.2 Carbon Monoxide

Health Impacts

Carbon monoxide can enter the body by inhalation and be rapidly absorbed by the bloodstream from the lungs. Typical levels in urban and rural areas are however, unlikely to cause ill effects. People can be exposed to CO through using malfunctioning equipment and using poorly vented vehicles.

Acute exposure to levels of 200 parts per million (ppm) or more for two to three hours can lead to headache, dizziness, light-headedness and fatigue. Exposure to higher concentrations (for example 400 ppm or more) of CO can cause sleepiness, hallucinations, convulsions, collapse, loss of consciousness and even death. It can also cause personality and memory changes, mental confusion and loss of vision.

Extremely high exposures to carbon monoxide can cause the formation of carboxyhaemoglobin and decrease the body's ability to transport oxygen. This can cause a bright red colour to the skin and mucous membranes causing trouble breathing, collapse, convulsions, coma and possibly death.

Long term (chronic) health effects can occur from exposure to low levels of carbon monoxide. These effects may produce heart disease and damage to the nervous system. Exposure of pregnant women to carbon monoxide may result in low birth weights and other defects in the offspring.

Environmental Impacts

Carbon monoxide, through complex atmospheric chemical reactions, can affect the amount of other greenhouse gases, which are linked to climate change. Additionally, high levels of CO may cause adverse health impacts for birds and animals, similar to the effects are experienced by humans, although high levels are unlikely to be experienced in rural environments, except in extreme events such as bushfires.

3.2.1 Sulphur Dioxide

Health Impacts

SO_2 may be inhaled or absorbed through the skin. SO_2 is a common pollutant to which we are exposed at very low levels every day by breathing air in cities and some industrial environments. Higher exposure levels are more likely to be found in the workplace where it is produced as a by-product, such as in smelting and the combustion of coal or oil.

Exposure to concentrations of 10 to 50 ppm for 5 to 15 minutes causes irritation of the eyes, nose and throat, choking and coughing. Exposure of the eyes to liquid SO_2 can cause severe burns, resulting in the loss of vision. On the skin it produces burns. Other health effects include headache, general discomfort and anxiety. Those with impaired heart or lung function and asthmatics are at increased risk. Repeated or prolonged exposure to moderate concentrations may cause inflammation of the respiratory tract, wheezing and lung damage. It has also proved to be harmful to the reproductive systems of experimental animals and caused developmental changes in their newborn.

Environmental Impacts

Sulphur dioxide in the atmosphere is absorbed by soils and plants. It is also captured within and below clouds and in certain circumstances may raise the acidity of the resultant rain. Even low concentrations of SO_2 can harm plants and trees and reduce crop productivity. Higher levels, and especially the acidic deposits from acid rain, will adversely affect both land and water ecosystems.

3.2.2 Nitrogen Dioxide

Health Impacts

Nitrogen oxides (NO_x) emitted from combustion sources are comprised mainly of nitric oxide (NO, approximately 95% at the point of emission) and nitrogen dioxide (NO_2, approximately 5% at the point of emission). Nitric oxide is much less harmful to humans than NO_2 and is not generally considered a pollutant with health impacts.

NO_x may be inhaled or absorbed through the skin. People who live in areas of high motor vehicle usage may be exposed to higher levels of nitrogen oxides. Acute exposure to low levels of NO_2 can irritate eyes, nose, throat and lungs, possibly leading to coughing, shortness of breath, tiredness and nausea. Exposure can also result in a build-up of fluid in the lungs for one to two days after exposure. Breathing high levels of NO_2 can cause rapid burning, spasms and swelling of tissues in the throat and upper respiratory tract, reduced oxygenation of tissues, a build-up of fluid in the lungs, and in extreme cases death.

Environmental Impacts

Excessive levels of the NO_x, particularly NO_2, can cause death in plants and roots and damage the leaves of many agricultural crops. NO_2 is the damaging component of photochemical smog. Excessive levels increase the acidity of rain (lower the pH), and thus lower the pH of surface and ground waters and soil. The lowered pH can have harmful effects, possibly even death, on a variety of biological systems.

In the atmosphere, NO_x are rapidly equilibrated to NO_2, which eventually forms acid rain. In the stratosphere, oxides of nitrogen play a crucial role in maintaining the levels of ozone. Concern with nitric oxide relates to its transformation to nitrogen dioxide and its role in the formation of photochemical smog.

4.0 Existing Environment

4.1 Meteorology

Meteorology in the area surrounding the Multi-User Facility is affected by several factors such as terrain and land use. Wind speed and direction are largely affected by topography at the small scale, while factors such as synoptic scale winds affect wind speed and direction on the larger scale. Wind speed and direction are important variables in assessing potential air quality impacts, as they dictate the direction and distance air pollutant plumes travel.

The Bureau of Meteorology (BoM) operates a network of meteorological monitoring stations around the country. The closest BoM station to the site is located at Observatory Hill (Station number: 066062) approximately 2.3km east of Glebe Island. The Observatory Hill station records temperature, rainfall, humidity and sea level pressure. Wind speed and wind direction are no longer recorded at this station due to removal of the sites anemometer in April 1992. As such local wind data is generally taken from the BoM station at Fort Denison (Station number: 066022) located 3.8km northeast from the site.

In addition to BoM data two additional monitoring stations that record wind direction and wind speed are located closer to the site. The NSW OEH air quality and meteorology monitoring station at Rozelle, approximately 2.2km north northwest of Glebe Island and the air quality monitoring station installed by the Port Authority in 2015 on the corner of Adolphus Street and Grafton Street, Balmain. Both the EPA and the Port Authority monitoring stations are not fully compliant with *AS/NZS 3580.1.1:2007 - Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*, (due to the presence of trees within 20m of the station). Wind data from the Fort Denison station (Station number: 066022) has been used in this report. Long term wind speed and wind direction data from the Observatory Hill station is discussed in **Table 4** and wind roses for Observatory Hill and Rozelle are presented in **Appendix A**.

Annual and seasonal wind roses for the Fort Denison monitoring station showing wind speed and wind direction data recorded between 2013 and 2015 are presented in **Figure 3** to **Figure 4**. It can be seen from **Figure 3** on an annual basis, west to west north westerly winds occur most frequently. The annual average wind speed is moderate at 4.3 metres per second (m/s) and calm conditions (wind speeds of less than 0.5m/s) occur less than one percent of the time.

During autumn through to spring the dominant wind direction is from the west to west northwest, with a high frequency of northeast to easterly winds also occurring during spring. During the winter months the predominant wind direction is from the northwest (refer to **Figure 4)**. Similar to the annual trend seasonal average wind speeds are also moderate with only small changes observed seasonally. The highest seasonal average occurs during summer at 4.5m/s and the lowest during autumn at 4.1m/s. Average wind speeds during winter and spring were found to be 4.2m/s and 4.3m/s respectively.

When viewing both **Figure 3** and **Figure 4** it can be seen that there are limited records of west to south westerly winds recorded at the monitoring station. Here the frequency of west to south westerly readings from the Rozelle monitoring station are misrepresented due to topographical features in the area and the presence of several large fig trees within 20 meters to the west of the station. This is further discussed in **Appendix A**.

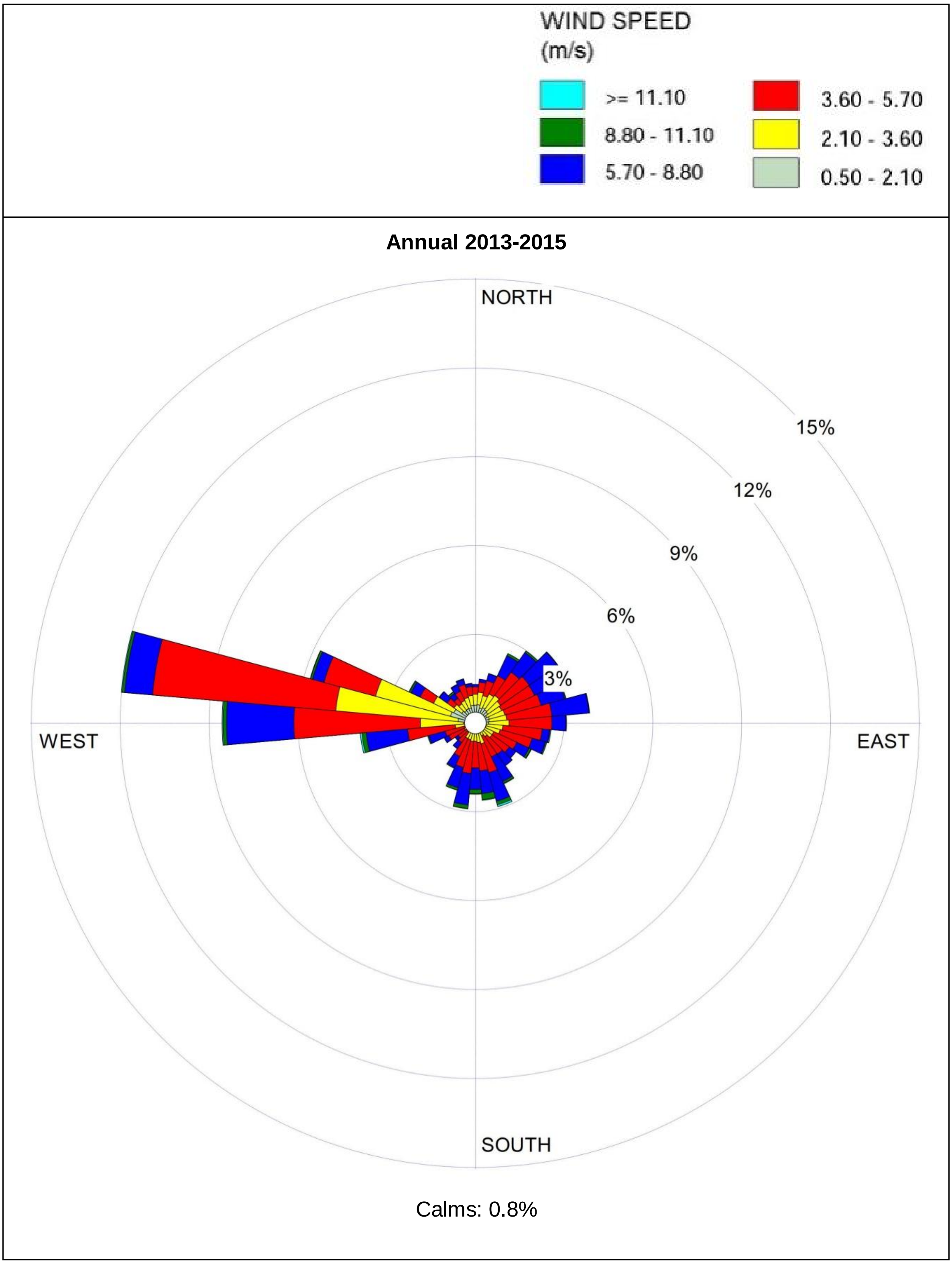

Figure 3 OEH Annual Wind Roses for Rozelle (2013 to 2015) (OEH 2016)

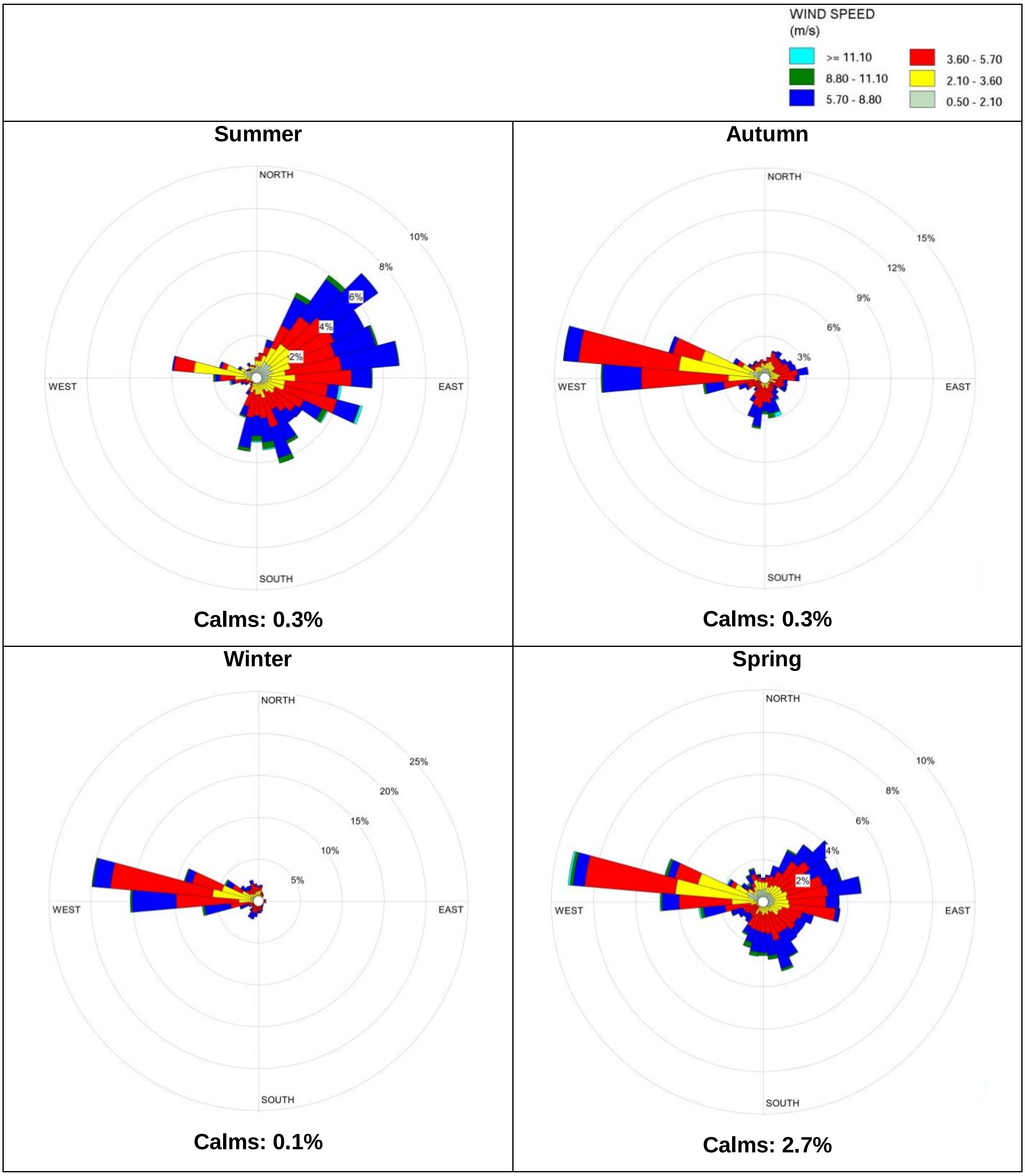

Figure 4 OEH Seasonal Wind Roses for Rozelle (2013 to 2015) (OEH 2016)

4.2 Local Climate

The BoM meteorological station at Observatory Hill records climate data for a range of meteorological parameters including, temperature, humidity, rainfall, wind speed and wind direction. Temperature, humidity and rainfall data are currently collected at Observatory Hill, while wind speed and wind direction data for the monitoring location have only been recorded up until April 1992 when the sites site anemometer was decommissioned. A summary of the long-term data recorded at this station between 1955 and 2017 is shown in **Table 4**.The data provide an indication of the regional climate of the area. Long term wind roses for Observatory Hill are provided in **Appendix A**.

Table 4 Climate Summary, BOM Monitoring Station at Observatory Hill, 1955 to 2017

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (°C)	26.0	25.8	24.8	22.5	19.5	17.0	16.4	17.9	20.1	22.2	23.7	25.2
Mean minimum temperature (°C)	18.7	18.8	17.6	14.7	11.6	9.3	8.1	9.0	11.1	13.6	15.7	17.5
Mean rainfall (mm)	102	118	131	129	119	133	97	81	68	76	84	78
Decile 5 (median) rainfall (mm)	80	94	101	98	91	103	73	55	53	55	67	60
Mean number of days of rain ≥ 1 mm	9	9	10	9	9	9	8	7	7	8	8	8
Mean number of clear days	7	5	7	9	10	9	12	13	11	8	6	7
Mean number of cloudy days	13	13	13	11	11	11	9	8	9	11	13	13
Mean 9am temperature (°C)	22.5	22.3	21.1	18.2	14.6	11.9	10.9	12.5	15.7	18.5	19.9	21.6
Mean 9am relative humidity (%)	71	74	74	72	74	74	71	66	62	61	66	67
Mean 9am wind speed (km/h)	8.6	8.2	7.9	8.8	10.5	11.9	13.1	13.3	12.4	12.2	11.0	9.8
Mean 3pm temperature (°C)	24.8	24.9	24.0	22.0	19.4	16.9	16.4	17.5	19.2	20.7	22.1	23.8
Mean 3pm relative humidity (%)	62	64	62	59	57	57	51	49	51	56	58	59
Mean 3pm wind speed (km/h)	17.9	16.8	15.2	13.8	12.7	13.6	15.3	17.6	18.3	19.1	19.4	19.5

As shown in **Table 4**, the warmest temperatures occur during the summer months, with the highest average maximum temperature (26.0°C) occurring in January. July is the coldest month, with a recorded average minimum temperature of 8.1°C. June is the wettest month, with an average rainfall of 133 millimetres, while September is driest month with an average rainfall of 68 millimetres. Humidity follows a diurnal cycle, with higher humidity in the morning compared to the afternoon. Wind speeds are higher in the afternoon compared to the morning, with the highest average wind speeds occurring in December (19.5 km/h).

4.3 Existing Air Quality

The NSW EPA operates a network of air quality monitoring stations around the site. The closest stations to the site are located in the grounds of Rozelle Hospital approximately 2.2km north northwest of Glebe Island. The monitoring site is surrounded by medium- to high-density residential and commercial developments and is close to major arterial roads. Air quality recorded at this station is considered to be generally representative of air quality at the Project site. Particulates (PM_{10} and $PM_{2.5}$), NO_2, CO and SO_2 are monitored at the Rozelle monitoring station. In addition to the OEH monitoring station at Rozelle, the Port Authority installed a monitoring station in September 2015 on the corner of Adolphus Street and Grafton Street, Balmain as discussed in **Section 4.2**. The monitoring station was installed to monitor ambient air quality in the immediate vicinity of the White Bay Cruise Terminal (WBCT) and monitors SO_2 and $PM_{2.5}$.

Ambient air quality data collected at Rozelle for the last three complete years is presented in **Table 5**. Ambient air quality data provided by Pacific Environment Pty Ltd (Pacific Environment) between September 2015 and August 2017 for averaging periods of 24 hours or less and rolling annual averages for the Grafton Street monitoring station are shown in **Table 6** and **Table 7** respectively.

Table 5 details the existing background pollutant concentrations for the study area. It can be seen from **Table 5** that for NO_2, CO and SO_2 existing ground level concentrations are well below the relevant ambient air quality criteria for all averaging periods. Similarly the maximum 10 minute, 1 hour and 24 hour SO_2 concentrations (refer to **Table 6**) and annual averages (refer to **Table 7**) recorded in Balmain were well below EPA criteria for ground level SO_2 concentrations.

For particulates annual averages recorded for PM_{10} and $PM_{2.5}$ recorded at Rozelle were below EPA criteria, however the exceedances were recorded for both particle fractions over the 24-hour averaging period (refer to **Table 5**). For PM_{10} one exceedance of the 24-hour average occurred in 2015 (60.3µg/m^3) and one in 2016 (58.8µg/m^3), with the second highest recorded maximums for each year falling below the criterion of 50µg/m^3 with recorded values of 44µg/m^3 and 49.6µg/m^3 respectively. There were no exceedances of the 24-hour average during 2014. The annual average for PM_{10} at Rozelle from 2014 to 2016 was found to be less than 60 percent of the OEH criterion of 30µg/m^3

At the OEH Rozelle monitoring station, for $PM_{2.5}$ one exceedance of the 24-hour average occurred in 2015 (33.4µg/m^3) and six exceedances in 2016 (49.4µg/m^3). No $PM_{2.5}$ data was recorded for 2014 and data capture for 2015 was limited to 77.5 percent of the year. Similarly in Balmain six exceedances of the 24 hour maximum $PM_{2.5}$ concentration occurred in 2016, five exceedances occurred during May 2016 and an additional two exceedances in October 2016. Exceedances of the 24 hour criterion in May were likely attributed to back burning events across the Sydney Basin (PE 2016a). Similarly elevated $PM_{2.5}$ concentrations in October were recorded at Rozelle at the same time as the two exceedances recorded in October in Balmain (PE 2016b). The annual average for $PM_{2.5}$ at Rozelle for both 2015 and 2016 was found to be close to the OEH criterion of 8µg/m^3 (refer to **Table 5**). Annual averages between September and August 2015-16 and 2016-17 at Balmain (refer to **Table 7**) were also elevated with annual average particulate concentrations above the EPA criterion of 8µg/m^3).

Pacific Environment, which operates the Grafton Street (Balmain) monitoring station on behalf of Port Authority, has indicated that the station has not been sited to be an urban background site (as OEH Rozelle is). It further notes that the station collects data for a specific purpose and should not be evaluated as representative of an urban background site (i.e. they are likely to be impacted by a number of local sources including domestic wood burning, periodic vehicle emissions, etc.). It is also noted that OEH operate a different type of Beta Attenuation Monitor (BAM) at their Rozelle site than the Port Authority operates at its Balmain site. Whilst both are approved instruments, there are inherent differences in the ways in which they operate that can result in material differences when looking at long term data (e.g. annual averages).

Table 5 Ambient Pollutant Concentrations Recorded at OEH Rozelle Air Quality Monitoring Station during 2014-2016

Pollutant	Averaging Period	Concentration (µg/m³)			EPA Criteria (µg/m³)
		2014	2015	2016	
PM_{10}	Max 24-hour average	43.8	**60.3**	**58.8**	50
	Annual Average	17.8	16.7	16.8	25
$PM_{2.5}$	Max 24-hour average	No data	**33.4**[1]	**49.4**	25
	Annual Average	No data	7.2[1]	7.4	8
NO_2	Max 1-hour average	112.8	123	102.5	246
	Annual Average	22.6	22.6	22.6	62
CO	Max 8-hour average	1,375	1,375	1,500	10,000
SO_2	Max 1-hour average	No Data	80.1[2]	57.2	570
	Max 24-hour average	No Data	14.3[2]	14.3	228
	Annual Average	No Data	2.9[2]	2.9	60

1. No $PM_{2.5}$ data recorded at Rozelle between 1 Jan 2014 and 17 March 2015. Data capture 77.5% for 2015.
2. No SO_2 data recorded at Rozelle between 1 Jan 2014 and 27 February 2015. Data capture 82.2% for 2015

Table 6 Ambient Pollutant Concentrations Recorded at Balmain WBCT Monitoring Station 2015-2017 (PE 2017)

Pollutant	Averaging Period	Concentration (µg/m³)			EPA Criteria (µg/m³)
		2015[1]	2016	2017[2]	
$PM_{2.5}$	Max 24-hour average	18	**68**	**48**	25
SO_2	Max 10 minute average	491	200	145	712
	Max 1-hour average	305	84	71	570
	Max 24-hour average	62	18	9	228

1. $PM_{2.5}$ and SO_2 data recorded between 1 Sept 2015 and 31 December 2015. Data capture approximately 33% for 2015.
2. $PM_{2.5}$ and SO_2 data recorded between 1 Jan 2017 and 31 August 2017. Data capture approximately 55% for 2017.
Note: Rolling annual averages from

Table 7 Annual Averages Recorded at Balmain WBCT Monitoring Station Sept 2015 to August 2017 (PE 2017)

Pollutant	Concentration (µg/m³)		EPA Criteria (µg/m³)
	Sept 2015 to Aug 2016	Sept 2016 to Aug 2017	
$PM_{2.5}$	**9.91**	**9.50**	8
SO_2	0.98	1.18	60

4.4 Terrain and Land Use

Figure 5 shows a three dimensional representation of the local terrain. Terrain data were captured from NASA's Shuttle Radar Topography Mission (SRTM), which produces terrain information for the entire globe. For Australia, terrain data are available at approximately 90m resolution (3-arc seconds).

The terrain surrounding the study area is generally low lying and gently undulating with higher elevations to the east towards Sydney CBD and west of the site towards Rozelle (refer **Figure 5**). The Project site is generally flat with the existing pavement ranging from RL 2.9m to RL 2.4m AHD (Douglas Partners, 2017). Glebe Island is bound by White Bay to the north, Jones Bay to the east and Rozelle and Blackwattle Bay to the south, forming part of Sydney Harbour.

Figure 5 Terrain

As discussed in **Section 2.1** existing land uses in the area include other port related uses including gypsum, cement and sugar importation and dispatch at the Glebe Island silos and shed, cruise operations at White Bay Berths 4 and 5 and other port and maritime related uses. There is also a proposal by Hanson Construction Materials Pty Ltd for a concrete batching plant to be located immediately west of the Multi-User Facility (SSD 8544) (refer **Figure 2**).

The nearest residents are located approximately 250m to the southeast and to the east across Jones Bay in Pyrmont on Bowmans Street and Refinery Drive. Waterfront Park is also located on Bowmans Street. Residents are also located approximately 520m north across White Bay in Balmain, 810m to the west in Rozelle and 500m southwest at Glebe Point.

5.0 Impact Assessment

The following subsections provide a semi-quantitative (construction) and qualitative (operation) assessment of the potential ground level air quality impacts of the Proposal. Potential construction impacts are assessed in **Section 5.1** and operational impacts are assessed in **Section 5.1.5**.

5.1 Potential Construction Impacts

5.1.1 Methodology Overview

A semi-quantitative risk assessment of potential dust impacts on surrounding sensitive receptors was undertaken for the construction phase of the Project. The assessment was based on the methodology described in the UK Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction*. The risk of dust soiling and human health impacts due to particulate matter (PM_{10}) on surrounding areas were determined based on the scale of activities and proximity to sensitive receptors. The IAQM method uses a four-step process to assess dust impacts:

- Step 1: Screening based on distance to nearest sensitive receptors.
- Step 2: Assess risk of dust impacts from activities based on:
  - Scale and nature of the works, which determines the potential dust emission magnitude; and
  - Sensitivity of the area.
- Step 3: Determine site-specific mitigation for dust-emitting activities.
- Step 4: Reassess risk of dust impacts after mitigation has been considered.

5.1.2 Step 1: Screening Assessment

The IAQM method recommends further assessment of dust impacts for construction activities where sensitive receptors are located closer than:

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

There are a number of sensitive receptors located within 350m of the boundary of the Project site and therefore further assessment of dust impacts was undertaken for the Project.

5.1.3 Step 2: Risk Assessment of Unmitigated Impacts

5.1.3.1 Step 2A: Dust Emission Magnitude

Dust emission magnitudes are estimated according to the scale of works being undertaken and other considerations such as meteorology, types of material being used, or general construction methodology. The IAQM guidance provides examples to aid classification and these are presented in **Appendix B**.

Potential dust emission magnitudes for the Project were estimated based on the IAQM examples listed in **Appendix B**. Justification and the factors used in determining the magnitudes are presented in **Table 8**.

Table 8 Dust Emission Magnitudes in Accordance with IAQM Guidance

Activity	Potential Dust Emission Magnitude	Justification
Demolition	NA	No demolition of buildings anticipated during construction.
Earthworks	Medium	· Proposed development footprint is approximately 13,000m^2, with excavation works limited to a portion of the site; including excavation (up to depth of 1m) at building footings and for service installation (Refer to Section 4.4 of the REF). Where

Activity	Potential Dust Emission Magnitude	Justification
		possible the existing slab would be retained. · Approximately 5,000m^3 of excavated material would be generated. · Earthmoving vehicles would potentially include concrete cutting equipment, an excavator with rock breaker, pad foot roller, smooth drum roller and compactor. · Materials to be excavated at the site are predominantly the existing slab, road base and crushed sandstone (refer to borelogs in Appendix F of the REF).
Construction	Medium	· The construction of a ship offloading and despatch building and associated small office and amenities block. · Assumed no onsite concrete batching. Concrete agitator movements on and offsite approximated at 30 movements per day (worst case scenario assuming that a new slab is constructed, on top of the existing slab, for the proposed building). · Assumed construction materials have low dust generating potential (e.g. steel, cladding).
Trackout	Medium	· Total number of outward truck movements per day expected to be approximately between 10-50 based on up to 10 truck and dogs (miscellaneous equipment), up to 30 concrete agitator movements and 10 truck earth moving equipment. · Access to site via paved road (James Craig Road), Glebe Island is currently largely hardstand area, thus low potential for wheel generated dust.

5.1.3.2 Step 2B: Sensitivity of the Surrounding Area

The IAQM methodology allows the sensitivity of an area to dust soiling, human health impacts due to PM_{10}, and ecological effects to be classified as high, medium, or low. Surrounding vegetation is limited to roadside vegetation within 100m from the bulk of dust-emitting activities are likely to take place. The sensitivity of the surrounding area due to ecological effects was therefore not assessed further. The classifications are determined according to matrix tables provided in the IAQM guidance document. Individual matrix tables for dust soiling and human health impacts are provided. Factors used in the matrix tables to determine the sensitivity of the surrounding area are described as follows:

- Receptor sensitivity (for individual receptors in the area):
  - High sensitivity – locations where members of the public are likely to be exposed to elevated concentrations of PM_{10} for eight hours or more in a day. For example private residences, hospitals, schools, or aged care homes;
  - Medium sensitivity - places of work where exposure is likely to be eight hours or more in a day;
  - Low sensitivity – locations where exposure is transient – i.e. one or two hours maximum. For example parks, footpaths, shopping streets, playing fields.
- Ambient annual mean PM_{10} concentrations (only applicable to the human health impact matrix).
- Number of receptors in the area (categorised as 1-10, 10-100 or >100).
- Proximity of receptors to dust sources based on radii of 20m, 50m 100m and 350m from the source.

According to the IAQM guidance listed above, the overall sensitivity of the Project area to both dust soiling and human health impacts is classified as low. The justification for this classification is provided in **Table 9**.

Table 9 Sensitivity of the Area in Accordance with IAQM Guidance

Potential Impact	Sensitivity of the Area	Justification
Dust Soiling	Low	No high-sensitivity receptors (residential) within 20m of the Project boundary. >100 high-sensitivity receptors (residential) within 350m of the Project boundary (refer **Section 4.3**).
Human Health (PM_{10})	Low	No high-sensitivity receptors (residential) within 20m of the Project boundary. >100 high-sensitivity receptors (residential) within 350m of the Project boundary Annual average PM_{10} concentration in the area between 16µg/m^3 and 18µg/m^3 which is below the EPA criterion of 25 µg/m^3(refer **Section 4.3**)

5.1.3.3 Step 2C: Unmitigated Risks of Impacts

The dust emission magnitudes for each activity in **Section 5.1.3.1** were combined with the sensitivity of the area in **Table 9** to determine the risk of construction dust air quality impacts, with no mitigation applied. The risk of impacts for each activity is assessed according to the IAQM risk matrix methodology. An example of the IAQM earthworks risk matrix is provided in **Table 10**. The without mitigation dust risk impacts for each activity are summarised in **Table 11**.

Table 10 Example IAQM Risk Matrix - Earthworks

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

Table 11 Summary of Project Dust Risks

Potential Impact	Risk of Dust Impacts on Sensitive Receptors – Without Mitigation			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	NA	Low Risk	Low Risk	Low Risk
Human Health (PM_{10})	NA	Low Risk	Low Risk	Low Risk

The outcome of the semi-quantitative air quality risk assessment shows that the unmitigated air emissions from the construction phase of the Project pose a low risk of dust soiling and a low risk of human health impacts.

5.1.4 Step 3: Mitigation Strategies

A range of in-principle and Project-specific mitigation strategies aimed at reducing the likelihood of air quality impacts to offsite sensitive receptors were identified. These mitigation strategies should be considered for all work elements of the Project. Recommended mitigation strategies include:

- Orientating stockpiles of excavated material in a direction that reduces exposed surfaces to prevailing winds.
- Watering of stockpiles when required to maintain a moisture content that minimises dust generation.
- Promptly removing and disposing of spilled materials which may cause a dust nuisance.
- Storing dust generating materials in enclosures where possible.
- Restrict vehicle movements to within designated access paths.
- Ensure machinery is working correctly.
- If possible, limit dust-producing work on windy days if the wind is blowing towards receptors.
- Enclose site or specific operations where there is high potential for dust production over long periods.
- Remove excavated material and any dust generating materials from site as soon as possible, unless being reused onsite.
- Ensure all vehicles are maintained and engines switched off when stationary.
- Avoid the use of diesel or petrol powered generators where possible and use mains electricity or battery powered equipment where possible.
- Dust suppression of exposed areas and stockpiles would be undertaken as required using a water cart or equivalent piece of equipment.
- Ensuring that trucks transporting any fine materials are covered and fitted with tight tailgates.
- Implementation of any additional mitigation options as required by the Project's Environmental Manager or as a result of community complaints.

5.1.5 Step 4: Reassessment

The final step of the IAQM methodology is to determine whether there are significant residual impacts, post mitigation, arising from a proposed development. The guidance states:

"For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'."

It is anticipated that the Project would not constitute an atypical case and that with implementation of the proposed mitigation strategies described above, the residual effect (impacts) would be "**not significant**" at all locations for both dust soiling and human health impacts. The mitigation strategies listed above should be incorporated into a Construction Environmental Management Plan (CEMP) to ensure the measures are implemented during construction of the facility.

5.2 Potential Operational Impacts

A qualitative assessment of potential dust impacts on surrounding sensitive receptors was undertaken for the operational phase of the Project. Operational impacts were assessed through the identification of potential air emission sources (**Section 5.2.1** and **Section 5.2.2**), factors influencing air dispersion of air pollutants and the proximity of sensitive receivers to potential sources (**Section 5.2.3**).

Air emissions from truck movements to and from Glebe Island were considered in the 2013 report *Sydney Ports Corporation, Multi* User Facility, Glebe Island Berths 1 and 2, Review of Environmental Factors (Sydney Ports, 2013). In terms of shipping, it is noted that White Bay and Glebe Island have operated as port facilities since the 19th Century for water based transport and industrial uses. Port Authority notes that this existing shipping use has fluctuated over the years depending on port requirements and berth availability (for example, recently, when Glebe Island was used as a car terminal, car carriers berthed at Glebe Island 1 and 2 almost daily (ship movements in Glebe Island 1 and 2 for 2007/08: 263 ships, for 2006/07: 264 ships, for 2005/06: 243 ships, and for 2004/5: 215 ships). This report has relied upon the 2013 REF for consideration of the environmental effects of shipping vessels associated with Glebe Island 1 and 2, as well as Port Authority's advice that shipping is an existing use of the port. As such assessment of operational impacts is limited to:

- Dust emissions from bulk material stockpiles.
- Dust emissions associated with the site's mobile equipment used in bulk material handling.
- Combustion emissions from mobile and stationary plant equipment during materials handling.

5.2.1 Dust Emissions

There is the potential for dust emissions from the proposed Multi-User Facility to occur from material handling including sand, aggregate and other dry bulk construction materials. Dust potential would be dependent on the particle size of imported construction products. Material with finer particle sizes such as sand created by the crushing of rock and very fine marine or dune sand (less than 100µm in diameter) have a greater potential for dust emissions. Aggregates are composed of a number of granular materials including sand, gravel and crushed stone. Dust potential for aggregates would be dependent on particle distribution size. Fine aggregates are largely comprised of sand and finely crushed stone and would have a greater dust potential than course aggregates largely comprised of gravel and coarsely crushed stone. Similarly courser grained sand (greater than 100µm in diameter) would have a low dust generating potential than its finer counterparts.

Dust emissions from material handling of sand, aggregates and other dry bulk construction materials may occur from the following transfer points:

- Transfer of bulk material from ship self-slewing conveyors to intermediate conveyors (if required) and mobile stackers.
- Transfer of bulk material from mobile stackers to bulk storage area.
- Transfer of bulk material from loaders to truck and dogs.

Potential dust emissions from the transfer of bulk material from ships to conveyors and mobile stackers would be transient in nature (occurring only when a ship is at berth and unloading). The duration of ship unloading events would vary depending on the ship size, however it may take approximately 24 to 36 hours at an approximate rate of 1500 tonnes per hour. Potential dust impacts would also be depended on the number of transfer points, with additional transfer points (e.g. use of intermediate conveyors) resulting in potential for higher dust impacts.

The storage area would be comprised of up to five bays, with a total capacity of 70,000m^3. Similar to potential dust impacts from operational conveyors and mobile stackers, potential dust impacts from stockpiling activities would only occur during shipment unloading events, when the slot(s) from the storage building would be fully or partially open. The remainder of the time stockpiles would be enclosed within the building with the exception of truck access gates, resulting in a much lower potential for dust emissions when compared to the existing approved method of temporary stockpiling on the wharf deck.

Potential dust emissions from truck loading would occur when bulk material is transferred from stockpiles to front end loaders and then from the front end loaders into trucks. Truck loading operations may occur 24 hours per day 7 days per week with up to 20 truck and dogs per hour during peak times. Truck loading operations would largely be contained inside the building limiting emission points to the truck access gates which would remain open during loading activities and potentially building slots(s) which would only be open during ship unloading events. Under the existing approval bulk materials are either transferred directly from the ship's conveyor to trucks via a mobile hopper or the material is directly stockpiled on the wharf prior to being loaded into trucks. The proposed activities are expected to be a general improvement compared to current practice given the added mitigation effect of enclosing the dust generating activities within the building with only a small percentage of the building enclosure (truck gates and building slot(s)) open at times.

In summary potential dust generating activities from ship unloading and stockpiling activities would be temporary in nature and dust emissions from stockpiling and truck loading activities would be contained within the building enclosure (with the exception to truck gates and building slot(s) open at times). A range of mitigation measures have been recommended to mitigate residual impacts. Overall, potential dust emissions from proposed material handling activities are not expected to be significant nor impact on nearby residents with the recommended mitigation measures in place. The dispersion of dust emissions and proximity of nearby sensitive receptors is discussed in **Section 5.2.3** and proposed dust mitigation measures are presented in **Section 6.2**

5.2.2 Combustion Emissions

Potential combustion emissions from operation of the Multi-User Facility would include combustion emissions from three front end loaders used within the storage bays to load trucks. Front end loaders would potentially be operational 24 hours per day 7 days per week when loading is occurring. Given the limited inventory of diesel or petrol fuelled mobile equipment used at the facility no significant impacts from combustion emissions are anticipated.

Intermediate conveyors (if required) and external radial stackers used for stockpiling would be electrically operated and therefore would not generate combustion emissions at the site.

5.2.3 Dispersion of Air Emissions and Proximity to Sensitive Receptors

Dispersion of potential air emissions from the Multi-User Facility would largely be affected by local meteorology and terrain. As discussed in **Section 4.1**, seasonal and annual average wind speeds measured at Fort Denison are moderate, this would aid in the dispersion of dust and combustion emissions from the site. On an annual basis winds most frequently occur from a west to north north-westerly direction west to north-westerly winds would result in dispersion of air pollutants largely towards the east to southeast of the site; here the closest sensitive receptors (residents and Waterfront Park) are located approximately 250m from the site at Pyrmont across Jones Bay. Seasonally north easterly and easterly winds are also common during spring and summer months. North easterly winds would result in the greatest potential air quality impacts southwest of the site; here the nearest receptors lie 500m to the southwest at Glebe Point. Easterly winds would result in dispersion of pollutants west of Glebe Island, the nearest resident lies approximately 810m to the west in Rozelle. Given the distance between the source and residential receptors, nature of potential pollutant sources (discussed in **Section 5.2.1** and **Section 5.2.2)** and local meteorological conditions aiding in dispersion of air pollutants only minor impacts and nearby receptors would be anticipated.

5.2.4 Cumulative Impacts

There is potential for cumulative dust impact from the project and both Hanson's proposed concrete batching plant (adjacent to the Multi-User Facility) and RMS's WestConnex M4-M5 Link project, as discussed in **Section 2.1**.

Potential dust emissions associated with the proposed concrete batching plant would include transfer of aggregates from the delivery vessel to storage bins and transfer of aggregates from storage bins to concrete mixer and cement handling and transfer. Cement handling and transfer would be conducted under negative pressure pneumatic conditions with dust filters fitted at air outlets to limit possible dust generation (JBA 2017). Hanson are currently undertaking an Environmental Assessment including an AQIA for the project in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the DP&E. The AQIA would be developed in accordance with the EPA's guidelines and include assessment of potential impacts from toxic air pollutants, dust and odour from diffuse and point sources during construction and operation. The AQIA would also include air quality management and monitoring procedures during construction and operation of the project.

The *M4-M5 Link Environmental Impact Statement* (RMS 2017) identifies risk of dust impacts associated with demolition and construction activities as part of the Rozelle interchange that would coincide with operation of the Multi-User Facility in 2019. A range of mitigation works have been proposed by RMS to minimise impacts on sensitive receptors during construction of the project.

6.0 Proposed Safeguards

6.1 Construction

Air quality mitigation measures to be applied during construction should be detailed in the site Construction Environmental Management Plan (CEMP). Proposed safeguards against air quality impacts during construction for inclusion in the CEMP are outlined in **Section 5.1.4** of this report.

6.2 Operation

Operational mitigation measures focus on undertaking of specific activities in a manner designed to minimise environmental impacts.

As part of the Operational Environmental Management Plan (OEMP) for each lessee or user of the facility an Air Quality Management Plan (AQMP) should be prepared for the Project and should include the following information:

- Sensitive receptors in proximity to the site.
- The legislative framework and standards applicable to the operation.
- Potential contributors to off-site pollutant impacts, including the pollutants that are of concern.
- Mitigation measures to minimise the operation's effects on local air quality would include:
  - Maintaining vehicles, plant and equipment in good working condition and turning off when not in use;
  - Building slot(s) would be open only during shipment unloading events;
  - The level of material placed in the radial stacker at any given time should be maintained as low as possible to reduce the risk of spillage and limit fugitive emissions;
  - The enclosing of conveyors leading to the operating radial stackers;
  - Undertake visual surveillance of material loading and handing activities to ensure that dust emissions are minimal; and
  - Should visual surveillance or complaints from neighbouring sensitive receivers indicate the potential for dust impacts at adjacent sensitive land uses, dust mitigation measures will be reviewed and further mitigation measures investigated and implemented as deemed appropriate to alleviate the impact.
- Contingency plans for complaints and pollution incidents.
- Review and reporting protocols.

7.0 Conclusion

A semi-quantitative and qualitative Air Quality Impact Assessment was undertaken to determine the potential impacts associated with the proposed Multi-User Facility on Glebe Island. This assessment addresses the potential air quality impacts associated with the proposed storage facility for bulk construction materials that was not assessed as part of the previous Part 5 Determination (SPC Reference C13/115) for a Multi-User Facility.

Dust impacts from construction works associated with the storage facility were assessed using the semi-quantitative risk assessment methodology provided in the UK Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction*. A pre-mitigation dust impact risk rating of "low" was determined for dust soiling and human health impacts due to potential dust emissions from the Project. This rating was based on the potential dust emission magnitude from the Project, sensitivity of nearby receptors, proximity of receptors, and the sensitivity of the area as a whole to both dust soiling and human health impacts. Residual impacts once appropriate dust mitigation measures are implemented were considered to be "not significant", in accordance with the post-mitigation reassessment guidance provided in the IAQM.

Operational air quality impacts were assessed qualitatively through the identification of potential air emission sources, factors influencing air dispersion of air pollutants and the proximity of sensitive receivers to potential sources. Key findings of the assessment were as follows:

- Potential dust emissions from the transfer of bulk material from ship conveyors and mobile stackers would be transient in nature (occurring only when a ship is at berth and unloading). The potential for dust emissions along transfer points would be managed through the implementation of mitigation measures.
- Potential dust emissions from stockpiling activities would only occur during shipment unloading events, when the slot(s) from the storage building would be fully or partially open. The remainder of the time stockpiles would be enclosed within the building with the exception of truck access gates, resulting in a much lower potential for dust emissions when compared to the existing approved method of temporary stockpiling on the wharf deck.
- Combustion pollutant emission impacts are likely to me minimal with a limited inventory of diesel or petrol fuelled mobile equipment used at the facility with larger equipment such as radial stackers and conveyor drawing electricity from the grid.
- Local meteorological data indicates residents to the east to south east (Pyrmont), west (Rozelle) and south west (Glebe Point) are most likely to be impacted by air emissions during unfavourable wind conditions. However given the distance between the source and residential receptors, nature of potential pollutant sources and local meteorological conditions aiding in dispersion of air pollutants, only minor impacts and nearby receptors would be anticipated.
- There is a potential for cumulative impacts associated the proposed development of Hanson's concrete batching plant adjacent to the Multi-User Facility. Hanson are currently undertaking an Environmental Assessment including an AQIA for the project in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the DP&E.
- There is the potential for cumulative impacts associated with demolition and construction works associated with the Rozelle Interchange as part of the WestConnex M4-M5 Link that would coincide with operation of the Multi-User Facility in 2019. A range of mitigation works have been proposed by RMS to minimise impacts on sensitive receptors during construction of the project.

Provided construction and operational mitigation measures recommended in this report are adopted, no significant air quality impacts are anticipated for the construction and operation of the Multi-User Facility storage facility at Glebe Island.

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Appendix A

BoM Data

Appendix A BoM Data

The Bureau of Meteorology (BOM) operates a network of meteorological monitoring stations around the country. The closest station to the site is located at Observatory Hill approximately 2.3km east of Glebe Island. Observatory Hill monitoring station also has long term wind speed and wind direction data collected between 1955 and 1992. Wind speed and wind direction are no longer recorded at this station due to removal of the sites anemometer in April 1992 as such data for this assessment has been sourced from the BoM monitoring station at Fort Denison. Annual and monthly wind roses for Observatory Hill meteorological station for 9am and 3pm data recorded between 1955 and 1992 are presented in **Figure 6** to **Figure 8**. A comparison of 9am and 3pm annual wind roses with 9am and 3pm annual wind roses from the BoM Fort Denison monitoring station and the NSW Office of Environment (OEH) monitoring station at Rozelle are also included in **Figure 6**. Meteorological monitoring data from the EPA Rozelle monitoring station is also further discussed further below.

It can be seen from **Figure 6** that at Observatory Hill on an annual basis, westerly winds are common during the morning while winds in the afternoon vary from an easterly direction. Annual average wind speed at 9am was 10.6 kilometres per hour (km/h) (2.9 metres per second (m/s)) with a 13% occurrence of calm conditions. Wind speeds are higher during 3pm with a moderate average winds speed of 16.6km/h (4.6m/s) and calms are less frequent occurring 3% of the time (BoM 2017).

When the Observatory Hill data is compared to the Fort Denison data (refer **Figure 6**) similar wind patterns are observed with a high frequency of westerly winds at 9am with north easterly to easterly and southerly winds more common at 3pm. A lower frequency of calms is observed at Fort Denison however at both 9am and 3pm.

When compared to the Observatory Hill BM data is compared to OEH data at Rozelle (refer **Figure 6**) a higher occurrence of westerly to south-westerly winds occur compared to north westerly winds which were recorded at 9am at Observatory Hill, also at 3pm while north easterly winds were also common the frequency of easterly winds at Observatory Hill was also higher than recorded at Rozelle. Average 9am and 3pm wind speeds were also higher than those recorded at Rozelle (1.6m/s and 2.8m/s), however the frequency of calms at Rozelle were also lower. Difference in the two data sets may be partially attributed to the siting of the Rozelle monitoring station. The frequency of west to south westerly readings from the Rozelle monitoring station are miss represented due to a raise in terrain and presence of several large fig trees within 20 meters to the west of the station. Based on the BoM Data at Observatory Hill residential receivers in Pyrmont and Rozelle were likely to be impacted by unfavourable westerly and easterly winds during the morning and afternoon respectively. The higher annual average winds speeds would indicate however that dispersion of potential air pollutants would occur more rapidly. In addition to the higher occurrence of westerly winds recorded at Observatory Hill the frequency of south westerly winds was also higher due to siting restrictions at Rozelle which limit the data captured from the west to south west. South westerly winds would result in potential air impacts north east of the site, where the nearest resident properties are located approximately 910 meters from Glebe Island within the suburb of Balmain East.

Similar to the annual trend at Observatory Hill, monthly records show a high frequency of westerly winds at 9am throughout the year, with southerly and east to north easterly winds also a common occurrence during the warmer months between October and March (refer to **Figure 7**). Monthly 3pm records show a high proportion of north easterly to easterly winds between September and April, variable winds during May, westerly and southerly winds during June and July and westerly and easterlies in August (refer to **Figure 8**).

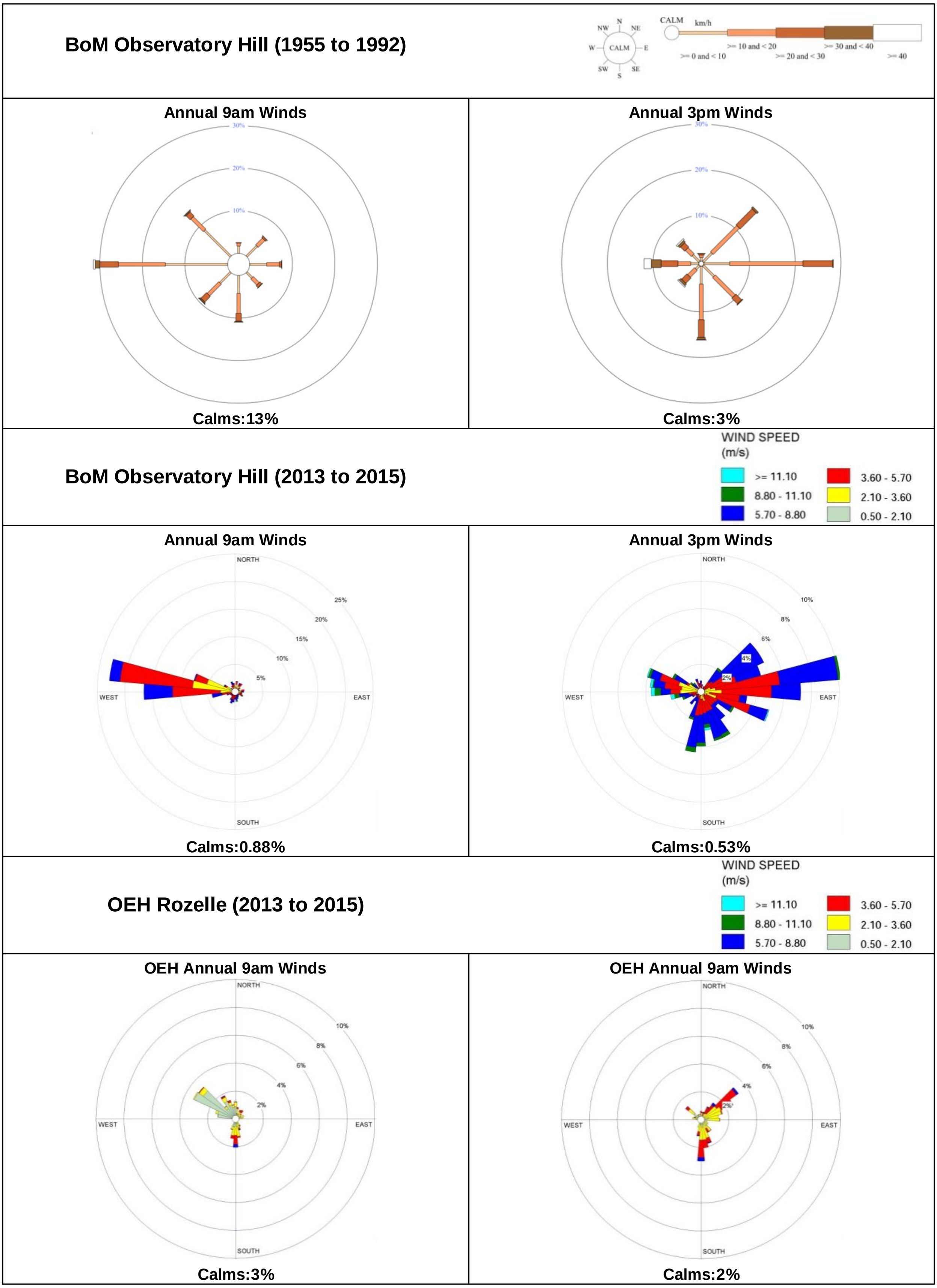

Figure 6 **OEH Rozelle (2013 to 2015) and BoM Observatory Hill (1955 to 1992) and Fort Denison (2013 to 2015) Annual 9am and 3pm Wind Roses**

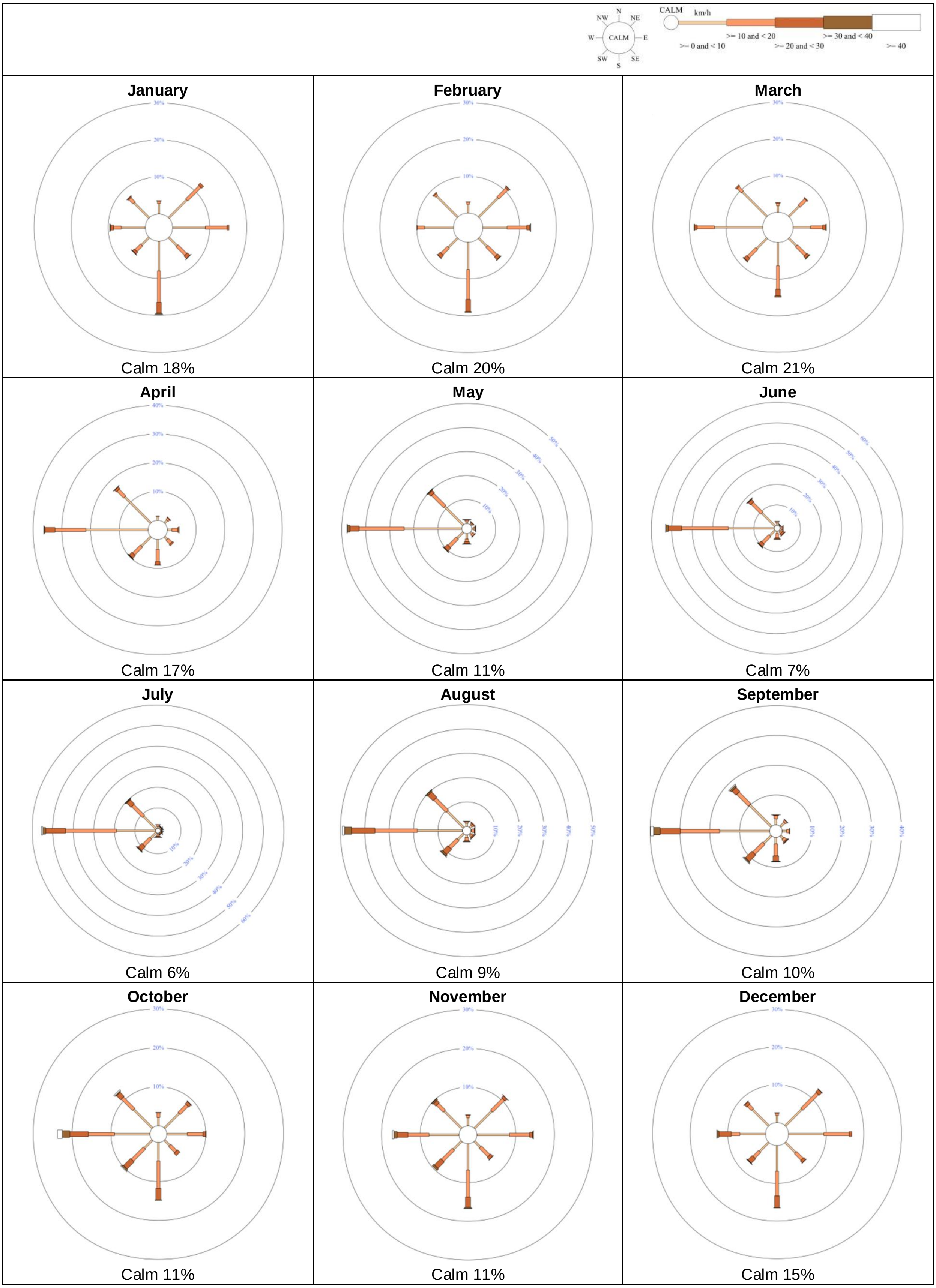

Figure 7 BoM 9am Monthly Wind Roses for Observatory Hill (1955 to 1992) (BoM 2017)

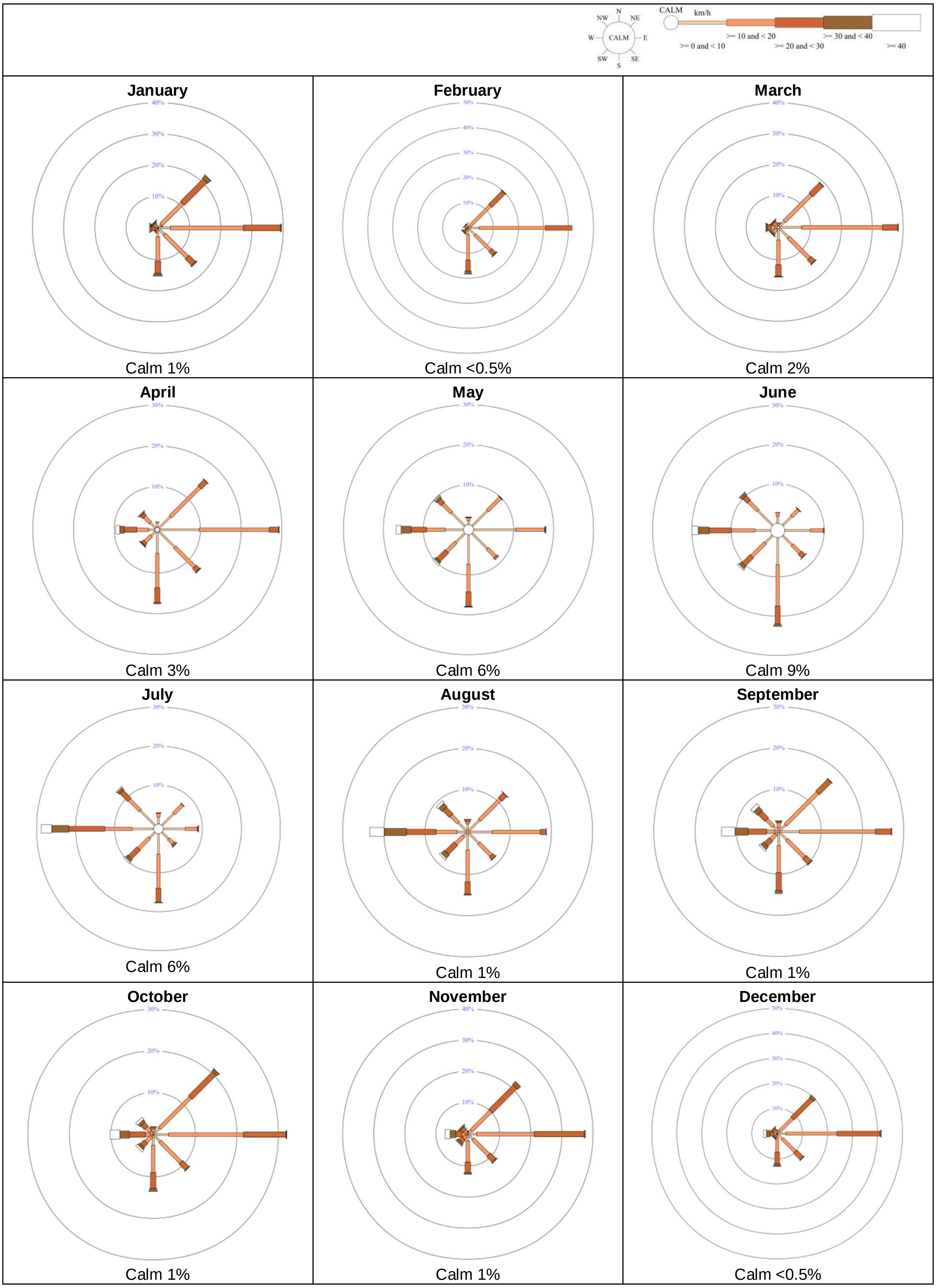

Figure 8 BoM 3pm Monthly Wind Roses for Observatory Hill (1955 to 1992) (BoM 2017)

Rozelle Monitoring Data

Annual and seasonal wind roses for the Rozelle monitoring station showing wind speed and wind direction data recorded between 2013 and 2015 are presented in **Figure 9** to **Figure 10**.

It can be seen from **Figure 9** on an annual basis, north westerly and southerly winds occur most frequently, while north easterly winds are also fairly prevalent. The annual average wind speed is relatively low at 1.6 metres per second (m/s) and calm conditions (wind speeds of less than 0.5m/s) occur 17.5 percent of the time.

During autumn through to spring north easterly and southerly winds are prevalent, with a high frequency of north westerlies also occurring during autumn and spring. During the winter months the predominant wind direction is from the northwest (refer to **Figure 10)**. Similar to the annual trend seasonal average wind speeds are also relatively low. The highest seasonal average occurs during summer at 2.3m/s and the lowest during winter at 1.1m/s. Average wind speeds during autumn and spring were found to be 1.4m/s and 1.8m/s respectively.

When viewing both **Figure 9** and **Figure 10** it can be seen that there are limited records of west to south westerly winds recorded at the monitoring station. Here the frequency of west to south westerly readings from the Rozelle monitoring station are misrepresented due to a raise in terrain and presence of several large fig trees within 20 meters to the west of the station.

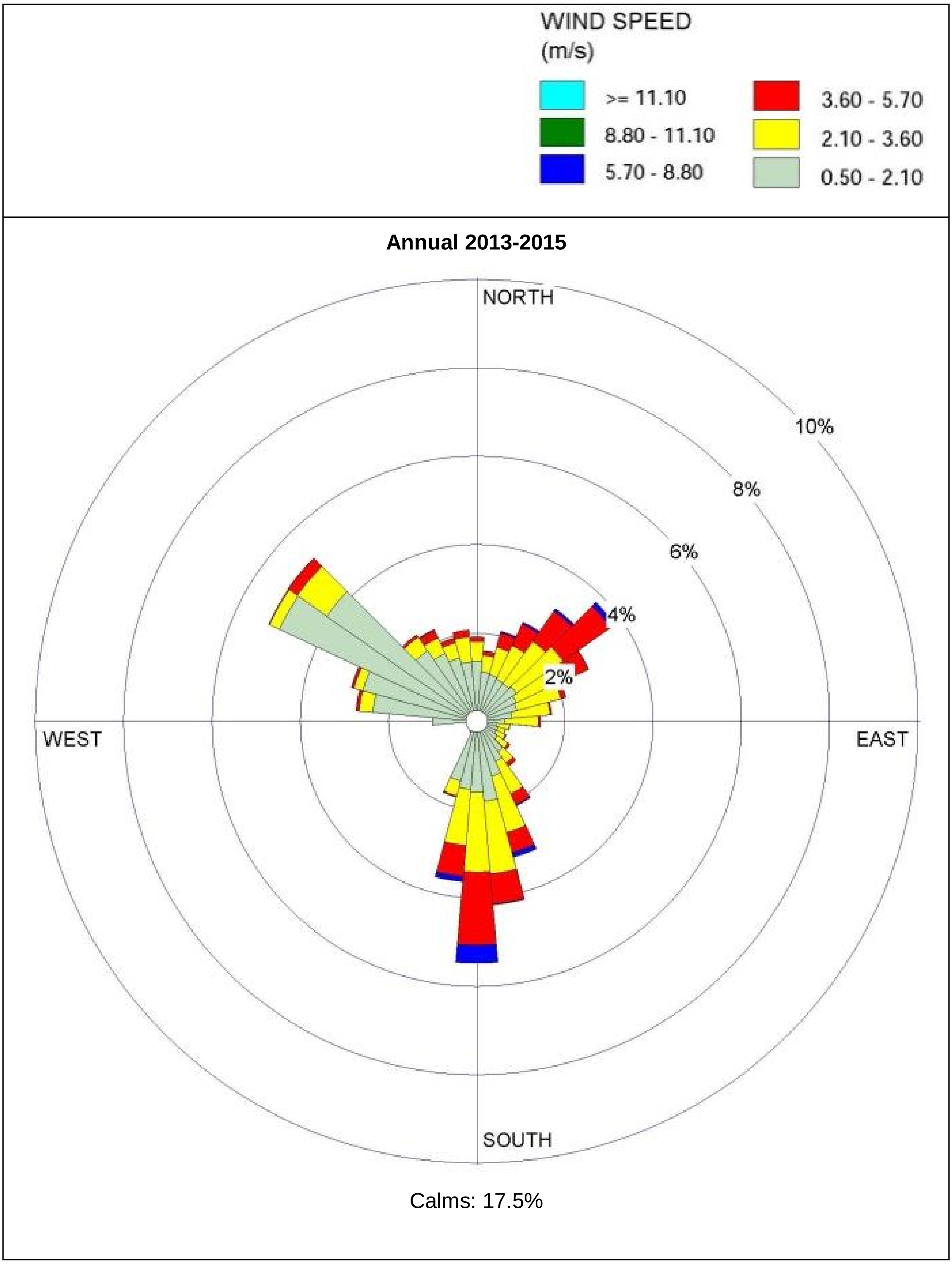

Figure 9 OEH Annual Wind Roses for Rozelle (2013 to 2015) (OEH 2016)

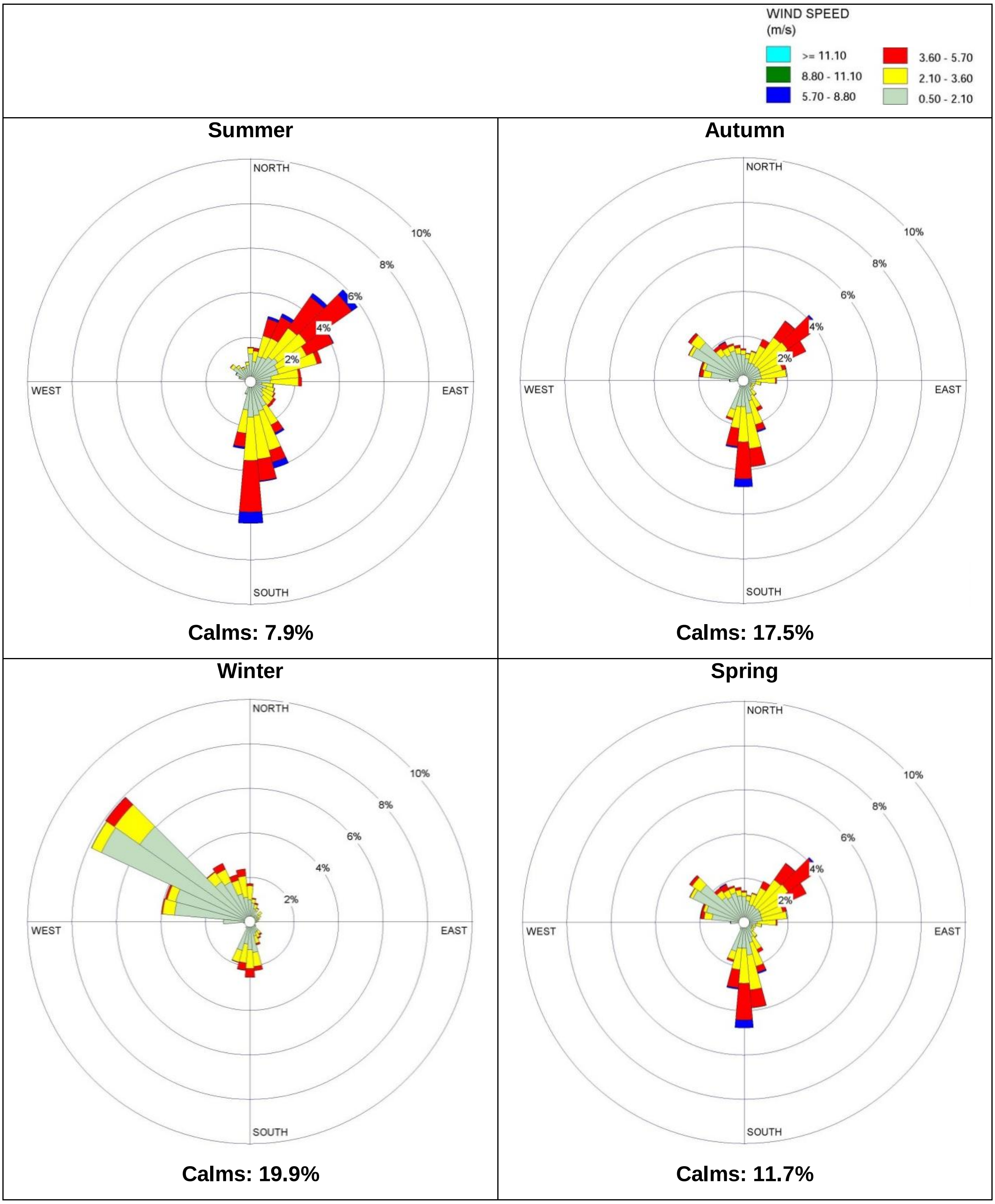

Figure 10 OEH Seasonal Wind Roses for Rozelle (2013 to 2015) (OEH 2016)

Appendix B

IAQM Dust Emission Magnitude Classification

Appendix B IAQM Dust Emission Magnitude Classification

Under the UK Institute of Air Quality Management (IAQM) document dust emission magnitudes are estimated according to the scale of works being undertaken and other considerations such as meteorology, types of material being used, or general construction methodology. The IAQM guidance provides examples to aid classification, as presented in the following excerpt from IAQM:

The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large. The following are examples of how the potential dust emission magnitude for different activities can be defined. Note that, in each case, not all the criteria need to be met, and that other criteria may be used if justified in the assessment:

Demolition: Example definitions for demolition are:

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

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

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

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

- Large: Total building volume >100, 000m^3, on site concrete batching, sandblasting;
- Medium: Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
- Small: Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. Example definitions for trackout are:

- Large: >50 truck (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- Medium: 10-50 truck (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and
- Small: <10 truck (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.