Appendix O

Air Quality and Odour

Port Botany Quayline Equalisation Project

Technical Report: Air Quality and Odour

August | 2025

Port Botany Quayline Equalisation Project

Technical Report: Air Quality and Odour

Client: Port Botany Operations Pty Ltd as Trustee for Port Botany Unit Trust

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Prepared by

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Overview

The Port Botany Operations Pty Ltd as Trustee for Port Botany Unit Trust (referred herein as NSW Ports) is seeking approval to undertake works to ensure equitable operational quayline length between the three container stevedore companies operating at Port Botany (the Project). The Project would involve two principal components:

- Construction of an extended quayline (BD12) on the southern side of Brotherson Dock, including dredging of the Brotherson Dock channel and berths to provide material for reclamation of land. This would provide:
  - Extension of the southern side of the Brotherson Dock quayline by around 314 metres to provide a combined quayline length on the southern side of Brotherson Dock of around 1,250 metres to accommodate up to three longer container vessels, commensurate with the quayline length available to stevedore operators in other parts of the port
  - An additional 5.3 hectares of wharf area (wharf hardstand)
- Consequential changes in bulk liquids operations at the port, including demolition of the existing Bulk Liquids Berth 1 (BLB1), construction and operation of a new Bulk Liquids Berth (BLB3) in a more southerly location, and associated changes to pipework and bulk liquids handling infrastructure within the port.

The assessment presented in this technical report, as part of the EIS, aims to address Secretary's Environmental Assessment Requirements (SEARs), in support of the application for the Project.

Existing environment

Meteorology in the area surrounding the Project Area 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.

Ten years of hourly meteorological data from the Little Bay and Sydney Kingsford Smith Airport Bureau of Meteorology (BoM) stations between 2014 and 2023 were analysed to provide an indication of local wind conditions within the study area.

Air quality surrounding Port Botany is influenced by local and regional pollutant sources, including road traffic and domestic sources, as well as aircraft, ship, and a variety of industrial emissions. The NSW Department of Climate Change, Energy, Environment, and Water (DCCEEW) operate an air quality monitoring network in NSW. A review of data found that observed concentrations for nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) are below criteria set by the Environment Protection Authority (EPA) for all averaging periods. At Port Botany, the largest quantities of pollutants emitted were SO_2 and Total Volatile Organic Compounds (VOCs). Combustion emissions also arise from road vehicles, water vessels associated with port activities, rail freight transport, and airport activities.

Nearby sensitive receivers are primarily industrial in nature and consist of locations where people are expected to work for eight to twelve hours per day or more. Additional nearby receivers include transient receivers including users of parks and lookout areas, and docked cargo ships. The Project Area itself is highly developed with limited vegetation. As such ecological receivers are limited.

Assessment findings

Construction assessment

Potential dust risks associated with construction have been assessed in accordance with the Institute of Air Quality Management (UK) (IAQM) *Guidance on the assessment of dust from demolition and construction* (IAQM, 2024). For human receivers, the risk of unmitigated dust soiling has been assessed as medium for all construction activities. Unmitigated dust health risks have been assessed as low for all activities, largely due to the low existing PM_{10} levels in the area as well and low sensitivity of sensitive receivers close to the Project Area. This assessment outcome has been used to identify and develop a series of construction dust minimisation and management measures to reduce potential dust related impacts to sensitive receivers and to manage dust emissions within acceptable limits.

A qualitative assessment has been carried out to consider the potential impacts from emissions from vehicles, water vessels, mobile equipment and stationary equipment associated with the construction of the Project. Construction traffic and shipping emissions, as well as use of mobile and stationary plant equipment exhaust emissions, are unlikely to result in adverse impacts to local air quality, provided standard mitigation measures are implemented.

There is the potential for dredging of marine sediments to lead to minor odour impacts, primarily due to the disturbance of organic materials and contaminants buried in the sediments. Potential odour emissions would be transient in nature and when appropriate safeguard measures are applied, including use of appropriate dredging methods to limit exposure of seabed sediments to air, odour impacts are not anticipated at sensitive receivers.

Operational assessment

Following relocation of the BLB (BLB3) about 750 m south of its existing position, changes to dispersion patterns may result in minor increases in VOC emissions from fugitive sources at the southern end of Port Botany, and a minor decrease its original position. The frequency, size, and types of vessels envisaged to use BLB2 and BLB3 would be consistent with those that currently use BLB1 and BLB2 in line with existing operations. As such, no changes to total fugitive VOC emissions from operation of BLB3 and associated pipelines are anticipated.

The Project would facilitate container operations on the extended quayline and wharf area. Together, the Project and the facilitated development would provide the infrastructure necessary to accommodate longer ships, equivalent with the longer quaylines available to other stevedores operating within the port. Longer ships generally require larger auxiliary engines and boilers; they have a higher marine fuel consumption rate which leads to higher emissions of pollutants. As such there is the potential for minor increases to both peak and average ground level pollutant concentrations with the introduction of longer ships to the extended quayline.

Whilst there would be changes to dispersion patterns of combustion pollutants from ships at berth trading across the extended quayline and the through the facilitated development, no significant changes are anticipated to annual emissions or annual average ground level concentrations of air pollutants because operations are expected to be consistent with the existing wharf area with a similar number of ships throughput. Emissions from vessels would be in accordance with emission standards under the International Convention for the Prevention of Pollution from Ships (MARPOL).

Mitigation and management measures

Construction activities would be managed to minimise the emission of visible dust beyond the construction footprint. Measures to minimise the generation and emission of dust and from combustion emissions would be detailed in the Construction Environmental Management Plan(s) (CEMP(s)) and applied to relevant construction activities.

Odour would be managed during construction through progressive reclamation of dredged material, covering waste materials, and utilising odour neutralising agents where practical. A dedicated hotline and email address would also be provided during construction to help ensure complaints are logged, investigated, and addressed promptly.

Based on the above assessment and proposed mitigation measures, the Project would be designed, constructed, and operated in a manner that minimises air quality impacts (including nuisance, dust and odour) to human health and the environment.

Glossary of terms and abbreviations

Term	Description
µg/m³	Micrograms per cubic metre
AAQ NEPM	National Environment Protection (Ambient Air Quality) Measure 1998
Approved Methods	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW 2022
AQIA	Air Quality Impact Assessment
AQMP	Air quality monitoring plan
BoM	Bureau of Meteorology
CO	Carbon monoxide
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	NSW Environment Protection Authority
Facilitated development	The subsequent development facilitated by the Project, being construction and operation of infrastructure for the purposes of container operations, involving: • Installation of up to three new quay cranes • Installation of quay rail sidings • Crane power and control systems. Further details of the facilitated development are provided in Section 3.4 (Facilitated development) of the EIS.
IAQM	Institute of Air Quality Management (United Kingdom)
impact	Influence or effect exerted by a development or other activity on the natural, built and community environment
MARPOL	MARPOL stands for "International Convention for the Prevention of Pollution from Ships" and is an international treaty established by the International Maritime Organization (IMO) to prevent and minimise pollution caused by ships
mitigation	Actions or measures to avoid or reduce the impacts of a development
mg/ m³	Milligrams per cubic metre
micrometre	Unit of length equal to one millionth of a metre
m/ s	Metres per second
NEPM	National Environment Protection Measure
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
$PM_{2.5}$	Particulate matter equal to or less than 2.5 micrometres in diameter
PM_{10}	Particulate matter equal to or less than 10 micrometres in diameter
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Project	The development for which approval is sought under Division 5.2, Part 5 of the EP&A Act, involving: • Construction of an extended quayline (BD12) on the southern side of Brotherson Dock, including dredging of the Brotherson Dock channel and berths to provide material for reclamation of land • Consequential changes to the bulk liquids berths at the port, including demolition of the existing Bulk Liquids Berth 1 (BLB1), construction and operation of a new Bulk Liquids Berth (BLB3) in a more southerly location,

Term	Description
	and associated changes to pipework and bulk liquids handling infrastructure within the port. Further details of the Project are provided in Chapter 3 (Project description) of the EIS.
SEARs	Secretary’s environmental assessment requirements issued under the EP&A Act
VOC	Volatile organic compounds

1.0 Introduction

1.1 Project context and overview

The Port Botany Operations Pty Ltd as Trustee for Port Botany Unit Trust (referred herein as NSW Ports)is seeking approval to undertake works to provide equitable operational quayline length between the three container stevedore companies operating at Port Botany (the Project). The Project would involve two principal components (refer to Figure 1-1):

- Construction of an extended quayline (BD12) on the southern side of Brotherson Dock, including dredging of the Brotherson Dock channel and berths to provide material for reclamation of land. This would provide:
  - Extension of the southern side of the Brotherson Dock quayline by around 314 metres to provide a combined quayline length on the southern side of Brotherson Dock of around 1,250 metres to accommodate up to three longer container vessels, commensurate with the quayline length available to stevedore operators in other parts of the port
  - An additional 5.3 hectares of wharf area (wharf hardstand)
- Consequential changes to the bulk liquids berths at the port, including demolition of the existing Bulk Liquids Berth 1 (BLB1), construction and operation of a new Bulk Liquids Berth (BLB3) in a more southerly location, and associated changes to pipework and bulk liquids handling infrastructure within the port. The types and volumes of bulk liquids would remain unchanged.

The extended quayline and associated wharf area would be constructed and made available for further development in future by a stevedore. NSW Ports does not seek approval for this further development, including construction and operation of infrastructure for the purposes of container operations.

More detailed descriptions of construction and operation of the Project are provided in Chapter 3 (Project description) of the EIS.

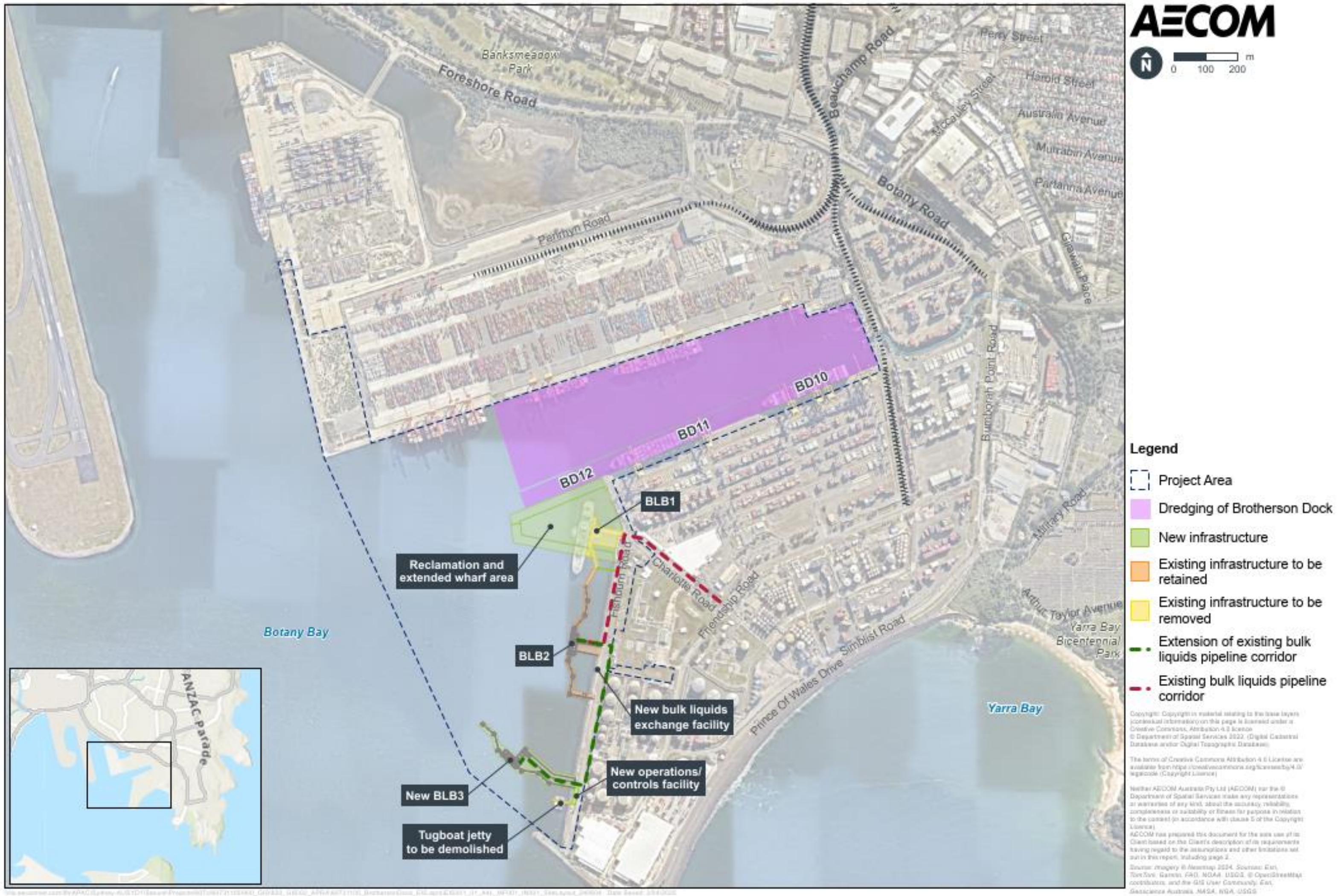


Figure 1-1 Project overview

1.2 The Project

Construction and operation of the Project is summarised in the following sections and described in detail in Chapter 3 (Project description) of the EIS.

1.2.1 Construction of the Project

A high level summary of the key construction activities for the Project are provided in Table 1-1. An indicative construction program for each construction phase is shown in Figure 1-3.

Table 1-1 Key construction activities

Construction phase	Key construction activities
Enabling works and establishment of construction compounds	Site establishment and enabling works would be required to establish four landside construction compounds (LSCCs) and one waterside construction compound (WSCC) (refer to Figure 1-2). Temporary environmental and safety controls, such as erosion and sediment controls, would be implemented.
Construction of the new BLB3	Construction of BLB3 would involve: • Construction of a suspended deck structure, requiring approximately 119 piles • Installation of BLB3 infrastructure and mooring dolphins, new pipeline rack and exchange facility, and electrical services • Construction of a new operations/ control facility and new emergency egress at the existing BLB2.
Decommissioning and removal of BLB1 and tugboat jetty	Decommissioning and demolition activities would involve: • Demolition and removal of the tugboat jetty south of BLB3 • Cessation of operations associated with BLB1, and flushing and pigging (pipe clearing) of pipelines associated with BLB1 • Demolition and removal of BLB1 infrastructure and associated pipelines.

Construction of the extended quayline (BD12) and wharf area	Construction of the extended quayline (BD12) on the southern side of Brotherson Dock would involve two main activities:
	• Construction of a bund wall, dredging and reclamation works:
	  - Construction of a bund wall including a core, geofabric textile layer, and outer rock armour layer
	  - Progressive dredging of Brotherson Dock, filling behind the bund wall
	  - Compaction of dredged materials within the reclamation area.
	• Piling and wharf deck construction, requiring approximately 380 piles with anticipated lengths of up to 70 metres.

Site demobilisation	Construction sites and compounds would be removed. Disturbance areas would be reinstated to pre-construction conditions. Disturbance areas used for construction would be reinstated to conditions comparable to those existing prior to the commencement of construction.

Figure 1-2 Indicative construction compound locations

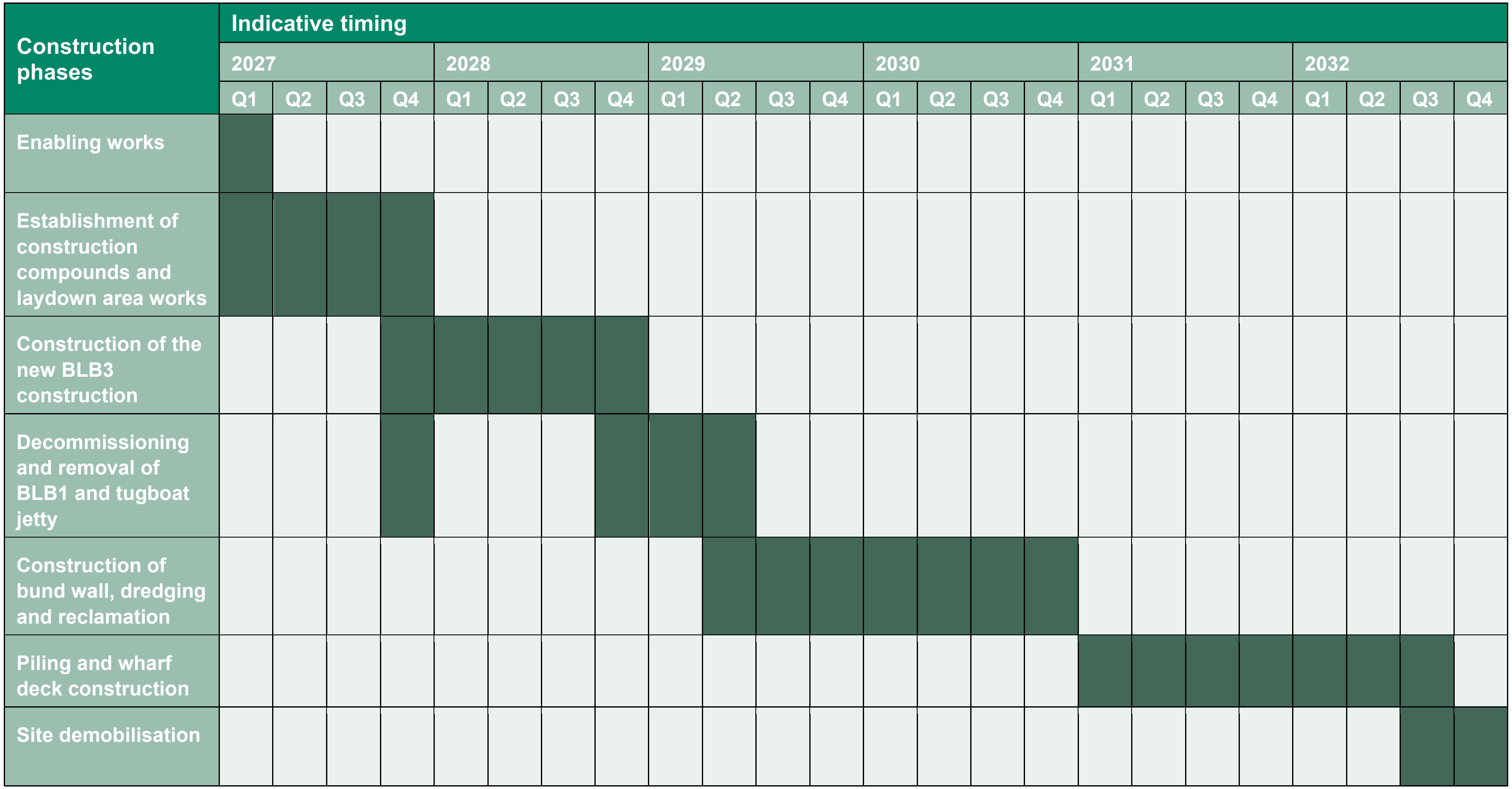


Figure 1-3 Indicative construction phases and timing

1.2.2 Operation of the Project

The key operational components of the Project are shown in Figure 1-3 and summarised in Table 1-2. The extended Brotherson Dock and BLB3 would operate 24 hours a day 7 days a week, consistent with existing operations at Port Botany managed by the stevedores.

Table 1-2 Project operation

Key operational component	Description
Extended quayline (BD12) and wharf area	The extended quayline would allow for the southern side of Brotherson Dock to accommodate longer ships, consistent with the longer quaylines available to other stevedores operating within the port. The key operational components would include: • An extended BD12 wharf area within the reclaimed area along and behind the extended quayline • A hardstand area around 5.3 hectares in area, composed of the reclaimed area (4 hectares) and suspended deck (1.3 hectares) • Forty-eight fenders along the BD12 quayline to absorb the impact of ships and provide secure points for vessels to tie up their mooring lines • Supporting services, including drainage and security.
BLB3 to replace BLB1 including associated pipeline infrastructure	The new BLB3 would operate similarly to the current BLBs, but would be located further south. BLB3 would be connected to the existing pipeline network or directly into the existing bulk liquids and gas tenancies that use this berth. The key operational components of the BLB3 would include: • A central working platform, including (but not limited to) three marine loading arms to transfer bulk liquids from ships to shore facilities, and provision for up to five additional arms • Access bridges connecting shore to the central working platform to the vessels, providing vehicle and pedestrian access, as well as a pipeline corridor • Additional emergency egress from BLB2 to shore • Pipeline infrastructure including: - Extension of the existing bulk liquids pipeline corridor along Fishburn Road from the BLB3 pipe manifold to existing Vopak and Elgas bulk liquids storage locations - An additional pipeline along Fishburn Road to the existing BLB2 exchange facility, replacing the existing BLB1 bitumen pipelines - An additional bulk liquids exchange facility located on Fishburn Road • Utilities including power, lighting, security, water, sewer, communications.

1.3 Purpose of this report

This report is one of a number of technical assessments that forms part of the EIS. The purpose of this technical report is to assess air quality and odour, in response to the Secretary Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning, Housing and Infrastructure (DPHI) (refer to Section 1.3.1), and to engagement with agencies (refer to Section 1.3.2).

1.3.1 Assessment requirements

The SEARs issued by the NSW Department of Planning, Housing and Infrastructure (DPHI), relating to air quality and where these requirements are addressed in this technical report are outlined in Table 1-3.

Table 1-3 Secretary's environmental assessment requirements – air quality and odour

Issue and desired performance outcome	Requirement	Section where addressed in report
Air quality and odour The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance, dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	An Air Quality and Odour Assessment as outlined in Section 6.2.7 of the Port Botany Quayline Equalisation Scoping Report Revision A 21 January 2025 (the Scoping Report)	Refer to Chapter 4.0 and Chapter 5.0
	The assessment must include emissions generated by larger vessels that may potentially use the proposed berth, and any change in the type, size and number of vessels as a result of the project	Refer to Section 6.0

1.3.2 Agency consultation

DPHI consulted with the NSW Environment Protection Authority (EPA) in preparing the SEARs for the Project (refer to Section 1.3.1). In providing input into the SEARs, the EPA provided the following input:

- The EIS must demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the POEO Act and the *Protection of the Environment Operations (Clean Air) Regulation 2022*. This consideration should include section 129 of the POEO Act concerning control of "offensive odour"
- The EIS must include an air quality impact assessment (AQIA). The AQIA must be carried out in accordance with the document, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2022)
- The EIS must detail emission control techniques/ practices that will be employed at the site and identify how the proposed control techniques/practices will meet the requirements of the POEO Act, POEO (Clean Air) Regulation (2022) and criteria within *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022).*

2.0 Assessment approach

2.1 Legislation, guidelines and standards

The legislation and guidelines relevant to this assessment are summarised in Table 2-1. Adopted air quality assessment criteria and standards are discussed in Section 2.1.1 and Section 2.1.2.

Table 2-1 Air quality legislation, guidelines and standards

Legislation, guidelines and standards	Description
Legislation	
National Environment Protection Council Act 1994 (Cth)	The *National Environment Protection Council Act 1994* (Cth) establishes and provides authority to the National Environment Protection Council (NEPC) to make National Environment Protection Measures (NEPMs) and to assess and report on their implementation and effectiveness in participating jurisdictions. NEPMs are a special set of national objectives designed to assist in protecting or managing aspects of the environment. Regarding concentrations of air pollutants, the two relevant NEPMs are as follows: • *National Environment Protection (Ambient Air Quality) Measure 2021* (AAQ NEPM) • *National Environment Protection (Air Toxics) Measure 2004* (Air Toxics NEPM) The AAQ NEPM was designed to create a nationally consistent framework for monitoring and reporting on common ambient air pollutants. The Air Toxics NEPM provides a framework for monitoring, assessing, and reporting on ambient levels of air toxics and was designed to collect information to facilitate the development of standards for ambient air toxics.
Protection of the Environment Operations Act 1997 (NSW) (POEO Act)	The *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) is the key piece of environment protection legislation administered by the Environment Protection Authority (EPA). The object of the POEO Act is to achieve the protection, restoration, and enhancement of the quality of the NSW environment. The POEO Act provides a board allocation of environmental responsibilities between the EPA, local councils, and other public authorities. The POEO Act also allows for the provision of Protection of the Environment Polices (PEPs), Environment Protection Licences (EPLs), and environmental protection notices. It also has a three-tier regime relating to environmental protection offences. The objects of the POEO Act relevant to air quality are to: • Protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development • Ensure that the community has access to relevant and meaningful information about pollution • Reduce risks to human health and prevent the degradation of the environment using mechanisms that promote the following: - Pollution prevention and cleaner production - The reduction to harmless levels of the discharge of substances likely to cause harm to the environment - The making of progressive environmental improvements, including the reduction of pollution at source - The monitoring and reporting of environmental quality on a regular basis

Legislation, guidelines and standards	Description
	• Rationalise, simplify and strengthen the regulatory framework for environment protection • Improve the efficiency of administration of the environment protection legislation. The POEO Act also allows for the making of regulations, including the *Protection of the Environment Operations (Clean Air) Regulation 2021* (POEO Clean Air Regulation). It is supported by EPA documents that provide methods for assessing and sampling air pollutants and assessment of odour, including the *Approved Methods for the Modelling and Assessment of Air pollutants in New South Wales* (Approved methods) (EPA 2022).
Protection of the Environment Operations (Clean Air) Regulation 2022 (NSW) (POEO Clean Air Regulation)	The POEO Clean Air Regulation under the POEO Act prescribes the requirements for several air pollutant generating activities in NSW. Requirements include domestic solid fuel heater certification, controlled burning, and installation of pollution control devices on certain motor vehicles, petrol supply standards, emission standards for industry groups and control storage and transport of volatile organic compounds.
The International Convention for the Prevention of Pollution from Ships (MARPOL)	*The International Convention for the Prevention of Pollution from Ships* (MARPOL) includes regulations aimed at preventing and minimising pollution from ships; both accidental pollution and from routine operations. Annex VI Prevention of Air Pollution from Ships sets limits on sulfur dioxide (SO_2) and nitrogen oxide (NO) emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SOx, NOx, and particulate matter. This International Standard applies to all international vessels that visit Port Botany.
Guidelines	
Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2022)	The *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2022) (the Approved Methods) under Part 5 of the POEO Clean Air Regulation provides the statutory methods for modelling and assessment air emissions in NSW. These methods outline the procedures for preparing emissions inventory data, conducting dispersion modelling, and interpreting results. The focus is on ensuring compliance with air quality criteria for common pollutants, air toxics, and odours pollutants.
Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction (IAQM, 2024)	The United Kingdom (UK) *Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction* (IAQM, 2024) document provides a qualitative risk assessment process for the potential unmitigated impact of dust generated from demolition, earthmoving, and construction activities. The IAQM methodology assesses the risk of impacts associated with demolition and construction without the application of any mitigation measures. The assessment provides a classification of the risk of dust impacts to both human and ecological receivers which then allows the identification of appropriate mitigation measures commensurate with the level of risk.

Legislation, guidelines and standards	Description
	It is widely accepted for the assessment of potential dust impacts associated with demolition and construction from road projects in NSW and other states in Australia. The IAQM methodology has been adopted to assess the potential dust impacts from the Project. The methodology has been modified to account for local conditions as follows: • Modification to the risk assessment matrix to account for more stringent criteria for particulate matter of sizes 10 micrometres or less (PM_{10}) set by NSW EPA. • Sensitivity classification of ecological receivers has been modified to account for protected areas in NSW based on conservational status as defined by NSW National Parks and Wildlife Service (NPWS).
Technical framework: Assessment and management of odour from stationary sources in NSW (DEC, 2006)	The framework is a technical reference document closely integrated with the existing legislative framework provided under the POEO Act, namely the requirement for no 'offensive odour' to be emitted by licenced activities, and the general provisions that apply to all premises. The offensive odour provision focuses on the impact of odour on people and their activities, while the general provisions deal with the cause of an odour. The general provisions make it an offence for any person to undertake an activity that emits air pollution (including odour) if the emission is caused by a failure to maintain or operate plant, or to deal with materials in a proper and efficient manner. Key principles adopted in the framework are: • Planning to prevent and minimise odour • Use of a range of strategies to manage odour • Ongoing environmental improvement. This Technical Framework is accompanied by a separate booklet, *Technical notes: assessment and management of odour from stationary sources in NSW* (the technical notes) (DEC, 2006a). The technical notes provide additional guidance on the classification of odour sources, odour criteria, odour sampling and analysis, and complaints handling.

2.1.1 Air quality assessment criteria

The air quality assessment criteria adopted for the Project are listed in Table 2-2 and are consistent with the ambient air quality criteria in the Approved methods for modelling (EPA, 2022). These values are consistent with the criteria set out in the AAQ NEPM and Air Toxics NEPM.

In addition to the adopted criteria in Table 2-2, the NEPM $PM_{2.5}$ goals, which commenced on 1 January 2025, have been considered in the assessment of the Project. These are provided in Table 2-3. To date, the NEPM 24-hour and annual average $PM_{2.5}$ goals for 2025 have not been adopted by NSW EPA as revised impact assessment criteria. A further review of criteria for $PM_{2.5}$ is scheduled to commence in 2025 (EPA, 2025).

Table 2-2 NSW EPA air quality criteria

Pollutant	Averaging period	Criterion (µg/m^3)
Particulate matter (PM_{10})	24-hour maximum	50
	Annual average	25
Particulate matter ($PM_{2.5}$)	24-hour maximum	25
	Annual average	8
Sulphur dioxide (SO_2)	1-hour maximum	215
	Annual average	57
Nitrogen dioxide	1-hour maximum	164
	Annual average	31
Carbon monoxide	1-hour maximum	30,000
	8-hour maximum	10,000
Benzene (C_6H_6)	99.9th percentile 1-hour average	29
Ethylbenzene	99.9th percentile 1-hour average	8000
Formaldehyde	99.9th percentile 1-hour average	20
1,3-butadiene	99.9th percentile 1-hour average	40
Toluene (C_7H_8)	99.9th percentile 1-hour average	360
Acetaldehyde (C_2H_4O)	99.9th percentile 1-hour average	42
Xylene (C_8H_{10})	99.9th percentile 1-hour average	190
PAHs (as benzo(a)pyrene)	99.9th percentile 1-hour average	0.04

Table 2-3 NEPM proposed national environment protection goals scheduled for 2025

Item	Pollutant	Averaging period	Goal	
			ppm	µg/m^3
7	Particles ≤ 2.5 micrometres in diameter ($PM_{2.5}$)	24-hour maximum	-	20
		Annual average	-	7

2.1.2 Odour assessment criteria

The perception of odour is based on an individual's response to chemical exposure. The odour threshold is the theoretical minimum concentration of a chemical that produces an olfactory response, which, in practice, is used to indicate whether an odour is detectable; the odour threshold defines 1 odour unit (1 OU) for each chemical. The threshold relates to odour detection and does not consider the recognition of an odour's character.

The EPA's impact assessment criteria for complex mixtures of odours (EPA, 2022) were designed to consider the ranges of individual sensitivity to odours based on a statistical evaluation of the size of the surrounding population. As population density increases, the proportion of sensitive individuals is also likely to increase; as such, areas with larger populations require more stringent criteria. The criteria are presented in Table 2-4.

The Project Area is located within a highly developed area surrounded by places of business, including industrial and commercial receivers. Recreational and residential development lies in proximity to the Project Area. Given the population density surrounding the Project Area, a criterion of 2 OU for odour has been adopted for this assessment.

Table 2-4 NSW EPA impact assessment criteria for complex odours

Population of affected community	Impact assessment criteria 1-hour 99th percentile* Odour
Urban (≥~2,000) and/or schools and hospitals	2 OU
~500	3 OU
~125	4 OU
~30	5 OU
~10	6 OU
Single rural residence (≤~2)	7 OU

*Notes: *99th percentile nose response time*

2.2 Methodology

This section describes the framework used to assess potential environmental impacts associated with the Project.

2.2.1 Study area

A study area has been defined for assessment of potential air quality impacts from the Project during construction (refer to Figure 2-1). The study area has been defined as in within 250 m of the boundary of the Project Area (within which, all works would occur), in line with the UK Institute of Air Quality Management (IAQM) document *Guidance on the assessment of dust from demolition and construction* (IAQM, 2024). For the purpose of applying the IAQM methodology, Figure 2-1 also shows a series of distances from the Project Area (20 metres, 50 metres, 100 metres and 250 metres).

A qualitative, comparative assessment has been applied to the consideration of air emissions from operational ships that may access the new BLB3 (refer to Section 5.0) and the extended quayline and wharf area and the facilitated development (refer to Section 6.0). Definition of a study area for the purpose of this assessment was not required.

2.2.2 Methods to determine the existing environment

A comprehensive desktop review has been undertaken to evaluate existing baseline data relating to air quality within the study area. The desktop review included consideration of:

- Meteorology utilising data from the Bureau of Meteorology (BoM) monitoring stations at Little Bay and Sydney Kingsford Smith Airport
- Background air quality data from the NSW Department of Climate Change, Environment, Energy, and Water (NSW DCCEEW) ambient air quality monitoring station at Randwick
- Identification of potential existing sources of air emissions including a review of existing site operations, and nearby sources listed under the National Pollution Inventory (NPI)
- Topography and land use information Land use information was reviewed for the study area based on satellite imagery and from the NSW Government Sharing and Enabling Environmental Data (SEED) database.

Existing environmental conditions have utilised meteorological and ambient air quality data within a 4.5 km radius from the Project Area. Existing sources of air pollution have been based on satellite imagery and NPI and EPA data within 2 km of the Project Area.

2.2.3 Construction impact assessment

Potential dust risks associated with the construction of the Project have been assessed in accordance with the IAQM document *Guidance on the assessment of dust from demolition and construction* (IAQM, 2024).

In addition to the dust risk assessment, a qualitative assessment of the following potential air quality impacts has been undertaken to meet the requirements of the SEARs:

- Combustion impacts from construction vehicles, water vessels and mobile equipment
- Odour impacts from dredging activities and demolition of the existing BLB1.

The methodologies applied to these assessments are detailed further in the following sections.

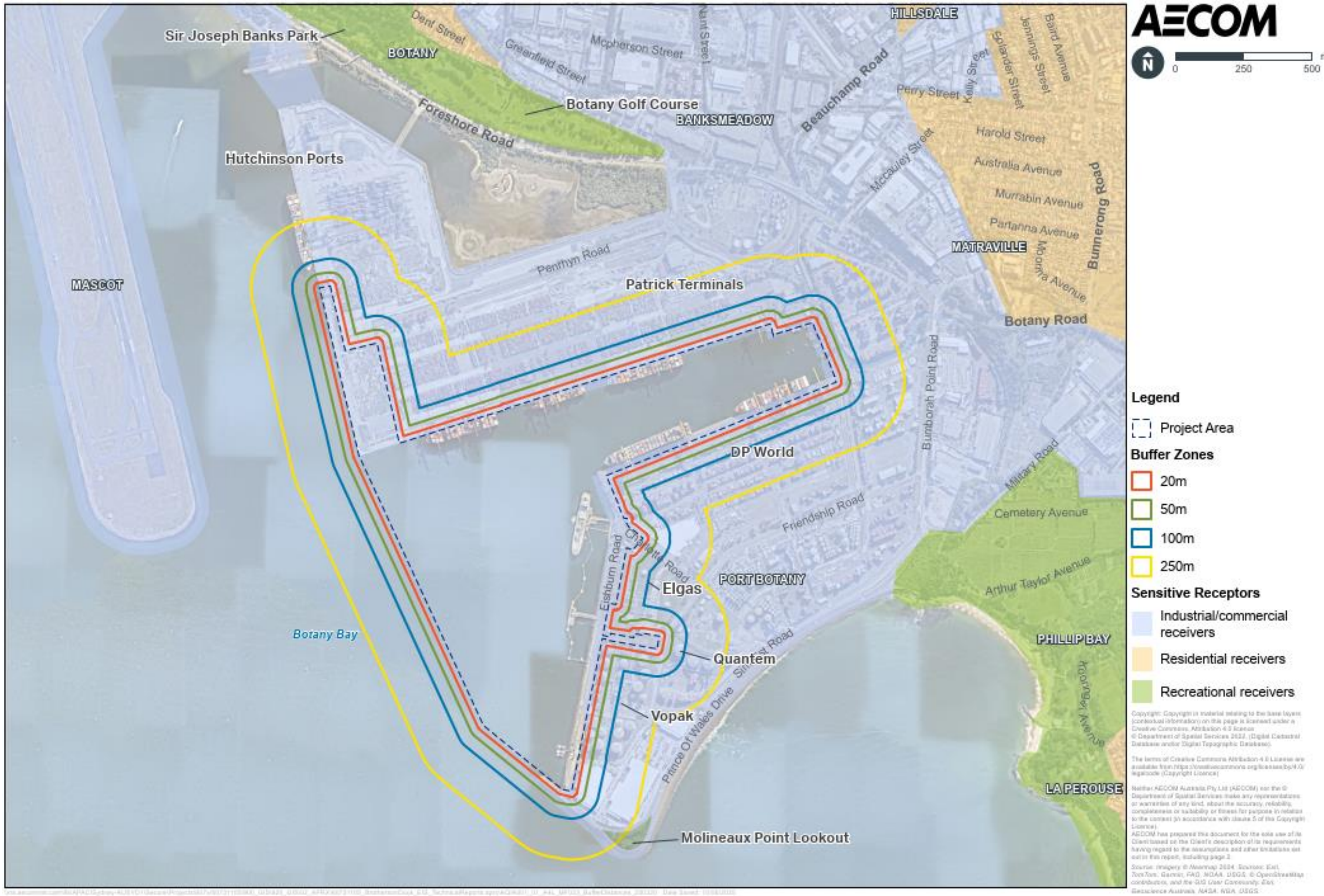


Figure 2-1 Construction impact assessment study area (based on IAQM assessment approach)

Assessment of construction dust

Potential impacts from dust generation during construction have been assessed using *Guidance on the assessment of dust from demolition and construction* (IAQM, 2024). The IAQM guidance process is a four-step risk-based assessment of dust emissions associated with demolition, earthworks, construction, and track-out activities:

- Step 1 – screening assessment
- Step 2 – dust risk assessment, including evaluation of dust emission magnitude (Step 2A), sensitivity of the surrounding area (Step 2B) and determination of unmitigated risk of impacts (Step 2C)
- Step 3 – identification of management strategies
- Step 4 – reassessment, taking into account identified management strategies.

Step 1 – Screening assessment

Step 1 requires the determination of whether there are receivers close enough to the construction footprint to warrant further assessment. An assessment is required where there is a human receiver within:

- 250 metres from the boundary of the site
- 50 metres from the route(s) used by construction vehicles on public roads up to 250 m from a site entrance.

An assessment is also required if an ecological receiver is within:

- 50 metres of the boundary of the site
- 50 metres from the route(s) used by construction vehicles on public roads up to 250 metres from a site entrance.

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is “negligible”, and any effects would be not be significant.

Step 2 – Dust risk assessment

Step 2 is designed to identify the potential for dust impacts due to unmitigated dust emissions. The key components of the risk assessment are:

- Defining the dust emission magnitude (**Step 2A**)
- Defining the surrounding area’s sensitivity to dust emissions (**Step 2B**)
- Combining these in a risk matrix (**Step 2C**) to determine a potential risk rating for dust impacts on surrounding receivers.

Dust emission magnitudes (**Step 2A**) are estimated according to the duration and scale of works being undertaken (area, volume, and height), the timing of works (seasonality), building type and construction materials, and soil type. The magnitude is classified as either small, medium, or large for each construction sub-activity. The IAQM guidance provides criteria for dust emission magnitudes during demolition, earthworks, construction, and track-out to aid classification (refer to Table 2-5).

Table 2-5 Emission magnitudes for small, medium and large demolition and construction activities

Activity	Activity criteria	Small	Medium	Large
Demolition	Total building volume (m^3)	<12,000	12,000–75,000	>75,000
	Material type	Material with low dust generating potential	Potentially dusty material	Potentially dusty and includes crushing and screening
	Demolition height (m AGL)	<6	6-12	>12
Earthworks	Total site area (m^2)	<18,000	18,000–110,000	>110,000
	Number of heavy earth moving vehicles active at one time	<5	5-10	>10
	Bund height (m)	< 3	3 to 6	>86
	Fine content of soil type	Low fine content (e.g. sand)	Moderately fine content (e.g. Silt)	High fine content (e.g. Clay)
Construction	Total building volume (m^3)	<12,000	12,000–750,000 Onsite concrete batching	>175,000 Onsite concrete batching and/or sandblasting
	Dust potential of construction materials	Material with low dust generating potential (e.g. metal or cladding)	Potentially dusty material (e.g. concrete)	Potentially dusty material (e.g. concrete)
Track-out	Number of heavy vehicle movements per day	<20	20-50	>50
	Surface material dust potential	Low fine content (e.g. sand)	Moderately fine content (e.g. silt)	High fine content (e.g. clay)
	Length of unpaved access roads (m)	<50	50-100	>100

The sensitivity of the surrounding area (**Step 2B**) considers sensitive receivers that may be affected by dust emissions. Human receivers include locations where people spend time (i.e. work, recreation, retail, etc.) and where property may be impacted by dust. Ecological receivers are habitats that might be sensitive to dust. The IAQM methodology classifies the sensitivity of an area to dust soiling and human health impacts due to particulate matter as high, medium, or low. The classification is determined by a matrix for both dust soiling and human health impacts (refer to Table 2-6 and Table 2-7, respectively), taking into account:

- Receiver sensitivity (for individual receivers in the area), as described in Table 2-6
- Number of receivers of each sensitivity type in the area
- Distance from source
- Annual mean PM_{10} concentration (only applicable to human health impacts).

Table 2-6 Receiver sensitivity classification for dust soiling and health effects

Receiver sensitivity	Dust soiling effects	Health effects of PM_{10}
High	Land uses where: • Users can reasonably expect enjoyment of a high level of amenity • The appearance, aesthetics or value of their property would be diminished by soiling • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples include dwellings, museums, culturally important collections, medium to long-term car parks and car showrooms.	Locations where members of the public are exposed over eight-hour period or more in a day. Examples include residential properties, hospitals, schools, and residential care homes.
Medium	Land uses where: • Users would expect to enjoy a reasonable level of amenity but would not reasonably expect to enjoy the same level of amenity as in their home • The appearance, aesthetics or value of their property could be diminished by soiling • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples include parks and places of work.	Locations where members of the public are exposed over eight-hour period or more in a day. Examples include office and shop workers.
Low	Land uses where: • The enjoyment of amenity would not reasonably be expected • Property would not reasonably be expected to be diminished in appearance, aesthetics, or value by soiling • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples include playing fields, farmland, footpaths, short term car parks, and roads.	Locations where human exposure is transient. Examples include public footpaths, playing fields, parks and shopping streets.

Table 2-7 Surrounding area sensitivity to dust soiling effects on people and property

Receiver sensitivity	Number of receivers	Distance from the source (m)			
		<20	<50	<100	<250
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

The IAQM guidance provides human health sensitivities for a range of annual average PM_{10} concentrations (in µg/m³). The annual average PM_{10} criteria for Australia differ from United Kingdom jurisdictions and, as such, concentrations corresponding to the risk categories need to be modified to match Australian conditions. The annual average criterion for PM_{10} in NSW is 25 µg/m³ and therefore the scaled criteria for NSW are:

- >25 µg/m³
- 22-25 µg/m³
- 19-22 µg/m³
- <19 µg/m³.

Table 2-8 provides the IAQM guidance sensitivity levels for human health impacts for the ranges outlined above for the annual average PM_{10} concentrations and highlights (in bold outline) the relevant range for NSW. The background PM_{10} concentrations in the region around the Project Area are outlined in Section 3.2.1, which notes that regional data from Randwick are less than 17 µg/m³. Therefore, the lowest PM_{10} category has been adopted for the IAQM assessment (i.e. <19 µg/m³) (outlined in red in Table 2-8).

The sensitivity for each construction activity defined by the IAQM guidance has been assessed for the Project. This has resulted in a sensitivity rating for the construction footprint along with ratings for portions of the construction footprint for each construction activity. The ratings depend on the sensitivity of the receivers and the distance from the boundary of the Project Area. As shown in Table 2-7 and Table 2-8, the greater the distance from the Project Area (the source), the lower the rating. Only the highest level of area sensitivity has been considered for the assessment.

It should be noted that this is not a quantitative human health assessment and risks discussed in this context should be understood in terms of the IAQM guidance. For receivers, a risk rating indicates the risk that a group of receivers may experience unmitigated dust concentrations above the NSW criteria, with the associated potential health effects linked to that criterion. Once mitigated through the application of air emissions mitigation measures (as part of a well-designed air quality management plan), the dust impacts would be expected to be negligible.

Table 2-8 Surrounding area sensitivity to human health impacts for annual average PM_{10} concentrations.

Receiver sensitivity	Annual average PM_{10} concentration	Number of receivers	Distance from the source (m)			
			<20	<50	<100	<200
High	>25 µg/m³	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	22-25 µg/m³	>100	High	High	Low	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	19-22 µg/m³	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<19 µg/m³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low

Receiver sensitivity	Annual average PM_{10} concentration	Number of receivers	Distance from the source (m)			
			<20	<50	<100	<200
Medium	>25 µg/m³	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	22-25 µg/m³	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	19-22 µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<19 µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low

The sensitivity of the surrounding with respect to ecological receivers relates to the deposition of dust on ecological areas. The sensitivity of ecological receivers is defined as:

- High sensitivity ecological receivers:
  - Locations with international or national designation and the designation features may be affected by dust soiling
  - Locations where there is a community of particularly dust sensitive species
- Medium sensitivity ecological receivers:
  - Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown
  - Locations within a national designation where the features may be affected by dust deposition
- Low sensitivity ecological receivers:
  - Locations with a local designation where the features may be affected by dust deposition.

In Australia (including in NSW), a 'designated' area refers to protected areas such as National Parks, Nature Reserves and State Conservation areas. These are managed by the NSW National Parks and Wildlife Service (NPWS) under DCCEEW which has been designated for the conservation of biodiversity, cultural heritage, and natural landscapes. Similarly, State Parks are protected reserved areas for recreational activities designed to balance conservation with public use and managed by the NSW Department of Lands. Regional and Local Parks are also managed by local or regional councils and are intended for public recreation.

The sensitivity of an ecological area to impacts has been assessed using the criteria listed in Table 2-9. The Project Area is highly developed and sparsely vegetated. Nearby vegetation (in areas that could be affected by deposition of construction dust) includes remnant vegetation south of Foreshore Road and some urban roadside vegetation along Friendship Road, Fishburn Road and Prince of Wales Drive at Port Botany. As such, the ecological sensitivity of the Project Area is considered low.

Table 2-9 Sensitivity of an area to ecological impacts

Receiver sensitivity	Distance from source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Evaluation of unmitigated risks of impacts (**Step 2C**) combines dust emission magnitude (determined in **Step 2A**) with the sensitivity of the surrounding area (**Step 2B**), according to the matrix provided as Table 2-10.

Table 2-10 Risk of dust impacts (for dust soiling and human health impacts)

Activity	Surrounding area sensitivity	Dust emission magnitude		
		Large	Medium	Small
Demolition	High	High	Medium	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Negligible
Earthworks	High	High	Medium	Low
	Medium	Medium	Medium	Low
	Low	Low	Low	Negligible
Construction	High	High	Medium	Low
	Medium	Medium	Medium	Low
	Low	Low	Low	Negligible
Track-out	High	High	Medium	Low
	Medium	Medium	Medium	Low
	Low	Low	Low	Negligible

Step 3 – Management strategies

The outcome of the dusk risk assessment (**Step 2**) is used to determine the level of management that is required to ensure that dust impacts on surrounding sensitive receivers are maintained at an acceptable level. Implementation of management measures is highly recommended for high or medium-level risk ratings. Management measures should be specifically designed to minimise the emissions from the source to which they are applied and implemented at an appropriate level (e.g., low level road watering on a dry highly trafficked roadway may not reduce dust impacts by the desired amount).

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 IAQM guidance states:

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

Based on this expectation, as well as experience within Australia, construction activities with targeted management measures can achieve high degrees of dust mitigation which significantly reduce dust impacts to a negligible level.

Assessment of construction combustion emissions

Potential impacts from combustion emissions from construction of the Project have been qualitatively assessed is Section 4.2.

As discussed in the IAQM (2024), experience of assessing the exhaust emissions from onsite mobile and stationary equipment, as well as construction traffic, suggests they are unlikely to make a significant impact on local air quality. Therefore, quantitative assessment of combustion emissions from construction of the Project is not warranted.

Assessment of construction odour emissions

A qualitative assessment of odour impacts from construction works associated with the Project is provided in Section 4.3.

Potential sources of odour identified during an analysis of the Project dredging and reclamation activities has identified that odour impacts are expected to largely limited to possible disturbance of contaminated soils and organic material. The *Characterisation of Sediment Quality in Port Botany Final Report and the Preliminary Sediment Investigation* (Geochemical Assessments, 2020) has been reviewed to assess potential odour risk from liberation of contaminated or organic material during dredging and reclamation works. Other minor potential odour emissions may include emissions associated with BLB1 demolition works which have also been assessed qualitatively.

2.2.4 Operational impact assessment

Key operational components of the Project that would potentially create air quality impacts would include operation of BLB3. Installation of operational infrastructure and container operations at the extended quayline (BD12) and wharf area does not form part of the Project application (refer to Section 2.2.6).

Prior to the facilitated container operations, the extended quayline and wharf area would be managed in line with existing procedures at DP World. The extended berth would not result in a net increase of vessel movements. Operational air quality impacts would be similar to that of existing operations, and would include combustion emission from operational machinery, light and heavy vehicles, and water-based vessels. Fugitive emissions from the BLB and pipes, whilst controlled via Environmental Protection Licences (EPL) and held by each of the operating users, has also been considered.

Therefore, a qualitative assessment of operational air quality impacts has been undertaken in Section 5.0.

2.2.5 Cumulative impact assessment

Cumulative impacts have the potential to occur when benefits or impacts from a development overlap or interact with those of other developments, potentially resulting in a larger overall impact (positive or negative) on the environment or local communities. Cumulative impacts may occur when developments are constructed or operated concurrently or consecutively, within the same area.

The extent to which another development or activity could interact with the construction and/ or operation of the Project would depend on its location, scale, and/ or timing of construction or operation. A screening assessment was undertaken to identify projects that may contribute to potential cumulative impacts. Refer to Chapter 18 (Cumulative and facilitated impacts) of the EIS for details of the full cumulative impact assessment methodology adopted for the Project. Based on this screening, the following four developments were identified to have potential for cumulative impacts with the Project:

- CP Group and KLF Group Waste Management Facility, Botany
- Modification of Orica Chlor-Alkali Plant, Botany Industrial Park
- Orica Southlands Warehouse Estate Stage 3
- Stephen Road Multi-level Warehouse, Banksmeadow.

The location of these developments is shown in Figure 2-2.

An assessment of potential cumulative impacts between these screened developments and the Project on air quality during construction and operation is presented in Section 6.0.

2.2.6 Facilitated impact assessment

Although the Project would involve construction of an extended quayline (BD12) and wharf area, it would not include the subsequent construction or operation of infrastructure for the purposes of container operations. Any future development of such infrastructure would be separately progressed by the stevedore.

Although installation and operation of infrastructure for the purposes of container operations does not form part of the Project, this would only be possible once the Project is completed and therefore are considered to be reasonably foreseeable outcomes of the Project's development.

Construction and operation of infrastructure for the purposes of container operations on the extended quayline and wharf area has been considered, where relevant, as a facilitated development. Consideration of potential facilitated impacts on air quality associated with the facilitated development on the extended quayline and wharf area is presented in Section 6.3.

2.2.7 Limitations, uncertainties, and assumptions

The following limitations, uncertainties, and assumptions apply to this assessment:

- It is assumed that the new BLB3 would operate similarly to the current BLBs, operating 24 hours a day 7 days a week, consistent with existing operations at Port Botany. It would be designed to accommodate the existing maximum bulk liquid vessel capacity, being 120,000 Deadweight Tonnage (DWT) of bulk liquid product. The frequency size and type of vessels envisaged to use BLB2 and BLB3 would be consistent with those that currently use BLB1 and BLB2 in line with existing operation
- The facilitated development would be operated consistent with the existing DP World container operations.

Figure 2-2 Developments identified for consideration of potential cumulative impacts with the Project

3.0 Existing environment

The existing environment in the area surrounding the Project includes a description of the conditions at the Project Area that may affect air quality. These conditions are typically categorised into background air quality (or existing pollutant concentrations), regional meteorology, an analysis of topography and land use and a description of the sensitive receivers around the Project Area.

3.1 Meteorology

Meteorology in the area surrounding the Project Area 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 wind impacts (such as wind comfort) as well as air quality impacts, as they dictate the direction and distance air pollutant plumes travel.

BoM operate a series of meteorological monitoring stations throughout NSW. The nearest BoM meteorological monitoring stations to the Project Area are:

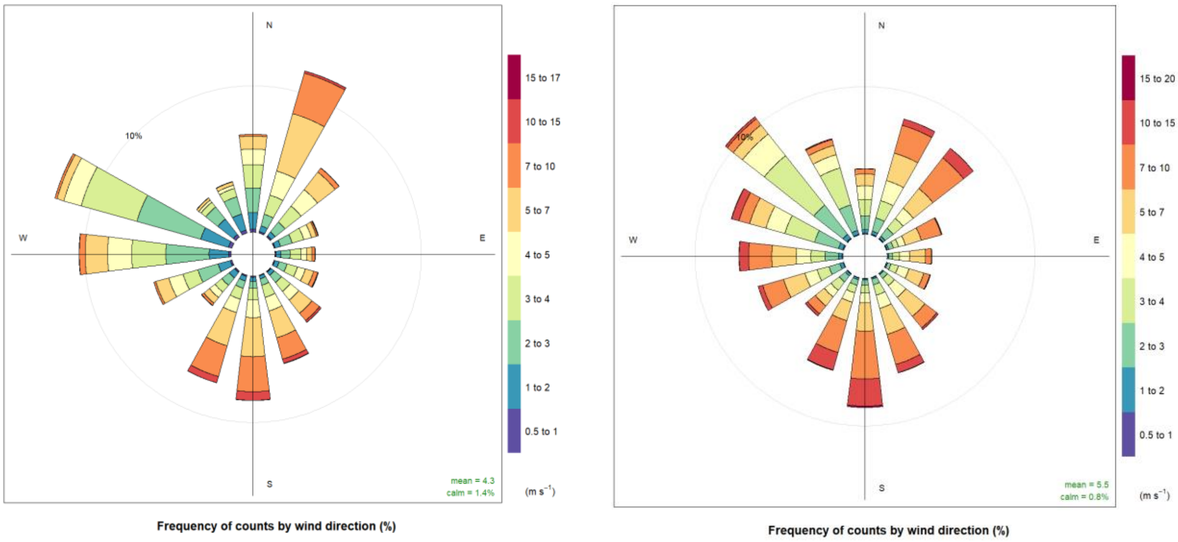
- The Little Bay (The Coast Golf Club) (Station ID 066051) located 3.1 km to the south-east of the Project Area at its closest point
- The Sydney Kingsford Smith Airport AMO (Automatic Meteorological Observing station) (Station ID 066037) located approximately 4.1 km to the north-west of the Project Area at its closest point.

Both the Little Bay and Sydney Kingsford Smith Airport stations are considered representative of local meteorological conditions and are discussed further below in Section 3.1.1 and Section 3.1.2.

3.1.1 Wind speed and wind direction

Ten years of hourly meteorological data from the Little Bay and Sydney Kingsford Smith Airport BoM stations between 2014 and 2023 have been analysed to provide an indication of local wind conditions. Annual average wind roses for the stations are presented in Figure 3-1.

Annual average wind roses at both monitoring stations between 2014 and 2024 show a high proportion of north-easterly, southerly, and north-westerly winds, although wind direction is more variable at Sydney Kingsford Smith Airport. Annual average wind speed was found to be a gentle breeze at Little Bay, at 4.3 m/s, and a more moderate breeze, recorded at Sydney Kingsford Smith Airport at 5.5 m/s. Calm conditions (i.e. wind speeds <0.5 m/s) over the ten year period examined occurred relatively infrequently at both sites, occurring 1.4% of the time at Little Bay and 0.7% of the time at Sydney Kingsford Smith Airport.



Little Bay **Sydney Kingsford Smith Airport BoM Station**

Figure 3-1 Annual average wind roses for Little Bay and Sydney Kingsford Smith Airport BoM stations (2014 to 2023)

Monthly wind roses for Little Bay and Sydney Kingsford Smith Airport BoM monitoring stations for 2014 to 2023 are also presented in Figure 3-2 and Figure 3-3. Monthly wind distribution patterns over the ten-year period are similar between each station. North-easterly winds are common between September through to March, and May through to September show a high occurrence of north westerlies. At Little Bay, winds from the south are most common between January and March, and at Sydney Kingsford Smith Airport between November and March. Higher monthly average wind speeds are generally observed during the warmer months at both sites. At Little Bay, monthly average winds speeds ranged from 3.8 m/s in May to July, to 4.7 m/s in January and February. At Sydney Kingsford Smith Airport, the lowest monthly average wind speed of 4.9 m/s was recorded during April and May, and the highest of 6.1 m/s in January. Calm conditions are consistently low across both sites, with monthly average frequency of occurrence of 0.8% to 2.3 % at Little Bay and 0.4% to 1.6% at Sydney Kingsford Smith Airport over the ten-year data set.

The annual and monthly average data at both sites suggests that gentle to moderate breezes are experienced frequently, whereas there is a low occurrence of calm conditions. The more frequent gentle to moderate breezes would result in favourable wind speed conditions for both air pollutant and odour dispersal. Moderate windspeeds, however, are likely to result in higher dust risk impacts associated with construction works from windblown dust on exposed surfaces and stockpiles and/or material handling activities.

In addition to annual and monthly wind roses, hourly wind speed data has also been examined to understand the difference in wind speed across the day in the Botany Bay area. Average wind speeds for all hours of the day have been calculated between 2014-2023 and are provided in Figure 3-4. Wind speeds for the area surrounding the Port Botany operations show moderate to high wind speeds across the day with winds increasing during the day to a peak around 4:00 pm. Given the consistent moderate to high wind speeds in the area, the occurrence of highly stable meteorology leading to the potential for inversion conditions is expected to be low. This trend is also observed during winter when the potential for inversions is higher (refer to Figure 3-5). Average wind speeds at night for both the Mascot and Little Bay BOM stations show moderate to high wind speeds across the year and consistently in winter.

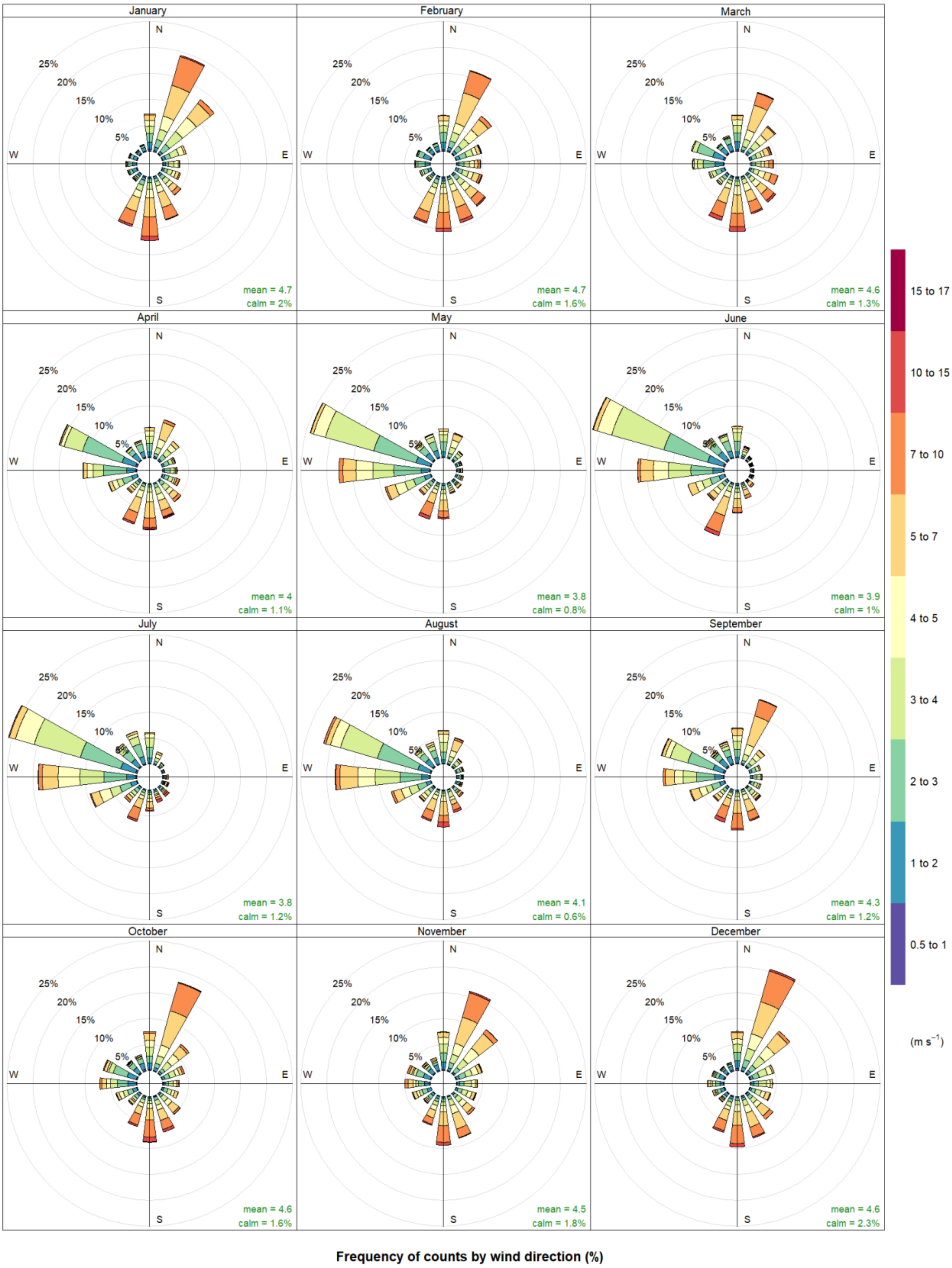


Figure 3-2 Monthly average wind roses for Little Bay BoM station (2014 to 2023)

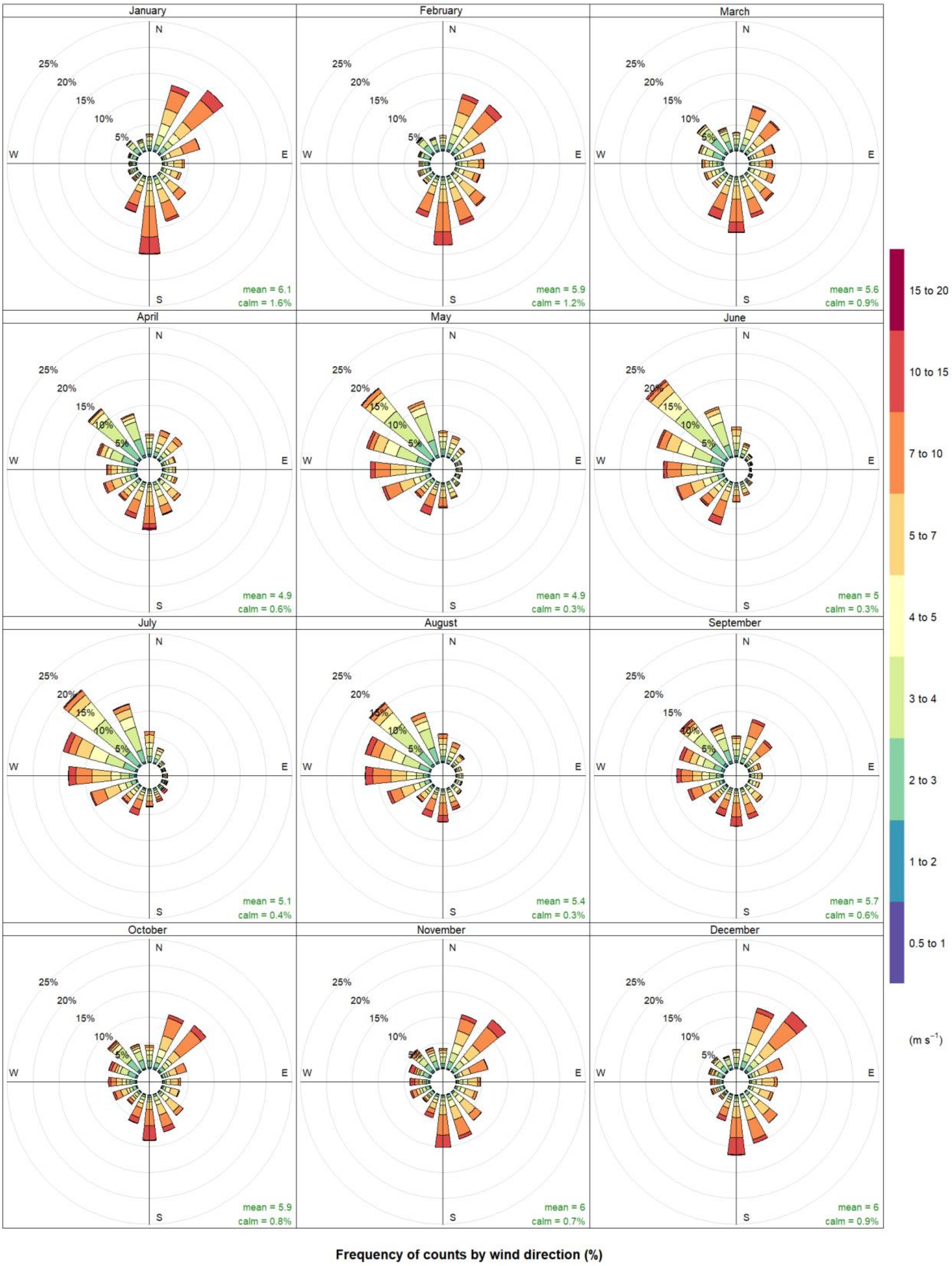


Figure 3-3 Monthly average wind roses for Sydney Kingsford Smith Airport BoM station (2014 to 2023)

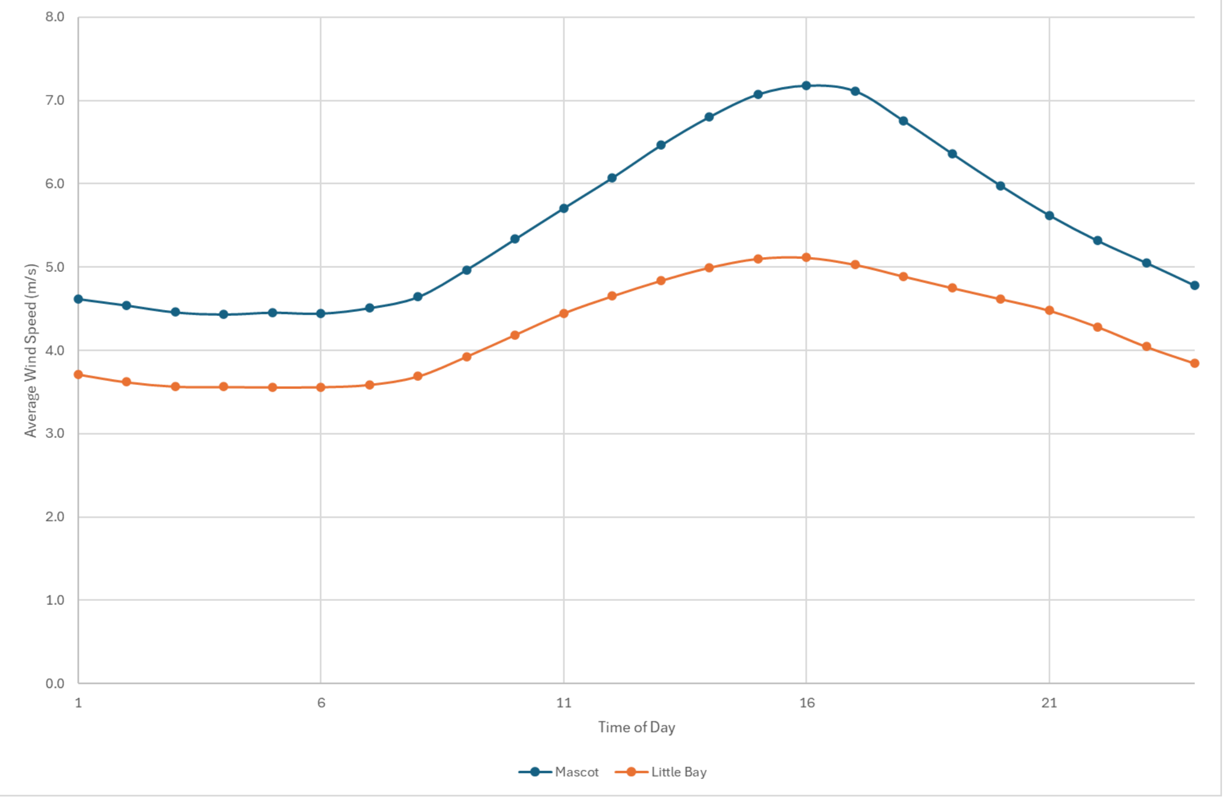


Figure 3-4 Average hourly wind speeds for Sydney Kingsford Smith Airport and Little Bay BoM station (2014 to 2023)

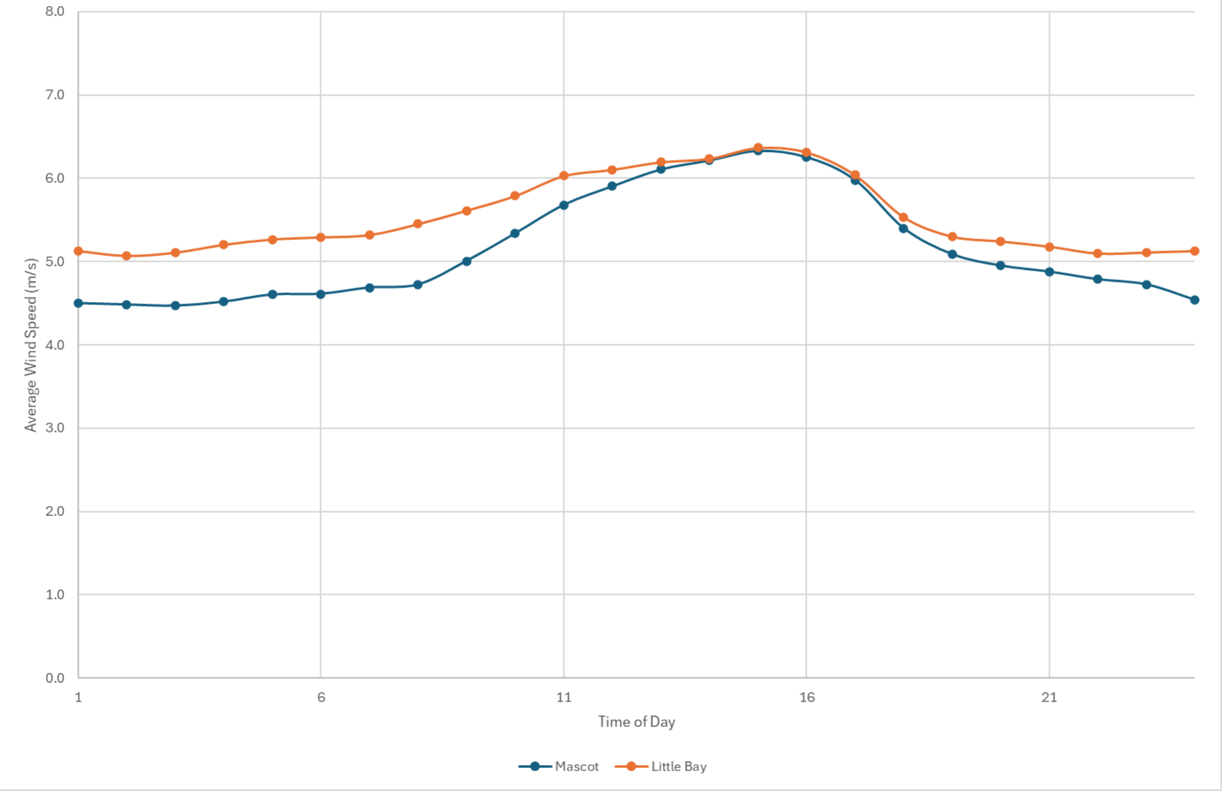


Figure 3-5 Average hourly wind speeds in winter for Sydney Kingsford Smith Airport and Little Bay BoM station (2014 to 2023)

3.1.2 Temperature and rainfall

Ten-year annual average rainfall and temperature data for Sydney Kingsford Smith Airport BoM station is presented in Figure 3-6. General seasonal trends observed show that temperature declines heading into and during the winter months with a gradual increase leading into the summer period. The hottest month was January, with an average maximum temperature of 27 °C, and the coldest month was July, with an average minimum temperature of approximately 10 °C.

Annual average rainfall between 2014 and 2023 was over 1,100 mm annually. Monthly rainfall is variable throughout the year, with the month of March having the highest rainfall; the driest month was found to be September.

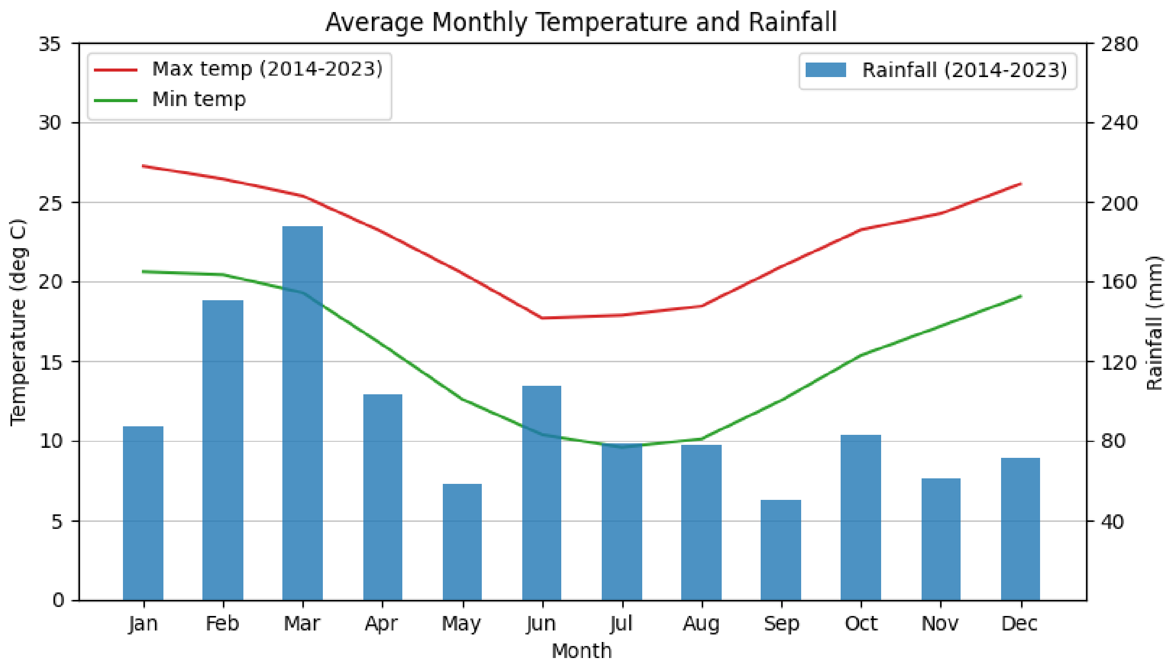


Figure 3-6 Temperature and rainfall averages at Sydney Kingsford Smith Airport AMO (BoM 2014-2023)

3.2 Existing air quality

Air quality within the area surrounding Port Botany is influenced by local and regional pollutant sources including road traffic, domestic sources, as well as aircraft, shipping, and a variety of industrial emissions. Ambient air quality monitoring data is discussed in Section 3.2.1 and a discussion on existing sources of air emissions is provided in Section 3.2.2.

3.2.1 Air quality monitoring data

The NSW DCCEEW operate a wide air quality monitoring network in NSW. The closest monitoring station to the Project Area is located at Randwick, approximately 4.5 km to the north east of the Project Area at its closest point. The Randwick monitoring station is located in the grounds of the Randwick Army Barracks, near Avoca Street and Bundock Street, and measures air quality in a residential area in the eastern suburbs of Sydney, where the main source of air pollution is likely from vehicle exhaust emissions.

The Randwick DCCEEW station monitors a range of pollutants including PM_{10}, $PM_{2.5}$, NO_2, and SO_2. Five years of air quality monitoring data at Randwick between 2019 and 2023 has been summarised in Table 3-1 and shows:

- Maximum 1-hour and annual average NO_2 concentrations are well below the EPA criteria for all years
- Maximum 1-hour and 24-hour SO_2 data are well below the EPA assessment criteria for all years

- The maximum 24-hour concentration for PM_{10} was above the EPA criterion for 2019, 2020, and 2023, but below the criterion for 2021 and 2022. Annual average PM_{10} concentrations were below the criterion for all years
- The maximum 24-hour concentration for $PM_{2.5}$ was above the EPA criterion for all years with exception to 2023. Annual average $PM_{2.5}$ concentrations were above the EPA criterion for 2019 but below the criterion between 2020 and 2023.

Elevated PM_{10} and $PM_{2.5}$ concentrations are primarily attributed to the high prevalence of bushfires that occurred during the extreme black summer bushfire event over the summer of 2019 and 2020. These were large scale events that contributed to elevated particulate matter concentrations at a regional scale and are not considered representative of local background concentrations.

The singular exceedance of the 24-hour $PM_{2.5}$ maximum at Randwick in 2021 occurred on 22 August 2021 and is considered an exceptional event attributed to a regional hazard reduction burn which resulted in exceedances of the criterion at Randwick and other stations in the Sydney East region (DPE, 2023). For 2023, exceedances of both the maximum 24-hour PM_{10} and $PM_{2.5}$ criteria were all attributed to extreme events relating to hazard reduction burns or bushfires (DCCEEW, 2024).

For the dust risk assessment of construction impacts, an annual average PM_{10} concentration of 16.6 micrograms per cubic metre (µg/m^3) has been adopted. This is the annual average for 2023 and is the highest annual average recorded in the most recent three years of data (post the black summer bushfire event).

Table 3-1 Randwick monitoring data summary (2019 to 2023)

Pollutant	Averaging Period	Concentration (µg/m^3)					Criteria (µg/m^3)
		2019	2020	2021	2022	2023	
NO_2	1-hour max	95.2	70.4	54.2	60.0	74.6	**164**
	Annual average	12.3	9.3	9.6	11.9	13.7	**31**
SO_2	1-hour max	76.8	35.8	57.1	74.5	63.2	**286 (215)**
	24-hour max	11.3	9.5	12.8	11.0	18.2	**57**
PM_{10}	24-hour max	**128.1**	**135.9**	37.3	37.3	**89.1**	**50**
	Annual average	24.0	19.5	16.3	14.6	16.6	**25**
	Number of exceedances	30	19	0	0	2	**0**
$PM_{2.5}$	24-hour max	**95.9**	**111.9**	**31.8**	13.9	**67.2**	**25 (20)**
	Annual average	11.0	7.6	6.4	4.9	6.2	**8 (7)**
	Number of exceedances	19	7	1	0	3	**0**

Notes: Criteria in brackets represents proposed NEPM standard or goals from 2025. Exceedances of the criteria have been denoted in bold text.

Nitrogen dioxide

Measured 1-hour NO_2 concentrations at Randwick between 2019 and 2023 are presented below in Figure 3-7 and annual averages are shown in Figure 3-8. The highest 1-hour NO_2 concentration occurred in November 2019. All 1-hour NO_2 values recorded between 2019 and 2023 were well below the EPA criterion of 164 µg/m³.

The highest annual average concentration occurred in 2023 at 13.7 µg/m³. All annual averages recorded were well below the annual average criterion of 31 µg/m³.

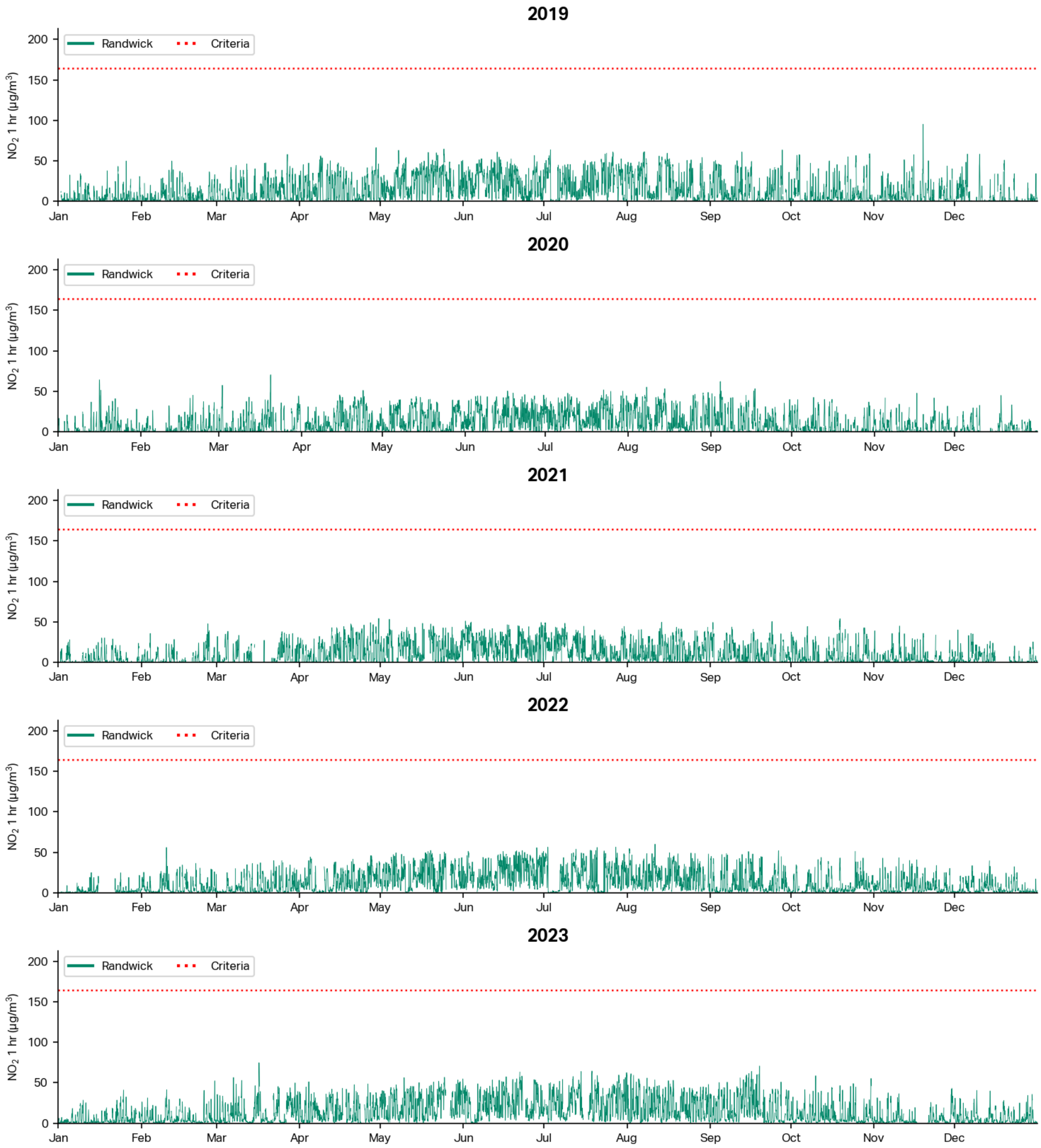


Figure 3-7 1-hour NO_2 concentrations at Randwick DCCEEW monitoring station for 2019 to 2023

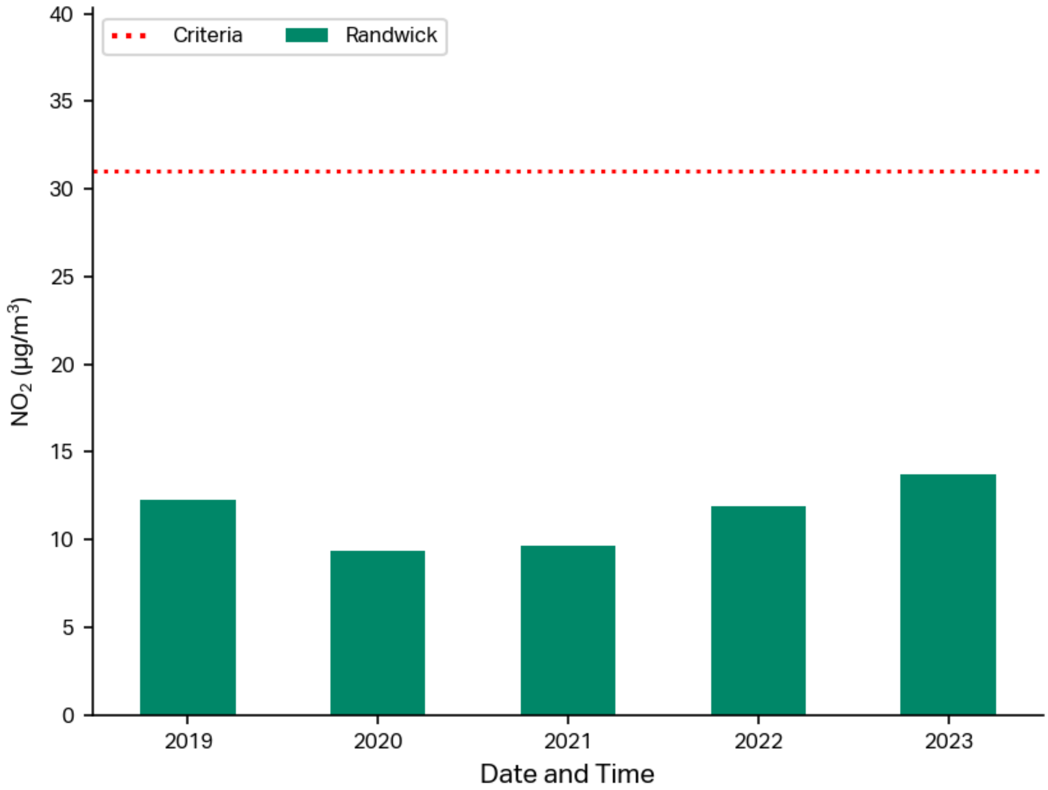


Figure 3-8 Annual average NO_2 concentrations at Randwick DCCEEW monitoring station for 2019 to 2023.

Sulfur dioxide

Recorded 1-hour and 24-hour SO_2 concentrations recorded by the DCCEEW monitoring station at Randwick between 2019 and 2023 are shown in Figure 3-9 and Figure 3-10. The highest 1-hour SO_2 concentration occurred in August 2019, recorded at 76.8 µg/m^3, all hourly concentrations recorded were well below the current EPA criterion of 286 µg/m^3 and proposed criteria of 215 µg/m^3 from 2025.

The highest 24-hour SO_2 concentration occurred in February 2019 recorded at 18.2 µg/m^3. All 24-hour concentrations recorded were well less than half the EPA criterion of 57 µg/m^3 over the five year period examined.

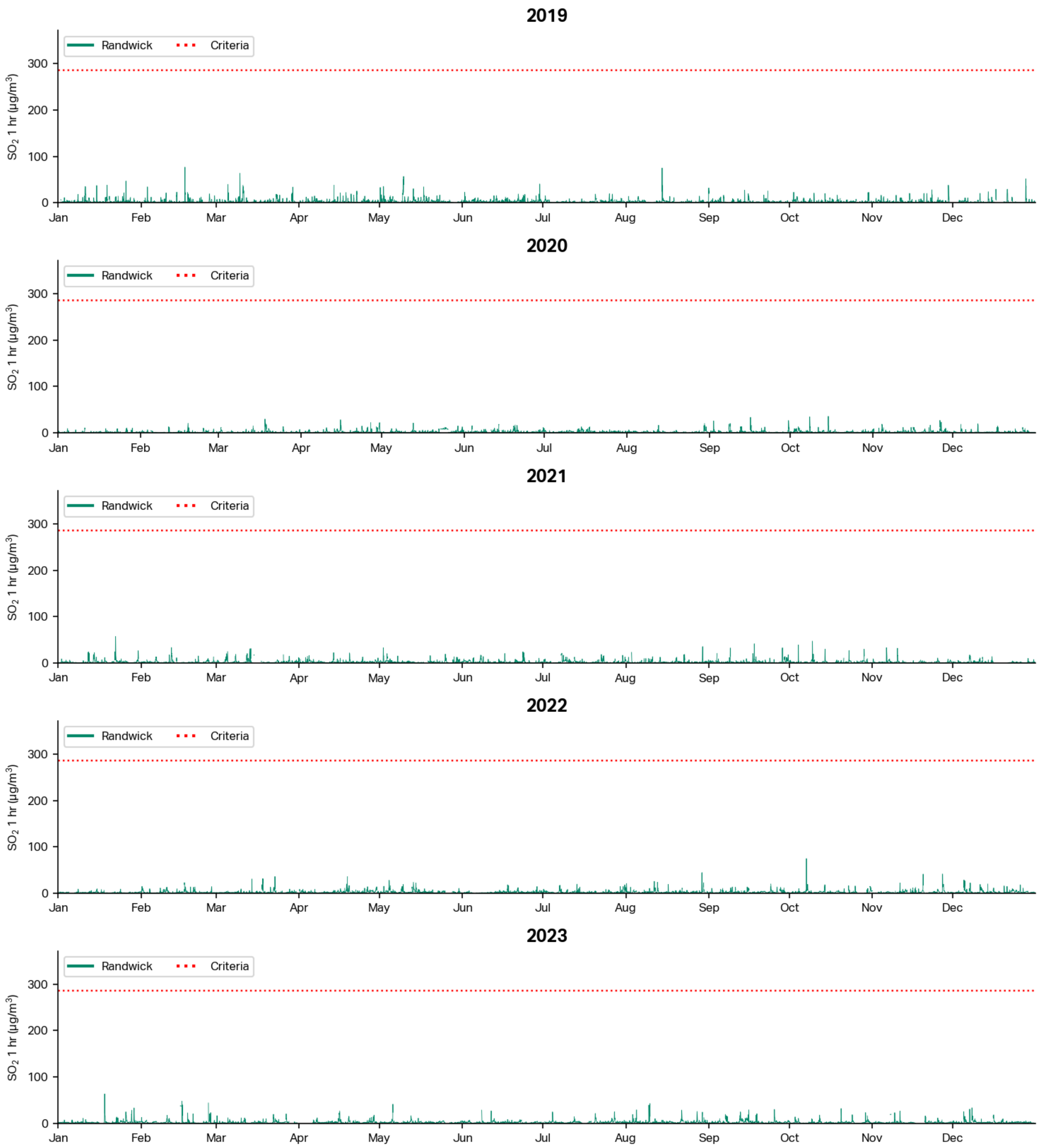


Figure 3-9 1-hour SO_2 concentrations at Randwick DCCEEW monitoring station for 2019 to 2023

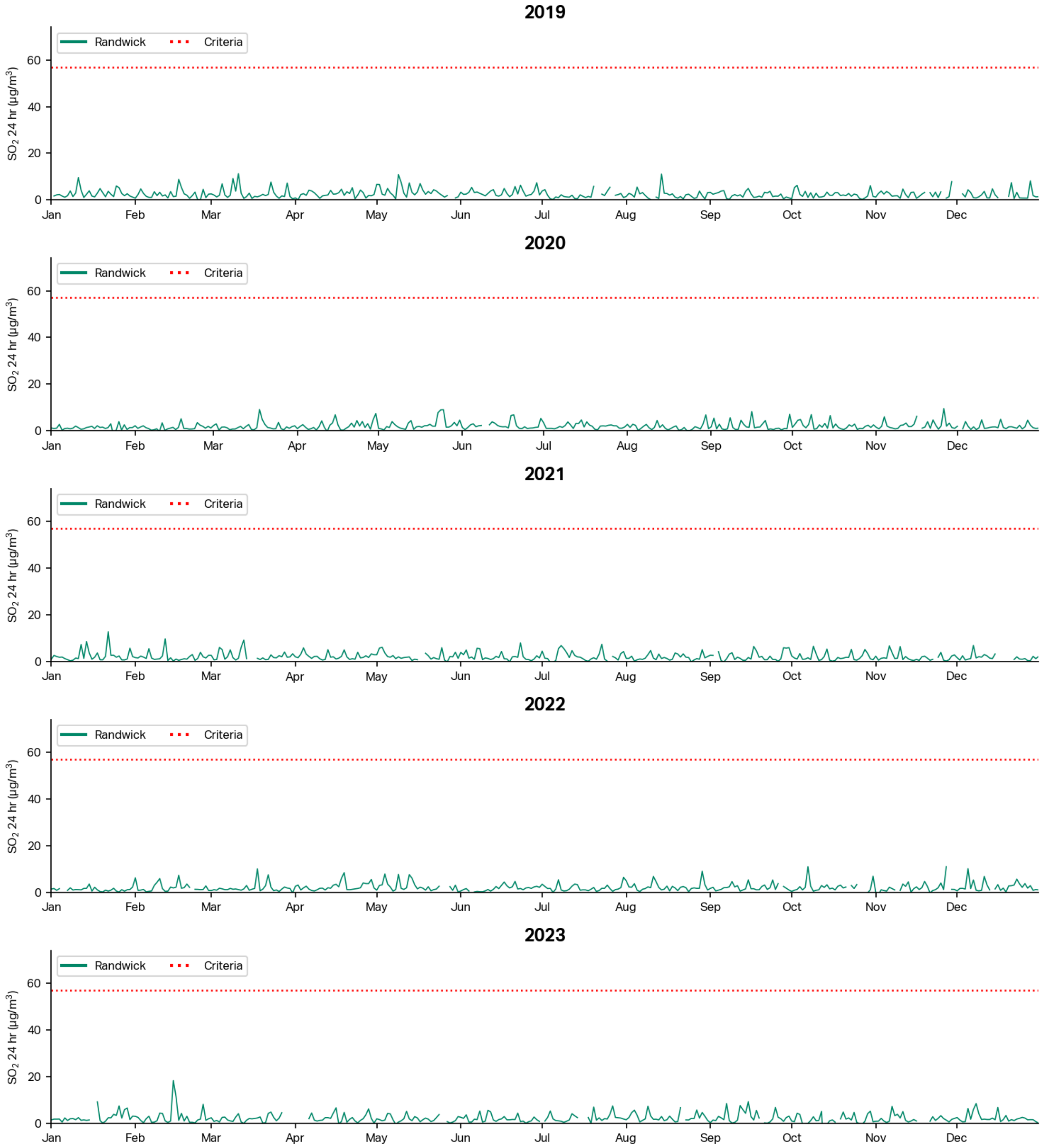


Figure 3-10 24-hour SO_2 concentrations at Randwick DCCEEW monitoring station for 2019 to 2023

Particulate matter (PM_{10})

Recorded 24-hour and annual average PM_{10} concentrations from the DCCEEW Randwick monitoring station in 2019 to 2023 are presented in Figure 3-11 and Figure 3-12.

Measured 24-hour PM_{10} concentrations show multiple exceedances of the EPA criterion of 50 µg/m^3 over the black summer bushfire period between the end of October 2019 and March 2020, with the highest concentration of 135.9 µg/m^3 recorded during January 2020. Additional exceedances in September 2023 were also attributed to hazard reduction burns. Particulate matter concentrations during unusual events should not be used as indicators of long-term peak particulate matter concentrations and compliance with EPA criteria.

The highest measured 24-hour concentrations that did not experience significant bushfires or other extreme events such as dust storms was 37.3 µg/m^3, occurring in both 2021 and 2022.

Annual average PM_{10} concentrations between 2019 and 2023 at Randwick were below the EPA criteria of 25 µg/m^3 for all years. While in compliance with the criterion annual averages reported for 2019 and 2020 are not considered representative of typical ambient air quality concentrations due to the black summer bushfire event. Of the most recent three years, the annual average of 16.6 µg/m^3 recorded in 2023 was the highest. This value has been adopted for dust health risk assessment for construction impacts as discussed in Section 4.1.

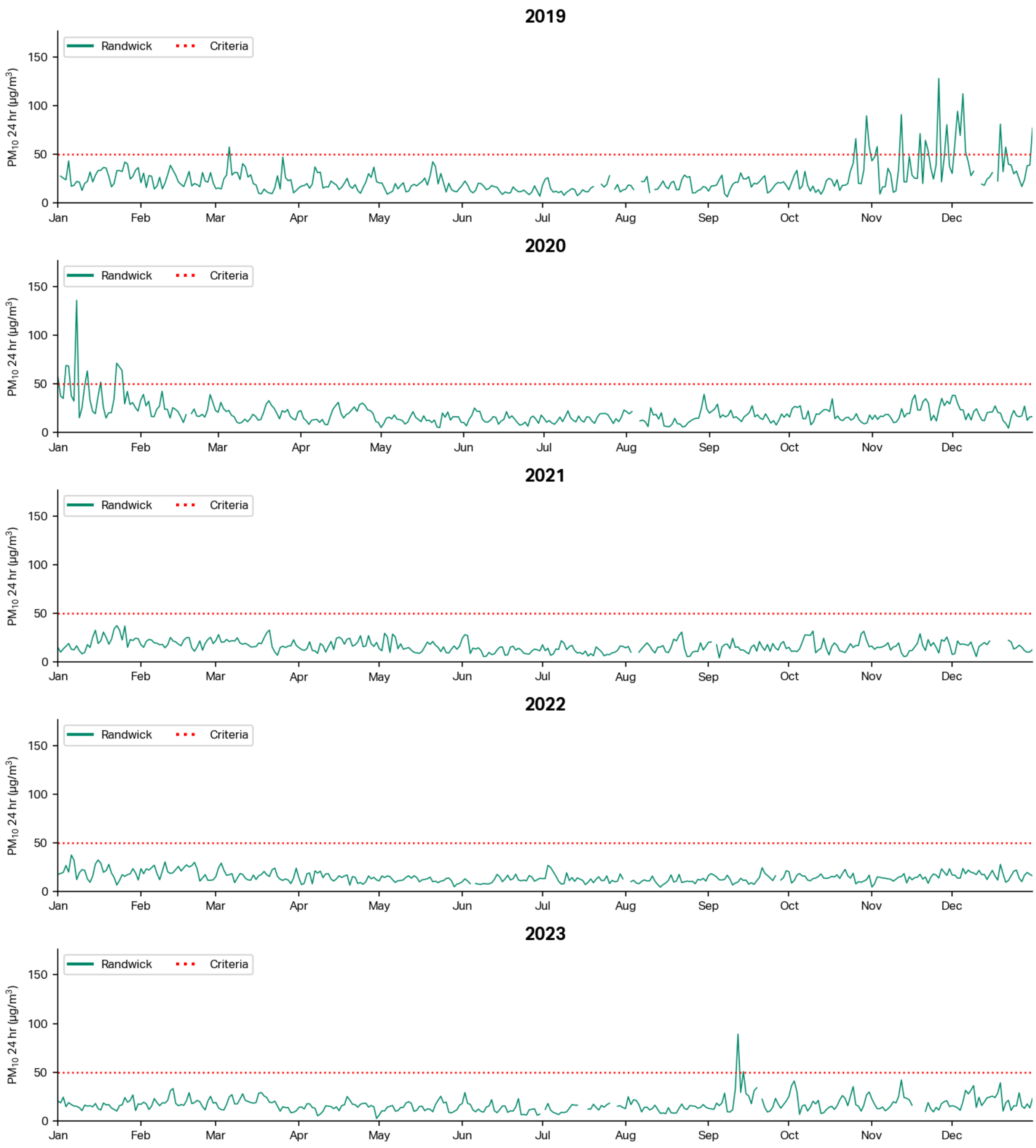


Figure 3-11 **24-hour PM_{10} concentrations at Randwick DCCEEW monitoring station for 2019 to 2023.**

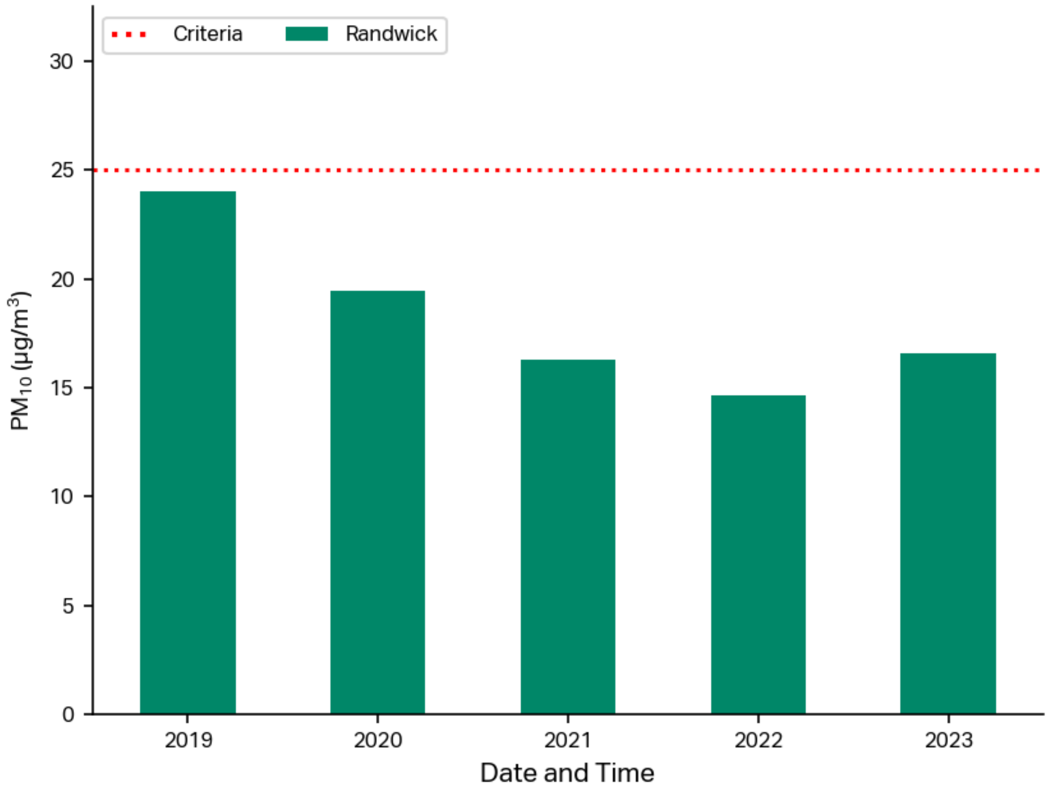


Figure 3-12 Annual average PM_{10} concentrations at Randwick DCCEEW monitoring station for 2019 to 2023

Particulate matter ($PM_{2.5}$)

Recorded 24-hour and annual average $PM_{2.5}$ concentrations from the DEECCW monitoring station in 2019 to 2023 are presented in Figure 3-13 and Figure 3-14.

Measured 24-hour $PM_{2.5}$ concentrations show multiple exceedances of the EPA criterion of 25 µg/m^3 and the NEPM advisory goal of 20 µg/m^3 over the black summer bushfire period from the end of October 2019 to February 2020. The highest concentration was observed in January 2020 at 111.9 µg/m^3. Similarly to PM_{10} concentrations, these exceedances are attributed to bushfire events that occurred over this period. Annual averages for $PM_{2.5}$ were also elevated for 2018 and 2019 and above the EPA criterion of 8 µg/m^3 for 2019 (as shown in Table 3-1**)**. The annual average for 2020 was below the EPA criterion for 2020, but was above the NEPM advisory goal of 7 µg/m^3.

There was also one exceedance in 2021 and three exceedances in 2023 of the maximum 24-hour EPA criterion and NEPM advisory goal. These exceedances, however, were attributed to exceptional events such as bushfires, back burning, or dust storms (DPE, 2023); (DCCEEW, 2025). The highest measured 24-hour concentration for 2022 that did not result in exceedances was 13.9 µg/m^3, occurring in July 2022. Of the most recent three years of data, the highest annual average occurred in 2021 with an annual average $PM_{2.5}$ concentration of 6.4 µg/m^3.

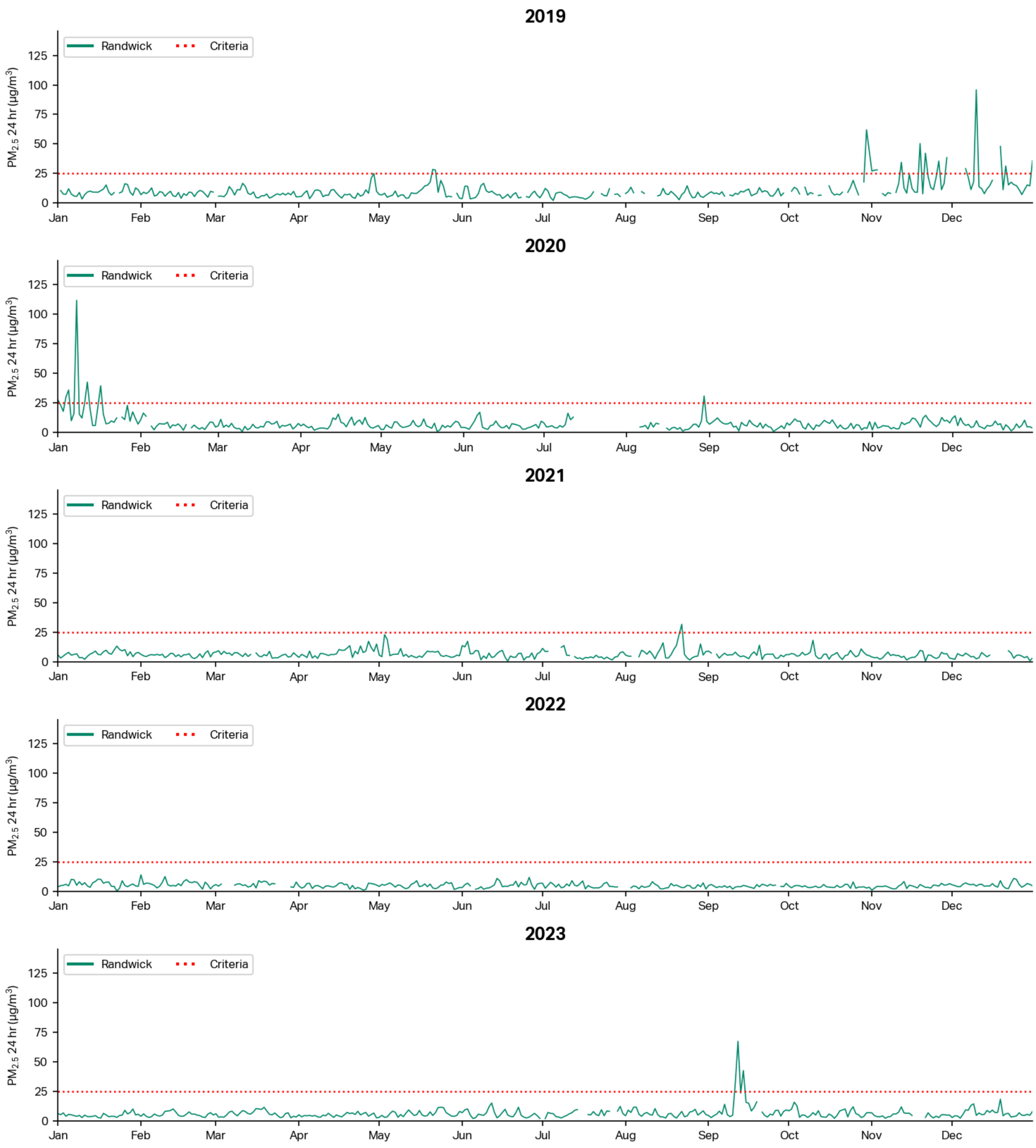


Figure 3-13 **24-hour $PM_{2.5}$ concentrations at Randwick DCCEEW monitoring station for 2019 to 2023**

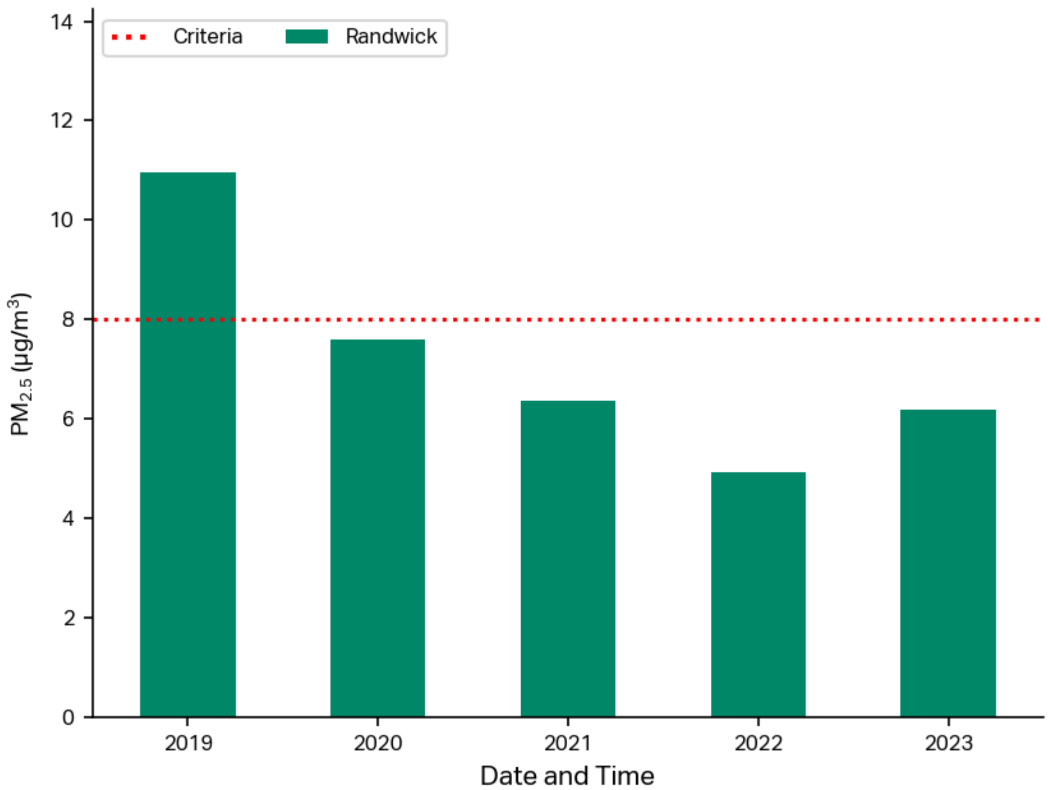


Figure 3-14 Annual average $PM_{2.5}$ concentrations at Randwick DCCEEW monitoring station for 2019 to 2023

3.2.2 Air emission sources

Industrial facility and associated activity emissions

A search of the NPI, maintained by the Commonwealth DCCEEW, was conducted on 26 February 2025. A total of 21 facilities reported air emissions within a 2 km radius from the Project Area for the 2022/ 2023 reporting period.

A summary of the facilities identified, and sources of air emissions, is provided in Table 3-2. The existing sources include the three container stevedores at Port Botany, Ampol Banksmeadow Terminal, and Banksmeadow Transfer Terminal. At Port Botany, the largest quantities of pollutants emitted were SO_2 and total volatile organic compounds (VOCs). Additionally, carbon monoxide (CO) and nitrogen oxides (NO) are existing pollutants present in the surrounding area, arising as a result of combustion processes at industrial facilities.

In addition to these industrial facilities, combustion emissions from transport activities in the surrounding area would be a key source of air emissions including, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, VOCs, and PAHs. Several transport modes would contribute to air emissions, such as:

- Petrol and diesel from road vehicles
- Marine fuel from water vessels from port activities
- Aviation fuel and diesel from airport activities from Sydney Kingsford Smith Airport including aircraft activities including idling, taxiing, take-off and landing and ground service equipment use
- Diesel from freight trains.

Existing operational emissions within the Project Area would include emissions from bulk liquid berths (BLB1 and BLB2) and fugitive emissions from pipelines. Most existing bulk liquid fuels across BLB1 and BLB2 is refined fuels, comprised of petrol, diesel and aviation fluids; however other throughputs include bitumen, bunkering, ethylene, other chemicals, oils and lubricants, and propane or LPG gas. These products are transported and exported to the tenant's relevant land-based storage facility via onshore and offshore pipelines. Vapour emission control systems are in place to control and mitigate the potential for fugitive emissions during the loading and unloading of bulk liquids. Combustion emissions would also be a source from operational machinery, light and heavy vehicles, and water-based vessels from auxiliary engines and boilers during berthing, unberthing, and idling.

Table 3-2 NPI database search

Facility	Address	Description	Pollutants of interest
Allnex Resins Botany	49-61 Stephen Road Botany NSW 2019	Resin manufacturing for coatings industry	VOCs, SO_2, CO
Ampol Banksmeadow Terminal	Penrhyn Road Banksmeadow NSW 2036	Petroleum product wholesaling	VOCs
Banksmeadow Transfer Terminal	Penrhyn Road Banksmeadow NSW 2036	Petroleum product wholesaling	VOCs and heavy metals
DP World	Gate B37 42 Friendship Road Port Botany NSW 2036	Container stevedore	VOCs, SO_2, CO, heavy metals
Elgas Sydney LPG Cavern	30 Friendship Road, Port Botany NSW 2036	LPG Import, storage; distribution and addition of odorant	VOCs, SO_2, CO, PAHs, NO_x
Etex - Matraville	31 Military Road Matraville NSW 2036	Plasterboard manufacturing	SO_2, CO, PAHs, heavy metals, dioxins and furans
Ground water treatment plant (Matraville)	16-20 Beauchamp Road Matraville NSW 2036	Water treatment recycling	VOCs, SO_2, heavy metals
Indorama Ventures Oxides Botany Surfactants Plant	77 Denison Street Hillsdale NSW 2036	Surfactant manufacture	VOCs, SO_2
IXOM Botany Chloralkali Plant	16-20 Beauchamp Road Matraville NSW 2036	Manufacture of chlor-alkali products	HCl, chlorine, SO_2
Kellogg Botany Plant	Swinbourne Street Botany NSW 2019	Manufacture, packaging and transport of ready-to-eat breakfast cereal products.	SO_2, CO, heavy metals
Opal Packaging Botany Mill	1891 Botany Road Matraville NSW 2036	Papermaking of liners and recycled corrugated mediums from recycled raw materials	VOCs, SO_2, CO, heavy metals

Facility	Address	Description	Pollutants of interest
Patrick Terminal, Port Botany	B105a Penrhyn Road Port Botany NSW 2019	Container stevedore	VOCs, SO_2, heavy metals
Port Botany Resource Recovery Facility	3 Military Road Matraville NSW 2036	Petroleum product wholesaling	Heavy metals
Qenos Alkathene and Alkatuff Plants, and Olefines and Site Utilities Plants	16-20 Beauchamp Road Matraville NSW 2019	Polyethylene and ethylene manufacture	VOCs, SO_2, heavy metals, NO_2
Qenos Hydrocarbon Terminal	Friendship Road Port Botany NSW 2036	Ethylene gas liquefaction and storage	VOCs, SO_2
Solvay Interox Pty Ltd	20-22 McPherson Street Banksmeadow NSW 2019	Manufacture and storage of industrial chemicals including hydrogen peroxide and peracetic acid	VOCs, SO_2, heavy metals
Sydney Logistics Park	Gate B2 1890 Botany Road Matraville NSW 2036	Container storage	VOCs, SO_2, heavy metals
Terminals Port Botany Facility	45 Friendship Road Port Botany NSW 2036	Bulk liquid storage	VOCs, SO_2, heavy metals
United Initiators Banksmeadow	20-22 McPherson Street Banksmeadow NSW 2019	Manufacture and storage of industrial chemicals (organic peroxides)	VOCs, sulfuric acid
Vopak Tank Terminals - Site B	20 Friendship Road Port Botany NSW 2036	Bulk storage and distribution of petroleum products. Road tanker loading	VOCs

Vessel emissions

Air pollutant emissions from vessels at Port Botany are tracked via a tool developed for the port known as the Maritime Emissions Portal (MEP). This portal utilises vessel-specific information along with automatically tracked movement data to estimate ship-sourced emissions inventory. This presents near-real-time data on ship movements that can be used to estimate air pollution dispersion and the effect of Port Botany on the overall air pollution in the port.

A summary of emissions between 2022 and 2024 is presented in Table 3-3. Only minor variations were observed, with many of the total pollutant emission loads decreasing across that time frame.

Table 3-3 Port emissions summary 2022-2024

Pollutant	Year	Total Port Emissions
NOx	2022	755.8
	2023	778.8
	2024	748.0
SOx	2022	264.0
	2023	252.3
	2024	245.1
PM_{10}	2022	36.6
	2023	34.5
	2024	33.7
$PM_{2.5}$	2022	33.6
	2023	32.2
	2024	30.9
VOC	2022	ND
	2023	29.3
	2024	28.4

3.2.3 Odour sources

A potential source of odour emissions is anticipated to be marine sediments that would be dredged as part of the Project.

The Technical report: Preliminary site investigation – contamination (Appendix I to the EIS) noted that the Project Area is underlain by coastal podosolic sandy dune deposits, which are characterised by highly leached siliceous sands, and soils are likely to accumulate iron and organic matter with depth. Desktop review indicates a high probability of acid sulfate soils (ASS) occurrence; however, the full extent is unknown. Oxidation of acid sulfide bearing minerals and organic material in seabed sediments during dredging and onshore handling may result in release of odour.

During investigations undertaken in 2020, sediment samples were collected at twenty locations in Brotherson Dock and five near the entrance of Botany Bay (shipping channel) (Geochemical Assessments, 2020). Physical characteristics, including odour, were recorded.

Sediments recovered at Brotherson Dock were muddy sands overlaying medium grained quartzose sands. Contaminants of potential concern were generally below the adopted contaminant screening levels with exception to metals (antimony, lead, zinc and mercury), PAHs, tributyl tin (TBT), and chlordane. Exceeding samples were noted to be restricted to the upper 0.5 m of sediment, with dark muddy sands (Geochemical Assessments, 2020). Two muddy sand sediment samples in Brotherson Dock at a depth of 0.0 to 0.9 m were dark grey to black and produced a moderate, organic odour. The location of the sediment samples (A10 and A14) is shown in Figure 3-15.

Further sampling of Brotherson Dock was undertaken in 2024 to support maintenance dredging. Four samples were collected, and samples and observations were described and noted in the field, and included soil type, colour, grain size, inclusions, moisture conditions, staining and odour. There were no visual or olfactory signs of contamination observed with exception to two sediment samples taken at 0.2 m (FF2 and NF2), which were noted to contain faint organic and sulfidic odours. However, neither of these sites were located within the Project Area and therefore would not be subject to dredging during construction.

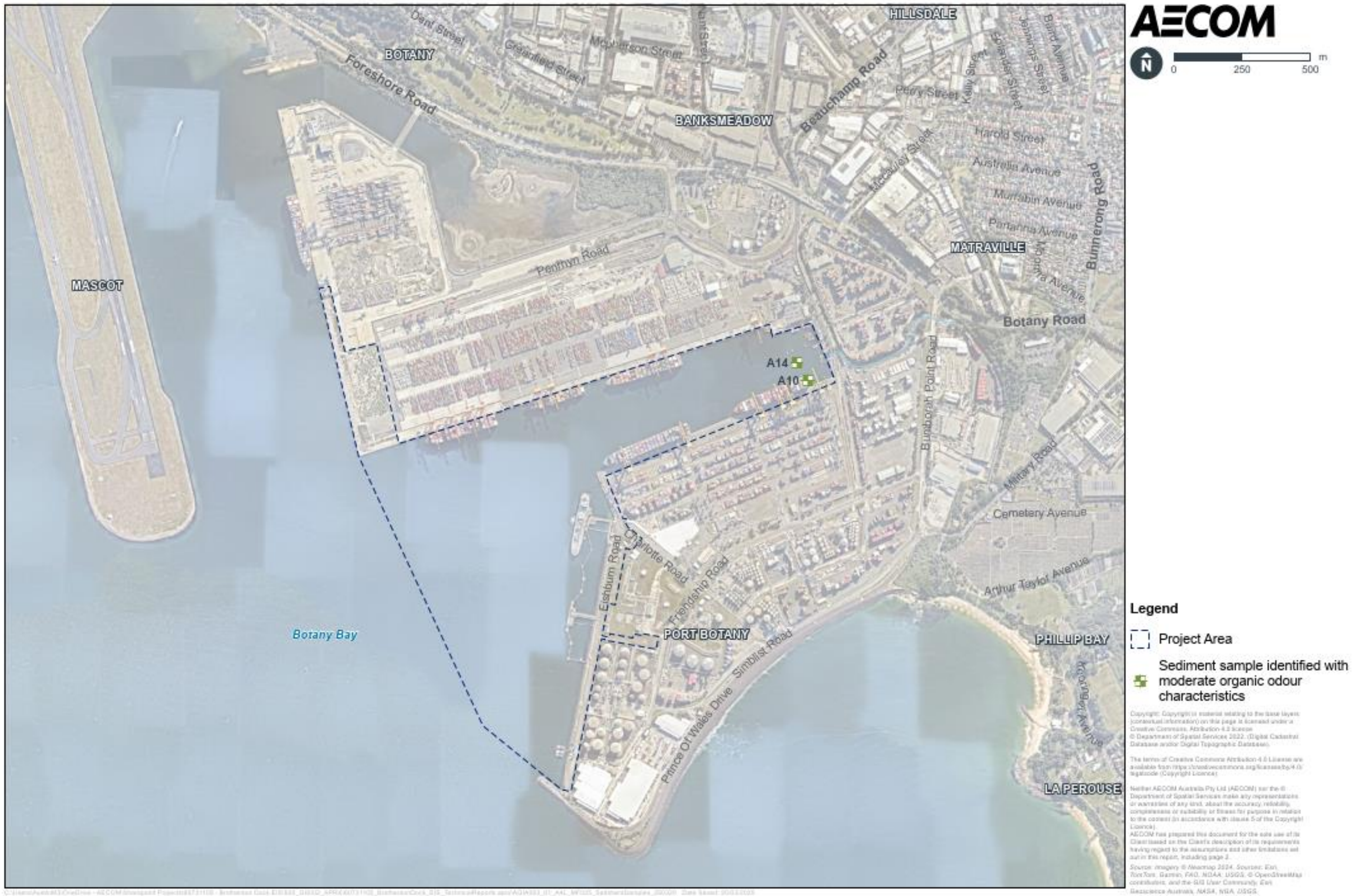


Figure 3-15 **Location of sediment samples displaying moderate organic odour characteristics.**

3.3 Topography

Port Botany is located on the northern shore of Botany Bay, a notable inlet of the Tasman Sea. Botany Bay is roughly circular, about 8 km in diameter and 1.6 km wide at its mouth which lies between the La Perouse and Kurnell Peninsulas. Botany Bay's average elevation is around 8 m above mean sea level (MSL), with terrain ranging from 0 to 40 m. The bay is surrounded by a mix of sandy beaches, rocky headlands, and low-lying coastal plains.

The Project Area and surrounding land at Port Botany has relatively flat topography with terrain elevation typically ranging from around 0 to 5 m. Terrain surrounding the Project Area is shown in Figure 3-16.

3.4 Land use

Land use surrounding the Project Area is heavily industrialised with numerous warehouses, manufacturing plants, and distribution centres associated with Port Botany. Nearby industrial sites, which have also been identified as a source of air emissions, are discussed in Section 3.2.2. Port Botany has a dedicated rail line: the Port Botany Freight Line, which connects the port to Sydney's network of intermodal terminals, facilitating movement of shipping containers to and from the port.

Additional land use surrounding the Project Area includes short term parking and recreational areas, including Molineaux Point Lookout and Bumborah Point. The nearest residential suburbs include Phillip Bay, Matraville, and Chiefly.

Figure 3-16 Terrain surrounding the Project Area

3.5 Sensitive receivers

The NSW EPA defines a sensitive receiver to be “a location where people are likely to work or reside; this may include a dwelling, school, hospital, office, or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receivers” (NSW EPA 2022).

Historically, sensitive receivers have been positioned at locations where people are expected to live and spend significant periods of time and not at places of work. Given that many people spend significant proportions of their lives at a workplace, this historical definition is not considered to present an accurate reflection of the potential impacts that may occur from air pollutant sources. As a result of this underrepresentation of commercial industrial location, sensitive receivers have been placed where anyone may “work or reside” surrounding the Project Area. This also includes transient receiver locations where people are only expected to reside for a short period of time. Cargo ships docked within Brotherson Dock may be regarded as a transient receiver: while people are expected to work and reside on the ship, it is not permanently stationed at the dock and its presence is temporary, typically lasting only for the duration of loading or unloading operations.

In addition to transient receivers, other traditional sensitive receivers as defined by the EPA for the Project would include nearby residents, industrial neighbours, commercial users, and recreational users. Residential receivers are found within the closest suburbs to the Project Area, being those in Matraville, about 780 m to the east; those in Chifley, about 1.13 km to the east; those in Botany, about 1.5 kilometre to the north, and those in Phillip Bay, about 1.7 km to the south-east. There are also recreational land users located east and south east of the Project Area, in the areas of La Perouse, Phillip Bay, and Henry Head.

The Project Area itself is highly developed with limited vegetation. Nearby vegetation includes remnant vegetation south of Foreshore Road and some urban roadside vegetation along Friendship Road, Fishburn Road and Prince of Wales Drive at Port Botany.

4.0 Assessment of construction impacts

The following sections outline the anticipated impacts of constructing the Project on air quality, including

- Dust generated during construction activities
- Combustion emissions from construction plant and equipment
- Odour emissions associated with the exposure of odour-forming sediments during dredging and reclamation activities.

The assessment of construction air quality impacts focuses principally on activities required to deliver the Project. It is noted that dust emissions and combustions emissions generated by construction of a facilitated development may be lower than for construction of the Project, based on a more limited construction footprint and the likely absence of bulk excavation and soil disturbing works.

4.1 Construction dust assessment

The following sections summarise the outcomes of the dust risk assessment carried out following the IAQM risk assessment process (refer to Section 2.2.3).

4.1.1 Screening assessment (Step 1)

Several human receivers are located within 250 metres of the Project Area including:

- Places of work including industrial and manufacturing facilities
- Transient receivers, including those accessing footpaths, carparks and using water vessels.

There are no significant ecological receivers in proximity to the Project Area that could be affected by deposition of construction dust.

4.1.2 Dust risk assessment (Step 2)

The dust risk assessment considers the Project Area shown in Figure 2-1 and provides an assessment of the potential for dust impacts due to unmitigated dust emissions from the Project.

Construction activity magnitudes (**Step 2A**) for each construction activity are presented in Table 4-1. The magnitudes have been estimated based on IAQM guidance provided in Appendix B and construction activities discussed in Chapter 3 (Project description) of the EIS.

The Project would involve dredging of approximately 600,000 m^3 of sediment from Brotherson Dock to be used for reclamation. Marine sediment would be collected and hydraulically placed into the reclamation area via a trailer suction dredge and pipeline. As such, it would have a negligible to low dust generating potential and therefore has not been included in the “earthworks” construction activity.

Sensitivity to dust soiling risks (**Step 2B**) have been examined for each of the construction buffer zones identified above and are summarised in Table 4-2. Dust risk ratings have been determined by the highest risk rating attributed to a construction buffer zone. The overall sensitivity rating for the Project has been determined to be medium based on the number of medium sensitivity receivers within 20 metres of the Project Area boundary.

An assessment of receiver sensitivity to health risk from PM_{10} emissions (**Step 2B**) is presented in Table 4-3. Dust health risk ratings for human receivers have been determined by the highest risk rating attributed to a construction buffer zone and have been estimated based on IAQM guidance, an annual average PM_{10} of less than 19 µg/m^3 and surrounding land use. Table 4-3 shows that the health risk from PM_{10} emissions is medium due to low PM_{10} background concentrations and the absence of highly sensitive receivers within close proximity to the Project Area.

Table 4-1 Stage 2 IAQM assessment construction activity magnitudes

Construction activity	Magnitude	Justification
Demolition	Medium	Total material volumes would be within the range of 12,000 m^3 and 75,000 m^3 and would include: • Demolition materials: - Removal of existing BLB1 and its associated pipeline infrastructure - Removal of the existing tugboat jetty - Removal of the current Brotherson Dock quay end by approximately 30 metres • Waste materials: - 88 piles from the BLB1 and tugboat jetty - 0.65 m^3 of excavated earthwork material - 3,000 m^3 concrete components - 1,000 m^3 steel components. Demolition material is expected to contain some dusty material largely attributed to removal of concrete but would also include material with low dust generating potential such as steel and timber.
Earthworks	Large	The total area of the reclamation works, construction of the rock bund, and aggregate fill would include: • Estimated reclamation area greater than 110,000 m^3 • Approximately 500,000 m^3 of rock bund and rock armour material required for construction of the bund wall • Aggregate fill material is expected to be sourced from tunnelling from similar projects or quarried from existing sites. Aggregate fill and outer rock armer material would be delivered by road and temporarily stockpiled at LSCC06. Truck and dog trailers would transport the material from LSCC06 to the relevant locations and material placed underwater using tipping trucks and long reach excavators • Additional earthworks within the Project Area are estimated to be less than 5,000 m^3. This equates to approximately 8,000 tonnes of excavated material.
Construction	Large	Construction works would include: • A large construction footprint area including: - Construction and commissioning of a new BLB3, associated pipeline infrastructure and bulk liquids berth building - Extension of quayline on the southern side of Brotherson Dock by 314 m, with an additional four hectares of wharf hardstand area • Onsite generators would be required. Onsite concrete batching may also be required • The construction program spans seven years between 2026 and 2032 • There would be five construction compounds for the Project including: - One waterside construction compound (WSCC01) - Four landside construction compounds (LSCC03, LSCC04, LSCC05, LSCC06).

Construction activity	Magnitude	Justification
Track-out	Large	Track-out for construction works would include: • Daily average construction vehicle movements of 156 vehicles per day for heavy and light vehicles • Construction vehicle numbers are anticipated to peak during Quarter 4 of 2027 at 517 heavy vehicles per day and 330 light vehicles per day. Peak daily vehicle numbers during this period are attributed to several concurrent activities including laydown area works, construction of the operations building and pipelines and demolition of the tugboat jetty • The Project is expected to include a mix of both land based and waterside deliveries. No track-out impacts are associated with water vessels • Surface material has moderate dust potential due to fines content (sandy clay-based soils) • It is assumed that most access roads would be paved and the length of unpaved access roads required would be less than 50 metres.

Table 4-2 Stage 2 IAQM assessment of sensitivity to dust soiling

Receiver type sensitivity	Distance from Project Area	Description of sensitive receivers (dust soiling)	Sensitivity of the area
High	<20 m	• There are no residential dwellings within 20 metres of the Project Area • There are no other highly sensitive properties to dust soiling such as hotels, museums or culturally important collections, medium to long term car parks or car showrooms.	Low
	<50 m	• As above.	Low
	<100 m	• As above.	Low
	<250 m	• As above.	Low
Medium	<20 m	• Several places of work are located within 20 metres of the Project Area, including DP World, Elgas, Quantem, Vopak, Hutchison Ports Sydney, and Patrick Terminals.	Medium
	<50 m	• As above.	Low
	<100 m	• Additional places of work including industrial, manufacturing facilities, transport logistics.	Low
	<250 m	• Additional places of work including industrial, manufacturing facilities, transport logistics • Recreational facilities are located within 250 metres of the Project Area including Molineaux Point Lookout.	Low
Low	<20 m	• Transient receivers associated with cargo ships docked at Hutchison Dock	Low

Receiver type sensitivity	Distance from Project Area	Description of sensitive receivers (dust soiling)	Sensitivity of the area
		• Short term carparking within 20 metres of the Project Area including: - Hutchison Port Sydney Carpark - Patrick Terminals Carpark.	
	<50 m	• As above.	Low
	<100 m	• As above.	Low
	<250 m	• Other nearby transient receivers including roads and pedestrian walkways • Short term carparking within 250 metres of the Project Area at Molineaux Point Lookout on Prince of Wales Drive.	Low

Table 4-3 Stage 2 IAQM assessment sensitivity to human health impacts

Receiver type sensitivity	Distance from source	Description of sensitive receivers (human health)	Sensitivity of the area
High	<20 m	• There are no residential properties, hospitals, schools, or residential aged care home within 20 metres of the Project Area.	Low
	<50 m	• As above.	Low
	<100 m	• As above.	Low
	<250 m	• As above.	Low
Medium	<20 m	• Several places of work are located within 20 metres of the Project Area, including DP World, Elgas, Quantem, Vopak, Hutchison Ports Sydney, and Patrick Terminals.	Low
	<50 m	• As above.	Low
	<100 m	• Additional places of work including industrial, manufacturing facilities, transport logistics.	Low
	<250 m	• Additional places of work including industrial, manufacturing facilities, transport logistics.	Low
Low	<20 m	• Transient receivers associated with cargo ships docked at Hutchison Dock.	Low
	<50 m	• As above.	Low
	<100 m	• As above.	Low
	<250 m	• Recreational facilities within 250 metres of the Project Area including Molineaux Point Lookout. • Other nearby transient receivers including roads and pedestrian walkways.	Low

The construction activity magnitudes and sensitivities of receivers (dust spoiling and human health) have been combined through the risk rating matrix (refer to Table 2-10) to determine potential unmitigated dust risks. The potential unmitigated risks associated with the construction of the Project range from low to medium, as summarised in Table 4-4. Specifically, the risk assessment identified the unmitigated risk for dust soiling was medium, while the unmitigated risk to human health was considered low.

Consistent with the IAQM approach, specific activity mitigation measures have been identified to further reduce risk, as described in Section 7.0. Following implementation of these mitigation measures, dust risks associated with dust soiling, human health, and to ecological receivers would be low to negligible.

Table 4-4 Summary of unmitigated risk assessment for the Project activities

Activity	Potential for dust emissions	Sensitivity of the area		Risk of unmitigated dust impacts		Risk of mitigated dust impacts	
		Dust soiling	Human health	Dust soiling	Human health	Dust soiling	Human health
Demolition	Medium	Medium	Low	Medium	Low	Low	Negligible
Earthworks	Large	Medium	Low	Medium	Low	Low	Negligible
Construction	Large	Medium	Low	Medium	Low	Low	Negligible
Track-out	Large	Medium	Low	Medium	Low	Low	Negligible

4.2 Construction combustion emissions assessment

Combustion emissions during the Project construction phase would occur due to the combustion of petrol and diesel fuels by light and heavy vehicles travelling to and from the Project Area, as well as onsite, mobile construction equipment and stationary equipment (including waterside vessels operating within the Project Area). Operation of diesel generators would also be required which would result in the emission of combustion pollutants. Emissions are expected to depend on the nature of the equipment source, i.e. the size of the equipment, usage rates, duration of operation. Pollutants emitted by construction vehicles and mobile and stationary equipment include CO, particulate matter (PM_{10} and $PM_{2.5}$), NO_2, SO_2, VOCs, and PAHs.

Heavy vehicle movements would include deliveries of construction plant, supplies, and infrastructure and to transport spoil and waste materials. The scheduling of construction heavy vehicle movements, including oversized loads, would occur outside peak periods wherever possible. The proposed haulage routes are identified and further assessed in Technical report: Transport and traffic (Appendix J to the EIS).

Construction traffic would fluctuate over the course of the construction program, with a daily average of 78 vehicles per day (156 movements) for both heavy and light vehicles individually. Construction vehicle numbers are anticipated to peak during Quarter 4 of 2027 at 517 heavy vehicles per day (1036 movements) and 330 light vehicles per day (660 movements). Peak daily vehicle numbers during this period are attributed to several concurrent activities including laydown area works, construction of the operations building and pipelines and demolition of the tug jetty.

Haulage routes for the Project would include busy arterial roads. Given their existing volumes, combustion emissions from construction traffic on inbound and outbound haul routes are unlikely to result in a notable change in ambient air quality at nearby sensitive receivers.

Combustion emissions would also be associated with both light and heavy water vessels. Light vessels would be used primarily to transport personnel (up to 12 persons) and heavy vessels would be used for transporting construction materials during enabling works, laydown area works, construction, demolition, and site demobilisation. Estimated daily water vessel numbers are as follows:

- Heavy water vessel numbers would average around 26 vessels per day (52 return trips) with a peak of 150 vessels per day (300 return trips)
- Light water vessel numbers would average around 19 vessels per day (38 return trips) with a peak of 90 vessels per day (180 return trips)

Daily shipping numbers would peak during the first half of 2031, which would coincide with the construction of the extended quayline (BD12) and wharf area.

Air emissions would primarily occur from combustion of marine gas oil (and potentially diesel for light water vessels) from auxiliary and engines, and boilers during berthing, unberthing, and idling and comprise primarily of particulates (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO, and VOCs. Air quality impacts associated with ships, berthing, idling, and unberthing associated with construction of the Project would be transient in nature. Like construction traffic, shipping activities associated with construction are unlikely to result in a notable change in ambient air quality at nearby sensitive receivers, based on the existing volume of shipping activities that would typically occur during operation at Port Botany.

Construction traffic and shipping emissions, as well as the use of mobile and stationary plant equipment exhaust emissions, are unlikely to result in adverse impacts to local air quality. Standard mitigation and management measures for construction vehicles, and plant and equipment are presented in Chapter 7.0. With the implementation of these measures, adverse air quality impacts from construction vehicles, and plant and equipment are not expected.

4.3 Construction odour impact assessment

Potential odour impacts may arise during dredging activities, during decommissioning and demolition of BLB1, and mishandling of wastes during construction.

Oxidation of acid sulfide bearing minerals and organic material in seabed sediments during dredging and onshore handling may result in release of odorous vapours. Potential odour impacts can include the release of hydrogen sulfide (H_2S), which is a common byproduct of the anerobic decomposition in sediments and can have a characteristic ‘rotten egg’ smell. Organic materials, such as plant debris, algae, and animal remains, can decompose when dredged, releasing odorous gases, typically with a musty or earthy smell.

Based on the marine sediment investigations to date (refer to Section 3.2.3), there is the potential for odour emissions to be released during dredging of Brotherson Dock. This has the potential to generate amenity or nuisance concerns at nearby receivers, primarily affecting workers at Brotherson Dock. Due to the distance from other sensitive receivers, residential receivers would not be affected. Use of appropriate dredging methods to limit exposure of seabed sediments to air, which can create odour emissions, would help prevent the release of odorous vapours. As such, impacts would be minor and temporary.

There is the potential for minor odour impacts from fugitive VOCs during decommissioning and demolition of BLB1, associated flushing and pigging (pipe clearing) of pipelines, and commissioning of BLB3. This would also be temporary in nature and managed through measures presented in Chapter 7.0.

To prevent onshore odour emissions, standard construction practices would be employed, such as covering waste materials and utilising odour neutralising agents where practical.

As such, odour emissions from the Project are not expected to result in adverse impacts on the surrounding environment.

5.0 Assessment of operational impacts

At the completion of construction, remaining operational elements of the Project would include:

- An extended quayline and around 5.3 hectares of new wharf area (hardstand)
- A new bulk liquids berth (BLB3) and associated pipelines and bulk liquids handling infrastructure.

The ongoing operational air emissions from the Project would include emissions from ships berthed at the new BLB3, and potential fugitive emissions during operation of the bulk liquids berth. Prior to the facilitated container operations, the extended quayline and wharf area would be managed in line with existing procedures at DP World. The Project is not anticipated to generate air emissions from the extended quayline or wharf area.

The Project would include a new BLB (BLB3) to replace BLB1, including associated pipeline infrastructure. BLB3 would be connected to the existing pipeline network or directly into the existing bulk liquid and gas tenancies that would utilise this berthing dock. The new BLB3 would operate similarly to the current BLBs, operating 24 hours a day, 7 days a week, consistent with existing operations at Port Botany.

The new BLB3 and associated infrastructure would be constructed about 750 metres south of the existing BLB1, effectively relocating air emissions sources from the current BLB1 site to the new BLB3 location. Conservatively, BLB3 has been assumed to be characterised with the same air emissions as BLB1.

Effective replacement of BLB1 emissions with BLB3 emissions would result in changes to the ground level distribution pattern of air emissions (notably VOCs). Changes to the dispersion patterns may result in minor increases in VOC emissions from fugitive sources at the southern end of Port Botany, which is closer to industrial receivers, such as Vopak and Quantem. Subsequently, there would be lower concentrations of VOC emissions at receivers to the north, such as Elgas and DP World, as well as cargo ships at Brotherson Dock (regarded as transient receivers), as the source moves further south. Importantly, the new BLB3 would not move emissions sources closer to sensitive receivers such as residential premises, recreation areas and sensitive infrastructure (schools, hospitals etc) relative to existing emissions from BLB1.

As per BLB2, BLB3 would be designed to accommodate bulk liquids vessels with fully laden capacity of up to 120,000 DWT. The frequency, size and types of vessels envisaged to use BLB2 and BLB3 would be consistent with those that currently use BLB1 and BLB2 in line with existing operations. As such, no changes to total fugitive VOC emissions from operation of BLB3 and associated pipelines are anticipated. Similarly, emissions from ship combustion sources at the new BLB3 are expected to remain this same as currently experienced at BLB1.

6.0 Assessment of cumulative and facilitated impacts

6.1 Overview

In addition to impacts that are wholly and directly related to its construction and operation, the Project has the potential to:

- Directly contribute to **cumulative impacts** with other developments or activities that coincide spatially or temporally with the Project
- Indirectly contributed to **facilitated impacts** as a consequence of enabling or encouraging subsequent development or activities.

As described in Section 2.2.6, this chapter considers these two types of potential impacts to help form a view on the acceptability of the Project and its contributions to those potential impacts. Where relevant, it also identifies environmental mitigation and management measures within the control and responsibility of the Project to address the Project's contributions to cumulative and facilitated impacts.

6.2 Cumulative impacts

Following the adoption of the proposed mitigation and management measures, sources of construction- and operation-related emissions are expected to be managed to a point where impacts to sensitive receiver would be negligible. As such, air quality residual impacts are not anticipated during construction or operation of the Project. Subsequently, an assessment of cumulative impacts of the Project and the developments listed in Section 2.2.5 is not required.

6.3 Facilitated impacts

The Project, including extension of the quayline and construction of the new wharf area would not by itself generate additional air emissions from ships at berth or container handling activities associated with those ships. It would, however, facilitate the development of container operations on the extended quayline and wharf area, as a potential expansion of the existing DP World container operations. Together, the Project and the facilitated development would provide the infrastructure to support ship trade across the extended quayline.

The facilitated development would introduce additional air emissions sources:

- Emissions from ships berthed at the new BD12 quayline as part of the operation of the facilitated development
- Other plant, equipment and vehicles associated with the operation of the facilitated development.

Emissions by vessels depend on the fuel consumption by the vessels, which can increase or decrease depending on the activities the vessel is performing and its age; for instance, newer vessels are more likely to have energy efficient designs and be subject to more stringent design requirements, both aimed at reducing their overall emissions. The two main demands for power on a vessel while at berth are hotelling (driving ships services and systems) and operation of refrigerated containers (reefers), which can be the larger demand on power. Longer ships (such as the New Panamax ships 15,000 TEU) generally require larger auxiliary engines and boilers and, as such, may produce a higher marine fuel consumption rate; whilst an older, shorter vessel with more reefers than a newer, longer vessel may in turn produce more emissions.

The extended quayline would allow for the southern side of Brotherson Dock to accommodate longer ships, equivalent with the longer quaylines available to other stevedores operating within the port. As described above, there is some potential for these longer vessels to produce more emissions than vessels currently accessing Brotherson Dock. As such, there is the potential for minor increases to both peak and average ground level pollutant concentrations with the introduction of longer ships to the extended quayline. These changes in ship lengths and emission profiles would be expected to result in minor changes to dispersion patterns of combustion pollutants from the extension of the quayline (BD12) and wharf area.

The expansion is designed to support ship berthing and other associated activities, including loading and unloading containers via quay cranes. Whist there are likely to be anticipated minor changes to pollutant emissions rates from the accommodation of longer ships and minor changes to dispersal patterns, the operation of the facilitated development is expected to be consistent with the existing wharf area, with a similar number of ships throughout on an annual basis. Similarly, extension of the quayline is not expected to increase the total number of ships berthed at any given time which would likely have a greater influence on total peak air emission concentrations. Ships entering Port Botany are also bound by emission standards under MARPOL, as discussed in Table 2-1.

Minor increases in combustion emissions are anticipated due to the operation of the facilitated development on the extended quayline and wharf area. This would largely be attributed to combustion of diesel and petrol fuels from mobile equipment. Operation is expected to be consistent with the existing container operations, including container stacks worked with mobile plant and equipment.

7.0 Mitigation and management of impacts

7.1 Overview

This section outlines how the identified aviation hazards associated with the Project would be mitigated and managed. These mitigation and management measures relate specifically to the Project, and include consideration of the facilitated development to the extent necessary to minimise potential inconsistency between the approach taken for the Project and the facilitated development.

The facilitated development would be separately progressed by the stevedore, including development of mitigation and management measures specific to that development, as required.

7.2 Mitigation and management measures

Mitigation and management measures for air quality and odour during construction and operation of the Project are outlined in Table 7-1.

In addition to mitigation and management controls presented below, measures to manage sediment quality risk, including organic material in dredged sediments as per the Technical report: Preliminary site investigation – contamination (Appendix I to the EIS) would be applied.

Table 7-1 Mitigation and management measures – air quality and odour

ID	Issue	Mitigation measure	Timing
AQ1	Minimisation of dust emissions from construction activities	Construction activities will be managed to minimise the emission of visible dust beyond the Project Area. Measures to minimise the generation and emission of dust will be detailed in the Construction Environmental Management Plan(s) (CEMP(s)) and applied to relevant construction activities. Dust mitigation measures for each location/ activity may include one or more of the following: • Visual inspection of construction sites to identify sources of dust emissions, considering weather conditions (particularly dry and windy conditions) and the scale, nature and intensity of construction activities • Scheduling of dust generating activities to minimise potential for elevated cumulative dust generation • Locating dust generating stockpiles away from sensitive receivers • Application of measures to minimise dust generation from surfaces and stockpiles, such as sealing (or other treatment), application of water sprays, covers and enclosures, dust barriers or similar • Implementation of speed limits on trafficked surfaces.	Construction

ID	Issue	Mitigation measure	Timing
AQ2	Minimisation of dust emissions from construction traffic	Dust emissions from construction vehicles travelling to or from the construction footprint will be minimised by: • Covering dust generating loads where practicable • Implementing a wheel washing system at relevant construction site access points (with rumble grids to dislodge accumulated dust and mud prior to leaving the Project Area) where practicable • Using water-assisted sweepers or similar on access roads around the construction footprint to remove any material tracked onto those roads by construction traffic.	Construction
AQ3	Minimisation of emissions from construction plant and equipment	Air emissions from construction plant and equipment will be minimised by: • Using mains electricity or battery powered equipment instead of diesel- or petrol-powered generators where practicable • Switching off vehicles, plant, and equipment when not in use • Using lower emissions plant and equipment where feasible and reasonable.	Construction
AQ4	Minimisation of construction odour generation	The potential for odour generation during construction will be minimised by: • Implementing practices, such as covering waste materials and utilising odour neutralising agents where practical • Establishing a dedicated hotline and email address for odour complaints during construction and ensure that all complaints are logged, investigated and addressed promptly • Informing the community about potential odour generating works and the measures being undertaken to mitigate them.	Construction
AQ5	Minimisation of air emissions from construction of BLB3	The CEMP(s) will outline measures to minimise and manage air emissions from the construction of BLB3 will include: • Where available, EPA approved emission controls will be used on construction vehicles and equipment • Records will be kept of air quality and odour complaints, documented within a complaints register including any details of corrective actions undertaken.	Construction

8.0 Conclusion

The purpose of this report is to assess the potential air quality impacts associated with Port Botany Quayline Equalisation, to inform the preparation of the EIS required for the Project. A summary of the key assets, values, or uses potentially affected by the Project, and an associated assessment of air quality impacts and recommended mitigation measures, are summarised below.

Assessment findings

Construction assessment

Potential dust risks associated with construction were assessed in accordance with the Institute of Air Quality Management (UK) (IAQM) *Guidance on the assessment of dust from demolition and construction* (IAQM 2024). The IAQM document provides a risk-based assessment process for the potential unmitigated impact of dust generated from demolition, earthmoving, construction and track-out.

The Project is expected to take around seven years to construct. Potential unmitigated dust risks on human receivers with regards to dust spoiling and health impacts, and dust risks to ecological receivers, were assessed for the Project. Specifically, for human receivers, the risk of unmitigated dust soiling was medium for all construction activities. Unmitigated dust health risks were considered low for all activities, largely due to the low existing PM_{10} levels in the area, as well and low sensitivity of receivers in proximity to the construction boundary. The unmitigated risk of dust impacts to ecological receivers were also rated low for all construction activities due the low sensitivity of the receiving environment.

A qualitative assessment has been carried to consider the potential impacts of emissions from vehicles, water vessels, mobile equipment, and stationary equipment associated with the construction of the Project. Emissions are unlikely to result in adverse impacts to local air quality, provided standard mitigation measures are implemented.

There is the potential for dredging of marine sediments to lead to minor odour impacts, primarily due to the disturbance of organic materials and contaminants buried in the sediments. Potential odour emissions would be transient in nature and when appropriate safeguard measures are applied, including use of appropriate dredging methods to limit exposure of seabed sediments to air, odour impacts are not anticipated at sensitive receivers.

Operational assessment

Following relocation of the BLB (BLB3) about 750 m south of its existing position, changes to dispersion patterns may result in minor increases in VOC emissions from fugitive sources at the southern end of Port Botany, and a minor decrease its original position. The frequency, size, and types of vessels envisaged to use BLB2 and BLB3 would be consistent with those that currently use BLB1 and BLB2 in line with existing operations. As such, no changes to total fugitive VOC emissions from operation of BLB3 and associated pipelines are anticipated.

The Project would facilitate the separate development of container operations on the extended quayline and wharf area. Together, the Project and the facilitated development would provide the infrastructure necessary to accommodate longer ships, equivalent with the longer quaylines available to other stevedores operating within the port. Longer ships generally require larger auxiliary engines and boilers; they have a higher marine fuel consumption rate which leads to higher emissions of pollutants. As such there is the potential for minor increases to both peak and average ground level pollutant concentrations with the introduction of longer ships to the extended quayline.

Whilst there would be changes to dispersion patterns of combustion pollutants from ships at berth trading across the extended quayline and the through the facilitated development, no significant changes are anticipated to annual emissions or annual average ground level concentrations of air pollutants because operations are expected to be consistent with the existing wharf area with a similar number of ships throughput. Emissions from vessels would be in accordance with emission standards under MARPOL.

Mitigation and management measures

Potential impacts on air quality and odour due to the Project would be avoided, minimised, or managed through the recommended mitigation measures.

Construction activities would be managed to minimise the emission of visible dust beyond the construction footprint. Measures to minimise the generation and emission of dust and from combustion emissions would be detailed in the Construction Environmental Management Plan(s) (CEMP(s)) and applied to relevant construction activities.

Odour would be managed during construction through progressive reclamation of dredged material, covering waste materials, and utilising odour neutralising agents where practical. A dedicated hotline and email address would also be provided during construction to ensure complaints are logged, investigated, and addressed promptly.

Based on the above assessment and proposed mitigation measures, the Project would be designed, constructed, and operated in a manner that minimises air quality impacts (including nuisance, dust and odour) to human health and the environment.

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