Prepared for
Ampol Australia Petroleum Pty Ltd
ABN: 17 000 032 128

AECOM

Kurnell Terminal
SSD-5544 MOD-7

Appendix N - Air Quality Impact Assessment

12 May 2025

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Client: Ampol Australia Petroleum Pty Ltd

ABN: 17 000 032 128

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Executive summary

The Kurnell Terminal ('the Site') is located on the southern side of Botany Bay, in Kurnell, New South Wales (NSW). In 2012, Ampol Refineries (NSW) Pty Ltd (Ampol) announced that the oil refinery and fuel terminal would be converted to a finished product terminal (the 'approved project'), ceasing refinery operations in 2014.

Development consent was received to complete the approved project under State Significant Development (SSD) application reference 5544 (SSD-5544). Ampol has modified SSD-5544 six times to complete the conversion and demolition works.

Currently, the operational infrastructure is primarily located in the northern part of the Site (Zones 1 and 1A). Other parts of Ampol's landholdings at Kurnell include largely vacant areas of previously developed land (Zones 2 and 3) and areas of undeveloped land containing extensive native vegetation (Zones 4 and 5).

Ampol intends to consolidate operational infrastructure, remove redundant assets, and undertake remediation and grading. Completion of these works (the 'proposed modification', MOD-7) would continue the safe, viable, and reliable operation of the Kurnell Terminal, whilst preparing the land for future uses. The location within the Site that these works would occur is referred to as the 'Project Area.'

This *Air Quality Impact Assessment* has been prepared in support of a modification application to the existing state significant development consent (SSD-5544), in order to identify potential sources of air pollution associated with the construction and operation of the proposed modification, potential offsite impacts, and appropriate mitigation measures.

The proposed modification would include the demolition of existing structures, earthworks remediation works, and grading of existing land. Potential air emission sources for these activities would primarily be dust and particulate emissions due to the mechanical disturbance of dusty materials. Other air pollutants, such as combustion emissions from vehicle exhaust, and odour and hazardous pollutants, such as volatile organic compounds (VOCs) or heavy metals attached to dust from remediation works, are also possible.

A dust impact assessment for construction activities was undertaken utilising the United Kingdom's Institute of Air Quality Management's (IAQM) guidance document, *Assessment for Dust from Demolition and Construction 2024*. This document provides a qualitative risk assessment tool for assessing construction projects for potential impacts to neighbouring sensitive receptors. The assessment is summarised in the following paragraphs.

Air quality risk ratings for dust soiling, human health, and ecological receptors for unmitigated construction activities were determined using the IAQM guidance. First, the sensitivity of the area and the potential dust emission magnitudes for four categories (demolition, earthworks, construction, and trackout – i.e. trucks leaving site) were categorised as either low, medium, or high. Sensitivity ratings were determined based on both the type of sensitive receptor and their proximity to the construction boundary. Dust magnitude ratings for each activity were determined based on the scope of work undertaken during each construction activity and their potential for dust generation. The unmitigated risk ratings were then determined using a matrix of the sensitivity of the area and dust emission magnitude categories. The following table presents the unmitigated risk ratings for the proposed modification works.

Table E.1 Summary of unmitigated risk assessment for sensitive receptors

Activity	Step 2C: Potential unmitigated dust impacts		
	Dust soiling	Human health (PM_{10})	Ecological
Demolition	High	High	High
Earthworks	High	High	High
Construction	High	High	High
Trackout	Low	Low	Low

Although the initial demolition, earthworks and construction unmitigated risk ratings were categorised as high, targeted mitigation strategies have been recommended. The final step of the IAQM methodology was to determine whether there would be 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 receptors 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 mitigation measures can achieve high degrees of dust mitigation which significantly reduce dust impacts to a negligible level. The proposed modification is not expected to be an exception to this rule and the mitigation measures identified in this assessment would adequately reduce dust impacts to a negligible level.

Emissions of combustion pollutants are expected to be minor and generic mitigation strategies would reduce the likelihood of impacts at neighbouring sensitive receptors to a negligible level.

Mitigation measures would be implemented to effectively manage emissions of odour and pollutants that may arise during remediation activities. Handling of contaminated soils would be managed according to the Conceptual Remedial Action Plan (RAP) (Appendix H of the Modification Report) for the proposed modification works. Controlled placement of biopiling and stockpiles as far from the Site boundary as practicable, as well as covering of wastes that need to be transported offsite would be implemented as required to ensure that air quality impacts at or beyond the boundary of the Site are mitigated.

As the general operation of the Site as a terminal would not change, there would be no material change to the potential for air emissions compared with the existing terminal operation. It is noted, however, that relocation of operational activities has the potential to result in changes to existing dispersal conditions of existing sources. Specifically, the relocation of the firewater system and associated diesel pumps. The new firewater tank and pumphouse would be located within the FWS Relocation Area, with the specific siting selected as part of detailed design. Two indicative locations have been considered, adjacent to Solander Street. Should Option 1 be selected, due to the distance between the pumps and nearby residential receivers, measures would be applied to the engines and building housing the equipment. The relocation of operational activities including the FWS, including diesel pumps, would be addressed during the detailed design to ensure that ground level pollutant concentrations are compliant with US Environmental Protection Agency (US EPA) air quality criterion.

An assessment of potential cumulative impacts for the proposed modification works was also undertaken by identifying other neighbouring projects, including those on the Site, that may emit similar pollutants. Several of these projects would overlap with the proposed modification works either spatially or temporally, and without mitigation could result in cumulative air quality impacts. Several of the identified projects are currently being undertaken, or would be undertaken, by Ampol. Ampol would be able to appropriately manage the projects together to minimise cumulative impacts. Each of the non-Ampol projects were assumed to have adequate air quality mitigation measures aimed at minimising offsite pollutant concentrations either identified as part of the development assessment stage, or already in use for those projects that have already commenced. Therefore, pollutant emissions from these projects are not likely to result in adverse cumulative air quality impacts at sensitive receptors.

1.0 Introduction

1.1 Overview

The Kurnell Terminal ('the Site') is located on the southern side of Botany Bay, in Kurnell, New South Wales (NSW) (Figure 1-1). In 2012, Ampol Refineries (NSW) Pty Ltd (Ampol) announced that the oil refinery and fuel terminal would be converted to a finished product terminal (the 'approved project'), ceasing refinery operations in 2014.

Development consent was received to complete the approved project under State Significant Development (SSD) application reference 5544 (SSD-5544). Ampol has modified SSD-5544 six times to complete the conversion and demolition works.

Currently, the operational infrastructure is primarily located in the northern part of the Site (Zones 1 and 1A, as shown in Figure 1-1). Other parts of Ampol's landholdings at Kurnell include largely vacant areas of previously developed land (Zones 2 and 3) and areas of undeveloped land containing extensive native vegetation (Zones 4 and 5).

Ampol intends to consolidate operational infrastructure, remove redundant assets, and undertake remediation and grading. Completion of these works (the 'proposed modification', MOD-7) would continue the safe, viable, and reliable operation of the Kurnell Terminal, whilst preparing the land for future uses. The location within the Site that these works would occur is referred to as the 'Project Area.'

A Modification Report has been prepared to support a modification application to SSD-5544. This *Air Quality Impact Assessment* is one of a number of technical documents that forms part of the Modification Report. In line with the requirements of Section 4.55 of the *Environmental Planning & Assessment Act 1979* (EP&A Act), the Modification Report provides the information required by Section 100 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation).

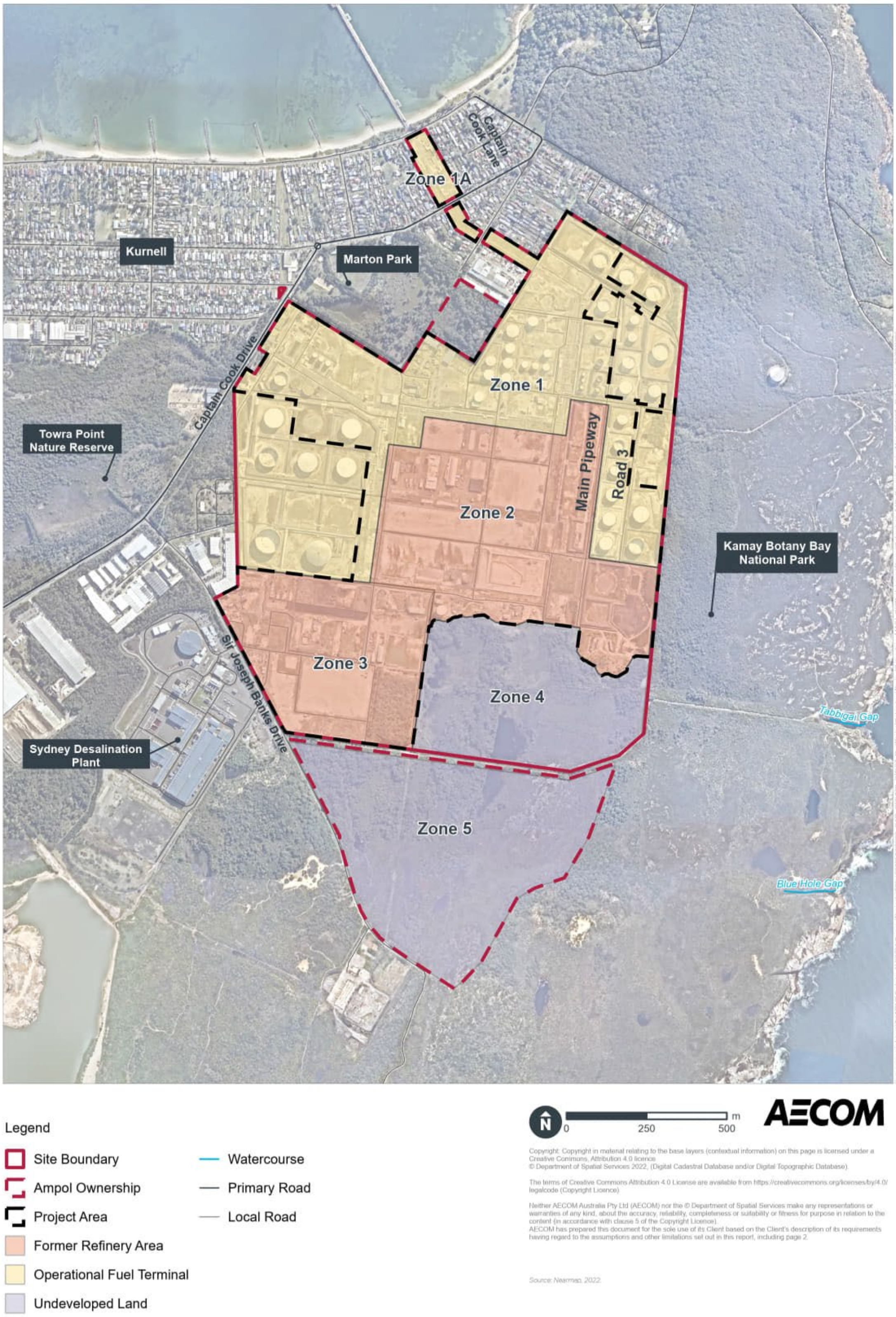

Figure 1-1 Ampol Kurnell Terminal (the Site)

1.2 The proposed modification

1.2.1 Key elements of the proposed modification

To support the continued safe, viable, and reliable operation of the Site and to facilitate the future use of the Site, the proposed modification works involve:

- **Stage 1 – Preparation works**: Preparing the Project Area for proposed modification works.
- **Stage 2 – Removal, relocation and/or augmentation of infrastructure**, including:
  - Relocation and/ or augmentation of firewater systems (FWS) and oily water sewer (OWS) systems and construction of new operational facilities, including replacement warehouses
  - Decommissioning and removal of non-operational assets, redundant structures and electrical assets.
- **Stage 3 – Remediation**: Addressing legacy ground contamination, including asbestos-contaminated soil (ACS).
- **Stage 4 – Grading**: Landforming the Project Area following removal of infrastructure and ground remediation activities and preparing Zones 2 and 3 for future use.
- **Stage 5 – Demobilisation**: Demobilisation of construction and remediation equipment.

These stages may occur sequentially or concurrently, depending on site requirements.

A summary of project elements requiring modification and how they relate to the approved project is provided in Table 1-1. The proposed modification works would be undertaken within the Project Area shown on Figure 1-2. All activities would adhere to the Kurnell Terminal permit to work system to ensure compliance with environmental and safety protocols.

Table 1-1 Modified project summary table

Stage	Element	Approved project	Modified project
Stage 1	Project Area	Project Area delineation	• Prepare the Project Area for the proposed modification works required under Stages 2, 3 and 4 and exclude other parts of the Site from proposed modification works.
Stage 2	Oily water sewer (OWS)	Maintain location in Zones 2 and 3	• Divert surface water runoff from potentially contaminated areas in Zone 2 to Zone 1 via new OWS interception pits/ lines until Stage 3 remediation is complete. • Divert potential leachate from ACS containment cell in Zone 2 to Zone 1 OWS system. • Remove all redundant OWS infrastructure.
	Firewater systems (FWS)	Maintain location in Zone 2 and 3	• Augment or remove FWS infrastructure from Zones 2 and 3. • If removed from Zone 2, augment existing FWS in Zone 1 with a new firewater tank and pipework to service the terminal infrastructure. • Locate the new firewater tank and pumphouse within the FWS Relocation Area (specific siting selected during detailed design).
	Electrical assets	Maintain location in Zone 2 and 3	• Remove redundant electrical assets in Zones 2 and 3, including five substations.

Stage	Element	Approved project	Modified project
	Structures	Maintain location in Zone 2 and 3	• Demolish remaining structures in Zones 2 and 3. • Construct new 'fit for purpose' warehouse and Oil Spill Equipment Storeroom within Zone 1. • Construct new storage shed in Zone 1A.
Stage 3	Remediation	Removal of ACS from pipeways and either containment onsite or offsite disposal	• Remediate land in Zones 2 and 3 as necessary. • Remediate land in Zone 1 where infrastructure is relocated and/ or augmented as necessary. • Conduct remediation to a commercial/ industrial land use under the ASC NEPM (2013).
Stage 4	OWS	Maintain location in Zones 2 and 3	• Disconnect and remove remaining underground OWS lines from Zones 2 and 3, except for lines connecting to the ACS Containment Cell. • Install a new pump adjacent to the ACS Containment Cell. Two site options have been identified (specific siting selected during detailed design).
Stage 4	Grading	Grading following demolition of structures and removal of infrastructure across the Site and relevant Project Areas	• Construct new onsite detention (OSD) basins in Zone 3 to attenuate runoff and maintain pre-construction surface water flow rates. • Grade Zone 2 following Stage 2 and Stage 3 activities to manage stormwater and prepare for future land uses. • Grade Zones 1 and 3 as necessary.
Stage 5	Demobilisation	Demobilisation of construction equipment.	• Demobilisation of construction equipment.

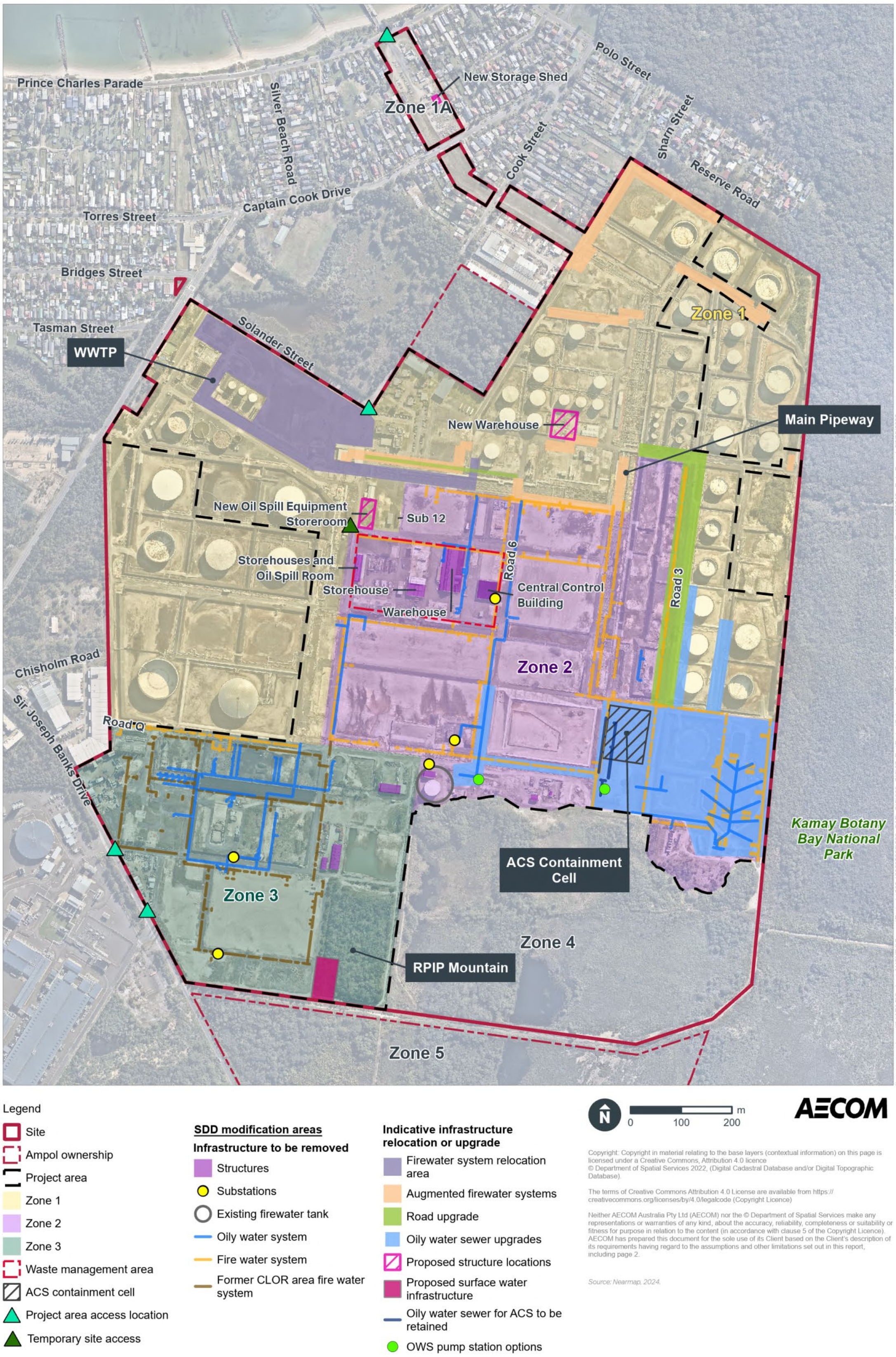

Figure 1-2 The proposed modification

Once the modification works are complete, the Site would continue to operate as described in the approval documentation for the approved project and would be consistent with the development consent for SSD-5544.

In line with Figure 1-2, relocated equipment would operate in their new locations

1.2.2 Construction timeline and equipment

Works are planned to commence in August 2025 and would continue for about 12 months for infrastructure removal scopes and up to four years for remediation works in accordance with the schedule in Table 1-2.

In line with Condition C18 of SSD-5544, construction works would comply with following hours:

- Monday to Sunday – 7am to 10pm.

High noise generating construction works, including works within the Eastern Right of Way (Zone 1A), would be confined to less sensitive times of the day and not undertaken on Sundays, public holidays, or outside of the hours 7am and 6pm Monday to Saturday (in line with Condition C19).

Construction works outside of the work hours identified above would only be undertaken in the following circumstances (in line with Condition C20):

- Works that are inaudible at nearest sensitive land receivers
- Works that are consistent with Ampol's existing maintenance procedures and are in accordance with the existing EPL
- Works agreed to in writing by the Environment Protection Authority (EPA) or the Department of Planning, Housing, and Infrastructure (DPHI)
- For the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons
- Where it is required in an emergency to avoid the loss of lives, property and/ or to prevent environmental harm.

Table 1-2 Proposed modification program

Stage	Timeframe
Stage 1 – Preparation works	August 2025
Stage 2 – Removal and/or relocation of infrastructure[1]	August 2025 – August 2026
Stage 3 – Remediation	August 2025 – July 2029
Stage 4 – Grading	Zone 2: August 2026 – December 2026 Zone 3: up to July 2029
Stage 5 – Demobilisation	September 2026 (for all works except remediation)
[1] Construction in Zone 1A expected to last 3 months.	

Plant and equipment that would be used to deliver the modification works is shown in Table 1-3.

Table 1-3 Indicative plant and equipment

Plant/equipment	Maximum number required per day (all stages except Stage 3)	Maximum number required per day (Stage 3)
Front end loader	6	6
20 t excavator	6	6
Dump truck	6	6
Grader (up to 7 m blade)	-	4
Large crane (60 t)	4	-
Elevated work platform	6	-
Franna crane (30 t)	6	-
Cement truck	6	-
Bobcat	6	2
Water cart	6	6
Concrete crusher	2	-
Telehandler	6	-
Truck and dog (offsite disposal)	6	6
Truck and dog (imported fill)	-	12
Generator	2	2
Biopiling blower	-	8

1.2.3 Other relevant elements of the proposed modification

Construction activities

For the purposes of this assessment, a number of assumptions have been made to categorise activities and quantities related to construction. A summary of the key construction assumptions for this assessment is provided in Table 1-4.

Table 1-4 Summary of Construction Activities

Activity	Description
Demolition	• Demolition of existing structures in Zone 2 and 3: - Central Control Building - Storehouse - Warehouse - Oil Spill Room - Other smaller structures and electrical assets, including five substations - Removal of OWS, firewater system, and firewater tank • Total building volume approximately 40,000 m^3: - Central Control Building (35 x 40 x 5 m = 7,000 m^3) - Storehouse (32 x 35 x 5 m = 5,600 m^3) - Warehouse (85 x 50 x 5 m = 21,250 m^3) - Oil Spill Room (18 x 60 x 5 m = 5,400 m^3) • Onsite concrete crushing.

Activity	Description
Earthworks	• The total excavation volume (inclusive of contingency) has been estimated at 398,295 m^3 based on Table 4-3 in the Modification Report. Specifically, excavation works would include: - For Zone 1, infrastructure construction works up 19,500m^3. This may include augmentation of the FWS, including excavation of up to 1 m depth. - For Zone 2 and 3, oily waster sewer removal 16,800 m^3 - For remediation works during Stage 3: ▪ For hydrocarbon impacted soils, PFAS and asbestos impacted soils, a total estimate of 87,300 m^3 would require excavation and either treatment or off-site disposal ▪ At worst case, approximately 274,695 m^3 of soil would require excavation prior to capping (based on Table 4-3 of the Modification Report) Number of heavy earthmoving vehicles active at one time >10 (see • Table 1-3) • Zone 2 is anticipated to require 46,600 m^3 of fill (it has been conservatively assumed that all fill would be imported onto Site as part of the proposed modification. Onsite reuse of material would occur where practical).
Construction	• Key construction activities would include: - Construction of a new 'fit for purpose' warehouse (40 x 50 x 5 m = ~10,000 m^3) - Construction of a new Oil Spill Equipment Storeroom (20 x 50 x 5 m = ~5,000 m^3) - Construction of a new firewater tank and pipework for the existing FWS in Zone 1: Firewater tank (~5,000 m^3) and firewater tank area (~12,000m^2 x 0.3 m = ~3,600 m^3) - Construction of a new storage shed in Zone 1A (10 x 8 x 5 m = ~400 m^3) - Construction of two road upgrades (600 x 30 x 0.3 m = ~5,000 m^3) • Overall volume of construction is expected to be approximately 30,000 m^3: • Onsite concrete batching.
Trackout	To assess the impact of construction traffic, it has been assumed that: • The number of heavy vehicles daily moving material off site would be about six for each stage of the proposed modification (see • Table 1-3). • Surface material dust potential would have a low-medium fine content (soils transported offsite for disposal) • Length of unpaved access roads would be less than 50 m.

Operational activities

The FWS would be relocated within the FWS Relocation Area in Zone 1, including a new firewater tank and pipework to allow it to service the terminal infrastructure, with specific siting selected during detailed design.

For the purpose of assessment in this *Air Quality Impact Assessment*, two indicative locations have been considered for the relocation of the FWS, which have been selected based on optioneering completed in the concept design phase in consultation with key stakeholders, including Firewater and Process Safety Subject Matter Experts. The location of each option is shown Figure 1-3.

Figure 1-3 Relocated FWS – Indicative locations

Operation and maintenance of the relocated FWS would be consistent with existing operations. The FWS would include three diesel engines used to operate FWS pumps housed within an enclosed area. Regular maintenance testing of the pumps would include:

- Operation of all three pumps simultaneously for approximately half an hour once a month
- One annual maintenance test conducted over a two hour period once per year.

1.3 Purpose of this report

This *Air Quality Impact Assessment* is one of a number of technical documents that forms part of the Modification Report. The purpose of this report is to understand potential impacts of the proposed modification upon air quality.

2.0 Assessment methodology

2.1 Relevant legislation and guidelines

2.1.1 National Environment Protection Measures

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.

2.1.2 Protection of the Environment Operations Act 1997 (NSW)

The *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) is the key piece of environment protection legislation administered by the 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 NSW EPA, local councils, and other public authorities.

The objects of the POEO Act relevant to air quality are:

- To protect, restore, and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development
- To ensure that the community has access to relevant and meaningful information about pollution
- To 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.
- To rationalise, simplify, and strengthen the regulatory framework for environment protection
- To improve the efficiency of administration of the environment protection legislation.

The POEO Act also allows for the provision of delegate legislation, including the *Protection of the Environment Operations (Clean Air) Regulation 2022* (POEO Regulation).

The POEO Act is supported by NSW EPA documents that provide methods for assessing and sampling air pollutants and includes the Approved methods for the modelling and assessment of air pollutants in NSW 2022 discussed in Section 2.1.3.

2.1.3 Approved Methods for the Modelling and Assessment of Air Pollutants in NSW

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2022) (the Approved Methods) for modelling under Part 5 of the POEO Regulation provides the statutory methods for modelling and assessment air emissions in NSW. The document outlines procedures for:

- Emissions inventories
- Meteorological data preparation
- Accounting for ambient air pollutant concentrations through cumulative impact assessments
- Dispersion modelling methodology
- Interpretation of modelling results
- Impact assessment criteria
- Modelling chemical transformation
- Procedures for developing site specific emission limits.

Under section 2.1 of the Approved Methods for modelling two levels of impact assessment are defined for dispersion modelling:

- Level 1: A screening level assessment using worst-case input data
- Level 2: A refined dispersion assessment using site specific input data.

A qualitative study has been conducted for assessing the proposed modification and, as such, dispersion modelling has not been conducted for this report.

The impact assessment criteria listed under the Approved Methods for modelling are presented in Section 2.2.

2.1.4 Assessment for Dust from Demolition and Construction 2024 (UK IAQM)

The United Kingdom (UK) Institute of Air Quality Management (IAQM) 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 receptors which then allows the identification of appropriate mitigation measures commensurate with the level of risk.

The IAQM methodology is widely accepted for the assessment of potential dust impacts associated with demolition and construction from projects in NSW and other states in Australia. The IAQM methodology has been adopted to assess the potential dust impacts from the proposed modification. The methodology has been modified to account for local conditions as follows:

- Modification to the sensitivity of the surrounding area to human health effects risk assessment matrix to account for more stringent PM_{10} criteria set by NSW EPA.
- Classification of ecological receptors consistent with Australian classifications for international, national, and local environmental designations.

The modified IAQM methodology for assessment of construction dust impacts from the proposed modification is described in Section 2.4.

2.2 Adopted assessment criteria

The air quality assessment criteria adopted for the proposed modification are listed in Table 2-1, 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.

Table 2-1 NSW EPA Air Quality Criteria

Pollutant	Averaging period	Criterion ($\mu g/m^3$)
Particulate matter (PM_{10})	24 Hour Maximum	50
	Annual Average	25
Particulate matter ($PM_{2.5}$)	24 Hour Maximum	25
	Annual Average	8

2.3 Key assumptions

All stages of the proposed modification were assessed assuming the worst-case for each major activity occurring (i.e. demolition, earthworks, construction, and trackout – see Section 1.2.3 for details of the assumptions used). Some stages would have lower potential air emissions compared with other stages for these activities and, if assessed individually, would have a lower risk of air quality impacts. However, the outcome of the worst-case assessment can be applied conservatively to stages with lower potential for air emissions.

2.4 Construction and operational assessment methodology

2.4.1 Overview

This section provides an overview of the methodology used for each phase of the assessment:

- Assessment of construction dust, using the qualitative IAQM methodology
- Assessment of combustion emissions
- Assessment of odour and other Potential Contaminants of Concern (PCOC)
- Assessment of operational conditions.

2.4.2 Construction dust impact assessment

The IAQM guidance process is a four-step risk-based assessment of dust emissions associated with demolition, earthworks, construction, and track-out activities. The process is summarised as follows.

Step 1 – Screening assessment

Step 1 requires the determination of whether there are any receptors (either human or ecological) located close enough to the Project Area to warrant further assessment.

An assessment is required where there is a human receptor within:

- 250 m from the boundary of the site, or
- 50 m from the route used by construction vehicles on public roads up to 500 m from the site entrance.

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

- 50 m of the boundary of the site, or
- 50 m from the route used by construction vehicles on public roads up to 500 m 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 will be not be significant.

Step 2 – Dust risk assessment

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

- Defining the dust emission magnitudes (Step 2A)
- Defining the surrounding area's sensitivity to dust emissions, separated into human health and property, and ecological health (Step 2B)
- Combining the magnitudes and receptor sensitivities into a risk matrix (Step 2C) to determine a potential risk rating for dust impacts on surrounding receptors.

Additional details on Steps 2A, 2B and 2C are provided as follows.

Step 2A – Dust emission magnitude.

Dust emission magnitudes 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 trackout to aid classification; these are presented in Table 2-2.

Table 2-2 Classification criteria for small, medium, and large demolition and construction activities

Activity	Activity Criteria	Dust emission magnitude		
		Small	Medium	Large
Demolition	Total building volume (m^3)	<12,000	12,000–75,000	>75,000
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
	Soil type	Soil type with large grain size (sand)	Dusty soil type (e.g. silt)	Dusty soil type prone to suspension (e.g. clay)
	Bund Size (m in height)	<3	3–6	>6
Construction	Total building volume (m^3)	<12,000	12,000–75,000	>75,000
	Construction material dust release potential	Low potential (e.g. timber or cladding)	Moderate potential (e.g. concrete)	High potential (e.g. onsite concrete batching or sandblasting)
Trackout	Number of heavy vehicle movements per day	<20	20-50	>50
	Surface material	Low potential for dust release	Moderately dusty (high clay content)	Potentially dusty (high clay content)
	Unpaved road length	< 50 m	50m -100 m	>100 m

Step 2B – Sensitivity of the surrounding area

The IAQM separates the sensitivity of the area into three categories:

- Sensitivity of the area to dust soiling effects on people and property
- Sensitivity of the area to human health impacts
- Sensitivity of the area to ecological impacts.

Each of these categories is assessed individually via a risk matrix that takes into account a number of factors, including:

- Specific sensitivity of a receptor:
  - High sensitivity: Locations where members of the public are likely to be exposed for eight hours or more in a day. (e.g. private residences, hospitals, schools, or aged care homes)
  - Medium sensitivity: Places of work where exposure is likely to be eight hours or more in a day
  - Low sensitivity: Locations where exposure is transient, around one or two hours maximum. (e.g. parks, footpaths, shopping streets, playing fields)
- Number of receptors of each sensitivity type in the area
- Distance from source, i.e. the proposed modification
- Annual mean background PM_{10} concentration (only applicable to the human health impact matrix).

Dust Soiling Effects on People and Property

The IAQM methodology classifies the sensitivity of a receptor to dust soiling on people and property due to particulate matter effects as either high, medium, or low. The classification is determined by a matrix for both dust soiling and human health impacts, as presented in Table 2-3.

Table 2-3 Surrounding area sensitivity to dust soiling effects on people and property

Receptor Sensitivity	Number of Receptors	Distance from the proposed modification (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

Human Health Impacts

The sensitivity of the area to human health effects are partially determined by existing background PM_{10} concentrations. Essentially, the higher the existing baseline, the higher the overall sensitivity of the area would be. In other words, a population that is already exposed to elevated particulate concentrations would be more sensitive to any further increases in local PM_{10} concentrations due to a project. The existing annual average PM_{10} concentrations are split into four categories, determined as follows:

> *The values are based on 32 µg/m³ being the annual mean concentration at which an exceedance of the 24-hour objective is likely in England, Wales and Northern Ireland*

PM_{10} criteria are more stringent in NSW compared to the UK, and therefore these categories must be adjusted downwards to reflect this. The categories for the UK and the equivalent adjusted categories for NSW are presented in Table 2-4.

Table 2-4 Equivalent annual average PM_{10} categories for determining sensitivity of the area to human health effects

Equivalent background annual average PM_{10} categories	PM_{10} concentration (µg/m³)	
	IAQM (UK)	NSW
Annual average criterion	40	25
IAQM categories	>32	>20
	28-32	18-20
	24-28	15-18

Equivalent background annual average PM_{10} categories	PM_{10} concentration (µg/m^3)	
	IAQM (UK)	NSW
	<24	<15

The background PM_{10} concentrations in the region surrounding the Project Area are outlined in Section 3.2, and fit within the 15 to 18 µg/m^3 concentration range (refer to Figure 3-5). Table 2-5 provides the IAQM guidance sensitivity levels for human health impacts for the adjusted category of 15 to 18 µg/m^3. Receptor sensitivity has been classified as high due to the presence of residential receptors, where members of the public are expected to reside eight or more hours in a day and members of the public may potentially exposed to air pollution over a time period relevant to the air quality objective for 24-hour PM_{10}.

Table 2-5 Surrounding area sensitivity to human health impacts – adopted matrix for the proposed modification

Receptor Sensitivity	Number of Receptors	Distance from the project (m)				
		<20	<50	<100	<200	<250
High	>100	High	Medium	Low	Low	Low
	10-100	High	Medium	Low	Low	Low
	1-10	Medium	Low	Low	Low	Low
Medium	>10	Low	Low	Low	Low	Low
	1-10	Low	Low	Low	Low	Low
Low	≥1	Low	Low	Low	Low	Low

Note: The matrix presented in this table is based on Table 3 in the IAQM guidance. Annual average PM_{10} concentration adopted as 15-18 µg/m^3 (refer to Section 3.2).

Ecological Impacts

Ecological impacts from construction activities occur due to deposition of dust on ecological areas. The sensitivity of ecological receptors can be defined by the following:

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

In addition to the nature of the ecological community, the proximity of the community to the boundary of the project is relevant to defining an ecological community's sensitivity to dust impacts. The sensitivity of an ecological area to distance from the boundary of the construction site is identified using the criteria listed in Table 2-6.

Table 2-6 Sensitivity of an area to ecological impacts

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

Step 2C – Unmitigated risks of impacts

The dust emission magnitude, as determined in Step 2A, is combined with the sensitivity of the area, as determined in Step 2B, to determine the risk of dust impacts with no mitigation applied. The risks assigned to each of the different construction activities are provided in Table 2-7. This matrix is applicable to all sensitivity of the area categories.

Table 2-7 Risk of dust impacts (for dust soiling effect, human health impacts and ecological 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
Trackout	High	High	Medium	Low
	Medium	Medium	Low	Negligible
	Low	Low	Low	Negligible

Step 3 – Management strategies

The outcome of Step 2C is used to determine the level of management that is required to ensure that dust impacts on surrounding sensitive receptors are maintained at an acceptable level.

A high or medium level risk rating suggests that implementation of management measures are highly recommended during the project.

Mitigation 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.

2.4.3 Combustion emissions

Potential air quality impacts due to combustion emission (vehicle exhaust) were assessed qualitatively and are discussed in Section 4.2.

2.4.4 Odour and other Potential Contaminants of Concern

Potential air quality impacts due to odour and PCOC were assessed qualitatively and are discussed in Section 4.3.

2.4.5 Operation

The assessment of potential operational impacts was undertaken qualitatively and is discussed in Section 5.0.

3.0 Existing environment

3.1 Meteorology

The nearest automated weather station to the Site is the Bureau of Meteorology (BOM) operated station at Kurnell, located about 1 km to the north. Wind speed and direction are monitored at the BOM Kurnell. The nearest station with long-term temperature and rainfall data is the BOM operated station at Sydney Airport, about eight kilometres north west of the Project Area.

3.1.1 Winds

Wind roses show the frequency of occurrence of winds in terms of direction and strength at a given location. The bars in the wind rose represent winds blowing from that direction; for example, the bar facing due north indicates winds blowing from north to south. The different colours represent the different wind strengths. The length of the bars and each coloured segment represent the frequency of occurrence; the longer the bar or segment, the more frequent that wind condition occurs.

A wind rose for all hours between 2000 and 2023 at the BOM Kurnell station is shown in Figure 3-1. Wind directions at the BOM Kurnell site are variable; however, winds are slightly more common from the north east, west, and south. The average wind speed over the period examined was 5.6 m/s, indicating there is a high occurrence of moderate breezes. Wind speeds above 5 m/s increase the potential for dust lift off and, based on Figure 3-1, are common and can blow from any direction. Calm conditions (winds lower than 0.5 m/s) occur only for 0.8 % of the time at BOM Kurnell. Dispersion of air pollutants is typically poorest during very light winds or calms. The BOM Kurnell station is overwater, and winds speeds across the Project Area are likely to be slightly lower than those presented here. Therefore, calm conditions are likely to occur slightly more frequently at the Project Area than at BOM Kurnell.

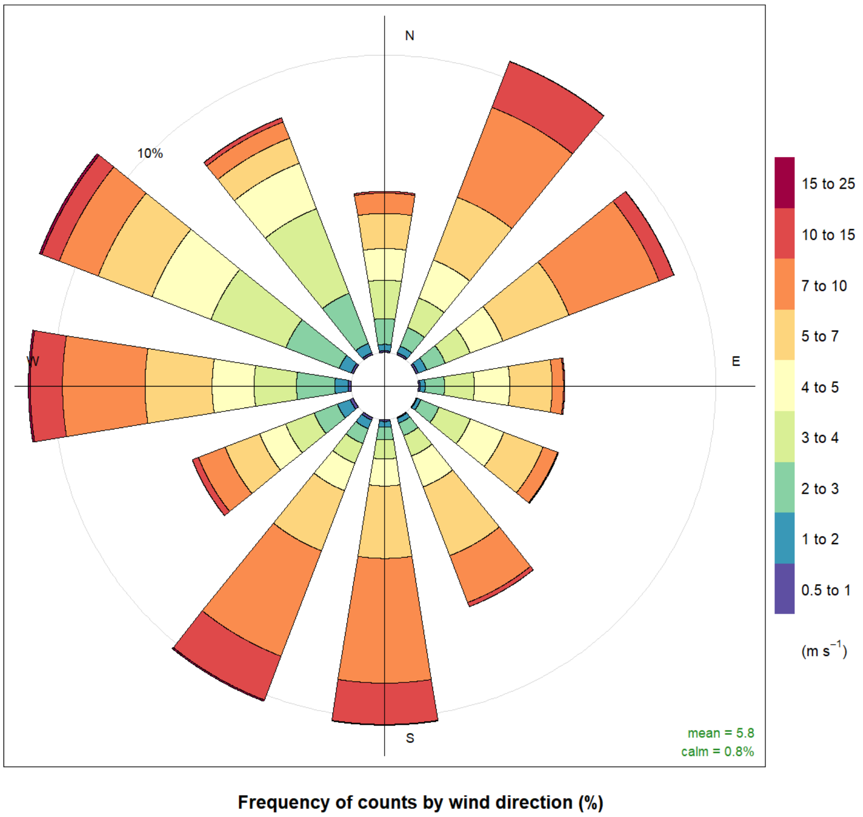

Figure 3-1 All hours wind rose, Kurnell BOM 2000-2023

Construction activities are expected to occur mostly during daylight hours. To analyse daylight winds, measured winds at BOM Kurnell were separated into day/ night wind roses, which are shown in Figure 3-2.

Winds during the day are most frequent from the north east and south to southwest, with wind speeds averaging around 6.4 m/s. Winds at night are more frequently from the west, with a mean wind speed of 5.1 m/s. As discussed above the BOM Kurnell station is over water, so wind speeds at the Project Area are likely to be slightly lower than those measured at the BOM station.

Wind speeds over 5 m/s are typically strong enough to raise dust from areas of exposed material or stockpiles and occur frequently at Kurnell during both the day and night.

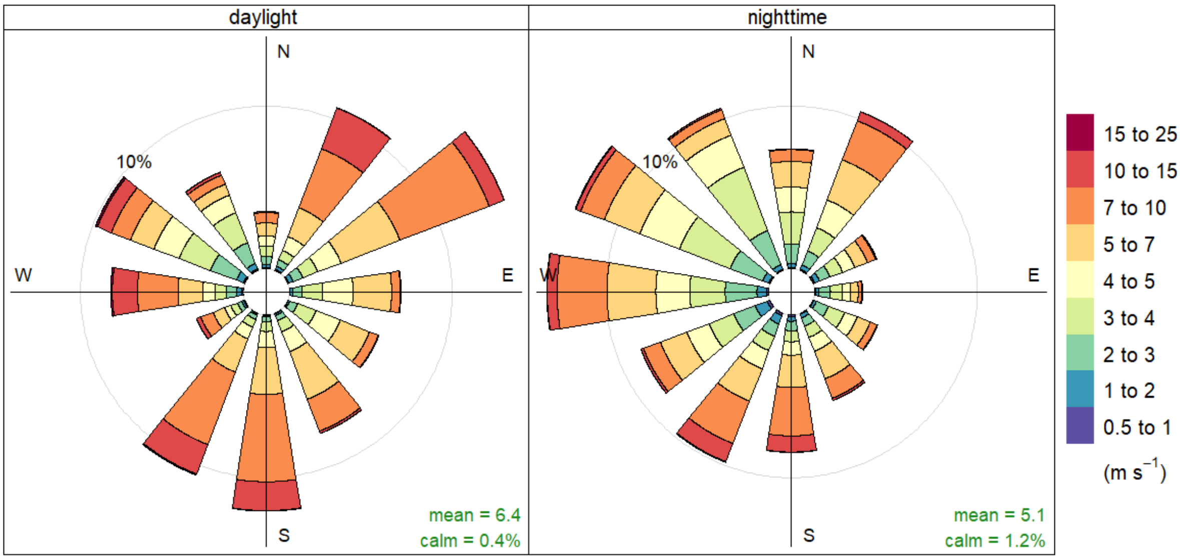

Figure 3-2 Day and night wind roses, BOM Kurnell 2000 to 2023

3.1.2 Temperature and rainfall

Long term monthly average rainfall and minimum and maximum temperatures measured at BOM Sydney Airport are presented in Figure 3-3. Rainfall is highest between January and April, with more than 120 mm on average per month. Rainfall is lowest in August and September, with less than 60 mm per month. Periods of low rainfall increase the potential for windblown dust, or emissions of dust from mechanical disturbance of dry materials, which can occur during construction activities. Temperatures generally range between daily minimums of about 9 to 10 °C in winter to daily maximums of around 26 to 27 °C in summer.

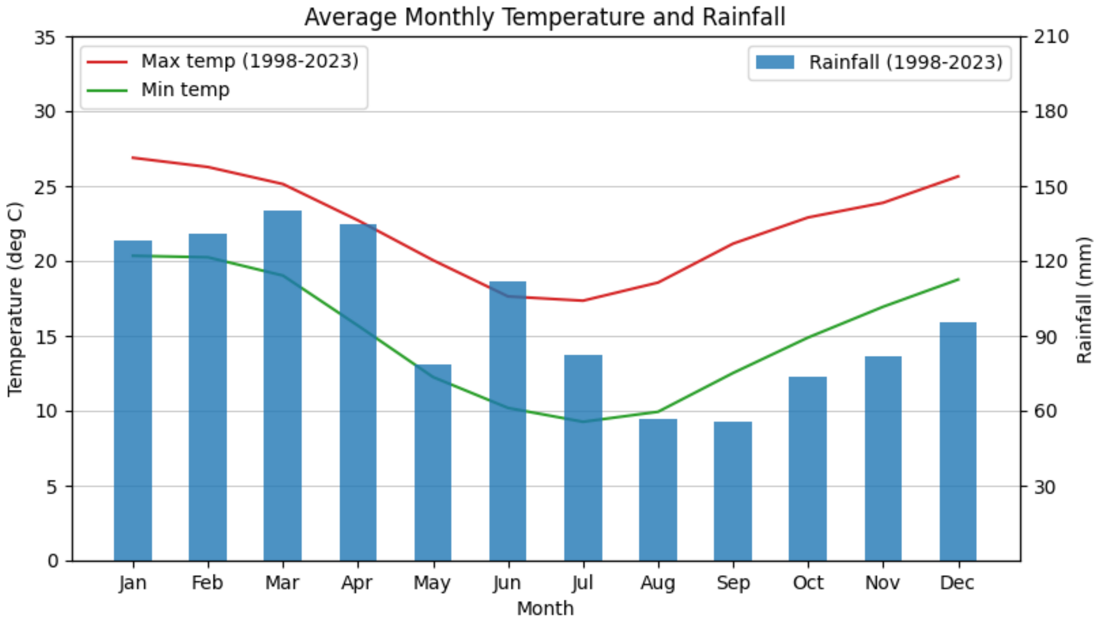

Figure 3-3 Rainfall and temperature averages, Sydney Airport BOM 1998-2023

3.2 Air quality

Existing air quality within and surrounding the Project Area, in terms of particulate matter, is described in this section. Particulate matter is a term that describes extremely small solid particles and liquid droplets suspended in air, that can be made up of a variety of components including nitrates, sulfates, organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mould spores). This section focuses on two types of particles: PM_{10} (particulate matter with a diameter of 10 micrometres or less) and $PM_{2.5}$ (particulate matter with a diameter of 2.5 micrometres or less).

The nearest permanent air quality monitoring station to the Project Area is the NSW EPA operated station at Randwick, about 10 km to the north of the Site. The Randwick monitoring station is located on the grounds of the Randwick Army Barracks near Galu Avenue and is largely surrounded by medium density residential land. The main likely source of local air pollution in the Randwick area is vehicular exhaust. This differs slightly from the Kurnell area, which has a lower residential population, and more general industrial land. Overall, however, background particulate concentrations are likely to be similar in Kurnell compared with Randwick. Days of very high particulate concentrations in the Sydney area are primarily driven by regional factors such as bushfire smoke or other extreme events such as large scale dust events that generally occur during periods of severe and widespread drought.

PM_{10} observations at the Randwick station from 2019 to 2023 are presented as 24-hour averages in Figure 3-4, and annual averages in Figure 3-5. Observations from the Earlwood station (about 13 km north west of the Project Area) have also been included to provide regional air quality context.

Elevated concentrations in 2019 and 2020 represent the high amounts of bushfire smoke during a very active bushfire season. There were only two exceedances of the 24-hour PM_{10} criterion since the 2019-2020 bushfire event at the Randwick station, measured on 12 and 14 September 2023. Earlwood also measured an exceedance on 12 September 2023, and an elevated concentrations just below the criterion on 14 September 2023. These elevated concentrations were due to smoke from hazard reduction burns. Overall, concentrations at Randwick and Earlwood are very similar, showing the regional nature of particulate concentrations in Sydney.

The lowest annual concentrations of 14.6 µg/m^3 were observed at Randwick in 2022, which was a year of high rainfall with an annual average rainfall of 2,203 mm recorded at BOM Sydney Airport (where the average year is 1,092 mm). The high rainfall likely reduced regional particulate concentrations due to both increased wet deposition and high soil moisture contents.

The 2023 calendar year was close to average in terms of rainfall (984 mm at BOM Sydney Airport) and overall PM_{10} concentrations were affected by a single hazard reduction burn event in mid-September. In most years, some bushfire or hazard reduction burn smoke events occur in Sydney, so 2023 is likely a typical year in terms of regional particulate concentrations. The annual average PM_{10} concentration in 2023 at Randwick was 16.6 µg/m^3. This has been adopted as the existing annual background concentration for this assessment.

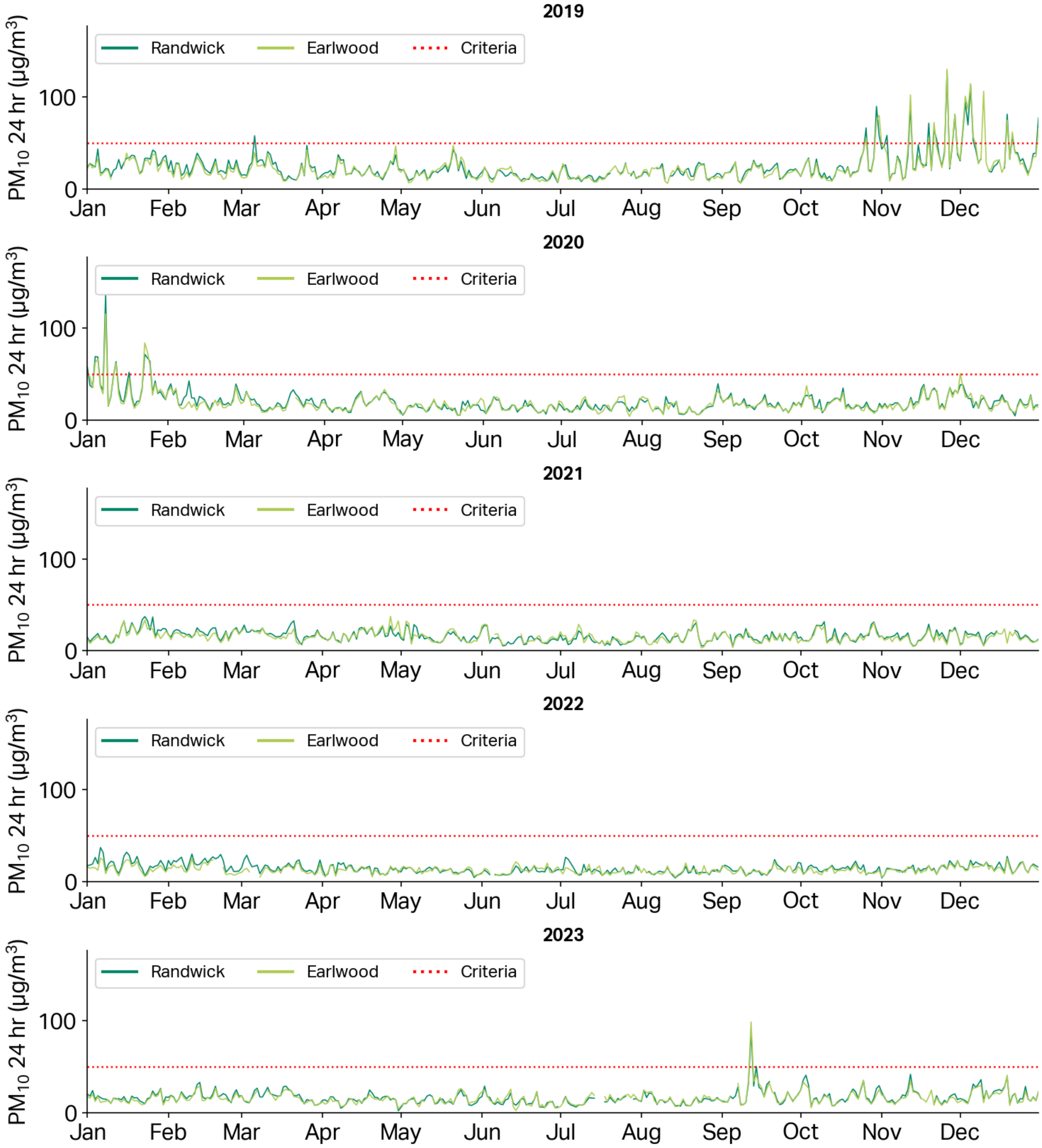

Figure 3-4 24-hour PM10 averages at Randwick and Earlwood 2019-2023

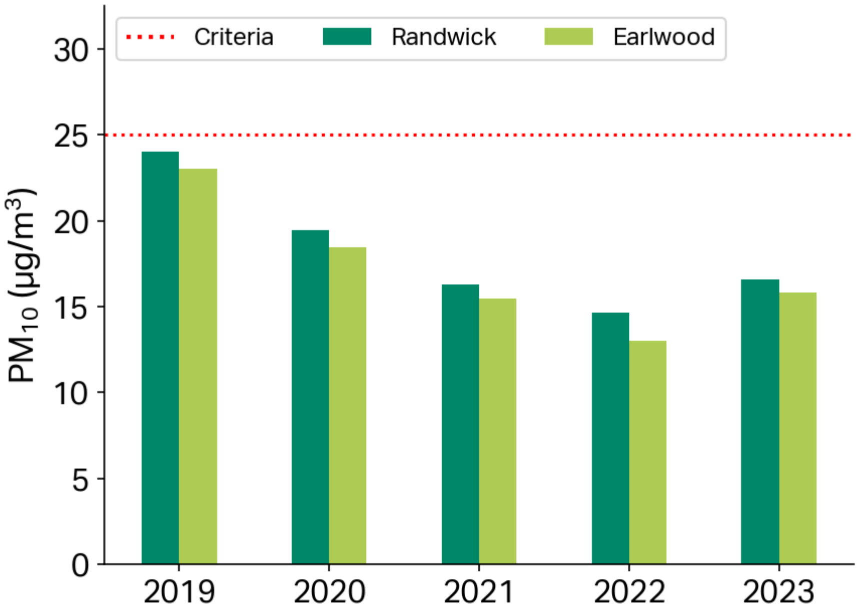

Figure 3-5 Annual PM10 averages at Randwick and Earlwood 2019-2023

Measured 24-hour average and annual average $PM_{2.5}$ concentrations for the period 2019 to 2023 at Randwick and Earlwood are presented in Figure 3-6 and Figure 3-7, respectively.

Measured 24-hour $PM_{2.5}$ concentrations show multiple exceedances of the EPA criteria of 25 µg/m^3 throughout the 2019/2020 bushfire events. Annual averages for $PM_{2.5}$ were also elevated for 2019 and 2020; and above the EPA criterion of 8 µg/m^3 in 2019 as shown in Figure 3-7.

The highest measured 24-hour $PM_{2.5}$ concentrations for the years 2021 to 2023 which did not experience any significant bushfires or dust storms were August 2021 (31.8 µg/m^3 at Randwick and 31.9 µg/m^3 at Earlwood) and September 2023 (67.2 µg/m^3 at Randwick and 92.1 µg/m^3 at Earlwood). Of the most recent three years of data the highest annual average occurred in 2023 at the Earlwood station with an annual average $PM_{2.5}$ concentration of 7.1 µg/m^3.

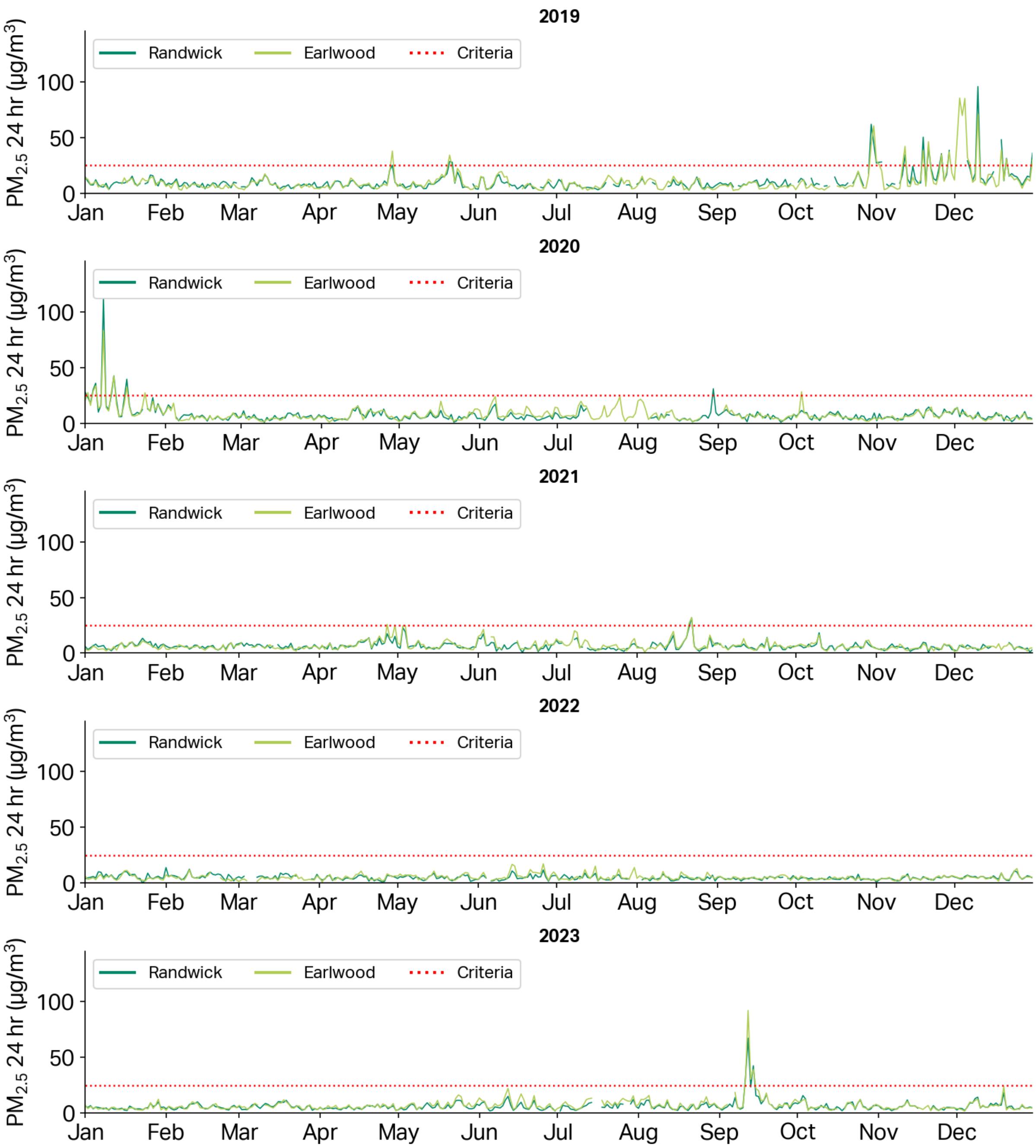

Figure 3-6 24-hour PM2.5 averages at Randwick and Earlwood 2019-2023

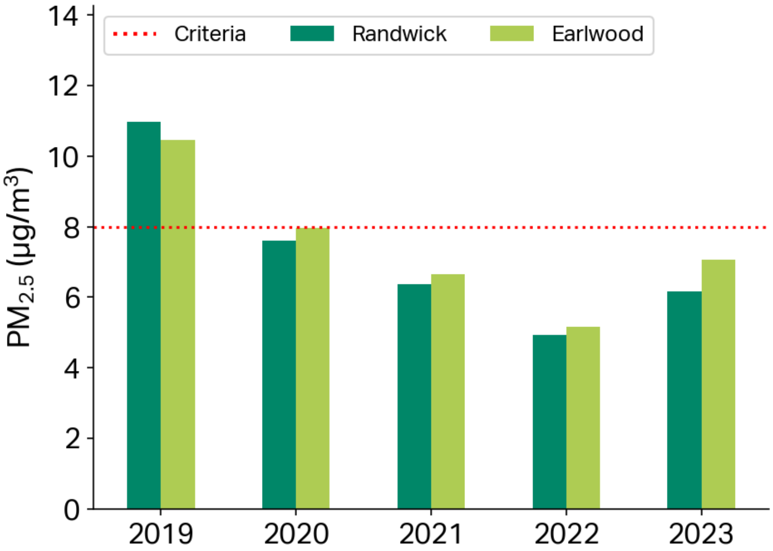

Figure 3-7 Annual PM2.5 averages at Randwick and Earlwood 2019-2023

3.3 Topography

The topography of the Project Area is mostly flat and low lying in the north west and central areas, with land ranging in elevations of 1 to 10 m above mean sea level (MSL). The land steeply increases in elevation along the eastern boundary, where elevations are 20 to 30 m above MSL. Winds from the north east, east, and south east may be somewhat lessened in strength by this higher ground, with winds speeds onsite generally lower than those measured at the BOM Kurnell station, which is on the over water to the north of the Project Area. Topographic features in the Kurnell area are presented in Figure 3-8.

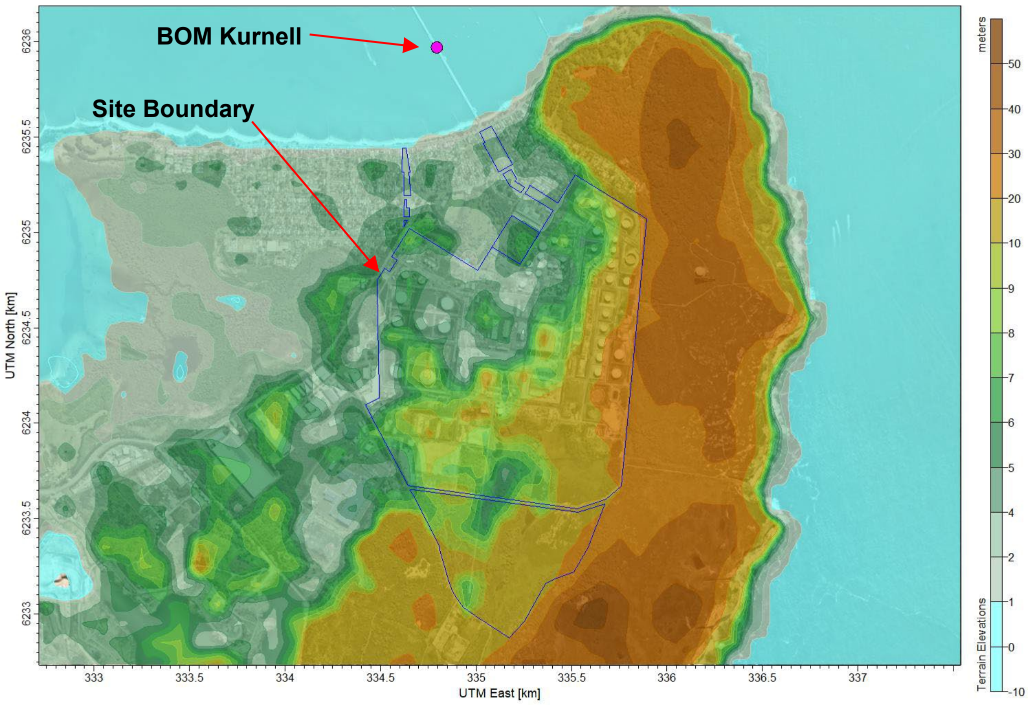

Figure 3-8 Terrain features surrounding the Project Area [1]

[1] Terrain data from United States Geological Survey's Shuttle Radar Topography Mission (SRTM) 1 Arc-Second Global

3.4 Land use

The Project Area is located in an area of heavy industrial land use on the Kurnell Peninsula. It is bounded by the Kamay Botany Bay National Park to the south and east, Captain Cook Drive to the north west, and St Joseph Banks Drive to the south west. The northern boundary of the Project Area is bordered by Solander Street, a small southern section of Cook Street, light industry, residential dwellings off the eastern side of Cook Street, and undeveloped land on the southern side of Reserve Road. The Eastern Right of Way (Zone 1A) is bounded by Prince Charles Parade to the north, and residential dwellings along Prince Charles Parade, Captain Cook Drive, and Cook Street along the east and west.

There are a number of reserves in proximity of the Project Area. Marton Park, comprising a developed recreational park area and an undeveloped wetland area, is located adjacent to the northern boundary of the Project Area on the northern side of Solander Street. Captain Cook's Landing Place Park is located approximately 500 m to the north of the Project Area, while Bonna Point Reserve is located approximately 1.4 km north west of the Project Area. Towra Point Nature Reserve is a Ramsar wetland and located west of the Project Area, on the opposite side of Captain Cook Drive. Quibray Bay also includes Towra Point Aquatic Reserve which, whilst not part of Towra Point Nature Reserve or Ramsar wetland, forms a wider ecosystem with it. To the north of Kurnell is Botany Bay, a large bay with a diverse number of uses and habitats and where the Georges and Cooks Rivers meet before joining the Pacific Ocean.

3.5 Sensitive receptors

The NSW EPA defines a sensitive receptor 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 receptors*" (NSW EPA, 2022).

Historically, sensitive receptors 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 time 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 receptors are now placed in locations where anyone may "work or reside" surrounding the Project Area.

The IAQM methodology that was used for this assessment (described in Section 2.4) specifies a screening buffer distance of within 50 m of the route used by construction vehicles and 250 m for the boundary of a project. If sensitive receptors are found within these distances, then an assessment of potential dust effects is triggered.

Figure 3-9 shows nearby sensitive receptors to the Project Area, in terms of the IAQM screening buffer distances. There are many residential sensitive receptors within 250 m of the boundary at the northern end of the Project Area, and several commercial receptors on the south western side of the Project Area.

Native bushland to the east of the Project Area in Botany Bay National Park is within 50 m of the proposed modification in places as has been considered an ecological receptor for the purpose of this assessment. Marton Park and Towra Point Nature Reserve are also within 50 m of the proposed modification and have been included for consideration.

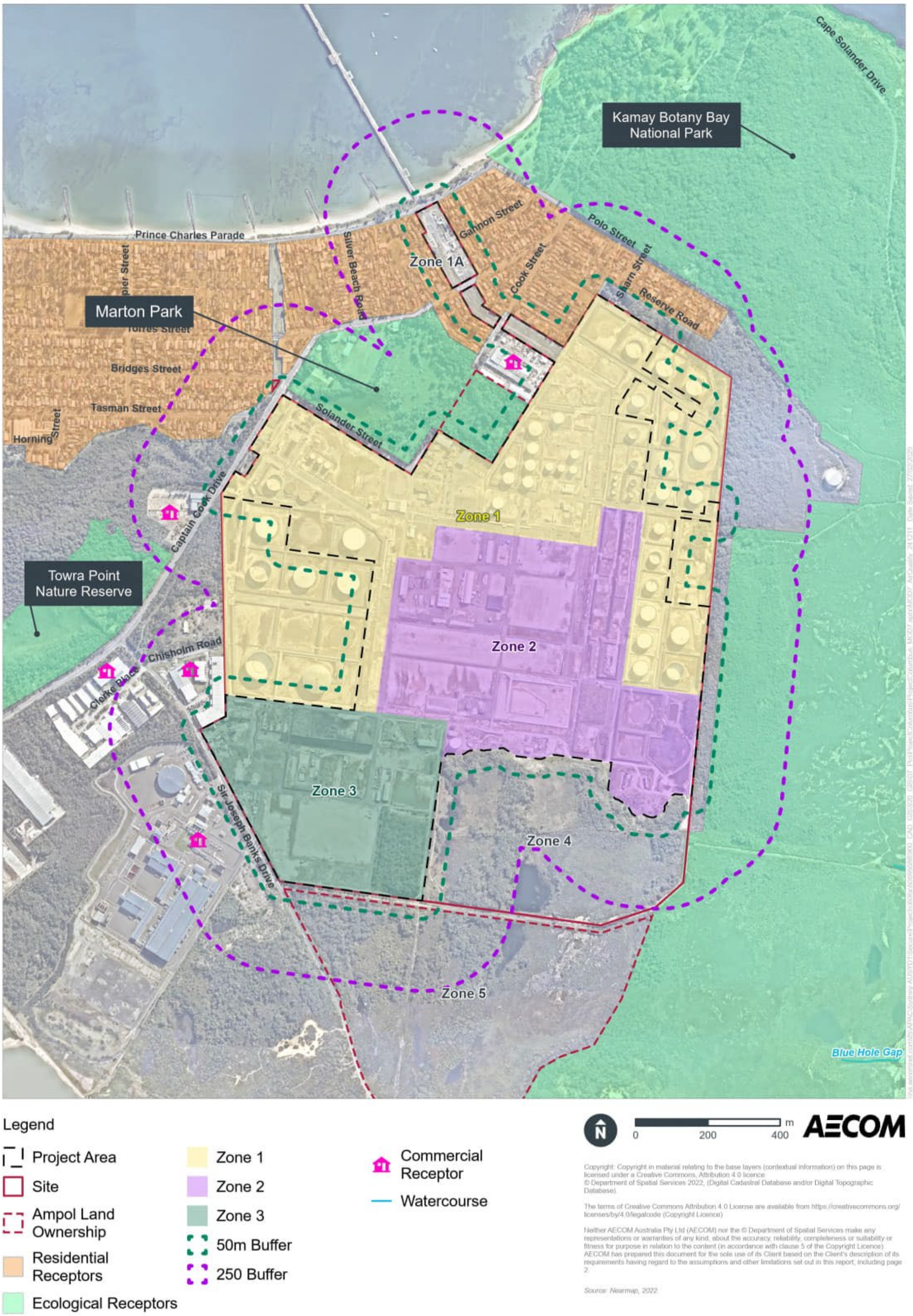

Figure 3-9 Sensitive receptors within the IAQM screening distances

4.0 Assessment of construction impacts

Assessment of construction impacts for the proposed modification is presented in the following sections.

4.1 Dust risk assessment

Potential dust impacts during the construction period have been determined based on the IAQM construction dust assessment guidance and the expected scale of the of construction activities.

4.1.1 Step 1 – Screening assessment

An initial screening assessment was undertaken for the proposed modification defined in Section 1.2**.** The aim of the assessment was to identify whether there are any:

- Human receptors within 250 m of the Project Area
- Ecological receptors within 50 m of the Project Area
- Human or ecological receptors within 50 m of the route used by construction vehicles on public roads up to 500 m from the Project Area.

Following the methodology outlined in Section 2.4, screening lines of 50 m and 250 m were drawn around the Project Area and are shown in Figure 3-9. This figure shows that there are multiple human receptors within the 250 m and 50 m buffers from the construction footprint. There are also ecological receptors within 50 m of the construction footprint and, as such, a Step 2 assessment has been triggered.

4.1.2 Step 2 – Dust risk assessment

Step 2 in the IAQM methodology consists of a risk assessment tool designed to appraise the potential for dust impacts due to unmitigated dust emissions. As outlined in Section 4.1.2, the key components of the risk assessment involve defining:

- Dust emission magnitudes (Step 2A)
- 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 receptors.

Step 2A – Dust Emission Magnitude

Estimated dust emission magnitudes and the justification for each for the proposed modification are presented in Table 4-1. The ratings have been estimated conservatively and are used in Step 2C below.

Table 4-1 Estimated dust emission magnitudes

Activity	Dust emission magnitude	Justification
Demolition	Large	• Total building volume approximately 40,000 m^3 • Onsite concrete crushing.
Earthworks	Large	• Worst case excavation of 398,295 m^3 • Up to 274,695 m^3 would be required for capping. • Up to an additional 46,600 m^3 of fill in Zone 2. • Excavation of infrastructure
Construction	Large	• Approximately 50,000 m^3 construction volume • Onsite concrete batching required. Moderate to high potential for construction dust.

Activity	Dust emission magnitude	Justification
Trackout	Small	• Maximum of six heavy vehicles moving offsite per day during all stages. • No unpaved offsite roads.

Step 2B – Sensitivity of Surrounding Area

The "sensitivity" component of the risk assessment is determined by defining the surrounding areas sensitivity to dust soiling, human health effects, and ecologically important areas. This is described further as follows.

Sensitivity of the area to dust soiling and human health impacts

There are at between 10 and 100 high sensitivity residential receptors within 20 m of the Project Area. These receptors are primarily adjacent to the boundary of Zone 1A at the northern end of the Site (see Figure 3-9). Using the matrix provided in for dust soiling (Table 2-3) and for human health impacts (Table 2-5), this places the sensitivity of the area to both dust soiling and human health impacts in the "High" category.

Sensitivity of area to ecological impacts

Kamay Botany Bay National Park is a nationally designated location which may be affected by dust soiling, especially if the dust contains contaminated material such as heavy metals. Marton Park and Towra Point Nature Reserve may also be affected by dust soiling due to their proximity to the Project Area. As these receptors are within 50 m of the Project Area the distance-refined sensitivity of the ecological community (according to the matrix provided in Table 2-6) is categorised as "high".

Step 2C – Unmitigated Risks of Impacts

Table 4-2 and Table 4-3 provide the risk ratings for dust soiling and human health effects, and for ecological effects, respectively, for each of the four activities.

Without mitigation, the risk ratings for dust soiling and human health effects were categorised as high for demolition, earthworks, and construction, while trackout was rated as low. Similarly, ecological effects were rated high for demolition, earthworks, and construction, and rated low for trackout. These classifications reflect the potential risk for air quality impacts in the absence of target mitigation measures which would be implements to effectively manage an minimise dust emissions. These mitigation measures are described in Section 7.0

Table 4-2 Summary of unmitigated risk assessment for sensitive receptors

Activity	**Step 2A:** Potential for dust emissions	Step 2B: Sensitivity of area		Step 2C: Potential unmitigated dust impacts	
		Dust soiling	Human health (PM_{10})	Dust soiling	Human health (PM_{10})
Demolition	Large	High	High	High	High
Earthworks	Large			High	High
Construction	Large			High	High
Trackout	Small			Low	Low

Table 4-3 Summary of unmitigated risk assessment for ecological receptors

Activity	Step 2A: Potential for dust emissions	Step 2B: Sensitivity of area	Step 2C: Potential unmitigated dust impacts
		Ecological	Ecological
Demolition	Large	High	High
Earthworks	Large		High
Construction	Large		High
Trackout	Small		Low

Sensitivity of the area for demolition works has been rated 'high' due to the proximity of the Project Area boundary from nearby sensitive receptors, and is consistent with the IAQM methodology and sensitivity ratings applied to earthworks, construction and trackout activities. It is important to highlight, however, that demolition activities, as indicated in Figure 3-9, are located more than 250 m from the nearest residential receptors and more than 50 m from ecological receptors. Therefore, the sensitivity rating (and subsequent dust unmitigated risk rating) for demolition activities for dust soiling, human health and ecological impacts is considered highly conservative.

Step 3 – Management Strategies

The outcome of Step 2C is used to determine the level of management that is required to ensure that dust impacts on surrounding sensitive receptors are maintained at an acceptable level. A high-level risk rating suggests that able management measures must be implemented for the project. In the case of a low rating, it is still recommended that appropriate mitigation should be identified and applied.

Given the unmitigated risk rating of high for demolition, earthworks, and construction, mitigation measures designed to minimise the generation of dust on construction sites of this magnitude are recommended. Mitigation measures are listed in Section 7.0.

Step 4 – Reassessment

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

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

Based on this expectation, as well as experience within Australia, construction activities with targeted mitigation measures can achieve high degrees of dust mitigation which significantly reduce dust impacts to a negligible level. With implementation of the proposed mitigation measures listed in Section 7.0, the proposed modification is not expected to be an exception to this rule. Residual impacts on receptors are therefore not expected.

4.2 Combustion emissions

The source of combustion emissions for the proposed modification would be due to the combustion of petrol and diesel fuel used by light and heavy vehicles traveling to and from the Site as well as onsite, mobile construction equipment and stationary equipment, such as diesel generators. Emission intensity depends on the nature of the source, i.e., size of the equipment, usage rates, duration of operation, etc. Pollutants emitted by construction vehicles would include carbon oxides (CO), particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs).

Offsite heavy vehicle movements would include material delivery and waste removal. Construction traffic to and from the Site (not including internal movements) is expected to include about six heavy vehicles per day during all stages (see Table 1-3). Given this relatively low number of additional trucks, combustion emissions from construction traffic are unlikely to result in a notable deterioration in ambient air quality at nearby sensitive receptors.

Combustion pollutants would also be emitted by from onsite diesel operated mobile equipment. There is expected to be a range of heavy mobile equipment utilised onsite (see Table 1-3); however, the bulk of these would be operating in Zones 2 and 3 with adequate buffer distance from the residential receptors to the north of the Site most of the time.

Emissions from construction traffic, as well as the use of mobile and stationary plant equipment are unlikely to make a significant impact on local air quality at nearby receptors. Typical mitigation and maintenance measures for operation of construction vehicles and plant equipment are discussed in Section 7.0 and, when applied, adverse air quality impacts from the operation of construction vehicles and plant equipment are not expected.

4.3 Odour and other Potential Contaminants of Concern

If not appropriately managed, soil contaminants have the potential to become airborne during earthworks associated with the remediation stage of the proposed modification works. These contaminants include VOCs and heavy metals attached to dust. VOCs and other odorous soil contaminants have the potential to cause odour impacts if not handled appropriately.

Contaminated soil would be excavated and remediated according to the Remedial Action Plan (RAP) for the proposed modification. Location of biopiling and stockpiling with adequate buffer distance from the Project Area boundary, combined with appropriate mitigation measures would allow for the appropriate management of potential odour and air quality impacts at or beyond the boundary. Mitigation measures are detailed in Section 7.0.

5.0 Assessment of operational impacts

Once the modification works are complete, the Site would continue to operate as described in the approval documentation for the approved project and would be consistent with the development consent for SSD-5544.

In line with Figure 1-2, relocated equipment would operate in their new locations.

As the general operation of the Site as a terminal would not change, there would be no material change to the potential for air emissions compared with the existing terminal operation. It is noted, however, that relocation of operational activities does have the potential to result in changes to existing dispersal conditions of existing sources. Specifically, the relocation of the FWS and associated diesel pumps within the FWS Relocation Area.

For the purpose of assessment in this *Air Quality Impact Assessment*, two indicative locations have been considered for the relocation of the FWS (Figure 1-3). Option 1 is located in closest proximity to residential and recreational receivers, and Option 2 lies in closer proximity to the operational terminal. The specific siting of the new firewater tank and pumphouse would be selected as part of detailed design.

As discussed in Section 1.2.3, three industrial Caterpillar 3406B diesel engines are used to operate the FWS pumps housed within an enclosed area (the 'pumphouse'). Regular maintenance testing of the pumps is expected to be consistent with existing operations and include:

- Operation of all three pumps individually for approximately half an hour once a month simultaneously with the operation of the diesel engines
- One annual maintenance test conducted over a two hour period once per year simultaneously with the operation of the diesel engines.

Operation of the diesel engines during maintenance testing of the FWS pumps would result in combustion emissions. Air emissions would include nitric oxides and nitrogen dioxide (NOx), CO, PM_{10}, and $PM_{2.5}$, as well as VOCs and PAH. While combustion emissions from maintenance activities are only expected to occur intermittently, with expected scheduled maintenance operations occurring for approximately 20 hours per year, there is the potential for elevated pollutant concentrations; specifically, NO_X and $PM_{2.5}$ and PM_{10} during operation.

Currently in Australia, there are no regulations to control diesel emission from non-road diesel engines. However, such regulations have been enforced internationally including within the United States and European Union. The US Environmental Protection Agency (US EPA) emission standards for non-road diesel engines aim to reduce air pollution and improve public health. These standards are known as the Tier 1 to Tier 4 standards, with each tier representing progressively stricter air emission limits on NOx, PM, non-methane hydrocarbons (NMHC), and CO. Tier 1 to Tier 3 standards were introduced between 1996 and 2008 and focused primarily on reducing NOx and PM emissions. Tier 4 standards were implemented in 2015, which significantly reduced allowable emissions for NO_2 and PM by over 90% compared to previous tiers. These significant reductions were achieved using advanced technologies, such as exhaust gas recirculation (EGR), selective catalytic reduction (SCR), and diesel particulate filters (DPF). A summary of US EPA emission standards is provided in Table 5-1.

It should be further noted that while there are currently no regulations to control diesel emission from non-road diesel engines, in 2018 a national approach to manage emissions from non-road diesel engines under the National Clean Air Agreement. In 2022, the evaluation concluded that best practice standards (Commonwealth regulation with emission standards that align with international best practice: US Tier 4) should be introduced as soon as practicable.

Table 5-1 US EPA Non-Road Compression-Ignition Engine Exhaust Emission Standards

Rated Power Kw	Tier	Emission Standard (g/kWh)				
		NMHC	NMHC + NO_x	NO_x	PM	CO
130 to <225	1	1.3	-	9.2	0.54	11.4
	2	-	6.6	-	0.2	3.5
	3	-	4.0	-	0.2	3.5
	4	0.19	4.0	0.4	0.02	3.5
225 to <450	1	1.3	6.4	9.2	0.54	11.4
	2	-	4.0	-	0.2	3.5
	3	-	4.0	-	0.2	3.5
	4	0.19	-	0.4	0.02	3.5

The Caterpillar 3406B diesel engines were manufactured in 1994 and currently do not meet the least stringent US EPA Tier 1 standards. Operation of the Caterpillar 3406B diesel engines may potentially result in short term elevated air pollutant concentrations at nearby sensitive receptors; particularly given both proposed FWS options are closer to sensitive receivers than its current location. This is particularly of note for Option 1, which is located within 75 m of the nearest sensitive receptor.

To minimise the potential for air quality impacts at nearby sensitive receptors, the Caterpillar 3406B diesel engines would be retrofitted to improve emission performance and bring up to a level that meets US EPA standards. Diesel engine would be retrofitted to achieve emission reductions to Tier 1 levels. The retrofit should be consistent with (or better) than the Caterpillar Technology Emissions Upgrade Group (EUG) for 3406 models, which includes upgrades to the turbocharger, fuel pump/ governor, fuel injection nozzles, pistons/ rings/ liners and jacket water aftercooler.

The above recommendations have been included in Section 7.0 (Management of impacts) of this report.

6.0 Assessment of cumulative impacts

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

Projects were reviewed against the following screening criteria for this cumulative impact assessment:

- Spatially relevant (i.e., the development or activity overlaps with, is adjacent to or within two kilometres of the Project Area)
- Scale (i.e., large-scale major development or infrastructure projects that have the potential to result in cumulative impacts with the proposed modification, as listed on the NSW Government Major Projects website and on the relevant council websites)
- Timing (i.e. the expected timing of its construction and/or operation overlaps or occurs consecutively to construction and/or operation of the proposed modification)
- Status (i.e., projects in development with sufficient publicly available information to inform this environmental impact statement and with an adequate level of detail to assess the potential cumulative impacts).

Projects with the potential for cumulative air quality effects with the proposed modification works are shown in Table 6-1 and Figure 6-1.

Table 6-1 Projects with potential for cumulative air quality effects

Project	Approximate distance to the proposed modification	Project Status/ Indicative Timing/ Overlap	Potential cumulative effects
Kamay Ferry Wharves	350 m north	Approved and currently under construction. Potential construction overlap: Under construction until late 2024	There are sensitive receivers close to and in between both projects and substantial earthworks required for both projects. There is the potential for cumulative impacts during construction.
Breen Resource Recovery Facility	2 km west	Currently under assessment. Construction overlap: Construction expected to continue until 2028	There are sensitive receivers close to and in between both projects and substantial earthworks required for both projects. There is the potential for cumulative impacts during construction.
Kurnell Stormwater Separation Improvement Project	Onsite	Approved May 2024. Construction to complete late 2024. Operational overlap with proposed modification construction	Construction of the two projects would not overlap so cumulative impacts are not likely.
Woolooware to Kurnell Tower Replacement Project	120 m south west	Preparing Review of Environmental Factors (REF) Potential construction overlap: Expected to commence in late 2023	There are sensitive receivers close to and in between both projects and substantial earthworks required for both projects. There is the potential for cumulative impacts during construction.

Project	Approximate distance to the proposed modification	Project Status/ Indicative Timing/ Overlap	Potential cumulative effects
Kurnell Planning Proposal	800 m south west	Determined a State Assessed Planning Proposal on 30 September 2024. Potential construction overlap: Once approved, construction would be completed in a phased manner in 10-20 years	There are sensitive receivers close to and in between both projects and substantial earthworks required for both projects. There is the potential for cumulative impacts during construction.

As shown in Table 6-1, several of these projects would overlap with the proposed modification either spatially or temporally, and without mitigation would likely result in cumulative air quality impacts during construction only. Each of the non-Ampol projects were assumed to have adequate air quality mitigation measures aimed at minimising offsite pollutant concentrations either identified as part of the development assessment stage, or already in use for those projects that have already commenced. Therefore, pollutant emissions from these projects are not likely to result in adverse cumulative air quality impacts at sensitive receptors.

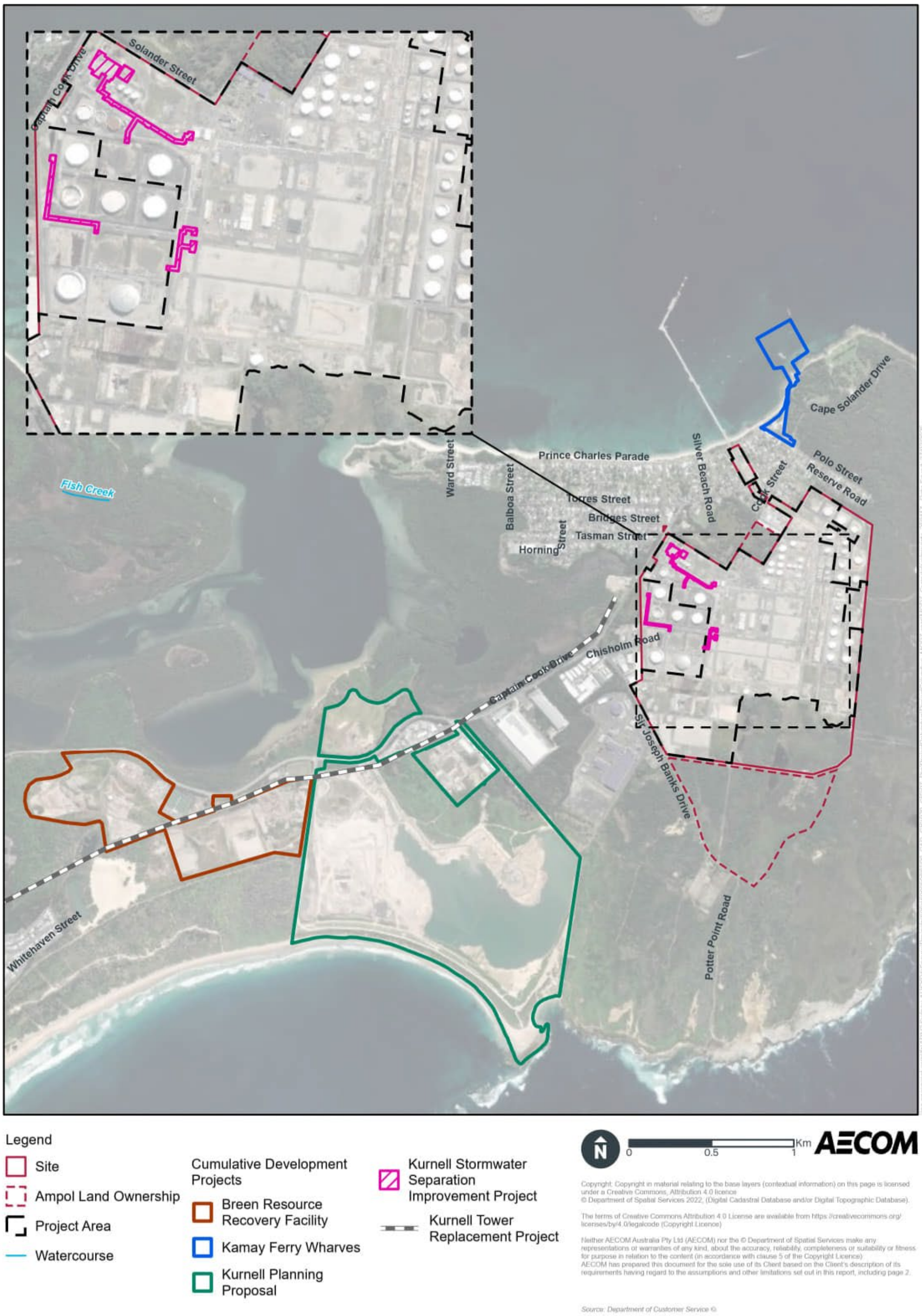

Figure 6-1 Cumulative development projects

7.0 Management of impacts

Mitigation measures to manage potential air quality impacts of the proposed modification are outlined in Table 7-1. Additional and/ or modified environmental safeguards and management measures to those presented in the approved SSD-5544 are shown in **bold**. Deleted measures, or parts of measures, have been ~~struck out~~. Where approved measures have been consolidated to reduce duplication, previously agreed text that has been brought into existing or new measures has been underlined.

Table 7-1 Mitigation measures – Air quality

ID	Issue	Mitigation measure
H1	Dust	An Air Quality Management Plan (AQMP) would be prepared as part of the CEMP to minimise the impact of dust upon sensitive receivers. This would include: • Measures to monitor dust emissions from the construction phase, such as visual inspections • Appropriate measures to be undertaken during adverse weather conditions • Appropriate, reasonable, and feasible measures to mitigate adverse air quality impacts, such as: - Vehicles would only travel on designated roads within the Site where possible and would be limited to a maximum speed of 10 km/hr in offroad areas and 25 km/hr elsewhere - Loads would be covered, and all tailgates would be securely fastened. Vehicles would not be loaded higher than the sides and tailboard. - Concrete cutting and coring would be undertaken using “wet tools” - Water sprays would be used to dampen down soils prior to excavation, handling and/or loading/ unloading materials - All plant would be maintained and operated in line with the manufacturer’s specifications in order to minimise the emission of air pollutants and offensive odours. - Plant and construction vehicles would be turned off when not in use. • ~~Dust emissions from the construction phase of the Project and during the demolition works would be monitored by construction/demolition staff.~~ • ~~Visual inspections would be completed by demolition staff during the works.~~ • ~~Demolition staff would also complete dust deposition monitoring during the demolition works (as per AS/NZS 3580) in appropriate locations on the Site boundary and in Kurnell. Staff would also monitor dust (PM_{10}) levels using the onsite real time ambient air quality monitoring station.~~ • ~~When required, during activities likely to cause high dust levels or adverse weather conditions etc., a designated worker would continuously monitor downwind emissions to the community or local residents, using the methods described above, and call a halt to activities if sensitive receptors are likely to be affected by airborne particulate matter.~~ ~~Should significant impacts be likely, appropriate measures would be taken to mitigate adverse air quality impacts.~~
H8	Odour	An odour reduction program would **continue to** be implemented in accordance with the existing EPL **during construction and operation.**

ID	Issue	Mitigation measure
H13	Odour	~~Soils or concrete with significant hydrocarbon staining or obvious hydrocarbon odours would be transported to the former CLOR area and stored appropriately.~~ **To minimise impacts related to odour, the AQMP would include the following measures:** • Stockpiles of contaminated soil stored onsite would be managed to prevent odorous VOC emissions and windblown particulate emissions • Excavation would be staged to manage potential VOC and odour emissions. Where practical, excavations would not commence prior to 8am nor after 4pm as weather conditions at these times are generally conducive to adverse odour air quality situations from fugitive emissions In the event of an odour complaint, an evaluation would be undertaken to confirm if the **proposed modification** ~~demolition~~ works are the source of the odours. If the construction works are confirmed as a potential ongoing odour source, additional mitigation measures would be implemented which could include the use of water sprays to suppress odours and, if necessary, the use of odour suppressants. Offsite olfactory observations and VOC monitoring using equipment would also be undertaken if necessary. In the event of ongoing odour issues, excavation activities would be stopped and if necessary, the excavation covered or backfilled.
H17	Dust and odour	Surface disturbance would be minimised. Exposed ground would be rehabilitated as soon as practicable.
H18	Dust and odour	During concrete crushing: • The crusher would be located as far as practicable from the Site boundary, allowing adequate buffer distance from receptors. • Real-time dust monitoring would be undertaking during the operation of the concrete crusher. Details of this monitoring (and associated response actions) would be incorporated into the AQMP for the **construction** ~~demolition~~ works. A number of dust suppression measures would be implemented. These could include regular watering of stockpiles, dust curtains and other measures as appropriate.
H23	Complaints	In line with ~~Caltex~~ **Ampol's** existing procedure, following a complaint and its subsequent investigation, feedback regarding the source and nature of the complaint would be provided to the affected community members.
H25	Monitoring	The onsite real time ~~ambient air quality~~ **meteorological** monitoring station would ~~continue to~~ operate throughout the **construction/**demolition works. This station **would** continuously monitor~~s, for PM_{10}~~, wind direction and speed, temperature**, air pressure,** ~~and~~ humidity and rainfall.
H30	**Emissions**	**Caterpillar 3406B diesel engines in the relocated firewater system would be retrofitted to improve emission performance to meet Tier 1 US EPA Nonroad Compression-Ignition Engines: Exhaust Emission Standards (EPA-420-B-16-022).**

References

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Glossary and abbreviations

Term	Description
AAQ NEPM	Ambient Air Quality National Environmental Protection Measure
ACS	Asbestos Contaminated Soil
Air Toxics NEPM	Air toxics National Environmental Protection Measure
BOM	Bureau of Meteorology
CO	Carbon monoxide
EPA	Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act
EP&A Regulation	Environmental Planning and Assessment Act
FWS	Firewater System
IAQM	Institute of Air Quality Management (UK)
NMHC	Non-methane hydrocarbons
NSW	New South Wales
NO_2	Nitrogen dioxide
OWS	Oily water sewer
PAHs	Polycyclic aromatic hydrocarbons
PM_{10}	Airborne particulate matter with an average diameter of 10 micrometres or less
$PM_{2.5}$	Airborne particulate matter with an average diameter of 2.5 micrometres or less
POEO Act	Protection of the Environment Operations Act
SO_2	Sulfur dioxide
SSD	State significant development
VOC	Volatile organic compound
WWTP	Waste water treatment plant