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Air Quality Impact Assessment

Greater Parramatta and Olympic Peninsula Water Cycle Management Project

December 2025

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Air Quality Impact Assessment
Greater Parramatta and Olympic Peninsula Water Resource Recovery Facility

Sydney Water

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Rev	Date	Details
1	25/06/2025	Draft
2	19/09/2025	Draft V2
3	05/12/2025	Final
4	24/12/2025	Minor edit on final

	Name	Date	Signature
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WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Abbreviations

AQIA	Air Quality Impact Assessment
ASS	Acid Sulfate Soils
BOM	Bureau of Meteorology
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DJF	December-January-February (summer months)
EP&A Act	Environmental Planning and Assessment Act 1979
GPOP	Greater Parramatta and Olympic Peninsula
IAC	Impact Assessment Criteria
JJA	June-July-August (winter months)
MAM	March-April-May (autumn months)
NEPC	National Environment Protection Council
NEPMs	National Environment Protection Measures
NSOOS	Northern Suburbs Ocean Outfall Sewer
NSW EPA	New South Wales Environment Protection Authority
OCF	Odour Control Facility
P/M60	Peak-to-mean ratio
POEO Act	Protection of the Environment Operations Act 1997
SOER	Specific Odour Emission Rate
SON	September-October-November (spring months)
STRM	Shuttle Radar Topography Mission
TAPM	The air pollution model
UTM	Universal Transverse Mercator
WRRF	Water Resource Recovery Facility

1 Introduction

1.1 Overview

Sydney Water Corporation (Sydney Water) is planning to build and operate a new water resource recovery facility (WRRF) to provide additional wastewater capacity to support growth across the northern suburbs of Sydney, and in the Greater Parramatta and Olympic Peninsula (GPOP) growth corridor. As a result of expected growth, increased demand is expected for the Northern Suburbs Ocean Outfall Sewer (NSOOS) and the North Head WRRF which provides wastewater services to around 1.7 million people. To respond to the expected demand increase, Sydney Water proposes to build a new WRRF to alleviate constraints on the NSOOS and North Head WRRF.

A scoping report for the proposed project was submitted by Sydney Water to the NSW Department of Planning, Housing and Infrastructure (SSI 74258485). In response, Secretary's Environmental Assessment Requirements (SEARs) were issued for the proposed project. The SEARs were issued in September 2024.

WSP Australia Pty Ltd (WSP) was appointed by Sydney Water to address the key air quality issues identified in the SEARs. Also, to demonstrate that the project will be constructed and operated in a manner that reduces potential negative air quality impacts and minimises the risk to human health and the environment. The WSP report includes an Air Quality Impact Assessment (AQIA) for both the construction and operation of the GPOP WCM project.

The AQIA is comprised of a risk-based dust assessment for the construction, and dispersion modelling of the WRRF operation, to assess the potential impacts from the project. It is understood the pumping station upgrades are not anticipated affect the potential for odour emissions, and Sydney Water is undertaking an odour control project at this site, which is separate to, and ahead of this Project. The pumping station is therefore not included as a modelled source within the AQIA however, construction around the pumping station was considered and included as part of the Construction Dust Impact Assessment for completeness.

1.2 Purpose and structure of the assessment

The SEARs describe the requirements to be addressed in the environmental impact statement (EIS). To address the requirements established in the SEARs, this AQIA report has been prepared in accordance with the New South Wales Environment Protection Authority (NSW EPA) *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022)* and the *Protection of the Environment Operations (Clean Air) Regulation 2021* (Approved Methods). This report is divided into eight sections as follows:

- Section 2 contains the project description and outlines the key features of the project.
- Section 3 outlines the construction and operation assessment methodologies. It describes the applicable legislation relevant to assessing the air quality impact for the construction and operation of the GPOP WCM Project. This section also describes the pollutants of interest for both stages of the project and the methodologies applied.
- Section 4 includes the description of the existing environment that influences the project. In it the study area, its climate and meteorology as well as ambient air quality are characterised. The surrounding existing and prospective land uses are also identified.
- Section 5 covers the construction impact assessment following the *Guidance on the assessment of dust from construction Version 2.2* (Institute of Air Quality Management IAQM, 2024).
- Section 6 contains the operational impact assessment following a Level 2 assessment as described in the Approved Methods for odours and nitrogen dioxide.
- Section 7 summarises the mitigation measures for both the construction and operation of the project.

— Section 8 holds a summary and concluding remarks from the assessment.

To aid the reader identifying where the specific SEARs are addressed in this document, Table 1.1 lists each requirement that is to be included in the AQIA and references the sections of this report where each is contained.

Table 1.1 Air quality SEARs for the GPOP WCM project (SSI 74258485)

AQIA Requirement	Section in this report where the requirement is addressed
(a) demonstrated ability to comply with the relevant regulatory framework, specifically Protection of the Environment Operations Act 1997 and Protection of the Environment Operations (Clean Air) Regulation (2022).	Section 3 and Section 6
(b) identification and assessment of construction air pollution sources and measures for preventing and/or minimising their generation, including nuisance dust, emissions from plant and equipment and potential odours from contaminated and acid sulfate soils	Section 5 and Section 7
(c) a description of operational odour control techniques proposed for the project and their effectiveness in reducing odour emissions	Section 3
(d) assessment of operational odour impacts, including on any future redevelopment of the Camellia-Rosehill precinct	Section 6.1 (with supporting information in Section 4)
(e) cumulative local and regional air quality impact assessment.	Section 6 and Section 8 (with supporting information in Section 4).

2 Project description

2.1 Project background

The Camellia-Rosehill Precinct is projected to play a key role in Sydney's growth. With an expected population to double by 2056, and an increase in residences and business in the Greater Parramatta and Olympic Peninsula (GPOP), the generation of large volumes of wastewater is anticipated. Additional growth is also predicted within Transport Orientated Developments along the NSOOS corridor.

To respond to the increase in the production of wastewater, and provide treatment of the wastewater locally, Sydney Water proposed to construct a new Water Resource Recovery Facility (WRRF), thus delivering a water cycle management solution for the GPOP area.

The WRRF is proposed within the Camellia-Rosehill Precinct. The Camellia-Rosehill Precinct is bound by the Parramatta River to the north, Duck River to the east, the M4 Motorway to the South and James Ruse Drive to the west, incorporating the entire suburb of Camellia and parts of Rosehill and Clyde suburbs. Figure 2.1 shows the location of the Camellia Rosehill WRRF.

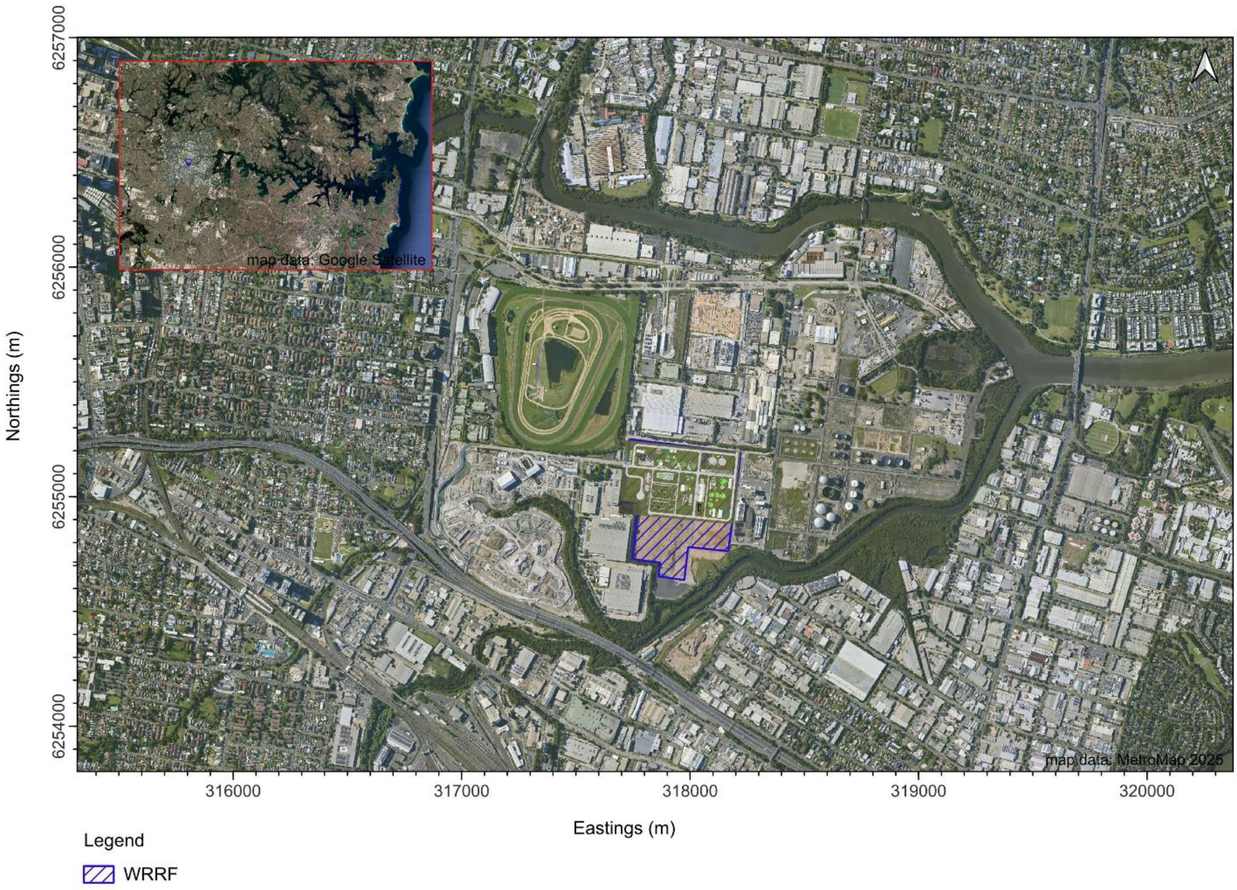


Figure 2.1 Location of the proposed Camellia Rosehill WRRF in Sydney, NSW

The following sections describe the key features of the project, and outline the expected construction and operation timeframes. A description of the potential air emission sources, per project stage, is presented at the end of this section.

2.2 Key features of the project

The Camellia Rosehill WRRF will have capacity to treat 70 megalitres per day (MLD) of wastewater. The assessment has been based on a plant with capacity for 70 MLD, although a smaller size WRRF may be constructed initially. The main components of the plant include:

- inlet works
- primary, secondary and tertiary wastewater treatment process units
- advanced treatment processes involving reverse osmosis
- disinfection systems
- biosolids handling facilities
- odour control facilities.

The WRRF will also include a range of structures and other treatment processes such as tanks, bioreactors, and digestors as well as ancillary facilities and amenities like an administration building. The proposed WRRF and associated infrastructure main elements are summarised in Table 2.1 as outlined by Sydney Water.

Table 2.1 Key project elements and description

Element	**Description**
New WRRF at Camellia-Rosehill	The Camellia Rosehill WRRF will have capacity to treat 70 megalitres per day. The main components include: — inlet works — primary, secondary, and tertiary untreated sewerage treatment process units — advanced treatment processes involving reverse osmosis (RO) — disinfection systems — biosolids handling facilities — odour control facilities Other structures to be built are — tanks — bioreactors — digestors — ancillary facilities (administration building, car park, chemical storage, and stormwater infrastructure) (see Section 3.3 and Figure 3.1)
New transfer main from the Camellia pumping station to the WRRF	A transfer pipeline of approximately 2.2 km to transfer the untreated sewerage
New brine pipeline from the WRRF to the Camellia pumping station and then repurposing an existing pipeline to transfer brine from the pumping station to the NSOOS	A brine pipeline of approximately 5.2 km in length will transfer brine from the WRRF to the NSOOS for treatment and offshore discharge at North Head WRRF. The brine pipeline will reuse an existing pipeline between the pumping station and the NSOOS. A new pipeline will be constructed between the WRRF and the pumping station.
Install a river release pipeline from the WRRF to release advanced quality treated water into Parramatta River	The river release pipeline of approximately 7.6 km long commencing at the WRRF and within the suburbs of Silverwater, Newington, Sydney Olympic Park and Meadowbank. The river release pipeline will discharge advanced quality advanced treated water into the Parramatta River at Meadowbank.

2.2.1 Construction

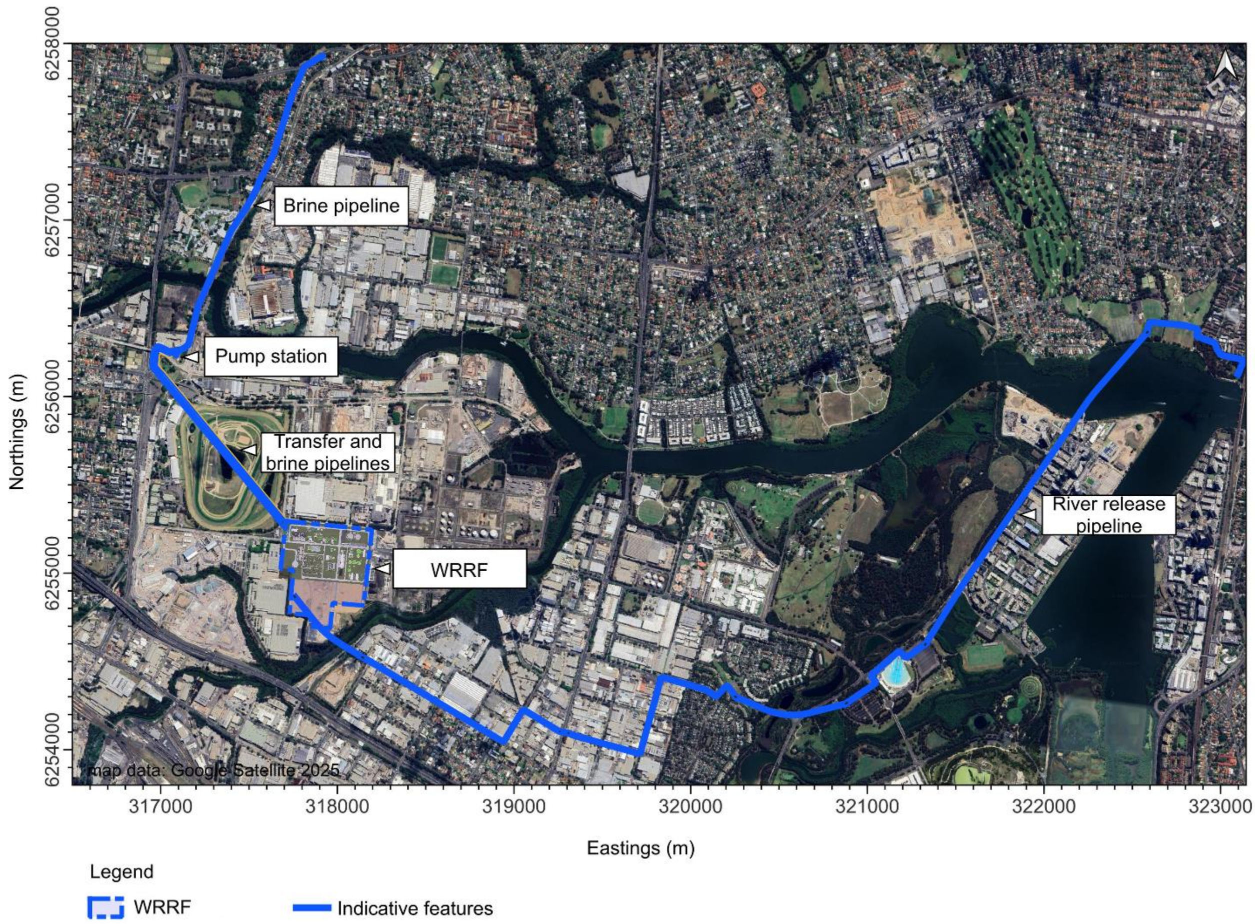
The construction of the project includes the following key activities:

- site establishment
- delivery of materials
- earthworks
- civil works
- structure construction
- installation of mechanical and electrical plant and equipment
- landscaping and rehabilitation
- commissioning.

The new sections of pipelines from the WRRF to the pumping station and the river release location, will be constructed using a combination of trenching and horizontal directional drilling techniques. Between the Camellia pumping station and the NSOOS, an existing unused wastewater rising main will be relined and repurposed to form part of the brine pipeline. The upgrade of the pumping station[1] will include augmentation of underground infrastructure, installation of pumps, and upgrade of power supply. The changes are not anticipated to affect potential emissions of odour.

The key features of the proposal are shown in Figure 2.2. The concept design presented in Figure 2.2 is indicative and may be further refined.

1 Upgrades to the pumping station were not included as a modelled source within the AQIA, as Sydney Water is undertaking an odour control project at this site, separate to and ahead of this Project. For completeness, construction around the pumping station as part of this GPOP WCM Project was considered and included as part of the Construction Dust Impact Assessment.



Source: Jacobs design

Figure 2.2 Indicative GPOP WCM project overview

2.3 Construction program and operation commencement

Subject to approvals, construction of the project would commence in 2028 with a duration of approximately 36 months. Operation is planned to commence in 2031. Sydney Water may construct the facility in two phases.

Table 2.2 provides an indicative timing per activity for the main construction.

Table 2.2 Indicative program and construction staging

Activity	Indicative timing
Camellia Rosehill WRRF construction	Q3 2028 – Q4 2030
Camellia pumping station upgrade works	Q2 2029 – Q3 2030
Transfer (two pipelines) and brine pipeline (one pipeline)	Q3 2028 – Q3 2039
Brine pipeline construction	Q3 2028 – Q3 2029
River release pipeline	Q3 2028 – Q2 2030
River release structure	Q4 2029 – Q2 2030
Commissioning	Q4 2030 – Q4 2031

2.4 Potential air emission sources and pollutants from the project

2.4.1 *Emissions and sources during the project construction*

The construction emission sources considered in this AQIA were those activities involving earthworks and civil works. Civil works include the provision of required structures for the WRRF such as pipeline installation, structure construction and others. During the construction stages, the most relevant sources are those activities that involve vegetation removal, surface grading and compaction, landscaping, excavation, removal, transportation and handling of soil and materials. As with any construction activity, the main pollutants of interest are:

- dust associated pollutants including:
  - total suspended particulates (TSP) i.e., airborne particles suspended in the atmosphere, regardless of size
  - particles with an aerodynamic diameter equal to or less than 10 micrometres (µm) in diameter (PM_{10})
  - particles with an aerodynamic diameter equal to or less than 2.5 µm in diameter ($PM_{2.5}$)
- deposited dust i.e., particles that settle out of the air and accumulate on surfaces over time

The assessment of construction dust emissions is addressed in this report via a construction dust assessment which includes reference to potential dust from contaminated soil and acid sulphate soils (ASS) (see Section 3.2).

In addition to the dust-related emissions described above, combustion emissions may arise from construction activities including vehicle movements, generators (if used) and on-site plant and machinery operation. Gases of interest that could be emitted include:

- carbon monoxide (CO)
- oxides of nitrogen (NO_x)
- sulphur dioxide (SO_2)
- trace amounts of non-combustible hydrocarbons (i.e., VOCs and PAHs).

Gaseous emission rates and their potential impact on surrounding areas would depend on the number and power output of the combustion engines, the quality of fuel used, the condition of the engines, and the intensity of their use. These types of emissions are usually low, can be managed by implementing mitigation strategies (see Section 7), and given their transient nature, are not considered in this assessment.

2.4.2 *Emissions and sources during the project operation*

The operational phase of the GPOP WCM project is not considered to generate particle emissions (PM_{10} or $PM_{2.5}$); however, because of the nature of the operations conducted in any WRRF, odour emissions are likely to occur. For this AQIA, four major emissions sources at the Camellia Rosehill WRRF considered were:

- Bioreactor – Long Sludge
- Membrane bioreactor
- Biogas cogeneration unit stacks
- Odour Control Facility (OCF).

The sources of odour correspond to those provided by Sydney Water from the key water treatment units to be installed at the facility. Other potential sources of odour at the WRRF are designed to redirect their emissions to the OCF or are considered low risk, and these include:

- Inlet works
- Primary sedimentation tanks
- Advanced water treatment plant and chemical storage
- Transfer pump

Solids handling including rotary drum thickens, digesters, bio-solids storage. In addition to odour emissions, nitrogen dioxide (NO_2) will be generated in the biogas cogeneration unit as part of the combustion process.

Gaseous emissions due to vehicle fuel combustion (CO, SO_2, NOx) and wheel-generated dust (on paved or unpaved roads), have the potential to be generated when the WRRF is fully operational, during routine inspections, maintenance, or emergency work. These types of emissions are not included in this assessment because of their sporadic nature, negligible expected contribution and unknown frequency. Routine mitigation measures including, good housekeeping, equipment maintenance in-line with manufactures recommendations, covers on vehicles transporting bio-solids and regular disposal of waste streams such as screenings and grit, will minimise the risk of fugitive emissions.

Dispersion modelling was used to determine odour and NO_2 impacts on local air quality . The methodology followed to build the dispersion model is detailed in Section 3.3. The modelling results for both odour and NO_2 were compared against the available criteria benchmark established in the Approved Methods to demonstrate compliance of the facility's operation.

2.5 Cumulative air quality impacts assessment

WSP has conducted a desktop review of the potential for cumulative impacts from the construction and operation of other major projects within approximately 1 km of the GPOP WCM project, this includes the Camellia- Rosehill Precinct, Hill Road, Meadowbank Park, Silverwater, and other nearby locations.

The projects considered are those classified as *Major Projects*, including State Significant Developments (SSD) and State Significant Infrastructure (SSI), listed on the NSW Planning Portal (www.planningportal.nsw.gov.au) and projects listed on Transport for NSW (www.transport.nsw.gov.au). The assessment was undertaken in consideration of the New South Wales Department of Planning and Environment (DPIE) *Cumulative Impact Assessment Guidelines for State Significant Projects* (2022) and is presented in Appendix C.

3 Assessment approach

3.1 Legislative and policy context

The legislative and regulatory documents relevant to assessing air quality impacts associated with the construction and operation of the proposed GPOP WCM project are discussed in this section.

3.1.1 Commonwealth legislation and policy

3.1.1.1 National Environment Protection Council Act 1994

The National Environment Protection Council (NEPC) was established under the *National Environment Protection Council Act 1994* (NEPC Act). The primary functions of the NEPC are to:

- prepare National Environment Protection Measures (NEPMs)
- assess and report on the implementation and effectiveness of the NEPMs in each state and territory.

NEPMs are a special set of national objectives designed to assist in protecting or managing aspects of the environment e.g., air quality. The NEPM relevant to air quality for the project is:

- the National Environment Protection (Ambient Air Quality) Measure 2021 (Air NEPM). The Air NEPM outlines standards and goals for key pollutants that are required to be achieved nationwide, with regard to population exposure. The national environment protection standards, relevant to this project correspond to those outlined for nitrogen oxide (NO_2) which is subject to modelling in this assessment. The standard criteria for the required averaging periods are presented in Table 3.1.

Table 3.1 Standard criteria for nitrogen dioxide (NO_2) per averaging period

Averaging period	**Maximum NO_2 concentration criteria [ppm]**	**Maximum NO_2 concentration criteria [µg/m^3]**
1 hour	0.08	164
Annual	0.015	31

3.1.2 New South Wales relevant legislation and guidelines

3.1.2.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the primary land use planning statute in NSW. It plays a crucial role in governing various aspects related to land use planning and development:

The EP&A Act aims to create a balanced and efficient planning system that considers community needs, environmental protection, and sustainable development.

3.1.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the legislative framework for the protection and enhancement of air quality in NSW. Its primary objectives are to reduce risk to harmless levels through pollution prevention, cleaner production, application of waste management hierarchy, continual environmental improvement, and environmental monitoring. The following sections of the POEO Act refer to air pollution related activities of relevance to this project:

- Section 124: Operation of Plant (Other Than Domestic Plant): deals with the operation of industrial plant (excluding domestic plant) and aims to prevent air pollution. Occupiers of non-residential premises must ensure that they operate their plant in a proper and efficient manner to avoid causing air pollution.
- Section 125: Maintenance Work of Plant (Other Than Domestic Plant): Like Section 124, this section focuses on maintenance work related to industrial plant (excluding domestic plant). It emphasises proper maintenance practices to prevent air pollution.
- Section 126: Dealing with Materials: Section 126 addresses the handling of materials in a way that avoids air pollution. Occupiers of non-residential premises must ensure that they handle materials properly and efficiently to prevent pollution.
- Section 126. Standards to Air Impurities Not to Be Exceeded: This section sets standards for air impurities. It prohibits exceeding these standards to maintain air quality and prevent pollution[2].

3.1.2.3 Environment Operations (Clean Air) Regulation 2022

The Protection of the Environment Operations (Clean Air) Regulation 2022 under the POEO Act is the principal legal framework for controlling air pollution in New South Wales. It aims to reduce harmful emissions from industrial, commercial, and domestic sources. The section on Air Impurities from Activities and Plant sets out requirements for controlling emissions from industrial, commercial, and agricultural operations. It applies to both scheduled and non-scheduled premises, with emission standards defined for specific pollutants such as particulates, sulphur dioxide, nitrogen oxides, volatile organic compounds, dioxins, and furans.

Facilities are grouped into categories (Groups 1–6) based on their age and activity type, with older plants required to transition to stricter standards by 2027 or 2030. Emission limits apply to individual discharge points (e.g. stacks or vents), and operators must monitor and report concentrations using approved methods.

3.1.3 Approved methods for the modelling and assessment of pollutants in NSW

Pursuant of the POEO Act, the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* 2022 (Approved Methods) prescribes the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in the state.

The Approved Methods lists impact assessment criteria (IAC) and individual air toxics criteria for a range of pollutants against which emissions from an activity are to be assessed. Within the approved methods, a series of definitions relevant to this project are outlined. This includes the description of a sensitive receiver: "*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 any known or likely future sensitive receivers*".

This assessment follows the impact assessment methodology outlined in the Approved Methods, including the identification of emissions inventory, presentation, use of meteorological data, as well as dispersion modelling configuration.

3.1.3.1 Peak-to-mean ratios

It is commonly recognised that dispersion models need to be supplemented to simulate atmospheric dispersion of odours. This is because the instantaneous perception of odours by the human nose typically occurs over a time scale of approximately one second. However, dispersion model predictions are typically valid for time scales equivalent to minutes to one hour averaging periods.

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2 The Camellia-Rosehill WRRF will operate under an Environment Protection Licence (EPL) issued under the POEO Act. This will require obligations consistent with those in Sections 124-126.

To estimate the effects of concentration fluctuations perceived instantaneously by the human nose, it is possible to multiply dispersion model predictions by a correction factor called a "peak-to-mean ratio" (P/M60). The P/M60 is defined as the ratio of peak one-second average concentrations to mean one-hour average concentrations. P/M60 are specified per source type, atmospheric stability classes and distance downwind from the sources. Table 3.2 shows the NSW EPA-recommended P/M60 to determine the peak concentrations. The Approved Methods establishes that the ratios in Table 3.2 can be applied to the emission rates that are to be used for dispersion modelling purposes.

Table 3.2 Peak-to-mean ratios (P/M60) per source type, atmospheric stability class, and distance from source in flat terrain

Source type	**Pasquill-Gifford stability class**	**Near-field P/M60 [a]**	**Far-field P/M60 [a]**
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A – F	6.0	6.0
Surface wake-free point	A, B, C	12.0	4.0
	D, E, F	25.0	7.0
Tall wake-free point	A, B, C	17.0	3.0
	D, E, F	35.0	6.0
Wake-affected point	A – F	2.3	2.3
Volume	A – F	2.3	2.3

Source: NSW, 2022

a Ratio of peak one-second average concentrations to mean one-hour average concentrations

3.1.4 Technical Framework: Assessment and management of odour from stationary sources in NSW (2006)

The Technical Framework is used by the NSW EPA to manage odours from industry in NSW as well as to prevent and minimise odours from a range of industrial activities (DEC, 2006). The odour assessment criteria established in the Technical Framework is presented in Table 3.3.

Table 3.3 Odour assessment criteria

Population of affected community	**Odour assessment criteria [a] [OU]**
Rural single residence (≤2)	7.0
approximately 10	6.0
approximately 30	5.0
approximately 125	4.0
approximately 500	3.0
Urban area (≥ 2000) and/or schools and hospitals	2.0

Source: DEC, 2006

a Nose-response-time average, 99^{th} percentile AS4323.3-2001

3.1.5 Guidance on the assessment of dust from demolition and construction

Guidance on the assessment of dust from construction Version 2.2 (Institute of Air Quality Management IAQM, 2024) (IAQM guidance) provides guidance for defining the significance of air quality impacts due to the construction of a new development based on the magnitude of change, i.e., the predicted increase or decrease in concentrations from the proposal, and the sensitivity of the receptor.

This guidance is widely used for the semi-quantitative assessment of the risk of air quality (primarily particulate matter) impacts from construction works. Gaseous emissions from the construction works and any construction works screened out by the IAQM guidance were assessed qualitatively.

3.2 Construction assessment methodology

The IAQM guidance describe factors that may contributes to dust emissions from a construction as:

- activities being undertaken (earthmoving, number of vehicles and plant etc.)
- duration of these activities
- size of the site
- meteorological conditions (wind speed, direction, and rainfall)
- proximity of receivers to the activities
- adequacy of the mitigation measures applied to reduce or eliminate dust
- sensitivity of the receivers to dust.

The quantity of dust emitted from construction is related to the area of land being worked, and the level of construction activity (nature, magnitude and duration). The wind direction, wind speed, and rainfall during construction activity also influences the potential for dust impacts. While adverse impacts can occur in any direction from a site, they are more likely to occur downwind and/or close to the site.

Local geographic features, including topography and natural barriers (e.g., woodland), may reduce airborne concentrations due to screening and impaction. Existing background concentrations can be used to estimate whether ambient air quality standards are likely to be exceeded as a result of construction activities.

The construction air quality impact assessment adopted the following approach:

- overview of the project, study area, and activities during construction
- review the existing environment conditions, including local topography, climate and existing ambient air quality
- identify sensitive human receivers within the study area and ecological receivers (e.g., national parks, farmland) within 50 metres of the project footprint
- conduct a qualitative assessment of potential dust impacts associated with the project:
  - risk-based assessment in accordance with the IAQM guidance

The following sections summarise the recommendations and assessment steps stablished by the IAQM. The risk matrixes used in this report to determine the risk level for each component are detailed in each step.

3.2.1 Step 1: Screen the requirement for a more detailed assessment

The IAQM guidance recommends that a risk assessment of potential dust impacts from construction activities is undertaken when sensitive human receivers are located within:

- 250 metres of the project footprint
- 50 metres of the routes used by construction vehicles on a public highway, up to 250 metres from the site entrances.

and for ecological receivers within:

- 50 metres of the project footprint
- 50 metres of the routes used by construction vehicles on a public highway, up to 250 metres from the site entrances.

For construction works screened out for a detailed risk assessment (in Step 1), the IAQM guidance indicates that it can be concluded that the level of risk is 'negligible' and any effects would not be of significance. To minimise the impacts on the environment from the project construction activities and implement best practices, the potential emissions from these construction site activities were qualitatively assessed.

3.2.2 Step 2: Assess the risk of dust impacts

The assessment of the risk of dust impacts is performed separately for each of the four activities: demolition, earthwork, construction, and track-out.

3.2.2.1 Step 2A: Determine the potential dust emission magnitude

For Step 2A, examples provided in the IAQM guidance have been used to classify potential large, medium or small dust emission magnitude, as shown in Table 3.4.

Table 3.4 Example definitions for large, medium, and small dust emission magnitude

Activities	Large	Medium	Small
Demolition	— total building volume > 75,000 m^3 — potentially dusty construction material — on-site crushing and screening — demolition activities >12m above ground level	— total building volume 12,000–75,000 m^3 — potentially dusty construction material — demolition activities 6–12 m above ground level	— total building volume <12,000 m^3, — construction material with low potential for dust release — demolition activities <6 m above ground level
Earthworks	— total site area >110,000 m^2 — potential dust soil type (e.g., clay) — >10 heavy earth moving vehicles active at any one time — formation of bunds >6 m in height — total material moved >100,000 tonnes.	— total site area 18,000–110,000 m^2 — moderately dusty soil type (e.g., silt) — 5–10 heavy earth moving vehicles active at any one time — formation of bunds 3–6 m in height — total material moved 20,000 tonnes – 100,000 tonnes.	— total site area <18,000 m^2 — soil type with large grain size (e.g., sand) — <5 heavy earth moving vehicles active at any one time — formation of bunds <3 m in height — total material moved <20,000 tonnes — earthworks during wetter months.
Construction	— total building volume >75,000 m^3 — on-site concrete batching — sandblasting.	— total building volume 12,000–75,000 m^3 — on-site concrete batching — potentially dusty construction material (e.g., concrete).	— total building volume <12,000 m^3 — construction material with low potential for dust release (e.g., metal cladding or timber).

Activities	Large	Medium	Small
Track out [a]	— >50 heavy duty vehicles (>3.5 tonne) outward movements in any one day — potential dusty surface material (e.g., high clay content) — unpaved road length >100 m.	— 20–50 heavy duty vehicles (>3.5 tonne) outward movements in any one day — moderately dusty surface material (e.g., high clay content) — unpaved road length 50–100 m.	— <20 heavy duty vehicles (>3.5 tonne) outward movements in any one day — surface material with low potential for dust release — unpaved road length <50 m.

a Track out is dirt, mud or other materials tracked onto a paved public roadway by a vehicle leaving a construction site.

3.2.2.2 Step 2B: determine the sensitivity of the area

For Step 2B, the sensitivity of the surrounding land uses takes account of several factors:

- the specific sensitivities of receivers
- the number of receivers and their proximity to the project area
- local background PM_{10} concentrations
- site-specific factors that may reduce the risk of wind-blown dust (e.g., trees).

The matrices for determining surrounding area sensitivity of the area to dust soiling effects on people, to ecological impacts and human health are presented in Table 3.5, Table 3.6, and Table 3.7.

Table 3.5 Sensitivity of the area 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

Table 3.6 Sensitivity of the area to ecological impacts

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

Table 3.7 Sensitivity of the area to human health impacts

Receiver sensitivity	Annual mean PM_{10} concentration [a]	Number of receivers	Distance from the source (m)			
			<20	<50	<100	<250
High	>20 µg/m^3	>100	High	High	High	Medium
		10–100	High	High	Medium	Low
		1–10	High	Medium	Low	Low
	17.5–20 µg/m^3	>100	High	High	Medium	Low
		10–100	High	Medium	Low	Low
		1–10	High	Medium	Low	Low
	15–17.5 µg/m^3	>100	High	Medium	Low	Low
		10–100	High	Medium	Low	Low
		1–10	Medium	Low	Low	Low
	<15 µg/m^3	>100	Medium	Low	Low	Low
		10–100	Low	Low	Low	Low
		1–10	Low	Low	Low	Low
Medium	> 20	> 10	High	Medium	Low	Low
		1–10	Medium	Low	Low	Low
	17.5 – 20	> 10	Medium	Low	Low	Low
		1–10	Low	Low	Low	Low
	15 – 17.5	> 10	Low	Low	Low	Low
		1–10	Low	Low	Low	Low
	< 15	> 10	Low	Low	Low	Low
		1–10	Low	Low	Low	Low
Low		> 1	Low	Low	Low	Low

a The annual mean PM_{10} concentration ranges were adjusted in accordance with the annual mean Air NEPM objective of 20 µg/m^3 as per CASANZ (2023).

3.2.2.3 Step 2C: assess the risk by combining the factors in Step 2A and Step 2B

For Step 2C, the dust emission magnitudes for earthworks, construction and track out during construction are combined with the sensitivity of the area to determine the risk of impacts. The matrices for the risk of dust impacts are presented in Table 3.8, Table 3.9, and Table 3.10.

Table 3.8 Risk of dust impacts from demolition

Sensitivity of the area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible risk

Table 3.9 Risk of dust impacts during earthworks and construction

Sensitivity of area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible risk

Table 3.10 Risk of dust impacts for track-out

Sensitivity of area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible risk

3.2.3 Step 3: Determine the site-specific mitigation

To define the site-specific mitigation measures to adopt, the dust risk categories for each of the outcome of Step 2C should be used. Site-specific mitigation would be required when there are low, medium or high risks of an impact. For cases where the risk category is negligible, no mitigation measures beyond those required by legislation are required (IAQM, 2024).

3.2.4 Step 4: Examine the residual effects

Step 4 assesses the residual impacts after the implementation of mitigation measures and determines whether these are significant.

3.3 Operation assessment methodology

For the operational phase of the project, air quality dispersion modelling was performed. The selected modelling tool used in the development of this assessment was CALPUFF. In this section, an overview of the model as well as other tools required for its configuration are described. These include the meteorological fields and other inputs that were used to generate the appropriate information to determine the dispersion of odours from the operation of the Camellia Rosehill WRRF. At the end of this section details regarding the assumptions and limitations of the dispersion modelling assessment are outlined.

3.3.1 Model overview

CALPUFF is a multi-layer, multi-species, non-steady-state Lagrangian Puff dispersion model used to simulate the effects of time and space varying meteorological conditions on pollutant transport. The model consists of three main components:

i CALMET, a diagnostic 3-dimensinonal meteorological model,
ii CALPUFF, an air quality dispersion model,
iii CALPOST, a post-processing model tool.

CALPUFF is recommended for use in all applications experiencing one or more of the following, most of which are relevant to the Camellia Rosehill WRRF site:

- coastal environment
- moderate terrain
- non-steady state atmospheric conditions
- surface temperature inversions
- periods of calm and light winds.

To capture important coastal induced flows, CALMET was used to develop a 3-dimensional hourly gridded meteorological domain. Inputs into CALMET included fine-scale terrain, and detailed fine scale land use as well as surface observation meteorological data and prognostic model upper air data from CSIRO's The Air Pollution Model (TAPM).

The latest available versions of the models were used in this analysis; CALMET Version 6.5.0, CALPUFF Version 7.2.1 (Level 150608) and TAPM Version 4.05.

3.3.2 Meteorological modelling

Two advanced State-of-Science models were used to develop the three-dimensional meteorological wind fields for this assessment:

- TAPM (The Air Pollution Model), developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- CALMET – a diagnostic meteorological model.

The following sections contain a brief description of the models accompanied by a summary of the model configuration in each case.

3.3.2.1 TAPM overview and model configuration

For the odour impact assessment of the WRRF, the TAPM model was used to generate upper air meteorological files. The air pollution model (TAPM) predicts 3-dimensional meteorology and air pollution concentrations. The model is a PC-based interface that is connected to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analysis.

Four TAPM modelling domains (30 km, 10 km, 3 km, and 1 km) were used to develop the 1 km 3-dimensional meteorological fields. The first coarse domain was at a grid size of 30 km followed by a 10 km nested 2nd domain followed by a 3 km nest and finally a 1 km innermost nest. TAPM data was used to provide essential upper air data to support the CALPUFF dispersion modelling. The detailed TAPM configuration is listed in Table 3.11. The selection of the modelling period considered the existing climate conditions around the project site. Details on the year selection criteria are found in Section 4.1 and Appendix A.

Table 3.11 Summary of TAPM key model settings and inputs

Parameter	Value/Description
Model version	4.0.5
Reference point (Centre)	UTM Zone 56S
Number of grids (spacing)	4 (30 km, 10 km, 3 km, and 1 km)
Vertical levels	Model has 35 vertical layers from the surface to 8,000 m; 18 of the vertical layers are in the lower boundary layer, below 1,000 m (i.e., 10, 25, 50, 75, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1,000 m).
Modelling period	2018 (31 Dec 2017 to 31 Dec 2018)
Terrain data source	STRM 30m
Land use data source	Default

From TAPM, an upper air data file was extracted at the Sydney Olympic Park AWS Station. The upper air data file output was then provided to CALMET.

3.3.2.2 CALMET overview and model configuration

CALMET is a diagnostic meteorological model that produces three-dimensional wind fields based on parameterised treatments of terrain effects such as slope flows and terrain blocking effects. It accounts for the micrometeorological effects on overland and overwater boundary layers. The diagnostic wind field module uses a two-step approach to the computation of the wind fields. CALMET can be run using gridded data fields generated by models (such as The Air Pollution Model (TAPM))), hourly observational data from weather stations, or a combination of the two (known as hybrid mode).

The key configuration parameters used to configure CALMET in this assessment are summarised in Table 3.12. The meteorological modelling domain extends to an area of 20 km in the east west direction and 20 km in the north-south direction. The model domain was made large enough to capture the main weather events and phenomena. At 0.2 km grid resolution, the horizontal grid is fine enough to capture all the local dominant geophysical features.

Hourly meteorological data from the three meteorological stations were captured and processed for input into the CALMET meteorological model using the SMERGE option (see existing environment). In addition to the surface meteorological stations, the single vertical profile extracted at the location of the Sydney Olympic Park location from TAPM was used to develop the upper air temperature and wind field. The output of the CALMET model, gridded 3-dimensional meteorology was used as input into CALPUFF.

Table 3.12 Summary of CALMET key model settings and inputs

Parameter	Value/Description
Model version	6.5.0
Mode	Hybrid
Modelled domains	1
Modelling period	2018 (31 Dec 2017 to 31 Dec 2018)
Modelling timestep	3,600 seconds
Terrain data source	Shuttle Research Topography Mission 1 (SRTM1) 30 m resolution (see Figure 4.1)

Parameter	Value/Description
Land use data source	Digitally generated using CALPUFF View Land Use Creator tool (see Section 4.1.1.1 and Figure 4.2)
Meteorological grid domain	20 km x 20 km
Number of cells	100
Meteorological grid resolution	0.2 km
Grid origin (SW Corner)	307.838 km E, 6,245.165 km N. UTM Zone 56 S
Number of vertical layers (and levels)	10 (0, 20, 40, 80, 160, 320, 640, 1200, 2000, 3000, 4000)
Surface meteorological stations	Sydney Olympic Park (Archery) BOM Station, Parramatta North NSW Station, Chullora NSW Station
Upper air	Upper air data file for the location of the Sydney Olympic Park (Archery) BOM Station retrieved from TAPM. Biased towards surface observations.
Convective mixing height options method	Maul-Carson for land and water
Relative weighting of field vs observations Surface Layer (R1), and Layers Aloft (R2)	0.5 km, 1 km
Wind field interpolation Over Land Surface (RMAX1), and Over Land Aloft (RMAX2)	5 km, 20 km
TERRAD option	2

3.3.3 CALPUFF overview and model configuration

CALPUFF was the selected dispersion and transport model for this assessment. The model advects "puffs" of a given species emitted from sources (be it particulate or gaseous), using the CALMET-generated meteorological fields within a provided set of model boundaries. The model calculates hourly concentrations of the required species at set receptors. CALPUFF offers a range of receptor options to determine the concentrations of the modelled species, such as discrete or gridded receptors. These concentrations are subsequently processed using the CALPOST utility which outputs a tabulated concentration results for the desired averaging time. The model settings used in CALPUFF are summarised in Table 3.13.

Table 3.13 Summary of CALPUFF key model settings and inputs

Parameter	Value/Description
Model version	7.2.1
Modelling period	2018 (31 Dec 2017 to 31 Dec 2018)
Modelling timestep	3,600 seconds
Plume rise options	Transitional Plume Rise, Partial Plume Penetration
Plume rise method for point sources	Briggs Plume Rise
Puff element	Puff
Dispersion option	Turbulence computed from micrometeorology
Turbulence computing method	Standard

Parameter	Value/Description
Terrain adjustment method	Partial Plume Path Adjustment
Building wake effects	PRIME
Receptors	Nested grids: — ridded receptors at 50 m resolution over a 3 km x 3 km grid. — Gridded receptors at 100 m resolution over at 5 km x 5 km grid Discrete receptors: — 20 discrete receptors at varying heights

3.3.3.1 Emission source types

In this assessment, two types of odour sources were represented in CALPUFF either as an area or point. The characteristics of each source type are outlined briefly below.

Area sources are usually low-lying odour emission sources such as tanks, ponds and stockpiles, where ambient conditions of wind and temperature determine the rate of odour emission from the source. The modelled SOER which is an odour flux rate per unit area, in ou.$m^3/m^2/s$. Note that this is the same as ou.m/s which is the nomenclature adopted in this report.

Point sources are odour emission sources such as stacks, where there is a relatively high velocity of air through a relatively small orifice. A wake-affected point source is where the discharge of the point source is within the zone of disturbed air that is created as the wind passes around or over nearby structures such as building or trees. To calculate the odour emission rate for a point source, the specified volumetric air flow rate (m^3/s) is multiplied by the odour concentration (ou). This provides an 'Odour Emission Rate' (OER) in ou.m^3/s.

Figure 3.1 shows the location of the modelled sources according to the plans provided by Sydney Water. The OCF and the biogas cogeneration unit stacks were modelled as point sources. The Bioreactor and MBR were configured as area sources.

Notes: OCF – Odour Control Facility, MBR – Membrane Bioreactor, COGEN – biogas cogeneration units.

Figure 3.1 View of the Camellia Rosehill WRRF modelled sources (labelled in black)

3.3.3.2 Operation emission sources and emissions inventory

The configuration of the Camellia Rosehill WRRF operational stage odour and NOx sources and emission rates are detailed in this section. For the proposed WRRF, Table 3.14 shows a summary of the area sources, their characteristics, and the emissions data used in this assessment for modelling purposes. The bioreactor emissions are divided and specified for each zone. In total the WRRF will have three operational bioreactors all of which have been included in the modelling using the same emission rates and dimensions as presented in Table 3.14. The membrane bioreactor comprises of 12 trains, the emissions shown in Table 3.14 correspond to one individual train. All 12 trains were considered in the modelling.

The odour emission rates for the modelled point sources are presented in Table 3.15. The point sources modelled were the OCF and the two biogas cogeneration unit stacks. Other potential sources of odour such as inlet works, solids handling, aerobic digester, and anaerobic digesters, will have their emissions extracted to the OCF. Fugitive sources of odour such as leaks from units or maintenance activities are not considered here as they are not expected to make a significant contribution to the estimated odour impacts determined in this report.

The OCF will be designed to meet the minimum requirements of the Sydney Water technical specification for odour control units. This requires an outlet concentration as measured at the exit of the OCF of ≤500 Odour Units. A list of the requirements can be found in Technical Specification Odour Control Unit (Version 7) (Sydney Water, 2025).

Table 3.14 Odour emission rates and source parameters for area sources

Source	Source unit	Raw SOER [ou/m²s] [a]	Peak to mean emission [ou.m³/m²s] [b]		Height [m] [c]	Width [m]	Length [m]
			A, B, C, D	E, F			
Bioreactor – Long Sludge Age	Aerobic zone 1	0.08	0.18	0.15	6	10.49	26.95
Bioreactor – Long Sludge Age	Aerobic zone 2	0.08	0.18	0.15	6	10.49	26.95
Bioreactor – Long Sludge Age	Aerobic zone 3	0.08	0.18	0.15	6	10.49	23.74
Bioreactor – Long Sludge Age	Deaeration zone	0.50	1.15	0.95	6	10.49	3.21
Bioreactor – Long Sludge Age	Swing zone 1 – Anox.	0.50	1.15	0.95	6	9	13.90
Bioreactor – Long Sludge Age	Swing zones 2 – Aero.	0.80	1.84	1.5	6	9	13.90
Bioreactor – Long Sludge Age	Swing zone 3 – Anox.	0.50	1.15	0.95	6	9	13.90
Bioreactor – Long Sludge Age	Outlet weir and chamber	0.50	1.15	0.95	6	9	2.70
Bioreactor – Long Sludge Age	Bypass weir and chamber	0.50	1.15	0.95	6	1.80	78
Membrane Bioreactor	MBR inlet channel	0.50	1.15	0.95	6	49	2
Membrane Bioreactor	MBR individual train [c]	0.08	0.18	0.15	6	2.75	20.9

a Sydney Water Database best practice SOER – Specific Odour Emission Rate (ou.m³/m²s) or OU – Odour concentration (ou) (Sydney Water ACP004, 2025)

b Effective emission used for modelling. Obtained from multiplying the emission by the peak-to-mean ratio. For the area sources the variable peak-to-mean ratio was implemented based on the stability classes.

c The emissions and characteristics of the MBR train correspond to a single train in the reactor. The reactor comprises of 12 trains that were included in the model.

Table 3.15 Odour emission rates and source parameters for point sources

Source	OU [a]	Air flow [m³/s]	Odour Emission Rate [ou.m³/s]	Peak to mean emission [ou.m³/s] [b]	Temp [K]	Vel [m/s]	Height [m]	Stack tip Diameter [m]
Biogas Cogeneration Plant [c]	1,589	1.0	1,614	3,712	453	21.4	6	0.23
Odour Control Facility (OCF)	500	31.6	15,819	36,384.7	293	15	18	1.50

a (Sydney Water ACP004, 2025)

b Effective emission used for modelling. Obtained from multiplying the emission by the peak-to-mean ratio. The emissions here is the OU x 2.3. For The fixed factor of 2.3 was used as prescribed in the approved methods for wake-affected sources for all stability classes.

c Emissions were split evenly between two biogas cogeneration unit stacks.

Table 3.16 presents the parameters used in the calculation of the NOx emissions for the biogas cogeneration unit stacks. The values presented in the table correspond to one plant. The NOx calculations followed the sample calculations and adjustment to reference conditions described in the Appendix 1 of the Approved Methods. In total two biogas cogeneration unit stacks were modelled in this assessment, both with the same characteristics and emissions as presented in Table 3.16.

Table 3.16 Stack parameters and NOx emission rates for the biogas cogeneration units (per unit)

Parameter	**Unit**	**Value**
Stack height	m	6
Stack tip diameter	m	0.23
Stack tip area	m^2	0.04
Exit Temperature	K	453
Exit Velocity	m/s	21.4
Oxygen Content	%	8.3
Moisture Content	%	4.0
Flow Rate (Actual)	Am^3/s	0.9
Flow Rate (Normalised Temp @ stack o2. Wet)	Nm^3/s	0.54
Flow Rate (Normalised Temp @ stack o2. Dry)	Nm^3/s	0.5
NOx @ Dry, 273K, 101.3kPa, 5% O_2	g/Nm^3	0.5
NOx @ Dry, 273K, 101.3kPa, Stack O_2	g/Nm^3	0.63
NOx emission rate	mg/s	106.3
NOx emission rate	g/s	0.3

Modelling of odour

The Approved Methods requires odour impacts to be evaluated on a nose-response-time average, which is approximately one second. As shown in Table 3.14 and Table 3.15, the odour emissions rates were multiplied by the "peak-to-mean" factors to convert the modelled one hour averaging time to a nose-response averaging time, as developed by Katestone Scientific (1995, 1998) and adopted by the NSW EPA in the Approved Methods. Upon simulation completion, the CALPUFF model output was processed with CALPOST to obtain the 99^{th} Percentile 1-hr odour concentration units. These values were compared against the selected model criteria (See Section 6.1).

Modelling of Nitrogen oxides: NOx to NO_2 conversion

The estimation of Nitrogen oxides from the biogas cogeneration units (presented in Table 3.16) followed the procedure outlined in the Approved Methods "Section 8 Modelling pollutant transformations".

The emission rate input in CALPUFF corresponded to that of NOx. NOx refers to the sum of the two most common oxides of nitrogen, namely nitric oxide (NO) and nitrogen dioxide (NO_2). The relative proportions of NO and NO_2 in ambient air changes as NO converts to NO_2 in the presence of solar radiation and ozone (O_3). To simulate the NO_2 impact of the biogas cogeneration units, including ambient background concentrations, Method 2: NO to NO_2 conversion limited by ambient ozone concentration (Ozone Limiting Method or OLM) outlined in the Approved Methods was used.

The OLM is known as a reactant-limited approach. It uses an approximation of the chemistry of NO and O_3 in order to estimate NO_2 concentrations. It is assumed that all the available O_3 in the atmosphere will react with the NO from the source until either all the O_3 is consumed, or all the NO is used up. The 100th Percentile 1-hr average NOx concentrations were converted to NO_2 using Equation 3.1. The background NO_2 and O_3 concentrations were obtained from the air quality measurements from the Parramatta North station (see Section 4.3.1).

$$[NO_2]_{TOTAL} = \{0.1 \times [NO_2]_{PRED.}\} + MIN\left\{0.9 \times [NO_X]_{PRED.}\ OR\ \frac{46}{48} \times [O_3]_{BACKGROUND}\right\} + [NO_2]_{BACKGROUND}$$

Equation 3.1 Ozone Limiting Method (OLM)

The Approved Methods designates that for the OLM method, there are two assessment levels that can be conducted. **Level 1 assessment**: Maximum prediction and maximum background concentrations, and **Level 2 assessment**: Contemporaneous prediction and background concentrations 1-hour average. The Level of assessment to be conducted is dictated by whether the impact assessment criteria is exceeded.

3.3.3.3 Building downwash

The Building Profile Input Program-Plume Rise Model Enhancements (BPIP-PRIME) downwash module within CALPUFF accounts for the influence of buildings and other structures that may influence the dispersion of air emissions. Based on the Camellia Rosehill WRRF drawings, a total of nine structures were configured in the model. Table 3.17 summarises the structures and buildings characteristics used for modelling. A view of the Camellia Rosehill WRRF plant buildings and structures configured in the model are shown in Figure 3.2.

Table 3.17 Buildings and structures dimensions and locations included in the model

Building or Structure ID	Base elevation	Height	Diameter	X Length	Y Length	Rotation angle	X coordinate	Y coordinate
	[m]	[m]	[m]	[m]	[m]	[deg]	[m]	[m]
TANK1	6.7	24.7	25	-	-	-	317895	6255182
TANK2	6.78	24.7	25	-	-	-	317935	6255177
TANK3	6.91	24.7	25	-	-	-	317978	6255172
DWBLD [a]	7.01	18	-	27	23	353	317827	6255167
MTANKS [b]	7.07	8	-	35	16	354	317823	6255123
CHEM [c]	7.56	12	-	23	9	175	317885	6255121
SCRUB [d]	7.1	10	-	19	4	355	317862	6255131
CG1 [e]	7.72	3	-	12	3	355	317952	6255123
CG2 [f]	7.91	3	-	12	3	355	317951	6255111

a Dewatering building

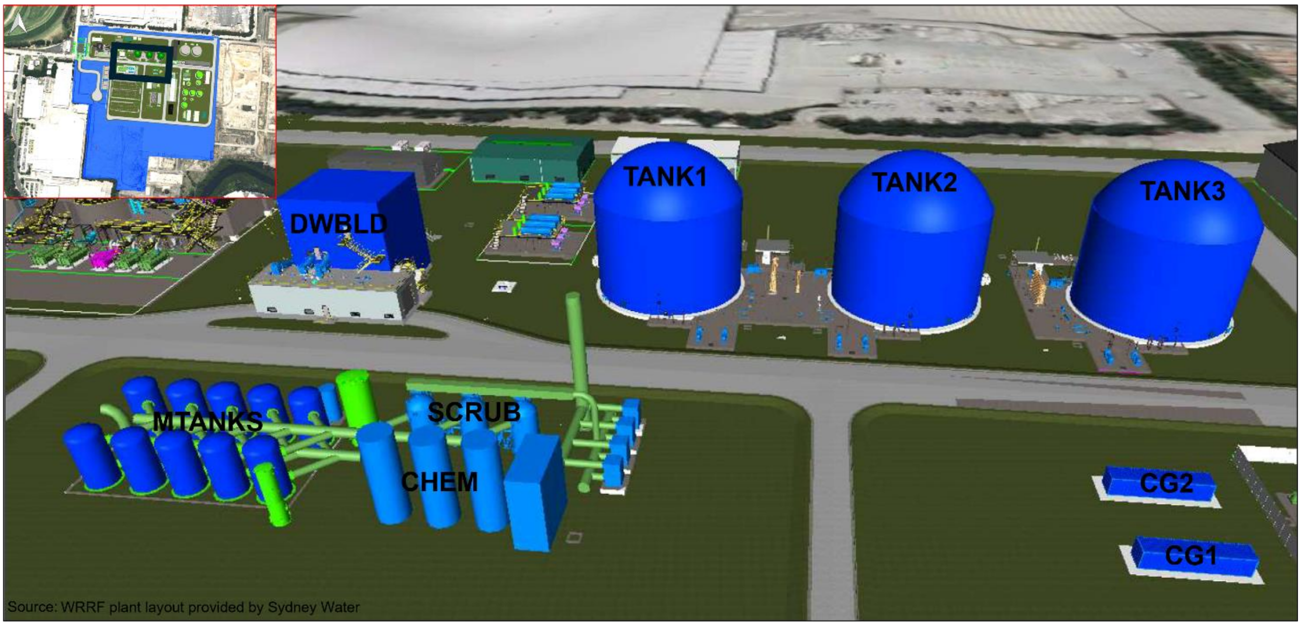
b Odour Control Facility Tanks

c Odour Control Facility Chemical Storage

d Odour Control Facility Scrubber

e Biogas cogeneration unit container 1

f Biogas cogeneration unit container 2



Note: The complete plan view can be seen on the top left with the black rectangle enclosing the zoomed area in the plant where buildings and structures included in the modelling are located.

Figure 3.2 Modelled buildings and structures within the Camellia Rosehill WRRF

3.3.3.4 Modelled receptors

Two types of receptors were configured in CALPUFF: nested and discrete receptors. The selection of the receptors followed the Approved Methods. For the nested receptors, two grids were configured with different resolutions as described in Table 3.13. The nested gridded receptors are shown in Figure 3.3. A description of the discrete receptors is found in the Existing Environment section (see Section 4.1). The prospective developments in the Camellia-Rosehill Precinct at the time of assessment, where the WRRF will be located, were considered.

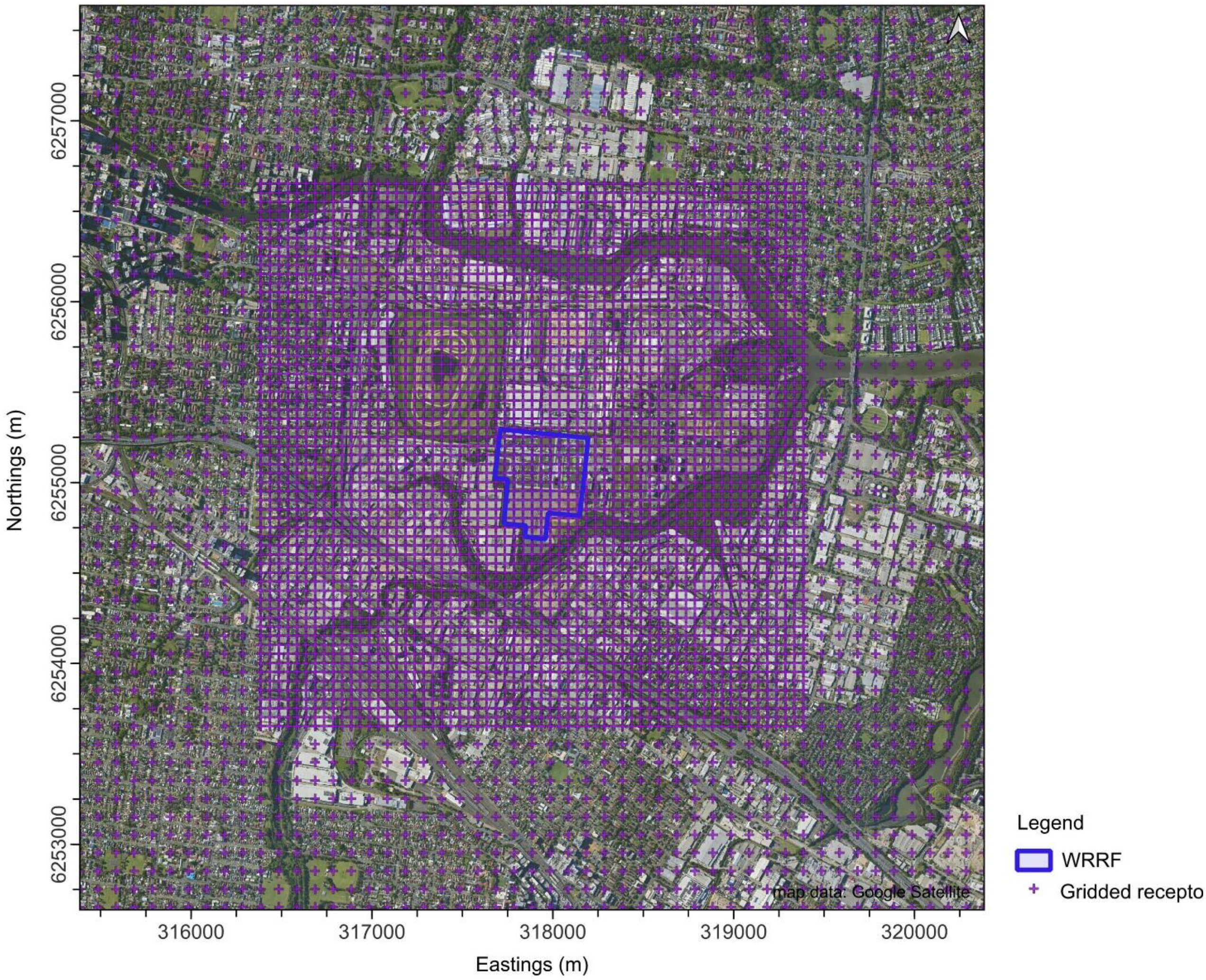


Figure 3.3 Nested gridded receptors used in CALPUFF

3.3.4 Assumptions and limitations

3.3.4.1 Modelled emissions data

The following key assumptions were made in the development of the Camellia Rosehill WRRF modelling regarding emissions data:

- Emission sources characteristics were configured based on the information provided by Sydney Water. Building and other tall structures heights (that can influence dispersion of the odour) in the WRRF were obtained from the drawings provided by Sydney Water.
- All modelled emissions from the emission sources were configured under "normal operation" conditions of the Camellia Rosehill WRRF.
- No cumulative odour impacts resulting from odours emitted from other potential or existing sources in the vicinity of the project site, or within the modelled domain were considered in this assessment. Unlike other pollutants, odour is not assessed cumulatively with emission from off-site sources, it's a criterion based largely on residential population density surrounding the site.
- The emissions inventory and dispersion modelling simulations did not consider venting events or leaks that can lead to odour generation.

3.3.4.2 Atmospheric dispersion modelling limitations

Atmospheric dispersion models are mathematical tools that link an emission source to a receptor, simulate the substance (gas or aerosol) trend, and predict its fate. They use differential equations that account for transport, turbulent diffusion, soil deposition (dry and wet), chemical transformation (in some cases) of the emitted substances. By solving these equations numerically (or analytically in simple cases) in time and space, they estimate the concentrations around and away from the emission sources.

Solving these processes accurately and completely is challenging due to the uncertainties and approximations in the input data (e.g., three-dimensional meteorological fields, terrain features) and the stochastic variability of the turbulent dispersion processes in the atmosphere.

In general, models have difficulty in accurately predicting dispersion under low wind speed conditions (<1 m/s) due to the dominance of physical processes other than advection and or turbulent diffusion under such conditions. Another limiting factor of dispersion modelling is the inability to accurately predict the minimum mixing height, of particular importance when the simulations involve low-level, non-buoyant (or with low buoyancy) emission sources.

Different metrics can be used to evaluate the model performance such as temporal and spatial correlations, exceedance frequencies or even maximum concentration occurrence. However, these metrics provide a general overview of how well the model can predict concentrations based on sets of benchmarks. In some cases, while a metric for one parameter may show a good performance, another metric could display low accuracy of the simulated data. Thus, a dispersion model may perform well in some aspects but poorly in others. It is therefore recommended that model performance be considered holistically, considering the quality and representativeness of the input data as well as errors and biases of measured data, and the suitability of the selected model for the application.

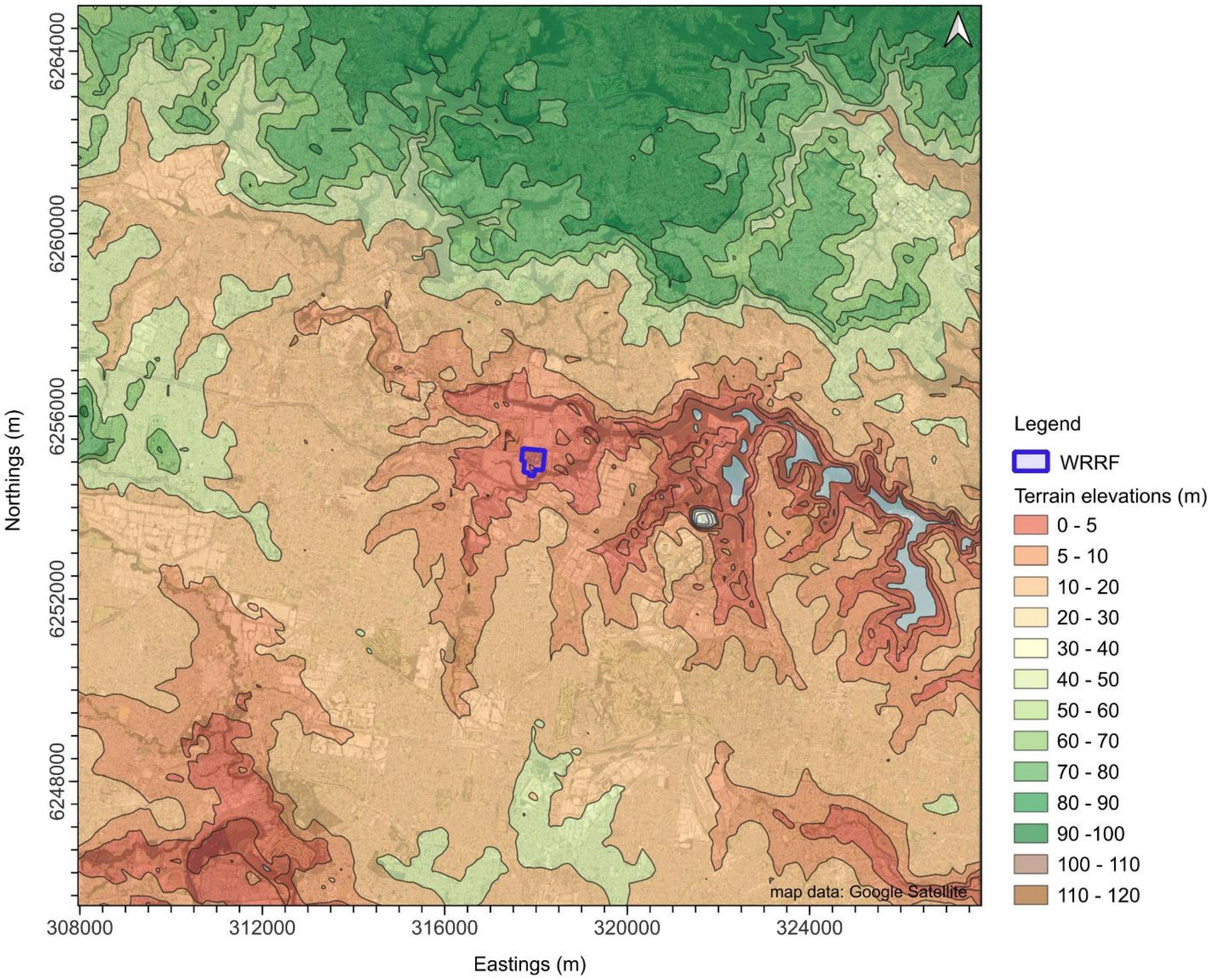
4 Existing environment

This section describes the local conditions of the area where the GPOP WCM project will be located, a review of the existing land use and receptors that can be impacted by the project (existing and prospect). The topography of the area is characterised, as well as the climate and meteorology. These two factors are of importance as they will mostly influence the fate of the emissions generated by the WRRF operations. The ambient air quality is also characterised to provide a picture of the baseline conditions. The analysis of the air quality serves to inform background concentrations of PM_{10} (for the construction dust assessment), NO_2, and O_3 (for the modelling of the biogas cogeneration units). Finally, a summary of the existing air emission sources in the vicinity of the project site serves to inform potential cumulative impacts.

4.1 Study area

The proposed Camellia Rosehill WRRF will be located on Sydney Water owned property at the intersection of Colquhoun and Devon Street, Rosehill (Lot 1, Deposited Plan 1308385). The WRRF site comprises an area of 21.41 hectares (ha) and is located within the City of Parramatta Local Government Area (LGA). Upgrades to the existing sewage pumping station at Camellia are also located on Sydney Water property within the City of Parramatta LGA. Pipeline alignments are generally within the road corridor, Council or Crown land or Sydney Water easements, except for the transfer and brine pipelines within Rosehill Gardens Racecourse.

The project is located within the City of Parramatta LGA. Throughout the project area, there is little change in elevation and the WRRF site location is flat. Figure 4.1 shows the terrain elevations obtained from the Shuttle Radar Topography Mission (SRTM1) 30 m, centred at the project site and extending at 10 km radius. As shown in Figure 4.1, the project site is 5 m above sea level. Terrain elevation increases up to 10 m above sea level in a 2 km radius from the centre of the proposed WRRF. Terrain elevations from 5 up to 20 m above sea level are found in sections where the proposed pipelines will be located. Elevations of 40 m and above are found to the north of the site.



Note: The terrain elevations were used as an input in CALMET for the odour modelling of the Camellia Rosehill WRRF.

Figure 4.1 Shuttle Radar Topography Mission (SRTM1) 30 m terrain elevations

4.1.1 Surrounds

The Camellia Rosehill WRRF will be located in the Camellia-Rosehill Precinct in Sydney's west (317832 m E, 6255164 m S). The WRRF site is surrounded predominately by industry with the exception of Rosehill Gardens Racecourse to the north-west. The closest industry is the adjacent reclaimed asphalt plant to the east of the project area (see Section 4.3.2), further north and east of the project area warehousing facilities can be found.

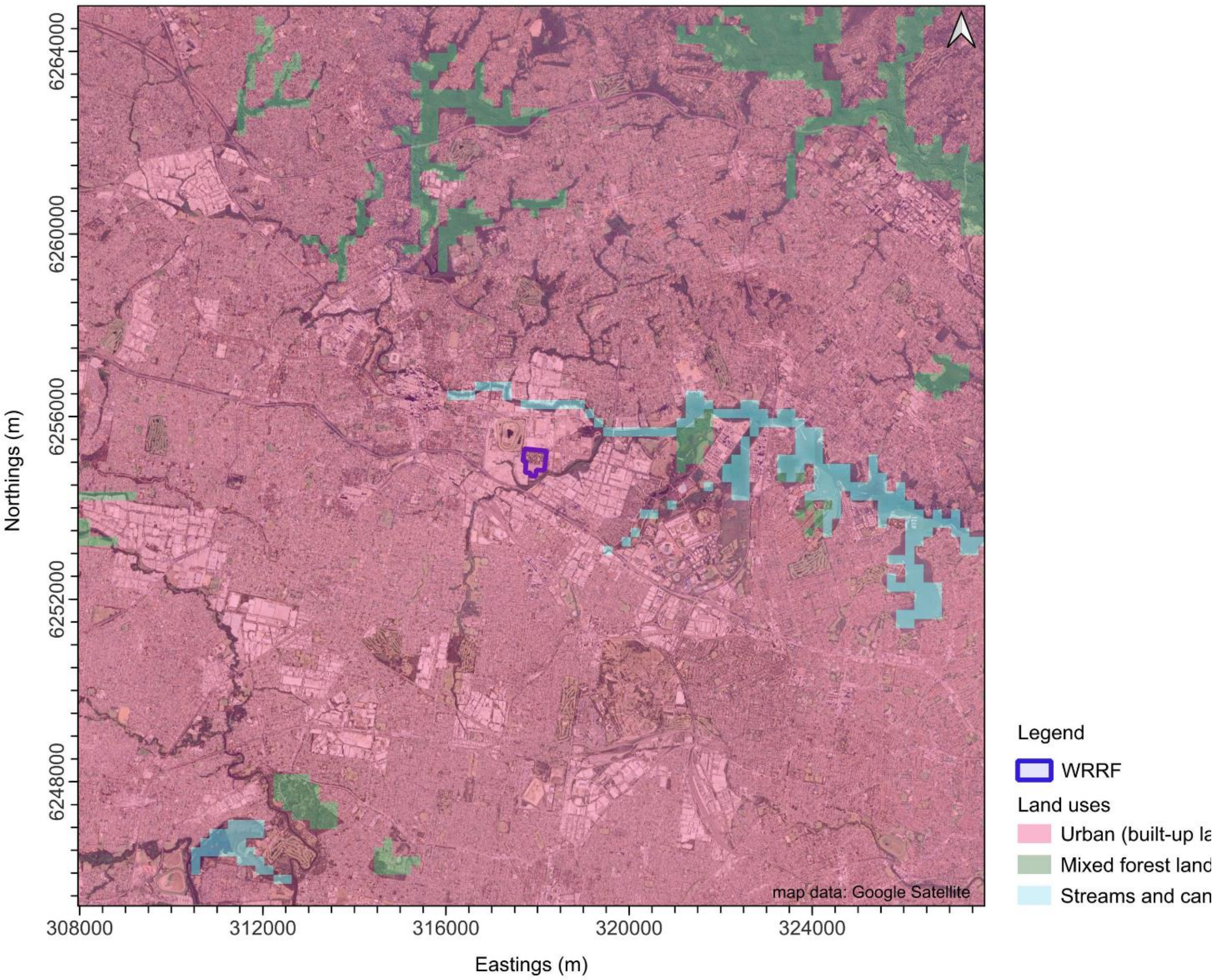
The closest residential area to the Camellia Rosehill WRRF site is found approximately 750m southwest on Asquith Street, Silverwater or 900 m to the west of the site. The southern boundary of the site is approximately 320 m away from Duck River, while the north boundary is approximately 900 m away from the Parramatta River.

4.1.1.1 Land use and sensitive receptors

Existing land use and sensitive receptors

The predominant land use of the WRRF site and most of its surroundings corresponds to a 'Services' land use according to the NSW Land Use (2017). Rosehill Gardens Racecourse is classified as 'Recreation and Culture'. 'Nature and conservation' areas are found next to the Parramatta and Duck Rivers. Expanding further away from the WRRF, the predominant land use is 'Urban and residential'.

Figure 4.2 shows a simplified version of the land uses expanding to a 10 km radius from the project site (set as the centre). This land use was generated using the Land Use Generator Tool from CALMET and corresponds to the land uses implemented in the dispersion modelling. In this simplified version, land uses such as Services, Industrial, Recreation and Culture, and Urban and residential have been grouped under the Urban (built-up land). The Nature and conservation areas were set as mixed forest land.



Note: Land uses correspond to those using the Land use generator tool from CALMET.

Figure 4.2 Land use types configured for the odour modelling of the Camellia Rosehill WRRF

Prospective development

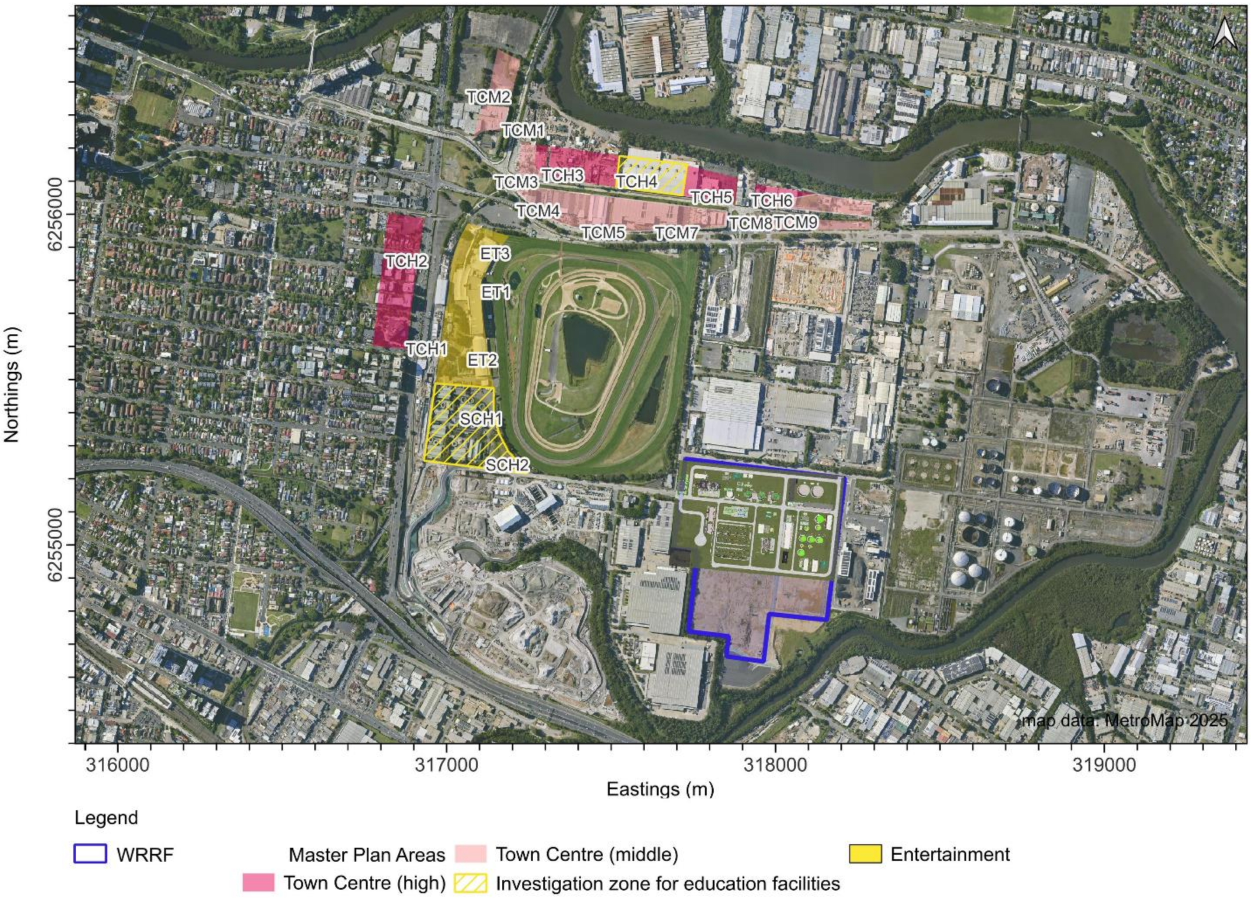
To evaluate the potential impacts of the Camellia Rosehill WRRF in its operational phase, future developments in the area were also considered. The Camellia-Rosehill Integrated Master Plan (NSW DPE, 2022) (the Master Plan) was used to identify these developments. The Master Plan "prepared for the NSW Department of Planning and Environment for the purpose of the Camellia-Rosehill strategy" (NSW DPE, 2022) describes the type of infrastructure and associated land uses that could be developed in the area.

Several proposed developments from the Master Plan were selected to represent discrete receptors with the potential to be impacted by the operation of the WRRF. A total of 20 discrete receptors were selected for the model with the building heights and locations based on information in the Master Plan.

At each receptor a '*flagpole*' (vertical assessment points) was configured at varying heights starting from ground level and increasing at 5m increments to represent each 'building level' up to the proposed building height. The maximum height for each type of receptor was determined by land use type described in the Master Plan. Four land uses were associated to the selected receptors:

- entertainment (36 m)
- investigation zone for educational facilities (height not specified in the plan)
- town centre high (130 m)
- town centre middle (80 m).

The flagpole for the Town Centre land uses (high and middle), were positioned every 5 m up to 50 m, and every 10 m to the maximum building height for residential towers. A maximum height of 50 m was used at the receptors for the Educational facilitates land use, as no maximum height was specified in the Master Plan. The discrete receptors configured for this assessment based on the prospective development of the Camellia-Rosehill precinct are shown in Figure 4.3.



Source: NSW DPE, 2022

Notes: ET: Entertainment, SC: School, TCM: Town Centre (middle), TCH: Town Centre (high).

Figure 4.3 Discrete receptor location based on the Camellia-Rosehill Integrated Master Plan indicative land uses

4.2 Climate and meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source disperses. The key meteorological parameters for air dispersion are wind speed, wind direction, temperature, rainfall and relative humidity. As established in the Approved Methods, the meteorological data in the vicinity of the evaluated project needs to be assessed and the most representative set is required to be used in air quality assessments.

WSP considered several meteorological stations in the vicinity of the project area and from these, three meteorological stations were identified nearby the location of the Camellia Rosehill WRRF. The closest station to the WRRF is Sydney Olympic Park (Archery Centre) AWS station (ID: 066212) managed by the Bureau of Meteorology (BOM), this station is approximately 4 km to the east of the WRRF. The two other stations close to the site are managed by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW), and are the Parramatta North station (approximately 5.5 km from the project site) and the Chullora station (approximately 7 km from the project site). Figure A.1 shows the location of the meteorological stations.

Historical meteorological data from the closest available meteorological station (Sydney Olympic Park BOM AWS) was selected to describe the existing local meteorological conditions. The station is located at 321575.9 m E, 6254599.6 m S, the terrain elevation where the station sits is 4 m above sea level. The Sydney Olympic Park BOM AWS has been operating since 2011 and has a high percentage of data completeness of data (more than 90%) for the measured parameters (Approved Methods), with all years having more than 95% of wind available data.

The latest six validated years of meteorological data from the Sydney Olympic Park BOM AWS were processed. A summary of the average values for meteorological parameters is shown in Table 4.1 alongside with the percentage of wind speed data completeness for each year. Table 4.2 shows additional metrics averaged by season for temperature, relative humidity and wind speed for the retrieved years.

Table 4.1 Average values per year for temperature, relative humidity, wind direction and speed, and percentage of wind speed data completeness from the Sydney Olympic Park BOM AWS Station

Year	Average temperature (°C)	Average relative humidity (%)	Average wind direction (Degrees)	Average wind speed (m/s)	Wind speed data completeness (%)
2017	18.2	71.8	170.2	2.3	100
2018	17.9	71.8	172.0	2.3	99.8
2019	18.2	72.4	175.9	2.2	99.9
2020	17.8	75.9	174.9	2.2	100
2021	17.2	75.3	177.4	2.1	99.8
2022	17.3	76.5	178.5	2.2	99.9

Table 4.2 Summary statistics of the climate at Sydney Olympic Park BOM AWS (2017–2022) by season

Parameter	Units	Summer (DJF)	Autumn (MAM)	Winter (JJA)	Spring (SON)
Max. temp	Degrees (°C)	27.8	23.4	18.3	23.4
Min. temp	Degrees (°C)	19.0	14.1	7.3	13.0
Relative humidity (9 am)	Percent (%)	72.3	80.4	76.3	69.5
Relative humidity (3 pm)	Percent (%)	88.3	92.3	87.8	85.2
Wind speed	Metres per second (m/s)	3.0	2.3	2.9	3.1

The following sections describe briefly the historic trend of the meteorological parameters of interest for dispersion modelling.

4.2.1 Winds

Figure 4.4 shows the average daily and maximum wind speeds at the Sydney Olympic Park BOM AWS Station from 2017 to 2022, while Figure 4.5 shows the average wind rose across the evaluated years, and Figure 4.6 shows the average seasonal wind roses. The average wind speed measured at the station from 2017 to 2022 was 2.21 m/s. Consistent average wind speeds were observed across the different seasons with the averages ranging between 1.85 m/s to 2.62 m/s.

The highest wind speeds were approximately 11 m/s. On average, higher wind speeds were present during the summer months (DJF), while lower wind speeds presented during the winter period (JJA) (as displayed in Figure 4.4). Figure 4.7 shows the individual year wind roses. As shown in Figure 4.5 to Figure 4.7, the predominant winds blow from the west-northwest with average frequencies of 15%, and of up to 30% during the winter months. Winds blowing from the south-southeast most predominant in summer. The wind patterns are consistent across the years. All the evaluated years present wind measurements with percentages of calm winds (wind speeds ≤0.5 m/s) of more than 20%.

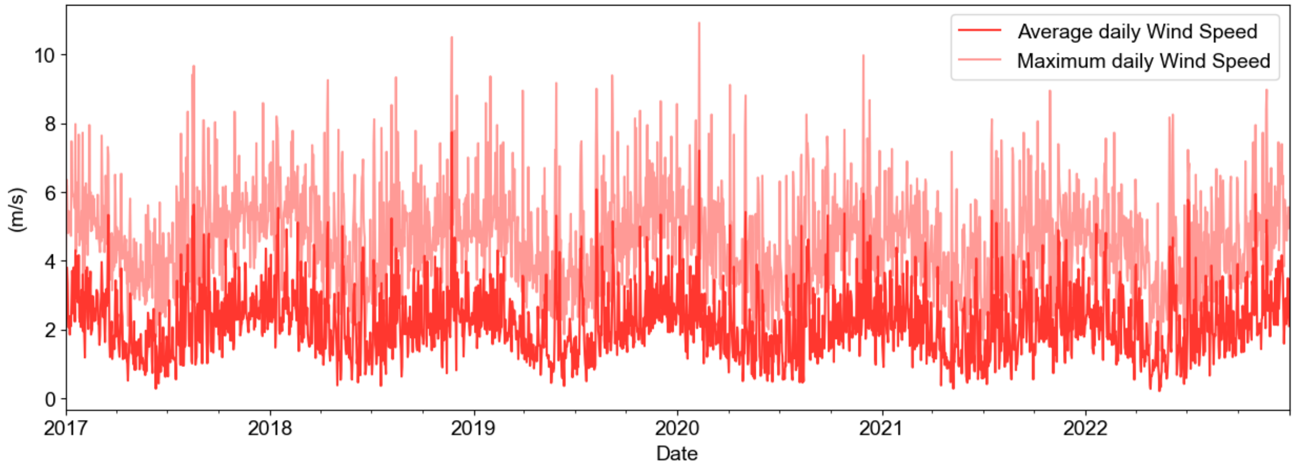


Figure 4.4 Time series at the Sydney Olympic Park BOM AWS from January 2017 to December 2022 for the average and maximum daily values of wind speed

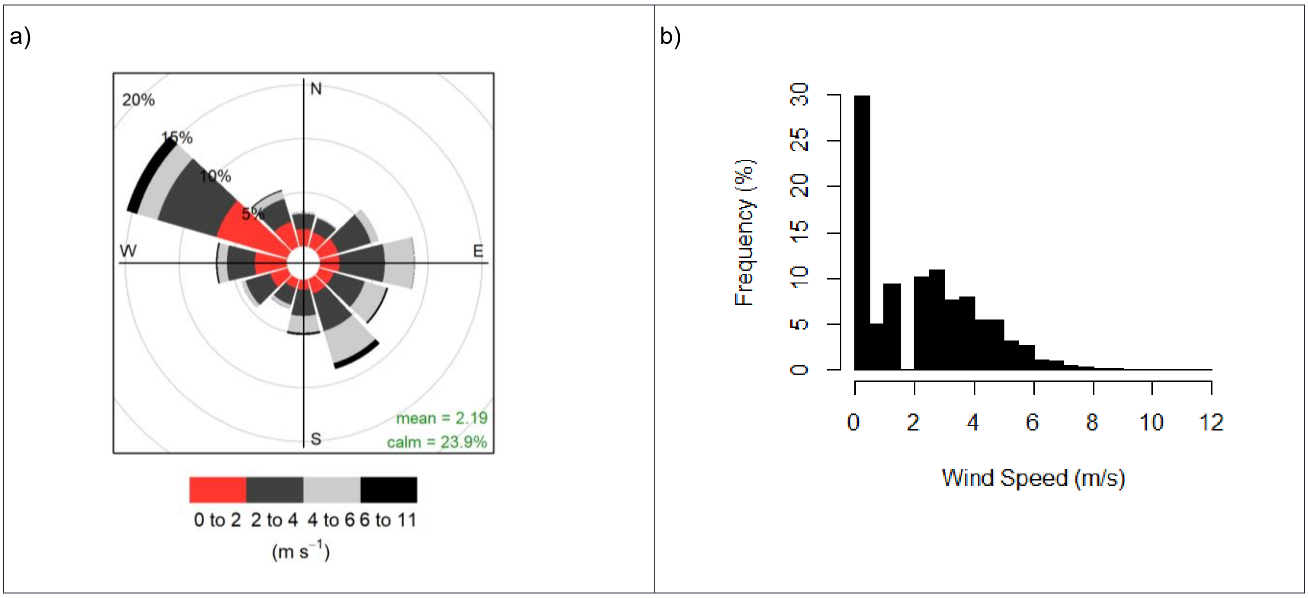
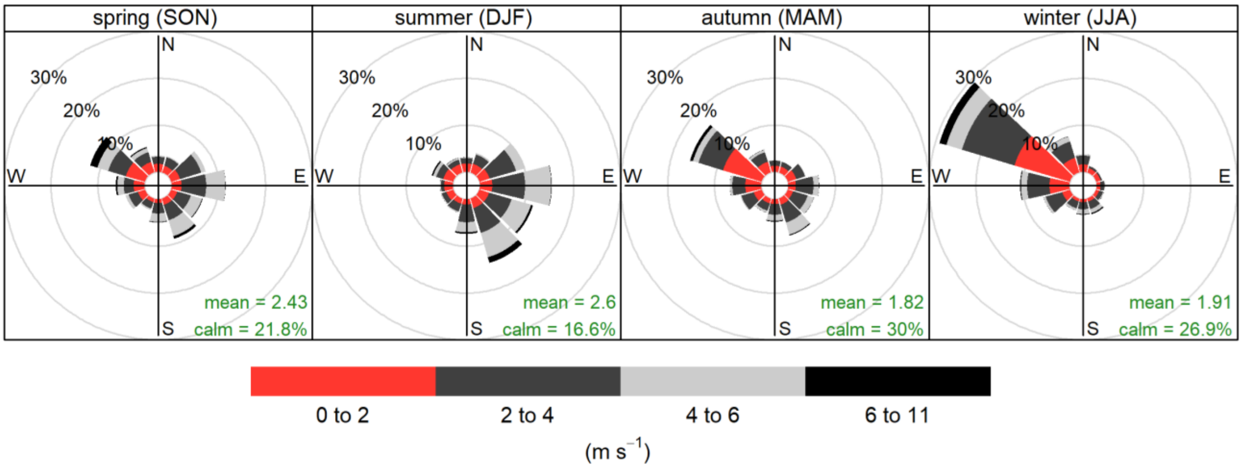


Figure 4.5 a) Average wind rose, and b) Histogram of wind speeds for 2017 to 2022 at Sydney Olympic Park BOM AWS



Note: Months abbreviations are SON: September, October, November, DJF: December, January, February, MAM: March, April, May and JJA: June, July, August.

Figure 4.6 Average seasonal wind roses at Sydney Olympic Park BOM AWS from 2017 to 2022

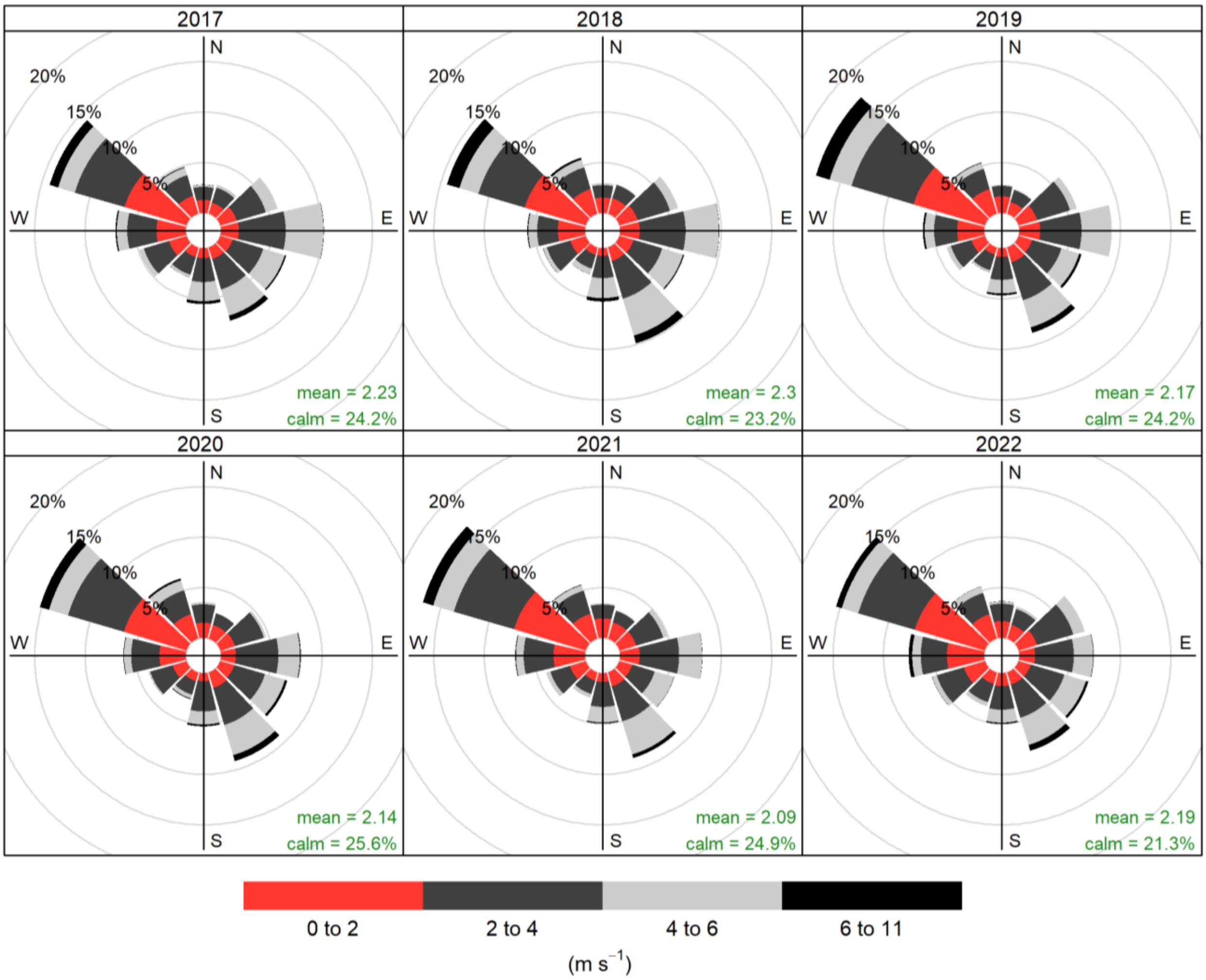


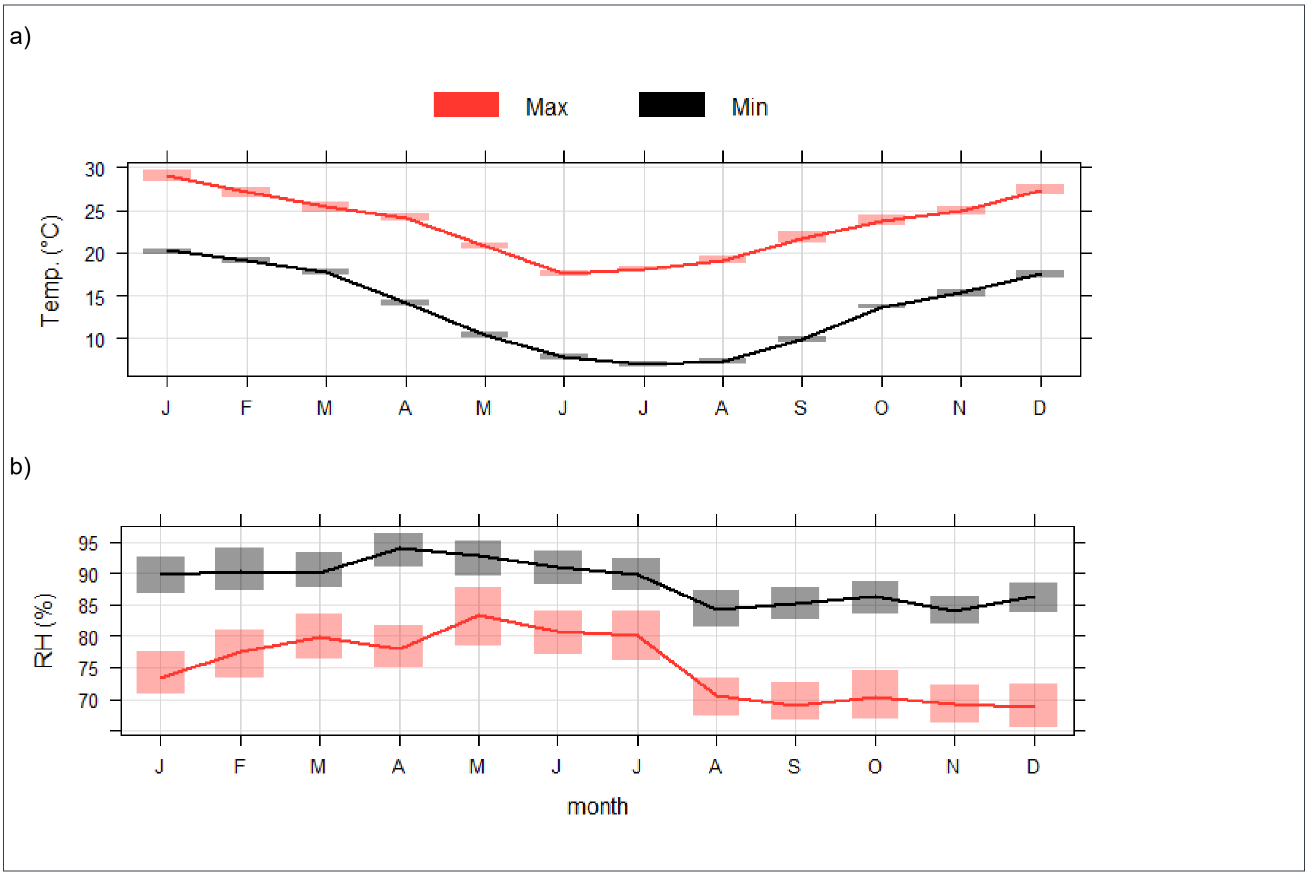
Figure 4.7 Annual wind roses from 2017 to 2022 at Sydney Olympic Park BOM AWS

Note: The shaded bars indicate 95% confidence intervals.

4.2.2 Temperature, relative humidity, and rainfall

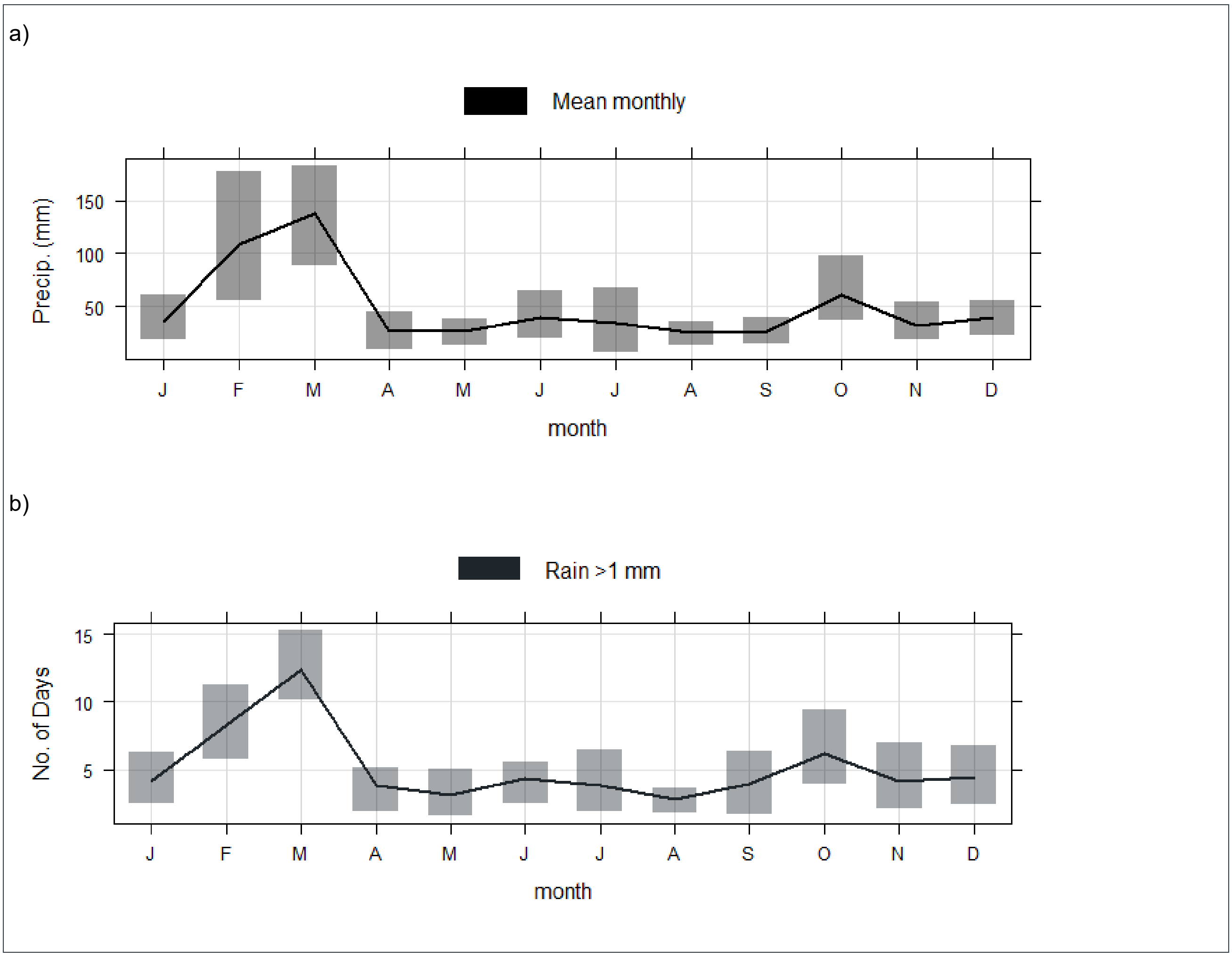
Figure 4.8 shows the maximum and minimum values for temperature and relative humidity at specific times of the day at the Sydney Olympic Park BOM AWS Station from January 2017 to December 2022, while Figure 4.10 shows the hourly time series for temperature, relative humidity, and rainfall. The time series show a consistent trend across the evaluated years. The area is characterised by cool winters and hot summers, typical for the region. The mean maximum temperature is around 28°C and 18°C for summer and winter, respectively. Figure 4.8b shows that the humidity peaks in the autumn and winter months, while being the lowest in the summer months.

The consistency in the wind patterns, temperature, and relative humidity that the measurements at the Sydney Olympic Park BOM AWS Station display, makes the data representative of the meteorological conditions of the site and its surrounding areas. Because of this, the meteorological data from the station was used to select a representative modelling year. From statistical analysis and availability of data, 2018 was selected as the representative modelling year for this assessment. More detail on the year selection can be found in Appendix A. Figure A.2 also shows the annual wind roses at the Parramatta North and Chullora stations managed by the DCCEEW for the selected modelling year. Details on the incorporation of the observed meteorological data into the air quality modelling are discussed in Section 3.3.2 (see Table 3.12).



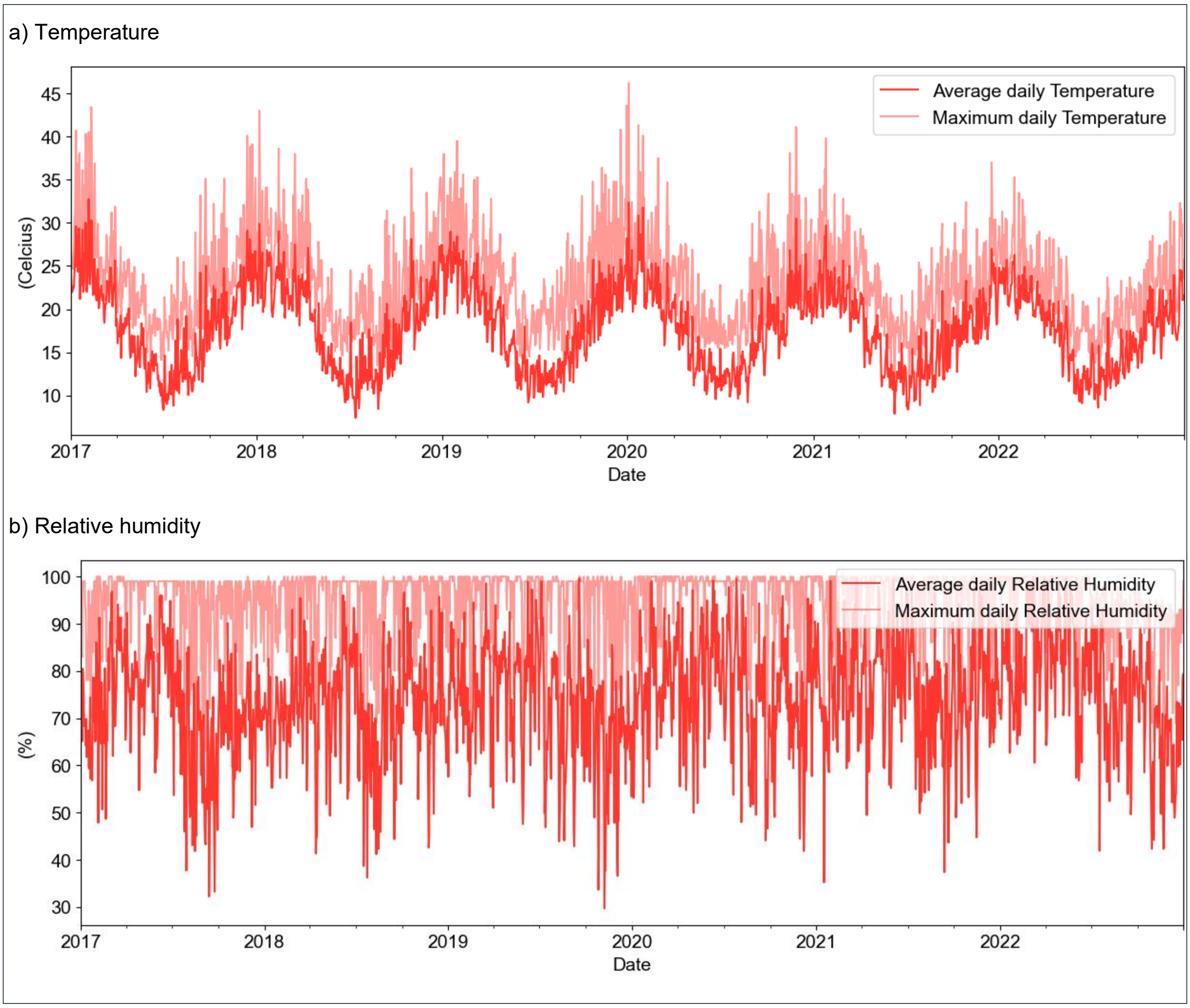
Note: The shaded bars indicate 95% confidence intervals.

Figure 4.8 Average monthly a) Temperature and b) Relative humidity (RH) at 9am and 3pm from 2017 to 2022 at Sydney Olympic Park BOM AWS



Note: The shaded bars indicate 95% confidence intervals.

Figure 4.9 a) Average monthly rainfall (mm), and b) Average number of days per month when rainfall was greater than 1 mm from 2017 to 2022 at Sydney Olympic Park BOM AWS



Notes: a) Average and maximum daily values of temperature, b) Average and maximum daily values of relative humidity

Figure 4.10 Time series at the Sydney Olympic Park BOM AWS from January 2017 to December 2022

4.3 Ambient air quality

4.3.1 Background air quality

The closest DCCEEW air quality monitoring station (AQMS) is Parramatta North. The station is located approximately 5.5 km northwest of the Camellia Rosehill WRRF site. The station was commissioned in December 2017 and is located at Cumberland Hospital, Fleet St at coordinates 313910.66 m E, 6259312.22 m S, and sits at an elevation of 16 m. Due to its proximity to the project site and the temporal availability of the data (more than five years of data on an hourly resolution), the station was selected as representative of the air quality conditions for this assessment.

Figure 4.11 and Figure 4.12 show the time series of hourly PM_{10} and $PM_{2.5}$ mass concentrations from January 2018 to December 2023 respectively, while Table 4.5 presents the statistics summary for the entire reviewed period.

Table 4.3 shows the average annual concentrations, while Table 4.4 shows the maximum annual concentrations, for the pollutants of interest for this assessment measured from 2018 to 2023. NO_2 and O_3 maximum annual concentrations presented in Table 4.4 were used as the background concentrations to consider in the Operational Impact Level 1 Assessment (see Section 6.2).

The years with the highest average and maximum values across all pollutants were measured were 2018 and 2019. Time series for the 24-hour average PM_{10} and $PM_{2.5}$ mass concentrations are shown in Figure 4.11 and Figure 4.12 respectively. In each case, a dashed line indicates the air quality criteria for each particulate matter size. As seen in both time series for PM_{10} and $PM_{2.5}$, during late 2019 and early 2020, the study area presented several exceedances of the PM_{10} and $PM_{2.5}$ 24-hour average criteria (50 µg/m^3 and 25 µg/m^3 respectively), particularly during December 2019 and January 2020 correlated with the period known as the "Black Summer". During that period, NSW was largely impacted by exceptional bush fire events. High concentrations of NO_2 and O_3 were also registered during those months and can be seen in Figure 4.13 and Figure 4.14 respectively.

Alongside the time series, Table 4.5 and Table 4.6 present summary statistics of the historical measurements at Parramatta North AQMS. Table 4.5 holds the statistics for PM_{10} and $PM_{2.5}$, while Table 4.6 contains the statistics for NO_2 and O_3. No exceedances of NO_2 were recorded since measurements began at the AQMS. O_3 criteria exceedances were recorded in several years, with the highest number occurring during the Black Summer period. On average, the Parramatta North station has a 'Good' air quality rating as per the NSW standards.

Table 4.3 Average annual concentrations for selected pollutants of interest measured at the Parramatta North Air Quality Station

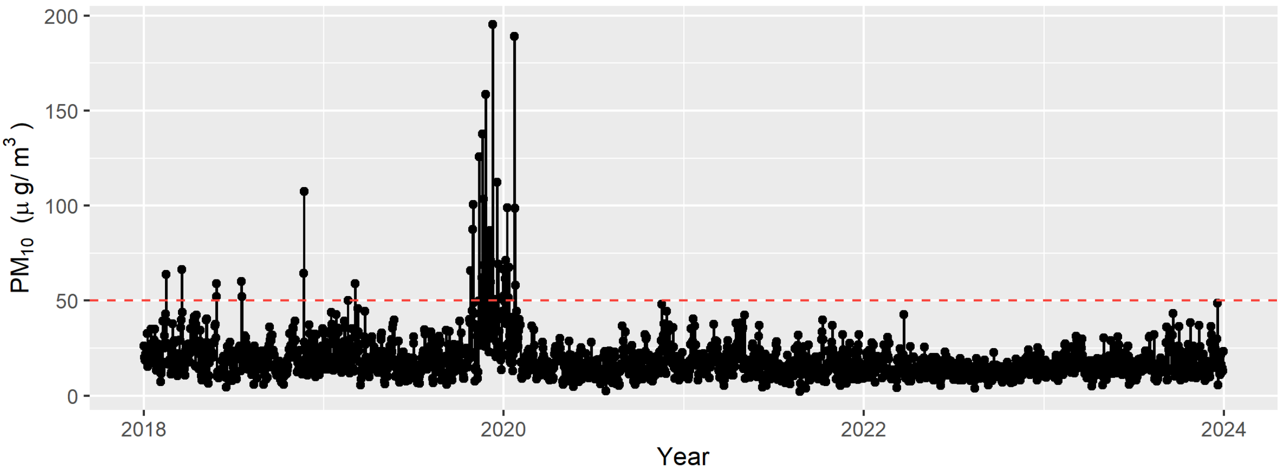
Year	PM_{10} [µg/m^3]	$PM_{2.5}$ [µg/m^3]	NO [µg/m^3]	NO_2 [µg/m^3]	O_3 [µg/m^3]
2018	21.6	9.2	15.9	22.0	36.2
2019	25.5	10.4	16.9	21.2	38.6
2020	19.3	8.2	12.7	15.4	38.2
2021	17.0	6.5	13.3	15.2	34.1
2022	14.1	5.2	12.3	13.4	31.3
2023	16.8	6.6	13.5	16.4	33.7
Criteria	25	8	-	31	-

Notes: Criteria from NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022)*

Table 4.4 Hourly maximum concentrations per year for selected pollutants of interest measured at the Parramatta North Air Quality Station

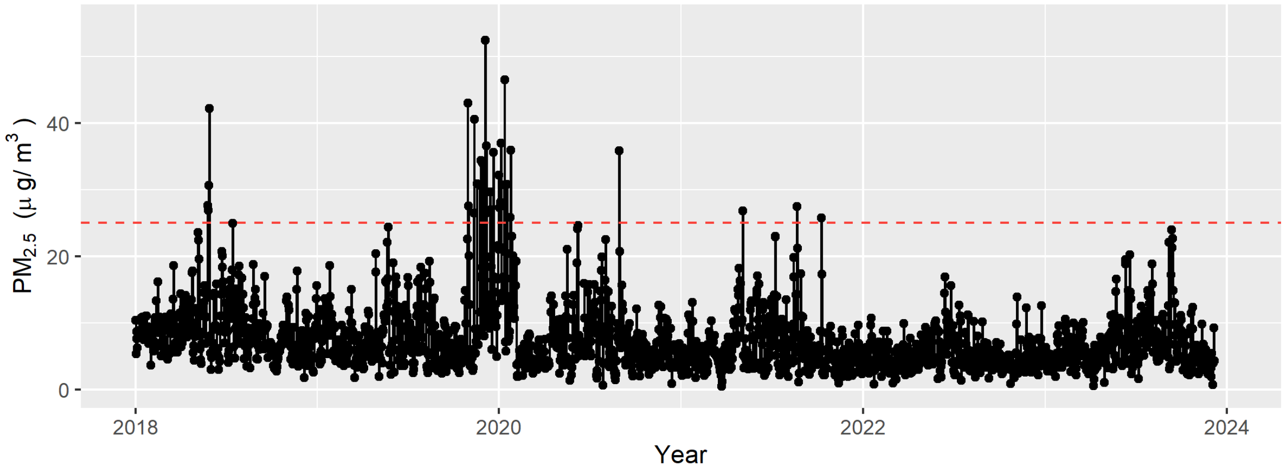
Year	PM_{10} [µg/m^3]	$PM_{2.5}$ [µg/m^3]	NO [µg/m^3]	NO_2 [µg/m^3]	O_3 [µg/m^3]
2018	400.7	114.6	548.1	131.5	218.6
2019	842.2	559.0	590.9	143.8	336.4
2020	803.7	107.9	364.5	76.0	199.3
2021	185.2	101.4	428.8	96.5	173.6
2022	161.6	67.5	392.6	69.8	150.0
2023	297.3	124.2	424.8	94.5	229.3
Criteria	50	25	-	164	-

Notes: Criteria from NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2022)*



Note: The dashed line indicates the 24-hr average criterion (50 µg/m³).

Figure 4.11 Time series of PM_{10} 24-hour average mass concentrations

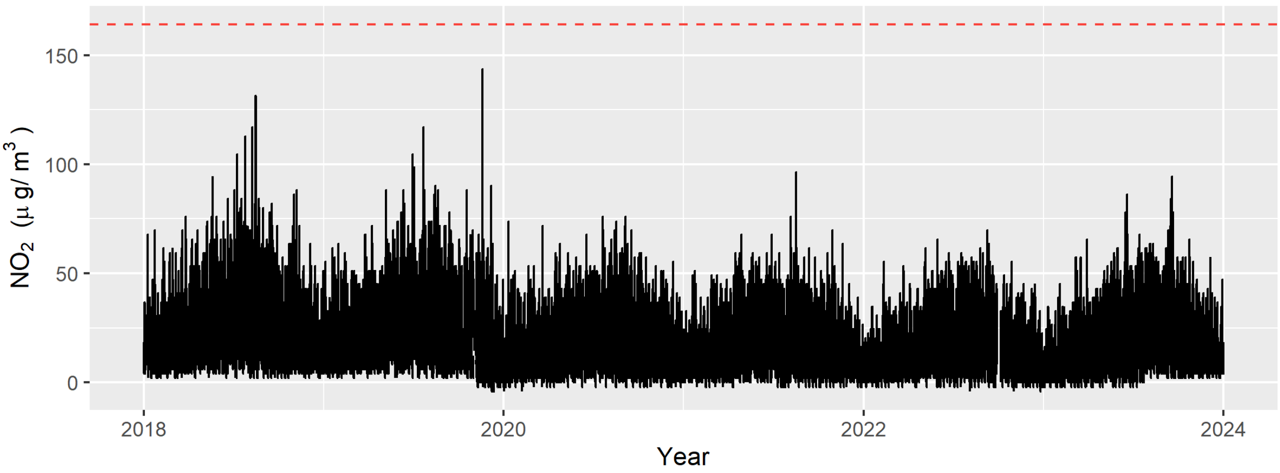


Note: The dashed line indicates the 24-hr average criterion (25 µg/m³).

Figure 4.12 Time series of $PM_{2.5}$ 24-hour average mass concentrations

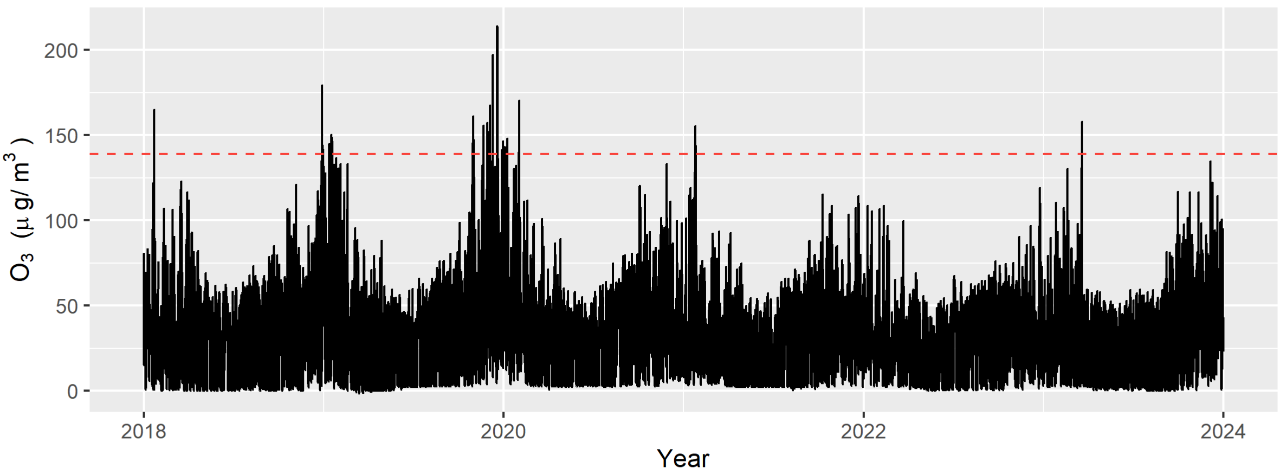
Table 4.5 Summary statistics of PM_{10} and $PM_{2.5}$ observations at Parramatta North between 2018 and 2023

Averaging period	Statistic	PM_{10}	$PM_{2.5}$
24-hr	Data Coverage (%)	99.7	98.4
	Max. Conc. (µg/m³)	195.3	130.1
	70th percentile (µg/m³)	20.7	8.4
	Criteria (µg/m³)	50	25
	No. exceedance days	39	38
Annual	Average concentration (µg/m³)	19.1	7.7
	Criteria (µg/m³)	25	8



Note: The dashed line indicates the 1-hr average criterion (164 µg/m³).

Figure 4.13 Time series of hourly NO_2 mixing ratios



Note: The dashed line indicated the 8-hr average criterion (139 µg/m³).

Figure 4.14 Time series of 8-hour rolling average O_3 mixing ratios

Table 4.6 Summary statistics of NO_2 observations at Parramatta North between 2018 and 2023

Averaging period	Statistic	NO_2	O_3
1-hr for NO_2 and 8-hr for O_3	Data Coverage (%)	92.8	98.6
	Max. Conc. (µg/m³)	143.8	214
	Criteria (µg/m³)	164	139
	No. exceedance days	None	101
	90th percentile (µg/m³)	39	63.2

4.3.2 Existing air emission sources

A review of the National Pollutant Inventory (NPI) Database was performed to establish the presence of other emission sources in the vicinity of the project site. Extractions of 2023/2024 NPI Database were done for a radius of 2.5 km from the centre of the site. Of special interest to this project, were those facilities that emit substances that can generate odour or emit criteria pollutants (NOx or SO_2). Facilities which Main Activity and Class (as designated in the NPI Database) relate with food production manufacturing, waste treatment and disposal, petroleum and coal product manufacturing.

Figure 4.15 shows the location of the identified existing industrial facilities reporting to the NPI, and Table 4.7 summarises the names, coordinates, reported pollutants, and distance to the Camellia Rosehill WRRF site in each case. There are three facilities within 0.2 km of the Camellia Rosehill WRRF project site. These are:

- Downer EDI Works Rosehill Sustainable Road Resource Centre *(I3)*
- IVE Group Bluestar Web Silverwater (*I5*)
- LGI Silverwater Flare (*I7*).

Facility *I3* produces hot-mix asphalt, and during the stages of production emits a mixture of hydrocarbons and volatile organic compounds that generate a distinctive odour.

The main activity for facility *I5* is listed as printing services and has emissions of NOx.

The *I7* facility has waste treatment and disposal services listed as the primary activity and emits a range of compounds that generate odour and other criteria pollutants.

The odour emission impacts from the Camellia Rosehill WRRF were assessed in isolation due to the differing characteristics of existing odours sources in the vicinity of the project site, and the uncertainty in cumulative impacts.

Figure 4.15 Locations of existing industrial facilities in the vicinity of the project site that reported their emissions to the NPI (2023/2024)

Table 4.7 List of the existing industrial facilities that reported to the NPI for the 2023/2024 period

ID	Facility name	Registered Name	Reported pollutants to the NPI	UTM X coordinate [m]	UTM Y coordinate [m]	Distance to the WRRF [km]
I1	Camellia Vinegar and MAURI ANZ Camellia	Goodman Fielder Consumer Foods Pty Limited & Mauri Yeast Australia Pty Limited	SO_2, TVOCs	318083	6255956	0.7
I2	Daniels Health	Daniels Health NSW Pty Ltd	SO_2	319234	6254237	1.2
I3	Downer EDI Works Rosehill Sustainable Road Resource Centre	Downer Edi Works Pty Ltd	SO_2	318231	6255222	0.04
I4	IVE Group Bluestar Web Silverwater	IVE Group Australia Pty Ltd	SO_2, TVOC, NOx	318850	6254441	0.8
I5	James Hardie Rosehill	James Hardie Australia Pty Ltd	SO_2	317691	6255391	0.1
I6	Knauf Camellia	USG Boral Building Products Pty Limited	SO_2	318692	6256198	1.1
I7	LGI Silverwater Flare	LGI Limited	SO_2, TVOC, NOx	318073	6254540	0.2
I8	Lubrizol International Inc.	Lubrizol International Inc.	TVOCs	319323	6255120	1.1
I9	Pacific National Clyde	Pacific National Pty Ltd	SO_2, TVOC	317201	6253799	1.1
I10	Rheem Rydalmere	Rheem Australia Pty Ltd	SO_2	317614	6256573	1.3
I11	Sami Bitumen Camellia	Sami Bitumen Technologies Pty Ltd	SO_2	318886	6255858	0.9
I12	Silverwater Terminal	Sydney Metropolitan Pipeline Pty Ltd	TVOCs	319887	6254918	1.7
I13	Viva Energy Clyde Terminal	Viva Energy Australia Pty Ltd	TVOCs	318375	6255654	0.4

5 Construction impact assessment

This section summarises the steps, assumptions and outcome of the construction impact assessment. A detailed description of the methodology described in Section 3.2.

5.1 Step 1 – Screen the need for a detailed assessment

For Step 1, a desktop investigation of the sensitive human and ecological receptors in proximity to the project footprint was undertaken. There are limited residential receptors close to the proposed construction areas for pipelines, pumping station upgrade and the WRRF. These receptors are within 250 m of the WRRF and pipeline construction footprint, and less than 50 m of the routes likely to be used by construction vehicles. This triggers the need for an assessment of the risk of dust impacts for demolition, earthworks, construction, and track-out. The following sections detail the outcome of each Step as outlined by the IAQM (2024).

The detailed assessment was performed by grouping components of the project construction (see Section 2.2 and in Figure 2.2). As the project involves the construction and repurposing of pipelines using a combination of trenching and horizontal directional drilling techniques, all the elements of the project that involve pipeline construction were assessed collectively. The features assessed here are:

- pipeline construction and repurposing/relining (includes brine, transfer main, and river release pipelines)
- pumping station upgrades
- WRRF construction.

5.2 Pipeline construction and repurposing/relining dust impact assessment

5.2.1 Step 2A – Determine the potential dust emission magnitude

Demolition

During the pipeline construction and repurposing works, the demolish a small toilet block within Memorial Park, Meadowbank, may be required. The toilet block is estimated to have volume of less than 50 m^3 (dimension of 3 x 5 x 3 m) and is a brick construction with a corrugated metal roof. The criteria for **small** magnitude dust emissions during demolition considers a total building volume of less than 12,000 and a structure below 6 m in height. The toilet block in Memorial Park is orders of magnitude below this volume and half the height. It is likely the demolition guidance was not designed to consider a structure this small, however, for completeness demolition works relating to the removal of the toilet block have been included as a **small** emission magnitude.

Earthworks

The pipelines (brine, transfer main, and river release pipelines), include earthworks activities that will be undertaken for construction of the trenches, and the launch, and receival pits for trenchless pipe sections. The area of the construction easement will vary along the alignment depending on the surrounding environment and the type of trenching/re-lining works taking place. The construction easement is expected to range from 10 – 30 m in width, and the excavated width of the trench itself approximately 2 m wide for the river release pipeline, and 3 m wide for the brine and transfer pipelines. The length of open trench construction in any section of the alignment is expected to range between 10 m and 20 m and will be backfilled before further excavation occurs.

As a result, the earthworks would occur in small segments across the alignment, with the disturbed area (up to 20 m in length and 30 m width) reinstated before progressing to the next. There will likely be earthworks occurring in more than one location concurrently, across the different pipelines, however these will be separated by considerable distance and therefore not generating a risk of dust emissions in the way a single, larger site would do.

It is expected that less than five heavy vehicles would be active in a pipeline work area at any one time. This is partly due to the limited area for operation, and because of the ordered progression required for the works. Each work area will progress through set phases including Site Establishment, Excavation, Pipe Installation and Reinstatement. These works need to be undertaken in a progressive order, with only the heavy vehicles required for each phase attending site at any one time.

A significant portion of the soil expected to be disturbed during earthworks is considered to be 'large grain' in size. This is due to trenching and pipeline works occurring in brownfield sites (under sealed roads and surfaces) and will result in the excavation of road subbase and other fill material. Management of the excavated material involves removing it directly from site to avoid stockpiling, there may be instances (planned reuse and backfilling) where stockpiles are required for short periods.

The earthwork dust emission magnitude has been set to **small**. This considers the method of pipeline construction and limited operational area (~ 600m^2) for a pipeline working area. The low number of heaving vehicles expected to active at any one time (<5) and the large grain size of the disturbed material along with management practices to predominately remove excavated material from site instead of stockpiling.

Construction

Construction of the pipelines is part of the same process described in the Earthworks Section above. It is also likely be undertaken concurrently in several locations, with each pipeline work area consisting of an open trench between 2 m - 3 m wide and up to 20 m in length. The construction and installation of the pipe includes installation of bedding material, the pipeline, and the backfilling of the trench. Civil works such as ancillary infrastructure will be installed. The construction requires the use of material considered to 'potentially dusty' in the IAQM guidance(e.g., concrete, sand, gravel), plus material used in back-filling activities. An estimation of the building volume for all pipeline construction, repurposing and relining works has been conservatively estimated to reach 50,000 m^3, therefore the construction dust emission magnitude has been set to **medium**.

Track-out

Track-out is dirt, mud or other material tracked onto a sealed public roadway by a vehicle leaving a construction site. Heavy vehicles (gross weight greater than 3.5 tonnes) involved in construction will include excavators, cranes, front-end loaders, dozers, graders, trucks, light vehicles and smaller construction equipment. It is expected that there will be less than 10 outward heavy vehicle movements from any pipeline work area in a day. All the roads where pipelines will be installed are paved roads, which are considered to be lower potential for dust release. Both the vehicle movements and surface material are categorised as small magnitude, therefore the dust emission magnitude for Track-out has been set to **small**.

Table 5.1 summarises the designated dust emission magnitudes for the pipeline construction and repurposing for Step 2A per activity.

Table 5.1 Dust emission magnitude for pipeline construction and repurposing

Activity	Demolition	Earthworks	Construction	Track-out
Dust emission magnitude	Small	Small	Medium	Small

5.2.2 Step 2B – Determine the sensitivity of the area

The level of sensitivity of the surrounding areas of the pipeline was based on the potential for impacts to dust soiling, human health, and ecological receptors. Near the WRRF site, and alongside the Parramatta River, there are several nature reserves that have the potential to be impacted by dust deposition. Due to their classification as nature reserves, they have been considered in this assessment, however, because of their distance from the pipeline alignments (more than 50 m), the ecological potential impact has been designated as **low** sensitivity for earthworks, construction and track-out activities.

Pipeline works are predicted to take place near to more than 100 residencies, some at distances less than 20 m, as well as various industrial sites where workers could also be impacted. The dust soiling impact on people and property have been designated as **high** for earthworks, construction, and track-out. This designation considers the close distance to the pipeline installation sites and the presence of a large number of receptors (mostly residential). The brine pipeline traverses through Rippon Avenue, a predominately residential area, and Railway Street in Parramatta within the Western Sydney University Rydalmere campus. Both residential properties and the university spaces are considered to be High Sensitivity receptors.

The 24-hour average historic PM_{10} concentrations measured at the Parramatta North Air Quality Station, is approximately 20 µg/m^3 (Section 4.3.1), and suggest that additional activities involving earthworks, constructions and track-out could increase the risk of exposure to higher levels of particulates for sensitive human receptors. The large number of nearby receivers considered to be high sensitivity, in conjunction with the annual mean PM_{10} concentration, results in the sensitivity of the area to human health impacts to be classified as **high** for earthworks, construction, while track track-out activities were considered **medium** sensitivity.

High sensitivity was conservatively selected for track-out and dust soiling due to the proximity of receptors to vehicle routes leaving site. It was considered to be medium and low for Human Health and Ecological impacts respectively.

Medium sensitivity was selected for dust soiling relating to demolition works, due to the close proximity of the toilet block to receptors. Human health and Ecological were given **low** sensitivities due to the density of residential receptors and duration of the impacts being expected to be very brief.

Table 5.2 presents the summary of the sensitivity of the area to the construction and repurposing of the brine pipeline.

Table 5.2 Sensitivity of the surrounding area to pipeline construction and repurposing per stage

Potential impact	Demolition	Earthworks	Construction	Track-out
Dust soiling	Medium	High	High	High
Human health	Low	High	High	Medium
Ecological	Low	Low	Low	Low

5.2.3 Step 2C – Define the risk of impacts

The dust emission magnitudes for earthworks, construction and track out assigned in the previous steps (Sections 5.2.1 and 5.2.2) were combined to determine the sensitivity of the area in a risk matrix. The result of the dust risks potential impacts is presented in Table 5.3.

Table 5.3 Risk matrix for potential dust impacts during pipeline construction and repurposing

Potential impact	Risk			
	Demolition	Earthworks	Construction	Track-out
Dust soiling	Low risk	Low risk	Medium risk	Low risk
Human health	Negligible risk	Low risk	Medium risk	Low risk
Ecological	Negligible risk	Negligible risk	Low risk	Negligible risk

5.2.4 Step 3 – Site-specific mitigation

The site-specific mitigation measures described in this section are those recommended in the IAQM guidance and could be applied to future mitigate the risk levels identified in Table 5.3.

These mitigation strategies can assist in reducing the risks of dust related to health impacts and soiling, particularly from construction activities, identified as a medium risk in Table 5.3.

Where construction or earthworks are considered to be in close proximity to sensitive receptors, the project team could choose to erect screens or barriers around the open trench works to act as a barrier to dust migration, particularly around the open trench sections. In the event these barriers are installed, they should be kept clean using wet methods.

The pipeline works plan to reuse spoil material where possible. Trench excavations are ideally to backfilled within the day, or as soon as practicable to minimise the construction area and limit potential impacts. In situations where material is be required to be stockpiled, for example, new bedding material or before the backfilling can occur, the stockpiled the material should be covered or treated to prevent dust generation.

Mobile plant or equipment used for cutting, grinding or excavating should be operated in conjunction with suitable dust suppression.

At locations where track-out is considered to be a risk, consider implementation of a wheel washing system and avoid dry sweeping of large areas. Load carrying vehicles leaving the site need to be covered to minimise the escape of dust and material. Ensure adequate water supply to facilitate suppression spraying, wash downs, and clean-up to for effective dust mitigation.

More general mitigation measures that can apply to the pipeline construction and upgrades are summarised in Section 7.1.

5.2.5 Step 4 – Determine significance of residual impacts

The risk assessment indicates that without mitigation, there is a medium risk of dust impacts to human health and soiling from construction activities. The risk is considered low or negligible risk of dust impacts relating to demolition, earthworks and track out for the pipeline works, when considering human health, dust soiling and ecological receptors. However, the risk assessment is conservative as the main source of dust would be temporary and relatively short-term at any one location.

The implementation of the mitigation measures in this section and in Section 7.1, will reduce risk when undertaking the pipeline construction and repurposing/relining works and assuming these are implemented, the predicted risk and associated potential impacts are considered to be low to negligible. These are presented in Table 5.4.

Table 5.4 Post mitigation and management risk matrix for potential dust impacts during pipeline construction and repurposing

Potential impact	Risk			
	Demolition	Earthworks	Construction	Track-out
Dust soiling	Low risk	Low risk	Low risk	Negligible risk
Human health	Negligible risk	Negligible risk	Low risk	Negligible risk
Ecological	Negligible risk	Negligible risk	Negligible risk	Negligible risk

5.3 Pumping station upgrades dust impact assessment

5.3.1 Step 2A – Determine the potential dust emission magnitude

Demolition

During pumping station upgrades works it is anticipated that two sheds at the rear (east) of the property will need to be removed. The sheds are largely constructed of corrugated metal, considered to be 'material with low potential for dust release' in the IAQM guidance. In addition to the material, the total building volume of the sheds is estimated to be approximately 2,500 m^3, well below the 12,000 m^3 value categorising a small emission magnitude. The demolition dust magnitude for the pumping station upgrades has been set to **small**.

Earthworks

No major earthworks are anticipated to occur during the pumping station upgrades. However, the surrounding area will see some earthworks corresponding to the excavation of trenches for some pipe sections that will serve the pumping station, such as trenching for the brine and transfer pipelines to the existing infrastructure. The dust impacts from pipeline construction have been assessed in the previous section (see Section 5.2). As the trenches for the required pipeline for the pumping station upgrades constitutes just a portion of the whole pipeline construction, the earthworks dust magnitude for the pumping station upgrades has been set to **small**.

Construction

The upgrade of the pumping station is expected to not exceed a building volume of 12,000 m^3. The upgrade consist of minor works including:

- Removal of existing pumps and redundant pipework
- Breakout of part of the concrete flooring and install new pumps and supporting pipework
- Construction of a new electrical switch room
- Installation of HV transformers in a yard to be located next to the proposed switch room
- Installation of new HV and LV connections
- Replacement of the seal on the front flood gate

All activities are small in scope and some are undertaken indoors, as such the potential of dust release is low and construction activities related to the pump station upgrade has been set as **small** dust emission magnitude.

Track-out

Because of the nature of the upgrades to the pumping station, it is anticipated that any track-out dirt, mud or other material tracked onto a sealed public roadway by a vehicle leaving a construction site, to be minimal. Thus, the dust magnitude for track-out was classified as **small**.

A summary of the dust magnitudes for the pumping station upgrades is presented in Table 5.5.

Table 5.5 Dust emission magnitude for the Pumping Station upgrade

Activity	Demolition	Earthworks	Construction	Track-out
Dust emission magnitude	Small	Small	Small	Small

5.3.2 Step 2B – Determine the sensitivity of the area

The sensitivity of the areas surrounding the pumping station upgrade works was evaluated for potential impacts of dust soiling, human health, and ecological receptors. To determine the human health potential impacts, a review of the surrounding areas to the pumping station was conducted. This review indicated that the pumping station is not in close proximity to residential areas, is mostly surrounded by industry and commercial sites.

Receptors identified during the review included:

- Various offices to the north (<20 m)
- Rosehill Gardens light rail station (~25 m)
- Explore & Develop Childcare Centre (~150 m)

The pumping station is approximately 250 m away from the closest boundary of the Rosehill Gardens Racecourse, an entertainment site with the potential to experience impacts during the pumping station upgrades. Any areas frequented by guests (pavilions, bars, ground-level viewing areas) are all well outside the 250 m assessment distance of the IAQM guidance, and as such, the racecourse has not been included in the assessment.

The close proximity of pumping station to the offices, and number of staff in these buildings, correspond to a medium sensitivity of dust soiling and human health for demolition, earthworks and construction. The low sensitivity of the light rail receptors (transient and short periods) and the separation distance to the childcare centre, results in lower sensitivity scores than the offices to the north of the pumping station. The background concentration of PM_{10} (20 µg/m^3), was considered in this assessment.

The resulting sensitivities are summarised in Table 5.6.

Table 5.6 Sensitivity of the surrounding area to pipeline construction and repurposing per stage

Potential impact	Demolition	Earthworks	Construction	Track-out
Dust soiling	Medium	Medium	Medium	Low
Human health	Medium	Medium	Medium	Low
Ecological	Low	Low	Low	Low

5.3.3 Step 2C – Define the risk of impacts

The resulting risk matrix for the potential dust impact during the pump station upgrades is presented in Table 5.7. The dust magnitudes and area sensitivities were combined to create the risk matrix.

Table 5.7 Risk matrix for potential dust impacts during Pump station upgrades

Potential impact	Risk			
	Demolition	Earthworks	Construction	Track-out
Dust soiling	Low risk	Low risk	Low risk	Negligible risk
Human health	Low risk	Low risk	Low risk	Negligible risk
Ecological	Negligible risk	Negligible risk	Negligible risk	Negligible risk

5.3.4 Step 3 – Site-specific mitigation

The identified risks for this part of the project were found to be negligible or low risks for all three potential impacts. For cases where the risk category is negligible, no mitigation measures beyond those required by legislation are required. For low risks, the site-specific mitigation for the pumping station upgrade should nonetheless include standard mitigation measures. These include the screening of sections of work to limit dust migration to receptors. As much of the construction is taking place inside the pumping stations, it is acting as an enclosure of sorts, and will naturally mitigate some of the potential of dust production during the upgrade works

5.3.5 Step 4 – Determine significance of residual impacts

Dust impacts relating to the pumping station were identified to be either low or negligible risk. No significant residual impacts are expected from this part of the project, routine management and mitigation measures during the works are assumed.

5.4 WRRF construction dust impact assessment

5.4.1 Step 2A – Determine the potential dust emission magnitude

Demolition

There is no demolition work expected to occur during the construction of the Camellia Rosehill WRRF.

Earthworks

Earthworks activities for the WRRF construction include the excavation of capped material for the installation of the pipe network as well as tank installation and structural foundations for the required buildings and other ancillary structures. The total area of the WRRF site is 214,000 m^2; however, the area designated for buildings and operational processes is estimated to be 146,000 m^2. The site has been capped; therefore earthworks are only expected to facilitate the development of structures and trenching to connect services and is estimated to reduce the total earthworks disturbance area to below 110,000 m^2. It is expected that less than 10 heavy vehicles will be operating simultaneously to undertake the earthworks.

The closest ecological receptor to the Camellia Rosehill WRRF site is Duck River, located less than 100 m to the south of the site.

The earthwork dust emission magnitude has been set as **medium**.

Construction

The construction of the Camellia Rosehill WRRF will require civil works to build administration buildings, chemical storage, switch rooms, workshops and other infrastructure such as internal roads. The total construction volume is estimated to be above 75,000 m^3 and large volume constructions includes:

- Inlets works
- Primary sedimentation tanks
- Bioreactors tanks
- Advanced treatment plant
- Transfer pumping station
- Solids handling facility
- Odour control units.

The construction dust emission magnitude has been set to **large** and is dictated primarily by the total building volume required for the WRRF.

Track-out

Heavy vehicles (gross weight greater than 3.5 tonnes) that will be involved in the construction include excavators, loaders, graders, articulated dump trucks and dozers. There is a high chance that material will track onto the sealed public roads that are the access route to and from site (Unwin Street and Colquhoun Street). Most of the heavy vehicles described above are expected to remain onsite when not in use (over-night) and therefore will not be routinely coming and going from the site. Heavy vehicles that will be coming and going routinely are those involved in deliveries and waste stream removal, largely during earthwork and construction periods. These are expected to remain below 10 heavy vehicles movements per day, and this will account for most of the vehicles entering and exiting the site.

Considering the site is capped and the surrounding roads are paved, the magnitude for dust emission associated with track out are set at **small**.

A summary of the dust emission magnitudes per activity is presented in Table 5.8.

Table 5.8 Dust emission magnitude for the WRRF construction

Activity	Demolition	Earthworks	Construction	Track-out
Dust emission magnitude	None	Medium	Large	Small

5.4.2 Step 2B – Determine the sensitivity of the area

The area surrounding the WRRF site is predominantly industrial. The Rosehill Gardens Racecourse south-east limit is less than 50 m from the WRRF limit. The south-east corner of the racecourse does not have any facilities and currently corresponds to the outer track of the racecourse, not a location patrons would gather. The closest grandstands of the racecourse are approximately 700 m from the WRRF. The racecourse horse agistment is approximately 600 m from the WRRF. The IAQM guidance doesn't provide a matrix to assess dust impacts to animals, however if the agistment were to be considered as a highly sensitive receptor (a human residence), it still falls beyond the assessment distance required by the guidance.

The residential areas in the Camellia - Rosehill area are more than 800 m away from the WRRF. Nearby receivers (industries, offices and workers) are classified as high sensitivity after considering the annual background PM_{10} concentration, (on average 20 µg/m^3 and is higher than many parts of the city), and the distance to the receivers (100 m to upwards of 250 m). These factors allow for the setting of the sensitivity of the area to potential human impact from all activities (earthworks, construction and track-out) as **medium**.

The sensitivity of the area relating to the potential impact of dust soiling has been conservatively set as **medium** for earthworks and construction, as the surrounding area is largely industrial with less than 100 receptors. For track-out, the sensitivity was also conservatively classified as **medium** due to the increased potential for dust soiling along the vehicle routes to major roads.

Potential ecological impacts could be experienced on the Duck River, which is the closest ecological receptor to the Camellia Rosehill WRRF site; however, the distance (~100 m to the south-east (closest area) of the site) reduces the sensitivity of the area. Consideration of the likely dust emission magnitudes during earthworks and construction activities, and the importance of the water body, resulted in a **medium** sensitivity classification. The sensitivity of the Camellia Rosehill WRRF surrounding area is summarised in Table 5.9.

Table 5.9 Sensitivity of the surrounding area to WRRF construction per stage

Potential impact	Demolition	Earthworks	Construction	Track-out
Dust soiling	None	Medium	Medium	Medium
Human health	None	Medium	Medium	Medium
Ecological	None	Medium	Medium	Medium

5.4.3 Step 2C – Define the risk of impacts

The risk of impacts for the Camellia Rosehill WRRF construction is presented in Table 5.10. The risks were identified by combining the dust emission magnitudes with the sensitivity of the area, yielding the resulting risk matrix.

Table 5.10 Risk matrix for potential dust impacts during the Camellia Rosehill WRRF construction

Potential impact	Risk			
	Demolition	Earthworks	Construction	Track-out
Dust soiling	None	Medium risk	Medium risk	Low risk
Human health	None	Medium risk	Medium risk	Low risk
Ecological	None	Medium risk	Medium risk	Low risk

5.4.4 Step 3 – Site-specific mitigation

The risk matrix presented in the previous section indicated that the construction of the Camellia Rosehill WRRF presents a medium risk during all construction activities. Mitigation activities to be implemented during earthworks include the staging of the earthwork and prompt removal of material. Where stockpiling is necessary, coverage or treatment of the material to supress dust should be undertaken until the removal from site. It is also highly recommended that aggregates, sand, and other building materials are stored in places that do not promote dry out, and enable control measures (e.g., watering) to take place. For medium risks activities, the IAQM suggests that bulk material, such as cement or other fines, should be delivered in enclosed tanks and stored properly ensuring emission control systems. Water-assisted sweepers are highly advisable as well to decrease the impact of track-out, especially since the connecting roads to the site led to major roads in the area. Further and general mitigation measures presented in Section 7.1 are also applicable to the WRRF construction.

5.4.5 Step 4 – Determine significance of residual impacts

The residual impacts are considered to be of low to negligible risk assuming implementation of appropriate mitigation strategies during the earthworks and construction stages of the project. The medium risk assigned to the WRRF earthwork and construction in Table 5.10, are considered to be largely manageable with the management and mitigation practices in place (as presented in Step 3). Assuming these measures are implemented, the predicted risk and associated potential impacts are presented in Table 5.11.

Table 5.11 Post mitigation and management risk matrix for potential dust impacts during WRRF construction

Potential impact	Risk			
	Demolition	Earthworks	Construction	Track-out
Dust soiling	None	Low risk	Low risk	Negligible risk
Human health	None	Low risk	Low risk	Negligible risk
Ecological	None	Low risk	Low risk	Negligible risk

5.5 Potential impacts from contaminated soils

5.5.1 Acid sulfate soils

In addition to the construction dust impact assessment, the potential impacts from Acid Sulfate Soils (ASS) were considered. ASS are naturally occurring soils and sediments containing iron sulphides and are typically found in coastal environments. When left undisturbed the soil have limited impact on air quality; however, if exposed to air (e.g., through excavation), oxidisation occurs and produces sulfuric acid which has distinctive rotten egg odour.

This assessment considered the NSW Acid Sulfate Soils Risk Dataset to assess the probability of encountering and disturbing ASS during construction works. To assess if the occurrence of ASS is likely around the areas where the construction of the project will take place, an overlapping of the ASS Risk Dataset with the project overview was conducted and is shown in Figure 5.1. Table 5.1 contains the description of each risk with the respective ID matching the areas shown in Figure 5.1.

As shown in Figure 5.1, the WRRF is located on an area with the designated occurrence risk of ASS of X4 (Disturbed terrain > 4 m below surface), corresponding to a Disturbed soil. Large sections of the pipeline would also be constructed in areas with an occurrence risk of ASS of X4 (Disturbed terrain > 4 m below surface) and X1 (Disturbed terrain and 1–2 m below surface). These include the ‘Transfer and brine pipelines’, and a large section of the river release pipeline as well. The Brine pipeline section (north to the pumping station) would be installed in an area that does not have any probability of occurrence of ASS assigned.

It is noted that the Parramatta River risk of ASS is considered a high probability in bottom sediments, and two small sections of both the brine pipeline and the river release pipeline are projected to cross the Parramatta River and Duck River. It is understood that the risk of disturbance of bottom sediments in the river would be managed through Horizontal Directional Drilling (HDD). It is noted that if the methodology were to be changed, care should be taken to avoid a disturbance of bottom sediment that could lead to a temporal acidification of the water body.

The soil that will be disturbed in the area during the construction of the pipelines and WRRF ‘corresponds to areas with previously disturbed soils. Previously disturbed and built-upon ASS are generally less likely to generate strong odours if they have been properly managed and sealed. However, it is noted that if these soils are uncovered or re-exposed, they can still produce odours depending on several factors including the extent of previous oxidation, moisture and oxygen levels, organic matter, soil sealing or capping. Based on the available information from the NSW Acid Sulfate Soils Risk Dataset, the construction of the project is expected to have negligible air quality impacts due to encountering and disturbance of ASS, and the potential for odour generation in these previously disturbed areas is considered to be lower risk.

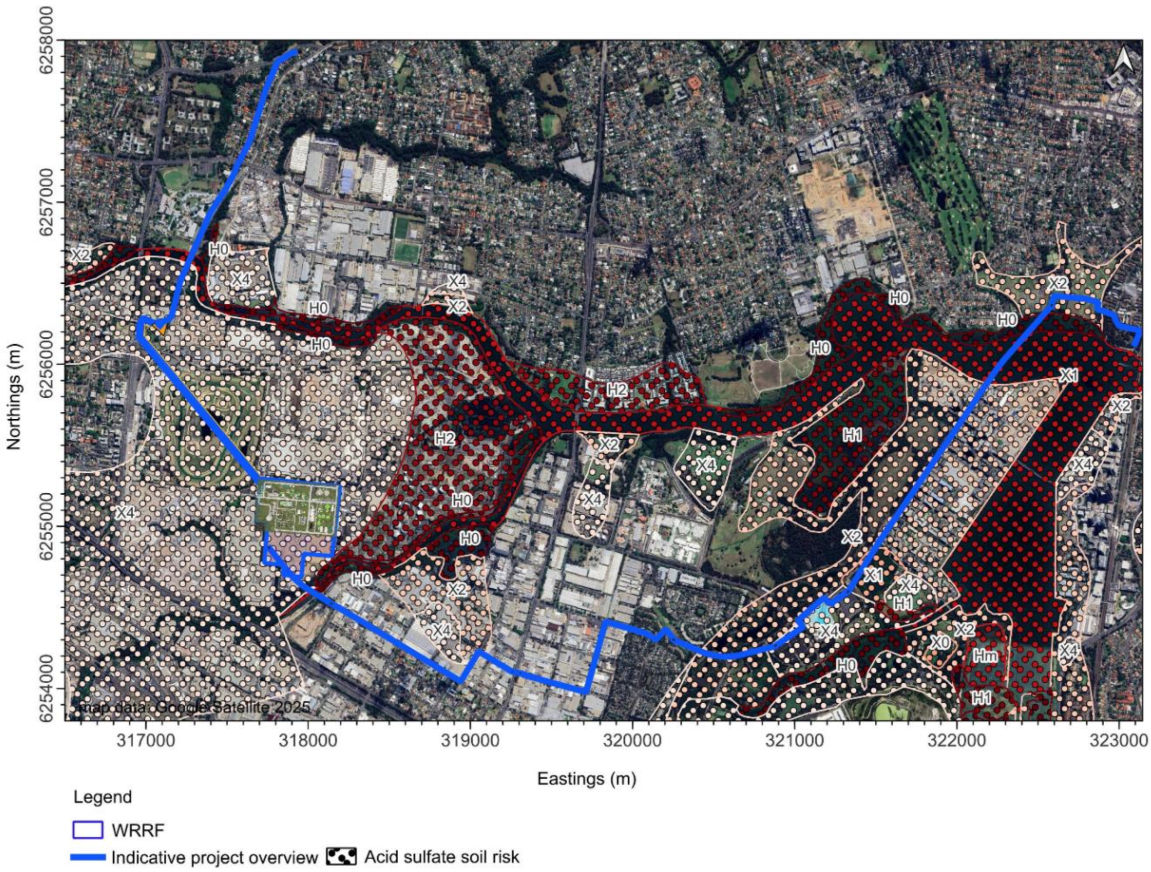


Figure 5.1 Acid sulfate soil risk mapping and project impacts

Table 5.12 Risk ID, description, probability of occurrence, and elevation

Risk ID	Description/Probability of occurrence	Probability elevation
H0	High probability of occurrence	High probability 0–1 m below surface
H1	High probability of occurrence	High probability 1–2 m below surface
H2	High probability of occurrence	High probability 2–4 m below surface
H4	High probability of occurrence	High probability >4 m below surface
Hm	High probability of occurrence	High probability in bottom sediments
L0	Low probability of occurrence	Low probability 0–1 m below surface
L1	Low probability of occurrence	Low probability 1–2 m below surface
L2	Low probability of occurrence	Low probability 2–4 m below surface
L2	Low probability of occurrence	Low probability >4 m below surface
L4	Low probability of occurrence	Low probability >4 m below surface
Lm	Low probability of occurrence	Low probability in bottom sediments
N	No known occurrence	No known occurrence
N4	No known occurrence	No known occurrence
NB	Beach	No known occurrence, Beach
X0	Disturbed Terrain	Disturbed terrain 0–1 m below surface
X1	Disturbed Terrain	Disturbed terrain 1–2 m below surface
X2	Disturbed Terrain	Disturbed terrain 2–4 m below surface
X4	Disturbed Terrain	Disturbed terrain >4 m below surface

5.5.2 Contaminated soils

Earthmoving and construction operations, especially those involving excavation activities at locations with a history of industrial use, can pose air quality risks beyond dust and fine particulate matter.

The general precinct area, including Camellia and the surrounding area, has a history of industrial use dating back over one hundred years. This has included oil refining, a tanneries and meatworks, facilities manufacturing asbestos products, plastic manufacturing, chemical manufacturing as well as bitumen, tyres, and paints.

Soil contamination testing from the area, and within the pipe work alignment includes polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), asbestos, heavy metals, per- and poly-fluoroalkyl substances (PFAS), dioxins and pesticides.

The mechanical disturbance of these contaminated soils through excavation, drilling, and stockpiling, can release these pollutants into the atmosphere via several pathways including:

- Volatilisation, typically associated with VOCs and lighter PAHs. When contaminated soil is exposed to atmosphere, these compounds can transition from the solid or liquid phase into the gas phase, especially under elevated temperatures or low humidity. This process is accelerated by mechanical agitation and increased surface area during excavation. Odour can be a side effect (and pollutant) as a result of these compound volatilising.

- Particulate entrainment is the process by which solid particles (fine dust or soil) are lifted and suspended into the air due to mechanical disturbance or environmental forces. This is a key pathway for dioxins, furans, and heavier PAHs. These compounds tend to adsorb onto fine soil particles. When soil is disturbed, these particles can become airborne as dust. Wind, vehicle movement, and equipment operation can further disperse contaminated particulates.
- Off-gassing from stockpiles also contributes to airborne contamination. Excavated soil, especially if loosely stored or uncovered, can continue to emit VOCs and other volatile compounds over time.
- Fugitive emissions from poorly cleaned plant and vehicles can occur when contaminated soil has adhered to machinery, is transported off site.

Measures to management or mitigate these pollutants will vary by site and activity, several management options that can be used concurrently are provided below:

1. Dust and Particulate Control – through water sprays or stabilisers, covering stockpiles and wheel washers.
2. Vapor Emission Control - minimize soil disturbance beyond what is required, use low-impact excavation techniques where feasible, schedule work in highly contaminated areas for cooler parts of the day (or year) if possible.
3. Air Monitoring - real-time air quality boundary monitoring for appropriate compounds and establish trigger levels for that prompt mitigation actions.
4. Administrative Controls - limit personnel in high-risk areas. Ensure adequate training so workers are competent in handling contaminated materials.

6 Operational impact assessment

The operational impact assessment presented in this report is divided into two sections. First, a consideration of potential odour impacts, the second a consideration of potential nitrogen dioxide impacts. The general aspects of model configuration (model domain, receptors, and meteorology) are the same for both impact assessments. Details on the model configuration for each case were described in Section 3.3.3.

6.1 Odour impacts

This section presents the modelling results of potential odour impacts during the normal operation of the Camellia Rosehill WRRF. In accordance with the Approved Methods, the results presented correspond to the 99th Percentile of dispersion model odour concentration (OU) predictions. These values were compared against the relevant odour criterium for the WRRF surroundings. The applicable criterion value of 2 OU (see Table 3.3) was used for this assessment as the forecasted population of the Camellia-Rosehill Precinct classified the area as Urban (≥2000 people). Figure 6.1 shows the ground level predicted OU isopleths at the gridded receptors.

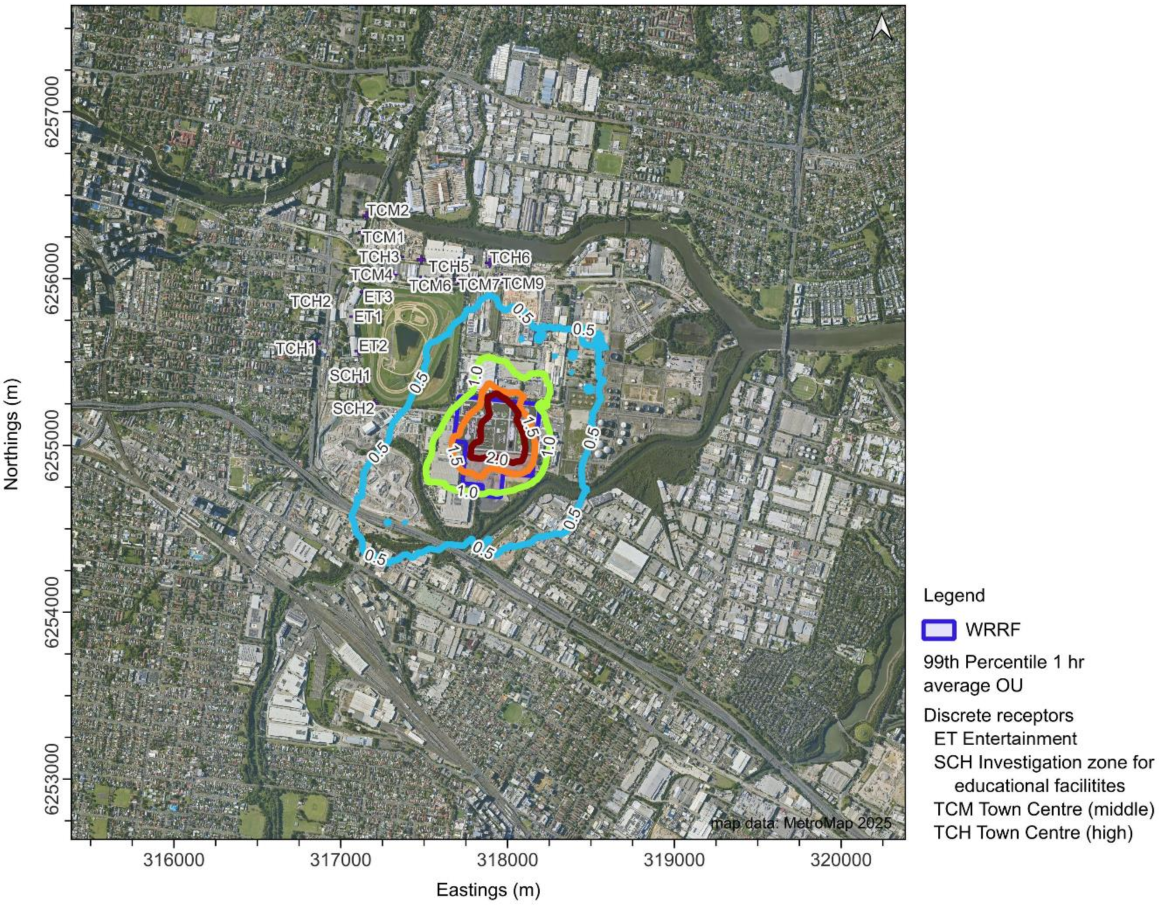


Figure 6.1 99th Percentile modelled odour concentration units (OU) at ground level estimated from the normal operation conditions of the Camellia Rosehill WRRF

As seen in Figure 6.1, odour concentrations > 2.0 OU are mostly contained within the WRRF boundaries, with some isopleths showing concentrations of 2.0 OU leaving the boundaries to the north of the WRRF by approximately 35 m. This can be observed in Figure 6.2 which shows a close-up of the isopleths over the WRRF. The small area beyond the north boundary, where the 2 OU isopleth can be seen, is largely contained to Devon Street and unlikely to impact sensitive receivers. At ground level, the odour concentrations decrease rapidly, and as shown in both Figure 6.1 and Figure 6.2, the odour concentrations were predicted to be a quarter of the odour criteria value at between 200m to 500m from the WRRF boundaries in all directions.

The results demonstrate the odour criteria (< 2 OU) is considered to be met at all locations outside project boundary during typical operations, and the current design, of the modelled sources at the Camellia Rosehill WRRF. No negative impact ground level odour impacts are expected.

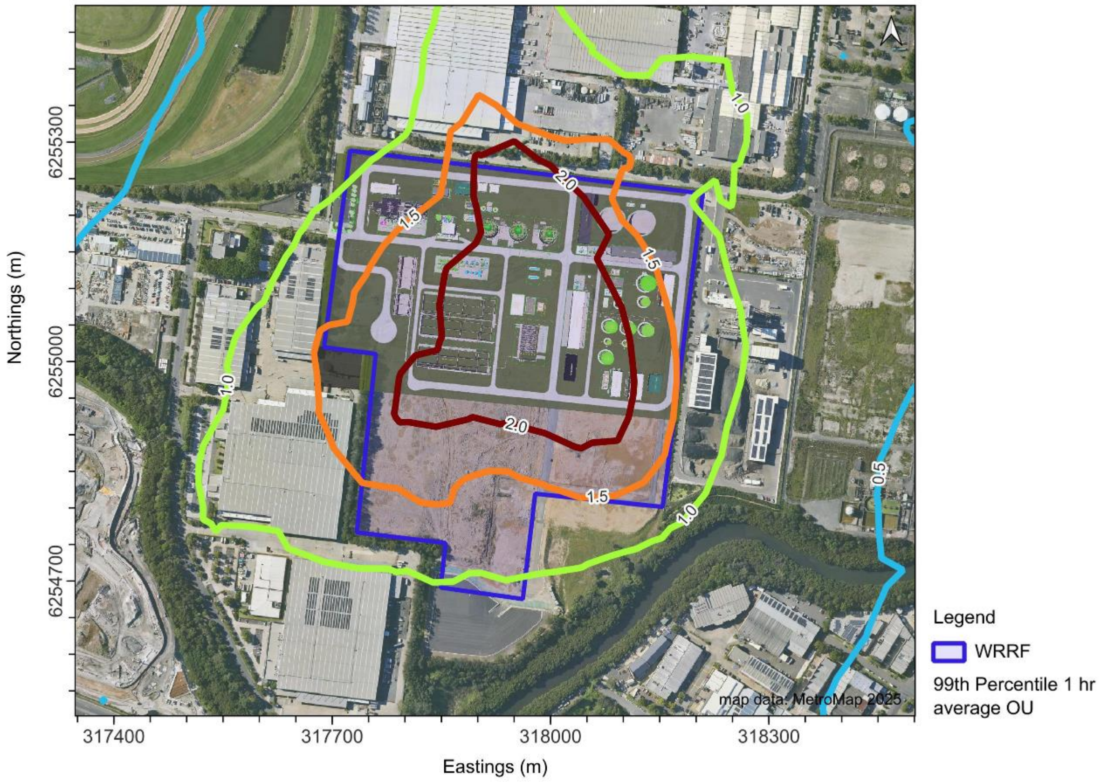


Figure 6.2 99th Percentile modelled odour concentration units (OU) at ground level estimated from the normal operation conditions of the CAMELLIA ROSEHILL WRRF (zoomed in area)

The isopleths show that the odour is predicted to disperse slightly towards the south-west direction of the Camellia Rosehill WRRF. This is consistent with the second most predominant wind direction observed at Sydney Olympic Park AWS BOM Station (see Figure 4.5) which was used to generate the meteorological fields for the simulation.

For the discrete receptors (locations selected based on the Camellia Rosehill Master Plan (DPE, 2022), see Figure 4.3), the maximum predicted concentrations are presented in Table 6.1. This shows the maximum concentrations that take place at different heights for each discrete receptor. Ground level estimated tabulated values for the discrete receptors are presented in Appendix B Table B.1.

All ground level predicted odour concentrations for the discrete receptors were well below the criteria with values ranging between 0.2 OU and 0.4 OU.

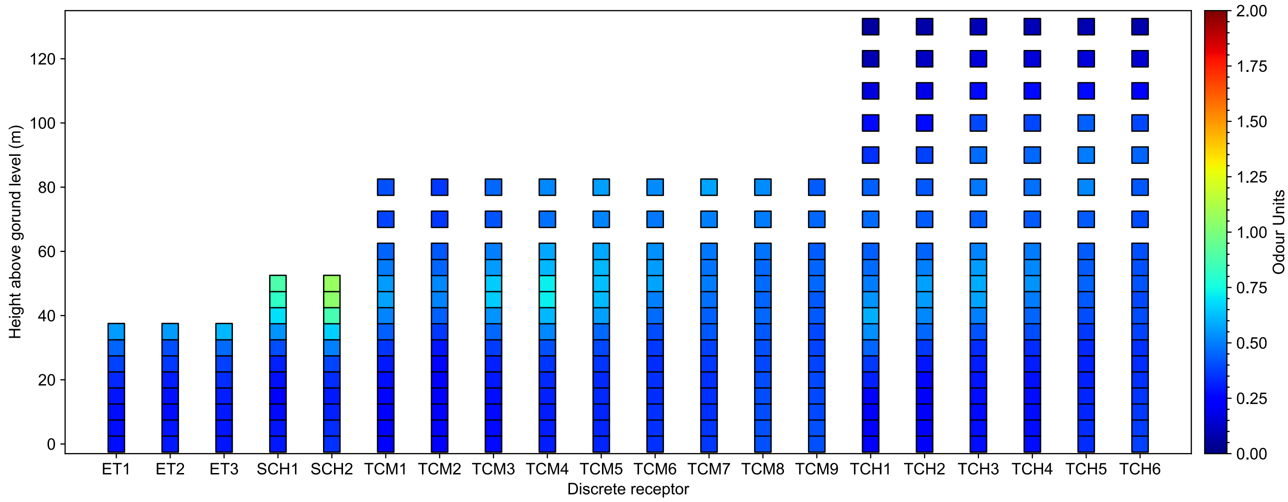
Table 6.1 Maximum 99th Percentile modelled odour concentration units (OU) estimated from the normal operation conditions of the Camellia Rosehill WRRF at the discrete receptors

Receptor ID	Receptor Type	Assessment criteria [OU]	Type of population	Height above ground level [a] [m]	Predicted odour [OU]	Percentage of criteria [%]
ET1	Entertainment	2	Urban	35	0.6	28%
ET2		2	Urban	35	0.6	28%
ET3		2	Urban	35	0.6	31%
SCH1	Investigation zone for education facilities	2	Urban	50	0.9	44%
SCH2		2	Urban	50	1.1	54%
TCM1	Town Centre (middle)	2	Urban	45	0.6	29%
TCM2		2	Urban	50	0.5	26%
TCM3		2	Urban	45	0.7	33%
TCM4		2	Urban	45	0.7	36%
TCM5		2	Urban	50	0.6	32%
TCM6		2	Urban	50	0.6	29%
TCM7		2	Urban	80	0.6	29%
TCM8		2	Urban	80	0.5	26%
TCM9		2	Urban	70	0.5	23%
TCH1	Town Centre (high)	2	Urban	40	0.6	30%
TCH2		2	Urban	50	0.6	28%
TCH3		2	Urban	50	0.6	30%
TCH4		2	Urban	50	0.5	27%
TCH5		2	Urban	80	0.5	26%
TCH6		2	Urban	90	0.4	22%

a The height above ground level (in m) corresponds to that where the maximum concentration was estimated by the model for each discrete receptor.

Note: The colour scale in the Percentage column has been set from green (lower values) to red (higher values).

Figure 6.3 displays the results for the discrete receptors at all the modelled heights (configured at 5 m increments from 0 m to 50 m elevation, followed by 10 m increments from 50 m and up above ground – flagpole receptors). Figure 6.3 shows that higher odour concentrations (compared against ground level estimates) tend to occur between 30 m and 80 m above ground level. Receptors that would experience the highest odour levels as a result of WRRF operation would be those at the proposed education facilities (SCH1 and SCH2) between 45 m and 50 m above ground level.



Notes: ET: Entertainment, SC: School, TCM: Town Centre (middle), TCH: Town Centre(high).

Figure 6.3 99th Percentile modelled odour concentration units (OU) at each discrete receptor located at proposed land uses at varying heights above ground level

The maximum odour concentration unit predicted value was 1.1 OU (at 50 m), followed by 1.0 OU (at 45 m), both concentrations were estimated at the SCH2 receptor. This is congruent with the location of the discrete receptors. The closest configured discrete receptors to the WRRF are SCH2 and SCH1 which are located 500 m and 600 m west to the boundary of facility respectively. It is assumed the education facilities buildings will not exceed 30 m above ground level, in which case, the perceived odour concentrations at 30 m would be 0.5 OU, 25% of the odour criteria. A height increase to 50 m – 60 m for the schools would still result in a predicted odour concentration before the 2 OU criteria, assuming the locations were not subject to change.

Other flagpole receptors that experience higher odour concentrations at similar elevations are the ones located in the Town Centre (middle) (TCM) prospect areas in the Master Plan (DPE, 2022). The peak concentrations modelled at these discrete flagpole receptors occur between 45 m and 80 m height with values ranging between 0.56 OU and 0.75 OU. Although modelled concentrations at elevation can be approximately 500% of ground level values, all are well below odour criteria. Operations at the WRRF under normal conditions are not predicted to have negative odour impact on elevated or ground-level receptors including those described in the Camellia-Rosehill Master Plan.

Sydney Water understands that additional precinct planning may be undertaken by DPHI in the future. Sydney Water anticipates that the land use surrounding the WRRF site would continue to be for the purposes of commercial/industrial/ urban services. Assuming these land uses remain, the odour modelling results in this air quality assessment would not suggest a likelihood of odour impacts to adjacent receivers.

6.2 Nitrogen dioxide impacts

The modelled NO_2 impacts are presented in this section. The modelled sources of NOx are the two biogas cogeneration units, and the results of the modelling are compared to the air quality criteria (1-hr and annual) to assess compliance. The assessment is made for the 100th percentile 1-hour concentrations, meaning the highest predicted pollutant level during the entire study period. It represents the worst-case scenario, showing the maximum concentration at any location and time. The 1-hr NO_2 air quality criteria is 164 $\mu g/m^3$ and annual criteria is 31 $\mu g/m^3$.

To compare modelling outputs (Nox) with the NO_2 criteria, Nox must be converted to NO_2 using the OLM method (see Section 3.3.3.2) for both 1-hr and annual results. This method involves using the maximum 1-hr background concentration, measured at Parramatta North (131.5 $\mu g/m^3$) and the maximum annual concentration (22 $\mu g/m^3$). The model output are also converted from NOx to NO_2 in CALPUFF, and applied at each modelled receptor along with the background concentration. This approach is the Level 1 impact assessment using Method 2 - NO to NO_2 conversion limited by ambient ozone concentration (OLM), and follows the guidance set out in the Approved Methods.

The result of the Level 1 impact assessment for 1-hr NO_2 is shown in Figure 6.4. The isopleths demonstrate that using the Level 1 assessment method, the NO_2 concentrations exceed the 1-hr air quality criteria (164 µg/m^3). This is partly due to the elevated concentration at the Parramatta Station for 2018 being one of the higher concentrations to be recorded at that AQS. It is not uncommon for the Level 1 impact assessment to exceed criteria the 1-hr criteria, as the requirement to use the maximum 1-hr background concentration can skew the results.

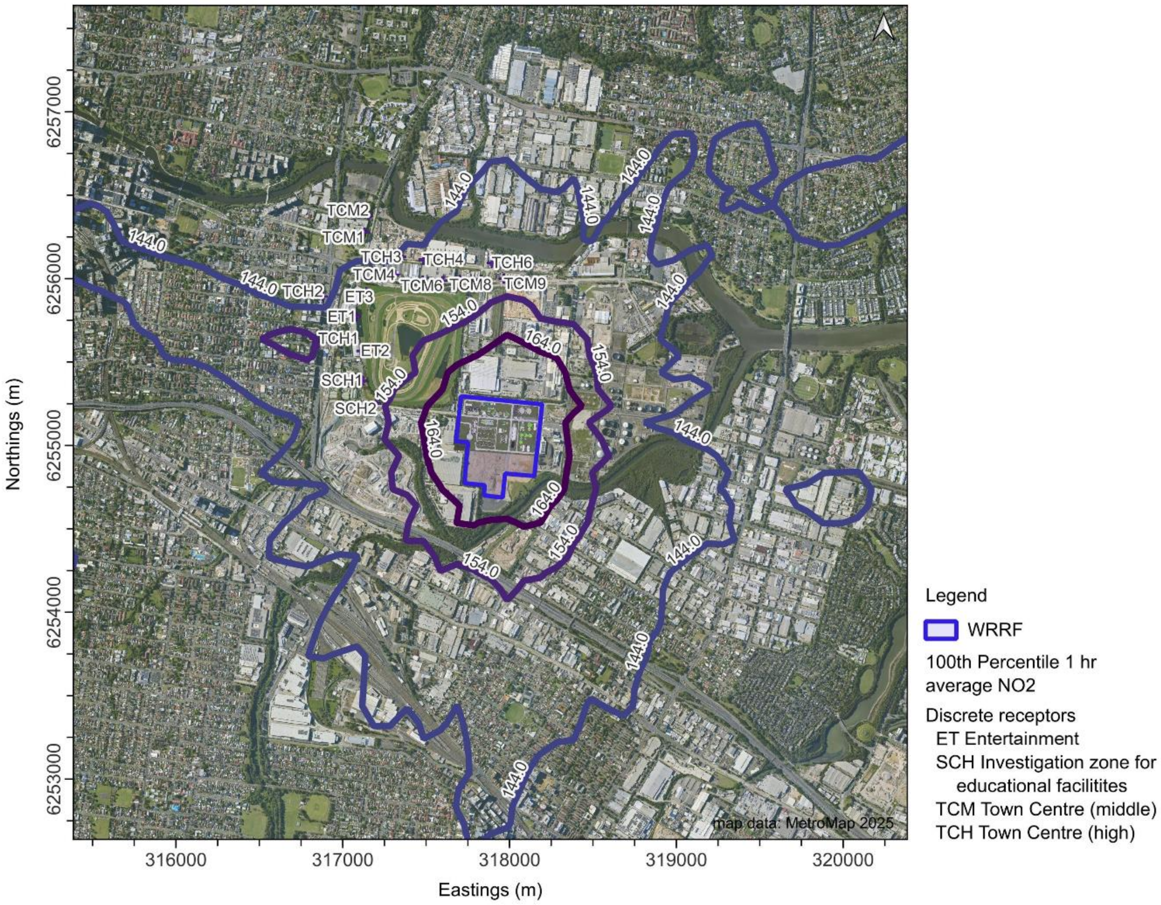


Figure 6.4 100th Percentile modelled 1-hr NO_2 concentration (µg/m^3) at ground level estimated from the normal operation conditions of the Camellia Rosehill WRRF (results for the Level 1 assessment)

As the Level 1 assessment demonstrates an exceedance of the 1-hr air quality criteria; the Approved Methods recommend the more refined assessment is undertaken – a Level 2 impact assessment. This involves using the contemporaneous background concentrations, and each hourly background concentration during the year (2018) is matched with the corresponding hourly modelled values for all receptors. This method reflects a more realistic operational scenario than Level 1.

The Level 2 assessment used contemporaneous background concentrations of NO_2 from the Parramatta North AQS and summed these with NO_2 modelled concentrations for all hours and days of 2018. The results are presented in Figure 6.5 are the frequency counts of the final estimated NO_2 concentrations at each receptor.

The Level 2 assessment predicts that the NO_2 maximum modelled concentration is 150 µg/m^3, this maximum value occurs near the emission source, within the site boundary, and is below the 1-hr criteria of 164 µg/m^3. All offsite locations are also below the 1-hr criteria.

The distribution presented in Figure 6.5 shows that majority of concentrations beyond the site boundary are below 60 µg/m^3. Statistics from the modelled gridded receptors of the Level 2 assessment are provided in Table 6.2.

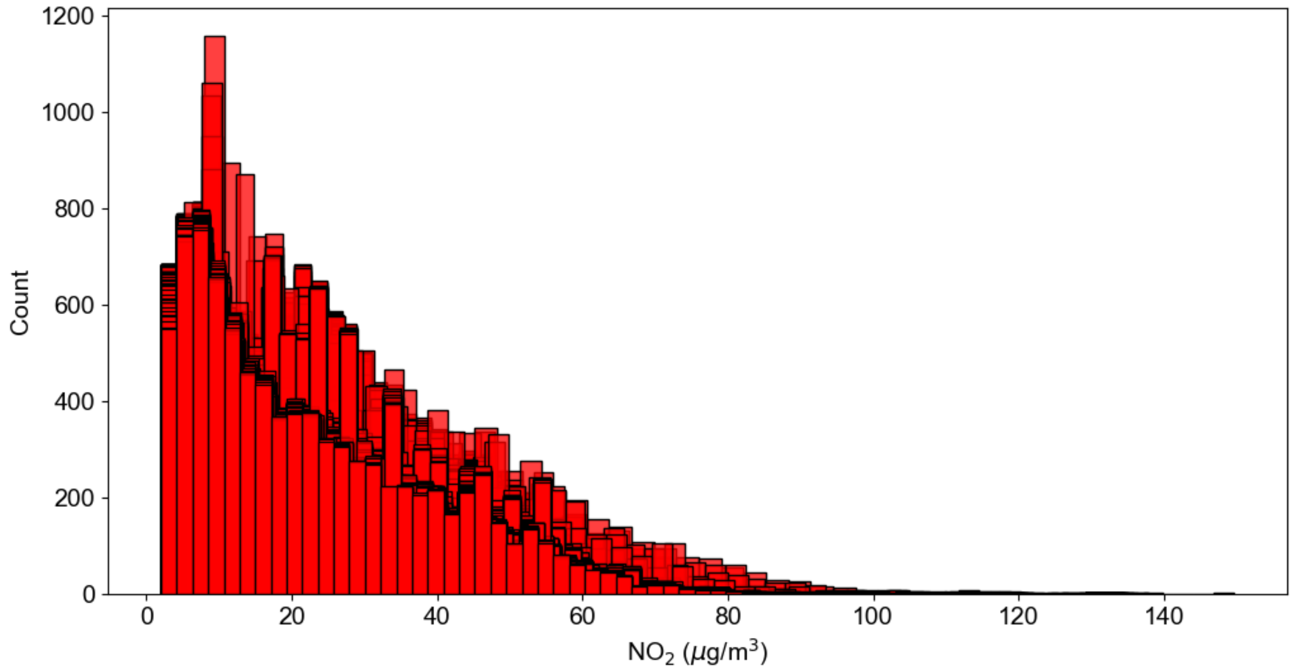


Figure 6.5 Frequency count of the modelled 1-hr NO_2 concentrations at ground level at each modelled receptor from the operation of the Biogas cogeneration units at the Camellia Rosehill WRRF (results for the Level 2 assessment)

Table 6.2 Calculated statistics for the 1-hr NO_2 modelled estimates at all gridded receptors for the modelled year

Statistic	**Value [µg/m^3]**
Mean	23.0
Median	18.5
Standard deviation	16.6
95th Percentile	55.5
90th Percentile	47.3
75th Percentile	32.9
70th Percentile	29.1
50th Percentile	18.5
Maximum	150
Minimum	2.0
Criteria	164

Note: the gridder receptors refer to any grid point within the model domain, these are not sensitive receptors. The maximum 1-hr NO_2 concentration occurs at a location within the site boundary.

Figure 6.6 presents the isopleths of the annual modelled NO_2 concentrations. The modelled annual NO_2 concentration were below the annual criteria of 31 µg/m^3 at all locations beyond the site boundary, No further refinement of the assessment is required for the annual averaging period. The WRRF operations are predicted to meet the current air quality legislation described in Section 3.1.

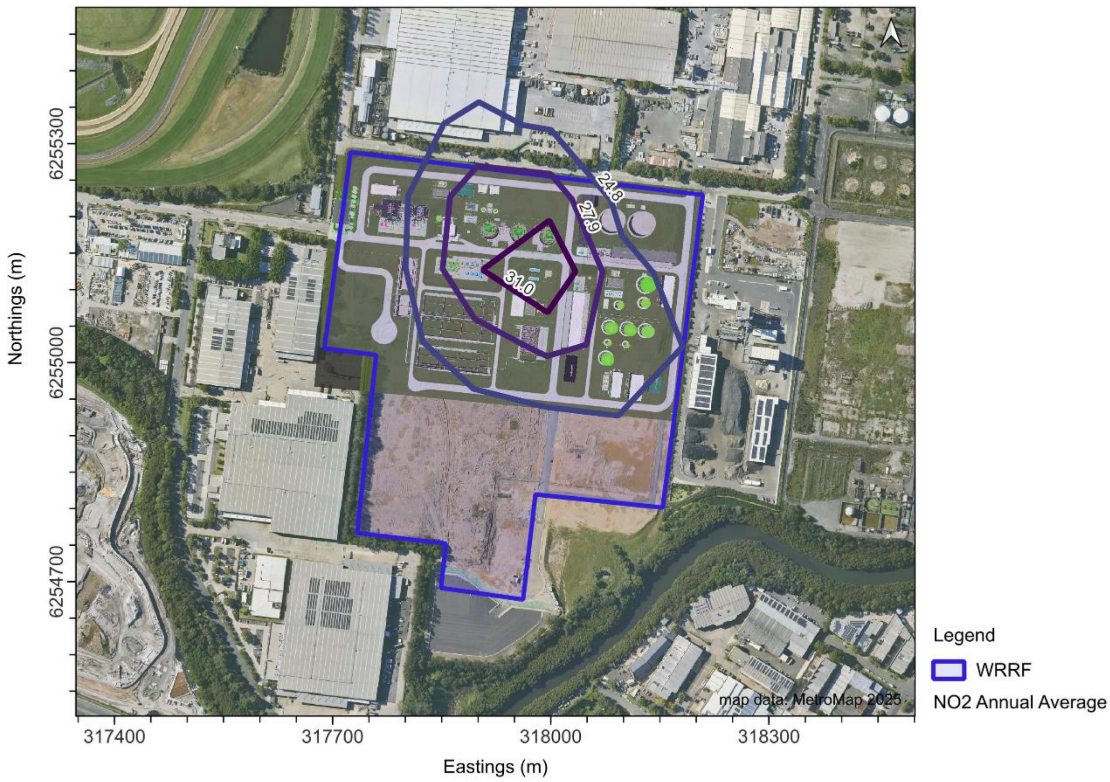


Figure 6.6 Modelled annual average NO_2 concentration (µg/m^3) at ground level estimated from the normal operation conditions of the Camellia Rosehill WRRF (results for the Level 1 assessment)

7 Mitigation measures

7.1 Construction

In the construction impact assessment presented in Section 5, the risks for the different components of the project were evaluated for the earthworks, construction, and track-out. Suggested management and mitigation measures were described in that section to assist in managing the level of risk.

In this section, a summary of those proposed measures, which could be adopted to assist manage and minimise dust generation during construction are listed. The contractor undertaking the civil works should consider which are most appropriate during the work. These measures include (but are not limited to):

- maintain equipment in good working order to comply with the Clean Air Regulations of the Protection of the Environment Operations Act 1997, having appropriate exhaust pollution controls, and meeting Australian Standards for exhaust emissions
- undertake dust suppression on exposed areas and stockpiles using a non-drinking water source, where possible.
- cover exposed areas or stockpiles when high wind conditions are expected and if expected to be left exposed for more than 20 days (for example with tarpaulins or geotextile fabric).
- modify or cease dust-generating work in windy conditions, where possible.
- maximise distance of dust-generating activities from sensitive receivers, where possible.
- using water carts, water sprays, or dust suppression surfactants as required
- minimising the volume of materials stockpiled and positioning stockpiles away from surrounding receivers
- vehicle movements are to be limited to designated entry/exit routes and parking areas
- covering of transported loads
- minimising the extent of disturbance as far as practicable and stabilising disturbed areas as soon as practicable
- stabilising site access points and/or using rumble grids and or wheel washing to minimise the tracking of material onto sealed roads.

The effectiveness of the controls can be monitored through site inspections.

Mitigation for gaseous emissions from construction vehicles and plant operation include:

- all vehicles and machinery will be maintained in a proper and efficient manner
- the use of diesel- or petrol-powered generators is to be minimised with mains electricity or battery powered equipment to be used where practicable.

7.2 Operation

The modelling results shown in Section 6.1 outline that the WRRF operation under normal conditions is unlikely to generate negative air quality impacts to the surrounding area. To maintain a low risk of offsite odour impacts, including the potential of general fugitive odours, good housekeeping and operating conditions should be maintained. These include, but are not limited to:

- Minimise the potential for fugitive odours (e.g., minimise the number of open access chambers, close maintenance holes overnight).
- Co-generation equipment (where selected) is to include consideration of engines with the lowest level of NO_2 generation per unit of energy production as far as practical
- Operate and maintain the odour control unit inline with manufactures specifications and maintenance procedures.
- Establish and manage an odour complaints system in accordance with Sydney Water's existing management system processes.
- Maintain all equipment in good working order, comply with the clean air regulations of the *Protection of the Environment Operations Act 1997*, have appropriate exhaust pollution controls, and meet Australian Standards for exhaust emissions.

8 Summary and conclusions

This report presents the results of the AQIA including a construction dust impact assessment, and the operational impact assessment for the proposed Camellia Rosehill WRRF within the Camellia-Rosehill Precinct. This assessment was prepared in accordance with the Approved Methods for the modelling and Assessment of Pollutants in NSW and the Technical Framework: Assessment and management of odour from stationary sources in NSW.

A description of the existing environment, climate and meteorology for the area where the WRRF will be located was conducted. The selected meteorological station to describe the project area was the Sydney Olympic Park AWS Station. Six years of meteorological information, starting in January 2017 to December 2022, were reviewed. The odour modelling used 2018 as the representative year based on the consistency of the meteorological measurements (annual and seasonal wind patterns), along with estimated statistical metrics.

The construction dust impact assessment followed the recommendations of the IAQM. The project was divided into three sections to assess the potential dust impact. The three sections were:

- all pipeline works,
- the pumping station upgrades,
- the WRRF.

Each section of the project was assessed separately, including the risks for different activities, i.e., earthworks, construction and track-out. This involved consideration of the potential dust magnitudes for each activity, the areas subject to disturbance, their proximity to sensitive receptors (human and ecological), and existing background concentrations. The sensitivity of the area was classified based on these considerations, followed by assigning the risk.

To assess the impacts of the WRRF during operation, plume dispersion modelling was conducted. The selected dispersion model was CALPUFF v 7.2.1. The meteorological fields were generated using CALMET v 6.5.0. The model was run using local surface meteorological information from the Sydney Olympic Park AWS BOM Station as well as information from the Parramatta North and Chullora stations managed by the DCCEEW. The TAPM model was used to generate upper air data. The modelled meteorological fields produced with CALMET where then used in CALPUFF. The modelled emission sources within the Camellia Rosehill WRRF and the corresponding emission rates were provided by Sydney Water.

Two source types were used for the odour modelling: area sources and point sources. Four major sources were modelled, and the emission rates for each source were considered to be under normal operating conditions within the WRRF. A total of nine buildings and structures that could influence the dispersion of odour were configured in the model.

Odour concentration (OU) was predicted at gridded and discrete receptors at ground level, and at elevated selected heights for the discrete receptors. The selection of the discrete receptors followed the indicative land uses outlined in the Camellia-Rosehill Integrated Master Plan (NSW DPE, 2022). The 99th percentile predicted values at all modelled receptors were compared against the odour criteria, the selected criterion was that established for a population of affected community of an urban population (2.0 OU).

All ground level odour concentration estimates outside of the boundaries of the Camellia Rosehill WRRF were below the criteria. Similarly, the estimated odour concentration units at the elevated discrete receptors were under 2.0 OU. While no elevated receptors exceeded the criteria, it is worth noting that at heights between 45 m and 50 m, odour concentrations under normal WRRF operation were predicted at up to half the odour criteria. The highest 99th percentile modelled value was 1.08 OU.

The NO_2 impact assessment included two modelled point-sources operating under normal conditions. Following the Level 1 Assessment outlined in the Approved Methods, exceedances to the 1-hr NO_2 criteria were found beyond the boundaries of the Camellia Rosehill WRRF plant, which triggered a Level 2 Assessment. This involved using contemporaneous hour measurements from the Parramatta North BOM Station, matched with the corresponding hourly CALPUFF estimations at each receptor. The results of the Level 2 Assessment predict the maximum concentrations resulting from the operation of the Camellia Rosehill WRRF, to be below the NO_2 criteria.

The air quality environmental outcome from the normal operation of the Camellia Rosehill WRRF is predicted to meet the intent of the EPA’s Approved Methods and the Protection of the Environment Operations (Clean Air) Regulation 2022.

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Appendix A

Meteorology

A1 Meteorological year selection

In addition to the time series for the meteorological parameters and the wind patterns described in Section 4.2, calculations for the standard deviation for each parameter were conducted. The annual standard deviations for temperature, relative humidity, wind direction and speed are shown in Table A.1.

All the years included in Table A.1. presented consistency in the data and meet the EPA's requirements for a 90% complete dataset. The year selected for the model, 2018, was chosen as the wind parameters were closer to the average of all years considered in the data set. The 2020 to 2022 wind patterns were also suitable but these years were not considered given that these years were characterised by a La Niña ENSO phase with 2021 being given a Southern Oscillation Index of Moderate to Strong by the BOM (BOM, 2025).

Table A.1 Annual standard deviation for temperature, relative humidity, wind direction, and speed

Year	Temperature Standard deviation (°C)	Relative humidity Standard deviation (%)	Wind direction Standard deviation (Degrees)	Wind speed Standard deviation (m/s)
2017	6.39	20.29	114.45	1.80
2018	6.31	20.46	114.09	1.86
2019	6.28	21.57	116.55	1.79
2020	5.92	20.32	117.28	1.79
2021	5.61	20.35	117.49	1.73
2022	5.28	19.25	113.76	1.70

A2 Meteorological conditions at selected stations

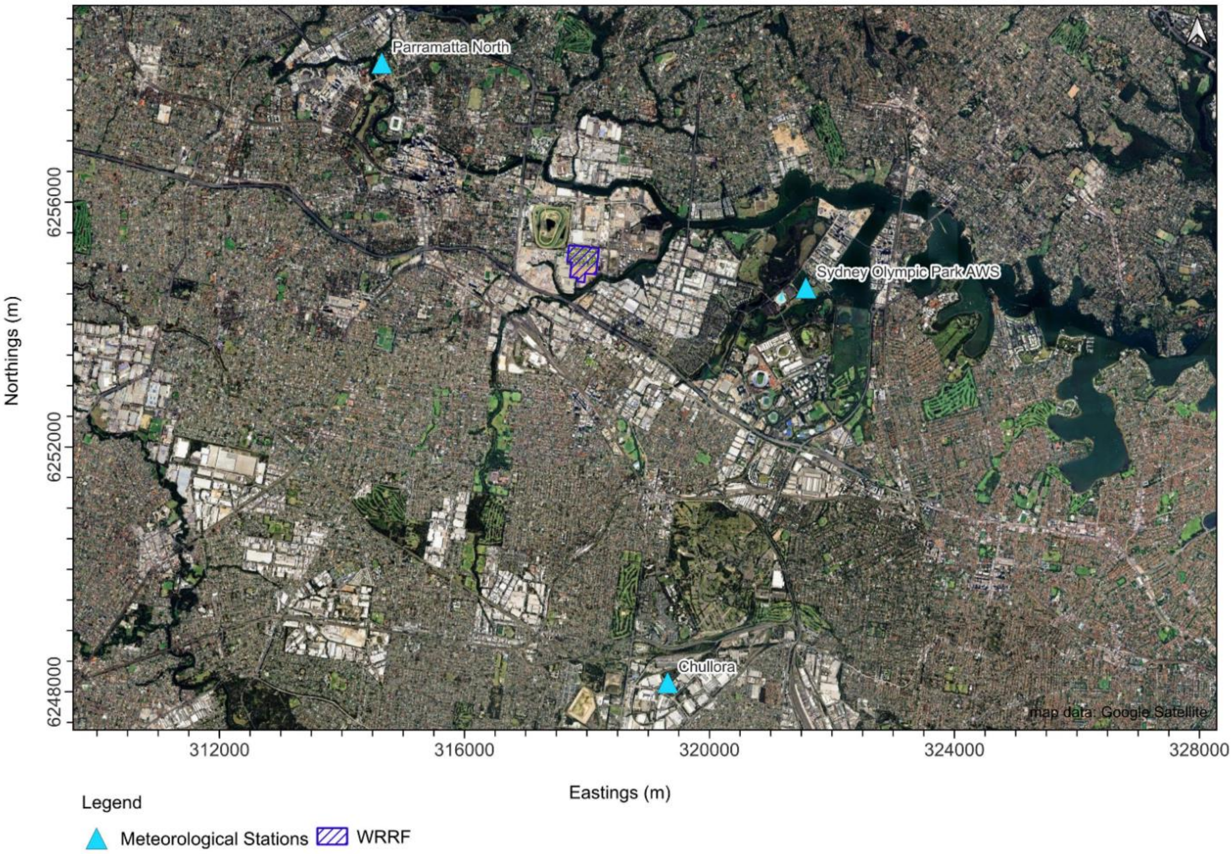

Figure A.1 Location of the nearest meteorological stations to the project area

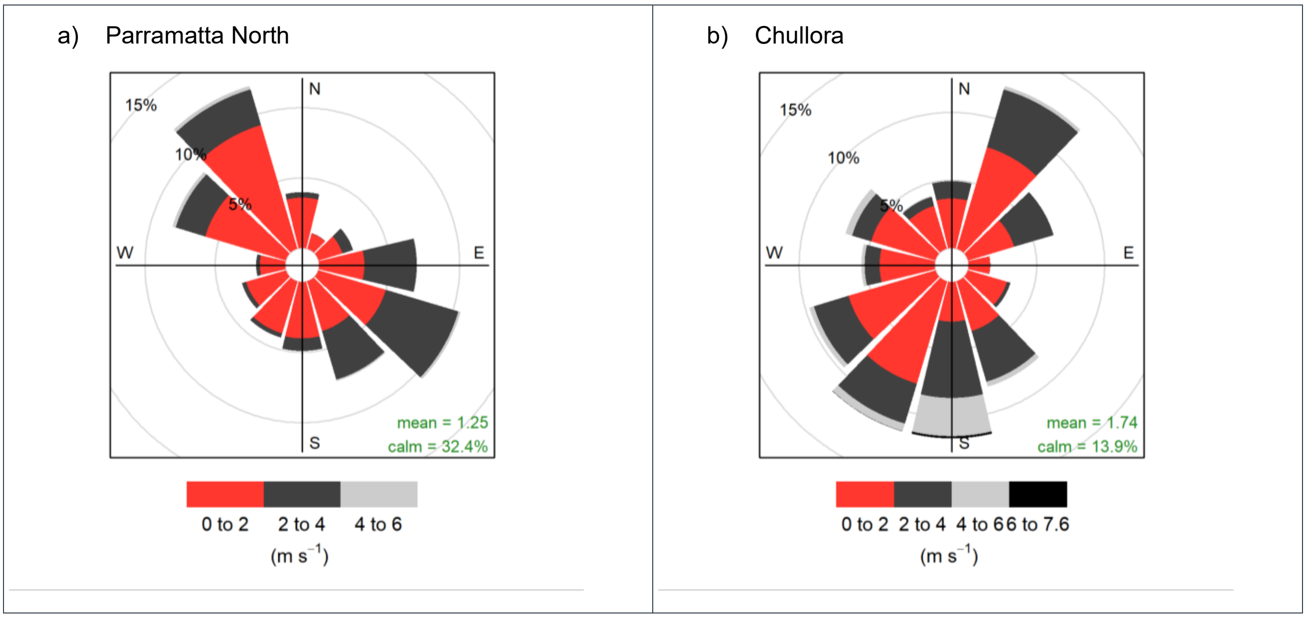

Figure A.2 Annual wind roses for 2018 at a) Parramatta North and b) Chullora DCCEEW stations.

Chullora coordinates 319319.26 m E 6248149.21 m S

A3 Stability classes from CALMET

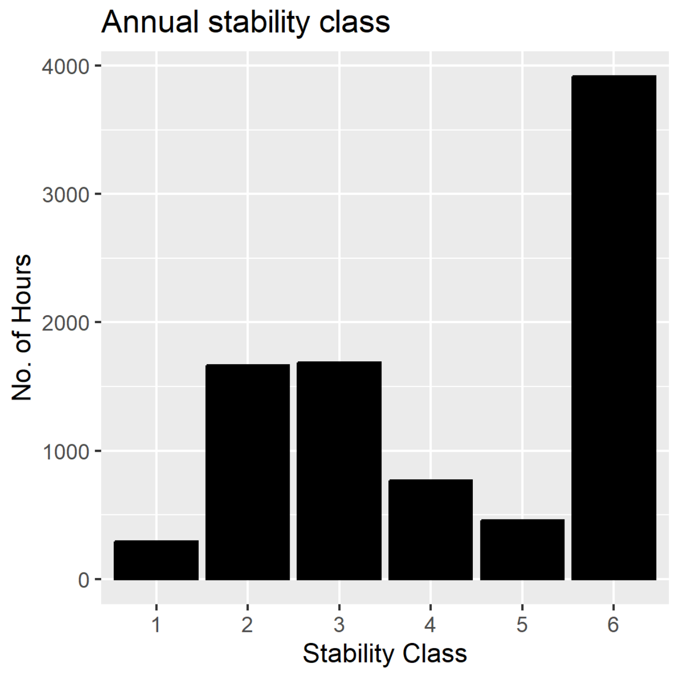

Figure A.3 Annual stability class extracted from CALMET

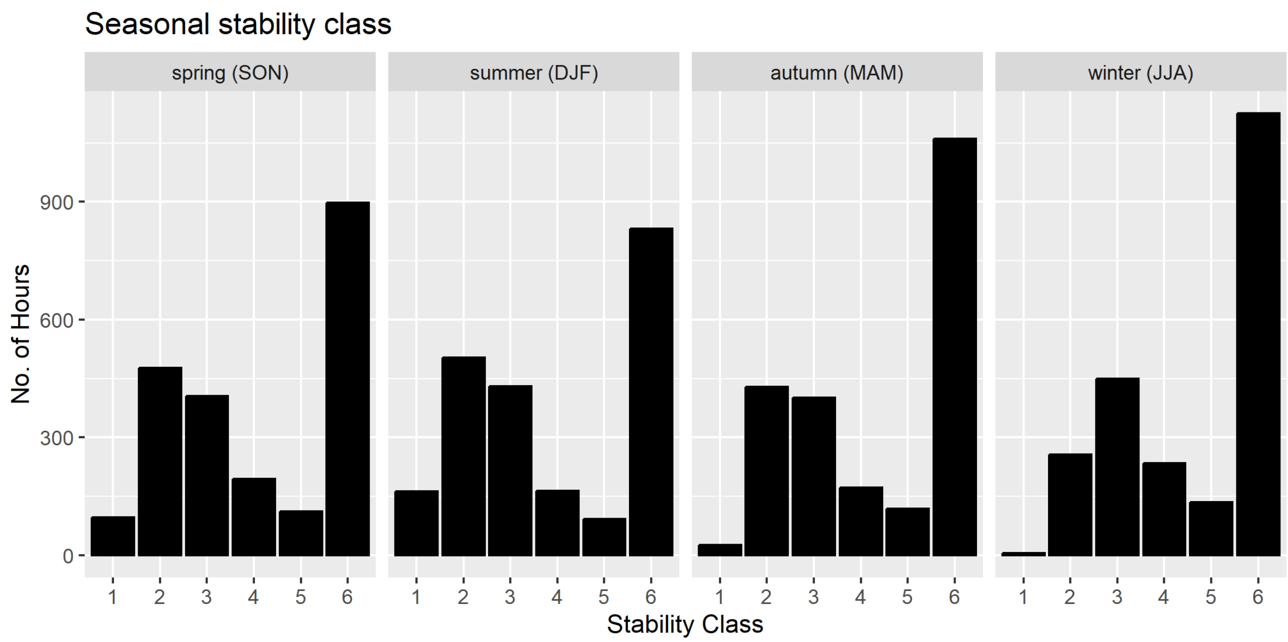

Figure A.4 Seasonal stability class extracted from CALMET

Appendix B

Modelling results

B1 Modelling results

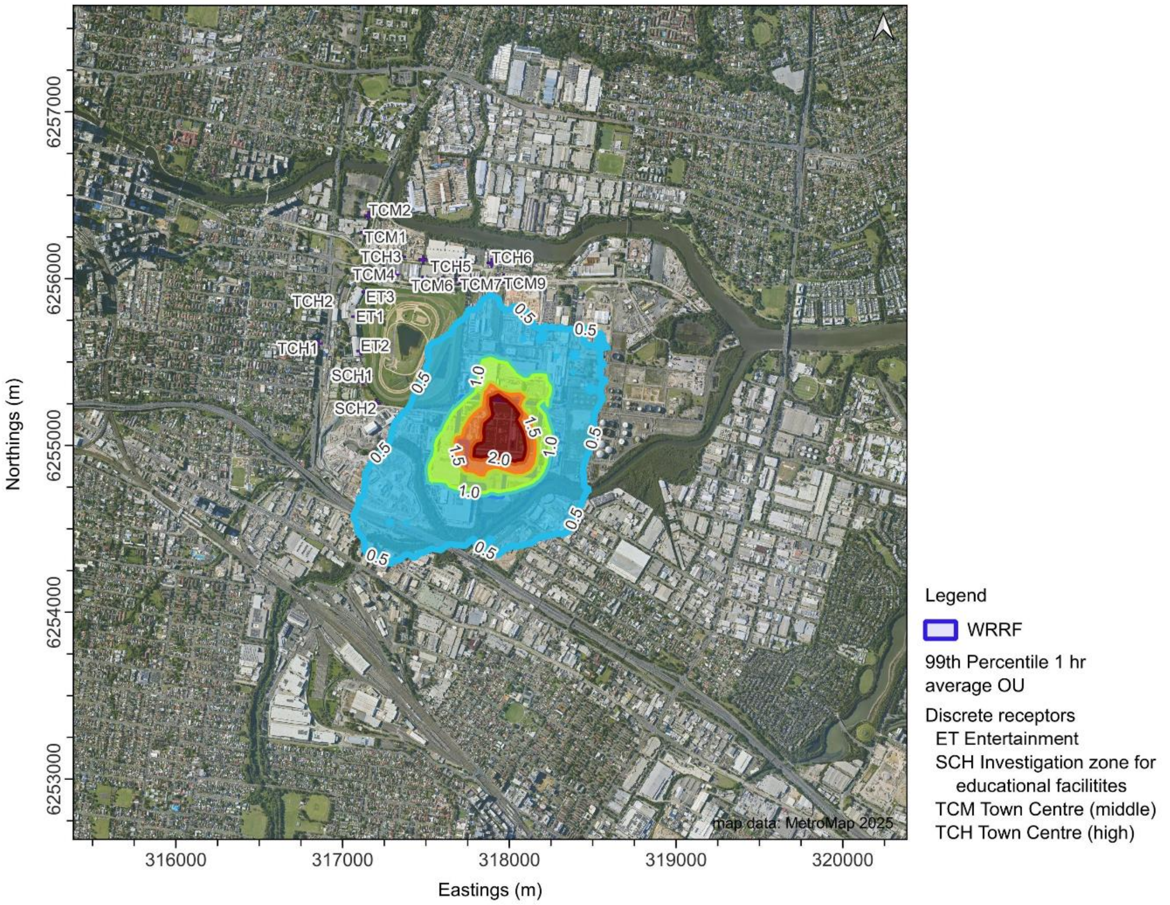

Figure B.1 99th Percentile modelled odour concentration units (OU) at ground level estimated from the normal operation conditions of the Camellia Rosehill WRRF (filled-in contours)

Table B.1 99th Percentile modelled odour concentration units (OU) at ground level estimated from the normal operation conditions of the Camellia Rosehill WRRF

Receptor ID	Receptor Type	Assessment criteria [OU]	Type of population	Predicted odour [OU]	Percentage of criteria [%]
ET1	Entertainment	2	Urban	0.3	14%
ET2		2	Urban	0.3	15%
ET3		2	Urban	0.3	15%
SCH1	Investigation zone for education facilities	2	Urban	0.3	15%
SCH2		2	Urban	0.3	17%

Receptor ID	Receptor Type	Assessment criteria [OU]	Type of population	Predicted odour [OU]	Percentage of criteria [%]
TCM1	Town Centre (middle)	2	Urban	0.3	13%
TCM2		2	Urban	0.2	12%
TCM3		2	Urban	0.3	13%
TCM4		2	Urban	0.3	15%
TCM5		2	Urban	0.3	16%
TCM6		2	Urban	0.4	18%
TCM7		2	Urban	0.4	18%
TCM8		2	Urban	0.4	21%
TCM9		2	Urban	0.4	21%
TCH1	Town Centre (high)	2	Urban	0.3	13%
TCH2		2	Urban	0.2	11%
TCH3		2	Urban	0.3	14%
TCH4		2	Urban	0.3	14%
TCH5		2	Urban	0.3	17%
TCH6		2	Urban	0.4	19%

Note: The colour scale in the Percentage column has been set from green (lower values) to red (higher values).

B2 Parramatta North air quality measurements

The Parramatta North 2018 air quality measurements for NOx and O_3 were used to determine the contemporaneous modelling predictions required for the Level 2 assessment. However, a total of 720 hours (approximately 8% of the data) were missing from the measured dataset. To overcome this, the hours were completed in two ways as follows:

- Where only one hour was missing (i.e., measurements were available for the preceding and following hours), the maximum value between the preceding and following hour was used to fill in the missing hour
- For cases where more than one hour was missing (i.e., two or more consecutive hours were missing), the 90th percentile for every hour throughout the year was used to fill missing hours.

Appendix C

Cumulative impacts

C1 Cumulative impacts review

Table C.1 Cumulative impacts review per project close to the Camellia Rosehill WRRF.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	Operational
Rosehill Resource Recovery Facility	0.85 km	Construction dates not available. If the construction period overlaps with the project commencement of works in 2028, there is the potential for an increase in ambient dust from both construction activities. The potential increase in dust emissions can be managed through standard mitigation and best practice operations.	The facility is to receive and process demolition and construction related waste materials from residential and civil construction projects, the Scope Report describes the waste streams as 'non-putrescible'. No cumulative operational impacts are anticipated.
Mixed Use Development with In-fill Affordable Housing - Melrose Park South - East	1 km	Construction dates not available. The development will be >1km from the river release pipeline. The development is unlikely to take place during pipeline construction. Potential for cumulative dust impacts is negligible.	No cumulative operational impacts are anticipated due to the separation distance and nature of the project.
River Road West Build-to-Rent	0.4 km	Construction dates not available. If the development takes place, dust impacts have potential to occur on nearby residencies due to potential overlapping activities in the period of the Brine Pipeline construction. Potential increase in dust from construction activities can be managed through standard mitigation and best practice operations.	No cumulative operational impacts are anticipated due to the nature of the project.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	**Operational**
SAMI - Camellia - Bitumen Plant Redevelopment	0.9 km	Construction dates not available. If construction overlaps with the project commencement of works in 2028, potential increase in dust from construction activities (more likely track-out) needs to be considered for the cumulative effects. Other construction activities are not expected to have the potential for cumulative impacts as the development is >800 m away from the boundary of the plant.	There is the potential of cumulative operational impacts for the Bitumen Plant. The facility is expected to generate VOCs and these compounds are often odourous. The odour characteristics are expected to be different than those emitted by the Camellia Rosehill WRRF and both sites are expected to meet the 2 OU criteria (as per this assessment) which is not cumulative across neighbouring sites.
Downer Rosehill Sustainable Resource Centre Mod 3 - Changes to Reconomy Facility and additional waste input and Mod 4 - DSRRC throughput increase	Directly adjacent to WRRF (east)	The Centre comprises a combined asphalt plant, reclaimed asphalt pavement (RAP) facility, bitumen products plant and a road waste sweeping recycling facility (Reconomy). The modifications seek to increase the volume of the processing plant from 250kton to 375kton p/year as well as processing additional waste materials (beach sweepings). The site is currently operational, and construction of the modifications will be complete before the GPOP WCM project commences. No cumulative construction impacts are anticipated.	The odour generated and emitted from this facility has the potential to created cumulative operational impacts with odour emitted from the WRRF. It originates primarily from the volatilisation of organic compounds during the heating and mixing of bitumen with aggregates. The odour thresholds for many bitumen-related VOCs are low, and small concentrations can be detectable by sensitive receptors at distance. The odour from the WRRF will be considerably different in character, and disperses quickly with distance from the source. Any cumulative odour impacts between the facilities is anticipated to be minimal.
9 Burroway Road, Wentworth Point - Mixed Use Development	0.42 km	A concept approval that will not generate significant air quality impacts. The project would take place near the pipeline river release. As a concept proposal no further impacts are expected, until the proposed development seeks further approval for detailed design and construction of the development (of mix-used nature)	No cumulative operational impacts are anticipated due to the nature of the project.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	Operational
WSU Indigenous Centre of Excellence	0.14 km (directly adjacent to compound access route)	The Centre of Excellence will include the demolition and construction of a four-storey development. Potential increases in the dust emission magnitude can arise as the two projects overlap. Cumulative impacts suggest that the risk to human receivers and dust soiling for the simultaneous construction activities are high without mitigation. The residual impacts are expected to be negligible if proper mitigation measures are in place.	No cumulative operational impacts are anticipated due to the nature of the project.
Gregory Place Build-to-Rent	0.8 km	Construction dates not available. The distance of 800m from the development to the indicative brine pipeline, pumping station and Camellia Rosehill WRRF significantly reduces the potential for cumulative impacts.	No cumulative operational impacts are anticipated due to the nature of the project.
6 Grand Avenue Multi-Level Warehouse Rosehill	0.5 km	Cumulative impacts are not expected from this activity if the completion of the project (Q2 2026) takes place. In case the works delay, overlapping of the construction with the construction works for the Camellia Rosehill WRRF would still be considered negligible.	No cumulative operational impacts are anticipated due to the nature of the project.
Grand Avenue Data Centre Expansion, Rosehill	0.3 km	The site is approximately 300m north of the Camellia Rosehill WRRF and no cumulative construction impacts are anticipated from this activity.	In the event of a power failure, the Data Centre backup diesel generators would become operational and generate emissions of odour and NO_2. Given the separation distance between the sites, both of these pollutants have to potential to create cumulative operational impacts in a grid power failure scenario. However, the likelihood of an extended power outage is low, and would not be considered a routine operational process. During normal activities at the data centre (which would include short-term generator testing) it is considered unlikely there would be cumulative operational impacts for either odour or NO_2.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	**Operational**
Boorea Street Warehouse & Distribution Centre	1.3 km	The plant sits just on the limit of the 1 km buffer. The operation of the ancillary facilities and the warehouse will overlap with the Camellia Rosehill WRRF operations. However, it is not anticipated that the vehicular emissions from the site operation increase further the background concentrations, and hourly criteria levels are most likely to stay below the criteria.	No cumulative operational impacts are anticipated due to the nature of the project.
Camellia Vinegar and MAURI ANZ Camellia	0.7 km	No cumulative construction impacts due as the facility operational.	The facility is likely to produce low levels of odour emissions; however the separation distance means cumulative operational impacts are highly unlikely.
Sydney Olympic Park Sites 2A and 2B - Serviced apartment tower and commercial	1 km	Construction dates not available. If construction begins at the same time as the Camellia Rosehill WRRF, potential cumulative impacts in the dust magnitudes can arise. However, the impacts should be minimal with the right mitigation strategies in place. Thus, impact is almost negligible. Because the type of development is accommodation, no operational impacts overlap is expected.	No cumulative operational impacts are anticipated due to the nature of the project.
Mixed-use development with affordable housing - Marquet and Mary Street, Rhodes	1 km	Construction dates not available. If construction begins at the same time as the Camellia Rosehill WRRF, potential cumulative impacts in the dust magnitudes can arise. However, the impacts should be minimal with the right mitigation strategies in place. Thus, impact is almost negligible. Because the type of development is accommodation, no operational impacts overlap are expected.	No cumulative operational impacts are anticipated due to the nature of the project.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	Operational
Mixed-use development including in-fill affordable housing - 9 Blaxland Road, Rhodes	1 km	Potential overlap when the residential and commercial development starts in late 2029 with the tail end of the river release pipeline construction. However, cumulative impacts are expected to be minimal. The operational phase is not expected to have any cumulative impacts.	No cumulative operational impacts are anticipated due to the nature of the project.
Rhodes East Mixed Use Seniors Housing Development	0.8 km	Construction dates not available. If the Seniors Housing development construction overlaps with the river release pipeline construction, the cumulative impacts from the added dust magnitudes is considered negligible.	No cumulative operational impacts are anticipated due to the nature of the project.
Residential development with affordable housing – Llewellyn Street, Rhodes	0.7 km	Construction dates not available. If the housing development construction overlaps with the river release pipeline construction, the cumulative impacts from the added dust magnitudes is considered negligible.	No cumulative operational impacts are anticipated due to the nature of the project.
Mixed-use development with in-fill affordable housing - Leeds Street, Rhodes	0.1 km	Construction dates not available. If the housing development construction overlaps with the river release pipeline construction, the cumulative impacts from the added dust magnitudes is considered negligible.	No cumulative operational impacts are anticipated due to the nature of the project.
Mixed-use development with affordable housing – 23-29 Marquet Street, Rhodes	0.9 km	Construction dates not available. If the housing development construction overlaps with the river release pipeline construction, the cumulative impacts from the added dust magnitudes is considered negligible.	No cumulative operational impacts are anticipated due to the nature of the project.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	Operational
Camellia-Rosehill Place Strategy	Overlaps with the project	The strategy will guide renewal of the precinct over the next 20 years. At various development stages there is the potential for cumulative construction impacts, however these are routine and well understood in nature. Standard management and mitigation measures during construction should reduce the risk to a low level.	Existing industries that can generate odour have been reviewed in the Background Air Quality Section on this report. Potential odours activities can have an additive risk to the area inside the Precinct. Although high risk, mitigation measures (control system) are designed for the Camellia Rosehill WRRF odour source to reduce risk. The modelling predicts that the operation of the facility would be compliant and odour emissions well below the criteria at sensitive receptors. The cumulative operational impact of the precinct developments are possible but considered low risk with the available information.
SOPA Master Plan	Overlaps with the project	The construction of the development could have some cumulative impacts however these are routine and well understood in nature. Standard management and mitigation measures during construction should reduce the risk to a negligible level.	The cumulative operational impact of the developments held in the Master Plan would be negligible.
Parramatta Light Rail Stage 2	Overlaps with the project	Some sections of the alignment overlap with the project pipeline works. Cumulative air quality impacts could present if simultaneous construction of the pipeline sections and Camellia Rosehill WRRF occur. Increases in dust magnitudes could result in higher impacts human receptors without mitigation. Once the Light rail construction is completed, no additional PM impacts from the simultaneous operation of the light rail and the Camellia Rosehill WRRF are expected.	No cumulative operational impacts are anticipated due to the nature of the project.
IVE Group Bluestar Web Silverwater	0.8 km	No cumulative construction impacts due as the facility operational.	The facility emits NOx, reported through their NPI obligations. The separation distance means cumulative operational impacts are anticipated to be highly unlikely.

Project name	Distance from project	Cumulative Air Quality Review	
		Construction	Operational
Sydney Metro West - Rail infrastructure, stations, precincts and operations	<1km	Overlapping of construction activities for the metro station and the Camellia Rosehill WRRF could lead to an increase in the dust magnitude and higher levels of particulate matter. Dust soiling impacts on nearby receivers and increased dust on connecting roads could augment the chances of resuspension dust from trackout activities.	No cumulative operational impacts are anticipated due to the nature of the project.
Duck River Nature Trail	Overlaps with the project	The third and largest stage of the construction of the Duck River Trail is expected to overlap with the Camellia Rosehill WRRF. Increase in the sensitivity of the area to ecological impacts could take place. The dust impacts from the cumulative activities without mitigation could increase the risk if high levels of PM, however mitigation strategies should be sufficient to reduce the potential effects.	No cumulative operational impacts are anticipated due to the nature of the project.
Meadowbank Bridge Remediation	Overlaps with the project	Construction dates not available. If the upgrades to the bridge overlap with the river release pipeline, potential cumulative dust impacts can arise, these will depend on the extent of the upgrades and mitigation measures applied by the bridge project. The operational phase of the plant will not see any cumulative impacts with the bridge upgrades.	No cumulative operational impacts are anticipated due to the nature of the project.